# SEV

## Servo Electronic Valve
### for Hydraulic Elevators


## System Information Handbook

No. E38

BLAIN HYDRAULICS

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ISO 9001:2008

# 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

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***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 neccessary.***

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# S E V

## Description

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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.

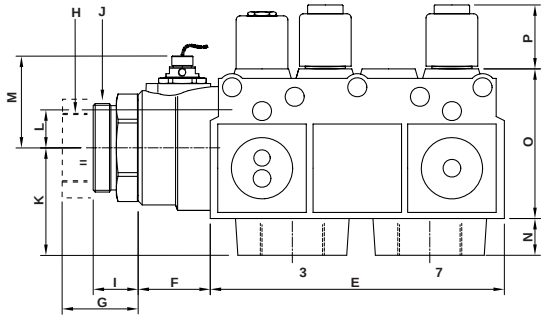
| SEV Technical Data | Metric | USA |
|---|---|---|
| Flow Range 1" | 40 - 180 lpm | 10 - 46 gpm |
| Flow Range 1 1/2" | 181 - 440 lpm | 47 - 114 gpm |
| Flow Range 2" | 441 - 600 lpm | 115 - 156 gpm |
| Flow Range 2 1/2" | <12 bar - 1000 lpm<br>>12 bar - 1200 lpm | <170 psi - 260 gpm<br>>170 psi - 317 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 |

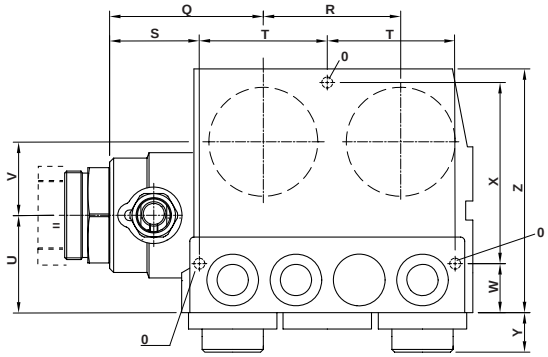
SEV 1"

Electronic Card

SEV 1 1/2" - 2"

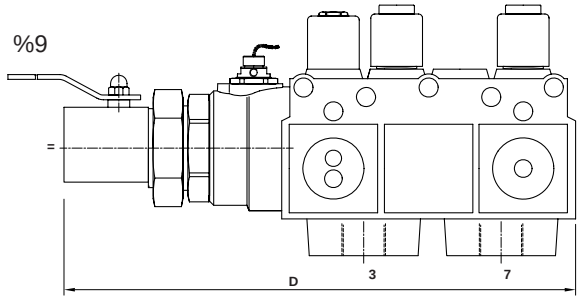
### SEV Valve Dimensions

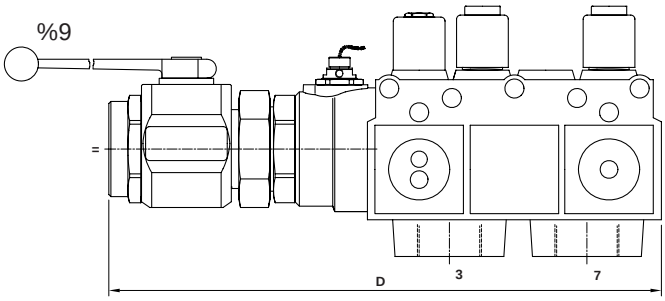



### SEV with BV Ball Valve

**Standard**

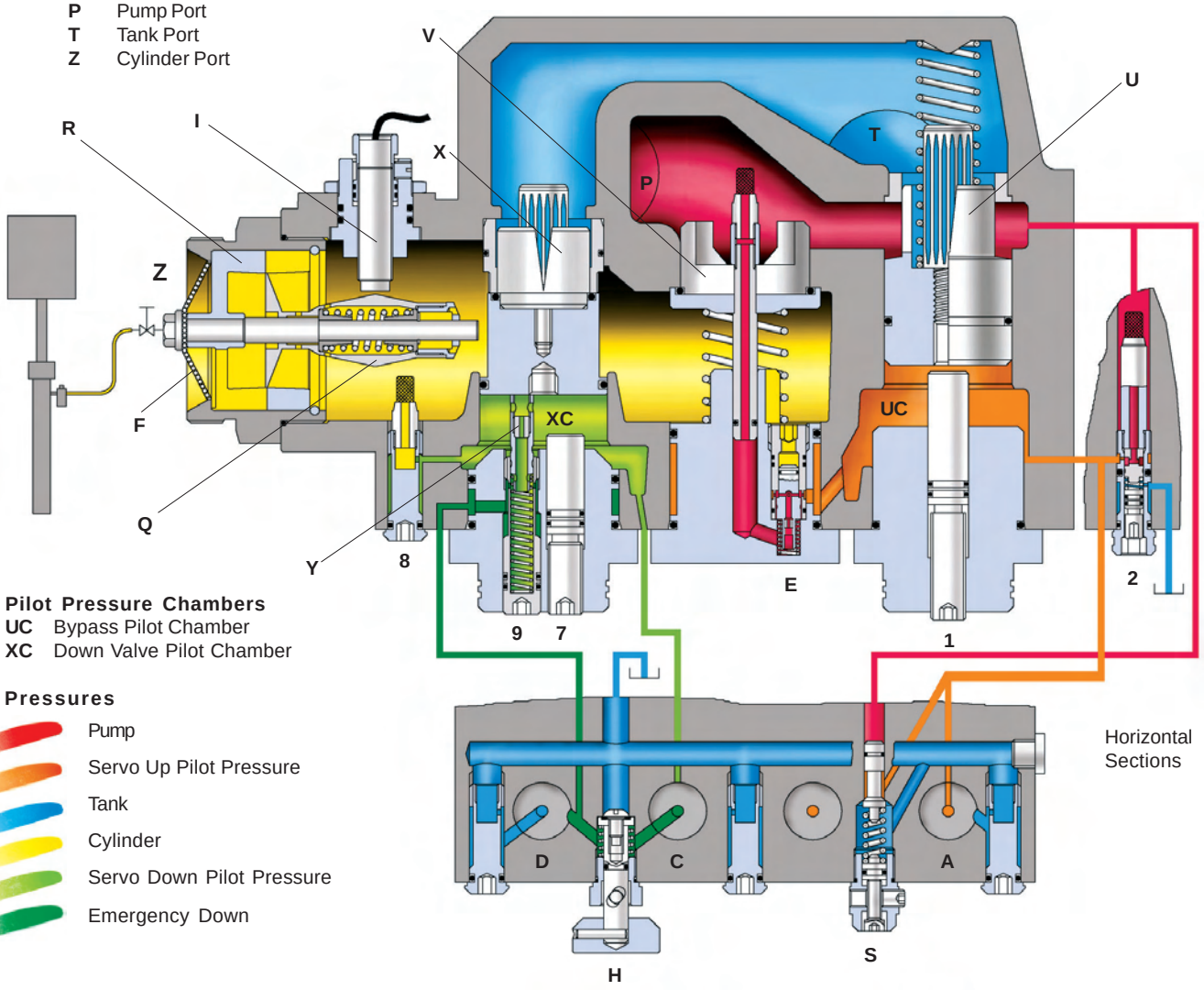



| SEV | | a | b | c | d* | e* | f | g | h | i | j | k | l | m | n | o | p | q | r | s | t | u | v | w | Weight / Gewicht SEV | Weight / Gewicht BV |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1" | mm | 376 | 216 | 53 | | | 33 | M 65x2 | 79 | 28 | 67,5 | 27 | 110 | 47 | 113 | 101 | 66 | 94 | 71,5 | 54 | 36 | 133 | 29 | 179 | 11 kg | 1,7 kg |
| | inch | 14,8 | 8,5 | 2,1 | | | 1,3 | | 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 lbs | 3,7 lbs |
| 1 ½" | 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 kg | 2,5 kg |
| | inch | 16 | 8,5 | 2,1 | | | 1,3 | | 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 lbs | 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 kg | 2,5 kg |
| | inch | 16 | 8,5 | 2,1 | 2,17 | 2" | 1,3 | | 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 lbs | 5,5 lbs |
| 2 ½" | 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 kg | 5 kg |
| | inch | 21,97 | 10,94 | 3,39 | 3,07 | 2 ½" | 2,17 | | 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 lbs | 16 lbs |

* Standard measurements - variationes possible.

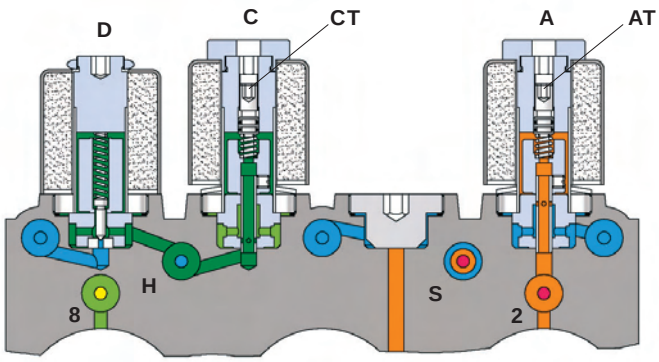
**Connections**
**P** Pump Port
**T** Tank Port
**Z** Cylinder Port




Horizontal Sections

**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

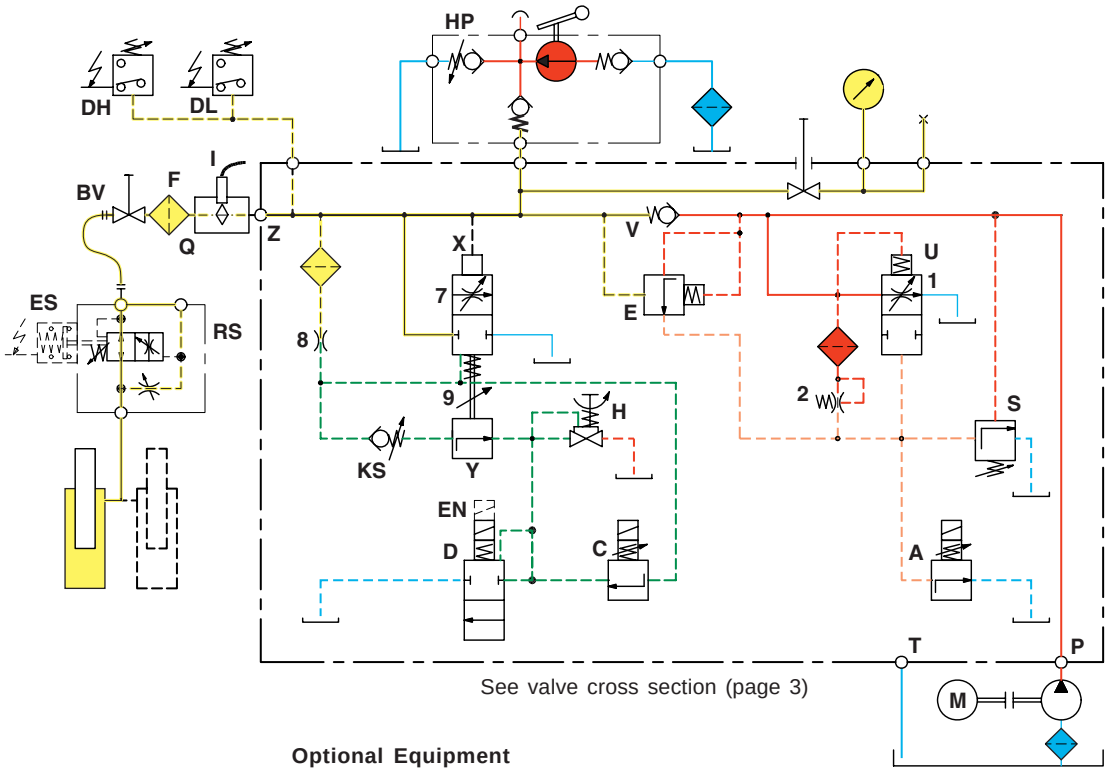



Vertical Section

**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 simultaniously 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 simultaniously 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.

# Installation

## Valve, Card, Switch Positions, Modem (optional)

Only experienced and qualified technicans 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**

| Travel speed | Decel.switch before floor | Leveling speeds | Stop switch before floor |
|---|---|---|---|
| m/sec | cm | cm/sec | cm |
| 0,3 | 25 | 6 | 1,0 |
| 0,4 | 45 | 6 | 1,0 |
| 0,5 | 60 | 6 | 1,0 |
| 0,6 | 75 | 6 | 1,0 |
| 0,7 | 95 | 7 | 1,5 |
| 0,8 | 110 | 7 | 1,5 |
| 0,9 | 130 | 8 | 2,0 |
| 1,0 | 145 | 8 | 2,0 |

**USA**

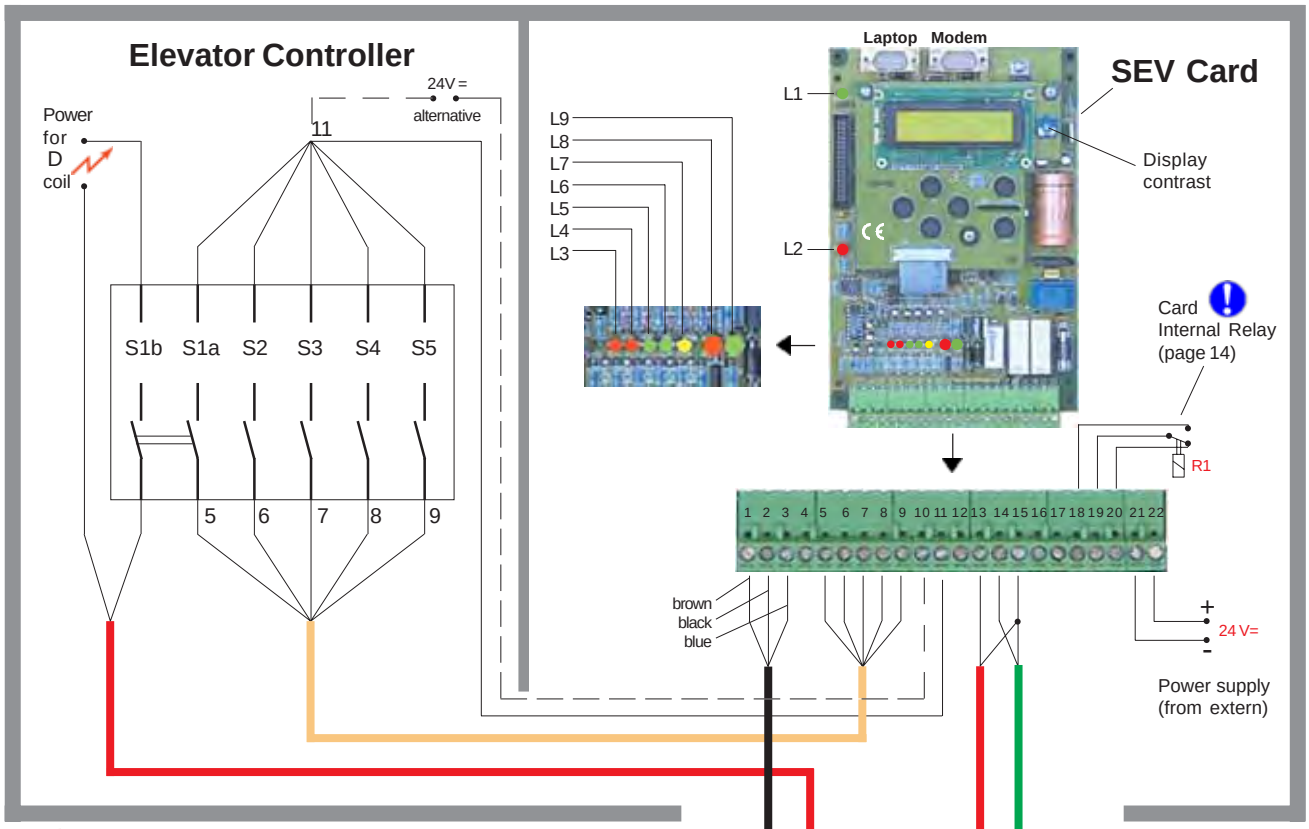
| Travel speed | Decel.switch before floor | Leveling speeds | Stop switch before floor |
|---|---|---|---|
| ft/min | inches | ft/min | inches |
| 60 | 10 | 12 | 0,4 |
| 80 | 17 | 12 | 0,4 |
| 100 | 24 | 12 | 0,4 |
| 120 | 30 | 12 | 0,4 |
| 140 | 37 | 14 | 0,6 |
| 160 | 43 | 14 | 0,6 |
| 180 | 51 | 16 | 0,8 |
| 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).

# Wiring of Electronic Card




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 | not used |
| ✓ | PIN 5 | Switch: Down Leveling (S1a) |
| ✓ | PIN 6 | Switch: Down Full Speed (S2) |
| ✓ | PIN 7 | Switch: Up Full Speed (S3) |
| ✓ | PIN 8 | Switch: Up Leveling (S4) |
| ✓ | PIN 9 | Switch: Inspection (S5) |
| | PIN 10 | Ground for alternative supply |
| ✓ | PIN 11 | Supply output **NO** input (+18...30VDC) |
| | PIN 12 | Ground (0VDC) for external consumer |
| ✓ | PIN 13 | Down Coil (+) |
| ✓ | PIN 14 | Up Coil (+) |
| ✓ | PIN 15 | Coils common(-) |
| | PIN 16 | not used |
| | PIN 17 | not used |
| * | PIN 18 | Relais 1 Internal Fault (closes) |
| | PIN 19 | Relais 1 Internal Fault common |
| * | PIN 20 | Relais 1 Internal Fault (opens) |
| ✓ | PIN 21 | Supply Voltage Ground |
| ✓ | PIN 22 | Supply Voltage 24V DC |

✓ Connections to be made by customer

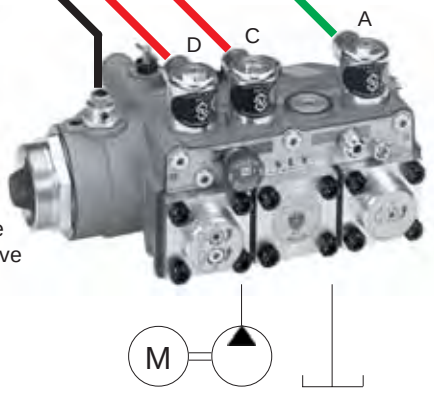
* 18 closed if OK - open if fault
* 20 open if OK - closed if fault

## Controller Relays

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

## Indicator

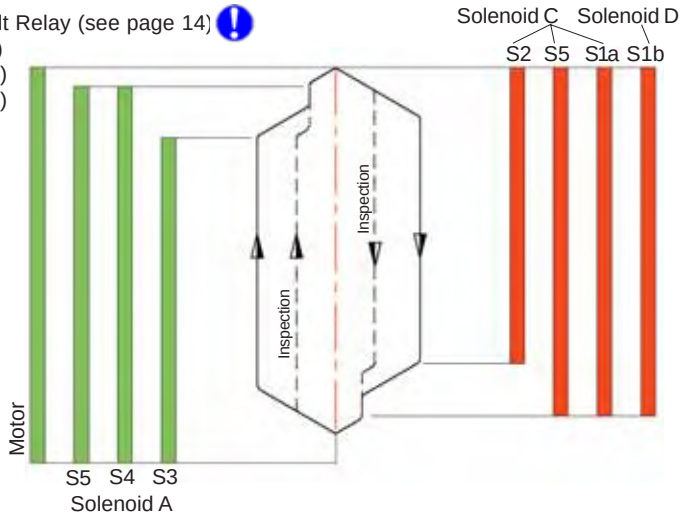
L1 : Power
L2 : Fault
L3 : Down Leveling (D) active
L4 : Down Full Speed (C) active
L5 : Up Full Speed (B) active
L6 : UP Leveling (A) active
L7 : Inspection active
L8 : Solenoid (C) active
L9 : Solenoid (A) active




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



# SEV Card Description

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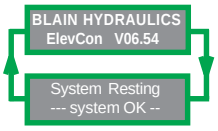
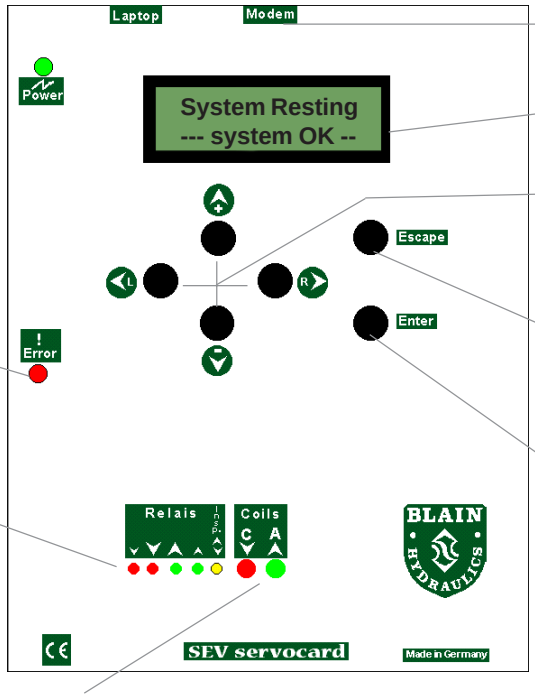
After the SEV valve and card have been correctly installed and the shaft switches positioned as recommended, turn on the electrical power to the card, 24 Vdc (50VA). Alternatively, 18Vac may be used for the power supply of the card.

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




The laptop and modem connections are both COM types.

The illuminated display communicates online data of the elevator as well as performance input data.

The four button group is for selecting the menu and for changing the value of data.

The Escape button is to exit a menu within the program, or to reset after an error status.

The Enter button is to confirm new data that has been entered into the SEV program.

The Error LED will illuminate if a system error has occurred. (see page 14)

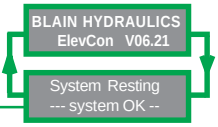
The Relay Indicator LED's will illuminate when a call signal is received from the elevator controller.

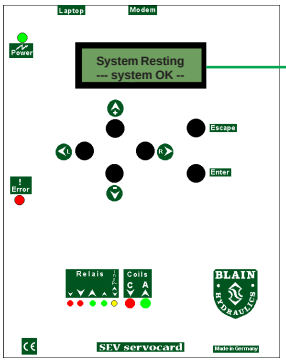
The coil indicator LED's will illuminate to show which solenoid (C or A) is energised.

## SEV Card

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

Card Display

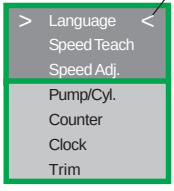


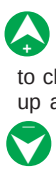




>...< Menu Cursor

Menu Display

(Select Display Language) (speeds) (Cylinder and Pump Data) (Operation counts) (Time and Date) (Sensor Trim)



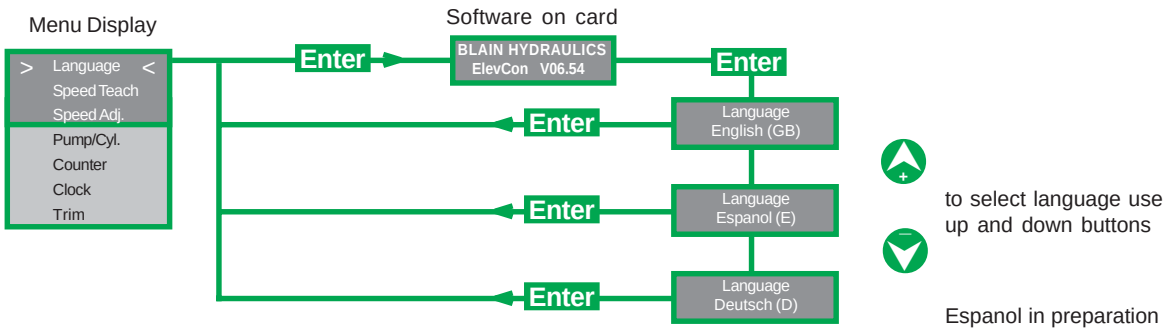



to change position use up and down buttons

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

# Initial Operation - Valve Adjustment
**(already factory adjusted and tested according to customers technical data)**

## Select Display Language




## Initial Operation

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

### UP

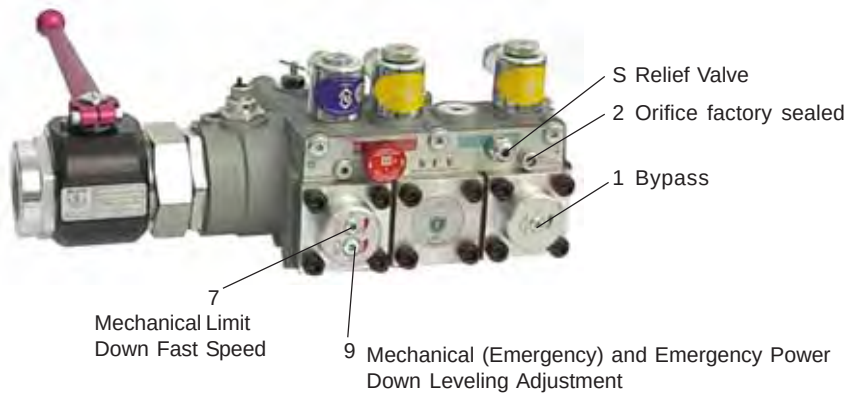
When the UP command is given for the initial operation, the first movement of the car may be delayed a few seconds whilst the pilot pressure chamber UC of the valve fills with oil.

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 S 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).

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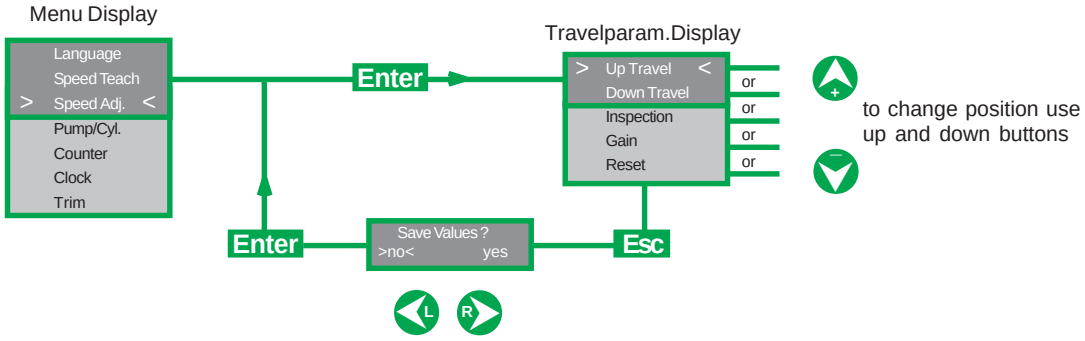
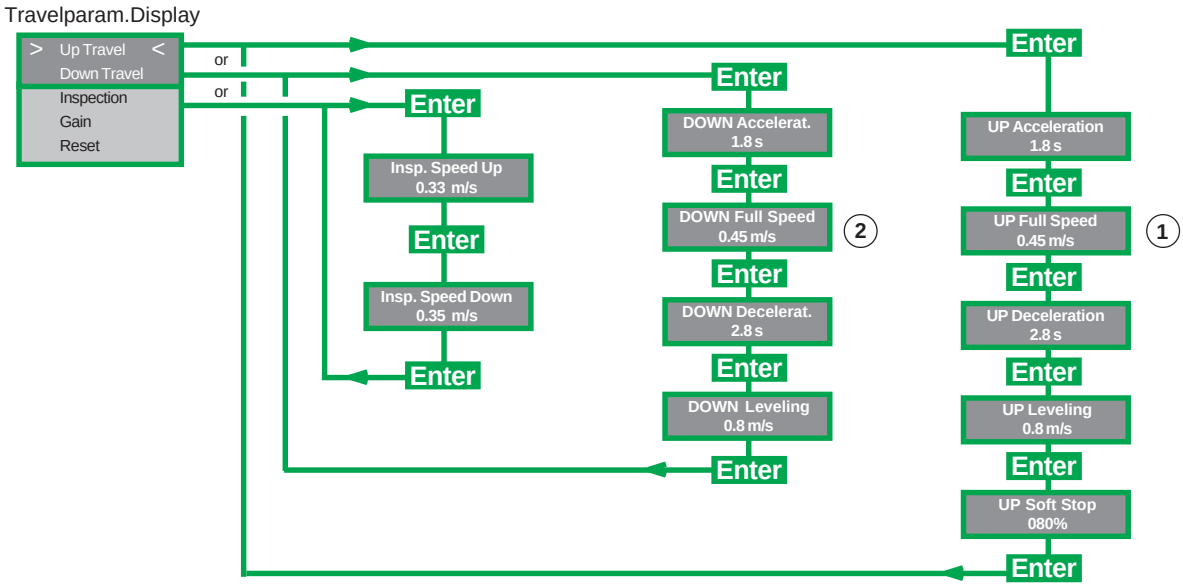
# Changing Speeds
## (factory adjusted and tested)

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.

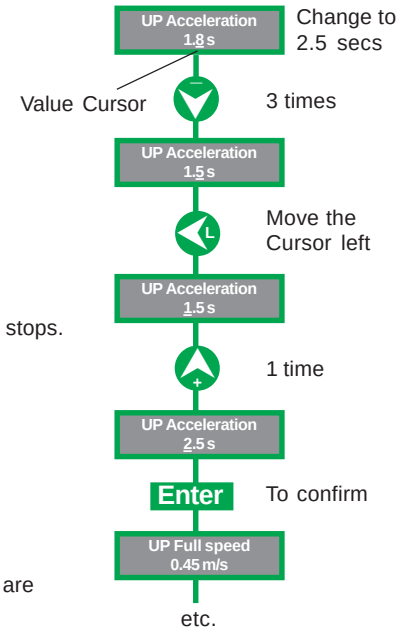
Slow speed however should not normally be less than 0.05 m/s (10 ft/min).

### 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

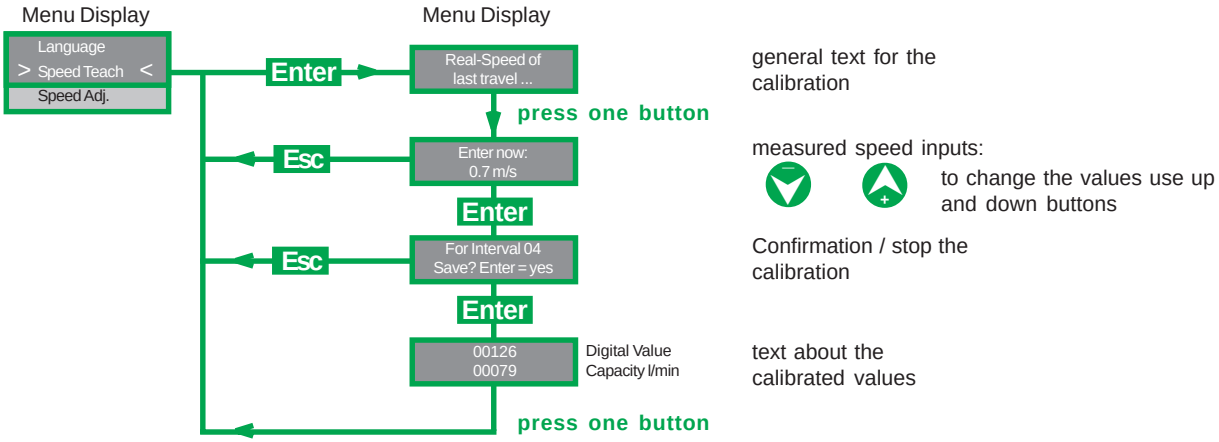


# Teach Speed
## (factory adjusted and tested)

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.



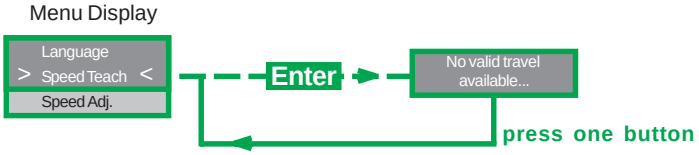

In case that the calibrated speed does not agree with the indicated speed on the card, a repetition of the calibrating process can be necessary.

### 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 desribed 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:



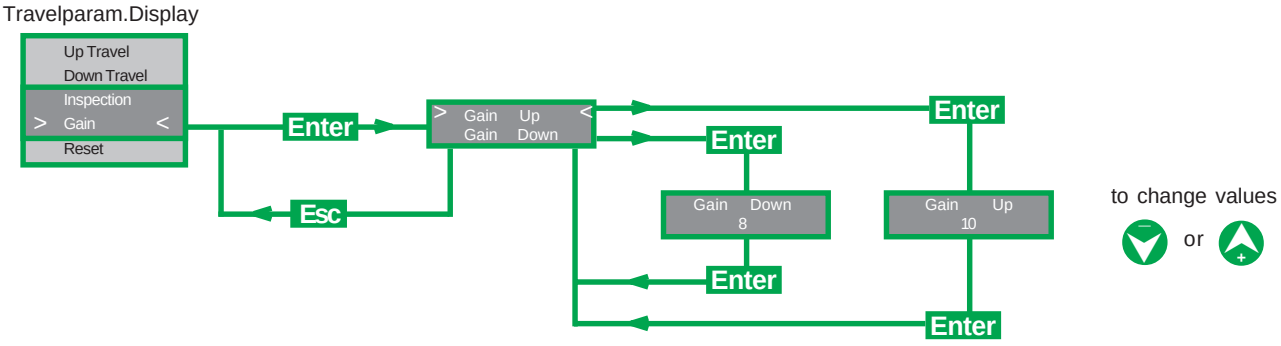

The switches in the shaft should be set to an other position to reach leveling speed or the deceleration should be increased on the card. This is necessary because the statuses of the leveling speed have to go through on the program. Afterwards the calibration can be repeated.

Prov. 38

# Changing Gain Values, Reset
## (factory adjusted and tested)

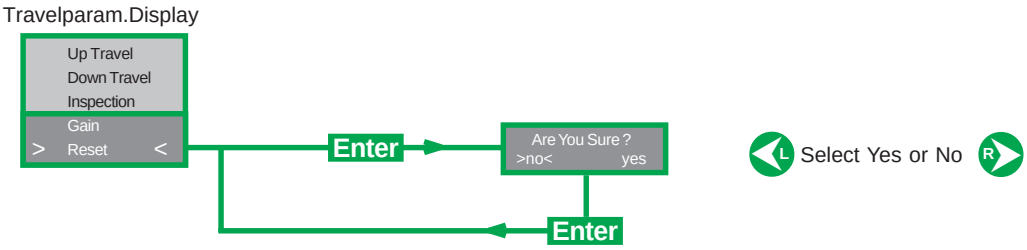
### Gain Values

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

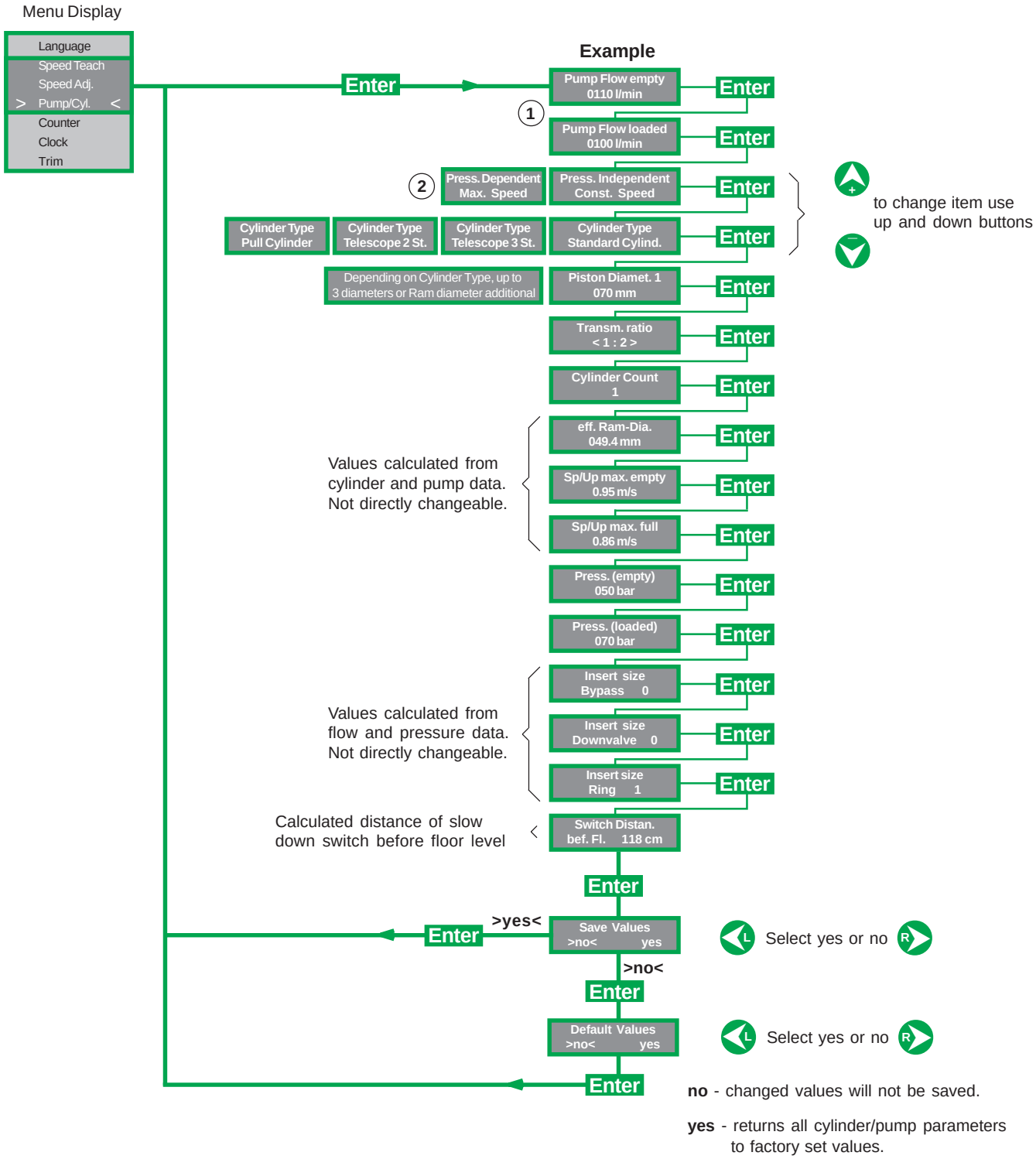



### Reset

Returns all travel parameters to factory set values.



# Changing Cylinder, Pump Data
## (factory adjusted and tested)




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

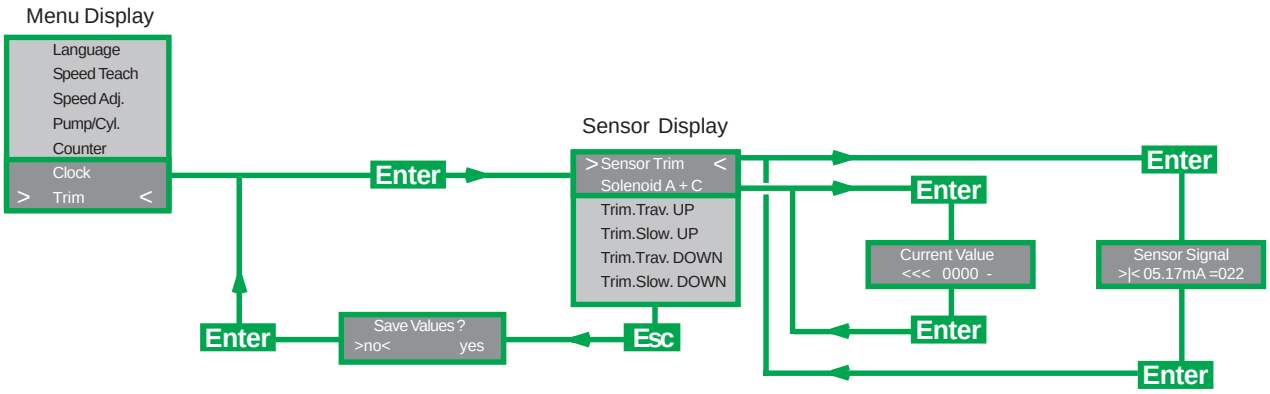
**(2) Selection: Constant or Maximum Up Speed**

**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 consistant 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.

Prov. 38

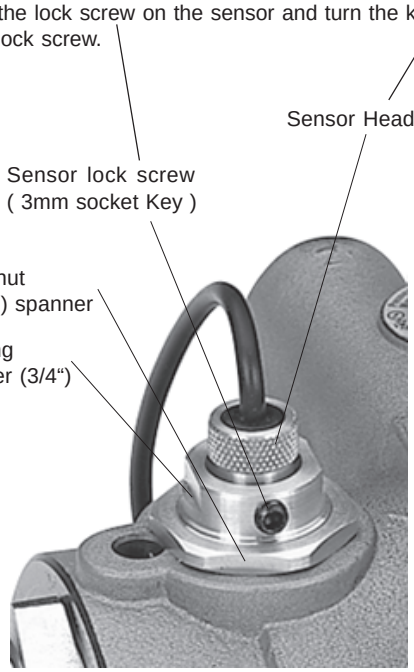
# Sensor and solenoid Trims
## (factory adjusted and tested)




### 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 sensorhead 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

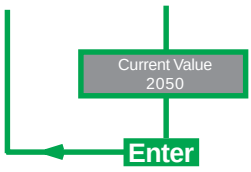
By repeating this process, rotating the bushing clockwise or anti-clockwise as required, it will be possible to set the up and down leveling speeds to be practically the same. Retighten the bushing lock nut.

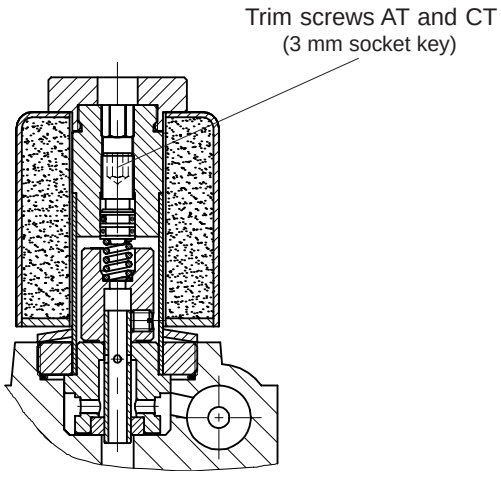
# Solenoids A and C, Trim
## already factory adjusted

### 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.



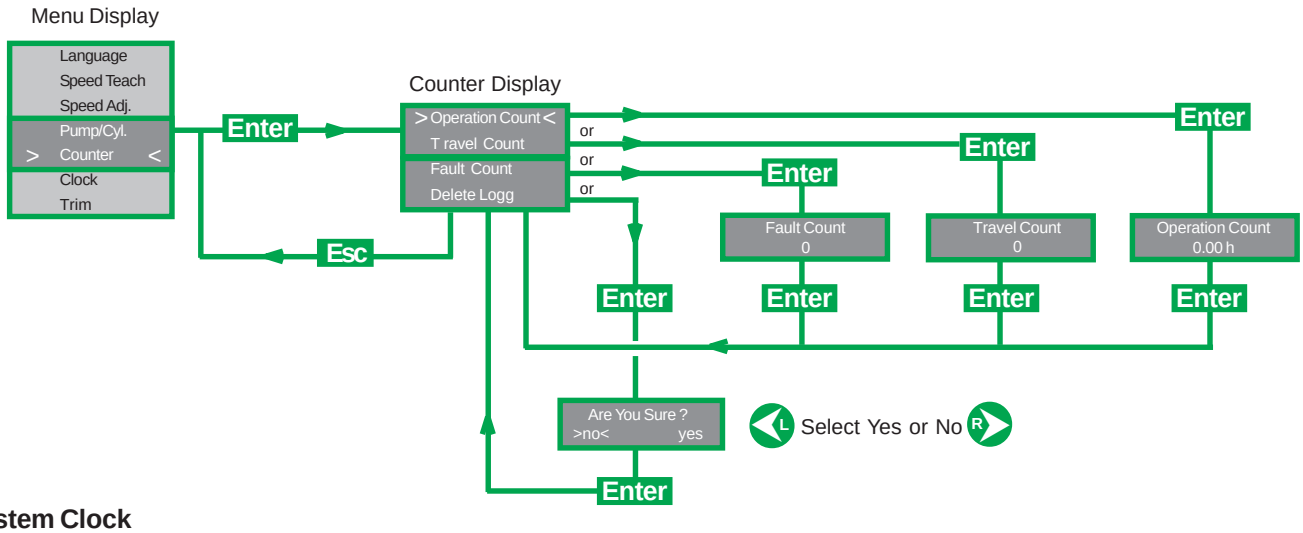



SEV

# Calibration of Counter and Clock

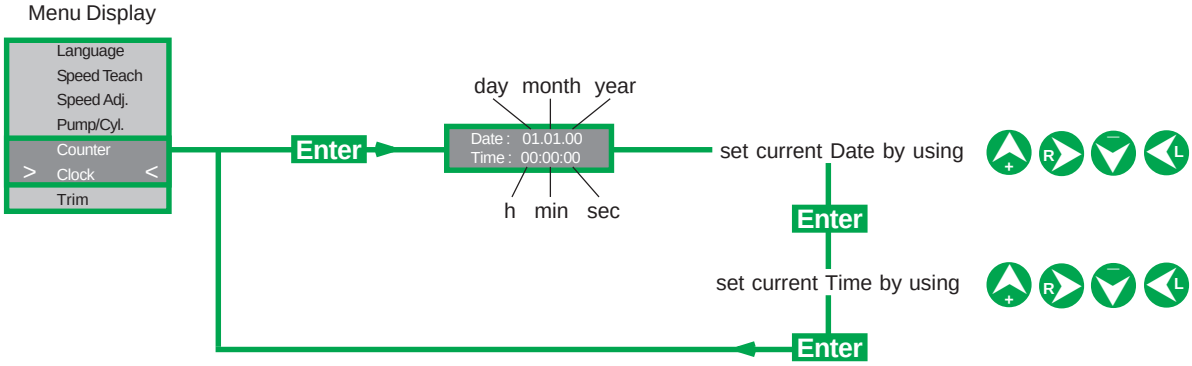
## Counter

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



Prov. 38

SEV

# Errors

## Card Internal Relay R1 - Evacuation of passengers

**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 occurence (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

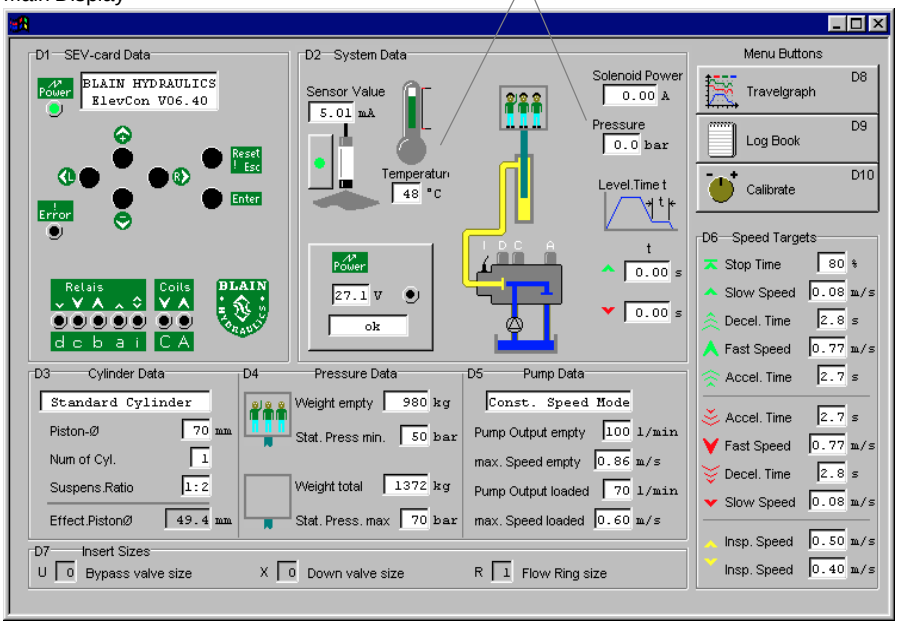
A Laptop PC is not necessary for the operation or adjustment of the SEV system, however it is of distinct advantage in setting up the operation of the elevator and preventative maintenance.
A CD containing the software required for the PC will be delivered with the SEV.

## 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.

Optional: Temperature and Pressure Data

Main Display

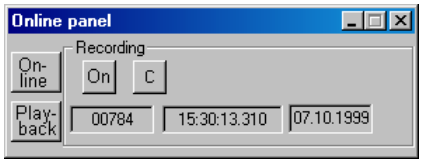



## Travelgraph Display

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

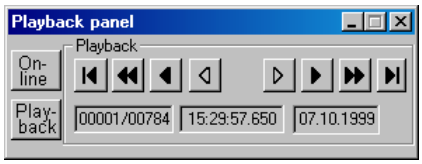

Return to Main Display




To see live displayed Travelgraph.

OR

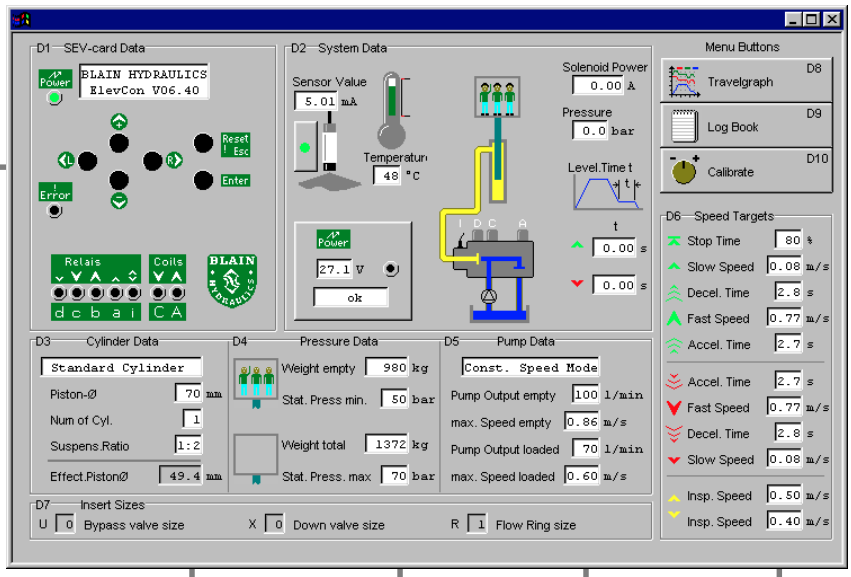
In Playback mode the Playback panel appears instead of Online.




To retrieve of screen graphs.

# Main Display
## D1 and D2 Sub-Displays

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.

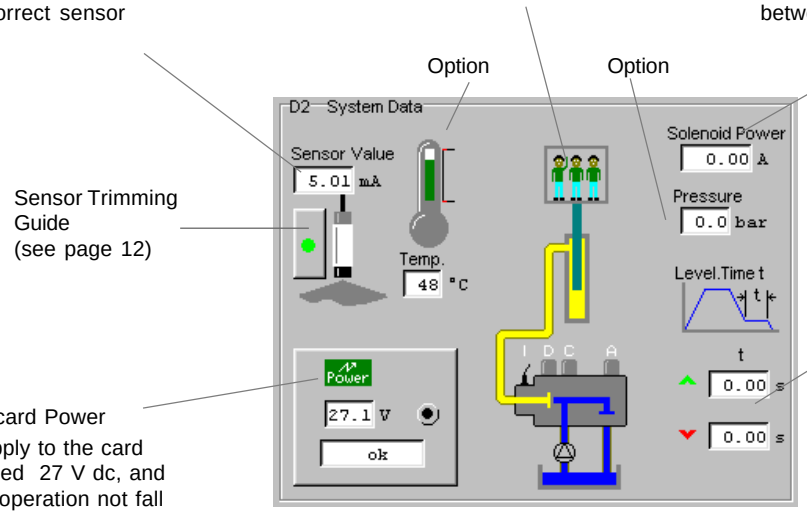
**D1** SEV-Card Data, displays a replica of the SEV card, communicating the direct online status of the SEV CARD.

**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.



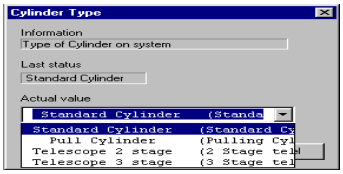

Sensor Trimming Guide
(see page 12)

### 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.

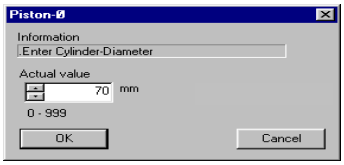
# D3 - D7 Sub-Displays
## Changing Data - Changing Speeds

## D3 Cylinder Data Input



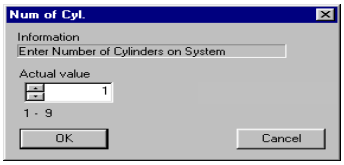

Mouse
1. Select the cylinder type

Mouse
2. Confirm



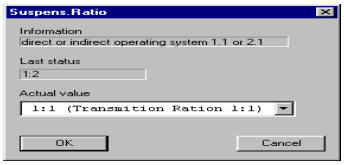

Keyboard
1. Type in piston size (or sizes) in mm

Mouse
2. Confirm




Keyboard
1. Type in the number of cylinders

Mouse
2. Confirm

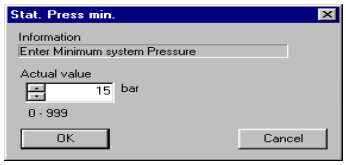



Mouse
1.Select the suspension ratio eg 1:2 or 1:1

Mouse
2. Confirm

## D4 Pressure Data Input

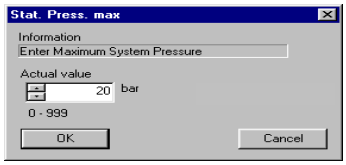
Either weight in kg or pressure in bar can be used as input data.




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

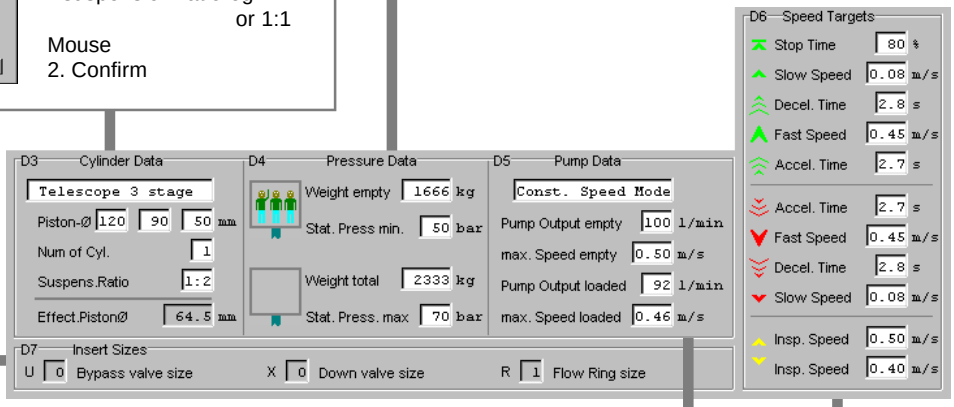
Mouse
2. Confirm

**Full** is car plus payload

## D7 Insert sizes

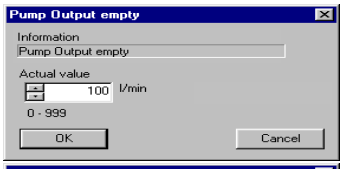
The Bypass Valve,Down Valve and Flow Ring are internal parts of the SEV installed at the factory. Alterations to system values may need changes to these sizes.

Check that correct sizes are installed.



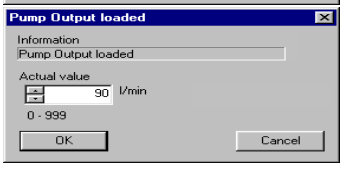

## D5 Pump Data Input Maximum or Constant Speed

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



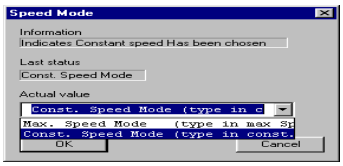

Keyboard
1. Type in lpm empty car

Mouse
2. Confirm




Keyboard
1. Type in lpm fully loaded car

Mouse
2. Confirm




Mouse
1. Select Constant or Maximum Speed mode

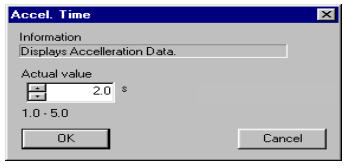
2. Confirm

## 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

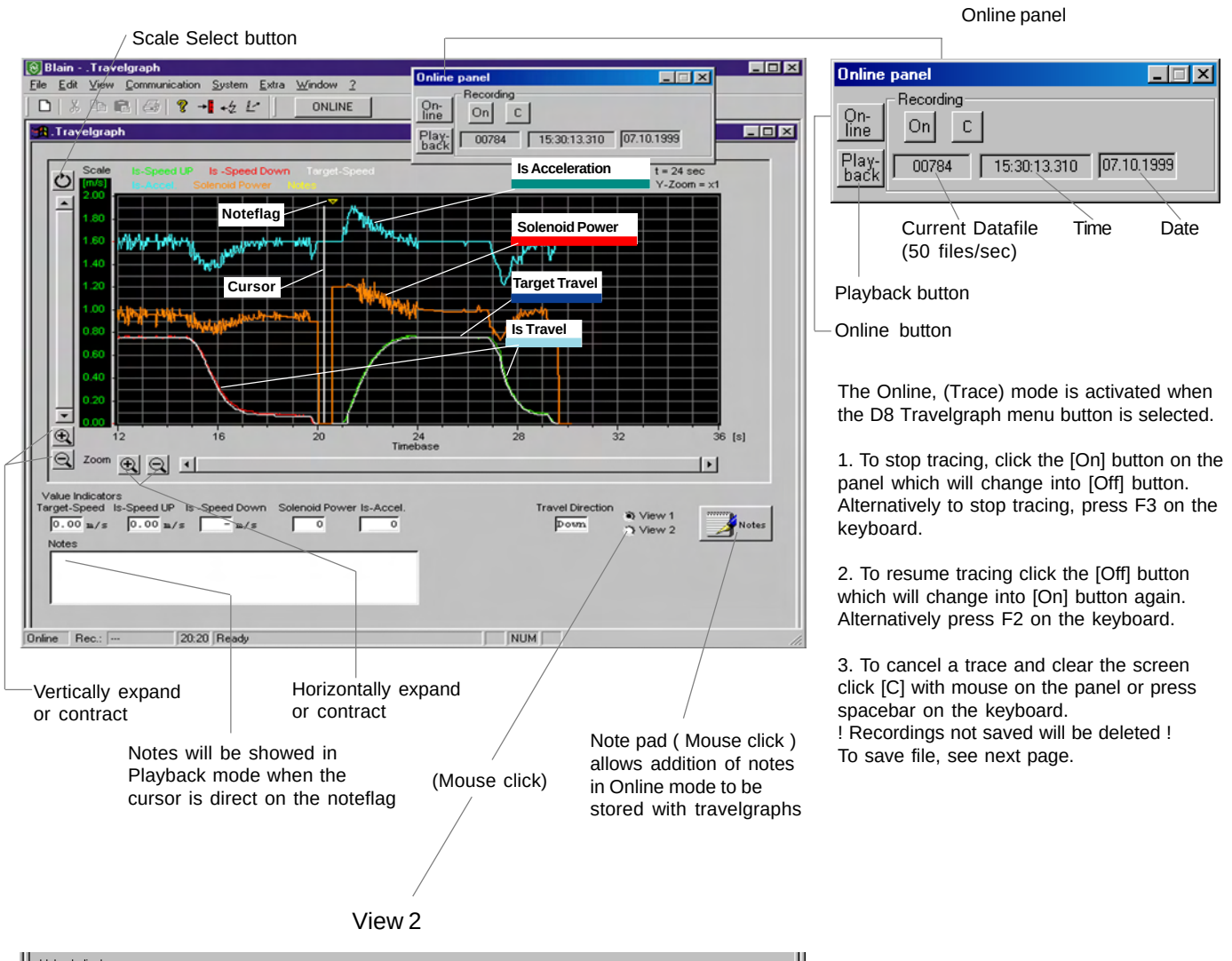
Mouse
2. Confirm

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.

# D8 Travelgraph
## Online

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.



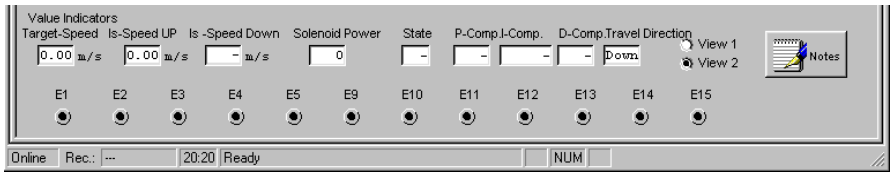

The Online, (Trace) mode is activated when the D8 Travelgraph menu button is selected.

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 spacebar on the keyboard.
! Recordings not saved will be deleted !
To save file, see next page.

View 2




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.

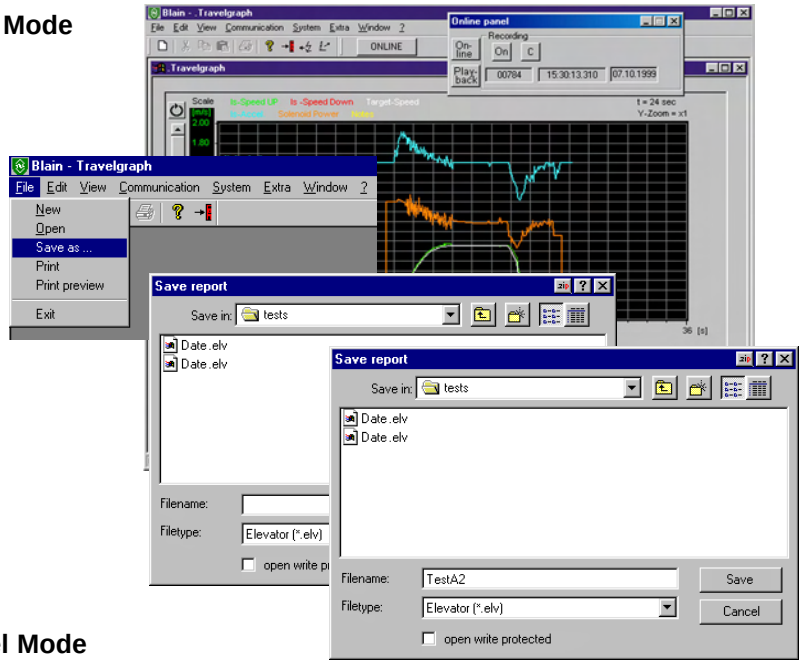
To view the travelgraphs of the last error runs, click on error run button on the Main Display (close Travelgraph display).


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

# D8 Travelgraph

## File Saving and Reviewing

### 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:

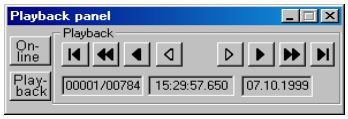
(On - Off button) is clicked.

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

### To Save 'Present' Travelgraphs, Online Panel Mode

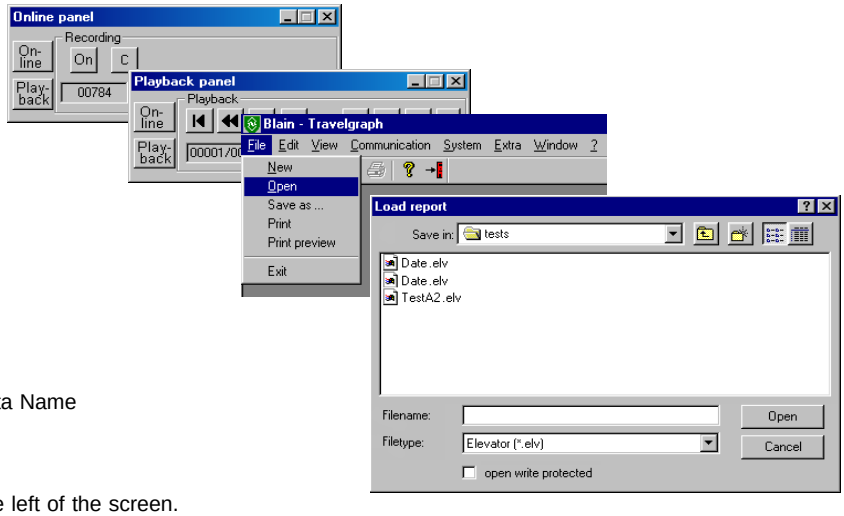
In case a Data Name has not been entered in the Save Report before tests began, tests already run can still be saved by taking the same steps 1 to 4 as above.
It is safer nevertheless to open the Save Report file before tests are run to avoid the possibility of test graphs being deleted by mistake.

### 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

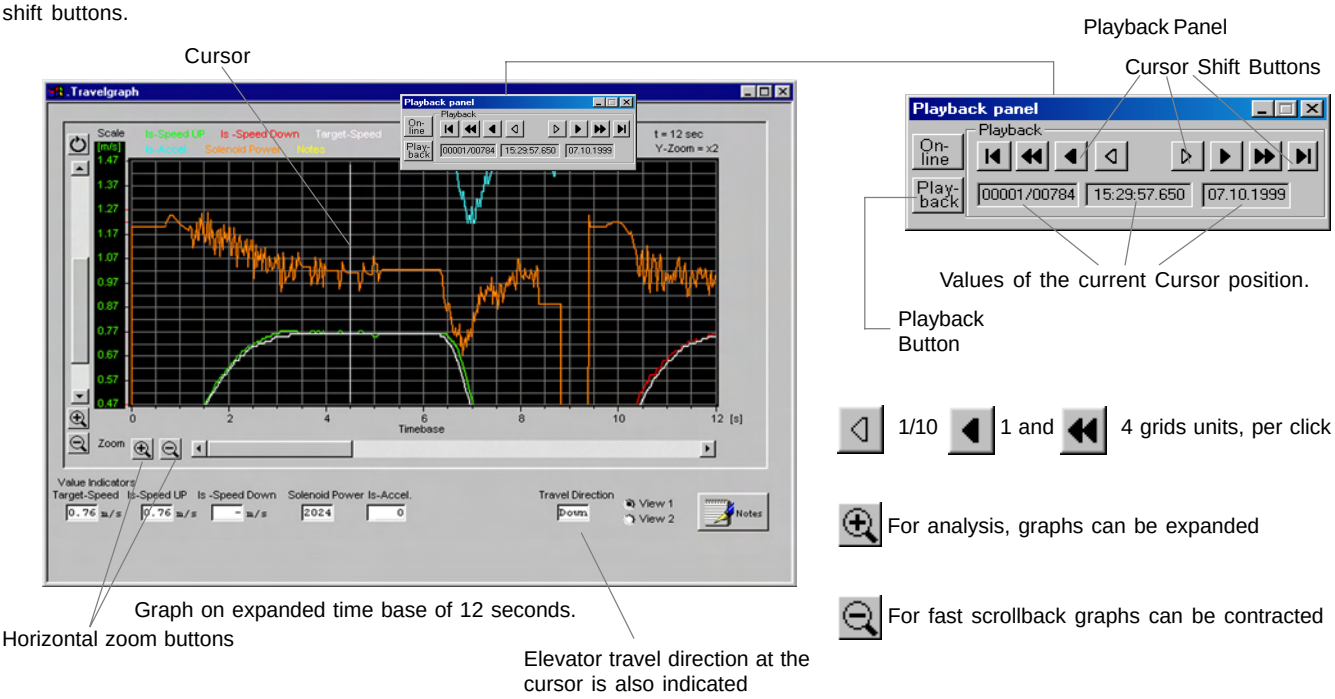
The selected graph will appear confirmed by the Data Name at the bottom of the Travelgraph display.

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.

# D8 Travelgraph
## Scrolling and Zoom

### Playback, Horizontal Scrolling and Zooming

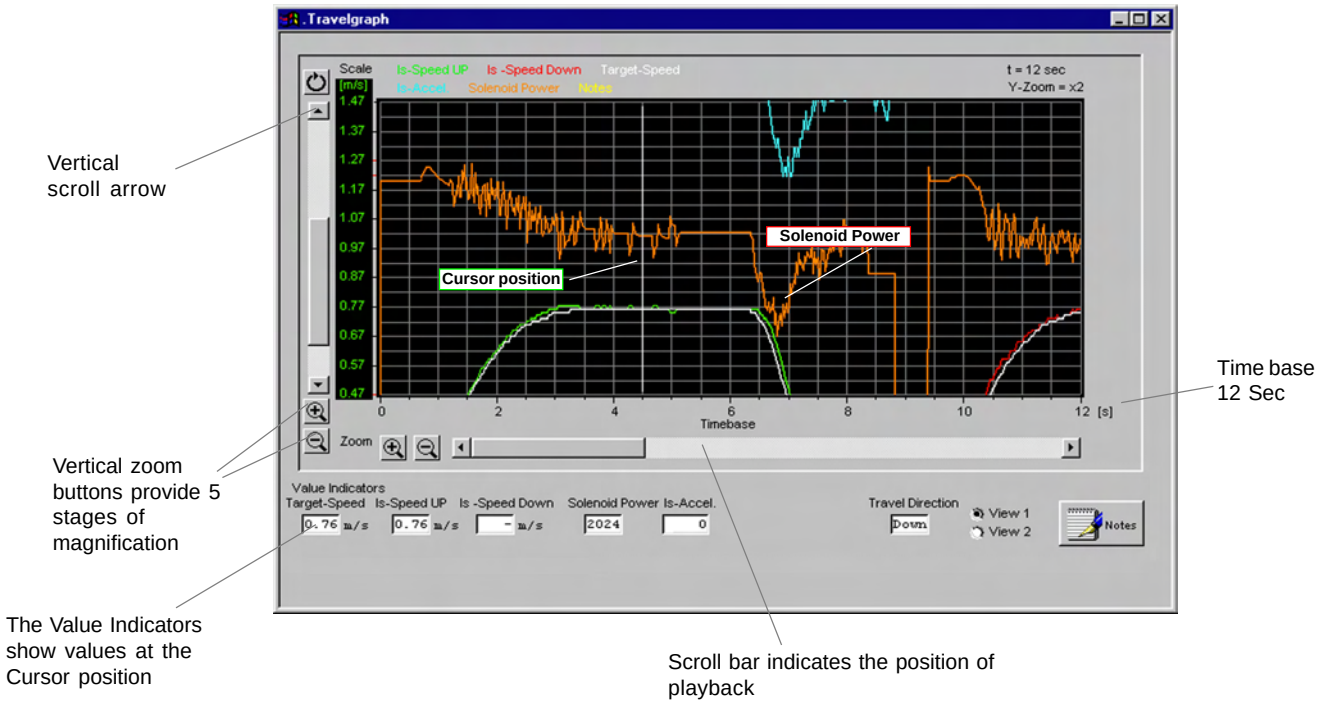
To view an online graph not on the screen, click the playback button.The playback panel will display cursor shift buttons.




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.



# D8 Travelgraph
## Cursor, Focus and Zoom

### Examples

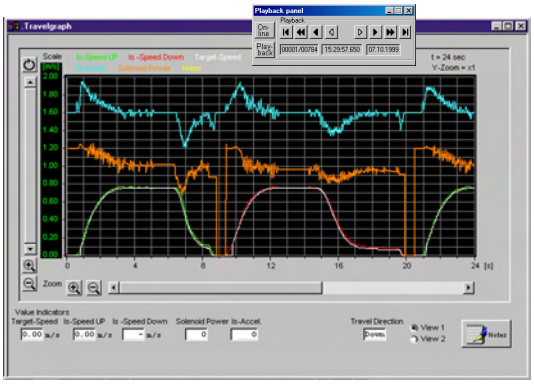
Graph zoom for review 

Normal viewing

Graph zoom for scrolling 

| Time Base Ranges | Seconds 0 - 1 ,2 ,6 ,12 , | Seconds 24 | Seconds 0 - 60, 120, 360 | Minutes 0 - 12 ,24 ,60 | Hours 0 - 12 ,24 ,48 | Days 0 - 6 , 12. |
|---|---|---|---|---|---|---|
| Cursor Shift |  1/10th Grid |  1 Grid |  4 Grids |  Start and End position | | |

### Focusing on values



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

Click Play-back

Click  until the review section appears on the Left of the screen.

Click  until the Cursor is within one grid of the required values.

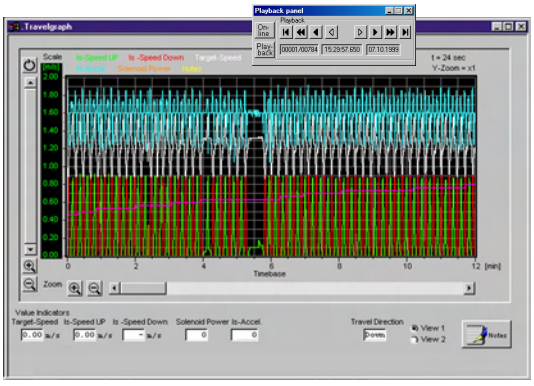
Click  Zoom (expand) to 2 second time base if necessary.

Click  moving the cursor exactly onto the values for review.

Read the required information from the cursor values bottom left.

---

### Faster Scrolling



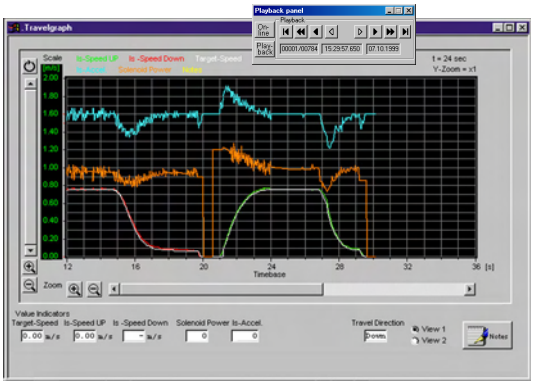
**Example B** Assume the values for review are approximatley 50 operations earlier, (approximately 15 minutes elevator operating time ).

Click Play-back

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.

# D8 Travelgraph

## Solenoids A and C Trimming
## (factory adjusted and tested)

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.

a. Signal the car to up level.

b. 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.

c. 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.

d. 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

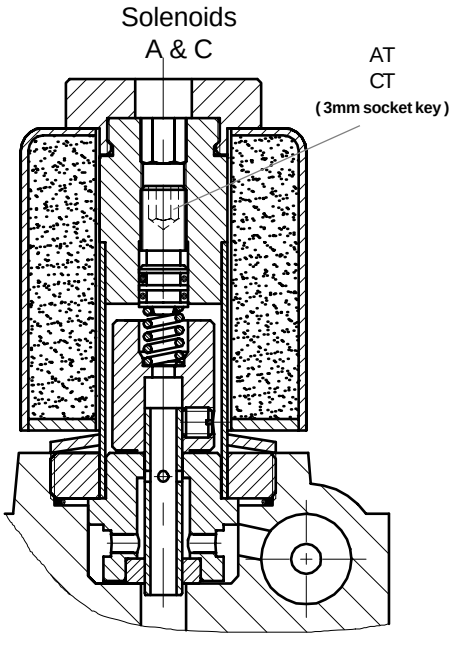
### Solenoid C (Adjustment CT)

e. Signal the car to down level.

f. 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.

g. 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.

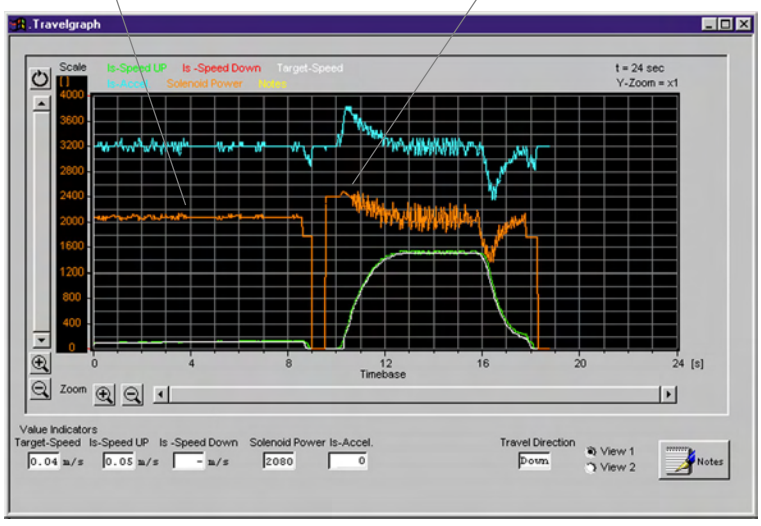
h. As the car starts downwards, the red trace should peak at 1,25-1,35 (2500-2700) as the car appoaches full speed. At full speed, the trace will decrease to about 1,0 (2000). Readjust CT if necessary that the solenoid trace peaks at 1,25-1,35 (2500-2700) as the car accelerates downwards.




**Pre-Adjustment**
Red trace during leveling should be adjusted to 1,15 (2100)

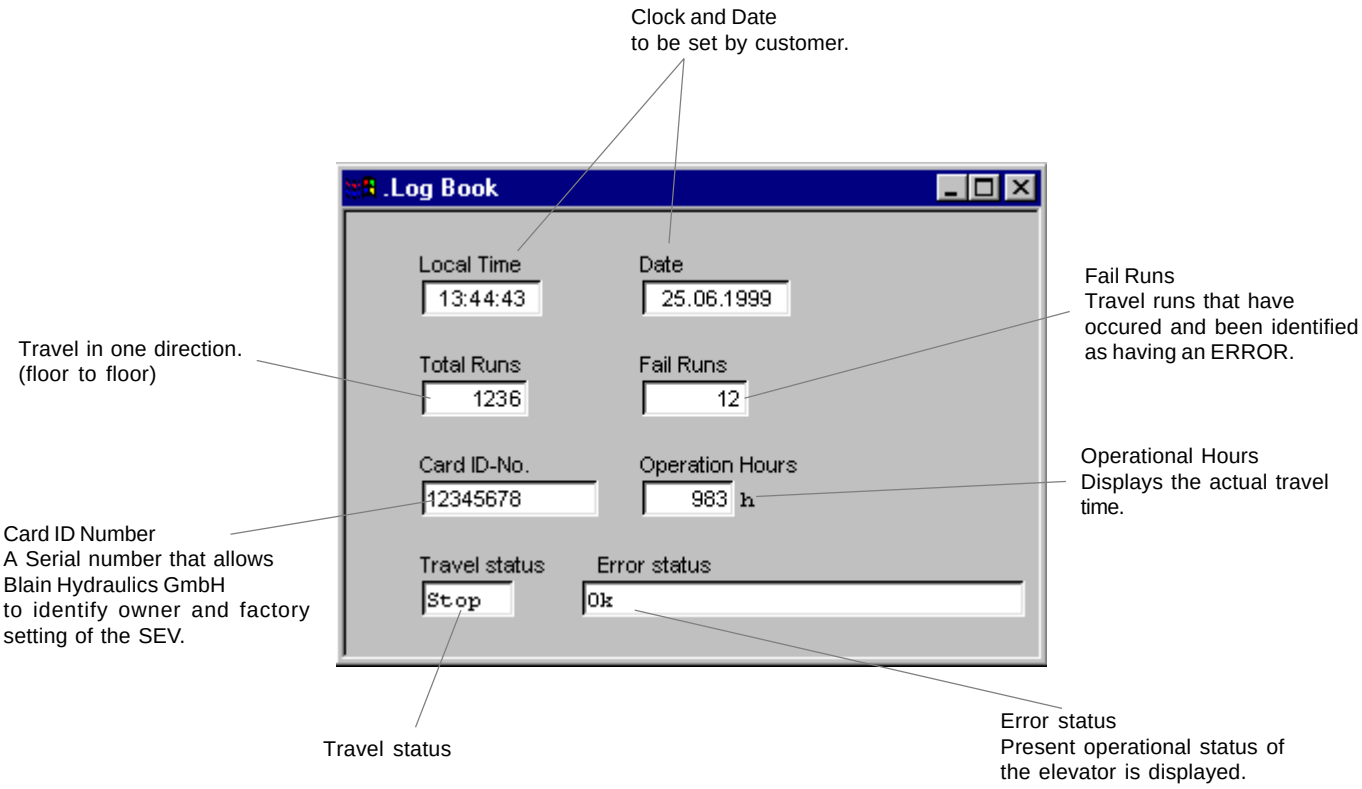
**Final Adjustment**
Red trace peak during acceleration should be between 1,25-1,35 (2500-2700)

Travelgraph D8

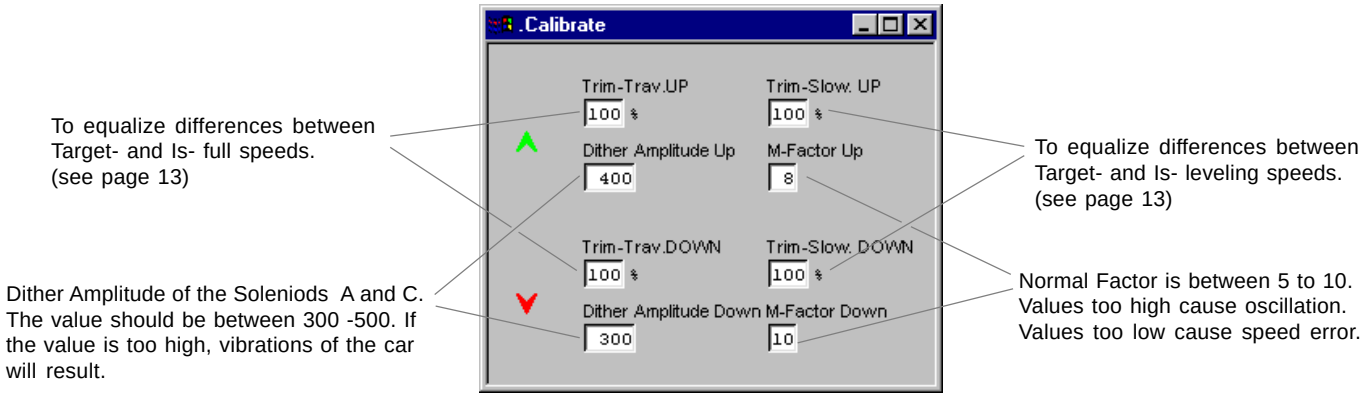


## Logbook

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.




## Calibrate



# Remote Monitoring
# E-Mail

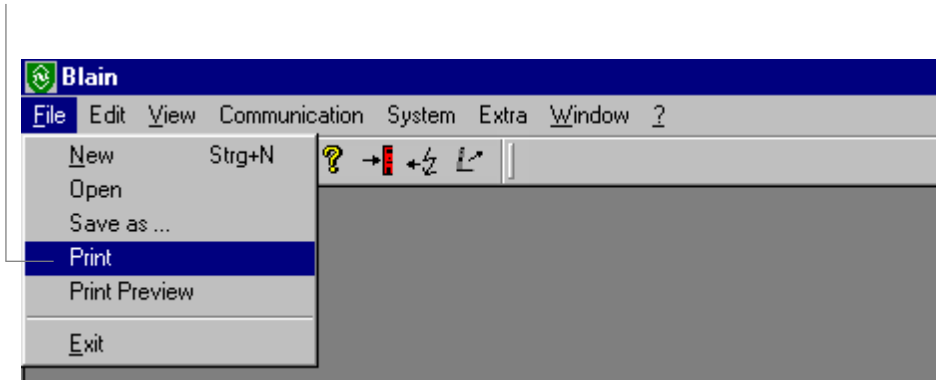
## Remote Monitoring

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

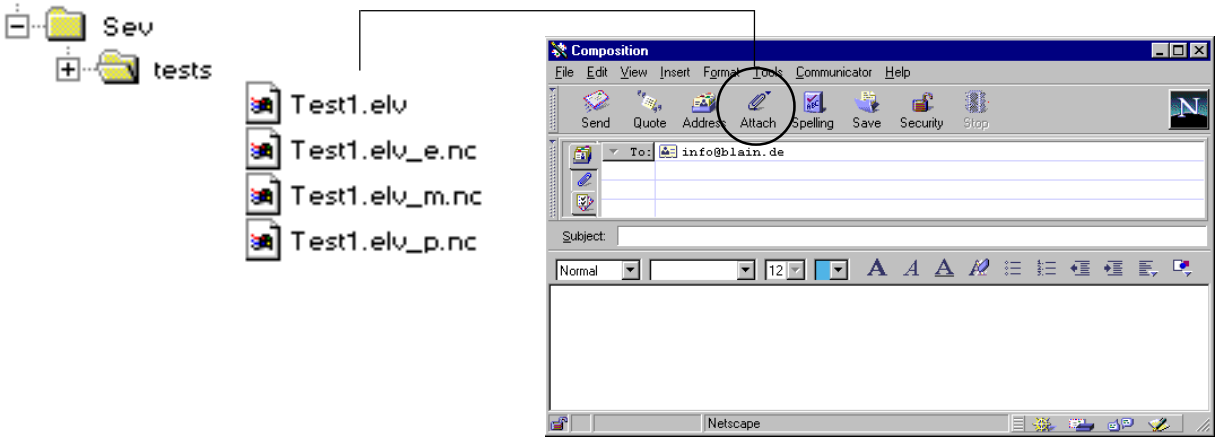
Display the section of graph to be printed using the zoom function if necessary, click ( File ) and select print from the menu. Follow the instructions for your printer. The printout can be faxed to a service station.




## 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 adress is: info@blain.de




Example: This shows the Netscape E-Mail window.

# Remote Monitoring

## Monitoring Connection

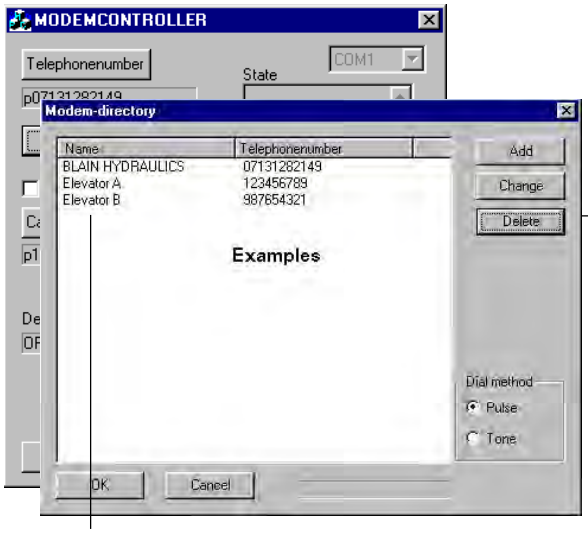
Precondition. The SEV card at the elevator site is modem connected. The PC at the monitoring center, equipped with Windows 95 – SEV program, is modem connected through the correct COM port.!

## Calling from the monitoring center

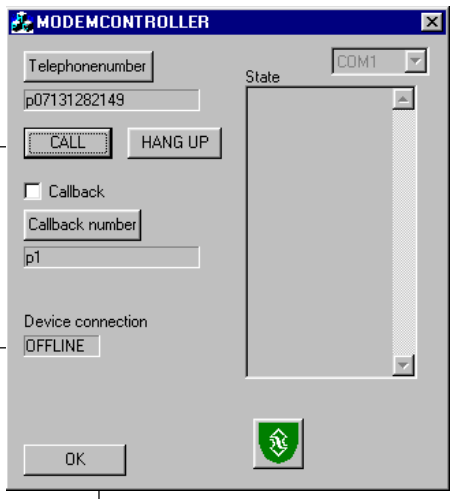
Select SEV [Main Display].
Click [Communication] button.
Click [Modem] button.

[Modemcontroller] window appears

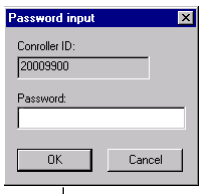
Click [Telephonenumber] button.
The [Modem directory] window appears showing SEV site names and numbers.




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 [Travelgraph] button, top right of the [Main Display].

### Changing or adding elevator site modem numbers

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.

## 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 !

# Selection Charts - Valve Inserts

**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 | ..... |

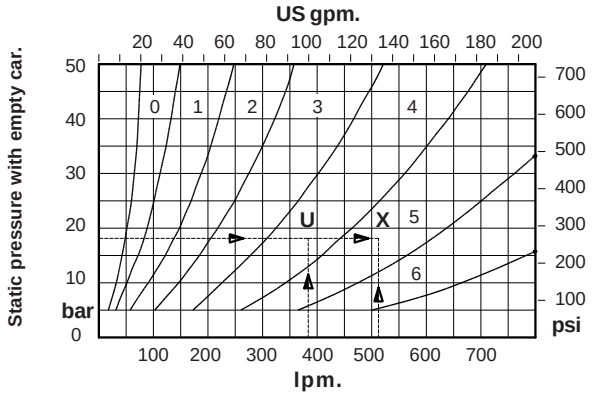
## Flow Ring R Selection

| ① lpm ② | 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



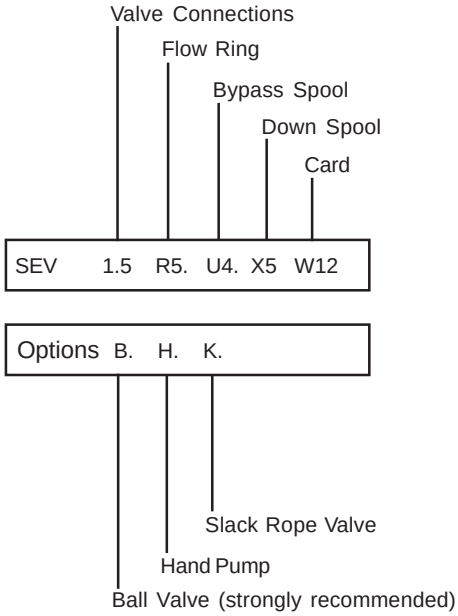

Example:

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

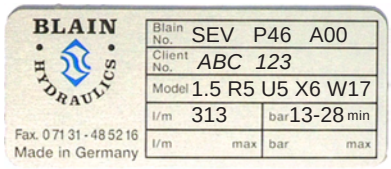
Selected Bypass Spool U, size 4
Selected Down Spool X, size 5

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

## Valve Type - Dataplate



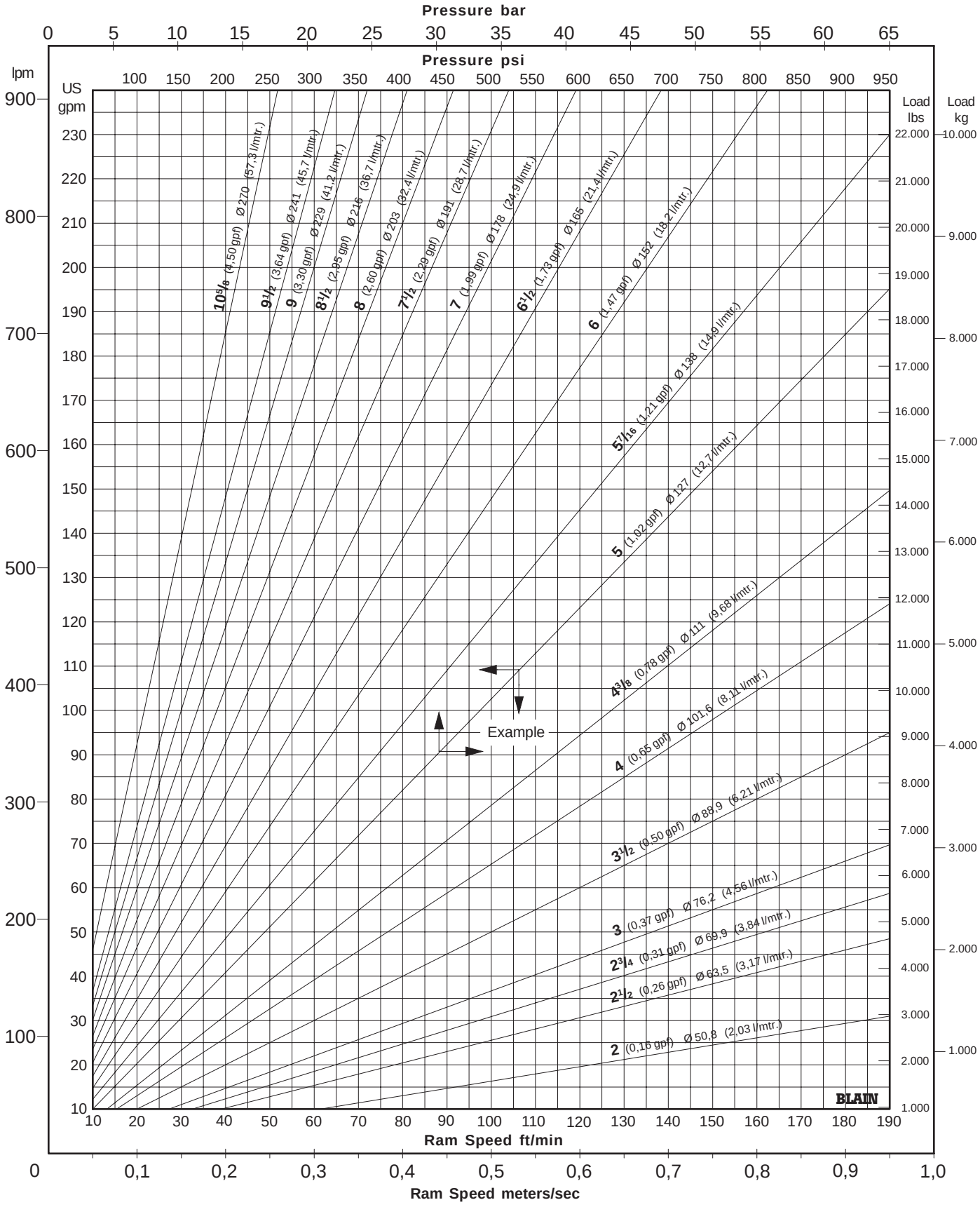

**Example**




## 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.

# Flow - Pressure Chart (US and Metric)



# Flow - Pressure Tables (US)





## Ram Ø • Area • Speed • Flow

| | ft/min | 10 | 20 | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 100 | 110 | 120 | 140 | 160 | 180 | 200 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Ø inch | in² | US gpm | | | | | | | | | | | | | | | |
| 1,4 | 1,5 | 0,8 | 1,6 | 2,4 | 3,2 | 4,0 | 4,8 | 5,6 | 6,4 | 7,2 | 8,0 | 8,8 | 9,6 | 11,2 | 12,8 | 14,4 | 16,0 |
| 1,6 | 2,0 | 1,0 | 2,1 | 3,1 | 4,2 | 5,2 | 6,3 | 7,3 | 8,4 | 9,4 | 10,5 | 11,5 | 12,5 | 14,6 | 16,7 | 18,8 | 20,9 |
| 1,8 | 2,5 | 1,3 | 2,6 | 4,0 | 5,3 | 6,6 | 7,9 | 9,3 | 10,6 | 11,9 | 13,2 | 14,6 | 15,9 | 18,5 | 21,2 | 23,8 | 26,5 |
| **2,0** | 3,1 | 1,6 | 3,3 | 4,9 | 6,5 | 8,2 | 9,8 | 11,4 | 13,1 | 14,7 | 16,3 | 18,0 | 19,6 | 22,9 | 26,1 | 29,4 | 32,7 |
| 2,2 | 3,8 | 2,0 | 4,0 | 5,9 | 7,9 | 9,9 | 11,9 | 13,8 | 15,8 | 17,8 | 19,8 | 21,7 | 23,7 | 27,7 | 31,6 | 35,6 | 39,5 |
| **2 1/2** | 4,9 | 2,6 | 5,1 | 7,7 | 10,2 | 12,8 | 15,3 | 17,9 | 20,4 | 23,0 | 25,5 | 28,1 | 30,6 | 35,7 | 40,8 | 45,9 | 51,0 |
| 2,6 | 5,3 | 2,8 | 5,5 | 8,3 | 11,0 | 13,8 | 16,6 | 19,3 | 22,1 | 24,8 | 27,6 | 30,4 | 33,1 | 38,6 | 44,2 | 49,7 | 55,2 |
| **2 3/4** | 5,9 | 3,1 | 6,2 | 9,3 | 12,4 | 15,4 | 18,5 | 21,6 | 24,7 | 27,8 | 30,9 | 34,0 | 37,1 | 43,2 | 49,4 | 55,6 | 61,8 |
| **3,0** | 7,1 | 3,7 | 7,3 | 11,0 | 14,7 | 18,4 | 22,0 | 25,7 | 29,4 | 33,1 | 36,7 | 40,4 | 44,1 | 51,4 | 58,8 | 66,1 | 73,5 |
| 3,2 | 8,0 | 4,2 | 8,4 | 12,5 | 16,7 | 20,9 | 25,1 | 29,3 | 33,4 | 37,6 | 41,8 | 46,0 | 50,2 | 58,5 | 66,9 | 75,3 | 83,6 |
| **3 1/2** | 9,6 | 5,0 | 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 | 90,0 | 100,0 |
| 3,6 | 10,2 | 5,3 | 10,6 | 15,9 | 21,2 | 26,5 | 31,7 | 37,0 | 42,3 | 47,6 | 52,9 | 58,2 | 63,5 | 74,1 | 84,7 | 95,2 | 105,8 |
| 3,8 | 11,3 | 5,9 | 11,8 | 17,7 | 23,6 | 29,5 | 35,4 | 41,3 | 47,2 | 53,1 | 59,0 | 64,9 | 70,7 | 82,5 | 94,3 | 106,1 | 117,9 |
| **4,0** | 12,6 | 6,5 | 13,1 | 19,6 | 26,1 | 32,7 | 39,2 | 45,7 | 52,3 | 58,8 | 65,3 | 71,9 | 78,4 | 91,5 | 104,5 | 117,6 | 130,7 |
| 4,2 | 13,9 | 7,2 | 14,4 | 21,6 | 28,8 | 36,0 | 43,2 | 50,4 | 57,6 | 64,8 | 72,0 | 79,2 | 86,4 | 100,8 | 115,2 | 129,6 | 144,0 |
| **4 3/8** | 15,0 | 7,8 | 15,6 | 23,4 | 31,3 | 39,1 | 46,9 | 54,7 | 62,5 | 70,3 | 78,1 | 86,0 | 93,8 | 109,4 | 125,0 | 140,7 | 156,3 |
| **4 1/2** | 15,9 | 8,3 | 16,5 | 24,8 | 33,1 | 41,3 | 49,6 | 57,9 | 66,1 | 74,4 | 82,7 | 90,9 | 99,2 | 115,8 | 132,3 | 148,8 | 165,4 |
| 4,8 | 18,1 | 9,4 | 18,8 | 28,2 | 37,6 | 47,0 | 56,4 | 65,8 | 75,3 | 84,7 | 94,1 | 103,5 | 112,9 | 131,7 | 150,5 | 169,3 | 188,1 |
| **5,0** | 19,6 | 10,2 | 20,4 | 30,6 | 40,8 | 51,0 | 61,2 | 71,5 | 81,7 | 91,9 | 102,1 | 112,3 | 122,5 | 142,9 | 163,3 | 183,7 | 204,1 |
| **5 7/16** | 23,2 | 12,1 | 24,1 | 36,2 | 48,3 | 60,4 | 72,4 | 84,5 | 96,6 | 108,6 | 120,7 | 132,8 | 144,9 | 169,0 | 193,1 | 217,3 | 241,4 |
| **5 1/2** | 23,8 | 12,4 | 24,7 | 37,1 | 49,4 | 61,8 | 74,1 | 86,5 | 98,8 | 111,2 | 123,5 | 135,9 | 148,2 | 172,9 | 197,6 | 222,3 | 247,0 |
| **6,0** | 28,3 | 14,7 | 29,4 | 44,1 | 58,8 | 73,5 | 88,2 | 102,9 | 117,6 | 132,3 | 147,0 | 161,7 | 176,4 | 205,8 | 235,2 | 264,6 | 294,0 |
| **6 1/2** | 33,2 | 17,3 | 34,5 | 51,8 | 69,0 | 86,3 | 103,5 | 120,8 | 138,0 | 155,3 | 172,5 | 189,8 | 207,0 | 241,5 | 276,0 | 310,5 | 345,0 |
| 6,8 | 36,3 | 18,9 | 37,8 | 56,6 | 75,5 | 94,4 | 113,3 | 132,2 | 151,0 | 169,9 | 188,8 | 207,7 | 226,6 | 264,3 | 302,1 | 339,8 | 377,6 |
| **7,0** | 38,5 | 20,0 | 40,0 | 60,0 | 80,0 | 100,0 | 120,0 | 140,0 | 160,1 | 180,1 | 200,1 | 220,1 | 240,1 | 280,1 | 320,1 | 360,1 | 400,1 |
| **7 1/2** | 44,2 | 23,0 | 45,9 | 68,9 | 91,9 | 114,8 | 137,8 | 160,8 | 183,7 | 206,7 | 229,7 | 252,6 | 275,6 | 331,5 | 367,5 | 413,4 | 459,3 |
| **8,0** | 50,3 | 26,1 | 52,3 | 78,4 | 104,5 | 130,7 | 156,8 | 182,9 | 209,0 | 235,2 | 261,3 | 287,4 | 313,6 | 365,8 | 418,1 | 470,4 | 522,6 |
| **8 1/2** | 56,7 | 29,5 | 59,0 | 88,5 | 118,0 | 147,5 | 177,0 | 206,5 | 236,0 | 265,5 | 295,0 | 324,5 | 354,0 | 413,0 | 472,0 | 531,0 | 590,0 |
| 8,8 | 60,8 | 31,6 | 63,2 | 94,9 | 126,5 | 158,1 | 189,7 | 221,3 | 252,9 | 284,6 | 316,2 | 347,8 | 379,4 | 442,7 | 505,9 | 569,1 | 632,4 |
| **9 1/2** | 70,9 | 36,8 | 73,7 | 110,5 | 147,4 | 184,2 | 221,1 | 257,9 | 294,8 | 331,6 | 368,5 | 405,3 | 442,2 | 515,9 | 589,6 | 663,3 | 737,0 |
| **10 5/8** | 88,7 | 46,1 | 92,2 | 138,3 | 184,4 | 230,5 | 276,6 | 322,6 | 368,7 | 414,8 | 460,9 | 507,0 | 553,1 | 645,3 | 737,5 | 829,7 | 921,9 |
| 11,2 | 98,5 | 51,2 | 102,4 | 153,6 | 204,9 | 256,1 | 307,3 | 358,5 | 409,7 | 460,9 | 512,2 | 563,4 | 614,6 | 717,0 | 819,5 | 921,9 | 1024,3 |
| 12,0 | 113,1 | 58,8 | 117,6 | 176,4 | 235,2 | 294,0 | 352,8 | 411,6 | 470,4 | 529,1 | 587,9 | 646,7 | 705,5 | 823,1 | 940,7 | 1058,3 | 1175,9 |

## Ram Ø • Area • Load • Pressure

| | lbs | 1100 | 1650 | 2200 | 3300 | 4400 | 5500 | 6600 | 7700 | 8800 | 10000 | 11000 | 13200 | 15400 | 17600 | 19800 | 22000 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Ø inch | in² | psi | | | | | | | | | | | | | | | |
| 1,4 | 1,5 | 714,6 | 1071,9 | 1429,1 | 2143,7 | 2858,3 | 3572,9 | 4287,4 | 5002,0 | 5716,6 | 6496,1 | 7145,7 | 8574,9 | 10004,0 | 11433,2 | 12862,3 | 14291,5 |
| 1,6 | 2,0 | 547,1 | 820,6 | 1094,2 | 1641,3 | 2188,4 | 2735,5 | 3282,6 | 3829,7 | 4376,8 | 4973,6 | 5471,0 | 6565,1 | 7659,3 | 8753,5 | 9847,7 | 10941,9 |
| 1,8 | 2,5 | 432,3 | 648,4 | 864,5 | 1296,8 | 1729,1 | 2161,4 | 2593,6 | 3025,9 | 3458,2 | 3929,8 | 4322,7 | 5187,3 | 6051,8 | 6916,4 | 7780,9 | 8645,5 |
| **2,0** | 3,1 | 350,1 | 525,2 | 700,3 | 1050,4 | 1400,6 | 1750,7 | 2100,8 | 2451,0 | 2801,1 | 3183,1 | 3501,4 | 4201,7 | 4902,0 | 5602,3 | 6302,5 | 7002,8 |
| 2,2 | 3,8 | 289,4 | 434,1 | 578,7 | 868,1 | 1157,5 | 1446,9 | 1736,2 | 2025,6 | 2315,0 | 2630,7 | 2893,7 | 3472,5 | 4051,2 | 4630,0 | 5208,7 | 5787,5 |
| **2 1/2** | 4,9 | 224,1 | 336,1 | 448,2 | 672,3 | 896,4 | 1020,5 | 1344,5 | 1568,6 | 1792,7 | 2037,2 | 2240,9 | 2689,1 | 3137,3 | 3585,4 | 4033,6 | 4481,8 |
| 2,6 | 5,3 | 207,2 | 310,8 | 414,4 | 621,6 | 828,7 | 1035,9 | 1243,1 | 1450,3 | 1657,5 | 1883,5 | 2071,8 | 2486,2 | 2900,6 | 3314,9 | 3729,3 | 4143,7 |
| **2 3/4** | 5,9 | 185,2 | 277,8 | 370,4 | 555,6 | 740,8 | 926,0 | 1111,2 | 1296,4 | 1481,6 | 1683,6 | 1852,0 | 2222,4 | 2592,8 | 2963,2 | 3333,6 | 3704,0 |
| **3,0** | 7,1 | 155,6 | 233,4 | 311,2 | 466,9 | 622,5 | 778,1 | 933,7 | 1089,3 | 1244,9 | 1414,7 | 1556,2 | 1867,4 | 2178,7 | 2489,9 | 2801,1 | 3112,4 |
| 3,2 | 8,0 | 136,8 | 205,2 | 273,5 | 410,3 | 547,1 | 683,9 | 820,6 | 957,4 | 1094,2 | 1243,4 | 1367,7 | 1641,3 | 1914,8 | 2188,4 | 2461,9 | 2735,5 |
| **3 1/2** | 9,6 | 114,3 | 171,5 | 228,7 | 343,0 | 457,3 | 571,7 | 686,0 | 800,3 | 914,7 | 1039,4 | 1143,3 | 1372,0 | 1600,6 | 1829,3 | 2058,0 | 2286,6 |
| 3,6 | 10,2 | 108,1 | 162,1 | 216,1 | 324,2 | 432,3 | 540,3 | 648,4 | 756,5 | 864,5 | 982,4 | 1080,7 | 1296,8 | 1513,0 | 1729,1 | 1945,2 | 2161,4 |
| 3,8 | 11,3 | 97,0 | 145,5 | 194,0 | 291,0 | 388,0 | 485,0 | 582,0 | 678,9 | 775,9 | 881,7 | 969,9 | 1163,9 | 1357,9 | 1551,9 | 1745,9 | 1939,8 |
| **4,0** | 12,6 | 87,5 | 131,3 | 175,1 | 262,6 | 350,1 | 437,7 | 525,2 | 612,7 | 700,3 | 795,8 | 875,4 | 1050,4 | 1225,5 | 1400,6 | 1575,6 | 1750,7 |
| 4,2 | 13,9 | 79,4 | 119,1 | 158,8 | 238,2 | 317,6 | 397,0 | 476,4 | 555,8 | 635,2 | 721,8 | 794,0 | 952,8 | 1111,6 | 1270,4 | 1429,1 | 1587,9 |
| **4 3/8** | 15,0 | 73,2 | 109,8 | 146,3 | 219,5 | 292,7 | 365,9 | 439,0 | 512,2 | 585,4 | 665,2 | 731,7 | 878,1 | 1024,4 | 1170,8 | 1317,1 | 1463,4 |
| **4 1/2** | 15,9 | 69,2 | 103,7 | 138,3 | 207,5 | 276,7 | 345,8 | 415,0 | 484,1 | 553,3 | 628,8 | 691,6 | 830,0 | 968,3 | 1106,6 | 1244,9 | 1383,3 |
| 4,8 | 18,1 | 60,8 | 91,2 | 121,6 | 182,4 | 243,2 | 303,9 | 364,7 | 425,5 | 486,3 | 552,6 | 607,9 | 729,5 | 851,0 | 972,6 | 1094,2 | 1215,8 |
| **5,0** | 19,6 | 56,0 | 84,0 | 112,0 | 168,1 | 224,1 | 280,1 | 336,1 | 392,2 | 448,2 | 509,3 | 560,2 | 672,3 | 784,3 | 896,4 | 1008,4 | 1120,5 |
| **5 7/16** | 23,2 | 47,4 | 71,1 | 94,7 | 142,1 | 189,5 | 236,9 | 284,2 | 331,6 | 379,0 | 430,6 | 473,7 | 568,4 | 663,2 | 757,9 | 852,7 | 947,4 |
| **5 1/2** | 23,8 | 46,3 | 69,4 | 92,6 | 138,9 | 185,2 | 231,5 | 277,8 | 324,1 | 370,4 | 420,9 | 463,0 | 555,6 | 648,2 | 740,8 | 833,4 | 926,0 |
| **6,0** | 28,3 | 38,9 | 58,4 | 77,8 | 116,7 | 155,6 | 194,5 | 233,4 | 272,3 | 311,2 | 353,7 | 389,0 | 466,9 | 544,7 | 622,5 | 700,3 | 778,1 |
| **6 1/2** | 33,2 | 33,1 | 49,7 | 66,3 | 99,4 | 132,6 | 165,7 | 198,9 | 232,0 | 265,2 | 301,4 | 331,5 | 397,8 | 464,1 | 530,4 | 596,7 | 663,0 |
| 6,8 | 36,3 | 30,3 | 45,4 | 60,6 | 90,9 | 121,2 | 151,4 | 181,7 | 212,0 | 242,3 | 275,4 | 302,9 | 363,5 | 424,0 | 484,6 | 545,2 | 605,8 |
| **7,0** | 38,5 | 28,6 | 42,9 | 57,2 | 85,7 | 114,3 | 142,9 | 171,5 | 200,1 | 228,7 | 259,8 | 285,8 | 343,0 | 400,2 | 457,3 | 514,5 | 571,7 |
| **7 1/2** | 44,2 | 24,9 | 37,3 | 49,8 | 74,7 | 99,6 | 124,5 | 149,4 | 174,3 | 199,2 | 226,4 | 249,0 | 298,8 | 348,6 | 398,4 | 448,2 | 498,0 |
| **8,0** | 50,3 | 21,9 | 32,8 | 43,8 | 65,7 | 87,5 | 109,4 | 131,3 | 153,2 | 175,1 | 198,9 | 218,8 | 262,6 | 306,4 | 350,1 | 393,9 | 437,7 |
| **8 1/2** | 56,7 | 19,4 | 29,1 | 38,8 | 58,2 | 77,5 | 96,9 | 116,3 | 135,7 | 155,1 | 176,2 | 193,8 | 232,6 | 271,4 | 310,2 | 348,9 | 387,7 |
| 8,8 | 60,8 | 18,1 | 27,1 | 36,2 | 54,3 | 72,3 | 90,4 | 108,5 | 126,6 | 144,7 | 164,4 | 180,9 | 217,0 | 253,2 | 289,4 | 325,5 | 361,7 |
| **9 1/2** | 70,9 | 15,5 | 23,3 | 31,0 | 46,6 | 62,1 | 77,6 | 93,1 | 108,6 | 124,1 | 141,1 | 155,2 | 186,2 | 217,3 | 248,3 | 279,3 | 310,4 |
| **10 5/8** | 88,7 | 12,4 | 18,6 | 24,8 | 37,2 | 49,6 | 62,0 | 74,4 | 86,8 | 99,3 | 112,8 | 124,1 | 148,9 | 173,7 | 198,5 | 223,3 | 248,1 |
| 11,2 | 98,5 | 11,2 | 16,7 | 22,3 | 33,5 | 44,7 | 55,8 | 67,0 | 78,2 | 89,3 | 101,5 | 111,7 | 134,0 | 156,3 | 178,6 | 201,0 | 223,3 |
| 12,0 | 113,1 | 9,7 | 14,6 | 19,5 | 29,2 | 38,9 | 48,6 | 58,4 | 68,1 | 77,8 | 88,4 | 97,3 | 116,7 | 136,2 | 155,6 | 175,1 | 194,5 |

SEV

# Flow - Pressure Tables (Metric)

Prov. 38

ISO 9001

## 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 | cm² | 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 | cm² | 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 |

$\frac{cm^2}{6,45}$ = in² m/sec x 197 = ft/min. l/min. x 0,22 = Imp. gals $\frac{mm}{25,4}$ = inches l/min x 0,26 = US. gals kg x 2,2 = lbs bar x 14,7 = psi