




Inverter Drives 3-140022-3F1A Variable Frequency Drive, User Guide

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Inverter Drives 3-140022-3F1A Variable Frequency Drive



1. CHECK: Check the correct drive type, check suitable motor type & info
2. 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
6. COMMISSION the drive parameters
7. OPERATE and check everything is as intended

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.

CHECK

Identifying the Drive by Model Number

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

Product Family

Generation

Frame Size

Input Voltage 1 = 110 – 115
2 = 200 – 240
4 = 380 – 480

No. Of Input Phases

Output Current x 10

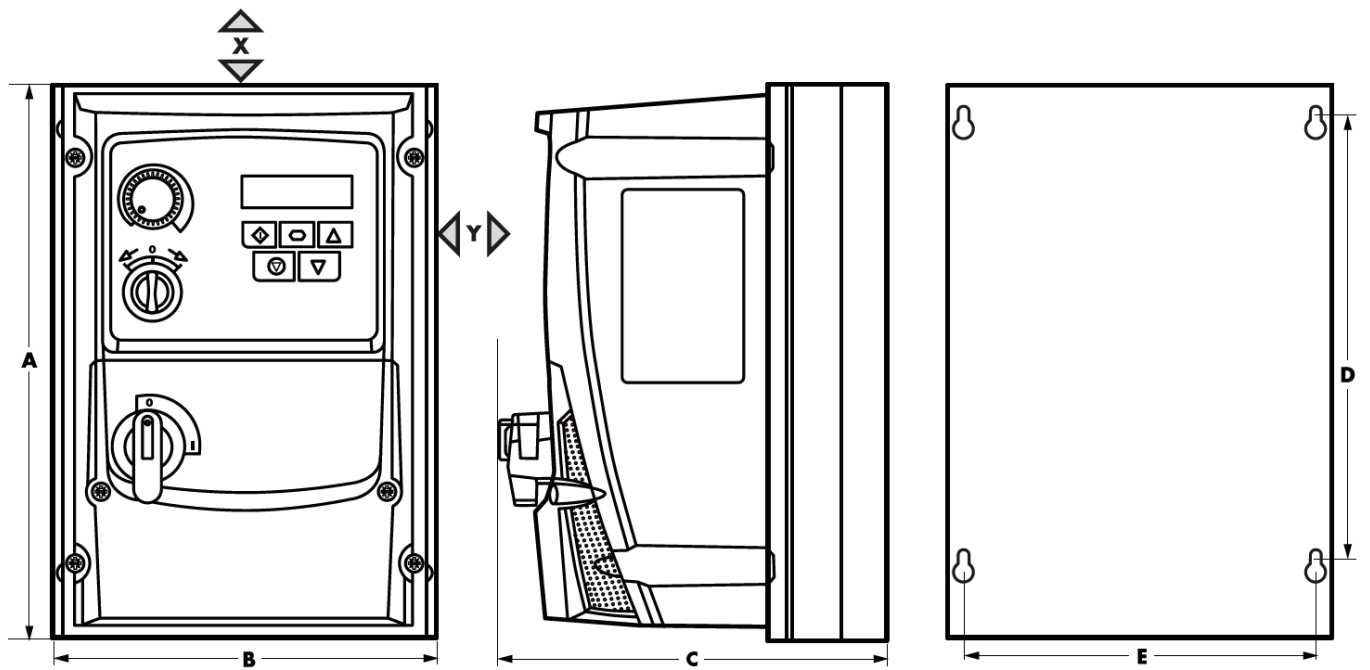
Filter Type 0 = No Filter
F = Internal EMC Filter

Dynamic Brake Transistor 1 = Not Fitted
4 = Internal Transistor

IP Rating

	IP66	FWD/REV	Pot	Disconnect
A	✓	x	x	x
B	✓	✓	✓	✓
C	✓	✓	✓	x
E	✓	x	x	✓

Mechanical Dimensions



Dimensions

Drive Size	A		B		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	182	7.16	200	7.87	178	7.00	3.5	7.7
3	310	12.2	211	8.3	235	9.25	252	9.92	197	7.75	6.6	14.5
4	360	14.17	240	9.44	271	10.67	300	11.81	227	8.94	9.5	20.9

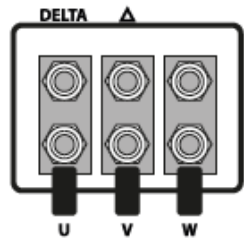
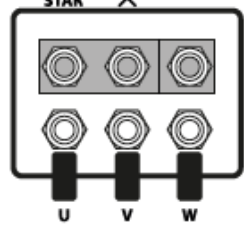
Mounting Clearance

Drive Size		X Above & Below		Y Either Side	
		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

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	Delta	
400	400 / 690		
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 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.
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Power cable connections and tightening torques are shown in the Mechanical Dimensions section of this Quick Start Guide.

Integral Solid State short circuit protection does not provide branch circuit protection. Branch circuit protection must be provided in accordance with the national electrical code and any additional local codes. 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.

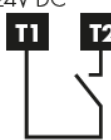











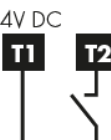

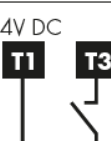

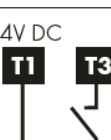


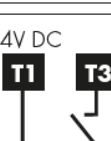

Not intended for installation using rigid conduit system.

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.

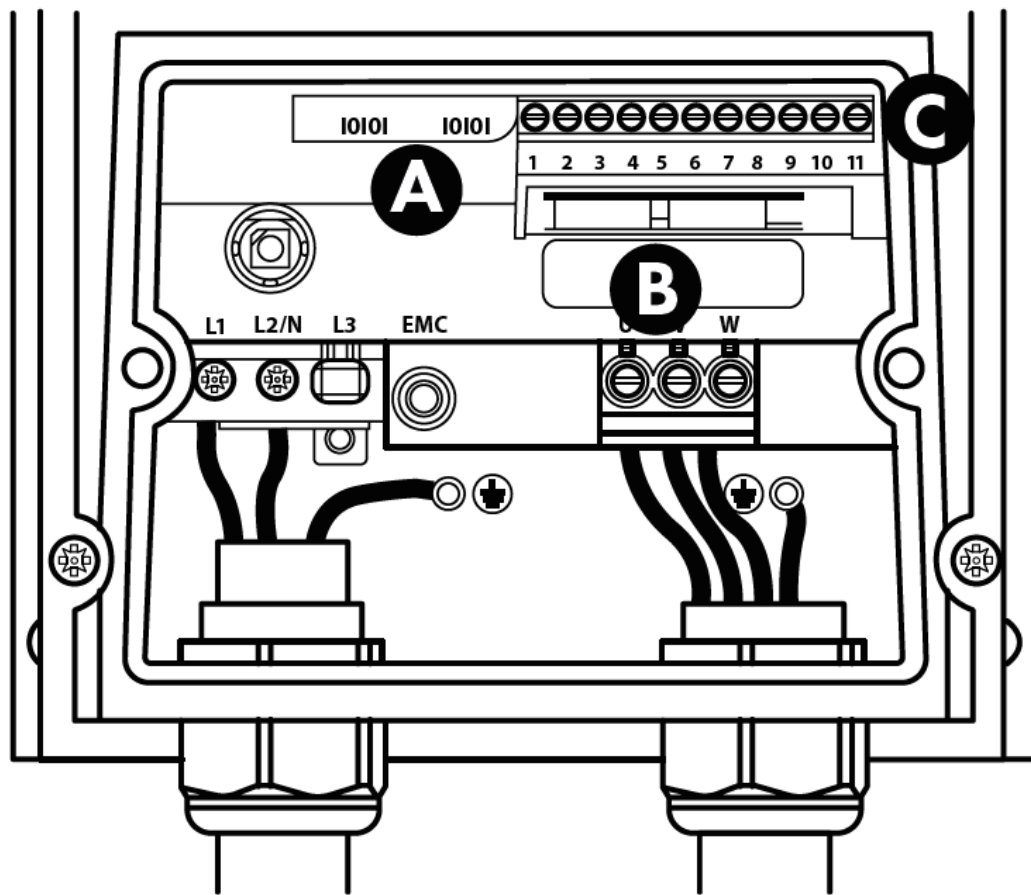
Default functions of the control switches

Switch Position			POT	Notes
				Factory Default Configuration. Run Forward or Reverse with speed controlled from the Local POT.
Run Reverse	STOP	Run Forward	Sets the output frequency	

Switch Configuration

P-64 = 0	T2 OR DI1 = Switch REV OR Switch FWD	+24V DC  VFD Control Terminals External User Switches	OR	 Run Reverse	OR	 Run Forward
P-64 = 1	DI1 = T2 only	+24V DC  VFD Control Terminals External User Switches		  Drive Switch is disabled		
P-64 = 2	T2 OR DI1 = Switch FWD	+24V DC  VFD Control Terminals External User Switches	OR	 Run Forward		
P-64 = 3	T2 AND Switch FWD OR T2 AND Switch REV	+24V DC  VFD Control Terminals External User Switches	AND	 Run Forward		
		+24V DC  VFD Control Terminals External User Switches	AND	 Run Reverse		
P-64 = 4	DI1 = T2 AND Switch FWD	+24V DC  VFD Control Terminals External User Switches	AND	 Run Forward		
P-65 = 0	DI2 = T3 OR Switch REV	+24V DC  VFD Control Terminals External User Switches	OR	 Run Reverse		
P-65 = 1	DI2 = T3 only	+24V DC  VFD Control Terminals External User Switches		  Drive Switch is disabled		
P-65 = 2	DI2 = T3 AND Switch REV	+24V DC  VFD Control Terminals External User Switches	AND	 Run Reverse		

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 – 2.5mm² / 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.

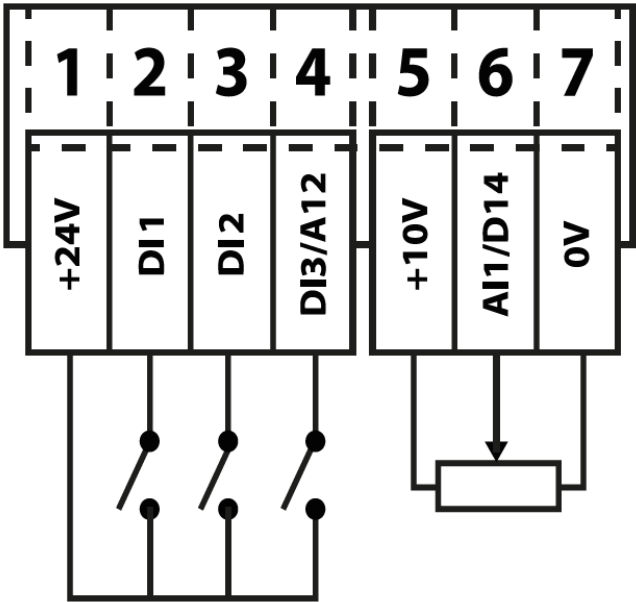
Non-Switched Units: Require external control signals to be connected to the control terminals.

Using the Control Terminals

										
1	2	3	4	5	6	7	8	9	10	11
+24 VDC	DI1	DI2	DI3 AI2	+10 VDC	DI4 AI1	0V	A0	0V	RL1	RL2
No.	Purpose						Function			

No.	Purpose	Function
1	+24VDC 100mA Output	24 VDC Output
2	DI1 Digital Input 1	Function defined by P-12 & P-15. See below for further info
3	DI2 Digital Input 2	
4	DI3 Digital Input 3/AI2 Analog Input 2	
5	+10VDC 10mA Output	10 VDC Output for external potentiometer
6	DI4 Digital Input 4/AI1 Analog Input 1	Function defined by P-12 & P-15. Signal format selected by P-16
7	0VDC Common	
8	AO Analog Output/Digital Output	Function selected by P-25. See Parameter List
9	0VDC Common	
10	RL1 Output Relay	Function defined by P-18. See Parameter List
11	RL2 Output Relay	

Connection Example



Factory Default Functions

No.	Description		
DI1	0/1	Open : Stop	Closed : Run
DI2	P/Q	Open : Forward Rotation	Closed : Reverse Rotation
DI3	Analog Speed Reference / Preset Speed	Open : Speed Reference set by Analog Speed Reference Closed : Speed Reference set by Preset Speed 1 (P-20) Sets the Speed Reference NOTE For Switched units, the internal pot is selected by default in P-16. For Non-switched units, an external pot or 0 – 10 V reference may be connected. Other signal types may also be used, set P-16 to the correct format.	
AI1	Analog Speed Reference Input		
NOTE	Additional functions are possible, refer to the online documentation 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.

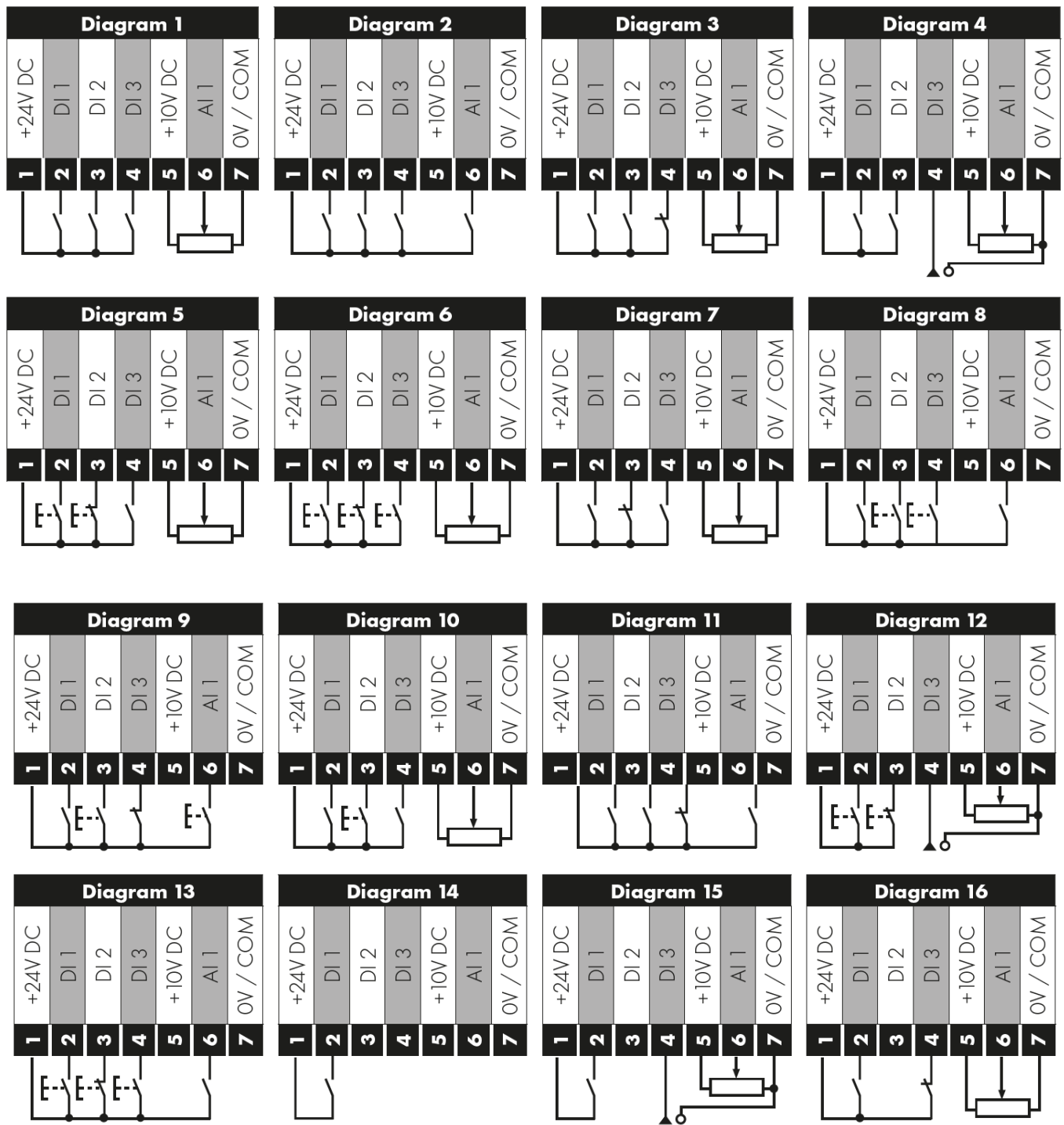
P-30 Determines whether the drive should automatically start following a power on if the Enable Input is present.

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
FWDP	Latched Input, selects the direction of motor rotation FORWARD
REVQ	Latched Input, selects the direction of motor rotation REVERSE
RUN FWDP	Latched Input, Close to Run in the FORWARD direction, Open to STOP
RUN REVQ	Latched Input, Close to Run in the REVERSE direction, Open to STOP
ENABLE	<p>Hardware Enable Input.</p> <p>In Keypad Mode, P-31 determines whether the drive immediately starts, or the keypad start key must be pressed.</p> <p>In other modes, this input must be present before the start command is applied via the fieldbus interface.</p>
START=	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=FWDP	Normally Open, Rising Edge, Close momentarily to START the drive in the forward direction (NC STOP Input must be maintained)
START=REVQ	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 depending on P-47 setting
Fire Mode	Activates Fire Mode
Analog Input AI1	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)

P-1 5	DI1		DI2		DI3 / AI2		DI4 / AI1		Diagram
	0	1	0	1	0	1	0	1	
0	STO P	RUN	FWD P	REV Q	AI1 R EF	P-20 REF	Analog Input AI1		1
1	STO P	RUN	AI1 REF	PR-REF	P-20	P-21	Analog Input AI1		1
			DI2	DI3	PR				
			0	0	P-20				

2	STOP	RUN	1	0	P-21		P-20 – P-23	P-01	2
			0	1	P-22				
			1	1	P-23				
3	STOP	RUN	AI1	P-20 REF	E-TRIP	OK	Analog Input AI1		3
4	STOP	RUN	AI1	AI2	Analog Input AI2		Analog Input AI1		4
5	STOP	RUN FWD P	STOP	RUN REV Q	AI1	P-20 REF	Analog Input AI1		1
		^——FAST STOP (P-24)—— ^							
6	STOP	RUN	FWD P	REV Q	E-TRIP	OK	Analog Input AI1		3
7	STOP	RUN FWD P	STOP	RUN REV Q	E-TRIP	OK	Analog Input AI1		3
		^——FAST STOP (P-24)—— ^							
8	STOP	RUN	FWD P	REV	DI3	DI4	PR		2
					0	0	P-20		
					1	0	P-21		

					0	1	P-22			
					1	1	P-23			
9	STOP	START FW DP	STOP	START REV Q	DI3	DI4	PR			2
		^——FAST STOP (P-24)—— ^				0	0	P-20		
						1	0	P-21		
						0	1	P-22		
						1	1	P-23		
10	(NO)	START =	STOP	(NC)	AI1 REF	P-20 REF	Analog Input AI1			5
11	(NO)	START = FWD Q	STOP	(NC)	(NO)	START = REV Q	Analog Input AI1			6
		^————FAST STOP (P-24)———— ^								
12	STOP	RUN	FAST STOP (P-24)	OK	AI1 REF	P-20 REF	Analog Input AI1			7
13	(NO)	START FW DP	STOP	(NC)	(NO)	START REV Q	KPD	REF	P-20 REF	13

		^————FAST STOP (P-24)———— ^								
14	STOP P	RUN	DI2		E-TRI P	OK	DI2	DI4	PR	11
							0	0	P-20	
							1	0	P-21	
							0	1	P-22	
							1	1	P-23	
15	STOP P	RUN	P-23 RE F	AI1	Fire Mode	Analog Input AI1			1	
16	STOP P	RUN	P-23 RE F	P-21 REF	Fire Mode	FWD		REV	2	
17	STOP P	RUN	DI2		Fire Mode	DI2	DI4	PR	2	
						0	0	P-20		
						1	0	P-21		
						0	1	P-22		
						1	1	P-23		

18	STOP	RUN	FWD P	REV Q	Fire Mode	Analog Input AI1	1
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Macro Functions – Keypad Mode (P-12 = 1 or 2)

P-15	DI1		DI2		DI3 / AI2		DI4 / AI1		Diagram
	0	1	0	1	0	1	0	1	
0	STOP	ENABLE	–	INC SPD = ^————START———— ^	–	DEC SPD ?	FWD P	REV Q	8
1	STOP	ENABLE	PI Speed Reference						2
2	STOP	ENABLE	–	INC SPD = ^————START———— ^	–	DEC SPD ?	KPD REF	P-20 REF	8
3	STOP	ENABLE	–	INC SPD = ^————START———— ^	E-TRIP	OK	–	DEC SPD ?	9
4	STOP	ENABLE	–	INC SPD =	KPD REF	AI1 REF	AI1		10

5	STOP	ENABLE	FWD P	REV Q	KPD R EF	AI1 REF	AI1		1
6	STOP	ENABLE	FWD P	REV Q	E-TRIP	OK	KPD R EF	P-20 REF	11
7	STOP	RUN FWD	STOP	RUN REV Q	E-TRIP	OK	KPD R EF	P-20 REF	11
		^——FAST STOP (P-24)——. ^							
8	STOP	RUN FWD P	STOP	RUN REV Q	KPD R EF	AI1 REF	AI1		1
14	STOP	ENABLE	—	INC SPD =	E-TRIP	OK	—	DEC SPD ?	
15	STOP	ENABLE	PR REF	KPD REF	Fire Mode		P-23	P-21	2
16	STOP	ENABLE	P-23 REF	KPD REF	Fire Mode		FWD P	REV Q	2
17	STOP	ENABLE	KPD REF	P-23 REF	Fire Mode		FWD P	REV Q	2
18	STOP	ENABLE	AI1 REF	KPD REF	Fire Mode		AI1		1
9, 10, 11, 12, 13 = Behavior as per setting 0									

<p>NOTE</p>	<p>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 Preset Speed 1 (P-20).</p> <p>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).</p>
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Macro Functions – Fieldbus Control Mode (P-12 = 3, 4, 7, 8 or 9)

P-15	DI1		DI2		DI3 / AI2		DI4 / AI1		Diagram
	0	1	0	1	0	1	0	1	
0	STOP	ENABLE	FB REF (Fieldbus Speed Reference, Modbus RTU / CAN / Master-Slave defined by P-12)						14
1	STOP	ENABLE	PI Speed Reference						15
3	STOP	ENABLE	FB REF	P-20 REF	E-TRIP	OK	Analog Input AI1		3
5	STOP	ENABLE	FB REF	PR REF	P-20	P-21	Analog Input AI1		1
		^—START (P-12 = 3 or 4 Only)— ^							
6	STOP	ENABLE	FB REF	AI1 REF	E-TRIP	OK	Analog Input AI1		3
		^—START (P-12 = 3 or 4 Only)— ^							
7	STOP	ENABLE	FB REF	KPD REF	E-TRIP	OK	Analog Input AI1		3
		^—START (P-12 = 3 or 4 Only)— ^							
14	STOP	ENABLE	—	—	E-TRIP	OK	Analog Input AI1		16
15	STOP	ENABLE	PR REF	FB REF	Fire Mode		P-23	P-21	2
16	STOP	ENABLE	P-23 REF	FB REF	Fire Mode		Analog Input AI1		1
17	STOP	ENABLE	FB REF	P-23 REF	Fire Mode		Analog Input AI1		1
18	STOP	ENABLE	AI1 REF	FB REF	Fire Mode		Analog Input AI1		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)

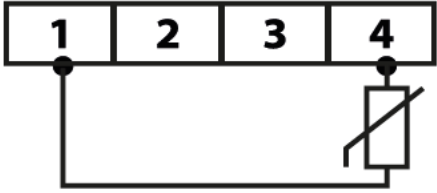
P-15	DI1		DI2		DI3 / AI2		DI4 / AI1		Diagram
	0	1	0	1	0	1	0	1	
0	STOP	RUN	PI REF	P-20 REF	AI2		AI1		4
1	STOP	RUN	PI REF	AI1 REF	AI2 (PI FB)		AI1		4
3, 7	STOP	RUN	PI REF	P-20	E-TRIP	OK	AI1 (PI FB)		3
4	(NO)	START	(NC)	STOP	AI2 (PI FB)		AI1		12
5	(NO)	START	(NC)	STOP	PI REF	P-20 REF	AI1 (PI FB)		5
6	(NO)	START	(NC)	STOP	E-TRIP	OK	AI1 (PI FB)		
8	STOP	RUN	FWD P	REV Q	AI2 (PI FB)		AI1		4
14	STOP	RUN	–	–	E-TRIP	OK	AI1 (PI FB)		16
15	STOP	RUN	P-23 REF	PI REF	Fire Mode		AI1 (PI FB)		1
16	STOP	RUN	P-23 REF	P-21 REF	Fire Mode		AI1 (PI FB)		1
17	STOP	RUN	P-21 REF	P-23 REF	Fire Mode		AI1 (PI FB)		1
18	STOP	RUN	AI1 REF	PI REF	Fire Mode		AI1 (PI FB)		1

2, 9, 10, 11, 12, 13 = Behavior as per setting 0

NOTE P1 Setpoint source is selected by P-44 (default is fixed value in P-45, AI 1 may also be selected). 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:

Control Terminal Strip	Additional Information
	<p>Compatible Thermistor: PTC Type, 2.5kΩ trip level.</p> <p>§ 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.</p>



COMMISSION




Managing the Keypad

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

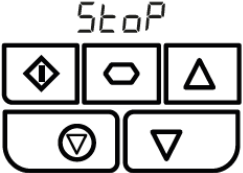
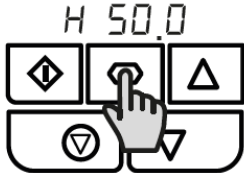
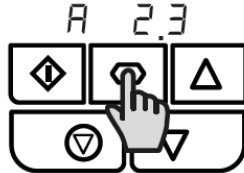
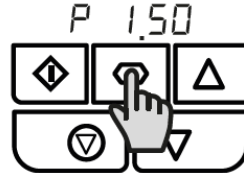
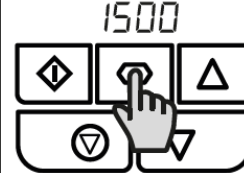
Managing the Keypad

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







	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.
	UP	Used to increase speed in real-time mode or to increase parameter values in parameter edit mode.

	DOWN	Used to decrease speed in real-time mode or to decrease parameter values in parameter edit mode.
	NAVIGATE	Used to display real-time information, to access and exit parameter edit mode and to store parameter changes.
	RESET / STOP	Used to reset a tripped drive. When in Keypad mode is used to Stop a running drive.

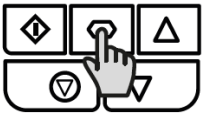



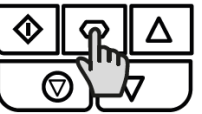
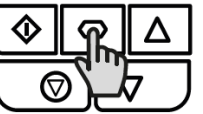
Operating Displays

				
Drive Stopped / Disabled	Drive is enabled / running, display shows the output frequency (Hz)	Press the Navigate key for < 1 second. The display will show the motor current (Amps)	Press the Navigate key for < 1 second. The display will show the motor power (kW)	If P-10 > 0, pressing the Navigate key for < 1 second will display the motor speed (RPM)

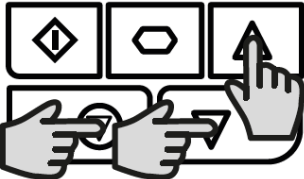

Changing Parameters

					
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

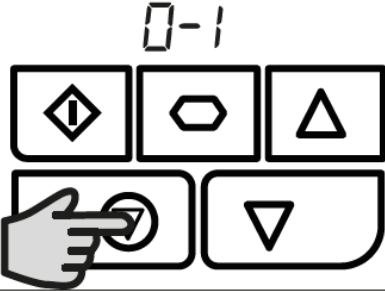
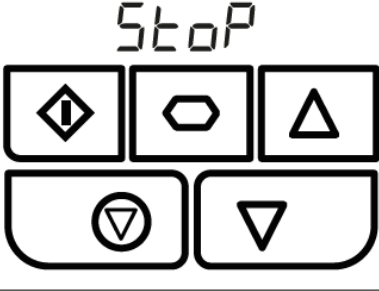
Read Only Parameter Access

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

Resetting a Fault

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

OPERATE

Parameters
Standard Parameters

P a r.	Description			Min	Max	Default	Units
P-01	Maximum Frequency/Speed Limit			P-02	500.0	50.0 (60.0)	Hz/RPM
P-02	Minimum Frequency/Speed Limit			0.0	P-01	0.0	Hz/RPM
P-03	Acceleration Ramp Time			0.00	600.0	5.0	s
P-04	Deceleration Ramp Time			0.00	600.0	5.0	s
P-05	Stopping Mode/Mains Loss Response			0	4	0	–
	Setting	On Disable	On Mains Loss				
	0	Ramp to Stop (P-04)	Ride Through (Recover energy from load to maintain operation)				
	1	Coast	Coast				
	2	Ramp to Stop (P-04)	Fast Ramp to Stop (P-24), Coast if P-24 = 0				

	3	Ramp to Stop (P-04) with AC Flux Braking	Fast Ramp to Stop (P-24), Coast if P-24 = 0				
	4	Ramp to Stop (P-04)	No action				
P - 0 6	Energy Optimiser			0	3	0	–
	Setting	Motor Energy Optimisation	Optidrive Energy Optimisation				
	0	Disabled	Disabled				
	1	Enabled	Disabled				
	2	Disabled	Enabled				
	3	Enabled	Enabled				
P - 0 7	Motor Rated Voltage/Back EMF at rated speed (PM/BLDC)			0	250/ 500	230/ 400	V
P - 0 8	Motor Rated Current			Drive Rating Dep endent			A
P - 0 9	Motor Rated Frequency			10	500	50 (60)	Hz
P -	Motor Rated Speed			0	3000 0	0	RP M

10

Optidrive E3 normally uses frequency for all speed related parameters, e.g. Minimum and Maximum Output Frequency. It is also possible to work directly in RPM, by setting P-10 to the rated speed from the motor nameplate.

When set to the default value of zero, all speed related parameters are displayed in Hz.

Entering the value from the motor nameplate enables the slip compensation function, and the Optidrive display will also now show motor speed in RPM. All speed related parameters, such as Minimum and Maximum Speed, Preset Speeds etc. will also be displayed in RPM.

NOTE If P-09 value is changed, P-10 value is reset to 0.

P-11	Low Frequency Torque Boost	0.0	Drive Dependent		%
P-12	Primary Command Source	0	9	0	–
	0: Terminal Control 1: Uni-directional Keypad Control 2: Bi-directional Keypad Control 3: Modbus Network Control 4: Modbus Network Control 5: PI Control 6: PI Analog Summation Control 7: CAN Control 8: CAN Control 9: Slave Mode				
	NOTE When P-12 = 1, 2, 3, 4, 7, 8 or 9, an enable signal must still be provided at the control terminals, digital input 1.				
	Operating Mode Select	0	2	0	–

1 3	0: Industrial Mode					1: Pu mp M ode	2: Fan Mode						
	Se tti ng	Ap pli- cati on	Curre nt Li mit (P-54)	Torqu e Cha racter istic	Spi n St art (P-33)								Thermal Ove rload Limit R eaction (P-60 Index 2)
	0	Ge ner al	150%	Const ant	0: O ff								0: Trip
	1	Pu mp	110%	Variab le	0: O ff								1: Current Li mit Reduction
	2	Fan	110%	Variab le	2: O n								1: Current Li mit Reduction
P - 1 4	Extended Menu Access code							0	65535	0	-		
	Enables access to Extended and Advanced Parameter Groups. This parameter must be set to the value programmed in P-37 (default: 101) to view and adjust Extended Parameters and value of P-37 + 100 to view and adjust Advanced Parameters. The code may be changed by the user in P-37 if desired.												

Extended Parameters

P a r.	Description	Min	Max	Defa ult	Unit s
P - 1 5	Digital Input Function Select	0	17	0	–
	Analog Input 1 Signal Format	See Below		U0-10	–

P-16	<p>U : Unidirectional, External 0 – 10Volt reference / pot</p> <p>B : Bi-directional, External 0 – 10Volt reference / pot</p> <p>: External 0 – 20mA signal</p> <p>4 : External 4 – 20mA signal, trip on loss</p> <p>4 : External 4 – 20mA signal, P-20 on loss</p>	<p>4 : External 20 – 4mA signal, trip on loss</p> <p>4 : External 20 – 4mA signal</p> <p>U : External 10 – 0 Volt signal</p> <p>n : Switched units only : Internal pot</p>				
	Output Relay Function Select		0	9	1	–
P-18	<p>0: Drive Enabled (Running)</p> <p>1: Drive Healthy</p> <p>2: At Target Frequency (Speed)</p> <p>3: Drive Tripped</p> <p>4: Output Frequency >= Limit</p>	<p>5: Output Current >= Limit</p> <p>6: Output Frequency < Limit</p> <p>7: Output Current < Limit</p> <p>8: Analog Input 2 > Limit</p> <p>9: Drive Ready to Run</p>				
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 - 2 4	2nd Ramp Time (Fast Stop)		0.00	600.0	0.00	s
	Analog Output Function Select		0	11	8	—
P - 2 5	Digital Output Mode. Logic 1 = +24V DC 0: 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	Analog Output Mode 8: Output Frequency (Motor Speed) 9: Output (Motor) Current 10: Output Power 11: Load Current				
	Start/ Restart / Fire Mode Configuration					
P - 3 0	Index 1: Start Mode / Auto Restart		N/A		Edge-r	—
	: Following Power on or reset, the drive will not start if Digital Input 1 remains closed. The Input must be closed after a power on or reset to start the drive. : Following a Power On or Reset, the drive will automatically start if Digital Input 1 is closed. To : Following a trip, the drive will make up to 5 attempts to restart at 20 second intervals.					
	Index 2: Fire Mode Input Logic		0	1	0	—
	0: Normally Closed (NC) input. Fire Mode active if input is open. 1: Normally Open (NO) input. Fire Mode active if input is closed.					
	Index 3: Fire Mode Input Latch		0	1	0	—

	<p>0: Latched input. The drive will remain in Fire Mode, only as long the fire mode input signal remains.</p> <p>1: Momentary input. Fire Mode is activated by a momentary signal on the input. Normally Open or Normally Closed operation is supported depending on Index 2 setting.</p> <p>2: Normally Closed (NC) Input, Preset Speed 4 (P-23).</p> <p>3: Normally Open (NO) Input, Preset Speed 4 (P-23).</p>				
	Keypad Start Mode Select	0 – 3	7	1	–
P – 3 1	0: Minimum Speed, Keypad Start 1: Previous Speed, Keypad Start 2: Minimum Speed, Terminal Enable 3: Previous Speed, Terminal Enable	4: Current Speed, Keypad Start 5: Preset Speed 4, Keypad Start 6: Current Speed, Terminal Start 7: Preset Speed 4, Terminal Start			
P – 3 3	Spin Start	0	2	0	–
	0: Disabled 1: Enabled	2: Enabled on Trip, Brown Out or Coast Stop			
	Brake Chopper Enable (Not Size 1)	0	4	0	–
P – 3 4	0: Disabled 1: Enabled With Software Protection 2: Enabled Without Software Protection	3: Enabled With Software Protection 4: Enabled Without Software Protection			

P a r.	Description	Min	Max	Default	Units
P	Parameter Access Lock	0	1	0	–

- 3 8	0: Unlocked	1: Locked				
P - 3 9	Analog Input 1 Offset		-500 .0	500. 0	0.0	%
P - 4 0	Index 1: Display Scaling Factor		0.00 0	16.0 00	0.00 0	–
	Index 2: Display Scaling Source		0	3	0	–
P - 4 1	PI Controller Proportional Gain		0.0	30.0	1.0	–
P - 4 2	PI Controller Integral Time		0.0	30.0	1.0	s
P - 4 3	PI Controller Operating Mode		0	3	0	–
	0: Direct Operation 1: Inverse Operation	2: Direct Operation, Wake at Full Speed 3: Reverse Operation, Wake at Full Speed				
P - 4 4	PI Reference (Setpoint) Source Select		0	1	0	–
	0: Digital Preset Setpoint	1: Analog Input 1 Setpoint				

P-45	PI Digital Setpoint		0.0	100.0	0.0	%
	PI Feedback Source Select		0	5	0	–
P-46	0: Analog Input 2 1: Analog Input 1 2: Motor Current	3: DC Bus Voltage 4: Analog 1 – Analog 2 5: Largest (Analog 1, Analog 2)				
	Analog Input 2 Signal Format		–	–	–	U0-10
P-47	U : Unidirectional, External 0 – 10Volt reference / pot External 0 – 20mA signal 4 : External 4 – 20mA signal , trip on loss 4 : External 4 – 20mA signal , P-20 on loss	4 : External 20 – 4mA signal, trip on loss 4 : External 20 – 4mA signal : Motor thermistor				
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

P a r.	Description	Min	Max	Default	Units
P - 5 1	Motor Control Mode	0	5	0	–
	0: Vector speed control mode 1: V/f mode 2: PM motor vector speed control	3: BLDC motor vector speed control 4: Synchronous Reluctance motor vector speed control 5: LSPM motor vector speed control			
P - 5 2	Motor Parameter Autotune	0	1	0	–
	0: Disabled	1: Enabled			
P - 5 4	Maximum Current Limit	0	175	150	%
	Defines the max current limit in vector control modes				
P - 6 1	Ethernet Service Option	0	1	0	–
	0: Disabled	1: Enabled			
P - 6 2	Ethernet Service Timeout	0	60	0	Mins
	0: Disabled	>0: Timeout in minutes			
P - 6 3	Modbus Mode Selection	0	1	0	–
	0: Standard1	1: Advanced2			
P -	IP66 DI1 Source	0	4	0	–

6 4	Visible only on IP66 Switched Drives 0: Terminal 2 OR Switch Forward OR Switch Reverse 1: Terminal 2 Only 2: Terminal 2 OR Switch Forward 3: Terminal 2 AND (S-Forward OR Switch Reverse) 4: Terminal 2 AND Switch Forward				
	IP66 DI2 Source	0	2	0	–
P - 6 5	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.
 - This requires Advanced Parameter Access, $P-14 = P-37 + 100$ (Default : 201).
 - 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.
 - This is achieved by setting $P-52 = 1$.

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

- 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.

- 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
 - IM motors require some additional voltage at low frequency to improve the low speed operation and torque.
 - By adjusting P-11, it is possible to optimise the low speed operation.
 - 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.
 - 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 range

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	HP	Input Current	Fuse/MCB (Type B)		Maximum Cable Size		Output Current	Recommended Brake Resistance
				Non UL	UL	mm	AWG	A	Ω
110 – 115 (+ / – 10%) V 1 Phase Input, 230V 3 Phase Output (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 (+ / – 10%) V 1 Phase 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 (+ / – 10%) V 3 Phase 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 (+ / – 10%)V 3 Phase Input, 3 Phase Output									
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-FLt	00	No Fault	Not required.
Ol-b	01	Brake channel over current	Check external brake resistor condition and connection wiring.
OL-br	02	Brake resistor overload	The drive has tripped to prevent damage to the brake resistor.
O-I	03	Output Over Current	Instantaneous Over current on the drive output. Excess load or shock load on the motor. NOTE 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.
I-t-trP	04	Motor Thermal Overload (I2t)	The drive has tripped after delivering >100% of value in P-08 for a period of time to prevent damage to the motor.
O-volt	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-volt	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.
O-t	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-t	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-tr iP	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.
SC-ObS	12	Optibus comms loss	Check communication link between drive and external devices. Make sure each drive in the network has its unique address.


FLt-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.
h O-I	15	Output Over Current	Check for short circuits on the motor and connection cable. NOTE 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.
th-FLt	16	Faulty thermistor on heatsink	
dAtA-F	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).
dAtA-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.
O-hERt	23	Drive internal temperature too high	Drive ambient temperature too high, check adequate cooling air is provided.
OUt-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
AtF-02	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.
SC-F01	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.
SC-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.

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Documents / Resources

	<p>Invertek Drives 3-140022-3F1A Variable Frequency Drive, [pdf] User Guide 3-140022-3F1A Variable Frequency Drive, 3-140022-3F1A, Variable Frequency Drive, Frequency Drive</p>
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References

- [Documentation For Optidrive E3 Variable Frequency Drive | Variable Speed Drive | AC Drive | Invertek Drives](#)
- [Variable Frequency Drive Manufacturer | Variable Speed Drives | AC Drives | Invertek Drives](#)