Apollo ISOBUS UT Sprayer
Operator's Manual

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TOPCON

Apollo ISOBUS UT Sprayer

Operator Manual

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Preface

This manual provides information about operating and maintaining this Topcon Precision Agriculture product. Correct use and servicing is important for safe and reliable operation of the product.

It is very important that you take the time to read this manual before using the product.

Information in this manual is current at the time of publication. A system may vary slightly. The manufacturer reserves the right to redesign and change the system as necessary without notification.

Terms and Conditions

Note: Please read these Terms and Conditions carefully.

General

APPLICATION - You accept these Terms and Conditions by purchasing the product from Topcon Precision Agriculture (TPA) or from one of TPA's product dealers.

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IMPORTANT: SAFETY - Improper use of the product can lead to death or injury to persons, damage to property and/or malfunction of the product. The product should only be repaired by authorized TPA service centers. You should closely review the safety warnings and directions as to the proper use of the product in this manual and at all times comply with the same.

Limited Warranty

ELECTRONIC AND MECHANICAL COMPONENTS -TPA warrants that the electronic components manufactured by TPA shall be free of defects in materials and workmanship

for a period of one year from the original date of shipment to the dealer. TPA warrants that all valves, hoses, cables and mechanical parts manufactured by TPA shall be free of defects in materials and workmanship for a period of 90 days from the date of purchase.

RETURN AND REPAIR - During the respective warranty periods, any of the above items found defective may be shipped to TPA for repair. TPA will promptly repair or replace the defective item at no charge, and ship it back to you. You must pay the shipping and handling charges in respect of the same. Calibration of components, labor and travel expenses incurred for in-field removal and replacement of components are not covered in this warranty policy. The foregoing warranty shall NOT apply to damage or defects resulting from:

(i) disaster, accident or abuse

(ii) normal wear and tear

(iii) improper use and/or maintenance

(iv) unauthorized modifications of the product; and/or

(v) use of the product in combination with other products not supplied or specified by TPA.

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In any event, TPA's liability to you or any other person for any claim, loss or damage (in contract, tort or on any other basis) will be limited (in TPA's option) to either (a) the replacement or repair of the product, or (b) payment of the cost of replacing or repairing the product.

Other

These Terms and Conditions may be amended, modified, superseded or cancelled, at any time by TPA. These Terms and Conditions will be governed by, and construed in accordance with:

- the laws of South Australia if the product is sold and supplied to you in Australia (in which case the courts of South Australia or the Federal Court of Australia (Adelaide Registry) have exclusive jurisdiction in respect of any claim or dispute) or
- the laws of the State of California if the product is sold and supplied to you outside of Australia
- the provisions of the United Nations Convention on Contracts for the International Sale of Goods shall not apply to these Terms and Conditions.

All information, illustrations, and applications contained herein are based on the latest available information at the time of publication. TPA reserves the right to make product changes at any time without notice.

If any part of these Terms and Conditions would be unenforceable, the provision must be read down to the extent necessary to avoid that result, and if the provision cannot be read down to that extent, it must be severed without affecting the validity and enforceability of the remainder of these Terms and Conditions.

Service Information

Service assistance can be provided by contacting your local TPA Authorized Dealer.

Communications Regulation Information

FCC Compliance Statement (USA)

This equipment has been tested and found to comply with the limits for a Class 'A' digital device, pursuant to Part 15 of the FCC Rules. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at the user's expense.

FCC Compliance Statement (Canada)

This Class A digital apparatus meets all requirements of the Canadian Interference-Causing Equipment Regulation.

CE EMC Statement (European Community)

Warning: This is a class 'A' product. In a domestic environment this product may cause radio interference in which case the user may be required to take adequate measures.

'C' Tick EMC Statement (Australia & New Zealand)

This product meets the applicable requirements of the Australia and New Zealand EMC Framework.

Type Approval and Safety Regulations

Type approval may be required in some countries to license the use of transmitters on certain band frequencies. Check with local authorities and your dealer. Unauthorized modification of the equipment may void that approval, the warranty and the license to use the equipment.

The receiver contains an internal radio-modem. This can potentially send signals. Regulations vary between countries, so check with the dealer and local regulators for information on licensed and unlicensed frequencies. Some may involve subscriptions.

Radio and Television Interference

This computer equipment generates, uses, and can radiate radio-frequency energy. If it is not installed and used correctly in strict accordance with TOPCON Precision Agriculture instructions, it may cause interference with radio communication.

You can check if interference is being caused by this equipment by turning the Topcon equipment off to see if the interference stops. If the equipment is causing interference to a radio or other electronic device, try:

- Turning the radio antenna until the interference stops
- Moving the equipment to either side of the radio or other electronic device
- Moving the equipment farther away from the radio or other electronic device
- Connecting the equipment to another circuit that is not linked to the radio.

To reduce potential interference operate the equipment at the lowest gain level that will allow successful communication.

If necessary contact your nearest Topcon Precision Agriculture dealer for assistance.

Note: Changes or modifications to this product not authorized by TOPCON Precision Agriculture could void the EMC compliance and negate authority to operate the product.

This product was tested for EMC compliance using Topcon Precision Agriculture peripheral devices, shielded cables and connectors. It is important to use Topcon

Precision Agriculture devices between system components to reduce the possibility of interference with other devices

General Safety

DANGER: It is essential that the following information and the product specific safety information is read and understood.

Most incidents arising during operation, maintenance and repair are caused by a failure to observe basic safety rules or precautions. Always be alert to potential hazards and hazardous situations.

Always follow the instructions that accompany a Warning or Caution. The information these provide aims to minimize risk of injury and/or damage to property.

In particular follow instructions presented as Safety Messages.

Safety Messages and Warnings

The safety symbol is used with the relevant word: DANGER, WARNING or CAUTION.

Messages marked in this way recommend safety precautions and practices. LEARN and apply them.

DANGER: Indicates an imminently hazardous situation that, if not avoided, could result in DEATH OR VERY SERIOUS INJURY.

WARNING: Indicates a potentially hazardous situation that, if not avoided, could result in DEATH OR SERIOUS INJURY.

CAUTION: Indicates a potentially hazardous situation that, if not avoided, may result in MINOR INJURY.

Safety Signs

WARNING: DO NOT remove or obscure safety signs. Replace any safety signs that are not readable or are missing. Replacement signs are available from your dealer in the event of loss or damage.

If a used vehicle has been purchased, make sure all safety signs are in the correct location and can be read. Replace any safety signs that cannot be read or are missing. Replacement safety signs are available from your dealer.

Operator Safety

WARNING: It is YOUR responsibility to read and understand the safety sections in this book before operating this vehicle. Remember that YOU are the key to safety.

Good safety practices not only protect you, but also the people around you. Study this manual as part of your safety program. This safety information only relates to Topcon equipment and does not replace other usual safe work practices.

WARNING: Ensure power is removed from the Topcon equipment prior to maintenance or repair of the vehicle or implements.

WARNING: Ensure appropriate precautions are taken prior to handling any hazardous substances. Always read the Material Safety Data Sheet prior to commencing work.

WARNING: In some of the illustrations or photos used in this manual, panels or guards may have been removed for demonstration purposes. Never operate the vehicle with any panels or guards removed. If the removal of panels or guards is necessary to make a repair, these MUST be replaced before operation.

WARNING: Always check that any suspended vehicle attachments are lowered to the ground before beginning repair or maintenance work on a vehicle.

WARNING: Vehicle and implement parts can become hot during operation and may be under pressure. Refer to vehicle manuals.

WARNING: Wear appropriate protective clothing for the task being undertaken and conditions.

WARNING: Do not operate equipment around explosive equipment or supplies.

WARNING: Topcon is committed to good environmental performance and minimizes the use of any potentially harmful substances in its products. However, it is always advisable not to handle damaged electronic equipment. This Topcon product may contain a sealed lithium battery. Always dispose of any electronic equipment thoughtfully and responsibly.

Exposure to Radio Frequency

Exposure to energy from radio frequencies is an important safety issue. Keep a distance of at least 20 cm (7.8 inches) between people and any radiating antenna. Keep a distance of at least 20 cm between transmitting antennas.

WARNING: Products using cellular modem or an RTK base station can transmit radio frequency energy. Check with your dealer.

This device is designed to operate with TPA approved antennas. Discuss with your dealer.

Preparation for Operation

- Read and understand this manual and learn all of the controls before you use the equipment.
- Keep the manual with the equipment.
- If the equipment is moved to another vehicle, move the manual as well.
- Read the manual for the vehicle with which the equipment will be used and check that the vehicle has the correct equipment required by local regulations.
- Make sure you understand the speed, brakes, steering, stability, and load characteristics of the vehicle before you start.
- Check all controls in an area clear of people and obstacles before starting work.
- Identify possible hazards.

WARNING: Topcon equipment must not be used by an operator affected by alcohol or drugs. Seek medical advice if using prescription or over-the-counter medication.

Disclaimer

Topcon accepts no responsibility or liability for damages to property, personal injuries, or death resulting from the misuse or abuse of any of its products.

Further, Topcon accepts no responsibility for the use of Topcon equipment or the GNSS signal for any purpose other than the intended purpose.

Topcon cannot guarantee the accuracy, integrity, continuity, or availability of the GNSS signal.

The operator must ensure that the equipment is correctly turned off when not in use.

Before operating any vehicle equipped with Topcon products, read and understand the following product specific safety precautions.

Important Safety Information

Operator Alertness and Responsibility

The console helps the operator to steer the vehicle, but the operator remains in charge and must be alert and in complete control of the vehicle at all times. The operator is ultimately responsible for safe operation of this equipment.

It is essential that safety requirements are met when operating the console and any of its components. All operators and other relevant personnel must be advised of safety requirements.

Electrical Safety

WARNING: Incorrectly connected power can cause severe injury and damage to people or the equipment.

When working with electrical components, you must do the following:

- Make sure the negative terminal of the battery is disconnected before doing any welding on the vehicle.
- Check that all power cables to system components are connected to the correct polarity as marked. Please refer to the vehicle manual for safety information.
- Check that equipment is grounded in accordance with installation instructions.

Operation and Risk of Obstacles

The following list is not exhaustive or limited. To use the console for assisted steering along a defined wayline, the operator must ensure that it is used:

- Away from people and obstacles
- Away from high voltage power lines or other overhead obstructions (identify any clearance problems before activating the console)
- On private property without public access
- Within cleared fields
- Off public roads or access ways.

Note that:

- The operator needs to know the vehicle's position and the field conditions at all times.
- The operator will need to respond if the GNSS satellite or differential correction signal is lost momentarily.
- The console cannot detect obstacles (people, livestock or other).
- Only use the console in areas that are clear of obstacles and keep a proper distance.
- Steering needs to be disengaged for manual control if an obstacle appears in the path or the vehicle moves away from the wayline.

On/Off and Manual Control

WARNING: Ensure the steering switch is Off to prevent unintentional engagement of the assisted steering. When repairing or maintaining the vehicle/implement, ensure the vehicle CANNOT be moved. Disengage steering, apply brakes and remove keys.

The operator must ensure that the steering switch is Off (*all* LED indicators are off) when assisted steering is not being used.

The operator must disengage assisted steering and use manual control if an obstacle is in the line of travel or moves into the line of travel, or if the vehicle steers away from the desired wayline.

To disengage assisted steering:

- Turn the steering wheel a few degrees OR
- Select the Disengage Auto Steering button on the console AND/OR
- If using an external steering switch, disengage using the switch if the above actions do not disengage assisted steering.

Vehicle Shut Down Safety

Before leaving the vehicle, disengage assisted steering, disengage external steering switch if this is being used, and remove the key from the key switch.

Using a Reference (Base) Station

WARNING: Do not move a reference station while in operation. Moving an operating reference station can interfere with the controlled steering of a system using the reference station. This could result in personal injury or damage to property.

Operators and other affected personnel must be advised of the following safety precautions.

- Do not erect the reference station under or within the vicinity of high voltage power lines.
- When using the portable reference station, make sure that the tripod is securely mounted.

To Get the Best Out of the Product

Back up data regularly. The console has large, but limited storage capacity. Use the Diagnostics Mini-view to view capacity available. A warning screen displays if storage is reaching its limit.

Be aware of file format compatibility. Discuss compatible formats with the dealer.

Topcon Agricultural Products are hardy and designed to work in tough conditions. However, if equipment is unused for a length of time, store away from water and direct heat sources.

Alert Symbols

In this manual two alert symbols are used:

Note: This offers additional information.

WARNING: A warning signal appears on safety signs and in this manual to show that this information is very important to your safety. LEARN these and APPLY them.

Table of contents

Chapter 1 – Introduction

The Apollo ISOBUS Universal Terminal (UT) Sprayer and Auto Section Controller allows better control of the amount of product being applied to a field. Once set up, it will adjust the flow according to vehicle speed, the area being covered and the preset application rate. This provides greater accuracy to manage product over specified areas.

Auto Section Control minimizes wastage, turning parts of the sprayer on and off and varying rates as the equipment passes through the defined areas. The system will turn on when it detects an area that has not been covered and it will turn off when it detects areas that have already been covered.

The sprayer pressure is adjusted with factors such as speed of the vehicle, unlike a manual pressure controlled sprayer where the pressure remains constant during speed changes.

Note: ISOBUS refers to the ISO 11783 communication protocol used in the agriculture industry. A vehicle must be fitted with an ISO 11783 compatible console for the Apollo ISOBUS UT Sprayer to operate.

1.1. Console / ECU interface

When viewing information from an ECU on a console via the Universal Terminal, the console has no knowledge of what is on the UT. The ECU has no knowledge of what the console is doing or the capabilities of the console.

A Task Controller (TC) is required for the console to be able to command the ECU to perform functions (for example; auto section control or variable rate control), or for the ECU to tell the console what it is doing (for example; the on/off state of each section or the current application rate). However, not all consoles that have a UT also have a TC. Additionally, some TCs may not be compatible with

the Apollo Sprayer ECU. To enable the TC, refer to Setting up the system, page 5.

Another ISOBUS component is the File Server (FS). This enables data such as configuration profiles or firmware upgrade files to be transferred between the console and the ECU. Many UT compatible consoles do not have FS support.

ECUs can only connect to a single UT, a single TC and a single FS. If there are multiple UTs etc on the ISOBUS, the ECU may initially not connect to the desired component. This can be fixed by using the 'Switch UT server' or 'Switch TC server' functions (refer to Setting up the system, page 5).

Chapter 2 – Sprayer Settings

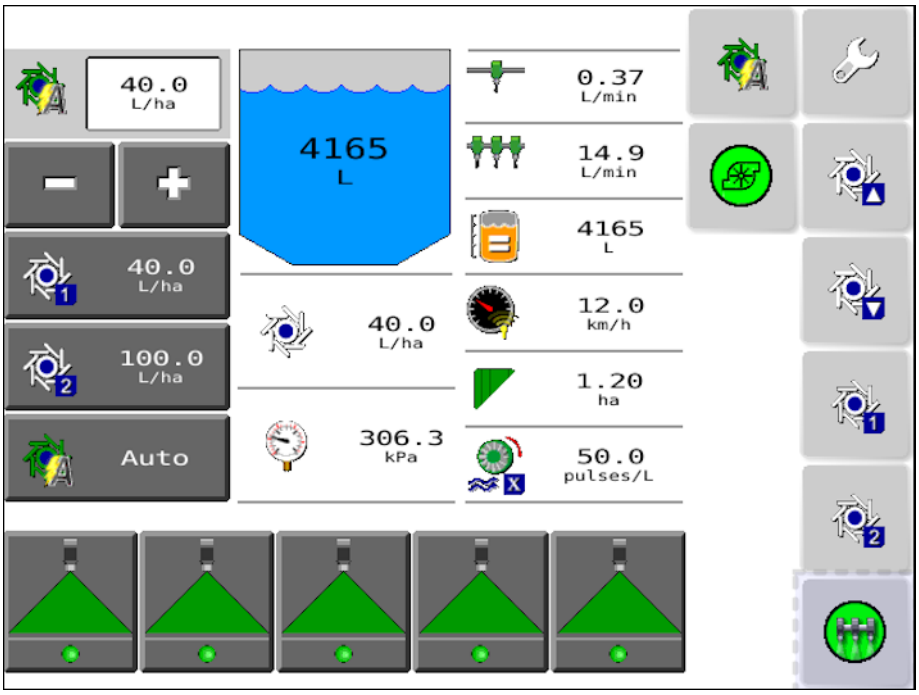
The sprayer settings must be defined prior to using the sprayer controller.

2.1. Opening the settings screen

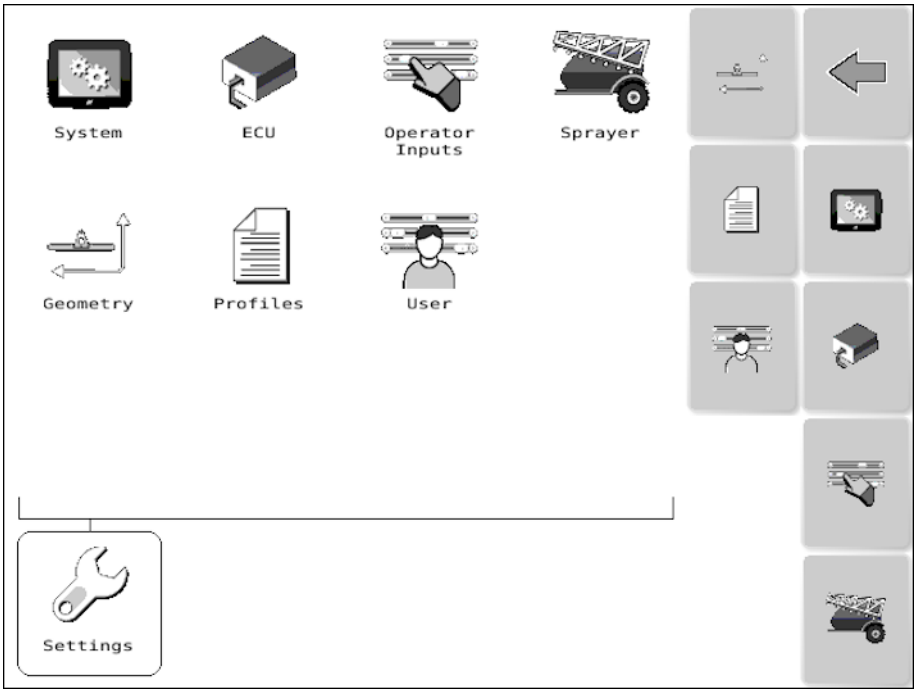
Follow these steps to launch the sprayer and open the settings screen.

1. Select  from the main Universal Terminal screen to open the sprayer.

   The operation screen displays.



2. Select  to open the Settings menu.



Note: To navigate through the setup screens, select the required options, then press the back button  to return to the previous screens.

2.2. Setting up the system

2.2.1. System Info

1. Select **System**  / **System Info**  .

Displays software and system information.

2.2.2. UT

1. Select **System**  / **UT**.

- **Switch UT server**: If there are multiple Universal Terminals on the ISOBUS, the Apollo ECU may not connect to the desired component. Select this option to change the terminal displaying the Apollo UT sprayer.

2.2.3. TC

1. Select **System**  / **TC**.

- **Enable TC**: This enables or disables the task controller for the Apollo ECU.

  Note: Enabling the task controller provides additional information from the Apollo ECU to the UT. This additional information can be used to perform functions such as setting application rates and section control commands.
- **TC Version**: Select the version of the task controller standard that is being used.
- **Switch TC server**: Change the task controller that is supplying information such as section and rate commands to the Apollo ECU.
- **Section control mode**: Sets the messaging format for the Task Controller to control section states; the way in which the ECU communicates with the console.

- **Separate setpoint**: There are two messages sent between the ECU and controller.
- **Single condensed**: The same message is used for communication both ways between the ECU and controller (used mostly when communicating with older consoles).

2.3. Setting up the ECU

2.3.1. Setup

1. Select **ECU**  / **Setup**  .

- **Clear ECU errors**: Used to clear the error if an ECU error is displayed.
- **Restore profile to defaults**: Restores the default settings to the current profile.
- **Restore ECU to factory**: Performs a factory reset of the Apollo ECU. This deletes all profiles, including the current profile. A warning message appears on screen to confirm the reset.

  Note: Factory reset deletes all the settings and data stored on the Apollo ECU. Use the factory reset option only when recommended by Topcon support or a service technician.
- **Firmware upgrade**: Select to open the firmware upgrade wizard.
- **EM-24 support**: Enables control for 24 additional single wire sections or 12 additional two wire sections via an Apollo EM-24 ECU. If enabled, the **Select section control ECU(s)** option displays.
- **Select section control ECU(s)**: Select which ECU(s) are providing section control.
- **Lock pin assignments**: Used to lock pin assignments on a non-standard (custom) harness. Should only be used if directed by Topcon support personnel.

2.3.2. Firmware upgrade

Note: The console must support File Server functionality for the firmware upgrade to work.

1. On a Windows machine, unzip the firmware ZIP file onto the root directory of a USB flash drive.
2. Open the README.html file that is supplied in the zipped files to check the supplied firmware CM-40 versions.

3. Select **System**  / **System Info**  and check the CM-40 firmware versions displayed. If the firmware versions do not match, the firmware must be updated.

4. Select **ECU**  / **Setup**  / **Firmware Upgrade**.
5. Select **CM-40 Main** or **CM-40 Aux** from the select item drop down and select next  .
6. Insert the USB flash drive containing the firmware into the console.
7. If the USB flash drive contains a valid *.ipk file in the root directory, select  to start the upgrade.

   The stop button is displayed while the upgrade is being performed.

   Once the upgrade is complete the ECU will restart automatically.

8. Select **System**  / **System Info**  to check that the firmware upgrade was successful.

2.4. Setting up operator inputs

2.4.1. Master switch setup

1. Select **Operator Inputs**  / **Master Switch**  .

- **Source**:
  - **Virtual**: Master switch to be controlled from the console screen.
  - **Apollo CM-40**: Use if Apollo CM-40 ECU switch is in use and connected to the Apollo harness.
- **Apollo CM-40 master switch**: Indicates whether the master switch input is activated by positive or zero volts. Refer to manufacturer's documentation.

2.4.2. Pump setup

1. Select **Operator Inputs**  / **Pump**  .

- **Pump override**: Enabling this option adds a pump button on the operation screen. This button allows the sprayer pump to be turned off if agitation is not required (for example, if the tank is empty). If agitation is enabled (see **Sprayer** / **Liquid** / **Pump Control**, page 23) the pump is running when the master switch is turned off. The pump button enables the agitation to be controlled independently of the master switch. Note: Pump override is not available for regulator valve.

  This button will also prevent the system from spraying if it is turned off while the master switch is turned on.

  Note: Enabling **Pump on/off external input** removes the pump button from the operation screen.
- **Pump on/off external input**: The sprayer pump may be turned on and off via an external switch.
- **Rate inc/dec external input**: The sprayer pump may have its speed increased / decreased via external switches.

- **Tank fill on/off external input**: The tank fill pump may be turned on and off via an external switch. (The tank fill pump type and fill control valve must be selected. See Tank Fill , page 17.)
- **Fill pump inc/dec external input**: The tank fill pump may have its speed increased / decreased via external switches.

2.4.3. Custom controls setup

Custom controls can be assigned to up to 16 functions. This allows control of auxiliary functions such as work lights, beacons, hydraulic functions etc.

Note: The console must support Aux-N functionality for the custom control option to work.

Note: Assign all functions and inputs before returning to the main screen. A message will then display to prompt a restart, which is required for the console to recognize the changes.

1. Select **Operator Inputs**  / **Custom Controls**  .

Functions

2. Highlight the required input number and select the associated settings.

- **Function name**: User assignable name that will show on the Custom Inputs screen.
- **Output type**: If output requires bi directional control, select Two Wire.
- **Action**: Sets whether the custom control button is momentary (press and hold) or latched on when it is pressed. Note: If the button is momentary, it is advisable to indicate this via the Function name. The button will only show as green while it is held down.
- **ECU Pin A**: Connected ECU pin for single wire output type or first pin of two wire output.

- **ECU Pin B**: Connected ECU pin for second pin of two wire output.

Inputs

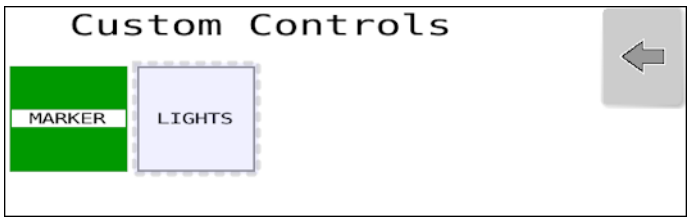
The number of inputs and action (latched or momentary) defined on the Functions screen must be defined on this screen.

1. Select **Number** and enter the required number of inputs.
2. Define the **Action** for each input.

Inputs must then be assigned to functions via Aux-N functionality. Refer to the user manual supplied with the console for instructions.

Once all the desired functions have been assigned, they can be activated by pressing the assigned inputs. Please be aware that some functions will require the device or console to be in a ready state before the function can be activated.

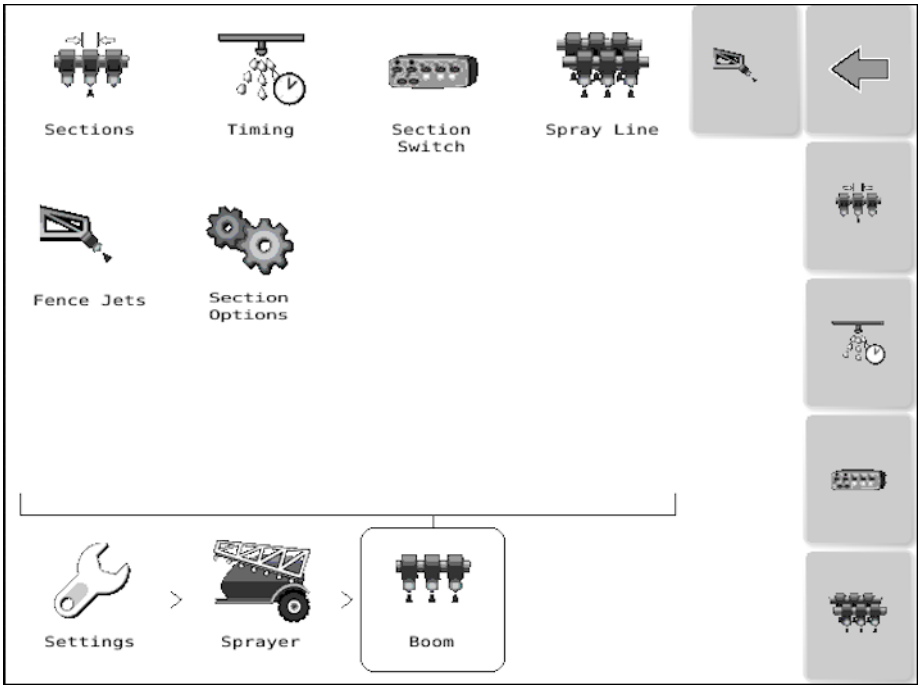
To access the custom inputs, select  on the main screen. The buttons are labeled with the function names. Latched inputs remain green once pressed. Momentary stay green only while being pressed.



2.5. Setting up the sprayer

2.5.1. Boom setup

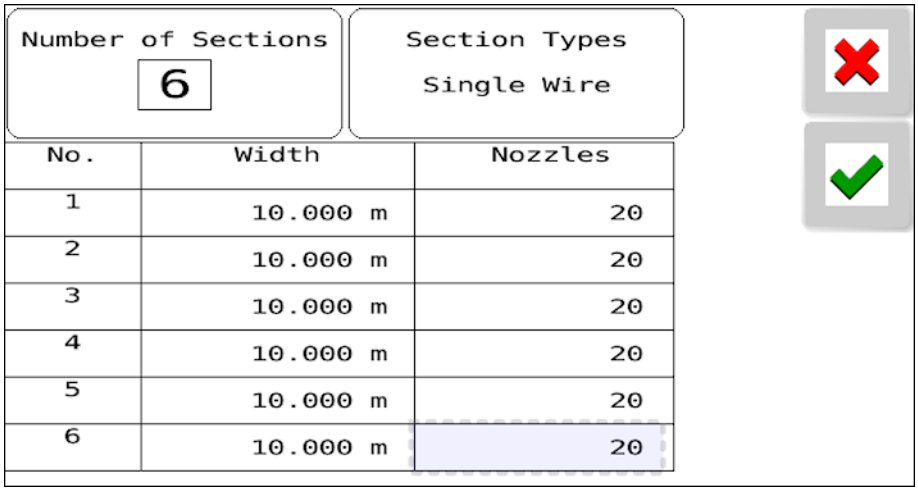
1. Select **Sprayer** / **Boom** .



Sections

The console can support up to 14 sections using one CM-40 (using single wire section types). The maximum total width of the boom is 100 m.

If multi-line is enabled, the maximum number of single wire sections is 12 (6 two wire sections).



1. Select **Number of Sections** to enter the number of sections.
2. Select single or two wire for the **Section Types**.
3. Enter the **Width** and number of nozzles for each section.

Timing

Note: This option is not visible if task controller is disabled (see TC, page 5).

These settings set the response times for the boom when switched on or off. It is important to accurately calculate the response times to avoid overlaps or gaps in product application.

To calculate the response times:

1. Ensure the implement is ready to begin product application and that the flow meter calibration for the product has been performed (refer to Auto flow calibration wizard, page 27).
2. Use a stop watch to time the delay between switching the boom on and the application of product. This is the **ON TIME**.
3. When the boom is switched off, time the delay between switching it off and the product ceasing to flow. This is the **OFF TIME**.

To set the response times:

1. Select **Sprayer** / **Boom** / **Timing** .

2. Select **ON TIME** to set how many seconds delay there is between switching the boom on and the application of product, then confirm.
3. Repeat for **OFF TIME** and confirm. This will set how many seconds delay there is between switching the boom off and stopping product flow.

Section switch

The section switch can be either virtual (on the console screen) or external (a physical switch connected to the Apollo ECU).

- **Type**:
  - **Virtual**: Sections can be manually turned on and off via the section display on the operation screen. See Sections, page 37.
  - **External ECU sense**: Uses an external switchbox that is connected to the Apollo ECU wiring.

Spray line

Note: This option is not visible if **Pressure Control** is enabled (see page 20)

- **Number of lines**: Multiple line sprayers are supported. Up to two lines may be configured.

  If the system has been configured with 14 single wire sections, 7 two wire sections, or 12 single wire sections and both fence jets, the multi-line option is not available.
- **Maximum flow, line 1**: Sets the flow at which line 1 is turned off and line 2 is turned on.
- **Maximum flow, line 2**: Sets the flow that triggers both lines to be turned on.

  Note: For this feature to work as intended, the nozzles used in line 2 should have a higher flow rate than the nozzles in line 1.

- **Line valves on and off time**: Enables the system to predict when to turn individual lines on and off to ensure that there will always be product flowing as the lines transition.

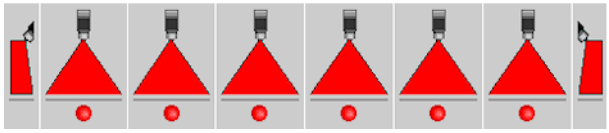
  To set the on/off times; observe the spray lines as they transition. If there is a gap in spray as the first line turns off and the second line turns on, increase the on time to turn the second line on sooner.

  If there is an overlap where both lines are on, which seems longer than acceptable, increase the off time to turn the first line off sooner.

Fence jets

Fence jets are designed to spray outwards from the ends of the boom. They have a 1-2 metre coverage, compared to approximately 1/2 metre for normal nozzles.

Fence jets are shown via the section display on the operation screen.



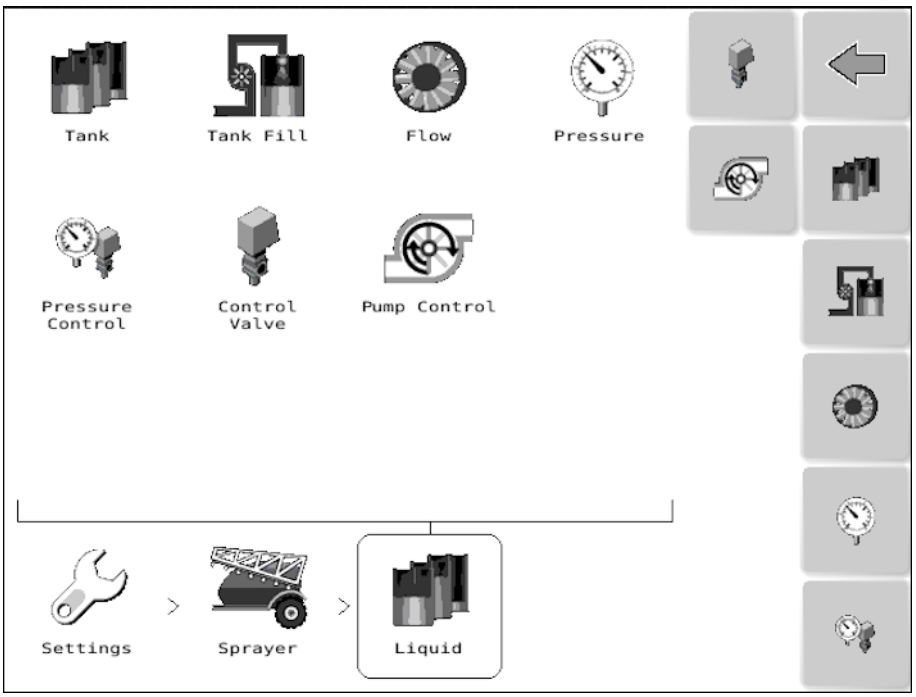
- **Fence jets**: The position of the fence jets on the boom (left, right or both ends).
- **Fence jet mode**: **Drive** means the jets are auto controlled by a relay, **Sense only** means they are turned on and off manually by a switch in the cab but the state is monitored by the ECU so that rate control remains accurate.
- **External inputs**: Select Enabled if Sense only is selected. This indicates that the fence jets are turned on and off by external switches.

Section options

- **Sections track master**: If disabled, the sections remain powered when the master switch is turned off.
- **Reverse section drive**: When this option is enabled, power is applied to the section when the section is off (instead of on).

2.5.2. Liquid tank setup

1. Select **Sprayer** / **Liquid** .



Tank

- **Capacity**: Enter the tank capacity.
- **Smart rate**: Smart rate enables spraying at a virtual speed when the vehicle is stationary, or moving below a specified speed.

  This feature is typically used when starting spraying in the corner of a field. It allows a suitable spray pattern to be achieved by simulating speed. It then automatically returns to the previous rate control mode (Auto or TC) at a configured time/speed.

  Smart rate is activated by linking to the master switch or by pressing **Smart** on the rate control mode selector (see Operation screen, page 33).
- **Smart rate virtual speed**: When in smart rate mode, the spray rate is equivalent to the rate if the vehicle was travelling at this speed.

- **Smart rate cancel speed**: Smart rate is deactivated when the vehicle reaches this speed.
- **Smart rate active time**: Time in seconds that smart rate is active (unless the vehicle goes above the cancel speed before the time expires).
- **Smart rate link to master**: Linking smart rate to the master switch will put the vehicle into smart rate mode when the master switch is turned on (if the smart rate conditions are met).

Tank Fill 

- **Fill preset 1**: Set a preset tank fill volume.
- **Fill preset 2**: Set a preset tank fill volume.
- **Filling calibration factor**: The calibration factor of the flow meter. Refer to the flow meter's manufacturer's specifications.
- **Pump type**: Pump type used to fill the sprayer tank:
  - **Spray pump**: Sprayer pump is being used to fill the tank.
  - **Secondary pump (on/off)**: Separate on/off pump is being used to fill the tank.
  - **Secondary pump (proportional)**: Separate proportional speed pump is being used to fill the tank.
- **Fill control valve**: Valve type being used to start and stop tank fill operation.
  - **1** and **2 wire active full**: Valve should be open when tank is full.
  - **1** and **2 wire active filling**: Valve should be open when tank is filling.
- **Fill aux output**: An auxiliary output that can be powered when the tank fill operation is in progress (Active Filling), or completed (Active Full).
- **Minimum PWM**: (Only available if Secondary Pump (proportional) is selected as Pump Type.) Sets the minimum amount of PWM or power required to allow the pump to operate.

- **Maximum PWM**: (Only available if Secondary Pump (proportional) is selected as Pump Type.) Sets the maximum amount of PWM power that can be provided to the pump before maximum possible speed is achieved.
- **Soft start**: (Only available if Secondary Pump (proportional) is selected as Pump Type.) Allows a gradual increase in the speed signal when the pump is activated. This is used to prevent mechanical damage from sudden starts.
- **Soft stop**: (Only available if Secondary Pump (proportional) is selected as Pump Type.) Allows a gradual decrease in the speed signal when the pump is deactivated. This is used to prevent mechanical damage from sudden stops.

Flow 

- **Calibration factor**: The number of pulses from the flow meter per liter of liquid or weight. Check the calibration factor on the tag on the flow meter of the sprayer.

  Note that manually specifying the calibration factor on this screen should only be performed if the flow factor is already known or has previously been calculated via the auto flow calibration wizard, see Auto flow calibration wizard, page 27.

  If the Calibration Factor is not known, this field should be left blank and the auto flow calibration wizard followed.
- **Auto flow calibration**: Starts the auto flow calibration wizard. See Auto flow calibration wizard, page 27.
- **Minimum flow**: Sets the minimum flow that the flow meter can effectively measure. When in auto mode, the system will not control below this value. This could cause over application of product, but will ensure that stable control can always be achieved. Refer to the flow meter manufacturer’s information.

- **Minimum nozzle flow**: Sets the minimum flow that will create an adequate spray pattern. When in auto mode, the system will not allow control below the flow rate that is calculated by the minimum nozzle flow multiplied by the number of nozzles activated. Refer to nozzle manufacturer's information.
- **Reverse dump valve**: The dump valve releases liquid back to the tank. In some cases the valve may have been wired to work in the opposite direction. To allow the dump valve to work in reverse, select Reverse Dump Valve.
- **Balanced valves**: The sprayer software is capable of controlling systems that use balanced valves. These valves, when closed, bypass the flow from the boom section back to the tank. This bypass flow is adjustable. This enables the system to maintain sprayer pressure when turning the sections off or on. In a normal system, when a section is turned off, the sprayer is working with a lesser width, and the regulator reduces the pressure to maintain the flow rate for the remaining sprayer width. This can affect the nozzle performance and thus the effectiveness of the sprayer. With a balanced valve system, the pressure is maintained and thus the spray pattern will always be optimal.
- **Recirculating flow**: Circulates excess product back through the tank to allow chemicals to continually move through the system.
- **Return flow factor**: The calibration factor for the flow meter that measures the recirculating flow returning to the tank.

Pressure 

- **Sensor type**: The pressure sensor may be Voltage sensor type.
- **Maximum pressure**: The maximum pressure rating that the sensor can read.
- **Minimum voltage**: Set the minimum output voltage at zero pressure. This value is read from the pressure transducer.

- **Maximum voltage**: Set the maximum output voltage at maximum pressure. This value is read from the pressure transducer.
- **Low speed pressure hold**: This allows the system to go into 'low pressure hold' based on speed. If the controller is in auto and the speed drops below the set value, the system will stop controlling to the set application rate and go into manual mode. When the speed goes back above this value it will go back into auto mode. The speed threshold must be entered.
- **Speed threshold**: Speed at which low speed pressure hold is triggered.

Pressure Control 

Note: This option is not visible if multiple spray lines are enabled.

- **Pressure control**: Pressure Only or Pressure Fallback control. Pressure fallback control uses flow control unless the flow falls below a set flow rate. It will then use pressure control until the flow increases.
- **Density**: The density of the liquid (water = 1).
- **Control switch point**: (Only available if Pressure Fallback is selected as Pressure Control.) The low flow rate that will activate pressure control.
- **Reference pressure**: This should be set at the target spraying pressure. Check nozzle manufacturer's information.
- **Nozzle calibration factor**: The flow per minute for a single nozzle when operated at the reference pressure. Check nozzle manufacturer's information or test the actual rate by collecting the flow over a minute and measuring the amount collected.

Control Valve 

- **Control valve**: Regulator valve systems are placed in line with the pump and adjust the flow of product to the boom by diverting

excess flow back to the tank.

Proportional valve systems typically control a hydraulic valve that adjusts the speed of the pump to control the flow that is being delivered directly to the boom.

- **Flow meter sampling**: Sets how frequently sampling is done. Standard sampling is recommended. Reduced is recommended only if flow may be highly irregular (for example, on worn equipment).
- **Add dither**: (Only available if Proportional selected as Control Valve.) Dither makes the valve vibrate slightly to help prevent sticking. Valve quality and brand will dictate whether this setting is required. Varies the PWM +/- of the set point.
- **Minimum PWM**: (Only available if Proportional selected as Control Valve.) Sets the minimum amount of PWM or power required to allow the metering unit to rotate or discharge product.

  The time that the Pulse Width Modulation (PWM) is active. Higher values set the pulse of power for longer during a pulse cycle. Minimum PWM is used to locate at what point a valve or motor will respond to the power provided. Anything under this figure the implement (motor, valve actuator) will not respond.
- **Maximum PWM**: (Only available if Proportional selected as Control Valve.) Sets the maximum amount of PWM power that can be provided to the valve before maximum possible speed is achieved.

  The time that the Pulse Width Modulation (PWM) is active. Higher values set the pulse of power for longer during a pulse cycle. Anything over this figure the implement (motor, valve actuator) will not respond.
- **Controller response**: (Only available if Proportional selected as Control Valve.) This sets how quickly the controller will try to achieve the required rate. If set too high, the sprayer may pass the target rate and take time to adjust, searching for the right level. If set too low, the valve will take a long time to move to the desired

rate and control will be slow to respond. Find the best setting for the equipment being used.

- **Soft start**: (Only available if Proportional Valve selected as Control Valve.) Allows a gradual increase in the valve signal when the valve is activated. This is used to prevent mechanical damage from sudden starts.
- **Soft stop**: (Only available if Proportional Valve selected as Control Valve.) Allows a gradual decrease in the valve signal when the valve is deactivated. This is used to prevent mechanical damage from sudden stops.
- **Valve speed**: (Only available if Regulator selected as Control Valve) Sets the speed at which the valve is driven to control the rate.
- **Manual pulse duration**: (Only available if Regulator selected as Control Valve) This setting is used to set how long the valve should be moved each time you press the +/- button when operating in manual.

  This has defaults based on the selected valve speed as follows:

  - Fastest: 600 ms
  - Medium: 75 ms
  - Slow: 50 ms

  These defaults can be overridden if required.
- **Close valve when off**: (Only available if Regulator selected as Control Valve.) Ensures that the valve is closed when the tank is not in use. This closes the valve when the Master Switch is off and/or when all sections are turned off.
- **Reverse valve**: (Only available if Regulator is selected as Control Valve.) In some sprayers the valve may have been wired to work in the opposite direction. This setting allows the valve to work in reverse.

- **Minimum on time**: (Only available if Regulator selected as Control Valve.) The minimum time that power needs to be applied to move the valve.
- **Maximum on time**: (Only available if Regulator selected as Control Valve.) The maximum time that power can be applied to move the valve.
- **Gain setting**: (Only available if Regulator selected as Control Valve.) This sets how quickly the controller will try to achieve the required rate. If set too high, the sprayer may pass the target rate and take time to adjust, searching for the right level. If set too low, the valve will take a long time to move to the desired rate and control will be slow to respond. Find the best gain percentage for the equipment being used.
- **PWM setting**: (Only available if Regulator selected as Control Valve.) This is the time that the Pulse Width Modulation (PWM) is active. This setting is used to reduce the overall applied voltage to the actuator. Use with caution as this will reduce the torque that the actuator is able to apply. Control of a motor or valve is achieved by varying the amount of time power is switched on/off. This happens at a very fast rate.

Pump Control 

- **Pump speed**: Some sprayers have a hydraulically driven pump and have a speed sensor fitted to monitor the driven speed of the pump. Setting up pump speed allows the pump speed to be monitored during operations.
- **Pulses/revolution**: (Only available if Pump Speed enabled.) If set at 1, the sensor picks up from a target bolt, one pulse per revolution. Sets the number of pulses detected per revolution of the pump.
- **Pressure boost**: This increases the pressure when the sprayer has been turned off. This drives the valve to increase pressure for a

short time after the Master Switch is turned off. This allows spraying to resume at normal pressure when it is restarted. Note: This option is not available if agitation is enabled.

- **Agitation mode**: (Only available if Proportional selected as Control Valve.) Keeps the proportional valve driving when the Master Switch is turned off. Allows slight agitation to keep the mixture moving.
  - **Preset PWM**: Pump speed is set at a fixed value.
  - **Preset pressure**: Pump pressure is set at a fixed value. Pressure is read via the main pressure sensor.
  - **Proportional PWM**: Pump speed is reduced as tank level decreases to prevent foaming.
- **Agitation PWM**: (Only available if Agitation Mode is set to Preset PWM.) Sets the pump speed to this fixed value.
- **Agitation pressure**: (Only available if Agitation Mode is set to Preset Pressure.) Sets the pump pressure to this fixed value.
- **Low tank PWM**: (Only available if Agitation Mode is set to Proportional PWM.) Sets the agitation power when the tank is empty.
- **Full tank PWM**: (Only available if Agitation Mode is set to Proportional PWM.) Sets the pump speed when the tank is full (more effort is required to agitate a full tank).

2.5.3. Speed source setup

1. Select **Sprayer**  / **Speed Source**  .

- **Speed source**: Sets the source of speed information supplied to the implement which is used to determine the application rate required.
- **Manual speed**: Enter the speed that will be used if **Manual** is selected as the **Speed Source**.

- **Wheel calibration**: If **Wheel Sensor** is selected as the **Speed Source**, the wheel factor must be calibrated. Wheel factor defines how many meters per pulse are received from the wheel speed sensor. Selecting this option opens the Auto Speed Calibration wizard. Follow the wizard prompts to calibrate the wheel sensor.
- **Wheel factor**: Defines how many meters per pulse are received from the wheel speed sensor. Enter the figure here if known, or perform a wheel calibration.
- **Low speed shutoff**: Low speed at which the sprayer will stop spraying.

2.5.4. Alarm setup

1. Select **Sprayer**  / **Alarms**  .

Alarms can be enabled / disabled individually.

Alarms that require more information are shown below.

- **Pressure High**: This alarm will sound and display when pressure exceeds the preset maximum pressure (at which the sprayer nozzles become inefficient) for each tank.
- **Pressure Low**: This alarm will sound and display when pressure drops below the preset minimum pressure (at which the sprayer nozzles become inefficient) for each tank.
- **Incorrect Rate**: This alarm will sound and display if the detected actual rate is different from the preset rate by the threshold percentage amount. Enter the percentage in **Tolerance** (lower is more sensitive).
- **Product Low**: This alarm will sound and display if the tank contents drop below the preset threshold.
- **High Pump Speed**: This alarm will sound and display when RPMs exceed the preset maximum RPMs for each tank.
- **Low Pump Speed**: This alarm will sound and display when RPMs drop below the preset minimum RPMs for each tank.

- **Low Fan Speed**: This alarm will sound and display when RPMs drop below the preset minimum RPMs.
- **High Fan Speed**: This alarm will sound and display when RPMs exceed the preset maximum RPMs.

2.6. Auto flow calibration wizard

Flow meter calibration determines the number of pulses from the flow meter per liter of liquid.

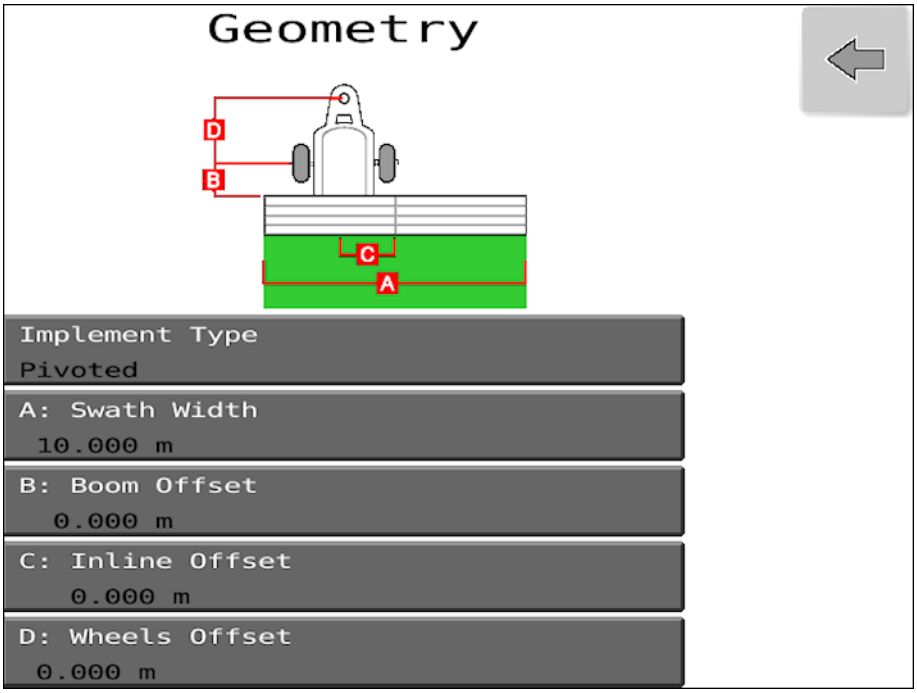
To calibrate the flow meter:

1. Select **Sprayer**  / **Liquid**  / **Flow**  .
2. Select the **Auto Flow Calibration** button. The auto flow calibration wizard displays.
3. Ensure the master is off and the pump and any required sections are turned on, then select next  .
4. Divert the flow from a section output into the calibration bucket.
5. Activate the master switch  .
6. Run the liquid drive until sufficient liquid product has been obtained. (The larger the volume measured, the more accurate the flow meter calibration will be. The increase  and decrease  buttons may be used to increase or decrease the flow and pressure.). Deactivate the master switch to turn off the liquid drive and select next  .
7. Measure the volume of product in the calibration bucket.
8. Select **Volume Captured** on the calibration wizard, and enter the amount of liquid measured in calibration bucket, then select next  .
9. Confirm the displayed calculated flow factor.

2.7. Setting up geometry

To set up implement geometry:

1. Select **Geometry** .



Note: Measure the implement dimensions as accurately as possible as these measurements will affect the modeling, mapping and GPS based product placement. The recommended tolerance is +/- 5 cm.

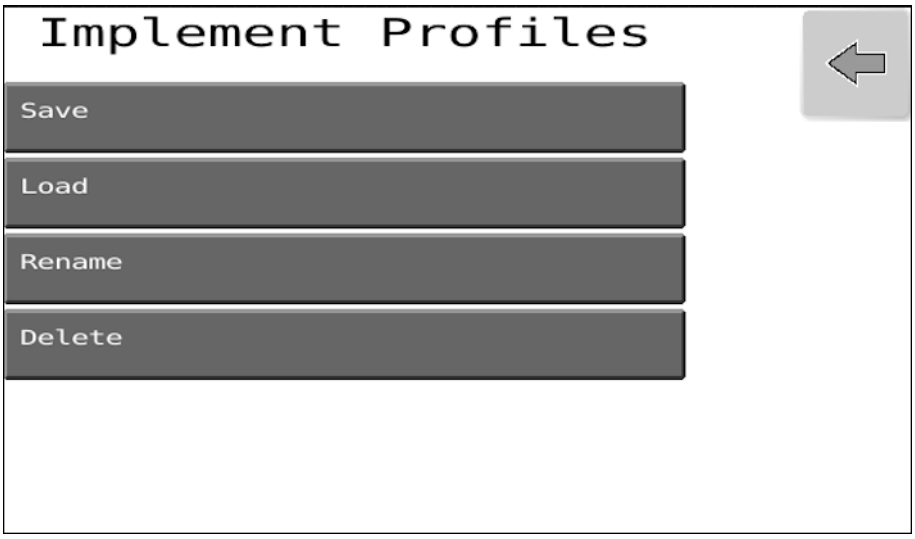
- **Implement type**: May be rigid, pivoted or front mount.
- **Swath width**: Measures the working width of the implement (that is, the width of the area that is treated during one pass of the implement).
- **Boom offset**: Measures the distance between the hitch point and the working area of the implement.
- **Inline offset**: Measures the off-center offset of the implement relative to the hitch point. Enter a positive number if the implement is shifted to the right and a negative number if it is shifted to the left.

- **Wheels offset**: Measures the distance between the wheels and the working area of the implement. If the sprayer has dual axles the wheels point should be set to midway between the axles.

2.8. Managing implement profiles

To manage implement profiles:

1. Select **Profiles** .



Note: Profiles are saved as .spf file type.

Save

The profile in use can be saved to ECU internal storage, or to an external file server (for example USB).

1. Select **File Name** to rename the profile, if required.
2. Select **Select Profile Storage** to choose the location to save the profile.
3. Select the tick button to confirm.

Load

Existing profiles can be loaded from ECU internal storage, or an external file server (for example USB) to become the profile in use.

1. Select **Select Profile Storage** to choose the location of the profile to be loaded.

2. Select the profile to be loaded.
3. Select the tick button  to confirm.

Rename

A profile can be renamed if required.

1. Select **Select Profile Storage** to choose the location of the profile to be renamed.
2. Select the profile to be renamed.
3. Select **New Name** to rename the profile.
4. Select the tick button  to confirm.

Delete

Any saved profile can be deleted if required.

1. Select **Select Profile Storage** to choose the location of the profile to be deleted.
2. Select the profile to be deleted.
3. Select the tick button  to confirm.

2.9. Setting up user

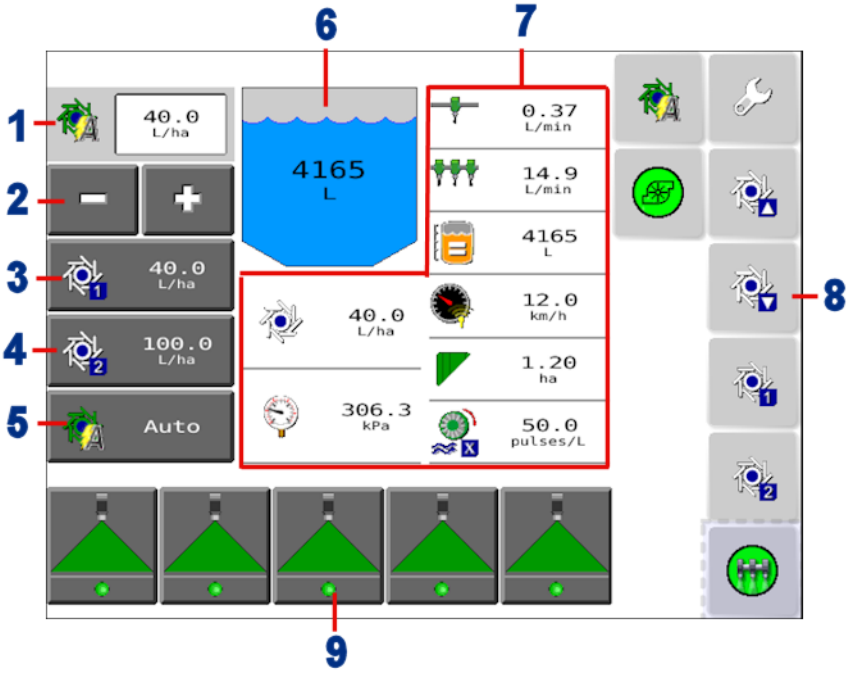
1. Select **User**  .

- **Datablock selection mode**: The tank parameters displayed on the operation screen (see page 33) can be selected by pressing and holding to display a list of options. This may not work on virtual terminals that do not have a touch screen. Select **On Press** if using a terminal that does not have a touch screen.
- **Metric pressure unit**: Metric pressure units may be shown as kPa or bar on the operation screen.

Chapter 3 – Sprayer Operation

Once setup is complete, the sprayer functions can be controlled via the operation screen.

3.1. Operation screen



1 Requested application rate. Press to enter and display the application rate. The control system uses the calibration factor to adjust the product flow for the given product. This is disabled if TC or Manual mode is being used.

2 Increase/decrease requested application rate by Rate Increment (set by selecting tank operations shown at **6**).

3 Set application rate to **Spray Rate (1)** (set by selecting tank setup shown at **6**).

4 Set application rate to **Alternate Rate (2)** (set by selecting tank setup shown at **6**).

5 Rate control mode selector. Allows you to select TC, Auto control or Smart rate (see Liquid tank setup, page 16).

   Manual may also be selected. Note that Auto Section Control will not work in manual mode. When in manual mode, the requested rate is greyed out and the actual rate may be adjusted using the + and – buttons.

6 Tank volume. Press to display Tank Operations screen. See Tank operations screen, page 34.

7 Tank parameters. Press and hold to select the displayed parameter.

8 Soft keys. See Soft keys, page 36.

9 Sections. See Sections, page 37.

3.1.1. Tank operations screen

Selecting the tank image displays the Tank Operations screen.

- **Rate operations**:
  - **Spray rate (1)**: Defines the preset application rate.
  - **Alternate rate (2)**: Defines an alternative preset application rate.
  - **Rate increment**: Defines how much the application rate will change when the operator presses the application rate up/down button.
- **Fill operations**:
  - **Current volume**: Current product volume in the tank.
  - **Fill tank**: Fill the tank to capacity.
  - **Auto fill control**: Allows the tank to be filled with a specified amount of liquid if a flow meter is connected to the tank fill. Ensure **Sprayer** / **Liquid** / **Tank Fill** has **Tank Fill** enabled on the setup screen (see Tank Fill , page 17).

Note: Auto fill is not available if the **Filling calibration factor** for the flow meter has not been entered. See Tank Fill , page 17.

 Fill the tank to capacity.

 Fill to the preset values (see Tank Fill , page 17).

 Set the tank volume to zero.

1. Enter the required **Target Volume** and select  .
2. Select  to start filling the tank to the required volume.
3. Alternatively select  to fill the tank to capacity.

- **Reset area covered**: Resets the area covered option displayed in the tank parameters.
- **Product type**: Select Crop Protection or Fertilizing. When Task Controller is enabled, it is important to correctly set the product type to ensure the console knows the type of product that is in each tank for documentation purposes. Some systems will not allow tanks that don't have the correct product type associated to be associated with certain layers on a variable rate map.

Diagnostics screen 

- **Set period**: The required flow meter pulse period for the requested application rate.
- **Actual period**: The actual flow meter pulse period.
- **Pulse count**: The number of pulses received from the flow meter since the system was started or diagnostics was reset.
- **Actual rate**: The current application rate.

- **Min rate**: The minimum application rate since the system was started or diagnostics was reset.
- **Max rate**: The maximum application rate since the system was started or diagnostics was reset.
- **Flow rate**: The current flow rate.
- **PWM value**: The position of the control valve within its operating range.
- **Reason off**: The reason (if any) for not operating.

Note: Values can be reset by selecting the reset button  .

3.1.2. Soft keys

The soft keys displayed will vary depending on sprayer setup.

 Display the setup screen.

 Increase the flow by the amount set in **Rate increment**.

 Decrease the flow by the amount set in **Rate increment**.

 Set the flow to the rate preset in **Spray rate (1)**.

 Set the flow to the rate preset in **Alternate rate (2)**.

 Sprayer master switch. Start and stop the sprayer.

 Rate control mode selector. Allows you to select Auto, TC, Smart rate or Manual control.

 Pump override button. See Pump setup, page 9.

 Custom controls. See Custom controls setup, page 10.

3.1.3. Sections

The number and width of sections displayed is set up via Boom setup, page 12.

Note: The number of nozzles per section is not displayed.

The sprayer icon color shows whether product is flowing through that section.

The circles at the base of each sprayer icon show the section switch state (on/off). Press to turn the section switch on and off manually.

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