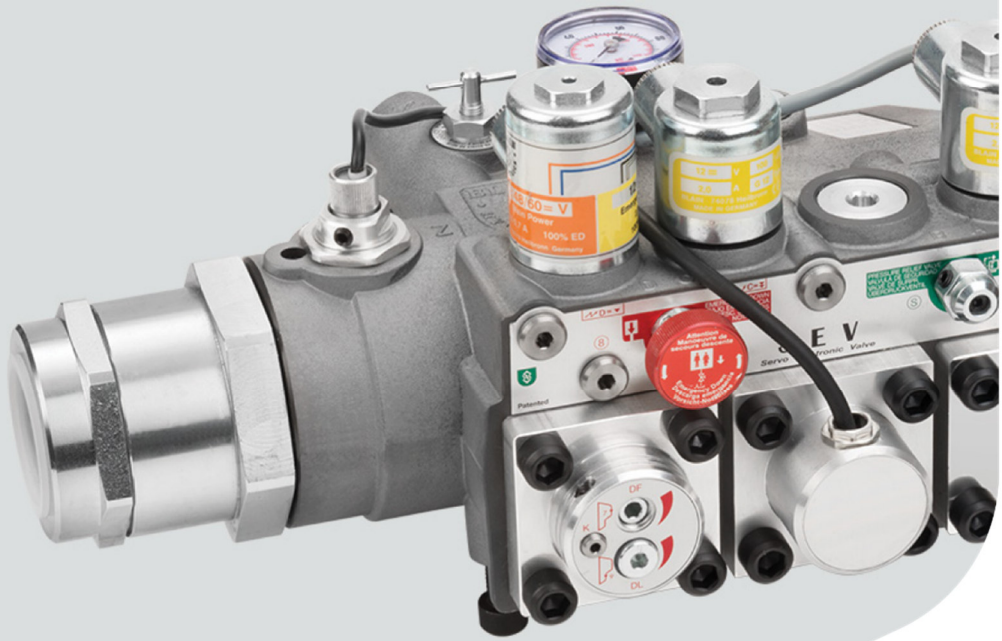
BLAIN VALVES FOR HYDRAULIC ELEVATORS

Excellence in Simplicity and Performance



SEV
Servo
Electronic
Valve

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Smart Servo Electronic Valve manual

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1. GENERAL INFORMATION

1.1 SAFETY PRECAUTIONS & GENERAL WARNINGS

Installation, operation and servicing of the **SEV** should only be performed by qualified personnel. Before installing the SEV package, the "**Quick Start Guide**" should be read, understood, and all safety precautions mentioned in these documents and warnings must be followed. The **SEV** must be installed according to the descriptions in this technical manual and in accordance with the local elevator safety codes and directives.

Figure 1: **Smart Servo Electronic Valve**

1.2 PRODUCT INTRODUCTION

The SEV package consists of:

1) SEV valve
2) Electronic card
3) User manual

The valve: The smart servo electronic valve has been integrated with a pressure and temperature sensor alongside a flow meter. The intelligent design has been further improvised by removing some adjustments to simplify and quicken the set-up process. Integration of pressure and temperature sensors enable excellent ride quality by providing real time compensation to pressure and temperature changes.

The smart electronic card: The onboard web server and Wi-Fi on the electronic card allows users with any Smart phone, Tablet, Laptop or PC having Wi-Fi connection possibilities to connect with the card and set-up the system, make changes or even see the travel graphs of the elevator. The platform is system independent and can be accessed using any standard web browser independent of the operating system of the device used for interacting with the card. The Wi-Fi connectivity makes it very easy to use any smart device for set-up, fine tuning and real time monitoring from a distance without the hassle of using different cables and compatible devices in a machine room. Since the complete system is platform independent, there is no need to download and install any app or software. The embedded software on electronic card stores all the settings, information and travel logs. The set-by-step set up guide and multilingual interface software in SI and Imperial units make inputting and monitoring information very easy.

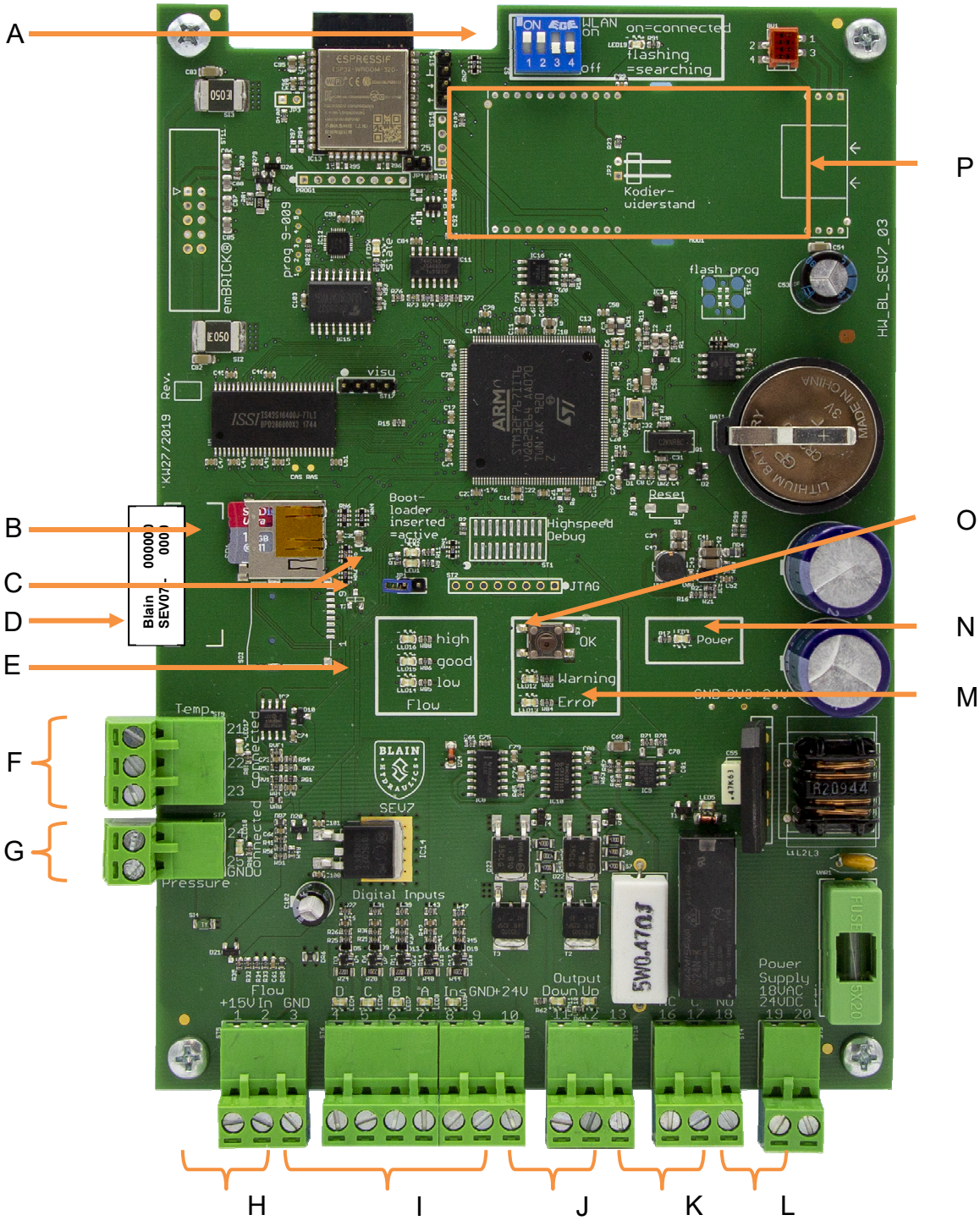
1.3 WARANTY INFORMATION

Blain's SEV User Manual is provided for qualified personnel, who are competent in installing, adjusting and servicing of hydraulic elevators. Blain Hydraulics assumes no liability for any personal injury, property damage, losses or claims arising from in appropriate use of its product or incompetence of the installer.

Warranty expires, if:

- Components or spare parts different than the original ones are installed.
- Elevator system or SEV is installed or serviced by unqualified personnel.
- SEV package is installed in any location without applying the elevator safety codes (EN81-20/50, ASME 17.1 or the existing local code).

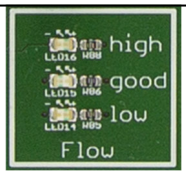
2. THE SEV CARD



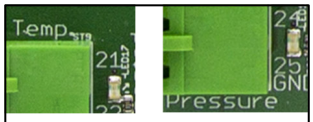
A	Mode switch	**I**	Input signals
B	Memory card slot	**J**	Output signals
C	Jumper for data upload	**K**	Error relay
D	Type plate	**L**	Power supply 24 V DC / 18 V AC
E	Flow sensor adjustment feedback	**M**	Error / warning LED
F	Temperature sensor connection	**N**	Power LED
G	Pressure sensor connection	**O**	Quit / confirm button
H	Flow sensor connection	**P**	Spot for additional interface PCB

2.1 LED DIAGNOSTICS

BOOT LOADER LEDs
If the jumper is set in non-bridged mode, the green and red LED will light up alternately.
Setting the jumper in bridged mode causes the red LED to glow continuously and the green LED to flash slowly. If an update is being processed, the green LED will flash rapidly until the update is finished.

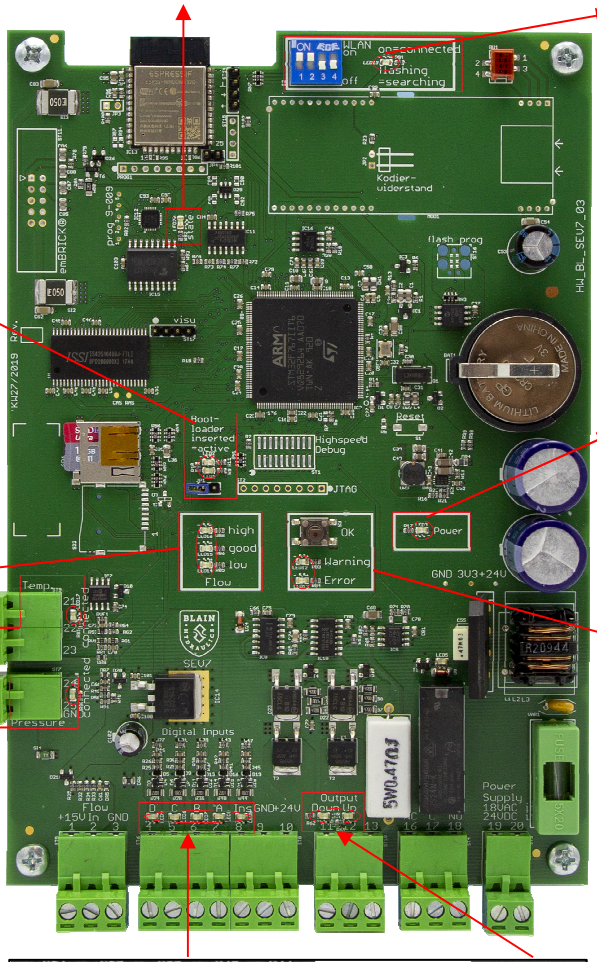


FLOW LEDs
They indicate if the sensor has been adjusted properly. If the adjustment is set higher or lower than the range, the corresponding LEDs will light up to signal, that the sensor has to be readjusted.

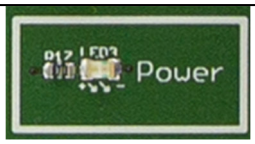


SENSOR LEDs
These will glow green if the pressure-temperature sensor is connected properly.

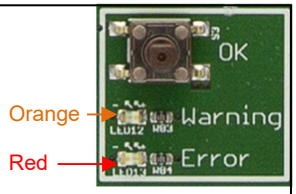
STATE LED
The orange state LED flashes slowly. Any other behaviour is related to communication problems and reflects a defect.



SWITCH LED
If switch “1” is in „ON“-position, the LED will flash slowly. Once a connection to a smart device is established, the LED glows continuously.



POWER LED
The green power LED will continuously glow as long as the electronic card is supplied with power.



DIAGNOSTIC LEDs
The orange “Warning” LED lights up in case of an unexpected behaviour. If there is a major fault interfering with the normal operation of the valve like the flow sensor or a coil being defect, the “Error” LED will light up and prevent the SEV from functioning until the error has been quit with the help of the “OK” button.

INPUT AND OUTPUT SIGNAL LEDs
D (red), **C** (red), **B** (green), **A** (green) and **Ins** (yellow) are reflecting the input signals into the electronic card.
Down (red) and **Up** (green) are the corresponding output signals and indicate the travel direction.

3. THE SEV VALVE

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 proportional solenoid valves. The elevator operation can be monitored, recorded and adjusted by a smart device using Wi-Fi connectivity. Additional intermediate speed for maintenance runs can also be programmed.

Figure 2: SEV valve sizes

SEV valves include the following essential features:

Self-cleaning pilot line filters
Self-cleaning main line filter (Z-T)
70HRc hardened bore surfaces
100% continuous duty solenoids
Temperature and pressure compensation
Built-in turbulence suppressors
Pressure gauge and shut off cock
Self-closing manual lowering

Technical data		1" SEV	1½" SEV	2" SEV
Flow range	l/min (USgpm)	40-180 (10-48)	-430 (-114)	-580 (-153)
Pressure range	bar (psi)	9-70 (130-1000)		
Burst pressure	bar (psi)	400 (5750)		
Pressure loss (static)	bar (psi)	≈ 2 – 3 bar (29 – 44 psi) depending on flow and valve port size		
Weight	kg (lbs)	10 (22)		
Oil viscosity		22-75 cSt. at 40°C (104°F)		
Max. oil temperature		14°-61°C (57°-142°F) for oil VG46; 200 cSt – 20 cSt.		
Optimal oil temperature		25°-50°C (77°-122°F) for oil VG46; 100 cSt – 30 cSt.		
Ambient temp range		0°-70°C (32°-158°F)		
Insulation class, AC and DC		IP 68		
Coils AC	24 V/1.8 A, 42 V/1.0 A, 110 V/0.43 A, 230 V/0.18 A			
Coils DC	12 V/2.0 A, 24 V/1.1 A, 42 V/0.5 A, 48 V/0.6 A, 80 V/0.3 A, 110 V/0.25 A, 196 V/0.14 A			
Elec. card input	24 V DC / 18 V AC			
Elec. card weight	0.5 Kg (1.1 lbs)			

Up travel Up to 1.0 m/s (197 fpm). 1 Full Speed, 1 Leveling Speed, 1 Inspection speed.

Down travel Up to 1.0 m/s (197 fpm). 1 Full Speed, 1 Leveling Speed, 1 Inspection speed.

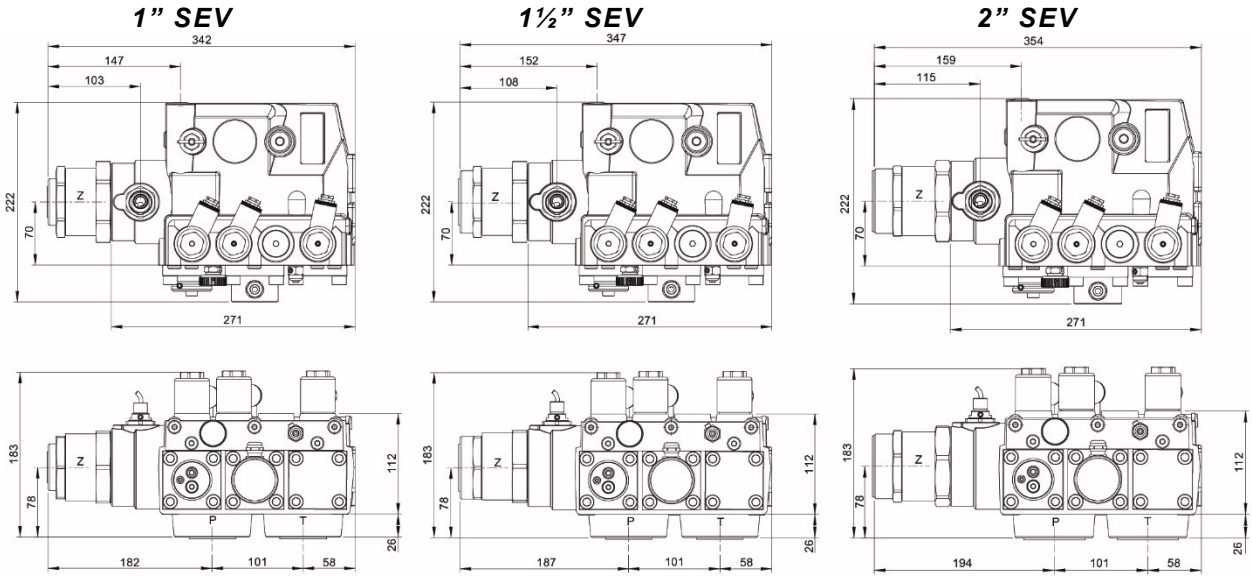
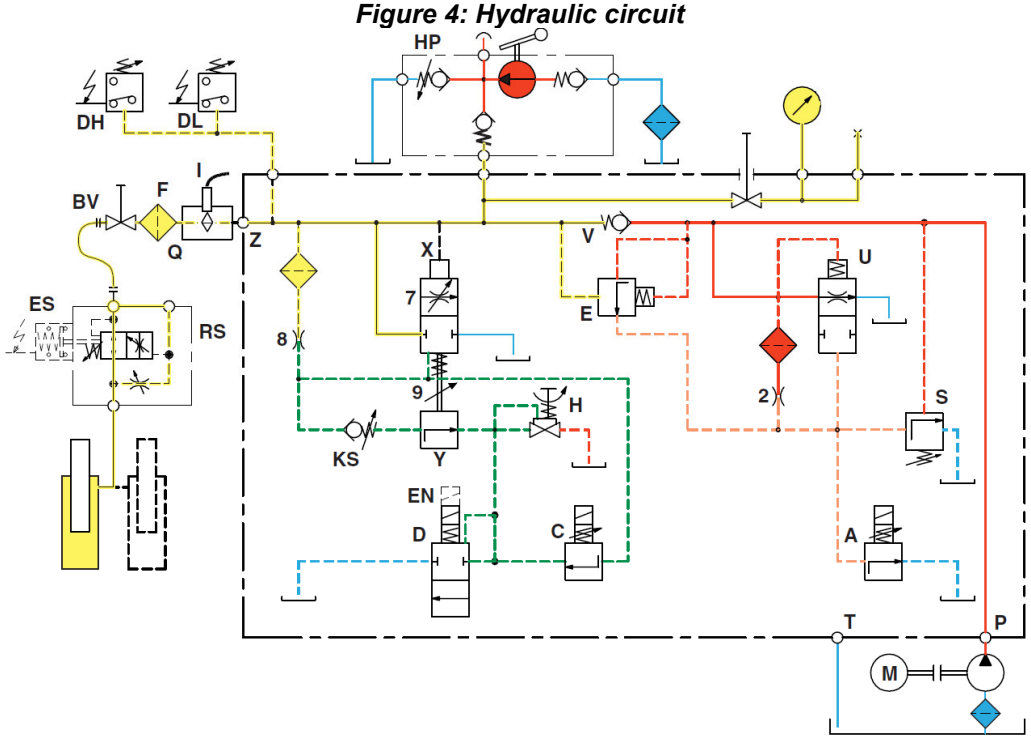


Figure 3: SEV valve dimensions

Optional Equipment

EN	Emergency coil	**DH**	High pressure switch
CSA	CSA coils	**DL**	Low pressure switch
KS	Slack rope valve	**BV**	Ball valve
HP	Hand pump	**HX**/MX	Auxiliary down valve

Figure 4: Hydraulic circuit



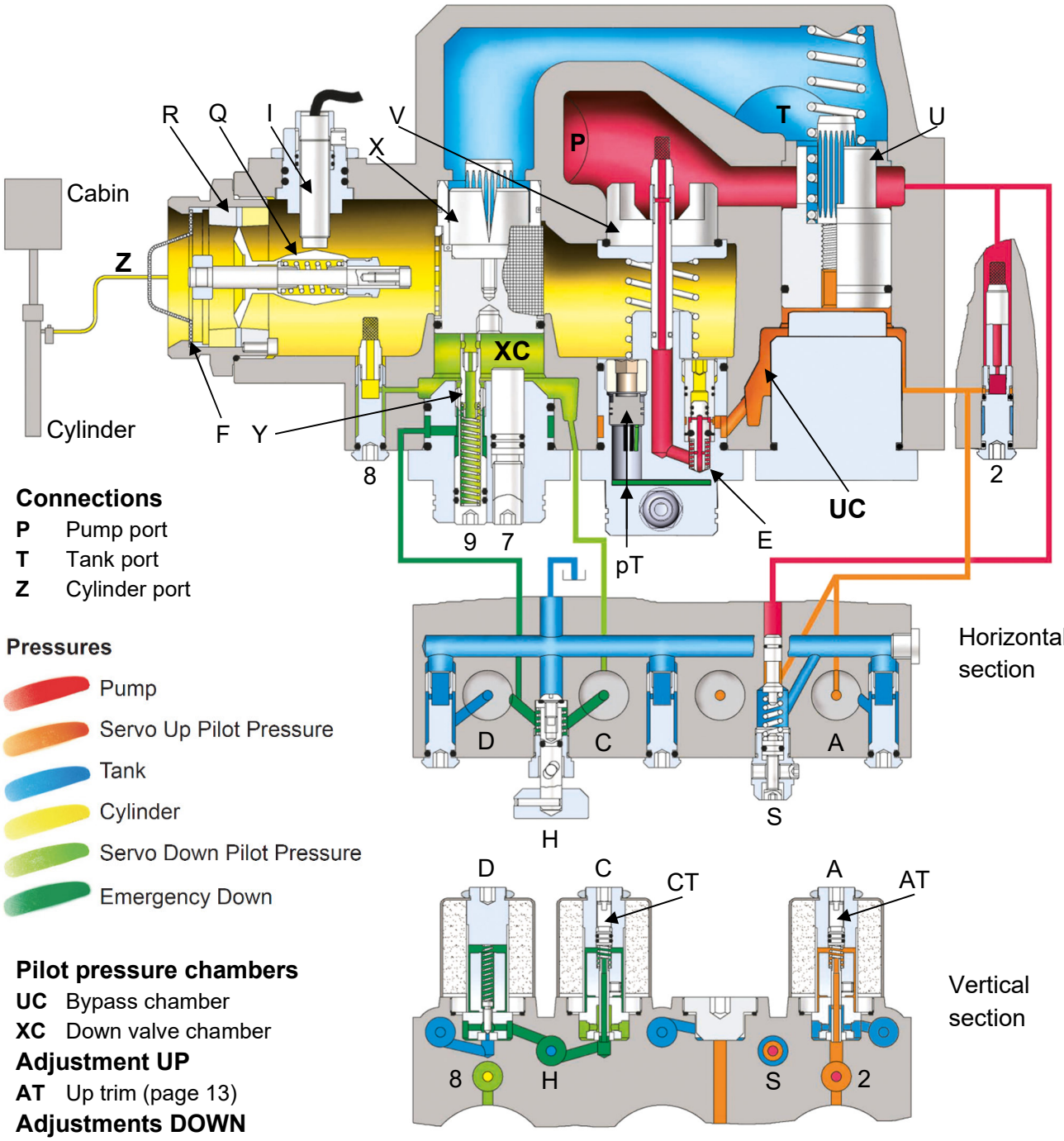
Control Elements

C	Solenoid Down control
D	Solenoid Down start/stop
H	Manual lowering
S	Pressure relief valve
U	Bypass valve
V	Check valve
X	Down valve
Y	Down leveling valve

Down adjustments

7	Full speed limitation
9	Manual lowering speed

Figure 5: Cut section view of the SEV valve



Connections

P Pump port
T Tank port
Z Cylinder port

Pressures

Pump
Servo Up Pilot Pressure
Tank
Cylinder
Servo Down Pilot Pressure
Emergency Down

Pilot pressure chambers

UC Bypass chamber
XC Down valve chamber

Adjustment UP

AT Up trim (page 13)

Adjustments DOWN

CT Down trim (page 13)
7 Full speed limitation
9 Manual lowering speed

Control elements

A Solenoid Up control
C Solenoid Down control
D Solenoid Down start/stop
E Short delay valve
F Filter
H Manual lowering
I Flow sensor
pT Pressure-temp.-sensor
Q Flow meter
R Flow ring
S Pressure relief valve
U Bypass valve
V Check valve
X Down valve
Y Manual lowering valve
2 Pilot orifice Up
8 Pilot orifice Down

3.1 VALVE OPERATION

UP operation

1. With an **Up** signal, the pump-motor is energized and the electronic card´s **Up** program starts simultaneously. Oil flows through orifice **2** into the bypass pilot chamber **UC**.
2. Coil **A** is energized and solenoid **A** (normally open) from the card and partially closes, reducing the volume of pilot oil flowing out from the bypass pilot chamber.
3. The bypass valve **U** begins to close as pressure increases in the bypass pilot chamber. As the bypass valve **U** closes, the check valve **V** begins to open as a steadily increasing volume of oil flows into the cylinder of the elevator, displacing the flow meter **Q**.
4. The inductive flow sensor **I**, measures the increasing displacement of the flow meter. This value is compared in the card with the target flow value, which prescribes the acceleration, full speed, deceleration and levelling speed of the car. Correction of the measured flow rate is made by varying the power from the card to coil **A**, controlling the position of the bypass valve through pilot pressure in chamber **UC**.
5. The comparison and correction of the measured flow to target flow values, continue throughout the complete **Up** operation of the elevator.

DOWN operation

(Caution! Voltage for coil D comes directly from the elevator´s controller, not from the SEV card)

6. With a **Down** signal, coil **D** is energized, solenoid **D** (normally closed) opens and the electronic card´s **Down** program starts simultaneously.
7. Coil **C** is energized from the card and solenoid **C** (normally closed) partially opens allowing oil to pass through fixed orifice **8** escaping from the down valve pilot chamber **XC** through solenoid **D** (fully open) back to tank.
8. The down valve **X** begins to open as pressure decreases in the down valve pilot chamber **XC**. As the down valve opens, a steadily increasing volume of oil flows from the elevator´s cylinder into the tank, displacing the flow meter **Q**.
9. The inductive sensor **I** measures the increasing displacement of the flow meter. This value is being compared by the card with the set value of the target flow.
10. Correction of the measured flow rate is made by variation of power from the card to coil **C** controlling the position of the down valve through pilot pressure in chamber **XC**.
11. The comparison and correction of the measured flow to target flow values continue throughout the complete **Down** operation of the elevator.

Inspection Speed

Besides full speed and levelling speed, an optional inspection speed is included in the electronic card´s software. Up and down inspection speeds can be independently adjusted between 0.05 m/s and 0.30 m/s.

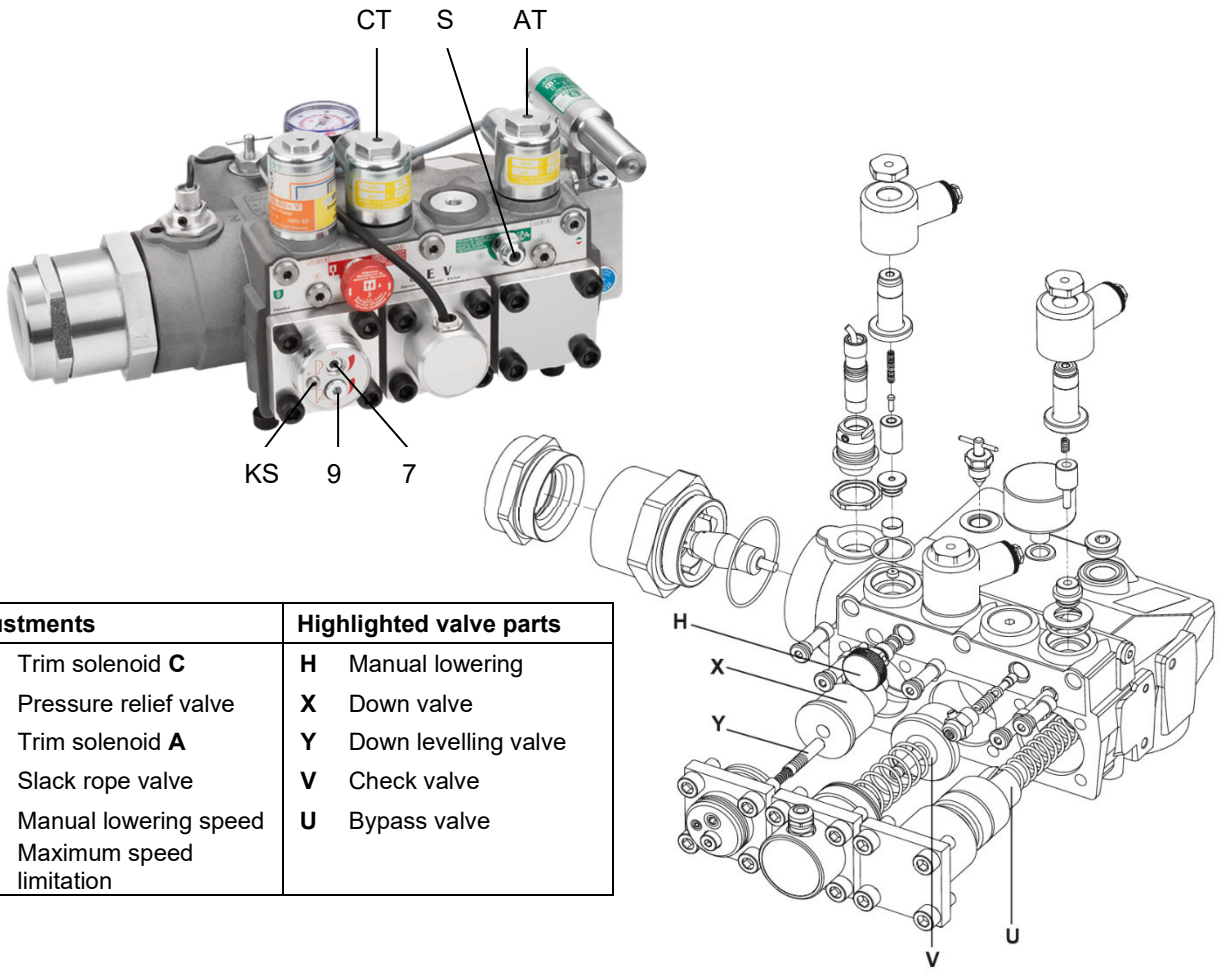
Valves are already adjusted and tested. Check electrical operation before changing valve settings. Test that the correct coil is energized by removing the nut and raising the coil slightly to feel magnetic pull.

S Pressure relief valve: Turning it 'In' (clockwise) produces a higher, 'out' (c-clockwise) a lower maximum pressure setting. After turning out, open manual lowering **H** for an instant to release pressure inside the valve.

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

KS Slack rope valve: Coils **C** and **D** must be de-energized! The **KS** is adjusted with a 3 mm Allen key. Turning the screw **K** 'in' results in a higher pressure setting and 'out' in a lower pressure setting. To adjust, turn **K** all the way 'in', then turn **K** 'out' until the empty car just begins to descend, then turn out another half a turn to ensure that with cold oil the empty car can be lowered as required.

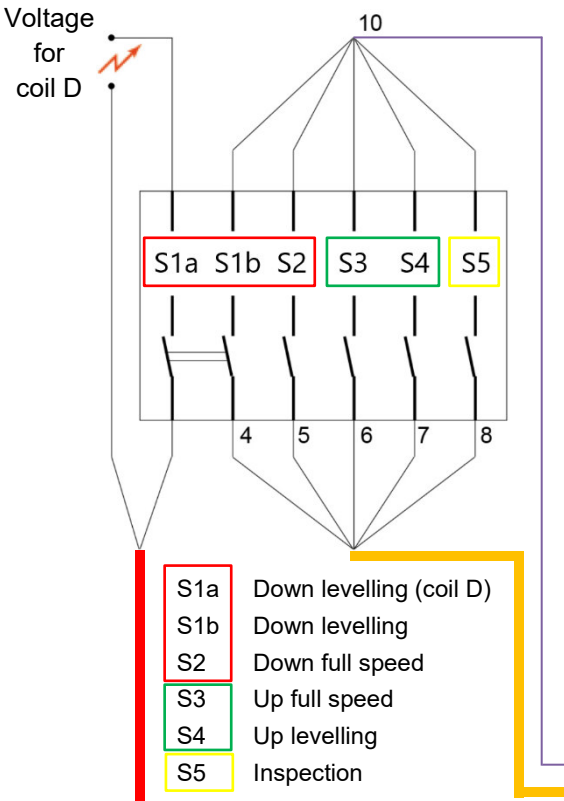
Figure 6: SEV adjustments and explosion drawing



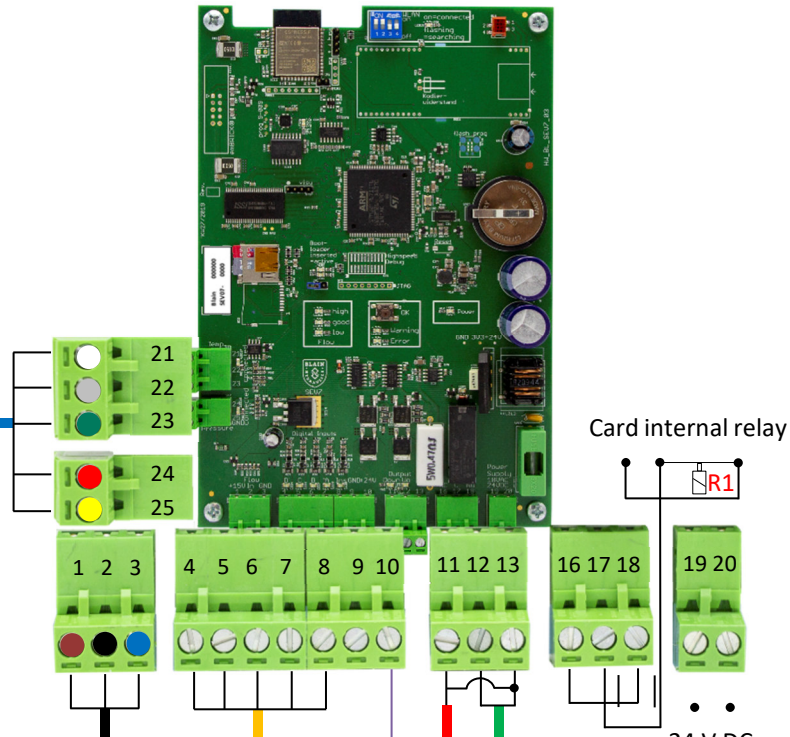
Adjustments		Highlighted valve parts	
CT	Trim solenoid **C**	**H**	Manual lowering
S	Pressure relief valve	**X**	Down valve
AT	Trim solenoid **A**	**Y**	Down levelling valve
KS	Slack rope valve	**V**	Check valve
9	Manual lowering speed	**U**	Bypass valve
7	Maximum speed limitation		

4. ELECTRICAL INSTALLATION

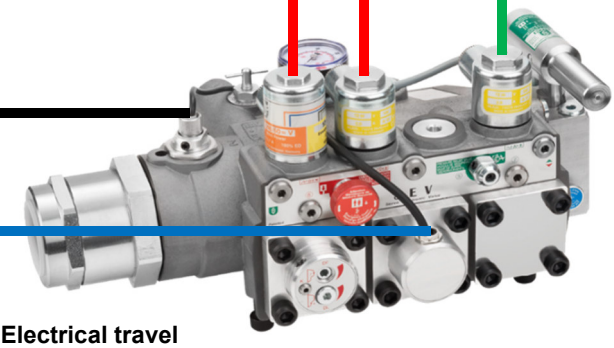
Lift Controller



SEV card

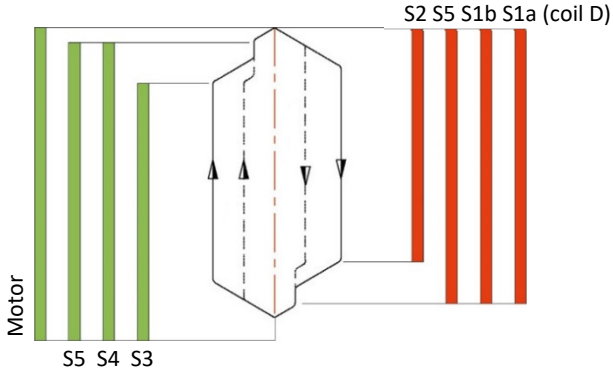


PIN	Explanation
1	Power supply 15 V (brown wire)
2	Sensor signal (black wire)
3	Neutral (blue wire)
4	Input signal "S1b" Down start/stop – D
5	Input Signal "S2" Down control – C
6	Input signal "S3" Up full speed – B
7	Input signal "S4" Up control – A
8	Input signal "S5" inspection – I
9	Input signal neutral (ext. supply)
10	Input signal 24 V DC
11	Output signal "C" Up
12	Output signal "A" Down
13	Output signal neutral for Up and Down
16	Error relay NC – closed if OK – open if fault
17	Error relay COM
18	Error relay NO – open if OK – closed if fault
19	Supply voltage ground
20	Supply voltage live 18V AC / 24V DC
21	PT100 C (white wire)
22	PT100 B (grey wire)
23	PT100 A (green wire)
24	24 V (red wire)
25	4-20 mA (yellow wire)



Electrical travel

Sequence	UP	DOWN
Normal travel:	S3+S4	S1a+S1b+S2
Inspection:	S3+S4+S5	S1a+S1b+S2+S5
Slow speed:	S4	S1a+S1b



5. CONTROL VALVE INSTALLATION

Check the following:

1. The flow on the data plate of the valve complies with the flow rate of the pump (±10 %).
2. The minimum and maximum static pressures on the valve data plate is in accordance with those of the elevator.
3. The electrical supply to the **SEV** card is 24 VDC / 18 VAC and 50 VA.
4. The star delta timer is set to between 0.3 and 0.4 secs.
5. The flow ring **R**, bypass valve **U** and down valve **X** are correct using chart **A** at rear of the handbook.
6. The flow sensor is adjusted between 4.8 and 5.3 mA

Installation of the SEV Valve onto the Power Unit

For a compact and time saving installation as well as easier servicing and protection of the flow meter, cylinder connection **Z** of the **SEV** is fitted with the Blain ball valve G1“, 1.5“, 2“or 2.5“.

Installation of the SEV Card into the Controller

The **SEV** Card can be connected into any standard type hydraulic elevator controller. The power to coils **A** and **C** is supplied from the card. Power to coil **D** is directly provided by the main controller. Page 11, 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 levelling speeds

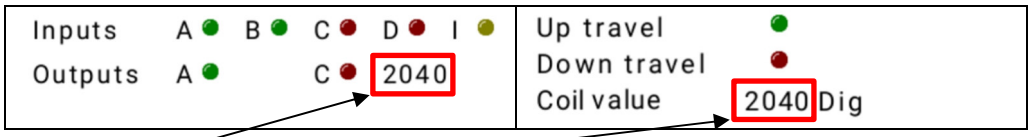
Metric				Imperial			
Travel speed	**Decel. switch before floor**	**Levelling speed**	**Stop switch before floor**	**Travel speed**	**Decel. switch before floor**	**Levelling speed**	**Stop switch before floor**
m/s	**cm**	**m/s**	**cm**	**ftm**	**in**	**ftm**	**in**
0.3	25	0.06	1.0	60	10	12	0.4
0.4	45	0.06	1.0	80	17	12	0.4
0.5	60	0.06	1.0	100	24	12	0.4
0.6	75	0.06	1.0	120	30	12	0.4
0.7	95	0.07	1.5	140	37	14	0.6
0.8	110	0.07	1.5	160	43	14	0.6
0.9	130	0.08	2.0	180	51	16	0.8
1.0	145	0.08	2.0	200	57	16	0.8

Depending on customers priorities, for travelling time or stopping accuracy, the recommended values for levelling speeds may be modified, i.e. for faster floor to floor times; faster levelling speeds, for more accurate floor stops; slower levelling speeds.

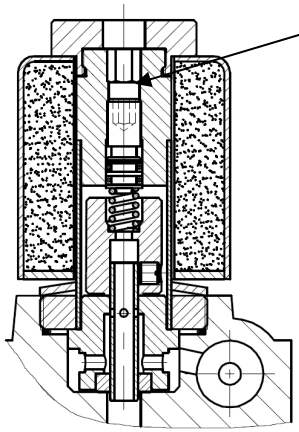
6. FLOW SENSOR AND SOLENOID ADJUSTMENTS

Adjustment of solenoid power levels A and C (already factory adjusted)

The adjustment of the solenoid power level is necessary if parts of the solenoids have been changed during servicing. Solenoid power level has to be adjusted to ensure the valves best possible performance and to produce a quick and smooth initial movement of the car away from the floor. The travel direction is shown by the color of the LEDs. Green LEDs are referring to Up direction while red LEDs are used for Down direction.



The "**MAIN MENU**" and the "**Status**" are showing the digital value of the **UP** solenoid (**A**) or **DOWN** solenoid (**C**) during an **UP** or **DOWN** travel. Depending on travel direction, the **green** LED for output signal **A** (**Up**) or **red** LED for output signal **C** (**Down**) will be illuminated. The digital value should be around 2100 ± 200 during *constant* travel while in full speed or slow speed. Setting up this value is easier done while travelling with slow speed since there is more time for adjusting. To alter the value, turn the trim screw in or out. Turn clockwise to increase digital value. Turn counter clockwise to decrease digital value.



Trim screws **AT** and **CT** at solenoids **A** and **C** (3mm Allen key)

Adjustment of flow sensor

Attention!

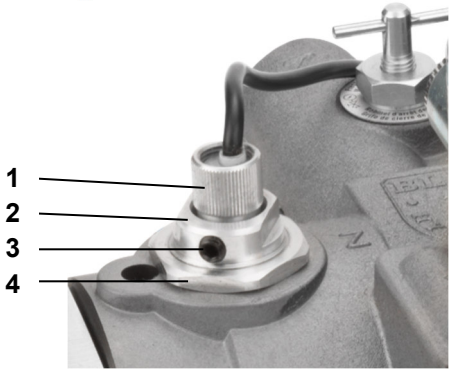
Flow sensor is already factory adjusted. Readjusting should only be necessary when replacing sensors.

Vertical sensor adjustment

If the sensor value [mA] under static condition is not between 4,8 and 5,3 mA, close the ball valve and open manual lowering to make the valve pressure-less, loosen up the lock screw of the sensor and turn the knurled sensor-head in or out until the value is between 4,8 and 5,3 mA. Re-tighten the lock screw. Adjusting the sensor value below 4.5 mA may cause the sensor to press against the flow meter.

Radial sensor adjustment

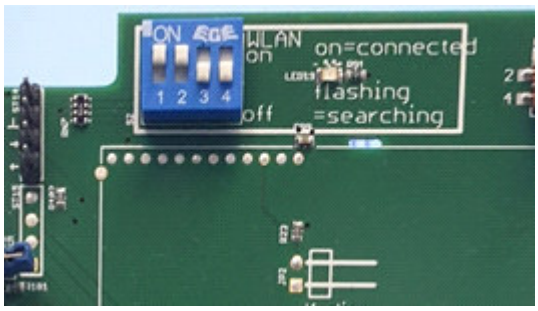
For radial adjustment of the sensor loosen the bushing lock nut (**4**), without turning the sensor bushing (**2**). Operate the elevator to run **Up** and **Down** at leveling speed. Measure the speed with stop watch or tachometer. Levelling speeds for both directions should have the same value. If Down leveling speed is slower than Up leveling speed, rotate the bushing (**2**) clockwise by 15° and re-measure the leveling speeds. If Down leveling speed is faster than Up leveling speed, rotate the bushing (**2**) counter-clockwise by 15° and re-measure the leveling speeds.
Repeat the process of rotating the bushing in clockwise or anti-clockwise as required to set the Up and Down leveling speeds to be practically the same. Re-tighten the bushing lock nut once the setup is finished.



1 Sensor head
2 Sensor bushing [19 mm (3/4") spanner]
3 Sensor lock screw (3mm Allen key)
4 Bushing lock nut [32 mm (1 1/4") spanner]

7. WI-FI CONNECTIVITY & SECURITY

The SEV electronic card uses the IEEE Standard 2.4GHz, 802.11 b/g/n connectivity protocols. Generally, all modern-day smart devices (phone/tablet/laptop) can communicate with the Wi-Fi access point on the card using these protocols. The SEV card is delivered using the default settings as shown in the picture below.



Switch 1 - The Wi-Fi switch in **ON** position allows communication with the electronic card using a smart phone. The on-board Wi-Fi access point is available for accepting connections.

Switch 2 – **OFF** position allows backward compatibility of the electronic card to be used for the older version of the SEV valve. Certain functions related to pressure and temperature measurements are not available.

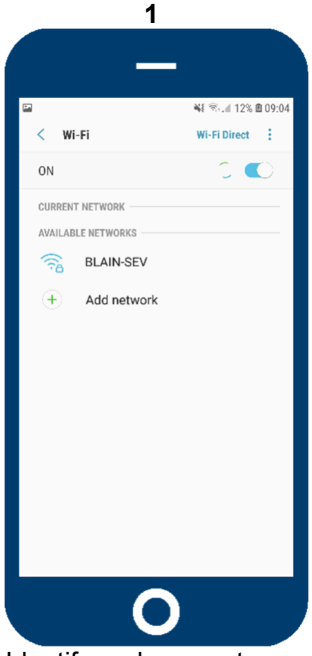
Switch 3 & 4 – Reserved for Blain Hydraulics.

To connect with the SEV card using your smart device, ensure the **switch 1** to be in **ON** position. The **Blue LED** will flash during the process of establishing a Wi-Fi connection. Once a stable connection is established, the **LED** would stop flashing and remain **ON**.

*In order to safeguard unauthorized access to the Wi-Fi and the electronic card, the Wi-Fi should be switched **OFF** on completion of setup / configuration / monitoring.*

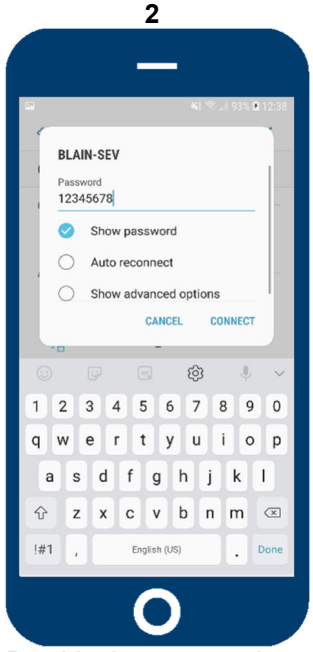
Getting connected

1



Identify and connect with the BLAIN-SEV Wi-Fi from your smart device.

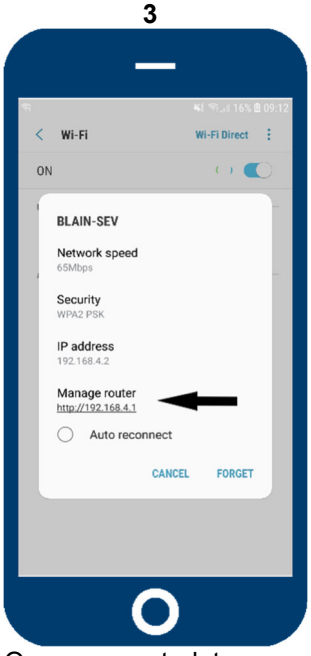
2



Provide the password to get connected. The default password is 12345678

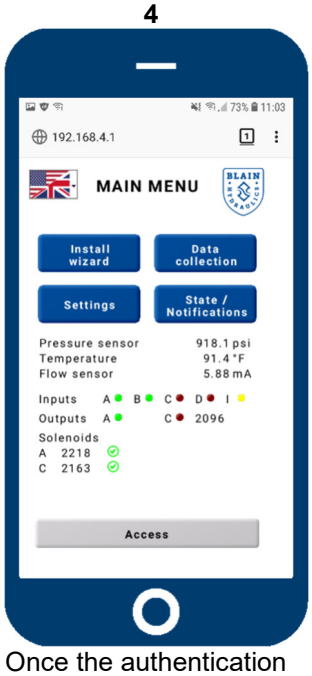
During the time the smart device is connected with the SEV card, no internet connectivity or other network connections are possible.

3



Once connected, tap on the Wi-Fi to get into the configuration. Tap on “Manage router” to enter the on-board APP on the access point in your preferred browser (Firefox recommended). Alternatively open your preferred browser and provide the IP address 192.168.4.1 in the navigation bar.

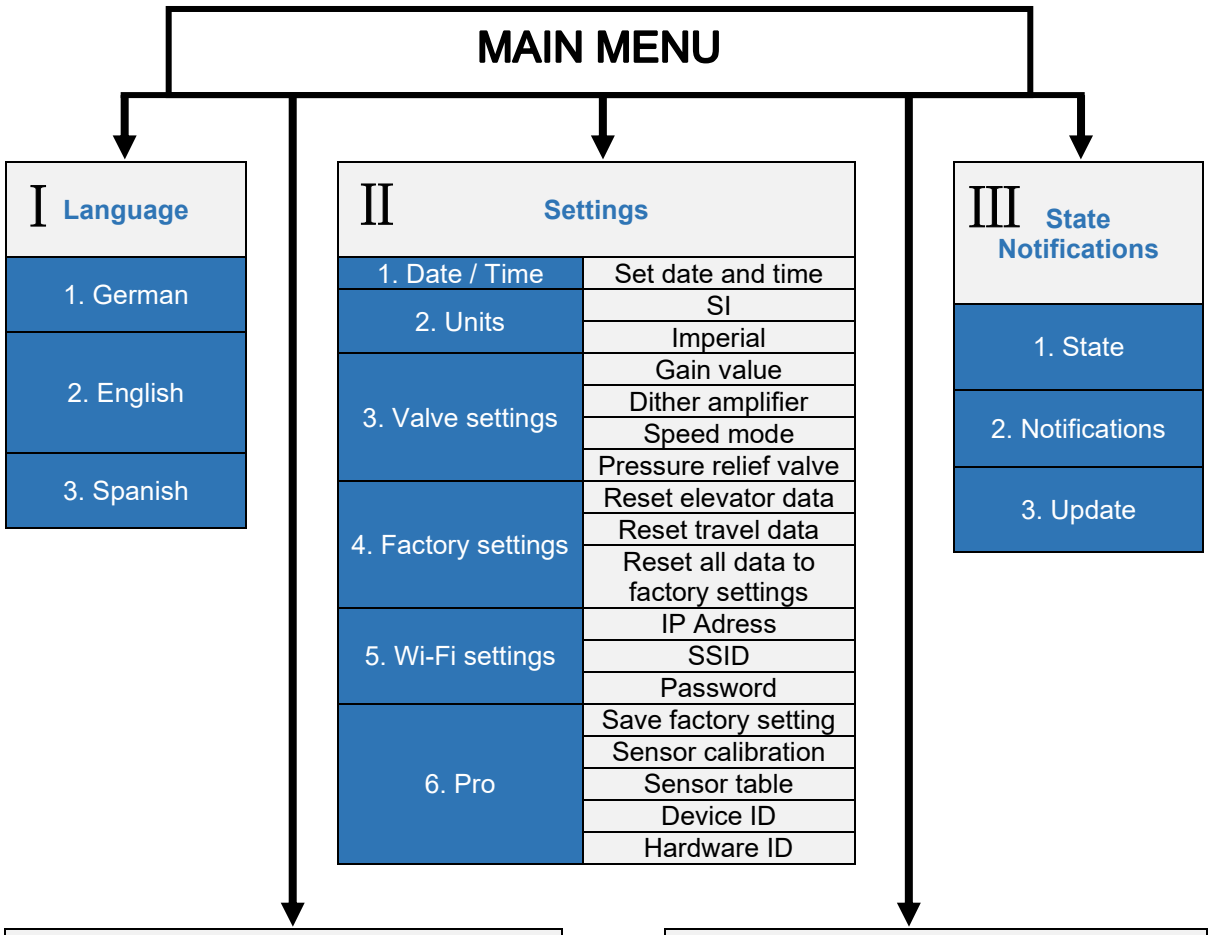
4



Once the authentication is completed, a loading screen will appear and confirm the successful connection. Once loading is completed the MAIN MENU can be seen.

8. SETUP PROCEDURE

8.1 SOFTWARE MENU OVERVIEW



I Language
1. German
2. English
3. Spanish

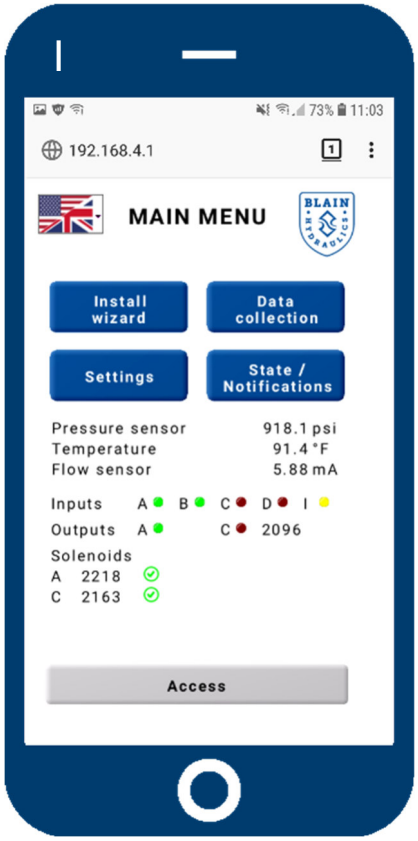
II Settings	
1. Date / Time	Set date and time
2. Units	SI
	Imperial
3. Valve settings	Gain value
	Dither amplifier
	Speed mode
	Pressure relief valve
4. Factory settings	Reset elevator data
	Reset travel data
	Reset all data to factory settings
5. Wi-Fi settings	IP Adress
	SSID
	Password
6. Pro	Save factory setting
	Sensor calibration
	Sensor table
	Device ID
	Hardware ID

III State Notifications
1. State
2. Notifications
3. Update

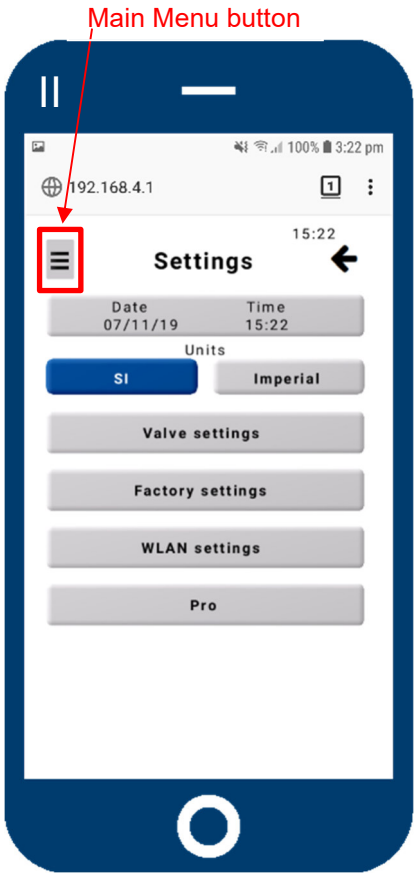
IV Install wizard	
1. Welcome screen	Introduction
2. Cylinder data	Transmission
	No. of cylinders
	Piston type / diameters
3. Pump data	Performance
	Efficiency
4. Weight & pressure	Empty cabin
	Payload
	Min. pressure
	Max. pressure
5. Up travel data	Speed
	Acceleration
	Soft stop
6. Down travel data	Speed
	Acceleration
7. Inspection travel data	Up travel
	Down travel
8. Final screen	Final information

V Data collection	
1. Elevator data	Cylinder data
	Pump data
	Weight
	Pressure
2. Travel data	Up travel
	Down travel
	Inspection travel
3. Teach run / speed adjustment	Teach values
	Standard values
	R10 Test
4. Logbook	Last runs
	Reset counters
5. Trouble shooting	General error
	Error Up travel
	Error Down travel

8.2 MAIN MENU



The language of the software can be changed by pressing the flag in the upper left corner. From the main menu the easy to use "**Install wizard**" for assisting during initial setup, the "Data collection", "**Settings**" and "**State/Notifications**" sub menus can be accessed.

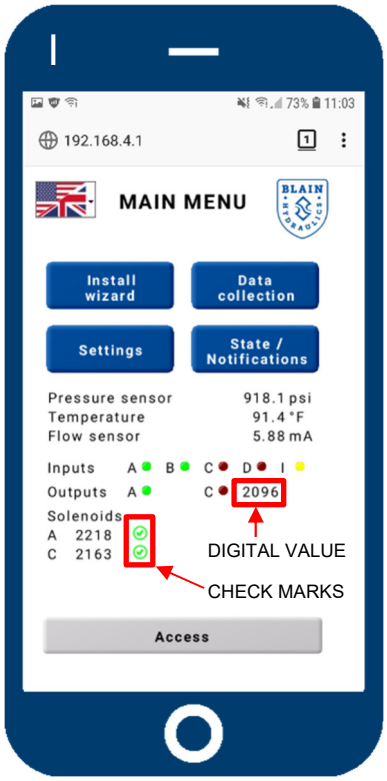


Once the preferred language has been selected, go to "**Settings**" to set the date and time and choose your units for setting up the valve. In order to set up the valve, please follow the instructions. Use the "Main Menu button" (highlighted) to get back to the "**MAIN MENU**".

The following chapter of this installation manual describes how to set up and service the valve with the help of the software. The most important points of navigating the menu will be covered and the sub menus "Install wizard", "Data collection", "Settings" and "State / Notifications" will be explained in detail.

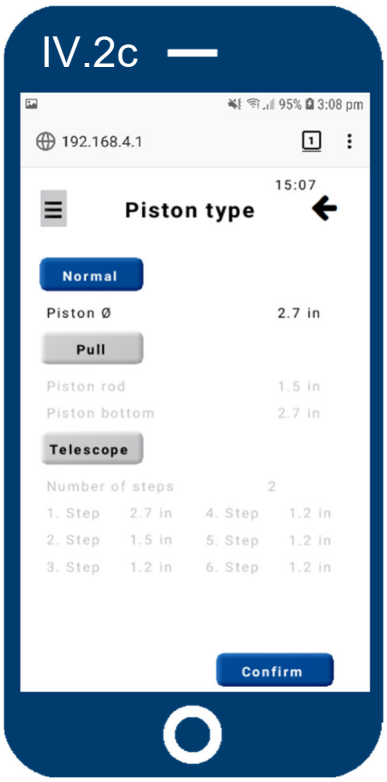
As the software for interacting with the SEV card resides on the webserver and on the card itself, no additional software installation on the smart device is necessary. This unique feature allows the user to use any smart device; independent of the operating system or software architecture. It is highly recommended to use **Mozilla Firefox for Android or Safari for iOS** as web browsers.

*Before the installation wizard is started it is highly recommended that all technical data of the lift is readily available and that the input unit is correctly selected. The choice for unit's selection between Metric and Imperial can be made from the "**Settings**" menu > units from the home screen.*



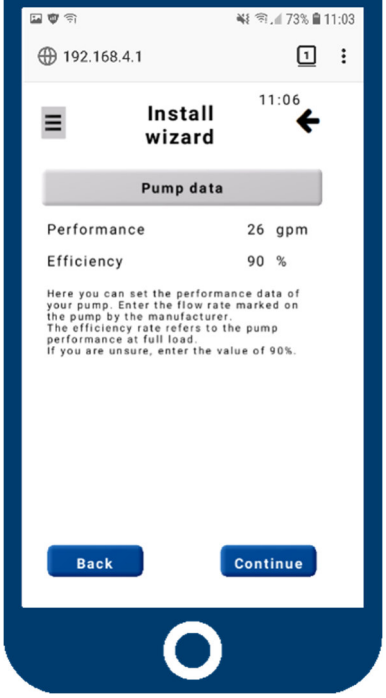
The "**MAIN MENU**" allows access to the "**Install wizard**", the "**Data collection**", the "**Settings**" and the "**State/notifications**" sub menus.
The "**Install wizard**" is being used to assist during valve setup and serves as a step by step guide to help users entering the complete and correct necessary elevator data.
The "**Data collection**" gives an overview about all entered data to make changes if necessary and it gives access to the "**Logbook**" and the "**Trouble shooting**" sections.
In the "**Settings**" menu you can change units, valve and Wi-Fi settings or reset settings to factory settings if desired.
The "**State/notifications**" shows the status of the system and allows for possible updates.
The "**Access**" button gives the user the possibility to enter and change passwords necessary for accessing the features of the software.
Furthermore the "**MAIN MENU**" acts as the first tool for analyzing and setting up the valve. Values for pressure, temperature and flow are displayed. In case of no readings the connections need to be rechecked or the sensors changed. LEDs for input and output give feedback for diagnostics.
While traveling constantly in full speed or levelling speed in Up or Down direction, the highlighted digital value should stay in the range of 2100 ± 200. The green check marks should show up behind the digital values of the solenoids giving feedback of the correct starting values.

←Left
After starting the install wizard and reading the welcome screen, you are asked to enter the necessary cylinder data. Pressing the buttons for the different piston types will bring up a dialogue field (screen on the right), where the desired values can be entered. To change transmission ratio or number of cylinders, press the corresponding values.
The effective piston diameter is being calculated depending on the entered data. Changing its value will override all other data. Press confirm to continue the setup.



Right→
Select a piston type and enter its diameters by touching the values. Use the confirm button on the bottom right to get back to the screen on the left.

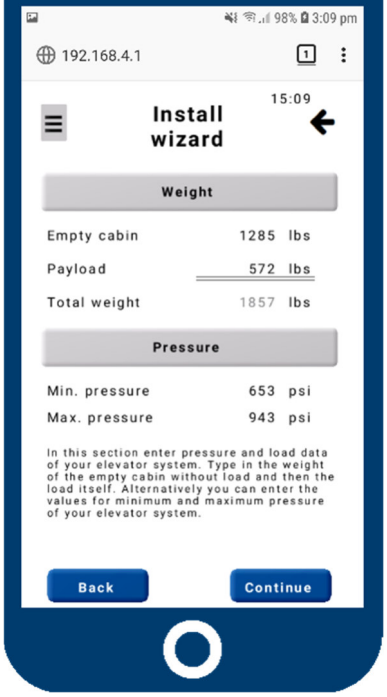
IV.3 —



←Left

Enter the pump performance data provided by the manufacturer. Due to changes in load and oil viscosity the pump will not always deliver its full flow. Furthermore some flow is needed by the SEV to regulate and provide constant speed and travel time. 90 % efficiency is an approximated value.

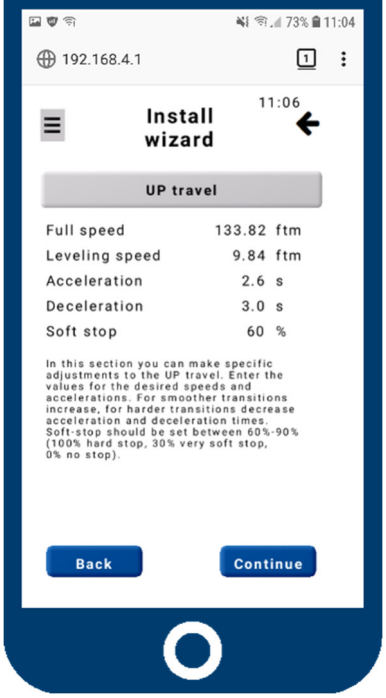
IV.4 —



Right→

Provide the static weight of your elevator system and the pay load data. Alternatively the values for minimum and maximum pressure can be entered. Please note that entering the weight would automatically calculate the pressure and vice versa.

IV.5 —



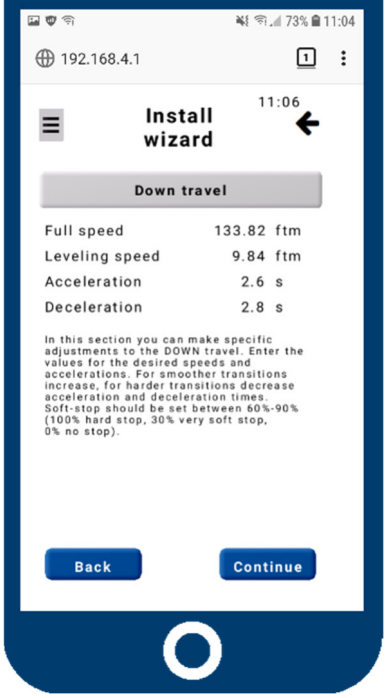
←Left and Right→

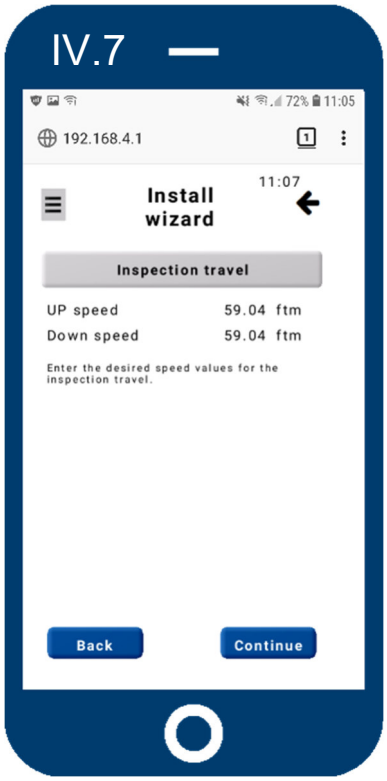
Enter your desired speeds, acceleration and deceleration times of the Up travel as well as the Down travel.

Your full speed in Up direction is already being calculated based on the entered piston and pump data. Speed in Down direction is limited to 196,85ftm (1m/s). Values shown in imperial units are displayed after being converted from Metric system and therefore vary slightly from the input value.

The soft stop setting controls the final stopping into the landing zone in the Up direction. Making it too soft which means choosing a smaller value may cause the elevator to continue traveling and surpassing the floor level.

IV.6 —



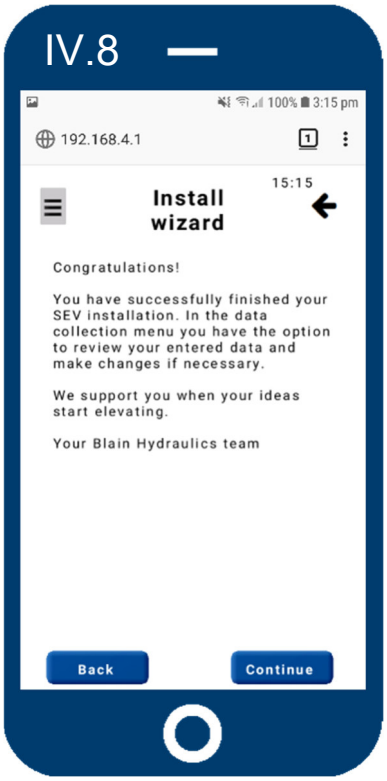


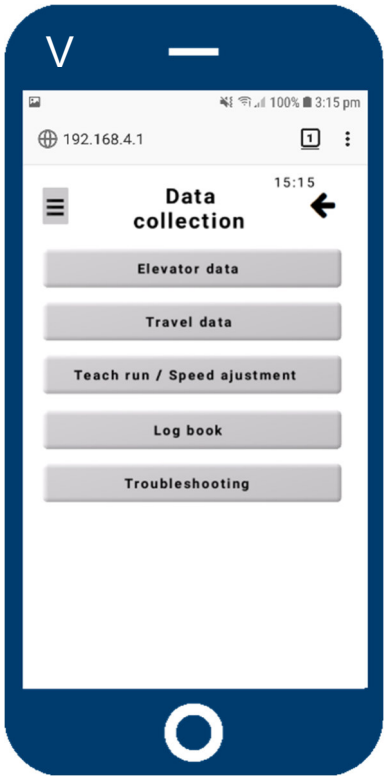
←Left

The inspection travel speed for Up and for Down direction can be set here. Inspection speed is sometimes referred to as the second slow speed, which can be used for inspections or short floor distances. Press continue to proceed further.

Right→

Once you reach the final screen, the install wizard ends, confirming that the entered data has been saved successfully on the electronic card. In order to review all entered data, you can run the install wizard again or check the "**Data collection**". Changes can be made in the "**Data collection**" sub menu as well.



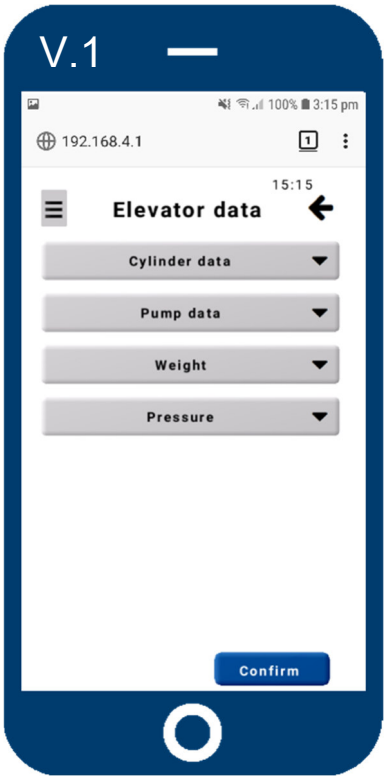


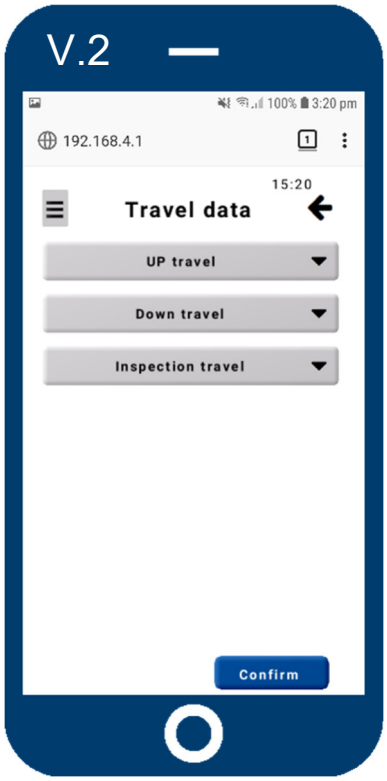
←Left

The "**Data collection**" sub menu of the software provides an overview of the existing data stored on the card. Data can be entered here when selecting "**Elevator data**" or "**Travel data**". In addition there is access to the "**Teach run**" menu, the "**Log book**" as well as the "**Trouble shooting**". The "**Teach run**" menu calibrates the flow sensor while the "**Logbook**" provides an overview of travel logs with the option of looking at the travel graph. "**Troubleshooting**" offers help on general errors and errors in **Up** and **Down** direction.

Right→

Within the "**Elevator data**" menu section you can check the data for your piston, pump, weight and pressures and change them if desired.





←Left

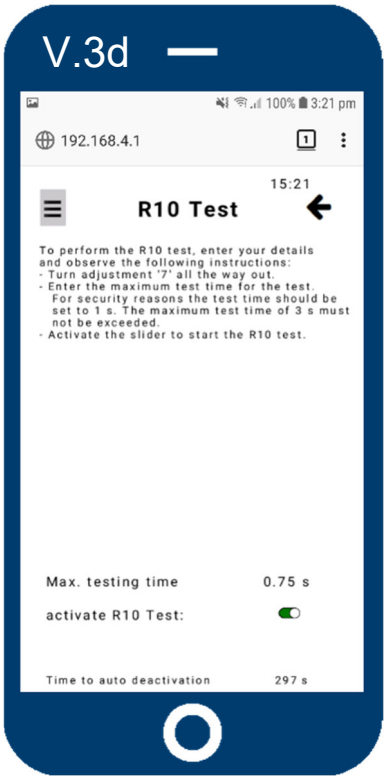
The "**Travel data**" section provides an overview about the selected speeds and accelerations for Up, Down and Inspection travel. Values can be changed according to customer´s wishes.

Right→

The "**Teach run**" function provides an option to fine-tune the **Up** and **Down** travel speeds after the elevator has travelled at least once and the data is captured. It's very useful to re-calibrate the system in case of flow sensor replacements. Each value can separately be taught and will be shown and highlighted with black letters when editable. In case of wrongly entered data a reset to standard values can be done. To do an R10 rupture valve test, choose the option from this menu.

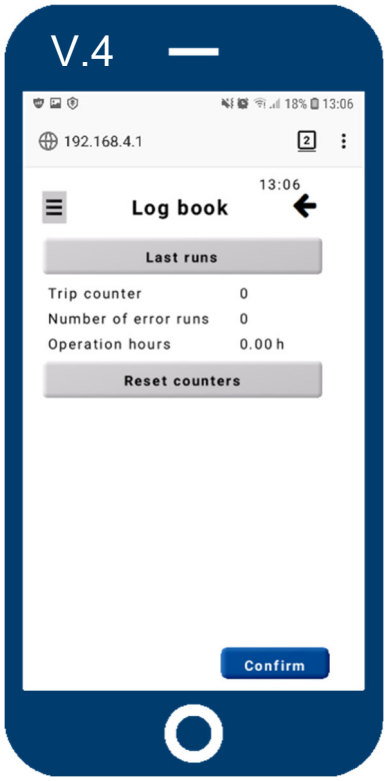
←Left

A warning comes up when trying to access the rupture valve test. Once confirmed, a small introduction about the test procedure will appear before the screen on the right is shown. This test should only be carried out by trained lift mechanics.



Right→

Follow the instructions on screen to test your rupture valve. The default setting of the testing time is set to 0.75 s for security reasons. After the test time limit is reached, the control valve will decelerate the elevator. If test time is too short for the rupture valve to be activated, the time can be increased. Once the slider for the activation is triggered, the test can be carried out within the next 300 s. To do the test, give a **Down call** to the elevator. The test will be disabled when leaving this screen.

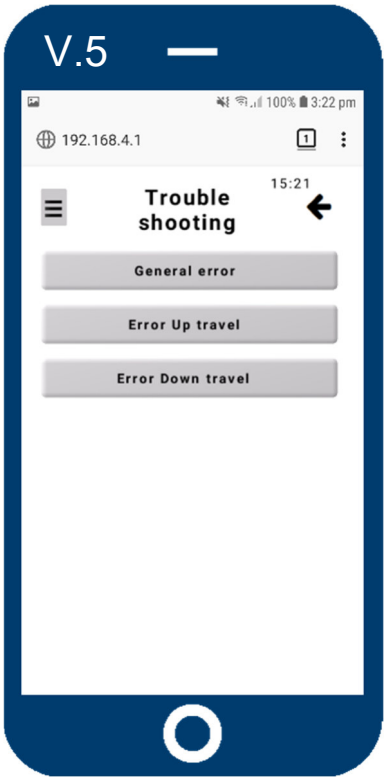


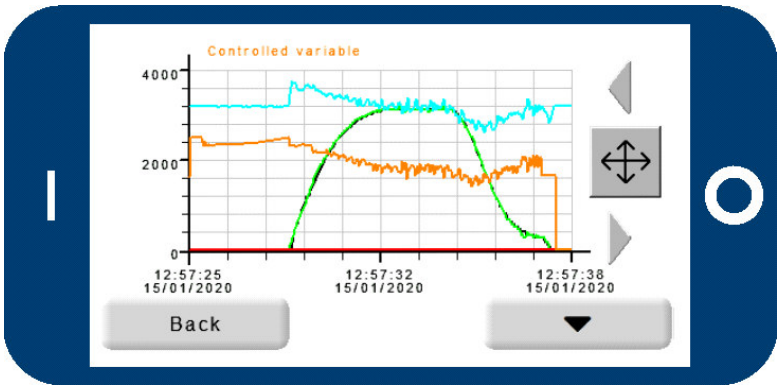
←Left

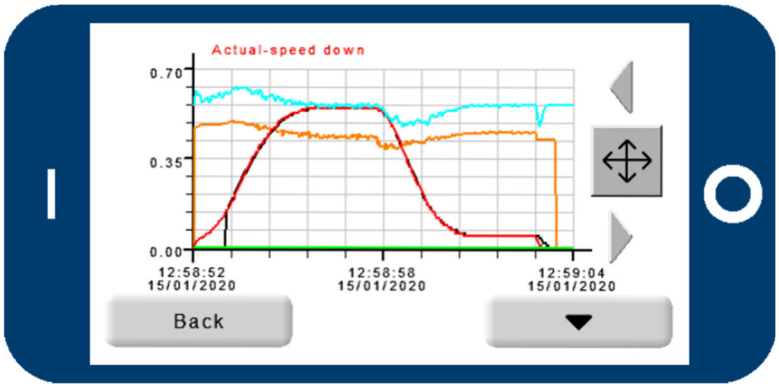
From the "**Logbook**" there are some counters to be seen giving feedback of runs, error runs and operating hours. More importantly there is access to the travel graphs when pushing the "**Last runs**" button. From there you can choose which travel graph you would like to check and analyze. Three views with different channels allow a detailed look into the travel characteristics and setup of the valve.

Right→

The trouble shooting section helps to find out about minor problems and give hints how to solve the issues yourself. The trouble shooting in the software includes the complete trouble shooting downloadable from our website and found in the manual. Read for additional information about the product and problem solving.

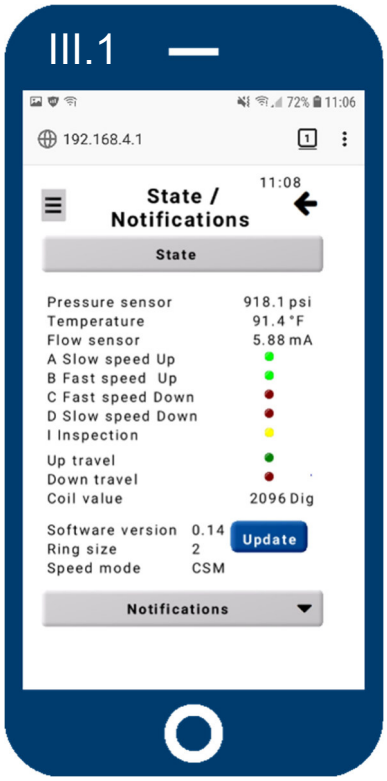






←Left

Looking at the travel graph section there are three different views to choose from.
Travel graphs give the customer and the Blain Hydraulics tech support the possibility to run system diagnostics and check for possible problems.
On the left there are two examples of travel graphs in this so called "View 1". The top figure is showing a travel in Up direction (green graph). The bottom figure is showing a travel in Down direction (red graph). The monitoring will be further explained in the **SEV** manual following section 10.

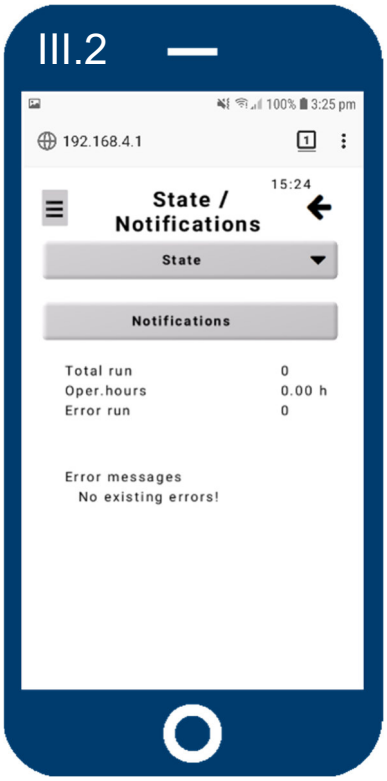


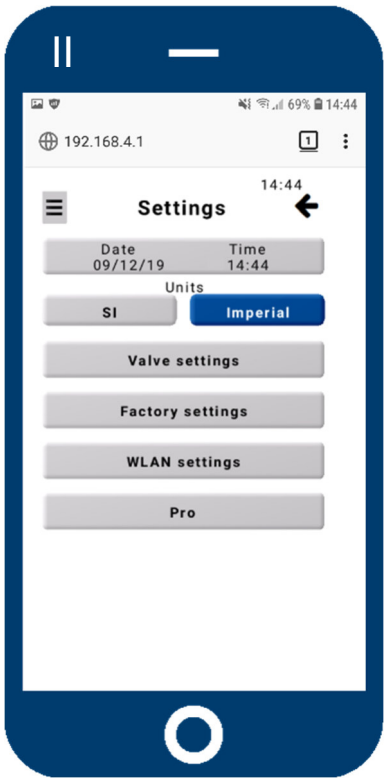
←Left

In this menu you will find the actual state of the elevator. The sensor values for pressure and temperature are displayed as well as input (A, B, C, D, I) and output (Up, Down) signals. The coil value should be around 2100 digits while traveling constantly in full or levelling speed. Furthermore there is information about the software version, the flow meter ring size and the speed mode, which can be chosen from the "**Valve settings**" menu. Using the update button will draw the new firmware from the inserted micro SD card.

Right→

Notifications inform about runs, error runs and operating hours. In case of errors they will be displayed in the error message section. Once corrected, the errors can be reset.



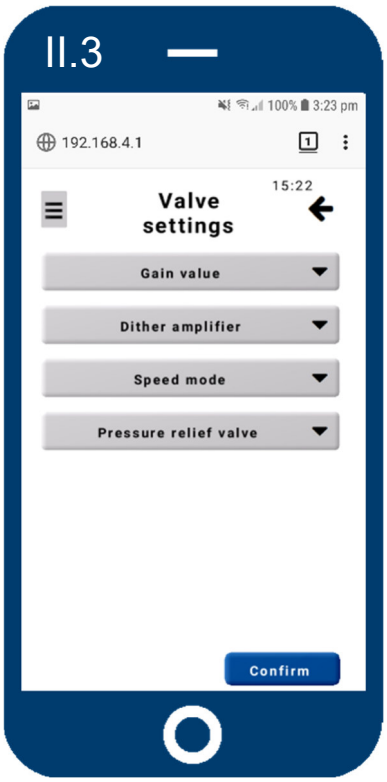


←Left

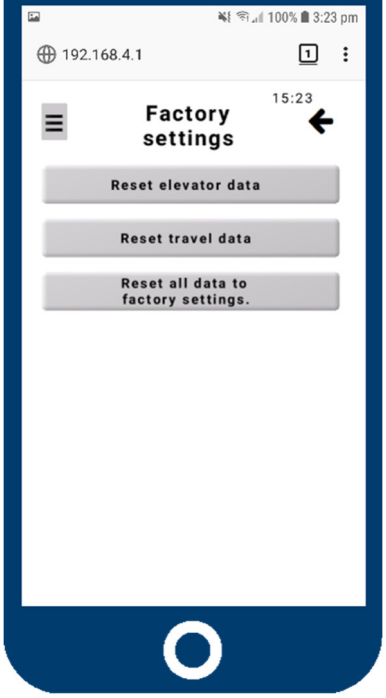
Within the settings you can change the date and time, set the units between SI and Imperial and access the "**Settings**" sub menus.

Right→

This section gives you the option to improve your travel quality in case of setup problems or wrongly chosen insert sizes. The gain value can be used to even out the problems caused by wrong insert size selection. The dither amplifier is used to get rid of vibrations experienced while travelling. Adjustments for Gain and Dither should only be done once Blain Hydraulics tech support has been consulted. Speed mode can be either set to Constant Speed Mode or Energy Saving Mode. The pressure relief valve allows a setup while receiving live feed from the pressure sensor within the system.



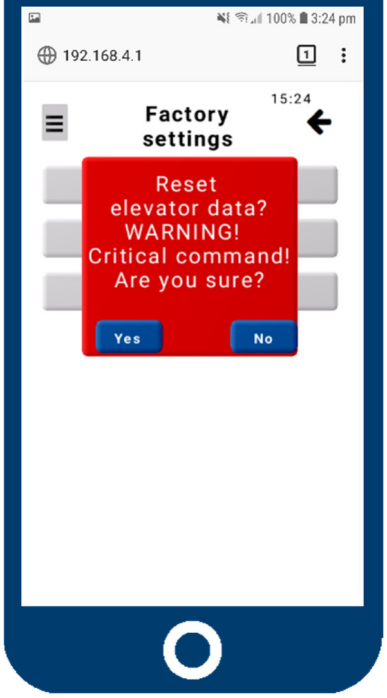
II.4



←Left

From this menu you can reset different data you previously entered and reset everything to factory settings. The factory settings are set by the OEM or Blain Hydraulics according to customer data.

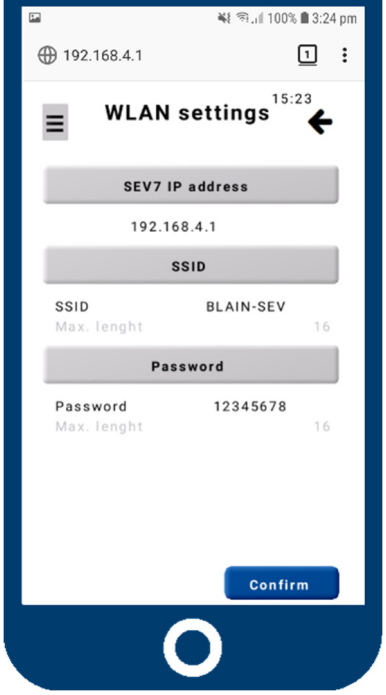
II.4a



Right→

A warning will show up when trying to reset the data to factory settings in order to avoid unintended resets.

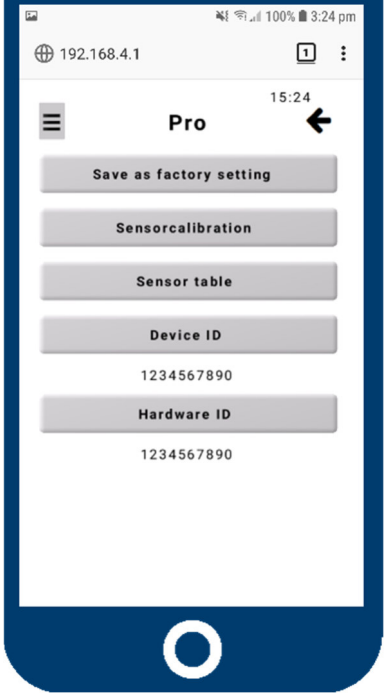
II.5



←Left

In this menu you can find the Wi-Fi settings, as well as the Wi-Fi password for the actual connection and the IP address. While the IP address is fixed, SSID and password can be changed to your liking, making it possible to customize your SEV so only you can connect and communicate.

II.6



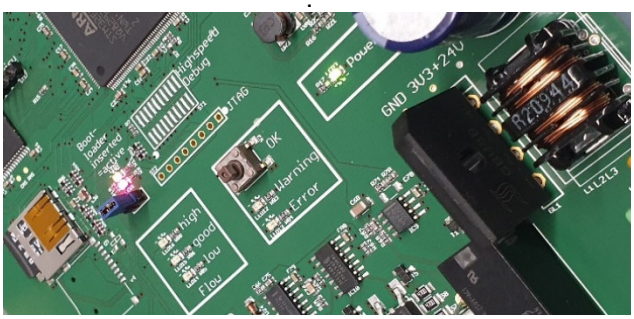
Right→

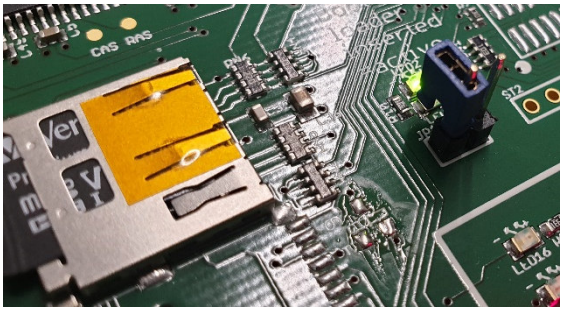
The “Pro” menu is reserved for OEM´s and Blain Hydraulics, since this menu section allows to save entered data as factory settings and change sensor values. OEMs are allowed to save settings as factory settings and change the device ID in reference to their elevator system. “Sensor calibration” and “Sensor table” as well as “Hardware ID” are for Blain Hydraulics only when setting up the valve for customers.

8.3 UPDATE

The jumper on the SEV card should bet set to bridged mode to allow the electronic card to be flashed with new firmware. A micro SD card with new firmware would be needed to upgrade the software. Disconnect the electronic card from the power supply, insert the micro SD with the new software and reconnect after the jumper has been set in bridged mode. Once the card has rebooted the led would flash rapidly as the card updates the firmware. The led would stop flashing rapidly and continue to flash slowly when the update process is complete. The update process would normally take 1-2 min.

Alternatively the software can be updated by pressing the update button in the status menu without disconnecting the power supply. The micro SD card and the jumper need to be set as well.
The jumper should be set to non-bridged mode once the update process has been completed.





Step by step guide:

1. Disconnect the electronic card from the power supply.
2. Set the jumper to bridge the 2 contacts.
3. Insert Micro SD card with new firmware.
4. Connect the electronic card to the power supply.
    a. Alternatively press the update button from the “Status menu”.
5. Wait till firmware has been successfully updated.
6. Disconnect the jumper and put it on one contact for non-bridging.
7. Connect Smart device with electronic card.

When choosing the update option within the “**Status menu**”, step 1 is not necessary.

9. ERRORS

Card Internal Relay R1 - Evacuation of passengers

Important

If there is a major fault interfering with the normal operation of the SEV card when travelling between floors, power supply to coil **A** or **C** will automatically be interrupted.

During Up travel the motor and during Down travel coil **D** (Down start/stop) remain energised unless the SEV relay **R1** signals otherwise.

*When a major fault occurs the relay **R1** on the **SEV** card switches to send and error signal to the main controller. The terminals **18**, **19** and **20** are used for error signal wiring. When **R1** relay switches, then the following emergency functions will initiate:*

- *Motor-pump combination will be switched off*
- *Coil **D** is energised to lower the car at levelling speed to the next lower floor*
- *Emergency service is being notified*

The following faults are signalled by illuminating the red LED labelled as **Error**. At the same time, the notifications section in the software menu will show the nature of the fault as follows:

Major Faults

1. Coil defect	Coil **A** or **C** disconnected or short circuited.	**Elevator stops. Relay R1 switches over.**
2. Sensor defect	Sensor disconnected, damaged or wrongly adjusted.	

After the fault has been corrected, errors 1-2 must be cancelled by pressing **OK** button on SEV Card and erased from the notifications menu.

Minor Faults

3 Supply Voltage	Power supply to the card is less than 17 V. Elevator operation continues at inspection speed.	**Elevator continues to operate. Relay R1 does not switch.**
4 Sensor feedback	The value of the sensor does not change within 8 seconds of the start signal.	
5 Sensor overflow	The value of the sensor exceeds its defined maximum value.	
6 Leveling too long	Duration of up or down levelling phase is excessively long.	
7 Overtravel	Elevator surpasses the floor level.	

Errors 3-7 do not have influence on the operation of the elevator. As long as the power supply to the SEV card is maintained, errors will be saved and the red LED will remain illuminated. The error indication can be cancelled one after the other in reversed order of occurrence (last error first) by pressing **OK** button on the SEV card or by erasing the error messages within the “notifications” menu.

10. MONITORING

The monitoring of travels have the purpose of providing easy and quick tech support, the possibility to run system diagnostics and check for possible problems.

Using the "**Logbook**" menu and selecting "**Last runs**", a list of the last saved travels will show up.

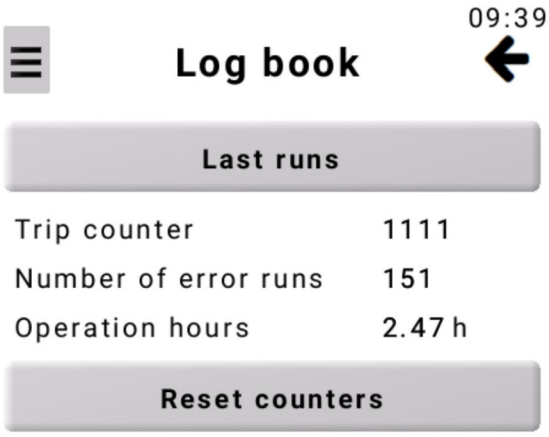


Figure 10.1

Figure 10.2

Each trip can be identified by time and date. Once a trip has been selected there are three different views to choose from. Each view will display different channels for analyzing.

View 1 is the most common and will be used by customers and Blain Hydraulics alike to analyze the travel characteristics of the elevator. Displayed are the actual and target speed values for Up and Down directions as well as the solenoid power level and the acceleration values. Examples are given below.

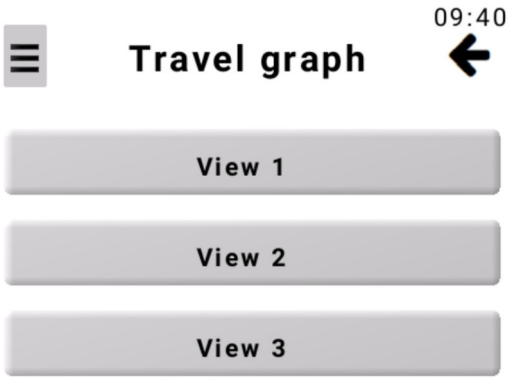
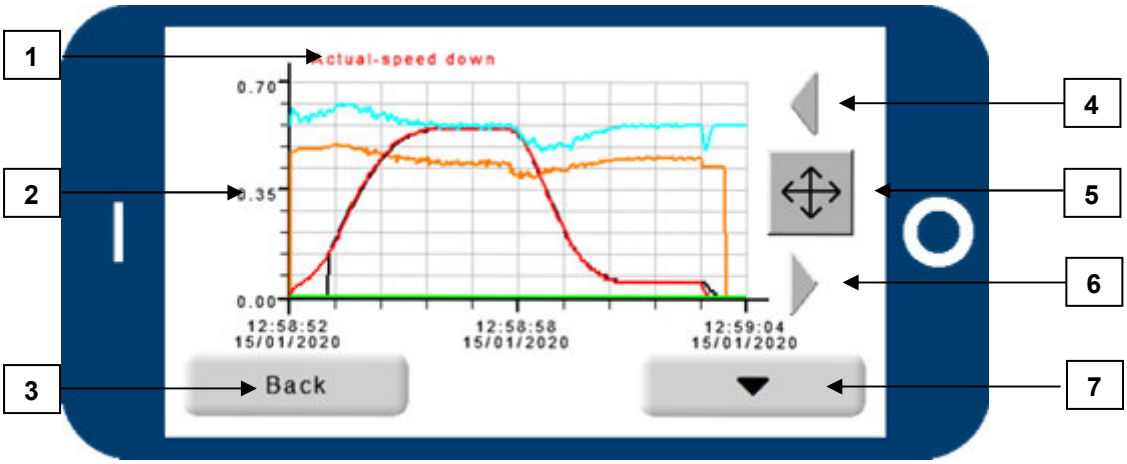


Figure 10.3

View 2 gives a more detailed look into values of the PID controller and will be used mainly by Blain Hydraulics tech support for system diagnostics. **View 3** shows the pressure and temperature changes during the travel.

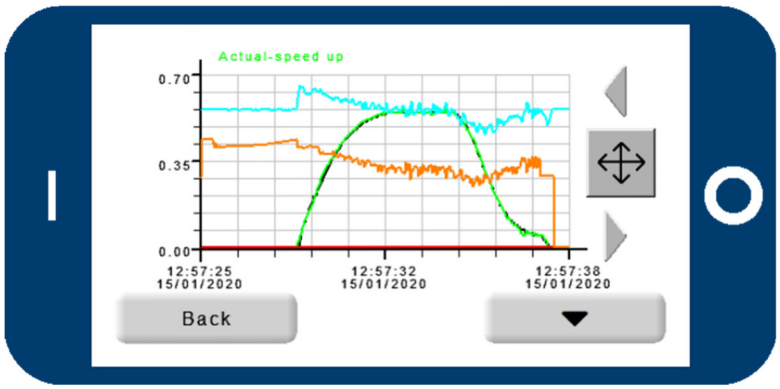
Each view has the same basic layout and buttons to fulfil the same functions.



1 – Channel
2 – Scale of selected channel
3 – Return to view selection
4 – Move left / zoom in
5 – Change between cross / lens
6 – Move right / zoom out
7 – Switch channel

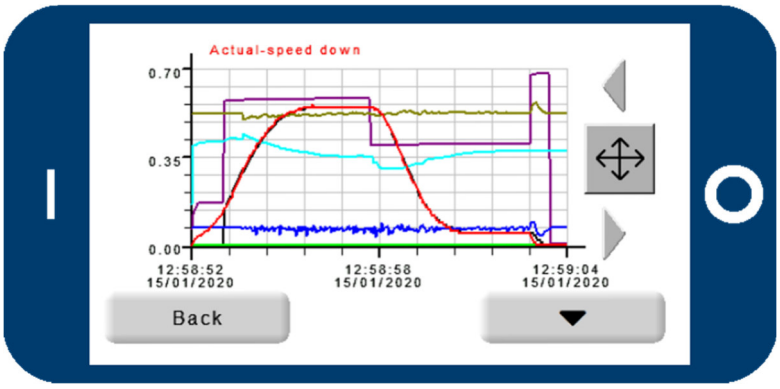
Depending on which channel is chosen (**1**) the scaling (**2**) will change automatically. Values shown on the Y-axis relate to the SI or Imperial units selected in the "**Settings**" accessible form the **"MAIN MENU**".

Pressing the "**Back**" button (**3**) results in a return to the view selection. If a cross-sign can be seen at position number **5**, then left (**4**) and right (**6**) arrows allow to move along the time axis of the graph. When the cross button is being pressed, it will turn into a lens. With the lens selected, the arrows will have a new function of zooming in (arrow left) and zooming out (arrow right). Pressing the lens again, the button will change back becoming a cross-sign. The button number **7** allows to switch between the different channels. Each view will have different channels to switch to. Depending if the travel was an Up or Down travel the green or red graph is clearly visible.



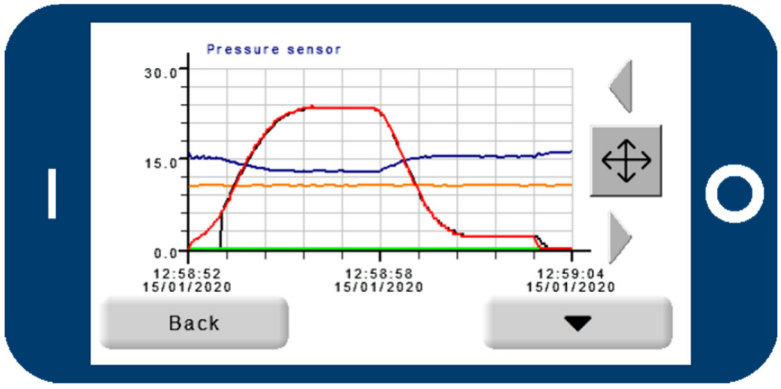
View 1 – Up travel

- Target trace
- Actual speed value Up
- Actual speed value Down
- Solenoid digital value
- Actual acceleration value



View 2 – Down travel

- Target trace
- Actual speed value Up
- Actual speed value Down
- Status
- Proportional term
- Integral term
- Derivative term



View 3 – Down travel

- Target trace
- Actual speed value Up
- Actual speed value Down
- Pressure
- Temperature

11. SELECTION CHARTS – VALVE INSERTS

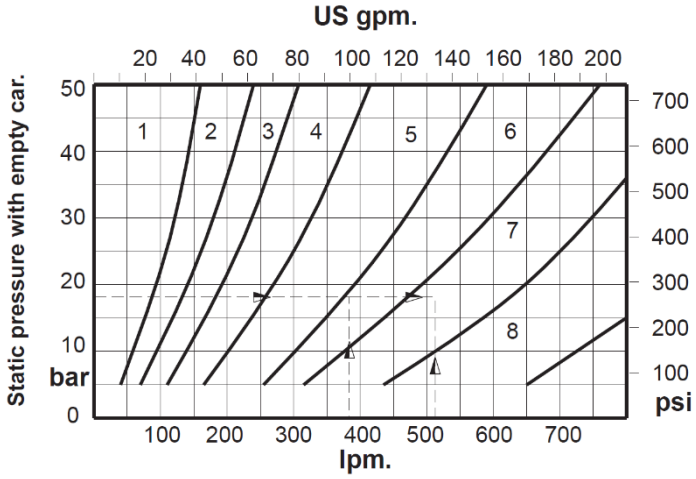
Data required when ordering:

- Pump data
- Static pressure empty car
- Static pressure with full load
- Up speed
- Down speed
- Voltage for coils
- options

Flow ring R selection

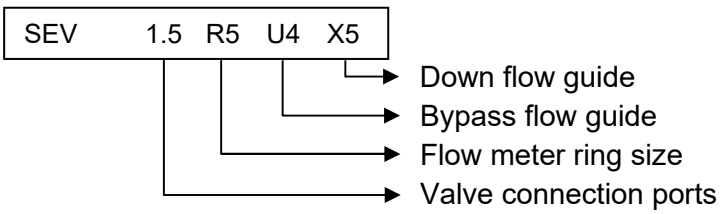
l/min	US gpm	Ring size	P, T, Z ports
40 – 75	10 – 20	R1	1” G
76 – 110	21 – 29	R2	1” G
111 – 180	30 – 47	R3	1” G
181 – 270	47 – 70	R4	1.5” G
271 – 430	71 – 112	R5	1.5”G
431 – 580	112 – 151	R6	2” G
581 – 1200	152 - 312	R7	2.5” G
Overlap	Flows 20% below these values are acceptable.		
	Flows 10% above these values are acceptable		

Flow Guide Selection Charts for Up and Down direction

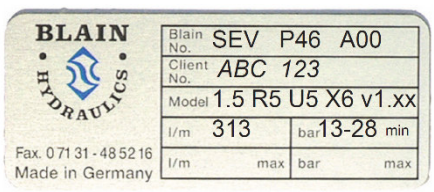


Example	
Up direction	**Down direction**
flow: 380 l/min (99 gpm)	flow: 510 l/min (133 gpm)
Static Empty Car Pressure. 18 bar (260 psi)	
Selected Bypass Valve **U**, ring size 5	Selected Down Valve **X**, ring size 6
* Overlap for valve sizes should not exceed 15%.	

Valve data plate



Example



Available options

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.

12. TROUBLESHOOTING

12.1 GENERAL ERRORS

Problem	Cause	Recommended
1. Cannot set the digital value of the solenoids **A** or **C** to 2100 PWM.	Spring of solenoid **A** and/or **C** is missing.	Insert spring.
	Needles of the solenoids **'A'** and **'C'** are swapped.	Insert the correct needles.
2. No travel in UP direction and only slow travel in DOWN direction.	Error notification on the card: sensor faulty.	Clear error and quit notification.
	No input signal to the SEV card.	Check the main controller signaling.
	Simultaneous Up and DOWN signal input on SEV card.	Check signal input and only give a signal for one direction.
3. Elevator always passes the floor level.	Elevator is travelling faster than set speed. Sensor is not correctly adjusted.	Adjust sensor correctly. Look at sensor adjustment in SEV manual.
4. Can't adjust the flow sensor to standard settings.	Sensor is faulty.	Change sensor.
	Broken spring in the flowmeter.	Change flow meter.
5. Pressure-temperature sensor not functioning or no reading on main menu.	Connection problem.	Check connection and signal input to SEV card. Change sensor if necessary.
	Sensor defect.	Flip switch Nr. 2 on SEV card to use SEV valve without p-T sensor. Change sensor (middle flange).

Table 1: Trouble shooting

12.2 UP DIRECTION TRAVEL

Problem	Cause	Recommended
1. No UP start. Elevator remains at floor level.	Coil **'A'** not energized, voltage too low.	Lift coil to check magnetic force.
	Insufficient voltage supplied to SEV card.	Voltage supplied to SEV card is 24 V DC.
	Spring preload of solenoid **'A'** not properly adjusted.	Run elevator with leveling speed in UP direction and set digital value of solenoid **'A'** to 2100.
	Solenoid **'A':** tube not screwed down tight.	Tighten solenoid **'A'** tube.
	Solenoid '**A':** needle '**AN**' and seat '**AS**' contaminated or damaged.	Clean or change needle and seat.
	Bypass flow guide **'U'** is too large.	Insert smaller bypass flow guide (flow chart).
	Pressure relief valve **'S'** is set too low.	Set relief valve higher (turn in).
	Pump running in the wrong direction.	Check motor direction, install pump correctly.
	The pump connection flange is leaking.	Seal the pump connection.
	The pump is undersized, worn or cracked.	Select bigger pump or change pump.
2. UP start is too hard.	Short delay valve is not closing.	Change short delay valve.
	Bypass flow guide **'U'** too small.	Insert larger bypass flow guide.
	O-Ring **'UO'** on bypass flow guide **'U'** is leaking.	Change O-Ring → look at SEV spare parts list.
	Star/delta motor switch period too long.	0.2 – 0.3 sec. switch time is sufficient.
	Excessive friction on the guide rails or in the cylinder head.	Cannot be eliminated through valve adjustment.
3. No deceleration into leveling speed.	O-Ring **'UO'** on bypass flow guide **'U'** is leaking.	Change O-Ring → look at SEV spare parts list.
	Deceleration time target value too high.	Set lower value for deceleration time (2.5 s)
4. Deceleration into leveling speed, but overtravel of floor level.	Deceleration time target value too high.	Set lower value for the deceleration time (2.5 s)
	Leveling speed target value too high.	Set lower value for the leveling speed.
	Deceleration signal received too late.	Change shaft switch position.
	Sudden and hard elevator stop caused by too soft setting of soft stop.	Increase setting for soft stop to make stop harder (standard: 60%).
	Target value cannot be reached, <u>because:</u> - pressure loss in the system is too big - dynamic pressure drops below 12 bar	<u>Possibilities:</u> - Use next larger insert size - Increase pressure and weight - Reduce friction in the system - Adjust deceleration time (longer) - Change position of deceleration switch
5. Vibration during the whole travel.	Bypass flow guide **'U'** is too large.	Choose smaller insert size if gain <6.
	Gain is too big (>11).	Decrease gain.
6. Vibrations during parts of the travel.	Control parameters are not optimal.	Decrease gain and respectively change P-and D- portion (slope).
7. Slow reaction of controlled variable.	Bypass flow guide **'U'** too small.	Use next larger insert size, if gain >11.
	Gain is too big.	Decrease gain (not >11).

Table 2: Up direction travel

12.3 DOWN DIRECTION TRAVEL

Problem	Cause	Recommended
1. No DOWN start.	Coil **'D'** not energized, voltage too low.	Lift coil to check magnetic force.
	Insufficient voltage supplied to SEV card.	Voltage supplied to SEV card is 24 V DC.
	O-Ring **'UO'** of down valve **'X'** leaking.	Change O-Ring → SEV spare parts list.
2. No full speed.	No input signal to the SEV card for full down speed.	Check input signals on SEV card (LEDs).
	Adjustment **'7'** closed too far.	Turn out adjustment **'7'.**
	Elevator is travelling faster than set speed. Sensor is not correctly adjusted.	Adjust sensor properly. Look at sensor adjustment in SEV manual.
3. Deceleration into leveling speed. Elevator travels through floor level.	Filter of deceleration nozzle contaminated or nozzle damaged.	Clean filter or change deceleration nozzle.
	Down leveling speed is too fast.	Turn in adjustment **'9'** to about 0.05 m/s leveling speed.
4. No deceleration into leveling speed. Elevator travels through floor level.	Solenoid **'C':** needle **'DN'** and seat **'DS'** contaminated or damaged.	Clean or change needle and seat.
	Inner O-Ring **'FO'** in flange **'7F'** is leaking.	Change O-Ring → SEV spare parts list.
5. Elevator sinks due to inner leakage	Solenoid **'D':** tube not screwed down tight.	Tighten solenoid **'D'** tube.
	Solenoid **'D':** needle **'DN'** and seat **'DS'** contaminated or damaged.	Clean or change needle and seat.
	O-Ring **'XO'** of down valve **'X'** leaking.	Change O-Ring → SEV spare parts list.
	O-Ring **'VO'** of check valve **'V'** leaking.	Change O-Ring → SEV spare parts list.
	O-Ring **'WO'** of check valve **'V'** leaking.	Change O-Ring → SEV spare parts list.
	Inner O-Ring **'FO'** in flange **'4F'** leaking.	Change O-Ring → SEV spare parts list.
	O-Ring **'HO'** of manual lowering **'H'** leaking.	Change O-Ring **'HO'** or change manual lowering.
	Short delay valve **'E'** is leaking.	Change short delay valve.
6. Deviation of target trend line during deceleration/ bandwidth too big.	Down valve flow guide **'X'** too small.	Use next larger insert size, if gain >11.
	Gain is set too low.	Increase gain if gain <6.
	Seat housing dimension is not correct.	Change seat housing.
7. Vibrations during the whole travel.	Down valve flow guide **'X'** too large.	Choose smaller insert size if gain <6.
	Gain is too big.	Decrease gain (not >11).
8. No leveling when using the manual lowering.	Adjustment **9** closed too far.	Turn out Nr. **9** to about 0.05 m/s leveling speed when using the manual lowering.
	Pressure setting of **'KS'** too high.	Turn out adjustment **'KS'.**
	Spring **9F** in adjustment **9** broken or down leveling valve **Y** blocked.	Check and clean tappet and spring, change faulty parts.
9. Leveling speed too fast when.	Tighten solenoid **'C'** tube.	Solenoid **'C':** tube not screwed down tight.
	Adjustment **'9'** opened too far.	Turn in adjustment **'9'** to about 0.05 m/s leveling speed.

Table 3: Down direction travel

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

13. FLOW – PRESSURE CHART (METRIC & IMPERIAL)

S E V

Flow - Pressure Tables (Metric)

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

SEV

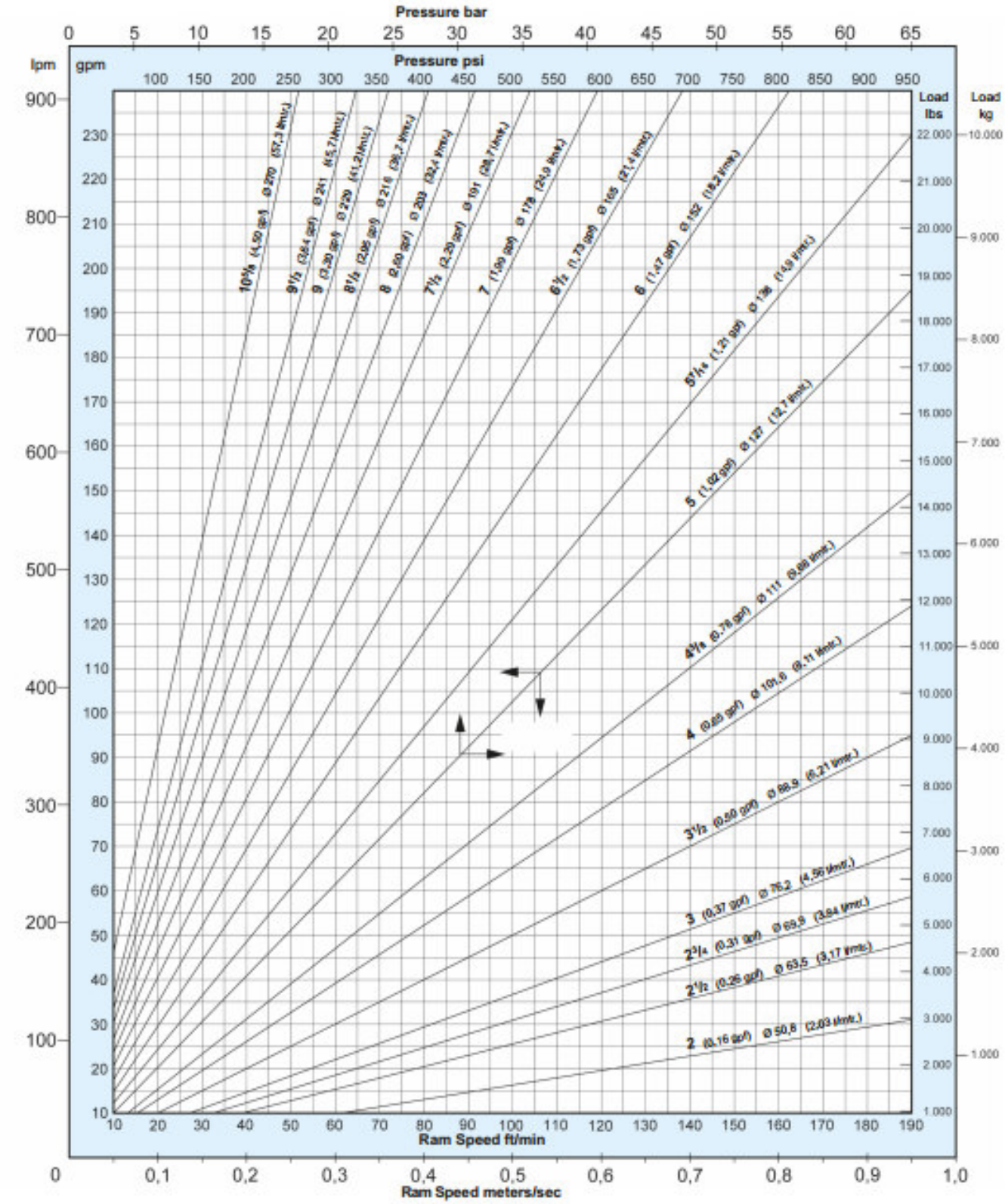
Flow - Pressure Tables (US)

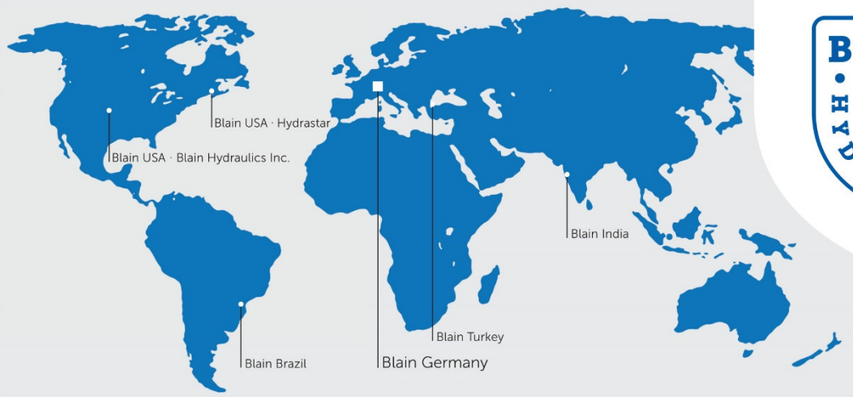
Ram Ø • Area • Speed • Flow

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
2½	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
2¾	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
3½	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
4⅜	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
4½	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
5⅞	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
5½	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
6½	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
7½	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
8½	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
9½	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
10⅝	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
2½	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
2¾	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
3½	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
4⅜	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
4½	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
5⅞	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
5½	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
6½	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
7½	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
8½	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
9½	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
10⅝	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


Pressure bar
0 5 10 15 20 25 30 35 40 45 50 55 60 65
lpm
gpm
Pressure psi
100 150 200 250 300 350 400 450 500 550 600 650 700 750 800 850 900 950
900 800 700 600 500 400 300 200 100
230 220 210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10
Load lbs
22.000 21.000 20.000 19.000 18.000 17.000 16.000 15.000 14.000 13.000 12.000 11.000 10.000 9.000 8.000 7.000 6.000 5.000 4.000 3.000 2.000 1.000
Load kg
10.000 9.000 8.000 7.000 6.000 5.000 4.000 3.000 2.000 1.000
10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 190
Ram Speed ft/min
0 0,1 0,2 0,3 0,4 0,5 0,6 0,7 0,8 0,9 1,0
Ram Speed meters/sec



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