Invertek Drives.com

User Guide

OPTIDRIVE™ HVAC

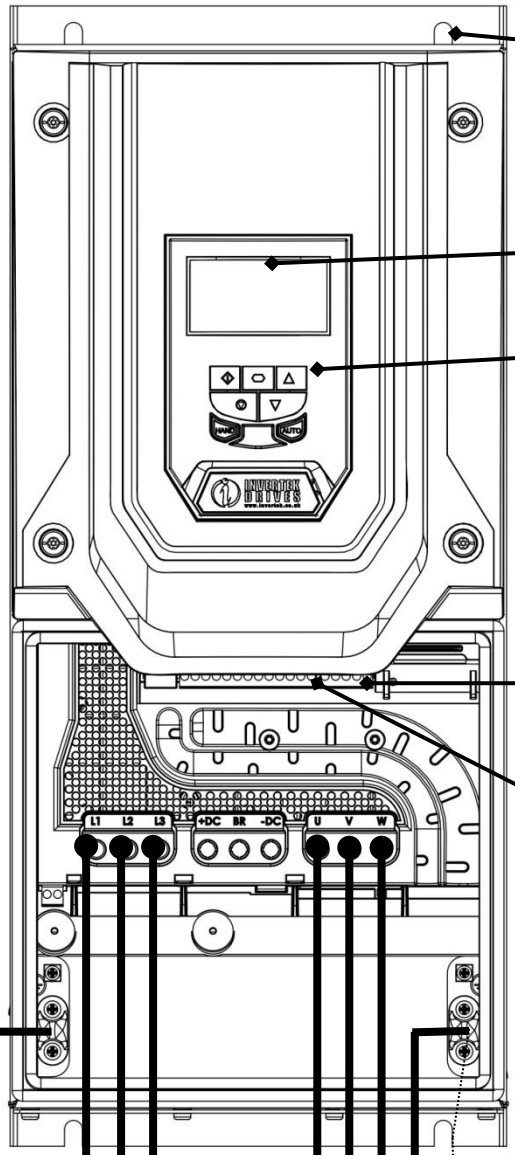
AC Variable Speed Drives
0.75 - 160kW / 1HP - 250HP
200-480V Single and 3 Phase Input

IP20
IP66 / NEMA 4X
IP55 / NEMA 12
IP40

Installation and Operating Instructions

Optidrive HVAC Start Up Guide

OPTIDRIVE HVAC (IP55 Enclosure).

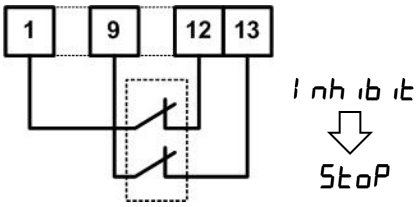


Mechanical Mounting
Information can be found in section 3.7 on page 16

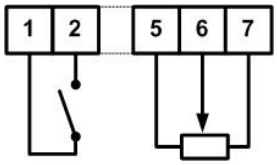
HVAC Display
(Status, Diagnostics, and Programming)

Keypad Operation can be found in section 5.5 on page 27

Hardware Enable Circuit
Link the terminals as shown, optionally through contacts to enable drive operation.



Control Terminal
Configuration based on factory settings



Close the switch to run (enable)
Open the switch to stop

Motor Cable
For correct cable size, see Technical Data on page 47
Observe the maximum permissible motor cable length.
For Motor cable lengths > 50 metres, an output filter is recommended.
Use a screened (shielded cable). The shield should be bonded to earth at both ends.

Fuses or MCB
Check Drive Rating info in section 13.4

PE L1 L2 L3

AC Supply Connection
200 – 240 Volts + / - 10%
380 – 380 Volts + / - 10%
Check Drive Input Voltage Ranges on page 47

Motor Connection

Check for Star or Delta connection according to the motor voltage rating in section 4.5.

Motor Nameplate Details
Motor Rated Voltage: P1-07
Motor Rated Current: P1-08
Motor Rated Frequency: P1-09
Motor Rated Speed (Optional): P1-10

Optidrive HVAC Start Up Guide

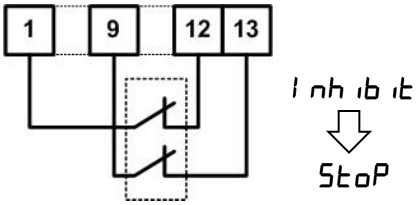
OPTIDRIVE HVAC (IP66 Enclosure).

Mechanical Mounting
Information can be found in section 3.8 on page 16

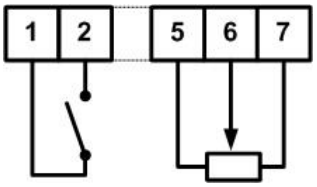
HVAC Display
(Status, Diagnostics, and Programming)

Keypad Operation can be found in section 5.5 on page 27

Hardware Enable Circuit
Link the terminals as shown, optionally through switch contacts to enable drive operation.



Control Terminal
Configuration based on factory settings



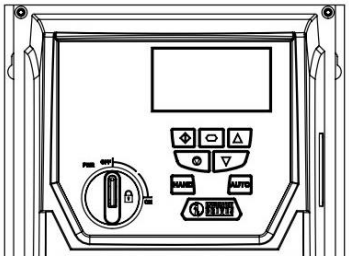
Run / Stop **10K Pot**
Close the switch to run (enable)
Open the switch to stop

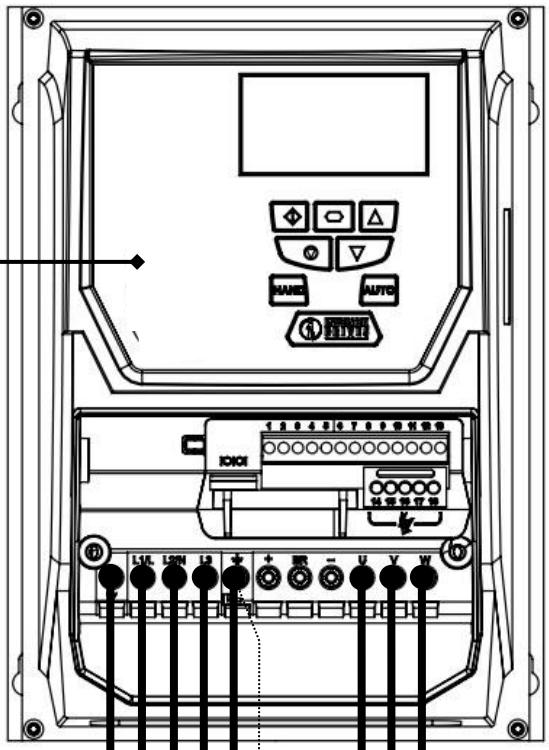
Motor Cable Sizes
Check the rating information in section 11.3 on page 47

Motor Connections
Check for Star or Delta connection according to the motor voltage rating – se section 4.5 on page 23

Motor Nameplate Details
Motor Rated Voltage: P1-07
Motor Rated Current: P1-08
Motor Rated Frequency: P1-09
Motor Rated Speed (Optional): P1-10

Applies to Switched version only
In-built Isolator:
Mains Power On / Off



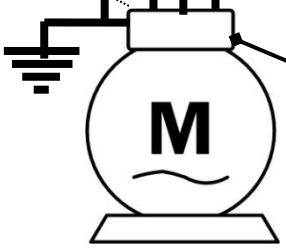


Fuses or MCB
Check Drive Rating info in section 13.4.

PE L1 L2 L3

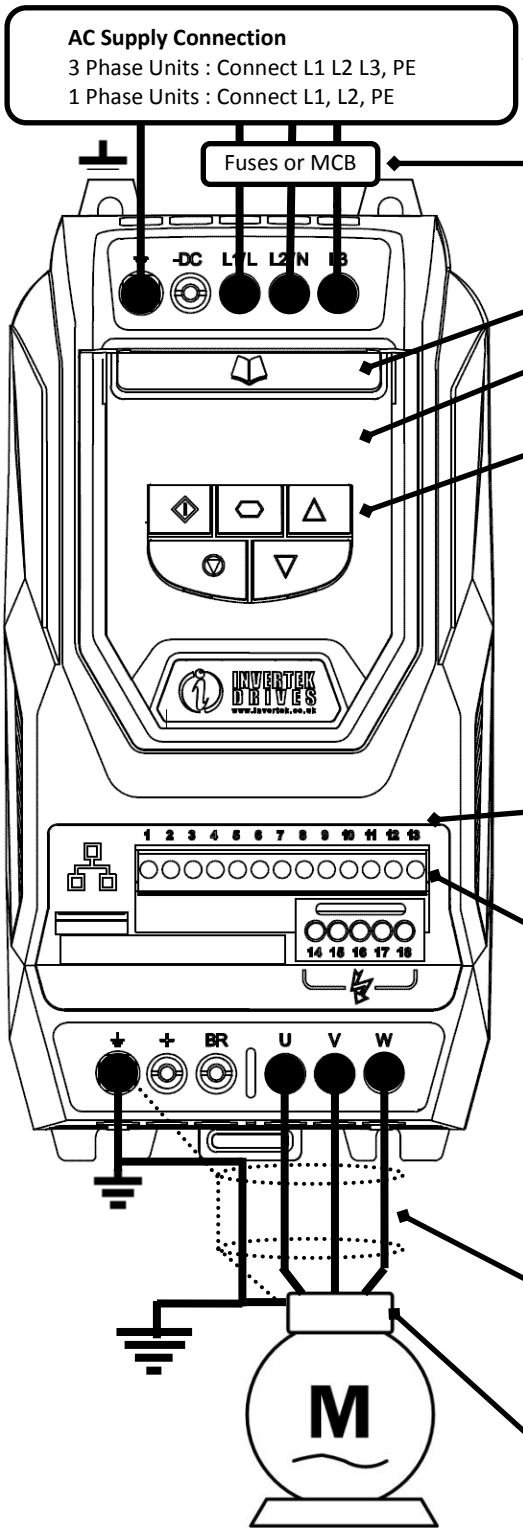
AC Supply Connection
200 – 240 Volts + / - 10%: 1 / 3 Phase
380 – 380 Volts + / - 10%: 3 Phase

Check Drive Input Voltage Ranges on page 47



Optidrive HVAC Start Up Guide

OPTIDRIVE HVAC (IP20 Enclosure).



AC Supply Connection
3 Phase Units : Connect L1 L2 L3, PE
1 Phase Units : Connect L1, L2, PE

Supply Voltage
200 – 240 Volts + / - 10%
380 – 380 Volts + / - 10%

Fuses or MCB
- Check the Technical Data in section 11 on page 47

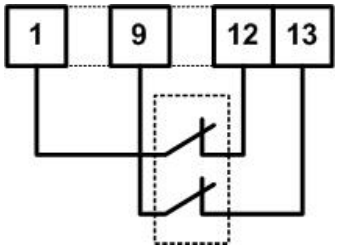
Help Card

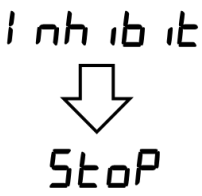
Display Information can be found in section 5.4 on page 26

Keypad Operation can be found in section 5.2 on page 25

IMPORTANT!

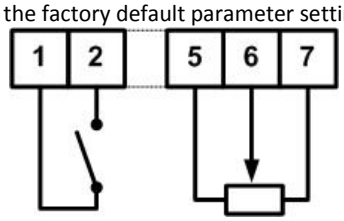
Hardware Enable Circuit





Link the terminals as shown, optionally through contacts to enable drive operation

Control Terminals
Based on the factory default parameter settings



Run – Stop **10K Speed Pot**

Close the switch to run (enable), open to stop

Motor Cable
- For correct cable size see Technical Data on page 47
- Observe the maximum permissible motor cable length
- For Motor cable lengths > 50 metres, an output filter is recommended
- Use a screened (shielded cable)

Motor Connection
- Check for Star or Delta connection according to the motor voltage rating - see section 4.5 on page 23

- **Motor Nameplate Details**
- Motor Rated Voltage : P1-07
- Motor Rated Current : P1-08
- Motor Rated Frequency : P1-09
- Motor Rated Speed (Optional) : P1-10

Declaration of Conformity:

Invertek Drives Limited
Offas Dyke Business Park
Welshpool
Powys
UK
SY21 8JF

Invertek Drives Ltd hereby states that the Optidrive ODV-2 product range conforms to the relevant safety provisions of the Low Voltage Directive 2006/95/EC and the EMC Directive 2004/108/EC and has been designed and manufactured in accordance with the following harmonised European standards:

EN 61800-5-1: 2003	Adjustable speed electrical power drive systems. Safety requirements. Electrical, thermal and energy.
EN 61800-3 2nd Ed: 2004	Adjustable speed electrical power drive systems. EMC requirements and specific test methods
EN 55011: 2007	Limits and Methods of measurement of radio disturbance characteristics of industrial, scientific and medical (ISM) radio-frequency equipment (EMC)
EN60529 : 1992	Specifications for degrees of protection provided by enclosures

Electromagnetic Compatibility

All Optidrives are designed with high standards of EMC in mind. All versions suitable for operation on Single Phase 230 volt and Three Phase 400 volt supplies and intended for use within the European Union are fitted with an internal EMC filter. This EMC filter is designed to reduce the conducted emissions back into the supply via the power cables for compliance with harmonised European standards.
It is the responsibility of the installer to ensure that the equipment or system into which the product is incorporated complies with the EMC legislation of the country of use. Within the European Union, equipment into which this product is incorporated must comply with the EMC Directive 2004/108/EC. When using an Optidrive with an internal or optional external filter, compliance with the following EMC Categories, as defined by EN61800-3:2004 can be achieved:

Drive Type / Rating	EMC Category		
	C1	C2	C3
1 Phase, 230 Volt Input ODV-2-x2xxx-1xFxx-xx	No additional filtering required Use shielded motor cable		
3 Phase, 400 Volt Input IP20 & IP66 Models ODV-2-x4xxx-3xFxx-xx	Use Additional External Filter Use shielded motor cable	No additional filtering required	
3 Phase, 400 Volt Input IP55 Models ODV-2-x4xxx-3xFxN-xx	Use Additional External Filter Use shielded motor cable		No Additional Filtering Required
3 Phase, 525 & 600 Volt Input All Models ODV-2-x5xxx-3x0xx-xx ODV-2-x5xxx-3x0xx-xx	This equipment is intended for fixed installation, and is not intended to conform to the EMC Directive without additional preventative measures being applied. Consult your Invertek Sales Partner for further information.		

Note	Compliance with EMC standards is dependent on a number of factors including the environment in which the drive is installed, motor switching frequency, motor, cable lengths and installation methods adopted.
	For motor cable lengths greater than 100m, an output dv / dt filter must be used, please refer to the Invertek Stock Drives Catalogue for further details

All Invertek Optidrive HVAC units carry a 2 year warranty against manufacturing defects from the date of manufacture. The manufacturer accepts no liability for any damage caused during or resulting from transport, receipt of delivery, installation or commissioning. The manufacturer also accepts no liability for damage or consequences resulting from inappropriate, negligent or incorrect installation, incorrect adjustment of the operating parameters of the drive, incorrect matching of the drive to the motor, incorrect installation, unacceptable dust, moisture, corrosive substances, excessive vibration or ambient temperatures outside of the design specification.

The local distributor may offer different terms and conditions at their discretion, and in all cases concerning warranty, the local distributor should be contacted first.

This user guide is the "original instructions" document. All non-English versions are translations of the "original instructions".

Contents of this User Guide are believed to be correct at the time of printing. In the interest of a commitment to a policy of continuous improvement, the manufacturer reserves the right to change the specification of the product or its performance or the contents of the User Guide without notice.

This User Guide is for use with version 1.30 Firmware.

User Guide 2.00

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

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1. Introduction

1.1. Important safety information

Please read the IMPORTANT SAFETY INFORMATION below, and all Warning and Caution information elsewhere.

 **Danger : Indicates a risk of electric shock, which, if not avoided, could result in damage to the equipment and possible injury or death.**	 **Danger : Indicates a potentially hazardous situation other than electrical, which if not avoided, could result in damage to property.**

	This variable speed drive product (Optidrive) is intended for professional incorporation into complete equipment or systems as part of a fixed installation. If installed incorrectly it may present a safety hazard. The Optidrive uses high voltages and currents, carries a high level of stored electrical energy, and is used to control mechanical plant that may cause injury. Close attention is required to system design and electrical installation to avoid hazards in either normal operation or in the event of equipment malfunction. Only qualified electricians are allowed to install and maintain this product.
	System design, installation, commissioning and maintenance must be carried out only by personnel who have the necessary training and experience. They must carefully read this safety information and the instructions in this Guide and follow all information regarding transport, storage, installation and use of the Optidrive, including the specified environmental limitations.
	Do not perform any flash test or voltage withstand test on the Optidrive. Any electrical measurements required should be carried out with the Optidrive disconnected.
	Electric shock hazard! Disconnect and ISOLATE the Optidrive before attempting any work on it. High voltages are present at the terminals and within the drive for up to 10 minutes after disconnection of the electrical supply. Always ensure by using a suitable multimeter that no voltage is present on any drive power terminals prior to commencing any work.
	Where supply to the drive is through a plug and socket connector, do not disconnect until 10 minutes have elapsed after turning off the supply.
	Ensure correct earthing connections and cable selection as per defined by local legislation or codes. The drive may have a leakage current of greater than 3.5mA; furthermore the earth cable must be sufficient to carry the maximum supply fault current which normally will be limited by the fuses or MCB. Suitably rated fuses or MCB should be fitted in the mains supply to the drive, according to any local legislation or codes.
	Do not carry out any work on the drive control cables whilst power is applied to the drive or to the external control circuits.
	Within the European Union, all machinery in which this product is used must comply with the Machinery Directive 2006/42/EC, Safety of Machinery. In particular, the machine manufacturer is responsible for providing a main switch and ensuring the electrical equipment complies with EN60204-1.
	The level of integrity offered by the Optidrive control input functions – for example stop/start, forward/reverse and maximum speed, is not sufficient for use in safety-critical applications without independent channels of protection. All applications where malfunction could cause injury or loss of life must be subject to a risk assessment and further protection provided where needed.
	The driven motor can start at power up if the enable input signal is present.
	The STOP function does not remove potentially lethal high voltages. ISOLATE the drive and wait 10 minutes before starting any work on it. Never carry out any work on the Drive, Motor or Motor cable whilst the input power is still applied.
	The Optidrive can be programmed to operate the driven motor at speeds above or below the speed achieved when connecting the motor directly to the mains supply. Obtain confirmation from the manufacturers of the motor and the driven machine about suitability for operation over the intended speed range prior to machine start up.
	Do not activate the automatic fault reset function on any systems whereby this may cause a potentially dangerous situation.
	IP55 and IP66 drives provide their own pollution degree 2 environments. IP20 drives must be installed in a pollution degree 2 environment, mounted in a cabinet with IP54 or better.
	Optidrives are intended for indoor use only
	When mounting the drive, ensure that sufficient cooling is provided. Do not carry out drilling operations with the drive in place, dust and swarf from drilling may lead to damage.
	The entry of conductive or flammable foreign bodies should be prevented. Flammable material should not be placed close to the drive
	Relative humidity must be less than 95% (non-condensing).
	Ensure that the supply voltage, frequency and no. of phases (1 or 3 phase) correspond to the rating of the Optidrive as delivered.
	Never connect the mains power supply to the Output terminals U, V, W.
	Do not install any type of automatic switchgear between the drive and the motor
	Wherever control cabling is close to power cabling, maintain a minimum separation of 100 mm and arrange crossings at 90 degrees Ensure that all terminals are tightened to the appropriate torque setting
	Do not attempt to carry out any repair of the Optidrive. In the case of suspected fault or malfunction, contact your local Invertek Drives Sales Partner for further assistance.

2. General Information and Ratings

2.1. Drive model numbers

2.1.1. IP20 Enclosed Units

200-240V ±10% - 1 Phase Input					
kW Model	**kW**	**HP Model**	**HP**	**Output Current (A)**	**Frame Size**
ODV-2-22075-1KF12-SN*	0.75	ODV-2-22010-1HF12-SN*	1	4.3	2
ODV-2-22150-1KF12-SN*	1.5	ODV-2-22020-1HF12-SN*	2	7	2
ODV-2-22220-1KF12-SN*	2.2	ODV-2-22030-1HF12-SN*	3	10.5	2
200-240V ±10% - 3 Phase Input					
kW Model	**kW**	**HP Model**	**HP**	**Output Current (A)**	**Frame Size**
ODV-2-22075-3KF12-SN*	0.75	ODV-2-22010-3HF12-SN*	1	4.3	2
ODV-2-22150-3KF12-SN*	1.5	ODV-2-22020-3HF12-SN*	2	7	2
ODV-2-22220-3KF12-SN*	2.2	ODV-2-22030-3HF12-SN*	3	10.5	2
ODV-2-32040-3KF12-SN*	4	ODV-2-32050-3HF12-SN*	5	18	3
ODV-2-32055-3KF12-SN*	5.5	ODV-2-32075-3HF12-SN*	7.5	24	3
380-480V ±10% - 3 Phase Input					
kW Model Number	**kW**	**HP Model Number**	**HP**	**Output Current (A)**	**Frame Size**
ODV-2-24075-3KF12-SN*	0.75	ODV-2-24010-3HF12-SN*	1	2.2	2
ODV-2-24150-3KF12-SN*	1.5	ODV-2-24020-3HF12-SN*	2	4.1	2
ODV-2-24220-3KF12-SN*	2.2	ODV-2-24030-3HF12-SN*	3	5.8	2
ODV-2-24400-3KF12-SN*	4	ODV-2-24050-3HF12-SN*	5	9.5	2
ODV-2-34055-3KF12-SN*	5.5	ODV-2-34075-3HF12-SN*	7.5	14	3
ODV-2-34075-3KF12-SN*	7.5	ODV-2-34100-3HF12-SN*	10	18	3
ODV-2-34110-3KF12-SN*	11	ODV-2-34150-3HF12-SN*	15	24	3
500 – 600V ±10% - 3 Phase Input					
kW Model Number	**kW**	**HP Model Number**	**HP**	**Output Current (A)**	**Frame Size**
ODV-2-26075-3K012-SN*	0.75	ODV-2-26010-3H012-SN*	1	2.1	2
ODV-2-26150-3K012-SN*	1.5	ODV-2-26020-3H012-SN*	2	3.1	2
ODV-2-26220-3K012-SN*	2.2	ODV-2-26030-3H012-SN*	3	4.1	2
ODV-2-26400-3K012-SN*	4	ODV-2-26050-3H012-SN*	5	6.5	2
ODV-2-26055-3K012-SN*	5.5	ODV-2-26075-3H012-SN*	7.5	9	2
ODV-2-36075-3K012-SN*	7.5	ODV-2-36100-3H012-SN*	10	12	3
ODV-2-36110-3K012-SN*	11	ODV-2-36150-3H012-SN*	15	17	3
ODV-2-36150-3K012-SN*	15	ODV-2-36200-3H012-SN*	20	22	3

**** Note : The final two characters of the model number relate to available factory build options as follows***

-SN Standard Seven Segment LED Display, standard PCB coating

-SC Standard Seven Segment LED Display, additional PCB conformal coating

2.1.2. IP66 Enclosed Units

200-240V ±10% - 1 Phase Input							
kW Model		**kW**	**HP Model**		**HP**	**Output**	**Frame**
Non Switched	**Switched**		**Non Switched**	**Switched**		**Current (A)**	**Size**
ODV-2-22075-1KF1X-TN*	ODV-2-22075-1KF1D-TN*	0.75	ODV-2-22010-1HF1X-TN*	ODV-2-22010-1HF1D-TN*	1	4.3	2
ODV-2-22150-1KF1X-TN*	ODV-2-22150-1KF1D-TN*	1.5	ODV-2-22020-1HF1X-TN*	ODV-2-22020-1HF1D-TN*	2	7	2
ODV-2-22220-1KF1X-TN*	ODV-2-22220-1KF1D-TN*	2.2	ODV-2-22030-1HF1X-TN*	ODV-2-22030-1HF1D-TN*	3	10.5	2
200-240V ±10% - 3 Phase Input							
kW Model Number		**kW**	**HP Model Number**		**HP**	**Output**	**Frame**
Non Switched	**Switched**		**Non Switched**	**Switched**		**Current (A)**	**Size**
ODV-2-22075-3KF1X-TN*	ODV-2-22075-3KF1D-TN*	0.75	ODV-2-22010-3HF1X-TN*	ODV-2-22010-3HF1D-TN*	1	4.3	2
ODV-2-22150-3KF1X-TN*	ODV-2-22150-3KF1D-TN*	1.5	ODV-2-22020-3HF1X-TN*	ODV-2-22020-3HF1D-TN*	2	7	2
ODV-2-22220-3KF1X-TN*	ODV-2-22220-3KF1D-TN*	2.2	ODV-2-22030-3HF1X-TN*	ODV-2-22030-3HF1D-TN*	3	10.5	2
ODV-2-32040-3KF1X-TN*	ODV-2-32040-3KF1D-TN*	4	ODV-2-32050-3HF1X-TN*	ODV-2-32050-3HF1D-TN*	5	18	3
380-480V ±10% - 3 Phase Input							
kW Model Number		**kW**	**HP Model Number**		**HP**	**Output**	**Frame**
Non Switched	**Switched**		**Non Switched**	**Switched**		**Current (A)**	**Size**
ODV-2-24075-3KF1X-TN*	ODV-2-24075-3KF1D-TN*	0.75	ODV-2-24010-3HF1X-TN*	ODV-2-24010-3HF1D-TN*	1	2.2	2
ODV-2-24150-3KF1X-TN*	ODV-2-24150-3KF1D-TN*	1.5	ODV-2-24020-3HF1X-TN*	ODV-2-24020-3HF1D-TN*	2	4.1	2
ODV-2-24220-3KF1X-TN*	ODV-2-24220-3KF1D-TN*	2.2	ODV-2-24030-3HF1X-TN*	ODV-2-24030-3HF1D-TN*	3	5.8	2
ODV-2-24400-3KF1X-TN*	ODV-2-24400-3KF1D-TN*	4	ODV-2-24050-3HF1X-TN*	ODV-2-24050-3HF1D-TN*	5	9.5	2
ODV-2-34055-3KF1X-TN*	ODV-2-34055-3KF1D-TN*	5.5	ODV-2-34075-3HF1X-TN*	ODV-2-34075-3HF1D-TN*	7.5	14	3
ODV-2-34075-3KF1X-TN*	ODV-2-34075-3KF1D-TN*	7.5	ODV-2-34100-3HF1X-TN*	ODV-2-34100-3HF1D-TN*	10	18	3
500-600V ±10% - 3 Phase Input							
kW Model Number		**kW**	**HP Model Number**		**HP**	**Output**	**Frame**
Non Switched	**Switched**		**Non Switched**	**Switched**		**Current (A)**	**Size**
ODV-2-26075-3K01X-TN*	ODV-2-26075-3K01D-TN*	0.75	ODV-2-26010-3H01X-TN*	ODV-2-26010-3H01D-TN*	1	2.1	2
ODV-2-26150-3K01X-TN*	ODV-2-26150-3K01D-TN*	1.5	ODV-2-26020-3H01X-TN*	ODV-2-26020-3H01D-TN*	2	3.1	2
ODV-2-26220-3K01X-TN*	ODV-2-26220-3K01D-TN*	2.2	ODV-2-26030-3H01X-TN*	ODV-2-26030-3H01D-TN*	3	4.1	2
ODV-2-26400-3K01X-TN*	ODV-2-26400-3K01D-TN*	4	ODV-2-26050-3H01X-TN*	ODV-2-26050-3H01D-TN*	5	6.5	2
ODV-2-26550-3K01X-TN*	ODV-2-36550-3K01D-TN*	5.5	ODV-2-26075-3H01X-TN*	ODV-2-26075-3H01D-TN*	7.5	9	2
ODV-2-36075-3K01X-TN*	ODV-2-36075-3K01D-TN*	7.5	ODV-2-36100-3H01X-TN*	ODV-2-36100-3H01D-TN*	10	12	3

*** Note : The final two characters of the model number relate to available factory build options as follows**

-TN OLED Text Display, standard PCB coating

-TC OLED Text Display, additional PCB conformal coating

2.1.3. IP55 Enclosed Units

200-240V ±10% - 3 Phase Input					
kW Model Number	**kW**	**HP Model Number**	**HP**	**Output Current (A)**	**Frame Size**
ODV-2-42055-3KF1N-TN*	5.5	ODV-2-42075-3HF1N-TN*	7.5	24	4
ODV-2-42075-3KF1N-TN*	7.5	ODV-2-42100-3HF1N-TN*	10	30	4
ODV-2-42110-3KF1N-TN*	11	ODV-2-42150-3HF1N-TN*	15	46	4
ODV-2-52150-3KF1N-TN*	15	ODV-2-52020-3HF1N-TN*	20	61	5
ODV-2-52185-3KF1N-TN*	18.5	ODV-2-52025-3HF1N-TN*	25	72	5
ODV-2-62022-3KF1N-TN*	22	ODV-2-62030-3HF1N-TN*	30	90	6
ODV-2-62030-3KF1N-TN*	30	ODV-2-62040-3HF1N-TN*	40	110	6
ODV-2-62037-3KF1N-TN*	37	ODV-2-62050-3HF1N-TN*	50	150	6
ODV-2-62045-3KF1N-TN*	45	ODV-2-62060-3HF1N-TN*	60	180	6
ODV-2-72055-3KF1N-TN*	55	ODV-2-72075-3HF1N-TN*	75	202	7
ODV-2-72075-3KF1N-TN*	75	ODV-2-72100-3HF1N-TN*	100	248	7
380-480V ±10% - 3 Phase Input					
kW Model Number	**kW**	**HP Model Number**	**HP**	**Output Current (A)**	**Frame Size**
ODV-2-44110-3KF1N-TN*	11	ODV-2-44150-3HF1N-TN*	15	24	4
ODV-2-44150-3KF1N-TN*	15	ODV-2-44200-3HF1N-TN*	20	30	4
ODV-2-44185-3KF1N-TN*	18.5	ODV-2-44250-3HF1N-TN*	25	39	4
ODV-2-44220-3KF1N-TN*	22	ODV-2-44300-3HF1N-TN*	30	46	4
ODV-2-54300-3KF1N-TN*	30	ODV-2-54040-3HF1N-TN*	40	61	5
ODV-2-54370-3KF1N-TN*	37	ODV-2-54050-3HF1N-TN*	50	72	5
ODV-2-64045-3KF1N-TN*	45	ODV-2-64060-3HF1N-TN*	60	90	6
ODV-2-64055-3KF1N-TN*	55	ODV-2-64075-3HF1N-TN*	75	110	6
ODV-2-64075-3KF1N-TN*	75	ODV-2-64120-3HF1N-TN*	120	150	6
ODV-2-64090-3KF1N-TN*	90	ODV-2-64150-3HF1N-TN*	150	180	6
ODV-2-74110-3KF1N-TN*	110	ODV-2-74175-3HF1N-TN*	175	202	7
ODV-2-74132-3KF1N-TN*	132	ODV-2-74200-3HF1N-TN*	200	240	7
ODV-2-74160-3KF1N-TN*	160	ODV-2-74250-3HF1N-TN*	250	302	7
480-525V ±10% - 3 Phase Input					
kW Model Number	**kW**	**HP Model Number**	**HP**	**Output Current (A)**	**Frame Size**
ODV-2-75132-3K01N-TN*	132			185	7
ODV-2-75150-3K01N-TN*	150			205	7
ODV-2-75185-3K01N-TN*	185			255	7
ODV-2-75200-3K01N-TN*	200			275	7
500-600V ±10% - 3 Phase Input					
kW Model Number	**kW**	**HP Model Number**	**HP**	**Output Current (A)**	**Frame Size**
ODV-2-46185-3K01N-TN*	18.5	ODV-2-46250-3H01N-TN*	25	28	4
ODV-2-46220-3K01N-TN*	22	ODV-2-46300-3H01N-TN*	30	34	4
ODV-2-56300-3K01N-TN*	30	ODV-2-56400-3H01N-TN*	40	43	5
ODV-2-56370-3K01N-TN*	37	ODV-2-56050-3H01N-TN*	50	54	5
ODV-2-56450-3K01N-TN*	45	ODV-2-56060-3H01N-TN*	60	65	5
ODV-2-66055-3K01N-TN*	55	ODV-2-66075-3H01N-TN*	75	78	6
ODV-2-66075-3K01N-TN*	75	ODV-2-66100-3H01N-TN*	100	105	6
ODV-2-66090-3K01N-TN*	90	ODV-2-66125-3H01N-TN*	125	130	6
ODV-2-66110-3K01N-TN*	110	ODV-2-66150-3H01N-TN*	150	150	6

*** Note : The final two characters of the model number relate to available factory build options as follows**

-TN OLED Text Display, standard PCB coating

-TC OLED Text Display, additional PCB conformal coating

2.2. Identifying the Drive by Model Number

Each drive can be identified by its model number, shown below. The model number is on the shipping label and the drive nameplate. The model number includes the drive and factory fitted options.

ODV	-	2	-	2	4	400	-	3	K	F	1	2	-	S	N

Product Family
ODE : E Series
ODP : Optidrive Plus Series
ODV : HVAC Product Series

Generation

Frame Size

Voltage Code
1 : 110 Volt
2 : 230 Volt
4 : 400 Volt
5 : 525 Volt
6 : 600 Volt

Three Digit Power Rating

Input Phases

Power Type
K : kW Rated
H : HP Rated

PCB Coating
N : Standard Localised Coating
C : Full Conformal Coating

Display
S : 7 Segment LED Display
T : OLED Text Display

Enclosure
2 : IP20
4 : IP40
D : IP66 with Internal Disconnect
N : IP55 Non Switched
S : IP55 Switched
X : IP66 Non Switched
Y : IP66 Switched

Brake Chopper
1 : No Brake Chopper
4 : Internal Brake Chopper

EMC Filter
0 : No Internal Filer
F : Internal EMC Filter

Note

- Optidrive HVAC drives are not available with brake chopper / transistor
- All IP20 Optidrive HVAC drives are available with 7 Segment LED Display only
- All IP55 & IP66 Optidrive HVAC drives are available with OLED Text Display only
- All 230 & 400 Volt drives have an internal EMC filter fitted as standard
- All 525 & 600 Volt drives have no internal EMC filter

3. Mechanical Installation

3.1. General

- The Optidrive should be mounted in a vertical position only, on a flat, flame resistant, vibration free mounting using the integral mounting holes or DIN Rail clip (Frame Size 2 only).
- The Optidrive must be installed in a pollution degree 1 or 2 environment only.
- Do not mount flammable material close to the Optidrive
- Ensure that the minimum cooling air gaps, as detailed in sections 3.6, 3.7 and 3.8 are left clear
- Ensure that the ambient temperature range does not exceed the permissible limits for the Optidrive given in section 11.1
- Provide suitable clean, moisture and contaminant free cooling air sufficient to fulfil the cooling requirements of the Optidrive

3.2. Before Installation

- Carefully Unpack the Optidrive and check for any signs of damage. Notify the shipper immediately if any exist.
- Check the drive rating label to ensure it is of the correct type and power requirements for the application.
- To prevent accidental damage always store the Optidrive in its original box until required. Storage should be clean and dry and within the temperature range –40°C to +60°C

3.3. UL Compliant Installation

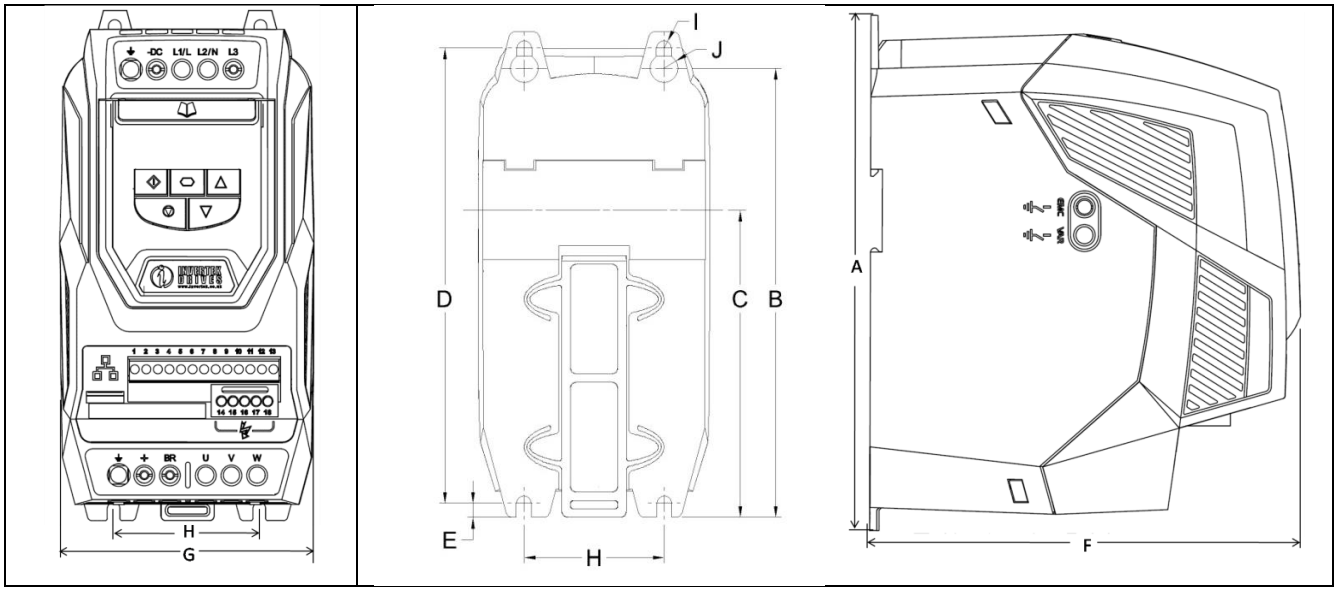
Note the following for UL-compliant installation:

- For an up to date list of UL compliant products, please refer to UL listing NMMS.E226333
- The drive can be operated within an ambient temperature range as stated in section 11.1
- For IP20 & IP40 units, installation is required in a pollution degree 1 environment
- For IP55 & IP66 units, installation in a pollution degree 2 environment is permissible
- UL Listed ring terminals / lugs must be used for all bus bar and grounding connections

Refer to section 11.4 on page 49 for Additional Information for UL Approved Installations

3.4. Mechanical dimensions and Weights

3.4.1. IP20 Units



Drive Size	A		B		C		D		E		F		G		H		I		J		Weight	
	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in	Kg	lb
2	221	8.70	207	8.15	137	5.39	209	8.23	5.3	0.21	185	7.28	112	4.41	63	2.48	5.5	0.22	10	0.39	1.8	4
3	261	10.28	246	9.69	-	-	247	9.72	6	0.24	205	8.07	131	5.16	80	3.15	5.5	0.22	10	0.39	3.5	7.7

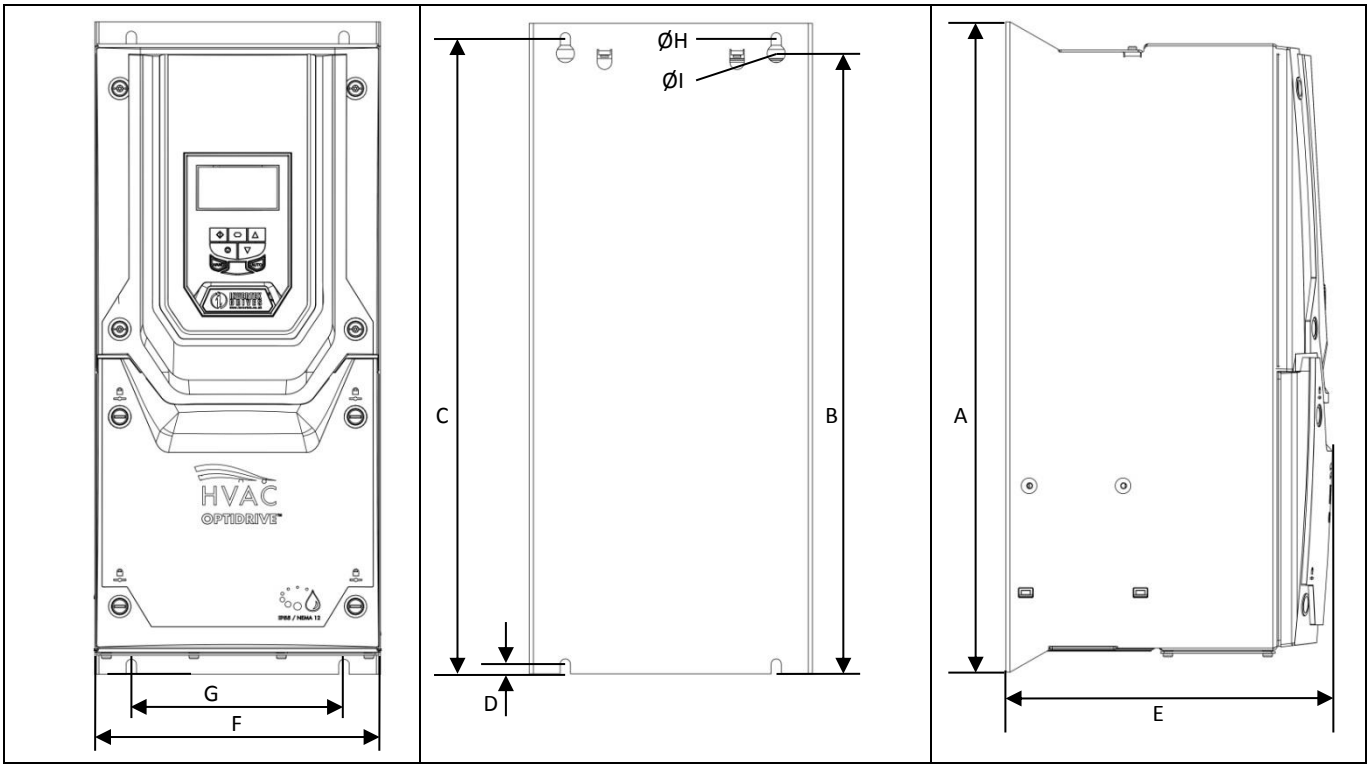
Mounting Bolts

All Frame Sizes : 4 x M5 (#10)

Tightening Torques

Control Terminal Torque Settings : All Sizes : 0.8 Nm (7 lb-in)
Power Terminal Torque Settings : All Sizes : 1 Nm (8.85 lb-in)

3.4.2. IP55 Units



Drive Size	A		B		C		D		E		F		G		H		I		Weight	
	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in	Kg	lb
4	450	17.32	428	16.46	433	16.65	8	0.31	252	9.92	171	6.73	110	4.33	4.25	0.17	7.5	0.30	11.5	25.4
5	540	21.26	515	20.28	520	20.47	8	0.31	270	10.63	235	9.25	175	6.89	4.25	0.17	7.5	0.30	22.5	49.6
6	865	34.06	830	32.68	840	33.07	10	0.39	330	12.99	330	12.99	200	7.87	5.5	0.22	11	0.43	50	110.2
7	1280	50.39	1245	49.02	1255	49.41	10	0.39	360	14.17	330	12.99	200	7.87	5.5	0.22	11	0.43	80	176.4

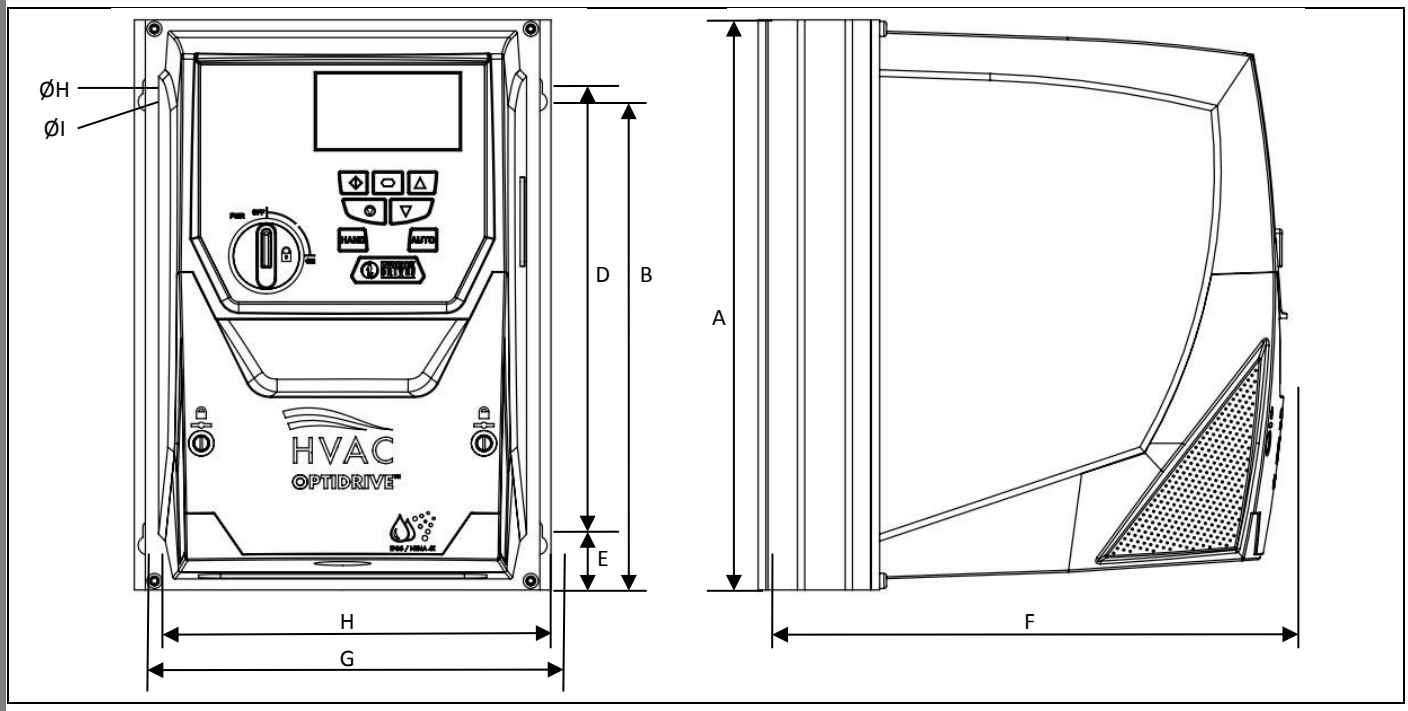
Mounting Bolts

Frame Size 4 : M8 (5/16 UNF)
Frame Size 5 : M8 (5/16 UNF)
Frame Size 6 : M10 (3/8 UNF)
Frame Size 7 : M10 (3/8 UNF)

Tightening Torques

Control Terminal Torque Settings : All Sizes : 0.8 Nm (7 lb-in)
Power Terminal Torque Settings : Frame Size 4 : 4 Nm (3 lb-ft)
Frame Size 5 : 15 Nm (11.1 lb-ft)
Frame Size 6 : 20 Nm (15 lb-ft)
Frame Size 7 : 20 Nm (15 lb-ft)

3.4.3. IP66 Units



Drive Size	A		B		D		F		G		H		I		J		Weight	
	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in	Kg	lb
2	257	10.12	220	8.66	200	7.87	239	9.41	188	7.40	176	6.93	4.2	0.17	8.5	0.33	4.8	10.6
3	310	12.20	277	10.89	252	9.90	251	9.88	211	8.29	198	7.78	4.2	0.17	8.5	0.33	7.3	16.1

Mounting Bolt Sizes

All Frame Sizes 4 x M4 (#8)

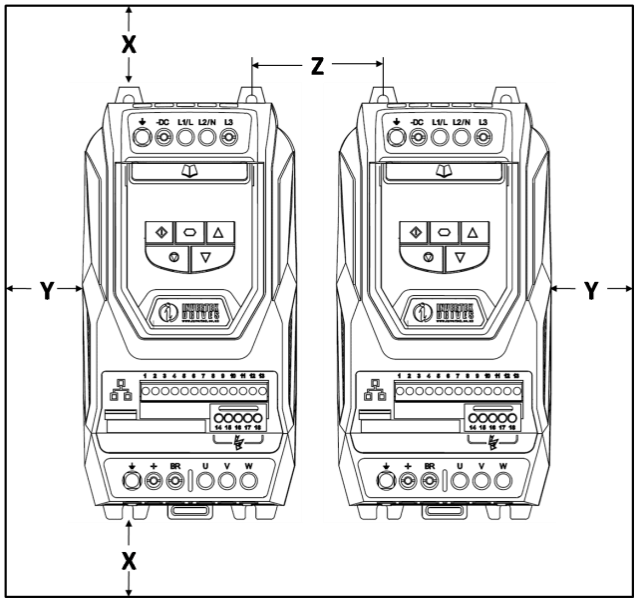
Tightening Torques

Control Terminal Torque Settings : All Sizes : 0.8 Nm (7 lb-in)
Power Terminal Torque Settings : Frame Size 2 : 1.2 – 1.5 Nm (10 – 15 lb-in)

3.5. Guidelines for Enclosure mounting (IP20 Units)

- IP20 drives are suitable for use in pollution degree 1 environments, according to IEC-664-1. For pollution degree 2 or higher environments, drives should be mounted in a suitable control cabinet with sufficient ingress protection to maintain a pollution degree 1 environment around the drive.
- Enclosures should be made from a thermally conductive material.
- Ensure the minimum air gap clearances around the drive as shown below are observed when mounting the drive.
- Where ventilated enclosures are used, there should be venting above the drive and below the drive to ensure good air circulation. Air should be drawn in below the drive and expelled above the drive.
- In any environments where the conditions require it, the enclosure must be designed to protect the Optidrive against ingress of airborne dust, corrosive gases or liquids, conductive contaminants (such as condensation, carbon dust, and metallic particles) and sprays or splashing water from all directions.
- High moisture, salt or chemical content environments should use a suitably sealed (non-vented) enclosure.

The enclosure design and layout should ensure that the adequate ventilation paths and clearances are left to allow air to circulate through the drive heatsink. Invertek Drives recommend the following minimum sizes for drives mounted in non-ventilated metallic enclosures:-



Drive Size	X Above & Below		Y Either Side		Z Between		Recommended airflow
	mm	in	mm	in	mm	in	CFM (ft^3/min)
2	75	2.95	50	1.97	46	1.81	11
3	100	3.94	50	1.97	52	2.05	26

Note :

Dimension Z assumes that the drives are mounted side-by-side with no clearance.

Typical drive heat losses are 3% of operating load conditions.

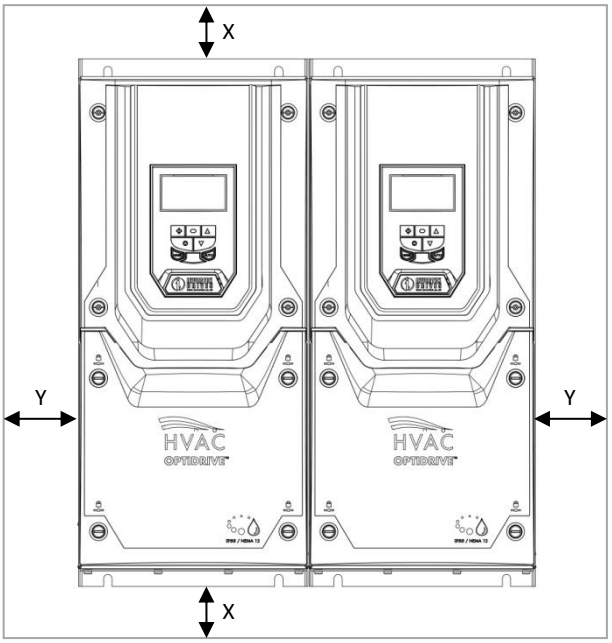
Above are guidelines only and the operating ambient temperature of the drive MUST be maintained at all times.

3.6. Mounting the Drive – IP20 Units

- IP20 Units are intended for installation within a control cabinet.
- When mounting with screws
  - Using the drive as a template, or the dimensions shown above, mark the locations for drilling
  - Ensure that when mounting locations are drilled, the dust from drilling does not enter the drive
  - Mount the drive to the cabinet backplate using suitable M5 mounting screws
  - Position the drive, and tighten the mounting screws securely
- When Din Rail Mounting (Frame Size 2 Only)
  - Locate the DIN rail mounting slot on the rear of the drive onto the top of the DIN rail first
  - Press the bottom of the drive onto the DIN rail until the lower clip attaches to the DIN rail
  - If necessary, use a suitable flat blade screw driver to pull the DIN rail clip down to allow the drive to mount securely on the rail
  - To remove the drive from the DIN rail, use a suitable flat blade screwdriver to pull the release tab downwards, and lift the bottom of the drive away from the rail first

3.7. Guidelines for mounting IP55 Units

- Before mounting the drive, ensure that the chosen location meets the environmental condition requirements for the drive shown in section 11.1
- The drive must be mounted vertically, on a suitable flat surface
- The minimum mounting clearances as shown in the table below must be observed
- The mounting site and chosen mountings should be sufficient to support the weight of the drives
- IP55 units do not require mounting inside an electrical control cabinet; however they may be if desired.



Drive Size	X Above & Below		Y Either Side	
	mm	in	mm	in
2 (IP66)	150	5.9	10	0.394
3 (IP66)	150	5.9	10	0.394
4 (IP55)	200	7.9	10	0.394
5 (IP55)	200	7.9	10	0.394
6 (IP55)	200	7.9	10	0.394
7 (IP55)	200	7.9	10	0.394

Note :

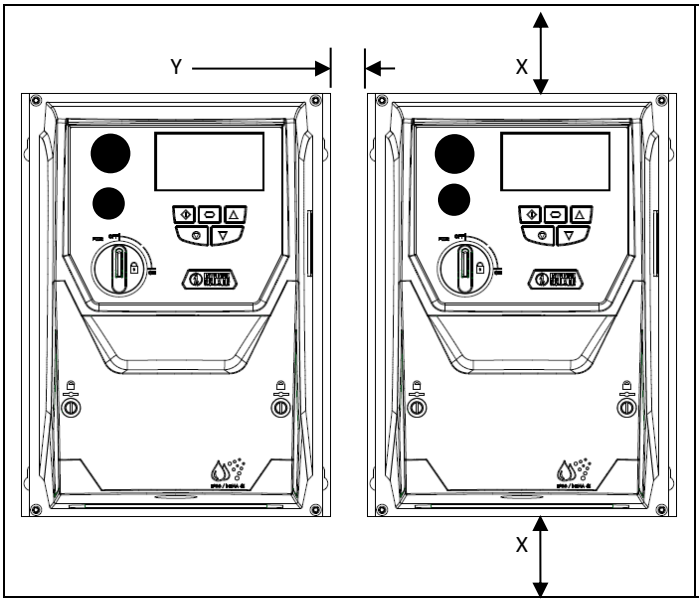
Typical drive heat losses are 3% of operating load conditions.

Above are guidelines only and the operating ambient temperature of the drive MUST be maintained at all times.

- Using the drive as a template, or the dimensions shown above, mark the locations required for drilling
- Suitable cable glands to maintain the IP protection of the drive are required. Gland sizes should be selected based on the number and size of the required connection cables. Drives are supplied with a plain, undrilled gland plate to allow the correct hole sizes to be cut as required. Remove the gland plate from the drive prior to drilling.

3.8. Guidelines for mounting (IP66 Units)

- Before mounting the drive, ensure that the chosen location meets the environmental condition requirements for the drive shown in section 11.1
- The drive must be mounted vertically, on a suitable flat surface
- The minimum mounting clearances as shown in the table below must be observed
- The mounting site and chosen mountings should be sufficient to support the weight of the drives



Drive Size	X Above & Below		Y Either Side	
	mm	in	mm	in
2	200	7.87	10	0.39
3	200	7.87	10	0.39

Note :

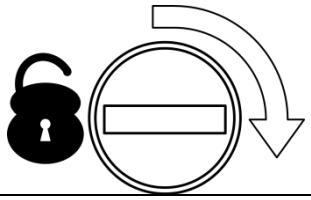
Typical drive heat losses are approximately 3% of operating load conditions.

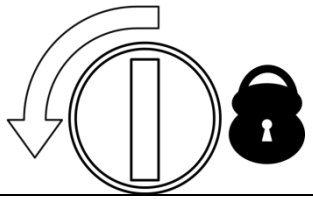
Above are guidelines only and the operating ambient temperature of the drive MUST be maintained at all times.

Cable Gland Sizes			
Frame	Power Cable	Motor Cable	Control Cables
2	M25 (PG2*	M25 (PG2*	M20 (PG13.5)
3	M25 (PG2*	M25 (PG2*	M20 (PG13.5)

- Using the drive as a template, or the dimensions shown above, mark the locations required for drilling
- Suitable cable glands to maintain the ingress protection of the drive are required. Gland holes for power and motor cables are pre-moulded into the drive enclosure, recommended gland sizes are shown above. Gland holes for control cables may be cut as required.

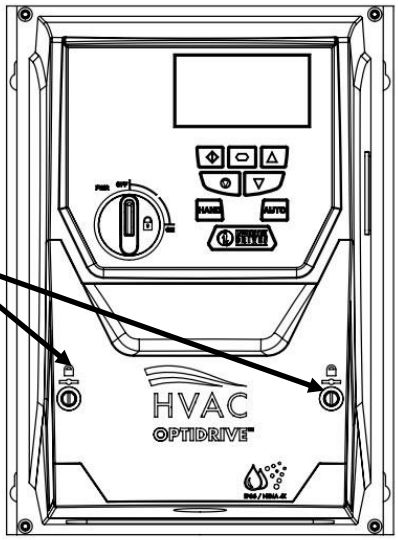
3.9. Removing the Terminal Cover





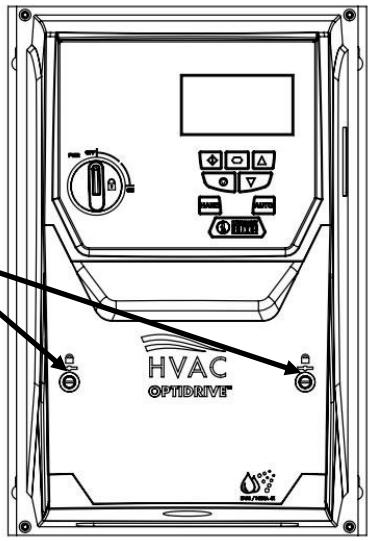
3.9.1. Frame Size 2

Using a suitable flat blade screwdriver, rotate the two retaining screws indicated until the screw slot is vertical



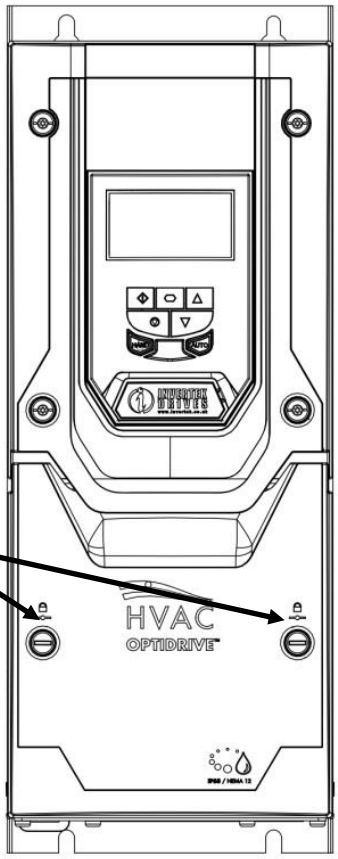
3.9.2. Frame Size 3

Using a suitable flat blade screwdriver, rotate the two retaining screws indicated until the screw slot is vertical



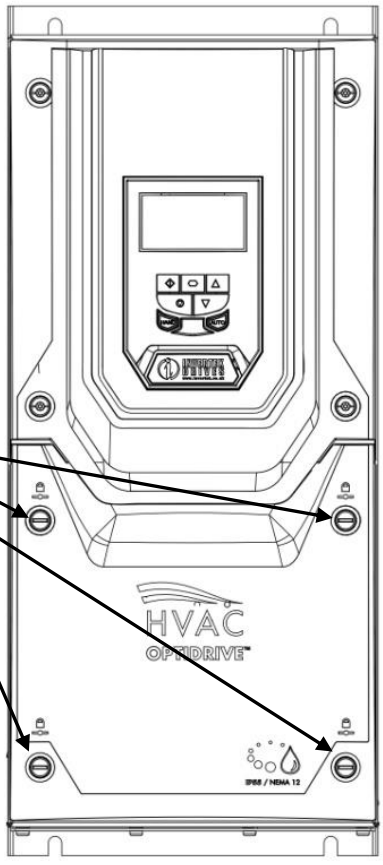
3.9.3. Frame Size 4

Using a suitable flat blade screwdriver, rotate the two retaining screws indicated until the screw slot is vertical.



3.9.4. Frame Size 5

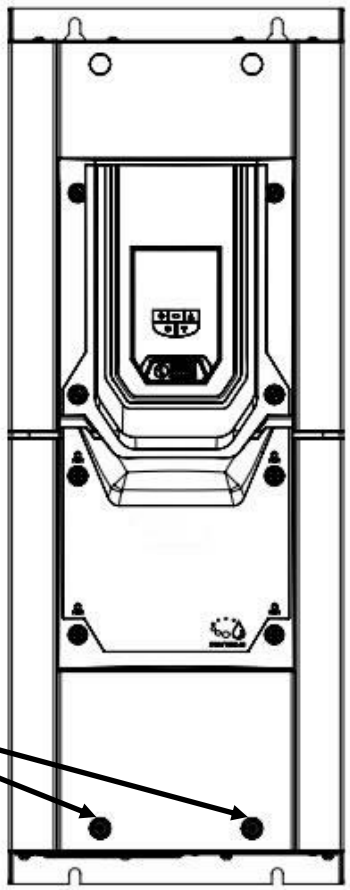
Using a suitable flat blade screwdriver, rotate the four retaining screws indicated until the screw slot is vertical.

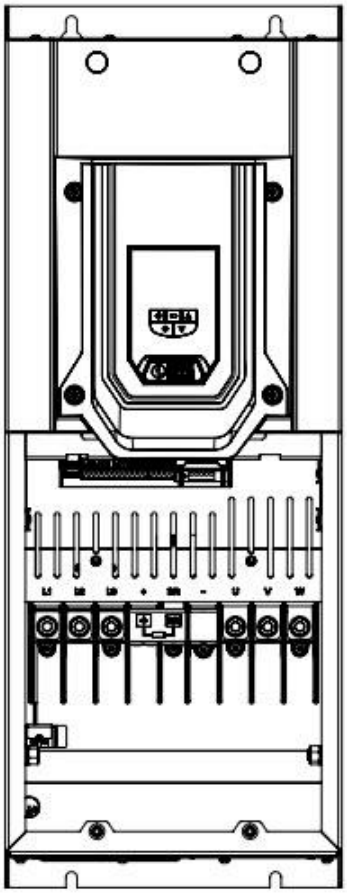


Terminal Cover Release Screws

3.9.5. Frame Size 6

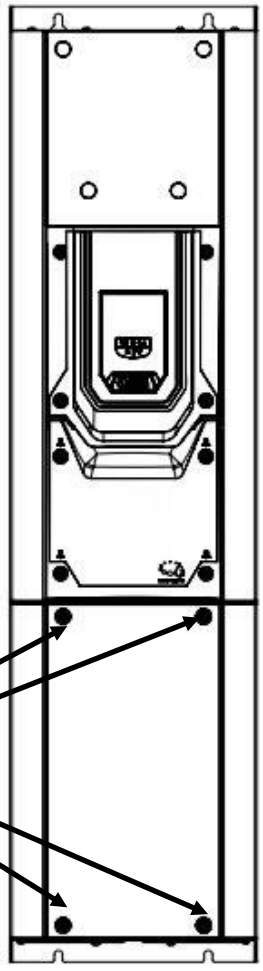
Using a suitable flat blade screwdriver, rotate the two retaining screws indicated until the screw slot is vertical

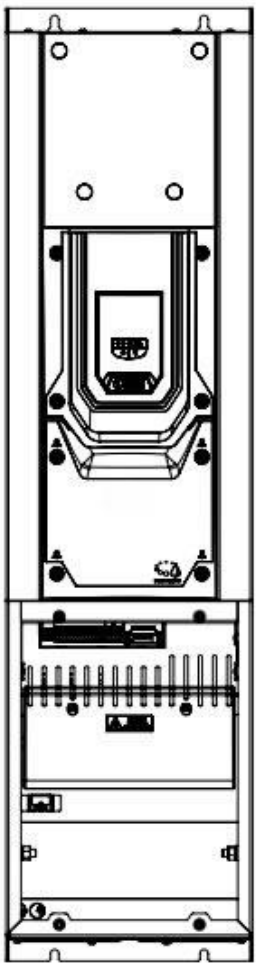




3.9.6. Frame Size 7

Using a suitable flat blade screwdriver, rotate the four retaining screws indicated until the screw slot is vertical





3.10. Routine Maintenance

The drive should be included within the scheduled maintenance program so that the installation maintains a suitable operating environment, this should include:

- Ambient temperature is at or below that set out in the “Environment” section.
- Heat sink fans freely rotating and dust free.
- The Enclosure in which the drive is installed should be free from dust and condensation; furthermore ventilation fans and air filters should be checked for correct air flow.

Checks should also be made on all electrical connections, ensuring screw terminals are correctly torqued; and that power cables have no signs of heat damage.

3.11. Gland Plate and Lock Off

The use of a suitable gland system is required to maintain the appropriate IP / Nema rating. Cable entry holes will need to be drilled to suit this system. Some guidelines sizes are defined below:
Please take care when drilling to avoid leaving any particles within the product.

Cable Gland recommended Hole Sizes & types:

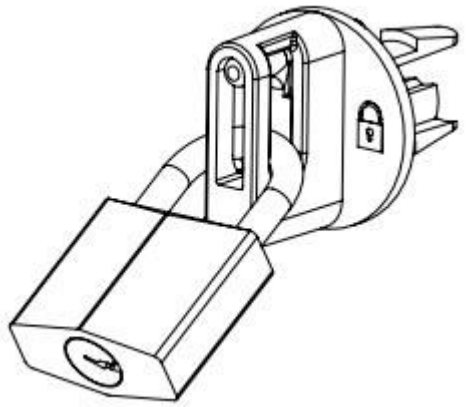
	Min Gland Rating	Hole Size	Imperial	Metric
Size 2	IP66	3 x 22mm	3 PG13.5	3 x M20
Size 3	IP66	1 x 22mm and 2 x 28mm	1 PG13.5 and 2 PG16	1 x M20 and 2 x M25

- UL rated ingress protection ("Type ") is only met when cables are installed using a UL recognized bushing or fitting for a flexible-conduit system which meets the required level of protection ("Type")
- For conduit installations the conduit entry holes require standard opening to the required sizes specified per the NEC
- Not intended for rigid conduit system

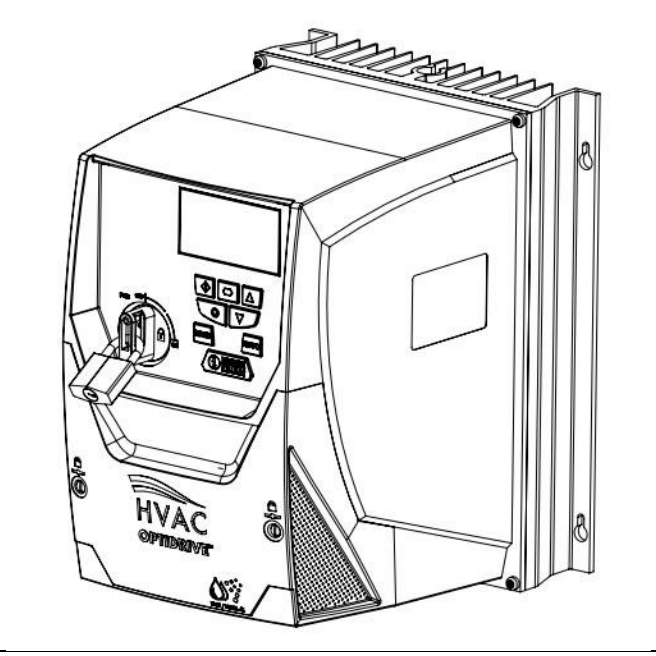
Power Isolator Lock Off – IP66 with Built in Isolator Option

On the switched models the main power isolator switch can be locked in the ‘Off’ position using a 20mm standard shackle padlock (not supplied).

IP66 / Nema 12 Unit Lock Off



IP66 / Nema 4X Unit Lock Off

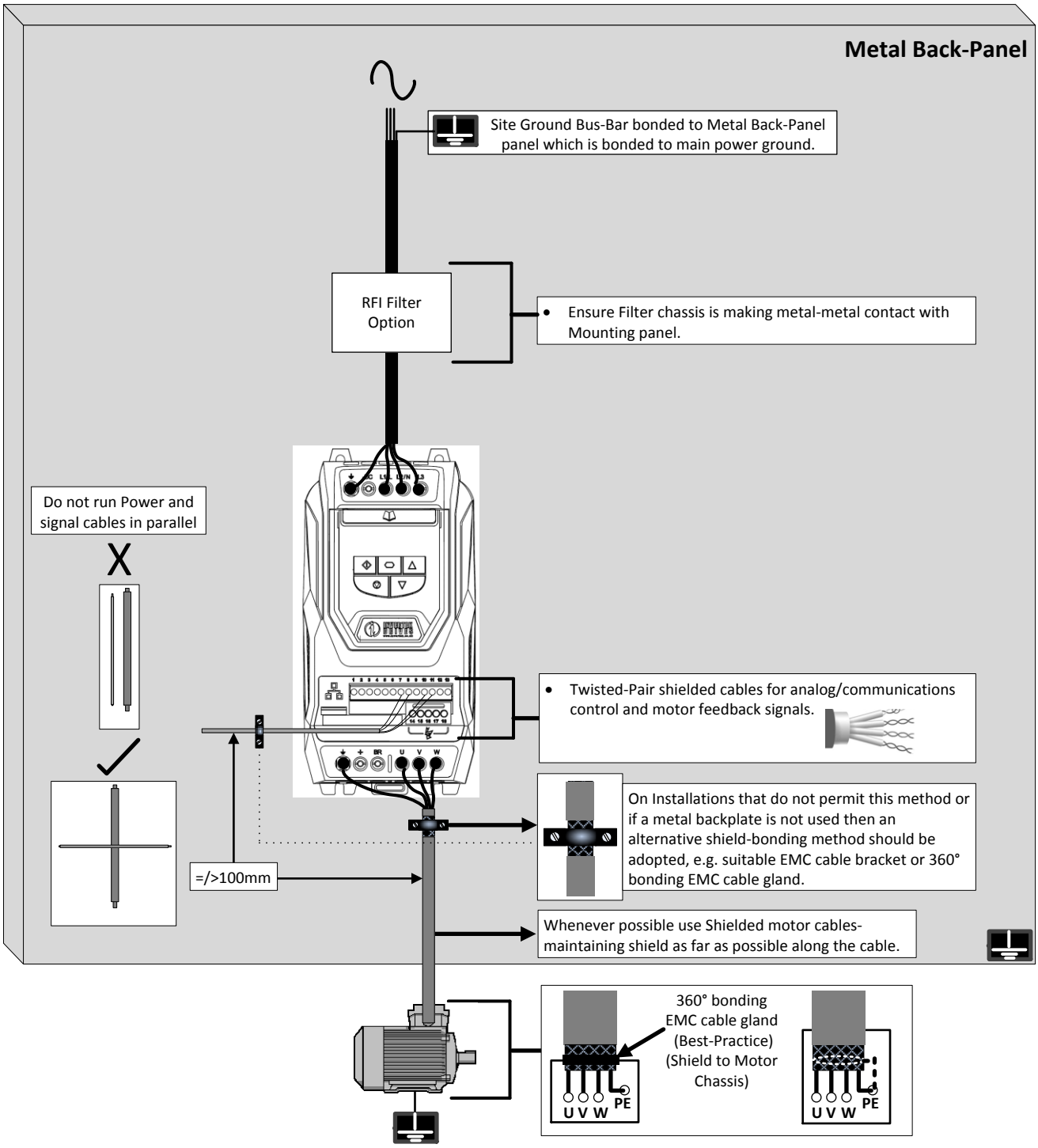


4. Electrical Installation

4.1. Grounding the Drive

	This manual is intended as a guide for proper installation. Invertek Drives Ltd cannot assume responsibility for the compliance or the non-compliance to any code, national, local or otherwise, for the proper installation of this drive or associated equipment. A hazard of personal injury and/or equipment damage exists if codes are ignored during installation.
	This Optidrive contains high voltage capacitors that take time to discharge after removal of the main supply. Before working on the drive, ensure isolation of the main supply from line inputs. Wait ten (10) minutes for the capacitors to discharge to safe voltage levels. Failure to observe this precaution could result in severe bodily injury or loss of life.
	Only qualified electrical personnel familiar with the construction and operation of this equipment and the hazards involved should install, adjust, operate, or service this equipment. Read and understand this manual and other applicable manuals in their entirety before proceeding. Failure to observe this precaution could result in severe bodily injury or loss of life.

4.1.1. Recommended installation for EMC compliance.



4.1.2. Grounding Guidelines

The ground terminal of each Optidrive should be individually connected DIRECTLY to the site ground bus bar (through the filter if installed). Optidrive ground connections should not loop from one drive to another, or to, or from any other equipment. Ground loop impedance must confirm to local industrial safety regulations. To meet UL regulations, UL approved ring crimp terminals should be used for all ground wiring connections.

The drive Safety Ground must be connected to system ground. Ground impedance must conform to the requirements of national and local industrial safety regulations and/or electrical codes. The integrity of all ground connections should be checked periodically.

4.1.3. Protective Earth Conductor

The Cross sectional area of the PE Conductor must be at least equal to that of the incoming supply conductor.

4.1.4. Safety Ground ⏚

This is the safety ground for the drive that is required by code. One of these points must be connected to adjacent building steel (girder, joist), a floor ground rod, or bus bar. Grounding points must comply with national and local industrial safety regulations and/or electrical codes.

4.1.5. Motor Ground

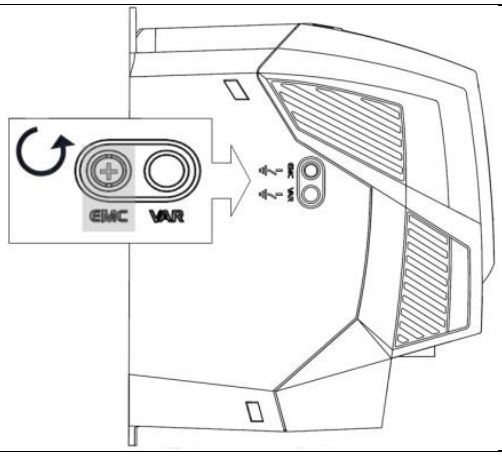
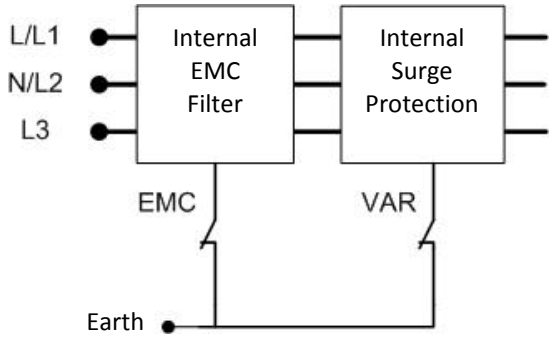
The motor ground must be connected to one of the ground terminals on the drive.

4.1.6. Ground Fault Monitoring

As with all inverters, a leakage current to earth can exist. The Optidrive is designed to produce the minimum possible leakage current whilst complying with worldwide standards. The level of current is affected by motor cable length and type, the effective switching frequency, the earth connections used and the type of RFI filter installed. If an ELCB (Earth Leakage Circuit Breaker) is to be used, the following conditions apply: -

- A Type B Device must be used
- The device must be suitable for protecting equipment with a DC component in the leakage current
- Individual ELCBs should be used for each Optidrive

Drives with an EMC filter have an inherently higher leakage current to Ground (Earth). For applications where tripping occurs the EMC filter can be disconnected (on IP20 units only) by removing the EMC screw on the side of the product.

Remove the screws as indicated below	
	

The Optidrive product range has input supply voltage surge suppression components fitted to protect the drive from line voltage transients, typically originating from lightning strikes or switching of high power equipment on the same supply.

4.1.7. Shield Termination (Cable Screen)

The safety ground terminal provides a grounding point for the motor cable shield. The motor cable shield connected to this terminal (drive end) should also be connected to the motor frame (motor end). Use a shield terminating or EMI clamp to connect the shield to the safety ground terminal.

4.2. Wiring Precautions

Connect the Optidrive according to section 4.3 and 4.4, ensuring that motor terminal box connections are correct. There are two connections in general: Star and Delta. It is essential to ensure that the motor is connected in accordance with the voltage at which it will be operated. For more information, refer to section 4.5 Motor Terminal Box Connection.

It is recommended that the power cabling should be 4-core PVC-insulated screened cable, laid in accordance with local industrial regulations and codes of practice.

4.3. Incoming Power Connection

- For a single phase supply, power should be connected to L1/L, L2/N.
- For 3 phase supplies power should be connected to L1, L2, and L3. Phase sequence is not important.
- For compliance with CE and C Tick EMC requirements, a symmetrical shielded cable is recommended.
- A fixed installation is required according to IEC61800-5-1 with a suitable disconnecting device installed between the Optidrive and the AC Power Source. The disconnecting device must conform to the local safety code / regulations (e.g. within Europe, EN60204-1, Safety of machinery).
- The cables should be dimensions according to any local codes or regulations. Guideline dimensions are given in section13.4.
- Suitable fuses to provide wiring protection of the input power cable should be installed in the incoming supply line, according to the data in section 13.4. The fuses must comply with any local codes or regulations in place. In general, type gG (IEC 60269) or UL type T fuses are suitable; however in some cases type aR fuses may be required. The operating time of the fuses must be below 0.5 seconds.
- Where allowed by local regulations, suitably dimensioned type B MCB circuit breakers of equivalent rating may be utilised in place of fuses, providing that the clearing capacity is sufficient for the installation.
- When the power supply is removed from the drive, a minimum of 30 seconds should be allowed before re-applying the power. A minimum of 10 minutes should be allowed before removing the terminal covers or connection.
- The maximum permissible short circuit current at the Optidrive Power terminals as defined in IEC60439-1 is 100kA.
- An optional Input Choke is recommended to be installed in the supply line for drives where any of the following conditions occur:-
    - The incoming supply impedance is low or the fault level / short circuit current is high
    - The supply is prone to dips or brown outs
    - An imbalance exists on the supply (3 phase drives)
    - The power supply to the drive is via a bus-bar and brush gear system (typically overhead Cranes).
- In all other installations, an input choke is recommended to ensure protection of the drive against power supply faults. Refer to your local Invertek sales partner for available options
- Optidrive HVAC models in frame sizes 4 to 8 are factory fitted with an Input choke as standard.

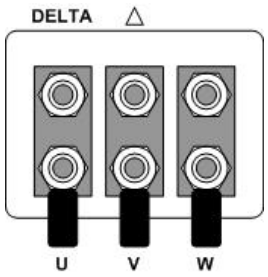
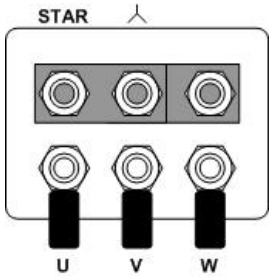
4.4. Drive and Motor Connection

- The drive inherently produces fast switching of the output voltage (PWM) to the motor compared to the mains supply, for motors which have been wound for operation with a variable speed drive then there is no preventative measures required, however if the quality of insulation is unknown then the motor manufacturer should be consulted and preventative measures may be required.
- The motor should be connected to the Optidrive U, V, and W terminals using a suitable 3 or 4 core cable. Where a 3 core cable is utilised, with the shield operating as an earth conductor, the shield must have a cross sectional area at least equal to the phase conductors when they are made from the same material. Where a 4 core cable is utilised, the earth conductor must be of at least equal cross sectional area and manufactured from the same material as the phase conductors.
- The motor earth must be connected to one of the Optidrive earth terminals.
- For compliance with the European EMC directive, a suitable screened (shielded) cable should be used. Braided or twisted type screened cable where the screen covers at least 85% of the cable surface area, designed with low impedance to HF signals are recommended as a minimum. Installation within a suitable steel or copper tube is generally also acceptable.
- The cable screen should be terminated at the motor end using an EMC type gland allowing connection to the motor body through the largest possible surface area
- Where drives are mounted in a steel control panel enclosure, the cable screen may be terminated directly to the control panel using a suitable EMC clamp or gland, as close to the drive as possible.
- For IP55 drives, connect the motor cable screen to the internal ground clamp

4.5. Motor Terminal Box Connections

Most general purpose motors are wound for operation on dual voltage supplies. This is indicated on the nameplate of the motor

This operational voltage is normally selected when installing the motor by selecting either STAR or DELTA connection. STAR always gives the higher of the two voltage ratings.

Incoming Supply Voltage	Motor Nameplate Voltages		Connection
230	230 / 400	Delta	
400	400 / 690		
600	600 / 1050		
400	230 / 400	Star	
600	340 / 600		

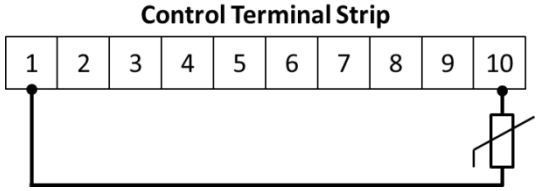
4.6. Motor Thermal overload Protection.

4.6.1. Internal Thermal overload protection.

The drive has an in-built motor thermal overload function; this is in the form of an "I.t-trP" trip after delivering >100% of the value set in **P**1-08 for a sustained period of time (e.g. 110% for 60 seconds).

4.6.2. Motor Thermistor Connection

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



Additional Information

- Compatible Thermistor : PTC Type, 2.5kΩ trip level
- Use a setting of P1-13 that have Input 5 function as External Trip, e.g. P1-13 = 6. Refer to section 8.1 for further details.

4.7. Control Terminal Wiring

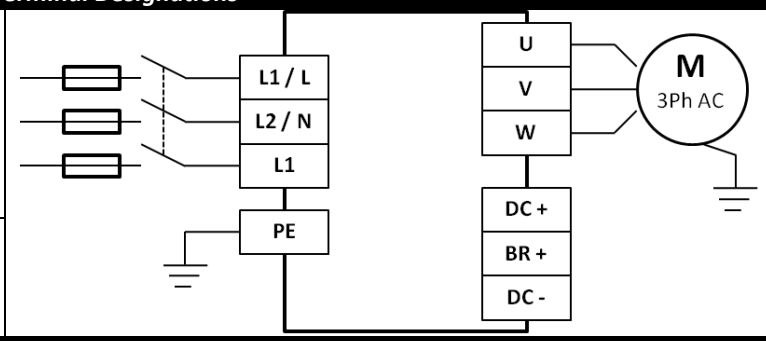
- All analog signal cables should be suitably shielded. Twisted pair cables are recommended.
- Power and Control Signal cables should be routed separately where possible, and must not be routed parallel to each other
- Signal levels of different voltages e.g. 24 Volt DC and 110 Volt AC, should not be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

4.8. Connection Diagram

4.8.1. Power Terminal Designations

Incoming Mains Power Supply
For 1 Phase Supply, connect to L1/L and L2/N terminals.
For 3 Phase Supply, connect to L1, L2 & L3 terminals.
Phase sequence is not important.

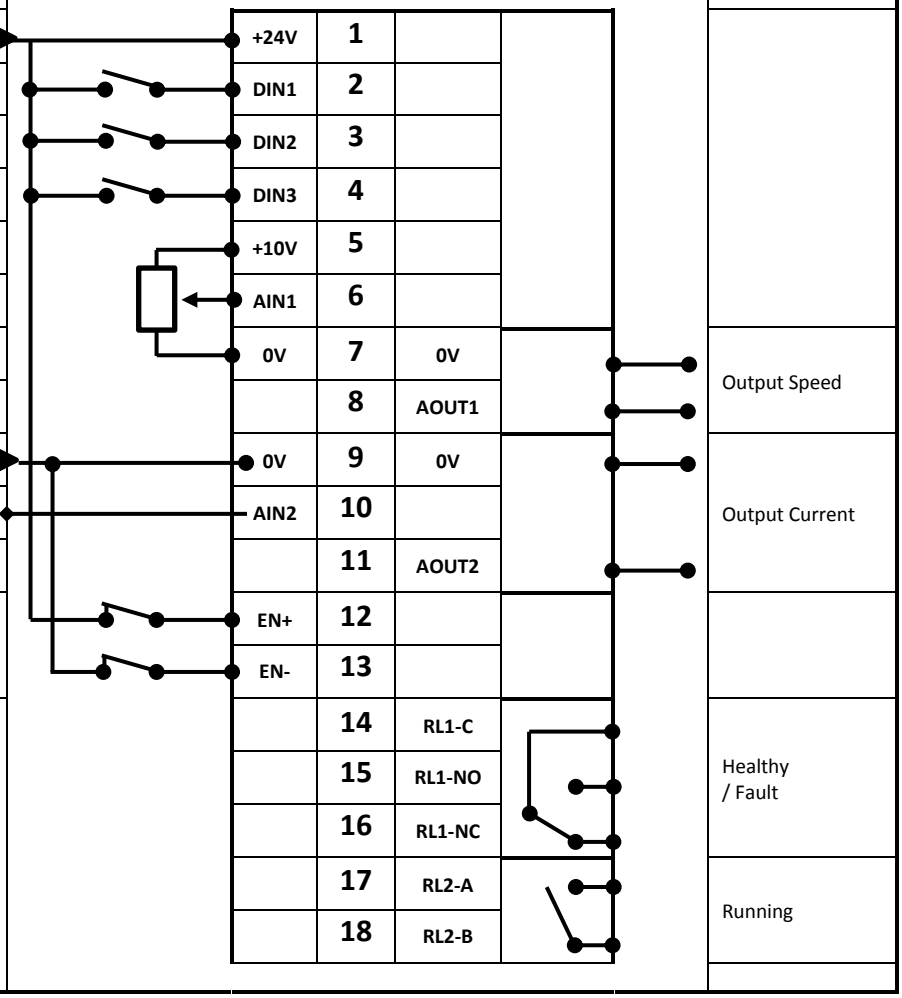
Protective Earth / Ground connection.
The drive must be Earthed / Grounded



Motor Connections
Connect the motor to the U, V & W terminals.
The motor earth must be connected to the drive

4.8.2. Control Terminal Connections & Factory Settings

	Open	Closed
+24V Supply (100mA) / External Input		
Digital Input 1	Stop	Run (Enable)
Digital Input 2	Analog Input Ref	Preset Speed 1
Digital Input 3	Analog Input 1 Ref	Analog Input 2 Ref
Digital Inputs : 8 – 30 Volt DC + 10 Volt, 10mA Output		
Analog Input 1		
Analog Output : 0 – 10 Volt / 4-20mA, 20mA Max		
0 Volt Supply / External Input		
Analog Input 2		
Analog Output : 0 – 10 Volt / 4-20mA, 20mA Max		
External Hardware Enable Circuit		
Relay Contacts 250VAC / 30VDC 5A Maximum		



5. Managing the Keypad

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

IP20 Drives:

IP20 rated drives are supplied with a 7 Segment LED display and a five button keypad (Start, Stop, Navigate, Up, Down)

IP55 and IP66 Drives:

IP55 and IP66 rated drives are supplied with an OLED multi-line text display and a seven button keypad (Start, Stop, Navigate, Up, Down, Hand, Auto)

Commissioning and operation of the drive with the two different Keypads and displays is detailed below.

5.1. Keypad Layout and Function – Standard LED Keypad (IP20 Drives)

	NAVIGATE	Used to display real-time information, to access and exit parameter edit mode and to store parameter changes
	UP	Used to increase speed in real-time mode or to increase parameter values in parameter edit mode
	DOWN	Used to decrease speed in real-time mode or to decrease parameter values in parameter edit mode
	RESET / STOP	Used to reset a tripped drive. When in Keypad mode is used to Stop a running drive.
	START	When in keypad mode, used to Start a stopped drive or to reverse the direction of rotation if bi-directional keypad mode is enabled

5.2. Changing Parameters – Standard LED Keypad (IP20 Drives)

Procedure	Display shows...
Power on Drive	StoP
Press and hold the for >2 seconds	P 1-01
Press the Key	P 1-02
The and can be used to select the desired parameter	P 1-03 etc..
Select the required parameter, e.g. P1-02	P 1-02
Press the button	0.0
Use the and keys to adjust the value, e.g. set to 10	10.0
Press the key	P 1-02
The parameter value is now adjusted and automatically stored. Press the key for >2 seconds to return to operating mode	StoP

5.3. Advanced Keypad Operation Short Cuts – Standard LED Keypad (IP20 Drives)

Function	When Display shows...	Press...	Result	Example
Fast Selection of Parameter Groups Note : Parameter Group Access must be enabled P1-14 = 101	Px- xx		The next highest Parameter group is selected	Display shows P1- 10 Press  Display shows P2-01
	Px- xx		The next lowest Parameter group is selected	Display shows P2-26 Press  Display shows P1-01
Select lowest Group Parameter	Px- xx		The first parameter of a group is selected	Display shows P1- 10 Press  Display shows P1-01
Set Parameter to minimum value	Any numerical value (Whilst editing a parameter value)		The parameter is set to the minimum value	When editing P1-01 Display shows 50.0 Press  Display shows 0.0
Adjusting individual digits within a parameter value	Any numerical value (Whilst editing a parameter value)		Individual parameter digits can be adjusted	When editing P1-10 Display shows 0 Press  Display shows _0 Press  Display shows 10 Press  Display shows _ 10 Press  Display shows 110 Etc...

5.4. Drive Operating Displays – Standard LED Keypad (IP20 Drives)

Display	Status	
StoP	Drive mains power applied, but no Enable or Run signal applied	
AUto-t	Motor Autotune in progress.	
H x.x	Drive running, display shows output frequency (Hz)	Whilst the drive is running, the following displays can be selected by briefly pressing the  button on the drive. Each press of the button will cycle the display through to the next selection.
A x.x	Drive running, display shows motor current (Amps)	
P x.x	Drive Running, display shows motor power (kW)	
C x.x	Drive Running, display shows customer selected units, see parameters P2-21 and P2-22	
Etl-24	Drive mains power not present, external 24 Volt control power supply present only	
Inh	Output power hardware enable circuit open. External links are required to the STO inputs (terminals 12 and 13) as shown in section 4.8 Connection Diagram	
P-dEF	Parameters reset to factory default settings	
U-dEF	Parameters reset to User default settings	
For drive fault code displays, refer to section 12.1		

5.5. Keypad Layout and Function – Standard OLED Keypad (IP55 and IP66 Drives)

OLED Display

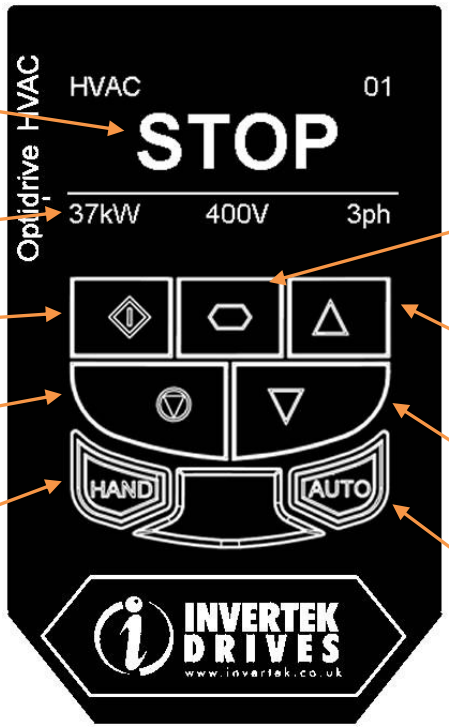
Main Displayed Parameter
Shows which of the selectable parameters is currently being shown on the main display, e.g. Motor Speed, Motor Current etc.

Operating Information
Provides a real time display of key operating information, e.g. output current and power

Start Button
When in Hand mode, used to Start the drive.

Stop / Reset Button
Used to reset a tripped drive.
When in Hand mode, used to Stop the drive.

Hand Button
Used to place drive in Hand (keypad) mode.



Control Keypad
Provides access to the drive parameters, and also allows control of the drive when Hand operation is selected.

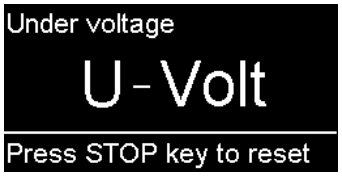
Navigate Button
Used to display real-time information, to access and exit parameter edit mode and to store parameter changes

Up Button
Used to increase speed in real-time mode or to increase parameter values in parameter edit mode

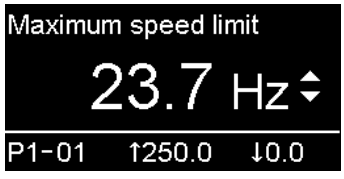
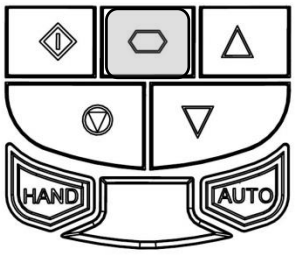
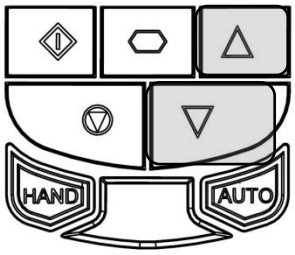
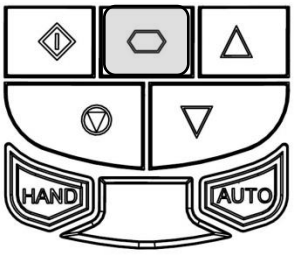
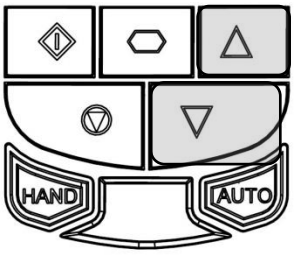
Down Button
Used to decrease speed in real-time mode or to decrease parameter values in parameter edit mode

Auto Button
Used to place drive in Auto (Remote) mode.

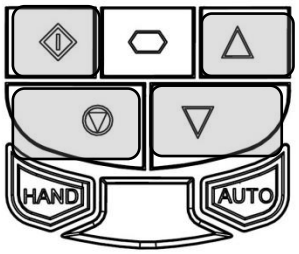
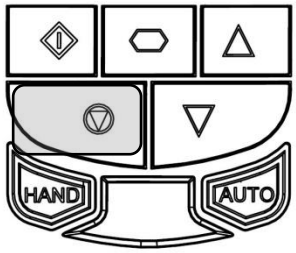
5.6. Drive Operating Displays – Standard OLED Keypad (IP55 and IP66 Drives)

			
Displayed when the hardware enable circuit is open	Displayed when the drive power is applied, motor stopped	Drive operating, display showing output information	Drive trip display showing trip condition

5.7. Accessing and Changing Parameter Values – Standard OLED Keypad (IP55 and IP66 Drives)

			
			
Hold navigate button in for >1 sec	Use up and down keys to scroll to required parameter.	Presss / release navigate button when required parameter shown	Use up and down keys to edit parameter value.

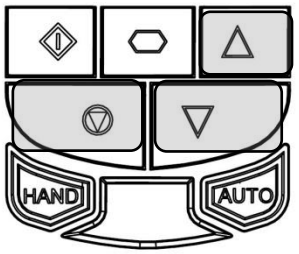
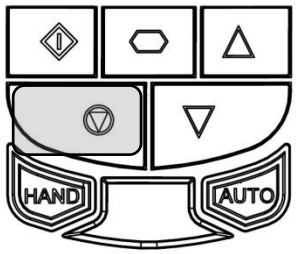
5.8. Resetting Parameters to Factory Default Settings – Standard OLED Keypad (IP55 and IP66 Drives)

	
	
Hold down the Up, Down, Start and Stop keys for >2s	The display shows P-Def. Drive is returned to factory settings. Press the Stop key

Note: Parameters cannot be defaulted whilst P2-39=1 (parameter set locked).

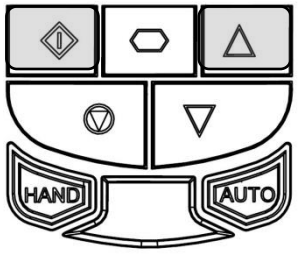
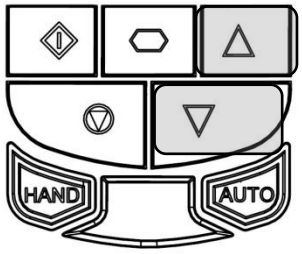
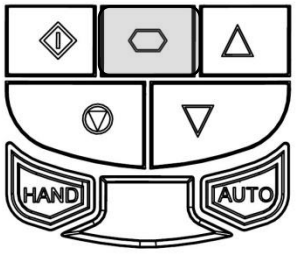
5.9. Resetting Parameters to User Default Settings – Standard OLED Keypad (IP55 and IP66 Drives)

The current parameter settings of the drive can be stored internally within the drive as the standard default settings. This does not affect the procedure for returning the drive to factory default settings as described above.
P6-29 (Save user parameters as default) can be enabled (set to * to invoke a parameter save of the current parameter values as the standard defaults for the drive. Parameter menu group 6 can only be accessed with advanced security level access (Default P1-14=20*.

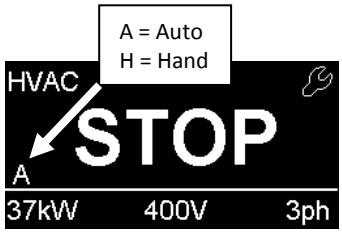
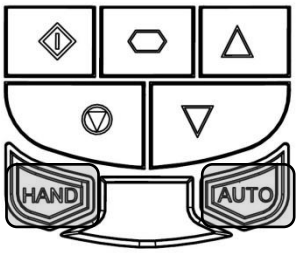
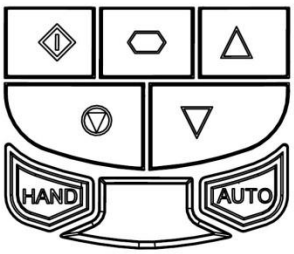
	
	
Hold down the Up, Down, and Stop keys for >2s	The display shows P-Def. Drive is returned to User Standard settings. Press the Stop key

Note: Parameters cannot be defaulted whilst P2-39=1 (parameter set locked).

5.10. Changing the Language on the OLED Display – Standard OLED Keypad (IP55 and IP66 Drives)

		
		
Hold down the Start, Navigate, and Up keys for >1s	Use the Up and Down arrows to select a language.	Press the Navigate button to select Language.

5.11. Selecting between Hand and Auto Control – Standard OLED Keypad (IP55 and IP66 Drives)

	
	
The active control source is shown on the OLED display. Use the Hand and Auto buttons on the keypad to switch between control sources	Hand mode permits drive control directly from the drive keypad. Auto mode control source is configured with Parameter P1-12 (Control Mode)

6. Commissioning

6.1. General

The following guidelines apply to all applications

6.1.1. Entering the motor nameplate information

Optidrive HVAC uses the information from the motor nameplate to

- Operate the motor with the best possible efficiency level
- Protect the motor against possible damage due to operation in overload condition

In order to achieve this, the Optidrive requires that the following information from the motor nameplate is entered into the parameters :-

P1-07 Motor Rated Voltage. This is the operating voltage for the motor in its present wiring configuration (Star or Delta). The maximum output voltage from the Optidrive can never exceed the incoming supply voltage.

P1-08 Motor Rated Current. This is the full load current of the motor from the nameplate

P1-09 Motor Rated Frequency. This is the standard operating frequency of the motor, generally 50 or 60Hz

P1-10 Motor Rated Speed. This parameter can optionally be set to the RPM shown on the motor nameplate. When this parameter is entered, all speed related parameters in the drive are displayed in RPM. When the parameter is set to zero, all speed related parameters are displayed in Hz.

6.1.2. Minimum and Maximum Frequencies / Speeds

Optidrive HVAC units are factory set to operate the motor from zero up to base speed (50 or 60Hz output). In general, this operating range is suitable for a wide range of requirements, however in some cases it may be desired to adjust these limits, e.g. where the maximum speed of a fan or pump may provide excessive flow, or where operation below a certain speed is never required. In this case, the following parameters can be adjusted to suit the application :-

P1-01 Maximum Frequency. In general this should match the motor rated frequency. If operation above this frequency is desired, confirmation from the motor manufacturer, and the manufacturer of any connected fan or pump should be sought that this is permissible, and will not cause damage to the equipment.

P1-02 Minimum Frequency. A suitable minimum can be set to prevent the motor operating at low speed, which may cause the motor to overheat. In some applications, such as a pump circulating water through a boiler, it may be necessary to set a speed to ensure the boiler does not run dry during operation.

6.1.3. Acceleration and Deceleration Ramp Times

Optidrive HVAC units are factory set with acceleration and deceleration ramp rates set to 30 seconds. The default value is suitable for the majority of HVAC applications but can be altered by changing the values in parameters P1-03 and P1-04. Care must be taken to ensure the driven load is capable of performing the specified ramps and that nuisance trips due to excessively short ramp times are not produced.

The ramp times entered in the parameter set always specify the time taken to ramp between 0Hz and motor rated speed P1-09.

*For example; If ramp rate = 30 seconds and P1-09 (motor vase speed) = 50Hz, and assuming the motor is currently running at 25Hz and the drive is commanded to accelerate to 50Hz. The time taken to reach 50Hz would be 30 seconds(P1-03) / 50 (P1-09) * 25 (required change in speed) = 15(s)*

P1-03 Acceleration Ramp Rate: Time taken for the drive to accelerate the motor from 0Hz to Motor base speed, P1-09 in seconds.

P1-04 Deceleration Ramp Rate: Time taken for the drive to decelerate the motor from Motor base speed, P1-09 to 0Hz in seconds.

6.1.4. Stop Mode Selection

Optidrive HVAC units can be programmed to either apply a fixed deceleration to the motor during stopping, or to release control of the motor and allow it to coast or free-wheel to a stop. The default selection is for the drive is ramp to stop and behaviour is programmed using parameter P1-05.

P1-05 Stop Mode Select: Defines how the motor will be stopped in the event of the enable input being removed from the drive. Ramp to stop (P1-05 = 0) will ramp the drive to stop using the value for deceleration entered in P1-04. Coast to stop (P1-05 = * will allow the motor to coast to stop (uncontrolled).

6.1.5. Energy Optimiser

The Energy Optimiser attempts to reduce the overall energy consumed by the drive and motor when operating at constant speeds and light loads. The Energy Optimiser is intended for applications where the drive may operate for some periods of time with constant speed and light motor load.

P1-06 Energy Optimiser: 0 = Disabled, 1 = Enabled.

6.1.6. Voltage Boost

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. The default value for Voltage boost is set between 0.5 and 2.5%, depending on drive size, and is typically ok for the majority of HVAC applications.

P1-11 Voltage Boost: Set as a percentage of motor rated voltage P1-07

7. Parameters

7.1. Parameter Set Overview

The Optidrive HVAC Parameter set consists of 9 groups as follows:

- Group 1 – Basic Parameter Set
- Group 2 – Extended Parameter Set
- Group 3 – User PID Control Parameter Set
- Group 4 – Motor Control Parameters
- Group 5 – Field Bus Communications Parameter Set
- Group 8 – HVAC Specific Functions Parameter Set
- Group 0 –Monitoring and Diagnostic Parameters (Read Only)

When the Optidrive is reset to factory defaults, or is in its factory supplied state, only Group 1 Parameters can be accessed. In order to allow access to parameters from the higher level groups, P1-14 must be set to the same value as P2-40 (Default setting = 10*. With this setting, parameter groups 1 – 5 and group 8 can be accessed, along with the first 39 parameters in Group 0. These parameters are listed in the tables below.
For advanced parameter access, P1-14 can be set to the same value as P6-30 (Default setting = 20*, which allows access to all parameter groups and ranges. Advanced parameter descriptions are listed in the advanced user guide.

Values given in brackets () are default settings for horsepower rated drive models.

7.2. Parameter Group 1 – Basic Parameters

Par	Parameter Name	Minimum	Maximum	Default	Units
P1-01	**Maximum Speed Limit**	P1-02	120.0	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 Speed Limit**	0.0	P1-01	0.0	Hz / Rpm
	Minimum speed limit – Hz or RPM. If P1-10 >0, the value entered / displayed is in Rpm				
P1-03	**Acceleration Ramp Time**	0.0	6000.0	30.0	Seconds
	Acceleration ramp time from 0 to base speed (P-1-09) in seconds.				
P1-04	**Deceleration Ramp Time**	0.0	6000.0	30.0	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				
P1-05	**Stop Mode Select**	0	1	0	-
	0 : Ramp To Stop. When the enable signal is removed, the drive will ramp to stop, with the rate controlled by P1-04 as described above. **1 : Coast to Stop**. When the enable signal is removed the motor will coast (freewheel) to stop				
P1-06	**Energy Optimiser**	0	1	0	0
	0 : Disabled **1 : Enabled**. When enabled, the Energy Optimiser attempts to reduce the overall energy consumed by the drive and motor when operating at constant speeds and light loads. The output voltage applied to the motor is reduced. The Energy Optimiser is intended for applications where the drive may operate for some periods of time with constant speed and light motor load.				
P1-07	**Motor Rated Voltage**	0	250 / 500	230 / 400 (460)	Volts
	This parameter should be set to the rated (nameplate) voltage of the motor (Volts)				
P1-08	**Motor Rated Current**	[Drive Dependent]	Drive Rated Current	100% drive rated current	Amps
	This parameter should be set to the rated (nameplate) current of the motor Parameter Range: Frame size 2, min 10% to max 100% of drive rated current Frame size 3 to 7, min 20% to max 100% of drive rated current				
P1-09	**Motor Rated Frequency**	25	120	50 (60)	Hz
	This parameter should be set to the rated (nameplate) frequency of the motor				
P1-10	**Motor Rated Speed**	0	7200	0	Rpm
	This parameter can optionally be set to the rated (nameplate) rpm of the motor. When set to the default value of zero, all speed related parameters are displayed in Hz, and the slip compensation for the motor is disabled. Entering the value from the motor nameplate enables the slip compensation function, and the Optidrive display will now show motor speed in estimated rpm. All speed related parameters, such as Minimum and Maximum Speed, Preset Speeds etc. will also be displayed in Rpm.				
P1-11	**Voltage Boost**	0	15 – 30% [Drive Dependent]	0.5 – 2.5% [Drive Dependent]	%
	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 Optidrive will automatically adjust this parameter based on the motor parameters measured during an auto-tune (See Parameter P4-02).				

Par	Parameter Name	Minimum	Maximum	Default	Units
P1-12	**Control Mode Select**	0	6	0	-
	0: Terminal Control. The drive responds directly to signals applied to the control terminals. **1: Uni-directional Keypad Control**. The drive can be controlled in the forward direction only using the internal or remote Keypad **2: Bi-directional Keypad Control**. The drive can be controlled in the forward and reverse directions using the internal 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** by the selected Fieldbus (Group 5 Parameters) – Excluded BACnet (see option 6) **5: Slave Mode**. The drive acts as a Slave to a connected Optidrive operating in Master Mode **6: BACnet Mode.** Drive communicates / responds as a slave within a BACnet network.				
P1-13	**Digital Input Function**	0	13	1	-
	Defines the function of the digital inputs. When set to 0 the inputs are user defined using group 9 parameters or the PLC software function in the OptiTools Studio software package. When set to a value other than 0 the digital input configuration is defined by digital input definition table (see section 10.*				
P1-14	**Extended Menu Access**	0	30000	0	-
	Parameter Access Control. The following settings are applicable : P1-14 <> P2-40 and P1-14 <> P6-30: Allows access to Parameter Group 1 only P1-14 = P2-40 (101 default): Allows access to Parameter Groups 0 – 5 and group 8 P1-14 = P6-30 (201 default): Allows access to Parameter Groups 0 - 9				

8. Digital Input Functions

8.1. Digital Input Configuration Parameter P1-13

P1-13 *(2)	Local (Hand) Control Function	Input 1 (Terminal 2)	Input 2 (Terminal 3)	Input 3 (Terminal 4)	Input 4 (Terminal 6)	Input 5 (Terminal 10)	Notes
0	N/A	All functions User defined in Menu 9 or configured through PLC function in OptiTools studio software suite.					
1 *(3)	Analog Input 2	O: Stop C: Run / Enable	O: Normal Operation C: Preset 1 / PI Set-point 2	O: Remote Ctrl C: Local Ctrl	Analog In 1	Analog In 2	When Input 3 is Closed: Speed Reference = Analog Input 2 Start Command = Input 1 In PI Mode, Analog Input 1 must be used for feedback
2		O: No Function C: Momentary Start	O: Stop (Disable) C: Run Permit	O: Remote Ctrl C: Local Ctrl	Analog In 1	Analog In 2	
3		O: Stop C: Run / Enable	O: Forward C: Reverse	O: Remote Ctrl C: Local Ctrl	Analog In 1	Analog In 2	
4		O: Stop C: Run / Enable	O: Fire Mode *(* C: Normal Operation *(*	O: Remote Ctrl C: Local Ctrl	Analog In 1	Analog In 2	
5	Preset Speeds	O: Stop C: Run / Enable	O: Preset Speed 1 C: Preset Speed 2	O: Remote Ctrl C: Local Ctrl	Analog In 1	O: Ext Trip C: Normal Operation	When Input 3 is Closed: Speed Reference = Preset Speed 1 / 2 Start Command = Input 1
6		O: No Function C: Momentary Start	O: Stop (Disable) C: Run Permit	O: Remote Ctrl C: Local Ctrl	Analog In 1	O: Preset 1 C:Preset 2	
7		O: Stop C: Run / Enable	O: Forward C: Reverse	O: Remote Ctrl C: Local Ctrl	Analog In 1	O: Preset 1 C:Preset 2	
8		O: Stop C: Run / Enable	O: Fire Mode *(* C: Normal Operation *(*	O: Remote Ctrl C: Local Ctrl	Analog In 1	O: Preset 1 C:Preset 2	
9 *(3)	Keypad Speed Reference	O: Stop C: Run / Enable	O: Normal Operation C: Preset 1 / PI Set-point 2	O: Remote Ctrl C: Local Ctrl	Analog In 1	Analog In 2	When Input 3 is Closed: Speed Reference = Keypad Start Command = Determined by P2-37
10 *(3)		O: Stop C: Run / Enable	O: Normal Operation C: Preset 1 / PI Set-point 2	O: Remote Ctrl C: Local Ctrl	Analog In 1	O: Ext Trip C: Normal Operation	
11		O: No Function C: Momentary Start	O: Stop (Disable) C: Run Permit	O: Remote Ctrl C: Local Ctrl	Analog In 1	Analog In 2	
12		O: Stop C: Run Fwd	O: Forward C: Reverse	O: Remote Ctrl C: Local Ctrl	Analog In 1	Analog In 2	
13		O: Stop C: Run Fwd	O: Fire Mode *(* C: Normal Operation *(*	O: Remote Ctrl C: Local Ctrl	Analog In 1	Analog In 2	
14	N/A	O: Stop C: Run	O: Forward C: Reverse				Up to 8 preset speeds can be selected using a combination of Digital Input 3 - 5

Digital Input 3	Analog input 1	Analog input 2	Preset Speed
Off	Off	Off	Preset Speed 1
On	Off	Off	Preset Speed 2
Off	On	Off	Preset Speed 3
On	On	Off	Preset Speed 4
Off	Off	On	Preset Speed 5
On	Off	On	Preset Speed 6
Off	On	On	Preset Speed 7
On	On	On	Preset Speed 8

Notes
Inputs 1 – 3 are Digital inputs only
Inputs 4 & 5 may be used as Analog or Digital inputs, depending on the setting of P1-13
(: Logic shown is as per the default setting. Fire mode logic can be configured through parameter P8-09.
*(2): Default setting for P1-13 = 1
*(3): When the drive is in PID control (P1-12 = 3) and digital preset reference is selected (P3-05 = 0) then P1-13 can be set to 1, 9, or 10 to allow selection between two independent digital references using digital input 2. Digital preset reference 1 and 2 are set in P3-06 and P3-15 respectively.

Note: “Motor thermistor trip” connection is via analog input 2 and is configured by parameter P2-33 (PtC-th). The “External trip” input is no longer utilised for the thermistor input (this is different to the ODP drive and E2 drive).

9. Extended Parameters

9.1. Parameter Group 2 - Extended parameters

Par	Parameter Name	Minimum	Maximum	Default	Units
P2-01	**Preset Speed 1**	-P1-01	P1-01	50.0	Hz / Rpm
	Preset speed 1 is selected by configuring P1-13 to an option that permits logic selection, by using the user defined logic configuration parameters in menu 9 (P9-21 to P9-23), or selection configured through the drive PLC function using the OptiTools Studio Suite PC software.				
P2-02	**Preset Speed 2**	-P1-01	P1-01	40.0	Hz / Rpm
	Preset speed 2 is selected by configuring P1-13 to an option that permits logic selection, by using the user defined logic configuration parameters in menu 9 (P9-21to P9-23), or selection configured through the drive PLC function using the OptiTools Studio Suite PC software.				
P2-03	**Preset Speed 3**	-P1-01	P1-01	25.0	Hz / Rpm
	Preset speed 3 is selected using the user defined logic configuration parameters in menu 9 (P9-21 – P9-23), or selection configured through the drive PLC function using the OptiTools Studio Suite PC software.				
P2-04	**Preset Speed 4**	-P1-01	P1-01	P1-01	Hz / Rpm
	Preset speed 4 is selected using the user defined logic configuration parameters in menu 9 (P9-21 – P9-23), or selection configured through the drive PLC function using the OptiTools Studio Suite PC software.				
P2-05	**Preset Speed 5 (Clean Speed ***	-P1-01	P1-01	0.0	Hz / Rpm
	Preset speed 5 is automatically reference by the clean function when this function is enabled. See section 7.5, Pump clean function. When clean function is disabled Preset speed 5 can be selected as per normal operation and is selected using the user defined logic configuration parameters in menu 9 (P9-21 to P9-23), or selection configured through the drive PLC function using the OptiTools Studio Suite PC software.				
P2-06	**Preset Speed 6 (Clean Speed 2)**	-P1-01	P1-01	0.0	Hz / Rpm
	Preset speed 6 is automatically reference by the clean function when this function is enabled. See section 7.5, Pump clean function. When clean function is disabled Preset speed 6 can be selected as per normal operation and is selected using the user defined logic configuration parameters in menu 6 (P9-21 to P9-23), or selection configured through the drive PLC function using the OptiTools Studio Suite PC software.				
P2-07	**Preset Speed 7 (Boost Speed 1 / Pump Stir Speed)**	-P1-01	P1-01	0.0	Hz / Rpm
	Preset speed 7 is automatically referenced by the start / stop boost function, or the Pump Stir Function, when these functions are enabled. See section 7.6, Pump Stir function and section 8, PID control applications. When HVAC functions are disabled Preset speed 7 can be selected as per normal operation and is selected using the user defined logic configuration parameters in menu 6 (P9-21 – P9-23), or selection configured through the drive PLC function using the OptiTools Studio Suite PC software.				
P2-08	**Preset Speed 8 (Boost Speed 2)**	-P1-01	P1-01	0.0	Hz / Rpm
	Preset speed 8 is automatically reference by the start / stop boost function when this function is enabled. See section 8, PID control applications. When boost function is disabled Preset speed 8 can be selected as per normal operation (and is selected using the user defined logic configuration parameters in menu 6 (P9-21 to P9-23), or selection configured through the drive PLC function using the OptiTools Studio Suite PC software.				
P2-09	**Skip Frequency Centre Point**	P1-02	P1-01	0.0	Hz / Rpm
	Defines the centre point of the skip frequency band. The width of the skip frequency band is defined by: Lower limit = P2-09 - P2-10/2 Upper limit = P2-09 + P2-10/2 All skip frequency bands defined for forward speeds are mirrored for negative speeds.				
P2-10	**Skip Frequency Band**	0.0	P1-01	0.0	Units
	Defines the width of the skip frequency band. The width of the skip frequency band is defined by: Lower limit = P2-09 - P2-10/2 Upper limit = P2-09 + P2-10/2 All skip frequency bands defined for forward speeds are mirrored for negative speeds.				
P2-11	**Analog Output 1 Function (Terminal 8)**	0	11	8	-
	Digital Output Mode. Logic 1 = +24V DC **0 : Drive Enabled (Running)**. Logic 1 when the Optidrive is enabled (Running) **1: Drive Healthy**. Logic 1 When no Fault condition exists on the drive **2 : At Target Frequency (Speed)**. Logic 1 when the output frequency matches the set-point frequency **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 : Reserved**. No Function **7 : Analog Input 2 Signal Level >= Limit**. Logic 1 when the signal applied to the Analog Input 2 exceeds the adjustable limit **Analog Output Mode (Format set in P2-12)** **8 : Output Frequency (Motor Speed)**. 0 to P-01 **9 : Output (Motor) Current**. 0 to 200% of P1-08 **10 : Reserved**. No Function **11 : Output (Motor) Power**. 0 to 150% of drive rated power **12 : PID Ouput**. 0 – 100% represents the output of the internal PID controller				
Note:	When using settings 4 – 7, parameters P2-16 and P2-17 are used to control the output 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.				

Par	Parameter Name	Minimum	Maximum	Default	Units
P2-12	**Analog Output 1 Format (Terminal 8)**	-	-	U 0-10	-
	U 0-10 = 0 to10V, U 10-0 = 10 to 0V, A 0-20 = 0 to 20mA A 20-0 = 20to 0mA A 4-20 = 4 to 20mA A 20-4 = 20 to 4mA				
P2-13	**Analog Output 2 Function (Terminal 1***	0	11	9	-
	Digital Output Mode. Logic 1 = +24V DC **0 : Drive Enabled (Running)**. Logic 1 when the Optidrive is enabled (Running) **1 : Drive Healthy**. Logic 1 When no Fault condition exists on the drive **2 : At Target Frequency (Speed)**. Logic 1 when the output frequency matches the set-point frequency **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 : Reserved**. No Function **7 : Analog Input 2 Signal Level >= Limit**. Logic when the signal applied to the Analog Input 2 exceeds the adjustable limit **Analog Output Mode (Format set in P2-14)** **8 : Output Frequency (Motor Speed)**. 0 to P-01 **9 : Output (Motor) Current**. 0 to 200% of P1-08 **10 : Reserved**. No Function **11 : Output (Motor) Power**. 0 to 150% of drive rated power **12 : PID Ouput**. 0 – 100% represents the output of the internal PID controller				
Note:	When using settings 4 – 7, parameters P2-19 and P2-20 are used to control the output 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.				
P2-14	**Analog Output 2 Format (Terminal 1***	-	-	U 0-10	-
	U 0-10 = 0 to10V. U 10-0 = 10 to 0V, A 0-20 = 0 to 20mA A 20-0 = 20to 0mA A 4-20 = 4 to 20mA A 20-4 = 20 to 4mA				
P2-15	**Relay Output 1 Function (Terminals 14, 15 & 16)**	0	7	1	-
	Selects the function assigned to Relay Output 1. The relay has normally open and normally closed contacts. Logic 1 indicates the relay is active, and therefore the normally open contact is closed (terminals 14 and 15 will be linked together) and the normally closed contact is opened (terminals 14 and 16 will no longer be connected together). **0 : Drive Enabled (Running)**. Logic 1 when the motor is enabled **1 : Drive Healthy**. Logic 1 when power is applied to the drive and no fault exists **2 : At Target Frequency (Speed)**. Logic 1 when the output frequency matches the set-point frequency **3 : Output Frequency > 0.0 Hz**. Logic 1 when the drive 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 : Reserved**. No Function **7 : Analog Input 2 Signal Level >= Limit**. Logic 1 when the signal applied to the Analog Input 2 exceeds the adjustable limit **8 : Reserved.** No Function **9 : Fire Mode Active.** Logic 1 when the drive in running in Fire Mode (Fire Mode input is active). **10 : Maintenance Due.** Logic 1 when Maintenance Timer expires indicating that Maintenance is now due. **11 : Drive Available.** Logic 1 when drive is in Auto-mode, no trips are present, and the safety circuit is enabled indicating that drive is ready for automatic control. **12 : Drive Tripped.** Logic one when the drive has tripped and the display shows the fault code. **13 : Hardware Inhibit Status.** Logic 1 when both Hardware Enable (STO) inputs are present and the drive is able to be operated **14 : PID Error >= Limit**. The PID Error (difference between setpoint and feedback) is greater than or equal to the programmed limit				
Note:	When using settings 4 – 7, parameters P2-16 and P2-17 are used to control the output 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 (AO1 / RO***	P2-17	200	100.0	%
	Setting the upper limited value for P2-11 and P2-15, please refer to P2-11 or P2-15				
P2-17	**Adjustable Threshold 1 Lower Limit (AO1 / RO***	0	P2-16	0.0	%
	Setting the lower limited value for P2-11 and P2-15, please refer to P2-11 or P2-15.				

Par	Parameter Name	Minimum	Maximum	Default	Units
P2-18	**Relay Output 2 Function (Terminals 17 & 18)**	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 : Drive Enabled (Running)**. Logic 1 when the motor is enabled **1 : Drive Healthy**. Logic 1 when power is applied to the drive and no fault exists **2 : At Target Frequency (Speed)**. Logic 1 when the output frequency matches the set-point frequency **3: Output Frequency > 0.0 Hz**. Logic 1 when the drive 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 : Reserved**. No Function **7 : Analog Input 2 Signal Level >= Limit**. Logic 1 when the signal applied to the Analog Input 2 exceeds the adjustable limit **8 : Assist Pump 1 Control (DOL*** . See section 7.1, Pump staging –DOL Cascade. **9 : Fire Mode Active.** Logic 1 when the drive in running in Fire Mode (Fire Mode input is active). **10 : Maintenance Due.** Logic 1 when Maintenance Timer expires indicating that Maintenance is now due. **11 : Drive Available.** Logic 1 when drive is in Auto-mode, no trips are present, and the safety circuit is enabled indicating that drive is ready for automatic control. **12 : Drive Tripped.** Logic one when the drive has tripped and the display shows the fault code. **13 : Hardware Inhibit Status.** Logic 1 when both Hardware Enable (STO) inputs are present and the drive is able to be operated **14 : PID Error >= Limit**. The PID Error (difference between setpoint and feedback) is greater than or equal to the programmed limit				
Note:	When using settings 4 – 7, parameters P2-19 and P2-20 are used to control the output 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 2 Upper Limit (AO2 / RO2)**	P2-20	200	100.0	%
	Setting the upper limited value for P2-13 and P2-18, please refer to P2-13 or P2-18.				
P2-20	**Adjustable Threshold 2 Lower Limit (AO2 / RO2)**	0	P2-19	0.0	%
	Setting the lower limited value for P2-13 and P2-18, please refer to P2-13 or P2-18.				
P2-21	**Display Scaling Factor**	-30.000	30.000	0.000	-
	Determines the factor for scaling display. The variable selected in P2-22 is scaled by the factor set in P2-21.				
P2-22	**Display Scaling Source**	0	2	0	-
	Source value used when custom units are to be shown on the drive display. **0: Motor Speed** **1: Motor Current** **2: Analog Input 2**				
Note:	P2-21 & P2-22 allow the user to program the Optidrive display to show an alternative output unit scaled from an existing parameter (for example, 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 is shown on the drive display whilst the drive is running.				
P2-23	**Zero Speed Holding Time**	0.0	60.0	0.2	Seconds
	Determines the time for which the drive output frequency is held at zero when stopping, before the drive output is disabled				
P2-24	**Switching Frequency**	4kHz	[Drive Dependent]	[Drive Dependent]	Default
	Effective power stage switching frequency. Higher frequencies reduce audible noise from the motor, and improve the output current waveform, at the expense of increased drive losses. **Note: De-rating of the drive output current may be required when increasing P2-24 beyond the minimum setting. Refer to section 11.5.3 on page 50 for further information.**				
P2-25	**Fast Decel Ramp Time**	0.0	30.0	0.0	Seconds
	This parameter allows an alternative deceleration ramp down time to be programmed into the Optidrive. Fast Deceleration ramp is selected Automatically in the case of a mains power loss if P2-38 = 2. When ramp rate in P2-25 is set to 0.0, the drive will coast to stop. Fast deceleration ramp can also be selected using the user defined logic configuration parameters in menu 9 (P9-02), or selection configured through the drive PLC function using the OptiTools Studio Suite PC software.				
P2-26	**Spin Start Enable**	0	1	1	-
	0 : Disabled **1 : Enabled**. The drive will attempt to determine if the motor is already rotating on start up and to detect rotational speed and direction. The drive will begin control of the motor from its current (detected) speed. A short delay may be observed when starting the drive whilst the spin start function is completed.				
P2-27	**Standby Mode Enable**	0.0	250.0	0.0	Seconds
	This parameter defines the time period, whereby if the drive operates at minimum speed for greater than the set time period, the Optidrive output will be disabled, and the display will show StndbY. The function is disabled if P2-27 = 0.0.				

Par	Parameter Name	Minimum	Maximum	Default	Units
P2-28	**Slave Speed Scaling**	0	3	0	-
	Active in Keypad mode (P1-12 = 1 or 2) and Slave mode (P1-12=4) only. The keypad 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 = Digital Speed x P2-29** **2 : Actual Speed = (Digital Speed x P2-29) + Analog Input 1 Reference** **3 : Actual Speed = (Digital Speed x P2-29) x Analog Input 1 Reference**				
P2-29	**Slave Speed Scaling Factor**	-500.0	500.0	%	100.0
	Slave speed scaling factor used in conjunction with P2-28.				
P2-30	**Analog Input 1 Format (Terminal 6)**	-	-	U 0- 10	-
	U 0- 10 = 0 to 10 Volt Signal (Uni-polar) U 10-0 = 10 to 0 Volt Signal (Uni-polar) - 10- 10 = -10 to +10 Volt Signal (Bi-polar) A 0-20 = 0 to 20mA Signal t 4-20 = 4 to 20mA Signal, the Optidrive will trip and show the fault code 4-20F if the signal level falls below 3mA r 4-20 = 4 to 20mA Signal, the Optidrive will ramp to preset speed 4 if the signal level falls below 3mA t 20-4 = 20 to 4mA Signal, the Optidrive will trip and show the fault code 4-20F if the signal level falls below 3mA r 20-4 = 20 to 4mA Signal, the Optidrive will ramp to preset speed 4 if the signal level falls below 3mA				
P2-31	**Analog Input 1 scaling**	0.0	500.0	100.0	%
	P2-31 is used to scale the analog input prior to being applied as a reference to the drive. For example, if P2-30 is set for 0 – 10V, and the scaling factor is set to 200.0%, a 5 volt input will result in the drive running at maximum speed (P1-0*				
P2-32	**Analog Input 1 Offset**	-500.0	500.0	0.0	%
	P2-32 defines an offset for the analog input, as a percentage of the full range of the input. A positive offset is deducted from the incoming analog signal and a negative offset is added to the signal. For example, if P2-30 is set for 0 – 10V, and the analog offset is set to 10.0%, then 1 volt (10% of 10V) will be deducted from the incoming analog reference prior to it being applied.				
P2-33	**Analog Input 2 Format (Terminal 10)**	-	-	U 0- 10	-
	U 0- 10 = 0 to 10 Volt Signal (Uni-polar) U 10-0 = 10 to 0 Volt Signal (Uni-polar) Ptc-th = Motor PTC Thermistor Input A 0-20 = 0 to 20mA Signal t 4-20 = 4 to 20mA Signal, the Optidrive will trip and show the fault code 4-20F if the signal level falls below 3mA r 4-20 = 4 to 20mA Signal, the Optidrive will ramp to preset speed 4 if the signal level falls below 3mA t 20-4 = 20 to 4mA Signal, the Optidrive will trip and show the fault code 4-20F if the signal level falls below 3mA r 20-4 = 20 to 4mA Signal, the Optidrive will ramp to preset speed 4 if the signal level falls below 3mA				
P2-34	**Analog Input 2 scaling**	0.0	500.0	100.0	%
	P2-34 is used to scale the analog input prior to being applied as a reference to the drive. For example, if P2-34 is set for 0 – 10V, and the scaling factor is set to 200.0%, a 5 volt input will result in the drive running at maximum speed (P1-0*				
P2-35	**Analog Input 2 Offset**	-500.0	500.0	0.0	%
	P2-35 defines an offset for the analog input, as a percentage of the full range of the input. A positive offset is deducted from the incoming analog signal and a negative offset is added to the signal. For example, if P2-33 is set for 0 – 10V, and the analog offset is set to 10.0%, then 1 volt (10% of 10V) will be deducted from the incoming analog reference prior to it being applied.				
P2-36	**Start Mode Select**	-	-	Auto-0	-
	Defines the behaviour of the drive relating to the enable digital input and also configures the Automatic Restart function. EdGE-r : Following Power on or reset, the drive will not start if Digital Input 1 remains closed. The Input must be closed after a power on or reset to start the drive. Auto-0 : Following a Power On or Reset, the drive will automatically start if Digital Input 1 is closed. Auto- 1 to Auto-5 : Following a trip, the drive will make up to 5 attempts to restart at 20 second intervals. The drive must be powered down to reset the counter. The numbers of restart attempts are counted, and if the drive fails to start on the final attempt the drive will trip with the fault and will require the user to manually reset the drive. **DANGER! "Auto" modes allow the drive to Auto-start, therefore the impact on system/Personnel safety needs to be considered.**				

Par	Parameter Name	Minimum	Maximum	Default	Units
P2-37	**Keypad Restart Speed**	0	7	2	-
	Options 0 to 3 are only active when P1-12 = 1 or 2 (keypad Mode) **0 : Minimum Speed**. Following a stop and restart, the drive will always initially run at the minimum speed P1-02 **1 : Previous Operating Speed**. Following a stop and restart, the drive will return to the last keypad set-point speed used prior to stopping **2 : Current Running Speed**. Where the Optidrive is configured for multiple speed references (typically Hand / Auto control or Local / Remote control), when switched to keypad mode by a digital input, the drive will continue to operate at the last operating speed **3 : Preset Speed 4**. Following a stop and restart, the Optidrive will always initially run at Preset Speed 4 (P2-04) Options 4 to 7 are only active in all control modes. Drive starting in these modes is controlled by the enable digital input on the control terminals. **4 : Minimum Speed (Terminal Enable)**. Following a stop and restart, the drive will always initially run at the minimum speed P1-02 **5 : Previous Operating Speed (Terminal Enable)**. Following a stop and restart, the drive will return to the last keypad set-point speed used prior to stopping **6 : Current Running Speed (Terminal Enable)**. Where the Optidrive is configured for multiple speed references (typically Hand / Auto control or Local / Remote control), when switched to keypad mode by a digital input, the drive will continue to operate at the last operating speed **7 : Preset Speed 4 (Terminal Enable)**. Following a stop and restart, the Optidrive will always initially run at Preset Speed 4 (P2-04)				
P2-38	**Mains Loss Stop Mode**	0	2	0	-
	Controls the behaviour of the drive in response to a loss of mains power supply whilst the drive is enabled. **0: Mains Loss Ride Through**. The Optidrive will attempt to continue operating by recovering energy from the load motor. Providing that the mains loss period is short, and sufficient energy can be recovered before the drive control electronics power off, the drive will automatically restart on return of mains power **1: Coast To Stop**. The Optidrive will immediately disable the output to the motor, allowing the load to coast or free wheel. When using this setting with high inertia loads, the Spin Start function (P2-26) may need to be enabled **2: Fast Ramp To Stop**. The drive will ramp to stop at the rate programmed in the Fast deceleration time P2-25				
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 Menu Access Code**	0	9999	101	-
	Defines the access code which must be entered in P1-14 to access parameter groups above Group 1				

9.2. Parameter Group 3 – PID Control

Par	Parameter Name	Minimum	Maximum	Default	Units
P3-01	**PID Proportional Gain**	0.1	30.0	1.0	-
	PID Controller Proportional Gain. Instantaneous error between the feedback and the set-point in the PID controller is multiplied by P3-01 to produce the output from the PID controller. Higher values of proportional gain produce a larger change in the drive output frequency in response to changes in the PID set-point or feedback signals. Too high a value can cause instability				
P3-02	**PID Integral Time**	0.0	30.0	1.0	Seconds
	PID Controller Integral Time. Accumulated error in the PID control. Uses accumulated errors between set-point and feedback signals to influence the output from the PID controller. P3-02 is the time constant for accumulating error. Larger values provide a more damped response. Lower values result is a faster system response but may result in instability.				
P3-03	**PID Differential Time**	0.00	1.00	0.0	Seconds
	PID Differential Time Constant. The Differential time constant references the rate of change of the feedback signal over time and works to slow the rate of change of the PID controller, particularly as it approached the set-point. Setting a shorter time will decrease overshoot but slow down response and may lead to instability. **Note: P3-03 is set to 0 by default which disables the differential time constant. Care must be taken when adjusting this value outside of its default value.**				
P3-04	**PID Operating Mode**	0	1	0	-
	0 : Direct Operation. Use this mode if an increase in the feedback signal should result in an decrease in the motor speed **1 : Inverse Operation**. Use this mode if an increase in the feedback signal should result in an increase in the motor speed				
P3-05	**PID Reference Select**	0	2	0	-
	Selects the source for the PID Reference / Set-point **0 : Digital Preset Set-point**. P3-06 is used **1 : Analog Input 1 Set-point** **2 : Analog Input 2 Set-point**				
P3-06	**PID Digital Reference Value**	0.0	100.0	0.0	%
	When P3-05 = 0, this parameter sets the preset digital reference (set-point) used for the PID Controller				
P3-07	**PID Output Upper Limit**	P3-08	100.0	100.0	%
	Limits the maximum value output from the PID controller				
P3-08	**PID Output Lower Limit**	0.0	P3-07	0.0	%
	Limits the minimum output from the PID controller				

Par	Parameter Name	Minimum	Maximum	Default	Units
P3-09	**PID Output Limit Select**	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 Source Select**	0	1	0	-
	Defines the source of the PID control feedback (location of the feedback sensor) **0 : Analog Input 2** : 0 – 100.0% **1 : Analog Input 1** : 0 – 100.0% **2 : Motor current** : 0 – 100.0% of P1-08 Value **3 : DC bus voltage** : 0 – 1000 Volt = 0 – 100.0% **4 : Analog input 1 – Analog input 2** : Differential of Analog 1 – Analog 2 = 0 – 100.0% **5 : Larger value between AnIn1 and AnIn2** : The greater of Analog input 1 or Analog Input 2 is always used				
P3-11	**PID Error to Enable Ramp**	0.0	25.0	0.0	%
	Defines a threshold PID error level, whereby if the difference between the set-point and feedback value is less than the set threshold, the internal ramp times of the drive are disabled to allow the drive to react quickly to small errors. Where a greater PID error exists, the ramp times are enabled to limit the rate of change of motor speed. Setting to 0.0 means that the drive ramps are always enabled. This parameter is intended to allow the user to disable the drive internal ramps where a fast reaction to the PID control is required, however by only disabling the ramps when a small PID error exists, the risk of possible over current or over voltage trips being generated are reduced.				
P3-12	**Feedback Display Scaling**	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.				
P3-13	**Feedback Wake Up Level**	0.0	100.0	0.0	%
	Sets a programmable level whereby if the drive enters standby mode whilst operating under PID control, the selected feedback signal must fall below this threshold before the drive will return to normal operation.				
P3-14	**Standby Activation Speed**	0.0	P1-01	0	Hz / Rpm
	Determines the level at which the drive will enter into standby mode. P2-27 must be set with a value (time) for standby function to be active. Drive enters standby mode if motor speed remains below the level set in P3-14 for the time period set in P2-27.				
P3-15	**2nd PID Digital Reference Value**	0.0	100.0	0.0	%
	When P3-05 = 0, and the 2nd digital reference is selected (see Digital Input Functions – Section 10.* this parameter sets the preset digital reference (set-point) used for the PID Controller				
P3-16	**Pump Prime Time**	0	600	0	Seconds
	A value other than zero in this parameter will automatically enable burst pipe protection function. Each time the drive is enabled whilst in PID control or is switched to PID control, the drive will monitor the PID feedback level for the time entered in P3-16. If the PID feedback level does not exceed the threshold entered in P3-17 before the time in P3-16 expires then the drive will trip with "Pr-Lo" (pressure low) trip.				
P3-17	**Burst Pipe Threshold**	0.0	100.0	0.0%	%
	PID feedback threshold for the burst pump control. In direct PID mode, PID feedback should be less than or equal to this threshold before the pump prime time (P3-16) expires. In inverse PID mode, PID feedback should be larger than or equal to the threshold before the pump prime time (P3-16) expires.				
P3-18	**PID Reset Control**	0	1	0	-
	This parameter is used to control the reset behaviour of the PID loop. 0: PID loop will continue running as long as P gain (P3-0* is not zero. 1: PID loop will only run when drive is enabled. If drive is not running, PID output will reset to 0 (Including integral result)				

9.3. Parameter Group 4 – High Performance Motor Control

	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.				
Par	**Parameter Name**	**Minimum**	**Maximum**	**Default**	**Units**
P4-02	**Auto-tune Enable**	0	1	0	-
	When set to 1, the drive immediately carries out a non-rotating auto-tune to measure the motor parameters for optimum control and efficiency. Following completion of the auto-tune, the parameter automatically returns to 0.				
P4-07	**Maximum Motoring Current Limit**	20.0	150.0	110.0	%-
	This parameter defines the maximum current limit or reference used by the drive.				
P4-12	**Thermal Overload Value Retention**	0	1	0	-
	0 : Disabled. **1 : Enabled**. All Optidrives feature electronic thermal overload protection for the connected motor, designed to protect the motor against damage. An internal overload accumulator monitors the motor output current over time, and will trip the drive if the usage exceeds the thermal limit. When P4-12 is disabled, removing the power supply from the drive and re-applying will reset the value of the accumulator. When P4-12 is enabled, the value is retained during power off.				

9.4. Parameter Group 5 – Communication Parameters

Par	Parameter Name	Minimum	Maximum	Default	Units
P5-01	**Drive Fieldbus Address**	0	63	-	1
	Sets the Fieldbus address for the Optidrive				
P5-03	**Modbus RTU / BACnet Baud rate**	9.6	115.2	115.2	kbps
	Sets the baud rate when Modbus/BACnet communications are used 9.6kbps, 19.2kpbs, 38.4kpbs, 57.6kpbs, 115 kbps				
P5-04	**Modbus RTU / BACnet Data Format**	-	-	n- 1	-
	Sets the expected Modbus or BACnet telegram data format as follows n- 1 : No Parity, 1 stop bit n-2 : No parity, 2 stop bits O- 1 : Odd parity, 1 stop bit E- 1 : Even parity, 1 stop bit				
P5-05	**Communications Loss Timeout**	0.0	5.0	1.0	seconds
	Sets the watchdog time period for the communications channel. If a valid telegram is not received by the Optidrive within this time period, the drive will assume a loss of communications has occurred and react as selected below (P5-07)				
P5-06	**Communications Loss Action**	0	3	0	-
	Controls the behaviour of the drive following a loss of communications as determined by the above parameter setting (P5-06). **0: Trip & Coast To Stop** **1: Ramp to Stop Then Trip** **2: Ramp to Stop Only (No Trip)** **3: Run at Preset Speed 4**				
P5-07	**Fieldbus Ramp Control**	0	1	0	-
	Selects whether the acceleration and deceleration ramps are control directly via the Fieldbus, or by internal drive parameters P1-03 and P1-04. **0 : Disabled**. Ramps are control from internal drive parameters **1 : Enabled**. Ramps are controlled directly by the Fieldbus				
P5-08	**Fieldbus Module PDO4**	0	7	1	-
	When using an optional Fieldbus interface, this parameter configures the parameter source for the 4th process data word transferred from the drive to the network master during cyclic communications: 0 : Output Power – Output power in kW to two decimal places, e.g. 400 = 4.00kW 1 : Output Power – Output power in kW to two decimal places, e.g. 400 = 4.00kW 2 : Digital Input Status – Bit 0 indicates digital input 1 status, bit 1 indicates digital input 2 status etc. 3 : Analog Input 2 Signal Level – 0 to 1000 = 0 to 100.0% 4 : Drive Heat-sink Temperature – 0 to 100 = 0 to 100°C 5 : User Register 1 – Can be accessed by PLC program or group 9 parameters 4 : User Register 2 – Can be accessed by PLC program or group 9 parameters 7 : P0-80 Value - P0-80 value can be selected by P6-28				
P5-09	**BACnet Device Instance Number (Low)**	0	65535	1	-
	Drive instance number within the BACnet network. Combined with P5-10 the value entered must represent a unique value with the BACnet system / network. P5-09 represents the lower 16 bits of the device instance number. Device instance number 22 bit total.				
P5-10	**BACnet Device Instance Number (High)**	0	63	0	-
	Drive instance number within the BACnet network. Combined with P5-09 the value entered must represent a unique value with the BACnet system / network. P5-10 represents upper 6 bits of the device instance number. Device instance number 22 bit total.				
P5-11	**BACnet Maximum Masters**	0	127	127	-
	Parameter defines the maximum address of any BACnet masters that can exist on the current local MSTP BACnet network. When the device is polling for the next master in the network it will not poll about the value set in P5-11. For example, if the value is set to 50 then when the drive finishes communicating and needs to pass control to the next master it will poll up to address 50 looking for a response before rolling back to address 0.				
P5-12	**Fieldbus Module PDO3**	0	7	0	-
	When using an optional Fieldbus interface, this parameter configures the parameter source for the 3rd process data word transferred from the drive to the network master during cyclic communications: 0 : Motor Current – With one decimal place, e.g. 100 1 : Output Power – Output power in kW to two decimal places, e.g. 400 = 4.00kW 2 : Digital Input Status – Bit 0 indicates digital input 1 status, bit 1 indicates digital input 2 status etc. 3 : Analog Input 2 Signal Level – 0 to 1000 = 0 to 100.0% 4 : Drive Heat-sink Temperature – 0 to 100 = 0 to 100°C 5 : User Register 1 – Can be accessed by PLC program or group 9 parameters 4 : User Register 2 – Can be accessed by PLC program or group 9 parameters 7 : P0-80 Value - P0-80 value can be selected by P6-28				

Par	Parameter Name	Minimum	Maximum	Default	Units
P5-13	**Fieldbus Module PDI4**	0	1	0	-
	When using an optional Fieldbus interface, this parameter configures the parameter source for the 4th process data word transferred from the network master to the drive during cyclic communications: 0: User ramp time – In second with two decimal places. 1: User Register 4 – Can be accessed by PLC program or group 9 parameters				
P5-14	**Fieldbus Module PDI3**	0	2	0	-
	When using an optional Fieldbus interface, this parameter configures the parameter source for the 3rd process data word transferred from the network master to the drive during cyclic communications: 0 : Not used - No function 1 : User PID Reference - 0 to 1000 = 0% to 100.0% 2 : User Register 3 – Can be accessed by PLC program or group 9 parameters				

9.5. Parameter Group 8 – HVAC Function Specific Parameters

Par	Parameter Name	Minimum	Maximum	Default	Units
P8-01	**Stir Interval Duration**	0	60000	0	mins
	Period of inactivity (drive is standby mode) that will trigger the drive stir function.				
P8-02	**Stir Activation Time**	1	6000	10	Secs
	Set the time period that the stir function will be active once triggered (excludes time for deceleration to stop)				
P8-03	**Cleaning Function Select**	0	3	0	-
	This parameter configures the drive conditions that will cause activation of the automatic pump clean function. **0 = Disabled** **1 = Active on Start up Only.** The pump cleaning function operates every time the pump is started. **2 = Active on start up and over-torque detection.** The pump cleaning function operates every time the pump is started, and also in the event that the drive detects a possible pump blockage during normal operation. This requires the Load Profile Monitoring function to be active and commissioned for correct operation, see parameter P8-06. **3 = Active on over-torque detection only.** The pump cleaning function operates only when a possible pump blockage is detected during normal operation. This requires the Load Profile Monitoring function to be active and commissioned for correct operation, see parameter P8-06. Note: The pump clean function can also be activated by digital input configured in group 9 parameters. For further information on the pump cleaning function, refer to the Optidrive HVAC Pump Cleaning Function Application Note.				
P8-04	**Cleaning Time**	0	600	0	Secs
	Sets the time period for the operation of the pump cleaning cycle. When bi-directional pump cleaning is selected, the time interval is used twice, once in each direction.				
P8-05	**Clean Function Ramp Time**	0.0	6000	30	Secs
	Independent ramp rate used only for the pump automatic cleaning function (see P8-03) when the motor is Accelerated as part of the cleaning cycle.				
Note:	For full detail of Clean function configuration see section 7.5, Pump Clean Function, or contact your local Invertek distributor				
P8-06	**Load Monitor Enable**	0	3	0	-
	This parameter enables the Load Profile Monitoring Function (load current monitoring), which can be used to detect belt failure in belt driven fan applications, or Dry Pump, Pump Blockage or broken impeller in Pump applications. **0: Disabled** **1: Low Load Detection Enabled (Belt Failure / Dry Pump / Broken Impeller)** **2: High Load Detection Enabled (Pump Blockage)** **3: Low and High Current Detection** For further information on the load monitoring function, refer to the Optidrive HVAC Load Profile Monitoring Function Application Note.				
	Adjustment of parameter P8-06 (<>0) will cause the drive to automatically run the motor through its programmed frequency range upon the next drive enable (input enable). Ensure the application is in a suitable condition to allow the motor to run safely through its frequency range prior to enabling this feature.				
P8-07	**Load Profile Bandwidth**	0.1	50.0	1.0	Amps
	Parameter sets a bandwidth around the Load profile generated by P8-06. If P8-06 has been set to an appropriate value to detect an over /under load condition and the drive operates outside of the bandwidth set in P8-07 for a period longer than that defined by P8-08 then the drive will trip. Value entered in P8-07 is the value between the normal current and the trip level, hence total bandwidth for the function is 2 x P8-07.				
P8-08	**Load Monitor Trip Delay**	0	60	0	Secs
	Parameter sets a time limit for the Load profile generated by P8-06. If P8-06 has been set to an appropriate value to detect an over /under load condition and the drive operates outside of the bandwidth set in P8-07 for a period longer than that defined by P8-08 and then the drive will trip.				
P8-09	**Fire Mode Logic**	0	1	0	-
	When Fire mode is assigned to a digital input on the drive then the logic configuration for the input is set by P8-09 to allow normally open or normally closed activation. Default behaviour is for Input logic off (0) to activate fire mode (Open activation). Input configuration for Fire mode is set by parameter P1-13 or can be user defined by the setting of P9-32. **0 : Open Activation** **1 : Closed Activation** For further information on Fire Mode, refer to the Optidrive HVAC Fire Mode Application Note.				

Par	Parameter Name	Minimum	Maximum	Default	Units
P8-10	**Fire Mode Speed**	-P1-01	P1-01	0.0	Hz / Rpm
	When set to a non-zero value, this parameter sets an operational fixed frequency / speed used when Fire Mode is selected. The drive will maintain operation at this frequency until the fire mode signal is removed or the drive is no longer able to sustain operation. When P8-10 is zero, and fire mode is activated, the drive will continue to operate under the control of the selected speed reference, dependent on parameter settings and digital input selection.				
P8-11	**Bypass Mode on Fault**	0	1	0	-
	Parameter configures the drive to switch to bypass mode automatically should a trip occur on the drive. When enabled the drive standard relays 1 and 2 are dedicated to bypass control and cannot be assigned other functions. **0 = Disabled** **1 = Enabled**				
P8-12	**Bypass mode of Fire**	0	1	0	-
	Parameter configures the drive to switch to bypass mode automatically should an input to the drive be configured for Fire Mode operation and that input becomes active. When enabled the drive standard relays 1 and 2 are dedicated to bypass control and cannot be assigned other functions. **0 = Disabled** **1 = Enabled** For further information on using the Bypass function, refer to the Optidrive HVAC Bypass function Application Note.				
P8-13	**Bypass Contactor Changeover Time**	0	30	2	Secs
	Parameter active when Bypass function is enabled. Parameter P8-05 sets a time delay or changeover time between the switching of the drive relays controlling the bypass circuitry.				
	Care must be taken when setting P8-13 to ensure that drive and DOL contactors are not switched in circuit simultaneously. **Both Mechanical and Electrical interlocking of drive and DOL contactors to regional standards are recommended in configuring the Bypass function.**				
P8-14	**Pump Staging Function Select**	0	2	0	-
	Parameter enables the pump staging (cascade) function on the drive **0 = Disabled** **1 = Single VFD with DOL Cascade (max 4 DOL pumps)** **2 = Multiple Drive Cascade Master Drive (Only valid when drive set to Optibus master address, P5-01 = *** For further information on using the Cascade function, refer to the Optidrive HVAC Cascade Operation application note.				
P8-15	**Number of Assist Pumps**	1	4	1	-
	Parameter valid when P8-14 is set to 1 or 2 to enable Pump Staging Function. P8-15 set the number of assist pumps (P8-14 = * or network slave drives (P8-14 = 2) that are available in the Pump Staging application. Setting the value to 0 disables Pump Staging.				
P8-16	**Pump Duty Switch Over Time**	0	1000	0	Hours
	In order to balance run time (duty) on each pump in the Pump staging application and to ensure periodic operation of each pump P8-16 can be set with a time limit for pump switch over. When set to a value other than 0 (disabled) the operation of each staging pump will be cycled to ensure the difference in duty between each pump does not exceed the time set in P8-16				
P8-17	**Assist Pump Start Speed**	P8-18	P1-01	0	Hz / RPM
	HVAC Optidrive upper speed Staging threshold. When the drive output increases beyond this threshold the next Staging pump is switch on. The Pump staging settle time must then expire before additional staging pumps can be brought on or off line. Priority for Staging pump switch on is always given to the pump with lowest run time accumulated.				
P8-18	**Assist Pump Stop Speed**	0	P8-17	0	Hz / RPM
	HVAC Optidrive lower speed Staging threshold. When the drive output decreases below this threshold one of the Staging pumps currently operating is switch off. The Pump staging settle time must then expire before additional staging pumps can be brought on or off line. Priority for Staging pump switch off is always given to the pump with highest run time accumulated.				
P8-19	**Pump Settling Time**	10	600	10	Secs
	Parameter sets a time delay for pump staging whereby, following switch in or switch out of a staging pump, further pumps are not permitted to be switched in or out until this time period has elapsed. This parameter should be set to allow adequate settle time between staging pump transitions.				
P8-20	**Pump Master Clock Reset**	0	1	0	-
	Master drive in pump staging monitors and maintains duty run times for all available staging pumps. All clocks are available to view in P0-20. P8-20 provides the master reset to all run time clocks used for Pump Staging Function (all clocks set to 0).				

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

Par	Parameter Name	Units
P0-01	**Analog Input 1 Value**	%
	Displays the signal level applied to analog input 1 (Terminal 6) after scaling and offsets have been applied.	
P0-02	**Analog Input 2 Value**	%
	Displays the signal level applied to analog input 2 (Terminal 10) after scaling and offsets have been applied.	
P0-03	**Digital Input Status**	Binary
	Displays the status of the drive inputs, including the extended I/O module (if fitted). 1st Entry: 00000 ... 11111. Drive digital Input status. MSB represents digital input 1 / LSB representing digital input 5. 2nd Entry: E 000 ... E 111. Drive Extended (option) Input status. MSB represents digital input 6 / LSB representing digital input 8.	
P0-04	**Speed Controller Reference**	Hz / Rpm
	Displays the set point reference input applied to the drive internal speed controller	
P0-06	**Digital Speed Reference**	Hz / Rpm
	Displays the value of the drive internal Motorised Pot (used for keypad) speed reference	
P0-07	**Fieldbus Speed Reference**	Hz / Rpm
	Displays the set-point being received by the drive from the currently active Fieldbus interface.	
P0-08	**PID Reference**	%
	Displays the set-point input to the PID controller.	
P0-09	**PID Feedback**	%
	Displays the Feedback input signal to the PID controller	
P0-10	**PID Output**	%
	Displays the output level of the PID controller	
P0-11	**Motor Voltage**	V
	Displays the instantaneous output voltage from the drive to the motor	
P0-13	**Trip Log**	%
	Displays the last four fault codes for the drive. Refer to section 15.1 for further information	
P0-14	**Magnetising Current (Id)**	A
	Displays the motor magnetising Current, providing an auto tune has been successfully completed.	
P0-16	**DC Bus Voltage Ripple**	Vrms
	Displays the level of ripple present on the DC Bus Voltage. This parameter is used by the Optidrive for various internal protection and monitoring functions.	
P0-17	**Stator Resistance (Rs)**	Ohms
	Displays the measured motor stator resistance, providing an auto tune has been successfully completed.	
P0-19	**Cascade Run Time Log**	Hrs
	Run Time values for variable speed and DOL pumps used in cascade function. 5 entry log. 0 = Master, 1 = DOL1, 2 = DOL2, 3 = DOL3, 4 = DOL4 Clocks can be reset through P8-20, Master Clock Reset.	
P0-20	**DC Bus Voltage**	Volts
	Displays the instantaneous DC Bus Voltage internally within the drive	
P0-21	**Drive Temperature**	°C
	Displays the Instantaneous Heatsink Temperature measured by the drive	
P0-22	**Time Left to Next Service**	Hours
	Displays the current time period remaining before the next maintenance becomes due. Maintenance interval is based on the value entered in P6-24 (Maintenance Time Interval) and the elapsed time since the maintenance interval was enabled or reset.	
P0-23	**Time Heatsink >80° C**	HH:MM:SS
	Two entry display: First display shows hours. Second display shows minutes and seconds Displays the amount of time in hours and minutes that the Optidrive has operated for during its lifetime with a heatsink temperature in excess of 80°C. This parameter is used by the Optidrive for various internal protection and monitoring functions.	
P0-24	**Time Ambient >80° C**	HH:MM:SS
	Two entry display: First display shows hours. Second display shows minutes and seconds Displays the amount of time in hours and minutes that the Optidrive has operated for during its lifetime with an ambient temperature in excess of 80°C. This parameter is used by the Optidrive for various internal protection and monitoring functions.	
P0-25	**Estimated Rotor Speed**	Hz
	Displays the estimated rotor speed of the motor.	
P0-26	**kWh Meter**	kWh
	Two entry display: First display shows user resettable meter (reset with P6-23). Second display shows none resettable value. Displays the amount of energy consumed by the drive in kWh. When the value reaches 1000, it is reset back to 0.0, and the value of P0-27 (MWh meter) is increased.	
P0-27	**MWh Meter**	MWh
	Two entry display: First display shows user resettable meter (reset with P6-23). Second display shows none resettable value. Displays the amount of energy consumed by the drive in MWh.	
P0-28	**Software Version**	-
	Displays the software version of the drive: Four entry display: First display = IO Version, Second display = IO Checksum, Third display = DSP Version, Fourth display = DSP Checksum	

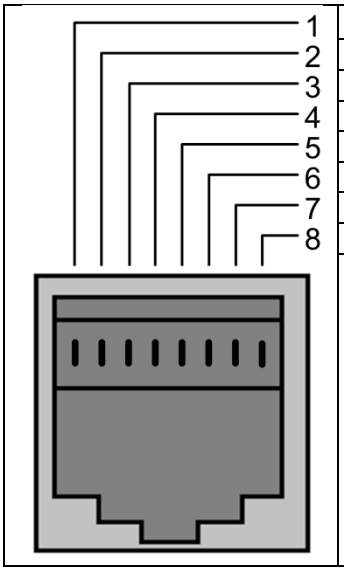
Par	Parameter Name	Units
P0-29	**Drive Type**	-
	Displays the type details of the drive: Three entry display: First display = Frame size and input voltage level Second display = Power rating Third display = Output Phase Count	
P0-30	**Serial Number**	-
	Displays the unique serial number of the drive.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

10. Serial communications

10.1. RS-485 communications

Optidrive HVAC has an RJ45 connector located within the wiring enclosure of the drive. This connector allows the user to set up a drive network via a wired connection. The connector contains two independent RS485 connections, one for Invertek's Optibus Protocol and one for Modbus RTU / BACnet.

The electrical signal arrangement of the RJ45 connector is shown as follows:



1	Not Used
2	Not Used
3	0 Volt
4	Optibus / Remote Keypad / PC Connection -
5	Optibus / Remote Keypad / PC Connection +
6	+24 Volt Remote Keypad Power Supply
7	RS 485- Modbus RTU / BACnet
8	RS 485+ Modbus RTU / BACnet

Warning:
This is not an Ethernet connection. Do not connect directly to an Ethernet port.

The Optibus data link is used for connection of Invertek peripherals and inter-drive communication. .

The Modbus interface allows connection to a Modbus RTU network as described below.

10.2. Modbus RTU Communications

10.2.1. Modbus Telegram Structure

The Optidrive HVAC2 supports Master / Slave Modbus RTU communications, using the 03 Read Holding Registers and 06 Write Single Holding Register commands. Many Master devices treat the first Register address as Register 0; therefore it may be necessary to convert the Register Numbers detail in section 12.2.2 by subtracting 1 to obtain the correct Register address. The telegram structure is as follows:-

Command 03 – Read Holding Registers						
Master Telegram	**Length**			**Slave Response**	**Length**	
Slave Address	1	Byte		Slave Address	1	Byte
Function Code (03)	1	Byte		Function Code (03)	1	Byte
1st Register Address	2	Bytes		Starting Address	1	Byte
No. Of Registers	2	Bytes		1st Register Value	2	Bytes
CRC Checksum	2	Bytes		2nd Register Value	2	Bytes
				Etc...		
				CRC Checksum	2	Bytes

Command 06 – Write Single Holding Register						
Master Telegram	**Length**			**Slave Response**	**Length**	
Slave Address	1	Byte		Slave Address	1	Byte
Function Code (06)	1	Byte		Function Code (06)	1	Byte
Register Address	2	Bytes		Register Address	2	Bytes
Value	2	Bytes		Register Value	2	Bytes
CRC Checksum	2	Bytes		CRC Checksum	2	Bytes

10.2.2. Modbus Control & Monitoring Registers

The following is a list of accessible Modbus Registers available in the Optidrive HVAC.

- When Modbus RTU is configured as the Fieldbus option, all of the listed registers can be accessed.
- Registers 1 and 2 can be used to control the drive providing that Modbus RTU is selected as the primary command source (P1-12 = 4) and no Fieldbus Option Module is installed in the drive Option Slot.
- Register 4 can be used to control the acceleration and deceleration rate of the drive providing that Fieldbus Ramp Control is enabled (P5-07 = *
- Registers 6 to 24 can be read regardless of the setting of P1-12

Register Number	Upper Byte	Lower Byte	Read Write	Notes
1	Command Control Word		R/W	Command control word used to control the Optidrive when operating with Modbus RTU. The Control Word bit functions are as follows :- Bit 0 : Run/Stop command. Set to 1 to enable the drive. Set to 0 to stop the drive. Bit 1 : Fast stop request. Set to 1 to enable drive to stop with 2nd deceleration ramp. Bit 2 : Reset request. Set to 1 in order to reset any active faults or trips on the drive. This bit must be reset to zero once the fault has been cleared. Bit 3 : Coast stop request. Set to 1 to issue a coast stop command.
2	Command Speed Reference		R/W	Set-point must be sent to the drive in Hz to one decimal place, e.g. 500 = 50.0Hz
3	Reserved		R/W	No Function
4	Command Ramp times		R/W	This register specifies the drive acceleration and deceleration ramp times used when Fieldbus Ramp Control is selected (P5-08 = * irrespective of the setting of P1-12. The input data range is from 0 to 60000 (0.00s to 600.00s)
6	Error code	Drive status	R	This register contains 2 bytes. The Lower Byte contains an 8 bit drive status word as follows :- Bit 0 : 0 = Drive Disabled (Stopped), 1 = Drive Enabled (Running) Bit 1 : 0 = Drive Healthy, 1 = Drive Tripped Bit 2 : 0 = In Auto Mode, 1 = In Hand Mode Bit 3 : 0 = Drive Ready, 1 = Drive Inhibit Bit 4 : Maintenance Time Not Reached, 1 = Maintenance Time Reached Bit 5 : 0 = Not In Standby (Sleep), 1 = Standby (Sleep) mode active The Upper Byte will contain the relevant fault number in the event of a drive trip. Refer to section 15.1 for a list of fault codes and diagnostic information
7	Output Frequency		R	Output frequency of the drive to one decimal place, e.g.123 = 12.3 Hz
8	Output Current		R	Output current of the drive to one decimal place, e.g.105 = 10.5 Amps
9	Output Torque		R	Motor output torque level to one decimal place, e.g. 474 = 47.4 %
10	Output Power		R	Output power of the drive to two decimal places, e.g.1100 = 11.00 kW
11	Digital Input Status		R	Represents the status of the drive inputs where Bit 0 = Digital Input 1 etc.
20	Analog 1 Level		R	Analog Input 1 Applied Signal level in % to one decimal place, e.g. 1000 = 100.0%
21	Analog 2 Level		R	Analog Input 2 Applied Signal level in % to one decimal place, e.g. 1000 = 100.0%
22	Pre Ramp Speed Reference		R	Internal drive frequency set-point
23	DC bus voltages		R	Measured DC Bus Voltage in Volts
24	Drive temperature		R	Measured Heatsink Temperature in °C

10.2.3. Modbus Parameter Access

All User Adjustable parameters (Groups 1 to 5) are accessible by Modbus, except those that would directly affect the Modbus communications, e.g.

- P5-01 Drive Fieldbus Address
- P5-03 Modbus RTU Baud Rate
- P5-04 Modbus RTU Data Format

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

When accessing a drive parameter via Modbus, 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 where a decimal point is used in the drive parameter, the register value will be multiplied by a factor of ten,
E.g. Read Value of P1-01 = 500, therefore this is 50.0Hz.

For further details on communicating with Optidrive using Modbus RTU, please refer to your local Invertek Sales Partner.

10.3. BACnet MS/TP Communications

Refer to the seperate Optidrive HVAC BACnet User Guide for further information.

11. Technical Data

11.1. Environmental

*A*mbient temperature range Operational : -10 … 50°C (refer to section 11.5.1 on page 50 for derating information)
Storage : -40 °C … 60 °C
Max altitude for rated operation : 1000m (refer to section 11.5.2 on page 50 for derating information)
Relative Humidity : < 95% (no condensation permitted)

11.2. Input Voltage Ranges

Depending upon model and power rating, the drives are designed for direct connection to the following supplies:

Model Number	Supply Voltage	Phases	Frequency
ODV-2-x2xxx-1xxxx	200 – 240 Volts + 10% / -15%	1	50 – 60Hz
ODV-2-x2xxx-3xxxx		3	
ODV-2-x4xxx-3xxxx	380 – 480 Volts +10% / - 15%	3	

All Optidrive HVAC units have phase imbalance monitoring. A phase imbalance of > 3% will result in the drive tripping. For input supplies which have supply imbalance greater than 3% (typically the Indian sub- continent & parts of Asia Pacific including China) Invertek Drives recommends the installation of input line reactors. Alternatively, the drives can be operated as a single phase supply drive with 50% de-rating.

11.3. Output Power and Current ratings

The following tables provide the output current rating information for the various Optidrive HVAC models. Invertek Drives always recommend that selection of the correct Optidrive is based upon the motor full load *current* at the incoming supply voltage.

200 – 240 Volts (+ / - 10%) 1 Phase Input, 3 Phase Output

kW	HP	Nominal Input Current	Fuse Or MCB		Supply Cable Size		Nominal Output Current	Motor Cable Size		Maximum Motor Cable Length	
		A	Non UL	UL	mm	AWG / kcmil	A	mm	AWG / kcmil	m	feet
0.75	1	8.5	16	15	2.5	14	4.3	1.5	14	100	330
1.5	2	15.2	20	20	4	12	7	1.5	14	100	330
2.2	3	19.5	25	25	4	10	10.5	1.5	14	100	330

Note

- The maximum motor cable length stated applies to using a shielded motor cable. When using an unshielded cable, the maximum cable length limit may be increased by 50%. When using the Invertek Drives recommended output choke, the maximum cable length may be increased by 100%
- The PWM output switching from any inverter when used with a long motor cable length can cause an increase in the voltage at the motor terminals, depending on the motor cable length and inductance. The rise time and peak voltage can affect the service life of the motor. Invertek Drives recommend using an output choke for motor cable lengths of 50m or more to ensure good motor service life
- For UL compliant installation, use Copper wire with a minimum insulation temperature rating of 70°C, UL Class CC or Class J Fuses

200 – 240 Volts (+ / - 10%) 3 Phase Input, 3 Phase Output

kW	HP	Nominal Input Current	Fuse Or MCB		Supply Cable Size		Nominal Output Current	Motor Cable Size		Maximum Motor Cable Length	
		A	Non UL	UL	mm	AWG / kcmil	A	mm	AWG / kcmil	m	feet
0.75	1	5.1	10	10	1.5	14	4.3	1.5	14	50	165
1.5	2	8.3	16	15	2.5	14	7	1.5	14	50	165
2.2	3	12.6	16	17.5	2.5	12	10.5	1.5	14	100	330
4	5	21.6	32	30	6	10	18	2.5	10	100	330
5.5	7.5	29.1	40	40	10	8	24	4	10	100	330
7.5	10	36.4	50	50	16	8	30	6	8	100	330
11	15	55.8	80	70	25	4	46	10	6	100	330
15	20	70.2	100	90	35	3	61	16	4	100	330
18.5	25	82.9	125	110	50	2	72	25	3	100	330
22	30	103.6	160	150	70	1	90	35	2	100	330
30	40	126.7	160	175	70	2/0	110	50	1/0	100	330
37	50	172.7	250	225	120	4/0	150	70	3/0	100	330
45	60	183.3	250	250	120	4/0	180	95	4/0	100	330
55	75	205.7	300	300	185	300	202	120	250	100	330
75	120	255.5	400	350	2 x 95	400	248	150	350	100	330

380 – 480 Volts (+ / - 10%) 1 Phase Input, 3 Phase Output											
kW	HP	Nominal Input Current	Fuse Or MCB		Supply Cable Size		Nominal Output Current	Motor Cable Size		Maximum Motor Cable Length	
		A	Non UL	UL	mm	AWG / kcmil	A	mm	AWG / kcmil	m	feet
0.75	1	2.4	10	6	1.5	14	2.2	1.5	14	100	330
1.5	2	5.1	10	10	1.5	14	4.1	1.5	14	100	330
2.2	3	7.5	10	10	1.5	14	5.8	1.5	14	100	330
4	5	11.2	16	15	2.5	14	9.5	1.5	14	100	330
5.5	7.5	19	25	25	4	10	14	1.5	12	100	330
7.5	10	21	32	30	6	10	18	2.5	10	100	330
11	15	28.9	40	40	10	8	24	4	10	100	330
15	20	37.2	50	50	16	8	30	6	8	100	330
18.5	25	47	63	60	16	6	39	10	8	100	330
22	30	52.4	80	70	25	4	46	10	6	100	330
30	40	63.8	80	80	25	4	61	16	4	100	330
37	50	76.4	100	100	35	3	72	25	3	100	330
45	60	92.2	125	125	50	1	90	35	2	100	330
55	75	112.5	160	150	70	1/0	110	50	1/0	100	330
75	100	153.2	200	200	95	3/0	150	70	3/0	100	330
90	150	183.7	250	250	120	4/0	180	95	4/0	100	330
110	175	205.9	300	300	185	300	202	120	250	100	330
132	200	244.5	400	350	185	350	240	150	350	100	330
160	250	307.8	400	400	2 x 95	600	302	2 x 70	500	100	330
200	300	370	500	500	2 x 150	750	370	2 x 95	750	100	330
250	350	450	600	600	2 x 150	1250	450	2 x 120	1250	100	330

480 – 525 Volts (+ / - 10%) 1 Phase Input, 3 Phase Output											
kW	HP	Nominal Input Current	Fuse Or MCB		Supply Cable Size		Nominal Output Current	Motor Cable Size		Maximum Motor Cable Length	
		A	Non UL	UL	mm	AWG / kcmil	A	mm	AWG / kcmil	m	feet
132		184	250	250	120	4/0	185	95	250	100	330
150		198.7	250	250	120	250	205	120	300	100	330
185		246.6	400	350	185	350	255	185	400	100	330
200		255.9	400	350	2 x 95	400	275	185	500	100	330

500 – 600 Volts (+ / - 10%) 1 Phase Input, 3 Phase Output											
kW	HP	Nominal Input Current	Fuse Or MCB		Supply Cable Size		Nominal Output Current	Motor Cable Size		Maximum Motor Cable Length	
		A	Non UL	UL	mm	AWG / kcmil	A	mm	AWG / kcmil	m	feet
0.75	1	2.5	10	6	1.5	14	2.1	1.5	14	100	330
1.5	2	3.7	10	6	1.5	14	3.1	1.5	14	100	330
2.2	3	4.9	10	10	1.5	14	4.1	1.5	14	100	330
4	5	7.8	10	10	1.5	14	6.5	1.5	14	100	330
5.5	7.5	10.8	16	15	2.5	14	9	1.5	14	100	330
7.5	10	14.4	20	20	4	12	12	1.5	14	100	330
11	15	20.6	32	30	6	10	17	2.5	10	100	330
15	20	26.7	40	35	10	8	22	4	10	100	330
18.5	25	34	50	45	16	8	28	6	8	100	330
22	30	41.2	63	60	16	6	34	6	8	100	330
30	40	49.5	63	70	16	6	43	10	6	100	330
37	50	62.2	80	80	25	4	54	16	4	100	330
45	60	75.8	100	100	35	3	65	25	4	100	330
55	75	90.9	125	125	50	2	78	25	3	100	330
75	100	108.2	160	150	70	1/0	105	50	1/0	100	330
90	125	127.7	160	175	70	2/0	130	70	2/0	100	330

Note

- The maximum motor cable length stated applies to using a screened motor cable. When using an unscreened cable, the maximum cable length limit is increased by 50%. When using the Invertek Drives recommended output choke, the maximum cable length limited can be increased by 100%
- The PWM output switching from any inverter when used with a long motor cable length can cause an increase in the voltage at the motor terminals, depending on the motor cable length and inductance. The rise time and peak voltage can affect the service life of the motor. Invertek Drives recommend using an output choke for motor cable lengths of 50m or more to ensure good motor service life
- For UL compliant installation, use Copper wir4 with a minimum insulation temperature rating of 75°C. When using fuses type should be Class CC or Class J

11.4. Additional Information for UL Approved Installations

Optidrive HVAC is designed to meet the UL requirements. In order to ensure full compliance, the following must be fully observed.

Input Power Supply Requirements	
Supply Voltage	200 – 240 RMS Volts for 230 Volt rated units, + /- 10% variation allowed. 240 Volt RMS Maximum
	380 – 480 Volts for 400 Volt rated units, + / - 10% variation allowed, Maximum 500 Volts RMS
	480 – 525 - NOT UL APPROVED
	500 – 600 Volts for 600 Volt rated units, + / - 10% variation allowed, Maximum 600 Volt RMS
Imbalance	Maximum 3% voltage variation between phase – phase voltages allowed
	All Optidrive HVAC units have phase imbalance monitoring. A phase imbalance of > 3% will result in the drive tripping. For input supplies which have supply imbalance greater than 3% (typically the Indian sub- continent & parts of Asia Pacific including China) Invertek Drives recommends the installation of input line reactors. Alternatively, the drives can be operated as a single phase supply drive with 50% derating.
Frequency	50 – 60Hz + / - 5% Variation
Short Circuit Capacity	All the models are suitable for use on a circuit capable of delivering not more than 100kA rms (AC) symetircal short-circuit current with the specified maximum supply voltage.
Incoming power supply connection must be according to section 4.3	
All Optidrive HVAC units are intended for indoor installation within controlled environments which meet the condition limits in section 13.1	
Branch circuit protection must be installed according to the relevant national codes. Fuse ratings and types are shown in section 13.4	
Suitable Power and motor cables should be selected according to the data shown in section 13.4	
Power cable connections and tightening torques are shown in section 3	
Optidrive HVAC provides motor overload protection in accordance with the National Electrical Code (US). • Where a motor thermistor is not fitted, or not utilised, Thermal Overload Memory Retention must be enabled by setting P4-12 = 1 • Where a motor thermistor is fitted and connected to the drive, connection must be carried out according to the information shown in section 4.6	

11.5. Derating Information

Derating of the drive maximum continuous output current capacity is require when

- Operating at ambient temperature in excess of 40°C / 104°F
- Operating at Altitude in excess of 1000m/ 3281 ft
- Operation with Effective Switching Frequency higher than the minimum setting

The following derating factors should be applied when operating drives outside of these conditions

11.5.1. Derating for Ambient Temperature

Enclosure Type	Maximum Temperature Without Derating	Derate by	Maximum Permissible
IP20	50°C / 122°F	N/A	50°C
IP40	40°C / 104°F	N/A	40°C
IP55	40°C / 104°F	1.5% per °C (1.8°F)	50°C
IP66	40°C / 104°F	2.5% per °C (1.8°F)	50°C

11.5.2. Derating for Altitude

Enclosure Type	Maximum Altitude Without Derating	Derate by	Maximum Perms sable (UL Approved)	Maximum Perms sable (Non-UL Approved)
IP20	1000m / 3281ft	1% per 100m / 328 ft.	2000m / 6562 ft.	4000m / 13123 ft.
IP40	1000m / 3281ft	1% per 100m / 328 ft.	2000m / 6562 ft.	4000m / 13123 ft.
IP55	1000m / 3281ft	1% per 100m / 328 ft.	2000m / 6562 ft.	4000m / 13123 ft.
IP66	1000m / 3281ft	1% per 100m / 328 ft.	2000m / 6562 ft.	4000m / 13123 ft.

11.5.3. Derating for Switching Frequency

	Switching Frequency (Where available)					
Enclosure Type	**4kHz**	**8kHz**	**12kHz**	**16kHz**	**24kHz**	**32kHz**
IP20	N/A	N/A	20%	30%	40%	50%
IP40	N/A	TBC	TBC	TBC	TBC	TBC
IP55	N/A	10%	10%	15%	25%	N/A
IP66	N/A	10%	25%	35%	50%	50%

11.5.4. Example of applying Derating Factors

A 4kW, IP66 drive is to be used at an altitude of 2000 metres above sea level, with 12 kHz switching frequency and 45°C ambient temperature.

From the table above, we can see that the rated current of the drive is 9.5 Amps at 40°C,

Firstly, apply the switching frequency derating, 12 kHz, 25% derating

9.5 Amps x 75% = 7.1 Amps

Now, apply the derating for higher ambient temperature, 2.5% per °C above 40°C = 5 x 2.5% = 12.5%

7.1 Amps x 87.5% = 6.2 Amps

Now apply the derating for altitude above 1000 metres, 1% per 100m above 1000m = 10 x 1% = 10%

7.9 Amps x 90% = 5.5 Amps continuous current available.

If the required motor current exceeds this level, it will be necessary to either

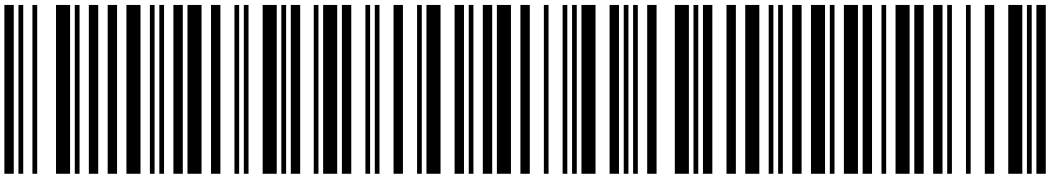
- Reduce the switching frequency selected
- Use a higher power rated drive and repeat the calculation to ensure sufficient output current is available.

12. Troubleshooting

12.1. Fault messages

Fault Code	No.	OLED Message	Description	Corrective Action
no-FLt	00	No Fault	No Fault	Displayed in P0-13 if no faults are recorded in the log
O-I	03	Over current trip	Instantaneous over current on drive output.	**Fault Occurs on Drive Enable** Check the motor and motor connection cable for phase – phase and phase – earth short circuits. Check the load mechanically for a jam, blockage or stalled condition Ensure the motor nameplate parameters are correctly entered, P1-07, P1-08, P1-09. Reduced the Boost voltage setting in P1-11 Increase the ramp up time in P1-03 If the connected motor has a holding brake, ensure the brake is correctly connected and controlled, and is releasing correctly
I.t-trP	04	Over load trip	Drive has tripped on overload after delivering >100% of value in P1-08 for a period of time.	Check to see when the decimal points are flashing (drive in overload) and either increase acceleration rate or reduce the load. Check motor cable length is within the limit specified for the relevant drive in section 11.3 Ensure the motor nameplate parameters are correctly entered in P1-07, P1-08, and P1-09 Check the load mechanically to ensure it is free, and that no jams, blockages or other mechanical faults exist
PS-trP	05	Hardware Over Current	Check the wiring to motor and the motor for phase to phase and phase to earth short circuits. Disconnect the motor and motor cable and retest. If the drive trips with no motor connected, it must be replaced and the system fully checked and retested before a replacement unit is installed.	
O-uoLt	06	Over voltage	Over voltage on DC bus	The value of the DC Bus Voltage can be displayed in P0-20 A historical log is stored at 256ms intervals prior to a trip in parameter P0-36 This fault is generally caused by excessive regenerative energy being transferred from the load back to the drive. When a high inertia or over hauling type load is connected. If the fault occurs on stopping or during deceleration, increase the deceleration ramp time P1-04. If operating in PID control, ensure that ramps are active by reducing P3-11
U-uoLt	07	Under voltage	Under voltage on DC bus	This occurs routinely when power is switched off. If it occurs during running, check the incoming supply voltage, and all connections into the drive, fuses, contactors etc.
O-t	08	Over temperature trip	Heatsink over temperature	The heatsink temperature can be displayed in P0-21. A historical log is stored at 30 second intervals prior to a trip in P0-38 Check the drive ambient temperature Ensure the drive internal cooling fan is operating Ensure that the required space around the drive as shown in section 3.8 thru 3.10 has been observed, and that the cooling airflow path to and from the drive is not restricted Reduce the effective switching frequency setting in parameter P2-24 Reduce the load on the motor / drive
U-t	09	Under temperature trip	Drive Under temperature	Trip occurs when ambient temperature is less than -10°C. The temperature must be raised over -10°C in order to start the drive.
P-dEF	10	Load default parameters	Factory Default parameters have been loaded	Press STOP key, the drive is now ready to be configured for the required application. Four button defaults – see section 5.8
E-trIP	11	External trip	Digital Input External trip	E-trip requested on control input terminals. Some settings of P1-13 require a normally closed contact to provide an external means of tripping the drive in the event that an external device develops a fault. If a motor thermistor is connected check if the motor is too hot.
SC-0bS	12	Optibus serial comms fault	Communications Fault	Communications lost with PC or remote keypad. Check the cables and connections to external devices
FLt-dc	13	Excessive DC ripple	Excessive DC Ripple on Internal DC bus	The DC Bus Ripple Voltage level can be displayed in parameter P0-16 A historical log is stored at 20ms intervals prior to a trip in parameter P0-37 Check all three supply phases are present and within the 3% supply voltage level imbalance tolerance. Reduce the motor load If the fault persists, contact your local Invertek Drives Sales Partner
P-LoSS	14	Input phase loss	Input phase missing trip	Drive intended for use with a 3 phase supply, one input phase has been disconnected or lost.
h O-I	15	Instant over current	Instantaneous over current on drive output.	Refer to fault 3 above
th-FLt	16	Thermistor Fault	Faulty thermistor on heat-sink.	Refer to your Invertek Sales Partner.

Fault Code	No.	OLED Message	Description	Corrective Action
dAtA-F	17	I/O processor data error	Internal memory fault.	Parameters not saved, factory defaults are reloaded. If problem reoccurs, refer to your IDL Authorised Distributor.
4-20F	18	4-20mA signal out of range	4-20mA Signal Lost	The reference signal on Analog Input 1 or 2 (Terminals 6 or 10) has dropped below the minimum threshold of 3mA when signal format is set to 4-20mA. Check the signal source and wiring to the Optidrive terminals.
dAtA-E	19	M/C processor data error	Internal memory fault.	Parameters not saved, factory defaults are reloaded. If problem reoccurs, refer to your IDL Authorised Distributor.
U-dEF	20	User Parameter Default	User Parameter Defaults	User Parameter default has been loaded. Press the Stop key. Three button default – see section 5.9
F-PtC	21	Motor PTC over heat	Motor PTC Over Temperature	The connected motor PTC device has caused the drive to trip (analog input 2 configured for PTC device).
FAn-F	22	Cooling Fan Fault	Cooling Fan Fault	Check and if necessary, replace the drive internal cooling fan
O-hEAt	23	Ambient Temperature High	Ambient Temperature too High	The measured temperature around the drive is above the operating limit. Ensure the drive internal cooling fan is operating Ensure that the required space around the drive as shown in sections 3.8 thru 3.10 has been observed, and that the cooling airflow path to and from the drive is not restricted Increase the cooling airflow to the drive Reduce the effective switching frequency setting in parameter P2-24 Reduce the load on the motor / drive
O-tor9	24	Exceed max torque	Over-Current Error	Current Monitoring Function has detected current levels above the normal operating condition for the application. Check mechanical load has not changed and that the load is not jammed or stalling. For pump application check for potential pump blockage For fan applications check airstream to and from the fan is not restricted
U-tor9	25	Output torque too low	Under-Current Error	Current Monitoring Function has detected current levels below the normal operating condition for the application. Check for mechanical breakages causing loss of load (e.g. belt break). Check motor has not become disconnected from the drive.
OUt-F	26	Drive Output Fault	Drive output fault	Drive output fault, refer to your IDL Authorised Distributor
Sto-F	29	Internal STO circuit Error	Refer to your Invertek Sales Partner	
AtF-01	40	Autotune fail 1	Autotune Failed	Measured motor stator resistance varies between phases. Ensure the motor is correctly connected and free from faults. Check the windings for correct resistance and balance.
AtF-02	41	Autotune fail 2		Measured motor stator resistance is too large. Ensure the motor is correctly connected and free from faults. Check that the power rating corresponds to the power rating of the connected drive.
AtF-03	42	Autotune fail 3		Measured motor inductance is too low. Ensure the motor is correctly connected and free from faults.
AtF-04	43	Autotune fail 4		Measured motor inductance is too large. Ensure the motor is correctly connected and free from faults. Check that the power rating corresponds to the power rating of the connected drive.
AtF-05	44	Autotune fail 5		Measured motor parameters are not convergent. Ensure the motor is correctly connected and free from faults. Check that the power rating corresponds to the power rating of the connected drive.
Pr-Lo	48	Feedback Pressure Low	Low Pressure Detected by Pipe Fill Function	Check the pump system for leaks for burst pipes. Check the Pipe fill function has been commissioned correctly (P3-16 & P3-17)
OUt-PH	49	Output Phase Loss	Output (Motor) Phase Loss	One of the motor output phases is not connected to the drive.
Sc-F01	50	Modbus Comms fault	Modbus communication error detected	
Sc-F03	52	Option Module Fault	Fitted communication Module Fault	Internal communication to the inserted Communications Option Module has been lost. Check the module is correctly inserted
Sc-F04	53	IO Card Comms fault	IO card comms trip	Internal communication to the inserted I/O Option Module has been lost. Check the module is correctly inserted
Sc-F05	54	BACnet Comms fault	BACnet comms loss trip	A valid BACnet telegram has not been received within the watchdog time limit set in P5-05 Check the network master / PLC is still operating Check the connection cables Increase the value of P5-05 to a suitable level



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