# 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, the Elevator core reference manual is also available (Scan QR code on Front cover) which covers all features and functions in more detail.

## 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, incorrect installation, unacceptable dust, moisture, corrosive substances, excessive vibration or ambient temperatures outside of the design specification.

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

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

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



## This User Manual is for use with version 1.0 Control Firmware and 1.03 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 Main AC supply, Battery supply, UPS supply.<br>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 sections of the above 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 with the standards listed below.

| Standard | Classification | Independent Approval |
|---|---|---|
| **EN 61800-5-2:2017** | **SIL3** | ***TUV** |
| **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** TUV Approval of the "STO" function is relevant for drives which have a TUV 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 TUV logo on the rating label.

## Unintended Car Movement

Brake Contact Monitoring (Unintended Car Movement) EN 81-20:2014+A3 (certification by Lift Institute)

## 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 (certification by Lift Institute)

## 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.

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.

### *4.2.1. 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

### *4.2.2. Derating for Altitude:*

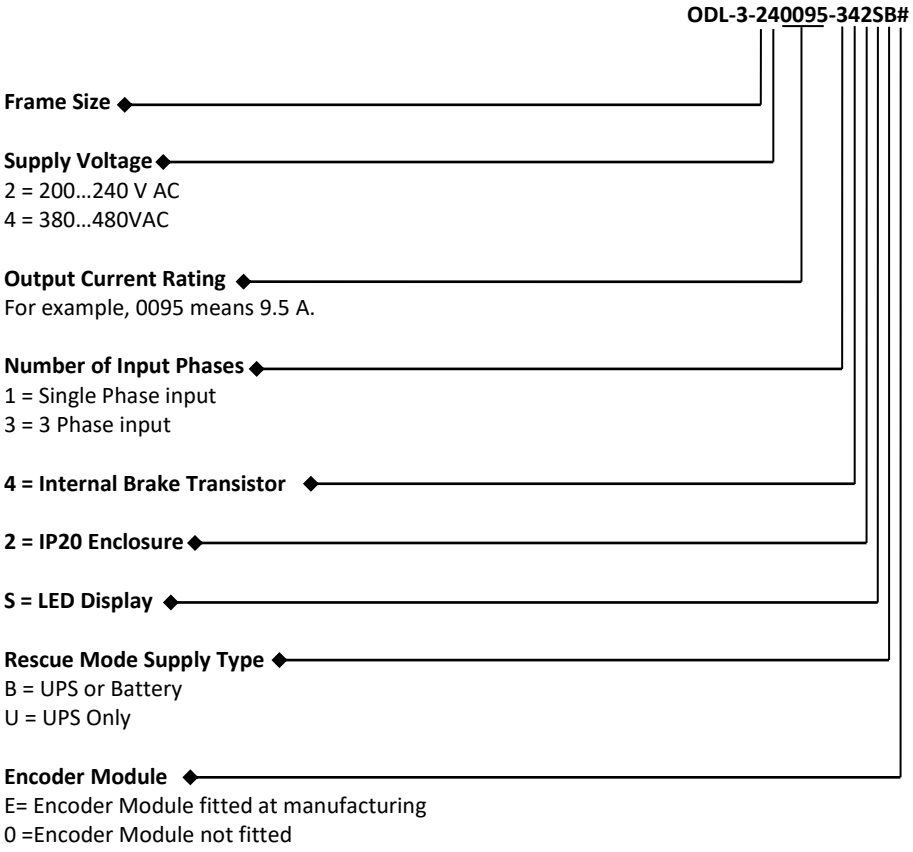
Derating of the drive maximum continuous output current capacity is required when Operating at Altitudes more than 1000m/ 3281 ft

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

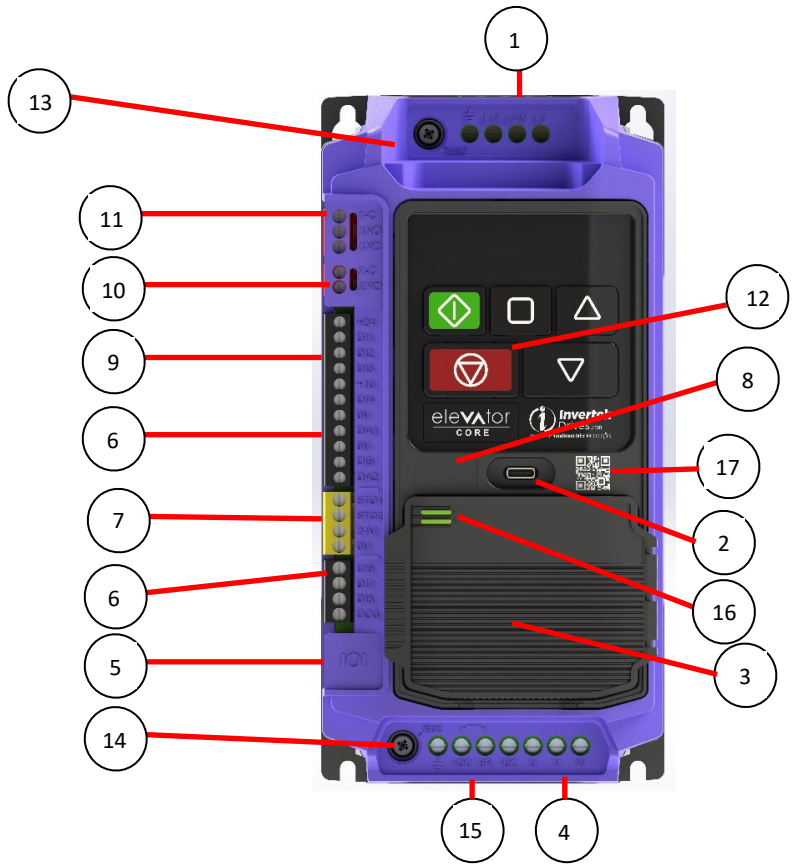
| Maximum Altitude Without Derating | Derate by | Maximum Permissible (UL Approved) | Maximum Permissible (Non-UL Approved) |
|---|---|---|---|
| 1000m / 3281ft | 1% per 100m / 328 ft | 2000m / 6562 ft | 4000m / 13123 ft |

# 5. Product Familiarisation.

## 5.1. Model Code Key

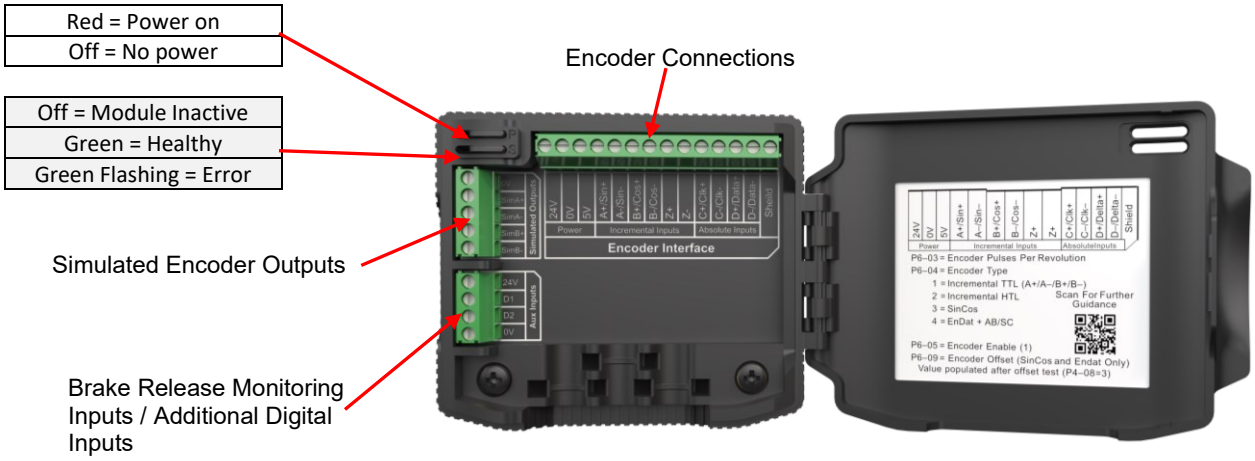


## *5.2.* Product Layout




| | |
|---|---|
| 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 / CAN open / PC interface (NOT FOR ETHERNET!) |
| 6 | Digital Inputs/Outputs |
| 7 | Safe Torque-Off Inputs |
| 8 | Drive Serial Number and Rating |
| 9 | Digital, Analogue 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 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 | 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 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 | 1000 |
| ODL-3-220240-342SB_ | 5.5 | 7.5 | 2 | 27 | 32 | 35 | 6 | 10 | 24 | | 20 | 1500 |
| ODL-3-320300-342SB_ | 7.5 | 10.0 | 3 | 34 | 40 | 40 | 16 | 6 | 30.0 | | 20 | 2000 |

## 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 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 | 1000 |
| ODL-3-240140-342SB_ | 5.5 | 7.5 | 2 | 21 | 32 | 30 | 6 | 10 | 14 | | 75 | 1500 |
| ODL-3-340180-342SB_ | 7.5 | 10 | 3 | 24 | 32 | 35 | 16 | 6 | 18 | | 50 | 2000 |
| ODL-3-340240-342SB_ | 11 | 15 | 3 | 30 | 40 | 40 | 16 | 6 | 24 | | 40 | 3000 |
| ODL-3-340300-342SB_ | 15 | 20 | 3 | 38 | 50 | 60 | 16 | 6 | 30.0 | | 50 | 4000 |

## 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 | 320Vdc |

## 6.5. Rescue Operation

| 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 (P4-03) 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 = 340Vdc<br>380-480V drives = 680Vdc | |
| | Control +24V connection to terminals 0V and +24V | 24V | 20V | 26V | 2.2A (60W) |

**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 assuming 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) Invertek Drives recommends the installation of input line reactors.

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

## 6.6. 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

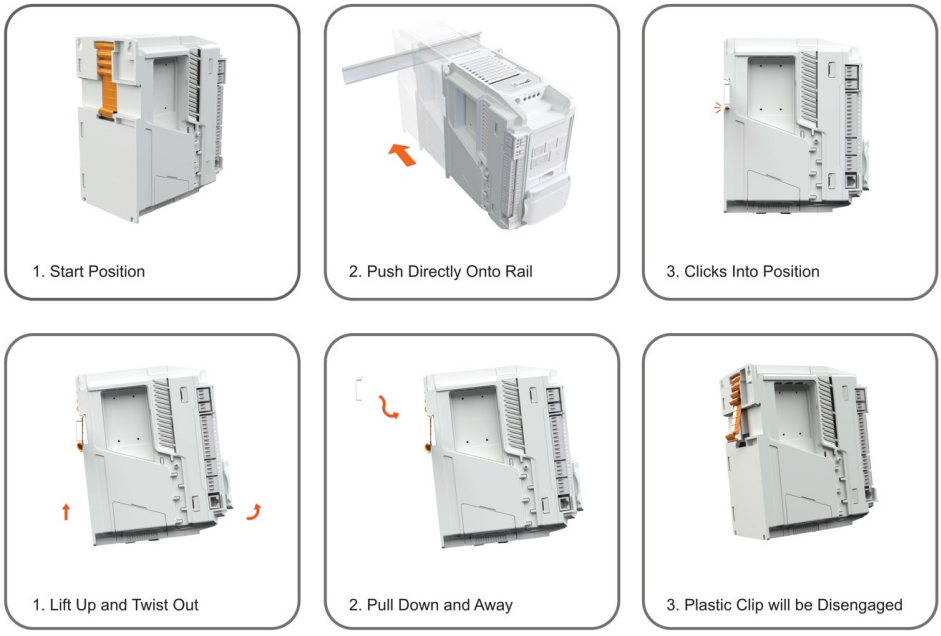
## 7.1. Preparing the drive for Mounting

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

## 7.2. 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 4.2.2
- Provide suitable clean, moisture and contaminant free cooling air sufficient to fulfil the cooling requirements of the drive.

**Using the DIN Rail mount on Frame Size 2**

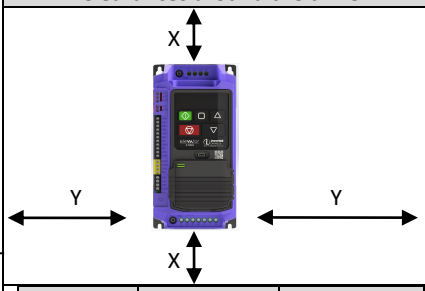



Patent pending GB 2625869.

**Using the Mounting Points**

| Mounting Bolts | | |
|---|---|---|
| Frame Size | Metric | UNF |
| 2 | M5 | #10 |
| 3 | M5 | #10 |

**Clearances around the drive**

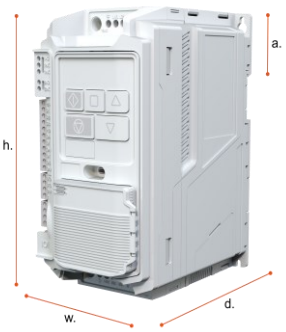



| Drive Size | X | | Y | |
|---|---|---|---|---|
| | mm | in | mm | in |
| 2 | 75 | 2.95 | 50 | 1.97 |
| 3 | 100 | 3.94 | 50 | 1.97 |

## 7.3. Weights and Dimensions

Note: Dimensions Include Encoder module but not Cable support brackets

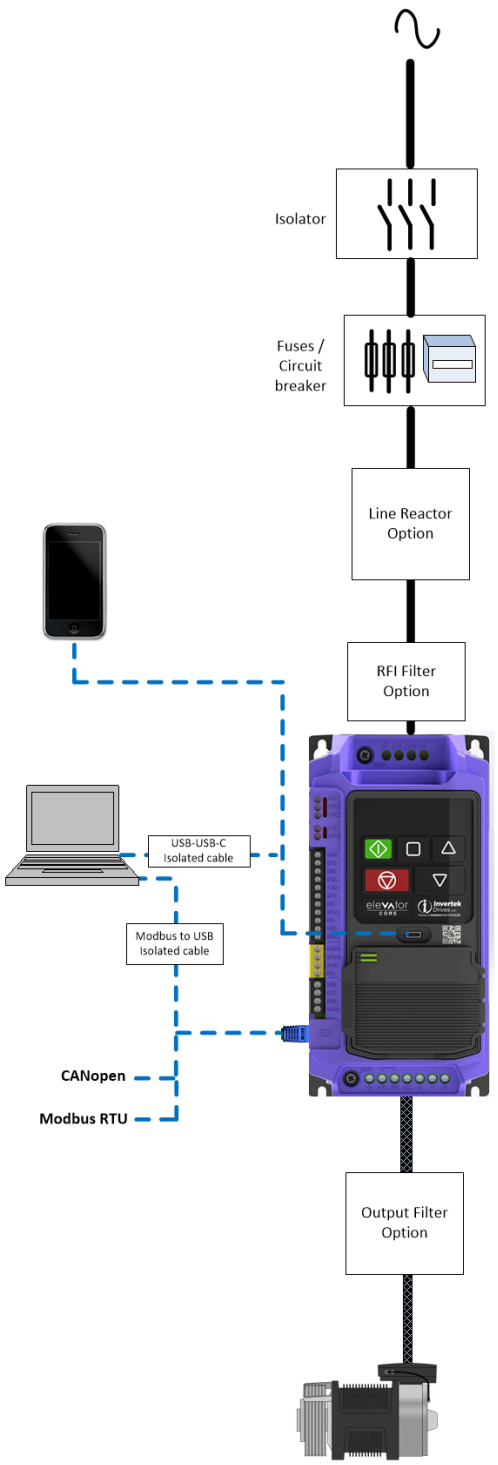
| Drive Size | H | | W | | D | | Weight | |
|---|---|---|---|---|---|---|---|---|
| | mm | in | mm | in | mm | in | Kg | lb |
| 2 | 220 | 8.66 | 110 | 4.33 | 184 | 7.24 | 1.8 | 4.0 |
| 3 | 264 | 10.39 | 131 | 5.16 | 207 | 8.15 | 3.5 | 7.7 |




**Installing the Encoder Module**

# 8. Electrical Installation

## 8.1. Electrical Installation quick reference diagram




- Check Supply Voltage does not exceed drive Voltage rating as shown on rating label.
- Check the number of supply phases is compatible with the drive as shown on 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 each power-on.

- 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 bus-bar and sliding contacts system.
- Reduction in mains Harmonic emission.

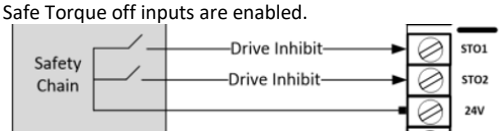
- Install External EMC filter if the motor cable length exceeds the Electromagnetic interference reduction capability of the internal filter
- Do Not Use EMC filters on IT (Ungrounded) or a corner grounded TN power supply systems.

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 the below conditions are met:

- Safe Torque off inputs are enabled.




- A direction Command (DI1 or DI2) has been given.
- 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.

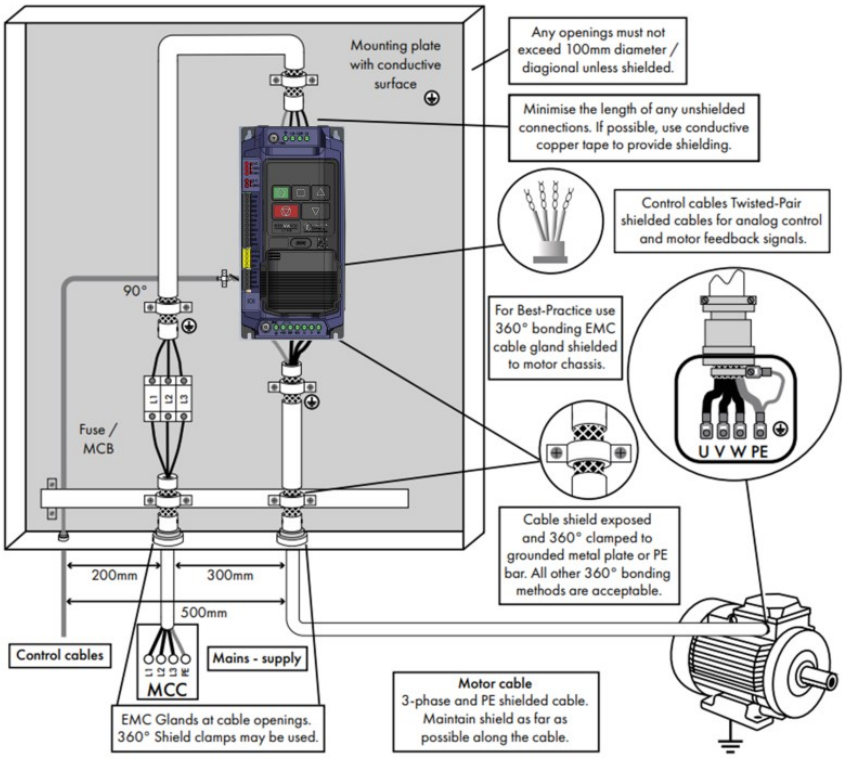
## 8.2. EMC Compliant Installation

### *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.

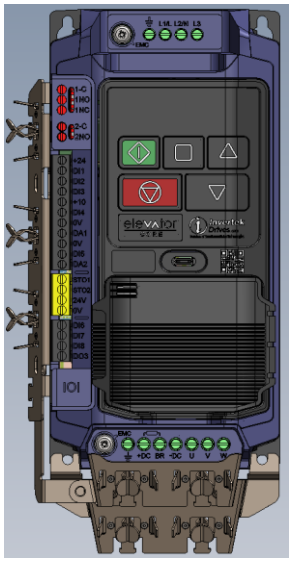
The diagram below provides general guidance to ensure compliance can be achieved.

### *8.2.2. Recommended Installation for EMC compliance*




### *8.2.3. EMC bracket*

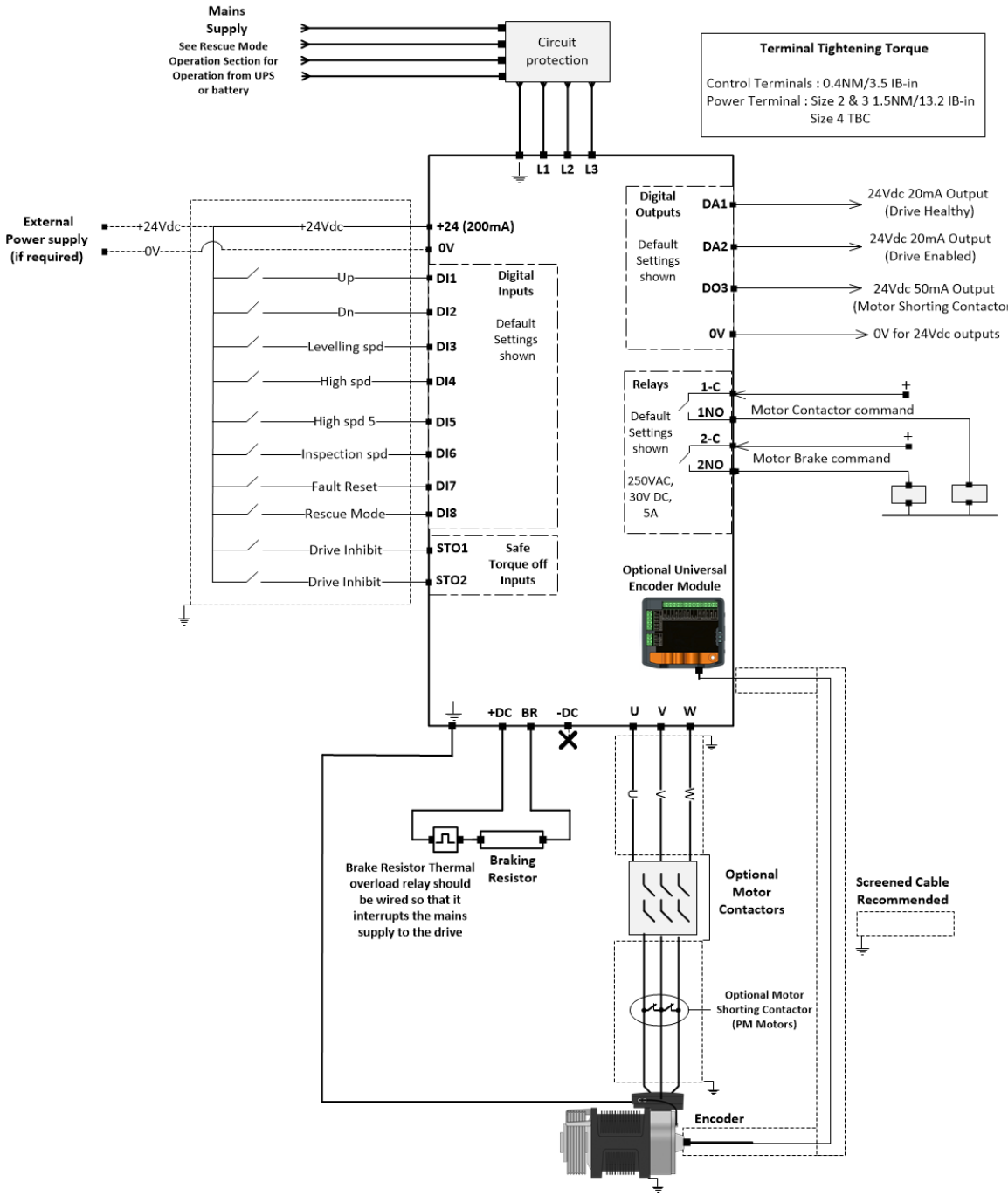
An optional EMC bracket is available to allow easy termination of cable shields/screens.



Part Number: OPT-3-ENCU-IN

## 8.3. Overall Wiring Diagram and default terminal functions

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



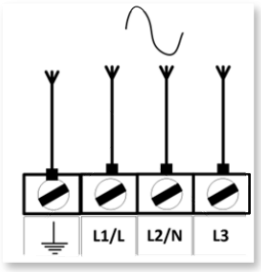

## 8.4. Encoder Wiring Connections

| 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)

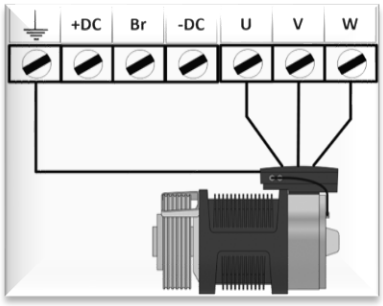
## 8.6. Power Supply Connections




- 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 EMC cable bracket should be used as per shown in section 8.2.

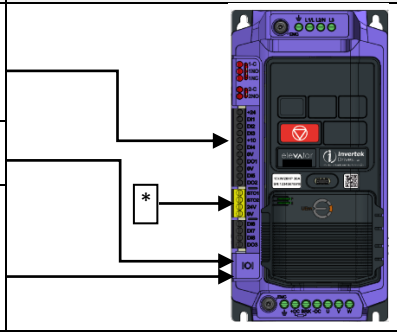
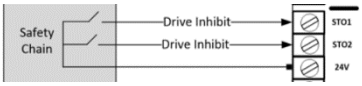
## 8.8. Motor Contactors

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.<br><br>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.<br>  | | |



## 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:

- Safe Torque off inputs are enabled.
- A direction Command (DI1 or DI2) has been given.
- 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 | 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**8-05 (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 | Off | 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 setting 7 above, the drive will only start if all the below conditions are met:

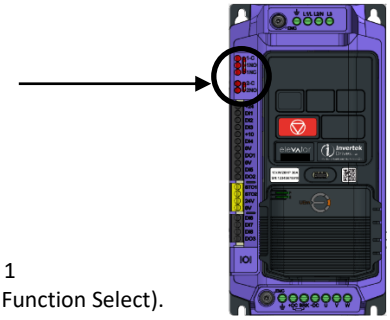
- Safe Torque off inputs are enabled.
- A direction command (DI1 or DI2) has been given.
- At least 1 speed has been selected.

| 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<br><br>(Only Active if **P**5-04 Brake Release Monitoring Enable is set to a value of 2) | Brake Release Monitor Input 2<br><br>(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) |
| *9 | Forward Direction Select | Reverse Direction Select | Rescue Mode Enable | 0 | 0 | 0 | Brake Release Monitor Input 1<br><br>(Only Active if **P**5-04 Brake Release Monitor Enable is set to a value of 2) | 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:<br><br>When a direction cmd 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<br><br>Also note in this mode the Auto-tune will only begin when a direction signal has been given (Digital Input 1 or Digital Input 2) | | | | | | | | | |
| 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) |

### *8.10.1. 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 | 6A/250VAC | 6A/30VDC |

Relay 2 provides a 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 or direction up.<br>(Fwd cmd given and speed is positive):<br>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 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,<br>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.<br>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.<br>(Fwd cmd given and speed is positive):<br>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

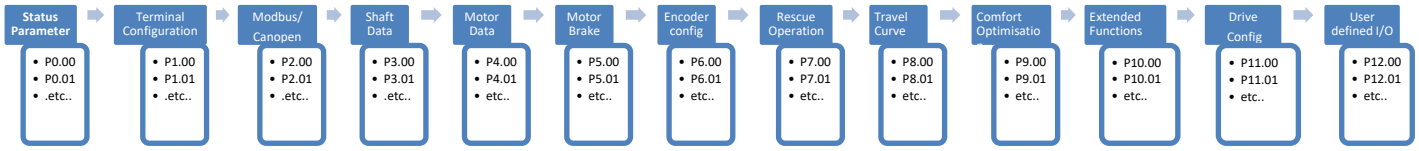
The drive is configured, and its operation monitored via the keypad and display.

## 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 Drive | StoP<br>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

**P**11-01 (Save user parameters as User default) can be enabled (set to 1) to invoke a parameter save of the current parameter values as the standard defaults for the drive, USr-PS will be shown to indicate a successful save.

The user can recall **User default** settings by following the below procedure.

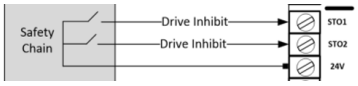

Note:

- 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-tH | Motor Autotune in progress. x indicates which autotune is being performed | |
| 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.<br><br>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<br><br>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 | |
| Inh ibt | Output power hardware inhibited, Safe Torque Off function activated.<br>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.<br>  | |
| P-dEF | Parameters reset to factory default settings | |
| U-dEF | Parameters reset to User default settings (**P**11-01=1) | |
| USb C | Drives is powered from the USB-C port | |
| USb P | Drives is powered from the USB-C port, but data transfer is disabled (**P**2-13=0) | |

Fault messages can be found in section 20 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 P**4-06 **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 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 |
|---|---|
|  <br>**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.<br>☐ Check that the intended voltage source matches that of the drive voltage rating.<br>☐ Check that any unexpected movement in the motor will not result in damage to equipment / safety risk to persons.<br>☐ Check that the elevator controller will not give a start signal to the drive when Electrical power is applied.<br>☐ 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.<br>☐ Check Motor Cables are connected to the drive U, V, W terminals (If cables have identification markers connect correct phase sequence).<br>☐ 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 and resistor is suitably protected from thermal overload.<br>☐ 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.

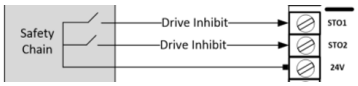
| | | |
|---|---|---|
| **Apply Electrical Power to the drive** | ☐ Apply rated voltage to the drive.<br>☐ Check that the drive displays StoP or Inhibit. | ➢ If StoP or Inhibit is not shown refer to the section 20 Troubleshooting. |

## 10.4. Step 4- Motor nameplate data entry.

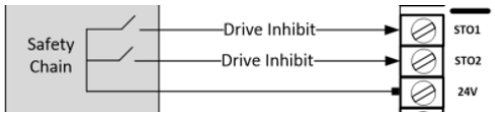
| Action | | Additional Information |
|---|---|---|
| **Select Geared (Induction) motor control** | ☐ Set **P**4-01 to 0 | |
| **Enter motor rated voltage (P4-02)** | ☐ Enter value into **P**4-02 | Enter Voltage value as shown on the motor nameplate (Volts). |
| **Enter Motor Rated Current (P4-03)** | ☐ 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).<br><br>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.<br>• If Motor power factor is unknown leave as default value.<br>Note: When the motor is running, 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. |

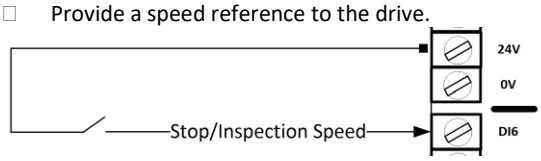
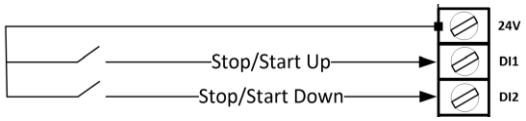
## 10.5. Step 5- Motor Auto-tune.

**A Motor Auto-tune must be carried out 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.**<br>**☐ 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 20 Troubleshooting.<br><br>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<br>and press ▢ on the drive keypad. | 1. The motor contactors will close (if controlled by the drive "Relay 1").<br>2. The motor brakes will remain applied. (Relay 2 as default)<br>3. The display will show AUto-t. (Test procedure may take several seconds to complete).<br>Note : If the drive trips refer to section 20 Troubleshooting.<br>4. The motor contactors will open once the test has completed. (Relay 1 controlled by default)<br><br>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).<br><br>**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<br> 


</td></tr>
<tr><td>☐ Provide a speed reference to the drive.<br> 
<br>☐ Normally inspection speed is 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.</td></tr>
<tr><td>☐ Provide a run-direction command to the drive.<br> 
</td></tr>
<tr><td>If the drive trips refer to section 20 Troubleshooting.</td></tr>
<tr><td colspan="2">☐ If no problems are encountered then the lift can now be run normally.</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 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 |
|---|---|
|  <br>**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.<br>☐ Check that the intended voltage source matches that of the drive voltage rating.<br>☐ Check that any unexpected movement in the motor will not result in damage to equipment / safety risk to persons.<br>☐ Check that the elevator controller will not give a start signal to the drive when Electrical power is applied.<br>☐ 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.<br>☐ Check Motor Cables are connected to the drive U, V, W terminals (If cables have identification markers connect correct phase sequence).<br>☐ 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 and resistor is suitably protected from thermal overload.<br>☐ Check correct control connections are made between the Elevator control panel and the drive. (as detailed in 0 Overall Wiring Diagram and default terminal functions).<br>☐ 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).<br>☐ 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. |
| **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<br>Overall Wiring Diagram and default terminal functions)<br>☐ 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.<br><br>☐ Check that the drive displays StoP or Inhibit.<br><br>☐ 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 20 Troubleshooting.<br><br>➢ If there is no red light shown on the encoder module :<br>o Check encoder module is pushed fully home.<br>o Check the encoder wiring is correct.<br><br>  |

## 11.4. Step 4- Motor nameplate data entry.

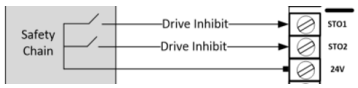
| Action | | Additional Information |
|---|---|---|
| **Select Geared (Induction) motor control** | ☐ Set **P**4-01 to 0 | |
| **Enter motor rated voltage (P4-02)** | ☐ Enter value into **P**4-02 | Enter Voltage value as shown on the motor nameplate (Volts). |
| **Enter Motor Rated Current (P4-03)** | ☐ 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).<br><br>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.<br>• If Motor power factor is unknown leave as default value.<br>Note: When the motor is running, 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

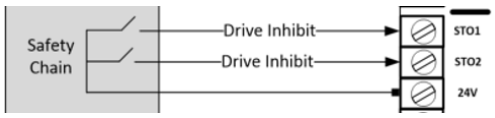
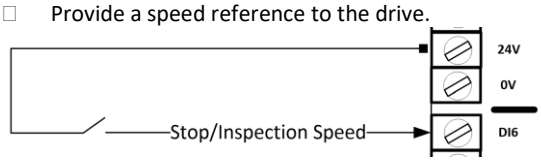
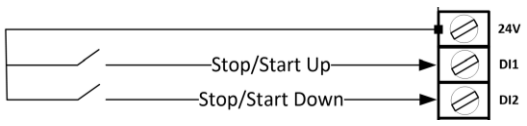
| Action | | Additional Information | |
|---|---|---|---|
| **Enter Encoder Resolution** | ☐ Enter encoder pulses per revolution into **P**6-03 | Refer to Encoder datasheet or nameplate. | |
| **Select Encoder Type** | ☐ Select the Encoder type in parameter **P**6-04 | **P6-04 setting** | **Encoder Type** |
| | | 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) |

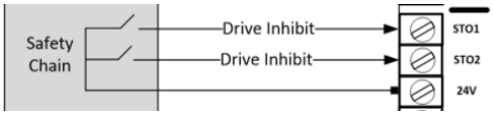
## 11.6. Step 6- Motor Auto-tune.

**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.**<br>☐ **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.**<br>**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 20 Troubleshooting.<br><br>The STO input status can be viewed in parameter P0-03.(0 = Open 1 = Closed) |
| ☐ **Enable 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").<br>2. The motor brakes will remain applied. (Relay 2)<br>3. The display will show AUto-t. (Test procedure may take several minutes to complete).<br>Note : If the drive trips refer to section 20 Troubleshooting.<br>4. The motor contactors will open once the test has completed. (Relay 1 controlled by default)<br><br>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).<br><br>**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<br>  <br>  |
| | ☐ Provide a speed reference to the drive.<br>  <br>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.<br>  |
| | If the drive trips refer to section 20 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).<br>☐ 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.<br>☐ 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.<br>☐ 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.<br>  |
| ☐ **Enable Encoder** | Set **P**6-05 to 1 | Enables Encoder Feedback |

☐ **If no problems are encountered then the lift can now be run normally.**

# 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 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 |
|---|---|
|  <br>**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.<br>☐ Check that the intended voltage source matches that of the drive voltage rating.<br>☐ Check that any unexpected movement in the motor will not result in damage to equipment / safety risk to persons.<br>☐ Check that the elevator controller will not give a start signal to the drive when Electrical power is applied.<br>☐ 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.<br>☐ Check Motor Cables are connected to the drive U, V, W terminals (If cables have identification markers connect correct phase sequence).<br>☐ 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 and resistor is suitably protected from thermal overload.<br>☐ 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).<br>☐ Check encoder module has been installed and the correct connections are made between the drive and the Encoder. |

## 12.3. Step 3- Apply Power.

| | | |
|---|---|---|
|  <br>**Apply Electrical Power to the drive** | ☐ Apply rated voltage to the drive.<br>☐ Check that the drive displays StoP or Inhibit.<br>☐ 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 20 Troubleshooting.<br>➢ If there is no green light shown on the encoder module :<br>o Check encoder module is pushed fully home.<br>o Check the encoder wiring is correct.<br>  |

## 12.4. Step 4- Motor nameplate data entry.

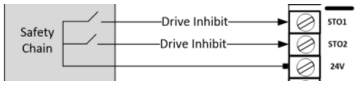
| Action | | Additional Information |
|---|---|---|
| **Select Gearless (Permanent Magnet) motor control mode. (P4-01** | ☐ Set **P**4-01 to 3 | Both IPM and SPM type motors are supported. |
| **Enter Motor Rated Current (P4-03)** | ☐ Enter motor rated current into **P**4-03 | Obtained from Motor nameplate (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.<br>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.

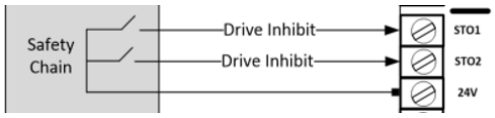
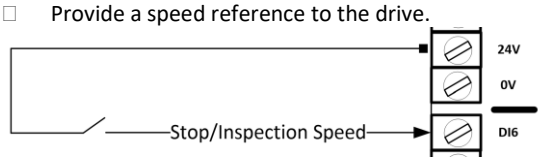
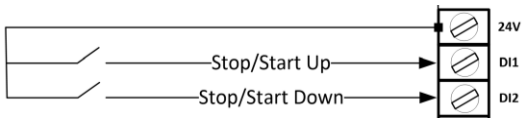
| Action | | Additional Information |
|---|---|---|
| **Select absolute encoder type (Endat or SinCos)**<br><br>**(P6-04)** | ☐ Select setting 3 for SinCos Encoder. ERN 1387 | |
| | ☐ Select setting 4 for Endat Encoder. ECN1313, ECN113, ECN413, ECN1325, ECN125, ECN425. | It is assumed Encoder incremental signals (A, A/ B, B/) are connected, if not then you can set **P**6-04 to 11 Instead. |
| **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).**

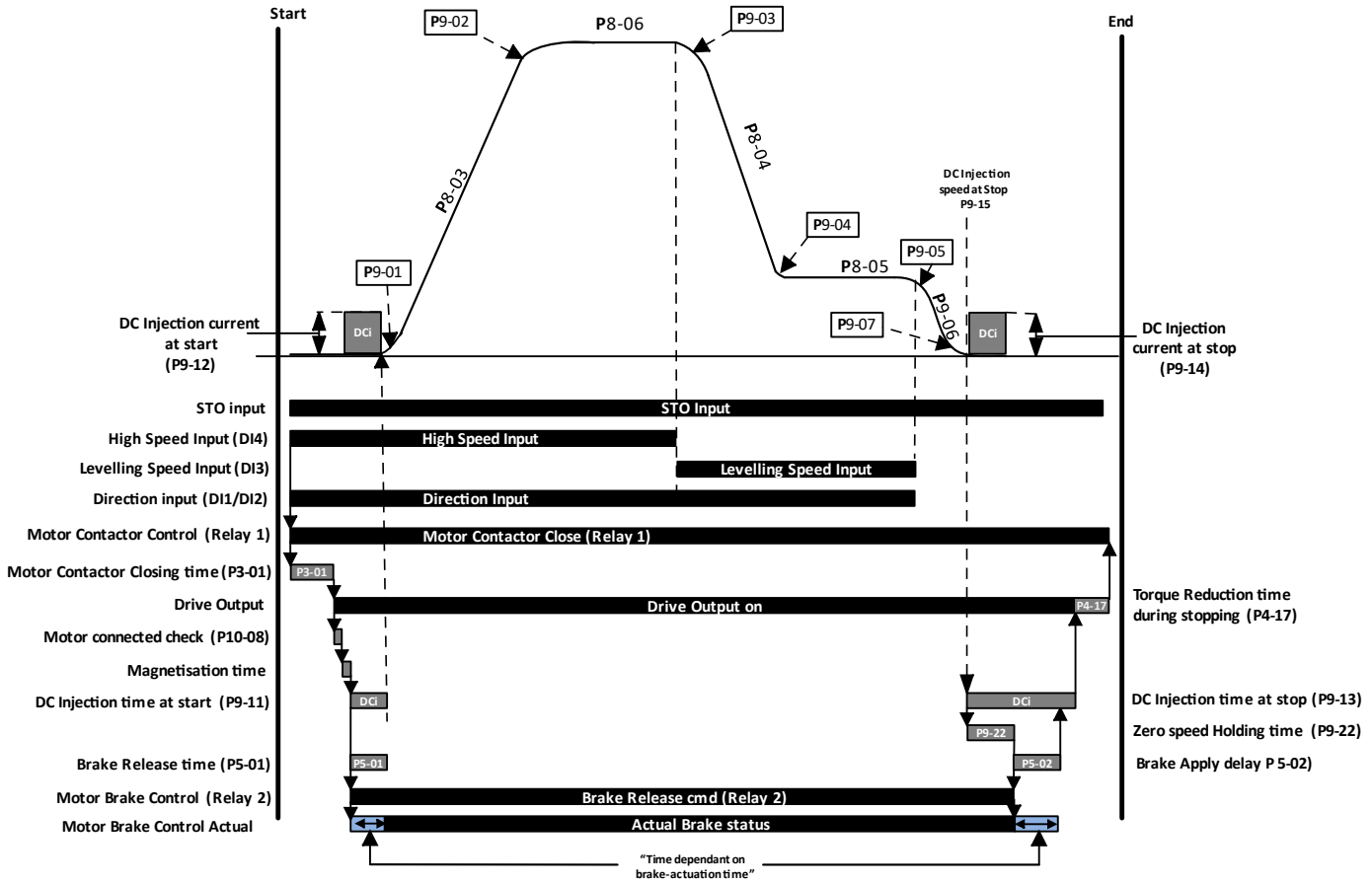
| Action | | Additional Information |
|---|---|---|
| **☐ If the motor contactor(s) are controlled by the elevator controller then they should be activated to close so that the motor is electrically connected to the drive, otherwise the "Auto-tune" cannot be carried out.**<br>**☐ If the motor contactor(s) are controlled by the drive (connected to relay 1) the motor contactor will automatically be energised when the "Auto-tune" is enabled.**<br>**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 20 Troubleshooting.<br><br>The STO input status can be viewed in parameter P0-03.(0 = Open 1 = Closed) |
| **Enable Motor Auto-tune**<br>**(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.<br>2. The motor brakes will remain applied. (Relay 2)<br>3. The display will show AUto-t. (Test procedure may take several minutes to complete).<br>Note : If the drive trips refer to section 20 Troubleshooting.<br>4. The motor contactors will open once the test has completed. (Relay 1 controlled by default)<br>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).<br>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.<br>**Note:**<br>• 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.<br>• Encoder offset value (**P**6-09) will be wrong if the motor poles (**P**4-05) has been set incorrectly. |

## 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<br>  |
| | ☐ Provide a speed reference to the drive.<br>  <br>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.<br>  |
| | If the drive trips refer to section 20 Troubleshooting. |
| ☐ **If no problems are encountered then the lift can now be run normally.** | |

# 13.Travel Curve Adjustment

## 13.1. Travel Curve Sequence



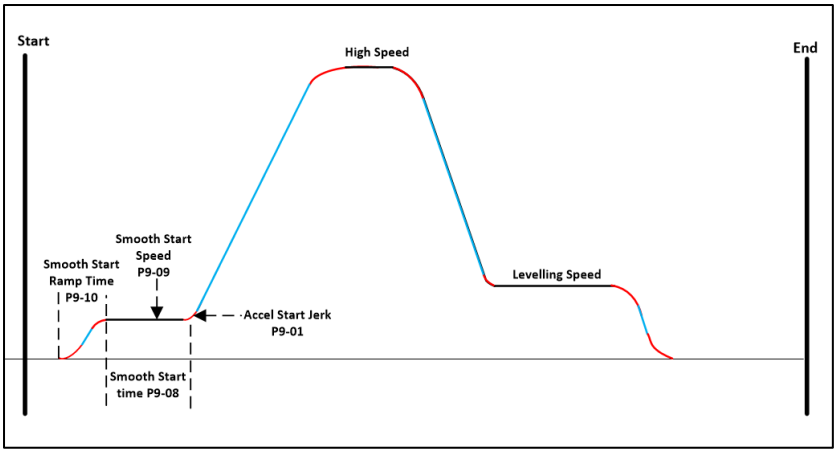

Note : The jerk parameters will have an effect on the overall ramp times in the following way :

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 | Sheave Locking During Stop |
|---|---|---|---|---|
| Geared (Induction) Motors without an Encoder | 0 | 0 | **P**9-11 (DC Injection time at start)<br>**P**9-12 (DC Injection current at start) | **P**9-13 (DC Injection time at stop)<br>**P**9-14 (DC Injection current at stop)<br>**P**9-15 (DC Injection speed at stop) |
| Geared (Induction) Motors with Encoder | 0 | 1 | **P**9-16 (Rollback Control P-Gain at start)<br>**P**9-17 (Rollback Control I-Gain at start)<br>**P**9-18 (Rollback Control activation pulses) | **P**9-20 (Rollback Control P-Gain at stop)<br>**P**9-21 (Rollback Control I-Gain at stop) |
| Gearless (Permanent Magnet) Motor | 3 | 1 | **P**9-16 (Rollback Control P-Gain at start)<br>**P**9-17 (Rollback Control I-Gain at start)<br>**P**9-18 (Rollback Control activation pulses) | **P**9-20 (Rollback Control P-Gain at stop)<br>**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 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.



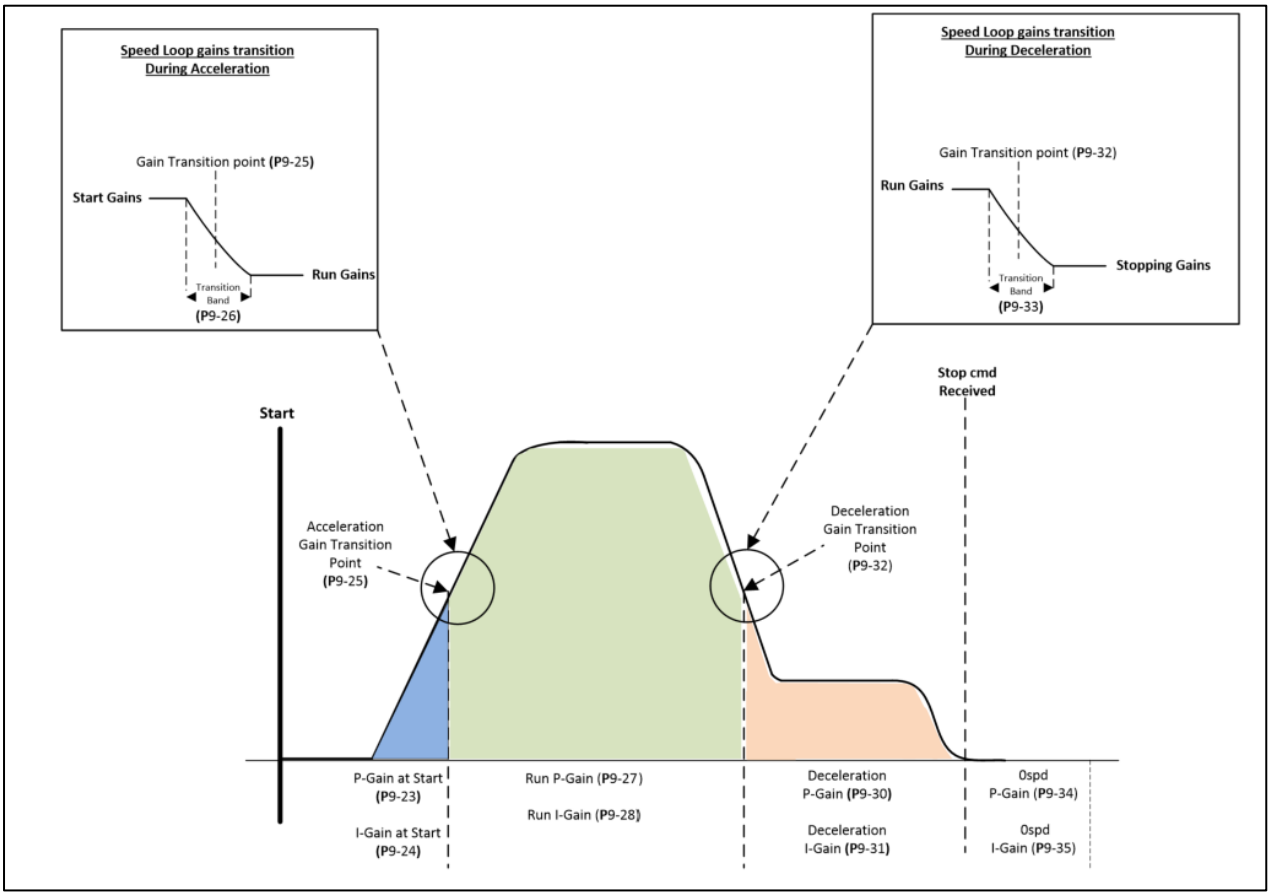

## 13.3. Speed Loop Gains

The setting of the speed loop gains defines how closely the actual motor speed follows the given speed reference; in the case of an Elevator the correct setting of the speed loop gains is critical in order 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/**P**9-32 >0.



# 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 gearlesss.

**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:<br>□ For Geared system **P**4-01 = 0, For Gearless system **P**4-01 = 3<br>□ Motor rated voltage (**P**4-02)<br>□ Motor Rated Current (**P**4-03)<br>□ Motor Rated Frequency (**P**4-04)<br>□ Number of Motor Poles (**P**4-05), set to 0 if unknown.<br>□ 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:<br>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)<br>□ **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:<br>Increase **P**9-16 (Rollback Control P-Gain at start) in steps of 20% and decrease the value in **P**9-18 (Rollback Control Activation Pulses). | The correct setting of **P**5-01, **P**9-16, **P**9-18 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 :**<br>**The longer the time set in P5-01 (Brake Release time) the more responsive P9-16 will be.**<br>**P9-18 Determines the movement of the motors shaft (as measured by the encoder) before the rollback function activates** | |

**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** | Jerk during Start | √ | √ | √ | □ Parameter **P**5-01 defines the actuation time of the motor brakes, generally the default value (0.20 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:<br>□ For Geared system **P**4-01 = 0, For Gearless system **P**4-01 = 3<br>□ Motor rated voltage (**P**4-02)<br>□ Motor Rated Current (**P**4-03)<br>□ Motor Rated Frequency (**P**4-04)<br>□ Number of Motor Poles (**P**4-05), set to 0 if unknown.<br>□ 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) | |
| | | √ | √ | √ | □ Increase Speed Error deadband | |
| | | 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)<br>□ 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 |

**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 | | |
| **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 reduce load and cabin balancing. | |
| | | √ | √ | √ | Check Motor parameters match the motor nameplate data:<br>☐ For Geared system **P**4-01 = 0, For Gearless system **P**4-01 = 3<br>☐ Motor rated voltage (**P**4-02)<br>☐ Motor Rated Current (**P**4-03)<br>☐ Motor Rated Frequency (**P**4-04)<br>☐ Number of Motor Poles (**P**4-05), set to 0 if unknown.<br>☐ 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 |
| | | √ | √ | √ | 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.<br>☐ 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)<br>☐ 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 | |
| | | √ | √ | √ | ☐ Increase Speed Error deadband | |
| | | 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).<br>☐ Increase **P**9-22 (Zero speed holding time on disable).<br>☐ 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:<br>☐ **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:<br>☐ **P**9-20 (Rollback Control P-Gain at stop), **P**9-21 (Rollback Control i-Gain at stop). |
| | | 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 | √ | √ | 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.Parameter Group 0 – Monitoring Parameters

<table>
<tr><th>Parameter Number</th><th>Parameter Description</th><th>Units</th></tr>
<tr><td>P0-00</td><td colspan="2">Keypad Parameter Display Mode<br>This parameter allows the user to see only the parameters that have been set different to defaults.<br>0 = Show all Parameters (Noting that the setting of parameter P11-04 limits the parameter groups which are shown)<br>1 = Show Only parameters that are different from Factory defaults.<br>2 = Show Only parameters that are different from User defaults.</td></tr>
<tr><td>P0-01</td><td colspan="2">Digital Input 1 to 5 Status<br>Displays the status of the drive digital input terminals 1 to 5<br><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<br>0 = Input InActive</td><td>-</td></tr>
<tr><td>P0-02</td><td colspan="2">Digital Input 6 to 10 Status<br>Displays the status of the drive digital input terminals 6 to 8 and Auxiliary inputs available on the universal encoder module<br><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<br>1 = Input Active<br>0 = Input InActive</td><td>-</td></tr>
<tr><td>P0-03</td><td colspan="2">STO Input Status<br>Displays the status of the Safe Torque Inputs.<br>Value Displayed:<br><table><tr><td>Display value</td><td></td><td></td><td></td><td>0</td><td>0</td></tr><tr><td>Input Terminal</td><td></td><td></td><td></td><td>STO1</td><td>STO2</td></tr></table>1 = Input Active<br>0 = Input InActive</td><td>-</td></tr>
<tr><td>P0-04</td><td colspan="2">Relay 1 Status<br>Displays the status of Relay 1<br><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<br>1 = Relay Closed</td><td>-</td></tr>
<tr><td>P0-05</td><td colspan="2">Relay 2 Status<br>Displays the status of Relay 2<br><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<br>1 = Relay Closed</td><td>-</td></tr>
<tr><td>P0-06</td><td colspan="2">Digital Output Status<br>Displays the status of the drive digital Outputs<br><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<br>1 = Digital Output Active</td><td>-</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<br>(Voltage Mode)<br><br>0.0 -20mA<br>(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<br>DA1 Output 1 Type</th><th>P1-18<br>DA1 Output 1 Format</th><th>P0-07<br>Display Value</th></tr>
<tr><td rowspan="3">Setting ></td><td>0 (Digital Output)</td><td>N/A</td><td>0.0 (Output off)<br>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)<br><br>0-20mA<br>(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<br>DA2 Output 1 (Terminal 11) Type</th><th>P1-25<br>DA2 Output 1 (Terminal 11) Format</th><th>P0-08<br>Display Value</th></tr>
<tr><td rowspan="3">Setting ></td><td>0 (Digital Output)</td><td>N/A</td><td>1.0 (Output off)<br>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"></td></tr>
<tr><td rowspan="2">P0-10</td><td>Motor contactor measured Closing time</td><td></td></tr>
<tr><td colspan="2"></td></tr>
<tr><td rowspan="2">P0-11</td><td>Brake Release measured opening time</td><td></td></tr>
<tr><td colspan="2"></td></tr>
<tr><td rowspan="2">P0-12</td><td>Brake Apply measured Closing time</td><td></td></tr>
<tr><td colspan="2"></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 input applied to the drive internal speed controller</td></tr>
<tr><td rowspan="2">P0-14</td><td>Speed Reference via Fieldbus Network</td><td>Hz/RPM/Linear</td></tr>
<tr><td colspan="2">Displays the setpoint being received by the drive from the currently active Fieldbus interface.</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..<br>Rotor speed (P0-18) with Encoder disabled<br>Encoder speed (P0-19) with Encoder 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</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.</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)</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></td></tr>
<tr><td colspan="2">Real time motor power factor whilst drive is running.</td></tr>
<tr><td rowspan="2">P0-23</td><td>Highest Current During Acceleration</td><td></td></tr>
<tr><td colspan="2"></td></tr>
<tr><td rowspan="2">P0-24</td><td>Highest Current During Deceleration</td><td></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>

<table>
<tr><th>Parameter Number</th><th>Parameter Description</th><th>Units</th></tr>
<tr><td rowspan="2">P0-26</td><td>Motor Magnetising Current (Id)</td><td>A</td></tr>
<tr><td colspan="2">Displays the motor magnetising Current, providing an auto tune has been successfully completed.</td></tr>
<tr><td rowspan="2">P0-27</td><td>Motor Rotor Current (Iq)</td><td>A</td></tr>
<tr><td colspan="2">Displays the motor Rotor (torque producing) current, providing an auto tune has been successfully completed.</td></tr>
<tr><td rowspan="2">P0-28</td><td>Output Torque</td><td>%</td></tr>
<tr><td colspan="2">Displays the instantaneous output torque level produced by the motor.<br>0.1% resolution<br>100% = motor rated torque.</td></tr>
<tr><td rowspan="2">P0-29</td><td>Motor Input Power</td><td></td></tr>
<tr><td colspan="2"></td></tr>
<tr><td rowspan="2">P0-30</td><td>Motor Shaft Power</td><td></td></tr>
<tr><td colspan="2"></td></tr>
<tr><td rowspan="2">P0-31</td><td>Motor Overload Accumulator (%)</td><td>%</td></tr>
<tr><td colspan="2"></td></tr>
<tr><td rowspan="2">P0-32</td><td>Back EMF Measured Value</td><td>VAC</td></tr>
<tr><td colspan="2">Ph-Ph back emf measurement</td></tr>
<tr><td rowspan="2">P0-33</td><td>Drive Output Voltage</td><td>VAC</td></tr>
<tr><td colspan="2">Displays the instantaneous output voltage from the drive to the motor</td></tr>
<tr><td rowspan="2">P0-34</td><td>Motor Poles Calculated</td><td></td></tr>
<tr><td colspan="2">Displays the calculated number of pole pairs when the motor pole parameter (P4-05) is set to 0 (Automatic calculation of motor poles).</td></tr>
<tr><td>P0-35</td><td colspan="2">Travel Profile State<br>Displays the current position on the travel curve.
<table>
<tr><th>State No</th><th></th></tr>
<tr><td>5</td><td>Motor Contactor Closing Time Active (P3-01)</td></tr>
<tr><td>6</td><td>Motor Connected Check Active (P10-08)</td></tr>
<tr><td>10</td><td>Motor Brake Release Time Active (P5-01)</td></tr>
<tr><td>13</td><td>DC Injection Time at start Active (P9-11)</td></tr>
<tr><td>14</td><td>Smooth Start Time Active (P9-08)</td></tr>
<tr><td>19</td><td>Accelerating to High Speed</td></tr>
<tr><td>18</td><td>Running at High Speed 1 (P8-06)</td></tr>
<tr><td>30</td><td>Running at High Speed 2 (P8-09)</td></tr>
<tr><td>33</td><td>Running at High Speed 3 (P8-10)</td></tr>
<tr><td>36</td><td>Running at High Speed 4 (P8-11)</td></tr>
<tr><td>39</td><td>Running at High Speed 5 (P8-12)</td></tr>
<tr><td>23</td><td>Decelerating to Levelling Speed</td></tr>
<tr><td>21</td><td>Running at Levelling Speed (P8-05)</td></tr>
<tr><td>46</td><td>Zero Speed holding time on disable active (P9-22)</td></tr>
<tr><td>47</td><td>Motor Brake Apply Delay Active (P5-02)</td></tr>
<tr><td>48</td><td>DC Injection Time At stop Active (P9-13)</td></tr>
<tr><td>49</td><td>Torque Reduction time during stopping (P4-17)</td></tr>
<tr><td>50</td><td>Motor Contactor Opening Time Active</td></tr>
</table></td></tr>
<tr><td>P0-36</td><td colspan="2">Travel Profile Trip point<br>This parameter indicates at what point on the travel curve the drive tripped.
<table>
<tr><th>State No</th><th></th></tr>
<tr><td>5</td><td>Motor Contactor Closing Time Active (P3-01)</td></tr>
<tr><td>6</td><td>Motor Connected Check Active (P10-08)</td></tr>
<tr><td>10</td><td>Motor Brake Release Time Active (P5-01)</td></tr>
<tr><td>13</td><td>DC Injection Time at start Active (P9-11)</td></tr>
<tr><td>14</td><td>Smooth Start Time Active (P9-08)</td></tr>
<tr><td>19</td><td>Accelerating to High Speed</td></tr>
<tr><td>18</td><td>Running at High Speed 1 (P8-06)</td></tr>
<tr><td>30</td><td>Running at High Speed 2 (P8-09)</td></tr>
<tr><td>33</td><td>Running at High Speed 3 (P8-10)</td></tr>
<tr><td>36</td><td>Running at High Speed 4 (P8-11)</td></tr>
<tr><td>39</td><td>Running at High Speed 5 (P8-12)</td></tr>
<tr><td>23</td><td>Decelerating to Levelling Speed</td></tr>
<tr><td>21</td><td>Running at Levelling Speed (P8-05)</td></tr>
<tr><td>46</td><td>Zero Speed holding time on disable active (P9-22)</td></tr>
<tr><td>47</td><td>Motor Brake Apply Delay Active (P5-02)</td></tr>
<tr><td>48</td><td>DC Injection Time At stop Active (P9-13)</td></tr>
<tr><td>49</td><td>Torque Reduction time during stopping (P4-17)</td></tr>
<tr><td>50</td><td>Motor Contactor Opening Time Active</td></tr>
</table></td></tr>
</table>

| Parameter Number | Parameter Description | Units |
|---|---|---|
| P0-37 | **Currently active Trip code**<br>This parameter indicates the current trip code. | - |
| P0-38 | **Trip History Log**<br>Displays the last four fault codes.<br>**P**0-38 Last Trip 1 (Newest Trip)<br>**P**0-38-1 Last Trip 2<br>**P**0-38-2 Last Trip 3<br>**P**0-38-3 Last Trip 4 (Oldest Trip) | - |
| P0-39 | **Reserved** | |
| P0-40 | **DC Bus Voltage**<br>Displays the instantaneous DC Bus Voltage internally within the drive | V |
| P0-41 | **DC Bus Voltage Ripple**<br>Displays the level of ripple present on the DC Bus Voltage. | V |
| P0-42 | **L1 Input Voltage** | VAC |
| P0-43 | **L2 Input Voltage** | VAC |
| P0-44 | **L3 Input Voltage** | VAC |
| P0-45 | **Motor Thermistor Resistance**<br>Analogue Input 1 thermistor | Ω |
| P0-46 | **Motor Thermistor 2 Resistance**<br>Analogue input 2 thermistor | Ω |
| P0-47 | **Brake Resistor Active**<br>0 = Brake Resistor Off<br>1 = Brake Resistor On | - |
| P0-48 | **IGBT Temperature**<br>Displays the Instantaneous Heatsink (IGBT thermistor) Temperature measured by the drive | °C |
| P0-49 | **Drive Internal Temperature**<br>Displays the Instantaneous Internal (Control PCB) Temperature measured by the drive | °C |
| P0-50 | **Drive Run Time Since Last Trip**<br>Displays the running time of the drive since the last trip occurred.<br>The first value shown is the number of hours. Pressing the Up key will display the seconds.<br>**P**0-50 Hours Running Since Last Trip<br>**P**0-50-1 Seconds Running Since Last Trip | H:S |
| P0-51 | **Drive Run Time Since Last Trip 2**<br>Displays the running time of the drive since the 2nd to last trip occurred.<br>The first value shown is the number of hours. Pressing the Up key will display the seconds.<br>**P**0-51 Hours Running Since 2nd to Last Trip<br>**P**0-51-1 Seconds Running Since 2nd to Last Trip | H:S |
| P0-52 | **Drive Run Time Since Last Enable**<br>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.<br>**P**0-52 Run time Hours Running Since 2nd to Last Trip<br>**P**0-52-1 Seconds Running Since 2nd to Last Trip | H:S |

<table>
<tr><th>Parameter Number</th><th>Parameter Description</th><th>Units</th></tr>
<tr><td rowspan="2">P0-53</td><td>Drive Lifetime Operating Time</td><td>H:S</td></tr>
<tr><td colspan="2">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.<br><br><table><tr><td>P0-53</td><td>Drive Operating time (Hours)</td></tr><tr><td>P0-53-1</td><td>Drive Operating time (S)</td></tr></table></td></tr>
<tr><td rowspan="2">P0-54</td><td>Drive Total Run Time</td><td>H:S</td></tr>
<tr><td colspan="2">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.<br><br><table><tr><td>P0-54</td><td>Drive Total Run Time (Hours)</td></tr><tr><td>P0-54-1</td><td>Drive Total Run Time (S)</td></tr></table></td></tr>
<tr><td rowspan="2">P0-55</td><td>Drive Heatsink Cooling Fan Total Operating Time</td><td>H:S</td></tr>
<tr><td colspan="2">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<br><br><table><tr><td>P0-55</td><td>Drive Heatsink Cooling Fan Total Run Time (Hours)</td></tr><tr><td>P0-55-1</td><td>Drive Heatsink Cooling Fan Total Run Time (S)</td></tr></table></td></tr>
</table>

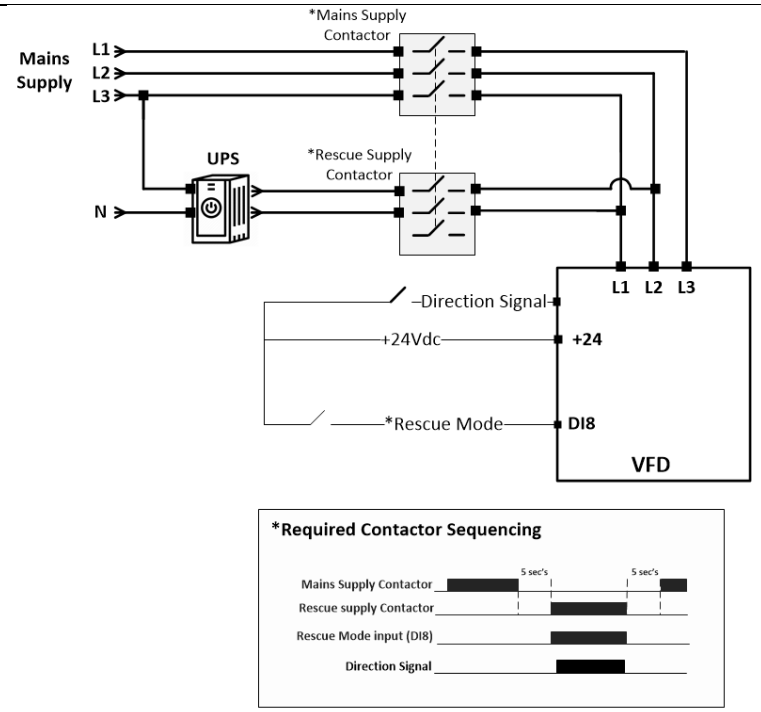
| Parameter Number | Parameter Description | Units |
|---|---|---|
| P0-56 | **Analog Input 1 Applied Signal Value** | V or mA depending on signal format set in **P**1-03 |
| | Displays the actual signal level applied to analog input 1 (DI4) before scaling and offsets have been applied. | |
| P0-57 | **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 | |
| P0-60 | **DC Bus Voltage Log** | V |
| P0-61 | **DC Bus Voltage Ripple Log** | V |
| P0-62 | **Heatsink Temperature Log** | °C |
| P0-63 | **Drive Internal Temperature Log** | °C |
| P0-64 | **Motor Current Log** | A |
| P0-65 | **Motor Speed Log** | Hz/RPM/Linear |
| | The above parameters are used to store the history of various measured levels within the drive at various regular time intervals prior to a trip. The values are frozen when a fault occurs and can be used for diagnostic purposes | |
| P0-66 | **Encoder Speed Log** | Hz/RPM/Linear |
| | The above parameters are used to store the history of various measured levels within the drive at various regular time intervals prior to a trip. The values are frozen when a fault occurs and can be used for diagnostic purposes | |
| P0-70 | **Drive Type** | - |
| | Displays the type details of the drive<br>**P**0-70 Drive Rated Voltage<br>**P**0-70-1 Drive Frame Size<br>**P**0-70-2 Drive Rated Power (kW)<br>**P**0-70-3 Number of input Phases<br>**P**0-70-4 Drive Type Code | |
| P0-71 | **Option Module Type** | - |
| | Displays the type details of the drive<br>**P**0-71 Option Module Type<br>**P**0-71-1 Option module firmware version major.minor<br>**P**0-71-2 Option module firmware version revision | |
| P0-72 | **Drive IO Firmware Version** | - |
| | **P**0-72 IO Firmware version<br>**P**0-72-1 IO Firmware checksum | |
| P0-73 | **Drive Power Stage Firmware Version** | - |
| | **P**0-73 Power Stage Firmware version<br>**P**0-73-1 Power Stage Firmware checksum | |
| P0-74 | **Drive Serial Number** | - |
| | Displays the unique serial number of the drive.<br>**P**0-74 Serial Number (High)<br>**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.

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

## 16.1. UPS power supply connections

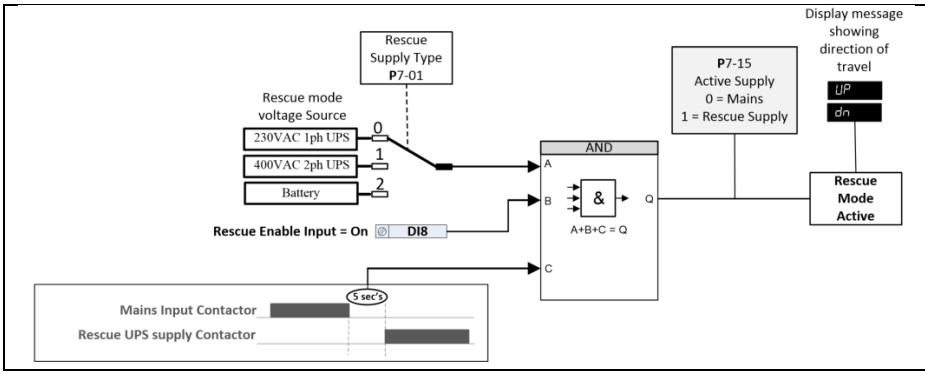



***Required Contactor Sequencing**

- The Rescue Supply Contactor must only be closed when the Main Contactor is open (Interlocking Mechanism)
- A delay time of no less than 5 sec'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, 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.**

## 16.2. 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).

# 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.
- Parameter editing via keypad or USB.

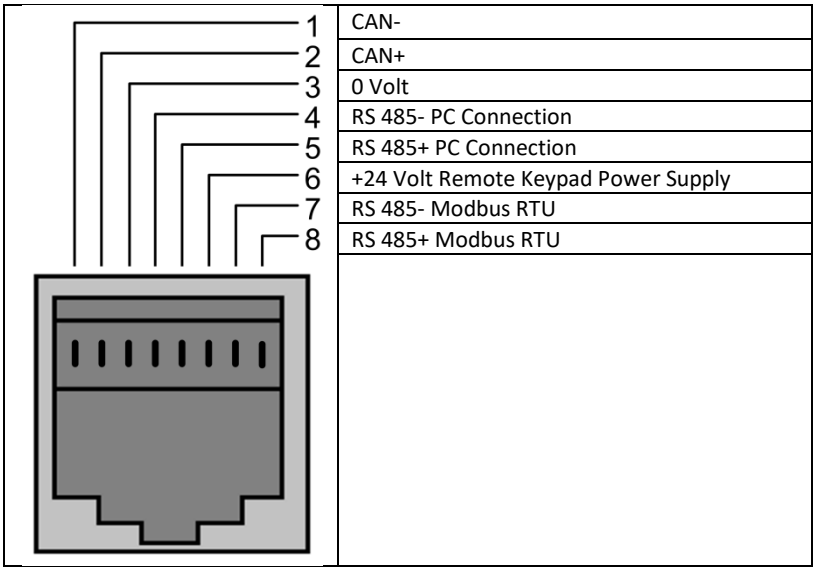
## 17.2. RS-485 communications

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

| P3-04 | 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 designed limits. |
| Adjustment | Populate the values of the brake resistor into P3-04 and P3-05<br>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. |

| 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.<br><br>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.<br>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. |

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

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

| P11-05 | Effective Switching Frequency |
|---|---|
| Function | IGBT Switching Frequency.<br>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 7.2.

### *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).

### *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 **"InHibit".**

Note: If the drive is in a tripped condition then the relevant trip will be displayed and not "InHibit").

**Drive Status parameter**

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

| **Display value** | | | | 0 | 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 | A fault has been detected within either of the internal channels of the "STO" circuit. | Refer to your Invertek Sales Partner |
| Sto-L | 101 | STO1/STO2 signals removed whilst drive running | - |

### *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.

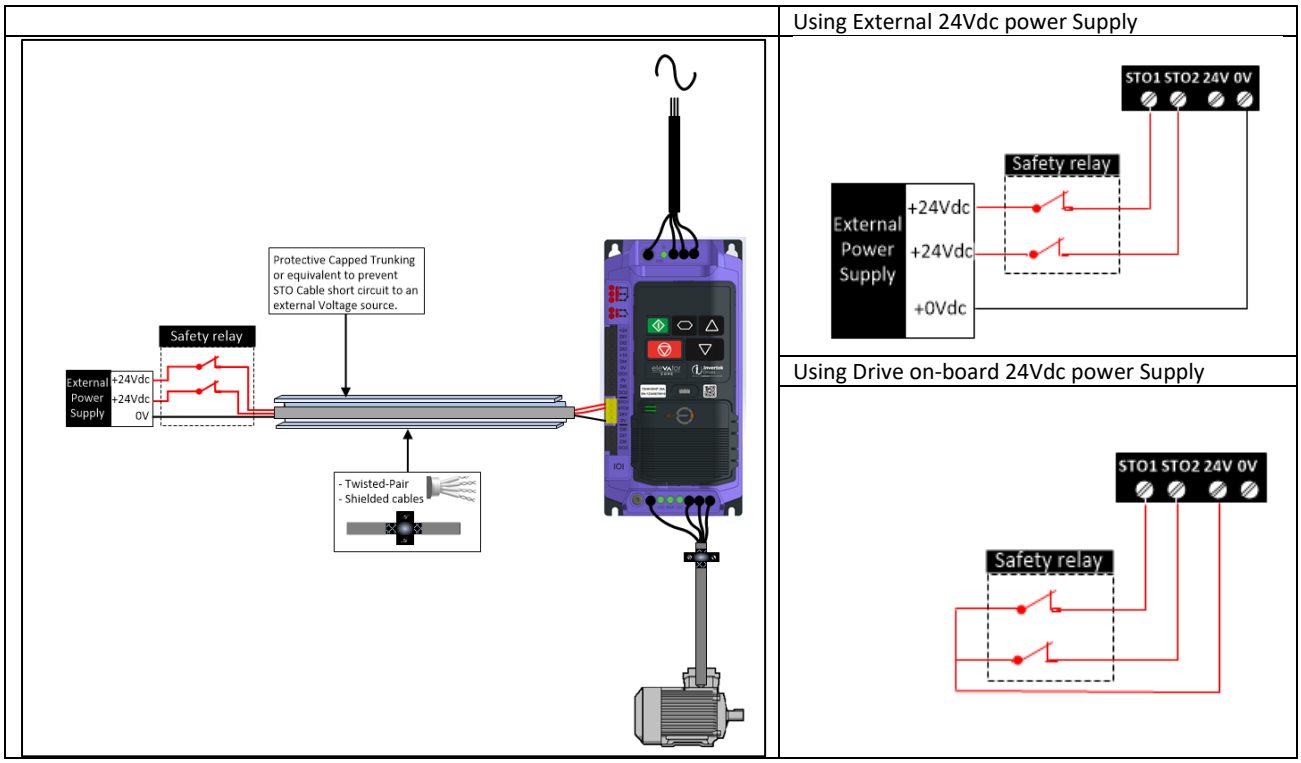
### *19.1.7. "STO"Electrical Installation*

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 diagrams 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).

### *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 relay 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.

If drive fault messages are observed refer to section 20 Troubleshooting for further guidance.

# 20.Troubleshooting

## 20.1. Warning Messages

| Warning message | Description | Corrective Action/Further information |
|---|---|---|
| OuLd | Motor Overload | Increase acceleration rate (**P**8-03).<br>Reduce the load, check the load mechanically to ensure it is free, and that no jams, blockages or other mechanical faults exist.<br>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<br>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-LE | Travel Limit Reached | Travel direction Change counter (Rope wear Counter) as per set in parameter **P**10-05 has been reached |

## 20.2. Fault messages and Display messages

| Display message | No. | Description | Corrective Action/Further information |
|---|---|---|---|
| A i-Lo5 | 59 | Analog input signal loss | |
| AtF-01 | 40 | Autotune Failed | Measured motor stator resistance varies between phases. Ensure the motor is correctly connected and free from faults. Check the windings for correct resistance and balance. |
| AtF-02 | 41 | | Measured motor stator resistance is too large. Ensure the motor is correctly connected (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 convergent. Ensure the motor is correctly connected and free from faults. Check that the power rating corresponds to the power rating of the connected drive. |
| AtF-06 | 45 | Encoder offset measurement failed | Drive has failed to measure the Encoder offset value using autotune method 2 in **P**4-08.<br>Normally Occurs on Permanent Magnet motors with Surface Mounted magnets. |
| AtF-nA | 109 | Selected Autotune method incorrect for the selected Motor | Use Autotune 1 (**P**4-08=1). |
| bF-Err | 46 | Brake Release Monitoring-Warning | 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.<br>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 |
| CF-Err | 96 | Motor Contactor feedback Error | Motor contactor is in wrong state as indicated by feedback signal from contactor. |
| CF9-Ch | 77 | Drive configuration data changed. | |
| CF9-dF | 78 | Drive configuration mismatch PS/IO | |
| CF9-Er | 79 | Drive configuration data missing or corrupt. | |
| CrFLt | 30.3 | Critical Module Error | |
| dAtA-3 | 98 | Internal data error | |
| dAtA-E | 19 | Internal memory fault. | 1. Reset drive (Red Button)<br>2. Power Cycle<br>3. Internal Comms Link Lost Refer to your Invertek Sales Partner.<br>Parameters not saved, defaults reloaded.<br>Try again. If problem recurs, refer to your Invertek Sales Partner |
| dAtA-F | 17 | Internal memory fault. | Parameters not saved, defaults reloaded.<br>Try again. If problem recurs, refer to your Invertek Sales Partner. |
| Ed-dAt | 30.7 | Encoder Feedback Error | Data Loss - Fault with CLK or DATA lines |
| Ed-Pd | 30.71 | | Propagation Delay Error (Cable too long) |
| Ed-Lo5 | 30.72 | | Comms Error (excessive signal drop out) or Line Loss whilst drive is running. |
| Ed- inc | 30.73 | | Encoder Incompatible |
| Ed-AOS | 30.74 | | Endat ABS Overspeed |
| Ed-SOS | 30.75 | | Endat SC Overspeed |

| Display message | No. | Description | Corrective Action/Further information |
|---|---|---|---|
| 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 | 30.8 | | 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 | Tbc | Encoder Module not fitted | Encoder I/O Comms Loss - Confirm module is fitted and pushed fully home. |
| Enc-PP | 99 | | Encoder Pulse per revolution parameter (**P**6-03) set as 0 with Encoder Enabled (**P**6-04>0) |
| E-trIP | 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<br>(Only visible when an encoder module is fitted and enabled) | Will also show sub-trip code to<br><br>Encoder communication /data loss |
| EncCF8 | | 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<br>Check all three supply phases are present and within the 3% supply voltage level imbalance tolerance.<br>Reduce the motor load. |
| F-Ptc | 21 | Motor PTC Over Temperature | The connected motor PTC device has caused the drive to trip |
| F-tY | | Motor KTY84 Thermistor Fault | |
| FAn-F | 22 | Cooling Fan Fault | Check and if necessary, replace the drive internal cooling fan |
| HtLO | 30.29 | | Quadrature TTL Over-speed |
| h O-I | 15 | Instantaneous over current on drive output. | Refer to fault 3 below |
| I_t-trP | 04 | 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.<br>Check motor cable length does not exceed exceeds 100m (screened cable), or 150m (un-screened cable).<br>Ensure the motor nameplate parameters are correctly entered in **P**4-02, **P**4-03, **P**4-04, **P**4-05.<br>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.<br>Check the load mechanically to ensure it is free, and that no jams, blockages or other mechanical faults exist.<br>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 | 30.2 | | Encoder Channel A Fault |
| 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 STO and direction input is applied **before** speed commands.<br>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.<br>Ensure the drive internal cooling fan is operating<br>Ensure that the required space around the drive as shown in section 7.2, and that the cooling airflow path to and from the drive is not restricted<br>Increase the cooling airflow to the drive<br>Reduce the effective switching frequency setting in parameter **P**11-05<br>Reduce the load on the motor / drive |

| Display message | No. | Description | Corrective Action/Further information |
|---|---|---|---|
| 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.<br>Confirm contactor control connections to the drive are correct. |
| O-t | 08 | Heatsink over temperature | The heatsink temperature can be displayed in **P**0-48.<br>Check the drive ambient temperature<br>Ensure the drive internal cooling fan is operating<br>Ensure there is the required space around the drive as shown in section 7.2, and that the cooling airflow path to and from the drive is not restricted<br>Reduce the effective switching frequency setting in parameter **P**11-05<br>Reduce the load on the motor / drive |
| OI-b | 01 | Brake channel over current | Ensure the connected brake resistor is above the minimum permissible level for the drive – refer to the ratings shown in section 6.<br>Check the brake resistor and wiring for possible short circuits. |
| OL-br | 02 | Brake resistor overload | The drive software has determined that the brake resistor is overloaded (based on the values entered in **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.<br>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. |
| O-I | 03 | Instantaneous over current on drive output<br>(Triggered from Drive Output Current Measurement) | **Fault Occurs on Drive Enable**<br>Check the motor and motor connection cable for phase – phase and phase – earth short circuits.<br>Check the load mechanically for a jam, blockage, or stalled condition.<br>Is the drive sized correctly for the connected motor?<br>Ensure the motor nameplate parameters are correctly entered in **P**4-02, **P**4-03, **P**4-04, **P**4-05.<br>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.<br>If operating in Enhanced V/F mode reduce the Boost voltage setting in **P**4-09<br>Increase the acceleration ramp up time in **P**8-03<br>If the connected motor has a holding brake, ensure the brake is correctly connected and controlled, and is releasing correctly.<br>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).<br><br>**Fault Occurs When Running**<br>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-'' | 90 | W Phase PWM output Loss | |
| O-uoLt | 06 | Over voltage on DC bus | Check that the lift has been correctly balanced.<br>Check that a brake resistor is connected correctly to terminals +DC and BR.<br>Check the resistance of the brake resistor complies with the values in section 6.<br>If the fault occurs on stopping or during deceleration, increase the deceleration time in **P**8-04<br>If operating in Vector Mode (**P**4-01 = 0,1,3), reduce the speed loop gains as detailed in section 13.3<br>Check that the mains voltage level is within the range detailed in section 6.<br>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 | |
| OI-u | 82 | Output (Motor) V Phase Loss overcurrent | |
| OI-'' | 83 | Output (Motor) W Phase Loss 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). |

| Display message | No. | Description | Corrective Action/Further information |
|---|---|---|---|
| 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-'''' | 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 | | 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 |
| 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 | | | 1. Reset drive (Red Button)<br>2. Power Cycle<br>3. Internal Comms Link Lost Refer to your Invertek Sales Partner. |
| PE | 30.2 | | Parameterisation Error |
| PS-trP | 05 | Instantaneous over current on drive output (Triggered from Power Module Current Measurement) | Refer to fault 3 above |
| SC-Ab | 30.5 | | Sin Cos A B Line Loss |
| 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<br>Check the network master / PLC is still operating, Check the connection cables.<br>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<br>Check the network master / PLC is still operating, Check the connection cables.<br>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.<br>Check the module is correctly inserted |
| Sc-F04 | 53 | IO card comms trip | Internal communication to the inserted Option Module has been lost.<br>Check the module is correctly inserted |
| SC-OS | 30.53 | | Sin Cos Over-speed |
| SC-LoS | 97 | | 1. Reset drive (Red Button)<br>2. Power Cycle<br>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 | 30.1 | 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<br>• Confirm that the speed loop gains have been optimised.<br>• In Gearless applications can be caused by excess rollback, see section 14 Comfort Optimisation<br>• 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)<br>• In Geared Open loop applications this can be caused by the motor stalling, check :<br>o Motor data is correct, and an auto-tune has been performed.<br>o Motor rated current is set correctly.<br>o Magnetising current in **P**4-28 is not too high.<br>o Brake is releasing. |
| Sto-L | 101 | STO inputs opened whilst drive running | |
| Sto-F | 29 | Internal STO circuit Error | Check supply to terminals STO1 and STO2 is >18V, otherwise Refer to your Invertek Sales Partner |
| ttLO | 30.3 | | 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. |
| U-dEF | 20 | User Parameter Defaults | User Parameter defaults have been loaded. Press the Stop key. |
| U-uoLt | 07 | Under voltage on DC bus | This occurs routinely when power is switched off.<br>If it occurs during running, check the incoming supply voltage, and all connections into the drive, fuses, contactors etc.<br>If in rescue mode confirm that the voltage is within the range detailed in section 6.5<br>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 | 09 | 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. |

| Display message | No. | Description | Corrective Action/Further information |
|---|---|---|---|
| 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 |

## 20.3. Encoder Module Status LED's .

| LED | Function | Indication |
|---|---|---|
| Top LED | Power Status | Red = Power on |
| | | Off = No power |
| Bottom LED | Error Status | Off = No Error |
| | | Green = No Signal connected/received |
| | | Green Flashing = Error |

**Intentional Blank Page**

**Intentional Blank Page**

# 21.Drive and Application Details

| | |
|---|---|
| **Building Name:** | |
| **Equipment No/Name:** | |
| **Drive Serial Number:** | |
| **Motor Details:** | |
| **Date of Installation** | |
| **Notes** | |
| **Parameter Changes**<br><br>***Tip :***<br>Setting Parameter P0-00 to 0 will show all parameters that are different from factory defaults | |



**Invertek Drives Ltd**. Offa's Dyke Business Park, Welshpool, Powys SY21 8JF United Kingdom Tel: +44 (0)1938 556868 Fax: +44 (0)1938 556869

www.InvertekDrives.com