

Nidec

Step by Step Guide

Pump Drive F600

High IP

Frame sizes 3 to 6

www.controltechniques.com/support



Part Number: 0478-0646-08 Issue: 8

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.



*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

1. Product range

Unidrive-M, Commander, Digitax HD and derivative products. Adjustable speed AC motor drives, including option modules and accessories.

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

Variable speed drives

Model number	Interpretation	Nomenclature aaaa - bbc ddddde
aaaa	Basic series	C200, C300, M100, M101, M200, M201, M300, M400, M600, M608, M700, M701, M702, M708, M709, M750, M751, M753, M754, M880, M881, M882, M888, M889, E300, E301, F300, F600, H300, HS30, HS70, HS71, HS72, M000, RECT
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, Q = 4 quadrant

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

Accessories (may not be suitable for every drive listed above)

Category	Description
Option modules	SI-Applications Compact, SI-Applications Plus, SI- BACnet IP, SI-CANopen V2, SI-CiA417, SI-DeviceNet, SI-DCP, SI-Encoder V2, SI-EtherCAT, SI-Ethernet, SI-Interbus 500kBd, SI-Interbus 2MBd, SI-IO, SI-IO 24 Plus, SI-IO V2, SI-Powerlink, SI-PROFIBUS, SI-PROFINET V2, SI-PROFINET RT, SI-Option mounting kit, SI-Universal Encoder, Encoder breakout kit, PTi210, PTi210 V2, SI-Safety, SI-SLM, SI-Varan, MCi200, MCi200 V2, MCi210, MCi210 V2, MiS210, MiS250, KI-485 Adaptor, AI-485 Adaptor, AI-485 Adaptor 24V, AI-Backup adaptor, AI-Smart adaptor
Control pods	Mxxx-STANDARD0, Mxxx-MASTER000, M000-FOLLOWER0 (where Mxxx denotes M600, M700, M701, M702, HS70, HS71, HS72, M708, M709, M880, M881, M882, M888, M889, E300, F300, F600 or H300.)
Displays, keypads, other accessories	KI-Keypad, KI-Keypad Plus, KI-Keypad RTC, KI-HOA keypad RTC, KI-Compact Display, KI-Compact 485 adaptor, Remote Keypad (LCD), Remote Keypad RTC, CI-Keypad, CI-485 Adaptor, Capacitor module M75C, External DC cable connection kit, Multi axis kit (standard – with and without SI option mounting kit fitted), Cable grommet kit, External EMC filter, Fan replacement kit, Input inductor, Vent kit, Compact brake resistor kit, External brake resistor 20/40 or 80 ohm, Digitax HD to Uni M panel mounted & through hole mounted DC bus paralleling kits

5. Declaration

Low Voltage Directive (2014/35/EU)

Electromagnetic Compatibility Directive (2014/30/EU)

Restriction of Hazardous Substances Directives (2011/65/EU and 2015/863/EU).

Regulation 2019/1781 of directive 2009/125/EC (Energy related products).

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 61800-5-1:2007 + A1:2017 + A11: 2021	Adjustable speed electrical power drive systems - Part 5-1: Safety requirements - Electrical, thermal and energy
EN 61800-3: 2018	Adjustable speed electrical power drive systems - Part 3: EMC requirements and specific test methods
EN 61000-6-2: 2019	Electromagnetic compatibility (EMC) - Part 6-2: Generic standards - Immunity for industrial environments
EN 61000-6-4: 2019	Electromagnetic compatibility (EMC) - Part 6-4: Generic standards - Emission standard for industrial environments
EN 61000-3-2:2019+A1:2021	Electromagnetic compatibility (EMC) - Part 3-2: Limits for harmonic current emissions (equipment input current .16 A per phase)
EN 61000-3-3:2013+A1:2019 + A2:2021	Electromagnetic compatibility (EMC) - Part 3-3: Limitation of voltage changes, voltage fluctuations and flicker in public, low voltage supply systems, for equipment with rated current .16 A per phase and not subject to conditional connection
EN 61000-3-12: 2011	Electromagnetic compatibility (EMC) - Part 3-12: Limits. Limits for harmonic currents produced by equipment connected to public low-voltage systems with input current > 16 A and . 75 A per phase

7. Responsible person:



Jon Holman-White
Global Vice President, Technology
Nidec Control Techniques Ltd
Date: 30th July 2026
Newtown, Powys, UK.

EU Declaration of Conformity (including 2006 Machinery Directive)

1. Product model

Unidrive-M, Digitax HD 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 ddddde
aaaa	Basic series	M600, M700, M701, M702, M608, M708, M709, CSD1, HS70, HS71, HS72, E200, E300, E301, 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
ddddd	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.

(Refer to the TUV Revision List: 01_205(U)_5270_0x_2x_RL_2025_01_09).

5. Declaration

The safety function STO within the above drive 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:

24th July 2025, Newtown, Powys, UK

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English

Introduction

The F600 is a simple and flexible range of drives from 1.1 kW to 22 kW in 4 frame sizes and three input voltage ranges (200 V, 400 V and 575 V).

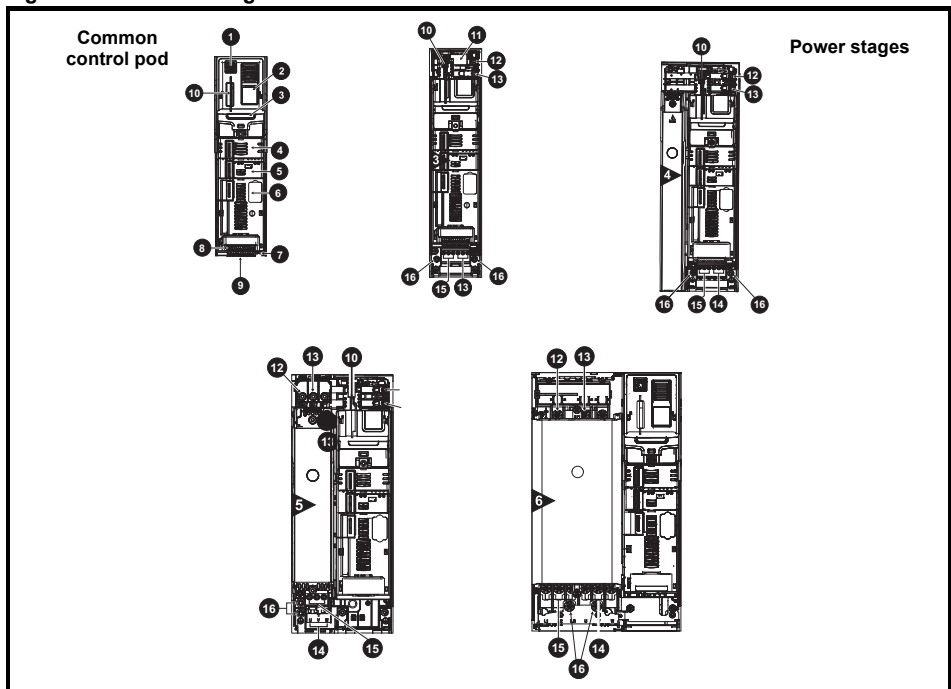
This Step-by Step guide provides simple instructions on how to mount the drive, fuse and cable selection, wiring the drive-up, programming the drive and running the motor keypad mode on frames 3 to 6.

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 6

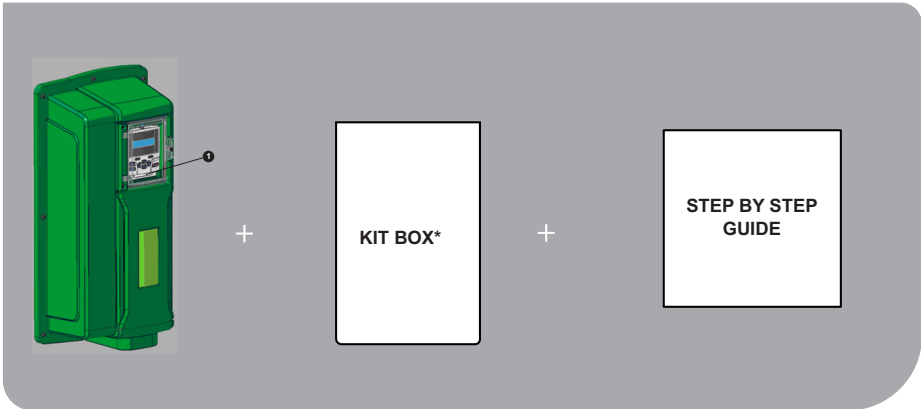


Key

- | | |
|-------------------------|---------------------------|
| 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 |

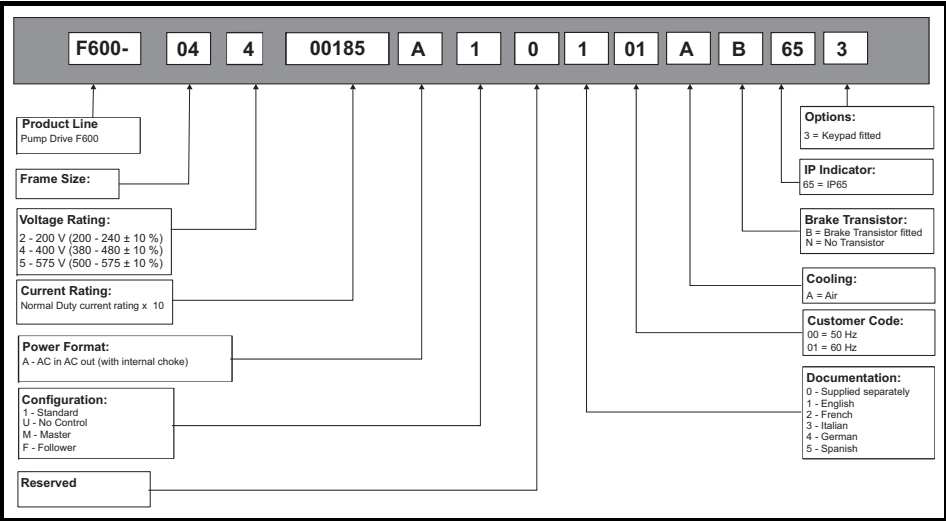
STEP 1: Check the contents of the box

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



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 (Refer to the **F600 User Guide**).

Table 3-1 highlights the clearances.

Table 3-1 Recommended spacing

Frame	Spacing Drive / Filter	Spacing Drive / Drive	Spacing above drive	Spacing below drive
3	0 mm (0.00 in)	0 mm (0.00 in)	100 mm (4.0 in)	100 mm (4.0 in)
4	30 mm (1.18 in)	30 mm (1.18 in)	100 mm (4.0 in)	100 mm (4.0 in)
5	30 mm (1.18 in)	30 mm (1.18 in)	100 mm (4.0 in)	100 mm (4.0 in)
6	30 mm (1.18 in)	30 mm (1.18 in)	100 mm (4.0 in)	100 mm (4.0 in)

Table 3-2 Drive dimensions and weights

Frame	Height		Width		Depth	Mounting holes (Ø)	Weight (kg)
	Mounting	Overall	Mounting	Overall			
3	465.5 mm (18.32 in)	571.4 mm (22.49 in)	52 mm (2.05 in)	255.8 mm (10.07 mm)	225 mm (8.86 in)	4 x 6 mm (0.23 in)	7.5
4	470 mm (18.5 in)	571.4 mm (22.49 in)	106 mm (4.17 in)	255.8 mm (10.07 mm)	221 mm (8.7 in)	4 x 7 mm (0.27 in)	9.3
5	467 mm (18.38 in)	570.7 mm (22.46 in)	110 mm (4.38 in)	255.8 mm (10.07 mm))	221 mm (8.7 in)	4 x 7 mm (0.27 in)	10.0
6	478 mm (18.81 in)	573.79 mm (22.59 in)	196 mm (7.72 in)	316.68 mm (12.46 in)	248 mm (9.76 in)	6 x 7 mm (0.27 in)	16.9

Figure 3-1 Size 3 High IP Drive and Mounting Hole Dimensions

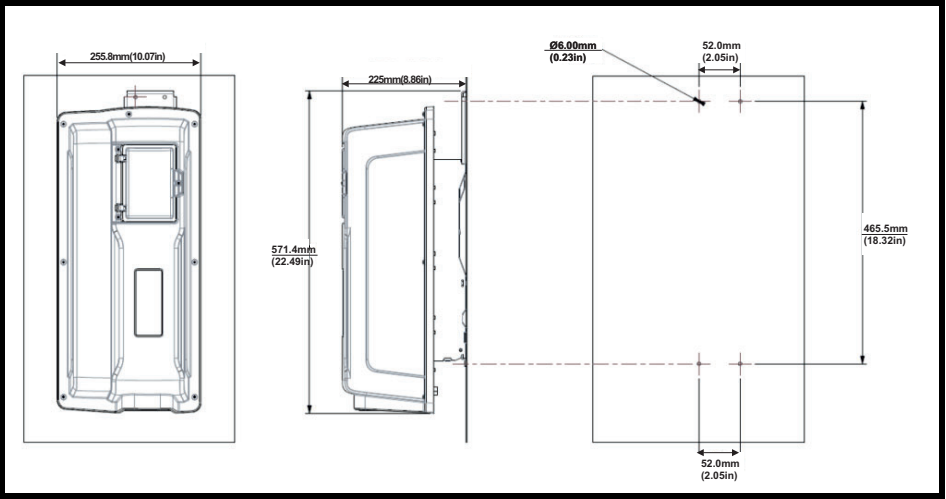


Figure 3-2 Size 4 High IP Drive and Mounting Hole Dimensions

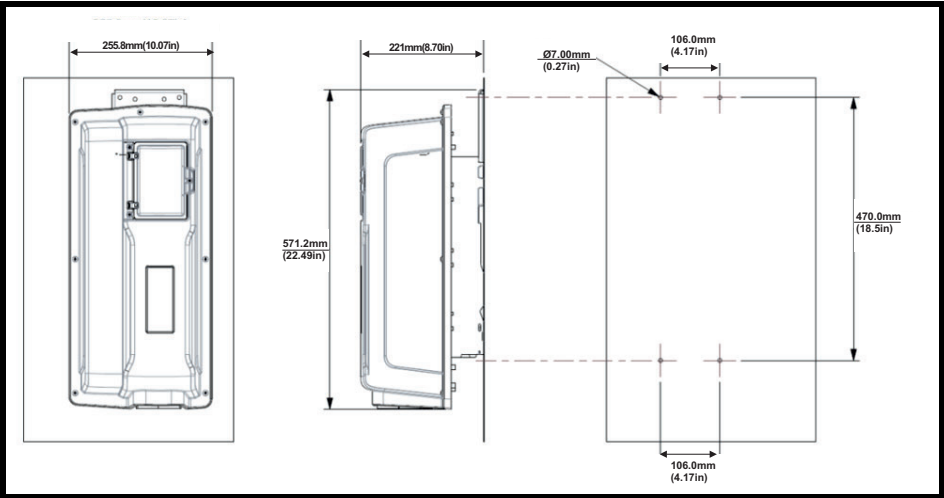


Figure 3-3 Size 5 High IP Drive and Mounting Hole Dimensions

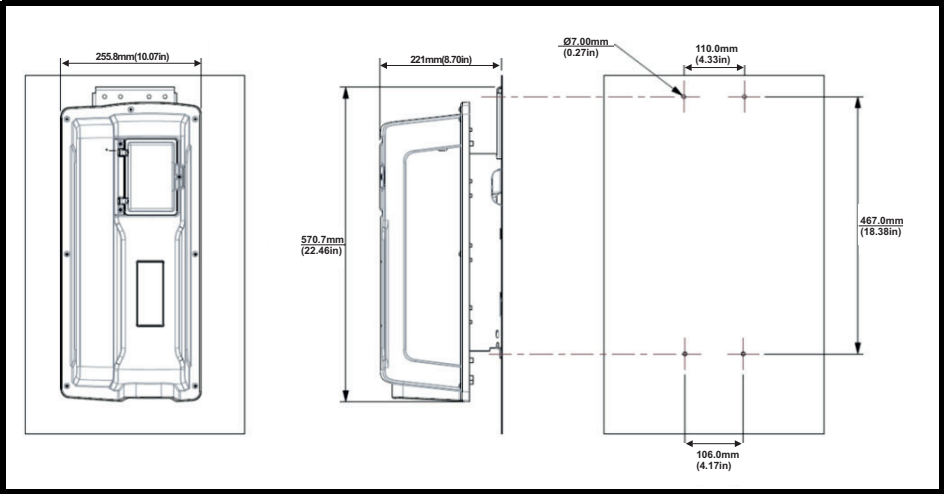
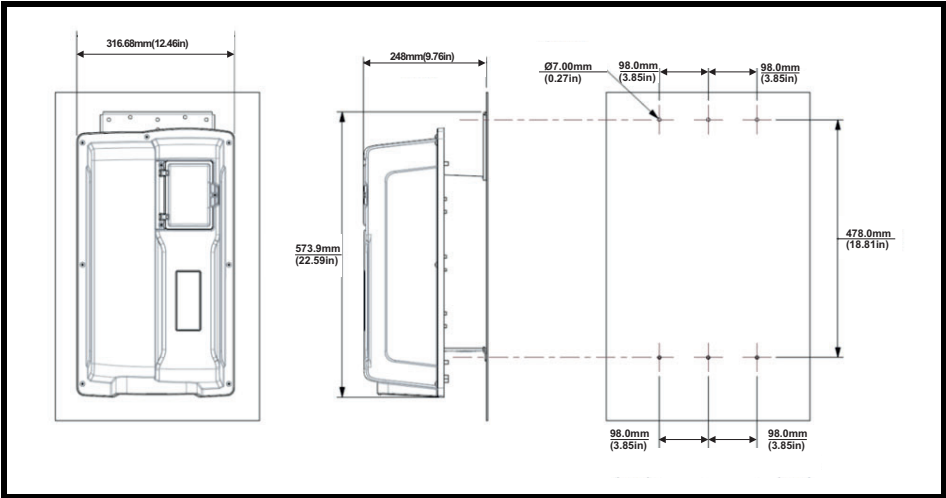


Figure 3-4 Size 6 High IP Drive and Mounting Hole Dimensions



STEP 4: Select supply / motor cables and fuses

Refer to Appendix B for the ratings for the 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
F600-03200066A	10.4	16	gG	20	CC, J or T*	2.5	2.5	14	14	6.6	1.1	1.5	
F600-03200080A	12.6	20		20		2.5	2.5	14	14	8	1.5	2	
F600-03200110A	17	20		25		4	4	12	12	11	2.2	3	
F600-03200127A	20	25		25		4	4	12	12	12.7	3	3	
F600-04200180A	20	25	gG	25	CC, J or T*	6	6	10	10	18	4	5	
F600-04200250A	28	32		30		6	6	10	10	22	5.5	7.5	
F600-05200300A	31	40	gG	40	CC, J or T*	10	10	8	8	30	7.5	10	
F600-06200500A	48	63	gG	60	CC, J or T*	16	16	4	4	50	11	15	

* These fuses are fast acting.

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

Model	Max. cont. input current	Fuse				Nominal cable size				Normal Duty			
		IEC		UL		European		USA					
		3ph	Nom	Class	Nom	Class	Input	Output	Input	Output	Max. count. output current	Nom power @ 400 V	Motor power @ 460 V
F600-03400034A	5	10	gG	10	CC, J or T*	1.5	1.5	18	18	3.4	1.1	1.5	
F600-03400045A	7	10		10		1.5	1.5	16	16	4.5	1.5	2	
F600-03400062A	9	10		10		1.5	1.5	14	14	6.2	2.2	3	
F600-03400077A	13	20		20		2.5	2.5	14	14	7.7	3	5	
F600-03400104A	13	20		20		2.5	2.5	14	14	10.4	4	5	
F600-03400123A	16	20	20	2.5	2.5	12	12	11	5.5	7.5			
F600-04400185A	19	25	gG	25	CC, J or T*	4	4	10	10	18.5	7.5	10	
F600-04400240A	24	32		30		6	6	10	10	21	11	15	
F600-05400300A	29	40	gG	35	CC, J or T*	10	10	8	8	29	15	20	
F600-06400380A	36	40	gR	40	CC, J or T*	10	10	6	6	38	18.5	25	
F600-06400480A	46	63		50		16	16	4	4	48	22	30	

* These fuses are fast acting.

STEP 5: 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 N m (17.7 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)

Power and Ground connections

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

Access to control and power terminals

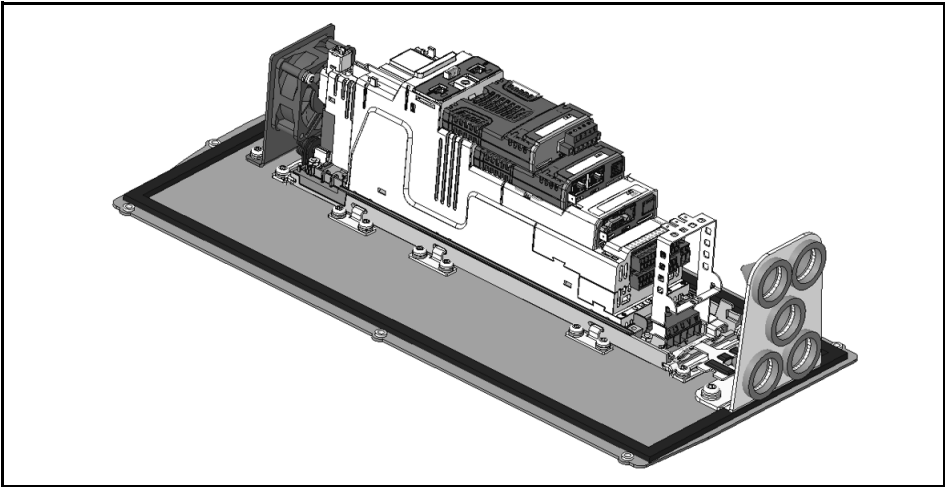
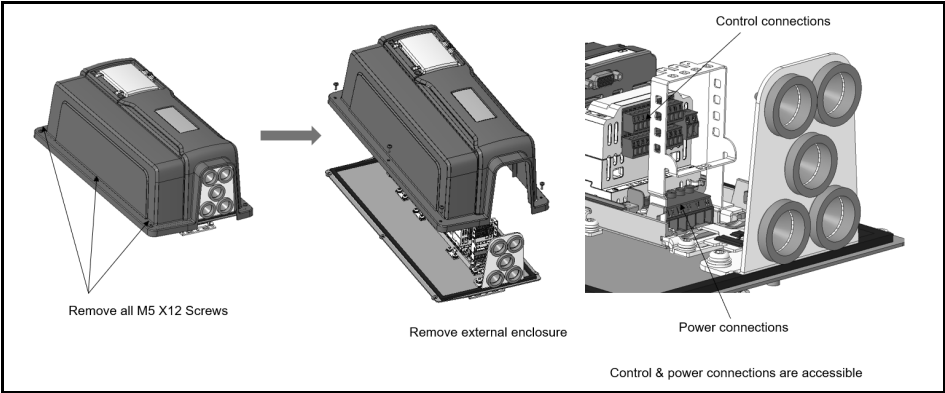


Figure 6-1 Size 3 power and ground connections

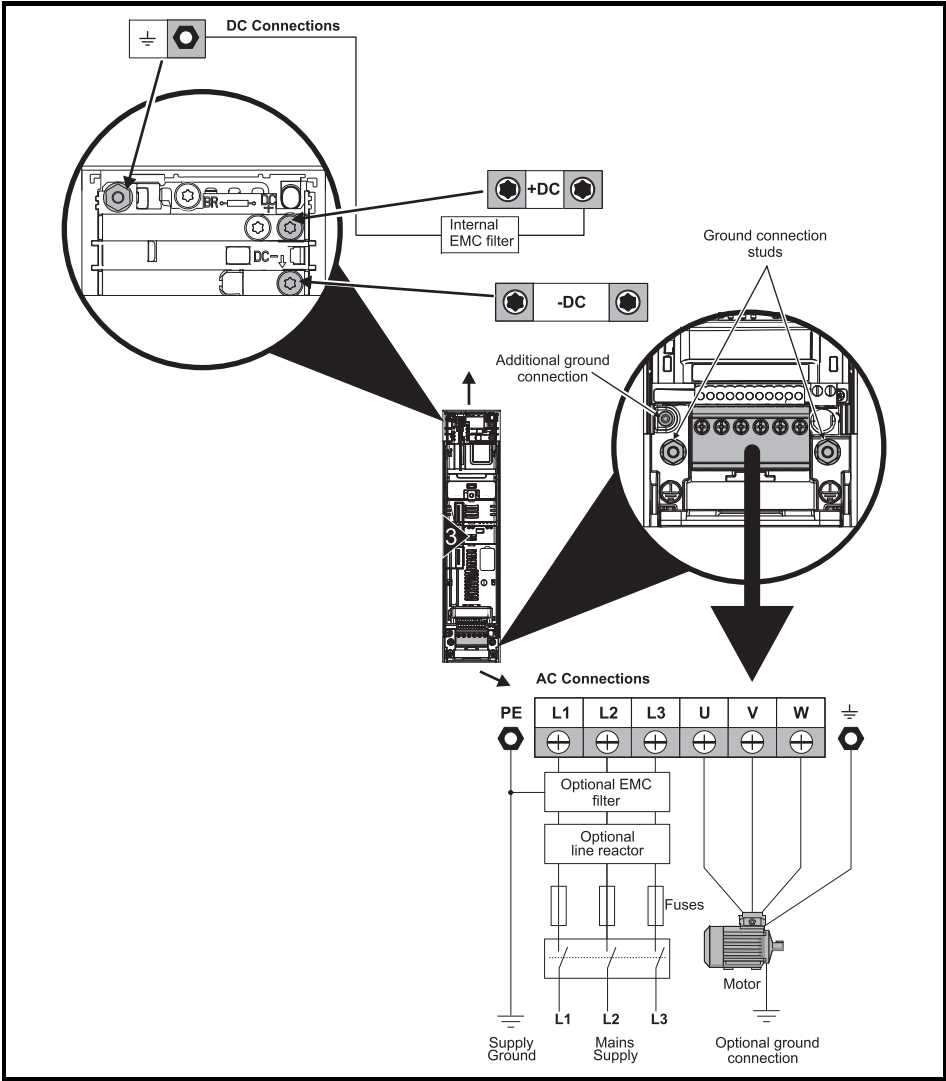


Figure 6-2 Size 4 power and ground connections

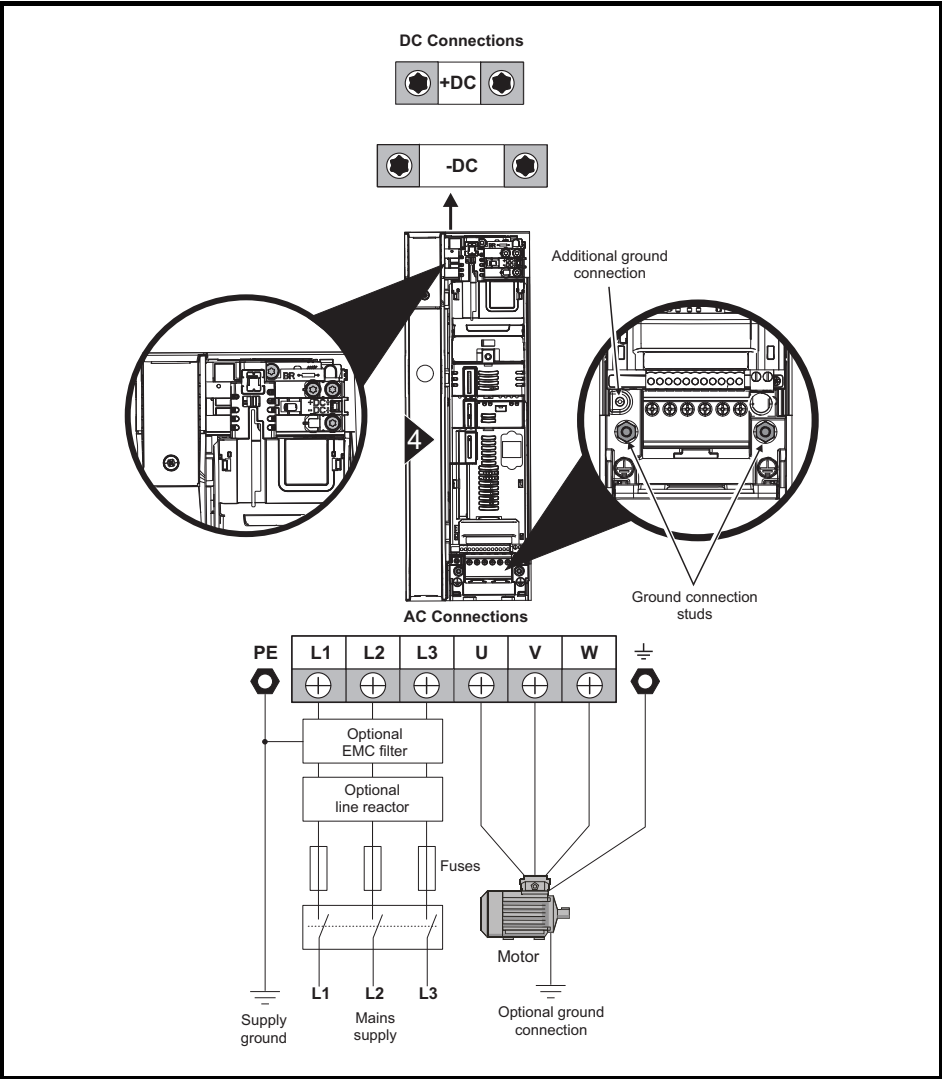


Figure 6-3 Size 5 power and ground connections

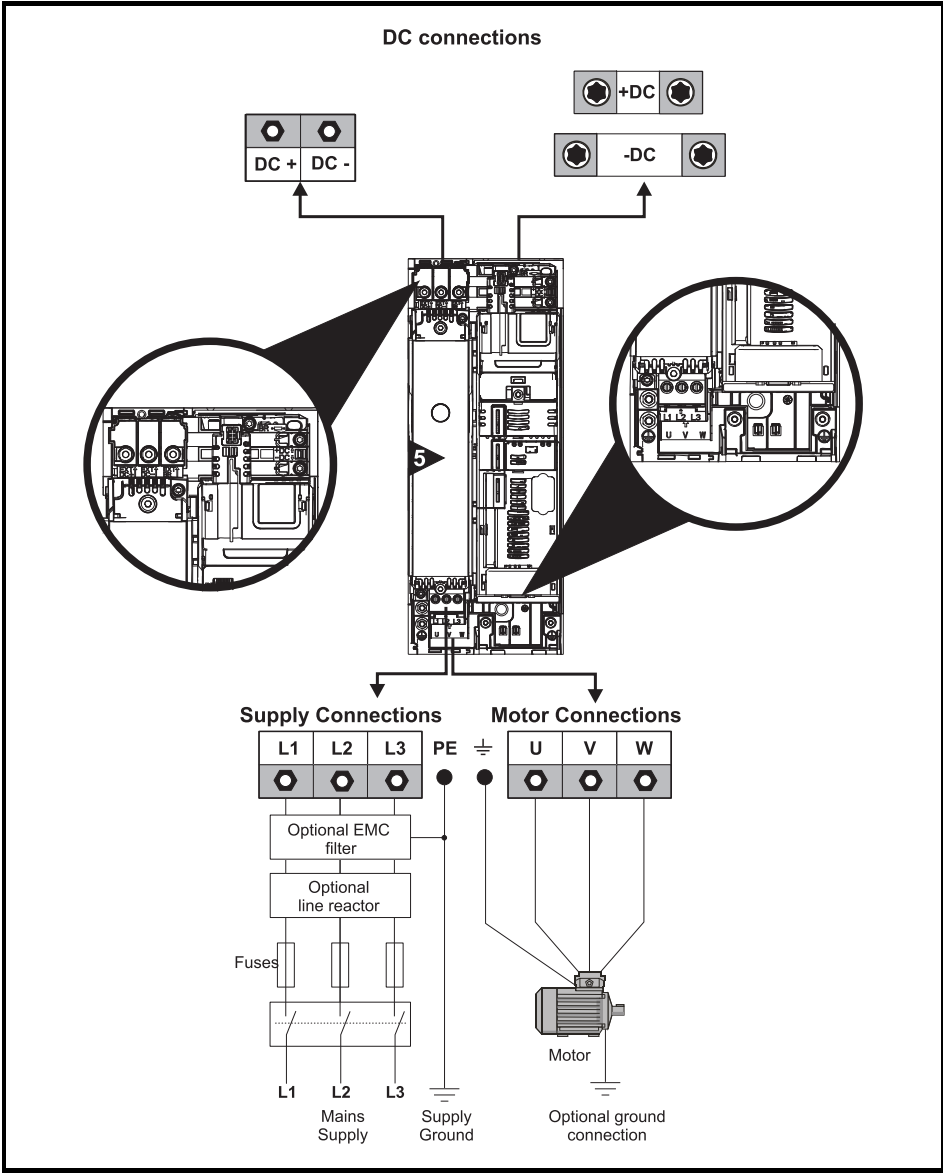
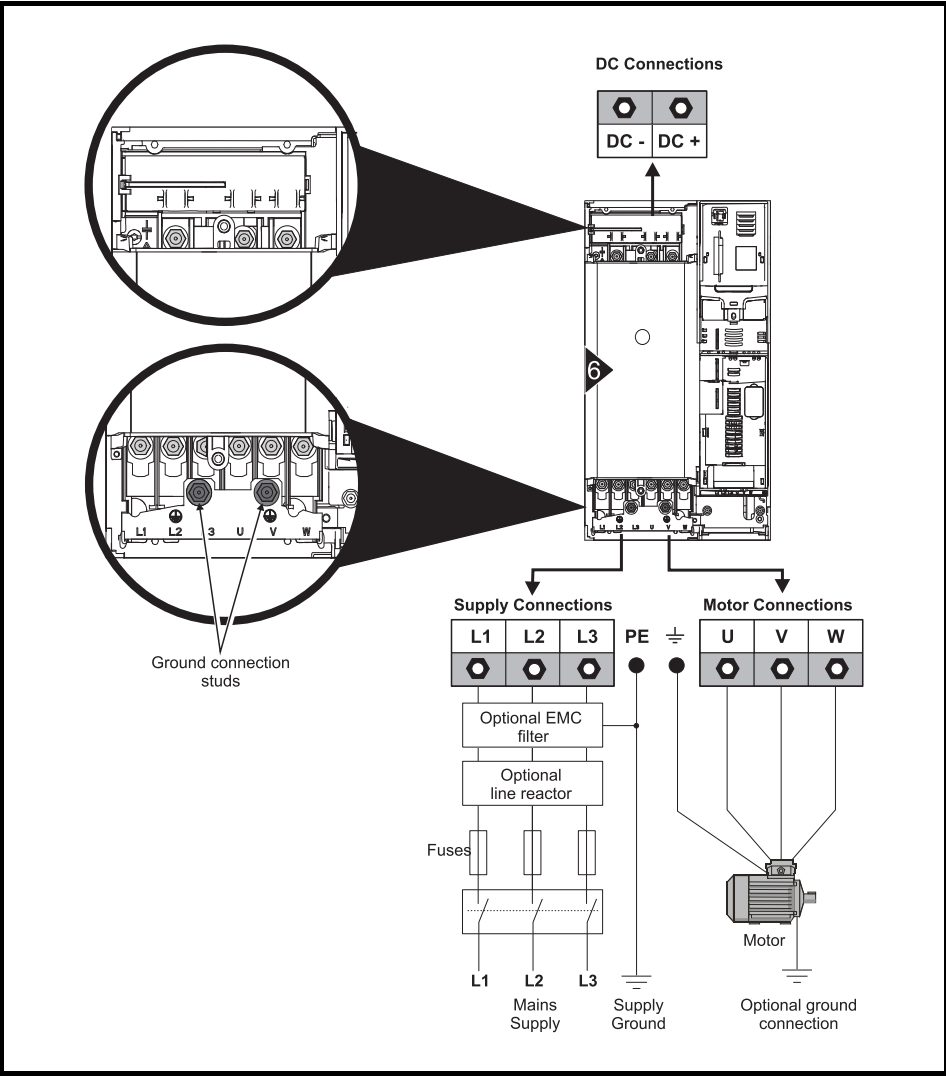


Figure 6-4 Size 6 power and ground connections



**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.

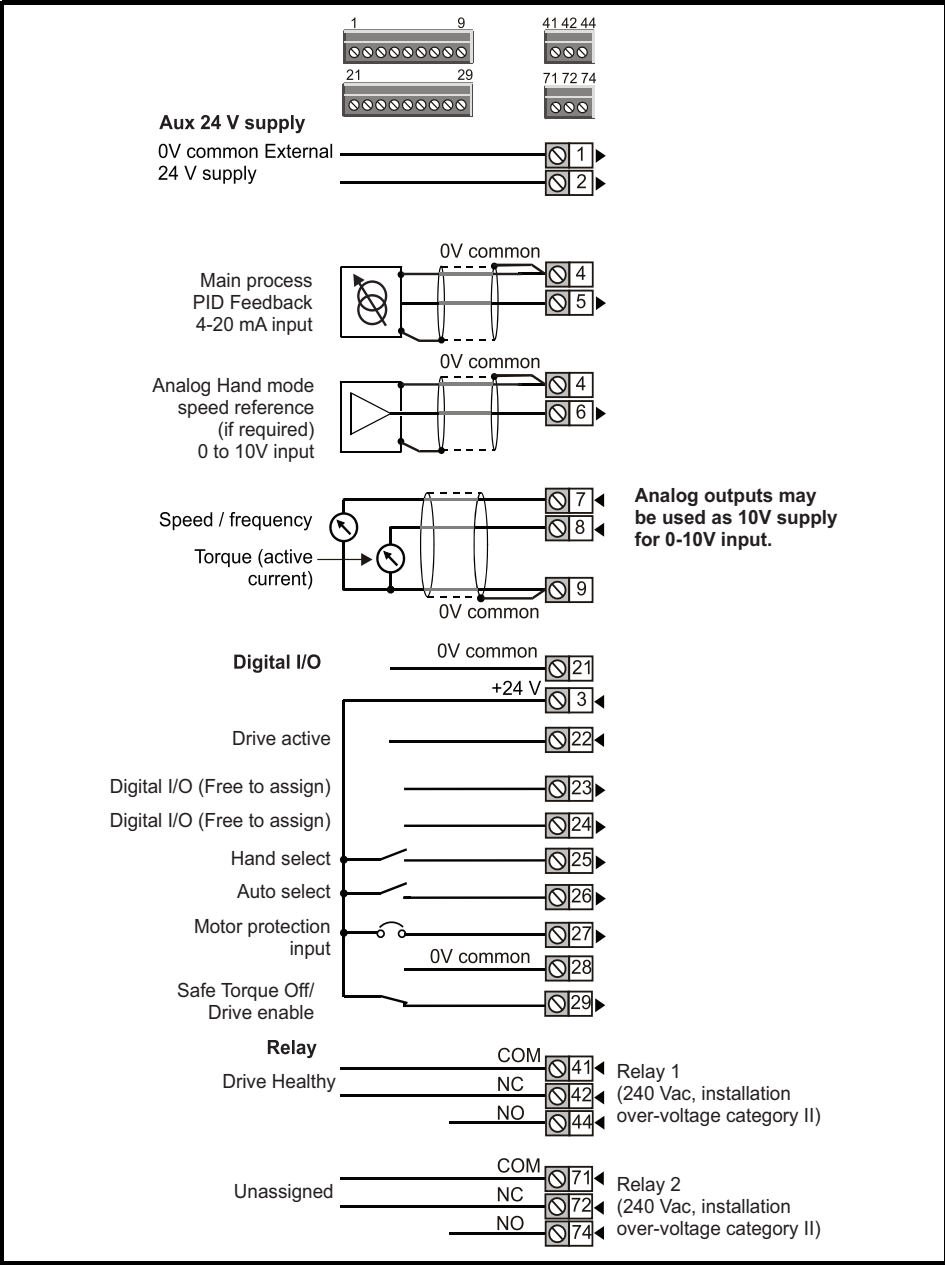
Table 6-3 Protective ground cable ratings

Input phase conductor size	Minimum ground conductor size
$\leq 10 \text{ mm}^2$	Either 10 mm^2 or two conductors of the same cross-sectional area as the input phase conductor
$> 10 \text{ mm}^2$ and $\leq 16 \text{ mm}^2$	The same cross-sectional area as the input phase conductor
$> 16 \text{ mm}^2$ and $\leq 35 \text{ mm}^2$	16 mm^2
$> 35 \text{ mm}^2$	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 6-5 F600 control terminal connections



Communications connections

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

Figure 6-6 Location of the comms connector

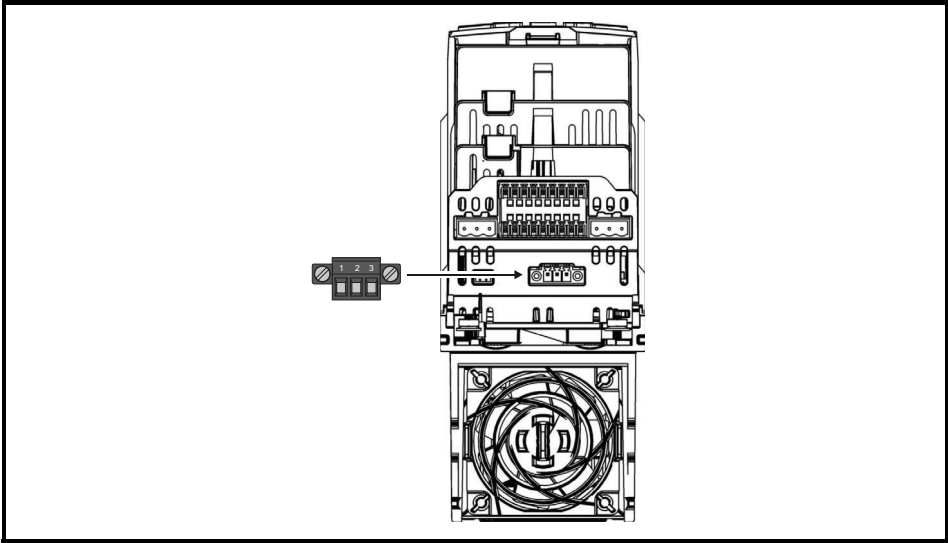


Table 6-4 Serial communication port pin-outs

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

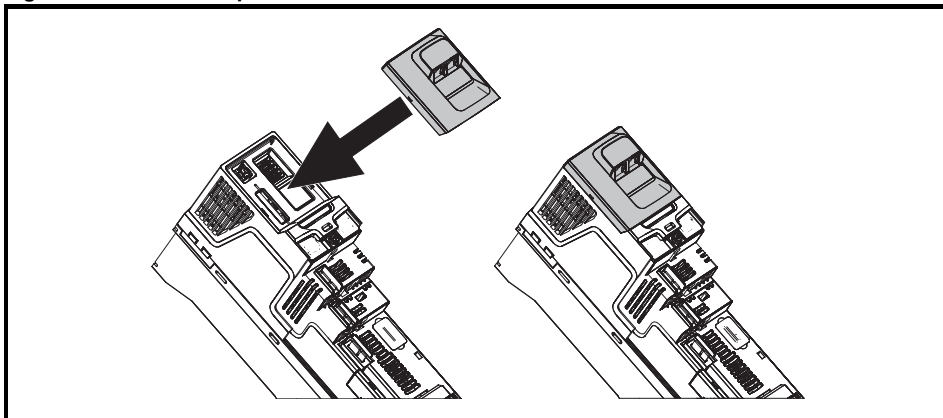
An external USB/EIA-232 hardware interface such as a PC cannot be used directly with the 2-wire EIA-485 interface of the drive.

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 mm² (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 6-7 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.

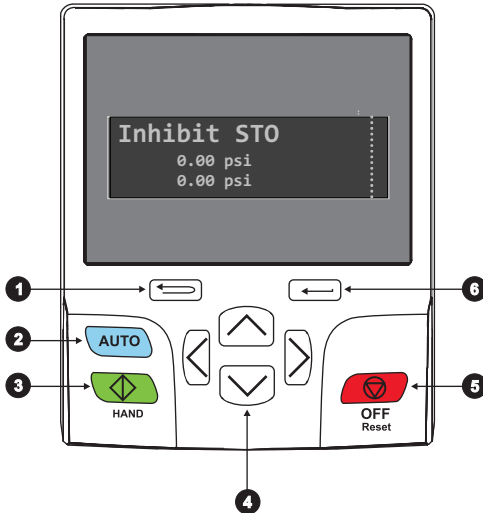
STEP 6: Use the keypad

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.

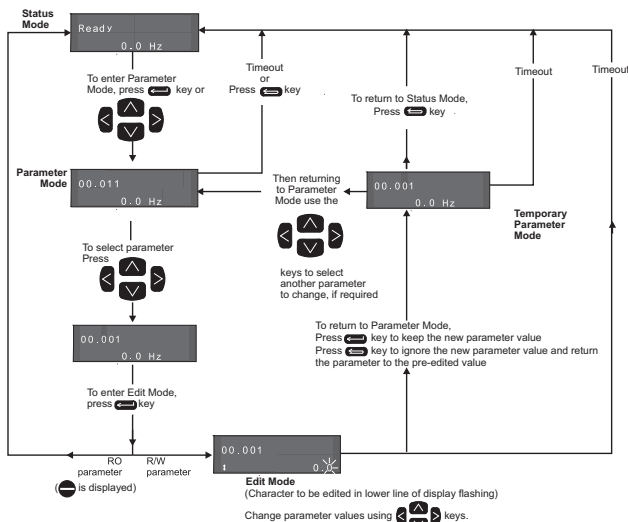
Keypad key identifier

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.

Drive Status
Configured by *Status Mode Parameter 1* Pr11.018
Configured by *Status Mode Parameter 2* Pr11.019

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 7: 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. Inhibit STO 0.00 psi 0.00 psi
Select "Induction" motor.	Set Motor Type Pr 0.004 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. Motor Type Induction OFF Reset If "Induction" is already shown, then skip this step.
Configure the motor name plate details.	- Set <i>Rated Current</i> Pr 00.006 to the motor rated current in Amps. - Set <i>Rated Speed</i> Pr 00.007, the motor rated speed in rpm. - Set <i>Rated Voltage</i> Pr 00.008, the motor rated voltage in Volts. - Set <i>Rated Power Factor</i> Pr 00.009, the motor rated power factor, (cos phi or cos φ). MOT. 3 ~ LS 80 L T N° 734570 BJ 002 Kg 9 IP 55 I d.F 40°C S1 V Hz min⁻¹ kW cos φ A Δ 230 50 2800 0,75 0,83 0,3 3 2 4 1 IEC 34-1 (B7)
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 00.017 to On. Otherwise leave Pr 00.017 set to Off. Motor Thermal Protection Enable Off

Set the Maximum Reference Clamp.	By default, <i>Maximum Reference Clamp</i> Pr 00.022 normally matches <i>Rated Frequency</i> Pr 00.005 Maximum Reference Clamp 50.0Hz It may be required when running to reduce this value if pump cavitation is suspected during operation.
Set the Hand Mode Reference frequency.	Set <i>Hand Mode Reference</i> Pr 00.026 to configure the frequency reference used in Hand mode. By default, this is half of the motor rated frequency Hand Mode Reference 25.0Hz
Enable the drive.	Close the Enable or Safe Torque Off input switch to the drive. The pump software status changes to <i>Off (Ready)</i>. Off (Ready) 0.00 psi 0.00 psi
Start the motor in Hand mode.	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>. Hand Run 0.00 psi 0.00 psi HAND  If the application requires more starting torque to get the motor turning, e.g. a waste water pump, increase <i>Low Frequency Voltage Boost</i> Pr 00.011, 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>. Off (Ready) 0.00 psi 0.00 psi OFF Reset  When safe to do so, check the application for physical items that may be preventing the motor from rotating.

Check the motor is turning in the correct direction.	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 00.026 may need to be lowered to see the direction. Hand Mode Reference 25.0Hz 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 00.018 to On to do this in software, and Set Pr 00.000 to <i>Save Parameters</i> and press the red OFF / Reset button. Reverse Output Phase Sequence On Parameter mm.000 Save parameters OFF Reset 
Stop the motor.	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>. Off (Ready) 0.00 psi 0.00 psi OFF Reset 

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

Action	Detail
Before power up.	Ensure: - The drive enable signal is not given (terminal 29). - The Run signal is not given - Motor is connected
Advanced menu access from the keypad	To access all menus required for commissioning Pr 00.001 = All Menus (1). Reminder: Select the menus using the left and right arrows. The parameters are selected using the up and down arrows.
Power up the drive.	If RFC-S mode is displayed when the drive is powered up: - If the frequency of the mains supply is 60 Hz, set Pr 00.000 = 1244, otherwise if the frequency of the mains is 50 Hz, set Pr 00.000 = 1233. If Open Loop or RFC-A mode is displayed when the drive is powered up: - If the frequency of the mains supply is 60 Hz, set Pr 00.000 = 1254, otherwise if the frequency of the mains is 50 Hz, Pr 00.000 = 1253. - Set Pr 00.048 = RFC-S (3) Press the red Reset button or toggle the Reset logic input. 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.
Motor thermistor setup.	The motor PTC thermistor must be connected to the drive, using analogue input 2 (terminals 4 and 6). For the drive to manage the thermistor: - Set <i>Analogue Input 2 Mode</i> (Pr 07.011) = Therm Short Cct (7). - Set <i>Analogue Input 2 Destination</i> (Pr 07.014) = 0.000 If two analogue inputs are required, then it may be necessary to fit an SI-I/O module.

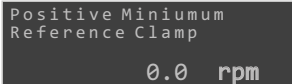
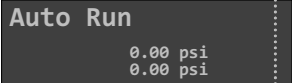
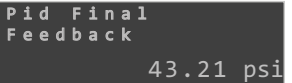
Enter motor nameplate details.	Refer to the Dyneo+ motor tables located in the Appendix. Select the table corresponding to the motor speed range (1500 or 3000 rpm). Then depending on the motor type and its power, select the line that corresponds to the voltage, the supply frequency and the rated speed of the application. From this line, set in the drive the values of all the parameters listed in the table. NOTE 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. 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 first line detail indicated in the table in Appendix C. NOTE When setting Pr 05.069, it may be necessary to increase the value entered, to ensure that the actual trip level displayed in Pr 05.068 is close to (but not greater than) the required value.
Set maximum speed.	Set the maximum speed in Pr 01.006 .
Set acceleration and deceleration rates.	Set: - Acceleration rate in Pr 02.011 (s up to Pr 01.006) - A value of 20 s suits most applications. - Deceleration rate in Pr 02.021 (s up to Pr 01.006) - A value of 20 s suits most applications. If a braking resistor is installed, set Pr 02.004 = Fast (0). Also ensure Pr 10.030 and Pr 10.031 and Pr 10.061 are set correctly, otherwise premature 'Brake R Too Hot' trips may be seen.
Additional settings.	Set: - Current Reference Filter 1 Time Constant (Pr 04.012) = 2 ms - Thermal Protection Mode (Pr 04.016) = Disabled (4) - Maximum Switching Frequency (Pr 05.018) = 3 kHz (1) - Flux Control Gain (Pr 05.027) = 0.1 - Minimum Switching Frequency (Pr 05.038) = 3 kHz (1) - Voltage Headroom (Pr 05.041) = 5 % [Do not set a lower value. Increase this value to 10 %, if the motor is unstable in the field weakening area] - RFC Low Speed Mode (Pr 05.064) = Injection (0) - Saliency Torque Control Select (Pr 05.065) = Auto [Ensure that Pr 05.066 = High, otherwise check the value entered for Pr 05.087 from the table] - Inverted Saturation Characteristic (Pr 05.070) = On (1) - Low Speed Sensorless Mode Current Limit (Pr 05.071) = 60 % [Note: This forces a reduced current limit between zero speed and 20 % of motor rated speed] If the load is a high inertia, Pr 03.010 may need to be increased.
Save parameters.	Select 'Save Parameters' in Pr mm.000 and press the red reset button or toggle the reset digital input.

STEP 8: 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.	Setup the <i>PID Minimum Scaling</i> Pr 00.030 and <i>PID Maximum Scaling</i> in Pr 00.031. By default, the feedback is configured in percent where the range is 0.00 % to 100.00 %, where 100 % = the feedback device maximum value e.g. for a 1 bar pressure sensor 100 % = 1 bar. PID Feedback Min Scaling 35.00 psi PID Feedback Max Scaling 350.0 psi 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.
Test the feedback device.	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>. Hand Run 0.00 psi 0.00 psi HAND Observe the <i>PID1 Feedback</i> Pr 0.067 and vary the Hand Mode Reference Pr 0.026. The <i>PID1 Feedback</i> Pr 0.067 should increase with an increase in <i>Hand Mode Reference</i> Pr 0.026. PID1 Feedback 43.21 % 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.
Find the frequency or speed where flow starts.	Observe the output of the application. Increase the <i>Hand Mode Reference</i> Pr 00.026 and note the value when output flow is detected. Hand Mode Reference 25.0Hz The resulting value should be entered as the <i>Positive Minimum Reference Clamp</i> Pr 00.023. Positive Minimum Reference Clamp 0.0 rpm
Stop the motor.	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>. Off (Ready) 0.00 psi 0.00 psi OFF Reset

Set the process PID setpoint.	Set process <i>PID Setpoint 0</i> Pr 00.029 to the value required by the system design, e.g. A system is designed to run at a constant 0.5 bar pressure and the pressure transducer maximum is 1 bar so the process PID setpoint in percent units would be 50.00 %. 
Set the wake threshold.	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 % and the wake threshold is 40.00 % the drive try to maintain its output between these values. Set the <i>Wake Detection Feedback Threshold</i> Pr 00.040. 
Set the sleep threshold.	The sleep threshold determines the frequency or speed below which the drive will stop during normal operation. Set the <i>Sleep Detect Speed Threshold</i> Pr 00.042 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 00.023 value.  Setting the sleep threshold less than the <i>Positive Minimum Reference Clamp</i> Pr 00.023 value disables the sleep threshold.
Run in Auto mode.	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>.   The application motor should run at a speed that controls the system output at the process <i>PID Setpoint 0</i> Pr 00.029. If the system remains in the sleeping state, the <i>process PID Final Feedback</i> Pr 00.075 has not fallen below the <i>Wake Detection Feedback Threshold</i> Pr 00.040.    Move to the next step when the drive is running in Auto mode.
Verify the sleep threshold.	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 00.042 to 1 % to 5 % above the noted value. 

Stop the motor when finished.	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>. Inhibit STO 0.00 psi 0.00 psi OFF Reset 
Save the drive parameters.	Set Pr 0.000 to “Save Parameters” and press the red OFF / Reset button. Parameter mm.000 Save parameters OFF Reset 
Choose the operating mode and additional features.	Set <i>Pump Control Mode</i> Pr 00.021 to match the system. The options available are Single Pump, Cascade and Multi-leader. Pump Control Mode Single Pump 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.

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 29.066 = 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 00.048 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 00.070 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 29.084 .

Pr 00.051	Dry Well Low Load Delay. The percentage load value in Pr 0.070 must be less than the Dry Well Low Load Threshold Pr 0.050 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 29.062 = 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 0.053 .
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 0.052 = Lower PID Output (3).
Pr 00.054	Dry Well Low Load Restart Delay. When Dry Well Low Load Mode Pr 0.052 = 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 00.023 or the Sleep Detect Speed Threshold Pr 00.042 . 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 00.045 .
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 00.059 . 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 00.060	Over-cycle Mode. Disabled (0), over-cycle detection is disabled. Alarm Only (1), Pr 29.131 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 00.061 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 00.061	Over-cycle Starts Per Hour. The Over-cycle Mode Pr 00.060 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 defs or 60Hz defs 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	STD: 1450 rpm US: 1750 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		
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)			OFF (0)		
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)

Parameter			Range			Default		
	Description		OL	RFC-A	RFC-S	OL	RFC-A	RFC-S
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] %			110 %		
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), Cascade Leader (4)			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 Wrd (2), Ctrl Wrd & 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		

Parameter			Range			Default		
	Description		OL	RFC-A	RFC-S	OL	RFC-A	RFC-S
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		
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	

Parameter			Range			Default		
	Description		OL	RFC-A	RFC-S	OL	RFC-A	RFC-S
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		
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 %					
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), Hand Stop (21), Auto Stop (22), No Flow Stop (23), Inhibit (24), Ready (25), Stop (26), Scan (27), Run (28), Supply Loss (29), Deceleration (30), dc Injection (31), Position (32), Active (33), Off (34), Hand (35), Auto (36), Heat (37), Phasing (38)			Inhibit STO (0)		

Parameter			Range			Default		
	Description		OL	RFC-A	RFC-S	OL	RFC-A	RFC-S
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						
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 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.5 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.6 Terminal Torque

Torque settings are specified in relevant sections of this guide.

A.7 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.

A.8 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.9 Thermal memory retention

All models are provided with thermal memory retention.

A.10 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.11 Dynamic braking

The drives have not been evaluated for dynamic braking.

A.12 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.13 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.

A.14 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

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 ± 10 %)

Model	Max. cont. input current	Fuse				Nominal cable size				Normal Duty			
		IEC		UL		European		USA					
		3ph	Nom	Class	Nom	Class	Input	Output	Input	Output	Max. count. output current	Nom power @ 575 V	Motor power @ 575 V
		A	A		A		mm²	mm²	AWG	AWG	A	kW	hp
F600-05500039A	4	10	gG	10	CC, J or T*	1.5	1.5	16	16	3.9	2.2	3	
F600-05500061A	7	10		10		1.5	1.5	14	14	6.1	4	5	
F600-05500100A	11	20		20		2	2	14	14	10	5.5	7.5	
F600-06500120A	13	20	gG	20	CC, J or T*	2.5	2.5	14	14	12	7.5	10	
F600-06500170A	19	32		25		6	6	10	10	17	11	15	
F600-06500220A	24	40		30		10	10	10	10	22	15	20	
F600-06500270A	29	50		35		10	10	8	8	27	18.5	25	
F600-06500340A	37	50		40		16	16	6	6	34	22	30	

* These fuses are fast acting.



Warning Before using this product you must read and understand the safety information within the User Guide at the URL below.	Avertissement 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.
Avvertenza 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.	Warnung Bevor Sie dieses Produkt verwenden, müssen Sie die Sicherheitshinweise in der Betriebsanleitung unter der nachstehenden URL lesen und verstehen.
Advertencia Antes de utilizar este producto, debe leer y comprender la información de seguridad de la Guía del usuario en la siguiente URL.	Предупреждение Преди да използвате този продукт, трябва да прочетете и разберете информацията за безопасност в ръководството за потребителя на URL адреса по-долу.
Upozorenje Prije upotrebe ovog proizvoda morate pročitati i razumjeti sigurnosne informacije iz Korisničkog vodiča na donjem URL-u.	Varování Před použitím tohoto výrobku si musíte na níže uvedené adrese URL přečíst v návodu k použití bezpečnostní informace a porozumět jim.
Προειδοποίηση Πριν από τη χρήση αυτού του προϊόντος, πρέπει να διαβάσετε και να κατανοήσετε τις πληροφορίες ασφαλείας που περιλαμβάνει ο Οδηγός χρήστη στην παρακάτω διεύθυνση.	Aviso Antes de utilizar este produto, deve ler e compreender as informações de segurança contidas no guia do utilizador que pode encontrar no URL abaixo.
Advarsel Før du tager dette produkt i brug, skal du have læst og forstået sikkerhedsoplysningerne i brugervejledningen på webadressen nedenfor.	Figyelem A termék használatá elött el kell olvasnia és meg kell értenie a Felhasználói útmutatóban található biztonsági információkat az alábbi URL-címen.
Avvertizare 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.	Waarschuwing Vóór gebruik van dit product moet u de veiligheidsinformatie in de Handleiding op de URL hieronder lezen en begrijpen..
Upozornenie Pred použitím tohto produktu si musíte prečítať a porozumieť všetkým bezpečnostným pokynom uvedeným v Používateľskej príručke, ktorú nájdete na nasledujúcej adrese URL.	Hoiatus Enne selle toote kasutamise alustamist peate lugema ja mõistma alltoodud URL-aadressil asuvas kasutusjuhendis toodud ohutusalaast teavet.
Brīdinājums Pirms šā produkta lietošanas ir jāizlasa un jāizprot informācija par drošību, kas iekļauta lietošanas pamācībā tālāk norādītajā URL.	Opozorilo Pred uporabo tega izdelka morate prebrati in razumeti varnostne informacije v navodilih za uporabo na spodnjem spletnem naslovu.
Varoituis Ennen kuin käytät tätä tuotetta, sinun on luettava ja ymmärrettävä turvallisuusohjeet, jotka sisältyvät alla mainitussa verkko-osoitteessa olevaan käyttöoppaaseen.	Ispėjimas Prieš pradėjami naudoti šį gaminį perskaitykite ir įsitinkinkite, kad supratote saugos informaciją, pateiktą naudotojo vadove, esančiamė toliau nurodytu universaliu adresu.
Twissija 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.	Varning Innan du använder denna produkt måste du läsa och förstå säkerhetsinformationen i användarhandboken på nedanstående URL-adress.
Ostrzeżenie Przed przystąpieniem do użytkowania produktu należy przeczytać ze zrozumieniem informacje dotyczące bezpieczeństwa przedstawione w Podręczniku użytkownika dostępnym pod następującym adresem.	

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