



**PRO Steer
Electrical and Tuning
Installation Manual**

Dealer Advanced

Part Number A3552
Rev. 4.4

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Preface

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



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

RETURN and REPAIR - During the respective warranty periods, any of the above items found defective may be shipped to TPA for repair. TPA will promptly repair the defective item at no charge, and ship it back to you. You must pay the shipping and

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- the laws of South Australia if the product is sold and supplied to you in Australia (in which case the courts of South Australia or the Federal Court of Australia (Adelaide Registry) have exclusive jurisdiction in respect of any claim or dispute); or
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Comments, suggestions, and questions about TPA products are welcomed. Contact your local TPA representative or a representative at our corporate facility.

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Service Information

Service assistance can be provided by contacting your local TPA Authorised Dealer or by calling the Topcon Precision Agriculture Service Centre.

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8.30am to 5pm (Adelaide Local Time), Monday through Friday.

Manual Conventions

This Manual uses the following conventions:

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

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



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



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



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



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



UNDER NO CIRCUMSTANCES SHOULD THIS ACTION BE PERFORMED.

Introduction



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 .

PRO Steer Electric kit consist's of the following components.

| Quantity : | Part # : | Description : |
|-------------------|-----------------|---|
| 1 | A2374 | Power Cable |
| 1 | A2398 | Cabin Harness |
| 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 | A3257 | GPS Cable - For MK II ECU only |

The harnessing is generic for all applications, so that the cabin,power,and switchbox always are the same.

No matter what machine they are fitted to.

The only harness that is machine dependant is the hydraulic harness.

Depending upon what machine/hydraulics are being used, the hydraulic harness may change.

| | |
|-------|---|
| 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 |

A2374 Power Harness



A3257 - MK II GPS Cable

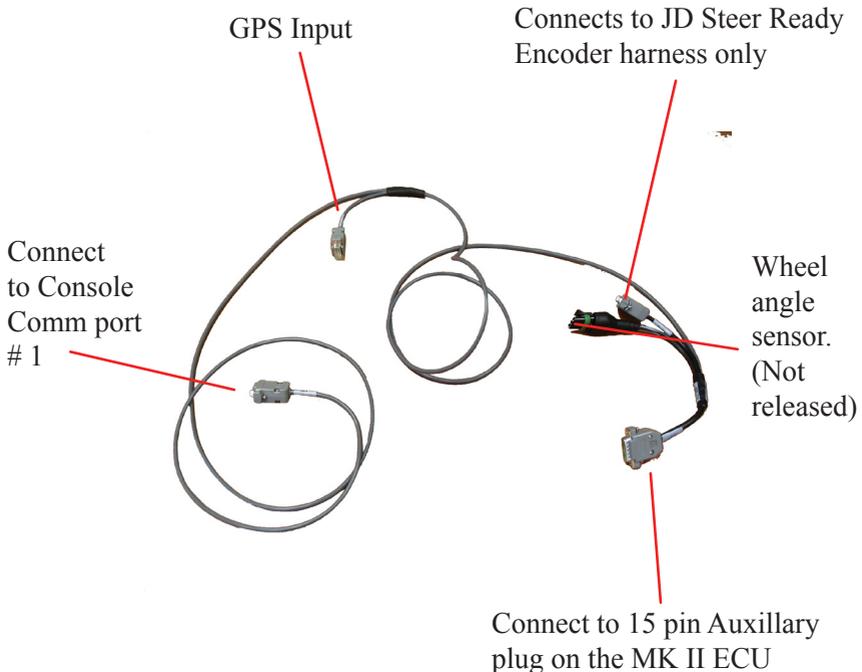


The GPS harness (A3257) is only used on MK II ECU's

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



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.



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



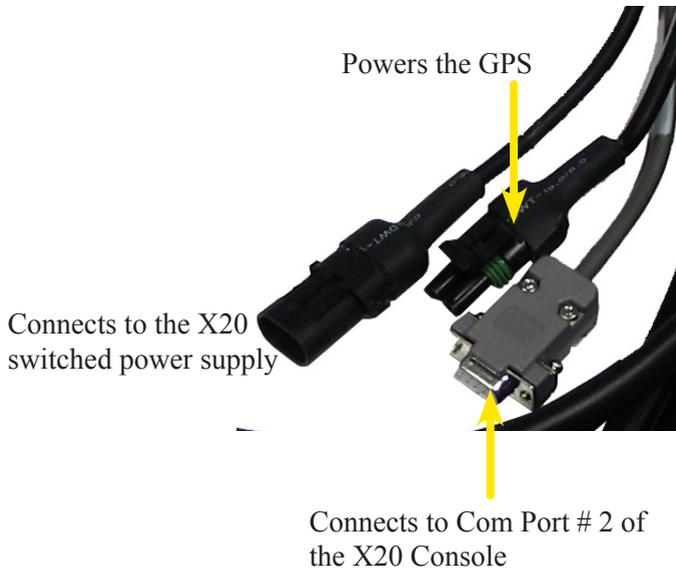


ECU Connectors.

DB9 Connector

Power Connector

Hydraulic Connector



A2558

Series III Hydraulic harness

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



9 Pin AMP plug, connects to 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 mounted close at hand 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

ECU Electronic Control Unit



ECU - Electronic Control Unit.

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. Failure to secure the ECU correctly will result in poor steering performance.



The Quick Mount Plate is supplied with securing screws, and must be mounted to metal, NOT RUBBER flooring



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



Slide the locks home around the locating poles.
The ECU is now firmly locked, and will be impervious to movement independent of the vehicle.

ECU Fitting

PRO Steer is an extremely easy system to fit to a vehicle. Adhere to the following instructions in order, and you will have issue free installation.

Mounting ECU :

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.

Note: If it is not convenient to mount the ECU flat with the connections facing the rear, facing connectors forward is acceptable but the software must be changed in the X20, as the default setting is assuming 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.



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

Switch Box Fitting

Mounting Switch Box

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

There are 3 methods of 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.

Showing the Switchbox mounted onto the tractor console.



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 is 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.

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.

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.

NOTE: This power circuit only powers a relay within the ECU that inturn powers the ECU from the main power wire that is connected to the RED connector on the ECU.

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 powerdup when the X20 console is switched on, and also powered down when the X20 is switched off.

3 - Switchbox Connector:

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:

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.



It is recommended that the 12V DC power is derived direct from the vehicle battery, however, if a 12V DC power supply is available at an auxiliary power plug within the cabin, this may be used providing the following is checked and verified.

- a - The 12V DC source must not be on a circuit breaker that is in series with other electrical functions.
- b - The correct power connector is used (as per the vehicle manufacturers specifications)
- c - The connection is to a constant 12V DC source, and not on the accessories side of the ignition switch.

Use a voltmeter to check 13.8V DC is present with motor running and the headlights switched on.

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

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.

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.

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

H 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 Hirschmann plugs, you will see that these are “looped” together, and these fit the proportional valve.

Pressure Switch,
hirschmann
connection point



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:

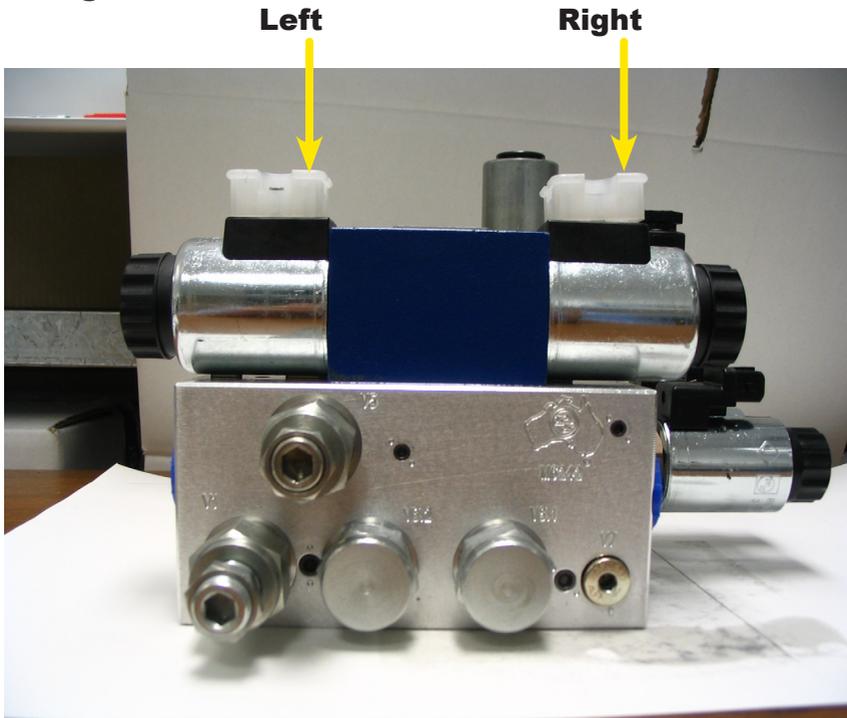
The two Hirschmann plugs referred to in the pressure sensor connection (1) are connected to the proportional valve connectors. The Hirschmann plugs will only fit one way onto the proportional valve spade terminals.

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 done within the calibration software program, PRO CAL, and is covered on page 37 of this manual.

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



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 weather-pack 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.



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



GPS Fitting



GPS Antenna location:

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

On Articulated tractors, mount the antenna above the front axle.

On Front Wheel Assist tractors, mount antenna as far forward of cab as practical, generally 300 mm to 500mm in front of cab on a solid bracket.

It is important to have the antenna with clear view of the sky without impedance from cabins etc.

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

Recomended GPS antenna installation on FWA vehicles



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



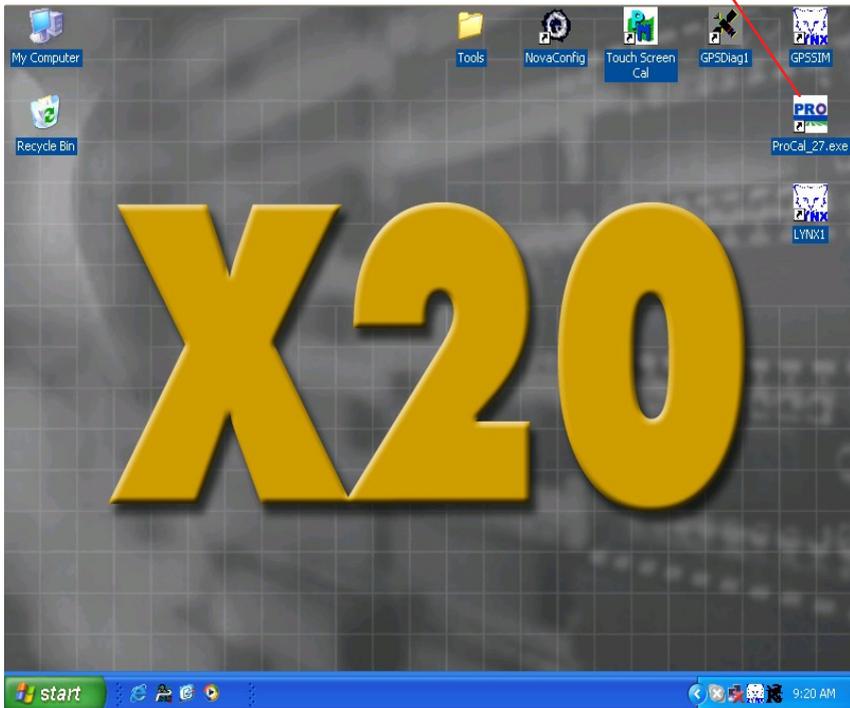
- 1- X20 console, Topcon GPS, 10hz is recommended. Anyother GPS, set them at 5Hz.
- 2 - X15 console, any GPS, 5Hz is recommended

PROCAL

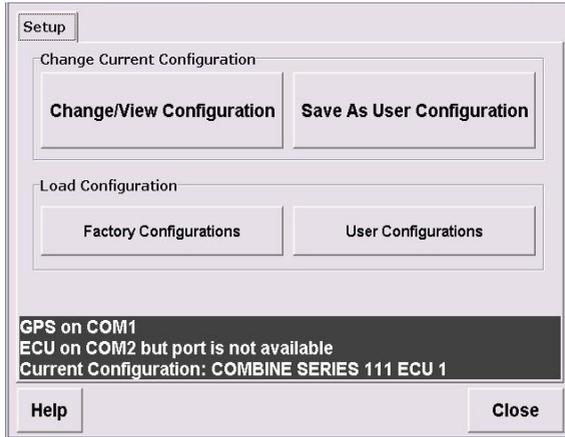
From the Desktop, the ProCal program is accessible by double tapping with a finger or double clicking with a “mouse”, the Icon as shown below.

Wait for the “hourglass” icon to appear (normally two/three seconds) and the program will start to activate.

PRO Cal Icon



Initial Vehicle Selection



Upon Startup of PRO CAL, the above screen appear.

The message is also stating that the GPS is being seen and registered on Comm # 1, and also that the ECU is being communicated with on Com # 2 of the X20 console.

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.



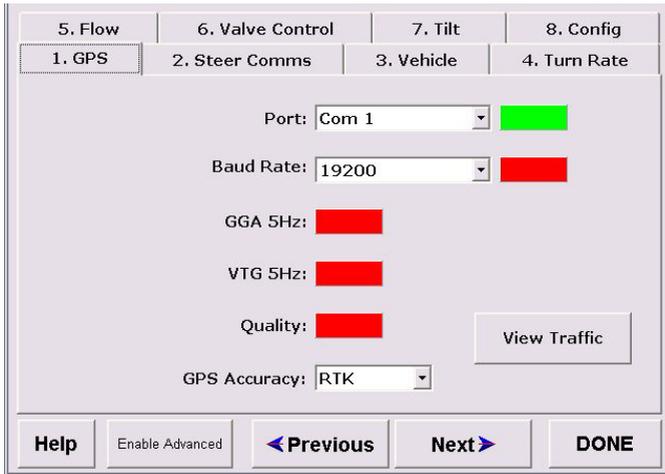
Select a machine that closest resembles the machine that the PRO Steer is about to be tuned into.

If Articulated is selected for a Front Wheel Assist tractor, the steering will be unstable. **Select the correct vehicle**

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.

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

GPS Validation



Step # 1: GPS:

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

PORT: The default setting is Comm 1.

If the DGPS is connected into Comm 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.

Baud Rate: PRO Steer requires the DGPS to be communicating at 19200 bits per second.

Any other baud rate is unacceptable.

If Baud Rate of 19200 set and all OK, indicator is green.

If not connected, indicator is Red.

If connected but at incorrect Baud Rate, indicator is Yellow.

DO NOT PROCEED if the status indicator is not green with the baud rate set at 19200.

GGA 5Hz:

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 5Hz:

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.

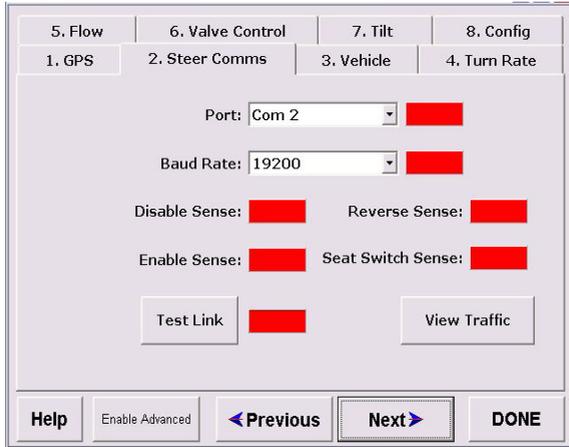
This is used by the customer service centre for diagnostic reasons, and will not be explained within this manual.

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



Step # 2: Steer Comms:

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

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.

Baud Rate: PRO Steer requires the ECU to be communicating at 19200 bits per second. Any other baud rate is unacceptable. If the ECU is communicating at 19200, the corresponding status indicator will be green, if it is not set at 19200, it will be red. If the indicator is yellow, data is being received from the ECU, but not at 19200.

The status indicator must be green with the baud rate set at 19200 to proceed.

| | | | |
|--|------------------|----------------------|------------------|
| 5. Flow | 6. Valve Control | 7. Tilt | 8. Config |
| 1. GPS | 2. Steer Comms | 3. Vehicle | 4. Turn Rate |
| <p>Port: <input type="text" value="Com 2"/> <input type="checkbox"/></p> <p>Baud Rate: <input type="text" value="19200"/> <input type="checkbox"/></p> <p>Disable Sense: <input type="checkbox"/> Reverse Sense: <input type="checkbox"/></p> <p>Enable Sense: <input type="checkbox"/> Seat Switch Sense: <input type="checkbox"/></p> <p><input type="button" value="Test Link"/> <input type="checkbox"/> <input type="button" value="View Traffic"/></p> | | | |
| Help | Enable Advanced | < Previous | Next > |
| | | DONE | |

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.

Seat 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.



Engage: 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: 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.



This switch must be in the DOWN position when the vehicle is in transport mode.
ie: travelling on roads, and not in the field.

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 PRO Cal 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 = 3.50A

Vehicle Measurement

| | | | |
|--|------------------|------------|---|
| 5. Flow | 6. Valve Control | 7. Tilt | 8. Config |
| 1. GPS | 2. Steer Comms | 3. Vehicle | 4. Turn Rate |
| Length Units <input checked="" type="radio"/> m <input type="radio"/> feet <input type="radio"/> inches | | | |
| Wheelbase (m): | | 4.300 |  |
| Antenna Height (m): | | 4.200 |  |
| Antenna to Fixed Axle Distance (m): | | 0.000 |  |
| Help | Enable Advanced | < Previous | Next > |
| | | DONE | |

Select the desired length units.

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. Do not forget the decimal point.

Important:

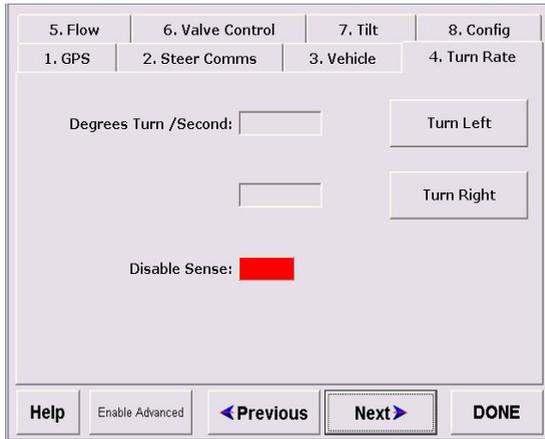
This must be entered in to the nearest centimeter (1/2 inch)

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.

Articulated vehicles, set at 0.0 and place the antenna above the front axle

Hydraulic Validation



Step # 4: Turn Rate:

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.

Note: 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.

Select TURN LEFT, until the machine is fully locked to the left, drive forward at approx 3km/p/h (2m/p/h) and select TURN RIGHT. Hold down the turn right button until the wheels have reached the full lock to the right.

The Disable Sense is to allow 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.

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 3>5 degrees on articulated vehicles, to 5 >15 on some FWA vehicles.

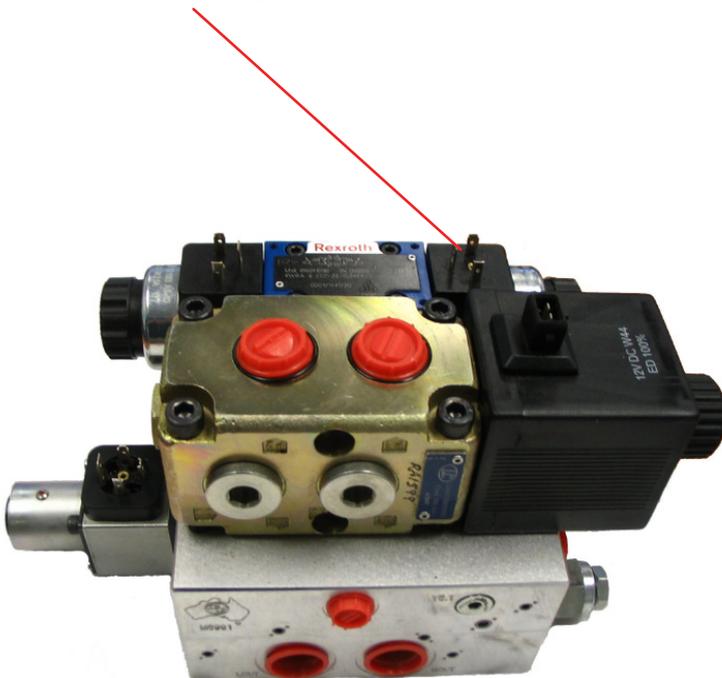
It is not uncommon to see different flows for the left Vs the right hand turn.

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

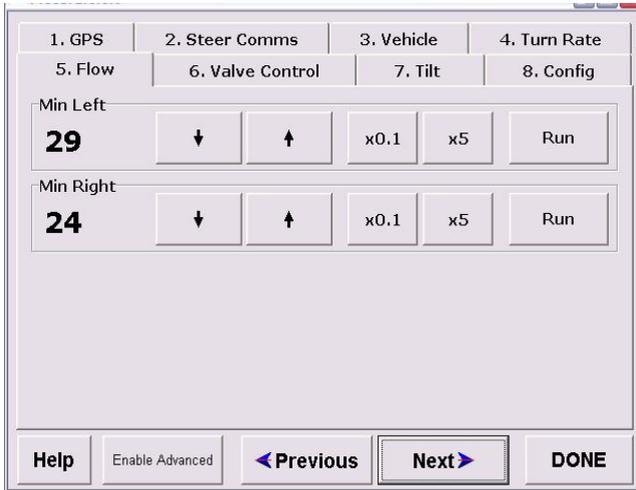
This step also confirms that the Hirschman plugs have been connected to the PRO Steer hydraulic valve block in the correct manner.

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



H ydraulic Minimum Setting



Step # 5: Min Flow :

The following settings are very important and have a large influence on the steering accuracy and stability of the ProSteer 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 (referring to steps 5 and 6) must be performed accurately to achieve constant smooth steering control.

This step (5) 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.

The Turn Left and Turn Right “slide settings “ (shown above) are set from factory, but will require infield tuning.

Setting Min Left and Min Right:

Drive forward at a speed around 6 kilometres (4 MPH) per hour 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.

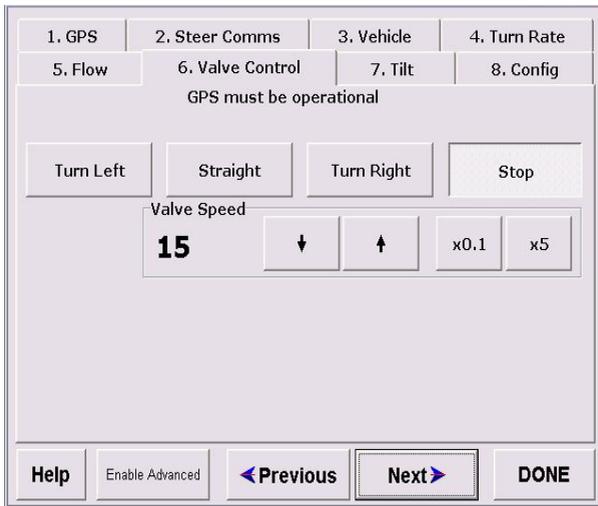
Continue this until, when pressing the button it does not start turning the wheels. The final setting should be that after a 3 second press, the start of a small movement should be noticeable.

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.

H ydraulic Valve Speed



Step # 6: Valve Control :

This calibration allows ProSteer to tune itself to the tractor hydraulic steering performance.

It is very important to carefully carry out this procedure.

If the Valve Speed setting is too high, the vehicle will oscillate or “snake” and direction change transitions will also be unstable. When the high Valve Speed figure is reached, the optimal setting is then set by entering in a figure of 70% of the valve speed prior to the machine oscillating.

It is important to take the Valve Speed setting too high to find this unstable point so with reduction, the best smooth control point can be found.

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.
- 4- Take a note of whatever the Valve Speed reads at this point.
- 5- Change the Valve Speed so that the value is 70% of the previously noted Valve Speed

Example:

FWA, SP Sprayers, Combine Harvesters

Once you have achieved a stable point, times the value by .7, and enter this number in as the valve speed.

EG: Valve Speed = 9 X .7 = 6.3 Enter 6.3 as the valve speed

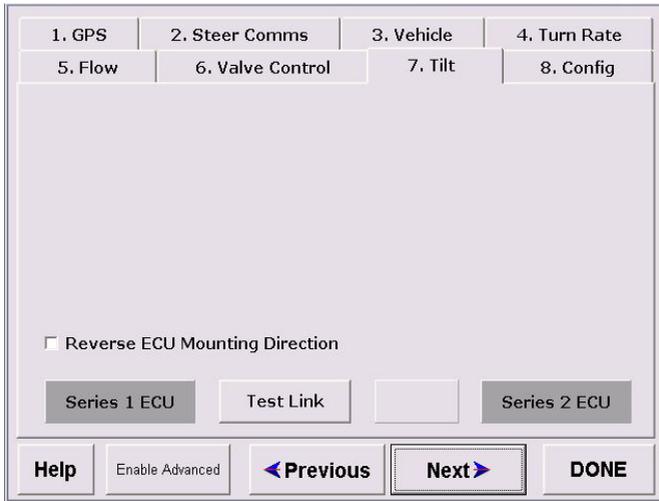
4WD Articulated

Generally the setting will remain at 20 when using a 15 liter valve on the hydraulic block.

The general rule to be adhered to here, is that a valve speed of 10 or higher is required.

If the valve speed is lower than 10, when using an ALL PORTS BLOCKED proportional valve, we must look at replacing the proportional valve with a smaller one.

ECU Orientation / Identification



Step # 7: Tilt :

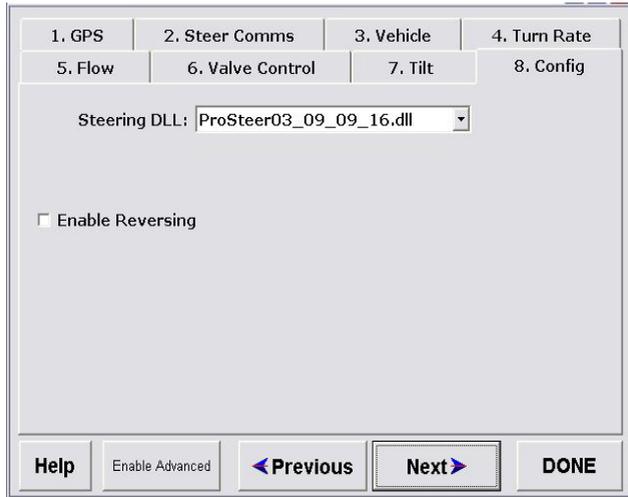
Reverse ECU Mounting Direction:

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.

NOTE: 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 1 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 11.

Operating Software DLL



Step # 8: Config :

The config step is utilised to select the version of PRO Steer software to be used within the X20 console.

As time elapses, there will be upgrades to the software, and this selection allows the operator the choice of software to be used with each particular vehicle.

ProSteer 03_09_09_18.dll is the first release ProSteer dll being used, as of December 2007 and is backward compatible for MK I 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.

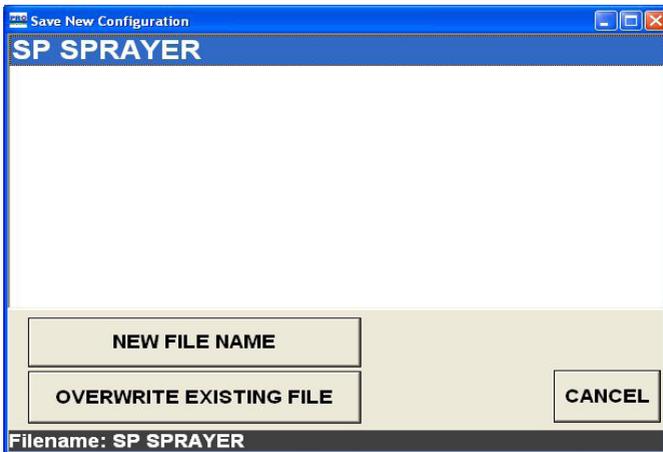
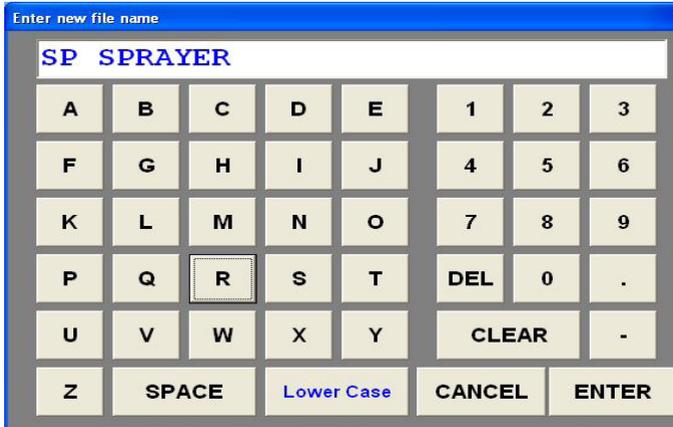
Saving Vehicle Configuration



Once the above 8 tabs have been completed, and there has been setting changes, this screen appears on the exit of ProcalNote: This is saving into User Configurations

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

Once NEW FILE NAME button is selected, you simply type in the name of the machine that you are calibrating Remembering that this is the file that you will recall for this particular machine.



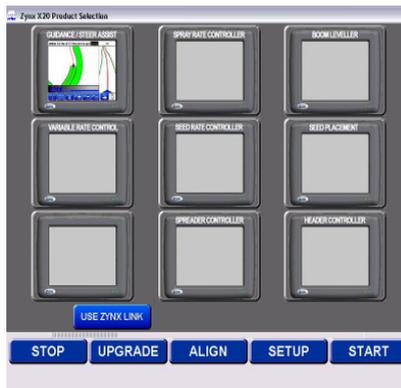
If you are altering a previous tune set for a particular machine, HIGHLIGHT the machine in question, and select OVERWRITE EXISTING FILE

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..

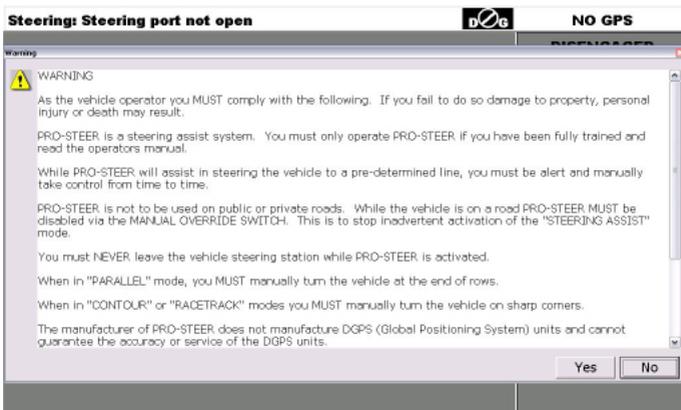
FIELD TUNING

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

From the desktop, open the ZYNX1 icon, and start the guidance software.



Once the guidance software has started, the operator acceptance appears, and if not agreed too, the steering assist will not function.



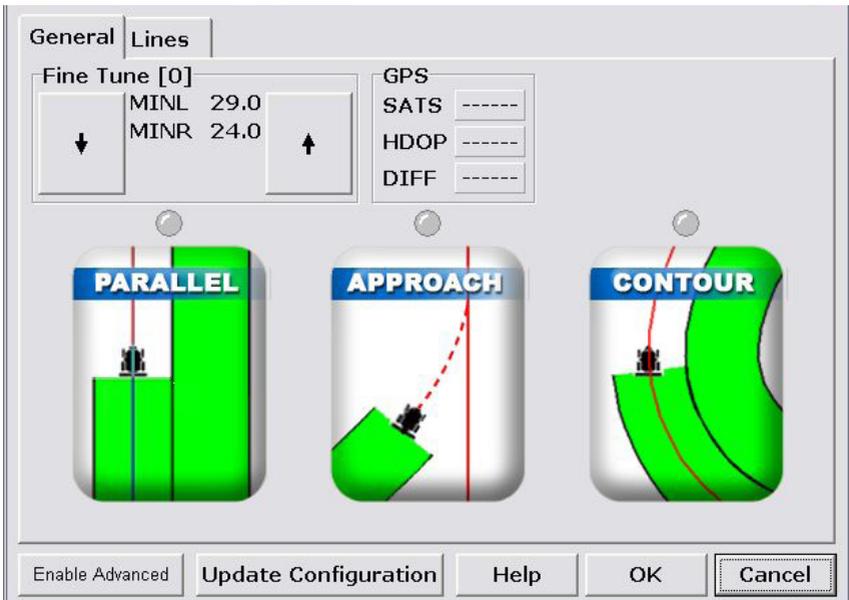
Tuning Software Access

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. 



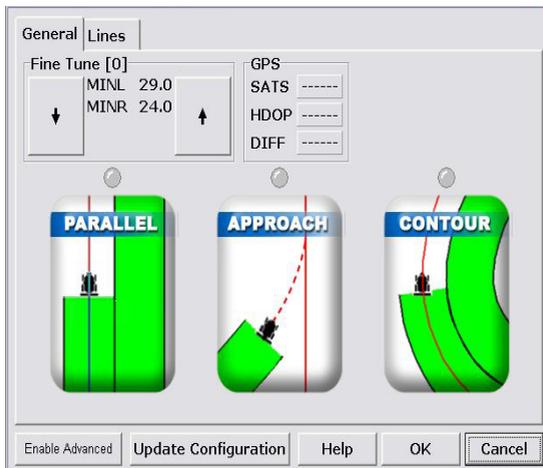
Once selected, the below screen appears, and adjustments can now be made to the steering performance



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.



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.

GENERAL:

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.

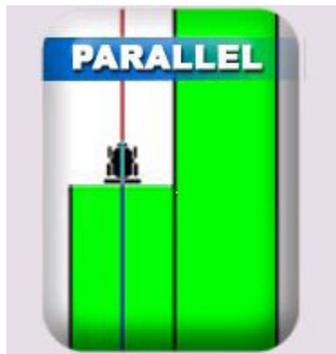
There are three main adjustment areas available from this screen, and the adjustments can be made whilst the vehicle is steering to the line.

Parallel: Enables adjustment so the machine steers to optimum level on a parallel line.

Approach: Enables the adjustment of the steering whilst approaching the parallel line.

Contour: Allows adjustments to the steering when steering to a curved line.

Parallel Adjustment

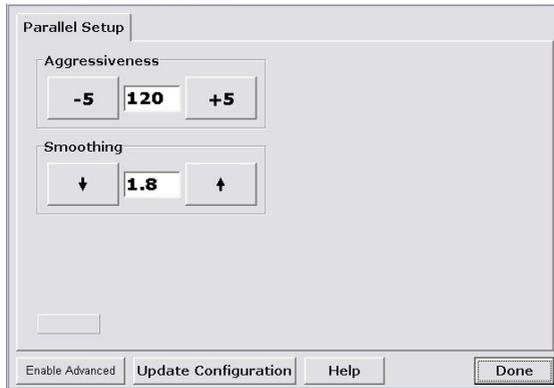


To utilise this function (adjust steering performance of parallel), firstly set a parallel line. Set point A, drive at least 20m (60 yards) and then select point B, and then PARALLEL.

This will give you a parallel line to steer to.

Engage the steering and increase the vehicle speed to working speed.

Open the “Wrench” icon as previously described, and select the PARALLEL button, pictured above.



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

Aggressiveness:

This is factory set at around 100. Increase the value to increase the steering aggressiveness to the line, decrease the value to lessen the aggressiveness.



Try and leave the aggressiveness at a value close to 100, if the value has to be increased to 70 or up to 140, we would suspect that the valve speed (procal) or the hydraulic valve size is incorrect. Either way the hydraulics should be looked at as optimum performance should be around 100.

Smoothing:

This figure relates to how far the software is looking in front of the machine. 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. Usually set around 1.4

Line Hold:

This is the same as the graph from the General page, it shows the antenna position in relation to the line, and can be used to see how the adjustments effect the performance.

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

Select Done, and go back to the General page.

Approach Adjustment



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.

Open the “Wrench” icon as previously described, and select the APPROACH button, pictured above.



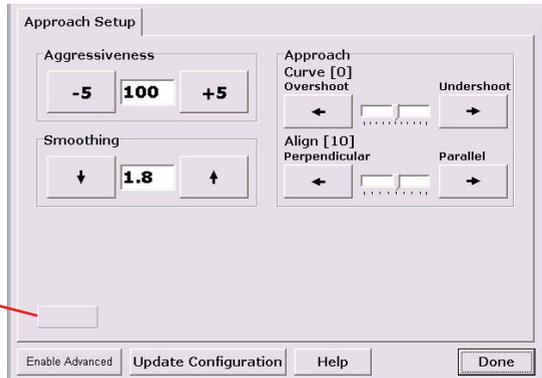
Turn at the end of a parallel run, and approach the next runline as you would normally do in the field.

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.

When the machine is in the approach mode, this indicator box will turn green. If it is not green, any adjustments made from this screen will not take affect until the box turns green.



There are four adjustments that can be made to improve the steering characteristics within the approach mode.

Aggressiveness:

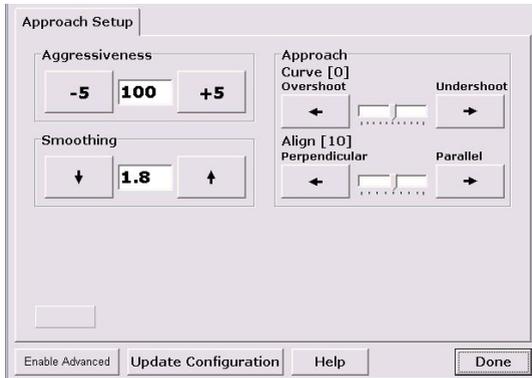
This is factory set at around 100. Increase the value to increase the steering aggressiveness to the line, decrease the value to lessen the aggressiveness.

Try and leave the aggressiveness at a value close to 100, if the value has to be increased to 70 or up to 140, we would suspect that the valve speed (procal) or the hydraulic valve size is incorrect. Either way the hydraulics should be looked at as optimum performance should be around 100.

Smoothing:

This figure relates to how far the software is looking in front of the machine. 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. Usually set around 1.4

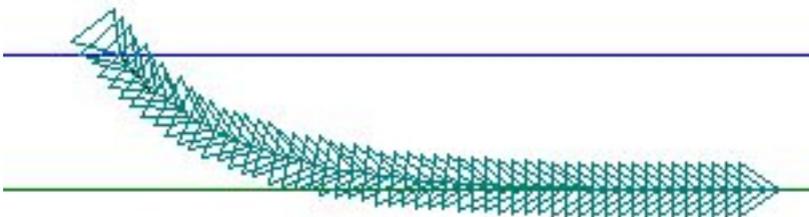
Once the adjustments have been made, select Update Configuration, and this will save the changes.



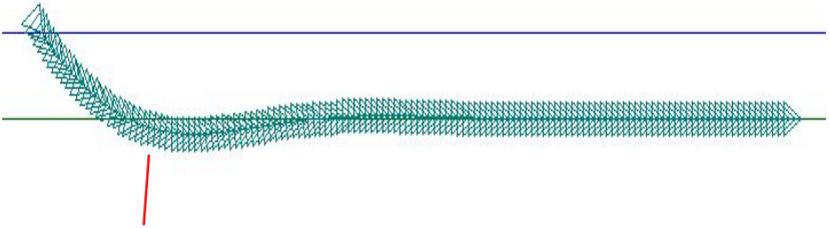
The Approach settings Curve and Align are adjusted to suit the application that is required.

Curve:

This setting has adjustments from +5 to -5. The factory default is 0, which allows a smooth approach to the steering line. The higher the figure entered will result in an “undershoot” approach to the steering line. The lower the number, will result in “overshooting” of the steering line upon approach. This may be required when operating broadacre tillage etc.



UnderShoot_ Showing the turning Curve on the inside of the required line

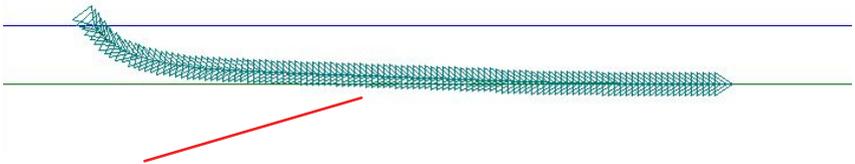


OverShoot_ Showing the turning Curve over shooting the required line.

Align:

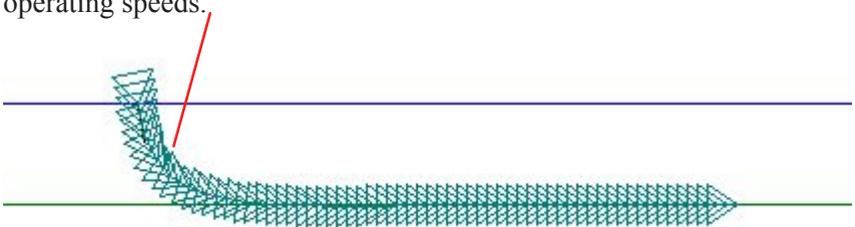
This allows the operator set the angle at which the vehicle will approach the steering line. The lower the number allows for a slow, “drift” onto the line. Ideal for sprayers etc.

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.



Select Done, and go back to the General page.

Contour Adjustment



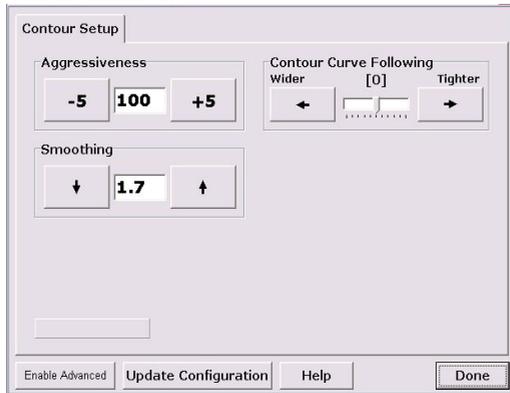
To utilise this function (adjust steering performance of contour), firstly set a curved application line. Go to the guidance run time screen and touch the tractor icon. This will start “painting” an application map in green when the vehicle is moving.

Drive free hand for approx 1 mile (2km) 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.

Open the “Wrench” icon as previously described, and select the CONTOUR button, pictured above.



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

Aggressiveness:

This is factory set at around 100. Increase the value to increase the steering aggressiveness to the line, decrease the value to lessen the aggressiveness.

Smoothing:

This figure relates to how far the software is looking in front of the machine. 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. Usually set around 1.4.

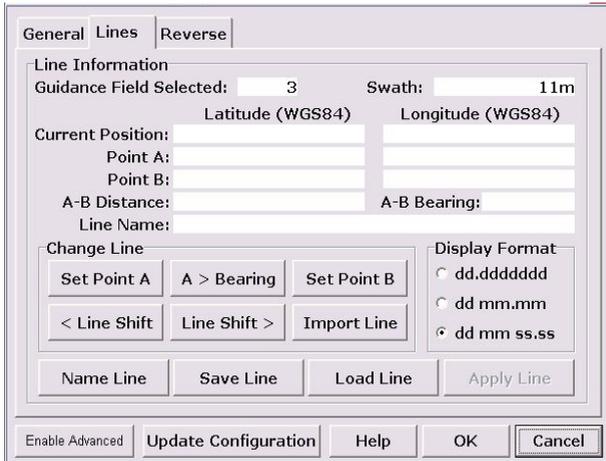
NOTE: This value will normally be lower than the smoothing settled upon in the Parallel mode.

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



Lines:

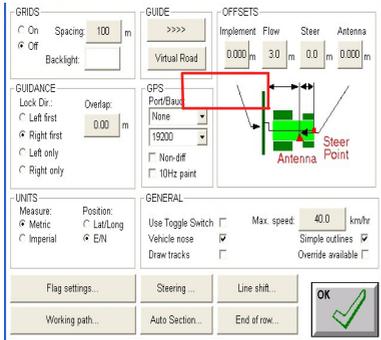
This feature allows the operator to save multiple series of start lines for each particular field. ie: North/South, East/West etc.

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.

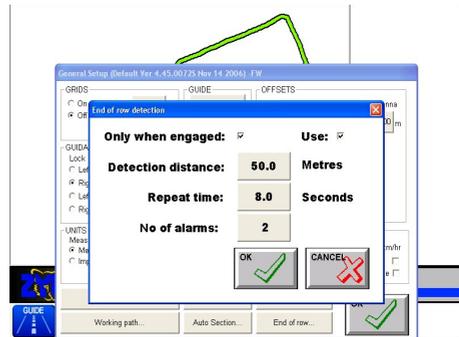
They also can be set by simply setting a bearing from a particular position within the field.

This feature is used when repeatability is required, inter-row planting using RTK GPS equipment.

End Of Row



Select End Of Row (above)
to access the screen (right)

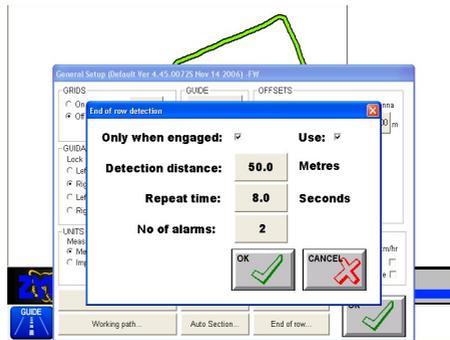


End Of Row

Press the “End Of row” button, the ‘End of row detection’ window will be displayed.

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.

See the X20 Console manual to adjust the volume.



End Of Row Continued.

Use- select this option (tick) to Enable the ‘End of Row’ warning.
Un -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 Guidance.

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

Repeat time- is the time between alarms.

No of alarms- this is the number of alarms that will be sounded when each end of row is approaching.

To use the above example; 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.

Wwarranty

The warranty provided by Topcon Precision Agriculture covers faulty manufacture, defective components and installation of components, but not installation to the machine.

For the warranty to be recognised by Topcon Precision Agriculture the end user of the equipment must in the first instance of a problem developing, contact the local Dealer from where the unit was purchased.

The Control Unit Micro Processor is covered for 12 months under this warranty.

Accessories such as cables, sensors and hydraulic kits are covered for 12 months under this warranty.

This warranty will become void if any attempt is made to repair or modify the Control Unit Micro Processor.

This warranty will become void for all components if they are misused, accidentally damaged, if any attempt is made to repair or modify them or operate them on other the recommended or specified voltage.

This warranty is in addition to and not in substitution for any warranty or condition implied by the provisions of the Trade Practices Act.

Operation of Warranty

IN THE EVENT OF WARRANTY CLAIM BEING MADE TOPCON PRECISION AGRICULTURE, WILL ENDEAVOUR VIA ITS AUTHORISED DEALER/INSTALLER TO RECTIFY THE PROBLEM AT THE EARLIEST OPPORTUNITY. TOPCON PRECISION AGRICULTURE WILL ARRANGE FOR THE PROBLEM TO BE FIXED AND IF NECESSARY SUPPLY AN EXCHANGE UNIT AND OR COMPONENTS. THE METHOD OF REPAIR SHALL BE DETERMINED BY TOPCON PRECISION AGRICULTURE AT ITS SOLE DISCRETION.

ANY WARRANTY CLAIM SHALL AT THE FIRST INSTANCE BE REPORTED TO TOPCON PRECISION AGRICULTURE.

TOPCON PRECISION AGRICULTURE SHALL NOT IN ANY EVENT BE LIABLE FOR ANY DIRECT OR CONSEQUENTIAL INJURY, LOSS OR DAMAGE ARISING OUT OF ANY MATTER GIVING RISE TO A WARRANTY CLAIM.

WARRANTY REGISTRATION MUST BE FILLED IN AND POSTED TO TOPCON PRECISION AGRICULTURE WITHIN 7 DAYS OF FITMENT TO AVOID WARRANTY CONFUSION AT A LATER DATE IF THE UNIT FAILS DURING THE WARRANTY PERIOD.

Procal Advanced

The screenshot displays the Procal Advanced software interface. At the top, there are five tabs: 5. Flow, 6. Valve Control, 7. Tilt, 8. Config, and ECU. Below these, there are four sub-tabs: 1. GPS, 2. Steer Comms, 3. Vehicle, and 4. Turn Rate. The main area contains the following configuration options:

- Port: Com 1 (dropdown menu) with a green status indicator.
- Baud Rate: 19200 (dropdown menu) with a red status indicator.
- GGA: 0 (red status indicator).
- VTG: 0 (red status indicator).
- Quality: (red status indicator).
- GPS Accuracy: HP (dropdown menu).
- GPS Delay: 0.12 seconds (input field) with a refresh button.
- View Traffic (button).

At the bottom, there are five buttons: Help, Disable Advanced, Previous, Next, and DONE. The Next button is highlighted with a blue border.

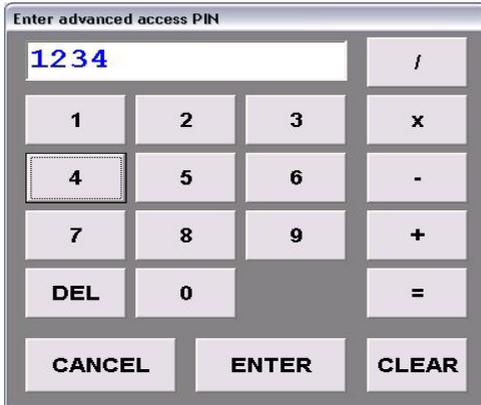
Procal has an area that the dealer is able to access during machine setup.

The reason it is hidden is two fold.

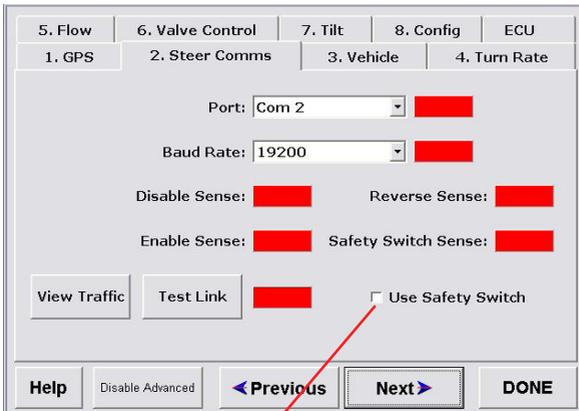
- 1- If an operator accesses Procal they will not see the advanced areas.
- 2- The dealer is able to set some parameters so the operator is unable to change them, such as the maximum allowable speed at which the steering assist will operate.

To access the advanced area, select the ENABLE ADVANCED button highlighted in the above picture.

Advanced Access



Type the dealer Access Code # 1234, and then select enter. The screen will change and additional tabs and functionality will appear.



Safety Switch option added. The cabin harness has a 2 pin Deutsch connector, marked seat switch. If this option is selected, an icon will show within the steering toolbox software on the General page. The circuit must have full continuity to allow steering

Vehicle Advanced

| | | | | |
|--|------------------|---------------|--------------------|------|
| 5. Flow | 6. Valve Control | 7. Tilt | 8. Config | ECU |
| 1. GPS | 2. Steer Comms | 3. Vehicle | 4. Turn Rate | |
| Length Units <input checked="" type="radio"/> m <input type="radio"/> feet <input type="radio"/> inches | | | | |
| Wheelbase (m) | | 3.700 | | |
| Antenna Height (m): | | 4.370 | | |
| Ant - Back Axle Distance (m): | | 0.000 | | |
| Non-Articulated | | Articulated | CAT C/D/E/F Series | |
| Wheel Vehicle | | Track Vehicle | | |
| Help | Disable Advanced | < Previous | Next > | DONE |

There are some added options when advanced is selected. These options are set when the machine is originally set using a **FACTORY CONFIGURATION** file when starting the Procal machine selection.

Antenna - Back Axle Distance:

On Articulated machines, set this at 0.0 (zero)

On Front Wheel Assist tractors, and Combine Harvesters, measure the distance from the Antenna to the “FIXED” axle (not the steering axle) Enter in 70% of this value. This will aide in the machines approach to the line.

Non Articulated: Front Wheel Assist Tractors, Combine Harvesters, Windrowers.

Articulated : Four Wheel Drive Articulated Tractors.

Cat C/D/E Series: Catapilla Tracked machines

Wheeled Vehicle : Rubber tyred machine with a minimum of 4 wheels.

Tracked Vehicle : Machines that have tracks. The only exception to this would be the Quad Track

M **inimum Advanced**

| | | | | |
|-------------|------------------|------------|--------------|-------------|
| 1. GPS | 2. Steer Comms | 3. Vehicle | 4. Turn Rate | |
| 5. Flow | 6. Valve Control | 7. Tilt | 8. Config | |
| ECU | | | | |
| Min Left | | | | |
| 29 | ↓ | ↑ | x0.1 | x5 |
| Run | | | | |
| Min Right | | | | |
| 24 | ↓ | ↑ | x0.1 | x5 |
| Run | | | | |
| Preset Max | | | Frequency | |
| Standard | | | Reduced | |
| Full | | | 100 Hz | |
| Max | | | 1000 Hz | |
| 70 | ↓ | ↑ | x5 | |
| Help | Disable Advanced | ◀ Previous | Next ▶ | DONE |

In the FLOW tab there are some options that relate to the operation of the proportional valve. These settings are again automatically set when the matching vehicle is set from the Factory Configuration at Initial Machine Selection.

Pre Set Max:

Standard : Set at 70% of the valve stroke.

Used for Series I and Series III hydraulic valve blocks

Reduced : Set at 40 % of the valve stroke. This is used on the JD Steer Ready machines, and the CNH STX/TJ Steer Ready tractors.

Full : Set at 100% of the valve stroke. This is used on Case MX Steer Ready, and when retrofitting Trimble hydraulic Valve blocks.

Frequency:

100Hz : Set for Series 1 and III valves

1000Hz : Set for the JD steer ready, and CNH STX/TJ machines that run the Sauer Danfoss Hydraulic Valves

V Valve Speed Advanced

| | | | |
|-------------------------------------|------------------|------------|--------------|
| 1. GPS | 2. Steer Comms | 3. Vehicle | 4. Turn Rate |
| 5. Flow | 6. Valve Control | 7. Tilt | 8. Config |
| ECU | | | |
| GPS must be operational | | | |
| VTG | ECU | KPH | Turn Rate |
| Turn Left | Straight | Turn Right | Stop |
| Radius (m) | Valve Speed | | |
| <input type="radio"/> 10 | 15 | ↓ | ↑ |
| <input checked="" type="radio"/> 20 | | x0.1 | x5 |
| <input type="radio"/> 50 | Limiter | | |
| <input type="radio"/> 100 | 10 | ↓ | ↑ |
| <input type="checkbox"/> Ramp Test | | x5 | OFF |
| | IG | | |
| | 0 | ↓ | ↑ |
| | | x0.1 | OFF |
| Help | Disable Advanced | ◀ Previous | Next ▶ |
| | | | DONE |

Added options that appear on this page .

Radius (M): This is the turn radius when executing a Turn Left Turn Right. This does not mean if you select turn right and let the machine do a full circle that the circle will be 40m across. It is a measurement that the engineers used when developing this product. Leave at 20.

Ramp Test: This again is a left over from the engineering process, and should be left unchecked.

Limiter: This value will normally be zero and is preset when the machine is selected from FACTORY CONFIGURATION. This will change the characteristics of the proportional valve control. Raising the figure can make the hydraulic control unstable, but on some machines, a figure of 45 has been achieved to deliver stable performance.

IG : Internal Gain of the Proportional valve. Again this is preset when selecting the machine from the FACTORY CONFIGURATION. This will also have dramatic effects on the hydraulic control. Usually left at ZERO

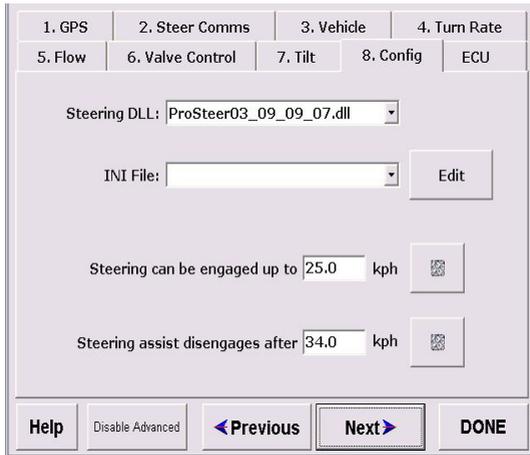
VTG: Used by engineers to view the GPS

ECU : Used by engineers to view the ECU load

KPH : Used by the engineers to view GPS speed.

Turn Rate: Used by the engineers to view the turn rate.

Speed Limitation



Upon opening the (8) CONFIG tab, the above options are added when the advanced area is accessed.

Steering Can Be Engaged up to : Enter in the maximum speed that the operator is able to engage the steering.

Steering Assist Disengages After : Enter the speed that the steering will stop working at. Max working speed is 34 kmph (20.4 mph)

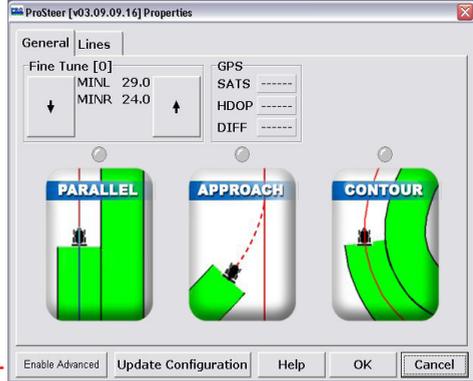


INI File: This area is where alterations can be made to the INI file directly. This is not recommended to be done by an operator or dealer.

Tuning Advanced

The field tuning of PRO Steer will at some stages require the dealer technician to access some functionality of the software that is not open for use by the operator.

To access the advanced tuning area, select the Enable Advanced button

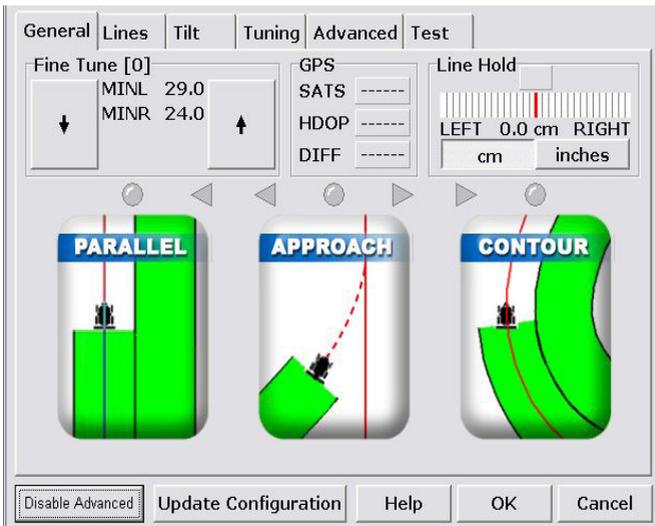


Type in the dealer code # 1234, and then select enter

Once the dealer advanced area is accessed, the technician will be presented with the screen below.



The dealer technician **MUST** access this area during the field tuning of PRO Steer for no other reason other than to calibrate the tilt sensor.



Tilt Sensor Calibration

Ensure that the tilt sensor box is checked

Double Check the ECU orientation.

The screenshot shows the 'Tilt Sensor' calibration window. The 'Tilt' tab is active. The 'Use Tilt Sensor' checkbox is checked. The 'Roll Gyro Angle' and 'Pitch Gyro Angle' fields are empty. The 'Auto Calibrate Tilt Offset' section shows 'Roll Gyro Offset °: -0.98' and 'Pitch Gyro Offset °: -2.38'. The 'ECU Direction' is set to 'Forward'. There are 'START', 'MARK', and 'CANCEL' buttons. A note at the bottom says 'Must be engaged and autosteering to a line to start calibration'. At the bottom of the window are 'Disable Advanced', 'Update Configuration', 'Help', 'OK', and 'Cancel' buttons.

The tilt calibration must be done once the vehicle is steering acceptably to the parallel line. Failure to calibrate the tilt sensor will result in inaccurate steering offsets.

Calibrate the tilt sensor by setting an A/B line and engage the steering so that the vehicle is steering to the line at approx 8kmph (5mph).

Press START (whilst moving) and drive for 100m (330feet) and press MARK.

Drive for a further 50m (165 feet) and turn the vehicle around so that the vehicle will traverse the same line that it has just driven on.

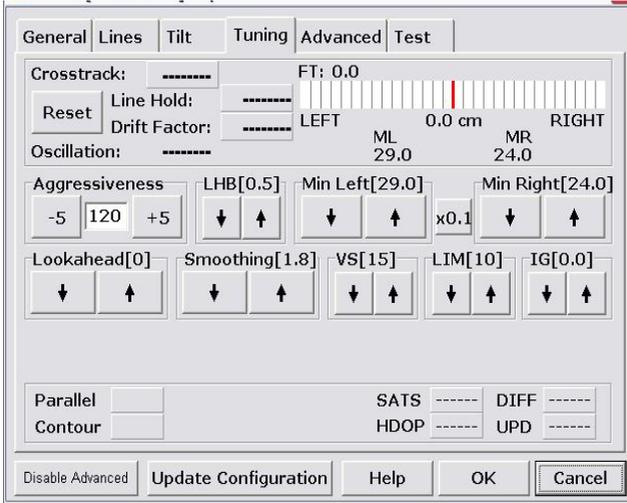
Engage the steering so that the vehicle is steering the line, ensuring that the vehicle is properly on the line before the vehicle reaches the position where MARK was selected.

With the steering engaged, drive down the line to the start position.

The offset will automatically appear once this process has been completed.

Once this has been set, you must save the settings by selecting the Update Configuration tab, and follow the prompts to save the settings.

Tuning Advanced



The advanced tuning page is available for the dealer technician, who is advanced in PRO Cal tuning, so as they are able to tune machines from the one page, meaning that they will not have to go back to Procal to change any parameters.

The idea is to get the Crosstrack, Line Hold and Drift Factor boxes to be GREEN. This will mean that the steering is operating to sub 2cm standard.

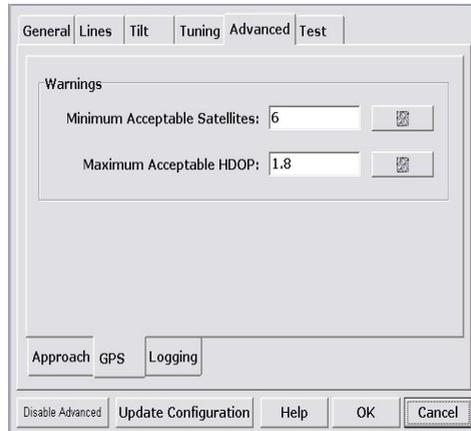
Remember that the colours are showing an actual measurement of the antenna in comparison to the required line.

This page also shows the Aggressiveness, Look ahead, Smoothing, Valve Speed, Limiter, and Internal Gain settings for PARALLEL, along with the valve minimums.

These settings are able to be changed from this page, but if they are to be kept, select the UPDATE button and then the OK button.

When the software is assuming the Parallel settings, the Parallel box at the left hand lower corner of the screen will be GREEN.

GPS Advanced



Minimum Satellites:

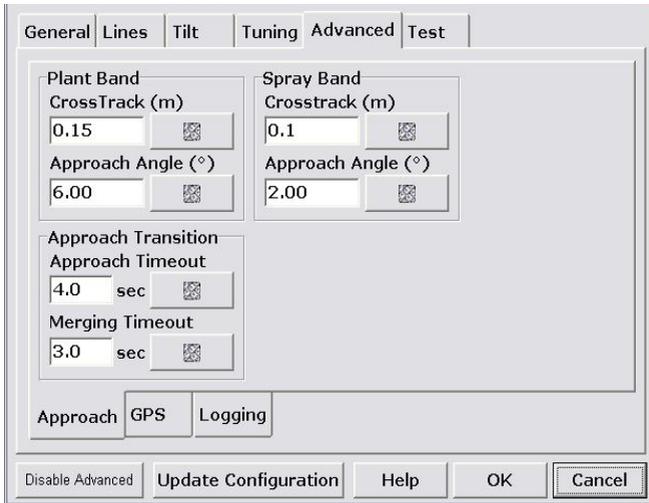
Once the number of satellites that are usable drop below the number selected, a low GPS warning will be sounded.

It is recommended that the number be kept at 6 for RTK.

Maximum HDOP:

Once the HDOP value reaches 1.8, an alarm will be sounded to warn the operator that the GPS quality is low.

Approach Advanced



Depending what was selected within the Approach adjustment (main screen Approach, first advanced) the settings can be adjusted differently for Planting and Spraying.

Planting generally requires tighter tolerances, so the “hand over” from Approach to Parallel can be set differently than those required for a spraying operation.

Cross Track:

This is the distance from the line the machine must be before changing from Approach to Parallel.

Approach Angle:

This is the machine direction of travel compared to the actual line required. Ie: if 2.0 was selected here, the machine must be within 2 degrees of the line before the Approach settings will be swapped to the Parallel settings.

Approach Timeout:

The machine must be within the Cross track measurement and the Approach angle for “X” seconds before the handover happens.

Merging Timeout:

Once the software has decided to change from the Approach settings to the Parallel settings, it will “smoothly” change the Aggressiveness and Smoothing settings from the Approach settings to the Parallel settings.

As a rule of thumb, the below settings are what would be acceptable.

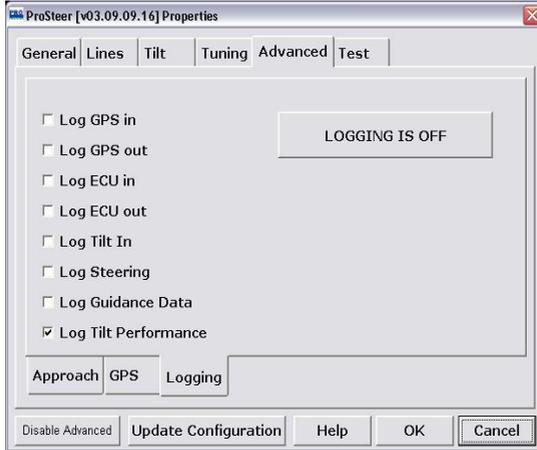
Cross Track : 0.10 = 10cm/4 inches

Approach Angle: 3.0 = 3 degrees

Approach Timeout : 3 seconds

Merging Timeout : 4 seconds

Logging Advanced



Logging is used when steering performance is required to be checked against a standard industry standard.

Log Tilt Performance = Checked

Leave the other options UNCHECKED

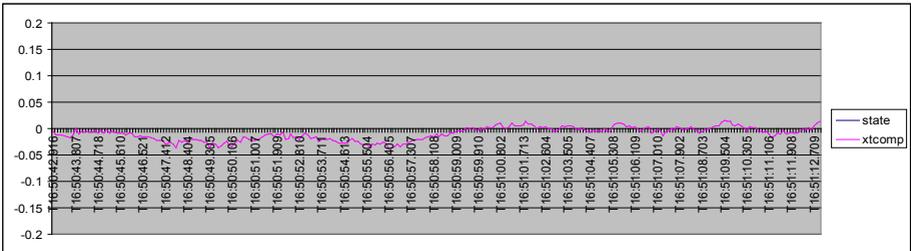
When LOGGING OFF button is selected, data will be accumulated in C/Lynx/Prosteer Logs.

Once the logging is finished, select the LOGGING IS ON button and then the OK button.

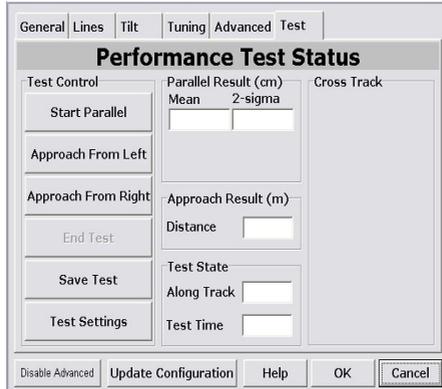
It is important to turn the LOGGING back off once data is collected, otherwise data will continue to be logged and will eventually fill the hard drive on the computer.

Once the logs have been saved, graphs, such as the example below, can be examined by Topcon Technicians to evaluate the steering performance

The below graph shows that the logged steering was accurate to 2.5cm/ or 1 inch



T est Validation



Allows the dealer/installer to test the steering performance once they feel that they have the vehicle steering acceptably.



The Tilt MUST have been completed, and all tuning processes taken place before the test performance can be carried out.

A parallel line MUST be set up on the guidance screen
Parallel test.

Drive the vehicle in a straight line at operating speed and with operation load, select the START PARALLEL button.

The steering will engage, and steer its own line (not the A/B line in guidance), drive for as long as possible and select END TEST.

Mean- average distance to the line performance

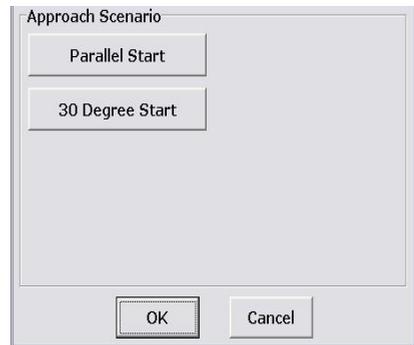
2-sigma – two standard deviations from the line. The reading here is in the units selected, and will show the true accuracy to the line.

5 cm (2 inches) and under is what RTK results should show

Test State-

Along Track – distance the test was conducted over (as long as possible, but at least 300m/1000feet, the longer distance the better)

Test Time- Time the test was conducted over



There are two tests for the approach.

Left and right approach, and if Test Setting button is selected,(above) you can select from parallel or 30 degree approach.

Parallel approach is 1.5 meters/ 5 feet from the line starting parallel to the line.

30 degree approach is defaulted at 30 degree approach, that will start at 6meters/20 feet from the line.

Make sure you are in a clear area and at operating approach speed, select the desired approach test.

Once the steering has aligned within 5cm (2 inches) and 5 degrees of the desired line (for over 3 meters/118 inches in distance) the steering will disengage and the result will be displayed.

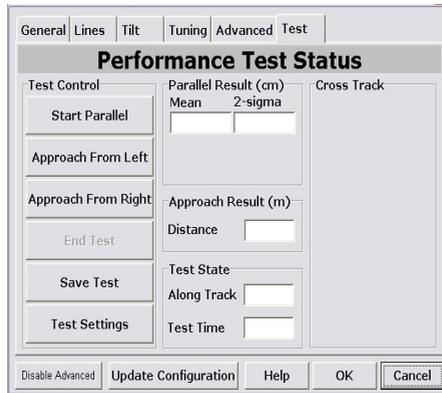
When the test results are to be saved, select the Save Test button prior to starting a new test.

The test file and the INI as it was tested, is saved into C/Lynx/PROSTEERLOGS folder.

The files are dated, so as many tests as you wish can be saved, but you must be able to ascertain which test is which file.

Handy hint is to save the tests, copy them to dealer/installer thumb drive for saving.

- 1- Dealer/installer has a copy of the INI and proof of steering performance.
- 2- If the machine requires revisiting, all test files can be compared by a Topcon technician.



What results are we looking for?

This depends entirely on what the requirements for the vehicle are.

Broadacre 10km (6mph) - 17km (10.5mph)

Parallel testing should result is a 2-sigma reading of 5cm/2 inches or lower.

Approach distance should be below 22m/72 feet when conducting the Parallel Approach test, and below 30m/100 feet when conducting the 30 degree Approach test.

Row Crop 3km (2mph) - 8km (5mph)

Parallel testing should result is a 2-sigma reading of 3cm/1 inches or lower.

Approach distance should be below 12m/40 feet when conducting the Parallel Approach test, and below 20m/72 feet when conducting the 30 degree Approach test.

