Advanced User Manual

HPVFP High Performance Full Function Vector Frequency Inverter

hapn

HP VER 1.00

1. HPVFP 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 HPVFP.

1.2. Parameter Structure Overview

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

Parameter	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 P3-12	PID Controller	Extended	Read / Write
Group 4	P4-01 to P4-12	Motor Control	Extended	Read / Write
Group 5	P5-01 to P5-10	Communications	Extended	Read / Write
Group 6	P6-01 to P6-30	Advanced Functions	Advanced	Read / Write
Group 7	P7-01 to P7-10	Advanced Motor Data	Advanced	Read / Write
Group 8	P8-01 to P8-10	Application Specific Group	Advanced	Read / Write
Group 9	P9-01 to P9-30	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	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				
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	See Below		5.0	Seconds
	Acceleration ramp time from 0 to base speed (P-1-09) in seconds. Note : For HPVFP series Frame Sizes A and B, the parameter range is adjustable between 0.00 and 600.0 seconds For HPVFP series Frame Sizes C and above, the parameter range is adjustable between 0.0 and 6000.0 seconds				
P1-04	Deceleration Ramp Time	See Below		5.0	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 Note : For HPVFP series Frame Sizes A and B, the parameter range is adjustable between 0.00 and 600.0 seconds For HPVFP series Frame Sizes C and above, the parameter range is adjustable between 0.0 and 6000.0 seconds				
P1-05	Stop Mode	0	3	0	
	0 : Ramp To Stop. When the enable signal is removed, the inverter will ramp to stop, with the rate controlled by P1-04 as described above. In this mode, the inverter brake transistor (where fitted) is disabled. 1 : Coast to Stop. When the enable signal is removed, the inverter output is immediately disabled, and the motor will coast (freewheel) to stop. If the load can continue to rotate due to inertia, and the inverter may possibly be re-enabled whilst the motor is still rotating, the spin start function (P2-26) should be enabled. In this mode, the inverter brake transistor (where fitted) is disabled. 2 : Ramp To Stop, Brake Chopper Enabled. When the enable signal is removed, the inverter will ramp to stop, with the rate controlled by P1-04 as described above. The inverter Brake chopper is also enabled in this mode. 3 : Coast to Stop, Brake Chopper Enabled. When the enable signal is removed, the inverter output is immediately disabled, and the motor will coast (freewheel) to stop. If the load can continue to rotate due to inertia, and the inverter may possibly be re-enabled whilst the motor is still rotating, the spin start function (P2-26) should be enabled. The inverter brake chopper is enabled in this mode, however it will only activate when required during a change in the inverter frequency setpoint, and will not activate when stopping.				
P1-06	Energy Optimiser	0	1	0	
	Only active when enhanced V/F motor control mode is selected (P4-01 = 2). 0 : Disabled 1 : Enabled. When enabled, the Energy Optimiser attempts to reduce the overall energy consumed by the inverter and motor when operating at constant speeds and light loads. The Energy Optimiser is intended for applications where the inverter may operate for some periods of time with constant speed and light motor load, whether constant or variable torque.				
P1-07	Motor Rated Voltage	According to the inverter rating			Volts
	This parameter should be set to the rated (nameplate) voltage of the motor (Volts) When this parameter is set to the motor nameplate voltage, the output voltage from the inverter 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	According to the inverter rating			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 inverter				
P1-09	Motor Rated Frequency	25	500	50 (60)	Hz
	This parameter should be set to the rated (nameplate) frequency of the motor.				

Par.	Name	Minimum	Maximum	Default	Units
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 inverter 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. Note : When the inverter is operated with the optional Encoder Feedback Interface, this parameter must be set to the correct nameplate Rpm of the connected motor.				
P1-11	V/F Mode Voltage Boost	0.0	See Below	See Below	%
	Voltage boost is used to increase the applied motor voltage at low output frequencies, in order to improve low speed and starting torque. Excessive voltage boost levels may result in increased motor current and temperature, and force ventilation of the motor may be required. An automatic setting (AUto) is also possible, whereby the inverter will automatically adjust this parameter based on the motor parameters measured during an autotune.				
P1-12	Primary Command Source Mode	0	6	0	
	0 : Terminal Control. The inverter responds directly to signals applied to the control terminals. 1 : Uni-directional Keypad Control 1)2)3) The inverter can be controlled in the forward direction only using an external or remote Keypad 2 : Bi-directional Keypad Control 4) The inverter can be controlled in the forward and reverse directions using an external or remote Keypad. Pressing the keypad START button toggles between forward and reverse. 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 inverter acts as a Slave to a connected inverter operating in Master Mode 6 : CAN bus Control. Control via CAN bus connected to the RJ45 serial interface connector Note : When operating with P1-12 = 1 or 2, the inverter 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 inverter 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 inverter after the link is closed between terminals 1 & 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. When operating in this mode and utilising a setting of P1-13 that allows preset speeds to be also selected from the inverter digital inputs, setting a negative value in the preset speed parameter will cause the inverter to reverse the direction of motor rotation. When P1-12 = 2, the direction of motor rotation may be changed by any of the following : a. Pressing the keypad Start button b. A Reverse Digital Input, dependent on the setting of P1-13 c. Selecting a Negative Preset Speed It is important to ensure that a combination of the above used incorrectly does not result in unexpected operation.				
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. See section 1.7 for further information.				
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 inverter parameters				

1.3.2. Parameter Group 2 - Extended parameters

Par.	Name	Minimum	Maximum	Default	Units
P2-01	Preset / Jog Frequency / Speed 1	-P1-01	P1-01	5.0	Hz / Rpm
P2-02	Preset / Jog Frequency / Speed 2	-P1-01	P1-01	10.0	Hz / Rpm
P2-03	Preset / Jog Frequency / Speed 3	-P1-01	P1-01	25.0	Hz / Rpm
P2-04	Preset / Jog Frequency / Speed 4	-P1-01	P1-01	50.0 (60.0)	Hz / Rpm
P2-05	Preset / Jog Frequency / Speed 5	-P1-01	P1-01	0.0	Hz / Rpm
P2-06	Preset / Jog Frequency / Speed 6	-P1-01	P1-01	0.0	Hz / Rpm
P2-07	Preset / Jog Frequency / Speed 7	-P1-01	P1-01	0.0	Hz / Rpm
P2-08	Preset / Jog Frequency / Speed 8	-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 (Refer to section 1.7). 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	P1-02	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 inverter 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 inverter 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 inverter is within the band, the inverter output frequency will remain at the upper or lower limit of the band.				
P2-11	Analog Output 1 (Terminal 8) Function Select	0	11	8	
	Digital Output Mode. Logic 1=+24v DC（20mA Max） 0 : Inverter Enabled (Running). Logic 1 when the inverter is enabled (Running) 1 : Inverter Healthy. Logic 1 When no Fault condition exists on the inverter and the STO input is closed. 2 : At Target Frequency (Speed). Logic 1 when the output frequency matches the setpoint frequency and the inverter is enabled. 3 : Output Frequency > 0.0. Logic 1 when the motor runs above zero speed 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 inverter rated power				
P2-12	Analog Output 1 (Terminal 8) Format			U 0-10	
	U 0-10=0~10V U 10-0=10~0V A 0-20=0~20mA A 20-0=20~0mA A 4-20=4~20mA A 20-4=20~4mA				
P2-13	Analog Output 2 (Terminal 11) Function Select	0	11	9	
	Digital Output Mode. Logic 1=+24v DC 0 : Inverter Enabled (Running). Logic 1 when the inverter is enabled (Running) 1 : Inverter Healthy. Logic 1 When no Fault condition exists on the inverter 2 : At Target Frequency (Speed). Logic 1 when the output frequency matches the setpoint frequency				

Par.	Name	Minimum	Maximum	Default	Units
	3 : Output Frequency > 0.0. Logic 1 when the motor runs above zero speed 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 inverter rated power				
P2-14	Analog Output 2 (Terminal 11) Format			U 0- 10	
	U 0- 10=0~10V U 10- 0=10~0V A 0-20=0~20mA A 20- 0=20~0mA A 4-20=4~20mA A 20- 4=20~4mA				
P2-15	User Relay 1 Output (Terminals 14, 15 & 16) Function select	0	7	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 : Inverter Enabled (Running). Logic 1 when the motor is enabled 1 : Inverter Healthy. Logic 1 when power is applied to the inverter and no fault exists 2 : At Target Frequency (Speed). Logic 1 when the output frequency matches the setpoint frequency 3 : Output Frequency > 0.0 Hz. Logic 1 when the inverter output frequency to the motor is exceeds 0.0Hz 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 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.				
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.				
P2-18	User Relay 2 Output (Terminals 17 & 18) Function select	0	8	0	
	Selects the function assigned to Relay Output 2. The relay has two output terminals, Logic 1 indicates the relay is active, and therefore terminals 17 and 18 will be linked together. 0 : Inverter Enabled (Running). Logic 1 when the motor is enabled 1 : Inverter Healthy. Logic 1 when power is applied to the inverter and no fault exists 2 : At Target Frequency (Speed). Logic 1 when the output frequency matches the setpoint frequency 3 : Output Frequency > 0.0 Hz. Logic 1 when the inverter output frequency to the motor is exceeds 0.0Hz 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				

Par.	Name	Minimum	Maximum	Default	Units
	8 : Hoist Brake Control. When P2-18 = 8, the inverter is set to 'Hoist Mode Operation', and output relay 2 must be used to control the motor holding brake. 9 – 12 : No Function 13 : STO Status. Logic 1 when the STO inputs are present, and the inverter is not in inhibit state **Note :** When using settings 4 – 7, parameters P2-19 and P2-20 must be used together to control the behaviour. The output will switch to Logic 1 when the selected signal exceeds the value programmed in P2-19, and return to Logic 0 when the signal falls below the value programmed in P2-20.				
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	2	0	
	P2-21 & P2-22 allow the user to program the inverter 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 inverter is running. The display will show a ⊂ 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 inverter output frequency is held at zero when stopping, before the inverter output is disabled. This can be utilised to ensure the motor has come to a complete standstill before the inverter 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. When operating in V/F mode, the output voltage and hence current will be dependent on the setting of P1-11. When operating in Vector Mode, the output voltage and current are automatically controlled by the vector algorithm.				
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 inverter power and voltage rating, refer to section 2.1. Higher frequencies reduce the audible 'ringing' noise from the motor, and improve the output current waveform, at the expense of increased inverter 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 inverter, 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 inverter output will be immediately disabled, and the load will coast to stop.				
P2-26	Spin Start Enable	0	1	0	
	0 : Disabled 1 : Enabled. When enabled, on start up the inverter 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 inverter 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. Note: The Spin Start function cannot detect motors which are rotating at speeds above the maximum speed limit parameter (P1-01) setting of the inverter.				

Par.	Name	Minimum	Maximum	Default	Units
P2-27	Standby Mode Timer	0.0	250.0	0.0	Seconds
	This parameter defines time period, whereby if the inverter operates continuously at minimum frequency / speed for at least the set time period, the inverter 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 inverter 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 HPVFP 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 HPVFP will ramp operate at Preset Speed 4 t 20-4= 20 to 4mA Signal, the HPVFP 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 HPVFP will ramp operate at Preset Speed 4				
P2-31	Analog Input 1 Scaling	0.0	500.0	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 P2-33 (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) - 10- 10= -10 to +10 Volt Signal (Bi-polar) A 0-20= 0 to 20mA Signal t 4-20= 4 to 20mA Signal, the HPVFP 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 HPVFP will ramp operate at Preset Speed 4 t 20-4= 20 to 4mA Signal, the HPVFP 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 HPVFP will ramp operate at Preset Speed 4				
P2-34	Analog Input 2 Scaling	0.0	500.0	100.0	%
	Scales the analog input by this factor. See parameter description below for further information.				

Par.	Name	Minimum	Maximum	Default	Units
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%				
P2-36	Start Mode Select / Automatic Restart			AUto-0	
	Defines the behaviour of the inverter relating to the enable digital input and also configures the Automatic Restart function. EdGE-r: Following Power on or reset, the inverter will not start if Digital Input 1 remains closed. The Input must be closed after a power on or reset to start the inverter (e.g. Edge Triggered). AUto-0: Following a Power On or Reset, the inverter will automatically start if Digital Input 1 is closed before power on. AUto- 1 to AUto-5: Following a trip, the inverter will make up to 5 attempts to restart at intervals defined by P6-03 (default 20 seconds). The inverter must be powered down or reset manually to reset the counter . The numbers of restart attempts are counted, and if the inverter fails to start on the final attempt, the inverter will fault with, and will require the user to manually reset the fault.				
P2-37	Keypad / Fieldbus Starting Control	0	7	1	
	This parameter controls the starting behaviour of the inverter when operating in Keypad Mode or Fieldbus Mode (selected by P1-12). Settings 0 to 3 are active in Keypad Mode only (P1-12 = 1 or 2), and define the speed at which the inverter will initially operate following the pressing of the keypad Start button. 0 : Minimum Speed, Keypad Start. Following a stop and restart, the inverter will always initially run at the minimum speed set in P1-02. This applies even if the inverter 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 inverter will return to the last keypad setpoint speed used prior to stopping. 2 : Current Running Speed. Where the inverter is configured for multiple speed references, when switched to keypad mode by a digital input, the inverter 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 inverter, e.g. typically Hand / Auto control or Local / Remote control. 3 : Preset Speed 8, Keypad Start. Following a stop and restart, the inverter will always initially run at Preset Speed 8 (P2-08) 4 : Minimum Speed, Terminal Start. Following a stop and restart, the inverter will always initially run at the minimum speed P1-02. The inverter 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 inverter will return to the last keypad setpoint speed used prior to stopping. The inverter starting is controlled from the digital inputs, based on the setting of P1-13. 6 : Current Running Speed, Terminal Start. Where the inverter is configured for multiple speed references (typically Hand / Auto control or Local / Remote control), when switched to keypad mode by a digital input, the inverter will continue to operate at the last operating speed. The inverter starting is controlled from the digital inputs, based on the setting of P1-13. 7 : Preset Speed 8, Terminal Start. Following a stop and restart, the inverter will always initially run at Preset Speed 8 (P2-08). The inverter starting is controlled from the digital inputs, based on the setting of P1-13.				
P2-38	Mains Loss Ride Through / Stop Control	0	2	0	
	Controls the behaviour of the inverter in response to a loss of mains power supply whilst the inverter is enabled. 0 : Mains Loss Ride Through. The inverter will attempt to continue operating by recovering energy from the motor and connected load. Providing that the mains loss period is short (e.g. a 'Brown Out'), the inverter enable control remains applied and that sufficient energy can be recovered before the inverter control electronics power off, the inverter will automatically maintain motor operation (with reduced output speed depending on the load), and recover back to the normal operating point on return of mains power. Where the mains power supply is lost for a longer period (e.g. a 'Black Out') and there is insufficient kinetic energy available from the load to maintain the inverter electronic power supply, the restarting behaviour of the inverter on return of the power supply will be controlled by P2-36.				

Par.	Name	Minimum	Maximum	Default	Units
	1 : Coast To Stop. On a loss of mains power supply, either 'Brown Out' or 'Black Out', the inverter will immediately disable the output to the motor, allowing the load to coast or free wheel. When using this setting with high inertia loads, which may still be rotating when the mains power returns, the Spin Start function (P2-26) should be enabled. 2 : Fast Ramp To Stop. On a loss of mains power supply, either 'Brown Out' or 'Black Out', the inverter will attempt to decelerate the load to standstill at the rate programmed in the Fast deceleration time (P2-25), by recovering energy from the load. As the speed of the load approaches zero, if the mains power supply has not been restored, the inverter control electronics may power down shortly before the load reaches a complete standstill. If the power returns whilst the inverter is still decelerating the load, and the run signal is maintained, the inverter will resume operation and accelerate the load back to the operating speed. 3 : DC Power Supply. This option should be used where the inverter is powered via the DC Bus terminals.				
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 inverter 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	1	0	
	0 : Analog Input 2 1 : Analog Input 1				

Par.	Name	Minimum	Maximum	Default	Units
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 inverter 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 inverter ramps are always enabled. This parameter is intended to allow the user to disable the inverter 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	0.0	%
	Sets a programmable level whereby if the inverter enters standby motor whilst operating under PID control, the difference between the setpoint and the selected feedback signal increase beyond this threshold before the inverter will return to normal operation.				

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	6	2	
	Selects the motor control method. An autotune must be performed if setting 0 or 1 is used. 0 : IM Motor Vector Speed Control with Torque Limit. Suitable for use with AC induction motors, Vector Speed Control Mode provides greater low speed torque, and improved motor speed regulation with respect to load changes. The inverter primarily operates in Speed Control Mode, where the motor speed is controlled by the chosen setpoint source. When the output torque level approaches the maximum limit, the inverter will reduce the motor speed in attempt to reduce the torque demand required. The factory parameter settings allow a fixed maximum torque limit of 200% set in parameter P4-07. Alternative torque limit settings and variable torque limits may be selected using P4-06 and P4-07. 1 : IM Motor Vector Torque Control with Speed Limit. Suitable for use with AC induction motors, when Vector Torque Control Mode is selected, the inverter primarily operates in Torque Control Mode, where the motor attempt to generate the output torque level required by the torque setpoint source. This will generally cause the motor to accelerate in speed. When the output speed approaches the maximum limit, the inverter will not accelerate beyond this point. The speed limit source should be selected by using P1-12 and P1-13, and the torque reference source should be set in P4-06. 2 : Speed Control (Enhanced V/F). This operating mode is suitable for general purpose operation of standard induction motors. 3 : PM Motor Vector Speed Control. Equivalent to setting 0, but intended for operation of Permanent Magnet motors. 4 : PM Motor Vector Torque Control. Equivalent to setting 1, but intended for operation of Permanent Magnet motors. 5 : BLDC Motor Speed Control. For operation of Brushless DC Motors. 6 : SynRel Motor Speed Control. For operation of Synchronous Reluctance Motors. **Note:** Options 3 to 6 are only available when Advanced Parameter Access has been set.				
P4-02	Motor Parameter Auto-tune Enable	0	1	0	
	When set to 1, the inverter 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 inverter, 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 not require the load to be removed from the motor, or the motor brake to be				

	released.				
Par.	**Name**	**Minimum**	**Maximum**	**Default**	**Units**
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	0.000	1.000	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	0.50	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.				
P4-06	Torque Control Reference / Limit Source	0	5	0	
	When P4-01 = 0, this parameter defines the source for the maximum output torque limit. When P4-01 = 1, this parameter defines the source for the torque reference (setpoint). 0 : Fixed Digital. The torque controller reference / limit is set in P4-07 1 : Analog Input 1. The output torque is controlled based on the signal applied to Analog Input 1, whereby 100% input signal level will result in the inverter output torque being limited by the value set in P4-07. 2 : Analog Input 2. The output torque is controlled based on the signal applied to Analog Input 2, whereby 100% input signal level will result in the inverter output torque being limited by the value set in P4-07. 3 : Fieldbus. The output torque is controlled based on the signal from the communications Fieldbus, whereby 100% input signal level will result in the motor output torque being set or limited to motor rated torque. 4 : Master / Slave. The output torque is controlled based on the signal from the Master / Slave, whereby 100% input signal level will result in the motor output torque being set or limited to motor rated torque. 5 : PID Controller Output. The output torque is controlled based on the output of the PID controller, whereby 100% input signal level will result in the inverter output torque being limited by the value set in P4-07.				
P4-07	Maximum Motoring Torque Limit	P4-08	400.0	200.0	%
	When operating in Vector Speed or Vector Torque motor control modes (P4-01 = 0 or 1), this parameter defines the maximum torque limit or reference used by the inverter in conjunction with P4-06.				
P4-08	Minimum Motoring Torque Limit	0.0	P4-07	0.0	%
	Active only in Vector Speed or Vector Torque motor control modes (P4-01 = 0 or 1). Sets a minimum torque limit, whereby the when the inverter is enabled, it will always attempt to maintain this torque on the motor at all times whilst operating.				
⚠	Note : This parameter should be used with extreme care, as the inverter output frequency will increase to achieve the torque level, and may exceed the selected speed reference				
P4-09	Generator Mode Maximum Torque Limit (Maximum Regenerative Torque)	0.0	200.0	200.0	%
	Active only in Vector Speed or Vector Torque motor control modes. Sets the maximum regenerating torque allowed by the inverter				
P4-10	V/F Characteristic Adjustment Frequency	0.0	100.0	0.0	%
	Entered as a percentage value of P1-09. When operating in V/F mode (P4-01 = 2), this parameter in conjunction with P4-11 sets a frequency point at which the voltage set in P4-11 is applied to the motor. Care must be taken to avoid overheating and damaging the motor when using this feature.				
P4-11	V/F Characteristic Adjustment Voltage	0.0	100.0	0.0	%
	Entered as a percentage of P1-07. Used in conjunction with parameter P4-10				

1.3.5. Parameter Group 5 – Communication Parameters

Par.	Name	Minimum	Maximum	Default	Units
P5-01	Inverter Fieldbus Address	0	63	1	-
	Sets the fieldbus address for the inverter				
P5-02	CAN Open Baud Rate	125	1000	500	kbps
	Sets the baud rate when CAN Open communications are used				
P5-03	Modbus RTU Baud Rate	9.6	115.2	115.2	kbps
	Sets the baud rate when Modbus RTU communications are used				
P5-04	Modbus Data Format				
	Sets the expected Modbus telegram data format as follows n-1: No Parity, 1 stop bit n-2: No parity, 2 stop bits 0-1: Odd parity, 1 stop bit E-1: Even parity, 1 stop bit				
P5-05	Communications Loss Timeout	0.0	5.0	2.0	Seconds
	Sets the watchdog time period for the communications channel. If a valid telegram is not received by the inverter within this time period, the inverter 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 inverter 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 8				
P5-07	Fieldbus Ramp Control	0	1	0	
	Selects whether the acceleration and deceleration ramps are control directly via the Fieldbus, or by internal inverter parameters P1-03 and P1-04. 0 : Disabled. Ramps are control from internal inverter parameters 1 : Enabled. Ramps are controlled directly by the Fieldbus				
P5-08	Fieldbus Process Data Output Word 4 Select	0	4	0	
	When using an optional fieldbus interface, this parameter configures the parameter source for the 4th process data word transferred from the inverter to the network master during cyclic communications 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 : Inverter Heatsink Temperature – 0 to 100 = 0 to 100°C				
P5-12	Fieldbus Process Data Output Word 3 Select				
	When using an optional fieldbus interface, this parameter configures the parameter source for the 3rd process data word transferred from the inverter 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 : Inverter 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 inverter from the network master during cyclic communications 0 : Fieldbus Ramp Control – This option must be selected if the inverter 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 inverter 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 PLC function code, although the value can be read.				

Par.	Name	Minimum	Maximum	Default	Units
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 inverter from the network master during cyclic communications 0 : Torque limit/reference – This option must be selected if the inverter 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 the PLC function. 2 : User register 3 - The value received by the inverter 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 PLC function code, although the value can be read. Refer to section 1.4 for further information.				

1.3.6. Parameter Group 6 – Advanced Functions

Par.	Name	Minimum	Maximum	Default	Units
P6-01	Enable Firmware Upgrade	0	0	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				
P6-02	Automatic Thermal Management	0	3	0	kHz
	This parameter defines the minimum allowed PWM effective switching frequency that can be used in the application. During operation, the inverter measures the power module temperature and will switch automatically to a lower PWM switching frequency if the temperature reaches a certain limit. This parameter determines the lowest frequency that can be used. In the event that the power module temperature continues to increase, the inverter will trip on over temperature.				
P6-03	Auto Reset Time Delay	1	60	20	s
	Sets the delay time which will elapse between consecutive inverter reset attempts when Auto Reset is enabled in P2-36				
P6-04	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 inverter 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				
P6-05	Encoder Speed Feedback Enable	0	1	0	
	0 : Disabled 1 : Enabled. Setting to 1 enables encoder control mode of operation, which requires the optional encoder feedback interface. For correct operation, ensure that the encoder has been properly fitted to the motor and its wiring is connected to the encoder feedback module in accordance with the Encoder Feedback Interface User Guide. Before enabling this parameter, ensure that the sense of rotation is correct by using parameter P0-57 (encoder feedback speed) while running in V/f mode. The sign in P0-57 should match that of the speed reference.				
P6-06	Encoder PPR	0	65535	0	
	When using the optional encoder feedback interface, this parameter should be set to the number of Pulses Per Revolution for the connected encoder. This value has to be set correctly to guarantee proper operation of the inverter when Encoder feedback mode is enabled (P6-05 = 1). Improper setting of this parameter could cause the loss of control of the inverter and / or a trip. If set to zero, encoder feedback will be disabled.				
P6-07	Encoder Feedback Speed Error Trip Level	0.0	50.0	5.0	%
	This parameter defines the maximum permissible speed error between the encoder feedback speed value and the estimated rotor speed calculated by the motor control algorithms. If the speed error exceeds this limit, the inverter will trip. When set to zero, this protection is disabled.				

Par.	Name	Minimum	Maximum	Default	Units
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.				
P6-09	Speed Droop Control	0.0	25.0	0.0	%
	This parameter only applies when the inverter is in vector speed control mode. (P4-01=0) When set to zero, the speed droop control function is disabled. If P6-09 > 0, this parameter effectively defines a slip speed at motor rated output torque. The droop speed is the percentage value of P1-09. Depending on the motor load condition, the reference speed will be reduced by a certain droop value before goes into speed controller, calculated as shown below: Droop speed = P6-09 * P1-09 Droop value = Droop speed * (Motor real torque / Motor rated torque) Speed controller input = Speed reference – Droop value Droop control can be used to provide a small reduction in motor speed in proportion to the applied load. This can be especially useful where multiple motors inverter a common load, and the load should be shared evenly between the motors.				
P6-10	Enable PLC Operation	0	1	0	
	0 : PLC Function Disabled. 1 : PLC Function Enabled. This parameter enables the inverters internal PLC function, and must be set to 1 before any PLC program loaded into the inverter will operate. When set to 0, the PLC program will be disabled.				
P6-11	Speed Holding Time on Enable	0	250	0	s
	Defines a time period for which the inverter will run at Preset Speed 7 (P2-07) when the Enable signal is applied to the inverter. The preset speed can be any value from minimum to maximum frequency and in either direction. This function can be useful in applications requiring a controlled start up behaviour regardless of the normal system operation, and allows the user to program the inverter to always start at the same frequency, with the same direction of rotation for a specified time period before returning to normal operation.				
P6-12	Speed Holding Time on Disable	0	250	0	s
	Defines a time period for which the inverter 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 inverter 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.				
P6-13	Hoist Mode : Brake Release Time	0.0	5.0	0.2	s
	Sets the time for which the inverter will hold at the Brake Release Speed (set in P2-07 - Preset Speed 7) to allow the motor brake to release.				
P6-14	Hoist Mode : Brake Apply Time	0.0	5.0	0.0	s
	Sets the time for which the inverter will hold at the Brake Apply Speed (set in P2-08 - Preset Speed 8) to allow the motor brake to engage. For vertical hoist applications this value should not be set below the time required for the brake to engage (brake response time, as specified by the brake manufacturer). The minimum time is 0.1s.				
P6-15	Hoist Mode : Brake Release Torque Threshold (Torque Prove)	0.0	200.0	8.0	%
	Sets the torque level, as a % of the nominal motor torque, which must be generated prior to the inverter Output Relay 2 closing to signal the motor holding brake to release. This is used to ensure the motor is connected and that sufficient torque has been generated to prevent the load dropping on release of the mechanical brake. The torque threshold function is not active in V/f mode.				
P6-16	Hoist Mode : Torque Threshold Timeout	0.0	25.0	5.0	s
	This parameter sets the time for which, following a start command, the inverter will attempt to apply enough torque to the motor to reach the hoist torque probe level (P6-15). Should the torque probe level not be reached within the set time the inverter will trip.				
P6-17	Maximum Torque Limit Timeout	0.0	25.0	0.0	s
	Sets the maximum time allowed for the motor to be operating at the motor/generator torque limit (P4-07/P4-09) before tripping. This parameter is enabled only for vector control operation.				
P6-18	DC Injection Braking Voltage	0.1	25.0		%
	Sets the amount of dc voltage as a percentage of the nominal voltage (P1-07) that is applied to the motor when a stop command is received. This parameter is enabled only for V/f control.				

Par.	Name	Minimum	Maximum	Default	Units
P6-19	Brake Resistor Resistance Value	See Below	200	See Below	Ohms
	Sets the brake resistor value in Ohms. This value is used for the brake resistor thermal protection.				
P6-20	Brake Resistor Power Rating	0.00	200.00	See Below	kW
	Sets the brake resistor power in kW, with a resolution of 0.1kW. This value is used for the brake resistor thermal protection				
P6-21	Brake Chopper under Temperature Duty Cycle	0.0	20.0	2.0	%
	This parameter defines the duty cycle applied to the brake chopper whilst the inverter is in an under temperature trip state. A brake resistor can be mounted to the inverter heat sink, and used to warm the inverter until the correct operating temperature is reached. This parameter should be used with extreme care, as incorrect adjustment may result in exceeding the rated power capacity of the resistor. External thermal protection for the resistor should always be used to avoid this risk.				
P6-22	Cooling Fan Runtime Counter Reset	0	1	0	
	0 : No Function 1 : Reset. Setting to 1 resets internal Fan run-time counter to zero (as displayed in 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 P0-26 and P0-27).				
P6-24	Maintenance Time Interval	0	60000	0	Hours
	Defines the service interval counter period. This defines the total number of run time hours which must elapse before the service indicator is shown on the inverter OLED display. 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				
P6-28	P0-80 Display Value Index	0	127	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 PLC function.				
P6-29	Save User Parameters as Default	0	1	0	
	Setting this parameter to 1 saves the current parameter settings as "User default parameters". When the User carries out a 3-button default parameter command (UP, DOWN and STOP), the parameter saved when P6-29 was last set to 1 will be restored.				
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 in Groups 6 to 9.				

1.3.7. Parameter Group 7 – Motor Data

⚠	The following parameters are used internally by the inverter 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.				
P7-02	Motor Rotor Resistance (Rr)				Ohms
	For induction motors: phase to phase rotor resistance value in ohms.				
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				

Par.	Name	Minimum	Maximum	Default	Units
P7-06	Motor Stator Inductance : PM Motors (Lsq)	0			
	For permanent magnet motors: phase d-axis stator inductance in Henry (H).				
P7-07	Enhanced Generator Mode	0	1	0	
	Valid in vector control mode and used to achieve better control performance when the inverter system enters regenerative mode.				
P7-08	Motor Parameter Adaptation Enable	0	1	0	
	For Induction motors: This parameter is only effective in vector operation and allows the stator inductance to be adapted during normal operation.				
P7-09	Over Voltage Current Limit	0.0	100.0	1.0	%
	This parameter is only valid in vector speed control mode and will come into function once the inverter 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 inverter, which may cause an Over-voltage trip. A small value in this parameter will limit the motor control torque when the inverter 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 inverter 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 dynamics. If the value is unknown then leave this set to the default value (10).				
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 cable applications. Increasing the value of this parameter will reduce the risk of over-current trips on long motor cables, but will also reduce the maximum available output motor voltage for a given input voltage.				
P7-12	V/F / PM Mode Magnetising Period	0	2000		ms
	This parameter is used to set up a minimum delay time for the magnetising current control in V/F mode when inverter run signal is given. Too small a value may cause the inverter to trip on over-current if the acceleration ramp is very short. In PM motor control mode, this value is used to align the rotor flux on enable.				
P7-13	Vector Speed Control D Gain	0.0	400.0	0.0	%
	Sets the differential gain (%) for the speed controller in vector mode operation.				
P7-14	Low Frequency Torque Boost	0.0	100.0	0.0	%
	Boost current applied at start-up, as % of motor rated current (P1-08). The inverter provides a boost function that can inject some current into the motor at low speed to help ensure the rotor alignment is maintained and to allow effective operation of the motor at lower speeds. To implement low speed boost, run the inverter at the lowest frequency required by the application and increase boost levels to provide both required torque and smooth operation.				
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.				

1.3.8. Parameter Group 8 – Application Specific Parameters

Par.	Name	Minimum	Maximum	Default	Units
P8-01	Acceleration Ramp 2	0.00	See Below	5.0	s
	Sets the ramp rate for Acceleration Ramp 2. The time set in this parameter is defined as the time taken to ramp from 0 to the frequency set in P1-09. For HPVFP series Frame Sizes A and B, the parameter range is adjustable between 0.00 and 600.0 seconds For HPVFP series Frame Sizes C and above, the parameter range is adjustable between 0.0 and 6000.0 seconds				
P8-02	Acceleration Ramp 2 Speed Threshold	0.0	P1-01	0.0	Hz
	Defines the speed boundary at which the Acceleration Ramp changes from Ramp 1 to Ramp 2.				
P8-03	Acceleration Ramp 3	0.00	See Below	5.0	s
	Sets the ramp rate for Acceleration Ramp 3. The time set in this parameter is defined as the time taken to ramp from 0 to the frequency set in P1-09 For HPVFP series Frame Sizes A and B, the parameter range is adjustable between 0.00 and 600.0 seconds For HPVFP series Frame Sizes C and above, the parameter range is adjustable between 0.0 and 6000.0 seconds				
P8-04	Acceleration Ramp 3 Speed Threshold	0.0	P1-01	0.0	Hz

	Defines the speed boundary at which the Acceleration Ramp changes from Ramp 2 to Ramp 3				
Par.	**Name**	**Minimum**	**Maximum**	**Default**	**Units**
P8-05	Acceleration Ramp 4	0.00	See Below	5.0	s
	Sets the ramp rate for Acceleration Ramp 4. The time set in this parameter is defined as the time taken to ramp from 0 to the frequency set in P1-09 For HPVFP series Frame Sizes A and B, the parameter range is adjustable between 0.00 and 600.0 seconds For HPVFP series Frame Sizes C and above, the parameter range is adjustable between 0.0 and 6000.0 seconds				
P8-06	Acceleration Ramp 4 Speed Threshold	0.0	P1-01	0.0	Hz
	Defines the speed boundary at which the Acceleration Ramp changes from Ramp 3 to Ramp 4				
P8-07	Deceleration Ramp 4	0.00	See Below	5.0	s
	Sets the ramp rate for Deceleration Ramp 4. The time set in this parameter is defined as the time taken to ramp from the frequency set in P1-09 to 0 For HPVFP series Frame Sizes A and B, the parameter range is adjustable between 0.00 and 600.0 seconds For HPVFP series Frame Sizes C and above, the parameter range is adjustable between 0.0 and 6000.0 seconds				
P8-08	Deceleration Ramp 4 Speed Threshold	0.0	P1-01	0.0	Hz
	Defines the speed boundary at which the Deceleration Ramp changes from Ramp 4 to Ramp 3.				
P8-09	Deceleration Ramp 3	0.00	See Below	5.0	s
	Sets the ramp rate for Deceleration Ramp 3. The time set in this parameter is defined as the time taken to ramp from the frequency set in P1-09 to 0. For HPVFP series Frame Sizes A and B, the parameter range is adjustable between 0.00 and 600.0 seconds For HPVFP series Frame Sizes C and above, the parameter range is adjustable between 0.0 and 6000.0 seconds				
P8-10	Deceleration Ramp 3 Speed Threshold	0.0	P1-01	0.0	Hz
	Defines the speed boundary at which the Deceleration Ramp changes from Ramp 3 to Ramp 2.				
P8-11	Deceleration Ramp 2	0.00	See Below	5.0	s
	Sets the ramp rate for Deceleration Ramp 2. The time set in this parameter is defined as the time taken to ramp from the frequency set in P1-09 to 0 For HPVFP series Frame Sizes A and B, the parameter range is adjustable between 0.00 and 600.0 seconds For HPVFP series Frame Sizes C and above, the parameter range is adjustable between 0.0 and 6000.0 seconds				
P8-12	Deceleration Ramp 2 Speed Threshold	0.0	P1-01	0.0	Hz
	Defines the speed boundary at which the Deceleration Ramp changes from Ramp 2 to Ramp 1				
P8-13	Ramp Select Control	0	1	0	
	When set to 0, Acceleration and Deceleration Ramps 1 (P1-03 and P1-04) only are selected, unless Parameter Group 9 configuration has been used to select alternate ramps. When Set to 1, the Acceleration and Deceleration Ramps are selected according to the parameters set in P8-01 to P8-12.				

1.3.9. Parameter Group 8 Function Overview

Parameter Group 8 allows for up to 4 separate Acceleration and 4 separate Deceleration times to be defined within the inverter parameters. These acceleration ramps can then be selected based on the inverter output frequency when the function is enabled in P8-13, or can be directly selected using parameter Group 9.

When P8-13 is set to 1, acceleration and deceleration ramps are selected based on the following :

Output Frequency > P8-06 = Acceleration Ramp 4

Output Frequency> P8-04 AND < P8-06 = Acceleration Ramp 3

Output Frequency> P8-02 AND < P8-04 AND < P8-06 = Acceleration Ramp 2

Output Frequency< P8-02 AND < P8-04 AND < P8-06 = Acceleration Ramp 1

Output Frequency > P8-08 = Deceleration Ramp 4

Output Frequency> P8-10 AND <P8-08 = Deceleration Ramp 3

Output Frequency> P8-12 AND < P8-10 AND < P8-08 = Deceleration Ramp 2

Output Frequency< P8-12 AND < P8-10 AND < P8-08 = Deceleration Ramp 1

1.4. Parameter Group 9 – Programmable Logic Functions

1.4.1. Parameter Group 9 Function Overview

Parameter Group 9 allows advanced programming of the inverter, including user defined functions for the digital and analog inputs of the inverter 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 inverter
Data Source Selection	These can be used to select the source for programmable Analog signal sources within the inverter
Function Enable Parameters	These are used to select whether inverter functions are controlled by their usual parameter selection, or have user defined behaviour (e.g. controlled by a PLC program within the inverter written by the user).

The following rules apply to parameter Group 9.

Parameters located within this group cannot be changed unless 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.

When P1-13 is changed from any value >0 to 0, the last settings in parameter Group 9 are retained, hence it is important when working with parameters in Group 9 that the user considers the parameter group as a whole, to avoid possible conflicting settings.

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 inverter. 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:

Programmable Logic Source Selection Options			
No.	**Inverter Display**	**Setting**	**Function**
0	OFF / SAFE	Always Off / STO Input	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	Analog Output 1	Function linked to Analog Output 1 Status
10	AoUt-2	Analog Output 2	Function linked to Analog Output 2 Status
11	doUt- 1	Digital Output 1	Function linked to Relay Output 1 Status
12	doUt-2	Digital Output 2	Function linked to Relay Output 2 Status
13	doUt-3	Digital Output 3	Function linked to Relay Output 3 Status (Requires Extended I/O or Cascade Option)

No.	Inverter Display	Setting	Function
14	doUt-4	Digital Output 4	Function linked to Relay Output 4 Status (Requires Cascade Option)
15	doUt-5	Digital Output 5	Function linked to Relay Output 5 Status (Requires Cascade Option)
16	On	ON	Function permanently enabled
17	USEr- 1	User Register 1	Function linked to User Register 1 (PLC Function)
18	USEr-2	User Register 2	Function linked to User Register 2 (PLC Function)
19	USEr-3	User Register 3	Function linked to User Register 3 (PLC Function)
20	USEr-4	User Register 4	Function linked to User Register 4 (PLC Function)
21	USEr-5	User Register 5	Function linked to User Register 5 (PLC Function)
22	USEr-6	User Register 6	Function linked to User Register 6 (PLC Function)
23	USEr-7	User Register 7	Function linked to User Register 7 (PLC Function)
24	USEr-8	User Register 8	Function linked to User Register 8 (PLC Function)
25	USEr-9	User Register 9	Function linked to User Register 9 (PLC Function)

1.4.3. Data Source Selection Parameters

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

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

Programmable Logic Source Selection Options			
No.	**Inverter Display**	**Setting**	**Reference Source**
0	AnUt- 1	Analog Input 1	Analog Input 1 Signal Level (P0-01)
1	AnUt-2	Analog Input 2	Analog Input 2 Signal Level (P0-02)
2	PrESEt	Preset Speed	Selected Preset Speed
3	d-Pot	Keypad (Motorised Pot)	Keypad Speed Reference (P0-06)
4	P id	PID Controller Output	PID Controller Output (P0-10)
5	SUb-dr	Master Speed Reference	Master Speed Reference (Master / Slave Operation)
6	F-bUS	Fieldbus Speed Reference	Fieldbus Speed Reference PDI2
7	USEr	User Defined Speed Reference	User Defined Speed Reference (PLC Function)
8	PULSE	Frequency Input	Pulse Frequency Input Reference

1.4.4. Parameter Group 9 Descriptions

Par.	Name	Minimum	Maximum	Default	Units
P9-01	Enable Input Logic Source				
	Defines the source of the Inverter Enable function. This function 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 PLC program. Logic 1 : Inverter operation is allowed Logic 0 : Inverter 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 inverter stops using the deceleration time set in P2-25. Logic 1 : Inverter operation is allowed Logic 0 : Inverter 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 : Inverter runs the motor in the forward direction of rotation Logic 0 : Inverter 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 : Inverter runs the motor in the reverse direction of rotation Logic 0 : Inverter 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 inverter simultaneously, the inverter 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 inverter 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 inverter to start. The inverter 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 inverter 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				
P9-08	External Trip Input Logic Source				
	Defines the source of the External Trip command. Logic 1 : Inverter operation is allowed Logic 0 : Inverter 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 inverter. 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 : Inverter operation is controlled from the sources defined in parameters P9-02 to P9-07. Logic 0 : Inverter command source selected by P1-12				
Note	The control sources to the inverter 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				
Par.	**Name**	**Minimum**	**Maximum**	**Default**	**Units**
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 inverter, 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 inverter 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)

P9-24	Acceleration Ramp Select Bit 0 Logic Source		
P9-25	Acceleration Ramp Select Bit 1 Logic Source		
Note	These parameters allow alternative acceleration ramp times to be selected based on the status of the parameters above. In order to use the function, P8-13 must be 0 (default setting), otherwise the ramps are automatically selected based on output frequency. The acceleration ramp time is selected according to the following logic :		

P9-25	P9-24	Acceleration Ramp Parameter
0	0	P1-03
0	1	P8-01
1	0	P8-03
1	1	P8-05

P9-26	Deceleration Ramp Select Bit 0 Logic Source

Par.	Name	Minimum	Maximum	Default	Units
P9-27	Deceleration Ramp Select Bit 1 Logic Source				
Note	These parameters allow alternative deceleration ramp times to be selected based on the status of the parameters above. In order to use the function, P8-13 must be 0 (default setting), otherwise the ramps are automatically selected based on output frequency. The acceleration ramp time is selected according to the following logic :				

P9-27	P9-26	Deceleration Ramp Parameter
0	0	P1-04
0	1	P8-11
1	0	P8-09
1	1	P8-07

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.				
P9-30	Speed Limit Switch Forward Input Logic Source				
	Defines the source of the logic signal used to act as a forward speed limit switch. Once enabled, if the input signal source is logic 0 and the speed reference is greater than 0, the inverter will Fast Stop.				
P9-31	Speed Limit Switch Reverse Input Logic Source				
P9-32	reservation				
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				
P9-40	Torque Reference Data Source Enable	0	1	0	
	0 : Torque Reference / Limit Source Set by P4.06 1 : Torque Reference 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) : Inverter Healthy Relay 4 (Cascade Option Module) : Inverter Tripped Relay 5 (Cascade Option Module) : Inverter Running 1 : Relay Output 1 Function set by User Defined Source				

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

Par.	Description	Units
P0-01	Analog Input 1 Applied Signal Level	%
	Displays the signal level applied to analog input 1 (Terminal 6) after scaling and offsets have been applied.	
P0-02	Analog Input 2 Applied Signal Level	%
	Displays the signal level applied to analog input 2 (Terminal 10) after scaling and offsets have been applied.	
P0-03	Digital Input Status	
	Displays the status of the inverter inputs, starting with the left hand side digit = Digital Input 1 etc.	
P0-04	Pre Ramp Speed Controller Reference	Hz/Rpm
	Displays the set point reference input applied to the inverter internal speed controller	
P0-05	Torque Controller Reference	%
	Displays the set point reference input applied to the inverter internal torque controller	
P0-06	Digital Speed Reference (Motorised Pot)	Hz/Rpm
	Displays the value of the inverter internal Motorised Pot (used for keypad) speed reference	
P0-07	Fieldbus Communication Speed Reference	Hz/Rpm
	Displays the setpoint being received by the inverter from the currently active Fieldbus interface.	
P0-08	PID Reference (Setpoint)	%
	Displays the setpoint input to the PID controller.	
P0-09	PID Feedback Level	%
	Displays the Feedback input signal to the PID controller	
P0-10	PID Controller Output	%
	Displays the output level of the PID controller	
P0-11	Applied Motor Voltage	Volts
	Displays the instantaneous output voltage from the inverter to the motor	
P0-12	Output Torque	%
	Displays the instantaneous output torque level produced by the motor	
P0-13	Trip History Log	
	Displays the last four fault codes for the inverter. Refer to section 0 for further information	
P0-14	Motor Magnetising Current (Id)	Amps
	Displays the motor magnetising Current, providing an auto tune has been successfully completed.	
P0-15	Motor Rotor Current (Iq)	Amps
	Displays the motor Rotor (torque producing) current, providing an auto tune has been successfully completed.	
P0-16	DC Bus Voltage Ripple Level	Volts
	Displays the level of ripple present on the DC Bus Voltage. This parameter is used by the inverter for various internal protection and monitoring functions.	
P0-17	Motor Stator resistance (Rs)	Ohms
	Displays the measured motor stator resistance, providing an auto tune has been successfully completed.	
P0-18	Motor Stator Inductance (Ls)	H
	Displays the measured motor stator inductance, providing an auto tune has been successfully completed.	
P0-19	Motor Rotor Resistance (Rr)	Ohms
	Displays the measured motor rotor resistance, providing an auto tune has been successfully completed.	
P0-20	DC Bus Voltage	Volts
	Displays the instantaneous DC Bus Voltage internally within the inverter	
P0-21	Inverter Temperature	°C
	Displays the Instantaneous Heatsink Temperature measured by the inverter	
P0-22	Time Remaining to next service	Hours
	Displays the number of hours remaining on the service time counter before the next service is due.	
P0-23	Operating Time Accumulated With Heatsink Temperature Above 85°C	HH:MM:SS
	Displays the amount of time in hours and minutes that the inverter has operated for during its lifetime with a heatsink temperature in excess of 85°C. This parameter is used by the inverter for various internal protection and monitoring functions.	
P0-24	Operating Time Accumulated With Ambient Temperature Above 80°C	HH:MM:SS
	Displays the amount of time in hours and minutes that the inverter has operated for during its lifetime with an ambient temperature in excess of 80°C. This parameter is used by the inverter for various internal protection and monitoring functions.	

Par.	Description	Units
P0-25	Rotor Speed (Estimated or Measured)	Rpm
	In Vector control mode, this parameter displays either the estimated rotor speed of the motor, if no encoder feedback is present, or the measured rotor speed if an optional Encoder Feedback Interface Option is fitted.	
P0-26	Energy Consumption kWh Meter	kWh
	Displays the amount of energy consumed by the inverter in kWh. When the value reaches 1000, it is reset back to 0.0, and the value of P0-27 (*MWh meter) is increased. This parameter contains 2 values. The first value, visible when entering the parameter, is the User Resettable kWh meter, which can be reset by setting P6-23 = 1. The second value cannot be reset by the user, and indicates the energy consumed by the inverter when operating since the date of manufacture.	
P0-27	Energy Consumption MWh Meter	MWh
	Displays the amount of energy consumed by the inverter in MWh. This parameter contains 2 values. The first value, visible when entering the parameter, is the User Resettable MWh meter, which can be reset by setting P6-23 = 1. The second value cannot be reset by the user, and indicates the energy consumed by the inverter when operating since the date of manufacture.	
P0-28	Software Version and Checksum	
	Displays the software version of the inverter	
P0-29	Inverter Type	
	Displays the type details of the inverter	
P0-30	Inverter Serial Number	
	Displays the unique serial number of the inverter.	
P0-31	Inverter Lifetime Operating Time	HH:MM:SS
	Displays the total operating time of the inverter. The first value shown is the number of hours. Pressing the Up key will display the minutes and seconds.	
P0-32	Inverter Run Time Since Last Trip (1)	HH:MM:SS
	Displays the total operating time of the inverter since the last fault occurred. The first value shown is the number of hours. Pressing the Up key will display the minutes and seconds.	
P0-33	Inverter Run time Since Last Trip (2)	HH:MM:SS
	Displays the total operating time of the inverter since the last fault occurred. The first value shown is the number of hours. Pressing the Up key will display the minutes and seconds.	
P0-34	Inverter Run Time Since Last Disable	HH:MM:SS
	Displays the total operating time of the inverter since the last Run command was received. The first value shown is the number of hours. Pressing the Up key will display the minutes and seconds.	
P0-35	Inverter Internal Cooling Fan Total Operating Time	HH:MM:SS
	Displays the total operating time of the inverter internal cooling fans. The first value shown is the number of hours. Pressing the Up key will display the minutes and seconds. This is used for scheduled maintenance information	
P0-36	DC Bus Voltage Log (256ms)	Volts
P0-37	DC Bus Voltage Ripple Log (20ms)	Volts
P0-38	Heatsink Temperature Log (30s)	°C
P0-39	Ambient Temperature Log (30s)	°C
P0-40	Motor Current Log (256ms)	Amps
	The above parameters are used to store the history of various measured levels within the inverter 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	Critical Fault Counter – Over Current	
P0-42	Critical fault counter – Over Voltage	
P0-43	Critical fault counter – Under Voltage	
P0-44	Critical fault counter – Over Temperature	
P0-45	Critical fault counter – Brake Transistor Over Current	
P0-46	Critical fault counter – Ambient Over Temperature	
	These parameters contain a record of how many times certain critical faults have occurred during a inverters operating lifetime. This provides useful diagnostic data	
P0-47	Reserved	
P0-48	Reserved	

Par.	Description	Units
P0-49	Modbus RTU Communication Error Counter	
	This parameter is incremented every time an error occurs on the Modbus RTU communication link. This information can be used for diagnostic purposes.	
P0-50	CAN Open Communication Error Counter	
	This parameter is incremented every time an error occurs on the CAN Open communication link. This information can be used for diagnostic purposes.	
P0-51	Reserved	
P0-52	Reserved	
P0-53	Current Phase U Offset and Ref	
P0-54	Current Phase V Offset and Ref	
P0-55	Current Phase W Offset and Ref	
P0-56	Brake Max On Time and Duty Cycle	
P0-57	Ud / Uq	
P0-58	Encoder Feedback Speed Value	
P0-59	Frequency Input Reference	
P0-60	Calculated Slip Speed Value	
P0-61	Relay Control Speed Hysteresis Value	
P0-62	Droop Speed	
P0-63	Post Ramp Speed Reference	
P0-64	Internal Effective Switching Frequency	
P0-65	Inverter Life Time	
P0-66	Calculated Power Factor	
P0-67	Fieldbus Torque Reference	
P0-68	User Ramp Value	
P0-69	I2C Error Count	
P0-70	Option Module Type	
	Displays the type of option module fitted in the inverter option slot.	
P0-71	Fieldbus Interface Type	
	Displays the type of fieldbus interface, if fitted in the inverter option slot	
P0-72	Ambient Temperature	
	Internal Value	
P0-73	24 Hour Timer	
	Internal Value	
P0-74	L1 Input	
	Internal Value	
P0-75	L2 Input	
	Internal Value	
P0-76	L3 Input	
	Internal Value	
P0-77	Test Parameter	
	Internal Value	
P0-78	Test Parameter	
	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	Inverter 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	…	Reserved	R	…
27	User register 11 (RAM)	RW	Binary/Data	124	PLC user ID	R	Data
28	User register 12 (RAM)	RW	Binary/Data	…	Reserved	R	…
29	User register 13 (RAM)	RW	Binary/Data	130	kWh meter (user resettable)	R	Data
30	User register 14 (RAM)	RW	Binary/Data	131	MWh meter (user resettable)	R	Data
31	User register 15 (RAM)	RW	Binary/Data	132	kWh meter (fixed)	R	Data

Address	Function Description	R/W	Remark	Address	Function Description	R/W	Remark
32	User analog output 1	RW	Data	133	MWh meter (fixed)	R	Data
33	User analog output 2	RW	Data	134	Total run hour	R	Data
34	Reserved	RW	Data	135	Total run minutes and seconds	R	Data
35	Reserved	RW	Data	136	Run hour since last enable	R	Data
36	User relay/digital output 1	RW	Binary	137	Run min/sec since last enable	R	Data
37	User relay/digital output 2	RW	Binary	…	Reserved	R	…
38	User relay/digital output 3	RW	Binary	143	Real time clock second	R	Data
39	User relay/digital output 4	RW	Binary	144	Real time clock minute	R	Data
40	User relay/digital output 5	RW	Binary	145	Real time clock hour	R	Data
41	User scaling value	RW	Data	146	Real time clock weekday	R	Data
42	User scaling decimal	RW	Data	147	Real time clock day	R	Data
43	User speed reference	RW	Data	148	Real time clock month	R	Data
44	User torque reference	RW	Data	149	Real time clock year	R	Data
45	User/fieldbus ramp reference	RW	Data	…	Reserved	R	
46	Scope index 1/2	RW	Data	255	Dummy register	R	
47	Scope index 3/4	RW	Data				
48	24hour timer clock (hh:mm)	RW	Data				
49	User display control register	RW	Data				
50	User display value register	RW	Data				
…	Reserved	RW					
61	Analog input 1 (Q12)	R	Data				
62	Analog input 1 (%)	R	Data				
63	Analog input 2 (Q12)	R	Data				
64	Analog input 2 (%)	R	Data				
65	Digital input status (1~5)	R	Data				
66	Speed reference	R	Data				
67	Digital speed pod	R	Data				
68	Field bus speed reference	R	Data				

Address	Function Description	R/W	Remark	Address	Function Description	R/W	Remark
69	Master speed reference	R	Data				
70	Slave speed reference	R	Data				
71	Frequency speed reference	R	Data				
72	Torque reference (Q12)	R	Data				
73	Torque reference (%)	R	Data				
74	Master torque reference	R	Data				
75	Fieldbus torque reference	R	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				

1.7. Control Terminal Connections

For standard applications and operation, the basic control of the inverter and functions of all inverter input terminals can be configured using just two parameters, P1-12 and P1-13. P1-12 is used to define the source of all control commands and the primary speed reference source. P1-13 then allows fast selection of Analog and Digital Input functions based on a selection table.

For applications which require a combination of control source and input functions which are not available using the standard approach, control sources can be manually configured in Parameter Group 9. To enable this User Defined function, both P1-12 and P1-13 must be set to 0.

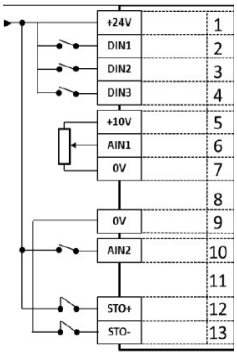
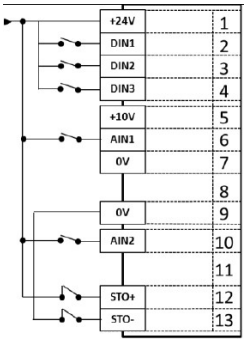
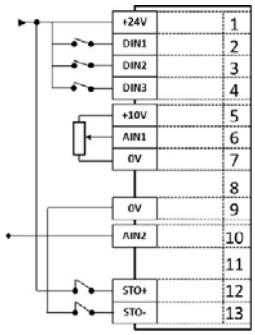
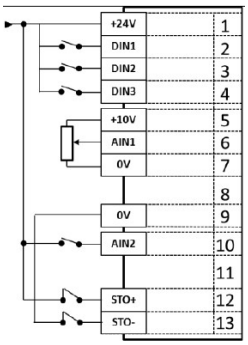
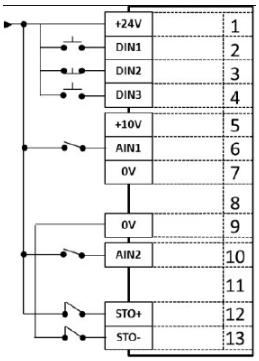
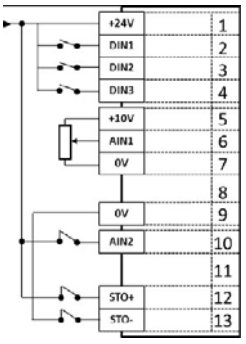
1.7.1. P1-12 Function

P1-12 is used to select the main control source of the inverter and the main speed reference according to the following table

P1-12	Function	Control Source	Main Speed Reference	Notes
0	Terminal Control	Terminals	Analog Input 1	
1	Keypad Control	Keypad / Terminals	Motorised Pot / Keypad	When keypad mode is selected, the default operation of the inverter requires the keypad Start & Stop buttons are used to control the inverter. This can be changed using P2-37 to allow the inverter to be started from Digital Input 1 directly.
2	Keypad Control	Keypad / Terminals	Motorised Pot / Keypad	
3	Terminal Control PID	Terminals	PID Controller	
4	Fieldbus Control	Fieldbus Interface		Fieldbus refers to the on-board Modbus RTU connection via the built in RJ45 connection or the optional Fieldbus Plug in modules. If no module is fitted, the inverter responds to the Modbus RTU interface. If a fieldbus Interface is fitted, Modbus RTU communication is disabled, and the inverter responds to control inputs from the Fieldbus.
5	Slave Mode	From Master Inverter	From Master Inverter	
6	CAN bus	CAN bus	CAN Bus	

1.7.2. P1-13 Function

P1-13 is used to select a pre-assigned list of functions to the digital inputs. These factory set assignments are designed to cater for the majority of standard applications.

<table>
<tr><td colspan="2">P1-13 = 0</td><td colspan="3">Input functions defined in Parameter Group 9. See section 5</td></tr>
<tr><td colspan="2">P1-13 = 1</td><td rowspan="2"> 
</td><td colspan="2">P1-13 = 2</td></tr>
<tr><td>Open</td><td>Closed</td><td>Open</td><td>Closed</td></tr>
<tr><td>Stop</td><td>Run</td><td rowspan="2"> 
</td><td>Stop</td><td>Run</td></tr>
<tr><td>Forward Rotation</td><td>Reverse Rotation</td><td>Forward Rotation</td><td>Reverse Rotation</td></tr>
<tr><td>Selected Speed Reference</td><td>Preset Speed Reference</td><td colspan="2" rowspan="2">Preset Speed Reference Selected as follows:
<table><tr><td>DIN3</td><td>AIN1</td><td>AIN2</td><td>Preset</td></tr><tr><td>OFF</td><td>OFF</td><td>OFF</td><td>P2-01</td></tr><tr><td>ON</td><td>OFF</td><td>OFF</td><td>P2-02</td></tr><tr><td>OFF</td><td>ON</td><td>OFF</td><td>P2-03</td></tr><tr><td>ON</td><td>ON</td><td>OFF</td><td>P2-04</td></tr><tr><td>OFF</td><td>OFF</td><td>ON</td><td>P2-05</td></tr><tr><td>ON</td><td>OFF</td><td>ON</td><td>P2-06</td></tr><tr><td>OFF</td><td>ON</td><td>ON</td><td>P2-07</td></tr><tr><td>ON</td><td>ON</td><td>ON</td><td>P2-08</td></tr></table></td></tr>
<tr><td colspan="2">Analog Input 1</td></tr>
<tr><td>Preset Speed 1</td><td>Preset Speed 2</td><td colspan="3"></td></tr>
<tr><td colspan="2">Safe Torque OFF inputs
Contacts must be closed to operate inverter</td><td colspan="3">Safe Torque OFF inputs
Contacts must be closed to operate inverter</td></tr>
<tr><td colspan="2">P1-13 = 3</td><td rowspan="2"> 
</td><td colspan="2">P1-13 = 4</td></tr>
<tr><td>Open</td><td>Closed</td><td>Open</td><td>Closed</td></tr>
<tr><td>Stop</td><td>Run</td><td rowspan="2"> 
</td><td>Stop</td><td>Run</td></tr>
<tr><td>Forward Rotation</td><td>Reverse Rotation</td><td>Forward Rotation</td><td>Reverse Rotation</td></tr>
<tr><td>Selected Speed Reference</td><td>Preset Speed 1</td><td colspan="2">Selected Speed Reference</td><td>Preset Speed 1</td></tr>
<tr><td colspan="2">Analog Input 1</td><td colspan="3">Analog Input 1</td></tr>
<tr><td colspan="2">Analog Input 2 (E.g. Torque Reference)</td><td>Decel ramp 1 (P1-04)</td><td>Decel Ramp 2 (P2-25)</td></tr>
<tr><td colspan="2">Safe Torque OFF inputs
Contacts must be closed to operate inverter</td><td colspan="3">Safe Torque OFF inputs
Contacts must be closed to operate inverter</td></tr>
<tr><td colspan="2">P1-13 = 5</td><td rowspan="2"> 
</td><td colspan="2">P1-13 = 6</td></tr>
<tr><td>Open</td><td>Closed</td><td>Open</td><td>Closed</td></tr>
<tr><td>Stop</td><td>Run</td><td rowspan="2"> 
</td><td>Stop</td><td>Run</td></tr>
<tr><td>Forward Rotation</td><td>Reverse Rotation</td><td>Forward Rotation</td><td>Reverse Rotation</td></tr>
<tr><td>Selected Speed Reference</td><td>Analog Input 2 Speed Reference</td><td colspan="2">Selected Speed Reference</td><td>Preset Speed 1</td></tr>
<tr><td colspan="2">Analog Input 1</td><td colspan="3">Analog Input 1</td></tr>
<tr><td colspan="2"></td><td colspan="3"></td></tr>
<tr><td colspan="2">Analog Input 2</td><td colspan="3">External Trip</td></tr>
<tr><td colspan="2">Safe Torque OFF inputs
Contacts must be closed to operate inverter</td><td colspan="3">Safe Torque OFF inputs
Contacts must be closed to operate inverter</td></tr>
</table>

P1-13 = 7

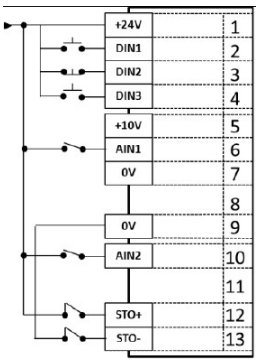
Open	Closed
Stop	Run
Forward Rotation	Reverse Rotation

Preset Speed Reference Selected as follows:

DIN3	AIN1	Preset
OFF	OFF	P2-01
ON	OFF	P2-02
OFF	ON	P2-03
ON	ON	P2-04

External Trip

Safe Torque OFF inputs
Contacts must be closed to operate inverter



P1-13 = 8

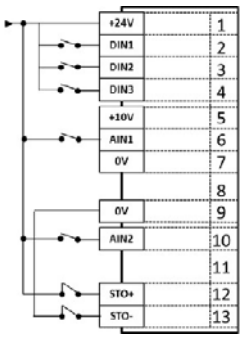
Open	Closed
Stop	Run
Forward Rotation	Reverse Rotation

Preset Speed Reference Selected as follows:

DIN3	AIN1	Preset
OFF	OFF	P2-01
ON	OFF	P2-02
OFF	ON	P2-03
ON	ON	P2-04

Decel ramp 1 (P1-04)	Decel Ramp 2 (P2-25)

Safe Torque OFF inputs
Contacts must be closed to operate inverter



P1-13 = 9

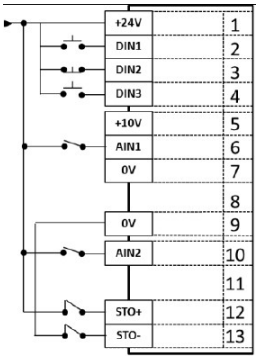
Open	Closed
Stop	Run
Forward Rotation	Reverse Rotation

Preset Speed Reference Selected as follows:

DIN3	AIN1	Preset
OFF	OFF	P2-01
ON	OFF	P2-02
OFF	ON	P2-03
ON	ON	P2-04

Selected Speed Reference	Preset Speeds Reference 1 - 4

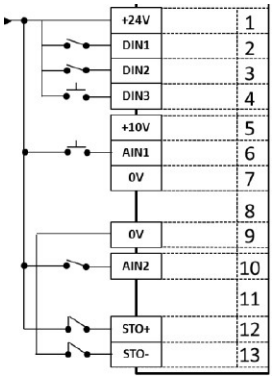
Safe Torque OFF inputs
Contacts must be closed to operate inverter



P1-13 = 10

Open	Closed
Stop	Run
Forward Rotation	Reverse Rotation
	Increase Speed1)
	Decrease Speed1)
Selected Speed Reference	Preset Speeds 1

Safe Torque OFF inputs
Contacts must be closed to operate inverter



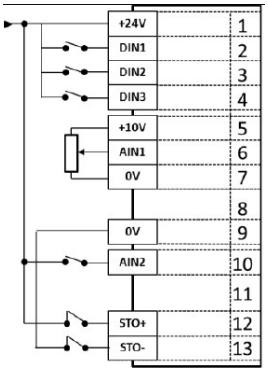
P1-13 = 11

Open	Closed
Stop	Run
Forward Rotation	Reverse Rotation
Selected Speed Reference	Preset Speeds Reference

Analog Input 1

Preset Speed 1	Preset Speed 2

Safe Torque OFF inputs
Contacts must be closed to operate inverter



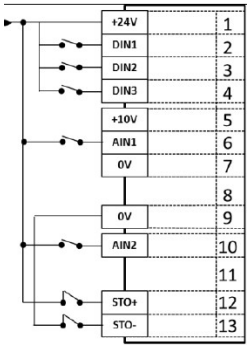
P1-13 = 12

Open	Closed
Stop	Run
Forward Rotation	Reverse Rotation

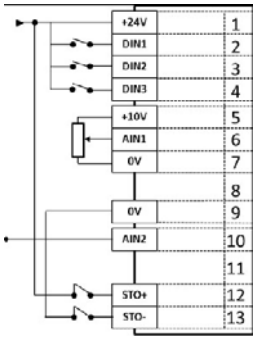
Preset Speed Reference Selected as follows:

DIN3	AIN1	AIN2	Preset
OFF	OFF	OFF	P2-01
ON	OFF	OFF	P2-02
OFF	ON	OFF	P2-03
ON	ON	OFF	P2-04
OFF	OFF	ON	P2-05
ON	OFF	ON	P2-06
OFF	ON	ON	P2-07
ON	ON	ON	P2-08

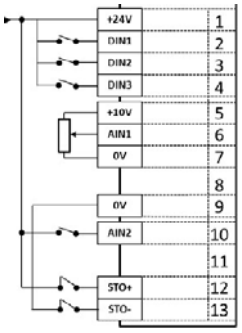
Safe Torque OFF inputs
Contacts must be closed to operate inverter



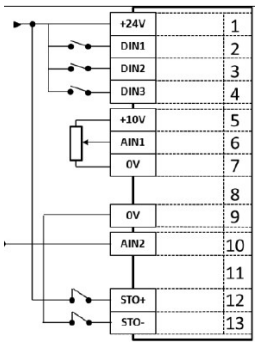
P1-13 = 13	
Open	Closed
Stop	Run
Forward Rotation	Reverse Rotation
Selected Speed Reference	Preset Speed 1
Analog Input 1	
Analog Input 2 (E.g. Torque Reference)	
Safe Torque OFF inputs Contacts must be closed to operate inverter	



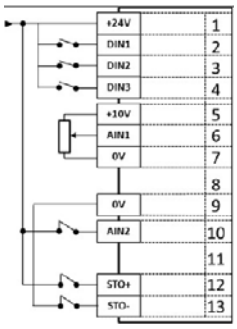
P1-13 = 14	
Open	Closed
Stop	Run
Forward Rotation	Reverse Rotation
Selected Speed Reference	Preset Speed 1
Analog Input 1	
Decel ramp 1 (P1-04)	Decel Ramp 2 (P2-25)
Safe Torque OFF inputs Contacts must be closed to operate inverter	



P1-13 = 15	
Open	Closed
Stop	Run
Forward Rotation	Reverse Rotation
Selected Speed Reference	Analog Input 1 Speed Reference
Analog Input 1	
Analog Input 2	
Safe Torque OFF inputs Contacts must be closed to operate inverter	



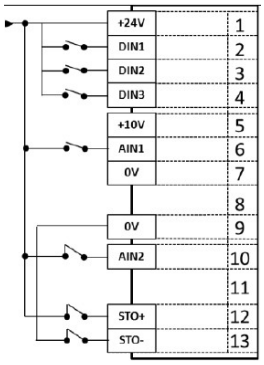
P1-13 = 16	
Open	Closed
Stop	Run
Forward Rotation	Reverse Rotation
Selected Speed Reference	Preset Speed 1
Analog Input 1	
External Trip	
Safe Torque OFF inputs Contacts must be closed to operate inverter	



P1-13 = 17	
Open	Closed
Stop	Run
Forward Rotation	Reverse Rotation
Preset Speed Reference Selected as follows:	

DIN3	AIN1	Preset
OFF	OFF	P2-01
ON	OFF	P2-02
OFF	ON	P2-03
ON	ON	P2-04

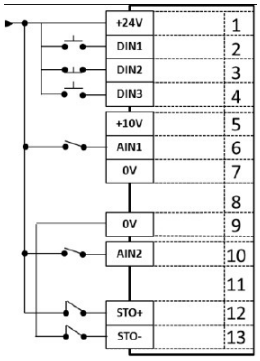
External Trip
Safe Torque OFF inputs Contacts must be closed to operate inverter

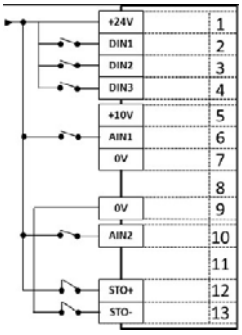
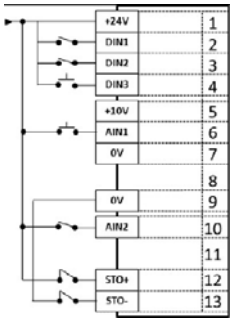


P1-13 = 18	
Open	Closed
Stop	Run
Forward Rotation	Reverse Rotation
Preset Speed Reference Selected as follows:	

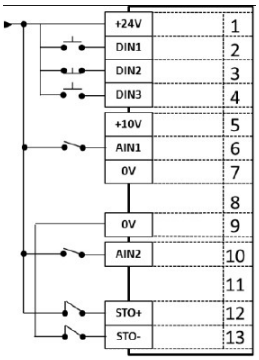
DIN3	AIN1	Preset
OFF	OFF	P2-01
ON	OFF	P2-02
OFF	ON	P2-03
ON	ON	P2-04

Decel ramp 1 (P1-04)	Decel Ramp 2 (P2-25)
Safe Torque OFF inputs Contacts must be closed to operate inverter	



P1-13 = 19				P1-13 = 20		
Open	Closed			Open	Closed	
Stop	Run			Stop	Run	
Forward Rotation	Reverse Rotation			Forward Rotation	Reverse Rotation	
Preset Speed Reference Selected as follows:					Increase Speed1)	
DIN3	AIN1	Preset				
OFF	OFF	P2-01			Decrease Speed1)	
ON	OFF	P2-02				
OFF	ON	P2-03		Selected Speed Reference	Preset Speed 1	
ON	ON	P2-04				
Selected Speed Reference	Preset Speed Reference 1-4					
Safe Torque OFF inputs Contacts must be closed to operate inverter				Safe Torque OFF inputs Contacts must be closed to operate inverter		

1) Increase / Decrease speed function only works if the Selected Speed reference is the Motorised Pot (P1-12 = 1 or 2)

P1-13 = 21		
Open	Closed	
N.O. Contact - Start Forward		
N.C. Closed Contact – Stop		
N.O. Contact – Start Reverse		
Analog Input 1		
Selected Speed Reference	Preset Speed 1	
Safe Torque OFF inputs Contacts must be closed to operate inverter		

2. Inverter Model Specific Parameter Variations

2.1. Available Effective Switching Frequency Options

400 Volt, 3 Phase Models				
kW	**HP**	**Default**	**Minimum**	**Maximum**
0.75	1	8 kHz	4 kHz	32 kHz
1.5	2	8 kHz	4 kHz	32 kHz
2.2	3	8 kHz	4 kHz	32 kHz
4	5	8 kHz	4 kHz	32 kHz
5.5	7.5	8 kHz	4 kHz	24 kHz
7.5	10	8 kHz	4 kHz	24 kHz
11	15	8 kHz	4 kHz	16 kHz
15	20	8 kHz	4 kHz	24 kHz
18.5	25	8 kHz	4 kHz	24 kHz
22	30	8 kHz	4 kHz	24 kHz
30	40	8 kHz	4 kHz	24 kHz
37	50	8 kHz	4 kHz	24 kHz
45	60	4 kHz	4 kHz	16 kHz
55	75	4 kHz	4 kHz	16 kHz
75	120	4 kHz	4 kHz	12 kHz
90	150	4 kHz	4 kHz	8 kHz
110	175	4 kHz	4 kHz	16 kHz
132	200	4 kHz	4 kHz	12 kHz
160	250	4 kHz	4 kHz	8 kHz

2.2. V/F Mode Voltage Boost Setting Options

400 Volt, 3 Phase Models			
kW	**HP**	**Default**	**Maximum**
0.75	1	2.5%	30.0%
1.5	2	2.5%	30.0%
2.2	3	2.5%	30.0%
4	5	2.5%	30.0%
5.5	7.5	2.0%	20.0%
7.5	10	1.5%	20.0%
11	15	1.5%	20.0%
15	20	1.5%	20.0%
18.5	25	1.5%	20.0%
22	30	1.5%	20.0%
30	40	1.0%	20.0%
37	50	1.0%	20.0%
45	60	1.0%	15.0%
55	75	1.0%	15.0%
75	120	1.0%	15.0%
90	150	1.0%	15.0%
110	175	0.5%	15.0%
132	200	0.5%	15.0%
160	250	0.5%	15.0%

3. Fieldbus Interface Support

3.1. Fieldbus Interface Options

HPVFP supports a number of Fieldbus Interface Options, either directly on-board the inverter (Modbus RTU, CAN Open) or using optional plug in interfaces (e.g. Profibus DP). Where possible, these fieldbus interfaces also provide access to the inverter parameters. This chapter details the parameters that can be accessed, and any scaling used when reading or writing (where permissible) to the parameters.
Only one Fieldbus can be supported at a time. When a Fieldbus module is inserted into the inverter (e.g. Profibus DP), the on-board fieldbus interfaces such as Modbus RTU and CANbus are disabled. Also, only one internal bus can be supported, hence it is not possible to simultaneously use CANbus and Modbus RTU.

3.2. Fieldbus Support Overview

HPVFP provides support for the following fieldbus networks and functions

Fieldbus	Interface	Availability	Inverter Control	Inverter Parameter Access
Modbus RTU	On-board RJ45	From Launch	Yes	Access to all Writable Parameters
CAN bus	On-board RJ45	From Launch	Yes	Access to all Writable Parameters
Profibus DP	Optional	From Launch	Yes	DPV-1 Access to all Writable Parameters

*These references apply to all other fieldbus systems

3.3. Simple Inverter Control

For the simplest implementation, all fieldbus systems allow control and monitoring of the inverter using a 4 words input, 4 words output cyclic process data exchange. The words are defined as follows :

Master > Inverter				
Reference	**Function**	**Scaling**	**Fieldbus Reference**	**Modbus RTU Register**
Word 1	Inverter control Word (Fixed)	N/A	PDI0*	1
Word 2	Frequency Setpoint (Fixed)	500 = 50.0Hz		2
Word 3	Torque Setpoint (or user selected value in P5-14)	1000 = 100.0%		3
Word 4	Fieldbus Ramps (or user selected value in P5-13)	3000 = 30.0 Seconds		4

Inverter > Master				
Reference	**Function**	**Scaling**	**Fieldbus Reference**	**Modbus RTU Register**
Word 1	Inverter Status Word (Fixed)	N/A	PDO0*	6
Word 2	Output Frequency (Fixed)	500 = 50.0Hz		7
Word 3	Output Current (or user selected value in P5-12)	100 = 10.0A		8
Word 4	Output Torque (or user selected value in P5-08)	1000 = 100.0%		9

*These references apply to all other fieldbus systems

3.4. Parameter Access Overview

The accessible parameter numbers and respective scaling are listed in the following tables. The method to access the parameters depends on the fieldbus type in use as described in the following section.

The R/W column indicates whether the values are Writeable as well as readable (R/W) or Read Only (R)

The data types for the parameter are defined as follows :

WORD Hexadecimal Word

U16 Unsigned 16 Bit Value

S16 Signed 16 Bit Value

3.4.1. Modbus RTU

The table shows the Modbus RTU register number corresponding to each parameter value. All values are holding registers.

All User Adjustable parameters (Groups 1 to 9) are accessible by Modbus, except those that would directly affect the Modbus communications, e.g.

- P5-01 Communication Protocol Select
- P5-02 Inverter Fieldbus Address
- P5-03 Modbus RTU Baud Rate
- P5-04 Modbus RTU Data Format

All parameter values can be read from the inverter and written to, depending on the operating mode of the inverter – some parameters cannot be changed whilst the inverter is enabled for example.

Parameter access via Modbus RTU is only possible when no other communication interface is installed in the inverter, e.g. it cannot be used simultaneously with a Profibus DP interface present.

When accessing a inverter parameter via Modbus RTU, the Register number for the parameter is the same as the parameter number,

E.g. Parameter P1-01 = Modbus Register 101.

Modbus RTU supports sixteen bit integer values, hence parameter values are transferred as integers, ignoring the decimal point.

E.g. Read Value of P1-01 = 500, therefore this is 50.0Hz.

Scaling applied to other parameters is described in the tables.

3.4.2. CAN Open

The table shows the Index and Sub Index required to address each parameter. All User Adjustable parameters (Groups 1 to 9) are accessible by CAN, except those that would directly affect the communications.

All parameter values can be read from the inverter and written to, depending on the operating mode of the inverter – some parameters cannot be changed whilst the inverter is enabled for example.

Parameter access via CAN is only possible when no other communication interface is installed in the inverter, e.g. it cannot be used simultaneously with a Profibus DP interface present.

3.5. Parameter Access Tables

3.5.1. Group 1 : Basic Parameter Set (Level 1)

Parameter Number	Modbus RTU Register Number	CAN Open Index	CAN Open Sub Index	Parameter Name	Setting Range	Scaling	Type
P1-01	101	2065h	0h	Max Frequency Limit	0 to 30000	3000 = 50.0Hz	U16
P1-02	102	2066h	0h	Min Frequency Limit	0 to 30000 (Limited by P1-01 Setting)	3000 = 50.0Hz	U16
P1-03	103	2067h	0h	Acceleration Ramp Time	0 to 6000	300 = 30.0s	U16
P1-04	104	2068h	0h	Deceleration Ramp Time	0 to 6000	300 = 30.0s	U16
P1-05	105	2069h	0h	Stop mode	0: Ramp to Stop 1: Coast to Stop 2 = Ramp to Stop, Brake Transistor Enabled 3 = Coast to Stop, Brake Transistor Enabled		U16
P1-06	106	206Ah	0h	Energy optimiser	0: Disable 1: Enable		WORD
P1-07	107	206Bh	0h	Motor rated voltage	0V, 20V to 250V 0V, 20V to 500V 0V, 20V to 600V	230 = 230 V	U16
P1-08	108	206Ch	0h	Motor rated current	20% to 100% of inverter rated current	1 = 0.1A	U16
P1-09	109	206Dh	0h	Motor rated frequency	25 to 500Hz	50 = 50Hz	U16
P1-10	110	206Eh	0h	Motor rated speed	0 to 30 000rpm	1500 = 1500rpm	U16
P1-11	111	206Fh	0h	V/F Voltage Boost	Auto, 0.1 to 20%	-1 = Auto 0 = Disabled 1 = 0.1%	S16
P1-12	112	2070h	0h	Control mode	0: Terminal mode 1: Keypad mode (Unipolar) 2: Keypad mode (Bipolar + direction toggle) 3: User PID mode 4: Fieldbus (Modbus, Profibus etc.) 5: Slave mode		U16
P1-13	113	2071h	0h	Digital inputs function select	0: User defined 1...20 see table		U16
P1-14	114	2072h	0h	Extended Menu Access code	0 to 30 000		U16

3.5.2. Group 2 : Extended parameter set (Level 2)

Parameter Number	Modbus RTU Register Number	CAN Open Index	CAN Open Sub Index	Parameter Name	Setting Range	Scaling	Type
P2-01	201	20C9h	0h	Preset speed 1	0 to 30000 (Limited by P1-01 Setting)	3000 = 50.0Hz	U16
P2-02	202	20CAh	0h	Preset speed 2	0 to 30000 (Limited by P1-01 Setting)	3000 = 50.0Hz	U16
P2-03	203	20CBh	0h	Preset speed 3	0 to 30000 (Limited by P1-01 Setting)	3000 = 50.0Hz	U16
P2-04	204	20CCh	0h	Preset speed 4	0 to 30000 (Limited by P1-01 Setting)	3000 = 50.0Hz	U16
P2-05	205	20CDh	0h	Preset speed 5	0 to 30000 (Limited by P1-01 Setting)	3000 = 50.0Hz	U16
P2-06	206	20CEh	0h	Preset speed 6	0 to 30000 (Limited by P1-01 Setting)	3000 = 50.0Hz	U16
P2-07	207	20CFh	0h	Preset speed 7	0 to 30000 (Limited by P1-01 Setting)	3000 = 50.0Hz	U16
P2-08	208	20D0h	0h	Preset speed 8	0 to 30000 (Limited by P1-01 Setting)	3000 = 50.0Hz	U16
P2-09	209	20D1h	0h	Skip frequency centre point	0 to 30000 (Limited by P1-01 Setting)	3000 = 50.0Hz	U16
P2-10	210	20D2h	0h	Skip frequency band	0 to 30000 (Limited by P1-01 Setting)	3000 = 50.0Hz	U16
P2-11	211	20D3h	0h	Analog output 1 function select	0: Inverter running 1: Inverter healthy 2: Motor at target speed 3: Motor Speed > 0 4: Motor Speed > limit 5: Motor Current > limit 6: Motor Torque > limit 7: 2nd Analog input > limit (Limit set by P2-18, P2-19) 8: Speed 9: Current 10: Torque 11: Power		U16
P2-12	212	20D4h	0h	Analog output 1 format	0 = 0…10V 1 = 10…0V 2 = 0-20mA 3 = 20-0mA 4 = 4-20mA 5 = 20-4mA		U16

Parameter Number	Modbus RTU Register Number	CAN Open Index	CAN Open Sub Index	Parameter Name	Setting Range	Scaling	Type
P2-13	213	20D5h	0h	Analog output 2 function select	0: Inverter running 1: Inverter healthy 2: Motor at target speed 3: Motor Speed > 0 4: Motor Speed > limit 5: Motor Current > limit 6: Motor Torque > limit 7: 2nd Analog input > limit (Limit set by P2-18, P2-19) 8: Speed 9: Current 10: Torque 11: Power		U16
P2-14	214	20D6h	0h	Analog output 2 format	0 = 0…10V 1 = 10…0V 2 = 0-20mA 3 = 20-0mA 4 = 4-20mA 5 = 20-4mA		U16
P2-15	215	20D7h	0h	User relay 1 output function select	0: Inverter running 1: Inverter healthy 2: Motor at target speed 3: Motor Speed > 0 4: Motor Speed > limit 5: Motor Current > limit 6: Motor Torque > limit 7: 2nd Analog input > limit		U16
P2-16	216	20D8h	0h	User relay 1 upper limit	P2-17 to 2000	1 = 0.1%	U16
P2-17	217	20D9h	0h	User relay 1 lower limit	0 to P2-16	1 = 0.1%	U16
P2-18	218	20DAh	0h	User relay 2 output function select	0: Inverter running 1: Inverter healthy 2: Motor at target speed 3: Motor Speed > 0 4: Motor Speed > limit 5: Motor Current > limit 6: Motor Torque > limit 7: 2nd Analog input > limit		U16
P2-19	219	20DBh	0h	User relay 2 upper limit	P2-20 to 2000	1 = 0.1%	U16
P2-20	220	20DCh	0h	User relay 2 lower limit	0 to P2-19	1 = 0.1%	U16
P2-21	221	20DDh	0h	Display scaling factor	0 to 30000	1 = 0.001	U16
P2-22	222	20DEh	0h	Display scaling source	0: Motor Speed 1: Motor Current 2: 2nd Analog input		U16

Parameter Number	Modbus RTU Register Number	CAN Open Index	CAN Open Sub Index	Parameter Name	Setting Range	Scaling	Type
P2-23	223	20DFh	0h	Zero Speed holding time	0 to 600	1 = 0.1	U16
P2-24	224	20E0h	0h	Effective switching frequency	0 = 4kHz 1 = 8kHz 2 = 12kHz 3 = 16kHz 4 = 24kHz 5 = 32kHz		U16
P2-25	225	20E1h	0h	Fast deceleration ramp time	0 to 3000	S2…S3 1 = 0.01s S4…S7 1 = 0.1s	U16
P2-26	226	20E2h	0h	Spin start enable	0 : Disabled 1 : Enabled	1	U16
P2-27	227	20E3h	0h	Standby mode	0 to 25000	1 = 0.1	U16
P2-28	228	20E4h	0h	Slave speed scaling control	0: Disabled 1: Preset by slave speed scaling 2: P2-33 scaling + analog in1 offset 3: P2-33 scaling + analog in1 scaling		U16
P2-29	229	20E5h	0h	Slave Speed scaling factor	-5000 to 5000	1 = 0.01	U16
P2-30	230	20E6h	0h	Analog input 1 format	0 = 0-10V 1 = -10-10V 2 = 0-20mA 3 = t 4-20mA 4 = r 4-20mA 5 = t 20-4mA 6 = r 20-4mA		U16
P2-31	231	20E7h	0h	Analog input 1 scaling	0 to 5000	1 = 0.1	U16
P2-32	232	20E8h	0h	Analog input 1 offset	-5000 to 5000	1 = 0.1	U16
P2-33	233	20E9h	0h	Analog input 2 format	0 = 0-10V 1 = Ptc-th 2 = 0-20mA 3 = t 4-20mA 4 = r 4-20mA 5 = t 20-4mA 6 = r 20-4mA		U16
P2-34	234	20EAh	0h	Analog input 2 scaling	0 to 5000	1 = 0.1	U16
P2-35	235	20EBh	0h	Analog input 2 offset	-5000 to 5000	1 = 0.1	U16
P2-36	236	20ECh	0h	Start mode select	0 = Edge-r 1 = Auto-0 2 = Auto-1 3 = Auto-2 4 = Auto-3 5 = Auto-4 6 = Auto-5		U16

Parameter Number	Modbus RTU Register Number	CAN Open Index	CAN Open Sub Index	Parameter Name	Setting Range	Scaling	Type
P2-37	237	20EDh	0h	Keypad restart speed	0: Minimum speed 1: Previous keypad speed 2: Current running Speed 3: Preset Speed 8		U16
P2-38	238	20EEh	0h	Mains loss stop control	0: Mains loss ride through 1: Coast to Stop 2: Fast ramp to stop		U16
P2-39	239	20EFh	0h	Parameter Lock	0: Unlocked 1: Locked		U16
P2-40	240	20F0h	0h	Extended parameter access code definition	0 ... 9 999		U16

3.5.3. Group 3 : User PID control (Level 2)

Parameter Number	Modbus RTU Register Number	CAN Open Index	CAN Open Sub Index	Parameter Name	Setting Range	Scaling	Type
P3-01	301	212Dh	0h	User PID Proportional Gain	1 to 300	1 = 0.1	U16
P3-02	302	212Eh	0h	User PID Integral time constant	0 to 300	1 = 0.1	U16
P3-03	303	212Fh	0h	User PID Differential time constant	0 to 100	1 = 0.01	U16
P3-04	304	2130h	0h	User PID operating mode	0: Direct 1: Inverse		WORD
P3-05	305	2131h	0h	User PID reference select	0: Digital preset (P3-06) 1: 1st Analog input 2: 2nd Analog input	1 = 1	U16
P3-06	306	2132h	0h	User PID digital reference	0 to 1000	1 = 0.1%	U16
P3-07	307	2133h	0h	User PID controller output high limit	P3-08 to 1000	1 = 0.1%	U16
P3-08	308	2134h	0h	User PID controller output low limit	0 to P3-07	1 = 0.1%	U16
P3-09	309	2135h	0h	User PID output control	0: Digital output limits 1: 1st Analog variable upper limit 2: 1st Analog variable lower limit 3: PID output + 1st analog input		U16
P3-10	310	2136h	0h	User PID feedback select	0: 2nd Analog input 1: 1st Analog input		WORD
P3-11	311	2137h	0h	PID error to enable ramps	0 to 250	1 = 0.1%	U16
P3-12	312	2138h	0h	PID feedback value display scaling factor	0 to 50000	0: Disabled 1 = 0.001	U16
P3-13	313	2139h	0h	PID feedback wake-up level	0 to 1000	1 = 0.1%	U16
P3-18	318	213Eh	0h	PID Operation Control	0 to 1	0 : Continuous Operation 1 : PID operates on Inverter	U16

						Enable	

3.5.4. Group 4 : Motor control parameter set (Level 2)

Parameter Number	Modbus RTU Register Number	CAN Open Index	CAN Open Sub Index	Parameter Name	Setting Range	Scaling	Type
P4-01	401	2191h	0h	Control mode	0 = Speed control (vector) 1 = Torque control (vector) 2 = Speed control (Enhanced V/F) 3 = PM motor speed control (P1-14 = 201) 4 = PM motor torque control (P1-14 = 201) 5 = BLDC motor speed control (P1-14=201)		U16
P4-02	402	2192h	0h	Motor parameter Auto-tune	0 = Disable 1 = Enable		WORD
P4-03	403	2193h	0h	Vector Speed controller Proportional Gain	1 to 4000	1 = 0.1%	U16
P4-04	404	2194h	0h	Vector Speed controller Integral time constant	1 to 1000	1 = 0.001s	U16
P4-05	405	2195h	0h	Motor power factor	0.00, 50 to 99	99 = 0.99	U16
P4-06	406	2196h	0h	Torque Control reference	0 = Max Torque limit (P4-07) 1 = 1st analog input 2 = 2nd analog input 3 = Fieldbus / communications 4 = Master inverter (Master / Slave) 5 = User PID output		U16
P4-07	407	2197h	0h	Max motoring torque limit	P4-08 to 2000	2000 = 200.0%	U16
P4-08	408	2198h	0h	Minimum torque limit	0 to P4-07	1 = 0.1%	U16
P4-09	409	2199h	0h	Generator mode maximum torque limit	0.0 ... 200%	1 = 1%	U16
P4-10	410	219Ah	0h	V/F characteristic adjustment frequency	0.0…100% of P1-07	1 = 0.1%	U16
P4-11	411	219Bh	0h	V/F characteristic adjustment voltage	0.0…100% of P1-09	1 = 0.1%	U16

3.5.5. Group 5 : Fieldbus communications (Level 2)

Parameter Number	Modbus RTU Register Number	CAN Open Index	CAN Open Sub Index	Parameter Name	Setting Range	Scaling	Type
P5-01	501	21F5h	0h	Fieldbus inverter address	0…63	1 = 1	U16
P5-02	502	21F6h	0h	CANbus baud rate	125kbps 250kbps 500kbps 1Mbps	0 = 125kbps 1 = 250kbps	U16
P5-03	503	21F7h	0h	Modbus baud rate	9.6kbps, 19.2kpbs, 38.4kpbs, 57.6kpbs, 115 kbps	0 = 9.6kbps 1 = 19.2kpbs	U16
P5-04	504	21F8h	0h	Modbus data format	N-1 : None Parity 1 stop bit N-2 : None parity 2 stop bits O-1 : Odd parity 1 stop bit E-1 : Even parity 1 stop bit	0 = N-1 1 = N-2	U16
P5-05	505	21F9h	0h	Comms loss timeout	0...0.1... 5.0	1 = 0.1s	U16
P5-06	506	21FAh	0h	Communications loss action	0: Trip 1: Ramp to Stop then trip 2: Ramp to stop (No trip) 3: Preset speed 8	1 = 1	U16
P5-07	507	21FBh	0h	Fieldbus ramp control	0: Disable 1: Enable	1 = 1	U16
P5-08	508	21FCh	0h	Anybus module output process data 4	0: Torque (%) 1: Power (x.xx kW) 2: Digital input status 3: 2nd analog input (%) 4. Power stage temperature	1=1	U16

3.5.6. Group 6 : Advanced Parameter set (Level 3)

Parameter Number	Modbus RTU Register Number	CAN Open Index	CAN Open Sub Index	Parameter Name	Setting Range	Scaling	Type
P6-01	601	2259h	0h	Firmware Upgrade enable	0: Disabled 1: Enable (IO and DSP) 2: Enable (IO only) 3: Enable (DSP only)		U16
P6-02	602	225Ah	0h	Auto thermal management	0: Disable 1: Enable		WORD
P6-03	603	225Bh	0h	Auto-reset delay time	1 to 60		U16
P6-04	604	225Ch	0h	User relay hysteresis band	0 - 250	1 = 0.1%	U16
P6-05	605	225Dh	0h	Encoder feedback enable	0: Disabled 1: Enable		WORD
P6-06	606	225Eh	0h	Encoder PPR	0 to 65535		U16
P6-07	607	225Fh	0h	Speed error trip level	0 to 500	1 = 0.1%	U16
P6-08	608	2260h	0h	Max speed ref frequency	0, 5 to 20		U16
P6-09	609	2261h	0h	Speed Droop Control	0 to 250	1 = 0.1%	U16
P6-10	610	2262h	0h	Enable PLC operation	0: Disable 1: Enable		WORD
P6-11	611	2263h	0h	Speed hold time on enable	0 to 2500	1 = 0.1s	U16
P6-12	612	2264h	0h	Speed hold time on disable	0 to 2500	1 = 0.1s	U16
P6-13	613	2265h	0h	Hoist mode brake release delay	0 to 50	1 = 0.1s	U16
P6-14	614	2266h	0h	Hoist mode brake apply delay	0 to 50	1 = 0.1s	U16
P6-15	615	2267h	0h	Torque threshold for hoist brake release	0 to 2000	1 = 0.1%	U16
P6-16	616	2268h	0h	Torque threshold timeout	0 to 250	1 = 0.1s	U16
P6-17	617	2269h	0h	Max Torque limit timeout	0 to 250	1 = 0.1s	U16
P6-18	618	226Ah	0h	DC injection braking voltage	0 : Auto 0 to 250	0 = Auto 1= 0.1%	U16
P6-19	619	226Bh	0h	Brake resistor value	0, Min value to 200	1 = 1	U16
P6-20	620	226Ch	0h	Brake resistor power	0 to 20000	1= 0.01kw	U16
P6-21	621	226Dh	0h	Brake chopper UT duty cycle	0 to 200	1 = 0.1%	U16
P6-22	622	226Eh	0h	Reset cooling fan run-time	0: Disable 1: Enable		WORD
P6-23	623	226Fh	0h	Reset kWh meter	0: Disable 1: Enable		WORD
P6-24	624	2270h	0h	Service time interval	0 … 60 000 h (0 = disabled)	1=1	U16
P6-25	625	2271h	0h	Reset service indicator	0: Disable 1: Reset	1=1	WORD
P6-26	626	2272h	0h	Analog output 1 scaling	0 to 5000	1 = 0.1	U16
P6-27	627	2273h	0h	Analog output 1 offset	-5000 to 5000	1 = 0.1%	S16
P6-28	628	2274h	0h	P0-80 display value index	0 to 127		U16

Parameter Number	Modbus RTU Register Number	CAN Open Index	CAN Open Sub Index	Parameter Name	Setting Range	Scaling	Type
P6-29	629	2275h	0h	Save User Parameters as default	0: Disable 1: Enable		WORD
P6-30	630	2276h	0h	Level 3 access code	0 to 9999		U16

3.5.7. Group 7 : Motor Control Parameter set (Level 3)

Parameter Number	Modbus RTU Register Number	CAN Open Index	CAN Open Sub Index	Parameter Name	Setting Range	Scaling	Type
P7-01	701	22BDh	0h	Motor Stator resistance	Inverter dependent	1 = 0.001ohm	U16
P7-02	702	22BEh	0h	Motor Rotor resistance	Inverter dependent	1 = 0.001ohm	U16
P7-03	703	22BFh	0h	Motor stator inductance	Inverter dependent	1 = 0.0001H	U16
P7-04	704	22C0h	0h	Motor Magnetising Current	Inverter dependent	1 = 0.1A	U16
P7-05	705	22C1h	0h	Motor Leakage Coefficient	0 to 250	1 = 0.001	U16
P7-06	706	22C2h	0h	Motor Stator inductance (PM only)	Inverter dependent	1 = 0.0001H	U16
P7-07	707	22C3h	0h	Enhanced generator control	0: Disable 1: Enable		WORD
P7-08	708	22C4h	0h	Parameter adaptation	0: Disable 1: Enable		WORD
P7-09	709	22C5h	0h	Over voltage current limit	0.0 to 100% of motor rated current	1 =0.1%	U16
P7-10	710	22C6h	0h	Load Inertia Factor	0 to 600	1=1	U16
P7-11	711	22C7h	0h	Pulse width minimum limit	0 to 500 (Time = value *16.67ns)	1 =1	U16
P7-12	712	22C8h	0h	V/F mode magnetising period	0 to 2000		U16
P7-13	713	22C9h	0h	Vector Speed Controller D-Gain	0 to 4000	1 = 0.1%	U16
P7-14	714	22CAh	0h	Low frequency torque boost	0 to 1000	1 =0.1%	U16
P7-15	715	22CBh	0h	Torque boost frequency limit	0 to 500	1 =0.1%	U16

3.5.8. Group 8 : Application Specific Parameters - Level 3

Parameter Number	Modbus RTU Register Number	CAN Open Index	CAN Open Sub Index	Parameter Name	Setting Range	Scaling	Type
P8-01	801	2321 h	0h	Accel Ramp 2	0 to 60000	S2…S3 1 = 0.01s S4…S7 1 = 0.1s	U16
P8-02	802	2322 h	0h	Speed boundary – Accel ramp 1 2	0 to 30000 (Limited by P1-01 Setting)	3000 = 50.0Hz	U16
P8-03	803	2323 h	0h	Accel Ramp 3	0 to 60000	S2…S3 1 = 0.01s S4…S7 1 = 0.1s	U16
P8-04	804	2324 h	0h	Speed boundary – Accel ramp 2 3	0 to 30000 (Limited by P1-01 Setting)	3000 = 50.0Hz	U16
P8-05	805	2325 h	0h	Accel Ramp 4	0 to 60000	S2…S3 1 = 0.01s S4…S7 1 = 0.1s	U16
P8-06	806	2326 h	0h	Speed boundary – Accel ramp 3 4	0 to 30000 (Limited by P1-01 Setting)	3000 = 50.0Hz	U16
P8-07	807	2327 h	0h	Decel Ramp 4	0 to 60000	S2…S3 1 = 0.01s S4…S7 1 = 0.1s	U16
P8-08	808	2328 h	0h	Speed boundary – Accel ramp 4 3	0 to 30000 (Limited by P1-01 Setting)	3000 = 50.0Hz	U16
P8-09	809	2329 h	0h	Decel Ramp 3	0 to 60000	S2…S3 1 = 0.01s S4…S7 1 = 0.1s	U16
P8-10	810	232A h	0h	Speed boundary – Accel ramp 3 2	0 to 30000 (Limited by P1-01 Setting)	3000 = 50.0Hz	U16
P8-11	811	232B h	0h	Decel Ramp 2	0 to 60000	S2…S3 1 = 0.01s S4…S7 1 = 0.1s	U16
P8-12	812	232C h	0h	Speed boundary – Accel ramp 2 1	0 to 30000 (Limited by P1-01 Setting)	3000 = 50.0Hz	U16
P8-13	813	232D h	0h	Ramp select by Preset Speed	0: Disabled 1: Enable		WORD

3.5.9. Parameter Group 9 ADI's

Parameter Number	Modbus RTU Register Number	CAN Open Index	CAN Open Sub Index	Parameter Name	Scaling	Type
P9-01	901	2385h	0h	Enable Source	0 : Safety Input 1 : Digital Input 1 2 : Digital Input 2 3 : Digital Input 3 4 : Digital Input 4 5 : Digital Input 5 6 : Digital Input 6 7 : Digital Input 7 8 : Digital Input 8	U16
P9-02	902	2386h	0h	Fast Stop Source	0 : Safety Input 1 : Digital Input 1 2 : Digital Input 2 3 : Digital Input 3 4 : Digital Input 4 5 : Digital Input 5 6 : Digital Input 6 7 : Digital Input 7 8 : Digital Input 8 9 : Analog Output 1 10 : Analog 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	U16
P9-03	903	2387h	0h	Run Forward Source		U16
P9-04	904	2388h	0h	Run Reverse Source		U16
P9-05	905	2389h	0h	Latch Enable	0 : Disabled 1 : Enabled	U16
P9-06	906	238Ah	0h	Reverse Source	0 : Safety Input 1 : Digital Input 1 2 : Digital Input 2	U16
P9-07	907	238Bh	0h	Reset Source		U16
P9-08	908	238Ch	0h	External Trip Source		U16

Parameter Number	Modbus RTU Register Number	CAN Open Index	CAN Open Sub Index	Parameter Name	Scaling	Type
P9-09	909	238Dh	0h	Terminal Control Override Source	3 : Digital Input 3 4 : Digital Input 4 5 : Digital Input 5 6 : Digital Input 6 7 : Digital Input 7 8 : Digital Input 8 9 : Analog Output 1 10 : Analog 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	U16
P9-10	910	238Eh	0h	Speed Source 1	0 : Analog Input 1 1 : Analog Input 2 2 : Preset Speed 3 : Keypad Speed 4 : User PID Speed 5 : Master Speed 6 : Fieldbus Speed 7 : User Speed 8 : Frequency Input 9 : Preset Speed 1 10 : Preset Speed 2 11 : Preset Speed 3 12 : Preset Speed 4 13 : Preset Speed 5 14 : Preset Speed 6 15 : Preset Speed 7 16 : Preset Speed 8	U16
P9-11	911	238Fh	0h	Speed Source 2		U16
P9-12	912	2390h	0h	Speed Source 3		U16
P9-13	913	2391h	0h	Speed Source 4		U16
P9-14	914	2392h	0h	Speed Source 5		U16
P9-15	915	2393h	0h	Speed Source 6		U16
P9-16	916	2394h	0h	Speed Source 7		U16
P9-17	917	2395h	0h	Speed Source 8		U16
P9-18	918	2396h	0h	Speed Source Select Input Bit 0	0 : Safety Input 1 : Digital Input 1 2 : Digital Input 2 3 : Digital Input 3 4 : Digital Input 4 5 : Digital Input 5 6 : Digital Input 6 7 : Digital Input 7 8 : Digital Input 8 9 : Analog Output 1	U16
P9-19	919	2397h	0h	Speed Source Select Input Bit 1		U16
P9-20	920	2398h	0h	Speed Source Select Input Bit 2		U16
P9-21	921	2399h	0h	Preset Speed Select Bit 0		U16
P9-22	922	239Ah	0h	Preset Speed Select Bit 1		U16
P9-23	923	239Bh	0h	Preset Speed Select Bit 2		U16
P9-24	924	239Ch	0h	Acceleration Ramp Select Bit 0		U16
P9-25	925	239Dh	0h	Acceleration Ramp Select Bit 1		U16
P9-26	926	239Eh	0h	Deceleration Ramp Select Bit 0		U16
P9-27	927	239Fh	0h	Deceleration Ramp Select Bit 1		U16

Parameter Number	Modbus RTU Register Number	CAN Open Index	CAN Open Sub Index	Parameter Name	Scaling	Type
P9-28	928	23A0h	0h	Remote Up Button Source	10 : Analog 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	U16
P9-29	929	23A1h	0h	Remote Down Button Source		U16
P9-30	930	23A2h	0h	Speed Limit FWD Source		U16
P9-33	933	23A5h	0h	Analog Output 1 Control	0 : P2-11 1: User Defined Digital 2 : User Defined Analog	U16
P9-34	934	23A6h	0h	Analog Output 2 Control	0 : P2-13 1: User Defined Digital 2 : User Defined Analog	U16
P9-35	935	23A7h	0h	Relay 1 Control	0 : P2-15 1: User Defined Digital	U16
P9-36	936	23A8h	0h	Relay 2 Control	0 : P2-18 1: User Defined Digital	U16
P9-37	937	23A9h	0h	Scaling Source Control	0 : P2-22 1: User Defined	U16
P9-38	938	23AAh	0h	PID Setpoint Source Control	0 : P3-05 1: User Defined	U16
P9-39	939	23ABh	0h	PID Feedback Source Control	0 : P3-10 1: User Defined	U16
P9-40	940	23ACh	0h	Torque Reference Source Control	0 : P4-06 1: User Defined	U16
P9-41	941	23ADh	0h	Relay 3 – 5 Control	0 : Predefined 1 : User Defined	U16

3.5.10. Read Only Parameters & Group 0.

Parameter Number	Modbus RTU Register Number	CAN Open Index	CAN Open Sub Index	Parameter Name	Scaling	Type
P0-01	20	2013h	0h	Analog Input 1 Signal Level (%)	1000 = 100.0%	S16
P0-02	21	2014h	0h	Analog Input 2 Signal Level (%)	1000 = 100.0%	S16
P0-03	11	2012h	0h	Digital Input Status		WORD
P0-04	22		0h	Pre Ramp Speed Reference (Hz)		
P0-05	41		0h	Torque reference value		
P0-06	42		0h	Digital pot reference value		
P0-12	9	200Eh	0h	Motor Torque	1000 = 100.0%	1000 = 100.0%
P0-20	23	2011h	0h	DC bus Voltage	600 = 600 Volts	600 = 600 Volts
P0-21	24	2010h	0h	Inverter Temperature	40 = 40°C	40 = 40°C
P0-26	30			kWh meter (User)	100 = 10.0kWh	100 = 10.0kWh
P0-26	32			kWh Meter		
P0-27	31			MWh meter (User)	100 = 100MWh	100 = 100MWh
P0-27	33			MWh Meter		
P0-28	15			IO Processor Software Version	100 = 1.00	100 = 1.00
P0-28	16			Motor control Processor Software Version	100 = 1.00	100 = 1.00
P0-29	12			Rating ID		
P0-29	13			Power rating		
P0-29	14			Voltage rating		
P0-29	17			Inverter Type		
P0-30	25			Inverter Serial Number 1		
P0-30	26			Inverter Serial Number 2		
P0-30	27			Inverter Serial Number 3		
P0-30	28			Inverter Serial Number 4		
P0-31	34			Running time – hour		
P0-31	35			Running time – min/sec		
P0-34	36			Running time since last enable – hour		
P0-34	37			Running time since last enable – min/sec		
P0-72	39			Room (Control PCB) temperature		
P0-80	43			User-defined display content		

4. 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.
OI-b	01	Brake channel over current	AtF-02	41	Measured motor stator resistance is too large.
OL-br	02	Brake resistor overload	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)	Out-Ph	44	Output (motor) phase missing
SAFE-1	05	Safety input circuit error (Processor output)	AtF-06	45	Reserved
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	AtF-09	48	Reserved
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	CANopen comms loss trip
SC-ObS	12	Bus 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	Reserved
h O-I	15	Instantaneous over current on inverter 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

Fault Code	No.	Description	Fault Code	No.	Description
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	Reserved	OF-05	64	Reserved
U-torq	25	Output torque too low (hoist mode)	OF-06	65	Reserved
Out-F	26	Inverter output fault	OF-07	66	Reserved
Err-01	27	Reserved	OF-08	67	Reserved
Err-02	28	Reserved	OF-09	68	Reserved
SAFE-2	29	Safety input circuit error (Buffer output)	OF-10	69	Reserved
Enc-01	30	Encoder comms/data loss	PLC-01	70	Unsupported PLC function block
Enc-02	31	Encoder speed error	PLC-02	71	PLC program over size
Enc-03	32	Incorrect Encoder PPR count set in parameters	PLC-03	72	Divide by 0
Enc-04	33	Encoder Channel A Fault	PLC-04	73	Lower limit larger than higher limit
Enc-05	34	Encoder Channel B Fault	PLC-05	74	Table function block index overflow
Enc-06	35	Encoder Channels A & B Fault	PLC-06	75	Reserved
Enc-07	36	RS485 data channel error (servo)	PLC-07	76	Reserved
Enc-08	37	IO comms loss (servo)	PLC-08	77	Reserved
Enc-09	38	Wrong type encoder (servo)	PLC-09	78	Reserved
Enc-10	39	KTY trip (servo)	PLC-10	79	Reserved

5. Rated Temperatures and De-rating curves

5.1. Thermal Management

The HPVFP product range has an integrated Thermal Management function. This function allows the inverter to automatically reduce the inverter output switching frequency when operating at higher heatsink temperatures to avoid the risk of an over temperature trip. The value set in the Thermal Management parameter (P6-02) determines the lowest switching frequency the inverter is permitted to automatically reduce too.

Table 1 below shows the heatsink temperature threshold points at which thermal management occurs.

Temperature Threshold	**Action**
70 ℃	Auto reduce from 32kHz to 24kHz
75℃	Auto reduce from 24kHz to 16kHz
80 ℃	Auto reduce from 16kHz to 12kHz
85 ℃	Auto reduce from 12kHz to 8kHz
90 ℃	Auto reduce from 8kHz to 4kHz
97℃	Over temp trip

Note:

The available range of switching frequencies is subject to the inverter frame size, power rating and voltage rating.

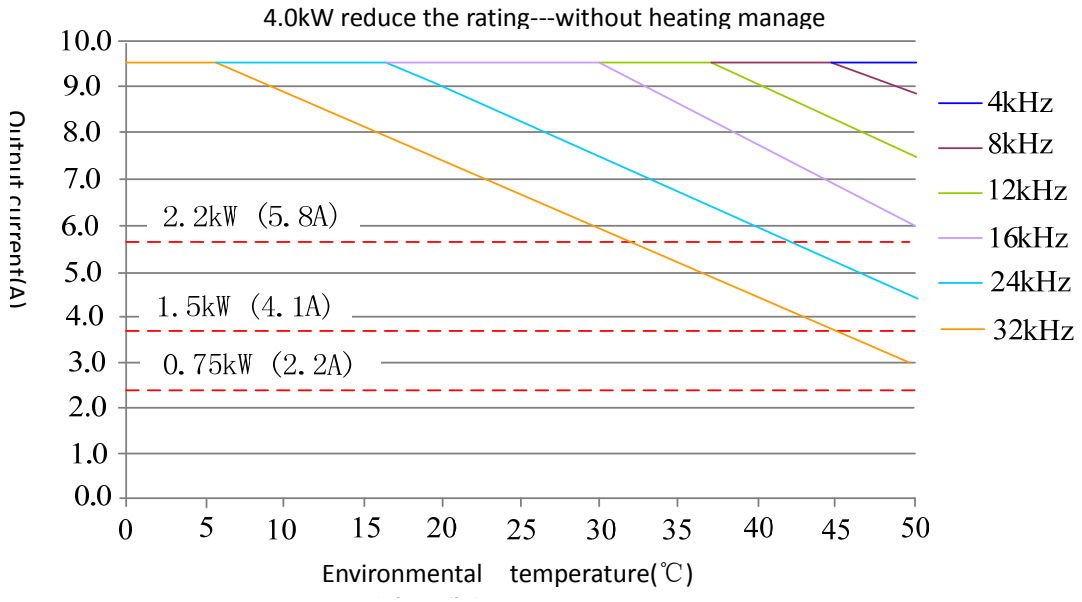
5.2. De-rating Curves Explained

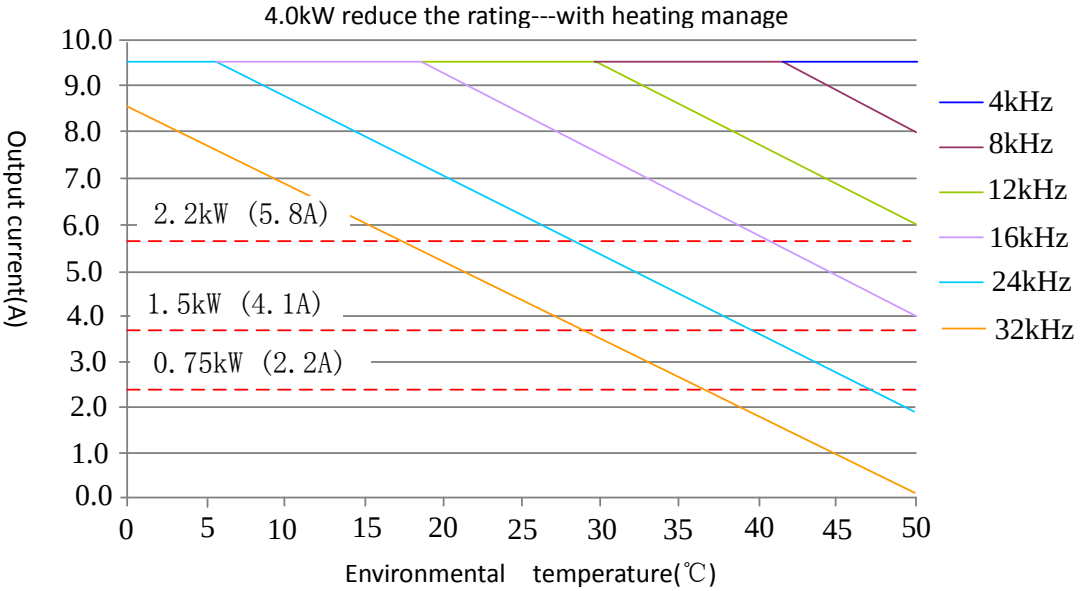
The following de-rating curves each show the maximum continuous output current against inverter heatsink temperature. In each graph the curves represent the performance of the largest rated inverter for that frame size and rated voltage for each available switching frequency. Where lower power rating variants are available their limits are shown as dotted lines to intersect the curves.

5.3. Frame Size , 380-480V,

Frame Size A

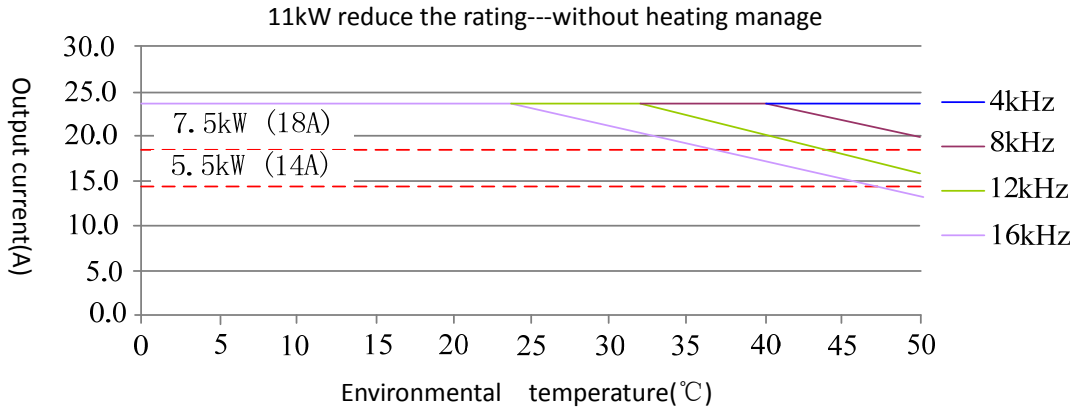
0.75kW, 1.5kW, 2.2kW and 4.0kW, IP20

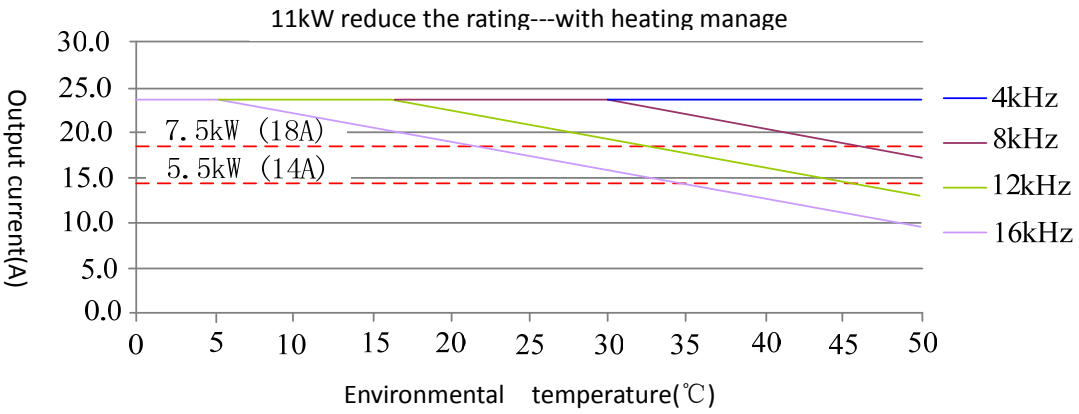




Frame Size B

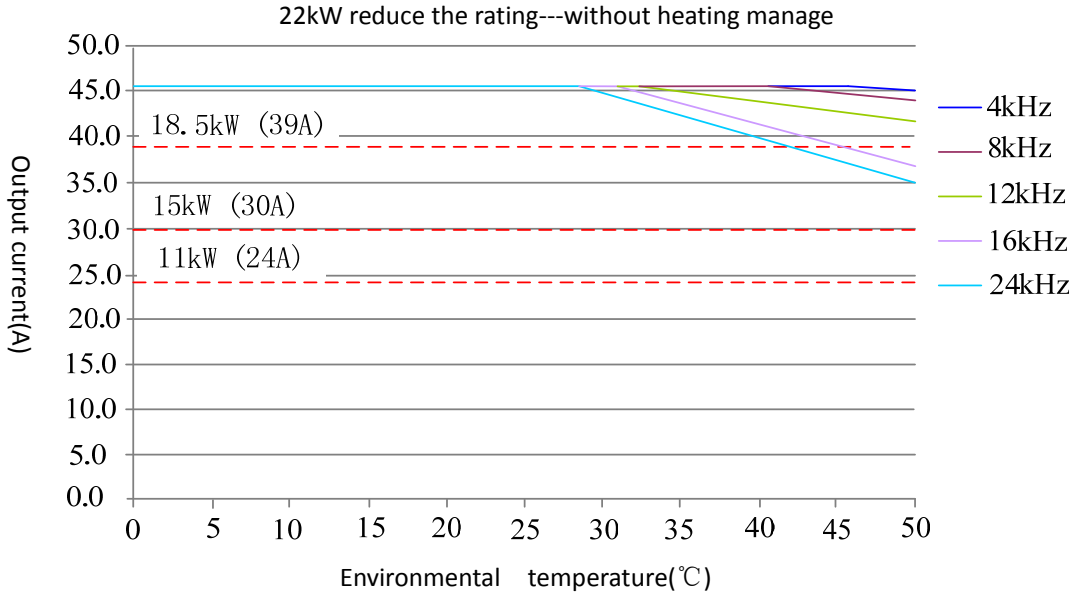
5.5kW, 7.5kW and 11kW, IP20

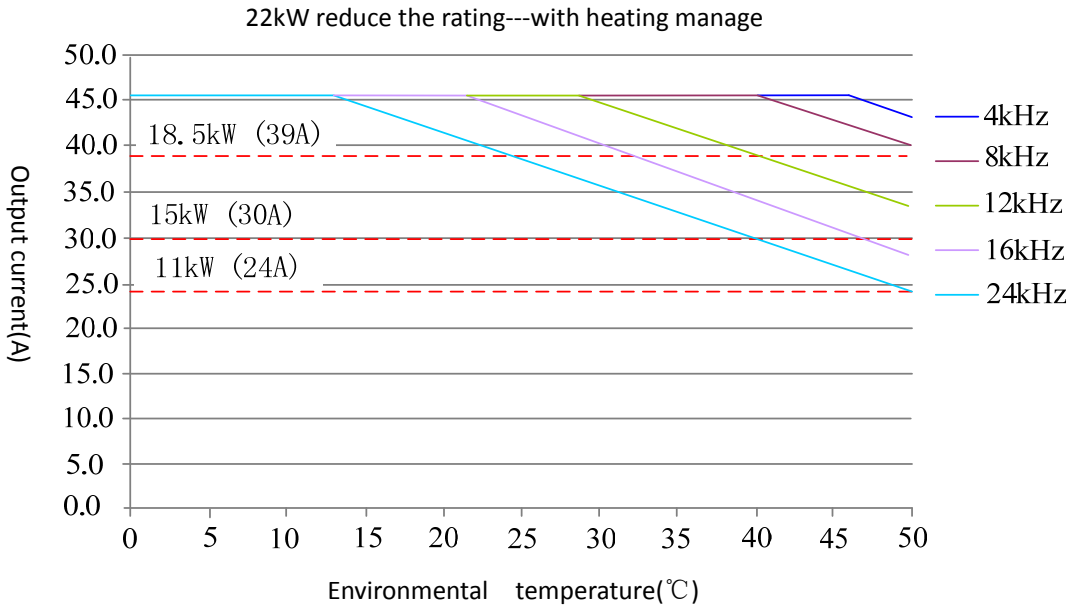




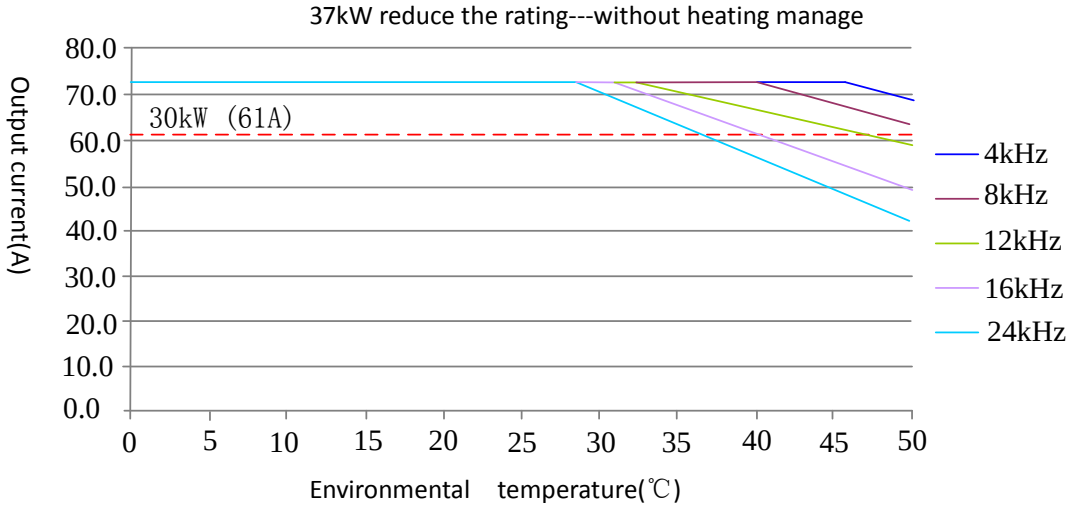
Frame Size C

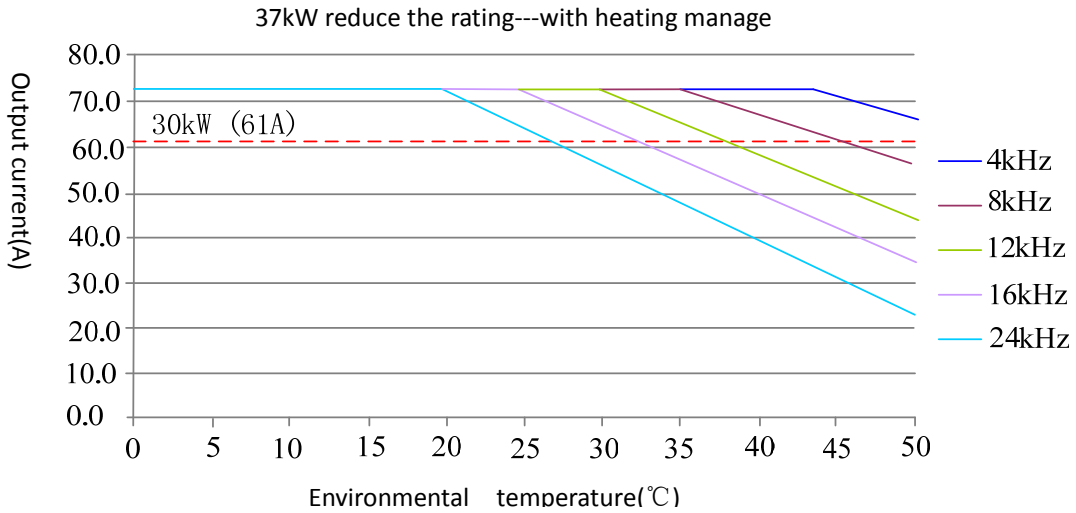
11kW, 15kW , 18.5kW and 22kW, IP20



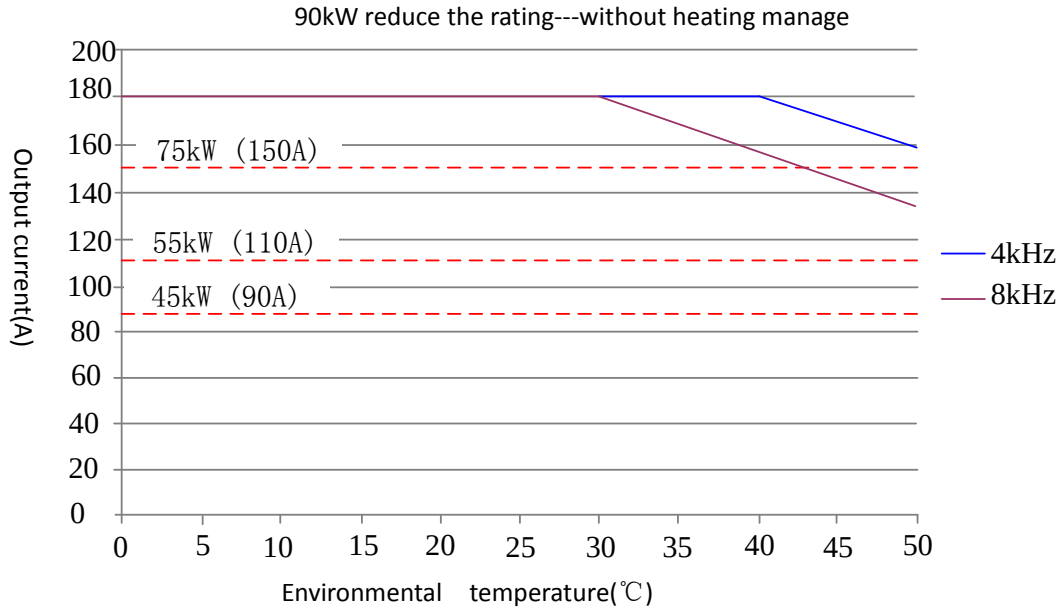


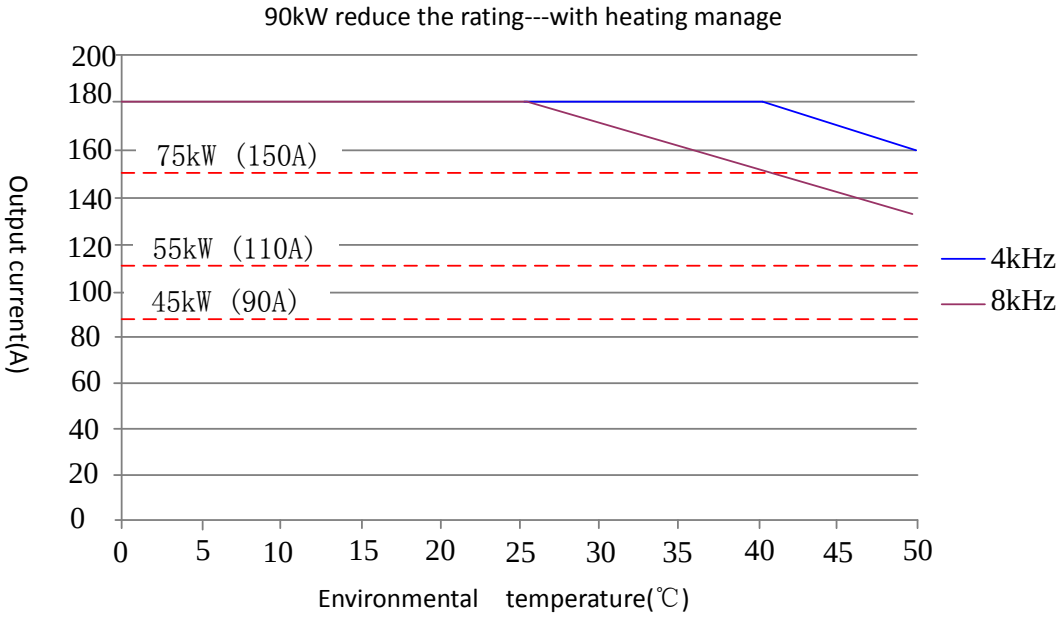
Frame Size D
30kW and 37kW, IP20





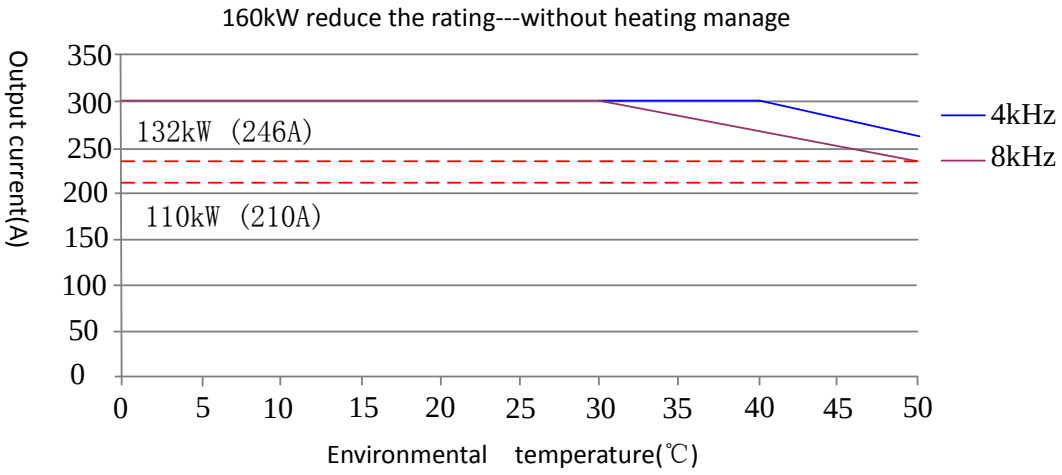
Frame Size E
45kW, 55kW,75kW and 90kW, IP20

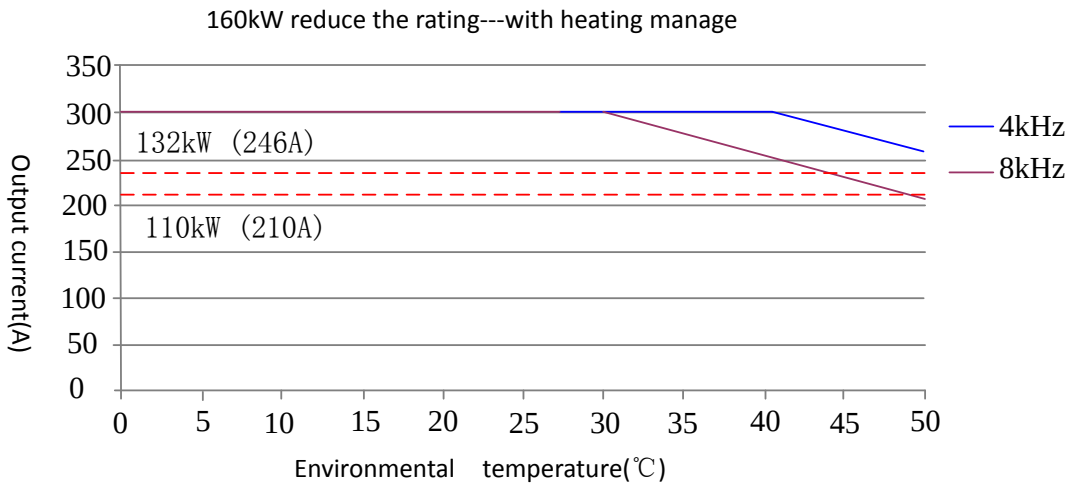




Frame Size F

110kW ,132kW and 160kW, IP20




160kW reduce the rating---with heating manage
Output current(A)
350
300
250
200
150
100
50
0
132kW (246A)
110kW (210A)
0
5
10
15
20
25
30
35
40
45
50
Environmental temperature(℃)
4kHz
8kHz

6. General Technical and Performance Data

6.1. Input Output Current Ratings and Efficiencies

Frame Size	Supply Voltage	Power Rating (kW)	Input Current (A)	Output Current (A)	Power Efficiency (%)	Recommend MCB / Fuse Rating (A)
A	400V, 3ph	0.75	2.4	2.2	>97	6
		1.5	4.3	4.1	>97	6
		2.2	6.1	5.8	>97	10
		4.0	9.8	9.5	>97	16
B	400V, 3ph	5.5	14.6	14	>97	20
		7.5	18.1	18	>97	25
		11	24.7	24	>97	32
C	400V, 3ph	11	24.8	24	>97	32
		15	30.8	30	>97	40
		18.5	40.0	39	>97	50
		22	47.1	46	>97	63
D	400V, 3ph	30	62.8	61	>97	80
		37	73.8	72	>97	80
E	400V, 3ph	45	92.2	90	>97	100
		55	112.5	110	>97	125
		75	153.2	150	>97	160
		90	183.7	180	>98	200
F	400V, 3ph	110	205.9	202	>98	225
		132	244.5	240	>98	315
		160	307.8	302	>98	350

6.2. DC Bus Discharge Time

DC Bus discharge times are based on maximum rated DC bus, i.e. 480Vac +10% AC supply equates to a DC Bus voltage of 746Vdc within the inverter.

All inverters have a caution on the rating labels stating “Power down for 5 minutes before removing cover”

Frame Size	Supply Voltage	DC Bus Voltage			Time to reach 50V
		Max	after 5s	after 60s	
A	480Vac +10%	746	621	64	86 s
B	480Vac +10%	746	625	73	120 s
C	480Vac +10%	746	685	98	182 s
D	480Vac +10%	746	671	99	179 s
E	480Vac +10%	746	703	246	181 s
F	480Vac +10%	746	701	343	190 s
A	480Vac +10%	746	621	64	86 s
B	480Vac +10%	746	625	73	120 s

6.3. Digital & Analog I/O

6.3.1. Digital Inputs Specification

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

6.3.2. Inhibit (Safe) Input

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

6.3.3. Analog Inputs Specification

Current Range : 0-20mA, 4-20mA. 20mA max input current
Voltage Range : -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

6.3.4. Analog Outputs Specification

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

6.3.5. 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

6.4. Environmental Data

Temperature Range	
Ambient Temperature Range : Operation	IP20 Inverters : -10°C - +50°C (14 - 122°F) without derating
Note : No frost or condensation permissible	
Ambient Temperature Range : Storage	-40°C - +60 °C. No Frost or Condensation
Altitude	
Maximum Altitude (No derating)	1000m Derate above 1000m by 1% per 100m
Maximum Altitude	4000m
Relative Humidity	
Relative Humidity Limit	95% Maximum, non condensing

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