Elevator Products Training

Elevator Drive
Line Regeneration

v1.71 – 02/12

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Keypad Operator Overview

Display

Serial Com. Active

Keypad

X6B:

For PC

X6C

Serial Bus Interface

RS232/RS485

DIN 66019 for PC or connection to controller

Status LED

Normal – LED “ON”

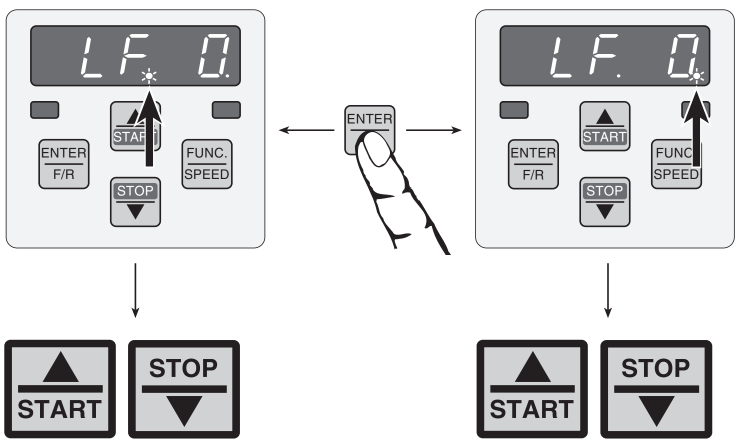
Drive Fault – LED “Flashes”

Operator

- Has its own micro-controller
- Provides the elevator parameter interface
- Elevator specific functionality and units

Keypad Navigation

Navigation of Parameter Group or Number



Parameter Groups

LF

US

ru

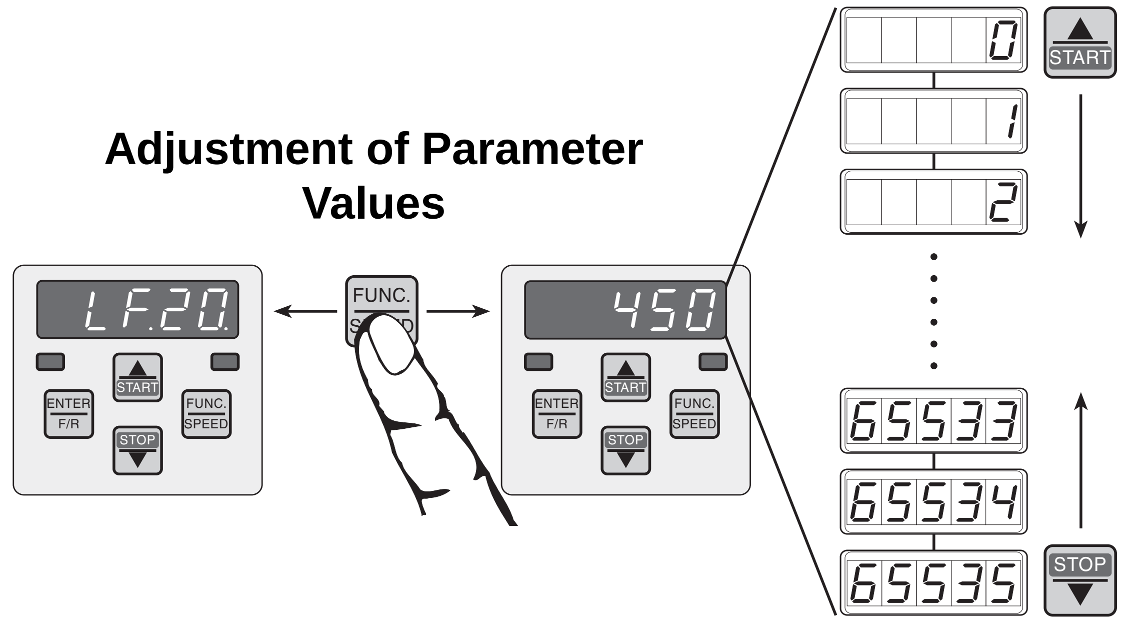
di

do

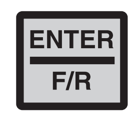
Parameter Number

0…99

Adjustment of Parameter Values

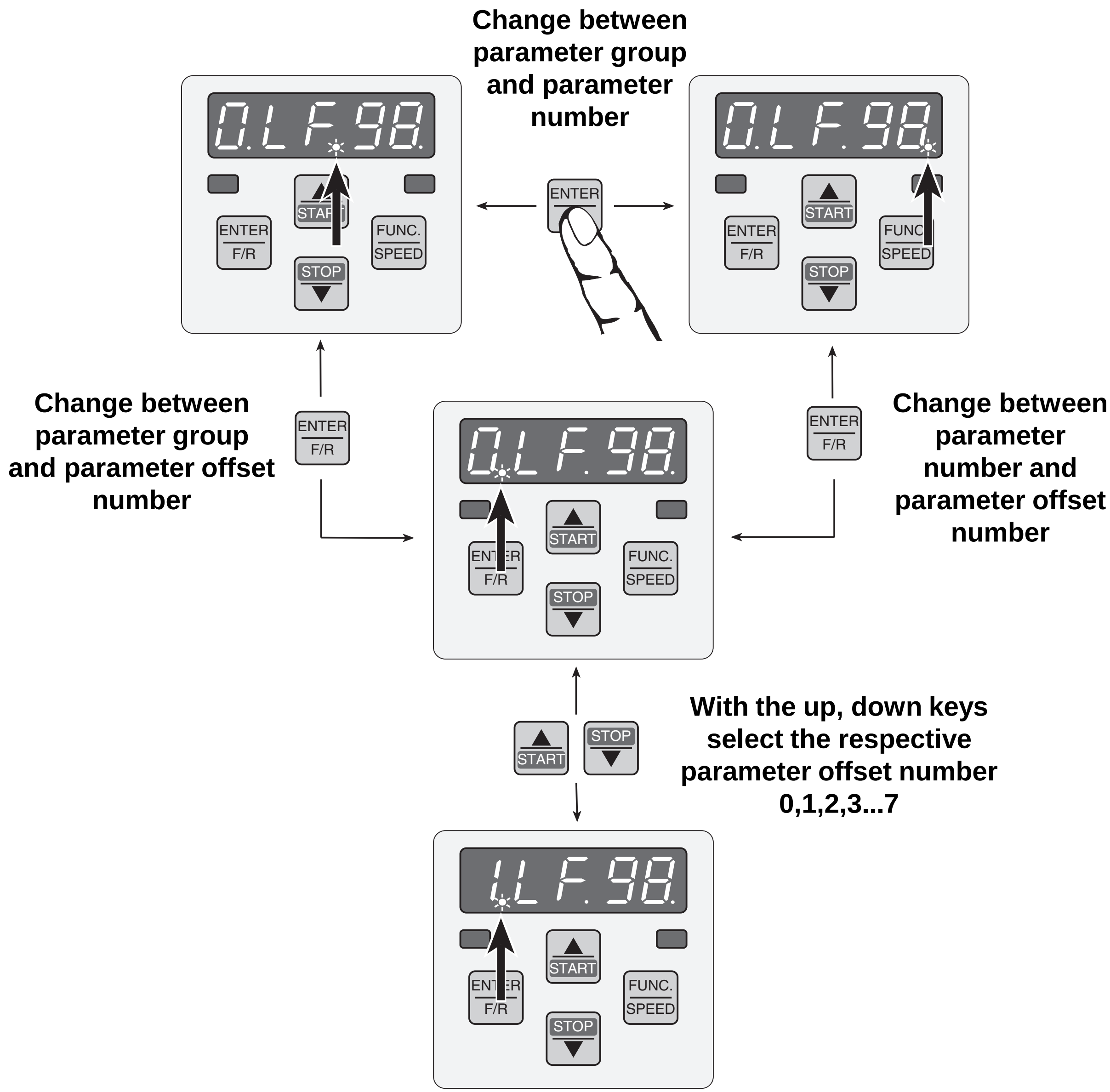


Press



to Save the new value

Keypad Navigation



Elevator Parameters

LF - Main Parameter List

General	LF.02	Steering/Operating Mode
General	LF.03	Drive configuration
General	LF.04	Drive Mode
General	LF.05	Auto Reset
Motor Data	LF.08	Electronic Mtr Protection
Motor Data	LF.09	Electronic Mtr Protection Current
Motor Data	LF.10	Rated Motor Power
Motor Data	LF.11	Rated Motor Speed
Motor Data	LF.12	Rated Motor Current
Motor Data	LF.13	Rated Motor Frequency
Motor Data	LF.14	Rated Motor Voltage (Induction) Back EMF Constant (PM)
Motor Data	LF.17	Rated Motor Torque
Motor Data	LF.18	Motor Resistance
Motor Data	LF.19	Motor Inductance
Machine Data	LF.20	Contract Speed
Machine Data	LF.21	Traction Sheave Diameter
Machine Data	LF.22	Gear Reduction Ratio
Machine Data	LF.23	Roping Ratio
Machine Data	LF.24	Load
Machine Data	LF.25	Estimated Gear Reduction

***LF.31…LF.33: A = Acceleration and High Speed**

d = Deceleration and Leveling Speed

P = Pre-Torque

****LF.50…LF.55: 0 = High and Intermediate Speeds**

1 = Leveling, Inspection Speeds

Encoder Data	0.LF.26	Encoder Feedback Card Type
Encoder Data	1.LF.26	Encoder Type
Encoder Data	2.LF.26	Encoder Status
Encoder Data	3.LF.26	Upload/Download to Encoder
Encoder Data	LF.27	Encoder Pulse Number
Encoder Data	LF.28	Swap Encoder Channels
Encoder Data	LF.29	Sample rate for encoder
Encoder Data	LF.30	Control Mode
Speed Control	A.LF.31	KP Speed
Speed Control	d.LF.31	KP Speed decel
Speed Control	P.LF.31	KP Speed pretorque
Speed Control	A.LF.32	KI Speed
Speed Control	d.LF.32	KI Speed decel
Speed Control	P.LF.32	KI Speed pretorque
Speed Control	A.LF.33	KI Speed offset
Speed Control	d.LF.33	KI Speed offset decel
Speed Control	0.LF.36	Maximum Torque
Speed Control	LF.38	Switching Frequency
Pattern Control	LF.41	Leveling Speed
Pattern Control	LF.42	High Speed
Pattern Control	LF.43	Inspection Speed
Pattern Control	LF.44	High Leveling Speed
Pattern Control	LF.45	Earthquake Speed
Pattern Control	LF.46	Emergency Generator Speed
Pattern Control	LF.47	Intermediate Speed
Pattern Control	LF.49	Overspeed Function Test
Pattern Control	0.LF.50**	Starting Jerk
Pattern Control	0.LF.51**	Acceleration
Pattern Control	0.LF.52**	Acceleration Jerk
Pattern Control	0.LF.53**	Deceleration Jerk
Pattern Control	0.LF.54**	Deceleration
Pattern Control	0.LF.55**	Approach Jerk
Pattern Control	LF.56	Stop Jerk

Miscellaneous Functions	LF.57	Speed Following Error
Miscellaneous Functions	LF.58	Speed Difference
Miscellaneous Functions	LF.59	Following Error Timer
Miscellaneous Functions	LF.61	Emergency Operation Mode
Miscellaneous Functions	LF.62	ETS Slowdown Speed
Miscellaneous Functions	LF.67	Pretorque Gain
Miscellaneous Functions	LF.68	Pretorque Offset
Miscellaneous Functions	LF.69	Pretorque Direction
Miscellaneous Functions	LF.70	Brake Release Time
Miscellaneous Functions	LF.71	Brake Release Delay
Miscellaneous Functions	LF.76	Encoder multiplier
Miscellaneous Functions	LF.77	Absolute Encoder Position
Miscellaneous Functions	LF.78	Brake Engage Time
Miscellaneous Functions	LF.79	Current Hold Time
Diagnostic Functions	LF.80	Software Version
Diagnostic Functions	LF.81	Software Date
Diagnostic Functions	LF.82	X2-Input State
Diagnostic Functions	LF.83	X2-Output State
Diagnostic Functions	LF.86	Selected Speed
Diagnostic Functions	LF.87	Actual Inverter Load
Diagnostic Functions	LF.88	Actual Set Speed
Diagnostic Functions	LF.89	Actual Motor Speed
Diagnostic Functions	LF.90	Actual Elevator Speed
Diagnostic Functions	LF.93	Phase Current
Diagnostic Functions	LF.94	Peak Phase Current
Diagnostic Functions	LF.95	DC Bus Voltage
Diagnostic Functions	LF.96	Peak DC Bus Votlage
Diagnostic Functions	LF.97	Actual output frequency
Diagnostic Functions	LF.98	Last Fault
Diagnostic Functions	LF.99	Inverter State

Elevator Parameters

KEB

US - User Setup Parameter List

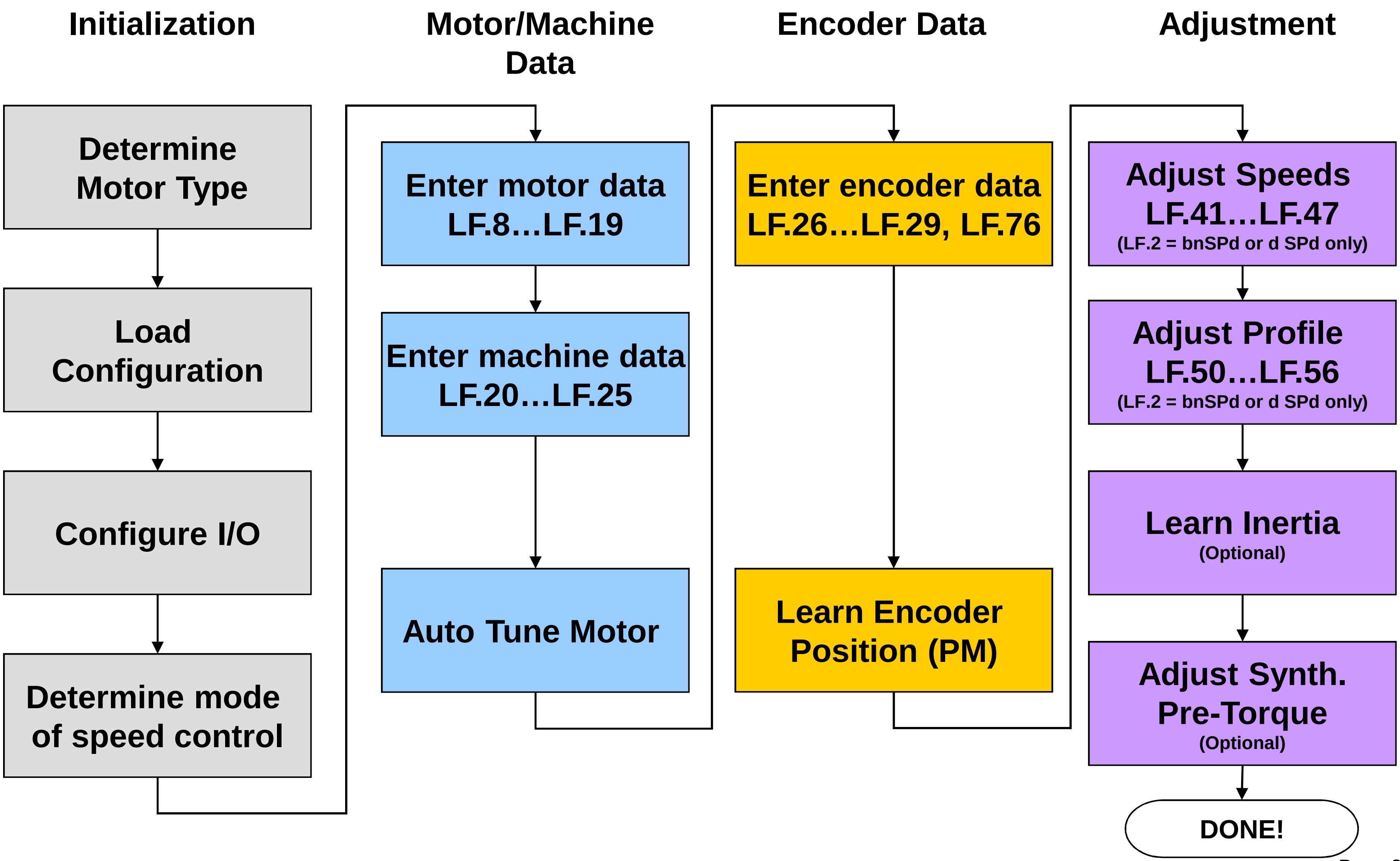
Configuration	US.01	Password
	US.03	Default all LF parameters
	US.04	**Load configuration**
	US.10	**Select Configuration**
Advanced Functions	US.16	E.OL2 function
	US.17	**Pre – Torque Timer ramp up**
	US.18	**Pre – Torque Timer ramp down**
	US.20	Max speed for max KI
	US.21	Speed for min KI
	US.22	Speed dependent KP gain
	US.23	Min KP Gain at High Speed
	US.24	KD speed gain
	US.25	Phase current check
	US.28	AN1 Zero Clamp
	US.29	HSP5 Watchdog Time
	US.33	E.dOH function
	US.34	AN1 Gain
	US.35	Reference Splitting
	US.36	Baud Rate
	US.37	Test Function
	US.83	Encoder 2 Output PPR

ru -Run Parameter List - Diagnostics

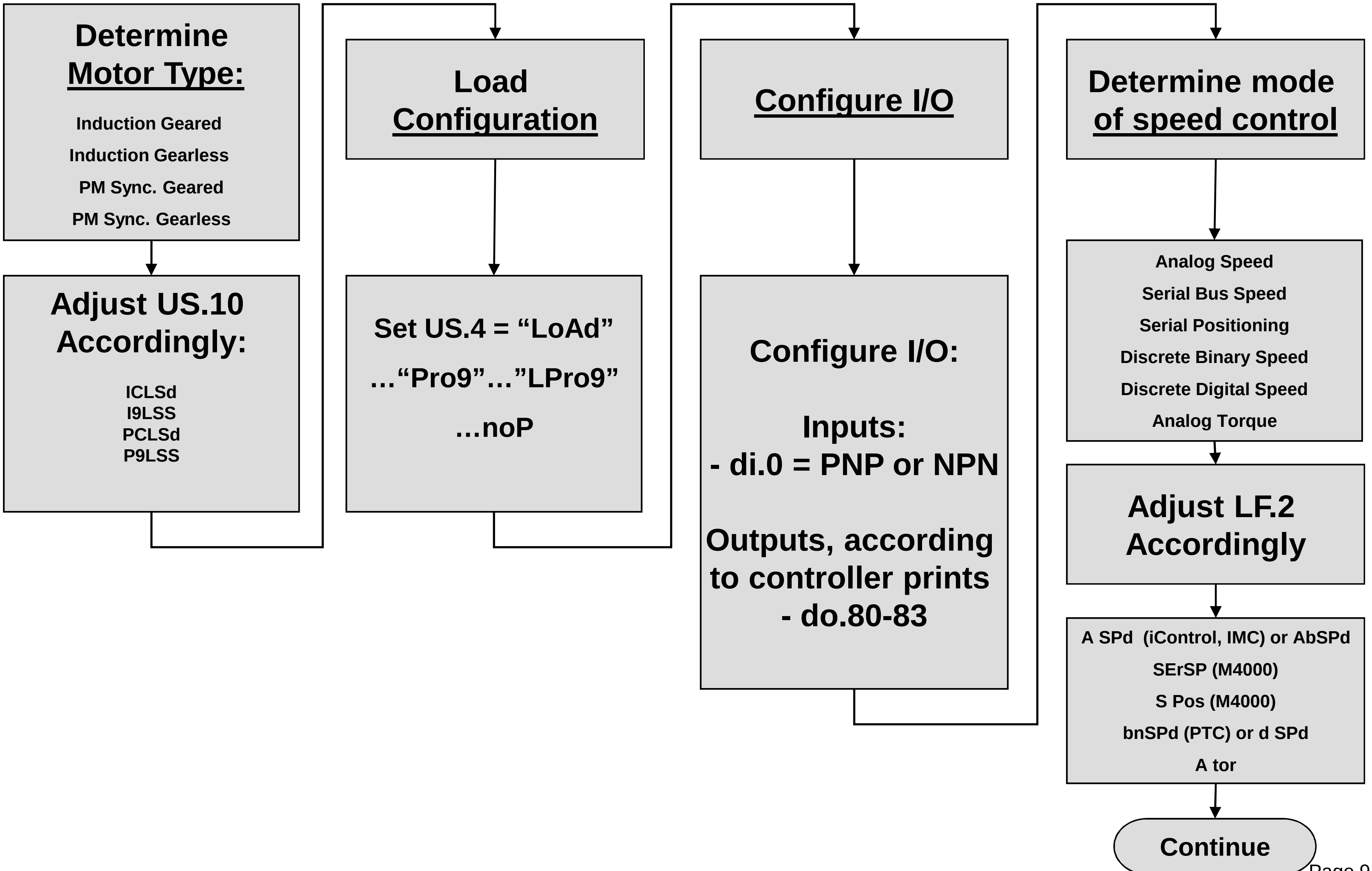
ru00	Drive status
ru01	Set speed
ru02	Command speed
ru03	Actual output frequency
ru07	Actual speed value
ru09	Encoder 1 speed raw
ru10	Encoder 2 speed raw
ru11	Command torque
ru12	Actual torque
ru13	Actual load
ru14	Peak load
ru15	Phase current
ru16	Peak phase current
ru17	Torque current
ru18	Actual DC bus voltage
ru19	Peak DC bus voltage
ru20	Output voltage
ru21	Input terminal state raw
ru22	Internal input state processed
ru23	Output condition state
ru24	State of output flags
ru25	Output terminal state

ru26	Active parameter set
ru27	Analog pattern pre amplifier
ru28	Analog pattern post amplifier
ru29	Pre-torque pre amplifier
ru30	Pre-torque post amplifier
ru31	Analog option pre amplifier
ru32	Analog option post amplifier disp.
ru33	Analog out1 pre ampl.
ru34	Analog out1 post ampl.
ru35	Analog out2 pre ampl.
ru36	Analog out2 post ampl.
ru37	Motorized pot actual value
ru38	Power module temperature
ru39	OL counter display
ru40	Power on counter
ru41	Modulation on counter
ru42	Modulation grade
ru43	Timer 1 display
ru44	Timer 2 display
ru45	Actual switching frequency
ru46	Motor temperature
ru54	Actual position

Start-Up Overview



Initialization



Enter PM Motor Data

Enter PM Motor Data:
LF.8…LF.19

Motor Overload
LF.8 = on
(Required by CSA)

LF.10 =
Motor Power (HP)
!Read Only!

This value is calculated from the torque and speed for PM.

LF.12 =
Motor Rated Current

LF.11 = Motor Rated Speed (rpm)

!! Important !!

The relationship between rated speed, frequency, and the number of motor poles is as follows:

Rated Speed (rpm) = Frequency (Hz) x 120 / # of poles

This relationship be exact ! Do not round to the nearest whole number.

LF.13 = Motor Rated Frequency

LF.17 = Motor torque [lb ft]

LF.17=Name plate HP x 5258/ LF.11
or
LF.17=Name plate kW x 7051 / LF.11
or
LF.17=Nameplate Nm x 1.355

These values are measured with the auto tune function in LF.3

LF.14 =
Motor no load back EMF
No load phase to phase volts rms at rated speed.
If unknown, this value can be learned.
Else, set to line voltage or nameplate.

LF.18 =
Motor Resistance
Phase to phase resistance
If unknown, this value can be learned.

LF.19 =
Motor Inductance
Phase to phase inductance
If unknown, this value can be learned.

Enter Induction Motor Data

Enter Induction Motor Data:
LF.8…LF.15

Motor Overload Protection
LF.8 = on

Motor Overload Current
LF.9 = Rated Motor Current

LF.10 = Motor Power (HP)

LF.11 = Motor Rated Speed (rpm)

LF.12 = Motor Rated Current

LF.13 = Motor Rated Frequency

LF.14 = Motor Rated Voltage

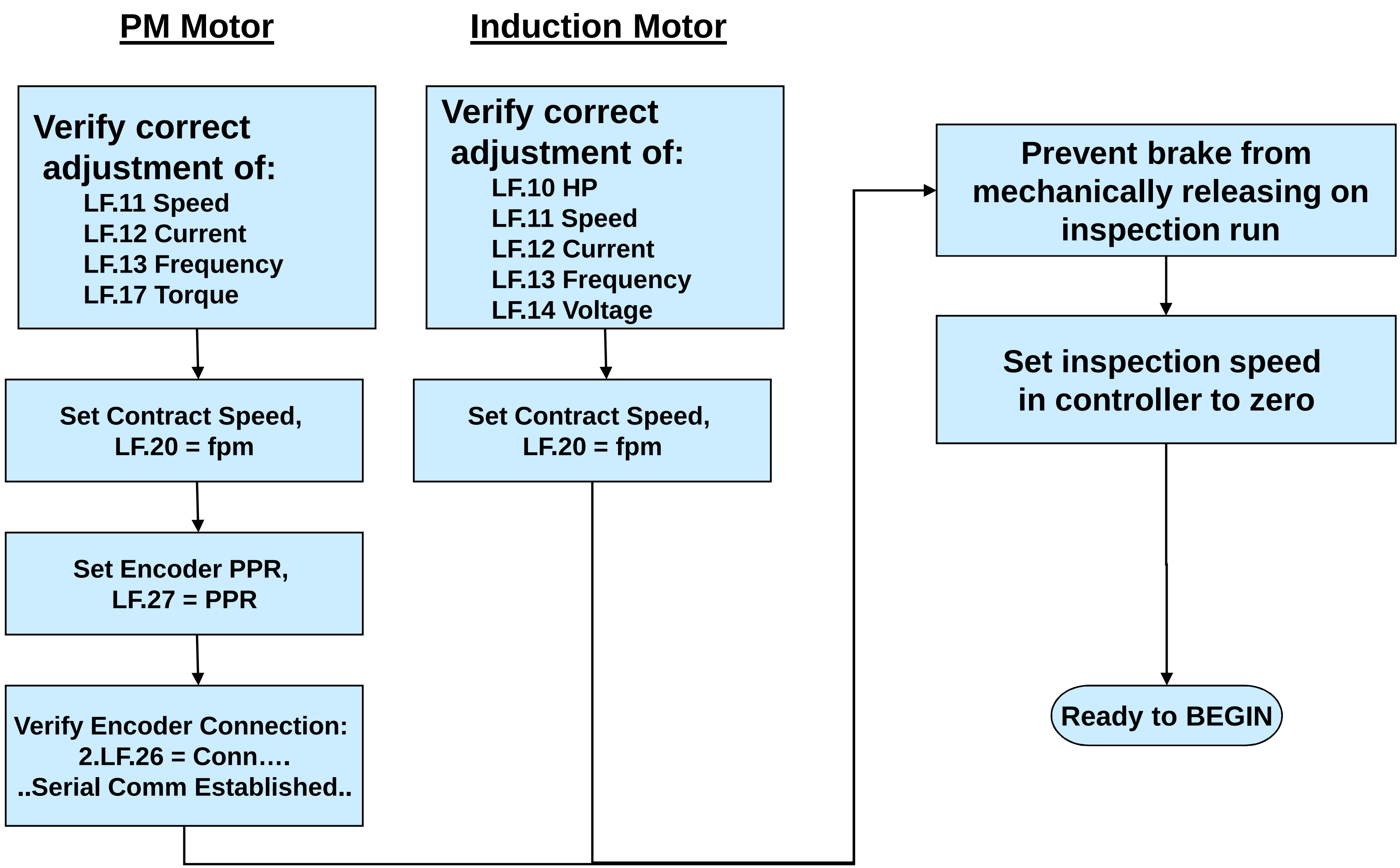
LF.15 = Power Factor

LF.17 = Motor torque [lb ft]
!Read Only!

This value is calculated from the torque and speed for induction motors.

Further values are measured with the auto tune function in LF.3

Prepare to Auto Tune Motor



Auto Tune Motor

Set LF.3 = S Lrn
Display = StArt

Press and hold inspection switch. Drive will display LS103 and the tuning process will begin.

Continue holding the inspection up button and the drive will measure various motor parameters and internal drive parameters. This display will show various codes which indicate what is being measured. Do not release the inspection switch early or the learn will be canceled. Release the switch when the display shows 'done', 'Fail', FailE, or 'Faild'.

Was result Fail, FailE, or Faild

YES

Fail: Controller is dropping the enable.
FailE: Drive fault occurred during learn process. View error and diagnose.
Faild: Verify parameter adjustments and start the tuning process over.

START OVER!

NO

The drive will finish by calculating the motor model, then reload all motor data and return to LF.99 = nOP.

The brake wire and inspection speed may also be returned.

DONE!

Enter Machine Data

Entering the machine data calculates a linear speed (fpm) to a rotary speed (rpm) that can be used by the drive.

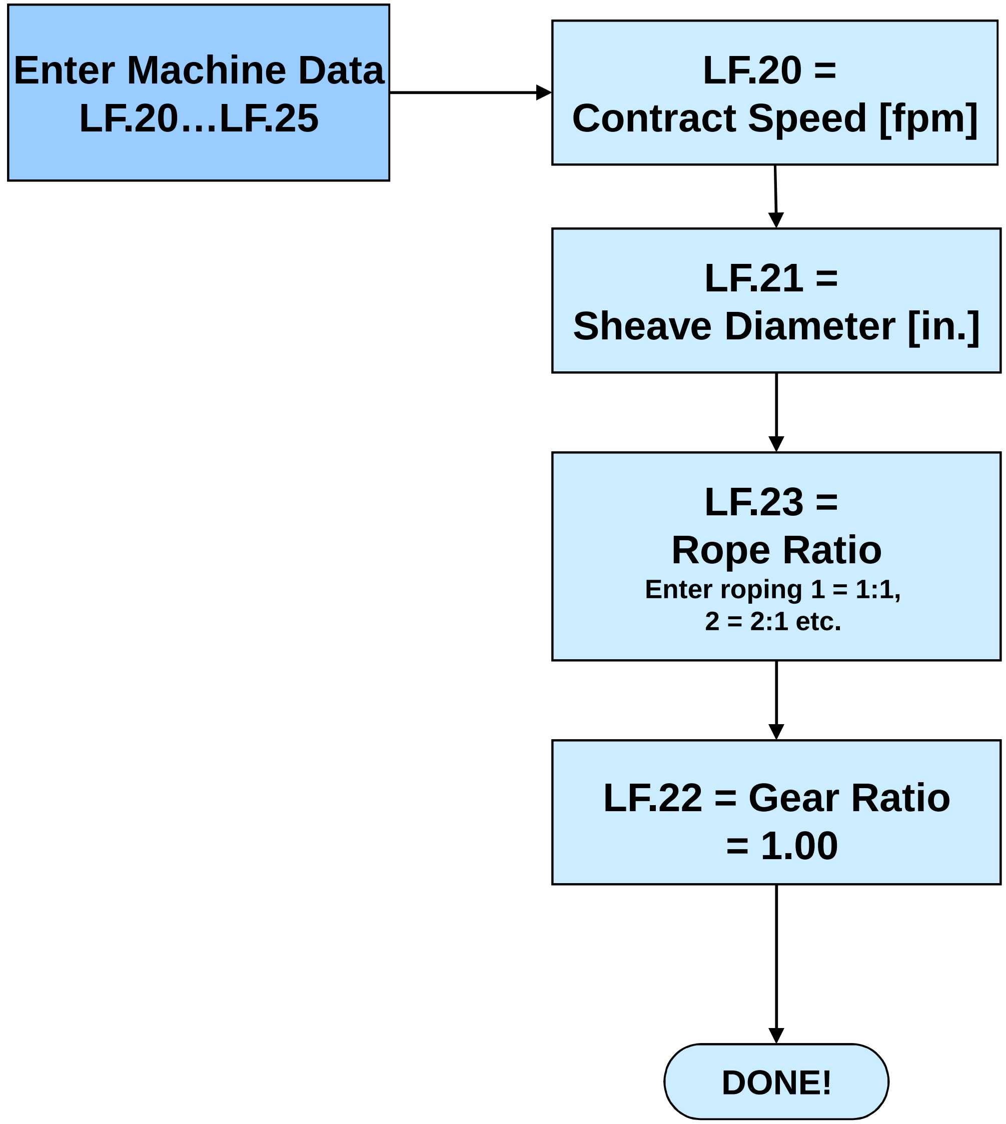
Incorrect setting of the machine data parameters may cause the elevator to run too fast or too slow.

*****Adjusting the Gear or Rope ratio can be used for overspeed tests.**

<u>With Serial Comm. speed profiles:</u>

- The controller always dictates the speed. Adjusting these parameters will not change the operating speed.

- These parameters are used internal to the drive only to determine an Overspeed Error level.



Enter Encoder Data

Enter Encoder Data:
LF.27…LF.29, LF.76

↓

LF.27 = Encoder PPR
EnDat = 2048

↓

LF.29 =
Encoder Sampling Time
4ms or 8ms typical

↓

LF.76 =
Encoder Multiplier
8 for EnDat,
2 for incremental

↓

LF.77 =
Encoder/Pole Position (PM)
Can be learned

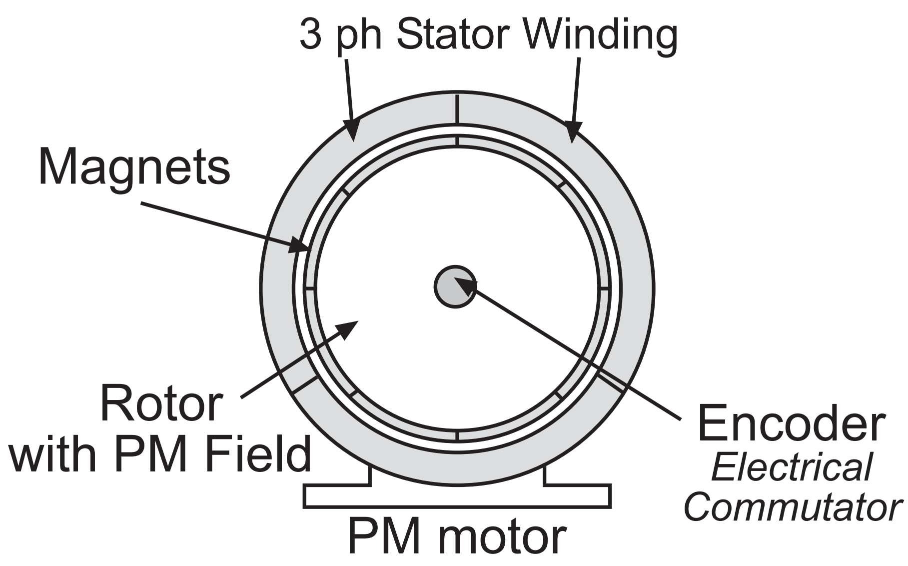
↓

Continue

PM Motors and Encoders

PM motors have a rotor with permanent magnets mounted on the surface. The magnets create a static (DC) field. As the rotor rotates, the PM field moves past the stator. The stator is a 3 phase winding with AC current.

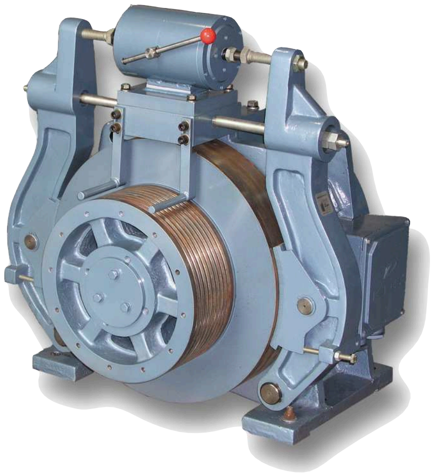
The rotation of the 3ph AC current on the stator winding must be exactly synchronized (commutated) to the rotation of the PM field on the rotor. This is accomplished using an <u>absolute position encoder</u> direct coupled to the rotor of the motor. The drive measures the position of the magnets and aligns the field on the stator accordingly.



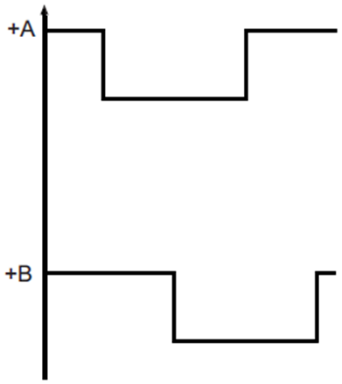
PM Motors and Encoders

To drive a PM Synchronous Motor it is necessary to know the absolute position of the rotor at all times in order to electrically commutate the field and in addition must have a high resolution due to the low operating speeds.

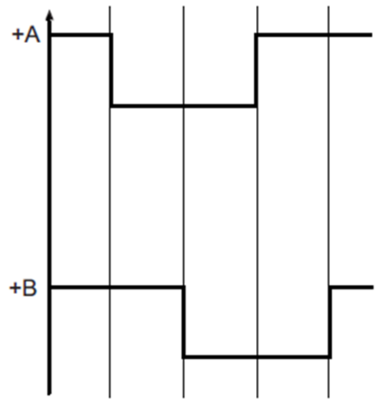
The typical absolute encoders used have two sinusoidal incremental channels for high resolution and an absolute channel for the digital position value. Most common is the proprietary format EnDat.



TTL Incremental Channels (Pulse)



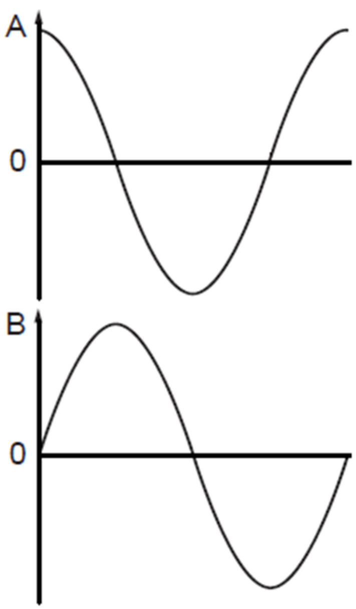
Multiplier = 2 (2^2 = 4), Max = 2



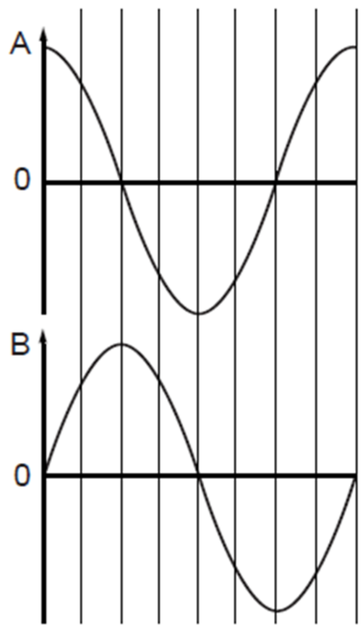
Resolution = 1024 x 2^2 = 4,096

Resolution = Base PPR x 2^Multiplier

EnDat Incremental Channels (Sinusoidal)



Multiplier = 8 (2^8 = 256), Max = Infinite, Multiplier = 8 Typical



Resolution = 2048 x 2^8 = 524,288

(128xTTL)

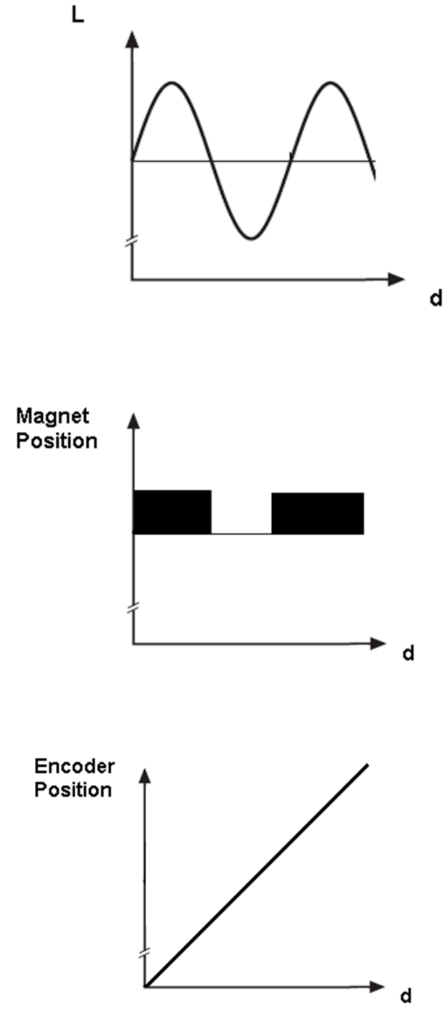
Learning Encoder Position (PM)

There are two different methods which the encoder absolute position or motor pole positions can be learned.

The first is a stationary method, which may be performed without movement and under brake. That is, the car does NOT need to be balanced or the sheave unroped. This method is particularly useful in troubleshooting, when the encoder absolute position is suspect. But, with this method, the encoder A/B channel phasing must be correct. So, this would be the preferred method if the A/B phasing has already been established. Otherwise, if the A/B phasing is unknown, the process might need a second iteration with the A/B channels swapped (via LF.28, 0<->1 or 2<->3) or it can be determined with the other method of learning the encoder absolute position, below.

The second method requires the sheave to be relatively unloaded so the sheave may move slightly, which can be achieved by either balancing the car or removing the sheave ropes. This method also automatically determines the correct A/B channel phasing. This method may be useful to determine the correct A/B phasing during the construction phase when the ropes are not yet on the sheave.

Learning Encoder Position
Stationary Pole Identification
(PM)

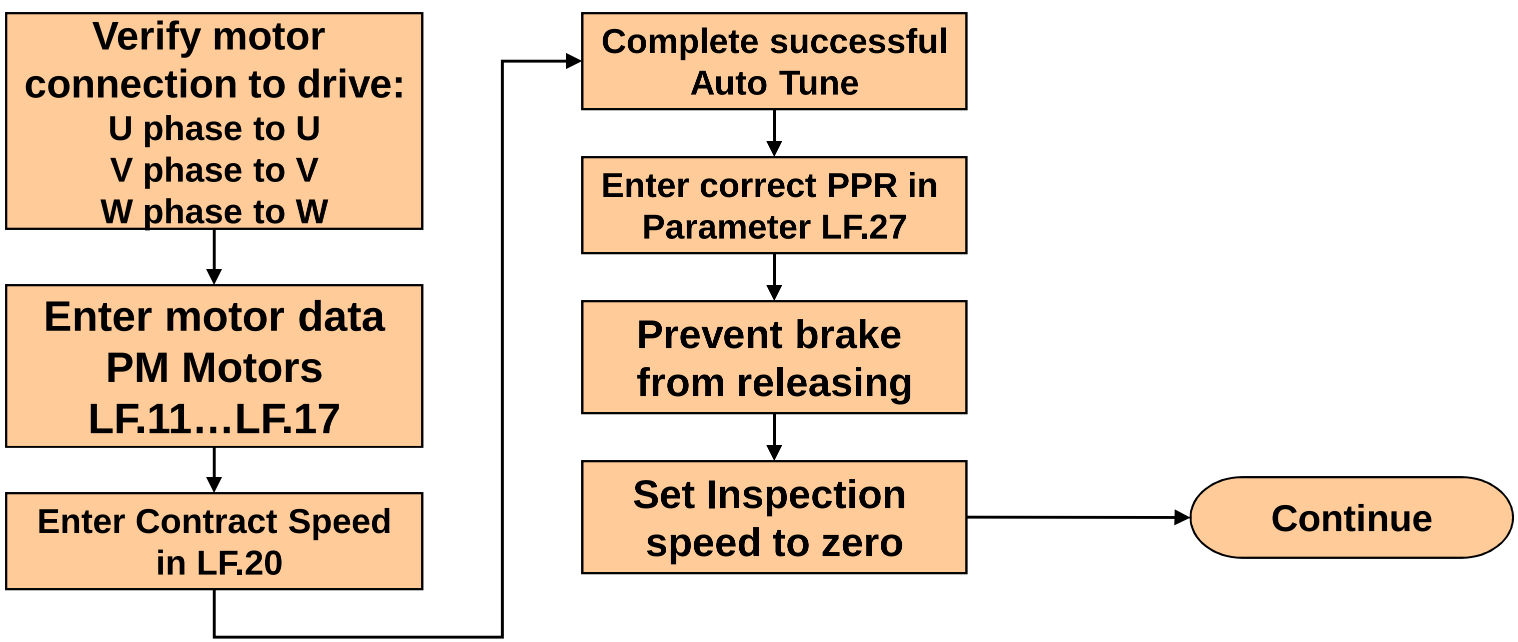


Learning Encoder Position
Stationary Pole Identification
(PM)

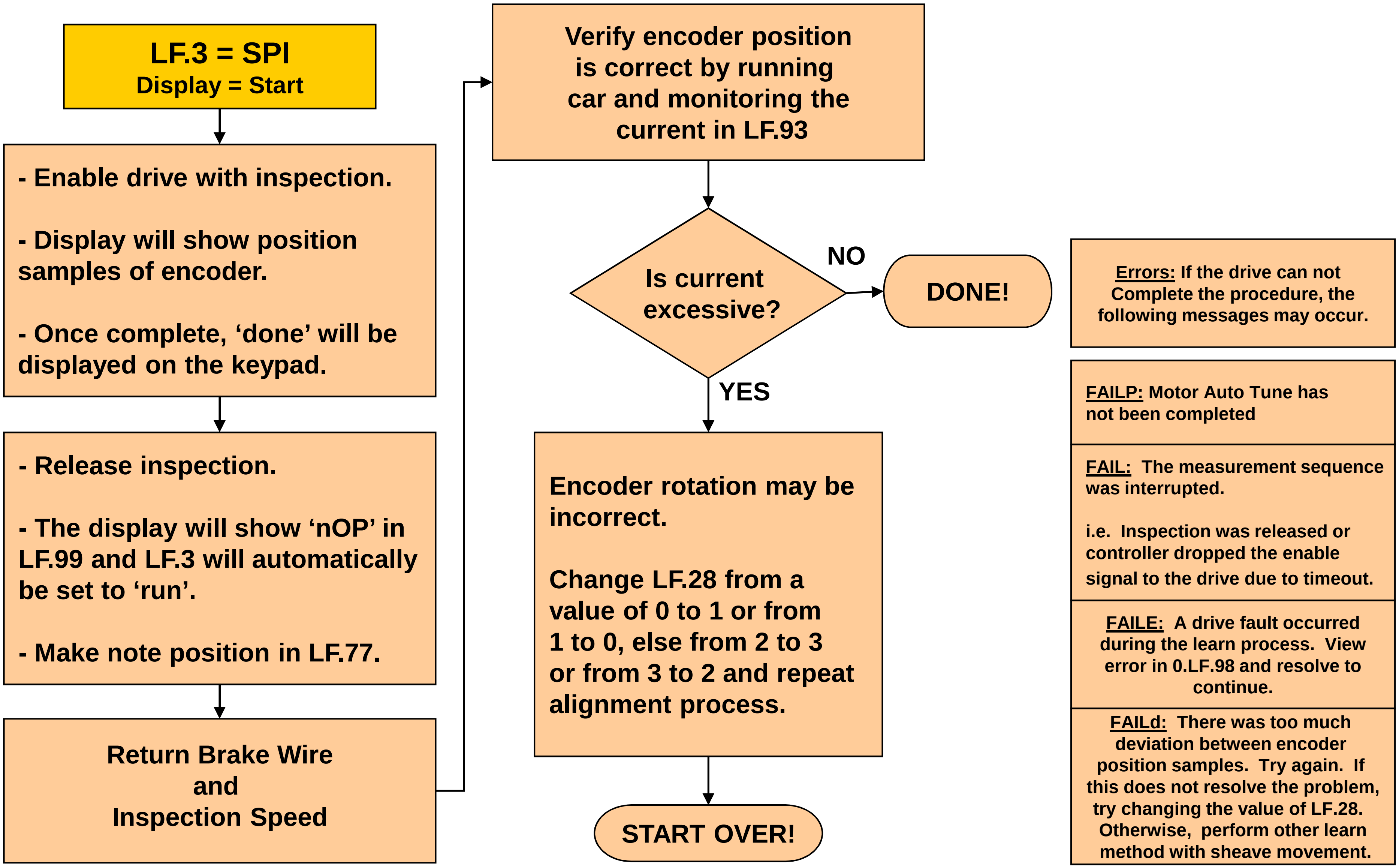
The SPI (Stationary Pole Identification) function allows the drive to learn the absolute encoder position for a PM machine under the brake without sheave movement.

This procedure can only be done with a Permanent Magnet Motor. Depending on the motor design, the SPI process may fail. In this case see the next section on Learning Absolute Position with Movement.

Preparation

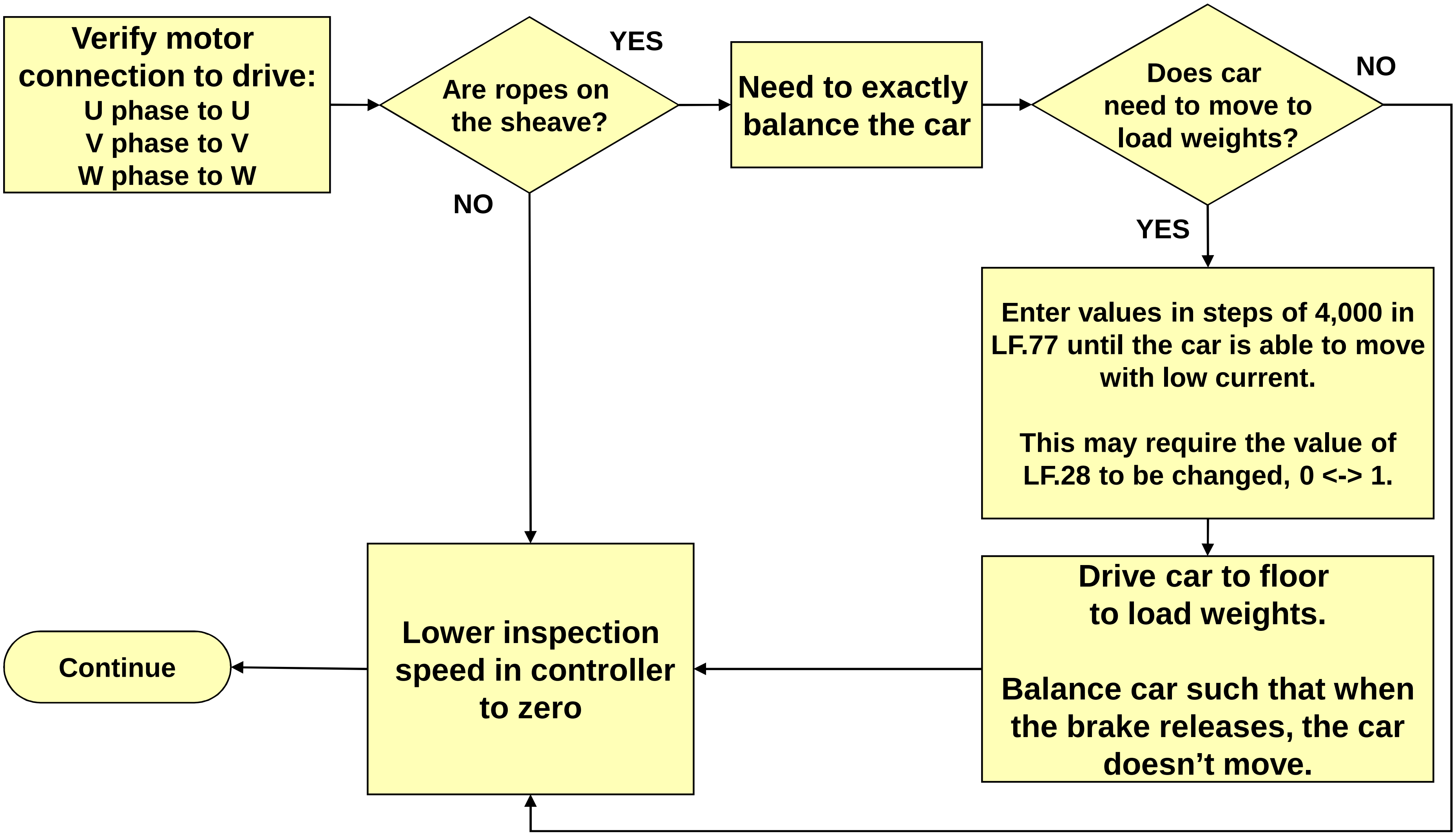


Learning Encoder Position
Stationary Pole Identification (PM)

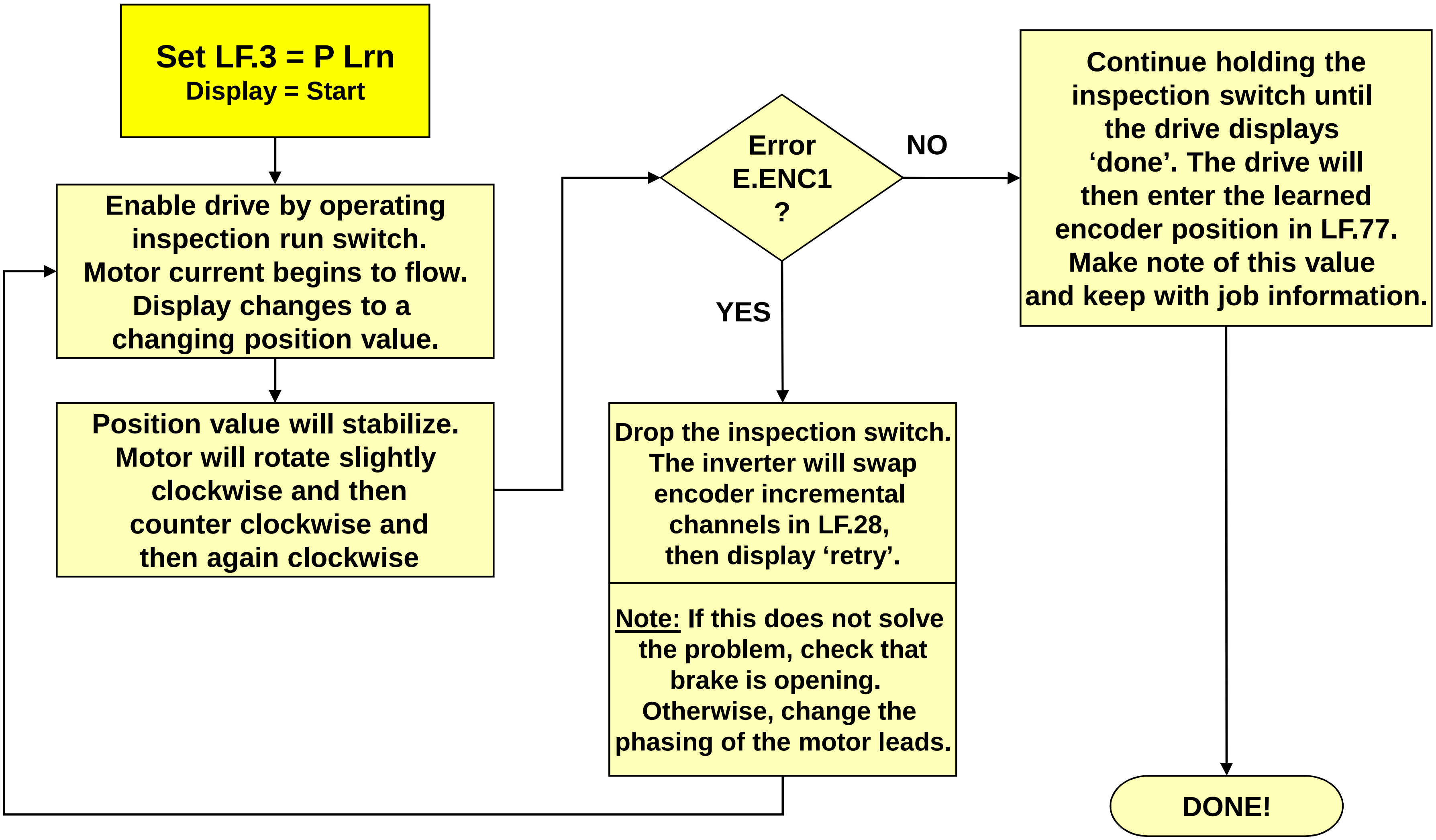


Learning Encoder Position With Sheave Movement (PM)

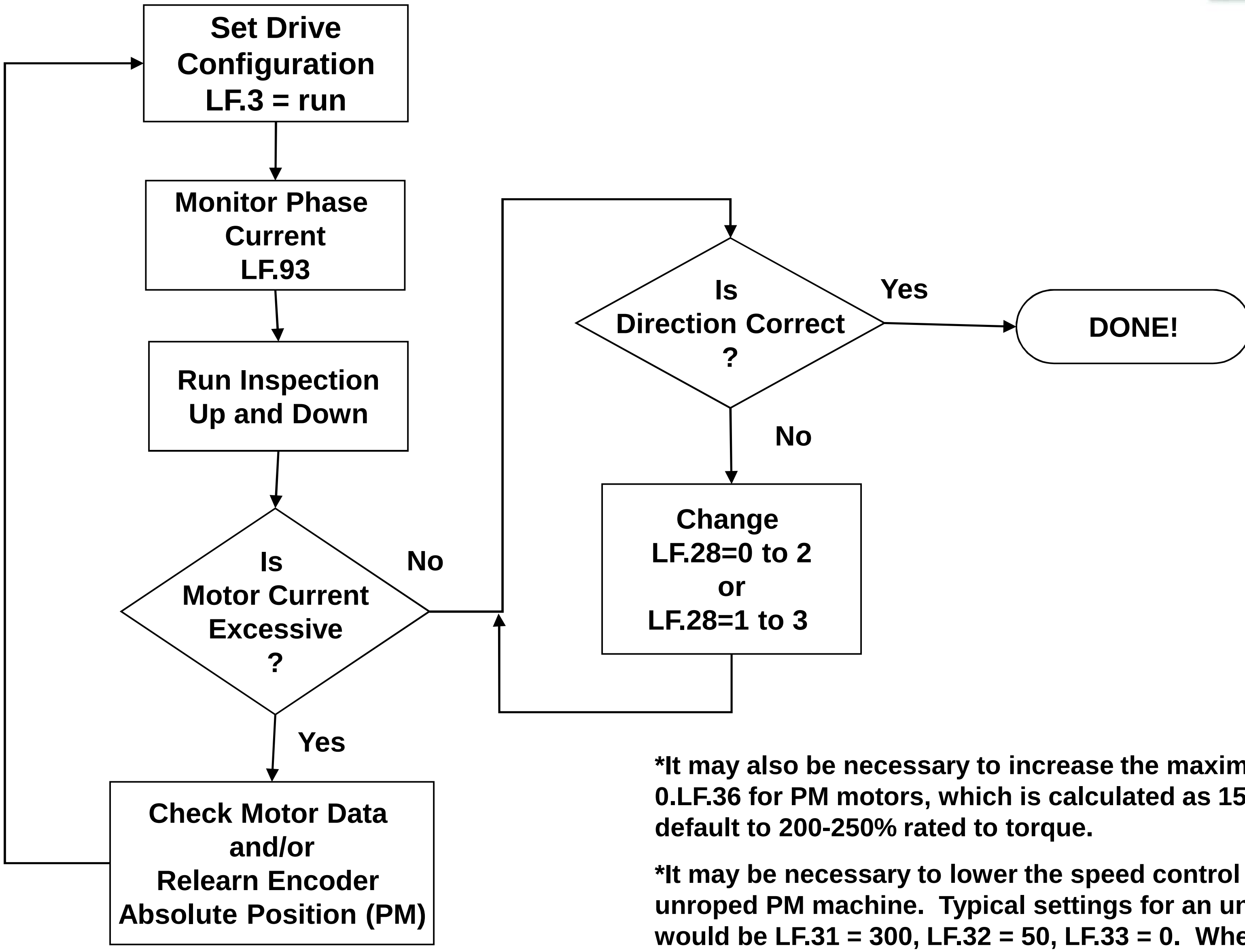
Preparation



Learning Encoder Position With Sheave Movement (PM)



Ready to Run the Motor



*It may also be necessary to increase the maximum torque in 0.LF.36 for PM motors, which is calculated as 150% x LF.17 as default to 200-250% rated to torque.

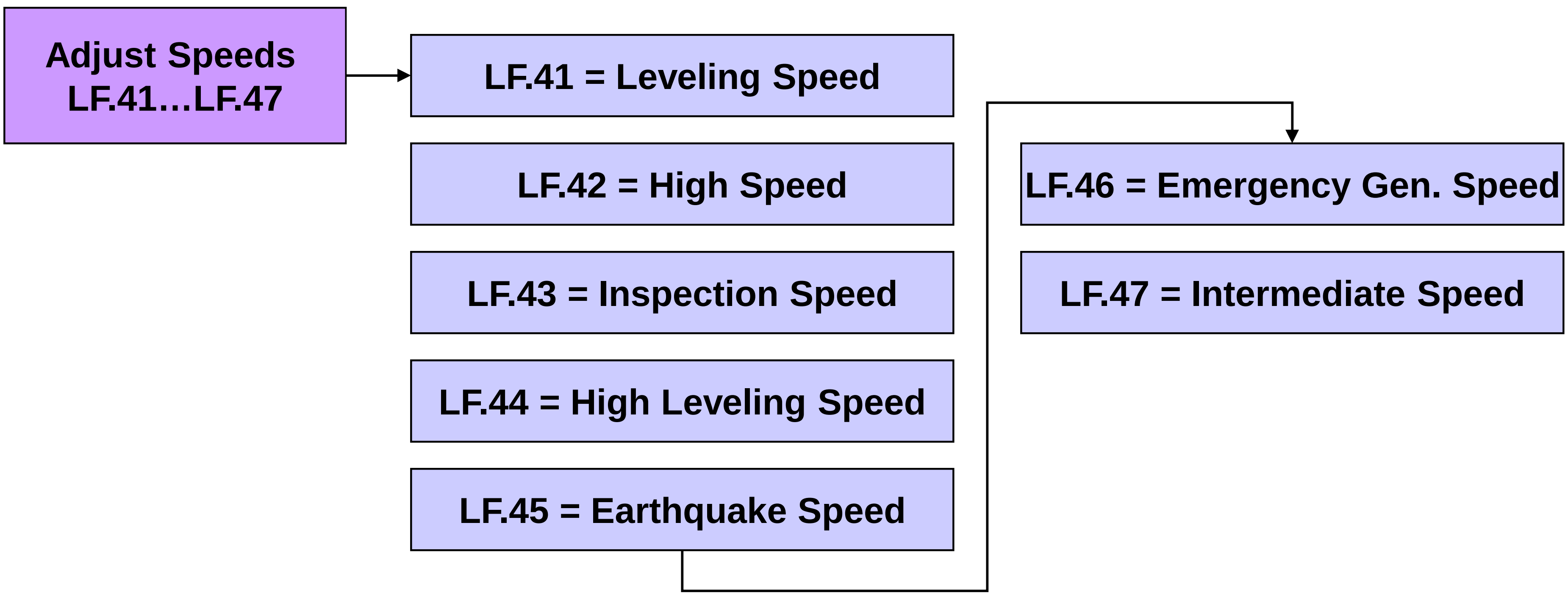
*It may be necessary to lower the speed control gains to run an unroped PM machine. Typical settings for an unroped machine would be LF.31 = 300, LF.32 = 50, LF.33 = 0. When the machine is roped, these values will need to be raised to drive the load and for better performance.

Speed & Profile Adjustment

Speeds

If the method of speed control is LF.2 = S Pos, bnSPd or d SPd, then the corresponding speeds can be set in parameters LF.41 – 47. Otherwise, for speed control LF.2 = ASPd, AbSPd, SerSP, the controller dictates the speed and these settings will have no affect on operations.

Note: The actual command speed is dictated by the combination of digital inputs. The controller may not use a specific combination for a given speed (i.e. the input combination corresponding to High Speed is actually Intermediate Speed 1 on the drive). See parameter LF.82 to determine which inputs are being signaled and the logic table for LF.2 in the manual for the corresponding speed selection.



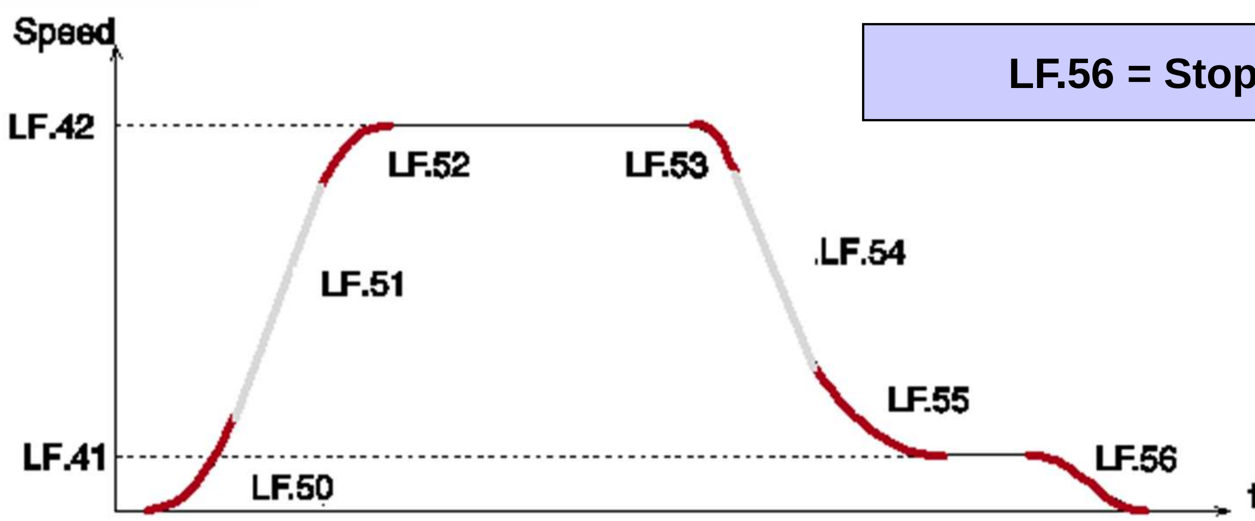
Speed & Profile Adjustment

Profiles

If the method of speed control is LF.2 = S Pos, bnSPd, or d SPd, then the acceleration, deceleration, and jerk rates are set in parameters LF.50 – 56. Otherwise, for speed controls LF.2 = ASPd, AbSPd, SerSP, the controller generates the speed profile and the default drive settings will be set to ‘off’.

Adjust Profile LF.50…LF.56 →

- **LF.50 = Start Jerk**
- **LF.51 = Acceleration**
- **LF.52 = Acceleration Jerk**
- **LF.53 = Deceleration Jerk**
- **LF.54 = Deceleration**
- **LF.55 = Flare Jerk**
- **LF.56 = Stop Jerk**

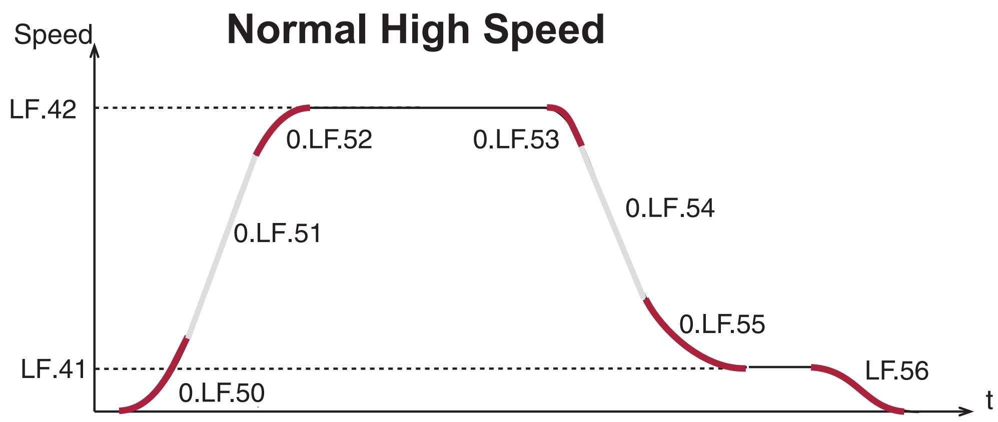


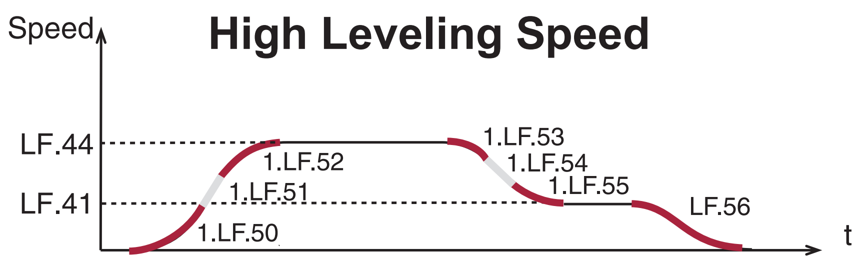
Speed & Profile Adjustment

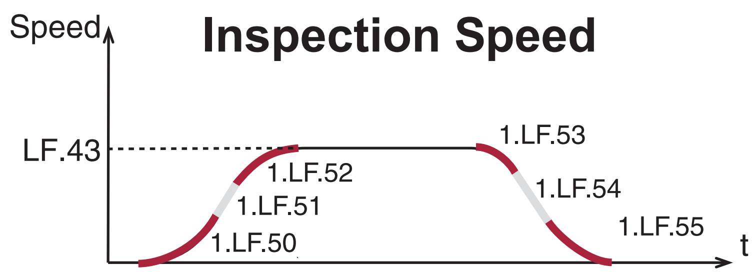
Profiles

Different profiles can be adjusted according to the selected speed. Profile adjustment parameters will have an index corresponding to which profile is being adjusted:

<u>xx.LF.5x</u>
0 = High or Intermediate Speeds
1 = Inspection, Leveling or High Leveling
2 = Emergency Speed Profile (if used, LF.61)





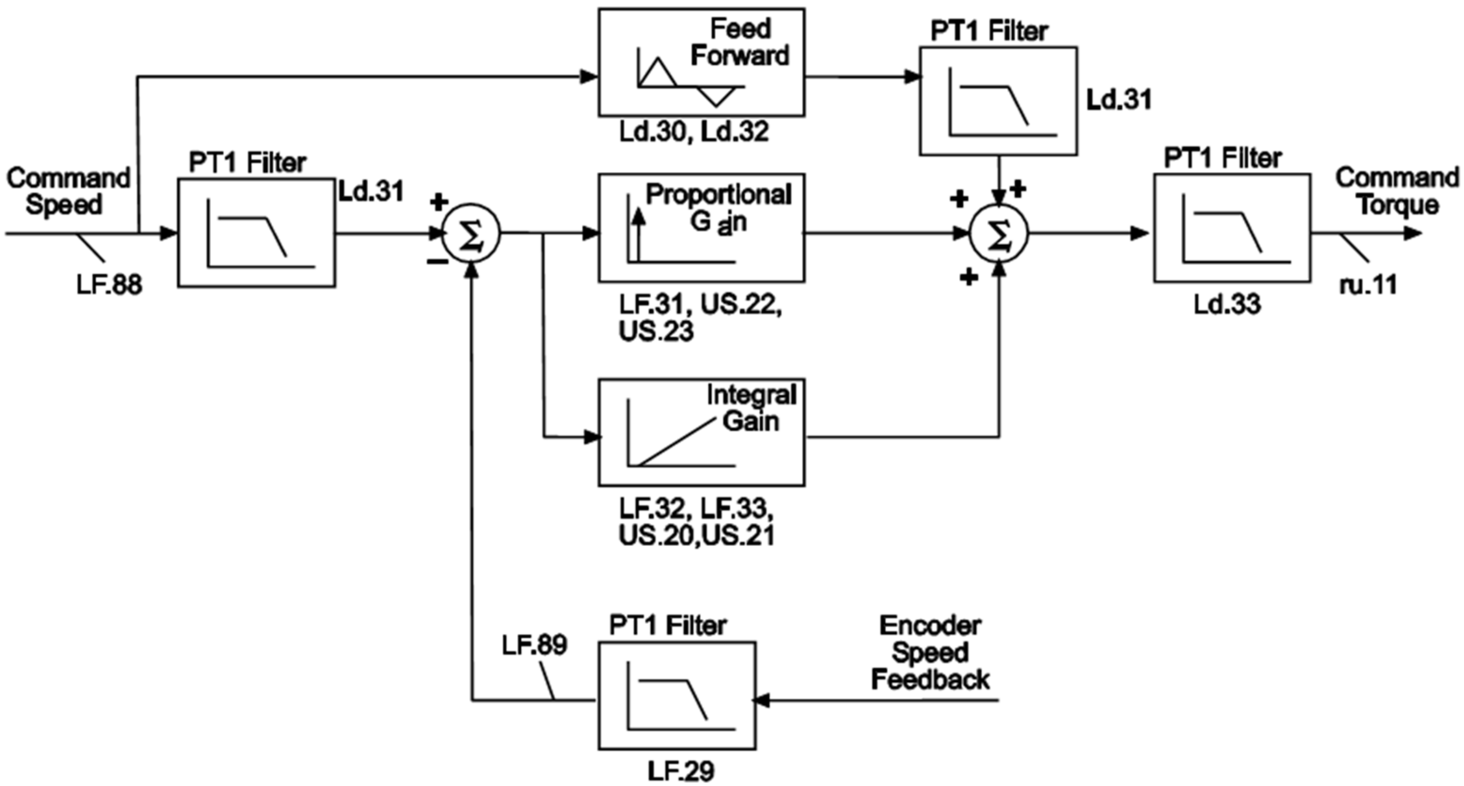


Speed Control – Inertia Learn

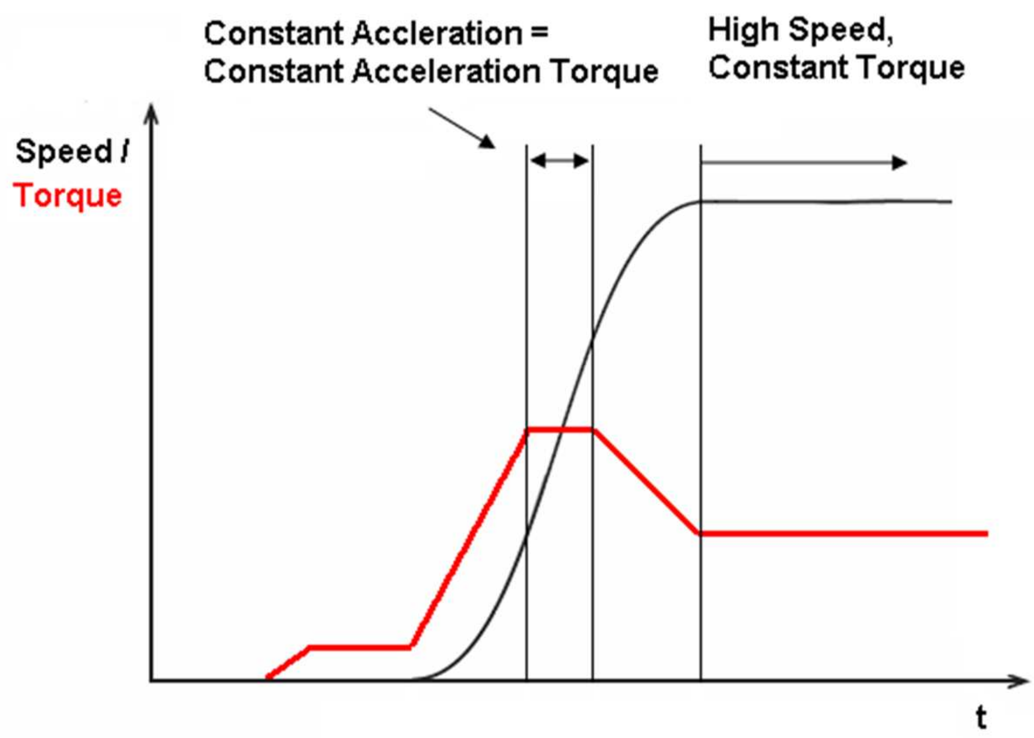
Feed Forward Torque Control

By learning the system inertia, the feed forward torque control is pre-adjusted and activated.

The feed forward torque control uses the learned system inertia in the motor model to make a pre-correction before the encoder feedback, providing a **more dynamic response with little or no further adjustment to the speed control gains** !



Speed Control – Inertia Learn



Ld.24 = Constant Acceleration Torque - High Speed Constant Torque

Speed Control – Inertia Learn

KEB

Preparation

Verify normal automatic operation in both direction, Without excessive current.

↓

Balance car

Verify the torque (not current) in ru.12 is approximately the same value in both the up and down direction. If not, add or remove weight from car as needed. If compensation is not used, adjust weight to best balanced value. Otherwise, compensation & counter weight should be in final adjusted state.

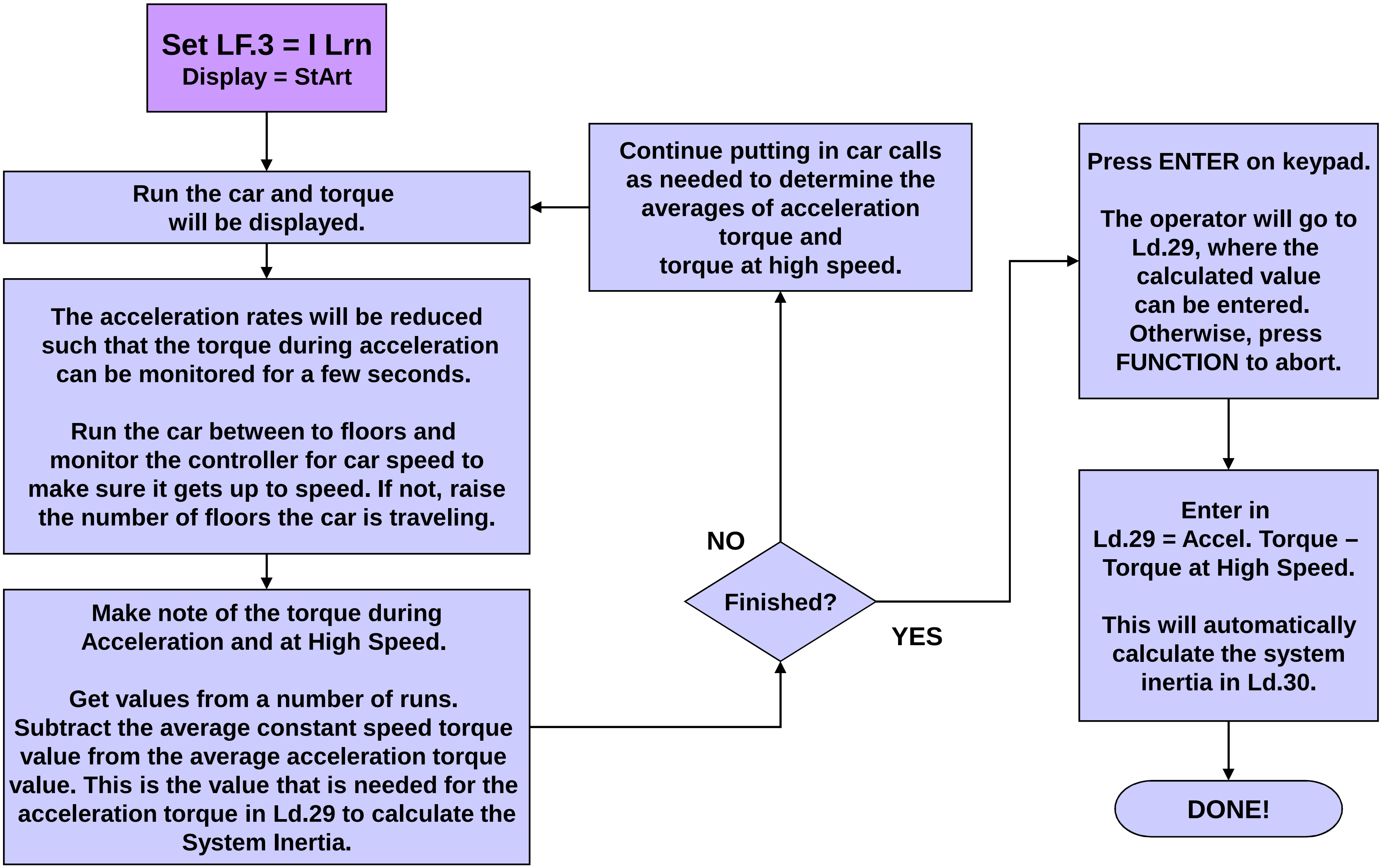
↓

Adjust speed (tach) following error in controller to max value.

↓

Continue

Speed Control – Inertia Learn



Speed Control – Inertia Learn

Feed Forward Torque Control

After learning the inertia, the drive now supports Feed Forward Torque Control.

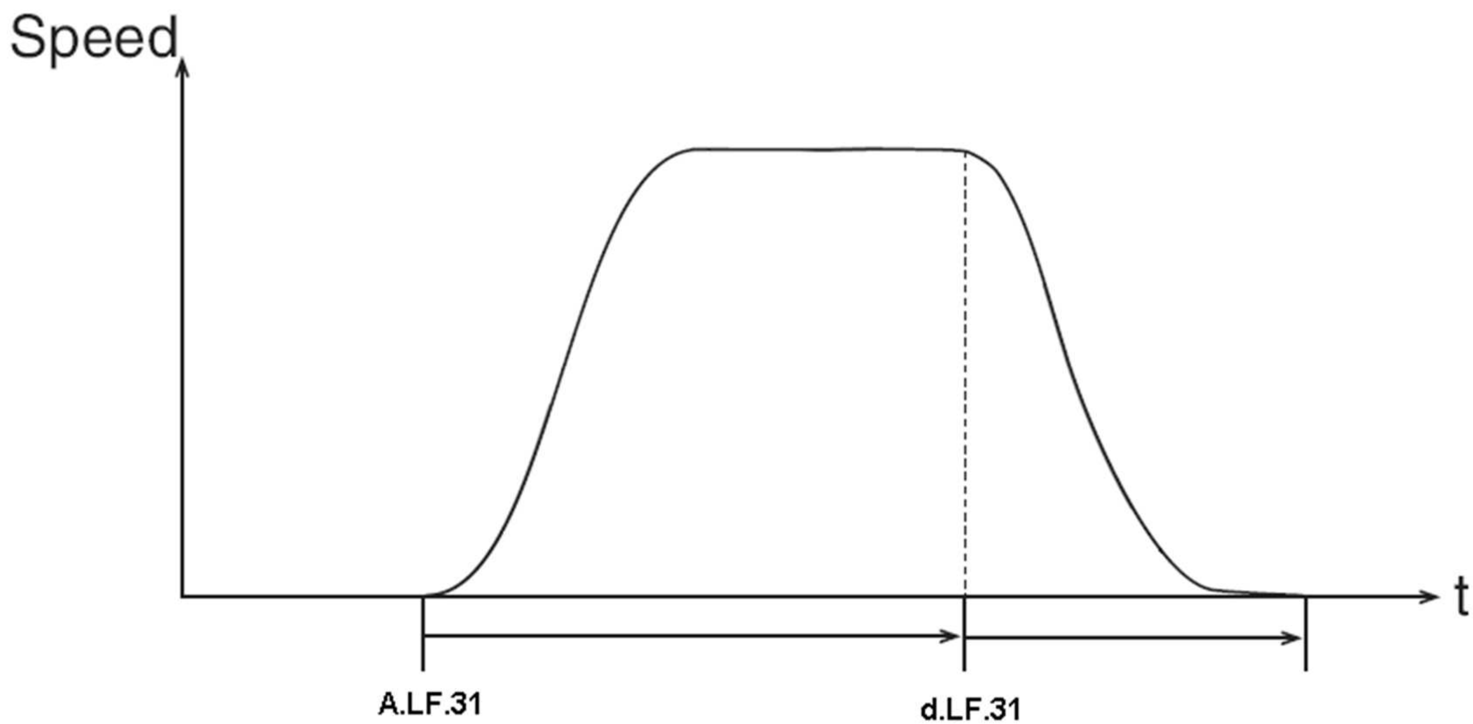
By entering the Acceleration Torque in Ld.29, the Feed Forward Torque Control parameters Ld.30 – 32 will be pre-adjusted.

With the system inertia activated, the integral speed gains A/d.LF.32 and A/d.LF.33 may be reduced by a factor of 5-10 if there is any roughness at initial take-off or final approach. The proportional speed gain may also be reduced, if needed.

If any additional roughness is introduced by learning the system inertia, Ld.31 is a low pass filter used to smooth the command speed. Increasing this value will reduce the response to any inflection points the generated speed profiles (analog, serial). Setting this value too high may cause issues due to the delayed response.

Speed Controller

The speed gains are split into two values, one for acceleration and constant run, and one for deceleration. This is denoted by either ‘A’ or ‘d’ before the parameter.



Note: If the system inertia process was completed, little or no further adjustment of the speed control gains in A/d.LF.31-33 may be needed.

Speed Controller

Proportional Gain

A.LF.31

d.LF.31

P.LF.31

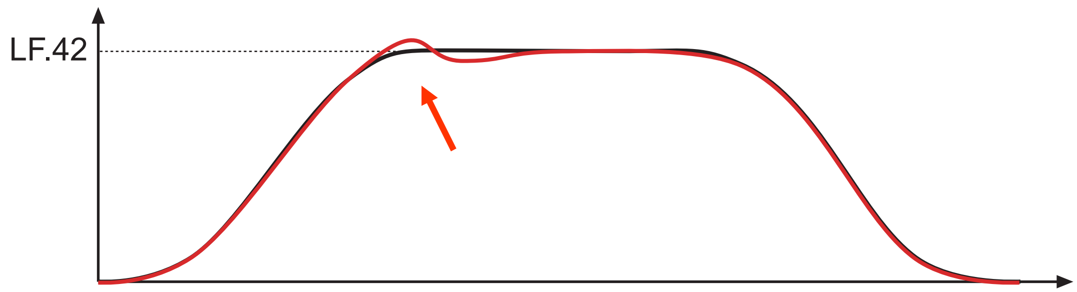
The proportional gain maintains general control and stability over the entire speed range. The proportional gain is split into three values one for acceleration and constant speed (A.LF.31), one for deceleration (d.LF.31) and one for pretorque (P.LF.31

Lower values, less than 1000, may result in loose control and overshoot of the command speed as high speed is reached. Higher values can cause high frequency oscillation or a buzzing sound in the motor. If tighter control is necessary during the start or stop that gain can be raised accordingly in A.LF.31 or d.LF.31.

Speed Controller

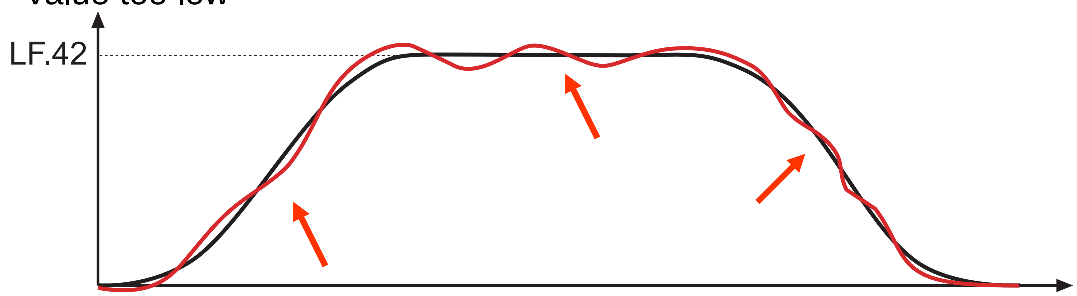
Proportional Gain - common problems and their solutions

High speed over shoot



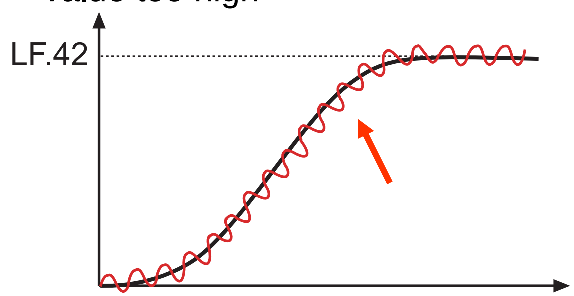
LF.31 = 1000
Actual speed overshoots during transition into high speed. Raise in steps of 500 until overshoot is gone. 1200 is a good number to start.

Value too low



LF.31 = 500
Motor has poor control with strong oscilations. Raise in steps of 500 until better control is achieved.

Value too high



LF.31 = 4500
Loud audible noise or vibration from the motor, lower the value in steps of 500 until the noise/vibration stops.

Speed Controller

Integral Gain

The integral gain is responsible for correcting long term average error in speed as well as providing increase control and rigidity at lower speeds for starting and stopping. The integral gain is split into three values one for acceleration and constant speed (A.LF.32), one for deceleration (d.LF.32) and one for pretorque (P.LF.32).

A.LF.32

d.LF.32

P.LF.32

KI Speed gain

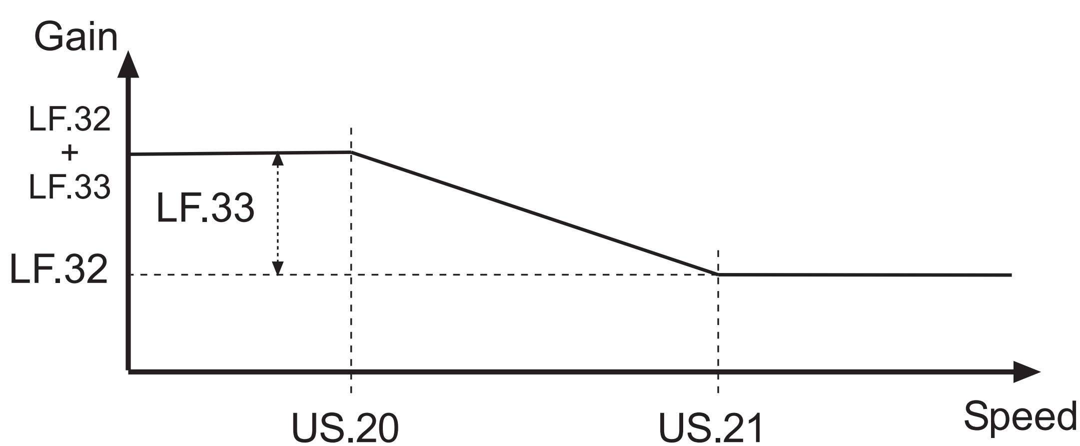
LF.32 provides an overall gain value for all speeds of operation. If this value is becomes too high, greater than 600, it can result in torque pulsations during acceleration and deceleration. If the value becomes too low, less than 250, the tracking of the command speed will suffer and the system may not reach contract speed.

A.LF.33

d.LF.33

KI Offset Speed gain

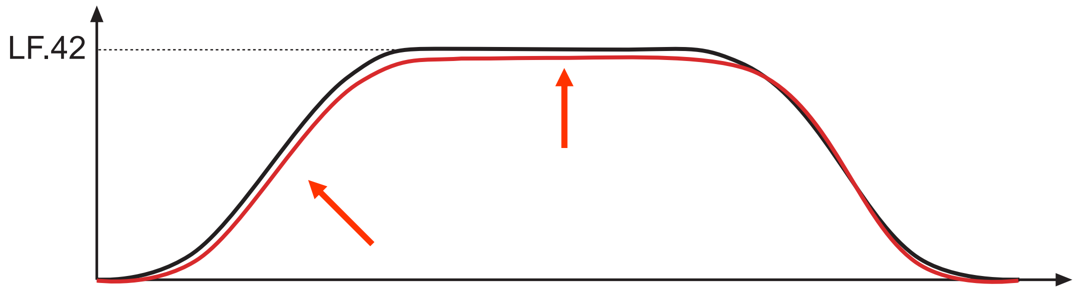
LF.33 provides an offset to the gain value at low speeds. Again this parameter provides two adjustments; one for acceleration and one for deceleration. During starting and stopping it is necessary to have a higher gain values to overcome friction as well as maintain good control. The total integral gain value is the sum of LF.32 and LF.33 at low speeds.



Speed Controller

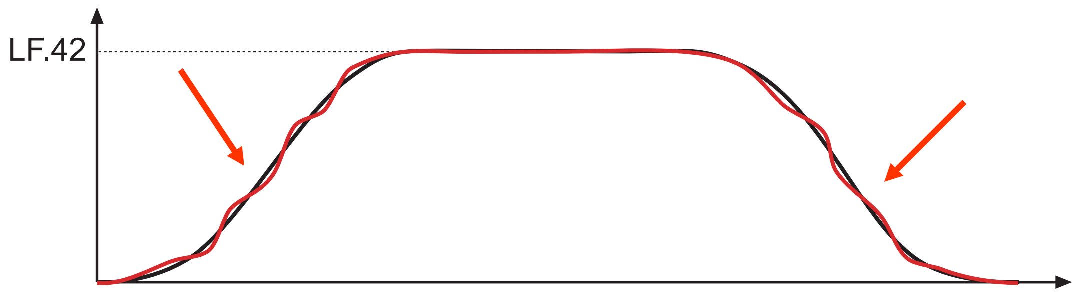
Integral Gain - common problems and their solutions

Value too low



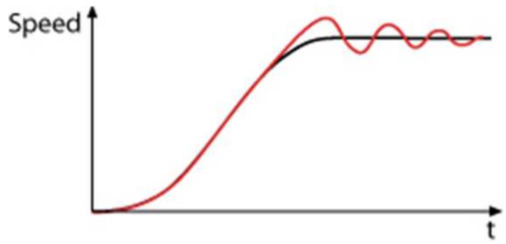
LF.32 = 100
Speed lags the command, sometimes does not reach contract speed, under shoots the floor.
Raise in steps of 100 until better control is achieved.

Value too high



LF.32 = 1500
Acceleration is jerky, bunching or spotting occurs during deceleration. Lower LF.32 in steps of 200. A good range is 300-600.

Value too high

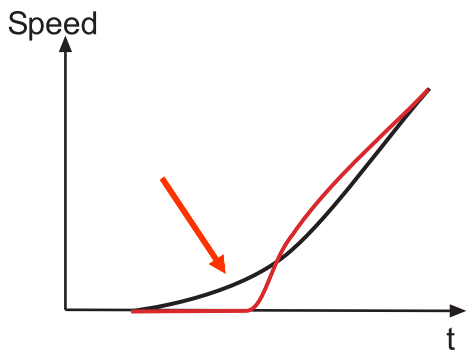


LF.32 = 1500
Ringing after overshoot before speed settles.

Speed Controller

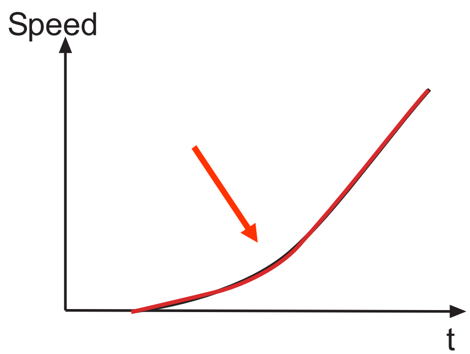
Integral Gain Offset - common problems during starting and their solutions

Value too low



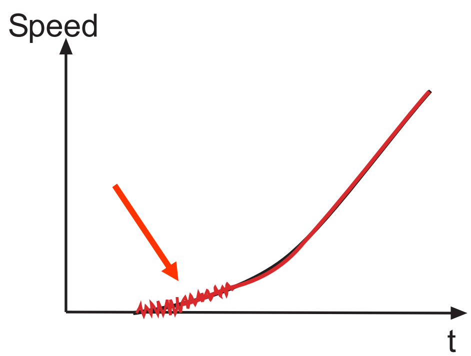
LF.33 = 1000
Speed lags the command, on take off, this is typical with worm gear machines when trying to break free. Raise in steps of 500.

Value correct



LF.33 = 3000
Higher KI Offset value aids the torque build during starting. Helps to over come break away torque of machine. Actual speed tracks the command.

Value too high

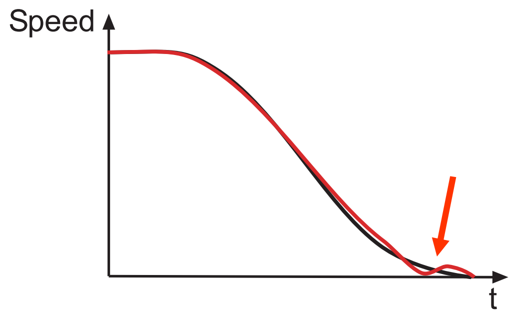


LF.33 = 6000
High KI Offset value causing vibration or audible noise in the motor at take off. Lower in steps of 500.

Speed Controller

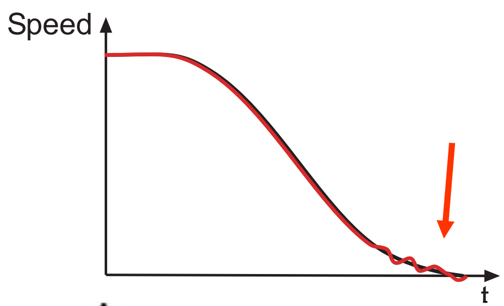
Integral Gain Offset - common problems during stopping and their solutions

Value too low

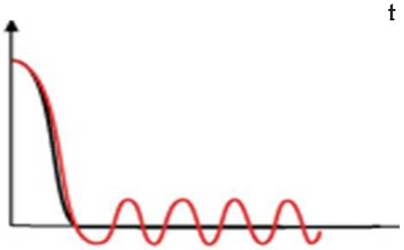


LF.33 = 500
Speed lags during the final phase of decel, one slow oscillation just before stop, under shooting of floor.
Raise in steps of 500.

Value too high

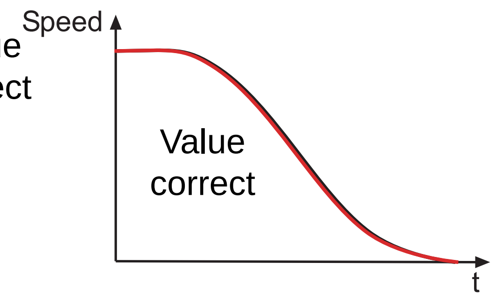


Value too high



LF.33 = 3000
Higher offset value leads to bunching or steps during final approach, faster oscilations.
Can also lead to bouncing feeling during sustained leveling.
Reduce value in steps of 500

Value correct



LF.33 = 1000
Offset value OK

Speed Controller

Filters

There are filters which allow the adjuster to filter out disturbances on the speed and torque command signals.

LF.29

Encoder Sample Time

Sets the sample rate of the encoder signal. With the default setting the actual speed is calculated every 4 mSec. Lower values provide faster response but lower resolution, higher values provide slower response and higher resolution.

Generally a value of 4mSec works well, however it can be that in some cases audible noise from the motor can occur. This arises from disturbance on the encoder signals and or the design of the motor stator. To reduce this audible noise it is often useful to raise the sample rate up to 8 or 16 mSec to filter off the disturbance from the encoder.

Ld.33

Torque Command PT1 Filter

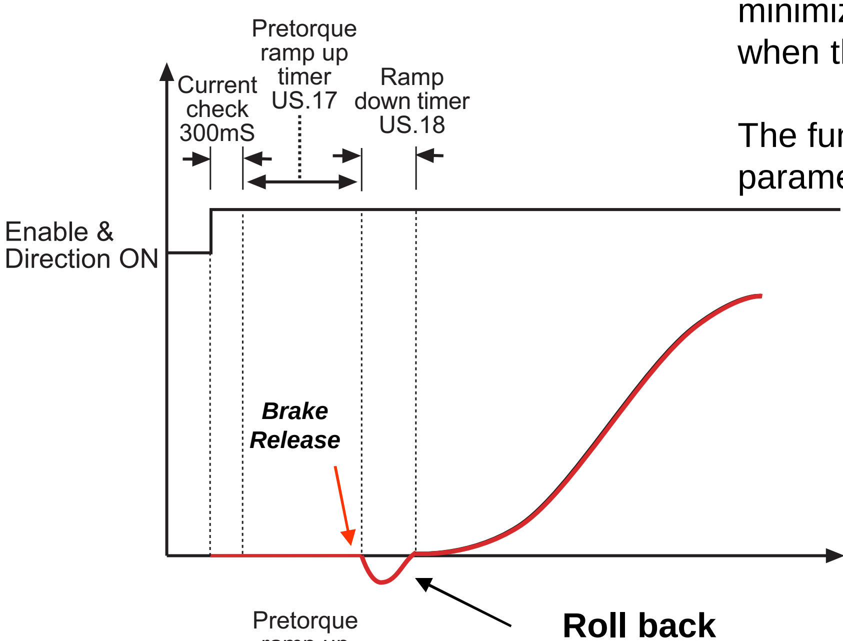
This filter is a low pass filter on the torque command just before it is feed into the current control loop. It is used to reduce high frequency oscillation or audible noise which is sometimes caused by either the KP speed gain being set to a high value, or the encoder sample time (LF.29) being set to a lower value. **Additionally this can be used to minimize audible noise coming from the motor.**

Try different setting in the range of 2mSec – 16mSec. 32mSec or higher may lead to lag in the control response or dampening of control.

Synthetic Pre-Torque

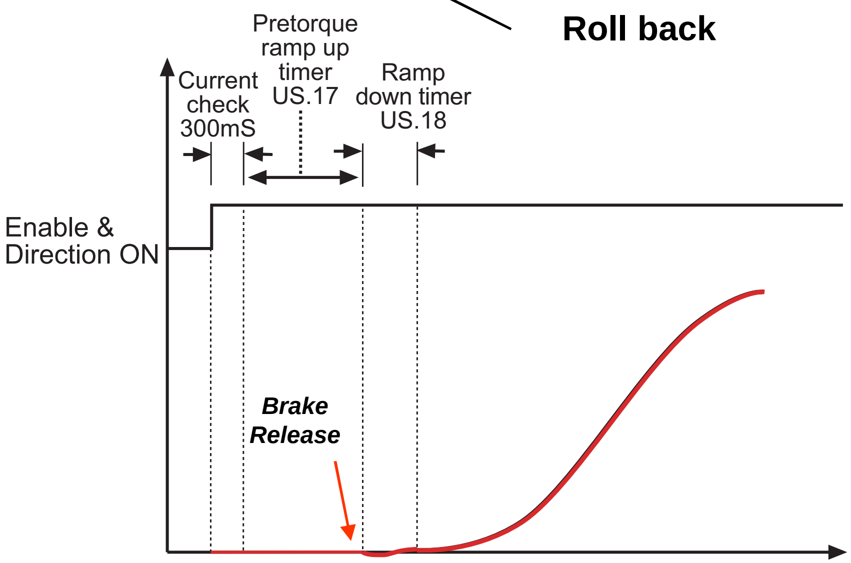
Synthetic pre-torque is a feature of the drive which can be used to minimize if not totally eliminate the roll back which normally occurs when the brake is lifted.

The function is turned on in parameter LF.30 and adjusted in parameters US.17&18 and P.LF.31&P.LF.32.



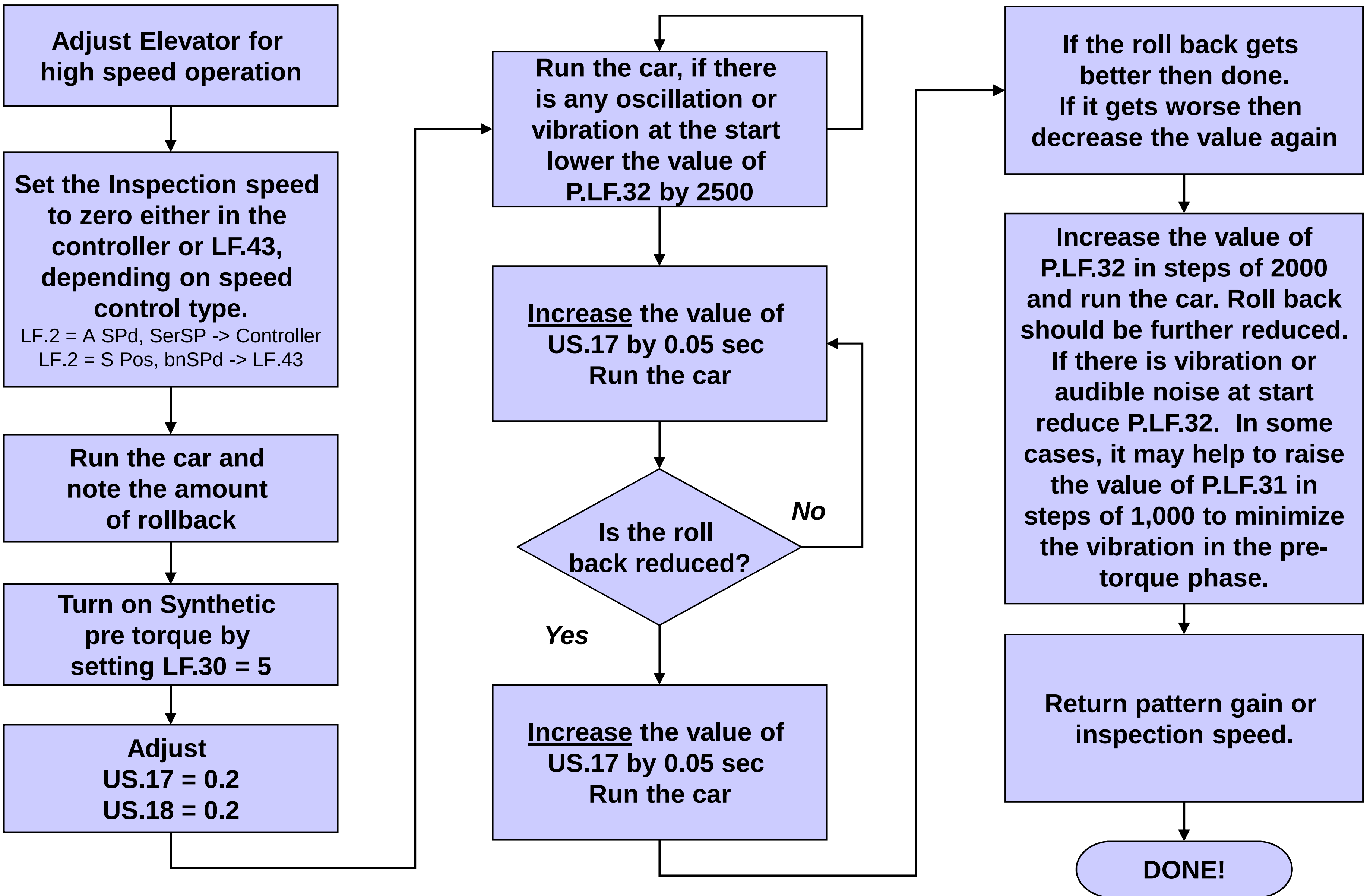
The goal is to adjust timer US.17 such that the pre-torque ramp down phase occurs exactly when the brake releases and the roll back occurs.

Note: by monitoring LF.86 it is possible to see what phase the drive is in. A value of 4 is the ramp up phase and is controlled by US.17. A value of 3 is the ramp down phase.



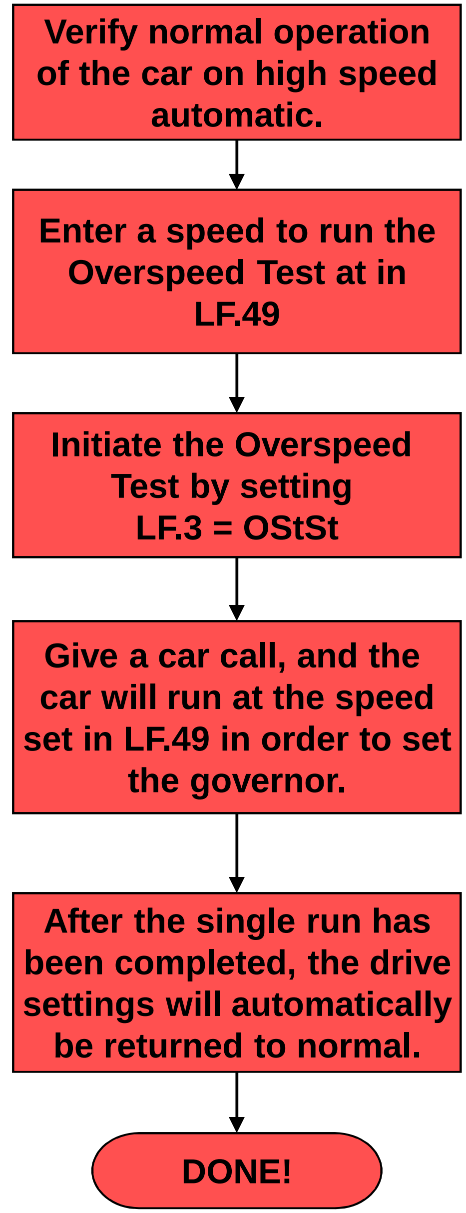
When adjusted properly, the brake should pick, the motor holds the load for a short period ¼ to ½ second, and then the acceleration begins.

Synthetic Pre-Torque



Overspeed Test

The Overspeed Test function allows the drive to run at a higher speed higher than contract speed for one run in order to complete an governor test, then return to normal operation after completion of the run cycle.



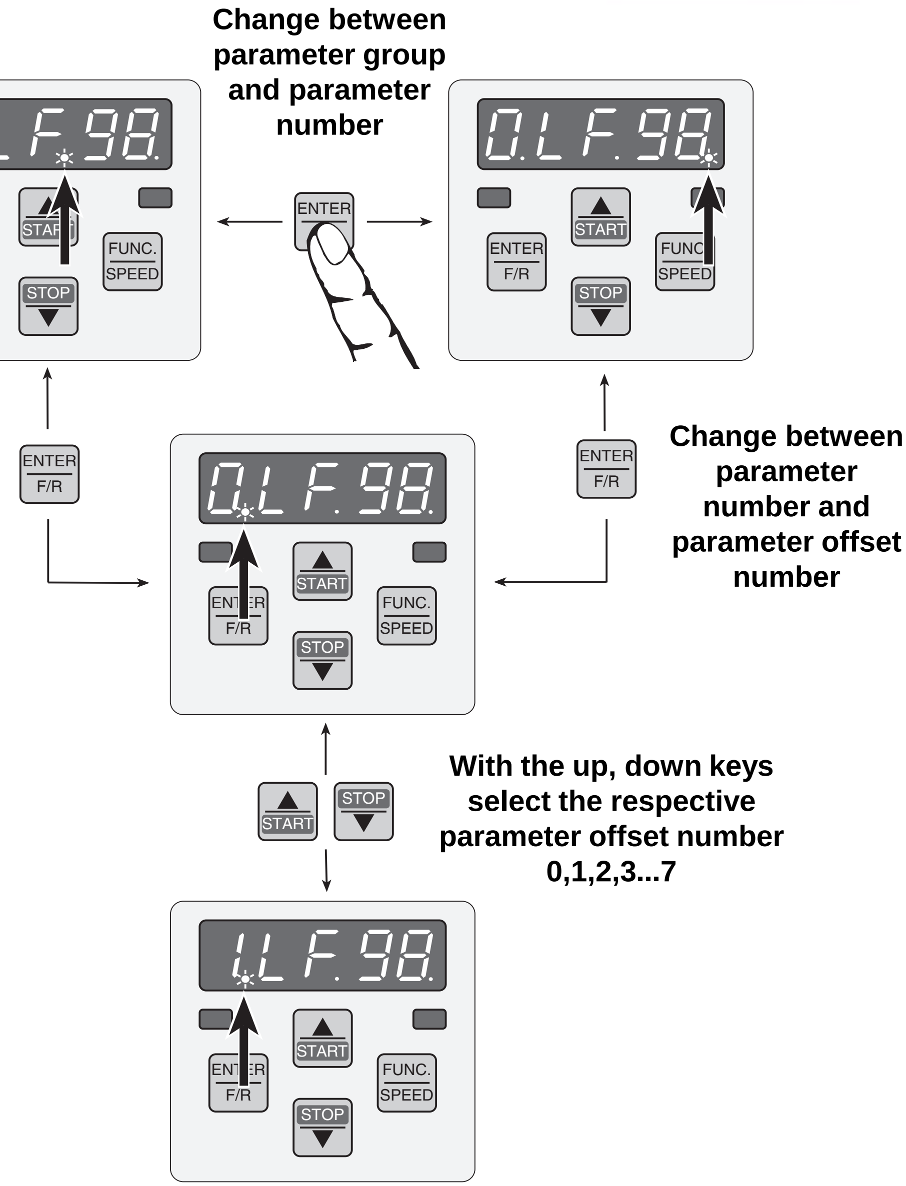
Drive Faults

LF.98

Fault History

Displays the last 8 drive faults which occurred. The fault list can be viewed by changing the number to the left of the LF on the display. This number is the parameter offset number. Zero is the newest fault and 7 is the oldest. See the adjustment steps on the right to view the fault messages. A list of common faults, their causes, and trouble shooting tips is located on the following pages.

Error messages are always represented by an “E” and the corresponding error on the display of the drive. The inverter fault displays are listed and described on the following pages. All faults, except E.ENCC, are automatically reset up to an adjustable number of times. See parameter LF.5.



Clearing the fault history

The fault history can be cleared with the following steps:
Set the display to 0.LF.98
Press Func.
Press the up arrow and the display will change to a number.
Press up or down to scroll to the value 10.
Press enter and the history will be cleared. The message noP will be loaded into all 8 fault histories.

Operation Problems

Problem	Cause	Solution
Machine does not rotate or only turns slightly		
-Machine stalls and draws high current.	- Motor data incorrect.	- Verify correct motor data in LF.10 - LF.19. Verify correct correlation between rated speed, rated frequency and number of motor poles for PM machines: LF.11 = 120 x LF.13 / # poles
	- Encoder rotation incorrect.	- Verify encoder mounting. Note value of LF.77, then relearn the encoder position for PM machines. If the re-learned value is different from the previous value by more than 2,000 then slippage may have occurred on the encoder. For IM machines, check A/B phasing in LF.28,
- No response from inverter.	- Inverter in 'configuration' or 'Stop' mode.	- Set LF.3 = run.
	- Input signals incorrect.	- Verify input terminal state in LF.82 for digital speed selection or analog input in ru.27 for analog speed and inverter state in LF.99 while running inspection.
Sheave rotates very fast and causes E.0S error	- Motor data incorrect.	- Verify correct motor data in LF.10 - LF.19. Verify correct correlation between rated speed, rated frequency and number of motor poles for PM machines: LF.11 = 120 x LF.13 / # poles.
	- Encoder position not correct.	- Verify encoder mounting. Note value of LF.77, then relearn the encoder position for PM machines. If the re-learned value is different from the previous value by more than 2,000 slippage may have occurred on the encoder.
	- Encoder sample time too high.	- Set LF.29 = 4 ms or 8ms.
	- Speed gains too high on unroped machine (PM)	- For an unroped machine, lower speed gains to about LF.31 = 300, LF.32 = 50, LF.33 = 0. Raise again when machine is loaded.

Operation Problems

Problem	Cause	Solution
Unable to learn encoder position with movement (PM) - E.EnC1 errors.	- Motor data incorrect.	- Verify correct motor data in LF.11 - LF.19. Verify correct correlation between rated speed, rated frequency and number of motor poles for PM machines: LF.11 = 120 x LF.13 / # poles.
	- Incorrect encoder rotation.	- Swap A and B encoder channels. Change LF.28 from a value of 0 to 1 or from 1 to 0 and relearn encoder position. Verify process has completed before dropping inspection switch. LF.99 will display 'done', 'Cddr' or 127 when complete.
	- Friction. Sheave unable to move freely.	- Verify brake is opening. If machine is unroped, the sheave should be movable by hand. If machine is roped, move balanced car to a different position in hoistway.
	- Encoder sample time too high.	- Set LF.29 = 4 ms or 8ms.
	- Motor phasing incorrect.	- Verify output connections: U-U, V-V, W-W. For PM machines, phases cannot be swapped to invert motor rotation. If unable to learn position with LF.28=0,1,2,3 swap V-W phases and try again for all values of LF.28.
-E.EnCC errors.	- Determine fault displayed in 2.LF.26 before clearing error and correct as needed.	- 2.LF.26 = PoSde (Position deviation). Verify encoder mounting, uncoil extra lenghts of encoder cable and separate from noise sources, install ferrite rings. - 2.LF.26 = bdCb (Bad Cable). Verify encoder connections, uncoil extra lenghts of encoder cable and separate from noise sources, install ferrite rings. - Verify correct encoder card in 0.LF.26 and encoder type in 1.LF.26. - Check for bent or missing encoder pins.
Elevator fails to reach contract speed	- Torque limit reached.	- Increase torque limit in 0.LF.36.
	- Voltage limit reached.	- Monitor the modulation grade in ru.42. If the value reaches 100% or higher, then the voltage limit is being reached and more output voltage is required than what is being input. Verify input voltage is correct and not sagging. For induction motors try decreasing the field weakening speed to

Operation Problems

Problem	Cause	Solution
Audible Motor Noise		For induction motors, try running open loop (LF.30 = 0). If the issue continues, it is not the speed control or encoder.
-Noise caused from physical vibration.	- Speed gains LF.31 – LF.33 are too high.	- After machine has been roped, start with low gain values and increase as needed. For example, LF.31 = 1,000, LF.32 = 200, LF.33 = 500.
	- Encoder sample time to high.	- Lower LF.29 encoder sample time to 4ms or 8ms.
	- Incorrect motor data.	- Verify LF.11 – LF.19. Use LF.3 = S_Learn function to learn the resistance, inductance, and back EMF if unknown.
-Noise due to electrical noise.	- Encoder sample rate too low.	- Raise LF.29 to 4ms or 8ms. If noise continues, try 16ms.
	- Encoder multiplier too low.	- Set LF.76 = 8 for PM machines.
	- Electric noise coupled on encoder cable.	-To prevent or eliminate motor noise make sure the encoder cables are run through their own conduit away from the motor or line power wires. Keep the encoder cable as short as possible. Do not leave extra lengths of wire coiled up inside the control panel. Make sure the controller is well grounded especially at the disconnect. If necessary run an additional bond wire to the building ground.
	- Incorrect motor data.	-Verify LF.11 – LF.19. Use LF.3 = S_Learn function to learn the resistance, inductance, and back EMF if unknown.
- Squealing noise.	- Incorrect motor data.	- Verify LF.10-LF.19. Relearn motor data with LF.3 = S_Lrn.
Overshoot on deceleration	- Torque limit being reached.	- Increase 0.LF.36. Anytime the LF.17 rated torque is re-entered, the maximum torque is automatically calculated to 150% x LF.17.
	- Decel profiles set too long.	- Adjust decel and jerk levels higher to determine if overshoot caused by signal timing.

Operation Problems

Problem	Cause	Solution
Drive not giving DRO Signal	- Input signals incorrect. - Motor phase current check not passed. - If it is a hardware issue it is possible to test the outputs in the procedures on the right.	- Verify enable and direction signals are being received in LF.82. - If motor phase current check does not pass E.br will be triggered. Check #1: Put car in inspection mode. Prevent brake from releasing (i.e. reduce pick voltage). Set drive for configuration mode, LF.3 = conf. In this mode the drive gives a fake DRO signal when ever the drive is enabled, regardless of whether motor current is flowing. Try to run on inspection. If the controller acknowledges the DRO then the hardware is working. This means the loss of DRO under normal operation may be timing related or possible a problem developing the rated motor current for motor magnetization on induction motors. Check #2: Put the car in inspection mode. On the X2A terminal strip swap the wire connected to terminal 24 and 27. Then swap the wires connected to 26 and 29. You are swapping the relays being used. Then change the settings for do.82 and do.83 and adjust do.42 as needed to invert any output. Try to run the car on inspection. If everything works put the car back on automatic and monitor the controller for dro faults. If this solves the problem, the drive can be left in this configuration. Just be sure to note the changes on the prints.
Cannot overspeed the machine to test governor.	- Inverter overspeed level reached.	- The inverter overspeed level is automatically calculated as 110% of the contract speed in LF.20. The level cannot be changed, although the gear ratio in LF.22 can be raised to cause the machine to turn faster. A value of 1.5 times the existing value will cause the machine to turn 1.5 times faster without trigger the inverter overspeed fault. Return LF.22 to nominal value when overspeed test has been completed.

Operation Problems

Problem	Cause	Solution
Cannot drive full load. Will not pick full load or car only moves in down direction with full load or up direction with empty car.	**Torque limit being reached.** **Motor data incorrect.** **Encoder position incorrect (PM)** **Speed gains too low.**	-Raise the torque limit 0.LF.36. Typicall is 200 – 250% of rated motor torque. -The drive may also be reaching the torque limit if the motor data in LF.11 – LF.19 is incorrect or if the encoder position in LF.77 is encoder. -After the machine has been roped, the speed gains will need to be raised to control the motor. Typical starting values are A/d.LF.31 = 3000, A/d.LF.32 = 250, A/d.LF.33 = 1000.

Drive Faults

Drive Fault	Cause	Solution
E.ENCC Error Encoder Card	- This messaged indicates either the encoder or the encoder card has triggered an error and has requested a drive fault from the CPU.	- For further diagnosis and corrective action, go to parameter 2.LF.26 for the error code from the encoder card. - This error does not auto-reset. It can be cleared by re-entering the existing value in 0.LF.26 after the problem has been corrected.
E.ENC1 Error Encoder	- One or more of the signals A+,A-, B+,B-, Z+,Z- are missing. - One or more of the differential signals are latched, ie. both A+ and A- are positive at the same time.	- Check all the encoder connections as well as the signal levels. All + and – signals should be opposite while the motor is standing still. The minimum voltage level for a valid "ON" state is 2.0V. The maximum voltage level for a valid "OFF" state is 0.5V. The signal levels should conform to the RS485 standard. Z or N channels are not needed; if not connected the Z+/Z- channels MUST be jumpered to 5V/0V.
E.OS Error Over Speed	-The measured speed was greater than 110% of the contract speed. - This can be an actual over speed event of the car	- Verify the motor data in LF.8…LF.19. A wrong frequency or speed value could cause the motor to spin too fast. - Verify the machine data in LF.20…25. The wrong sheave diameter or gear ratio can lead to excessive motor speed. - Verify the ppr number if LF.27. A wrong value could also cause the motor to spin too fast.
E.br Error Low Current	- At the start of each run, the drive tests the motor current. If the current flowing in one or more phases is too low the test fails and E.br is triggered. - PM Contactor damaged - The timing of the closing of the PM contactor to the enable and direction signals is wrong. - Loose connection between the drive and motor or loose connection in the drive.	- Inspect the motor contactor for damage. - Check for loose connections at the motor and motor contactor. - Try to bypass (not simply jumper) the motor contactor. If the problem clears then the issue is the contactor.

Drive Faults

Drive Fault	Cause	Solution
E.buS Error Serial Bus Communication	Serial communication between the operator and the control card has stopped for more than 100mSec. Because the operator has some real time functionality during the operation of the motor, it is necessary to monitor the serial communication between the operator and the main CPU. If this communication stops, the main CPU will trigger a drive fault and thus shut down the drive.	This will occur when ever the operator is unplugged from the drive. It can also happen during drive configuration or during a download of the drive parameters from a PC. Solution is to plug the operator back in or if it is already plugged in to force the operator to re-boot. This can be done by unplugging the operator and then plugging it back in again. If this does not clear the problem, try to reload the configuration US.4 = 1. Change US.29 to 2.00 seconds. *For Diagnostic purposes it is possible to turn off the watch dog by setting US.29 = OFF. This should only be used during trouble shooting.* If this does not work try to swap the operator with another car. If the E.buS error resets, then the original operator has been damaged. Inspect operator for bent or missing pins, then verify connection to inverter.

Drive Faults

Drive Fault	Cause	Solution
E.OL **Error Over Load**	The drive itself is overloaded. Greater than 105% of the drive's rated current is flowing for more than 30 seconds.	- Verify parameter settings, motor connections, and the motor itself. - Look for mechanical problems which would create a high friction load on the machine.
E.OL2 Error Low Speed Over Load	This is a time dependent overload when the output frequency is below 3Hz. Normally when the drive is properly sized this should not be a problem. However if it is, there might be a mechanical cause.	-Verify motor data, particularly LF.11 and LF.13 and encoder position for PM motors. - Make sure brake is opening. - Could be caused if encoder position incorrect.
E.OH Error Over Heat	Heatsink temp of the drive is too high.	- Verify the heatsink temp in parameter ru.38. Under normal operation it should be below 65 C. - Make sure there is adequate air flow through the drive heatsink. -Check for clogged fans or inoperative fans (when heatsink temp is above 45C all fans should be running). - Make sure fans are functioning properly. Run function test US.37 to ensure all cooling fans turn on. Note: In 4 qtr of 2005 the changes were made to the cooling fans such that now the internal cooling fan as well as the heatsink fans remain idle while the heatsink temp is below 45C. This will reduce the amount of dirt and debris which gets pulled into the unit during standby operation.
E.OH2 Error Electronic Motor Overload	The average current flowing to the motor exceeds the setting of parameter LF.12. This parameter should be adjusted to the rated FLA name plate current of the motor.	- Check the motor phase current in LF.93, if the average current is above the FLA of the motor then there could be an adjustment problem or a mechanical load problem. - Verify all motor data and check parameters LF.8 - LF.19. - Check to be sure the encoder is functioning. The motor rpm in LF.89 should be equal to LF.88. - Check for mechanical loading problems.

Drive Faults

Drive Fault	Cause	Solution
E.OP Error Over Voltage	- This error occurs whenever the DC bus voltage rises above 800V for 460V units and 400V for 230V units. - If the fault is triggered while the unit is sitting idle the problem is voltage spikes on the main line. - If the fault occurs while the unit is in operation, it is most likely a problem with the braking resistors.	- Verify the input voltage to the drive. Also look at LF.94 and LF.95 to read the actual and peak DC bus voltage. With 480VAC input the DC bus should be around 675DC and with 230VAC around 325VDC; about a factor of 1.4 time the AC input voltage. A higher ratio or factor may indicate sever harmonic distortion on the AC line. - Install a 5% line reactor on the main line in front of the drive to filter out these spikes. Note: an isolation transformer will not reduce these spikes. They will pass through the transformer. - Check the connection of the braking resistors and the resistance of the resistor assembly. If the resistance is too high, the drive can not dissipate the overhauling energy and the voltage will rise up to the limit.
E.OC Error Over Current	This error occurs whenever there is a phase to phase short or phase to ground short. - Typically it can be triggered by an internal short in the motor, i.e. punch through of the winding insulation either phase to phase or phase to ground. -Another cause for E.OC is an electrical noise problem normally associated with bad grounding of the drive and controller. - Damaged or burned contacts on the motor contactor can also cause this error to occur. - There could be a short in the braking resistor assembly. - If E.OC occurs every time the drive is run, and the error occurs even when the motor leads are disconnected, the problem is a blown power transistor.	- Check the motor winding with a megger. Look for damaged wires connecting the motor to the controller. - Check all ground connections between drive, motor, controller and the main supply. Make sure there is a solid ground connection going all the way back to the main distribution/fuse panel in the building. - Inspect the motor contactor for damage, replace as needed. - Check for shorts to ground or a total resistance value below the acceptable limit. - Power transistor is defective. Replace the drive.

Drive Faults

Drive Fault	**Cause**	**Solution**
E.UP Error Under Voltage	- The DC bus voltage is too low or there is more than a 2% imbalance phase to phase on the main line.	- Verify the input voltage. - Check for main line blown fuses. The phase to phase voltages should be with in 2% of each other. Greater than 2% will result in damage to the drive.
bbL	This is not an error. It is a status in which the power transistors are blocked. This status precedes all faults and can also be triggered if the enable signal is dropped while the motor is running. It is a normal system function.	None

AC Line Regen for Elevators
Training Manual

VERSION 1.3

Regen Wiring

There are two primary wiring schemes for the regen and drive, listed on the next pages.

Wiring Scheme A:

Simplest method.

Regen power goes out the same way motoring power comes in.

Wiring Scheme B:

Requires an additional line reactor and line contactor.

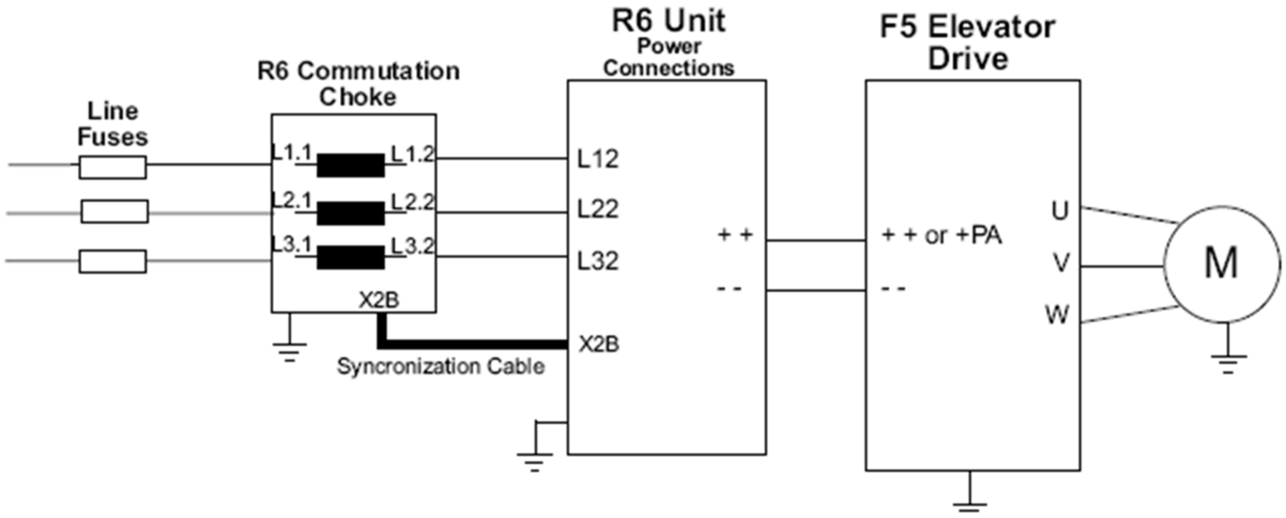
Motor power comes in through the inverter and regen power goes out through the regen unit.

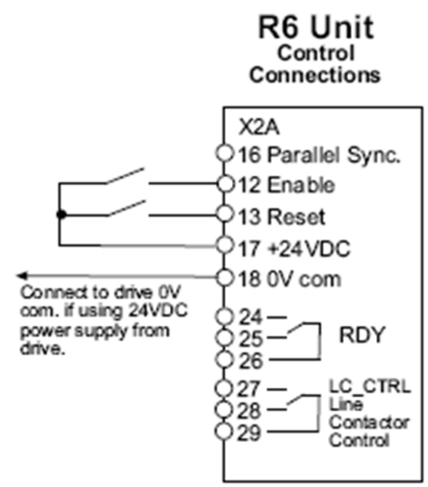
Line contactor is controlled by regen DC Bus level relay. Once the regen unit is powered up, the relay will signal the line contactor to close.

Being able to quickly identify whether Wiring Scheme A or B is used will expedite troubleshooting:

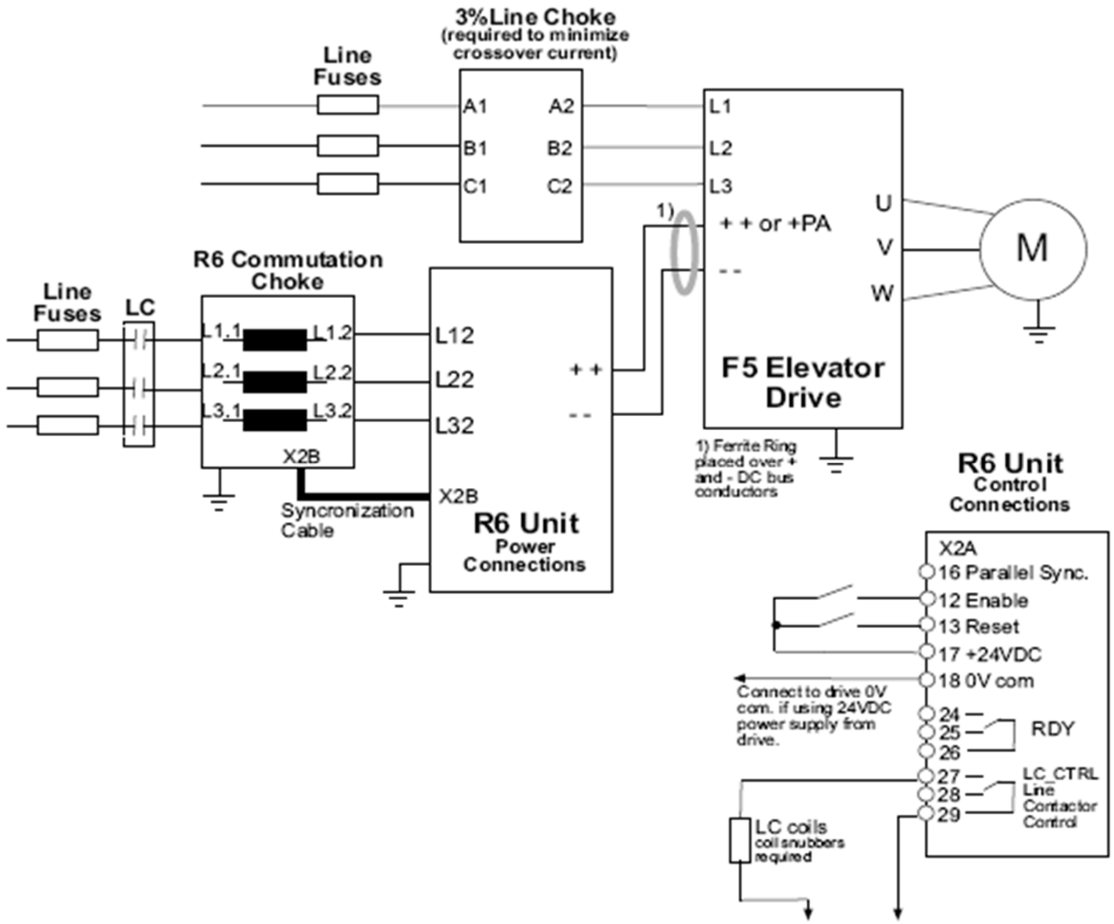
Wiring Scheme A -> No AC on inverter L1, L2, L3; No Line Contactor; Only 1 filter (commutation choke)
Wiring Scheme B -> AC to both inverter inverter and regen unit (after filters); Line Contactor; 2 filters (line reactor in front of inverter and commutation choke in front of regen unit).

Wiring Scheme A



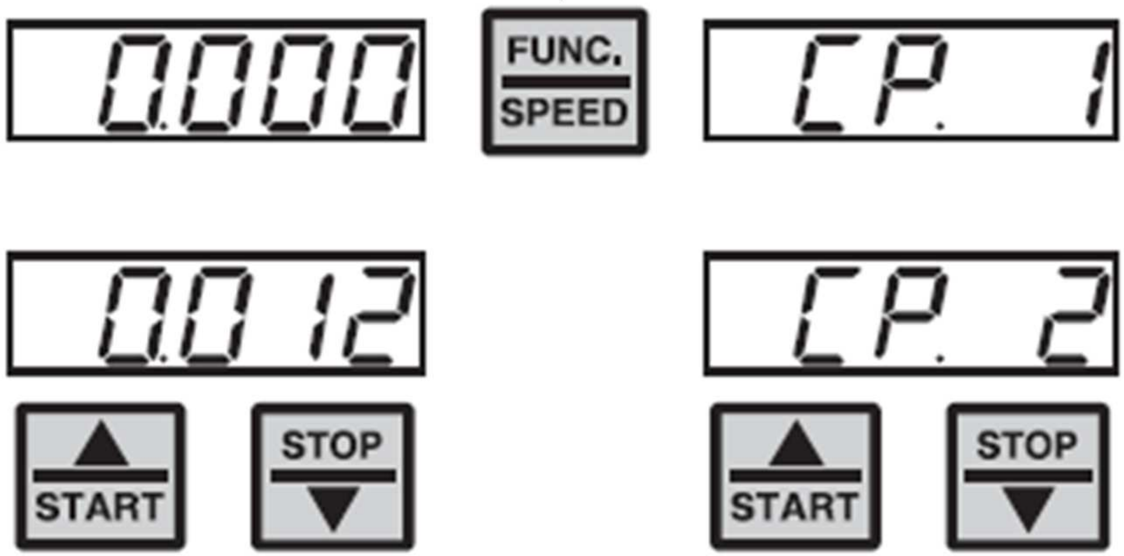


Wiring Scheme B



Regen Keypad Operation

Adjustment of Parameter Values | **Navigation of Parameter Number**



Press

to Save the new value

Parameter Group CP

Regen Parameters

Display	Parameter	Setting range	Resolution	Factory setting
CP.0	Password input	0…9999	1	–
CP.1	Status display	–	–	–
CP.2	Main Line Frequency	–	0.1 Hz	–
CP.3	AC-Phase current L1	–	0.1 A	–
CP.4	AC-Phase current L2	–	0.1 A	–
CP.5	AC-Phase current L3	–	0.1 A	–
CP.6	Actual Load	–	1%	–
CP.7	Actual Load / peak value	–	1%	–
CP.8	DC output current	–	0.1 A	–
CP.9	Actual DC voltage	–	1V	–
CP.10	DC voltage / peak value	–	1V	–
CP.11	Heat sink temperature	–	1°C	–
CP.12	Over load counter	–	1%	–
CP.13	Active power	–	0.1kW	–
CP.14	Total regen kWhr counter	–	0.1kWh	–
CP.15	Total motor kWhr counter	–	0.1kWh	–
CP.16	Total net kWhr counter	–	0.1kWh	–
CP.17	Apparent power / Line input	–	0.1kVA	–

Regen Parameters

Display	Parameter	Setting range	Resolution	Factory setting
CP.18	**Analog output 1 / amplification factor**	**-20.00…20.00**	**0.01**	**1**
CP.19	**DC bus switching level**	**+/-30000.00**	**0.01**	**600**
CP.20	**Auto error reset counter**	**0...10**	**1**	**3**
CP.21	Last Error	-	-	-
CP.22	Last Error 1	-	-	-
CP.23	Last Error 2	-	-	-
CP.24	Last Error 3	-	-	-
CP.25	Last Error 4	-	-	-
CP.26	Last Error 5	-	-	-
CP.27	Last Error 6	-	-	-
CP.28	Last Error 7	-	-	-
CP.29	Software version	-	-	1.2
CP.30	Software date code	DDMM.Y	-	1902.7
CP.31	**Power part ID code**	**-**	**-**	**253**
CP.32	**Pulse off level**	**0.0…-100kW**	**-0.1kW**	**-0.8kW**
CP.33	**Operating mode**	**0…3**	**1**	**0**
CP.34	**Control angle**	**0.0…60.0°**	**0.1 °**	**30.0 °**
CP.35	**Input Type**	**PNP…NPN**	**-**	**PNP**

Adjustable

Regen Adjustment Parameters

<u>The regen unit will require very little or no adjustment from factory default !</u>

The few items that may need setting would be:

CP.31 : Power ID Code. If receiving E.PUCH at first power on, re-enter this parameter. It varifies a change in line voltage (units are tested at 460V). The value has nothing to do with the actual line voltage.

CP.19 : DC Bus Level for Line Contractor Relay Output.

This parameter will **<u>only</u>** need adjustment if **<u>Wiring Scheme B</u>** is utilized.

For a 208V line, it can be set to 250VDC.
For a 460V line, it can be set in the range 550 – 600VDC.

Setting this value too high may cause E.net errors on the regen and E.OP errors on the drive if the DC bus sags and causes the line contactor to open during peak motoring situations (Full Load Up, Empty Down)

Setting this value to low may cause the regen unit to power up simultaneously from the line and from the DC bus connecting the drive, which could cause the internal DC bus fuses or the regen unit to blow.

CP.34 : Control Angle. This parameter adjusts the conduction angle during regen mode. The default value is 30.0 degrees. By lowering this value, the audible sound from the commutation choke can be reduced. The typical adjustment range is 25.0 to 30.0 degrees. Values higher than 36 can result in random E.OC errors. Values lower than 25 can limit the available regen power.

Regen Adjustment Parameters

CP.33 : Operating mode. Parallel Units and Harmonic Filters.

Determines the operating mode of the unit. When more than one unit is connected in parallel it is necessary to set one unit as the master and the remaining unit(s) as slave(s). Likewise, whether a harmonic filter is used instead of a commutation choke.

0: Master with commutation choke
1: Master with harmonic filter
2: Slave with commutation choke
3: Slave with harmonic filter

CP.35 : Input Logic. Whether the digital input logic is PNP or NPN. This would likely be set up by the control manufacturer.

CP.20 : Auto reset counter

This parameter can be used to activate an auto reset counter to reset errors.

A value of 0 means no automatic reset and errors can only be reset via the terminal strip or power cycle.

Values of 1…10 determine the maximum number of times per hour the unit will auto reset an error. If the number of errors exceeds this value, the unit will stop with the last error. Reset will then only be possible via the terminal strip.

Regen Monitoring Parameters

CP.21...28 Last error(s)

The parameters CP.21...28 display the last eight triggered errors with the exception of "Under voltage" E.UP which is not stored. The oldest error is found in CP.28. When a new error occurs, the error message is stored in CP.21. All previous error messages are shifted by one to the next parameter. The oldest error in CP.28 is lost. The meaning of the error codes can be found in the description for CP.1.

Note: The error log cannot be cleared. But, you may force a distinct error, E.EF, by jumpering X2A terminals 15 and 17.

Also, of interest may be the power monitors found in CP.14 – 16 that monitor the amount of energy used and regenerated. Knowing the utility rate, you'd be able to give customers a $$$ savings.

CP.14 Total regen

Counter of the total regenerated electrical energy returned to the line in kWh.

CP.15 Total motor

Counter for the total supplied electrical energy from the line in kWh.

CP.16 Total net

Display of the difference between supplied and regenerated energy. The sign of the value displayed indicates a net energy supply from the line (+) or return to the line (-).

Regen Operation

Turn-on procedure
The regen unit is initialized after connection of the main line supply. The power circuit identification is checked first. If an invalid power circuit is recognized, error E.PuCi (power unit check) is triggered and displayed in the operator. This error cannot be reset, the power circuit must be checked.

If a valid power circuit is recognized, The regen unit changes into status "Syn". The following procedures take place one after another during this synchronisation phase:
Verification of correct synchronisation to the line, (error E.nEt is triggered, if the synchronization signals are missing)

Verification of the phasing of the synchronization signals to the main line phases. Error E.Syn is triggered if a phase signal is missing or in case the phasing is not correct.
The actual line frequency is determined. If the frequency is outside the set window the unit will trigger an E.FnEt fault
The unit is now ready for operation. If the enable (terminal I1) is activated, the regen unit is put into operation. Depending on the actual value of the DC bus voltage, the regen unit is in status rEgEn or Stdby.

Status Stdby
The regen unit detects the idle voltage level in the DC bus circuit of the connected frequency inverter (motor operation) and keeps the modulation signals of the regen unit deactivated.

Status rEgEn
If the DC bus voltage rises above 103% of the idle voltage (CP.9), the modulation signals are activated and the unit changes into regen operation. Alternately, if another regen unit connected in parallel switches into rEgEn mode, the slave unit will immediately switch into regen mode simultaneously.

Regen Status and Faults

CP.01 Status display

The status display shows the actual operating mode of the regen unit.
Possible displays and their meanings are:

rEgEn	Regen active (regeneration operation)
bbL	base-block time, Unit is blocked from operation for a short period - follows all errors.
noP	"no Operation" the enable input is not activated, output modulation switched off
nEtoF	Line power failure; Regen operation mode is possible
Stdby	The unit is enabled but in stand-by operation (motoring operation)
Syn	Phase synchronization mode, checks connection and phase angle of the line voltage
E.dOH	Error: Over temperature commutation choke; temperature sensing on the commutation choke is indicating the choke is too hot and the overheat delay timer has run out.
E. EF	Error: External Fault, error trigger by an external device through one of the digital inputs
E.nEt	Error: Line, one or more phases are missing, line contactor is open
E.FnEt	Error: Line Frequency, line frequency too high or low.
E.nOH	Error: NO Over Heat, over-temperature condition not present (E.OH error can be reset)
E.nOL	Error: NO Over load, cooling period after E.OL is over, error can now be reset
E. OC	Error: Over current, output current too high or ground fault
E. OH	Error: Over temperature, overheating of the heat sink (see "technical data")
E.OHI	Error: Regen Unit interior temperature too high, temperature in the interior > 95℃
E. OL	Error: Over Load, the actual load was greater than 105% and the overload timer timed out.
E. OP	Error: Over Voltage, DC bus voltage is too high, > 900VDC
E.PuC	Power unit identification is invalid
E.SYn	Error: Synchronization, connection of line phases at the commutation choke is not correct
E. UP	Error: Under voltage, line voltage too low

Regen Troubleshooting

Fault	Cause	Solution
E.net **Wiring Scheme B**		**E.nEt errors may occur after a previous error. Check error log for pattern.**
	Line Contactor Open	- Verify DC bus level for line contactor to close in CP.19. - If it occurs when trying to carry a load, the DC bus may be sagging. View DC bus level in CP.9 and adjust CP.19 below the lowest value by 25VDC.
	Loss of line phase	- Occurs when going into regen. Abrupt switch to regen may cause line notching and be perceived as a momentary phase loss. Reduce level at which regen begins by adjusting cs.2 = 101% (requires application level password)
Wiring Scheme A	Transformer secondary is delta.	- Line regen systems require the use of a center-grounded wye secondary.
	Loss of line phase	- Occurs when going into regen. Abrupt switch to regen may cause line notching and be perceived as a momentary phase loss. Reduce level at which regen begins by adjusting cs.2 = 101% (requires application level password)
	Transformer secondary is delta.	- Line regen systems require the use of a center-grounded wye secondary.
E.PuCh Error Power Unit Code Changed	The control card is reading a different power stage ID number. This typically happens when the control card is installed in a different sized or voltage drive.	To manually clear this error, go to parameter CP.31 and re-enter the existing value to confirm the change.

Regen Troubleshooting

Fault	Cause	Solution
E.Sync Connection of commutation signals from choke not detected.	Bad synch. Cable connection. Bad Synch. Cable Crossed Connections Bad Synch. Module	- Replug in both ends of synch cable. - Replace CAT5 cable. - Inputs from line to synch. module on choke are phased incorrect. Try different combinations for these inputs. - Replace synch. choke. Try the above first.
E.Fnet Line Frequency too high or too low.	Phase imbalance. 'Dirty' construction power.	The issue is with the main line phasing. If it continues to be an issue on permanent power, there is a possible solution to delay the auto-reset to allow for more time before resetting.
Too much audible noise from commutation choke.	Control Angle	- Lower the control angle in CP.34 to 24. Lowering this value too low may reduce the response to the peak regen capacity.