

# **OPTIDRIVE**<sup>™</sup> (É<sup>3</sup>

AC Variable Speed Drive

# IP66 (NEMA 4X)

0.37kW – 22kW / 0.5HP – 30HP 110V & 230V Single Phase input, 230V & 480V 3 Phase input





- **CHECK:** Check the correct drive type, check suitable motor type & info
- **PREPARE:** Correct tools, suitable mounting location, weather protection
- 3 MOUNT: Mechanical mounting
- 4 CONNECT: Power & Control connections
- 5 CHECK: Final check of everything before operation
- 6 POWER ON
- **7 COMMISSION** the drive parameters
- 8 OPERATE and check everything is as intended



Or visit bit.ly/E3manuals

# WARNING! The Optidrive should ONLY be installed by a qualified electrician. WARNING! In a residential environment, this product may cause radio interference in which case supplementary mitigation measures may be required.

**NOTE** This guide does not provide detailed installation, safety or operational instructions. See the Optidrive E3 IP66 Outdoor User Manual for complete information. Unpack and check the drive. Notify the supplier and shipper immediately of any damage.

# 1 CHECK

# Identifying the Drive by Model Number

Each drive can be identified by its model number, as shown in the table below.



# 2 PREPARE

# **Prepare the Mounting Location**

- The Optidrive must be mounted in a vertical position only.
- Installation should be on a suitable flat, flame resistant surface. Do not mount flammable material close to the drive.
- Refer to Technical Data and ensure the chosen mounting location is within the drive specification.
- The mounting location should be free from vibration.
- Do not mount the drive in any area with excessive humidity, corrosive airborne chemicals or potentially dangerous dust particles.
- Avoid mounting close to high heat sources.

- The drive must not be mounted in direct sunlight. If necessary, install a suitable shade cover.
- The mounting location must be free from frost.
- Do not restrict the flow of air through the drive heatsink. The drive generates heat which must be naturally allowed to dissipate. Correct air clearance around the drive must be observed.
- If the location is subject to wide ambient temperature and air pressure variation, install a suitable pressure compensation valve in the drive gland plate.

**NOTE** If the drive has been in storage for a period longer than 2 years, the DC link capacitors must be reformed. Refer to online documentation for further information.

# **Mechanical Dimensions**



### Dimensions

Drive Size	A		В		c		D		E		Weight	
	mm	in	mm	in	mm	in	mm	in	mm	in	kg	lb
1	232	9.13	161	6.34	162	6.37	189	7.44	148.5	5.85	2.3	5
2	257	10.12	188	7.4	186	7.32	200	7.87	176	6.93	3.5	7.7
3	310	12.2	211	8.3	235	9.25	251.5	9.9	197.5	7.78	6.6	14.5
4	360	14.17	240	9.44	271	10.67	300	11.08	226	8.89	9.5	20.9

### **Mounting Clearance**

Duitur Cina	X Above	& Below	Y Either Side			
Drive Size	mm	in	mm	in		
All Frame Sizes	200	7.87	10	0.39		

NOTE

Typical drive heat losses are approximately 3% of operating load conditions. Above are guidelines only and the operating ambient temperature of the drive MUST be maintained below the maximum limit at all times.

### **Mounting Bolts & Tightening Torques**

Mountii	ng Bolts	Tightening Torques						
Frame Size		Control Terminals	Power Terminals					
All Frame Sizes	4 × M4 (#8)	1, 2, 3	0.5 Nm (4.4 lb-in)	0.8 Nm (7 lb-in)				
		4	0.5 Nm (4.4 lb-in)	2 Nm (19 lb-in)				

# 4 CONNECT

# **Cable Selection**

- For 1 phase supply (Sizes 1-3 only), the mains power cables should be connected to L1/L, L2/N.
- For 3 phase supplies, the mains power cables should be connected to L1, L2, and L3. Phase sequence is not important.
- For compliance with CE and C Tick EMC requirements, refer to online documentation.
- A fixed installation is required according to IEC61800-5-1 with a suitable disconnecting device installed between the Optidrive and the AC Power Source. The disconnecting device must conform to the local safety code / regulations (e.g. within Europe, EN60204-1, Safety of machinery).
- The cables should be dimensioned according to any local codes or regulations. Maximum dimensions are given in the Rating Tables section of this Quick Start Guide.

# Install the Power Wiring

### Single phase supply



3 phase supply



	Power & Motor Cables								
Drive Size	Hole Size	Recommended PG Gland	Alternative Metric Gland						
Size 1	22	PG16	M20						
Size 2 & 3	27	PG21	M25						
Size 4	37	PG29	-						

# Motor Terminal Box Connections

Most general purpose motors are wound for operation on dual voltage supplies. This is indicated on the nameplate of the motor. This operational voltage is normally selected when installing the motor by selecting either STAR or DELTA connection. STAR always gives the higher of the two voltage ratings.

Incoming Supply Voltage	Motor Nameplate Voltages		Connection			
230	230 / 400					
400	400 / 690	Delta				
400	230 / 400	Star				

# Information for UL Compliance

Optidrive E3 is designed to meet the UL requirements. For an up to date list of UL compliant products, please refer to UL listing NMMS.E226333. In order to ensure full compliance, the following must be fully observed.

Input Power Su	Input Power Supply Requirements								
Supply Voltage	200 – 240 RMS Volts for 230 Volt rated units, + /- 10% variation allowed. 240 Volt RMS Maximum.								
	380 – 480 Volts for 400 Volt rated units, + / - 10% variation allowed, Maximum 500 Volts RMS.								
Frequency	50 – 60Hz + / - 5% Variation								
Short Circuit Capacity	All drives are suitable for use on a circuit capable of delivering not more than 100kA maximum short-circuit Amperes symmetrical with the specified maximum supply voltage when protected by Class J fuses.								

### Mechanical Installation Requirements

All Optidrive E3 units are intended for installation within controlled environments which meet the condition limits shown in the Environment section of this Quick Start Guide.

The drive can be operated within an ambient temperature range as stated in the Environment section of this Quick Start Guide.

### **Electrical Installation Requirements**

Incoming power supply connection must be according to the Install the Wiring section of this Quick Start Guide.

Suitable power and motor cables should be selected according to the data shown in Rating Tables section of this Quick Start Guide and the National Electrical Code or other applicable local codes.

Motor Cable 75°C Copper must be used.

Power cable connections and tightening torques are shown in the Mechanical Dimensions section of this Quick Start Guide.

Integral Solid Sate short circuit protection does not provide branch circuit protection. Branch circuit protection must be provided in accordance with the national electrical code and any additional local codes. Ratings are shown in the Rating Tables section of this Quick Start Guide.

For Canadian installations transient surge suppression must be installed on the line side of this equipment and shall be rated 480Volt (phase to ground), 480 Volt (phase to phase), suitable for over voltage category iii and shall provide protection for a rated impulse withstand voltage peak of 2.5kV.

UL Listed ring terminals / lugs must be used for all bus bar and grounding connections.

### **General Requirements**

Optidrive E3 provides motor overload protection, set at 150% of full load, in accordance with the National Electrical Code (US). Where a motor thermistor is not fitted, or not utilised, Thermal Overload Memory Retention must be enabled by setting P-60 = 1.

Where a motor thermistor is fitted and connected to the drive, connection must be carried out according to the information shown in the Motor Thermistor Connection section of the Quick Start Guide.

UL rated ingress protection ("Type") is only met when cables are installed using a UL recognized bushing or fitting for a flexible conduit system which meets the required level of protection ("Type").

For conduit installations the conduit entry holes require standard opening to the required sizes specified per the NEC.

Not intended for installation using rigid conduit system.

**WARNING:** The opening of the branch-circuit protective device may be an indication that a fault has been interrupted. To reduce the risk of fire or electric shock, current-carrying parts and other components of the controller should be examined and replaced if damaged. If burnout of the current element of an overload relay occurs, the complete overload relay must be replaced.

**ATTENTION:** Le déclenchement du dispositif de protection du circuit de dérivation peut être dû à une coupure qui résulte d'un courant de défaut. Pour limiter le risque d'incendie ou de choc électrique, examiner les pièces porteuses de courant et les autres éléments du contrôleur et les remplacer s'ils sont endommagés. En cas de grillage de l'élément traversé par le courant dans un relais de surcharge, le relais tout entier doit être remplacé.

# Default functions of the control switches



# **Control Connections**



A Serial RS485 Port

B Ethernet Ports (Factory fit option)

**c** Control Terminals

# **Control Terminal Wiring**

- All analog signal cables should be suitably shielded. Twisted pair cables are recommended.
- Power and Control Signal cables should be routed separately where possible, and must not be routed parallel to each other.
- Signal levels of different voltages e.g. 24 Volt DC and 110 Volt AC, should not be routed in the same cable.
- Maximum control terminal tightening torque is 0.5Nm.
- Control Cable entry conductor size: 0.05 2.5mm<sup>2</sup> / 30 12 AWG.

# **Control Terminal Connections**

**Control Switched Units:** May use the built in control switch and potentiometer, or external control signals connected to the control terminals.

Non-Switched Units: Require external control signals to be connected to the control terminals.

# **Using the Control Terminals**

	$\square$	Ο	Ο	Ο	Ω	Ω	Ω	Δ	Ο		- Connection Example							
	$\overline{\bigcirc}$			$\bigcirc$						$\square$	Г	4						<b>_</b>
1	2	3	4	5	6	7	8	9	10	11	ļ	1	2	3	4	5	6	
+24 VDC	DI1	DI2	DI3 Al2	+10 VDC	DI4 Al1	ov	<b>A</b> 0	0V	RL1	RL2	Ľ	+24V	D11	DI2	3/A12	+10V	1/D14	8
No.	Purpo	ose					Function								⊡		A	
1	+24VD	DC 100n	nA Outp	ut			24 VDC Output											
2	DI1 Di	gital Inp	ut 1				Function defined						*	*	•	ե	+	ป
3	DI2 Di	gital Inp	ut 2				by P-12 & P-15.						1	1	′ <b>†</b>	7		
4	DI3 Di	gital Inp	ut 3/Al2	2 Analog	Input 2		See below for further into											
5	+10VD	)C 10mA	A Output				10 VDC Output for external potentiometer											
6	DI4 Di	gital Inp	ut 4/Al 1	Analog	Input 1		Function defined by P-12 & P-15. Signal format selected by P-16											
7	OVDC	Commo	n															
8	AO Ar	nalog O	utput/Di	gital Out	put		Functio	on select	ted by P-	25. See	Par	ame	ter Lis	st				
9	OVDC Common																	
10	RL1 O	utput Rel	ay				E	an al a Car	l l D	10 С Г			19.1					
11	RL2 O	utput Rel	ay				runctio	on aetine	ea by P-	io. see f	rarc	mete	er List					

# **Factory Default Functions**

No.	Description							
DI1	0/1	Open : Stop	Closed : Run					
DI2	ひ/び	Open : Forward Rotation	Closed : Reverse Rotation					
DI3	Analog Speed Reference / Preset Speed	vpen : Speed Reference set by Analog Speed Reference losed : Speed Reference set by Preset Speed 1 (P-20)						
AI1	Analog Speed Reference Input	Sets the Speed Reference <b>NOTE</b> For Switched units, the internal pot is so For Non-switched units, an external pot or O - signal types may also be used, set P-16 to the	elected by default in P-16. 10 V reference may be connected. Other e correct format.					
NOTE	Additional functions are	possible, refer to the online documen	tation for further information.					

# **Analog and Digital Input Macro Configurations**

### Overview

Optidrive E3 uses a Macro approach to simplify the configuration of the Analog and Digital Inputs. There are two key parameters which determine the input functions and drive behaviour:

- P-12 Selects the main drive control source and determines how the output frequency of the drive is primarily controlled.
- P-15 Assigns the Macro function to the analog and digital inputs.

Additional parameters can then be used to further adapt the settings, e.g.

- P-16 Used to select the format of the analog signal to be connected to analog input 1, e.g. 0 10 Volt, 4 20mA.
- P-30 Determines whether the drive should automatically start following a power on if the Enable Input is present.
- P-31 When Keypad Mode is selected, determines at what output frequency / speed the drive should start following the enable command, and also whether the keypad start key must be pressed or if the Enable input alone should start the drive.
- P-47 Used to select the format of the analog signal to be connected to analog input 2, e.g. 0 10 Volt, 4 20mA.

### **Example Connection Diagrams**

The diagrams below provide an overview of the functions of each terminal macro function, and a simplified connection diagram for each.



Macro Functions Guide Key The table below should be used as a key on the following pages.

Function	Explanation
STOP	Latched Input, Open the contact to STOP the drive
RUN	Latched input, Close the contact to Start, the drive will operate as long as the input is maintained
<b>FWD</b> ひ	Latched Input, selects the direction of motor rotation FORWARD
REV೮	Latched Input, selects the direction of motor rotation REVERSE
RUN FWDÙ	Latched Input, Close to Run in the FORWARD direction, Open to STOP
RUN REV ೆ	Latched Input, Close to Run in the REVERSE direction, Open to STOP
ENABLE	Hardware Enable Input. In Keypad Mode, P-31 determines whether the drive immediately starts, or the keypad start key must be pressed. In other modes, this input must be present before the start command is applied via the fieldbus interface.
<b>START</b>	Normally Open, Rising Edge, Close momentarily to START the drive (NC STOP Input must be maintained)
^- START -^	Simultaneously applying both inputs momentarily will START the drive (NC STOP Input must be maintained)
STOP↓	Normally Closed, Falling Edge, Open momentarily to STOP the drive
START.ÌFWDÙ	Normally Open, Rising Edge, Close momentarily to START the drive in the forward direction (NC STOP Input must be maintained)
START1REV ರ	Normally Open, Rising Edge, Close momentarily to START the drive in the reverse direction (NC STOP Input must be maintained)
^-FAST STOP (P-24)-^	When both inputs are momentarily active simultaneously, the drive stops using Fast Stop Ramp Time P-24
FAST STOP↓ (P-24)	Normally Closed, Falling Edge, Open momentarily to FAST STOP the drive using Fast Stop Ramp Time P-24
E-TRIP	Normally Closed, External Trip input. When the input opens momentarily, the drive trips showing <i>E-tr</i> <sup>,</sup> <i>P</i> or <i>Ptc-th</i> depending on P-47 setting
Fire Mode	Activates Fire Mode
Analog Input AI 1	Analog Input 1, signal format selected using P-16
Analog Input AI2	Analog Input 2, signal format selected using P-47
AI1 REF	Analog Input 1 provides the speed reference
AI2 REF	Analog Input 2 provides the speed reference
P-xx REF	Speed reference from the selected preset speed
PR-REF	Preset speeds P-20 – P-23 are used for the speed reference, selected according to other digital input status
PI-REF	PI Control Speed Reference
PI FB	Analog Input used to provide a Feedback signal to the internal PI controller
KPD REF	Keypad Speed Reference selected
FB REF	Selected speed reference from Fieldbus (Modbus RTU / CAN Open / Master depending on P-12 setting)
(NO)	Input is Normally Open, Close momentarily to activate the function
(NC)	Input is Normally Closed, Open momentarily to activate the function
INC SPD	Normally Open, Rising Edge, Close momentarily to increase the motor speed by value in P-20
DEC SPD ↓	Normally Open, Rising Edge, Close momentarily to decrease the motor speed by value in P-20

### Macro Functions – Terminal Mode (P-12 = 0)

		DI1		DI2	DI	3 / AI2	DI4 /	´ Al1	-1	
P-15	0	1	0	1	0	1	0	1	Diagram	
0	STOP	run	FWD ひ	rev <b>U</b>	AI1 REF	P-20 REF	Analog I	nput Al 1	1	
1	STOP	run	AI1 REF	PR-REF	P-20	P-21	Analog I	nput Al 1	1	
2	STOP	run	DI2	DI3		PR	P-20 - P-23	P-01	2	
			0	0		P-20				
			1	0		P-21				
			0	1		P-22				
			1	1		P-23				
3	STOP	run	Al1	P-20 REF	E-TRIP	ОК	Analog I	nput Al 1	3	
4	STOP	RUN	Al1	AI2	Analo	og Input Al2	Analog I	nput Al 1	4	
5	STOP	RUN FWD <b>じ</b>	STOP	run rev <b>u</b>	AI1	P-20 REF	Analog I	nput Al 1	1	
		^FAS	ST STOP (P-2-	4)^	1					
6	STOP	run	FWD ひ	rev 🗸	E-TRIP	OK	Analog I	nput Al 1	3	
7	STOP	RUN FWD ဎ	STOP	run rev 🗸	E-TRIP	OK	Analog I	nput Al 1	3	
		^FAS	ST STOP (P-2	4)^						
8	STOP	run	FWD ひ	REV	DI3	DI4	P	R	2	
					0	0	P-2	20		
					1	0	P-1	21		
					0	1	1 P-22			
					1	1	P-2	P-23		
9	STOP	START FWD ひ	STOP	START REV <b>U</b>	DI3	DI4	P	R	2	
		^FAS	ST STOP (P-2	4)^	0	0	P-2	20		
					1	0	P-2	21		
					0	1	P-2	22		
				1	1	1	P-2	23		
10	(NO)	START 🕇	STOP	(NC)	AI1 REF	P-20 REF	Analog I	nput Al 1	5	
11	(NO)	START 1 FWD	Stop	(NC)	(NO)	START 1	Analog I	nput Al 1	6	
		0				KEV O				
		^	FAS	ST STOP (P-24)		^				
12	STOP	run	FAST STOP (P-24)	OK	AI1 REF	P-20 REF	Analog I	nput Al 1	7	
13	(NO)	Start fwd <b>じ</b>	STOP	(NC)	(NO)	START REV ${\bf J}$	KPD REF	P-20 REF	13	
		^	FAS	ST STOP (P-24)		^				
14	STOP	run		DI2	E-TRIP	OK	DI2 DI	4 PR	11	
							0 0	P-20		
							1 0	P-21		
							0 1	P-22		
				1			1 1	P-23		
15	STOP	run	P-23 REF	Al 1	Fir	e Mode	Analog I	nput Al 1	1	
16	STOP	run	P-23 REF	P-21 REF	Fir	e Mode	FWD	REV	2	
17	STOP	run		DI2	Fir	e Mode	DI2 DI	4 PR	2	
							0 0	P-20		
							1 0	P-21		
							0 1	P-22		
							1 1	P-23		
18	STOP	run	FWD ひ	REV 🖒	Fir	e Mode	Analog I	1		

### Macro Functions - Keypad Mode (P-12 = 1 or 2)

		DI1	D	12	DI	3 / AI2	DI4	/ AI1	<b>_</b> .	
P-15	0	1	0	1	0	1	0	1	Diagram	
0	STOP	enable	-	INC SPD 🗅	-	DEC SPD 🤉	FWD ひ	REV 🗸	8	
				^	START	^	1			
1	STOP	enable			PI Speed	Reference			2	
2	STOP	enable	-	INC SPD 🗅	-	DEC SPD 🤉	KPD REF	P-20 REF	8	
				^	^START^					
3	STOP	enable	-	INC SPD 🗅	E-TRIP	OK	- DEC SPD 🤉		9	
				^						
4	STOP	enable	-	INC SPD 🗅	KPD REF	AI1 REF		10		
5	STOP	enable	FWD <b>U</b>	rev 🗸	KPD REF AI1 REF AI1		AI1	1		
6	STOP	enable	FWD <b>U</b>	rev <b>U</b>	E-TRIP	OK	KPD REF	P-20 REF	11	
7	STOP	run fwd	STOP	RUN REV 🗸	E-TRIP	OK	KPD REF	P-20 REF	11	
		^FA	ST STOP (P-24	4)^						
8	STOP	RUN FWD ဎ	STOP	RUN REV 🗸	KPD REF	AI1 REF		AI1	1	
14	STOP	ENABLE	-	INC SPD 🗅	E-TRIP	OK	-	DEC SPD 🤉		
15	STOP	ENABLE	PR REF	KPD REF	Fire	e Mode	P-23	P-21	2	
16	STOP	enable	P-23 REF	KPD REF	Fire	e Mode	FWD ひ	REV <b>び</b>	2	
17	STOP	enable	KPD REF	P-23 REF	Fire	e Mode	FWD U	REV 🗸	2	
18	STOP	ENABLE	AI1 REF	KPD REF	Fire	e Mode	All		1	
			9, 10, 1	1, 12, 13 = Be	havior as	per setting 0				

When P15=4 in keypad mode, DI2 &DI4 are edge triggered. Digital pot speed will be increased or decreased once for each rising edge. The step of each speed change is defined by the absolute value of Pre-set Speed 1 (P-20).

Speed change only happens during normal running condition (no stop command etc.). Digital pot will be adjusted between minimum speed (P-02) and maximum speed (P-01).

### Macro Functions - Fieldbus Control Mode (P-12 = 3, 4, 7, 8 or 9)

NOTE

D 15		DI1	D	012	DI	3 / AI2	DI4 /	/ AI1	D:				
P-15	0	1	0	1	0	1	0	1	Diagram				
0	STOP	enable	FB REF (	Fieldbus Speed	Reference,	Modbus RTU / C	AN / Maste	r-Slave	14				
-	07.0.0	5111015			aerineo	1 Dy P-12)			1.5				
1	STOP	enable		PI Speed Keterence									
3	STOP	enable	FB REF	P-20 REF	E-TRIP	OK	Analog I	3					
5	STOP	ENABLE	FB REF	PR REF	P-20	P-21	Analog I	nput Al 1	1				
		^START	(P-12 = 3 or 4	2 = 3 or 4 Only)^									
6	STOP	enable	FB REF	AI1 REF	E-TRIP	OK	Analog Input Al 1		3				
		^START	(P-12 = 3 or 4	Only)^									
7	STOP	ENABLE	FB REF	KPD REF	E-TRIP	OK	Analog I	nput Al 1	3				
		^START	(P-12 = 3 or 4	Only)^									
14	STOP	ENABLE	-	-	E-TRIP	OK	Analog I	nput Al 1	16				
15	STOP	enable	PR REF	FB REF	Fire	e Mode	P-23	P-21	2				
16	STOP	enable	P-23 REF	FB REF	Fire	e Mode	Analog I	nput Al 1	1				
17	STOP	ENABLE	FB REF	P-23 REF	Fire	e Mode	Analog I	nput Al 1	1				
18	STOP	ENABLE	AI1 REF	FB REF	Fire Mode		Fire Mode Analog Input Al 1		1				
	2, 4, 8, 9, 10, 11, 12, 13 = Behavior as per setting 0												

### Macro Functions - User PI Control Mode (P-12 = 5 or 6)

D 15		DI1	DI2		DI	DI3 / AI2		´ Al 1	<b>D</b> .
P- 15	0	1	0	1	0	1	0	1	Diagram
0	STOP	run	PI REF	P-20 REF		AI2	AI	1	4
1	STOP	run	PI REF	AI1 REF	AĽ	2 (PI FB)	AI	1	4
3, 7	STOP	run	PI REF	P-20	E-TRIP OK		AI1 (F	PIFB)	3
4	(NO)	START	(NC)	STOP	AI2 (PI FB)		AI	1	12
5	(NO)	START	(NC)	STOP	PI REF	P-20 REF	AI1 (F	PIFB)	5
6	(NO)	START	(NC)	STOP	E-TRIP	OK	AI1 (F	PIFB)	
8	STOP	run	FWD Ŭ	rev 🗸	AĽ	2 (PI FB)	AI1		4
14	STOP	run	-	-	E-TRIP	OK	AI1 (F	PIFB)	16
15	STOP	run	P-23 REF	PI REF	Fire	e Mode	AI1 (F	PIFB)	1
16	STOP	run	P-23 REF	P-21 REF	Fire	e Mode	AI1 (F	PIFB)	1
17	STOP	run	P-21 REF	P-23 REF	Fire	e Mode	AI1 (PI FB)		1
18	STOP	run	AI1 REF	PI REF	Fire	e Mode	AI1 (F	PIFB)	1
			2, 9, 10,	11, 12, 13 = 1	Behavior c	is per setting C	)		
NOTE	P1 Setp	oint source is	selected by	P-44 (defa	ult is fixed	value in P-45,	Al 1 may a	also be sel	ected).

P1 Feedback source is selected by P-46 (default is AI 2, other options may be selected).

# **Motor Thermistor Connection**

Where a motor thermistor is to be used, it should be connected as follows:

<b>Control Terminal Strip</b>	Additional Information
	<ul> <li>Compatible Thermistor: PTC Type, 2.5kΩ trip level.</li> <li>Use a setting of P-15 that has Input 3 function as External Trip, e.g. P-15 = 3. Refer to online documentation for further details.</li> <li>Set P-47 = "Ptc-th"</li> </ul>

# 5 CHECK

6 POWER ON

# 7 COMMISSION

# Operation

### Managing the Keypad

The drive is configured and its operation monitored via the keypad and display.

$\Diamond$	START	When in keypad mode, used to Start a stopped drive or to reverse the direction of rotation if bi-directional keypad mode is enabled.
$\triangle$	UP	Used to increase speed in real-time mode or to increase parameter values in parameter edit mode.

### **Operating Displays**



### **Changing Parameters**

StoP StoP					
Press and hold the Navigate key > 2 seconds	Use the up and down keys to select the required parameter	Press the Navigate key for < 1 second	Adjust the value using the Up and Down keys	Press for < 1 second to return to the parameter menu	Press for > 2 seconds to return to the operating display

### **Read Only Parameter Access**

StoP StoP	P-00	P00-0 I ♦ ¶ △ ♥ √			5±₀₽ ♦₽△ ♥₽
Press and hold the Navigate key > 2 seconds	Use the up and down keys to select P-00	Press the Navigate key for < 1 second	Use the up and down keys to select the required Read Only parameter	Press the Navigate key for < 1 second to display the value	Press and hold the Navigate key > 2 seconds to return to the operating display

### **Resetting Parameters**



To reset parameter values to their factory default settings, press and hold Up, Down and Stop buttons for > 2 seconds. The display will show "*P-dEF*"

# ≶⊧₀₽ �৹∆ ₽₽∇

Press the Stop key. The display will show "**560**"

### **Resetting a Fault**



Used to decrease speed in real-time

Used to display real-time information,

to access and exit parameter edit mode and to store parameter changes. Used to reset a tripped drive.

When in Keypad mode is used to Stop

in parameter edit mode.

a running drive.

mode or to decrease parameter values

DOWN

NAVIGATE

RESET /

STOP

### **Parameters**

**Standard Parameters** 

Par.	Description						Max	Default	Units	
P-01	Maximum Frequency/Speed Limit Minimum Frequency/Speed Limit Acceleration Ramp Time						500.0	50.0 (60.0)	Hz/RPM	
P-02							P-01	0.0	Hz/RPM	
P-03							600.0		s	
P-04	Deceleration Ramp Time						600.0	5.0	s	
P-05	Stopping	Mode/Maiı	ns Loss Response	•		0	4	0	-	
	Cathing.	On Disable								
	Serring	Pamp to Stor		Piz	n Mains I	IPacovar on	oray from load to	maintain oporati	ionl	
		Coast	(1-04)	C	ae mougn aast	IKecover en	eigy nonniodd io i	indinidiri operali	onj	
	2	Ramp to Stor	(P-04)	Fa	st Ramp to	Stop (P-24)	Coast if $P-24 = 0$			
	3	Ramp to Stop	(P-04) with AC Flux	Braking Fa	st Ramp to	Stop (P-24),	Coast if P-24 = 0			
	4	Ramp to Stop	(P-04)	N	o action					
P-06	Energy O	ptimiser				0	3	0	-	
	Setting	Motor Ene	ray Optimisation	. 0	ptidrive l	Eneray Or	timisation	<u> </u>		
	0	Disabled	57	Di	sabled			_		
	1	Enabled		Di	sabled			_		
	2	Disabled		En	abled			_		
	3	Enabled		En	abled					
P-07	Motor Ra	ted Voltage,	Back EMF at rate	d speed (PM/E	BLDC)	0	250/ 500	230/400	V	
P-08	Motor Ra	ted Current		<u> </u>		Dri	ve Rating Depe	ndent	A	
P-09	Motor Ra	ted Freauen	cv			10	500	50 (60)	Hz	
P-10	Motor Ra	ted Speed	-/			0	30000	0	RPM	
1-10			<i>( (</i> ))	1.1.1.1				•		
	show motor displayed in <b>NOTE</b> If P-0	speed in RPM n RPM. D9 value is cha	nged, P-10 value is i	reset to 0.	as Minimu	m and Maxi	mum Speed, Prese	et Speeds etc. w	rill also be	
P-11	Low Frequ	ency Torque	Boost			0.0	Drive De	%		
P-12	Primary C	Command Se	ource			0	9	0	-	
	0: Terminal (	Control			5: PI (	Control				
	1: Uni-direc	tional Keypad	Control		6: PI /	Analog Sumi	mation Control			
	2: Bi-direction	onal Keypad C	Control		7: CA	N Control				
	3: Modbus	Network Cont	rol		8: CA	IN Control				
		D 10 1 0			9: 310	ive iviode		le se la se a d		
D 10	NOTE VVhe	en P-12 = 1, 2,	3, 4, 7, 8 or 9, an en	able signal mus	t still be pro	ovided at the	control terminals,	digital input 1.		
P-13			err	- M		U	<b>4</b>	0	-	
						<b>e</b>		1 1.1 1.		
	Setting Appli- Current Limit Torque Sp (P.54) Characteristic						Reaction (P-	erload Limit 60 Index 2)		
	0 General 150% Constant						0: Off 0: Trip			
	1 Pump 110% Variable				C	: Off	1: Current Lim	nit Reduction		
	2	Fan	110%	Variable	2	: On	1: Current Lim	nit Reduction		
P-14	Extended	Menu Access	code			0	65535	0	-	
	Enables acc	cess to Extende	d and Advanced Pa	rameter Groups	This parar	neter must b	e set to the value r	roarammed in F	P-37 (default:	
	101) to view changed by	v and adjust Ex v the user in P-3	tended Parameters a 7 if desired.	and value of P-3;	7 + 100 to	view and ac	djust Advanced Pa	rameters. The co	ide may be	

### **Extended Parameters**

Par.	Description		Min	Max	Default	Units
P-15	Digital Input Function Select		0	17	0	-
P-16	Analog Input 1 Signal Format		See B	elow	U0-10	-
	U D-1D: Unidirectional, External O – 10Volt reference / pot b D-1D: Bi-directional, External O – 10Volt reference / pot R D-2D: External O – 20mA signal E 4-2D: External 4 – 20mA signal, trip on loss	E 20-4 r 20-4 U 10-1 I n-Pol	1 : External 2 1 : External 2 2 : External 10 5 : <b>Switche</b>	0 – 4mA signa 0 – 4mA signa 0 – 0 Volt signa <b>d units only</b>	l, trip on loss l al : Internal pot	
	r 4-20 : External 4 – 20mA signal, P-20 on loss		•	-	-	
P-18	Output Relay Function Select		0	9	1	-
	0: Drive Enabled (kunning) 1: Drive Healthy 2: At Target Frequency (Speed) 3: Drive Tripped 4: Output Frequency >= Limit	5: Outp 6: Outp 7: Outp 8: Anal 9: Drive	out Current >= out Frequency out Current <   og Input 2 > 2 Ready to Ru	- Limit v < Limit Limit Limit n		
P-20	Preset Frequency / Speed 1		-P-01	P-01	5.0	Hz/RPM
P-21	Preset Frequency / Speed 2		-P-01	P-01	25.0	Hz/RPM
P-22	Preset Frequency / Speed 3		-P-01	P-01	40.0	Hz/RPM
P-23	Preset Frequency / Speed 4		-P-01	P-01	P-09	Hz/RPM
P-24	2nd Ramp Time (Fast Stop)		0.00	600.0	0.00	s
P-25	Analog Output Function Select		0	11	8	-
P-30	Digital Output Mode. Logic 1 = +24V DC         O: Drive Enabled (Running)         1: Drive Healthy         2: At Target Frequency (Speed)         3: Drive Tripped         4: Output Frequency >= Limit         5: Output Current >= Limit         6: Output Frequency < Limit         7: Output Current >= Limit         8: Output Current < Limit         Start/ Restart / Fire Mode Configuration         Index 1: Start Mode / Auto Restart         EdgE-r: Following Power on or reset, the drive will not start if Dig on or reset to start the drive.         RULa-D: Following a Power On or Reset, the drive will automatic         RULa-D: Following a Fixed power on or reset will make up to 5	Analo 8: Outp 9: Outp 10: Out 11: Load gital Input 1 cally start if	g Output A nut Frequency nut (Motor) C iput Power d Current N, remains clo Digital Input prestart at 20	Aode	i) Edge-r nust be closed d	- after a power
	Index 2: Fire Mode Input Logic	dilempisic		1 second intervo	0	-
	0: Normally Closed (NC) input. Fire Mode active if input is 1: Normally Open (NO) input. Fire Mode active if input is	s open. closed.	-		-	
	Index 3: Fire Mode Input Latch		0	1	0	-
	<ul> <li>O: Latched input. The drive will remain in Fire Mode, only as least 1: Momentary input. Fire Mode is activated by a momentar operation is supported depending on Index 2 setting.</li> <li>2: Normally Closed (NC) Input, Preset Speed 4 (P-23).</li> <li>3: Normally Open (NO) Input, Preset Speed 4 (P-23).</li> </ul>	ong the fire ry signal on	e mode input 1 the input. No	signal remains. ormally Open o	or Normally Clo	osed
P-31	Keypad Start Mode Select		0 - 3	7	1	-
	O: Minimum Speed, Keypad Start 1: Previous Speed, Keypad Start 2: Minimum Speed, Terminal Enable 3: Previous Speed, Terminal Enable	4: Curre 5: Prese 6: Curre 7: Prese	ent Speed, Ke et Speed 4, K ent Speed, Te t Speed 4, Te	eypad Start eypad Start erminal Start erminal Start		
P-33	Spin Start		0	2	0	-
	O: Disabled 1: Enabled	2: Enab	oled on Trip, E	Brown Out or C	Coast Stop	
P-34	Brake Chopper Enable (Not Size 1)		0	4	0	-
	0: Disabled 1: Enabled With Software Protection 2: Enabled Without Software Protection	3: Enab 4: Enab	oled With Sof Ned Without	tware Protectio Software Protec	n ction	

Par.	Description		Min	Max	Default	Units
P-38	Parameter Access Lock		0	1	0	-
	0: Unlocked	1: Lo	cked			
P-39	Analog Input 1 Offset		-500.0	500.0	0.0	%
P-40	Index 1: Display Scaling Factor		0.000	16.000	0.000	-
	Index 2: Display Scaling Source		0	3	0	-
P-41	PI Controller Proportional Gain		0.0	30.0	1.0	-
P-42	PI Controller Integral Time		0.0	30.0	1.0	s
P-43	PI Controller Operating Mode		0	3	0	-
	0: Direct Operation	2: Dii	rect Operation,	Wake at Full S	peed	
	1: Inverse Operation	3: Re	verse Operatio	n, Wake at Full	Speed	
P-44	PI Reference (Setpoint) Source Select		0	1	0	-
	O: Digital Preset Setpoint	1: An	alog Input 1 S	etpoint		
P-45	PI Digital Setpoint		0.0	100.0	0.0	%
P-46	PI Feedback Source Select		0	5	0	-
	0: Analog Input 2	3: DC	C Bus Voltage			
	1: Analog Input 1	4: An	alog 1 – Analo	og 2		
	2: Motor Current	5: La	rgest (Analog 1	, Analog 2)		
P-47	Analog Input 2 Signal Format		-	-	-	U0-10
	U D- ID : Unidirectional, External O – 10Volt reference / pot	F 50	<b>I- 4</b> : External 2	0 – 4mA signa	l, trip on loss	
	A D-2D : External O – 20mA signal	r 20	<b>I-4</b> : External 2	0 – 4mA signa	I	
	E 4−20 : External 4 – 20mA signal, trip on loss	Ptc-	<b>Lh</b> : Motor the	rmistor		
	r Ч-20 : External 4 − 20mA signal, P-20 on loss				1	
P-48	Standby Mode Timer		0.0	25.0	0.0	S
P-49	PI Control Wake Up Error Level		0.0	100.0	5.0	%
P-50	User Output Relay Hysteresis		0.0	100.0	0.0	%

### **Advanced Parameters**

Par.	Description	Min	Max	Default	Units
P-51	Motor Control Mode	0	5	0	-
	0: Vector speed control mode 3	: BLDC motor ve	ctor speed contr	ol	
	1: V/f mode 4	: Synchronous Rel	uctance motor ve	ector speed contro	ol
	2: PM motor vector speed control 5	: LSPM motor ve	ctor speed contr	ol	
P-52	Motor Parameter Autotune	0	1	0	-
	0: Disabled 1	: Enabled			
P-54	Maximum Current Limit	0	175	150	%
	Defines the max current limit in vector control modes				
P-61	Ethernet Service Option	0	1	0	-
	0: Disabled 1	: Enabled			
P-62	Ethernet Service Timeout	0	60	0	Mins
	0: Disabled >	0: Timeout in min	utes		
P-63	Modbus Mode Selection	0	1	0	-
	0: Standard <sup>1</sup> 1	: Advanced <sup>2</sup>			
P-64	IP66 DI1 Source	0	4	0	-
	Visible only on IP66 Switched Drives				
	0: Terminal 2 OR Switch Forward OR Switch Reverse 3	: Terminal 2 ANI	) (S-Forward O	R Switch Reverse	)
	1: Terminal 2 Only 4	: Terminal 2 ANI	D Switch Forwar	d	
	2: Terminal 2 OR Switch Forward				
P-65	IP66 DI2 Source	0	2	0	-
	Visible only on IP66 Switched Drive				
	0: Terminal 3 OR Switch Reverse				
	1: Terminal 3 Only				
	2: Terminal 3 AND Switch Reverse				

### Asynchronous Induction Motors (IM) Vector Control

Optidrive E3 factory default parameters are intended for use with IM motors where the power rating of the motor is approximately the same or slightly less than the indicated power rating of the drive. In this case, it should be possible to operate the motor without any parameter adjustment at all for initial testing.

For optimum performance, the drive parameters should be adjusted to match the motor ratings. This will also ensure correct protection of the motor from damage due to overload.

The basic parameters that should be adjusted are:

- P-07 : Motor Rated Voltage (V)
- P-08 : Motor Rated Current (A)
- P-09 : Motor Rated Frequency (Hz)
- In addition, it is also possible to set:
- P-10 : Motor Rated Speed (RPM)

When this parameter is adjusted, slip compensation is activated. Slip compensation attempts to compensate the motor speed relative to the load applied, such that when operating at a constant speed with different loads, the motor shaft speed should remain approximately the same.

To further improve the performance of the motor, the following additional steps can be followed:

- Carry out an Autotune.
  - o This requires Advanced Parameter Access, P-14 = P-37 + 100 (Default : 201).
  - o After the correct nameplate information is entered from the motor, the drive can additionally measure some electrical characteristics of the motor to further optimise the motor control to suit connected motor.
  - o This is achieved by setting P-52 = 1.

The autotune will begin IMMEDIATELY following the setting of this parameter!

- o The drive output will be enabled, and the motor shaft may move. It is important to ensure this is safe before carrying out the autotune.
- o For IM motors, the autotune takes only a few seconds, and measures only the motor stator resistance. Parameter P-55 will be updated with the new value.
- Adjust the Low Frequency Torque Boost
  - o IM motors require some additional voltage at low frequency to improve the low speed operation and torque.
  - o By adjusting P-11, it is possible to optimise the low speed operation.
  - o If P-11 is increased too far, excessive motor heating or over current trips may result.
- Speed regulation and response to load changes may be improved by adjusting P-11 Vector Gain to suit the motor and connected load.
  - o Higher values will provide a more dynamic behaviour at the risk of instability.

**NOTE** For other motor types refer to online document.

# **Technical Data**

### Environment

Operational ambient temperature rar	ige
Enclosed Drives:	-20 40°C (frost and condensation free)
Storage ambient temperature range:	-40 60°C
Maximum altitude:	2000m. Derate above 1000m: 1% / 100m
Maximum humidity:	95%, non-condensing

### **Rating Tables**

Frame Size	kW	НР	Input Current	Fuse/ (Typ	/MCB e B)	Maximum Cable Size		Output Current	Recommended Brake Resistance
				Non UL	UL	mm	AWG	A	Ω
110 - 115	(+ / - 10%	6) V 1 Pho	ase Input,	230V 3 Ph	ase Outpı	ut (Voltage	Doubler)		
1	0.37	0.5	7.8	10	10	8	8	2.3	-
1	0.75	1	15.8	25	20	8	8	4.3	-
2	1.1	1.5	21.9	32	30	8	8	5.8	100
200 - 240	0 (+ / - 10	%) V 1 Pl	hase Input	, 3 Phase	Output	·			
1	0.37	0.5	3.7	10	6	8	8	2.3	-
1	0.75	1	7.5	10	10	8	8	4.3	-
1	1.5	2	12.9	16	17.5	8	8	7	-
2	1.5	2	12.9	16	17.5	8	8	7	100
2	2.2	3	19.2	25	25	8	8	10.5	50
3	4	5	29.2	40	40	8	8	15.3	25
200 - 240	0 (+ / - 10	%) V 3 Pl	nase Input	, 3 Phase (	Output				
1	0.37	0.5	3.4	6	6	8	8	2.3	-
1	0.75	1	5.6	10	10	8	8	4.3	-
1	1.5	2	8.9	16	15	8	8	7	-
2	1.5	2	8.9	16	15	8	8	7	100
2	2.2	3	12.1	16	17.5	8	8	10.5	50
3	4	5	20.9	32	30	8	8	18	25
3	5.5	7.5	26.4	40	35	8	8	24	20
4	7.5	10	33.3	40	45	16	5	30	15
4	11	15	50.1	63	70	16	5	46	10
380 - 480	0 (+ / - 10	%)V 3 Ph	ase Input,	3 Phase C	Dutput				
1	0.75	1	3.5	6	6	8	8	2.2	-
1	1.5	2	5.6	10	10	8	8	4.1	-
2	1.5	2	5.6	10	10	8	8	4.1	250
2	2.2	3	7.5	16	10	8	8	5.8	200
2	4	5	11.5	16	15	8	8	9.5	120
3	5.5	7.5	17.2	25	25	8	8	14	100
3	7.5	10	21.2	32	30	8	8	18	80
3	11	15	27.5	40	35	8	8	24	50
4	15	20	34.2	40	45	16	5	30	30
4	18.5	25	44.1	50	60	16	5	39	22
4	22	30	51.9	63	70	16	5	46	22

**NOTE** Cable sizes shown are the maximum possible that may be connected to the drive. Cables should be selected according to local wiring codes or regulations at the point of installation.

# Troubleshooting

# Fault Code Messages

Fault Code	No.	Description	Suggested Remedy
no-Filt	00	No Fault	Not required.
OI - Ь	01	Brake channel over current	Check external brake resistor condition and connection wiring.
ОL- <i>Б</i> г	02	Brake resistor overload	The drive has tripped to prevent damage to the brake resistor.
0-1	03	Output Over Current	Instantaneous Over current on the drive output. Excess load or shock load on the motor. <b>NOTE</b> Following a trip, the drive cannot be immediately reset. A delay time is inbuilt, which allows the power components of the drive time to recover to avoid damage
1_5-5-P	04	Motor Thermal Overload (12t)	The drive has tripped after delivering >100% of value in P-08 for a period of time to prevent damage to the motor.
0-uolt	06	Over voltage on DC bus	Check the supply voltage is within the allowed tolerance for the drive. If the fault occurs on deceleration or stopping, increase the deceleration time in P-04 or install a suitable brake resistor and activate the dynamic braking function with P-34.
U-uort	07	Under voltage on DC bus	The incoming supply voltage is too low. This trip occurs routinely when power is removed from the drive. If it occurs during running, check the incoming power supply voltage and all components in the power feed line to the drive.
0-E	08	Heatsink over temperature	The drive is too hot. Check the ambient temperature around the drive is within the drive specification. Ensure sufficient cooling air is free to circulate around the drive.
U- E	09	Under temperature	The drive temperature is below the minimum limit and must be increased to operate the drive.
P- dEF	10	Factory Default parameters loaded	
E-צר וP	11	External trip	E-trip requested on digital input 3. Normally closed contact has opened. If motor thermistor is connected check if the motor is too hot.
50-065	12	Optibus comms loss	Check communication link between drive and external devices. Make sure each drive in the network has its unique address.
FLE-dc	13	DC bus ripple too high	Check incoming supply phases are all present and balanced.
P-LOSS	14	Input phase loss trip	Check incoming power supply phases are present and balanced.
н O-I	15	Output Over Current	Check for short circuits on the motor and connection cable. <b>NOTE</b> Following a trip, the drive cannot be immediately reset. A delay time is inbuilt, which allows the power components of the drive time to recover to avoid damage.
Eh-FLE	16	Faulty thermistor on heatsink	
dAFA-E	17	Internal memory fault (IO)	Press the stop key. If the fault persists, consult you supplier.
4-20 F	18	4-20mA Signal Lost	Check the analog input connection(s).
dAFA-E	19	Internal memory fault (DSP)	Press the stop key. If the fault persists, consult you supplier.
F-Ptc	21	Motor PTC thermistor trip	Connected motor thermistor over temperature, check wiring connections and motor.
FAn-F	22	Cooling Fan Fault (IP66 only)	Check / replace the cooling fan.
0- HEAF	23	Drive internal temperature too high	Drive ambient temperature too high, check adequate cooling air is provided.
OUE-F	26	Output Fault	Indicates a fault on the output of the drive, such as one phase missing, motor phase currents not balanced. Check the motor and connections.

Fault Code	No.	Description	Suggested Remedy
AFE-05	41	Autotune Fault	The motor parameters measured through the autotune are not correct. Check the motor cable and connections for continuity. Check all three phases of the motor are present and balanced.
5C-FO I	50	Modbus comms loss fault	Check the incoming Modbus RTU connection cable. Check that at least one register is being polled cyclically within the timeout limit set in P-36 Index 3.
5C-F02	51	CAN comms loss trip	Check the incoming CAN connection cable. Check that cyclic communications take place within the timeout limit set in P-36 Index 3.

**NOTE** Following an over current or overload trip (1, 3, 4, 15), the drive may not be reset until the reset time delay has elapsed to prevent damage to the drive.



82-E3I66-IN\_V1.07

Invertek Drives Ltd. Offa's Dyke Business Park, Welshpool, Powys SY21 8JF United Kingdom Tel: +44 (0) 1938 556868 Fax: +44 (0) 1938 556869

www.invertekdrives.com