INDUSTRIAL MOTION CONTROL, LLC.

CAMCO FERGUSON

Getting Started Guide

IM-pAC

AC variable speed drive for 3 phase induction motors from 0.25kW to 4kW, 0.33hp to 5hp

Model sizes A, B and C

Part Number: 0472-0056-04
Issue: 4

General Information

The manufacturer accepts no liability for any consequences resulting from inappropriate, negligent or incorrect installation or adjustment of the optional parameters of the equipment or from mismatching the variable speed drive with the motor.

The contents of this guide are believed to be correct at the time of printing. In the interests of commitment to a policy of continuous development and improvement, the manufacturer reserves the right to change the specification of the product or its performance, or the content of the guide without notice.

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Issue: 4

Contents

Declaration of Conformity

IMC

92C85797010000
92C85797020000

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

EN 61800-5-1	Adjustable speed electrical power drive systems - safety requirements - electrical, thermal and energy
EN 61800-3	Adjustable speed electrical power drive systems. EMC product standard including specific test methods
EN 61000-6-2	Electromagnetic compatibility (EMC). Generic standards. Immunity standard for industrial environments
EN 61000-6-4	Electromagnetic compatibility (EMC). Generic standards. Emission standard for industrial environments
EN 61000-3-2	Electromagnetic compatibility (EMC), Limits, Limits for harmonic current emissions (equipment input current <16A per phase)
EN 61000-3-3	Electromagnetic compatibility (EMC), Limits, Limitation of voltage fluctuations and flicker in low-voltage supply systems for equipment with rated current <16A

These products comply with the Low Voltage Directive 73/23/EEC, the Electromagnetic Compatibility (EMC) Directive 89/336/EEC and the CE Marking Directive 93/68/EEC.

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. Compliance with safety and EMC regulations depends upon installing and configuring drives correctly, including using the specified input filters. The drives must be installed only by professional assemblers who are familiar with requirements for safety and EMC. The assembler is responsible for ensuring that the end product or system complies with all the relevant laws in the country where it is to be used. Refer to the *IM-pAC Getting Started Guide*. An EMC Data Sheet is also available giving detailed EMC information.

1 Read Me First Instructions

1.1 Data Sheet

You will need a copy of the data sheet your sales representative provided you for your application. You will need to refer to the data sheet in order to set motor speeds and dwell times.

1.2 Drive Size

You will need to determine which size drive you have for proper mounting and wiring.

IMC Part Number	Drive Size	Motor Power	Rating
92C85797010000	A	1 hp 0.75 kW	200-240V Single Phase 48-62 hz input
92C85797020000	B	1 hp 0.75 kW	380-480V Three Phase 48-62 hz input

NOTE Single phase can be obtained from a 3 phase "wye" by wiring two of the "hots" (L1 and L2 or L2 and L3 or L1 and L3) to the single phase control. Power supplied to the drive must be from a balanced power supply with an earth ground. A floating ground or an unbalanced supply can permanently damage the drive.

1.3 Safety

Read Chapter 2 *Safety Information* before mounting or wiring the drive.

The STOP and START controls or electrical inputs of the drive must not be relied upon to ensure the safety of the personnel. They do not isolate dangerous voltages from the output of the drive or from any external unit. The supply must be disconnected by an approved electrical isolation device before gaining access to electrical connections. The drive contains capacitors that remain charged to a potentially lethal voltage after AC supply has been disconnected. Wait at least 10 minutes for the stored charge to dissipate. See section 2.9.4 *Stored charge* .

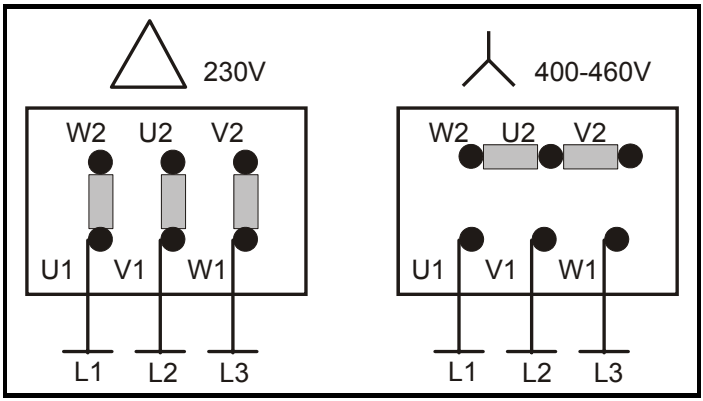
1.4 Mounting of Drive

The drive is designed to mount to a wall within a control panel or on a DIN rail. For proper functioning, mount the drive with the minimum recommended clearances. See Chapter 4.

1.5 Wiring Motor

The IMC high performance motor can be wired as either 200 or 400 volts. Wire the motor as 200V for the A Size IM-pAC and wire the motor as 400V for the B Size IM-pAC. See section 5.1, Figure 5-1 and Figure 5-2.

1.6 Motor Jumper ▭ Configuration for 1/3 hp and 1.00 hp motors



1.7 Wiring Power and Switches to Drive

1. Fusing for Size A 200V drive is a single 16 Amp and for the Size B 400V use (3) 6 Amp - one for each phase. Refer to Chapter 3 *Rating Data* for all other fuse sizes and control and motor cable wire sizes. Single phase can be obtained from a 3 phase "wye" by wiring two of the "hots" (L1 and L2 or L2 and L3 or L1 and L3) to the drive. Do not remove internal EMC filter. See Chapter 5.

2. The control terminal B2 outputs 24 volts DC and will be used to power the signals. The control terminal B4 is used to enable the drive. As long as B2 and B4 are connected the drive will run. Use a normally closed switch (not supplied by IMC) or jumper between B2 and B4 to enable the drive. The control terminal B5 runs the motor forward and B6 runs the motor in reverse. If the indexer is not turning in the proper direction interchange B5 and B6.

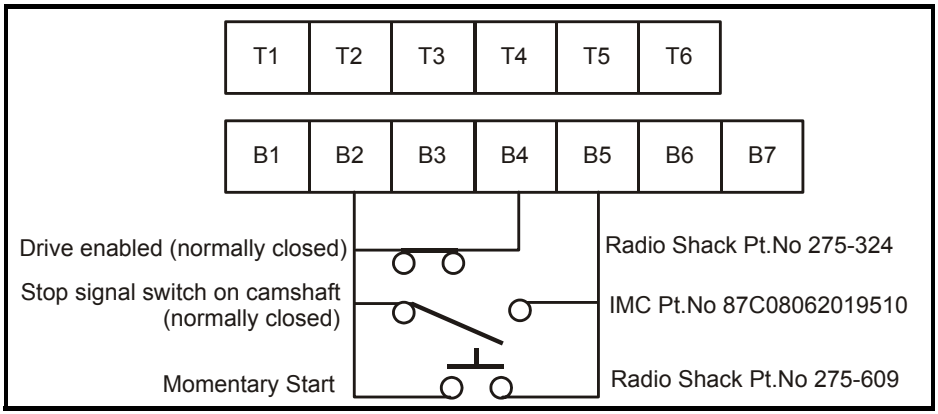
3. Make sure the indexer is in the middle of its dwell position before starting or stopping the motor. see section 1.16 *Indexer drive shown in middle of dwell position diagram.* on page 9.

4. The motor is made to run by closing the B2-B5 or B2-B6 terminals. Opening them will stop the motor.

5. Cycling on demand using a limit switch and inverter duty motor. The normally closed side of the cam shaft limit switch should be wired to terminals B2 and B5 (or B6). When the indexer is in dwell the switch will be open. A start signal is sent by momentarily closing B2 and B5 with an external switch. As the camshaft is turning the limit switch on the cam shaft will close and thus maintain the B2-B5 (or B6) closure. When the indexer enters dwell the trip cam on the cam shaft will cause the limit switch to open the B2-B5 (or B6) connection and stop the motor.

Diagram for wiring switches to the IM-pAC control terminals (cover has been removed) for cycling on demand using a limit switch, momentary start and inverter duty motor. Index drive is in middle of dwell position see section 1.16 *Indexer drive shown in middle*

of dwell position diagram. on page 9.



1.8 Programming

The IM-pAC drive is delivered to you programmed for the 1/3 hp 230V 60 hz motor (IMC Pt. No 92C49952070000). For a different motor rated frequency, amperage, voltage or power factor you must change the motor parameters Pr **39**, Pr **06**, Pr **08** and Pr **09**. Below is a chart of the values for all the possible configurations of the standard IMC motors. If you are not using an IMC motor then you must **read these values from the motor name plate**. See section 6.3 *Selecting and changing parameters* on page 46 for how to edit the parameter values.

hp	kw	IMC Motor	Frequency Pr 39 hz	Current Pr 06 amp	Rpm Pr 07	Voltage Pr 08 volt	Power factor Pr 09 cos ∅
0.33	0.25	92C49952070000	60	1.14	0	230	0.74
0.33	0.25	92C49952070000	60	0.57		460	0.74
0.33	0.25	92C49952070000	50	1.14		200	0.74
0.33	0.25	92C49952070000	50	0.57		400	0.74
1.00	0.75	92C49955410000	60	3.15		230	0.79
1.00	0.75	92C49955410000	60	1.9		460	0.66
1.00	0.75	92C49955410000	50	3.65		200	0.70
1.00	0.75	92C49955410000	50	2.1		400	0.70

1.9 Speed Control

Never auto tune the motor

You must now determine how you wish to control the maximum speed for your application.

You can use a single preset speed parameter, or use an external potentiometer, or use a potentiometer and 3 other preset speeds, or use a PLC to control speed. Please refer to one of the four parameter list sections for the additional parameter changes for the speed control you require for your application.

1.10 Overload Protection

The IM-pAC drive can provide protection to the indexer if the indexer is restrained from movement by an obstruction or jammed during motion. See section 1.24 *How to configure the IM-pAC drive to trip for a current overload.* on page 22

1.11 Brake Motors

See "24V brake motor - wiring and parameters" section.

1.12 Reversing the Motor

See "Reversing the motor direction - wiring and parameters" section.

1.13 Emergency Stop Safety

It is recommended that you purchase a commercial safety relay and motor contactor product from a vendor such as Schneider Electric, Square D, Telemecanique or Phoenix Contact that complies with the OSHA, ANSI or IEC safety directives you are required to follow.

NOTE The drive must be disabled (open the B2 - B4 connection) before the motor contactors are opened. Failure to do so will damage the drive.

1.14 Warranty and Return Policy

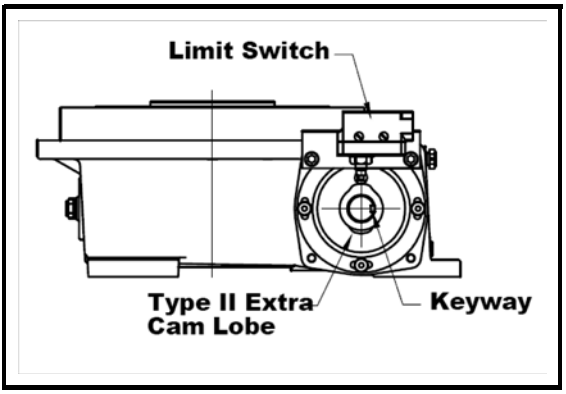
The IM-pAC Drive is warranted for 1 year from date of receipt. For technical support call CAMCO-FERGUSON (847-215-5658).

1.15 Disposal

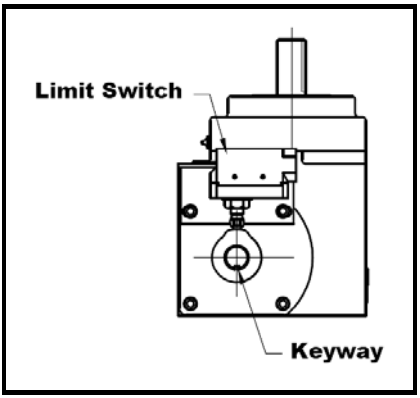
Waste Electrical and Electronic Equipment (WEEE) Directive and the Restriction on the use of Hazardous Waste (RoHS) Directive does not apply to the IM-pAC drive.

1.16 Indexer drive shown in middle of dwell position diagram.

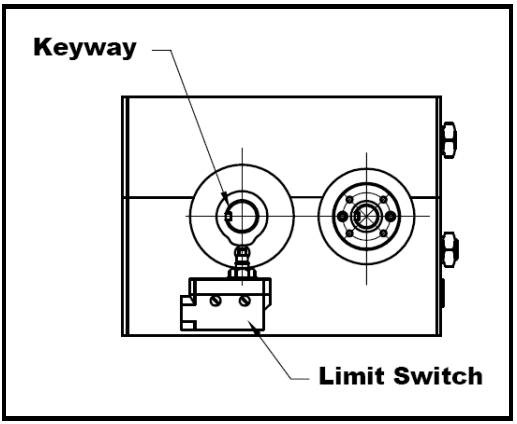
Camshaft keyway position of a Roller Gear, Right Angle or Parallel indexer stopped in the middle of dwell. For an RPP, LPP or WBD see the timing diagram or an assembly drawing for the middle dwell locations.



A standard Roller Gear unit with cam and limit or proximity switch mounted on the correct keyway position directly opposite of the output shaft, 90 degrees clockwise from the cam lobe. The cam and switch may also be mounted on the reducer. If the unit is a Type II motion a special switch cam is need with one extra lobe, 180 degrees from the first lobe.



A standard Right Angle unit with cam and limit or proximity switch mounted on the housing has a correct keyway position directly opposite the cam lobe. The cam and switch may also be mounted on the reducer.



A standard Parallel unit with cam and limit or proximity switch mounted on the housing has a correct keyway position directly opposite the output shaft, 90 degrees clockwise from the cam lobe. The cam and switch may also be mounted on the reducer.

1.17 Drive default parameter list for a single preset speed application

NOTE a) Default parameters are for motor 92C49952070000 1/3 hp. 230 V 60 hz motor. See motor name plate.

NOTE b) You should have a copy of the data sheet for the indexer application in order to set Pr **18** correctly. You must change Pr **10** (Security Level) to 2 or L3 before you can change Pr **18**, the preset speed. On the data sheet you will find the motor speed for your application and the motor's rated rpm.
Use the following calculation to determine Pr **18**.
Pr **18** = Pr **39** x Motor Speed for Application / Motor Rated RPM
Pr **18** = 60 hz x 1650 rpm / 1750 rpm = 57 hz (round all values up to a whole number)

Parameter	Description	Value	Units
Pr 01	Minimum set speed	0	Hz
Pr 02	Maximum set speed	60	Hz
Pr 03	Acceleration rate 1	0.1	s/100Hz
Pr 04	Deceleration rate 1	0.2	s/100Hz
Pr 05	Drive configuration	3:Pr	
Pr 06	Motor rated current	1.14	A (from motor plate)
Pr 07	Motor rated full load rpm	0	RPM (always 0)
Pr 08	Motor rated voltage	230	V (from motor plate)
Pr 09	Motor rated power factor	0.74	(from motor plate)
Pr 10	Security status	2:L3	
Pr 11	Start / stop logic select	0	
Pr 12	Brake controller enable	0:dis	
Pr 15	Jog reference	1.5	Hz
Pr 16	Analog input 1 mode (terminal T2)	6:VoLt	
Pr 17	Allow negative references	OFF	
Pr 18	Preset speed 1	57	Hz (See note b)
Pr 19	Preset speed 2	0	Hz
Pr 20	Preset speed 3	0	Hz
Pr 21	Preset speed 4	0	Hz
Pr 22	Load display units	Ld	
Pr 23	Speed display units	0:Fr	
Pr 24	Customer defined scaling	1	
Pr 25	User security code	0	
Pr 27	Power-up keypad reference	0	
Pr 28	Parameter cloning	0:no	
Pr 29	Load defaults	0:no	
Pr 30	Ramp mode select	3:FSt.Hv	
Pr 31	Stopping mode select	1	
Pr 32	Dynamic V to f select	OFF	
Pr 33	Catch a spinning motor select	0	
Pr 34	Terminal B7 mode select	0:dig	
Pr 35	Digital output control (terminal B3)	0:n=0	
Pr 36	Analog output control (terminal Bi)	0:Fr	

Parameter	Description	Value	Units
Pr 37	Maximum switching frequency	12	kHz
Pr 38	Auto-tune	0	
Pr 39	Motor rated frequency	60	Hz (from motor plate)
Pr 40	Number of motor poles	2:4 pole	
Pr 41	Voltage mode select	2:Fd	
Pr 42	Low frequency voltage boost	4	
Pr 43	Serial comms baud rate	19.2	
Pr 44	Serial comms address	1	
Pr 45	Software version	1.04	
Pr 46	Brake release current threshold	50	
Pr 47	Brake apply current threshold	10	
Pr 48	Brake release frequency	1	Hz
Pr 49	Brake apply frequency	2	Hz
Pr 50	Pre-brake release delay	0	s
Pr 51	Post brake release delay	0	s

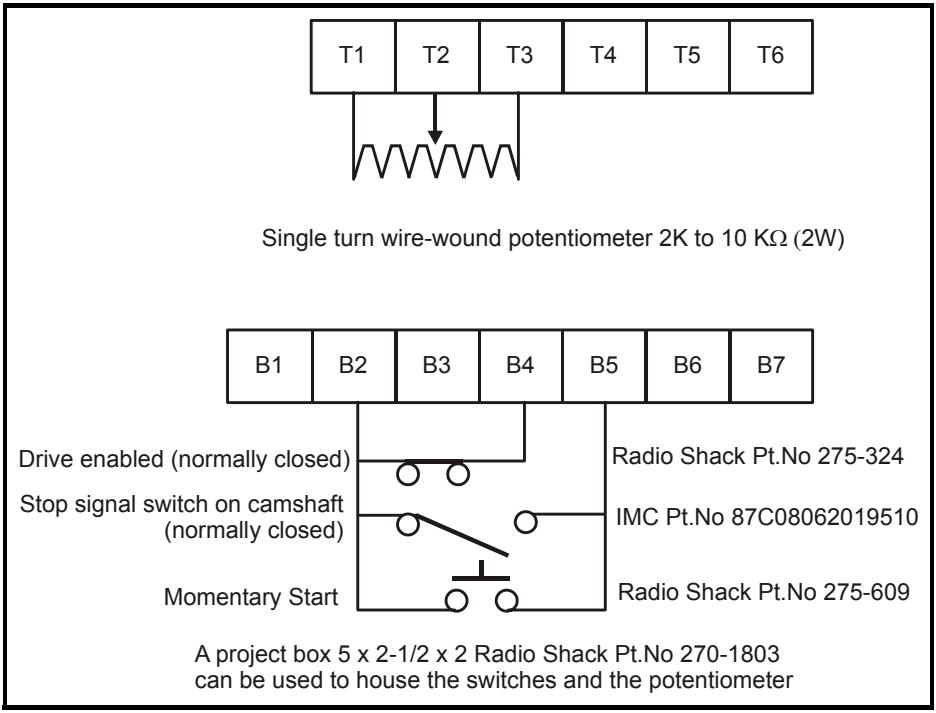
1.18 Drive parameter list for using a potentiometer to control speed

NOTE The speed range of the potentiometer is from 0 to the Pr **02** value.

Parameter	Description	Value	Units
Pr 01	Minimum set speed	0	Hz
Pr 02	Maximum set speed	60	Hz
Pr 03	Acceleration rate 1	0.1	s/100Hz
Pr 04	Deceleration rate 1	0.2	s/100Hz
Pr 05	Drive configuration	1:Av.Pr	
Pr 06	Motor rated current	-	A (from motor plate)
Pr 07	Motor rated full load rpm	0	RPM (always 0)
Pr 08	Motor rated voltage	-	V (from motor plate)
Pr 09	Motor rated power factor	-	(from motor plate)
Pr 10	Security status	0:L1	
Pr 11	Start / stop logic select	0	
Pr 12	Brake controller enable	0:dis	
Pr 15	Jog reference	1.5	Hz
Pr 16	Analog input 1 mode (terminal T2)	6:VoLt	
Pr 17	Allow negative references	OFF	
Pr 18	Preset speed 1	0	Hz
Pr 19	Preset speed 2	0	Hz
Pr 20	Preset speed 3	0	Hz
Pr 21	Preset speed 4	0	Hz
Pr 22	Load display units	Ld	

Parameter	Description	Value	Units
Pr 23	Speed display units	0:Fr	
Pr 24	Customer defined scaling	1	
Pr 25	User security code	0	
Pr 27	Power-up keypad reference	0	
Pr 28	Parameter cloning	0:no	
Pr 29	Load defaults	0:no	
Pr 30	Ramp mode select	3:FSt.Hv	
Pr 31	Stopping mode select	1	
Pr 32	Dynamic V to f select	OFF	
Pr 33	Catch a spinning motor select	0	
Pr 34	Terminal B7 mode select	0:dig	
Pr 35	Digital output control (terminal B3)	0:n=0	
Pr 36	Analog output control (terminal Bi)	0:Fr	
Pr 37	Maximum switching frequency	12	kHz
Pr 38	Auto-tune	0	
Pr 39	Motor rated frequency	-	Hz (from motor plate)
Pr 40	Number of motor poles	2:4 pole	
Pr 41	Voltage mode select	2:Fd	
Pr 42	Low frequency voltage boost	4	
Pr 43	Serial comms baud rate	19.2	
Pr 44	Serial comms address	1	
Pr 45	Software version	1.04	
Pr 46	Brake release current threshold	50	
Pr 47	Brake apply current threshold	10	
Pr 48	Brake release frequency	1	Hz
Pr 49	Brake apply frequency	2	Hz
Pr 50	Pre-brake release delay	0	s
Pr 51	Post brake release delay	0	s

Diagram for wiring switches to the IM-pAC control terminals (cover has been removed) for cycling on demand using a limit switch, momentary start and inverter duty motor.
Index drive is in middle of dwell position see section 1.16 *Indexer drive shown in middle of dwell position diagram.* on page 9.



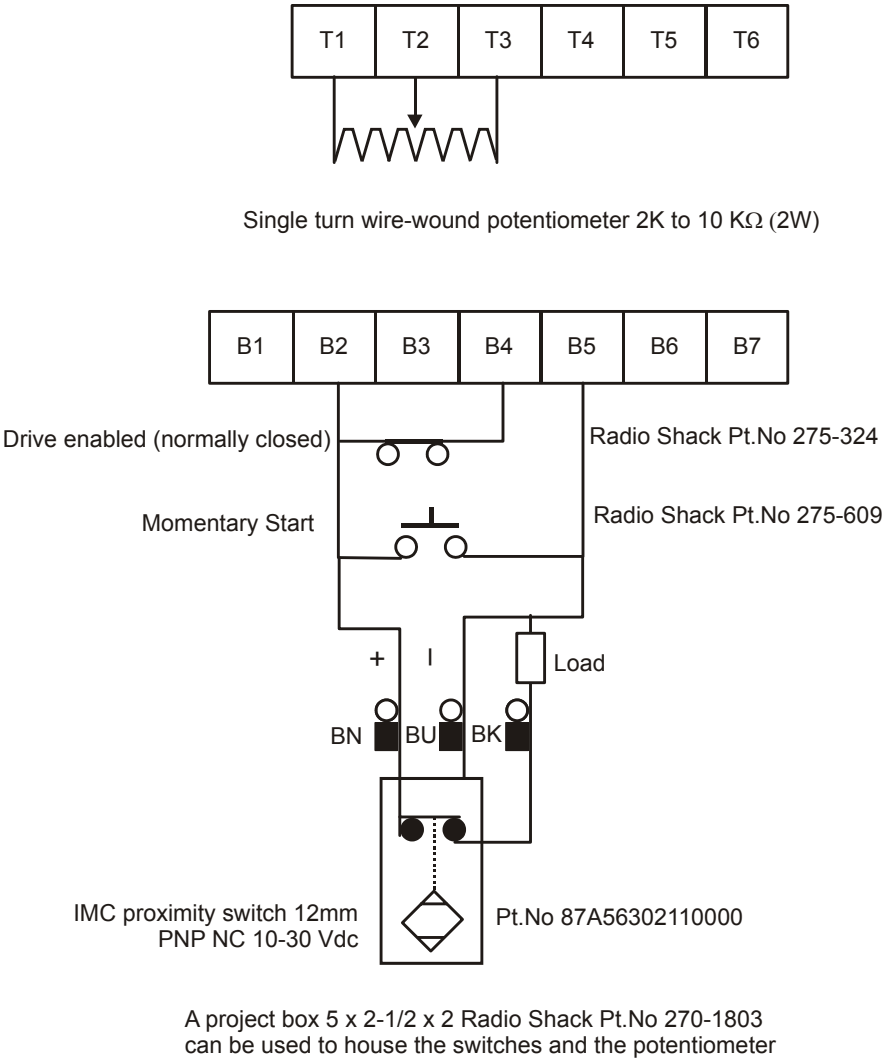
1.19 Drive parameter list for using a potentiometer to control speed with a proximity switch for cycling

NOTE The speed range of the potentiometer is from 0 to the Pr **02** value.

Parameter	Description	Value	Units
Pr 01	Minimum set speed	0	Hz
Pr 02	Maximum set speed	60	Hz
Pr 03	Acceleration rate 1	0.1	s/100Hz
Pr 04	Deceleration rate 1	0.2	s/100Hz
Pr 05	Drive configuration	1:Av.Pr	
Pr 06	Motor rated current	-	A (from motor plate)
Pr 07	Motor rated full load rpm	0	RPM (always 0)
Pr 08	Motor rated voltage	-	V (from motor plate)
Pr 09	Motor rated power factor	-	(from motor plate)
Pr 10	Security status	0:L1	
Pr 11	Start / stop logic select	0	
Pr 12	Brake controller enable	0:dis	
Pr 15	Jog reference	1.5	Hz
Pr 16	Analog input 1 mode (terminal T2)	6:VoLt	

Parameter	Description	Value	Units
Pr 17	Allow negative references	OFF	
Pr 18	Preset speed 1	0	Hz
Pr 19	Preset speed 2	0	Hz
Pr 20	Preset speed 3	0	Hz
Pr 21	Preset speed 4	0	Hz
Pr 22	Load display units	Ld	
Pr 23	Speed display units	0:Fr	
Pr 24	Customer defined scaling	1	
Pr 25	User security code	0	
Pr 27	Power-up keypad reference	0	
Pr 28	Parameter cloning	0:no	
Pr 29	Load defaults	0:no	
Pr 30	Ramp mode select	3:FSt.Hv	
Pr 31	Stopping mode select	1	
Pr 32	Dynamic V to f select	OFF	
Pr 33	Catch a spinning motor select	0	
Pr 34	Terminal B7 mode select	0:dig	
Pr 35	Digital output control (terminal B3)	0:n=0	
Pr 36	Analog output control (terminal Bi)	0:Fr	
Pr 37	Maximum switching frequency	12	kHz
Pr 38	Auto-tune	0	
Pr 39	Motor rated frequency	-	Hz (from motor plate)
Pr 40	Number of motor poles	2:4 pole	
Pr 41	Voltage mode select	2:Fd	
Pr 42	Low frequency voltage boost	4	
Pr 43	Serial comms baud rate	19.2	
Pr 44	Serial comms address	1	
Pr 45	Software version	1.04	
Pr 46	Brake release current threshold	50	
Pr 47	Brake apply current threshold	10	
Pr 48	Brake release frequency	1	Hz
Pr 49	Brake apply frequency	2	Hz
Pr 50	Pre-brake release delay	0	s
Pr 51	Post brake release delay	0	s

Diagram for wiring switches to the IM-pAC control terminals (cover has been removed) for cycling on demand using a limit switch, momentary start and inverter duty motor.
Index drive is in middle of dwell position see section 1.16 *Indexer drive shown in middle of dwell position diagram.* on page 9.


T1
T2
T3
T4
T5
T6
Single turn wire-wound potentiometer 2K to 10 KΩ (2W)
B1
B2
B3
B4
B5
B6
B7
Drive enabled (normally closed)
Radio Shack Pt.No 275-324
Momentary Start
Radio Shack Pt.No 275-609
+
I
Load
BN
BU
BK
IMC proximity switch 12mm
PNP NC 10-30 Vdc
Pt.No 87A56302110000
A project box 5 x 2-1/2 x 2 Radio Shack Pt.No 270-1803
can be used to house the switches and the potentiometer

1.20 Drive parameter list for using a potentiometer and switch selected presets to control speed

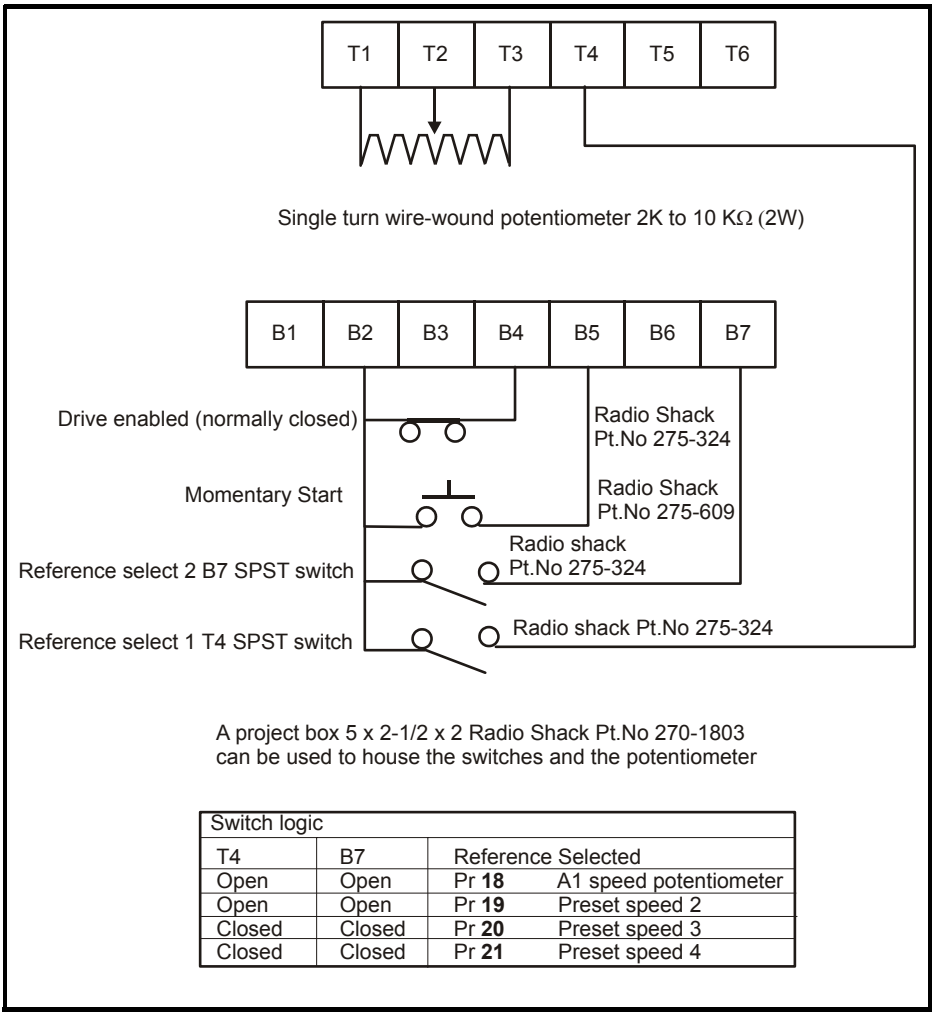
NOTE The speed range of the potentiometer is from 0 to the Pr **02** value.

Parameter	Description	Value	Units
Pr 01	Minimum set speed	0	Hz
Pr 02	Maximum set speed	60	Hz
Pr 03	Acceleration rate 1	0.1	s/100Hz
Pr 04	Deceleration rate 1	0.2	s/100Hz
Pr 05	Drive configuration	1:Av.Pr	
Pr 06	Motor rated current	-	A (from motor plate)
Pr 07	Motor rated full load rpm	0	RPM (always 0)
Pr 08	Motor rated voltage	-	V (from motor plate)
Pr 09	Motor rated power factor	-	(from motor plate)
Pr 10	Security status	2:L3	
Pr 11	Start / stop logic select	0	
Pr 12	Brake controller enable	0:dis	
Pr 15	Jog reference	1.5	Hz
Pr 16	Analog input 1 mode (terminal T2)	6:VoLt	
Pr 17	Allow negative references	OFF	
Pr 18	Preset speed 1	0	Hz
Pr 19	Preset speed 2	20	Hz
Pr 20	Preset speed 3	30	Hz
Pr 21	Preset speed 4	40	Hz
Pr 22	Load display units	Ld	
Pr 23	Speed display units	0:Fr	
Pr 24	Customer defined scaling	1	
Pr 25	User security code	0	
Pr 27	Power-up keypad reference	0	
Pr 28	Parameter cloning	0:no	
Pr 29	Load defaults	0:no	
Pr 30	Ramp mode select	3:FSt.Hv	
Pr 31	Stopping mode select	1	
Pr 32	Dynamic V to f select	OFF	
Pr 33	Catch a spinning motor select	0	
Pr 34	Terminal B7 mode select	0:dig	
Pr 35	Digital output control (terminal B3)	8:User	
Pr 36	Analog output control (terminal Bi)	0:Fr	
Pr 37	Maximum switching frequency	12	kHz
Pr 38	Auto-tune	0	
Pr 39	Motor rated frequency	-	Hz (from motor plate)

Parameter	Description	Value	Units
Pr 40	Number of motor poles	2:4 pole	
Pr 41	Voltage mode select	2:Fd	
Pr 42	Low frequency voltage boost	4	
Pr 43	Serial comms baud rate	19.2	
Pr 44	Serial comms address	1	
Pr 45	Software version	1.04	
Pr 46	Brake release current threshold	50	
Pr 47	Brake apply current threshold	10	
Pr 48	Brake release frequency	1	Hz
Pr 49	Brake apply frequency	2	Hz
Pr 50	Pre-brake release delay	0	s
Pr 51	Post brake release delay	0	s

1.21 Drive wiring for using a potentiometer and switch selected presets to control speed

Diagram for wiring switches to the IM-pAC control terminals (cover has been removed) for cycling on demand using a limit switch, momentary start and inverter duty motor.
Index drive is in middle of dwell position see section 1.16 Indexer drive shown in middle of dwell position diagram on page 10.



A project box 5 x 2-1/2 x 2 Radio Shack Pt.No 270-1803 can be used to house the switches and the potentiometer

Switch logic			
T4	B7	Reference Selected	
Open	Open	Pr **18**	A1 speed potentiometer
Open	Open	Pr **19**	Preset speed 2
Closed	Closed	Pr **20**	Preset speed 3
Closed	Closed	Pr **21**	Preset speed 4

1.22 Drive parameter list for using a PLC to control speed

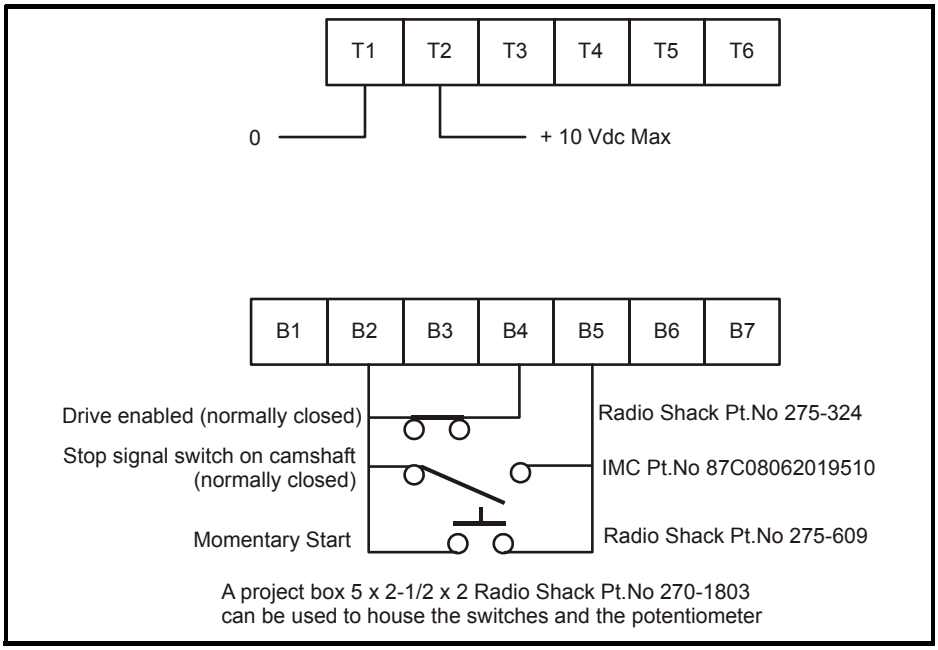
NOTE 10 Vdc applied to T1 and T2 will run the motor to the Pr **02** Maximum set speed. The speed is proportional to the applied voltage.

Parameter	Description	Value	Units
Pr 01	Minimum set speed	0	Hz
Pr 02	Maximum set speed	60	Hz
Pr 03	Acceleration rate 1	0.1	s/100Hz
Pr 04	Deceleration rate 1	0.2	s/100Hz
Pr 05	Drive configuration	2:AI.Pr	
Pr 06	Motor rated current	-	A (from motor plate)
Pr 07	Motor rated full load rpm	0	RPM (always 0)
Pr 08	Motor rated voltage	-	V (from motor plate)
Pr 09	Motor rated power factor	-	(from motor plate)
Pr 10	Security status	0:L1	
Pr 11	Start / stop logic select	0	
Pr 12	Brake controller enable	0:dis	
Pr 15	Jog reference	1.5	Hz
Pr 16	Analog input 1 mode (terminal T2)	6:VoLt	
Pr 17	Allow negative references	OFF	
Pr 18	Preset speed 1	0	Hz
Pr 19	Preset speed 2	0	Hz
Pr 20	Preset speed 3	0	Hz
Pr 21	Preset speed 4	0	Hz
Pr 22	Load display units	Ld	
Pr 23	Speed display units	0:Fr	
Pr 24	Customer defined scaling	1	
Pr 25	User security code	0	
Pr 27	Power-up keypad reference	0	
Pr 28	Parameter cloning	0:no	
Pr 29	Load defaults	0:no	
Pr 30	Ramp mode select	3:FSt.Hv	
Pr 31	Stopping mode select	1	
Pr 32	Dynamic V to f select	OFF	
Pr 33	Catch a spinning motor select	0	
Pr 34	Terminal B7 mode select	0:dig	
Pr 35	Digital output control (terminal B3)	0:n=0	
Pr 36	Analog output control (terminal Bi)	0:Fr	
Pr 37	Maximum switching frequency	12	kHz
Pr 38	Auto-tune	0	
Pr 39	Motor rated frequency	-	Hz (from motor plate)
Pr 40	Number of motor poles	2:4 pole	

Parameter	Description	Value	Units
Pr 41	Voltage mode select	2:Fd	
Pr 42	Low frequency voltage boost	4	
Pr 43	Serial comms baud rate	19.2	
Pr 44	Serial comms address	1	
Pr 45	Software version	1.04	
Pr 46	Brake release current threshold	50	
Pr 47	Brake apply current threshold	10	
Pr 48	Brake release frequency	1	Hz
Pr 49	Brake apply frequency	2	Hz
Pr 50	Pre-brake release delay	0	s
Pr 51	Post brake release delay	0	s

1.23 Drive wiring for a PLC to control speed

Diagram for wiring switches to the IM-pAC control terminals (cover has been removed) for cycling on demand using a limit switch, momentary start and inverter duty motor.
Index drive is in middle of dwell position see section 1.16 Indexer drive shown in middle of dwell position diagram on page 10.



1.24 How to configure the IM-pAC drive to trip for a current overload.

The current overload configuration will protect the index drive only and is not meant to be a means of protecting any personnel or tooling. Always make sure that no person is near the indexer and the indexer is clear of any obstructions before operating the drive while testing the configuration settings or during normal operation.

Overview

The IM-pAC drive is factory preset to constantly monitor the current seen by the motor and the drive will trip if the accumulated motor current values over time exceed a set value. This is a calculation and does not require a wired motor themistor input.

The motor thermal constant parameter controls the drive trip and is set at a default value of 89. The 89 value will allow the motor to draw 1.65 times its rated amperage for a little over 40 seconds before the drive will trip. When the drive trips the drive healthy relay (T5 and T6 contacts) will open to signal the trip. You will wire your PLC input line through the drive healthy relay to signal the trip. When the drive is tripped the display will show [It.AC]

The overload configuration scheme for the IM-pAC uses a thermal constant parameter set to 1 (the minimum) and a symmetrical current value set for the application. Index drives 601RDM and 902RDM have been tested at IMC using a thermal constant of 1 and a symmetrical current constant of 165. The drives successfully tripped without any indexer damage for a jammed dwell or an obstruction encountered during the middle of the index.

For now based upon our test results we are limiting use of this overload configuration to applications under 1 horsepower demand.

The following steps describe how to view the torque required for you application and how to change the symmetrical current and motor constant values to protect your indexer from damage.

We are assuming that you have already entered in the correct parameter values for Pr **39**, Pr **06**, Pr **08** and Pr **09** from your motor name plate.

We also assume you have placed the jumpers and wired your motor for the correct applied voltage. Remember the control voltage must be greater than or equal to the motor's voltage.

The instructions in this document are detailed and should be read carefully before proceeding. In addition we have included as a reference on the last page of this paper a page from the IM-pAC manual showing how to view and change parameters from the keypad.

Parameters Used

Parameter	Description
Pr **10**	Security level - default is L1
Pr **88**	Current magnitude - current demand for your application
Pr **4.07**	Symmetrical current value - default is 165 percent
Pr **4.15**	Motor thermal constant - default is 89

The key pad display should show [ih 0.0] and not [rd 0.0] when you start. You must put the control into inhibit mode by opening B2 and B4.

Step 1 - Changing the security level.

Press the M (memory) button on the key pad. The display will start to show the flashing parameter numbers on the left side and the non-flashing parameter values on the right side. Now, press the /\ button to the right of the M button several time until the left parameter value changes to 10. If you happen to go passed Pr **10** then use the \/ key to return to Pr **10**. Once you are at the flashing Pr **10,** press the M key and the parameter value on the right L1 should start to flash.

Press the /\ key 2 times until a value of L3 appears [10 L3].

Press the M key 2 times to return the display back to [ih 0.0].

Step 2 - How to map the motor thermal constant to Pr 61.

Press the M button on the key pad. Now, press the \/ button until the left parameter value changes to Pr **71**. If you happen to go passed Pr **71**, then use the /\ key to return to Pr **71**. Once you are at the flashing Pr **71**, press the M key and the parameter value on the right 0.0 should start to flash.

Press the /\ key several times until a value of 4.15 appears [71 4.15].

Press the M key 2 times to return the display back to the [ih 0.0].

Step 3 - How to map the symmetrical current value to Pr 62.

Press the M button on the key pad. Now, press the \/ button until the left parameter value changes to Pr **72**. If you happen to go passed Pr **72**, then use the /\ key to return to Pr **72**. Once you are at the flashing Pr **72**, press the M key and the parameter value on the right 0.0 should start to flash.

Press the /\ key several times until a value of 4.07 appears [72 4.07].

Press the M key 2 times to return the display back to [ih 0.0].

Step 4 - How to view the current magnitude for your application.

See the Safety Warning on the first page before continuing.

The key pad display should show [rd 0.0] when you start. If the display shows [ih 0.0] you must take the control out of inhibit mode by closing B2 and B4. Make sure you are set to run at your intended speed and load. You will now run the motor continuously in order to view and record the maximum current demand for your application. In order to run the motor continuously you must keep connection B2 and B5 closed. You can do this with a simple jumper. Once the motor and drive are running, press the M button on the key pad. Now, press the \/ button until the left parameter value changes to Pr **88**. If you happen to go passed Pr **88**, then use the /\ key to return to Pr **88**. The maximum value for Pr **88** is the maximum value for your application. You will use this amperage value in step 6 as part of a calculation for the symmetrical current value.

Press the M key 2 times to return the display back to the [rd 0.0].

You can now remove the jumper between B2 and B5.

Step 5 - How to change the motor thermal constant Pr 61.

Press the M button on the key pad. Now, press the \/ button several times until the left parameter value changes to Pr **61**. If you happen to go passed Pr **61**, then use the /\ key to return to Pr **61**. Once you are at the flashing Pr **61**, press the M key and the parameter value on the right Pr **89** should start to flash.

Press the \/ key several times until a value of 1 appears [61 1].

Press the M key 2 times to return the display back to the [ih 0.0].

Step 6 - How to change the symmetrical current value Pr 62.

The new symmetrical current value is calculated by the following method.

Take the value of the maximum current value observed from step 4 and divide it by the motor rated current value (Pr **06** or the name plate value) and then multiply it by 100.
e.g. XXX = 0.94 / 1.14 x 100 = 83

This means we would like the drive to fault at 83 percent of the motor rated current. We may want to add a few percent to this to avoid some nuisance trips so we will round this up to 100.

NOTE Never exceed a value of 165 for the symmetrical current or raise the value of Pr **06** above the name plate value for the applied voltage.

Press the M button on the key pad. Now, press the \/ button several until the left parameter value changes to Pr **62**. If you happen to go passed Pr **62**, then use the /\ key to return to Pr **62**. Once you are at the flashing Pr **62**, press the M key and the parameter value on the right 0.0 should start to flash. Press the /\ key several times until the value of XXX appears [62 XXX.0]. (For our revised calculated example we would have entered 100 [62 100.0].) Press the M key 2 times to return the display back to the [ih 0.0]. The drive has now been configured to trip during a current overload. You can take the drive out of the inhibit state by closing connections B2 and B4.

How to manually recover from an overload.

See the Safety Warning on the first page before starting this step.

You must put the control into inhibit mode by opening B2 and B4.

You must recover from the overload condition by returning the indexer to a dwell position at a reduced speed. You can reduce the motor speed by either changing Pr **18** or turning the speed pot down if you have one wired.

Press the button on the key pad with the red circle.

Put the control out of inhibit mode by closing B2 and B4. If the index drive does not start, then send a start signal. Once you are in a dwell position reset the motor preset value back to its original value or return the speed pot back to its normal setting.

1.25 Drive parameter list for a motor reversing application

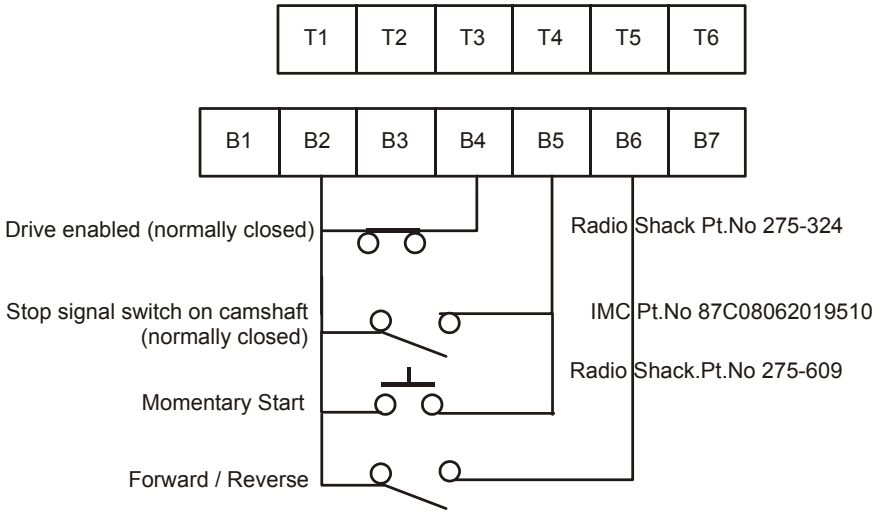
NOTE You should have a copy of the data sheet for the indexer application in order to set Pr **18** correctly. You must change Pr **10** (Security Level) to 2 or L3 before you can change Pr **18**, the preset speed. On the data sheet you will find the motor speed for your application and the motor's rated rpm.
Use the following calculation to determine Pr **18**.
Pr **18** = Pr **39** x Motor Speed for Application / Motor Rated RPM
Pr **18** = 60 hz x 1650 rpm / 1750 rpm = 57 hz (round all values up to a whole number)

Parameter	Description	Value	Units
Pr 01	Minimum set speed	0	Hz
Pr 02	Maximum set speed	60	Hz
Pr 03	Acceleration rate 1	0.1	s/100Hz
Pr 04	Deceleration rate 1	0.2	s/100Hz
Pr 05	Drive configuration	3:Pr	
Pr 06	Motor rated current	-	A (from motor plate)
Pr 07	Motor rated full load rpm	0	RPM (always 0)
Pr 08	Motor rated voltage	-	V (from motor plate)
Pr 09	Motor rated power factor	-	(from motor plate)
Pr 10	Security status	2:L3	
Pr 11	Start / stop logic select	2	
Pr 12	Brake controller enable	0:dis	
Pr 15	Jog reference	1.5	Hz
Pr 16	Analog input 1 mode (terminal T2)	6:VoLt	
Pr 17	Allow negative references	OFF	
Pr 18	Preset speed 1	50	Hz
Pr 19	Preset speed 2	0	Hz
Pr 20	Preset speed 3	0	Hz
Pr 21	Preset speed 4	0	Hz
Pr 22	Load display units	Ld	
Pr 23	Speed display units	0:Fr	
Pr 24	Customer defined scaling	1	
Pr 25	User security code	0	
Pr 27	Power-up keypad reference	0	
Pr 28	Parameter cloning	0:no	
Pr 29	Load defaults	0:no	
Pr 30	Ramp mode select	3:FSt.Hv	
Pr 31	Stopping mode select	1	
Pr 32	Dynamic V to f select	OFF	
Pr 33	Catch a spinning motor select	0	
Pr 34	Terminal B7 mode select	0:dig	
Pr 35	Digital output control (terminal B3)	0:n=0	
Pr 36	Analog output control (terminal Bi)	0:Fr	
Pr 37	Maximum switching frequency	12	kHz
Pr 38	Auto-tune	0	
Pr 39	Motor rated frequency	-	Hz (from motor plate)
Pr 40	Number of motor poles	2:4 pole	
Pr 41	Voltage mode select	2:Fd	
Pr 42	Low frequency voltage boost	4	
Pr 43	Serial comms baud rate	19.2	

Parameter	Description	Value	Units
Pr 44	Serial comms address	1	
Pr 45	Software version	1.04	
Pr 46	Brake release current threshold	50	
Pr 47	Brake apply current threshold	10	
Pr 48	Brake release frequency	1	Hz
Pr 49	Brake apply frequency	2	Hz
Pr 50	Pre-brake release delay	0	s
Pr 51	Post brake release delay	0	s

1.26 Drive wiring for a motor reversing application.

Diagram for wiring switches to the IM-pAC control terminals (cover has been removed) for cycling on demand using a limit switch, momentary start and inverter duty motor.
Index drive is in middle of dwell position see section 1.16 Indexer drive shown in middle of dwell position diagram on page 10.



You must provide the logic which will open and close the B2-B6 terminals.
Opening or closing the B2-B6 terminals with parameter Pr **11** set to 2 will reverse the motor direction for the next move.
There must be two limit switch cams mounted to signal the motor stop for the middle of dwell,
one for the forward motion and the other for the reverse, see below.

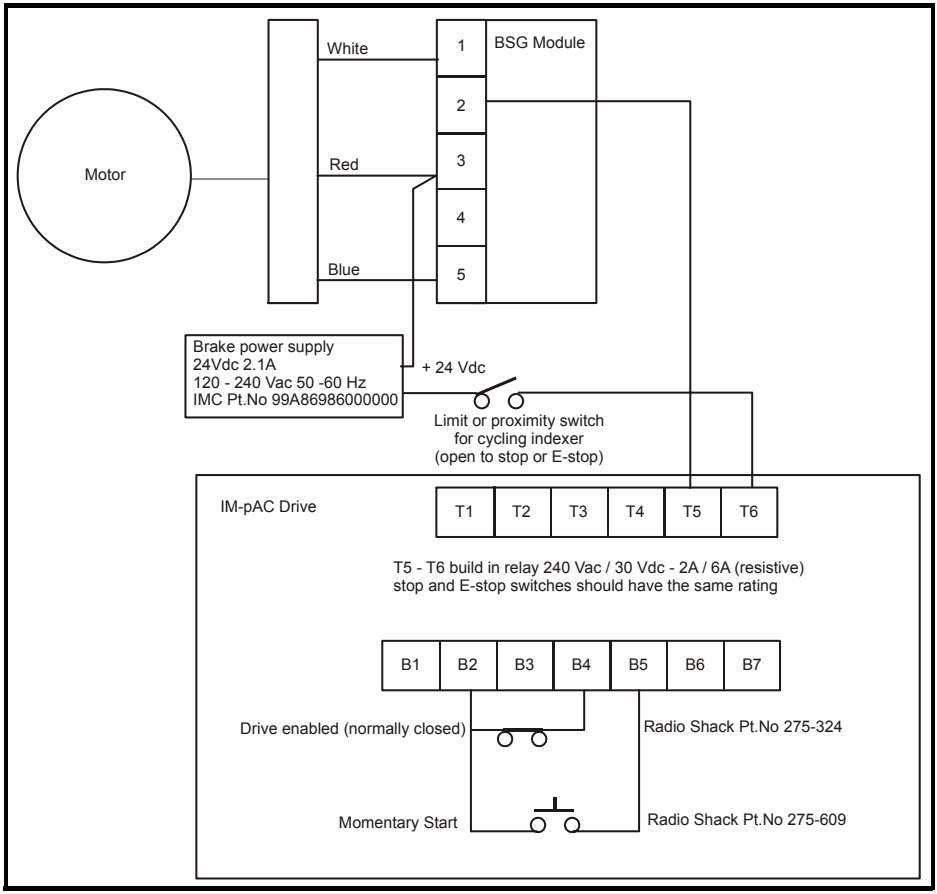
1.27 Drive parameter list for a 24Vdc brake motor

Parameter	Description	Value	Units
Pr 01	Minimum set speed	0	Hz
Pr 02	Maximum set speed	60	Hz
Pr 03	Acceleration rate 1	0.1	s/100Hz
Pr 04	Deceleration rate 1	0.2	s/100Hz
Pr 05	Drive configuration	3:Pr	
Pr 06	Motor rated current	-	A (from motor plate)
Pr 07	Motor rated full load rpm	0	RPM (always 0)
Pr 08	Motor rated voltage	-	V (from motor plate)
Pr 09	Motor rated power factor	-	(from motor plate)
Pr 10	Security status	2:L3	
Pr 11	Start / stop logic select	0	
Pr 12	Brake controller enable	1:rEL	
Pr 15	Jog reference	1.5	Hz
Pr 16	Analog input 1 mode (terminal T2)	6:VoLt	
Pr 17	Allow negative references	OFF	
Pr 18	Preset speed 1	60	Hz
Pr 19	Preset speed 2	0	Hz
Pr 20	Preset speed 3	0	Hz
Pr 21	Preset speed 4	0	Hz
Pr 22	Load display units	Ld	
Pr 23	Speed display units	0:Fr	
Pr 24	Customer defined scaling	1	
Pr 25	User security code	0	
Pr 27	Power-up keypad reference	0	
Pr 28	Parameter cloning	0:no	
Pr 29	Load defaults	0:no	
Pr 30	Ramp mode select	3:FSt.Hv	
Pr 31	Stopping mode select	1	
Pr 32	Dynamic V to f select	OFF	
Pr 33	Catch a spinning motor select	0	
Pr 34	Terminal B7 mode select	0:dig	
Pr 35	Digital output control (terminal B3)	0:n=0	
Pr 36	Analog output control (terminal Bi)	0:Fr	
Pr 37	Maximum switching frequency	12	kHz
Pr 38	Auto-tune	0	
Pr 39	Motor rated frequency	-	Hz (from motor plate)
Pr 40	Number of motor poles	2:4 pole	
Pr 41	Voltage mode select	2:Fd	
Pr 42	Low frequency voltage boost	4	

Parameter	Description	Value	Units
Pr 43	Serial comms baud rate	19.2	
Pr 44	Serial comms address	1	
Pr 45	Software version	1.04	
Pr 46	Brake release current threshold	50	
Pr 47	Brake apply current threshold	10	
Pr 48	Brake release frequency	1	Hz
Pr 49	Brake apply frequency	2	Hz
Pr 50	Pre-brake release delay	0	s
Pr 51	Post brake release delay	0	s

1.28 Drive wiring for a 24Vdc brake motor

Diagram for wiring switches to the IM-pAC control terminals (cover has been removed) for cycling on demand using a limit switch, momentary start and inverter duty motor.
Index drive is in middle of dwell position see section 1.16 Indexer drive shown in middle of dwell position diagram on page 10.



1.29 Drive and Options part numbers

Table 1-1 Sizes

IMC Part Number	Drive size	Motor Power	Rating
92C85797010000	A	1 HP 0.75 kW	200 - 240V 0.75 kW 1 phase 48 - 62 hz
92C85797020000	B	1 HP 0.75 kW	380 - 380V 0.75 kW 3 phase 48 - 62 hz
92C85797030000	B	1.5 HP 1.1 kW	200 - 240V 1.1 kW 1 or 3 phase 48 - 62 hz
92C85797040000	B	2 HP 1.5 kW	200 - 240V 1.5 kW 1 or 3 phase 48 - 62 hz
92C85797050000	C	3 HP 2.2 kW	200 - 240V 2.2 kW 1 or 3 phase 48 - 62 hz
92C85797060000	B	2 HP 1.5 kW	380 - 380V 1.5 kW 3 phase 48 - 62 hz
92C85797070000	C	3 HP 2.2 kW	380 - 380V 2.2 kW 3 phase 48 - 62 hz
92C85797080000	C	5 HP 4.0 kW	380 - 380V 4.0 kW 3 phase 48 - 62 hz

Table 1-2 Options

IMC Part Number	Description
92C857970110000	Profibus option module size B or C only
92C857970120000	DeviceNet option module size B or C only
92C857970130000	CAN Open option module size B or C only
92C857970140000	Interbus Option module size B or C only
92C857970150000	Ethernet Option module size B or C only
92C857970160000	Additional I/O option module size B or C only
92C857970170000	Additional I/O with Real Time Clock option module size B or C only
92C857970180000	Cloning memory option
92C857970190000	PLC ladder logic option
92C857970200000	Kit consisting of plastic top and side covers and steel bottom conduit entry cover to comply with UL Type 1 for size A
92C857970210000	Kit consisting of plastic top and side covers and steel bottom conduit entry cover to comply with UL Type 1 for size B
92C857970220000	Kit consisting of plastic top and side covers and steel bottom conduit entry cover to comply with UL Type 1 for size C
92C857970230000	Kit consisting of plastic top and side covers to comply with IP4X for size A
92C857970240000	Kit consisting of plastic top and side covers to comply with IP4X for size B
92C857970250000	Kit consisting of plastic top and side covers to comply with IP4X for size C
92C857970260000	Cable strain relief - fits sizes A, B, or C
92C857970270000	Communications cable for connecting the drive to a PC
92C857970280000	LCD Text keypad IP54
92C857970290000	LED Remote keypad IP54
92C857970300000	Filter for IM-pAC size A
92C857970310000	Filter for IM-pAC size B
92C857970320000	Line reactor for IM-pAC size A
92C857970330000	Line reactor for IM-pAC size B

2 Safety Information

2.1 Warnings, Cautions and Notes

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

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

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

2.2 Electrical Safety - general warning

The voltages used in the drive can cause severe electrical shock and/or burns, and could be lethal. Extreme care is necessary at all times when working with or adjacent to the drive.

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

2.3 System design and safety of personnel

The drive is intended as a component for professional incorporation into complete equipment or system. If installed incorrectly, the drive may present a safety hazard.

The drive uses high voltages and currents, carries a high level of stored electrical energy, and is used to control equipment which can cause injury.

System design, installation, commissioning and maintenance must be carried out by personnel who have the necessary training and experience. They must read this safety information and this guide carefully.

The STOP and START controls or electrical inputs of the drive must not be relied upon to ensure safety of personnel. They do not isolate dangerous voltages from the output of the drive or from any external option unit. The supply must be disconnected by an approved electrical isolation device before gaining access to the electrical connections.

The drive is not intended to be used for safety-related functions.

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

2.4 Environmental Limits

Instructions within the supplied data and information within the *IM-pAC Technical Data Guide* regarding transport, storage, installation and the use of the drive must be complied with, including the specified environmental limits. Drives must not be subjected to excessive physical force.

2.5 Access

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

The IP (Ingress Protection) rating of the drive is installation dependant. For further information, refer to the *IM-pAC Technical Data Guide*.

2.6 Compliance and regulations

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

The *IM-pAC EMC Guide* contains instructions for achieving compliance with specific EMC standards.

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

98/37/EC: Safety of machinery

89/336/EEC: Electromagnetic compatibility

2.7 Motor

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

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

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

The values of the motor parameters set in the drive affect the protection of the motor. The default values in the drive should not be relied upon.

It is essential that the correct value is entered into parameter **06**, motor rated current. This affects the thermal protection of the motor.

2.8 Adjusting parameters

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

2.9 Electrical installation

2.9.1 Electric shock risk

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

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

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

2.9.2 Isolation device

The AC supply must be disconnected from the drive using an approved isolation device before any cover is removed from the drive or before any servicing work is performed.

2.9.3 STOP function

The STOP function does not remove dangerous voltages from the drive, the motor or any external option units.

2.9.4 Stored charge

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

Normally, the capacitors are discharged by an internal resistor. Under certain, unusual fault conditions, it is possible that the capacitors may fail to discharge, or be prevented from being discharged by a voltage applied to the output terminals. If the drive has failed in a manner that causes the display to go blank immediately, it is possible the capacitors will not be discharged. In this case, consult IMC or their authorised distributor.

2.9.5 Equipment supplied by plug and socket

Special attention must be given if the drive is installed in equipment which is connected to the AC supply by a plug and socket. The AC supply terminals of the drive are connected to the internal capacitors through rectifier diodes which are not intended to give safety isolation. If the plug terminals can be touched when the plug is disconnected from the socket, a means of automatically isolating the plug from the drive must be used (e.g. a latching relay).

2.9.6 Ground leakage current

The drive is supplied with an internal EMC filter capacitor fitted. If the input voltage to the drive is supplied through an ELCB or RCD, these may trip due to the ground leakage current. See section 5.3.1 *Internal EMC filter* on page 41 for further information and how to disconnect the internal EMC capacitor.

3 Rating Data

Table 3-1 IM-pAC 200V units A Size

Model Number	Nominal motor power		Supply voltage and frequency	Typical full load input current A		100% RMS output current A	150% overload current for 60s A	Minimum braking resistor value Ω
	hp	kW		1ph	3ph	Heavy Duty		
92C85797010000	1.0	0.75	1 phase 200 to 240Vac ±10% 48 to 62Hz	10.5		4.0	6.0	68
92C85797030000	1.5	1.1	1 and 3 phase 200 to 240V ±10% 48 to 62Hz	14.2	16.7	5.2	7.8	28
92C85797040000	2.0	1.5	1 or 3 phase 200 to 240V ±10% 48 to 62Hz	17.4	8.7	7.0	10.5	28
92C85797050000	3.0	2.2	1 or 3 phase 200 to 240V ±10% 48 to 62Hz	23.2	11.9	9.6	14.4	28

Table 3-2 IM-pAC 400V units B and C Size

Model Number	Nominal motor power		Supply voltage and frequency	Typical full load input current A	Maximum continuous input current A	100% RMS output current A	150% overload current for 60s A	Minimum braking resistor value Ω
	kW	hp				Heavy Duty		
92C85797020000	0.75	1.0	3 phase 380 to 480Vac ±10% 48 to 62Hz	3.1	3.75	2.1	3.15	100
92C85797060000	2.0	1.5	3 phase 380 to 480Vac ±10% 48 to 62Hz	5.2	5.9	3.8	5.7	100
92C85797070000	2.2	3.0	3 phase 380 to 480Vac ±10% 48 to 62Hz	7.3	9.6	5.1	7.65	100
92C85797080000	4.0	5.0	3 phase 380 to 480Vac ±10% 48 to 62Hz	11.9	13.4	9.0	13.5	55

Output frequency: 0 to 1500Hz

Output voltage: 3 phase, 0 to drive rating (240 or 480Vac maximum set by Pr **08**).

NOTE The output voltage can be increased by 20% during deceleration. See Pr **30** on page 57

NOTE The maximum continuous current inputs are used to calculate input cable and fuse sizing. Where no maximum continuous input currents are indicated, use the typical full load input current values.

Model Number	Phases ph		Fuse		Input cable		Motor cable	
	1	3	1ph	3ph	AWG	mm^2	AWG	mm^2
92C85797010000	x	N/A	16	N/A	14	1.5	16	1
92C85797020000	N/A	x	N/A	6	16	1	16	1
92C85797030000	x	x	16	10	12 / 14	2.5 / 1.5	16	1
92C85797040000	x	x	20	16	12 / 14	2.5 / 1.5	16	1
92C85797050000	x	x	25	20	10 / 12	4.0 / 2.5	14	1.5
92C85797060000	N/A	x	N/A	10	16	1	16	1
92C85797070000	N/A	x	N/A	16	14	1.5	16	1
92C85797080000	N/A	x	N/A	16	12	2.5	14	1.5

NOTE The two cable sizes for 92C85797030000, 92C85797040000 and 92C85797050000 refer to 1 and 3 phase values respectively.

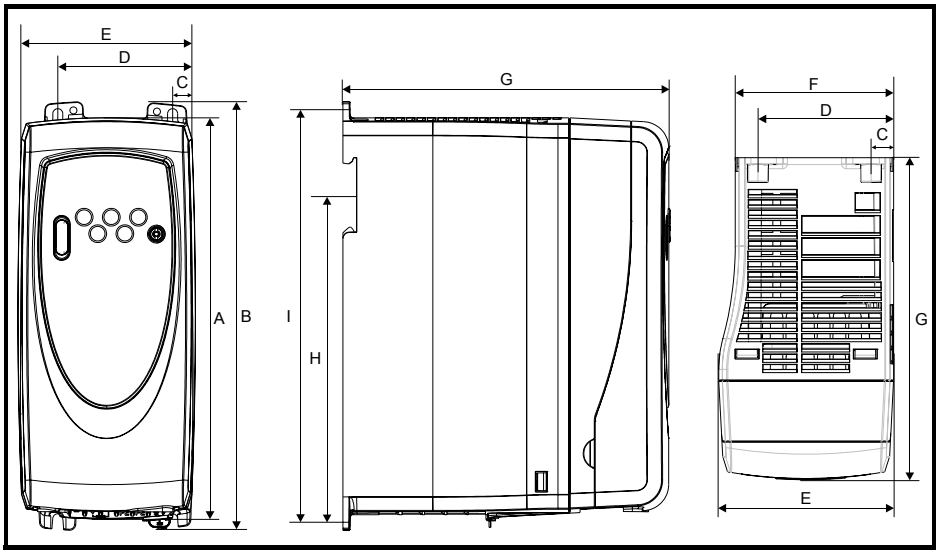
4 Mechanical Installation

WARNING

Enclosure

The drive is intended to be mounted in an enclosure which prevents access except by trained and authorised personnel, and which prevents the ingress of contamination. It is designed for use in an environment classified as pollution degree 2 in accordance with IEC 60664-1. This means that only dry, non-conducting contamination is acceptable.

Figure 4-1 IM-pAC dimensions



Mounting holes: 4 x M4 holes

Table 4-1 IM-pAC dimensions

Drive size	A		B		C		D		E		F		G		H*		I	
	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in
A	140	5.51	154	6.06	11	0.43	64	2.52	75	2.95			145	5.71	104	4.09	143	5.63
B	190	7.48	205	8.07	10.9	0.43	65.9	2.6	85	3.35	77	3.0	156	6.15	155.5	6.12	194	7.64
C	240	9.45	258	10.16	10.4	0.41	81.1	3.2	100	3.94	91.9	3.62	173	6.81			244	9.61

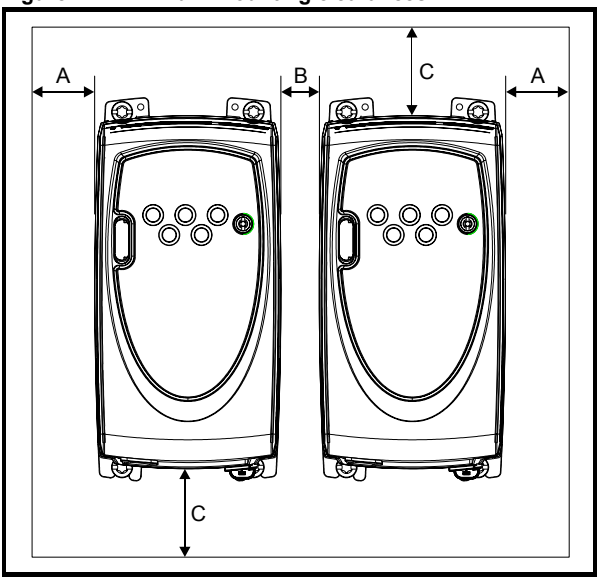
*Size C is not DIN rail mountable.

NOTE If DIN rail mounting is used in an installation where the drive is to be subjected to shock or vibration, it is recommended that the bottom mounting screws are used to secure the drive to the back plate.

If the installation is going to be subjected to heavy shock and vibration, then it is recommended that the drive is surface mounted rather than DIN rail mounted.

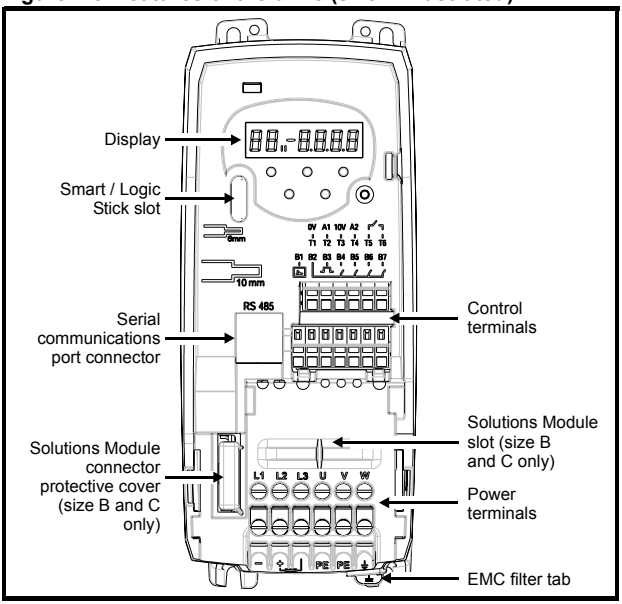
NOTE The DIN rail mounting mechanism has been designed so no tools are required to install and remove the drive from a DIN rail. Please ensure the top mounting lugs are located correctly on the DIN rail before installation is initiated.

Figure 4-2 Minimum mounting clearances



Drive size	A		B		C	
	mm	in	mm	in	mm	in
A	10	0.39	0	0	100	3.94
B (≤0.75kW)			10	0.39		
B (≥1.1kW)			0	0		
C						

Figure 4-3 Features of the drive (size B illustrated)



5 Electrical Installation

5.1 Power terminal connections

Figure 5-1 Size A power terminal connections

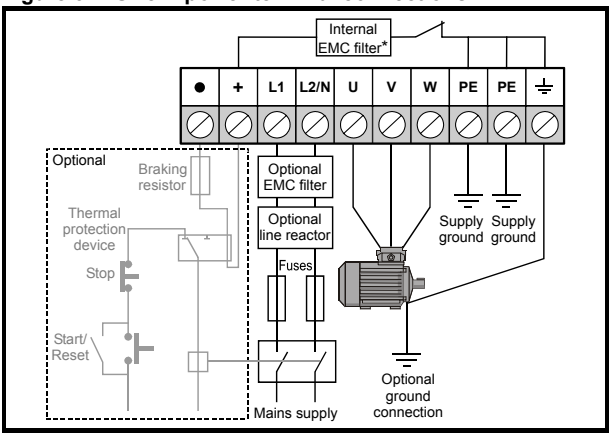
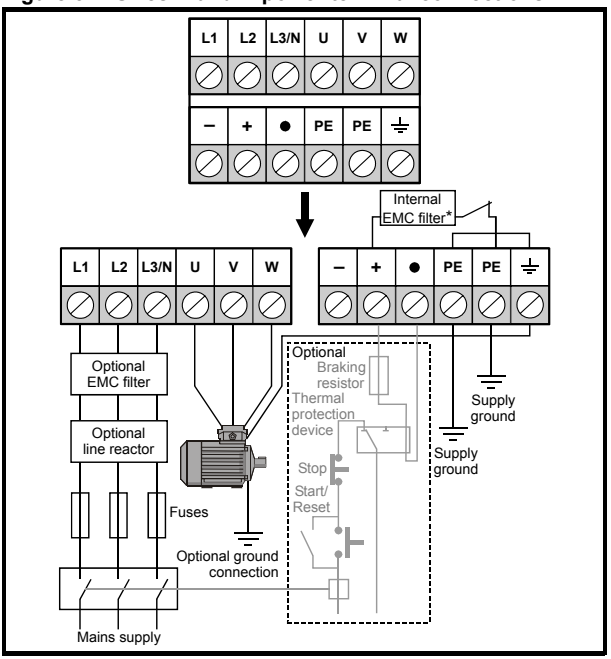


Figure 5-2 Sizes B and C power terminal connections



*For further information, see section 5.3.1 *Internal EMC filter* on page 41.

Fuses/MCB

The AC supply to the drive must be fitted with suitable protection against overload and short circuits. Failure to observe this requirement will cause risk of fire.

WARNING

WARNING

The drive must be grounded by a conductor sufficient to carry the prospective fault current in the event of a fault. See also the warning in section 5.2 *Ground leakage* relating to ground leakage current.

WARNING

To avoid a fire hazard and maintain validity of the UL listing, adhere to the specified tightening torques for the power and ground terminals. Refer to the table below.

Frame size	Maximum power terminal screw torque
A	0.5 N m / 4.4 lb in
B and C	1.4 N m / 12.1 lb in

WARNING

Braking resistor: High temperatures and overload protection

Braking resistors can reach high temperatures. Locate braking resistors so that damage cannot result. Use cable having insulation capable of withstanding the high temperatures.

It is essential that the braking resistor be protected against overload caused by a failure of the brake control. Unless the resistor has in-built protection, a circuit like those shown in Figure 5-1 and Figure 5-2 should be used, where the thermal protection device disconnects the AC supply to the drive. Do not use AC relay contacts directly in series with the braking resistor circuit, because it carries DC.

NOTE When connecting single phase to a dual rated 200V unit, use terminals L1 and L3.

NOTE For control terminal connections, see Pr **05** on page 50.

NOTE For information on the internal EMC filter, see section 5.3.1 *Internal EMC filter* .

5.2 Ground leakage

The ground leakage current depends upon the internal EMC filter being fitted. The drive is supplied with the filter fitted. Instructions for removal of the internal EMC filter are given in section 5.3.2 *Removing the internal EMC filter* .

With internal EMC filter fitted

30μA DC (10MΩ internal bleed resistor, relevant where DC leakage current is being measured)

Size A

10mA AC at 230V, 50Hz (proportional to supply voltage and frequency)

Size B and C

1 phase 200V drives

20mA AC at 230V, 50Hz (proportional to supply voltage and frequency)

3 phase 200V drives

8mA AC at 230V, 50Hz (proportional to supply voltage and frequency)

3 phase 400V drives

8.2mA AC at 415V, 50Hz (proportional to supply voltage and frequency)

NOTE The above leakage currents are just the leakage currents of the drive with the internal EMC filter connected and do not take into account any leakage currents of the motor or motor cable.

With internal EMC filter removed

<1mA

NOTE In both cases, there is an internal voltage surge suppression device connected to ground. Under normal circumstances, this carries negligible current.

WARNING

When the internal EMC filter is fitted, the leakage current is high. In this case, a permanent fixed ground connection must be provided using two independent conductors each with a cross-section equal to or exceeding that of the supply conductors. The drive is provided with two ground terminals to facilitate this. The purpose is to prevent a safety hazard occurring if a connection is lost.

5.2.1 Use of earth (ground) leakage circuit breakers (ELCB) / residual current device (RCD)

There are three common types of ELCB/RCD:

Type AC - detects AC fault currents

Type A - detects AC and pulsating DC fault currents (provided the DC current reaches zero at least once every half cycle)

Type B - detects AC, pulsating DC and smooth DC fault currents

- Type AC should never be used with drives
- Type A can only be used with single phase drives
- Type B must be used with three phase drives

5.3 EMC

5.3.1 Internal EMC filter

It is recommended that the internal EMC filter is kept in place unless there is a specific reason for removing it.

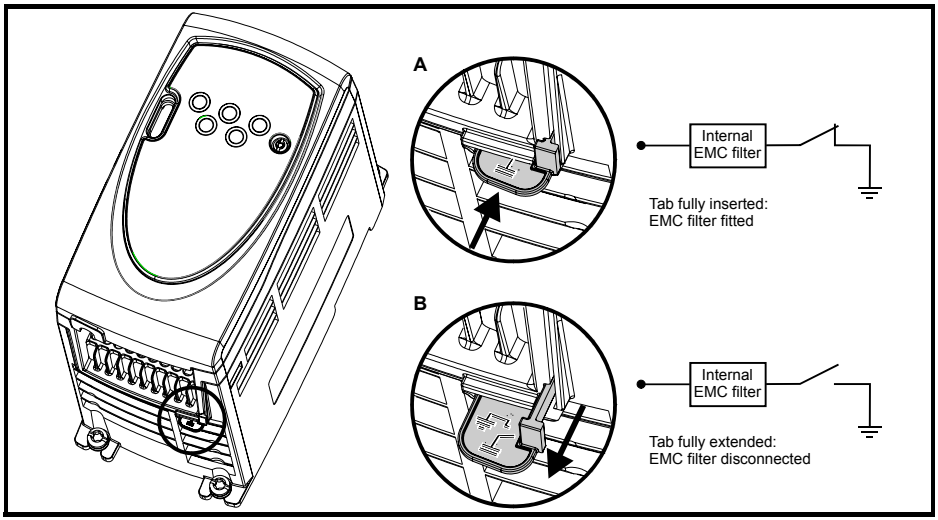
If the drive is to be used on an IT supply, then the filter must be removed.

The internal EMC filter reduces radio-frequency emissions into the mains supply. Where the motor cable is short, it permits the requirements of EN61800-3 to be met for the second environment.

For longer motor cables, the filter continues to provide a useful reduction in emission level, and when used with any length of shielded cable up to the limit for the drive, it is unlikely that nearby industrial equipment will be disturbed. It is recommended that the filter be used in all applications unless the ground leakage current is unacceptable or the above conditions are true.

5.3.2 Removing the internal EMC filter

Figure 5-3 Removal and re-fitting of internal EMC filter



5.3.3 Further EMC precautions

Further EMC precautions are required if more stringent EMC emission requirements apply:

- Operation in the first environment of EN 61800-3
- Conformity to the generic emission standards
- Equipment which is sensitive to electrical interference operating nearby

In this case it is necessary to use:

- The optional external EMC filter
- A screened motor cable, with screen clamped to the grounded metal panel
- A screened control cable, with screen clamped to the grounded metal panel

Full instructions are given in the *IM-pAC EMC Guide*.

A full range of external EMC filters is also available for use with IM-pAC.

5.4 Control terminals I/O specification

WARNING The control circuits are isolated from the power circuits in the drive by basic insulation (single insulation) only. The installer must ensure that the external control circuits are insulated from human contact by at least one layer of insulation (supplementary insulation) rated for use at the AC supply voltage.

WARNING If the control circuits are to be connected to other circuits classified as Safety Extra Low Voltage (SELV) (e.g. to personal computer), an additional isolating barrier must be included in order to maintain the SELV classification.

WARNING The above warnings also apply to the PCB edge connector for the optional Solutions Modules. To allow a Solutions Module to be fitted to IM-pAC, a protective cover must be removed to allow access to the PCB edge connector. See Figure 4-3 on page 38. This protective cover provides protection from direct contact of the PCB edge connector by the user. When this cover is removed and a Solutions Module fitted, the Solutions Module provides the protection from direct contact by the user. If the Solutions Module is then removed, this PCB edge connector becomes exposed. The user is required to provide protection in this case, to protect against direct contact of this PCB edge connector.

NOTE See Pr **05** on page 50 (*Drive configuration*) for terminal connection / set-up diagrams and details.

NOTE The digital inputs are positive logic only.

NOTE The analog inputs are unipolar. For information on a bipolar input, see the *IM-pAC Advanced User Guide*.

T1	**0V common**

T2	**Analog input 1 (A1), either voltage or current (see Pr 16)**
Voltage: Current input	0 to 10V: mA as parameter range
Parameter range	4-20, 20-4, 0-20, 20-0, 4-.20, 20-.4, VoLt
Scaling	Input range automatically scaled to Pr **01** *Minimum set speed* / Pr **02** *Maximum set speed*
Input impedance	200Ω (current): 100kΩ (voltage)
Resolution	0.1%

0-20: Current input 0 to 20mA (20mA full scale)
20-0: Current input 20 to 0mA (0mA full scale)
4-20: Current input 4 to 20mA with current loop loss (cL1) trip (20mA full scale)
20-4: Current input 20 to 4mA with current loop loss (cL1) trip (4mA full scale)
4-.20: Current input 4 to 20mA with no current loop loss (cL1) trip (20mA full scale)
20-.4: Current input 20 to 4mA with no current loop loss (cL1) trip (4mA full scale)
VoLt: 0 to 10V input

T3	**+10V reference output**
Maximum output current	5mA

T4	**Analog input 2 (A2), either voltage or digital input**
Voltage: Digital input	0 to +10V: 0 to +24V
Scaling (as voltage input)	Input range automatically scaled to Pr **01** *Minimum set speed* / Pr **02** *Maximum set speed*
Resolution	0.1%
Input impedance	100kΩ (voltage): 6k8 (digital input)
Normal threshold voltage (as digital input)	+10V (positive logic only)

T5 **T6**	**Status relay - Drive healthy (Normally open)**
Voltage rating	240Vac/30Vdc
Current rating	2A/6A (resistive)
Contact isolation	1.5kVac (over voltage category II)
Operation of contact	OPEN AC supply removed from drive AC supply applied to drive with drive in tripped condition CLOSED AC supply applied to drive with drive in a 'ready to run' or 'running' condition (not tripped)

Provide fuse or other over-current protection in status relay circuit.

B1	**Analog voltage output - Motor speed**
Voltage output	0 to +10V
Scaling	0V represents 0Hz/rpm output +10V represents the value in Pr **02** *Maximum set speed*
Maximum output current	5mA
Resolution	0.1%

B2	**+24V output**
Maximum output current	100mA

B3	**Digital output - Zero speed**
Voltage range	0 to +24V
Maximum output current	50mA at +24V (current source)

NOTE The total available current from the digital output plus the +24V output is 100mA.

B4	**Digital Input - Enable/Reset*/****
B5	**Digital Input - Run Forward****
B6	**Digital Input - Run Reverse****
B7	**Digital Input - Local/Remote speed reference select (A1/A2)**

Logic	Positive logic only
Voltage range	0 to +24V
Nominal threshold voltage	+10V

If the enable terminal is opened, the drive's output is disabled and the motor will coast to a stop. The drive will not re-enable for 1.0s after the enable terminal is closed again.

*Following a drive trip, opening and closing the enable terminal will reset the drive. If the run forward or run reverse terminal is closed, the drive will run straight away.

**Following a drive trip and a reset via the stop/reset key, the enable, run forward or run reverse terminals will need to be opened and closed to allow the drive to run. This ensures that the drive does not run when the stop/reset key is pressed.

The enable, run forward and run reverse terminals are level triggered apart from after a trip where they become edge triggered. See * and ** above.

If the enable and run forward or enable and run reverse terminals are closed when the drive is powered up, the drive will run straight away up to a set speed.

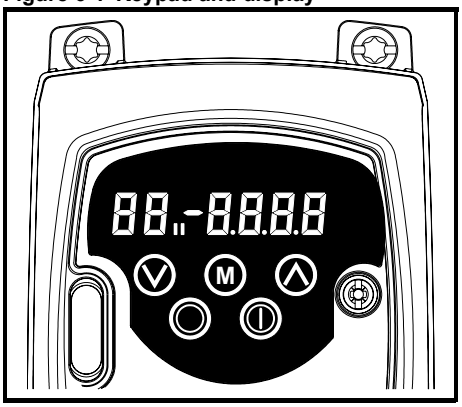
If both the run forward and run reverse terminals are closed, the drive will stop under the control of the ramp and stopping modes set in Pr **30** and Pr **31**.

6 Keypad and Display

The keypad and display are used for the following:

- Displaying the operating status of the drive
- Displaying a fault or trip code
- Reading and changing parameter values
- Stopping, starting and resetting the drive

Figure 6-1 Keypad and display



6.1 Programming keys

The **MODE** key is used to change the mode of operation of the drive.

The **UP** and **DOWN** keys are used to select parameters and edit their values. In keypad mode, they are used to increase and decrease the speed of the motor.

6.2 Control keys

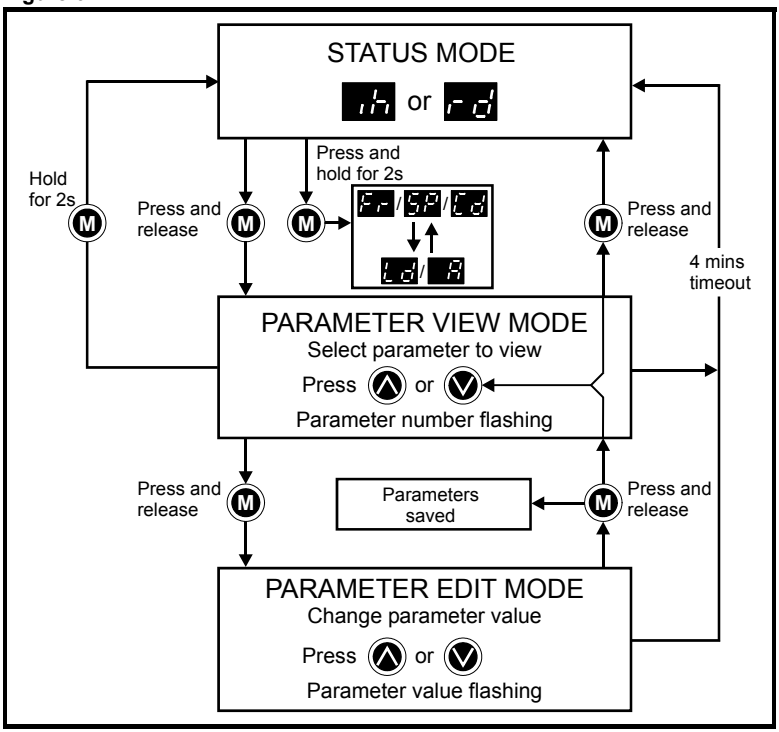
The **START** key is used to start the drive in keypad mode.

The **STOP/RESET** key is used to stop and reset the drive in keypad mode. It can also be used to reset the drive in terminal mode.

6.3 Selecting and changing parameters

NOTE This procedure is written from the first power up of the drive and assumes no terminals have been connected, no parameters have been changed and no security has been set.

Figure 6-2



When in Status mode, pressing and holding the M MODE key for 2 seconds will change the display from displaying a speed indication to displaying load indication and vice versa.

Pressing and releasing the M MODE key will change the display from status mode to parameter view mode. In parameter view mode, the left hand display flashes the parameter number and the right hand display shows the value of that parameter.

Pressing and releasing the M MODE key again will change the display from parameter view mode to parameter edit mode. In parameter edit mode, the right hand display flashes the value in the parameter being shown in the left hand display.

Pressing the M MODE key in parameter edit mode will return the drive to the parameter view mode. If the M MODE key is pressed again then the drive will return to status mode, but if either of the up or down keys are pressed to change the parameter being viewed before the M MODE key is pressed, pressing the M MODE key will change the display to the parameter edit mode again. This allows the user to very easily change between parameter view and edit modes whilst commissioning the drive.

Status Modes

Left hand display	Status	Explanation
	Drive ready	The drive is enabled and ready for a start command. The output bridge is inactive.
	Drive inhibited	The drive is inhibited because there is no enable command, or a coast to stop is in progress or the drive is inhibited during a trip reset.
	Drive has tripped	The drive has tripped. The trip code will be displayed in the right hand display.
	DC injection braking	DC injection braking current is being applied to the motor.

Speed Indications

Display Mnemonic	Explanation
	Drive output frequency in Hz
	Motor speed in rpm
	Machine speed in customer define units

Load indications

Display Mnemonic	Explanation
	Load current as a % of motor rated load current
	Drive output current per phase in A

6.4 Saving parameters

Parameters are automatically saved when the (M) MODE key is pressed when going from parameter edit mode to parameter view mode.

6.5 Parameter access

There are 3 levels of parameter access controlled by Pr **10**. This determines which parameters are accessible. See Table 6-1.

The setting of the user security Pr **25** determines whether the parameter access is read only (RO) or read write (RW).

Table 6-1

Parameter access (Pr 10)	Parameters accessible
L1	Pr **01** to Pr **10**
L2	Pr **01** to Pr **60**
L3	Pr **01** to Pr **95**

6.6 Security codes

Setting a security code allows view only access to all parameters.

A security code is locked into the drive when Pr **25** is set to any other value than 0 and then **LoC** is selected in Pr **10**. On pressing the (M) MODE key, Pr **10** is automatically changed from **LoC** to **L1** and Pr **25** will be automatically set to 0 so as not to reveal the security code.

Pr **10** may be changed to L2 or L3 to allow view only access to parameters.

6.6.1 Setting a security code

- Set Pr **10** to L2.
- Set Pr **25** to the desired security code e.g. 5
- Set Pr **10** to LoC.
- Press the (M) MODE key
- Pr **10** will now be reset to L1 and Pr **25** will be reset to 0.
- The security code will now be locked into the drive.
- Security will also be set if the drive is powered down after a security code has been set into Pr **25**.

6.6.2 Unlocking a security code

- Select parameter to be edited
- Press the (M) MODE key, the right hand display will flash 'CodE'
- Press the (▲) UP key to start entering the set security code. The left hand display will show 'Co'
- Enter the correct security code
- Press the (M) MODE key
- If the correct security code has been entered, the right hand display will flash and can now be adjusted.
- If the security code has been entered incorrectly, the left hand display will flash the parameter number. The above procedure should be followed again.

6.6.3 Re-locking security

When a security code has been unlocked and the required parameter changes made, to re-lock the same security code:

- Set Pr **10** to LoC
- Press the (M) MODE key

6.6.4 Setting security back to 0 (zero) - no security

- Set Pr **10** to L2
- Go to Pr **25**
- Unlock security as described above.
- Set Pr **25** to 0
- Press the (M) MODE key.

7 Parameters

Parameters are grouped together into appropriate subsets as follows:

Level 1

Pr **01** to Pr **10**: Basic drive set-up parameters

Level 2

Pr **11** to Pr **12**: Drive operation set-up parameters
Pr **15** to Pr **21**: Reference parameters
Pr **22** to Pr **29**: Display / keypad configuration
Pr **30** to Pr **33**: System configuration
Pr **34** to Pr **36**: Drive user I/O configuration
Pr **37** to Pr **42**: Motor configuration (non-standard set-up)
Pr **43** to Pr **44**: Serial communications configuration
Pr **45**: Drive software version
Pr **46** to Pr **51**: Mechanical brake configuration
Pr **52** to Pr **54**: Fieldbus configuration
Pr **55** to Pr **58**: Drive trip log
Pr **59** to Pr **60**: PLC ladder programming configuration
Pr **61** to Pr **70**: User definable parameter area

Level 3

Pr **71** to Pr **80**: User definable parameter set-up
Pr **81** to Pr **95**: Drive diagnostics parameters

These parameters can be used to optimise the set-up of the drive for the application.

7.1 Parameter descriptions - Level 1

No	Function	Range	Defaults	Type
01	Minimum set speed	0 to Pr **02** Hz	0.0	RW

Used to set the minimum speed at which the motor will run in both directions.
(0V reference or minimum scale current input represents the value in Pr **01**)

No	Function	Range	Defaults	Type
02	Maximum set speed	0 to 1500 Hz	60.0	RW

Used to set the maximum speed at which the motor will run in both directions.

If Pr **02** is set below Pr **01**, Pr **01** will be automatically set to the value of Pr **02**. (+10V reference or full scale current input represents the value in Pr **02**)

NOTE The output speed of the drive can exceed the value set in Pr **02** due to slip compensation and current limits.

No	Function	Range	Defaults	Type
03	Acceleration rate	0 to 3200.0 s/100Hz	0.1	RW
04	Deceleration rate		0.2	

Sets the acceleration and deceleration rate of the motor in both directions in seconds/ 100Hz.

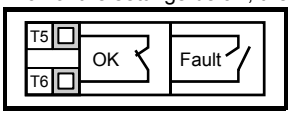
NOTE If one of the standard ramp modes is selected (see Pr **30** on page 57), the deceleration rate could be extended automatically by the drive to prevent over voltage (OU) trips if the load inertia is too high for the programmed deceleration rate.

No	Function	Range	Defaults	Type
05	Drive configuration	AI.AV, AV.Pr, AI.Pr, Pr, PAd, E.Pot, tor, Pid, HUAC	3:Pr	RW

The setting of Pr **05** automatically sets up the drives configuration.

NOTE A change to Pr **05** is set by pressing the (M) MODE key on exit from parameter edit mode. The drive must be disabled, stopped or tripped for a change to take place. If Pr **05** is changed while the drive is running, when the (M) MODE key is pressed on exit from parameter edit mode, Pr **05** will change back to its previous value.

In all of the settings below, the status relay is set up as a drive healthy relay:



Configuration	Description
AI.AV	Voltage and current input
AV.Pr	Voltage input and 3 preset speeds
AI.Pr	Current input and 3 preset speeds
Pr	4 preset speeds
PAd	Keypad control
E.Pot	Electronic motorised potentiometer control
tor	Torque control operation
Pid	PID control
HUAC	Fan and pump control

Figure 7-1 Pr 05 = AI.AV

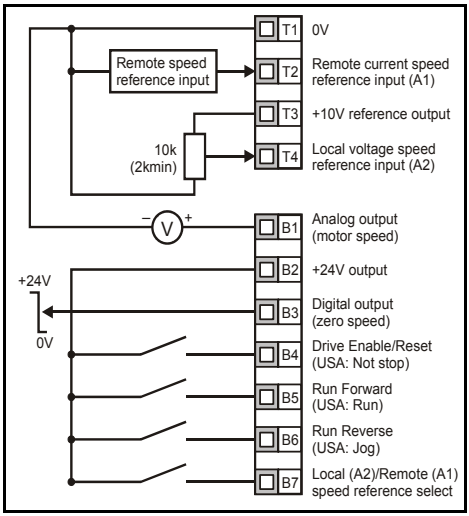
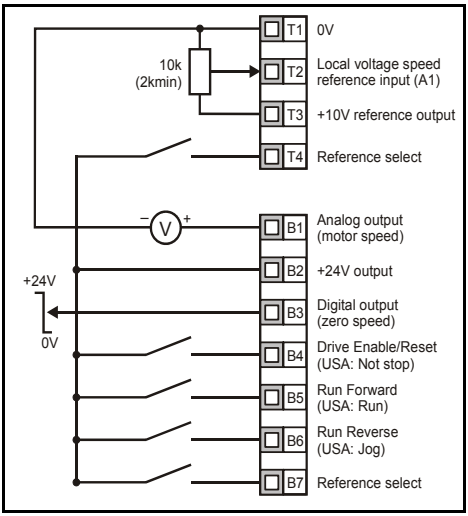


Figure 7-2 Pr 05 = AV.Pr

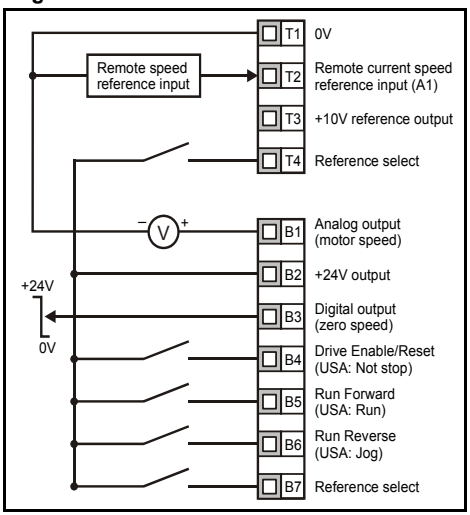


Terminal B7 open: Local voltage speed reference (A2) selected

Terminal B7 closed: Remote current speed reference (A1) selected

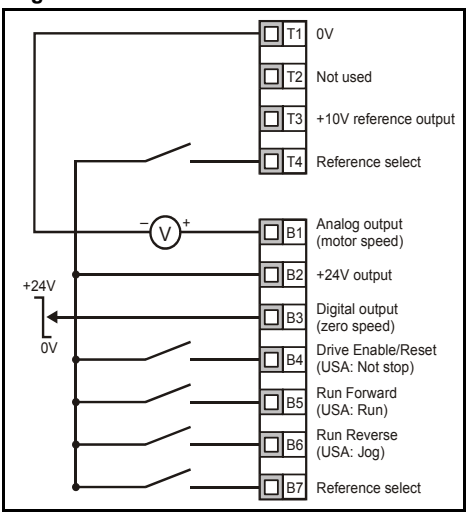
T4	B7	Reference selected
0	0	A1
0	1	Preset 2
1	0	Preset 3
1	1	Preset 4

Figure 7-3 Pr 05 = AI.Pr



T4	B7	Reference selected
0	0	A1
0	1	Preset 2
1	0	Preset 3
1	1	Preset 4

Figure 7-4 Pr 05 = Pr



T4	B7	Reference selected
0	0	Preset 1
0	1	Preset 2
1	0	Preset 3
1	1	Preset 4

Figure 7-5 Pr 05 = PAd

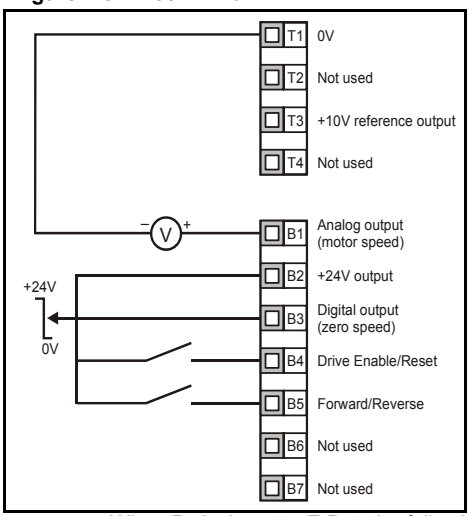
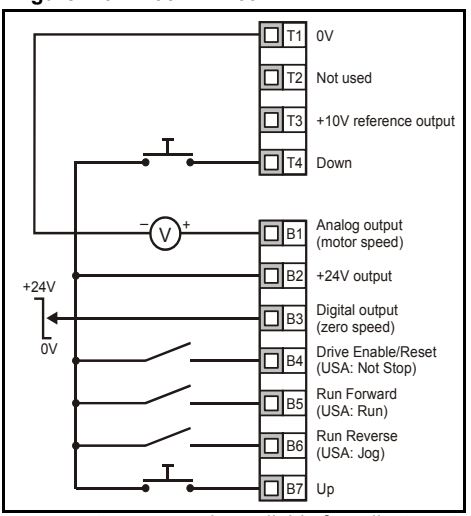


Figure 7-6 Pr 05 = E.Pot



When Pr **05** is set to E.Pot, the following parameters are made available for adjustment:

- Pr **61**: Motorised pot up/down rate (s/100%)
- Pr **62**: Motorised pot bipolar select (0 = unipolar, 1 = bipolar)
- Pr **63**: Motorised pot mode: 0 = zero at power-up, 1 = last value at power-up,
  2 = zero at power-up and only change when drive is running,
  3 = last value at power-up and only change when drive is running.

Figure 7-7 Pr 05 = tor

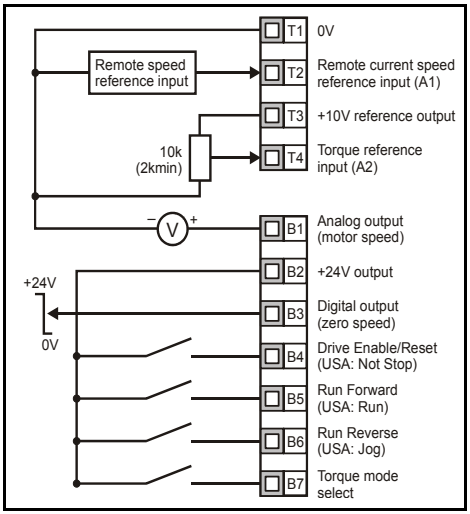
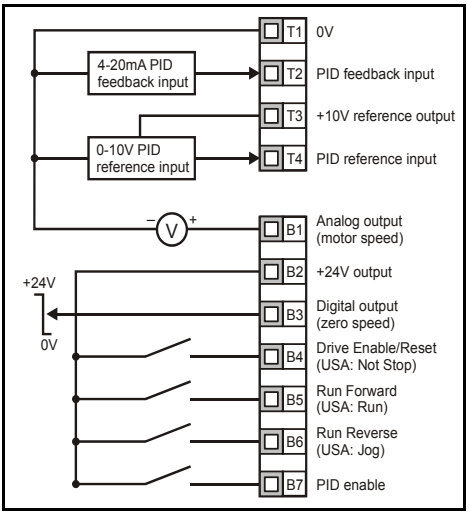


Figure 7-8 Pr 05 = Pid



WARNING

When torque mode is selected and the drive is connected to an unloaded motor, the motor speed may increase rapidly to the maximum speed (Pr **02** +20%)

When Pr **05** is set to Pid, the following parameters are made available for adjustment:

- Pr **61**: PID proportional gain
- Pr **62**: PID integral gain
- Pr **63**: PID feedback invert
- Pr **64**: PID high limit (%)
- Pr **65**: PID low limit (%)
- Pr **66**: PID output (%)

Figure 7-9 PID logic diagram

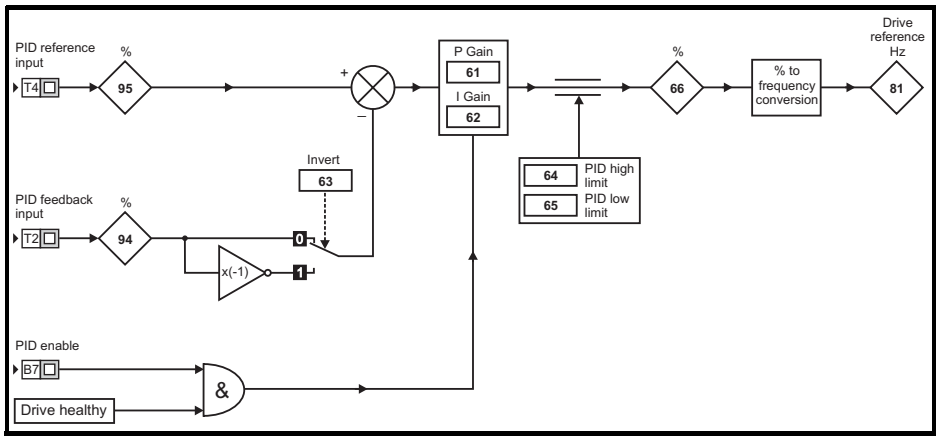
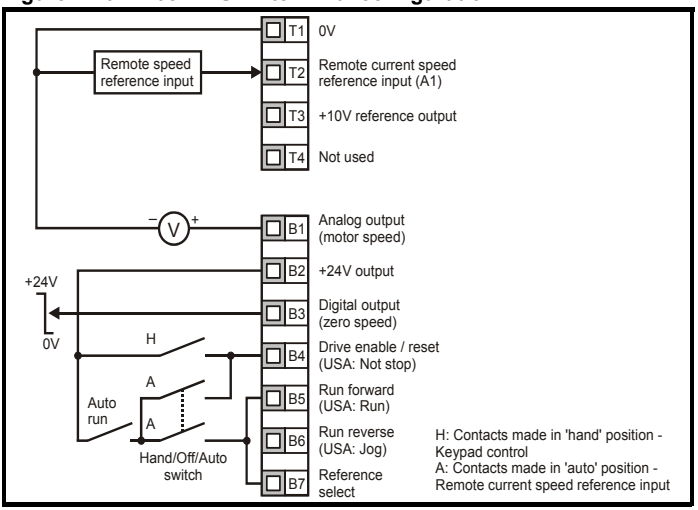


Figure 7-10 Pr 05 = HUAC terminal configuration



No	Function	Range	Defaults	Type
06	Motor rated current	0 to Drive rated current A	1.14	RW

Enter the motor current rating (taken from the motor name plate).

The drive rated current is the 100% RMS output current value of the drive. This value can be set to a lower value but not to a higher value than the drive rated current.

WARNING

Pr **06** *Motor rated current* must be set correctly to avoid a risk of fire in the event of a motor overload.

No	Function	Range	Defaults	Type
07	Motor rated speed	0 to 9999 rpm	0	RW

Enter the rated full load speed of the motor (taken from the motor name plate).

The motor rated speed is used to calculate the correct slip speed for the motor.

NOTE A value of zero entered into Pr **07** means slip compensation is disabled.

NOTE If the full load speed of the motor is above 9999rpm, enter a value of 0 in Pr **07**. This will disable slip compensation as values >9999 cannot be entered into this parameter.

No	Function	Range	Defaults	Type
08	Motor rated voltage	0 to 240, 0 to 480 V	230	RW

Enter the motor rated voltage (taken from the motor name plate).
This is the voltage applied to the motor at base frequency.

NOTE If the motor is not a standard 50 or 60Hz motor, see Pr **39** on page 59 and adjust accordingly.

No	Function	Range	Defaults	Type
09	Motor power factor	0 to 1	0.74	RW

Enter the motor rated power factor cos φ (taken from the motor name plate).

No	Function	Range	Defaults	Type
10	Parameter access	L1, L2, L3, LoC	2:L3	RW

L1: Level 1 access - only the first 10 parameters can be accessed
L2: Level 2 access - All parameters from 01 to 60 can be accessed
L3: Level 3 access - All parameters from 01 to 95 can be accessed
LoC: Used to lock a security code in the drive. See section 6.6 *Security codes* on page 47 for further details.

7.2 Parameter descriptions - Level 2

No	Function	Range	Defaults	Type
11	Start/Stop logic select	0 to 6	0	RW

Pr 11	Terminal B4	Terminal B5	Terminal B6	Latching
0	Enable	Run Forward	Run Reverse	No
1	Not Stop	Run Forward	Run Reverse	Yes
2	Enable	Run	Forward / Reverse	No
3	Not Stop	Run	Forward / Reverse	Yes
4	Not Stop	Run	Jog	Yes
5	User programmable	Run Forward	Run Reverse	No
6	User Programmable	User Programmable	User Programmable	User Programmable

NOTE A change to Pr **11** is set by pressing the (M) MODE key on exit from parameter edit mode. The drive must be disabled, stopped or tripped for a change to take place. If Pr **11** is changed while the drive is running, when the (M) MODE key is pressed on exit from parameter edit mode, Pr **11** will change back to its previous value.

No	Function	Range	Defaults	Type
12	Brake controller enable	diS, rEL, d IO, USEr	0:diS	RW

diS: Mechanical brake software disabled
rEL: Mechanical brake software enabled. Brake control via relay T5 & T6. The digital output on terminal B3 is automatically programmed as a drive healthy output.
d IO: Mechanical brake software enabled. Brake control via digital output B3. The relay outputs on terminals T5 and T6 are automatically programmed as a drive healthy output.
USEr: Mechanical brake software enabled. Brake control to be programmed by user. The relay and digital output are not programmed. The user should programme the brake control to either the digital output or relay. The output not programmed to the brake control can be programmed to indicate the required signal.

NOTE A change to Pr **12** is set by pressing the (M) MODE key on exit from parameter edit mode. The drive must be disabled, stopped or tripped for a change to take place. If Pr **12** is changed while the drive is running, when the (M) MODE key is pressed on exit from parameter edit mode, Pr **12** will change back to its previous value.

See Pr **46** to Pr **51** on page 60.

Great care should be taken when implementing a brake control set-up, as this may cause a safety issue depending on the application, e.g. crane. If in doubt, contact the supplier of the drive for further information.

No	Function	Range	Defaults	Type
13 14	Not used			

No	Function	Range	Defaults	Type
15	Jog reference	0 to 400.0 Hz	1.5	RW

Defines the jog speed

No	Function	Range	Defaults	Type
16	Analog input 1 mode	0-20, 20-0, 4-20, 20-4, 4-.20, 20-.4, VoLt	6:VoLt	RW

Determines the input on terminal T2

0-20: Current input 0 to 20mA (20mA full scale)
20-0: Current input 20 to 0mA (0mA full scale)
4-20: Current input 4 to 20mA with current loop loss (cL1) trip (20mA full scale)
20-4: Current input 20 to 4mA with current loop loss (cL1) trip (4mA full scale)
4-.20: Current input 4 to 20mA with no current loop loss (cL1) trip (20mA full scale)
20-.4: Current input 20 to 4mA with no current loop loss (cL1) trip (4mA full scale)
VoLt: 0 to 10V input

NOTE In the 4-20 or 20-4mA modes (with current loop loss) the drive will trip on cL1 if the input reference is below 3mA. Also, if the drive trips on cL1, the voltage analog input cannot be selected.

NOTE If both analog inputs (A1 and A2) are to be set-up as voltage inputs, and if the potentiometers are supplied from the drive's +10V rail (terminal T3), they must have a resistance >4kΩ each.

No	Function	Range	Defaults	Type
17	Enable negative preset speeds	OFF or On	OFF	RW

OFF:Direction of rotation controlled by run forward and run reverse terminals
On: Direction of rotation controlled by preset speed values (use run forward terminal)

No	Function	Range	Defaults	Type
18	Preset speed 1	±1500 Hz (Limited by setting of Pr **02** *Maximum set speed*)	57	RW
19	Preset speed 2		0.0	
20	Preset speed 3		0.0	
21	Preset speed 4		0.0	

Defines preset speeds 1 to 4.

No	Function	Range	Defaults	Type
22	Load display units	Ld, A	Ld	RW

Ld: Active current as a % of motor rated active current
A: Drive output current per phase in A

No	Function	Range	Defaults	Type
23	Speed display units	Fr, SP, Cd	0:Fr	RW

Fr: Drive output frequency in Hz
SP: Motor speed in rpm
Cd: Machine speed in customer defined units (See Pr **24**).

No	Function	Range	Defaults	Type
24	Customer defined scaling	0 to 9.999	1	RW

Multiplying factor on motor speed (rpm) to give customer defined units.

No	Function	Range	Defaults	Type
25	User security code	0 to 999	0	RW

Used to set-up a user security code. See section 6.6 *Security codes* on page 47.

No	Function	Range	Defaults	Type
26	Not used			

No	Function	Range	Defaults	Type
27	Power up keypad reference	0, LASt, PrS1	0	RW

0: keypad reference is zero
LASt: keypad reference is last value selected before the drive was powered down
PrS1: keypad reference is copied from preset speed 1

No	Function	Range	Defaults	Type
28	Parameter cloning	no, rEAd, Prog, boot	0:no	RW

no: no action
rEAd: program the drive with the contents of the SmartStick
Prog: program the SmartStick with the current drive settings
boot: SmartStick becomes read only. The contents of the SmartStick will be copied to the drive every time the drive is powered up.

NOTE Before setting boot mode, the current drive settings must be stored in the SmartStick by using Prog mode, otherwise the drive will trip on C.Acc at power-up.

Parameter cloning is initiated by pressing the (M) MODE key on exit from parameter edit mode after Pr **28** has been set to rEAd, Prog or boot.

NOTE If parameter cloning is enabled when no SmartStick is fitted to the drive, the drive will trip on C.Acc.

NOTE The SmartStick can be used to copy parameters between drives of different ratings. Certain drive dependant parameters will be stored on the SmartStick but will not be copied to the cloned drive.

The drive will trip on C.rtg when being written to by a cloned parameter set of a different drive rating.

The drive dependant parameters are: Pr **06** Motor rated current, Pr **08** Motor rated voltage, Pr **09** Motor power factor and Pr **37** Maximum switching frequency.

NOTE For best motor performance, an autotune should be carried out after parameter cloning has taken place.

No	Function	Range	Defaults	Type
29	Load defaults	no, Eur, USA	0:no	RW

no: defaults are not loaded
Eur: 50Hz default parameters are loaded
USA: 60Hz default parameters are loaded

Default parameters are set by pressing the (M) MODE key on exit from parameter edit

mode after Pr **29** has been set to Eur or USA.
When default parameters have been set, the display will return to Pr **01** and Pr **10** will be reset to L1.

NOTE The drive must be in a disabled, stopped or tripped condition to allow default parameters to be set. If default parameters are set while the drive is running, the display will flash FAIL once before changing back to no.

No	Function	Range	Defaults	Type
30	Ramp mode select	0 to 3	3:FSt.Hv	RW

0: Fast ramp selected
1: Standard ramp with normal motor voltage selected
2: Standard ramp with high motor voltage selected
3: Fast ramp with high motor voltage selected

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

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

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

No	Function	Range	Defaults	Type
31	Stop mode select	0 to 4	1	RW

0: Coast to stop selected
1: Ramp to stop selected
2: Ramp to stop with 1 second DC injection braking
3: DC injection braking with detection of zero speed
4: Time DC injection braking

No	Function	Range	Defaults	Type
32	Dynamic V to f select	OFF or On	OFF	RW

OFF:Fixed linear voltage to frequency ratio (constant torque - standard load)
On: Voltage to frequency ratio dependant on load current (dynamic/variable torque/ load). This gives a higher motor efficiency.

No	Function	Range	Defaults	Type
33	Catch a spinning motor select	0 to 3	0	RW

0: Disabled
1: Detect positive and negative frequencies
2: Detect positive frequencies only
3: Detect negative frequencies only

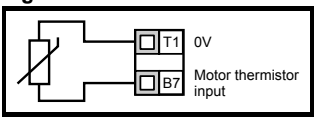
If the drive is to be configured in fixed boost mode (Pr **41** = Fd or SrE) with catch a spinning motor software enabled, an autotune (see Pr **38** on page 59) must be carried out to measure the motor's stator resistance beforehand. If a stator resistance is not measured, the drive may trip on OV and OI.AC while trying to catch a spinning motor.

No	Function	Range	Defaults	Type
34	Terminal B7 mode select	dig, th, Fr, Fr.hr	0:dig	RW

dig: Digital input
th: Motor thermistor input, connect as per diagram below
Fr: Frequency input.

Fr.hr: High resolution frequency input.

Figure 7-11



Trip resistance: 3kΩ
Reset resistance 1k8

NOTE If Pr **34** is set to th so that terminal B7 is used as a motor thermistor, the functionality of terminal B7 as set-up with Pr **05**, drive configuration, will be disabled.

No	Function	Range	Defaults	Type
35	Digital output control (terminal B3)	n=0, At.SP, Lo.SP, hEAL, Act, ALAr, I.Lt, At.Ld, USEr	0:n=0	RW

n=0: At zero speed
At.SP: At speed
Lo.SP: At minimum speed
hEAL: Drive healthy
Act: Drive active
ALAr: General drive alarm
I.Lt: Current limit active
At.Ld: At 100% load
USEr: User programmable

NOTE This parameter is automatically changed by the setting of Pr **12**. When Pr **12** automatically controls the setting of this parameter, this parameter cannot be changed.

NOTE A change to this parameter is only implemented if the drive is disabled, stopped or tripped and the ◉ STOP/RESET key is pressed for 1s.

No	Function	Range	Defaults	Type
36	Analog output control (terminal B1)	Fr, Ld, A, Por, USEr	0:Fr	RW

Fr: Voltage proportional to motor speed
Ld: Voltage proportional to motor load
A: Voltage proportional to output current
Por: Voltage proportional to output power
USEr: User programmable

NOTE A change to this parameter is only implemented if the drive is disabled, stopped or tripped and the ◉ STOP/RESET key is pressed for 1s.

No	Function	Range	Defaults	Type
37	Maximum switching frequency	3, 6, 12, 18 kHz	12	RW

3: 3kHz
6: 6kHz
12: 12kHz
18: 18kHz

NOTE 18kHz is not available on IM-pAC B and C sizes.

No	Function	Range	Defaults	Type
38	Autotune	0 to 2	0	RW

0: No autotune
1: Non-rotating static autotune
2: Rotating autotune

Never Autotune

No	Function	Range	Defaults	Type
39	Motor rated frequency	0.0 to 1500.0 Hz	60.0	RW

Enter the motor rated frequency (taken from the motor name plate).

Defines the voltage to frequency ratio applied to the motor.

No	Function	Range	Defaults	Type
40	Number of motor poles	Auto, 2P, 4P, 6P, 8P	2:4 pole	RW

Auto: Automatically calculates the number of motor poles from the settings of Pr **07** and Pr **39**
2P: Set for a 2 pole motor
4P: Set for a 4 pole motor
6P: Set for a 6 pole motor
8P: Set for an 8 pole motor

No	Function	Range	Defaults	Type
41	Voltage mode select	Ur S, Ur, Fd, Ur A, Ur I, SrE	2:Fd	RW

Ur S: Stator resistance is measured each time the drive is enabled and run
Ur: No measurement is taken
Fd: Fixed boost
Ur A: Stator resistance is measured the first time the drive is enabled and run
Ur I: Stator resistance measured at each power-up when the drive is enabled and run
SrE: Square law characteristic

In all Ur modes, the drive operates in open loop vector mode.

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

No	Function	Range	Defaults	Type
42	Low frequency voltage boost	0.0 to 50.0 %	4.0	RW

Determines the boost level when Pr **41** is set to Fd or SrE.

No	Function	Range	Defaults	Type
43	Serial communications baud rate	2.4, 4.8, 9.6, 19.2, 38.4	19.2	RW

2.4: 2400 baud
4.8: 4800 baud
9.6: 9600 baud
19.2: 19200 baud
38.4: 38400 baud

No	Function	Range	Defaults	Type
44	Serial comms address	0 to 247	1	RW

Defines the unique address for the drive for the serial interface.

No	Function	Range	Defaults	Type
45	Software version	1.00 to 99.99	1.04	RO

Indicates the version of software fitted to the drive.

Pr 46 to Pr 51 appear when Pr 12 is set to control a motor brake.

No	Function	Range	Defaults	Type
46	Brake release current threshold	0 to 200 %	50	RW
47	Brake apply current threshold		10	

Defines the brake release and brake apply current thresholds as a % of motor current.

If the frequency is >Pr **48** and the current is >Pr **46**, the brake release sequence is started.

If the current is <Pr **47**, the brake is applied immediately.

No	Function	Range	Defaults	Type
48	Brake release frequency	0.0 to 20.0 Hz	1.0	RW
49	Brake apply frequency		2.0	

Defines the brake release and brake apply frequencies.

If the current is >Pr **46** and the frequency is > Pr **48**, the brake release sequence is started.

If the frequency is <Pr **49** and the drive has been commanded to stop, the brake is applied immediately.

No	Function	Range	Defaults	Type
50	Pre-brake release delay	0.0 to 25.0 s	0	RW

Defines the time between the frequency and load condition being met and the break being released. The ramp is held during this time.

No	Function	Range	Defaults	Type
51	Post brake release delay	0.0 to 25.0 s	0	RW

Defines the time between the brake being released and the ramp hold being released.

Figure 7-12 Brake function diagram

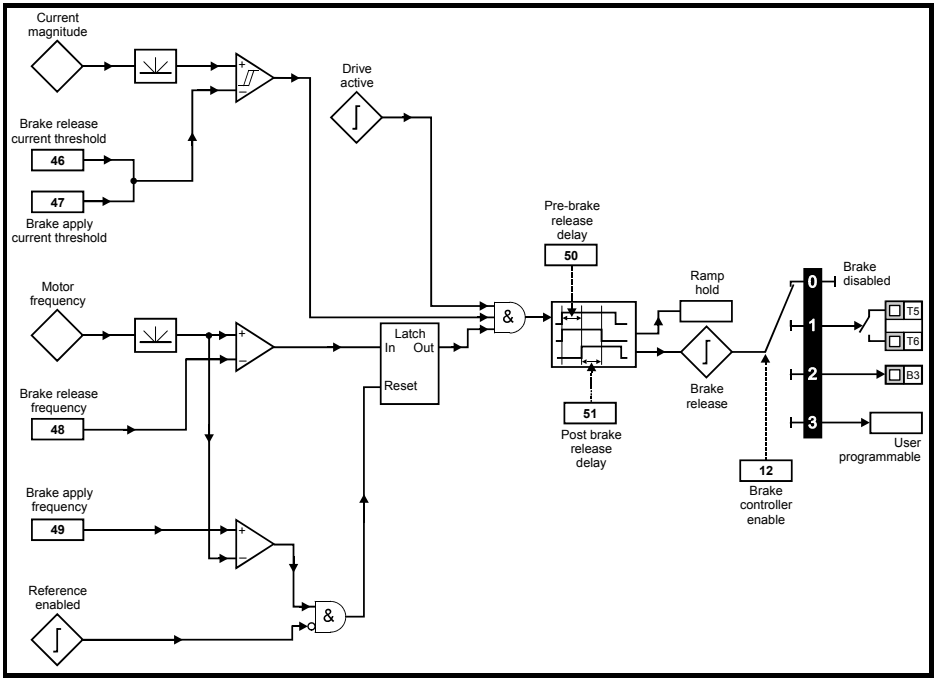
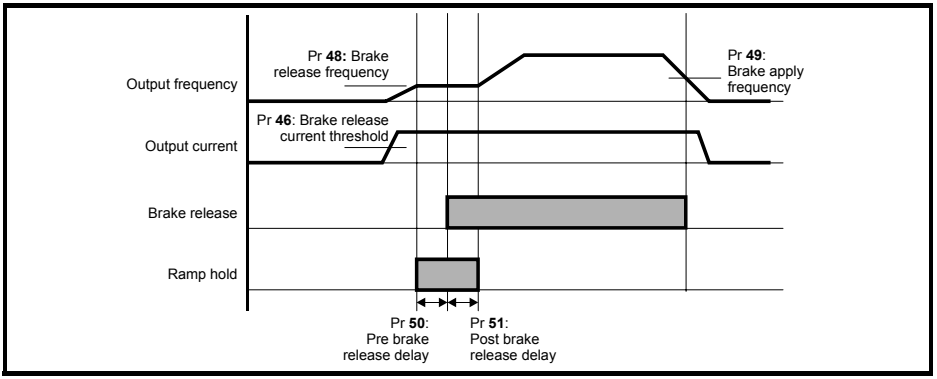


Figure 7-13 Brake sequence



Pr 52 to Pr 54 appear when a fieldbus Solutions Module is fitted to the drive.

No	Function	Range	Defaults	Type
52	Fieldbus node address	0 to 255	0	RW

No	Function	Range	Defaults	Type
53	Fieldbus baud rate	0 to 8	0	RW

No	Function	Range	Defaults	Type
54	Fieldbus diagnostics	-128 to +127	0	RW

See the appropriate fieldbus Solutions Module manual for further information.

No	Function	Range	Defaults	Type
55	Last trip			
56	Trip before Pr **55**		0	RO
57	Trip before Pr **56**			
58	Trip before Pr **57**			

Indicates the last 4 trips of the drive.

No	Function	Range	Defaults	Type
59	PLC ladder program enable	0 to 2	0	RW

The PLC ladder program enable is used to start and stop the PLC ladder program.

0: Stop the PLC ladder program

1: Run the PLC ladder program (trip drive if LogicStick is not fitted). Any out-of-range parameter writes attempted will be limited to the maximum/minimum values valid for that parameter before being written to.

2: Run the PLC ladder program (trip drive if LogicStick is not fitted). Any out-of-range parameter writes attempted will cause the drive to trip.

No	Function	Range	Defaults	Type
60	PLC ladder program status	-128 to +127		RO

The PLC ladder program status parameter indicates the actual state of the PLC ladder program.

-n: PLC ladder program caused a drive trip due to an error condition while running rung n. Note that the rung number is shown on the display as a negative number.

0: LogicStick is fitted with no PLC ladder program

1: LogicStick is fitted, PLC ladder program is installed but stopped

2: LogicStick is fitted, PLC ladder program is installed and running

3: LogicStick is not fitted

No	Function	Range	Defaults	Type
61 to 70	Configurable parameter 1 to configurable parameter 10	As source		

Pr **61** to Pr **70** and Pr **71** to Pr **80** can be used to access and adjust advanced parameters.

Example: It is desired that Pr **1.29** (*Skip frequency 1*) is to be adjusted. Set one of the parameters Pr **71** to Pr **80** to 1.29, the value of Pr **1.29** will appear in the corresponding parameter from Pr **61** to Pr **70**. I.e. if Pr **71** is set to 1.29, Pr **61** will contain the value of Pr **1.29** where it can be adjusted.

NOTE Some parameters are only implemented if the drive is disabled, stopped or tripped and the ◉ STOP/RESET key is pressed for 1s.

7.3 Parameter descriptions - Level 3

No	Function	Range	Defaults	Type
71 to 80	Pr **61** to Pr **70** set up	0 to Pr **21.51**		RW

Set Pr **71** to Pr **80** to the required advanced parameter number to be accessed.

The value within these parameters will be displayed in Pr **61** to Pr **70**. Pr **61** to Pr **70** can then be adjusted to change the value within a parameter.

7.4 Diagnostic parameters

The following read only (RO) parameters can be used as an aid to fault diagnosis on the drive. See Figure 8-1 *Diagnostics logic diagram* on page 65.

No	Function	Range	Type
81	Frequency reference selected	±Pr **02** Hz	RO
82	Pre-ramp reference	±Pr **02** Hz	RO
83	Post-ramp reference	±Pr **02** Hz	RO
84	DC bus voltage	0 to Drive maximum VDC	RO
85	Motor frequency	±Pr **02** Hz	RO
86	Motor voltage	0 to Drive rating V	RO
87	Motor speed	±9999 rpm	RO
88	Motor current	+Drive maximum A	RO
89	Motor active current	±Drive maximum A	RO
90	Digital I/O read word	0 to 95	RO
91	Reference enabled indicator	OFF (0) or On (1)	RO
92	Reverse selected indicator	OFF (0) or On (1)	RO
93	Jog selected indicator	OFF (0) or On (1)	RO
94	Analog input 1 level	0 to 100 %	RO
95	Analog input 2 level	0 to 100 %	RO

8 Diagnostics

Do not attempt to carry out internal repairs. Return a faulty drive to the supplier for repair.

Trip code	Condition	Possible cause
UU	DC bus under voltage	Low AC supply voltage Low DC bus voltage when supplied by an external DC power supply
OV	DC bus over voltage	Deceleration rate set too fast for the inertia of the machine Mechanical load driving the motor
OI.AC**	Drive output instantaneous over current	Insufficient ramp times Phase to phase or phase to ground short circuit on the drives output Drive requires autotuning to the motor Motor or motor connections changed, re-autotune drive to motor
OI.br**	Braking resistor instantaneous over current	Excessive braking current in braking resistor Braking resistor value too small
O.SPd	Over speed	Excessive motor speed (typically caused by mechanical load driving the motor)
tunE	Auto tune stopped before completion	Run command removed before autotune complete
It.br	I^2t on braking resistor	Excessive braking resistor energy
It.AC	I^2t on drive output current	Excessive mechanical load High impedance phase to phase or phase to ground short circuit at drive output Drive requires re-autotuning to motor
O.ht1	IGBT over heat based on drives thermal model	Overheat software thermal model
O.ht2	Over heat based on drives heatsink	Heatsink temperature exceeds allowable maximum
th	Motor thermistor trip	Excessive motor temperature
O.Ld1*	User +24V or digital output overload	Excessive load or short circuit on +24V output
cL1	Analog input 1 current mode, current loss	Input current less than 3mA when 4-20 or 20-4mA modes selected
SCL	Serial communications loss time-out	Loss of communication when drive is under remote control
EEF	Internal drive EEPROM failure	Possible loss of parameter values (set default parameters (see Pr **29** on page 56))
PH	Input phase imbalance or input phase loss	One of the input phases has become disconnected from the drive (applies to 200/400V three phase drives only, not dual rated drives)
rS	Failure to measure motors stator resistance	Motor too small for drive Motor cable disconnected during measurement
C.Err	SmartStick data error	Bad connection or memory corrupt within SmartStick
C.dAt	SmartStick data does not exist	New/empty SmartStick being read
C.Acc	SmartStick read/write fail	Bad connection or faulty SmartStick
C.rtg	SmartStick/drive rating change	Already programmed SmartStick read by a drive of a different rating
O.cL	Overload on current loop input	Input current exceeds 25mA
HFxx trip	Hardware faults	Internal drive hardware fault usually a damaged drive

* The Enable/Reset terminal will not reset an O.Ld1 trip. Use the ◉ Stop/Reset key.

** These trips cannot be reset for 10 seconds after they occur.

Table 8-1 DC bus voltages

Drive voltage rating	UV Trip	UV Reset	Braking level	OV trip
200V	175	215 *	390	415
400V	330	425 *	780	830

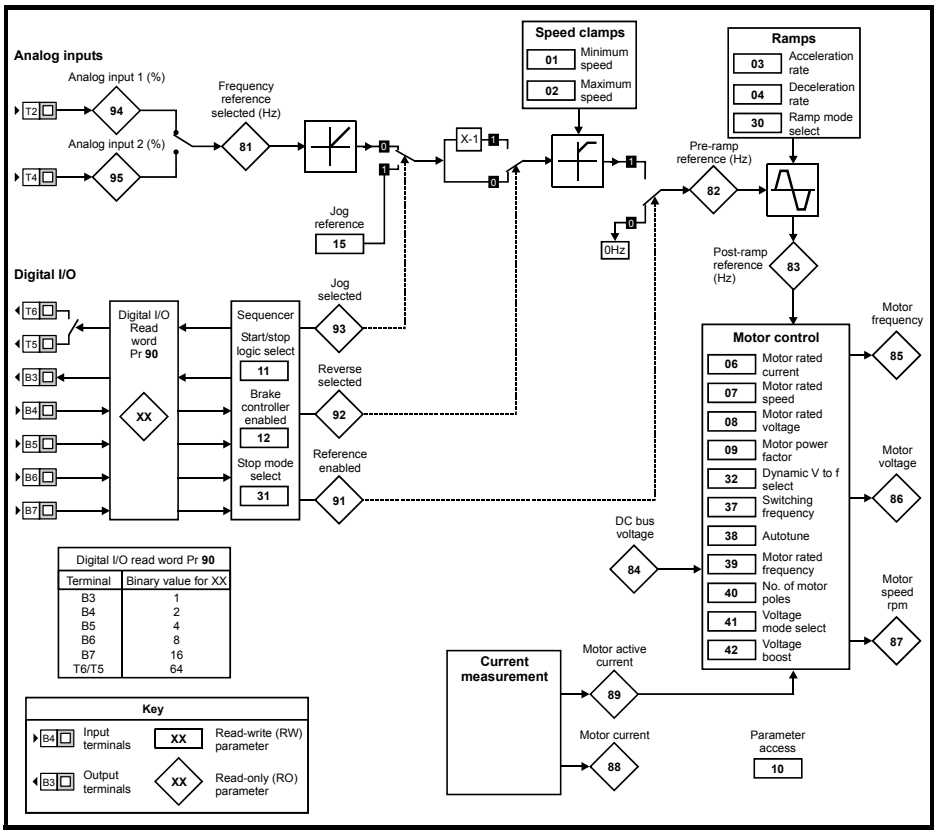
NOTE * These are the absolute minimum DC voltages the drives can be supplied by.

Table 8-2 Alarm warnings

Display	Condition	Solution
OUL.d	I x t overload	Reduce motor current
hot	Heatsink/IGBT temperature high	Reduce ambient temperature or reduce motor current
br.rS	Braking resistor overload	Increase deceleration time

NOTE If no action is taken when an alarm warning appears, the drive will trip on the appropriate fault code.

Figure 8-1 Diagnostics logic diagram



Cooling fan control (size B and C only)

As default, the drive's cooling fan is controlled by the drive. The fan will remain off until the heatsink temperature reaches 60°C or the output current rises above 75% of the drive rating. The fan will then switch on and run at full speed for a minimum of 10s.

9 UL Listing Information

Table 9-1 Approvals

CE	CE approval	Europe
N1652	C Tick approval	Australia
c UL us	UL / cUL approval	USA & Canada

9.1 Common UL information (for IM-pAC size A and B)

9.1.1 Conformity

The drive conforms to UL listing requirements only when the following are observed:

- Class 1 60/75°C (140/167°F) copper wire only is used in the installation
- The ambient temperature does not exceed 40°C (104°F) when the drive is operating
- The terminal tightening torques specified in section 5.1 *Power terminal connections* are used
- The drive is installed into a separate electrical enclosure. The drive has a UL 'Opentype' enclosure rating

9.1.2 AC supply specification

The drive is suitable for use in a circuit capable of delivering not more than 100,000 RMS symmetrical Amperes at 264Vac RMS maximum (200V drives) or 528Vac RMS maximum (400V drives).

9.1.3 Motor overload protection

The drive provides motor overload protection. The overload protection level is 150% of full-load current. It is necessary for the motor rated current to be entered into Pr **06** for the protection to operate correctly. The protection level may be adjusted below 150% if required.

9.1.4 Overspeed protection

The drive provides overspeed protection. However, it does not provide the level of protection afforded by an independent high integrity overspeed protection device.

9.2 Power dependant UL information

9.2.1 IM-pAC size A and B

Conformity

The drive conforms to UL listing requirements only when the following is observed:

- UL listed class CC fast acting fuses e.g. Bussman Limitron KTK series, Gould Amp-Trap ATM series or equivalent are used in the AC supply.

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