Nidec

All for dreams

Closed Loop RFC-S Mode Setup Guide

Elevator Drive

PM synchronous motors with position feedback

Part Number: 0479-0043-01
Issue: 1

Original Instructions

For the purposes of compliance with the EU Machinery Directive 2006/42/EC, the English version of this manual is the Original Instructions. Manuals in other languages are Translations of the Original Instructions.

Documentation

Manuals are available to download from the following locations: **http://www.drive-setup.com/ctdownloads**

The information contained in this manual is believed to be correct at the time of printing and does not form part of any contract. The manufacturer reserves the right to change the specification of the product and its performance, and the contents of the manual, without notice.

Warranty and Liability

In no event and under no circumstances shall the manufacturer be liable for damages and failures due to misuse, abuse, improper installation, or abnormal conditions of temperature, dust, or corrosion, or failures due to operation outside the published ratings. The manufacturer is not liable for consequential and incidental damages. Contact the supplier of the dive for full details of the warranty terms.

Environmental policy

Control Techniques Ltd operates an Environmental Management System (EMS) that conforms to the International Standard ISO 14001.

Further information on our Environmental Policy can be found at: **http://www.drive-setup.com/environment**

Restriction of Hazardous Substances (RoHS)

The products covered by this manual comply with European and International regulations on the Restriction of Hazardous Substances including EU directive 2011/65/EU and the Chinese Administrative Measures for Restriction of Hazardous Substances in Electrical and Electronic Products.

Disposal and Recycling (WEEE)

When electronic products reach the end of their useful life, they must not be disposed of along with domestic waste but should be recycled by a specialist recycler of electronic equipment. Control Techniques products are designed to be easily dismantled into their major component parts for efficient recycling. The majority of materials used in the product are suitable for recycling.

Product packaging is of good quality and can be re-used. Large products are packed in wooden crates. Smaller products are packaged in strong cardboard cartons which have a high recycled fibre content. Cartons can be re-used and recycled. Polythene, used in protective film and bags for wrapping the product, can be recycled. When preparing to recycle or dispose of any product or packaging, please observe local legislation and best practice.

REACH legislation

EC Regulation 1907/2006 on the Registration, Evaluation, Authorisation and restriction of Chemicals (REACH) requires the supplier of an article to inform the recipient if it contains more than a specified proportion of any substance which is considered by the European Chemicals Agency (ECHA) to be a Substance of Very High Concern (SVHC) and is therefore listed by them as a candidate for compulsory authorisation.

Further information on our compliance with REACH can be found at: **http://www.drive-setup.com/reach**

Registered Office

Nidec Control Techniques Ltd
The Gro
Newtown
Powys
SY16 3BE
UK
Registered in England and Wales. Company Reg. No. 01236886.

Copyright

Contents

1 Safety information

1.1 Warnings, Cautions and Notes

WARNING A Warning contains information which is essential for avoiding a safety hazard.

CAUTION A Caution contains information which is necessary for avoiding a risk of damage to the product or other equipment.

NOTE
A Note contains information which helps to ensure correct operation of the product.

1.2 Important safety information. Hazards. Competence of designers and installers

This guide applies to products which control electric motors either directly (drives) or indirectly (controllers, option modules and other auxiliary equipment and accessories). In all cases the hazards associated with powerful electrical drives are present, and all safety information relating to drives and associated equipment must be observed.

Specific warnings are given at the relevant places in this guide.

Drives and controllers are intended as components for professional incorporation into complete systems. If installed incorrectly they 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 equipment which can cause injury. Close attention is required to the electrical installation and the system design to avoid hazards either in normal operation or in the event of equipment malfunction. System design, installation, commissioning/start-up and maintenance must be carried out by personnel who have the necessary training and competence. They must read this safety information and this guide carefully.

1.3 Responsibility

It is the responsibility of the installer to ensure that the equipment is installed correctly with regard to all instructions given in this guide. They must give due consideration to the safety of the complete system, so as to avoid the risk of injury both in normal operation and in the event of a fault or of reasonably foreseeable misuse.

The manufacturer accepts no liability for any consequences resulting from inappropriate, negligent or incorrect installation of the equipment.

1.4 Compliance with regulations

The installer is responsible for complying with all relevant regulations, such as national wiring regulations, accident prevention regulations and electromagnetic compatibility (EMC) regulations. Particular attention must be given to the cross-sectional areas of conductors, the selection of fuses or other protection, and protective ground (earth) connections.

This guide contains instructions for achieving compliance with specific EMC standards.

All machinery to be supplied within the European Union in which this product is used must comply with the following directives:

2006/42/EC Safety of machinery.

2014/30/EU: Electromagnetic Compatibility.

1.5 Electrical hazards

The voltages used in the drive can cause severe electrical shock and/or burns, and could be lethal. Extreme care is necessary at all times when working with or adjacent to the drive. Hazardous voltage may be present in any of the following locations:

- AC and DC supply cables and connections
- Output cables and connections
- Many internal parts of the drive, and external option units

Unless otherwise indicated, control terminals are single insulated and must not be touched.

The supply must be disconnected by an approved electrical isolation device before gaining access to the electrical connections.

The STOP and Safe Torque Off functions of the drive do not isolate dangerous voltages from the output of the drive or from any external option unit.

The drive must be installed in accordance with the instructions given in this guide. Failure to observe the instructions could result in a fire hazard.

1.6 Stored electrical charge

The drive contains capacitors that remain charged to a potentially lethal voltage after the AC supply has been disconnected. If the drive has been energized, the AC supply must be isolated at least ten minutes before work may continue.

1.7 Mechanical hazards

Careful consideration must be given to the functions of the drive or controller which might result in a hazard, either through their intended behaviour or through incorrect operation due to a fault. In any application where a malfunction of the drive or its control system could lead to or allow damage, loss or injury, a risk analysis must be carried out, and where necessary, further measures taken to reduce the risk - for example, an over-speed protection device in case of failure of the speed control, or a fail-safe mechanical brake in case of loss of motor braking.

With the sole exception of the Safe Torque Off function, none of the drive functions must be used to ensure safety of personnel, i.e. they must not be used for safety-related functions.

The Safe Torque Off function may be used in a safety-related application. The system designer is responsible for ensuring that the complete system is safe and designed correctly according to the relevant safety standards.

The design of safety-related control systems must only be done by personnel with the required training and experience. The Safe Torque Off function will only ensure the safety of a machine if it is correctly incorporated into a complete safety system. The system must be subject to a risk assessment to confirm that the residual risk of an unsafe event is at an acceptable level for the application.

1.8 Access to equipment

Access must be restricted to authorized personnel only. Safety regulations which apply at the place of use must be complied with.

1.9 Environmental limits

Instructions in this guide regarding transport, storage, installation and use of the equipment must be complied with, including the specified environmental limits. This includes temperature, humidity, contamination, shock and vibration. Drives must not be subjected to excessive physical force.

1.10 Hazardous environments

The equipment must not be installed in a hazardous environment (i.e. a potentially explosive environment).

1.11 Motor

The safety of the motor under variable speed conditions must be ensured.

To avoid the risk of physical injury, do not exceed the maximum specified speed of the motor.

Low speeds may cause the motor to overheat because the cooling fan becomes less effective, causing a fire hazard. The motor should be installed with a protection thermistor. If necessary, an electric forced vent fan should be used.

The values of the motor parameters set in the drive affect the protection of the motor. The default values in the drive must not be relied upon. It is essential that the correct value is entered in the Motor Rated Current parameter.

1.12 Mechanical brake control

Any brake control functions are provided to allow well co-ordinated operation of an external brake with the drive. While both hardware and software are designed to high standards of quality and robustness, they are not intended for use as safety functions, i.e. where a fault or failure would result in a risk of injury. In any application where the incorrect operation of the brake release mechanism could result in injury, independent protection devices of proven integrity must also be incorporated.

1.13 Adjusting parameters

Some parameters have a profound effect on the operation of the drive. They must not be altered without careful consideration of the impact on the controlled system. Measures must be taken to prevent unwanted changes due to error or tampering.

1.14 Electromagnetic compatibility (EMC)

Installation instructions for a range of EMC environments are provided in the E300 Elevator drive Installation and System Design guide. If the installation is poorly designed or other equipment does not comply with suitable standards for EMC, the product might cause or suffer from disturbance due to electromagnetic interaction with other equipment. It is the responsibility of the installer to ensure that the equipment or system into which the product is incorporated complies with the relevant EMC legislation in the place of use.

2 Introduction

Before reading this Setup guide it is assumed that the user is familiar with the Elevator drive and user documentation Installation and System Design Guide and Parameter Reference Guide. This Setup guide contains the required detail for setup and commissioning of the Elevator drive for Closed loop vector RFC-S mode operation with a PM synchronous motor and position feedback. Detail does not include detailed parameter listings, for full descriptions refer to the Installation and System Design Guide and Parameter Reference Guide.

3 Elevator Drive Keypad

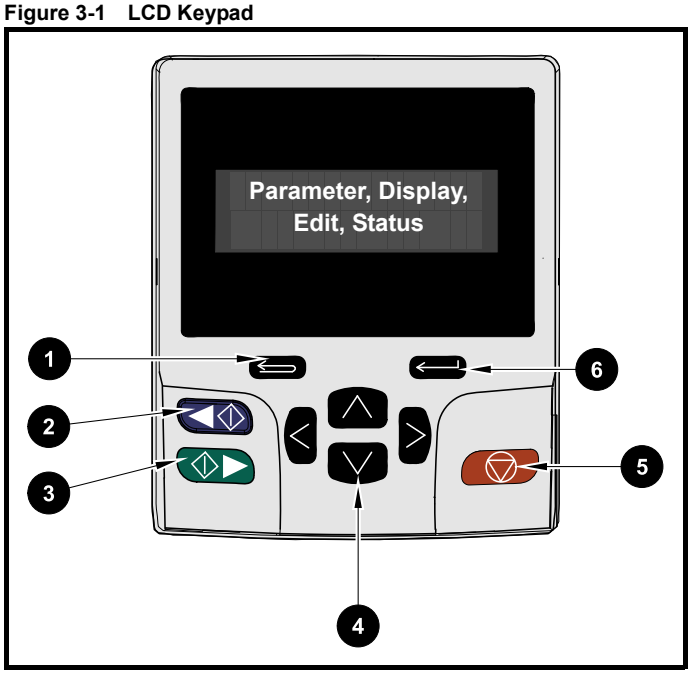
For setting the Elevator drive parameters there are the following options

- Parameters can be setup directly on the Elevator drive using the LCD keypad. The LCD Keypad can be fitted or removed with the drive powered up and operating. The Elevator drive can also be operated without the LCD keypad.
- It is also possible to setup the Elevator drive using serial communications and Elevator Connect. The parameters can also be displayed on the LCD keypad of the drive if required.

3.1 Elevator Drive Display

The parameter display on the Elevator drives LCD keypad is as follows.

Figure 3-1 LCD Keypad



1. Escape button - Used to exit from parameter edit or view mode. In edit mode, if parameter values are edited and exit button pressed, the value will be restored to the value it had on entry to edit mode.

2. Start reverse (Auxiliary) button - Not used.

3. Start forward button - Not used.

4. Navigation keys (x4) - Used to navigate through menu and parameters and edit values.

5. Reset button - Used to Reset the drive.

6. Enter / Mode button - Used to toggle between parameter edit and view mode.

The Elevator drive has a full set of menus from Menu A up to Z. Menus and parameters are defined as, Menu number = mm, Parameter number = nnn

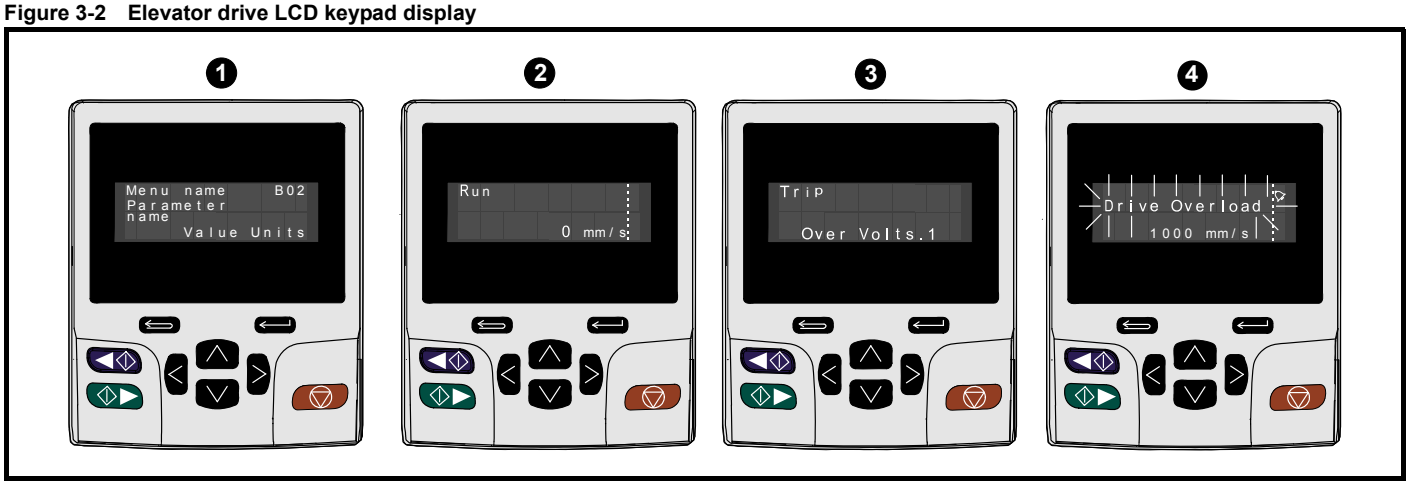
Table 3-1 Elevator drive LCD keypad functions

Key	Function in Display Mode (Static display	Function in Edit Mode (Blinking number)
	Drive State	-- : --
M	Change to Edit Mode	Change to Display Mode
⇑	Increase Parameter number	Increase Parameter value
⇓	Decrease Parameter number	Decrease Parameter value
⇐	Decrease Menu number	Increase Decimal place
⇒	Increase Menu number	Decrease Decimal place

Four display modes can be seen during operation as shown following:

1. **Parameter view mode**
   Menu and parameter view mode, read write (RW) or read only (RO)
2. **Status mode**
   If the drive is OK and parameters are not being edited or viewed, the upper row of the display will show one of the following **Inhibit** or **Run**.
3. **Trip status mode**
   When the drive is in a trip condition the upper row of the display will indicate that the drive has tripped and the lower row of the display will show the trip code.
4. **Alarm status mode**
   During an 'alarm' condition the upper row of the display flashes between the drive status Inhibit or Run (drive not in parameter view or edit mode) and the alarm condition.

Figure 3-2 Elevator drive LCD keypad display



4 Closed loop RFC-S mode Setup, Configuration

4.1 SMARTCARD, NV Media Card Setup

The most effective was to setup the Elevator drive parameter set is to use the SMARTCARD, NV Media Card as follows with the required parameter set defined.

Figure 4-1 Elevator drive, fitting SMARTCARD, NV Media Card

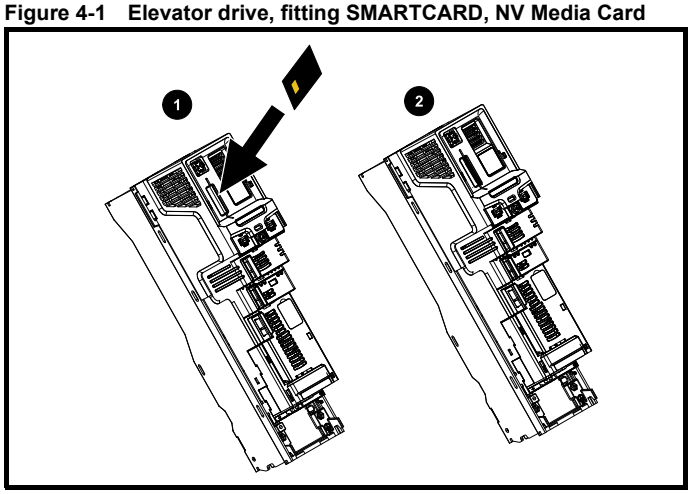


Figure 4-2 Elevator drive programming from SMARTCARD, NV Media Card

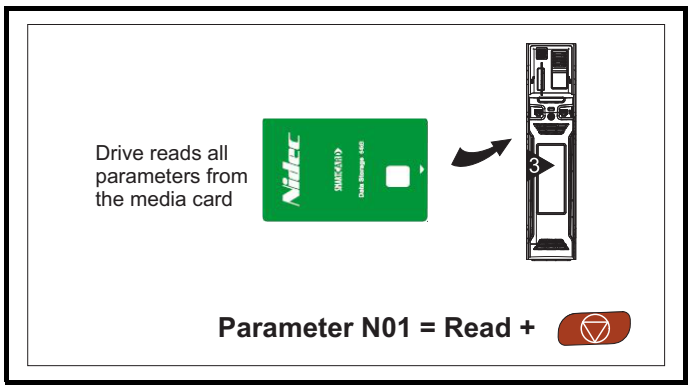
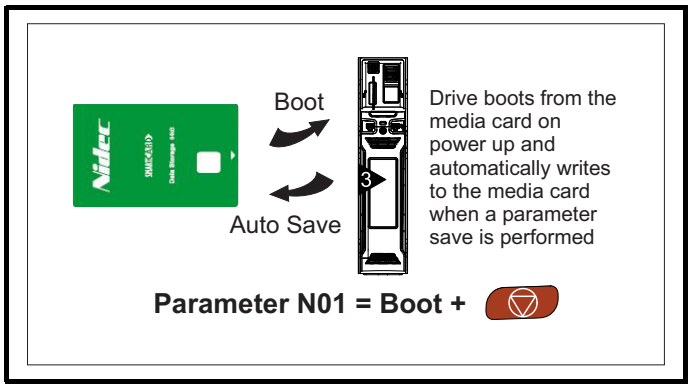


Figure 4-3 Elevator drive Boot and Auto save with SMARTCARD, NV Media Card



If a **Card Rating** trip (186) occurs parameters are being transferred from the SMARTCARD, NV Media Card, however the current and/or voltage ratings are different between source and destination drives.

This trip also applies if a compare (using Parameter **mm.000** = 8yyy) is attempted between the data block on a SMARTCARD, NV Media Card and the drive. The **Card Rating** trip (186) does not stop the data transfer but is a warning that rating specific parameters with the RA attribute may not be transferred to the destination drive.

- **Recommended actions**

Reset the drive to clear the trip.

Ensure that the drive rating dependent parameters have transferred correctly.

After SMARTCARD, NV Media Card operation the setup can be continued with … **4.3 First Test**

When transferring parameters from one drive to another **C13** Position Feedback Phase Angle, is also copied. If the phase angle between drives and motors is different, it should be noted before and restored after the SMARTCARD, NV Media Card transfer.

4.2 Manual programming

4.2.1 Selecting Motor Type

The default operating mode for the Elevator drive is set for a Permanent Magnet Motor and RFC-S mode:

- **A02 (B01)** = RFC-S

4.2.2 Selecting Control Interface

The control input mode can be selected as follows to suit the Lift (Elevator) controller, also refer section 7 *System Connection Diagram*.

A10 (H11)	= Analog Run Permit	(0)
A10 (H11)	= Analog 2 Directions	(1)
A10 (H11)	= 1 Direction Priority	(2)
A10 (H11)	= 1 Direction Binary	(3)
A10 (H11)	= 2 Directions Priority	(4)
A10 (H11)	= 2 Directions Binary	(5)
A10 (H11)	= Control word, Modbus	(6)
A10 (H11)	= DCP 3	(7)
A10 (H11)	= DCP 4	(8)

Save operating mode

mm.000 = Save parameters + Reset Button

4.2.3 Position Feedback Device Setup

The following section provides guidance for setup of the position feedback device when operating in RFC-S operating mode. In this operating mode an absolute position feedback device should be used.

SC EnDat (Default encoder selected)

SC EnDat encoder, the default setting for **A13 / C02** Auto Configuration = On (1) therefore only the Encoder supply voltage requires settings if > 5V.

Parameter	Description	Setting
A12 / C01	Encoder Type	**SC.EnDat**
A13 / C02	Auto Configuration	**On**
A14 / C03	Encoder count	**2048**
A15 / C04	Encoder supply voltage	**5V**
A16 / C13	Encoder phase offset value	**Auto-tune**

SC Hiperface

SC Hiperface encoder, the default setting for **A13 / C02** Auto Configuration = On (1) therefore only the Encoder supply voltage requires settings if > 5V.

Parameter	Description	Setting
A12 / C01	Encoder Type	**SC.HiPEr**
A13 / C02	Auto Configuration	**On**
A14 / C03	Encoder count	**2048**
A15 / C04	Encoder supply voltage	**8V**
A16 / C13	Encoder phase offset value	**Auto-tune**

SC SC

SC SC encoder (e.g. ERN 1387) **A13 / C02** Auto Configuration = On (1) however this does not setup the encoder as there is no communications channel as with EnDat or Hiperface, therefore encoder type, count and supply voltage must all be setup.

Parameter	Description	Setting
A12 / C01	Encoder Type	**SC.SC**
A13 / C02	Auto Configuration	**On**
A14 / C03	Encoder count	**2048**
A15 / C04	Encoder supply voltage	**5V**
A16 / C13	Encoder phase offset value	**Auto-tune**

4.2.4 Motor Data Setting

The following provides guidance to setup the Motor data, for motor settings refer to Motor nameplate.

Parameter	Description	Setting
A18 / B02	Motor nominal current	**... A**
A19 / B03	Motor nominal voltage	**400 V**
A20 / B05	Motor pole count	**Automatic**
A22 / B07	Motor rated frequency	**50 Hz**
A16 / C13	Position feedback phase angle	**...**
A25 / B13	Drive switching frequency	**6, 8, 12, 16 kHz**

The default switching frequency for the Elevator drive is 8 kHz with the highest switching frequency being 16 kHz. Higher switching frequencies will provide operation with lower acoustic noise at the Motor. Switching frequency modulation under high levels of current is active.

4.2.5 Adjusting Symmetrical Current Limit

The final setting for **A24 / B16** Symmetrical Current Limit (default = 175 %) will be dependent upon a number of factors including the Motor, Drive rating, and Elevator system profile.

- **Symmetrical current limit: A24 / B16 = … %**

4.2.6 Auto Tuning

When carrying out an auto-tune using **A26 / B11** the following tests will be done automatically.

- Measurement of motor parameters
- Automatic setup of the current loop gains **Start I03**, **I04** and **Run I08**, **I09**
- Setup of the position feedback phase offset angle **A16 / C13**

If the position feedback phase offset value **A16 / C13** is unknown an auto tune should be carried out. If the encoder phase angle is provided on the motor nameplate this can be manually setup in **A16 / C13** Position Feedback Phase Angle.

The position feedback direction of rotation is not checked during a Stationary (1) auto tune, but is checked during the Rotating (2) auto tune. The Rotating auto tune (**A26 / B11** = Rotating (2)) should be carried out with the ropes removed, lifted.

NOTE

From default the Elevator drive has a Fast disable **B27** configured, if this is not required disable setting **F21** T27 Dig Input 4 = **A00**.

Stationary Auto-tune, Motor Data, Current Loop Gains

Stationary auto tune setting up Position feedback phase angle and Current loop gains. During this test the Motor will not rotate and the brake will not be released, the current loop gains will be setup along with the position feedback phase angle.

- **A26 (B11)** = Stationary (1) or Full stationary (5)
  Inspection start and hold until complete
  Full stationary (5) test is required for non-salient motors with similar inductances in d- and q-axis
- **A26 (B11)** = None (0)
  Inspection stop
- Check Position Feedback Phase Angle **A16 / C13**
- Check auto tune calculated current loop gains

Parameter	Description	Setting
I03	Start Current Loop Kp	150 default
I04	Start Current Loop Ki	2000 default
I08	Run Current Loop Kp	150 default
I09	Run Current Loop Ki	2000 default

By default the Start and Run current loop gains are used and it is recommended that the calculated gains are used unless the Motor becomes acoustically noisy in which case the current loop Kp can be reduced by up to 40 %.

Rotating Auto-tune, Position Feedback Phase Angle, Current Loop Gains

If a rotating auto tune is to be carried out to setup **A16 / C13** Position Feedback Phase Angle and the current loop gains the following steps can be followed. Lift the ropes from the sheave of the motor, or if not possible place the Lift into a balanced condition for the rotating auto tune with sufficient headroom above and below the Lift car for movement in the Lift shaft.

- **A26 / B11** = Rotating (2)
  Inspection start and hold until complete

If the motor rotates in the incorrect direction the following parameter can be used where the motor connections U, V, W are incorrect

- Reverse Motor phase sequence
  A27 / B26 = Off (0) or On (1)
- **A26 / B11** = None (0)
  Inspection stop
- Check Position Feedback Phase Angle **A16 / C13**
- Check auto tune calculated current loop gains

Parameter	Description	Setting
I03	Start Current Loop Kp	150 default
I04	Start Current Loop Ki	2000 default
I08	Run Current Loop Kp	150 default
I09	Run Current Loop Ki	2000 default

By default the Start and Run current loop gains are used and it is recommended that the calculated gains are used unless the Motor becomes acoustically noisy in which case the current loop Kp can be reduced by up to 40 %.

Diagnostics

If a drive trip occurs during an auto tune this could be due to a number of reasons e.g. the rotation of the motor phases or the encoder connections. Check wiring connections if required for the drive trip, and refer to the following brief descriptions and the diagnostics section for further details.

- **Auto tune 1** - The position feedback position did not change during a rotating auto tune or the motor did not reach the required speed.
- **Auto tune 2** - The position feedback direction is incorrect or motor phases rotated during a rotating auto tune, or the motor did not reach the required speed.
- **Auto tune 3** - The commutation signals changed in the incorrect direction during a rotating auto-tune, or the drive has been unable to identify the motor inertia or the measured inertia has exceeded the parameter range.

- **Auto tune 4** - A position feedback device with commutation signals is being used i.e AB Servo, SC Servo and the U commutation signal did not change during a rotating auto-tune.
- **Auto tune 5** - A position feedback device with commutation signals is being used i.e AB Servo, SC Servo and the V commutation signal did not change during a rotating auto-tune.
- **Auto tune 6** - A position feedback device with commutation signals is being used i.e AB Servo, SC Servo and the W commutation signal did not change during a rotating auto-tune.
- **Auto tune 7** - Initiated during a rotating auto-tune, if the number of motor poles is set incorrectly, or the position feedback lines per revolution **A14 / C03** has been set up incorrectly.
- **Auto tune No Dir** - A direction signal was not given while attempting to perform an auto-tune. A direction signal must be given within 6 s of enabling the drive to prevent this trip while attempting to auto-tune.
- **Auto tune Stopped** - The drive was prevented from completing an auto-tune, because either the Drive enable or the Drive run signal was removed.
- **Resistance** - This trip indicates that either the value being used for Motor stator resistance is too high or that an attempt to measure the Motor stator resistance has failed. If the value is the result of a measurement made by the drive then sub-trip 1 is applied, or if it is because the parameter has been changed by the user then sub-trip 3 is applied. During the stator resistance section of auto-tuning an additional test is performed to measure the drive inverter characteristics to provide the compensation necessary for dead-times. If the inverter characteristic measurement fails then sub-trip 2 is applied.

4.2.7 Distance & Speed Scaling, Mechanical data

Speeds, acceleration and deceleration distances can be set in normal units (mm/s, mm, mm/s²). The scaling of these is done by setting the Mechanical data for the Lift in the following parameters.

Parameter	Description	Setting
A28 / E01	Nominal Elevator speed mm/s	**1000 mm/s**
A29 / E02	Sheave diameter	**480 mm**
A30 / E03	Roping	**1 = 1:1**
E04	Gear ratio numerator (Geared Lift)	**1**
E05	Gear ratio denominator (Geared Lift)	**1**
A33 / E07	Nominal Elevator speed rpm	**... rpm**

If the mechanical data is not available adjust Nominal Elevator speed rpm **A33 / E07** with the Motor nominal rpm or data sheet value.

4.2.8 Adjusting Maximum Speed

The maximum Motor speed **A34 / E08** is setup and automatically limited for the speed set-point as well as for the Nominal Elevator speed rpm **A33 / E07**. The maximum Motor speed **A34 / E08** calculated internally to be the equivalent of 110 % of Nominal Elevator speed and can be manually adjusted where required following initial setup using **A33 / E07**.

4.2.9 Direction Invert

By activating the direction input invert **A11 / H12** the travel direction can be inverted where the control signals to the drive are incorrect, without wiring changes.

- Direction Input Invert
  A11 / H12 = Off (0) or On (1)

In addition the following parameters will invert the main position feedback and Motor phase rotation.

- Drive encoder feedback reverse (*excluding SC.EnDat*, *SC Hiperface* and *SC SSI encoders*)
  A17 / C12 = Off (0) or On (1)
- Reverse Motor phase sequence
  A27 / B26 = Off (0) or On (1)

4.2.10 Speeds Reference Settings

The Elevator control software offers up to a maximum of 10 speed selections.

Parameter	Description	Setting
A43 / G01	V1 Speed reference (Default Creep speed **G52**)	50 mm/s
A44 / G02	V2 Speed Reference	400 mm/s
A45 / G03	V3 Speed Reference	600 mm/s
A46 / G04	V4 Speed Reference	10 mm/s
G05	V5 Speed Reference	100 mm/s
G06	V6 Speed Reference	100 mm/s
G07	V7 Speed Reference	100 mm/s
G08	V8 Speed Reference	100 mm/s
G09	V9 Speed Reference	100 mm/s
G10	V10 Speed Reference	100 mm/s

4.2.11 Soft Start

This feature can be used to overcome starting friction for Elevators fitted with a gearbox, or systems fitted with guide rail pads rather than rollers resulting in a jerk during the start.

Parameter	Description	Setting
A58 / G48	Start optimiser time	1000 ms
A59 / G47	Start optimiser jerk	10 mm/s³ x 10
A60 / G46	Start optimiser speed	10 mm/s
A61 / G45	Start optimiser enable	Off (0) or On (1)

4.2.12 Profile Parameters

For the Elevator system profile there are a number of different settings including acceleration, deceleration and jerk settings along with Creep stop optimisation as detailed following.

Parameter	Description	Setting
A35 / G13	Run jerk 1	50 mm/s³ x 10
A36 / G14	Run jerk 2	100 mm/s³ x 10
A37 / G15	Run jerk 3	100 mm/s³ x 10
A38 / G16	Run jerk 4	80 mm/s³ x 10
A40 / G11	Acceleration rate	500 mm/s²
A41 / G12	Deceleration rate	800 mm/s²
A39 / G18	Creep stop jerk	100 mm/s³ x 10
A42 / G17	Creep stop deceleration rate	1000 mm/s²

4.2.13 Brake Control Delay Times

Using the drives adjustable brake control delay times the brake operation can be optimised. The target is to have a continuous and fast transition from standstill to travel and onto stop without any jerk impacting on the ride quality.

Parameter	Description	Setting
A47 / D04	Brake control release delay	500 ms
A48 / D05	Brake control apply delay	500 ms

In addition to the brake control release and apply delays above there is an additional parameter which defines the time taken to build torque during the start, prior to brake release, and releasing the load from the motor to the Motors mechanical brake during the stop as follows, preventing acoustic noise during operation.

Parameter	Description	Setting
D02	Motor torque ramp time	100 ms
D32	Motor torque ramp down time	100 ms

4.2.14 Current Control Loop Gains

The current loop gains are automatically setup during the auto tune and normally no further adjustment is required with these being setup based upon the Motors parameters (stator resistance and inductance,).
As default dual current loop gains are used Start and Run.

Parameter	Description	Setting
I03	Start Current Loop Kp	150
I04	Start Current Loop Ki	2000
I08	Run Current Loop Kp	150
I09	Run Current Loop Ki	2000

If the motor becomes acoustically noisy during operation the current loop Kp can be reduced by up to 50 %. Reducing the current loop proportional Kp gains can provide damping of high frequency noise and overcome Motor acoustic noise.

4.2.15 Current Demand Filter

Using the current demand filter time constants it is possible to damp control noise, position feedback induced noise and quantisation at the Motor to overcome Motor acoustic noise. For the Elevator drive there are filters available to support Start and Run. Values in the region of 1.0 to 5.0 ms are typical.

Parameter	Description	Setting
A52 / I05	Start current loop filter	1.0 ms
A54 / I10	Run current loop filter	1.0 ms

4.2.16 Speed Control Loop Gains

The speed loop gains are adjusted separately for the Start and Run. The optimal values for high ride quality are dependent upon the Motor, Position feedback and Mechanics of the Lift. The values below are basic values for gearless PM Motors with high resolution position feedback devices, installed correctly these could be increased up to 10…20 times.

Parameter	Description	Setting
A49 / I01	Start Speed Loop Kp	1.0000 s/rad
A50 / I02	Start Speed Loop Ki	20.00 s²/rad
A52 / I06	Run Speed Loop Kp	0.5000 s/rad
A53 / I07	Run Speed Loop Ki	10.00 s²/rad
C09	Encoder Feedback Filter	Disabled (0)

In addition to the Start and Run speed loop gain settings there is a Drive encoder speed feedback filter **C09** which may be required for systems where there is noise present on the speed feedback due to the installation, or where a low resolution speed feedback device is being used and there is quantization. These effects unless overcome will result in limited speed loop gain settings.

4.2.17 Start Locking Position Loop

The Start locking position controller applies compensation during starting preventing movement during start brake release, roll back and jerk in the lift car when the Motor brakes are opened.

In order to get the best performance from the Start locking position control and lift control a high resolution position feedback device should be used (for example SC.EnDat, SC.Hiperface, SC.SC). The P gain value given is a basic value and will require some adjustment to reach the optimal value which is also dependent upon the Start speed loop gain settings, position feedback device resolution and installation.

In order to get the best performance during starting without roll-back, and also preventing brake noise **I23** Start Lock Position Change Max can be setup and adjusted for example from 0.25…0.50 %.

Parameter	Description	Setting
A55 / I22	Start Lock Enable	Off (0) or On (1)
A56 / I21	Start Lock P Gain Speed Clamp	100.000 mm/s
A57 / I20	Start Lock P Gain	50.000
I23	Start Lock Position Change Max	0.00 %

4.3 First Test

To check the control of the Lift and the direction of movement of the Lift car carry out a travel with Inspection speed and observe the direction of movement of the Lift car

- Display **J23** Percentage load
  Start Inspection travel
  Check **J23** Percentage load > 0
  Check correct direction of Motor and Lift car

Display “Run” does not occur

- Check speed selection on either control terminal T29 (**F08**), T26 (**F05**), T7 (**F36**), T5 (**F35**)
- Check direction input on control terminal T28 (**F0&**)
- Check T31 (**F10**) Safe Torque Off (STO), Drive enable input
- Check control interface to Elevator drive and settings

No movement of the Motor during the start

- Check **J09** Reference parameter selected
  J09 Reference parameter selected = No reference selected
- Check control interface to Elevator drive and settings
- Ensure Start Optimizer Speed **G46** > Brake Release Frequency **D08**

Percentage load **J23** = 0

- Check output Motor contactor control from the Elevator drive (**B31**) or Lift (Elevator) controller and control interface

Elevator drive trips **Speed err** or **Distance err**

- Check **Speed err** thresholds in **H15**, and **Distance err** threshold in **H16** are set correctly
- Check Motor connections
- Check **A16 / C13** Encoder phase offset value
- Check speed loop gain settings

Parameter	Description
A49 / I01	Start Speed Loop Kp
A50 / I02	Start Speed Loop Ki
A52 / I06	Run Speed Loop Kp
A53 / I07	Run Speed Loop Ki

Elevator drive trips **Motor Too Hot**

- Check Motor load, balance, and **A16 / C13**
- Encoder phase offset value

High Motor acoustic noise (PM Motor)

- Reduce current loop P gain for Start, and Run
  Reduce the value of current loop Kp by up to a maximum of 50 % in steps of 10 %

Parameter	Description
I03	Start Current Loop Kp
I08	Run Current Loop Kp

Motor rotates a short distance and stops with **J24** Torque producing current > 0

- Check Motor poles in **A20 / B05**
- Check position feedback lines per revolution **A14 / C03**

Motor rotates in the opposite direction as demanded for the travel

- Set **A11 / H12** Direction input invert = Off (0) or On (1)

Where poor Motor control can be seen, vibration, acoustic noise

- Check encoder connections to the drive, screening and ground termination

Other Elevator drive issues, trips

- Refer to diagnostics section

No Elevator drive trips and stable operation in the correct direction at Inspection speed continue optimization of the speed loop gain settings.

Parameter	Description
A49 / I01	Start Speed Loop Kp
A50 / I02	Start Speed Loop Ki
A52 / I06	Run Speed Loop Kp
A53 / I07	Run Speed Loop Ki

Diagnostic Parameters which can be used during the first test

Parameter	Description	Setting
G39	Direction input 1	Off (0) or On (1)
G40	Direction input 2 (Dual direction inputs)	Off (0) or On (1)
J09	Reference parameter selected	… V1 – V7
F10	Safe Torque Off (STO), Drive enable	Off (0) or On (1)
D03	Brake control output	Off (0) or On (1)
G01 to **G10**	V1 to V10 speed reference	… mm/s
A06 (J39)	Profile speed	… mm/s
A06 / J40	Actual speed	… mm/s
J22	Total output current	… A
J23	Percentage load	... %
B16	Symmetrical current limit	... %
J03	Software State	… 0 - 14

4.3.1 Adjusting Speed Loop Gains

The default speed loop gain values provide acceptable out of box operation, and adjustment will be required to the speed loop gain settings to reach improved performance. It is recommended that Inspection speed is used during tuning of the speed loop gains.

Parameter	Description
A49 / I01	Start Speed Loop Kp
A50 / I02	Start Speed Loop Ki
A52 / I06	Run Speed Loop Kp
A53 / I07	Run Speed Loop Ki

Start Speed loop gains

Tuning the Start Speed Loop Ki gain

- Increase the value of **A50 / I02** Start Speed Loop Ki (default value 20.00) in steps of 1.00 until Motor becomes noisy or unstable to prevent movement, roll back on brake release

If Motor becomes noisy

- Increase **A51 / I05** Start current loop filter to between 2... 6 ms

If Motor becomes unstable

- Reduce **A50 / I02** Start Speed Loop Ki value in steps of 1.00

Setting the Start Speed Loop Kp gain

- The default value for **A49 / I01** Start Speed Loop Kp is 1.000 optimise if during start if there is undershoot or vibration

Undershoot on start of profile

- Increase **A49 / I01** Start Speed Loop Kp in steps of 0.500

Vibration on start of profile

- Reduce **A49 / I01** Start Speed Loop Kp in steps of 0.100

Run Speed loop gains

Tuning the Run Speed Loop Kp gain

- Increase **A52 / I06** Run Speed Loop Kp (default value 0.5000) in steps of 0.1000 until Motor becomes noisy or unstable to overcome overshoot at the end of acceleration or vibration during constant speed

If Motor becomes noisy

- Increase **A54 / I10** Run current loop filter to between 2... 6 ms

If Motor becomes unstable

- Reduce **A52 / I06** Run Speed Loop Kp by up to 60 % of the value in steps of 10 %

Setting the Run Speed Loop Ki gain

- Set the value of **A53 / I07** Run Speed Loop Ki (default value 10.00) to 10 x **A52 / I06** Run Speed Loop Kp value

The current filters can be used to overcome control noise, position feedback noise and quantization overcoming Motor acoustic noise.

Parameter	Description	Setting
A51 / I05	Start current loop filter	1.0 ms
A54 / I10	Run current loop filter	1.0 ms

4.3.2 Further Optimization

Further optimization can be carried out to achieve a fast, smooth travel meeting the ride quality of the customer based upon their Lift system.

In addition to the ride comfort felt within the Lift car during optimization, CT Scope can also be used to further examine the Elevator travel and control. Optimization of the Lift should be carried out with a range of travels, including single and multiple floor floors with an empty and full Lift car. Also refer to the Elevator drives Installation and System Design Guide and Parameter Reference Guide for detailed descriptions of software functions.

Modifying the profile parameters during further optimization can lead to the Lift not reaching maximum speed or overshooting the floor levels and reaching the limit switches, end stops.

4.3.3 Brake Release

Jerk and movement of the Motor sheave when the Motor brakes open

- Increase **A57 / I20** Start Lock P Gain for faster response during brake release until control noise / instability appears where **A51 / I05** can be adjusted, increased to overcome Motor noise.
- Increase **A50 / I02** Start Speed Loop Ki for stiffer control and maintaining zero speed during and following brake release

If Jerk and movement of the Motor sheave is still present

- Increase **A57 / I20** Start Lock P Gain further along with **A56 / I21** Start Lock P Gain Speed Clamp for the Start locking position control
- When vibrations start to occur with the higher gain setting reduce **A57 / I20** Start Lock P Gain in steps of 1.00 from the current setting.

Parameter	Description	Setting
A55 / I22	Start Lock Enable	Off (0) or On (1)
A56 / I21	Start Lock P Gain Speed Clamp	100.000 mm/s
A57 / I20	Start Lock P Gain	50.000
I23	Start Lock Position Change Max	0.0

4.3.4 Brake Release & Controlled Start

Jerk during start and following brake release

- Decrease **A35 / G13** Run Jerk 1 to introduce a softer, slower start profile.

If there are high levels of friction during the start

- The Start Optimizer can be enabled with **A61 / G45** Start Optimiser Enable. The active time for the Start Optimiser increased with **A58 / G48** Start Optimiser Time, if the start takes too long, reduce **A58 / G48** Start Optimiser Time.

If the profile has starting against the Motors brakes.

- Increase **A47 / D04** Brake Control Release Delay time. If the Motor is at standstill following brake release reduce **A47 / D04** Brake Control.

4.3.5 Start & Acceleration

Overshoot or undershoot following start to acceleration to profile speed

- Decrease **A36 / G14** Run Jerk 2 for a soft controlled transition from acceleration to the end of acceleration and onto travel.
- Increase **A36 / G14** Run Jerk 2 for a harder transition from acceleration to the end of acceleration and onto travel.

Vibrations during constant acceleration

- Check to see if the drive is operating in current limit, **L15** Current Limit Reached = On (1)

If the drive is operating in current limit

- Increase **A24 / B16** Symmetrical Current Limit where too low, and still possible to increase further
- Reduce acceleration rate in **A40 / G11** Acceleration Rate

4.3.6 Constant Speed

Vibrations present in the Lift car during constant speed travel up to deceleration

- Increase **A52 / I06** Run Speed Loop Kp to provide a faster response
- Increase **A53 / I07** Run Speed Loop Ki to provide stiffer control

If Motor acoustic noise increases

- Optimise **A54 / I10** Run current Loop Filter, maximum 6 ms
- If instability occurs reduce **A53 / I07** Run Speed Loop Ki

4.3.7 Deceleration

Adjusting deceleration distance

Increase the deceleration distance by

- Reducing **A40 / G11** Acceleration Rate to be slower
- And/or reduce **A36 / G14** Run Jerk 2 to be softer

Decrease deceleration distance by

- Increasing the **A40 / G11** Acceleration Rate to be faster
- And/or reduce **A36 / G14** Run Jerk 2 to be harder

If constant speed is reached the deceleration distance can only be influenced by **A41 / G12** Deceleration rate

4.3.8 Approaching Stop

Stopping with a jerk at the end of the profile

- Reduce **A38 / G16** Run Jerk 4 to provide a softer transition to stop at the end of travel

Movement of the Motor sheave during Motor brake apply

- Check the drives enable signal **F10** from the Lift (Elevator) controller and ensure this is not being removed too early

L06 Drive Active

- Increase **A48 / D05** Brake Control Apply Delay to maintain Motor torque whilst Motor brakes fully close

4.4 Save Parameter Settings

4.4.1 Save Elevator Drive Parameter Settings

To save parameters in the Elevator drive use the following procedure

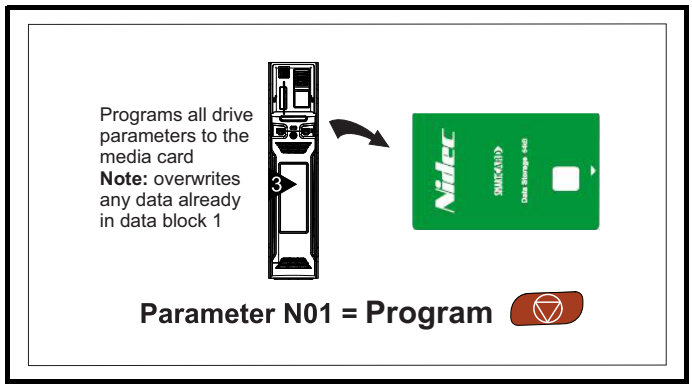
Save drive parameters

- **mm.000** = Save parameters
- Reset
- Wait 3 s

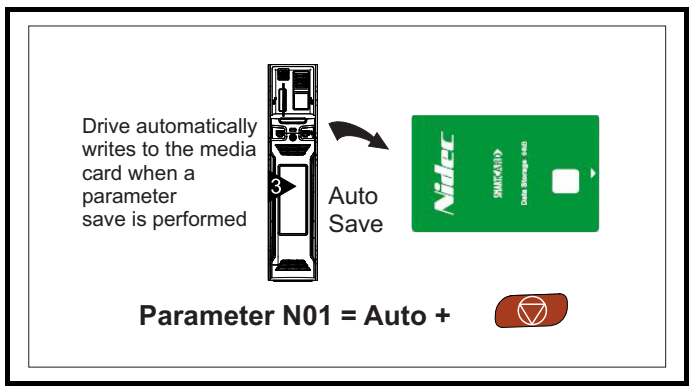
4.4.2 Save Elevator Drive Parameter Settings To SMARTCARD, NV Media Card

To save the Elevator drive parameters to the SMARTCARD, NV Media Card the following two options are available.

A save can be carried out setting **A03 / N01** Parameter Cloning = Program + Reset Button and Wait 3 s.



An Auto save can be carried out setting **A03 / N01** Parameter Cloning = Auto + Reset Button.



5 User Menu A

Parameter		Parameter Description	Range
A00		Parameter 00 for code entry	No Action (0), Save parameters (1), Load file 1 (2), Save to file 1 (3), Load file 2 (4), Save to file 2 (5), Load file 3 (6), Save to file 3 (7), Show non-default (8), Destinations (9), Reset 50Hz defs (10), Reset 60Hz defs (11), Reset modules (12), Read enc. NP P1 (13), Read enc. NP P2 (14)
A01	H02	User Security Status	Menu A (0), All Menus (1), Read-only Menu A (2), Read-only (3), Status-only (4), No-Access (5)
A02	B02	Drive Control Mode	Open loop (1), RFC-A (2), RFC-S (3)
A03	N01	Parameter Cloning	None (0), Read (1), Program (2), Auto (3), Boot (4)
A04	J22	Total Output Current	± VM_DRIVE_CURRENT_UNIPOLAR A
A05	J23	Percentage Load	± VM_USER_CURRENT %
A06	J40	Actual Speed	0 to 1000 mm/s
A07	J59	Output Power	± VM_POWER kW
A08	J60	Output Frequency	± VM_SPEED_FREQ_REF Hz
A09	J61	Output Voltage	± VM_AC_VOLTAGE V
A10	H11	Control Input Mode	Analog Run Prmit (0), Analog 2 Dir (1), Priority 1 Dir (2), Binary 1 Dir (3), Priority 2 Dir (4), Binary 2 Dir (5), Control Word (6), DCP3 (7), DCP4 (8)
A11	H12	Direction Input Invert	Off (0) or On (1)
A12	C01	Encoder Type	AB (0), FD (1), FR (2), AB Servo (3), FD Servo (4), FR Servo (5), SC (6), SC Hiperface (7), EnDat (8), SC EnDat (9), SSI (10), SC SSI (11), SC Servo (12), SC SC (15)
A13	C02	Encoder Auto Configuration	Off (0) or On (1)
A14	C03	Encoder Pulses Per Rev	1 to 100,000 ppr
A15	C04	Encoder Voltage Select	5 V (0), 8 V (1), 15 V (2)
A16	C13	Position Feedback Phase Angle	0.0 to 359.9°
A17	C12	Encoder feedback reverse	Off (0) or On (1)
A18	B02	Motor Rated Current	± VM_RATED_CURRENT A
A19	B03	Motor Rated Voltage	± VM_AC_VOLTAGE_SET V
A20	B05	Number Of Motor Poles	Automatic (0) to 480 Poles (240)
A22	B07	Rated Speed	0.00 to 33000.00 rpm
A23	B09	Phasing Test On enable	Disabled (0), Short (1), Short Once (2), Long (3), Long Once (4)
A24	B16	Symmetrical Current Limit	± VM_MOTOR1_CURRENT_LIMIT %
A25	B13	Maximum Switching Frequency	3 kHz (1), 4 kHz (2), 6 kHz (3), 8 kHz (4) 12 kHz (5), 16 kHz (6)
A26	B11	Motor Auto tune	None (0), Static (1), Rotating (2), Inertia 1 (3), Inertia 2 (4), Full Stationary (5)
A27	B26	Reverse Motor Phase Sequence	Off (0) or On (1)
A28	E01	Nominal Elevator Speed mm/s	0 to 4000 mm/s
A29	E02	Sheave Diameter	1 to 32,767 mm
A30	E03	Roping	1:1 (1), 2:1 (2), 3:1 (3), 4:1 (4)
A33	E07	Nominal Elevator Speed rpm	1.00 to 4000.00 rpm
A34	E08	Motor Maximum Frequency Clamp	= 1.1 x **A33 (E07)**
A35	G13	Run Jerk 1	1 to 65535 mm/s³ x10
A36	G14	Run Jerk 2	1 to 65535 mm/s³ x10
A37	G15	Run Jerk 3	1 to 65535 mm/s³ x10
A38	G16	Run Jerk 4	1 to 65535 mm/s³ x10
A39	G18	Creep Stop Jerk	1 to 65535 mm/s³ x10
A40	G11	Acceleration Rate	0 to 10000 mm/s²
A41	G12	Deceleration Rate	0 to 10000 mm/s²
A42	G17	Creep Stop Deceleration	0 to 10000 mm/s²
A43	G01	V1 Speed Reference	0 to *Nominal* Elevator Speed **A28 (E01)**
A44	G02	V2 Speed Reference	0 to *Nominal* Elevator Speed **A28 (E01)**
A45	G03	V3 Speed Reference	0 to *Nominal* Elevator Speed **A28 (E01)**
A46	G04	V4 Speed Reference	0 to *Nominal* Elevator Speed **A28 (E01)**
A47	D04	Brake Control Release Delay	0 to 10000 ms
A48	D05	Brake Control Apply Delay	0 to 10000 ms
A49	I01	Start Speed Loop Kp	0.0000 to 200.0000 s/rad
A50	I02	Start Speed Loop Ki	0.00 to 655.35 s²/rad
A51	I05	Start Current Loop Filter	0.0 to 25.0 ms
A52	I06	Run Speed Loop Kp	0.0000 to 200.0000 s/rad
A53	I07	Run Speed Loop Ki	0.00 to 655.35 s²/rad
A54	I10	Run Current Loop Filter	0.0 to 25.0 ms
A55	I22	Start Lock Enable	Off (0) or On (1)
A56	I21	Start Lock Speed Clamp	0 to 10000 mm/s
A57	I20	Start Lock Kp	0.000 to 1000.000

Parameter		Parameter Description	Range
A58	G48	Start Optimiser Time	0 to 10,000 ms
A59	G47	Start Optimiser Jerk	± VM_EX00_RUN_JERK_1
A60	G46	Start Optimiser Speed	0 to 10000 mm/s
A61	G45	Start Optimiser Enable	Off (0) or On (1)

6 Diagnostics

6.1 Trip Codes & Corrective Actions

The Elevator protects itself, the control environment and Motor by many monitoring functions and operating levels. If the monitor system detects a problem, a trip is initiated. To identify the causes of a trip refer to the following diagnostics section and the Installation and System Design Guide for further detailed information.

<table>
<tr><th>Trip</th><th>Description / Recommended action</th></tr>
<tr><td>An Input 1 Loss</td><td>Analog input 1 current loss</td></tr>
<tr><td>28</td><td>An Input 1 Loss trip indicates that a current loss was detected in current mode on Analog input 1 (T5, T6). In 4-20 mA and 20-4 mA modes loss of input is detected if the current < 3 mA.
Recommended actions:
• Check control wiring is correct.
• Check control wiring is undamaged.
• Check the Analog Input 1 Mode F38.
• Current signal is present and greater than 3 mA.</td></tr>
<tr><td>An Input 2 Loss</td><td>Analog input 2 current loss</td></tr>
<tr><td>29</td><td>An Input 2 Loss indicates that a current loss was detected in current mode on Analog input 2 (T7). In 4-20 mA and 20-4 mA modes loss of input is detected if the current < 3 mA.
Recommended actions:
• Check control wiring is correct.
• Check control wiring is undamaged.
• Check the Analog Input 2 Mode F45.
• Current signal is present and greater than 3 mA.</td></tr>
<tr><td>An Output Calib</td><td>Analog input 2 current loss</td></tr>
<tr><td>29</td><td>The zero offset calibration of one or both the Analog outputs has failed. This indicates that the drive hardware has failed or a voltage has been applied to the output via low impedance.
<table><tr><th>Sub-trip</th><th>Reason</th></tr><tr><td>1</td><td>Output 1 failed</td></tr><tr><td>2</td><td>Output 2 failed</td></tr></table>Recommended actions:
• Check the wiring associated with Analog outputs.
• Remove all the wiring that is connected to Analog outputs and perform the calibration.</td></tr>
<tr><td>Analog No Dir</td><td>Run signal not received when starting in Analog control input mode</td></tr>
<tr><td>79</td><td>A direction signal or run permit was not provided within 1 s of the brake release time elapsing in Analog control input mode, Control Input Mode H11 = Analog Run Prmit (0) or Analog 2 Dir (1).
Recommended actions:
• Check Direction Input 1 G39 and Direction Input 2 G40 ensuring a direction signal is received.
• Check control wiring is correct.
• Check control wiring is undamaged.</td></tr>
<tr><td>Autotune 1</td><td>Position feedback did not change or required speed could not be reached</td></tr>
<tr><td>11</td><td>The drive has tripped during a rotating auto-tune. The cause of the trip can be identified from the associated sub-trip number.
<table><tr><th>Sub-trip</th><th>Reason</th></tr><tr><td>1</td><td>Position feedback did not change when used during a rotating auto-tune.</td></tr><tr><td>2</td><td>Motor speed did not reach the required speed for rotating auto-tune or mechanical load measurement.</td></tr></table>Recommended actions:
• Ensure the motor is free to turn i.e. mechanical brake was released.
• Ensure C01 Drive Encoder Type is set correctly.
• Check feedback device wiring is correct.
• Check encoder mechanical coupling to the motor.</td></tr>
</table>

<table>
<tr><th>Trip</th><th>Description / Recommended action</th></tr>
<tr><td>Autotune 2</td><td>Position feedback direction incorrect</td></tr>
<tr><td>12</td><td>The drive has tripped during a rotating auto-tune. The cause of the trip can be identified from the associated sub-trip number.
<table><tr><th>Sub-trip</th><th>Reason</th></tr><tr><td>1</td><td>Position feedback did not change when used during a rotating auto-tune.</td></tr><tr><td>2</td><td>Motor speed did not reach the required speed for rotating auto-tune or mechanical load measurement.</td></tr></table>Recommended actions:
• Check motor cable wiring is correct.
• Check feedback device wiring is correct.
• Check setting of C12 Drive Encoder Feedback Reverse.
• Swap any two motor phases (U, V, W).</td></tr>
<tr><td>Autotune 3</td><td>Measured inertia exceeded parameter, commutation signals changed in wrong direction</td></tr>
<tr><td>13</td><td>The drive has tripped during a rotating auto-tune or mechanical load measurement test. The cause of the trip can be identified from the associated sub-trip number.
<table><tr><th>Sub-trip</th><th>Reason</th></tr><tr><td>1</td><td>Measured inertia > parameter E15 during mechanical load measurement.</td></tr><tr><td>2</td><td>Commutation signals changed in the wrong direction during a rotating auto-tune.</td></tr><tr><td>3</td><td>The mechanical load test has been unable to identify the motor inertia.</td></tr></table>Recommended actions:
• Check motor cable wiring is correct
• Check feedback device U, V and W commutation signal wiring is correct
• Check setting of C12 Drive Encoder Feedback Reverse.</td></tr>
<tr><td>Autotune 4</td><td>Drive encoder U commutation signal fail</td></tr>
<tr><td>14</td><td>A position feedback device with commutation signals is being used (i.e. AB Servo, FD Servo, FR Servo, SC Servo) and the U commutation signal did not change during a rotating auto-tune.
Recommended actions:
• Check feedback device U commutation signal wiring is correct (Encoder T7 and T8).</td></tr>
<tr><td>Autotune 5</td><td>Drive encoder V commutation signal fail</td></tr>
<tr><td>15</td><td>A position feedback device with commutation signals is being used (i.e. AB Servo, FD Servo, FR Servo, SC Servo) and the V commutation signal did not change during a rotating auto-tune.
Recommended actions:
• Check feedback device V commutation signal wiring is correct (Encoder T9 and T10).</td></tr>
<tr><td>Autotune 6</td><td>Drive encoder W commutation signal fail</td></tr>
<tr><td>16</td><td>A position feedback device with commutation signals is being used (i.e. AB Servo, FD Servo, FR Servo, SC Servo) and the W commutation signal did not change during a rotating auto-tune.
Recommended actions:
• Check feedback device W commutation signal wiring is correct (Encoder T11 and T12).</td></tr>
<tr><td>Autotune 7</td><td>Motor number of poles / position feedback resolution set incorrectly</td></tr>
<tr><td>17</td><td>An Auto-tune 7 trip is initiated during a rotating auto-tune, if the motor poles or the position feedback resolution have been set up incorrectly where position feedback is being used.
Recommended actions:
• Check line per revolution for feedback device C03.
• Check the number of poles B05.</td></tr>
<tr><td>Autotune No Dir</td><td>Direction signal not received when starting an auto-tune</td></tr>
<tr><td>78</td><td>Direction signal not given while attempting to perform auto-tune. A direction signal must be given within 6 s of drive enable to prevent this trip while attempting to auto-tune B11 ≥ 1.
Recommended actions:
• Check Direction Input 1 G39 and Direction Input 2 G40 ensuring a direction signal is received.
• Check control wiring is correct.
• Check control wiring is undamaged.
• Check control sequence from Elevator controller.</td></tr>
</table>

Trip	Description / Recommended action
Autotune Stopped	**Auto tune test stopped before completion**
18	The drive was prevented from completing an auto-tune test, because the Safe Torque Off (STO), Drive enable, Fast Disable or the Run commands were removed. **Recommended actions:** • Check the Safe Torque Off (STO), Drive enable signal on T31 is active **F10**. • Check the Fast stop is active, where used. • Check the direction command is active **G39**, **G40**.
Brk Ctrl Release	**Conditions not met for motor brake release during start**
68	The brake release control conditions were not met within 6 s to allow transition from state 3 to 4. **Recommended actions:** • Check motor torque ramp time in Motor Torque Ramp Time **D02**. • Check correct motor map settings. • Check motor contactor control. • Check motor electrical connections. • Check Brake Lower Current Threshold **D07**. • Check Start Optimiser Speed **G46** > Brake Release Frequency **D08**.
Brake Contact	**Motor brake contacts detected in the incorrect state**
72	This trip indicates that there has been a brake contact error. This trip can only happen when brake monitoring is enabled, where Brake contact monitoring select **D11** > None (0). This trip is detected if the number of brake monitoring inputs selected with Brake Contact Monitoring Select **D11** is not equal to Brake Control Output **D03** for Brake Contact Monitoring Time **D14** seconds. This is a delayed trip where the travel will complete before the drive trips where possible. If a fault has been detected during travel Global Warning **L04** = On (1) indicating the delayed trip at end of the travel. Brake contact monitoring input signals are used to generate a Brake Contact trip. Once a Brake Contact trip has occurred and Brake Contact Monitoring has been selected for Unintended Car Movement (UCM) Brake Contact Monitoring Select **D11** = 1 + UCM to 1, 2, 3 & 4 + UCM the trip can only be cleared by setting **mm.000** to 1298 in line with the requirements of EN 81-20 and EN 81-50. **Recommended actions:** • Check motor brake contact feedback is connected as required from inputs 1 to 4. • Check motor brake monitoring is configured correctly, Brake Contact Monitoring Select **D11**. • Check for correct motor brake contacts operation at motor brakes. • Check operating times for motor brake contacts Brake Contact Monitoring Time **D14**.
Brake R Too Hot	**Braking resistor overload timed out (I^2t)**
19	The Brake R Too Hot indicates that braking resistor overload has timed out. The value in Braking Resistor Thermal Accumulator **D17** is calculated using Braking Resistor Rated Power **D15**, Braking Resistor Thermal Time Constant **D16** and Braking Resistor Resistance **D18**. The Brake R Too Hot trip is initiated when Braking Resistor Thermal Accumulator **D17** reaches 100 %. **Recommended actions:** • Ensure the values entered are correct • If an external thermal protection device is being used and the braking resistor software overload protection is not required, set **D15**, **D16** or **D18** = 0 to disable the function.
Card Access	**NV Media Card Write fail**
185	The Card Access trip indicates that the drive was unable to access the NV Media Card. If the trip occurs during the data transfer to the card the file being written may be corrupted. If the trip occurs when the data being transferred to the drive the data transfer may be incomplete. If a parameter file is transferred to the drive and this trip occurs during the transfer, the parameters are not saved to non-volatile memory, and so the original parameters can be restored by powering the drive down and up again. **Recommended actions:** • Check NV Media Card is installed / located correctly. • Replace the NV Media Card.
Card Busy	**NV Media Card cannot be accessed as it is being accessed by an option module**
178	The Card Busy trip indicates an attempt has been made to access a file on the NV Media Card, but the NV Media Card is being accessed by an Option Module. No data is transferred. **Recommended actions:** • Wait for the option module to finish accessing the NV Media Card and re-attempt the required function.
Card Data Exists	**NV Media Card data location already contains data**
179	The Card Data Exists trip indicates that an attempt has been made to store data on a NV Media Card in a data block which already contains data. **Recommended actions:** • Erase the data in data location. • Write data to an alternative data location.

Trip	Description / Recommended action
Card Compare	**NV Media Card file/data is different to the one in the drive**
188	A compare has been carried out between a file on the NV Media Card, a Card Compare trip is initiated if the parameters on the NV Media Card are different to the drive. **Recommended actions:** • Set parameter **mm.000** = 0 and Reset the trip. • Check to ensure the correct data block on the NV Media Card has been used for the compare.
Card Drive Mode	**NV Media Card parameter set not compatible with current drive mode**
187	The Card Drive Mode trip is produced during a compare if the drive mode in the data block on the NV Media Card is different from the current drive mode. This trip is also produced if an attempt is made to transfer parameters from a NV Media Card to the drive if the operating mode in the data block is outside the allowed range of operating modes. **Recommended actions:** • Ensure the destination drive supports the drive operating mode in the parameter file. • Clear the value in parameter **mm.000** and Reset the drive. • Ensure destination drive operating mode is the same as the source parameter file.
Card Error	**NV Media Card data structure error**
182	The Card Error trip indicates that an attempt has been made to access a NV Media Card but an error has been detected in the data structure on the card. Resetting the trip will cause the drive to erase and create the correct folder structure. The cause of the trip can be identified by the sub-trip. **Sub-trip** / **Reason** **1** – The required folder and file structure is not present. **2** – The HEADER.DAT file is corrupted. **3** – Two or more files in the GT8DATA\DRIVE folder have the same file identification number. **Recommended actions:** • Erase all the data block (**7xxx**, where 7001 = data block 1) and re-attempt the process. • Ensure the card is located correctly. • Replace the NV Media Card.
Card Full	**NV Media Card full**
184	The Card Full trip indicates that an attempt has been made to create a data block on a NV Media Card, but there is not enough space left on the card. **Recommended actions:** • Delete a data block (**7xxx**, where 7001 = data block 1) or the entire NV Media Card to create space • Use a different NV Media Card.
Card No Data	**NV Media Card data not found**
183	The Card No Data trip indicates that an attempt has been made to access non-existent file or block on a NV Media Card. **Recommended actions:** • Ensure data block number is correct.
Card Product	**NV Media Card data blocks are not compatible with the drive derivative**
175	The Card Product trip is initiated either at power-up or when the card is accessed, If Drive Derivative **J96** is different between the source and target drives. This trip can be reset and data can be transferred in either direction between the drive and the card. **Recommended actions:** • Use a different NV Media Card. • This trip can be suppressed by setting parameter **mm.000** to 9666 and Reset the drive.
Card Rating	**NV Media Card voltage, current ratings different between source and destination drive**
186	The Card Rating trip indicates that parameter data is being transferred from a NV Media Card to the drive, but the current and / or voltage ratings are different between source and destination drives. This trip also applies if a compare (using parameter **mm.000** set to 8yyy) is attempted between the data block on a NV Media Card and the drive. The Card Rating trip does not stop the data transfer but is a warning that rating specific parameters with the RA attribute may not be transferred to the destination drive. **Recommended actions:** • Reset the drive to clear the trip. • Ensure that the drive rating dependent parameters have transferred correctly.
Card Read Only	**NV Media Card has the Read Only bit set**
181	The Card Read Only trip indicates an attempt has been made to modify a read-only NV Media Card or read-only data block. A NV Media Card is read-only if the read-only flag has been set. **Recommended actions:** • Clear the read only flag by setting parameter **mm.000** to 9777 and Reset the drive. This will clear the read-only flag for all data blocks in the NV Media Card.

Trip	Description / Recommended action
Card Slot	**NV Media Card Trip; Option module application program transfer has failed**
174	The Card Slot trip is initiated, if the transfer of an option module application program to or from an application module failed because the option module does not respond correctly. If this happens this trip is produced with the sub-trip indicating the option module slot number. **Recommended actions:** • Ensure the source / destination option module is installed on the correct slot.
Ctrl Watchdog	**Comms fault during operation with control word**
77	Control Input mode **H11** = Control Word (6) and Control Word **G51** bit 12 (watchdog bit) has not been set = 1 for 1 s. It is assumed that the Elevator controller or the comms interconnection between the Elevator controller and the Elevator drive has stopped working. When the system is powered up, or when Control Input mode **H11** = Control Word (6) for the first time after power up, a 10 s delay is implemented before calling a Ctrl Watchdog trip. The delay reverts back to 1 s after this initial period. This is a delayed trip where travel will complete and then the drive will trip. If a delayed trip is scheduled during travel then Global Warning **L04** = On (1) indicating a delayed trip will occur when the travel completes. **Recommended actions:** • Check hardware connections from Elevator controller to drive • Check Modbus control to drive including bit 12 (watchdog bit) is being set as required • Check comms at Elevator controller.
Current Offset	**Current feedback offset error**
225	The Current Offset trip indicates that the current offset is too large to be trimmed. **Recommended actions:** • Ensure there is no possibility of current flowing in the drive output (U,V,W) when the drive is disabled. • Hardware fault – Contact the supplier of the drive.
Current On Stop	**Current flowing at drives output at end of travel, prior to opening motor contactors**
67	The current at the drive output (U, V, W) has not decayed after a stop. Total Output Current **J22** ≥ 25 % of the motor rated current after 4 s in State 14 (end of travel and contactor control). **Recommended actions:** • Check control signals from Elevator controller to Elevator drive ensuring travel complete. • Check motor brakes applied as requested, correct motor brake operation.
Data Changing	**Drive parameters are being changed on drive enable**
97	A user parameter transfer is active changing drive parameters and the drive has been Enabled. **Recommended actions:** • Ensure the drive is not enabled when one of the following is being carried out Loading defaults Changing drive mode Transferring data from NV Media Card or position feedback device.
Derivative ID	**Derivative identification error**
247	The derivative image for the drive has been changed for an image with a different identifier. **Recommended actions:** • Contact the supplier of the drive.
Derivative Image	**Derivative Image error**
248	The Derivative Image trip indicates that an error has been detected in the derivative image. **Recommended actions:** • Contact the supplier of the drive.
Destination	**Two or more parameters are writing to the same destination parameter**
190	The Destination trip indicates that destination output parameters of two or more functions (e.g. Menu F IO Hardware, Menu K Logic) within the drive are writing to the same parameter. **Recommended actions:** • Set **mm.000** = 'Destinations' or 12001 and check all visible parameters in all menus for parameter write conflicts.
Dir Changed	**Direction signal from Elevator controller changed during travel**
76	The direction selected has been reversed during a travel from the original selection in both single and dual direction input modes. In this event a controlled stop will occur, and the trip will be generated. This is a delayed trip. If a delayed trip has been scheduled during travel then Global Warning **L04** = On (1) indicating a trip will be generated on completion of the stop. **Recommended actions:** • Check drive control connections and sequence from Elevator controller to Elevator drive. • Check drive control connections from Elevator controller to Elevator drive during operation and eliminate EMC related issues. • Check correct setup of the drive control for the Elevator controller, Control Input Mode **H11**.

Trip	Description / Recommended action
Distance Err	**Excessive distance error during travel**
63	This trip indicates a distance error greater than the level defined in Maximum Distance Error Threshold **H16**. The distance error detection is the integral of the difference between Profile Speed **J39** and Actual Speed **J40** for closed loop operation. The calculated distance error is compared to the user defined distance error threshold in Maximum Distance Error Threshold (**H16**) and where this is exceeded a trip is generated. The distance error is displayed in Maximum Distance Error **J56** independent of the activation of the distance error detection and is reset = 0 at the start of each travel. **Recommended actions:** **Motor** • Check motor power connections. • Check motor phase rotation. • Check motor brake control. **Position feedback** • Check position feedback mechanical mounting. • Check position feedback phase rotation. • Check position feedback wiring arrangement, risk of induced noise. • Position feedback device failure, replace feedback device. **Drive set-up** • Check motor details and parameter set-up, including current limit. • Check position feedback device parameter set-up. • Check position feedback device phase offset, static auto-tune has been completed. • Check speed control loop gain settings where motor instability exists. • Increase the maximum distance error threshold. • Distance error detection can be disabled setting Maximum Distance Error Threshold **H16** = 0.
Drive Rating	**Motor rated current exceeds allowable HD rating**
61	The motor rated current set-up in Motor Rated Current **B02** exceeds the limit for heavy duty, HD operation resulting in reduced, limited overload capability **B16** and the Elevator drive operating in the normal duty, ND region. **Recommended actions:** • Motor rated current should be reduced to ≤ heavy duty rating. • A larger drive should be used.
Drive Size	**Power stage recognition: Unrecognized drive size**
224	The Drive Size trip indicates that the control PCB has not recognized the drive size of the power circuit to which it is connected. **Recommended actions:** • Ensure the drive is programmed to the latest firmware version. • Hardware fault - return drive to supplier.

<table>
<tr><th>Trip</th><th>Description / Recommended action</th></tr>
<tr><td>EEPROM Fail</td><td>Default parameters have been loaded</td></tr>
<tr><td>31</td><td>The EEPROM Fail trip indicates that default parameters have been loaded. The exact cause/reason of the trip can be identified from the sub-trip number.
<table>
<tr><th>Sub-trip</th><th>Reason</th></tr>
<tr><td>1</td><td>The most significant digit of the internal parameter database version has changed.</td></tr>
<tr><td>2</td><td>The CRCs applied to the parameter data stored in internal non-volatile memory indicate that a valid set of parameters cannot be loaded.</td></tr>
<tr><td>3</td><td>The drive mode restored from internal non-volatile memory is outside the allowed range for the product or the derivative image does not allow the previous drive mode.</td></tr>
<tr><td>4</td><td>The drive derivative image has changed.</td></tr>
<tr><td>5</td><td>The power stage hardware has changed.</td></tr>
<tr><td>6</td><td>The internal I/O hardware has changed.</td></tr>
<tr><td>7</td><td>The position feedback interface hardware has changed.</td></tr>
<tr><td>8</td><td>The control board hardware has changed.</td></tr>
<tr><td>9</td><td>The checksum on the non-parameter area of the EEPROM has failed.</td></tr>
</table>
The drive holds two banks of user save parameters and two banks of power down save parameters in non-volatile memory. If the last bank of either set of parameters that was saved is corrupted a User Save or Power Down Save trip is produced. If one of these trips occurs the parameter values last saved successfully are used. It can take some time to save parameters when requested by the user and if the power is removed from the drive during this process it is possible to corrupt the data in the non-volatile memory.
If both banks of user save parameters or both banks of power down save parameters are corrupted or one of the other conditions given in the table above occurs EEPROM Fail.xxx trip is produced. If this trip occurs it is not possible to use the data that has been saved previously, and so the drive will be in lowest allowed drive mode with default parameters. The trip can only be Reset if parameter mm.000 is set to 10, 11, 1233 or 1244 or if Load Defaults H04 is set to a non-zero value.
Recommended actions:
• Default the drive and perform a reset.
• Allow sufficient time to perform a save before the supply to the drive is removed.
• If the trip persists - return drive to supplier.</td></tr>
<tr><td>Encoder 1</td><td>Drive position feedback interface power supply overload</td></tr>
<tr><td>189</td><td>The Encoder 1 trip indicates the drive encoder power supply has been overloaded. Terminals 13 & 14 on 15 way D type connector can supply a maximum current of 200 mA @ 15 V or 300 mA @ 8 V and 5 V.
Recommended actions:
• Check encoder power supply wiring.
• Disable the termination resistors C05 = 0 to reduce current consumption.
• For 5 V encoders with long cables, select 8 V C04 and install a 5 V voltage regulator close to the encoder.
• Check encoder specification, compatibility with the drive encoder power supply current capability.
• Replace the encoder.
• Use an external power supply with higher current capability.</td></tr>
<tr><td>Encoder 2</td><td>Drive encoder (Feedback) wire break</td></tr>
<tr><td>190</td><td>The Encoder 2 trip indicates that the drive has detected a wire break on the 15 way D-type connector on the drive.
The exact cause of the trip can be identified from the sub-trip number.
<table>
<tr><th>Sub-trip</th><th>Reason</th></tr>
<tr><td>1</td><td>Drive position feedback interface 1 on any input.</td></tr>
<tr><td>11</td><td>Drive position feedback interface 1 on the A channel.</td></tr>
<tr><td>12</td><td>Drive position feedback interface 1 on the B channel.</td></tr>
<tr><td>13</td><td>Drive position feedback interface 1 on the Z channel.</td></tr>
</table>
Recommended actions:
• Ensure that the position feedback device type selected in C01 is correct for the position feedback device connected to the drive.
• If encoder wire break detection on the drive is not required set C21 = 0000000 (disables Encoder 2 trip).
• Check cable continuity.
• Check wiring of feedback signals is correct.
• Check encoder power supply is set correctly C01.
• Replace encoder.</td></tr>
</table>

Trip	Description / Recommended action
Encoder 3	**Phase offset incorrect while running**
191	The Encoder 3 trip indicates that the drive has detected an incorrect UVW phase angle while running or SinCos phase error. **Recommended actions:** • Check encoder shield connections. • Ensure the encoder cable is one uninterrupted cable. • Check the encoder signal for noise with an oscilloscope. • Check the integrity of the encoder mechanical mounting. • For a UVW servo encoder, ensure that the phase rotation of the UVW commutation signals is the same as the phase rotation of the motor. • For a SinCos encoder, ensure that motor and incremental SinCos connections are correct and that for forward rotation of the motor, the encoder rotates clockwise (when looking at the shaft of the encoder). • Repeat the offset measurement test.
Encoder 4	**Feedback device comms failure**
192	The Encoder 4 trip indicates that the encoder communications has timed out or the communications position message transfer time is too long. This trip can also be caused due to wire break in the communication channel between the drive and the encoder. **Recommended actions:** • Ensure the encoder power supply setting **C04** is correct. • Complete encoder auto-configuration **C02**. • Check the encoder wiring. • Replace the feedback device.
Encoder 5	**Checksum or CRC error**
193	The Encoder 5 trip indicates that there is a checksum or CRC error, or the SSI encoder is not ready. The Encoder 5 trip can also indicate a wire break to a communications based encoder. **Recommended actions:** • Check the encoder cable shield connections. • Ensure the cable is one uninterrupted cable - remove any connector blocks or if unavoidable minimise the length of any shield pigtails to the connector block. • Check the encoder signal for noise with an oscilloscope. • Check the comms resolution setting **C08**. • If using a Hiperface, EnDat encoder carry out an encoder auto-configuration **C02** = Enabled. • Replace the encoder.
Encoder 6	**Encoder has indicated an error**
194	The Encoder 6 trip indicates that the encoder has indicated an error or that the power supply has failed to an SSI encoder. The Encoder 6 trip can also indicate a wire break to an SSI encoder. **Recommended actions:** • For SSI encoders, check the wiring and encoder power supply setting **C04**. • Replace the encoder / contact the supplier of the encode.
Encoder 7	**Set-up parameters for position feedback device have changed**
195	Encoder 7 trip indicates the set-up parameters for the position feedback device have changed. **Recommended actions:** • Reset the trip and perform a save. • Ensure **C07** and **C08** are set correctly or carry out an encoder auto-configuration **C02** = Enabled.
Encoder 8	**Position feedback interface has timed out**
196	An Encoder 8 trip indicates that Position feedback interface communications time exceeds 250 us. **Recommended actions:** • Ensure the encoder is connected correctly. • Ensure that the encoder is compatible. • Increase baud rate.
Encoder 9	**Position feedback selected from an option module which is not a feedback module**
197	The Encoder 9 trip indicates that position feedback is not valid. **Recommended actions:** • Ensure the feedback is connected to the correct location drive, or option slot.
Encoder 12	**Encoder could not be identified during auto-configuration**
162	The Encoder 12 trip indicates that the drive is communicating with the encoder but the encoder type is not recognized. **Recommended actions:** • Enter the encoder setup parameters manually. • Check to see the encoder supports auto-configuration.

<table>
<tr><th>Trip</th><th>Description / Recommended action</th></tr>
<tr><td>Encoder 13</td><td>Data read from the encoder is out of range during auto-configuration</td></tr>
<tr><td>163</td><td>The Encoder 13 trip indicates that the data read from the encoder was out of the range during auto-configuration.
No parameters will be modified with the data read from the encoder as a result of auto configuration.
<table>
<tr><th>Sub-trip</th><th>Reason</th></tr>
<tr><td>11</td><td>Rotary lines per revolution error.</td></tr>
<tr><td>12</td><td>Linear comms pitch error.</td></tr>
<tr><td>13</td><td>Linear line pitch error.</td></tr>
<tr><td>14</td><td>Rotary turns bits error.</td></tr>
<tr><td>15</td><td>Communications bits error.</td></tr>
<tr><td>16</td><td>Calculation time is too long.</td></tr>
<tr><td>17</td><td>Line delay measured is longer than 5 µs.</td></tr>
</table>
Recommended actions:
• Enter the encoder setup parameters manually.
• Check to see the encoder supports auto-configuration.</td></tr>
<tr><td>Encoder Not Init</td><td>Encoder initialisation failure</td></tr>
<tr><td>84</td><td>The drive's encoder interface has not initialized prior to travel. This may be because the encoder has an older / slower comms interface. Drive Encoder Additional Power Up Delay C10 may be increased to allow extra time for the encoder comms to initialize Position Feedback Initialize C18 may be used to manually initialize the feedback, and Position Feedback Initialized Indication C19 indicates the initialization status.
Recommended actions:
• Ensure the encoder is connected correctly.
• Ensure that the encoder is compatible.
• Ensure Elevator controller does not attempt to enable drive before encoder is initialised.</td></tr>
<tr><td>Fast Disable Err</td><td>Fast disable control sequence error</td></tr>
<tr><td>65</td><td>The Fast disable input sequence is incorrect i.e. the Fast disable input sequence is incorrect during the stop following brake apply, or during the start. The Fast disable input does not become active, On (1) during start and within 6 s, or removed = Off (0) following brake apply within 4 s.
Recommended actions:
• Check the control wiring arrangement (default T27) Fast disable input.
• Check T27 Digital Input 04 State F06 for the correct sequence Off (0) or On (1).
• Disable the Fast disable by setting the control input destination from Fast Disable B27 = A00.</td></tr>
<tr><td>Fast Start En</td><td>Fast start enable sequence error</td></tr>
<tr><td>80</td><td>The Fast start enable trip occurs where the Fast Start Enable H20 = On (1) and remains active after 4 s in state 14 at the end of the travel.
Recommended actions:
• To prevent this trip the Fast start enable input must be set = Off (0) at the end of the travel where the motor contactors are opened or the Safe Torque Off (STO), Drive enable is removed.</td></tr>
<tr><td>Fast Start Err</td><td>Fast start monitored distance move error</td></tr>
<tr><td>69</td><td>The Fast start monitoring distance in mm specified by Fast Start Monitoring Distance H21 has been reached / exceeded and the drive has been tripped to apply the brake and prevent further movement.
Recommended actions:
• Check movement of car on brake release during the Fast start.
• For example check car loading, rope slip, rope stretch.</td></tr>
<tr><td>Freeze Protect</td><td>Freeze protection limit exceeded</td></tr>
<tr><td>60</td><td>Freeze protection threshold in Freeze Protection Threshold H28 has been exceeded. This parameter is provided to prevent operation of the drive is sub-zero temperatures.
This is a delayed trip, where the travel will complete before the drive will trip. If a delayed trip has been scheduled during the travel Global Warning L04 = On (1) indicating trip scheduled at end of travel.
Recommended actions:
• Check the temperature setting in Freeze Protection Threshold H28.
• Check the actual temperature in Monitored Temperature 3 J73.
• Provide heating, air conditioning, ventilation to support allowable operating temperature.</td></tr>
</table>

<table>
<tr><th>Trip</th><th>Description / Recommended action</th></tr>
<tr><td>Feedback Rev</td><td>Encoder feedback is reversed</td></tr>
<tr><td>64</td><td>Encoder feedback is reversed with regards to the motor power connections U, V, W and rotation.
Recommended actions:
• Check power connections to motor and rotation.
• Motor rotation can be reversed with Reverse motor phase sequence B26.
• Check correct encoder feedback connections to the drive.
• Encoder feedback can be rotated with Drive Encoder Feedback Reverse C12.
• Note the setting of A11 Direction Input Invert H12 when changing any settings.</td></tr>
<tr><td>Inductance</td><td>Inductance measurement out of range or motor saturation not detected</td></tr>
<tr><td>8</td><td>This trip occurs in RFC-S mode when the drive has detected the motor inductance is not suitable for the operation being attempted. The trip is either caused because the ratio or difference between Ld and Lq is too small or because the saturation characteristic of the motor cannot be measured. If the inductance ratio or difference is too small this is because one of the following conditions is true:

(No-load Lq (B37)- Ld (B33)) / Ld (B33) < 0.1
(No-load Lq (B37) - Ld (B33)) < (K / Full Scale Current Kc (J06))H

where:
<table>
<tr><th>Drive Rated Voltage J07</th><th>K</th></tr>
<tr><td>200 V</td><td>0.0073</td></tr>
<tr><td>400 V</td><td>0.0146</td></tr>
<tr><td>575 V</td><td>0.0174</td></tr>
<tr><td>690 V</td><td>0.0209</td></tr>
</table>
If the saturation characteristic of the motor cannot be measured this is because when the flux in the motor is changed the measured value of Ld does change sufficiently due to saturation to be measured. When half of Rated Current B02 is applied in the d axis of the motor in each direction the inductance must fall, change at least (K / (2 x Full Scale Current Kc J06)). The specific reasons for each of the sub-trips are given in the table below:
<table>
<tr><th>Sub-trip</th><th>Reason</th></tr>
<tr><td>1</td><td>The inductance ratio, difference is too small when started in sensor-less mode.</td></tr>
<tr><td>2</td><td>The saturation characteristic of the motor cannot be measured when started in sensor-less mode.</td></tr>
<tr><td>3</td><td>The inductance ratio, difference is too small when an attempt is made to determine the location of the motor flux during a stationary auto-tune. This trip is also produced when the inductance ratio, difference is too small when carrying out a phasing test on starting. If position feedback is being used the measured value for Position Feedback Phase Angle C13 may not be reliable. Also the measured values of Ld B33 and No-load Lq B37 may not correspond to the d and q axis respectively.</td></tr>
<tr><td>4</td><td>The direction of the flux in the motor is detected by the change of inductance with different currents. This trip is initiated if the change cannot be detected when an attempt is made to perform a stationary auto-tune when position feedback is used, or to perform a phasing test on starting.</td></tr>
</table>
Recommended actions for sub-trip 1:
• Ensure Low Speed Mode (C15) is set to Non-salient (1), Current (2) or Current No test (3).
Recommended actions for sub-trip 2:
• Ensure Low Speed Mode (C15) is set to Non-salient (1), Current (2) or Current No test (3).
Recommended actions for sub-trip 3:
• None. The trip acts as a warning.
Recommended actions for sub-trip 4:
• Stationary auto-tune is not possible. Perform a minimal movement or rotating auto-tune.
• Phasing test on starting is not possible. Use a position feedback device with commutation signals or absolute position.</td></tr>
</table>

<table>
<tr><th>Trip</th><th>Description / Recommended action</th></tr>
<tr><td>I/O Overload</td><td>Digital output overload</td></tr>
<tr><td>26</td><td>The I/O Overload trip indicates the total current drawn from 24 V user supply or the digital output has exceeded the limit. A trip is initiated if one or more of the following conditions is true:
Date Code < 1724
• Maximum output current from one digital output is > 100 mA.
• • The combined maximum output current from outputs 1 and 2 is > 100 mA.
• • The combined maximum output current from output 3 and +24 V output is > 100 mA.
Date Code ≥ 1724
• Maximum output current from one digital output is > 200 mA.
• The combined maximum output current from outputs 1 and 2 is > 200 mA.
• The combined maximum output current from output 3 and +24 V output is > 200 mA.
Recommended actions:
• Check total loading on digital circuit supplied from drives 24 V user supply.
• Check control configuration is correct along with drive setup.
• Check control output wiring is terminated correctly and undamaged.</td></tr>
<tr><td>Motor Contactor</td><td>Motor contactor</td></tr>
<tr><td>70</td><td>The motor contactors have been detected open or closed when they should be closed or open using the motor contactor monitoring when enabled, and the feedback is connected to the drive from the motor contactors. When Elevator Software State J03 = 1 the motor Contactor trip can be called after 6 s for incorrect operation.
This is a delayed trip, where travel will complete and then the drive will trip. If a delayed trip has been scheduled during a travel Global Warning L04 = On (1) indicating the delayed trip.
Recommended actions:
• Check control wiring connections from motor contactor monitoring to the drives control terminal.
• Check correct signal from motor feedback during operation (Default configuration, motor contactors open, feedback = +24 V, motor contactors closed feedback = 0 V).
• Disable motor contactor monitoring with Motor Contactor Monitoring Enable B29.</td></tr>
<tr><td>Motor Too Hot</td><td>Output current overload timed out (I^2t)</td></tr>
<tr><td>20</td><td>The Motor Too Hot trip indicates a motor thermal overload based on the Rated Current B02 and Motor Thermal Time Constant B20. J26 displays the motor temperature as a percentage of the maximum value. The drive will trip when Motor Too Hot J26 reaches 100 %.
Recommended actions:
• Ensure there is no mechanical issue resulting in stiction or increased loading.
• Check the load on the motor has not changed.
• Ensure the Motor Rated Current in B02 is ≤ Heavy duty current rating of the drive.
• Check feedback signal for noise.
• Ensure the motor rated current is not zero.
• Check the Motor Thermal Protection Mode setting in B19 is as required.</td></tr>
<tr><td>OHt Control</td><td>Control stage over temperature</td></tr>
<tr><td>23</td><td>This OHt Control trip indicates that a control stage over-temperature has been detected. From the sub-trip ‘xx y zz’, the Thermistor location is identified by ‘zz’.
<table>
<tr><th>Source</th><th>xx</th><th>y</th><th>zz</th><th>Description</th></tr>
<tr><td>Control system</td><td>00</td><td>0</td><td>01</td><td>Control board thermistor 1 over temperature</td></tr>
<tr><td>Control system</td><td>00</td><td>0</td><td>02</td><td>Control board thermistor 2 over temperature</td></tr>
<tr><td>Control system</td><td>00</td><td>0</td><td>03</td><td>I/O board thermistor over temperature</td></tr>
</table>
Recommended actions:
• Check enclosure / drive fans are still functioning correctly.
• Check enclosure ventilation paths.
• Check enclosure door filters.
• Increase ventilation.
• Reduce the drive switching frequency.
• Check ambient temperature.</td></tr>
</table>

<table>
<tr><th>Trip</th><th>Description / Recommended action</th></tr>
<tr><td>OHt DC Bus</td><td>DC bus over temperature</td></tr>
<tr><td>27</td><td>The OHt dc bus trip indicates a DC bus over temperature based on a software thermal model. This includes the effects of the output current and DC bus ripple. The estimated temperature is displayed as a percentage of the trip level in J78. If this parameter reaches 100 % then an OHt dc bus trip with sub-trip 200 is initiated.
<table>
<tr><th>Source</th><th>xx</th><th>y</th><th>zz</th><th>Description</th></tr>
<tr><td>Control system</td><td>00</td><td>2</td><td>00</td><td>DC bus thermal model gives trip with sub-trip 0</td></tr>
</table>
Recommended actions:
• Check the AC supply voltage balance and levels.
• Check DC bus ripple level.
• Reduce duty cycle.
• Reduce motor load.
• Check the output current stability. If unstable;
Check the motor map settings with nameplate (B06, B02, B07, B03, B04, B05)
Disconnect the load and complete a rotating auto-tune
Auto-tune the rated speed value B25 = 1
Reduce speed loop gains
Add a speed feedback filter C09
Add a current demand filter
Check encoder signals for noise with an oscilloscope
Check encoder mechanical coupling.</td></tr>
<tr><td>OHt Inverter</td><td>Inverter over temperature based on thermal model</td></tr>
<tr><td>21</td><td>This trip indicates that an IGBT junction over-temperature has been detected based on a software thermal model. The sub-trip indicates which model has initiated the trip in the form xx y zz as given below:
<table>
<tr><th>Source</th><th>xx</th><th>y</th><th>zz</th><th>Description</th></tr>
<tr><td>Control system</td><td>00</td><td>1</td><td>00</td><td>Inverter thermal model</td></tr>
<tr><td>Control system</td><td>00</td><td>3</td><td>00</td><td>Braking IGBT thermal model</td></tr>
</table>
Recommended actions with sub-trip 100:
• Ensure extended operation is not being attempted at zero speed due to crash stop.
• Check motor loading, reduce if excessive.
• Check counter balance loading.
• Reduce maximum drive switching frequency.
• Increase acceleration / deceleration rates.
• Reduce settings for Run and Creep Stop Jerks.
• Reduce duty cycle.
• Check DC bus ripple.
• Ensure all three input phases are present and balanced.
Recommended actions with sub-trip 300:
• Reduce the braking load.</td></tr>
<tr><td>OI ac</td><td>Instantaneous output over current detected</td></tr>
<tr><td>3</td><td>The instantaneous drive output current has exceeded VM_DRIVE_CURRENT [MAX]. This trip cannot be reset until 10 s after the trip was initiated.
<table>
<tr><th>Source</th><th>xx</th><th>y</th><th>zz</th><th>Description</th></tr>
<tr><td>Control system</td><td>01</td><td>0</td><td>00</td><td rowspan="2">Instantaneous over-current trip when the measured AC current exceeds VM_DRIVE_CURRENT[MAX].</td></tr>
<tr><td>Power system</td><td>Power module</td><td>0</td><td>00</td></tr>
</table>
Recommended actions:
• If seen during auto-tune reduce the voltage boost.
• Check for short circuit on the output cabling.
• Check integrity of the motor insulation using an insulation tester.
• Check feedback device wiring.
• Check feedback device mechanical coupling.
• Check feedback signals are free from noise.
• Ensure the speed loop gains setting and Start locking are not excessive
• Has the phase angle auto-tune been completed, RFC-S.</td></tr>
</table>

<table>
<tr><th>Trip</th><th>Description / Recommended action</th></tr>
<tr><td>OI Brake</td><td>Brake IGBT over current detected: short circuit protection for the braking IGBT activated</td></tr>
<tr><td>4</td><td>The OI Brake trip indicates that over current has been detected in braking IGBT or braking IGBT protection has been activated. This trip cannot be reset until 10 s after the trip was initiated.
Recommended actions:
• Check brake resistor wiring.
• Check braking resistor value is greater than or equal to the minimum resistance value.
• Check braking resistor insulation.</td></tr>
<tr><td>OI dc</td><td>Power module over current detected from IGBT on state voltage monitoring</td></tr>
<tr><td>109</td><td>The OI dc trip indicates the short circuit protection for the inverter stage has been activated. The table below shows where the trip has been detected. This trip cannot be reset until 10 s after the trip was initiated.
<table>
<tr><th>Source</th><th>xx</th><th>y</th><th>zz</th></tr>
<tr><td>Control system</td><td>00</td><td>0</td><td>00</td></tr>
<tr><td>Power system</td><td>Power module</td><td>0</td><td>00</td></tr>
</table>
Recommended actions:
• Disconnect the motor from the drive and check motor and cable insulation with an insulation tester.
• Check and ensure any output motor contactor shorting contactor is not being applied whilst the Elevator drive is enabled.
• Replace the drive.</td></tr>
<tr><td>Option Disable</td><td>Option module failed to acknowledge during drive mode changeover</td></tr>
<tr><td>215</td><td>The Option Disable trip indicates that the option module did not acknowledge to the drive that communications with the drive has been stopped during the drive mode changeover with in the allocated time.
Recommended actions:
• Reset the trip
• If the trip persists, replace the option module.</td></tr>
<tr><td>Out Phase Loss</td><td>Output phase loss detected</td></tr>
<tr><td>98</td><td>The Out Phase Loss trip indicates that a motor phase loss has been detected at the drive output. If Reverse Output Phase Sequence B26 = On (1) the physical output phases to the motor U, V, W are reversed, and so sub-trip 3 refers to physical output phase V and sub-trip 2 refers to physical output phase W.
<table>
<tr><th>Sub-trip</th><th>Reason</th></tr>
<tr><td>1</td><td>U phase detected as disconnected when drive enabled to run.</td></tr>
<tr><td>2</td><td>V phase detected as disconnected when drive enabled to run.</td></tr>
<tr><td>3</td><td>W phase detected as disconnected when drive enabled to run.</td></tr>
<tr><td>4</td><td>Output phase loss detected when the drive is running.</td></tr>
</table>
Recommended actions:
• Check Motor and drive connections.
• To disable the trip set Output Phase Loss Detection Enable H06 = Disabled (0).</td></tr>
<tr><td>Over Speed</td><td>Motor speed has exceeded the over speed threshold</td></tr>
<tr><td>7</td><td>If the Drive Encoder Speed Feedback J51 exceeds Motor Over Speed Threshold E09 in either direction an Over speed trip is produced. If Motor Over Speed Threshold E09 = 0.0 the threshold is then equal to 1.2 x the value set in Motor Maximum Speed Clamp E08.
The above description relates to a standard Over Speed trip, it is possible to produce an Over Speed.1 trip. This is caused if the speed is allowed to exceed the safe level with flux weakening when Enable High Speed Mode B28 = Enable (1).
Recommended actions:
• Check the motor is not being driven by another part of the system.
• Adjust the speed loop proportional gain to reduce overshoot.
• Check drive selection and operation in current limit, unable to deliver required torque.</td></tr>
</table>

<table>
<tr><th>Trip</th><th>Description / Recommended action</th></tr>
<tr><td>Over Volts</td><td>DC bus voltage has exceeded the peak level or maximum continuous level for 15 s</td></tr>
<tr><td>2</td><td>The Over Volts trip indicates that the DC bus voltage has exceeded ± VM_DC_VOLTAGE[MAX] for 15 s. The trip threshold varies depending on voltage rating of the drive as shown below.
<table>
<tr><th>Voltage rating</th><th>VM_DC_VOLTAGE[MAX]</th><th>VM_DC_VOLTAGE_SET[MAX]</th></tr>
<tr><td>200</td><td>415</td><td>410</td></tr>
<tr><td>400</td><td>830</td><td>815</td></tr>
<tr><td>575</td><td>990</td><td>970</td></tr>
<tr><td>690</td><td>1190</td><td>1175</td></tr>
</table>
Sub-trip Identification:
<table>
<tr><th>Source</th><th>xx</th><th>y</th><th>zz</th></tr>
<tr><td>Control system</td><td>00</td><td>0</td><td>01: Instantaneous trip when the DC bus voltage exceeds VM_DC_VOLTAGE[MAX].</td></tr>
<tr><td>Control system</td><td>00</td><td>0</td><td>02: Time delayed trip indicating that the DC bus voltage is above VM_DC_VOLTAGE_SET[MAX].</td></tr>
</table>
Recommended actions:
• Check the nominal AC power supply level.
• Check the nominal AC power supply for disturbances which could cause the DC bus to rise.
• Check external braking resistor circuit is connected.
• Check operation of external braking resistor protection.
• Check Elevator balanced correctly.
• Decrease the braking resistor value staying above the minimum value for drive model).
• Increase the deceleration rate.
• Check motor insulation using a insulation tester.</td></tr>
<tr><td>Phase Loss</td><td>Supply phase loss</td></tr>
<tr><td>32</td><td>The Phase Loss trip indicates that the drive has detected an input phase loss or large supply imbalance. Phase loss can be detected directly from the supply where the drive has a thyristor based charge system (Frame size 7 and above). If phase loss is detected using this method the drive trips immediately and the xx part of the sub-trip is set to 01.
In all sizes of drive phase loss is also detected by monitoring the ripple in the DC bus voltage in which case the drive attempts to stop the drive before tripping unless bit 2 of Action On Trip Detection H45 = 1 (disables trip and allow continued operation until the user stops the drive or another trip is generated due to the phase loss). When phase loss is detected by monitoring the ripple in the DC bus voltage the xx part of the sub-trip is zero.
Input phase loss detection can be disabled when the drive is operating from a DC supply or single phase UPS Input Phase Loss Detection Mode H08.
<table>
<tr><th>Source</th><th>xx</th><th>y</th><th>zz</th></tr>
<tr><td>Control system</td><td>00</td><td>0</td><td>00: Phase loss detected based on control system feedback. The drive attempts to stop the drive before tripping unless bit 2 of Action On Trip Detection H45 = 1.</td></tr>
<tr><td>Power system</td><td>01</td><td>Rectifier number</td><td>00: Phase loss has been detected by the rectifier module.</td></tr>
</table>
Recommended actions:
• Check the AC supply voltage balance and level at full load.
• Check the DC bus ripple level with an isolated oscilloscope.
• Check the output current stability.
• Check for mechanical resonance with the load.
• Reduce the duty cycle.
• Reduce the motor load.</td></tr>
<tr><td>Phasing Error</td><td>RFC-S phasing failure due to incorrect phase angle</td></tr>
<tr><td>198</td><td>The Phasing Error trip indicates that the phase angle in Position Feedback Phase Angle C13 is incorrect and the drive is unable to control the motor correctly. If sensor-less control is active this indicates that significant instability has occurred and the motor has accelerated without control.
Recommended actions:
• Carry out auto-tune OR manually set-up phase angle in Position Feedback Phase Angle C13.
• Check the encoder wiring.
• Check the encoder mechanical coupling.
• Check the encoder signals for noise with an oscilloscope.
• If the trip occurs during power up ensure sufficient time is allowed for the position feedback device to initialise Position Feedback Initialized Indication C19.</td></tr>
</table>

<table>
<tr><th>Trip</th><th>Description / Recommended action</th></tr>
<tr><td>Power Comms</td><td>Communication has been lost, errors detected between power, control and rectifier</td></tr>
<tr><td>90</td><td>A Power Comms trip indicates a communications problem within the power system of the drive. The reason for the trip can be identified by the sub-trip number.
<table><tr><th>Source</th><th>xx</th><th>y</th><th>zz</th></tr><tr><td>Single power module system</td><td>01</td><td>Rectifier number</td><td>00: Excessive communications errors detected by the rectifier module.</td></tr></table>Recommended actions:
• Hardware fault – Contact the supplier of the drive.</td></tr>
<tr><td>Power Data</td><td>Power system configuration data error</td></tr>
<tr><td>220</td><td>This trip can be generated either from the drive control system or from the power system and is produced if there is an error in the configuration data stored in the power system. If the source of the trip is the control system then the trip related to the table that is uploaded from the power system at power-up.
The Power Data trip indicates that there is an error in the configuration data stored in the power system.
<table><tr><th>Source</th><th>xx</th><th>y</th><th>zz</th></tr><tr><td>Control system</td><td>00</td><td>0</td><td>02: There is no data table to be uploaded to the control board.</td></tr><tr><td>Control system</td><td>00</td><td>0</td><td>03: The power system data table is bigger than the space available in the control board to store it.</td></tr><tr><td>Control system</td><td>00</td><td>0</td><td>04: The size of the table given in the table is incorrect.</td></tr><tr><td>Control system</td><td>00</td><td>0</td><td>05: Table CRC error.</td></tr><tr><td>Control system</td><td>00</td><td>0</td><td>06: The version number of the generator software that produced the table is too low, i.e. a table from a newer generator is required that includes features that have been added to the table that may not be present.</td></tr><tr><td>Control system</td><td>00</td><td>0</td><td>07: The power board data table does not match the power board hardware identifier.</td></tr><tr><td>Power system</td><td>01</td><td>0</td><td>00: The power data table used internally by the power module has an error.</td></tr><tr><td>Power system</td><td>01</td><td>0</td><td>01: The power data table that should be uploaded to the control system on power up has an error.</td></tr><tr><td>Power system</td><td>01</td><td>0</td><td>02: The power data table used internally by the power module does not match the hardware identification of the power module.</td></tr></table>Recommended actions:
• Hardware fault – Contact the supplier of the drive.</td></tr>
<tr><td>PSU 24</td><td>24V internal power supply overload</td></tr>
<tr><td>9</td><td>The total user load of the drive and option modules have exceeded the internal user +24 V power supply limit. The user load consists of the drive digital outputs and main encoder supply.
Recommended actions:
• Reduce the user load and Reset the drive.
• Remove control connections from the drive and perform a Reset.
• Remove any option modules and perform a Reset.
• Remove encoder connection and perform a Reset.
• Provide an external +24 V power supply on Control Terminal 2 of the drive.
• Permanent trip, hardware fault within the drive – return the drive to the supplier.</td></tr>
<tr><td>Resistance</td><td>Measured resistance has exceeded the parameter range</td></tr>
<tr><td>33</td><td>The Resistance trip indicates that the measured motor stator resistance during an auto-tune test has exceeded the maximum possible value allowable for the drive in Stator Resistance B34.
The maximum for the stator resistance parameters is generally higher than the maximum value that can be used in the control algorithms. If the value exceeds (VFS / v2) / Full Scale Current Kc J06, where VFS is the full scale DC bus voltage then this trip is initiated.
Recommended actions:
• Check the value entered in Stator resistance B34.
• Ensure the stator resistance of the motor falls within the allowable range of the drive model.
• Check the motor cable / connections.
• Check the motor phase to phase resistance at the drive terminals, including motor cables.
• Check the motor phase to phase resistance at the motor terminals.
• Check the integrity of the motor stator winding using a insulation tester.
• Replace the motor.</td></tr>
</table>

<table>
<tr><th>Trip</th><th>Description / Recommended action</th></tr>
<tr><td>Slot4 Different</td><td>Option module fitted in Slot 4 has changed between power cycles</td></tr>
<tr><td>254</td><td>If the option module fitted in Slot 4 is different to the option module present at the last power-down then this trip is produced. The sub-trip number gives the identification code of the module that was originally fitted.
The priority order for the option module different trips is Slot1 Different highest, then Slot2 Different, then Slot3 Different then Slot4 Different. Drive user parameters must be saved to prevent this trip on the next power-up if the module has changed. If the menus have been changed, but not the module, the trip will not occur on the next power-up. The sub-trip number gives the following indications of the reason for the trip.
<table>
<tr><th>Sub-trip</th><th>Reason</th></tr>
<tr><td>1</td><td>No option module was fitted previously.</td></tr>
<tr><td>2</td><td>An option module with the same identifier is fitted, but the set-up menu has been changed, and so default parameters have been loaded for this menu.</td></tr>
<tr><td>3</td><td>An option module with the same identifier is fitted, but the applications menu for this option slot has been changed, and so default parameters have been loaded for this menu.</td></tr>
<tr><td>4</td><td>An option module with the same identifier is fitted, but the set-up and applications menu have been changed, and so default parameters have been loaded for these menus.</td></tr>
<tr><td>>99</td><td>Shows the identifier of the module previously fitted.</td></tr>
</table>
Recommended actions:
• Turn off the power, ensure the correct option modules are installed in the correct option slots and re-apply the power.
• Confirm that the currently installed option module is correct, ensure option module parameters are set correctly and perform a user save in mm.000.</td></tr>
<tr><td>Slot4 Error</td><td>Slot 4 option module error</td></tr>
<tr><td>252</td><td>The option module in Slot 4 has indicated an error. The option module can give the reason for the error and is shown in the sub-trip number. As default the sub-trip number is shown as a number on the display, however it is possible for the option module to supply sub-trip number strings which will be displayed instead of the number if available.
Recommended actions:
• See relevant Option Module User Guide for details of the trip.</td></tr>
<tr><td>Slot4 HF</td><td>Option module in Slot 4 has Hardware fault</td></tr>
<tr><td>250</td><td>This trip indicates that there is a fault with the option module in option Slot 4 that means that this module cannot operate. The possible causes of the trip are given by the sub-trip value.
<table>
<tr><th>Sub-trip</th><th>Reason</th></tr>
<tr><td>1</td><td>The option module category cannot be identified.</td></tr>
<tr><td>2</td><td>All the required customisable menu table information has not been supplied or the tables supplied are corrupt.</td></tr>
<tr><td>3</td><td>There is insufficient memory available to allocate the comms buffers for this module.</td></tr>
<tr><td>4</td><td>The option module has not indicated that it is running correctly during drive power-up.</td></tr>
<tr><td>5</td><td>The option module has been removed after power-up or it has ceased to indicate to the drive processor that it is still active.</td></tr>
<tr><td>6</td><td>The option module has not indicated that it has stopped accessing drive parameters during a drive mode change.</td></tr>
<tr><td>7</td><td>The option module has failed to acknowledge that a request has been made to reset the drive processor.</td></tr>
<tr><td>8</td><td>Drive failed to read correctly the menu table from the option module during power-up.</td></tr>
<tr><td>9</td><td>Drive failed to upload menu tables from the option module and timed-out (5 s).</td></tr>
<tr><td>10</td><td>Menu table CRC invalid.</td></tr>
</table>
Recommended actions:
• Ensure the option module is installed correctly.
• Replace the option module.
• Replace the drive.</td></tr>
</table>

Trip	Description / Recommended action
Slot4 Not Fitted	**Option module in Slot 4 no longer fitted**
253	Each option module fitted in the drive is identified at power-up and the option fitted is stored by the drive in its non-volatile memory. If an option module was fitted in Slot 4 at power-down, but that option module has subsequently been removed before power up then this trip is produced. The sub-trip number gives the identification code of the option module that has been removed. The priority order for the option module not fitted trips is Slot1 Not Fitted highest, then Slot2 Not Fitted, then Slot3 Not Fitted then Slot4 Not Fitted. Drive user parameters must be saved to prevent this trip on the next power-up. **Recommended actions:** • Ensure the option module is installed correctly in Slot 4. • Re-install the option module. • To confirm that the removed option module is no longer required perform a save function in **mm.000**.
Slot4 watchdog	**Watchdog service fail**
251	This trip indicates that the option module in Slot 4 has started the option module watchdog function and then failed to service this watchdog correctly. **Recommended actions:** • Replace the option module.
Slot App Menu	**Multiple option modules requesting to change application menus**
216	This trip indicates that more than one option module Slot has requested to customize application menus S, T and U. The sub-trip number indicates which option Module Slot has been allowed to customize the menus. **Recommended actions:** • Ensure that only one Application module is configured to customize the application menus U, V and W.
SlotX Different	**Option module fitted in Slot X has changed between power cycles**
204 **209** **214**	If the option module fitted in option module Slot X is different to the option module present at the last power-down then this trip is produced. The sub-trip number gives the identification code of the option module that was originally fitted. The priority order for the option module different trips is Slot1 Different highest, then Slot2 Different, then Slot3 Different then Slot4 Different. Drive user parameters must be saved to prevent this trip on the next power-up if the module has changed. If the menus have been changed, but not the module, the trip will not occur on the next power-up. The sub-trip number gives the following indications of the reason for the trip.

Sub-trip	Reason
1	No option module was fitted previously.
2	An option module with the same identifier is fitted, but the set-up menu has been changed, and so default parameters have been loaded for this menu.
3	An option module with the same identifier is fitted, but the applications menu for this option slot has been changed, and so default parameters have been loaded for this menu.
4	An option module with the same identifier is fitted, but the set-up and applications menu have been changed, and so default parameters have been loaded for these menus.
>99	Shows the identifier of the module previously fitted.

	Recommended actions: • Turn off the power, ensure the correct option modules are installed in the correct option module Slots and re-apply the power. • Confirm that the currently installed option module is correct, ensure option module parameters are set correctly and perform a user save in **mm.000**.
SlotX Error	**Slot X option module error**
202 **207** **212**	The option module in Slot X has indicated an error. The option module can give the reason for the error and is shown in the sub-trip number. As default the sub-trip number is shown as a number on the display, however it is possible for the option module to supply sub-trip number strings which will be displayed instead of the number if available. **Recommended actions:** • See relevant Option Module User Guide for details of the trip.

<table>
<tr><th>Trip</th><th>Description / Recommended action</th></tr>
<tr><td>SlotX HF</td><td>Option module in Slot X has Hardware fault</td></tr>
<tr><td>200
205
210</td><td>This trip indicates that there is a fault with the option module in option Slot X that means that this module cannot operate. The possible causes of the trip are given by the sub-trip value.
<table>
<tr><th>Sub-trip</th><th>Reason</th></tr>
<tr><td>1</td><td>The option module category cannot be identified.</td></tr>
<tr><td>2</td><td>All the required customisable menu table information has not been supplied or the tables supplied are corrupt.</td></tr>
<tr><td>3</td><td>There is insufficient memory available to allocate the comms buffers for this module.</td></tr>
<tr><td>4</td><td>The option module has not indicated that it is running correctly during drive power-up.</td></tr>
<tr><td>5</td><td>The option module has been removed after power-up or it has ceased to indicate to the drive processor that it is still active.</td></tr>
<tr><td>6</td><td>The option module has not indicated that it has stopped accessing drive parameters during a drive mode change.</td></tr>
<tr><td>7</td><td>The option module has failed to acknowledge that a request has been made to reset the drive processor.</td></tr>
<tr><td>8</td><td>Drive failed to read correctly the menu table from the option module during power-up.</td></tr>
<tr><td>9</td><td>Drive failed to upload menu tables from the option module and timed-out (5 s).</td></tr>
<tr><td>10</td><td>Menu table CRC invalid.</td></tr>
</table>
Recommended actions:
• Ensure the option module is installed correctly.
• Replace the option module.
• Replace the drive.</td></tr>
<tr><td>SlotX Not Fitted</td><td>Option module in Slot X no longer fitted</td></tr>
<tr><td>203
208
213</td><td>Each option module fitted in the drive is identified at power-up and the option fitted is stored by the drive in its non-volatile memory. If an option module was fitted in Slot X at power-down, but that option module has subsequently been removed before power up then this trip is produced. The sub-trip number gives the identification code of the option module that has been removed. The priority order for the option module not fitted trips is Slot1 Not Fitted highest, then Slot2 Not Fitted, then Slot3 Not Fitted then Slot4 Not Fitted.
Drive user parameters must be saved to prevent this trip on the next power-up.
Recommended actions:
• Ensure the option module is installed correctly
• Re-install the option module.
• To confirm that the removed option module is no longer required perform a save function in mm.000.</td></tr>
<tr><td>SlotX watchdog</td><td>Watchdog service fail</td></tr>
<tr><td>201
206
211</td><td>This trip indicates that the option module in Slot X has started the option module watchdog function and then failed to service this watchdog correctly.
Recommended actions:
• Replace the option module.</td></tr>
<tr><td>Soft Start</td><td>Soft start relay fault</td></tr>
<tr><td>226</td><td>This trip indicates that the soft start relay in the drive (Drive frame sizes 3 to 6) has failed to close or the soft start monitoring circuit has failed.
Recommended actions:
• Hardware fault - contact the supplier of the drive.</td></tr>
</table>

<table>
<tr><th>Trip</th><th>Description / Recommended action</th></tr>
<tr><td>Spd / Dir Select</td><td>Control sequence speed and direction signals to the Elevator drive</td></tr>
<tr><td>81</td><td>This trip is related to speed reference or direction selection timing issues:
<table>
<tr><th>Sub-trip</th><th>Reason</th></tr>
<tr><td>1</td><td>There is no speed reference or direction selected at the end of State 4 Release Motor Brakes.
- There is a 3 s delay after Brake Control Release Delay D04 to activate this trip.
There is no speed reference or direction selected in the end of State 5 Load Measurement when Load measurement time O04 > 0 ms.
- There is a 3 s delay after Load measurement time O04 to activate this trip.</td></tr>
<tr><td>2</td><td>The direction and speed are still selected at the end of travel in State 14 Contactor Control after 4 s. Remove the speed or direction signals to Reset the trip.
- When Control Input mode H11 = Analog Run Prmit (0), the Run Permit signal using Direction Input 1 G39 must be removed at the end of travel.
- When Control Input mode H11 = Analog 2 Dir (0), Priority 2 Dir (4) or Binary 2 Dir (5) the direction signals (Direction Input 1 G39 or Direction Input 2 G40) OR the speed selection (Reference Select Bit 0 Input G32 to Reference Select Bit 6 Input G38) must be removed at the end of travel.
- When Control Input mode (11 = Priority 1 Dir (2) or Binary 1 Dir (3) the speed selection (Reference Select Bit 0 Input G32) to Reference Select Bit 6 Input G38) must be removed at the end of travel.
- When Control Input mode H11 = Control Word (6), the direction signals (Control Word G51 Bit 10 or Bit 11) OR the speed selection (Control Word G51 Bit 0 to Bit 9) must be removed at the end of travel.</td></tr>
</table>
Recommended actions:
• Check control sequence from Elevator controller and Elevator drive setup (Control mode selection and control input logic).
• Check control wiring from Elevator controller to Elevator drive, and routing through external components.
• Ensure control system noise does not result in spurious speed and direction signals being received at the drive.</td></tr>
<tr><td>Speed Err</td><td>Excessive following speed error</td></tr>
<tr><td>62</td><td>The speed error is calculated from the difference between Profile Speed J39 and Actual Speed J40. The calculated speed error is then compared with the speed error threshold in Maximum Speed Error Threshold H15 and where the threshold is exceeded for more than 100 ms a trip is generated.
The speed error during a travel is displayed in Maximum Speed Error J57 independent of the activation of the speed error detection and this is reset to 0 at each start.
Recommended actions:
• Possible causes for the speed error trip can be due to the following
Motor
Check motor power connections and phase rotation
Check motor brake control
Check Elevator safety gear
Position feedback
Check position feedback mechanical mounting
Check position feedback phase rotation
Check position feedback wiring arrangement, risk of induced noise
Position feedback device failure, replace feedback device
Drive set-up
Check motor details and parameter set-up, including current limit
Check position feedback device parameter set-up
Check position feedback device phase offset, static auto-tune has been completed
Check speed control loop gain settings where motor instability exists.
• Increase the Maximum Speed Error Threshold H15.
• The speed error detection can be disabled setting Max Speed Error Threshold H15 = 0.</td></tr>
<tr><td>STO Ctrl Err</td><td>Safe Torque Off (STO), Drive enable control sequence error</td></tr>
<tr><td>66</td><td>The Safe Torque Off (STO), Drive enable input sequence is incorrect i.e. the Safe Torque Off (STO), Drive enable was not removed at the end of the travel following motor contactor control and within 4 s, or applied during the start of a travel following motor contactor control within 6 s.
Recommended actions:
• Check for correct control connection of Safe Torque Off (STO), Drive enable to T31 on the drive.
• Check parameter T31 STO Input 1 State F10 the Safe Torque Off (STO), Drive enable input for the correct sequence during start / stop.
• Check correct operation of output motor contactors and auxiliary contacts.
• Check open / close delay time of output motor contactors.
• Check motor contactor delay in Motor Contactor Measured Delay Time B32.</td></tr>
</table>

Trip	Description / Recommended action
Stored HF	**Drive Hardware fault trip stored following Hardware fault**
221	If a HF01 to HF19 trip occurs, then a Stored HF trip occurs each time the drive is powered up until the HF01 to HF19 trip is Reset. The sub-trip code is the number of the original HF trip. The Stored HF trip can only be Reset by first writing 1299 to **mm.000** and Resetting the drive. **Recommended actions:** • Enter 1299 into **mm.000** and press Reset to clear the trip.
Sub-array RAM	**Excessive RAM request from option module**
227	An option module has requested more parameter RAM than is allowed. The RAM allocation is checked in order of resulting sub-trip numbers, and so the failure with the highest sub-trip number is given. The sub-trip is calculated as (parameter size x 1000) + (parameter type x 100) + sub-array number. Note that if this trip occurs, all menu customisation provided by option modules are not used. The tables below show the values corresponding to the parts of the sub-trip number.

Parameter size	**Value**	
1 bit	1	
8 bit	2	
16 bit	3	
32 bit	4	
64 bit	5	

Parameter type	**Value**	
Volatile	0	
User save	1	
Power down save	2	

Parameter type	**Menus**	**Value**
Applications menus	S, T, U	1
Option slot 1 set-up	P	4
Option slot 1 applications	V	5
Option slot 2 set-up	Q	6
Option slot 2 applications	W	7
Option slot 3 set-up	R	8
Option slot 3 applications	X	9
Option slot 4 set-up	M	10

Recommended actions:

- Check option module fitted and processes being carried out.

Temp Feedback	**Elevator drive internal temperature feedback error**
218	This trip indicates a fault with a thermistor internally to the drive (i.e. open circuit or short circuit).

Source	**xx**	**y**	**zz**
Control board	01	00	01: Control board thermistor 1 02: Control board thermistor 2 03: I/O board thermistor
Power system	Power module number	0	Zero temperature feedback via power system comms 21, 22 and 23 for direct ELV temperature feedback.
Power system	01	Rectifier number	Always zero.

Recommended actions:

- Hardware fault - contact the supplier of the drive.

Th Brake Res	**Brake resistor over temperature**
10	If hardware based braking resistor thermal monitoring is provided and the resistor overheats this trip is initiated. If the braking resistor is not present then this trip must be disabled with bit 3 of Action On Trip Detection **H45** to prevent this trip. **Recommended actions:** • Check braking resistor wiring. • Check braking resistor value is greater than or equal to the minimum resistance value. • Check braking resistor insulation.

<table>
<tr><th>Trip</th><th>Description / Recommended action</th></tr>
<tr><td>TH Short Circuit</td><td>Motor thermistor short circuit</td></tr>
<tr><td>25</td><td>This trip indicates that a temperature sensor connected to an Analog input 3 or Terminal 15 on the position feedback interface has a low impedance (i.e. < 50 Ω). The cause of the trip can be identified by the sub-trip number.
<table><tr><th>Sub-trip</th><th>Reason</th></tr><tr><td>3</td><td>Resistance of thermistor connected to Analog input 3 is < 50 Ω.</td></tr><tr><td>4</td><td>Resistance of thermistor connected on position feedback interface is < 50 Ω.</td></tr></table>Recommended actions:
• Check thermistor connection at drive control terminal, encoder connection.
• Check thermistor wiring, continuity and signs of damage.
• Replace motor / motor thermistor.</td></tr>
<tr><td>Thermistor</td><td>Motor thermistor over-temperature</td></tr>
<tr><td>24</td><td>This trip indicates that a temperature sensor connected to Analog input 3 or Terminal 15 on the position feedback interface has indicated an over-temperature. The source of the trip can be identified by checking Motor Thermistor Input Select F74. If Motor Thermistor Input Select F74 = T8 Analog IP 3 (1) then T8 Analog Input 3 was the source of the trip, and if Motor Thermistor Input Select F74 = Encoder D Type (2) then the drive D type encoder input was the source of the trip.
This is a delayed trip where the travel will complete and then the drive will trip. If a delayed trip has been scheduled a Global Warning L04 = On (1) is active and the drive will trip when the travel completes.
<table><tr><th>Sub-trip</th><th>Reason</th></tr><tr><td>1</td><td>Trip initiated from thermistor connected to the drive position feedback interface.</td></tr><tr><td>2</td><td>Trip initiated from thermistor connected to Analog input 3.</td></tr></table>Recommended actions:
• Check motor thermistor wiring connections and continuity.
• Check motor temperature.
• Check motor ventilation, provide additional forced cooling.
• Replace motor / motor thermistor.</td></tr>
<tr><td>Undefined</td><td>Unidentified fault generated by power stage</td></tr>
<tr><td>110</td><td>This trip indicates that the power system has generated a fault however the cause of the trip was not identified from the power system. The cause of the trip is unknown.
Recommended actions:
• Check ensure no EMC related issues with installation which could contribute to spurious trips.
• Hardware fault - contact the supplier of the drive.</td></tr>
<tr><td>User 24V</td><td>User 24 V supply is not present on Control terminals 1 (0 V) and 2 (24 V)</td></tr>
<tr><td>91</td><td>A User 24 V trip is initiated, if User Supply Select O10 = On (1) for 24 V backup of the control PCB and no user 24 V supply is present on Control terminals 1 and 2 of the drive.
Recommended actions:
• Ensure user + 24 V supply is connected to Control terminals 1 (0 V) and 2 (24 V) of the drive.
• Ensure user + 24 V supply meets the specification of the + 24 V user input on the drive.
• Disable user 24 V backup if not required.</td></tr>
<tr><td>User Save</td><td>User Save error / not completed</td></tr>
<tr><td>36</td><td>This trip indicates that an error has been detected in the user save parameters saved in non-volatile memory. For example, following a user save command, if the power to the drive was removed when the user parameters were being saved.
Recommended actions:
• Perform a user save in mm.000 to ensure the trip doesn't occur the next time the drive is powered up.
• Ensure that the drive has enough time to complete the save before removing the power to the drive.</td></tr>
<tr><td>Watchdog</td><td>Control word watching not serviced and timed out</td></tr>
<tr><td>30</td><td>This trip indicates that the control word watchdog has been enabled and has timed out. Watchdog bit must be set = 1 at least every 500 ms or less during operation.
A 10 s delay is implemented before calling a Ctrl Watchdog trip during power up and on enabling the Control Word function. If a travel is in progress when the fault occurs the Elevator drive will perform a controlled Stop and then trip.
Recommended actions:
• Check setting on Elevator controller to ensure Control word watchdog bit 12 is serviced.</td></tr>
</table>

Trip	Description / Recommended action
550Hz Limit	**Drive output frequency exceeded the maximum allowed operating frequency**
83	The values used to configure the drive in the mechanical menu parameters **E01** to **E05** and motor map settings have resulted in the maximum output frequency being > 550 Hz which is not allowed. **Recommended actions:** • Adjust **E01** to **E05** mechanical system data to the correct settings to limit the output frequency. • Ensure motor map settings are correct to prevent excessive output frequencies.

6.2 Auto-Reset

The Auto-Reset function can be used to clear Elevator drive trips automatically.

The Auto-Reset is only active, if parameter **H46** Number Of Auto-reset Attempts > None (0) and parameter **H47** Auto-reset Delay is setup correctly. If the Auto-reset function is active, an attempt is made following every Elevator drive trip to reset the trip after the reset delay, which can range from its default of 1.0 s up to a maximum of 600.0 s

Value	Text
0	None
1	1
2	2
3	3
4	4
5	5
6	Infinite

If repeated trips occur, the Reset will be repeated up to a maximum number of times as defined in **H46** Number Of Auto-Reset Attempts (None (0) to Infinite (6)) using the programmed delay between the attempted trip Reset as defined in **H47** Auto-Reset Delay. If the **H46** Number Of Auto-Reset Attempts reaches the maximum where **H46** = 1 (1) 2 (2) 3 (3) 4 (4) or 5 (5), the next trip will not be Reset.

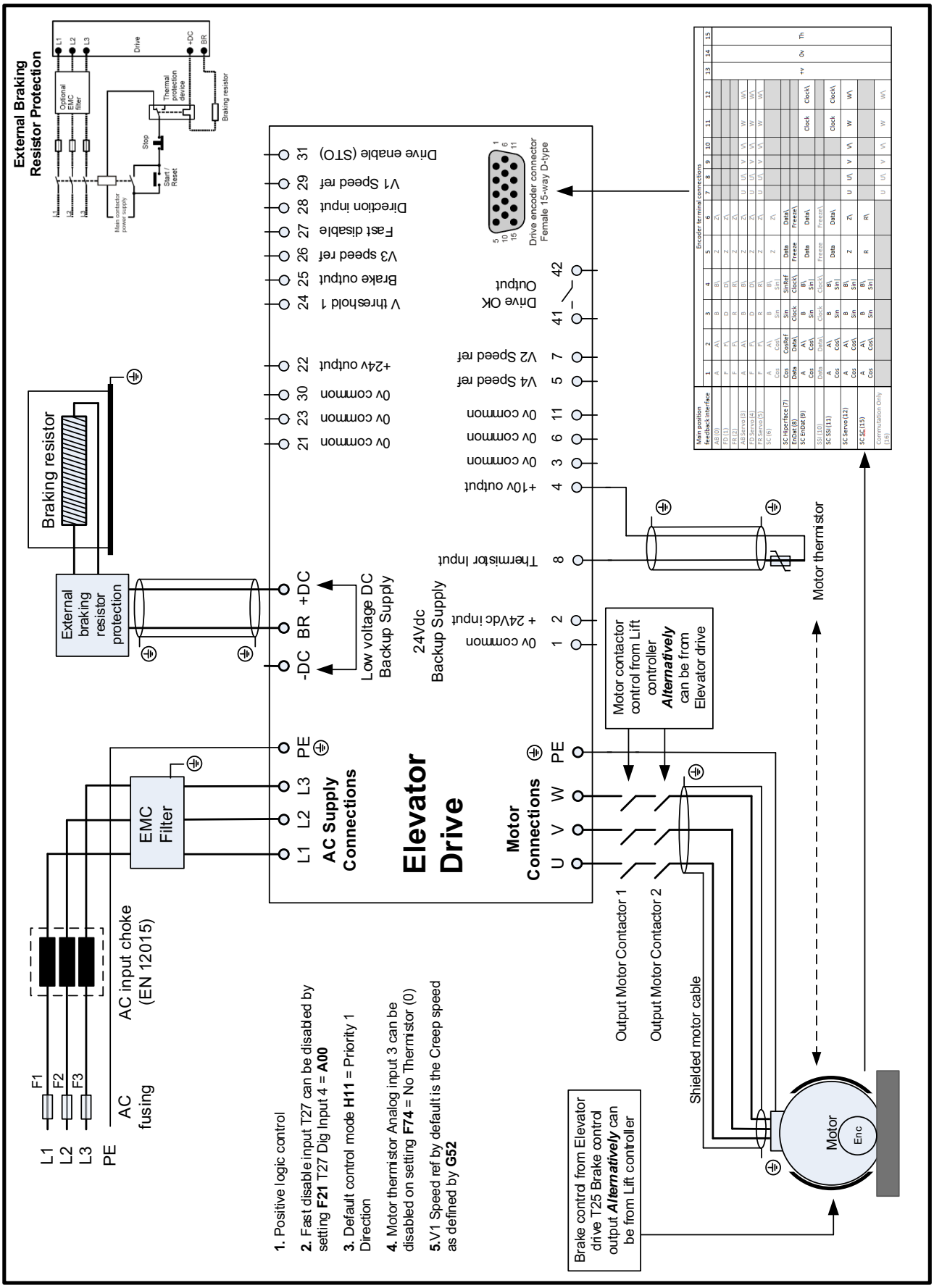
If no Elevator drive trip occurs for 5 minutes, the trip counter for **H46** Number Of Auto-Reset Attempts will be cleared, or when a manual Elevator drive trip Reset is carried out the Auto-Reset counter is also cleared.

Auto Reset will not occur after any trips with priority levels 1, 2 or 3.

Table 6-1 Trip categories

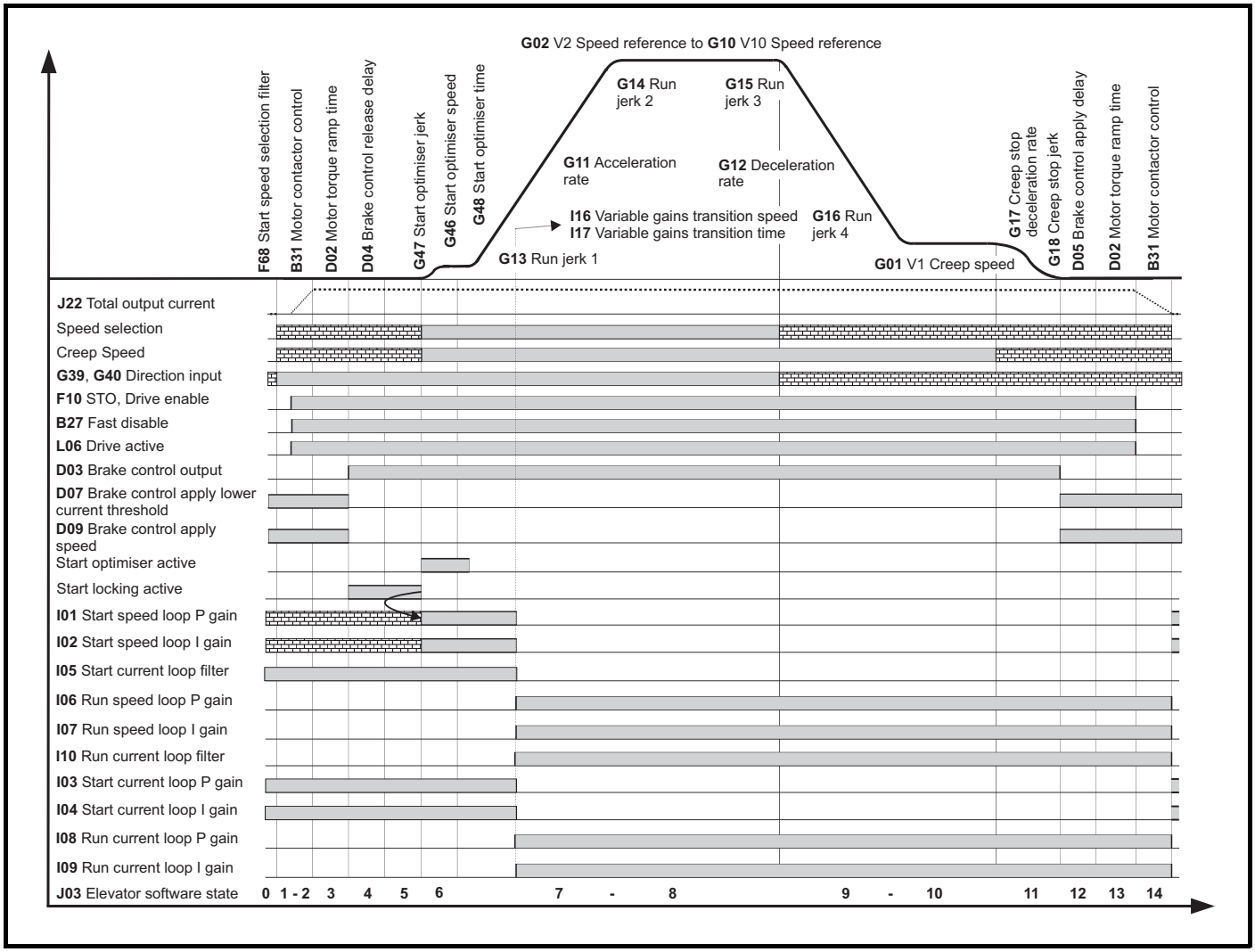
Priority	Category	Trips	Comments
1	Internal faults	HFxx	These indicate internal problems and cannot be Reset. All drive features are inactive after any of these trips occur. If a keypad is installed it will show the trip, but the keypad will not function.
1	Stored HF trip	{Stored HF}	This trip cannot be cleared unless 1299 is entered into parameter **mm.000** and a reset is initiated.
2	Non-resettable trips	Trip numbers 218 to 247, {Slot1 HF}, {Slot2 HF}, {Slot3 HF} or {Slot4 HF}	These trips cannot be reset.
3	Volatile memory failure	{EEPROM Fail}	This can only be Reset if parameter **mm.000** is set to 1233 or 1244, or if Default Drive **H04** is set to a non-zero value.
4	NV Media Card trips	Trip numbers 174, 175 and 177 to 188	These trips are priority 5 during power-up.
4	Internal 24V and position feedback interface power supply	{PSU 24V} and {Encoder 1}	These trips can override {Encoder 2} to {Encoder 6} trips.
5	Trips with extended reset times	{OI ac}, {OI Brake}, and {OI dc}	These trips cannot be Reset until 10 s after the trip was initiated.
5	Phase loss and d.c. link power circuit protection	{Phase Loss} and {Oht dc bus}	The drive will attempt to stop the motor before tripping if a {Phase Loss} 000 trip occurs unless this feature has been disabled (see Action On Trip Detection (H46). The drive will attempt to finish the travel before tripping if an {Oht dc bus} occurs.
5	Standard trips	All other trips	

7 System Connection Diagram



8 Timing Diagram

8.1 RFC-S operation



9 Re-Configuring Control Terminals

The default control terminal configuration for the Elevator drive is as follows. All of the control terminals are user configurable.

Terminal No	Function	IO Default Destination-Source	IO State	IO Invert
05	Input	**F41** = **G35** Speed select Bit 3 input	**F35**	**F40**
07	Input	**F48** = **G33** Speed select Bit 1 input	**F36**	**F47**
09	Input	**F55** = **A00** Unassigned	**F37**	**F54**
24	Input / Output **F24**	**F18** = **J48** Velocity threshold 1 output	**F03**	**F12**
25	Input / Output **F25**	**F19** = **D03** Brake output	**F04**	**F13**
26	Input / Output **F26**	**F20** = **G34** Speed select Bit 2 input	**F05**	**F14**
27	Input	**F21** = **B27** Fast disable input	**F06**	**F15**
28	Input	**F22** = **G39** Direction input 1	**F07**	**F16**
29	Input	**F23** = **G32** Speed select Bit 0 input	**F08**	**F17**
41, 42	Relay output	**F27** = **L05** Drive OK output	**F09**	**F28**

Control Mode		Description
H11 = 0	Analog Run Permit	Analog speed reference (T07 Analog input 1) with run permit, Direction Input 1 **G39** = On (1) to start the profile
H11 = 1	Analog 2 Dir	Analog speed reference (T07 Analog input 1) with dual direction inputs **G39** and **G40**
H11 = 2	Priority 1 Dir	Priority speed selection with single direction input **G39**
H11 = 3	Binary 1 Dir	Binary speed selection with single direction input **G39**
H11 = 4	Priority 2 Dir	Priority speed selection with dual direction inputs **G39** and **G40**
H11 = 5	Binary 2 Dir	Binary speed selection with dual direction inputs **G39** and **G40**
H11 = 6	Control Word	Control over on-board 485 Modbus port using Control word **G51** and Status Word **L74**

Binary Speed Selection	Bit 0 G32	Bit 1 G33	Bit 2 G34	Bit 3 G35	Speed reference
V0	–	–	–	–	–
V1	1	–	–	–	G01
V2	–	1	–	–	G02
V3	1	1	–	–	G03
V4	–	–	1	–	G04
V5	1	–	1	–	G05
V6	–	1	1	–	G06
V7	1	1	1	–	G07
V8	–	–	–	1	G08
V9	1	–	–	1	G09
V10	–	1	–	1	G10

Priority Speed Selection	Bit 0 G32	Bit 1 G33	Bit 2 G34	Bit 3 G35	Bit 4 G36	Bit 5 G37	Bit 6 G38	Speed reference
V0	–	–	–	–	–	–	–	–
V1	1	–	–	–	–	–	–	G01
V2	–	1	–	–	–	–	–	G02
V3	–	–	1	–	–	–	–	G03
V4	–	–	–	1	–	–	–	G04
V5	–	–	–	–	1	–	–	G05
V6	–	–	–	–	–	1	–	G06
V7	–	–	–	–	–	–	1	G07

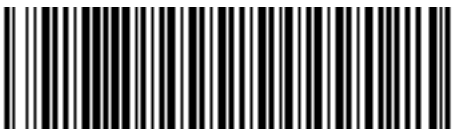
Control Word G51			**Status Word L74**	
Bit	**Description**	**Priority**	**Bit**	**Description**
0	V1 speed reference by default Creep Speed (**G52**)	10 (Lowest)	0	Drive OK (**L05**)
1	V2 speed reference	9	1	Drive Active (**L06**)
2	V3 speed reference	8	2	At Zero Speed (**L08**)
3	V4 speed reference	7	3	Reserved
4	V5 speed reference	6	4	Reserved
5	V6 speed reference	5	5	Reserved
6	V7 speed reference	4	6	Reserved
7	V8 speed reference	3	7	Rated Load Reached (**L13**)
8	V9 speed reference	2	8	Current Limit Reached (**L15**)
9	V10 speed reference	1 (Highest)	9	Regenerating (**L14**)
10	Direction input 1 CCW		10	Braking IGBT Active (**L16**)
11	Direction input 2 CW		11	Braking Resistor Alarm (**L17**)
12	Watchdog bit Must be set to 1 at least every 500 ms. Failure to do so will result in a **Ctrl Watchdog** fault.		12	Reverse Direction Commanded (**L27**)
13	Control Word enable Must be set to 1 to allow travel. For a normal travel this bit is set to 1 when travel is requested i.e. following Speed / Direction / Enable and set to 0 when the travel has completed.		13	Reverse Direction Running (**L28**)
14	Reserved		14	Reserved
15	Reserved	N/A	N/A	N/A

Configuration Options		**Notes**
B31	Motor contactor control output	Can be routed via a digital output to the Elevator control system for control of the output motor contactors.
G39	Direction input 1 CCW	Direction counter clock wise
G40	Direction input 2 CW	Direction clock wise
E11	Load cell compensation input	The external load cell compensation uses the Elevator car load cell to generate a torque feed forward reference. Also refer to setup parameters **E10** Enable **E12** Filter **E13** Reference **E19** Offset and **E20** Scaling.
H26	FAST stop enable	A FAST stop can be carried out using either Speed control or Direction control (dual direction inputs), once the FAST stop mode is enabled. Also refer to **G29** Deceleration rate.

Index

V

W



0479-0043-01