

SEV

Servo Electronic Valve
for Hydraulic Elevators



System Information Handbook No. E38



Boellinger Hoefe 74078 Heilbronn Germany
Tel.: +49 7131 2821-0 Fax: +49 7131 485216 www.blain.de e-mail: info@blain.de



ISO 9001



Caution

Only experienced, qualified elevator mechanics are permitted to install and adjust elevator control valves and controllers.

Every Blain control valve is subjected to strong quality standards from production, adjustment and testing, to final shipment.

In case of questions this handbook will provide assistance. Should there nevertheless be remaining problems please contact our technical department, stating the P-number, which is engraved in the SEV casting.

BLAIN Technical Servicing

		(from USA):
Frank Pausder:	Tel: +7131 282132	01149 7131 282132
Dr. Ferhat Celik:	Tel: +7131 282139	01149 7131 282139
	Fax: +7131 485216	01149 7131 485216
	E-Mail: info@blain.de	
	URL: http://www.blain.de	

The SEV Servo Electronic Valve is being supplied to a limited number of customers on condition that the customer is familiar with and understands the SEV handbook describing the installation and operation of the SEV and has the facility to transfer to Blain, Germany through modem or e-mail, the on-line or stored data of the specific installation, should servicing be necessary.

SEV Card Control and Modem Connection

	Page
Description	2
Valve Cross Section.....	3
Hydraulic Circuit, Inspection Speed.....	4
Installation Valve, Card, Switches, Modem (optional).....	5
Wiring of Electronic Card, PC and Modem connections.....	6
SEV Card Description.....	7
Initial Operation, Display Language, Valve Adjustment	8
Changing Speeds and Traveldata, Inspection Speed.....	9
Teach speed.....	10
Changing Gain Values, Reset.....	11
Changing Cylinder Pump Data, Maximum or Constant Up Speed Selection	12
Sensor, Solenoid Trims using SEV Card	13
Calibration of speeds, Counter, Clock.....	14
Errors, Emergency Operation, Card Relay R1.....	15
Notices..... PC Control and Monitoring (Windows)	16
PC Optional Servicing.....	17
Main Display	18
Sub Displays Changing Data and Speeds.....	19
Travelgraph Online	20
Travelgraph File Saving and Reviewing	21
Travelgraph Scrolling Zooming	22
Travelgraph Cursor Focus and Zoom	23
Travelgraph Solenoid Trimming using PC	24
Logbook, Calibration.....	25
Remote Monitoring, Travelgraph Printout and E-Mailing	26
Remote Monitoring, Modem Operation.....	27
PC Notices..... Charts	28
Selection Charts - Valve Inserts.....	A
Flow - Pressure Chart.....	B
Flow - Pressure Tables (US)	C
Flow - Pressure Tables (Metric)	D



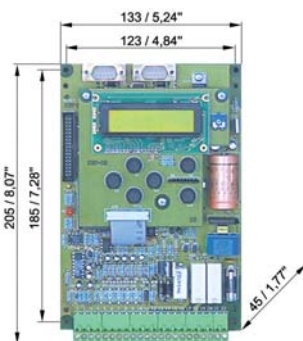
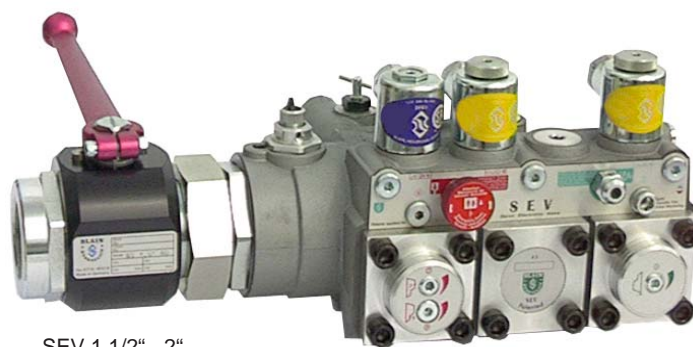
SEV

Description

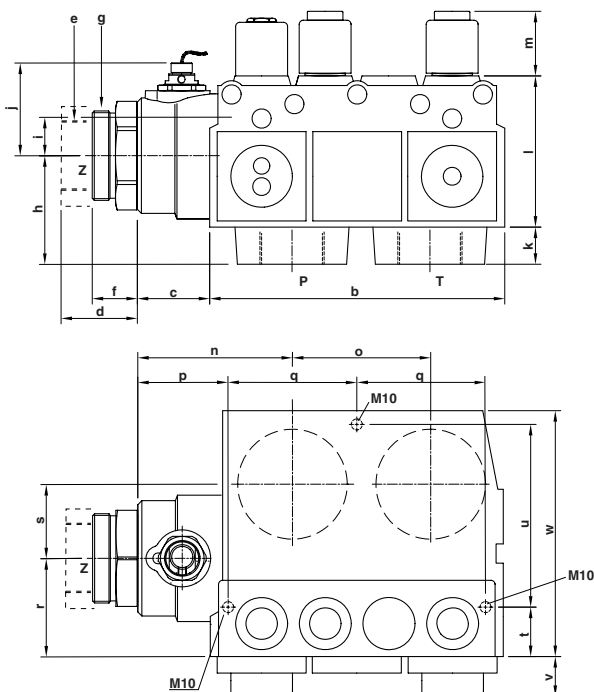
Prov. 38

The Blain Servo Electronic Valve (SEV) is controlled by closed loop digital electronics, providing consistent acceleration and deceleration of hydraulic elevators largely independent of load and oil temperature. An electronic card regulates the performance of the car via variable flow solenoid valves. The elevator operation can be monitored, recorded and adjusted by laptop computer either on site or remotely through the modem connection on the card. Additional intermediate speeds for maintenance runs can be programmed.

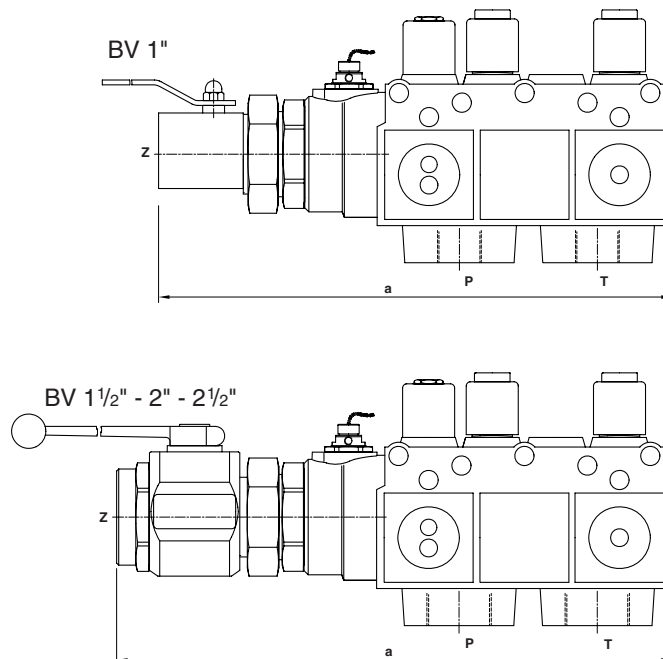
SEV Technical Data	Metric	USA
Flow Range 1":	40 - 180 lpm	10 - 46 gpm
Flow Range 1 1/2":	181 - 440 lpm	47 - 114 gpm
Flow Range 2":	441 - 600 lpm	115 - 156 gpm
Flow Range 2 1/2":	<12 bar - 1000 lpm	<170 psi - 260 gpm
	>12 bar - 1200 lpm	>170 psi - 317 gpm
Pressure Range 1" - 2":	9 - 70 bar	130 - 1050 psi
Pressure Range 2 1/2":	9 - 47 bar	130 - 690 psi
Burst Pressure 1" - 2":	400 bar	5800 psi
Burst Pressure 2 1/2":	240 bar	3400 psi
Electr. Card Supply:	24 V DC 2 A	
Electr. Card Weight:	0,5 kg	1.1 lbs



SEV Valve Dimensions



SEV with BV Ball Valve Standard

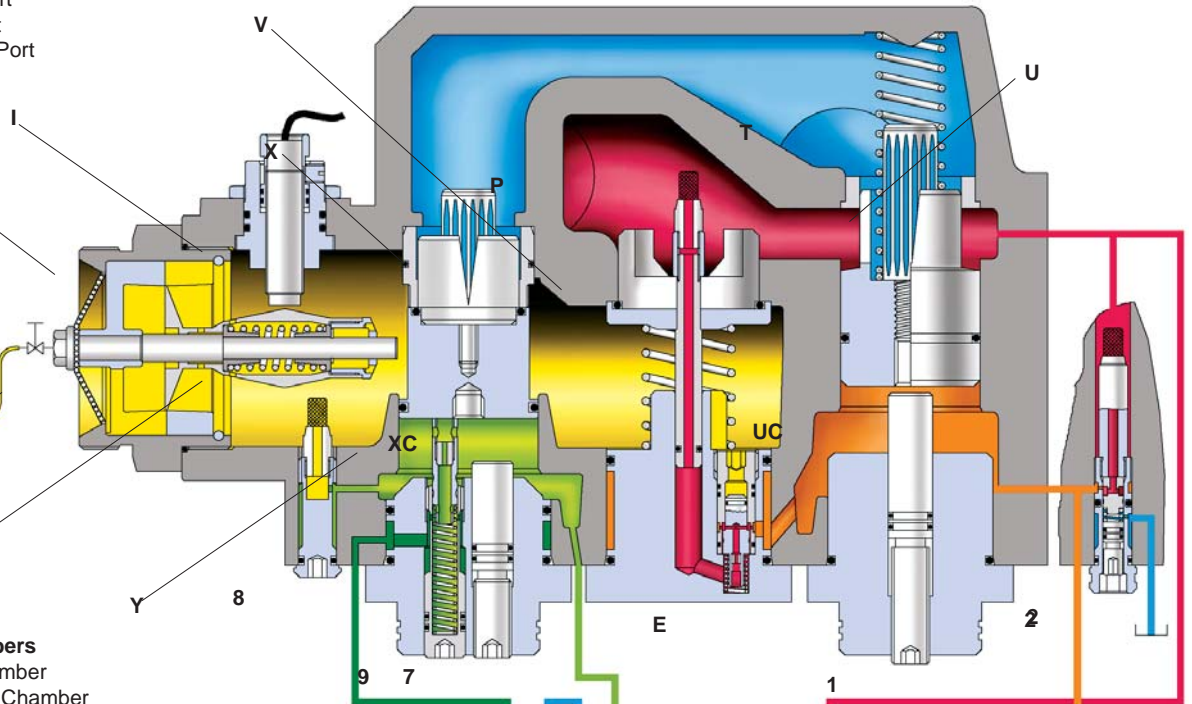
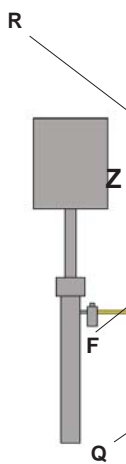


SEV		a	b	c	d*	e*	f	g	h	i	j	k	l	m	n	o	p	q	r	s	t	u	v	w	Weight / Gewicht		
		SEV	BV																								
1"	mm	376	216	53			33	M 65x2	79	28	67,5	27	110	47	113	101	66	94	71,5	54	36	133	29	179	11	1,7	kg
	inch	14,8	8,5	2,1			1,3	M 65x2	3,1	1,1	2,66	1,06	4,33	1,85	4,45	4,0	2,6	3,7	2,8	2,13	1,42	5,24	1,14	7,0	24	3,7	lbs
1 1/2"	mm	406	216	53			33	M 65x2	79	28	67,5	27	110	47	113	101	66	94	71,5	54	36	133	29	179	11	2,5	kg
	inch	16	8,5	2,1			1,3	M 65x2	3,1	1,1	2,66	1,06	4,33	1,85	4,45	4,0	2,6	3,7	2,8	2,13	1,42	5,24	1,14	7,0	24	5,5	lbs
2"	mm	406	216	53	55	G / NPT	33	M 78x2	79	28	67,5	27	110	47	113	101	66	94	71,5	54	36	133	29	179	11	2,5	kg
	inch	16	8,5	2,1	2,17	2"	1,3	M 78x2	3,1	1,1	2,66	1,06	4,33	1,85	4,45	4,0	2,6	3,7	2,8	2,13	1,42	5,24	1,14	7,0	24	5,5	lbs
2 1/2"	mm	558	278	86	78	G / NPT	55	M 78x2	103	37,5	88	37	139	47	159	130	115	105	75	65	34	151	29	198	16	5	kg
	inch	21,97	10,94	3,39	3,07	2 1/2"	2,17	M 78x2	4,06	1,48	3,46	1,46	5,47	1,85	6,26	5,12	4,53	4,13	2,95	2,56	1,34	5,94	1,14	7,8	35	16	lbs







* Standard measurements - variations possible.

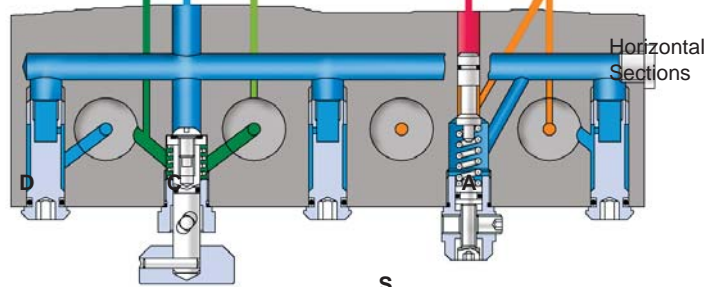


- Connections**
 P Pump Port
 T Tank Port
 Z Cylinder Port

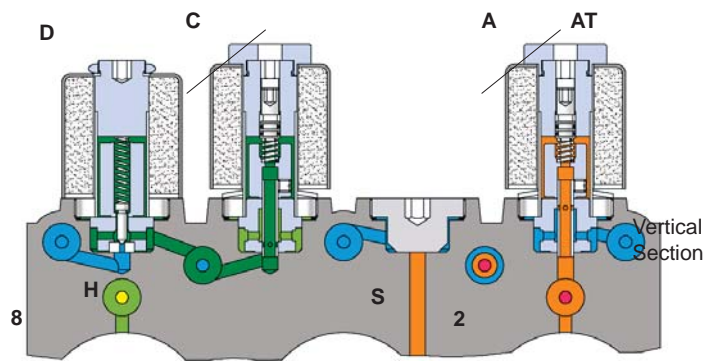


- Pilot Pressure Chambers**
 UC Bypass Pilot Chamber
 XC Down Valve Pilot Chamber

- Pressures**
-  Pump
 -  Servo Up Pilot Pressure
 -  Tank
 -  Cylinder
 -  Servo Down Pilot Pressure
 -  Emergency Down

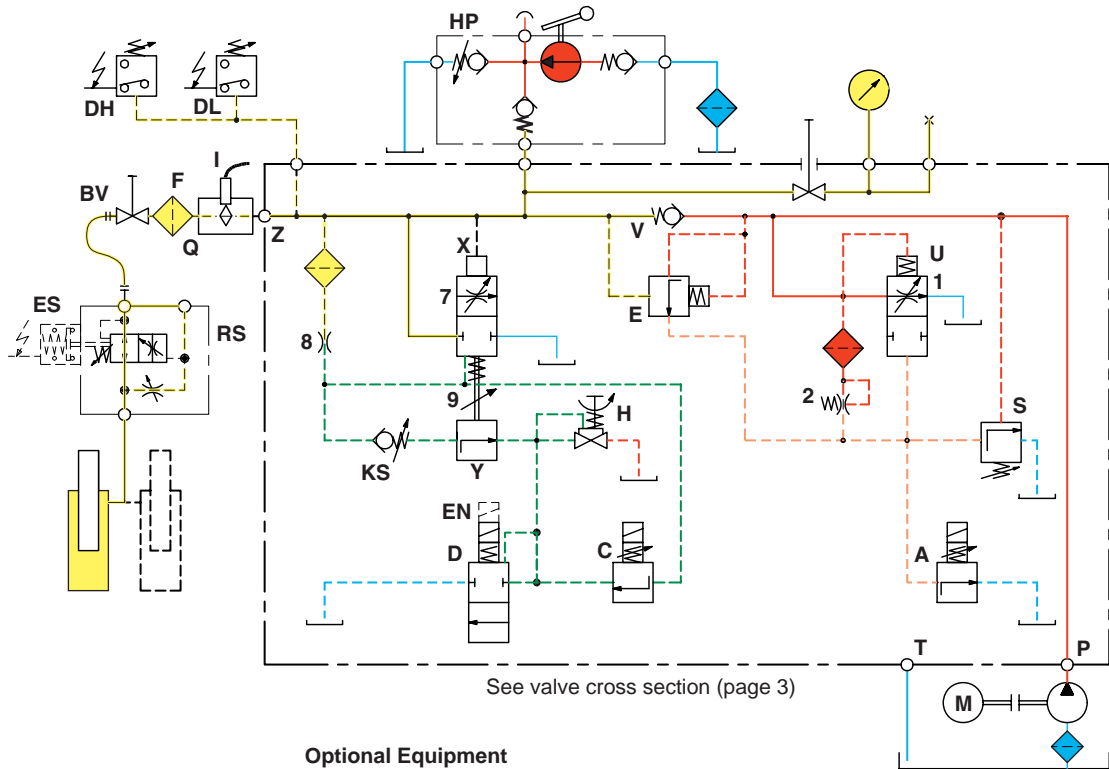


- Control Elements**
- A Solenoid Up
 - C Solenoid Down
 - D Solenoid Down Stop
 - E Short Delay Valve
 - F Servo Filter
 - H Manual Lowering
 - I Flow Sensor
 - Q Flow Spool (patented)
 - R Flow Ring
 - S Relief Valve
 - U By Pass Valve
 - V Check Valve
 - X Down Valve
 - Y Emergency Down Valve
 - 2 Pilot Orifice Up
 - 8 Pilot Orifice Down



- Adjustments UP**
- 1 Bypass
 - AT Up Trim (page 23)

- Adjustments DOWN**
- 7 Full Speed Limit
 - 9 Emergency Down Speed
 - CT Down Trim (page 23)



See valve cross section (page 3)

Optional Equipment

EN	Emergency Power Solenoid	RS	Pipe Rupture Valve
KS	Slack Rope Valve	ES	Pipe Rupture Valve Switch
BV	Main Shut-Off Valve	DH	High Pressure Switch
HP	Hand Pump	DL	Low Pressure Switch

Operation

Up Operation

With an UP signal, the pump motor is energised simultaneously with the start of the electronic card UP program. Pilot oil flows through orifice 2 into the bypass pilot chamber UC. Solenoid A (normally open) is energised from the card and partially closes, reducing the volume of pilot oil flowing out of the bypass pilot chamber.

The bypass spool U, normally open, begins to close as pressure increases in the bypass pilot chamber. As the bypass spool U closes, the check valve V begins to open as a steadily increasing volume of oil flows to the elevator cylinder, displacing the flow spool Q. The inductive flow sensor I, measures the increasing displacement of the flow spool. This value is compared in the card with the target flow value.

The target flow prescribes the acceleration, full speed, deceleration and leveling speed of the car.

Correction of the measured flow rate is made by varying the power from the card to solenoid A, controlling through pilot pressure in chamber UC, the position of the bypass spool.

The comparison and correction of the measured flow to target flow values, continues throughout the complete UP operation of the elevator.

Down Operation (Caution: Voltage at solenoid D comes directly from the elevator controller, not from the SEV card)

With a DOWN signal, solenoid D, normally closed, is energised and opens, whilst simultaneously the electronic card DOWN program is started. Solenoid C, (normally closed) is energised from the card and partially opens, allowing oil entering through fixed orifice 8, to escape from the down valve pilot chamber XC, through solenoid valve D, which is fully open, back to tank.

The down valve X, normally closed, begins to open as pressure decreases in the down valve pilot chamber. As the down valve opens, a steadily increasing volume of oil flows from the elevator cylinder, displacing the flow spool Q and starting the 'target flow' trace of the electronic program.

The inductive sensor I measures the increasing displacement of the flow spool, this value being compared in the card with the set value of target flow.

Correction of the measured flow rate is made by variation of power from the card to the solenoid C, controlling through pilot pressure in chamber XC, the position of the down valve.

The comparison and correction of the measured flow to target flow values, continues throughout the complete DOWN operation of the elevator.

Inspection Speeds

Besides full speed and leveling speed, optional inspection (middle) speeds are included in the electronic card software. Up and down inspection speeds can be independently adjusted.



Only experienced and qualified technicians may install elevator control equipment.

Check the following:

- 1) The flow lpm on the dataplate of the valve compares with the flow rate of the pump, plus-minus 10 %.
- 2) The minimum and maximum static pressures on the valve dataplate agree with those of the elevator plus-minus 20 %.
- 3) The electrical supply to the SEV card is 24 Vdc and 50 VA.
- 4) The star delta timer is set to between 0,3 and 0,4 secs.
- 5) The flow Ring R, Bypass Spool U and Down Spool X are correct using Chart A at rear of the handbook.
- 6) The flow sensor is adjusted between 4,8 and 5,3 mA (see page 12).

Installation of the SEV Valve onto the Power Unit

For a compact and time saving installation as well as easier servicing and protection for the flow meter, cylinder connection Z of the SEV is fitted with the Blain Ball valve G1", 1 1/2", 2" or 2 1/2".

Installation of the SEV Card into the Controller

The SEV Card can be connected into any standard type hydraulic elevator controller.

The power to valve solenoids A and C is supplied from the card. Power to solenoid D is directly from the main controller.

Page 6, shows the detailed wiring diagram for connecting the SEV card to the elevator controller.

Installation of Deceleration Switches in the Elevator Shaft

Slow-down (deceleration) and stop switches should be set according to the following recommendations.

Recommended Switch Positions and Leveling Speeds

Metric				USA			
Travel speed	Decel.switch before floor	Leveling speeds	Stop switch before floor	Travel speed	Decel.switch before floor	Leveling speeds	Stop switch before floor
m/sec	cm	cm/sec	cm	ft/min	inches	ft/min	inches
0,3	25	6	1,0	60	10	12	0,4
0,4	45	6	1,0	80	17	12	0,4
0,5	60	6	1,0	100	24	12	0,4
0,6	75	6	1,0	120	30	12	0,4
0,7	95	7	1,5	140	37	14	0,6
0,8	110	7	1,5	160	43	14	0,6
0,9	130	8	2,0	180	51	16	0,8
1,0	145	8	2,0	200	57	16	0,8

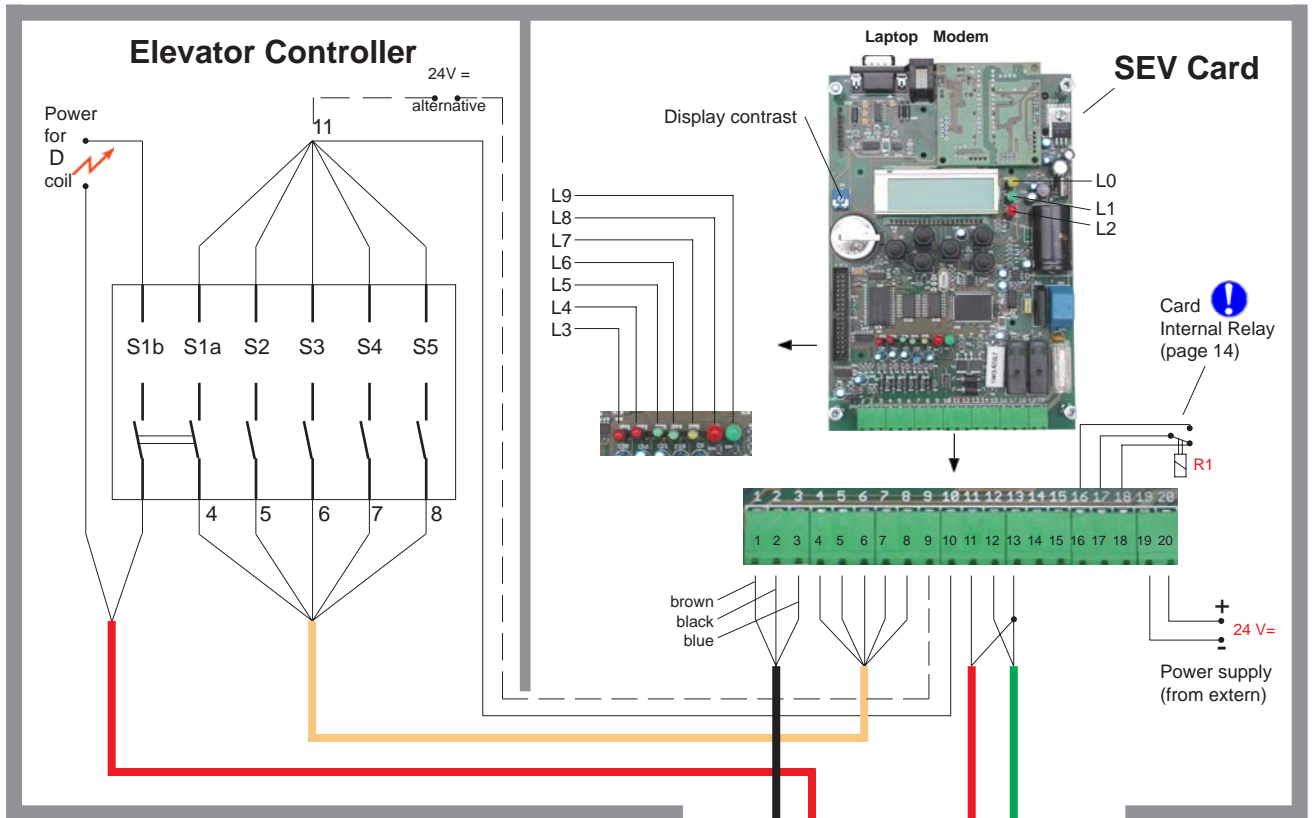
Depending on customers priorities, for travelling time or stopping accuracy, the recommended values for leveling speeds may be modified, i.e

- For faster floor to floor times; faster leveling speeds,
- For more accurate floor stops; slower leveling speeds.

Installation of Modem connection (optional)

To take advantage of remote monitoring of the elevator operation, the corresponding telephone modem connection to the card must be installed (see pages 6 and 26).





D Voltage Optional: 12V, 24V, 42V, 48V, 80V, 110V, 196V, DC
24V, 42V, 110V, 230V AC

Connections

Laptop/PC - Connection (Laplink)
Modem - Connection

- ✓ PIN 1 Sensor (+), brown wire
- ✓ PIN 2 Sensor (signal), black wire
- ✓ PIN 3 Sensor (-), blue wire
- ✓ PIN 4 Switch: Down Leveling (S1a)
- ✓ PIN 5 Switch: Down Full Speed (S2)
- ✓ PIN 6 Switch: Up Full Speed (S3)
- ✓ PIN 7 Switch: Up Leveling (S4)
- ✓ PIN 8 Switch: Inspection (S5)
- ✓ PIN 9 Ground for alternative supply
- ✓ PIN 10 Supply output **NO** input (+18...30VDC)
- ✓ PIN 11 Down Coil (+)
- ✓ PIN 12 Up Coil (+)
- ✓ PIN 13 Coils common(-)
- PIN 14 not used
- PIN 15 not used
- * PIN 16 Relais 1 Internal Fault (closes)
- PIN 17 Relais 1 Internal Fault common
- * PIN 18 Relais 1 Internal Fault (opens)
- ✓ PIN 19 Supply Voltage Ground
- ✓ PIN 20 Supply Voltage 24V DC

✓ Connections to be made by customer

- * 16 closed if OK - open if fault
- * 18 open if OK - closed if fault

Controller Relays

- S 1 a : Down Leveling (D)
- S 1 b : Down Leveling (D)
- S 2 : Down Full Speed (C)
- S 3 : Up Full Speed (B)
- S 4 : UP Leveling (A)
- S 5 : Inspection

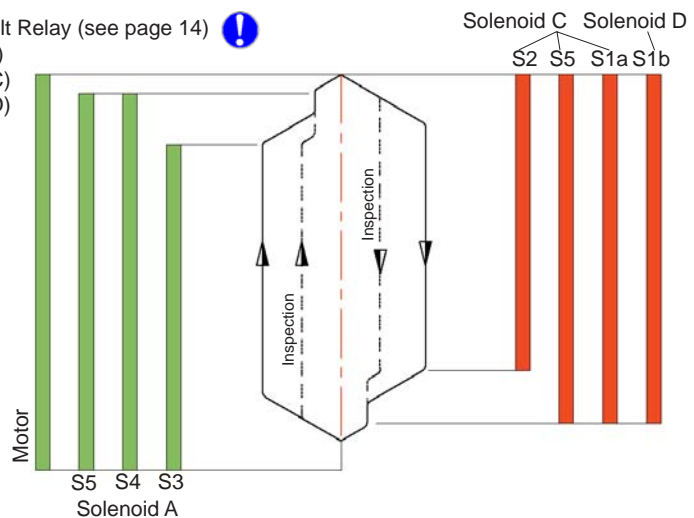
Indicator

- L0 : Power
- L1 : Processor
- L2 : Error
- L3 : Down Leveling (D) active
- L4 : Down Full Speed (C) active
- L5 : Up Full Speed (B) active
- L6 : UP Leveling (A) active
- L7 : Inspection active
- L8 : Solenoid (C) active
- L9 : Solenoid (A) active

- R 1 : Internal Fault Relay (see page 14) !
- A : Solenoid (A)
- C : Solenoid (C)
- D : Solenoid (D)

Electrical Travel Sequence:

Inspection: S3 + S4 + S5 (Up Travel) Serving Solenoid A
S1 + S2 + S5 (Down Travel) Serving Solenoid C



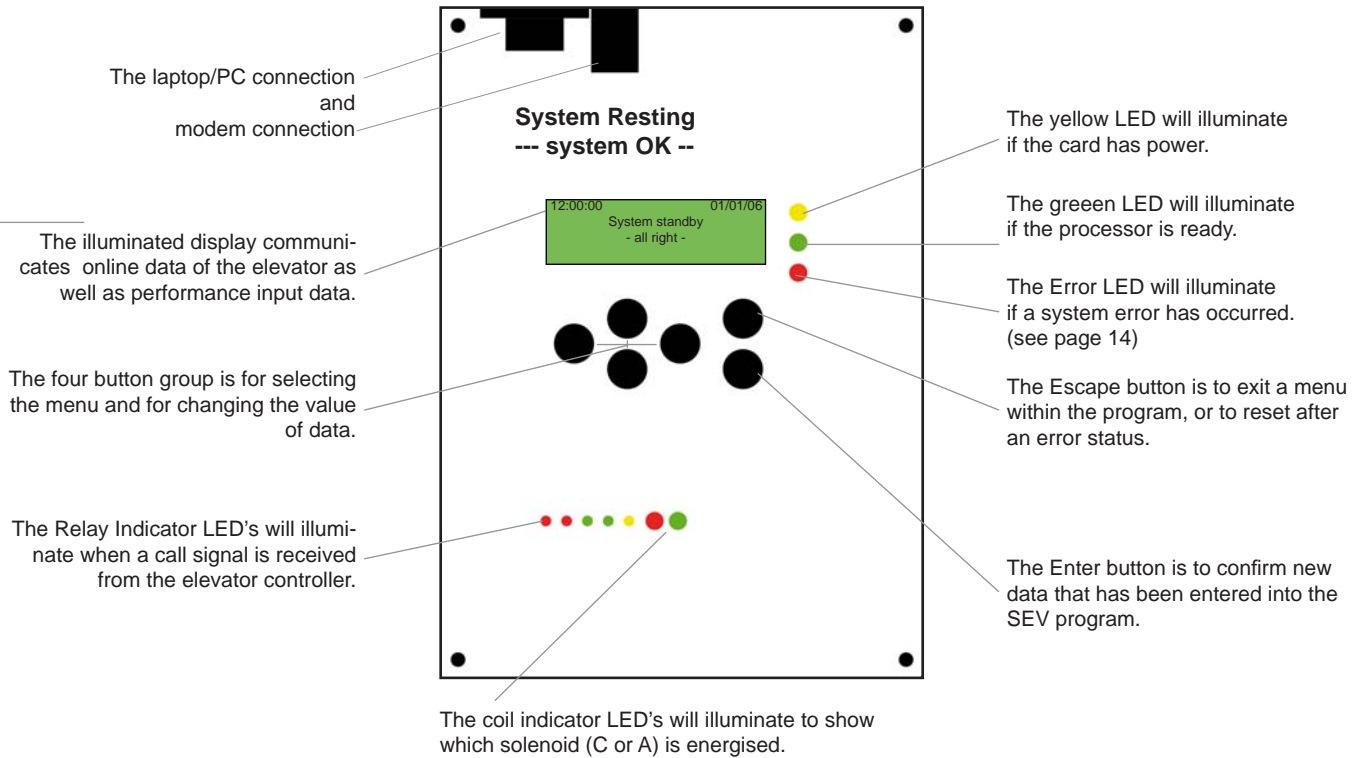
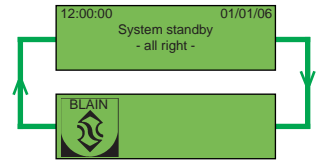


Prov. 38

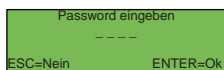
After the SEV valve and card have been correctly installed and the shaft switches positioned as recommended, turn on the electrical power to the card, 24 Vdc (50VA). Alternatively, 18Vac may be used for the power supply of the card.

The power LED will illuminate and the display will alternate between 'System Resting' and the Software which is present on the card.

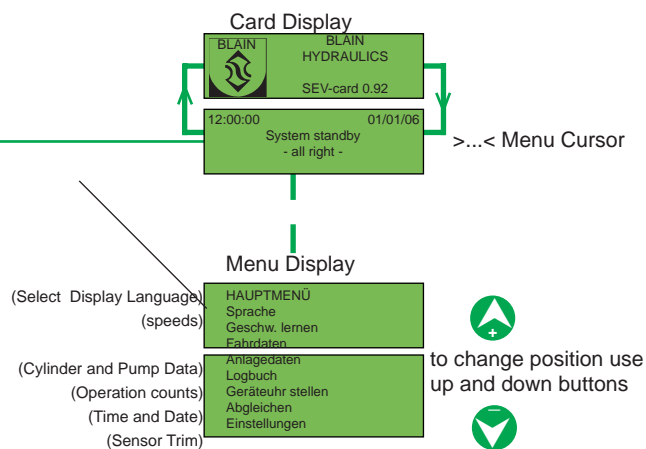
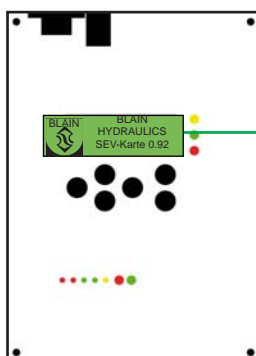
The SEV Card



SEV Card



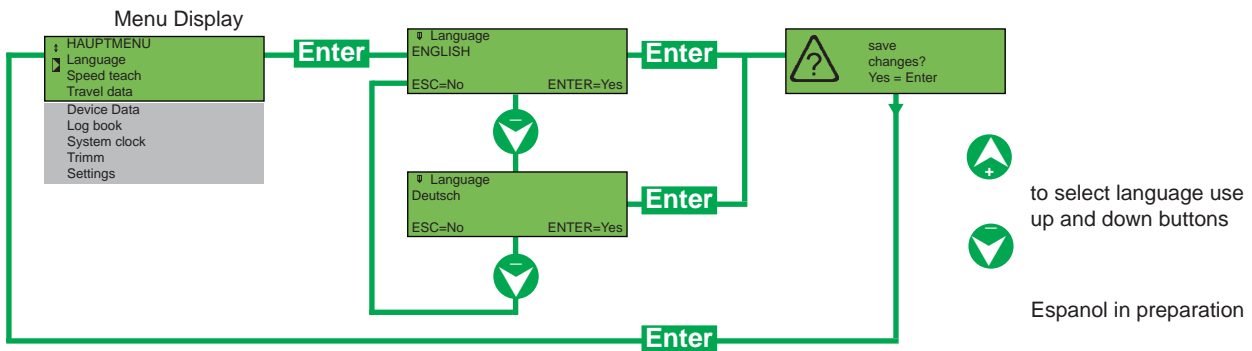
To gain access to the menu, enter the following code:



! A changed value can be canceled by using the **Esc** button.



Select Display Language



Initial Operation

Once installed correctly by the customer, the system is ready for operation.

UP

When the UP command is given for the initial operation, the first movement of the car may be delayed a few seconds whilst the pilot pressure chamber UC of the valve fills with oil.

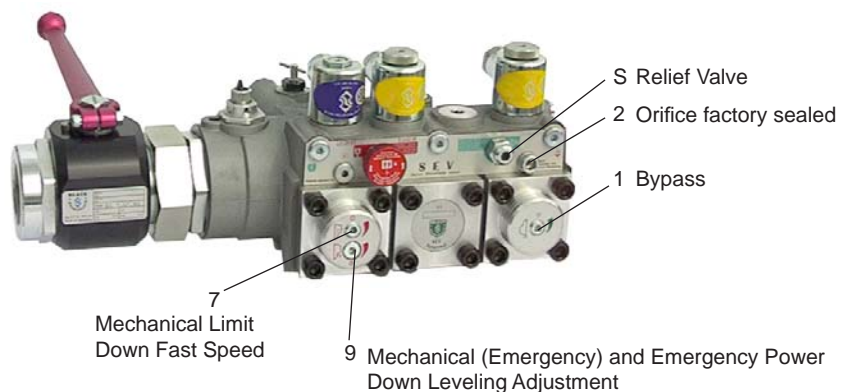
The SEV valve does not require manual bleeding.

Minor Corrections

Adjustment 1 Bypass. With no load in the car, the SEV card disconnected (no power to coil A) and the pump running, turn adjustment 1 'in' until the car barely moves, then one full turn 'out' so that the car stands.

Adjustment 5 Relief Valve. With the SEV card connected, close the ball valve on the SEV valve cylinder outlet and open the manual lowering briefly. The pressure gauge on the SEV valve will register zero.

Place an up call. The pressure gauge will reach and remain at the relief pressure setting. The SEV card will shut down after 3 seconds. If an adjustment of the relief valve is necessary, press reset on the card, make the relief valve readjustment, open the manual lowering briefly and place a second up call. Observe the new relief pressure setting. Repeat as is necessary. For each 1/4 turn of the relief valve adjustment, the pressure setting changes by about 6 bar (90 psi). Finally, tighten the side lock screw on the relief valve.



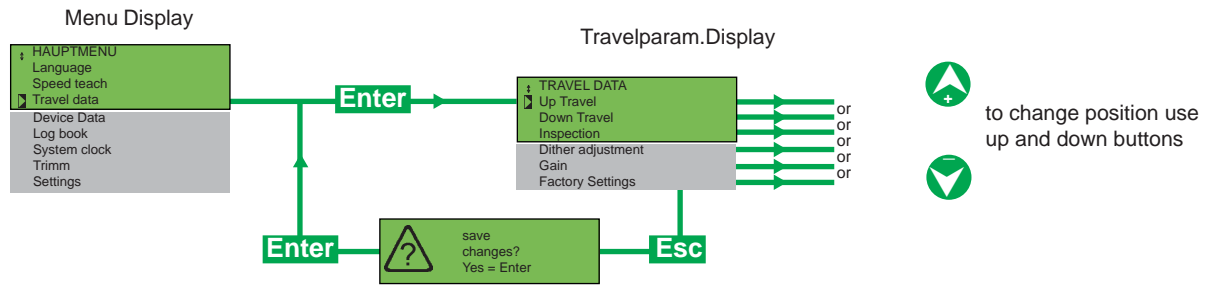
DOWN Adjustment 7 and 9

Adjustment 7 Down Fast Speed Limit. In case the technical data programmed into the card was not correct, to avoid a possible overspeed of the car on the initial down run, screw adjustment 7 all the way in (clockwise), then 4 turns back out. This will ensure a maximum down speed lower than the contract down speed.

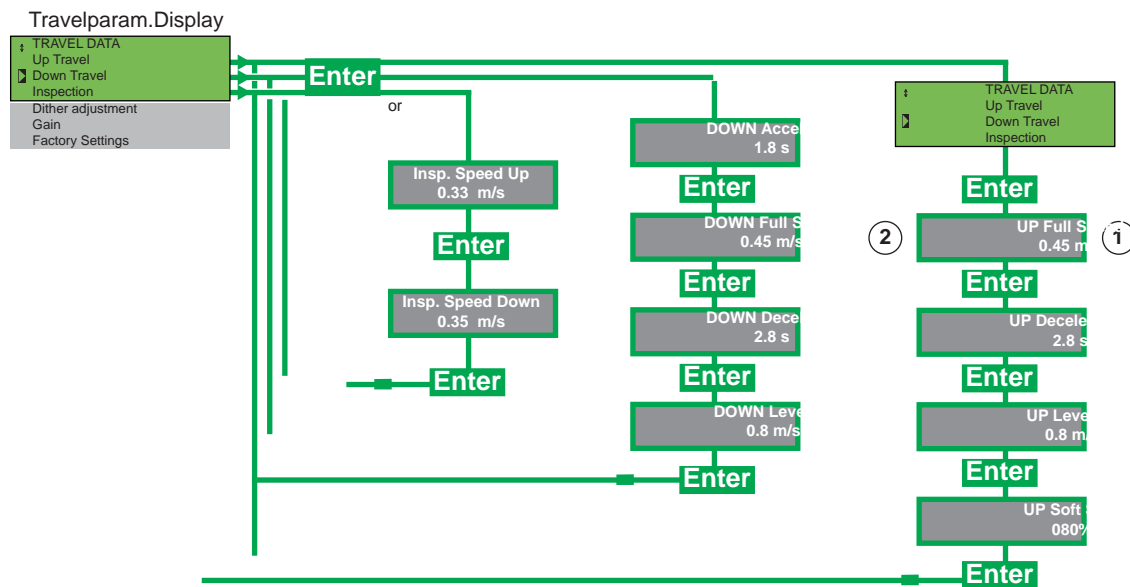
Back out No 7 one turn following each down run until contract speed is reached, as programmed into the card.

Adjustment 9 Emergency Down Leveling. Set to 5 cm/sec (10 ft/m). Operates with manual lowering knob or when D coil is energised. We recommend setting the electronic controlled speed to between 6 and 8 cm/sec (12 and 16 Ft/min).

! During a change of travel parameters, persons should not travel in the elevator until satisfactory operation is assured.



Changing up, down and inspection speeds (assuming cylinder-pump data is correct, page 11)



- ① Up maximum speed limited by pump output.
- ② Down maximum speed limited by down flow guide X and/or flow ring R.

Acceleration Time is the time taken for the elevator to reach approximately 80% of fast speed.

Deceleration Time is the time taken for the fast speed to reduce down to 80% of fast speed.

Recommended acceleration and deceleration times are 2,5 sec, whatever the contract speed.

Leveling (Slow Speed)

Initially, slow speeds can be set to approximately 1/10 of the fast speed.

Set higher slow speeds for quicker floor to floor times. Set lower slow speeds for more accurate stops.

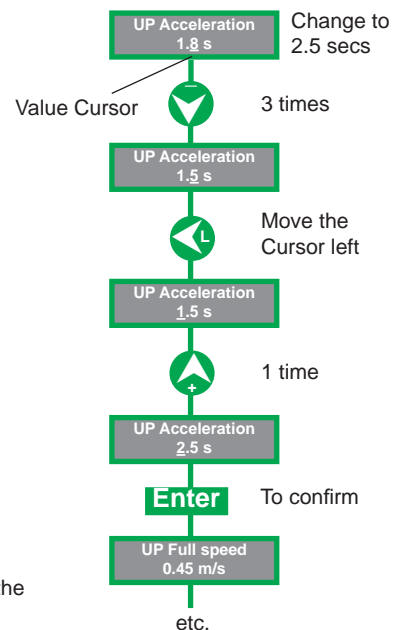
Slow speed however should not normally be less than 0.05 m/s (10 ft/min).

Soft Stop

Soft Stop should normally be set between 60-70%.
100% produces a hard stop, 30% produces a very soft stop.

Inspection Speeds if employed, can be changed. Their accelerations and decelerations however are the same as with up and down full speed.

How to change values

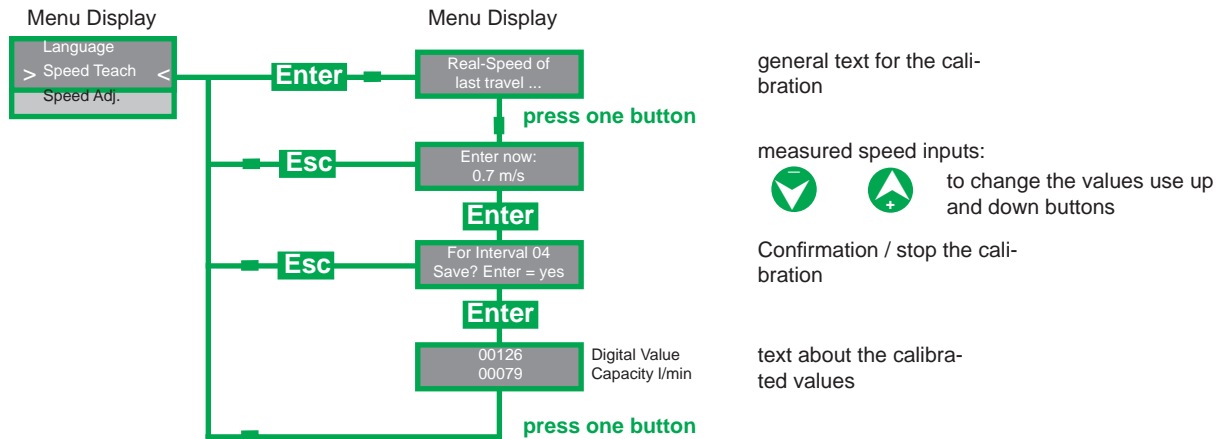




Some factors which can not be influenced, e.g. variations in pump efficiency or sensor tolerances, may result in differences between the programmed speed and the actual speed of the car. These differences can be reduced by calibrating. A tachometer will be necessary.
After changing of the sensor or the SEV-Karte, the system is to be calibrated again.

Full speed

In order to calibrate the full-speed, the elevator must carry out a complete out trip, i.e. the status of the slow speed must be reached. Because the calibration always takes place for the last ridden direction of the elevator, this is executed directly after the trip.



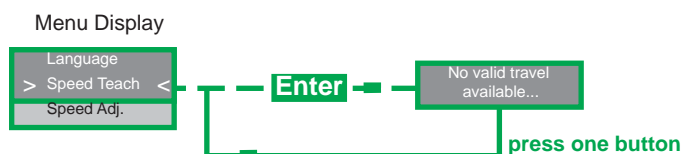
In case that the calibrated speed does not agree with the indicated speed on the card, a repetition of the calibrating process can be necessary.

Leveling speed

In order to calibrate the leveling speed, the elevator is to be traveled only with leveling speed into the direction of calibrating. NO full-trip may be driven with it. After the trip, proceed like described at full speed.

No complete trip

If the elevator does not carry out a complete trip, calibration is not possible. In this case, the following message appears on the display:

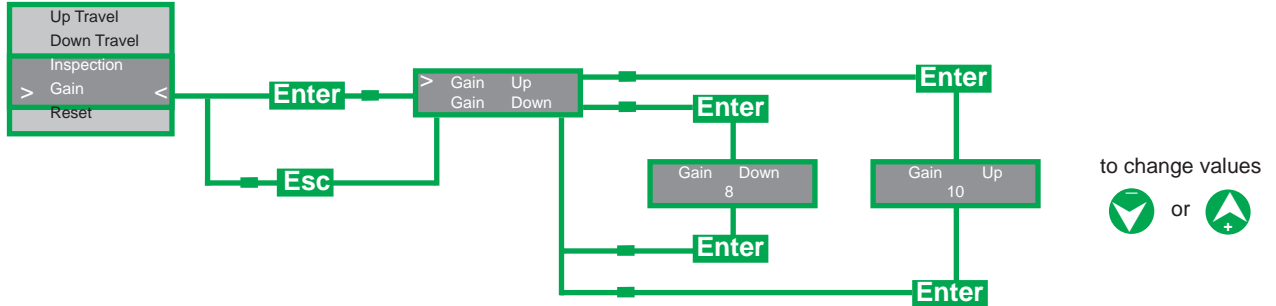


The switches in the shaft should be set to an other position to reach leveling speed or the deceleration should be increased on the card. This is necessary because the statuses of the leveling speed have to go through on the program. Afterwards the calibration can be repeated.

Gain Values

Influence closed loop performance. Gain is normally between 5 (weaker response) and 10 (stronger response).

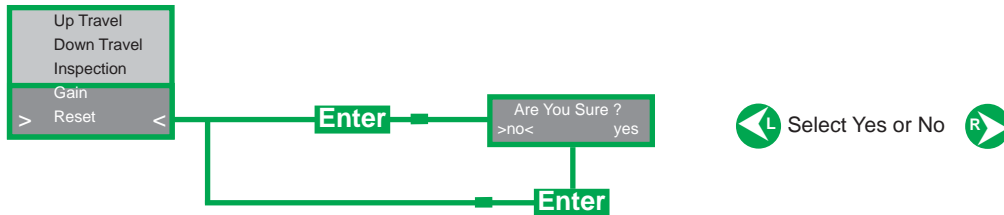
Travelparam.Display

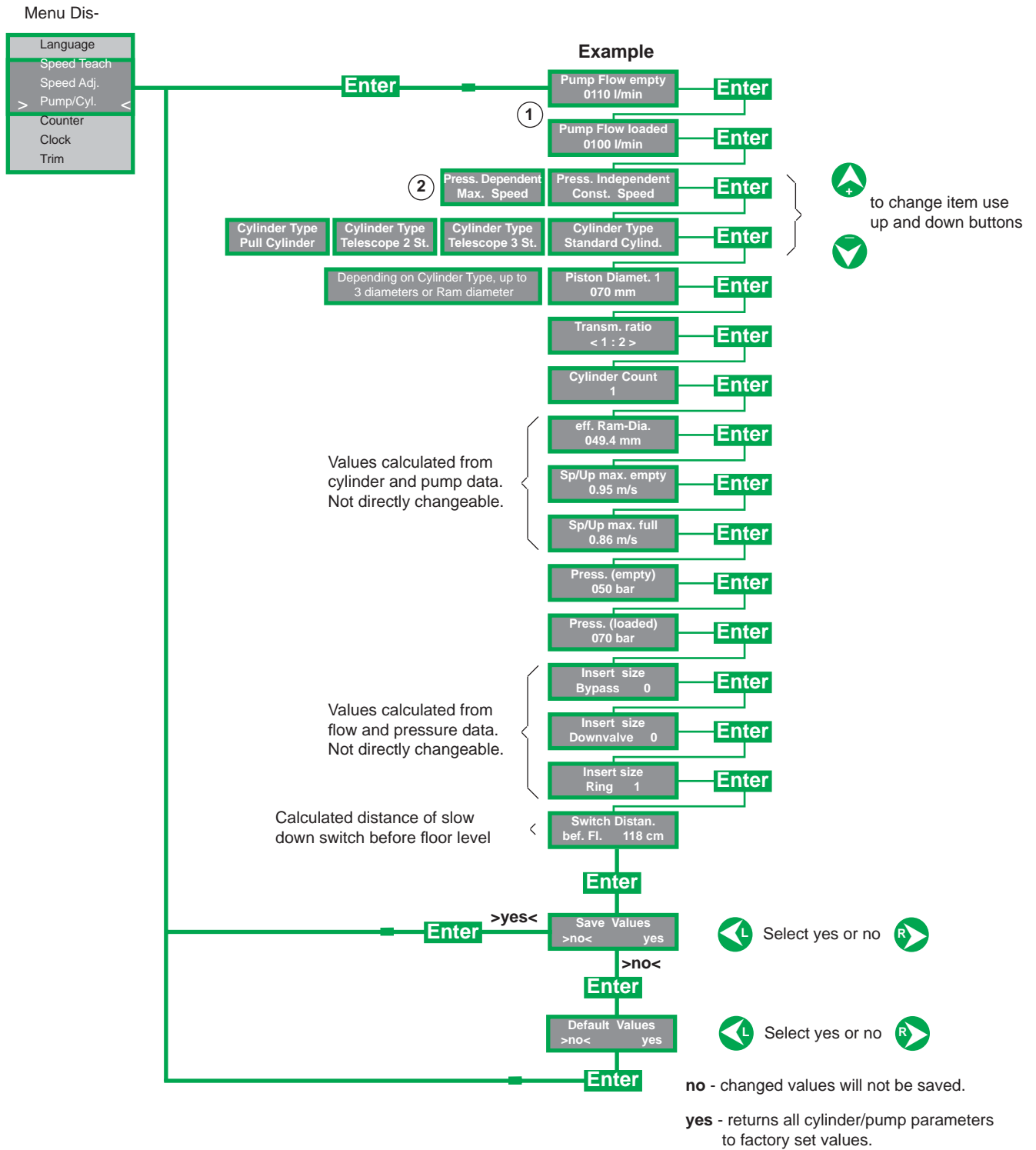


Reset

Returns all travel parameters to factory set values.

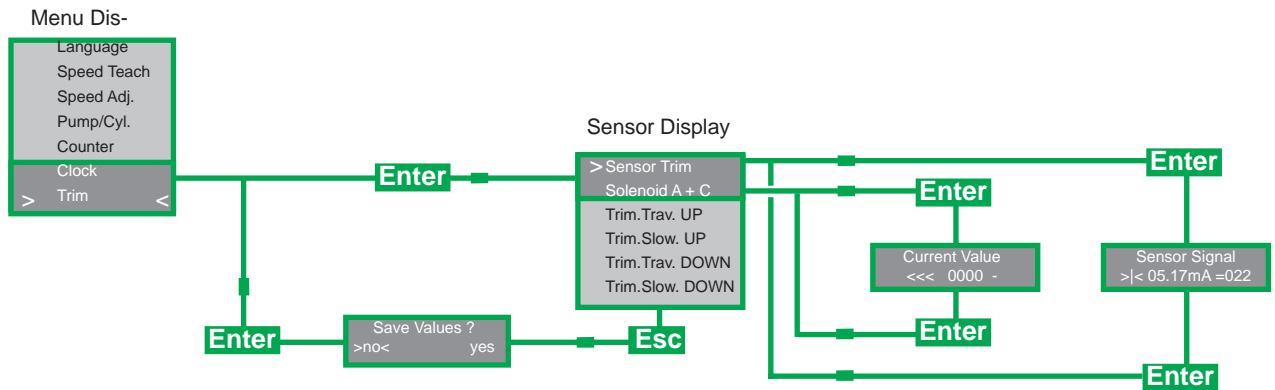
Travelparam.Display





① **Pump Data Input**
Use pump manufacturers flow tables, employing the elevator systems static pressures under empty and loaded conditions.

② **Selection: Constant or Maximum Up Speed**
Maximum 'UP Speed' (Dependent of Pressure)
 When the car is fully loaded, the car speed will be slower than when empty. The SEV will self correct the deceleration of the car to provide a constant up leveling distance.
Constant 'UP Speed' (Independent of Pressure)
 When the car is empty the higher pump output will be 'dumped' back to the tank to maintain the same target speed, as at full load.



Vertical Sensor Trim

If the sensor mA value under static condition is not between 4,8 and 5,3 mA, slacken the lock screw on the sensor and turn the knurled sensor-head in or out with pliers until the value is between 4,8 and 5,3 mA. Retighten lock screw.

Do not adjust under 4.5 mA, otherwise the sensor may press against the flow spool.

Radial Sensor Trim

To adjust the sensor radially the up and down leveling speeds should both be programmed to the same value (eg:10 cm/sec).

Loosen the bushing lock nut, not the lock screw, without turning the sensor bushing.

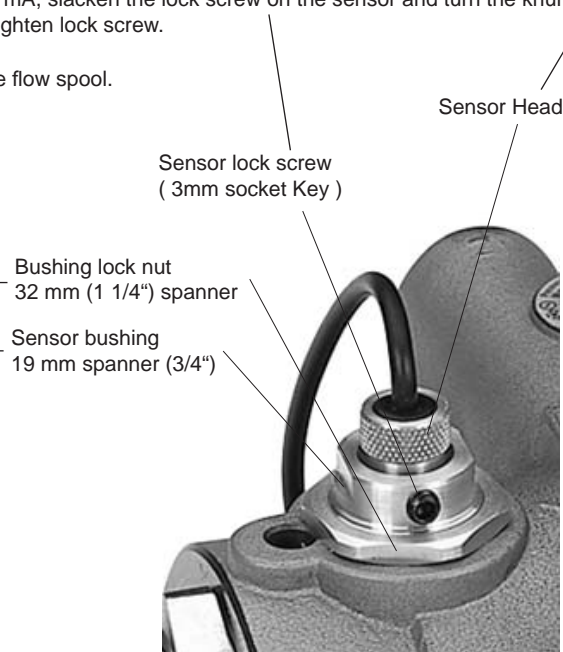
Operate the elevator to run at up leveling and down leveling speeds. Measuring with a tacho or stop watch.

If the down leveling speed is different from the up leveling speed, rotate the bushing by 15° and re-measure the leveling speeds.

If up speed is faster than down speed - turn clockwise

If down speed is faster than up speed - turn counterclockwise

By repeating this process, rotating the bushing clockwise or anti-clockwise as required, it will be possible to set the up and down leveling speeds to be practically the same. Retighten the bushing lock nut.



**Solenoids A and C,
already factory adjusted**

Solenoids A and C, Trim screws

To produce a quicker and smoother initial movement of the car away from the floor.

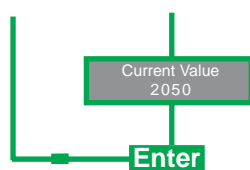
The electrical Current Value display shows the representative value of the UP solenoid (A) or DOWN solenoid (C).

The value should be between 2000 and 2100 during leveling.

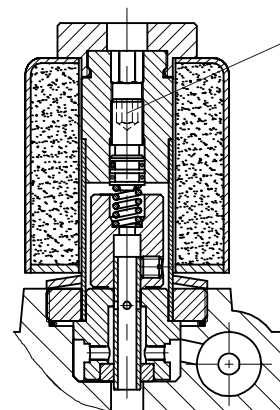
To alter the value, turn trim screw during leveling speed.

Turn clockwise - to increase value.

Turn counterclockwise - to decrease value.



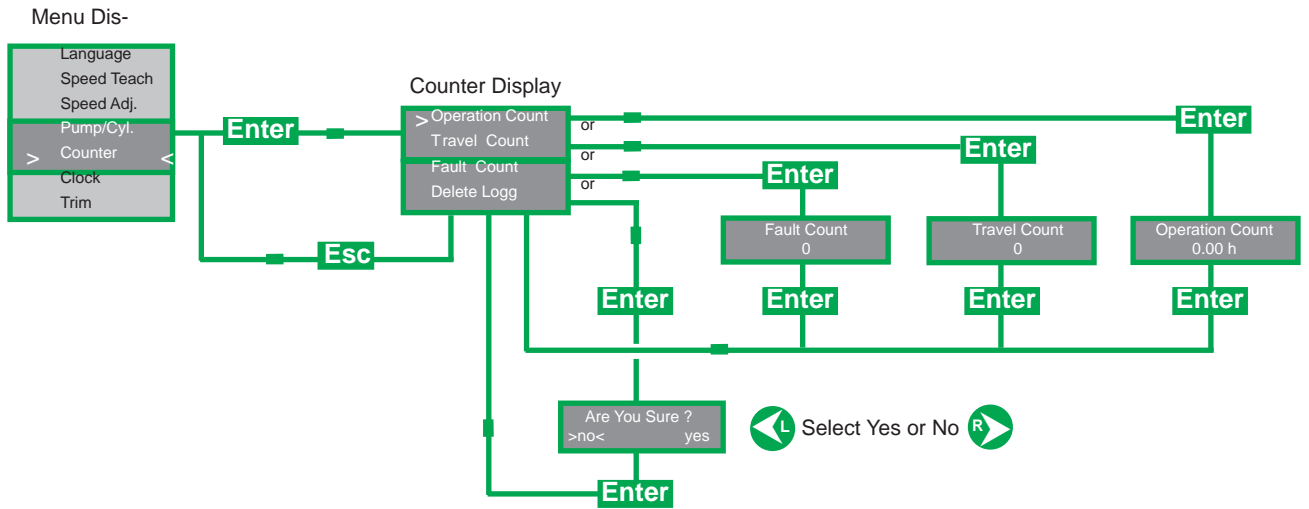
Trim screws AT and CT
(3 mm socket key)





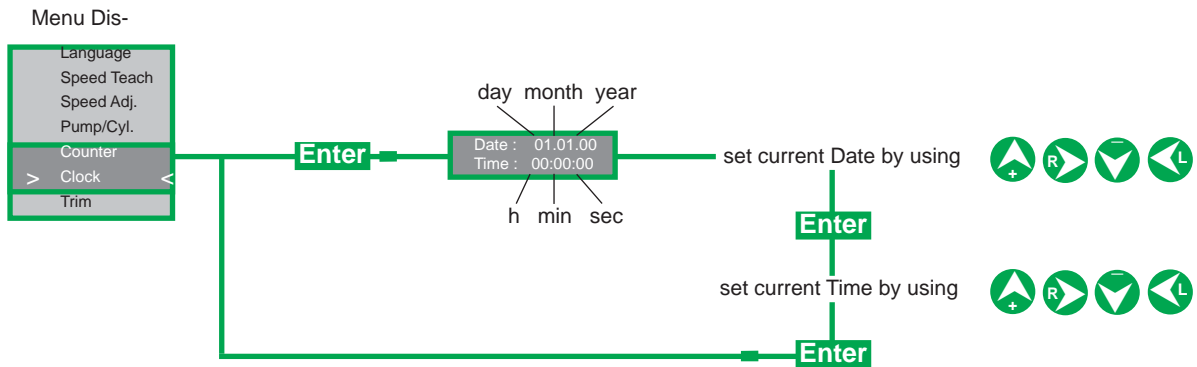
Counter

Shows operational time of the elevator, the number of runs and the number of "Error" runs.
By using "Delete Logg" all counters will be set to zero.



System Clock

To set local Date and Time



**Important**

If there is a major fault interrupting the normal operation of the SEV card when traveling between floors, power to Solenoids **A** or **C** is automatically interrupted.

During upwards travel the motor and during downwards travel solenoid D (down leveling), remain energised unless the SEV relay R1 is employed to signal otherwise.

**Card Relay R1 - Evacuation of passengers**

When make and break internal relay R1 switches over due to a major operational fault, the resulting signal must be tapped from Pins 18, 19 and 20. and employed within the main controller to initiate emergency functions including switching off the pump drive, energising solenoid D to lower the car at leveling speed to the next lower floor and warning an emergency service.

SEV Card

The following faults are signalled by the illuminating of the red LED labelled **Error**. At the same time, the card display indicates the nature of the fault as follows:

Major Faults

1	Coil defect	A or C coil disconnected or short circuited.	} Elevator electronic operation stops. Relay R1 switches over.
2	Sensor defect	Sensor disconnected, damaged or mis-adjusted.	

After the fault has been corrected, errors 1-3 must be canceled by pressing **Reset/Esc** button on SEV Card. If the elevator is modem connected (see page 26) the errors can be canceled by clicking the **Reset/Esc** button on the Main Display.

Minor Faults

3	Supply Voltage	Power supply to the card less than 17 V. Elevator operation continues at inspection speed.	} Elevator operation continues. Relay R1 does not switch.
4	Sensor feedback	The value of the sensor does not change within 8 seconds of the start signal being given.	
5	Sensor overflow	The value of the sensor exceeds its defined maximum value.	
6	Level. too long	Duration of up or down leveling speed is excessive.	
7	Overtravel	Elevator travels past floor level.	

Errors 4-7 do not have to be canceled.

As long as the power supply to the SEV card is maintained, the errors will be saved and the red LED will remain illuminated. The error indication can be canceled one after the other in reversed order of occurrence (last error first) by pressing **Reset/Esc** button on SEV card.

If the red Error LED is blinking (not permanent illuminating), disconnect the power supply of the card for a few seconds. In case the card is not re-activated, please contact Blain Hydraulics.



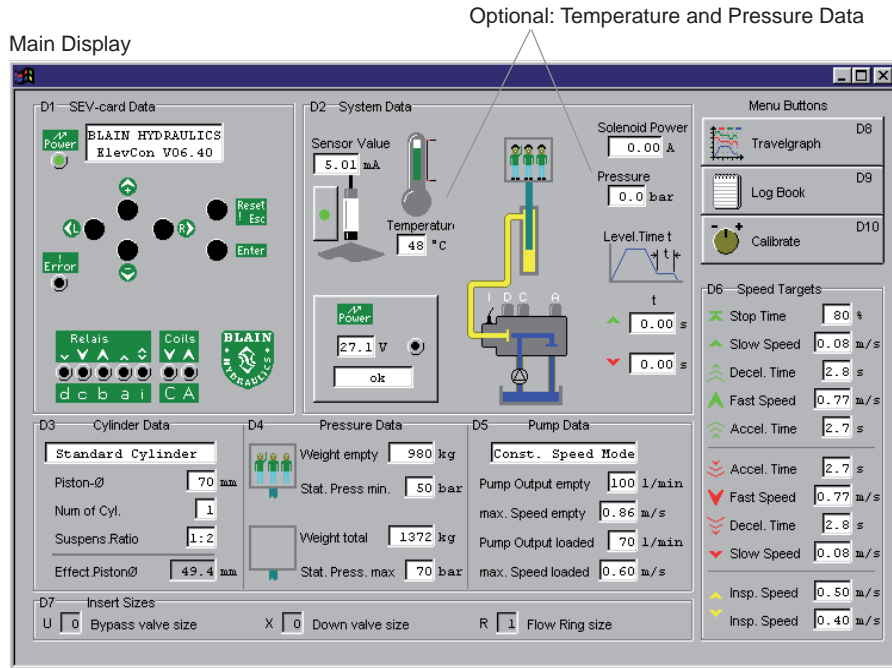


Laptop Displays

A Laptop PC is not necessary for the operation or adjustment of the SEV system, however it is of distinct advantage in setting up the operation of the elevator and preventative maintenance.
A CD containing the software required for the PC will be delivered with the SEV.

Main Display

Upon starting the program, the following MAIN DISPLAY panel appears on the PC screen.
The main display shows all the (calculated) data for the control of the elevator travel as well as online information from the SEV card.
Changes of ride characteristics are easily made and the values shown in the appropriate boxes.



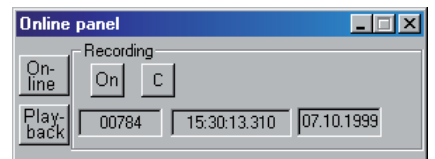
Travelgraph Display

The second display in the SEV Software is the TRAVELGRAPH. Information can be recorded and evaluated for comparison. To go from the Main Display to the Travelgraph select D8 - on the above screen top right. Closing the Travelgraph Display returns the program to the Main Display.

Travelgraph



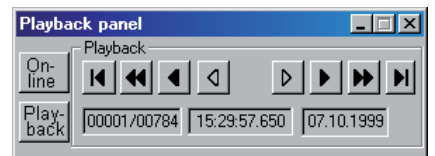
Return to Main Display



To see live displayed Travelgraph.

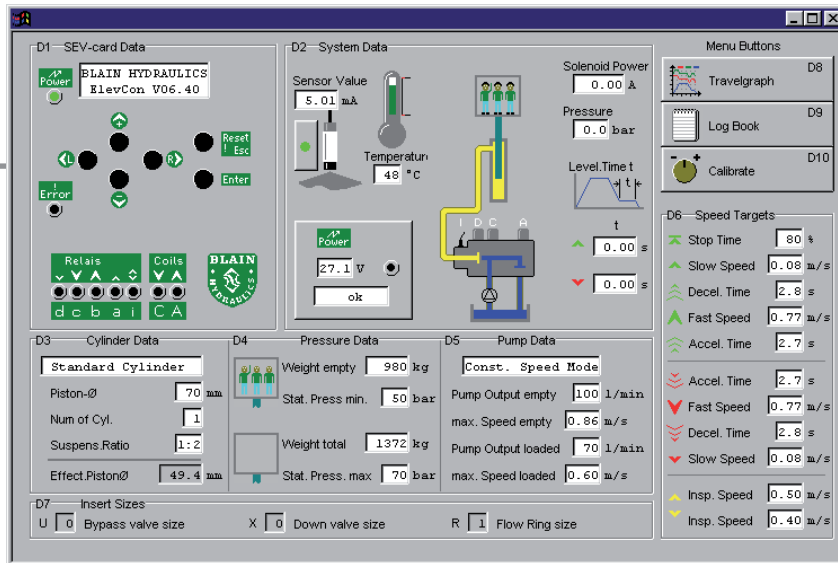
OR

In Playback mode the Playback panel appears instead of Online.



To retrieve of screen graphs.

The Main Display of the SEV shows seven data fields, D1 to D7 and three menu buttons, D8 to D10.



D3 to D6

To change values in white boxes, click box with mouse. A sub-window will appear above D3. Enter the new values in the sub-windows as illustrated on the next page.

D1 SEV-Card Data, displays a replica of the SEV card, communicating the direct online status of the SEV CARD.

D2 System Data includes the following five indicators:

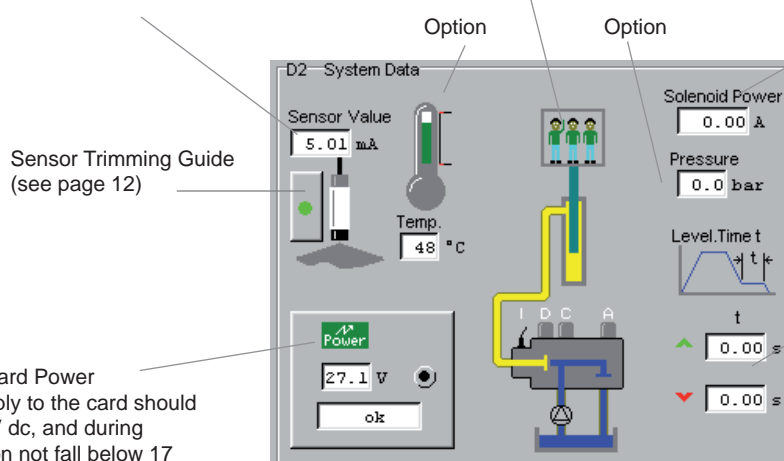
D2.1 Sensor Value
The Feedback signal from the flow sensor is displayed in mA. Two yellow arrows and a green point confirm correct sensor trimming.

D2.2 Cylinder System Graphic
Illustrates which system has been entered into Cylinder Data (D3) (see page 18).

D2.3 Solenoid Power
The control current to the solenoid is displayed in Amps. The normal operating range is between 1.2 A and 2.5 A.

D2.4 Servocard Power
The voltage supply to the card should not exceed 27 V dc, and during elevator operation not fall below 17 V dc. The LED illuminates should the voltage be too low.

D2.5 Leveling Time (t)
Ideally, the time the elevator is moving at leveling speed once the car has decelerated should be kept to between 0.5 and 1.0 seconds.



D3 Cylinder Data Input

Mouse

1. Select the cylinder type

Mouse

2. Confirm

Keyboard

1. Type in piston size (or sizes) in mm

Mouse

2. Confirm

Keyboard

1. Type in the number of cylinders

Mouse

2. Confirm

Mouse

1. Select the suspension ratio eg 1:2 or 1:1

Mouse

2. Confirm

D4 Pressure Data Input

Either weight in kg or pressure in bar can be used as input data.

Keyboard

1. Type-in the empty weight of the car in kg or the empty pressure in bar.

Mouse

2. Confirm

Empty is car without load

Keyboard

1. Type-in the full weight of the car in kg or the full pressure in bar

Mouse

2. Confirm

Full is car plus payload

D7 Insert sizes

The Bypass Valve, Down Valve and Flow Ring are internal parts of the SEV installed at the factory. Alterations to system values may need changes to these sizes.

! Check that correct sizes are installed.

D6 - Speed Targets

Stop Time	80 %
Slow Speed	0.08 m/s
Decel. Time	2.8 s
Fast Speed	0.45 m/s
Accel. Time	2.7 s
Accel. Time	2.7 s
Fast Speed	0.45 m/s
Decel. Time	2.8 s
Slow Speed	0.08 m/s
Insp. Speed	0.50 m/s
Insp. Speed	0.40 m/s

D5 Pump Data Input Maximum or Constant Speed

Use pump manufacturers flow tables, employing the elevator systems static pressures under empty and loaded conditions.

Keyboard

1. Type in lpm empty car

Mouse

2. Confirm

Keyboard

1. Type in lpm fully loaded car

Mouse

2. Confirm

Mouse

1. Select Constant or Maximum Speed mode

2. Confirm

D6 Target Speed Input

Acceleration and Deceleration times recommended is 2.5 seconds, which will be the time the car takes to complete 80% of the selected change of speed.

FAST UP speed is determined by the data in D5. FAST DOWN speed can be selected independently.

SLOW UP (UP Leveling) and SLOW DOWN would normally be set to between 0,05 and 0,1m/sec.

Keyboard

1. Type in the required Target Speed

Mouse

2. Confirm

Each Target speed has its own data input window and each can be individually changed.

Maximum 'UP Speed'. When the car is fully loaded, the car speed will be slower than when empty. The SEV will self correct the deceleration of the car to compensate for the loss of speed to prevent prolonged 'UP leveling'.

Constant 'UP Speed'. When the car is empty the higher pump output will partially be 'dumped' back to the tank to maintain the same target speed, as at full load.

The Travelgraph D8 in Online mode displays the travel status of the elevator. To file the graphs, see next page. Trace lines are displayed in different colours for ease of identification.

Scale Select button

Online panel

Scale (m/s) 2.00

Is-Speed UP (m/s) 1.60

Is-Speed Down (m/s) 1.40

Target-Speed (m/s) 1.20

Is Acceleration 1 = 24 sec

Noteflag

Solenoid Power

Cursor

Target Travel

Is Travel

Timebase 12 16 20 24 28 32 36 [s]

Value Indicators:
 Target-Speed 0.00 m/s
 Is-Speed UP 0.00 m/s
 Is-Speed Down 0.00 m/s
 Solenoid Power 0
 Is-Accel. 0

Travel Direction Down

Notes

Online panel (Inset):
 Recording On [C]
 Play-back 00784 15:30:13.310 07.10.1999

Current Datafile (50 files/sec)
Time
Date

Play-back button

Online button

Vertically expand or contract

Horizontally expand or contract

Notes will be showed in Playback mode when the cursor is direct on the noteflag

Note pad (Mouse click) allows addition of notes in Online mode to be stored with travelgraphs

(Mouse click)

View 2

Value Indicators
 Target-Speed 0.00 m/s
 Is-Speed UP 0.00 m/s
 Is-Speed Down 0.00 m/s
 Solenoid Power 0
 State -
 P-Comp. I-Comp. D-Comp. Travel Direction Down

E1 E2 E3 E4 E5 E9 E10 E11 E12 E13 E14 E15

Online Rec: ... 20:20 Ready NUM

The Online, (Trace) mode is activated when the D8 Travelgraph menu button is selected.

1. To stop tracing, click the [On] button on the panel which will change into [Off] button. Alternatively to stop tracing, press F3 on the keyboard.

2. To resume tracing click the [Off] button which will change into [On] button again. Alternatively press F2 on the keyboard.

3. To cancel a trace and clear the screen click [C] with mouse on the panel or press space-bar on the keyboard.

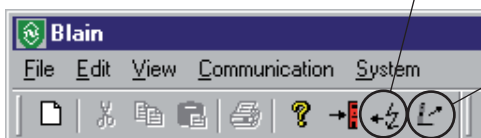
! Recordings not saved will be deleted !
 To save file, see next page.

Status, P-Comp., I-Comp and D-Comp. are intern values that are necessary for the PID-Controller.

Minor deviations in ride characteristics, E1 to E15 will only be shown for the last run. They will be deleted at the start of the following run.

The sum of error runs is documented in the Log book D9.

To view the travelgraphs of the last error runs, click on error run button on the Main Display (close Travelgraph display).



To view travelgraph of the last elevator run, click on this button.

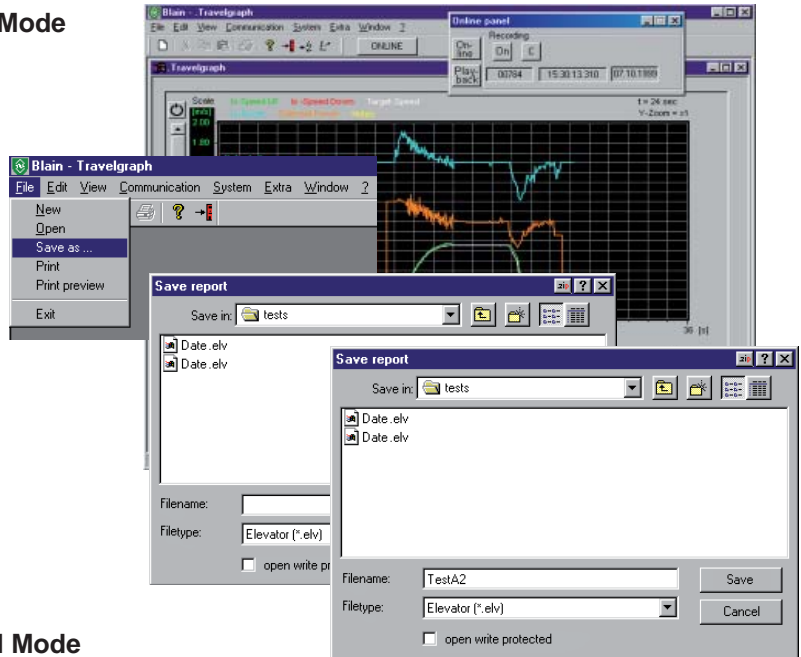
To Save 'Future' Travelgraphs, Online Panel Mode

1. Click [File] at top left of screen
File menu appears
2. Click [Save as] on File menu
Save report appears
3. Type in Data Name on Save Report
e.g. [test a2]
4. Click [OK] on Save Report

The Travelgraph remains on-line.
Graphs will be saved until:

(On - Off button) is clicked.

To resume saving of graphs, repeat steps 1 to 4
typing in a different data name.

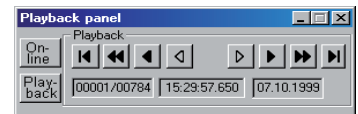


To Save 'Present' Travelgraphs, Online Panel Mode

In case a Data Name has not been entered in the Save Report before tests began, tests already run can still be saved by taking the same steps 1 to 4 as above. It is safer nevertheless to open the Save Report file before tests are run to avoid the possibility of test graphs being deleted by mistake.

To Review and Save 'Present' Travelgraphs, Playback Panel Mode

To review off-screen graphs still in the Online Panel mode click to Playback Panel mode and use the cursor to scroll.
To save these graphs, steps 1 to 4 as above must be taken.

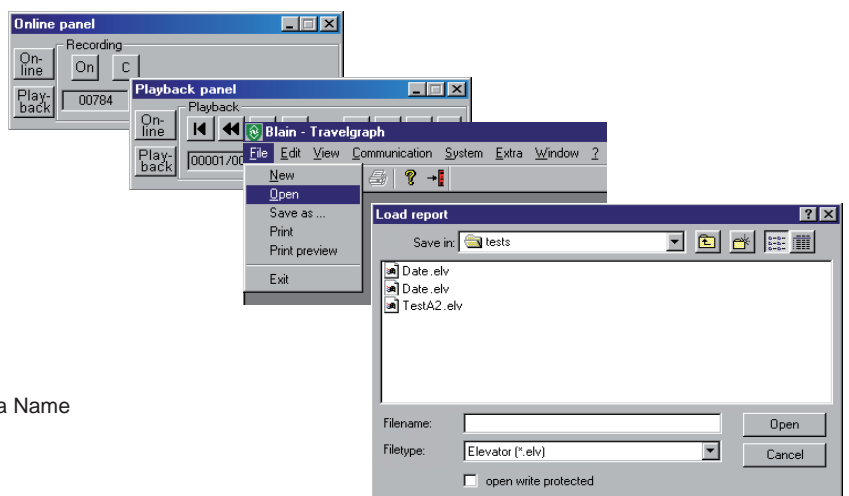


To Review Saved Graphs

5. Click [Playback] on Online Panel.
The Playback Panel appears.
6. Click [File] at top left of screen.
File menu appears.
7. Click [Open] on File
Load Report appears.
8. Click data to be reviewed on Load Report
e.g. test A2
9. Click [OK] on Load Report

The selected graph will appear confirmed by the Data Name
at the bottom of the Travelgraph display.

Cursor in playback mode, the cursor is initially at the left of the screen.
See pages 21 and 22 for cursor use, and for scrolling and zooming.



Playback, Horizontal Scrolling and Zooming

To view an online graph not on the screen, click the playback button. The playback panel will display cursor shift buttons.

Cursor

Playback Panel

Cursor Shift Buttons

Values of the current Cursor position.

Playback Button

1/10 1 and 4 grids units, per click

For analysis, graphs can be expanded

For fast scrollbar graphs can be contracted

Graph on expanded time base of 12 seconds.

Horizontal zoom buttons

Elevator travel direction at the cursor is also indicated

The Travelgraph D8. In Playback mode, recorded data can be reviewed and scrolled in either direction using the Cursor shift buttons located on the Playback panel. Shifting the cursor to the extreme left (Start of travel) will move the graph to the right. Shifting the cursor to the extreme right (End of travel) will move the graph to the left.

Vertical Scrolling and Zooming

The vertical axis can be scrolled to bring a specific trace point to the middle of the screen for zooming and review. To scroll the vertical axis click the UP or DOWN directional arrow on the left of the display.

Vertical scroll arrow

Solenoid Power

Cursor position

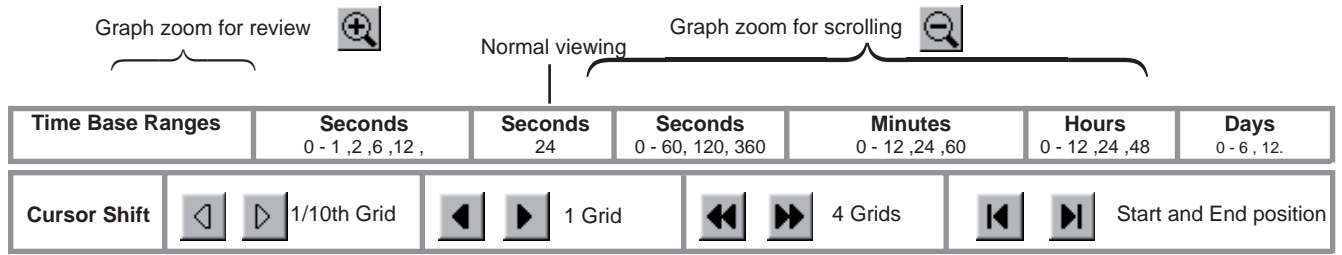
Time base 12 Sec

Vertical zoom buttons provide 5 stages of magnification

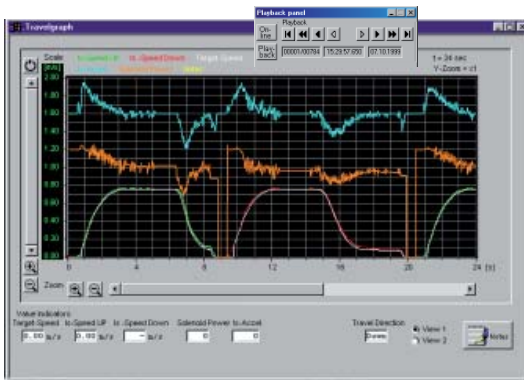
The Value Indicators show values at the Cursor position

Scroll bar indicates the position of playback

Examples



Focusing on values

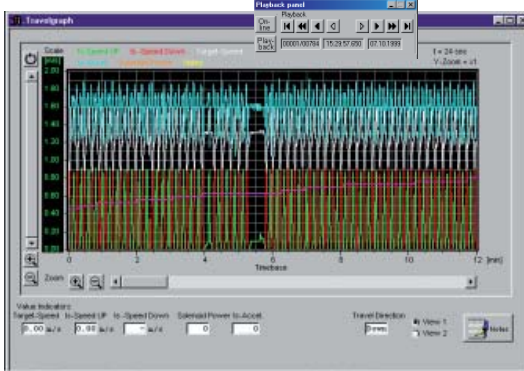


Example A Assume the values for review are off the screen to the left. (time base 24s).

- Click
 - Click until the review section appears on the Left of the screen.
 - Click until the Cursor is within one grid of the required values.
 - Click Zoom (expand) to 2 second time base if necessary.
 - Click moving the cursor exactly onto the values for review.
- Read the required information from the cursor values bottom left.

Faster Scrolling

Example B Assume the values for review are approximately 50 operations earlier, (approximately 15 minutes elevator operating time).



- Click
- Click Zoom to 12 minute time base for faster scrolling.
- Click or until the values appear on the left of the screen.
- Click Zoom to 24 second time base.



- Click or until the Cursor is within 1 grid of the values.
 - Click Zoom to 2 second time base if necessary.
 - Click or moving the cursor exactly onto the values for review.
- Read the required information from the value Indicators bottom left.

Assuming that friction in the guide rails or cylinder packing is not causing slip-stick, a smooth initial movement of the car away from the floor depends upon the solenoid trim screw adjustments AT (UP) and CT (DOWN).

UP

Solenoid A (Adjustment AT)

Using a 3 mm socket key.

Adjust a laptop or PC to monitor Travelgraph.

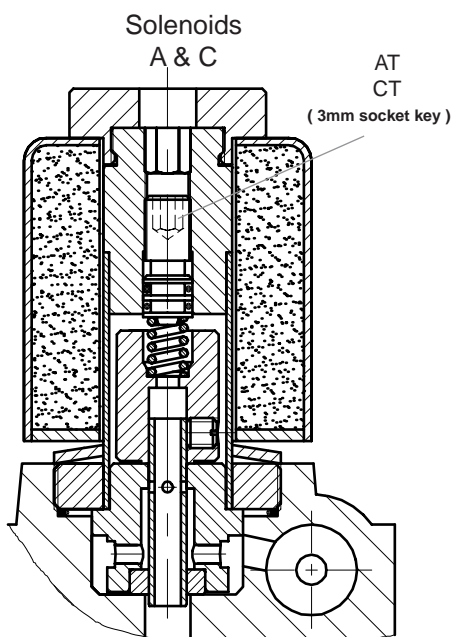
When using the 0 - 4000 vertical scale, adjust to the values in brackets.

- Signal the car to up level.
- Turn AT so that the red solenoid trace runs at 1,15 (2100) on the graph whilst the car is up leveling.
Turning 'in' (clockwise) raises the graph trace, 'out' lowers the trace.
- Return the car to the lower floor level and place a normal full up speed call to the next floor.
The red trace will start and should remain at 1,2 (2400) units for 0,5 to 1,5 seconds during which time the car will start upwards.
- As the car starts upwards, the red trace should peak at 1,25-1,35 (2500-2700) as the car approaches full speed. At full speed, the trace will decrease to about 1,0 (2000). Re-adjust AT if necessary so that the solenoid trace peaks at 1,25-1,35 (2500-2700) as the car accelerates upwards.

Down

Solenoid C (Adjustment CT)

- Signal the car to down level.
- Turn CT so that the red trace runs at 1,15 (2100) on the graph whilst the car is down leveling.
Turning 'in' (clockwise) raises the graph trace, 'out' lowers the trace.
- Return the car to the upper floor level and place a normal full down speed call to the next floor.
The red trace will start and should remain at 1,2 (2400) units for 0,5 to 1,5 seconds during which time the car will start downwards.
- As the car starts downwards, the red trace should peak at 1,25-1,35 (2500-2700) as the car approaches full speed. At full speed, the trace will decrease to about 1,0 (2000). Readjust CT if necessary that the solenoid trace peaks at 1,25-1,35 (2500-2700) as the car accelerates downwards.



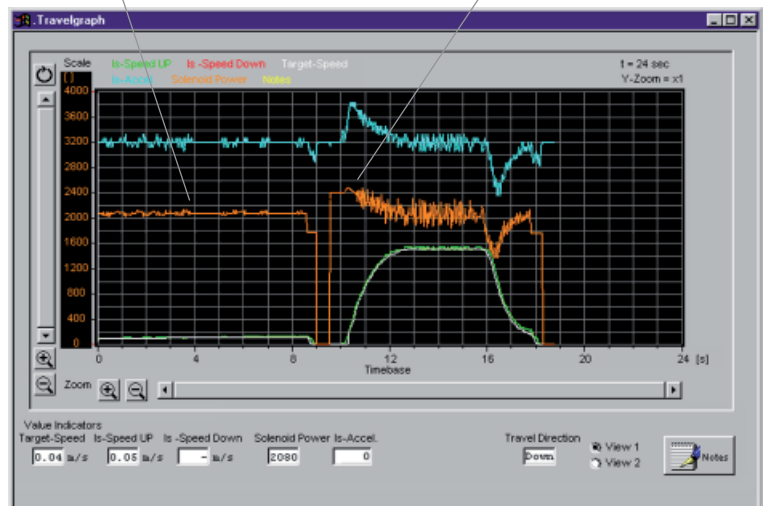
Pre-Adjustment

Red trace during leveling should be adjusted to 1,15 (2100)

Final Adjustment

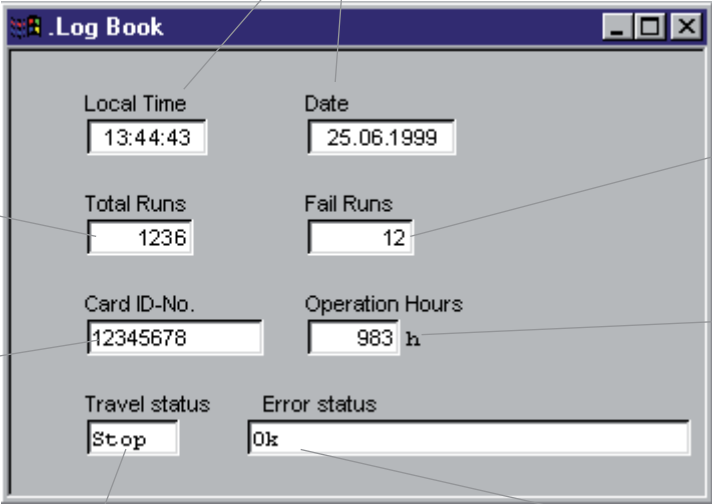
Red trace peak during acceleration should be between 1,25-1,35 (2500-2700)

Travelgraph D8



Logbook

The SEV Logbook stores operating time, number of operations and fail runs. By accessing the system through modem the engineer can observe the operational status and operating time of the system including operational hours.



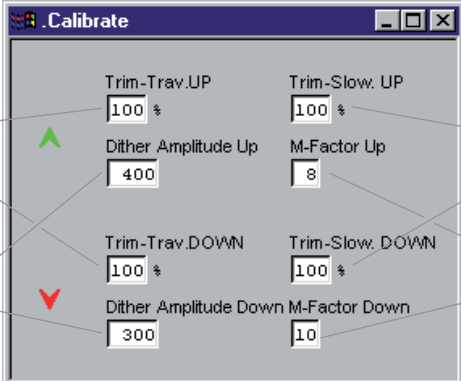
Log Book

Local Time	13:44:43	Date	25.06.1999
Total Runs	1236	Fail Runs	12
Card ID-No.	12345678	Operation Hours	983 h
Travel status	Stop	Error status	0k

Callouts:

- Clock and Date to be set by customer.** (points to Local Time and Date)
- Travel in one direction. (floor to floor)** (points to Total Runs)
- Fail Runs** Travel runs that have occurred and been identified as having an ERROR. (points to Fail Runs)
- Operational Hours** Displays the actual travel time. (points to Operation Hours)
- Card ID Number** A Serial number that allows Blain Hydraulics GmbH to identify owner and factory setting of the SEV. (points to Card ID-No.)
- Travel status** (points to Travel status)
- Error status** Present operational status of the elevator is displayed. (points to Error status)

Calibrate



Calibrate

Trim-Trav.UP	100 %	Trim-Slow. UP	100 %
Dither Amplitude Up	400	M-Factor Up	8
Trim-Trav.DOWN	100 %	Trim-Slow. DOWN	100 %
Dither Amplitude Down	300	M-Factor Down	10

Callouts:

- To equalize differences between Target- and Is- full speeds. (see page 13)** (points to Trim-Trav.UP and Trim-Slow. UP)
- To equalize differences between Target- and Is- leveling speeds. (see page 13)** (points to M-Factor Up and M-Factor Down)
- Dither Amplitude of the Solenoids A and C. The value should be between 300 -500. If the value is too high, vibrations of the car will result.** (points to Dither Amplitude Up and Dither Amplitude Down)
- Normal Factor is between 5 to 10. Values too high cause oscillation. Values too low cause speed error.** (points to M-Factor Up and M-Factor Down)

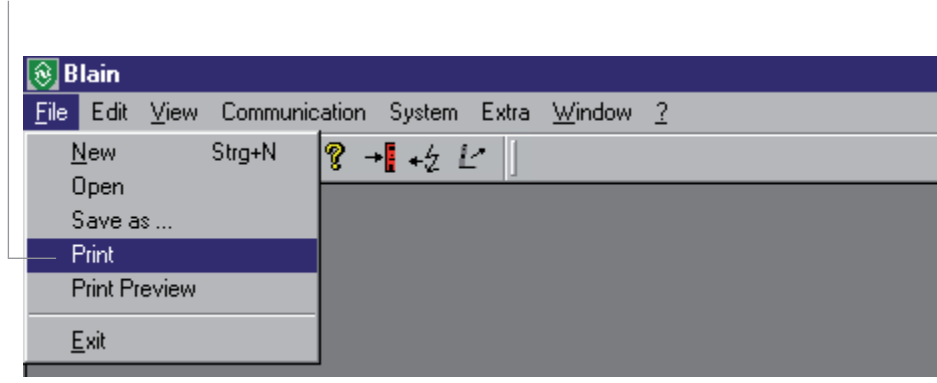
Remote Monitoring

To ensure that an SEV valve can be efficiently installed and serviced and to exploit fully the considerable advantages of remote monitoring through the SEV card, it is important to be able to communicate the information stored in the SEV card or PC from the elevator machine room of the installation to Blain Hydraulics or other servicing centre through modem on-line or through e-mail.

This information includes a number of graphs of the last normal elevator operations and also graphs of any faulty operations, imparative to the efficient diagnosing or prevention of a problem.

Printing a Travelgraph

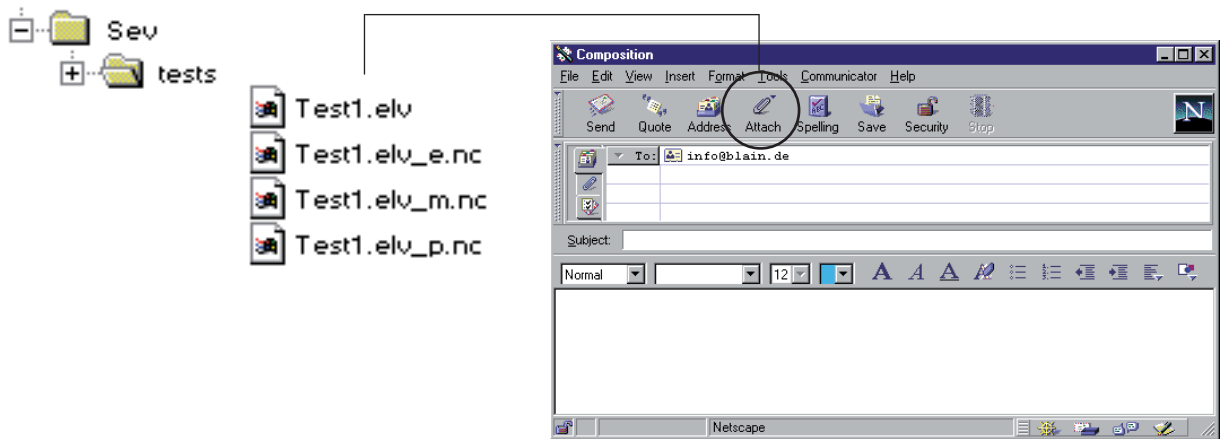
Display the section of graph to be printed using the zoom function if necessary, click (File) and select print from the menu. Follow the instructions for your printer. The printout can be faxed to a service station.



Transmission of Travelgraph through E-Mail

The performance of the elevator in the form of the travelgraph can be saved (see File Saving, page 20) and transmitted through E-Mail from the elevator station to a servicing station anywhere world wide. For every Travelgraph, 4 files (see below) are needed. If the transmission capacity is excessive (depending on the E-Mail provider), or to reduce transmission time, compress the files, e.g. through "winzip".

Blain E-Mail address is: info@blain.de



Example: This shows the Netscape E-Mail window.

Monitoring Connection

Precondition. The SEV card at the elevator site is modem connected. The PC at the monitoring center, equipped with Windows 95 – SEV program, is modem connected through the correct COM port.!

Calling from the monitoring center

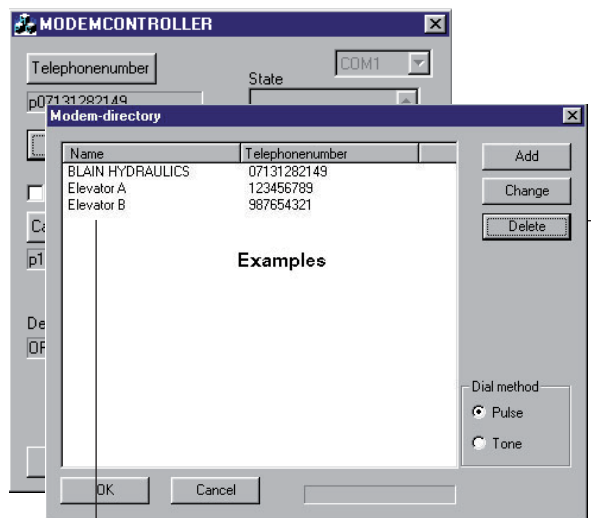
Select SEV [Main Display].
Click [Communication] button.
Click [Modem] button.

[Modemcontroller] window appears

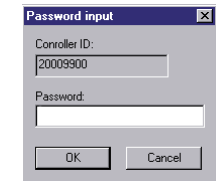
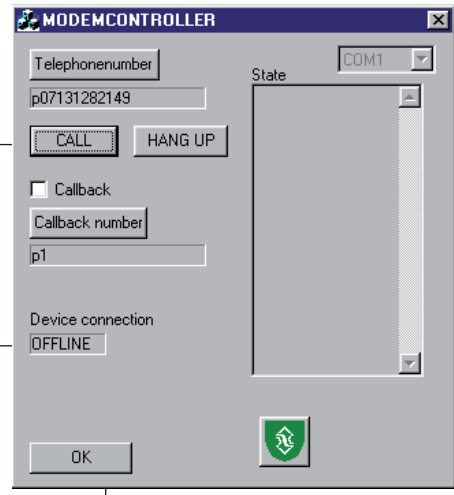
Click [Telephonenumber] button.
The [Modem directory] window appears showing SEV site names and numbers.

Changing or adding elevator site modem num-

Click [Communication] button.
Click [Modem] button.
Click [Telephonenumber] button.
[Modem directory] window appears.
To add, change or delete a number, click the appropriate button. The appropriate window opens. [Input] window for [add] or [change], [Delete entry] for [delete].
Click button required.
Type in name of installation and Telephone number. Confirm by clicking [OK].
In case of Delete, click name to be deleted, click [Delete] button, click [Yes] button.



Click [required] name.
Click [OK] button.
[Modemcontroller] window appears.
Click [Call] button.
In the [State] box, the communication protocol appears.
After 4 dialling tones, usually lasting about 15 seconds the [Offline] box will display [Online].
In case no communication protocol appears, check for the correct COM port.!



Enter required Password and click [OK].
(The original Password is set to 11111111 and can be changed direct on the SEV Card)



Upon successful connection. Click [OK] button to close the [Modem Connection] window.
The system data from the elevator will now appear live in the appropriate boxes of the [Main Display].
Alternatively the graphical operation of the elevator can be observed by clicking the [Travel-graph] button, top right of the [Main Display].

Changing the elevator operation

As described on page 17, changes to the operation of the elevator can be made from the monitoring center.
Downloading and print out of data, received from the elevator site can be made.
To close the modem connection

Click [Communication] button - Click [Modem] button - Click [Hang Up] button

And avoid unnecessary telephone (modem connection) costs !



Data required when ordering:

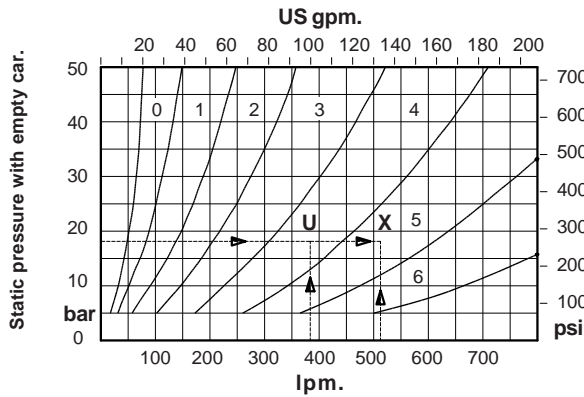
Pump Output Car empty	lpm.....	gpm
Pump Output Car loaded	lpm.....	gpm
Static Pressure Car empty	bar.....	psi
Static Pressure Car loaded	bar.....	psi
Up Speed	m/s.....	fpm
Down Speed	m/s.....	fpm
D coil volts	

Flow Ring R Selection

① lpm	② US gpm	① US gpm	② Ring No.	P, T & Z2
40 - 70	11 - 18	R1	1" G	
71 - 110	19 - 29	R2	1" G	
111 - 180	30 - 47	R3	1" G	
181 - 270	48 - 71	R4	1 1/2" G	
271 - 440	72 - 116	R5	1 1/2" G	
441 - 600	117 - 156	R6	2" G	
601 - 1000	157 - 260	R7	2 1/2" G	

Overlap ① Flows 20% below these values are acceptable.
 ② Flows 10% above these values are acceptable.

Bypass Spool U and Down Spool X Selection

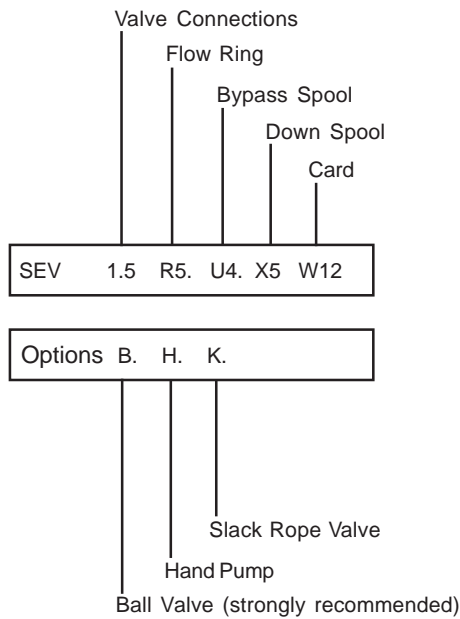


Example:
 Required flow up 380 lpm (99 gpm)
 Required flow down 510 lpm (133 gpm)
 Static Empty Car Pressure. 18 bar (260 psi)

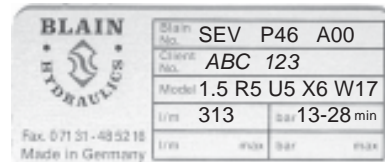
Selected Bypass Spool U, size 4
 Selected Down Spool X, size 5

* Overlap of Spool or Flow Ring selected sizes should not exceed 15%

Valve Type - Dataplate

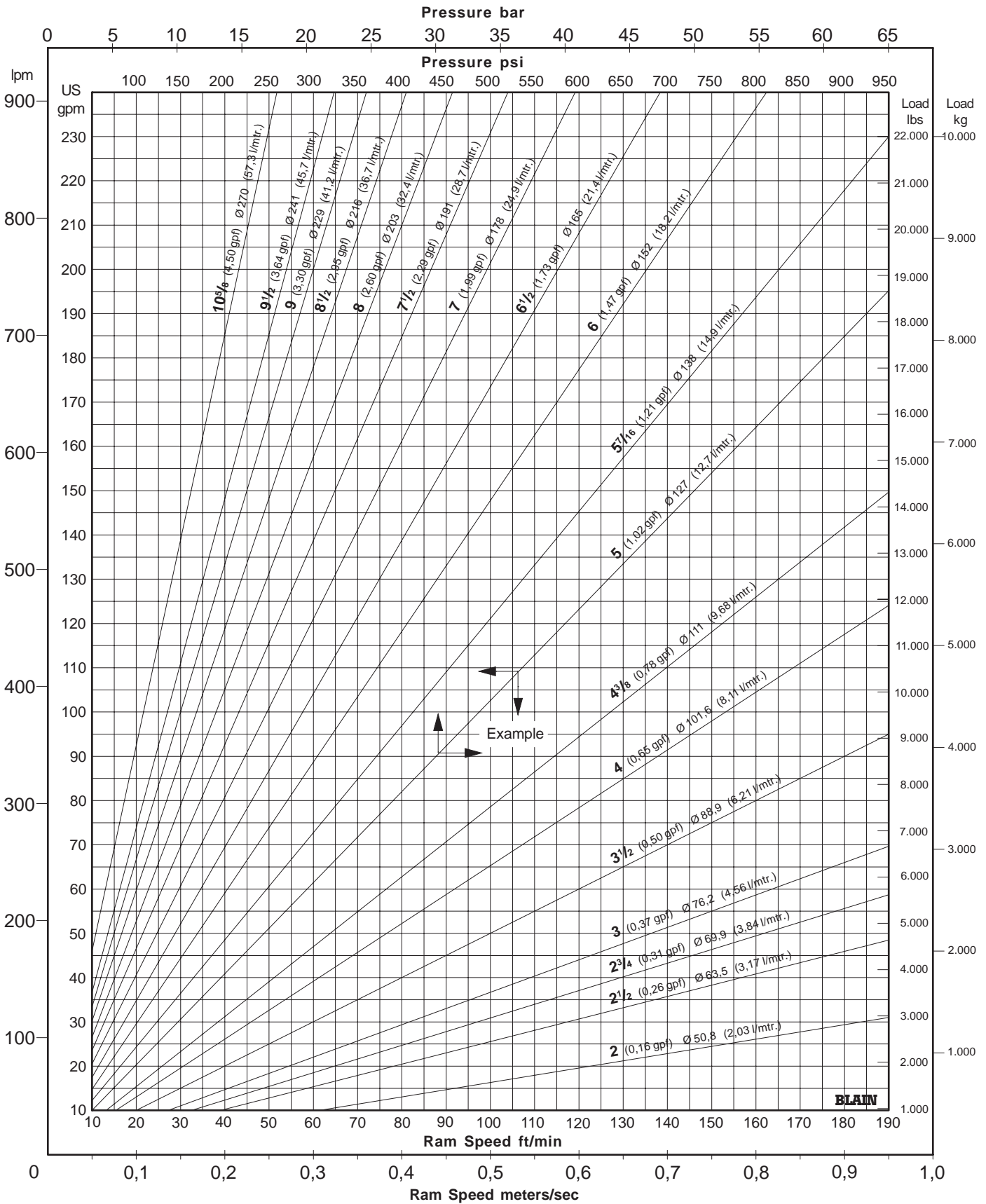


Example



Available Options (same as with EV 100)

- BV** - Ball Valve: Pressure Line Shut off. (Recommended for easier installation).
- EN** - Emergency Power Coil: Battery lowering in case of power failure. (D coil double wound)
- KS** - Slack Rope Valve: Prevents excessive slack rope condition in 2:1 systems.
- HP** - Hand Pump: To raise car manually.
- DH** - Pressure Switches: Signals hydraulic pressure above the normal operating pressure.
- DL** - Pressure Switches: Signals hydraulic pressure below the normal operating pressure.
- MX** - Down Valve: Extra Solenoid Down Valve.
- HX** - Down Valve: Extra Manual Down Valve.





Ram Ø • Area • Speed • Flow

m/sec.		0,05	0,10	0,15	0,20	0,25	0,30	0,35	0,40	0,45	0,50	0,55	0,60	0,70	0,80	0,90	1,00
Ø mm	cm ²	l/min.															
35	9,6	2,9	5,8	8,7	11,5	14	17	20	23	26	29	32	35	40	46	52	58
40	12,6	3,8	7,5	11,3	15,1	19	23	26	30	34	38	41	45	53	60	68	75
45	15,9	4,8	9,5	14,3	19,1	24	29	33	38	43	48	52	57	67	76	86	95
50	19,6	5,9	11,8	17,7	23,6	29	35	41	47	53	59	65	71	82	94	106	118
55	23,8	7,1	14,3	21,4	28,5	36	43	50	57	64	71	78	86	100	114	128	143
60	28,3	8,5	17,0	25,4	33,9	42	51	59	68	76	85	93	102	119	136	153	170
65	33,2	10,0	19,9	29,9	39,8	50	60	70	80	90	100	110	119	139	159	179	199
70	38,5	11,5	23,1	34,6	46,2	58	69	81	92	104	115	127	139	162	185	208	231
75	44,2	13,3	26,5	39,8	53,0	66	80	93	106	119	133	146	159	186	212	239	265
80	50,3	15,1	30,2	45,2	60,3	75	90	106	121	136	151	166	181	211	241	271	302
85	56,7	17,0	34,0	51,1	68,1	85	102	119	136	153	170	187	204	238	272	306	340
90	63,6	19,1	38,2	57,3	76,3	95	115	134	153	172	191	210	229	267	305	344	382
95	70,9	21,3	42,5	63,8	85,1	106	128	149	170	191	213	234	255	298	340	383	425
100	78,5	23,6	47,1	70,7	94,2	118	141	165	188	212	236	259	283	330	377	424	471
105	86,6	26,0	52,0	77,9	103,9	130	156	182	208	234	260	286	312	364	416	468	520
110	95,0	28,5	57,0	85,5	114,0	143	171	200	228	257	285	314	342	399	456	513	570
115	103,9	31,2	62,3	93,5	124,6	156	187	218	249	280	312	343	374	436	499	561	623
120	113,1	33,9	67,9	101,8	135,7	170	204	238	271	305	339	373	407	475	543	611	679
125	122,7	36,8	73,6	110,4	147,3	184	221	258	295	331	368	405	442	515	589	663	736
130	132,7	39,8	79,6	119,5	159,3	199	239	279	319	358	398	438	478	557	637	717	796
140	153,9	46,2	92,4	138,5	184,7	231	277	323	369	416	462	508	554	647	739	831	924
150	176,7	53,0	106,0	159,0	212,1	265	318	371	424	477	530	583	636	742	848	954	1060
160	201,1	60,3	120,6	181,0	241,3	302	362	422	483	543	603	664	724	844	965	1086	1206
170	227,0	68,1	136,2	204,3	272,4	340	409	477	545	613	681	749	817	953	1090	1226	1362
180	254,5	76,3	152,7	229,0	305,4	382	458	534	611	687	763	840	916	1069	1221	1374	1527
190	283,5	85,1	170,1	255,2	340,2	425	510	595	680	766	851	936	1021	1191	1361	1531	1701
200	314,2	94,2	188,5	282,7	377,0	471	565	660	754	848	942	1037	1131	1319	1508	1696	1885
210	346,4	103,9	207,8	311,7	415,6	520	623	727	831	935	1039	1143	1247	1455	1663	1870	2078
220	380,1	114,0	228,1	342,1	456,2	570	684	798	912	1026	1140	1254	1368	1597	1825	2053	2281
240	452,4	135,7	271,4	407,2	542,9	679	814	950	1086	1221	1357	1493	1629	1900	2171	2443	2714
260	530,9	159,3	318,6	477,8	637,1	796	956	1115	1274	1434	1593	1752	1911	2230	2548	2867	3186
280	615,8	184,7	369,5	554,2	738,9	924	1108	1293	1478	1663	1847	2032	2217	2586	2956	3325	3695
300	706,9	212,1	424,1	636,2	848,2	1060	1272	1484	1696	1909	2121	2333	2545	2969	3393	3817	4241

Ram Ø • Area • Load • Pressure

kg		500	750	1000	1500	2000	2500	3000	3500	4000	4500	5000	6000	7000	8000	9000	10000
Ø mm	cm ²	bar															
35	9,6	51	76	102	153	204	255	306	357	408	459	510	612	714	816	918	1020
40	12,6	39	59	78	117	156	195	234	273	312	351	390	468	546	625	703	781
45	15,9	31	46	62	93	123	154	185	216	247	278	308	370	432	493	555	617
50	19,6	25	38	50	75	100	125	150	175	200	225	250	300	350	400	450	500
55	23,8	21	31	41	62	83	103	124	145	165	186	206	248	289	330	372	413
60	28,3	17	26	35	52	69	87	104	121	139	156	173	208	243	278	312	347
65	33,2	15	22	30	44	59	74	89	103	118	133	148	177	207	237	266	296
70	38,5	13	19	26	38	51	64	76	89	102	115	127	153	178	204	229	255
75	44,2	11	17	22	33	44	56	67	78	89	100	111	133	155	178	200	222
80	50,3	9,8	15	20	29	39	49	59	68	78	88	98	117	137	156	176	195
85	56,7	8,6	13	17	26	35	43	52	61	69	78	86	104	121	138	156	173
90	63,6	7,7	12	15	23	31	39	46	54	62	69	77	93	108	123	139	154
95	70,9	6,9	10	14	21	28	35	42	48	55	62	69	83	97	111	125	138
100	78,5	6,2	9,4	13	19	25	31	38	44	50	56	62	75	87	100	112	125
105	86,6	5,7	8,5	11	17	23	28	34	40	45	51	57	68	79	91	102	113
110	95,0	5,2	7,7	10	16	21	26	31	36	41	47	52	62	72	83	93	103
115	103,9	4,7	7,1	9,4	14	19	24	28	33	38	43	47	57	66	76	85	94
120	113,1	4,3	6,5	8,7	13	17	22	26	30	35	39	43	52	61	69	78	87
125	122,7	4,0	6,0	8,0	12	16	20	24	28	32	36	40	48	56	64	72	80
130	132,7	3,7	5,5	7,4	11	15	19	22	26	30	33	37	44	52	59	67	74
140	153,9	3,2	4,8	6,4	9,6	13	16	19	22	26	29	32	38	45	51	57	64
150	176,7	2,8	4,2	5,6	8,3	11	14	17	19	22	25	28	33	39	44	50	56
160	201,1	2,4	3,7	4,9	7,3	9,8	12	15	17	20	22	24	29	34	39	44	49
170	227,0	2,2	3,2	4,3	6,5	8,6	11	13	15	17	19	22	26	30	35	39	43
180	254,5	1,9	2,9	3,9	5,8	7,7	9,6	12	14	15	17	19	23	27	31	35	39
190	283,5	1,7	2,6	3,5	5,2	6,9	8,6	10	12	14	16	17	21	24	28	31	35
200	314,2	1,6	2,3	3,1	4,7	6,2	7,8	9,4	11	13	14	16	19	22	25	28	31
210	346,4	1,4	2,1	2,8	4,2	5,7	7,1	8,5	9,9	11	13	14	17	20	23	26	28
220	380,1	1,3	1,9	2,6	3,9	5,2	6,5	7,7	9,0	10,3	12	13	16	18	21	23	26
240	452,4	1,1	1,6	2,2	3,3	4,3	5,4	6,5	7,6	8,7	9,8	11	13	15	17	20	22
260	530,9	0,9	1,4	1,8	2,8	3,7	4,6	5,5	6,5	7,4	8,3	9,2	11	13	15	17	19
280	615,8	0,8	1,2	1,6	2,4	3,2	4,0	4,8	5,6	6,4	7,2	8,0	9,6	11	13	14	16
300	706,9	0,7	1,0	1,4	2,1	2,8	3,5	4,2	4,9	5,6	6,2	6,9	8,3	9,7	11	13	14

cm² = in² m/sec x 197 = ft/min. l/min. x 0,22 = Imp. gals mm = inches l/min x 0,26 = US. gals kg x 2,2 = lbs bar x 14,7 = psi

