



X20 Sprayer Reference Manual

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Preface

This manual has been developed to provide you with the information necessary to operate and maintain this Topcon Precision Agriculture (TPA) product. Proper service and use is important for the safe and reliable operation of the product. The sections provided in this manual include information necessary for the safe and correct operation, care, and troubleshooting of this product. The benefits this product provides can be greatly influenced by your knowledge of the products described in this manual.



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Manual Conventions

This Manual uses the following conventions:

File>Exit ~ Click/tap/press the **File** menu, then click/tap/press **Exit**.

Enter ~ Click/tap/press the button or key labelled **Enter**.



Supplementary information that can help you configure, maintain, or set up a system.



Supplementary information that can have an effect on system operation, system performance, measurements & personal safety.



Notification that an action has the potential to adversely effect system operation, system performance, data integrity, or personal health.



Notification that an action *will* result in systems damage, loss of data, loss of warranty, or personal injury.



UNDER NO CIRCUMSTANCES SHOULD THIS ACTION BE PERFORMED.

Introduction

The Spray Electronic Control Unit (ECU) is a new generation Spray Controller, which is used in conjunction with the Topcon Precision Agriculture X20 (or X15) console. The X20 console is the graphical interface of the Spray ECU controller. The Spray ECU replaces the Spray Rate Interface.

The Spray ECU can control up to 30 section valves (3 wire), and allows Automatic Section Control (ASC) of the 30 section valves (the X15 console can control up to 15 sections under ASC). The Spray ECU can control up to 2 liquid tanks directly. If the Spray ECU is used in conjunction with a Multi-Drive Electronic Control (MDECU) unit, it can control up to 3 liquid injection tanks.

The Spray ECU can handle Boom Sensing inputs, therefore it can be connected to existing Remote switches. The Spray ECU also has a new feature called Section Mapping, which allows one section switch to control a number of section valves. Therefore the existing Topcon Precision Agriculture Switchbox or remote switches (usually 6 or 8 switches) can control all 30 section valves, when they are controlled manually. The X20 Sprayer software sets up the section mapping to allow the six switches to control the 30 section valves. The ASC still controls all 30 section valves individually.

The Spray ECU can control Regulator or Proportional type Control Valves. The Spray ECU can control 3 Wire, 2 Wire (reverse polarity) or Solenoid type Section Valves.

sing This Manual

This manual is written for:

- First time users of this Spray ECU
- Operators who are upgrading their existing Sprayer software to a later version and their Spray Rate Interface or Spray ECU is already installed.

First Time Users

First time users of Topcon Precision Agriculture's Spray ECU must read all chapters.

Operators Who Are Upgrading Their Software

Operators who are upgrading their existing Topcon Precision Agriculture Sprayer software must read Chapter 4.

After reading Chapter 4, upgrading operators may then go to Chapter 7, "Configuration Setup".

Before Installing or Servicing Your Spray ECU

You must follow the procedures in this chapter to ensure your safety while installing or servicing your Spray ECU.



WARNING

Damage will occur if any external power is applied to the Section Drive Outputs on the Spray ECU.



TIP

Follow the procedures carefully, to ensure that no damage is done.



WARNING

Disconnect both the X20 console and Spray ECU controller from the battery before charging, jump starting or welding on the vehicle and/or Sprayer.

Testing Procedure



WARNING

Before commencing testing procedure disconnect the existing tractor harness from the existing controller.

You must complete one of two testing procedures, before upgrading your software.

Make sure you choose the testing procedure that is applicable to your product.

Testing Procedure For Installations With No Existing Switchbox (switches on existing controller)

1. On existing tractor harness, turn the ignition on
2. Check each Section Drive Output pin for voltage (refer to manufacturer manual of existing tractor harness for pin details)
3. Locate where voltage is supplied, to determine if it can be removed without limiting existing functionality



WARNING

If it is not possible to remove this voltage, then you must install a Section Drive Output Protection Adaptor (A2812 for 37-pin on Connector 1 and A2813 for 16-pin on Connector 3).

4. When no voltage is found, disconnect the vehicle's battery before continuing with installation.

Testing Procedure for Installations With Existing Switchbox (including Joystick Control):

1. Determine whether it is possible to disconnect the existing Switchbox without limiting existing functionality, eg: Boom, Lift, Lower or Fold



WARNING

If it is not possible to remove the existing Switchbox, without limiting functionality and voltage is present, then you must install a Section Drive Output Protection Adaptor (A2812 for 37-pin on Connector 1 and A2813 for 16-pin on Connector

2. If it is possible to disconnect the existing Switchbox without limiting existing functionality disconnect the Switchbox
3. On existing tractor harness, turn the ignition on
4. Check each Section Drive Output pin for voltage (refer to manufacturer manual of existing tractor harness for pin details)
5. When no voltage is found, disconnect the vehicle's battery before continuing with installation.



WARNING

The vehicle battery must be disconnected before proceeding with any installation or servicing of the Spray ECU, Tractor, Sprayer or Valve Harnesses.

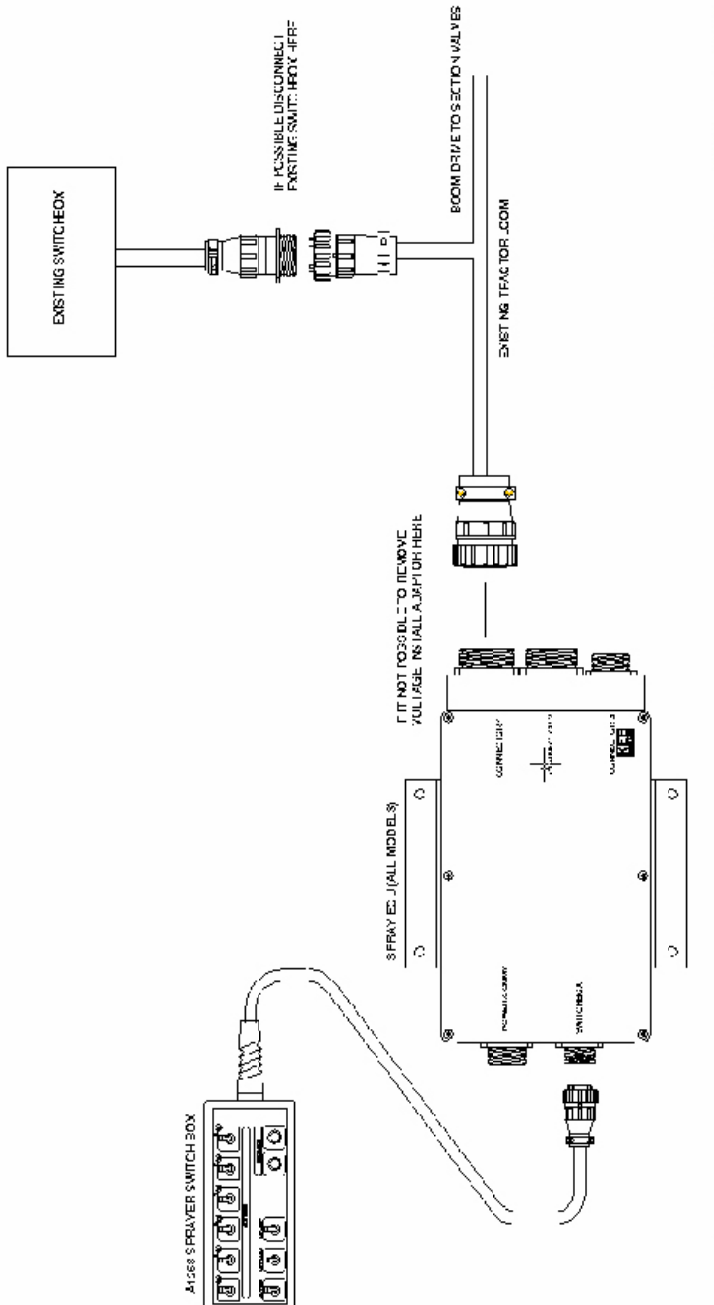


Figure 4-1. Connecting the Spray ECU to Existing Installations

Installing the Spray ECU (all models)

This chapter is for first time operators of the Sprayer software. If you are an operator who is installing upgrades to your existing software (Spray Rate Interface or Spray ECU is already installed) please ensure you have read Chapter 4, and then continue to Chapter 7.



WARNING

Damage will occur if any external power is applied to the Section Drive Outputs on the Sprayer ECU.



TIP

Follow the following procedures carefully, to ensure that no damage is done.



WARNING

Disconnect both the X20 console and Spray ECU controller, from the battery, before charging, jump starting or welding on the vehicle and/or Sprayer.

Installing the Spray ECU 30S



Figure 5-1. Spray ECU 30S



Figure 5-2. Sprayer Switchbox



TIP

When mounting the Spray ECU, it is important that the Spray ECU itself, and its connectors cannot be accidentally damaged by moving objects.

1. Mount the Spray ECU (Figure 5-1), in a suitable position inside the cab.

The Spray ECU can be mounted in any orientation.

Figure 5-3 on page 5-7 shows the in cab assembly showing Spray ECU, Switchbox, Power Comms and Tractor Harness.

2. Connect the Power Comms harness to the Spray ECU and route the red and black wires to a 12 Volt battery



WARNING

Do not connect the Power Comms harness to the battery until the installation is complete.



NOTICE

Use the cable ties provided to secure the Power Comms Harness away from hot and moving parts, and to avoid chaffing and wear.

3. Plug the Switched Power connector that is located on the Power Comms Harness, into the Switched Power connector on the X20 Power Cable



TIP

If this connection is already being used, connect it via the A1953 Power Splitter Harness.

This connection ensures that the Spray ECU is only powered up when the X20 console is switched ON.

4. Connect the end of the Power Comms Harness, that has a DB 9-Pin to the next available COM Port on the back of the X20 console
5. Connect the other end of the Power Comms Harness to the 16-Pin connector marked POWER/COMMS on the Spray ECU

6. Connect the Sprayer Switchbox (Figure 5-2 on page 5-2), to the 9-Pin connector, marked SWITCHBOX on the Spray ECU.

Mount the Sprayer Switchbox, using the double-sided tape supplied (or other suitable means).



TIP

Mount the Sprayer Switchbox in a position which is easily accessible while spraying.

Installing the Spray ECU 30S Topcon Precision Agriculture Sprayer Kits

All Topcon Precision Agriculture Sprayer kits come with their own installation guide, which is specific to each kit. Please use the installation guide which came with your TPA Sprayer kit.

This section is a general guide for the installation of all Topcon Precision Agriculture Spray ECU 30S Sprayer kits.

This section will cover:

- Installing the Tractor Harness
- Installing the Sprayer Harness
- Installing the Valve Harness.

Installing the Tractor Harness

Figure 5-3 on page 5-7 shows the in cab assembly showing Spray ECU, Switchbox, Power Comms and Tractor Harness.

1. Connect the Tractor Harness to the 37-Pin connector marked CONNECTOR 1 on the Spray ECU
2. Run the Tractor Harness from the Spray ECU to the drawBar or the back of the vehicle.



NOTICE

Ensure that the Tractor Harness is tied away from moving, hot and sharp objects.



WARNING

Do not cut or splice the Tractor Harness, all excess cable should be strapped away to avoid vibration and wear.

Tractor Harness Extras

Two 37-Pin Connectors

If your Tractor Harness has two 37-Pin connectors you would have (in step 1) connected the male pin, marked CONNECTOR 1 to the plug marked CONNECTOR 1 on the Spray ECU.

You will also have to plug the other 37-Pin connector (female pins), marked CONNECTOR 2 to the plug marked CONNECTOR 2 on the Spray ECU.

Please note: As a general rule the CONNECTOR 2 plug is only required if the Sprayer:

- Has more than 10 Boom Sections
- Has more than 2 tanks
- Is connecting to external switches which control the Boom Sections (boom sensing), eg: Boom Section switches on a T Bar or Joy Stick or other third party section switches.

Connector 3

Normally CONNECTOR 3 (16 pin) is only required if the Sprayer requires extra pressure inputs, tank level sensors and extra encoder inputs.

3-Pin Weather Pack Connector/Ground Speed

The Tractor Harness has a 3-Pin Weather Pack connector labelled 'Ground Speed'.

Either an A328 Shaft/Speed Sensor Kit or A449 Radar Sensor Interface Harness (not included in this kit) can be connected to this connector.

Typically, the Radar Sensor Interface Harness would be connected to the Tractor Harness Ground Speed Connector.



NOTICE

Only one speed connector can be used at any one time.

See "Connecting to a Speed Sensor", page 5-11 for installing the Shaft/Speed Sensor Kit or Radar Interface Kit.

Installing the Sprayer Harness

Figure 5-5 on page 5-10 shows the Sprayer Harness and Valve Harness Assembly.

1. Connect the connector on the Sprayer Harness to the Tractor Harness, at the back of the tractor or vehicle
2. Continue to run the Sprayer Harness across the Sprayer's chassis, to the valve set



WARNING

Do not cut or splice the Sprayer Harness; all excess cable should be strapped away to avoid vibration and wear.

Sprayer Harness Connectors

The typical Sprayer Harness has 5 connectors (Figure 5-5 on page 5-10), which are labelled:

- Ground Speed—connects to the Shaft/Speed Sensor Kit (supplied in kit)
- Flow Meter 1—connects to a Flow Meter (not supplied in kit)
- Pressure Sensor 1—connects to the Pressure Sensor (supplied in kit)
- Reg Valve 1—connects to a Regulator Valve (not supplied in kit)
- Valve Harness—connects to the Valve Harness (supplied in kit).

Please note: The Sprayer Harness may have other connectors, refer to the Sprayer Installation kit that came with your Sprayer kit for more information.

The Dump Valve connector may be located on the Sprayer Harness. If the Valve Harness has an Arag Interface box incorporated into the Valve Harness, then the Dump Valve connector will be located on the Valve Harness.

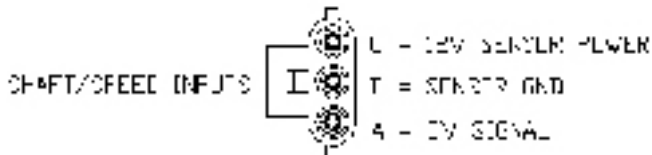


Figure 5-4. 3-Pin Weather Pack Sensor



TIP

For testing purposes on all 3-Pin sensor connectors (Shaft/Speed Sensor and Flow Meter) the voltage on each pin should be:

- Pin A: +% VDC Signal
- Pin B: Ground
- Pin C: +12VDC Sensor Power

See Figure 5-4.

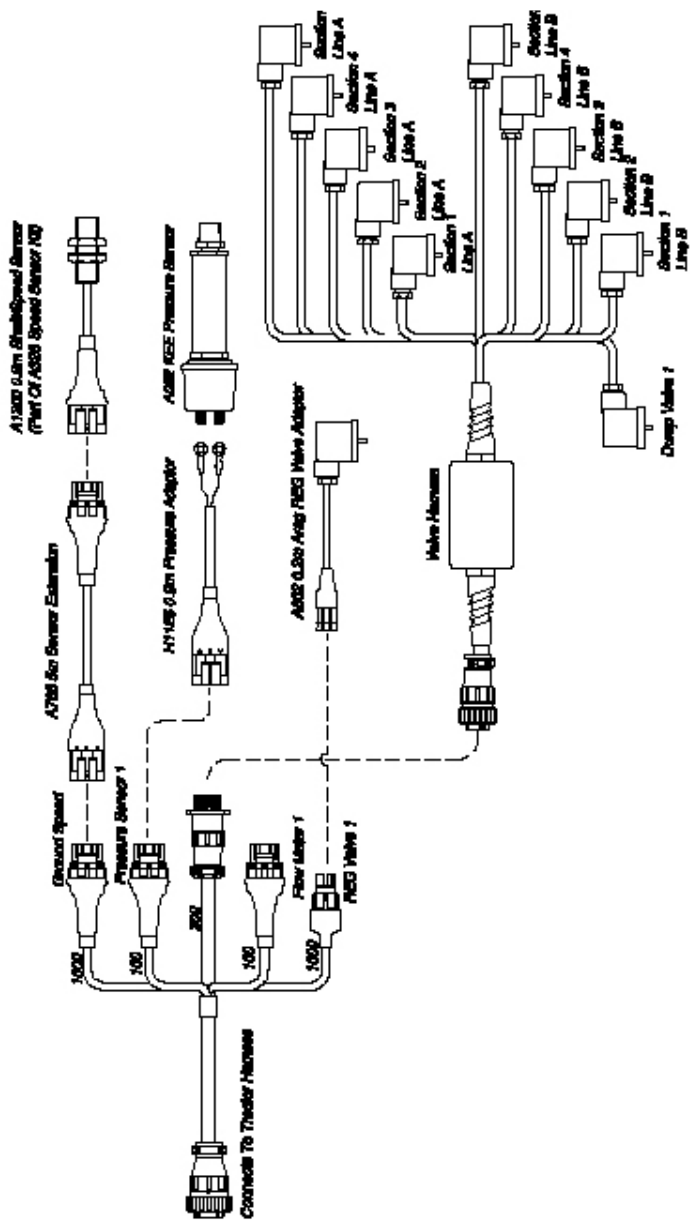


Figure 5-5. General Sprayer and Valve Harness assembly

Connecting to a Speed Sensor

This installation is used if connecting an A238 Shaft/Speed Sensor kit (for ground speed) or A449 Radar Sensor Interface Harness (not supplied in kit) to the Ground Speed Connector on either the Tractor Harness or Sprayer Harness.



NOTICE

Connect to only one of the Ground Speed connectors.

Select one of the following:

- Installing the Shaft/Speed Sensor kit to an un-driven wheel on either the Tractor Harness or Sprayer Harness
- Installing the Shaft/Speed Sensor kit to the Tailshaft of a vehicle on either the Tractor Harness or the Sprayer Harness
- Use an existing Radar Speed sensor for Ground Speed

Installing the Shaft/Speed Sensor Kit to an Un-Driven Wheel for Ground Speed



NOTICE

Use of a driven wheel for ground speed may be subject to “wheel slip” and may not always reflect true ground speed.

The Shaft/Speed Sensor and Wheel Stud Magnets can be fitted to any un-driven ground wheel, eg: the front wheel of the tractor or wheel on a trailing Sprayer.

The magnet activates the sensor as the wheel magnets sweep past (Figure 5-6 on page 5-12).

NOTICE *NOTICE*

A wheel Calibration Factor of no greater than 0.6m (24 inches) is required. See Section

1. Glue the magnets to the wheel studs (Figure 5-6), with the side marked with a plus (+) facing the Shaft/Speed Sensor.



TIP

Use any silicone or epoxy type adhesive to glue the magnets to the wheel studs. Make sure you leave adequate time for the glue to set.

NOTICE *NOTICE*

Space the magnets equally around the wheel, on all the available wheel studs (Figure 5-6), to ensure accurate speed updates.

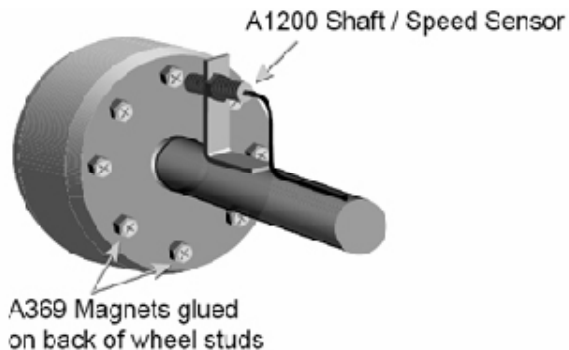


Figure 5-6. Shaft/Speed Sensor on an Un-Driven Wheel Installation

2. Mount the Shaft/Speed Sensor to an existing structure on the wheel axle, ideally in a protected position to face the magnet.

**NOTICE**

The distance between the Shaft/Speed Sensor to Wheel Stud Magnet needs to be 2 to 3 mm (1/16 to 1/8 inch). The Shaft/Speed Sensor must be mounted so that the Wheel Stud Magnets pass the sensor evenly and squarely.

To mount the Shaft/Speed sensor you can either:

- Use the Mounting Bracket Assemblies (slotted brackets and angle brackets with hose clamps) provided (Figure 5-7 on page 5-14)
- Fabricate your own mounting bracket to suit the Sprayer chassis.

**NOTICE**

There must be no movement of the sensor relative to the magnet.



Figure 5-7. Shaft/Speed Sensor with Mounting Bracket

If necessary, protect the Shaft/Speed Sensor and wiring from damage by welding or bolting a suitable plate over them.

NOTICE

NOTICE

Damage to the front face of the Shaft/Speed Sensor will stop the speed readout and prevent the controller from working.

NOTICE

NOTICE

If the Shaft/Speed sensor is mounted on a steered wheel, then make sure the sensor moves with the steering mechanism, to maintain constant clearance between the magnets and the sensor when the wheel is turning from lock to lock.

If required, use the 3-Pin Weather Pack Extension provided, by connecting the Shaft/Speed Sensor to either the Ground Speed connector on the Tractor Harness or Sprayer Harness.

Installing the Shaft/Speed Sensor Kit to a Tailshaft

On a tray mounted Sprayer the Shaft/Speed Sensor kit can be used to read from the vehicle Tailshaft (Figure 5-8).

1. Securely mount the Magnet Block on the flange, between the Transmission Housing and Tailshaft, using the Hoseclamp or other suitable means (Figure 5-8)



NOTICE

Do not attach the Magnet Block (Figure 5-8) directly to the Tailshaft as its position changes, throughout its rotation.

Please note: The wheel stud magnets are not used in this case.

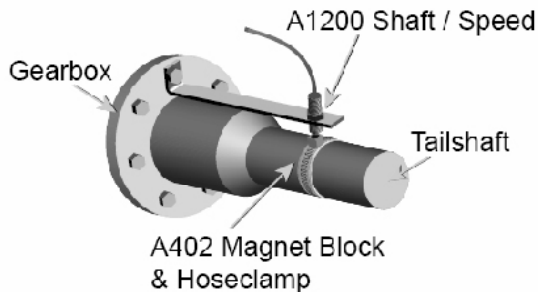


Figure 5-8. Shaft/Speed Sensor installation to a Tailshaft

2. Securely mount the Shaft/Speed Sensor so it squarely faces the Magnet Block with a clearance of 2 to 3mm (1/16 to 1/8 inch), using an existing bolt on the transmission housing and the supplied Mounting Brackets or other suitable means.

Ensure that the Shaft/Speed Sensor is firmly attached and protected so that it cannot be damaged by wire or stones. If necessary cover the Shaft/Speed Sensor with a plate.

If required, use the 3-Pin Weather Pack Extension provided, by connecting the Shaft/Speed Sensor to either the Ground Speed connector on the Tractor Harness or Sprayer Harness.

Using an Existing Radar Speed Sensor for Ground Speed

An optional Radar Sensor Interface Harness (A449—not provided in kit but can be ordered separately) allows direct connection to any existing Radar Speed Sensor on the tractor.

1. Connect the Radar Sensor Interface Harness to the Ground Speed connector on the Tractor Harness or Sprayer Harness
2. Connect the other end of the wire to the signal wire from the Radar Sensor (not provided in kit) to enable the Spray ECU to read the speed.



CAUTION

Check the Radar Sensor Manufacturer's manual before attempting connection.

If required, use the Extension Harness provided, by connecting the Radar Sensor to either the Ground Speed connector on the Tractor Harness or Sprayer Harness.

Connecting to a Flow Meter

The Flow Meter (not supplied in kit) is installed between the Regulator Valve and the Section Valves. The Flow Meter will be installed so that it measures only the quantity of liquid being delivered to the spray line.



NOTICE

There must be no return line to tank or pump after the Flow Meter.

1. Connect the Flow Meter 3-Pin Connector to the 3-Pin connector marked Flow Meter 1 on the Sprayer Harness (Figure 5-5 on page 5-10)



NOTICE

The Flow Meter may require a connector change to attach to the 3-Pin connector marked Flow Meter 1 on the Sprayer Harness. Refer to the Flow Meter manufacturer's specifications for correct pin allocation.



CAUTION

Care should be taken when replacing these connectors, not to damage the Sprayer Harness or Flow Meter and connectors should be fully circuit tested prior to installation.

Most Flow Meters have a label on the meter body that shows the Flow Meter Calibration Factor in pulses/volume. Eg: ‘645 ppl (pulses per liter)’ or ‘2441 ppg (pulses per gallon)’. This means the Flow Meter sends 645 pulses to the Spray ECU for every liter (or 2441 pulses for every gallon) of liquid that passes through the Flow Meter. This value is the Calibration Factor and will be required to be entered into the Sprayer software setup (see “Calibration Factor”, page 8-39).

NOTICE

NOTICE

If connecting to a Raven Flow Meter. The value marked on the label represents pulses/10 units of liquid. Divide this number by 10 for the correct value to enter as the Calibration Factor into the Sprayer software setup.

Connecting to the Regulator Valve

The Regulator Valve (not supplied) is a motorized flow control valve used to maintain the product flow to the section valves. It will be situated between the pump and the Flow Meter.

NOTICE

NOTICE

All bypass or agitation return lines that return to the tank, must be taken before the Regulating Valve, so there is no return path after the Regulating Valve and the Flow Sensor.

1. Connect the Regulator Valve’s 2-Pin connector to the 2-Pin connector marked REG Valve 1 on the Sprayer Harness (Figure 5-5 on page 5-10), using the Regulator Valve Adaptor Harness (A802) (Figure 5-5 on page 5-10)

**NOTICE**

The Regulator Valve may require a connector change to attach to the 2-Pin connector marked REG Valve 1 on the Sprayer Harness. Refer to the Regulator Valve manufacturer's specifications for correct pin allocation.

**CAUTION**

Care should be taken, when replacing these connectors, not to damage the Sprayer Harness or Regulator Valve and connectors should be fully circuit tested prior to installation.

When you test the Sprayer with water you may find that the Regulator Valve works in the opposite direction to what you require. For example: The pressure increases when it should decrease. You can set the Reverse Valve Direction in the Sprayer software setup to remedy this, see “Reverse Valve Direction”, page 8-20.

Pressure Sensor Installation and Connection

1. Mount the Pressure Sensor (A092) (Figure 5-5 on page 5-10) either upright or horizontally and support the Brass Gauge saver

The supplied Pressure Sensor is a 5 Bar (72 psi) Pressure Sensor.

**NOTICE**

To properly measure Spray Line operating pressure the Pressure Sensor must be positioned between the Flow Meter and the Section Valves (Figure 5-5 on page 5-10).

2. Connect the Pressure Adaptor Harness (H1125) to the connector labeled Pressure Sensor 1 on the Sprayer Harness (Figure 5-5 on page 5-10)
3. Undo the two nuts ontop of the Pressure Sensor
4. Place the two ring terminals, on the Pressure Adaptor Harness, onto the terminals on the Pressure Sensor

It does not matter which way around the terminals are attached to the Pressure Sensor.

5. Replace the two nuts and tighten the nuts securely.

Installing the Valve Harness

Figure 5-5 on page 5-10 shows the Sprayer Harness and Valve Harness Assembly.

The Valve Harness continues from the connector on the Sprayer Harness and connects to the Section and Dump Valves on the Sprayer.

The Valve Harness normally contains connectors for the section valves, they are either: 3 Wire Section Valves, 2 Wire Section Valves or Solenoid Valves. See “Different Valve Types”, page 5-25 for an explanation of the different types of Section Valves.



NOTICE

If the Valve Harness has an Arag Interface Box incorporated into the Harness then the Dump Valve plug will be on the Valve Harness.

The typical Valve Harness has the following connectors, which are labelled as follows:

- Dump 1—connects to the Dump Valve
- Section X—connects to the Section Valves. ‘X’ represents the section number
- Sprayer Harness—connects to the Sprayer Harness.

There are different Valve Harness’, depending on which type of Section Valves are fitted on the Sprayer.



WARNING

If the Valve harnesses need to be re-terminated, because the connectors are different to the section valves being connected to, then you should ensure the Sprayer Harness is disconnected from the Tractor Harness. Otherwise damage to the Spray ECU will occur if the wires are shorted out during the installation.

1. Connect the Valve Harness to the Sprayer Harness.



NOTICE

Use the cable ties provided to secure the Power/Comms Harness away from hot and moving parts, and to avoid chaffing and wear.

Single Line Install

1. Connect the connectors marked Section X to the correct section valves



TIP

If there are too many connectors for the section valves use the connectors with the lowest numbers first.

- Section 1— connects to the section valve on the far left
- Section 2—connects to the next section valve, and so forth, until all the section valves are connected to the Valve Harness
- The section valve with the highest number will operate the Boom Section on the far right.

2. Cable-tie the spare connectors to the Valve Harness.

Dual Line Install

1. Connect the connectors that operate the primary Spray Line (Spray A)



TIP

Use the lowest numbers first.

Section 1 will operate the section on the far left of the spray line (when facing forward) and the highest number section valve on Line A will operate the far right Boom Section.



WARNING

If the Valve Harness needs the connectors replaced to suit the valve connectors, then you should ensure that the Sprayer Harness is disconnected from the Tractor Harness. Otherwise damage to the Spray ECU will occur, if the wires are shorted out during this procedure.

Connecting to the Dump Valve

The Dump Valve (not supplied in kit) is activated when all sections are switched OFF or when the Master Switch is switched OFF, this directs all the flow back to the tank.



NOTICE

The Dump Valve must be located between the pump and Flow Meter.

1. Connect the ARAG connector labeled Dump 1 to the Dump Valve



TIP

If you notice that the Dump Valve is going in the wrong direction, you have to swap the wires in the Arag connector.

If the Dump Valve connector is on the Sprayer Harness, then an adaptor will be required to connect the 4-Pin Weather Pack to the Dump Valve. You must connect the correct adaptor to the Dump Valve. See Table 5-1 on page 5-24 to determine which adaptor you should use.

Choosing the Correct Adaptor for the Dump Valve	
Part No.	Usage
A2266	Use if connecting to a 2-wire dump valve and 12V is applied to the dump valve when the Master switch is OFF
A2267	Use if connecting to a Solenoid Valve, with 6mm spade terminals and 12V is applied to the dump valve when the Master switch is OFF
A2268	Use if connecting to a 3-Wire Dump Valve and 12V is applied to the Dump Valve when the Master is OFF
A2269	Use when connecting to a 3-Wire Dump Valve and 12V is applied to the Dump Valve when the Master is ON

Figure 5-1. How to Choose the Correct Adaptor for the Dump Valve

2. When all the Arag connectors are in place, tighten the screw at the top of the Arag connector, using a screwdriver, to secure the connector to the Section and Dump Valves
3. Tidy any excess harness, using cable ties

To complete the installation go to page 5-31, to connect the Spray ECU Power/Comms Harness to the battery.

Different Valve Types

There are three different valve types, which are:

- 2-Wire Valve—this refers to an electric section, dump or Regulator Valve

The valve is driven by an electric motor that is able to rotate in both directions. Two wires are connected to this type of valve from the controller. To rotate the motor 12V is applied to one of the wires whilst GND is applied to the other. When opposite voltage is applied to the two wires the motor will rotate in the opposite direction.

Common terms for this system are Reverse Polarity or Bi-Directional.

- 3-Wire Valve—this refers to an electric section, dump or Regulator Valve

The valve is driven by an electric motor that is able to rotate in both directions. Unlike the 2-wire valve, the 3-wire valve has in built changeover relays that change the motor direction, depending on whether 12V or 0V is applied to the signal wire.

Constant 12V and GND are required in addition to the signal wire.

- Solenoid Valve—this refers to electromagnetic coil type valves.

Solenoid Valves usually consist of a coil, that when exposed to voltage produces a magnetic field. The magnetic field draws a needle against a spring away from its seat, to allow liquid to flow.

Plumbing for Diaphragm Pumps for Topcon Precision Agriculture Sprayer Kits

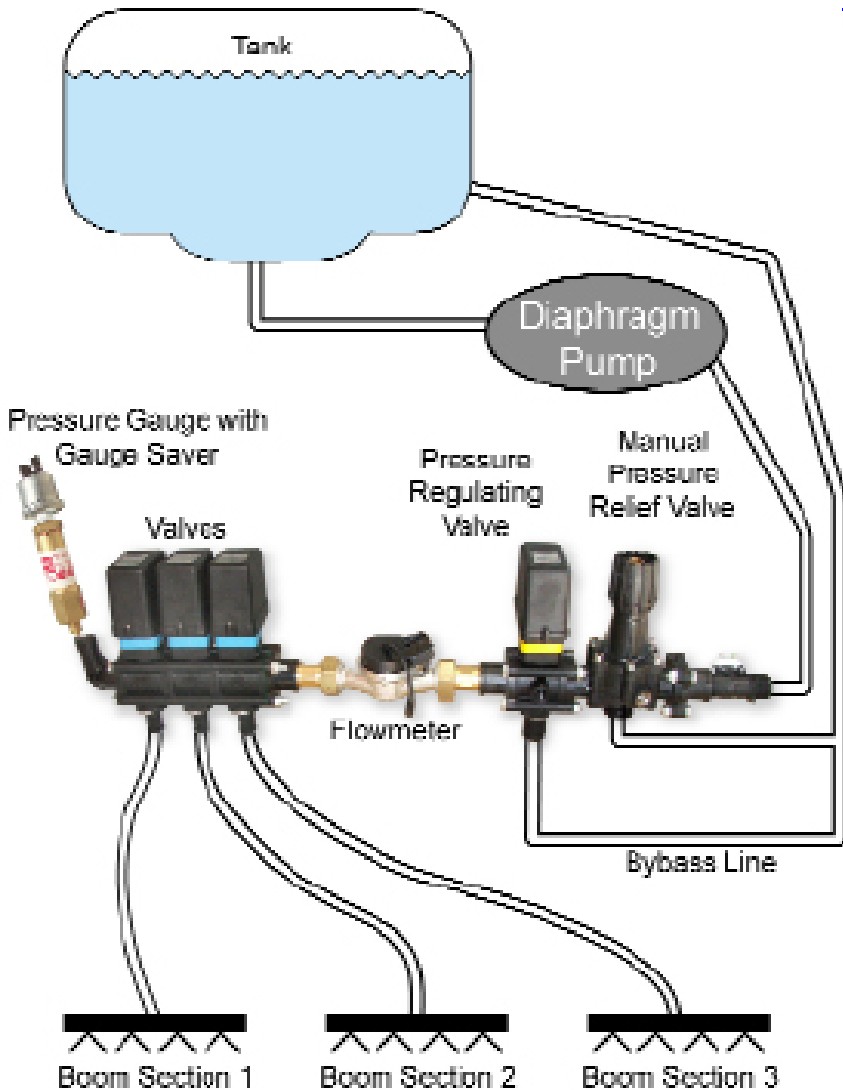


Figure 5-9. Plumbing for Diaphragm Pumps for TPA Sprayer Kits

Plumbing for Centrfrical Pumps for Topcon Precision Agriculture Sprayer Kits

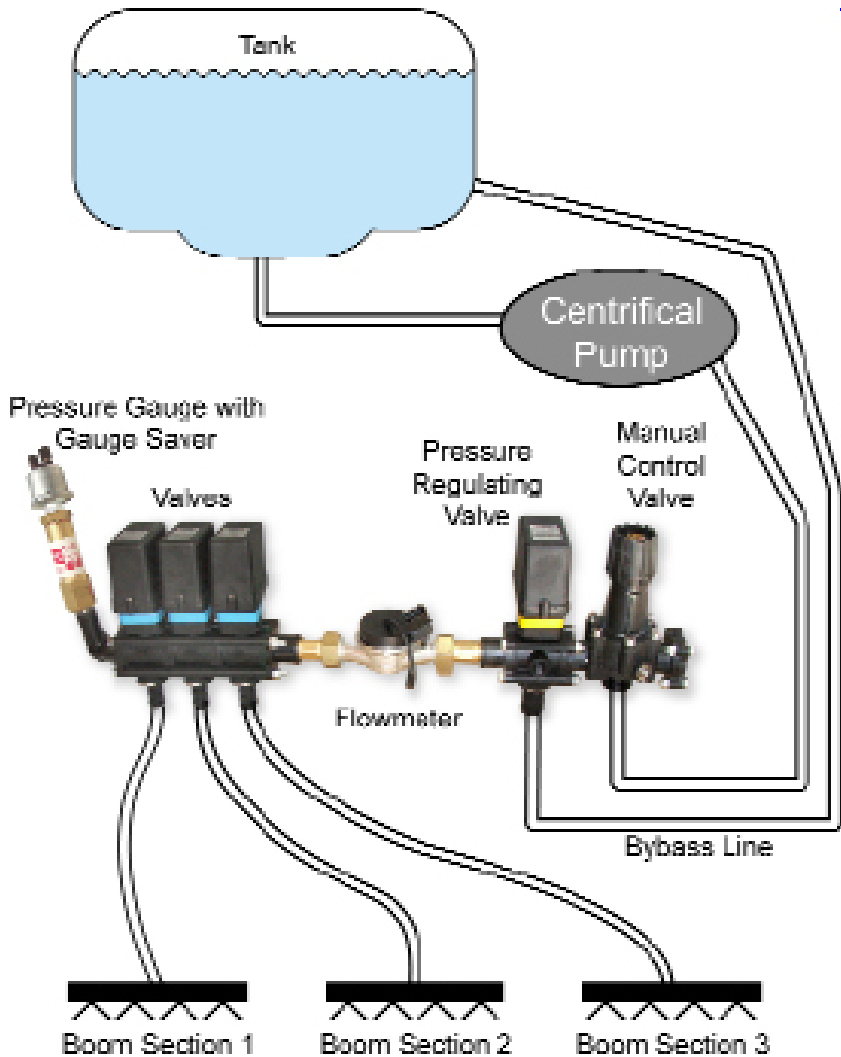


Figure 5-10. Plumbing for Centrfrical Pumps for TPA Sprayer Kits

Installing the Spray ECU 30S Kits to an Existing Topcon Precision Agriculture Controller

This section is for users who are *replacing* an existing Topcon Precision Agriculture (I.E. KEE) MK3, MK5 Sprayer console or Spray Rate Interface.

Before Removing the Existing Controller

1. Ensure that the system is functioning correctly
2. Run the Sprayer and record the minimum and maximum pressure and flow rates attainable
3. Record all of the calibration factors
4. Record all of the section width values.

Removing the Existing Controller

1. Remove the existing TPA Spray Rate Controller console or TPA Spray Rate Interface
2. Remove the existing Tractor Harness.

Installing the Spray ECU 30S Kits

1. Connect the Tractor Harness to Connector 1 on the Spray ECU (Figure 5-11 on page 5-30)

The Tractor Adaptor Harness connects to the Spray ECU and runs the Harness as far as the drawBar of the tractor or vehicle, where a breakaway is attached so the vehicle can be easily detached from the trailing Sprayer.



NOTICE

Care should be taken when running the Tractor Harness from the Spray ECU.

2. Lead the Harness from the Spray ECU to the back of the vehicle



TIP

Tie cable back, where possible.



WARNING

Do not cut or splice the Sprayer Harness, all excess cable should be strapped away to avoid vibration and wear.

3. Securely mount the Breakaway connector above any hydraulic outlets, to reduce the risk of oil ingress to the connectors



WARNING

Do not expose the connectors to high pressure water or oil.

4. Connect the Tractor Adaptor Harness to the existing Sprayer Harness.

Refer to the console manual for installing the console to the vehicle.

To complete the installation go to page 5-31, to connect the Spray ECU Power/Comms Harness to the battery.

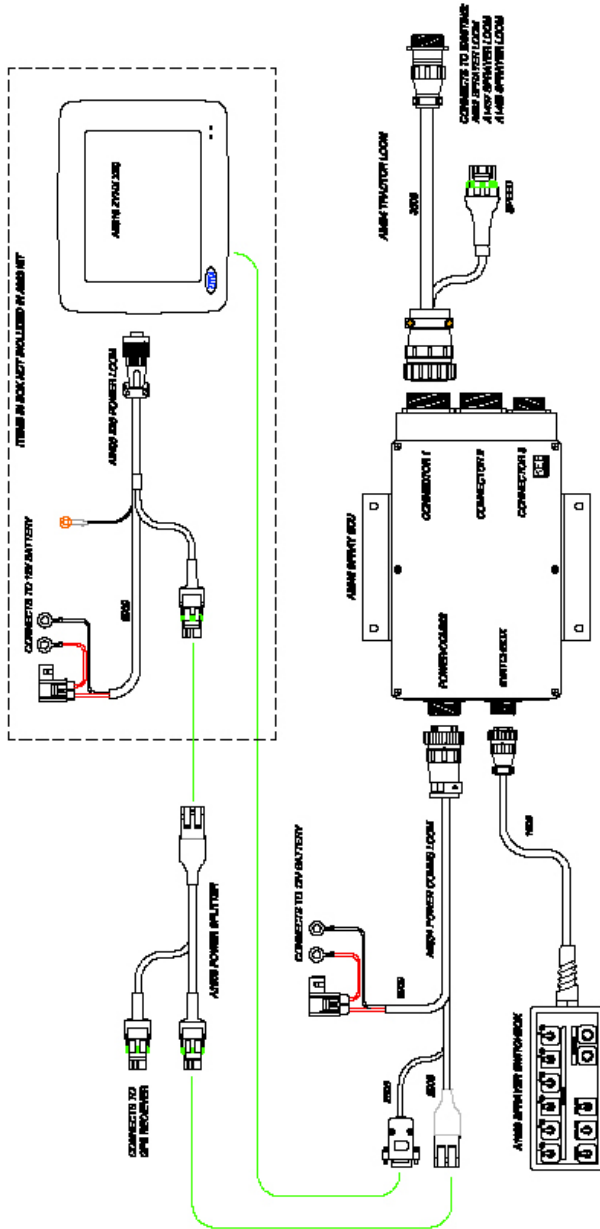


Figure 5-11. General Layout of Spray ECU Connecting to Existing Topcon Precision Agriculture Sprayer Harness

Connecting the Spray ECU to the Battery



WARNING

Do not attach the wires to the battery terminals until the installation of the Tractor Harness, Sprayer Harness and Valve Harness is completed.



WARNING

If your tractor uses 24 Volt batteries, you must use a 12 Volt/15 Amp (minimum) inverter.

1. Connect the Power/Comms Harness directly to 12 VDC battery terminals (Figure 5-12)

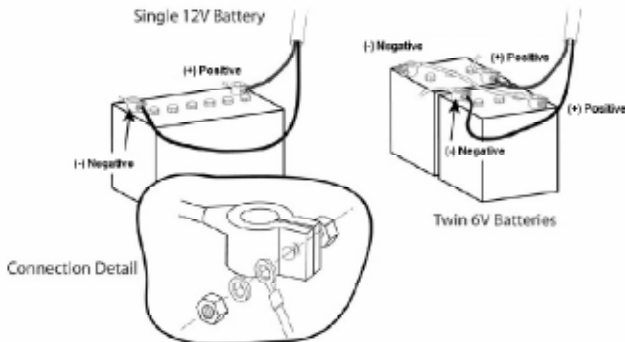


Figure 5-12. Battery Configuration



CAUTION

Do not connect the Power/Comms Harness to an alternator or starter motor as this may cause interference or power fluctuations or surges and may damage your system.

2. Attach the red wire to the positive (+) battery terminal (Figure 5-12)



WARNING

Do not connect the black wire to the vehicle chassis unless an Isolation Switch is fitted to the negative side of the battery.

3. Attach the black wire to the negative (-) battery terminal (Figure 5-12)



WARNING

Except for other Topcon Precision Agriculture products do not power other equipment from the power cable.



CAUTION

Connection to the battery terminals must be kept clean and tight at all times.

Getting Started

Warnings

The first window that is displayed when your console starts up is a **Warning** page (Figure 6-1 and 6-2).



Figure 6-1. Warning Window Part I



Figure 6-2. Warning Window Part II

Starting the X20 Console

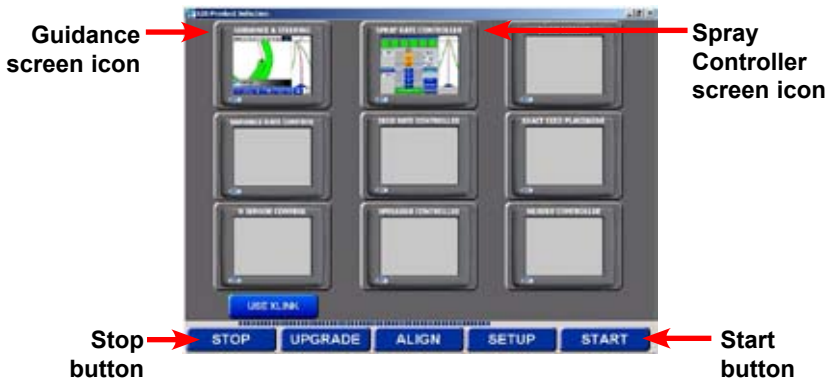


Figure 6-3. X20 Product Selection Screen

1. Switch the X20 console on by pressing the green **Power** button on the rear of the console
2. Read and understand the warnings (page 6-1) and select **Yes** to continue or **No** to shutdown
3. Press **Stop** when the *X20 Product Selection* screen (Figure 6-3) is displayed

Using Spray Controller Only

Please note: This operators manual assumes that Guidance and Spray Controller are being used together. To use Guidance and Spray Controller together see “For use of Spray Controller and Guidance”, on this page.

4. Press the **Spray Controller** screen icon (Figure 6-3 on page 6-2)

Using Spray Controller and Guidance

Please note: This operators manual assumes that Guidance and Spray Controller are being used together.

4. Press the **Spray Controller** screen icon and **Guidance** screen icon (Figure 6-3 on page 6-2)

Press the **Start** button (Figure 6-3 on page 6-2)

The Spray Controller and Guidance (if selected) software will be loaded.

The **Guidance** screen (Figure 6-4) (if Guidance was selected) will be displayed.



Figure 6-4. Guidance Screen Showing Sprayer Icon

5. Select the **Sprayer** icon

The *Sprayer Working* screen (Figure 6-5) will be displayed.

Please note: If you selected to display the Spray Controller only then the *Sprayer Working* screen (Figure 6-5) will be displayed after Step 4, instead of the *Guidance* screen (Figure 6-4 on page 6-3).

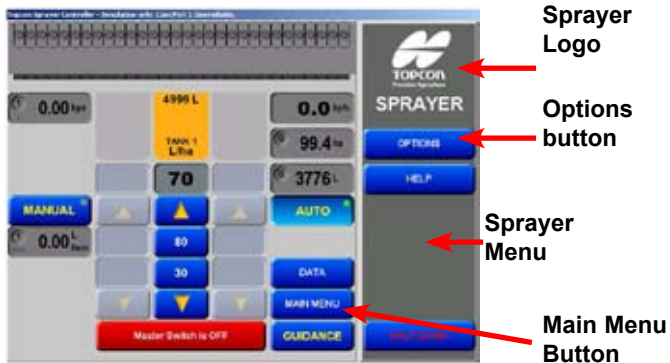


Figure 6-5. Sprayer Working Screen

About Spray Rate Controller Window

When the *Sprayer Working* screen (Figure 6-5) is displayed the Sprayer Menu (Figure 6-5) will be displayed on the right side of the screen.

1. Press the **Sprayer Logo** (Figure 6-5)

An *About Spray Rate Controller* window (Figure 6-6 on page 6-5) will be displayed.

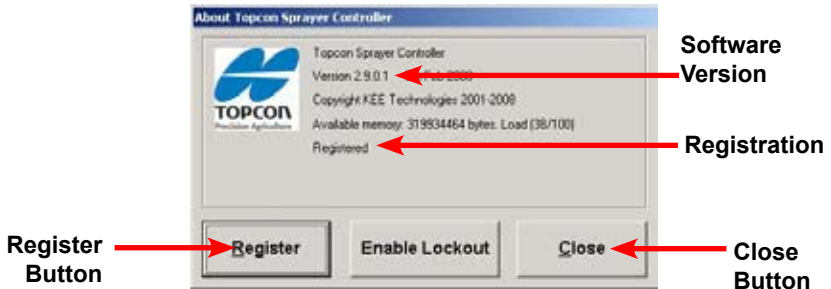


Figure 6-6. About Spray Rate Controller window

The *About Spray Rate Controller* window displays:

- The Spray Rate Controller software version number—this version number may be requested by a Topcon Precision Agriculture service person.

The Spray ECU version number will be displayed, when the console is connected to the Spray ECU.

- Whether the Sprayer software is registered or unregistered
- The **Enable Lockout** button (see "Enable Lockout" page 10-21)
- **Close** button—when selected the *Sprayer Working* screen (Figure 6-5 on page 6-4) will be displayed again.

Registering the Sprayer Software

If the Sprayer software is unregistered you must contact your local Topcon Precision Agriculture dealer.

Overview of the Sprayer Working Screen Functions

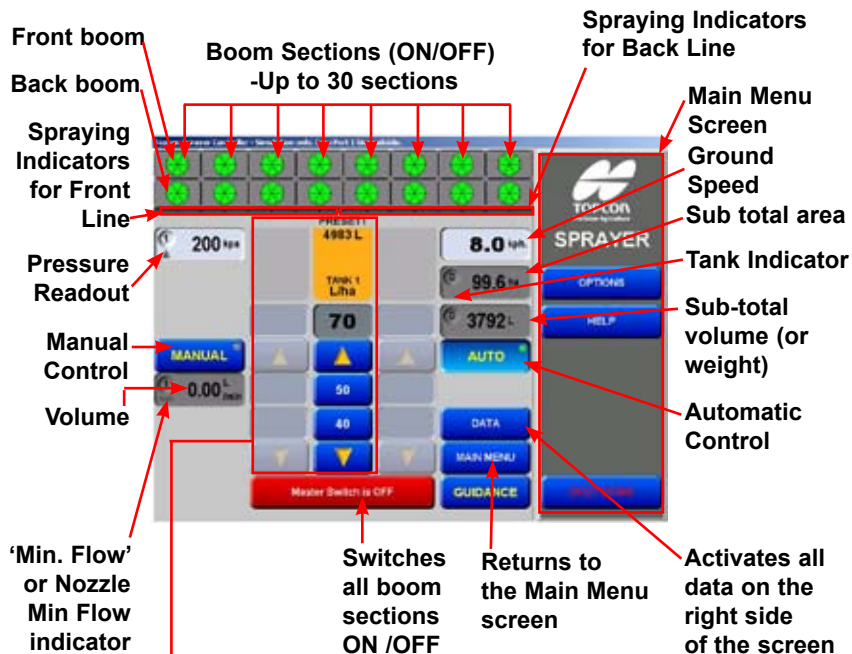
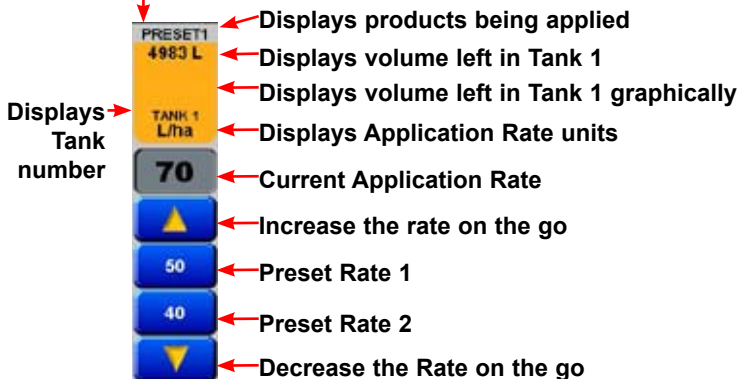


Figure 6-7. Sprayer Working screen



- Boom Sections—displays the number of Boom Sections selected.

If **Dual** line is selected (see "Lines", page 8-25) dual boom is shown, showing the front and back lines; the top line representing the front line and the bottom line representing the back line.

If **Single** line is selected (see "Lines", page 8-25) then only a single line of sections will be displayed.

The Boom Sections are numbered starting from the left side of the spray line, with the far left Section Valve being section valve '1'.

The Boom Sections can be switched ON/OFF, either by touching the Boom Section on the *Sprayer Working* screen (Figure 6-7) on page 6-6) or by switching the Boom Sections switches ON/OFF on the External Switchbox.

Table 6-1 shows what different color Boom Sections and Spraying Indicators indicate about their status.

Boom Sections and Spraying Indicators Color Indicators		
Boom Section	Spraying Indicator	Meaning
■	<input type="checkbox"/>	Boom Sections are switched OFF.
■	<input type="checkbox"/>	Boom Sections are switched ON but the Low Speed Shutoff speed has not been reached or Master is OFF
■	<input type="checkbox"/>	Boom Sections are switched ON, the Low Speed Shutoff speed has been reached, ready to start spraying.
■	■	Boom Section is ready for spraying but Master Switch is OFF.
■	■	Master Switch is ON and Boom Section valve is spraying.

Table 6-1. Color indicators

Please note: When using Automatic Section Control (ASC), when the sections are switched OFF, the Boom Sections and the Spray Indicators turn grey; when the sections are switched ON, under ASC the Boom Sections and Spray Indicators turn green.

- Spraying Indicators— are displayed below the Boom Sections

On the *Sprayer Working* screen (Figure 6-7 on page 6-6) there are 16 Spraying Indicators, because there are 16 section valves in total (8 front Section Valves and 8 back Section Valves). The 8 Spraying Indicators on the left represent the Boom Sections on the front line, the 8 Spraying Indicators on the right represent the Boom Sections on the back line.

Table 6-1 on page 6-7 displays and explains the different states of the Spraying Indicators. Table 6-2 shows what different color Spraying Indicators indicate about their status.

Spraying Indicators Color Indicators	
Spraying Indicator	Meaning
■	Boom Section is not spraying.
■	Boom Sections is spraying.

Table 6-2. Spraying Indicators Color Indicators

- Auto—when selected (by selecting **Auto** on the Switchbox or *Sprayer Working* screen) the **AUTO** button will become highlighted and a green indicator will be shown in the **AUTO** button

When **AUTO** is selected the Spray Controller automatically adjusts the flow, according to speed, width or number of sections that are ON..

- **Manual**—when selected (by selecting **Manual** on the Switchbox or **MANUAL** from the *Sprayer Working* screen) the **MANUAL** button will become highlighted and a green indicator will be shown on the **MANUAL** button

When **MANUAL** is selected the Spray Controller does not automatically adjust the flow, according to speed and area. Pressing the INC & DEC buttons will increase or decrease the pressure by opening or closing the regulator valve.

- **Pressure Readout**—displays the system pressure if an electronic Pressure Sensor is installed and selected in Options, see "Pressure (Pr) Sense", see "Pressure Sensor", page 8-15

The number in the top left corner indicates which tank (1,2 or 3) the pressure readout is from.

Selecting the **Pressure Readout** button displays a **Tank Pressure** window on the right of the screen, see "Pressure Sensor", page 10-1.

- **Volume**—displays volume per minute (for the front line) or volume per nozzle (for the front line nozzles), depending on which was selected, see "Flow", page 10-6

Selecting the **Volume** button displays a **Flow** window, on the right side of the screen, see "Flow", page 10-6.

- **Pump is On**—this button only appears when the **Spray ECU**, **Prop. Valve** and **Enable Pump Control** buttons are all selected

When selected the button says PUMP is ON and turns green; this switches the hydraulic pump ON.

When selected again the button says PUMP is OFF and turns red; this switches the hydraulic pump OFF.

- Ground Speed—displays the actual ground speed, whether it is from the Wheel Sensor, tractor radar or GPS, depending on what is selected, see "Speed From", page 8-8

Selecting the **Ground Speed** button displays a *Speed* window on the right side of the screen, see "Speed", page 10-8.

- Sub Total (Area)—readout displays the area sprayed for the sub area selected, depending on the units selected, see "Units", page 8-55

The number in the top left corner of the readout displays the current sub area number. There are 10 sub area numbers (0-9).

Selecting the **Sub Total Area** button displays an *Area* window on the right side of the screen, see "Area/Volume", page 10-10.

- Sub Total (Volume Used)—readout displays the volume (or weight) sprayed for the sub area selected, depending on the units selected, see "Units", page 8-55

The number in the top left corner of the readout displays the current sub area number. There are 10 sub area numbers (0-9).

Selecting the **Sub Total Volume** button displays an *Area* window on the right side of the screen, see "Area/Volume", page 10-10.

- Tank Indicator—only appears when more than 1 tank is selected in Options

This allows the Sub Total Area and Sub Total Volume to be displayed for each tank.

To change which tank is displayed select either the **Sub Total Area** button or **Sub Total Volume** button (Figure 6-7 on page 6-6). You will notice the orange Tank Indicator will change each

time the readouts are selected.

- Pump Speed—this displays the actual pump speed. The Pump Speed readout is only displayed if **Enable Pump Speed Indicator** is selected in Options, see "Pump Options", page 8-52
- Min. Flow or Nozzle Min. Flow Indicator—a red indicator will be displayed in the Volume readout (Figure 6-7 on page 6-6) when the minimum flow for the Regulator Valve is reached, or the minimum flow for the nozzles is reached.

Select the **Volume** button to see the reason the red indicator is being displayed. The reason will be displayed in the **Flow** window on the right side of the screen, see "Flow", page 10-6.

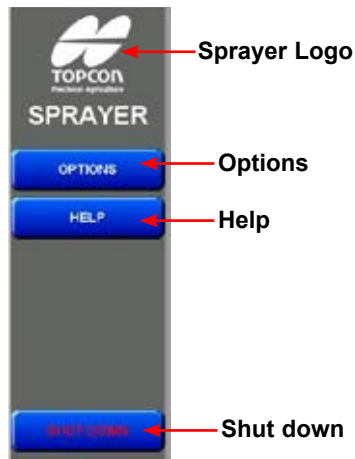


Figure 6-8. Main Menu screen

- Sprayer Logo—when selected information about your Sprayer will be displayed, see “About Spray Rate Controller Window”, page 6-4.
- Options—when pressed the *Options* window will open.

The *Options* window is where the Sprayer settings can be entered, see “Setting Up the Software”, Chapter 8.

- Help—displays the on screen help.
- Shutdown—when selected returns the operator to the Windows Desktop or turns OFF the console.

Configuration Setup

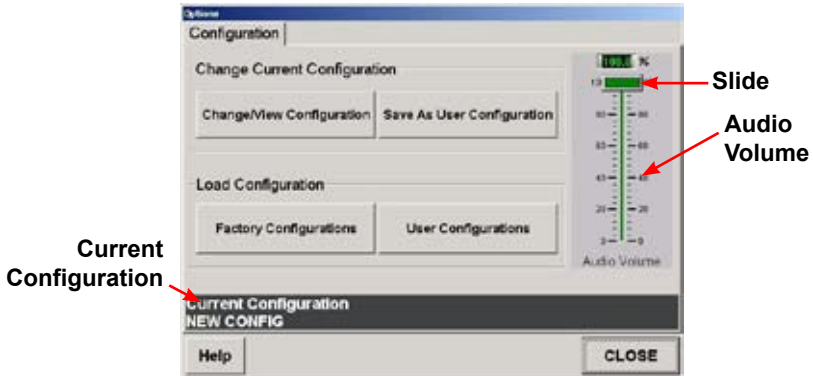


Figure 7-1. Configuration Screen

1. Press **Options** (Figure 6-8 on page 6-12).

The *Configuration* screen (Figure 7-1) will be displayed.



NOTICE

Complete the installation of the Sprayer before setting up the software and applying settings.

Audio Volume

In the *Audio Volume* window the operator can set the desired audio level.

Setting the Audio Volume

1. Select and hold down the slide and slide it up or down, until the desired audio volume is achieved.

Configuration

The *Configuration* screen contains two configuration windows (Figure 7-1 on page 7-1):

- Change Current Configuration
- Load Configuration

Change Current Configuration

The *Change Current Configuration* window has 2 buttons:

- Change/View Configuration—This button allows the operator to view the settings of the current Sprayer, loaded from either the Factory Configuration or User Configurations
- Save As User Configuration—This is used to save the current Sprayer settings, see "Saving the Sprayer Configuration", Chapter 9.

Load Configuration

The *Load Configuration* window has 2 buttons:

- Factory Configuration—The **Factory Configurations** button opens a list of Sprayer models and Topcon Precision Agriculture Sprayer kits

The files contain all the Sprayer settings for the particular Sprayer.

The Factory Configuration files are pre-loaded with the console or new Sprayer software.

When the operator selects the **Factory Configurations** button all the settings for that particular Sprayer model are loaded in the *Options* windows.

Selecting a Factory Configuration File

1. Select the **Factory Configurations** button

The *Select File* window (Figure 7-2) will be displayed.

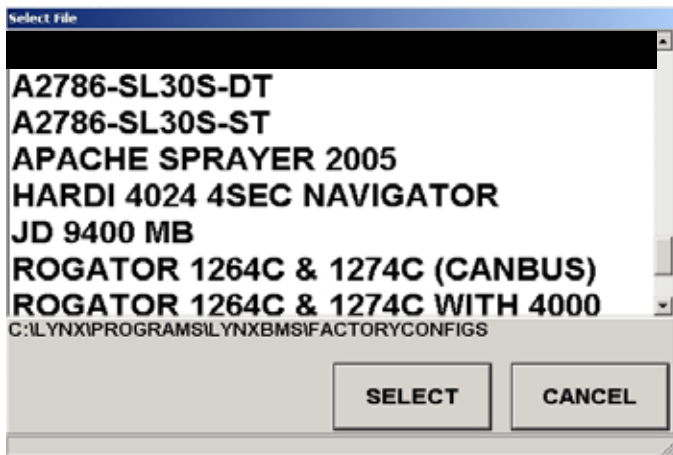


Figure 7-2. Select File Window

2. Check to see if your Sprayer or TPA Sprayer kit is listed on the list shown in the *Select File* window (shown in Figure 7-2)

If your Sprayer is listed:

3. Select the Sprayer, by touching the name

This will highlight the option you have chosen.

4. Press **Select** (Figure 7-2 on Page 7-3), to load the Sprayer configuration

A window will appear confirming that the Sprayer you selected in Step 3 will be loaded.

5. Select **Yes**, to load the settings for the selected Sprayer

OR

Select **No** to stop loading the selected Sprayer

If you selected **Yes** the Sprayer Configuration will be loaded and listed under Current Configuration (Figure 7-3).

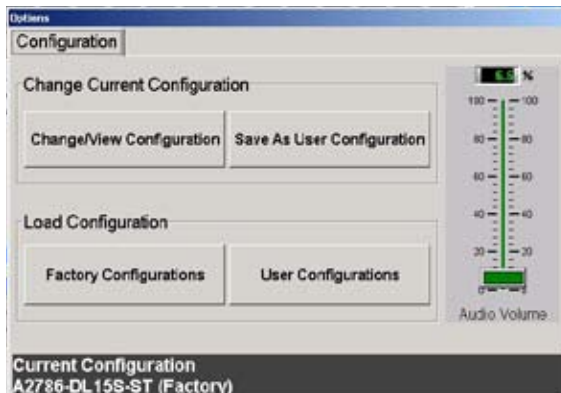


Figure 7-3. Configuration Showing Selected Sprayer Kit

If your Sprayer is not listed:

3. Press the **Cancel** button (Figure 7-2 on page 7-3).

This will close the *Select File* window.

4. Go to “Change/View Configuration Button”, page 7-8 to proceed.
- User Configuration—The User Configurations list can be changed any time the Sprayer settings are changed; the operator will be prompted to overwrite the file or select a new file.

The operator can have all their different Sprayers saved in the User Configurations list and these Sprayers can be recalled at any time.

Setup

Once a Sprayer or Sprayer kit is selected then most of the Sprayer values and settings will be loaded into the Sprayer software Options and you will only have to enter a few values (eg. Section Widths, Unit type, Wheel Calibration Factor) to get started.

You must choose one of two options:

- Go to "Setting Up the Software", Chapter 8 of the Software Setup and work through the manual, which outlines all the Sprayer options within the software

OR

- Use the Quick Setup Guide (below) and enter in the Sprayer settings which are unique to your Sprayer.

Quick Setup Guide

1. Select the **Change/View Configuration** button

This will allow you to view the settings of the Sprayer that was loaded.

For help with understanding and navigating the *Options* windows see Appendix A.

2. Select the COM Port the Spray ECU is connected to on the back of the console, on the *ECU* page, see page 8-6
3. Enter the Tank Capacity of the Sprayer, on the *Tanks* page, see page 8-13
4. Change the number of sections if they are different to the ones displayed on the *Sections* page, see page 8-26

5. Check the number of Guidance sections used, in the **Guidance** window, and change if necessary, see page 8-28
6. Enter the swath width of the Spray Boom, on the **Sections** page, by entering in the Section widths of each of the Boom Sections, see page 8-25
7. Enter the number of nozzles on each Boom Section, on the **Sections** page, see page 8-28
8. Enter the Minimum Flow value of the nozzles fitted to the Spray Line, on the **Sections** page, check nozzle chart, see page 8-29
9. Enter the Flow Calibration factor for the Flow Meter, on the **Sensors** page, see page 8-39
10. Enter the Flow Meter's Minimum Flow value, check the Flow Meter's specifications, on the **Sensors** page, see page 8-40
11. Enter the Wheel Calibration, on the **Setup** page, see page 8-46
12. You may change the Units, on the **Units** page, to suit your preferences, see page 8-55
13. Save changes to the User Configuration, see Chapter 9

Configuration

GPS

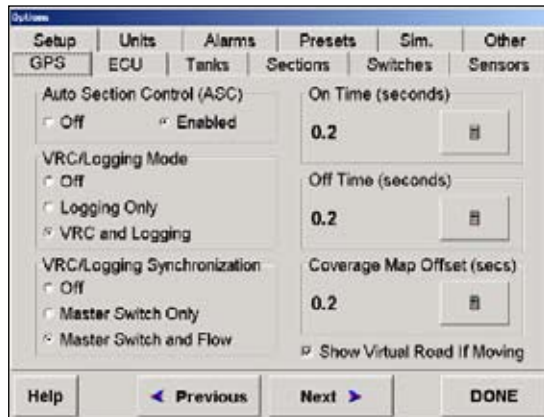


Figure 8-1. Options>GPS Page

Please note: The **GPS** page is only displayed if Guidance and/or Variable Rate Control (VRC) are selected with Spray Rate Control, on the **Product Selection** screen.

If Guidance and/or VRC are not selected on the **Product Selection** screen, the **ECU** page (page 8-6) will be the first to be displayed.

Automatic Section Control (ASC)

ASC can only be **Enabled** when DGPS is used in conjunction with Guidance. This feature will automatically switch sections on the Sprayer ON and OFF, therefore preventing the Sprayer from overlapping or under lapping previously sprayed areas.

The ASC option in Guidance General Setup must also be selected (see X20 Guidance manual Page 4-21 Chapter 4).

Select **Off** (Figure 8-1 on page 8-1) if Guidance is not working.

Variable Rate Control (VRC)/Logging Mode

If you are not using VRC or Logging select **Off** (Figure 8-1 on page 8-1).

Select **Logging Only** if you are *not* using a VRC prescription map but are logging the Spray Rate's elevation mapping, using the Maplink VRC software. This allows logging to be done without loading a VRC prescription map.

Select **VRC and Logging** if using the Maplink VRC software, to load a VRC prescription map to control the Spray Rate to a region based map. A **VRC Master** button will be displayed on the *Guidance* and *Maplink VRC* screens.

The only difference between Logging Only and VRC and Logging, is when **Logging Only** is selected, the **VRC Master** button is removed from the *Guidance* screen, to prevent confusion.



NOTICE

When selecting Logging Only and VRC and Logging, Variable Rate Control (Maplink VRC) must be selected in the Product Selection screen during startup.

(VRC)/Logging Synchronization

When **Logging Only** and **VRC and Logging** are selected, then the *VRC/Logging Synchronization* window will be displayed.

Select **Off** if you want to be able to switch the **Treatment** button ON and OFF (on the *VRC [Maplink] screen*), independently of the Sprayer Master Switch.

Select **Master Switch Only** for the logging in the VRC to follow the Master Switch.

Master ON means that logging is ON and Master OFF means that logging is OFF.

Master Switch and Flow is usually selected when **ASC** is enabled, see “Automatic Section Control (ASC)”, page 8-1.

If all the sections are switched OFF under ASC, but the Master is still ON the logging will stop because there is no flow present. Therefore logging will stop if all the sections are switched OFF, the Master is switched OFF or the actual spray rate is ‘0’.



NOTICE

When using Spray Rate Controller Version 1.98 or later with X20 Guidance the On Time and Off Time options are inaccessible in the X20 Guidance and the values have to be entered in the Spray Rate Controller Options>GPS page.

On Time

On Time is the time the Sprayer looks ahead (in seconds) to switch ON the section valves.

Change the ON Time by pressing the **calculator icon** and entering the desired value, see Appendix A for more detail.

Off Time

Off Time is the time the Sprayer looks ahead (in seconds) to switch OFF the section valves.

Change the OFF Time by pressing the **calculator icon** and entering the desired value, see Appendix A for more detail.

Coverage Map Offset

Coverage Map Offset allows for the coverage in the Guidance and Treatment maps in the Maplink software to keep drawing for the set time after the Spray Control turns the section valves OFF and also when the section valves are switched ON.

This feature allows for no gaps to be left on the map.

Change the Coverage Map Offset by pressing the **calculator icon** and entering the desired value, see Appendix A for more detail.

Show Virtual Road If Moving

When the **Show Virtual Road If Moving** option is selected the Guidance Virtual Road will appear on the right side of the screen when Guidance detects that the vehicle is moving.

ASC Master Button

The **ASC Master** button will appear on the logo Bar on the **Guidance Working** screen. The **ASC Master** button will also be displayed on the **VRC** screen, if the VRC software is loaded.

This button will be displayed when both **Guidance** and **Spray Rate Controller** are selected from the **Product Selection** screen and ASC is enabled in the Sprayer Software

When the **ASC Master** button is green ASC is switched ON.
When the **ASC Master** button is red ASC is switched OFF, and

Guidance will not switch section valves ON and OFF by the Coverage map.

The operator can override the sections by using the section switches on the external Switchbox or on screen section switches of the Spray Rate Controller.

Select the button to switch the ASC Master ON or OFF.

ASC will only operate with software that is compatible with Guidance. Some other makes of controllers will interact with the TPA software. Speak to your dealer for more information.

VRC Master Button

The **VRC Master** button will appear on the logo Bar on the **Guidance** and **Maplink** screens when VRC and Logging option is enabled in the VRC/Logging mode window.

When the **VRC Master** button is green VRC is switched ON.
When the **VRC Master** button is red VRC is switched OFF.

Select the button to switch the VRC Master ON or OFF.

Electronic Control Unit (ECU)

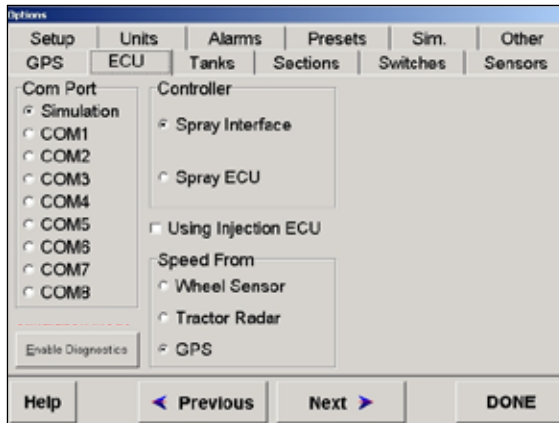


Figure 8-2. Options>ECU Page

COM Port

Select which Communications Port (COM Port) the 9 pin serial cable from the Spray Rate Controller ECU is connected on the back of the X console.

Usually **COM2** is selected.

COM 1 is usually reserved for the Guidance GPS or DGPS receiver.



NOTICE

If the COM Port is changed or selected you must restart the software.

Simulation is selected for desktop use when the console is not connected to the Spray ECU. This disables all the alarms.

The COM Ports are greyed out if the Spray Rate software is not registered, contact Topcon to register your software.

Controller

Select **Spray Interface** if one of the following is written on the Spray Rate Controller:

- KEE Spray Rate Interface
- ZYNX 5500 Interface
- ZYNX 2500 Interface

Select **Spray ECU** if Spray ECU is written on the Spray Controller.

If **Spray ECU** was selected see pages 8-10, 8-33, 8-42 and 8-53 also.

Using Injection ECU

Before selecting **Using Injection ECU** an additional Chemical Injection pump has to be purchased and an additional Multi Drive Electronic Control Unit (MDECU) and harnesses would also be required.

This option, with the appropriate hardware will allow all the Spray ECU's to control up to 3 injection tanks if connected to a 4 channel MDECU.

Please note: A Supplement Manual will be required to install the Chemical Injection Pump.

Speed From

For Speed From select from one of the three options:

- Wheel Sensor
- Tractor Radar
- GPS.

Spray Interface

If **Spray Interface** was selected as the controller (page 8-7):

- Select **Wheel Sensor** if a ground speed sensor is connected to the spray harness plug marked Wheel Sensor (usually located on the Spray Harness)
- Select **Tractor Radar** if connecting a Tractor Radar to the spray interface

The Tractor Radar plugs into the 3-pin weatherpack plug marked Tractor Radar on the spray interface.

- Select **GPS** if the speed is coming from a DGPS receiver.



NOTICE

Guidance (or Maplink VRC) and Spray Rate Control must be selected from the Product Selection screen before GPS is selected.

Spray ECU

If **Spray ECU** was selected as the controller (page 8-7):

- Select **Wheel Sensor** if a ground speed sensor is connected to the spray harness plug marked Connector 1 on the Spray ECU

The wheel sensor is usually located on the boom spray.

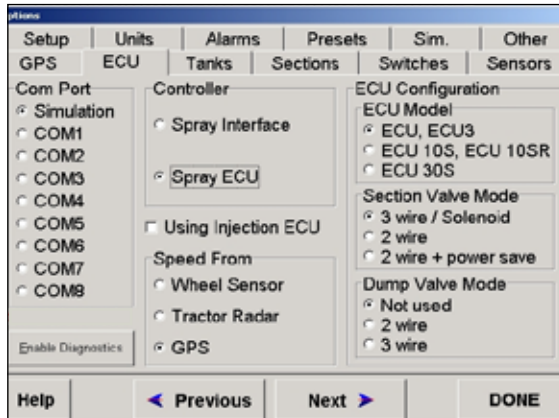
- The Raven Spray ECU 3 and Spray ECU/SR has a 3-pin weatherpack plug marked Radar on the Spray ECU 3, if a Radar is connect to this plug select **Tractor Radar**
- Select **GPS** if the speed is coming from a DGPS receiver.



NOTICE

Guidance and Spray Rate Control must be selected from the Product Selection screen before GPS is selected.

ECU Configuration (Spray ECU Only)



**Figure 8-3. Options>ECU Page>
ECU Configuration**

The *ECU Configuration* window (Figure 8-3) will only be displayed when **Spray ECU** is selected as the controller (page 8-7).

ECU Model

- Select **ECU, ECU3** if the description on the overlay reads either ‘Spray ECU’, ‘Spray ECU 3’ or ‘Hardi 5500 Spray ECU’

The corresponding art number on the Spray ECU is either A2036, A2445 or A2243.

- Select **ECU 10S, ECU 10SR** if the description on the overlay reads ‘Spray ECU 10S’ or ‘Spray ECU 10SR’

The corresponding part number on the Spray ECU is A2644.

- Select **ECU 30S** if the description on the overlay reads ‘Spray ECU 30S’.

The corresponding part number is A2643.

Please note: The ECU models: ECU and ECU 3 will come factory loaded with the firmware version BMS207 or higher.

The ECU models ECU 10S, 10SR and 30S will come factory loaded with firmware version BMS 209 or higher.

Section Valve Mode

- Select **3 wire/Solenoid** if the Sprayer is fitted with 3 Wire Motorized Section Valves or Solenoid Section Valves.

Please note: When **3-Wire/Solenoid** is selected the Sprayer can control 31 Section Valves and one 3-Wire Dump Valve. This is because both 3-Wire Motor Valves and Solenoids only require a single signal wire to switch the valves ON and OFF. Therefore, 31 sections can be selected. The current harness only support 30 sections.

- Select **2 wire** if the Sprayer is fitted with 2-Wire Motorized Section Valves (Reverse Polarity Valves).

Please note: When **2 wire** is selected (2 wire Motorized Valves of Reverse Polarity Valves) this enables the Sprayer to control 15 section valves and one 2 wire Dump Valve, because 2 wire valves require 2 signal wires to switch the section valves ON or OFF. Therefore, only 15 sections can be selected.

- Select **2 wire + power save** if the Sprayer is fitted with 2 wire Motorized Section Valves and the power saving feature is required. If the section valves do not receive a signal from the controller for 2 minutes the power to the section valves is switched OFF, this conserves power.

Please note: The 2 wire + power save feature is only supported on Spray ECUs with firmware version 209 or higher.

Dump Valve Mode

If 3 wire/Solenoid was selected from Section Valve Mode (page 8-12) then select:

- **Not used**—if no Dump Valve is fitted to the Sprayer
- **2 wire**—if fitting a 2 wire Dump Valve to the Sprayer
- **3 wire**—if fitting a 3 wire Dump Valve to the Sprayer.

If **2 wire** or **2 wire + power save** was selected from Section Valve Mode (page 8-12) then select **Not used**.

Please note: When 2 wire section valves are fitted to the Sprayer then only a 2 wire Dump Valve can be fitted to the Sprayer; a 3 wire Dump Valve is not an option.

Tanks

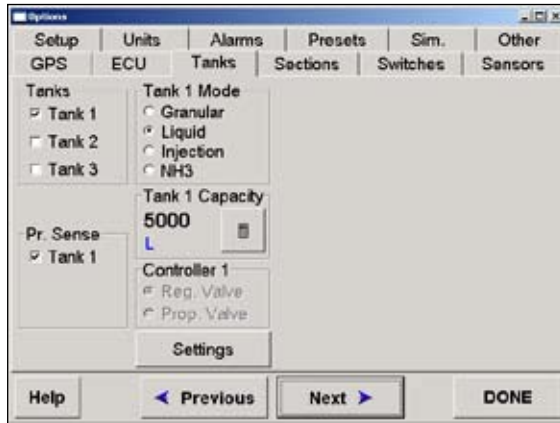


Figure 8-4. Options>Tanks Page

Tanks

Select the appropriate tanks for your Sprayer. Most Sprayers will only have one tank. Therefore select **Tank 1** only.

Please note: If any of the Spray ECUs have the appropriate Chemical Injection Pump hardware installed with a 4 channel MDECU and the **Using Injection ECU** option selected (page 8-7) then up to 3 tanks may be selected.

If more than 1 tank is selected then Tank 2 Mode and/or Tank 3 Mode will appear next to Tank 1 Mode.

If more than 1 tank is selected then *Pr. Sense* for Tank 2 and/or Tank 3 will appear; also additional *Capacity* and *Controller* windows will appear.

Tank 1 Mode

Tank 1 Mode selects the appropriate units depending on which mode is chosen, ie: when **Liquid** is selected then the units are set to 'Litres', 'L/Ha' and Flow Sensor to 'pulses per litre' (if metric units is selected, see page 8-55). For imperial units, the units could be replaced with 'Gallons', 'Gallons/Acre' and Flow Sensor to 'Pulses per Gallon'

Tank Mode is normally set to **Liquid** for spraying.

Select **Granular** if using the Spray Rate Controller as a spreader controller.

Select **Injection** if the Spray system has a Chemical Injection Pump and a 2 or 4 channel MDECU installed.

Select **NH3** if connecting the Spray Rate Controller to an Anhydrous Gas Tank.

If **Tank 2** or **Tank 3** was selected in the **Tanks** window (page 8-13) select the Tank Mode for each of these tanks in the appropriate windows.

Controller 1

If **Spray Interface** is selected as the controller, then only **Reg. Valve (Regulator Valve)** can be selected and that is why the option is greyed out and no selection is possible.

If **Spray ECU** is selected as the controller, then either **Reg. Valve** or **Prop. Valve (Proportional Valve)** can be selected. Depending on whether the type of controller is Regulator or Proportional.

Select the **Settings** button (Figure 8-4 on page 8-13) to personalize the Controller settings. See "Regulator Valve Settings", page 8-16 if **Reg. Valve** is selected or "Proportional Valve Settings", page 8-21 if **Prop. Valve** is selected.

Pressure (Pr) Sense

The Spray Rate Controller can monitor the pressure in a spray system, which is displayed as a Pressure readout on the *Working* screen (Figure 6-7 on page 6-7). The Spray Rate Controller uses Flow to control.

Low and high pressure alarms can be set, to alert the operator when the pressure in the system goes above the high alarm point or below the low alarm point, see “Alarms”, 8-57.

Select **Tank 1** if an electronic Pressure Sensor is fitted to the Sprayer, otherwise leave deselected. See page 8-38 or 8-42 (for Spray ECU configuration) to select the type of electronic Pressure Sensor fitted to the system.

If more than 1 tank was selected in the *Tanks* window then a Pressure Sensor can be selected for each tank that has a Pressure Sensor present.

Regulator Valve Settings



Figure 8-5. Regulator Valve Settings

The Regulating Valves and their settings are critical for the correct operation of the Sprayer, particularly if Automatic Section Control (ASC) is to be used.

To have good control when using ASC a faster Regulator Valve may need to be installed. A 20 second KZCO Valve will be sluggish and give poor control when using ASC and should be updated to the 6 second ARAG Valve (grey band) or faster Regulator Valve. 6 seconds represents the time for the Reg Valve to go from fully closed to fully open.

When a Controller mode is selected then the Max On Time, PWM Setting, Min On Time and Gain Setting settings are automatically set. These settings can then be fine tuned manually.

Controller Mode

Select one of the following options:

- Standard—will account for most regulating valve types available in the market. Standard mode takes into account

regulating valves that take between 4 and 20 seconds to go from fully closed to fully open. Check the specifications of the regulator fitted valve fitted to the Sprayer

Examples include Topcon (aka KEE) KZCO, Arag Yellow band, Hardi, Raven Standard and Arag Grey band Regulator Valves.

If **Standard** is selected you will have to select the Regulator Valve that best suits your Regulator Valve from Table 8-1 and enter the settings from the table into the *Max On Time*, *PWM Setting*, *Min On Time* and *Gain Setting* windows.

Settings for Common Regulator Valves					
	Controller	Max On Time	PWM Setting	Min On Time	Gain Setting
20 sec. or higher Reg valve Eg.: TPA KZCO	Standard	4.0 sec.	100%	8 msec.	16ms/%
16 sec. Reg valve Eg.: Arag Yellow Band	Standard	4.0 sec.	100%	8 msec.	16ms/%
Hardi Reg Valve	Standard	4.0 sec.	100%	8 msec.	16ms/%
Raven STD Reg Valve	Standard	4.0 sec.	100%	8 msec.	16ms/%
6 sec. Reg valve Eg.: Arag Grey Band	Standard	2.0 sec.	100%	2 msec.	16ms/%

Table 8-1. Settings for Common Regulator Valves

- **Micro-Trak**—should be selected if a Micro-Trak Regulator Valve is used for regulation. When **Micro-Trak** is selected the settings are entered automatically into the **Max On Time**, **PWM Setting**, **Min On Time** and **Gain Setting** windows and are optimized for the Micro-Trak Regulator Valve
- **DICKEY-john**—should be selected if a DICKEY-john Regulator Valve is used for regulation. When **DICEKY-john** is selected the default settings are entered automatically into the **Max On Time**, **PWM Setting**, **Min On Time** and **Gain Setting** windows and are optimized for the DICKEY-john Regulator Valve
- **Raven**—should be selected if the Sprayer has Raven Fast Flow Regulator Valve fitted, unless a Topcon Pressure Relief (495181) has been fitted to the Raven Fast Flow Regulator Valve.

The Raven Fast Flow has a three way valve which acts as both a regulator and dump valve. The valve will go from fully closed to fully open in 1.5 seconds. The PWM Setting must be left on full (100%) otherwise this will impair the operation of the Dump Valve and Automatic Section Control.

If **Raven** is selected you will have to enter the settings from Table 8-2 (page 8-19) into the **Max On Time**, **PWM Setting**, **Min On Time** and **Gain Setting** windows.

Settings for Raven Controller Mode					
	Controller	Max On Time	PWM Setting	Min On Time	Gain Setting
Raven Fast Flow Reg valve (1.5 sec.)	Raven	40 msec.	100%	8 msec.	2.4ms/%

Table 8-2. Settings for Raven Controller Mode

**CAUTION**

When using a Raven Regulator that operates as a Dump Valve then you must select the Close Valve When Flow Off option. Failure to do this could dead end the system and cause damage to pumps, hoses etc.

See "Service Bulletins", Chapter 7 if a positive displacement (piston or diaphragm) pump and a Raven Fast Flow Regulator Valve are fitted.

TPA recommends a Pressure Relief kit (495181) to be fitted to the Sprayer. If the kit is fitted then follow the settings recommended in the Service Bulletin.

Reverse Valve Direction

All Regulator Valves have a two wire control system. Polarity is reversed to change the direction of the regulator when in use.

Select Reverse Valve Direction if the valve is turning in the wrong direction, ie: pressure is being increased when the **decrease** button is selected on the *Working* screen.

Close Valve When Flow Off

Select this option if using a 3 way Regulator Valve, which also operates as a Dump Valve, such as the Raven Fast Valve.

Also select this option if Anhydrous Gas is being used through the regulator.

Sensitivity

The Sensitivity setting refers to the Flow Meter signal and may need to be set to **Reduced** to stop 'hunting'. This setting will also make the response to rate changes sluggish.



TIP

It is recommended that Standard is selected.

Proportional Valve Settings

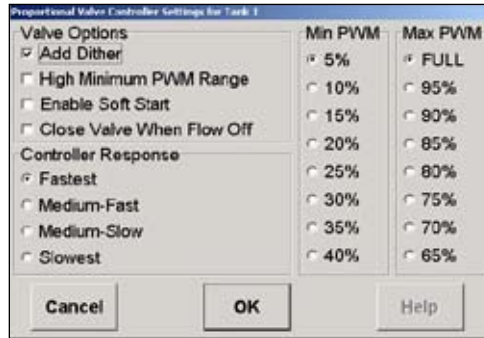


Figure 8-6. Proportional Valve Settings

Spraying systems that use a proportional valve are controlling a hydraulic valve, which in turn drives a hydraulic motor which drives a pump. Spray regulation is controlled by changing the pump speed. The settings will need to be tuned for the Sprayer.

Valve Options

- Add Dither—Select this when using Proportional Valves
- High Minimum PWM Range—Deselecting the **High Minimum PWM Range** option (default) displays Min PWM range values between 5% and 40%.

Selecting the **High Minimum PWM Range** option displays the Min PWM range from 42.5% to 60%

- Enable Soft Start—should be left deselected
- Close Valve When Off—should be left deselected.

Min PWM

To set the Min PWM put the Sprayer into Manual mode from the *Working* screen, with Agitation on full, all Boom Sections ON and a manual pressure gauge installed.

Determine the minimum pressure value for the spraying system, which is normally the lower limit of the nozzles being used. For this example we will use 100kpa.

From the *Working* screen, making sure the **MANUAL** button is selected, use the **Dec** button to decrease the pressure until 100kpa is reached (taking the reading from the manual pressure gauge).

Then go to the *Options>Sprayer>Settings* page. Starting at 5% increase the value to 10% and select the **OK** button to accept the change, then take a look at the pressure gauge.

Keep increasing the value in 5% increments (after each change, close the window by selecting the **OK** button) until the pressure just starts increasing above 100kpa on the manual pressure gauge. Use the value before the pressure increased above 100kpa; therefore, if 30% made the pressure increase above 100kpa, then use 25% as the Min PWM value.

The value will normally be around 25%.

Using High Minimum PWM Range Option

If after selecting 40% PWM and there is still no increase of pressure above 100kpa, then your system may have a Minimum PWM value above 40%. If this is the case, select **High Minimum PWM Range** from the *Valve Options* window. The *Min PWM* window will now have a range from 42.5% PWM to 60% PWM displayed.

Continue the procedure of increasing the PWM value until the pressure starts increasing above the 100kpa as displayed by the manual pressure gauge. Use the value before the pressure increased above 100kpa. Therefore, if 47.5% made the pressure increase above 100kpa, then use 45% as the Min PWM value

Max PWM

To set the Max PWM put the Sprayer into Manual mode from the *Working* screen, with Agitation on Full, all Boom Sections ON and a manual pressure gauge installed.

Determine the maximum pressure value for the spraying system, which is normally the upper limit of the nozzles being used, eg: we will use 500kpa.

On the *Working* screen, make sure the **MANUAL** button is selected, use the **Inc** button to increase the pressure until 500kpa is reached (taking the reading from the manual pressure gauge).

Then go to the *Options>Sprayer>Settings* page. Starting at a Full (100%) decrease the value to 95% and select the **OK** button to accept the change; then take a look at the pressure gauge.

Keep decreasing the value in 5% increments, after each change, close the window by selecting the **OK** button, until the pressure just starts dropping above 500kpa on the manual pressure gauge. Use the value before the pressure dropped below 500kpa therefore, if 70% made the pressure increase above 500kpa, then use 75% as the Max PWM value.

The value will normally be around 75%.

Note: the 100kPa min and 500kPa max are dependant on the type of nozzles used and limitations of the system. These valves are only a guide.

Controller Response

Once the Max PWM and Min PWM have been set the Controller Response can be set.

Make sure the Sprayer is in Auto mode.

Start at **Fastest** and select a spray rate, for example: 80L/ha then increase the rate to 100L/ha and see how quickly the rate changes. If the rate overshoots and starts “hunting” too much then select **Medium Fast** and repeat the procedure until the rate selected is obtained quickly without overshooting too much.

Sections

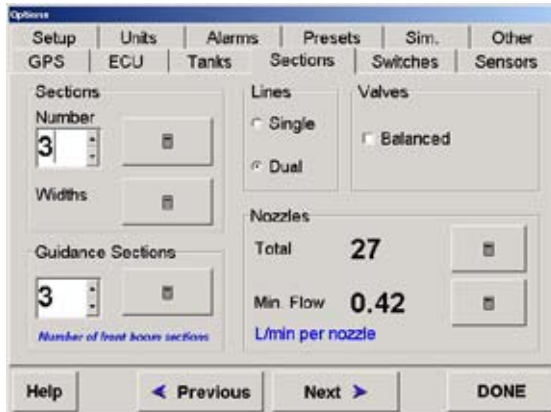


Figure 8-7. Options>Sections Page

Lines

The Sprayer can control either single boom lines or dual boom lines.

If **Single** is selected the Spray Interface can operate up to 6 primary Boom Sections or 5 primary Boom Sections with the second line being controlled by the section valve 6 circuitry. Special plumbing and wiring considerations need to be implemented for this system.

If **Single** is selected and **Spray ECU** (see page 8-7) is selected, then the system can operate up to:

- 30 Boom Sections using 3 wire section valves or solenoids with a 3 wire dump valve fitted.

Please note: When using an X15 console the number of sections is limited to 15 sections under ASC control.

- 15 Boom Sections using 2 wire section valves with a 2 wire dump valve fitted.

If **Dual** is selected the Spray Interface can control 3 primary sections valves and 3 secondary sections valves, giving a total of 6 sections.

If **Dual** is selected and **Spray ECU** (see page 8-7) is selected, then the system can operate up to:

- 15 Boom Sections on the primary and 15 Boom Sections on the secondary line, using 3 wire section valves or solenoids with a 3 wire dump valve fitted
- 7 Boom Sections on the primary line and 7 Boom Sections on the secondary line using 2 wire section valves with a 2 wire dump valve fitted
- 8 Boom Sections on the primary line and 8 Boom Sections on the secondary line and no Dump Valve fitted.

Sections

Set the number of sections by pressing the **calculator icon**. See Appendix A for help with using the calculator icon.

Enter the number of section valves on the primary line.

Setting the Number of Sections When Selecting Dual

If **Dual** was selected and, for example there are 8 sections on the primary line and 8 sections on the secondary line, then '8' would be entered as the number of sections.

See page 8-49 to set the Low Speed Shutoffs for the primary line (section valves 1-8) and the secondary line (section valves 9-16).

The Low Speed Shutoff for the secondary line (sections 9-16) would be all set at the same speed you require the secondary line to switch ON.

Setting the Number of Sections When Using a Primary Section Valve to Switch Secondary Line On

If the Spray Boom has been setup, for example with 5 sections on the primary line and a section valve to control the secondary line, then select the Lines as **Single** and the number of Sections as 6.

Then enter '5' as the number of Guidance Sections.

Enter the section widths of each of the sections (1-5) and enter a zero width for the '6' section.

See page 8-49 to set the Low Speed Shutoffs for section '6', set the Low Speed Shutoff for section '6' at the speed you require the secondary line to switch ON.

Widths

To enter the width for each Boom Section select the **calculator icon**. See Appendix A for help with using the calculator icon.

Only the number of sections selected will be displayed.

Each section has a calculator icon next to it. Select the **calculator icon** and enter in a value for each of the sections.

If all the sections are the same width then the **Set All** button can be used. Enter in the section width using the calculator keypad and select **Enter**, then all the sections will have that width value entered.

Select **OK** to close the **Section Widths** window when all section

Guidance Sections

The Guidance sections are displayed on the Guidance screen and are used to produce the Coverage map. The Guidance sections are also used by Guidance to know how many sections are used by Auto Section Control (ASC).

Enter in the number of section valves on the primary line.

Valves

Hardi Sprayers require special hardware to operate. When fitting the Sprayer controller to an existing Hardi Sprayer, it needs to cater for their balanced valves.

Balanced valves, when closed, bypass the flow back to the tank instead of just stopping it. However, the flow back to tank is being calculated by the X20 console, therefore the system needs to know when all the section valves are switched OFF; the signal pulses from the Flow Meter are ignored.

Select **Balanced** when connecting the TPA system to a Hardi type Sprayer with Balanced valves.

Nozzles

Total

The total number of nozzles fitted on the primary line can be entered here. This number is used to calculate an average flow rate per nozzle which can be displayed on the *Working* screen.

The number of nozzles is also used to calculate the Minimum Flow.

The number of nozzles should be the number of primary line nozzles only, with the nozzle count for each section entered into the appropriate section.

Min. Flow

The Min. Flow allows a value to be entered which represents the minimum flow rate of the nozzles fitted on the Sprayer. This value can be found on the nozzle chart that came with the Sprayer.

When this value is entered the Spray Rate Controller will not allow the nozzle minimum flow to fall below the value set. The Spray Controller will hold the regulator at that position until the flow increases above the Min. Flow.

The Spray Controller knows what the total flow is, because of the feedback from the Flow Meter; it knows how many sections are switched ON and how many nozzles are on each section. Therefore, it can determine the flow per nozzle. When the flow per nozzle falls below the Min. Flow Value a red indicator will appear on the Flow readout, on the *Working* Screen (Figure 6-7 on page 6-7).

An explanation of the red indicator can be seen by selecting the **Flow** readout (button).

Switches

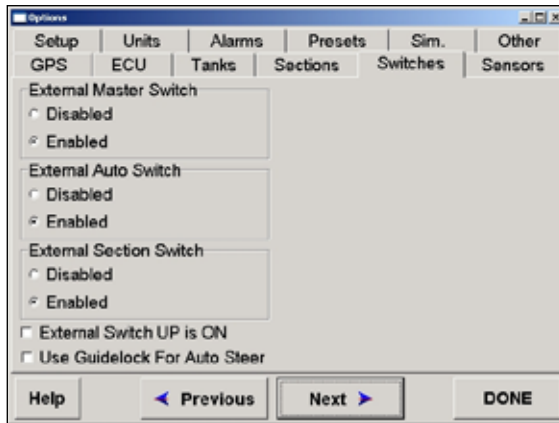


Figure 8-8. Options>Switches Page

Please note: If **Enabled** is selected on any of the 3 options then the relevant **Working** screen options become disabled and all three options can only be operated by the external Switchbox (A1268) or other external switches.

External Master Switch

The external master switch switches all sections— that are switched ON—ON or OFF.

Select **Enabled** if one of the following is connected to the Spray ECU or Spray Rate Interface:

- The Sprayer Switchbox (A1268) (connected to the Spray ECU marked SWITCHBOX)
- An external master switch (A601) (connected to the Spray Controller marked MASTER SWITCH [TPA Spray Rate Interface only])

- An external master switch (connected to the Spray ECU to either CONNECTOR 1 or CONNECTOR 3 on the Tractor harnesses or Spray ECU adaptor harness [Spray ECU Only]).

Select **Disabled** if no external master switch is connected to the Spray Rate Controller.

External Auto Switch

The external auto switch switches the Sprayer mode between automatic or manual.

Select **Enabled** if one of the following is connected to the Spray ECU or Spray Rate Interface:

- The Sprayer Switchbox (A1268) (connected to the controller box marked SWITCHBOX)
- An Auto/Manual switch (connected to CONNECTOR 2 harness on the Spray ECU).

Select **Disabled** if no Auto/Manual switch is connected to the Spray Rate Controller.

External Section Switch

The External Section Switch switches the Boom Sections ON or OFF.

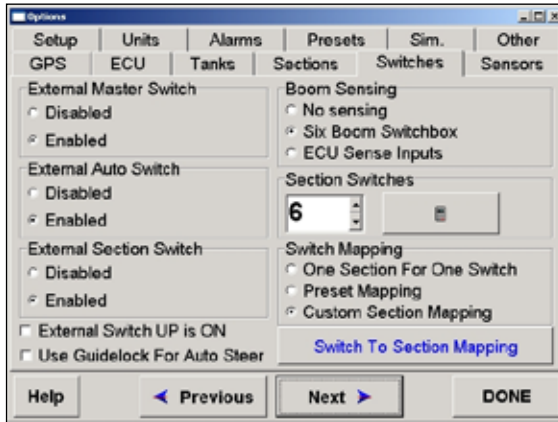
Select **Enabled** if one of the following is connected to the Spray ECU or Spray Rate Interface:

- The Sprayer Switchbox (A1268) (connected to the controller box marked SWITCHBOX)
- Remote section switches (connected to the Boom Sensing pins on CONNECTOR 2 harness on the Spray ECU).

Select **Disabled** if no external section switches are connected to the Spray Rate Controller.

- External Switch UP is ON—is only applicable when a TPA external Switchbox is connected to the Spray ECU or Spray Rate Interface. Select the option to have the Master and Section switches switch ON when in the up position.

Switches (Spray ECU Only)



**Figure 8-9. Options>Switches Page>
ECU Configuration**

The *Boom Sensing*, *Section Switches* and *Switch Mapping* windows will only be displayed when **Spray ECU** is selected as the controller (page 8-7).

Boom Sensing

- No Sensing—select this if no external section switches are connected to the Spray ECU
- Six Boom Switchbox—select this if the Sprayer Switchbox is connected to the connector marked SWITCHBOX on the Spray ECU
- ECU Sense Inputs—select this if customized section switches are connected to the CONNECTOR 2 connector on the Spray ECU.

Section Switches

1. Select the **calculator** icon
2. Enter how many physical section switches are connected to the Spray ECU box
3. Select **Enter** to save and close the window.

Switch Mapping

- One Section For One Switch—select this if the number of sections entered in the *Sprayer>Guidance* window is the same as the number of section switches entered into the *Switches>Section Switches* window
- Preset Mapping—select this if the number of sections entered in the *Sprayer>Guidance* window is more than the number of section switches entered into the *Switches>Section Switches* window and if you prefer the Sprayer software to work out which section switches control particular section valves
- Custom Section Mapping—select this if the number of sections entered in the *Sprayer>Guidance* window is more than the number of section switches entered into the *Switches>Section Switches* window and if you prefer to customize which section switches turn OFF particular section valves

Please note: When **Custom Section Mapping** is selected, the **Switch To Section Mapping** button will become accessible. Select the **Switch To Section Mapping** button to advance to the *Custom Section Mapping* window.

Custom Section Mapping

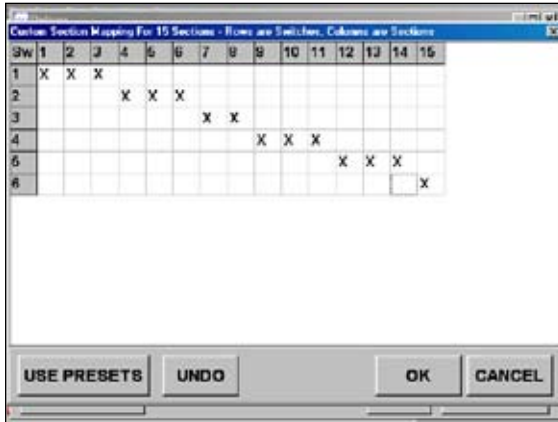


Figure 8-10. Custom Section Mapping

As the current Sprayer Switchbox has only 6 switches available, and the Spray ECU can control up to 30 sections. Custom Section Mapping provides a method of operating several sections from each switch.

Specific requirements will vary between operators and this window allows the operator to set which section switches operate which section valves.

The example (Figure 8-10) shows a 14 section dual line system with section 15 controlling the second line. Sections 1, 2 and 3 are operated by Switch 1, sections 4,5 and 6 are operated by Switch 2 etc, with the second line being controlled from switch 6 through the control circuit for section 1.

By touching the screen put an 'X' in the box (touching the same box again will remove the 'X' from the box).

Any configuration is possible, simply by putting an 'X' in the box that is common to the switch required and the section to be controlled.

This selection does not affect the Auto Section Control (ASC) operation or the Low Speed Shutoff settings for a particular Boom Section.

Use Presets

Selecting the **USE PRESET** button uses a formula depending on how many sections are selected and automatically sets which section switches control which section valves.

Undo

Selecting the **UNDO** button will undo one change at a time.

The **UNDO** button can be selected several times to go back several steps; **UNDO** can be selected until the button is greyed out. A greyed out **UNDO** button means the configuration is the same as when the window was opened.

OK

Select the **OK** button once the Section Mapping configuration is finalized.

Selecting **OK** closes the *Custom Section Mapping* window and saves the changes.

Cancel

Selecting the **CANCEL** button closes the *Custom Section Mapping* window without saving.

Sensors



Figure 8-11. Options>Sensors Page

Pressure

Please note: Normal operation is with Tank 1, but the system can control up to 3 separate tanks. The above screen shows the page as shown when Spray Interface is selected as the controller (page 8-7); see page 8-42 also if Spray ECU was selected as the controller (page 8-7).

If **Pr. Sense** was selected on the *Sprayer* page (page 8-15) for a Tank then this page allows the type of sensor installed on the Sprayer to be selected.

If only one tank has been selected on the *Sprayer>Pr.Sense* window then make sure that when selecting the Type that Tank 1 is selected.

To select the tank the Pressure sensor is connected to, use the arrows (◀▶) to display the correct tank.

Type

- 5 Bar—select this if using the standard TPA Pressure Sensor
- 10 Bar—select this if a 10 Bar Pressure Sensor is fitted.

See “Calibrating the Pressure Sensor”, page 10-3.

Input Gain

- x1—select this (default) if the Spray Interface controller was purchased after July 2005
- x2—select this if the Spray Interface controller was purchased before July 2005.

Please note: When the Spray ECU is selected Input Gain is not required.

Flow



NOTICE

Most Flow Sensors have a calibration factor stamped or labeled on the Flow Sensor body. The factor will be in pulses per volume, (volume can be Litres, US Gallons etc).

This factor may be entered manually into the **Flow Sensor Specifications** window. Make sure the units (volume), selected from the **Units** page (page 8-38), corresponds to the units used on the Flow Sensor.

If the Flow Meter calibration is not known or the operator wants to check the Calibration Factor, return to the **Working** screen, see “Calibrating the Flow Meter”, page 10-13.

To select the tank (1,2 or 3) (normally Tank 1) use the arrows (◀▶).

The **Sensor Specifications** button opens the *Flow Sensor Specifications* window (Figure 8-12).

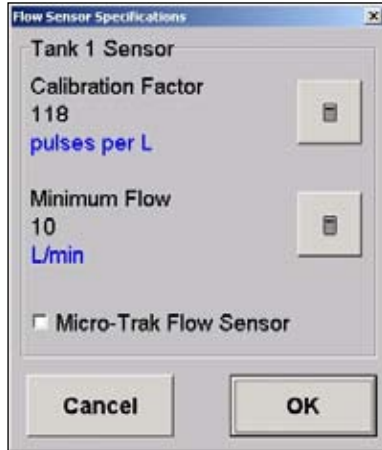


Figure 8-12. Flow Sensor Specifications

Calibration Factor

1. Select the **calculator** icon
2. Type in the Flow Sensor Calibration



TIP

Do not forget to enter a decimal point if required.



NOTICE

If typing a Flow Sensor Calibration for a Raven Flow Sensor then you must divide the factor by 10 before entering the factor. This is because the Raven console does not have decimal points and assumes the last digit is a decimal place.

For example: If the Raven label says '187', then you should enter 18.7 as the calibration factor.

3. Select **Enter** to accept and save the factor.

The current calibration factor is displayed and the current units are displayed in blue.

Minimum Flow

1. Select the **calculator** icon
2. Enter the minimum flow of the Flow Meter fitted to the Sprayer

Every Flow Meter has a minimum value. Below this point, it can not control accurately. Therefore when the Flow Meter reaches this value, the Regulator Valve will not attempt to control below this minimum value, it will hold the Regulator Valve at that point. Then the Flow readout will display a red indicator alerting the operator of this.

Selecting the **Flow** readout (button) displays an explanation of the red indicator, as the red indicator can mean Minimum Flow (Flow Meter) or Minimum Nozzle Flow.

3. Select **Enter** to accept and save the factor.

The current factor is displayed.

Micro-Trak Flow Sensor

Select **Micro-Trak Flow Sensor** if a Micro-Trak Flow Sensor is fitted. The Micro-Trak Flow sensor uses a latch system and when enabled the software handles this.

Sensors (Spray ECU Only)

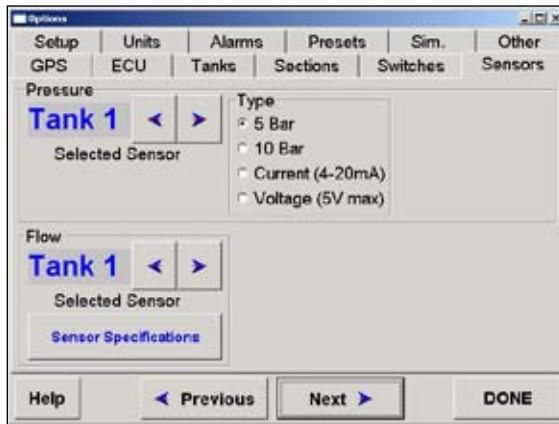


Figure 8-13. Options>Sensors Page>
ECU Configuration

Pressure

When Spray ECU is selected as the controller (page 8-7) there are 2 extra types of Pressure sensors available: Current and Voltage.

If 5 Bar or 10 Bar are selected in the *Type* window then the *Calibration Method* window and the **Sensor Specifications** button in the *Pressure* window are not displayed.

Select the type of Pressure sensor connected to the Sprayer. Check the Pressure Sensor manufacturers details to select the correct type of Pressure Sensor.

If **Current** or **Voltage** is selected then the *Calibration Method* window is displayed (Figure 8-14 on page 8-43).

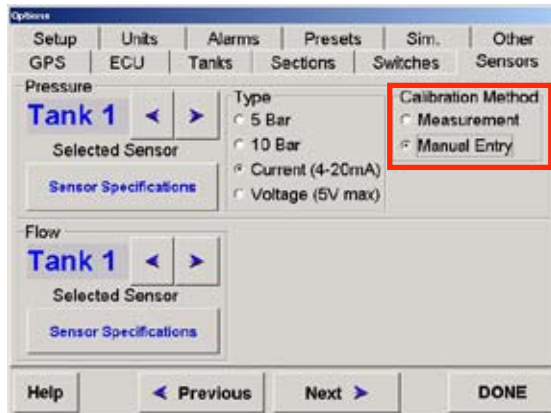


Figure 8-14. Calibration Method Window

Calibration Method

- Select **Measurement** if a Calibration is required for the Pressure Sensor (Current or Voltage)

Calibration is done from the *Working* screen, see “Calibrating the Pressure Sensor”, page 10-3.

- Select **Manual Entry** if the sensor specifications are known for the Pressure Sensor fitted.

When **Manual Entry** is selected a **Sensor Specification** button appears in the *Pressure* window.

Sensor Specifications

Current



Figure 8-15. Sensor Specifications for Current Type

1. Select the **Sensor Specifications** button (Figure 8-13 on page 8-42) to do a manual entry with **Current** selected

A *Pressure Sensor Specifications* window will be displayed.

2. Select the **calculator** icon
3. Enter the Maximum Pressure
4. Select **Enter** to save the value and close the window

The current units will be displayed in blue.

5. Select **OK** to close the window.

Voltage

1. Select the **Sensor Specifications** button (Figure 8-13 on page 8-42) to do a manual entry with **Voltage** selected

A *Pressure Sensor Specifications* window will be displayed.

You will need to enter the specifications for Maximum Pressure, Minimum Voltage and Maximum Voltage.

2. Select the **calculator** icon for each window, in turn
3. Enter the specification
4. Select **Enter** to save the value and close the window
5. Repeat the process for each window

The current units will be displayed in blue.

6. Select **OK** to close the window.

Setup

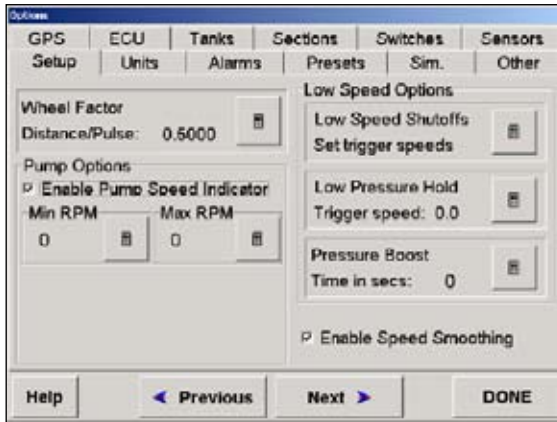


Figure 8-16. Options>Setup Page

Wheel Factor

The current Wheel Factor is displayed on the *Options>Setup* page, in distance per pulse.

To set the Wheel Factor:

1. Select the **calculator** icon in the *Wheel Factor* window (Figure 8-16).

The *Wheel Factor Entry* window will be displayed (Figure 8-17 on page 8-47).



Figure 8-17. Wheel Factor Entry

Manual Entry

If the Wheel Factor is known:

2. Select the **calculator** icon in the *Manual Entry* window to enter the Wheel Factor
3. Select **OK** to save and close the screen

The current Wheel Factor will be displayed.

Calibrate

If the Wheel Factor is unknown:

2. Place a mark on the ground alongside a Sprayer wheel
3. If the pulses are not on '0' press **Reset**, in the *Calibrate* window (Figure 8-17)
4. Drive along in a straight line, at a steady pace, and watch the pulses accumulate

As the wheel sensor passes past the magnet a pulse is counted for every pulse from the radar.

5. Stop after approximately 20 meters (60 feet)
6. Put another mark on the ground alongside the same wheel as used in Step 2
7. Measure the distance of the two marks, using a tape measure
8. Press the **calculator** icon next to 'Enter Distance', in the **Calibrate** window

The Wheel Factor is automatically calculated

9. Press **ENTER** to save the Wheel Factor and close the window.

Distance Check

To check the Wheel Factor:

1. Press **Reset**, in the **Distance Check** window (Figure 8-17 on page 8-47)
2. Drive back between the two marks made in steps 2 and 6 during the Calibration

The distance travelled must be the same as the distance measured, if it is not you must re-calibrate the Wheel Factor.

3. Press **ENTER** to save changes and return to the **Setup** page (Figure 8-16 on page 8-46).

Low Speed Options

Low Speed Shutoffs

Low Speed Shutoffs sets the speed at which the section valves will switch ON or OFF, when in Auto mode.

Low Speed Shutoffs are set according to the Sprayer performance and operator requirements.

Selecting the **calculator** icon in the *Low Speed Shutoffs* window (Figure 8-16 on page 8-46) opens the *Low Speed Shutoffs* screen.

The number of sections displayed depends on the number of sections selected in the Sections page (page 8-26). Individual speeds can be set for each Section Valve.

- **Single Boom**—In a single line system, all sections valves would be set to the same value, eg. 2 or 3 kph. This will ensure that the boom shuts OFF if the operator comes to a stop while in Auto mode
- **Dual Line using a Section Valve Switching**—If the Sprayer is configured with a Dual Boom using a Section valve to switch the secondary line ON and OFF, then all the section valves need to be set the same, eg. 2 or 3 kph. Except for the section valve switching the second line ON and OFF, this needs to be set at the speed at which the primary line nozzles reach their upper limit (Maximum Pressure), eg. 17kph, and the secondary line needs to switch ON
- **Dual Line**—A Dual Line with separate wiring going to each individual section valve. The first half of the section valves (section valves on the Primary Line) would have a Low Speed Shutoff set at, for example, 2 or 3 kph. The second half of the section valves (Section Valves on the

Secondary Line) would have a Low Speed Shutoff set at the speed at which the primary line nozzles reach their upper limit (Maximum Pressure), eg 17kph.

For example if a Dual Line with 15 Primary Line section valves and 15 Secondary Line section valves with separate wiring was setup. Then the primary line valves 1 to 15 would have the Low Speed Shutoffs set at 2kph and the secondary line valves would have the Low Speed Shutoffs set at 17kph.

Low Pressure Hold

It is recommended that the Low Pressure Hold option be set at '0.0' if using X20 Guidance with ASC. An alternative to this would be to set a Min. Flow per Nozzle and Min. Flow for the Regulator valve (refer Page 8-29 and 8-40)



NOTICE

Low Pressure Hold should be set to 0.0 for boom testing and setup. When this is completed a Low Pressure Hold can be set.

A Pressure sensor would be required to set the Low Pressure Hold.

The Low Pressure Hold is mainly designed for inline spraying systems.

When using a Regulator Bypass system you will not be required to set a Low Pressure Hold value, therefore the Low Pressure Hold can be set at '0.0'.

The Low Pressure Hold is normally set at the speed just above the point where the nozzles are at the bottom end of their range eg. 100kpa. To determine the Low Pressure Hold, the speed of the Sprayer would have to be determined when the nozzles reach

100kpa.

The idea is to maintain a spray pattern, even if the application rate is above the desired rate. If a value is set in this option, and the Sprayer speed falls below the set value, the spray system switches to Manual mode and locks the Regulator Valve. When the Sprayer is in this mode it is most likely that the Sprayer will be over applying the chemical.

When the Sprayer speed goes above the set value the spray switches to Auto mode and the Regulator Valve will start controlling.

Select the **calculator** icon in the **Low Pressure Hold** window (Figure 8-16 on page 8-46) to enter the value (in kph). Select **Enter** to save the value you entered and close the window.

Pressure Boost

Leave the Pressure Boost value at '0' when using a 6 second Regulator Valve or faster and especially when using ASC.

Pressure Boost is a function mainly used for viticulture applications and if using a 20 second Regulator Valve (slow).

The idea is to close the regulator to increase the pressure in the Sprayer after the boom spray has switched OFF under Low Speed Shutoff, so the correct application occurs when the Sprayer turns ON again, when entering the next row.

The Pressure Boost compensates for the pressure loss the Sprayer experiences as it travels slower, coming out of the row or when entering the row.

Select the **calculator** icon in the **Pressure Boost** window (Figure 8-16 on page 8-46) and enter the value (normally 2-3 seconds).

Pump Options

Select **Enable Pump Speed Indicator** (Figure 8-16 on page 8-46) when a speed sensor is fitted to the pump to readout the RPM of the pump shaft.

If **Enable Pump Speed Indicator** is selected enter in a Min. and Max RPM value for the Pump Shaft (by selecting the relevant **calculator** icon). An alarm will be displayed when the pump speed falls below the set minimum RPM value and above the set maximum RPM value.

Enable Speed Smoothing

By default **Enable Speed Smoothing** is enabled. Under normal spraying operations this should not be changed.

If a need arises for faster response to vehicle acceleration and deceleration then deselect the box.



NOTICE

The rate displayed on the screen may fluctuate more when the Enable Speed Smoothing option is disabled.

Setup (Spray ECU Only)

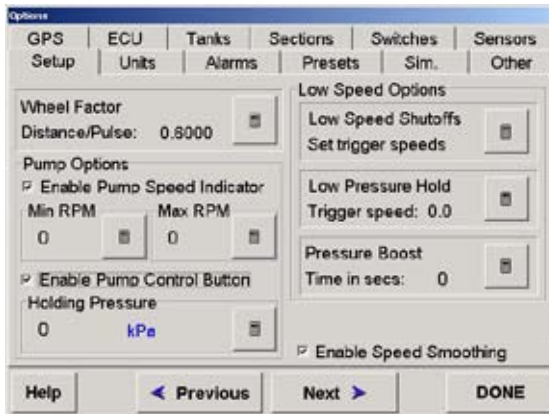


Figure 8-18. Options>Setup Page>
ECU Configuration

Enable Pump Control Button

The **Enable Pump Control Button** option is displayed when Spray ECU is selected as the controller (page 8-7) and when Prop. Valve (Proportional Valve) (page 8-14) and Pr. Sense (Pressure Sensor) (page 8-15) are selected.

When the **Enable Pump Control Button** option is selected an extra button to the left of the **Master Switch** on the *Working* screen, called **PUMP** will be displayed.

When the **PUMP** button is switched OFF, on the *Working* screen the proportional valve closes (by setting the PWM to zero) and stops the oil flow to the pump.

See page 16-1 for more information.



CAUTION

Do not select the Enable Pump Control Button if the Hydraulic pump is controlled by an independent switch.

Holding Pressure

This feature is for future developments. Make sure the Holding Pressure remains set at '0'.

Units

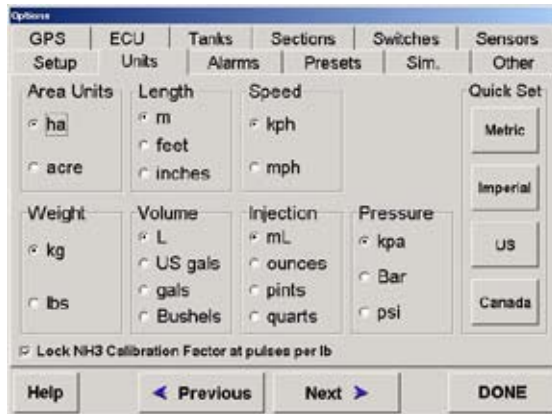


Figure 8-19. Options>Units Page

The *Units* page allows the operator to select the units preferred for operation.

Select a unit from each of the windows:

- Area Units
- Length
- Speed
- Weight
- Volume
- Injection—applies when Injection is selected as one of the Tank Modes (page 8-14)
- Pressure—applies when an electronic Pressure Sensor is installed on the Sprayer.

Quick Set

Quick Set allows the operator to quickly change all the units to all Metric, Imperial, US or Canadian units (by pressing the appropriate button).

The operator can still change the units to suit their operation.

Lock NH3 Calibration Factor at Pulses per lb

Selecting the **Lock NH3 Calibration Factor at pulses per lb** option when applying Anhydrous Gas and the Calibration Factor on the NH3 Regulator Valve is in lb's (pulses per lb of N) means you can change the setting so you can work in kg of N.

The operator enters the Calibration Factor (pulses per lb of N), selects the Units>Weight to **kg** then the Sprayer software will convert the pulses per lb of N and display kg of N on the **Working** screen.

Select this option if one of the Tank Modes is set to NH3 (page 8-14) and the operator has manually entered a Calibration Factor in pulses per lb of N and selected **kg** in the **Units>Weight** window.

Alarms

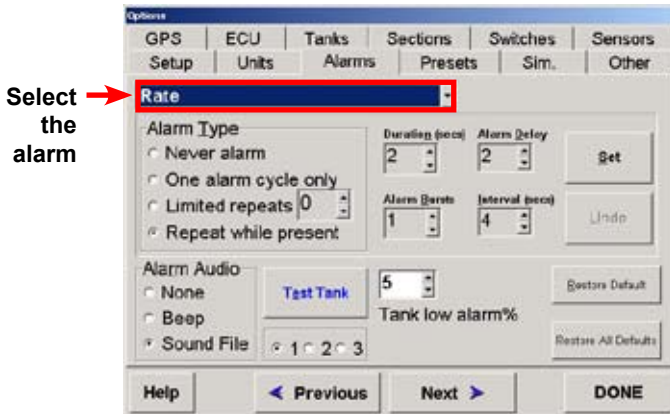


Figure 8-20. Options>Alarms Page

Topcon Spraying software has a comprehensive alarm system, with various options for indicating alarm conditions.

Voice alarms can indicate the alarm condition, without the need for the operator to look at the console to see what is happening.

Each of the alarm conditions can be set for individual conditions. For example if there is no Pressure Transducer fitted, the pressure alarms can be set to Never Alarm.

The alarms are set from the factory, there should be little reason to change the alarms.

Selecting the Alarm

Select the alarm you wish to change from the drop down list, by pressing the arrow (▼) (Figure 8-20 on page 8-57).

The example (Figure 8-20 on page 8-57) shows the Rate Alarm selected; the changes made will apply to this alarm only.

Alarm Type

Select the preference for the type of alarm:

- Never Alarm—switches the selected alarm OFF
- One alarm cycle only—will alarm only once while the alarm condition is present
- Limited repeats—when a number is entered next to it eg. '2' then while the alarm condition is present it will only alarm for 2 cycles
- Repeat while present—the alarm will keep alarming while the alarm condition is present.



WARNING

All critical alarms should be set to "Repeat while present."

Audio Alarm

Select the preference for the type of audio:

- None—no audio alarm, only an *Alarm* window will be displayed on the console showing the type of alarm

- Beep—a beep will be sounded through the console speaker, and the **Alarm** window will be displayed, showing the alarm type
- Sound File—a voice alarm will be sounded through the console, and the **Alarm** window will be displayed, showing the alarm type.

Select Tank

Select the Tank (**1**, **2** or **3**) you wish to set the alarms for. Each tank can have different alarm conditions.

Setting Alarms

Select the alarm conditions for the selected alarms using the arrows (▲ ▼) (Figure 8-20 on page 8-57) next to each parameter.



TIP

Use the supplied mouse to set these values.

- Duration—the length of time the alarm will stay present
- Alarm Bursts—the number of alarm bursts you will receive throughout the duration
- Interval—the time between each duration
- Alarm Delay—the time gap between when the system detects a problem to when an alarm is sounded and displayed on the console.

Press the **SET** button (Figure 8-20 on page 8-57) to save all changes.

Once an alarm has been changed and the **SET** button has been selected. The alarm changes can be undone by selecting the **UNDO** button (Figure 8-20 on page 8-57).

Tank Low Alarm %

The Tank Low Alarm is set at a percentage of the total volume.

The Total Volume is set from the *Working* screen, see “Tank Setup”, page 10-13.

Use the mouse to set the Tank Low Alarm %, by selecting the arrows (▲ ▼) next to the value (Figure 8-20 on page 8-57).

Test Tank

Select the **Test Tank** button (Figure 8-20 on page 8-57) to preview the alarm sound, duration, cycles etc.

Reselect the **Test Tank** button to turn test OFF.

Defaults

- Restore Defaults—resets the alarm you have selected, to the factory setting
- Restore All Defaults—resets all alarms to the factory settings.

See Table 8-3 (page 8-61) for information on the alarm defaults.

Alarm Defaults						
Alarm	Type	Duration	Delay	Bursts	Interval	Reason
Rate	Repeat While Present	2 seconds	2 seconds	1	4 seconds	Default rate alarms need to be investigated quickly
Tank Empty	Repeat While Present	2 seconds	5 seconds	1	30 seconds	If the tank is really empty the rate alarm will also sound
Tank Low	Limited Repeats or One Cycle	2 seconds	2 seconds	1	4 seconds	Set limited repeats to required cycles, 2 to 4 times
Flow Sensor Fail	Repeat While Present	2 seconds	5 seconds	1	30 seconds	Delay time is increased to allow for booms to activate and flow to start
High Pressure	Repeat While Present or Never Repeat	2 seconds	2 seconds	2	5 seconds	Turn off if no pressure sender
Low Pressure	Repeat While Present or Never Repeat	2 seconds	2 seconds	2	5 seconds	Turn off if no pressure sender
No Ground Speed	Repeat While Present	2 seconds	2 seconds	2	4 seconds	
No Comms	Repeat While Present	2 seconds	2 seconds	3	10 seconds	Continual alarms when setting Comms Port is difficult

Table 8-3. Alarm Defaults

Presets

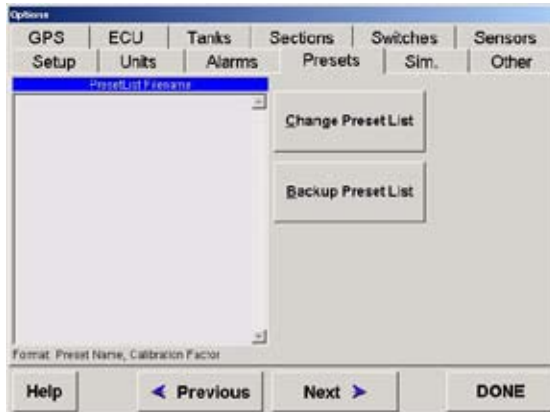


Figure 8-21. Options>Presets Page

The *Presets* page can display various products and associated Flow Meter calibrations.

This would normally only be used when a product density or viscosity is significant enough to change the Flow Meter Calibration or if the Flow Meter is routinely changed to cater for different rates with different chemicals such as in the Viticulture industry.

Unless specifically required it is recommended that you leave this table blank.

Change Preset List

Only follow this procedure if required to.

1. Select **Change Preset List** (Figure 8-21)

The *Preset Entry* window will be displayed (Figure 8-22 on page 8-63).

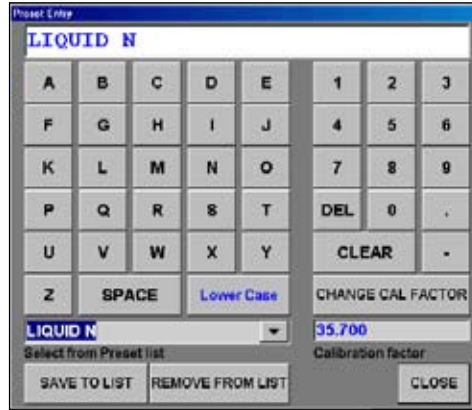


Figure 8-22. Preset Entry Window

- Using the alpha, space and numeric buttons, enter a name for the product

As you are typing the name of the product will appear in the white window (Figure 8-22)

- Select **CHANGE CAL FACTOR**

A screen keyboard will appear

- Enter the Calibration Factor value (pulses per volume) for the product
- Select **Enter** to save the Calibration Factor and close the window

The new Calibration Factor will be displayed

- Select **SAVE TO LIST**

A window will be displayed showing the new product name with the new Calibration Factor

7. Select **YES** to save or **NO** to cancel
8. Select **CLOSE**

The new product and Calibration Factor will now be displayed in the **Preset List** window.

Backup Preset List

The **Backup Preset List** button allows you to backup the preset list to another directory on the console or USB thumbdrive.

The Preset List can be restored from the USB thumbdrive at a later date.

1. Select **Backup Preset List** (Figure 8-21 on page 8-62)

The *Preset List Backup* window will be displayed

2. Select **Set Transfer Path**
3. Select **D: Drive** (USB Thumbdrive) from the drop down list
4. Select **OK** to close the window
5. Select **Backup List** to save the Preset List to the USB Thumbdrive
6. Select the **Restore List** button to transfer the Preset List from the USB thumbdrive to the console
7. Select **Close** to close the window.

Simulation

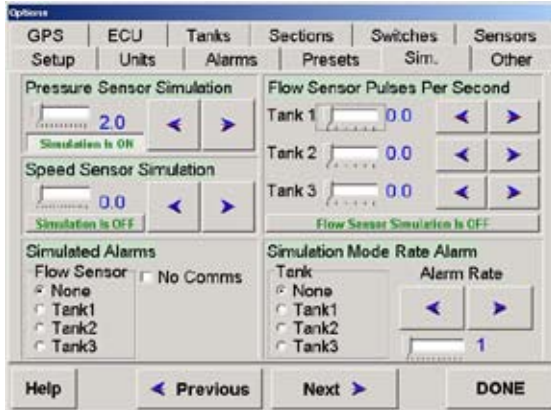


Figure 8-23. Options>Sim. Page

The Sim. (Simulation) page is used to setup various parameters and operating conditions to demonstrate the Sprayer program, without the need to have a Sprayer connected.

The Simulation page is normally only used by sales representatives at demonstrations and field days.

Other

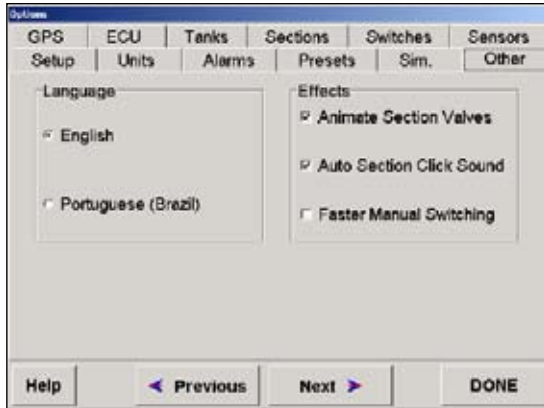


Figure 8-24. Options>Other Page

Language

Select the language the system will operate in.

Effects

- Animate Section Valves—this will animate the section valves on the *Sprayer Working* screen and the screen section valves rotate when there is a flow present
- Auto Section Click Sound—there will be an Auto Section “click” when the section valve switches ON or OFF, under Auto Section Control (ASC)

Deselect the option to disable the ASC “click” sound

- Faster Manual Switching—when an external Switchbox is connected, this option allows the system to read the Switchbox more often, to speed up the response to manual switches when the coverage map is being drawn on the Guidance screen.

You have now successfully entered all the details for your Sprayer.

Select **DONE**.

Go to Chapter 9, “Saving your Sprayer Configuration”.

Saving the Sprayer Configuration

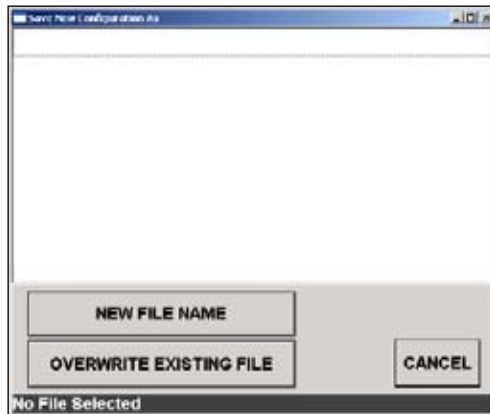


Figure 9-1. Save New Configuration As Window

Once **DONE** has been selected on an *Options* page the *Save New Configuration As* window (Figure 9-1) will be displayed

If this is the first time a Sprayer configuration has been saved there will be no User Configurations listed

1. Select **NEW FILE NAME**

The screen shown in Figure 9-2 on page 9-2 will be displayed

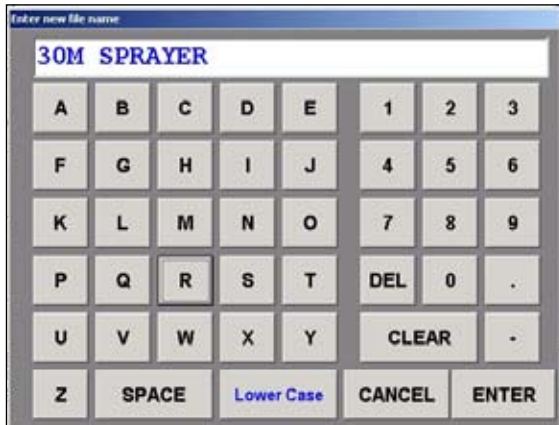
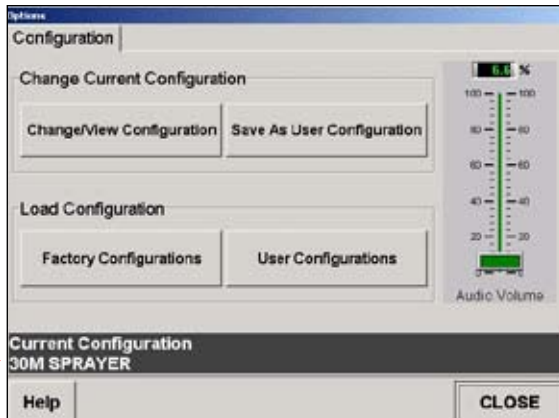


Figure 9-2. Screen Keyboard

- Using the screen keyboard (Figure 9-2) enter in a name for the Sprayer

The Sprayer in the above example was named 30M SPRAYER

- Select **ENTER** to accept and save the Sprayer name



Current Configuration →

Figure 9-3. Current Configuration Displayed

The **Configuration** window will be displayed and the current configuration will be displayed (Figure 9-3 on page 9-2)

The Sprayer settings for the Sprayer will be saved and loaded onto the Working screen, ready to finish setting up the Sprayer

4. Press **CLOSE** to go back to the **Working** screen.

The Sprayer settings are now saved in the User Configuration folder.

If a Factory Configuration listed Sprayer was originally loaded from the Factory Configurations folder then the settings for the Sprayer have not changed in the Factory Configurations list.

The Sprayers listed in the Factory Configurations folder can be loaded but they cannot be changed.

The Sprayers lists in the User Configurations folder can be changed by the user.

Changing the Sprayer Settings of the Current Configuration

1. Select **Options** from the Sprayer Main Menu (Figure 6-7 on page 6-7)

The Configuration window will appear

2. Check that the Sprayer that needs to be changed is loaded (it will be listed in the **Current Configuration** window (Figure 9-3 on page 9-2)

3. Select **Change/View Configuration**

The **Options** window will be displayed

4. Change the Sprayer settings that need to be changed

See Chapter 8, “Setting Up the Software” for help

5. Select **DONE** when you have finished making changes

The *Save New Configuration As* window (Figure 9-4) will be displayed

Please note: If no changes were made the *Save New Configuration As* window will not be displayed

The Sprayer that is changed will be listed (Figure 9-4)

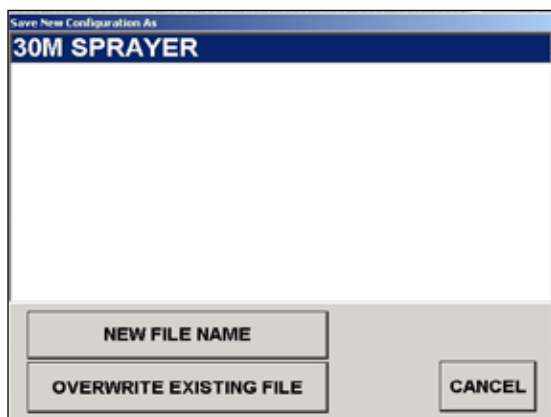


Figure 9-4. Save New Configuration As Window

6. From the list select the Sprayer that the changes have been made to
7. Select either:
 - **NEW FILE NAME**
 - **OVERWRITE EXISTING FILE**

New File Name

An *Enter New File Name* window will appear

- Using the screen keyboard enter in a name for the Sprayer



CAUTION

The name of the Sprayer has to be different from the other listed Sprayers.

- Select **ENTER** to accept the new Sprayer name

The *Configuration* window will be displayed.

The new Sprayer settings will be loaded and the name of the new Sprayer will be displayed in the *Current Configuration* window.

- Select **CLOSE** to return to the *Working* screen, using the new Sprayer settings.

Overwrite Existing File

A confirmation window will appear, asking to overwrite the existing file

- Select either:
 - YES—to overwrite the selected Sprayer
 - NO—to cancel the overwrite

If **YES** was selected a *Configuration* window will be displayed

The changed Sprayer settings will be saved to the existing file name.

The ***Current Configuration*** window will display the current Sprayer.

9. Select **CLOSE** to return to the ***Working*** screen, using the new Sprayer settings.

Setting Up the Sprayer

Pressure Sensor



Figure 10-1. Working Screen Showing Tank Pressure Window

Please note: The Pressure Readout display is only displayed if Pr. Sense (page 8-15) is selected in Options and an electronic Pressure Sensor is installed on the Sprayer.

The number in the top left corner of the Pressure Readout represents which tank (1,2 or 3) the Pressure Sensor is connected to. The Pressure Readout shown in Figure 10-1 is displaying a '1', therefore the pressure readout displayed is connected to Tank 1. Up to 3 Pressure Readouts can be displayed. The units used are displayed in the Pressure Readout.

Selecting the Pressure Readout from the *Working* screen, displays the *Tank Pressure* window.

Alarms

For a standard Broadacre System a low pressure alarm of 80 to 100kpa and a high pressure alarm point of 450kpa are reasonable values. These settings will depend on the Sprayer configuration, nozzles, pumps and usage and could vary considerably from these values.

High Pressure

The current High Pressure alarm is displayed

1. Select the **calculator** icon (Figure 10-1 on page 10-1) next to High Press. 1 to set a new High Pressure alarm

A screen keyboard will be displayed

2. Enter the value using the screen keyboard
3. Select **ENTER** to save the new value and close the window

Low Pressure

The current Low Pressure alarm is displayed

1. Select the **calculator** icon (Figure 10-1 on page 10-1) next to Low Press. 1 to set a new Low Pressure alarm

A screen keyboard will be displayed

2. Enter in the value using the screen keyboard
3. Select **ENTER** to save the new value and close the window

Calibrating the Pressure Sensor

Before calibrating the Pressure Sensor make sure you have selected which Type of Pressure Sensor is connected to the system (page 8-38) and what Calibration Method you are going to use (page 8-43).



NOTICE

A Manual Pressure gauge must be fitted to the system to determine the actual pressure for calibration purposes.

1. Select **RESTORE FACTORY DEFAULTS** at the bottom of *Tank Pressure* window (Figure 10-1 on page 10-1)
2. Select **CALIBRATE SENSOR** in the *Tank Pressure* window (Figure 10-1 on page 10-1)
3. Follow the on screen directions to calibrate the Pressure Sensor

To calibrate the Pressure Sensor the console will take a zero reading of the pressure when the pump is switched OFF. Then another reading of the pressure when the pump is at operating pressure. You will enter the actual pressure as read from a Glass Pressure Gauge, using the screen keyboard.

4. Once the calibration is complete, check the Pressure Readout from the *Working* screen and compare it against the Glass Pressure Gauge.

If the difference is more than 10% then make note of the Actual Pressure and the Pressure Readout from the Working screen.

Correction Factor After a Pressure Calibration is Unacceptable

If the Pressure Readout is less than the Pressure Gauge:

1. Add the difference

If the Pressure Readout is more than the Pressure Gauge:

1. Subtract the difference

Eg: If the Pressure Readout reads 400kpa and the Pressure Gauge reads 450kpa, add the difference of 50kpa to the Pressure Gauge reading during the next calibration: enter a correction factor of '500kpa' using the screen keyboard.

1. Select **RESTORE FACTORY DEFAULTS** at the bottom of *Tank Pressure* window (Figure 10-1 on page 10-1)
2. Select **CALIBRATE SENSOR** in the *Tank Pressure* window (Figure 10-1 on page 10-1)
3. Follow the on screen directions to calibrate the Pressure Sensor.

When the pump is at operating pressure (eg: 450kpa) and the screen keyboard window appears, you will enter in the new correction factor, using the above formula (eg: '500').

Manual Entry of Pressure Calibration Factors (Spray ECU Only)

Manual Entry of Pressure Calibration Factors can only be selected if Spray ECU was selected as the controller (page 8-7) and either a Current or Voltage type of Pressure Sensor is fitted to the Sprayer.

Manual Entry has to be selected as the Calibration Method (page 8-43).

When the Calibration Method is set to Manual Entry, the Pressure Sensor factors can be entered using the **Sensor Specifications** button on the *Options>Sensors* page or they can be entered by selecting the **CALIBRATE SENSOR** button on the *Tank Pressure* window. Both buttons perform the same function and either button can be used to enter the Pressure Sensor factors.

See page 8-43 for an explanation on entering the Pressure Sensor factors.

Flow

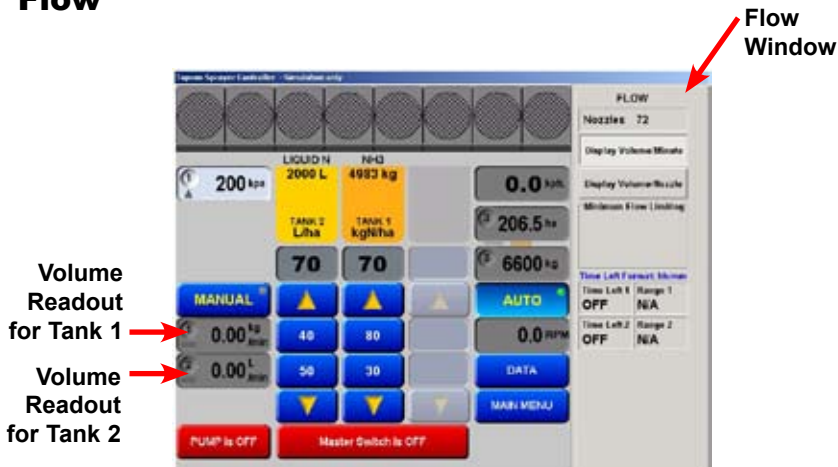


Figure 10-2. Working Screen Showing Flow Window

The Volume Readout (Figure 10-2) displays Volume/Minute or Volume/Nozzle, depending on which option is selected from the **Flow** window (Figure 10-2).

There is a Volume Readout displayed for each Tank (1,2 and 3) selected. The example shown in Figure 10-2 shows a Volume readout for Tank 1 and Tank 2 because there are 2 tanks selected. The number on the left hand side of the Volume Readout displays which tank the Volume Readout is displaying.

The units displayed are determined by the units selected on the **Options>Units** page (page 8-55) and whether, Liquid, Granular, Injection or NH3 (page 8-14) was selected for the Tank Mode.

By selecting the **Volume Readout** the **Flow** window is displayed on the right side of the screen (Figure 10-2).

The current number of nozzles is displayed. The number of nozzles are set from the **Options>Sections** page (page 8-28).

The number of nozzles does not affect Sprayer Operation. The number of nozzles is used to calculate an average flow rate per nozzle. This is displayed in the Volume Readout when the **Display Volume/Nozzle** button is selected from the **Flow** window (Figure 10-2 on page 10-2).

Display Volume/Minute is displayed in the Volume Readout when the **Display Volume/Minute** button is selected from the **Flow** window (Figure 10-2 on page 10-2).

- Range (Spray ECU 2 only)—shows the actual Pulse Width Modulation (PWM) applied to the Hydraulic Valve as a percentage (%)

Please note: The Range is only displayed for the Tanks or Tank which have Proportional Valve selected as the Controller (page 8-14).

- Time Left—these windows display the approximate spraying time left (in hh:mm), before the tank is empty, taking into account the current speed, volume left in tank, sections ON and widths and application rate. Each Tank has its own Time Left display, the number of Time Left windows is determined by the number of Tanks selected. 'OFF' is displayed where the time (hh:mm) is normally displayed, when the Tank is switched OFF or the Master is switched OFF.

Speed

Valve
Number
Low
Speed
Shutoff
Value



Speed
Window

Speed
Readout

Figure 10-3. Working Screen Showing Speed Window

The Speed Readout (Figure 10-3) displays the current ground speed, either from: Wheel sensor, Tractor Radar, GPS Speed (page 8-8) or Test Speed.

Select the **Speed Readout** to display the *Speed* window (Figure 10-3).

- **Test Speed**—A test speed can be entered to perform all tests necessary while the Sprayer is stationary. The Spraying software will simulate a speed whilst stationary, the Sprayer will operate in Manual or Auto modes, enabling the checking of pumps, Flow Meter, nozzles, regulator etc

Select the Increase Speed arrow (▶) or Decrease Speed arrow (◀) (Figure 10-3) to set a test speed. The test speed will be displayed in the Speed Readout

- **Wheel Factor**—The current Wheel Factor is displayed. When the **calculator** icon, next to the Wheel Factor is selected, the *Wheel Factor Entry* window is displayed. This is the same window as

selected in the **Options>Setup** page (page 8-46 to 8-47)

- **Spray Width**—The current Spray Width is displayed. When the **calculator** icon next to the Spray Width is selected, the **Section Widths** window is displayed. This is the same window as selected in the **Options>Sections** page (page 8-27)
- **Low Speed Shutoffs**—displays the Low Speed Shutoffs for each section valve
- **Valve Info**—this button will display the valve information for each section valve, on the Boom Section icons (Figure 10-3 on page 10-8). This displays which Boom Section is connected to each section valve and displays the Low Speed Shutoff for each valve

The Valve Information will be displayed until the **VALVE INFO** button is selected again.

- **Low Speed Shutoff**—Selecting the Low Speed Shutoff **calculator** icon will display the **Low Speed Shutoff** window. This is the same window as selected in the **Options>Setup** page (page 8-49)
- **Low Pressure Hold**—The current Low Pressure Hold value is displayed. When the **calculator** icon next to Low Pressure Hold is selected the screen keyboard is displayed. A Low Pressure Hold value can be entered. The Low Pressure Hold can also be selected on the **Options>Setup** page (page 8-50).

Area/Volume

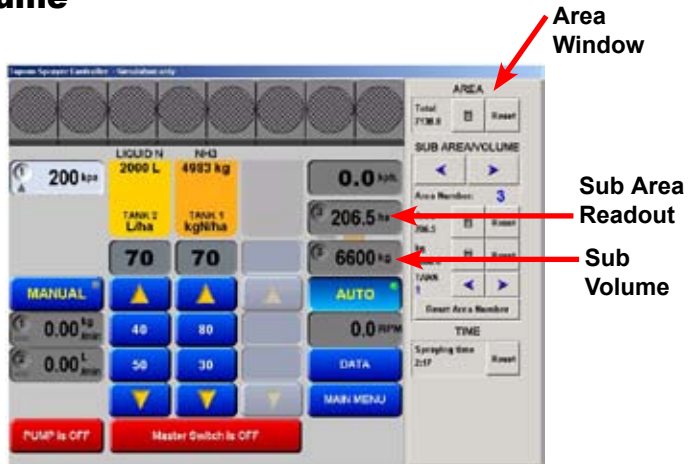


Figure 10-4. Working Screen Showing Area Window

The Sub Area Readout displays the Sub Area for the Sub Area Number shown. The Sub Area Number is displayed in the top left corner of the Sub Area Readout.

The Sub Volume Readout displays the Sub Volume for the Sub Area Number shown. The Sub Area Number is displayed in the top left corner of the Sub Volume Readout.

Select the **Sub Area Readout** or the **Sub Volume Readout** to display the *Area* window (Figure 10-4).

- Total Area—displays the cumulative total of area sprayed

Select the **calculator** icon to enter a preset total area.

Select the **Reset** button to reset the Total Area. A window will appear to confirm the reset, select **YES** to reset or **NO** to cancel. Resetting the Total Area does not reset the 10 Sub Area Numbers.

- Sub Area Number—displays the selected Sub Area Number. The Sub Area Number is displayed in the *Area* window and in the Sub Area and Sub Volume Readouts

The Sub Area Number is selected by using the Sub Area Number Selector arrows (◀▶) (Figure 10-4 on page 10-10). By using the arrows you can select from 10 Sub Areas (0-9). As the Sub Area Number changes the Sub Area and Sub Volume values will change to display the areas and volumes accumulated for the selected Sub Area Number.

Select the **calculator** icon aligned next to Area or Volume to enter a preset value.

Selecting the **Reset** button next to the Area or Volume allows the area and volume (weight) to be reset individually for the Sub Area Number selected.

Please note: The Sub Volume units reflect which Tank Mode was selected for each tank Liquid, NH3, Granular or Injection (page 8-14) and also the units that are selected (page 8-55).

If only one tank is selected then the Sub Area/Volume readouts are for Tank 1. If more than one tank is selected, then the operator can elect to display the Sub Area/Volume readouts for each tank. When more than one tank is selected arrows (◀▶) appear next to the Tank Number, the arrows are used to select a tank number. The Sub Area/Volume readouts will display the area covered and volume used for each tank, on both the *Working* screen and *Area* window readouts. As the arrows are used to select the Tank number you will notice the Tank Indicator on the *Working* screen will change to show which Tank the Sub Area/Volume readouts are displaying.

The Tank Indicators can also be changed from the *Working* screen. By repeatedly selecting either the Sub Area or Sub Volume readouts, the orange Tank Indicator will indicate which Tank the readouts are displaying for. The orange Tank Indicators are aligned in the same position as the Tank (1,2 or 3) icons.

- **Reset Area Number**—The **Reset Area Number** button resets the both the Sub Area and Sub Volume for the Sub Area Number displayed
- **Time**—The *Time* window displays the accumulated spraying time while the Master is ON. By selecting the **Reset** button the spraying time can be reset, a window is displayed warning the operator, select **YES** to reset or **NO** to cancel.

Tank Setup



Figure 10-5. Working Screen Showing Tank Setup Window

Selecting the **Tank** icon (1,2 or 3) (Figure 10-4) displays the **Tank Setup** window (Figure 10-4) on the right side of the screen.



NOTICE

If more than one tank is selected then each tank has to be setup independently.

To setup Tank 1, for example, select the **Tank 1** icon from the **Working** screen, the operator will know which Tank is being changed because the **FILL** and **CAL** buttons in the **Tank Setup** window (Figure 10-4) will reflect which Tank (1,2 or 3) was selected.

Next to each option the current value is displayed. To change the value, select the **calculator** icon next to the value to be changed and enter in the new value using the screen keyboard. Select the **ENTER** button to save the new value and close the window.

- **Tank Capacity**—allows the operator to set the Tank Capacity, so when the **FILL** button is selected the Tank is filled to that capacity

The units being used are displayed on the Tank icon.

- **Preset Rate 1 & 2**—Preset Rate 1 is the main application rate that is used when spraying, Preset Rate 2 is the second application rate. These rates are shown on the *Working* screen in between the Increase and Decrease buttons when in Auto mode, the buttons are aligned with the Tank icon being changed

The units being used are displayed on the Tank icon, above the Tank number.

- **Increment**—allows the increase or decrease of the application rate (set by the Rate Increment) while spraying.

Use the Increase or Decrease buttons from the *Working* screen, for the selected Tank.

- **Preset Name**—allows the selection of different products, if the products have different Flow Calibration Factors.

A drop down list is displayed, when the product is selected a Cal. Factor is displayed next to the selected product. Select **ENTER** to use the selected product

The current Cal. Factor for the selected product is displayed under the product name.

New Products cannot be entered here. See Chapter 9 to enter new products to the list.

- **Total Capacity**—displays the cumulative total of product applied since the last reset

- Tank is ON (or OFF)—this button allows individual tanks to be switched ON or OFF when more than one tank is selected.

If only one tank is selected then the button is not displayed.

The button displays whether the tank is ON or OFF, select the button to change. The Tank icons on the *Working* screen are greyed out when the tank is switched OFF and when the tank is switched ON the Tank icon is orange.

Filling the Tank



NOTICE

Each tank will have to be refilled separately if using more than one tank.

1. Select the tank icon (Figure 10-5 on page 10-13) for the tank (1,2 or 3) which needs to be refilled

The *Tank Setup* window is displayed (Figure 10-5 on page 10-13).

2. Select **FILL** (Figure 10-5 on page 10-13)



NOTICE

The Master must be OFF to select the FILL button.

A window will be displayed showing 4 options:

- Fill—completely refills the tank to its total capacity, as set in the *Tank Setup* window

- **Set Volume**—allows the operator to set a known tank volume which is not the tank capacity
- **Add Volume**—allows the operator to add a known volume to an already existing volume in the tank
- **Cancel**—returns to the main screen without altering any of the above.

Flow Meter Setup

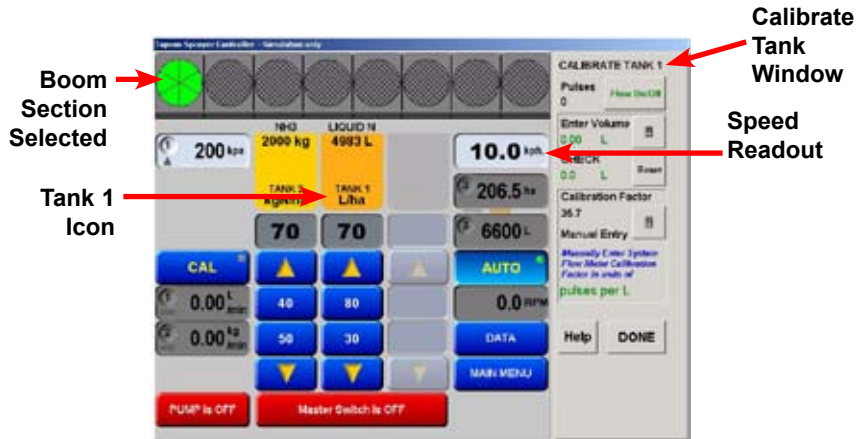


Figure 10-6. Working Screen Showing Calibrate Tank Window

Calibrate the Flow Meter using one of the following methods:

- Flow Calibration for normal valves (see below)
- Flow Calibration for balanced (Hardi) type valves (see page 10-19)
- Manual entry of Calibration Factor (see page 8-38).

Calibrating the Flow Meter

1. Disconnect a line from one valve going to a Boom Section
2. Connect a line from the valve to the measuring container (20 liter drum)
3. Select the Speed Readout
4. Set a test close to normal spraying speed

5. Select the Boom Section that has been disconnected from the valve and is now supplying the measuring container

The section should turn green on the screen (Figure 10-6 on page 10-17)

6. Select the Tank icon on the screen you are calibrating
7. Select **CAL X** (X is the tank number)

A *Calibrate Tank* window appears on the right of the screen

8. Start the pump and select **Flow On/Off**

The Valve and the Master will turn on, and liquid will flow into the measuring container.

The pulse readout next to the flow button should increment

9. Press **Flow On/Off** when there is approximately 20 liters in the measuring container
10. Measure this volume as accurately as possible and enter this volume into the appropriate section of the window

The system will calculate the correct Flow Calibration Factor and register this into the system.

11. Press **Reset**
12. Repeat the procedure if required
13. Select **DONE** when finished.

Flow Calibration for Balanced (Hardi) Valves

Because the Balanced valve system is used on Hardi Sprayers, the normal calibration procedure cannot be used. The following procedure is required for Balanced valve systems but it can also be used on "normal" valve systems.

1. Select **Manual** on the Sprayer Switchbox
2. Turn the pump and all Boom Sections on
3. Turn the Master ON

The Sprayer should start spraying

4. Adjust the pressure to the normal spraying pressure around the middle of the nozzle range
5. Ensure **Display Volume/Nozzle** is selected on the **Flow** window (page 10-7)

The Flow Readout units will be volume (L or Gal)/noz.

The value displayed in the Flow readout window will be volume/nozzle/minute.

For this test to be accurate all nozzles on the boom spray must be the same type and the nozzles must be in good condition (not worn). The Flow Meter should also be in good condition for this test to be accurate.

6. Place a jug under a nozzle and time for 1 minute
7. Measure the volume of liquid coming out of the nozzle, this is the "Actual" amount
8. Write the "Actual" value down

9. Compare this volume with the value shown in the Flow readout, volume/nozzle/minute directly under the **Manual** button, this is the "Calculated" amount
10. Write the "Calculated" value down
11. Select the **Tank** icon

The **Tank Setup** window will be displayed (Figure 10-5 on page 10-13)

12. Write down the current Cal. Factor for the Flow Meter as displayed
13. Using the formula below, calculate the new Cal. Factor:

$$\text{Current Cal. Factor} \times \frac{\text{"Calculated" Amount}}{\text{"Actual" Amount}} = \text{New Cal. Factor}$$

14. Enter the New Cal. Factor using the Manual Entry method (page 8-38).

Please note: Jug tests are not as accurate as the total volume measurement as some errors will exist due to misting, over spray, nozzle tolerances and variations in flow rates through boom hoses.

Enable Lockout



NOTICE

Enabling the Lockout feature means access to the Sprayer Options menu will be prohibited by unauthorized users, therefore settings can only be changed when a password is entered.

1. On the **Working** screen press the **Main Menu** button

A **Sprayer** window will appear on the right side of the screen

2. Select the **Topcon** logo

An **About Topcon Spray Rate Controller** window will appear

3. Select **Enable Lockout**

A screen keyboard will appear, allowing an alpha-numeric password to be entered

4. Enter in a password that you will remember

5. Write your password down _____, in case you forget it
password

6. Select **ENTER**

Another screen keyboard window will be displayed

7. Re-enter the same password

8. Select **ENTER**

A window will be displayed saying 'Lockout Enabled'

9. Select **OK**

10. Select **Close**

The Lockout feature has now been enabled and no one will be able to access the *Options* screens without entering the correct password. When the **OPTIONS** button is selected a window will be displayed saying 'Lockout Enabled'.

Disable Lockout

1. On the *Working* screen press the **Main Menu** button

A *Sprayer* window will appear on the right side of the screen

2. Select the **Topcon** logo

An *About Topcon Spray Rate Controller* window will appear

3. Select **Disable Lockout**

A screen keyboard will appear, allowing an alpha-numeric password to be entered

4. Enter in the password you used to Enable Lockout (step 4, page 10-21)

If the password was incorrect then a window will be displayed saying 'Password Incorrect- Try Again'

Select **OK**, then select **Disable Lockout** and re-enter the correct password

5. Select **ENTER**

A window will be displayed saying 'Lockout Disabled'

6. Select **OK**

7. Select **Close**

The Lockout has now been disabled and anyone using the software can access the *Options* screens.

Sprayer Switchbox

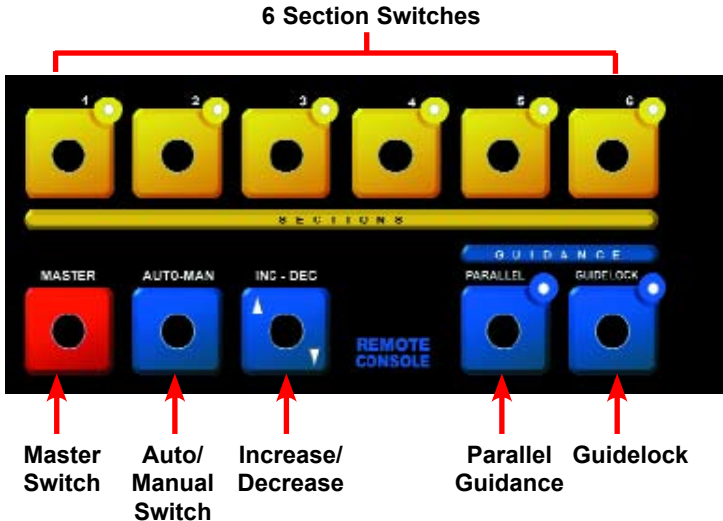


Figure 10-6. Sprayer Switchbox

The Switchbox functions are only available if enabled in the *Options>Switches* page (page 8-31), if connecting the TPA External Switchbox to the Spray ECU.

The Switchbox connects to the 9 pin plug marked SWITCHBOX.

When the External Switchbox switches are enabled, the equivalent *Working* screen buttons on the *Sprayer Working* screen become disabled.

- Section Switches—The section switches turn the Boom Sections ON or OFF. Up is OFF, down is ON

The red LEDs next to each section switch turn ON when spraying and flash when the Boom Section is switched ON but the Master switch is OFF.

The red LEDs next to each section also turn ON when the sprayer's ground speed drops below the Low Speed Shut Off value while the Boom Section is switched ON and the Master switch is ON

- Master Switch—turns all selected Boom Sections ON or OFF. Up is OFF, down is ON. This applies as long as the option on Page 8-30 'External Switch Up is ON' is not ticked
- Auto/Manual Switch—turns the system from automatic mode to manual. Up is Manual, down is Auto
- Increase/Decrease—Each toggle changes the rate either up or down by the preset Increment Rate whilst in the Auto mode. Up is increase, down is decrease

When in the manual mode it increases and decreases the system pressure. Up is increase, down is decrease

- Parallel Guidance—When using Guidance in conjunction with your Topcon Spray Rate Controller you can use this button in lieu of the **PARALLEL** button. You still must select point A and point B, on the screen
- Guide Lock—When using Guidance in conjunction with your Topcon Spray Rate Controller you can use this button in lieu of the **GUIDE LOCK** button on the guidance screen

Start Spraying

Simulate Spraying

The Spray Rate Controller allows the operator to check the plumbing of the system and operation of spraying without the need to go into the field. The operator can check the pressure reliefs, nozzle setup, wiring etc is correct.

1. Fill the tank with water
2. Start the console
3. On the **Product Selection** screen select only the Spray Rate Controller (for testing procedure only)
4. Start the Pump and bring to operating pressure
5. Select the **Speed Readout**, to display the **Speed** window and set a test speed of normal spraying speed

The test speed will be displayed in the Speed Readout.

The test speed should be above the set Low Speed Shutoff and Low Pressure Hold speeds (this should be disabled during testing).

The following tests refer to the Screen buttons only. If the Switch Box is enabled, you will need to use the switches instead of the screen buttons where necessary.

6. Switch on all of the boom sections
7. Select **MANUAL**

Please note: When the Sprayer is first started it always starts in Manual mode.

8. Select the Master Switch

The Boom Sections will switch ON and start spraying.

If a Glass Pressure Gauge is installed, then when the **increase** arrows (▲) are pressed the pressure should start increasing.

Please note: If the pressure decreases when the **increase** arrow (▲) is pressed then you have to select **Reverse Valve Direction** (page 8-20) then check again and make sure the pressure increases when the **increase** arrow (▲) is pressed.

9. Keep pressing the **increase** arrow (▲) until the pressure stops increasing

When the pressure reaches the maximum point, the regulator valve will be at the end of it's travel and stop moving. At this point, the bypass back to the tank will be at it's minimum, and the maximum available liquid will be going through the spray lines.

At this point the regulator is allowing full flow to the boom.

The current application rate will be displayed with a white background, letting the operator know the Sprayer is spraying in Manual mode.

10. Check the Boom sections are functioning correctly by turning each section off then back on one at a time and checking that the correct section on the sprayer turns off.
11. Press the **AUTO** button

The Sprayer will go into Auto mode with the Sprayer controlling

the Regulator Valve.

12. Select a rate by selecting one of the **Preset Rate** (1 or 2) buttons

If the boom spray is controlling to that rate, the application rate will turn to an orange background, indicating the Spray Controller is controlling to the required rate.

13. Using the **increase** arrow (▲) the application rate will increase by the Rate Increment as set in the **Tank Setup** window.

As the **increase** arrow (▲) is pressed the application rate will keep increasing until full flow is being supplied to the booms.

At this point the application rate displayed will flash between the target rate and the actual rate, this is the limit of the Sprayer for that speed, nozzle selection etc.

The operator can change the test speed, application rates etc, to see what range the Sprayer will achieve in the field, before chemical is put in the tank.

Start Spraying

1. Switch the console ON
2. Make sure **Spray Rate Controller** is selected on the **Product Selection** screen
3. Start pump and bring to operating pressure
4. Check the Preset Rates and Rate Increment are set correctly for the spray job (if spraying in Auto mode)
5. Select a Sub Area Number and reset if necessary
6. Fill or Set a Volume for the tank

If using more than one tank, make sure **Tank is ON** is switched ON for each tank. The Tank icon will be an orange color if the tanks are ON and a volume is entered into the console.

Spraying in Manual Mode

7. Select the **MANUAL** button

The button will be highlighted and the green indicator, on the **MANUAL** button will be displayed.

8. Press the **increase** and **decrease** arrows (**▲▼**) to set the pressure
9. Switch the Master Switch ON and drive to the set speed and pressure for the nozzle selection, using the increase and decrease arrows (**▲▼**) to set the pressure.

Spraying in Auto Mode

7. Select the **AUTO** button

The **MANUAL** button will still be highlighted but the indicator light on the **MANUAL** button will be red; indicating the Sprayer has the Auto mode selected but is not spraying in Auto mode yet.

8. Select the Master Switch

If a Low Speed Shutoff is selected then the Boom Sections will be red and are not spraying.

Once the Sprayer takes off, the Speed Readout will display the current speed. When the speed goes above the Low Speed Shutoff value the Boom Sections turn green and start spraying in manual mode. The indicator on the

MANUAL button is still red and the application rate will be displayed but showing a white background; these both indicate the Sprayer is spraying in manual mode. This will happen if a Low Speed Shutoff value has not been reached.

Once the speed increases and the speed goes above the Low Speed Shutoff value then the **AUTO** button will become highlighted and the green indicator will be shown on the **AUTO** button, the application rate will have an orange background when the rate has been achieved.

The Sprayer is now spraying in Auto mode.

While Spraying

While spraying:

- Speed will be displayed
- Area and Volume will start accumulating
- Pressure will be displayed (if selected)
- Either Volume/Minute or Volume/ Nozzle will be displayed
- The Volume remaining on the Tank icon will start counting down
- The current application rate will be displayed
- Any alarms that arise will be displayed
- Once the tank icon turns to red, the Low Volume point has been reached, alerting the operator the tank has reached the low point' alarm
- When the Master Switch is OFF it turns red, when the Master Switch is ON it turns green.

Guidance and Spray Rate Control

To use Spray Rate Controller with Guidance:

1. Turn the console on



Figure 11-1. Product Selection Screen

2. On the *Product Selection* screen (Figure 11-1) select **Guidance and Spray Rate Controller**

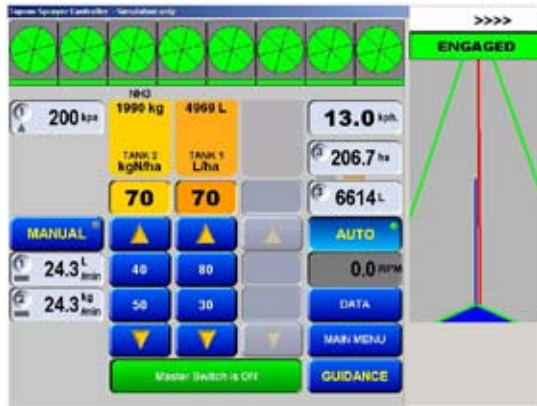


Figure 11-2. Sprayer Working Screen Showing Virtual Road

When using the Spray Rate Controller, press the **Main Menu** button (Figure 11-2) to view the Virtual Road on the right side of the screen. After the Menu button is pressed it takes 5 seconds for the Virtual Road to appear

The Virtual Road will only be displayed when the vehicle is moving.

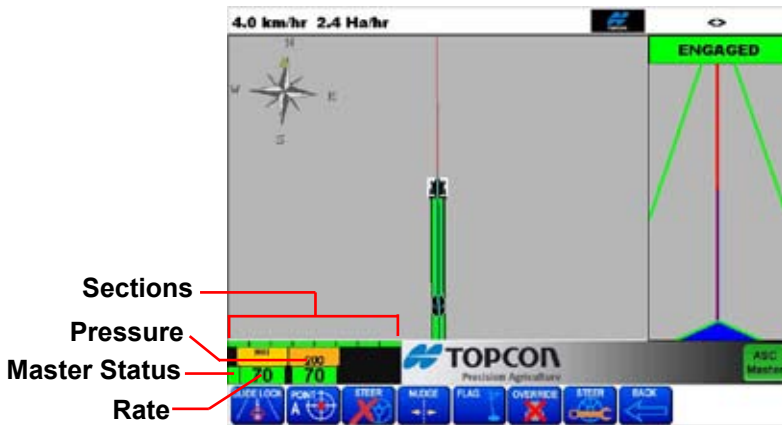


Figure 11-3. Guidance Showing Sprayer Icon

To view the entire **Guidance Working** screen (Figure 11-3 on page 11-7) press the **Guidance** button (Figure 11-2 on page 11-7).

You will then be able to see the **Guidance** screen with the **Spray Rate Controller** screen minimized in the Topcon logo Bar.

The miniaturized **Spray Control** screen shows you the number of Boom Sections in operation, the rate currently applied and the current system pressure.

You can revert to the **Sprayer Working** screen (Figure 11-2 on page 11-7) by pressing the minimized version of the **Sprayer Working** screen.

When the screens are minimized all alarms will still be heard by audio alarms and will show on the screen, if activated.

Automatic Section Control (ASC)

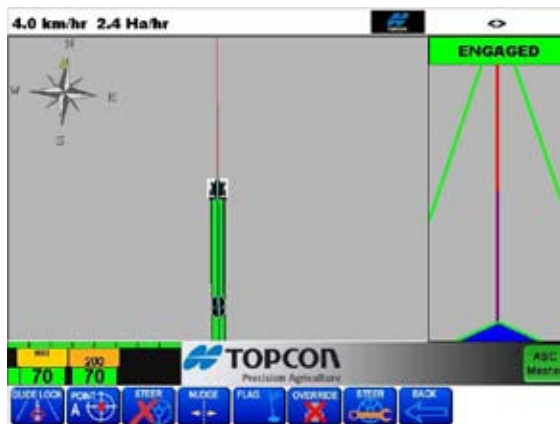


Figure 11-4. Guidance Showing ASC Master Button

With Automatic Section Control (ASC) activated, the Sprayer will automatically switch the Boom Sections ON/OFF, as required by the Coverage map.

For ASC to work the **Auto Section Enabled** option has to be enabled (page 8-1) in the Sprayer software. When **Auto Section Enabled** has been selected then the **ASC Master** button will appear on the Topcon Logo Bar, on the **Guidance Working** screen. The **ASC Master** button will not function unless ASC has also been enabled in the Guidance software General Setup (see Guidance Manual).

When the **ASC Master** button is green then the ASC control will control sections ON or OFF as required. When the **ASC Master** button is red then the ASC control will be disabled and the switching OFF and ON of sections will be performed by the operator. Therefore the ASC can be left enabled in the Guidance, and enabled or disabled from the **Guidance Working** screen by selecting the **ASC Master** button.

Please note: The sections switch OFF when the Boom Section is fully over an already mapped (applied) area. The sections also switch ON so that there is no untreated areas left.

T esting

Regulator

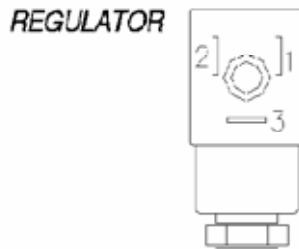


Figure 12-1. Regulator Connector

The Regulator Drive outputs (Reg INC and Reg DEC on schematics) drive a 2-Wire Motor Valve (generally referred to as Servo, Flow Control Valve or Electric Pressure Regulating Valve).

To increase Flow the controller applies 12 Volts to Pin-1 and Gnd to Pin-2 of the connector (Figure 12-1). To decrease flow the controller applies Gnd to Pin-1 and 12 Volts to Pin-2. The polarity is constantly changing while the controller adjusts the valve to maintain the desired flow rate.

Regulator Drive Test Procedure

1. Set a Digital Multimeter to measure 20vdc
2. Measure the voltage between Pin-1 and Pin-2 in the following states:
 - State 1—Controller set to manual, sections and master ON, pressing and holding the **increase** arrow (▲). The meter should display 12 or -12 Volts.

Please note: It is not important which polarity is displayed.

- State 2—Controller set to manual, sections and master ON, pressing and holding the **decrease** arrow (▼). The meter should display opposite to State 1.

Confirming this verifies the regulator outputs on the controller are working correctly.

Please note: If the Spray-line pressure increases when the decrease arrow (▼) is pressed select Reverse Valve Direction (page 8-20).

Switched Power

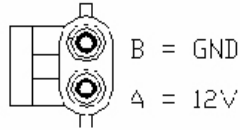


Figure 12-2. Switched Power Connector

This input is connected to the power cable via the relevant extensions and Y cable. When the console is powered on a low current, filtered 12 Volt supply is applied to Pin-A to power up the ECU's processors.

Switched Power Test

1. Power the console ON
2. Confirm 12 Volts between Pin-A and Pin-B



WARNING

It is important to ensure that the polarity is not reversed as damage will result to the ECU.

3. Make certain that the negative (black) probe is in Pin-B and the positive (red) Probe in Pin-A, and that the Multimeter display does NOT show -12V (correct reading is 12 Volts)



WARNING

Do not use this output for any other application, other than what is described in all TPA literature.

Dump

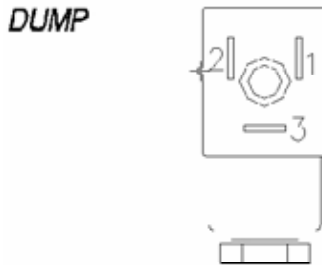


Figure 12-3. Dump Valve Connector

The Dump Valve Drive Outputs (Dump open and Dump close on schematics) drive a 2-Wire Motor Valve (generally referred to as Dump, Main Valve or Master Valve).

To open the Dump Valve the controller applies 12 Volts to Pin-1 and Gnd to Pin-2 of the connector (Figure 12-3). To close the dump valve the controller applies Gnd to Pin-1 and 12 Volts to Pin-2. The Dump is open (bypass to tank) when all sections or the master switch is OFF and closed (pressure to Spray-line) when the master and any sections are ON.

Dump Drive Test

1. Set a Digital Multimeter to measure 20vdc
2. Measure the voltage between Pin-1 and Pin-2 in the following states:
 - State 1—Controller set to manual, sections and master ON, pressing and holding the **increase** arrow (▲). The meter should display 12 or -12 Volts.

Please note: It is not important which polarity is displayed.

- State 2—Controller set to manual, sections and master ON, pressing and holding the **decrease** arrow (▼). The meter should display opposite to State 1.

Confirming this verifies the regulator outputs on the controller are working correctly.

Please note: If the Dump valve opens when it should close swap the wires connected to Pin-1 and Pin-2 in the connector (Figure 12-3 on page 12-4).

Topcon Sensors

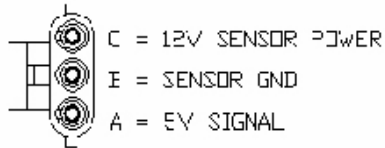


Figure 12-4. Sensor Connector

All shaft sensor inputs (other references Flow Sensor, Speed Sensor, Encoder and Feedback) are pinned alike.

Each time the Sensor is exposed to magnetic field (Hall effect) or metallic objects (Proximity) the circuit is closed between Pin-A and Pin-B. The controller sees this as 0 Volts, then 5 Volts when the sensor is clear of the magnet or metallic object.

Sensor Input Test

1. Power ECU on
2. On the Harness with the sensor disconnected check:
 - 11-12 Volts between Pin-B and Pin-C

- 5 Volts between Pin-A and Pin-B
3. Sensor connected but not exposed to the magnet:
 - 11-12 Volts between Pin-B and Pin-C
 - 5 Volts between Pin-A and Pin-B
 4. Sensor connected with exposure to the magnet:
 - 11-12 Volts between Pin-B and Pin-C
 - 0 Volts between Pin-A and Pin-B



WARNING

Sensor power is 1 Amp current limited and should never be limited for any other purpose.

3-Wire Section Valves



Figure 12-5. 3-Wire Connector

The Boom Section Drive outputs from the controller simply apply a 12 Volt signal to Pin-3 of the section valve to open. 0 Volts closes the valve.

The 3-Wire Section Valves require constant 12 Volt (Pin-1) and constant Gnd (Pin-2) as well as the 12V signal to Pin-3.

Section Valve Drive Test

1. Set the controller to Manual mode
2. Using a digital Multimeter, set to 20vdc connect probes to Pin-1 and Pin 2 on section one Valve tail
3. Confirm 12 Volts
4. Repeat this for all section valve tails.

Switch Master Switch ON

1. Using a digital Multimeter, set to 20vdc connect probes to Pin-2 and Pin-3 on section one Valve tail
2. Turn on Section 1
3. Confirm 12 Volts on Pin 3

4. Turn Section 1 OFF and confirm 0 Volts
5. Repeat this process for all section valves.

PWM Regulator Valve

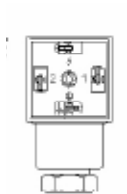


Figure 12-6. PWM Regulator Valve Connector

The proportional drive output allows control of PWM Hydraulic Solenoid valves.

Pin-1 provides a constant 12 Volt supply to the coil while Pin-3 delivers a Switched Gnd PWM signal.

Prop Output Test

1. Connect an automotive test light between Pin-1 and Pin-3
2. Switch a tank ON
3. Switch the Master Switch ON
4. With the controller set to Manual press and hold the **increase** arrow (▲)

The light should glow progressively brighter in 1 second time increments, to full brightness

5. Stop pressing the **increase** arrow (▲)

The light should maintain the current brightness

6. Press the **decrease** arrow (▼).

The Light should become progressively dimmer.

Sprayer Components **Spare Parts List**

<u>Part Number</u>	<u>Description</u>
A2643	Spray ECU 30S Console
A2644	Spray ECU 10SR Console

In Cab

<u>Part Number</u>	<u>Description</u>
A2634	Power/COMMS Harness
A1268	Sprayer Switchbox
A1953	2 Wire Power Splitter Harness
A449	Radar Interface
A601	Remote Master Switch (Spray Rate Interface Only)

Ground Speed/Shaft Sensor

<u>Part Number</u>	<u>Description</u>
A1200	Sensor
A006	"L" Angle Speed Sensor Bracket
A007	Slotted Speed Sensor Bracket
A369	10 Magnet Wheel Kit
A402	Block Magnet and Clamp

Flow Sensors

<u>Part Number</u>	<u>Description</u>
A093	TPA Flow Sensor (10-100l/min)
4623822	Polmac Flow Sensor (10-100l/min) 1" BSP Flange
P41316399	Polmac Rapid Check Insert
P413003AL	Polmac Electronic Sensor

Pressure

<u>Part Number</u>	<u>Description</u>
A092	5 Bar Electronic Pressure Sensor with Gauge Saver
	Pressure Adaptor for Eagle & Spray ECU
	Pressure Adaptor for MK5 and Spray Rate Interface

Dump Valve Adaptors (to suit Sprayer Harness)

<u>Part Number</u>	<u>Description</u>
	2 Wire Motorized Dump Adaptor
A2266	3 Wire Dump Adaptor (12 V ON when Master OFF)
A2269	3 Wire Dump Adaptor (12 V ON when Master OFF)
	Solenoid Dump Valve Adaptor

Spares

<u>Part Number</u>	<u>Description</u>
A1478	16 Pin Locking Ring Kit (pack of 3)
Y846	Fuse 10 Amp 3AG (console fuse)
A2677	Sprayer Manual
A768	3 Pin Weather Pack 5m Extension
A802	Arag Regulator Valve Adaptor

Specifications

Console

Supply Voltage	12.5-16 Volts Negative Earth System
Supply Current Console	0.9 amps approximately
Maximum Solenoid Supply Current	2 amps each
Maximum Electric Regulator Valve Motor Current	Approximately 250 milli-amps



WARNING

The Spray ECU's power leads must be connected directly to the tractor's battery terminals. No attempt should be made to connect the system to a positive earth vehicle. Damage will result and warranty will become void.

Ground Speed, Fan Speed and Auxiliary Shaft Sensors

Ground Speed Sensor	Hall Effect type sensors
Fan Speed Sensor and Auxiliary Shaft Sensors	3-Pin Weather Pack Plug (Pin A, B and C)
Sensor to Magnet Distance	2-3 millimeters (mm)
Supply Voltage	Supply 12 Volts from Spray ECU
Signal Voltage	4-5 Volts sensor inactive <1 Volt sensor activated by magnet

Flow Sensors

With switch OFF	Open Circuit
Switch ON Resistance	1800 Ohms
2 Wire only	
Maximum Contact Current	50 milli-amps
Accuracy	2% in range 10% to 200% of nominal flow
Bore	15mm
Nominal Flow Rate	80l/min
Calibration	45.7 pulse/l

Polmac (Broadacre)

3 Wire Flow Sensor	
Flow Rate	20-200 l/min
Calibration	Approximately 630 pulse/l
Accuracy	+/- 1% when flow is 10-100 l/min +/- 3% when flow is 100-200 l/min
Bone	25 mm

Orion (Broadacre)

3 Wire Flow Sensor	
Flow Rate	10-200 l/min
Calibration	Approximately 300 pulse/l
Accuracy	+/- 0.5% when flow is 10-200 l/min
Bone	25 mm
Maximum Contact Current	300 milli-amps

Pressure Transducer

VDO type 360 710 V variable resistance sender fitted with gauge saver	
0kpa Pressure	8-11 Ohms
500 kpa Pressure	Approximately 180 Ohms

Spray ECU 30S

Console



Figure 15-1. Spray ECU 30S

- Part number—A2643
- Firmware version—BMS 209
- Power/Comms Harnesses—A2634
- Tractor Harness—A2434 (Economy Tractor Harness)
 Sprayer Harness—(To suit A2434): A862 (Sprayer Harness 6.5m)
 A1437 (Sprayer Harness 13m)
 A1438 (Sprayer Harness 15m)
- Tractor Harness—A2753 (Section Dual Line/14 Section Single
 Line Tractor Harness)
 Sprayer Harness—(To suit A2753): A2102

- Tractor Harness—A2432 (7 Section 2 Wire)
Sprayer Harness—(To suit A2432): A2102

- Tractor Harness—A2435 (30 Section Tractor Harness 3.5m)
Sprayer Harness—A2436 (30 Section Sprayer Harness)

Setup

1. Select **Spray ECU** on the *Options>ECU* page, in the *Controller* window (page 8-7)

2. Select **ECU 30S** on the *Options>ECU* page, in the *ECU Model* window (page 8-11)

Wiring Connection

REV	DATE	DCR	CHANGE	APPRVD
1.0	1/3/06	-	R3PCB Rev 1 - Added switched power input to Connector 4. Removed instructions to disconnect Raven harness battery connections. Uses new power harness part number A2634 - SPRAY ECU 30S & 10SR POWER COMMS Harness (RELAY NOT FITED)	

Connector 1

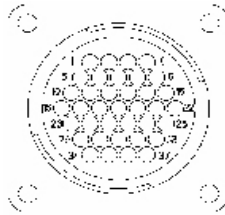


Figure 15-2. 37 Male Pins

Connector 1 - 37 Pin Sprayer Drive			I/O
Pin	Label	Primary Function	
1	GND	Ground	Ground
2	GND	Ground	Ground
3	Section 1B	Section Drive	Output
4	Section 1A	Section Drive	Output
5	Section 2A	Section Drive	Output
6	Section 3A	Section Drive	Output
7	Section 4A	Section Drive	Output
8	Section 5A	Section Drive	Output
9	Section 6A	Section Drive	Output
10	Section 7A	Section Drive	Output
11	Section 8A	Section Drive	Output
12	Section 9A	Section Drive	Output
13	Section 10A	Section Drive	Output
14	Section 2B	Section Drive	Output
15	Reg Drive 1B	Reg Drive - Decrease	Output
16	Reg Drive 1A	Reg Drive - Increase	Output
17	Section 3B	Section Drive	Output
18	Section 4B	Section Drive	Output
19	Section 5B	Section Drive	Output

Table 15-1. Connector 1 - 37 Pin Sprayer Drive

Connector 1 - 37 Pin Sprayer Drive			I/O
Pin	Label	Primary Function	
20	Section 6B	Section Drive	Output
21	Sensor GND	Ground for Sensors	Ground
22	Sensor Power (5V)	Power for Sensors - 5V	Sensor Power
23	Section 16A	Section Drive (Dump)	Output
24	Master Switch	12 V Master Switch Sense	Input
25	Sensor Power (5V)	Power for Sensors - 5V	Sensor Power
26	Sensor Power (5V)	Power for Sensors - 5 V	Sensor Power
27	Speed	Encoder Input, Ground Speed	Input
28	Flow Sensor 1	Encoder Input, Flow Channel 1	Input
29	Sensor GND	Ground for Sensors	Ground
30	Section 7B	Section Drive	Output
31	Pressure 1	Pressure Sensor 1 Input	Input
32	Section 8B	Section Drive	Output
33	Section 9B	Section Drive	Output
34	Section 16B	Section Drive (Dump)	Output
35	Section 10B	Section Drive	Output
36	Battery	Power Out for Valves	Output
37	Sensor Power (12V)	Power for Sensors - 12V	Sensor Power

Table 15-1. Connector 1 - 37 Pin Sprayer Drive (continued)

Connector 2

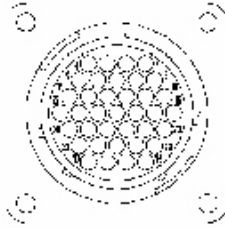


Figure 15-3. 37 Female Pins (Reverse Gender Plugs)

Connector 2 - 37 Pin Sensors - Sprayer Drive/Sense 1			I/O
Pin	Label	Primary Function	
1	GND	Ground	Ground
2	Reg Drive 2B	Reg Drive - Decrease	Output
3	Reg Drive 2A	Reg Drive - Increase	Output
4	Section 1 Sense	Section 1 12V Sense	Input
5	Section 2 Sense	Section 2 12V Sense	Input
6	Section 3 Sense	Section 3 12V Sense	Input
7	Section 4 Sense	Section 4 12V Sense	Input
8	Section 5 Sense	Section 5 12V Sense	Input
9	Section 6 Sense	Section 6 12V Sense	Input
10	Section 7 Sense	Section 7 12V Sense	Input
11	Section 8 Sense	Section 8 12V Sense	Input
12	Section 9 Sense	Section 9 12V Sense	Input
13	Section 10 Sense	Section 10 12V Sense	Input
14	Section 11 Sense	Section 11 12V Sense	Input
15	Section 12 Sense	Section 12 12V Sense	Input
16	Flow Sensor 2	Encoder Input Flow Channel 2	Input
17	Pressure 2	Pressure Sensor 1 Input	Input
18	Section 11A	Section Drive	Output
19	Section 11B	Section Drive	Output

Table 15-2. Connector 2 - 37 Pin Sensors - Sprayer Drive/Sense 1

Connector 2 - 37 Pin Sensors - Sprayer Drive/Sense 1			I/O
Pin	Label	Primary Function	
20	Section 12A	Section Drive	Output
21	Section 12B	Section Drive	Output
22	Section 13A	Section Drive	Output
23	Section 13B	Section Drive	Output
24	Section 14A	Section Drive	Output
25	Section 14B	Section Drive	Output
26	Section 15A	Section Drive	Output
27	Section 15B	Section Drive	Output
28	UP/DOWN TOG1	Parallel (12V) Guidelock (GND)	Input
29	UP/DOWN TOG2	AutoSteer - Enable (12V), Disable (GND)	Input
30	UP/DOWN TOG3	Tank 2 - INC (12V), DEC (GND)	Input
31	UP/DOWN TOG4	Tank 1 - INC (12V), DEC (GND)	Input
32	Auto/Manual Switch	Manual (Open), Auto (GND)	Input
33	Encoder 1	Encoder Input	Input
34	Battery	Power Out	Output
35	Battery	Power Out	Output
36	GND	Ground	Ground
37	Sensor Power (12V)	Power for Sensors - 12 V	Sensor Power

**Table 15-2. Connector 2 - 37 Pin Sensors - Sprayer Drive/Sense 1
(continued)**

Connector 3

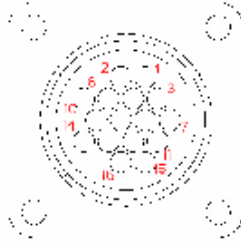


Figure 15-4. 16 Male Pins

Connector 3 - 16 Pin Sprayer Drive/Sense 2			I/O
Pin	Label	Primary Function	
1	GND	Ground	Ground
2	Pressure 3	Pressure Sensor	Input
3	Pressure 4	Pressure Sensor	Input
4	External Switch	External Switch - Pull to GND	Input
5	Tank Level 1	Tank Level Sensor	Input
6	Tank Level 2	Tank Level Sensor	Input
7	Encoder 2	Encoder Sensor	Input
8	Sensor Power (5V)	Sensor Power 5V	Output
9	Pot 1	Pot Input	Input
10	Encoder 3	Encoder Sensor	Input
11	Sensor GND	Sensor GND	Ground
12	Sensor Power (12V)	Sensor Power 12V	Output
13	Encoder 4	Encoder Sensor	Input
14	Pot 2	Pot Input	Input
15	Radar/Spare Sensor	Encoder Sensor	Input
16	Sensor Power (12V)	Sensor Power 12V	Output

Table 15-3. Connector 3 - 16 Pin Sprayer Drive/Sense 2

Connector 4

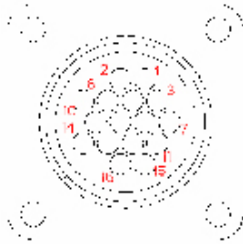


Figure 15-5. 16 Male Pins

Connector 4 - 16 Pin Comms/Power			I/O
Pin	Label	Primary Function	
1	Battery	Battery Power	Input
2	NC		
3	COMMS A	COMMS/Programming	Input/ Output
4	Shield	Ground	Ground
5	COMMS B	COMMS/Programming	Input/ Output
6	NC		
7	Battery	Battery Power	Input
8	Battery	Battery Power	Input
9	RS232 RXD	COMMS/Programming	Input
10	Shield	Ground	Ground
11	RS232 TXD	COMMS/Programming	Output
12	GND	Ground	Ground
13	NC		
14	Switched Power	Switched Power	Input
15	GND	Ground	Ground
16	NC		

Table 15-4. Connector 4 - 16 Pin Comms/Power

Hardi 5500 Spray ECU

Console

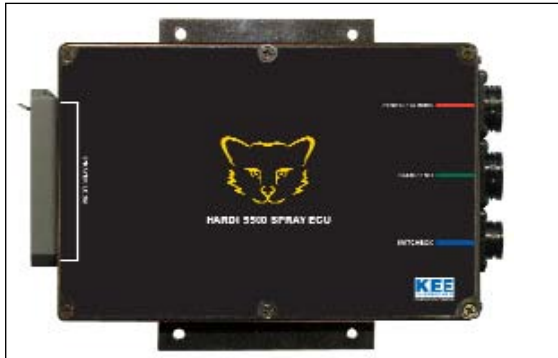


Figure 16-1. Hardi 5500 Spray ECU

- Part number—A2243
- Firmware version—BMS 207
- Power/Comms Harnesses—1: (Revision 1.1) A2634
2: (Revision 1.0) A2278

Please note: Serial No. A2243 050001 to A2243 050010 and A2243 060001 to A2243 060002, the C8 pin was not connected, therefore no pump speed could be displayed on the console.

Serial No. A2243 060003 and later had the C8 pin connected, therefore Enable Pump Speed Indicator can be selected on the **Option>Setup** page, in the **Pump Options** window (page 8-53).

- Sprayer Harnesses—Hardi 5500 Spray Interface

Please note: Hardi 5500 Spray ECU Rev 1.0 (you can find the Rev No. next to the Part No. on the label) had no logo or labels next to the plugs. Rev 1.0 also had tails on the Power/Comms and Foam/End plugs.

Connecting

1. Connect the 39 pin plug Sprayer Harness from the Hardi 5500 controller to the Sprayer Harness on the Hardi 5500 Spray ECU
2. Connect the Power/Comms harness to the Power/Comms connection on the Spray ECU
3. Connect the 9 pin serial plug to the back of the X console
4. Connect the battery leads to the tractor battery
5. Connect the Foam/End to the Hardi's Foam/Fence End harness
6. Connect the external Switchbox to the plug marked 'Switchbox' on the HARDI 5500 Spray ECU

Setup

1. Select **Spray ECU** on the *Options>ECU* page, in the *Controller* window (page 8-7)
2. Select **ECU ECU, ECU 3** on the *Options>ECU* page, in the *ECU Model* window (page 8-11)

Wiring Connection

REV	DATE	DCR	CHANGE	APPRVD
1.0	-	-	Rev 2 PCB and connections on tails	JDT
1.1	1/3/06	-	R3PCB Rev 1 - Added switched power input to Connector 4. Removed instructions to disconnect Raven harness battery connections. Uses new power harness part number A2634 - SPRAY ECU 30S & 10SR POWER COMMS HARNESS (RELAY NOT FITED)	JDT
1.2	23/3/06	353	Enable Pump Speed Input. Add wire to H1104 Harness.	JDT

Connector 1

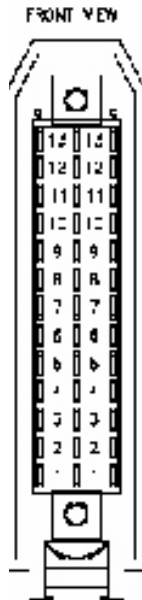


Figure 16-2. 39 Pins

Connector 1 - 39 Pole F/M Hardi Sprayer Drive			I/O
Pin	Label	Primary Function	
a1	RELAY 1A	Section 1 ON (12V)	Output
a2	RELAY 2A	Section 2 ON (12V)	Output
a3	RELAY 3A	Section 3 ON (12V)	Output
a4	RELAY 4A	Section 4 ON (12V)	Output
a5	RELAY 5A	Section 5 ON (12V)	Output
a6	RELAY 6A	Section 6 ON (12V)	Output
a7	RELAY 7A	Section 7 ON (12V)	Output
a8	RELAY 8A	Section 8 ON (12V)	Output
a9	RELAY 9A	Section 9 ON (12V)	Output
a10			
a11	VALVE 1A	Reg Valve	Output
a12	INC Foam	Increment	Output
a13	FML	Foam Marker Left	Output
b1	RELAY 1B	Section 1 ON (12V)	Output
b2	RELAY 1B	Section 2 ON (12V)	Output
b3	RELAY 1B	Section 3 ON (12V)	Output
b4	RELAY 1B	Section 4 ON (12V)	Output
b5	RELAY 1B	Section 5 ON (12V)	Output
b6	RELAY 1B	Section 6 ON (12V)	Output
b7	RELAY 1B	Section 7 ON (12V)	Output
b8	RELAY 1B	Section 8 ON (12V)	Output
b9	RELAY 1B	Section 9 ON (12V)	Output
b10			
b11	VALVE 1B	Reg Valve DEC	Output
b12	DEC Foam	Decrement	Output
b13	FMR	Foam Marker Right	Output
c1	End Nozzle L	End Nozzle Left	Output
c2	End Nozzle R	End Nozzle Right	Output

Table 16-1. Connector 1 - 39 Pole F/M Hardi Sprayer Drive

Connector 1 - 39 Pole F/M Hardi Sprayer Drive			I/O
Pin	Label	Primary Function	
c3	Sensor Power		Input
c4			
c5			
c6			
c7			
c8	Radar/Pump Speed	Radar/Pump Speed	Input
c9			
c10			
c11	Flow Sensor 1	Flow Sensor Signal	Input
c12	Speed Sensor	Speed Sensor Signal	Input
c13	Ground		Ground

**Table 16-1. Connector 1 - 39 Pole F/M Hardi Sprayer Drive
(continued)**

Connector 4

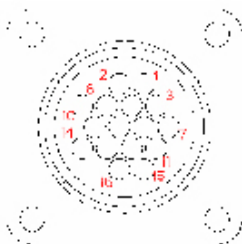


Figure 16-3. 16 Male Pins

Connector 4 - 16 Pin COMMS/Power			I/O
Pin	Label	Primary Function	
1	Battery	Battery Power	Input
2	NC		
3	COMMS A	COMMS/Programming	Input/ Output
4	Shield	Ground	Ground
5	COMMS B	COMMS/Programming	Input/ Output
6	NC		
7	Battery	Battery Power	Input
8	Battery	Battery Power	Input
9	RS232 RXD	COMMS/Programming	Input
10	Shield	Ground	Ground
11	RS232 TXD	COMMS/Programming	Output
12	GND	Ground	Ground
13	NC		
14	Switched Power	Switched Power	Input
15	GND	Ground	Ground
16	NC		

Table 16-2. Connector 4 - 16 Pin COMMS/Power

Connector 5

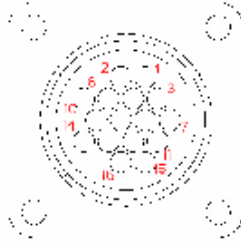


Figure 16-4. 16 Male Pins

Connector 5 - 16 Pin Foam Marker			I/O
Pin	Label	Primary Function	
1	INC Foam	Increment	Output
2			
3	FML	Foam Marker Left	Output
4			
5	FMR	Foam Marker Right	Output
6			
7	End Nozzle L	End Nozzle Left	Output
8			
9	End Nozzle R	End Nozzle Right	Output
10			
11	Ground		Ground
12			
13	DEC Foam	Decrement	Output
14			
15			
16	Battery + 12V		Output

Table 16-3. Connector 5 - 16 Pin Foam Marker

Service Bulletins

Pressure Relief

Sprayers fitted with the Raven Flow Regulator Valve and a Positive Displacement (Piston or Diaphragm) pump require the fitting of a Pressure Relief Valve to the Sprayer.

The Raven Fast Flow Valve switches to Dump when the sectional switches or Master switch are turned off. With the Topcon system this can make the time to obtain spraying pressure slow. To rectify this, a manual Pressure Relief Valve is fitted to the system which then allows rate to be achieved within 3 seconds.

The other benefit of fitting the pressure relief valve is that it will protect the system from over pressurizing, other pressure damage and the possibility of hoses being "burst" off of their fittings. Fitting the Pressure Relief Valve will also prevent the operator from getting covered in chemical.

Fitting



WARNING

The Sprayer and Pump must be turned OFF and there must be zero chemical in the system, when fitting the Pressure Relief Valve.

Protective clothing, gloves and eyewear must be used when fitting the Pressure Relief Valve.

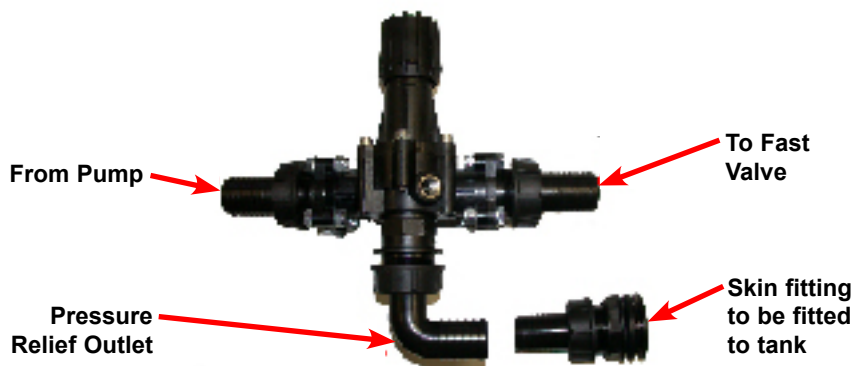


Figure 17-1. Pressure Relief Valve Layout

The Pressure Relief Valve will be fitted between the pump in the pressure hose and the Fast Valve.

The Pressure Hose is a 1 ¼" hose; it will need to be cut to add the Pressure Relief Hose.

A Skin Fitting (supplied) must be fitted to the tank, for the relief chemical. Fit the Skin Fitting approximately 20 centimetres above the base of the tank, so that "frothing" does not occur and agitation is not enhanced.

The dealer/end users will have to supply an appropriate 1 ¼" chemical resistant hose, to connect the Pressure Relief Outlet and the Skin Fitting. An appropriate hose clamp will also have to be supplied.

Once the pressure relief valve is fitted to the pump. Pressure Outlet Hose and then connected to the tank skin fitting, wind the Pressure Regulating Adjuster fully out, this will result in all fluids being "dumped".

Sprayer Software Settings



Figure 17-2. Close Valve When Flow Off

When setting up the software make sure the **Close Valve When Flow Off** option (page 8-20) is not selected.

The controller mode must be selected as **Standard** (page 8-16) when this kit is fitted.

Setting the Pressure Relief

To adjust the Pressure Relief Valve you must know the correct working pressures applicable to the spray nozzles. The valve needs to be set at a point that will allow 1 Bar (approximately 100kpa) more than the nozzle maximum pressure.

1. Place water into the Sprayer
2. Start the pump
3. Place the controller into manual and press the **Up** arrow (**▲**) on the screen for 20 seconds

4. Screw the Pressure Relief Adjuster in (clockwise), until the dial pressure gauge on the Sprayer registers 1 Bar (approximately 100kpa) more than the maximum rating of the nozzles. Eg.: If the nozzle pressure range is rated at 1-4.5 Bar, set the relief valve to a reading of 5.5 Bar.

The system will never have a pressure exceeding the displayed pressure, thus protecting the Sprayer and the operator.

The rate will be achieved, from the OFF position, in approximately 3 seconds, thus eliminating under sprayed areas.

Troubleshooting

In general, as long as you follow the instructions provided in this manual, you should have few problems with your Sprayer. This chapter will help you diagnose and solve some common problems you may encounter.

Communication

Problem		
No Comms		
Causes	Solutions	Tips
1. Incorrect Comms Port selected	Select correct Port from Sprayer	Can be any port on console, usually 2 or 3
2. No power on ECU	Rev 3 ECU's require power on pin 14 of Power plug, earlier ECU's have only the battery connection	Main battery power missing on Rev 3 ECU's do not give Comms Errors
3. Faulty Comms lead between console and ECU	Check lead for damage, repair as necessary	Check harnesses for support. If left hanging on the Comms connectors, the cable could be strained and break wires in the plug

Speed

Problem			
No Speed			
Speed From	Causes	Solutions	Tips
4. Wheel Sensor	Signal from speed sensor missing or no Circ value	Check Circ value, sensor magnet clearance, connector voltages, connector corrosion, loose connections, magnet polarity and sensor damage	Try manual speed, disconnect sensor or select Radar. A pulse from an intermittent sensor will switch back to sensor input
5. Radar	Signal from Radar system missing	Check wiring and Radar specifications	Radar speed inputs are unreliable, do not use unless proven reliable (see Speed Erratic)
6. GPS	GPS input missing	Check GPS signal and Guidance programs are running. Circ must have a value	The GPS speed comes from the Guidance program, which must be running to get a speed reading. Response is slow as speed changes get passed through several programs and the GPS receiver

Problem			
Speed Erratic			
Speed From	Causes	Solutions	Tips
7. Wheel Sensor	Inconsistent speed pulses from sensor	Check for loose connections, sensor and wheel bearings, missing magnets, incorrect installation or broken wires in harness	Magnets get dislodged, wheel wobble changes sensor clearance and wires break where constant flexing occurs
8. Radar	Bad Radar signal	Use other speed source	Radar outputs change type of signal with speed, ie: change pulse rate above set speed, varies with Radar.

Boom Sections

Problem		
Boom Sections do not work		
Causes	Solutions	Tips
9. Incorrect valve type selected	Select correct valve type for Sprayer and wiring	Harnesses are designed for certain valve types, check system components are matches to configuration

Problem		
Boom Sections do not work in Auto		
Causes	Solutions	Tips
10. Low speed shutoff, ASC active	Check low speed shutoff is correct, ASC is OFF/disabled	When troubleshooting Sprayer problems run the Sprayer program by itself. ASC and GPS do odd things when stationary, even with ASC turned OFF

Problem			
Second line does not work correctly			
Causes	Solutions	Tips	Additional Data
11. Trigger speed point incorrectly set	Check trigger points and boom configuration	Dural line configuration is only when the second line valves are controlled from the ECU. If using one line to operate the second line configuration must be single line with the Sprayer hardware operating the second line	Yes, see Additional Data, Problem 11, page 18-11.

Problem		
Booms do not turn off from Switchbox		
Causes	Solutions	Tips
12. Faulty switches	Disable external switches in configuration and operate from the screen	Switches collect dirt etc, the circuit requires the switch to make contact to turn the Sprayer OFF, unless UP is ON is selected, when the Sprayer will not turn ON

Problem		
Booms stay ON when stopped		
Causes	Solutions	Tips
13. Low speed shutoff set to zero	Enter a low speed shutoff of 3 kph	The low speed shutoff will turn the booms OFF when coming to a stop in Auto. A lower value (1 kph) could result in the booms turning on when stationary, if using GPS speed

Rate and Pressure

Problem			
Rate Unstable			
Causes	Solutions	Tips	Additional Data
14. Regulator settings	Tune regulator settings, check correct valve type is selected	All setup steps can be done stationary with manual speed	Yes, see Additional Data, Problem 14, page 18-12.
15. Faulty pump	Test and repair pump	Pump may be sucking air or pulsing due to faulty valves	Yes, see Additional Data, Problem 15, page 18-14.
16. Faulty Flow Meter	Test and repair Flow Meter	Faulty Flow Meter (worn out) or below Flow Meter minimum rate	Yes, see Additional Data, Problem 16, page 18-14.

Problem		
Wrong Pressure		
Causes	Solutions	Tips
17. Bad Flow Meter calibration	Check Flow Meter calibration and type select	If Flow Meter calibration is incorrect the pressure for the rate showing will be out. Check nozzle charts

Problem		
Incorrect pressure reading		
Causes	Solutions	Tips
18. Bad pressure calibration	Check selection of correct pressure sender and calibration	Confirm range selected is what is required ie: most systems use kpa, but if Bar is selected, the reading is 1/100 th of the value

Problem			
Rate and Pressure do not match unless whole Boom is ON			
Causes	Solutions	Tips	Additional Data
19. Balanced Valves is selected	Deselect Balanced Valves if balanced valves are not used	HARDI use balance valves, most other Sprayers use a normal shutoff valve	Yes, see Additional Data, Problem 19, page 18-15.

Problem			
Rate goes up when slowing down			
Causes	Solutions	Tips	Additional Data
20. Minimum Flow settings activated	Check trigger points for the minimum flow settings, may be normal behaviour	There are 3 minimum hold settings: Nozzle, Flow Meter and Speed. When activated, the Sprayer switches to Manual and holds the regulator at that point	Yes, see Additional Data, Problem 20, page 18-16.

Problem		
Incorrect pressure reading		
Causes	Solutions	Tips
21. Regulator Faulty	Check and repair regulator	If regulator is seized there will be no control. If at the end of travel only control in manual is still possible. Check other configuration factors.

Control

Problem		
Will not control in Auto		
Causes	Solutions	Tips
22. Regulator Valve is operating wrong way	Select Reverse Valve Direction	Pressure should go up when the Up arrow is pressed in Manual

Volumes

Problem			
Incorrect volumes			
Causes	Solutions	Tips	Additional Data
23. Flow Meter calibration is incorrect	Perform FCAL procedure	Performing the FCAL procedure takes into account wear, plumbing etc. The FCAL supplied with the Flow Meter is valid when new and the plumbing is as specified as the manufacturer	Yes, see Additional Data, Problem 23, page 18-16.
24. Volume reference is inaccurate	Measure the volume of liquid placed into tank, or use volume after calibration of Flow Meter as reference	Tank markings are very inaccurate and change over time	Yes, see Additional Data, Problem 24, page 18-17.

Nozzles

Problem			
Nozzles losing pattern when slowing down			
Causes	Solutions	Tips	Additional Data
25. Pressure dropping too low when at low speeds	Change nozzles to give better range, set the low pressure hold to hold pressure at minimum for nozzles	There are 3 minimum hold settings: Nozzle, Flow Meter and Speed. When activated, the Sprayer switches to Manual and holds the regulator at that point	Yes, see Additional Data, Problem 25, page 18-18.

Alarms

Problem			
Alarm keeps sounding			
Causes	Solutions	Tips	Additional Data
26. A problem has developed that triggers the alarm	Fix the problem that has caused the alarm to sound	There is a wide variety of alarms associated with the Sprayer, some are critical, others are warnings only. See the associated text for the alarm types and suggested settings	Yes, see Additional Data, Problem 26, page 18-19.

Additional Data

Problem 11
Second line does not work correctly
Information
<p>Dual line Sprayers give a larger effective speed range of operation without the need to change nozzles to travel faster or slower and maintain the desired application rate. The X20 uses 2 different methods of controlling a second line, which is determined by the hardware fitted to the Sprayer. The first method is to control the individual valves on both lines. For this the X20 is configured as a dual line. The second line is turned on as required by setting the low speed shutoffs for the second line valves. The second line follows directly on from the main line valves, ie: a 6 section Sprayer has boom 1 second line valve on section 7. A fully featured harness is required to control this configuration.</p>
<p>The second system uses a single output to control the second line. For this, the Sprayer needs to be configured as a single line, with one more section enabled than is used for spraying. This extra section uses the speed to turn the line on at the right time, and must be configured with a zero width. The hardware needs to be setup to control the second line, either with a valve to turn the liquid on, or an interface to drive the second line valves.</p>
<p>The X20 does NOT have Tiered Switching but with the Dual line type of configuration, by setting the cut in speeds, you can determine which line come on first.</p>

Problem 14

Rate Unstable

Information

The X20 has a selection of Regulator valves specified by the manufacturer in the valve settings options. The Standard option suits all valves supplied by Topcon and many others with speeds varying from 6 seconds to 30 seconds.

The **Max On Time** is the maximum time power is applied to the valve to correct the rate. If the target rate and the current rate are widely different, this is the maximum time that the valve will be driven before power will be removed and if necessary, reapplied. If this value is too low, the system will be sluggish and slow to respond. The maximum value will suit most applications.

The **Min On Time** is the minimum or shortest time that the power will be applied to the Regulator Valve. The maximum value will also suit most systems. If set too low, the valve may not move when a small correction is required.

The **PWM Setting** varies the average voltage applied to the valve motor. At 100%, a full 12 Volts is applied, whereas at the lesser settings reduce the voltage to the percentage shown. The reduced voltage makes the valve turn slower and is helpful when trying to correct an overshooting problem with the faster valves, 6 seconds etc. The slow valves, 20 seconds, usually need to be 100% for good control.

The **Gain Setting** is simply like a volume control, how hard the controller is going to respond to changes required. The second level down will suit most applications.

The **Micro-trak** setting is designed for the Micro-trak Regulator Valve which is a fast control valve.

The **Dickey-John** setting is for the Dickey-John Regulator Valve and is very fast. The same principles apply in setting up or tuning the system, just the numbers will be different. Note that the PWM settings have an entirely different range of settings. If good control cannot be achieved with the set of values available for that valve, try another set. The settings groups are simply optimized for the valve indicated. Different models may require different settings, although they are from the same manufacturer. (See Raven below).

The **Raven** setting is for the Raven Fast Flow valve only. The normal Raven system uses the Standard settings. The Fast Flow valve **MUST** have the PWM set to 100%. Any reduction of the PWM results in the valve operating very slowly due to the control electronics in the valve. This valve operates fully closed to fully open in 1.5 seconds and is used for the dump as well as the control. Because it is the dump valve as well as control, the Close Valve When Flow Off option needs to be ticked.

This valve can be difficult to setup, but the Max and Min values and the Gain settings are the only settings that can be changed. Setting the (Flow Meter) Sensitivity to Reduced may help. The Sprayers fitted with this valve usually have an under-rated pressure relief system and it is recommended to install another adjustable relief valve.

Problem 15

Rate Unstable

Information

The rate is determined from the pulses received from the Flow Meter. These pulses are processed along with the Sprayer width, speed, and target rate and a determination is made as to how to drive the Regulator Valve to achieve the target rate. Most unstable rate displays are due to erratic signals coming from the Flow Meter. With a Centrifugal pump, air can be sucked into the pump through seals, loose hose fittings, faulty hoses etc. This air can dramatically increase in volume in the pump due to cavitation, and when this air pocket passes through the Flow Meter, it will cause erratic operation, as well as giving fluctuating pressures due to poor pump efficiency.

If using a Positive Displacement pump, Piston, Diaphragm etc, a faulty valve in either the suction or pressure side will give a pulsating flow which will also give erratic readings. If there is 5 or less pistons, the pump will have an Accumulator (Air Pressure reservoir) that is designed to smooth out the pulsing from the pistons. The pressure in this accumulator is critical and should be as determined by the pump manufacturer.

Problem 16

Rate Unstable

Information

A faulty Flow Meter can give erratic readings as well. The Flow Meter fault can vary depending on the design of the meter. The most common problem is wear. As the components in the Flow Meter wear, the impeller will move around and can drag on the side of the housing, giving poor readings. Also, it can become jammed or sticky due to contamination, foreign objects or poor cleaning routines. These causes will also give incorrect volume used readings, which could be corrected by changing the FCAL, but this only masks the problem of a failing Flow Meter.

Problem 19

Rate and Pressure do not match unless whole Boom is ON

Information

The Sprayer software is capable of controlling systems that use Balanced Valves. These valves are used by Hardi, and need to be adjusted regularly. These valves, when closed, bypass the flow from the Boom Section back to the tank. This bypass flow is adjustable. The idea of the system is to maintain Sprayer pressure when turning the booms off or on. In a normal system, when a boom 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.

In the X20 Sprayer Program, when Balance valves are ticked, the Flow Meter pulses are reduced by the proportion of the boom that is turned off. Control is still maintained, and if the valves are balanced properly, the pressure will not change with any variation in which booms are operating.

If the Balanced valve option is ticked WITHOUT balanced valves fitted, the pressure will rise when a boom is turned off. If it is NOT ticked with balanced valves fitted, the pressure will drop excessively when a boom is turned off.

Problem 20

Rate goes up when slowing down

Information

This is an indication of the Regulator Valve not controlling and could be caused by a number of things. There are 3 minimum hold settings in the Configuration Options. The first is Nozzle Minimum Flow. This would be set at the minimum flow rate recommended by the nozzle manufacturer for the nozzles fitted to the Sprayer. The second hold point is for the Flow Meter, and is set at the minimum flow rate for the Flow Meter. For example, the Polmac Flow Meter has a minimum flow of 20 l/min. The third hold is a Low Pressure Hold based on vehicle speed. Depending on the speed, application rate and active booms, different holds would become effective at different times. On the operating screen, the system will show as being in Manual with the red Bar in the flow rate button lit up.

Problem 23

Incorrect volumes

Information

Flow Meter Calibration figure is wrong. This calibration figure can change over time due to wear and pump dynamics. The FCAL supplied by the manufacturer is usually only accurate under certain conditions. The build and design of the Sprayer could effect the calibration of the Flow Meter, such as an elbow at the Flow Meter connection. This creates turbulence within the Flow Meter, which will change with the rate of flow throughout the Flow Meter. A Flow Meter calibration should be performed periodically to ensure continued accuracy of the system.

Problem 24

Incorrect volumes

Information

The volume used, and the rate both require the FCAL to be accurate. If the FCAL is incorrect, the volume used shown in the console will not be correct, and the rate control will not be operating at the correct rate. The console will not show any problem as it will be working with the data received, but when a comparison with the activity on the ground is made, there could be spray left over or run out before the expected area was covered. When an FCAL is performed correctly, the accuracy of the FCAL is only limited by the accuracy of the measurement of the liquid drawn off. Typically this could be less than 0.1% for a system in good order. Most volume errors come from the expectation that the tank markings are accurate. At the best, tank markings are only a guide, and if there is less than 10% error between the real volume and tank markings, it is luck. Most tanks these days are plastic or fibreglass. Take a 2000 litre plastic tank, put 2 tonne of water in it, and it has got to change shape/volume etc. Make it 2 years old, the plastic characteristics will change, and the change will be different with the same 2 tonne load.

Problem 25

Nozzles losing pattern when slowing down

Information

Sprayer nozzles need a minimum pressure to maintain an effective spray pattern. When operating in Auto, the pressure is reduced when slowing down to keep the application rate at the desired level. When operating with Auto Section Control, the system will turn booms off as required according to the settings for the ASC. This can result in single sections being on, speed down due to turning, with a corresponding very low pressure. This results in the loss of spray fan with ineffective Sprayer coverage.

By setting the limits as described in index 18 above, the Sprayer will go into 'Hold' before this problem shows up. When operating in this mode, the Sprayer will actually be over applying, but in most applications, this is preferable to missing bits.

Problem 26	
Alarm keeps sounding	
Alarm Type	Information
<p>There are various alarms built into the Sprayer software to indicate when things are not right. The following text covers all of the alarms, their settings and what they mean. Any alarm for a facility not installed should normally be set to Never Alarm. Common uninstalled functions include Pump speed and Pressure.</p>	
Rate	<p>The Rate alarm indicates that the Sprayer is not controlling to the programmed rate in Auto. This shows up on the operating screen with the value in the Rate window alternating from the target rate (Yellow background) to the actual rate, (White background)</p> <p>If the actual rate is zero, this could be a faulty flow-meter, out of spray, pump failure, or faulty harness.</p> <p>If the rate is low, it usually indicates pump problems or other plumbing issues with flow, including pump too small for the rate being attempted at the speed the Sprayer is running at. If achieved rate is higher, this could be due to the regulator being jammed, faulty, or fully at one end of travel with blockages in the return line from the regulator.</p>

Rate	<p>The Rate display is filtered to prevent the numbers from continually changing. If the achieved rate is within 5% of the target rate, the display will only show the target rate, but the system will still control to the target rate. If an error of less than 5% persists, the error is reported as a rate alarm after approximately 1 minute. When first turning the Sprayer on, the system should control to rate within 10 seconds, subject to the position of the Regulator Valve when it was last turned off. If the 'Close Valve When Off' is selected with a slow valve, ie, 20 second type, it may take longer, but this is because the option is selected when it shouldn't be. Because of the filtering, the display may take up to 30 seconds to stabilize if there is a long adjustment required to change the rate with a slow valve. This can result in a false Rate alarm where the actual rate displayed is still catching up to the target rate. The Sprayer is usually controlling correctly, which can be checked by checking the pressure reading, it is just the display that is sluggish.</p>
	<p>The alarm default is set to 'Repeat While Present' and as the alarm is critical, needs to sound while the condition is present. As applies to all alarms, they can be changed to different cycle patterns, with differing delays.</p>
Tank Empty	<p>This alarm simply states that the calculated volume has reached zero. If there is still spray in the tank, the system will still operate giving the volume used still accumulating, and the tank volume as a negative figure. The default setting is one alarm cycle only, but other alarms will sound when the tank really runs out.</p>

Tank Low	This alarm gives a warning that the tank is running low (Calculated) The default warning point is set at 5%, but can be changed in the alarm settings.
Flow Sensor Fail	This alarm is triggered whenever the master is turned on, ground speed present, and at least 1 Boom Section is turned on, and there are no flow sensor pulses being received. The default Alarm Delay is 1 second, which can cause some false alarms. If a Sprayer is turned off with the Regulator Valve closed and a centrifugal pump is in use, the pump may cavitate and have virtually no pressure. When the Sprayer is turned on, it will usually take several seconds for the pump to clear the cavitation and produce flow. With 1 second delay, the alarm will sound almost every time the Sprayer is turned off and on with ASC. Setting the delay to 3 seconds will usually stop this false alarm. If the Sprayer is slowed down before the booms turn off, the regulator will be bypassing some liquid back to the tank which will avoid the cavitation problem. If adjutation is sufficient, this could also stop the pump cavitation.
High Pressure	The high pressure alarm indicates that the pressure signal input has exceeded the alarm point setting. If correctly set, this usually indicates a blockage, booms off when they should be on, or Sprayer speed too high. Normally this would be set around the maximum pressure the nozzles are rated for
Low Pressure	The most common cause of this alarm is an empty tank. With minimum flows set for nozzles, flowmeter and pressure, this alarm will only show up with a pump or plumbing failures, or an empty tank.

<p>No Ground Speed</p>	<p>This alarm is triggered if the master switch is turned on in Auto and there is no ground speed present. If there is a large circumference figure in the Sprayer, the time between pulses when travelling slowly may be interpreted as not travelling. The Sprayer would only work at this speed in manual and have no application rate showing.</p>
<p>No Comms</p>	<p>This indicates that the ECU is not communicating to the X20 console. Refer to the "NO COMMS" troubleshooting above.</p>
<p>High Pump Speed</p>	<p>The Pump speed is an option and is usually required where a piston or diaphragm pump is being driven from a hydraulic motor. These pumps will be damaged is driven over their maximum speed.</p>
<p>Low Pump Speed</p>	<p>A low pump speed will usually reduce the efficiency of the pump and cause other Sprayer problems.</p>

Appendix A

Options Window

Opening

1. Select the **Options** button on the *Sprayer Working* screen

Please note: To explain the various options for navigating around the screen, the Tanks and Sections pages will be used as examples.

The following pages offer an explanation of the terms used in Figures A-1 and A-2 (next page). These explanations will help you select the right options for your Sprayer.

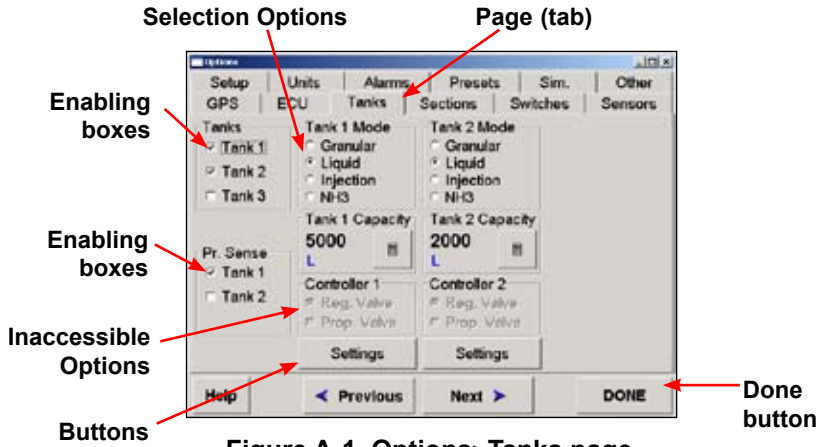


Figure A-1. Options>Tanks page

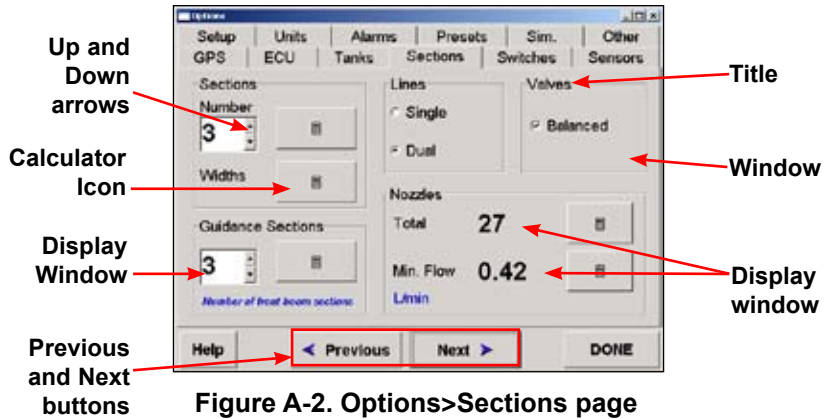


Figure A-2. Options>Sections page

- **Selecting**—means selecting an item by touching the screen with your finger, pen stylus or by clicking with your mouse (if it is connected).

There are various ways of selecting the different options.

Selecting an Option with a Checkbox

To select an option with a checkbox next to it (eg. Pr. Sense option [Figure A-1 on page A2]):

1. Select the white checkbox next to the desired option, so that a black tick appears in the box.

To deselect the option touch or click the box again.

Selecting an Option with a Radio Button

To select an option with a circular radio button next to it (eg. a Tank 1 Mode option [Figure A-1 on page A2]):

1. Select the white radio button next to the desired option, so that a black dot appears in the circle.

To deselect the option touch or click the circle again.

Selecting a Button

1. Select the button within the outline of the box.

Selecting a button will usually open a window. The **DONE** or **OK** button will close a window.

- Pages—Within the Options window there are 12 Pages or tabs (some users may have 11), these can be seen lining the top of the page (Figure A-1 on page A2)

The pages include: GPS (this page is only displayed if the Guidance or Variable Rate Control is selected with the Spray Rate Controller), ECU, Tanks, Sections, Switches, Sensors, Setup, Units, Alarms, Presets, Sim. (Simulation) and Other.

Selecting Another Page (Tab)

1. Select the required page (tab)

OR

2. Select the **Next** button (Figure A-2 on page A2) to advance to the next page.

Each time the **Next** button is selected it will advance one page.

The previous **Button** goes back one page each time it is selected.

Exiting Back to the Sprayer Working Screen

1. Select the **DONE** button (Figure A-1 on page A2).

- **Windows and Titles**—Each page is broken into areas called windows (Figure A-2 on page A2), these windows are bordered by a thin grey line

Each window has a title (Figure A-2 on page A2), which gives a description of the options available in that window.

- **Enabling boxes**—are options identified with square white checkboxes lying next to the written option

The operator can often check more than one enabling option, in a window. You choose the enabling option that applies to your system and setup.

- **Selection options**—are options identified with white circular radio buttons lying next to the written option

Only one selection option can be selected in a window. At least one of the selection options must be selected.

- **Buttons**—allow the operator to access extra options
- **Up and Down arrows (▲ ▼)**—Next to some display windows (Figure A-2 on page A2) there are up and down arrows, which when pressed alter the current value shown in the display window, without using the calculator button.

Usually a mouse is required to use the up and down arrows.

The **Up** arrow (▲) increases the value displayed in the display window.

The **Down** arrow (▼) decreases the value displayed in the display window.

- Inaccessible options—When a window is greyed out (Figure A-1 on page A2) it means that the options in the window are inaccessible

The example (Figure A-1 on page A2) shows the Controller 1 window as greyed out, this is because the Controller selected on the ECU page is not capable of controlling proportional valves, therefore the window is locked on the Regulator Valve option. When a different Controller (eg. Spray ECU 2) is selected, the Controller 1 window will become accessible.

- Display window—displays the current value of the option
- Simulation mode—If Simulation mode is displayed in red on the ECU page then Simulation has been selected from the COM Port window

Simulation mode stops all alarms from being displayed, this is useful if the X console is being setup and is not connected to the Spray ECU.

- Options window—The *Options* window cannot be resized, minimized or maximized
- Calculator icon-When selected, the **calculator** icon allows the operator to enter a value for the option that was next to the calculator icon (eg. Guidance sections).

The following page explains the *Calculator* window and Table A-1 on page A8 shows and explains the different commands on the *Calculator* window.

- Title—displays a description of the value being entered in the *Calculator* window
- Calculator window—displays the value being typed in, using the screen keyboard.



Figure A-3. Calculator Window

Calculator commands	
Command	Using the command
Numbers (0-9)	Enter the value with these numbers
Calculator Functions (/ x - + =)	Perform simple calculations with these
DEL	Press Del to delete one value at time from the Calculator window
CLEAR	Press Clear to clear all values from the Calculator window
CANCEL	Press Cancel to close the window without saving any changes
ENTER	Press Enter to save the value entered in the Calculator window and exit the Calculator screen.

Table A-1. Calculator Commands

Using the Calculator Icon to Change an Option's Value

1. Select the **Calculator** icon next to the value you want to change

The *Calculator* window will appear

2. Using the calculator, select the desired value
3. When finished, select **Enter** to save the value and close the *Calculator* window.

The new value will be displayed in the display window

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