



**PRO STEER**  
**Operator's and Electrical Installation**  
**Manual**

**(Manual relates only to MK II ECU with Wheel Angle Sensor)**

Part Number AGA3529  
Rev. 4.9

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This manual applies to the  
following software versions and  
above:

PROSTEER 03.09.29.00

PROCAL V2.9.93

# Preface

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## Manual Conventions

This Manual uses the following conventions:



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.**



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# Introduction



## CAUTION

***PRO STEER is an automated steering system that must only be operated by a trained operator at all times. Whilst PRO STEER will automatically steer the vehicle to a predetermined line, the operator must be alert and manually take control from time to time. Failure to adhere to this and the following points may result in the damage of property, personal injury and even death.***

PRO STEER is not to be used on public or private roads, and whilst on the roads and in transport mode, PRO STEER must be disabled via the MANUAL OVERRIDE SWITCH. This is to stop inadvertent activation of the automated steering.

The operator must never leave the vehicle steering station whilst PRO STEER is activated.

When in “Parallel” mode, the operator MUST manually turn the vehicle at the end of rows.

When in “Contour, or Racetrack” modes the operator MUST manually turn the vehicle on sharp corners.

Whilst every effort has been made to ensure the manual contents are correct, some makes and models of vehicles and DGPS units change periodically, and therefore the manufacturer warns that the purchaser may have to purchase extra hydraulic fittings for their particular vehicle, and that the electrical connections of DGPS units and radios may not be correct at the time of fitment .

The manufacturer of PRO STEER does not manufacture DGPS units

and cannot guarantee the accuracy or service of the DGPS units.

However, all reasonable time and effort has been spent on ensuring reputable signal transmitting and receiving devices have been procured for the PRO STEER system.

# Kit Components

This chapter will provide you with an overview of the components that you will find in your PRO STEER Kit.

## Kit Contents

Part Number	Description	Quantity
A2374	Power Cable	1
A3413	Cabin Harness - Combines the previous A2398 cabin harness and A3257 GPS cable	1
A2558	Hydraulic Harness (depending on application)	1
A2039	Switch Box	1
A2392	6m Extension Harness ( optional extra that is used on some makes of combine harvesters)	1

The harnesses (except for the hydraulic harness) are generic for all installations. The hydraulic harness will vary depending on the type of tractor that is being fit-up.

A2558	Standard PRO STEER Series III Hydraulic Valve
A2684	Cat MT
A2903	Cat C,D,E Series
A3010	Case MX/NH TG Steer Ready
A3218	Case STX/NH TJ Steer Ready
A2399	JD Wheeled Steer Ready
A2624	JD Tracked

## A3413 Cabin Harness

This harness is used to supply in-cab power as well GPS input for your PRO STEER system. This harness combines the previous A2398 Cabin Harness with no GPS input (refer page 2-4) and A3257 GPS cable (refer page 2-3). The A3413 Cabin harness is the latest harness and is supplied in all new PRO STEER series IV kits equipped with MK II ECU's.

## A2374 Power Harness



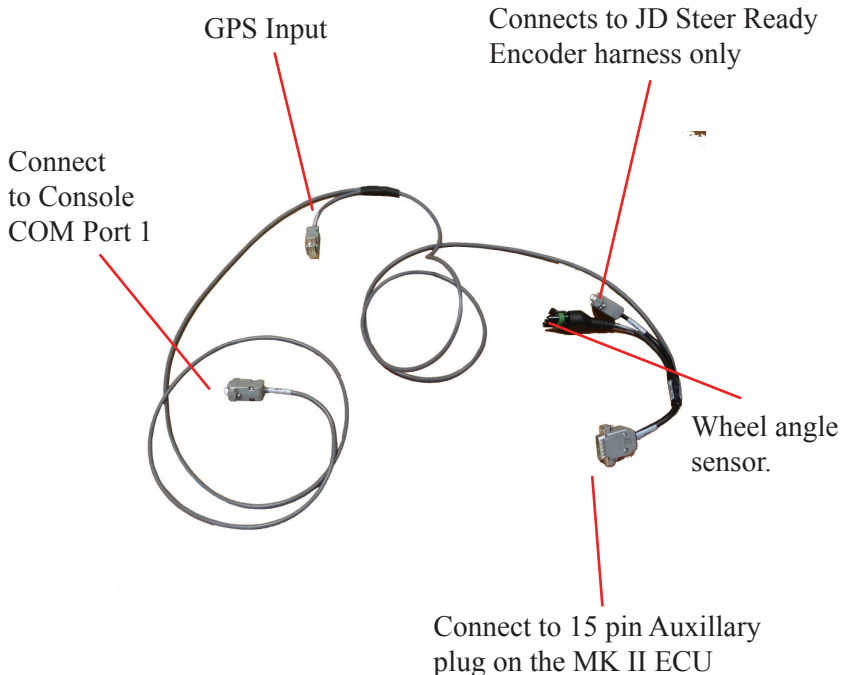
## A3257 MK II GPS Cable



### NOTICE

*The A3257 GPS harness is only used with MK II ECU's supplied with the A2398 cabin harness. If your kit is supplied with the A3413 cabin harness, you will not need the A3257 GPS harness. This is because the A3413 harness combines both the A3257 and A2398 harnesses into a single harness.*

From 2005 to October 2007 PRO STEER utilised the Series I ECU. From October 2007, the MK II ECU was released, and this is signified by the markings on the top decal as, PRO STEER MK II ECU. The MK II ECU will require the A3257 (GPS Cable) if the steering is to have RTK GPS fitted.



## A2398 Cabin Harness



This is the older cabin harness without an inbuilt GPS input. If your PRO STEER kit is equipped with this harness, you will need the A3257 GPS Cable to receive GPS input.

This harness supplies in-cab power connection. (only to be used if the power cable cannot be connected to the hydraulic harness).

It is preferred to be left capped, and use the Hydraulic Harness power inlet connection.

## Switch box and Hydraulic Harness connections



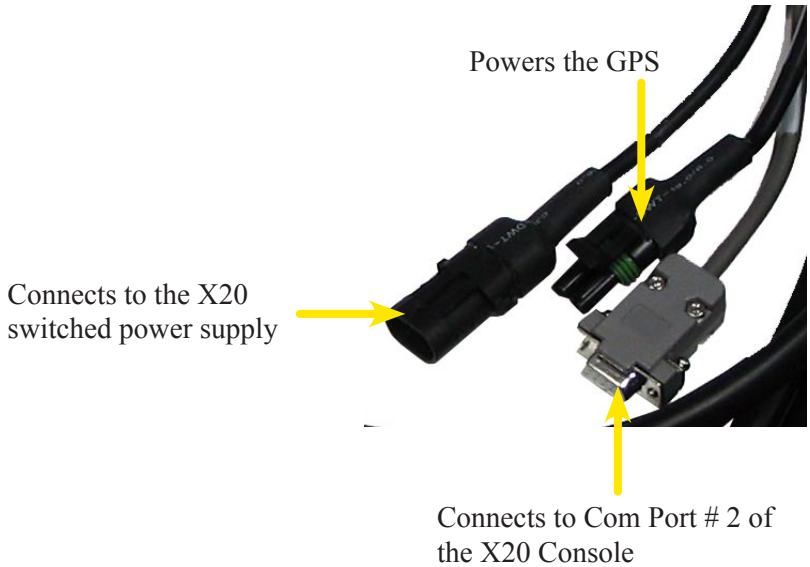
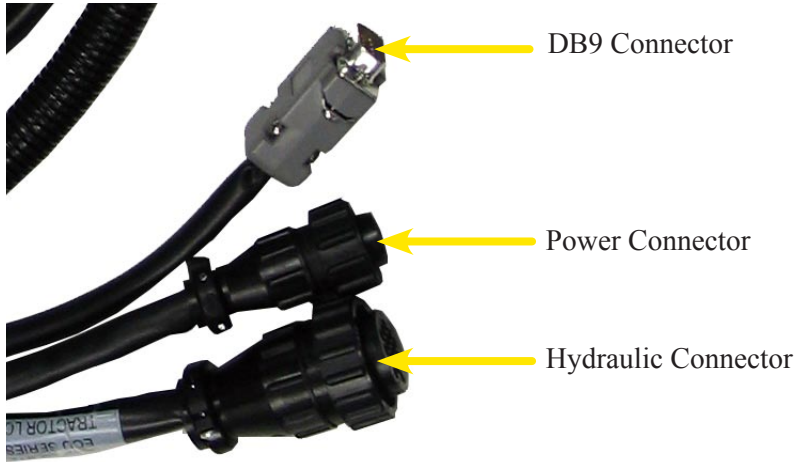
### WARNING

**Both connectors are the same, be careful when connecting, damage can occur to the ECU**





## ECU Connectors



## A2558 Series III Hydraulic Harness

Power inlet connection: This is where A2374 ( Power Harness) connects to the Hydraulic Harness.



9 Pin AMP plug: Connects the Cabin Harness (A2398) to the connection marked Hydraulic Valves.

Pressure Sensor connection fits the pressure sensor on the Series III hydraulic valve block.



Left and Right proportional valve connectors, fit onto the proportional valve on the Series III hydraulic valve block.

If the vehicle turns left (when right is selected) when testing within PROCAL, simply swap the proportional hirshman connectors over.



There are two Bosch connectors that fit to the isolation valves on the Series III hydraulic valve block.

It does not matter which isolation valve cartridge they fit, as they are wired in series.

## A2039 Switch Box



The switchbox serves several different purposes, and it is important that the switchbox is easily accessible within the cabin.

The switchbox connects to the cabin harness at the 9 pin AMP plug, be careful when connecting this, as the hydraulic harness connection is identical, both connectors are marked clearly.

**Left Switch:** This is a two position switch. It is either in the ENGAGE or DISENGAGE positions. This switch stops power to the ECU relays when in the DISENGAGE position. This is the preferred position whilst in transport.

For field operation the switch must be in the ENGAGE position.

**Right Switch:** This is a three position switch:

1. Momentary ENGAGE, to allow engagement of the steering system.
2. Central position, the switch will return to this position after the engagement has been selected.
3. Momentary DISENGAGE, this allows the operator to disengage the steering without turning the steering wheel (this activates the pressure sensor on the Series III Valve, that disengages the ECU)

## A1967 Electronic Control Unit (ECU)



PRO STEER utilises an ECU to communicate between the X20 and the hydraulic valve block, as well as the other associated components. The ECU houses the GYRO's and TILT compensators, and therefore must be mounted securely on a flat surface within the vehicle cabin.

From 2005 to October 2007 PRO STEER utilised the Series I ECU. (A1967)

From October 2007, the MK II ECU was released, and this is signified by the markings on the top decal as, PRO STEER MK II ECU. (A3030)

The MK II ECU (A3030) will require the A3257 (GPS Cable) to be fitted as the ECU imports the GPS signal direct from the GPS.

## A2907 Quick Mount Bracket



The ECU is supplied with a Quick Mount Plate (A2907) for ease of moving the ECU from one vehicle to another. It is also provided to so that the ECU has a stable mounting surface so that it is unable to move, and thus allowing the tilt/gyro sensors to work effectively.



### NOTICE

*The Quick Mount Plate is supplied with securing screws, and must be mounted to metal, NOT RUBBER flooring. Failure to secure the ECU correctly will result in poor steering performance.*



Once the Quick Mount is securely installed, place the ECU over the locating poles.



Once in place, slide the locks home around the locating poles to secure the ECU onto the mounting plate.

When locked, the ECU will be firmly attached to the mounting plate. Attempt to lift or move the ECU to ensure that locks are secure and that the ECU has been mounted properly.

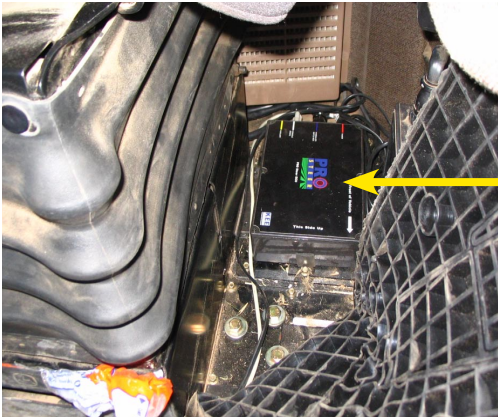
When you have confirmed that the ECU is secure, this completes the procedure for mounting the ECU.



# Installation

This chapter will explain how to install the PRO STEER system to your vehicle.

## Mounting the ECU



Showing the ECU mounted to the floor on the left hand side of the seat (as you sit in the seat), on a JD 7920 FWA tractor

The ECU Quick Mount bracket ( A2907 ) must be bolted/screwed on a flat horizontal surface, with the electrical connection of the ECU facing the rear of the vehicle.

It must not be mounted with the electrical connection side facing either side of the vehicle.

NOTICE

### NOTICE

*If it is not convenient to mount the ECU flat with the connections facing the rear, facing the connectors forward is acceptable, however the software must be configured in PROCAL to reflect this change.*

*The default setting is assumes the connections are at the rear facing to the rear of the vehicle.*

It is important that the ECU Quick Mount is screwed firmly into place, and that it does not shake or move when the vehicle is in motion.

This is due to the GYRO and TILT COMPENSATION devices within the ECU. Failure to secure the ECU will result in erratic performance of PRO STEER, and performance will be hindered.

## Mounting the Switch Box



Showing the Switch-box mounted onto the tractor console.

Secure the Switch Box in a position that places the operator in easy reach.

There are 3 methods for mounting the Switch Box:

1. Utilize the adhesive tape to directly attach to a flat surface, window etc. Clean surface before sticking.
2. Use hose clamp to secure Switch Box to a gear, hydraulic or throttle lever in easy reach.
3. Use mounting bolt to bolt directly onto a mounting plate or bracket in a convenient position.

## Cabin Harness Fitting

The A2398 Cabin Harness is a universal harness, and in some instances will be too long. In this instance the harness is not to be cut, but the excess cabling is to be coiled up in approx. 8"/20cm coils, and placed in an area of the cabin that will not cause damage to the harness.

There are 5 main leads on the cabin harness.

### 1 - ECU connections:

- The 3 connectors from the cabin harness will be fitted directly to the PRO STEER ECU(Electronic Control Unit).
- The power connection amp plug connects to the Red, power ECU connection.
- The Hydraulic valve connection, connects to the Blue ECU connection.
- The Comms connector, connects to the White ECU connection.
- The Yellow ECU connection is only utilised if a steering wheel mounted override encoder is supplied.

### 2 - X20 Connection:

The X20 connections have three connectors:

1. Comms cable must be connected to the Comm # 2 at the rear of the X20 console. This sends communication data from the X20 console and the ECU. The PRO STEER software has a default connection of Comm port 2.
2. Power connection, connects directly to the 2 pin wetherpack connection on the X20 main power lead. This is located on the X20 power cable approx. 2"/50mm from the X20 /Power connector at the rear of the X20 console. This supplies power to the ECU when the X20 console is powered up, and disconnects power to the ECU when the X20 is switched off.



## NOTICE

*This power circuit only powers a relay within the ECU that in turn powers the ECU from the main power wire that is connected to the RED connector on the ECU.*

3. GPS Connection, The GPS units supplied with the PRO STEER will have a 2 pin wetherpack connector that is connect to the Cabin Harness. This allows the GPS to be poweredup when the X20 console is switched on, and also powered down when the X20 is switched off.

### **3 - Switchbox Connector:**

The switchbox connector is a 9 pin amp plug that connects to the supplied PRO STEER swithbox. The cabin harness connection end is marked "SWITCHBOX" and cannot be confused with the hydraulic valve harness connector.

### **4 - Hydraulic Valve:**

Hydraulic Valve, connects to the hydraulic valve harness, that in turn connects directly to the PRO STEER hydraulic valve block.

### **5 - Power Connector:**

This connection is able to be used as the main ECU power source connector, which is connected to the supplied power cable that is wired directly to the battery.

The cabin harness power, 2 pin wetherpack has a protective plug fitted. If this power option is not used the plug must remain on, and is not to be used to power any other auxillary equipment.

**NOTICE**

*It is recommended that the 12V DC power is derived direct from the vehicle battery*

If the vehicle battery is inaccessible, a separate 12V DC power supply may be used provided the power supply meets the below 4 criteria:

1. The 12V DC source must not be on a circuit breaker that is in series with other electrical functions.
2. The correct power connector is used ( as per the vehicle manufacturers specifications )
3. The connection is to a constant 12V DC source, and not on the accessories side of the ignition switch.
4. 13.8V DC must be present across the power supply when the vehicle motor running and the headlights switched on. This can be verified with a voltmeter.

The power cable is able to be connected to the PRO STEER harness's at one of two connection points:

1. The first (and preferable) is to the connection point on the Hydraulic Harness. This is obviously outside the vehicle cabin and will reach to the vehicle 12v battery connection.
2. The second option is connected to the Cabin Harness. This is if connection is required within the cabin area.

The red wire in the power cables is 12V positive, and is on PIN A of the connector. PIN B is the black wire and is 12V negative.

**NOTICE**

*The power cable comes with a fuse, and under no circumstances is this fuse to be removed from the electrical circuit.*

## Hydraulic Harness Fitting

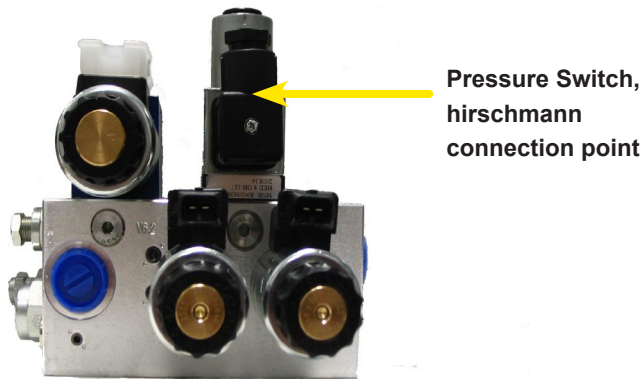
The Hydraulic harness connects to the Cabin harness with the 9 pin amp connector, the other end of this Hydraulic Harness connects to the PRO STEER hydraulic valve block.

There are 4 connections to be fitted to the PRO STEER hydraulic valve block:

### 1 - Pressure Switch:

The pressure switch connection is a Hirshmann plug, and will only fit one way on the pressure switch. Be sure to fit the supplied rubber dust seal prior to fitting the plug and tightening the retaining screw within the Hirschmann plug.

While there are two other Hirshmann plugs, you will see that these are “looped” together, and these fit the proportional valve.



## 2 - Isolation Valves:

There are two “wire retained” connectors that will fit to the isolation valves. It does not matter which isolation valve either of these two connectors are fitted to, as they both are activated by 12V at the same times.



**Isolation Valves**

## 3 - Proportional Valves:

The two Hirschmann plugs referred to in the pressure sensor connection (1) are connected to the proportional valve connectors. The Hirschmann plugs will only fit one way onto the proportional valve spade terminals.

Be sure to fit the supplied rubber dust seal prior to fitting the plugs and tightening the retaining screws within the Hirschmann plugs.

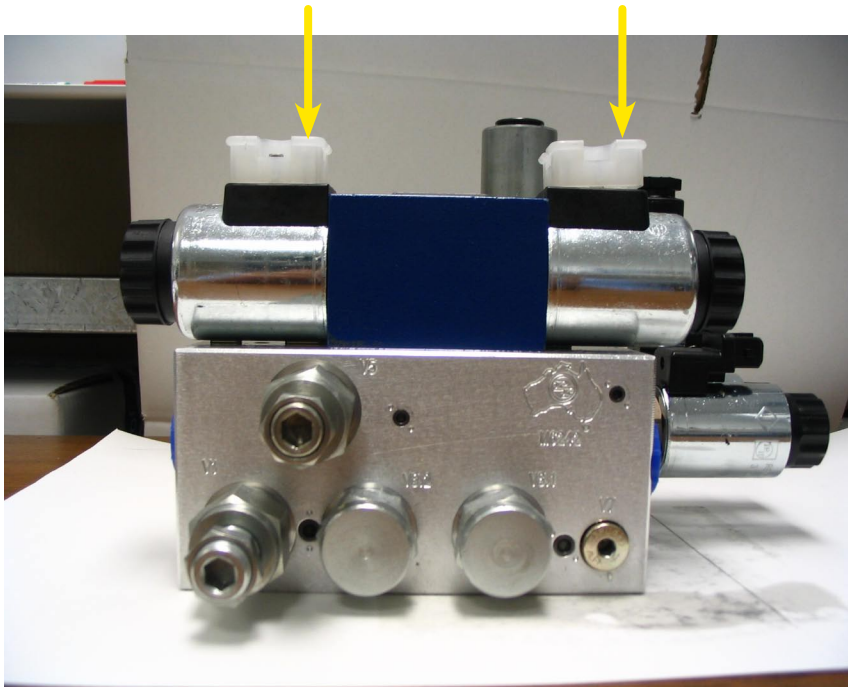
The Hirschmann plugs are able to be fitted on either proportional valve connection point, but this may result in the incorrect steering turning when the PRO STEER is activated.

The testing procedure for correct connection is carried out in the PROCAL Setup section of this manual.

Remove the protecting caps, fit the Hirshman connectors to the left and right proportional electrical fittings.

**Left**

**Right**





#### 4 - Power Connector:

This connection is able to be used as the main ECU power source connector, which is connected to the supplied power cable that is wired directly to the battery.

The hydraulic valve harness power, 2 pin wetherpack has a protective plug fitted. If this power option is not used the plug must remain on, and is not to be used to power any other auxillary equipment.



#### NOTICE

*It is preferred that the Hydraulic Harness power inlet is used, rather than the cabin power inlet connection.*



## GPS Fitting

The GPS Antenna location will vary depending on the tractor type.

On Combine harvesters, mount the antenna above the drive wheel axle.

On Articulated tractors, mount the antenna as close to the front of the cabin roof.

On Front Wheel Assist tractors, mount the antenna on any part of the cabin roof.



### NOTICE

*It is important that the antenna is placed with a clear view of the sky without obstruction. Obstructions may effect the quality of the GPS signal which will in turn effect the accuracy of the steering system*

Steering will be deminished if this mounting of the antenna is not taken into account.



## GPS Console

The GPS requires fitting in the cab in any convenient position. The power to operate the GPS comes from the PRO STEER Cabin Harness, and the connection point will be at the rear of the X20 console.

This power connection ( 2 pin wetherpack) supplies power when the X20 console is switched on, discontinues power when the X20 console is turned off.

The Antenna cable should be run into the cab avoiding any sharp bends and connected to the GPS console. The Communications cable should also be connected at the rear to Port A (if GPS has a Port A and Port B) or the appropriate socket and this connects to the X20 into Com 1.

When using MK II ECU's, utilise the A3257 GPS cable, so that the ECU will have GPS data feed as well.

Run the power and communications cable together to the rear of the X20 console.

The DGPS unit must be configured to the following data outputs.

Baud Rate of 19200

Output of 5Hz

NMEA Data String GGA 5Hz

NMEA Data String VTG 5Hz



### NOTICE

1. *X20 console, Topcon GPS, 10hz is recomended. Any other GPS, set them at 5Hz.*
2. *X15 console, any GPS, 5Hz is recomended*

# Notes:

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# PROCAL Setup

PROCAL is the software that controls your PRO STEER hardware. This chapter will explain how to configure PROCAL.

## Access the PROCAL software

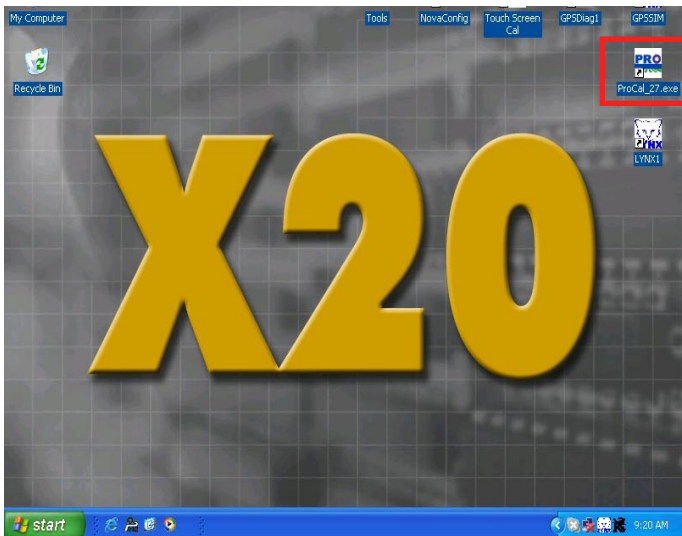
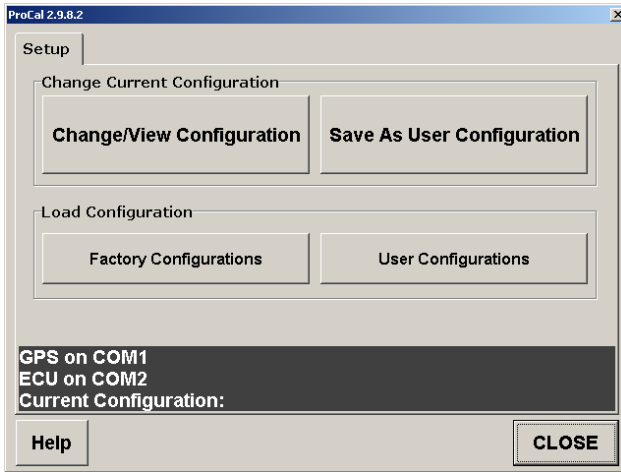


Figure 4-1. X20 Desktop

1. Double-Tap (Double-Click) the PROCAL icon located on the X20 desktop (figure 4-1)
2. Wait for the “hourglass” icon to appear (normally two/three seconds) and the program will begin to load

## Initial Vehicle Selection



**Figure 4-2. PROCAL Setup screen**

The screen shown in figure 4-2 will appear when the PROCAL software has loaded

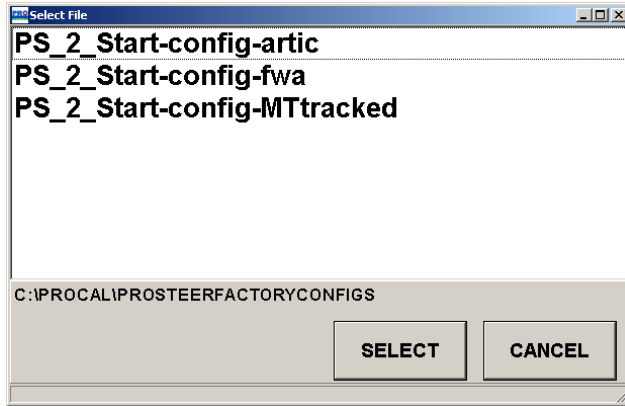
If the PRO STEER hardware has been installed properly, the grey area on the lower part of the screen should state that the GPS is being seen and registered on COM 1, and also that the ECU is being communicated with on COM 2 of the X20 console.

### **Change Current Configuration**

To change or view the calibration settings select the **Change/View Configuration** button.

### **Load Configuration**

Factory Configurations: these are settings that have been preset by Equipment Manufacturers, so that their equipment powered by PRO STEER are able to be configured quickly and to a known set of parameters.



### NOTICE

*Select a vehicle configuration that resembles closest the machine that the PRO STEER is about to be tuned to. Do not select a vehicle configuration that is completely different. For example, do not select Articulated if your PRO STEER is mounted to a Front Wheel Assist tractor. This will cause the steering to be unstable.*

User Configurations: are the settings that the user has defined as being correct for their particular machines, and are able to save the calibration settings of their particular vehicles. They are then able to quickly reset the ECU if changing from one vehicle to another.

## GPS Validation

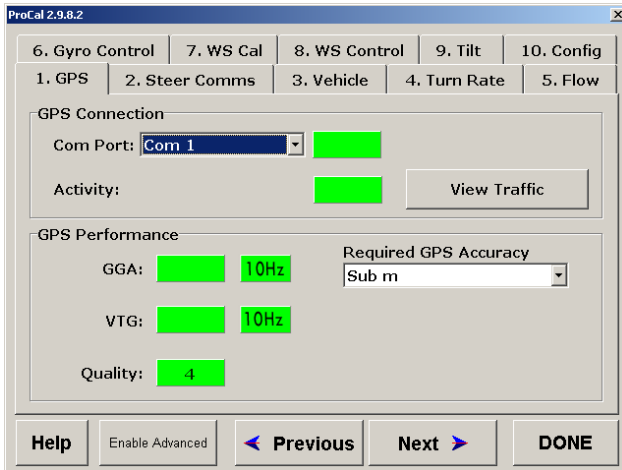


Figure 4-3. GPS tab

When the PROCAL program starts, this is the first screen that appears, and is the first check that is made.

### PORT:

The default setting is COM Port 1.

If the DGPS is connected into COM Port 1, the corresponding indicator will be green. If this is incorrect, the indicator will be red.

DO NOT PROCEED if the status indicator is not green.



**GGA:**

PRO STEER needs to receive the GGA data string at 5 Hz from the DGPS.

Indicator must be green to proceed. If indicator is Yellow, GGA is being received but not at 5Hz, If indicator is Red, GGA is not being received at all.

DO NOT PROCEED if the status indicator is not green.

NOTE: The indicator may occasionally flash Yellow, this is OK.

**VTG:**

This has the exact same requirements as the above ( GGA 5Hz )

DO NOT PROCEED if the status indicator is not green.

**Quality:** This number indicates the DGPS signal accuracy.

Quality	Description
1	10m (30ft), Autonomous GPS
2	Sub Metre (3 feet), VBS
3	(PPS fix, Military P code)
4	2cm (1inch), RTK
5	10cm (4inch), HP or RTK float
7	Novatel is acting as a Base

**View Traffic:**

With all of the status icons green, the View Traffic option is able to be selected. This allows for the DGPS NEMA data streams to be viewed.

This is used by the customer service centre for diagnostic reasons, and will not be explained within this manual.

**Required GPS Accuracy:**

From the drop down scroll, select the GPS differential that is being used on the PRO STEER.

The steering will work if the incorrect source is selected, but there will be warnings appear on the runtime screen if the correct one is not selected.

## Harness Communication Validation

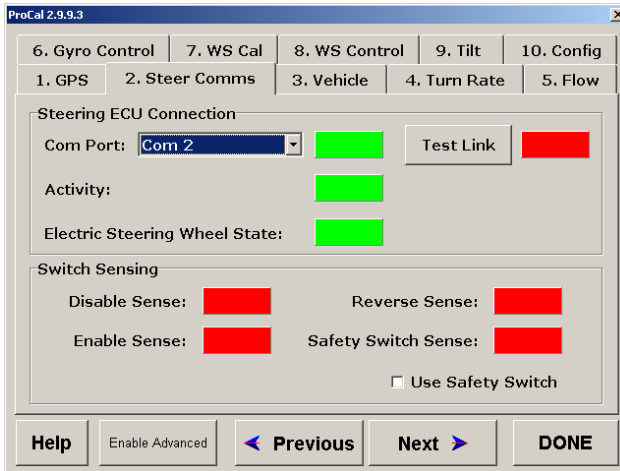


Figure 4-4. Steer Comms tab

### Steer Comms tab

This tab is selected to determine that the PRO STEER ECU is communicating correctly with the PRO STEER software within X20

**COM PORT:** The default setting is COM 2, and if the ECU is connected into COM 2, the corresponding status indicator will be green. If it is incorrect the indicator will be red. The status indicator must be green to proceed.

**Electrical Steering Wheel State:** This option appears when *Using Electric Steering Wheel* is enabled under the **Vehicle tab** (refer to page 4-9)

**Disable Sense:**

PRO STEER uses an operator controlled switch box to “Enable” and “Disable” the automated steering. The switch status is able to be checked by the colour of the corresponding status indicators. When the switches are selected to DISABLE, the status indicator will turn green. If the indicator does not change colour, the switchbox is either not connected, or is faulty. The status indicator must turn green when the disable switch on the switchbox is activated, and return to Grey after the switch is returned to the “neutral” position. The same events occur when turning the steering wheel, and the pressure sensor activates the disable sense

**Reverse Sense:**

When the vehicle is to be used with the reverse feature in row cropping etc, this icon allows the reverse signal switch to be checked for operation. When the switch is activated, the icon will turn green. If the indicator does not change colour, the switchbox is either not connected, or is faulty.

**Safety Switch Sense:**

When the seat switch is activated (the wires are opened within the switch, meaning the operator has left the seat) the icon will turn green and the steering will be disabled.

**Enable Sense:** This status indicator works the same as the Disable Sense indicator. When the momentary enable switch is activated on the Switch Box, the status indicator must turn green.

When the momentary enable switch is released the status indicator will turn grey.

The above status indicator changes must be observed prior to proceeding.

**Test Link:** When this button is selected, the status indicator will turn green, to signify that the PROCAL program is communicating with the ECU. The version number of firmware embedded into the ECU will appear within the status indicator.

MK I ECU = 2.21 and 2.34

MK II ECU = 3.84A

## Toggle Switch Information



### Engage: (Right Switch)

Momentary switch, that is used to engage the steering. Push the switch up, it will engage the Auto Steering and return to the centre position

### Disengage: (Right Switch)

Push the switch down, and the steering will be disengaged. The switch will return to the center position. This is used for a quick disengage if there is not an oil pressure or steering wheel disengage sensor installed.

### Transport Disengage: (Left Switch)

This switch will disconnect power to the hydraulic valve drives within the ECU when switched DOWN. This will mean the steering will be disengaged, and cannot be engaged unless the switch is moved to the UP position.



## WARNING

**The transport disengage switch must be in the DOWN position when the vehicle is in transport mode (ie: when travelling on roads, and not in the field) to prevent accidental activation of the auto-steering system**

## Vehicle Tab

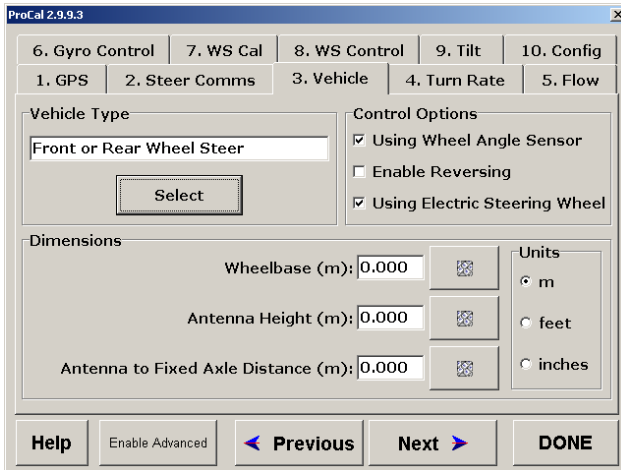


Figure 4-5. Vehicle tab

### Vehicle Type:

Select the vehicle type that best matches the vehicle you are currently configuring your steering system for. You may choose between 3 presets which are Front or Rear Wheel Steer, Articulated or Tracked.



### NOTICE

*When Tracked is selected as the Vehicle Type, the WS Cal and WS Control tabs are automatically disabled since Tracked vehicles do not use Wheel Angle Sensors.*

### Control Options:

Tick the box next to **Using Wheel Angle Sensor** to enable the WS Cal and WS Control tabs. This allows you to then calibrate your Wheel Angle Sensor if your vehicle is equipped with one.

Tick the box next to **Using Electric Steering Wheel** to enable the use of the Electric Steering Wheel.

**Units:**

Select your desired units of measurement. This will determine the units used when measuring your Wheel Base, Antenna Height and Antenna to Fixed Axle Distance.

**Wheel Base :**

This is the measurement from the front axle to the rear axle on all vehicles. To enter this value, simply select the calculator icon on the corresponding line, and type in the correct measurement. Do not forget the decimal point.

**Antenna Height:**

This is the measurement from the ground to where the DGPS antenna is positioned. To set the height, simply select the calculator icon on the corresponding line, and enter the correct measurement.

**Antenna to Fixed Axle Distance:**

This distance is measured from the antenna to the “drive wheels” of the Front Wheeled Assist tractor, or combine harvester. For Articulated vehicles, set at 0.5 and place the antenna above the front axle.

For FWA tractors, measure the antenna to rear axle distance and deduct 40% of the measured value from result.

Example: Antenna to rear axle distance = 1.6m

$$\text{Antenna height} = 1.6\text{m} - (0.4 \times 1.6) = 0.96\text{m}$$

For Articulated tractors, enter the the actual horizontal distance from the antenna to the front drive axle.



**NOTICE**

*Do not forget the decimal point. This is important and must be entered in to the nearest centimeter (1/2 inch)*

## Hydraulic Validation

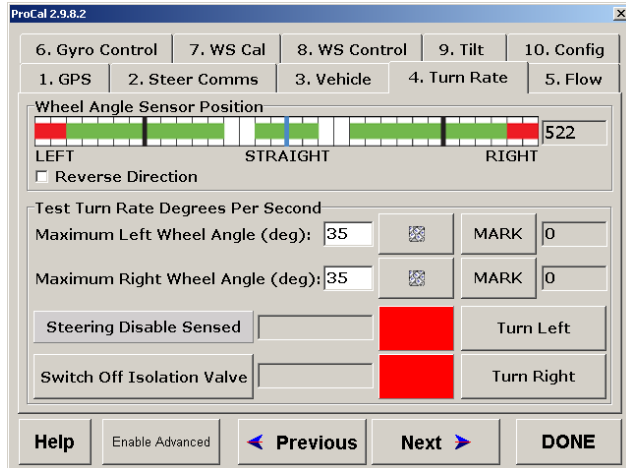


Figure 4-6. Turn Rate tab

### Turn Rate tab

This step is used to determine that the hirschman electrical connections are fitted correctly to the hydraulic valve, and also to check that the valve speed is acceptable.



### NOTICE

*the Switchbox must be in the engage/run positions for this function to activate. This function will not work if the switchbox is not activated or connected.*

**Reverse Direction:** When setup correctly, the blue bar indicating the Wheel Angle Sensor position should move in the same direction the steering wheel is turned. This means that if the steering wheel is turned left, the blue bar will move to the left and vice versa. Tick the box next to **Reverse Direction** if you find that the blue bar is moving in the opposite direction of the direction that the steering wheel is turned.

**Steering Disable Sensed:** This feature allows the calibrating technician to ensure that the pressure sensor is not being activated whilst the PRO STEER is trying to turn the wheels. If the coloured icon turns Green in this operation, the sensor will require adjusting.

**Switch Off Isolation Valve:** This option is used to check if the isolation valve is working. To turn the wheel, the button on this page needs to be depressed. Ensure that the isolation valve is turned back on after the test by pressing the button again.

**Wheel Angle Sensor Position:**

Drive your vehicle at around 4kph (2.5mph) and when ready, turn your steering wheel full lock to the left. When the steering wheel is fully locked, select the first **MARK** button (Figure 4-6) to record the maximum left turning angle.

A confirmation window will appear. Select **YES** to confirm the recorded angle or select **NO** to cancel and take a new reading.

Repeat this procedure with the steering wheel fully locked to the right. Select the second **MARK** button (Figure 4-6) to record the maximum right turning angle.

A confirmation window will appear. Select **YES** to confirm the recorded angle or select **NO** to cancel and take a new reading.

**Test Turn Rate Degrees Per Second:**

Select and hold the **TURN LEFT** button until the wheels are fully locked to the left.

Drive forward at approx 3kph (2mph) and select **TURN RIGHT**.

Hold down the **TURN RIGHT** button until the wheels are fully locked to the right.

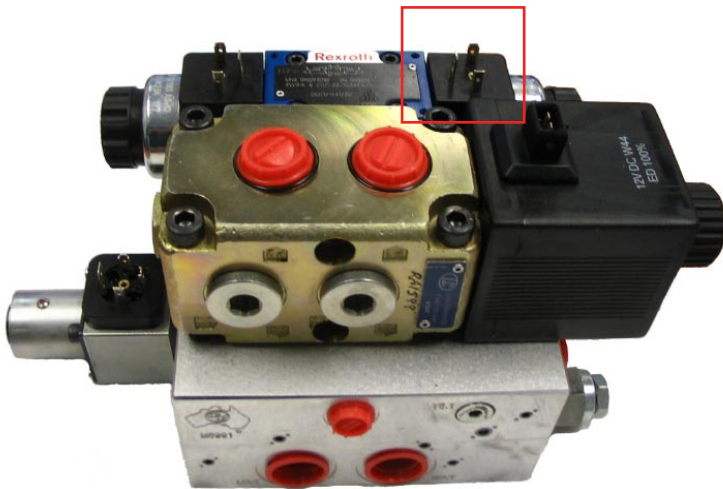
When the process is complete, a measurement of degrees/per second will appear in them.



The figure that will be shown will differ for every machine, from 4>8 degrees on articulated vehicles, to 10>20 on some FWA vehicles. It is not uncommon to see different flows for the left Vs the right hand turn.

If the calibration process is halted through this procedure, simply redo the step on the previous page.

This step also confirms that the Hirschman plugs have been connected to the PRO STEER hydraulic valve block in the correct manner. If the steering operates left, when right is selected, and vica versa, simply swap the Hirschman plugs around.



**Showing the Hirschman plugs on a Series 4 hydraulic manifold**

## Hydraulic Minimum Setting

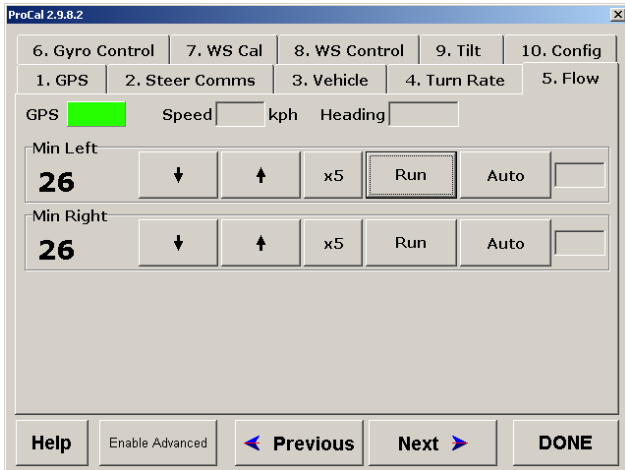


Figure 4-7. Flow tab



### NOTICE

*The following settings are very important and have a large influence on the steering accuracy and stability of the PRO STEER on this vehicle.*

If the Min Left and Min Right are set too low, the vehicle may drift off the centre line regularly. If these settings are too high, the system may become too aggressive and over and undershoot across the centre line.

PRO STEER utilises Proportional Valve controls, which gives greater, smoother control over the hydraulic oil flow. Setting Min Left and Min Right must be performed accurately to achieve constant smooth steering control.

This is to determine the minimum % of PWM (electric power) to open the valve enough to start oil flow. The tractor hydraulic steering circuit can be quite complex with all tractors varying in pressure and flow to actually turn the wheels. Sometimes restrictions may exist in the circuit

which will require more pressure to initiate a turn.

**Setting Min Left and Min Right:**

Drive forward at around 6kph (4mph) with the engine at normal operating revs. and the oil at normal operating temperature.

With the wheels in the straight ahead position, press and hold the **Run** button adjacent to the Turn Left slide. If the wheels begin turning immediately, reduce the indicated number with the down arrow button and press **Run** again.

Continue this until, when pressing the button it does not start turning the wheels. The final setting should be that after a 3 second press, the start of a small movement should be noticeable.

You have now just set the valve at minimum flow for the Left Hand turn.

Repeat this for the Right.

The Min Left and Min Right settings can be different, sometimes up to 4 points.

**Auto Tune for Mins:**

Set Mins (either Left or Right depending on which one you are setting first) at 22 and drive forward at around 6kph (4mph).

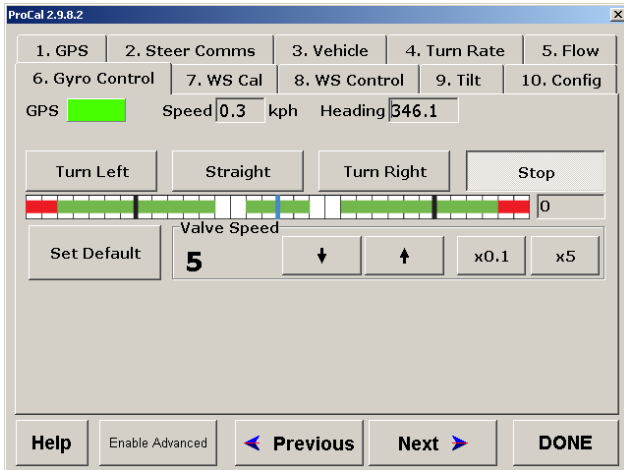
Select **Auto** - The software will make adjustments until sufficient movement is detected. The R/H Box will turn green and the Min will be set at a value the software considers suitable.

This must be done when setting both Min Left and Min Right.

To test manually after Auto has set the Mins, drive straight at 6kph (4mph) then press and hold the **Run** button.

If set correctly, the vehicle should begin turning in that direction (either left or right depending on which you are testing) within 2 to 3 seconds.

## Gyro Control



**Figure 4-8. Gyro Control tab**

This page is used to allow PRO STEER to tune itself to the hydraulic steering of the tractor it is fitted to.

Select the Set Default button to apply the default settings of the vehicle type you selected before.

The valve speed should be set at a minimum value that allows the tractor to be steered responsively without undue oscillation in the wheels. Usually the default value is sufficient however you may adjust the settings to suit your preference.

If the valve speed is set too high, this can cause your wheels to oscillate during steering.

If the valve speed is set too low, this can cause your steering system to be sluggish and non-responsive.



## NOTICE

*When setting the valve speed, it is important not to increase the valve speed too rapidly. Doing this can cause the vehicle to jerk and oscillate very suddenly. Always increase the valve speed value gradually watching for a response from the steering system.*

### Setting up Valve Speed

1. Select STRAIGHT and operate the machine at the intended operating speed.
2. Adjust the Valve Speed UP, until the wheels just start to oscillate.
3. Lower the Valve Speed, so that the oscillation just stops.

## Wheel Angle Sensor Calibration

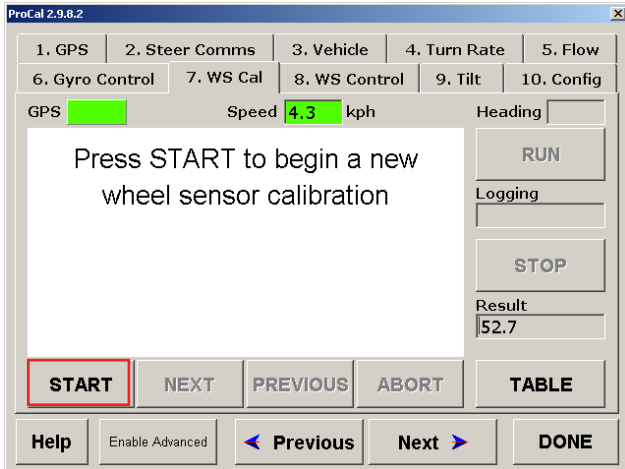


Figure 4-9. WAS Calibration tab

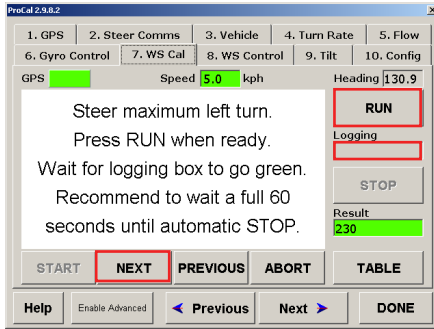
The Wheel Angle Sensor Calibration tab is fairly straight forward. The on-screen prompts will guide you in calibrating your wheel angle sensor.

To perform the Wheel Angle Sensor calibration effectively, the GPS must be operational and updating and 5Hz or higher. If the update rate is not fast enough, the Wheel Angle Sensor Calibration will be unsuccessful.

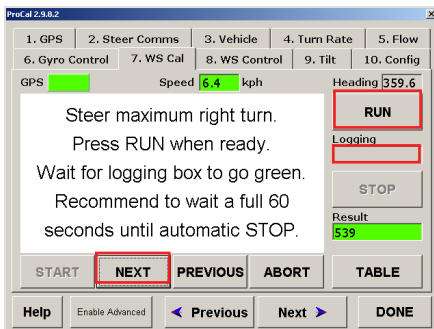
Also, in order to perform the Wheel Angle Sensor Calibration, an area of at least 100m x 100m is required.

Once the above requirements have been confirmed, begin driving your vehicle straight at approximately 6kph (4mph) and select **START** to begin the Wheel Sensor Calibration procedure.

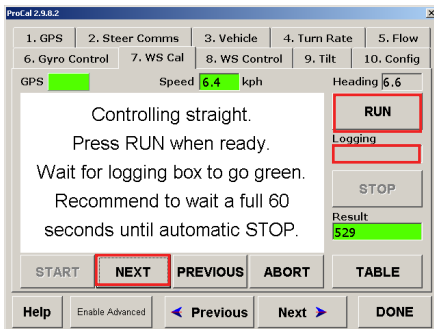
## WAS Calibration Procedure



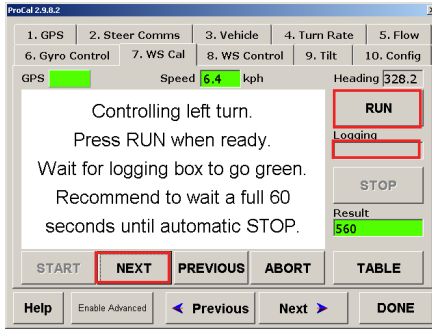
1. Turn your steering wheel to the left until locked and press **RUN**
2. The logging bar will display red initially and turn green once it begins logging
3. Once it turns green, wait at least 60 seconds or until logging stops automatically
4. Select **NEXT** when logging is complete



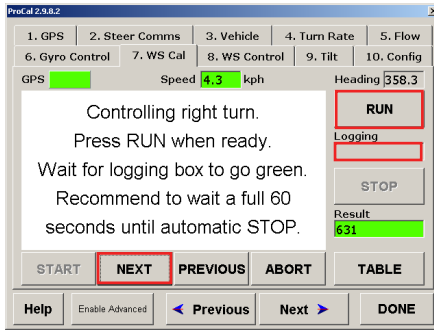
1. Turn your steering wheel to the right until locked and press **RUN**
2. The logging bar will display red initially and turn green once it begins logging
3. Once it turns green, wait at least 60 seconds or until logging stops automatically
4. Select **NEXT** when logging is complete



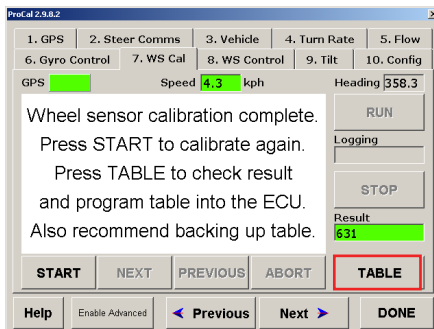
1. Return your steering wheel to center position and press **RUN**
2. The logging bar will display red initially and turn green once it begins logging
3. Once it turns green, wait at least 60 seconds or until logging stops automatically
4. Select **NEXT** when logging is complete



1. Steer straight and press **RUN**
2. The wheels will turn to the left automatically
3. The logging bar will display red initially and turn green once it begins logging
4. Wait at least 60 seconds or until logging stops automatically
5. Select **NEXT** when logging is complete

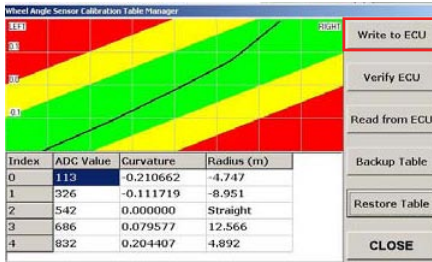


1. Steer straight and press **RUN**
2. The wheels will turn to the right automatically
3. The logging bar will display red initially and turn green once it begins logging
4. Wait at least 60 seconds or until logging stops automatically
5. Select **NEXT** when logging is complete

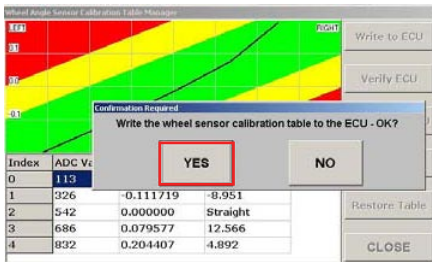


1. When you get this screen, this indicates that the Wheel Angle Sensor calibration procedure is complete
2. Select **Table**

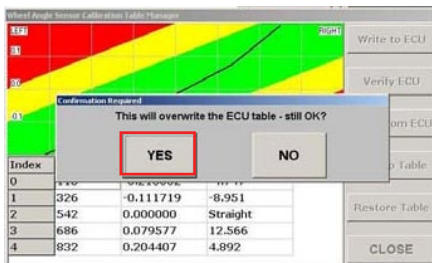




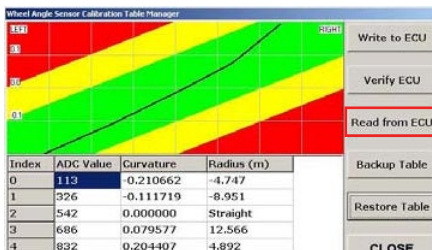
1. The calibration file needs to be loaded into the ECU and a copy saved on the X20
2. Select **Write to ECU**



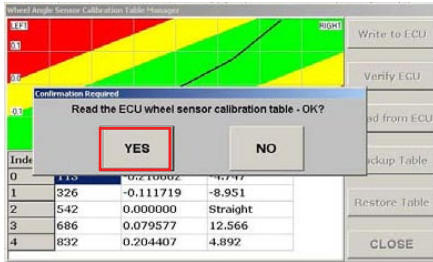
1. A confirmation window will appear
2. Select **YES** to confirm



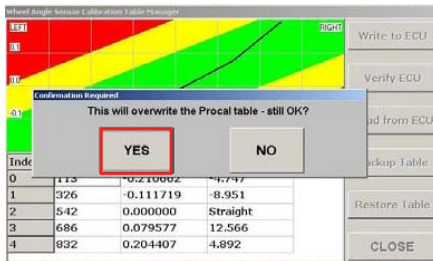
1. Another confirmation window will appear
2. Select **YES** to overwrite the ECU table



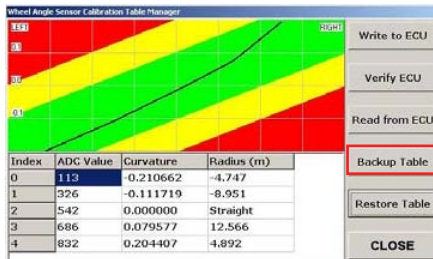
1. Select **Read from ECU** to ensure that the values have been loaded correctly



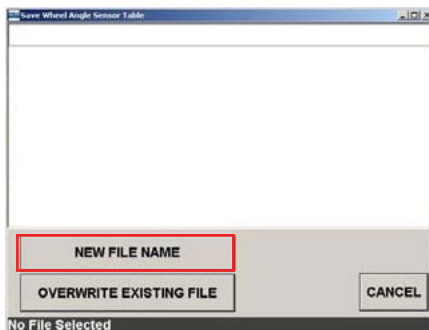
1. A confirmation window will appear
2. Select **YES** to confirm



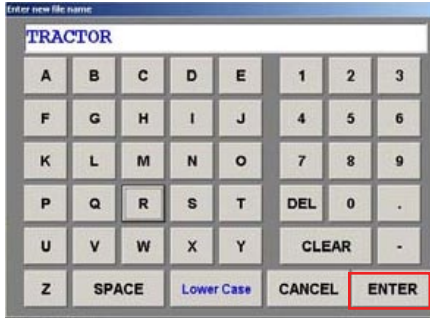
1. Another confirmation window will appear
2. Select **YES** to overwrite the PROCAL table



1. Confirm that the table loaded into the ECU is the same as the table that has been read from the ECU into PROCAL
2. Once you have confirmed they are the same, select **Backup Table** to save your table for future use



1. Select **NEW FILE NAME**



1. Type in a name that will allow you to easily reference the file for future use. Recommended names include the name and model of the tractor the calibration was performed on
2. Select **ENTER** to confirm

This completes the Wheel Angle Sensor calibration.

## Wheel Angle Sensor Control

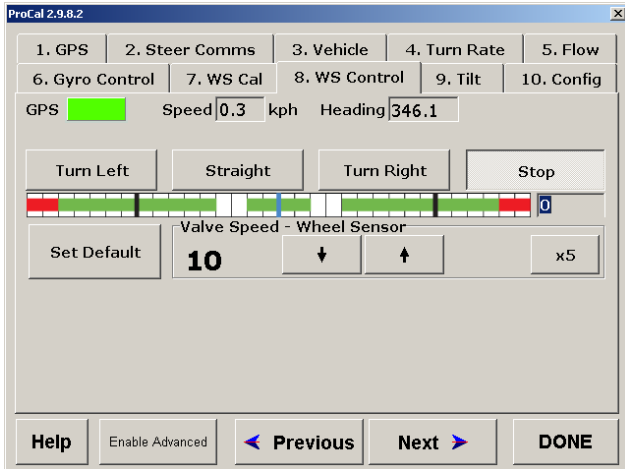


Figure 4-10. WAS Control tab

Use this page to set the wheel angle sensor valve speed for your steering system.

Select the **Set Default** button to apply the default settings of the vehicle type you selected before.

Usually the default value is sufficient however you may adjust the settings to suit your preference.

If the valve speed is set too high, this can cause your wheels to oscillate during steering. If the valve speed is set too low, this can cause your steering system to be sluggish and non-responsive.



## NOTICE

*When setting the valve speed, it is important not to increase the valve speed too rapidly. Doing this can cause the vehicle to jerk and oscillate very suddenly. Always increase the valve speed value gradually watching for a response from the steering system.*

### **Setting up Valve Speed.**

1. Select STRAIGHT and operate the machine at the intended operating speed.
2. Adjust the Valve Speed UP, until the wheels just start to oscillate.
3. Lower the Valve Speed, so that the oscillation just stops.

## ECU Orientation / Identification

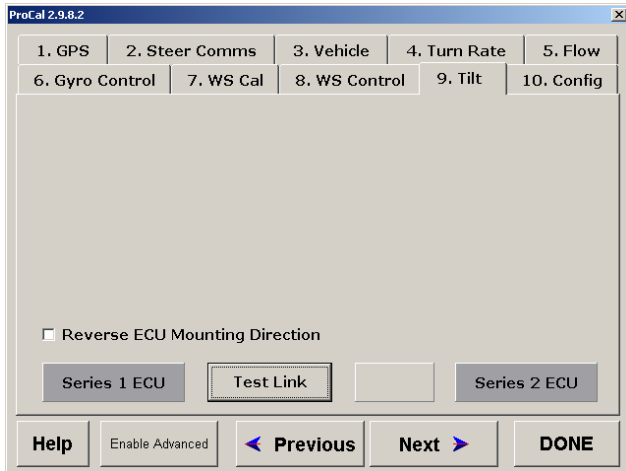


Figure 4-11. Tilt tab

### Reverse ECU Mounting Direction:

The software is default set to have the ECU mounted with the ARROW on the top decal to be facing the front of the vehicle. If the ECU has to be mounted with the ARROW to the rear of the vehicle, simply touch the Reverse Box Direction box and an arrow will appear.



### NOTICE

*The ECU cannot be mounted with the orientation arrow any other way than either towards the vehicle front or rear, due to the directional GYROs and TILT sensor.*

The software will automatically detect the ECU that it is connected too. Series I ECU's were released at the conception of PRO STEER. Series II ECU's were released October 2007, and are clearly marked on the cover housing as Series II.

## Operating Software DLL

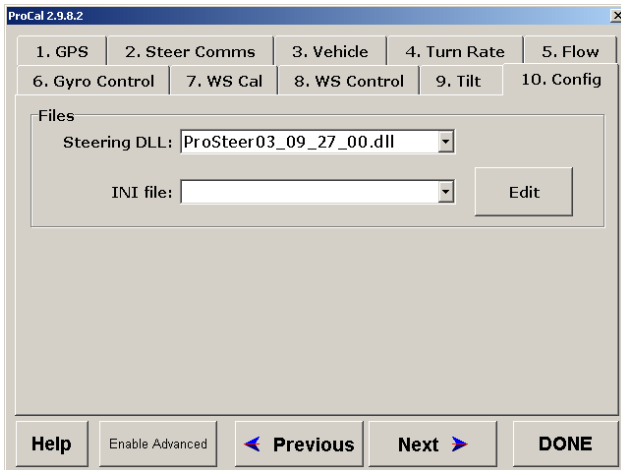


Figure 4-12. Config tab

### Files:

The config step is utilised to select the version of PRO STEER software to be used within the X20 console. Over time there will be upgrades to the software, and this selection allows the operator the choice of software to be used with each particular vehicle.



### NOTICE

*PRO STEER 03\_09\_27\_00.dll is the current release PRO STEER dll being used as of March 2009 and is only for use with MK II ECUs.*

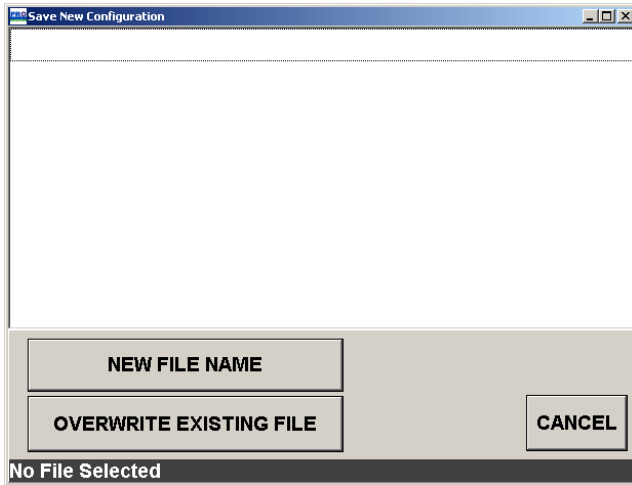
### Help:

The contents of this manual, in word form text is displayed upon selecting this button

### Done:

The PROCAL program will be closed once this button is selected, and the screen will return to the Desktop.

## Saving Vehicle Configuration



**Figure 4-13. Save New Configuration**

Once the PROCAL setup has been completed, the screen in figure 4-13 appears on the exit of PROCAL

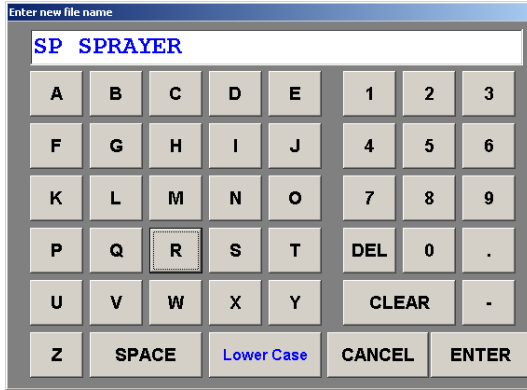
Note: This is saving into User Configurations

Select the **NEW FILE NAME** button if you are not altering a known machine. This is the name that you will be able to recall these particular settings.

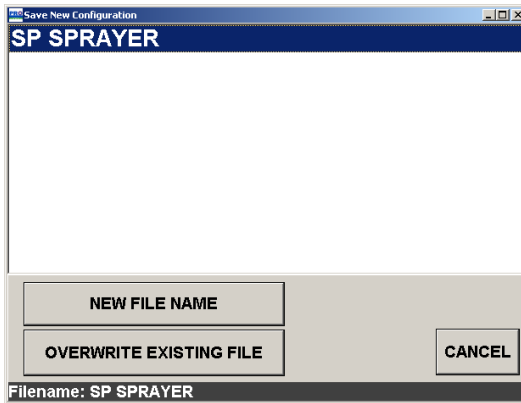
If the **NEW FILE NAME** button is selected, type in a name for your calibration file.

It is recommended that you type in the name of the machine that you are calibrating for easier future reference, however this is not necessary.





**Figure 4-14. Enter New File Name**



**Figure 4-15. Overwrite Existing File**

If you are altering a previous tune set for a particular machine, **HIGHLIGHT** the machine in question, and select the **OVERWRITE EXISTING FILE** button

The file will be overwritten and saved in the USER CONFIGURATION folder, and this configuration can be selected when the console is refitted to the vehicle, if being used in multi-vehicle operation..



# Field Tuning

Once the basic settings have been entered in the PROCAL program, the vehicle must be individually tuned to achieve the best steering results.

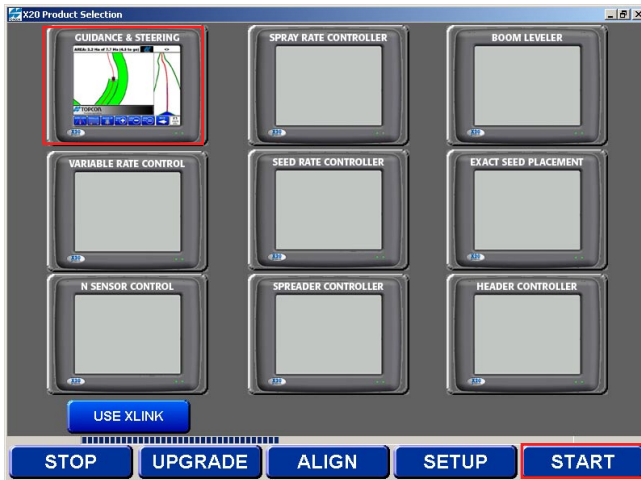


Figure 5-1. X20 Product Selection screen

1. From the X20 desktop, select the LYNX icon to access the *X20 Product Selection screen*
2. Select the **Guidance & Steering** software (figure 5-1)
3. Select **START** (figure 5-1) to load the software

## Tuning Software Access

When initially setting up the steering, the first thing you must do is, set a parallel A-B line. This is covered in the guidance manual.

Once this is done, select the **Wrench icon** from the selection at the base of the console.



Figure 5-3. Access Steering setup

Once selected, the below screen appears, and adjustments can now be made to the steering performance

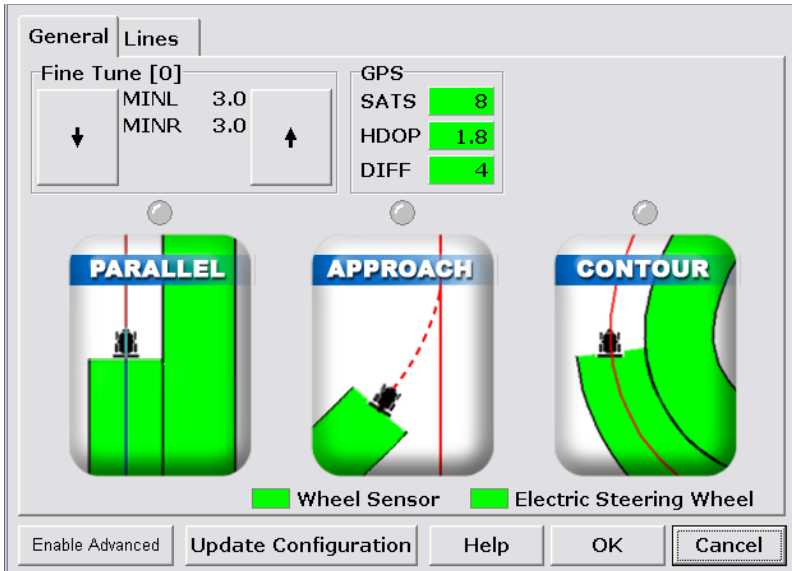


Figure 5-4. Steering Setup screen

## General Tab

From this screen the operator can adjust the steering performance, while at the same time, monitor the GPS input.

Once the steering is tuned properly, access to this screen will be rarely required, unless the operator wishes to change the steering characteristics.

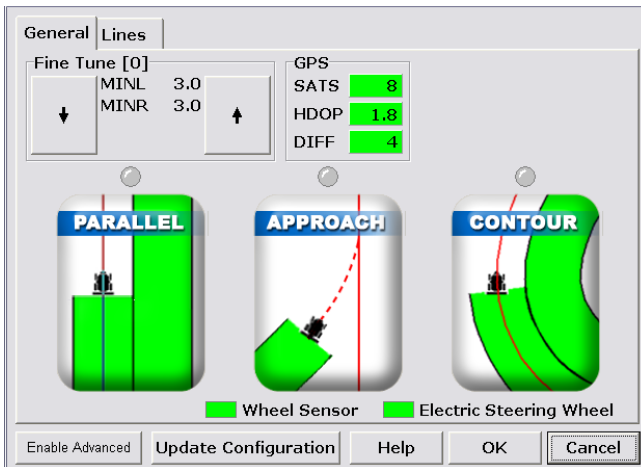


Figure 5-5. General tab

**Enable Advanced:** This button allows dealers and suitably trained technicians to gain access to the advanced settings within the PRO STEER. This is covered in dealer manuals only.

**Update Configuration:** When this button is selected, the changes that have been made to the steering are saved, so when the console is shut down the adjustments made will not be lost.

**Help:** Selecting this button will show text as to what functions this screen has to offer, and how to use them.

**Fine Tune:** The figures stated here are exactly what was entered in PROCAL when the hydraulic minimums were settled upon. Due to oil changing viscosity from being cold to hot, adjusting the values in this area can be done when in the steering mode.

This function is rarely used, and is left within the software for extreme cases only.

**GPS:** The three figures shown when GPS is fitted, allow the operator to determine the GPS quality and accuracy required for the steering to perform at its optimum performance.

**Sats:** Indicate the number of GPS satellites being used by the software. If there is insufficient satellites in view, the surrounds will be GREY, if there is sufficient satellites, the surrounds will be GREEN, and the number of satellites will be shown. If the satellite numbers are down, an audible warning will be sounded.

**HDOP:** This reading designates the possible inaccuracies of the GPS. As the number of satellites drop, the HDOP will rise. Also, if the constellation of satellites is in a poor configuration, the HDOP will rise. Basically, the higher the HDOP, the poorer ground position will be. If the HDOP rises too high, the surrounds will change from GREEN to GREY. Again, if the surrounds are GREEN, every thing is OK. If the HDOP rises to an unacceptable level, an audible warning will be sounded.

**DIFF:** The differential number signifies what GPS accuracy you entered within PROCAL. If you are using VBS/WAAS/Marine Beacon/EDIF/JD, the number will be shown as 2. Decimeter and RTK float will be read as 5. RTK will be read as 4. To know that the GPS is functioning correctly the DIFF reading should be surround coloured in GREEN. If the differential quality changes, the surround colour will change to grey, and an audible warning will be sounded.

Bottom line with the GPS indicators, all surround colours should be GREEN, if they are not, either the incorrect GPS has been entered, or the satellite constellation is poor.

There are three main adjustment areas available from this screen, and the adjustments can be made whilst the vehicle is steering to the line:

1. **Parallel:** Enables adjustment so the machine steers to optimum level on a parallel line.
2. **Approach:** Enables the adjustment of the steering whilst approaching the parallel line.
3. **Contour:** Allows adjustments to the steering when steering to a curved line.

## Parallel Adjustment

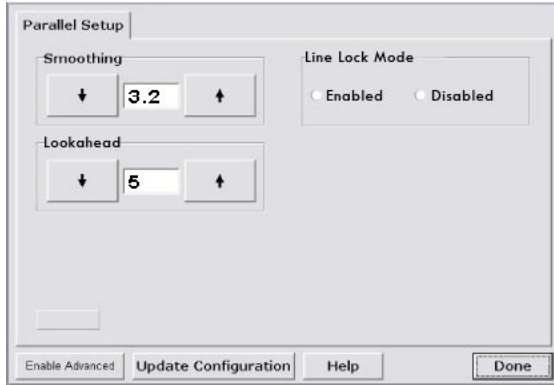


Figure 5-6. Parallel button

To utilise this function (adjust steering performance of parallel), firstly set a parallel line. Set point A, drive at least 20m (60 yards) and then select point B, and then PARALLEL.

This will give you a parallel line to steer to. Engage the steering and increase the vehicle speed to working speed.

Select the **Wrench icon** (figure 4-3) to access the *Steering Setup screen*, and select the **PARALLEL** button (figure 4-6).



**Figure 5-7. Parallel Setup**

There are two adjustments that can be made to improve the steering characteristics.

**Smoothing:**

This feature relates to how far the software is looking in front of the vehicle. The lower the value the closer it looks and the higher the value the further out it looks. Lowering the figure (0.5 - 1.0) will result in short oscillations.

Raising the figure will “smooth” the the adjustments, but if it is raised too high, slow wanders down the line will be observed. The system will generally use Smoothing at higher speeds and switch to Lookahead at lower speeds.

When smoothing is being used by the software, the box indicating the current smoothing value will be green

**Lookahead:**

Similar to Smoothing, the software uses the Lookahead to determine how far to look in front of the vehicle when the moving at lower speeds. The lookahead value is always in meters.

The software will determine automatically when to use the Lookahead value or Smoothing value depending on the speed that the vehicle is travelling. When Lookahead is being used by the software, the box



indicating the current lookahead value will be green.

**Line Lock Mode:**

Line Lock Mode is enabled by default and can be set based on your preference. When enabled, this will cause your PRO STEER system to steer ONLY to the line that your vehicle was on when steering is engaged

For example, if Line Lock Mode is enabled and steering is engaged while you are on the first row; your PRO STEER system will steer the vehicle back to the first row when steering is re-engaged, no matter where you are on the field.

If Line Lock Mode is disabled, the vehicle will steer onto the closest line available when steering is engaged.

Once you are satisfied with your settings, select the **Done** button to return to the *General page*.

## Approach Adjustment



**Figure 5-8. Approach button**

To utilise this function (adjust steering approach to the line), firstly set a parallel line. Set point A, drive at least 20m (60 yards) and then select point B, and then PARALLEL.

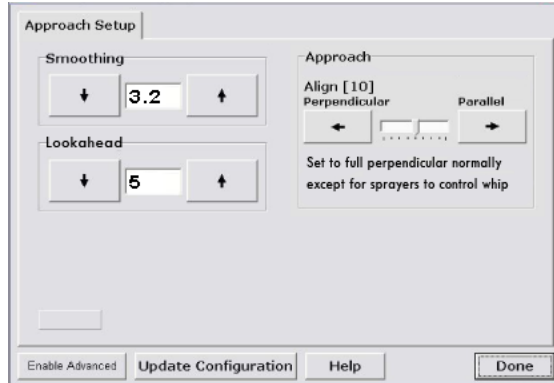
This will give you a parallel line to steer to. Engage the steering and increase the vehicle speed to working speed.

Select the **Wrench icon** (figure 4-3) to access the *Steering Setup screen*, and select the **APPROACH** button (figure 4-8).

Turn at the end of a parallel run, and approach the next runline as you would normally do in the field. Engage the steering when the runline is at a figure of less than 30 degrees to the direction of travel.

If the machine is articulated, having the articulation point straight will help the steering achieve a short distance approach.

Going over the intended line prior to engagement will lengthen the distance that the steering achieves the line.



**Figure 5-9. Approach Setup**

There are two adjustments that can be made to improve the steering characteristics.

### **Smoothing:**

This feature relates to how far the software is looking in front of the vehicle. The lower the value the closer it looks and the higher the value the further out it looks. Lowering the figure (0.5 - 1.0) will result in short oscillations.

Raising the figure will “smooth” the the adjustments, but if it is raised too high, slow wanders down the line will be observed. The system will generally use Smoothing at higher speeds and switch to Lookahead at lower speeds.

When smoothing is being used by the software, the box indicating the current smoothing value will be green

### **Lookahead:**

Similar to Smoothing, the software uses the Lookahead to determine how far to look in front of the vehicle when the moving at lower speeds. The lookahead value is always in meters.

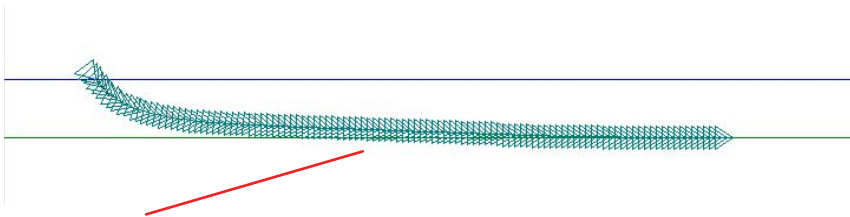
The software will determine automatically when to use the Lookahead value or Smoothing value depending on the speed that the vehicle is

travelling. When Lookahead is being used by the software, the box indicating the current lookahead value will be green.

**Align:**

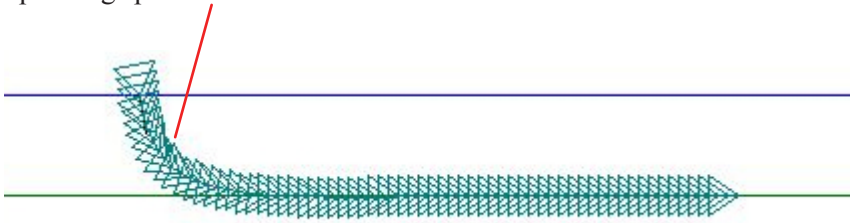
This allows the operator set the angle at which the vehicle will approach the steering line. The lower the number allows for a slow, “drift” onto the line. Ideal for sprayers etc.

The higher the number will promote a more aggressive approach to the steering line, almost perpendicular.



Parallel\_ Showing the turning Curve approaching the required line in a slow manner, more suited to sprayers.

Perpendicular\_ Showing the turning Curve coming onto the line in a more aggressive manner, more suited to row cropping at slower operating speeds.



Once you are satisfied with your settings, select the **Done** button to return to the *General page*.

## Contour Adjustment



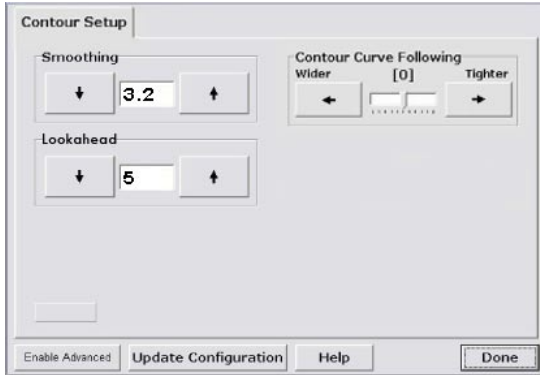
**Figure 5-10. Contour button**

To utilise this function (adjust steering performance of contour), firstly set a curved application line. Go to the guidance run time screen and touch the tractor icon. This will start “painting” an application map in green when the vehicle is moving.

Drive free hand for approx 2km (1mile) in a manner that simulates the curves of the field.

Once this has been achieved, stop mapping, this will give you a contoured line to steer to, once you select **GUIDE LOCK**. Engage the steering and increase the vehicle speed to working speed.

Select the **Wrench icon** (figure 5-3) to access the *Steering Setup screen*, and select the **CONTOUR** button (figure 5-10).



**Figure 5-11. Contour Setup**

There are three adjustments that can be made to improve the steering characteristics within the contour mode.

**Smoothing:**

This feature relates to how far the software is looking in front of the vehicle. The lower the value the closer it looks and the higher the value the further out it looks. Lowering the figure (0.5 - 1.0) will result in short oscillations.

Raising the figure will “smooth” the the adjustments, but if it is raised too high, slow wanders down the line will be observed. The system will generally use Smoothing at higher speeds and switch to Lookahead at lower speeds.

When smoothing is being used by the software, the box indicating the current smoothing value will be green

**Lookahead:**

Similar to Smoothing, the software uses the Lookahead to determine how far to look in front of the vehicle when the moving at lower speeds. The lookahead value is always in meters.

The software will determine automatically when to use the Lookahead value or Smoothing value depending on the speed that the vehicle is

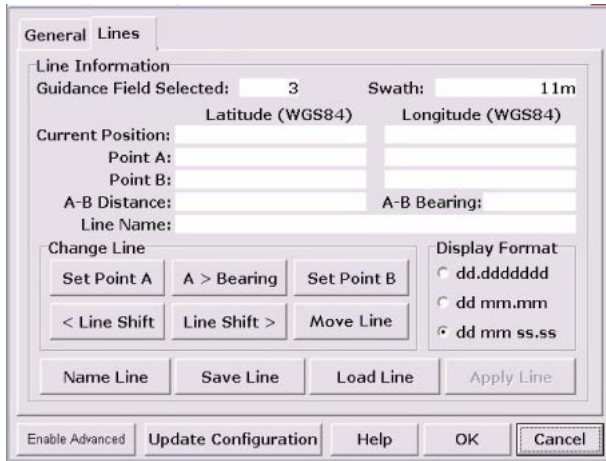
travelling. When Lookahead is being used by the software, the box indicating the current lookahead value will be green.

**Contour Curve Following:**

Normally left at zero, but can be adjusted from -5 through to +5. The higher the number, in effect, raises the valve speed. The lower the number, lowers the valve speed. This helps the way the machine tracks the curves of the field. Higher number will result in tighter turns.

Once the adjustments have been made, select Update Configuration, and this will save the changes.

## Lines Tab



**Figure 5-12. Lines Tab**

### Lines:

This feature allows the operator to save multiple series of start lines for each particular field. ie: North/South, East/West etc.

They can be saved in by setting A and B points, Naming the line, and then saving them to the GDX files. They can be recalled at any stage for later work, by selecting Load Line From File, and selecting the saved file.

They also can be set by simply setting a bearing from a particular position within the field. This feature is used when repeatability is required, inter-row planting using RTK GPS equipment.



## End of Row

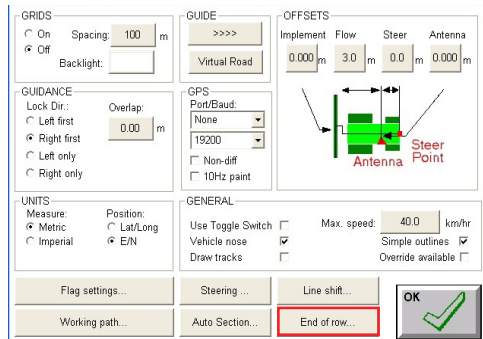


Figure 5-13. General Setup screen

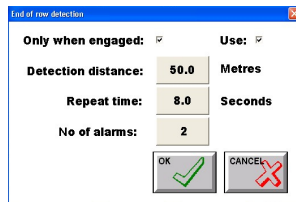


Figure 5-14. End of Row window

Access the *General Setup* screen (figure 5-13) from the *Main screen* in the X20 Guidance software.

Select the **End of Row** button (figure 5-13) to display the *End of row detection* window (figure 5-14).

This feature is used to warn the operator when the end of a run or row is approaching. The alarm is sounded through the X20's internal speaker or external speaker if fitted.

The alarm is a \*.wav file, which when sounded will say “End of Row is Near”. The volume of the alarm is control through the ‘X20 Manager’ program. Refer to the X20 Console Operator’s manual for information on setting the volume.

## End of Row Window Options

**Use:** Select this option (tick) to Enable the 'End of Row' warning. De-select the box (no tick) to Disable the 'End of Row' warning.

**Only when engaged:** When this option is selected the 'End of Row' warning will only appear when the auto steer is Engaged.

When the this option is not selected (no tick), the end of row warnings will be sounded whether the auto steer is engaged or not. This option would be used when the 'End of Row' warning is required for Visual

**Detection distance:** is the distance before the end of the row the vehicle icon reaches before the alarm starts to sounds.

**Repeat time:** This is the time interval between alarms.

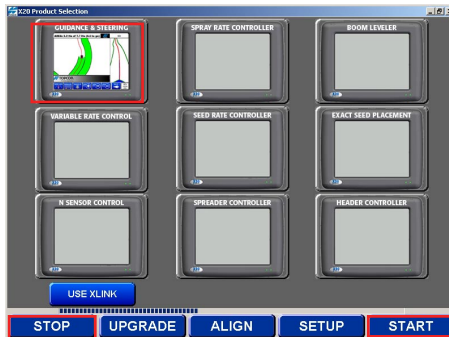
**No of alarms:** This is the number of alarms that will be sounded when each end of row is approaching.

No of alarms explanation - The alarm will not sound when the operator has control of the steering. When the operator engages the vehicle, and the vehicle is approaching 50m before the end of the row; a warning will be sounded "End of Row is Near", through the X20 Console's speaker.

Then after 8.0 seconds has lapsed the second warning will be sounded. Because the number of alarms is set at '2' there will no more warnings. Until the vehicle is turned around and the auto-steer is re-engaged and the vehicle is within 50m of an end of a row.

# Operations

This chapter will explain how to operate your PRO STEER system.



**Figure 6-1. X20 Product Selection screen**

When the TOPCON Ag software gets to this screen (figure 6-1), select the **STOP** button at the bottom left of the screen.

This allows you to select the software functions you wish to control. For the PRO Steer function, select the **GUIDANCE & STEERING** button (figure 6-1).

This icon will appear highlighted, and will be selected when the **START** button (figure 6-1) is selected, which is located in the bottom right hand screen corner.

This is also where you select any other products that you may need to use.

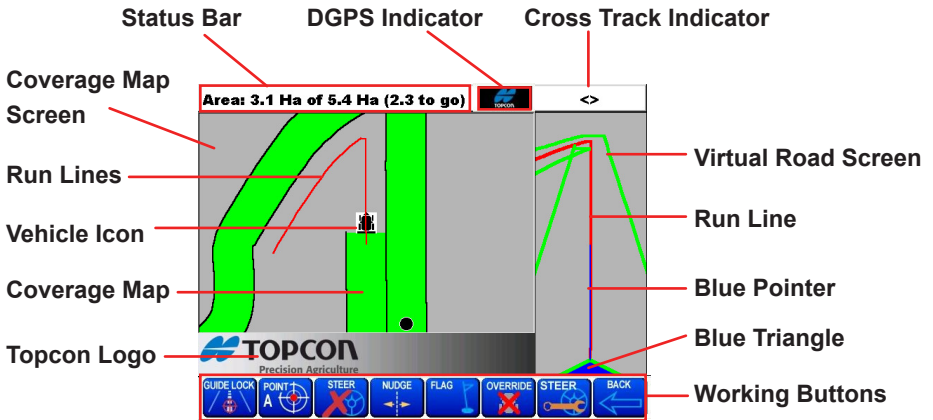
For further information on these products, please refer to the relevant X20 Operational manuals.



**Figure 6-2. Main Guidance screen**

Once the PRO Steer software has loaded up (figure 6-2), there are several settings that should be entered prior to use.

With this screen (figure 6-2) showing, select the **GENERAL SETUP** button.



**Figure 6-3. Main Guidance screen functions**

**Status Bar:**

The “Status Bar” allows the operator to observe information such as Speed; Area Covered, Boundary Area; DGPS Position; Current Field Number, Current Swath Width. The different items can be shown by selecting “Status Bar”.

**Coverage Map Screen:**

The “Coverage Map Screen” displays the green coverage map showing the areas that have been treated.

The “Coverage Map Screen” displays vehicle position, shows the current “Run Line”, the operator is driving to; displays “Flag Points”, displays the Parallel Points, if the points were selected.

**Coverage Map:**

The machine width is displayed with Green swaths, enabling the operator to determine which areas that have been treated and the areas that are yet to be covered.

**Vehicle Icon:**

The “Vehicle Icon” represents the vehicle in relation to the paddock, the vehicle shows whether the Guidance is mapping or not. The “Vehicle Icon” is shown at all times whether the mapping is turned ON or OFF. By selecting the “Vehicle Icon” the mapping can be switched ON; by selecting the “Vehicle Icon” again the mapping will switch OFF.

**TOPCON Logo:**

The “Topcon Logo” allows access to:

1. X20 Console Audio Volume adjustment.
2. Setting Up a Boom Sensing Interface Kit. (Optional Extra).
3. Setting Up a GuideLock Switchbox. (Optional Extra).

**Run Lines**

The “Run Lines” represent the path the vehicle has to follow.

The “Run Lines” when in “Round and Round” mode were setup whilst mirrorimaging the previous lap.

While the vehicle is following the current “Run Line”, the “Run Lines” are being setup for the next lap. So when in “Round and Round” mode the Guidance is continually giving the operator a Virtual Road to follow and setting up “Run Lines” for the next lap.

The “Run Lines” are setup for “Parallel Mode” by selecting an “A” and “B” point and selecting the **PARALLEL** button. Then the closest

Parallel Line is shown in the “Virtual Road” screen.

The “Run Lines” shown in the “Coverage Map” screen are represented in the “Virtual Road” screen as the “Red Line” in the middle of the road.

### **Virtual Road Screen**

The “Virtual Road” gives the operator the fine adjustment for driving to the screen. The Virtual Road shows any curves, bends or corners coming up and allows the operator to accurately drive to the road.

The “Green ‘3D’ lines” gives the appearance of looking into the distance and represents the outside edges of the implements swath.

The “Blue Pointer” projecting out of the “Blue Triangle” is like an imaginary line coming out of the vehicle giving the operator an idea how the vehicle is positioned to the “Red Run Line”.

Whether the vehicle is running parallel to the “Red Run Line” or at an angle. The “Blue Pointer” projects an estimated path of approximately 10-20m from the vehicle.

The “Blue Triangle” represents the vehicle. The apex of the triangle represents the DGPS antenna, on the vehicle. The Base of the triangle represents the swath of the implement.

When driving to the “Virtual Road” the operator should be driving to where the apex of the triangle is and NOT where the “Blue Pointer” is projecting to.

### **Crosstrack Indicator**

The “Crosstrack Indicator” shows the operator how accurately he is driving to the “Virtual Road” screen. Arrows (<) are displayed and each ‘<’ represents a distance; the more arrows displayed the more inaccurately the operator is driving to the “Virtual Road”. The distance each arrow (<) represents can be changed.

### **DGPS Indicator**

The ‘Flashing’ icon appears when a Differential GPS (DGPS) Correc-

tion is present.

By selecting the “DGPS Indicator” a “GPS Details” window appears displaying GPS information. ie. No of Satellites, PDOP, GPS heading etc.

### Function Buttons

The “Function Buttons” gives the operator access to all the operations needed whilst using the guidance. There are 4 different views of the “Function Buttons” they are:

1. Guidance Startup buttons, see Figure 6-4.
2. Field/Restart buttons, see Figure 6-7.
3. Guidance Working buttons, see Figure 6-6.
4. View buttons, see Figure 6-5.

The different views, display different buttons, the next section will show the operator what the different views look like and how to switch from one view to another. The section will also give a brief explanation of the Function buttons.

The “Function Buttons” that are shaded out are not accessible, ie.”NUDGE”.



**Figure 6-4. Guidance Startup buttons**

The Guidance Startup buttons are displayed when:

1. The Guidance screen is first started.
2. The **BACK** button from the **FIELD/RESTART** buttons, (Figure 6-7) is selected.
3. The **BACK** button from the Guidance Working buttons (Figure 6-6) is selected.
4. **GUIDE** button- when selected will display the Guidance Working buttons, Figure 6-6.

5. **FIELD** button- when selected will display the **FIELD/RESTART** buttons, Figure 5.
6. **GENERAL SET-UP** button- when selected will display the 'General Setup' window, this allows the Guidance settings to be entered.
7. **VIEW** button- when selected will display **VIEW** buttons, Figure 6-5.
8. **EXIT/OFF** button- when selected will allow to shut down the Guidance.



**Figure 6-5. VIEW buttons**

The **VIEW** buttons in Figure 6-5 are displayed when the **VIEW** button is selected from the Guidance Startup buttons Figure 6-4, is selected.

1. Select the **BACK** button, to display the Guidance Startup buttons, Figure 6-4.
2. A brief description of the **VIEW** buttons:
  - The “**VIEW IN**” button ‘zooms in’ on the coverage map.
  - The “**VIEW OUT**” button ‘zooms out’ on the coverage map.
  - The “**VIEW ALL**” button is only accessible when the “**VIEW MODE**” button is selected. This button sizes the coverage map to fit within the Coverage Map screen.
3. The **VIEW MODE** button switches the Coverage Map screen from **LIVE MODE** to **VIEW MODE**.
4. The **LIVE MODE** button displays actual Coverage map screen receiving updated DGPS positions. The “**LIVE MODE**” is the default mode.
5. **HEADS UP** button displays the coverage map so the vehicle is always facing up the screen no matter what direction the vehicle is facing, the map moves around under the vehicle. Heads Up is the default setting.
6. **NORTH UP** button displays the coverage map so the vehicle icon changes and will face the degree direction that the DGPS is reading at the particular time.

The map is stationary and the vehicle moves around the map. The top of the console screen is due north.





**Figure 6-6. New PRO STEER system buttons**

The Guidance Working buttons in Figure 6-6 are displayed when the **GUIDE** button is selected from the Guidance Startup buttons Figure 2, is selected. The Guidance Working buttons are the buttons normally displayed when using the guidance.

Select the **BACK** button, to display the Guidance Startup buttons, Figure 6-4.

A brief description of the Guidance Working buttons:

1. The **GUIDE LOCK** button allows the operator to activate the “Virtual Road” when within a swath of the last lap, when in “Round and Round” mode. Allows the operator to switch from “Parallel” mode back to “Round and Round” mode.
2. The **POINT A** button allows the setup of Parallel lines so the operator will have guidance in Parallel mode. When the **POINT A** button is selected it sets an “A” point and the button changes to “POINT B”. When the **POINT B** button is selected this sets up an “B” point then the button changes to “PARALLEL”. When the **PARALLEL** button is selected switches the mode from “Round and Round” mode to “Parallel” mode. If no Parallel Points have been setup then the “A” button is displayed indicating the Parallel points have to be setup.
3. The **STEER** button has two states:
  - 1. Engage (green tick)
  - 2. Disengage (red cross).

The **STEER- Engage** button is displayed when there is valid RunLine. When the **STEER-Engage** is pressed and the steering engages, the button changes to STEER-Disengage. Then when the **STEER-Disengage** button is pressed this disengages the auto-steer and displays the **STEER-Engage** button.

4. The **NUDGE** button becomes accessible when the Guidance is set up for Parallel Mode. The NUDGE feature corrects changes and 'drift' in DGPS position. The NUDGE feature when selected will correct DGPS positions of the 'Coverage map', Parallel Lines and Flag Points.
5. The **FLAG** button allows the operator to flag points of interest while using the Guidance. The operator can name 10 different Flag points to suit your operation.
6. The **OVERRIDE** button is only displayed when selected in "General Setup". This is used in conjunction with the Sprayer Interface (Optional) when using Auto Section Control (ASC). This allows the operator, by selecting the **OVERRIDE** button, ( a X is displayed on the "Vehicle Icon" to show the **OVERRIDE** button is being used), to drive over and treat areas that have already been treated. When using ASC in normal mode the ASC will not allow the operator to treat areas that have already been treated previously..
7. The **STEER-Setup** button accesses the 'ProCal Setup' window (this allows settings to be changed) while on the Guidance Working screen.



## NOTICE

*The STEERING button in the Guidance/General Setup accesses the same 'ProCal Setup' window, as the STEER- Setup button either can be used.*



**Figure 6-7. FIELD/RESTART buttons**

The **FIELD/RESTART** buttons displayed in Figure 6-7 are displayed when the **FIELD** button is selected from Guidance Startup buttons, see Figure 6-4.

1. **FIELD** button- when selected will access the 9 Field screens.
2. **RESTART/SWATH** button- select this button to clear the current field and/or set a new swath value.
3. **BACK** button- select this button to display the Guidance Startup buttons, Figure 6-4.

# Notes:

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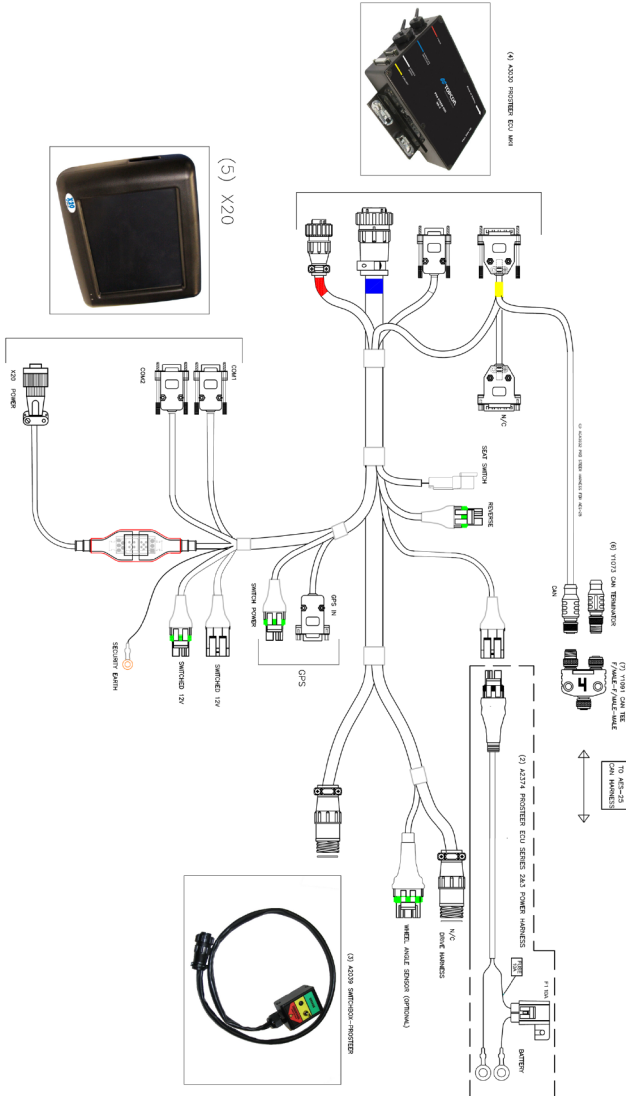
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# Appendix A

## A3413 Wiring Layout



# Notes:

Lined area for taking notes, consisting of 20 horizontal lines.



# Notes:

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