elevator CORE

AC Variable Speed Drives for Geared and Gearless Elevators

Part of the OPTIDRIVE™ Family

Quick Start-Up Instructions

For more Information

Invertek Drives.com
Member of Sumitomo Drive Technologies

1. Contents

2. About this Document

This document is intended as a Quick Start Up instruction manual and does not cover all features and functions of the product, for more detailed descriptions of features and functions scan the below QR code:

2.1. Target Audience

The information detailed within this document is intended for those persons who will mechanically, and electrically install the drive, and those who will program the drive.

2.2. Prerequisites

The Installer and user must have read and understood this manual and other applicable manuals in their entirety before proceeding.

2.3. Terminology

The word **Drive or Variable Frequency Drive** refers to this product, the **Optidrive Elevator Core**.

IM refers to Induction Motor.
Geared refers to Induction Motor.
PM refers to Permanent Magnet Motor.
Gearless refers to Permanent Magnet Motor.

2.4. Cyber Security

The overall system designer is responsible for ensuring that there is a maintained secure connection between the drive and any network that could be prone to a cyber-attack.
Furthermore, the overall system designer is responsible for applying appropriate measures such as firewalls, data encryption etc.

Invertek Drives Ltd cannot be held responsible for any loss or damages regarding a Cyber Security breach.

2.5. Warranty

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, 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 Manual is for use with version 1.3.0 Control Firmware and 1.5.0 Power 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.

3. Safety First

	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 drive contains high voltage capacitors that take time to discharge after removal of the power supply. Before working on the drive, ensure isolation of all voltage sources, this includes Mains AC supply, Battery supply, UPS supply. 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.
	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 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 drive. Any electrical measurements required should be carried out with the drive disconnected.

Electric shock hazard! Disconnect and ISOLATE the 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 and cable selection as defined by local legislation or codes. The drive may have a leakage current of greater than 3.5mA; furthermore, the earth cable must be sufficient to carry the maximum supply fault current which normally will be limited by the fuses or MCB. Suitably rated fuses or MCB should be fitted in the mains supply to the drive, according to any local legislation or codes.

Do not carry out any work on the drive control cables whilst power is applied to the drive or to the external control circuits.
The “Safe Torque Off” Function does not prevent high voltages from being present at the drive power terminals.

When installing the drive on any power supply where the phase-ground voltage may exceed the phase-phase voltage (typically IT supply networks or Marine vessels) it is essential that the internal EMC filter ground and surge protection varistor ground (where fitted) are disconnected. If in doubt, refer to your Sales Partner for further information.

Within the European Union, all machinery in which this product is used must comply with the Machinery Directive 2006/42/EC, Safety of Machinery. In particular, the machine manufacturer is responsible for ensuring that the electrical equipment complies with EN60204-1 and providing a disconnecting device which must be one of the following types:

- A switch-disconnector, utilization category AC-23B (EN 60947-3).
- A circuit breaker suitable for isolation in accordance with EN 60947-2.
- A disconnector with an integrated auxiliary contact that ensures under all circumstances the switching devices break the load circuit prior to opening of the main contacts of the disconnector (EN 60947-3).

For installation in other regions, conformance with local electrical regulations and codes of practice must be adhered to.

The level of integrity offered by the drive control input functions – for example stop/start, forward/reverse and maximum speed, is not sufficient for use in safety-critical applications without independent channels of protection. All applications where malfunction could cause injury or loss of life must be subject to a risk assessment and further protection provided where needed.

The driven motor can start at power up if the enable/run input signals are 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 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 drive must be installed in a pollution degree 2 environment, mounted in a cabinet with IP54 or better.

The 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 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 which can switch state whilst the drive is running.

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.

Do not operate the drive with any of the enclosure covers removed.

4. Introduction

4.1. General Information

It is the responsibility of the installer to ensure that the equipment or system into which the product is incorporated complies with all relevant legislation and codes of practice which apply in the country of use.

CE Marking

All Invertek Drives products intended for use within the European Union carry the CE mark to indicate compliance with European Directives (EMC Directive, Low Voltage Directive and Machinery Directive). A declaration of conformity is available from the website, www.invertekdrives.com. For compliance with the European EMC Directive, the necessary guidance is provided within this document, and it is the responsibility of the installer to ensure this guidance is followed to ensure compliance.

UKCA Marking

All Invertek Drives products intended for use within the United Kingdom carry the UKCA mark to indicate compliance with Following UK regulations: Electromagnetic Compatibility Regulations, Supply of Machinery (Safety) Regulations, Electrical Equipment (Safety) Regulations. A declaration of conformity is available from the website, www.invertekdrives.com. For compliance with the relevant regulations, the necessary guidance is provided within this document, and it is the responsibility of the installer to ensure this guidance is followed to ensure compliance.

UL Conformity

A list of currently listed products is available from the UL website, www.ul.com. For compliance with UL requirements, the necessary guidance is provided within this document, and it is the responsibility of the installer to ensure this guidance is followed to ensure compliance.

Safe Torque OFF ("STO") Function

The drive incorporates a hardware STO (Safe Torque Off) Function, designed in accordance and certified with the standards listed below.

Standard	Classification	Independent Approval
EN 61800-5-2:2017	**SIL3**	*** TÜV**
EN ISO 13849-1:2015	**PL "e"**	
EN 61508 (Part 1 to 7):2010	**SIL3**	
EN60204-1:2006 + A1:2009 + AC: 2010	**Uncontrolled Stop "Category 0"**	
EN 62061:2021	**SIL3**	

*__NOTE__ TÜV Approval of the "STO" function is relevant for drives which have a TÜV logo applied on the drive rating label. The STO input must not be used for any safety related function if the drive unit does not carry the TÜV logo on the rating label.

Unintended Car Movement

Brake Contact Monitoring (Unintended Car Movement) EN 81-20:2014+A3 (Certified)

Contactorless Operation

The drive can be used without a Motor contactor using the Safe Torque Off inputs according to parts of EN 81-20:2014 and EN 81-50:2014 (Certified)

4.2. Intended Application

The Elevator Core drive is intended to control the motor of Counterweighted Traction Passenger Elevators and not intended for hydraulic Elevators.

The Elevator Core drive can control Induction or Permanent Magnet IPM (Internal Permanent Magnet) or SPM (Surface Mounted Permanent Magnet) motor types.

4.2.1. Matching the drive to the intended motor:

The selection of the correct drive should be based upon the motor full load current rating at the incoming supply voltage, noting that the drive has a maximum continuous overload capacity of 150% for 60 sec's (200% for 4 sec's), this must be checked to ensure that it matches the application requirements in terms of required acceleration times and load conditions.

The continuous operating current of the drive can be found on the drive rating label.

4.2.2. Ambient temperature range:

Operational	: -20 … 50°C
Storage and Transportation	: -40 °C … 60 °C
Max altitude for rated operation	: 1000m
Relative Humidity	: < 95% (non-condensing)

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

4.2.3. Derating for Altitude:

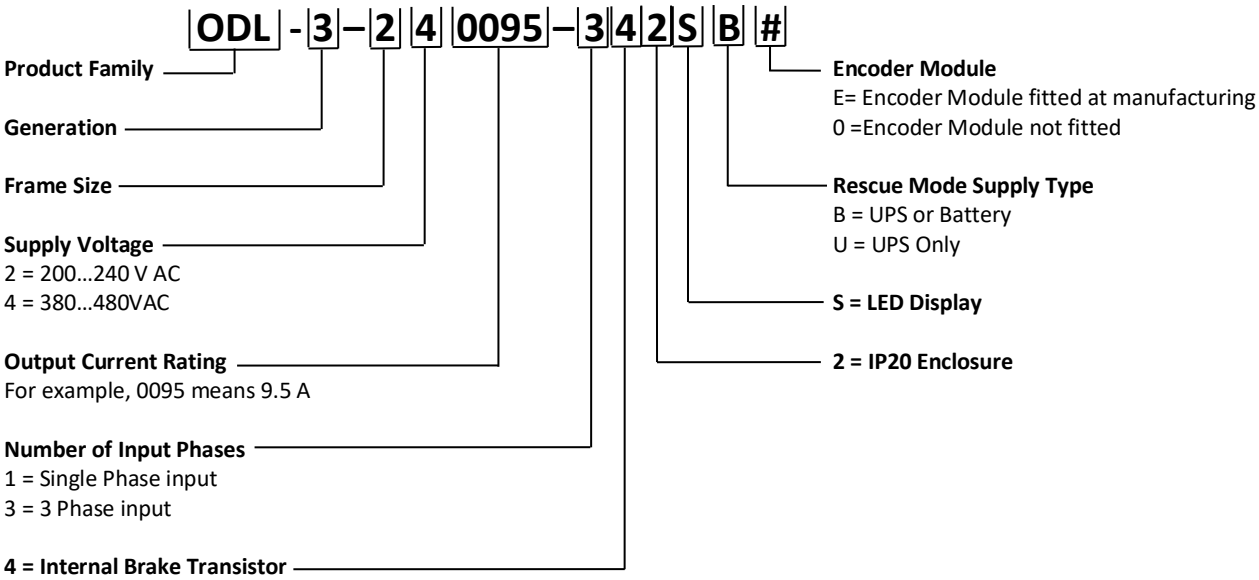
Derating of the drive maximum continuous output current capacity is required when operating at Altitudes more than 1000m/ 3281 ft

The following derating factors should be applied when operating the drive outside of these conditions:-

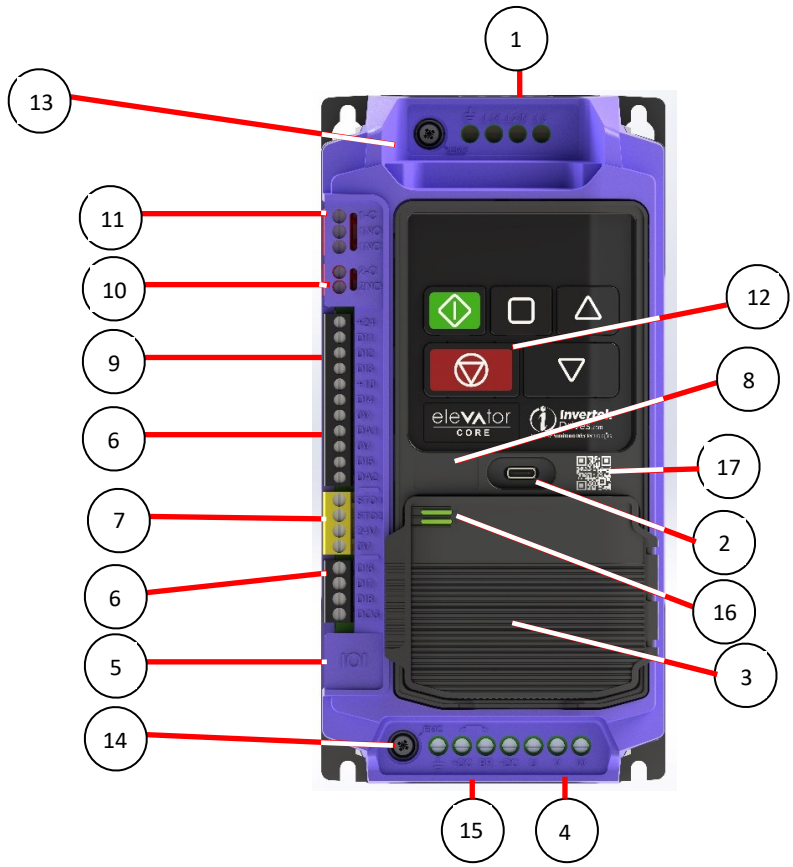
Maximum Altitude Without Derating	Derate by	Maximum Permissible (UL Approved)
1000m / 3281ft	1% per 100m / 328 ft	2000m / 6562 ft

5. Product Familiarisation.

5.1. Model Code Key

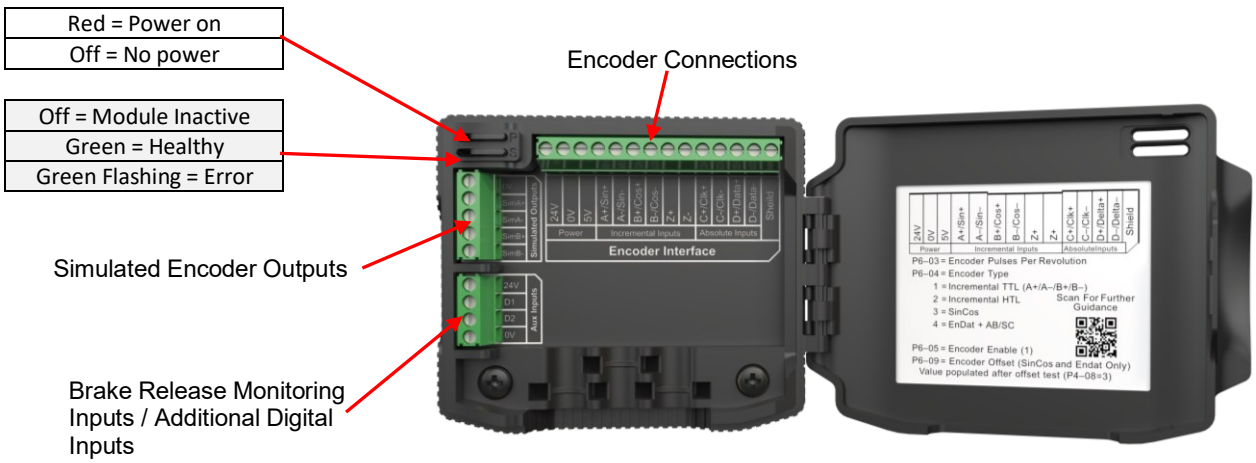


5.2. Product Layout



1	Power Supply Input Terminals
2	USB-C Port Used to light up the drive display and allow drive programming and parameter viewing (Using a device with USB-C output)
3	Optional Universal Encoder Module for closed loop operation
4	Motor Connection Terminals
5	RJ45 Port for Modbus RTU / CANopen / PC interface (NOT FOR ETHERNET!)
6	Digital Inputs/Outputs
7	Safe Torque-Off Inputs
8	Drive Serial Number and Rating
9	Digital, Analog Inputs/Outputs
10	Motor Brake Control Output
11	Motor Contactor Control Output (Default Function)
12	Trip reset Button (In addition to terminal & network reset)
13	Input EMC Filter and Varistor Circuit to earth Disconnect
14	DC Link EMC Filter Circuit to earth Disconnect
15	Brake Resistor Connection Terminals (Only Connect brake resistor between **+DC** and **BR**)
16	Encoder Status LED's
17	QR Code for on-line support documentation

5.3. Encoder Module Layout



6. Product Technical Information

6.1. 200 – 240 Volt (+/-10%), 1 Phase Input (50-60Hz +/- 5%)

Model Code	Power Rating		Frame Size	Input Current A	Fuse or MCB (Type B)		Maximum Supply/Motor Cable Size		Rated Output Current A	Overload	Recommended Brake Resistance Ω (Minimum)	*Resistor power rating (W)
	kW	HP			Non UL	UL	mm	AWG/ kcmil				
ODL-3-220105-142SB_	2.2	3	2	22	25	25	6	10	10.5	150% 60 sec's / 200% 2 sec's	35 (20)	1000

6.2. 200 – 240 Volt (+/-10%), 3 Phase Input (50-60Hz +/- 5%)

Model Code	Power Rating		Frame Size	Input Current A	Fuse or MCB (Type B)		Maximum Supply/Motor Cable Size		Rated Output Current A	Overload	Recommended Brake Resistance Ω (Minimum)	*Resistor power rating (W)
	kW	HP			Non UL	UL	mm	AWG/ kcmil				
ODL-3-220180-342SB_	4	5	2	22	25	30	6	10	18	150% 60 sec's / 200% 2 sec's	20 (20)	1000
ODL-3-220240-342SB_	5.5	7.5	2	27	32	35	6	10	24		20 (20)	1500
ODL-3-320300-342SB_	7.5	10.0	3	34	40	40	16	6	30		20 (12)	2000
ODL-3-420460-342SB_	11	15	4						46			
ODL-3-420610-342SB_	15	20	4						61			
ODL-3-420720-342SB_	18.5	25	4						72			

6.3. 380 – 480 Volt (+/-10%), 3 Phase Input (50-60Hz +/- 5%)

Model Code	Power Rating		Frame Size	Input Current A	Fuse or MCB (Type B)		Maximum Supply/Motor Cable Size		Rated Output Current A	Overload	Recommended Brake Resistance Ω (Minimum)	*Resistor power rating (W)
	kW	HP			Non UL	UL	mm	AWG/ kcmil				
ODL-3-240095-342SB_	4	5	2	14	16	20	6	10	9.5	150% 60 sec's / 200% 2 sec's	100 (40)	1000
ODL-3-240140-342SB_	5.5	7.5	2	21	32	30	6	10	14		75 (40)	1500
ODL-3-340180-342SB_	7.5	10	3	24	32	35	16	6	18		50 (22)	2000
ODL-3-340240-342SB_	11	15	3	30	40	40	16	6	24		40 (22)	3000
ODL-3-340300-342SB_	15	20	3	38	50	60	16	6	30		50 (22)	4000
ODL-3-440390-342SB_	18.5	25	4						39			
ODL-3-440460-342SB_	22	30	4						46			

6.4. Voltage Trigger Levels

	200-240V Rated Drive	380-480V Rated Drive
Braking Resistor Turn-On Voltage	390Vdc	780Vdc
Overvoltage	418Vdc	835Vdc
Undervoltage	160Vdc (24Vdc in Battery Rescue Operation)	320Vdc (24Vdc in Battery Rescue Operation)

Notes

- Ratings shown above apply to 50°C ambient temperature and a maximum of 10kHz switching frequency.
- For UL compliant installation, use copper wire with a minimum insulation temperature rating of 70°C, and UL Class CC or Class J Fuses
- For Non-UL/ IEC installation use gG fuses
- To meet UL regulations, UL approved ring crimp terminals should be used for all ground wiring connections
- Input currents assume a minimum of 1% supply impedance for single phase input drives, the input current can be reduced by increasing the supply impedance by installing input chokes.
- Input currents can vary from those shown depending on supply voltage and supply impedance.
- All 3 phase input 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) installation of input line reactors is recommended.

*The Resistor power rating shown is a guideline only, the values should be calculated based on the individual application, considering the braking power and duty cycle of the elevator.

6.5. Energy Efficiency

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

For more detailed information please visit www.invertekdrives.com/ecodesign to learn more about the Ecodesign Directive and for specific product efficiency classification and part load loss data in accordance with IEC 61800-9-2:2017

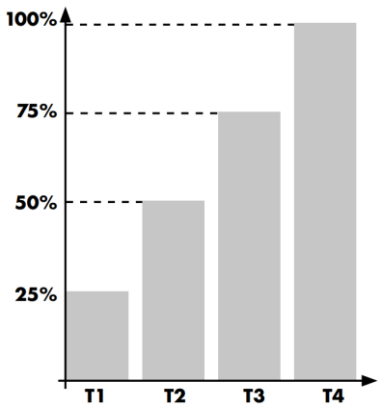
7. Mechanical Installation

7.1. Installation Following a Period of Storage

Where the drive has been stored for some time prior to installation, or has remained without the main power supply present for an extended period of time, it is necessary to reform the DC capacitors within the drive according to the following table before operation.

For drives which have not been connected to the main power supply for a period of more than 2 years, this requires a reduced mains voltage mains voltage to be applied for a time period, and gradually increased prior to operating the drive.

The voltage levels relative to the drive rated voltage, and the time periods for which they must be applied are shown in the following table. Following completion of the procedure, the drive may be operated as normal.



Storage Period / Power-OFF Period	Initial Input Voltage Level	Time Period T1	Secondary Input Voltage Level	Time Period T2	Third Input Voltage Level	Time Period T3	Final Input Voltage Level	Time Period T4
Up to 1 Year	100%	N/A						
1 – 2 Years	100%	1 Hour	N/A					
2 – 3 Years	25%	30 Minutes	50%	30 Minutes	75%	30 Minutes	100%	30 Minutes
More than 3 Years	25%	2 Hours	50%	2 Hours	75%	2 Hours	100%	2 Hours

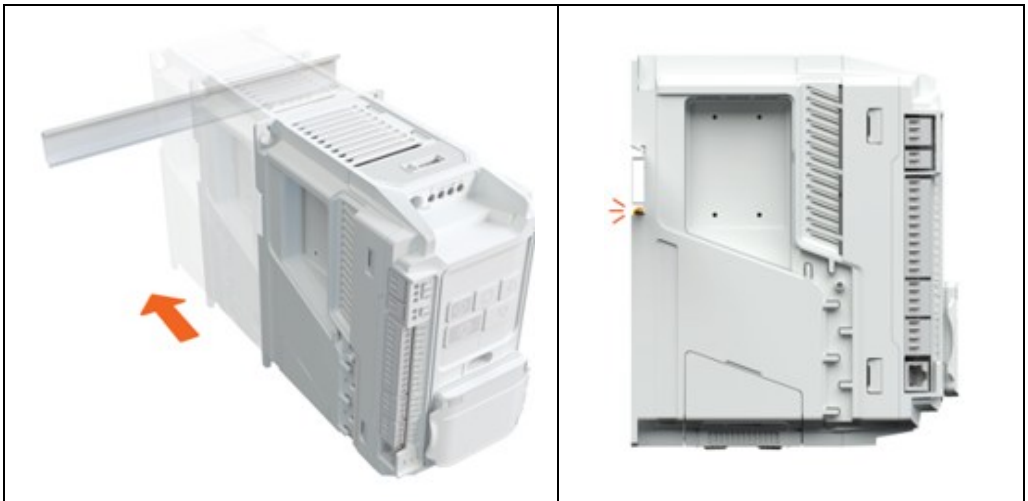
7.2. Preparing the drive for Mounting

Carefully remove the drive from its carton, check for damage etc.. Notify the shipper immediately if any exist.

7.3. Mounting Guidelines

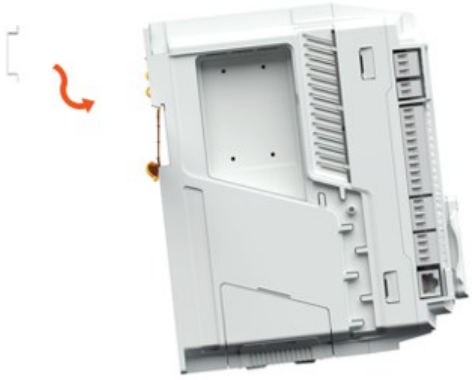
- The drive should be mounted prior to any wires being connected to the drive.
- For ease of installation the drive packaging carton has a mounting template to follow, ensuring dust from drilling does not enter the drive.
- Installation should be in a suitable enclosure, according to EN60529 or other 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, 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 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 drive should be mounted in a vertical position only, on a flat, flame resistant, vibration free mounting using the integral mounting holes.
- The drive must be installed in a pollution degree 1 or 2 environment only.
- Do not mount flammable material close to the drive.
- For drives mounted in non-ventilated metallic enclosures ensure that the minimum clearances below are met.
- Ensure that the ambient temperature where the drive will be installed does not exceed 50°C or below -20°C
- Ensure that the height above sea level where the drive will be installed does not exceed 1000m, if it does then refer to section 4.2.3
- Provide suitably clean, moisture and contaminant free cooling air sufficient to fulfil the cooling requirements of the drive.

7.3.1. DIN Rail Mounting (Frame Size 2 only)



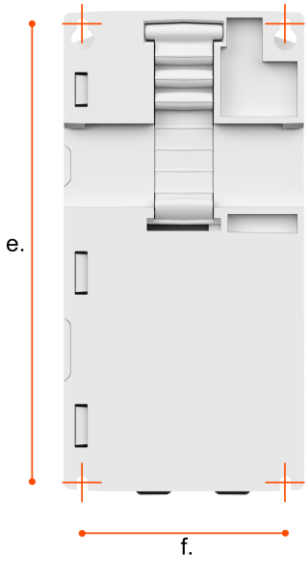
Push Directly onto Rail	Clicks into Position

7.3.2. DIN Rail Dis-Mounting (Frame Size 2 only)

		
Lift Up and twist Outwards	Pull down and away	Plastic Clip will be Disengaged

Din Rail Mounting system Patent pending GB 2625869.

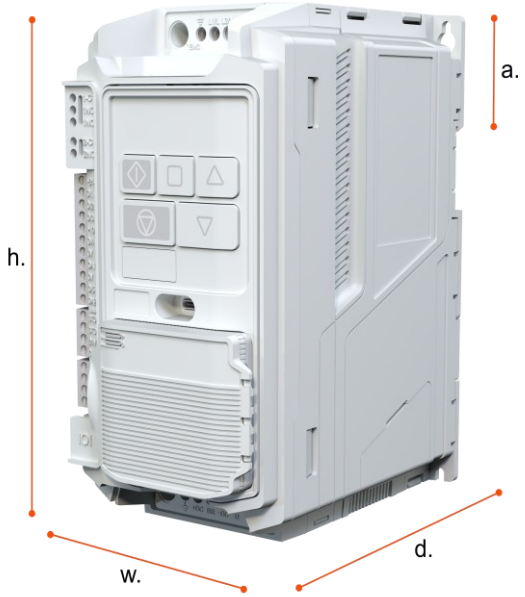
7.3.3. Using the Foot Mounting points



Mounting Points				
Drive Size	E		F	
	mm	in	mm	in
2	210	8.27	93	3.66
3	113	4.45	250	9.84
4	125	4.92	399	15.70

Mounting Bolts		
Drive Size	Metric	UNF
2	M5	#10
3	M5	#10
4	M6	1/4

7.4. Weights and Dimensions



Drive Size	H		W		D		Weight	
	mm	in	mm	in	mm	in	Kg	lb
2	220	8.66	110	4.33	184	7.24	1.8	4.0
3	264	10.39	131	5.16	207	8.15	3.5	7.7
4	418	16.46	172	6.77	254	10	10.36	22.9

Note: Dimensions Include Encoder module but not Cable support brackets

7.5. Required Clearances around the drive

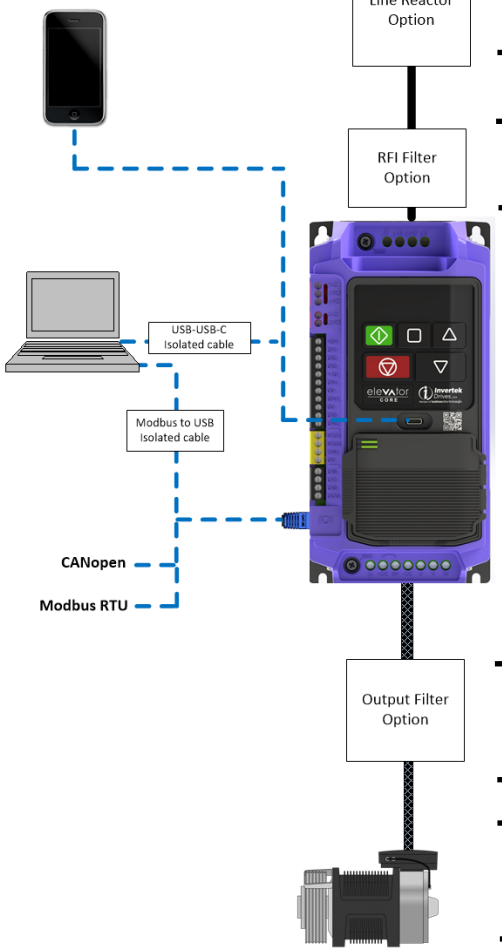
Drive Size	X		Y	
	mm	in	mm	in
2	75	2.95	50	1.97
3	100	3.94	50	1.97
4	200	7.87	10	0.39

7.6. Fitting the Encoder Module to the drive

0.5Nm / 4.4Ib-in

8. Electrical Installation

8.1. Electrical Installation quick reference diagram



- Check Supply Voltage does not exceed Voltage rating shown on the drive rating label.
- Check the number of supply phases is compatible with the drive as shown on drive rating label.
- 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 Invertek sales partner for further guidance.

- Ensure there is at least 30 seconds between power cycles.

- 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.

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 busbar and sliding contacts system.
- Reduction in mains Harmonic emission.

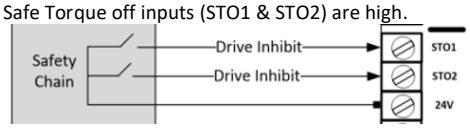
- Install External EMC filter if the motor cable length exceeds the Electromagnetic interference reduction capability of the internal filter per section 8.2.4.
- Do Not Use EMC filters on IT(Ungrounded)/corner grounded TN power supply system.

Functionality of control terminals is pre-configured according to parameter **P**1-02, default functionality is shown below :

DI1	DI2	DI3	DI4	DI5	DI6	DI7	DI8
Open Disabled/ Close Forward	Open Disabled/ Close Reverse	Open Disabled/ Levelling Speed (**P**8-05)	Open Disabled/ High Speed (**P**8-06)	Open Disabled/ High Speed 5 (**P**8-12)	Open Disabled/ Inspection Speed (**P**8-08)	Fault Reset	Rescue Mode Enable

The drive will only start if all of the below conditions are met:

1. Safe Torque off inputs (STO1 & STO2) are high.



2. A direction Command (DI1 or DI2) has been given.
3. At least 1 speed has been selected.

Note: If more than 1 speed selection input is high the highest speed will be used.

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”.

Encoder Wiring:

- 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.
- The maximum recommended Encoder cable length is 100mtrs, however the encoder datasheet should be referred to for Encoder specific maximum allowable cable length.

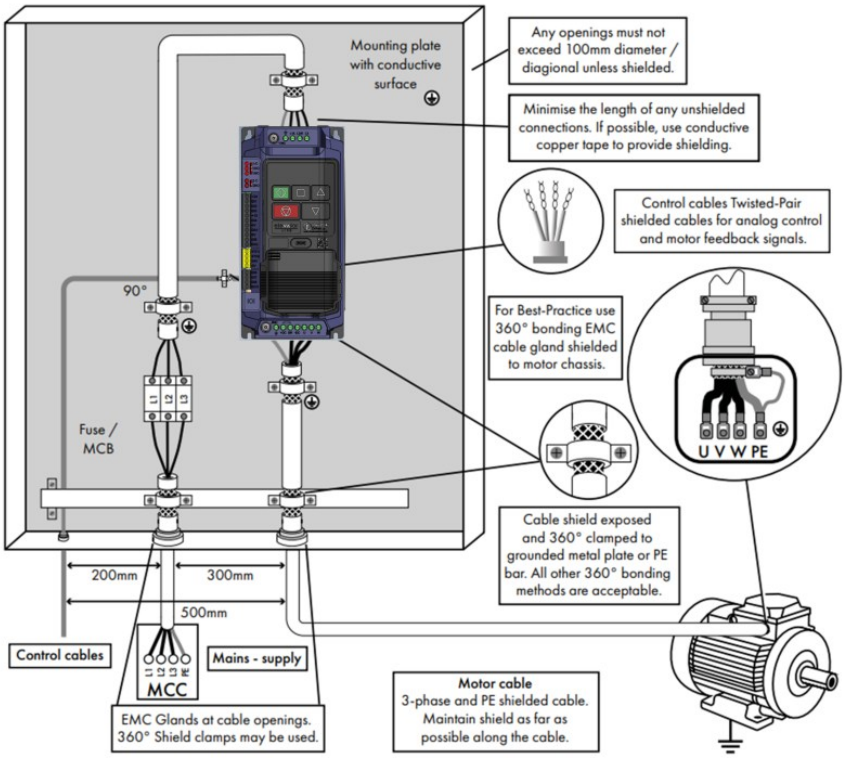
8.2. EMC Compliant Installation

8.2.1. Installation within the UK and European Union

All equipment installed within the UK or European Union must comply with the applicable UK or European EMC Directive. The installer must be familiar with the Directive and appropriate good EMC practice. Invertek Drives' products may be considered as a Basic Drive Module or Complete Drive Module according to the EMC standard definition dependent on the drive type. The BDM or CDM may then be incorporated into a Power Drive System. It is the sole responsibility of the installer to ensure that the complete PDS is compliant with the Directive.

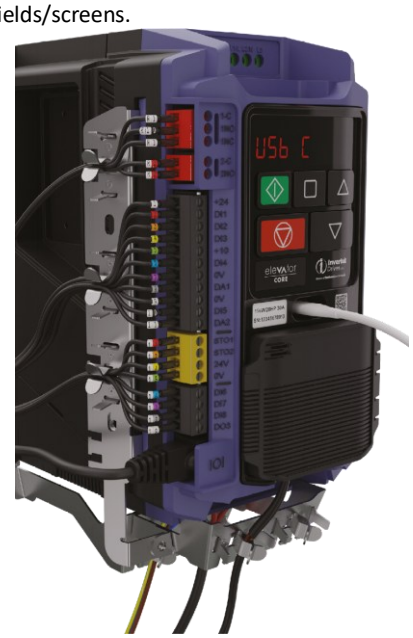
The diagram below provides general guidance to ensure compliance is achieved.

8.2.2. Recommended Installation for EMC compliance



8.2.3. Cable management bracket

An optional cable management bracket is available to allow easy termination of cable shields/screens.



Part Number
Size 2: OPT-3-L3EMC-S2-IN
Size 3: OPT-3-L3EMC-S3-IN

8.2.4. Maximum motor cable lengths in accordance with EMC category

Maximum Motor Cable Length to Achieve (m)		
C1 1,2,4,5,7	**C2** 3,4,5,7	**C3** 6,7
1	5	25

General

[1] Compliance with category C1 conducted emissions only is achieved.

Supply Cable

[2] A screened (shielded) cable suitable for fixed installation with the relevant mains voltage in use. 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. Installation of a standard cable within a suitable steel or copper tube is also acceptable - in this case, ensure that metal tube is adequately grounded.

[3] A cable suitable for fixed installation with relevant mains voltage with a concentric protection wire. Installation of a standard cable within a suitable steel or copper tube is also acceptable.

Motor Cable

[4] A screened (shielded) cable suitable for fixed installation with the relevant voltage in use. 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.

[5] The cable shield should be terminated at the motor end using an EMC type gland allowing connection to the motor body through the largest possible surface area. The shield must also be terminated at the drive end, as close as practically possible to the drive output terminals. Where drives are mounted in a steel control panel enclosure, the cable screen may be terminated directly to the control panel backplate using a suitable EMC clamp or gland fitted as close to the drive as possible. The drive earth terminal must also be connected directly to this point, using a suitable cable which provides low impedance to high frequency currents. For IP55 and IP66 drives, connect the motor cable shield to the gland plate or internal ground clamp.

Electrical Installation

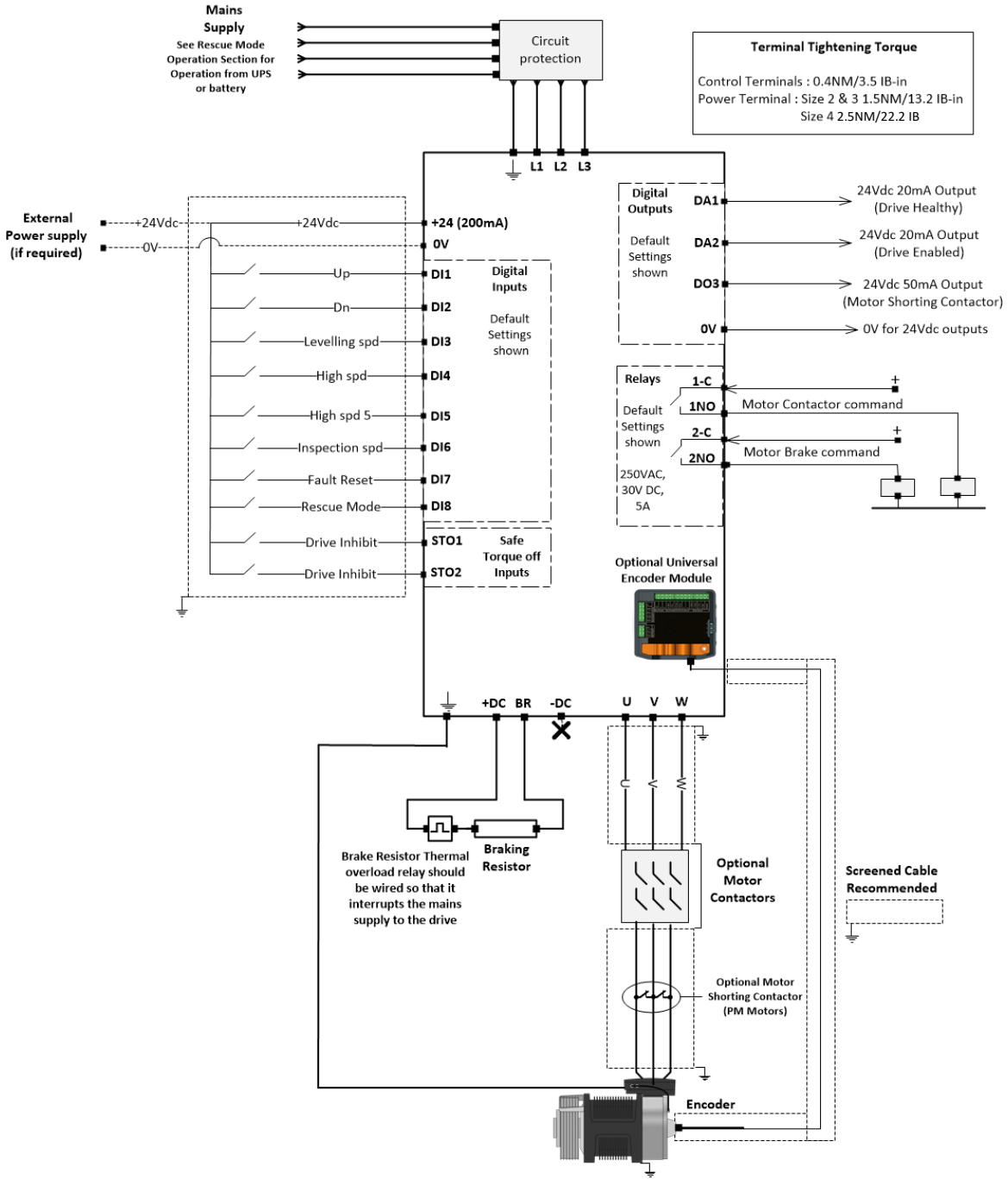
[6] A cable suitable for fixed installation with relevant voltage with a concentric protection wire. Installation of a standard cable within a suitable steel or copper tube is also acceptable.

Control Cable

[7] A shielded cable with low impedance shield. Double shielded twisted pair cable should be used for analog signals.

8.3. Overall Wiring Diagram and default terminal functions

Before making any wiring connections ensure that all voltage/power sources are isolated.



Note : From factory defaults the drive will only start if all of the below conditions are met:

1. Safe Torque off inputs (STO1 & STO2) are high.
2. A direction Command (DI1 or DI2) has been given.
3. At least 1 speed has been selected.

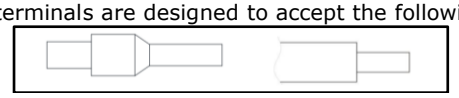
Note : Refer to Safe Torque of Section 19 for requirements of wiring protection.

8.4. Encoder Wiring Connections

Encoder Type	24V	0V	5V	A+/Sin+	A-/Sin-	B+/Cos+	B-/Cos-	C+ CLOCK	C- /CLOCK	D+ DATA	D- /DATA	Shield
Incremental TTL Differential		0V	5V	A+	A-	B+	B-					Cable Shield
Incremental HTL Differential	24V	0V		A+	A-	B+	B-					
Incremental TTL		0V	5V	A	Connect to 0V	B	Connect to 0V					
Incremental HTL	24V	0V		A	Connect to 0V	B	Connect to 0V					
SinCos (ERN 1387)		0V	5V	A+	A-	B+	B-	C+	C-	D+	D-	
Endat with Incremental Signals		0V	5V	A+	A-	B+	B-	CLOCK	/CLOCK	DATA	/DATA	
Endat without Incremental Signals		0V	5V					CLOCK	/CLOCK	DATA	/DATA	

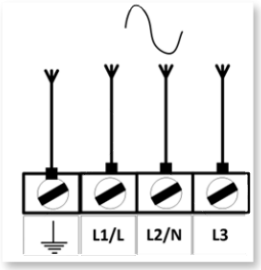
8.5. Cable Termination

The terminals are designed to accept the following termination methods (Bare conductor or Ferrule).



The control terminal entries are designed to accept a maximum cable/Ferrule of 3.3mm^2/12AWG.
Power and Motor cable sizes are detailed in the Product Technical Information section on page 11.

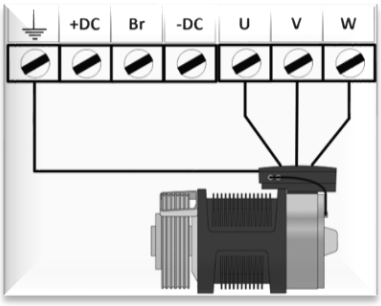
8.6. Power Supply Connections



- 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 is section 6 Product Technical Information.
- Suitable fuses to provide wiring protection of the input power cable should be installed in the incoming supply line, recommended ratings are given in section 6 Product Technical Information.. 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.

- A fixed installation is required according to IEC61800-5-1 with a suitable disconnecting device installed between the 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).
- 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.
- The maximum permissible short circuit current at the drive Power terminals as defined in IEC60439-1 is 100kA.
- 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 5 minutes should be allowed before removing the terminal covers or connection.
- An optional Input Choke/Line reactor 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.
- In all other installations, an input choke is recommended to ensure protection of the drive against power supply faults

8.7. Motor Connections



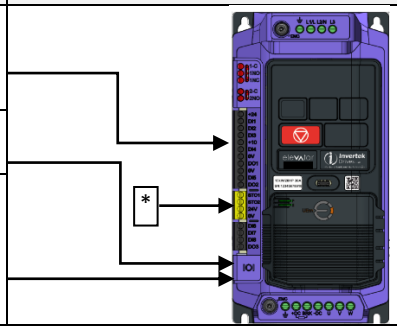
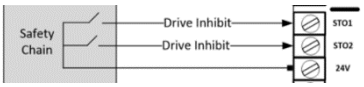
- There are sometimes multiple connections within the motor terminal box, in general: Star and Delta. It is essential to ensure that the motor is connected in accordance with the voltage at which it will be operated.
- Maximum Motor cable length for shielded type cables is 100mtrs/330ft (150mtrs/495ft for un-shielded cables).
- Note that the maximum motor cable length stated is the maximum permissible cable length for the drive hardware and does not take into consideration EMC compliance.
- The motor earth must be connected to one of the 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.
- 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.
- The motor must be connected to the 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 in section 8.2 alternatively the optional cable management bracket should be used as per shown in section 8.2.

8.8. Motor Contactors

Do not install any type of automatic switchgear between the drive and the motor which will change state whilst the drive is running, failure to do so will likely result in damage to the contactors as well as nuisance drive errors.
The drive STO SIL3 Inputs can be used to replace the motor contactors according to parts of EN 81-20:2014 and EN 81-50:2014.

8.9. Control Source Selection

From default the drive is set to operate from the control terminals (Discrete Inputs), control from a different method (Modbus rtu/CanOpen) can be achieved by changing the Primary Command Source in parameter **P**1-01.

P1-01	**Primary Command Source**	
Setting	**Start, direction and Speed reference source**	
tEr (Default)	The drive responds directly to control signals applied to the drive control terminals. Terminal designations assigned with parameter **P**1-02.	
rtU	The drive responds to Modbus RTU commands sent to the RJ45 port on the drive.	
CAn	The drive responds to CAN bus commands sent to the RJ45 port on the drive.	
*	**Note :** The drive will not start unless safe Torque inputs STO1 and STO2 are closed. 	

8.10. Control Input Terminal Functions

The status of the control terminals can be monitored using parameter **P**0-01 and **P**0-02.

P0-01 Display value	0	0	0	0	0
Function	Digital Input 1 status	Digital Input 2 status	Digital Input 3 status	Digital Input 4 status	Digital Input 5 status

P0-02 Display value	0	0	0	0	0
Function	Digital Input 6 status	Digital Input 7 status	Digital Input 8 status	Daux 1 Input Status	Daux 2 Input Status

Use the Macro tables below to select an appropriate value of **P**1-02 to match the elevator controller output signals.

E.g. if **P**1-02 = 1 then high speed is selected when terminal DI4 is on and **P**0-01 will show 00010

P1-02 Value ↓	**Drive Control Input Terminals**								**Speed Source**
	DI1	**DI2**	**DI3**	**DI4**	**DI5**	**DI6**	**DI7**	**DI8**	
0	User Configurable using group 12.								
*1 (Default)	*Open Disabled/ Close Forward	*Open Disabled/ Close Reverse	*Open Disabled/ Levelling Speed (**P**8-05)	*Open Disabled/ High Speed(**P**8-06)	*Open Disabled/ High Speed 5/Relevelling Speed (**P**8-12)	*Open Disabled/Inspection Speed (**P**8-08)	Fault Reset	Rescue Mode Enable	If more than 1 speed selection input is high the highest speed will be used.
*2	*Open Disabled/ Close Forward	*Open Disabled/ Close Reverse	*Open Disabled/ Levelling Speed (**P**8-05)	*Open Disabled/ High Speed(**P**8-06)	Ok when closed / E-Trip when open or thermistor trip if thermistor function selected in **P**1-09 Analog Input 2 (DI5) Format or motor contactor feedback trip if **P**3-02 is set to 1 (Enabled)	*Open Disabled/ Inspection Speed (**P**8-08)	Fault Reset	Rescue Mode Enable	

*For settings 1 and 2 above, the drive will only start if all the below conditions are met and in the correct sequence.
1. Safe Torque off inputs are enabled.
2. A direction Command (DI1 or DI2) has been given.
3. At least 1 speed has been selected.

Note : If more than 1 speed selection input is high the highest speed will be used.

P1-02 Value ↓	Drive Control Input Terminals								Speed Source
	DI1	**DI2**	**DI3**	**DI4**	**DI5**	**DI6**	**DI7**	**DI8**	
3	Open Disabled/ Close Forward	Open Disabled/ Close Reverse	1	0	0	Ok when closed / E-Trip when open or motor contactor feedback trip if **P**3-02 is set to 1 (Enabled)	Fault Reset	Rescue Mode Enable	**P**8-06 (High Speed)
			0 or 1	0	1				**P**8-07 (Intermediate Speed)
			0 or 1	1	0 or 1				**P**8-08 (Inspection Speed)
			0	0	0				**P**8-05 (Levelling Speed)
4	Open Disabled/ Close Forward	Open Disabled/ Close Reverse	1	0	Ok when closed / E-Trip when open or thermistor trip if thermistor function selected in **P**1-09 Analog Input 2 (DI5) Format or motor contactor feedback trip if **P**3-02 is set to 1 (Enabled)	0	Fault Reset	Rescue Mode Enable	**P**8-06 (High Speed)
			0 or 1	0		1			**P**8-07 (Intermediate Speed)
			0 or 1	1		0 or 1			**P**8-08 (Inspection Speed)
			0	0		0			**P**8-05 (Levelling Speed)
5	Open Disabled/ Close Forward	Open Disabled/ Close Reverse	0	0	0	No Function	Fault Reset	Rescue Mode Enable	**P**8-05 (Levelling Speed)
			1	0	0				**P**8-06 (High Speed)
			0	1	0				**P**8-07 (Intermediate Speed)
			1	1	0				**P**8-08 (Inspection Speed)
			0	0	1				**P**8-09 (Speed 2)
			1	0	1				**P**8-10 (Speed 3)
			0	1	1				**P**8-11 (Speed 4)
			1	1	1				**P**8-12 (Speed 5)
6	Open Disabled/ Close Forward	Open Disabled/ Close Reverse	No Function	Speed Reference from Analogue input	Ok when closed / E-Trip when open or thermistor trip if thermistor function selected in **P**1-09	Ok when closed / E-Trip when open or motor contactor feedback trip if **P**3-02 is set to 1 (Enabled)	Fault Reset	Rescue Mode Enable	Analogue input Ref level
7	Open Disabled/ Close Forward	Open Disabled/ Close Reverse	Open Disabled/ Levelling Speed (**P**8-05)	Torque Sensor Input	Open Disabled/ High Speed (**P**8-06)	Open Disabled/Inspection Speed (**P**8-08)	Fault Reset	Rescue Mode Enable	If more than 1 speed selection input is high the highest speed will be used.

For settings 3,4,5,6,7 above, the drive will only start if all the below conditions are met and in the correct sequence.

1. Safe Torque off inputs are enabled.
2. A direction command (DI1 or DI2) has been given.
3. At least 1 speed has been selected (For Macros 3,4,5)

P1-02 Value ↓	Drive Control Input Terminals								Speed Source
	DI1	**DI2**	**DI3**	**DI4**	**DI5**	**DI6**	**DI7**	**DI8**	
8	Open Disabled/ Close Forward	Open Disabled/ Close Reverse	0	0	Brake Release Monitor Input 1 (Only Active if **P**5-04 Brake Release Monitoring Enable is set to a value of 2)	Brake Release Monitor Input 2 (Only Active if **P**5-04 Brake Release Monitoring Enable is set to a value of 2)	Fault Reset	Rescue Mode Enable	**P**8-05 (Levelling Speed)
			1	0					**P**8-06 (High Speed)
			0	1					**P**8-07 (Intermediate Speed)
			1	1					**P**8-08 (Inspection Speed)
For settings 8 above, the drive will only start if all the below conditions are met and in the correct sequence. 1. Safe Torque off inputs are enabled. 2. A direction command (DI1 or DI2) has been given.									
*9	Forward Direction Select	Reverse Direction Select	Rescue Mode Enable	0	0	0	No Function	Drive Enable	**P**8-05 (Levelling Speed)
				1	0	0			**P**8-06 (High Speed)
				0	1	0			**P**8-07 (Intermediate Speed)
				1	1	0			**P**8-08 (Inspection Speed)
				0	0	1			**P**8-09 (Speed 2)
				1	0	1			**P**8-10 (Speed 3)
				0	1	1			**P**8-11 (Speed 4)
				1	1	1			**P**8-12 (Speed 5)
*Setting 9 above has a different operation (in terms of Motor contactor control) to all other operating modes: When a direction command is given the motor contactor relay will Close and normal contactor sequence will begin, however the drive will not start until STO inputs are closed and then Digital Input 8 (Drive Enable signal) has been given.									
10	Open Disabled/ Close Forward	Open Disabled/ Close Reverse	0	0	Ok when closed / E-Trip when open or thermistor trip if thermistor function selected in **P**1-09 Analog Input 2 (DI5) Format	Ok when closed / E-Trip when open or motor contactor feedback trip if **P**3-02 is set to 1 (Enabled)	Ok when closed / E-Trip when open or Brake resistor monitor feedback trip if **P**3-06 is set to 1 (Enabled)	Rescue Mode Enable	**P**8-05 (Levelling Speed)
			1	0					**P**8-06 (High Speed)
			0	1					**P**8-07 (Intermediate Speed)
			1	1					**P**8-08 (Inspection Speed)

P1-02 Value ↓	Drive Control Input Terminals								Speed Source
	DI1	DI2	DI3	DI4	DI5	DI6	DI7	DI8	
11	Forward Direction Select	Reverse Direction Select	Rescue Mode Enable	0	0	0	No Function	No Function	**P**8-05 (Levelling Speed)
				1	0	0			**P**8-06 (High Speed)
				0	1	0			**P**8-07 (Intermediat e Speed)
				1	1	0			**P**8-08 (Inspection Speed)
				0	0	1			**P**8-09 (Speed 2)
				1	0	1			**P**8-10 (Speed 3)
				0	1	1			**P**8-11 (Speed 4)
				1	1	1			**P**8-12 (Speed 5)
*Setting 11 above has a different operation (in terms of Motor contactor control) to all other operating modes: When a direction command is given the motor contactor relay will Close and normal contactor sequence will begin, however the drive will not start until STO inputs are closed.									
12	Open Disabled/ Close Forward	Open Disabled/ Close Reverse	1	0	Open = Coast to Stop Closed = No Action	No Function	Fault Reset	Rescue Mode Enable	**P**8-06 (High Speed)
			0 or 1	1					**P**8-08 (Inspection Speed)
			0	0					**P**8-05 (Levelling Speed)

8.10.1. Motor Contactor Sequence

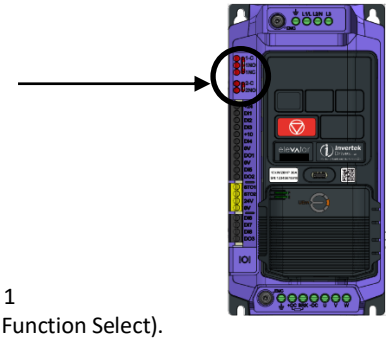
The table below defines for each macro setting what signals are required at the drive terminals to close the motor contactor and in what sequence as shown in (x)

Macro Number	Safe Torque off signals	Direction Signal	Speed Source Signal	Motor Contactor state (As driven by Relay 1)
1,2,3,4,5,6,7,8,10,12	On (1st)	On (2nd)	On (3rd)	Closed
9,11	On/Off	On	On/Off	Closed (Driven By Direction Signal only)

8.10.2. Positive and Negative Logic

By default, the drive operates in positive logic, **P**1-43 set to 1 allows negative logic operation (Not STO1 and STO2 inputs)

8.11. Control Output Terminal Functions



8.11.1. User Relays

The drive has 2 relays, they can be used to switch external resistive loads up to :

Relay 1	8A/250VAC	10A/30VDC
Relay 2	N/C = 5A/250VAC N/O = 6A/250VAC	N/C = 5A/30VDC N/O = 6A/30VDC

Relay 2 provides an open or closed contact and has a fixed function of motor brake control.

Relay 1 has both normally open and normally closed contacts available; by default, the function of Relay 1 is to control the motor contactors, if an alternative function is required adjust parameter **P**1-30 (Relay 1 Function Select).

Parameter Number	Parameter Name	Available Settings			Default
P1-30	**Relay 1 Function Select**	**Setting**	**Status/Function Source**	**Conditions for Status**	1
		0	Drive Enabled (Running)	Logic 1 when Drive is enabled and output stage is on	
		1	Drive Healthy	Logic 1 When no Fault condition exists on the drive. (“inH” is not included as a fault)	
		2	Motor at Zero speed	Logic 1 when motor speed is </=minimum output frequency (**P**8-02) or </= DC injection at stop speed (**P**9-15)	
		3	Motor at Target speed	Logic 1 when the output frequency matches the setpoint speed	
		4	Motor Speed > 0	Logic 1 when the motor runs above zero speed	
		5	Motor Speed >/= Limit	Logic 1 when the motor speed exceeds the adjustable limit as per set in **P**1-35 and **P**1-36	
		6	Motor Current >/= Limit	Logic 1 when the motor current exceeds the adjustable limit as per set in **P**1-35 and **P**1-36	
		7	Motor Torque >/= Limit	Logic when the motor torque exceeds the adjustable limit as per set in **P**1-35 and **P**1-36	
		8	STO Status	Logic 1 when both STO inputs are present, and the drive is able to be operated	
		9	Rescue Mode active	Logic 1 when the drive is operating in Rescue Mode	
		10	2nd Anip > limit	Logic when the signal applied to terminal DI5 (Analog Input 2) exceeds the adjustable limit as per set in **P**1-35 and **P**1-36	
		Note: When using settings 5, 6, 7, 10, parameters **P**1-35 and **P**1-36 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**1-35 and return to Logic 0 when the signal falls below the value in **P**1-36.			
		11	Motor Contactor control	Used to control the operation of a motor contactor.	
		12	Motor Shorting Contactor control	Used to control the operation of a motor shorting contactor.	
		13	Direction of Travel	Logic 1 when direction down, Logic 0 when stopped/direction up. (Fwd cmd given and speed is positive): UP direction means UP command has been given and motor turns clockwise (Looking at shaft) and motor speed is positive.	
		14	Service Indicator	Logic 1 when service time interval set in **P**11-17 has been met	
		15	Brake Control	Used to control the motor brake.	
		16	Door Zone	Logic 1 when motor speed equals (**P**10-02 Early Door Opening Speed Threshold).	
		17	Light Load direction	Logic 0=Easiest direction is up, Logic 1=easiest direction is downwards.	
		18	Travel limit counter reached	Logic 1 when Travel Direction Change Counter limit **P**10-05 has been reached.	
		19	Set speed and actual speed > P1-42	Logic 1 when the % difference (as per set in Speed following error **P**1-42) is exceeded between set speed and the actual speed (estimated speed in open loop/encoder speed in closed loop-with encoder)	
		20	Alarm	Logic 1 when an alarm is active, e.g **P**3-07 has been set to 2.	

8.11.2. Digital and Analogue Outputs

DA1 and DA2 Outputs can operate as either a Digital Output or an Analog Output, whereas DO3 Output operates as a Digital Output only.

Parameter Number	Parameter Name	Available Settings	Default
P1-15	**DA1 Digital Output 1 Function Select**		1
P1-22	**DA2 Digital Output 2 Function Select**		0
P1-28	**DO3 Digital Output 2 Function Select**		12

Setting	Status/Function Source	Conditions for Status (Default Logic 1 = 24Vdc output)
0	Drive Enabled (Running)	Logic 1 when Drive is enabled and output stage is on
1	Drive Healthy	Logic 1 When no Fault condition exists on the drive. ("inH" is not included as a fault)
2	Motor at Zero speed	Logic 1 when motor speed is </=minimum output frequency (**P**8-02) or </= DC injection at stop speed (**P**9-15)
3	Motor at Target speed	Logic 1 when the output frequency matches the setpoint frequency
4	Motor Speed > 0	Logic 1 when the motor runs above zero speed
5	Motor Speed >/= Limit	Logic 1 when the motor speed exceeds the adjustable limit as per detailed in note below.
6	Motor Current >/= Limit	Logic 1 when the motor current exceeds the adjustable limit as per detailed in note below.
7	Motor Torque >/= Limit	Logic when the motor torque exceeds the adjustable limit as per detailed in note below.
8	STO Status	Logic 1 when both STO inputs are present, and the drive is able to be operated
9	Rescue Mode active	Logic 1 when the drive is operating in Rescue Mode
10	2nd Anip > limit	Logic when the signal applied to the DI5 (Analog Input 2) exceeds the adjustable limit as per detailed in note below.
Note: When using settings 5 – 7, 10, parameters **P**1-31 and **P**1-32 (For DA1), **P**1-33 and **P**1-34 (For DA2), **P**1-38 and **P**1-39 (For DO3) must be used together to control the behaviour. e.g the output will switch to Logic 1 when the selected signal exceeds the value programmed in **P**1-31 (Upper Limit) and return to Logic 0 when the signal falls below the value in **P**1-32 (Lower Limit).		
11	Motor Contactor control	Used to control the operation of a motor contactor.
12	Motor Shorting Contactor control	Used to control the operation of a motor shorting contactor.
13	Direction of Travel	Logic 1 when direction down, Logic 0 when stopped or direction up. (Forward command given and speed is positive): UP direction means UP command has been given and motor turns clockwise (Looking at the shaft) and motor speed is positive.
14	Service Indicator	Logic 1 when service time interval as per set in **P**11-17 has been met
15	Brake Control	Used to control the motor brake.
16	Door Zone	Logic 1 when motor speed equals (**P**10-02 Early Door Opening Speed Threshold).
17	Light Load direction	Logic 0=Easiest direction is up, Logic 1=easiest direction is downwards.
18	Travel limit counter reached	Logic 1 when Travel Direction Change Counter limit **P**10-05 has been reached.
19	Set speed and actual speed > P1-42	Logic 1 when the % difference (as per set in Speed following error **P**1-42) is exceeded between set speed and the actual speed (estimated speed in open loop/encoder speed in closed loop-with encoder)
20	Alarm	Logic 1 when an alarm is active, for example when **P**3-07 has been set to 2.

9. Using the Keypad

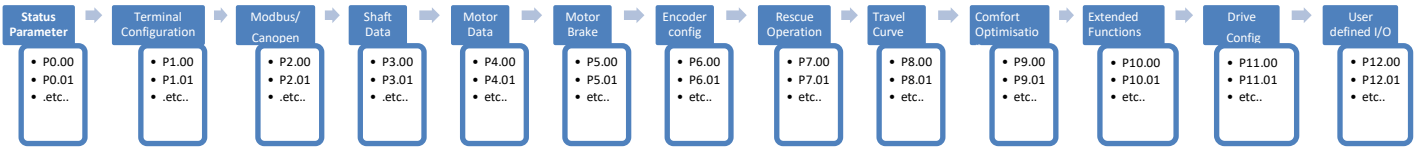
The drive can be configured, and its operation monitored via the keypad and display.

9.1. Keypad Layout and Function

	NAVIGATE	Used to display real-time information, to access and exit parameter edit mode and to store parameter changes
	UP	Used to increase parameter values in parameter edit mode
	DOWN	Used to decrease parameter values in parameter edit mode
	RESET	Used to reset a tripped drive.
	Used in combination with the UP, DOWN and RESET buttons to perform a factory reset of the drive parameters.	

9.2. Parameter Map

There are 12 groups of editable Parameters within the drive, for ease of parameter navigation the groups are ordered in alignment with the order of work when commissioning a typical system.



9.3. Changing Parameters

Procedure	Display shows...
Power on the Drive	StoP Inhibit
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

9.4. Resetting Parameters to Factory Default Settings

Note:

- Parameters cannot be defaulted whilst **P**11-03=1 (Parameter Access Lock).

9.5. Resetting Parameters to OEM Default Settings

P11-01 (Save user parameters as OEM default) can be enabled (set to 1) to invoke a parameter save of the current parameter values as the OEM defaults for the drive, USr-PS will be shown to indicate a successful save.

The user can recall **OEM defaults** settings by following the below procedure.

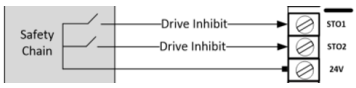
Note:

- Parameters cannot be defaulted whilst **P**11-03=1 (Parameter Access Lock).

9.6. Showing Difference from defaults.

Difference from default values can be shown by setting parameter **P**0-00 (Show Difference from defaults) to a value of 1, once set only the parameters which have been changed by the user will be displayed.

9.7. Drive Operating Displays

Display	Status	
StoP	Drive mains power applied, but no Enable or Run signal applied	
AUto-t	Motor Autotune in progress.	
H H_H	Drive running, display shows output frequency (Hz)	Whilst the drive is running, the following displays can be selected by briefly pressing the mode button on the drive. Each press of the ▢ button will cycle the display through to the next selection.
r H_H	Drive running, display shows motor Speed in rpm providing P4-06 (Motor Rated speed) value has been entered, if not entered then this Display status is skipped	
A H_H	Drive running, display shows motor current (Amps)	
P H_H	Drive Running, display shows motor power (kW)	
L H_H	Drive Running, display shows motor speed in linear units (e.g. m/s or ft/s). P3-08 (Sheave diameter), P3-09 (Roping Ratio) , P3-10 (Gear Ratio), P4-06 (Motor rated speed) must be set correctly.	
C H_H	Drive Running, display shows customer selected units, see parameters P11-11 and 11-12	
UP H_H dn H_H	When in rescue mode (with encoder) the direction of travel can be displayed, it is assumed that when a run up (forward) command (e.g. terminal 2 closed) is given the motor rotates clockwise (looking at the motor with the sheave facing you).	
Etc-24	Drive mains power not present, external 24 Volt control power supply present only	
Inhibt	Output power hardware inhibited, Safe Torque Off function activated. Note: Both STO inputs need to be high to take the drive out of this state, this is normally part of the system safety chain. 	
P-dEF	Parameters reset to factory default settings	
U-dEF	Parameters reset to User default settings (**P**11-01=1)	
USb C	Drive is powered from the USB-C port	
USb P	Drive is powered from the USB-C port, but data transfer is disabled (**P**2-13=0)	

Fault messages can be found in section 21 Troubleshooting.

9.8. Elevator Specific Linear Units

The drive provides the user with the option to operate in linear 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**4-06**)**
- Sheave Diameter (**P**3-08**)** (<100 drive assumes inches)/(>100 drive assumes mm)
- Roping Ratio (**P**3-09)
- Gear Ratio for Geared (Induction) systems (**P**3-10)

Note: If P4-06 **and P**3-08 **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 ▢ button until "L " is shown in the left side of the display and all speed and jerk parameters will operate in linear units mode.

10.First Start-up of Geared (Induction) Motors without an Encoder.

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

10.1. Step 1- Wiring Connections.

It is assumed the drive is connected as per Section 8.3 Overall Wiring Diagram and default terminal functions.

10.2. Step 2- Pre-Power Checks.

Action/Checks	Additional Information
 **Do Not Apply Electrical Power Yet!**	☐ Check that all safety circuits/safety chains are in the correct state, failure to do so could result in unexpected movement of the lift car, damage to the equipment and possible injury or death. ☐ Check that the intended voltage source matches that of the drive voltage rating. ☐ Check that any unexpected movement in the motor will not result in damage to equipment / safety risk to persons. ☐ Check that the elevator controller will not give a start signal to the drive when Electrical power is applied. ☐ Ideally the Lift car should be balanced (i.e. with brakes off the lift car should not naturally move) and with enough shaft headroom to prevent reaching end stops during initial test travels.
Check all necessary electrical connections.	☐ Check Electrical Supply cables are connected to the Input power terminals of the drive. ☐ Check Motor Cables are connected to the drive U, V, W terminals (if cables have identification markers connect correct phase sequence). ☐ Check Brake resistor is connected to the "+DC" and "BR" terminals of the drive and that the resistance is higher than the minimum allowable value (as shown in section 6 Product Technical Information) and the resistor is suitably protected from thermal overload. ☐ Check correct control connections are made between the Elevator control panel and the drive.(as detailed in section 8.3 Overall Wiring Diagram and default terminal functions).

10.3. Step 3- Apply Power.

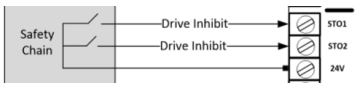
Apply Electrical Power to the drive	☐ Apply rated voltage to the drive. ☐ Check that the drive displays StoP or Inhibit.	➢ If StoP or Inhibit is not shown refer to the section 21 Troubleshooting..

10.4. Step 4- Motor nameplate data entry.

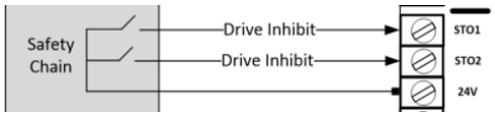
Action		Additional Information
Select Geared (Induction) motor control	☐ Set **P**4-01 to 0	
Enter Motor Rated Voltage (P4-02)	☐ Enter value into **P**4-02	Enter Voltage value as shown on the motor nameplate (Volts).
Enter Motor Rated Current (P4-03)	☐ Enter value into **P**4-03	Enter Current value as shown on the motor nameplate (Amps).
Enter Motor Rated Frequency (P4-04)	☐ Enter value into **P**4-04	Enter Frequency value as shown on the motor nameplate (Hz).
Enter Number of Motor Poles (P4-05)	☐ Enter value into **P**4-05	Enter motor pole value as shown on the motor nameplate, if unknown set **P**4-05 to 0 where the drive will automatically calculate the value providing **P**4-04 (Motor rated frequency) and **P**4-06 (Motor rated speed) have been entered correctly.
Enter Motor Rated Speed (P4-06)	☐ Enter value into **P**4-06	Enter motor rated speed value as shown on the motor nameplate (rpm). The 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.
Enter Motor power factor Cos Ø (P4-07)	☐ Enter value into **P**4-07	• Obtained from Motor nameplate. • If Motor power factor is unknown leave as default value. Note: When the motor is running and at rated load current, parameter **P**0-22 displays the measured power factor value, and this can then be entered into **P**4-07.
Enter the Maximum speed (P8-01)	☐ Enter value into **P8**-01	This is the maximum allowable speed in rpm.

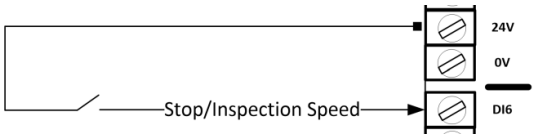
10.5. Step 5- Motor Auto-tune.

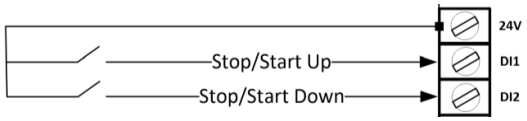
A Motor Auto-tune must be carried out to measure the motor electrical characteristics, during this test brakes will be applied by the drive (unless controlled by other means).

Action		Additional Information
☐ If the motor contactor(s) are controlled by the elevator controller then they should be activated to close so that the motor is electrically connected to the drive, otherwise the "Auto-tune" cannot be carried out and the drive will trip AtF-02. **☐ If the motor contactor(s) are controlled by the drive (connected to relay 1) the motor contactor will automatically be energised when the "Auto-tune" is enabled.**		
☐ Check Safe Torque off input connections have been made.		Drive should now show StoP if not see section 21 Troubleshooting. The STO input status can be viewed in parameter P0-03 (0 = Open 1 = Closed)
☐ Enable Stationary Motor Auto-tune	Set **P**4-08 to a 1 and press ▢ on the drive keypad.	1. The motor contactors will close (if controlled by the drive "Relay 1"). 2. The motor brakes will remain applied. (Relay 2 as default) 3. The display will show AUto-t. (Test procedure may take several seconds to complete). Note : If the drive trips refer to section 21 Troubleshooting. 4. The motor contactors will open once the test has completed. (Relay 1 controlled by default) Once the Auto-tune is completed **P**4-08 will return to 0 and the display will show StoP (**P**4-24 thru to **P**4-28 will be populated). **Note:** Motor Auto-tune will need to be repeated if the motor, motor cables, motor parameters or drive control mode is changed in **P**4-01.

10.6. Step 6 – Running the Elevator

<table>
<tr><th>Action</th><th>Guidance</th></tr>
<tr><td>☐ Check for Suitable travel headroom</td><td>Ideally the Lift car should be balanced (i.e. with brakes off, the lift car should not naturally move) and with enough shaft headroom to prevent reaching end stops during initial test travels.</td></tr>
<tr><td rowspan="4">☐ Run the elevator at reduced speed.</td><td>☐ Close ST01 & STO2 inputs and the drive should show StoP
 


</td></tr>
<tr><td>☐ Provide a reduced speed reference to the drive.
☐ Inspection speed terminal can be used. If P1-02 is at default value (P1-02=1) then inspection speed is defined in parameter P8-08, in this case inspection speed is selected when DI6 is high.
 

☐ Alternatively, the maximum speed parameter (P8-01) can be used to limit the maximum speed reference.</td></tr>
<tr><td>☐ Provide a run-direction command to the drive.
 
</td></tr>
<tr><td>If the drive trips refer to section 21 Troubleshooting.</td></tr>
<tr><td colspan="2">☐ If no problems are encountered then the lift can now be run normally.</td></tr>
<tr><td colspan="2">☐ Got to section 14 to further optimise travel comfort.</td></tr>
</table>

11. First Start-up of Geared (Induction) Motors with an Encoder.

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

11.1. Step 1- Wiring Connections.

It is assumed the drive is connected as per Section 8.3 Overall Wiring Diagram and default terminal functions.

11.2. Step 2- Pre-Power Checks.

Action/Checks	Additional Information
 **Do Not Apply Electrical Power Yet!**	☐ Check that all safety circuits/safety chains are in the correct state, failure to do so could result in damage to the equipment and possible injury or death. ☐ Check that the intended voltage source matches that of the drive voltage rating. ☐ Check that any unexpected movement in the motor will not result in damage to equipment / safety risk to persons. ☐ Check that the elevator controller will not give a start signal to the drive when Electrical power is applied. ☐ Ideally the Lift car should be balanced (i.e. with brakes off the lift car should not naturally move) and with enough shaft headroom to prevent reaching end stops during initial test travels.
Check all necessary electrical connections to the drive.	☐ Check Electrical Supply cables are connected to the Input power terminals of the drive. ☐ Check Motor Cables are connected to the drive U, V, W terminals (If cables have identification markers connect correct phase sequence). ☐ Check Brake resistor is connected to the "+DC" and "BR" terminals of the drive and that the resistance is higher than the minimum allowable value (as shown in section 6 Product Technical Information) and the resistor is suitably protected from thermal overload. ☐ Check correct control connections are made between the Elevator control panel and the drive. (as detailed in section 8.3 Overall Wiring Diagram and default terminal functions).
Check all necessary electrical connections to the Encoder Module.	☐ Check encoder module has been installed and the correct connections are made between the drive and the Encoder. as detailed in Section 8.3 Overall Wiring Diagram and default terminal functions ☐ The encoder module expects that the Encoder A channel leads the B channel when the motor is running clockwise (looking in the direction of the motor shaft), if this is not the case then parameter **P**6-02 (Encoder feedback direction) can be set to a 1 to change the sequence internally in the drive.

11.3. Step 3- Apply Power.

Apply Electrical Power to the drive	☐ Apply rated voltage to the drive. ☐ Check that the drive displays StoP or Inhibit. ☐ Check that the Encoder module Top LED light is illuminated Red	➢ If StoP or Inhibit is not shown or a red light is shown on the encoder module refer to section 21 Troubleshooting. ➢ If there is no red light shown on the encoder module : ○ Check encoder module is pushed fully home. ○ Check the encoder wiring is correct. 

11.4. Step 4- Motor nameplate data entry.

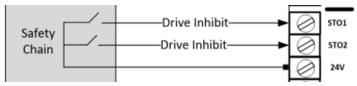
Action		Additional Information
Select Geared (Induction) motor control	☐ Set **P**4-01 to 0	
Enter Motor Rated Voltage (P4-02)	☐ Enter value into **P**4-02	Enter Voltage value as shown on the motor nameplate (Volts).
Enter Motor Rated Current (P4-03)	☐ Enter value into **P**4-03	Enter Current value as shown on the motor nameplate (Amps).
Enter Motor Rated Frequency (P4-04)	☐ Enter value into **P**4-04	Enter Frequency value as shown on the motor nameplate (Hz).
Enter Number of Motor Poles (P4-05)	☐ Enter value into **P**4-05	Enter motor pole value as shown on the motor nameplate, if unknown set **P**4-05 to 0 where the drive will automatically calculate the value providing **P**4-04 (Motor rated frequency) and **P**4-06 (Motor rated speed) have been entered correctly.
Enter Motor Rated Speed (P4-06)	☐ Enter value into **P**4-06	Enter motor rated speed value as shown on the motor nameplate (rpm). The 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.
Enter Motor power factor Cos Ø (P4-07)	☐ Enter value into **P**4-07	• Obtained from Motor nameplate. • If Motor power factor is unknown leave as default value. Note: When the motor is running at rated load current, parameter **P**0-22 displays the measured power factor value, and this can then be entered into **P**4-07.
Enter the Maximum speed (P8-01)	☐ Enter value into **P8**-01	This is the maximum allowable speed in rpm.

11.5. Step 5 - Encoder Setup

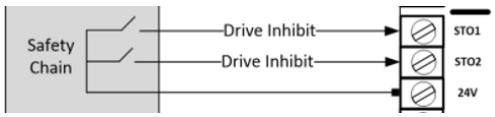
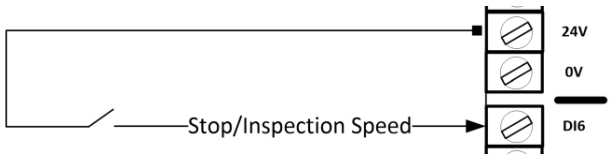
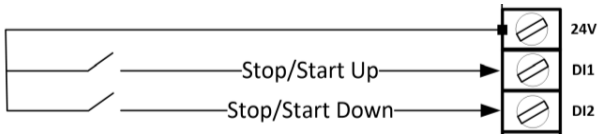
Action		Additional Information	
Enter Encoder Resolution	☐ Enter encoder pulses per revolution into **P**6-03	Refer to Encoder datasheet or nameplate.	
Select Encoder Type	☐ Select the Encoder type in parameter **P**6-04	**P6-04 setting**	**Encoder Type**
		0 (Default)	No Encoder Type Selected
		1	Incremental TTL- Differential (A,/A,B,/B) (RS422)
		2	Incremental HTL-Differential (A,/A,B,/B) (24V)
		5	Incremental TTL- Differential (A,/A,B,/B, Z,/Z) (RS422)
		6	Incremental TTL (A,B)
		7	Incremental TTL (A,B, Z)
		8	Incremental HTL- Differential (A,/A,B,/B, Z/Z) (24V)
		9	Incremental HTL (A,B) (24V)
		10	Incremental HTL (A,B,Z) (24V)

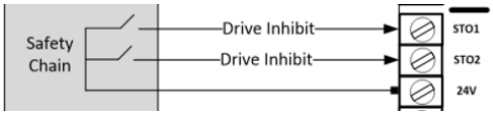
11.6. Step 6- Motor Auto-tune.

A Motor Auto-tune must be carried out in order to measure the motor electrical characteristics, brakes will be applied by the drive (unless controlled by other means) during this test.

Action		Additional Information
☐ **If the motor contactor(s) are controlled by the elevator controller then they should be activated to close so that the motor is electrically connected to the drive, otherwise the "Auto-tune" cannot be carried out.** ☐ **If the motor contactor(s) are controlled by the drive (connected to relay 1) the motor contactor will automatically be energised when the "Auto-tune" is enabled.** **Note : For the motor contactor to close the safety chain will need to be closed.**		
☐ **Check Safe Torque off input connections have been made.**		Drive should now show StoP if not see section 21 Troubleshooting. The STO input status can be viewed in parameter P0-03.(0 = Open 1 = Closed)
☐ **Enable Stationary Motor Auto-tune**	Set **P**4-08 to a 1 and press the  button.	1. The motor contactors will close (if controlled by the drive "Relay 1"). 2. The motor brakes will remain applied. (Relay 2) 3. The display will show AUto-t. (Test procedure may take several minutes to complete). Note : If the drive trips refer to section 21 Troubleshooting. 4. The motor contactors will open once the test has completed. (Relay 1 controlled by default) Once the Auto-tune is completed **P**4-08 will return to 0 and the display will show StoP (**P**4-24 thru to **P**4-28 will be populated). **Note:** Motor Auto-tune will need to be repeated if the motor, motor cables, motor parameters or drive control mode is changed in **P**4-01.

11.7. Step 7- Running the Elevator.

Action	Guidance
☐ **Check for Suitable travel headroom**	Ideally the Lift car should be balanced (i.e. with brakes off, the lift car should not naturally move) and with enough shaft headroom to prevent reaching end stops during initial test travels.
☐ **Run the elevator at reduced speed.**	☐ Close ST01 & STO2 inputs and the drive should show StoP  
	☐ Provide a reduced speed reference to the drive. ☐ Inspection speed terminal can be used. If **P**1-02 is at default value (**P**1-02=1) then inspection speed is defined in parameter **P**8-08, in this case inspection speed is selected when DI6 is high.  ☐ Alternatively, the maximum speed parameter (**P**8-01) can be used to limit the maximum speed reference.
	☐ Provide a run-direction command to the drive. 
	If the drive trips refer to section 21 Troubleshooting.

☐ **Check motor direction and encoder direction is correct.**	☐ During this check you will need to Navigate between parameters **P**0-18 (Estimated motor speed) and **P**0-19 (Encoder speed). ☐ Provide a run-direction command to terminal 2 and run at low speed for a short travel e.g. levelling/10% of motor rated speed. ☐ Check that the value shown in **P**0-18 is positive in the Up direction and Negative in the down direction, if it is not then set **P**11-09 to 1. ☐ Check that the value in **P**0-18 and **P**0-19 match in sign.	☐ If the drive shows Inhibit when a run-direction command is given ensure that the Safe Torque off inputs are made.  ☐ If the values in P0-18 and P0-19 do not match in sign then solve using parameters **P**11-09 (Output Phase sequence) and **P**6-02 (Encoder feedback direction)
☐ **Enable Encoder**	Set **P**6-05 to 1	Enables Encoder Feedback
☐ **If no problems are encountered then the lift can now be run normally.**		
☐ **Got to section 14 to further optimise travel comfort.**		

12.Start-up of Gearless (Permanent Magnet) Motor.

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

12.1. Step 1- Wiring Connections.

It is assumed the drive is connected as per Section 8.3 Overall Wiring Diagram and default terminal functions.

12.2. Step 2- Pre-Power Checks.

Action/Checks	Additional Information
 **Do Not Apply Electrical Power Yet!**	☐ Check that all safety circuits/safety chains are in the correct state, failure to do so could result in damage to the equipment and possible injury or death. ☐ Check that the intended voltage source matches that of the drive voltage rating. ☐ Check that any unexpected movement in the motor will not result in damage to equipment / safety risk to persons. ☐ Check that the elevator controller will not give a start signal to the drive when electrical power is applied. ☐ Ideally the Lift car should be balanced (i.e. with brakes off the lift car should not naturally move) and with enough shaft headroom to prevent reaching end stops during initial test travels.
Check all necessary electrical connections.	☐ Check Electrical Supply cables are connected to the Input power terminals of the drive. ☐ Check Motor Cables are connected to the drive U, V, W terminals (If cables have identification markers connect correct phase sequence). ☐ Check Brake resistor is connected to the "+DC" and "BR" terminals of the drive and that the resistance is higher than the minimum allowable value (as shown in section 6 Product Technical Information) and the resistor is suitably protected from thermal overload. ☐ Check correct control connections are made between the Elevator control panel and the drive.(as detailed in Section 8.3 Overall Wiring Diagram and default terminal functions). ☐ Check encoder module has been installed, and the correct connections are made between the drive and the encoder.

12.3. Step 3- Apply Power.

 **Apply Electrical Power to the drive**	☐ Apply rated voltage to the drive. ☐ Check that the drive displays StoP or Inhibit. ☐ Check that the Encoder module (Optional) left hand LED light is illuminated Red	➢ If StoP or Inhibit is not shown or a red light is shown on the encoder module refer to section 21 Troubleshooting. ➢ If there is no green light shown on the encoder module : o Check encoder module is pushed fully home. o Check the encoder wiring is correct. 

12.4. Step 4- Motor nameplate data entry.

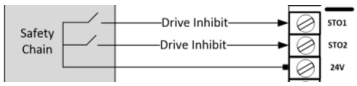
Action		Additional Information
Select Gearless (Permanent Magnet) motor control mode. (P4-01	☐ Set **P**4-01 to 3	Both IPM and SPM type motors are supported.
Enter Motor Rated Current (P4-03)	☐ Enter motor rated current into **P**4-03	Obtained from Motor nameplate (Amps).
Enter Motor Rated Frequency (P4-04)	☐ Enter motor rated frequency into **P**4-04	Obtained from Motor nameplate (Hz).
Enter Number of Motor Poles (P4-05)	☐ Enter value into **P**4-05	Enter motor pole value as shown on the motor nameplate, if unknown set **P**4-05 to 0 where the drive will automatically calculate the value providing **P**4-04 (Motor rated frequency) and **P**4-06 (Motor rated speed) have been entered correctly.
Enter Motor Rated Speed (P4-06)	☐ Enter motor rated speed into **P4**-06	Obtained from Motor nameplate. If not available it can be calculated: Motor rated frequency*120/motor poles.
Enter the Maximum speed (P8-01)	☐ Enter value into **P**8-01	This is the maximum allowable speed.

12.5. Step 5- Encoder setup.

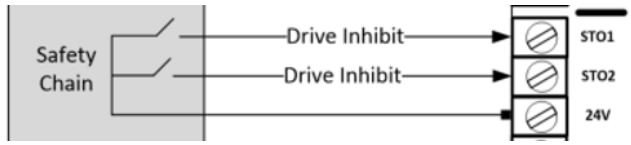
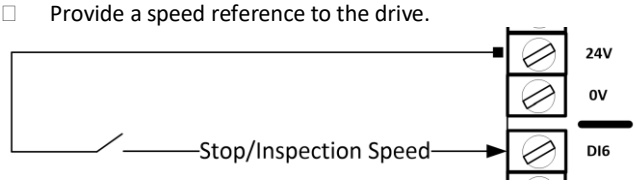
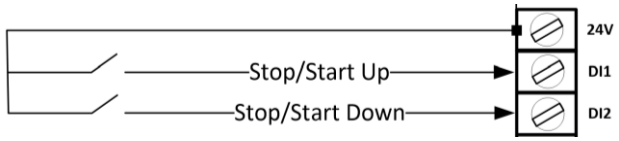
Action		Additional Information
Select absolute encoder type (Endat or SinCos) (P6-04)	☐ Select setting 3 for SinCos Encoder. ERN 1387	
	☐ Select setting 4 for Endat Encoder. ECN1313, ECN113, ECN413, ECN1325, ECN125, ECN425.	It is assumed Encoder incremental signals (A, A/ B, B/) are connected.
Enable the Encoder (P6-05)	☐ Set **P**6-05 to 1	Enables Encoder Feedback and puts the drive into closed loop operation.

12.6. Step 6- Motor Auto-tune.

A Motor Auto-tune must be carried out in order to measure the motor electrical characteristics, during the Auto-tune test the motor brakes will be applied by the drive (assuming they are controlled by Relay 2 on the drive).

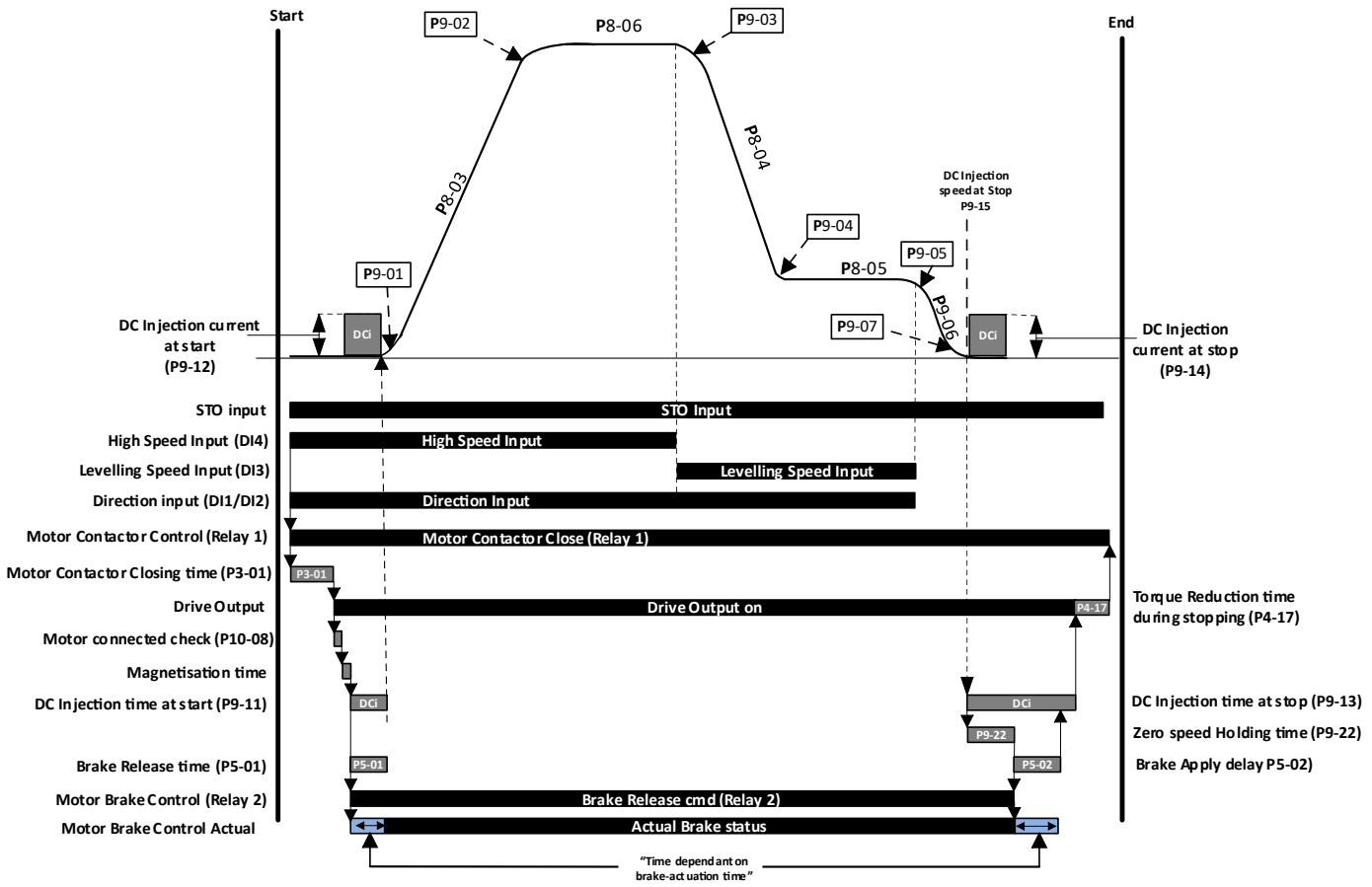
Action		Additional Information
☐ If the motor contactor(s) are controlled by the elevator controller then they should be activated to close so that the motor is electrically connected to the drive, otherwise the "Auto-tune" cannot be carried out. **☐ If the motor contactor(s) are controlled by the drive (connected to relay 1) the motor contactor will automatically be energised when the "Auto-tune" is enabled.** **Note: For the motor contactor to close the safety chain will need to be closed.**		
☐ Check Safe Torque off inputs have been made.		Drive should now show StoP , if not see section 21 Troubleshooting. The STO input status can be viewed in parameter P0-03.(0 = Open 1 = Closed)
Enable Stationary Motor Auto-tune **(Motor Electrical measurement & Encoder offset measurement)**	☐ Set **P**4-08 to a 3 and press the  button.	1. The motor contactors will close (if controlled by the drive "Relay 1"), if not by Relay 1 then they need to be closed. 2. The motor brakes will remain applied. (Relay 2) 3. The display will show AUto-t. (Test procedure may take several minutes to complete). Note : If the drive trips refer to section 21 Troubleshooting. 4. The motor contactors will open once the test has completed. (Relay 1 controlled by default) Once the Auto-tune is completed **P**4-08 will return to 0 and the display will show StoP (**P**4-24, **P**4-26, **P**4-27 and **P**6-09 will be populated). If the drive trips on AtF-06 it means that the motor has surface mount magnets, in this case set **P**4-08 to a 4 for the drive to perform an alternative Encoder offset measurement. **Note:** • Motor Auto-tune will need to be repeated if the Encoder, motor, motor cables, motor parameters or drive control mode is changed in **P**4-01. • Encoder offset value (**P**6-09) will be wrong if the motor poles (**P**4-05) has been set incorrectly or if phase orientation is incorrect **P**11-09 (Output Phase sequence)

12.7. Step 7- Running the Elevator.

Action	Guidance
☐ **Check for Suitable travel headroom**	Ideally the Lift car should be balanced (i.e. with brakes off, the lift car should not naturally move) and with enough shaft headroom to prevent reaching end stops during initial test travels.
☐ **Run the elevator at reduced speed.**	☐ Close ST01 & STO2 inputs and the drive should show StoP 
	☐ Provide a speed reference to the drive.  Normally inspection speed is used. If **P**1-02 is at default value (**P**1-02=1) then inspection speed is defined in parameter **P**8-08, in this case inspection speed is selected when DI6 is high.
	☐ Provide a run-direction command to the drive. 
	If the drive trips refer to section 21 Troubleshooting.
☐ **If no problems are encountered then the lift can now be run normally.**	
☐ **Got to section 14 to further optimise travel comfort.**	

13.Travel Curve Adjustment

13.1. Travel Curve Sequence



The starting and Stopping sequence shown above is the out of Box (Factory Default) setting (**P**1-02=1), other sequences are available by selecting a different macro in parameter **P**1-02, see section 8.10 for more details.

Note : The jerk parameters will have an effect on the overall ramp times in the following way :

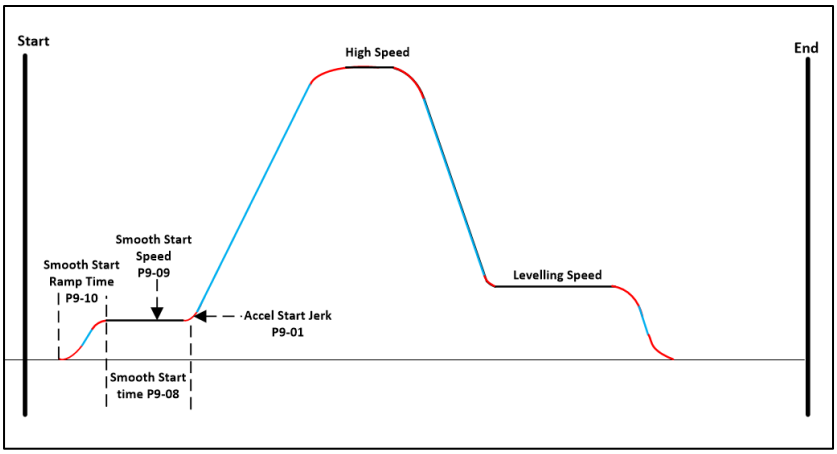
Total Acceleration Ramp time = **P**8-03 (Acceleration ramp time) + (**P**9-01+**P**9-02 / 2)

Operating Mode	P4-01	P6-05	Sheave Locking during start (e.g. Rollback)	Sheave Locking During Stop
Geared (Induction) Motors without an Encoder	0	0	**P**9-11 (DC Injection time at start) **P**9-12 (DC Injection current at start)	**P**9-13 (DC Injection time at stop) **P**9-14 (DC Injection current at stop) **P**9-15 (DC Injection speed at stop)
Geared (Induction) Motors with Encoder	0	1	**P**9-16 (Rollback Control P-Gain at start) **P**9-18 (Rollback Control activation pulses)	**P**9-20 (Rollback Control P-Gain at stop) **P**9-21 (Rollback Control I-Gain at stop)
Gearless (Permanent Magnet) Motor	3	1	**P**9-16 (Rollback Control P-Gain at start) **P**9-18 (Rollback Control activation pulses)	**P**9-20 (Rollback Control P-Gain at stop) **P**9-21 (Rollback Control I-Gain at stop)

13.2. Smooth Start Function

The smooth start function can also help in some cases of rollback, for example in applications with high starting stiction.

In this mode the motor is run at a speed that should be set just above 0 so that it overcomes the stiction before accelerating away towards high speed.



13.3. Speed Loop Gains

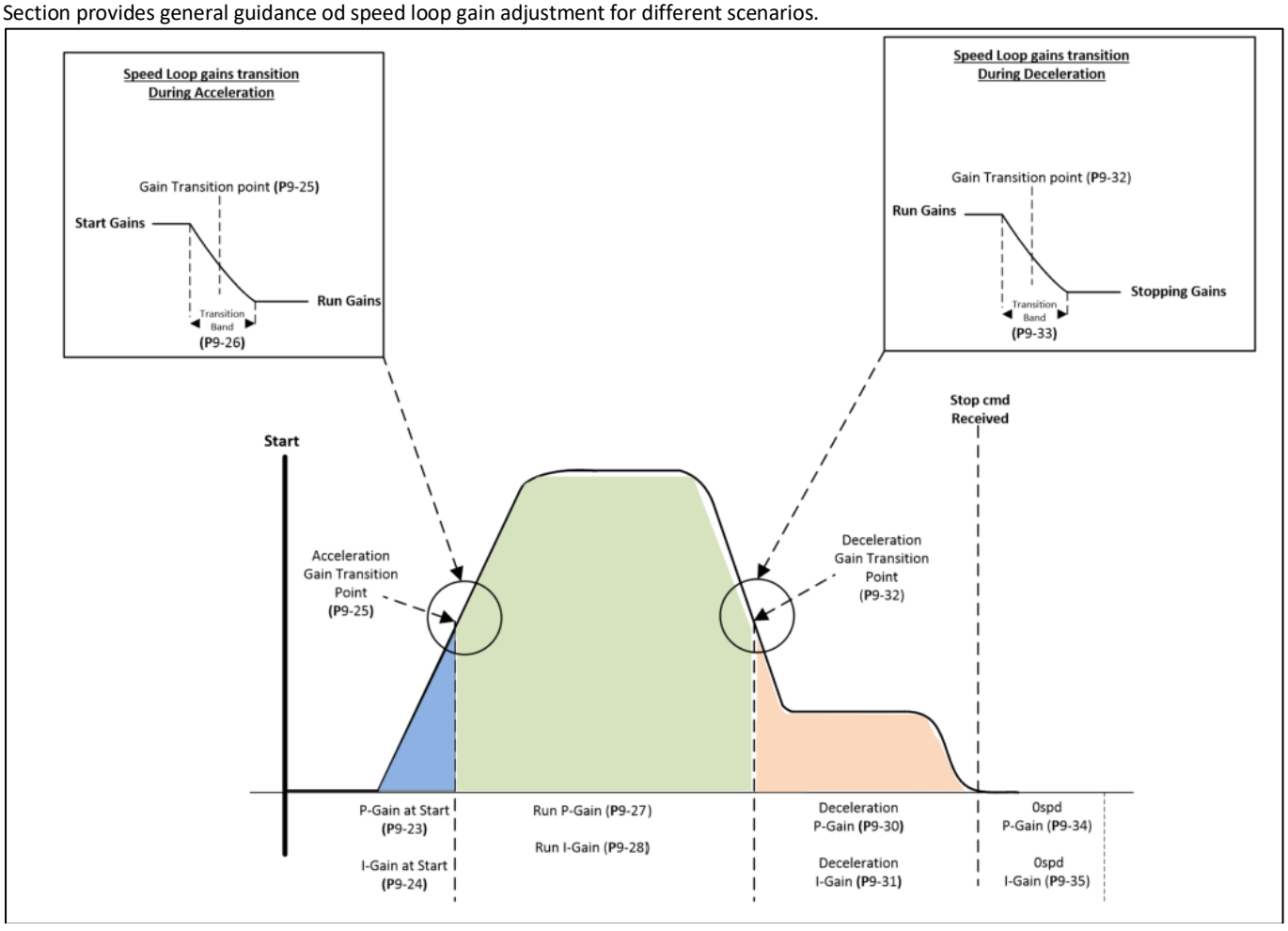
The setting of the speed loop gains defines how closely the actual motor speed follows the given speed reference; the correct setting of the speed loop gains is critical to provide optimum comfort levels.

The speed loop gains are available in all motor operating modes except “Enhanced V/F IM Speed Control mode” (**P**4-01=2).

In general, the default speed loop gains should provide a good starting point.

Different speed loop gains are available for different parts of the travel profile as shown in the diagram below, noting that from default the drive will operate with only the run gains (**P**9-27 and **P**9-28), to utilise the full set of speed loop gains set **P**9-25 (Speed Loop Gain Transition speed During Acceleration)/**P**9-32 (Speed Loop Gain Transition speed During Deceleration) to >0.

Section provides general guidance od speed loop gain adjustment for different scenarios.



14.Comfort Optimisation

The tables below shows the relevant parameters for adjusting the comfort level throughout the travel curve, noting that the parameters maybe different depending on if the system is geared with or without an encoder or gearless.

Key for Motor Type : GD = Geared without Encoder, GD+E = Geared with Encoder, GL = Gearless.
√ = Relevant with this Motor Type X = Not Relevant with this Motor Type

Problem		Motor Type			Solutions	
		GD	GD+E	GL		
Starting Comfort	Rollback at start.	√	√	√	**Tip: Parameter P0-17 can be monitored to show the rollback error after each run.**	
		√	√	√	Check Motor parameters match the motor nameplate data: ☐ For Geared system **P**4-01 = 0, For Gearless system **P**4-01 = 3 ☐ Motor Rated Voltage (**P**4-02) ☐ Motor Rated Current (**P**4-03) ☐ Motor Rated Frequency (**P**4-04) ☐ Number of Motor Poles (**P**4-05), set to 0 if unknown. ☐ Motor Rated Speed (**P**4-06)	
		√	√	X	☐ Motor power factor Cos ∅ (**P**4-07)	
		X	√	√	☐ Has Encoder been enabled and setup?	☐ If no Set **P**6-05 to a 1, set encoder Pulses Per Revolution in **P**6-03 and set encoder type in **P**6-04.
		√	√	X	☐ Has Motor auto-tune been performed?	☐ If no Set **P**4-08 to a 1
		X	X	√	☐ Has Motor auto-tune and Encoder Offset test been performed?	☐ If no Set **P**4-08 to a 3
		√	√	√	☐ Ensure motor contactor is closing before the drive output is enabled.	☐ Increase **P**3-01 (Motor Contactor Closing time)
		√	√	√	☐ Increase brake release time.	☐ **P**5-01 (brake release time) If the time is set too long it may not be acceptable in the application
		√	X	X	☐ Adjust DC Injection parameters: Increase **P**9-12 (DC Injection Current at Start) in steps of 10%, whilst ensuring time set in **P**9-11 (DC Injection Time at Start) is not too long.	☐ **P**9-12 (DC Injection Current at Start) ☐ **P**9-11 (DC Injection Time at Start)
					Tip : The correct setting of the DC Injection parameters are those which result in no rollback under all load conditions, and with no vibration or jerk when the motor brakes lift/car moves away from the floor.	
		X	√	√	☐ Adjust Rollback Control Gain parameters: Increase **P**9-16 (Rollback Control P-Gain at start) in steps of 20%.	The correct setting of **P**5-01 & **P**9-16 are those which result in no rollback under all load conditions, and with no vibration or jerk when the motor brakes lift/car moves away from the floor.
					Tip : The longer the time set in P5-01 (Brake Release time) the more responsive P9-16 will be.	

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Problem		Motor Type			Solutions
		GD	GD+E	GL	
Starting Comfort	Jerk during Start	√	√	√	□ Parameter **P**5-01 defines the actuation time of the motor brakes, generally the default value (0.5 sec) is suitable for most situations, if there is a jerk felt during acceleration after brake release then reduce **P**5-01.
		√	√	√	□ Increasing the value of **P**9-01 (Acceleration Start Jerk) can help reduce start jerks.
		√	X	X	□ Try Increasing **P**9-11 (DC Injection Time at Start).
		√	√	√	□ If jerk is felt after brake is released try adjusting speed loop gains, generally **P**9-23(Speed Loop Proportional Gain at start) is increased.
		√	√	√	□ Also see "Rollback at start" above.
		√	X	X	□ Use Smooth Start function, See Section 13.2

Problem		Motor Type			Solutions	
		GD	GD+E	GL		
Travel Comfort during acceleration and High Speed.	Vibration at High speed	√	√	√	□ Check there are no mechanical problems.	
		√	√	√	Check Motor parameters match the motor nameplate data: □ For Geared system **P**4-01 = 0, For Gearless system **P**4-01 = 3 □ Motor Rated Voltage (**P**4-02) □ Motor Rated Current (**P**4-03) □ Motor Rated Frequency (**P**4-04) □ Number of Motor Poles (**P**4-05), set to 0 if unknown. □ Motor Rated Speed (**P**4-06)	
		√	√	X	□ Motor power factor Cos ∅ (**P**4-07)	
		X	√	√	□ Has Encoder been enabled and setup?	□ If no Set **P**6-05 to a 1, set encoder Pulses Per Revolution in **P**6-03 and set encoder type in **P**6-04.
		√	√	X	□ Has Motor auto-tune been performed?	□ If no Set **P**4-08 to a 1
		X	X	√	□ Has Motor auto-tune and Encoder Offset test been performed?	□ If no Set **P**4-08 to a 3
		√	√	√	□ Reduce **P**9-27 (Speed Loop proportional gain during run) and Increase **P**9-28 (Speed loop integral gain during run)	
		X	√	√	□ Increase Encoder filter **P**6-07	

Problem		Motor Type			Solutions
		GD	GD+E	GL	
Travel Comfort during acceleration and High Speed.	Jerk as high speed is reached	√	√	√	□ Increase **P**9-02 (Acceleration end Jerk) □ Increase **P**9-27 (Speed Loop proportional gain during run) and reduce **P**9-28 (Speed loop integral gain during run).
	Travel speeds different between up and down direction	√	X	X	□ Adjust **P**4-20 (Slip Compensation Gain in Motoring Mode) & **P**4-21 (Slip Compensation Gain in Regenerating Mode) until the motor speed is the same in both directions

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√ = Relevant with this Motor Type X = Not Relevant with this Motor Type

Problem		Motor Type			Solutions	
		GD	GD+E	GL		
Travel Comfort at Levelling speed/Low speed	Vibration at low speed	√	√	√	☐ Check there are no mechanical problems.	
		√	√	√	☐ Confirm that the drive is not operating in current limit (OuLd on Display), if it is then reduce the load and check cabin/counterweight balancing.	
		√	√	√	Check Motor parameters match the motor nameplate data: ☐ For Geared system **P**4-01 = 0, For Gearless system **P**4-01 = 3 ☐ Motor Rated Voltage (**P**4-02) ☐ Motor Rated Current (**P**4-03) ☐ Motor Rated Frequency (**P**4-04) ☐ Number of Motor Poles (**P**4-05), set to 0 if unknown. ☐ Motor Rated Speed (**P**4-06)	
		√	√	X	☐ Motor power factor Cos Ø (**P**4-07)	
		X	√	√	☐ Has Encoder been enabled and setup?	☐ If no Set **P**6-05 to a 1, set encoder Pulses Per Revolution in **P**6-03 and set encoder type in **P**6-04.
		√	√	X	☐ Has Motor auto-tune been performed?	☐ If no Set **P**4-08 to a 1
		X	X	√	☐ Has Motor auto-tune and Encoder Offset test been performed?	☐ If no Set **P**4-08 to a 3
		√	√	√	If it is found that the travel comfort is good at high speed but poor at Levelling speed then the low speed gains can be utilised. ☐ If low speed gains (**P**9-30 & **P**9-31) are being used then reduce **P**9-30 (Low speed P-gain) and Increase **P**9-31 (Low speed I-gain) ☐ If low speed gains (**P**9-30 & **P**9-31) are not being used then reduce **P**9-27 (Speed Loop proportional gain during run) and Increase **P**9-28 (Speed loop integral gain during run	
		X	√	√	☐ Increase Encoder filter **P**6-07	

Problem		Motor Type			Solutions
		GD	GD+E	GL	
Stopping Comfort	Bump felt when stopping	√	√	√	☐ Ensure motor contactor is not opening before the drive output is disabled/Brake applied, if controlled by the drive try increasing **P**3-01 (Motor Contactor Closing time). ☐ Increase **P**9-22 (Zero speed holding time on disable). ☐ If a brake apply speed (**P**5-03) has been set reduce the value.
	Motor is pulled in the opposite direction during stopping (over-hauling effect of the load)	√	√	√	☐ Increase **P**9-27 (Run speed P-gain) or **P**9-30 (Low speed P-gain) if low speed gains are being used.
		√	X	X	Adjust DC Injection during stop parameters: ☐ **P**9-13 (DC Injection time at stop), **P**9-14 (DC Injection Current at Stop), **P**9-15 (DC Injection speed at stop).
		X	√	√	Adjust Rollback Control Gains during stop parameters: ☐ **P**9-20 (Rollback Control P-Gain at stop), **P**9-21 (Rollback Control I-Gain at stop).
		X	X	√	☐ Check **P**4-17 (Torque reduction during stopping) is not set too high resulting in torque loss prior to stopping.
		√	√	√	Increase Brake Apply speed in parameter in **P**5-03.
	Noise when the motor brake applies	X	X	√	Decrease **P**4-17 (Torque reduction during stopping), parameter **P**9-22 (Zero speed holding time on disable) can also be increased to give further improvement.

Key for Motor Type : GD = Geared without Encoder, GD+E = Geared with Encoder, GL = Gearless.
√ = Relevant with this Motor Type X = Not Relevant with this Motor Type

Problem		Motor Type			Solutions
		GD	GD+E	GL	
Floor Level Accuracy	Car not reaching floor	√	√	√	☐ Confirm that the drive is not operating in current limit (OuLd on Display) if it is then reduce load and cabin balancing.
		√	√	√	☐ Increase **P**8-05 (levelling speed)/ **P**9-07 (Stopping jerk)
		√	X	X	☐ Decrease DC injection speed at stop **P**9-15
		√	√	√	☐ Ensure speed loop gains are optimally tuned so that the speed following error is minimised Increase **P**9-27 (Run speed P-gain) and reduce **P**9-28 (Run speed I-gain) or if using the low speed gains increase **P**9-30 (Low speed P-gain) and reduce **P**9-31 (Low speed I-gain).
	Car over-shooting floor	√	√	√	☐ Decrease **P**8-05 (levelling speed)/ **P**9-07 (Stopping jerk).
		√	√	√	☐ Increase **P**8-05 (levelling speed)/ **P**9-07 (Stopping jerk)
		√	√	√	☐ Increase Brake Apply speed in parameter in **P**5-03.
		√	X	X	☐ Increase DC injection speed at stop **P**9-15
		√	√	√	☐ Ensure speed loop gains are optimally tuned so that the speed following error is minimised Increase **P**9-27 (Run speed P-gain) and reduce **P**9-28 (Run speed I-gain) or if using the low-speed gains increase **P**9-30 (Low speed P-gain) and reduce **P**9-31 (Low speed I-gain).

15.Monitoring Parameters

<table>
<tr><th>Parameter Number</th><th>Parameter Description</th><th>Units</th></tr>
<tr><td rowspan="2">P0-00</td><td colspan="2">Keypad Parameter Display Mode</td></tr>
<tr><td colspan="2">This parameter allows the user to see only the parameters that have been set different to defaults.
0 = Show all Parameters (Noting that the setting of parameter P11-04 limits the parameter groups which are shown)
1 = Show Only parameters that are different from Factory defaults.
2 = Show Only parameters that are different from User defaults.</td></tr>
<tr><td rowspan="2">P0-01</td><td>Digital Input 1 to 5 Status</td><td>-</td></tr>
<tr><td colspan="2">Displays the status of the drive digital input terminals 1 to 5

<table><tr><td>Display value</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td></tr><tr><td>Input Terminal</td><td>DI1 status</td><td>DI2 status</td><td>DI3 status</td><td>DI4 status</td><td>DI5 status</td></tr></table>
1 = Input Active
0 = Input InActive</td></tr>
<tr><td rowspan="2">P0-02</td><td>Digital Input 6 to 10 Status</td><td>-</td></tr>
<tr><td colspan="2">Displays the status of the drive digital input terminals 6 to 8 and Auxiliary inputs available on the universal encoder module

<table><tr><td>Display value</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td></tr><tr><td>Input Terminal</td><td>DI6 status</td><td>DI7 status</td><td>DI8 status</td><td>*Daux 1 Input Status</td><td>*Daux 2 Input Status</td></tr></table>
*Daux are the auxiliary inputs on the universal encoder module

1 = Input Active
0 = Input InActive</td></tr>
<tr><td rowspan="2">P0-03</td><td>STO Input Status</td><td>-</td></tr>
<tr><td colspan="2">Displays the status of the Safe Torque Inputs.
Value Displayed:

<table><tr><td>Display value</td><td></td><td></td><td></td><td></td><td>0</td></tr><tr><td>Input Terminal</td><td></td><td></td><td></td><td></td><td>STO1/STO2</td></tr></table>
1 = Input Active
0 = Input InActive</td></tr>
<tr><td rowspan="2">P0-04</td><td>Relay 1 Status</td><td>-</td></tr>
<tr><td colspan="2">Displays the status of Relay 1

<table><tr><td>Display value</td><td></td><td></td><td></td><td></td><td>0</td></tr><tr><td>Output Terminal</td><td></td><td></td><td></td><td></td><td>Relay 1 Status</td></tr></table>
0 = Relay Open
1 = Relay Closed</td></tr>
<tr><td rowspan="2">P0-05</td><td>Relay 2 Status</td><td>-</td></tr>
<tr><td colspan="2">Displays the status of Relay 2

<table><tr><td>Display value</td><td></td><td></td><td></td><td></td><td>0</td></tr><tr><td>Output Terminal</td><td></td><td></td><td></td><td></td><td>Relay 2 Status</td></tr></table>
0 = Relay Open
1 = Relay Closed</td></tr>
<tr><td rowspan="2">P0-06</td><td>Digital Output Status</td><td>-</td></tr>
<tr><td colspan="2">Displays the status of the drive digital Outputs

<table><tr><td>Display value</td><td></td><td></td><td>0</td><td>0</td><td>0</td></tr><tr><td>Output Terminal</td><td></td><td></td><td>DA1</td><td>DA2</td><td>DO3</td></tr></table>0 = Digital Output InActive
1 = Digital Output Active</td></tr>
</table>

<table>
<tr><th>Parameter Number</th><th>Parameter Description</th><th>Units</th></tr>
<tr><td rowspan="2">P0-07</td><td>Analog Output 1 Value</td><td>0.0V – 10.0V
(Voltage Mode)

0.0 -20mA
(Current mode)</td></tr>
<tr><td colspan="2">Shows the voltage/Current output value from Analog output 1(DA1) after scaling and offsets have been applied.
<table>
<tr><th>Parameter ></th><th>P1-14
DA1 Output 1 Type</th><th>P1-18
DA1 Output 1 Format</th><th>P0-07
Display Value</th></tr>
<tr><td rowspan="3">Setting ></td><td>0 (Digital Output)</td><td>N/A</td><td>0.0 (Output off)
0.1 (Output On)</td></tr>
<tr><td rowspan="2">1 (Analog Output)</td><td>U 0-10, U 10-0</td><td>Value in Volts</td></tr>
<tr><td>A 0-20, A 20-0, A 4-20, A 20-4</td><td>Value in mA</td></tr>
</table></td></tr>
<tr><td rowspan="2">P0-08</td><td>Analog Output 2 Value</td><td>0.0V – 10.0V (Voltage Mode)

0-20mA
(Current mode)</td></tr>
<tr><td colspan="2">Shows the voltage/Current output value from Analog output 2 after scaling and offsets have been applied.
<table>
<tr><th>Parameter ></th><th>P1-21
DA2 Output 1 (Terminal 11) Type</th><th>P1-25
DA2 Output 1 (Terminal 11) Format</th><th>P0-08
Display Value</th></tr>
<tr><td rowspan="3">Setting ></td><td>0 (Digital Output)</td><td>N/A</td><td>1.0 (Output off)
0.1 (Output On)</td></tr>
<tr><td rowspan="2">1 (Analog Output)</td><td>U 0-10, U 10-0</td><td>Value in Volts</td></tr>
<tr><td>A 0-20, A 20-0, A 4-20, A 20-4</td><td>Value in mA</td></tr>
</table></td></tr>
<tr><td rowspan="2">P0-09</td><td>Motor contactor measured opening time</td><td></td></tr>
<tr><td colspan="2">Feature Pending</td></tr>
<tr><td rowspan="2">P0-10</td><td>Motor contactor measured Closing time</td><td></td></tr>
<tr><td colspan="2">Feature Pending</td></tr>
<tr><td rowspan="2">P0-11</td><td>Brake Release measured opening time</td><td></td></tr>
<tr><td colspan="2">Feature Pending</td></tr>
<tr><td rowspan="2">P0-12</td><td>Brake Apply measured Closing time</td><td></td></tr>
<tr><td colspan="2">Feature Pending</td></tr>
<tr><td rowspan="2">P0-13</td><td>Pre-Ramp Speed Controller Reference</td><td>Hz/RPM/Linear</td></tr>
<tr><td colspan="2">Displays the set point reference applied to the drive internal speed controller</td></tr>
<tr><td rowspan="2">P0-15</td><td>Post-Ramp Speed Controller Reference</td><td>Hz/RPM/Linear</td></tr>
<tr><td colspan="2">Displays the post-ramp set-point reference applied to the drive internal speed controller</td></tr>
<tr><td rowspan="2">P0-16</td><td>Speed Error</td><td>Hz/RPM/Linear</td></tr>
<tr><td colspan="2">Speed Error between the post-ramp speed reference (P0-15) and..
Rotor speed (P0-18) when Encoder feedback is disabled
Encoder speed (P0-19) when Encoder is Enabled.</td></tr>
<tr><td rowspan="2">P0-17</td><td>Rollback Error (Encoder Modes only)</td><td>Pulses</td></tr>
<tr><td colspan="2">Displays the rollback count each time the motor is run.</td></tr>
<tr><td rowspan="2">P0-18</td><td>Rotor Speed (Estimated or Measured)</td><td>Hz/RPM/Linear</td></tr>
<tr><td colspan="2">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 and enabled).</td></tr>
<tr><td rowspan="2">P0-19</td><td>Encoder Feedback Speed</td><td>Hz/RPM/Linear</td></tr>
<tr><td colspan="2">Displays the Actual Encoder Feedback speed.</td></tr>
<tr><td rowspan="2">P0-20</td><td>Real-time Encoder offset Value</td><td>°</td></tr>
<tr><td colspan="2">Live Encoder offset value shown in Degrees (1 degree resolution) when operating in Open Loop Gearless mode.</td></tr>
<tr><td rowspan="2">P0-21</td><td>Calculated Slip Speed Value (Enhanced V/F Mode Only)</td><td>-</td></tr>
<tr><td colspan="2"></td></tr>
<tr><td rowspan="2">P0-22</td><td>Measured Motor Power Factor</td><td>Cos Phi</td></tr>
<tr><td colspan="2">Real time motor power factor value whilst drive is running and at rated load current.</td></tr>
<tr><td rowspan="2">P0-23</td><td>Highest Current During Acceleration</td><td>A</td></tr>
<tr><td colspan="2"></td></tr>
<tr><td rowspan="2">P0-24</td><td>Highest Current During Deceleration</td><td>A</td></tr>
<tr><td colspan="2"></td></tr>
<tr><td rowspan="2">P0-25</td><td>Motor Current</td><td>A</td></tr>
<tr><td colspan="2"></td></tr>
</table>

Parameter Number	Parameter Description	Units
P0-26	**Motor Magnetising Current (Id)**	A
	Displays the motor magnetising Current, providing an auto tune has been successfully completed.	
P0-27	**Motor Rotor Current (Iq)**	A
	Displays the motor Rotor (torque producing) current, providing an auto tune has been successfully completed.	
P0-28	**Output Torque**	%
	Displays the instantaneous output torque level produced by the motor. 0.1% resolution 100% = motor rated torque.	
P0-29	**Motor Input Power**	kW
P0-30	**Motor Shaft Power**	kW
P0-31	**Motor Overload Accumulator (%)**	%
P0-32	**Back EMF Measured Value**	VAC
	Ph-Ph back emf measurement	
P0-33	**Drive Output Voltage**	VAC
	Displays the instantaneous output voltage from the drive to the motor	
P0-34	**Motor Poles Calculated**	
	Displays the calculated number of pole pairs when the motor pole parameter (**P**4-05) is set to 0 (Automatic calculation of motor poles).	

P0-35 — **Travel Profile State**

Displays the current position on the travel curve.

State No	
4	Drive Output not running
5	Motor Contactor Closing Time Active (**P**3-01**)**
6	Motor Connected Check Active (**P**10-08)
10	Motor Brake Release Time Active (**P**5-01**)**
13	DC Injection Time at start Active (**P**9-11**)**
14	Smooth Start Time Active (**P**9-08**)**
19	Accelerating to High Speed
18	Running at High Speed 1 (**P**8-06)
30	Running at High Speed 2 (**P**8-09)
33	Running at High Speed 3 (**P**8-10)
36	Running at High Speed 4 (**P**8-11)
39	Running at High Speed 5 (**P**8-12)
23	Decelerating to Levelling Speed
21	Running at Levelling Speed (**P**8-05)
46	Zero Speed holding time on disable active (**P**9-22)
47	Motor Brake Apply Delay Active (**P**5-02**)**
48	DC Injection Time At stop Active (**P**9-13**)**
49	Torque Reduction time during stopping (**P**4-17**)**
50	Motor Contactor Opening Time Active

P0-36 — **Travel Profile Trip point**

This parameter indicates at what point on the travel curve the drive tripped.

State No	
4	Drive Output not running
5	Motor Contactor Closing Time Active (**P**3-01**)**
6	Motor Connected Check Active (**P**10-08)
10	Motor Brake Release Time Active (**P**5-01**)**
13	DC Injection Time at start Active (**P**9-11**)**
14	Smooth Start Time Active (**P**9-08**)**
19	Accelerating to High Speed
18	Running at High Speed 1 (**P**8-06)
30	Running at High Speed 2 (**P**8-09)
33	Running at High Speed 3 (**P**8-10)
36	Running at High Speed 4 (**P**8-11)
39	Running at High Speed 5 (**P**8-12)
23	Decelerating to Levelling Speed
21	Running at Levelling Speed (**P**8-05)
46	Zero Speed holding time on disable active (**P**9-22)
47	Motor Brake Apply Delay Active (**P**5-02**)**
48	DC Injection Time At stop Active (**P**9-13**)**
49	Torque Reduction time during stopping (**P**4-17**)**
50	Motor Contactor Opening Time Active

Parameter Number	Parameter Description	Units
P0-37	**Currently active Trip code**	-
	This parameter indicates the current trip code number as detailed in section 21 Troubleshooting.	
P0-38	**Trip History Log**	-
	Displays the last four fault codes. **P**0-38 Last Trip 1 (Newest Trip) **P**0-38-1 Last Trip 2 **P**0-38-2 Last Trip 3 **P**0-38-3 Last Trip 4 (Oldest Trip)	
P0-40	**DC Bus Voltage**	V
	Displays the instantaneous DC Bus Voltage internally within the drive	
P0-41	**DC Bus Voltage Ripple**	V
	Displays the level of ripple present on the DC Bus Voltage.	
P0-42	**L1 Input Voltage**	VAC
P0-43	**L2 Input Voltage**	VAC
P0-44	**L3 Input Voltage**	VAC
P0-45	**Motor Thermistor Resistance**	Ω
	Analogue Input 1 thermistor	
P0-46	**Motor Thermistor 2 Resistance**	Ω
	Analogue input 2 thermistor	
P0-47	**Brake Resistor Active**	-
	0 = Brake Resistor Off 1 = Brake Resistor On	
P0-48	**IGBT Temperature**	°C
	Displays the Instantaneous Heatsink (IGBT thermistor) Temperature measured by the drive	
P0-49	**Drive Internal Temperature**	°C
	Displays the Instantaneous Internal (Control PCB) Temperature measured by the drive	
P0-50	**Drive Run Time Since Last Trip**	H:S
	Displays the running time of the drive since the last trip occurred. The first value shown is the number of hours. Pressing the Up key will display the seconds. **P**0-50 Hours Running Since Last Trip **P**0-50-1 Seconds Running Since Last Trip	
P0-51	**Drive Run Time Since Last Trip 2**	H:S
	Displays the running time of the drive since the 2nd to last trip occurred. The first value shown is the number of hours. Pressing the Up key will display the seconds. **P**0-51 Hours Running Since 2nd to Last Trip **P**0-51-1 Seconds Running Since 2nd to Last Trip	
P0-52	**Drive Run Time Since Last Enable**	H:S
	Displays the total running 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 seconds. **P**0-52 Run time Hours Running Since 2nd to Last Trip **P**0-52-1 Seconds Running Since 2nd to Last Trip	
P0-53	**Drive Lifetime Operating Time**	H:S
	Displays the total operating time of the drive. The first value shown is the number of hours. Pressing the Up key will display the seconds. **P**0-53 Drive Operating time (Hours) **P**0-53-1 Drive Operating time (S)	
P0-54	**Drive Total Run Time**	H:S
	Displays the total run time of the drive. The first value shown is the number of hours. Pressing the Up key will display the seconds. **P**0-54 Drive Total Run Time (Hours) **P**0-54-1 Drive Total Run Time (S)	
P0-55	**Drive Heatsink Cooling Fan Total Operating Time**	H:S
	Displays the total operating time of the 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. **P**0-55 Drive Heatsink Cooling Fan Total Run Time (Hours) **P**0-55-1 Drive Heatsink Cooling Fan Total Run Time (S)	

Parameter Number	Parameter Description	Units
P0-56	**Analog Input 1 Applied Signal Value**	V or mA depending on signal format set in **P**1-03
	Displays the actual signal level applied to analog input 1 (DI4) before scaling and offsets have been applied.	
P0-57	**Analog Input 1 Final Signal Value**	V or mA depending on signal format set in **P**1-03
	Displays the signal level after Offset (**P**1-04) and Scaling (**P**1-05) is applied	
P0-58	**Analog Input 2 Applied Signal Value**	V or mA depending on signal format set in **P**1-09
	Displays the actual signal level applied to analog input 2 (DI5) before scaling and offsets have been applied.	
P0-59	**Analog Input 2 Final Signal Value**	V or mA depending on signal format set in **P**1-09
	Displays the signal level after Offset (**P**1-10) and Scaling (**P**1-11) is applied	
P0-70	**Drive Type**	-
	Displays the type details of the drive **P**0-70 Drive Rated Voltage **P**0-70-1 Drive Frame Size **P**0-70-2 Drive Rated Power (kW) **P**0-70-3 Number of input Phases **P**0-70-4 Drive Type Code	
P0-71	**Option Module Type**	-
	Displays the type details of the drive **P**0-71 Option Module Type **P**0-71-1 Option module firmware version major.minor **P**0-71-2 Option module firmware version revision	
P0-72	**Drive IO Firmware Version**	-
	P0-72 IO Firmware version **P**0-72-1 IO Firmware checksum	
P0-73	**Drive Power Stage Firmware Version**	-
	P0-73 Power Stage Firmware version **P**0-73-1 Power Stage Firmware checksum	
P0-74	**Drive Serial Number**	-
	Displays the unique serial number of the drive. **P**0-74 Serial Number (High) **P**0-74-1 Serial Number (**Low**)	
P0-75	**PS Read Value**	-
	Internal Use Only	

16.Rescue Operation

Rescue operation is normally used in the event of a mains borne power failure, with the primary goal of moving the elevator car at a limited motor speed for passenger evacuation, the power source comes from either DC (Batteries) or a UPS power supply as defined by the setting of **P**7-01 and with wiring in accordance with the connection diagrams shown below.

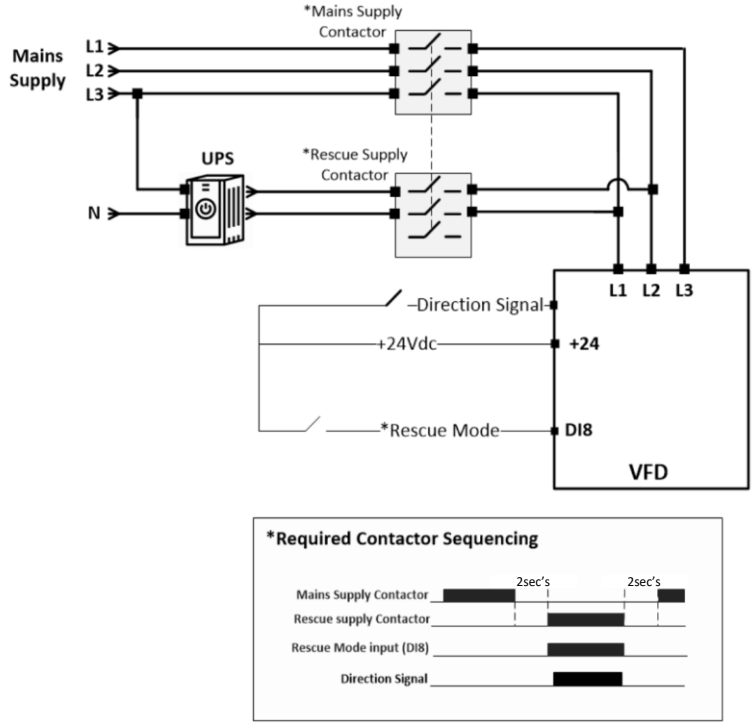
From factory defaults the direction of travel during rescue operation is governed by the direction signal from the controller, other modes are available as detailed in section 18 (Parameter **P**7-02).

P7-01	Rescue Supply Type
UPS230	**230VAC 1ph UPS (Default)**
UPS400	400VAC 2ph UPS
bAtt	Battery Operation

16.1. Rescue Operation Power Supply Requirements

Rescue Power Supply Type	Required Connections	Nominal Rating	Minimum Voltage	Maximum Voltage	Current Requirements
UPS Power Supply	UPS must be connected to terminals L1 and L2	230VAC 1Ph	160VAC (226Vdc)	280VAC	Motor Rated current (**P**4-03) and considering overload, typically no greater than 200%
Battery Power Supply	High Power connections to terminals +DC and -DC	-	32Vdc (<24Vdc will result in an undervoltage trip)	200-240V drives = 240Vdc 380-480V drives = 450Vdc	
	Control +24V connection to terminals 0V and +24V	24V	20V	26V	2.2A (60W)

16.2. UPS power supply connections

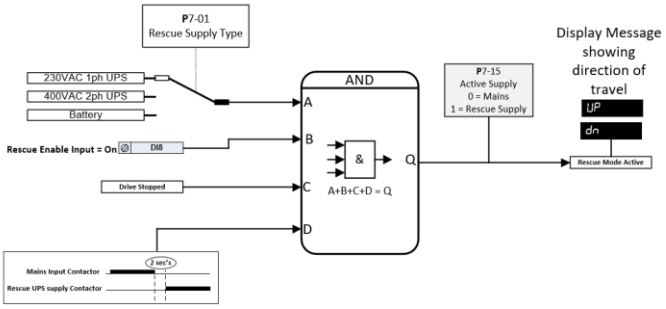


***Required Contactor Sequencing**

- The Rescue Supply Contactor must only be closed when the Main Contactor is open (Interlocking Mechanism)
- A delay time of no less than 2sec's must be included when changing over to/from UPS supply to/From mains supply mode.
- The Main Supply Contactor and Rescue Supply Contactor must be interlocked so that both cannot be energised at the same time, failure to do so may result in damage to the UPS and/or contactor.
- The drive will always wait until the next stop command (direction input removal) before rescue mode operation is activated and likewise when rescue mode is de-activated the drive will wait until the next stop command before changing back to normal mains supply operation.

Note : Circuit protection must be provided for all wiring.

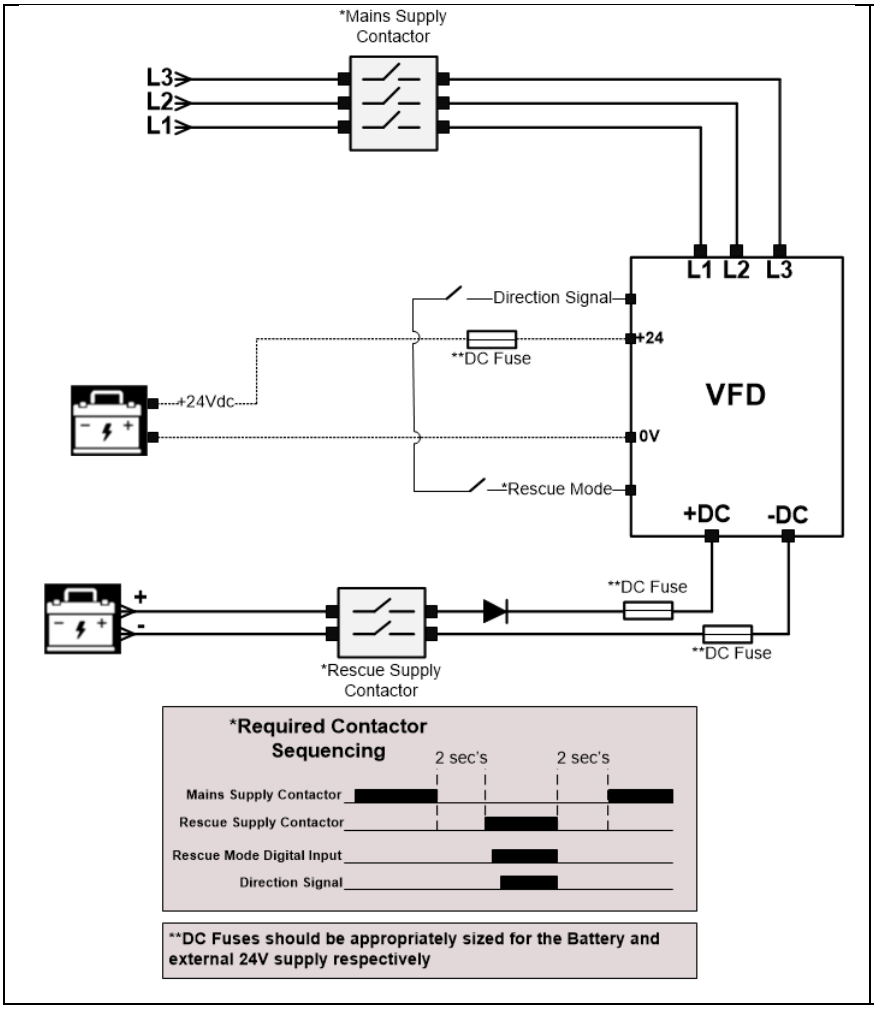
16.3. Activating UPS Rescue mode



The drive will only run when a direction command is given.

Direction of travel can be shown on the display by pressing the  button, it is assumed that when a Run up (Forward) command is given the motor rotates clockwise (looking at the motor with the sheave facing you).

16.4. Battery Mode power supply connections



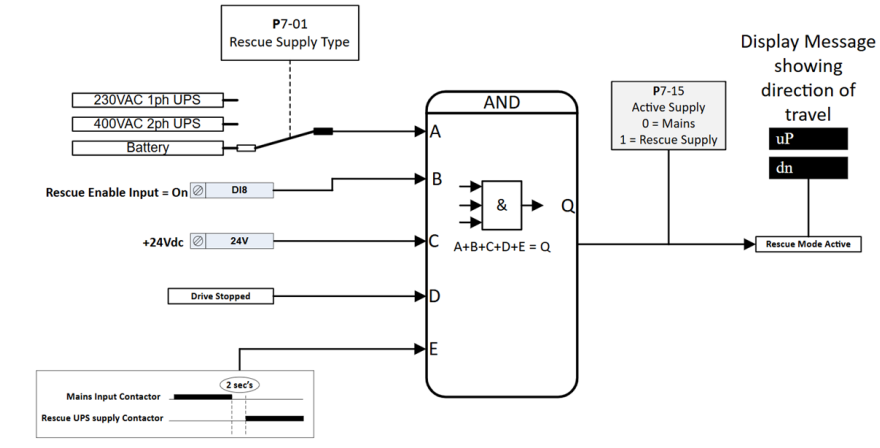
***Required Contactor Sequencing**

- The Rescue Supply Contactor must only be closed when the Main Contactor is open.
- A delay time of no less than 2 sec's must be included when changing over to/from Rescue supply to/From mains supply mode.
- The Main Supply Contactor and Rescue Supply Contactor must be interlocked so that both cannot be energised at the same time, failure to do so may result in damage to the Battery, contactor.
- The Battery must have a reverse power protection diode fitted as shown in the diagram opposite.
- The protection diode must have a voltage rating of at least 1000V and with a current rating of 2 x drive rated current.
- The drive will always wait until the next stop command (Direction input removal) before rescue mode operation is activated and likewise when rescue mode is de-activated the drive will wait until the next stop command before changing back to normal mains supply operation.

A suitable protection diode must be fitted to the battery supply as shown in the example to prevent damage to the system

Note : Circuit protection must be provided for all wiring.

16.5. Activating Battery Rescue mode



The drive will only run when a direction command is given.

Direction of travel can be shown on the display by pressing the button, it is assumed that when a Run up (Forward) command is given the motor rotates clockwise (looking at the motor with the sheave facing you).

17.Serial communications

17.1. USB-C

The drive has a UCB-C connection which provides the following facilities:

- A means to power the drive display up without the need for mains power. This allows the user to navigate and edit the drive parameters using the drives built-in keypad.
- A PC connection over USB-C which can be used in conjunction with the OptiTools Pro software suite. (Available as a free download from www.invertekdrives.com/variable-frequency-drives/optidrive-elevator-core

Invertek Drives recommends that an isolated cable is used between the drive and the PC.

Note: When the drive is powered from the USB-C connection only:

- Other serial communication interfaces will not operate.
- Allows Parameter editing via keypad or USB-C.

The USB-C port can be turned off by setting **P**2-13 (USB Port Enable) to 0 (Disabled).

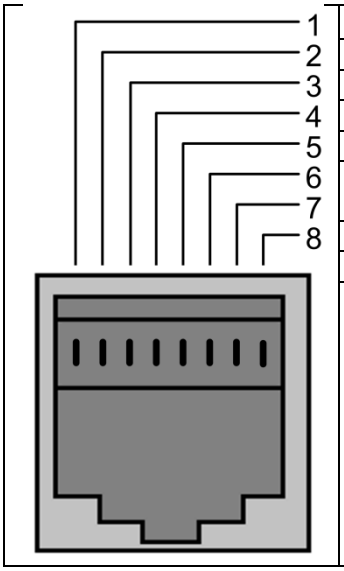
17.2. RS-485 communications

The drive has an on-board RJ45 connector. This connector provides the following connections:

- Connection of the drive to a PC with OptiTools Pro software installed.
- Modbus-RTU network Connection.
- CanOpen network Connection.

PC Connection and network connection can be used simultaneously.

The electrical signal arrangement of the RJ45 connector is shown below :



1	CAN-
2	CAN+
3	0 Volt
4	RS 485- PC Connection
5	RS 485+ PC Connection
6	+24 Volt Remote Keypad Power Supply
7	RS 485- Modbus RTU
8	RS 485+ Modbus RTU

17.3. PC Tool

Download PC tool here

18.Other Commonly Used Functions

P3-02	Motor Contactor—Monitoring Terminal Enable
Function	The drive can monitor the state of the motor contactor by using an auxiliary contact connected to one of the drives digital input terminals, this allows early detection of a motor contactor fault. **0 = Off** — Motor Contactor Monitoring Disabled **1 = Enabled** — Motor Contactor Monitoring Enabled Through Digital Input 5 when **P**1-02 Macro = 2 or 4 Through Digital Input 6 when **P**1-02 Macro = 3, 5, 6, or 10

P3-04	Brake Resistor Resistance
P3-05	Brake Resistor Power
Function	For software protection of the connected brake resistor, enter the rated power and resistance of the resistor into the above parameters. The drive will then monitor the brake resistor to ensure that it does not operate outside of its design limits.
Adjustment	Populate the values of the brake resistor into P3-04 and P3-05 Where an external thermal protection device is fitted, and software protection is not required. Setting the parameter to zero will disable the software protection feature.

P6-02	Encoder Feedback Direction
Function	Changes the direction of the incremental signals of the encoder feedback signal. **0** = **A leads B when an Up command is given (Clockwise Direction)** 1 = B leads A when an Up command is given (Anti-Clockwise Direction)

P6-11	Speed Error Trip Level
Function	Sets the speed error detection level as a % of motor rated speed, setting 0 disables the speed error detection.

P7-02	Rescue Operation Mode
Function	**0 = Rescue direction governed by controller direction signal to the drive control terminals.** 1 = Rescue direction based on load measurement test in both directions. 2 = Rescue direction based on last load measurement during last stop.

P10-08	Motor Connected Check
Function	This function ensures that all 3 phases of the motor are connected prior to releasing the electro-mechanical brake, helps detect breaks in the connection between the drive and the motor, for example a broken cable or a faulty contactor. The drive will trip "OUt-Phx" if the drive detects the motor is not connected, where x is the phase that is missing e.g. "OUt-PhU"
Adjustment	Setting 0 means function is disabled. The correct value is one in which the audible noise level is acceptable, but the drive still detects a missing motor phase should it not be connected.

P11-01	Save User Defaults
Function	0 = No Action 1 = Save currently active parameters as user defaults.

P11-09	Output Phase Sequence
Function	0 = U, V, W 1 = U, W, V. Direction of motor rotation when operating in a forward direction will be reversed.

P11-05	Effective Switching Frequency
Function	IGBT Switching Frequency. Higher switching frequencies reduce the audible 'ringing' noise from the motor, and improve the output current waveform, at the expense of increased drive losses.

19.Safe Torque Off

19.1. Safe Torque Off

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

19.1.1. 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.

19.1.2. 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 (STO1 & STO2), 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 occurred, the drive has been proven in respect of this by meeting the following safety standards :

Safe Torque Off (STO)	IEC 61800-5-2:2016	SIL 3
	EN ISO 13849-1:2015	PL "e"
	EN 61508 (Part 1 to 7): 2010	SIL 3
	EN 60204-1: 2006 & A1: 2009	Cat 0
	EN 62061: 2005 & A2: 2015	SIL CL 3
	Independent Approval	Pending

Note : The values achieved above maybe jeopardised if the drive is installed outside of the Environmental limits detailed in section 4.2 and 7.3.

19.1.3. 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 Gearless (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).

19.1.4. "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**1-02) 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.

The STO inputs are positive logic inputs only and are therefore not affected by the setting of parameter **P**1-43 (Positive/negative logic select).

The STO inputs STO1 and STO2 can tolerate a maximum synchronisation delay of 120ms, otherwise the drive will trip Sto-F , (Power cycle required to clear the trip).

19.1.5. "STO" Status and Monitoring

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

Drive Display

In normal drive operation (Mains AC power, UPS Power or Battery Power), when the drives "STO" input is de-energised ("STO" Function activated) the drive will highlight this by displaying **"I nH ib it".**

Note: If the drive is in a tripped condition, then the relevant trip will be displayed and not "I nH ib it").

Drive Status parameter

Parameter **P**0-03 can be viewed to see the STO input status as illustrated below :

Display value					0
Input Terminal					STO1/STO2

1 = Input Active 0 = Input Inactive

Drive Output Relay and Digital Outputs

Relay 1 or the digital outputs can be used to monitor the status of the STO inputs by setting the function to 8.

For Relay 1 set **P**1-30 to 8.
For Digital Output 1 (DA1) set **P**1-15 to 8 and **P**1-14 to 0
For Digital Output 2 (DA2) set **P**1-22 to 8 and **P**1-21 to 0
For Digital Output 3 (DO3) set **P**1-28 to 8.

"STO" Fault Codes

Fault Code	Code Number	Description	Corrective Action
Sto-F	29	Internal STO circuit Error	• Check supply to terminals STO1 and STO2 is >18V • Ensure the synchronisation delay between STO1 and STO2 is no greater than 120ms • Can also be caused by a short circuit in the safety circuit. Note : A Power Cycle is required to clear this trip (Providing the cause of the trip has been removed) Otherwise refer to your Invertek Sales Partner
Sto-L	101	STO1 / STO2 inputs opened whilst drive running	
Sto-S	30	The STO1/STO2 inputs have not changed state since the end of the travel profile (Default 2.0 sec's)	• Ensure Safety chain is disabled at the end of travel profile. Feature can be disabled by setting P11-24 to 0. Can also be caused by a short circuit in the safety circuit.

19.1.6. "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)

- 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 20ms.
- The response time from the "STO" inputs being de-energised to the "STO" monitoring status changing state is less than 20ms
- 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.

19.1.7. "STO" Electrical Installation

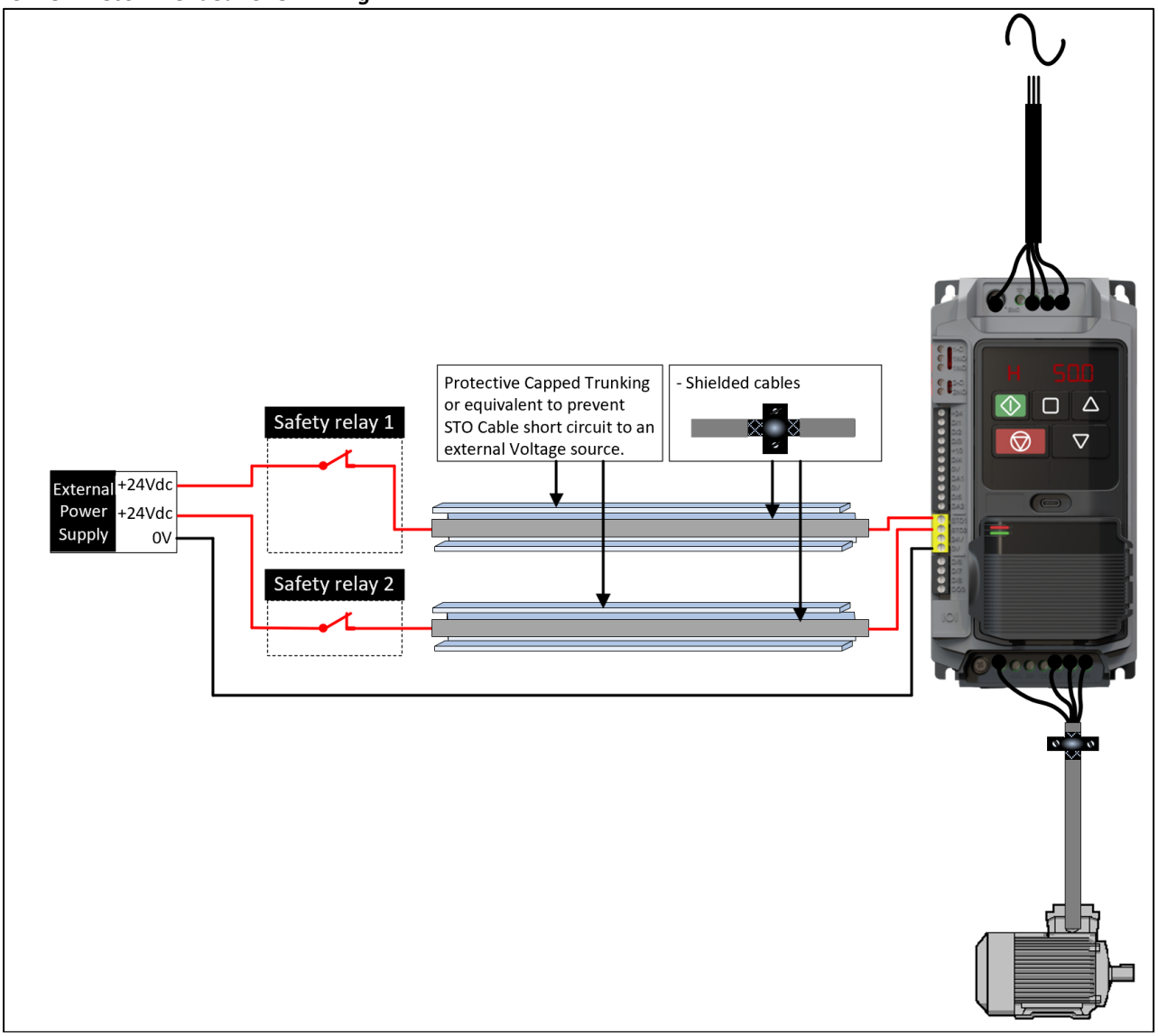
The "STO" wiring shall be protected from inadvertent short circuits or tampering which could lead to failure of the "STO" input signal, further guidance is given in the diagram below.

In addition to the wiring guidelines for the "STO" circuit below, section 8.2 "EMC compliant installation" should also be followed.

The drive should be wired as illustrated below; the 24Vdc signal source applied to the "STO 1 and STO 2" inputs can be either from the 24Vdc on the drive or from an External 24Vdc power supply (as per the diagram below), noting that the same installation rules apply for protection of the cables.

The diagram below only considers the STO part of the circuit for a full system wiring diagram then refer to section 8.3

19.1.8. Recommended "STO" wiring



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

19.1.9. External Power supply Specification.

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

19.1.10. Safety Relay Specification.

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

Standard Requirements	SIL3 or PLe or better (With Forcibly guided Contacts)
Number of Output Contacts	2 independent
Switching Voltage Rating	30Vdc
Switching Current	100mA

19.1.11. Enabling the "STO" Function

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

19.1.12. 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 primary command source selected in **P**1-01)*:
    - De-energise the "STO" inputs (Drive will display "Inhibit").
    - Give a start command *(as per the primary command source selected in **P**1-01) and check that the drive still displays "Inhibit" and* that the operation is in line with section 19.1.5 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 19.1.4 "STO" Operation *and section 19.1.5* "STO" Status and Monitoring.

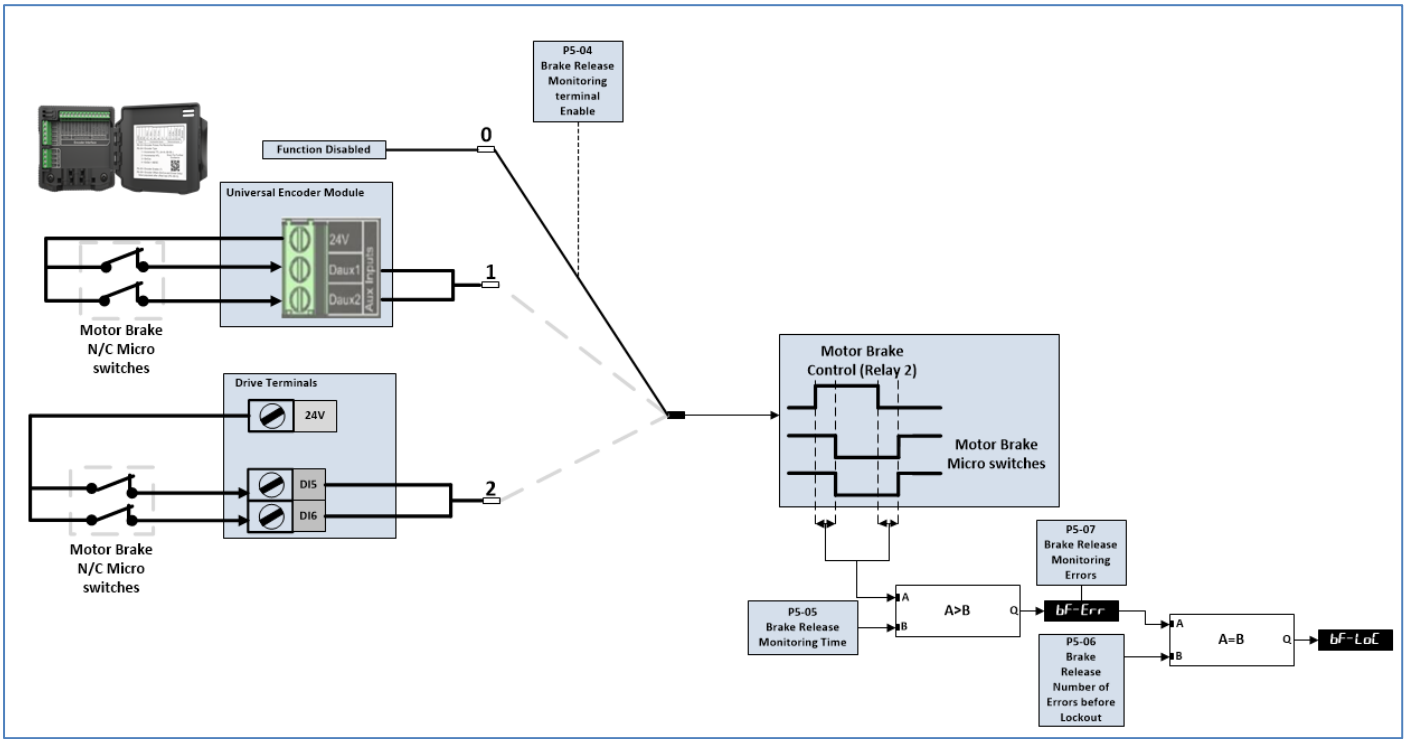
19.1.13. "STO" Function Maintenance.

Periodic testing of the entire safety circuit within which the drive STO is integrated, is a mandatory requirement. The testing should be repeated every three months or less to ensure the integrity level of the safety circuit is maintained, furthermore the function should be integrity tested following any safety system modifications or maintenance work.

20.Motor Brake Monitoring (UCM)

In accordance with EN81-20 the drive can be used to monitor and verify (using Brake micro switches) the mechanical brake dropping mechanism after each brake release (Relay 2 of the drive as default), and if verification fails then the drive will trip and prevent the drive reacting to any further run commands, once the trip occurs then it can only be reset by a "competent person" and not by a normal trip reset or power cycle.

The brake micro switches can be connected to either the Universal Encoder Module or directly to the drive terminals as illustrated in the diagram below, noting that the function is enabled using parameter P5-04.



Par	Parameter Name	Minimum	Maximum	Default	Units	Visibility Modes	Accessibility
P5-04	**Brake Release Monitoring Enable**	0	2	0	n/a	All	
	0 (Function Off) : Motor Brake Release Monitoring Disabled **1 (Function Enabled) :** Motor Brake Release Monitoring Enabled and monitored via Daux 1 Input and Daux 2 Input on the Universal Encoder Module with 2 N/C contacts. **2 (Function Enabled) :** Motor Brake Release Monitoring Enabled and monitored via Digital Inputs DI5 and DI6 providing that **P**1-02 is set to Macro 8.						
P5-05	**Brake Release Monitoring Time**	0.1	5.0	0.5	sec's	All	
	If the monitoring terminal has not changed state in this time (since the brake has been released by relay 2 of the drive) then the drive will trip "bF-Err" or "bF-LoC" (if number of attempts as set in **P**5-06 has been met)						
P5-06	**Brake Release Number of Errors Before Lockout**	0	5	0	-	All	
	The drive will automatically try to clear the "bF-Err" at 1.5 second intervals for the number of times set, after each attempt the travel sequence will restart, once the number of brake release monitoring errors has reached the number set in this parameter a permanent trip "bF-LoC" will be displayed.						
P5-07	**Brake Release Monitoring Errors**	0	65535	0	-	All	
	Total number of "bF-Err" trips since the drive was installed.						

Note :	bF-Err trip will automatically reset itself after 1.5 second or can be reset manually e.g. direction input/reset input toggled.

20.1.1. Method of Operation

When the function (Motor brake monitoring) is enabled, the drive will monitor the chosen terminals as per set in **P**5-04 and check that each time the brake is commanded to open/close the micro-switches change to the correct state within a set time (**P**5-05), if the state is incorrect then the drive will display the warning message "bF-Err", reset and have another attempt, if after the number of attempts (as set in **P**5-06) the brake micro switches are indicating the incorrect state then the drive will permanently show the error message "bF-Loc".

Before the lift is put into service, test runs should be performed to ensure that the function works as expected.

In the instance of the permanent error message "bF-Loc" being shown, then it can be cleared as follows:

1. Disable drive.
2. Set **P**5-04 to Off.
3. Press Mode button.
4. Set **P**5-04 back to the required monitoring terminal as per set in (**P**5-04).

20.1.2. Checking for correct Operation

Once the relevant parameters have been programmed (as detailed above) then the "Brake release monitoring" function should be verified for correct operation, this can be carried out by exercising the micro switches/monitoring input (during a low speed run) to simulate the brake not releasing/closing and checking that the ""bF-Err"/"bF-LoC" error message/s is shown.

21.Troubleshooting

21.1. Warning Messages

Warning message	Description	Corrective Action/Further information
OuLd	Motor Overload	Increase acceleration rate (**P**8-03). Reduce the load, check the load mechanically to ensure it is free, and that no jams, blockages or other mechanical faults exist. If operating a Gearless motor check the encoder offset is correct and try repeating the measurement to confirm consistent values are being measured (**P**4-08=3)
Ot-br	Brake Resistor Overtemperature warning	
Ot-mt	Motor Overtemperature warning	
Ot-dr	Drive Overtemperature warning	
noAc in	Mains Loss	Check AC Supply is connected Check AC is connected to the drive input terminals and not the drive output terminals U,V,W
SEr	Service Required	The time programmed in parameter **P**11-17 (Service time interval) has elapsed
tr-Lt	Travel Limit Reached	Travel direction change counter (Rope wear Counter) as per set in parameter **P**10-05 has been reached

21.2. Clearing Fault Messages

Providing the cause of the fault message has been removed the fault can be reset by pressing the reset button on the drive, toggling a direction input, or providing a reset signal into the digital input that is assigned as a reset input.
The exception to the above is in the case of an STO-F fault which requires a power cycle.

Fault Messages and Display Messages

21.3. Fault Messages and Display Messages

Display message	No.	Description	Corrective Action/Further information
A i-Lo5	59	Analog input signal loss	Drive has observed that there is no signal/speed reference being received at the Analogue input terminal DI4 (when **P**1-02 is set for Macro 6)
AtF-01	40	Auto-tune 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 (motor contactor is closed) 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 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 as expected. Ensure the motor is correctly connected and free from faults. Check that the power rating corresponds to the power rating of the drive.
AtF-06	45	Encoder offset measurement failed	Drive has failed to measure the Encoder offset value using autotune method 2 in **P**4-08. Normally Occurs on Permanent Magnet motors with Surface Mounted magnets.
AtF-nA	109	Selected Auto-tune method incorrect for the selected Motor	Use Auto-tune 1 (**P**4-08=1) instead.
bF-Err	46	Brake Release Monitoring-Warning	Check that there are no problems with the actual brakes, if confirmed as ok then check brake micro-switches, and brake release monitoring time set in **P**5-05 is suitable.
bF-Loc	47	Brake Release Monitoring-Lockout	
bUS-08	67	Internal Communication Error	Power Cycle Drive, remove all power sources including USB-C. If error still shows after power cycle, then contact your local Invertek representative.
bUS-__	-	Internal Communication Error	Contact your local Invertek representative.
CC	-	Motor Contactor Closing/opening delay time	Shown during the period set in parameter(**P**3-01) motor contactor closing/opening time allowance (Feature Pending)
cF-Err	96	Motor Contactor feedback error	Motor contactor is in wrong state as indicated by feedback signal from contactor.
CFG-Ch	77	Drive configuration data changed.	
CFG-dF	78	Drive configuration mismatch PS/IO	

Display message	No.	Description	Corrective Action/Further information
CF9-Er	79	Drive configuration data missing or corrupt.	
CrFLt	30.03	Critical Module error	
dAtA-3	98	Internal data error	
dAtA-E	19	Internal memory fault	1. Reset drive (Red Button) 2. Power Cycle 3. Internal Comms Link Lost Refer to your Invertek Sales Partner. Parameters not saved, defaults reloaded. Try again. If problem recurs, refer to your Invertek Sales Partner
dAtA-F	17	Internal memory fault	Can happen if the drive firmware has been downgraded and a feature which was being used previously is no longer available, in this case the solution is to cycle power and perform a parameter defaults and reprogram the drive with required parameter settings. If problem recurs, refer to your Invertek Sales Partner.
Ed-dAt	30.70	Encoder Feedback Error	Data Loss - Fault with CLK, DATA or supply lines.
Ed-Pd	30.71		Propagation Delay Error (Cable too long)
Ed-LoS	30.72		Comms Interruption due to excessive signal drop out or Line Loss on one of the encoder lines, if after a reset Ed-dAt shows it would indicate a Line Loss on one of the encoder lines.
Ed- inc	30.73		Encoder Incompatible
Ed-AOS	30.74		Endat ABS Overspeed
Ed-SOS	30.75		Endat SC Overspeed
Ed-SAb	30.76		Sin Cos Line Loss
Ed- 1	30.77		Endat Error - Light Unit Failure
Ed-2	30.78		Endat Error - Signal Amplitude to low
Ed-3	30.79		Endat Error - Position calculation error
Ed-4	30.80		Endat Error - Supply Overvoltage
Ed-5	30.81		Endat Error - Supply Undervoltage
Ed-6	30.82		Endat Error - Supply Overcurrent
Ed-7	30.83		Endat Error - Battery need replacing
Ed-8	30.84		Encoder Reported Unknown Error
Enc-CL	32	Encoder Module not fitted	Encoder I/O Comms Loss - Confirm module is fitted and pushed fully home.
Enc-PP	99	Encoder PP is 0 with encoder enabled	Set Encoder Pulse per revolution into parameter (**P**6-03)
E-tr iP	11	External trip	E-trip requested on control input terminals. Some settings of **P**1-02 require a normally closed contact to provide an external means of tripping the drive if an external device develops a fault. If a motor thermistor is connected check if the motor is too hot.
Enc-Er	30	Encoder Feedback Faults (Only visible when an encoder module is fitted and enabled)	Will also show sub-trip code to Encoder communication /data loss
EncCF8	111	Encoder Configuration Error	Encoder type has not been set in parameter **P**6-04.
EncCF9	100	Encoder Configuration Error	Encoder offset measurement has been attempted with Encoder disabled, check Encoder is Enabled (**P**6-05=1)
E- 103	103	Unexpected PS Firmware Change	
E-250	250	Internal Error	
E-251	251	Module not supported	
E-252	252	IO not supported	
E-253	253	Hardware ID not supported	
E-254	254	Drive ID not supported	
E-255	255		
FLt-dc	13	Excessive DC Ripple	The DC Bus Ripple Voltage level is displayed in parameter **P**0-41 Check all three supply phases are present and within the 3% supply voltage level imbalance tolerance. Reduce the motor load.
F-Ptc	21	Motor PTC Over Temperature	The connected motor PTC device has caused the drive to trip
F-tY	57	Motor KTY84 Thermistor Fault	
FAn-F	22	Cooling Fan Fault	Check and if necessary, replace the drive internal cooling fan
HtL0	30.29	Quadrature TTL Over-speed	
h 0-1	15	Instantaneous over current on drive output.	Refer to fault 3 below

Display message	No.	Description	Corrective Action/Further information
I_t-trP	4	Drive has tripped on overload after delivering >100% of value in **P**4-03 for a period of time.	Increase acceleration rate (**P**8-03) or reduce the load. Check motor cable length does not exceed exceeds 100m (screened cable), or 150m (un-screened cable). Ensure the motor nameplate parameters are correctly entered in **P**4-02, **P**4-03, **P**4-04, **P**4-05. If operating in Vector mode (**P**4-01 – 0 or 1), also check the motor power factor in **P**4-07 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. If operating a Gearless motor check the encoder offset is correct and try repeating the measurement to confirm consistent values are being measured (**P**4-08=3)
InLoSS	102	3 Phase input loss whilst running	
IC-A	30.20	Encoder Channel A Fault	Check Encoder wiring. Check Encoder
IC-b	30.23	Encoder Channel B Fault	
IC-2	30.26	Encoder Channel Z Fault	
L1-LoS	92	L1 Phase is not present	
L2-LoS	93	L2 Phase is not present	
L3-LoS	94	L3 Phase is not present	
no-FLt	0	No Fault	
Odr-Er	55	Wrong Run Sequence	Confirm STO1/STO2 and direction input is applied **before** speed commands. This function can be disabled by setting **P**11-23 to 1:Disabled
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 is as shown in section 7.5 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 **P**11-05 Reduce the load on the motor / drive
OUt-F	26	Drive output fault	Drive output fault, confirm all 3 motor phases are connected, check that output contactors are closing fully, not arcing, or not opening whilst the drive is running. Confirm contactor control connections to the drive are correct.
O-t	8	Heatsink over temperature	The heatsink temperature can be displayed in **P**0-48. Check the drive ambient temperature Ensure the drive internal cooling fan is operating Ensure there is the required space around the drive as shown in section 7.5 and that the cooling airflow path to and from the drive is not restricted Reduce the effective switching frequency setting in parameter **P**11-05 Reduce the load on the motor / drive
OI-b	1	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 6. Check the brake resistor and wiring for possible short circuits.
OL-br	2	Brake resistor overload	The drive software has determined that the brake resistor is overloaded (based on the values entered in **P**3-04 and **P**3-05), 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 time **P**8-04, reduce the load inertia or add further brake resistors in parallel, observing the minimum resistance value for the given drive.

Display message	No.	Description	Corrective Action/Further information
O-I	3	Instantaneous over current on drive output (Triggered from Drive Output Current Measurement)	**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. Is the drive sized correctly for the connected motor? Ensure the motor nameplate parameters are correctly entered in **P**4-02, **P**4-03, **P**4-04, **P**4-05. If operating in Vector mode (**P**4-01 – 0 or 1), also check the motor power factor in **P**4-07 and ensure an auto-tune has been successfully completed for the connected motor. If operating in Enhanced V/F mode reduce the Boost voltage setting in **P**4-09 Increase the acceleration ramp up time in **P**8-03 If the connected motor has a holding brake, ensure the brake is correctly connected and controlled, and is releasing correctly. If operating a Gearless motor check the encoder offset is correct and try repeating the measurement to confirm consistent values are being measured (**P**4-08=3). **Fault Occurs When Running** If operating in Vector mode (**P**4-01 – 0 or 1, 3), reduce the speed loop gains as described in section 13.3
OUt-PH	49	Output phase loss	Check all 3 motor phases are connected, confirm that motor contactor is closing
OUt-U	88	U Phase PWM output Loss	
OUt-u	89	V Phase PWM output Loss	
OUt-V	90	W Phase PWM output Loss	
O-uoLt	6	Over voltage on DC bus	Check that the lift has been correctly balanced. Check that a brake resistor is connected correctly to terminals +DC and BR. Check the resistance of the brake resistor complies with the values in section 6. If the fault occurs on stopping or during deceleration, increase the deceleration time in **P**8-04 If operating in Vector Mode (**P**4-01 = 0,1,3), reduce the speed loop gains as detailed in section 13.3 Check that the mains voltage level is within the range detailed in section 6. The value of the DC Bus Voltage can be displayed in **P**0-40
Ot-br	58	Brake resistor overtemperature	Based on Brake resistor over temperature feedback via drive terminals.
OI-U	81	Output (Motor) U Phase overcurrent	See O-I diagnosis
OI-u	82	Output (Motor) V Phase overcurrent	
OI-V	83	Output (Motor) W Phase overcurrent	
OI-2	84	Ground current fault	
OPh-U	85	Output (Motor) U Phase Loss	U phase is not connected to the drive, check that output contactors are closing fully, not arcing, or not opening whilst the drive is running, and see **P**10-08 (Motor connected check).
OPh-u	86	Output (Motor) V Phase Loss	V phase is not connected to the drive, check that output contactors are closing fully, not arcing, or not opening whilst the drive is running, and see **P**10-08 (Motor connected check.
OPh-V	87	Output (Motor) W Phase Loss	W phase is not connected to the drive, check that output contactors are closing fully, not arcing, or not opening whilst the drive is running, and see **P**10-08 (Motor connected check.
O-SPd	91	Maximum speed has been exceeded	Shown when the rotor speed is higher than 150% of maximum speed (**P**8-01) (immediate trip) or higher than 125% maximum speed (**P**8-01) for more than 100ms, whichever happens first.
P-ASY	95	Input phase voltage imbalance	
P-dEF	10	Factory Default parameters have been loaded	Press STOP key, the drive is now ready to be configured for the required application.

Display message	No.	Description	Corrective Action/Further information
P-LOSS	14	Input phase loss trip	Drive intended for use with a 3 phase supply, one input phase has been disconnected or lost.
Prog-2	-	Error during firmware upgrade	1. Reset drive (Red Button) 2. Retry firmware Upgrade 3. Power Cycle 4. Internal Comms Link Lost refer to your Invertek Sales Partner.
PE	30.02		Parameterisation Error
PS-trP	5	Instantaneous over current on drive output (Triggered from Power Module Current Measurement)	Refer to fault 3 above
SC-Ab	30.50	Sin Cos A B Line Loss	Check Encoder wiring. Check Encoder
SC-C	30.51	Sin Cos C Line Loss	
SC-d	30.52	Sin Cos D Line Loss	
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 **P**2-06 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 **P**2-06 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
SC-OS	30.53	Sin Cos Over-speed	
SC-LoS	97		1. Reset drive (Red Button) 2. Power Cycle 3. Internal Comms Link Lost refer to your Invertek Sales Partner.
SC-th	27	Motor thermistor short circuit	Check motor thermistor for wiring faults, check thermistor has not failed.
ShoS	30.01	Motor Over Speed	
SP-Err	31	Speed Error	Encoder Speed Error. The % error between the estimated (open loop)/measured encoder feedback speed and the actual motor speed is greater than the value set in **P**6-11 for the time set in **P**6-12 • Confirm that the speed loop gains have been optimised. • Confirm that the encoder direction and motor direction are the same. **P**11-09 (Output Phase sequence) and **P**6-02 (Encoder Feedback Direction) can be used to match the directions. • In Gearless applications can be caused by excess rollback, see section 14 Comfort Optimisation • If operating a Gearless motor check the encoder offset is correct and try repeating the measurement to confirm consistent values are being measured (**P**4-08 to 3) • In Geared Open loop applications this can be caused by the motor stalling, check : o Motor data is correct, and an auto-tune has been performed. o Motor rated current is set correctly. o Magnetising current in **P**4-28 is not too high. o Brake is releasing.
Sto-F	29	Internal STO circuit Error	Check supply to terminals STO1 and STO2 is >18V Ensure the synchronisation delay between STO1 and STO2 is no greater than 120ms Can also be caused by a short circuit in the safety circuit. A Power Cycle is required to clear this trip (Providing the cause of the trip has been removed) Otherwise refer to your Invertek Sales Partner
Sto-L	101	STO1 / STO2 inputs opened whilst drive running	
Sto-S	39	The STO1/STO2 inputs have not changed state since the end of the travel profile (Default 2.0s)	Ensure Safety chain is disabled at the end of travel profile. Feature can be disabled by setting P11-24 to 0. Can also be caused by a short circuit in the safety circuit.
ttLO	30.30	Quadrature HTL Over-speed	
th-FLt	16	Faulty thermistor on heatsink.	Refer to your Invertek Sales Partner.
tr-Lt	Tbc	Travel limit counter reached	The value set in parameter **P**10-05 (Travel Direction Change Counter limit) has been reached.

Display message	No.	Description	Corrective Action/Further information
U-dEF	20	User Parameter Defaults	User Parameter defaults have been loaded. Press the Stop key.
U-uoLt	7	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. Confirm that the voltage is within the range detailed in section 6.4 and 16.1 If in rescue mode try decreasing rescue mode speed (**P**7-03)
UPS-L	110	UPS Overload	Whilst operating in Rescue mode the output power to the motor exceeded the value of UPS rating (**P**7-04) for the time set in parameter (**P**7-16) UPS Overload Time Limit, Reduce Rescue Mode Speed/Motor Load.
U-t	9	Under temperature	Trip occurs when ambient temperature is less than -20°C. The temperature must be raised over -20°C in order to start the drive.
USb C	-	Drive is being powered from the USB-C port on the front of the drive.	
USb P	-	Drive is being powered from the USB-C port on the front of the drive and data transmitting via USB-C is disabled (**P**2-13 set to 0)	
USr-PS	-	Save User defaults action has been performed	Shown when **P**11-01 is set to 1 to save values as user default parameters.
USr-cL	-	Clear User defaults action has been performed	Shown when **P**11-01 is set to 2 to clear user default parameters.
4-20 F	18	4-20mA Signal Lost	The reference signal on Analog Input 1 or 2 (DI4/DI5) has dropped below the minimum threshold of 3mA. Check the signal source and wiring to the drive terminals.
4-20 I	28	Current input >25mA	Reduce current to maximum of 20mA on terminals DI4/DI5

21.4. Encoder Module Status LED's.

LED	Function	Indication
Top LED (P)	Power Status	Red = Power on
		Off = No power
Bottom LED (S)	Error Status	Off = No Error
		Green = No Signal connected/received
		Green Flashing = Error

21.5. Common Problems and Solutions

Problem: Drive is showing Stop even though a start command has been given to terminal DI1/DI2

Solution: If using Macro 1-8,10,12 (as set in P1-02), ensure that STO1/2 inputs come on before direction and speed selections, if it is required for the drive to run with STO1/2 inputs coming on last then use alternative macro 10 or 12.

Problem: How can I check if the heatsink fan is working correctly.

Solution: Press all 5 keypad buttons at exactly the same time and the fan will run at full speed, the display will also show 8.8.8.8.8.8.8.8

Problem: Drive will not perform an Auto-tune

Solution: Check that the drive is not in Rescue mode, Auto-tune is prohibited in Rescue mode.

22. Drive and Application Details

Building Name:	
Equipment No/Name:	
Drive Serial Number: ***Tip :*** Found on the front of drive	
Drive Firmware version: ***Tip :*** Shown in parameters P0-72 & P0-73	
Motor Details:	
Date of Installation	
Notes	
Parameter Changes ***Tip :*** Setting Parameter **P**0-00 to 0 will show all parameters that are different from factory defaults	

82-ECMAN-IN_V1.02

EFFECTIVE: 29-05-2025

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