

# Pump drive F600

## Step By Step Guide



Frame sizes 3 to 12



[www.controltechniques.com/support](http://www.controltechniques.com/support)

EN

This guide provides a fast and simple start-up procedure for a basic drive and motor installation.

For help with more advanced installations: Comprehensive user guides, online videos and help tools can be accessed using the web address or QR code above.



*Please read the safety information booklet supplied with the drive before installation or set-up.  
It is essential to read Section 4.15 in the **F600 User Guide** using the web address or QR code above prior to using the Safe Torque Off function in safety systems.*

# EU Declaration of Conformity (including 2006 Machinery Directive)

## 1. Product model

Unidrive-M and derivative products incorporating a Safe Torque Off (STO) function used as a safety component of a machine. Only the Safe Torque Off function may be used as a safety component of a machine..

## 2. Name and address of the manufacturer and authorised representative

Manufacturer:	Authorised representative:
Nidec Control Techniques Ltd The Gro Newtown Powys SY16 3BE UK  Registered in England and Wales. Company Reg. No. 01236886 Telephone: 00 44 1686 612000 Email: cthoadmin@mail.nidec.com Web: www.controltechniques.com	Nidec Netherlands B.V. Kubus 155 3364 DG Sliedrecht Netherlands

## 3. Responsibility

This declaration is issued under the sole responsibility of the manufacturer.

## 4. Object of the declaration

Model number	Interpretation	Nomenclature aaaa - bbc dddd
aaaa	Basic series	M600, M700, M701, M702, M708, M709, CSD1, HS70, HS71, HS72, E200, E300, M880, M881, M882, M889, F300, F600, H300, M751, M753, M750, M754
bb	Frame size	01, 02, 03, 04, 05, 06, 07, 08, 09, 10, 11, 12
c	Voltage rating	1 = 100 V, 2 = 200 V, 4 = 400 V, 5 = 575 V, 6 = 690 V
dddd	Current rating	Example 01000 = 100 A
e	Drive format	A = 6P Rectifier + Inverter with internal choke, D = Inverter, E = 6P Rectifier + Inverter, T = 12P Rectifier + Inverter

The model number may be followed by additional characters that do not affect the ratings.

## 5. Declaration

The safety function STO within the Unidrive-M series fulfils the requirements of SIL 3 of EN 61800-5-2 / EN 61508 and Cat 4 / PLe of EN ISO 1384901 and can be used in safety related applications up to these safety levels and in the application area of EN IEC 62061:2021.

Further it can be used for electric passenger and goods lifts within the scope of EN 81-20, clause 5.9.2.5.4 d) as a SIL 3 drive control featuring a defined interface for stopping of the drive by a means of static elements.

The object of the declaration is in conformity with the following European Union harmonisation legislation:

Machinery Directive (2006/42/EC)

Electromagnetic Compatibility Directive (2014/30/EU)

Type examination has been carried out by the following notified body:

TUV Rheinland Industrie Service GmbH, Am Grauen Stein, D-51105 Köln, Germany

Notified body identification number: 0035

EC type-examination certificate number: 01/205/5270.03/22 dated 2022-08-26, valid until 2027-08-26.

## 6. References to the relevant harmonised standards used

The variable speed drive products listed above have been designed and manufactured in accordance with the following European harmonised standards:

EN 61800-5-2:2017	Adjustable speed electrical power drive systems - Part 5-2: Safety requirements - Functional
EN 61800-5-1:2007 + A1: 2017 + A11: 2021, 4.3, 5.2.3.8, 5.2.6	Adjustable speed electrical power drive systems - Part 5-1: Safety requirements - Electrical, thermal and energy
EN ISO 13849-1:2015	Safety of Machinery, Safety-related parts of control systems, General principles for design
IEC 61508 Parts 1 - 7:2010	Functional safety of electrical/ electronic/programmable electronic safety-related systems

**7. Signed for and on behalf of:**

Person authorised to complete the technical file:      Authorised representative (see details above)

DoC authorised by:



**Jon Holman-White, Vice President, Research and Development.**

Date:

13<sup>th</sup> November 2023, Newtown, Powys, UK

**IMPORTANT NOTICE**

These electronic drive products are intended to be used with appropriate motors, controllers, electrical protection components and other equipment to form complete end products or systems. It is the responsibility of the installer to ensure that the design of the complete machine, including its safety-related control system, is carried out in accordance with the requirements of the Machinery Directive and any other relevant legislation. The use of a safety-related drive in itself does not ensure the safety of the machine. Compliance with safety and EMC regulations depends upon installing and configuring drives correctly, including using the specified input filters. The drive must be installed only by professional installers who are familiar with requirements for safety and EMC. The assembler is responsible for ensuring that the end product or system complies with all relevant laws in the country where it is to be used. For more information regarding Safe Torque Off, refer to the Product Documentation.

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# English

## Introduction

The F600 is a simple and flexible range of drives from 1.1 kW to 280 kW in 10 frame sizes and four input voltage ranges (200 V, 400 V, 575 V and 690 V).

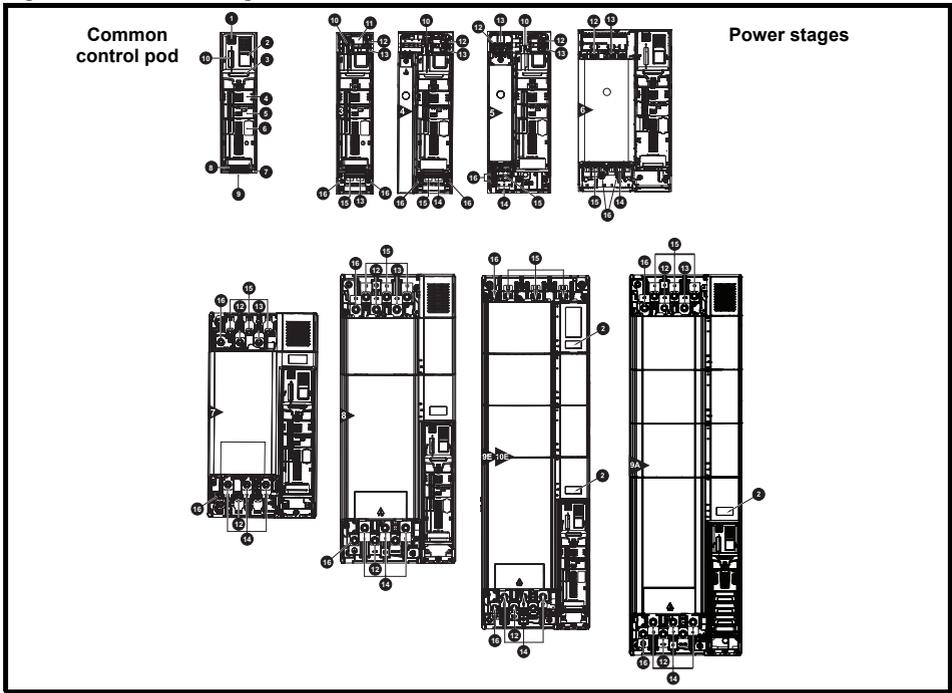
This Step-by Step guide provides simple instructions on how to mount the drive, fuse and cable selection, wiring the drive-up, programming the drive and running the motor keypad mode on frames 3 to 12.

The following information is available for download at 'www.controltechniques.com/support':

- F600 User Guide  
There is also a guided set-up contained in the software tool Connect available from:  
<https://acim.nidec.com/drives/control-techniques/downloads>
- F600 Parameter Reference Guide

## Features of the drive

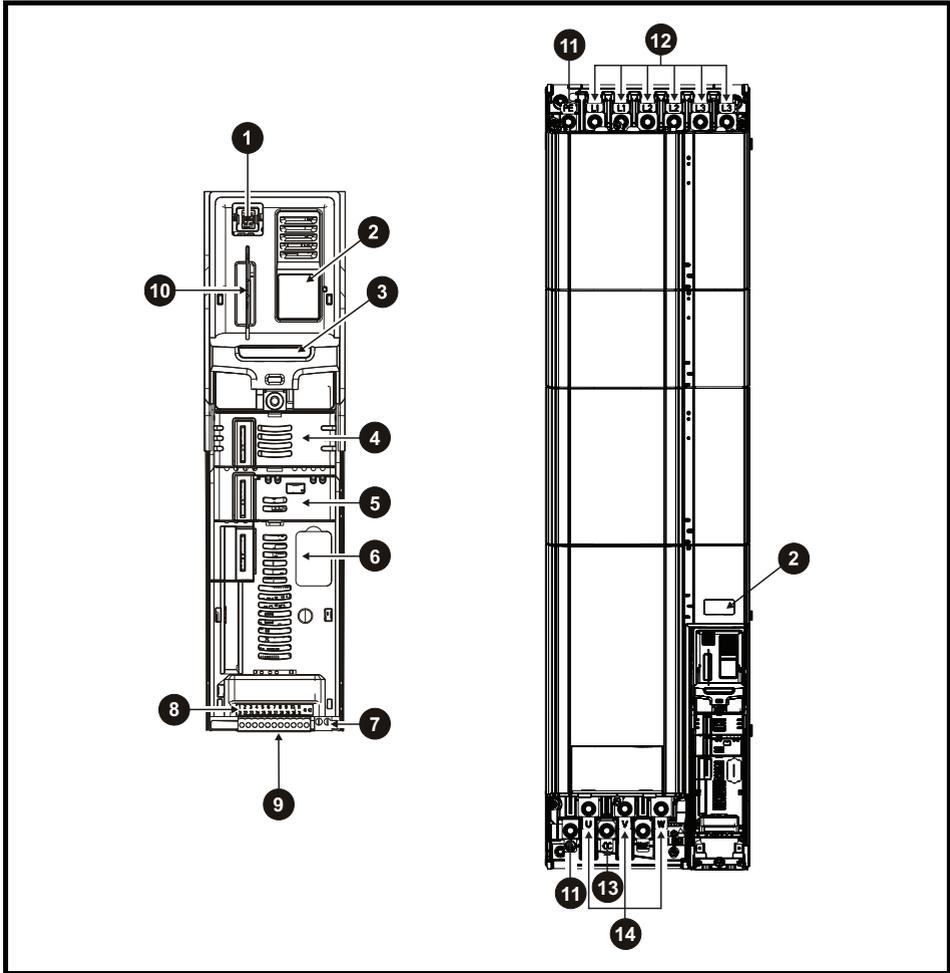
Figure 1-1 Feature diagram for frame sizes 3 to 10



### Key

- |                         |                           |
|-------------------------|---------------------------|
| 1. Keypad connection    | 9. Communications port    |
| 2. Rating label         | 10. NV media card slot    |
| 3. Identification label | 11. Internal EMC filter   |
| 4. Option module slot 1 | 12. DC bus +              |
| 5. Option module slot 2 | 13. DC bus -              |
| 6. Option module slot 3 | 14. Motor connections     |
| 7. Relay connections    | 15. AC supply connections |
| 8. Control connections  | 16. Ground connections    |

Figure 1-2 Feature diagram for frame size 11



**Key**

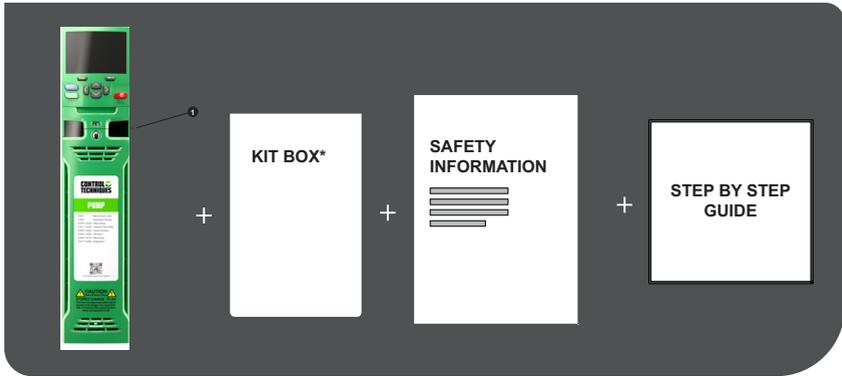
- |                         |                            |
|-------------------------|----------------------------|
| 1. Keypad connection    | 8. Control connections     |
| 2. Rating label         | 9. Communications port     |
| 3. Identification label | 10. NV media card slot     |
| 4. Option module slot 1 | 11. Ground connections     |
| 5. Option module slot 2 | 12. AC supply connections* |
| 6. Option module slot 3 | 13. DC bus +               |
| 7. Relay connections    | 14. Motor connections      |

\*Common AC Supply connections are internally linked on the 11E 6 pulse drive

**NOTE** For Frame 12 Drives consult with the Unidrive M Power Module Frame 12 Installation Guide for more information

## STEP 1: Check the contents of the box

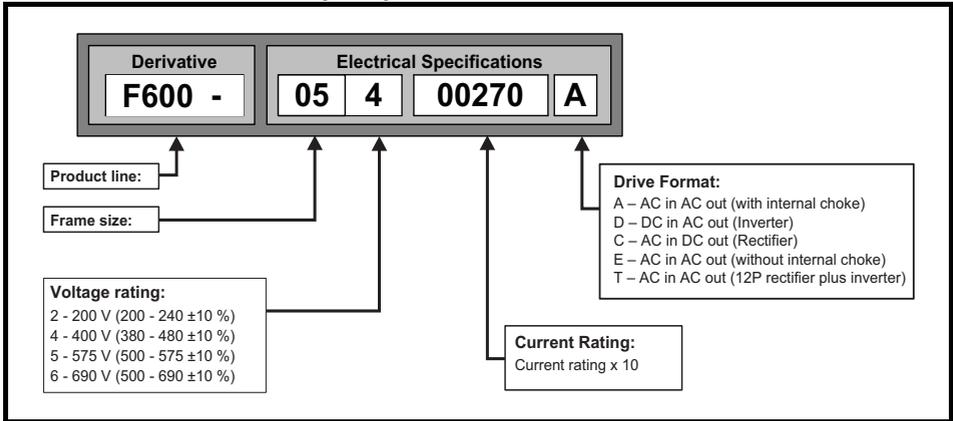
Check you have all the components and your drive has not been damaged during transportation.



\* With frame size 7 to 11, surface mounting brackets are also supplied with the drive.

## STEP 2: Check model and voltage

The model number can be found on the identification label **1** on the top of the drive. Please check that the model and the drive voltage range is suitable for the installation.



### STEP 3: Mount the drive

The drive should be mounted in an ambient temperature range of - 20 °C to 55 °C (- 4 °F to 131 °F). Output current derating may be required at ambient temperatures > 40 °C (104 °F). Refer to the **F600 User Guide** (section 5). For UL installations, the maximum ambient temperature permitted is 50 °C (122 °F) with any specified derating applied.

The drive can be screwed on a wall or Through-panel mounted (Refer to the **F600 User Guide**). Table 6-3 highlights the clearances.

Figure 3-1 Recommended spacing

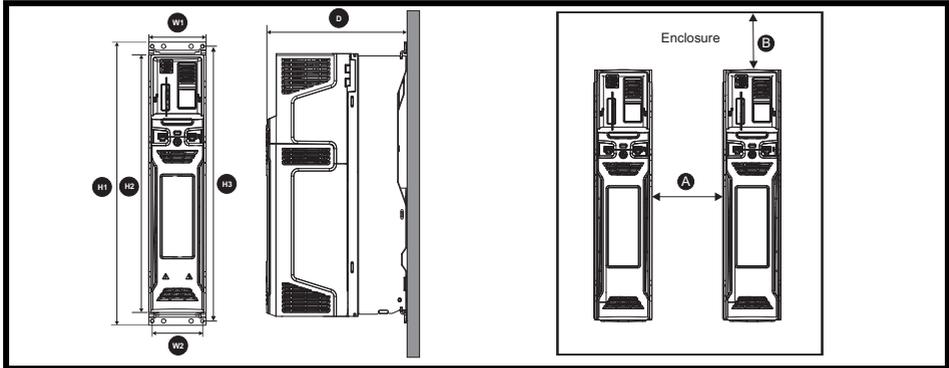


Table 3-1 Drive dimensions and weights

Frame	H1 mm (in)	H2 mm (in)	H3 mm (in)	W1 mm (in)	W2 mm (in)	D mm (in)	Mounting hole diameter	Weight kg (lb)	* Clearance	
									A	B
									40 °C	
3 03400078 / 03400100	382	365	370	83	73	200	5.5	4.5	0	0
	(15.04)	(14.37)	(14.57)	(3.27)	(2.87)	(7.87)	(0.22)	(9.9)	0	0
3 All other variants	382	365	370	83	73	200	5.5	4	0	0
	(15.04)	(14.37)	(14.57)	(3.27)	(2.87)	(7.87)	(0.22)	(8.8)	0	0
4	391	365	375	124	106	200	6.5	6.5	0	30 mm
	(15.39)	(14.37)	(14.76)	(4.88)	(4.17)	(7.87)	(0.26)	(14.3)	0	1.18 in
5	391	365	375	143	106	200	6.5	7.4	0	30 mm
	(15.39)	(14.37)	(14.76)	(5.63)	(4.17)	(7.87)	(0.26)	(16.3)	0	1.18 in
6	391	365	378	210	196	227	7	14	0	30 mm
	(15.39)	(14.37)	(14.88)	(8.27)	(7.72)	(8.94)	(0.27)	(30.9)	0	1.18 in
7	557	508	538	270	220	280	9	28	30 mm	30 mm
	(21.93)	(20)	(21.18)	(10.63)	(8.66)	(11.02)	(0.35)	(61.7)	1.18 in	1.18 in
8	804	753	794	310	259	290	9	52	30 mm	30 mm
	(31.65)	(29.65)	(31.26)	(12.21)	(10.20)	(11.42)	(0.35)	(114.6)	1.18 in	1.18 in
9A	1108	1049	1090	310	259	290	9	66.5	60 mm	45 mm
	(43.61)	(41.30)	(42.91)	(12.21)	(10.20)	(11.42)	(0.35)	(146.6)	2.37 in	1.77 in
9E and 10E	1069	1010	1051	310	259	290	9	46	60 mm	45 mm
	(42.09)	(39.70)	(41.38)	(12.21)	(10.20)	(11.42)	(0.35)	(101.4)	2.37 in	1.77 in
11E	1242	1190	1222	310	259	313	9	63		45 mm
	(48.9)	(46.9)	(48.11)	(12.21)	(10.20)	(12.32)	(0.35)	(138.9)		1.77 in
12	1750			295		526		130		
	(68.89)			(11.61)		(20.70)		(287)		

\* Frame 12 drives are mounted with cubicle enclosures where distance is already taken into account.

## STEP 4: Select supply / motor cables and fuses

Refer to Appendix B for the ratings for the 575V and 690V drives. The supply/motor cables and fuses or MCB's used should follow the ratings provided in the table below:



The voltage rating of fuses must be greater than or equal to the highest supply voltage of the system.  
**Fuses:** The AC supply to the drive must be installed with suitable protection against overload. Failure to observe this requirement will cause risk of fire.

### NOTE

The product is UL listed for use on a circuit up to 100 kA maximum supply symmetrical fault current, when protected by fuses.

### NOTE

IEC cable sizes assume Copper conductor, PVC insulation, Installation method B2 and ambient temperature of 40 °C (104 °F). UL cable sizes assume Copper conductor with insulation rated at 75 °C (167 °F).

**Table 4-1 200 V drive ratings, cable sizes and fuse ratings (200 V to 240 V ±10 %)**

Model	Max. cont. input current	Fuse				Nominal cable size				Normal Duty			
		IEC		UL		European		USA		Max. count. output current	Nom power @ 230 V	Motor power @ 230 V	
		3ph	Nom	Class	Nom	Class	Input	Output	Input				Output
03200066	10.4	16	gG	20	CC, J or T*	2.5	2.5	14	14	6.6	1.1	1.5	
03200080	12.6	20		20		2.5	2.5	14	14	8	1.5	2	
03200110	17	20		25		4	4	12	12	11	2.2	3	
03200127	20	25		25		4	4	12	12	12.7	3	3	
04200180	20	25	gG	25	CC, J or T*	6	6	10	10	18	4	5	
04200250	28	32		30		6	6	10	10	25	5.5	7.5	
05200300	31	40	gG	40	CC, J or T*	10	10	8	8	30	7.5	10	
06200500	48	63	gG	60	CC, J or T*	16	16	4	4	50	11	15	
06200580	56	63		70		25	25	3	3	58	15	20	
07200750	67	80	gG	80	CC, J or T*	35	35	2	2	75	18.5	25	
07200940	84	100		100		35	35	1	1	94	22	30	
07201170	105	125		125		70	70	1/0	1/0	117	30	40	
08201490	137	200	gR	200	HSJ	6	95	3/0	3/0	149	37	50	
08201800	166	200		225		2 x 70	2 x 70	2 x 1	2 x 1	180	45	60	
09202160	205	250	gR	250	HSJ	2 x 70 (B1)	2 x 95 (B2)	2 x 2/0		216	55	75	
09202660	260	315		300		2 x 95 (B1)	2 x 120 (B2)	2 x 4/0		266	75	100	
10203250	305	400	gR	400	HSJ	2 x 120 (B1)	2 x 120 (B2)	2 x 250		325	90	125	
10203600	361	450		450		2 x 150 (C)		2 x 300		360	110	150	

**Table 4-2 400 V drive ratings, cable sizes and fuse ratings (380 V to 480 V ±10 %)**

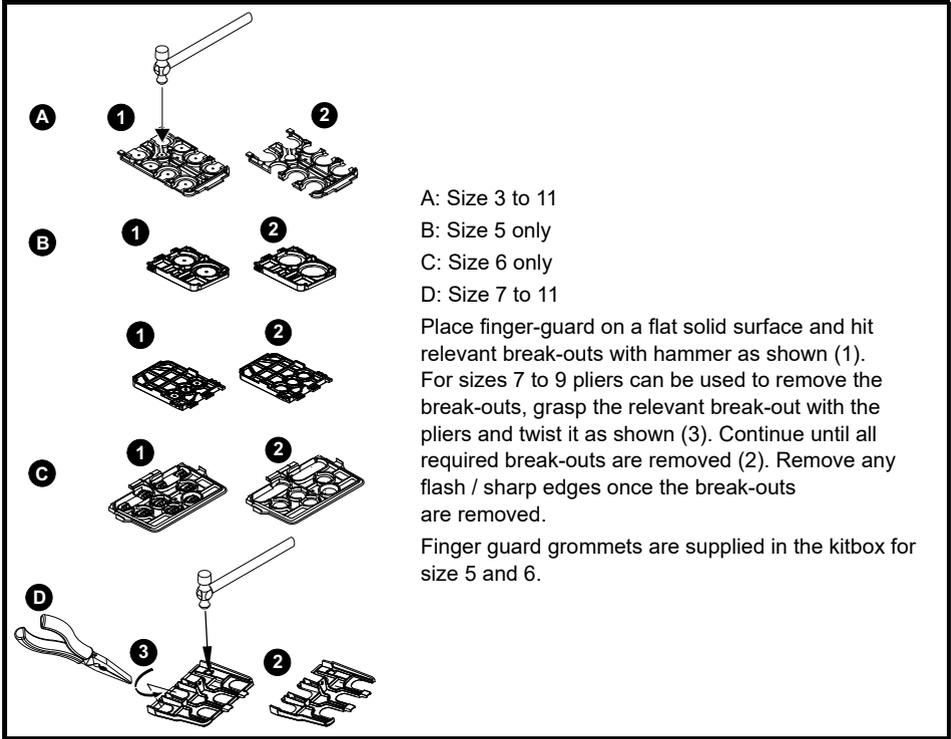
Model	Max. cont. input current	Fuse				Nominal cable size				Normal Duty			
		IEC		UL		European		USA		Max. count. output current	Nom power @ 400 V	Motor power @ 460 V	
		3ph	Nom	Class	Nom	Class	Input	Output	Input				Output
03400034	5	10	gG	10	CC, J or T*	1.5	1.5	18	18	3.4	1.1	1.5	
03400045	7	10		10		1.5	1.5	16	16	4.5	1.5	2	
03400062	9	10		10		1.5	1.5	14	14	6.2	2.2	3	
03400077	13	20		20		2.5	2.5	14	14	7.7	3	5	
03400104	13	20		20		2.5	2.5	14	14	10.4	4	5	
03400123	16	20	20	2.5	2.5	12	12	12.3	5.5	7.5			
04400185	19	25	gG	25	CC, J or T*	4	4	10	10	18.5	7.5	10	
04400240	24	32		30		6	6	10	10	24	11	15	
05400300	29	40	gG	35	CC, J or T*	10	10	8	8	30	15	20	
06400380	36	40	gR	40	CC, J or T*	10	10	6	6	38	18.5	25	
06400480	46	63		50		16	16	4	4	48	22	30	
06400630	60	63		60		25	25	3	3	63	30	40	
07400790	74	100	gG	80	CC, J or T*	35	35	2	2	79	37	60	
07400940	88	100		100		35	35	1	1	94	45	60	
07401120	105	125		125		70	70	1/0	1/0	112	55	75	
08401550	155	250	gR	225	HSJ	2 x 50	2 x 50	2 x 1	2 x 1	155	75	100	
08401840	177	250		225		2 x 70	2 x 70	2 x 1/0	2 x 1/0	184	90	125	
09402210	232	315	gR	300	HSJ	2 x 70 (B1)	2 x 95 (B2)	2 x 3/0	2 x 2/0	221	110	150	
09402660	267			350		2 x 95 (B1)	2 x 120 (B2)	2 x 4/0	2 x 4/0	266**	132	200	
10403200	332	400	gR	400	HSJ	2 x 120 (C)	2 x 120 (B2)	2 x 300	2 x 250	320	160	250	
10403610	397	450		450		2 x 150 (C)	2 x 150 (B2)	2 x 350	2 x 300	361	200	300	
11404370	449	500	gR	600	HSJ	4 x 95 (C)	2 x 185 (C)	4 x 3/0	2 x 400	437	225	350	
11404870	492	500					2 x 240 (C)	4 x 4/0		487**	250	400	
11405070	539	630				507**	280	450					
12404800T	720	550	gR	400	gR	4 x 120	3 x 150	3 x 150	600	315	500		
12405660T	777	550		450		4 x 120	4 x 120	4 x 120	660	355	550		
12406600T	845	550		500		4 x 150	4 x 400	3 x 185	755	400	650		
12407200T	995	550		550		4 x 185	4 x 150	4 x 185	865	500	700		

\* These fuses are fast acting.

\*\* These ratings are for 2 kHz switching frequency. For ratings at 3 kHz switching frequency refer to the power and current ratings in the *F600 User Guide*.

## STEP 5: Remove the finger guard breakouts

### Removing the finger-guard break-outs



## STEP 6: Wire the drive up

This step covers connection of input power connection L1,L2, and L3 including the ground terminals, motor phases U V W and the control terminals.

The tools required for this are terminal screwdriver, flat screwdriver, M7, M8, M10 and M17 sockets T20 and T25 driver. When wiring the drive's power, ground and control connections, they should be tightened to the recommended torque settings shown in the table below:

**Table 6-1 Drive control and relay terminal data**

Model	Connection type	Torque settings
All	Plug-in terminal block	2.0 Nm (17.7 lb in)
12		0.5 Nm (4.4 lb in)

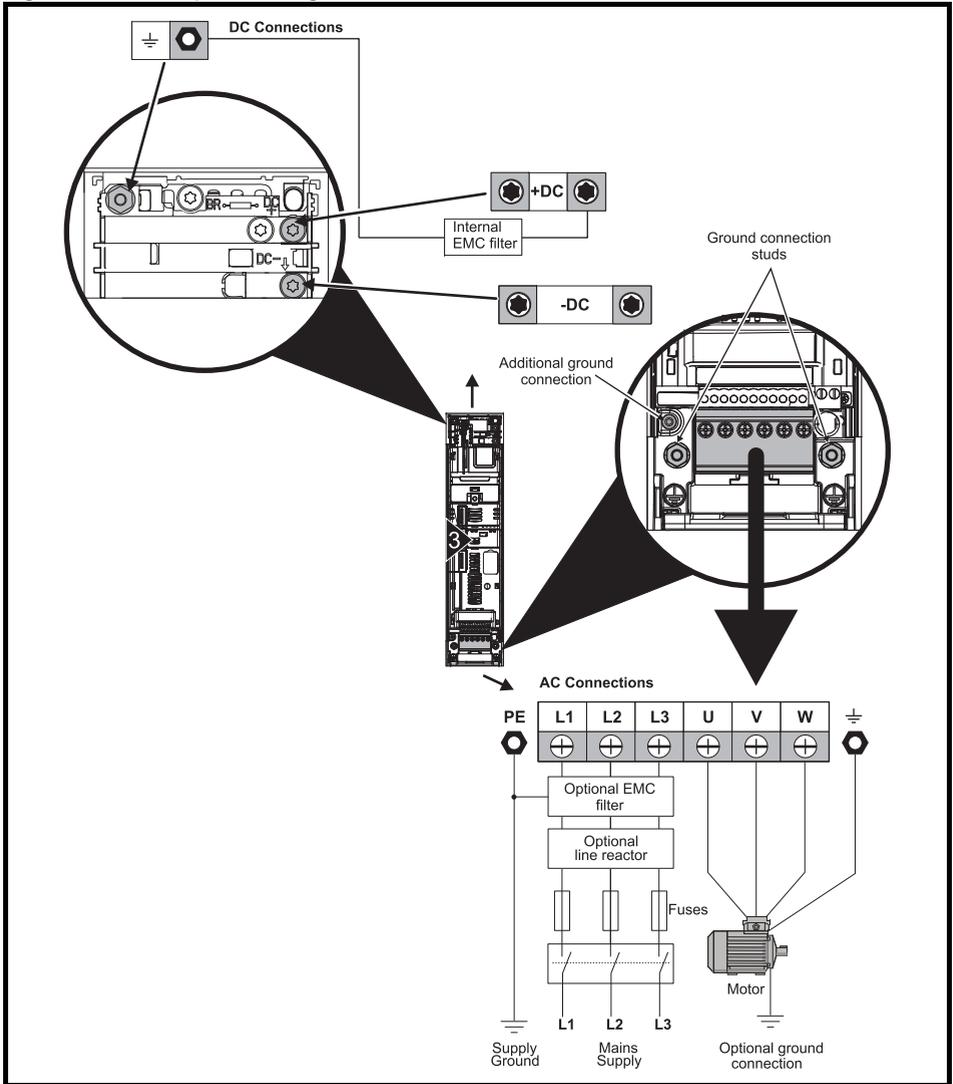
**Table 6-2 Drive power terminal data**

Model size	AC and motor terminals		DC terminal		Ground terminal	
	Recommended	Maximum	Recommended	Maximum	Recommended	Maximum
3 and 4	Plug-in terminal block		T20 Torx (M4)		T20 Torx (M4) / M4 Nut (7 mm AF)	
	0.7 Nm (4.4 lb in)	0.8 Nm (7.1 lb in)	2.0 Nm (17.7 lb in)	2.5 Nm (22.1 lb in)	2.0 Nm (17.7 lb in)	2.5 Nm (22.1 lb in)
5	Plug-in terminal block		T20 Torx (M4) / M4 Nut (7 mm AF)		M5 Nut (8 mm AF)	
	1.5 Nm (13.3 lb in)	1.8 Nm (15.9 lb in)	1.5 Nm (13.3 lb in)	2.5 Nm (22.1 lb in)	2.0 Nm (17.7 lb in)	5.0 Nm (44.3 lb in)
6	M6 Nut (10 mm AF)		M6 Nut (10 mm AF)		M6 Nut (10 mm AF)	
	6.0 Nm (53.1 lb in)	8.0 Nm (70.8 lb in)	6.0 Nm (53.1 lb in)	8.0 Nm (70.8 lb in)	6.0 Nm (53.1 lb in)	8.0 Nm (70.8 lb in)
7	M8 Nut (13 mm AF)		M8 Nut (13 mm AF)		M8 Nut (13 mm AF)	
	12 Nm (106.2 lb in)	14 Nm (123.9 lb ft)	12 Nm (106.2 lb in)	14 Nm (123.9 lb ft)	12 Nm (106.2 lb in)	14 Nm (123.9 lb ft)
8 to 11	M10 Nut (17 mm AF)		M10 Nut (17 mm AF)		M10 Nut (17 mm AF)	
	15 Nm (132.8 lb in)	20 Nm (177 lb in)	15 Nm (132.8 lb in)	20 Nm (177 lb in)	15 Nm (132.8 lb in)	20 Nm (177 lb in)
12	M10 Nut (17 mm AF)		M10 Nut (17 mm AF)		M8 Nut (13 mm AF)	

## Power and Ground connections

Connect the supply and motor connections using the cables and fuses quoted in the table shown in Step 4.

**Figure 6-1 Size 3 power and ground connections**



**Figure 6-2 Size 4 power and ground connections**

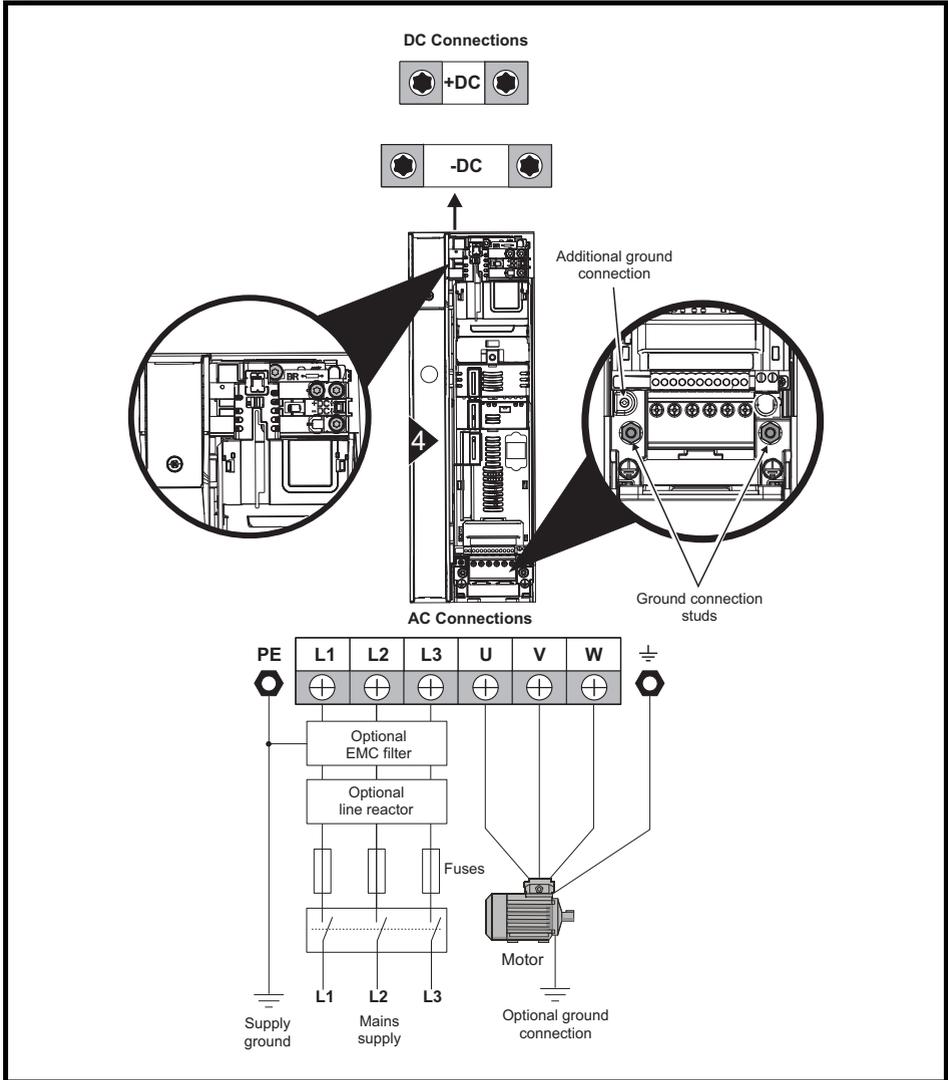
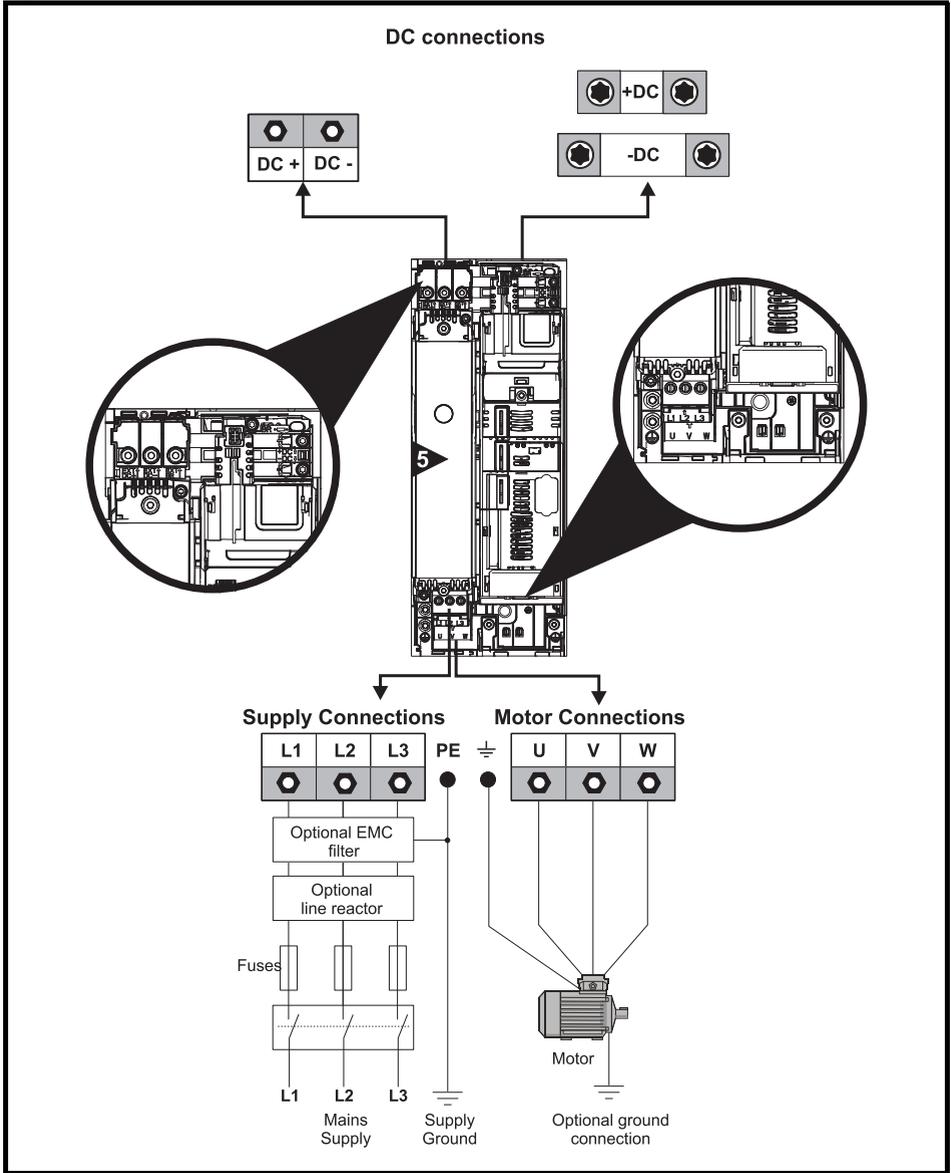


Figure 6-3 Size 5 power and ground connections



**Figure 6-4 Size 6 power and ground connections**

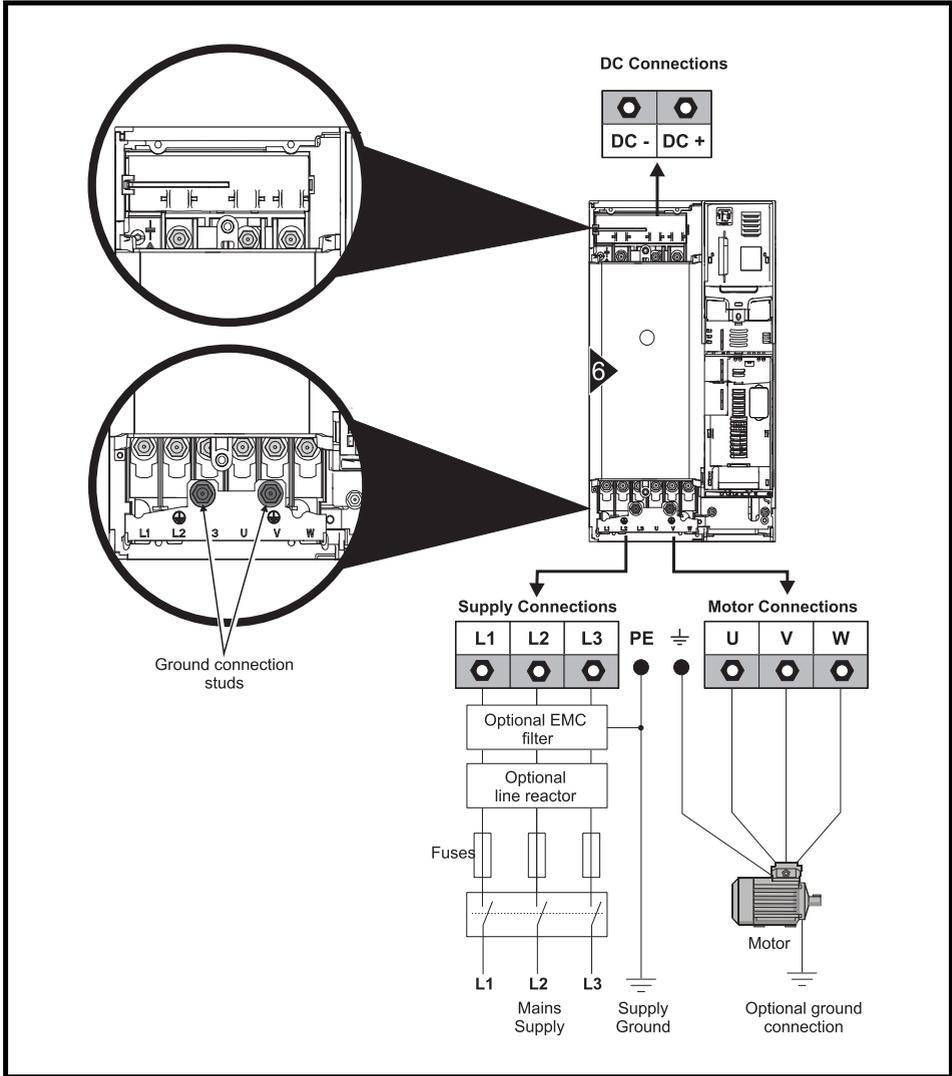
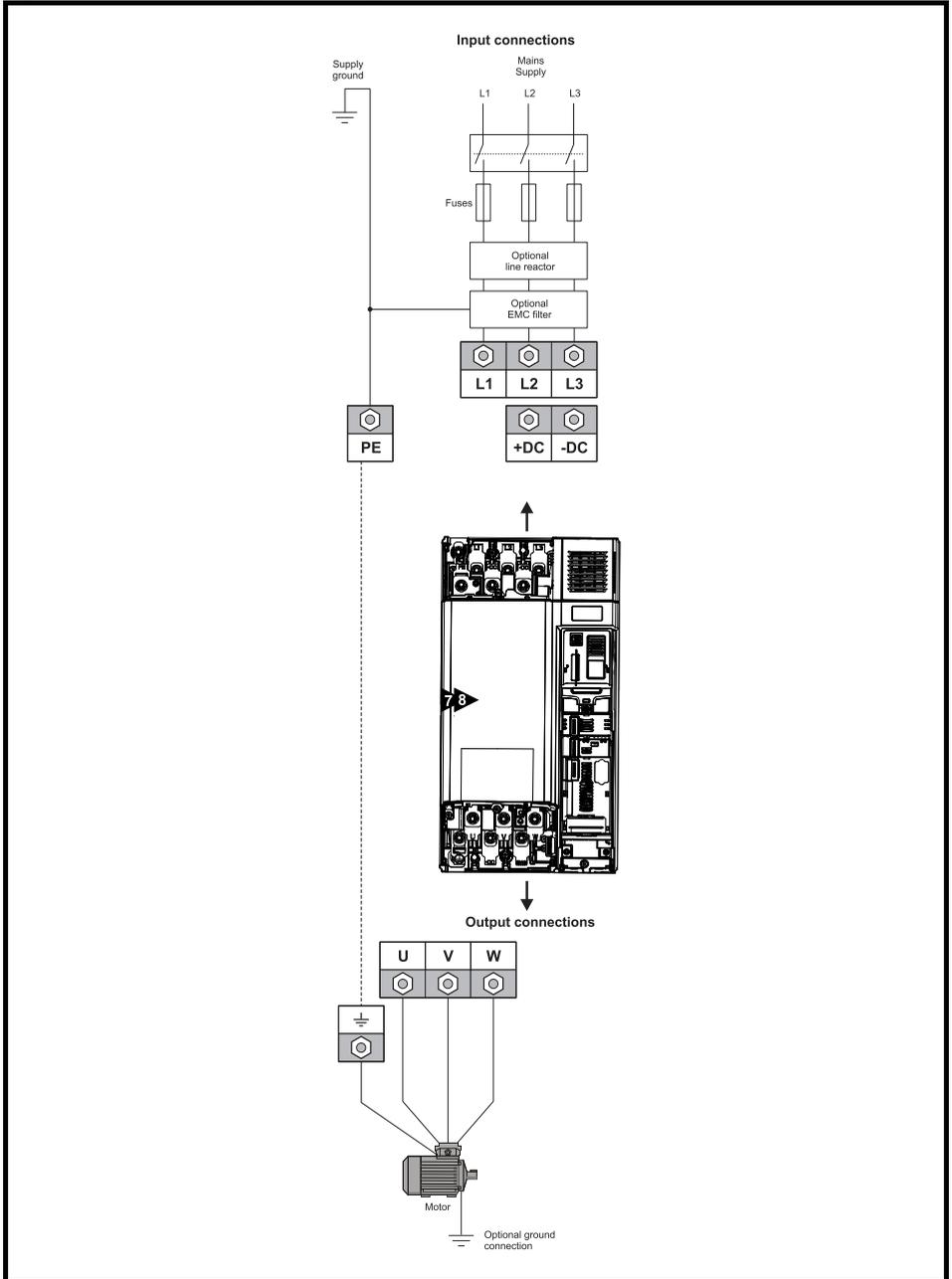
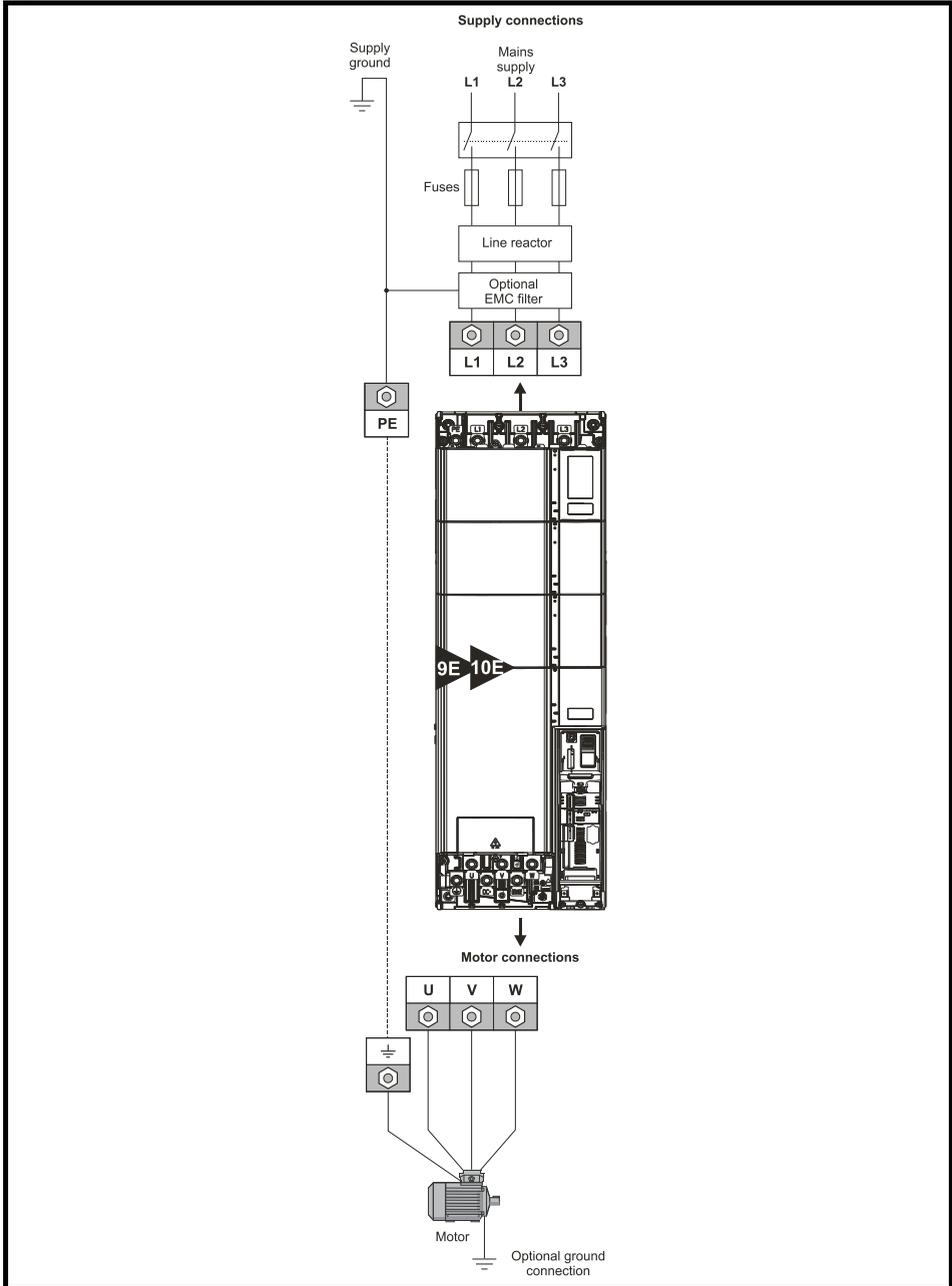


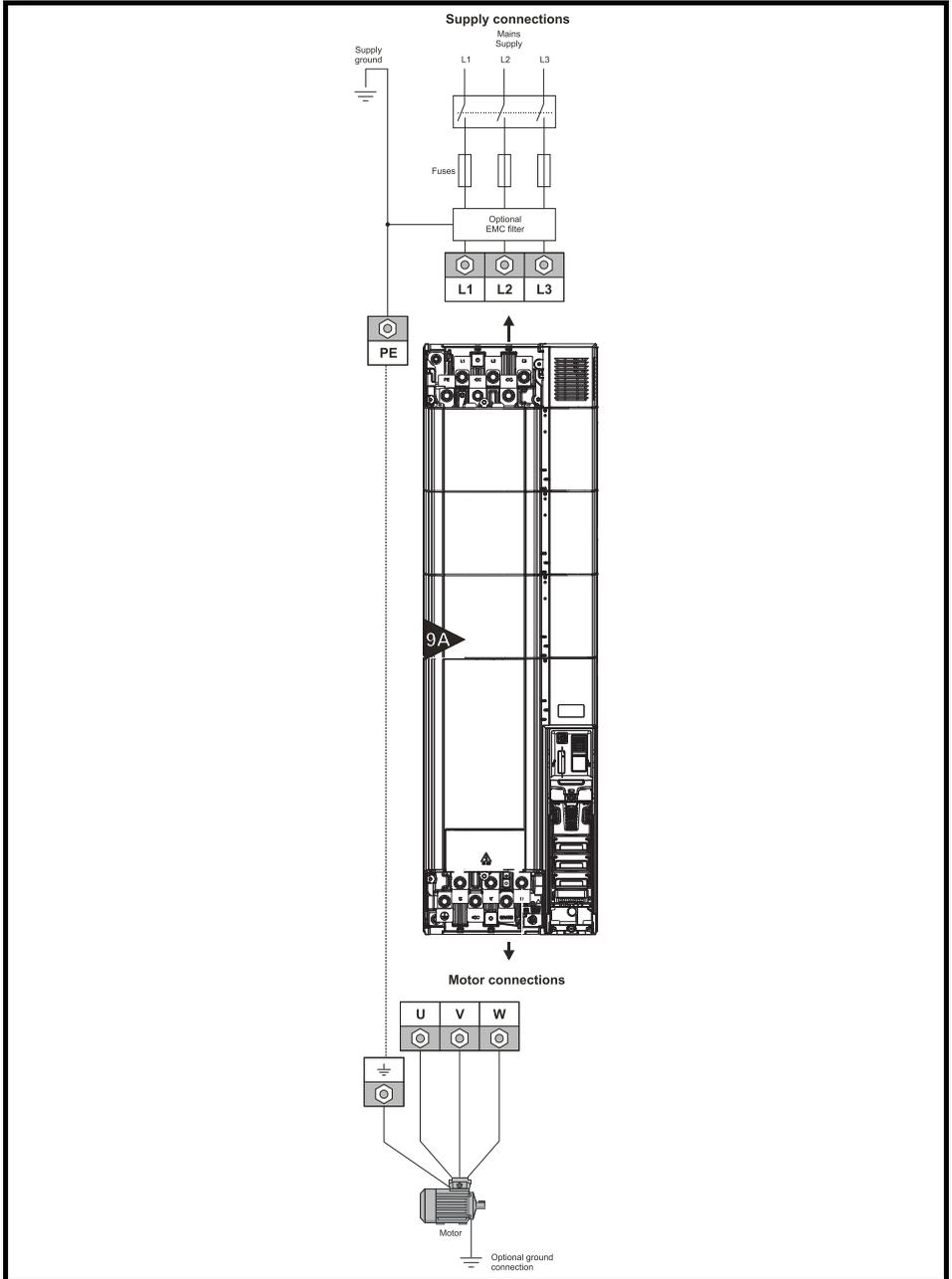
Figure 6-5 Size 7 and 8 power and ground connections (size 7 shown)



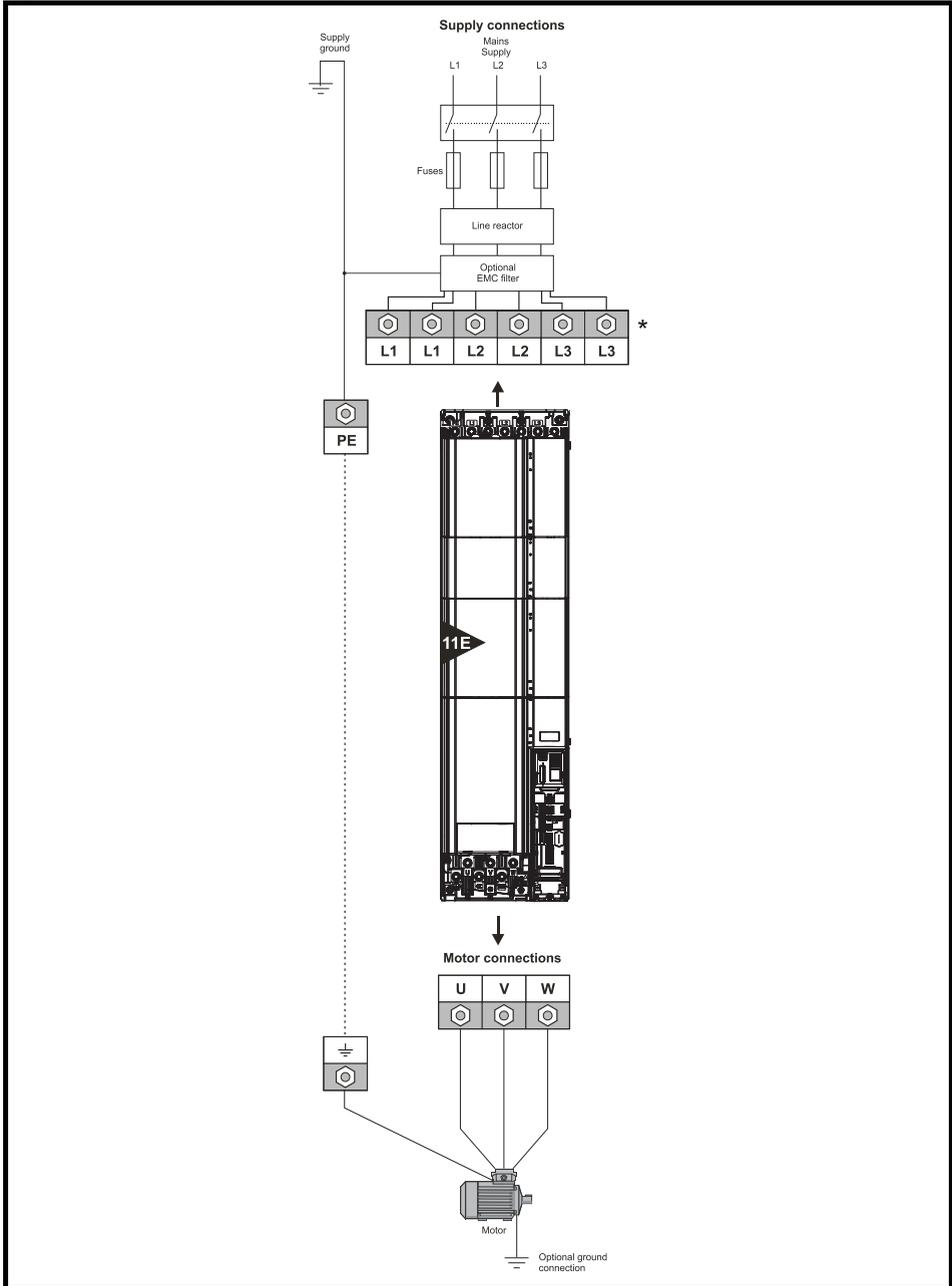
**Figure 6-6 Size 9E, 10E power and ground connections**



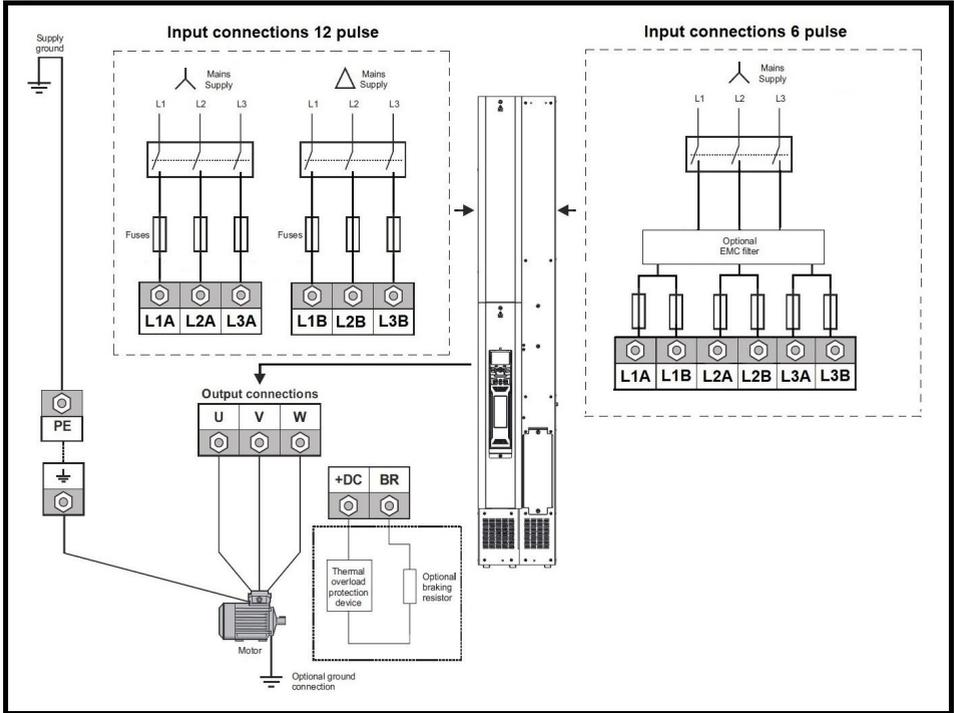
**Figure 6-7 Size 9A power and ground connections**



**Figure 6-8 Size 11E power and ground connections**



**Figure 6-9 Power Module Frame 12 power connections**



**Electrochemical corrosion of grounding terminals**

Ensure that grounding terminals are protected against corrosion i.e. as could be caused by condensation.

The drive must be connected to the system ground of the AC supply. The ground wiring must conform to local regulations and codes of practice.



The ground loop impedance must conform to the requirements of local safety regulations. The drive must be grounded by a connection capable of carrying the prospective fault current until the protective device (fuse, etc.) disconnects the AC supply. The ground connections must be inspected and tested at appropriate intervals.

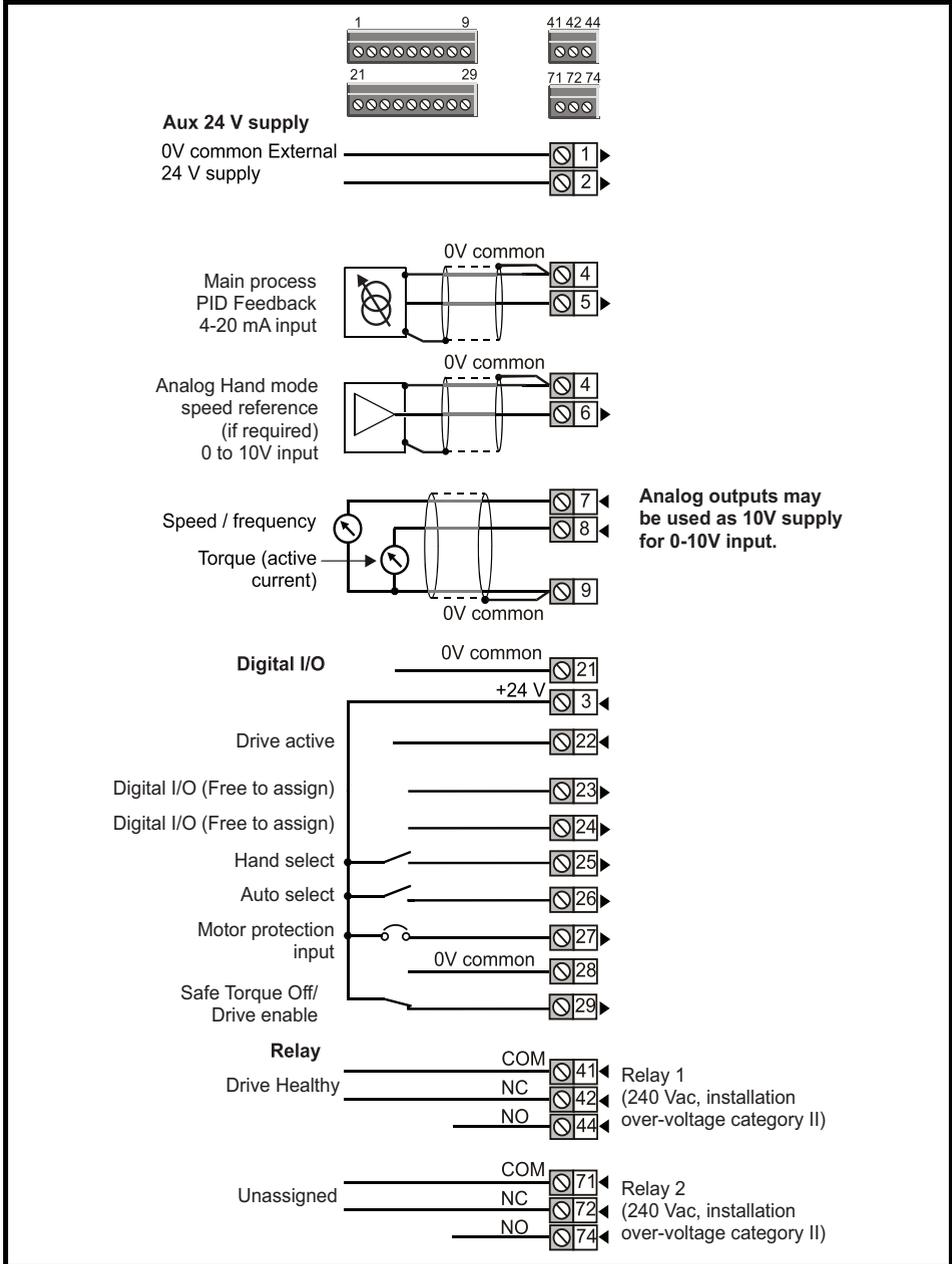
**Table 6-3 Protective ground cable ratings**

Input phase conductor size	Minimum ground conductor size
≤ 10 mm <sup>2</sup>	Either 10 mm <sup>2</sup> or two conductors of the same cross-sectional area as the input phase conductor
> 10 mm <sup>2</sup> and ≤ 16 mm <sup>2</sup>	The same cross-sectional area as the input phase conductor
> 16 mm <sup>2</sup> and ≤ 35 mm <sup>2</sup>	16 mm <sup>2</sup>
> 35 mm <sup>2</sup>	Half of the cross-sectional area of the input phase conductor

## Control connections

The control terminals are configured by default for the arrangement shown below:

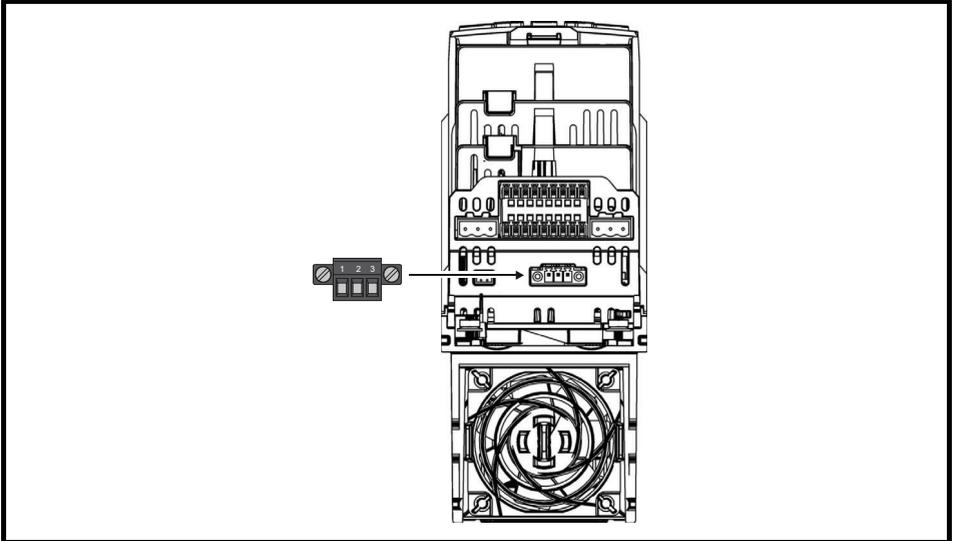
**Figure 6-10 F600 control terminal connections**



## Communications connections

The drive offers a 2 wire EIA-485 serial interface located beneath the control terminals, see Figure 6-11 *Location of the comms connector* below. The drive supports the Modbus RTU protocol as standard. See Table 6-4 for the connection details.

**Figure 6-11** Location of the comms connector



**Table 6-4** Serial communication port pin-outs

Pin	Function
1	RX TX
2	Isolated 0V
3	RX\ TX\

### EIA-485 Serial communications

The serial communications port is a 3 way screw type connector, which is isolated from the power stage and the other control terminals. The communications port applies a 2 unit load to the communications network.

#### USB/EIA-232 to EIA-485 Communications

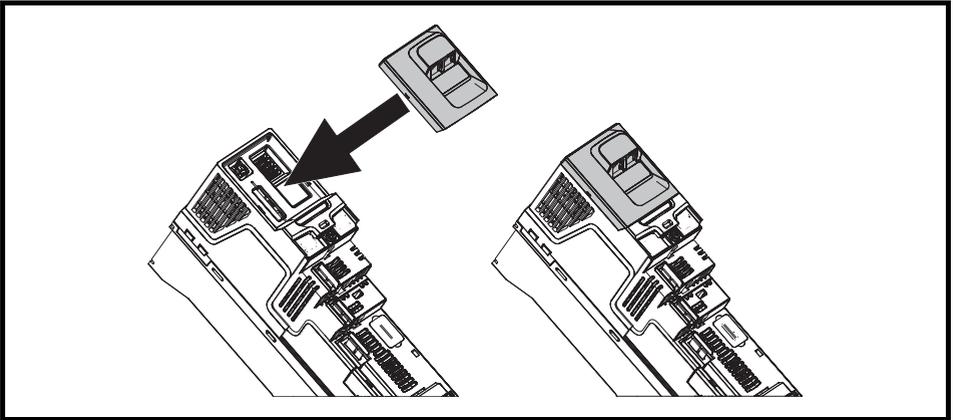
An external USB/EIA-232 hardware interface such as a PC cannot be used directly with the 2-wire EIA-485 interface of the drive.

To gain access to the drive parameters (including connection to Connect), a KI-485 Adaptor should be installed as shown in Figure 4-15 and used in conjunction with a suitable USB to EIA-485 isolated converter. A suitable isolated converter is available from Control Techniques:

- CT USB Comms Cable (CT part number: 4500-0096).

A KI-485 Adaptor is also required for remote LCD keypad operation. The communications cable between the KI-485 Adaptor and keypad is wired one to one. The maximum cable length is 100 m when conductors of 0.129 mm<sup>2</sup> (AWG 26) or larger are used and the cable shield should be connected to the grounded panel / cubicle at the keypad end of the cable.

**Figure 6-12 KI-485 Adaptor Installation**



To install, align the KI-485 Adaptor and press gently in the direction shown until it clicks into position. To remove, reverse the installation instructions.

**NOTE** IEC cable sizes assume Copper conductor, PVC insulation, Installation method B2 and ambient temperature of 40 °C (104 °F). UL cable sizes assume Copper conductor with insulation rated at 75 °C (167 °F).

When using the Control Techniques converters or any other suitable converter with the drive, it is recommended that no terminating resistors be connected on the network. It may be necessary to disconnect the terminating resistor within the converter depending on which type is used.

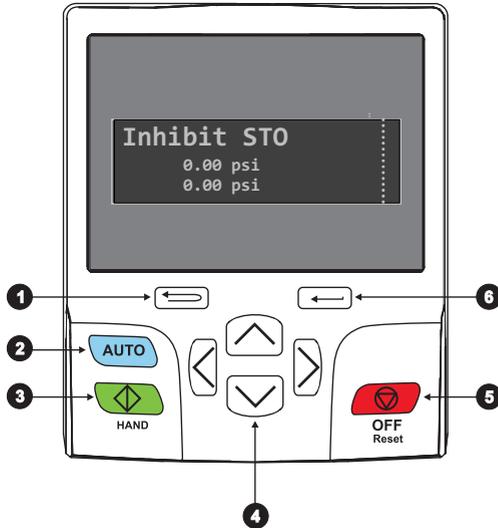
## STEP 7: Use the keypad

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

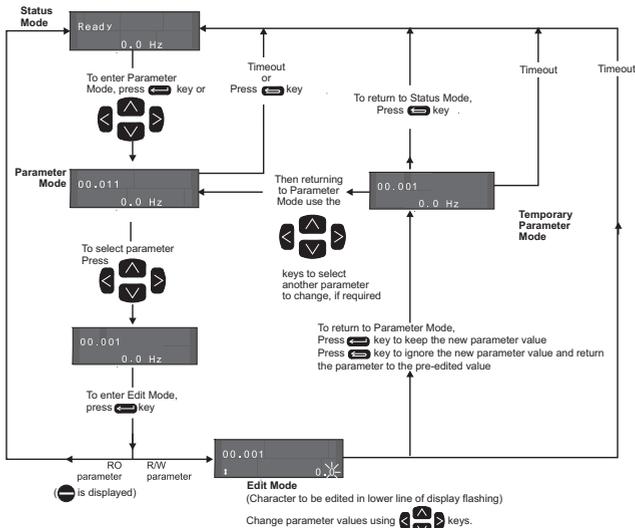
### Keypad key identifier

1. Escape button
2. Auto
3. Hand
4. Navigation keys (x4)
5. OFF/ Reset
6. Enter button

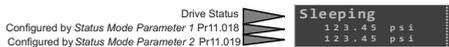
Press and hold the Hand or Auto buttons for 2 s to select those functions. A short press will activate the Off function.



### Instructions to edit parameters



The default status display shows the drive status, the Pump software status and the motor Frequency or Speed.



The default status display will be automatically shown after 4 minutes if no buttons are pressed, or to show it quickly press the escape button, .

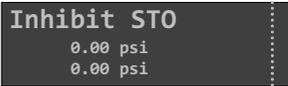
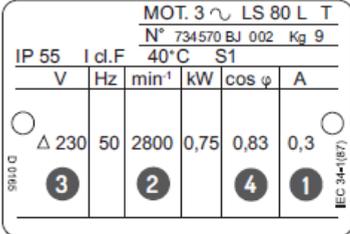
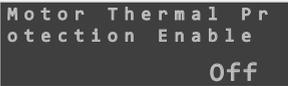
## STEP 8: Run the drive for the first time in Hand mode

Step 8 and 9 cover basic fixed pressure pump setup. There is a comprehensive guided set-up wizard included in the Connect PC software package which covers pump system set-up.

Hand mode is where the drive runs from a fixed frequency or speed reference where the process PID loop is disabled. The user can modify the hand mode frequency or speed as detailed in the following steps.

Before starting, it is important to identify the type of motor used in the application. If the type of motor isn't known, please contact the motor manufacturer to find out if it is an induction or permanent-magnet motor.

### Run an Induction motor in open-loop (OL) control

Action	Detail
Before power up.	Open the Enable or Safe Torque Off, Hand and Auto mode switches so the drive powers up in the <i>Inhibit</i> state. Make sure that no items are preventing the application motor from turning e.g. a seized pump.
Power up the drive.	After power up the display indicates as shown below. 
Select "Induction" motor.	Set Motor Type Pr <b>0.004</b> to <i>Induction</i> and press the red OFF / Reset button to change the mode. This selects open-loop (OL) control for an induction motor.  If "Induction" is already shown, then skip this step.
Configure the motor name plate details.	<ul style="list-style-type: none"> <li>Set <i>Rated Current</i> Pr <b>00.006</b> to the motor rated current in Amps.</li> <li>Set <i>Rated Speed</i> Pr <b>00.007</b>, the motor rated speed in rpm.</li> <li>Set <i>Rated Voltage</i> Pr <b>00.008</b>, the motor rated voltage in Volts.</li> <li>Set <i>Rated Power Factor</i> Pr <b>00.009</b>, the motor rated power factor, (cos phi or cos <math>\phi</math>).</li> </ul> 
Configure motor thermal protection.	If a normally closed motor thermal protection switch has been connected, (contacts closed = temperature OK, contacts open = temperature fault), set <i>Motor Thermal Protection Enable</i> Pr <b>00.017</b> to On. Otherwise leave Pr <b>00.017</b> set to Off. 

Set the Maximum Reference Clamp.	<p>By default, <i>Maximum Reference Clamp Pr 00.022</i> normally matches <i>Rated Frequency Pr 00.005</i></p> <div data-bbox="269 145 561 228" style="background-color: #333; color: #fff; padding: 5px; text-align: center;">       Maximum Reference Clamp  50.0Hz     </div> <p>It may be required when running to reduce this value if pump cavitation is suspected during operation.</p>
Set the Hand Mode Reference frequency.	<p>Set <i>Hand Mode Reference Pr 00.026</i> to configure the frequency reference used in Hand mode. By default, this is half of the motor rated frequency</p> <div data-bbox="269 339 561 422" style="background-color: #333; color: #fff; padding: 5px; text-align: center;">       Hand Mode Reference  25.0Hz     </div>
Enable the drive.	<p>Close the Enable or Safe Torque Off input switch to the drive. The pump software status changes to <i>Off (Ready)</i>.</p> <div data-bbox="269 491 561 574" style="background-color: #333; color: #fff; padding: 5px;">       Off (Ready) 0.00 psi 0.00 psi     </div>
Start the motor in Hand mode.	<p>Make sure it is safe to run the motor. Press and hold the green Hand button for 2 s or close the Hand switch. The motor will turn at the Hand mode speed reference and the pump software status changes to <i>Hand Run</i>.</p> <div data-bbox="269 667 561 750" style="background-color: #333; color: #fff; padding: 5px;">       Hand Run 0.00 psi 0.00 psi     </div> <div data-bbox="624 715 804 750" style="display: inline-block; text-align: center;">       HAND  </div> <p>If the application requires more starting torque to get the motor turning, e.g. a waste water pump, increase <i>Low Frequency Voltage Boost Pr 00.011</i>, in 1 % steps. If 5 % is reached and the motor still does not turn, stop the Motor by pressing the red OFF / Reset button or by opening the Hand switch. The pump software status changes to <i>Off (Ready)</i>.</p> <div data-bbox="269 855 561 938" style="background-color: #333; color: #fff; padding: 5px;">       Off (Ready) 0.00 psi 0.00 psi     </div> <div data-bbox="624 895 785 938" style="display: inline-block; text-align: center;">       OFF Reset  </div> <p>When safe to do so, check the application for physical items that may be preventing the motor from rotating.</p>

<p>Check the motor is turning in the correct direction.</p>	<p>All pumps have a direction to turn in for their main operation. Use the manufacturer's data or labels on the apparatus and compare to the direction of rotation of the cooling fan or motor output shaft. <i>Hand Mode Reference</i> Pr <b>00.026</b> may need to be lowered to see the direction.</p> <div style="background-color: #333; color: white; padding: 5px; text-align: center;"> <p>Hand Mode Reference</p> <p style="font-size: 1.2em;">25.0Hz</p> </div> <p>If the motor appears to be running in the wrong direction, reverse two motor phases electrically when safe to do so. Alternatively, set <i>Reverse Output Phase Sequence</i> Pr <b>00.018</b> to On to do this in software, and Set Pr <b>00.000</b> to <i>Save Parameters</i> and press the red OFF / Reset button.</p> <div style="background-color: #333; color: white; padding: 5px; text-align: center;"> <p>Reverse Output Phase Sequence</p> <p style="font-size: 1.2em;">On</p> </div> <div style="background-color: #333; color: white; padding: 5px; text-align: center;"> <p>Parameter mm.000</p> <p style="font-size: 1.2em;">Save parameters</p> </div> <div style="display: flex; align-items: center; justify-content: center; margin-top: 10px;"> <div style="text-align: center;"> <p>OFF Reset</p> </div>  </div>
<p>Stop the motor.</p>	<p>Stop the motor by pressing the red OFF / Reset button or by opening the Hand switch. The pump software status in changes to <i>Off (Ready)</i>.</p> <div style="background-color: #333; color: white; padding: 5px; text-align: center;"> <p>Off (Ready)</p> <p style="font-size: 0.8em;">0.00 psi 0.00 psi</p> </div> <div style="display: flex; align-items: center; justify-content: center; margin-top: 10px;"> <div style="text-align: center;"> <p>OFF Reset</p> </div>  </div>

### Run a Permanent-magnet motor in closed-loop sensorless (RFC-S)

Action	Detail
Before power up.	<p>Ensure:</p> <ul style="list-style-type: none"> <li>• The drive enable signal is not given (terminal 29).</li> <li>• The Run signal is not given</li> <li>• Motor is connected</li> </ul>
Power-up the drive	<p>If RFC-S mode is displayed when the drive is powered up:</p> <ul style="list-style-type: none"> <li>• If the frequency of the mains supply is 60 Hz, set Pr <b>00.000</b> = 1244, otherwise if the frequency of the mains is 50 Hz, set Pr <b>00.000</b> = 1233.</li> </ul> <p>If Open Loop or RFC-A mode is displayed when the drive is powered up:</p> <ul style="list-style-type: none"> <li>• Set Pr <b>00.048</b> = RFC-S (3)</li> <li>• If the frequency of the mains supply is 60 Hz, set Pr <b>00.000</b> = 1254, otherwise if the frequency of the mains is 50 Hz, Pr <b>00.000</b> = 1253.</li> </ul> <p>Press the red Reset button or toggle the Reset logic input.</p> <p>These actions will leave the drive in RFC-S mode with defaulted parameters. The drive will be in a tripped state, but the associated trips are addressed by settings within this procedure.</p>
Advanced menu access from the keypad	<p>To access all menus required for commissioning Pr <b>00.001</b> = All Menus (1).</p> <p>Reminder: Select the menus using the left and right arrows. The parameters are selected using the up and down arrows.</p>
Motor thermistor setup.	<p>The motor PTC thermistor must be connected to the drive, using analogue input 2 (terminals 4 and 6).</p> <p>For the drive to manage the thermistor:</p> <ul style="list-style-type: none"> <li>• Set <i>Analogue Input 2 Mode</i> (Pr <b>07.011</b>) = Therm Short Cct (7).</li> <li>• Set <i>Analogue Input 2 Destination</i> (Pr <b>07.014</b>) = 0.000</li> </ul> <p>If two analogue inputs are required, then it may be necessary to fit an SI-I/O module.</p>

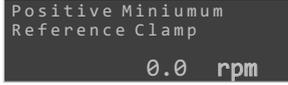
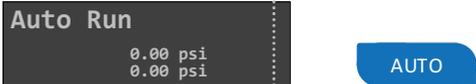
Enter motor nameplate details.	<p>Refer to the Dyneo+ motor tables located in the Appendix.</p> <p>Select the table corresponding to the motor speed range (1500 or 3000 rpm). Then depending on the motor type and its power, select the line that corresponds to the voltage, the supply frequency and the rated speed of the application. From this line, set in the drive the values of all the parameters listed in the table.</p> <p><b>NOTE</b></p> <p><b>If the motor type does not appear in the table, then it is from the Compact range. In this case, please contact Control Techniques Technical Support.</b></p> <p>Example: For the 1500 range motor, LSHRM 160MR1 – 11 kW 400 V – 50 Hz with a rated speed of 1500 rpm, parameter values to set in the drive is shown on fist line detail indicated in the table in Appendix C.</p> <p><b>NOTE</b></p> <p>When setting Pr <b>05.069</b>, it may be necessary to increase the value entered, to ensure that the actual trip level displayed in Pr <b>05.068</b> is close to (but not greater than) the required value.</p>
Set maximum speed.	Set the maximum speed in Pr <b>01.006</b> .
Set acceleration and deceleration rates.	<p>Set:</p> <ul style="list-style-type: none"> <li>• Acceleration rate in Pr <b>02.011</b> (s up to Pr <b>01.006</b>) - A value of 20 s suits most applications.</li> <li>• Deceleration rate in Pr <b>02.021</b> (s up to Pr <b>01.006</b>) - A value of 20 s suits most applications.</li> </ul> <p>If a braking resistor is installed, set Pr <b>02.004</b> = Fast (0). Also ensure Pr <b>10.030</b> and Pr <b>10.031</b> and Pr <b>10.061</b> are set correctly, otherwise premature 'Brake R Too Hot' trips may be seen.</p>
Additional settings.	<p>Set:</p> <ul style="list-style-type: none"> <li>• Current Reference Filter 1 Time Constant (Pr <b>04.012</b>) = 2 ms</li> <li>• Thermal Protection Mode (Pr <b>04.016</b>) = Disabled (4)</li> <li>• Maximum Switching Frequency (Pr <b>05.018</b>) = 3 kHz (1)</li> <li>• Flux Control Gain (Pr <b>05.027</b>) = 0.1</li> <li>• Minimum Switching Frequency (Pr <b>05.038</b>) = 3 kHz (1)</li> <li>• Voltage Headroom (Pr <b>05.041</b>) = 5 % [Do not set a lower value. Increase this value to 10 %, if the motor is unstable in the field weakening area]</li> <li>• RFC Low Speed Mode (Pr <b>05.064</b>) = Injection (0)</li> <li>• Saliency Torque Control Select (Pr <b>05.065</b>) = Auto [Ensure that Pr <b>05.066</b> = High, otherwise check the value entered for Pr <b>05.087</b> from the table]</li> <li>• Inverted Saturation Characteristic (Pr <b>05.070</b>) = On (1)</li> <li>• Low Speed Sensorless Mode Current Limit (Pr <b>05.071</b>) = 60 % [Note: This forces a reduced current limit between zero speed and 20 % of motor rated speed]</li> </ul> <p>If the load is a high inertia, Pr <b>03.010</b> may need to be increased.</p>
Save parameters.	Select 'Save Parameters' in Pr mm.000 and press the red reset button or toggle the reset digital input.

## STEP 9: Running the drive in Auto mode

This section gives guidance on how to get running in Auto mode assuming the most common application, a single pump application running with closed process PID loop to control pressure. For alternative setups see the *F600 User Guide*.

It is assumed that the process feedback device is a 4-20 mA transducer which has been connected to terminal 4 and 5 during Step 7 – Wire the drive control connections up.

Action	Detail
Setup the process PID control feedback scaling.	<p>Setup the <i>PID Minimum Scaling</i> Pr <b>00.030</b> and <i>PID Maximum Scaling</i> in Pr <b>00.031</b>. By default, the feedback is configured in psi.</p> <div style="display: flex; justify-content: space-around;"> <div style="border: 1px solid black; padding: 5px; width: 45%;"> <p>PID Feedback Min Scaling</p> <p style="text-align: center; font-size: 1.2em;">35.00 psi</p> </div> <div style="border: 1px solid black; padding: 5px; width: 45%;"> <p>PID Feedback Max Scaling</p> <p style="text-align: center; font-size: 1.2em;">350.0 psi</p> </div> </div> <p>Note that all setpoints and feedback related parameters will use this scaling. The units of the feedback and setpoint may be scaled into any unit type.</p>
Test the feedback device.	<p>Make sure it is safe to run the motor. Press and hold the green Hand button for 2 s or close the Hand switch. The motor will turn at the Hand mode speed reference and the pump software status changes to <i>Hand Run</i>.</p> <div style="display: flex; align-items: center;"> <div style="border: 1px solid black; padding: 5px; width: 45%;"> <p>Hand Run</p> <p style="text-align: center;">0.00 psi 0.00 psi</p> </div> <div style="margin-left: 20px;"> <p>HAND </p> </div> </div> <p>Observe the <i>PID1 Feedback</i> Pr <b>00.067</b> and vary the Hand Mode Reference Pr <b>00.026</b>. The <i>PID1 Feedback</i> Pr <b>00.067</b> should increase with an increase in <i>Hand Mode Reference</i> Pr <b>00.026</b>.</p> <div style="border: 1px solid black; padding: 5px; width: 45%; margin-left: 20px;"> <p>PID1 Feedback</p> <p style="text-align: center; font-size: 1.2em;">43.21 %</p> </div> <p>If the feedback does not respond in proportion to the speed e.g. remains at 0. Please check the configuration of the feedback device and wiring.</p>
Find the frequency or speed where flow starts.	<p>Observe the output of the application. Increase the <i>Hand Mode Reference</i> Pr <b>00.026</b> and note the value when output flow is detected.</p> <div style="border: 1px solid black; padding: 5px; width: 45%; margin-left: 20px;"> <p>Hand Mode Reference</p> <p style="text-align: center; font-size: 1.2em;">25.0Hz</p> </div> <p>The resulting value should be entered as the <i>Positive Minimum Reference Clamp</i> Pr <b>00.023</b>.</p> <div style="border: 1px solid black; padding: 5px; width: 45%; margin-left: 20px;"> <p>Positive Minimum Reference Clamp</p> <p style="text-align: center; font-size: 1.2em;">0.0 rpm</p> </div>
Stop the motor.	<p>Stop the Motor by pressing the red OFF / Reset button or by opening the Hand switch. The pump software status changes to <i>Off (Ready)</i>.</p> <div style="display: flex; align-items: center;"> <div style="border: 1px solid black; padding: 5px; width: 45%;"> <p>Off (Ready)</p> <p style="text-align: center;">0.00 psi 0.00 psi</p> </div> <div style="margin-left: 20px;"> <p>OFF </p> <p>Reset</p> </div> </div>
Set the process PID setpoint.	<p>Set process <i>PID Setpoint 0</i> Pr <b>00.029</b> to the value required by the system design.</p> <div style="border: 1px solid black; padding: 5px; width: 45%; margin-left: 20px;"> <p>PID Setpoint 0</p> <p style="text-align: center; font-size: 1.2em;">50.00 psi</p> </div>

<p>Set the wake threshold.</p>	<p>The wake threshold determines the feedback value, below which, the drive will start operating and the minimum working feedback level, e.g. if the setpoint pressure is 50.00 psi and the wake threshold is 40.00 psi the drive try to maintain its output between these values. Set the <i>Wake Detection Feedback Threshold</i> Pr <b>00.040</b>.</p> 
<p>Set the sleep threshold.</p>	<p>The sleep threshold determines the frequency or speed below which the drive will stop during normal operation. Set the Sleep Detect Speed Threshold Pr <b>00.042</b> to a value in the order of 1 % to 5 % of motor rated frequency or speed above the <i>Positive Minimum Reference Clamp</i> Pr <b>00.023</b> value.</p>  <p>Setting the sleep threshold less than the <i>Positive Minimum Reference Clamp</i> Pr <b>00.023</b> value disables the sleep threshold.</p>
<p>Run in Auto mode.</p>	<p>When it is safe to do so, run the system in Auto mode. To do this, press and hold the blue Auto button for 2 s or close the Auto switch. The display will change to <i>Auto Run</i>.</p>  <p>The application motor should run at a speed that controls the system output at the process <i>PID Setpoint 0</i> Pr <b>00.029</b>. If the system remains in the sleeping state, the <i>process PID Final Feedback</i> Pr <b>00.075</b> has not fallen below the <i>Wake Detection Feedback Threshold</i> Pr <b>00.040</b>.</p>  <p>Move to the next step when the drive is running in Auto mode.</p>
<p>Verify the sleep threshold.</p>	<p>If the application has a discharge valve, slowly close it and make sure that the drive enters the <i>Sleeping</i> state. If the sleeping state is not entered with a fully closed discharge valve, note the frequency or speed while in this condition, and increase the <i>Sleep Detect Speed Threshold</i> Pr <b>00.042</b> to 1 % to 5 % above the noted value.</p> 
<p>Stop the motor when finished.</p>	<p>Stop the Motor by pressing the red OFF / Reset button for or by opening the Hand switch. The pump software status changes to <i>Off (Ready)</i>.</p> 

Save the drive parameters.	<p>Set Pr <b>00.000</b> to “Save Parameters” and press the red OFF / Reset button.</p> 
Choose the operating mode and additional features.	<p>Set <i>Pump Control Mode</i> Pr <b>00.021</b> to match the system. The options available are Single Pump, Cascade and Multi-leader.</p>  <p>Configure the Pump system features required. See the user guide functional description section or the Basic Features section for more details on the on the control modes and features available.</p>

## Drive Operating modes

### Open-loop (OL) mode

The drive operating mode is set using Pr **00.004**, by selecting either “Induction” or “Permanent-magnet” and pressing the red OFF / Reset button.

Selecting “Induction” sets the drive into Open-loop (OL) mode and selecting “Permanent-magnet” sets the drive into RFC-S sensorless mode, which are the most common operating modes used.

The drive supports the following operating modes:

#### Open-loop (OL) mode for use with an induction motor

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.

#### RFC-A mode for use with an induction motor with feedback device

The drive directly controls the speed of the motor using the feedback device. The motor flux is accurately controlled to provide full torque down to zero speed.

#### Synchronous permanent magnet brushless motor without feedback (RFC-S sensorless mode)

Flux control is not required because the motor is self-excited by the permanent magnets which form part of the rotor. Full torque is available down to zero speed, with salient motors. Position information from the sensorless algorithm is used to ensure the output voltage is matched to the back EMF of the motor.

#### Synchronous permanent magnet brushless motor with feedback device (RFC-S feedback mode)

The drive directly controls the speed of the motor using the feedback device. Flux control is not required because the motor is self-excited by the permanent magnets which form part of the rotor. Position information is required from the feedback device to ensure the output voltage is accurately matched to the back EMF of the motor. Full torque is available down to zero speed.

## Pump software operation

Menu 0 is arranged so that:

Pr 00.001 – Menu Access Level

Pr 00.002 – Parameter Cloning

Pr 00.004 – Pr 00.020 - Motor set-up

Pr 00.021 – Pr 00.039 – Control & PID Config

Pr 00.040 – Pr 00.063 – Pump Functions

Pr 00.064 – Pr 00.065 – PID Gains

Pr 00.066 – Pr 00.076 – Monitoring

Pr 00.077 – Pr 00.080 – Diagnostics

## Basic Features

This section details some of the basic features available in Menu 0 for the F600 to assist with a Pump application. For a complete feature list please see the *F600 User Guide*.

### Auto Reset Attempts

In the event of a drive trip during operation e.g. Dry Well trip, the drive can automatically reset itself a user defined number of times after a delay period. The trip log parameters in Pr **00.078** to Pr **00.080** may be used to see which trip has occurred.

Parameter	Description
Pr 00.044	Number of Auto-reset Attempts.
Pr 00.045	Auto-reset Delay. This is the time in seconds after a trip to action an auto-reset.

### Pipe Filling

In a pump application, when starting the drive in Auto mode but prior to automatic running, the drive may optionally run a fixed reference pipe filling routine. The routine has a time limit, (maximum time), to run which can be superseded by either reaching a PID feedback threshold or if flow is indicated from a hardware flow switch. When the routine completes, the system moves to Auto Run where the PID controls the motor speed.

Parameter	Description
Pr 00.046	Pipe Fill Mode. Disabled (0), pipe filling is disabled. Feedback Level (1), pipe filling is stopped when the main process PID level is reached. Flow Switch (2), pipe filling is stopped when Flow Switch Input Pr <b>29.066</b> = On(1) indicating flow.
Pr 00.047	Pipe Fill Reference. The frequency or speed used while pipe filling.
Pr 00.048	Pipe Fill Maximum Time. The maximum time in seconds that the pipe fill routine will run for. If the feedback level or flow switch indicates liquid in the pipe, the drive switches to auto run.
Pr 00.049	Pipe Fill Threshold. This is the PID feedback level that must be reached to terminate the pipe fill routine and not wait for Pipe Fill Maximum Time Pr <b>00.048</b> to elapse.

### Dry Well / Low load detection

In a pump application, e.g. pumping from a well or tank, the level of liquid being pumped may drop below the level of the pump suction pipe. In this situation the pump should be slowed down or stopped to prevent pump wear. Dry Well Low Load detection automatically checks for this condition and can respond in a user selected way.

Parameter	Description
Pr 00.050	Dry Well Low Load Threshold. This is the load percentage below which a Dry Well condition is detected. This is typically set 10% above the percentage load value seen in Percentage Load Pr <b>00.070</b> when the pump runs dry. Dry well is detected when the load threshold is reached and the drive has reached the maximum reference, as indicated by At Maximum Drive Reference Pr <b>29.084</b> .

Pr 00.051	Dry Well Low Load Delay. The percentage load value in Pr <b>00.070</b> must be less than the Dry Well Low Load Threshold Pr <b>00.050</b> for the Dry Well Low Load Delay in seconds. This filters transient load values.
Pr 00.052	Dry Well Low Load Mode. Disabled (0), Dry Well Low Load detection is not operational. Alarm Only (1), Dry Well Low Load Alarm in Pr <b>29.062</b> = On(1) when a dry well is detected. Trip (2), The drive trips on Dry Well when a dry well low load condition is detected. Lower PID Output (3) the PID Output limit is reduced to the value set in Dry Well Low Load PID Reduction Pr <b>00.053</b> .
Pr 00.053	Dry Well Low Load PID Reduction. This is the PID output limit percentage used when a dry well low load condition is detected and Dry Well Low Load Mode Pr <b>00.052</b> = Lower PID Output (3).
Pr 00.054	Dry Well Low Load Restart Delay. When Dry Well Low Load Mode Pr <b>00.052</b> = Trip (2) and a dry well trip has been actioned, the drive will remain in the Dry Well Stop state for the duration of the Dry Well Low Load Restart Delay, allowing time for the well to fill.

## No Flow

The no flow by software detection scheme is intended to detect when there is no liquid flow due to a closed pump discharge valve e.g. a closed tap. This is intended to be used in a pump system where the main process PID feedback is a pressure transducer and not a flow transducer.

Parameter	Description
Pr 00.055	No Flow Detect Threshold. This is a frequency or speed threshold below which No flow is detected. This must be set higher than the Positive Minimum Reference Clamp Pr <b>00.023</b> or the Sleep Detect Speed Threshold Pr <b>00.042</b> . When a pump discharge valve is closed, the PID output will reduce to maintain pressure. No Flow Detect Threshold must be greater than 0 to enable the feature.
Pr 00.056	No Flow Detection Band. This is a band above and below the No Flow Detect Threshold Pr <b>00.045</b> .
Pr 00.057	No Flow Detect Delay. When the process PID output is in the No flow detection band it must remain there for No Flow Detect Delay to filter intermittent no flow frequency or speed detection.
Pr 00.058	No Flow Setpoint Settling Delay. After the PID output is in the No flow detection band for No Flow Detect Delay seconds, the main process PID setpoint is lowered by a small value defined by No Flow Setpoint Reduction Pr <b>00.059</b> . If after the reduction is applied the PID output is still in the No Flow Detection Band, the system will be stopped due to no flow where the drive will enter the "Sleeping" state.
Pr 00.059	No Flow Setpoint Reduction. This is the amount that the main process PID setpoint will be reduced by in order to test to see if there is liquid flow.

## Over-cycle protection

Over-cycle protection handles when the drive wakes and sleeps too many times in an hour.

Parameter	Description
Pr 00.059	Over-cycle Mode. Disabled (0), over-cycle detection is disabled. Alarm Only (1), Pr <b>29.131</b> indicates when the over-cycle threshold has been reached this hour. Trip (2), the drive trips Over-cycle when the Over-cycle Starts Per Hour Pr <b>00.061</b> is reached. Inc Setpoint (3) the main process PID setpoint is automatically increased to prevent the system from going to Sleep when the over-cycle limit is reached.
Pr 00.060	Over-cycle Starts Per Hour. The Over-cycle Mode Pr <b>00.060</b> is actioned when the number of starts per hour threshold is reached.

## Diagnostics –

The last 3 trips are stored in Pr **00.077** to Pr **00.080**, with Pr **00.077** being the most recent trip.

Refer to the *F600 User guide* for a complete list of trips and their meaning.

## Additional Information

### Restoring drive defaults

The drive can be restored to the original factory settings by following the procedure below:

1. Ensure the drive is not enabled.
2. Select either 50Hz defcs or 60Hz defcs as appropriate in Pr **00.000**.
3. Press the red  reset button.

### Basic parameters range and default

For information on the full list of Menu 0 parameters please refer to the *F600 User Guide*.

Parameter			Range			Default		
	Description		OL	RFC-A	RFC-S	OL	RFC-A	RFC-S
00.001	Menu access level	11.044	Menu 0 (0), All Menus (1), Read only Menu 0 (2), Read only (3), Status Only (4), No Access (5)					
00.002	Parameter cloning	11.042	None (0), Load File 1 (1), Save File 1 (2), Auto (3), Boot (4)			None (0)		
00.003		00.000						
00.004	Motor type	29.157	Induction (0), Permanent magnet (1)			Induction (0)	Permanent-magnet (1)	
00.005	Rated frequency	05.006	0.0 to 599.0 Hz			50 Hz: 50.0 Hz 60 Hz: 60.0 Hz		
00.006	Rated current	05.007	VM_RATED_CURRENT[MIN] to VM_RATED_CURRENT[MAX] A			0.000 A		
00.007	Rated speed	05.008	0 to 35940 rpm	0.00 to 33000.00 rpm		Std: 1500 rpm US: 1800 rpm	1450.00 rpm	Std: 1500 rpm US: 1800 rpm
00.008	Rated voltage	05.009	VM_AC_VOLTAGE_SET[MIN] to VM_AC_VOLTAGE_SET[MAX] V			200V drive: 230 V 400V drive 50Hz: 400 V 400V drive 60Hz: 460 V 575V drive: 575 V 690V drive: 690 V		
00.009 (Not RFC-S)	Rated power factor	05.010	0.000 to 1.000			0.850		
00.010	Number or motor poles	05.011	Automatic (0) to 480 (240) Poles			Automatic (0) Poles		8 (4) Poles
00.011 (Not RFC-S)	Low frequency voltage boost	05.015	0.0 to 25.0 %			1.0 %		
00.012 (OL only)	Low load power saving	05.013	OFF (0) or ON (1)			ON (1)		
00.013 (RFC modes only)	Autotune	05.012		None (0), Basic (1), Improved (2)	None (0) Stationary(1) Full Stationary(5)	None (0)		
00.014 (RFC-S mode only)	RFC low speed mode	05.064	Injection (0), Current (1), Current (2), Current No Test (3), Current Step (4), Current Only (5)			Current (2)		
00.015 (RFC-S mode only)	Low speed sensor-less mode current	05.071		0.0 to 1000.0 %			100.0 %	
00.016	Symmetrical current limit	04.007	VM_MOTOR1_CURRENT_LIMIT[MIN] to VM_MOTOR1_CURRENT_LIMIT[MAX] %			0.0 %		

Parameter			Range			Default		
	Description		OL	RFC-A	RFC-S	OL	RFC-A	RFC-S
00.017	Motor thermal protection enable	29.087	OFF (0) or ON (1)			OFF (0)		
00.018	Reverse output phase sequence	05.042	OFF (0) or ON (1)			OFF (0)		
00.019 (RFC-S mode only)	Sensor-less mode filter	03.079			4 (0), 8 (1), 16 (2), 32 (3), 64 (4) ms			4 (0) ms
00.020		00.000						
00.021	Pump control mode	29.011	Single Pump (0), Cascade (1), Multi leader (2), Basic Mode (3)			Single Pump (0)		
00.022	Maximum reference clamp	01.006	VM_NEGATIVE_REF_CLAMP1[MIN] to VM_NEGATIVE_REF_CLAMP1[MAX]			Std: 50 Hz US: 60 Hz	Std: 1500.0 rpm US: 1800.0 rpm	
00.023	Positive minimum reference clamp	01.004	VM_SPEED_FREQ_REF[MIN] to VM_SPEED_FREQ_REF[MAX]			0.0 Hz	0.0 rpm	
00.024	Control input mode	29.012	Input (0), Input & Keypad (1), Ctrl Wrđ (2), Ctrl Wrđ & Input (3)			Input & Keypad (1)		
00.025	Hand mode reference select	29.016	Digital Speed (0), Analog Speed (1)			Digital Speed (0)		
00.026	Hand mode frequency/ speed reference	01.022	VM_SPEED_FREQ_REF[MIN] to VM_SPEED_FREQ_REF[MAX]			Std:25 Hz US:30 Hz	Std: 750 rpm US: 900 rpm	
00.027	General acceleration rate 1	02.011	VM_ACCEL_RATE[MIN] to VM_ACCEL_RATE[MAX] s			1.0 s	1.000 s	
00.028	General deceleration rate 1	02.021	VM_ACCEL_RATE[MIN] to VM_ACCEL_RATE[MAX] s			1.0 s	1.000 s	
00.029	PID setpoint 0	29.022	0.00 to 327.67 psi			0.00 psi		
00.030	PID feedback min scaling	29.031	0.00 to 327.67 psi			0.00 psi		
00.031	PID feedback max scaling	29.032	0.01 to 327.67 psi			100.00 psi		
00.032	PID feedback filter time constant	29.033	0.00 to 327.67 s			1.00 s		
00.033	PID feedback loss action	29.048	Ignore (0), Trip (1), Fixed Speed (2)			Trip (1)		
00.034	PID feedback high trip threshold	29.041	0.00 to 327.67 psi			0.00 psi		
00.035	PID feedback low delay	29.042	0.0 to 6553.5 s			5.0 s		
00.036	PID feedback low mode	29.043	Disabled (0), Threshold (1), Bandwidth (2)			Disabled (0)		
00.037	PID feedback low threshold	29.044	0.00 to 327.67 psi			2.00 psi		

Parameter			Range			Default		
	Description		OL	RFC-A	RFC-S	OL	RFC-A	RFC-S
00.038		00.000						
00.039		00.000						
00.040	Wake detect feedback threshold	29.049	0.00 to 327.67 psi			1.00 psi		
00.041	Wake detect delay	29.050	0.0 to 6553.5 s			5.0 s		
00.042	Sleep detect speed threshold	29.051	0.0 to 60.0	0.0 to 3000.0		25.0	750.0	
00.043	Sleep detect delay	29.052	0.0 to 6553.5 s			5.0 s		
00.044	Number of auto-reset attempts	10.034	None (0), 1 (1), 2 (2), 3 (3), 4 (4), 5 (5), Infinite (6)			5 (5)		
00.045	Auto-reset delay	10.035	1.0 to 600.0 s			10.0 s		
00.046	Pipe fill mode	29.075	Disabled (0), Feedback Level (1), Flow Switch (2)			Disabled (0)		
00.047	Pipe fill reference	01.024	VM_SPEED_FREQ_REF[MIN] to VM_SPEED_FREQ_REF[MAX]			Std: 25 Hz US: 30 Hz	Std: 750 rpm US: 900 rpm	
00.048	Pipe fill maximum time	29.077	0.0 to 6553.5 s			0.0 s		
00.049	Pipe fill threshold	29.076	0.00 to 327.67 psi			0.00 psi		
00.050	Dry well low load detection threshold percent	29.057	0.0 % to 100.0 %			1.0 %		
00.051	Dry well low load detection delay	29.058	0.0 to 6553.5 s			5.0 s		
00.052	Dry well low load mode	29.059	Disabled (0), Alarm Only (1), Trip (2), Lower PID Output (3)			Disabled (0)		
00.053	Dry well low load PID output reduction	29.060	0.00 % to 100.00 %			50.00 %		
00.054	Dry well low load restart delay	29.061	0.0 to 6553.5 s			5.0 s		
00.055	No flow detection threshold	29.069	0.0 to 60.0	0.0 to 3000.0		0.0 Hz	0.0 rpm	
00.056	No flow detection band	29.070	0.0 to 60.0	0.0 to 3000.0		5.0	150.0	
00.057	No flow detection delay	29.071	0.0 to 6553.5 s			5.0 s		
00.058	No flow setpoint settling delay	29.072	0.0 to 6553.5 s			1.0 s		

Parameter			Range			Default		
	Description		OL	RFC-A	RFC-S	OL	RFC-A	RFC-S
00.059	No flow setpoint reduction	29.073	0.00 to 2.55 psi			0.06 psi		
00.060	Over-cycle mode	29.127	Disabled (0), Alarm Only (1), Trip (2), Inc Setpoint (3)			Alarm Only (1)		
00.061	Over-cycle starts per hour	29.128	0 to 255			5		
00.062		00.000						
00.063		00.000						
00.064	PID 1 proportional gain	14.010	0.000 to 4.000			2.000		
00.065	PID 1 integral gain	14.011	0.000 to 4.000			1.000		
00.066	PID1 reference	14.020	±100.00 %					
00.067	PID feedback	14.021	±100.00 %					
00.068	PID 1 output	14.001	+/-100%					
00.069	Output frequency	05.001	VM_SPEED_FR EQ_REF[MIN] to VM_SPEED_FR EQ_REF[MAX] Hz					
	Speed feedback	03.002		VM_SPEED[MIN] to VM_SPEED[MAX]				
00.070	Percentage load	04.020	VM_USER_CURRENT[MIN] to VM_USER_CURRENT[MAX] %					
00.071	Output power	05.003	VM_POWER[MIN] to VM_POWER[MAX] kW					
00.072	Analog input 1 current loop loss	07.028	OFF (0) or ON (1)					
00.073	Operating status	29.003	Inhibit STO (0), Off (Ready) (1), Hand Run (2), Waking (3), Pipe Fill (4), Auto Run (5), Auto Run Leader (6), Auto Run Assist (7), Pre-sleep (8), Sleeping (9), Cleaning (10), Level Stop (11), Timer Stop (12), Hand Timeout (13), Over-cycle (14), Fbck Loss Run (15), Dry Well Run (16), Dry Well Stop (17), Auto Stop Assist (18), Trip (19), Under Voltage (20)			Inhibit STO (0)		
00.074	NV Media Card Action Status	11.078	None (0), Active (1), Card Slot 1 (2), Card Slot 2 (3), Card Slot 3 (4), Card Slot 4 (5), Card Product (6), Card User Prog (7), Card Busy (8), Card Data Exists (9), Card Option (10), Card Read Only (11), Card Error (12), Card No Data (13), Card Full (14), Card File Error (15), Card Rating (16), Card File Data (17), Card Derivative (18)					
00.075	PID final feedback	29.036	-327.68 to 327.67 psi			0.00 psi		
00.076		00.000						

Parameter			Range			Default		
	Description		OL	RFC-A	RFC-S	OL	RFC-A	RFC-S
00.077	Derivative software version	29.001	0 to 99999999					
00.078	Trip 0	10.020	0 to 255					
00.079	Trip 1	10.021	0 to 255					
00.080	Trip 2	10.022	0 to 255					

## **Appendix A UL information**

### **A.1 UL file reference**

These products are cUL Listed to Canadian and US requirements.

UL file reference is: NMMS/7 E171230.

Products that incorporate the Safe Torque Off (STO) function are Certified for Functional Safety.

UL file reference: FSPC E171230.

### **A.2 Operating environment**

#### **Pollution Degree**

Products must be installed in a Pollution Degree 2 environment or better (dry, non-conductive pollution only).

#### **Ambient temperature**

The drives have been evaluated for use at ambient temperatures up to 40 °C. The drives have additionally been evaluated for 50 °C and 55 °C ambient air temperatures with a derated output.

The maximum surrounding air temperature is 55 °C.

### **A.3 Enclosure Ratings**

#### **Open Type**

The products are Open Type as supplied.

#### **Type 1**

When fitted with a conduit box, the products meet the requirements for UL Enclosed Type 1.

Suitable conduit boxes are available.

### **A.4 Through-panel (Type 12) mounting**

#### **Mounting hole access**

When the drive is through-panel mounted, the main terminal cover(s) must be removed in order to provide access to the mounting holes. Once the drive has been mounted, the terminal cover(s) can be replaced.

### **A.5 Mounting bracket torque setting**

#### **Frame sizes 3 & 4**

Through panel mounting brackets should be tightened to a maximum torque of 2 N m (16.8 lb in).

### **A.6 Installation in air handling spaces (plenum rating)**

These products have been evaluated in accordance with the Standard for Fire Test for Heat and Visible Smoke Release for Discrete Products and their Accessories Installed in Air-Handling Spaces, UL 2043.

Products installed in air handling spaces must be Enclosed Type 1 as a minimum. A conduit box must be fitted. Alternatively, the product can be through-panel mounted in a Type 12 enclosure with the heatsink protruding through the wall of the enclosure into the air-handling space.

### **A.7 Mechanical Installation**

#### **Mounting**

Products can be mounted on a vertical surface using the brackets provided. Several products may be mounted side by side without airspace between them.

In installations where space is limited, products with frame sizes 3, 4 and 5 may be 'Tile Mounted'.

In this configuration, the unit is mounted sideways with the side panel against the mounting surface. A Tile Mounting Kit is available but must be ordered separately.

## A.8 Terminal Torque

Torque settings are specified in relevant sections of this guide.

## A.9 Electrical Installation

### Overvoltage category

Drives have been evaluated for OVC III

### Branch circuit Protection

Branch circuit protection must be provided in accordance with the National Electrical Code (NEC), The Canadian Electrical Code, and any additional local codes.

The recommended fuses are specified within this guide.

### Opening of branch circuit protective device

The opening of the branch-circuit protective device may be an indication that a fault has been interrupted. To reduce the risk of fire or electric shock, the equipment may be examined and replaced if damaged. If burnout of the current element of an overload relay occurs, the complete overload relay must be replaced. Integral solid-state short circuit protection does not provide branch circuit protection. Branch circuit protection must be provided in accordance with the National Electrical Code and any additional local "codes", or the equivalent.

### Cables

Field wiring must use 75 °C rated copper wire only.

### Ground connections

UL Listed closed-loop connectors sized according to the field wiring must be used for all ground connections.

### Power connections

Frame sizes 3, 4 and 5: These frame sizes use plug-in terminal blocks for the power connections.

Frame sizes 6 to 11: UL Listed closed loop connectors sized according to the field wiring must be used for all power connections.

## A.10 Motor overload protection

All models incorporate internal overload protection for the motor load that does not require the use of an external or remote overload protection device. The protection level is adjustable with the maximum current overload being dependent on the values entered into the current limit parameters (Pr 4.005 motoring current limit, Pr 4.006 regenerative current limit and Pr 4.007 symmetrical current limit entered as percentage) and Pr 5.007 motor rated current parameter (entered in Amperes). The duration of the overload is dependent on Pr 4.015 motor thermal time constant.

## A.11 Thermal memory retention

All models are provided with thermal memory retention.

## A.12 Motor protection using an external sensor

User terminals are provided that can be connected to a motor thermistor to protect the motor from high temperature, in the event of a motor cooling fan failure.

## **A.13 Transient Surge Suppression**

### **Frames sizes 7 & 8 – 575 V ratings**

Transient surge suppression shall be installed on the line side of this equipment and shall be rated to 575 Vac (phase to ground), 575 Vac (phase to phase), suitable for overvoltage category III, and shall provide protection for an impulse withstand voltage peak of 6 kV and a clamping voltage of maximum 2400 V.

## **A.14 Dynamic braking**

The drives have not been evaluated for dynamic braking.

## **A.15 External Class 2 supply**

### **Frame sizes 7 to 11**

The external power supply shall be marked with the following: “Class 2” and the power supply shall not exceed 24 Vdc.

## **A.16 Modular Drive Systems**

Products with DC+ and DC- supply connections have been investigated for use in Modular Drive Systems as inverters when supplied by the converter sections from the Unidrive-M or Mentor MP range. In these applications the inverters are required to be additionally protected by supplemental fuses.

## **A.17 AC supply, AC supply fuses and short circuit current rating (SCCR)**

### **Frame sizes 3 & 4**

Suitable for use on a circuit capable of delivering not more than 100,000 RMS symmetrical Amperes, 480 Volts AC maximum when protected by the specified fuses.

UL Listed closed-loop connectors sized according to the field wiring shall be used for grounding connections. Frame size 6 only for closed loop connectors on all power connections (size 4 has a power connector like size 3 not studs)

### **Frame sizes 5 & 6**

Suitable for use on a circuit capable of delivering not more than 100,000 RMS symmetrical Amperes, 575 Volts AC maximum when protected by the specified fuses.

### **Frame size 7 & 8**

Suitable for use on a circuit capable of delivering not more than 100,000 RMS symmetrical Amperes, (rated voltage in the ratings table or the product label) Volts AC Maximum when protected by the specified fuses.

### **Frame sizes 9 & 10**

Suitable for use on a circuit capable of delivering not more than 100,000 RMS symmetrical Amperes, (voltage rating in ratings table or the product label) Volts AC Maximum when protected by the specified fuses.

### **Frame size 11**

Suitable for use on a circuit capable of delivering not more than 100,000 RMS symmetrical Amperes, (voltage rating in ratings table or the product label) Volts AC Maximum when protected by the specified fuses.

## **A.18 Modular / group / parallel installation**

### **Supply wiring**

When used in modular drives/group / parallel installation applications the supply wires are not to be larger than 125 % of full load current of the device ratings

### **CSA (Canadian Standards Authority) approval**

Frame sizes 9 to 11 are not certified for CSA approval when used in a modular / parallel setup.

### **Supply from converters**

These devices are only intended to be supplied by converters manufactured by Control Techniques Ltd. when used as inverters.

## Appendix B Drive ratings, cable sizes and fuse ratings

Table B-1 575 V drive ratings, cable sizes and fuse ratings (500 V to 575 V  $\pm 10\%$ )

Model	Max. cont. input current	Fuse				Nominal cable size				Normal Duty		
		IEC		UL		European		USA		Max. count. output current	Nom power @ 575 V	Motor power @ 575 V
		3ph	Nom	Class	Nom	Class	Input	Output	Input			
										A	A	A
05500039	4	10	gG	10	CC, J or T*	1.5	1.5	16	16	3.9	2.2	3
05500061	7	10		10		1.5	1.5	14	14	6.1	4	5
05500100	11	20		20		2.5	2.5	14	14	10	5.5	7.5
06500120	13	20	gG	20	CC, J or T*	2.5	2.5	14	14	12	7.5	10
06500170	19	32		25		6	6	10	10	17	11	15
06500220	24	40		30		10	10	10	10	22	15	20
06500270	29	50		35		10	10	8	8	27	18.5	25
06500340	37	50		40		16	16	6	6	34	22	30
06500430	47	63		50		16	10	6	6	43	30	40
07500530	45	50	gG	50	CC, J or T*	16	16	4	4	53	45	50
07500730	62	80		80		25	25	3	3	73	55	60
08500860	83	125	gR	100	HSJ	35	35	1	1	86	75	75
08501080	104	160		150		50	50	1	1	108	90	100
09501250	166	150	gR	150	HSJ	2 x 70 (B2)	2 x 35 (B2)	2 x 1	2 x 3	125	110	125
09501500	166	200		175			2 x 50 (B2)		2 x 1	150	110	150
10502000	197	250	gR	250	HSJ	2 x 70 (B2)		2 x 2/0		200	150	200
11502480	265	400	gR	400	HSJ	2 x 70 (C)		2 x 3/0		248	185	250
11502880	310					2 x 95 (C)		2 x 4/0		288**	225	300
11503150	338					2 x 120 (C)		2 x 250		315**	250	350

\* These fuses are fast acting.

\*\* These ratings are for 2 kHz switching frequency. For ratings at 3 kHz switching frequency refer to the power and current ratings in the *F600 User Guide*.

**Table B-2 690 V drive ratings, cable sizes and fuse ratings (500 V to 690 V ±10 %)**

Model	Max. cont. input current	Fuse				Nominal cable size				Normal Duty			
		IEC		UL		European		USA		Max. count. output current	Nom power @ 690 V	Motor power @ 690 V	
		3ph	Nom	Class	Nom	Class	Input	Output	Input				Output
07600060	10	16	gG	16	CC, J or T*	2.5	2.5	14	14	7.5	5.5	7.5	
07600100	16	16		16		2.5	2.5	12	12	13	11	15	
07600230	20	25		25		10	10	8	8	23	18.5	25	
07600300	26	32		30		10	10	6	6	30	22	30	
07600360	31	40		35		10	10	6	6	36	30	40	
07600460	39	50		50		16	16	4	4	46	37	50	
07600520	44	50		50		16	16	4	4	52	45	60	
07600730	62	80		80		25	25	3	3	73	55	75	
08600860	83	125		gR		100	HSJ	50	50	2	2	86	75
08601080	104	160	150		70	70		1/0	1/0	108	90	125	
09601250	149	150	gR	150	HSJ	2 x 50 (B2)	2 x 35 (B2)	2 x 1	2 x 3	125	110	150	
09601550	171	200		200		2 x 70 (B2)	2 x 50 (B2)	2 x 1/0	2 x 1	155	132	175	
10601720	202	225	gR	250	HSJ	2 x 70 (B2)	2 x 70 (B2)	2 x 2/0	2 x 1/0	172	160	200	
10601970	225	250		250		2 x 95 (B2)		2 x 3/0	2 x 2/0	197	185	250	
11602250	256	400	gR	400	HSJ	2 x 70 (C)		2 x 3/0		225	200	250	
11602750	302					2 x 95 (C)		2 x 4/0		275**	250	300	
11603050	329					2 x 95 (C)		2 x 250		305**	280	400	

\* These fuses are fast acting.

\*\* These ratings are for 2 kHz switching frequency. For ratings at 3 kHz switching frequency refer to the power and current ratings in the *F600 User Guide*.

# Appendix C Leroy Somer permanent magnet motor data

Motor Rated Frequency	Parameters															
	04.013	04.014	05.007	05.008	05.009	05.011	05.017	05.024	05.033	05.069	05.072	05.075	05.078	05.082	05.084	05.087
Hz	Current controller Vg Gain	Current controller Vg Gain	Rated current	Rated speed	Rated voltage	Number Of Motor Poles	Stator Resistance	Ld	Volts per 1000 rpm	Over-current Level	No-load Lq	Iq Test Current For Inductance Measurement	Lq At The Defined Id Current	Id Test Current For Inductance Measurement	Lq At The Defined Id Current	User Defined Rated Torque Angle
044-00240A	50	152	269	21	1500	400	0.315822	7.63	72	236%	68.5	73	44.8	-108	88.5	56
044-00240A	60	152	269	20	1800	400	0.315822	7.63	72	244%	68.5	73	44.8	-108	88.5	56
044-00240A	60	152	269	21	1800	460	0.315822	7.63	72	233%	68.5	73	44.8	-108	88.5	56
064-00480A	87	124	219	38	2600	400	0.105274	2.54	42	218%	22.8	73	14.9	-108	22.8	56
064-00380A	50	304	463	28	1500	400	0.284540	7.48	79	199%	67.9	75	40.5	-106	67.9	58
054-00300A	60	234	381	27	1800	400	0.284540	7.48	79	204%	67.9	75	40.5	-106	67.9	58
064-00300A	60	234	381	27	1800	460	0.284540	7.48	79	204%	67.9	75	40.5	-106	67.9	58
064-00630A	87	136	221	49	2600	400	0.094847	2.49	45	189%	22.6	75	13.5	-106	22.6	58
064-00480A	50	277	444	36	1500	400	0.213304	5.68	73	181%	43.3	71	31.5	-109	43.3	57
064-00480A	60	277	444	35	1600	400	0.213304	5.68	73	185%	43.3	71	31.5	-109	43.3	57
064-00480A	60	277	444	36	1600	460	0.213304	5.68	73	183%	43.3	71	31.5	-109	43.3	57
074-00940A	87	127	172	74	2600	400	0.045054	1.42	41	189%	11.0	73	6.3	-108	11.0	56
064-00630A	50	190	252	57	1500	400	0.108310	3.49	72	174%	27.5	69	19.7	-110	27.5	58
064-00630A	60	190	252	55	1600	400	0.108310	3.49	72	181%	27.5	69	19.7	-110	27.5	58
064-00630A	60	190	252	56	1600	460	0.108310	3.49	72	177%	27.5	69	19.7	-110	27.5	58
074-01120A	87	135	179	99	2600	400	0.036103	1.16	41	168%	9.17	69	6.6	-110	9.2	58
074-00780A	50	232	290	70	1500	400	0.088734	3.03	72	164%	24.1	69	16.7	-110	24.1	58
074-00780A	60	232	290	68	1600	400	0.088734	3.03	72	168%	24.1	69	16.7	-110	24.1	58
074-00780A	60	232	290	69	1600	460	0.088734	3.03	72	166%	24.1	69	16.7	-110	24.1	58
084-01550A	87	157	196	122	2600	400	0.045053	2.467	77	201%	23.6	67	14.6	-111	23.6	59
074-00940A	50	220	172	82	1500	400	0.045053	2.467	77	207%	23.6	67	14.6	-111	23.6	59
074-00940A	60	220	172	80	1600	400	0.045053	2.467	77	195%	23.6	67	14.6	-111	23.6	59
074-00940A	60	220	172	83	1600	460	0.045053	2.467	77	195%	23.6	67	14.6	-111	23.6	59
084-01840A	87	150	177	142	2600	400	0.010289	0.822	44	195%	7.9	67	4.9	-111	7.9	59
074-01120A	50	234	168	99	1500	400	0.033680	2.015	77	199%	19.7	67	10.9	-111	19.7	59
074-01120A	60	234	168	95	1600	400	0.033680	2.015	77	208%	19.7	67	10.9	-111	19.7	59
074-01120A	60	234	168	98	1600	460	0.033680	2.015	77	202%	19.7	67	10.9	-111	19.7	59
094-02210A	87	136	98	176	2600	400	0.011269	0.872	44	189%	6.6	67	3.6	-111	6.6	59
084-01550A	50	261	163	134	1500	400	0.024613	1.677	82	195%	16.7	63	9.0	-114	16.7	61
084-01550A	60	261	163	130	1600	400	0.024613	1.677	82	190%	16.7	63	9.0	-114	16.7	61
084-01550A	60	261	163	131	1600	460	0.024613	1.677	82	189%	16.7	63	9.0	-114	16.7	61
094-02680A	87	127	80	231	2600	400	0.008204	0.559	47	160%	5.6	63	3.0	-114	5.6	61
084-01840A	50	261	154	163	1500	400	0.010819	1.432	80	174%	14.4	63	7.5	-114	14.4	61
084-01840A	60	261	154	158	1600	400	0.010819	1.432	80	179%	14.4	63	7.5	-114	14.4	61
084-01840A	60	261	154	155	1600	460	0.010819	1.432	80	182%	14.4	63	7.5	-114	14.4	61
104-03200E	87	149	77	279	2600	400	0.006606	0.477	46	171%	4.8	63	2.5	-114	4.8	61

		Parameters															05.087				
		05.006	04.013	04.014	05.007	05.008	05.009	05.011	05.017	05.024	05.033	05.069	05.072	05.075	05.078	05.082	05.084	05.087			
		Motor/Rated Frequency	Current controller Kp Gain	Current controller Ki Gain	Rated current	Rated speed	Rated voltage	Number Of Motor Poles	Stator Resistance	Transient Inductance	Volts per 100rpm	Over-current Level	No-load Lq	Iq Test Current For Inductance Measurement	Lq At The Defined Iq Current	Id Test Current For Inductance Measurement	Lq At The Defined Iq Current	User Defined Rated Torque Angle			
		Hz	-	-	A	rpm	V		$\Omega$	mH	V/kmin-1	% I <sub>nom</sub>	mH	%	mH	%	mH	°			
3000 range Motor Type	Pump Drive F600 Drive Type	044-00240A	100	95	213	20	3000	400	4 Poles	0.250147	4.78	4.3	239%	41.3	73	27.8	41.3	-108	41.3	56	
		044-00240A	120	95	213	20	3600	400	4 Poles	0.250147	4.78	4.3	244%	41.3	73	27.8	41.3	-108	41.3	56	
		044-00240A	120	95	213	20	3600	460	4 Poles	0.250147	4.78	4.3	243%	41.3	73	27.8	41.3	-108	41.3	56	
		064-00480A	173	76	173	36	5200	400	4 Poles	0.063382	1.59	25	223%	13.8	83	9.3	108	13.8	-108	13.8	56
		064-00360A	100	117	223	28	3000	400	4 Poles	0.128766	2.88	39	254%	25.5	75	17.7	-106	25.5	-106	25.5	55
		054-00300A	120	90	172	27	3600	400	4 Poles	0.128766	2.88	39	259%	25.5	75	17.7	-106	25.5	-106	25.5	55
		064-00380A	120	117	223	28	3600	460	4 Poles	0.128766	2.88	39	249%	25.5	75	17.7	-106	25.5	-106	25.5	55
		064-0060A	173	52	100	51	5200	400	4 Poles	0.042922	0.96	23	226%	8.5	75	5.9	-106	8.5	-106	8.5	55
		064-00380A	100	117	223	34	3000	400	4 Poles	0.128766	2.88	39	209%	25.5	71	16.0	-109	25.5	-109	25.5	57
		064-00380A	120	117	223	33	3600	400	4 Poles	0.128766	2.88	39	214%	25.5	71	16.0	-109	25.5	-109	25.5	57
		064-00380A	120	117	223	33	3600	460	4 Poles	0.128766	2.88	39	212%	25.5	71	16.0	-109	25.5	-109	25.5	57
		LSHRM 160 M1_22kW	074-00780A	173	74	140	62	5200	400	4 Poles	0.042922	0.96	23	186%	8.5	71	5.3	-105	8.5	-105	8.5
064-00480A	100		104	192	42	3000	400	4 Poles	0.092501	2.13	38	216%	15.8	76	12.6	-105	15.8	-105	15.8	54	
064-00480A	120		104	192	40	3600	400	4 Poles	0.092501	2.13	38	224%	15.8	76	12.6	-105	15.8	-105	15.8	54	
064-00480A	120		104	192	41	3600	460	4 Poles	0.092501	2.13	38	218%	15.8	76	12.6	-105	15.8	-105	15.8	54	
074-00940A	173		64	118	74	5200	400	4 Poles	0.030534	0.71	22	200%	5.3	76	4.2	-105	5.3	-105	5.3	54	
064-0060A	100		116	215	57	3000	400	4 Poles	0.092501	2.13	38	159%	15.8	69	11.0	-110	15.8	-110	15.8	58	
064-0060A	120		116	215	57	3600	400	4 Poles	0.092501	2.13	38	158%	15.8	69	11.0	-110	15.8	-110	15.8	58	
064-0060A	120		116	215	57	3600	460	4 Poles	0.092501	2.13	38	160%	15.79	69	11.0	-110	15.8	-110	15.8	58	
074-00780A	100		109	174	70	3000	400	4 Poles	0.063326	1.42	37	178%	10.8	71	8.0	-109	10.8	-109	10.8	57	
074-00780A	120		109	174	69	3600	400	4 Poles	0.063326	1.42	37	181%	10.8	71	8.0	-109	10.8	-109	10.8	57	
074-00780A	120		109	174	69	3600	460	4 Poles	0.063326	1.42	37	181%	10.8	71	8.0	-109	10.8	-109	10.8	57	
LSHRM 225 MY1_45kW	074-00940A		100	106	142	84	3000	400	4 Poles	0.037145	1.185	38	180%	9.2	71	6.8	-109	9.2	-109	9.2	57
	074-00940A	120	106	142	82	3600	400	4 Poles	0.037145	1.185	38	184%	9.2	71	6.8	-109	9.2	-109	9.2	57	
	074-00940A	120	106	142	83	3600	460	4 Poles	0.037145	1.185	38	181%	9.2	71	6.8	-109	9.2	-109	9.2	57	
	074-01120A	100	118	104	100	3000	400	4 Poles	0.021063	1.019	43	226%	9.5	71	5.7	-109	9.5	-109	9.5	57	
	074-01120A	120	118	104	101	3600	400	4 Poles	0.021063	1.019	43	225%	9.5	71	5.7	-109	9.5	-109	9.5	57	
	074-01120A	120	118	104	104	3600	460	4 Poles	0.021063	1.019	43	226%	9.5	71	5.7	-109	9.5	-109	9.5	57	
	084-01560A	100	123	109	138	3000	400	4 Poles	0.016370	0.794	38	185%	7.4	65	4.1	-113	7.4	-113	7.4	60	
	084-01560A	120	123	109	136	3600	400	4 Poles	0.016370	0.794	38	187%	7.4	65	4.1	-113	7.4	-113	7.4	60	
	084-01560A	120	123	109	135	3600	460	4 Poles	0.016370	0.794	38	189%	7.4	65	4.1	-113	7.4	-113	7.4	60	
	084-01840A	100	112	88	160	3000	400	4 Poles	0.011253	0.617	38	190%	5.9	65	3.3	-113	5.9	-113	5.9	60	
	084-01840A	120	112	88	160	3600	400	4 Poles	0.011253	0.617	38	198%	5.9	65	3.3	-113	5.9	-113	5.9	60	
	084-01840A	120	112	88	168	3600	460	4 Poles	0.011253	0.617	38	189%	5.9	65	3.3	-113	5.9	-113	5.9	60	



<b>Warning</b> Before using this product you must read and understand the safety information within the User Guide at the URL below.	<b>Avertissement</b> Avant d'utiliser ce produit, il est impératif de lire et de bien comprendre les consignes de sécurité du Guide de mise en service, disponible à l'adresse ci-dessous.
<b>Avvertenza</b> Prima di utilizzare questo prodotto leggere e assicurarsi di aver compreso le informazioni sulla sicurezza contenute nella Guida dell'utente consultabile all'URL indicato qui sotto.	<b>Warnung</b> Bevor Sie dieses Produkt verwenden, müssen Sie die Sicherheitshinweise in der Betriebsanleitung unter der nachstehenden URL lesen und verstehen.
<b>Advertencia</b> Antes de utilizar este producto, debe leer y comprender la información de seguridad de la Guía del usuario en la siguiente URL.	<b>Предупреждение</b> Преди да използвате този продукт, трябва да прочетете и разберете информацията за безопасност в ръководството за потребителя на URL адреса по-долу.
<b>Upozorenje</b> Prije upotrebe ovog proizvoda morate pročitati i razumjeti sigurnosne informacije iz Korisničkog vodiča na donjem URL-u.	<b>Varovány</b> Před použitím tohoto výrobku si musíte na níže uvedené adrese URL přečíst v návodu k použití bezpečnostní informace a porozumět jim.
<b>Προειδοποίηση</b> Πριν από τη χρήση αυτού του προϊόντος, πρέπει να διαβάσετε και να κατανοήσετε τις πληροφορίες ασφαλείας που περιλαμβάνει ο Οδηγός χρήστη στην παρακάτω διεύθυνση.	<b>Aviso</b> Antes de utilizar este produto, deve ler e compreender as informações de segurança contidas no guia do utilizador que pode encontrar no URL abaixo.
<b>Advarsel</b> Før du tager dette produkt i brug, skal du have læst og forstået sikkerhedsoplysningerne i brugervejledningen på webadressen nedenfor.	<b>Figyelem</b> A termék használatá elött el kell olvasnia és meg kell értenie a Felhasználói útmutatóban található biztonsági információkat az alábbi URL-címen.
<b>Avertizare</b> Înainte de a utiliza acest produs, trebuie să citiți și să înțelegeți informațiile referitoare la siguranță din Ghidul de utilizare de la adresa URL de mai jos.	<b>Waarschuwing</b> Vóór gebruik van dit product moet u de veiligheidsinformatie in de Handleiding op de URL hieronder lezen en begrijpen..
<b>Upozornenie</b> Pred použitím tohto produktu si musíte prečítať a porozumieť všetkým bezpečnostným pokynom uvedeným v Používateľskej príručke, ktorú nájdete na nasledujúcej adrese URL.	<b>Hoiatus</b> Enne selle toote kasutamise alustamist peate lugema ja mõistma alltoodud URL-aadressil asuvas kasutusjuhendis toodud ohutusalasat teavet.
<b>Břidinājums</b> Pirms šā produkta lietošanas ir jāizlasa un jāizprot informācija par drošību, kas iekļauta lietošanas pamācībā tālāk norādītajā URL.	<b>Opozorilo</b> Pred uporabo tega izdelka morate prebrati in razumeti varnostne informacije v navodilih za uporabo na spodnjem spletnem naslovu.
<b>Varoitus</b> Ennen kuin käytät tätä tuotetta, sinun on luettava ja ymmärrettävä turvallisuusohjeet, jotka sisältyvät alla mainitussa verkko-osoitteessa olevaan käyttöoppaaseen.	<b>Ispėjimas</b> Prieš pradėjami naudoti šį gaminį perskaitykite ir įsitinkinkite, kad supratote saugos informaciją, pateiktą naudotojo vadove, esančiame toliau nurodytu universaliu adresu.
<b>Twissija</b> Qabel ma tuza dan il-prodott inti għandek taqra u tifhem l-istruzzjonijiet ta' sikurezza fi hdan il-Gwida għall-Utent fil-URL t'isfel.	<b>Varning</b> Innan du använder denna produkt måste du läsa och förstå säkerhetsinformationen i användarhandboken på nedanstående URL-adress.
<b>Ostrzeżenie</b> Przed przystąpieniem do użytkowania produktu należy przeczytać ze zrozumieniem informacje dotyczące bezpieczeństwa przedstawione w Podręczniku użytkownika dostępnym pod następującym adresem.	

[www.controltechniques.com/support](http://www.controltechniques.com/support)

EN

**Free 5-year Manufacturer's Warranty**

In order to qualify for the free 5-year manufacturer's warranty, you must register your drive on [www.controltechniques.com/shield](http://www.controltechniques.com/shield) within six (6) months of date of purchase. Failure to register within the specified period will mean that your drive will only benefit from the warranty given to you by the person or entity that sold the drive to you.

**Warranty Terms**

This offer is subject to our 5-year Warranty Terms and Conditions which can also be found on [www.controltechniques.com/shield](http://www.controltechniques.com/shield).

FR

**5 ans de garantie fabricant gratuite**

Afin de profiter des 5 ans de garantie fabricant gratuite, vous devez enregistrer votre variateur sur [www.controltechniques.com/shield](http://www.controltechniques.com/shield) dans les six (6) mois à compter de la date d'achat. Si vous n'enregistrez pas votre produit dans le délai spécifié, il sera uniquement couvert par la garantie proposée par la personne ou l'organisme vous l'ayant vendu.

**Conditions de garantie**

Cette offre est soumise à nos Conditions générales de garantie sur 5 ans, également disponibles sur [www.controltechniques.com/shield](http://www.controltechniques.com/shield).

IT

**5 anni di garanzia gratuita del costruttore**

Per aver diritto ai 5 anni di garanzia gratuita del costruttore bisogna registrare l'azionamento sul sito [www.controltechniques.com/shield](http://www.controltechniques.com/shield) entro 6 (sei) mesi dalla data di acquisto. Laddove non venisse registrato entro il termine specificato, l'azionamento sarà coperto unicamente dalla garanzia concessa dalla persona o dalla società venditrice.

**Termini di garanzia**

La presente offerta è soggetta ai nostri Termini e condizioni di garanzia quinquennale, consultabili anche sul sito [www.controltechniques.com/shield](http://www.controltechniques.com/shield).

DE

**Kostenlose 5-jährige Herstellergarantie**

Um die kostenlose 5-jährige Herstellergarantie in Anspruch nehmen zu können, müssen Sie Ihren Umrichter innerhalb von sechs (6) Monaten nach Kaufdatum unter [www.controltechniques.com/shield](http://www.controltechniques.com/shield) registrieren. Wenn Sie Ihren Umrichter nicht innerhalb der angegebenen Frist registrieren, ist dieser nur durch die Gewährleistung gedeckt, die Ihnen von der Person bzw. dem Unternehmen gewährt wird, welche(s) Ihnen den Umrichter verkauft hat.

**Garantiebedingungen**

Diesem Angebot liegen die Bedingungen unserer 5-Jahres-Garantie zugrunde, die auch unter [www.controltechniques.com/shield](http://www.controltechniques.com/shield) zu finden sind.

ES

**Garantía del fabricante de 5 años gratuita**

Para poder disfrutar de la garantía del fabricante de 5 años gratuita, debe registrar su accionamiento en [www.controltechniques.com/shield](http://www.controltechniques.com/shield) en un plazo de seis (6) meses desde la fecha de compra. En caso de no registrarlo en el plazo especificado, el accionamiento solo estará cubierto por la garantía proporcionada por la persona o entidad que le vendió el accionamiento.

**Términos de la garantía**

Esta oferta está sujeta a nuestros Términos y Condiciones de la Garantía de 5 años, que puede encontrar también en [www.controltechniques.com/shield](http://www.controltechniques.com/shield).

## ***Company information***

Nidec Control Techniques Limited. Registered Office: The Gro, Newtown, Powys SY16 3BE. Registered in England and Wales. Company Reg. No. 01236886.

Moteurs Leroy-Somer SAS. Headquarters: Bd Marcellin Leroy, CS 10015, 16915 Angoulême Cedex 9, France. Share Capital: 65 800 512 €, RCS Angoulême 338567258.



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