Invertek Drives.com

eco OPTIDRIVE™

AC Variable Speed Drive

0.75kW – 250kW / 1HP – 350HP

200 – 480 Volt 1 & 3 Phase

Advanced User Guide

Revision 1.00

This Document is for use with version 2.10 Firmware.

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Invertek Drives Ltd adopts a policy of continuous improvement and whilst every effort has been made to provide accurate and up to date information, the information contained in this User Guide should be used for guidance purposes only and does not form the part of any contract.

Revision History

Revision	Note
1.00	First Draft

This user guide is intended to provide technical information and explanation of the operation and parameters of the Optidrive Eco product range. The information contained withn is intended to reflect the latest available firmware functionality at the time of release. This user guide must be read in conjunction with the Optidrive Eco User Guide included with each product, and in particular, all relevant safety information and warnings. The information is intended to reflect the product as accurately as possible, however Invertek Drives accepts no liability for information contained herein.

This document is intended for persons who are already familiar with the installation, mounting, start-up and operation of the equipment and the hazards involved. The reader should be trained and in the operation of electrical equipment, and heave the necessary authority to energize, de-energize, clear, ground and tag circuits and equipment in accordance with established safety procedures. In addition, they should be trained in the proper care and use of protective equipment in accordance with established safety procedures.

1. Optidrive Eco Parameter Set Overview

1.1. About this section

This document provides a list of the available parameters, and a description of their respective functions, for the Optidrive Eco.

1.2. Parameter Structure Overview

The parameter set is arranged in Groups according to the following structure

Parameter Group	Range	Name	Access Level	Access Type
Group 0	P0-01 to P0-50	Basic Monitoring	Extended	Read Only
	P0-51 to P0-80	Advanced Monitoring	Advanced	Read Only
Group 1	P1-01 to P1-14	Quick Start Menu	Basic	Read / Write
Group 2	P2-01 to P2-40	Extended Parameters	Extended	Read / Write
Group 3	P3-01 to P3-18	PID Controller	Extended	Read / Write
Group 4	P4-01 to P4-14	Motor Control	Extended	Read / Write
Group 5	P5-01 to P5-15	Communications	Extended	Read / Write
Group 6	P6-01 to P6-30	Advanced Functions	Advanced	Read / Write
Group 7	P7-01 to P7-19	Advanced Motor Data	Advanced	Read / Write
Group 8	P8-01 to P8-20	Application Specific Group	Advanced	Read / Write
Group 9	P9-01 to P9-44	Programmable Logic	Advanced	Read / Write

Access to all parameter groups is controlled by setting P1-14 as follows
P1-14 = P2-40 (Factory setting: 101) Allows Extended Parameter Access
P1-14 = P6-30 (Factory Setting: 201) Allows Advanced Parameter Access

1.3. Parameter Descriptions

1.3.1. Parameter Group 1 – Basic Parameters

Par.	Name	Minimum	Maximum	Default	Units
P1-01	**Maximum Frequency / Speed Limit**	P1-02	500.0 / 30000	50.0 (60.0)	Hz / Rpm
	Maximum output frequency or motor speed limit – Hz or rpm. If P1-10 > 0, the value entered / displayed is in Rpm The value which may be entered by the user is limited by the lower of the following :- 5 x P1-09 value **OR** P2-24 / 16				
P1-02	**Minimum Frequency / Speed Limit**	0.0	P1-01	0.0	Hz / Rpm
	Minimum speed limit – Hz or rpm. If P1-10 >0, the value entered / displayed is in Rpm				
P1-03	**Acceleration Ramp Time**	0.0	6000	30	Seconds
	Acceleration ramp time from 0 to base speed (P-1-09) in seconds.				
P1-04	**Deceleration Ramp Time**	0.0	6000	30	Seconds
	Deceleration ramp time from base speed (P1-09) to standstill in seconds. When set to zero, fastest possible ramp time without trip is activated				
P1-05	**Stop Mode**	0	2	0	-
	This parameter has several functions :- - To select the stopping mode (Ramp or Coast) - To enable the AC Flux Braking function **0 : Ramp To Stop**. When the enable signal is removed, the drive will ramp to stop, with the rate controlled by P1-04 as described above. **1 : Coast to Stop**. When the enable signal is removed, the drive output is immediately disabled, and the motor will coast (freewheel) to stop. If the load can continue to rotate due to inertia, and the drive may possibly be re-enabled whilst the motor is still rotating, the spin start function (P2-26) should be enabled. **2 : AC Flux Braking.** AC Flux braking provides improved braking torque during stopping and dceceleration.				
P1-07	**Motor Rated Voltage**	0	See Below	See Below	Volts
	This parameter should be set to the rated (nameplate) voltage of the motor (Volts) The factory default setting of this parameter is drive model dependent as follows :- All kW & HP models intended for 200 – 240 volt operation (e.g. ODV-3-x2xxx-xxF1x-xN) : Factory setting = 230 Volts, Maximum 250 Volts All kW & HP models intended for 380 – 480 volt operation (e.g. ODV-3-x4xxx-3F1x-xN) : Factory setting = 400 Volts, Maximum 500 Volts When this parameter is set to the motor nameplate voltage, the output voltage from the drive is controlled automatically and maintained at the correct level wherever possible regardless of variations in supply voltage or DC Bus Voltage. When P1-07 = 0, the voltage compensation function of the inverter is disabled. The output voltage applied to the motor will increase or decrease with changes in the DC Bus voltage. **Note** The RMS output voltage from the inverter can never exceed the incoming supply voltage.				
P1-08	**Motor Rated Current**	-	-	See Below	Amps
	This parameter should be set to the rated (nameplate) current of the motor. The factory default setting of this parameter is the set to the maximum continuously available output current of the drive				
P1-09	**Motor Rated Frequency**	10	500	50 (60)	Hz
	This parameter should be set to the rated (nameplate) frequency of the motor. The factory default setting of this parameter is drive model dependent as follows :- All kW models : Factory setting = 50Hz All HP models : Factory setting = 60 Hz				
P1-10	**Motor Rated Speed**	0	30000	0	Rpm
	This parameter can optionally be set to the rated (nameplate) rpm of the motor. When set to the default value of zero, all speed related parameters are displayed in Hz, and the slip compensation for the motor is disabled. Entering the value from the motor nameplate enables the slip compensation function, and the Optidrive display will now show motor speed in estimated rpm. All speed related parameters, such as Minimum and Maximum Speed, Preset Speeds etc. will also be displayed in Rpm.				

P1-11	**Torque Boost**	0.0	See Below	See Below	%
	This parameter is effective only when operating in Vector Mode (P4-01 = 0, 1 or 2). Torque Boost is used to increase the applied motor voltage and hence motor current at low output frequencies. This can improve the starting torque and torque at low speeds. Increasing the boost level will increase the motor current at low speed, which may result in the motor temperature rising – forced ventilation of the motor may then be required. In general, the lower the motor power, the higher the boost setting that may be safely used. This parameter has no affect when P4-01 is set to 3, 4 or 5 An automatic setting (AUto) is also possible, whereby the Optidrive will automatically adjust this parameter based on the motor parameters measured during an autotune. To use the automatic setting, P1-11 should be set to -1				
P1-12	**Primary Command Source Mode**	0	6	0	-
	0 : Terminal Control. The drive responds directly to signals applied to the control terminals. **1 : Uni-directional Keypad Control** [1)2)3)] The drive can be controlled in the forward direction only using an external or remote Keypad **2 : Uni-directional Keypad Control** [1)2)3)] The drive can be controlled in the forward direction only using an external or remote Keypad **3 : PID Control**. The output frequency is controlled by the internal PID controller. **4 : Fieldbus Control**. Control via Modbus RTU if no fieldbus interface option is present, otherwise control is from the fieldbus option module interface **5 : Slave Mode**. The drive acts as a Slave to a connected Optidrive operating in Master Mode **6 : BACnet MSTP Control.** Control via BACnet bus connected to the RJ45 serial interface connector of the drive **Note** 1) When operating with P1-12 = 1 or 2, the drive will not operate the motor unless the enable signal is present (e.g. Control Terminals 1 & 2 are linked together), regardless of the setting of P2-37. If P2-37 > = 4, the drive will start when the link is closed between terminals 1 & 2, and will not require the keypad start button to be pressed. If P2-37 < 4, the Start Button must be pressed to operate the drive after the link is closed between terminals 1 & 2. 2) The motor direction of rotation may still be controlled by signals applied to the digital inputs, dependent on the setting of P1-13, e.g. the motor can still be controlled in both forward and reverse directions if required, however the Reverse direction function of the Start key is disabled. 3) When operating in this mode and utilising a setting of P1-13 that allows preset speeds to be also selected from the drive digital inputs, setting a negative value in the preset speed parameter will cause the drive to reverse the direction of motor rotation.				
P1-13	**Digital Inputs Function Select**	0	21	1	-
	Defines the function of the digital inputs depending on the control mode setting in P1-12.				
P1-14	**Extended Menu Access Code**	0	30000	0	-
	Parameter Access Control. The following settings are applicable : P1-14 = P2-40 (Factory Setting = 101) : Allows access to Parameter Groups 0 – 5 P1-14 = P6-30 (Factory Setting = 201) : Allows Access to all drive parameters				

1.3.2. Parameter Group 2 - Extended parameters

Par.	Name	Minimum	Maximum	Default	Units
P2-01	**Preset Speed 1**	-P1-01	P1-01	50.0	Hz / Rpm
P2-02	**Preset Speed 2**	-P1-01	P1-01	40.0	Hz / Rpm
P2-03	**Preset Speed 3**	-P1-01	P1-01	25.0	Hz / Rpm
P2-04	**Preset Speed 4**	-P1-01	P1-01	50.0 (60.0)	Hz / Rpm
P2-05	**Preset Speed 5 / Clean Speed 1**	-P1-01	P1-01	0.0	Hz / Rpm
P2-06	**Preset Speed 6 / Clean Speed 2**	-P1-01	P1-01	0.0	Hz / Rpm
P2-07	**Preset Speed 7 / Boost Speed / Stir Speed 1**	-P1-01	P1-01	0.0	Hz / Rpm
P2-08	**Preset Speed 8 / Boost Speed / Stir Speed 2**	-P1-01	P1-01	0.0	Hz / Rpm
	Preset Speeds / Frequencies which may be selected by the digital inputs dependent on the setting of P1-13 (If P1-10 = 0, the values are entered as Hz. If P1-10 > 0, the values are entered as Rpm. Setting a negative value will reverse the direction of motor rotation.				
P2-09	**Skip Frequency Centre Point**	0.0	P1-01	0.0	Hz
P2-10	**Skip Frequency Band Width**	0.0	P1-01	0.0	Hz
	The Skip Frequency function is used to avoid the Optidrive operating at a certain output frequency, for example at a frequency which causes mechanical resonance in a particular machine. Parameter P2-09 defines the centre point of the skip frequency band, and is used conjunction with P2-10. The Optidrive output frequency will ramp through the defined band at the rates set by the acceleration and deceleration ramps currently in use, and will not hold any output frequency within the defined band. If the frequency reference applied to the drive is within the band, the Optidrive output frequency will remain at the upper or lower limit of the band.				
P2-11	**Analog Output 1 (Terminal 8) Function Select**	0	12	8	-
	Digital Output Mode. Logic 1 = +24V DC (20mA Max) **0 : Drive Enabled (Running)**. Logic 1 when the Optidrive is enabled (Running) **1 : Drive Healthy**. Logic 1 When no Fault condition exists on the drive and the STO input is closed. **2 : At Target Frequency (Speed)**. Logic 1 when the output frequency matches the setpoint frequency and the drive is enabled. Hysterisis is applied, defined by P6-04. **3 : Output Frequency > 0.0**. Logic 1 when the motor runs above zero speed. Hysterisis is applied, defined by P6-04. **4 : Output Frequency >= Limit**. Logic 1 when the motor speed exceeds the adjustable limit **5 : Output Current >= Limit**. Logic 1 when the motor current exceeds the adjustable limit **6 : Motor Torque >= Limit**. Logic when the motor torque exceeds the adjustable limit **7 : Analog Input 2 Signal Level >= Limit**. Logic when the signal applied to the Analog Input 2 exceeds the adjustable limit **Note** : When using settings 4 – 7, parameters P2-16 and P2-17 must be used together to control the behaviour. The output will switch to Logic 1 when the selected signal exceeds the value programmed in P2-16, and return to Logic 0 when the signal falls below the value programmed in P2-17. **Analog Output Mode** **8 : Output Frequency (Motor Speed)**. 0 to P-01 **9 : Output (Motor) Current**. 0 to 200% of P1-08 **10 : Motor Torque**. 0 to 200% of motor rated torque **11 : Output (Motor) Power**. 0 to 200% of drive rated power **12 : PID Controller Output.** 0 – 100% of PID Controller Output				
P2-12	**Analog Output 1 (Terminal 8) Format**	-	-	U 0-10	-
	U 0-10 = 0 to10V. U 10-0 = 10 to 0V, A 0-20 = 0 to 20mA A 20-0 = 20 to 0mA A 4-20 = 4 to 20mA A 20-4 = 20 to 4mA				

Par.	Name	Minimum	Maximum	Default	Units
P2-13	**Analog Output 2 (Terminal 11) Function Select**	0	12	9	-
	Digital Output Mode. Logic 1 = +24V DC **0 : Drive Enabled (Running)**. Logic 1 when the Optidrive is enabled (Running) **1 : Drive Healthy**. Logic 1 When no Fault condition exists on the drive **2 : At Target Frequency (Speed)**. Logic 1 when the output frequency matches the setpoint frequency. Hysterisis is applied, defined by P6-04. **3 : Output Frequency > 0.0**. Logic 1 when the motor runs above zero speed. Hysterisis is applied, defined by P6-04. **4 : Output Frequency >= Limit**. Logic 1 when the motor speed exceeds the adjustable limit **5 : Output Current >= Limit**. Logic 1 when the motor current exceeds the adjustable limit **6 : Output Toque >= Limit**. Logic when the motor torque exceeds the adjustable limit **7 : Analog Input 2 Signal Level >= Limit**. Logic when the signal applied to the Analog Input 2 exceeds the adjustable limit **Note** : When using settings 4 – 7, parameters P2-16 and P2-17 must be used together to control the behaviour. The output will switch to Logic 1 when the selected signal exceeds the value programmed in P2-16, and return to Logic 0 when the signal falls below the value programmed in P2-17. **Analog Output Mode** **8 : Output Frequency (Motor Speed)**. 0 to P-01 **9 : Output (Motor) Current**. 0 to 200% of P1-08 **10 : Motor Torque**. 0 to 200% of motor rated torque **11 : Output (Motor) Power**. 0 to 200% of drive rated power **12 : PID Controller Output.** 0 – 100% of PID Controller Output				
P2-14	**Analog Output 2 (Terminal 11) Format**	-	-	U 0-10	-
	U 0-10 = 0 to10V. U 10-0 = 10 to 0V, A 0-20 = 0 to 20mA A 20-0 = 20to 0mA A 4-20 = 4 to 20mA A 20-4 = 20 to 4mA				
P2-15	**User Relay 1 Output (Terminals 14, 15 & 16) Function select**	0	15	1	-
	Selects the function assigned to Relay Output 1. The relay has three output terminals, Logic 1 indicates the relay is active, and therefore terminals 14 and 15 will be closed together. **0 : Drive Enabled (Running)**. Logic 1 when the motor is enabled **1 : Drive Healthy**. Logic 1 when power is applied to the drive and no fault exists **2 : At Target Frequency (Speed)**. Logic 1 when the output frequency matches the setpoint frequency. Hysterisis is applied, defined by P6-04. **3 : Output Frequency > 0.0 Hz**. Logic 1 when the drive output frequency to the motor is exceeds 0.0Hz. Hysterisis is applied, defined by P6-04. **Note** : When using settings 4 – 7, parameters P2-16 and P2-17 must be used together to control the behaviour. The output will switch to Logic 1 when the selected signal exceeds the value programmed in P2-16, and return to Logic 0 when the signal falls below the value programmed in P2-17. **4 : Output Frequency >= Limit**. Logic 1 when the motor speed exceeds the adjustable limit **5 : Output Current >= Limit**. Logic 1 when the motor current exceeds the adjustable limit **6 : Output Torque >= Limit**. Logic 1 when the motor torque exceeds the adjustable limit **7 : Analog Input 2 Signal Level >= Limit**. 1 Logic when the signal applied to the Analog Input 2 exceeds the adjustable limit **8 : No Function** **9 : Fire Mode Activated.** Logic 1 when fire mode is activated **10 : Service Due**. Logic 1 when the user settable maintenance time (P6-24) has expired. This allows the user to set a service interval time, for example in the even where a machine requires a defiend service time interval for maintenance, the drive can provide visual indication of the maintenance interval. **11 : Drive Ready to Run**. Defined as drive in Auto (not Hand), not in inhibit mode (hardware enable present), not in mains loss condition and no trip. **12 : Drive Tripped.** Logic 1 when the drive has tripped and the display shows a fault. **13 : STO Status.** Logic 1 when the STO inputs are present, and the drive is not in inhibit state **14 : PID Error >= Limit.** Logic 1 when the PID Error exceeds the adjustable threshold **15 : High or Low load detected.** Logic 1 when the output current falls outside of the load monitoring profile (See P8-06 to P8-08)				
P2-16	**Adjustable Threshold 1 Upper Limit (Analog Output 1 / Relay Output 1)**	P2-17	200.0	100.0	%
P2-17	**Adjustable Threshold 1 Lower Limit (Analog Output 1 / Relay Output 1)**	0.0	P2-16	0.0	%
	Used in conjunction with some settings of Parameters P2-11 & P2-15.				

Par.	Name	Minimum	Maximum	Default	Units
P2-18	**User Relay 2 Output (Terminals 17 & 18) Function select**	0	15	0	-
	Selects the function assigned to Relay Output 2. . The relay has three output terminals, Logic 1 indicates the relay is active, and therefore terminals 14 and 15 will be closed together. **0 : Drive Enabled (Running)**. Logic 1 when the motor is enabled **1 : Drive Healthy**. Logic 1 when power is applied to the drive and no fault exists **2 : At Target Frequency (Speed)**. Logic 1 when the output frequency matches the setpoint frequency. Hysterisis is applied, defined by P6-04. **3 : Output Frequency > 0.0 Hz**. Logic 1 when the drive output frequency to the motor is exceeds 0.0Hz. Hysterisis is applied, defined by P6-04. **Note** : When using settings 4 – 7, parameters P2-16 and P2-17 must be used together to control the behaviour. The output will switch to Logic 1 when the selected signal exceeds the value programmed in P2-16, and return to Logic 0 when the signal falls below the value programmed in P2-17. **4 : Output Frequency >= Limit**. Logic 1 when the motor speed exceeds the adjustable limit **5 : Output Current >= Limit**. Logic 1 when the motor current exceeds the adjustable limit **6 : Output Torque >= Limit**. Logic 1 when the motor torque exceeds the adjustable limit **7 : Analog Input 2 Signal Level >= Limit**. 1 Logic when the signal applied to the Analog Input 2 exceeds the adjustable limit **8 : No Function** **9 : Fire Mode Activated.** Logic 1 when fire mode is activated **10 : Service Due**. Logic 1 when the user settable maintenance time (P6-24) has expired. This allows the user to set a service interval time, for example in the even where a machine requires a defiend service time interval for maintenance, the drive can provide visual indication of the maintenance interval. **11 : Drive Ready to Run**. Defined as drive in Auto (not Hand), not in inhibit mode (hardware enable present), not in mains loss condition and no trip. **12 : Drive Tripped.** Logic 1 when the drive has tripped and the display shows a fault. **13 : STO Status.** Logic 1 when the STO inputs are present, and the drive is not in inhibit state **14 : PID Error >= Limit.** Logic 1 when the PID Error exceeds the adjustable threshold **15 : High or Low load detected.** Logic 1 when the output current falls outside of the load monitoring profile (See P8-06 to P8-08)				
P2-19	**Adjustable Threshold 1 Upper Limit (Analog Output 2 / Relay Output 2)**	P2-20	200.0	100.0	%
P2-20	**Adjustable Threshold 1 Lower Limit (Analog Output 2 / Relay Output 2)**	0.0	P2-19	0.0	%
	Used in conjunction with some settings of Parameters P2-13 & P2-18.				
P2-21	**Display Scaling Factor**	-30.000	30.000	0.000	-
P2-22	**Display Scaling Source**	0	3	0	-
	P2-21 & P2-22 allow the user to program the Optidrive to display an alternative output unit scaled from an existing parameter, e.g. to display conveyer speed in metres per second based on the output frequency. This function is disabled if P2-21 is set to 0. If P2-21 is set >0, the variable selected in P2-22 is multiplied by the factor entered in P2-21, and can be displayed whilst the drive is running. The display will show a '**c**' on the left hand side to indicate the customer scaled units. **P2-22 Setting Options :-** **0 : Motor Speed** **1 : Motor Current** **2 : Analog Input 2** **3 : P0-80 Value**				
P2-23	**Zero Speed Holding Time**	0.0	60.0	0.2	Seconds
	Determines the time for which the drive output frequency is held at zero when stopping, before the drive output is disabled. This can be utilised to ensure the motor has come to a complete standstill before the drive switches off, or to allow time for a holding brake to engage. It is not intended to provide a continuous output holding torque for prolonged periods.				
P2-24	**Effective Switching Frequency**	See Below			kHz
	Effective power stage switching frequency. The range of settings available and factory default parameter setting depend on the drive power and voltage rating, refer to section **Error! Reference source not found.**. Higher frequencies reduce the audible 'ringing' noise rom the motor, and improve the output current waveform, at the expense of increased drive heat losses.				
P2-25	**Fast Deceleration Ramp Time (Fast Stop)**	0.00	240.0	0.00	Seconds
	This parameter allows an alternative deceleration ramp down time to be programmed into the Optidrive, which can be selected by digital inputs (dependent on the setting of P1-13) or selected automatically in the case of a mains power loss if P2-38 = 2. When set to 0.00, the drive output will be immediately disabled, and the load will coast to stop.				

Par.	Name	Minimum	Maximum	Default	Units
P2-26	**Spin Start Enable**	0	2	1	-
	0 : Disabled **1 : Enabled**. When enabled, on start up the drive will attempt to determine if the motor is already rotating, and will begin to control the motor from its current speed. This can be useful for high inertia loads, or fans which may spin due to air movement even when the drive is not enabled. A short delay may be observed when starting motors which are not already rotating. The spin start will detect the motor direction of rotation, and will automatically operate and control the motor from that point, including reversing the direction of motor rotation where required. **2 : Enabled on Fault, Brown Out or Coast.** As setting one, however the Spin Start function activates only following any event that may have caused an uncontrolled stop of the motor previously. **Note** The Spin Start function cannot detect motors which are rotating at speeds above the maximum speed limit parameter (P1-01) setting of the drive.				
P2-27	**Standby Mode Timer**	0.0	250.0	20.0	Seconds
	This parameter defines time period, whereby if the drive operates continuously at the frequency / speed set in P3-14 (Standby speed threshold) for at least the set time period, the Optidrive output will be disabled, and the display will show StndbY. The function is disabled if P2-27 = 0.0. If the speed demand rises above minimum, the drive will immediately restart automatically.				
P2-28	**Slave Speed Scaling Control**	0	3	0	-
	Active in Slave mode (P1-12=5) only. The Master speed reference can be multiplied by a preset scaling factor or adjusted using an analog trim or offset. **0 : Disabled**. No scaling or offset is applied. **1 : Actual Speed = Master Speed x P2-29** **2 : Actual Speed = (Master Speed x P2-29) + Analog Input 1 Reference.** Analog Input 1 Full Scale 100.0% = P1-01 **3 : Actual Speed = (Master Speed x P2-29) x Analog Input 1 Reference.** Analog input 1 full scale = 200.0% (unsigned/absolute)				
P2-29	**Slave Speed Scaling Factor**	-500.0	500.0	100.0	%
	Used in conjunction with P2-28.				
P2-30	**Analog Input 1 (Terminal 6) Format**	-	-	U 0- 10	-
	U 0- 10 = 0 to 10 Volt Signal (Uni-polar) U 10-0 = 10 to 0 Volt Signal (Uni-polar) - 10- 10 = -10 to +10 Volt Signal (Bi-polar) A 0-20 = 0 to 20mA Signal t 4-20 = 4 to 20mA Signal, the Optidrive will trip and show the fault code 4-20F if the signal level falls below 3mA r 4-20 = 4 to 20mA Signal. In the event that the signal falls below 3mA, the Optidrive will ramp operate at Preset Speed 4. t 20-4 = 20 to 4mA Signal, the Optidrive will trip and show the fault code 4-20F if the signal level falls below 3mA r 20-4 = 20 to 4mA Signal. In the event that the signal falls below 3mA, the Optidrive will ramp operate at Preset Speed 4.				
P2-31	**Analog Input 1 Scaling**	0.0	2000.0	100.0	%
	Scales the analog input by this factor. See parameter description below for further information.				
P2-32	**Analog Input 1 Offset**	-500.0	500.0	0.0	%
	Sets an offset, as a percentage of the full scale range of the input, which is applied to the analog input signal. Analog Input Scaling and Offset are applied to the Analog Input Signal as follows :- Result (%) = (Analog Input Level (%) – Analog Input Offset (%)) x Analog Input Scaling (%) The resultant value for Analog Input 1 can be displayed in P0-01. E.g. If the analog Input Signal format is 0 – 10 Volts, Offset = 20.0%, Scaling = 50.0% An analog input signal level of 7 Volts gives the following result :- Analog Input Level (%) = 7 / 10 = 70.0% Result = (70.0 – 20.0)% X 50.0%) = 25.0%				
P2-33	**Analog Input 2 (Terminal 10) Format**	-	-	U 0- 10	-
	U 0- 10 = 0 to 10 Volt Signal (Uni-polar) U 10-0 = 10 to 0 Volt Signal (Uni-polar) Ptc-th = Motor PTC Thermistor Input. The drive will trip if the resistance is greater than 2.5kΩ A 0-20 = 0 to 20mA Signal t 4-20 = 4 to 20mA Signal, the Optidrive will trip and show the fault code 4-20F if the signal level falls below 3mA r 4-20 = 4 to 20mA Signal, the Optidrive will ramp to stop if the signal level falls below 3mA t 20-4 = 20 to 4mA Signal, the Optidrive will trip and show the fault code 4-20F if the signal level falls below 3mA r 20-4 = 20 to 4mA Signal, the Optidrive will ramp to stop if the signal level falls below 3mA				
P2-34	**Analog Input 2 Scaling**	0.0	2000.0	100.0	%
	Scales the analog input by this factor. See parameter description below for further information.				
P2-35	**Analog Input 2 Offset**	-500.0	500.0	0.0	%
	Sets an offset, as a percentage of the full scale range of the input, which is applied to the analog input signal Analog Input Scaling and Offset are applied to the Analog Input Signal as follows :- Result (%) = (Analog Input Level (%) – Analog Input Offset (%)) x Analog Input Scaling (%) The resultant value for Analog Input 2 can be displayed in P0-02. E.g. If the analog Input Signal format is 0 – 10 Volts, Offset = 20.0%, Scaling = 50.0% An analog input signal level of 7 Volts gives the following result :- Analog Input Level (%) = 7 / 10 = 70.0% Result = (70.0 – 20.0)% X 50.0%) = 25.0%				

Par.	Name	Minimum	Maximum	Default	Units
P2-36	**Start Mode Select / Automatic Restart**	-	-	AUto-0	-
	Defines the behaviour of the drive relating to the enable digital input and also configures the Automatic Restart function. 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 (e.g. Edge Triggered). AUto-0 : Following a Power On or Reset, the drive will automatically start if Digital Input 1 is closed before power on. AUto- 1 to AUto-5 : Following a trip, the drive will make up to 5 attempts to restart at intervals defined by P6-03 (default 20 seconds). The drive must be powered down or reset manually to reset the counter. The numbers of restart attempts are counted, and if the drive fails to start on the final attempt, the drive will fault with, and will require the user to manually reset the fault.				
P2-37	**Keypad Mode Restart Speed**	0	7	2	-
	This parameter controls the starting behaviour of the drive when operating in Keypad Mode (P1-12 = 1 or 2). Settings 0 to 3 are active in Keypad Mode only (P1-12 = 1 or 2), and define the speed at which the drive will initially operate following the pressing of the keypad Start button. **0 : Minimum Speed, Keypad Start**. Following a stop and restart, the drive will always initially run at the minimum speed set in P1-02. This applies even if the drive is re-enabled whilst still decelerating the motor from the previous stop command. **1 : Previous Operating Speed, Keypad Start**. Following a stop and restart, the drive will return to the last keypad setpoint speed used prior to stopping. **2 : Current Running Speed**. Where the Optidrive is configured for multiple speed references, when switched to keypad mode by a digital input, the drive will continue to operate at the last operating speed. This setting can be used for 'Bumpless' changeover between automatic and manual operating modes of the drive, e.g. typically Hand / Auto control or Local / Remote control. **3 : Preset Speed 4, Keypad Start**. Following a stop and restart, the Optidrive will always initially run at Preset Speed 4 (P2-04) **4 : Minimum Speed, Terminal Start**. Following a stop and restart, the drive will always initially run at the minimum speed P1-02. The drive starting is controlled from the digital inputs, based on the setting of P1-13. **5 : Previous Operating Speed, Terminal Start**. Following a stop and restart, the drive will return to the last keypad setpoint speed used prior to stopping. The drive starting is controlled from the digital inputs, based on the setting of P1-13. **6 : Current Running Speed, Terminal Start**. Where the Optidrive is configured for multiple speed references (typically Hand / Auto control or Local / Remote control), when switched to keypad mode by a digital input, the drive will continue to operate at the last operating speed. The drive starting is controlled from the digital inputs, based on the setting of P1-13. **7 : Preset Speed 4, Terminal Start**. Following a stop and restart, the Optidrive will always initially run at Preset Speed 4 (P2-04). The drive starting is controlled from the digital inputs, based on the setting of P1-13.				
P2-38	**Mains Loss Ride Through / Stop Control**	0	3	0	-
	Controls the behaviour of the drive in response to a loss of mains power supply whilst the drive is enabled. **0: Mains Loss Ride Through.** The Optidrive will attempt to continue operating by recovering energy from the load motor. Providing that the mains loss period is short, and sufficient energy can be recovered before the drive control electronics power off, the drive will automatically restart on return of mains power **1: Coast To Stop.** The Optidrive will immediately disable the output to the motor, allowing the load to coast or free wheel. When using this setting with high inertia loads, the Spin Start function (P2-26) may need to be enabled **2: Fast Ramp To Stop.** The drive will ramp to stop at the rate programmed in the Fast deceleration time P2-25 **3: DC Bus Power Supply Mode.** This mode is intended to be used when the drive is powered directly via the +DC and –DC Bus connections. Refer to your Invertek Sales Partner for further details				
P2-39	**Parameter Access Lock**	0	1	0	-
	0 : Unlocked. All parameters can be accessed and changed **1 : Locked**. Parameter values can be displayed, but cannot be changed				
P2-40	**Extended Parameter Access Code Definition**	0	9999	101	-
	Defines the access code which must be entered in P1-14 to access parameter groups above Group 1.				

1.3.3. Parameter Group 3 – PID Control

Par.	Name	Minimum	Maximum	Default	Units
P3-01	**PID Proportional Gain**	0.1	30.0	1.0	-
	PID Controller Proportional Gain. Higher values provide a greater change in the drive output frequency in response to small changes in the feedback signal. Too high a value can cause instability				
P3-02	**PID Integral Time Constant**	0.0	30.0	1.0	Seconds
	PID Controller Integral Time. Larger values provide a more damped response for systems where the overall process responds slowly				
P3-03	**PID Differential Time Constant**	0.00	1.00	0.00	Seconds
	PID Differential Time Constant				
P3-04	**PID Operating Mode**	0	1	0	-
	0 : Direct Operation. Use this mode if an increase in the motor speed should result in an increase in the feedback signal **1 : Inverse Operation**. Use this mode if an increase in the motor speed should result in a decrease in the feedback signal				
P3-05	**PID Reference (Setpoint) Source Select**	0	2	0	-
	Selects the source for the PID Reference / Setpoint **0 : Digital Preset Setpoint**. P3-06 is used **1 : Analog Input 1 Setpoint** **2 : Analog Input 2 Setpoint**				
P3-06	**PID Digital Reference (Setpoint)**	0.0	100.0	0.0	%
	When P3-05 = 0, this parameter sets the preset digital reference (setpoint) used for the PID Controller				
P3-07	**PID Controller Output Upper Limit**	P3-08	100.0	100.0	%
	Limits the maximum value output from the PID controller				
P3-08	**PID Controller Output Lower Limit**	0.0	P3-07	0.0	%
	Limits the minimum output from the PID controller				
P3-09	**PID Output Limit Control**	0	3	0	-
	0 : Digital Output Limits. The output range of the PID controller is limited by the values of P3-07 & P3-08 **1 : Analog Input 1 Provides a Variable Upper Limit**. The output range of the PID controller is limited by the values of P3-08 & the signal applied to Analog Input 1 **2 : Analog Input 1 Provides a Variable Lower Limit**. The output range of the PID controller is limited by the signal applied to Analog Input 1 & the value of P3-07 **3 : PID output Added to Analog Input 1 Value**. The output value from the PID Controller is added to the speed reference applied to the Analog Input 1				
P3-10	**PID Feedback Signal Source Select**	0	5	0	-
	0 : Analog Input 2 **1 : Analog Input 1** **2 : Motor Current**. The feedback value is scaled such that 100.0% = P1-08 **3 : DC bus voltage**. The feedback is scaled such that 100.0% = 1000 Volts **4 : Differential : Analog input 1 – Analog input 2.** PID Feedback = P0-01 – P0-02, limited to 0.0 minimum value **5 : Largest Value : Analog Input 1 or Analog Input 2.**				
P3-11	**Maximum PID Error to Enable Ramps**	0.0	25.0	0.0	%
	Defines a threshold PID error level, whereby if the difference between the setpoint and feedback values is less than the set threshold, the internal ramp times of the drive are disabled. Where a greater PID error exists, the ramp times are enabled to limit the rate of change of motor speed on large PID errors, and react quickly to small errors. Setting to 0.0 means that the drive ramps are always enabled. This parameter is intended to allow the user to disable the drive internal ramps where a fast reaction to the PID control is required, however by only disabling the ramps when a small PID error exists, the risk of possible over current or over voltage trips being generated are reduced.				
P3-12	**PID Feedback Value Display Scaling Factor**	0.000	50.000	0.000	-
	Applies a scaling factor to the displayed PID feedback, allowing the user to display the actual signal level from a transducer, e.g. 0 – 10 Bar etc. The value is displayed with an 'r' prefix, to one decimal place.				
P3-13	**PID Error Wake Up Level**	0.0	100.0	5.0	%
	Sets a programmable level whereby if the drive enters standby motor whilst operating under PID control, the difference between the setpoint and the selected feedback signal increase beyond this threshold before the drive will return to normal operation.				
P3-18	**PID Reset Control**	0	1	0	-
	This parameter is used to control the reset behaviour of the PID controller. **0 : Continuous Run**. In this mode, the PID controller operates continuously, regardless of the operating state of the drive. This can result in the output of the PID controller integrating up to the maximum limit prior to the drive being enabled. **1 : Reset On Disable**. In this mode, the PID controller output is reset to zero when the drive is disabled, and restarts when the drive is enabled.				

1.3.4. Parameter Group 4 – High Performance Motor Control

Par.	Name	Minimum	Maximum	Default	Units
	**Incorrect adjustment of parameters in menu group 4 can cause unexpected behaviour of the motor and any connected machinery. It is recommended that these parameters are only adjusted by experienced users.**				
P4-01	**Motor Control Mode**	0	5	0	-
	Selects the motor control method. An autotune should be performed for all modes but is mandatory for modes 2 - 5. **0 : Eco Vector Speed Control (VT).** Suitable for use with AC induction motors with a variable torque load such as centrifugal fans or pumps where the voltage to frequency characteristic follows a quadratic relationship. **1 : Eco Vector Speed Control (CT).** Suitable for use with AC induction motors with a constant torque load such as blowers or positive displacement pumps where the voltage to frequency characteristic follows a linear relationship.. **2 : IM Vector Speed Control.** Similar to mode 1 but requires more accurate motor information including motor power factor P4-05. **3 : PM Motor Vector Speed Control.** Equivalent to setting 1, but intended for operation of Permanent Magnet motors. **4 : BLDC Motor Speed Control.** For operation of Brushless DC Motors. **5 : SynRel Motor Speed Control.** For operation of Synchronous Reluctance Motors.				
P4-02	**Motor Parameter Auto-tune Enable**	0	1	0	-
	When set to 1, the drive immediately carries out an autotune to measure the motor parameters for optimum control and efficiency. Following completion of the autotune, the parameter automatically returns to 0. **Note** All motor nameplate data should be programmed into the drive, e.g. P1-07, P1-08, P1-09 and P4-05 prior to starting the autotune  **Whilst the autotune does not require the motor to rotate, it may still cause some movement of the motor shaft, thereby it is important to ensure that the motor and load are safe to operate prior to starting the autotune. The autotune does <u>not</u> require the load to be removed from the motor, however the motor brake should be released providing it is safe to do so. The motor must be stationary during the auto-tune procedure, if the motor is rotating then the auto-tune will fail or incorrect motor data will be measured by the drive.**				
P4-03	**Vector Speed Controller Proportional Gain**	0.1	400.0	50.0	%
	Sets the proportional gain value for the speed controller when operating in Vector Speed or Vector Torque motor control modes (P4-01 = 0 or 1). Higher values provide better output frequency regulation and response. Too high a value can cause the speed to overshoot the setpoint during acceleration, and may also cause speed instability and possibly over current trips. For applications requiring best possible performance, the value should be adjusted to suit the connected load by gradually increasing the value and monitoring the actual output speed of the load until the required dynamic behaviour is achieved with little or no overshoot of the target speed during acceleration and deceleration. In general, higher friction loads can tolerate higher values of proportional gain, and high inertia, low friction loads may require the gain to be reduced.				
P4-04	**Vector Speed Controller Integral Time Constant**	0.010	2.000	0.050	Seconds
	Sets the integral time for the speed controller. Smaller values provide a faster response in reaction to motor load changes, at the risk of introducing instability. For best dynamic performance, the value should be adjusted to suit the connected load.				
P4-05	**Motor Power Factor Cos Ø**	0.00	0.99	-	-
	When operating in Vector Speed or Vector Torque motor control modes, this parameter must be set to the motor nameplate power factor before an autotune is carried out.				
P4-07	**Maximum Motoring Torque Limit**	P4-08	150.0	110.0	%
	This parameter defines the maximum torque limit (or current limit) of the drive				
P4-12	**Motor Thermal Memory Retention**	0	1	0	-
	0 : Disabled. The present value of the motor overload accumulator is not stored during power off. **1 : Enabled.** The value of the motor thermal overload accumulator is stored during power off. Whilst the motor is being operated, the drive continuously monitors the output current over a time period, to determine the likely operating temperature of the motor. If the motor operates at high current for a period of time, the drive may trip to protect the motor and prevent damage. When this function is disabled (default setting), removing the power supply from the drive will result in the thermal overload value for the motor being reset to zero, hence the motor could potentially be operated and damaged. By enabling this parameter, even if the mains power is removed from the drive, the value is retained, and reused at the next power on, in order to avoid the risk of damage to the motor.				
P4-13	**Output Phase Sequence**	0	1	0	-
	0 : U, V, W. **1 : U, W, V.** Direction of motor rotation when operating in a forward direction will be reversed.				

1.3.5. Parameter Group 5 – Communication Parameters

Par.	Name	Minimum	Maximum	Default	Units
P5-01	**Drive Fieldbus Address**	0	63	1	-
	Sets the fieldbus address for the Optidrive				
P5-03	**Modbus RTU / BACnet MSTP Baud Rate**	9.6	115.2	115.2	kbps
	Sets the baud rate when Modbus RTU / BACnet MSTP communications are used				
P5-04	**Modbus RTU /BACnet MSTP Data Format**	0	3	0	-
	Sets the expected Modbus telegram data format as follows n- 1 : No Parity, 1 stop bit n-2 : No parity, 2 stop bits O- 1 : Odd parity, 1 stop bit E- 1 : Even parity, 1 stop bit				
P5-05	**Communications Loss Timeout**	0.0	5.0	1.0	Seconds
	Sets the watchdog time period for the communications channel for fieldbus systems where the drive must monitor for loss of communications with the network master, e.g. Modbus RTU. If a valid telegram is not received by the Optidrive within this time period, the drive will assume a loss of communications has occurred and react as selected below. Setting to zero disables the function.				
P5-06	**Communications Loss Action**	0	3	0	-
	Controls the behaviour of the drive following a loss of communications as determined by the above parameter setting. **0 : Trip & Coast To Stop** **1 : Ramp to Stop Then Trip** **2 : Ramp to Stop Only (No Trip)** **3 : Run at Preset Speed 4**				
P5-07	**Fieldbus Ramp Control**	0	1	0	-
	Selects whether the acceleration and deceleration ramps are control directly via the Fieldbus, or by internal drive parameters P1-03 and P1-04. **0 : Disabled**. Ramps are control from internal drive parameters **1 : Enabled**. Ramps are controlled directly by the Fieldbus				
P5-08	**Fieldbus Process Data Output Word 4 Select**	0	7	1	-
	When using an optional fieldbus interface, this parameter configures the parameter source for the 4th process data word transferred from the drive to the network master during cyclic communication. **0 : Output Torque** – 0 to 2000 = 0 to 200.0% **1 : Output Power** – Output power in kW to two decimal places, e.g. 400 = 4.00kW **2 : Digital Input Status** – Bit 0 indicates digital input 1 status, bit 1 indicates digital input 2 status etc. **3 : Analog Input 2 Signal Level** – 0 to 1000 = 0 to 100.0% **4 : Drive Heatsink Temperature** – 0 to 100 = 0 to 100°C **5 : User Register 1** **6 : User Register 2** **7 : P0-80 Value**				
P5-09	**BACnet Device Instance Number (Low)**	0	65535	1	-
	Specifies the Low word of the BACnet device instance number				
P5-10	**BACnet Device Instance Number (High)**	0	65535	0	-
	Specifies the High word of the BACnet device instance number				
P5-11	**BACnet Maximum Number of Masters**	0	127	127	-
	Defines the maximum number of BACnet masters on the local MSTP BACnet network				
P5-12	**Fieldbus Process Data Output Word 3 Select**	0	7	0	-
	When using an optional fieldbus interface, this parameter configures the parameter source for the 3rd process data word transferred from the drive to the network master during cyclic communications **0 : Motor current** – Output current to 1 decimal place, e.g. 100 = 10.0 Amps **1 : Power (x.xx kW)** Output power in kW to two decimal places, e.g. 400 = 4.00kW **2 : Digital input status** – Bit 0 indicates digital input 1 status, bit 1 indicates digital input 2 status etc. **3 : Analog Input 2 Signal Level** - 0 to 1000 = 0 to 100.0% **4 : Drive Heatsink Temperature** – 0 to 100 = 0 to 100°C **5 : User register 1** – User Defined Register 1 Value **6 : User register 2**– User Defined Register 1 Value **7 : P0-80 value** – User Selected data value – see section 0				
P5-13	**Fieldbus Process Data Input Word 4 Select**	0	1	0	-
	When using an optional fieldbus interface, this parameter configures destination for the 4th process data word received by the drive from the network master during cyclic communications **0 : Fieldbus Ramp Control** – This option must be selected if the drive acceleration and deceleration ramps are to be controlled from the fieldbus. P5-07 must also be set to 1 to enable this function. **1 : User register 4** – The value received by the drive in PDI 4 is transferred to User Register 4. This option allows the function of the process data word to be defined in Parameter Group 9. In this case, User Register 4 should not be written to within any Function Block code, although the value can be read. Refer to section 1.4 for further information.				

P5-14	**Fieldbus Process Data Input Word 3 Select**	0	2	0	-
	When using an optional fieldbus interface, this parameter configures destination for the 3rd process data word received by the drive from the network master during cyclic communications **0 : Torque limit/reference** – This option must be selected if the drive output torque limit / setpoint is to be controlled from the fieldbus. This also requires setting P4-06 = 3. **1 : User PID reference register** – This option allows the setpoint to the PID controller to be received from the Fieldbus. In order for this option to be used, P9-38 must be set to 1, and the PID User setpoint must not be utilised within any Function Block Code. **2 : User register 3** - The value received by the drive in PDI 3 is transferred to User Register 3. This option allows the function of the process data word to be defined in Parameter Group 9. In this case, User Register 3 should not be written to within any Function Block code, although the value can be read. Refer to section 1.4 for further information.				
P5-15	**Modbus Response Delay**	0	16	0	Chr
	Allows the user to configure an additional delay between the drive receiving a request via the Modbus RTU interface, and transmitting a reply. The value entered represents the delay in addition to the minimum delay permissible according to the Modbus RTU specification, and is expressed as the number of additional characters.				

1.3.6. Parameter Group 6 – Advanced Functions

Par.	Name	Minimum	Maximum	Default	Units
P6-01	**Enable Firmware Upgrade**	0	3	0	-
	Enables the firmware upgrade mode, allowing the User Interface firmware and/or the Power Stage Control firmware to be upgraded. Options are: **0 : Disabled** **1 : Upgrade User Interface and Power Stage Control firmware** **2 : Upgrade User Interface firmware only** **3 : Upgrade Power Stage Control firmware only** **NOTE** This parameter should not be adjusted by the User. The firmware upgrade process is carried out fully automatically using Optitools Studio PC software.				
P6-02	**Automatic Thermal Management Minimum Switching Frequency**	10	Model Dependent	10	kHz
	This parameter defines the minimum effective switching frequency which the drive will use. During operation, the drive measures the power module temperature and will switch automatically to a lower switching frequency if the temperature reaches a pre-defined limit. This parameter determines the lowest frequency that can be used. In the event that the power module temperature continues to increase, the drive will trip on over temperature.				
P6-03	**Auto Reset Time Delay**	1	60	20	s
	Sets the delay time which will elapse between consecutive drive reset attempts when Auto Reset is enabled in P2-36				
P6-04	**User Relay Output Hysteresis Control**	0.0	25.0	0.3	-
	This parameter works in conjunction with P2-11 and P2-13 = 2 or 3 to set a band around the target speed (P2-11 = 2) or zero speed (P2-11 = 3). When the speed is within this band, the drive is considered to be at target speed or Zero speed. This function is used to prevent "chatter" on the relay output if the operating speed coincides with the level at which the digital / relay output changes state. e.g. if P2-13 = 3, P1-01 = 50Hz and P6-04 = 5%, the relay contacts close above 2.5Hz				
P6-08	**Maximum Speed Reference Frequency**	0	20	0	kHz
	When the motor speed reference is to be controlled by a frequency input signal (connected to Digital input 3), this parameter is used to define the input frequency which corresponds to the maximum motor speed (set in P1-01). This maximum frequency that can be set in this parameter must be in the range 5kHz to 20kHz. When set to 0, this function is disabled.				
P6-10	**Enable Function Block Program Operation**	0	1	0	-
	0 : Function Block Program Disabled. **1 : Function Block Prgram Enabled**. This parameter must be set to 1 to enable any Function Block Program loaded into the drive to operate. When set to 0, the Function Block Program will be disabled.				
P6-11	**Speed Holding Time on Enable**	0	250	0	s
	Defines a time period for which the drive will run at Preset Speed 7 (P2-07) when the Enable signal is applied to the drive. The preset speed can be any value from minimum to maximum frequency and in either direction. This function can be useful in applications requiring controlled start-up behaviour regardless of the normal system operation, and allows the user to program the drive to always start at the same frequency, with the same direction of rotation for a specified time period before returning to normal operation. This function can be used with pumps to provide a reverse spin on start-up to clear any potential blockages.				
P6-12	**Speed Holding / DC Injection Time on Disable**	0	250	0	s
	When P6-18 = 0, defines a time period for which the drive will run at Preset Speed 8 (P2-08) following removal of the Enable signal, before ramping to stop. **Note** Setting this parameter > 0 will result in the drive continuing to operate for the set time at the preset speed *after* the enable signal has been removed. It is important to ensure this method of operation is safe prior to using this function.				
P6-18	**DC Injection Braking Current**	0.0	100.0	0.0	%
	Defines the DC current level as a percentage of motor rated current (P1-08) that is applied to the motor when a stop command is received and the DC Injection function is activated.				
P6-22	**Cooling Fan Runtime Counter Reset**	0	1	0	-
	0 : No Function **1 : Reset**. Setting to 1 resets the internal Fan run-time counter to zero (as displayed in Index 1 of P0-35).				
P6-23	**Energy Consumption (kWh) Meter Reset**	0	1	0	-
	0 : No Function **1 : Reset** . Setting to 1 resets internal kWh meter to zero (as displayed in Index 1 of P0-26 and Index 1 of P0-27).				
P6-24	**Maintenance Time Interval**	0	60000	0	Hours
	Allows the user to define a maintenance interval period for the application. This defines the total number of run time hours which must elapse before the service indicator is displayed. This may be viewed on the drive OLED display, may be programmed to a relay output, and also sets a bit in the drive status word. When P6-25 is set to 1, the internal service interval counter is set to this value				
P6-25	**Maintenance Time Reset**	0	1	0	-
	When this parameter is set to 1, the internal service interval counter is set to the value defined in P6-24				
P6-26	**Analog Output 1 Scaling**	0.0	500.0	100.0	%
	Defines the scaling factor as a % used for Analog Output 1				
P6-27	**Analog Output 1 Offset**	-500.0	500.0	0.0	%
	Defines the offset as a % used for Analog Output 1				

Par.	Name	Minimum	Maximum	Default	Units
P6-28	**P0-80 Display Value Index**	0	200	0	-
	This parameter defines the index of the internal variable, the value of which will be displayed in P0-80. This is usually used in conjunction with the Function Block Program. Refer to section 1.6 for further information.				
P6-29	**Save User Parameters as Default**	0	2	0	-
	0 : No Function **1 : Save Parameters.** Setting this parameter to 1 saves the present drive parameter settings to the User Default Parameters Memory. Following this, if the User carries out a 3-button default parameter command (UP, DOWN and STOP), the parameter saved at this time will be restored. **2 : Erase Parameters**. Setting 2 clears the User Default Parameters Memory.				
P6-30	**Advanced Parameter Access Code Definition**	0	9999	201	-
	Defines the access code which must be entered into P1-14 to allow access to the Advanced Parameters.				

1.3.7. Parameter Group 7 – Motor Data

The following parameters are used internally by the drive to provide optimum possible motor control. Incorrect setting of the parameters can result in poor performance and unexpected behaviour of the motor. Adjustments should only be carried out by experienced users who fully understand the functions of the parameters.

Par.	Name	Minimum	Maximum	Default	Units
P7-01	**Motor Stator Resistance (Rs)**	-	-	-	Ohms
	Motor stator resistance value measured during the autotune.				
P7-03	**Motor Stator Inductance (Lsd)**	-	-	-	H
	For induction motors: phase stator inductance value. For permanent magnet motors: phase d-axis stator inductance in Henry (H).				
P7-04	**Motor Magnetising Current (Id rms)**	0.0	-	-	A
	For induction motors: magnetizing / no load current. Before Auto-tune, this value is approximated to 60% of motor rated current (P1-08), assuming a motor power factor of 0.8.				
P7-05	**Motor Leakage Coefficient (Sigma)**	-	-	-	-
	For induction motors: motor leakage inductance coefficient				
P7-06	**Motor Stator Inductance : PM Motors (Lsq)**	0	-	-	-
	For permanent magnet motors: phase d-axis stator inductance in Henry (H).				
P7-09	**Over Voltage Current Limit**	0.0	100.0	5.0	%
	Effective in vector speed control mode only, and will come into function once the drive DC bus voltage increases above a preset limit. This voltage limit is set internally just below the over voltage trip level. This parameter will effectively limit the output torque current in order to prevent a large current flowing back to the drive, which may cause an Over-voltage trip. A small value in this parameter will limit the motor control torque when the drive DC bus voltage exceeds the preset limit. A higher value may cause a significant distortion in the motor current, which may cause an aggressive, rough motor behaviour.				
P7-10	**System Inertia Constant**	0	600	10	-
	System Load Inertia to Motor Inertia Ratio entered as H = (JTot / JMot). This value can normally be left at the default value (10) and is used by the drive control algorithms as a feed-forward control variable to provide optimum torque current to accelerate the load. Hence accurate setting of the inertia ratio will produce a better system response and dynamic behaviour.				
P7-11	**Pulse Width Minimum Limit**	0	500	-	-
	This parameter is used to limit the minimum output pulse width, which can be used for long motor cable applications. Increasing the value of this parameter will reduce the risk of over-current trips, but will also reduce the maximum available output motor voltage.				
P7-12	**Magnetising Period**	0	5000	-	ms
	Defines the delay time between the output stage enabling at 0.0Hz prior to the output frequency beginning to ramp to accelerate the motor. This allows time for the motor to correctly magnetise, and avoids possible over current trips that may occur if the output frequency begins to ramp before the motor flux has stabilised.				
P7-14	**Low Frequency Torque Boost**	0.0	100.0	0.0	%
	Effective in all motor control modes, except V/F mode (P4-01 = 2), but primarily intended for use with synchronous motors. Allows a boost current to be applied at start-up and low frequency (limit defined by P7-15), as a percentage of the motor rated current (P1-08). Injecting some additional current into the motor at low speed helps to ensure that the rotor alignment is maintained, imrpoving operation of the motor at lower speeds. In order to determine the correct setting, run the drive at the lowest frequency required by the application and increase boost levels to provide both required torque and smooth operation whilst avoiding excessive current levels which may cause nuisance tripping.				
P7-15	**Torque Boost Frequency Limit**	0.0	50.0	0.0	%
	Frequency range for applied boost current (P7-14) as a % of motor rated frequency (P1-09). This sets the frequency cut-off point above which boost current is no longer applied to the motor.				
P7-18	**Over Modulation Enable**	0	1	0	-
	0: Disabled **1 : Enabled.** When enabled, over modulation provides a small increase in the available output voltage from the drive, which can assist in applications where the supply voltage is too low to provide the required motor voltage, resulting in an increased motor current.				
P7-19	**BLDC Light Load Optimisation**	0	1	0	-
	0: Disabled **1 : Enabled.** When enabled and the drive is set in BLDC Mode (P4-01 = 4), the drive will reduce the output voltage during loght load operation in order to improve motor efficiency and performance. This setting has no effect when the motor is significantly loaded.				

1.3.8. Parameter Group 8 – Application Specific Parameters

Par.	Name	Minimum	Maximum	Default	Units
P8-01	**Stir Interval Duration**	0	60000	0	s
	This parameter can be used to set a pre-defined period of inactivity, whereby if the drive remains in standby mode for a period of time exceeding the limit, stir function is activated, and the drive will operate at preset speed 7 (P2-07) for the time set in P8-02. This allows the pump to stir, preventing sediment from settling and avoiding a blockage.				
P8-02	**Pump Stir Activation Time**	1	6000	10	s
	Set the time period that the stir function will be active once triggered (excludes time for deceleration to stop)				
P8-03	**Pump Clean Function Select**	0	3	0	-
	This parameter configures the drive conditions that will cause activation of the automatic pump clean function. When activated, the pump clean will operate the pump at preset speed 5 (P2-05) for the time period set in P8-04, followed by Preset Speed 6 (P2- 06) (Providing P2-06 <> 0) for the time set in P8-04, before resuming normal operation. During the cleaning cycle, the ramp time set in P8-05 is used for both acceleration and deceleration, and overrides P1-03 and P1-04. Where possible, P2-05 and P2-06 may be set to negative values, to allow the pump to be reversed. For best results, it is recommended to use as high a speed as possible, and to adjust P8-05 to allow a short acceleration time whilst avoiding over current trips. **0 : Disabled** **1 : Active on start-up only.** The pump cleaning function operates every time the pump is started. **2 : Active on start-up and over-torque detection.** The pump cleaning function operates every time the pump is started, and also in the event that the drive detects a possible pump blockage during normal operation. This requires the Load Profile Monitoring function to be active and commissioned for correct operation, see parameter P8-06. **3 : Active on over-torque detection only.** The pump cleaning function operates only when a possible pump blockage is detected during normal operation. This requires the Load Profile Monitoring function to be active and commissioned for correct operation, see parameter P8-06. Note: The pump clean function can also be activated by digital input configured in group 9 parameters				
P8-04	**Pump Cleaning Time**	0	600	0	S
	Sets the time period for the operation of the pump cleaning cycle. When bi-directional pump cleaning is selected, the time interval is used twice, once in each direction.				
P8-05	**Clean Function Ramp Time**	0.0	6000	30	s
	Independent ramp rate used only for the pump automatic cleaning function (see P8-03) when the motor is Accelerated as part of the cleaning cycle.				
P8-06	**Load Monitor Enable**	0	3	0	-
	This parameter enables the Load Profile Monitoring Function (load current monitoring), which can be used to detect belt failure in belt driven fan applications, or Dry Pump, Pump Blockage or broken impeller in Pump applications. **0: Disabled** **1: Low Load Detection Enabled** (Belt Failure / Dry Pump / Broken Impeller) **2: High Load Detection Enabled** (Pump Blockage) **3: Low and High Load Detection** **4: Low and High Load Detection**, warning only - bit 7 of the status word goes high in the event of a high or low load being detected but the drive will not trip				
	**Adjustment of parameter P8-06 (<>0) will cause the drive to automatically run the motor through its programmed frequency range upon the next drive enable (input enable). Ensure the application is in a suitable condition to allow the motor to run safely through its frequency range prior to enabling this feature.**				
P8-07	**Load Profile Bandwidth**	0.1	50.0	1.0	A
	This parameter sets a bandwidth around the Load profile generated by P8-06. If P8-06 has been set to an appropriate value to detect an over /under load condition and the drive operates outside of the bandwidth set in P8-07 for a period longer than that defined by P8-08 then the drive will trip. Value entered in P8-07 is the value between the normal current and the trip level, hence total bandwidth for the function is 2 x P8-07.				
P8-08	**Load Monitor Trip Delay**	0	60	0	S
	This parameter sets a time limit for the Load profile generated by P8-06. If P8-06 has been set to an appropriate value to detect an over /under load condition and the drive operates outside of the bandwidth set in P8-07 for a period longer than that defined by P8-08 and then the drive will trip.				
P8-09	**Fire Mode Logic**	0	1	0	-
	When Fire mode is assigned to a digital input on the drive then the logic configuration for the input is set by P8-09 to allow normally open or normally closed activation. Default behaviour is for Input logic off (0) to activate fire mode (Open activation). Input configuration for Fire mode is set by parameter P1-13 or can be user defined by the setting of P9-32. **0 : Open Activation** **1 : Closed Activation**				
P8-10	**Fire Mode Speed**	-P1-01	P1-01	0	Hz
	When set to a non-zero value, this parameter sets an operational fixed frequency / speed used when Fire Mode is selected. The drive will maintain operation at this frequency until the fire mode signal is removed or the drive is no longer able to sustain operation. When P8-10 is zero, and fire mode is activated, the drive will continue to operate under the control of the selected speed reference, dependent on parameter settings and digital input selection.				
P8-11	**Bypass Mode on Fault**	0	1	0	-
	Parameter configures the drive to switch to bypass mode automatically should a trip occur on the drive. When enabled the drive standard relays 1 and 2 are dedicated to bypass control and cannot be assigned other functions. **0 : Disabled** **1 : Enabled**				

P8-12	**Bypass Mode on Fire**	0	1	0	-
	Parameter configures the drive to switch to bypass mode automatically should an input to the drive be configured for Fire Mode operation and that input becomes active. When enabled the drive standard relays 1 and 2 are dedicated to bypass control and cannot be assigned other functions. **0 = Disabled** **1 = Enabled**				
P8-13	**Bypass Contactor Changeover Time**	0	30	2	s
	Parameter active when Bypass function is enabled. Parameter P8-05 sets a time delay or changeover time between the switching of the drive relays controlling the bypass circuitry.				
	**Care must be taken when setting P8-13 to ensure that drive and DOL contactors are not switched in circuit simultaneously. Both Mechanical and Electrical interlocking of drive and DOL contactors to regional standards are recommended in configuring the Bypass function**				
P8-14	**Pump Staging Function Select**	0	4	0	-
	Parameter enables the pump staging (cascade) function on the drive **0 : Disabled** **1 : Single VFD with DOL Cascade (max 4 DOL pumps)** **2 : Multiple Drive Cascade (Optiflow) Master Drive (Only valid when drive set to Optibus master address, P5-01 = 1)** **3 : Multiple Drive Cascade with Jockey Pump (Optiflow) Master Drive (Only valid when drive set to Optibus master address, P5-01 = 1)** In this instance, the Master drive (with address P5-01 =1) will remain active and will not be switched off to support the pump rotation ordinarily used for the purpose of sharing operating hours across all pumps. **4 : Multiple Drive Cascade Mode 2 (Optiflow) Master Drive (Only valid when drive set to Optibus master address, P5-01 = 1)** This mode is similar to mode 2 but the settling time works differently which can prevent multiple motors starting simultaneously when waking up from PID Standby mode				
P8-15	**Number of Assist Pumps**	1	4	1	-
	Parameter valid when P8-14 is set to 1 or 2 to enable Pump Staging Function. P8-15 set the number of assist pumps (P8-14 = 1) or network slave drives (P8-14 = 2) that are available in the Pump Staging application. Setting the value to 0 disables Pump Staging.				
P8-16	**Pump Duty Switch Over Time**	0	1000	0	Hours
	In order to balance run time (duty) on each pump in the Pump staging application and to ensure periodic operation of each pump P8-16 can be set with a time limit for pump switch over. When set to a value other than 0 (disabled) the operation of each staging pump will be cycled to ensure the difference in duty between each pump does not exceed the time set in P8-16				
P8-17	**Assist Pump Start Speed**	P8-18	P1-01	49.0	Hz / RPM
	This parameter defines the speed at which an "Assist" Pump is started when using the Pump Cascade or Optiflow feature. When the drive output increases beyond this threshold the next Staging pump is switch on. The Pump staging settle time must then expire before additional staging pumps can be brought on or off line. Priority for Staging pump switch on is always given to the pump with lowest run time accumulated.				
P8-18	**Assist Pump Stop Speed**	0	P8-17	30.0	Hz / RPM
	This parameter defines the speed at which an "Assist" Pump is stopped when using the Pump Cascade or Optiflow feature. When the drive output decreases below this threshold one of the Staging pumps currently operating is switch off. The Pump staging settle time must then expire before additional staging pumps can be brought on or off line. Priority for Staging pump switch off is always given to the pump with highest run time accumulated.				
P8-19	**Pump Settling Time**	2	600	60	Secs
	Parameter sets a time delay for pump staging whereby, following switch in or switch out of a staging pump, further pumps are not permitted to be switched in or out until this time period has elapsed. This parameter should be set to allow adequate settle time between staging pump transitions.				
P8-20	**Pump Master Clock Reset**	0	1	0	-
	Master drive in pump staging monitors and maintains duty run times for all available staging pumps. All clocks are available to view in P0-20. P8-20 provides the master reset to all run time clocks used for Pump Staging Function (all clocks set to 0).				

1.4. Parameter Group 9 – Programmable Logic Functions

Parameter Group 9 is intended to allow the user complete flexibility to control the behaviour of the drive in more complex applications which require specialised parameter settings to accomplish. The parameters contained within this group should be used carefully, and the user should ensure they are fully familiar with the operation of the drive and its control functions prior to making any adjustment to parameters contained within this group.

1.4.1. Parameter Group 9 Function Overview

Parameter Group 9 allows advanced programming of the drive, including user defined functions for the digital and analog inputs of the drive and control of the speed reference source.

Group 9 Consists of three types of parameters

Logic Source Selection	These can be used to select the source for programmable Digital signals internally within the drive
Data Source Selection	These can be used to select the source for programmable Analog signal sources within the drive
Function Enable Parameters	These are used to select whether drive functions are controlled by their usual parameter selection, or have user defined behaviour (e.g. controlled by a Function Block Program within the drive written by the user).

The following rules apply to parameter Group 9.

- Parameters P9-01 to P9-32 inclusive may only be changed when P1-13 = 0
- When the value of P1-13 is changed, all previous settings in Parameter Group 9 will be cleared, and new settings entered based on the P1-13 selection.

1.4.2. Logic Source Selection Parameters

Logic Source Selection parameters allow the user to directly define the source for a control function within the drive. These parameters can only be linked to digital values, which either enable or disable the function depending on their state.

Parameters defined as logic sources have the following range of possible settings:-

No.	Drive LED Display	Drive OLED Display	Function
0	OFF / SAFE	Off / Safe	Function permanently disabled, or where allowed, linked to the status of the STO inputs
1	d in- 1	Digital Input 1	Function linked to Digital Input 1 Status
2	d in-2	Digital Input 2	Function linked to Digital Input 2 Status
3	d in-3	Digital Input 3	Function linked to Digital Input 3 Status
4	d in-4	Digital Input 4	Function linked to Digital Input 4 (Analog Input 1) Status
5	d in-5	Digital Input 5	Function linked to Digital Input 5 (Analog input 2) Status
6	d in-6	Digital Input 6	Function linked to Digital Input 6 Status (Requires Extended I/O option)
7	d in-7	Digital Input 7	Function linked to Digital Input 7 Status (Requires Extended I/O option)
8	d in-8	Digital Input 8	Function linked to Digital Input 8 Status (Requires Extended I/O option)
9	AoUt- 1	Ana Output 1	Function linked to Analog Output 1 Status
10	AoUt-2	Ana Output 2	Function linked to Analog Output 2 Status
11	doUt- 1	Dig Output 1	Function linked to Relay Output 1 Status
12	doUt-2	Dig Output 2	Function linked to Relay Output 2 Status
13	doUt-3	Dig Output 3	Function linked to Relay Output 3 Status (Requires Extended I/O or Cascade Option)
14	doUt-4	Dig Output 4	Function linked to Relay Output 4 Status (Requires Cascade Option)
15	doUt-5	Dig Output 5	Function linked to Relay Output 5 Status (Requires Cascade Option)
16	On	ON	Function permanently enabled
17	USEr- 1	USEr 1	Function linked to User Register 1 (Function Block Program)
18	USEr-2	USEr2	Function linked to User Register 2 (Function Block Program)
19	USEr-3	USEr3	Function linked to User Register 3 (Function Block Program)
20	USEr-4	USEr4	Function linked to User Register 4 (Function Block Program)
21	USEr-5	USEr5	Function linked to User Register 5 (Function Block Program)
22	USEr-6	USEr6	Function linked to User Register 6 (Function Block Program)
23	USEr-7	USEr7	Function linked to User Register 7 (Function Block Program)
24	USEr-8	USEr8	Function linked to User Register 8 (Function Block Program)
25	USEr-9	USEr9	Function linked to User Register 9 (Function Block Program)

1.4.3. Data Source Selection Parameters

Data Source selection parameters define the signal source for analog signals used within the drive, or example speed and torque setpoints. These parameters can be linked to analog values within the drive.

Parameters defined as Data Sources have the following range of possible settings:-

Programmable Logic Source Selection Options				
No.	**Drive LED Display**	**Drive OLED Display**	**Setting**	**Reference Source**
0	An-1	Analog Input 1	Analog Input 1	Analog Input 1 Signal Level (P0-01)
1	An-2	Analog Input 2	Analog Input 2	Analog Input 2 Signal Level (P0-02)
2	PrESEt	Preset Speed	Preset Speed	Selected Preset Speed
3	d-Pot	Keypad Speed	Keypad (Motorised Pot)	Keypad Speed Reference (P0-06)
4	Pid	PID Speed	PID Controller Output	PID Controller Output (P0-10)
5	SUb-dr	Master Speed	Master Speed Reference	Master Speed Reference (Master / Slave Operation)
6	F-bUS	Fieldbus Speed	Fieldbus Speed Reference	Fieldbus Speed Reference PDI2
7	USEr	User Speed Ref	User Defined Speed Reference	User Defined Speed Reference (Function Block Program)
8	PULSE	Frequency Input	Frequency Input	Pulse Frequency Input Reference
9	PrE-1	Preset Speed 1	Preset Speed 1	Preset Speed 1 P2-01
10	PrE-2	Preset Speed 2	Preset Speed 2	Preset Speed 2 P2-02
11	PrE-3	Preset Speed 3	Preset Speed 3	Preset Speed 3 P2-03
12	PrE-4	Preset Speed 4	Preset Speed 4	Preset Speed 4 P2-04
13	PrE-5	Preset Speed 5	Preset Speed 5	Preset Speed 5 P2-05
14	PrE-6	Preset Speed 6	Preset Speed 6	Preset Speed 6 P2-06
15	PrE-7	Preset Speed 7	Preset Speed 7	Preset Speed 7 P2-07
16	PrE-8	Preset Speed 8	Preset Speed 8	Preset Speed 8 P2-08

1.4.4. Parameter Group 9 Descriptions

Par.	Name	Minimum	Maximum	Default	Units
P9-01	**Enable Input Logic Source**				
	Defines the source of the Drive Enable function. This function must be provided by hardware, and is normally assigned to Digital Input 1, and allows a hardware enable signal to be utilised in situations where for example the Run Forward or Run Reverse commands are applied from external sources, e.g. Fieldbus control signals or a Function Block Program. **Logic 1 :** Drive operation is allowed **Logic 0 :** Drive stops using deceleration ramp time selected by P9-26 & P9-27				
P9-02	**Fast Stop Input Logic Source**				
	Defines the Source of the Fast Stop Input. In response to a Fast Stop command, the drive stops using the deceleration time set in P2-25. **Logic 1 :** Drive operation is allowed **Logic 0 :** Drive stops using the deceleration ramp time set in P2-25				
P9-03	**Run Forward Input Logic Source**				
	Defines the source of the Run Forward command. **Logic 1 :** Drive runs the motor in the forward direction of rotation **Logic 0 :** Drive stops using deceleration ramp time selected by P9-26 & P9-27				
P9-04	**Run Reverse Input Logic Source**				
	Defines the source of the Run Reverse command. **Logic 1 :** Drive runs the motor in the reverse direction of rotation **Logic 0 :** Drive stops using deceleration ramp time selected by P9-26 & P9-27 **Note** When both the Run Forward and Run Reverse commands are applied to the drive simultaneously, the drive executes a Fast Stop.				
P9-05	**Latch Function Enable Logic Source**	0	1	0	-
	0 : Disabled **1 : Enabled.** Enables the latching function of the digital inputs. The latching function allows momentary start signals to be used to start and stop the drive in either direction. In this case, the Enable Input Source (P9-01) must be linked to a normally closed / open to stop control source. This control source must be Logic '1' to allow the drive to start. The drive will then respond to momentary or pulse start and stop signals as defined in parameters P9-03 and P9-04.				
P9-06	**Reverse Input Logic Source**				
	Defines the source of the Reverse command, which reverses the direction of motor rotation. **Note** The Reverse input only takes effect when the drive is operating in a Forward direction. Therefore • Applying Run Forward & Reverse inputs simultaneously = Motor Runs Reverse • Applying Run Reverse and Reverse inputs simultaneously = Motor Runs Reverse				
P9-07	**Reset Input Logic Source**				
	Defines the source of the Reset command. **Logic 1 :** Faults are reset on a rising edge of the Reset command. **Logic 0 :** No effect				

Par.	Name	Minimum	Maximum	Default	Units
P9-08	**External Trip Input Logic Source**				
	Defines the source of the External Trip command. **Logic 1 :** Drive operation is allowed **Logic 0 :** Drive trips with fault External Trip				
P9-09	**Terminal Control Override Logic Source**				
	Defines the source of the command used to select Terminal Control operation of the drive. This parameter is effective only when P1-12 > 0, and allows terminal control to be selected to override the control source defined in P1-12. **Logic 1 :** Drive operation is controlled from the sources defined in parameters P9-02 to P9-07. **Logic 0 :** Drive command source selected by P1-12				
Note	The control sources to the drive are handled in the following order of priority, from Highest to Lowest :- • STO Circuit • External Trip • Fast Stop • Enable • Terminal Control Override • Run Forward / Run Reverse / Reverse • Reset				
P9-10	**Speed Setpoint 1 Data Source**				
P9-11	**Speed Setpoint 2 Data Source**				
P9-12	**Speed Setpoint 3 Data Source**				
P9-13	**Speed Setpoint 4 Data Source**				
P9-14	**Speed Setpoint 5 Data Source**				
P9-15	**Speed Setpoint 6 Data Source**				
P9-16	**Speed Setpoint 7 Data Source**				
P9-17	**Speed Setpoint 8 Data Source**				
Note	It is possible to define up to 8 speed setpoint sources for the drive, and to select them during operation using P9-18 – P9-20. When changing the setpoint source, the operation is effective immediately, and does not require the drive to stop and restart.				
P9-18	**Speed Reference Select Bit 0 Logic Source**				
P9-19	**Speed Reference Select Bit 1 Logic Source**				
P9-20	**Speed Reference Select Bit 2 Logic Source**				
Note	The active speed setpoint source can be selected during operation by the status of the above logic source parameters. The Speed setpoints are selected according to the following logic :-				

P9-20	P9-19	P9-18	Speed Setpoint Source
0	0	0	1 (P9-10)
0	0	1	2 (P9-11)
0	1	0	3 (P9-12)
0	1	1	4 (P9-13)
1	0	0	5 (P9-14)
1	0	1	6 (P9-15)
1	1	0	7 (P9-16)
1	1	1	8 (P9-17)

P9-21	**Preset Speed Select Bit 0 Logic Source**				
P9-22	**Preset Speed Select Bit 1 Logic Source**				
P9-23	**Preset Speed Select Bit 2 Logic Source**				
Note	When Preset Speeds are to be used for the speed setpoint, the active preset speed can be selected based on the status of these parameters. The selection is according to the following logic :-				

P9-23	P9-22	P9-21	Preset Speed
0	0	0	1 (P2-01)
0	0	1	2 (P2-02)
0	1	0	3 (P2-03)
0	1	1	4 (P2-04)
1	0	0	5 (P2-05)
1	0	1	6 (P2-06)
1	1	0	7 (P2-07)
1	1	1	8 (P2-08)

P9-28	**Remote (Keypad) Up Input Logic Source**				
	Defines the source of the logic signal used to increase the value of the Keypad / Motorised Pot speed reference. When the defined signal source is Logic 1, the value will increase at the rate defined by P1-03.				
P9-29	**Remote (Keypad) Down Input Logic Source**				
	Defines the source of the logic signal used to decrease the value of the Keypad / Motorised Pot speed reference. When the defined signal source is Logic 1, the value will decrease at the rate defined by P1-04.				
P9-32	**Fire Mode Input Source**				
	Defines the source of the input signal used to activate fire mode.				

Par.	Name	Minimum	Maximum	Default	Units
P9-33	**Analog Output 1 Data Source Enable**	0	1	0	-
	0 : Analog Output 1 Function Set by P2-11 1 : Analog Output 1 Function Set by User Defined Digital Source 2 : Analog Output 1 Function set by User Defined Analog Source				
P9-34	**Analog Output 2 Data Source Enable**	0	1	0	-
	0 : Analog Output 1 Function Set by P2-13 1 : Analog Output 1 Function Set by User Defined Digital Source 2 : Analog Output 1 Function set by User Defined Analog Source				
P9-35	**Relay Output 1 Logic Source Enable**	0	1	0	-
	0 : Relay Output 1 Function Set by P2-15 1 : Relay Output 1 Function set by User Defined Source				
P9-36	**Relay Output 2 Logic Source Enable**	0	1	0	-
	0 : Relay Output 1 Function Set by P2-18 1 : Relay Output 1 Function set by User Defined Source				
P9-37	**Scaling Control Data Source Enable**	0	1	0	-
	0 : Scaling Control Data Source Set by P2-21 1 : Scaling Control by User Defined Source				
P9-38	**PID Setpoint Data Source Enable**	0	1	0	-
	0 : PID Setpoint Source Defined by P3-05 1 : PID Setpoint Source set by User Defined Source				
P9-39	**PID Feedback Data Source Enable**	0	1	0	-
	0 : PID Feedback Source Defined by P3-10 1 : PID Feedback Source set by User Defined Source				
P9-41	**Relay Output Option Module Logic Source Enable**	0	1	0	-
	0 : Option Module Output Relays Factory Preset Functions Assigned Factory Preset Functions are as follows :- Relay 3 (Extended I/O & Cascade Option Module) : Drive Healthy Relay 4 (Cascade Option Module) : Drive Tripped Relay 5 (Cascade Option Module) : Drive Running **1 : Relay Output 1 Function set by User Defined Source**				
P9-42	**Clean Trigger Input (Edge Trigger)**	0	25	0	-
	This parameter defines the source of the signal to be used to trigger the Pump Clean Function. 0 = Off, 1 = DI1, 2 = DI2, 3 = DI3, 4 = DI4, 5 = DI5, 6 = DI6, 7 = DI7, 8 = DI8, 9 = Analogue Output 1, 10 = Analogue Output 2, 11 = Digital Output 1, 12 = Digital Output 2, 13 = Digital Output 3, 14 = Digital Output 4, 15 = Digital Output 5, 16 = On, 17 = User Register 1, 18 = User Register 2, 19 = User Register 3, 20 = User Register 4, 21 = User Register 5, 22 = User Register 6, 23 = User Register 7, 24 = User register 8, 25 = User Register 9				
P9-43	**Bypas Trigger Input**	0	25	0	-
	This parameter defines the source of the signal to be used to trigger the Drive Bypas Function. 0 = Off, 1 = DI1, 2 = DI2, 3 = DI3, 4 = DI4, 5 = DI5, 6 = DI6, 7 = DI7, 8 = DI8, 9 = Analogue Output 1, 10 = Analogue Output 2, 11 = Digital Output 1, 12 = Digital Output 2, 13 = Digital Output 3, 14 = Digital Output 4, 15 = Digital Output 5, 16 = On, 17 = User Register 1, 18 = User Register 2, 19 = User Register 3, 20 = User Register 4, 21 = User Register 5, 22 = User Register 6, 23 = User Register 7, 24 = User register 8, 25 = User Register 9				
P9-44	**PID 2nd Digital Reference Select Input**	0	1	0	-
	This parameter defines the source of the signal to be used to select the 2nd digital PID reference (P3-15). 0 = Off, 1 = DI1, 2 = DI2, 3 = DI3, 4 = DI4, 5 = DI5, 6 = DI6, 7 = DI7, 8 = DI8, 9 = Analogue Output 1, 10 = Analogue Output 2, 11 = Digital Output 1, 12 = Digital Output 2, 13 = Digital Output 3, 14 = Digital Output 4, 15 = Digital Output 5, 16 = On, 17 = User Register 1, 18 = User Register 2, 19 = User Register 3, 20 = User Register 4, 21 = User Register 5, 22 = User Register 6, 23 = User Register 7, 24 = User register 8, 25 = User Register 9				

1.5. Parameter Group 0 – Monitoring Parameters (Read Only)

Par	Parameter Name	Units
P0-01	**Analog Input 1 Value**	%
	Displays the signal level applied to analog input 1 (Terminal 6) after scaling and offsets have been applied.	
P0-02	**Analog Input 2 Value**	%
	Displays the signal level applied to analog input 2 (Terminal 10) after scaling and offsets have been applied.	
P0-03	**Digital Input Status**	Binary
	Displays the status of the drive inputs, including the extended I/O module (if fitted). 1st Entry: 00000 ... 11111. Drive digital Input status. MSB represents digital input 1 / LSB representing digital input 5. 2nd Entry: E 000 ... E 111. Drive Extended (option) Input status. MSB represents digital input 6 / LSB representing digital input 8.	
P0-04	**Speed Controller Reference**	Hz / Rpm
	Displays the set point reference input applied to the drive internal speed controller	
P0-06	**Digital Speed Reference**	Hz / Rpm
	Displays the value of the drive internal Motorised Pot (used for keypad) speed reference	
P0-07	**Fieldbus Speed Reference**	Hz / Rpm
	Displays the set-point being received by the drive from the currently active Fieldbus interface.	
P0-08	**PID Reference**	%
	Displays the set-point input to the PID controller.	
P0-09	**PID Feedback**	%
	Displays the Feedback input signal to the PID controller	
P0-10	**PID Output**	%
	Displays the output level of the PID controller	
P0-11	**Motor Voltage**	Volts
	Displays the instantaneous output voltage from the drive to the motor	
P0-12	**Output Torque**	%
	Displays the instantaneous output torque produced by the motor	
P0-13	**Trip Log**	-
	Displays the last four fault codes for the drive. Refer to section 15.1 for further information	
P0-14	**Magnetising Current (Id)**	A
	Displays the motor magnetising Current, providing an auto tune has been successfully completed.	
P0-15	**Torque Producing Current (Iq)**	A
	Displays the rotor current (torque producing current), providing an auto tune has been successfully completed.	
P0-16	**DC Bus Voltage Ripple**	Volts
	Displays the level of ripple present on the DC Bus Voltage. This parameter is used by the Optidrive for various internal protection and monitoring functions.	
P0-17	**Stator Resistance (Rs)**	Ohms
	Displays the measured motor stator resistance, providing an auto tune has been successfully completed.	
P0-19	**Cascade Run Time Log**	Hours
	Run Time values for variable speed and DOL pumps used in cascade function. 5 entry log. 0 = Master, 1 = DOL1, 2 = DOL2, 3 = DOL3, 4 = DOL4. Clocks can be reset through P8-20, Master Clock Reset.	
P0-20	**DC Bus Voltage**	Volts
	Displays the instantaneous DC Bus Voltage internally within the drive	
P0-21	**Drive Temperature**	°C
	Displays the Instantaneous Heatsink Temperature measured by the drive	
P0-22	**Time Left to Next Service**	HH:MM:SS
	Displays the current time period remaining before the next maintenance becomes due. Maintenance interval is based on the value entered in P6-24 (Maintenance Time Interval) and the elapsed time since the maintenance interval was enabled or reset.	
P0-23	**Time Heatsink >85° C**	HH:MM:SS
	Two entry display: First display shows hours. Second display shows minutes and seconds Displays the amount of time in hours and minutes that the Optidrive has operated for during its lifetime with a heatsink temperature in excess of 85°C. This parameter is used by the Optidrive for various internal protection and monitoring functions.	
P0-24	**Time Ambient >80° C**	HH:MM:SS
	Two entry display: First display shows hours. Second display shows minutes and seconds Displays the amount of time in hours and minutes that the Optidrive has operated for during its lifetime with an ambient temperature in excess of 80°C. This parameter is used by the Optidrive for various internal protection and monitoring functions.	
P0-25	**Estimated Rotor Speed**	Hz / Rpm
	Displays the estimated rotor speed of the motor.	
P0-26	**kWh Meter**	kWh
	Two entry display: First display shows user resettable meter (reset with P6-23). Second display shows none resettable value. Displays the amount of energy consumed by the drive in kWh. When the value reaches 1000, it is reset back to 0.0, and the value of P0-27 (MWh meter) is increased.	
P0-27	**MWh Meter**	MWh
	Two entry display: First display shows user resettable meter (reset with P6-23). Second display shows none resettable value. Displays the amount of energy consumed by the drive in MWh.	

Par	Parameter Name	Units
P0-28	**Software Version**	-
	Displays the software version of the drive: Four entry display: First display = IO Version, Second display = IO Checksum, Third display = DSP Version, Fourth display = DSP Checksum	
P0-29	**Drive Type**	-
	Displays the type details of the drive: Three entry display: First display = Frame size and input voltage level Second display = Power rating Third display = Output Phase Count	
P0-30	**Serial Number**	-
	Displays the unique serial number of the drive. Dual entry display: First display = Serial number (MSB), Second display = Serial number (LMSB)	
P0-31	**Run Time Since Date of Manufacturer**	HH:MM:SS
	Two entry display: First display shows hours. Second display shows minutes and seconds Displays the total operating time of the drive.	
P0-32	**Run Time Since Last Trip 1**	HH:MM:SS
	Two entry display: First display shows hours. Second display shows minutes and seconds Displays the total operating time of the drive since the last fault occurred. Run-time clock stopped by drive disable (or trip), reset on next enable only if a trip occurred. Reset also on next enable after a drive power down.	
P0-33	**Run Time Since Last Trip 2**	HH:MM:SS
	Two entry display: First display shows hours. Second display shows minutes and seconds Displays the total operating time of the drive since the last fault occurred. Run-time clock stopped by drive disable (or trip), reset on next enable only if a trip occurred (under-volts not considered a trip) – not reset by power down / power up cycling unless a trip occurred prior to power down.	
P0-34	**Run Time Since Last Disable**	HH:MM:SS
	Two entry display: First display shows hours. Second display shows minutes and seconds Displays the total operating time of the drive since the last Run command was received.	
P0-35	**Fan Run Time**	Hours
	Displays the total operating time of the Optidrive internal cooling fans. Two entry display: First display shows user resettable time (reset with P6-22). Second display shows none resettable time. This is used for scheduled maintenance information	
P0-36	**DC Bus Voltage Log (256ms)**	Volts
	Diagnostic log for DC bus voltage. Values logged every 256mS with 8 samples total. Logging suspended on drive trip.	
P0-37	**DC Bus Voltage Ripple Log (20ms)**	Volts
	Diagnostic log for DC bus voltage ripple. Values logged every 20mS with 8 samples total. Logging suspended on drive trip.	
P0-38	**Heatsink Temperature Log (30s)**	°C
	Diagnostic log for heatsink temperature. Values logged every 30S with 8 samples total. Logging suspended on drive trip.	
P0-39	**Drive Internal Temperature Log (30s)**	°C
	Diagnostic log for drive internal temperature. Values logged every 30S with 8 samples total. Logging suspended on drive trip.	
P0-40	**Motor Current Log (256ms)**	A
	Diagnostic log for Motor Current. Values logged every 256mS with 8 samples total. Logging suspended on drive trip.	
Note	The above parameters (P0-36 to P0-40) are used to store the history of various measured levels within the drive at various regular time intervals prior to a trip. The values are frozen when a fault occurs and can be used for diagnostic purposes.	
P0-41	**Over Current Fault Counter**	-
P0-42	**Over Voltage Fault Counter**	-
P0-43	**Under Voltage Fault Counter**	-
P0-44	**Heatsink Over Temperature Fault Counter**	-
P0-45	**Brake Chopper Short Circuit Fault Counter**	-
P0-46	**Ambient Over Temperature Fault Counter**	-
Note	These parameters (P0-41 to P0-46) contain a record of how many times certain critical faults have occurred during a drives operating lifetime. This provides useful diagnostic data	
P0-47	**I/O comms fault counter**	-
	Displays the number of communication errors detected by the I/O processor in messages received from the power stage processor since the last power up	
P0-48	**DSP comms fault counter**	-
	Displays the number of communication errors detected by the Power Stage processor in messages received from the I/O processor since the last power up	
P0-49	**Modbus RTU / BACnet Fault Counter**	-
	This parameter is incremented every time an error occurs on the Modbus RTU communication link. This information can be used for diagnostic purposes.	

Par	Description	Units
P0-51	**PDI Cyclic Data**	-
	Displays the incoming PDI processor data when a fieldbus interface is connected and operating that supports process data interchange, useful for fieldbus diagnostics and trouble shooting.	
P0-52	**PDO Cyclic Data**	-
	Displays the outgoing PDO processor data when a fieldbus interface is connected and operating that supports process data interchange, useful for fieldbus diagnostics and trouble shooting.	
P0-53	**Current Phase U Offset and Ref**	-
	Index 1 : Reference Index 2 : Sampled Value	
P0-54	**Current Phase V Offset and Ref**	-
	Index 1 : Reference Index 2 : Sampled Value	
P0-55	**Last Fire Mode Activation Time**	Hours
	Specifies the time (from the drive lifetime clock) at which the Fire Mode was last activated	
P0-56	**Fire Mode Activation Period**	Minutes
	Specifies the duration of the last fire mode activation	
P0-57	**Ud / Uq**	-
	Index 1 : Ud Index 2 : Uq	
P0-58	**Load Profile Current Values**	A
	This parameter has 5 indeces which hold the load profile current values following the activation of the torque monitoring function where the drive carries out a load profile autotune. See P8-06 for further information	
P0-59	**Frequency Input Reference**	Hz / Rpm
	Displays the speed setpoint when a frequency input is used for the speed reference.	
P0-60	**Fire Mode Total Activation Time**	Minutes
	Specifies the total accumulated time that fire mode has been activated on the drive	
P0-61	**Relay Control Speed Hysteresis Value**	Hz / rpm
	Displays the speed hysteresis value in use for output relay settings that use hysteresis, defined by P6-04.	
P0-62	**Fire Mode Total Acitvation Counter**	-
	Specifies the total number of times that Fire Mode has been activated on the drive	
P0-63	**Post Ramp Speed Reference**	Hz / rpm
	Displays the speed reference after all ramps and limits are applied.	
P0-64	**Internal Effective Switching Frequency**	-
	Shows the effective switching frequency presently active.	
P0-65	**Drive Life Time**	-
	Displays the total time for which the drive has been powered on. The value is not resettable.	
P0-66	**Function Block Program ID**	-
	Displays the ID of any internally loaded Function Block Program.	
P0-67	**Overload Integration Level**	**%**
	Displays the value of the motor thermal overload integration level in %. The value in this parameter will increase if the motor current is greater than the motor rated current (P1-08) or decrease if the motor current is lower than the motor rated current. When this value reaches 100% the drive will trip out on It.trP	
P0-68	**User Ramp Value**	s
	Displays the “User Ramp Time” value, which may be set via the internal Function Block Program.	
P0-69	**I2C Error Count**	-
P0-70	**Option Module Type**	-
	Displays the type of option module fitted in the drive option slot. The displayed values are PL-EI O : Extended I/O or Cascade Module PL-bUS : Fieldbus Interface PL-UnF : No Module Fitted PL-UnA : Unkown or onrecognised Module	
P0-71	**Fieldbus Interface Type**	-
	Displays the type of option module, if fitted in the drive option slot. The displayed values are n.A : No Filedbus Module ProF-b : Profibus Module fitted dE-nEt : DeviceNet Module fitted Eth-I P : Ethernet IP Module fitted bAC-I P : BACnet IP Module fitted	
P0-72	**Drive Internal Temperature**	°C
	Internal Value	
P0-73	**24 Hour Timer**	H:MM
	Internal Value	

Par	Description	Units
P0-74	**L1 – L2 Input Voltage**	Volts
	Displays the supply voltage measured between L1 and L2 terminals, for indication to the user	
P0-75	**L2 – L3 Input Voltage**	Volts
	Displays the supply voltage measured between L2 and L3 terminals, for indication to the user	
P0-76	**L3 – L1 Input Voltage**	Volts
	Displays the supply voltage measured between L3 and L1 terminals, for indication to the user	
P0-77	**Test Parameter 1 / 2**	-
	Internal Value	
P0-78	**Test Parameter 3 / 4**	-
	Internal Value	
P0-79	**Motor Control & DSP Version**	-
	Internal Value	
P0-80	**User Defined Internal Parameter**	-
	Internal Value. Refer to section 1.6 for further information.	

1.6. P6-28 Value Selection

Parameter P6-28 allows the user to select an internal register which can then be displayed in parameter P0-80.
To display any value from the list below, enter the corresponding index value in to P6-28.
E.g. setting P6-28 = 48 reads out the 24hour timer value in P0-80

Note that any of these variables can also be read out via the plug-in Fieldbus modules by setting PDO-3 or PDO-4 to P0-80 – see section 1.3.5.

Address	Function Description	R/W	Remark		Address	Function Description	R/W	Remark
0	Off condition	R	Binary		81	Motor speed	R	Data
1	Digital input 1	R	Binary		82	Motor current	R	Data
2	Digital input 2	R	Binary		83	Motor torque	R	Data
3	Digital input 3	R	Binary		84	Motor power	R	Data
4	Digital input 4	R	Binary		85	PID speed reference	R	Data
5	Digital input 5	R	Binary		86	DC bus voltage	R	Data
6	Digital input 6	R	Binary		87	Drive temperature	R	Data
7	Digital input 7	R	Binary		88	AMB temperature	R	Data
8	Digital input 8	R	Binary		89	Scaling display value 1	R	Data
9	Analog output 1	R	Data		90	Scaling display value 2	R	Data
10	Analog output 2	R	Data		91	Reserved	R	
11	Digital output 1	R	Binary		92	Reserved	R	
12	Digital output 2	R	Binary		93	Extension IO input	R	Data
13	Digital output 3	R	Binary		94	Reserved	R	
14	Digital output 4	R	Binary		95	Reserved	R	
15	Digital output 5	R	Binary		96	Plug-In module ID	R	Data
16	On condition	R	Binary		97	Anybus module type ID	R	Data
17	User register 1 (RAM)	RW	Binary/Data		98	Anybus module error	R	Data
18	User register 2 (RAM)	RW	Binary/Data		99	Anybus status	R	Data
19	User register 3 (RAM)	RW	Binary/Data		100	Reserved	R	Data
20	User register 4 (RAM)	RW	Binary/Data		101	Scope channel 1 data	R	Data
21	User register 5 (RAM)	RW	Binary/Data		102	Scope channel 2 data	R	Data
22	User register 6 (RAM)	RW	Binary/Data		103	Scope channel 3 data	R	Data
23	User register 7 (RAM)	RW	Binary/Data		104	Scope channel 4 data	R	Data
24	User register 8 (RAM)	RW	Binary/Data		105	OLED language index	R	Data
25	User register 9 (RAM)	RW	Binary/Data		106	OLED display version	R	Data
26	User register 10 (RAM)	RW	Binary/Data		107	Reserved	R	
27	User register 11 (RAM)	RW	Binary/Data		108	Drive Rating ID	R	Data
28	User register 12 (RAM)	RW	Binary/Data		…	Reserved	R	
29	User register 13 (RAM)	RW	Binary/Data		119	FS8 Stir Fan Speed	R	Data
30	User register 14 (RAM)	RW	Binary/Data		…			
31	User register 15 (RAM)	RW	Binary/Data		123	Function Block Program Cycle Time	R	Data
32	User analog output 1	RW	Data		124	Function Block Program ID	R	Data
33	User analog output 2	RW	Data		…	Reserved	R	
34	Reserved	RW	Data		130	kWh meter (user resettable)	R	Data
35	Reserved	RW	Data		131	MWh meter (user resettable)	R	Data
36	User relay/digital output 1	RW	Binary		132	kWh meter (fixed)	R	Data
37	User relay/digital output 2	RW	Binary		133	MWh meter (fixed)	R	Data
38	User relay/digital output 3	RW	Binary		134	Total run hour	R	Data
39	User relay/digital output 4	RW	Binary		135	Total run minutes and seconds	R	Data
40	User relay/digital output 5	RW	Binary		136	Run hour since last enable	R	Data
41	User scaling value	RW	Data		137	Run min/sec since last enable	R	Data
42	User scaling decimal	RW	Data		…	Reserved	R	
43	User speed reference	RW	Data		143	Real time clock second	R	Data
44	User torque reference	RW	Data		144	Real time clock minute	R	Data
45	User/fieldbus ramp reference	RW	Data		145	Real time clock hour	R	Data
46	Scope index 1/2	RW	Data		146	Real time clock weekday	R	Data
47	Scope index 3/4	RW	Data		147	Real time clock day	R	Data
48	24hour timer clock (hh:mm)	RW	Data		148	Real time clock month	R	Data
49	User display control register	RW	Data		149	Real time clock year	R	Data
50	User display value register	RW	Data		…	Reserved	R	
…	Reserved	RW			185	User register 16 (RAM)	RW	Binary/Data
61	Analog input 1 (Q12)	R	Data		186	User register 17 (RAM)	RW	Binary/Data
62	Analog input 1 (%)	R	Data		187	User register 18 (RAM)	RW	Binary/Data
63	Analog input 2 (Q12)	R	Data		188	User register 19 (RAM)	RW	Binary/Data
64	Analog input 2 (%)	R	Data		189	User register 20 (RAM)	RW	Binary/Data
65	Digital input status (1~5)	R	Data		190	User register21 (RAM)	RW	Binary/Data
66	Speed reference	R	Data		191	User register 22 (RAM)	RW	Binary/Data
67	Digital speed pod	R	Data		192	User register 23 (RAM)	RW	Binary/Data
68	Field bus speed reference	R	Data		193	User register 24 (RAM)	RW	Binary/Data
69	Master speed reference	R	Data		194	User register 25 (RAM)	RW	Binary/Data
70	Slave speed reference	R	Data		195	User register 26 (RAM)	RW	Binary/Data
71	Frequency speed reference	R	Data		196	User register 27 (RAM)	RW	Binary/Data
72	Torque reference (Q12)	R	Data		197	User register 28 (RAM)	RW	Binary/Data
73	Torque reference (%)	R	Data		198	User register 29 (RAM)	RW	Binary/Data
74	Master torque reference	R	Data		199	User register 30 (RAM)	RW	Binary/Data
75	Fieldbus torque reference	R	Data		200	User register 31 (RAM)	RW	Binary/Data
76	PID user reference	R	Data					
77	PID user feedback	R	Data					
78	PID reference	R	Data					
79	PID feedback	R	Data					
80	PID output	R	Data					

2. Diagnostic and Fault Messages

Fault Code	No.	Description		Fault Code	No.	Description
no-Flt	00	No Fault		AtF-01	40	Measured motor stator resistance varies between phases.
	01	Reserved		AtF-02	41	Measured motor stator resistance is too large.
	02	Reserved		AtF-03	42	Measured motor inductance is too low.
O-I	03	Instantaneous over current		AtF-04	43	Measured motor inductance is too large.
I.t-trp	04	Motor Thermal Overload (I2t)		AtF-05	44	Measured motor parameters are non convergent
PS-trp	05	Hardware derived over current trip		Ph-Seq	45	Supply Phase SequenceIncorrect (FS8 Only)
O-Volt	06	Over voltage on DC bus		AtF-07	46	Reserved
U-Volt	07	Under voltage on DC bus		AtF-08	47	Reserved
O-t	08	Heatsink over temperature		Pr-lo	48	Low pressure (feedback) detected during pipe fill function
U-t	09	Under temperature		Out-Ph	49	Output (Motor) phase loss
P-dEF	10	Factory Default parameters have been loaded		SC-F01	50	Modbus comms loss fault
E-trip	11	External trip		SC-F02	51	Reserved
SC-ObS	12	Optibus comms loss		SC-F03	52	Anybus module comms loss trip
FLt-dc	13	DC bus ripple too high		SC-F04	53	IO card comms loss trip
P-LOSS	14	Input phase loss trip		SC-F05	54	BACnet comms loss trip
h O-I	15	Instantaneous over current on drive output.		SC-F06	55	Reserved
th-Flt	16	Faulty thermistor on heatsink.		SC-F07	56	Reserved
dAtA-F	17	Internal memory fault. (IO)		SC-F08	57	Reserved
4-20 F	18	4-20mA Signal Lost		SC-F09	58	Reserved
dAtA-E	19	Internal memory fault. (DSP)		SC-F10	59	Reserved
U-dEF	20	User Default Parameters Loaded		OF-01	60	Internal link to option module loss
F-Ptc	21	Motor PTC thermistor trip		OF-02	61	Option module in exceptional condition
FAN-F	22	Cooling Fan Fault		OF-03	62	Reserved
O-hEAt	23	Environmental temperature too high		OF-04	63	Reserved
O-torq	24	Output torque too high – load monitoring enabled		OF-05	64	Reserved
U-torq	25	Output torque too low – load monitoring enabled		OF-06	65	Reserved
Out-F	26	Drive output fault		OF-07	66	Reserved
	27	Reserved		OF-08	67	Reserved
	28	Reserved		OF-09	68	Reserved
STO-F	29	Safety input circuit error		OF-10	69	Reserved
	30	Reserved		PLC-01	70	Unsupported Function Block Program block
	31	Reserved		PLC-02	71	Function Block Program over size
	32	Reserved		PLC-03	72	Divide by 0
	33	Reserved		PLC-04	73	Lower limit larger than higher limit
	34	Reserved		PLC-05	74	Table function block index overflow
	35	Reserved		PLC-06	75	Reserved
	36	Reserved		PLC-07	76	Reserved
	37	Reserved		PLC-08	77	Reserved
	38	Reserved		PLC-09	78	Reserved
	39	Reserved		PLC-10	79	Reserved

3. Immunity Tests

3.1. Electrostatic Discharge (ESD)

The Optidrive Eco product range has been designed and tested to comply with the limits defined in EN 61800-3:2004+A1-2012. The test techniques used are as defined in EN 61000-4-2:2009.

Application	Test points	Test Method	Level
Direct	Control Terminals	Contact Discharge	±4kV
		Air Discharge	±8kV
	Power Terminals	Air Discharge	±8kV
Indirect	Vertical coupling plane	Contact Discharge	±4kV
	Horizontal coupling plane	Contact Discharge	±4kV

3.2. Electrical Fast Transient Burst (EFT/B)

The Optidrive Eco product range has been designed and tested to comply with the limits defined in EN 61800-3: 2004+A1-2012. The test techniques used are as defined in EN 61000-4-4:2004.

Test points	Test Method	Level
Control Terminals	Capacitive clamp	±1kV at 5kHz
Motor Power Terminals	Capacitive clamp	±2kV at 5kHz
1-PH Supply Power Terminals	Coupling Decoupling Network	±2kV at 5kHz
3-PH Supply Power Terminals	Capacitive clamp	±4kV at 5kHz

3.3. Surge

The Optidrive Eco product range has been designed and tested to comply with the limits defined in EN 61800-3: 2004+A1-2012. The test techniques used are as defined in EN 61000-4-5:2006.

Drive Type	Test Method	Level
200-240V	Line to Line/Neutral	±1kV
	Line/Neutral to Earth	±2kV
380-480V	Line to Line	±2kV
	Line to Earth	±4kV

3.4. Dielectric strength (Flash)

The Optidrive Eco product range has been designed and tested to comply with the limits defined in EN 61800-5-1: 2007. The test techniques used are as defined in EN 61800-5-1: 2007.

Drive Type	Level
200-240V	1.5kV
380-480V	2.5kV

4. General Technical and Performance Data

4.1. Electrical Data

4.1.1. Mains Supply Details	
Supply Voltage Range	230 Volt Units – 200 – 240 Volt +10% / -10% 400 Volt Units – 380 – 480 Volt +10% / -10% 600 Volt Units – 500 – 600 Volt +10% / -10%
Supply Frequency	48 – 62Hz
Inrush Current	< rated input current
Power Up Cycles	>120 x / hr, evenly spaced
Single Phase Operation	This is only possible with the dedicated single phase input drives – supplying a three phase drive with single phase is not possible in this product range
4.1.2. Motor Control	
Output Frequency Range	0 to 500Hz in 0.1 Hz steps Max Output Frequency = Max Switching Frequency / 16.
Output Voltage Range	0 to Supply Voltage
Speed Regulation	Open Loop < 1% motor rated speed
Effective Switching Frequency	4 – 32kHz – Drive size dependant
Acceleration Time	Four independent acceleration ramps 0 – 600 seconds, 0.01s resolution (Frame 2 & 3) 0 – 6000 seconds, 0.1s resolution (Frame 4 & above)
Deceleration Time	Four individual deceleration ramps 0 – 600 seconds, 0.01s resolution (Frame 2 & 3) 0 – 6000 seconds, 0.1s resolution (Frame 4 & above)
4.1.3. Overload Capacity	
Overload Capacity	110% of rated current for 60 seconds, repeat cycle every 10 minutes. 150% of rated current for 1 second, repeat cycle every 10 minutes

4.2. Digital & Analog I/O

4.2.1. Digital Inputs Specification

Voltage Range	8 – 30 V dc, Internal or External supply, NPN (positive logic)
Response Time	< 8ms

4.2.2. Inhibit (Safe) Input

Voltage Range	Inhibit input 18 – 30V dc
Response Time	Inhibit input < 100us for shutdown

4.2.3. Analog Inputs Specification

Range	Current : 0-20mA, 4-20mA. 20mA max input current Voltage: -10-10V (Analog Input 1 Only), 0-10V, 0-5V, 0/24V, 30V max input
Resolution	Analog Input 1: 12-bit + sign, <16ms response time (bipolar) Analog Input 2: 12-bit, <16ms response time (Uni-Polar)
Accuracy	better than 1% of full scale
Scaling & Offset	Parameter adjustable

4.2.4. Analog Outputs Specification

Range	Current : 0..20mA, 4..20mA, 20mA max Analog : 0..10V, 0 / 24V (digital), 20mA max
Resolution	10-bit
Accuracy	better than 1% of full scale

4.2.5. Relay Outputs (1x N.O, 1x C.O)

Maximum Switching Voltage :	250VAC, 30 VDC
Maximum Switching Current :	5A at 30 Volt DC, 6A at 250 Volt AC

4.3. Environmental Data

4.3.1. Temperature Range	
Ambient Temperature Range : Operation	IP20 Drives : -10 - +50°C (14 - 122°F) without derating IP55 & IP66 Drives : -10 - + 40°C (14 - 104°F) without derating
Note : No frost or condensation permissible	
Ambient Temperature Range : Storage	-40 … 60 ºC. No Frost or Condensation
4.3.2. Altitude	
Maximum Altitude (No derating)	1000m Derate above 1000m by 1% per 100m
Maximum Altitude (UL Approved)	2000m
Maximum Altitude	4000m
4.3.3. Relative Humidity	
Relative Humidity Limit	95% Maximum, non-condensing
4.3.4. Vibration Levels	
Bump Test	Testing in each of three mutually perpendicular axes in turn. Reference standard: IEC 60068-2-29 Severity: 18g, 6ms, half sine No of bumps: 600 (100 per axis)
Random Vibration Test	BS EN61800-5-1
Sinusoidal vibration test	BS EN61800-5-1

4.4. Response Times

Command Source	**Response Time**
STO Input	<25ms
Digital Input	<8ms
Analog Input	<16ms
Modbus RTU Interface	<8ms From receipt of valid command
BACnet MSTP Interface	<8ms From receipt of valid command
Extended I/O Option	<8ms
Plug In Fieldbus Option	<20ms + Fieldbus Cycle Time From receipt of valid command
Master / Slave Function	<8ms, response, 60ms cycle
Power Stage	<10ms to enable output

4.5. Output Current Limit

4.5.1. Overload Operation

Optidrive Eco provides the following

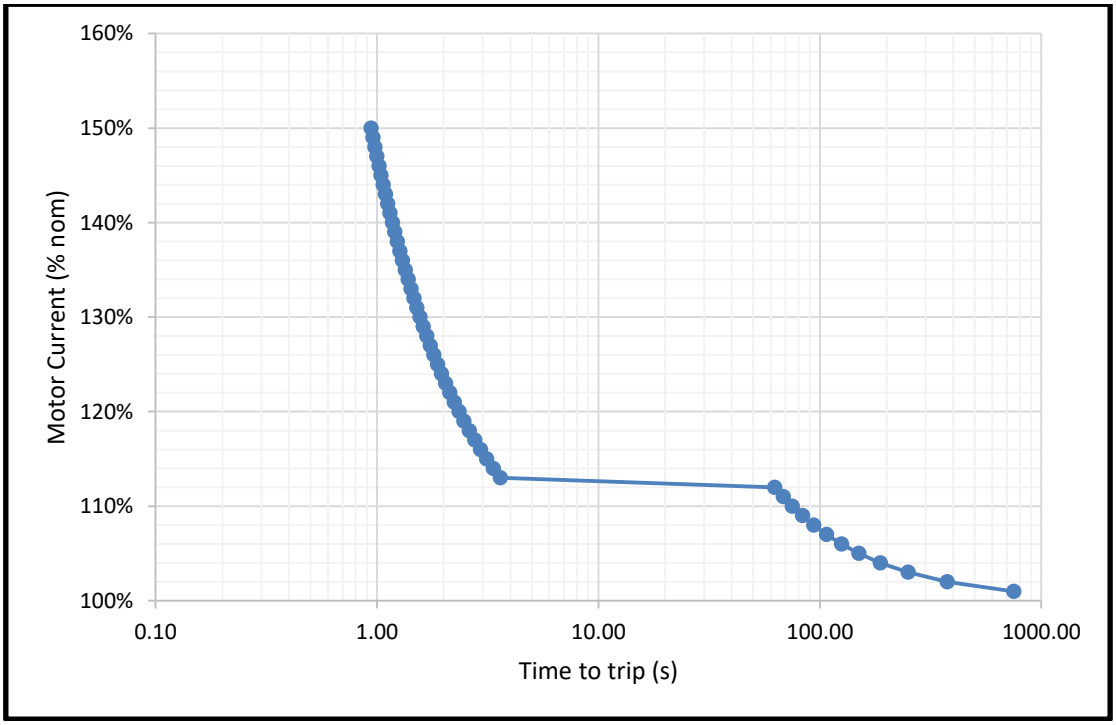
- 110% Output current / 60 Seconds Maximum
- 150% Output current / 0.98 Seconds Maximum

At low output frequency levels, overload accumulation is faster, to account for the reduced motor cooling effect of the fan.

4.5.2. Overview

Optidrive Eco features both hardware and software protection of the output stage to prevent damage. In addition, an Ixt system is used to monitor motor overload condition and prevent damage to the motor due to operation for prolonged periods at high load.
I x t protection is software based, using the value for motor rated current programmed in P1-08. An internal accumulator register is used to estimate the point at which damage may occur to the motor, and operates as follows
Motor Current < P1-08
The accumulator value reduces towards zero. The time required depends on the actual load current as explained further below.
Motor Current = 100% P1-08
The accumulator value remains static.
Motor Current > 100% P1-08 < 110% P1-08
The accumulator value increases at a rate proportional to the overload level, e.g. (Motor Current / Rated current) – 100%. If the overload limit is reached, the drive will trip, displaying it.trp. to protect the motor.
Motor Current > 110% P1-08
For high current levels, the accumulator operates 16 times faster than for current levels below 110% of P1-08.

4.5.3. Overload Curve



4.6. Under / Over Voltage Trip Levels

The following levels are not user adjustable, and define the operating voltage levels of the drive and brake chopper circuit.

Drive Rated Supply Voltage	DC Bus Voltage Level (Volts DC)		
	Under Voltage Trip	Minimum Operating	Over Voltage Trip
200 – 240 Volts AC	160	239	418
380 – 480 Volts AC	320	474	835
480 – 525 Volts AC	360	540	930
500 – 600 Volts AC	400	598	1020

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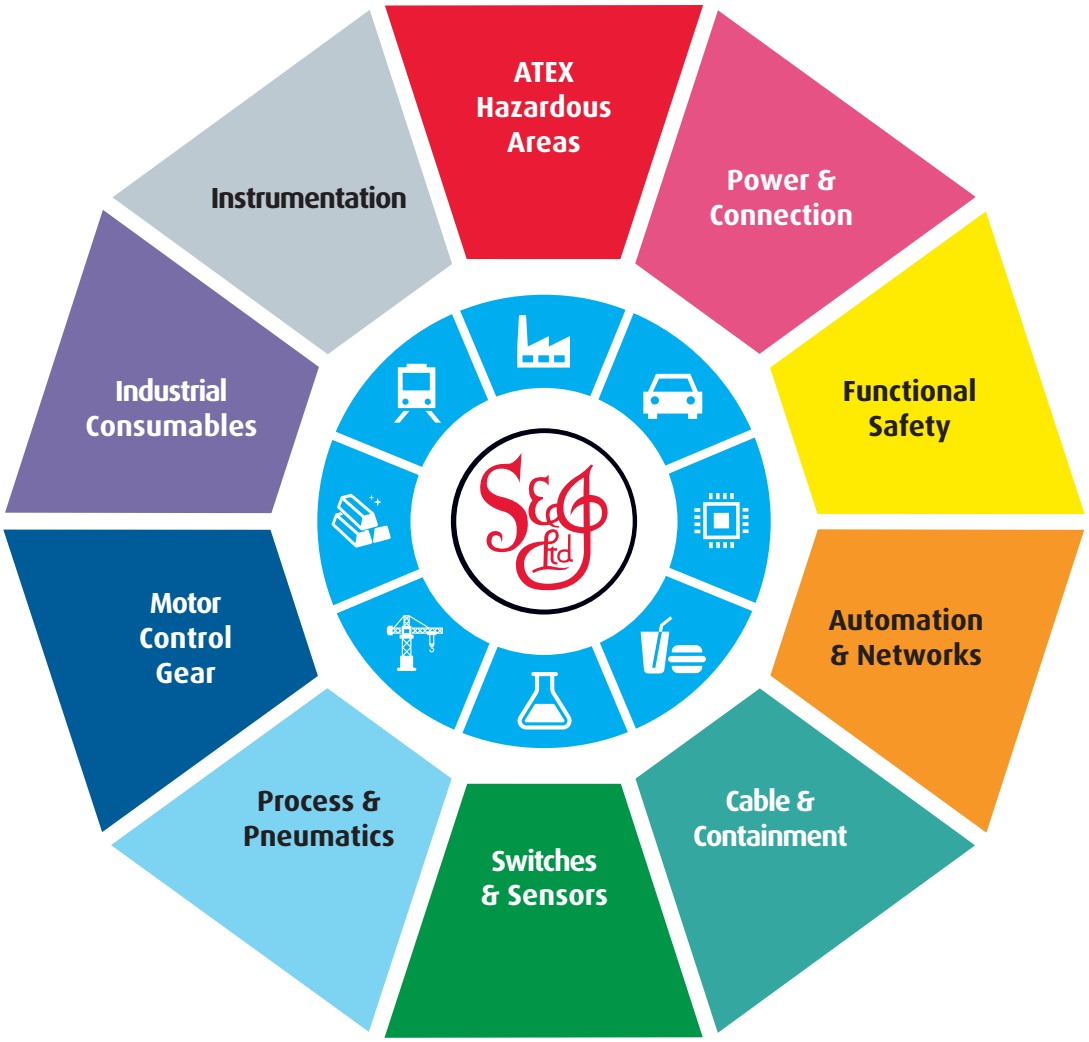

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