Invertek Drives.com

OPTIDRIVE™ eleVAtor

AC Variable Speed Drive

4kW – 37kW / 5HP – 50HP

380 – 480 Volt 3 Phase

Installation & Operating Instructions

Declaration of Conformity:

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

Invertek Drives Ltd hereby states that the Optidrive P2 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

Safe Torque Off ("STO") Function

Optidrive P2 incorporates a hardware "Safe Torque Off" Function, designed in accordance with the standards listed below.

Standard	Classification	Independent Approval
EN 61800-5-2:2007	Type 2	*TUV
EN ISO 13849-1:2006	PL "d"	
EN 61508 (Part 1 to 7)	SIL 2	
EN60204-1	Uncontrolled Stop "Category 0"	
EN 62061	SIL CL2	

*Note : TUV Approval of the "STO" function is relevant for drives which have a TUV logo applied on the drive rating label.

Electromagnetic Compatibility

All Optidrive P2 drives 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 P2 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		
	Cat C1	Cat C2	Cat C3
1 Phase, 230 Volt Input ODL-2-x2xxx-xxBxx	No additional filtering required Installation should be in accordance with Good EMC Practice (Refer to section 6.1)		
3 Phase, 400 Volt Input ODL-2-x4xxx-xxAxx	Use External Filter OD-Fx34x Installation in accordance with Good EMC Practice (Refer to section 6.1)	No additional filtering required	
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		
	Vector Speed mode may not operate correctly with long motor cables and output filters. It is recommended to operate in V/F mode for cable lengths exceeding 50m		

All Invertek Optidrive P2 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".
The 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 **1.25** or later Firmware.
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.

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 P2 Elevator) 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 drive 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 drive, including the specified environmental limitations.
	Do not perform any flash test or voltage withstand test on the Optidrive P2 Elevator drive. Any electrical measurements required should be carried out with the drive disconnected.
	Electric shock hazard! Disconnect and ISOLATE the Optidrive P2 Elevator drive 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. 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.
	The “Safe Torque Off” Function does not prevent high voltages from being present at the drives power terminals.
	Within the European Union, all machinery in which this product is used must comply with the machinery directive 2006/42/EC. 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 P2 Elevator control input functions (excluding the ‘Safe Torque OFF Input’) – 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 P2 Elevator drive 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.
	The Optidrive P2 Elevator drive has an Ingress Protection rating of IP20 or IP55 depending on the model. IP20 units must be installed in a suitable enclosure.
	The Optidrive P2 Elevator drive is 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 P2 Elevator drive 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 drive. In the case of suspected fault or malfunction, contact your local Invertek Drives Sales Partner for further assistance.

2. Electrical Installation quick reference

- Check Supply Voltage does not exceed drive Voltage rating.
- Check the number of supply phases is compatible with the drive.
- If the power supply has a low supply impedance /high short circuit current a Line reactor/Isolation transformer maybe required.
- For generator Bourne power supplies please contact your IDL Authorised Distributor for further guidance.

Isolator

- Ensure there is at least 30 seconds between each power-on.

Fuses / Circuit breaker

- Install suitably rated fuses/Circuit breakers .
- If an earth leakage detection device is used (e.g.ELCB/RCD), a type B trip characteristic which is suitable for protecting equipment with a DC component should be used, 1 device for multiple drives should be avoided.

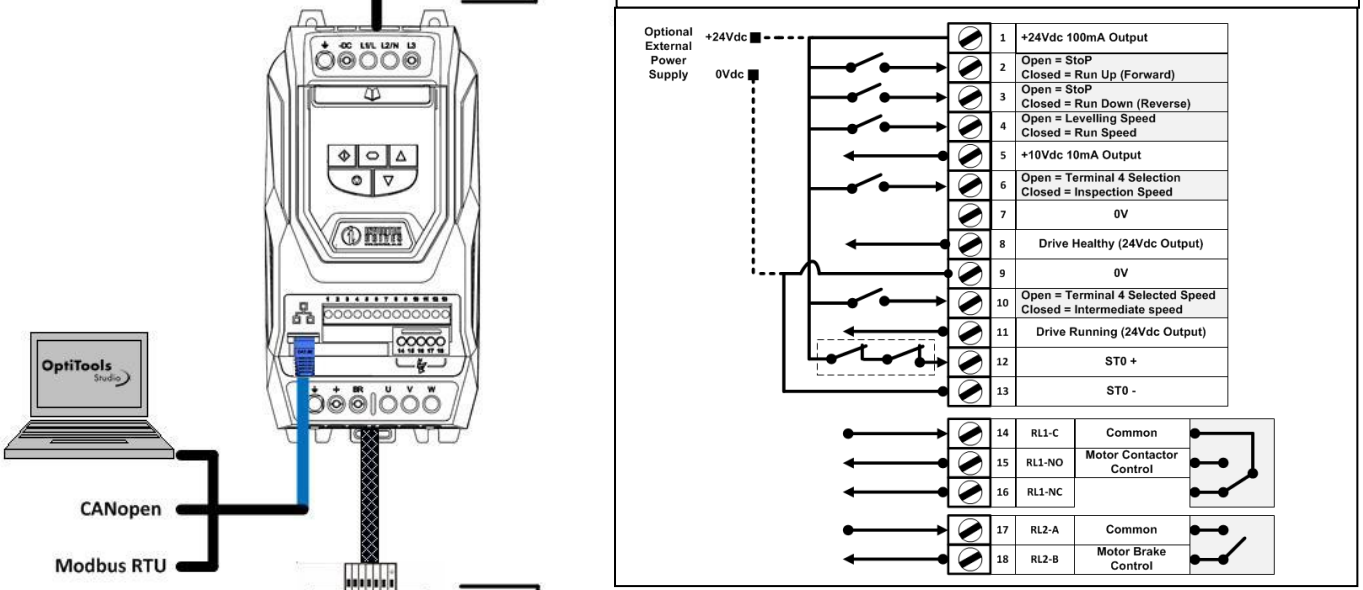
Line Reactor Option

Install Line reactor as close to the drive as possible and under the following conditions:

- If phase-phase imbalance is >3% (3Ø drives).
- To reduce Inrush current.
- If power supply has a low supply impedance/high short circuit current.
- If power supply is prone to dips or brown-outs.
- If power supply is via a bus-bar and sliding contacts system.
- Reduction in mains Harmonic emission.

RFI Filter Option

- Install External EMC filter if the motor cable length exceeds the Electromagnetic interference reduction capability of the internal filter
- Do Not Use EMC filters on IT (Ungrounded) or a corner grounded TN power supply systems.



Output Filter Option

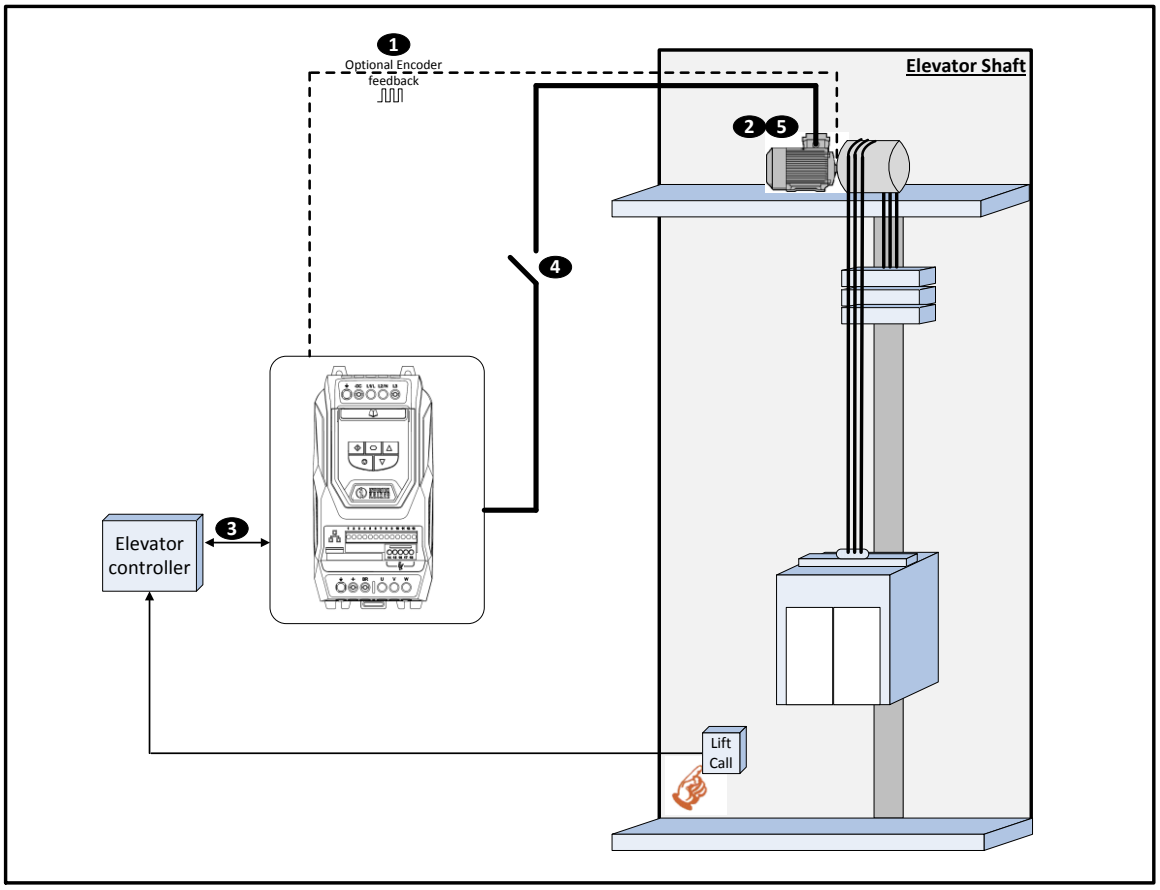
Install Output Choke under the following conditions:

- If cable between the drive and motor exceeds 100m (screened cable), or 150m (un-screened cable).
- If motor is not “inverter rated”.

- Whenever possible use a motor that is designed for operation from an inverter.
- Ensure the voltage rating of the drive and motor match, special care should be taken with dual voltage motors and that the correct configuration has been set.

3. Optidrive P2 Elevator Features and Functions

The Diagram below illustrates a typical Elevator drive system and the available solutions using the Optidrive P2 Elevator drive.



Feature/Function	Section	Notes
1 **Encoder :** • Incremental • Absolute (With simulated Encoder Output)	8	With Expansion Module • OPT-2-ENCOD/OPT-2-ENCHT-IN • OPT-2-ENDAT-IN
2 **Induction Motor Control :** • Open Loop Enhanced V/F • Open Loop Vector • Closed Loop Vector **Permanent Magnet :** • Open loop Vector • Closed Loop Vector	14.3	
3 **Communications Interface** • CANopen • Modbus RTU	15	
Safe Torque Off Input	7	
Built-in Dynamic Braking	6.4	Dynamic braking Automatically Enabled. Brake Resistor overload protection can optionally be enabled.
Stationary motor parameter Autotune	10.9	
Car drop compensation	-	Car floor position correction when drive is used with an Encoder.
4 **Motor Contactor Control**	10.5	If required the drive can control the motor contactor operation, furthermore the drive output signal can be optimally delayed to prevent nuisance drive trips/contactor and motor wear.
5 **Motor Brake Control**	10.6	
5 independent s-ramps	10.8	
Short Floor Operation	12.1	
Rescue Mode operation with Light Load Detection	12.2/12.2.4	UPS 240V single phase.
Elevator programmable user units	9.6	

4. Product Ratings

4.1. Drive model numbers – IP20

380-480V ±10% - 3 Phase Input					
kW Model Number With Filter	kW	HP Model Number With Filter	HP	Output Current (A)	Frame Size
ODL-2-24400-3KF42	4	ODL-2-24050-3HF42	5	9.5	2
ODL-2-34055-3KF42	5.5	ODL-2-34075-3HF42	7.5	14	3
ODL-2-34075-3KF42	7.5	ODL-2-34100-3HF42	10	18	3
ODL-2-34110-3KF42	11	ODL-2-34150-3HF42	15	24	3

4.2. Drive model numbers – IP55

380-480V ±10% - 3 Phase Input					
kW Model Number With Filter	kW	HP Model Number With Filter	HP	Output Current (A)	Frame Size
ODL-2-44110-3KF4N	11	ODL-2-44150-3HF4N	15	24	4
ODL-2-44150-3KF4N	15	ODL-2-44200-3HF4N	20	30	4
ODL-2-44185-3KF4N	18.5	ODL-2-44250-3HF4N	25	39	4
ODL-2-44220-3KF4N	22	ODL-2-44300-3HF4N	30	46	4
ODL-2-54300-3KF4N	30	ODL-2-54040-3HF4N	40	61	5
ODL-2-54370-3KF4N	37	ODL-2-54050-3HF4N	50	72	5

5. Mechanical Installation

5.1. General

- The Optidrive P2 Elevator drive 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 P2 Elevator drive must be installed in a pollution degree 1 or 2 environment only.
- Do not mount flammable material close to the Optidrive P2 Elevator drive.
- Ensure that the minimum cooling air gaps, as detailed in section 5.5 and 5.8 are left clear
- Ensure that the ambient temperature range does not exceed the permissible limits for the Optidrive P2 Elevator drive given in section 16.1
- Provide suitable clean, moisture and contaminant free cooling air sufficient to fulfil the cooling requirements of the Optidrive P2 Elevator drive.
- Before Installation check the drive rating label to ensure it is of the correct type and power requirements for the application.
- Carefully Unpack the Optidrive P2 Elevator drive and check for any signs of damage. Notify the shipper immediately if any exist.
- Store the Optidrive P2 Elevator drive in its original box until required. Storage should be clean and dry and within the temperature range –40°C to +60°C

5.2. 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 within the temperature range as set out in the “Environmental” section 16.1.
- 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.

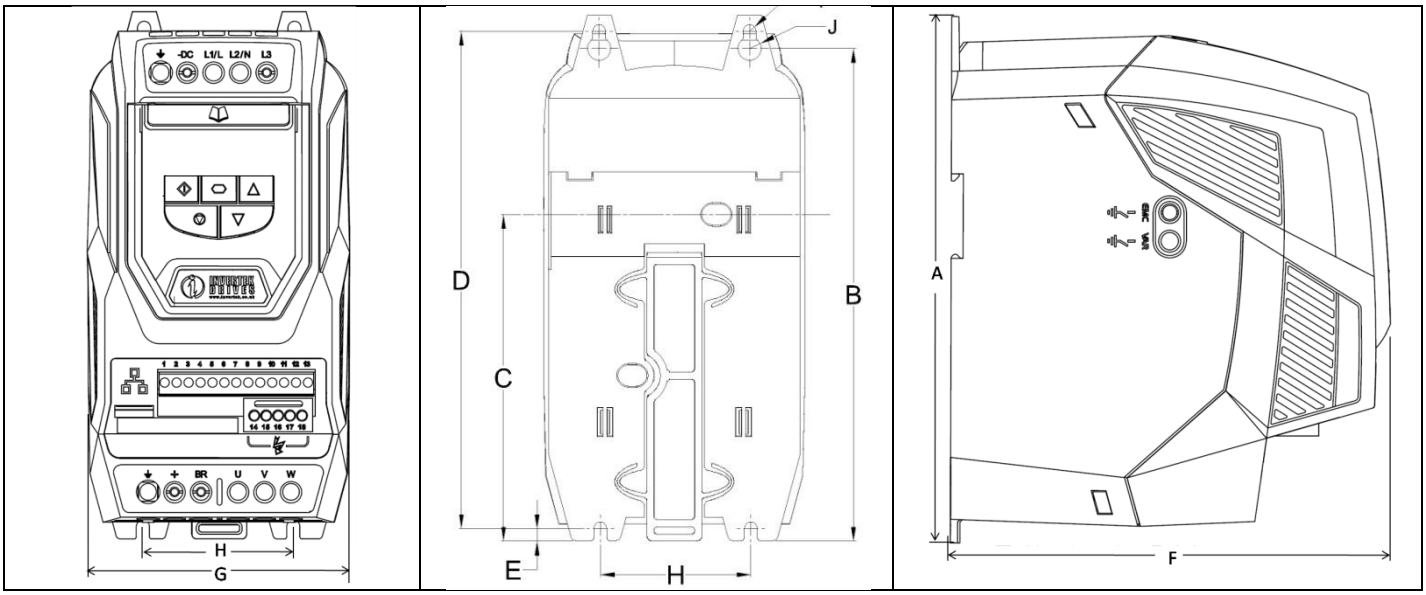
Checks should also be made on all electrical connections, ensuring screw terminals are correctly torqued; and that power cables have no signs of heat damage.

5.3. UL Compliant Installation

Note the following for UL-compliant installation:

- The drive can be operated within an ambient temperature range as stated in section 16.1
- For IP20 units, installation is required in a pollution degree 1 environment
- For IP55 units, installation in a pollution degree 2 environmant is permissible
- UL Listed ring terminals / lugs must be used for all bus bar and grounding connections

5.4. Mechanical dimensions – IP20 Units



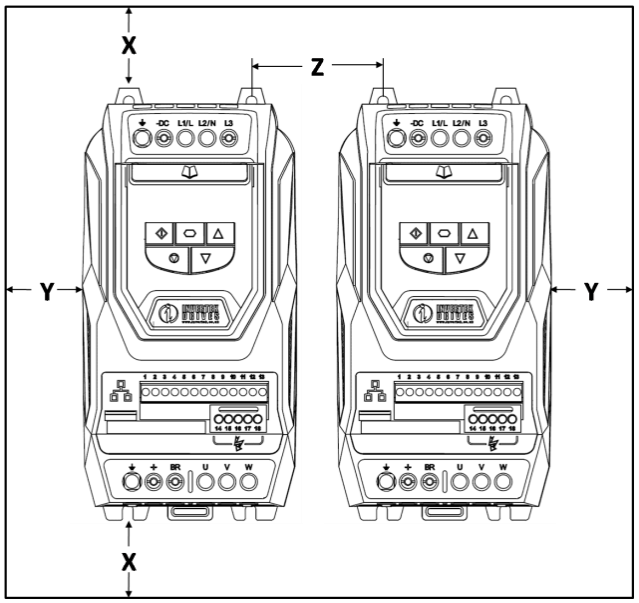
Drive Size	A		B		C		D		E		F		G		H		I		J	
	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in
2	221	8.70	207	8.15	137	5.39	209	8.23	5.3	0.21	185	5.91	112	4.29	63	2.48	5.5	0.22	10	0.39
3	261	10.28	246	9.69	-	-	247	9.72	6	0.24	205	6.89	131	5.16	80	3.15	5.5	0.22	10	0.39

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

5.5. Guidelines for Enclosure mounting (IP20 Units)

- Installation should be in a suitable enclosure, according to EN60529 or other relevant local codes or standards.
- Enclosures should be made from a thermally conductive material.
- Where vented enclosures are used, there should be venting above the drive and below the drive to ensure good air circulation – see the diagram below. 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 P2 Elevator drive 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.

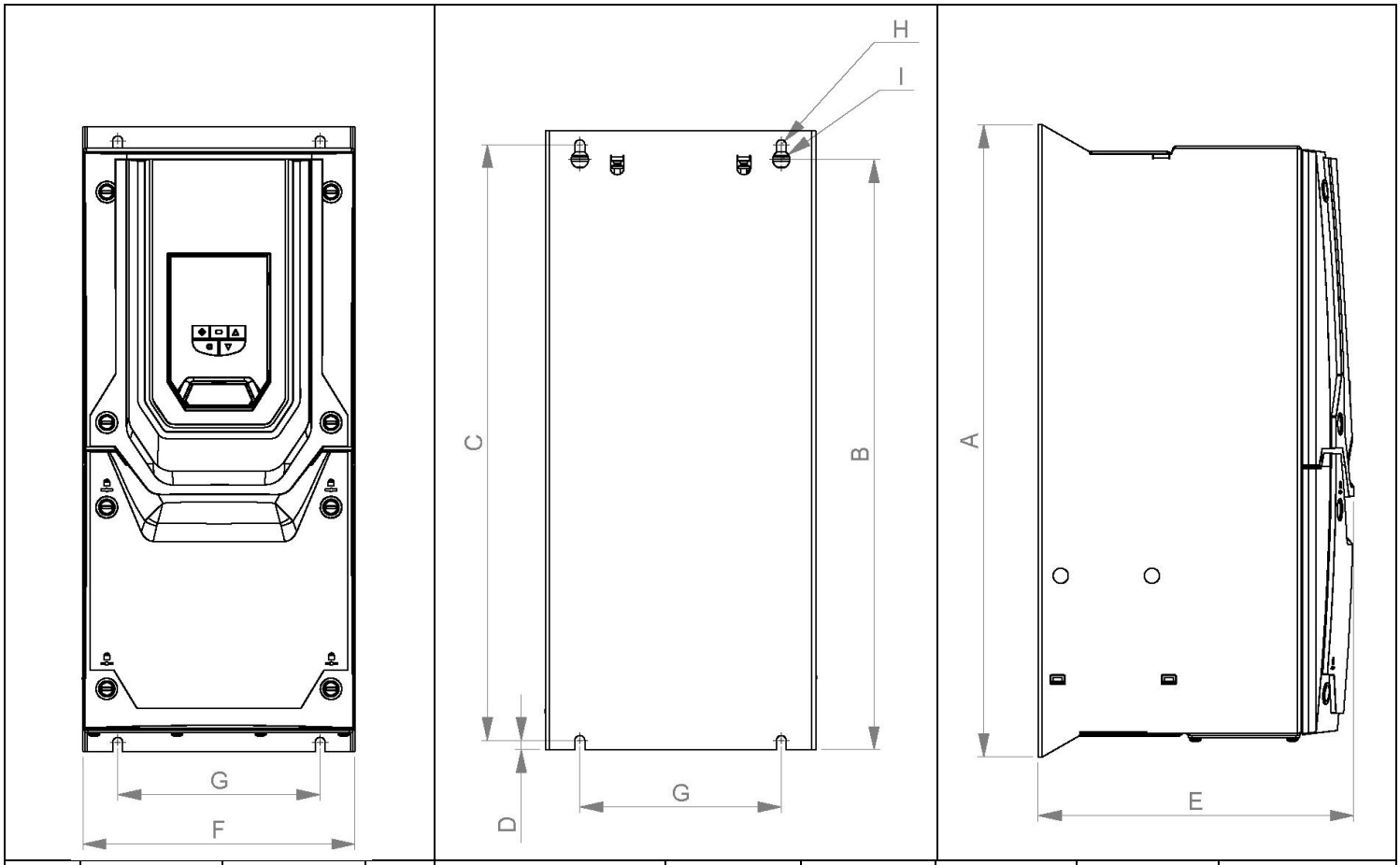
Typical drive heat losses are 3% of operating load conditions.

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

5.6. Mounting the Drive – IP20 Units

1. IP20 Units are intended for installation within a control cabinet.
2. 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
3. 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 suiatble flat blade screwdrive to pull the release tab downwards, and elevator the bottom of the drive away from the rail first

5.7. Mechanical dimensions – IP55 Units

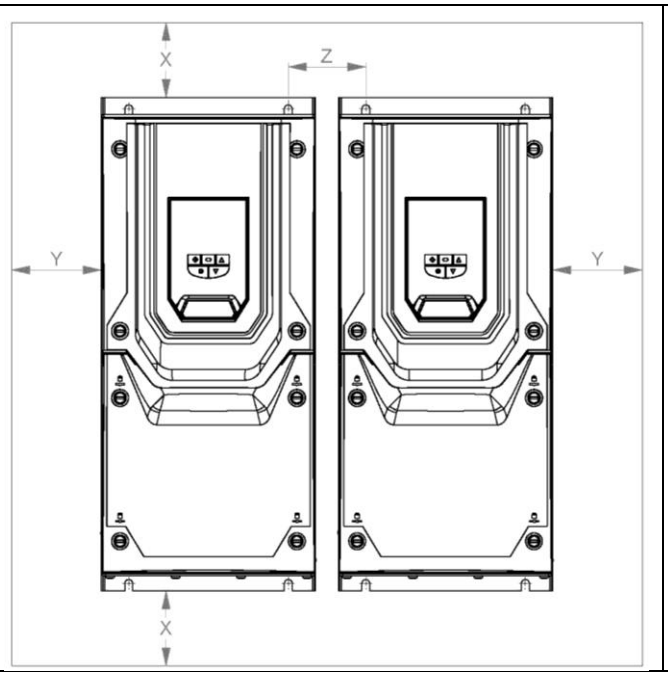


Drive Size	A		B		C	D			E		F		G		H		I	
	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in
4	450	17.32	418	16.46	423	16.65	8	0.315	252	9.449	171	6.732	110	4.331	4.25	0.167	7.5	0.295
5	540	21.26	515	20.28	520	20.47	8	0.315	270	10.63	235	9.252	175	6.89	4.25	0.167	7.5	0.295

Control Terminal Torque Settings:	All Sizes:	0.8 Nm (7 lb-in)
Power Terminal Torque Settings:	Frame Size 4:	1.2 – 1.5 Nm
	Frame Size 5:	2.5 – 4.5 Nm

5.8. 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 16.1
- 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
4	200	7.87	10	0.39
5	200	7.87	10	0.39

Note :

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

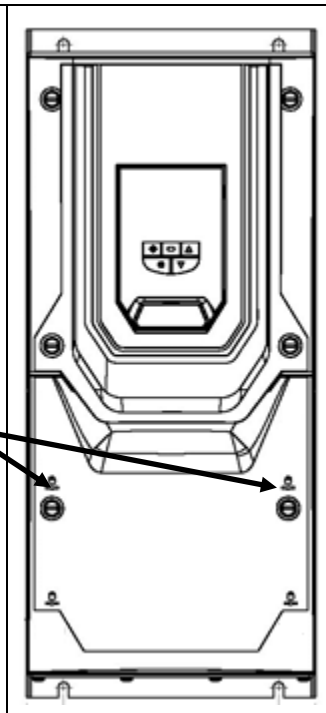
Above are guidelines only and the operating ambient temperature of the drive MUST be maintained at all times.

- Using the drive as a template, or the dimensions shown above, mark the locations required for drilling
- The drive should be mounted using M8 (Frame Sizes 4 & 5) mounting bolts

5.9. Removing the Terminal Cover

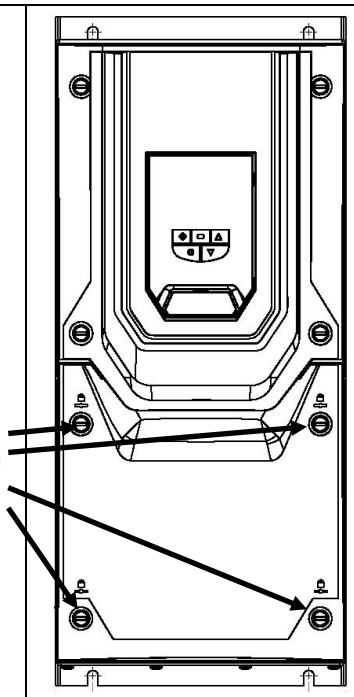
5.9.1. Frame Size 4

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

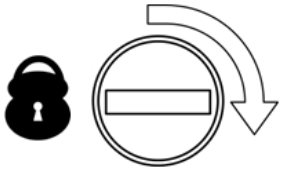


5.9.2. Frame Size 5

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



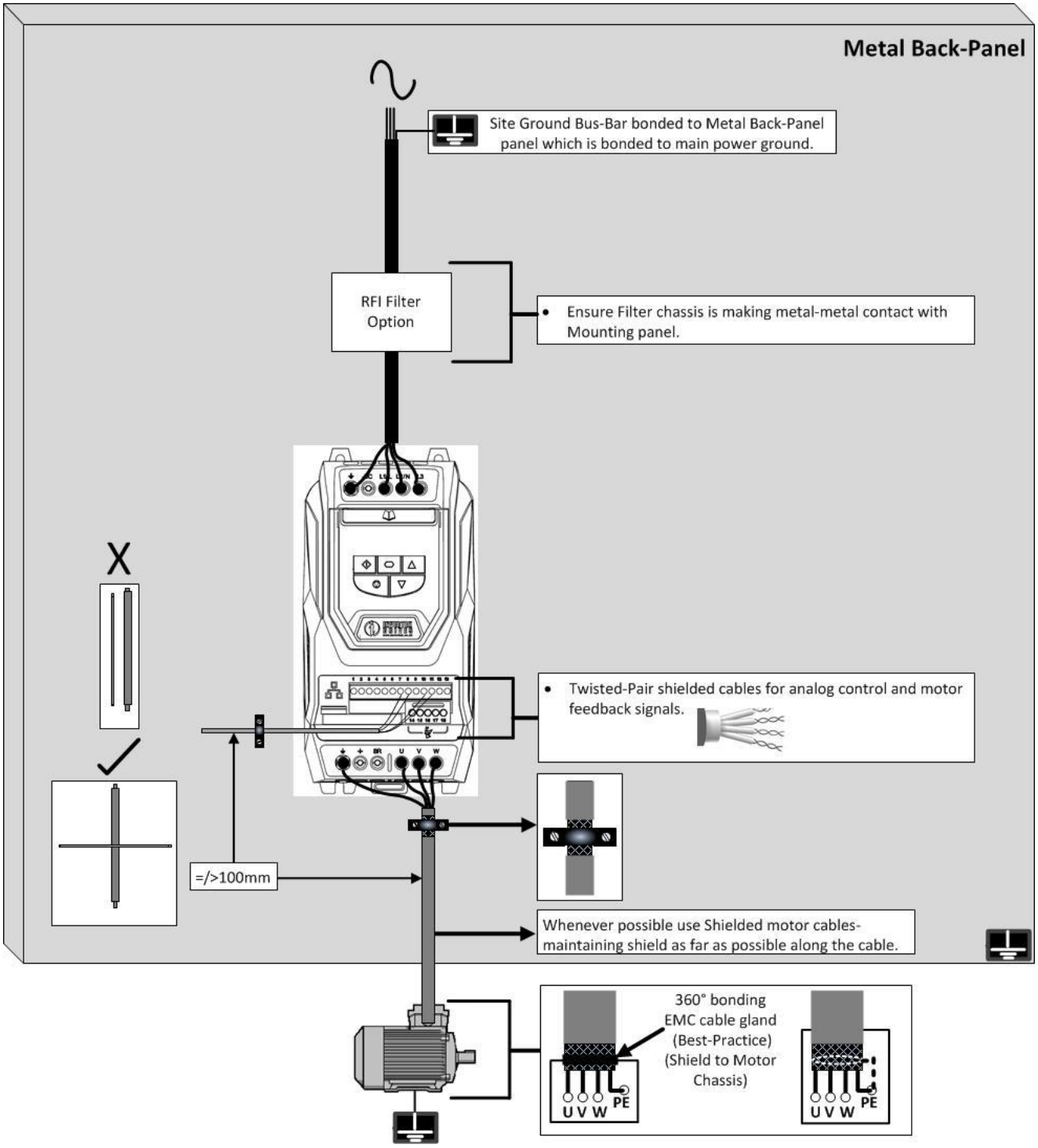
Terminal Cover Release Screws



6. Electrical Installation

	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 P2 Elevator drive 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.

6.1. Installation in accordance with Good EMC Practice



6.2. Grounding the Drive

6.2.1. Grounding Guidelines

The ground terminal of each Optidrive P2 Elevator drive should be individually connected DIRECTLY to the site ground bus bar (through the filter if installed). Optidrive P2 Elevator drive 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.

6.2.2. Protective Earth Conductor

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

6.2.3. 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.

6.2.4. Motor Ground

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

6.2.5. Ground Fault Monitoring

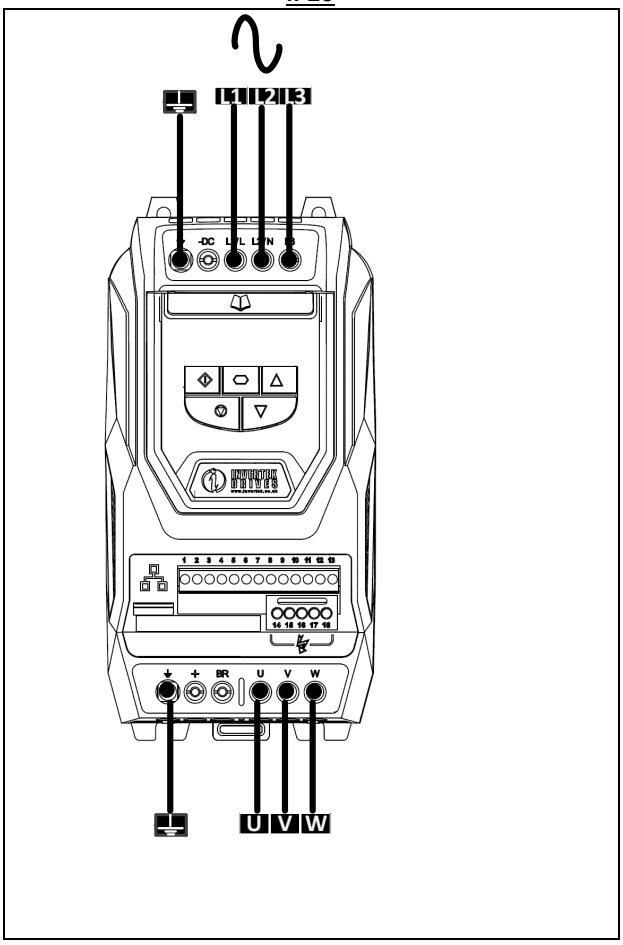
As with all inverters, a leakage current to earth can exist. The Optidrive P2 Elevator drive is designed to produce the minimum possible leakage current whilst complying with worldwide standards. The level of current is affected by motor cable length and type, the effective switching frequency, the earth 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 P2 Elevator drive.

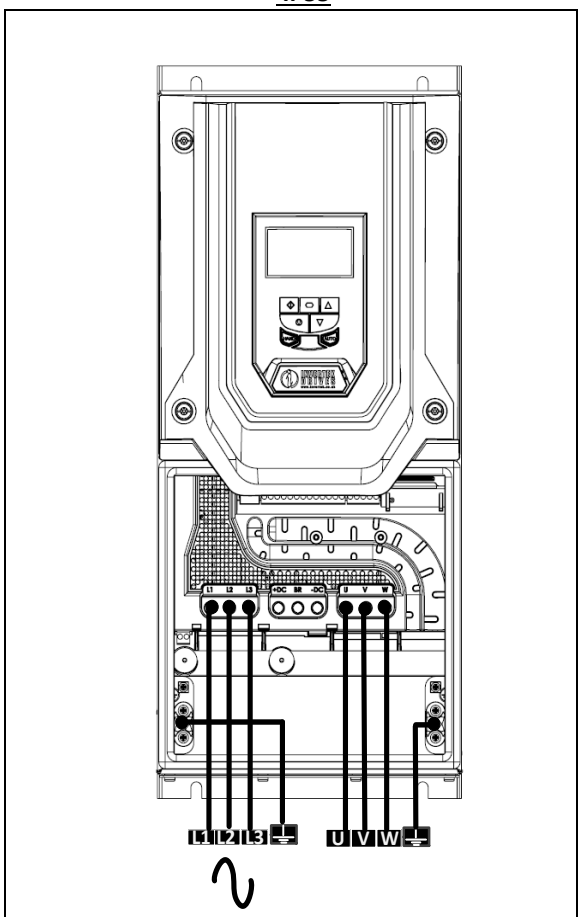
6.3. Electrical Connections (Mains Side)

6.3.1. Mains Power Connections

IP20



IP55



1. A fixed installation is required according to IEC61800-5-1 with a suitable disconnecting device installed between the Optidrive P2 Elevator drive 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).

2. 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.

3. The maximum permissible short circuit current at the Optidrive P2 Elevator drive Power terminals as defined in IEC60439-1 is 100kA.

4. 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.

- 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 busbar 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. Part numbers are shown in the table.

6.3.2. Input Chokes

Supply	Frame Size	AC Input Inductor
400 Volt 3 Phase	2	OPT-2-L3010-20
	3	OPT-2-L3036-20
	4	OPT-2-L3050-20
	5	OPT-2-L3090-20

6.3.3. Cables

- For compliance with CE and C Tick EMC requirements, a symmetrical shielded cable is recommended.
- It is recommended that the power cabling should be 4-core PVC-insulated screened cable, and laid in accordance with local industrial regulations and codes of practice
- The cables should be dimensioned according to any local codes or regulations. Guideline dimensions are given in section 16.3
- 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 16.3. 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.

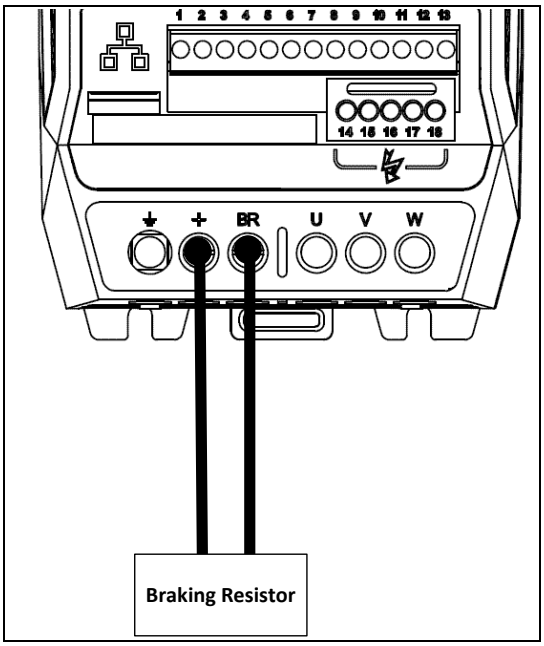
6.4. Electrical Conections (Brake Resistor)

The drive has an internal brake transistor fitted as standard and is enabled automatically.

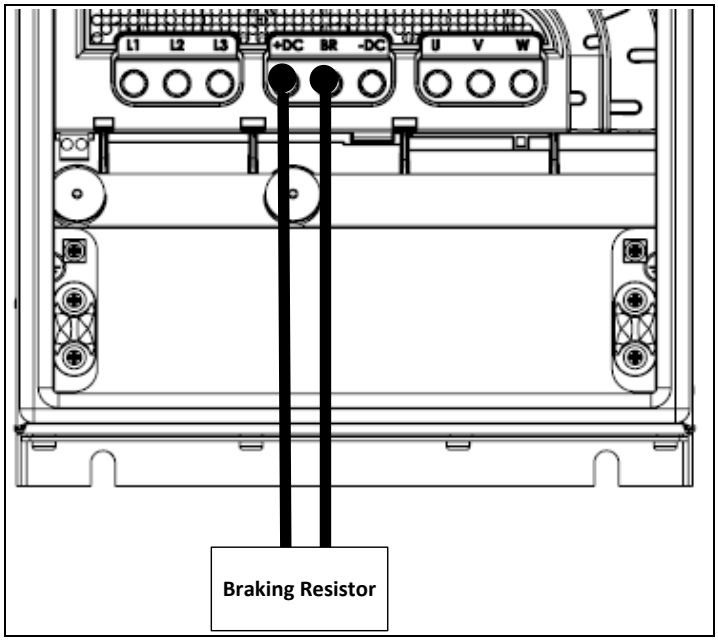
6.4.1. Connecting the brake resistor

The brake resistor should be connected between the +/+DC and BR Terminals of the drive as shown in the images below.

IP20



IP55



6.4.2. Brake resistor overload protection

From defaults the brake resistor overload protection is disabled.

Provividing the correct values have been entered into parameters **P**3-13 and **P**3-14 the drive will protect the brake resistor against overload.

For correct protection :

- Enter the resistance of the brake resistor in **P**3-13 (Ohms)
- Enter the power of the brake resistor in **P**3-14 (kW)

6.5. Electrical Connections (Motor Side)

6.5.1. Cables

- The motor should be connected to the Optidrive P2 Elevator drive 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.

- 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

- Where drives are mounted in a steel control panel enclosure, the cable screen should be terminated directly to the control panel using a suitable EMC clamp or gland, as close to the drive as possible and as illustrated is section 6.1.

- For IP55 drives, connect the motor cable screen to the internal ground clamp

6.5.2. Motor Termination

- The motor earth must be connected to one of the Optidrive P2 Elevator drive earth terminals.

- 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.

6.5.3. Precautions

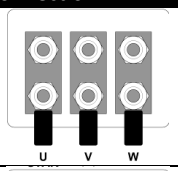
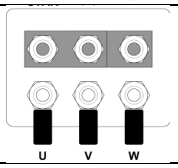
- The PWM output switching from any inverter when used with a long motor cable length can cause an increase in the voltage at the motor terminals, depending on the motor cable length and inductance. The rise time and peak voltage can affect the service life of the motor. Invertek Drives recommend using an output choke for motor cable lengths of 50m or more to ensure good motor service life.

- Connect the Optidrive P2 Elevator drive according to section 6.3, 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 6.5.4 Motor Terminal Box Connections.

6.5.4. Motor Terminal Box Connections

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

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

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

6.6. Motor Thermal overload Protection.

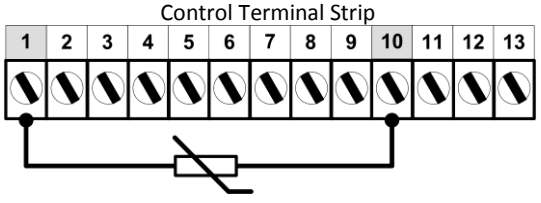
6.6.1. Internal Thermal overload protection.

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. 150% for 60 seconds).

6.6.2. Motor Thermistor Connection

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

Control Terminal Strip



Additional Information

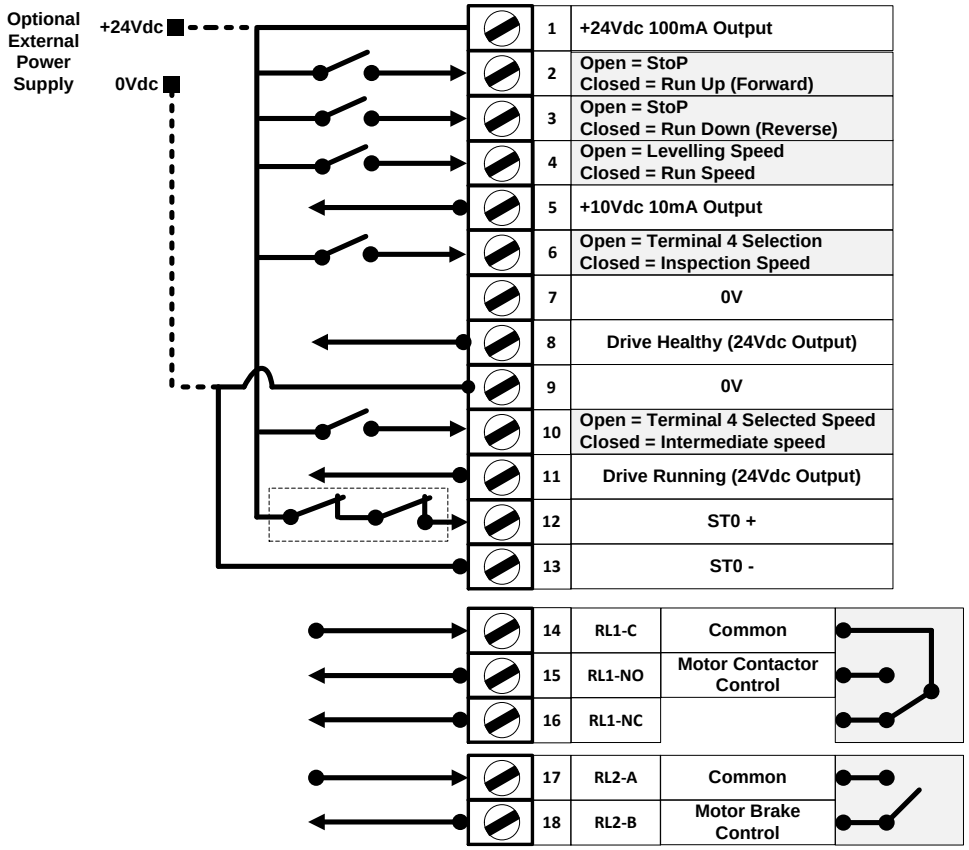
- Compatible Thermistor : PTC Type, 2.5kΩ trip level
- Use a setting of **P**1-13 that has an input as External Trip, e.g. **P**1-13 = 2. Refer to section 10.4.1 for further details.

6.7. Control Terminal Wiring

1. All analog signal cables should be suitably shielded. Twisted pair cables are recommended.
2. Power and Control Signal cables should be routed separately where possible, and must not be routed parallel to each other
3. Signal levels of different voltages e.g. 24 Volt DC and 110 Volt AC, should not be routed in the same cable.
4. Maximum control terminal tightening torque is 0.5Nm

6.8. Control Terminals Connection Diagram

Control Terminal Designations and Default Function Assignments



For SAFE TORQUE OFF Input (STO+/STO-) Also refer to section 7.1.7
Logic High = 18-30Vdc ("SAFE TORQUE OFF" Standby mode.).

6.9. Control Terminal Connections

Main Terminal Strip			
1	+24V	+ 24V User Input / Output	100mA User Output
2	DI 1	Input 1	Digital 8 – 30 Volt DC
3	DI 2	Input 2	Digital 8 – 30 Volt DC
4	DI 3	Input 3	Digital 8 – 30 Volt DC
5	+10V	+ 10 Volt User Output	10mA for user potentiometer
6	AI 1	Input 4	Digital 8 to 30V DC / Analog Input 1, -10 to +10V, 0 / 4 to 20mA or +24VDC Digital
7	0V	0 Volt Common	
8	AO1	Output 1	1st Analog / Digital Output, 0 to 10V, 4 to 20mA or +24VDC Digital
9	0V	0 Volt Common	
10	AI 2	Input 5	Digital 8 to 30V DC / Analog Input 2, 0 to 10V, 0 / 4 to 20mA or 20 to 4mA
11	AO2	Output 2	Analog Input 2 / Digital Output, 0 to 10V, 4 to 20mA, Digital 24V
12	STO+	Drive hardware inhibit	"Safe torque Off" 24V input - must be linked to ext +24 Volt (18 – 30 Volt) DC to enable power stage
13	STO-	Inhibit 0V input	0V return for the 24V "Safe torque OFF" input (STO)
Additional Terminal Strip			
14	RL1-C	Relay Output 1 Common	Relay contacts, 250V AC, 30V DC, 5A
15	RL1-NO	Relay Output 1 NO	Relay contacts, 250V AC, 30V DC, 5A
16	RL1-NC	Relay Output 1 NC	Relay contacts, 250V AC, 30V DC, 5A
17	RL2-A	Relay Output 2 Common	Relay contacts, 250V AC, 30V DC, 5A
18	RL2-B	Relay Output 2 NO	Relay contacts, 250V AC, 30V DC, 5A

7. Safe Torque Off

7.1. Safe Torque Off

Safe Torque OFF will be referred to as "STO" through the remainder of this section.

7.1.1. Responsibilities

The overall system designer is responsible for defining the requirements of the overall "Safety Control System" within which the drive will be incorporated; furthermore the system designer is responsible for ensuring that the complete system is risk assessed and that the "Safety control System" requirements have been entirely met and that the function is fully verified, this must include confirmation testing of the "STO" function before drive commissioning.

The system designer shall determine the possible risks and hazards within the system by carrying out a thorough risk and hazard analysis, the outcome of the analysis should provide an estimate of the possible hazards, furthermore determine the risk levels and identify any needs for risk reduction. The "STO" function should be evaluated to ensure it can sufficiently meet the risk level required.

7.1.2. What STO Provides

The purpose of the "STO" function is to provide a method of preventing the drive from creating torque in the motor in the absence of the "STO" input signals (Terminal 12 with respect to Terminal 13), this allows the drive to be incorporated into a complete safety control system where "STO" requirements need to be fulfilled.[1]

The "STO" function can typically eliminate the need for electro-mechanical contactors with cross-checking auxiliary contacts as per normally required to provide safety functions.[2]

The drive has the "STO" Function built-in as standard and complies with the definition of "Safe torque off" as defined by IEC 61800-5-2:2007.

The "STO" Function also corresponds to an uncontrolled stop in accordance with category 0 (Emergency Off), of IEC 60204-1. This means that the motor will coast to a stop when the "STO" function is activated, this method of stopping should be confirmed as being acceptable to the system the motor is driving.

The "STO" function is recognised as a fail safe method even in the case where the "STO" signal is absent and a single fault within the drive has occured, the drive has been proven in respect of this by meeting the following safety standards :

	SIL (Safety Integrity Level)	PFH_D (Probability of dangerous Failures per Hour)	SFF (Safe failure fraction %)	Lifetime assumed
EN 61800-5-2	2	1.23E-09 1/h (0.12 % of SIL 2)	50	20 Yrs

	PL (Performance level)	CCF (%) (Common Cause Failure)
EN ISO 13849-1	PL d	1

	SILCL
EN 62061	SILCL 2

Note : The values acheived above maybe jepardised if the drive is installed outside of the Environmental limits detailed in section 16.1 "Environmental".

7.1.3. What STO does not provide

Disconnect and ISOLATE the drive before attempting any work on it. The "STO" function does not prevent high voltages from being present at the drive power terminals.

[1] Note : The "STO" function does not prevent the drive from an unexpected re-start. As soon as the "STO"inputs receive the relevant signal it is possible (subject to parameter settings) to restart automatically, Based on this, the function should not be used for carrying out short-term non-electrical machinery operations (such as cleaning or maintenance work).

[2]Note : In some applications additional measures may be required to fulfil the systems safety function needs : the "STO" function does not provide motor braking. In the case where motor braking is required a time delay safety relay and/or a mechanical brake arrangement or similar method should be adopted, consideration should be made over the required safety function when braking as the drive braking circuit alone cannot be relied upon as a fail safe method.

When using permanent magnet motors and in the unlikely event of a multiple output power devices failing then the motor could effectively rotate the motor shaft by 180/p degrees (Where p denotes number of motor pole pairs).

7.1.4. "STO" Operation

When the "STO" inputs are energised, the "STO" function is in a standby state, if the drive is then given a "Start signal/command" (as per the start source method selected in **P**1-13) then the drive will start and operate normally.

When the "STO" inputs are de-energised then the STO Function is activated and stops the drive (Motor will coast), the drive is now in "Safe Torque Off" mode.

To get the drive out of "Safe Torque Off" mode then any "Fault messages" need to be reset and the drive "STO" input needs to be re-energised.

7.1.5. "STO" Status and Monitoring

There are a number of methods for monitoring the status of the "STO" input, these are detailed below:

Drive Display

In Normal drive operation (Mains AC power applied), when the drives "STO" input is de-energised ("STO" Function activated) the drive will highlight this by displaying **"InHibit",** (Note: If the drive is in a tripped condition then the relevant trip will be displayed and not "InHibit").

Drive Output Relay

- Drive relay 1: Setting **P**2-15 to a value of "13" will result in relay opening when the "STO" function is activated.
- Drive relay 2: Setting **P**2-18 to a value of "13" will result in relay opening when the "STO" function is activated.

"STO" Fault Codes

Fault Code	Code Number	Description	Corrective Action
"Sto-F"	29	A fault has been detected within either of the internal channels of the "STO" circuit.	Refer to your Invertek Sales Partner

7.1.6. "STO" Function response time

The total response time is the time from a safety related event occurring to the components (sum of) within the system responding and becoming safe. (Stop Category 0 in accordance with IEC 60204-1)

1. The response time from the "STO" inputs being de-energised to the output of the drive being in a state that will not produce torque in the motor ("STO" active) is less than 1ms.
2. The response time from the "STO" inputs being de-energised to the "STO" monitoring status changing state is less than 20ms
3. The response time from the drive sensing a fault in the STO circuit to the drive displaying the fault on the display/Digital output showing drive not healthy is less than 20ms.
4.

7.1.7. "STO"Electrical Installation

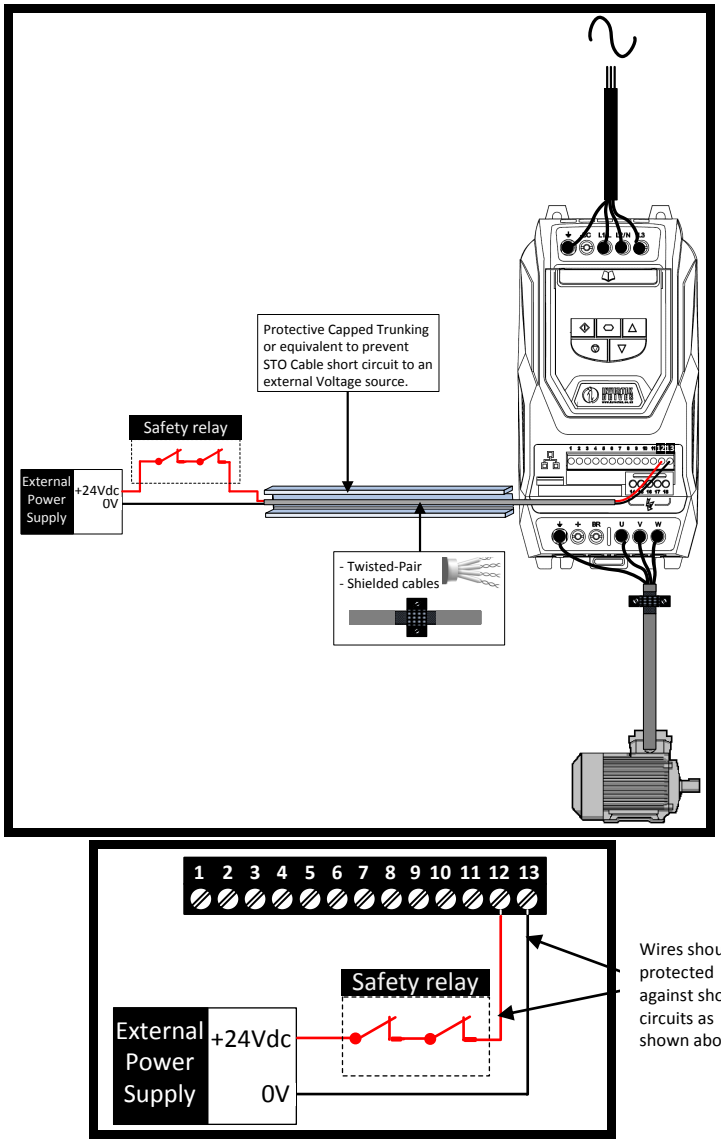
The "STO" wiring shall be protected from inadvertent short circuits or tampering which could lead to failure of the "STO" input signal, further guidance is given in the diagrams below.

In addition to the wiring guidelines for the "STO" circuit below, section 6.1"Installation in accordance with Good EMC Practice" should also be followed.

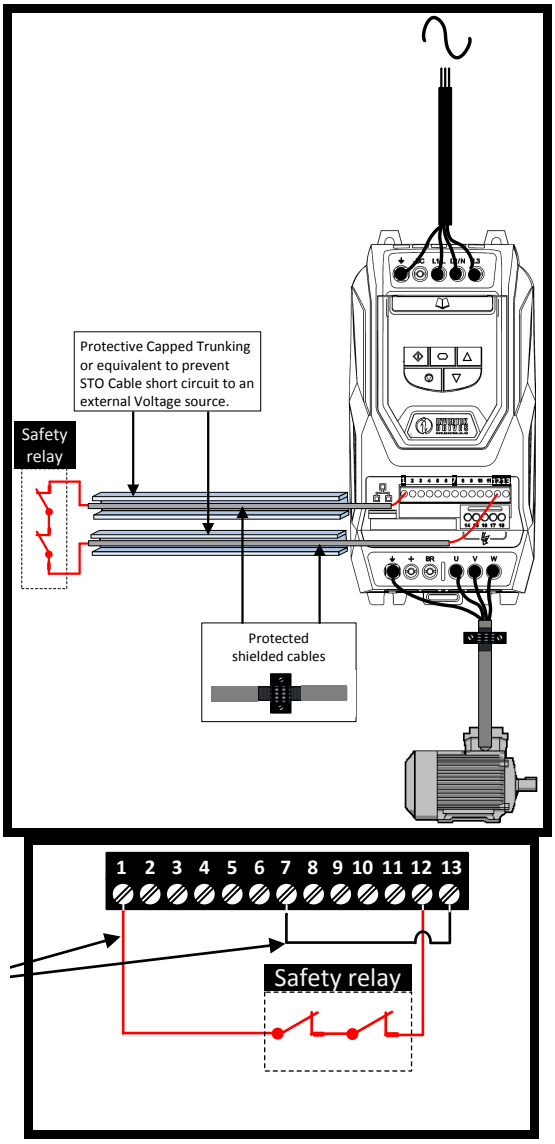
The drive should be wired as illustrated below; the 24Vdc signal source applied to the "STO" input can be either from the 24Vdc on the drive or from an External 24Vdc power supply.

7.1.8. Recommended "STO" wiring

Using an External 24Vdc Power Supply.



Using the drives on-board 24Vdc supply



Note: The Maximum cable length from Voltage source to the drive terminals should not exceed 25 metres.

7.1.9. External Power supply Specification.

Voltage Rating (Nominal)	24Vdc
STO Logic High	18-30Vdc (Safe torque off in standby)
Current Consumption (Maximum)	100mA

7.1.10. Safety Relay Specification.

The safety relay should be chosen so that at minimum it meets the safety standards in which the drive meets.

Standard Requirements	SIL2 or PLd SC3 or better (With Forcibly guided Contacts)
Number of Output Contacts	2 independent
Switching Voltage Rating	30Vdc
Switching Current	100mA

7.1.11. Enabling the "STO" Function

The "STO" function is always enabled in the drive regardless of operating mode or parameter changes made by the user.

7.1.12. Testing the "STO" Function

Before commissioning the system the "STO" function should always be tested for correct operation, this should include the following tests:

- With the motor at standstill, and a stop command given to the drive *(as per the start source method selected in **P**1-13)*:
  - De-energise the "STO" inputs (Drive will display ""InHibit").
  - Give a start command *(as per the start source method selected in **P**1-13) and check that the drive still displays "Inhibit" and* that the operation is in line with section 7.1.4 *and section 7.1.5* "STO" Status and Monitoring

- With the motor running normally (from the drive):
  - De-energise the "STO" inputs
  - Check that the drive displays "InHibit" and that the motor stops *and* that the operation is in line with the section 7.1.4 "STO" Operation *and section 7.1.5* "STO" Status and Monitoring.

7.1.13. "STO" Function Maintenance.

The "STO" function should be included within the control systems scheduled maintenance program so that the function is regularly tested for integrity (Minimum once per Year), furthermore the function should be integrity tested following any safety system modifications or maintenance work.

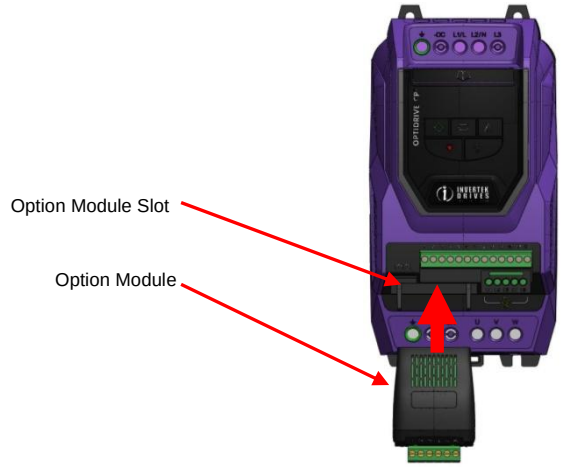
If drive fault messages are observed refer to section 17.1 Fault messages for further guidance.

8. Optional Encoder Interface modules

There are 3 types of encoder interface modules which allow the Optidrive P2 Elevator drive to interface with the following encoder types.

- 5V TTL Incremental Encoder – A & B Channel with Compliment
- 24V HTL Incremental Encoder – A & B Channel with Compliment
- Endat Absolute Rotary Encoder (Heidenhain) – ECN1313, ECN113, ECN413, ECN1325, ECN125, ECN425.

8.1. Encoder interface module Mechanical Installation



8.2. Encoder interface module electrical installation

OPT-2-ENCOD-IN
Connection Example – 5V TTL Encoder

OPT-2-ENCHT-IN
Connection Example – 24V HTL Encoder

OPT-2-ENDAT-IN
Endat Absolute Encoder Connections

Terminal	Encoder Connection
1	+5V Supply to Encoder
2	0V
3	DATA
4	DATA/
5	CLOCK
6	CLOCK/
7	SIN
8	SIN_REF
9	COS
10	COS_REF
11	Shield/Screen

Terminal	Simulated Encoder Output
12	0V
13	A_P (Out)
14	A_N (Out)
15	B_P (Out)
16	B_N (Out)
17	Shield/Screen

- The encoder cable should be screened, ideally with each signal pair individually screened. The screen should be connected to the 0V of the encoder module, or shield/screen connection (OPT-2-ENDAT-IN).
- The resolution of the simulated encoder output is as per the connected encoder.

Note : Simulated Encoder output only possible if incremental signals 7 thru to 10 are connected.

8.3. Encoder interface module parameter setup

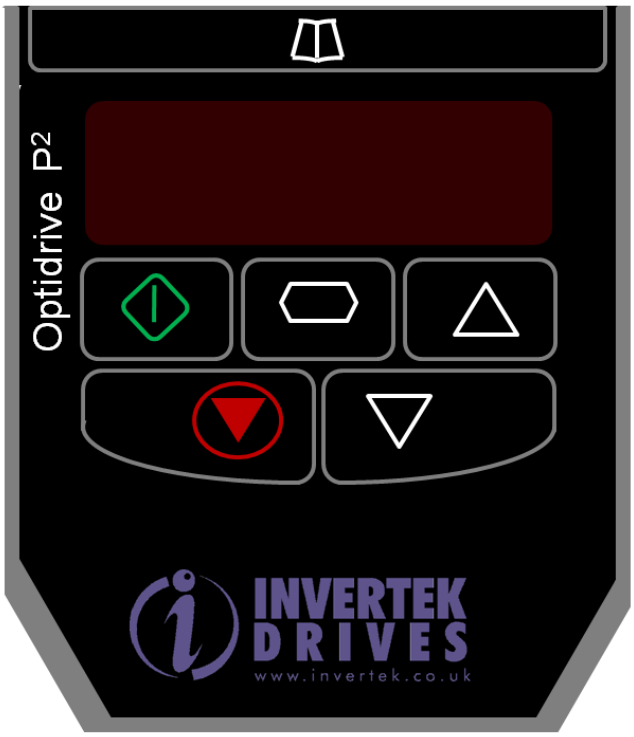
See section 10.9 for parameterisation and commissioning.

9. Managing the Keypad

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

9.1. Keypad Layout and Function – Standard LED Keypad

	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



9.2. Changing Parameters

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

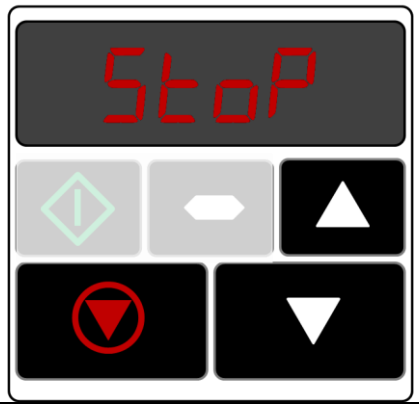
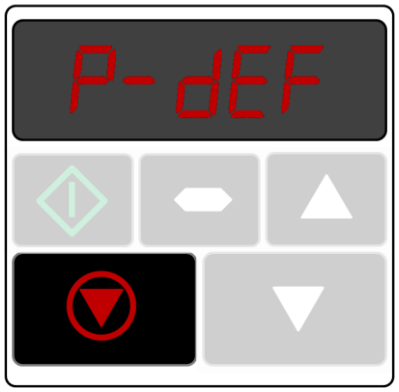
9.3. Advanced Keypad Operation Short Cuts

Function	When Display shows...	Press...	Result	Example
Fast Selection of Parameter Groups Note : Parameter Group Access must be enabled **P**1-14 = 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...

9.4. Drive Operating Displays

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 **P**2-21 and **P**2-22	
Etl-24	Drive mains power not present, external 24 Volt control power supply present only	
Inh ibt	Output power hardware inhibited, Safe Torque Off function activated. External links are required to the STO inputs (terminals 12 and 13) as shown in section 6.8 Control Terminals Connection Diagram	
P-dEF	Parameters reset to factory default settings	
U-dEF	Parameters reset to User default settings (**P**6-29=1)	
For drive fault code displays, refer to section 17.1 on page 58		

9.5. Resetting Parameters to Factory Default Settings

LED Display		
	Press and hold the  Keys for at least 2 seconds The display will show P-dEF Press the  key	

9.6. Elevator Specific Linear Units

The drive provides the user with the option to program the drive and view the elevator speed in real time in elevator units e.g. m/s, the drive calculates the value internally providing the correct values are entered into the below parameters.

To enable this feature the user must program the following parameters:

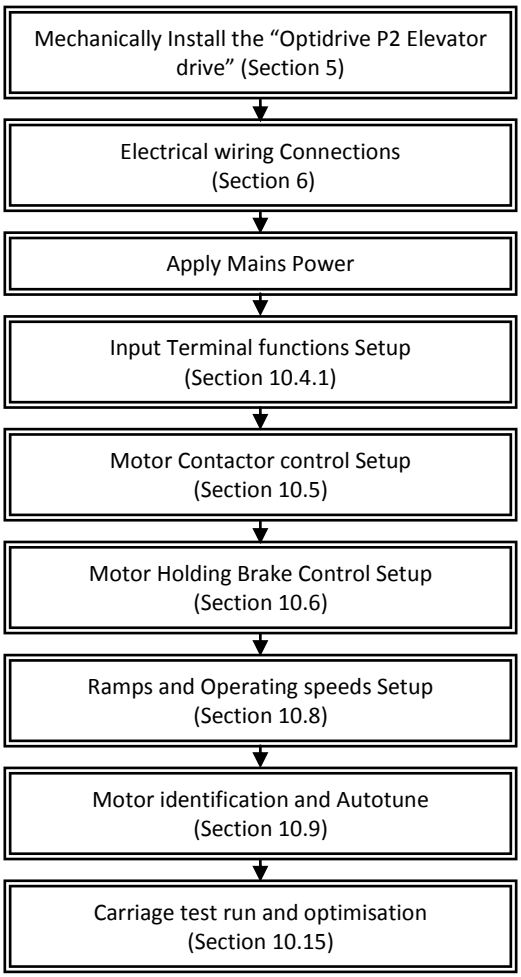
- Motor Rated Speed (**P**1-10**)**
- Sheave Diameter (**P**3-15**)** (<100 drive assumes inches)/(>100 drive assumes mm)
- Roping Ratio (**P**3-16)
- Gear Ratio (for geared systems) (**P**3-17)

Note: If P1-10 **and P**3-15 **are zero then the function is inactive.**

Once the above parameters are programmed the user can view the real time travel speed by pressing the  (navigate button) untill „r“ is shown in the left side of the display , this is further detailed in section 9.1.

10.Start up and Commissioning

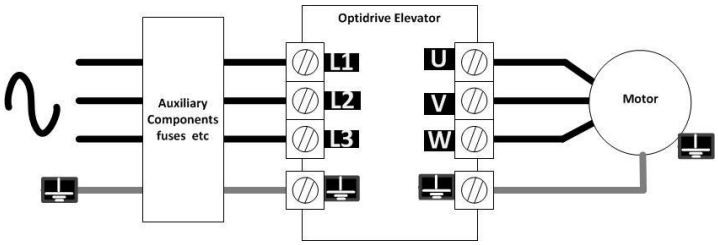
10.1. Commissioning flow diagram.



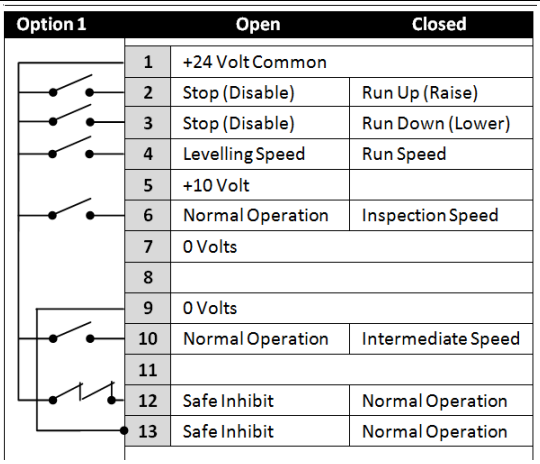
10.2. Electrical wiring

The below procedure illustrates a method for commissioning the Optidrive P2 Elevator drive in a typical elevator application, it is assumed the drive has already been mechanically installed.

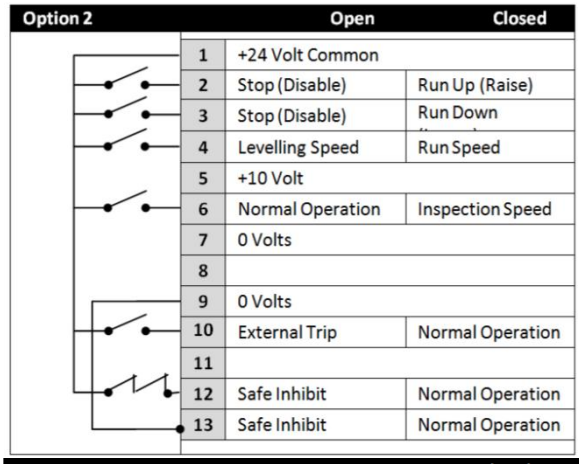
Mains Power Connections		
1	Connect Mains Power wiring to the drive (See image below)	Further details in section 6.3.1
2	Connect Motor to the drive (See image below)	Further details in section 6.5



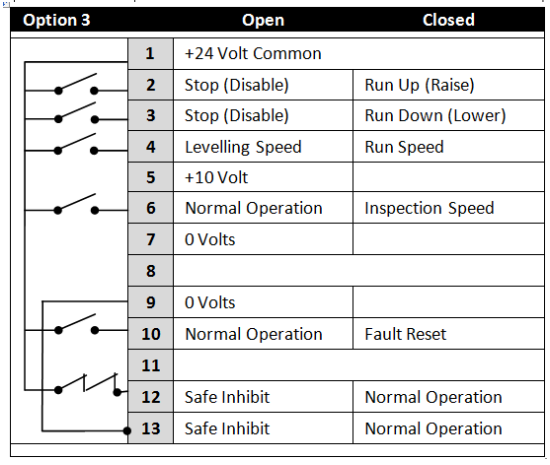
Control Connections		
1	Connect Encoder to the drive (Optional)	Further details in section 8
2	Connect Motor Contactor to drive (If not controlled by elevator controller)	Further details in section 6.8
3	Connect Motor brake to drive (If not controlled by elevator controller)	Further details in section 6.8
4	Connect Elevator controller to drive as per one of the options below	Example wiring options are shown below.



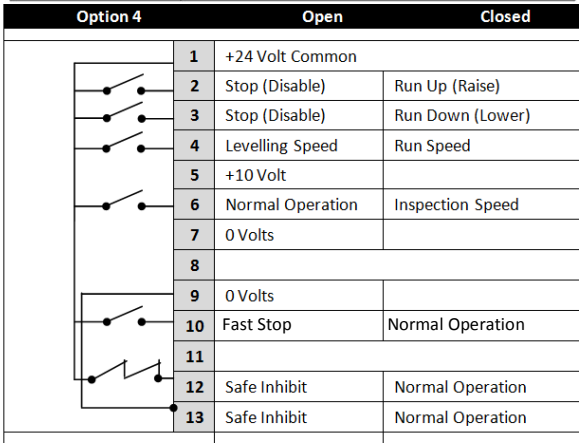
Option 1	Open	Closed
1	+24 Volt Common	
2	Stop (Disable)	Run Up (Raise)
3	Stop (Disable)	Run Down (Lower)
4	Levelling Speed	Run Speed
5	+10 Volt	
6	Normal Operation	Inspection Speed
7	0 Volts	
8		
9	0 Volts	
10	Normal Operation	Intermediate Speed
11		
12	Safe Inhibit	Normal Operation
13	Safe Inhibit	Normal Operation



Option 2	Open	Closed
1	+24 Volt Common	
2	Stop (Disable)	Run Up (Raise)
3	Stop (Disable)	Run Down
4	Levelling Speed	Run Speed
5	+10 Volt	
6	Normal Operation	Inspection Speed
7	0 Volts	
8		
9	0 Volts	
10	External Trip	Normal Operation
11		
12	Safe Inhibit	Normal Operation
13	Safe Inhibit	Normal Operation



Option 3	Open	Closed
1	+24 Volt Common	
2	Stop (Disable)	Run Up (Raise)
3	Stop (Disable)	Run Down (Lower)
4	Levelling Speed	Run Speed
5	+10 Volt	
6	Normal Operation	Inspection Speed
7	0 Volts	
8		
9	0 Volts	
10	Normal Operation	Fault Reset
11		
12	Safe Inhibit	Normal Operation
13	Safe Inhibit	Normal Operation



Option 4	Open	Closed
1	+24 Volt Common	
2	Stop (Disable)	Run Up (Raise)
3	Stop (Disable)	Run Down (Lower)
4	Levelling Speed	Run Speed
5	+10 Volt	
6	Normal Operation	Inspection Speed
7	0 Volts	
8		
9	0 Volts	
10	Fast Stop	Normal Operation
11		
12	Safe Inhibit	Normal Operation
13	Safe Inhibit	Normal Operation

10.3. Applying Power

Before Applying rated power ensure the drive is in a disabled state e.g. terminal 12 input low.(switch open)

Apply rated power to the drive (see section 16.2 for ratings), once powered up the drive will display `Inh Ibt/StoP`, if this does not show then refer to the troubleshooting table in section 17.

10.4. Control Terminals Parameter setup

Note : The following parameter settings assume that the drive is in a factory default state.

Based on which control wiring option was choosen in step 4 of Section "10.2 Electrical wiring select“ the matched setting in **P**1-13 as shown in the table below.

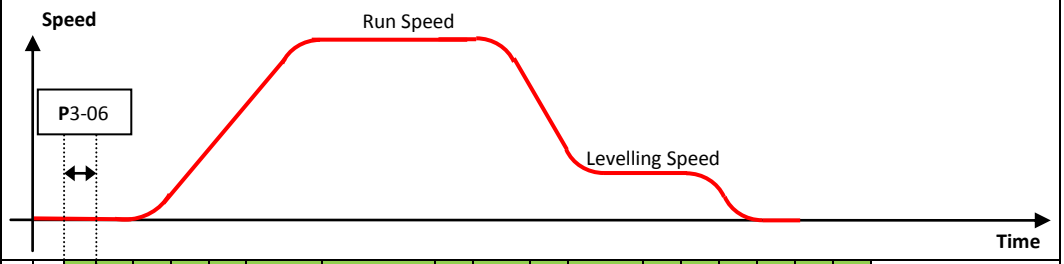
10.4.1. Digital Input Configuration Parameter

P1-13	Digital Input 1 (Terminal 2)	Digital Input 2 (Terminal 3)	Digital Input 3 (Terminal 4)	Analog Input 1 (Terminal 6)	Analog Input 2 (Terminal 10)
0	User defined	User defined	User defined	User defined	User defined
1 (Option 1) Default	O: Stop C: Run Up (Raise)	O: Stop C: Run Down (Lower)	O: Levelling Speed (***P2-01 value)*** C: Run Speed (***P2-02 value)***	O : Normal Operation C : Inspection Speed(***P2-04 value)***	O: Normal Operation C: Intermediate Speed(***P2-03 value)***
2 (Option 2)	O: Stop C: Run Up (Raise)	O: Stop C: Run Down (Lower)	O: Levelling Speed(***P2-01 value)*** C: Run Speed (***P2-02 value)***	O : Normal Operation C : Inspection Speed(***P2-04 value)***	O : External Trip / Thermistor* C : Normal Operation
3 (Option 3)	O: Stop C: Run Up (Raise)	O: Stop C: Run Down (Lower)	O: Levelling Speed(***P2-01 value)*** C: Run Speed(***P2-02 value)***	O : Normal Operation C : Inspection Speed(***P2-04 value)***	O : Normal Operation C : Fault Reset
4 (Option 4)	O: Stop C: Run Up (Raise)	O: Stop C: Run Down (Lower)	O: Levelling Speed (***P2-01 value)*** C: Run Speed (***P2-02 value)***	O: Normal Run C: Inspection Run (***P2-04 value)***	O: **Fast Stop Decel 2(***P2-25* value) C: Normal Run

*Note: If a motor thermistor is to be connected, this must be selected in **P**2-33.
If **P2-25 is set to 0 then drive will coast to stop.

10.5. Motor Contactor Control

Related Parameters	Action
P3-06 (OUTPUT CONTACTOR CLOSING TIME/RUN COMMAND DELAY TIME)	**1** Ensure advanced parameter access is enabled by setting **P**1-14 = 101
	2 If Motor contactor activation is to come from the drive set **P**2-15 to **8**. (Relay 1 output function select)
	3 Program parameter **P**3-06 as per the profile diagram below.



STO Input (T12+ T13)
Enable & Direction Input (T2 or T3)
Run Speed Input (T4)
Motor Contactor Close (Relay 1)
Zero speed Holding (IM motor only)
Drive Output Enabled

P3-06 (OUTPUT CONTACTOR CLOSING TIME/RUN COMMAND DELAY TIME)

If Elevator controller is being used for motor contactor activation

Sets a delay time between the enable signal being applied to the drive and the drive energising the motor.
This ensures that an output contactor between the drive and motor has had enough time to close before the drive output comes on.
A value too low in this parameter may cause over current trips/Excess wear on the Contactor/Motor winding stress.

Observation : When the drive is started it will remain in a “StoP” state until the value in **P**3-06 has elapsed, however if the start command signal is toggled in the time less than **P**3-06 then the drive will not carry out the delay time and the drive output will come on immediately.

If drive is being used for motor contactor activation (P2-15=8) via Relay 1

Use **P**3-06 to set the delay time required for the relay contacts to close/open.

When the Enable (Run) signal is applied to the drive, the drive will signal the contactor to close, and then wait for the delay time set in **P**3-06 before applying torque to the motor.

When the Enable (Run) signal is removed from the drive, the drive will signal the contactor to open after the time set in **P**3-06 has elapsed.

10.6. Motor Holding Brake Parameter setup

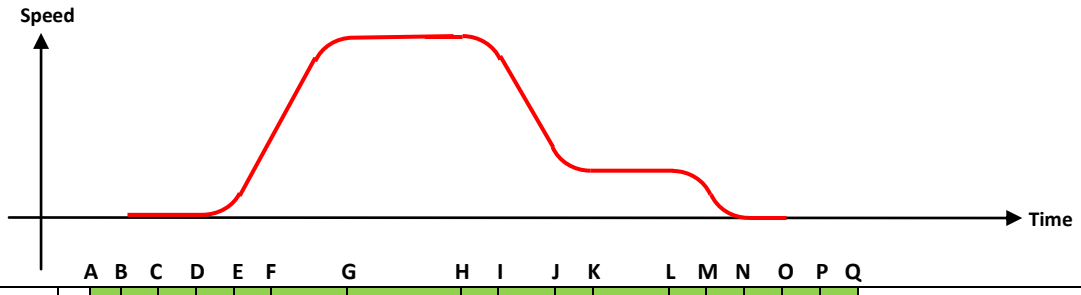
The Optidrive P2 Elevator drive has been designed to control the holding brake on motors where a separate electromechanical brake is fitted. The brake is controlled by the output relay (terminals 17 and 18) – see section 6.8 for details.

There are two different options for controlling the closing operation of the brake during stopping.

10.6.1. Motor Holding Brake control-Option 1

Closing the brake at a parameter adjustable output frequency level. This allows the brake to be signalled to close whilst the drive is decelerating, allowing the user to preset the frequency so that the brake closes simultaneously when the output frequency reaches zero.

Related Parameters	Action
P3-07 (Brake Release Time) **P**3-09 (Brake Apply Speed) **P**3-10 (Zero Speed Holding Time on disable)	Program parameters as per the profile diagram below.

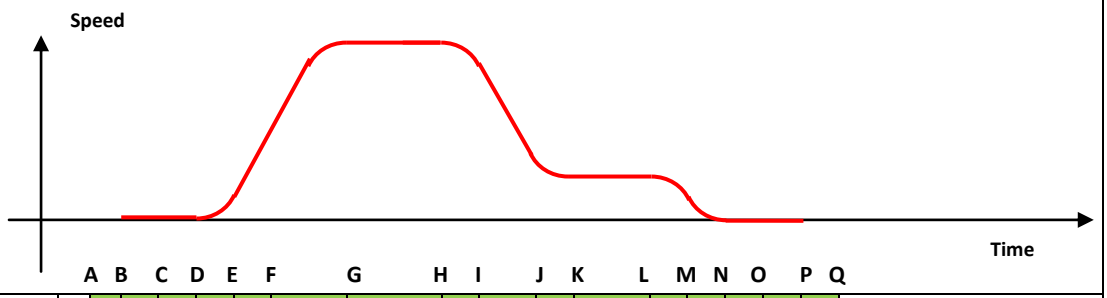


A	STO Input Closed by external control system Run Forward / Run Reverse input applied by External Control System Run Speed (High Speed) Input Closed by External Control System Motor Contactor Output (Relay 1) set by drive (to close motor contactor) Drive waits for Output Contactor Closing time (**P**3-06) before enabling the output stage to drive the motor
B	After the Motor Contactor Delay time (**P**3-06) has elapsed, the Drive Output to the motor is enabled at zero speed Drive holds zero speed on the output, and magnetises the motor (IM Motor) For PM Motor, the magnetizing time is zero
C	After the Motor Magnetizing Time has elapsed, the motor brake control output (Relay 2) is set to release the motor brake The output Frequency remains at zero until the Motor Brake Release Time (**P**3-07) has elapsed
D	After the Motor Brake Release Time (**P**3-07) has elapsed, the drive output frequency is ramped up. The Ramp Rate is controlled initially using Acceleration S-Ramp 1 (**P**3-01)
E	The Acceleration rate is now controlled linearly by the Acceleration Ramp Parameter (**P**1-03)
F	As the Run Speed is approached, the acceleration is now controlled by Acceleration S-Ramp 2 (**P**3-02)
G	Operation at Run Speed (**P**2-02)
H	When the Run Speed Input is removed, the drive output frequency is reduced to the Levelling Speed (**P**2-01). Deceleration is initially controlled by Deceleration S-Ramp 1 (**P**3-03)
I	After Deceleration S-Ramp 1 (**P**3-03) has completed, deceleration is controlled linearly by the Deceleration Ramp Parameter (**P**1-04)
J	As the output frequency approaches the Levelling Speed (**P**2-01), Deceleration S-Ramp 2 (**P**3-04) is applied
K	The drive operates at the Levelling Speed (**P**2-01) until the Direction Input is removed
L	On removal of the Direction input, the output frequency is reduced towards zero, with deceleration rate initially controlled by Levelling S-Ramp (**P**3-05)
M	If the deceleration time is long enough to require linear deceleration, Deceleration Ramp Time (**P**1-04) is used As the output frequency approaches zero, Levelling S-Ramp (**P**3-05) is again applied
N	When the output frequency reaches the Brake Apply Speed (**P**3-09), the motor brake control signal is removed to allow the motor brake to close. Output frequency continues to ramp towards zero speed, holding at zero speed.
O	After the Zero Speed Holding Time (**P**3-10) has elapsed, the drive output is disabled For IM Motor control, a demagnetisation time is allowed for the motor prior to removing the Motor Contactor Output signal, allowing the contactor to open. (This is not required for PM motors)
P	The Motor Contactor signal is removed allowing the contactor to open
Q	The STO Input to the drive can now be opened by the control system

10.6.2. Motor Holding Brake control-Option 2

If the brake Apply Speed (**P**3-09) parameter is set to zero (default setting), an additional parameter (**P**3-08) is used to define the time that the drive should wait whilst holding the motor at zero speed prior to signalling the brake to close.

Related Parameters	Action
P3-07(Brake Release Time) **P**3-08(Brake Apply Delay) **P**3-10(Zero Speed Holding Time on disable)	Program parameters as per the profile diagram below.

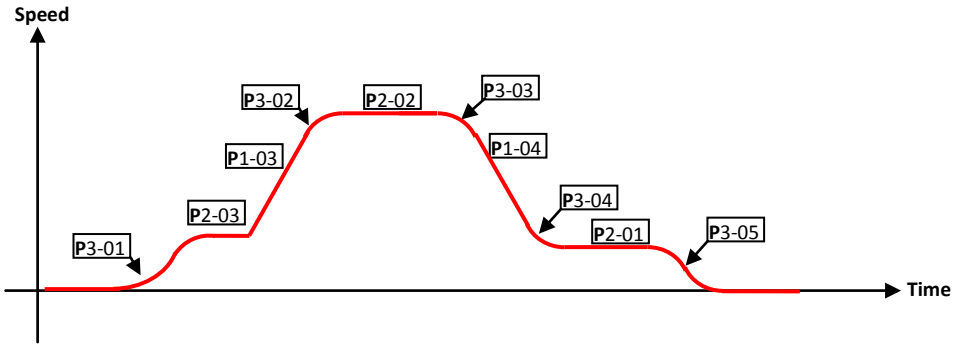


A	STO Input Closed by external control system Run Forward / Run Reverse input applied by External Control System Run Speed (High Speed) Input Closed by External Control System Motor Contactor Output (Relay 1) set by drive (to close motor contactor) Drive waits for Output Contactor Closing Time (**P**3-06) before enabling the output stage to drive the motor
B	After the Motor Contactor Delay (**P**3-06) time has elapsed, the Drive Output to the motor is enabled at zero speed Drive holds zero speed on the output, and magnetises the motor (IM Motor) For PM Motor, the magnetizing time is zero
C	After the Motor Magnetizing Time has elapsed, the motor brake control output (Relay 2) is set to release the motor brake The output Frequency remains at zero until the Motor Brake Release Time (**P**3-07) has elapsed
D	After the Motor Brake Release Time (**P**3-07) has elapsed, the drive output frequency is ramped up. The Ramp Rate is controlled initially using Acceleration S-Ramp 1 (**P**3-01)
E	The Acceleration rate is now controlled linearly by the Acceleration Ramp Parameter (**P**1-03)
F	As the Run Speed is approached, the acceleration is now controlled by Acceleration S-Ramp 2 (**P**3-02)
G	Operation at Run Speed (**P**2-02)
H	When the Run Speed Input is removed, the drive output frequency is reduced to the Levelling Speed (**P**2-01). Deceleration is initially controlled by Deceleration S-Ramp 1 (**P**3-03)
I	After Deceleration S-Ramp 1 (**P**3-03) has completed, deceleration is controlled linearly by the Deceleration Ramp Parameter (**P**1-04)
J	As the output frequency approaches the Levelling Speed (**P**2-01)., Deceleration S-Ramp 2 (**P**3-04) is applied
K	The drive operates at the Levelling Speed (**P**2-01) until the Direction Input is removed
L	On removal of the Direction input, the output frequency is reduced towards zero, with deceleration rate initially controlled by Levelling S-Ramp (**P**3-05)
M	If the deceleration time is long enough to require linear deceleration , Deceleration Ramp Time (**P**1-04) is used As the output frequency approaches zero, Levelling S-Ramp (**P**3-05) is again applied
N	The Output frequency reaches zero. The drive holds at zero frequency and waits until the Motor Brake Apply Delay Time (**P**3-08) has elapsed
O	When the Motor Brake Apply Delay (**P**3-08) has elapsed, the Holding brake control relay opens(relay 2), so that the motor brake applies. The drive output remains enabled at zero frequency for the Zero Speed Holding Time (**P**3-10)
P	When the Zero Speed Holding Time (**P**3-10) has elapsed, the drive output is disabled The Motor Output Contactor signal remains on for the time period set in the Motor Contactor Delay Parameter (**P**3-06)
Q	After the Motor Contactor Delay Time (**P**3-06) has elapsed, the motor contactor output switches off allowing the motor contactor to open
R	The STO Input to the drive can now be opened by the control system

10.7. Speed Limits

Related Parameters	Action
P1-01 (Maximum Frequency/Speed Limit)	Enter the maximum required output frequency into **P**1-01 Note: Set **P**1-10 to motor rated rpm if entry in RPM is preferred.

10.8. Ramps and operating speeds

Related Parameters	Action
P1-03 (Accel ramp time) **P**1-04 (Decel ramp time) **P**2-01 (Levelling Speed) **P**2-02(Run Speed) **P**2-03 (Intermediate Speed) **P**2-04 (Inspection Speed) **P**3-01 (S-ramp 1 accel start duration) **P**3-02 (S-ramp 2 accel end duration) **P**3-03 (S-ramp 3 decel start duration) **P**3-04 (S-ramp 4 decel end duration) **P**3-05 (S-ramp 5 levelling duration)	Program the required ramp times per the profile diagram below. 
Note : Speeds can be optionally entered in elevator units e.g. m/s, see section 9.6 for further details.	

10.8.1. Operating speed selection

The below table assumes the drive already has a run command i.e. Terminal 2 or 3 input is high.

P1-13	Digital Input 3 Terminal 4	Analog Input 1 Terminal 6	Analog Input 2 Terminal 10	Active Speed
1	1	0	0	**P**2-02 (Run Speed)
1	0 or 1	0	1	**P**2-03 (Intermediate Speed)
1	0 or 1	1	0 or 1	**P**2-04 (Inspection Speed)
1	0	0	0	**P**2-01 (Levelling Speed)
2	1	0	1	**P**2-02 (Run Speed)
2	0 or 1	1	1	**P**2-04 (Inspection Speed)
2	0	0	1	**P**2-01 (Levelling Speed)
3	1	0	0	**P**2-02 (Run Speed)
3	0 or 1	1	0	**P**2-04 (Inspection Speed)
3	0	0	0	**P**2-01 (Levelling Speed)
4	1	0	1	**P**2-02 (Run Speed)
4	0 or 1	1	1	**P**2-04 (Inspection Speed)
4	0	0	1	**P**2-01 (Levelling Speed)

1 = Input High
0 = Input Low

10.9. Motor Setup.

In order to support a wide range of elevator motor types and vintages the Optidrive P2 Elevator drive has 4 different operating modes, the various operating modes are selected in parameter **P**4-01 and are detailed in the table below.

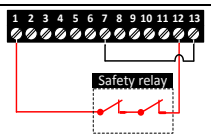
P4-01	**Operating Mode**	**Application**
0	**Advanced Vector IM Speed Control** (With or Without Incremental Encoder feedback)	• Recommended operating mode for Induction motors. • Induction (geared) Motors where all motor data is available from the motor rating plate/ datasheet (Motor rated Voltage/Current/Frequency/Rated rpm/Power factor). • Excellent low speed torque performance.
1	**Vector IM Speed Control** (With or Without Incremental Encoder feedback)	• Alternative to setting 0 for Induction (geared) Motors where not all motor data is available from the motor rating plate/ datasheet, for example on older motors which do not have the power factor value available. • Low speed torque performance reduced compared to setting 0.
2	**Enhanced V/F IM Speed Control**	• Induction (geared) Motors where not all motor data is available from the motor rating plate/ datasheet for example on older motors which do not have the power factor available. • Low speed torque performance reduced compared to setting 0 and 1.
3	**PM Motor Speed Control** (With or Without Absolute Encoder feedback)	• Permanent magnet (gearless) Motors. • Excellent low speed torque performance and efficiency.

10.10. Induction Motors-Without Encoder Feedback (P4-01=0).

In all applications, to ensure good performance and safe control over the motor and connected load, it is essential to ensure that the drive parameters are adjusted to suit the connected motor. Following this, an autotune **must** be carried out, this allows the drive to measure the data required for vector control of the connected motor.

Note : The autotune is a stationary test and can therefore be carried out with the motor holding brake applied, furthermore the ropes/load do not need to be removed.

WARNING	**Whilst the autotune procedure does not rotate the motor shaft, the motor shaft may still turn if the motor holding brake is not applied. It is not normally necessary to uncouple the load from the motor; however the user should ensure that no risk arises from the possible movement of the motor shaft.**

Step		Action	Notes
1	**Motor Nameplate data entry**	Enter "201" into **P**1-14	Opens Advanced parameter group access.
		Select the Motor Control mode in **P**4-01	**P**4-01 = 0 for Advanced Vector Control
		Enter Motor Rated Voltage into **P**1-07	Obtained from Motor nameplate (Volts)
		Enter Motor Rated Current into **P**1-08	Obtained from Motor nameplate (Amps)
		Enter Motor Frequency into **P**1-09	Obtained from Motor nameplate (Hz)
		Enter Motor Speed into **P**1-10	Obtained from Motor nameplate (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 P2 Elevator drive 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.
		Enter Motor Power factor Cos Ø into **P**4-05*	Obtained from Motor nameplate
2	**Close Safe Torque off input connections**		Drive should now show "StoP"
3	**Motor Autotune**	Set **P**4-02 to a 1 and press the button.	The display will show AUto-t. The test procedure may take several minutes to complete depending on the motor. Once the auto tune is completed, the drive will operate as normal, and no further auto tuning will be required unless the motor, motor cables, motor parameters or drive control mode is changed in **P**4-01.
4	**You can now move to section 10.15 Carriage Test run and Optimisation.**		

Following a factory reset (See section 9.5 on page 26) or when a new drive is to be installed, the correct data from the motor nameplate should be entered into the drive parameters as detailed above.

*If Motor power factor is unknown use Vector IM speed control instead (**P**4-01 to a 1).

10.10.1. Troubleshooting/Optimisation

Observation	Action
Motor power factor not available for step 1.	Use Vector IM speed mode instead (**P**4-01=1)
Drive shows "inH" in step 2.	Check that Terminal 1 is connected to terminal 12 and terminal 7 is connected to terminal 13.
When carrying out step 3 drive trips "Atf-…"	1. Check connection between drive and motor. 2. Check output/Motor contactor is closed. 3. Check motor winding is not open circuit.
Drive shows fault message	Refer to section 17.1 Fault messages

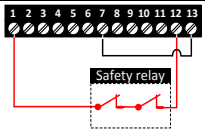
Note : To get the best speed control performance, especially in vector speed control mode (**P**4-01 =0), the speed control loop parameters (**P**4-03, **P**4-04) will need to be adjusted. Reducing the value of **P**4-03 (e.g. **P**4-03 = 300) and increasing the value of **P**4-04 (e.g. **P**4-04 = 0.100) will in general give an improved low speed control performance.

10.11. Induction Motors-With Incremental Encoder Feedback.(P4-01=0).

In all applications, to ensure good performance and safe control over the motor and connected load, it is essential to ensure that the drive parameters are adjusted to suit the connected motor. Following this, an autotune **must** be carried out. This allows the drive to measure the data required for vector control of the connected motor.

Note : The autotune is a stationary test and can therefore be carried out with the motor holding brake applied, furthermore the ropes do not need to be removed.

WARNING	**Whilst the autotune procedure does not rotate the motor shaft, the motor shaft may still turn if the motor holding brake is not applied. It is not normally necessary to uncouple the load from the motor; however the user should ensure that no risk arises from the possible movement of the motor shaft.**

Step		Action	Notes
1	**Install Encoder interface Module**	Connect the Encoder to the drive via the Encoder interface module.	See section 8 for more details.
2	**Motor Nameplate data entry**	Enter "201" into **P**1-14	Opens Advanced parameter group access.
		Select the Motor Control mode in **P**4-01	**P**4-01 = 0 or 1 for Vector Control **P**4-01 = 2 for Enhanced V/F mode
		Enter Motor Rated Voltage into **P**1-07	Obtained from Motor nameplate (Volts)
		Enter Motor Rated Current into **P**1-08	Obtained from Motor nameplate (Amps)
		Enter Motor Frequency into **P**1-09	Obtained from Motor nameplate (Hz)
		Enter Motor Speed into **P**1-10	Obtained from Motor nameplate (rpm) Enables the slip compensation function, and the Optidrive P2 Elevator drive display will now show motor speed in estimated rpm. All speed related parameters, such as Minimum and Maximum Speed, Preset Speeds etc. will also be displayed in Rpm. **Note** This parameter must be set to the correct nameplate Rpm of the connected motor.
		Enter Motor Power factor Cos Ø into **P**4-05	Obtained from Motor nameplate
3	**Encoder data entry**	Set **P**6-05 to 1	Enables Encoder Feedback
		Enter Encoder Pulses Per Revolution Value into **P**6-06	Obtained from Encoder nameplate/datasheet
		Enter Speed error trip level in **P**6-07 (default=5%)	Defines the maximum allowed speed error % between the encoder feedback of motor speed and the expected speed of the motor. If the error exceeds this level, the drive will trip "Enc-02"
4	**Close Safe Torque off input connections**		Drive should now show "StoP"
5	**Motor Autotune**	Set **P**4-02 to a 1 and press the button.	The display will show AUto-t. The test procedure may take several minutes to complete depending on the motor. Once the autotune is completed, the drive will operate as normal, and no further autotuning will be required unless the motor, motor cables, motor parameters or drive control mode is changed in **P**4-01.
6	**Encoder Feedback Check**	Run the drive with a low positive speed, e.g. 10Hz. Monitor the encoder feedback speed in parameter **P**0-58. If the value in this parameter is positive, the encoder wiring is correct. If the value is negative, the speed feedback is inverted. To correct this, reverse the A and B signals from the encoder.	
7	**You can now move to section 10.15 Carriage Test run and Optimisation.**		
	Following a factory reset (See section 9.5 on page 26) or when a new drive is to be installed, the correct data from the motor nameplate should be entered into the drive parameters as detailed above.		

Note : To get the best speed control performance, especially in vector speed control mode (**P**4-01 =0), the speed control loop parameters (**P**4-03, **P**4-04) will need to be adjusted. Reducing the value of **P**4-03 (e.g. **P**4-03 = 300) and increasing the value of **P**4-04 (e.g. **P**4-04 = 0.100) will in general give an improved low speed control performance.

10.11.1. Troubleshooting/Optimisation

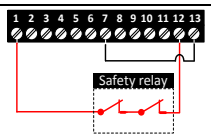
Observation	Action
Motor power factor not available for step 1.	Use Vector IM speed mode instead (**P**4-01=1)
Drive shows "inH" in step 2.	Check that Terminal 1 is connected to terminal 12 and terminal 7 is connected to terminal 13.
When carrying out step 3 drive trips "Atf-…"	4. Check connection between drive and motor. 5. Check output/Motor contactor is closed. 6. Check motor winding is not open circuit.
Drive shows fault message	Refer to section 17.1 Fault messages

10.12. Permanent Magnet Motors-Without Encoder Feedback. (P4-01=3).

In all applications, to ensure good performance and safe control over the motor and connected load, it is essential to ensure that the drive parameters are adjusted to suit the connected motor. Following this, an autotune **must** be carried out, this allows the drive to measure the data required for correct control of the connected motor.

Note : The autotune is a stationary test and can therefore be carried out with the motor holding brake applied, furthermore the ropes do not need to be removed.

WARNING	**Whilst the autotune procedure does not rotate the motor shaft, the motor shaft may still turn if the motor holding brake is not applied. It is not normally necessary to uncouple the load from the motor; however the user should ensure that no risk arises from the possible movement of the motor shaft.**

Step		Action	Notes
1	**Motor Nameplate data entry**		
		Set **P**1-14 to 201	Opens Advanced parameter group access.
		Set **P**4-01 to 3	**P**4-01 = 3 (Permanent magnet motor control)
		Enter Motor Nominal back EMF into **P**1-07	Obtained from Motor nameplate or datasheet or alternatively it can be calculated as per section 10.14.1.
		Enter Motor Rated Current into **P**1-08	Obtained from Motor nameplate (Amps)
		Enter Motor Frequency into **P**1-09	Obtained from Motor nameplate (Hz)
		Enter Motor Speed into **P**1-10	Obtained from Motor nameplate (rpm) **Note**: This parameter must be set to the correct nameplate Rpm of the connected motor.
		Set **P**2-24 to 16kHz	Motor Switching frequency
		Set **P**7-14 to 25%	Boost Current Level
		Set **P**7-15 to 10%	Boost Frequency
2	**Close Safe Torque off input connections**		Drive should now show “StoP”
3	**Motor Autotune**	Set **P**4-02 to a 1 and press the button.	The display will show AUto-t. The test procedure may take several minutes to complete depending on the motor. Once the autotune is completed **P**4-02 will return to 0 and the drive will operate as normal, no further autotuning will be required unless the motor, motor cables, motor parameters or drive control mode is changed in **P**4-01.
4	**You can now move to section 10.15 Carriage Test run and Optimisation.**		

Following a factory reset (See section 9.5 on page 26) or when a new drive is to be installed, the correct data from the motor nameplate should be entered into the drive parameters as above.

10.12.1. Troubleshooting/Optimisation

Observation	Action
Rotor not orientating on start up	Increase **P**7-12 (Current Magnetising time)
Long delay following Rotor orientation on start up	Decrease **P**7-12 (Current Magnetising time)
Poor torque performance at low speed	Increase value in **P**7-14 (Boost current level) and **P**7-15 (Torque boost frequency limit)
	Suitable starting values are 25% (**P**7-14) and 10% (**P**7-15)
Motor Vibration/O-I trips/Cogging at low speed	Check correct settings of motor nameplate data. Check correct value of P1-07 (Motor Nominal Back EMF). Reduce value of **P**4-03 (Vector Speed Gain)(As much as 50% reduction in some instances)
I_t-trP	Check correct settings of motor nameplate data. Check correct value of **P**1-07 (Motor Nominal Back EMF). Check Correct setting of **P**7-14 and **P**7-15.

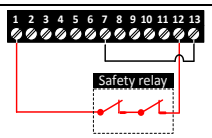
Care should be taken not to apply to high of a value in **P**7-14 and **P**7-15 as excess motor heating may result.

10.13. Permanent Magnet Motors-With Absolute Encoder Feedback. (P4-01=3).

In all applications, to ensure good performance and safe control over the motor and connected load, it is essential to ensure that the drive parameters are adjusted to suit the connected motor. Following this, an autotune **must** be carried out, this allows the drive to measure the data required for correct control of the connected motor.

Note : The autotune is a stationary test and can therefore be carried out with the motor holding brake applied, furthermore the ropes do not need to be removed.

WARNING	**Whilst the autotune procedure does not rotate the motor shaft, the motor shaft may still turn if the motor holding brake is not applied. It is not normally necessary to uncouple the load from the motor; however the user should ensure that no risk arises from the possible movement of the motor shaft.**

Step		Action	Notes
1	**Install Encoder interface Module**	Connect the Encoder to the drive via the Encoder interface module.	See section 8 for more details.
2	**Motor Nameplate data entry**	Set **P**1-14 to 201	Opens Advanced parameter group access
		Set **P**4-01 to 3	**P**4-01 = 3 (Permanent magnet motor control)
		Enter Motor Nominal back EMF into **P**1-07	Obtained from Motor nameplate or datasheet or alternatively it can be calculated as per section 10.14.1
		Enter Motor Rated Current into **P**1-08	Obtained from Motor nameplate (Amps)
		Enter Motor Frequency into **P**1-09	Obtained from Motor nameplate (Hz)
		Enter Motor Speed into **P**1-10	Obtained from Motor nameplate (rpm)
		Set **P**2-24 to 16kHz	Motor Switching frequency
3	**Encoder data entry**	Set **P**6-05 to 1	Enables Encoder Feedback
		Enter 65535 into **P**6-06	Absolute Encoder identifier.
		Enter Encoder offset/Angle value into **P**6-09	Value Obtained from Motor manufacturer or manual test as detailed in section 0 (Angle e.g. 270°)
		Enter Speed error trip level in **P**6-07 (default=5%)	Defines the maximum allowed speed error % between the encoder feedback of motor speed and the expected speed of the motor. If the error exceeds this level, the drive will trip "Enc-02"
4	**Close Safe Torque off input connections**		Drive should now show "StoP"
5	**Motor Autotune**	Set **P**4-02 to a 1 and press the button.	The display will show AUto-t. The test procedure may take several minutes to complete depending on the motor. Once the autotune is completed **P**4-02 will return to 0 and the drive will operate as normal, no further autotuning will be required unless the motor, motor cables, motor parameters or drive control mode is changed in **P**4-01.
6	**Encoder Feedback Check**	Run the drive with a low positive speed, e.g. 10Hz. Monitor the encoder feedback speed in parameter **P**0-58. If the value in this parameter is positive, the encoder wiring is correct. If the value is negative, the speed feedback is inverted. To correct this, reverse the A and B signals from the encoder.	
7	**You can now move to section 10.15 Carriage Test run and Optimisation.**		

Following a factory reset (See section 9.5 on page 26) or when a new drive is to be installed, the correct data from the motor nameplate should be entered into the drive parameters as follows:-

10.13.1. Troubleshooting/Optimisation

Observation	Action
Rotor not orientating on start up	Increase **P**7-12 (Current Magnetising time)
Long delay following Rotor orientation on start up	Decrease **P**7-12 (Current Magnetising time)
Poor torque performance at low speed	Increase value in **P**7-14 (Boost current level) and **P**7-15 (Torque boost frequency limit)
	Suitable starting values are 25% (**P**7-14) and 10% (**P**7-15)
Motor Vibration/0-1 trips/Cogging at low speed	Check correct settings of motor nameplate data. Check correct value of P1-07 (Motor Nominal Back EMF). Reduce value of **P**4-03 (Vector Speed Gain)
I_t-trP	Check correct settings of motor nameplate data. Check correct value of **P**1-07 (Motor Nominal Back EMF). Check Correct setting of **P**7-14 and **P**7-15.

10.14. Permanent Magnet Motors- Manual Back EMF and Encoder offset value Method.

10.14.1. Manual method of obtaining motor Back EMF value.

In applications where a permanent magnet motor is being used, it is vitally important that the correct value of "motor back EMF" is entered into parameter **P**1-07, failure to do so can result in abnormal motor operation (motor vibration, motor over-current trips), ideally the value from the motor nameplate/datasheet should be entered.

The below procedure is a method for calculating a close approximation of the back EMF value in instances where the value is not available.

P1-07 = Motor Rated Power / Motor Efficiency / Motor Power factor /1.732 / Motor rated Current.

Example: Motor rated Power = 7.2kW Therefore: **P**1-07 = 7200/0.9/0.9/1.732/16.9 = **304V**

Motor Efficiency = 0.9

Motor Power factor (CosØ) = 0.9

Motor rated current = 16.9A

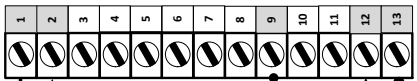
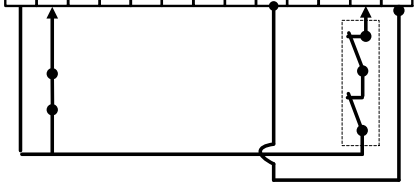
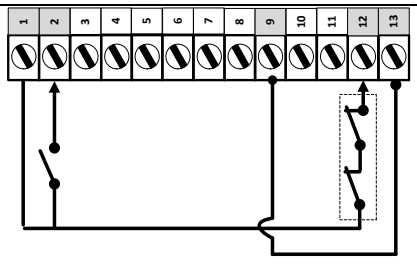
Note : Typical values are in the region of 0.95 for Motor efficiency and 0.90 for Motor power factor.

10.14.2. Manual Encoder offset value Method.

In applications where an absolute encoder (Endat for example) is being used it is vitally important that the correct value of "Encoder offset (Entered in degrees)" is entered into parameter **P**6-09, failure to do so can result in abnormal motor operation (motor vibration, motor over-current trips), ideally the value provided by the motor manufacturer should be entered.

The below procedure is a method for measuring the Encoder offset value in instances where the value is not available.

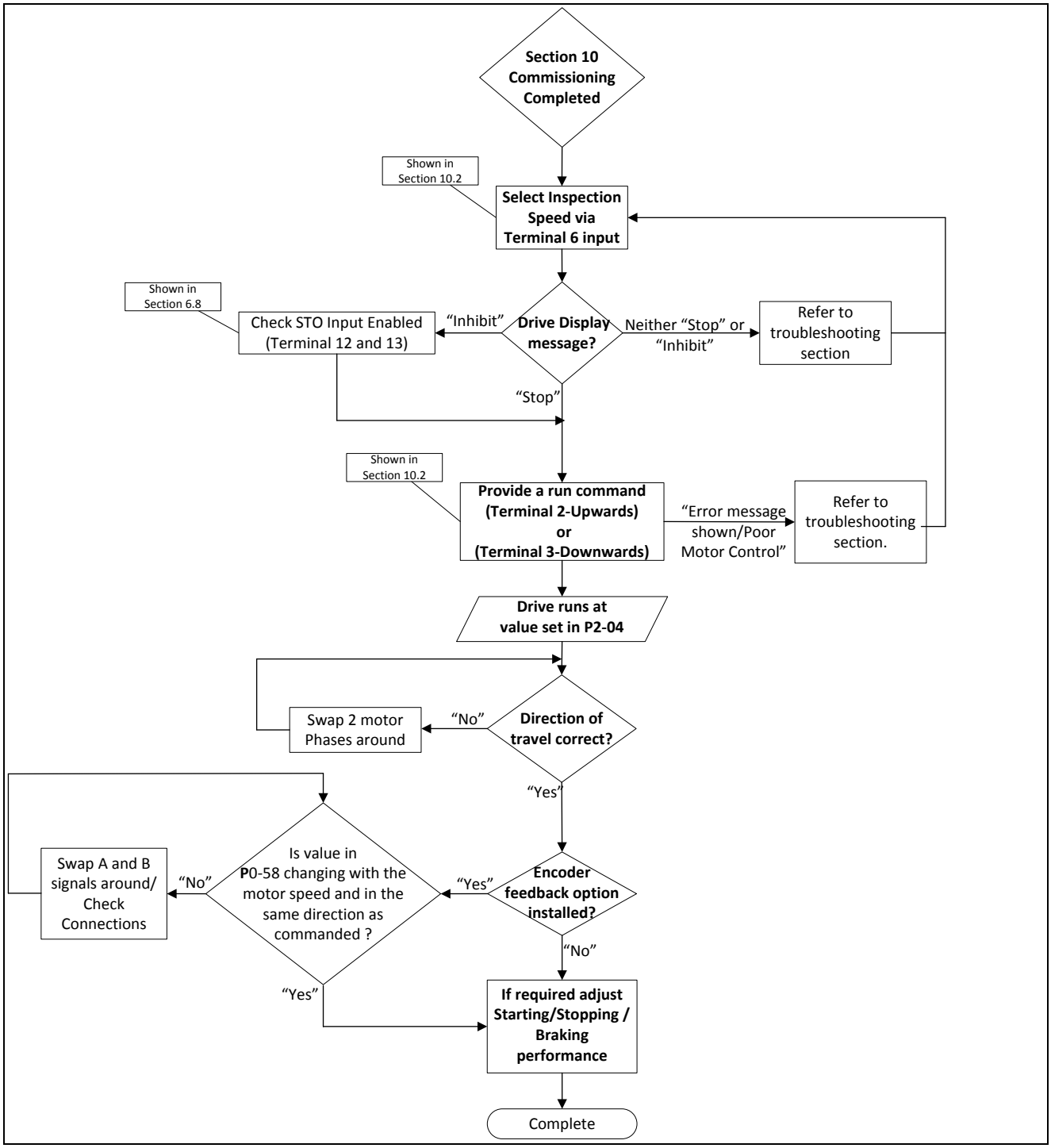
Note : The below procedure should be carried out with the ropes and motor brake off.

Step		Action	Notes
1	**Motor Nameplate data entry**		
		Set **P**1-14 to 201	Opens Advanced parameter group access.
		Set **P**4-01 to 2	Motor control mode enhanced V/F
		Enter Motor Rated Voltage into **P**1-07	Obtained from Motor nameplate or datasheet or alternatively it can be calculated as per section 10.14.1
		Enter Motor Rated Current into **P**1-08	Obtained from Motor nameplate (Amps)
		Enter Motor Frequency into **P**1-09	Obtained from Motor nameplate (Hz)
		Enter Motor Speed into **P**1-10	Obtained from Motor nameplate (rpm).
2	**Encoder data entry**	Set **P**6-05 to 1	Enables Encoder Feedback
		Enter 65535 Value into **P**6-06	Absolute Encoder Identifier
		Enter Speed error trip level in **P**6-07 (default=5%)	Defines the maximum allowed speed error % between the encoder feedback of motor speed and the expected speed of the motor. If the error exceeds this level, the drive will trip "Enc-02"
3	**Close Safe Torque off inputs (T12/T13)**		Drive should show "StoP" when the STO inputs are closed.
4	**Start Drive (T1 to T2)**		Motor Shaft will move slightly whilst the encoder offset measurement is being carried out.
5	**Record the Encoder offset value**	The Encoder offset value is shown in **P**0-78 index 2 in the range 0-360 degrees (Index 2 indicated by lit upper segment)	 e.g. 55 degrees
6	**Disable the drive**		Drive should show "StoP"
7	Proceed to section 10.13 "Permanent Magnet Motors-With Encoder Feedback" and use the value obtained above for parameter **P**6-09.		

10.15. Carriage Test run and Optimisation

WARNING

- At this point all of the steps detailed in section 10 should have been successfully completed.
- The test run should be initially carried out with an empty carriage and at inspection speed.



11.Configuring the Analog & Digital Outputs

The Analog/Digital outputs can be used to provide a signal to a PLC or controller input, or can be used to drive a small relay for other control circuit functions. The output is capable of providing signal to control a contactor installed between the Optidrive P2 Elevator drive and the motor, or to provide a 'torque limit exceeded' signal to warn of a possible overload situation.

Par	Parameter Name	Minimum	Maximum	Default	Units
P2-11	**Analog / Digital Output 1 (Terminal 8) Function Select**	0	11	1	-
	Digital Output Mode. Logic 1 = +24V DC **0 : Drive Enabled (Running)**. Logic 1 when the Optidrive P2 Elevator drive is enabled (Running) **1: Drive Healthy**. Logic 1 When no Fault condition exists on the drive. ("inH" is not included as a fault) **2 : At Target Frequency (Speed)**. Logic 1 when the output frequency matches the setpoint 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 : Motor Torque >= Limit**. Logic when the motor torque exceeds the adjustable limit **7 : STO Status.** Logic 1 when both STO inputs are present and the drive is able to be operated. **Note** : When using settings 4 – 6, parameters P2-16 and P2-17 must be used together to control the behaviour. The output will switch to Logic 1 when the selected signal exceeds the value programmed in P2-16, and return to Logic 0 when the signal falls below the value programmed in P2-17. **Analog Output Mode** **8 : Output Frequency (Motor Speed)**. 0 to P-01 **9 : Output (Motor) Current**. 0 to 200% of P1-08 **10 : Motor Torque**. 0 to 200% of motor rated torque **11 : Output (Motor) Power**. 0 to 150% of drive rated power				
P2-12	**Analog Output 1 (Terminal 8) Format**	See Below		U 0-10	-
	U 0-10 = 0 to10V. U 10-0 = 10 to 0V, A 0-20 = 0 to 20mA A 20-0 = 20 to 0mA A 4-20 = 4 to 20mA A 20-4 = 20 to 4mA				
P2-13	**Analog/Digital Output 2 (Terminal 11) Function Select**	0	11	0	-
	Digital Output Mode. Logic 1 = +24V DC **0 : Drive Enabled (Running)**. Logic 1 when the Optidrive P2 Elevator drive is enabled (Running) **1: Drive Healthy**. Logic 1 When no Fault condition exists on the drive ("inH" is not included as a fault condition) **2 : At Target Frequency (Speed)**. Logic 1 when the output frequency matches the setpoint 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 : Rescue Mode Active**. Logic 1 when the drive is operating in "Rescue Mode" (Rescue mode is detailed in section 12.2). **7 : Analog Input 2 Signal Level >= Limit**. Logic when the signal applied to the Analog Input 2 exceeds the adjustable limit **Note** : When using settings 4 – 7, parameters P2-16 and P2-17 must be used together to control the behaviour. The output will switch to Logic 1 when the selected signal exceeds the value programmed in P2-16, and return to Logic 0 when the signal falls below the value programmed in P2-17. **Analog Output Mode** **8 : Output Frequency (Motor Speed)**. 0 to P-01 **9 : Output (Motor) Current**. 0 to 200% of P1-08 **10 : Motor Torque**. 0 to 200% of motor rated torque **11 : Output (Motor) Power**. 0 to 150% of drive rated power				
P2-14	**Analog Output 2 (Terminal 11) Format**	See Below		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				

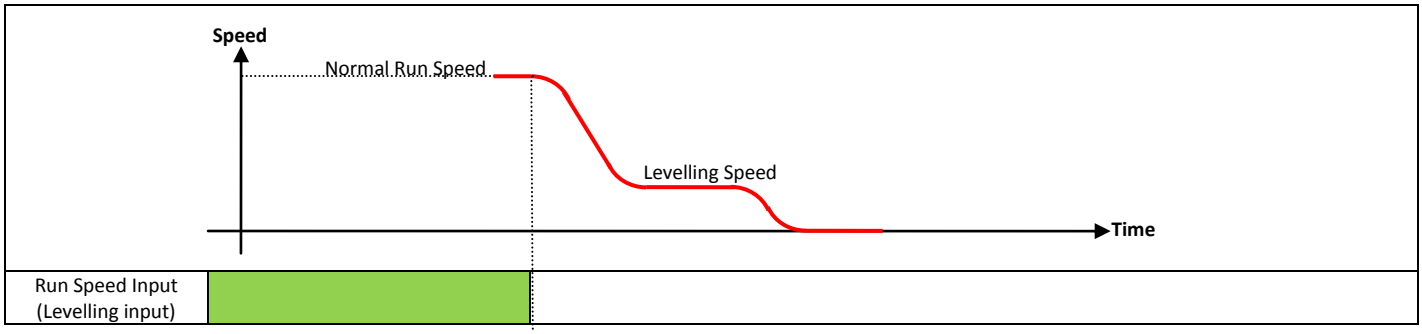
Par	Description				Units
P2-15	**User Relay 1 Output (Terminals 14, 15 & 16) Function select**	0	7	8	-
	Selects the function assigned to Relay Output 1. The relay has three output terminals, Logic 1 indicates the relay is active, and therefore terminals 14 and 15 will be linked together. **0 : Drive 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 ("inH" is not included as a fault) **2 : At Target Frequency (Speed)**. Logic 1 when the output frequency matches the setpoint frequency **3: Output Frequency > 0.0 Hz**. Logic 1 when the 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 : Output Torque >= Limit**. Logic 1 when the motor torque exceeds the adjustable limit **7 : Analog Input 2 Signal Level >= Limit**. 1 Logic when the signal applied to the Analog Input 2 exceeds the adjustable limit **Note** : When using settings 4 – 7, parameters P2-16 and P2-17 must be used together to control the behaviour. The output will switch to Logic 1 when the selected signal exceeds the value programmed in P2-16, and return to Logic 0 when the signal falls below the value programmed in P2-17 **8 : Motor Contactor Control.** Used to control the operation of a contactor installed on the output side of the drive between the drive and motor. (see section 10.5 for more details)				
P2-16	**Adjustable Threshold 1 Upper Limit (Analog Output 1 / Relay Output 1)**	P2-17	200.0	100.0	%
P2-17	**Adjustable Threshold 1 Lower Limit (Analog Output 1 / Relay Output 1)**	0.0	P2-16	0.0	%
	Used in conjunction with some settings of Parameters P2-11 & P2-15.				

12.Advanced Features

12.1. Short Floor Operation

In a normal elevator travel profile the drive will be travelling at the Run Speed when the levelling input is received (essentially, the Run Speed input is removed). If the levelling input (run speed input removed) is received prior to the drive having reached the Run Speed (e.g. Whilst still accelerating) the Short floor operation will work to reduce the Elevator travel time by automatically adjusting the speed to reach the floor in a shorter time.

12.1.1. Normal Elevator travel profile

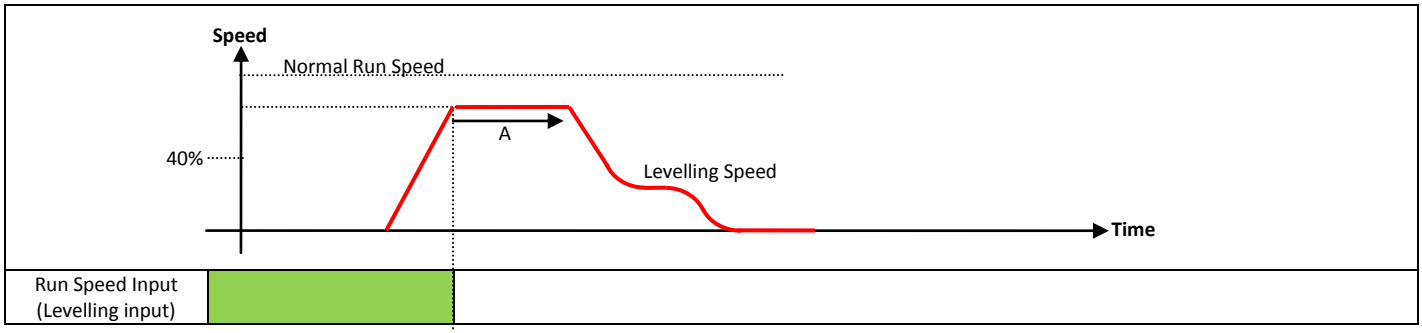


12.1.2. Short Floor profile

Short floor operation is enabled by setting parameter **P**3-11 to 1, once set the drive will operate as follows:

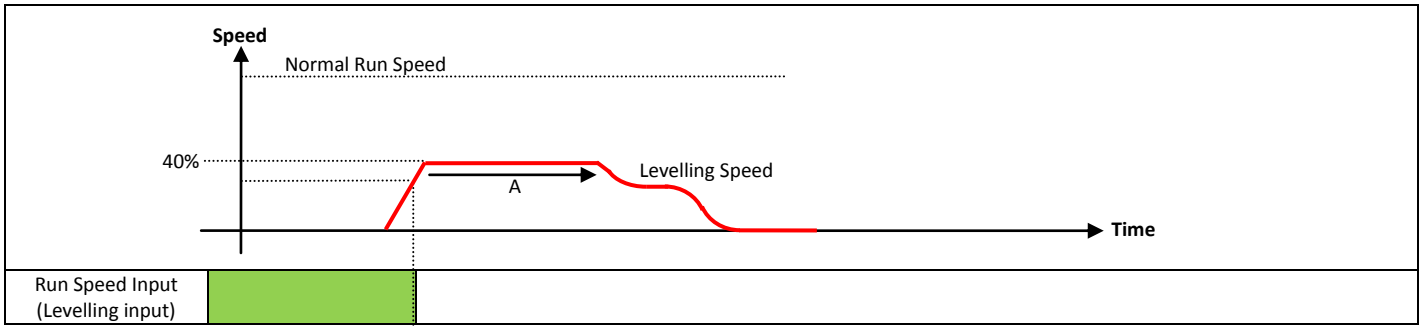
Output Frequency > 40% of Run Speed when levelling Input received

In this case, the drive will hold the present output frequency for the time period calculated (Line A) based on the travel distance from Run Speed to the present output frequency, before decelerating to the levelling speed.



Output Frequency < 40% of Run Speed when levelling Input received

In this case, the drive will accelerate to 40% of the Run Speed, and maintain this frequency for a time period calculated (Line A) based on the travel distance from Run Speed to the present output frequency, before decelerating to the levelling speed.



12.2. Rescue Mode Operation (UPS Power Supply)

Rescue mode allows the drive (400V 3Ø drives) to be operated from a single phase 230V AC UPS (Uninterruptible power supply) so that in an emergency situation (Passenger evacuation) the elevator car can still be operated at a limited speed, for example in the event of a mains Bourne power failure.

Rescue mode is automatically activated as soon as the drive detects connection of a single phase 230V AC power supply on terminals L1 and L2 as shown in the diagram below.

Rescue mode operation can be monitored via a digital output by setting **P**2-13 to a 6 (Rescue Mode Active):

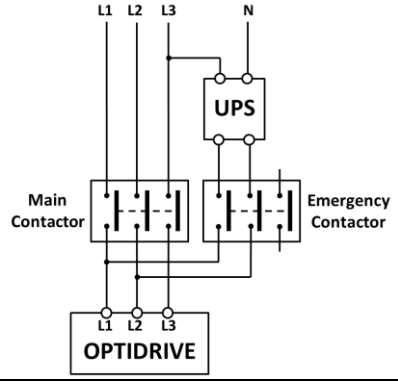
- Digital output 2 (terminal 11) will be Logic 1 (24V) when the drive is operating in Rescue Mode.

12.2.1. Dimensioning the UPS

The UPS must be of the following type.

Output Voltage	VA Rating
1 Phase 200 – 240 Volt Sine Wave Output.	>= 230 x Motor Rated Current **P**1-08

12.2.2. UPS Connection Diagram



Note

- The Emergency Contactor can only be closed when the Main Contactor is open.
- A delay time (>30 sec's) must be allowed when changing over to/from UPS supply to/From mains supply mode, failure to do so can result in the drive not detecting that it is in Rescue Mode operation.

When the rescue operation is complete, the Emergency Contactor must be opened before the Main Contactor can be closed.

12.2.3. Rescue Mode speed control

When rescue mode is activated the target motor speed should be set in parameter **P**2-05 (Rescue Mode speed).

Par	Parameter Name	Minimum	Maximum	Default	Units
P2-05	**Rescue Mode Speed**	0	P1-09	5.0	Hz / Rpm
	Preset Speeds / Frequencies selected by digital inputs depending on the setting of **P**1-13. If **P**1-10 = 0, the values are entered as Hz. If **P**1-10 > 0, the values are entered as Rpm. Note : If light load detection is not enabled (**P**3-12=1) then the Rescue mode Direction is governed by the status of the direction signal applied to the drive control terminals (T2 & T3).(assuming **P**1-13 is >0 and **P**1-12=0)				

Note :

- The actual speed will be limited depending on the drives internal DC bus voltage level as shown in the below calculation.

$$\text{Rescue Mode Speed Limit} = \frac{\text{DC Bus Voltage (P0-20)} \times \text{Motor Rated Frequency (P1-09)}}{1.7 \times \text{Motor Rated Voltage (P1-07)}}$$

- It should also be noted that the level of motor load will affect the available DC bus Voltage; in some cases (More likely on Induction Motors) it may be necessary to reduce the Rescue Speed further in order to prevent Under Voltage trips.

Note: In Rescue mode operation S-Ramps are disabled.

12.2.4. Rescue Mode Light Load Detection

- When the drive is in Rescue mode and Light load detection is enabled, carriage travel direction is governed by the light load detection function and elevator controller signals are ignored.
- Light load detection function will only operate when the drive is in Rescue mode operation.

When light load detection is enabled **P**3-12 =1 (Light load detection) the drive will determine which direction of carriage travel will result in the lowest power draw from the UPS and then runs in that direction, this allows longevity of travel distance to reach a landing position before the available UPS capacity has been exhausted.

During the direction determination phase :

- The Carriage will initially move in the downward direction.
- The drive will operate the motor at 10% of the motor rated frequency (**P**1-09**).**

.

13.Parameters

13.1. Parameter Set Overview

The Optidrive P2 Elevator drive Parameter set consists of 6 groups as follows:

- Group 0 – Read Only Monitoring Parameters
- Group 1 – Basic Configuration Parameters
- Group 2 – Extended Parameters
- Group 3 – Elevator Specific Control Parameters
- Group 4 – High Performance Motor Control Parameters
- Group 5 –Field Bus Parameters
- Group 6 – Encoder Parameters

When the Optidrive P2 Elevator drive 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, **P**1-14 must be set to the same value as **P**2-40 (Default setting = 101). With this setting, parameter groups 1 – 6 can be accessed, along with the first 38 parameters in Group 0.

13.2. Parameter Group 1 – Basic Parameters

Par	Parameter Name	Minimum	Maximum	Default	Units
P1-01	**Maximum Frequency / Speed Limit**	P1-02	500.0	50.0 (60.0)	Hz / Rpm
	Maximum output frequency or motor speed limit – Hz or rpm. If P1-10 >0, the value entered / displayed is in Rpm				
P1-02	**Minimum Frequency / Speed Limit**	0.0	P1-01	0.0	Hz / Rpm
	Minimum speed limit – Hz or rpm. If P1-10 >0, the value entered / displayed is in Rpm				
P1-03	**Acceleration Ramp Time**	0.00	600	2.0	Seconds
	Acceleration ramp time in seconds. (Detailed in section 10.8)				
P1-04	**Deceleration Ramp Time**	0.00	600	2.0	Seconds
	Deceleration ramp time in seconds. (Detailed in section 10.8)				
P1-07	**Motor Rated Voltage**	Drive Rating Dependent			Volts
	This parameter should be set to the rated (nameplate) voltage of the motor (Volts)				
P1-08	**Motor Rated Current**	Drive Rating Dependent			Amps
	This parameter should be set to the rated (nameplate) current of the motor				
P1-09	**Motor Rated Frequency**	10	500	50 (60)	Hz
	This parameter should be set to the rated (nameplate) frequency of the motor				
P1-10	**Motor Rated Speed**	0	30000	0	Rpm
	This parameter can optionally be set to the rated (nameplate) rpm of the motor. When set to the default value of zero, all speed related parameters are displayed in Hz, and the slip compensation for the motor is disabled. Entering the value from the motor nameplate enables the slip compensation function, and the Optidrive P2 Elevator drive display will now show motor speed in estimated rpm. All speed related parameters, such as Minimum and Maximum Speed, Run Speeds etc. will also be displayed in Rpm. **Note** : When the drive is operated with the optional Encoder Feedback Interface, this parameter must be set to the correct nameplate Rpm of the connected motor.				
P1-11	**V/F Mode Voltage Boost**	0.0	Drive Rating 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 P2 Elevator drive will automatically adjust this parameter based on the motor parameters measured during an autotune.				
P1-12	**Primary Command Source Mode**	0	6	0	-
	0 : Terminal Control. The 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 an external or remote Keypad **2 : Bi-directional Keypad Control**. The drive can be controlled in the forward and reverse directions using an external or remote Keypad. Pressing the keypad START button toggles between forward and reverse. **3 : Terminal Control**. The drive responds directly to signals applied to the control terminals. **4 : Fieldbus Control**. Control via Modbus RTU if no fieldbus interface option is present, otherwise control is from the fieldbus option module interface **6 : CAN bus Control.** Control via CAN bus connected to the RJ45 serial interface connector				
P1-13	**Digital Inputs Function Select**	0	4	1	-
	Defines the function of the digital inputs depending on the control mode setting in **P**1-12. See section 10.4.1 for more information.				
P1-14	**Extended Menu Access Code**	0	30000	0	-
	Parameter Access Control. The following settings are applicable : **P**1-14 = **P**2-40 = 101 : Allows access to Parameter Groups 0 – 5				

14.Extended Parameters

14.1. Parameter Group 2 - Extended parameters

Par	Parameter Name	Minimum	Maximum	Default	Units
P2-01	**Levelling Speed**	P1-02	P1-01	5.0	Hz / Rpm
P2-02	**Run Speed**	P1-02	P1-01	50.0	Hz / Rpm
P2-03	**Intermediate Speed**	P1-02	P1-01	25.0	Hz / Rpm
P2-04	**Inspection Speed**	P1-02	P1-01	5.0	Hz / Rpm
P2-05	**Rescue Mode Speed**	P1-02	P1-09	5.0	Hz / Rpm
	Speeds / Frequencies are selected by digital inputs depending on the setting of **P**1-13.(see section 10.4.1) If **P**1-10 = 0, the values are entered as Hz. If **P**1-10 > 0, the values are entered as Rpm.				
P2-11	**Analog / Digital Output 1 (Terminal 8) Function Select**	0	11	1	-
	Digital Output Mode. Logic 1 = +24V DC **0 : Drive Enabled (Running)**. Logic 1 when the Optidrive P2 Elevator drive is enabled (Running) **1: Drive Healthy**. Logic 1 When no Fault condition exists on the drive. (“inH” is not included as a fault) **2 : At Target Frequency (Speed)**. Logic 1 when the output frequency matches the setpoint 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 : Motor Torque >= Limit**. Logic when the motor torque exceeds the adjustable limit **7 : STO Status.** Logic 1 when both STO inputs are present and the drive is able to be operated. **Note** : When using settings 4 – 6, parameters **P**2-16 and **P**2-17 must be used together to control the behaviour. The output will switch to Logic 1 when the selected signal exceeds the value programmed in **P**2-16, and return to Logic 0 when the signal falls below the value programmed in **P**2-17. **Analog Output Mode** **8 : Output Frequency (Motor Speed)**. 0 to P-01 **9 : Output (Motor) Current**. 0 to 200% of P1-08 **10 : Motor Torque**. 0 to 200% of motor rated torque **11 : Output (Motor) Power**. 0 to 150% of drive rated power				
P2-12	**Analog Output 1 (Terminal 8) Format**	See Below		U 0- 10	-
	U 0- 10 = 0 to10V. U 10-0 = 10 to 0V, A 0-20 = 0 to 20mA A 20-0 = 20 to 0mA A 4-20 = 4 to 20mA A 20-4 = 20 to 4mA				
P2-13	**Analog/Digital Output 2 (Terminal 11) Function Select**	0	11	0	-
	Digital Output Mode. Logic 1 = +24V DC **0 : Drive Enabled (Running)**. Logic 1 when the Optidrive P2 Elevator drive is enabled (Running) **1 : Drive Healthy**. Logic 1 When no Fault condition exists on the drive (“inH” is not included as a fault) **2 : At Target Frequency (Speed)**. Logic 1 when the output frequency matches the setpoint 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 : Rescue Mode Active**. Logic 1 when the drive is operating in “Rescue Mode” (Rescue mode is detailed in section 12.2). **7 : Analog Input 2 Signal Level >= Limit**. Logic when the signal applied to the Analog Input 2 exceeds the adjustable limit **Note** : When using settings 4 – 7, parameters P2-16 and P2-17 must be used together to control the behaviour. The output will switch to Logic 1 when the selected signal exceeds the value programmed in P2-16, and return to Logic 0 when the signal falls below the value programmed in P2-17. **Analog Output Mode** **8 : Output Frequency (Motor Speed)**. 0 to P-01 **9 : Output (Motor) Current**. 0 to 200% of P1-08 **10 : Motor Torque**. 0 to 200% of motor rated torque **11 : Output (Motor) Power**. 0 to 150% of drive rated power				

Par	Parameter Name	Minimum	Maximum	Default	Units
P2-14	**Analog Output 2 (Terminal 11) Format**	See Below	See Below	U 0- 10	-
	U 0- 10 = 0 to10V. U 10-0 = 10 to 0V, A 0-20 = 0 to 20mA A 20-0 = 20to 0mA A 4-20 = 4 to 20mA A 20-4 = 20 to 4mA				
P2-15	**User Relay 1 Output (Terminals 14, 15 & 16) Function select**	0	8	8	-
	Selects the function assigned to Relay Output 1. The relay has three output terminals, Logic 1 indicates the relay is active, and therefore terminals 14 and 15 will be 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. ("inH" is not included as a fault) **2 : At Target Frequency (Speed)**. Logic 1 when the output frequency matches the setpoint frequency **3: Output Frequency > 0.0 Hz**. Logic 1 when the 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 : Output Torque >= Limit**. Logic 1 when the motor torque exceeds the adjustable limit **7 : Analog Input 2 Signal Level >= Limit**. 1 Logic when the signal applied to the Analog Input 2 exceeds the adjustable limit **Note** : When using settings 4 – 7, parameters P2-16 and P2-17 must be used together to control the behaviour. The output will switch to Logic 1 when the selected signal exceeds the value programmed in P2-16, and return to Logic 0 when the signal falls below the value programmed in P2-17. **8 : Motor Contactor Control.** Used to control the operation of a contactor installed on the output side of the drive between the drive and motor. (see section 10.5 for more details)				
P2-16	**Adjustable Threshold 1 Upper Limit (Analog Output 1 / Relay Output 1)**	P2-17	200.0	100.0	%
P2-17	**Adjustable Threshold 1 Lower Limit (Analog Output 1 / Relay Output 1)**	0.0	P2-16	0.0	%
	Used in conjunction with some settings of Parameters P2-11 & P2-15.				
P2-21	**Display Scaling Factor**	-30.000	30.000	0.000	-
P2-22	**Display Scaling Source**	0	2	0	-
	P2-21 & P2-22 allow the user to program the Optidrive P2 Elevator drive to display an alternative output unit scaled from an existing parameter, e.g. to display conveyer speed in metres per second based on the output frequency. This function is disabled if P2-21 is set to 0. If P2-21 is set >0, the variable selected in P2-22 is multiplied by the factor entered in P2-21, and displayed whilst the drive is running, with a 'c' to indicate the customer scaled units. **P2-22 Options** **0 : Motor Speed** **1 : Motor Current** **2 : Analog Input 2** **3: P0-80 (signed with one decimal place)**				
P2-24	**Effective Switching Frequency**	Drive Rating Dependent			kHz
	Effective power stage switching frequency. The range of settings available and factory default parameter setting depend on the drive power and voltage rating. Higher frequencies reduce the audible 'ringing' noise from the motor, and improve the output current waveform, at the expense of increased drive losses				
P2-25	**2nd Deceleration Ramp Time**	0.00	240	0.00	Seconds
	This parameter allows an alternative deceleration ramp down time to be programmed into the Optidrive P2 Elevator drive, which can be selected by digital inputs (dependent on the setting of P1-13). When set to 0.0, the drive will coast to stop.				
P2-30	**Analog Input 1 (Terminal 6) Format**	See Below		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 P2 Elevator drive 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 P2 Elevator drive will ramp to stop if the signal level falls below 3mA t 20-4 = 20 to 4mA Signal, the Optidrive P2 Elevator drive 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 P2 Elevator drive will ramp to stop if the signal level falls below 3mA				

Par	Parameter Name	Minimum	Maximum	Default	Units
P2-31	**Analog Input 1 Scaling**	0.0	500.0	100.0	%
	Scales the analog input by this factor, e.g. 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 (P1-01)				
P2-32	**Analog Input 1 Offset**	-500.0	500.0	0.0	%
	Sets an offset, as a percentage of the full scale range of the input, which is applied to the analog input signal				
P2-33	**Analog Input 2 (Terminal 10) Format**	See Below		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 P2 Elevator drive 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 P2 Elevator drive will ramp to stop if the signal level falls below 3mA t 20-4 = 20 to 4mA Signal, the Optidrive P2 Elevator drive 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 P2 Elevator drive will ramp to stop if the signal level falls below 3mA				
P2-34	**Analog Input 2 Scaling**	0.0	500.0	100.0	%
	Scales the analog input by this factor, e.g. 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 (P1-01)				
P2-35	**Analog Input 2 Offset**	-500.0	500.0	0.0	%
	Sets an offset, as a percentage of the full scale range of the input, which is applied to the analog input signal				
P2-36	**Start Mode Select / Automatic Restart**	See Below		EdgE-r	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 fault with, and will require the user to manually reset the fault. Note : The reset time (default 20 sec's) can be modified using parameter **P**6-03 (1s..60s)				
P2-37	**Keypad Mode Restart Speed**	0	3	1	-
	This parameter is only active when P1-12 = 1 or 2. When settings 0 to 3 are used, the drive must be started by pressing the Start key on the keypad. When settings 4 – 7 are used, the drive starting is controlled by the enable digital input. **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 setpoint speed used prior to stopping **2 : Current Running Speed**. Where the Optidrive P2 Elevator drive 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 : Inspection Speed**. Following a stop and restart,the Optidrive P2 Elevator drive will always initially run at Inspection Speed(**P**2-04) **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 setpoint speed used prior to stopping **6 : Current Running Speed (Terminal Enable)**. Where the Optidrive P2 Elevator drive 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 : Inspection Speed**. **(Terminal Enable)**. Following a stop and restart, the Optidrive P2 Elevator drive will always initially run at Inspection Speed(**P**2-04)				
P2-39	**Parameter Access Lock**	0	1	0	-
	0 : Unlocked. All parameters can be accessed and changed **1 : Locked**. Parameter values can be displayed, but cannot be changed				
P2-40	**Extended Parameter Access Code Definition**	0	9999	101	-
	Defines the access code which must be entered in P1-14 to access parameter groups above Group 1				

14.2. Parameter Group 3 – Elevator Parameters

Par	Parameter Name	Minimum	Maximum	Default	Units
P3-01	**Acceleration S-Ramp 1 Duration**	0.0	5.0	0.5	s
P3-02	**Acceleration S- Ramp 2 Duration**	0.0	5.0	0.5	s
P3-03	**Deceleration S- Ramp 1 Duration**	0.0	5.0	0.5	s
P3-04	**Deceleration S- Ramp 2 Duration**	0.0	5.0	0.5	s
P3-05	**Levelling S-Ramp Duration**	0.0	5.0	0.5	s
	S- Ramps are used to smooth the starting and stopping behaviour of the drive, refer to the diagram in section 10.8 for further information on the operation of the S-Ramps.				
P3-06	**Output Contactor Closing Time/Run command delay time**	0.0	5.0	0.2	s
	Sets a delay time between the enable signal being applied to the Optidrive P2 Elevator drive and energising of the motor. This prevents over current trips which may be caused when a contactor is installed between the Optidrive P2 Elevator drive and the motor. The contactor can optionally be controlled by the drive using Output Relay 1.				
P3-07	**Brake Release time**	0.0	2.00	0.2	s
	Sets the speed at which the drive will run prior to releasing the motor brake				
P3-08	**Brake Apply Delay**	0.00	2.00	0.20	s
	Sets the delay time allowed for the motor brake to apply when stopping. (Motor brake control method 2 in section 10.6.2)				
P3-09	**Brake Apply Speed**	0.0	P1-01	0.0	Hz
	Sets the speed at which the drive will signal the motor brake to apply. This speed must not be greater than the levelling & maintenance speeds.				
P3-10	**Zero Speed Holding Time on disable**	0.0	60.0	0.2	s
	Sets the time for which the drive will hold at the motor at zero speed prior to the output being disabled to allow the motor brake to engage. This value should be obtained from the motor manufacturer.				
P3-11	**Short Floor Operation**	0	1	0	-
	0 : Disabled **1 : Enabled**.				
	See section 12.1 Short Floor Operation for more detail				
P3-12	**Light Load Detection**	0	1	0	-
	0 : Disabled **1 : Enabled**.				
	See section 12.2.4 Rescue Mode Light Load Detection for more detail				
P3-13	**Brake Resistor Resistance**	0.0	Drive Rating Dependant	Drive Rating Dependant	Ω
P3-14	**Brake Resistor Power**	0.0	200.00	0.00	kW
	For software protection of the connected brake resistor, enter the rated power and resistance of the resistor into the relevant parameters. The drive will then monitor the brake resistor to ensure that it does not operate outside of its designed limits. Where an external thermal protection device is fitted, and software protection is not required. Setting parameter **P**3-14 to zero will disable the software protection feature.				
P3-15	**Sheave diameter**	0.0	2000.0	0.0	-
	If value entered is <100 drive assumes inches, if >100 drive assumes mm				
P3-16	**Roping Ratio**	1	4	1	-
	1 : 1:1 **2 : 2:1** **3 : 3:1** **4 : 4:1**				
P3-17	**Gear Ratio**	1.0	100.0	1.0	-
	P3-15,**P**3-16 and **P**3-17 are used internally by the drive to provide elevator speed in user units as per section 9.6				
Note : P1-10 must also be programmed for elevator speed in user units to operate.					

14.3. 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
P4-01	**Motor Control Mode**	0	3	0	-
	Selects the motor control method. An autotune must be performed if setting 0 or 1 or 3 is used. **0: Advanced Vector IM Speed Control** **1: Vector IM Speed Control** **2: Enhanced V/F IM Speed Control** **3 : PM Motor Speed Control**				
P4-02	**Motor Parameter Auto-tune Enable**	0	1	0	-
	When set to 1, the drive immediately carries out a non-rotating autotune to measure the motor parameters for optimum control and efficiency. Following completion of the autotune, the parameter automatically returns to 0.				
P4-03	**Vector Speed Controller Proportional Gain**	0.1	400.0	50.0	%
	Sets the proportional gain value for the speed controller when operating in Vector Speed or Vector Torque motor control modes (P4-01 = 0 or 1). Higher values provide better output frequency regulation and response. Too high a value can cause instability or even over current trips. For applications requiring best possible performance, the value should be adjusted to suit the connected load by gradually increasing the value and monitoring the actual output speed of the load until the required dynamic behaviour is achieved with little or no overshoot where the output speed exceeds the setpoint. In general, higher friction loads can tolerate higher values of proportional gain, and high inertia, low friction loads may require the gain to be reduced.				
P4-04	**Vector Speed Controller Integral Time Constant**	0.000	1.000	0.050	s
	Sets the integral time for the speed controller. Smaller values provide a faster response in reaction to motor load changes, at the risk of introducing instability. For best dynamic performance, the value should be adjusted to suit the connected load.				
P4-05	**Motor Power Factor Cos Ø**	0.50	0.99	-	-
	When operating in Vector Speed motor control modes (P4-01 = 0 or 1),this parameter must be set to the motor nameplate power factor				
P4-07	**Maximum Motoring Torque Limit**	0.0	500.0	100.0	%
	When operating in Vector Speed motor control modes (P4-01 = 0 or 1), this parameter defines the maximum torque limit.				
P4-09	**Generator Mode Max. Torque Limit (Maximum Regenerative Torque)**	0.0	500.0	200.0	%
	Active only in Vector Speed motor control modes (P4-01 = 0 or 1). Sets the maximum regenerating torque allowed by the Optidrive P2 Elevator drive.				
P4-10	**V/F Characteristic Adjustment Frequency**	0.0	P1-09	0.0	Hz
	When operating in V/F mode (P4-01 = 2), this parameter in conjunction with P4-11 sets a frequency point at which the voltage set in P4-11 is applied to the motor. Care must be taken to avoid overheating and damaging the motor when using this feature.				
P4-11	**V/F Characteristic Adjustment Voltage**	0	P1-07	0.0	V
	Used in conjunction with parameter P4-10				
P4-12	**Thermal Overload Value Retention**	0	1	0	-
	0 : Disabled. **1 : Enabled**. All Optidrive P2 drives 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.				

14.4. 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 P2 Elevator drive				
P5-02	**CAN Open Baud Rate**	125	1000	500	kbps
	Sets the baud rate when CAN Open communications are used				
P5-03	**Modbus RTU Baud Rate**	9.6	115.2	115.2	kbps
	Sets the baud rate when CAN Open communications are used				
P5-04	**Modbus Data Format**	-	-	n-1	-
	Sets the expected Modbus telegram data format as follows n- 1 : No Parity, 1 stop bit n-2 : No parity, 2 stop bits O- 1 : Odd parity, 1 stop bit E- 1 : Even parity, 1 stop bit				
P5-05	**Communications Loss Timeout**	0.0	5.0	1.0	s
	Sets the watchdog time period for the communications channel. If a valid telegram is not received by the Optidrive P2 Elevator drive within this time period, the drive will assume a loss of communications has occurred and react as selected below				
P5-06	**Communications Loss Action**	0	3	0	-
	Controls the behaviour of the drive following a loss of communications as determined by the above parameter setting. **0 : Trip** **1 : Ramp to Stop Then Trip** **2 : Ramp to Stop Only (No Trip)** **3 : Run at Inspection Speed (P**2-04**)**				
P5-07	**Fieldbus Ramp Control**	0	1	0	-
	Selects whether the acceleration and deceleration ramps are control directly via the Fieldbus, or by internal drive parameters P1-03 and P1-04. **0 : Disabled**. Ramps are control from internal drive parameters **1 : Enabled**. Ramps are controlled directly by the Fieldbus				
P5-08	**Fieldbus Process Data Word 4 Output Select**	0	4	0	-
	When using an optional fieldbus interface, this parameter configures the parameter source for the 4th process data word transferred from the drive to the network master during cyclic communications **0 : Output Torque** – 0 to 2000 = 0 to 200.0% **1 : Output Power** – Output power in kW to two decimal places, e.g. 400 = 4.00kW **2 : Digital Input Status** – Bit 0 indicates digital input 1 status, bit 1 indicates digital input 2 status etc. **3 : Analog Input 2 Signal Level** – 0 to 1000 = 0 to 100.0% **4 : Drive Heatsink Temperature** – 0 to 100 = 0 to 100°C **5 : User register 1** **6 : User register 2** **7 : P0-80 Value**				
P5-12	**Fieldbus Process Data Word 4 Output Select**	0	4	0	-
	When using an optional fieldbus interface, this parameter configures the parameter source for the 4th process data word transferred from the drive to the network master during cyclic communications **0 : Output Torque** – 0 to 2000 = 0 to 200.0% **1 : Output Power** – Output power in kW to two decimal places, e.g. 400 = 4.00kW **2 : Digital Input Status** – Bit 0 indicates digital input 1 status, bit 1 indicates digital input 2 status etc. **3 : Analog Input 2 Signal Level** – 0 to 1000 = 0 to 100.0% **4 : Drive Heatsink Temperature** – 0 to 100 = 0 to 100°C **5 : User register 1** **6 : User register 2** **7 : P0-80 Value**				
P5-13	**Fieldbus Process Data Word 4 Output Select**	0	4	0	-
	When using an optional fieldbus interface, this parameter configures the parameter source for the 4th process data word transferred from the drive to the network master during cyclic communications **0 : Output Torque** – 0 to 2000 = 0 to 200.0% **1 : Output Power** – Output power in kW to two decimal places, e.g. 400 = 4.00kW				
P5-14	**Fieldbus Process Data Word 4 Output Select**	0	4	0	-
	When using an optional fieldbus interface, this parameter configures the parameter source for the 4th process data word transferred from the drive to the network master during cyclic communications **0 : Output Torque** – 0 to 2000 = 0 to 200.0% **1 : Output Power** – Output power in kW to two decimal places, e.g. 400 = 4.00kW **2 : Digital Input Status** – Bit 0 indicates digital input 1 status, bit 1 indicates digital input 2 status etc.				

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

Par	Description	Units
P0-01	**Analog Input 1 Applied Signal Level**	%
	Displays the signal level applied to analog input 1 (Terminal 6) after scaling and offsets have been applied.	
P0-02	**Analog Input 2 Applied Signal Level**	%
	Displays the signal level applied to analog input 2 (Terminal 10) after scaling and offsets have been applied.	
P0-03	**Digital Input Status**	-
	Displays the status of the drive inputs, starting with the left hand side digit = Digital Input 1 etc.	
P0-04	**Pre Ramp Speed Controller Reference**	Hz
	Displays the set point reference input applied to the drive internal speed controller	
P0-05	**Torque Controller Reference**	%
	Displays the set point reference input applied to the drive internal torque controller	
P0-06	**Digital Speed Reference (Motorised Pot)**	Hz
	Displays the value of the drive internal Motorised Pot (used for keypad) speed reference	
P0-07	**Fieldbus Communication Speed Reference**	Hz
	Displays the setpoint being received by the drive from the currently active Fieldbus interface.	
P0-08	**PID Reference (Setpoint)**	%
	Displays the setpoint input to the PID controller.	
P0-09	**PID Feedback Level**	%
	Displays the Feedback input signal to the PID controller	
P0-10	**PID Controller Output**	%
	Displays the output level of the PID controller	
P0-11	**Applied Motor Voltage**	V
	Displays the instantaneous output voltage from the drive to the motor	
P0-12	**Output Torque**	%
	Displays the instantaneous output torque level produced by the motor	
P0-13	**Trip History Log**	-
	Displays the last four fault codes for the drive. Refer to section 17.1 for further information	
P0-14	**Motor Magnetising Current (Id)**	A
	Displays the motor magnetising Current, providing an auto tune has been successfully completed.	
P0-15	**Motor Rotor Current (Iq)**	A
	Displays the motor Rotor (torque producing) current, providing an auto tune has been successfully completed.	
P0-16	**DC Bus Voltage Ripple Level**	V
	Displays the level of ripple present on the DC Bus Voltage. This parameter is used by the Optidrive P2 Elevator drive for various internal protection and monitoring functions.	
P0-17	**Motor Stator resistance (Rs)**	Ω
	Displays the measured motor stator resistance, providing an auto tune has been successfully completed.	
P0-18	**Motor Stator Inductance (Ls)**	H
	Displays the measured motor stator inductance, providing an auto tune has been successfully completed.	
P0-19	**Motor Rotor Resistance (Rr)**	Ohms
	Displays the measured motor rotor resistance, providing an auto tune has been successfully completed.	
P0-20	**DC Bus Voltage**	V
	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 Remaining to next service**	V
	Displays the number of hours remaining on the service time counter before the next service is due.	
P0-23	**Operating Time Accumulated With Heatsink Temperature Above 80°C**	HH:MM:SS
	Displays the amount of time in hours and minutes that the Optidrive P2 Elevator drive has operated for during its lifetime with a heatsink temperature in excess of 80°C. This parameter is used by the Optidrive P2 Elevator drive for various internal protection and monitoring functions.	
P0-24	**Operating Time Accumulated With Ambient Temperature Above 80°C**	HH:MM:SS
	Displays the amount of time in hours and minutes that the Optidrive P2 Elevator drive has operated for during its lifetime with an ambient temperature in excess of 80°C. This parameter is used by the Optidrive P2 Elevator drive for various internal protection and monitoring functions.	
P0-25	**Rotor Speed (Estimated or Measured)**	-
	In Vector control mode, this parameter displays either the estimated rotor speed of the motor, if no encoder feedback is present, or the measured rotor speed if an optional Encoder Feedback Interface Option is fitted.	

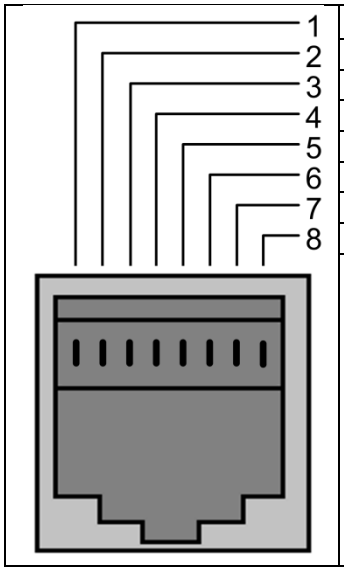
Par	Description	Units
P0-26	**Energy Consumption kWh Meter**	kWh
	Displays the amount of energy consumed by the drive in kWh. When the value reaches 1000, it is reset back to 0.0, and the value of P0-27 (*MWh meter) is increased.	
P0-27	**Energy Consumption MWh Meter**	MWh
	Displays the amount of energy consumed by the drive in MWh.	
P0-28	**Software Version and Checksum**	-
	Displays the software version of the drive	
P0-29	**Drive Type**	-
	Displays the type details of the drive	
P0-30	**Drive Serial Number**	-
	Displays the unique serial number of the drive.	
P0-31	**Drive Lifetime Operating Time**	HH:MM:SS
	Displays the total operating time of the drive. The first value shown is the number of hours. Pressing the Up key will display the minutes and seconds.	
P0-32	**Drive Run Time Since Last Trip (1)**	HH:MM:SS
	Displays the total operating time of the drive since the last fault occurred. The first value shown is the number of hours. Pressing the Up key will display the minutes and seconds.	
P0-33	**Drive Run time Since Last Trip (2)**	HH:MM:SS
	Displays the total operating time of the drive since the last fault occurred. The first value shown is the number of hours. Pressing the Up key will display the minutes and seconds.	
P0-34	**Drive Run Time Since Last Disable**	HH:MM:SS
	Displays the total operating time of the drive since the last Run command was received. The first value shown is the number of hours. Pressing the Up key will display the minutes and seconds.	
P0-35	**Drive Internal Cooling Fan Total Operating Time**	HH:MM:SS
	Displays the total operating time of the Optidrive P2 Elevator drive internal cooling fans. The first value shown is the number of hours. Pressing the Up key will display the minutes and seconds. This is used for scheduled maintenance information	
P0-36	**DC Bus Voltage Log (256ms)**	V
P0-37	**DC Bus Voltage Ripple Log (20ms)**	V
P0-38	**Heatsink Temperature Log (30s)**	°C
P0-39	**Ambient Temperature Log (30s)**	°C
P0-40	**Motor Current Log (256ms)**	A
	The above parameters 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 – see section for further information.	
P0-41	**Critical Fault Counter – Over Current**	-
P0-42	**Critical fault counter – Over Voltage**	-
P0-43	**Critical fault counter – Under Voltage**	-
P0-44	**Critical fault counter – Over Temperature**	-
P0-45	**Critical fault counter – Brake Transistor Over Current**	-
P0-46	**Critical fault counter – Ambient Over Temperature**	-
	These parameters contain a record of how many times certain critical faults have occurred during a drives operating lifetime. This provides useful diagnostic data	
P0-47	**Reserved**	
	Reserved Parameter	
P0-48	**Reserved**	
	Reserved Parameter	
P0-49	**Modbus RTU Communication Error Counter**	-
	This parameter is incremented every time an error occurs on the Modbus RTU communication link. This information can be used for diagnostic purposes.	
P0-50	**CAN Open Communication Error Counter**	-
	This parameter is incremented every time an error occurs on the CAN Open communication link. This information can be used for diagnostic purposes.	

15.Serial communications

15.1. RS-485 communications

Optidrive P2 Elevator drive has an RJ45 connector on the front of the control panel. 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. Both connections can be used simultaneously.

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



1	CAN-
2	CAN+
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
8	RS 485+ Modbus RTU

15.2. Modbus RTU Communications

15.2.1. Modbus Telegram Structure

The Optidrive P2 Elevator drive 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 0 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		Starting Address	1	Byte
1st Register Address	2	Bytes		1st Register Value	2	Bytes
No. Of Registers	2	Bytes		2nd Register Value	2	Bytes
CRC Checksum	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

15.2.2. Modbus Control & Monitoring Registers

The following is a list of accessible Modbus Registers available in the Optidrive P2 Elevator drive.

- When Modbus RTU is configured as the Fieldbus option (P5-01 = 0, factory default setting), 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)
- Register 3 can be used to control the output torque level providing that
  - The drive is operating in Vector Speed modes (P4-01 = 0 or 1)
  - The torque controller reference / limit is set for 'Fieldbus' (P4-06 = 3)
- Register 4 can be used to control the acceleration and deceleration rate of the drive providing that Fieldbus Ramp Control is enabled (P5-08 = 1)
- 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 P2 Elevator drive 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	Setpoint must be sent to the drive in Hz to one decimal place, e.g. 500 = 50.0Hz
3	Command Torque Reference		R/W	Setpoint must be sent to the drive in % to one decimal place, e.g. 2000 = 200.0%
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 = 1) 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 The Upper Byte will contain the relevant fault number in the event of a drive trip. Refer to section 17.1 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 setpoint
23	DC bus voltages		R	Measured DC Bus Voltage in Volts
24	Drive temperature		R	Measured Heatsink Temperature in °C

15.2.3. 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 Communication Protocol Select
- P5-02 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 P2 Elevator drive using Modbus RTU, please refer to your local Invertek Sales Partner.

16.Technical Data

16.1. Environmental

Ambient temperature range:

Operational : -10 … 50°C IP20 Units
: - 10 … 40°C IP55 Units (UL Approved)
: -10 … 50°C IP55 Units (Non UL Approved with derating, refer to section 16.5.1 for Derating for Ambient Temperature Information)

Storage and Transportation : -40 °C … 60 °C

Max altitude for rated operation : 1000m (Refer to section 16.5.2 for Derating for Altitude Information)

Relative Humidity : < 95% (non condensing)

Note : Drive must be Frost and moisture free at all times
Installation above 2000m is not UL approved

16.2. Input voltage ranges

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

16.2.1. 3 Phase Supply

Model Number	Supply Voltage	Phases	Frequency
ODL-2-x4xxx-3xxxx	380 – 480 Volts + / - 10%	3	50 – 60Hz + / - 5%

16.2.1. Rescue Mode (UPS) supply.

Model Number	Supply Voltage
ODL-2-x4xxx-3xxxx	• Sine wave Output UPS = 200-240VAC • If using a Simulated Sine Wave UPS the DC bus as measured by parameter **P**0-20 must be in the range 280Vdc - 370Vdc.

All Optidrive P2 Elevator drives 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.

16.3. Output Power and Current ratings

380 - 480 Volt (+ / - 10%) 3 Phase Input, 3 Phase Output

kW (400V)	HP (460V)	Nominal Input Current	Fuse Or MCB (Type B)		Supply Cable Size		Nominal Output Current	Motor Cable Size		Maximum Motor Cable Length	Recommended Brake Resistance Ω
			Non UL	UL (A)	mm	AWG / kcmil		mm	AWG / kcmil		
4	5	11.7	16	15	2.5	14	9.5	1.5	14	100	100
5.5	7.5	14.1	20	20	4	12	14	1.5	12	100	75
7.5	10	18.3	25	25	4	10	18	2.5	10	100	50
11	15	27	40	35	10	8	24	4	10	100	40
15	20	29	40	40	10	8	30	6	8	100	22
18.5	25	39.7	50	50	16	8	39	10	8	100	22
22	30	48.6	63	70	16	6	46	10	6	100	22
30	40	61.5	80	80	25	4	61	16	4	100	12
37	50	72.3	100	100	35	3	72	25	3	100	12

Note

- Ratings shown above apply to 40°C Ambient temperature. For derating information, refer to section 16.5
- 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

16.4. Additional Information for UL Approved Installations

Optidrive P2 is designed to meet the UL requirements. In order to ensure full compliance, the following must be fully observed.

<table>
<tr><th colspan="5">Input Power Supply Requirements</th></tr>
<tr><td>Supply Voltage</td><td colspan="4">380 – 480 Volts for 400 Volt rated units, + / - 10% variation allowed, Maximum 500 Volts RMS</td></tr>
<tr><td rowspan="2">Imbalance</td><td colspan="4">Maximum 3% voltage variation between phase – phase voltages allowed</td></tr>
<tr><td colspan="4">All Optidrive P2 Elevator drives 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.</td></tr>
<tr><td>Frequency</td><td colspan="4">50 – 60Hz + / - 5% Variation</td></tr>
<tr><td rowspan="3">Short Circuit Capacity</td><td>Voltage Rating</td><td>Min kW (HP)</td><td>Max kW (HP)</td><td>Maximum supply short-circuit current</td></tr>
<tr><td>400 / 460V</td><td>4 (5)</td><td>37 (50)</td><td>100kA rms (AC)</td></tr>
<tr><td colspan="4">All the drives in the above table are suitable for use on a circuit capable of delivering not more than the above specified maximum short-circuit Amperes symmetrical with the specified maximum supply voltage.</td></tr>
<tr><td colspan="5">Incoming power supply connection must be according to section 6.3.1</td></tr>
<tr><td colspan="5">All Optidrive P2 Elevator drives are intended for indoor installation within controlled environments which meet the condition limits shown in section 16.1</td></tr>
<tr><td colspan="5">Branch circuit protection must be installed according to the relevant national codes. Fuse ratings and types are shown in section 16.3</td></tr>
<tr><td colspan="5">Suitable Power and motor cables should be selected according to the data shown in section 16.3</td></tr>
<tr><td colspan="5">Power cable connections and tightening torques are shown in section 5 and 6.</td></tr>
<tr><td colspan="5">Optidrive P2 Elevator drives provide 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 6.6.2</td></tr>
</table>

16.5. Derating Information

Derating of the drive maximum continuous output current capacity is required when :

- Operating at ambient temperature in excess of 40°C / 104°F for enclosed drives (non UL approved)
- 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

16.5.1. Derating for Ambient Temperature

Enclosure Type	Maximum Temperature Without Derating (UL Approved)	Derate by	Maximum Permissable Operating Ambient Temperature with Derating (Non UL Approved)
IP20	50°C / 122°F	N/A	50°C
IP55	40°C / 104°F	1.5% per °C (1.8°F)	50°C

16.5.2. Derating for Altitude

Enclosure Type	Maximum Altitude Without Derating	Derate by	Maximum Permssable (UL Approved)	Maximum Permssable (Non-UL Approved)
IP20	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

16.5.3. Derating for Swicthing Frequency

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

16.5.4. Example of applying Derating Factors

A 4kW, IP66 drive is to be used at an altitude of 2000 metres above sea level, with 12kHz 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 swicthing frequency derating, 12kHz, 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 neccesary to either

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

17.Troubleshooting

17.1. Fault messages

Fault Code	No.	Description	Corrective Action
no-FLt	00	No Fault	Displayed in **P**0-13 if no faults are recorded in the log
OI-b	01	Brake channel over current	Ensure the connected brake resistor is above the minimum permissible level for the drive – refer to the ratings shown in section 16.3. Check the brake resistor and wiring for possible short circuits.
OL-br	02	Brake resistor overload	The drive software has determined that the brake resistor is overloaded (based on the values entered in P3-13 and P3-14), and trips to protect the resistor. Always ensure the brake resistor is being operated within its designed parameter before making any parameter or system changes. To reduce the load on the resistor, increase deceleration the time, reduce the load inertia or add further brake resistors in parallel, observing the minimum resistance value for the drive in use.
O-I	03	Instantaneous over current on drive output. Excess load on the motor.	**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. If operating in Vector mode (P4-01 – 0 or 1), also check the motor power factor in P4-05 and ensure an autotune has been successfully completed for the connected motor. 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 **Fault Occurs When Running** If operating in Vector mode (P4-01 – 0 or 1), reduce the speed loop gain in P4-03
I.t-trP	04	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 16.3 Ensure the motor nameplate parameters are correctly entered in P1-07, P1-08, and P1-09 If operating in Vector mode (P4-01 – 0 or 1), also check the motor power factor in P4-05 and ensure an autotune has been successfully completed for the connected motor. Check the load mechanically to ensure it is free, and that no jams, blockages or other mechanical faults exist
PS-trP	05	Instantaneous over current on drive output.	Refer to fault 3 above
O-uoLt	06	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 or connect a suitable brake resistor to the drive. If operating in Vector Mode, reduce the speed loop gain P4-03 If operating in PID control, ensure that ramps are active by reducing P3-11
U-uoLt	07	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	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 parameter 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 sections 0 and 5.8 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 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	Factory Default parameters have been loaded	Press STOP key, the drive is now ready to be configured for the required application
E-trIP	11	External trip	E-trip requested on control input terminals. Some settings of P1-13 require a normally closed contactor 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-Obs	12	Communications Fault	Communications lost with PC or remote keypad. Check the cables and connections to external devices
FLt-dc	13	Excessive DC Ripple	The DC Bus Ripple Voltage level can be displayed in parameter P0-22 A historical log is stored at 20ms intervals prior to a trip in parameter P0-39 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 trip	Drive intended for use with a 3 phase supply, one input phase has been disconnected or lost.

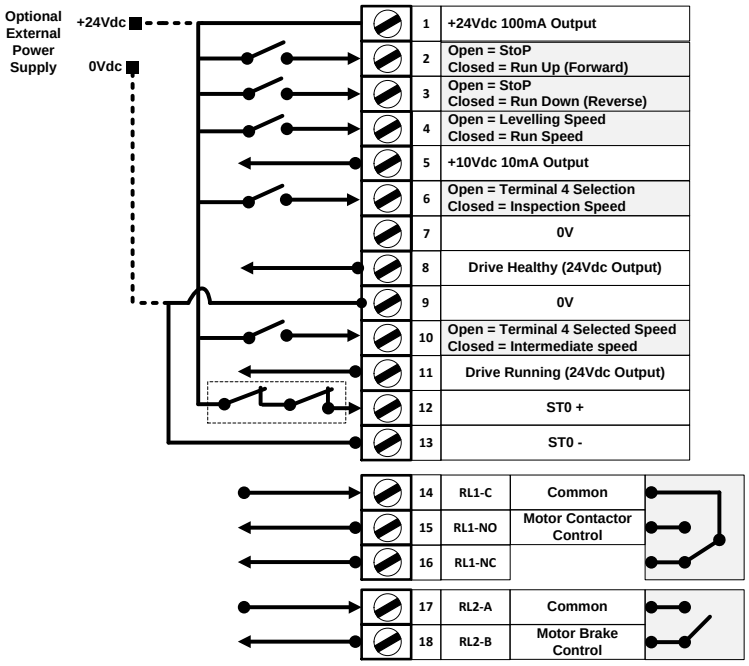
Fault Code	No.	Description	Corrective Action
h O-I	15	Instantaneous over current on drive output.	Refer to fault 3 above
th-FLt	16	Faulty thermistor on heatsink.	Refer to your Invertek Sales Partner.
dAtA-F	17	Internal memory fault.	Parameters not saved, defaults reloaded. Try again. If problem recurs, refer to your IDL Authorised Distributor.
4-20F	18	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. Check the signal source and wiring to the Optidrive P2 Elevator drive terminals.
dAtA-E	19	Internal memory fault.	Parameters not saved, defaults reloaded. Try again. If problem recurs, refer to your IDL Authorised Distributor.
U-dEF	20	User Parameter Defaults	User Parameter defaults have been loaded. Press the Stop key.
F-Ptc	21	Motor PTC Over Temperature	The connected motor PTC device has caused the drive to trip
FAn-F	22	Cooling Fan Fault	Check and if necessary, replace the drive internal cooling fan
O-hEAt	23	Ambient Temperature too High	The measured temperature around the drive is above the operating limit of the drive. Ensure the drive internal cooling fan is operating Ensure that the required space around the drive as shown in sections 0 and 5.8 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-torq	24	Maximum Torque Limit Exceeded	The output torque limit has exceeded the drive capacity or trip threshold Reduce the motor load, or increase the acceleration time
U-torq	25	Output Torque Too Low	The torque developed prior to releasing the motor holding brake is below the preset threshold.
OUt-F	26	Drive output fault	Drive output fault
Sto-F	29	Internal STO circuit Error	Refer to your Invertek Sales Partner
Enc-01	30	Encoder Feedback Faults (Only visible when an encoder module is fitted and enabled)	Encoder communication /data loss
Enc-02	31		Encoder Speed Error. The error between the measured encoder feedback speed and the Optidrive P2 Elevator drive estimated rotor speed is greater than the pre-set limit allowed.
Enc-03	32		Incorrect Encoder PPR count set in parameters
Enc-04	33		Encoder Channel A Fault
Enc-05	34		Encoder Channel B Fault
Enc-06	35		Encoder Channels A & B Fault
Enc-07	36		Encoder Communication loss (check Encoder wiring Connections and that encoder module is pushed fully into the option slot of the drive)
AtF-01	40	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		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		Measured motor inductance is too low. Ensure the motor is correctly connected and free from faults.
AtF-04	43		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		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.
OUt-Ph	49	Output (Motor) Phase Loss	One of the motor output phases is not connected to the drive.
Sc-F01	50	Modbus comms fault	A valid Modbus telegram has not been received within the watchdog time limit set in P5-06 Check the network master / PLC is still operating Check the connection cables Increase the value of P5-06 to a suitable level
Sc-F02	51	CAN Open comms trip	A valid CAN open telegram has not been received within the watchdog time limit set in P5-06 Check the network master / PLC is still operating Check the connection cables Increase the value of P5-06 to a suitable level
Sc-F03	52	Communications Option Module Fault	Internal communication to the inserted Communication Option Module has been lost. Check the module is correctly inserted
Sc-F04	53	IO card comms trip	Internal communication to the inserted Option Module has been lost. Check the module is correctly inserted

17.2. Motor Performance troubleshooting.

If operating with an Induction motor See Section 10.10.1(Without encoder) or 10.11.1 (With encoder).
If operating with a Permanent magnet (Synchronous) motor See Section 10.12.1(Without encoder) or 10.13.1 (With encoder).

18. Quick Reference Sheet

18.1. Terminal Functions (default Settings).



18.2. Speed Profile setup.

Related Parameters	Action
P1-03 (Accel ramp time) **P**1-04 (Decel ramp time) **P**2-01 (Levelling Speed) **P**2-02(Run Speed) **P**2-03 (Intermediate Speed) **P**2-04 (Inspection Speed) **P**3-01 (S-ramp 1 accel start duration) **P**3-02 (S-ramp 2 accel end duration) **P**3-03 (S-ramp 3 decel start duration) **P**3-04 (S-ramp 4 decel end duration) **P**3-05 (S-ramp 5 levelling duration)