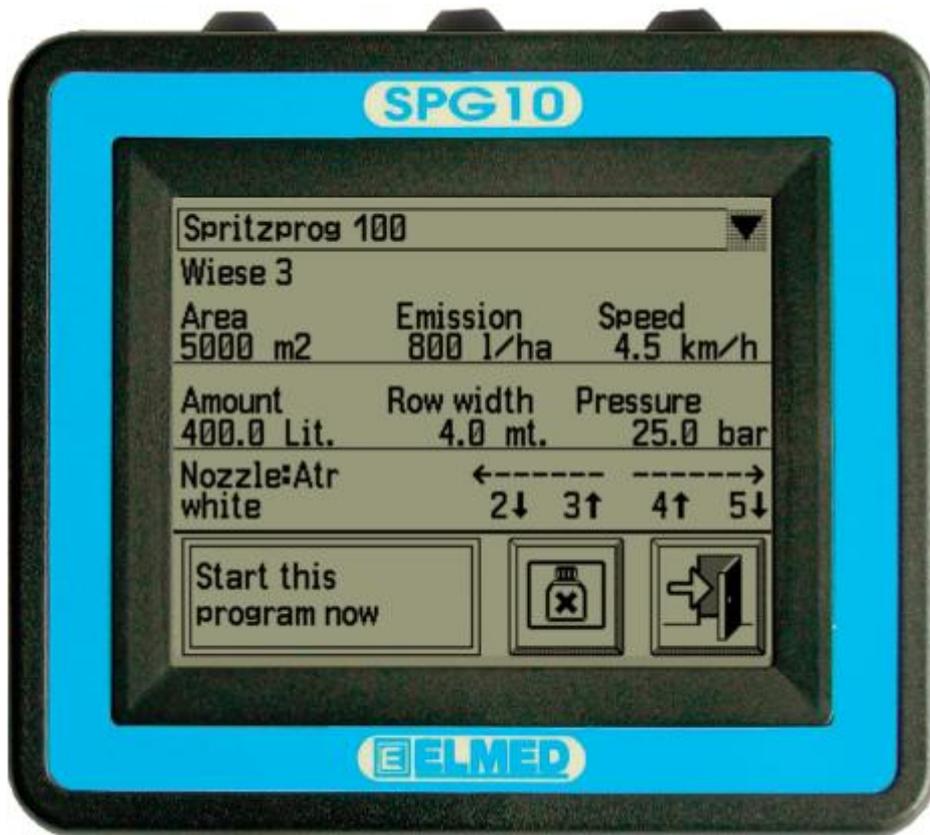


SPG10

Sprayer Computer



Instructions

Microprocessor control system
for agricultural sprayers



The SPG10 Control Unit

The **SPG10** sprayer computer is used in fruit and vine cultivation. It is used as a control and regulation device for agricultural sprayers that are designed for use with tractors.

In combination with the **SPG20** control module and all the connected sensors, the **SPG10** offers a tightly controlled spraying system for modern agriculture. There are clear economic and environmental strengths to the spraying system. The regulation aspect guarantees constant pressure through the sprayer valves and so it is easy to accurately meter the quantity of product applied and to spray the required amount.

The system consists of an operating unit (**SPG10**), the control module (**SPG20**), one valve actuator and various sensors. The operating unit has a clear **Touch Monitor** and it is fitted directly in the tractor cab. The control module is attached to the sprayer tank and it is connected to all the components of the sprayer control system. The measured nozzle pressure and tank volume values are provided by a **pressure sensor** and a **volume sensor** and transmitted to the control module.

Technical Data:

Display	Size	3.5 inches
	Resolution:	320×240 pixels (black & white)
	Backlight	white LED; 7.0 cd/m ² (type)
Touch screen	Input pin	10÷70 g
	Finger	20÷80 g
Connections	Mains supply:	12V DC power supply and RS485 serial interface
	Serial interface:	USB
Connections to the SPG-20 control unit	Volume sensor:	IDS03 spray and water resistant IP64
	Alternate motor for pump:	±12V statistically with overload protection
	Pressure sensor	Up to 0÷60bar with 4÷20mA output signal
	Speed sensor	2 wire Inductive sensor (NAMUR)
	Flow sensor	
	Valve outlets for max. 8 nozzle rings and 1 supplementary relay	For motor or magnet valves (max. 8A per outlet)
Dimensions (SPG10 without plug):		(H × B × T) 104mm × 124mm × 45mm
Power consumption (SPG10 and SPG20 with all valves switched off):		270mA @ 12V DC
 CE mark		CEE 89/336 EMC Directive CEE 73/23 Low Voltage Directive
 WEEE (en) ; RAEE (it) Disposal of electrical and electronic equipment		This device complies with the WEEE directive regarding the proper disposal of electrical and electronic equipment. Disposal in household waste is prohibited. May cause environmental damage and health problems. The unit must be disposed of by a municipal waste disposal service (e.g. recycling centre)

Safety information

⚠ WARNING! The following safety information aims to preserve the personal safety of the user and protect the equipment and working environment from possible damage.

General

- Do not attempt to repair the device yourself if you have not received appropriate training. Always fully comply with all installation instructions.
- Improper use of or interference with the device may result in damage to the device, fire or other hazards. In addition, guarantee and warranty claims will be invalidated.
- Do not insert any objects in component apertures. This may damage the device by short-circuiting the internal components.
- The device is protected against condensation and atmospheric moisture by a protective lacquer. Nevertheless, deterioration of the lacquer may cause the device to be damaged due to condensation. For this reason, if you enter a room with strongly fluctuating temperatures or atmospheric humidity, please wait until the moisture has evaporated before starting up the device.

Power supply

- Ensure that the polarity is correct before starting up the device. The correct polarity for the connecting wires is shown in the wiring diagram.
- Check the operating voltage! When the motor is running and all of the nozzle rings are switched on, the operating voltage must be over 13V. It is possible to display the voltage in the display area (→ *chapter 1.1*).
- Protect the connecting wires: do not use the lead for pulling out the plug or carrying the device. Make sure that the connecting wires do not come into contact with heat or sharp edges. Damaged connecting wires may cause fire, short circuits and electric shocks.



Cleaning

- Do not use chemical solvents for cleaning, as these may damage the plastic surface. You should also not use a pressure washer for cleaning. Any water penetration could result in damage to the device.
- Clean the display with a soft, clean cloth and water. Moisten the cloth with water and wipe the screen evenly in one direction from top to bottom. Quickly remove any remaining moisture from the display and keep it dry. Over the long term, moisture may damage the display. Do not use conventional window cleaner for cleaning the display.



Assembly

- The SPG20 control unit that is fitted to the tank must be fitted in such a way that the cable grommets point downwards to make it harder for water to penetrate.

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1 The Main Window

The main window appears after switching the computer on (Fig. 1).

The main window consists of the **button area** around the sides and the **display area** in the middle of the screen. At the top of the screen there is also a **status area**. This displays the current spray programme (three dashes (“--”) mean that no spray programme is active).

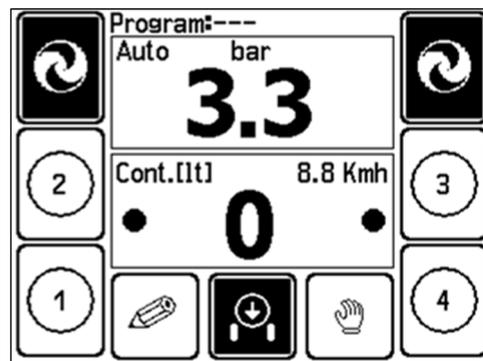


Fig. 1: Main window with 4 nozzle rings

1.1 Display area

The display area shows – in big bold figures – the pressure (above) and various measures available for selection (e.g. content, distance, speed, etc.) (below).

The top of the display area only shows the pressure:

- **Pressure:** The current pressure is shown at the top of the display area in bar. This area is also used for setting the pressure either manually or automatically. The current pressure regulation mode is indicated in the top left-hand corner of this display area by either “auto” or “man”. (→ See chapter 1.4 „Setting the pressure manually“ or chapter 1.5 “Setting the pressure automatically”).

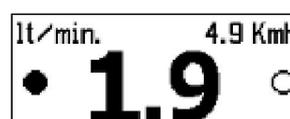


In the *bottom part of the display area* it is possible to select various measured values (content, distance, speed etc.) (by clicking in the middle of the screen):

- **Content in litres:** The content of the spray tank in litres. The display speed can be adjusted in Settings (→ Chapter 4.3) (fast when filling, slow during travel).
- **Distance [m]/[km]:** This is the distance travelled since commencing spraying*. Below 1km the distance will be given in meters (**m**), then only in **km**. Periods during which the nozzle rings are closed are not counted. The recording ends with the conclusion of the spray programme. (See also → chapter 3.5 “Starting/stopping spraying”).
- **Speed [km/h]:** The current speed in **km/h**. This also appears in smaller text above all the other measured variables selected (on the right).
- **l/ha:** The amount of spray (converted to litres per hectare) currently being applied.
- **l/min.:** The current output in litres per minutes.



If a flow meter is in use, then a ring appears above the measured quantity, which flashes when receiving a signal from the flow meter.



- **Amount [l]:** The total amount of spray in litres that has been applied since the start of the current spraying operation*.
- **Area [ha]:** Area covered since the start of the spraying operation in hectares*.
- **Voltage [V]:** The supply voltage (battery voltage). In addition, an alarm is triggered as soon as the voltage falls too low.



* A new spraying operation starts when a new spray programme starts or by resetting the counter in semi-automatic mode (→ chapter 2.1)

In the button area there are buttons for the *nozzle rings*, the *menu button*, the button for the *main switch*, the button for switching between manual and automatic pressure control, and optionally the switch symbol for the fan cover:

Nozzle rings	Menu	Fan cover	Main switch	Pressure control
 to 				 or 

The individual functions of these buttons are described in the following chapters.

1.2 Nozzle rings

  On the right and left side of the display there are numbered buttons for the nozzle rings. Depending on the number of nozzle rings that can be switched on there may be 2, 4, 6 or 8 buttons.

The buttons on the left-hand side correspond to the nozzle rings on the left side of the sprayer. Likewise the lower buttons correspond to the lower nozzle rings.

1.2.1 Nozzle ring selection

The nozzle rings are selected by pressing the corresponding button. The nozzle rings selected are highlighted with a circle. Individual rings can be deselected by pressing the relevant button again (circle disappears):



1.2.2 Switching on the left/right-hand nozzle rings

By pressing in the left or right-hand area of the content display (highlighted in blue in Fig. 2), or by using the left/right button (on top of the device), the right or left nozzle rings can be turned on or off individually. If one side is turned on, this will be shown with a solid dot (circled in red in Fig. 2).

Note: The nozzle rings can only be switch on/off when the main switch (→ chapter 1.3) has been deactivated.

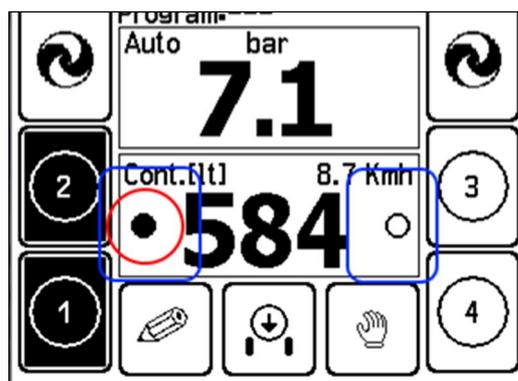


Fig. 2: Switching on left/right-hand nozzle rings



● Nozzle ring on



○ Nozzle ring off

Notes: In the case of prolonged inactivity (about 5 min. without speed, pressure and in absence of any keys being operated on the display), all valves are switched off automatically for safety reasons and in order to reduce power consumption (nozzle rings and suction). Even the display illumination is turned off. The same applies to the IDS03 volume sensor (if in place).

1.2.3 Fan cover



The two switch symbols for switching the left and right-hand fan covers on and off can be operated either manually or automatically (see also chapter 2 "Cover"). In the case of sprayers without the relevant covers, these buttons are not available.

1.2.4 Sectors in multi-row sprayers

With multi-row sprayers the individual sectors are switched on and off with the nozzle ring buttons described above, and not the nozzle rings. In the case of tunnel sprayers, the left and right sides of a sector are always turned on at the same time, even if you just click on one of the two sides.

1.3 Main switch

All nozzle rings are switched off or on again with the main switch (press on the corresponding symbol or with the middle button on the top of the device).



Main switch on,
(=nozzle rings off)



Main switch off
(=nozzle rings on)

1.4 Setting the pressure manually

In order to control the pressure manually, the manual control needs to be activated (“**Man.**” is displayed at the top left-hand edge of the pressure display, see Fig. 3). Otherwise



this must first be switched to manual control mode with the **pressure control button**.



Fig. 3: Manual pressure setting

The pressure can be reduced and increased by pressing the left or right-hand side of the pressure gauge (down or up arrows, highlighted in blue in Fig. 3).

Briefly pressing the button reduces or increases the pressure gradually. Holding the arrows increases or reduces the pressure continuously.

1.5 Setting the pressure automatically



Activate the automatic pressure gauge with the **pressure control button**. The word “**Auto**” will appear top left in the display

(see Fig. 4).

The pressure will now be regulated automatically to the given set-point or the nominal pressure required by the spray programme.

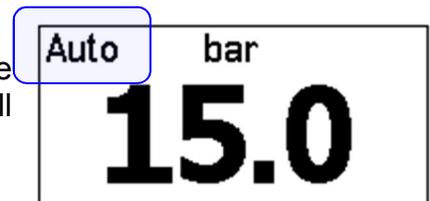


Fig. 4: Automatic pressure setting

1.5.1 Setting the nominal pressure without a spray programme:

Press in the middle of the pressure display. A window opens in which the nominal pressure can be set (fig. 5).

The value can be increased or decreased gradually using the plus and minus buttons. Alternatively, you can also set the pressure directly by sliding your finger on the bar. Then press the OK button to accept the revised nominal pressure value.

Notes: When using the automatic pressure control, i.e. **without** an active spray programme, it is very important to adhere precisely to the correct **speed of travel**. Otherwise, at too high a speed too little or at too low a speed too much spray will be applied per hectare. (→ More information on working without a spray programme can be found in chapter 2.1 “Settings in semi-automatic mode (½Auto)”).

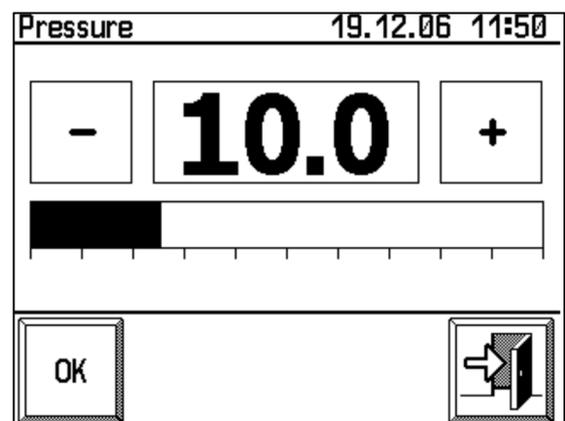


Fig. 5: Nominal pressure settings

1.5.2 Setting the pressure with a spray programme:

When the pressure is set with an active spray programme, the nominal pressure setting described above is ignored! The pressure is regulated solely by the spray programme, so that the volume of spray applied per hectare – **even if the speed is not adhered to exactly** – remains constant.

(See “Setting the pressure automatically” → chapter 3.5).

1.6 The alarm list

The alarm list can be displayed by pressing on the top edge of the screen (on "bar" or above, see Fig. 6). All active alarms are shown in this list (Fig. 7).

The following errors may be shown:

- **Battery voltage too low**

Ensure that the sprayer computer is being operated with sufficient voltage (between 12 and 14V DC). Unpredictable errors may occur if the voltage is too low. The power may also be interrupted if there is a poor connection between the power supply cable and the port (e.g. due to dirt or rust).

- **SPG10 + SPG20 versions not compatible!**

If this error occurs, then one of the devices has an out-of-date software version and needs to be updated.

- **Pressure out of range!**

This error message appears if the pressure deviates for a long period of time from the nominal pressure. This may happen, for example, if nozzles are blocked or if the nominal pressure has been set incorrectly.

- **Pressure sensor error!**

The pressure sensor is defective or not connected. Check the pressure sensor or its connections.

- **Tank volume table error!**

The tank volume table is needed to determine the volume of the sprayer tank. This error message appears if the tank volume table is damaged or no table has been assigned to the system yet. This error can be resolved by selecting a new table in the service menu.

- **Volume sensor error!**

The volume sensor is defective or not connected.

- **Speed out of range!**

The speed of travel is too high or too low to guarantee the required sprayer output. The nominal speed is specified in the spray programme. The maximum permitted speed deviation may be adjusted in System setup under "Alarm" (→ chapter 4.2 "Alarm").

- **Off-line, no connection!**

It has not been possible to establish communication with the SPG20 control module. For example, due to a missing or faulty connection to the control module.

- **Overcurrent has occurred**

The amount of current absorbed by the pressure control motor has reached the maximum value permitted. The motor will be switched off immediately until the error has been resolved. If this error occurs often, please contact the customer service. The overcurrent parameters can only be adjusted in the Service menu.



Fig. 6: Opening the alarm list

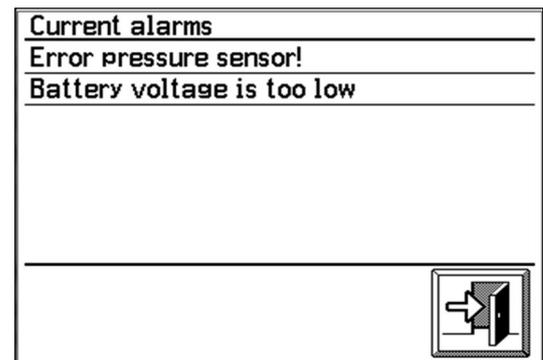


Fig. 7: The alarm list

2 Settings

Press the menu button to open the “setup” menu.

The status indicator that indicates the name of the active spray programme is located in the bottom part of the screen (Fig. 8). If no programme has been started, “----” is displayed.

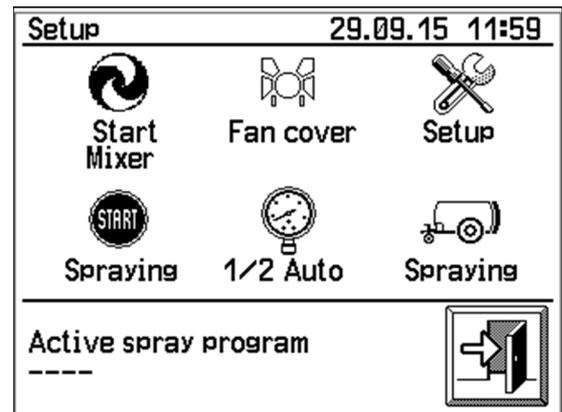
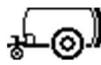


Fig. 8: Settings

 Pressing the “**spraying**” button opens the spray management menu, where new or modified spray programmes can be set up or edited. Fields or chemicals/products can be displayed, edited or added (→ chapter 3).

 Clicking the “**setup**” button opens System setup, where you can change date, time and language (→ chapter 4).

 **ON/OFF button:** This button is used to switch a supplementary relay on or off. Devices such as a stirrer, nozzle lighting etc. can be connected to this relay.

The label for this button can be freely selected (depending on the function assigned to it) and can be changed in the service menu. (→ chapter 7.1)

 **Cover:** This button is used to switch the fan cover control to automatic (the inverse of the symbol is shown and the word "auto" appears in brackets).

If at least one nozzle ring is switched on on one side in automatic mode, then the corresponding fan cover for this side is automatically switched on.

2.1 Settings in semi-automatic mode (½Auto)

If **no** active spray programme is running, so is the semi-automatic mode automatically active. It allows to work without a spray-program. In order to display all measurements correctly in the display area, the following settings need to be made:

- **Number of nozzles**

The number of nozzles for each nozzle ring is shown separately in the top part of the screen (order is clockwise, starting with the bottom left nozzle ring).

To adjust the number of nozzles, press this top area and a window will open (Fig. 10), where the position of the nozzle rings with the number of nozzles is displayed in graphic form (bottom left to bottom right). Press one of the nozzle rings (=selection fields) to define a new number of nozzles.

- **Row width**

Enter the row width in meters.

- **l/ha** (optional)

The quantity in litres per hectare to be applied.

If the check box in the “l/ha” window is checked, then by clicking on the **Sprayer output** field (a small distance from the check box), the desired quantity can be entered using the number keypad. With this setting, it is also possible in semi-automatic mode to regulate the pressure in the event of changes to the speed of travel.

- **km/h**

The target speed of the sprayer during spraying is entered here in km/h. (Small deviations in speed are taken into consideration as the vehicle is moving and compensated for automatically).

Note: When the speed limiter function is active, then the value entered here (minus 0.2 km/h) is used as the threshold value. (For more information see Setup → chapter 6.8 “Minimum speed”)

- **Pressure in Bar:**

The working pressure calculated by the programme is displayed. The value cannot be adjusted. If you wish to change the pressure, the above-mentioned parameters must be changed.

- **Nozzle type**

The type of nozzle used (**ATR** or **ISO**) can be selected in the corresponding selection box (under “Nozzles, right”, Fig. 9). The nozzle colour can be chosen in the preceding field.

Fig. 9: Settings for semi-automatic mode

Fig. 10: Selecting the number of nozzles

- **The distance, content and area buttons**

The three buttons for “Dist. = 0”, “Liter = 0” and “Area = 0”, can be used to reset the counters for the display in the main window for distance, amount (litres) and area to 0 (see also chapter 1.1 → distance [m]/kmh], content [l] and area [ha]). Useful before starting a new spraying operation without a spray programme.

Notes: Spraying operations are not recorded in semi-automatic mode and are therefore also not available for statistical purposes or for evaluation on the PC.

3 Spray Management

Spray programmes can be created and edited in Spray Management. These are required for starting a spraying operation in automatic mode. A spray programme is started using the Start button in the "Setup" menu (see also → chapter “3.5 Starting/stopping spraying”). The fields and chemicals/products involved can be managed here too. Moreover, the spraying operations recorded to date can be viewed in the statistics.

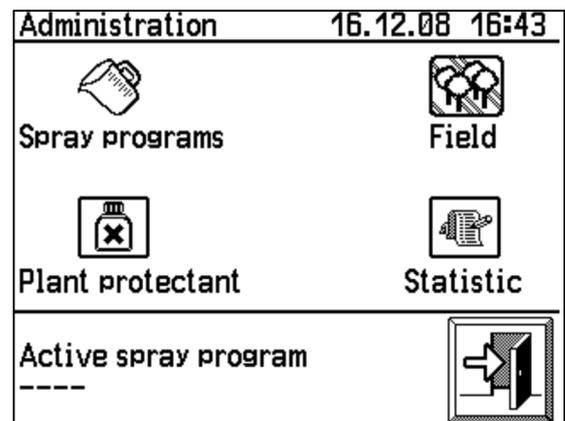


Fig. 11: Spray management

Creating a spray programme

1. Set up a **field** (→ chapter 3.1) in the Field Management menu.
2. In the Spray programme menu (→ chapter 3.2) press on the pencil button. This will enable you to access the “Spray programme management” menu (→ chapter 3.1.4) where you can create a new spray programme.
3. Once you have returned to the Spray programme menu, you will be able to select the desired programme and allocate it to a field (see → chapter 3.1.1)
4. As soon as the desired programme has been allocated to a field, you can proceed with programming the spray programme. (→ chapter 3.1.2).
5. Save the programme with the “save” button.

Summary:

- **Field** (→ chapter 3.1)
- **Spray programmes** (→ chapter 3.2)
 - **Page 1: (Programme and field selection)** (→ chapter 3.2.1)
 - **Page 2: (Programme settings)** (→ chapter 3.2.2)
 - **Page 3: (Selecting the chemical/product)** (→ chapter 3.2.3)
- **Chemicals/Products** (→ chapter 3.3)
- **Statistics** (→ chapter 3.4)

3.1 Field



The “**Field management**” menu (accessed via spray management) is where all of the fields that are needed for creating the spray programmes can be created and edited. Fields can also be edited on the PC using the SPG10 software.

Field selection

The name of the field is displayed in the top part of the screen. Pressing on this area opens a selection window where another (existing) field can be selected. Alternatively, you can switch between fields with the arrow keys.

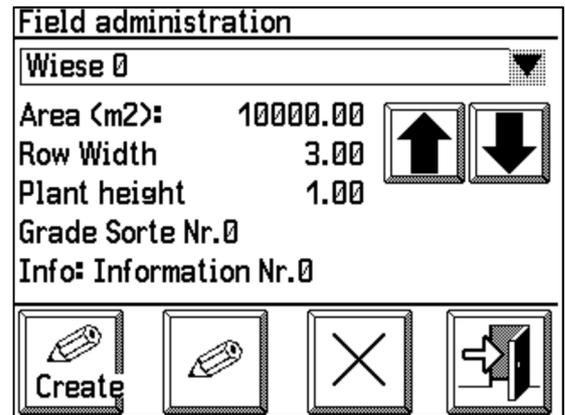


Fig. 12: Field management

Editing parameters

Simply press one of the five lines (area, row width, plant height, variety or info). The data to be amended can be amended with the input window now opened.

- **Area (m²)**
Enter the field size in square meters here.
- **Row width**
Enter the row width in meters here.
- **Plant height**
Enter the plant height, also in meters.
- **Variety**
All the varieties planted in the field can be entered here.
- **Info**
Any text/note of your choice can be entered in the information line.



Create a new field

As soon as you click on the “New” button a new field is created with the name “New”.



Change field name

One press of this button opens the input field where the name can be changed.



Delete field

Press the delete button to delete a field. If the confirmation prompt is confirmed with OK, the field will be irrevocably deleted.

3.2 Spray programmes



Existing programmes can be viewed or edited in the “spray programmes” menu, and new spray programmes can also be created or even deleted. In general, it is recommended just to change little things. The programmes can be managed much more comfortably on the PC, with the help of the SPG10 software.

The “spray programmes” menu consists of 3 pages, which can be scrolled through with the next and back arrows. They are described individually in the following 3 sub-sections:

Program	Field
Spritzprog 100	Wiese 3
Grade:Sorte Nr.3	
Info:Information Nr.3	
Width:4.0 mt.	Height:3.0 mt.
Amount:	750.0 Lit.
Emission: 33.8 l/min	1500.0 l/ha
Pressure: (25.0) ***	25.0 bar







Fig. 13: Spray programmes - page 1

3.2.1 Page 1: (Programme and field selection)

First of all the programme to be viewed or edited must be selected in the programme box (Fig. 13, top left). To do this press on the relevant area. A list appears. (Fig. 14), where you can choose the desired programme. Confirm with the OK button. (If you wish to apply a new programme, create it first, see → chapter 3.2.4).

Select program

Spritzprog 100	↑
Spritzprog 98	
Spritzprog 96	
Spritzprog 94	
Spritzprog 92	




OK



Fig. 14: Drop-down list

Each programme is assigned a field which is displayed in the field area (Fig. 13, top right). Press in the relevant area to select another field. (To edit fields or create new ones see → chapter 3.2.4). The most important parameters of the field selected are shown under the two selection areas. (Fig. 13): variety, row width, plant height.

Below are those values that can be calculated using the selected field and settings on page 2 and 3:

- **Water application in litres required for the spraying operation**
- **The expected water output in “litres per minute” and in “litres per hectare”**
- **And the necessary working pressure in bar**

If **3 stars (***)** also appear in the “working pressure” line, this means that the recommended nozzles have not been selected for this pressure (nozzle selection → chapter 3.1.2).



Please make sure that all your changes are saved by pressing the “save” button.

3.2.2 Page 2: (Programme settings)

Depending on the device settings, for the second page there are two different input options (standard and SBR). Which of the two options are applicable can be ascertained from the parameters to be entered:

- **Standard option** (→ *chapter 3.2.2.1*)
with the following inputs: area, application quantity and speed. (see Fig. 15)
- **SBR South Tyrol option** (→ *chapter 3.2.2.2*)
with the following inputs: area, concentration, water required and speed. (see Fig. 17)

3.2.2.1 Standard option

The window with the “*standard option*” programme settings only appears if the check-box for “Calculation by *SBR South Tyrol option*” is **disabled** in the Service menu (→ *chapter 7.1*). Otherwise please follow the instructions in the next chapter (→ 3.2.2.2).

The following parameter can be set:

- **Number of nozzles**
The number of nozzles in each ring is shown individually in the top part of the screen (in clockwise order, starting with the bottom left ring).
To adapt the number of nozzles press this top area and a window will open (Fig. 16), where the position of the nozzle rings with the number of nozzles are shown in graphic form (bottom left to bottom right). Press one of the nozzle rings (=selection fields) to define a new number of nozzles.

In the case of multi-row sprayers, just the number of nozzles per sector needs to be indicated.

- **Area**
The area to be worked is taken from the data for the assigned field. It can be adjusted individually here.
- **Application rate**
The amount in litres per hectare to be applied.

Fig. 15: Spray programmes - page 2

Fig. 16: Selecting the number of nozzles

- **Speed**

This is where the recommended speed that should be adhered to when driving with the sprayer is displayed in km/h. (Small deviations in speed are taken into consideration as the vehicle is moving and compensated for automatically).

Note: When the speed limiter function is active, then the value entered here (minus 0.2 km/h) is used as the threshold value. (For more information see Setup → chapter 6.8 “Minimum speed”)

- **Nozzle-type**

The type of nozzle used (**ATR** or **ISO**) can be selected in the corresponding selection area (Fig. 15). The nozzle colour can be chosen in the neighbouring area. The recommended nozzle colour indicated beneath is determined using the spray programme settings.

3.2.2.2 SBR South Tyrol Option

The window with the “**SBR South Tyro option**” programme settings only appears, if the check-box for the “Calculation by SBR South Tyrol option” is **activated** in the Service menu (→ chapter 7.1). Otherwise follow the instructions in the previous chapter (→ 3.2.2.1).

The following parameters can be set:

- **Number of nozzles**

The number of nozzles in each ring is shown individually in the top part of the screen (in clockwise order, starting with the bottom left ring).

To adapt the number of nozzles press this top area and a window will open (Fig. 18), where the position of the nozzle rings with the number of nozzles are shown in graphic form (bottom left to bottom right). Press one of the nozzle rings (=selection fields) to define a new number of nozzles.

- In the case of multi-row sprayers, just the number of nozzles per sector needs to be indicated.

- **Area**

The area to be worked is taken from the data for the assigned field. It can be adjusted individually here.

- **Concentration**

The spray concentration can be set here (1 to 30).

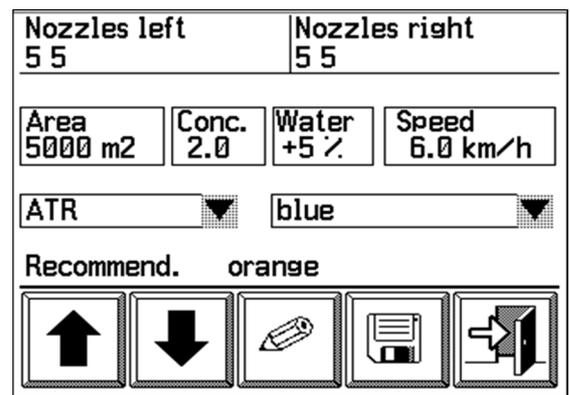


Fig. 17: Spray programmes - page 2

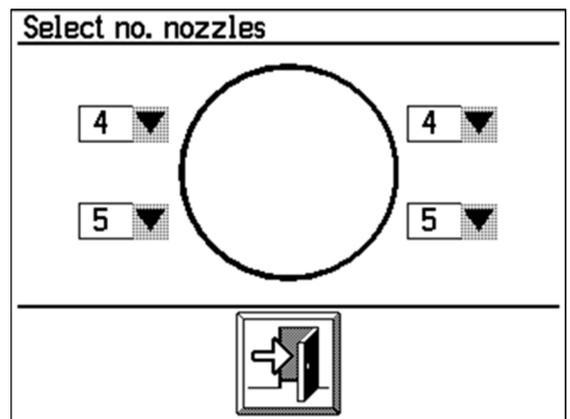


Fig. 18: Selecting the number of nozzles

- **Water application deviation in percent**

Depending on the existing plant system it may be necessary to adapt the water application rate. Enter the deviation in percentage points (-50 to +50%).

Plant systems with recommended deviation:

0% = single row	30% = bed planting
10% = double row	-10% = palms
20% = triple row	

- **Speed**

This is where the recommended speed that should be adhered to when driving with the sprayer is displayed in km/h. (Small deviations in speed are taken into consideration as the vehicle is moving and compensated for automatically).

Note: When the speed limiter function is active, then the value entered here (minus 0.2 km/h) is used as the threshold value. (For more information see Setup → chapter 6.8 “Minimum speed”)

- **Nozzle-type**

The type of nozzle used (**ATR** or **ISO**) can be selected in the corresponding selection area (Fig. 15). The nozzle colour can be chosen in the neighbouring area. The recommended nozzle colour indicated beneath is determined using the spray programme settings.

3.2.3 Page 3: (Selecting the chemical/product)

The chemicals/products used for the spraying operation are entered on the last page.

Up to 5 chemicals/products may be selected. For each chemical/product used the required (= max. recommended) quantity per hectolitre is displayed in grams alongside (may be amended by pressing on the corresponding number). The final number is the absolute quantity necessary for the field to be worked.

No. protectant	g/ha	Tot.[g]
1. ----	150.0	75
2. Wirkstoff 0	151.0	75
3. Wirkstoff 1	152.0	76
4. Wirkstoff 2	153.0	76
5. Wirkstoff 3	154.0	77







Fig. 19: Spray programme – page 3

3.2.4 Spray Programme Management



To delete, copy or create programmes press the button for managing the spray programmes the “spray programmes” menu (in the middle of the button area, Fig. 13 & 15 or 17 & 19). A new window opens (Fig. 20) with the following four buttons:

Administration spray programs

Create new program	Edit program name
Copy program	Delete program



Fig. 20: Spray programme management

- **Create new programme**

Press this button to create a new programme.

A name is suggested for the new programme in the window that now opens. This can be amended by pressing on it.



The new programme is then saved with the “save” button.

- **Edit programme name**

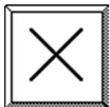
Select the programme whose name you wish to change. The name can be changed in the field below. Since every spray programme is assigned to a field and at least one chemical/product, it is recommended that the names should be chosen so that the field and type of spraying operation can be recognized, e.g. “Home meadow scab treatment”.

- **Copy programme**

The programme to be copied is selected in the “source” box in this window (Fig. 21) and the programme to be overwritten is selected in the “target” box. The programme in the target box is overwritten by pressing the arrow key. If you do not wish to overwrite an existing programme, simply create a new programme with the “new” button.

Fig. 21: Copy programme

- **Delete programme**

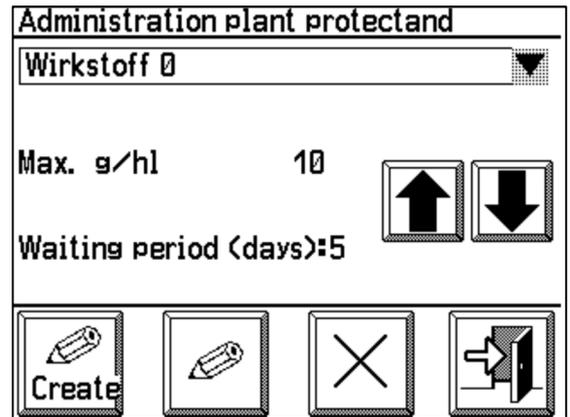


Any programme selected in the list can be deleted with the “delete” button. Once the confirmation prompt has been confirmed with OK the programme will be irretrievably deleted.

3.3 Chemicals/Products

 The individual chemicals/products can be displayed and edited in Chemical/Product Management. A chemical/product can be selected using the selection window or with the two arrow keys.

- The **maximum amount per hectolitre** in grams that should not be exceeded for this chemical/product appears under the chemical/product selection. The maximum value can be adjusted by pressing this line.
- The **waiting period in days** is safe period of time between treatments prescribed under integrated plant protection. This value is solely for information purposes and can also be amended by pressing on it.



Administration plant protectand

Wirkstoff 0

Max. g/hl 10

Waiting period (days):5

Create

Fig. 22: Chemical/product management



Create new chemical/product

A new chemical/product with the name "New" is created by pressing the "New" button.



Change name of chemical/product

The edit button opens the input field where the name can be changed.



Delete chemical/product

A chemical/product can be deleted with the delete button (after confirmation prompt).

3.4 Statistics

The statistics section is where the recorded spraying operations are stored and remain until they are transferred to the PC or deleted individually using the delete button.

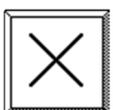
One spraying operation is displayed per window. The next or previous spraying operation can be displayed using the arrow keys. The total number of all spraying operations recorded is shown in the status bar (top right).

The date indicated for each spraying operation corresponds to the date on which the spray programme started.

Sprayings		2/7	
Program:	Hausacker Schorf		
Field:	Hausacker		
Date:	17.12.2008 14:44:39		
Amount:	5148 lt	Dist.:	2072 mt
l/ha	375 l/ha	Conc.	2.0 x
Width	2.5 m	Height	1.5 m
Area:	6000 m2	Speed	5.0 kmh

↑ ↓ × ↗

Fig. 23: Statistics



Delete individual records

Individual records can be deleted using the delete button. After the confirmation prompt, they will be irrevocably deleted and can thus no longer be transferred to the PC.

3.5 Starting/stopping spraying

  To work efficiently in automatic mode you first need an active spray programme. This makes it possible, even without exactly adhering to the correct speed, to keep the indicated application rate per hectare constant through targeted pressure regulation. Apart from this, spray programmes are recorded and only recorded spray programmes can subsequently be transferred to the PC.

In order to be able to work with a spray programme, it first needs to be started up. To do this, press the start symbol in Setup. A new window will open (Fig. 24), in which an existing spray programme can be selected. (The spray programmes and other necessary settings can be adjusted in Spray management [→ Chapter 3]). To do this, click on the top area of the screen and search for the right programme (confirm with OK.)

Once the desired spray programme has been selected, the key spraying data beneath will also be updated accordingly. These contain information required for the spraying operation, such as recommended speed, water application, working pressure or type and number of nozzles.

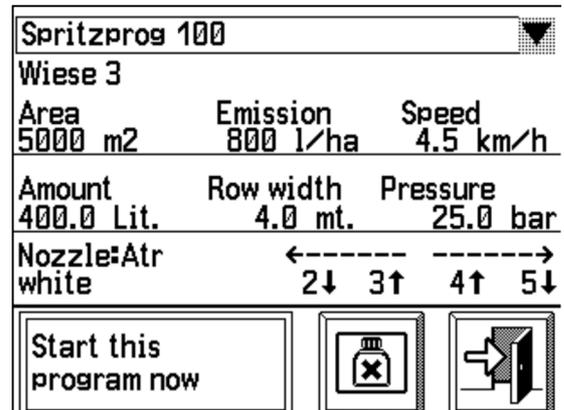
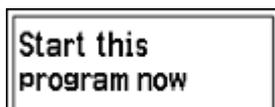


Fig. 24: Starting the spraying programme

 It is also possible to display the chemicals/products to be used; to do this press the corresponding button.



To start up the selected programme, click on “**Start this programme now**”. After the confirmation prompt, which must be answered with OK, a window with the message “**The programme has been started**” appears. The remaining available memory is shown underneath.

1.1.1 Recording spray programmes and free memory

The spray programme is recorded once it has been started. The available memory is gradually used up as a result. Ensure that at least 10% of the memory is still available. If the available memory falls below this level, no more spraying operations will be recorded. To free up more memory, the recorded spraying operations must be transferred to your PC or individual records must be manually deleted in the Statistics menu [→ Chapter 3.4].

 An ongoing spray programme is ended using the stop symbol. The stop button appears after starting a spray programme in place of the start button. (Fig. 8).

When a spray programme is running, it is possible to press on the text “Active Spray Programme” in the “2 Setup” menu (*in the lower part of the screen*), in order to view the settings and parameters for the current programme. Changes can only be made when the spray programme has been stopped.

4 System Setup

Various settings can be adjusted in System setup:

- **Language** (→ chapter 4.1)
- **Alarms** (→ chapter 4.2)
- **Content display** (→ chapter 4.3)
- **Date & time** (→ chapter 4.4)
- **Operating hours** (→ chapter 4.5)
- **Display settings** (→ chapter 5)
- **Setup** (→ chapter 6)
- **Service** (→ chapter 7)

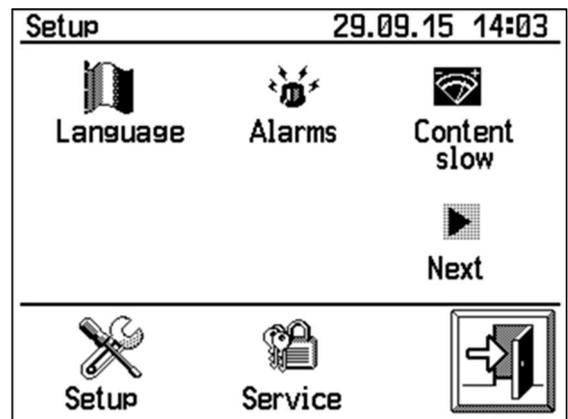


Fig. 25: System setup

4.1 Language

 Select your chosen language in the language selection list. The language will change as soon as the OK button is pressed.

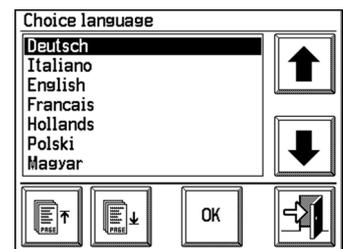


Fig. 26: Language selection

4.2 Alarm



Alarm when the speed exceeds or falls below the limit

If the speed of travel exceeds or falls below the value set here, the alarm is triggered. The alarm is a repetitive beep, and a “ringing” bell appears on the screen.

Important: This speed monitoring only functions in the **main screen**, if **automatic mode** is active and when a **spray programme** is operating.

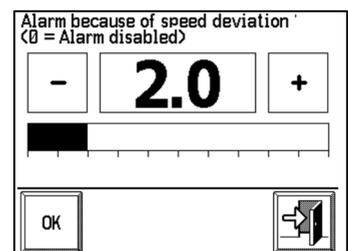


Fig. 27: Speed alarm

4.3 Content display (fast / slow)

The button for setting the volume display can be found in the "Settings" menu. It changes function with each push of the button:



Volume fast



Volume slow

If level changes need to be displayed quickly, then press on the symbol with the "**Volume fast**" label. Every change in level will now be displayed immediately. This setting is especially beneficial when dosing chemicals.

If, on the other hand, you wish to have the volume displayed more slowly, then press "**Volume slow**". This setting is especially recommended during travel, where otherwise small jolts can sometimes cause big fluctuations in the display, which make it unnecessarily difficult to use.

4.4 Date and Time

One click on “date” opens a window where the date and time can be set.

Date:

 After clicking on “date” the input window appears.
 Enter the current date here in the given format: [DD.MM.YY] for day, month and year (please enter also the dot “.”).
 Inputting is completed by pressing “OK”.

Date: DD.MM.YY				19.12.06
7	8	9	-	ESC
4	5	6	.	CE
1	2	3	0	OK

Fig. 28: Date

Time:

 Press the “time” button to open the window to input the time.
 The time must also be entered using the given format: [HH:MM] for hours and minutes (please also enter the colon “:”).

Time: HH:MM:SS				11:32
7	8	9	-	ESC
4	5	6	:	CE
1	2	3	0	OK

Fig. 29: Time

4.5 Operating hours



The total operating hours with the **SPG20** sprayer device are displayed in this menu.
 The operating hours counter can be changed or reset to zero with the two buttons “change” and “delete all”. These functions are password protected.

5 Display Settings

This menu contains settings and tests that concern the display:

- **Contrast** (→ chapter 5.1)
- **Backlight** (→ chapter 5.2)
- **Display test** (→ chapter 5.3)

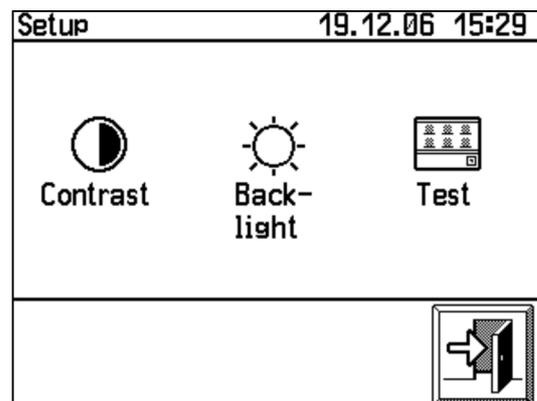


Fig. 30: Display settings

5.1 Contrast

 The contrast can be increased or decreased with the plus and minus buttons or by swiping the bar.

 Alternatively, the value (10 to 100) can also be entered numerically. Press number input button to do so.

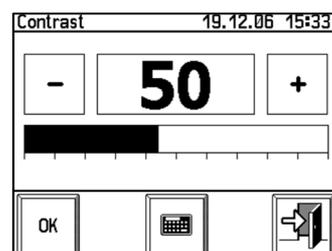


Fig. 31: Contrast

5.2 Backlight

-  The backlight can also be changed by pressing the plus and minus buttons or by swiping the bar. Alternatively, the value (0 to 100) can be entered using the numeric keypad.
-  Enter "0" to switch off the backlight.

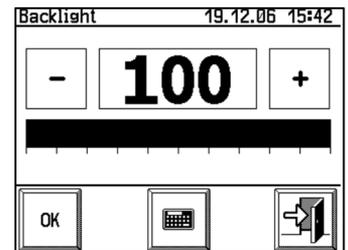


Fig. 32: Backlight

5.3 Display test

The accuracy of the touch-screen functions can be checked using the "test" button (Fig. 30). Press anywhere in the grid. A dot (small square, → Fig. 33) should appear in this exact area. If the dot deviates too much from the position pressed, it will be necessary to calibrate the display. Consult the service department.

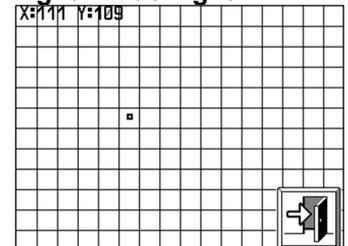


Fig. 33: Display-test

6 Setup

-  First of all the current software version of the SPG10 display unit and the SPG20 control module are displayed along with the serial number in the Setup menu. To enter the actual Setup menu press anywhere on the display.

The parameter to be changed will be surrounded by a frame. If you press in the frame, a numeric keypad will appear.

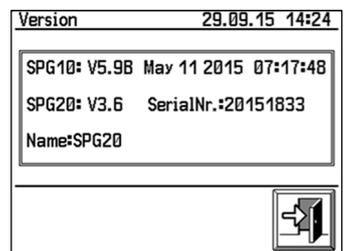


Fig. 34: Information

6.1 Impulses per 100mt

Enter the **number of impulses after 100 meters of travel** (for the odometer and speedometer). Valid values: 10 ÷ 65,000 (default value = 270).

-  The number of impulses can be recorded directly in this window. For this, the counter must be reset using the reset button (measured impulses = 0). Afterwards, exactly 100 meters can be driven with the spray trailer. The "measured impulses" can now be entered as a parameter.

Access the next parameter with the arrow keys:

6.2 Tank name

The "Name" button opens an input window in which the name of the sprayer can be entered. As this (tank) name is saved in the SPG20 control module (which is mounted on the sprayer), it is possible to issue a separate name to each machine when working with several sprayers. This name makes it possible to identify later which sprayer was being used - once the data have been transferred to the computer.

6.3 Beep if alarm?

This setting makes it possible to switch the beep on / off when there is an alarm.

6.4 Pressure display to one decimal place

As standard, the pressure display accuracy is limited to 0.5 bar. If the check box in this option is checked, then the accuracy level is set to 0.1 bar. This means that the accuracy

level is much greater, admittedly with the disadvantage of a possibly more unstable display (the decimal place fluctuates more frequently).

6.5 Standby after X minutes

The sprayer computer switches to standby mode after the number of minutes of inactivity set here. It is possible to enter between 10 and 1000 minutes (approx. 16 hours). The standard setting is 15 minutes. Together with the sprayer computer the volume sensor immediately followed by the SPG20 control module will also go into standby. The power consumption falls below 50mA in standby mode.

6.6 Adjustment level sensor

This menu button is password protected. The password is: 135799

The content display can be corrected by adapting the values of an empty tank and of a full tank. It is important to ensure that the zero balance is always set before the max. balance. Moreover, you also need to be sure that the volume sensor has been fitted in accordance with the instructions (→ chapter 12.1)

Zero balance

- Be sure that the tank and the sensor tube are free
- Press the plus button in the “zero balance” section until the number is greater than zero.
- If the value is greater than zero, then the minus button must be pressed until you see the value “0” appear.
- The zero point is now adjusted, press on the “save”-symbol in the middle of the lower screen area.

Max. balance

- Fill the tank up to the maximum (or another volume that you know)
- If the value now displayed does not correspond to the actual volume, you can correct it using the “plus” or “minus” buttons.
 - As soon as the value has been set correctly, press the “save” button. The correction of the content display is then concluded and the menu can be exited again using the “exit” symbol.

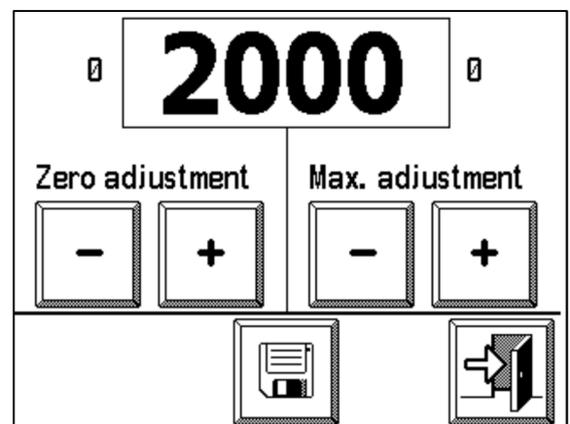


Fig. 35: Correcting the content display

6.7 Minimum pressure limit (pressure control)

In automatic mode (spray programme or semi-automatic mode) where the pressure regulation is dependent on the speed of travel, it is possible to set a pressure drop limit. The software keeps the pressure at least at this value or above, but never below. Valid values: 0 ÷ 255 bar (standard = 0 bar).

Warning: If using the flow sensor for regulation, this function is not available.

6.8 Minimum speed (km/h)

If this button is activated, in automatic mode (spray programme and semi-automatic) a minimum speed is applied. This means that if the vehicle drops below the minimum speed, then the pressure will still be maintained for a certain time (x seconds, adjustable in the service menu (→ chapter 7.1). This means that a drop in pressure will be delayed.

The target speed entered in the spray programme / semi automatic mode (minus 0.2 km/h) will be used as the minimum speed.

Note: When working with a minimum speed, then the minimum pressure limit function will not be active (see point 6.7).

Warning: If using the flow sensor for regulation, only the minimum speed limit function is available.

6.9 Pressure losses in percent

As pressure losses are possible from the pump through the valves and pipes to the nozzles, there is a discrepancy between the pressure measured by the pressure sensor and the actual pressure at the nozzles. This discrepancy can be compensated with this parameter. Valid values: 0 ÷ 20% (standard = 0%).

6.10 Flow rate impulses/litre

The flow rate provides a certain number of impulses per litre. The number can be entered here. If inaccuracies in measurement become noticeable, slight corrections can be made here.

Valid values: 1 ÷ 5,000 (standard = 1200).

Reference: This menu item only appears if a flow meter is installed.

6.11 Control with flow meter

Regulation based on the flow can be switched on and off here. If the flow regulation is switched off, then the regulation is based on the pressure.

Notes: This menu item will only be displayed if a flow meter is installed.

7 Service menu

Press the Customer Service button in the System setup (→ chapter 4)

A password must then be entered to access the Service menu.



Login

Many sensitive settings can have additional password protection assigned to them in the Service menu. So that it is not necessary to enter the password every time, it is also possible to login "globally". To do this, it is only necessary to press the "Login" button and then enter the global password.

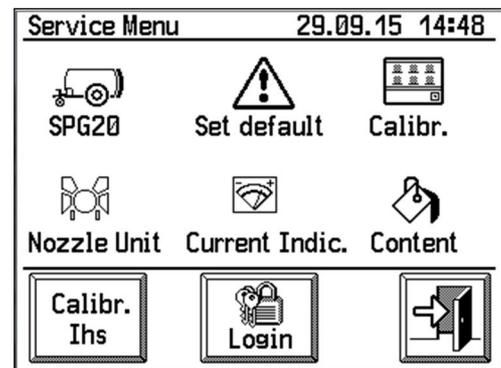


Fig. 36: Service menu

7.1 Setup SPG20



All parameters concerning the SPG20 control module, can be changed in this list. The circled parameter can be changed by pressing within the frame.

Parameter	Valid Values	Description
Calculation by SBR South Tyrol option	on/off	Activate the control button to activate the South Tyrol consulting group's spray calculation. This also relates to the type of input in the spray programmes (→ chapter 3.2.2).
With fan cover	on/off	Two additional buttons are made available in the main window for controlling the fan cover with this setting. (Only possible with a maximum of six nozzle rings).
Control time for pressure control with speed limit	2 ÷ 20 Standard=5 [seconds]	This is where the length of time is entered for which the computer will wait before starting to reduce the pressure if the vehicle drops below the input speed. (Only when the "minimum speed" function is active → chapter 6.8)
Spray programme allowed	on/off	This control button has to be activated to allow working with the help of the spray programmes. Otherwise you can only work with manual or automatic pressure control.
Save spray programmes into flash memory?	on/off	If the sprayer control is used without a PC programme (without releasing memory while transferring data to the PC), the function must be deactivated.
Multi-row version?	on/off	Must be activated in the case of multi-row sprayers, as the application rate is calculated differently with multi-rows.
Tunnel type (only with multi-row)	on/off	In the case of tunnel sprayers (only if the "multi-row version" is activated)
Pressure sensor max value	20 ÷ 60 (standard=40) [bar]	The pressure at which the pressure sensor provides the maximum current of 20mA. Example: Sensor: 4...20mA ≙ 0...40bar → i.e. 40 bar

Overcurrent	1.0 ÷ 8.0 (standard=6.0) [ampere]	Concerns the over current of servomotor: Enter the current at which the servomotor must switch off.
Tolerable pressure deviation	0.1 ÷ 2.0 (standard=0.2) [bar]	Enter the maximum pressure deviation from the set point.
Tolerable flow deviation	(0.1 ÷ 2.0) (standard=0.2) [litre per minute]	Enter the maximum value deviation from the set point.
Control time	0.7 ÷ 4.0 (standard=1.0) [sec.]	The maximum after control time in seconds.
With flow sensor	on/off	Setting that indicates if a flow meter is installed in the system.
Min. flow: if flow is inferior, the controller uses the pressure method	0 ÷ 120 (standard=6.0) [litre per minute]	Since flow-based regulation only works accurately in a certain range, the upper and lower limits can be set using these parameters, whereby the system will switch to pressure regulation if the levels either exceed or fall below them.
Max. flow: if flow is superior, the control uses the pressure method Valid values	0 ÷ 120 (Standard=60) [litre per minute]	
Supplementary relay text	Max. 11 characters Standard= ---	The label on the ON/OFF button, which can be switched on and off in the “Settings” menu (→ chapter 2).
Start relay text	Max. 11 characters Standard= Start	ON/OFF button text display when switched on
Stop relay text	Max. 11 characters Standard= Stop	ON/OFF button text display when switched off
Format file system! All data will be deleted with no possibility of recovery		Irreversibly formats the file system (after a confirmation prompt). The fields, chemicals and spray programmes of all recorded spraying operations are contained in the file system.

7.2 Factory settings (default settings)



The device can be reset to factory settings (default settings) following a confirmation prompt.

7.3 Display calibration



The calibration function for the touch screen can be accessed using the “calibr.” button (Fig. 36), but should only be used if the touch screen function becomes too inaccurate.

You will be requested (4 times in succession) to press on a square symbol (Fig. 37). This should be done as accurately as possible in the middle of the square (e.g. with a suitable pen).

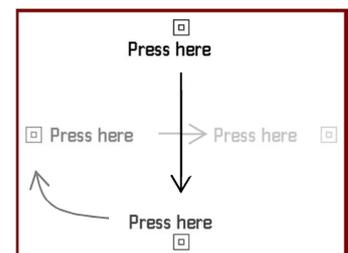


Fig. 37: Display calibration

7.4 Number of nozzle rings



Enter the number of nozzle rings to be switched on here. To do this it is only necessary to press within the framed text. 2, 4, 6 or 8 nozzle rings can be selected. The number of buttons in the main window with which the nozzle rings can be switched on/off reduces/increases with this setting.

Note: If the fan cover is switched on with the device, then only a maximum of 6 nozzle rings may be selected. (The relay outputs for nozzle rings 7 and 8 are then already allocated to the left and right fan cover.)

7.5 Current display



With the activation of the current display (the symbol is shown inversely) the current of the servomotor (in ampere) is displayed in the main window, instead of the content display. This function is only provided for servicing purposes.

8 Content



Different level curves can be assigned or new ones created in the “content” menu.

The level curve is necessary for calculating the tank content. Since every tank differs in shape and size, every tank will also have its own individual level curve. This curve can be assigned in the “*assign*” menu (→ chapter 8.2).

In the case of a new tank or an unknown tank, a level curve can be created in the “*Calibration*” menu (→ chapter 9).

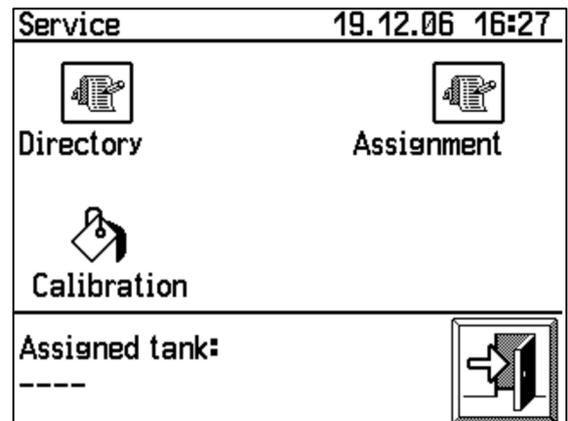


Fig. 38: Service menu content

8.1 Directory

The available level curves are saved in the form of a table. All tables are listed in the menu directory.



The name of every single table can be edited with this button.



Single tables can be deleted with this button.

8.2 Assignment

A directory opens in which the appropriate level curve for this sprayer or tank can be assigned. Highlight the table you wish to use and confirm with the OK button.

9 Tank calibration

The container is filled up gradually during dosing. At each step the analogue value is recorded and stored together with the associated litre data in a table.

The menu consists of a graphic (with the level curve), the analogue value and the litre data in plain text and from the underlying keypad:

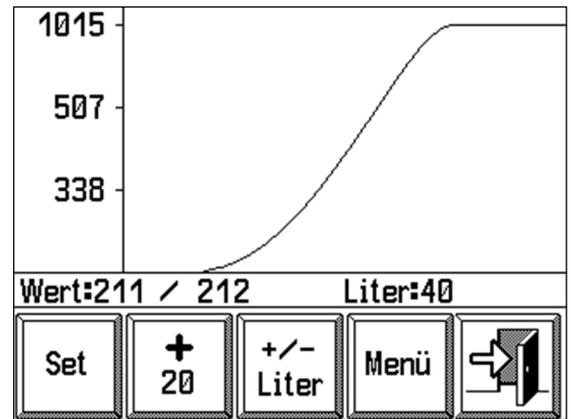


Fig. 39: Dosing curve

The level characteristic curve:

The x-axis of the line bar corresponds to the analogue value of the content sensor. The level in litres is shown on the Y-axis.

The analogue value:

Below the diagram on the left (next to “value”), the current analogue value (from the content sensor) is displayed twice - separated by a slash. The first value as a slow indicator and the second as a quick indicator.

If possible, only take the value after the two values have been balanced.

The litre specification:

In addition to the analogue values, the tank capacity in litres is indicated, to which the analogue value can be assigned.

The key area:

9.1 Accept “set” analogue value



Press on the button to assign the current analogue value of the related litre data.

9.2 Increase content incrementally



By pressing on this button, the litre data increases by a specified value (increment). By default, this value is set at 20 litres. It can also be changed. (→ chapter 9.4.1).

The increment must be the same value in litres as the amount being gradually fed into the tank.

Example: the tank is fed with 20 litres, afterwards, the litre data on the device must also be increased by 20 litres before the new analogue value can be accepted with “set”.

9.3 Edit content manually “+/- litre”



The litre data can be entered directly with this button (e.g. if the quantity fed in does not correspond to the increment).

9.4 Calibration menu

In this menu you can change the increment, save, load or edit the table.

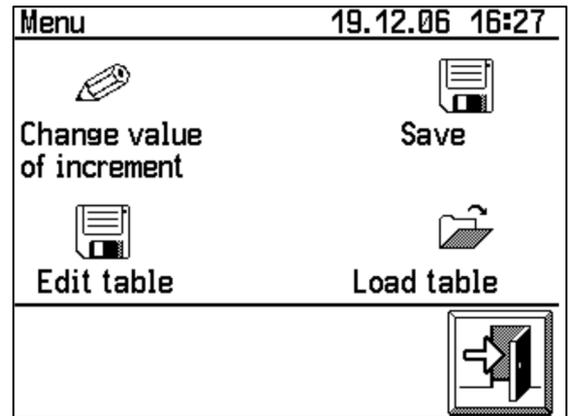


Fig. 40: Dosing menu

9.4.1 Change increment value

The increment can be altered here using the number keypad. This value can be between 1 and 100 (litres). By default, this value is 20 litres.

(See also “Increase content incrementally” → chapter 9.2)

9.4.2 Save table

If you create a new table you need to save it here, so that you can use the device (see “Assignment” → chapter 8.2). Up to 30 tables can be saved. Existing tables can also be overwritten.

Before saving, you must specify a name for your table. The appropriate input box appears after pressing “OK” (Fig. 41).

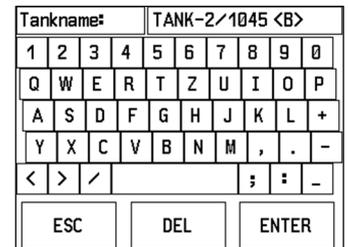


Fig. 41: Input field

9.4.3 Edit table

With this menu it is possible to edit a table retrospectively to correct, for example, any incorrect measurements.



Because each table consists of 1024 entries (=analogue values), it may be helpful to switch the “row-oriented” button to “page-oriented” to scroll page by page with the arrow keys.



Furthermore, on the upper edge of the screen, you can find the two buttons **<--50** and **50-->**, for scrolling by 50 rows at a time.

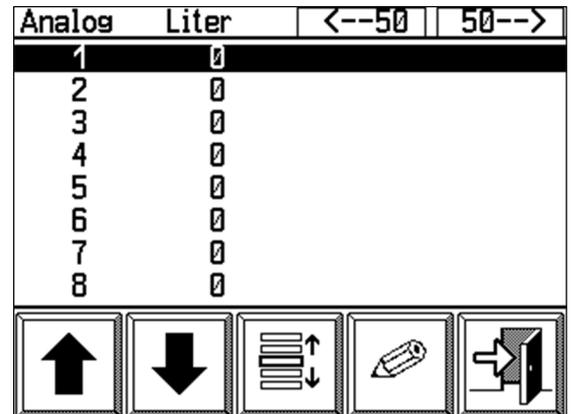


Fig. 42: Level table



Any analogue value can be assigned a new litre value using the edit button.

Important: After editing you need to open the “Calibration” menu again(→ chapter 9), to save the changed table.

9.4.4 Load table

Previously stored tables can be opened again using the “load table” button. With this process, the values in the current table will be overwritten! In this way it is possible, for example, to edit existing tables or to continue dosing with an as yet incomplete table.

10 Exchanging data with a PC

To exchange data, the (optional) supplied programme should be installed and started on the PC.

Using the cable provided, the SPG10 display device should be connected into a free USB port on the PC. As the power is also supplied via the USB cable, the display device can be disconnected from the SPG20 control module.

Now, all of the data recorded on the SPG10 can be transmitted and analysed. Further information can be found in the manual for the SPG10 PC programme.

11 IDS03 Volume Sensor

When dealing with the volume sensor some points must be considered: the differential pressure sensor of the volume sensor has no contact with the medium to be measured, this allows a measurement of various problematic or even aggressive liquids. In addition, air is pumped through the measuring tube by means of a diaphragm pump. This ensures constant conditions, thus making the measurement insensitive to temperature changes. So that this process can work properly the end of the tube must remain open for the egress of air. Otherwise, the device switches off and will indicate excess pressure. **Do not use a high pressure cleaner for cleaning!**

Standby-mode:

If the SPG10 sprayer computer switches to standby (after about 5 min. of inactivity) the diaphragm pump is also switched off and the content measurement ceases (indicator falls to zero).

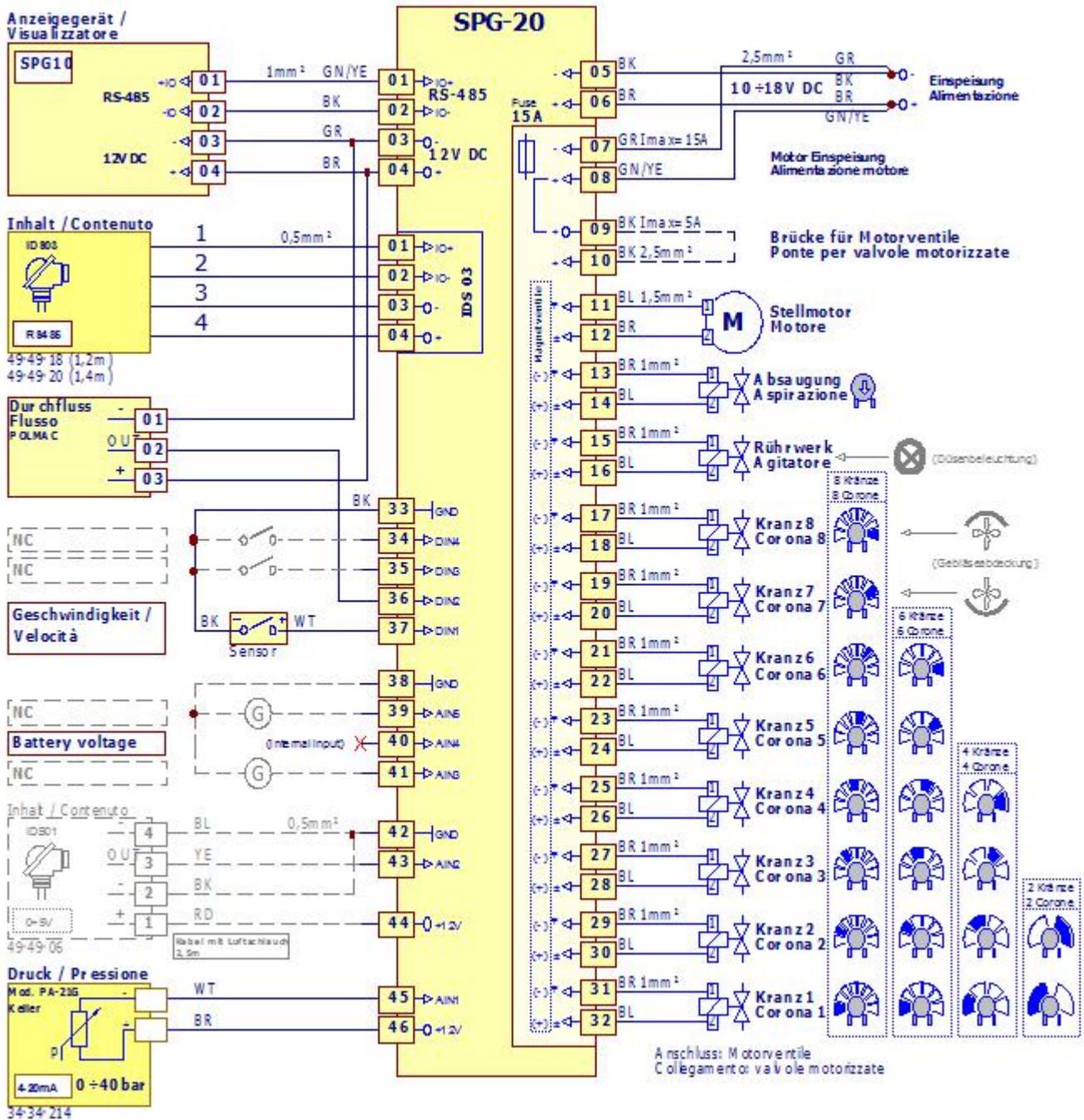


Fig. 43: IDS03 volume sensor

11.1 Instructions on installing the volume sensor

- The measuring tube must reach almost to the ground; only a small gap must remain to allow the egress of air.
- **The stainless steel tube must be cut off cleanly and deburred inside and outside.**

12 Wiring diagram



BK = black, BL = blue, BR = brown, GR = grey, GN/YE = green-yellow, RD = red, YE = yellow, WT = white

Fig. 44: SPG20 wiring diagram