BLAIN HYDRAULICS

EV4

User Manual

Software Versions 1310, 3310, 3350, 3351

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For technical support please contact

Dr. Ferhat Celik

Tel: +49-7131-282139

Fax: +49-7131-485216

Email: ferhat.celik@blain.de

For sales and spare parts inquiry (Refer to Annexure 1) please contact

Sales

Tel: +49-7131-28210

Fax: +49-7131-485216

Email: info@blain.de

TABLE OF CONTENTS

1. GENERAL INFORMATION 5
1.1 SAFETY PRECAUTIONS & GENERAL WARNINGS 5
1.2 PRODUCT INTRODUCTION 5
1.3 WARANTY INFORMATION 6
2. VALVE SETTINGS AND HYDRAULIC LAYOUT 7
2.1 PRESSURE RELIEF VALVE ADJUSTMENTS 9
3. ELECTRICAL INSTALLATION 12
3.1 MAIN AND CONTROL CIRCUIT WIRING 12
3.2 SIGNAL (INPUT) CONNECTIONS 14
3.3 SINK MODE – TRANSISTOR INPUT SIGNAL USING 0V COMMON 14
3.4 SOURCE MODE – TRANSISTOR INPUT SIGNAL USING +24V COMMON 14
3.5 TEMPERATURE SENSOR AND CONVERTER 15
3.6 CONNECTING PERIPHERALS DEVICES 15
3.7 USING DIGITAL OPERATORS 15
4. START UP 22
4.1 VALVE INSTALLATION 22
4.2 MAINS & CONTROL CIRCUIT WIRING 22
4.3 SWITCHING THE MAIN POWER ON 22
4.4 INITILIAZATION OF THE DRIVE 22
4.5 CHECK MOTOR ROTATION DIRECTION 22
4.6 MOTOR TUNING 23
4.7 AUTO-TUNING 23
4.8 BASIC AUTO-TUNING PREPARATIONS 23
4.9 ROTATIONAL AUTO-TUNING 24
4.10 AUTO-TUNING FOR EXISTING POWER UNITS (MOTOR & PUMP SUBMERSED IN OIL) 25
4.11 PERFORMING ROTATIONAL AUTO TUNING 26
4.12 AUTO-TUNING EXAMPLE 26
4.13 STATIONARY AUTO-TUNING 27
4.14 CHECKING MOTOR SLIP (E2-02) 27
4.15 checking motor no-load current (E2-03) 27
4.16 obtaining motor parameters (E1-xx & E2-xx) for some known motors 27
4.17 INITIAL PARAMETER SETTINGS 28
4.18 TYPES OF PARAMETERS 28
4.19 TARGET CURVE PARAMETERS 28
4.20 EFFECTIVE RAMP TIME 30
5. TEACHING FUNCTION 31
5.1 STEP 1: CHECKING TARGET CURVE 31

5.2 STEP 2: INPUTTING P1-XX PARAMETERS; OIL, PUMP & ELEVATOR DATA....33
5.3 OBTAINING PUMP DATA FROM BLAIN EV4 CALCULATOR (www.blain.de/calc)....34
5.4 STEP 3: SET P4-01=1....35
5.5 STEP 4: TEACH RUN....36
5.6 STEP 5: ALM LED....36
5.7 STEP 6: PERFORM AN EMPTY CAR TEACH RUN.....36
5.8 STEP 7: SAVE or WRTP....37
6. TRAVEL PARAMETERS....38
6.1 P3-xx TYPE PARAMETERS: FREQUENCY REFERENCE & LOAD REFERENCE SETTINGS....38
6.2 P4-01 PARAMETER: OPERATION MODE SELECTION....39
6.3 P5-xx PARAMETERS: SETTING COMPENSATION LIMITS....39
6.4 P6-xx PARAMETERS: PARAMETERS FOR DWELL FUNCTIONS....39
6.5 P7-xx PARAMETERS: PARAMETERS FOR LEVELING RECOVERY FUNCTION....40
6.6 P8-xx PARAMETERS: PARAMETERS FOR SPECIAL TUNING....41
6.7 MONITORING PARAMETERS....41
6.8 SETTING UP EXAMPLE....42
7. DRIVE SEQUENCE AND RUN COMMAND....44
7.1 TRAVEL PROCEDURE....44
7.2 verifying correct signaling from lift controller....45
7.3 TRAVEL STOP....45
7.4 REFERENCE AND RUN SOURCE....45
8. SPECIAL FUNCTIONS....46
8.1 DECELERATION TIME COMPENSATION....46
8.2 LEVELING SPEED CONTROL....46
8.3 LEVELING TIME CONTROL....47
9. ENERGY SAVING MODE/OVERLOAD OPERATION....48
10. Missellenous functions....49
10.1 parameter access level (A1-01)....49
10.2 setting up user initilization values (o2-03)....49
10.3 copy function (o3-01)....49
10.4 Drive initilization (a1-03)....49
10.5 Monitor parameters (UX-xx)....50
11. FINE ADJUSTMENTS & TROUBLESHOOTING....51
11.1 UP DIRECTION TRAVEL....51
11.2 DOWN DIRECTION TRAVEL....53
12. ANNEXURE 1 – MOTOR PARAMETERS....55
13. ANNEXURE 2 – LIST OF SPARE PARTS....56
14. ANNEXURE 3 – EV4 PACKAGE DETAILS....57
15. ANNEXURE 4 – POWER UNIT DESIGN....58

1. GENERAL INFORMATION

1.1 SAFETY PRECAUTIONS & GENERAL WARNINGS

Installation, operation and servicing of the **EV4-vvvf** package should be performed by qualified personnel. Before installing the EV4 package, the "**Quick Start Guide** and **Technical Manuals**" of L1000V/L1000A and this "**EV4 User Manual**" should be read, understood, and all safety precautions mentioned in these documents and warnings must be followed. The **EV4-vvvf** package must be installed according to the descriptions in Technical Manuals, the EV4 User Manual and the local codes.

Blain's EV4 valve Inverter

Figure 1: EV4 valve and L1000H drive

1.2 PRODUCT INTRODUCTION

The EV4 package consists of (Annexure 2);

1) EV4 valve
2) Yaskawa L1000H drive
3) Temperature sensor
4) Temperature converter
5) Yaskawa line filter
6) Yaskawa AC reactor
7) Quick Start Guide (QSG-included in the inverter box)
8) EV4 User Manual

L1000H drive architecture is based on L1000V (up to 15kW) and L1000A (above 15kW), however it has modified software designed for hydraulic elevators. Though some overlapping functions of L1000V/L1000A have been removed for general drive functions, users should consult the Yaskawa's L1000V/L1000A Technical Manuals or L1000H Quick Start Guide whenever referring is made to these manuals.

Verify receipt of the correct valve and drive type by checking the information on the nameplate. The selection and application of EV4 package remains the responsibility of the elevator manufacturer or end user.

kW size	Inverter model	AC reactors model	Line filter model
3	CIMR-LC4V00**07**FAA-0011	B 0903**084** or B 1103136	FS23639-**15**-07
4	CIMR-LC4V00**09**FAA-0011		
5.5	CIMR-LC4V00**15**FAA-0011	B 0903**085** or B 1103138	FS23639-**30**-07
7.5	CIMR-LC4V00**18**FAA-0011		
11	CIMR-LC4V00**24**FAA-0011	B 0903**086** or B 1103**139**	FS23639-**50**-07
15	CIMR-LC4V00**31**FAA-0011	B 0903**087** or B 1103**140**	
18,5	CIMR-LC4A00**39**BAC-09110	B 0910009 or B 1103**141**	FB-40044A
22	CIMR-LC4F00**45**BAC-09120		FB-40060A
30	CIMR-LC4F00**60**BAC-09120	B 0910011 or B 1103**142**	
37	CIMR-LC4F00**75**BAC-09120		FB-40105A
45	CIMR-LC4A00**91**BAC-09110	B 0910013	
55	CIMR-LC4A0**112**BAC-09110		FB-40170A
75	CIMR-LC4A0150BAC-09110		

EV4 valve has been designed to use L1000H Yaskawa inverter for the up travel, whereas the down travel is managed mechanically. Nevertheless, a limited control of down direction travel is also provided optionally to provide better riding quality in down travel. Functionality of EV4 valve is tested and down direction adjustments are done in the factory.

Necessary inverter parameters for the up direction are set by the user. An on-line calculator at **http://www.blain.de/calc** or a smartphone app called "EV4 Calculator" is available on **Google Play app store** to assists the user to obtain correct set-up parameters.

EV4 valve can be installed either on a new or an existing power unit without necessitating to change the motor and the pump or the whole power unit.

With a worn-out pump the contracted car speed may not be reached within the nominal and synchronous motor speed range. Leakage from the worn-out pump may become excessive with loaded car or/and warm oil therefore, increasing motor speed may not provide higher flow rate. In such a case, replacement of the pump is necessary.

If motor stalls with loaded car, either switch into the energy saving mode or reduce speed.

Yaskawa L1000H drive (inverter) contains sophisticated, specially designed hydraulic elevator software to provide highest level of ride quality regardless of the changes in load and oil temperature. The current L1000H drive (based on L1000V) is utilized at heavy duty mode for motors up to 15kW (20HP) power size. Motors from 16kW (22HP) or above should use L1000H drives based on L1000A(1) series.

EV4 has been designed to offer not only an energy-efficient but also an economically effective solution. It provides better ride quality, saves energy and diminishes the inrush current. In addition, EV4 offers 4 different travel speeds, all of which are adjustable. These are shown in ***Table 1***.

Speed	Explanation	Setting Range
Nominal speed	Nominal travel speed	0.05 to 1.00 m/s
Intermediate speed	Used for short floor to floor distances	0.05 to 1.00 m/s
Inspection speed	Used during inspection	0.05 to 0.30 m/s
Leveling speed	Used for approaching to the floor	0.00 to 0.15 m/s

Table 1: Speeds used by EV4-vvvf

The order of speed magnitudes should be Nominal Speed > Intermediate Speed > Inspection Speed > Leveling Speed otherwise, oPE12 error is given by the drive

1.3 WARANTY INFORMATION

The Yaskawa L1000V/L1000A/L1000H Technical Manuals, Quick Start Guides and Blain's EV4 User Manual are provided for qualified personnel, who are competent in installing, adjusting and servicing of hydraulic elevators. Blain Hydraulics assumes no liability for any personal injury, property damage, losses or claims arising from in appropriate use of EV4 product or incompetence of the installer.

Warranty expires: If components or spare parts that are different than the original ones are installed, and the elevator system or EV4 is installed or serviced by unqualified personnel.

If the EV4 package is installed in any location without applying the elevators safety codes (EN81-20/50, ASME 17.1 or the existing local code).

2. VALVE SETTINGS AND HYDRAULIC LAYOUT

EV4 valve is a modified version of EV series of mechanical valve therefore; it can be easily utilized by people who have little experience with Blain valves. As shown in *Figure 1*, apart from the pressure relief valve, all up direction adjustments and up solenoids are cancelled. This is because of the fact that flow control in up direction is performed by the L1000H Yaskawa inverter. Adjustments in down direction however, are the same as in EV100 as shown in the hydraulic layout.

¾" EV4 *1½" EV4* *2½" EV4*

Figure 2: EV4 valve sizes

EV4 valves include the following essential features:

Simple Responsive Down Adjustment
Temperature and Pressure Compensation
Built-in Turbulence Suppressors
Pressure Gauge and Shut Off Cock
Self-Closing Manual Lowering
Self Cleaning Pilot Line Filters
Self Cleaning Main Line Filter (Z-T)
70HRc Hardened Bore Surfaces
100% Continuous Duty Solenoids

Technical data		**¾" EV4**	**1½-2" EV4**	**2½" EV4**
Flow range	l/min (USgpm)	10-125 (2-33)	30-800 (8-212)	500-1530 (130-405)
Pressure range	bar (psi)	8-55 (73-797)	8-55 (44-797)	8-55 (44-797)
Burst Pressure Z	bar (psi)	575 (8340)	505 (7324)	340 (4931)
Pressure Drop P–Z	bar (psi)	6 (88) at 125 lpm	4 (58) at 800 lpm	4 (58) at 1530 lpm
Weight	kg (lbs)	5 (11)	10 (22)	14 (31)
Oil Viscosity		25-75 cSt. at 40°C (104°F)		
Max. Oil Temperature		55°C (131°F)		
Insulation Class, AC and DC		IP 68		
Solenoids AC	24 V/1.8 A, 42 V/1.0 A, 110 V/0.43 A, 230 V/0.18 A, 50/60 Hz			
Solenoids DC	12 V/2.0 A, 24 V/1.1 A, 42 V/0.5 A, 48 V/0.6 A, 80 V/0.3 A, 110 V/0.25 A, 196 V/0.14 A			

Up travel Up to 1 m/s (197 fpm). 2 Full Speeds and 1 Leveling Speed, 1 Inspection speed. Up Start, speeds transition times and up stop are adjusted by inverter parameters.

Down travel Up to 1.0 m/s (197 fpm). 1 Full Speed and 1 Leveling Speed. All down functions are smooth and adjustable.

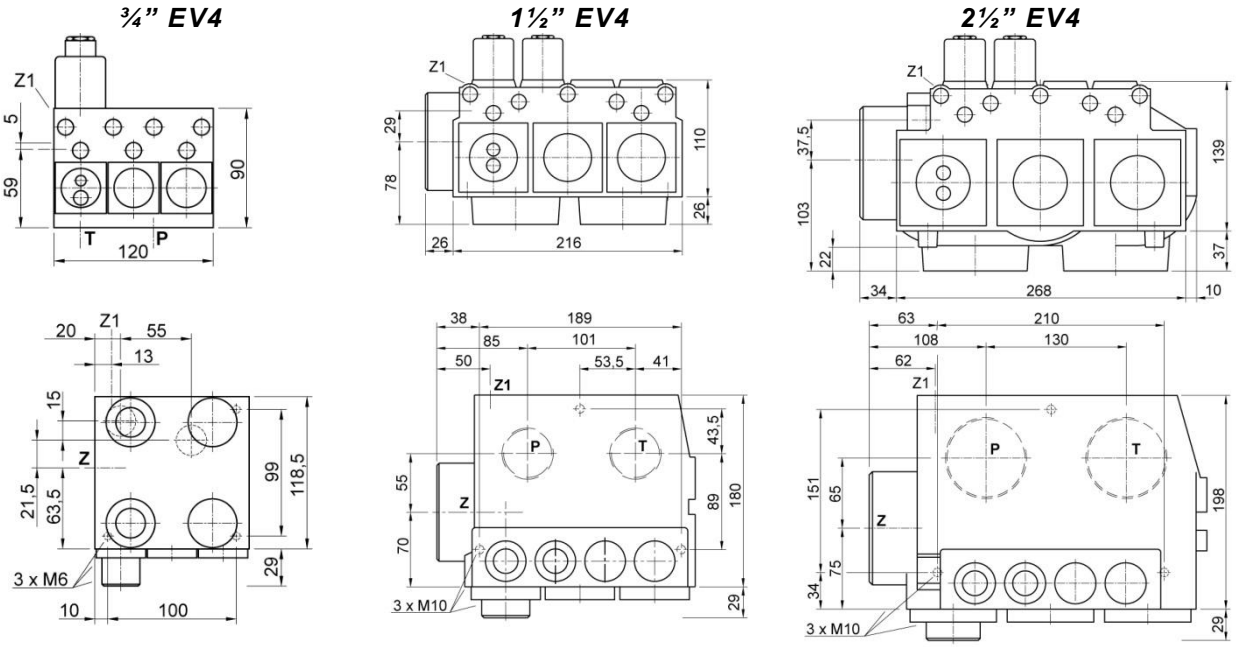


Figure 3: EV4 valve dimensions

Optional Equipment

EN	Emergency Power Solenoid	DH	High Pressure Switch
CSA	CSA Solenoids	DL	Low Pressure Switch
KS	Slack Rope Valve	CX	Pressure Compensated Down
BV	Main Shut-Off Valve	HP	Hand Pump
HX/MX	Auxiliary Down		

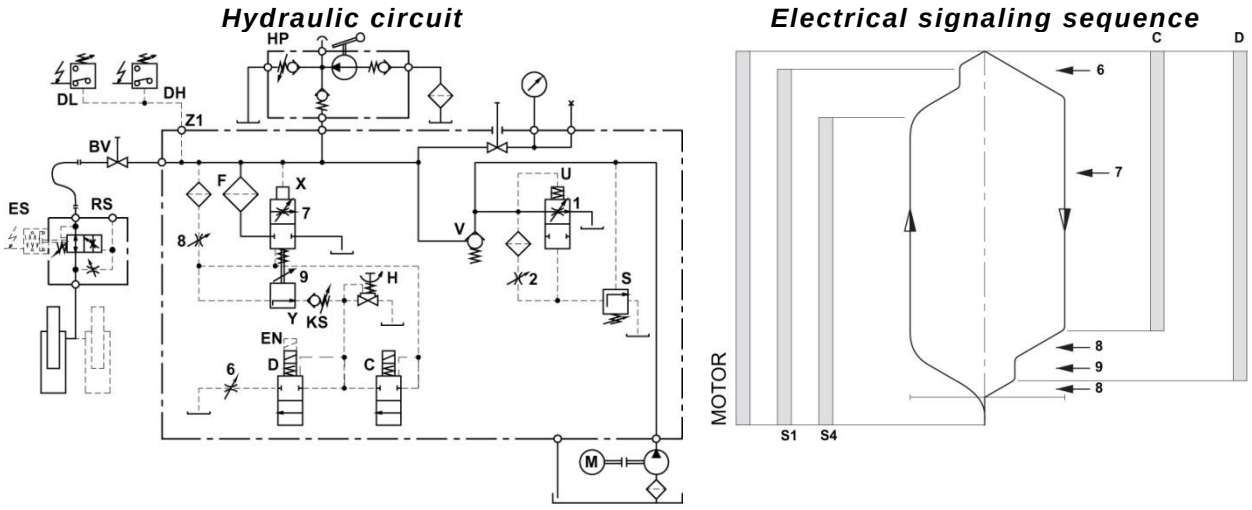


Figure 4: Hydraulic circuit and electrical signaling sequence

Control Elements

C	Solenoid (Down Deceleration)	U	By Pass Valve	6	Down Acceleration
D	Solenoid (Down Stop)	V	Check Valve	7	Down Full Speed
H	Manual Lowering	X	Full Speed Valve (Down)	8	Down Deceleration
S	Relief Valve	Y	Leveling Valve (Down)	9	Down Leveling Speed
		F	Filter		

DOWN Adjustments

	WARNING: Only qualified personnel should adjust or service valves. Unauthorized manipulation may result in injury, loss of life or damage to equipment. Prior to servicing of internal parts, ensure that the electrical controller is switched off and residual pressure in the valve is reduced to zero. **Valves are already checked for functionality.** Check electrical operation before changing inverter settings. Please refer to the EV4 inverter manual for necessary parameter settings.

2.1 PRESSURE RELIEF VALVE ADJUSTMENTS

S Relief Valve: In (clockwise) produces a higher, out (c-clockwise) a lower maximum pressure setting. After turning out, open manual lowering **H** for an instant.

Important: When testing relief valve, do not close ball valve sharply

DOWN Adjustments

Valves are already adjusted and tested. Check electrical operation before changing valve settings. Test that the correct solenoid is energized, by removing nut and raising solenoid slightly to feel pull.

Nominal Settings: Adjustments **7** & **9** approx. level with flange face. Two turns in either direction may then be necessary. Adjustments **6** & **8** turn all the way 'in' (clockwise), then 1.5 turns 'out' (c-clockwise). One final turn in either direction may be necessary.

6. Down Acceleration: When solenoids **C** and **D** are energized, the car will accelerate downwards according to the setting of adjustment **6**. 'In' (clockwise) provides a softer down acceleration, 'out' (c-clockwise) a quicker acceleration.

7. Down Speed: With solenoids **C** and **D** energized as in **6** above, the full down speed of the car is according to the setting of adjustment **7**. 'In' (clockwise) provides a slower down speed, 'out' (c-clockwise) a faster down speed.

8. Down Deceleration: When solenoid **C** is de-energized whilst solenoid **D** remains energized, the car will decelerate according to the setting of adjustment **8**. 'In' (clockwise) provides a softer deceleration, 'out' (c-clockwise) a quicker deceleration. **Attention: Do not close all the way in! Closing adjustment 8 completely (clockwise) may cause the car to fall on the buffers.**

9. Down Leveling: With solenoid **C** de-energized and solenoid **D** energized as in 8 above, the car will proceed at its down leveling speed according to the setting of adjustment **9**. 'In' (clockwise) provides a slower, 'out' (c-clockwise) a faster down leveling speed.

Down Stop: When solenoid **D** is de-energized with solenoid **C** remaining de-energized, the car will stop according to the setting of adjustment **8** and no further adjustment will be required.

KS Slack Rope Valve: Solenoids **C** and **D** must be de-energized! The KS is adjusted with a 3 mm Allan Key by turning the screw **K** 'in' for higher pressure and 'out' for lower pressure. With **K** turned all the way 'in', then half a turn back out, the unloaded car should descend when Manual Lowering **H** is opened. Should the car not descend, **K** must be backed off until the car just begins to descend, then backed off a further half turn to ensure that with cold oil, the car can be lowered as required.

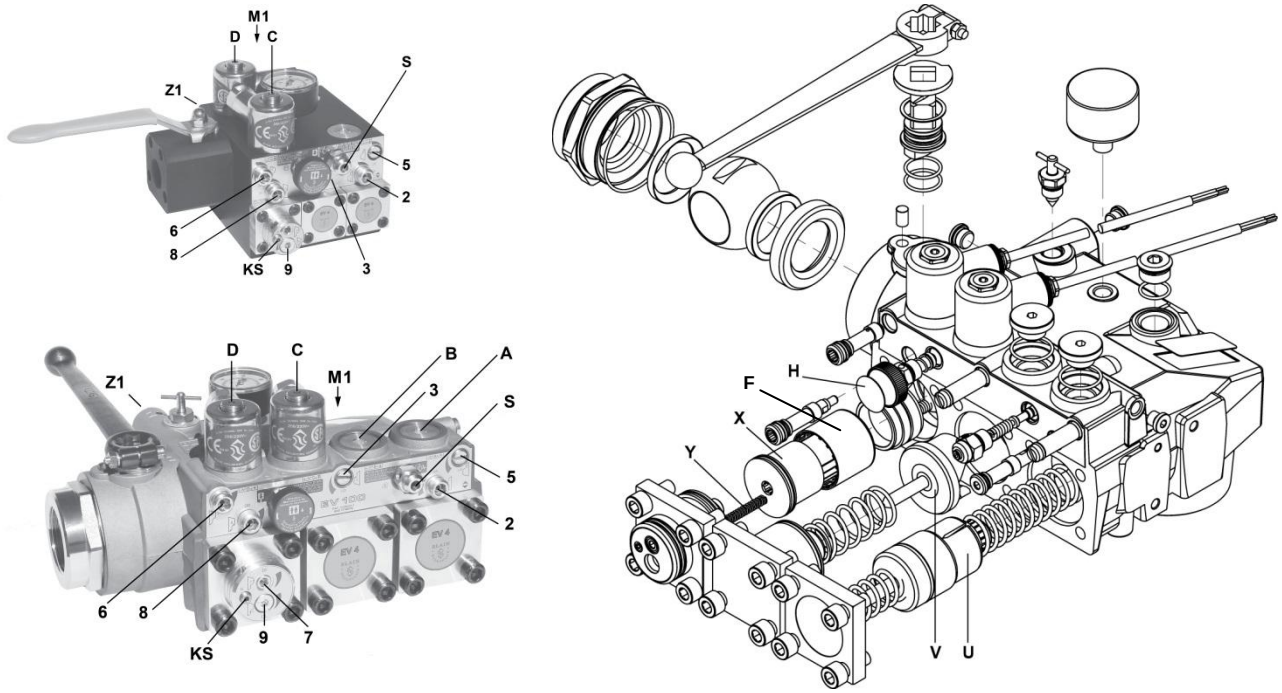


Figure 5: EV4 adjustments and explosion drawing

Control Elements

C	Solenoid (Down Deceleration)	U	By Pass Valve	**DOWN Adjustments**	
D	Solenoid (Down Stop)	V	Check Valve	6	Down Acceleration
H	Manual Lowering	X	Full Speed Valve (Down)	7	Down Full Speed
S	Relief Valve	Y	Leveling Valve (Down)	8	Down Deceleration
		F	Filter	9	Down Leveling Speed

EV4 Spare Parts List

EV4

Pos.	No.	Item
1	FS	Lock Screw - Flange
	FO	O-Ring - Flange
	1F4	Flange - By Pass
	UO	0-Ring - By Pass Valve
	U4	By Pass Valve
	UD	Noise Suppressor
	UF1	Spring - By Pass
	UF2	Spring - By Pass
	US	Dead Stop
2	2	Fixed orifice
3	3	Plug
4	4F4	Flange - Check Valve
	FO	0-Ring - Flange
	VF	Spring - Check Valve
	VO	Seal - Check Valve
	V4	Check Valve
5	3	Plug
6	3	Adjustment - Down Acceleration
7	7F	Flange - Down Valve
	FO	0-Ring - Flange
	7O	0-Ring - Adjustment
	7E	Adjustment - Down Valve
	UO	0-Ring - Down Valve
	XO	Seal - Down Valve
	X	Down Valve
	XD	Noise Suppressor
	F	Main Filter
8	8	Adjustment - Down Deceleration
9	EO	0-Ring - Adjustment
	9E	Adjustment - Down Levelling
	9F	Spring - Down Valve
	Y	Down Levelling Valve
H	H	Manual Lowering - Self Closing
	HO	Seal - Manual Lowering
S	SE	Adjustment - Screw
	SM	Hexagonal
	MS	Grub Screw
	SO	0-Ring - Nipple
	SZ	Nipple
	SF	Spring
	SK	Piston
A+B		Solenoid plugs
C+D	MM	Nut - Solenoid
	M	Coil - Solenoid (indicate voltage)
	DR	Tube - Solenoid 'Down'
	MO	0-Ring - Solenoid
	DF	Spring - Solenoid 'Down'
	DN	Needle - 'Down'
	DK	Core - Solenoid
	DG	Seat Housing with Screen-'Down'
	FD	Filter Solenoid
	DS	Seat - Solenoid 'Down'

Some parts occur more than once in different positions of the valve.

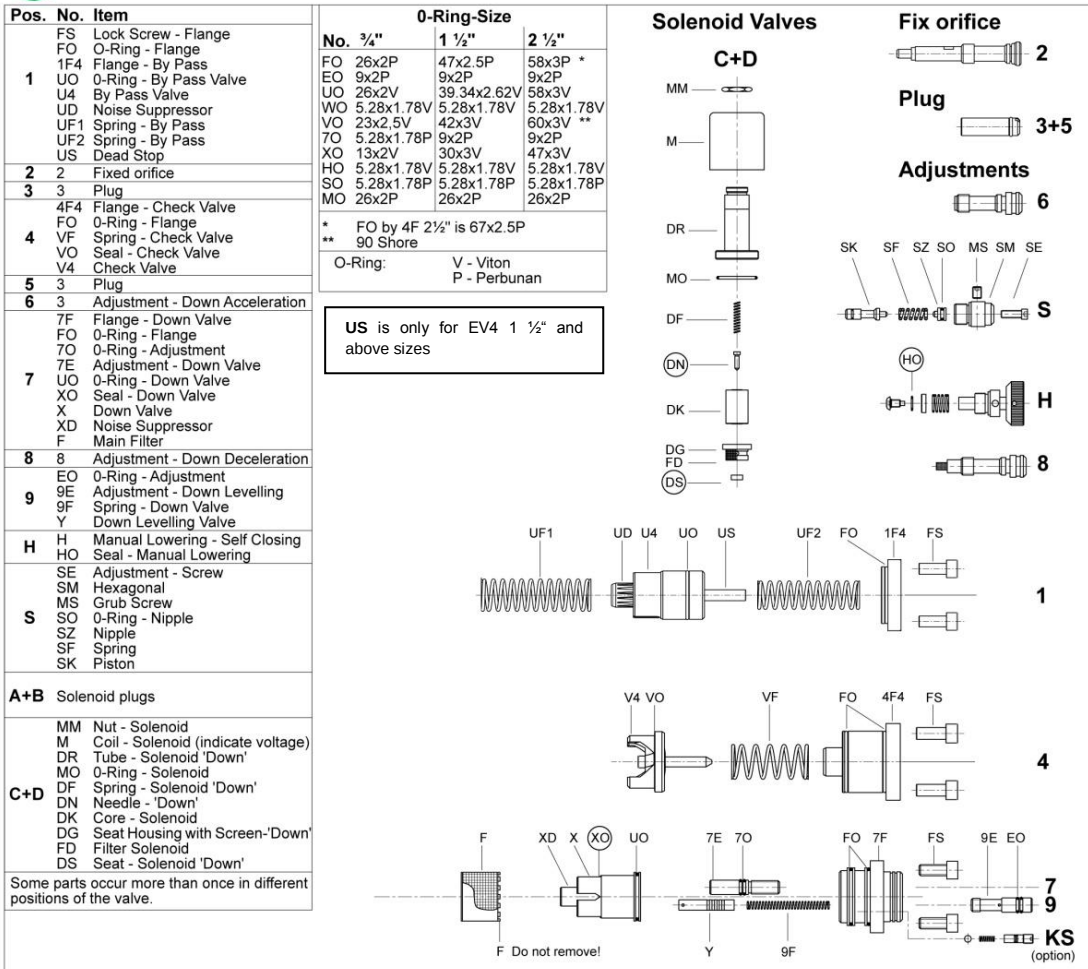
0-Ring-Size

No.	¾"	1 ½"	2 ½"
FO	26x2P	47x2.5P	58x3P *
EO	9x2P	9x2P	9x2P
UO	26x2V	39.34x2.62V	58x3V
WO	5.28x1.78V	5.28x1.78V	5.28x1.78V
VO	23x2,5V	42x3V	60x3V **
7O	5.28x1.78P	9x2P	9x2P
XO	13x2V	30x3V	47x3V
HO	5.28x1.78V	5.28x1.78V	5.28x1.78V
SO	5.28x1.78P	5.28x1.78P	5.28x1.78P
MO	26x2P	26x2P	26x2P

* FO by 4F 2½" is 67x2.5P
** 90 Shore

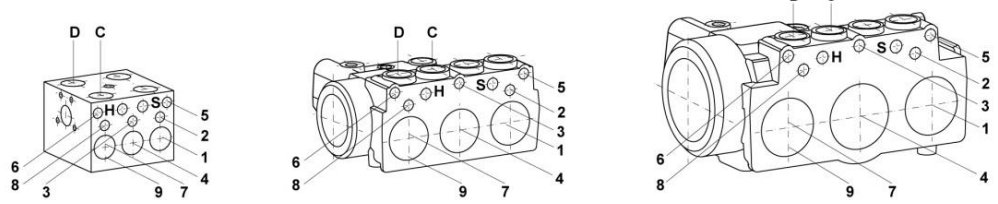
O-Ring: V - Viton, P - Perbunan

US is only for EV4 1 ½" and above sizes

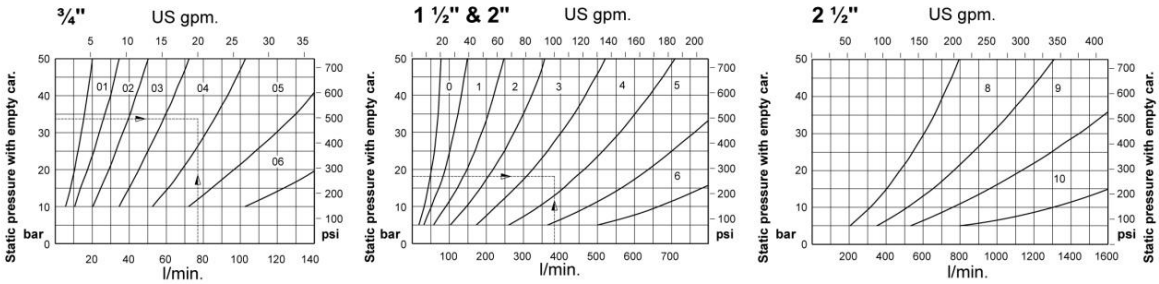


In case of down leakage, replace and test in the following order: (DS) & (DN), (XO), (VO), (WO), (FO) + (HO).

Taper threads: Do not exceed 8 turns of piping into the valve connections.



Flow Guide Selection Charts for Down Direction



To order EV4, state pump flow, empty car pressure (or flow guide size) and solenoid voltage.
Example order: EV4, 380lpm, 18 bar (empty), 110 AC ≡ EV 100/4/110AC

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Figure 6: Spare parts & flow guide selection charts for down direction-EV4

3. ELECTRICAL INSTALLATION

	All drive connections should be carried out according to the instructions in the Technical Manuals of L1000V/L1000A and Quick Start Guide of L1000H by qualified personnel. Technical Manuals can be downloaded from http://www.blain.de/EV4/downloads***.***

3.1 MAIN AND CONTROL CIRCUIT WIRING

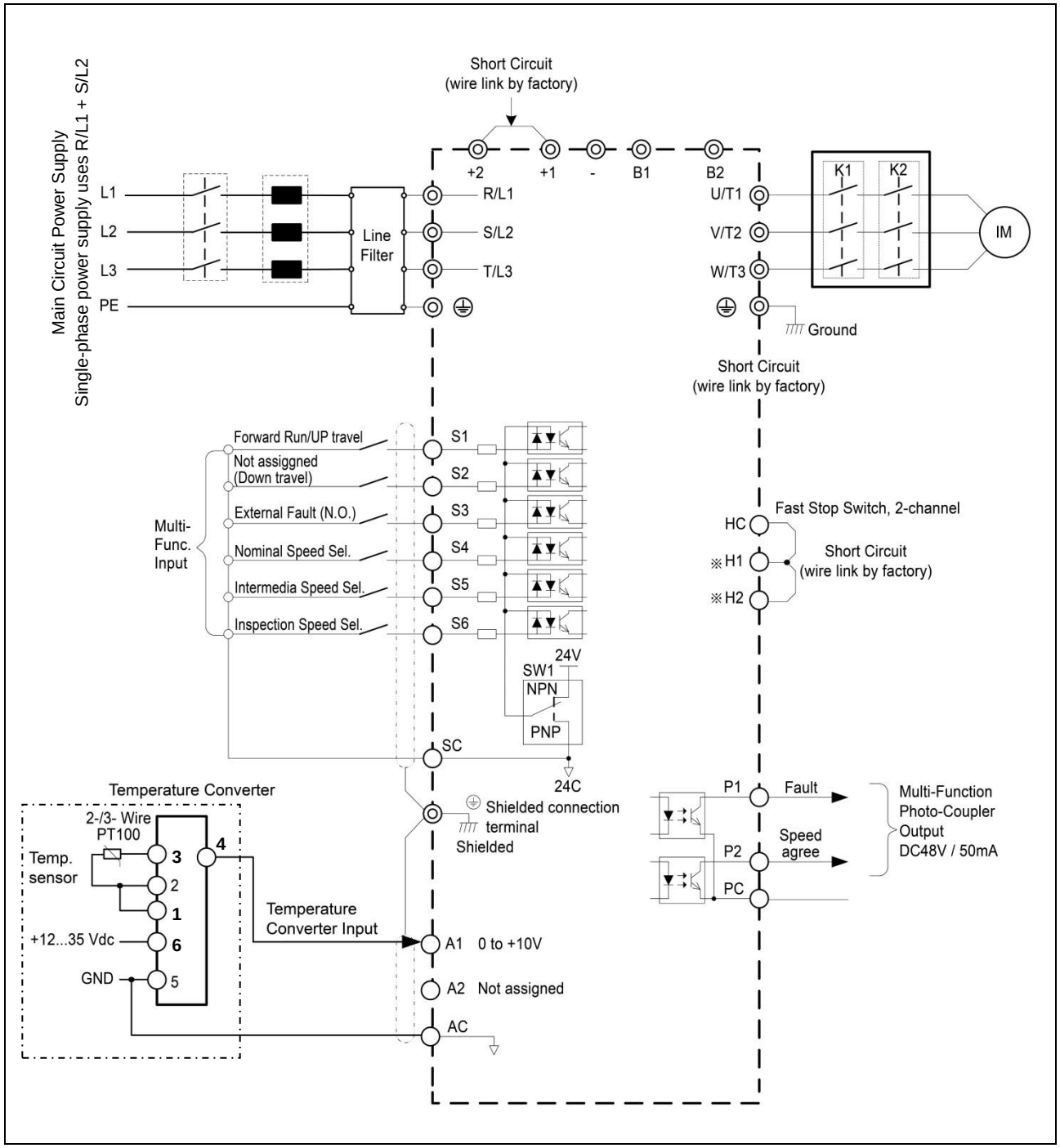


Figure 7: Wiring of the drives 15kW and below

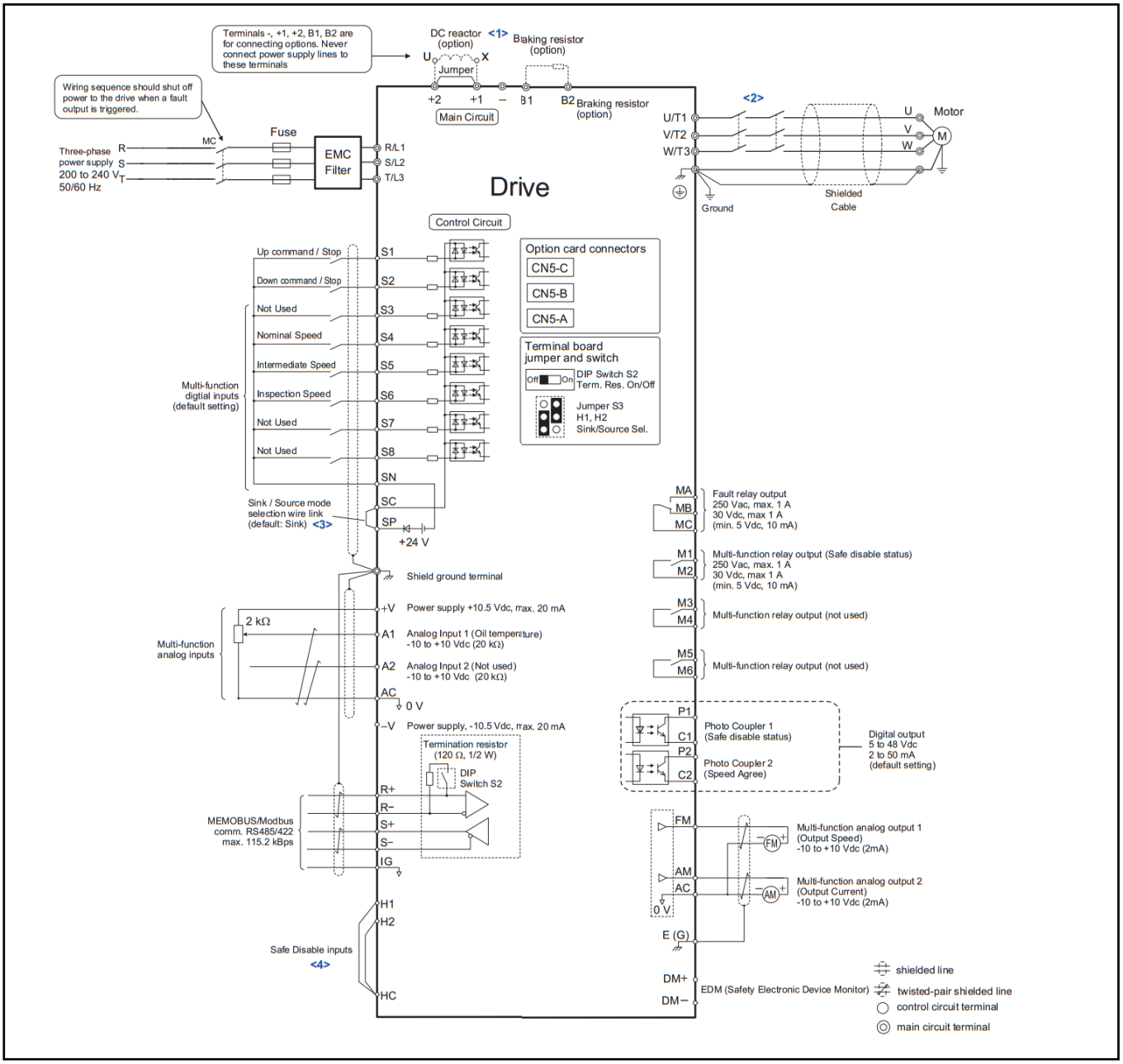


Figure 8: Wiring of the drives above 15kW

<1> Remove the jumper when installing a DC reactor. Models 4#0045 through 4#0150 come with a built-in DC reactor.

<2> The drive provides a stop function in compliance with Stop Category 0 (EN 60204-1) and “Safe Torque Off” (IEC/EN 61800-5-2). It has been designed to meet the requirements of the ISO/EN 13849-1, Category 3 PLd, and IEC/EN 61508, SIL2 (Models CIMR-L##A#) or SIL3 (Models CIMR-L##F#). Using this function the number of motor contactors can be reduced to one. Refer to Safe Disable Input Function on page 42 of Yaskawa Quick Start Guide for details.

<3> Never short terminals SP and SN, as doing so will damage the drive.

<4> Disconnect the wire jumper between H1-HC and H2-HC when utilizing the Safe Disable inputs.

Note

1. The drive should be implemented in the system in a way so that a drive fault causes the safety chain to open. Always use terminal MA-MB-MC for this purpose.
2. Even though no fault is present, conditions where the drive may not start can occur. Use the “Drive Ready” output (default set to terminals M5-M6) to interlock operation in such situations.

	Before installing the EV4 valve make sure that motor and inverter sizes match. When a smaller size inverter is used targeted up-speed may not be reached.

3.2 SIGNAL (INPUT) CONNECTIONS

According to the elevator controller design, the digital input terminal logic can be switched between sinking and sourcing mode by setting the DIP switch S3 on the front face of the drive (See *Figure 9*). The drive is preset to sink mode as shown in *Figure 9*. Source mode is shown in *Figure 10*.

3.3 SINK MODE – TRANSISTOR INPUT SIGNAL USING 0V COMMON

To signal the drive for a travel, 24Vdc power from the inverter is used through a relay circuitry whose activation/deactivation is done by the elevator controller.

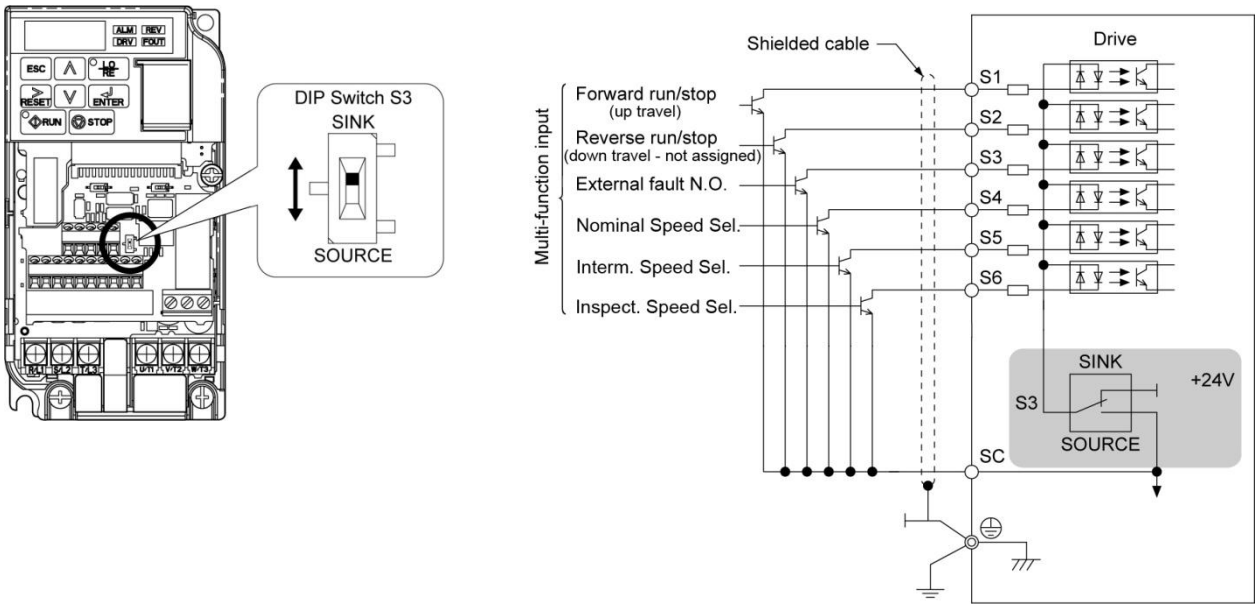


Figure 9: Sink mode

3.4 SOURCE MODE – TRANSISTOR INPUT SIGNAL USING +24V COMMON

To signal the drive for a travel, 24Vdc power supplied to the drive from outside is used through a relay circuitry whose activation/deactivation is done by the elevator controller.

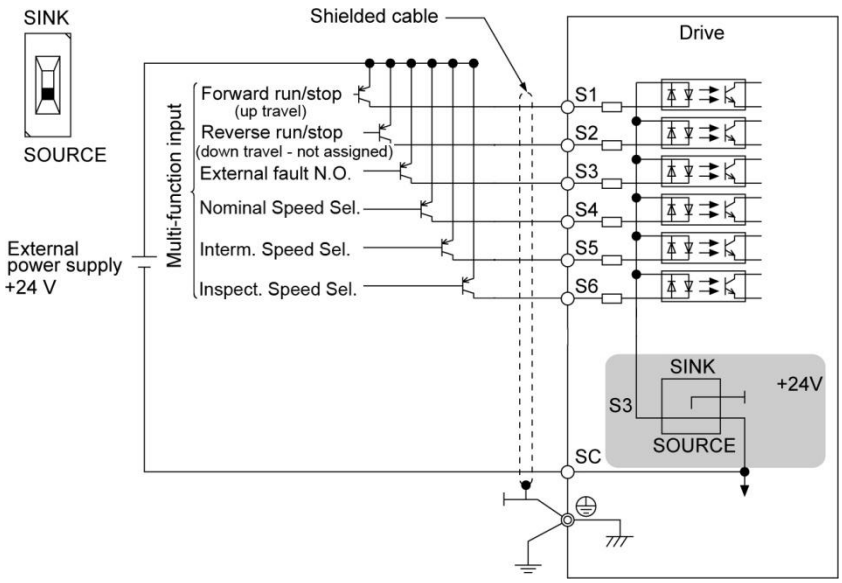
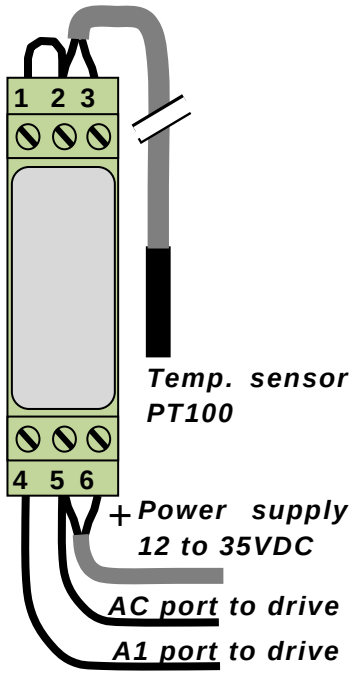


Figure 10: Source mode

3.5 TEMPERATURE SENSOR AND CONVERTER

A temperature sensor (PT100 Class B - DIN EN 60751) together with a converter is used for measuring the oil temperature in the tank. The temperature sensor is connected to the L1000H drive through the converter. Electrical connection is depicted in ***Figure 11***.

Figure 11: Pt 100 temp converter connections



Temperature Converter Specifications	
Power supply	12...35 V DC
Input	Pt100
Output	0 - 10 VDC
Ambient temperature	0 to 50 °C
Default bias value (H3-04)	-51%
Connections	Power supply: 6 (+ve) & 5 (-ve) Temperature sensor: 2 & 3 Signal Output: 4 to A1, 5 to AC Bridge: 1 & 2

Table 2: Temperature converter and its characteristics

Calibrating the temperature sensor

After the converter and sensor is connected to the inverter, temperature can be read from monitoring menu by selecting the parameter U7-02. If U7-02 value is different than the real medium temperature (± 1 °C), then change H3-04 parameter (bias of A1 input) to calibrate temperature reading. Increase/decrease H3-04 if U7-02 is smaller/bigger than the real medium temperature. Refer to Yaskawa's Quick Start Guide for the complete parameter list.

An external 12 to 35 V DC power supply is needed for the temperature converter. For CIMR-LC4A model drives supply power can be taken from the drive, SN (-) and SP (+).

When the set-up procedure is performed, the oil temperature in the tank is recommended to be between 18°C to 30°C.

Immerse the temperature sensor near the pump suction port and make sure that it will not be drifted with suction of the pump. It should also be prevented from touching the tank wall.

3.6 CONNECTING PERIPHERALS DEVICES

Figure 12 illustrates how the drive and the motor are connected together with various peripheral devices. Refer to L1000V/L1000A Technical Manual for detailed installation instructions.

3.7 USING DIGITAL OPERATORS

A Digital LED operator on the drive is used to activate run and stop commands, display data, edit parameters, as well as display fault and alarm information.

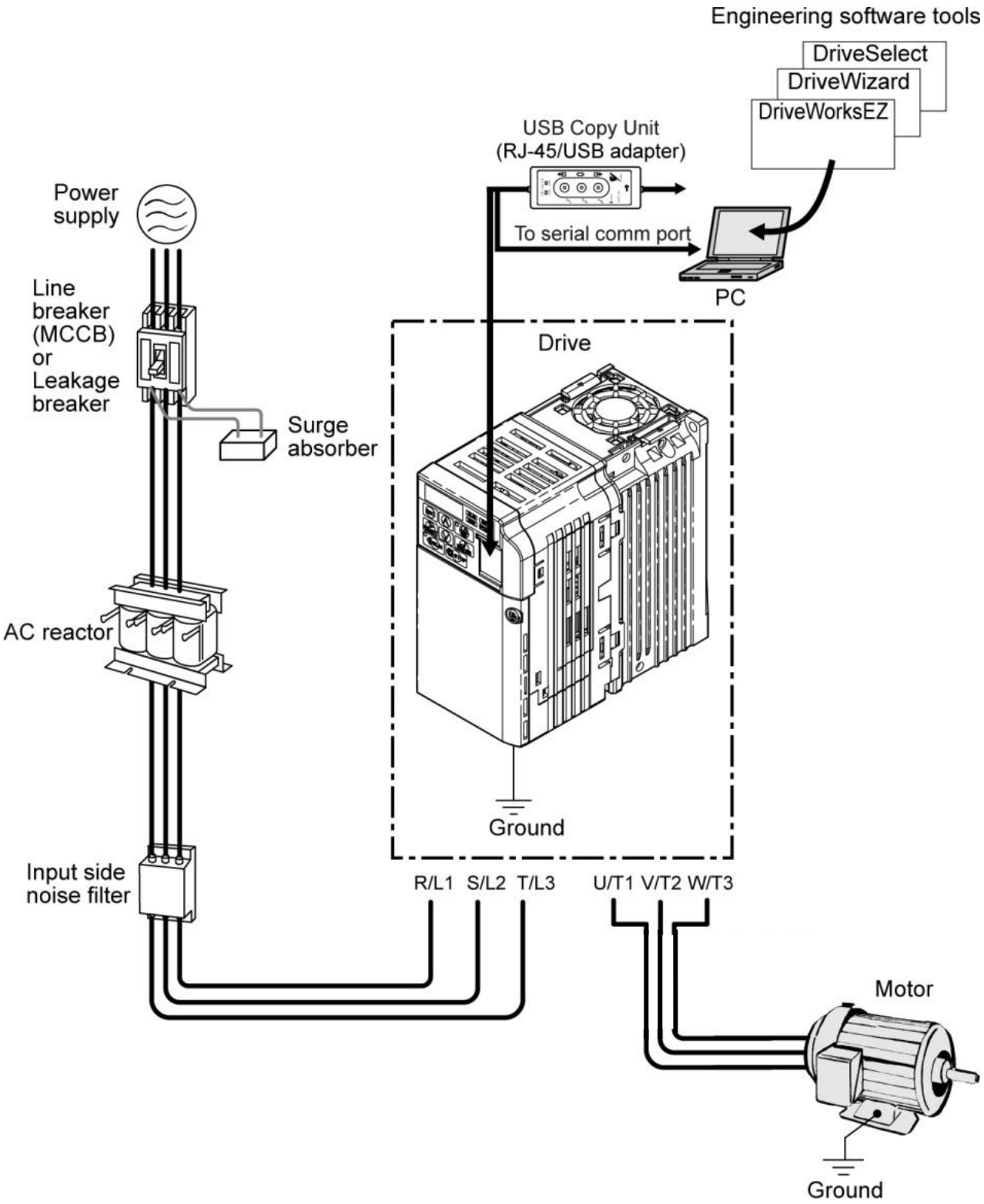
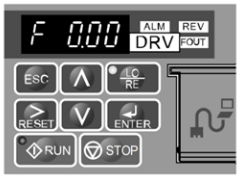


Figure 12: Connecting peripheral devices



***Digital LED Operator** on Yaskawa drives up to 15kW power*

Remote Digital Operator

A Remote Digital Operator (JVOP-180) can be connected to the inverter using an extension cable up to 3 m long. This makes it easier to operate the inverter when it is installed in a location where it cannot be accessed easily. The remote digital operator and the extension cable are optional accessories for L1000H drives up to 15kW power rate and should be requested while ordering the EV4 package. Drives that are having bigger power rates (over 15kW) have the remote digital operator as standard.

The parameter settings can be stored in the remote digital operator and copied to another drive (see L1000V Technical manual).

Figure 13: Digital operators

3.7.1 Using LED Operator

The following illustrations explain the outlook of digital text characters and the Digital LED Operator keypad menu structure. Refer to L1000V or L1000A technical manuals to learn more about using the digital operators.

Text	LED	Text	LED	Text	LED	Text	LED
0	0	9	9	I	ı	R	r
1	1	A	A	J	J	S	5
2	2	B	b	K	t	T	t
3	3	C	C	L	L	U	U
4	4	D	d	M	n <1>	V	u
5	5	E	E	N	n	W	uu <1>
6	6	F	F	O	o	X	none
7	7	G	G	P	P	Y	y
8	8	H	H	Q	q	Z	none

<1> Displayed in two digits.

Figure 14: Digital text characters

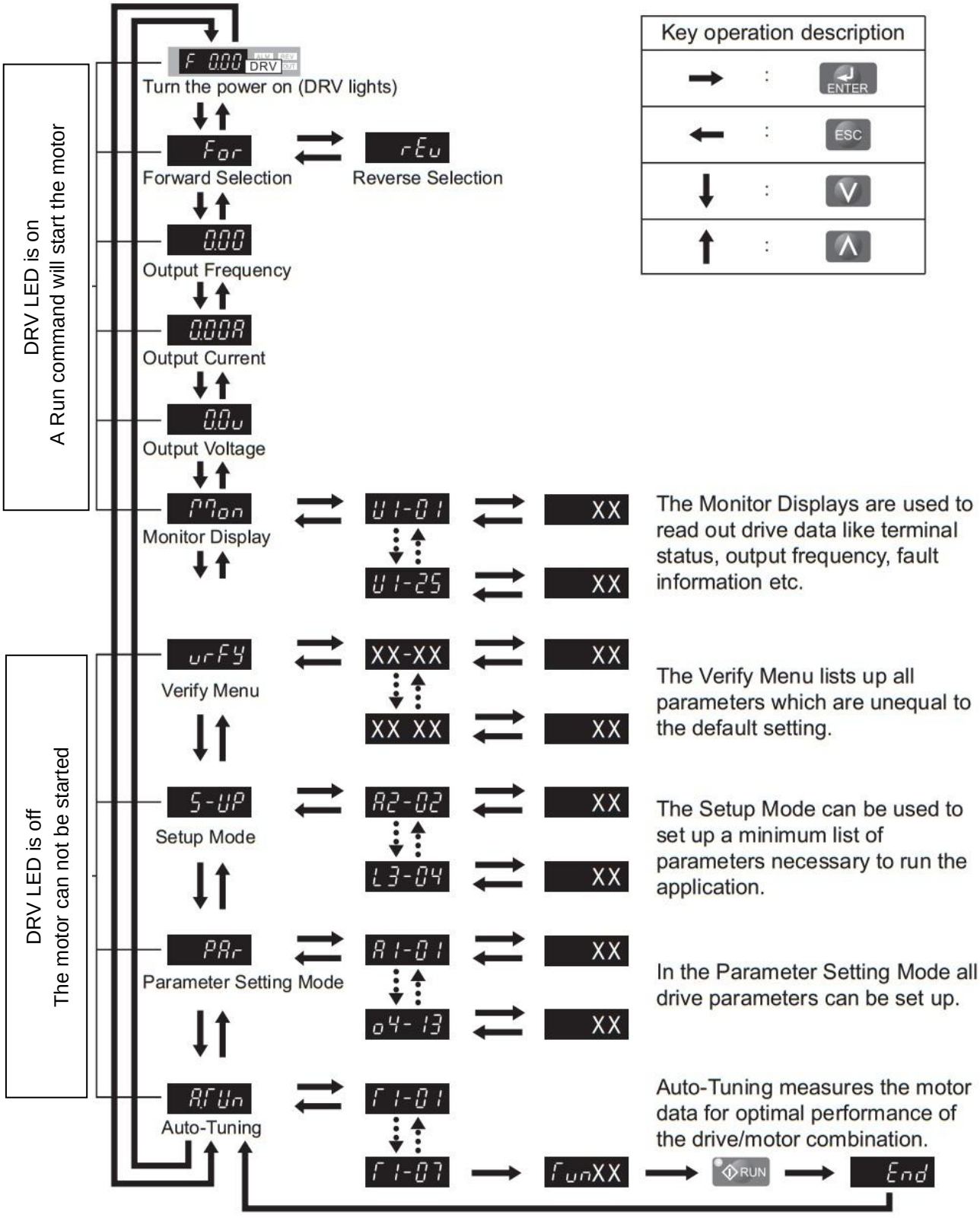


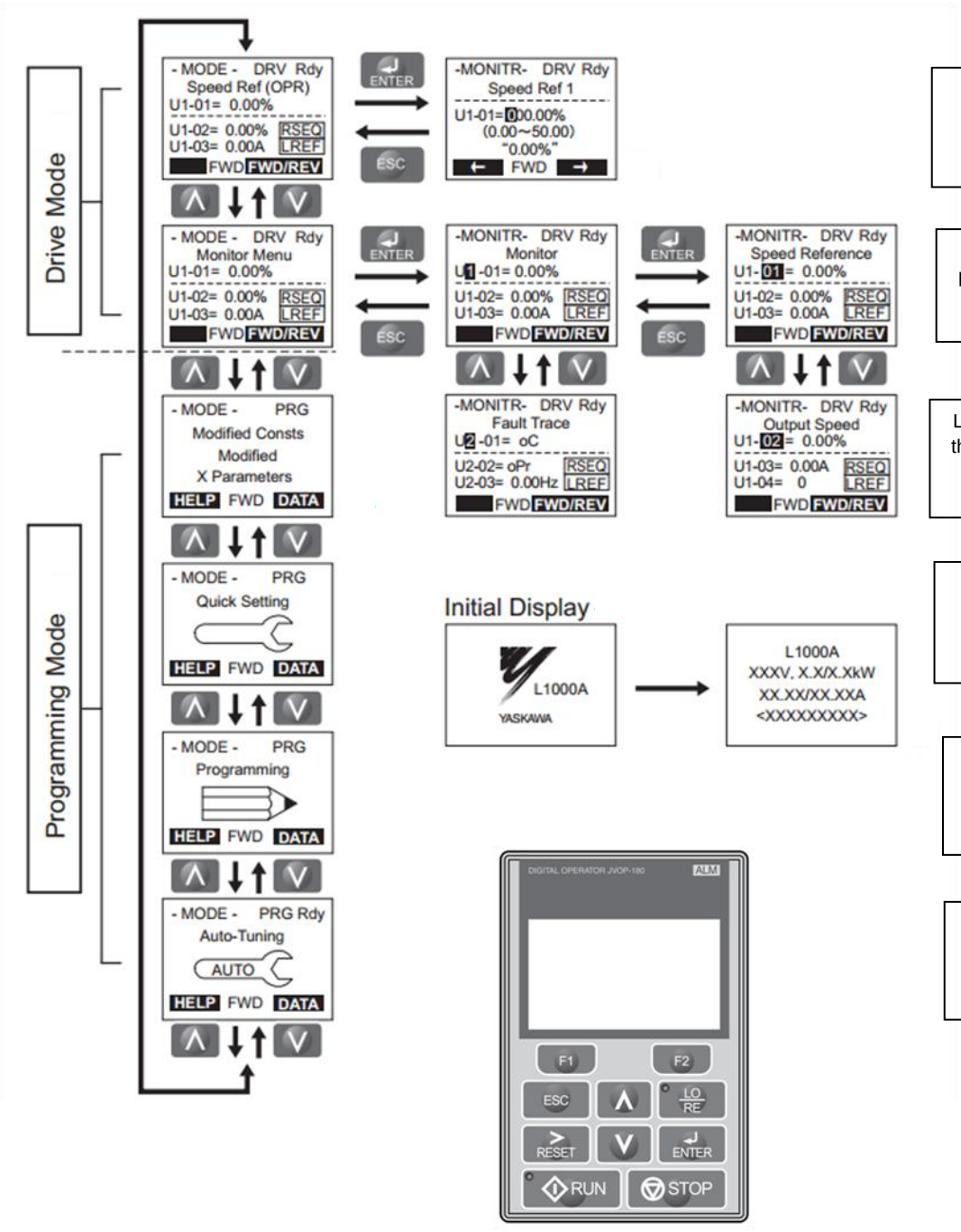
Figure 15: Keypad menu structure and modes

3.7.2 Using Remote Digital Operator

Keys on the remote digital operator are explained in the table below.

No.	Display	Name	Function
1		Function Key (F1, F2)	The functions assigned to F1 and F2 vary depending on the currently displayed menu. The name of each function appears in the lower half of the display window.
2		ESC Key	• Returns to the previous display. • Moves the cursor one space to the left. • Pressing and holding this button will return to the Speed Reference display.
3		RESET Key	• Moves the cursor to the right. • Resets the drive to clear a fault situation.
4		RUN Key	Starts the drive in the LOCAL mode. The Run LED • is on, when the drive is operating the motor. • flashes during deceleration to stop or when the speed reference is 0. • flashes quickly, the drive is disabled by a DI, the drive was stopped using an emergency stop DI, or an Up/ Down command was active during power up.
5		Up Arrow Key	Scrolls up to display the next item, select parameter numbers, and increment setting values.
6		Down Arrow Key	Scrolls down to display the previous item, select parameter numbers, and decrements setting values.
7		STOP Key <1>	Stops drive operation.
8		ENTER Key	• Enters parameter values and settings. • Selects a menu item to move between displays.
9		LO/RE Selection Key <2>	Switches drive control between the operator (LOCAL) and the control circuit terminals (REMOTE) for the Run command and speed reference. The LED is on when the drive is in the LOCAL mode (operation from keypad).
10		RUN Light	Lit while the drive is operating the motor. Refer to L1000A Tech. Manual
11		LO/RE Light	Lit while the operator is selected to run the drive (LOCAL mode). Refer to L1000A Tech. Manual
12		ALM LED Light	Refer to L1000A Tech. Manual

Menu structure for the remote digital operator



Start up display

Lists monitor parameters (Ux-xx),

Lists parameters that are edited or changed.

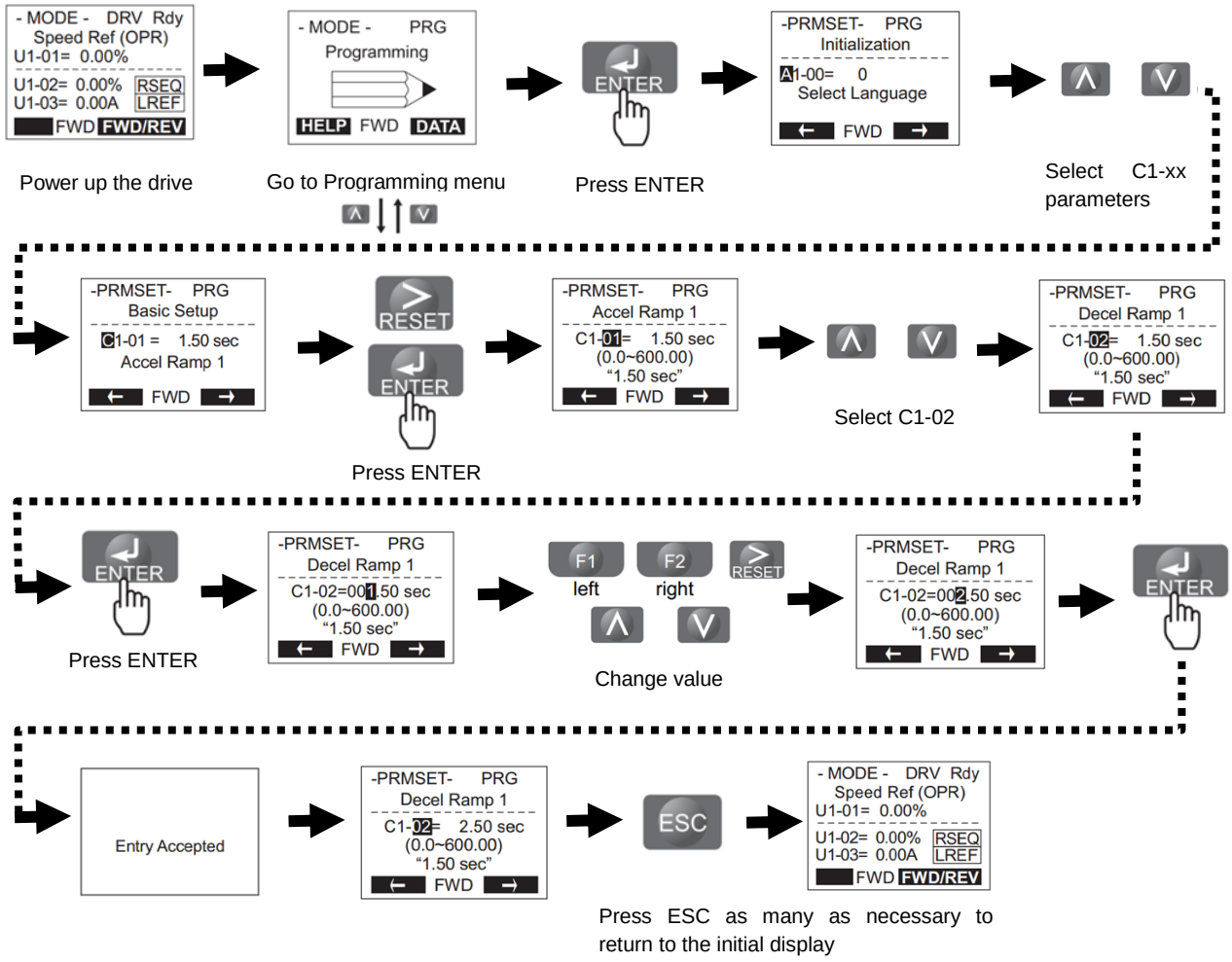
Selection of a List of parameters for quick setting

To access and edit parameters

To calculate & set motor parameters

Changing parameter settings or values

Below example explains changing **C1-02** (Deceleration ramp) from **1.50** seconds to **2.50** seconds.



4. START UP

The flow chart below shows the start-up procedure of EV4 drive. In the following sections each step of the start-up procedure is explained in details

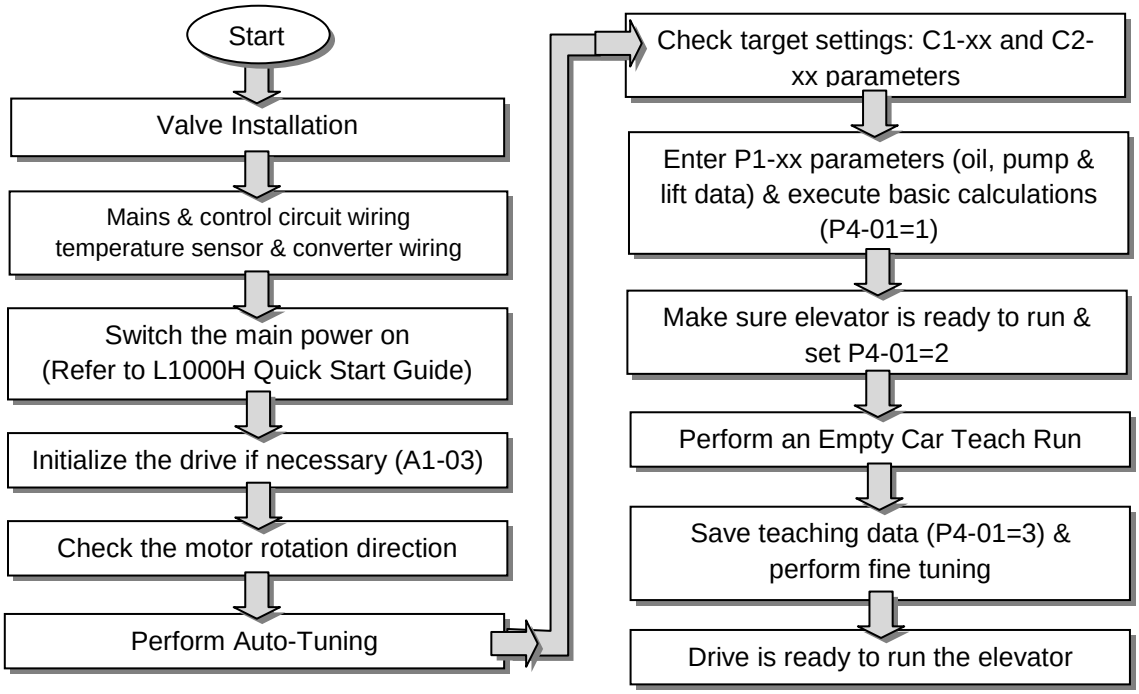


Figure 16: Basic set up procedure

4.1 VALVE INSTALLATION

Make sure that pump, cylinder and tank connections of the valve have been performed according to hydraulic practice and are air-tight. Refer to Section 2 for EV4 valve specifications.

	The main functions of the EV4 valve are checked and proved in the factory. Pressure relief valve and down travel adjustments are also done according to customer data. If no specification is given, the pressure relief valve is adjusted to 65 bar (940psi) by default.

4.2 MAINS & CONTROL CIRCUIT WIRING

Refer to Section 3, "Electrical Connections" and L1000V/L1000A Technical Manual.

4.3 SWITCHING THE MAIN POWER ON

Refer to the Quick Start Guide and L1000V Technical Manual.

4.4 INITILIAZATION OF THE DRIVE

The initialization is not normally needed, if required set A1-03 to 2220 and redo the set-up procedure starting from Motor Tuning.

4.5 CHECK MOTOR ROTATION DIRECTION

In order to have a positive pump flow the motor should rotate in correct direction. Check the arrow on the pump, showing positive flow rate direction, otherwise set the motor shaft rotation direction in clockwise.

	Motor rotation direction can be changed by setting the parameter b1-14 to 1. The user can check and correct the direction of motor rotation during motor tuning (see section 4.6)

4.6 MOTOR TUNING

In this manual only brief information about motor tuning is given. For further information the user should refer to the **Quick Start Manual** of L1000H drive or the Technical Manual of Yaskawa L1000V/L1000A drive.

4.7 AUTO-TUNING

After installing the EV4 valve on the power unit and performing mains & control circuit wirings of the L1000H drive successfully, auto-tuning is the next step in order to teach the drive the electrical characteristics of the motor.

There are two types of auto-tunings; Rotational and Non-rotational. **Rotational auto-tuning** is recommended to be used while it provides more precise data. **During the rotational tuning process the motor must be able to rotate without load. Non-rotational tuning** can be used if the load cannot be disconnected (e.g. Tank is filled with fluid or/and pump cannot be disconnected from the motor).

Tuning mode	Parameter	Description
Rotational Auto-Tuning	**T1-01=0**	The motor must be able to rotate without load during the tuning process
Non-rotational (Terminal resistance tuning)	**T1-01=1**	Perform if the motor cable is long or if the cable has been changed or motor load cannot be disconnected

	When using the same motor type in multiple installations but normally having them not available without load, perform an Auto-Tuning with the same type motor (unloaded) and then set the motor data parameters (E1-xx and E2-xx) manually in other installations (See section 4.16). ***Motor contactors must be closed during the Auto-Tuning process and to cancel Auto-Tuning, press the STOP key on the digital operator.***

4.8 BASIC AUTO-TUNING PREPARATIONS

User is required to input motor data during Auto-Tuning. Therefore, motor nameplate information (Power, Voltage, Nominal Current, RPM, No. of Poles, etc.) should be obtained before Auto-Tuning process is started.

For best performance, be sure that the drive supply voltage equals or slightly exceeds the motor rated voltage.

4.9 ROTATIONAL AUTO-TUNING

	Yaskawa L1000H drive uses Open Loop Vector (OLV) control (A1-02=2) and Heavy Duty Mode as default.

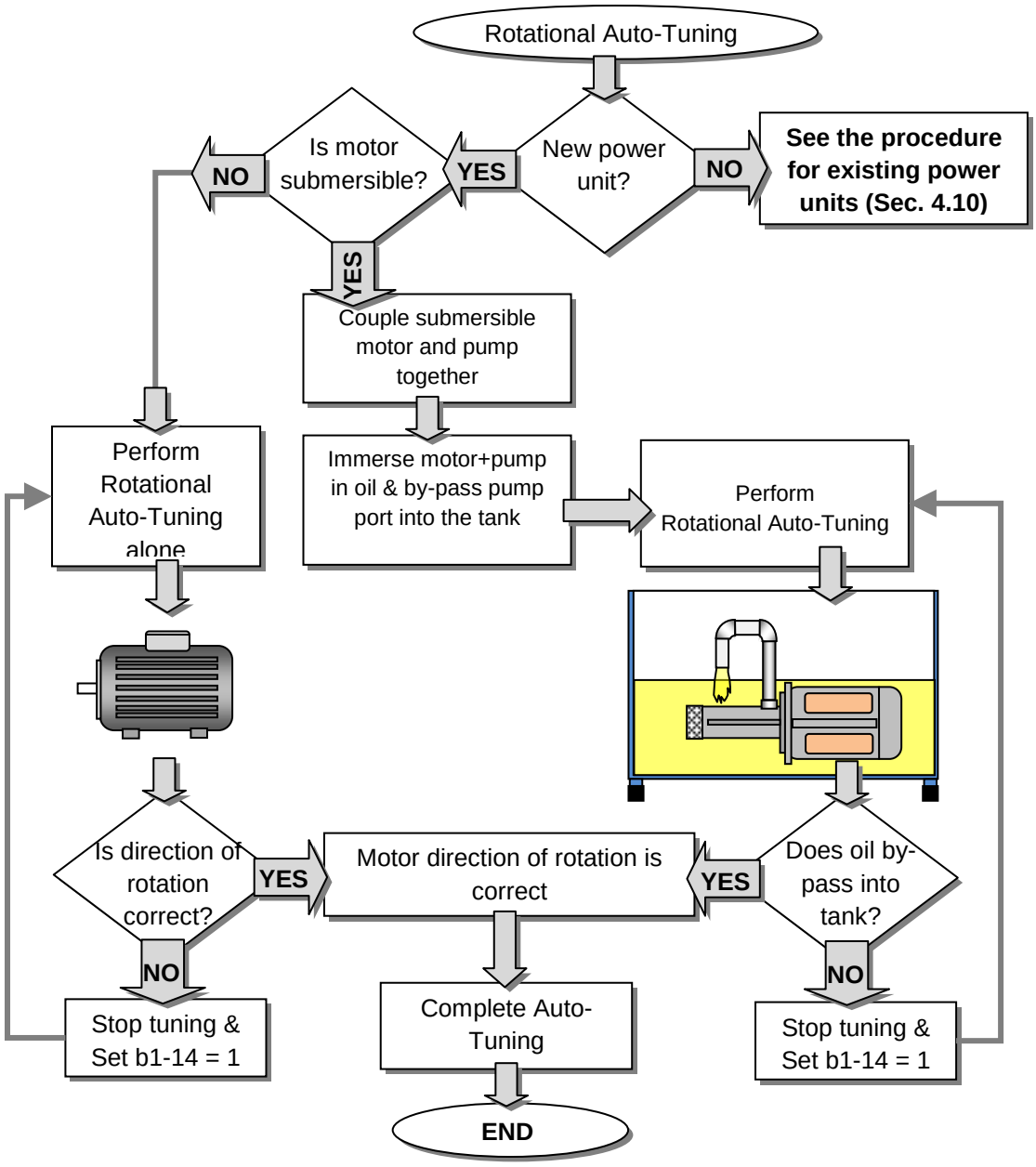


Figure 17: Motor tuning method

	For optimal performance, rotational Auto-Tuning should only be done with no load. Perform Auto-Tuning according to the motor types as shown in Figure 17. ***Never touch the motor until Auto-Tuning is finished. Even though the motor may not be rotating when Auto-tuning, voltage is still supplied to the motor during the tuning process. When the tuning is finished, "END" will appear on the operator panel. Do not touch the motor until this display is shown and the motor has completely stopped.***

	Do not tune a submersible motor alone, without a pump. Otherwise, the motor may damage since it usually does not have a front bearing. ***Do not run a pump dry, without submersing it in the oil. Running the pump dry in air will damage the pump.***

	If motor and pump should remain connected to the elevator system, the load should be lower than 30% of the rated load (Motor power). Performing Rotational Auto-Tuning with higher loads will set motor parameters incorrectly, and can cause improper drive/motor operation.

4.10 AUTO-TUNING FOR EXISTING POWER UNITS (MOTOR & PUMP SUBMERSED IN OIL)

When hydraulic line set up has already been done (EV4 valve mounted on the power unit and the tank already filled with oil), the following preparation on EV4 valve is necessary to allow tuning with less than 30% of the load:

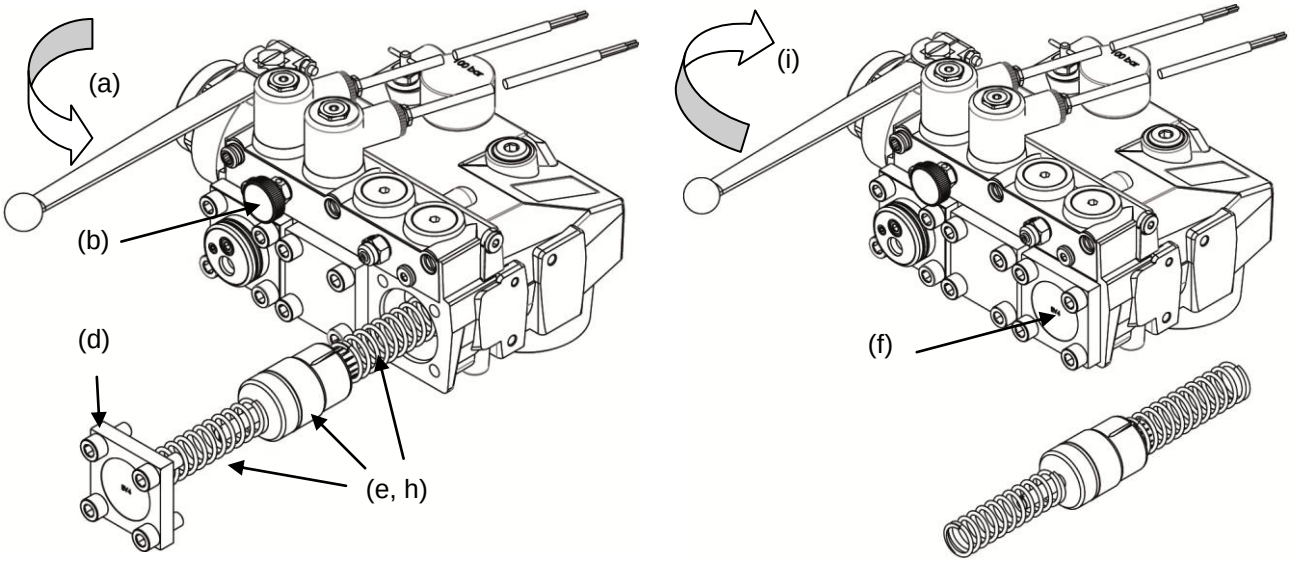


Figure 18: Auto-tuning for existing power units

(a) Close the ball valve on the cylinder line
(b) Relieve pressure in the valve (Turn manual lowering)
(c) Shut down the L1000H or make sure that L1000H receives no run signal
(d) Remove the by-pass flange
(e) Take the by-pass piston and its two springs out
(f) Place the by-pass flange back and tighten its bolts
(g) Proceed with Auto-Tuning as it is described in Yaskawa L1000H QSG.
(h) After Auto-tuning is finished successfully, replace the by-pass piston and the springs in the valve as before.
(i) Open the ball valve slowly to allow pressure build up in the system.
(j) Do not forget to **check motor slip (E2-02)** parameter (see Section **4.14**)

4.11 PERFORMING ROTATIONAL AUTO TUNING

1) Obtain nameplate information of the motor (see **4.8**)
2) Go to Auto Tuning mode
3) Set **T1-01=0** for **Rotational Auto-Tuning**.
4) Enter the motor nameplate data.
   - T1-02, Motor Power in kW (e.g., 14.7kW)
   - T1-03, Motor Rated Voltage (e.g., 400V)
   - T1-04, Motor Rated Current (e.g., 16A)
   - T1-05, Motor Base Frequency (e.g., 50Hz)
   - T1-06, Number of Motor Poles (e.g., 2)
   - T1-07, Motor Rated Speed (e.g., 2780 r/min)

5) Start the Auto-Tuning process when prompted by the drive (press RUN button when it blinks). Auto tuning is performed automatically by the drive.

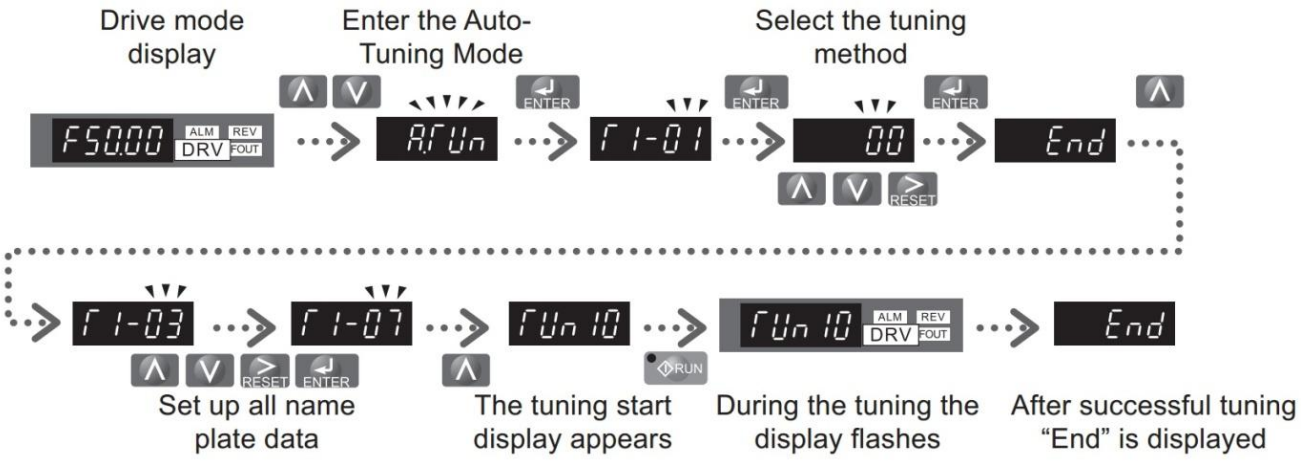
	When a fault is detected during auto-tuning it is displayed on the digital operator and the motor coasts to a stop. If a fault occur then check Auto-Tuning Fault Detection from the L1000V/L1000A technical manuals.

	When submersible motor and pump are coupled together and run in oil make sure that direction of motor rotation is correct. If oil does not by-pass into the tank or/and there is extreme noise and vibration, stop auto-tuning and correct the direction of rotation by changing the setting of b1-14. To cancel Auto-Tuning, press the STOP key.

4.12 AUTO-TUNING EXAMPLE

The following example illustrates how to perform Rotational Auto-Tuning.

Set the selected type of Auto-Tuning using LED operator



Entering data from the motor nameplate

	Step		Display/Result
1.	Press ∧ to access the motor output power parameter T1-02.	→	T1-02
2.	Press ENTER to view the default setting.	→	00040
3.	Press RESET to select the digit to edit.	→	00040
4.	Press ∧ and enter the motor power nameplate data in kW.	→	00020
5.	Press ENTER to save the setting.	→	End
6.	The display automatically returns to the display in Step 1.	→	T1-02
7.	Repeat Steps 1 through 5 to set the following parameters: • T1-03, Motor Rated Voltage • T1-04, Motor Rated Current • T1-05, Motor Base Frequency • T1-06, Number of Motor Poles • T1-07,Motor rated speed	→	T1-03 ⋮ T1-10

4.13 STATIONARY AUTO-TUNING

Refer to Yaskawa L1000V/L1000A Technical Manuals.

4.14 CHECKING MOTOR SLIP (E2-02)

After Auto-tuning process is successfully ended, check motor rated slip parameter **E2-02** whether it matches with manufacturers slip value. If the difference is above 20% then set E2-02 manually to the manufacturers' slip value. To calculate actual motor slip:-

$$Motor\ slip = Motor\ rated\ frequency - \frac{Nominal\ motor\ speed * no.of\ motor\ poles}{120}$$

For a 50Hz, 2 pole and 2780 rpm motor, slip can be calculated as:-

$$Motor\ slip = 50 - \frac{2780 * 2}{120} = 3.67Hz$$

4.15 CHECKING MOTOR NO-LOAD CURRENT (E2-03)

After auto-tuning check the assigned no-load current parameter (E2-03). Modify it if this is not matching with the conditions below;

For submersible motors:
No load current =0.5 to 0.6 x Nominal motor current that is, E2-03 = 0.5 to 0.65 x E2-01.

For external motors:
No load current = 0.3 to 0.4 x Nominal motor current that is, E2-03 = 0.3 to 0.4 x E2-01

4.16 OBTAINING MOTOR PARAMETERS (E1-XX & E2-XX) FOR SOME KNOWN MOTORS

For some know motors **E1-xx** and **E2-xx** motor parameters are listed in **Annexure 1**. If user has one of the motors in the Annexure 1 he/she can copy the parameters directly to the drive without needing to perform auto-tuning. To access the complete motor parameters change the access level from “Customer” to “Advance” (**A1-01=2**), see Section **10.1**. After inputting motor parameters (E1-xx & E2-xx) set **A1-01** to **3** again.

4.17 INITIAL PARAMETER SETTINGS

As the drive is energized, hydraulic functions of the Yaskawa **L1000H** drive becomes automatically active. The Yaskawa **L1000H** drive regulates the motor speed to provide constant travel speed and better ride-quality against varying volumetric efficiency (flow rate) of the screw-pump with car load and oil temperature. The drive requires certain parameters (Speed frequencies, load and temperature references and compensation gains) to be set in order to provide good ride quality. The drive software derives these parameters from oil, lift, pump data (**P1-xx** type input parameters), which are readily available to the lift designer, and from a teach run. Alternatively, necessary parameters can be set manually with a much time consuming method of "trial and error".

In order to derive the pump data, pump performance table is necessary to obtain from the pump manufacturer. Blain EV4 calculator (www.blain.de/calc) assists the user to obtain the pump data by simply inputting available elevator data.

4.18 TYPES OF PARAMETERS

There are series of parameters from **A** to **P** to be used for setting up the drive. Detail information about the complete drive parameters can be obtained from the technical manuals of **L1000V/L1000A**. The user will however, mostly use **P** type parameters, which have been particularly designed for hydraulic elevator applications, and **T** and **C** type parameters, which are mainly used for motor tuning and target curve setting. Other type parameters will be mentioned in the text as they are needed for specific settings. A general view on **P** type parameters is given below in ***Table 3***

Group	Parameter Name	Description
P	Hydraulic Pump	For setting up hydraulic pump functions
P1-##	Teach Function Input Data	Input data for Teach Function: Oil, pump and lift data
P2 ##	Down Travel Control	Improved travel quality in down direction
P3-##	Reference Data	Output from Teach Function: Frequency & Load References
P4-##	Lift Initialization	Basic setup / Teach selection
P5-##	Limit Settings	Limits for compensations, energy saving mode etc.
P6-##	Dwell Functions	Start and stop dwell functions
P7-##	Leveling Recovery Function	Leveling recovery function
P8-##	Special Tuning	Special tuning

Table 3: General outlook for hydraulic elevator parameters

4.19 TARGET CURVE PARAMETERS

A target curve consists of ramps (**C1-xx** type parameters) and s-curves (**C2-xx** type parameters) as shown below. In order to have better travel performance, special start- and end-dwell functions are also included in the target setting. Target parameters, their setting ranges and default values are also shown in *Table 4*. Default values of the target parameters may be changed by the user to customize the target.

Parameter	Parameter Name	Setting range	Default value
C1-01	*Ramp - Acceleration time 1*	0.0 to 6000.0 s	3.5s
C1-02	*Ramp - Deceleration time 1*		2.6s
C1-03	*Ramp - Acceleration time 2*		2.0s
C1-04	*Ramp - Deceleration time 2*		1.6s
C2-01	*S-Curve characteristic at accel start*	0.0 to 10.0s	2.0s
C2-02	*S-Curve characteristic at accel end*		0.7s
C2-03	*S-Curve characteristic at decel start*		0.3s
C2-04	*S-Curve characteristic at decel end*		1.6s
P3-01	*Nominal speed frequency – empty*	0.00 to E1-06 Hz	42.87Hz

Parameter	Parameter Name	Setting range	Default value
P3-02	*Intermediate speed frequency – empty*		32.75Hz
P3-03	*Inspection speed frequency – empty*	0.00 to 50.00Hz	17.59Hz
P3-04	*Leveling speed frequency – empty*	0.00 to 50.00Hz	5.45Hz
P3-07	*Pump leakage – empty*	0.00 to 25.00Hz	2.43Hz
P6-01	*Special dwell frequency offset*	0.00 to 20.00Hz	2.00Hz
P6-02	*Special dwell time 1*	0.00 to 20.00s	2.00s
P6-03	*Special dwell time 2 (re-leveling)*		1.00s
P6-05	*Special dwell at start leakage multiplier for re-leveling*	0.000 to 3.000	1.200
P6-06	*Stop dwell leakage multiplier*		1.000
P6-07	*Stop dwell time*	0.00 to 5.00s	0.30s
E1-04	*Maximum output frequency*	0 to 400	60Hz

Table 4: Target curve parameters, their settings ranges and default values

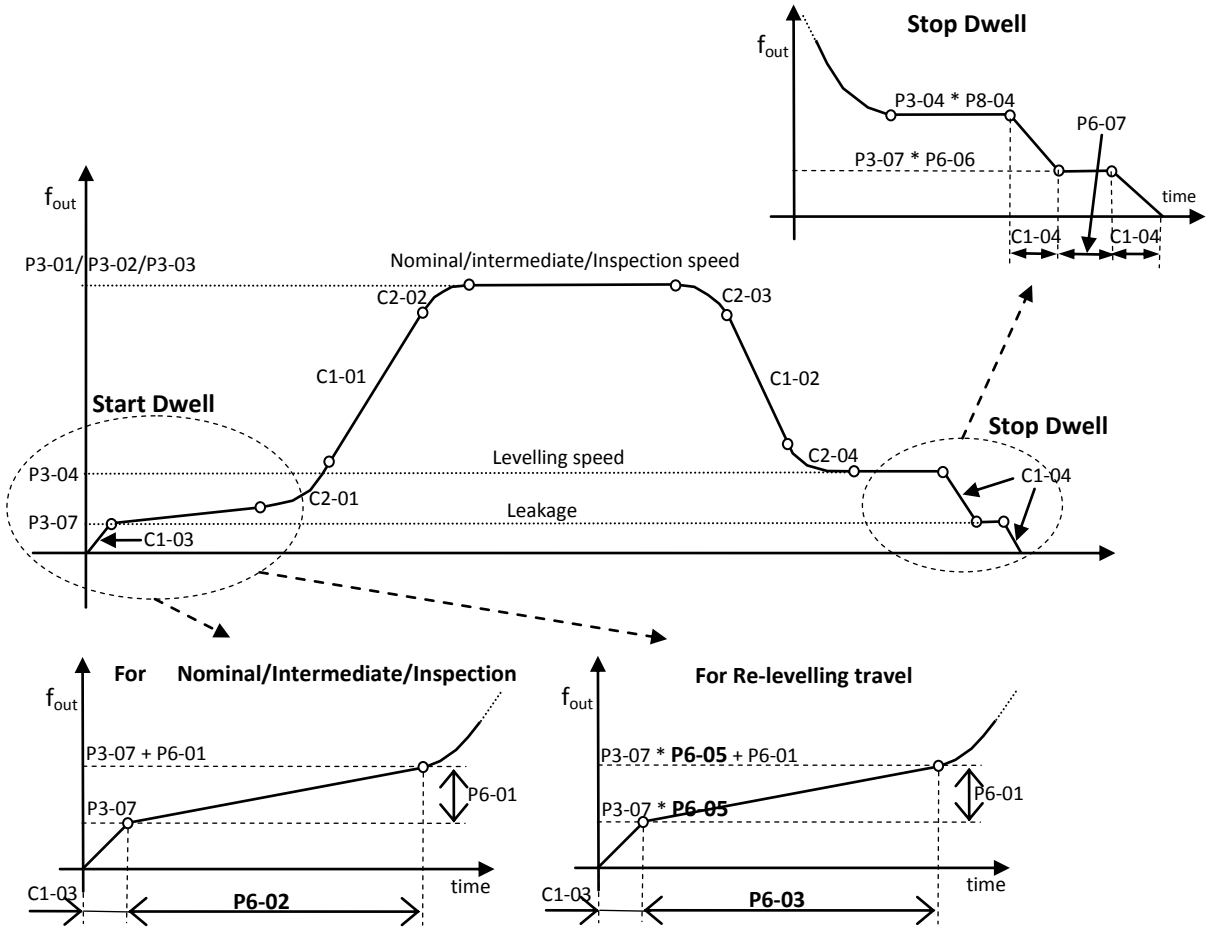


Figure 19: Target parameters

4.20 EFFECTIVE RAMP TIME

Ramp times are calculated with reference to the maximum output frequency (**E1-04**). This means that the given time for a **C1-xx** ramp is the time spent by the drive to reach **E1-04** from zero speed. This is depicted in Figure 19.

For example, if **E1-04** (max. output frequency) and **P3-07** (leakage frequency) were set as 60Hz and 3Hz respectively, and **C1-03** was input as 2s, then the effective ramp time for **C1-03 c**an be calculated as:

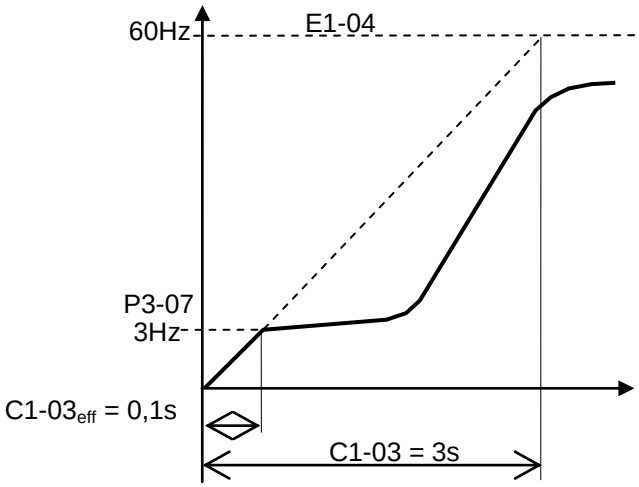


Figure 20: Effective ramp time

$$\text{Effectivel ramp time } (\text{C1-03}_{\text{eff}})[\text{s}] = \frac{\text{Given ramp time } (\text{C1-03}) * \text{Frequency difference}}{\text{E1-04}}$$

$$\text{Effective ramp time } (\text{C1-03}_{\text{eff}})[\text{s}] = \frac{2 * (3 - 0)}{60} = 0.1\text{s}$$

Set **C1-01** and **C1-02** ramps in seconds by considering the effective ramp times.

5. TEACHING FUNCTION

Teaching function automatically sets up the data that is needed by the drive to control the elevator speed. There are three main phases for teaching;

Teaching phase	Parameter	Description
Basic Calculations	P4-01=1	Based on pump, oil and elevator data, the drive sets for example frequency references.
Empty Car Teach Run	P4-01=2	Determines remaining operation data during an empty car trail run.
Data Saving	P4-01=3	Saves teach data into the memory of the drive.

During normal elevator operation P4-01 is set to 0.

In Figure 21, the given flow chart describes the procedure for setting initial parameters and performing the necessary teachings.

5.1 STEP 1: CHECKING TARGET CURVE

Make sure that the distance between deceleration and stop switches would allow the elevator to slow down into leveling speed, see Figure 20(a). As shown in Fig. 20(b) too short switch distance or/and incorrect deceleration path parameters (**C1-02**, **C2-03** and **C2-04**) can cause the elevator to reach the stop switch at a higher speed than the leveling speed. Apply parameter settings and switch distances given in ***Table 5*** to assure leveling speed travel. Depending on the speed level at the stop switch the drive may go into **SEQF** alarm that puts the elevator out of service until reset button is pressed.

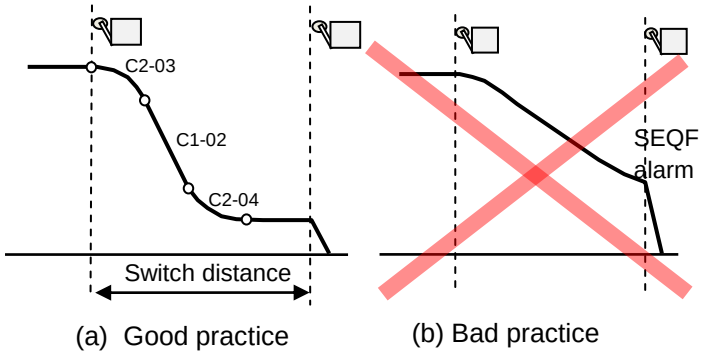


Figure 21: Deceleration path

	When SEQF occurs increase the switch distance or/and decrease deceleration path parameters. To cancel SEQF error press reset button. ***SEQF error function is only active for nominal and intermediate speeds. To eliminate SEQF error from happening:*** ***For*** CIMR-LC**4V** ***model code drives: connect S2 and SC ports with a little wire and set H1-02 to 14.*** ***For*** CIMR-LC**4A** ***model code drives: connect S7 and SN ports with a little wire and set H1-07 to 14.***

Deceleration path (**C1-02**, **C2-03** and **C2-04**) needs to be modified according to the nominal speed in order to have smooth deceleration and soft stop. It is advised to follow the parameter settings and deceleration switch distances that are given in the table below.

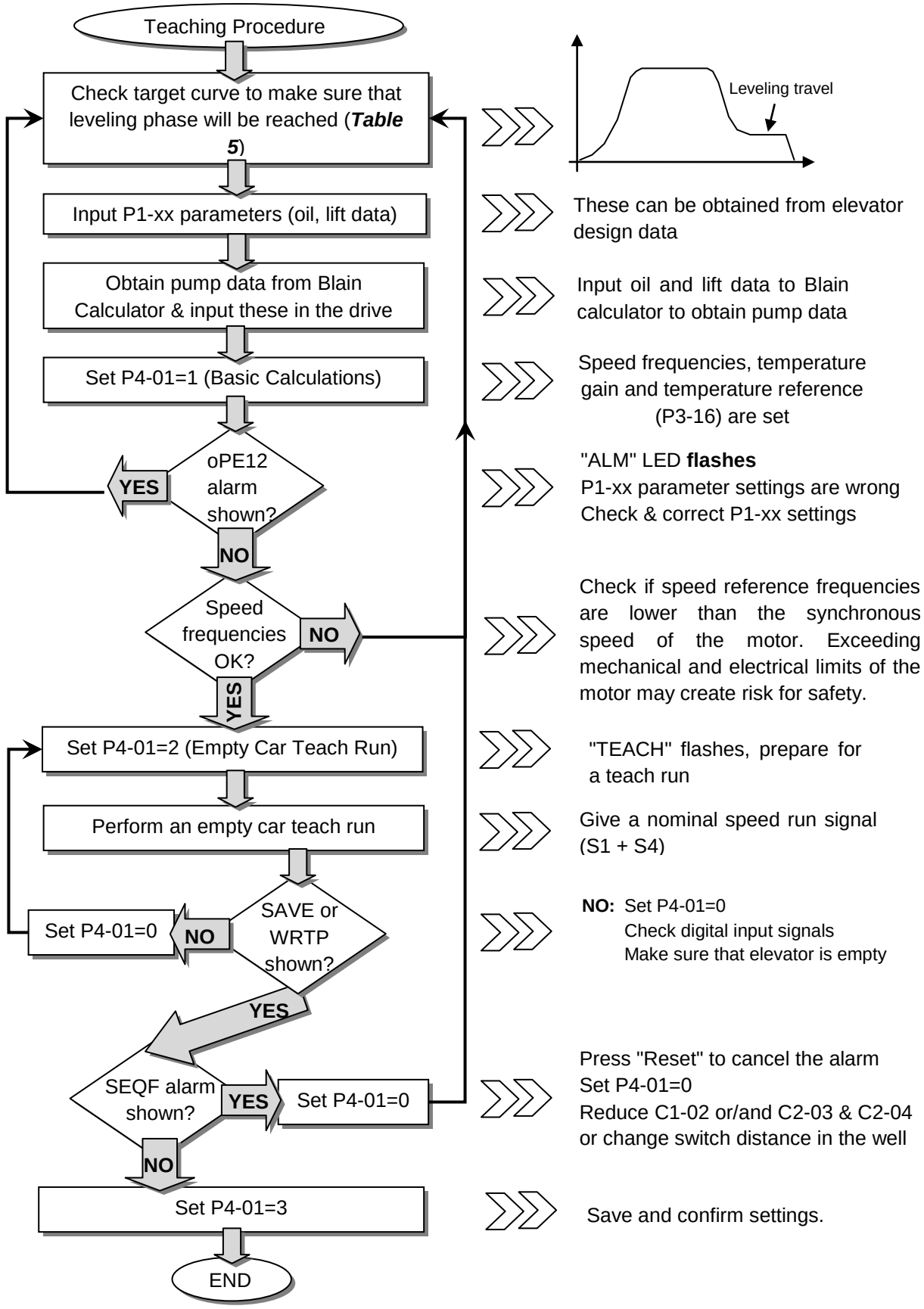


Figure 22: Teaching function algorithm

Elevator speed [m/s]	C1-02	C2-03	C2-04	Deceleration switch distance [cm]
0.3	1,8	0.3	1.3	50
0.4	2.0	0.3	1.3	65
0.5	2.2	0.3	1.4	85
0.6	2.4	0.3	1.4	105
0.7	2.6	0.4	1.5	130
0.8	2.7	0.4	1.6	150
0.9	2,8	0.4	1.6	170
1.0	2,9	0.4	1.7	190

Table 5: Recommended deceleration path parameters and switch distances

5.2 STEP 2: INPUTTING P1-XX PARAMETERS; OIL, PUMP & ELEVATOR DATA

L1000H drive automatically calculates the contracted elevator speeds (nominal, intermediate, inspection and leveling) in terms of motor revolutions per second (Hz) according to oil, pump & elevator data (P1-xx parameters), which are asked to be input by the user. These parameters are shown in ***Table 6*** below

Apart from the pump parameters from P1-11 to P1-15, all others can be obtained from the elevator design data and input in the L1000H drive. In order to obtain pump parameters, Blain EV4 Calculator from www.blain.de/calc can be used. Alternatively a smartphone app from Google Play app store can be used.

Input Parameter	Operator Display Parameter Name	Description	Setting range	Default value
P1-01	*Oil ISO VG No* Hydraulic Oil ISO VG Number	0: Manual Setting 1: ISO VG 22 2: ISO VG 32 3: ISO VG 46 4: ISO VG 68	0 to 4	3
P1-02	*Temp. @100cSt* Temperature at 100 cSt	Preselectable by P1-01:	0 to 100°C	25°C
P1-03	*Temp. @25 cSt* Temperature at 25 cSt	P1-01 / P1-02 /°C / P1-03 /°C 0 / 25 / 55 1 / 11 / 37 2 / 18 / 46 3 / 25 / 55 4 / 33 / 64	0 to 100°C	55°C
P1-04	*Ram Diameter* Ram Diameter	Lift data, input manually	10 to 1000mm	70mm
P1-05	*No. of Rams* Number of rams	Lift data, input manually	1 to 10	1
P1-06	*Suspension Rati* Suspension Ratio	Lift data, input manually	1 to 10	2
P1-07	*Static pressure* Empty car static pressure	Lift data, input manually	1 to 100bar	20bar
P1-08	*Pay load* Pay load	Lift data, input manually	1 to 65000kg	300kg
P1-09	*Pressure increase* Dynamic pressure in-crease	Lift data, input manually	1 to 30bar	5bar
P1-11	*Flow@100cStMaxP* Flow at 100cSt & at max. Pressure	Pump data, obtained from the calculator, input manually.	2.0 to 1600.0 LPM	102.5 LPM

P1-12	*Flow@25cSt_MaxP* Flow at 25cSt & at max. Pressure	Pump data, obtained from the calculator, input manually.	2.0 to 1600.0 LPM	93.9 LPM
P1-13	*Pump Rated Speed* Pump Rated Speed	Pump data, obtained from the calculator, input manually.	500 to 4000 RPM	2750 RPM
P1-14	*Flo@EmpCar100cSt* Flow at empty car pressure & at 100cSt	Pump data, obtained from the calculator, input manually.	2.0 to 1600.0 LPM	104.6 LPM
P1-15	*Flow@1bar_100cSt* Flow at 1 bar pressure & at 100cSt	Pump data, obtained from the calculator, input manually.	2.0 to 1600.0 LPM	111.3 LPM
P1-16	*Nominal Speed* Nominal speed	Lift data, input manually	0.000 to 1.200 m/s	0.80 m/s
P1-17	*Intermediate Speed* Intermediate speed	Lift data, input manually	0.000 to 1.200 m/s	0.60 m/s
P1-18	*Inspection Speed* Inspection speed	Lift data, input manually	0.000 to 0.300 m/s	0.30 m/s
P1-19	*Level Speed* Leveling speed	Lift data, input manually	0.000 to 0.1500 m/s	0.06 m/s

Table 6: P1-xx type parameters: Oil, pump & elevator data

5.3 OBTAINING PUMP DATA FROM BLAIN EV4 CALCULATOR (www.blain.de/calc)

Blain EV4 Calculator consists of three tables. In the first 2 tables necessary **P1-xx** variables are input whereas the pump data (parameters) are obtained from **Table 3**.

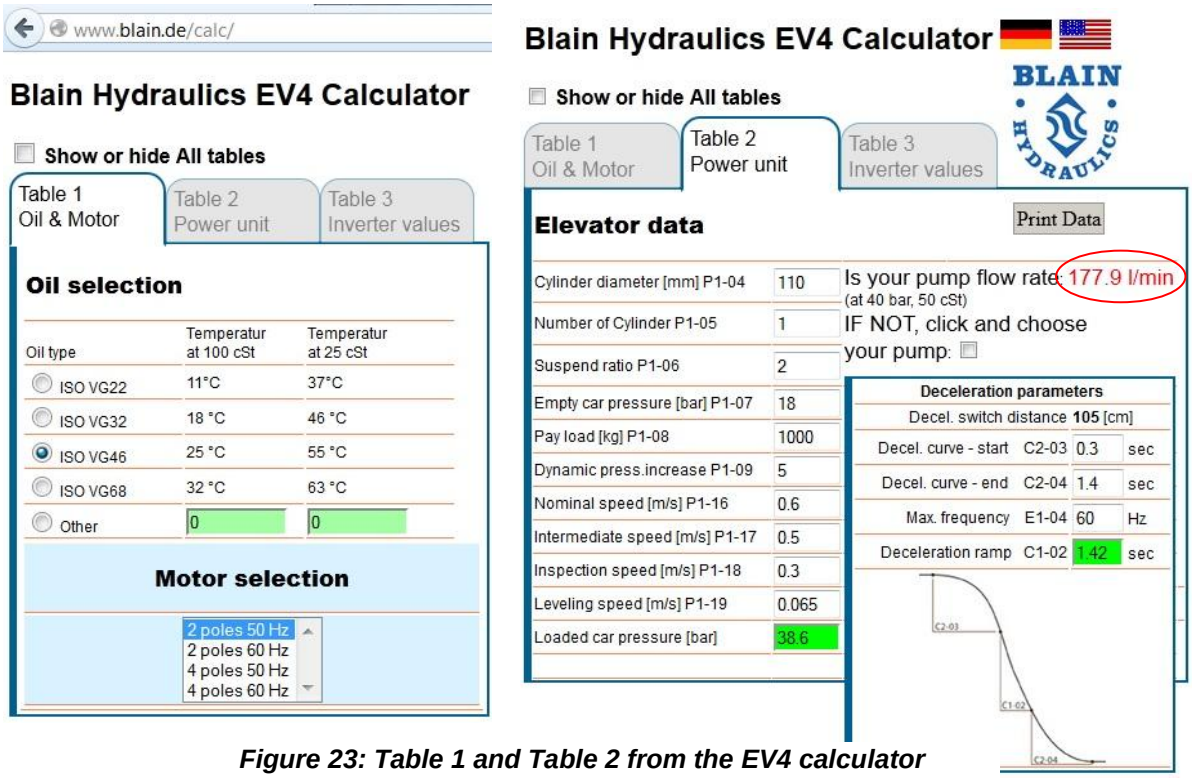


Figure 23: Table 1 and Table 2 from the EV4 calculator

Table 1: Oil type, number of motor poles and motor frequency are selected in Table 1. See *Figure 23*.

Table 2: Elevator data is input in Table 2 and optimized deceleration path parameters (**C2-03**, **C1-02** and **C2-04**) are obtained, see *Figure 23*. Use the indicated deceleration path parameters initially.

	Necessary pump size (Flow rate) is given in Table 2. If the actual pump is different then click in the box "pumpfixing" and choose the correct pump. ***Dynamic pressure increase depends on the power unit, hydraulic layout and friction in rails. It can normally be between 3 bar to 6 bar in normal cases.***

Table 3: Parameters of the pump data are calculated and displayed in Table 3 (from **P1-11** to **P1-15**). These parameters should be entered in the **L1000H** drive.

By clicking on the box "Show or hide all parameters" one can also see the rest of the parameters that are calculated by the drive. Parameters with blue characters (**P3-10**, **P3-13** and **P3-16**) are registered by the drive during the empty car teach run.

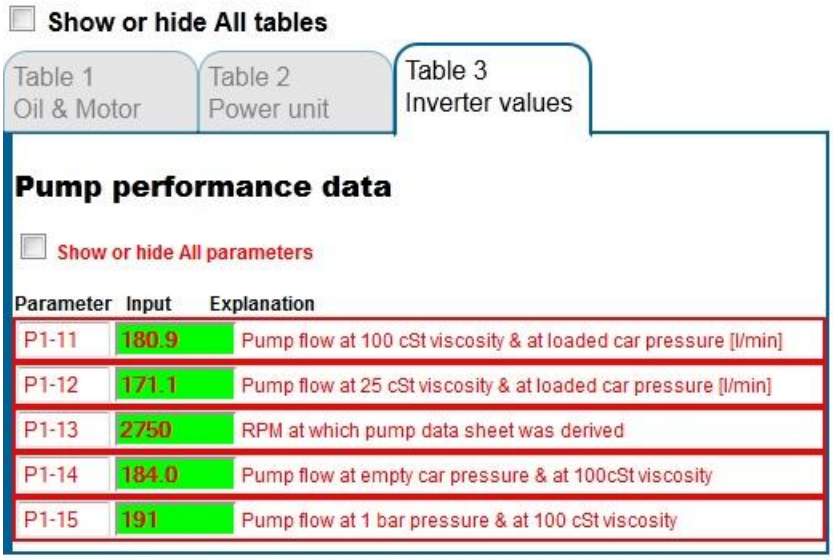


Figure 24: Results from Table 3

5.4 STEP 3: SET P4-01=1

By doing so the **L1000H** drive reads the oil temperature, calculates necessary speed frequencies and the temperature gain (Basic calculations).

If calculation is done successfully the display will show "**END**" directly followed by "**0**" (Parameter **P4-01** will be reset to "**0**" automatically).

P1 parameters are used for calculating frequency references (P3-xx) when **P4-01** is set to **1**. Changing any **P1** parameters manually simply would not make any effect on existing parameters (**P3-xx** type parameters) unless **P4-01** is set to **1** again.

	In case that the drive shows oPE12 alarm (ALM LED flashing), check and correct P1 setting (Check that P1-16 > P1-17 > P1-18 > P1-19 or P3-04 > P3-07 x P6-05 or P3-04 > P3-07 x P6-06 or P7-05 > P3-04 or P1-03 > P1-02 or P1-11 > P1-12 conditions are obeyed).

	Do not perform the Basic Calculations (P4-01=1) only. It should be followed by an Empty Car Teach Run otherwise, bad ride quality may occur. ***Changing P1-xx parameters after Basic Calculation is performed does not have any effect on calculated parameters. If it is necessary to change any parameter then repeat the Basic Calculations.*** ***If speed frequencies (P3-01, P3-02, P3-03, P3-04, P3, 07) are not giving the expected speed do not change them instead, change the velocities in mps (P1-16, P1-17, P1-18, P1-19) and repeat the Basic Calculations.***

5.5 STEP 4: TEACH RUN

Get the drive ready for a teach run. Make sure that the elevator will run with nominal speed and there will be leveling travel at least for one second. Set **P4-02 = 2**.

5.6 STEP 5: ALM LED

The drive will show "**TEACH**" flashing and the **ALM** (alarm) LED illuminates.

In case the Remote Digital Operator is used, go out of programming mode otherwise TEACH will not show on the display (After going out of programming mode, it may take approx. 20 s to see "**TEACH**" on the display).

5.7 STEP 6: PERFORM AN EMPTY CAR TEACH RUN.

- Make sure that the elevator car is empty.
- Select Nominal Speed and the run the elevator between two consecutive floors.
- After the run command is released (stop switch is reached) and teach run is completed successfully the drive will show either "**SAVE**" or "**WRTP**".

	In case the drive shows "SAVE" or "WRTP", P4-01 must be set either to 3 for accepting the current teach run settings or to 0 for cancelation. When intending to re-execute the teach run in such a case, first set P4-01 to 0, then restart the procedure by setting P4-01 to 2.

WRTP means, the drive re-executed the "**Basic Calculations**" automatically once more. This is done when the oil temperature during the empty car teach run differs significantly from the oil temperature while executing "**Basic Calculations**".

All parameters, modified from the Teaching Function can be viewed in the "**Verify**" and "**Programming**" menu. Manual modification is also possible but not necessary.

Empty car teach run should be done only once. Necessary settings for Intermediate Speed and Inspection Speed are done automatically.

Do not expect good start and stop travel quality during teach run.

	After completing the teach run, in case the drive shows "TEACH" or "SQEF" then set P4-01 to 0 and check if the elevator could reach the leveling speed at all (U7-07). Correct the deceleration parameters or the switch distance in the shaft and repeat the teach run by setting P4-01 to 2.

5.8 STEP 7: SAVE OR WRTP

As the teach run successfully completed and "**SAVE**" or "**WRTP**" is blinking on the display, press "**ENTER**", to get back to the programming mode and set the parameter **P4-01** to **3**. The drive will show "**END**" followed by "**0**", meaning Empty Car Teach Run settings has been accepted and then **P4-01** is set back to the normal operation mode automatically.

6. TRAVEL PARAMETERS

6.1 P3-XX TYPE PARAMETERS: FREQUENCY REFERENCE & LOAD REFERENCE SETTINGS

Speed frequency references (Hz) are calculated by using the **P1-xx** type data and saved in **P3-xx** parameters together with load and temperature references. These are shown in ***Table 7***.

Input Parameter	*Operator Display* Parameter Name	Description	Setting range	Default value
P3-01	*FullSpdRef-Empty* Full Speed Frequency – Empty	Calculated by the drive	0.00 to E1-06 Hz	42.87 Hz
P3-02	*SecSpdRef-Empty* Second Speed Frequency – Empty	Calculated by the drive	0.00 to E1-06 Hz	32.75 Hz
P3-03	*InspSpdRef-Empty* Inspection Speed Frequency – Empty	Calculated by the drive	0.00 to 50.00 Hz	17.59 Hz
P3-04	*LevSpdRef-Empty* Levelling Speed Frequency – Empty	Calculated by the drive	0.00 to 50.00 Hz	5.45 Hz
P3-07	*Leak Freq-Empty* Pump Leakage Empty	Calculated by the drive	0.00 to 25.00 Hz	2.43 Hz
P3-10	*F SpdTqRef-Empty* Full Speed Torque Reference – Empty [%] at P3-16	Obtained during teaching run	0 to 150%	75 %
P3-11	*S SpdTqRef-Empty* Second Speed Torque Reference – Empty	Calculated by the drive	0 to 150%	70 %
P3-12	*I SpdTqRef-Empty* Inspection Speed Torque Reference – Empty	Calculated by the drive	0 to 150%	67 %
P3-13	*L SpdTqRef-Empty* Levelling Speed Torque Reference – Empty	Obtained during teaching run	0 to 150%	64 %
P3-16	*Temperature Ref* Temperature Reference	Obtained during teaching run	0.0 to 100.0°C	21.0 °C

Table 7: Speed frequencies, torque and temperature references

	The speed frequency references (particularly for nominal and intermediate speeds) should not exceed synchronous motor speed. The installer should not allow to exceed mechanical and electrical limits of the motor and is responsible for ensuring safety measures.

Alternatively, frequency references for different speeds can be approximately input manually. However, it is recommended to provide **P1-xx** input data and let the calculation to be carried out by the inverter.

6.2 P4-01 PARAMETER: OPERATION MODE SELECTION

There are 4 different modes of operation, which are shown in Table 8. Modes "1", "2" and "3" are used during the set-up procedure whereas, "0" is used for normal elevator travel.

Parameter	Operator Display Parameter Name	Description	Setting range	Default Value
P4-01	OperationModeSel Operation Mode Selection	0: Travel Mode 1: Basic Calculations 2: Empty Car Teach Run 3: Save Teach Results	0 to 3	0

Table 8: Operation modes

6.3 P5-XX PARAMETERS: SETTING COMPENSATION LIMITS

According to the car load and oil temperature, output frequencies are modified by the software. However, maximum and minimum frequency limits are set to prevent over compensation. *Table 9* shows **P5-xx** parameters for frequency limits.

Parameter	*Operator Display* Parameter Name	Description	Setting range	Default value
P5-01	*Max Torque Comp* Maximum Torque Compensation	Sets the upper limit for the amount of compensation.	0.00 to 20.00 Hz	8.00Hz
P5-02	*Min Torque Comp* Minimum Torque Compensation	Sets the lower limit for the amount of compensation.	0.00 to 20.00 Hz	0.00Hz
P5-03	*Max Temp. Comp* Maximum Temperature Compensation	Sets the upper limit for the amount of compensation.	0.00 to 20.00 Hz	8.00Hz
P5-04	*Min Temp. Comp* Minimum Temperature Compensation	Sets the lower limit for the amount of compensation.	-20.00 to 20.00 Hz	-2.00Hz

Table 9: Limits for load and temperature compensations

6.4 P6-XX PARAMETERS: PARAMETERS FOR DWELL FUNCTIONS

In order to provide smooth & quick start and smooth stop, special dwell functions have been introduced with **P6-xx** parameters. Related parameters of the dwell functions are shown in ***Table 10***.

Parameter	*Operator Display* Parameter Name	Description	Setting range	Default value
P6-01	*Dwell FreqOffset* Special Dwell Frequency Offset	Start Dwell ramp time	0.00 to 20.00Hz	2.00Hz
P6-02	*Dwell Time 1* Special Dwell Time 1	Used when Nominal, Intermediate or Inspection Speed is selected	0.00 to 20.00s	2.00s
P6-03	*Dwell Time 2* Special Dwell Time 2	Used for re-Leveling operation	0 to 20.00s	1.00s
P6-05	*StrtDwellLeakGRlv* Special Dwell at Start Leakage Multiplier for Re-Levelling	Gain applied to leakage at Start-Dwell (used for re-Leveling operation)	0.000 to 3.000	1.200
P6-06	*StpDwellLeakGain* Stop Dwell Leakage Mul-tiplier	Gain applied to leakage at Stop Dwell (used for all speed operations)	0.000 to 3.000	1.000
P6-07	*Stop Dwell Time* Stop Dwell Time	Time setting for Dwell at stop	0.00 to 5.00	0.30s

Table 10: Dwell function parameters

6.5 P7-XX PARAMETERS: PARAMETERS FOR LEVELING RECOVERY FUNCTION

In case of zero or very low leveling speed due to worn pumps or wrong parameter settings, "Leveling Speed Control (Recovery) Function" is introduced to assure that the car will always reach the next floor. ***Table 11*** shows related **P7-xx** parameters for the leveling speed control function.

Parameter	*Operator Display* Parameter Name	Description	Setting Range	Default value
P7-01	*LevelRecoverTime* Leveling speed control wait time	When Leveling time exceeds this value, Leveling speed is increased step wise.	0.00 to 10.00 s	3.00 s
P7-02	*Level Step Freq* Leveling speed control Frequency Step	Step width for increasing frequency by Leveling speed control function.	0.00 to 5.00 Hz	0.25 Hz
P7-03	*Level Step Time* Leveling speed control Step Time	Wait time for increasing frequency by Leveling speed control	0.00 to 5.00s	0.30 s
P7-05	*Level. Up Lim* Leveling speed control Upper Limit	Upper limit for Leveling frequency, increased by Leveling speed control function	0.00 to 20.00 Hz	7.00Hz

Table 11: Parameters for leveling recovery function

6.6 P8-XX PARAMETERS: PARAMETERS FOR SPECIAL TUNING

Torque and temperature control gains and overload detection parameters are listed in ***Table 12***.

Parameter	*Operator Display* Parameter Name	Description	Setting range	Default value
P8-01	*Temperature Gain* Temperature Gain	*Used for temperature compensations.*	0 to 1000 [1/°C]	211
P8-02	*Torque Gain* Torque Gain	*Used for load compensations.*	0 to 1000 [1/%]	84
P8-03	*TrqRef Comp Gain* Torque Reference Compensation Gain	*Used for load compensations.*	0 to 1000 [1/°C]	400
P8-04	*LevelSpdGRelev* Levelling Speed Muntiplier for Re-Levelling	*Used for increasing re-leveling speed*	0.000 to 5.000	1.000
P8-05	*LevDelayTmeGain* Gain for Leveling Delay Time	*Gain applied to t_x time (see section 8.1).*	0.00 to 3.00	1.00
P8-06	*TrqRefOverLdGain* Torque Reference Overload Gain	*Gain applied to torque reference in overload condition.*	0.1 to 3.0	1.0
P8-07	*Overload Current* Overload Current	*Sets the current level to trigger overload travel function*	0 to 200%	150%
P8-08	*OverloadDetTime* Overload Detection Time	*Sets the time (during which current is above P8-07) to trigger overload function. P8-08=0 cancels overload function.*	0.00 to 3.00	1.00
P8-11	*SEQF Detec Gain* SEQF Detection Gain	*Sets the detection speed level for SEQF error*	1.00 to 2.00	1.35

Table 12: Control gains and overload parameters

6.7 MONITORING PARAMETERS

P type parameters can be monitored during or after the run. These are also helpful for diagnostics. ***Table 13*** shows the hydraulic module parameters that can be observed from the monitor menu.

Parameter	Monitor Name	Description
U7 - 02	Current temperature value	Current oil temperature value [°C]
U7 - 03	Car load monitor	Captured torque % that is used for calculating car load.
U7 - 04	Torque compensation amount	Torque compensation [Hz] Amount of calculated load compensation.
U7 - 05	Temperature compensation amount	Temperature compensation [Hz] Amount of calculated temperature compensation.
U7 - 06	Torque Reference-Temperature Compensation Factor	Temperature depended factor for correcting load reference.
U7 - 07	Previous run leveling time	Previous run leveling time [s]
U7 – 08	Minimum overload frequency	Minimum frequency for triggering the overload function [Hz]

Table 13: Monitoring parameters and their status

For the complete list of standard monitoring parameters of the drive refer to the Quick Start Guide (QSG).

6.8 SETTING UP EXAMPLE

A passenger elevator data is given in the table below.-

Property	Value	Related EV4 parameter
Oil type	ISO VG46	P1-01, P1-02 & P1-03
Ram diameter [mm]	110	P1-04
Number of rams	1	P1-05
Suspension ratio	2:1	P1-06
Empty car pressure [bar]	18	P1-07
Pay load [kg]	1000	P1-08
Dynamic pressure increase [bar]	5	P1-09
Nominal speed [m/s]	0.6	P1-16
Intermediate speed [m/s]	0.5	P1-17
Inspection speed [m/s]	0.3	P1-18
Leveling speed [m/s]	0.065	P1-19
Pump flow rate [l/min] 100cSt, 40bar	181	-
Motor, 3 phase, 400Vac, 2780 1/min	11kW – 50Hz	-

1) Set the target

According to the nominal speed of the elevator following target parameters can be chosen:

Acceleration parameters	Value		Deceleration parameters	Value (From Table 5)
C1-03	10.0s		C2-03	0.3s
C2-01	1.8s		C1-02	2.4s
C1-01	2.8s		C2-04	1.4s
C2-02	0.5s		C1-04	2.0s

Set deceleration switch distance to 105cm (***Table 5***).

2) Inputting oil and lift data (P1- xx parameters)

Input above given oil and lift data to the drive.

3) Obtain pump data from http://www.blain.de/calc (Blain EV4 Calculator)

From the Blain EV4 Calculator pump data can be obtained as below

Pump data	Input values to the drive
P1-11 (Flow at 100cSt & at max. pressure)	180.9
P1-12 (Flow at 25cSt & at max. pressure)	171.1
P1-13 (Pump rated speed)	2750
P1-14 (Flow at 100cSt & at empty car press.)	184.0
P1-15 (Flow at 100cSt & at 1 bar pressure)	191.0

4) Input pump parameters (from P1-11 to P1-15) to the drive

5) Set P4-01 to 1 (Teaching function: Basic Calculations is done by the drive)
If **oPE02** error occurs then parameters were given or calculated parameters are outside the setting range. Press "**Enter**" on the Remote Digital Operator to see the parameter that is outside the setting range.

If oPE12 error occurs then calculated speed frequencies are not correct. One of the above conditions is not obeyed;
P1-16 > P1-17 > P1-18 > P1-19 or
P3-01 > P3-02 > P3-03 > P3-04 or
P3-04 > (P3-07 x P6-05) and P3-04 >(P3-07 x P6-06) or
P7-05 > P3-04 or
P1-03 > P1-02 or
P1-11 > P1-12 or
P1-15 + P1-23 > P1-14

Speed frequencies (from **P3-01** to **P3-07**) should be below the synchronous speed of the motor (in this case 50Hz). Ideally **P3-01** should be around the nominal speed of the motor (in this case around 46 Hz).

Speed frequency parameters	Frequency [Hz]
P3-01 (Nominal speed)	46.3
P3-02 (Intermediate speed)	37
P3-03 (Inspection speed)	22.79
P3-04 (leveling speed)	6.1
P3-07 (leakage)	1.49

6) Set P4-01 to 2 (Teaching function: Teach run)

As the setting is done, "ALM" LED and "TEACH" warning flashes and the user is asked for performing a Teach Run.

7) Perform an empty car teach run
8) If digital LED operator shows "SAVE" or "WRTP", press ENTER and set P4-01=3 otherwise repeat teaching according to the error messages (see *Figure 22*).
9) Run the elevator and check acceleration, deceleration quality and stopping accuracy. If necessary modify target parameters for better ride quality.

7. DRIVE SEQUENCE AND RUN COMMAND

7.1 TRAVEL PROCEDURE

The Upward Run Command (**S1** signal) and/or the Speed Selection Command (one of the **S4, S5** or **S6** signals) are given to the drive to perform a travel. When only **S1** signal is closed (given to the drive) the elevator travels at leveling speed. On the other hand, when **S1** and **S4** signals are both closed, the drive accelerates the elevator to the nominal speed and as **S4** (Speed Selection signal) is removed, the elevator decelerates to the leveling speed. The drive then continues on traveling at leveling speed until **S1** signal (Run command) is removed. After the removal of **S1** signal, motor contactors should be kept closed approximately 1 second until the stop dwell is executed.

Base block (bb) signal can be used optionally by the elevator controller. When it is used, in case of a failure the elevator controller sends the bb signal to the drive (**S3**) to cancel the run. The parameter for the signal is **H1-03** (set to **24** by default). When bb signal is not used **H1-03** may be set to **F** to cancel it (normally open contact). If the bb signal is given during the run the elevator stops suddenly with a jerk. Base block (bb) signal should be sent to the drive after the stop dwell is executed.

According to the signal combination speed selections are shown below.

	RUN Command	Speed Selection Command
Nominal speed	S1	S4
Intermediate speed	S1	S5
Inspection speed	S1	S6
Leveling speed	S1	-

Table 14: Signaling the drive for different elevator travels

The drive signaling sequence is shown in *Figure 25*.

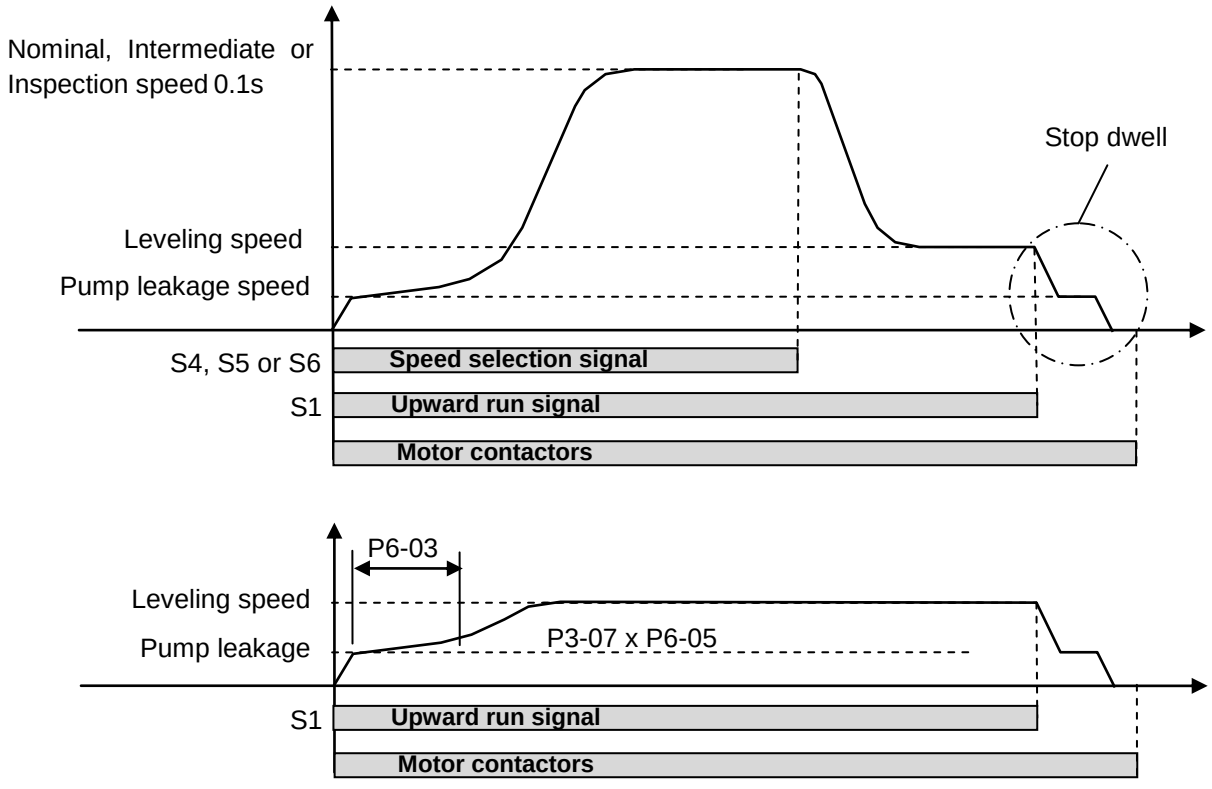


Figure 25: Signaling the drive for different travels

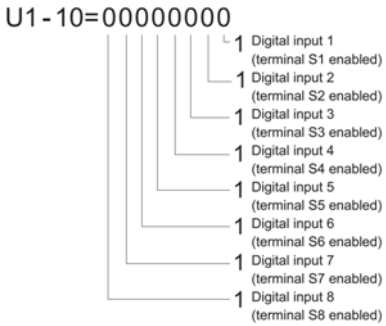
While setting speed parameters in m/s (from **P1-16** to **P1-19**), the rule of Nominal Speed > Intermediate Speed > Inspection Speed > Leveling Speed should be satisfied otherwise oPE12 alarm occurs.

In case more than one speed selection is closed, always the lower speed will be executed.

In order to have quick re-leveling, the leakage frequency (P3-07) and start dwell time (P6-03) can be increased for the re-leveling operation. Increasing the parameter **P6-05** (default is 1.20) and/or decreasing the parameter **P6-03** (default is 1.00) allows quicker re-leveling – See Figure 18.

7.2 VERIFYING CORRECT SIGNALING FROM LIFT CONTROLLER

When signaling from the lift controller is not correctly done, the lift may not run or execute unintended travel behavior. In order to verify correct signaling from the lift controller observe **U1-10** parameter (Input Terminal Status) from the monitor menu. Initially **U1-10** will show "**00000000**". When the drive receives signals for a nominal speed travel it changes to "**00001001**" and lift accelerates to the nominal speed. As deceleration switch is reached in the shaft **U1-10** changes to "**00000001**" while lift decelerates to the leveling speed. Eventually, the lift reaches the stop switch then **U1-10** changes to "**00000000**" and the lift stops. A similar observation occurs for intermediate and inspection travels. In these cases, **U1-10** initially takes the values of "**00001010**" and "**00001100**" for intermediate and inspection travels respectively.



U1-10: Input terminal status

7.3 TRAVEL STOP

The drive will cancel the travel in the following cases:

Stop method	Case
Ramp to stop (stops with the ramp of C1-04)	The run signal/command is removed while speed selection input is still closed
Coast to stop (immediately power off)	The Run command is removed while the drive is decelerating to Leveling speed
Coast to stop	When leveling time exceed 60s
Stops as defined by the input	One of the digital inputs is set to "External Fault"
Coast to stop	Removing the wire link from the safety inputs (H1, H2, HC) or activating a digital input, set to "Base Block"

Table 15: Stopping methods with respect to causes

7.4 REFERENCE AND RUN SOURCE

The "LO/RE" key on the drive's operator keypad is normally used for switching from remote mode to local mode. Local mode means that frequency reference and run signal are input from the operator panel. To use this function (e.g. for testing the motor) set **o2-01** to **1** (to modify o2-01 parameter change the access level from "Customer" to "Advance", see section Miscellaneous).

8. SPECIAL FUNCTIONS

8.1 DECELERATION TIME COMPENSATION

In case the drive runs with a slower speed than the nominal speed, removal of upward run signal is delayed by $\mathbf{t_x}$ seconds in order to ensure the shortest possible travel time (i.e. the same leveling travel time) and good ride quality (*Figure 26*). t_x time is calculated by the drive automatically.

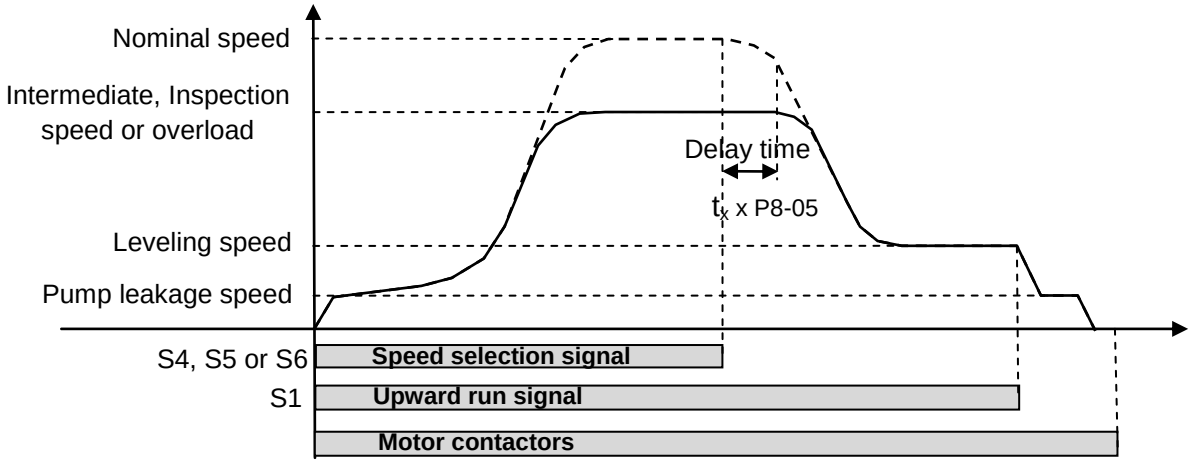


Figure 26: Deceleration time compensation to have constant leveling comfort

In case the modified leveling travel time does not match with that of the nominal speed, change the parameter **P8-05** as follows (P8-05 is set to 1.00 by default);

Leveling time with intermediate, Inspection or overload case	Action
Too long	Increase P8-05 by 0.05 at a time
Too short	Decrease P8-05 by 0.05 at a time

Table 16: Leveling time & overload case

If leveling speed is too low during intermediate or inspection travel, reduce respective torque reference (P3-11 for intermediate speed or P3-12 for inspection speed) by 5% at a time or decrease P8-06 parameter 0.05 unit at a time.

8.2 LEVELING SPEED CONTROL

In case of wrong set up (e.g. P1 parameters are incorrectly entered), the pump might not generate enough positive flow or leveling speed may become very low. In such cases the car could never reach the next floor or it may take a long time. Both cases cause bad ride quality and lower the conditions of safety. To allow recovery in such cases, after a certain waiting time the drive starts to increase the speed automatically in steps up to a maximum value (P7-05).

	Leveling speed control function becomes inactive during set-up procedure (teaching). ***After an empty car travel, measure the leveling time from the monitor menu (U7-07) and set this value to the waiting time (P7-01).***

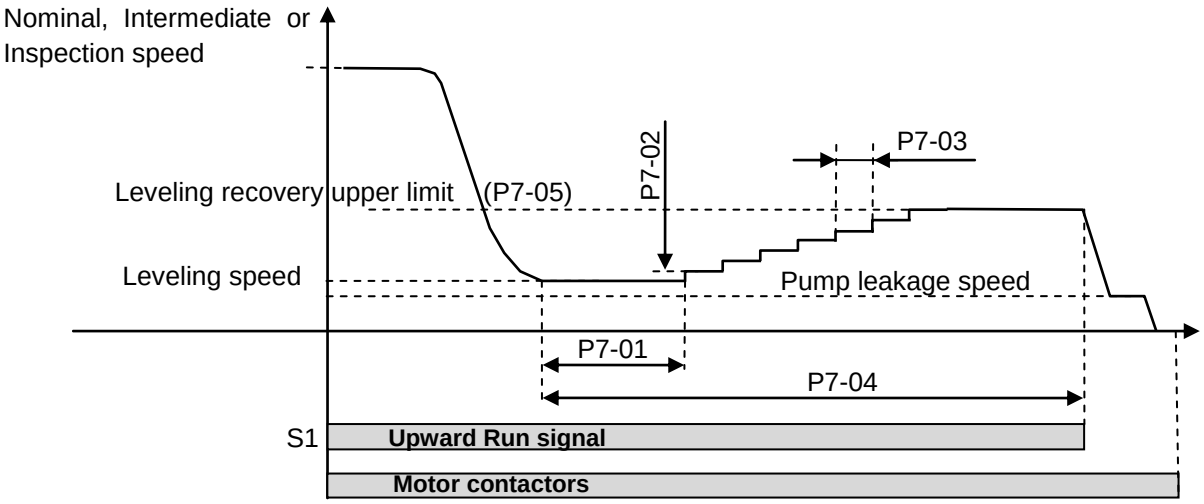


Figure 27: Leveling recovery function

8.3 LEVELING TIME CONTROL

When leveling time exceeded the maximum set value **P7-04** (60 seconds), the drive gives **LETA** (Leveling Time Alarm) alarm and stops with stop-dwell procedure. To restart the drive, the external RUN command must be cycled. The leveling time control is applied to all travels including re-leveling in order to prevent the power unit from malfunctioning due to unforeseen reasons (***Figure 27***)

9. ENERGY SAVING MODE/OVERLOAD OPERATION

In order to lower the energy consumption, the motor and drive size can be chosen 20% smaller and let drive to change the elevator speed depending on the car load. This means that the elevator will have the maximum nominal speed when it is empty and the lowest when it is fully loaded. In this way the power unit energy efficiency is increased as well as the economical effectiveness of the elevator system. Overload operation is only possible for nominal and intermediate speeds. Please check software version (21300 or 21310) from parameter U1-25 in “Monitor Menu” and apply overload settings as described below.

9.1 SOFTWARE VERSION 21300

"Stall prevention during acceleration" function (L3-01) is used for determining the overload condition. By default stall prevention function is set to **1** (enabled). When the output current (U1-03) exceeds 85% of the level that is set by the parameter **L3-02**, the acceleration rate is reduced. The acceleration is stopped when the current exceeds **L3-02** and it continues when the current falls below **L3-02**. For further information the user should refer to Yaskawa L1000H Technical Manual.

As the output current exceeds the limiting current level (L3-02), the overload operation is triggered. In that, the drive stops accelerating and replaces the full speed frequency with the one as the overload operation is triggered. In such a case deceleration time is also compensated to have the shortest travel time.

	Energy saving/overload mode can be switched off by setting L3-01 to 0. It is recommended to leave L3-01 setting enabled to prevent the drive from being overloaded. Overloading (L3-01=0) may result in uncomfortable travel.

9.2 SOFTWARE VERSION 21310

"Stall prevention during acceleration" function (L3-01) is no longer used for the overload condition. **L3-01** parameter is recommended to be set to “**0**”.

As the output current exceeds the limiting current level set in **P8-07** (by default 150%) for the time set in **P8-08** (recommended to be to 0.10 seconds) the overload operation is triggered. In such a case deceleration time is also compensated to have the shortest travel time. Overload operation is disabled by setting **P8-08** to **0**.

When travel speed is reduced by the drive leveling speed and leveling time should remain the same. If leveling speed becomes too low/high then decrease/increase **P8-06** by **0.1** unit at a time. If leveling time becomes too short/long then decrease/increase **P8-05** by **0.05** unit at a time.

	There is a minimum frequency level (MFL) below which overload operation is not active. MFL can be adjusted by the settings of the deceleration parameters and value of MFL (U7-08) can be seen from the monitor menu. Recommended deceleration parameters can be obtained from EV4 Calculator (www.blain.de/calc***) in Table 2. If it is not low/high enough then modify the deceleration ramp according to the formulation given below;***

	Minimun frequency level [Hz]: $$\text{U7-08} = (\text{P3-04}) + \frac{(\text{C2-03}) + (\text{C2-04})}{2\ (\text{C1-02})} \times (\text{E1-04}) + \text{Temp compensation}$$ ***Example:*** *P3-04=8.0Hz, E1-04=60Hz, C1-02=2.5s, C2-03=0.5s, C2-04=2.0s, Temp compens.=1.0Hz* $$\text{Minimun freq level [Hz]} = (\text{U7-08}) = 8 + \frac{0.5 + 2.0}{2 \text{ x } 2.5} \text{ x } 60 + 1.0 = 39 \text{ Hz}$$ *This means that as the motor is overloaded the drive determines the new speed level above 39Hz (minimum frequency level).*

10. MISSELLENOUS FUNCTIONS

10.1 PARAMETER ACCESS LEVEL (A1-01)

By default the user accesses to "**Customer level**" (A1-01=3), where only necessary parameters are listed. Unless necessary the user should stay in customer level for a quick and trouble free set-up. To swap into "**Advance level**" set **A1-01** to **2**.

Parameter name	Setting	Access level
A1-01	2	Advance
	3	Customer

10.2 SETTING UP USER INITILIZATION VALUES (O2-03)

Once drive parameters are set up completely, the set values can be saved as "**User Initialization Values**" by setting parameter **o2-03**. Once this has been done, the "Initialize Parameters" (A1-03) will offer the choice of "**1110: User Initialize**". Choosing **A1-03** = "**1110: User Initialized**", will reset all parameters to the values saved as "User Initialization Values". Refer to section 10.4.

Parameter	Setting	Effect
o2-03	0	No Change all "User Initialization Values" are kept as they are
	1	The current parameter settings are saved as "User Initialization Values"
	2	All "User Initialization Values" are cleared

10.3 COPY FUNCTION (O3-01)

This parameter controls the copying of parameters to and from the LED operator.

Parameter	Setting	Effect
o3-01	0	COPY SELECT (no function)
	1	INV →OP READ All parameters are copied from the drive to the LED operator.
	2	OP → INV WRITE All parameters are copied from the LED operator to the drive.
	3	OP<-->INV VERIFY Parameter settings in the drive are compared to those in the LED operator.

Note: When using the copy function, the drive model number (o2-04) and the software number (U1-25) must match or an error will occur. To enable Copy Function Selection set **o3-02** to **1**, for disabling set **o3-02** to **0**.

10.4 DRIVE INITILIZATION (A1-03)

Resets parameter settings back to their original default values. After the initialization the parameter automatically returns to 0.

Parameter	Setting	Effect
A1-03	0	No Initialization
	1110	User Initialization: drive returns to the parameters selected as user settings.
	2220	2-Wire Initialization: Resets all parameters back to their original default settings

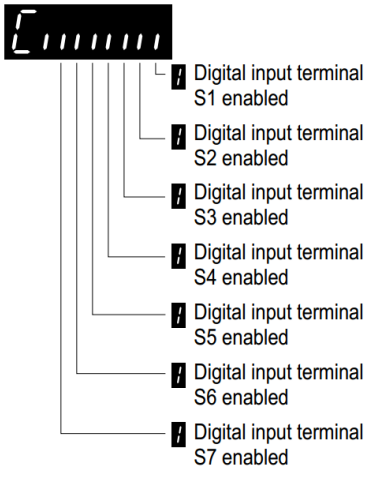
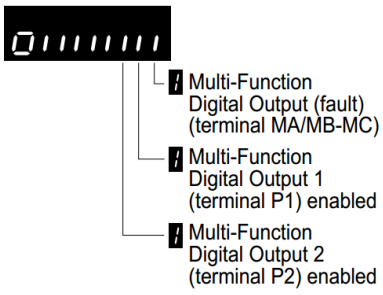
Note: A "**user-initialization**" resets all parameters to a user-defined set of default values that were previously saved to the drive. To clear the user-defined default values, set parameter **o2-03** to "**2**".

10.5 MONITOR PARAMETERS (UX-XX)

Monitor parameters lets the user the user view various aspects of inverter performance during the run. These are shown in the table below.

Monitor parameter	Description
U1-xx : Operation status	Monitors status parameters during run
U2-xx : Fault trace	Monitors the status of various inverter aspects when a fault occurs
U3-xx : Fault history	Gives the history of faults occurred

Amongst these parameters U1-xx is rather helpful for troubleshooting. These parameters are shown in the table below

Parameter	Name	Description
U1-01	Frequency reference	Monitors the frequency reference
U1-02	Output frequency	Displays the output frequency
U1-03	Output current	Displays the output current
U1-04	Control mode	2: open loop vector
U1-05	Motor speed	Displays the motor speed feedback
U1-06	Output voltage reference	Displays the output voltage
U1-07	DC bus voltage	Displays the DC bus voltage
U1-08	Output power	Displays the output power
U1-09	Torque reference	Monitors internal torque reference
U1-10	Input terminal status	Input terminal status is displayed as "0" for no input otherwise as "1" 
U1-11	Output terminal status	Output terminal status 

11. FINE ADJUSTMENTS & TROUBLESHOOTING

11.1 UP DIRECTION TRAVEL

Problem	Possible cause	Corrective action
Drive is running but elevator is not moving or moving too slow (<0.03m/s).	Low pressure relieve valve setting.	Increase the setting (see page 9).
	Motor no-load current (E2-03) setting is too high (Check output current →U1-03).	Correct no-load current (E2-03) setting (see page 23).
	V/f parameter settings (E1-08 & E1-10) are incorrect (Check output current →U1-03).	Lower E1-08 & E1-10 settings.
	Elevator is overloaded.	Remove load.
	C1-03 time is too short	Increase C1-03 time
	Failure with the connections of the temperature converter or insufficient power supply	Correct the connections or replace the power supply (12Vdc to 35Vdc).
Elevator too slow when heavily loaded	Torque gain (P8-02) is low	Increase P8-02 setting. Increase P8-02 value by 10% at a time
	Torque reference value is too high (incorrect empty car teach run)	After an empty car run check U7-03. If P3-10>>U7-03 then set P3-10 = U7-03.
	Drive is overloaded and settings for overload function is incorrect	Set L3-01=1 Limit car load or select bigger drive
	Worn-out pump	Replace the pump
	Low motor performance	Reduce speed Limit car load Change the motor
Elevator too slow with increased oil temperature	Incorrect temperature measurement	Check temperature sensor & converter connections and make sure the converter has correct power supply (12 to 35V DC) Make sure the sensor dipped in the oil Check if value for analogue input bias (H3-04) is set correctly Increase P8-01 value by 10% at a time
	Wrong temperature reference (P3-16)	Check temperature reference (P3-16) and compare with the actual one (U7-02)
	Worn-out pump	Replace the pump
Uncomfortable, harsh begin of travel in normal operation.	Low start-dwell time (P6-02)	Increase start dwell time (P6-02).
	Too high leakage frequency (P3-07)	Reduce leakage frequency (P3-07) by 20%
	Too small start dwell ramp (P6-01)	Increase start dwell ramp 0.5Hz at a time
	Too little C2-01 time	Increase C2-01 time.
Uncomfortable, harsh ending of travel.	Motor contactors open too early	Delay motor contactors opening time by approx. 1 second after stop switch is reached.
	Base block signal is closed too early	Delay base block signal closing time by approx. 1 second after stop switch is reached.
	Too short ramp time	Increase C1-04 time.
	No leveling travel	Reduce C1-02 and/or C2-03 and C2-04 deceleration parameters or increase switch distance.
	Stop dwell time is too short	Increase parameter P6-07 by 20% at a time.
	Leveling control upper limit is too high.	Decrease P7-05 by 0,5Hz at a time while P7-05 > P3-04.

Problem	Possible cause	Corrective action
Leveling time too long when running with slower speed than nominal.	Insufficient deceleration time compensation before deceleration.	Increase parameter P8-05 carefully in steps of 0.02.
Car speed is good for Nominal Speed, but not for Intermediate or Inspection Speed.	Incorrect torque references.	After an empty car run with intermediate/inspection speed check U7-03. If P3-11/P3-12>>U7-03 then set P3-11/P3-12 = U7-03.
Energy Saving / Overload function is enabled but the drive limits the speed to a value, lower than the frequency shown in U7-08.	Drive too heavy loaded for the given car load.	Limit car load or select a bigger drive.
	Deceleration path ramp (C1-02) is too high or s-curves (C2-03 & C2-04) times are too low.	Change deceleration path parameters accordingly.
Temperature reading (U7-02) is unexpectedly high/low	Broken power connection to the temperature converter.	Correct the power connection
	Wrong wiring of the temperature converter.	Correct wiring (See page 14)
After decelerating to leveling speed the drive ramps down to a lower speed.	Leveling recovery upper limit (P7-05) is lower than leveling speed (P3-04)	Increase P7-05 parameter
oPE12 alarm is displayed on the operator.	Check speed frequency references.	Make sure that P3-01>P3-02>P3-03>P3-04 or P3-04>P3-07xP6-05 or P3-04>P3-07xP6-06 or P7-05>P3-04 or (P1-15+P1-23)>P1-14 or P1-03>P1-02 or P1-11>P1-12.
	Check if temperature converter is connected correctly, see U7-02.	Correct the connection and repeat teaching.
oPE02 alarm is displayed on the operator	Parameters were set outside the possible setting range.	Press “enter” to see the improperly set parameter and correct it.
During auto-tuning Er-12 error is displayed on the operator	Auto-tuning was attempted without connecting the motor or motor contactors are not closed.	Connect the motor or correct the contactor layout. To reset the error switch off the drive about 30s and switch it on again.
Excessive vibration in the car.	Pump pulsations resonates with the natural frequency of the elevator structure.	Change the pump with a higher or lower flow or use a pulsation damper (refer to spare part list; Annexure 1 and 4).
LETA alarm is displayed on the operator.	Leveling run after deceleration is longer than 60s.	Check lift controller signaling sequence Make sure speed compensations are done accurately. Incorrect input data or/and incorrect basic calculations. Incorrect empty car teach run procedure.
SEQF alarm is displayed on the operator.	Check the deceleration path parameters	Reduce C1-02 and/or C2-03 and C2-04 deceleration path parameters or increase the switch distance in the shaft.
	Run (S1) and Speed selection (e.g. S4) signals are swapped.	Correct the signaling.
Elevator controller sends a travel signal but the drive does not work.	The drive is at alarm or program mode.	Trace the cause, remove it and press reset button to cancel the alarm.
	Check if signaling from controller to the drive is correct.	Verify the controller signal wiring.

Table 17: Trouble shooting

To have further information on operator programming errors (oPE01 to oPE10), Auto-Tuning errors (Er-01 to Er-12 and End 1 to End 3) and others and their corrective actions refer to L1000H Quick Start Guide or L1000V Technical Manual.

11.2 DOWN DIRECTION TRAVEL

Problem	Possible cause	Corrective action
No Down Start	Solenoid D not energized or voltage too low.	Lift coil to check magnetic pull. See A below.
	Adjustment 6 turned in too far.	Turn out adjustment 6.
	Adjustment 8 turned out too far.	Turn in adjustment 8 cautiously. Attention: Danger of traveling through
	O-Ring UO on Down Valve X is leaking.	Change O-Ring →see EV Spare Parts List.
No full speed	Solenoid C not energized or voltage too low.	Lift coil to check magnetic pull. See A below.
	Adjustment 7 turned in too far.	Turn out adjustment 7.
	Down Valve flow guide X too small.	Check insert size (see flow guide charts page 6)
No down leveling. Elevator stops before floor level	Solenoid C and D reversed.	Lift coil to check magnetic pull. See A below.
	Solenoid D has no energy	Check electrical connections
	Adjustment 9 turned in too far.	Turn out adjustment 9 to about 0.05 m/s leveling speed.
	Spring 9F in adjustment 9 is broken.	Replace adjustment 9 complete.
No down leveling. Elevator travels though floor level	Adjustment 8 turned in too far. Filter of adjustment 8 blocked or adjustment 8 is damaged.	Turn out adjustment 8 about ½ turn.
	Adjustment 9 turned out too far.	Turn in adjustment 9 to about 0.05 m/s leveling speed.
	Solenoid valve C: Dirt or damage between needle DN and seat DS.	Clean or change needle and seat.
	Inner O-Ring FO on flange 7F is leaking.	Change O-Ring → see EV Spare Parts List.
Elevator sinks quickly	Solenoid D is tight enough	Tighten Solenoid D tube.
	Adjustment 8 is turned in too far	Turn out adjustment 8 app. ½ turn
	Solenoid C is dirty and blocked; no function.	Clean needle and seat.
	Adjustment 8 turned in too far.	Turn out adjustment 8 about ½ turn.
Elevator sinks slowly due to inner leakage (Re-leveling)	For possible down leakage points, see „Technical Documentation System Leakage“.	Replace one seal at a time and test before proceeding to the next point of possible leakage, if still necessary.
	Solenoid valve D: Dirt or damage between needle DN and seat DS.	Clean or change needle and seat.
	O-Ring XO of Down Valve X is leaking.	Change O-Ring → see EV Spare Parts List. When Down Valve is compensated, replace Down Valve.
	O-Ring VO of Check Valve V is leaking.	Change Check Valve → see EV Spare Parts List.
	O-Ring WO of Leveling Valve W is leaking.	Change O-Ring → see EV Spare Parts List.
	Inner O-Ring FO on flange 4F is leaking.	Change O-Ring → see EV Spare Parts List.
	O-Ring HO of Manual Lowering H is leaking.	Replace Manual Lowering.
Elevator sinks due to inner leakage of auxiliary equipment	HP: Hand pump is leaking.	Remove suction tube and observe if hand pump leaks. Replace complete hand pump.
	HX/MX Adjustment 8M turned in too far.	Turn out adjustment 8M.
	HX/MX: Down valve 9M is leaking.	Clean or change needle and seat.

	Dirt or damage between the needle DN and seat DS.	
	HX/MX: O-Ring XO of Down Valve YM is leaking.	Change O-Ring → see EV Spare Parts List.
	HX/MX: Manual Lowering is leaking (HX/MX).	Replace Manual Lowering.
	Contraction of oil during cooling especially from 35°C or above.	Consider oil cooler if hot oil is a problem.

Table 18: Down direction travel

A: For checking the operation of the solenoids, remove the top nuts. By lifting the coils a few millimeters, the magnetic pull of the coil can be felt.
For testing, the operation of the elevator car can also be controlled by lifting and replacing the coil.

12. ANNEXURE 1 – MOTOR PARAMETERS

Motor Type: ELMO Srl.

Power	7.7 kW 10.5 HP	50 Hz, 400V-Delta 3 Phase, 2780 rpm	
Type	S342A-77T690NEY		
E1-01	400 VAC	E2-01	18.5 A
E1-03	F	E2-02	3.00 Hz
E1-04	60 Hz	E2-03	10.80 A
E1-05	400 VAC	E2-04	2
E1-06	50 Hz	E2-05	2.158 Ohm
E1-07	3.0 Hz	E2-06	15.5%
E1-08	31.7 VAC	E2-07	0.50
E1-09	0.5 Hz	E2-08	0.75
E1-10	5.8 VAC	E2-09	0.0%
E1-11	0.0 Hz	E2-11	7.7 kW
E1-12	0.0Hz	E2-12	1.30
E1-13	400 VAC		

Power	9.5 kW 13 HP	50 Hz, 400V-Delta 3 Phase, 2780 rpm	
Type	S342A-95T690NEY		
E1-01	400 VAC	E2-01	23.4 A
E1-03	F	E2-02	3.00 Hz
E1-04	60 Hz	E2-03	15.0 A
E1-05	400 VAC	E2-04	2
E1-06	50 Hz	E2-05	1.652 Ohm
E1-07	3.0 Hz	E2-06	19.6%
E1-08	26.4 VAC	E2-07	0.50
E1-09	0.5 Hz	E2-08	0.75
E1-10	4.8 VAC	E2-09	0.0%
E1-11	0.0 Hz	E2-11	9.5 kW
E1-12	0.0Hz	E2-12	1.30
E1-13	400 VAC		

Power	11 kW 15 HP	50 Hz, 400V-Delta 3 Phase, 2790 rpm	
Type	S342A11-T690NEY		
E1-01	400 VAC	E2-01	26.8 A
E1-03	F	E2-02	3.00 Hz
E1-04	60 Hz	E2-03	18.5 A
E1-05	400 VAC	E2-04	2
E1-06	50 Hz	E2-05	1.420 Ohm
E1-07	3.0 Hz	E2-06	19.6%
E1-08	26.4 VAC	E2-07	0.50
E1-09	0.5 Hz	E2-08	0.75
E1-10	4.8 VAC	E2-09	0.0%
E1-11	0.0 Hz	E2-11	11 kW
E1-12	0.0Hz	E2-12	1.30
E1-13	400 VAC		

Power	12 kW 16 HP	50 Hz, 400V-Delta 3 Phase, 2790 rpm	
Type	S342A12-T690NEY		
E1-01	400 VAC	E2-01	27.8 A
E1-03	F	E2-02	3.00 Hz
E1-04	60 Hz	E2-03	16.7 A
E1-05	400 VAC	E2-04	2
E1-06	50 Hz	E2-05	1.208 Ohm
E1-07	3.0 Hz	E2-06	19.6%
E1-08	31.7 VAC	E2-07	0.50
E1-09	0.5 Hz	E2-08	0.75
E1-10	5.8 VAC	E2-09	0.0%
E1-11	0.0 Hz	E2-11	12 kW
E1-12	0.0Hz	E2-12	1.30
E1-13	400 VAC		

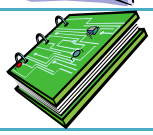
Power	13 kW 17.5 HP	50 Hz, 400V-Delta 3 Phase, 2760 rpm	
Type	S342A13-T690NEY		
E1-01	400 VAC	E2-01	29.7 A
E1-03	F	E2-02	3.00 Hz
E1-04	60 Hz	E2-03	17.2 A
E1-05	400 VAC	E2-04	2
E1-06	50 Hz	E2-05	1.238 Ohm
E1-07	3.0 Hz	E2-06	17.2%
E1-08	31.7 VAC	E2-07	0.50
E1-09	0.5 Hz	E2-08	0.75
E1-10	5.8 VAC	E2-09	0.0%
E1-11	0.0 Hz	E2-11	13 kW
E1-12	0.0Hz	E2-12	1.30
E1-13	400 VAC		

Power	14.7 kW 20 HP	50Hz, 400V- Delta 3 Phase, 2800rpm	
Type	S442A147T690NEY		
E1-01	400 VAC	E2-01	32.0 A
E1-03	F	E2-02	3.00 Hz
E1-04	60 Hz	E2-03	18.8 A
E1-05	400 VAC	E2-04	2
E1-06	50 Hz	E2-05	1.046 Ohm
E1-07	3.0 Hz	E2-06	17.2%
E1-08	31.7 VAC	E2-07	0.50
E1-09	0.5 Hz	E2-08	0.75
E1-10	5.8 VAC	E2-09	0.0%
E1-11	0.0 Hz	E2-11	14.7 kW
E1-12	0.0Hz	E2-12	1.30
E1-13	400 VAC		

13. ANNEXURE 2 – LIST OF SPARE PARTS

Blain article number	Spare Parts
105188	Yaskawa Inverter L1000H 3 KW
500045	Yaskawa Inverter L1000H 4 KW
105189	Yaskawa Inverter L1000H 5.5 KW
500047	Yaskawa Inverter L1000H 7.5 KW
500048	Yaskawa Inverter L1000H 11 KW
500049	Yaskawa Inverter L1000H 15 KW
105190	Yaskawa EMC Line-Filter 400VAC 15A (for 3KW & 4 KW inverter)
105191	Yaskawa EMC Line-Filter 400VAC 30A (for 5.5 KW & 7.5 KW inverter)
105192	Yaskawa EMC Line-Filter 400VAC 50A (for 11 KW & 15 KW inverter)
105197	Yaskawa Line-Reactor IP00 400VAC 8A (for 3KW & 4 KW inverter)
105198	Yaskawa Line-Reactor IP00 400VAC 16A (for 5.5 KW & 7.5 KW inverter)
105199	Yaskawa Line-Reactor IP00 400VAC 21A (for 11 KW inverter)
105200	Yaskawa Line-Reactor IP00 400VAC 27A (for 15 KW inverter)
105453	Yaskawa Digital Operator with cable
500235	Blain EV4 0.75” Renovation kit (includes Article 500039 & 500052)
500038	Blain EV4 1.5-2” Renovation kit (includes Article 500039 & 500052)
500039	Temperature converter for Pt100
500052	Temperature sensor Pt100
105246	Pulsation damper 25 bar
105247	Pulsation damper 30 bar

14. ANNEXURE 3 – EV4 PACKAGE DETAILS

Product	Details
EV4 valve	
Yaskawa L1000H inverter	
Temperature sensor	
Temperature converter	
Yaskawa line filter	
Yaskawa AC Reactor	
Quick start manual	
EV4 user manual	

Note: Pictures depicted are for reference only. Actual product may vary.

15. ANNEXURE 4 – POWER UNIT DESIGN

In case of vibration in the car:

In some applications vibration in the car might be experienced, particularly at low frequencies. This cannot be predicted precisely as it depends on the structural design of the elevator system & the shaft. In such a case try to eliminate the sources for structure borne noises (eliminating metal to metal bridging, placing the tank on rubber legs, etc.) and for fluid borne noises (using a meter long hose at the ends of the pipe line). Using expansion chambers (silencers) may not remedy the problem. Vibrations in the car are mainly related with pump leakage & pulsation, motor performance at low frequencies, pressure, natural frequency of the elevator system and hydraulic layout.

An easy solution to the problem is to connect a small pulsation damper to the power unit.

Blain Hydraulics approves the use of pulsation dampers by Hydac with 0.075 liter volume. Refilling pressure could be chosen between 0.5 to 0.8 times of the average static pressure.

To install the pulsation damper easily, the pipe connections in the tank should be prepared as shown in Figures 1. If vibration in the car is disturbing then a pulsation damper can be connected to the EV4 valve via Z1 port by using a ½"G to ¼"G adaptor.

If some vibration is felt at start or at low frequencies and cannot be eliminated with the connection of a gas damper (Z1 port on the EV4 valve) the cause might come from the pump leakage or poor motor performance at low frequencies.

If auditable noise at full contracted travel speed is higher than the pump manufacturer's specification (after eliminating all sources of noise) change the pump with a silent one (follow pump manufacturer's recommendations).

In some cases, the natural frequency of the elevator system resonates with the pump pulsations and might generate high level of vibrations in the car. Though this kind of occurrences are low, when happens, the second pulsation damper might be assembled on the tank (via Connection A) in addition to the first pulsation damper on the EV4 valve. Normally the Connection A (1/2" male-tread) is plugged as it is seen from Figure 1-a.

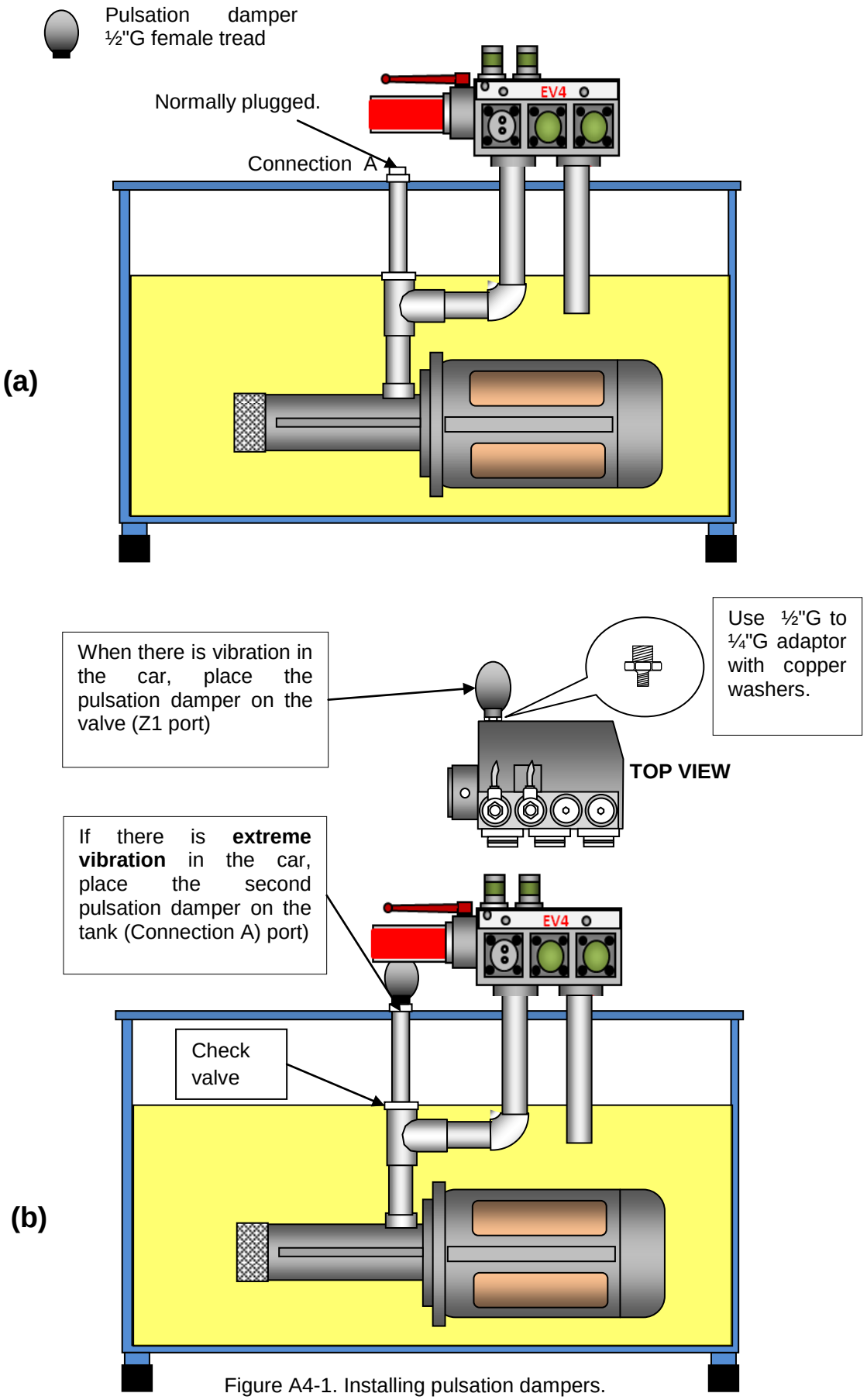


Figure A4-1. Installing pulsation dampers.

EV4 Quick Start Guide: Sheet 1- Set up

1) INPUT Motor parameters

How? Set **A1-01** to **2** (this allows access to all E1 and E2 parameters). Input ***E1-xx*** and ***E2-xx*** parameters, which are given for **ELMO** motors in the **EV4 User Manual** (Annexure 1). For other motors perform **Auto Tuning** (Refer to EV4 User Manual) or ask for support from Blain Hydraulics. **Set A1-01 back to 3** (this eases set-up procedure by accessing only set-up parameters).

2) CHECK the direction of motor rotation

How? Give only levelling speed signal (**S1**) and observe the movement or hear the pump noise. If motor rotates in reverse direction correct the rotation direction by changing the parameter ***b1-14*** (eg. If b1-14 is 1 then set it to 0 or vice versa).

3) CHECK oil temperature

How? Read oil temperature [°C] from ***U7-02***. For that, go to "Monitor Menu", press Enter and change ***U1-01*** parameter to ***U7-02***. If reading is much different than the real oil temperature (like ±50°C) in the tank:-

Check the connections of temperature converter (See pages 12 or 14 in EV4 User manual)

MAKE SURE THAT OIL TEMPERATURE IS BETWEEN 18°C AND 30°C

4) OBTAIN pump parameters (*P1-11* to *P1-15*)

How? Go to www.blain.de/calc or install EV4 Calculater Android app from Google Play Store. **SELECT oil** and **motor type** from **Table 1**, **INPUT lift data** in **Table 2** and **OBTAIN** pump paremeters from **Table 3**.

5) INPUT deceleration parameters (*C1-01*, *C2-03* and *C2-04*)

How? From **Table 2** read the values of ***C1-01, C2-03*** and ***C2-04*** and input them in the drive *(Go to Programming menu → Select **Cx-xx** parameters → Press ENTER → Modify the value → Press ENTER)*

6) INPUT lift data into the drive

How? Go to Programming menu → Select ***P1*** parameters → *Press ENTER* → Input the value for ***P1-01*** → Press ENTER. Do this for all ***P1-xx*** parameters.

P1 Parameter	Parameter description	Example	Parameter type
P1-01	Hydraulic Oil ISO VG Number	3: ISO VG 46	Oil parameters
P1-02	Temperature at 100 cSt	25°C	
P1-03	Temperature at 25 cSt	55°C	
P1-04	Ram Diameter	85mm	Lift parameters
P1-05	Number of rams	1	
P1-06	Suspension Ratio	1	
P1-07	Empty car static pressure	18bar	
P1-08	Pay load	1000kg	
P1-09	Dynamic pressure in-crease	3	
P1-11	Flow at 100cSt & at max. Pressure	72,7 l/min	Pump parameters (obtain them from www.blain.de/calc)
P1-12	Flow at 25cSt & at max. Pressure	64,2 l/min	
P1-13	Pump Rated Speed	2750	
P1-14	Flow at empty car pressure & at 100cSt	76,2 l/min	
P1-15	Flow at 1 bar pressure & at 100cSt	81,3 l/min	
P1-16	Nominal speed	0,40 m/s	Speed parameters
P1-17	Intermediate speed	0,35 m/s	
P1-18	Inspection speed	0,30 m/s	
P1-19	Leveling speed	0,06 m/s	

7) SET *P4-01* to 1: Basic calculations

How? Go to Programming menu → Select ***P4-01*** parameters → *Press ENTER* → Set the value to 1 → Press ENTER (after pressing ENTER the value automatically return to 0)

8) MAKE SURE that lift is empty and shaft switch distances allow leveling travel (See page 32 and correct deceleration switch distance if necessary)

9) SET *P4-01* to 2: Prepare for a teach run

How? Go to Programming menu → Select ***P4-01*** parameters → *Press ENTER* → Set the value to **2** → Press ENTER (after pressing ENTER the ALM LED blinks and the drive asks for an empty car teach travel)

10) PERFORM A TEACH RUN: Send the empty car up to the next stop

11) SET *P4-01* to 3: Save registered data

How? Go to Programming menu → Select ***P4-01*** parameters → *Press ENTER* → Set the value to **3** → Press ENTER.

IF NECESSARY PERFORM FINE TUNING

Notes:

Pfaffenstrasse 1
Boellinger Hoefe
74078 Heilbronn
Germany

Tel. 07131 2821-0
Fax 07131 485216
http://www.blain.de
e-mail:info@blain.de

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