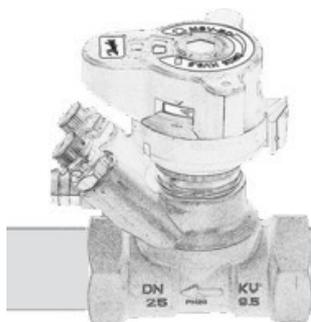


User Guide:
SBS 5000 Measuring Instrument - Standard Version



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SBS 5000 main features

- Separated main pressure unit and computing unit based on Smart Phone with Android OS connected by Bluetooth
- Possible connection up to 10 pressure units
- Accurate pressure measuring with true differential pressure sensor and 24 bit ADC
- Hydraulic by-pass for exact small differential pressure measuring

Introduction

SBS 5000 Standard has been designed to create hydraulic balance in heating and cooling systems. It enables measuring of pressure flow and temperatures in a system. Using differences in pressure, SBS 5000 is capable of turning these two pressures on both sides of a valve into flow. Flow through individual branches of the system can be measured, creating perfect balance in the whole system.

SBS 5000 Standard has a number of key features, that makes it easy to use.

SBS 5000 Standard consists of two separate units: a measuring unit for measuring pressure, flow and temperature, and a computing unit for displaying results and data analysis.

The measuring unit is extremely robust, with a sturdy frame. Inside the measuring unit is a hydraulic part with an integrated true differential pressure sensor for accurate digital data processing.

The flow meter automatically corrects the flow for different types of mediums being measured, such as antifreeze liquids in cooling systems.

- External PT-100 thermometer
- Working with projects
- Programmable autonomous recording mode
- Main unit powered by rechargeable Li-Ion battery

SBS 5000 Standard can calculate complicated multi-branch heating systems by simulating the hydraulic system with balancing calculations based on two measuring in each branch.

During balancing calculations, the SBS 5000 Standard utilises a sophisticated method for calculating hydraulic resistances within the system. As a result, the SBS 5000 Standard comes up with a proposal for the lowest energy loss. This function dramatically decreases the time required for balancing.

SBS 5000 Standard has the advantage of high class digital technology, which enables it to compensate for inaccuracies, normally associated with pressure measurements, such as temperature dependency and non-linearity. In order to increase the accuracy of low pressure measuring and to enable deaeration of the hoses, the main pressure unit is designed with incoming by-pass for hydraulic zero setting.

Introduction

(continued)

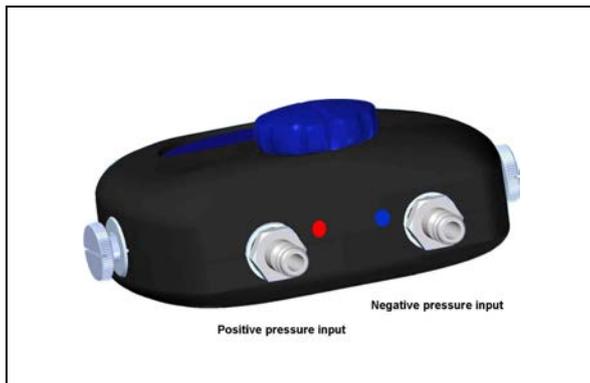
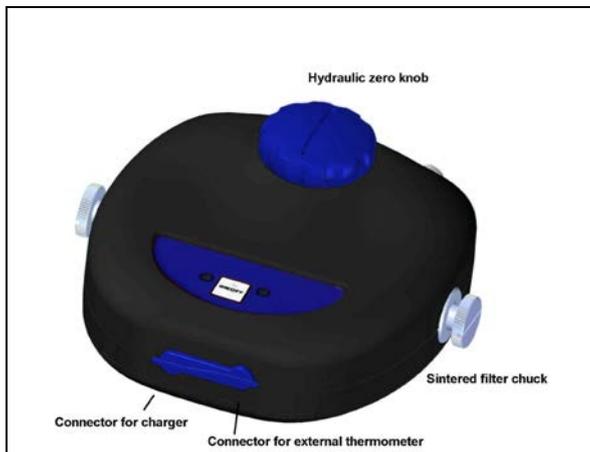
This increase the base accuracy of the measurements.

The SBS 5000 Standard can be supplemented with an external thermometer connected via a coaxial connector. The temperature of the working medium can be easily measured by inserting the thermometer into the measuring nipples of the valve, were you normally insert 3 mm measuring needles.

Specifications for the valve manufacturers are pre-programmed in the memory of the SBS 5000 Standard.

The autonomous measuring mode of SBS 5000 Standard allows independent data recording based on a pre-programmed period. The acquired data are initially saved in the measuring unit and can subsequently be analysed in computing unit.

SBS 5000 Standard components

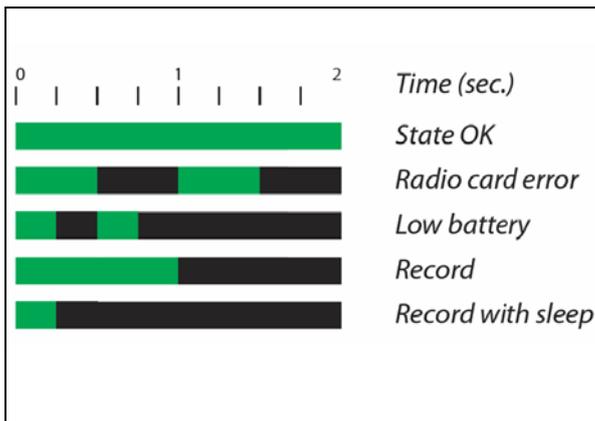


Switching on and off

1. Press ON/OFF button to switch on SBS 5000 Standard.
The measuring unit switches off automatically 60 minutes after the end of communication with Smartphone.



Introduction



Getting started

1. Smartphone has touch-sensitive display and usually three basic buttons:

Home – it serves for return to Smartphone main window.

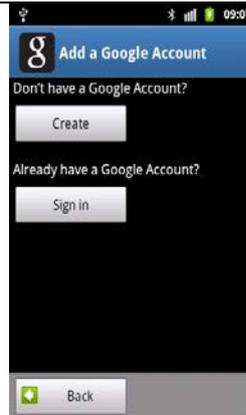
Back – it returns the current window of a back. While application is running, you can return up to the phone main window and stops application.

Menu – phone or application menu.

2. Insert SIM card to your Smartphone. Unlock SIM card by standard procedure for mobile phones.

Make sure that you have arranged internet services to your SIM card due to downloading about 50 MB of data during Smartphone activation. Next amount of data will be charged during SBS5000 application download.

3. Create Google Account.



4. Fill in requested fields.



Getting started (continued)

5. You have created Google account after some standard steps.



Installation of SBS 5000 application

1. Enter Play Store

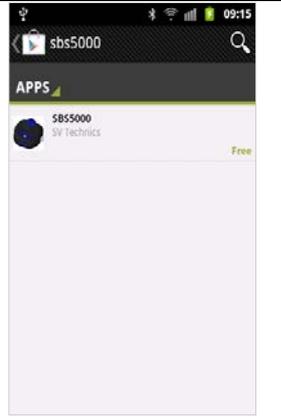


2. Search for SBS 5000 application.

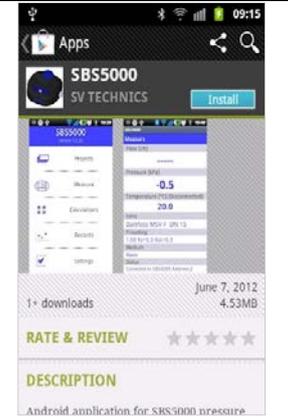


Installation of SBS 5000 application (continued)

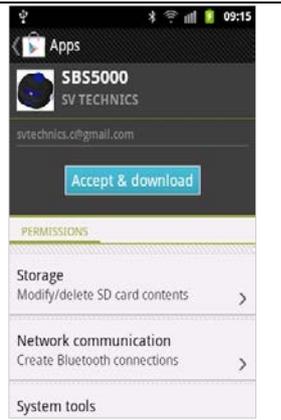
3. Choose SBS 5000.



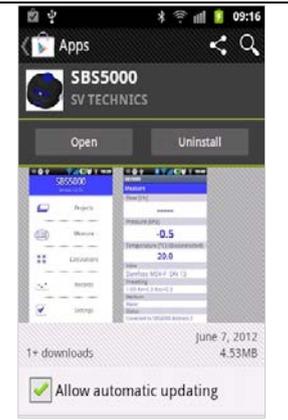
4. Click Download.



5. Continue by Accept & download

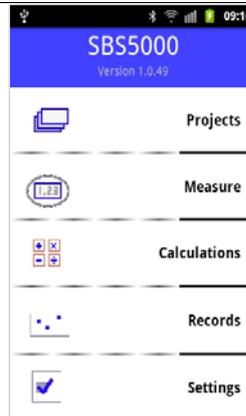


6. Continue by Open.

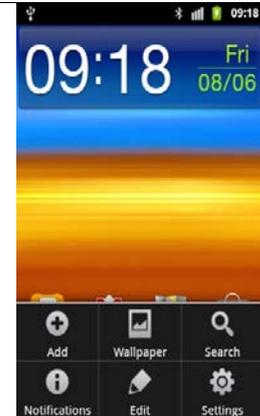


Installation of SBS 5000 application (continued)

7. SBS 5000 main menu.



8. Return to Smartphone Main Window by Back button



Delivery with Smartphone

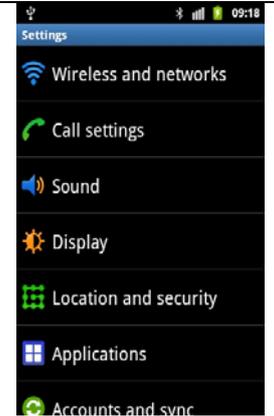
SBS 5000 application is installed on the Smartphone. You need only insert SIM card to the Smartphone and setup call and internet services.
It is necessary to create Google account, if you want later download upgrades of SBS5000 application.

Bluetooth settings

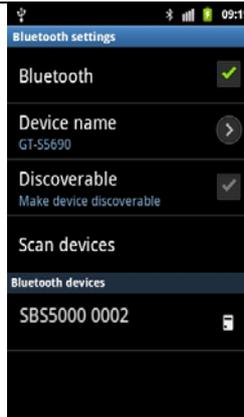
1. Enter Phone setup by Menu/Settings Button.



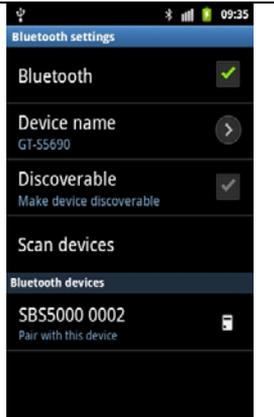
2. Enter Wireless & networks/ Bluetooth settings



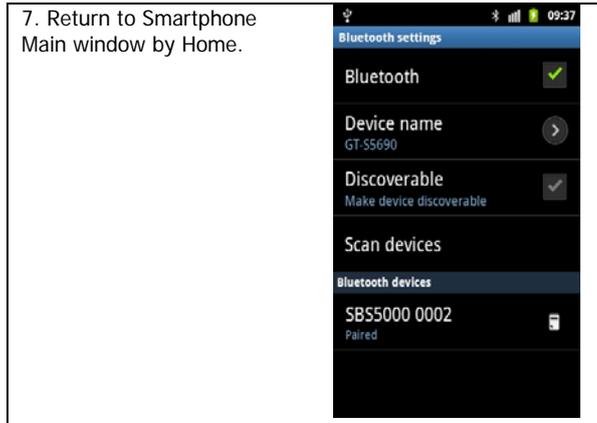
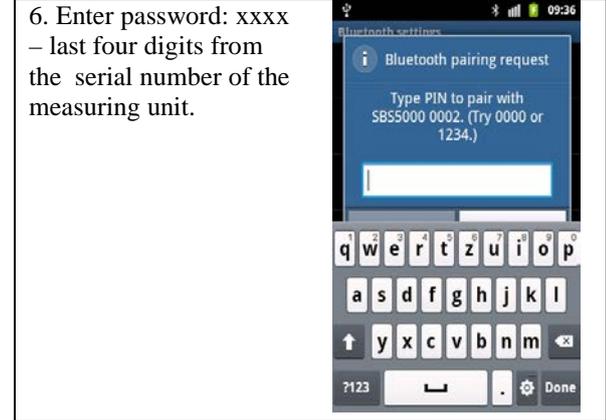
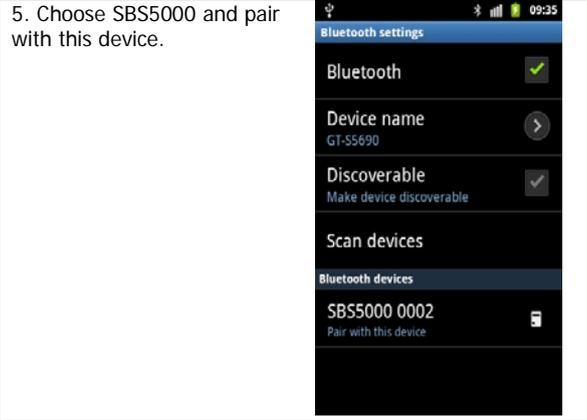
3. Switch On Bluetooth.



4. Continue by Scan devices.

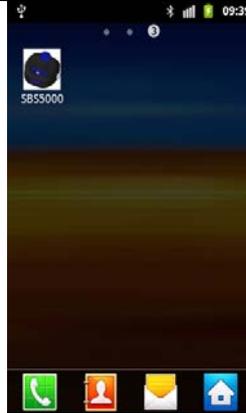


Bluetooth settings (continued)



Run SBS 5000 application

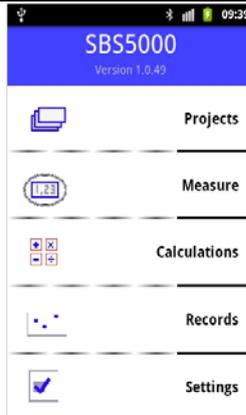
1. Enter Applications window. Tap and hold SBS5000 icon. SBS5000 application makes link on Smartphone Main window.



2. Click on the SBS 5000 application from Main window.

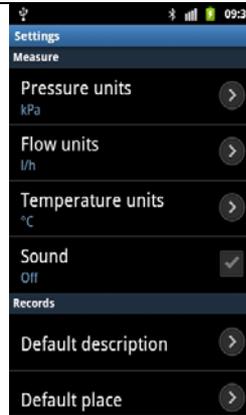


3. SBS5000 application is running.



SBS 5000 application settings

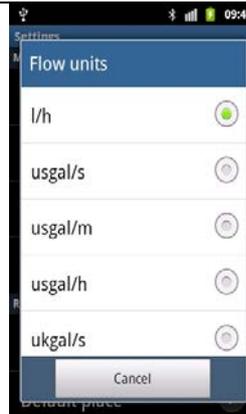
1. Enter Settings from SBS 5000 main menu.



2. Select all items by your request – Pressure Units.



3. Flow Units.

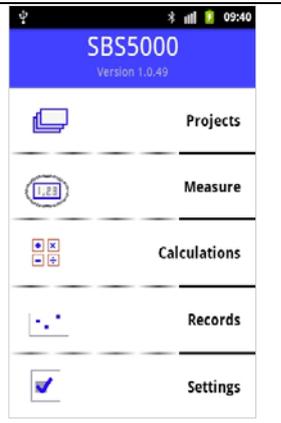


4. Temperature units.
Return back to SBS 5000 main menu.



Start of measuring

1. Enter Measure.



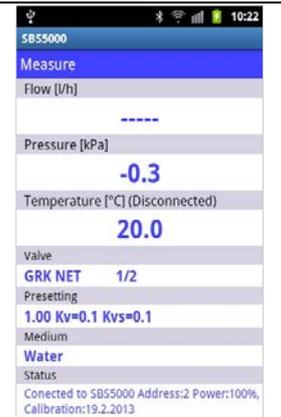
2. You need permit Bluetooth module, if you have Bluetooth module switched off.



3. Select your SBS 5000 ST measuring unit.

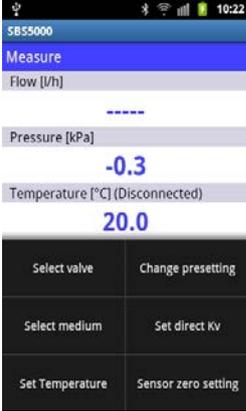


4. Measuring Main Window.



Start of measuring (continued)

5. Set your measuring to real situation by Menu phone button.



Flow [l/h]

Pressure [kPa]
-0.3

Temperature [°C] (Disconnected)
20.0

Select valve Change presetting

Select medium Set direct Kv

Set Temperature Sensor zero setting

6. Select valve:
Select Manufacturer from list box. Then select valve type and click Ok.



Select valve

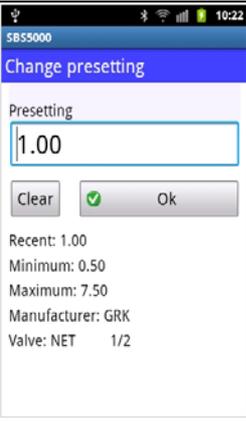
Select manufacturer
GRK

Select type
NET 1/2



Ok

7. Change valve presetting.



Change presetting

Presetting
1.00

Clear Ok

Recent: 1.00
Minimum: 0.50
Maximum: 7.50
Manufacturer: GRK
Valve: NET 1/2

8. Change medium.



Select medium

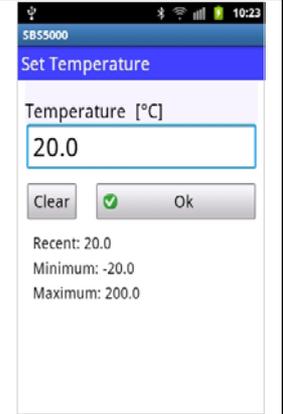
Medium
Water

Ok

Start of measuring
(continued)

9. Medium temperature:
Because the properties of the medium and thus the measured flow rate for non-freezing mediums, depend on temperature, SBS 5000 must know media temperature.

You can either enter temperature manually or measure it by SBS 5000 temperature probe.

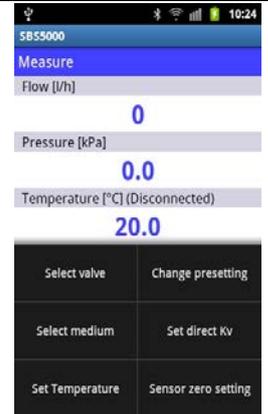


Sensor zero setting

1. Should you want to measure small differential pressures, less than 500Pa, on the SBS 5000 measuring unit should be set zero.



2. Zero setting is achieved by clicking on Sensor zero setting button.



3. Connect sensor to the system, turn zero valve to the horizontal position and continue by clicking on OK.

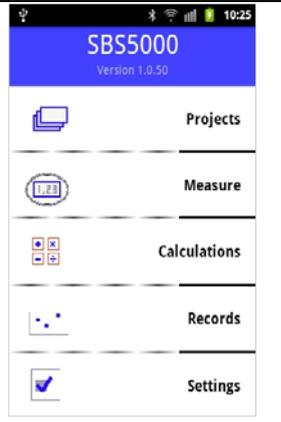


4. Turn zero valve back to the vertical position and confirm by clicking OK.

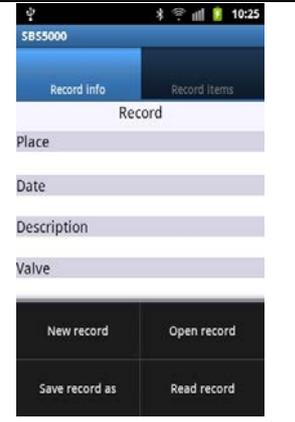


Data recording

1. Select Records in the main menu.



2. Click on Menu/New button.



3. Select recording items.



4. Select place, name, period and number of records.



Data recording
(continued)

5. Click OK. The setting will be transmitted to the SBS 5000 Standard measuring unit and recording will begin. The recording status will be indicated by SBS 5000 Standard LED.

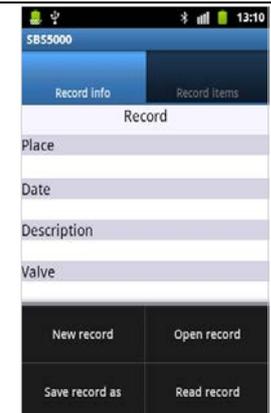
6. Clicking on New or Read button during recording will pop up a message. After your decision to stop or continue with the recording press on the YES or NO button.



7. Enter name of file for the read data. File is saved to save onto Memory card/SBS5000/Records folder.



8. Data recorded into the measuring unit can be accessed by clicking on the Read button. Clicking on the Save button will save data.



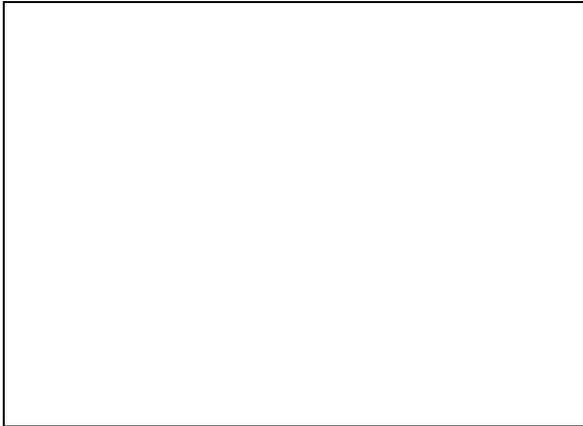
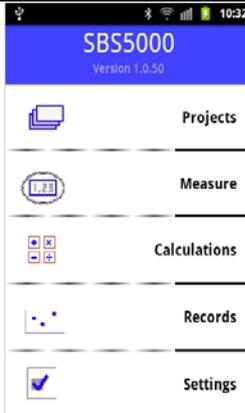
Data recording (continued)

9. Saved data can be accessed by clicking on the Open button.

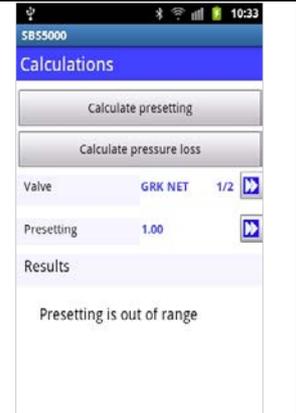


Calculation of valve presetting for a required flow in one branch

1. Click on the Calculations button in the main menu.



2. Select valve and enter the current presetting in the branch. Click on Calculate presetting button.



Calculation of the valve presetting for a required flow in one branch *(continued)*

3. Enter the required flow for the branch.

Requested flow [l/h]
10

Clear Ok

Recent: 10
Minimum: 0
Maximum: 10000000

4. Measure the current flow through the branch.

Initial flow
1

Temperature [°C] (Disconnected)
20.0

Valve
GRK NET 1/2

Presetting
1.00 Kv=0.1 Kvs=0.1

Medium
Water

Status
Connected to SB55000 Address:2 Power:100%, Calibration:19.2.2013

Save

5. Close the valve and measure the available pressure in the branch.

Pressure [Pa]
5335

Valve
GRK NET 1/2

Presetting
0.50 Kv=0.0 Kvs=0.0

Medium
Water

Status
Connected to SB55000 Address:2 Power:100%, Calibration:19.2.2013

Save

6. Presetting for the required flow will appear in the Results window. For the Presetting out of range will appear message "Presetting is out of range". It means, that is not possible to achieve the required flow.

Calculate presetting

Calculate pressure loss

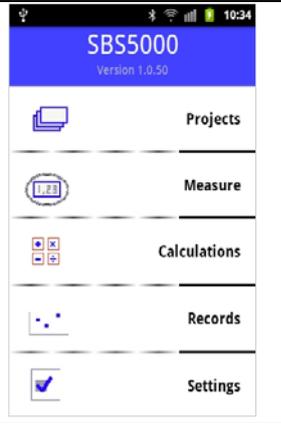
Valve GRK NET 1/2

Presetting 0.50

Results
Presetting is out of range

Calculation of the pressure loss on the valve for the required flow

1. Click on the Calculations button in the main menu.



2. Select valve and enter the current presetting in the branch. Click on the Calculate pressure loss button.



3. Enter the required flow for the branch.



4. Answer will appear in the Results window.

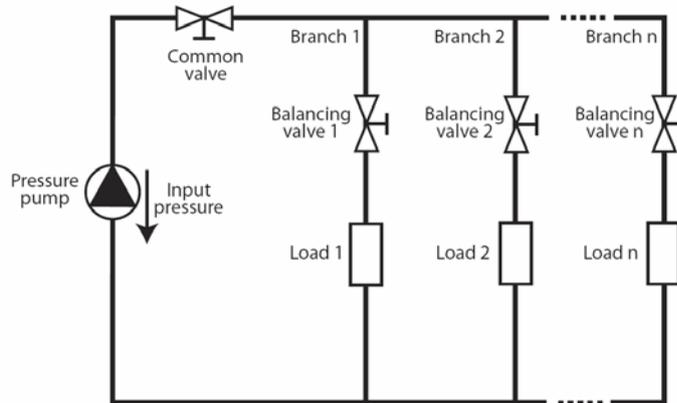


Working with the projects

SBS 5000 Standard includes a built-in module for project balancing calculations comprised of one horizontal and a maximum of 100 vertical branches. The calculation assumes that the pressure input of the project is constant and

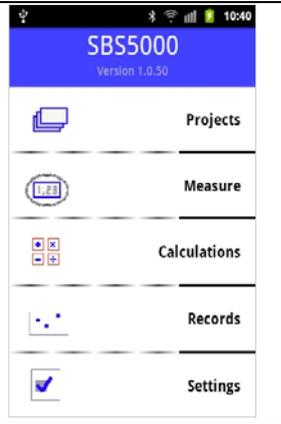
that the project is devoid of negative feedback of the hydraulic elements (for instance differential pressure regulators within branches or thermostatic valves).

Basic Project Schematic



Starting with the projects

1. Select Projects in the main menu.



2. The last project to be opened in the Project window.



Manual entry Icon



Measure Icon



Creating new project

1. Press the Menu button on the Smartphone and New. Projects are stored on the Memory card/SBS5000 /Projects folder for safety in case of system failure.



2. Enter name of the new project.



Creating new project

(continued)

3. Check Common valve box or uncheck, if it is not present in the project.



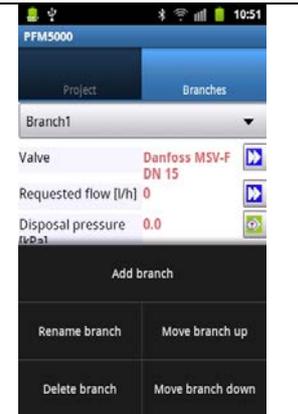
4. Select Common valve manufacturer. Fill Initial presetting of the common valve.



5. You can measure Input pressure using the Measure icon in its line. The calculated Common valve presetting can be viewed in the Presetting Window at the end of project balancing.



6. Select the Branch tab. Click on Menu/Add branch button.



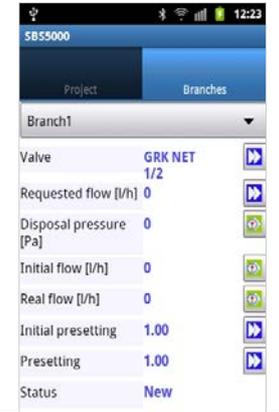
Creating new project

(continued)

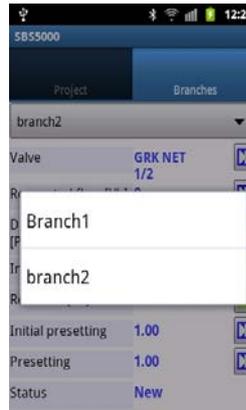
7. Fill in the Branch name, Valve, Requested flow and the Initial presetting. The other fields will be filled automatically during branch measuring or after the balancing calculation.



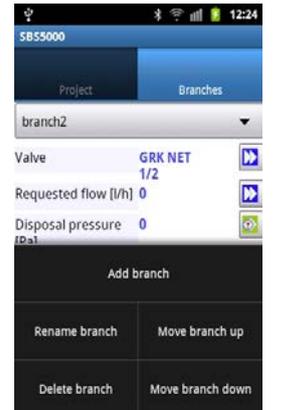
8. Similarly to the Input Initial flow add the Disposal pressure.



9. Add the rest of the branches included in the project following the above instructions. Note that the order of branches in the project must correspond to the distance of each branch from the input pressure source.



10. The correct order of branches in the project can be set by moving selected branch up or down in the project structure.



Creating new project (continued)

11. Save the project.

Preparing for the project balancing – measuring

1. Prior to measuring, the Initial presetting has to be set on all balancing valves within the project including the common valve. When re-balancing an existing or newly designed project, it is most effective to enter the actual presetting of the balancing valves within.

2. Connect SBS 5000 Standard measuring unit to the Project input pressure. Open the Project.



Preparing for the project balancing - measuring

(continued)

3. Measuring of the project input pressure.



4. Connect SBS 5000 Standard measuring unit to the balancing valve at any branch and select the appropriate branch in the Branch tab. It is necessary to measure both the Flow through the valve with Initial presetting of the balancing valve and the Disposal pressure in the branch with the balancing valve being closed. The value measured will be automatically filled in the corresponding field.



5. Measuring of disposal pressure. Close the balancing valve in the branch prior to measuring the available pressure in the branch. The value measured will again be saved along with branch data.



6. Measuring of Initial flow in branch. SBS 5000 Standard will automatically choose the correct valve and presetting according to the branch selected. The Initial flow measured will be saved along with the rest of the branch data.



Preparing for the project balancing - measuring

(continued)

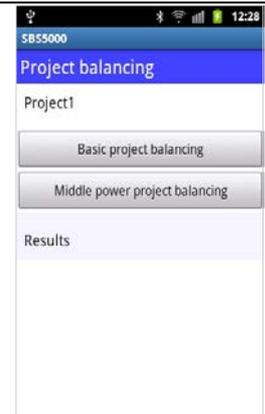
7. The project is ready for balancing after the Initial flow and Available pressure for each branch of the project has been measured.

Balancing of the basic project

1. Return to the Project tab and click on the Smartphone Menu/Balancing project button.



2. Select Basic project balancing.

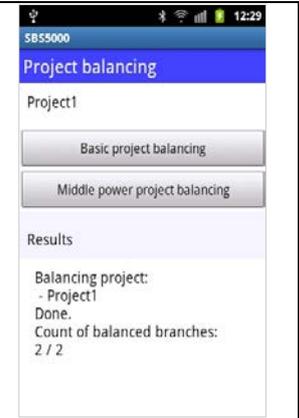


Balancing of the basic project

(continued)

3. In order to minimize the power losses in the project, SBS 5000 Standard starts balancing with a 3kPa pressure drop on the balancing valve in the last branch. Next, the non-balanced branches are optimized. If for any branch a higher pressure drop is required on the balancing valve, the computing will be restarted with an increased pressure drop in the last branch. The balancing stops when the minimum number of branches is not balanced.

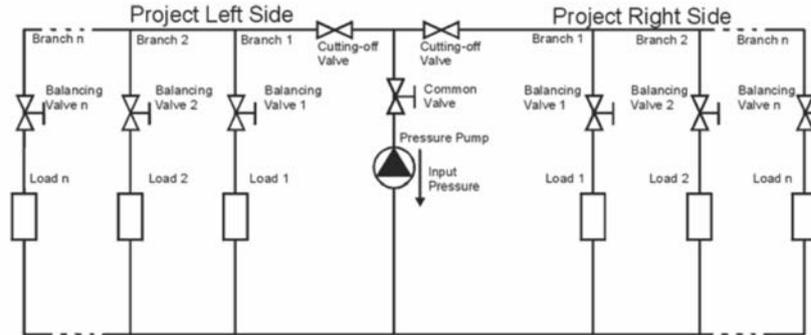
4. The result of balancing appears in the Results field in the Start Balancing window.



Project with the Central Pressure Input

We often come across systems with a central pressure input with a distribution of the medium to either side of the input. It is possible to balance such project by virtually dividing it into two separate projects with

unidirectional branch distribution. The two projects are measured and balanced individually and subsequently drawn together using the Bind Projects command as follows.



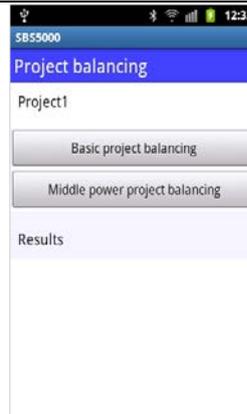
Balancing calculation of a project with central pressure input - procedure

1. Create two projects - *Left Side* and *Right Side* as described above.
2. Close the Right Side project by a stop valve.
3. Measure the Left Side project.
4. Close the Left Side project by a stop valve.
5. Open and measure the Right Side project.

6. Return to the Project tab and open one side of the middle powered project – for instance Project2 L. Click on the Smartphone Menu/Balancing project button.



7. Click on Middle power project balancing button.

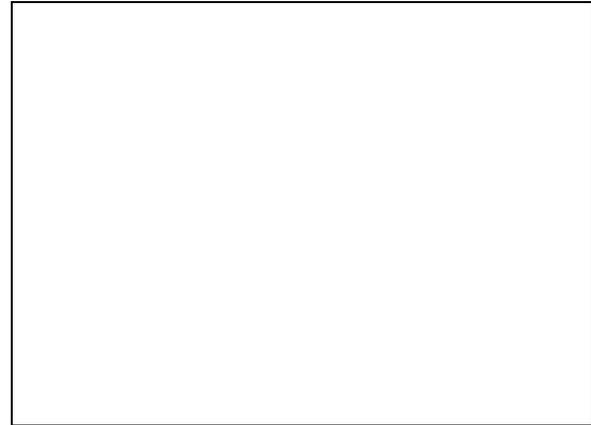
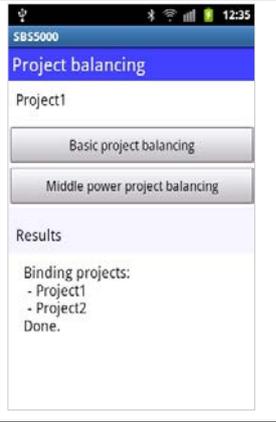


8. Open the second side of the middle powered project – Project01.



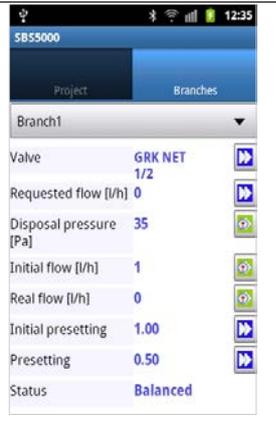
Balancing calculation of a project with central pressure input - procedure
(continued)

9. SBS 5000 Standard will balance the two projects separately. Next, it will rebalance the side of the project that requires higher pressure after the common valve. Finally, it will correct the presetting of the common valve.

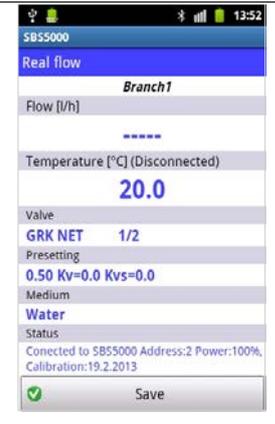


Measuring actual flow

1. Click on Branch tab and select branch to measure. Click on Measure icon at Real flow line.



2. The flow value measured will be entered under the "Real flow" parameter of the selected branch.



Replacement of sintered filters

When SBS 5000 Standard starts reacting slowly to changes in pressure or when after powering up of the measuring unit the pressure displayed exceeds 5 kPa, it is necessary to change sintered filters as shown in the picture below. If there is no improvement, please return the device to the manufacturer for servicing.



Technical specifications

Measuring unit	
Pressure range.....	0-1000 kPa ~ 0-10 bar 0-2000 kPa ~ 0-20 bar
Max. static pressure.....	10 or 20 bar
Max. over pressure.....	1200 kPa ~ 12 bar 2200 kPa ~ 22 bar
Reliability, linearity and hysteresis error.....	0.15 % of range
Temperature error.....	0.25 % of range
Static pressure effect.....	± 200 Pa
Medium temperature.....	- 5 to 90° C
Ambient temperature.....	- 5 to 50° C
Storage temperature.....	-10 to 70° C
Temperature probe.....	Pt 100 digital
Temperature measuring range.....	-20 to 120° C
Temperature measuring error.....	± 1° C
Power.....	Li Ion battery 3.6 V 950 mAh (for Nokia 6230 mobile phone)
Operating time.....	Max. 120 hours
Charging time.....	7 hours
Interface, Standard	Bluetooth
Number of records.....	Max. 3500
Dimensions (w x h x d).....	77 x 19 x 25 mm
Weight.....	620 g
Cover.....	IP 65
Calibration validity.....	12 months

Computing unit

Menu languages	11
Number of projects	20
Number of branches	60
PC interface	USB

Recommended computing unit:

Smartphone with display resolution 320x480 and above for instance:

Samsung Galaxy Ace
Samsung Galaxy Ace Plus
Samsung Galaxy Xcover S5690
LG Optimus Black P970

Supported OS Android 2.1 and above