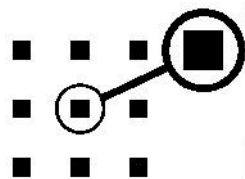


Primo 400

Primo 400

# Primo 400

## INSTALLATION & OPERATION INSTRUCTIONS



FARMSCAN

PART No: AM - PrimoV2

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# 1.0 Introduction

## 1.1 General Outline

The Primo 400 spray controller will automatically maintain the selected target spray rate regardless of speed or pressure variations within the limits of the sprayer **pump capacity and nozzle size**.

Rates can be changed under GPS control when the Primo 400 is connected via the serial port to a computer-based product with GPS rate mapping and appropriate controlling software.

The Primo 400 spray controller operates using a DC motorised valve to control spray rates. The Primo has in built section control for up to 4 sections or 3 sections with left and right foam marker control.

The Primo requires calibration of a flow sensor and a wheel sensor, which after installation is easily done with the unit's in-built test function.

The Primo provides a "MANUAL" function, giving the operator manual control of the rate and also giving the ability of flushing the tank.

The Primo automatically opens a path for liquid to be returned to the tank. This occurs automatically whenever the sprayer is stationary and the unit is put on hold.

The Primo's built in trip meter keeps records for up to 10 trips. Each trip will record the area covered and the amount of product sprayed. The "TOTAL" key displays overall area and distance covered as well as the total amount of product sprayed.

### About this Manual

This manual contains the necessary instructions to install, operate and calibrate the Primo 400 spray controller.

The calibration section of the manual is divided into two to accommodate the 4- section control Primo and 3 section Control Primo with left and right foam marker option.

## 2.0 Installation

### 2.1 Controller Installation

When installing the monitor use the brackets, securing knobs and mounting hardware supplied to mount the controller. Keep the following points in mind when finding the best location for the controller.

- The controller should be installed in the cab, clearly visible to the operator but not subject to intense heat or moisture.
- Keep the unit away from radios or other electronic equipment to minimise any risk of interference. As a precaution all connection cables should take an alternative route to other cables in the cab, especially antenna cables or clutch, solenoid and engine kill switch cables.
- Mount the unit firmly on the bracket using securing knobs supplied (AH-861). Don't use substitute bolts into the controller.
- When installing the tractor loom, ensure the DB 25 way connector is inserted into the back of the controller with the screws tightened holding the connector in place.
- Use the cable ties supplied to secure the cable away from risk of damage.

## 2.2 Power connection

Do not connect power until all other installation is complete.

Connect **power cable** from tractor loom **direct** to 12-volt DC vehicle battery terminals to ensure a clean uninterrupted source of power.

**DO NOT** connect power cable to alternative power source such as the starter solenoid as damage may result.

**DO NOT** connect other electrical equipment to the controller **power cable**.

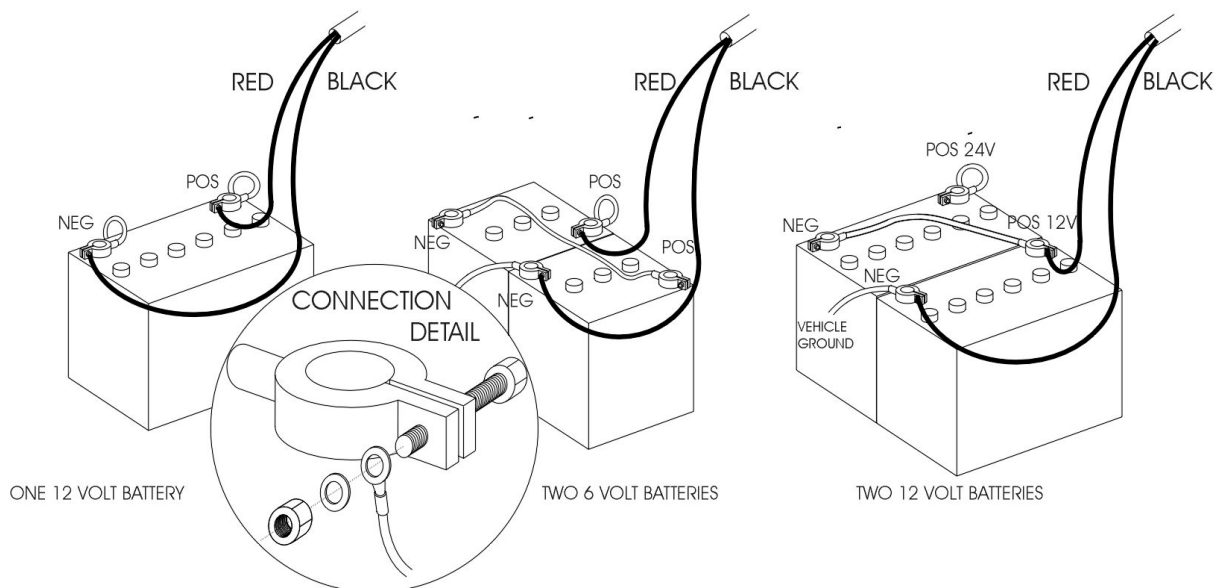
Run the **power cable** away from radio antenna leads and mobile phones or wiring to solenoids or electric clutches.

Use cable ties supplied to secure power cable away from risk of damage.

Connections to battery terminals must be clean and tight.

**! WARNING** - Disconnect power cable when arc welding!

TYPICAL BATTERY HOOK-UPS



## 2.3 Implement Loom Installation

- Lay the implement loom out down the length of the machine and fasten with cable ties along the body of the machine.
- Don't tighten the cable ties at this stage. This allows the loom to be adjusted so that the connectors align properly with the sensors (wheel and flow) and the section valves.
- When the sensors have been installed and connected to the loom, align the loom so that there is the least amount of excess cable near the sensors and the section valves. When correct tighten the cable ties.

## 2.4 Wheel Sensor Installation

The wheel sensor supplied, consists of a reed type sensor and magnet to be fitted onto **any undriven** ground wheel. The sensor is activated every time the magnet sweeps past the sensor. Follow the procedure below to install the wheel sensor.

### Wheel Sensor Installation Procedure:

Bolt the wheel magnet onto the inside of wheel in a position that allows the magnet to sweep directly past the wheel sensor within 15 - 20 mm clearance.

If fitting more than one wheel magnet, ensure that they are exactly opposite to achieve the same interval between pulses.

Magnets can be mounted anywhere in a radius from centre of the wheel. Nearer to the hub will ensure the best ground clearance.

The sensor must be rigidly bolted to an existing structure, ideally in a protected position, to face the **magnets** as shown.

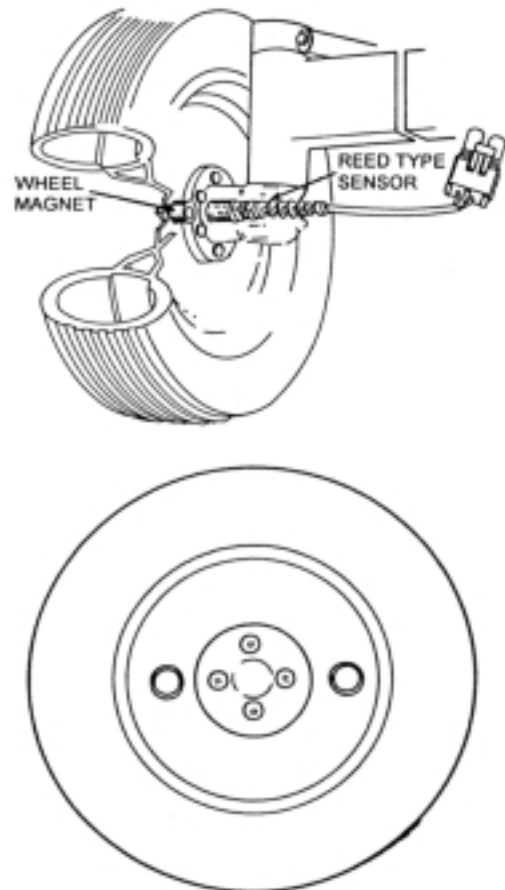
If mounting the sensor on a steered wheel, make sure the **sensor** moves with the steering mechanism to maintain equal clearance between the **magnets** and sensor when turning from lock to lock.

Connect **sensor** to the wheel sensor loom, and use cable ties to secure cable away from potential damage. Allow enough slack for axle movement and steering.

#### NOTE:

- magnet** may be removed from housing and glued onto wheel using Araldite.

- magnets** are not polarity conscious.





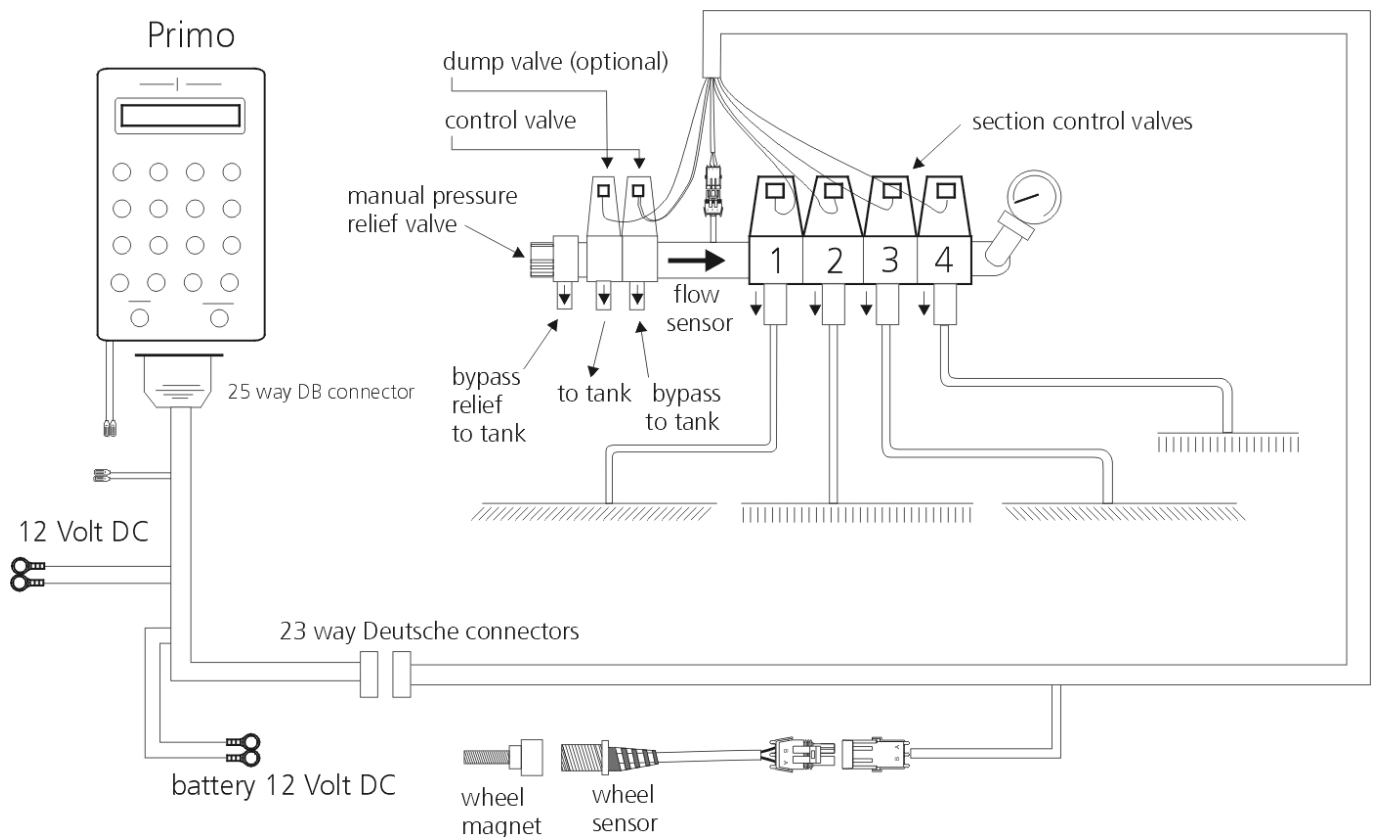
## 2.5 Proportional Control Valve Installation

The DC proportional control valve operates on the bypass line to automatically regulate pressure to spray at the selected rate.

As ground speed increases the control valve closes to increase sprayline pressure. As ground speed decreases the control valve opens to decrease sprayline pressure.

Bypass control must be plumbed so that the bypass is taken before the flow sensor and section valves as shown in the diagram below.

An adjustable pressure relief valve must be fitted before the proportional control valve bypass line to provide a secondary relief path if the proportional valve is closed and sections are switched off (see drawing below of Arag setup only).



### NOTES:

#### PUMP HAMMER

Some diaphragm or piston pumps will hammer the liquid through the spray lines if the pulsation damper on the pump is not working correctly. This is immediately obvious because you will see the spray lines or the mechanical pressure gauge vibrate excessively.

This vibration can severely upset the operation of the spray controller and will result in control errors or erratic control behaviour.

The solution is to either fix the existing pulsation dampener (normally this means adjusting the air pressure on top of the dampener until the hammering stops) or replace the device completely. Adjustment of the dampener should be done when the sprayer is working at the **normal pressure**.

## 2.6 Flow Sensor Installation

The flow sensor is installed on the main delivery line **after** the proportional control valve but **before** section control valves to provide flow rate to the controller.

All material passing through the flow sensor must go to the sections and must not return to the tank. Take care to install the flow sensor with the arrow pointing in the direction of flow.

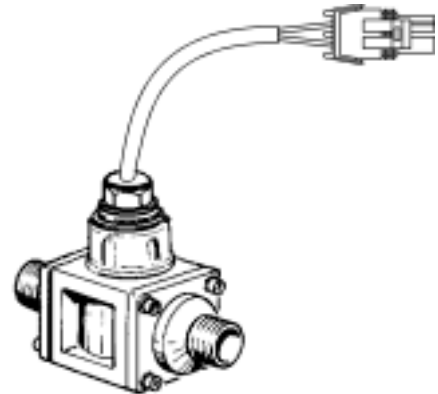
Specifications of the supplied flow sensor are given below.

### AA-230 1" Rapid Check flow sensor

flow range: 10 - 100 L/min (2 – 22 G/min)

PPL factor: marked on meter tag

Max pressure: 5000kPa



To calculate the flow rate use the following formula:

$$\frac{\text{MAX L/HA} \times \text{Kph} \times \text{Boom Width (M)}}{600} = \text{L/MIN}$$

eg.  $\frac{1500 \times 8 \times 4}{600} = 80 \text{ L/MIN}$

If your flow rate is outside the limits contact your dealer to arrange an alternative flow sensor to suit your application.

## 2.7 Connections

The Primo 400 can control up to 4 sections or 3 sections plus left and right foam marker using the front panel switches.

The Primo is able to calibrate and adjust for various widths of active sections by detecting which switches are turned **on** or **off**.

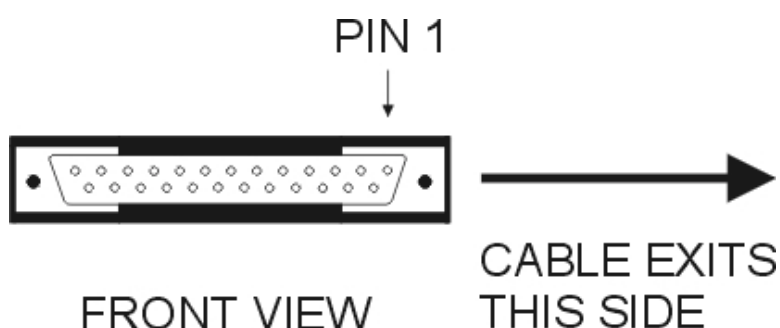
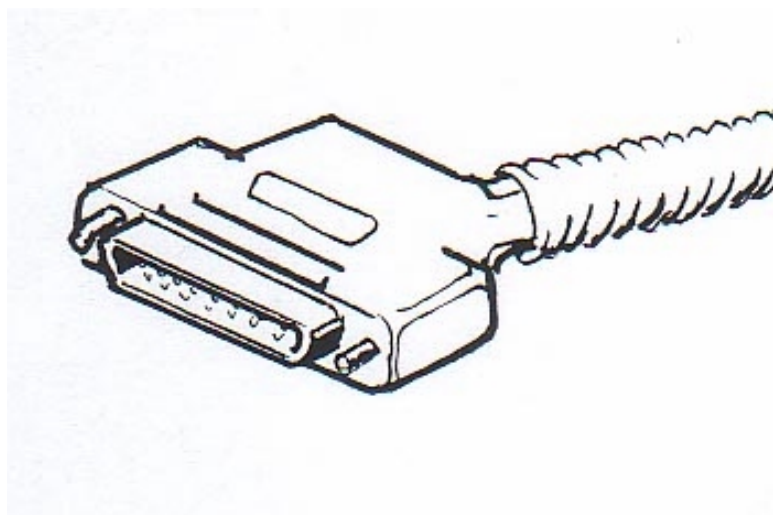
The 4 section Primo has four connectors on the sprayer loom to go to sections and there is also a connector for a dump valve. The 3 section Primo with left and right foam marker option has three connectors on the sprayer loom to go to section, a connector for a dump, foam marker left and right connector along with a compressor and fill meter power. Make connections to all valves using the labelled connectors on the implement loom.

Also connect the implement loom to the motorised control valve.

## 2.8 Primo 400 Pin Outs

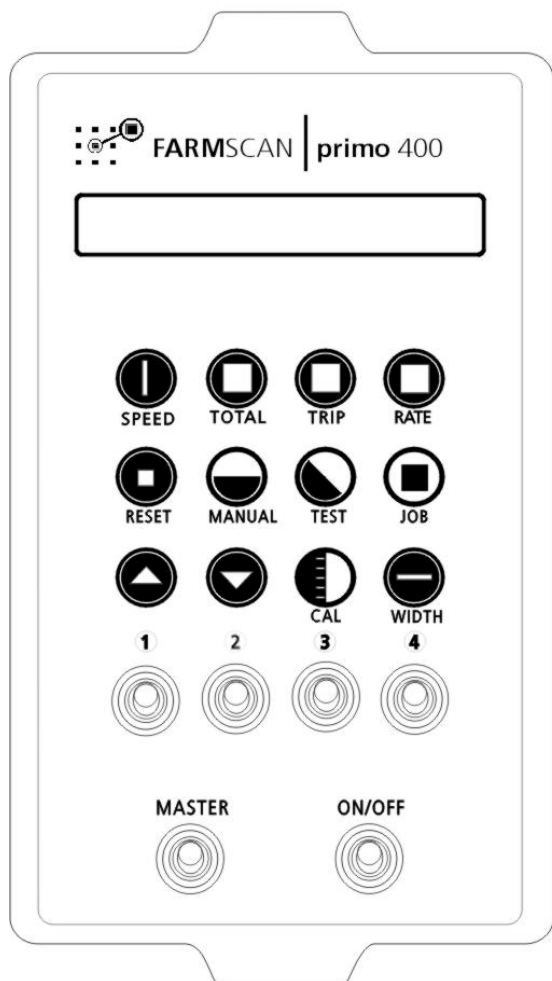
The pin out for the DB25 connector on the tractor loom is given below:

Port Number	Function
1	N/C
2	Pressure
3	Ground
4	Wheel
5	Ground
6	Ground
7	12 Volts OUT
8	Section 4 IN +
9	Section 3 IN +
10	Section 2 IN +
11	Section 1 IN +
12	Dump Valve
13	DC Motor Valve
14	Temperature IN
15	Ground
16	Flow
17	Ground
18	Ground
19	12 Volts OUT
20	Section 4 IN
21	Section 3 IN
22	Section 2 IN
23	Section 1 IN
24	Dump Valve
25	DC Motor Valve

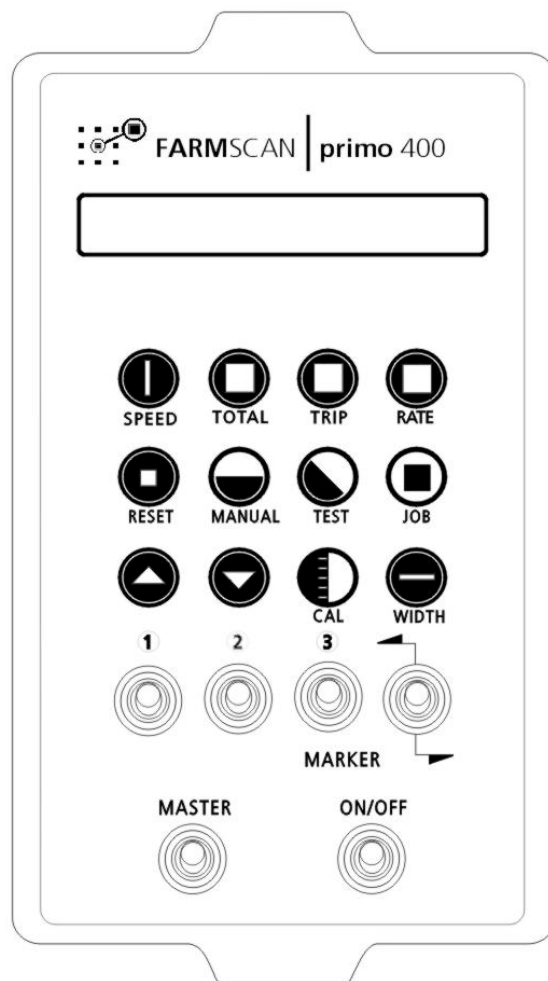


### 3.0 Operation

4 Section



3 Section with Left & Right Foam Marker



#### 3.1 On/Off Switch

To switch the unit **on**, flick the on/off switch down.

Whenever the unit is switched **on** the display will run through a start up routine displaying the version of software and the program the unit is running.

SILVAN PRIMO 400

e.g.

SPRAY CONTROLLER

VERSION 2.0.0S

The version number indicates which generation of functions and features are programmed into your unit.


After momentarily displaying the current program and version number, the controller will then display the speed and the target rate.

e.g.

0. 0kmh	0. 0LHa
---------	---------

If stationary the controller will immediately go into '**hold**' mode when first switched on, see section **3.12 Run/Hold Function** for an explanation of this alarm.

### 3.2 Speed Key


Press the  key to display the current working speed and flow rate.

SPEED


e.g.

15Kmh	7. 6L/m
-------	---------

### 3.3 Total Key

The  key is used to display total area covered, total liquid sprayed and the total distance travelled.


Area, amount sprayed and distance readings are only incremented when the unit is off hold.

Press  key once to display total "AREA".

TOTAL

e.g.


AREA	150. 0Ha
------	----------

Press  key again to display total amount sprayed.

TOTAL

e.g.

LI TRES	255. 8L
---------	---------

Press  key again to display total "DISTANCE"

TOTAL

e.g.

DI STANCE	2. 325km
-----------	----------

**TO RESET TOTALS** Press  key once to start reset process.

RESET

Total area, total amount sprayed and total distance are reset simultaneously; this can be done at the start of a spraying program to keep overall records.

e.g.

RESET TOTAL ?
---------------

Press  key again to complete reset process OR **to abort reset process**, press any other key.


After reset of totals you will have the **option** to reset all trip memories at the same time

e.g.

RESET ALL TRIP S?

Press  key again to reset all trips OR **to abort reset of all trips**, press any other key.


### 3.4 Trip Key

The  key allows the display of a sub total for area covered and litres applied. The "TRIP" function has 10 resetable memories to keep a tally of the areas and litres for 10 different plots or loads.

To display the current "TRIP AREA" press  key once.

e.g.

TRIP 1 3.5Ha

Press  key again to display "TRIP 1" litres.


e.g.

TRIP 1 789.8L

**TO RESET TRIP MEMORY** Press  key to start reset process

e.g.

RESET TRIP S 1?



Press  key again to complete reset process OR **to abort reset process**, press any other key.

To change to another trip memory, press the  or  arrow keys to change the current trip number on display.

e.g.

TRIP 2 0.00L

#### NOTE:

Previously engaged trips can be viewed or reactivated by using the  and  keys to display and hence activate any one of the 10 trip memories 1-10. Whichever trip number is displayed will be **active** when working.

### 3.5 Rate Key

The rate readout is the amount of liquid being sprayed per hectare or acre.



Press the RATE key to display the current working speed and rate readout.

e.g.



7kmh	⊙	250Lha
------	---	--------



Press the RATE key again to display the total litres sprayed and rate readout.

15L	⊙	250Lha
-----	---	--------

The rate that is displayed is the target spraying rate. Based on the **width** of the sprayer and the **speed**, the controller will increase or decrease the flow rate by controlling the proportional valve to attain the target rate. See section **4.4.1 Target Rate** for information on setting the target rate.

To increase or decrease the spraying rate while operating use the  or  keys. The amount of change in the rate from each press of the arrow keys can be set to any amount, e.g. 20, 100, 250 LHA per step up or down from the standard target rate. This is referred to as the **STEP SET**. See section **4.4.2 Step Set** for instructions on changing the step set.

When the rate has been changed an arrow will appear on the display. This arrow reminds the operator which way the rate has been adjusted from the base target rate.

e.g.

7kmh	↑	500LHa
------	---	--------



To return back to the base target rate quickly, press the RESET key.

e.g.

7kmh	⊙	250LHa
------	---	--------

If the controller cannot achieve the desired rate, the controller will display one of the following alarms.

RATE	TOO	LOW
------	-----	-----

e.g.

RATE	TOO	HIGH
------	-----	------



#### Tank Function

The rate readout also shows the amount of liquid sprayed from the tank. This reading starts at 0L and counts up as more liquid from the tank is sprayed.

The Primo has a tank alarm function that is activated when the programmed percentage of the tank volume entered in the calibration menu has been used. When activated the Primo will beep

for 3 seconds and display the "TANK LOW" message. Press another key to clear this message.

### RESET TANK





Reset the tank reading by putting the unit on hold and pressing the  key. "RESET TANK?" will be displayed, press  again to confirm.



### 3.6 Reset Key

To reset total area & litres (gallons), distance, trip area & litres (gallons) and timer, press the

key and follow the prompts on the screen. The  key can also be used to return the controller to the base target rate quickly.


### 3.7 Manual Key

Use the  and  keys to flush the system at any time. Press the  key first then press and hold the  key to open the electric control valve. The sections that are on will be flushed.

When in Manual mode the rate pressure can be increased or decreased using the  or  keys.

To ensure that the DC proportional control valve is wired correctly, when in "MANUAL" mode you should see spray from the nozzles increase to a maximum (pressing up key). If the spray goes to a minimum the two wires connected to the DC proportional control valve need to be reversed.

### 3.8 Test Key

The  key provides a means of testing that the sensors are working correctly. The test function is also used in the calibration procedures. **Note** the master and at least one section switch must be on when in flow test.

Press the  key and the "DISTANCE TEST" will appear.

e.g.

DI STANCE TST 0

The distance test enables the operator to test the wheel sensor mounted on the wheel. Each time the magnet passes the sensor the controller will beep and count the pulse.

To reset the pulse-count back to zero press the  key.

Pressing the  key again will display "FLOW TST".

e.g.

The "FLOW TST" display

FLOW TST 0

should increment together



with a regular beep that becomes faster as the flow rate increases until the beep becomes an almost constant tone.

#### NOTE:

To test the flow sensor at least one section must be turned on and liquid is ready to flow.

To reset the flow count press the  RESET key.

### 3.9 Job Key

The  JOB key is used when using the Primo QA Data Exchange option.


Pressing this key without a QA multi media card inserted into the Primo will display the following message for 1 second.

e.g.


NO CARD FOUND

The display will then return to the last screen you were in.

### 3.10 Cal Key

Pressing the  CAL key will step you through a series of set up factors that need to be entered for the controller to work correctly. The calibration sections of this manual explains each of these set-up factors in greater detail.

### 3.11 Width Key

Press the  WIDTH key to display the current width you are working with. Press and hold the width key to scroll through the "WIDTH A, B and C" figures. Scroll to the correct working width eg "WIDTH B 6.00m" and press any other key to exit.

The width displayed before exiting will be the new working width.

**NOTE:** If you have the 3 section Primo with left and right foam marker control you won't have the option of 3 pre-programmed widths. When the width key is pressed it will display the total boom width for 1 second and then return to the last screen you were in.

### 3.12 Run/Hold Function

The run / hold function is activated whenever the speed is zero (wheel is stationary) or all sections have been turned off or the "MASTER" switch has been switched off (upwards).

When 'on hold' trip, total and distance functions will stop accumulating.

The "UNIT ON HOLD" message will re-appear every thirty seconds accompanied by an alarm to remind the operator that the monitor is not accumulating.

e.g.

UNI	T	ON	HOLD
-----	---	----	------

The monitor will go "OFF HOLD" and the trip and total functions will begin to accumulate as soon as speed is detected.

e.g.

UNI	T	OFF	HOLD
-----	---	-----	------

If driving and all sections are turned off the monitor will go 'on hold' and the dump valve if installed will be activated cycling product back to the tank.

While moving turning sections back on will take the monitor off hold and return it to the normal spray mode and de-activate the dump valve (optional).

### Note

A dump valve can be installed before the flow sensor. When 'on hold' the dump valve will be activated opening a path for product to be pumped back to the tank.

## 3.13 Section Switches & Master

Sections can be switched on or off using the front panel switches. To switch on a section flick the switch downwards. For sections to be switched on the "MASTER" switch must be **on** (downward).

The "MASTER" switch when switched off closes all sections and puts the unit on hold.



When sections are switched on the number above the section will light up.

When sections are switched on or off the unit will automatically compensate by opening or closing the proportional valve to maintain the same spray rate.

## 3.14 Pressure Setting Manual Control Valve

The sprayer will also normally be fitted with a manual pressure relief valve in addition to the controller's electrically operated pressure control valve. The manual pressure relief valve acts as a safety valve and sets the maximum pressure that the system will achieve, and should be set below the maximum operating pressure of the pump.

To set the pressure on the manual control valve ensure all boom sections are off, and the master switch is on ie dump valve is off.



Also adjust the electric pressure control so it is closed for maximum pressure, ie press the  **MANUAL** key and hold the up arrow key  until maximum pressure is achieved.

Now adjust the manual pressure relief valve to the maximum pump pressure or to approximately 10 bar above your normal spray pressure for high pressure pumps and 5 bar for low pressure pumps.

### 3.15 Operation of Control if Computer Fails

If the spray computer program becomes corrupted or a sensor fails it may still be possible to operate the controller in manual mode. The computer can be switched off using the on/off switch and the boom sections should still function.

The pressure will need to be set using the manual pressure relief valve, but first the electric control

valve may need to be closed by using the  **MANUAL** key and holding the up arrow key  until maximum pressure is achieved.

If it is not possible to close the electric control valve in this way consult your dealer who will advise you how to connect a battery directly to the terminals of the electrical control valve to close it.

## 4.0 Calibration



### 4.1 General Outline: Primo 400 3 Sections with Left/Right Foam Marker Control (FS-PR03)


The Primo spray controller has a four level calibration menu:

1. Level 1 calibration menu – used to change settings that may vary frequently: target rate, step set and tank volume.
2. Level 2 calibration menu – sets the section widths and calibrates the wheel and flow sensors.
3. Level 3 calibration menu – changes the display language, sound on/off, radar on/off and sets up units imp/met.
4. Level 4 calibration menu – used to set the response time of the DC motor control valve.

All calibration factors in levels 1 and 3 must be entered before operation.

All calibration factors must be entered in **metric** units only. To adjust the factor displayed, use the

 or  arrow keys to change the displayed value.

Holding the  or  arrow keys will cause the numbers to change faster.

To save a calibration figure into memory, press the  key after the required figure is set. The controller will then proceed to the next calibration function in that menu.

To exit from the calibration routine, press any other operation key (e.g. "RATE") to return the controller to normal operation.

### 4.2 Memory Backup

An inbuilt memory backup system will hold all calibrations and accumulated totals in memory whenever the power is switched off.

Memory will last for at least 3 months after disconnection from the 12 Volt DC power source.

### 4.3 Calibration Warning

A calibration checking system incorporated into the system will warn you if any calibration factors are lost from memory or change value without your knowledge.


If for any reason a calibration factor does change, a continuous series of beeps will sound and the display will indicate which calibration factor has changed.

e.g.

CHECK CALS!





In this case the operator must press the  key to check and re-enter the correct factor.

Save this factor by pressing  key again. Press any other key (e.g. "SPEED") to return to the normal display.

## 4.4 Level 1 Calibration Menu


Press the  key at any time during operation to go into the calibration menu.

### 4.4.1 Target Rate

With target displayed, the  or  arrow keys can be used to set the base target spraying rate.

e.g.

TARGET 500L/Ha

Press the  key to set the step set size.

### 4.4.2 Step Set


The step set is the amount the target rate can be increased or decreased on the go e.g. 20L/HA, 100L/HA, or 250L/HA steps. This is done using the up or down the arrow keys in the opening screen. Use the arrow keys to set the step size.

e.g.

STEPSET ↑↓ 100LHa

#### NOTE:

If operating under GPS rate map control, the step set may be used but your selection will be automatically overridden anytime the computer commands the rate to change.


Press the  key again to set the tank volume.

### 4.4.3 Tank Volume Calibration

Entering a tank volume in this screen enables the tank alarm function. When the programmed percentage of the tank volume entered in this screen has been used the tank alarm will sound.


Enter the volume of the tank typically used. For example if only 200 litres is used in a 500L tank enter 200L.

## 4.5 Level 2 Calibration Menu

Enter level 2 of the calibration menu by pressing and holding the  key while in any level 1 calibration screen.

ie. press and hold "CAL"

TARGET 50LHA

By pressing the  key in this mode you will go through "T-WIDTH", "WHEEL", "SLOW HOLD", "AUTO SHUT OFF", "TANK ALARM" and "PULSES/L" settings.

### 4.5.1 Width

The following screen, is the first screen in the level 2 calibration menu.

T- W I D T H 12. 00m

Follow the procedure below to enter section widths into the Primo 400.

#### Procedure

1. Turn off all section switches and leave MASTER switch 'on'.


ALL SECTIONS OFF

2. Switch **on** one section at a time to display the SECTION width.
3. Use the up and down arrow keys to enter the displayed section width.
4. Turn off that section and turn on another section.
5. Enter the width of the next section and repeat steps 4 and 5 until all the required section widths have been entered.

When all the required section widths have been entered, switch all the required sections 'on' to display the correct total width "T-WIDTH". For example:

T- W I D T H 12. 00m

**Note:** If only two sections are needed enter a width for sections 1 and 2 and enter **0.00m** as the width for sections 3. When sections 1 and 2 are 'on', the total width will be displayed.

Press the  key to set the wheel sensor calibration factor.

## 4.5.2 Wheel

The Wheel factor is the distance covered per rotation of the wheel. Carry out the procedure below to establish this value.



Press the **TEST** key until "DISTANCE TST" is displayed.

e.g.

DI STANCE TST	0
---------------	---

Make the sprayer crawl forward and stop when the "DISTANCE TST" beeps and counts up (when the wheel magnet and sensor are aligned).

e.g.

DI STANCE TST	1
---------------	---

Peg the ground at the bottom centre of the sprayer main ground wheel tyre.



Press the **RESET** key to reset the "DISTANCE TST" counter to 0.

Drive forward in a straight line until the controller has accumulated a number of pulses, stop exactly on a beep count.

***(If you go past a beep don't reverse; go forward to the next beep.)***

e.g.

DI STANCE TST	31
---------------	----

Measure the distance from the peg to the bottom centre of the same tyre.

Divide the distance travelled by the number displayed on the screen.

e.g.  $16.7\text{m} \div 31 = 0.538$  wheel factor



Pressing the **CAL** key when in the "DISTANCE TST" screen will get you into the level 2 calibration

menu displaying "WHEEL". Use the  or  arrow keys to enter the wheel factor.

e.g.

WHEEL	0.538m
-------	--------



Press the **CAL** key to set the slow hold speed.

## 4.5.3 Slow Hold Speed

When the sprayer is forced to travel too slow, a loss of full spray pattern can occur due to low pressure at the nozzles.

The resulting stripping effect can be avoided by setting a **slow hold speed**, which will make the controller hold pressure when ground speed falls below a set point.

If slow hold is set for 4kph,  
e.g.

SLOW HOLD	4Kph
-----------	------



for speeds below 4kph the spray pressure will be held constant.

**Warning:** Operating below the **slow hold speed** will result in over application and activation of the "RATE HIGH" alarm.

### To Determine SLOW HOLD SPEED

1. Calibrate Primo as normal for the required rate.
2. Start spraying at normal speed then slow down until nozzle fan pattern begins to deteriorate. Take note of the ground speed readout when this happens and use this point for the slow hold speed.

Use the  or  arrow keys to enter the desired slow hold speed.

**To disable** the slow hold function set the slow hold speed to **OFF** by pressing the  key or by pressing and holding the  arrow key.

Press the  key again to set the auto shut off speed.



### 4.5.4 Auto Shut Off Speed


An Auto shut off speed can be programmed to allow the Primo to shut down sections when the sprayer slows down below the set speed and automatically switches on the sections when the sprayer travels above the set speed.

eg.

AUTO HOLD	5Kph
-----------	------

When the sprayer speed drops below 5kph the sections will switch off and will switch back on when the sprayer speeds back up over the 5kph.

**To disable** the auto shut off function set the auto shut off speed to **OFF** by pressing the  key or by pressing and holding the  arrow key.


Press the  key again to set the Tank Alarm.



## 4.5.5 Tank Alarm

A Tank Alarm can be set to a desired percentage of the tank level.

For example if you have entered a Tank Volume of 1000 litres and you have the Tank Alarm set to 10% then the Primo will give an audible alarm and warning message when you have 100 litres left in the tank (you have used up 900 litres).

Press the  key to set the flow sensor calibration.






## 4.5.6 Flow Sensor Calibration - Pulses/L

The flow sensor calibration factor relates to the number of pulses per litre (PPL) generated by the flow sensor. The PPL factor of every flow sensor is unique and will vary slightly depending on liquid viscosity.

Attached to every flow sensor is a tag, which gives the PPL factor for that sensor. Enter this PPL factor into the "PULSES/L" screen.

**Important:** After installing the system, the PPL factor should be checked before operating the controller by measuring into a known container. Disconnect a hose after the flow sensor that can be directed into a bucket. Preferably after a section valve or another valve that can be used easily to stop and start the test. Follow the procedure below to test the flow sensor's PPL calibration factor.

### Test Procedure:

1. Switch the Primo on. Before proceeding fully prime the flow sensor and hose. Press the  key and use the  or  arrow keys to set a manual rate in "L/MIN" or G/MIN".
2. Press the  key on the front panel to display "TEST FLOW" on the screen. Press the  key to clear accumulated pulses.

Eg

**TEST FLOW 0**

3. Start pump, activate section, and measure flow coming out using a measuring bucket. Usually 10 – 20 litres is plenty. Shut off flow exactly at the desired point using section control. The test flow counter should stop counting.

eg

**TEST FLOW14250**

4. Take the "TEST FLOW" pulse reading from the Primo and divide it by the total litres. For example: **14250 pulses ÷ 22.1 L = 644.8 pulses per litre** or a PPL factor of 644.8.
5. Repeat steps 1 –4 at least 3 times to verify the accuracy of the final result.
6. See below to enter the pulses per litre flow calibration factor into the controller.

### Important:


Perform calibration with the actual product for accurate results.

Recheck calibration when changing nozzles or if operating at significantly higher or lower pressures

### Note:

On "TEST FLOW" you can increase or decrease flow by using the  or  arrow keys.

### To Set Pulses/L Flow Cal Factor

1. Press  key until "FLOW TST" is displayed.



eg


FLOW TST 0

2. Press the  key and use the '▲' and '▼' keys to set correct the "PULSES/L" factor.


eg

PULSES/L 644.8

3. Press the  or  key to return to the normal display.


**Note:** The "PULSES/L" factor can also be entered when in level 2 calibration and pressing the  key until the "PULSES/L" screen is displayed and then using the up and down arrow keys to enter the factor.

## 4.6 Level 3 Calibration Menu

Enter level 3 of the calibration menu by pressing and holding down the  key while in any screen of the level 2 calibration menu.

ie. Press and hold "CAL"

T-WIDTH 8.00m


By pressing the  key in this mode you will go through the following settings: "LANGUAGE", "SOUND", "UNITS" and "RADAR".

### 4.6.1 To Change Language Setting


Scroll to the language setting in the level 3 calibration menu.

LANGUAGE ENGLISH



Press the up and down arrow keys to select a different display language. The display will be set to this language when pressing any other key such as "RATE" to exit the level 3 calibration menu.


Press the  key to set the Sound on/off.

### 4.6.2 Sound On/Off

Pressing the  key while in the dump valve activation screen will display the following screen.


SOUND ON

If you want to turn the buzzer off then change "ON" (default) in the above screen to "OFF" using the  or  arrow keys.

Press the  key to set the Units Metric/Us imp.

### 4.6.3 Units Metric /Us imp

When in the UNITS screen pressing the  or  arrow keys will set the Primo to read in either Metric or US imp.

Press the  key to set Radar on/off.

### 4.6.4 Radar




When in the rate screen pressing the  or  arrow keys will set the Radar option to on or off.

If you are connecting up to a radar to for ground speed you need to set the setting to on.

## 4.7 Level 4 Calibration Menu

There is a special screen to set the proportional control valve response time.

### To Set Control Valve Response Time:

Press the  key to display the "TARGET" screen as seen in section 4.4.1. Then press and hold the  and  keys simultaneously to access the valve calibration menu. The "VALVE RESP" screen will be displayed.

VALVE RESP 5

This value controls how quick the valve is driven to reach the set point. The default value is 5. If after setting the response time you find that the system takes too long to reach the set rate (L/Ha), increase this value, or if it over shoots continuously, decrease this value.

## 5.0 Calibration



### 5.1 General Outline: Primo 400 4 Section Option (FS-PR01, FSPR04 & FS-PR05)



The Primo spray controller has a four level calibration menu:

1. Level 1 calibration menu – used to change settings that may vary frequently: target rate, step set and tank volume.
2. Level 2 calibration menu – sets the section widths calibrates the wheel and flow sensors along with setting the slow hold speed, auto shut off speed and tank alarm.
3. Level 3 calibration menu – changes the display language, sound on/off, radar on/off , units imp/met and rate control option L/ha or L/100m.
4. Level 4 calibration menu – used to set the response time of the DC motor control valve.

All calibration factors in levels 1 and 3 must be entered before operation.

All calibration factors must be entered in **metric** units only. To adjust the factor displayed, use the

 or  arrow keys to change the displayed value.

Holding the  or  arrow keys will cause the numbers to change faster.

To save a calibration figure into memory, press the  key after the required figure is set. The controller will then proceed to the next calibration function in that menu.

To exit from the calibration routine, press any other operation key (e.g. "RATE") to return the controller to normal operation.

### 5.2 Memory Backup

An inbuilt memory backup system will hold all calibrations and accumulated totals in memory whenever the power is switched off.

Memory will last for at least 3 months after disconnection from the 12 Volt DC power source.



### 5.3 Calibration Warning

A calibration checking system incorporated into the system will warn you if any calibration factors are lost from memory or change value without your knowledge.

If for any reason a calibration factor does change value, a continuous series of beeps will sound and the display will indicate which calibration factor has altered.

e.g.



CHECK CALS!

In this case the operator must press the  key to check and re-enter the correct factor. Save this factor by pressing the  key again. Press any other key (e.g. "SPEED") to return to the normal display.

## 5.4 Level 1 Calibration Menu


Press the  key at any time during operation to go into the calibration menu.

### 5.4.1 Target Rate

With target displayed, the  or  arrow keys can be used to set the base target spraying rate.

e.g.

TARGET 500L/Ha

Press the  key to set the step set size.

### 5.4.2 Step Set


The step set is the amount the target rate can be increased or decreased on the go e.g. 20L/HA, 100L/HA, or 250L/HA steps. This is done using the up or down the arrow keys in the opening screen. Use the arrow keys to set the step size as desired.

e.g.

STEPSET ↑↓ 100LHa

#### NOTE:

If operating under GPS rate map control, the step set may be used but your selection will be automatically overridden anytime the computer commands the rate to change.


Press the  key again to set the tank volume.

### 5.4.3 Tank Volume Calibration

Entering a tank volume in this screen enables the tank alarm function. When programmed percentage of the tank volume entered in this screen has been used the tank alarm will sound.


Enter the volume of the tank typically used. For example if only 200 litres is used in a 500L tank enter 200L.

## 5.5 Level 2 Calibration Menu

Enter level 2 of the calibration menu by pressing and holding the  key while in any screen of the level 1 calibration.

ie. press and hold "CAL"

TARGET 50LHA

By pressing the  key in this mode you will go through "WIDTH A", "WIDTH B", "WIDTH C", "WHEEL", "SLOW HOLD", "AUTO SHUT OFF", "TANK ALARM" and "PULSES/L" settings.

### 5.5.1 Width

The following screen, is the first of the level 2 calibration menu.

WIDTH A 12.00m

Follow the procedure below to enter section widths into the Primo 400. You have the ability to program up to 3 different total widths with this version Primo. WIDTH A, WIDTH B and WIDTH C.

#### Procedure

1. Turn off all section switches and leave MASTER switch 'on'.


ALL SECTIONS OFF


2. Switch **on** one section at a time to display the SECTION width.
3. Use the up and down arrow keys to enter the displayed section width.
4. Turn off that section and turn on another section.
5. Enter the width of the next section and repeat steps 4 and 5 until all the required section widths have been entered.

When all the required section widths have been entered, switch all the required sections 'on' to display the correct width A total. For example:

WIDTH A 4.00m

**Note:** If only two sections are needed enter a width for sections 1 and 2 and enter **0.00m** as the width for sections 3 and 4. When sections 1 and 2 are 'on', the total width A will be displayed.

Press the  key to proceed to set the section widths of WIDTH B. Follow the procedure above to enter Width B figures.

Press the  key to proceed to set the section widths of WIDTH C. Follow the procedure above to enter Width C figures.

If you are operating in a vineyard/orchard and you have some different row spacings eg old plantation, different variety etc, this option of entering 3 different widths A,B & C gives you the ability to program the different row spacing and change them on the go by using the Width key refer to section 3.11.

**NOTE:** If you want to operate with one total width eg boom sprayers, just set width B and C to zero.

## 5.5.2 Wheel

The Wheel factor is the distance covered per rotation of the wheel. Carry out the procedure below to establish this value.

Press the  key until "DISTANCE TST" is displayed.

e.g.

DI STANCE TST 0

Crawl the sprayer forward and stop when the "DISTANCE TST" beeps and counts up. (When the wheel magnet and sensor are aligned)

e.g.

DI STANCE TST 1

Peg the ground at the bottom centre of the sprayer main ground wheel tyre.

Press the  key to reset the "DISTANCE TST" counter to 0.

Drive forward in a straight line until the controller has accumulated a number of pulses, stop exactly on a beep count.

***(If you go past a beep don't reverse; go forward to the next beep.)***

e.g.

DI STANCE TST 31

Measure the distance from the peg to the bottom centre of the same tyre.

Divide the distance traveled by the number displayed on the screen.


e.g.  $16.7\text{m} \div 31 = 0.538$  wheel factor

Pressing the  key when in the "DISTANCE TST" screen will get you into the level 2 calibration

menu displaying "WHEEL". Use the  or  arrow keys to enter the wheel factor.

e.g.

WHEEL 0.538m

Press the  key to set the slow hold speed.

### 5.5.3 Slow Hold Speed

When the sprayer is forced to travel too slow, a loss of full spray pattern can occur due to low pressure at the nozzles.

The resulting stripping effect can be avoided by setting a **slow hold speed**, which will make the controller hold pressure when ground speed falls below a set point.

If slow hold is set for 4kph,

e.g.

for speeds below 4kph the constant.

SLOW HOLD	4Kph
-----------	------

spray pressure will be held


**Warning:** Operating below the **slow hold speed** will result in over application and activation of the "RATE HIGH" alarm.

#### To Determine SLOW HOLD SPEED

1. Calibrate Primo as normal for the required rate.
2. Start spraying at normal speed then slow down until nozzle fan pattern begins to deteriorate. Take note of the ground speed readout when this happens and use this point for the slow hold speed.

Use the  or  arrow keys to enter the desired slow hold speed.

**To disable** the slow hold function set the slow hold speed to **zero**.

Press the  key again to set the auto shut off speed.


### 5.5.4 Auto Shut Off Speed

An Auto shut off speed can be programmed to allow the Primo to shut down sections when the sprayer slows down below the set speed and automatically switches on the sections when the sprayer travels above the set speed.

eg.

AUTO HOLD	5Kph
-----------	------

When the sprayer speed drops below 3kph the sections will switch off and will switch back on when the sprayer speeds back up over the 3kph.

Press the  key again to set the Tank Alarm.


### 5.5.5 Tank Alarm

A Tank Alarm can be set to a percentage relevant to the tank volume calibration.

For example if you have entered a Tank Volume of 1000 litres and you have the Tank Alarm set to 10% then the Primo will give an audible alarm and warning message on the LCD when you have 100 litres left in the tank (you have used up 900 litres).





Press the  key to set the Flow sensor calibration.


### 5.5.6 Flow Sensor Calibration – Pulses/L

The flow sensor calibration factor relates to the number of pulses per litre (PPL) generated by the flow sensor. The PPL factor of every flow sensor is unique and will vary slightly depending on liquid viscosity.

Attached to every flow sensor is a tag, which gives the PPL factor for that sensor. Enter this PPL factor into the “PULSES/L” screen.

**Important:** After installing the system, the PPL factor should be checked before operating the controller by measuring into a known container. Disconnect a hose after the flow sensor that can be directed into a bucket. Preferably after a section valve or another valve that can be used easily to stop and start the test. Follow the procedure below to test the flow sensor’s PPL calibration factor.

#### Test Procedure:

1. Switch the Primo on. Before proceeding fully prime the flow sensor and hose. Press the  key and use the ‘UP’ and ‘DOWN’ arrow keys to set a flush rate in “L/MIN” or G/MIN”.

2. Press the  key on the front panel to display “TEST FLOW” on the screen. Press the “RESET” key to clear accumulated pulses.

eg

TEST FLOW 0

3. Start pump, activate section, and measure flow coming out using a measuring bucket. Usually 10 – 20 litres is plenty. Shut off flow exactly at the desired point using section control. The test flow counter should stop counting.

eg

TEST FLOW14250

4. Take the “TEST FLOW” pulse reading from the Primo and divide it by the total litres. For example: **14250 pulses ÷ 22.1 L = 644.8 pulses per litre** or a PPL factor of 644.8.

5. Repeat steps 1 –4 at least 3 times to verify the accuracy of the final result.

6. See below to enter the pulses per litre flow calibration factor into the controller.

#### Important:


Perform calibration with the actual product for accurate results.

Recheck calibration when changing nozzles or if operating at significantly higher or lower pressures

#### Note:

On “TEST FLOW” you can increase or decrease flow by using the ‘up’ and ‘down’ arrow keys.

#### To Set Pulses/L Flow Cal Factor

1. Press the  key until "FLOW TST" is displayed.



eg


FLOW TST	0
----------	---

2. Press the  key and use the '▲' and '▼' keys to set correct the "PULSES/L" factor.


eg

PULSES/L	644.8
----------	-------

3. Press the  or  key to return to the normal display.


**Note:** The "PULSES/L" factor can also be entered when in level 2 calibration and pressing the  key until the "PULSES/L" screen is displayed and then using the up and down arrow keys to enter the factor.

## 5.6 Level 3 Calibration Menu

Enter level 3 of the calibration menu by pressing and holding down the  key while in any screen of the level 2 calibration menu.

ie. Press and hold "CAL"

T- W I D T H	8. 00m
--------------	--------

By pressing the  key in this mode you will go through "LANGUAGE ", "SOUND" AND "UNITS"

### 5.6.1 To Change Language Setting

Scroll to the language setting in the level 3 calibration menu.


LANGUAGE ENGLI SH
-------------------

Press the up and down arrow keys to select a different display language.

Press the Cal key to set the Sound on/off.

### 5.6.2 Sound On/Off

When in the SOUND screen pressing the up or down keys will turn the buzzer either on or off.

Press the  key to set the Units Metric/US imp.

### 5.6.3 Units Metric /Us imp

When in the UNITS screen pressing the up and down arrow keys will set the Primo to read in either Metric or US imp

### 5.6.4 Rate option

When in the RATE screen pressing the up and down arrow keys will set the Primo operate in Litres per hectare or litres per 100 metres.

### 5.6.5 Radar




When in the rate screen pressing the up and down arrow keys will set the Radar option to on or off.

If you are connecting up to a radar to for ground speed you need to set the setting to on.

## 5.7 Level 4 Calibration Menu

There is a special screen to set the proportional control valve response time.

### To Set Control Valve Response Time:

Press the  key to display the "TARGET" screen as seen in section 4.4.1. Then Press the  and  keys simultaneously to access the valve calibration menu. The "VALVE RESP" screen will be displayed.

VALVE RESP 5

This value controls how quick the valve is driven to reach the set point. The default value is 5. If after setting the response time you find that the system takes too long to reach the set rate, increase this value, or if it over shoots continuously, decrease this value.


## 6.0 Litres per 100 metres control option


The Primo 400 has the ability to control the litres per 100 metres of liquid. This option replaces the hectare as the base unit for calibration.

Calibrate the Primo as stated in SECTION 5 of the manual with the following calibration changes.

### 6.1 Setting up Litre/100m option

To set up the Primo to control L/100m enter into the RATE option screen in the level 3 calibration.


Press and hold the  key when in a level 2 calibration screen to enter into level 3 calibration.

Press the  key to scroll through Language, Sound, Units till Rate is displayed.

Press the up arrow key to set to L/100m


eg.

RATE L/100m

Press any other key eg  to exit.

### 6.2 Setting Row Spacing

To set the row spacing calibration enter into the Level 2 Calibration.

Press and hold the  key when in a level 1 calibration screen to enter into level 2 calibration.

If all section switches are off the monitor will display

ALL SECTIONS OFF

Switch on all the required sections of your sprayer.

Eg: If your sprayer has 2 section control valves then switch on section switches 1 & 2.

Or

If your sprayer has 4 section control valves then switch on section switches 1,2,3 &4.

When this is done the monitor will display

eg.

SPACING A 0.00m

Press the up or down arrow keys to enter the row spacing on your vineyard/orchard

eg.

SPACING B 3.00m

Switch off your section switches and leave MASTER switched 'on'  
Switch on one section at a time. The monitor will display

eg.

SECTION 1 OFF

Use the up or down arrow keys to too set to either OFF, HALF or FULL. This relates to the section and whether it will spray a full row or half row.

Switch that section off and switch on another section.

Eg.


SECTION 2 OFF


Use the up or down arrow keys too set to either OFF, HALF or FULL.

If you don't use sections 3 and 4 repeat as above and set SECTION 3 to OFF and SECTION 4 to OFF.


For example if you have a 2 row sprayer with 2 section valves you would set SECTION 1 to FULL and SECTION 2 to FULL.

If you have a 1 row sprayer with 2 section valves you would set SECTION 1 to HALF and SECTION 2 to HALF.


Press the  key to proceed to set SPACING B. Follow the procedure above to enter SPACING B figures.

Press the  key to proceed to set SPACING C. Follow the procedure above to enter SPACING C figures.

If you are operating in a vineyard/orchard and you have some different row spacings eg old plantation, different variety etc, this option of entering 3 different SPACINGS: A,B & C gives you

the ability to program the different row spacing and change them on the go by using the  key refer to section 3.11.

**NOTE:** If you want to operate with one row spacing, just set SPACING B and C to zero.

Press any other key eg  to exit.

## 6.3 Setting up Target Rate

Set the Target Rate, Step Set and Tank Volume as per Section 4.4. The Target Rate and Step Set figures will now be based on L/100m.

### Calibration Record Table

Use the table below to record your controller's calibration settings.

	1	2	3	4
Target Rate				
Step Set				
Tank Volume				
Section 1 Width				
Section 2 Width				
Section 3 Width				
Section 4 Width				
Wheel Factor				
Low Speed Shutoff				
Flow Meter Factor Pulse/L				
Dump No/Yes				
Sound on/off				
Valve Response Speed				
Nozzle Size Fitted				
Date				
Crop Type				
Spraying Speed				
Nozzles Fitted:				
<ul style="list-style-type: none"> <li>- Size</li> <li>- Colour</li> <li>- Quantity</li> </ul>				
Notes				

## 7.0 Flow Sensor Service Procedure

### To be Followed Daily After Work is Finished

1. Unscrew the red cap and lift the turbine assembly out of the green sensor body.
2. Use clean water to wash away any foreign particles from the turbine assembly.
3. Use compressed air or simply blow without direct mouth contact into the turbine assembly to ensure the propeller spins freely.
4. Insert the turbine assembly into the housing and tightly fasten the red cap.

### To be Followed After Every 50 hours of Operation

1. Unscrew the red cap and lift the turbine assembly out of the green sensor body.
2. Unscrew and lift out the yellow sensor from the turbine assembly.
3. Place the turbine assembly unit in a detergent bath for a few hours.
4. Remove the turbine assembly from the detergent bath and use compressed air to check that the propeller spins freely.
5. Reassemble the flow sensor making sure the yellow sensor and turbine assembly are tightly fastened.

## 8.0 Troubleshooting Guide

PROBLEM		POSSIBLE CAUSE / REMEDY
1.	CONTROLLER DOES NOT TURN ON.	<p>a) A fuse has blown. The controller uses internal poly-fuses which cut out if the monitor is drawing too much current and will automatically restore power when the fault has been repaired.</p> <p>b) Disconnect controller's power cable and test voltage is 12-13.8V DC from battery. Reconnect power to the controller and check that there is 12V between power wires.</p> <p>c) Check connections at battery are <b>clean</b> and tight at terminals, try with engine running.</p> <p>d) Check that <b>red</b> wire is to positive and <b>black</b> wire is to negative.</p> <p>e) Check that no other electrical device is connected to the same power cable - the power cable must be completely independent. Do not share power with other devices using the controller loom.</p> <p>f) Connect controller direct to another 12 Volt battery known to be in good condition.</p> <p>g) Unable to locate fault – contact nearest Dealer.</p>
2.	LCD DISPLAY DROPS OUT OR GREY SQUARES APPEAR ON HALF THE READOUT	<p>a) If display rectifies when engine running this indicates battery is in poor condition or connections to battery are poor.</p> <p>b) If problem persists when engine running, then voltage supply is low or low current is a problem due to poor connections at battery or corroded inline fuse holder on loom.</p> <p>c) Clean battery terminals and power cable connections.</p> <p>d) Connect controller directly to an independent battery to prove if controller is OK.</p> <p>e) Disconnect proportional control valve - if problem goes away then this confirms insufficient current available from power cable.</p>
3.	CONTROLLER LOOSING CALIBRATION VALUES.	<p>a) Controller not connected directly to battery. Connect black from loom directly to negative and red to positive side of battery. Do not share power with any other devices such as foam markers, using the controller loom.</p> <p>b) If problem occurs regularly, then it is probably caused by outside interference. See "Interference Causes and Remedies" "Troubleshooting" section 23.</p>
4.	SPEED READOUT TOO FAST OR TOO SLOW	<p>a) Recheck "WHEEL" calibration is measured correctly and entered in metres. Eg. 2.445 metres.</p>



PROBLEM		POSSIBLE CAUSE / REMEDY
5.	SPEED READOUT JUMPY	<p>a) Make sure magnet is facing sensor correctly as shown in "Wheel Sensor Installation" section 2.4. Use of an alternative magnet may cause problems due to wrong orientation of magnet.</p> <p>b) Check that wheel magnet is present and the magnet is 15 - 20 mm away from wheel sensor as they pass. Magnet too close can cause jumpy speed.</p> <p>c) If the readout is jumpy, it indicates that the pulses from the wheel sensor are inconsistent. Check for poor or intermittent connections to sensor.</p> <p>Check sensor cable for physical damage, make sure cable has not rubbed through to the chassis due to sharp edges.</p> <p>d) If fault can not be found, press "TEST" key on controller until "TEST WHEEL" is displayed. Drive slowly forward and listen to the beeps. The sound should be rhythmic at a fixed speed. If the sound is jumpy, and wiring is OK, then replace sensor.</p> <p>e) If the beeps can be heard whilst stationary, then vibration or interference could be the cause. See 'Troubleshooting Section' 23 " Interference Causes and Remedies".</p>
6.	SPEED READOUT INTERMITTENT OR STAYS AT ZERO	<p>a) Fault is probably a broken or intermittent connection to wheel sensor or perhaps a faulty sensor. Check all connections first.</p> <p>b) Make sure clearance between wheel magnets and wheel sensor is 10-15 mm. Check for the correct sensor, it should be black.</p> <p>c) Press "TEST" key until "TEST WHEEL" is displayed</p> <p>Disconnect wheel sensor from cable and use a short length of wire to short circuit across connector plug to wheel sensor cable (black &amp; white wires).</p> <p>Controller in cab should 'beep' continuously whilst wires are short circuited. Now wriggle all connections from wheel sensor plug back to controller to try and make beep sound fail thereby isolating cause of fault.</p> <p>d) If wiring and controller can not be faulted, replace sensor.</p> <p>e) If no audible response from shorting out wiring at wheel sensor connection, you can short out pins P &amp; L on the tractor loom breakaway connector. If audible response, problem is in the sprayer loom. If no audible response problem is in the tractor loom or controller.</p>

PROBLEM		POSSIBLE CAUSE / REMEDY	
7.	WHEEL SENSOR TEST PROCEDURE		<p>USE A MULTIMETER ONLY TO TEST THE WHEEL SENSOR.</p> <p>a) Disconnect wheel sensor from cable.</p> <p>b) Switch Multimeter "ON: and select "OHMS" scale.</p> <p>c) Touch test probes together and meter needle should read zero "0 <math>\Omega</math>" resistance.</p> <p>d) Connect test probes to wheel sensor pins. If meter goes immediately to zero without magnet, then sensor is short circuit (faulty). If meter stays to left of scale, hold wheel magnet in front of sensor, meter should go straight to zero. If meter fails to change, then sensor is open circuit (faulty).</p>
8.	SPEED CAN'T GO HIGHER	a)	If receiving more than 100 pulses per second then set jumper setting on main circuit board to "/10" ie divide by 10. See section "4.5.2 Wheel Calibration".
9.	TOTAL AND TRIP AREA INCORRECT	a)	Check "SPEED" readout is correct and steady - if not, this will affect the area totals. See Troubleshooting sections 4, 5, 6 & 7.
		b)	Recheck "WIDTH" calibration is set correctly in <u>metres</u> .
10.	TOTAL AND TRIP AREA WON'T RECORD	a)	Check that "SPEED" readout is working. If not see Troubleshooting Section 6.
		b)	At least one section valve must be switched on. (if used)
		c)	Flow sensor must be working OK.
		d)	With liquid flowing, press "SPEED" key and check if L/min readout is working. If not see flow sensor test procedure.
11.	RATE READOUT FLUCTUATES MORE THAN +/- 2%.	a)	Big fluctuations may be normal for 2-5 seconds only when changing speed or rates.
		b)	Check "SPEED" readout is stable at a constant driving speed. If not, follow Troubleshooting Section 6.
		c)	Check <b>all</b> calibrations are set correctly.
		d)	<p>Check if flow sensor is giving a stable pulse rate as follows:</p> <ul style="list-style-type: none"> <li>* Activate section controls</li> <li>* With pump running, and stationary, press the "FLUSH" key .</li> <li>* Adjust the flow in "L/MIN" or "G/MIN" using the up and down arrows to set a small rate such as "20L/MIN". Place a container under the section to capture spray. Start timing for a minute. After a minute measure the volume of liquid it should be 20L. If not the flow sensor is either faulty, requires cleaning or is subject to outside interference. Eliminate external causes as a possibility before servicing.</li> </ul>
		e)	Press "TEST" key and select "TEST FLOW", slow the pump down and listen to the pulse rate. The beeps should be rhythmic and steady.

PROBLEM		POSSIBLE CAUSE / REMEDY													
11.	RATE READOUT FLUCTUATES MORE THAN +/- 2% continued...	f)	Check the nozzle manufacturers spray chart to see if the rate selected is compatible with the nozzles and driving speed. If nozzles are too large for the intended rate and speed, then the proportional valve will hunt for the right setting. Increase rates or get the right nozzles for the job.												
		g)	If "SPEED" and "L/MIN RATE" fluctuating, follow section flow sensor service procedure.												
		h)	Fluctuation could be caused by a faulty pressure relief valve that dumps pressure prematurely, this will cause a continuous self defeating response from the spray controller as it tries to compensate.												
		i)	Water hammer could be the reason - See 2.5 "Proportional Control Valve Installation – Notes".												
		j)	Electrical interference could be causing the flow sensor to pulse erratically - this would result in the controller trying to compensate. See "Interference Causes and Remedies". Troubleshooting Section 23.												
		k)	Check if air is entering the system.												
12.	RATE READOUT STAYS AT ZERO	a)	Check "SPEED" readout. If no speed follow Troubleshooting Section 7.												
		b)	Use a multimeter to check for + 12 volts between red and black wires (on loom) to flow sensor. Check for +12 volts between pins O & P of breakaway plug on tractor loom.  AA-230 Polmac Rapid Check flow sensor wiring:												
			<table border="0"> <tr> <td><b>Flow sensor wiring</b></td> <td><b>Loom wiring</b></td> <td></td> </tr> <tr> <td>Brown</td> <td>Red</td> <td><b>+12 V</b></td> </tr> <tr> <td>White</td> <td>Black</td> <td><b>Ground</b></td> </tr> <tr> <td>Green</td> <td>White/Black</td> <td><b>Signal</b></td> </tr> </table>	<b>Flow sensor wiring</b>	<b>Loom wiring</b>		Brown	Red	<b>+12 V</b>	White	Black	<b>Ground</b>	Green	White/Black	<b>Signal</b>
<b>Flow sensor wiring</b>	<b>Loom wiring</b>														
Brown	Red	<b>+12 V</b>													
White	Black	<b>Ground</b>													
Green	White/Black	<b>Signal</b>													

	PROBLEM	POSSIBLE CAUSE / REMEDY
12.	RATE READOUT STAYS AT ZERO continued...	<p>f) If voltage OK to flow sensor, press "TEST" key until "TST FLOW" is displayed.</p> <p>g) Disconnect flow sensor plug and use a short length of wire or long nose pliers to short out between black (pin B) and black/white (pin A) wires on the flow sensor input plug on the sprayer loom.</p> <p>h) A continuous beep should be heard from the spray controller. Now wriggle all wiring and connections from flow sensor plug to rear of spray controller and listen if the beep can be made to drop out.</p> <p>i) If no beep heard, test directly across pins P &amp; X on the tractor loom at the breakaway connector.</p> <p>j) If no audible response then controller or tractor loom may have fault.</p>
13.	<b>RATE LOW "SLOWER" ALARM OR CAN'T REACH MAXIMUM SPEED.</b>	<p>a) Indicates target rate selected is not achievable.</p> <p>b) Check manufacturers spray chart to see what rates should be achievable at maximum pressure.</p> <p>c) Check inline filters and nozzle filters which may be blocked causing restriction to available flow rate.</p> <p>d) Check flow sensor <b>inlet</b> for debris causing restriction</p>
14.	FLOW SENSOR INACCURATE	<p>a) Make sure flow direction arrow points in direction of flow.</p> <p>b) If diaphragm or piston pump, make sure pump is not hammering. See 2.5 "Proportional Control Valve Installation- Notes"</p> <p>c) Remove flow sensor and check <b>inlet</b> strainer on flow sensor is clear.</p> <p>d) Follow flow sensor calibration test procedure 5.1 and <b>make sure correct flow cal factor is set.</b></p> <p>e) Follow "FLOW SENSOR SERVICING PROCEDURE 5.1".</p> <p>f) If your litres accumulated figure on the screen is different to the actual litres used, then your flow sensor calibration figure could be incorrect. To work out the correct figure either refer to the flow sensor calibration section of the manual or use the following formula:</p> <p><u>Monitor displayed litres x current Pulses/L</u> Actual used litres</p> <p>= NEW PULSES/L figure</p>

PROBLEM		POSSIBLE CAUSE / REMEDY	
15.	CONTROL VALVE WON'T OPEN AUTOMATICALLY	a)	1. Check "WIDTH" calibration factor is correctly. 2. Check "FLOW" cal factor is set. 3. Check "WHEEL" cal factor is set. 4. Check rates are set.
		b)	Check input connector at rear of controller is inserted properly and check implement breakaway connection, make sure pins on male side are contacting properly.
		c)	Check ground speed readout is working correctly.
		d)	If no pressure, make sure pump is working correctly.
16.	VALVE KEEPS OPENING WHILE SPRAYING	a)	Check speed readout is working accurately. Refer Troubleshooting Sections 4 – 7.
		b)	Follow Troubleshooting 11 (c) to isolate flow sensor as cause.
		c)	Read nozzle manufacturers spray chart and make sure the intended rate can be delivered at the speed required within the minimum recommended operating pressure.
17.	VALVE RESPONSE TOO SLOW TO START SPRAYING	a)	If switching spray "OFF" regularly you must use "MASTER" switch to instantly start / stop spray.
		b)	You must switch 'OFF' master switch whilst <b>still travelling at working speeds</b> . If you shut 'OFF' too late the valve will have opened to bypass.
		c)	If centrifugal pump, when shutdown, pump must be able to cycle some material back to tank, otherwise cavitation may cause loss of pressure.
		d)	If ground wheel is large ie 'wheel cal' greater than 2 metres then additional magnets may be required to improve response at slow working speeds.
18.	RATE HI ALARM ACTIVATES FOR MORE THAN 2-3 SECONDS	a)	Check proportional valve operation.
		b)	Press "CAL" key until slow hold function is displayed and check setting.
19.	PRESSURE TOO LOW UNDER AUTO CONTROL	a)	Check all calibration factors are correctly entered.
		b)	With air blast or low volume spraying make sure sufficient pressure is available.
		c)	Run sprayer and check hoses for split after proportional control valve.
		d)	Make certain nozzles are correct for the job.
20.	NO SPRAY OUT OF NOZZLES	a)	Check if proportional valve is connected correctly. Refer to section "3.3 Manual Key".
		b)	If you have an auto shut speed set ensure that you are above this setting

**Note:**

Troubleshooting points 20 to 22 below are only applicable to the 3 section Primo with Left and Right Foam Marker Option.

PROBLEM		POSSIBLE CAUSE / REMEDY	
20.	LEFT AND RIGHT FOAM MARKERS NOT OPERATING:	a)	Check for 12 volts between (Green) Pin A & (Black) Pin B on the 3 pin Packard Foam Marker connector when the foam marker is switched to left. If no 12 volts check for 12 volts between (Green) Pin N & (Black) Pin S on the Deutsch plug on the tractor loom. If no 12 volts then monitor is faulty. If 12 volts at this point then fault is in the sprayer loom.
		b)	Check for 12 volts between (Black) Pin B & (Pink) Pin C on the 3 pin Packard Foam Marker connector when the foam marker is switched to right. If no 12 volts check for 12 volts between (Black) Pin S & (Pink) Pin M on the Deutsch plug on the tractor loom. If no 12 volts then monitor is faulty. If 12 volts at this point then fault is in the sprayer loom.
21.	COMPRESSOR NOT SWITCHING ON	a)	Check to see if the AA-400/SBA Compressor Relay Module is connected to the 4 pin Packard connector.
		b)	Check that you have constant 12 volts between (Red) Pin A & (Black) Pin B on the 2-way Packard connector coming out of the AA-400/SBA when the foam marker is switched to left or right.
		c)	If no 12 volts then disconnect the AA-400/SBA Compressor Relay Module from the 4 way Packard connector. Check for constant 12 volts across (Red) Pin C & (Black) Pin B on the 4 way Packard connector. If no 12 volts check for 12 volts between (Black) Pin S & (Red) Pin R on the Deutsch plug on the tractor loom. If no 12 volts check the in-line fuses on the power cable coming from the tractor loom. If 12 volts at this point then fault is in the sprayer loom.
		d)	Check for 12 volts between (Black) Pin B & (Green) Pin A on the 4 way Packard connector when the foam marker is switch to left. If no 12 volts check for 12 volts between (Black) Pin S & (Green) Pin N on the Deutsch plug on the tractor loom. If no 12 volts then monitor is faulty. If 12 volts at this point then fault is in the sprayer loom.
		e)	Check for 12 volts between (Black) Pin B & (Pink) Pin D on the 4 way Packard connector when the foam marker is switched to right. If no 12 volts check for 12 volts between (Black) Pin S & (Pink) Pin M on the Deutsch plug on the tractor loom. If no 12 volts then monitor is faulty. If 12 volts at this point the fault is in the sprayer loom.
22.	NO POWER TO FILL METER	a)	Check for constant 12 volts between the (Black) Pin B & (Red) Pin A on the 2 way packard Fill Meter power connector.

## 23. INTERFERENCE CAUSES AND REMEDIES

CAUSES	REMEDY
Noisy wire ignition leads on petrol engine or pump motor	Replace with carbon leads. Fit suppressors to coil and distributor.
Faulty alternator	Have alternator serviced
Other electrical equipment running off spray controller power cable.	Run separate power cable <b>direct</b> to 12 V battery for spray controller.
Kill switch on pump motor upsets Controller	Run kill switch cable away from spray controller cables.

### 8.1 Summary of Alarms

Alarm Type	Description
RATE TOO HIGH	Speed too slow to control to rate set
RATE TOO LOW	Speed too fast to control to rate set
UNIT ON HOLD	Monitor stopped accumulating data and product is returned to back to the tank
UNIT OFF HOLD	Monitor is returned to the normal spray mode.

## 9.0 Appendix

### 9.1 Specifications

#### Inputs

	DB25 (J1)	Radar Interface Disabled	Radar Interface Enabled
Wheel	4	200Hz Maximum	2KHz Maximum
		Active Low	Active Low
		0.5V Maximum To Activate	0.5V Maximum To Activate
		4.5mA	4.5mA

	DB 25 (J1)	Minimum	Maximum
Flow	16	1 Hz	10Khz
		Active Low	Active Low
		0.5V Maximum To Activate	0.5V Maximum To Activate
		4.5mA	4.5mA

	Minimum	Maximum	Maximum Total Current Allowed
Input Voltage	11.5V	14.5V	10A
Sections			5A

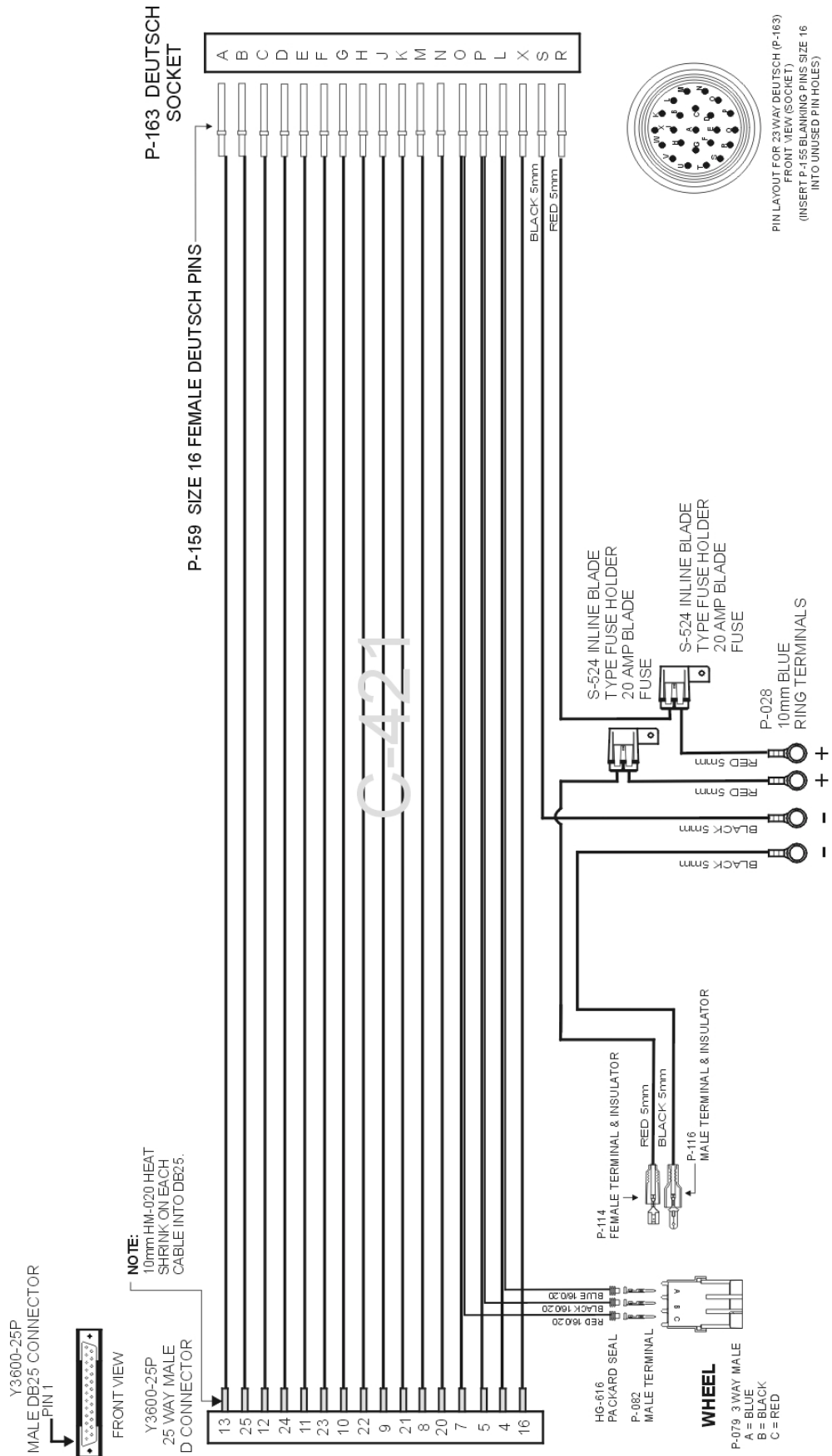
	DB9 (J2)	
Serial	2	RS485+
Interface	3	RS485-
	5	GND
	9	+12VOut Printer supply voltage

#### Outputs

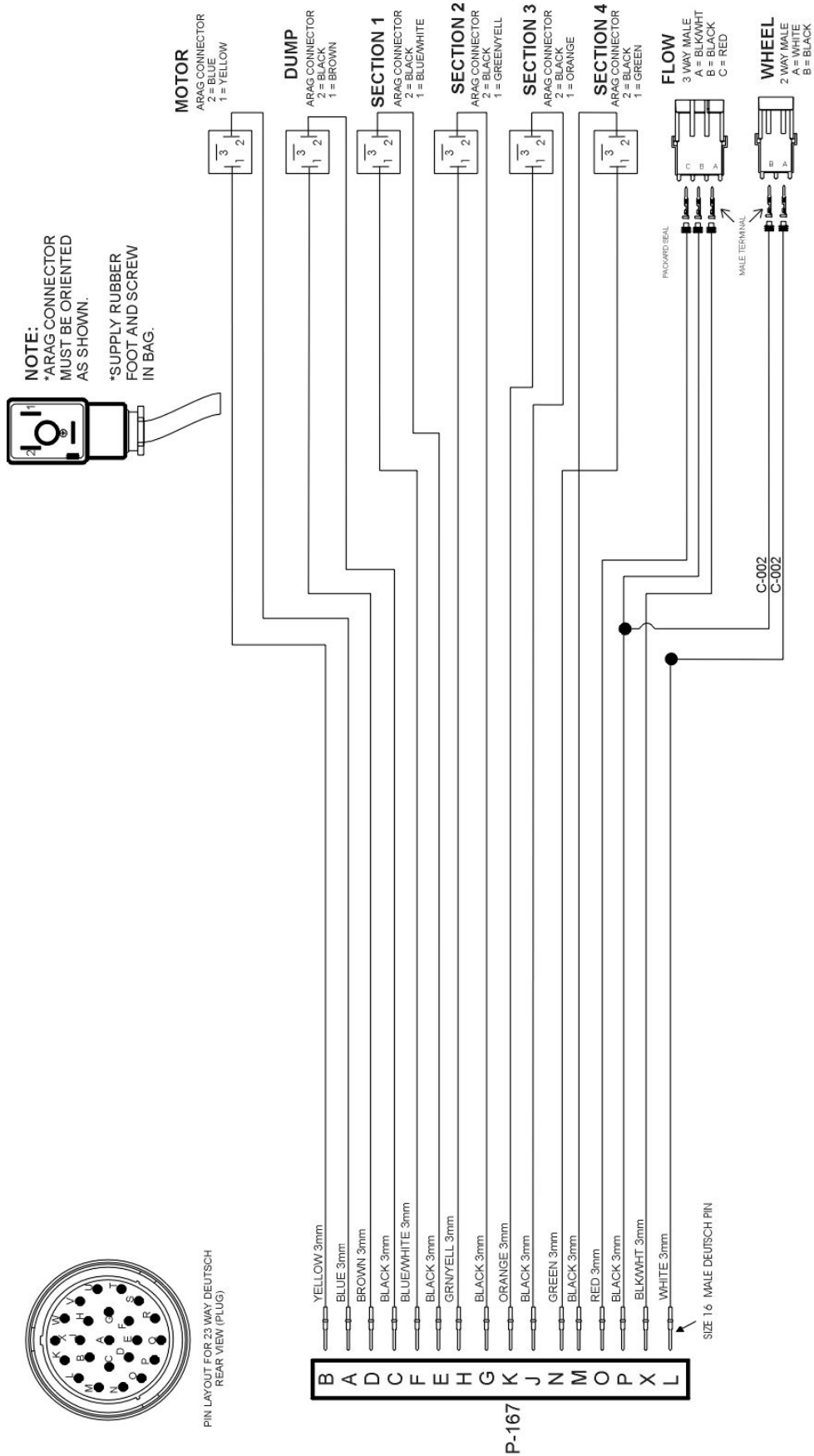
	DB25 (J1)	Minimum	Maximum	Maximum Individual Current
DCMotor	13,25	11V	14V	2.5A
Section 1	11,23	11V	14V	1A
Section 2	10,22	11V	14V	1A
Section 3	9,21	11V	14V	1A
Section 4	8,20	11V	14V	1A
Dump	12,24	11V	14V	1A
+12Vout	7,19	10.4V	13.4V	1.5A



# 9.2 Tractor Loom Diagram



### 9.3 Implement Loom Diagram (FS-PR01)



TITLE: AC-400/S-01 CONTROL LOOM



# 9.5 Implement Loom Diagram (FS-PR04)

