

User's Guide
for
Leisure Pilots
715, 730 & 740

Issue 06
for use with
version V3.00 software (or later) in the Pilot Computer



Welcome

All of us at **Cetrek** would like to welcome you to the reliable world of our autopilot systems and thank you for buying our product.

Your new autopilot, whether it is the fixed 730 or 740 or the hand held 715, is easy to operate, helping you to enjoy your boating. It will consistently steer your boat on a straight course, helping to give optimum fuel economy and minimise wear on your steering system.

Your Safety

It is the responsibility of the Helmsman to ensure and maintain the safe navigation and control of the vessel at all times. The autopilot is only an aid to steering, suitable for unconfined waters.

Your System

The system consists of the following basic units:

- Autopilot Control
- Pilot Computer
- Compass Sensor
- Rudder Feedback Unit
- Drive Unit for the steering system

It may also include options such as:

- a second autopilot control
- connections to a chartplotter or navigator
- connections to instruments

These options can be added to the system at any time. Your **Cetrek Dealer** will be glad to give you the latest information on any of them.



EMC Directive 89/336/EEC

This product has been designed to be compliant with the above Directive. Maximum performance and compliance with the EMC Directive can only be ensured by correct installation. It is strongly recommended that the installation conforms with the following standards:

- SMALL CRAFT - ELECTRICAL SYSTEMS:
- a) ISO 10133 - Extra Low-Voltage DC Installations
 - b) ISO 13297 - Alternating Current Installations
- ISO - International Standards Organisation

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1. Using the Pilot

1.1 The Autopilot Control

The Pilot Control is where the helmsman controls all of the functions of the autopilot system. Operation has been kept very simple with just 5 or 6 function keys and a Course Control Knob.

The LCD constantly displays autopilot related data; Autopilot status, Heading or Course, Rudder Position and Course control device.

It also has an information display area across the top of the LCD. You can choose which of the available information is shown here, giving you quick access to relevant information. You can also quickly access and change Sea State settings.

Course changing is a simple turn of the Course control knob or a press of the direction key.

The direction keys can be either used for Course change or Dodge. Course change can be either 1° per press or 10° per press. Dodge is an easy means of momentarily changing course to avoid an obstruction, release the key and the pilot returns you back to your original course.

The stylish Pilot 715 has been designed for hand held control.

The compact Pilot 730 and the larger 740 have been designed for bulkhead or trunnion mounting.

The only operating difference between the three pilots is that the 715 does not have a dedicated 'OFF' function key.



In an EMERGENCY press the (OFF) key or press and hold the (AUTO) key for three seconds to turn the autopilot OFF and regain manual control.

Functionality of the Pilot system is dependant on the Pilot Computer fitted. The basic unit is the 930609, the enhanced unit is the 930619.

This User's Guide covers both systems. Parts that are relevant only to the 619 are marked as such.

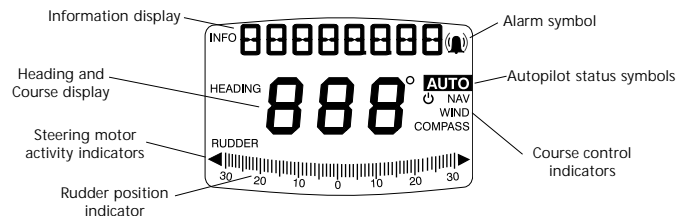
A summary of the extra features a 619 systems has:

- 3 memory settings, PILOT A, B & C.
- up to 3 navigators can be connected and easily selected.
- a Gyro compass can be used.
- an Off Course alarm is available.
- a 'Turn Rate' setting is available.
- an external alarm connection is available.
- a Rate sensor connection is available.

Audible warning Device.

The Pilot 740 has an audible warning device in the form of a buzzer that accompanies any alarm, and confirms any key presses.

1.2 The LCD display



The LCD Display

1.3 The Function Keys



- powers up (turns on) the autopilot system.
- with the system powered up, toggles between Standby and Auto mode.
- press and hold for three seconds to switch the system OFF and save any changed settings.
- Accepts new course in Manual waypoint sequence.



- gives access to lighting and selected Sea state adjustments, plus NMEA information.
- press and hold for three seconds to access the full list of information that may be viewed.



- selects the course control device; Compass, Wind or Navigator.
- press and hold for three seconds to display the Pilot Configuration Menu.
- press and hold the **INFO** and **MODE** keys together for three seconds to access the Dockside and Sea Trial Menus.



- to Dodge, Change course or Tack in Auto mode, depending on function selected.
- moves the rudder in Standby mode.
- changes the values of the settings.



Course Control knob

- to change course in Auto mode.
- changes value in some menus.



fitted on the Pilot 730 and 740.

- saves the settings and powers down (turns off) the system (the Auto key still turns the system off as well).


1.4 Getting started

The pilot will always be in 1 of 2 basic modes of operation:



AUTO

1. This symbol displayed on the right of the LCD, indicates that the pilot is in Standby mode allowing manual control of the steering. The Pilot is switched on, but not in control of the vessel rudder.
2. This symbol indicates that the pilot is in Auto mode where the Pilot is in control of the vessel's course, via a Compass, Windvane or Navigator.

As soon as the  key is pressed, the Pilot will power up (turn on) in Standby mode and display the live compass Heading.

There will be a delay of about 10 seconds while the Pilot carries out a self test routine.

First the pilot displays all the elements of the LCD.
Next the Information display shows:

C E T R E K

Cetrek,

6 0 9 V * . * *

Pilot Computer type (609 or 619) and Software Version,

S P O O L V A L

This will only be displayed, when J3 (in the Pilot Computer) has been set to solenoid (spool valve) control.

P I L O T * * *

Pilot Control Type, "PILOT715" or "PILOT730" or "PILOT740" or if a mixture of Leisure heads "LEISURE".

If 730/740 and ProPilot heads are mixed, "ERROR" will appear.

R A T E G Y R O

This will only be displayed, when a Rate sensor is fitted to the Pilot Computer.

T E S T I N G

This is displayed during the rest of the test.

HEAD 123

The vessel's heading is displayed after successful testing.

GYRO CAL

This is displayed only if a 619 has a Gyro stepper selected. See section 8.25, page 61.



1.5 Standby mode (Manual Control of the steering)



The Standby symbol is displayed to show that the Pilot is in Standby mode.

The large numbers in the centre of the LCD are showing the live Heading. The Heading will change as you manually steer, just like a conventional compass.
The Pilot is not in control of the vessel's steering.


1.6 Jog Steer

When in Standby mode the Jog Steer function can be used. Pressing either the  or  key, moves the rudder in that direction. The rudder stops moving when the key is released, it does not return to the midships position.

(- - - J O G

To Jog Steer to Port (left), press the  key.


J O G - - -)


To Jog Steer to Starboard (right), press the  key.

The Jog Steer function will not operate in Auto mode or when settings are being altered.

AUTO

1.7 Auto mode (with "COMPASS" heading control)

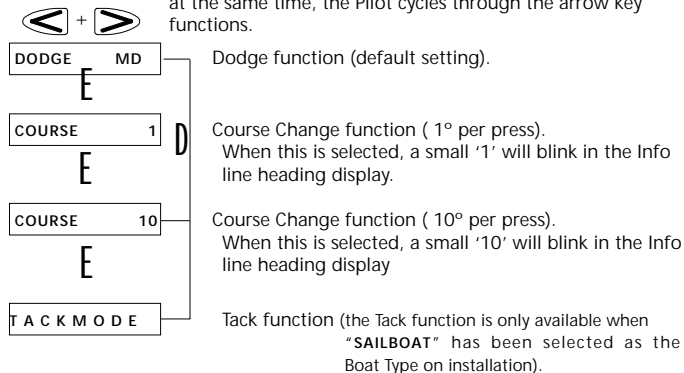
Press the  key to switch the Pilot from Standby to Auto mode. The pilot is now controlling the vessels steering to maintain its instructed course to steer.

Press the  key at any time to revert to Standby mode and resume manual control.

The LCD display changes from showing the standby symbol to showing the Auto symbol. The large numbers show the Course to Steer which is set by the compass, navigator or windvane, as indicated on the right of the LCD.

1.8 Selecting how the Arrow Keys function

In Auto mode, each time the and keys are pressed at the same time, the Pilot cycles through the arrow key functions.



When this is selected, a small 'T' will blink in the Info line heading display.

These functions only operate in Auto mode, but NOT when an adjustable setting has been selected.

Dodge

When you are in Auto mode with the Dodge function selected, pressing either the or key will move the rudder in that direction. When the key is released, the Pilot will return the vessel to its original course. This function is used to "Dodge" obstacles in the vessel's path and return to a parallel track from your original.

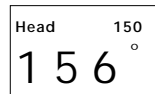
(- - D O D G E) Press the key and the display will indicate a Dodge to Port (left) and the vessel will turn to Port.

D O D G E - -) Press the key and the display will indicate a Dodge to Starboard (right) and the vessel will turn to Starboard.

For safety, Dodge limits should be set to limit rudder movement when dodging. These should prevent sudden, severe course changes, see section 8.11, page 54.

Changing course

The Course Control knob allows course changes in 1° increments for fine tuning.



To change course, in Auto mode, rotate the Course Control knob until the large numbers on the LCD show the new course (or wind angle in Wind mode).

Alternatively, if the arrow key function is set to Course Change, press the or keys, (one press represents 1° or 10° depending which is selected). The Pilot will immediately bring the vessel on to the new course. Be cautious, 10° on a fast boat is a substantial turn.

For large course changes it is usually safest to switch the Pilot back to Standby mode, steer to the new course manually, then switch back to Auto mode.

Tack

The Tack function is available only if "SAILBOAT" has been selected as the Boat Type in the Pilot Configuration.

When the pilot is in Auto mode and the and keys have been set to Tack function, pressing either of the keys will change the Course to steer through a preset angle in that direction, effecting a Tack. The Pilot will then hold course on this new heading. The angle of the Tack depends on the angle set, see section 8.15, page 56.

See section 2 for use with Compass course control, section 3 for use with Wind course control.

1.9 The Information display

The key steps through a list of information items displayed in the Information area of the LCD. Items may be added or removed from the list, customising the pilot to suit your own requirements.

The default displayed settings that will show without additional NMEA inputs are: Heading, Lighting, (Pilot A,B,C, 619 only), Rudder Ratio and Battery Voltage.

When showing adjustable items, such as Lighting and Rudder ratio, the ◀ or ▶ keys change the value of the setting. If no adjustment is made within 7 seconds, the information display will automatically revert to the live heading display, returning the ◀ and ▶ keys to their previous function.

Non adjustable items do not time-out after 7 seconds, and do not change the function of the ◀ and ▶ keys.

Customising the Information display List

The full list of items that can be displayed and their default status[] are:

<i>always available:</i>	<i>with suitable NMEA messages supplied:</i>
Live heading, [ON]	Waypoint Name, [ON]
Lighting, [ON]	XTE (Cross Track Error), [ON]
Pilot A,B,C (619 only) [ON]	Bearing, [ON]
Rudder Ratio, [ON]	Distance, [ON]
Response, [OFF]	Speed, [ON]
Counter rudder, [OFF]	Depth, [ON]
Turn Rate (619 only), [OFF]	Wind Angle, [ON]
Trim, [OFF]	Wind Speed, [ON]
Battery Voltage, [ON].	SOG (Speed Over Ground), [ON]
Digital Rudder angle, [OFF]	COG (Course Over Ground), [ON]
	Water Temperature. [ON]

To change which items are displayed

Press and hold the **INFO** key for three seconds to enter the Information Menu.

The **INFO** key now steps through all items in the menu, except Heading and Lighting which cannot be turned off.

If there is an asterisk ' * ' by the item it will be displayed.

Stop at the item you wish to change.

Use the ◀ or ▶ key to:

- turn the item on or off
- change the units of the Depth and Temperature displays.

The value displayed is the one that the Pilot will use.

Despite being turned on, information requiring an NMEA message will only be displayed if the correct message is available to the autopilot.

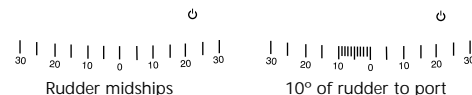
Press and hold the **INFO** key for three seconds to exit the Information Menu.

Press and hold the **AUTO** key to save the settings (this also turns the Pilot Off).

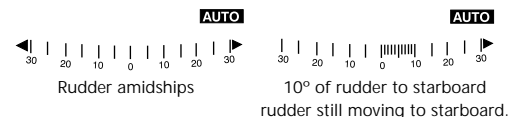
Connection details, and a list of NMEA sentences supported, are in the 930609/619 Pilot Computer Installation Guide.

1.10 Rudder Position Indicator

The LCD displays a bar graph of the rudder position, up to 30°. The graph shows the rudder position in 5° steps from midships.



In Auto mode, when the pilot is controlling rudder movement, two black arrows are used to indicate steering motor activity. Both arrows are displayed when the rudder is not active. One arrow indicates that the rudder is being driven in that direction.



Rudder Position Indicator

When the rudder has reached the autopilots Rudder Limit the segments will flash.

1.11 Digital Rudder position display

This digital readout gives rudder position in 1° steps and can be added to the displayed Information list, section 1.9, page 14 explains how.

RUD	(00)	Rudder is at midships
RUD	(05)	Rudder is 5 degrees to Port.
RUD	(20)	Rudder is 20 degrees to Starboard.

1.12 Lighting

Press the **INFO** key repeatedly until "LIGHT HI" or "LIGHT LO" is displayed.

Press the **◀** or **▶** key to change the Lighting setting between high and low.

The Information display reverts back to showing Live Heading if it has not received a key press for 7 seconds

1.13 Pilot A, B, C (619 only)

The Pilot will store 3 sets of Sea State and Configuration values, PILOT A set, PILOT B set and PILOT C set. Each set can be tuned for a different speed or sea condition. The helmsman can then quickly switch between the settings as he needs them.

These may have been set up during Sea Trials but you will need to know which Pilot set is for which conditions. These can be modified to suit your needs. See section 8 'Pilot Configuration Reference'

Press the **INFO** key until "PILOT" is displayed.

Press the **◀** or **▶** key to change between sets.

The Information display reverts back to showing Live Heading if it has not received a key press for 7 seconds



2. Compass course control

To engage Compass course control

If "COMPASS" is displayed on the right of the LCD, simply press the **AUTO** key to turn the Pilot to Auto mode. The Pilot will take the live compass heading as its Course to steer, and hold the vessel on that heading.

If "NAV" or "WIND" is displayed, press the **MODE** key repeatedly until the word "COMPASS" flashes. Press the **AUTO** key to select Auto mode under Compass control, otherwise the pilot will return to its previous setting.

In an emergency, press the **OFF** key or press and hold the **OFF/AUTO** key to turn the pilot OFF and regain manual control.

To make small changes to the course heading, whilst still in Auto mode, turn the Course Control knob (or the **◀** or **▶** keys if set to Course change). The Pilot will turn the vessel onto the new heading.

To make large course changes, press the **AUTO** key to return the Pilot to Standby mode, steer the vessel manually, then press the **AUTO** key again to engage the Pilot and continue on your new heading.

A 'blinking' top bar after 'HEAD' in the Info line indicates an external compass is being used, see section 8.23 and 8.24.

Tacking under Compass control (*SAILBOAT types only*)

When the pilot is in Auto mode and the **◀** or **▶** keys have been set to Tack function, pressing either of the keys will change the Course to steer through a preset angle in that direction, effecting a Tack. The Pilot will then hold course on this new heading. The angle of the Tack may be adjusted in the Pilot Configuration menu, section 8.15, page 54.

Press the **◀** key for a port Tack, left of your course. The new course is displayed by the LCD's large characters.

Press the **▶** key for a starboard Tack, right of your course. The new course is displayed by the LCD's large characters. The Tack function will not operate in Standby mode or when Menu settings are being altered.



3. Wind course control

Wind Control is only available when "SAILBOAT" is selected as the Boat Type and an NMEA Windvane is fitted.

To engage Wind course control

If the word 'Wind' is not displayed on the right side of the LCD, press the **(MODE)** key repeatedly until the word "WIND" flashes.

Press the **(AUTO)** key to engage Auto mode under Wind Control, otherwise the pilot will return to using the previous selection.



In an emergency press the **(OFF)** key or press and hold the **(AUTO)** key to turn the pilot OFF and regain manual control.

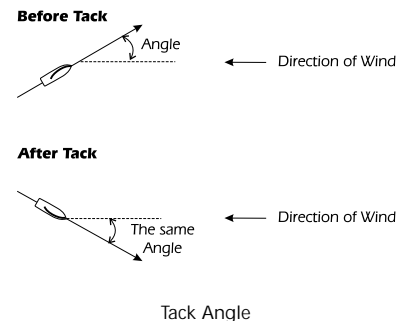
The autopilot will now steer the vessel under Windvane control, to a course that maintains the current wind angle. The pilot will adjust the vessel's course with any shifts in wind angle.

The heading display now shows the True wind angle relative to the vessel. So for example, 090 indicates true wind on the starboard beam.

Tacking under Wind control

To initiate the Tack function of the **(◀)** and **(▶)** keys, press them at the same time, repeatedly until "TACKMODE" is displayed in the Information line of the LCD.

To tack, press either the **(◀)** or **(▶)** key. The Pilot Computer will automatically calculate the new course (double the present true wind angle) and will steer the vessel on to the new course, holding the new wind angle.



The Tack function will also work when gybing.

To make small changes to the wind angle, whilst still in Auto mode, turn the Course control knob. The Pilot will turn the vessel onto the new heading and hold the new wind angle.

To make larger course changes press the **(AUTO)** key to disengage Auto mode, turn the vessel manually, then press the **(AUTO)** key to engage Auto mode again to continue on your new heading and a new wind angle.

4. Navigator course control

The Pilot can be interfaced to a navigation device such as a GPS, Loran or Plotter using the Industry Standard NMEA 0183 format.

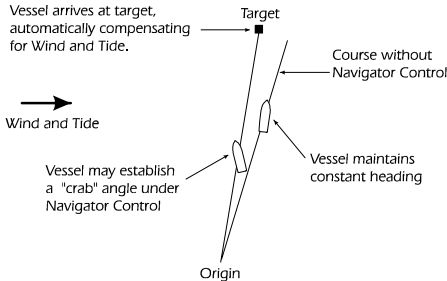
Once a waypoint has been selected as a target and the navigation device is providing the Pilot with navigation data to the target, the Pilot may be engaged under Navigator course control.

Steer the boat onto the desired heading to minimise any Cross Track Error so that Auto mode can be engaged.

As soon as Navigator course control is selected the Pilot will read the magnetic bearing to the target from the navigator and use this as the course to steer. Selecting Auto mode will then cause the Pilot to turn the vessel onto that course and hold it.

The Pilot constantly monitors the Cross Track Error signal from the navigator and applies Navigator Gain to maintain a direct Course Over Ground to the target.

Note that the vessel may establish a “crab” angle to compensate for wind and tide as it steers to the waypoint.



Navigator Control

If a new waypoint is selected in the navigator, manually or because it is in a route, the Pilot will be triggered, by a change of waypoint identifier, to accept a new course to steer.

The Pilot will then automatically turn to the new course, or wait until the **AUTO** key is pressed before it turns, depending whether the automatic or manual option has been set. See section 8.20, page 59 for setting instructions.

While under Navigator Control, both the arrow keys and Course control knob still operate.

4.1 NMEA 0183 messages

The Pilot Computer is capable of processing the following NMEA 0183 messages for navigation (it will also process other messages for instrumentation, see the Pilot Computer Installation Guide for details). Cross Track Error, Bearing to Waypoint and Waypoint identifier are required as a minimum.

NMEA MESSAGE	CROSS TRACK ERROR	BEARING TO WAYPOINT	WAYPOINT IDENTIFIER	VELOCITY
APB/APA	✓	✓	✓	-
BOD	-	✓	✓	-
BWC	-	✓	✓	-
XTE	✓	-	-	-
RMA	-	-	-	✓
RMB	✓	✓	✓	-
RMC	-	-	-	✓
VTG	-	-	-	✓
VHW	-	-	-	✓

✓ indicates that the data should be present in the given message according to the NMEA 0183 specification, however please note that not all manufacturers provide all the data required by a given message.

Providing the navigator outputs the minimum information, automatic waypoint sequence can be used.

4.2 Using Navigator control

Programme the navigator with a waypoint or route, and select the target. The basic information used for Pilot control is:-

- Bearing to Next Waypoint.
- Cross Track Error: Whether you are port or starboard of the course and by how much, expressed in units of one hundredth of a nautical mile (60ft).
- Alarm Condition: This indicates if information received from the navigator is valid or not.
- Change of Waypoint Identifier.

If you do not want Automatic Waypoint switching, change to Manual Waypoint switching, see section 8.20, page 57.

4.3 Selecting a Navigator

If 'NAV' is not displayed on the right of the LCD, press the key repeatedly until the word "NAV" flashes. The option "NAV1" is shown in the Information display.

NAV 1

This selects the navigator connected to NMEA 1 in the Pilot Computer (PL11).

If the system has a 930619 Pilot Computer, additional navigators can be connected. Press the key to select the navigator connected to:

NAV 2

NMEA 2 in the Pilot Computer (PL17).

NAV 3

NMEA 3 in the Pilot Computer (PL16).

C 7 7 5

Only displayed when used as a 2nd station to a Chartplot 775 system

4.4 To engage Navigator control

While NAV is flashing, press the key to engage Auto mode under navigator control, otherwise the pilot will return to its previous setting.

If the Bearing to Waypoint is within 20° of your heading and there is less than 0.05 nautical miles Cross Track Error, the Pilot will immediately engage Auto mode under Navigator course control.

Bearing and Cross Track Error can be viewed in the Information display.

The Pilot will not engage Navigator Control immediately if the Bearing to Waypoint is greater than 20° of your heading (more than 0.05 nautical miles Cross Track Error) as this would cause a sharp turn.

BWP 145

In this instance, the press of the key displays the BWP (Bearing to Waypoint).

The next press of the key displays the XTE (Cross Track Error).

XTE (0 . 1 4

The number displayed is the cross track error in one hundredth's of a mile. The arrow indicates if the error is to Port or Starboard. This example shows 0.14 miles Port (left) of the track.

XTE 0 . 0 2)

This example shows 0.02 miles Starboard (right) of the track.

XTE 000

This example shows that the pilot is on track.



The third press of the key will engage the autopilot and is likely to cause a sharp turn.

So if the Bearing to waypoint is greater than 20° from your heading, or the XTE is greater than 0.05, it would be safer to manually steer closer to the course. Once the Bearing to Next Waypoint and Cross Track Error are at acceptable values press the key to engage Navigator control.

Once the Pilot reaches the waypoint, the Navigator will send it a new Course to steer.

If Automatic Waypoint Sequence is selected, the Pilot will flash the bearing to next waypoint, for 7 seconds, but turn onto it automatically after the first 2 seconds.

If Manual Waypoint Acceptance is selected, the Pilot will scroll the message "NEW WPT PRESS AUTO" for 10 seconds. The vessel will not turn onto the new course unless the key is pressed.

If the key has NOT been pressed, after 10 seconds the Pilot will switch to Compass control and continue on its present heading until Nav is re-selected or new instructions are received.

4.5 Navigator errors

NO	NAV
----	-----

If the Pilot is not receiving navigator data, this message will appear. Navigator control cannot be selected. Check the cable, connections and message format.

NO	XTE
----	-----

This indicates that no Cross Track Error information is being received from the Navigator. In the event of a navigator error or fault condition, the Pilot will display a fault message, hold the vessel on its present heading and will not accept any further course changes from the Navigator until the error clears.

If the alarm clears, the Pilot will accept data again and Navigator control can resume. If the fault condition remains, turn back to Compass control, or manually steer the vessel.

NAVG	ERR
------	-----

If the Pilot receives an error message from the navigator when Auto mode is selected it will display this message and remain in Standby mode.

NO	WAYPT
----	-------

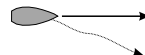
"No waypoint" is only displayed when the Pilot is used as a 2nd station to a Chartplot 775, and no 'Target' waypoint has been selected on the Chartplot.

An explanation of navigator alarms is given in section 9, page 64.

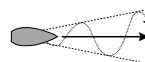
5. Sea State Adjustments

5.1 Rudder ratio

The Rudder ratio setting is used primarily to match rudder movement to boat speed. Generally the higher the speed the less movement is required, the lower the setting needs to be.



If the setting is too low the vessel will understeer and tend to drift off course to one side.



If the setting is too high the vessel will oversteer and build up oscillations from side to side.

If NMEA Speed information is connected to the Pilot Computer, the Pilot can be configured to automatically adjust the Rudder ratio setting in relation to the vessel's speed, see section 8.8, page 51.

To manually adjust the Rudder ratio setting, press the **INFO** key repeatedly until **"RUDDER"** is displayed (this setting can be turned off from the Information list, in which case the method described in section 8 can be used). Adjust the setting using the **<** and **>** keys.

The range is from 0 (Minimum movement) to 20 (Maximum movement).

The Information display reverts back to showing Live Heading if it has not received a key press for 7 seconds

5.2 Response (also known as Yaw).

The Response setting is primarily the autopilot's "weather" control. It sets the amount that the vessel is permitted to move off course before rudder is applied to bring it back onto its set heading.

Response needs to open (increase the setting value) in heavy seas and close (decrease the setting value) in calm seas.

This will normally be set to Adaptive (the factory default) and so require no manual adjustment.

Adaptive control

The Pilot's "Adaptive" software has been designed to optimise Response, Counter Rudder and Trim in order to obtain the best performance, as conditions change.

With Response set to Adaptive, the Pilot automatically fine tunes the controlled rudder movements to roughly the same frequency and magnitude as those performed by hand when steering manually. If viewed, the value will change between A0 (calm sea) and A5 (rough sea) as it adjusts itself.

When sea states or conditions obviously change, for instance, after turning to a new course from a following sea to a head sea, the Adaptive Software adjusts to suit the change in conditions.

Proper setting has a marked effect on steering system wear and tear, as well as battery life in sailing craft.

Manual control

To manually control Response, add the setting to the Information cycle (see section 1.9, page 14).

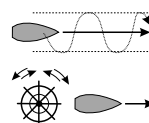
To adjust the Response setting, press the **INFO** key repeatedly until "Resp" is displayed.

Adjust using the **◀** and **▶** keys. 'Adaptive' control can still be turned on and off from here.

The range of settings is: Adaptive (A0 to A5) then from 1 (Very responsive) to 20 (Least responsive).

To avoid incorrect setting:

Planing boat types are limited to a maximum setting of 2,
Semi-displacement boat types to a maximum of 5,
Sailboat and Displacement boat types to a maximum of 20.



If the response setting is too high, the vessel moves a long way from the course before it is corrected. You will need to decrease the Response setting to correct this.

If the response setting is too low, the vessel will hold its course but the helm will be constantly and rapidly moving, making small unnecessary corrections.

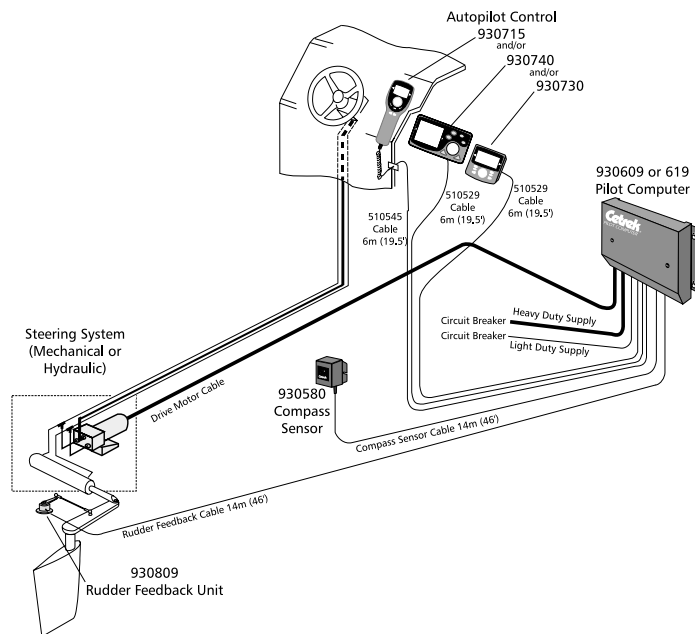
Increase the Response setting to correct this. This condition causes the most wear in the steering gear and is wasteful of power.

The Information display reverts back to showing Live Heading if it has not received a key press for 7 seconds.

Proper setting has a marked effect on steering system wear and tear, as well as battery life in sailing craft.

The next sections relate to:

- the installation of the autopilot system
- pilot settings reference guide
- fault finding



A Basic System

Basic Equipment

- Pilot Control 930715, 930730 or 930740
- Pilot Computer 930609 or 930619
- 930580 Compass Sensor
- 930809 Rudder Feedback Unit
- Drive Unit for the steering
- Heavy Duty Power Supply, fused to suit drive unit
- Light Duty Power Supply, fused at 5 Amp

6. Installing the Pilot

It is important to read the Manual / Installation Leaflet for each unit prior to commencing installation.

1. Refer to the 930609/619 Pilot Computer Installation Guide for:
 - A step by step installation procedure for connecting the Pilot 715/730/740 system into the Pilot Computer.
 - Connecting Cetrek peripheral equipment.
 - Setting the Jumpers and Links.
2. To install the Pilot 715/730/740 itself, refer to section 6.2 of this manual.
3. Once the system's mechanical installation is complete, carry out:
 - Dockside Settings (section 7, steps 1 - 6), and
 - Sea Trials (section 7, steps 7 - 10) to configure the pilot to the vessel.
 - Pilot Configuration (section 8) explains the Pilot and peripheral equipment settings for the system.

6.1 Specifications

Voltage:	Nominal 12V / 24V DC
Operating Temperature:	0° to +55°C
Storage Temperature:	-20° to +70°C

Pilot 715

Cable (510545):	6 way x 6m (19.5') Screened.
Dimensions:	220mm max (8.65") x 75mm max (2.9")
Enclosure:	Weatherproof

Pilot 730

Cable (510529):	6 way x 6m (19.5') Screened
Dimensions:	110 mm (4.3") x 110 mm (4.3")
Enclosure:	Weatherproof.

Pilot 740

Cable (510529): 6 way x 6m (19.5') Screened
 Dimensions: 110 mm (4.3") x 200 mm (7.8")
 Enclosure: Weatherproof.

6.2 Mounting the Autopilot Control

For the sake of safety, there must be an autopilot control within reach of the Helmsman AT ALL TIMES, to enable quick disengagement of the Pilot.

Pilot 715

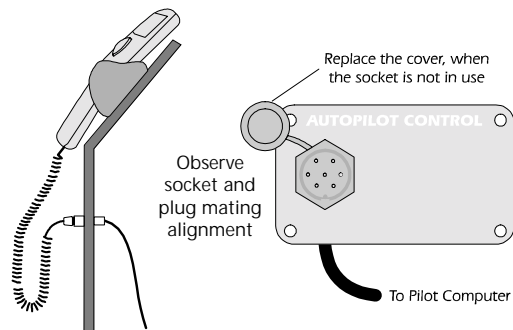
The Pilot 715 connects to the Bulkhead Socket. The bulkhead socket and its cable connect to the Pilot Computer. The Socket requires a 25 mm (1.0") diameter hole for mounting.

A 6 metre (19.5ft) extension cable is available, part n° 510499.



Extra socket positions can be installed, part n° 930027

Allow adequate clearance for cable connections to ensure cables are not unduly stressed.



Pilot 730

A Trunnion Mounting kit is available, part number 930293.

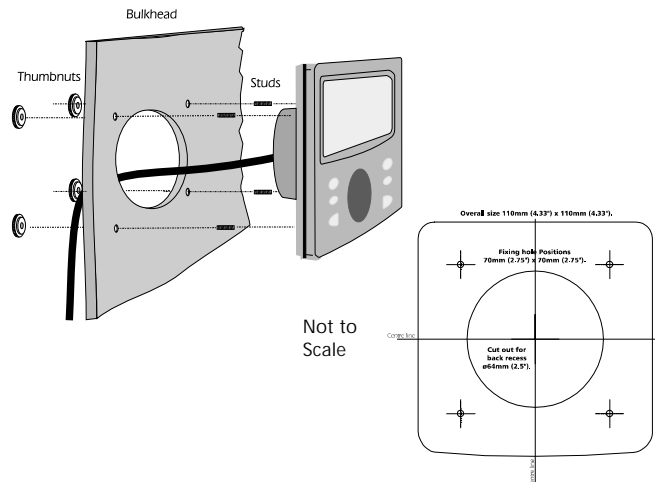
To bulkhead mount: Use the template to cut the holes in the bulkhead for the cable and 4 studs.

Pass the cable out through the bulkhead and connect it to the rear of the Pilot 730. Screw the M4 studs into the rear case. Place the pilot in position, then secure it to the bulkhead with the thumbnuts supplied.

Ideally, if the rear of the 730 is going into an enclosed area, that area should be adequately ventilated so that the rear sees the same ambient temperature as the front.

A 15 metre (49ft) cable is available, part n° 510548.

Allow adequate clearance for cable connections to ensure cables are not unduly stressed and that there is sufficient length of cable to remove the unit for service purposes.



Pilot 740

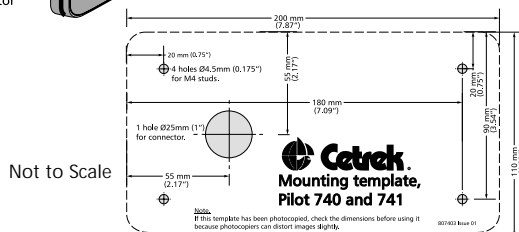
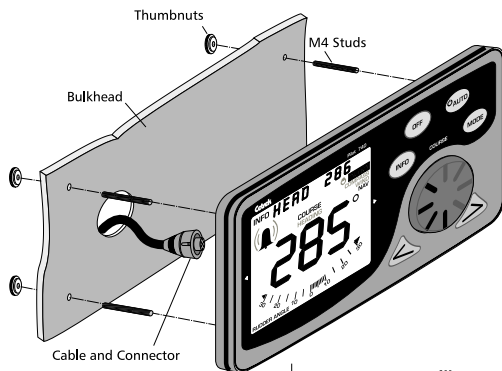
A Trunion Mounting kit is available, part number 930289.

To bulkhead mount: Use the template to cut the holes in the bulkhead for the cable and 4 studs.

Pass the cable out through the bulkhead and connect it to the rear of the Pilot 740. Screw the M4 studs into the rear case. Place the pilot in position, then secure it inside the bulkhead with the thumbnuts supplied.

A 15 metre (49ft) cable is available, part n° 510548.

Allow adequate clearance for cable connections to ensure cables are not unduly stressed and that there is sufficient length of cable to remove the unit for service purposes.



6.3 Connecting the Pilot Control

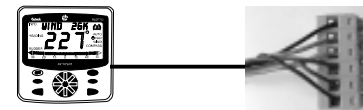
Route the cable to the Pilot Computer. If the cable needs to pass through a bulkhead, note the wire colours in the connector, then remove it temporarily.

Incorrect wiring (e.g. reverse polarity) can cause irreparable damage to some equipment and is not covered by Cetrek warranty.

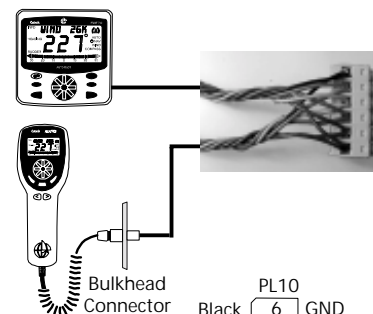
Insert the connector into the Pilot Computer (PL10). Connect the cable screen securely to the fixing 'tongue' using the two cable ties provided.

When connecting two or more Leisure Pilots, **the wires must be connected in parallel, into the same connector**, then plugged into PL10.

Remove the plug from the first cable.



Then connect the wires of both units into the plug of the second cable. The wires are the same colours.



Insert the plug into PL10.

Connect the cable screen to the fixing 'tongue'.

	PL10	
Black	6	GND
Orange	5	TX data
Yellow	4	TX Latch
Red	3	LDSS+
Violet	2	RX data
Brown	1	TX clock

7. Dockside and Sea trial settings

Having completed the mechanical installation and wiring of the system, the next step is to configure the Pilot for the characteristics of the boat.

In order to use the pilot successfully, it is **MANDATORY** that you carry out the Boat Type and the Rudder Settings Routine. For the system to work correctly, both Dockside settings and Sea trials, need to be completed fully.

The method below is used during Dockside settings and Sea trials.

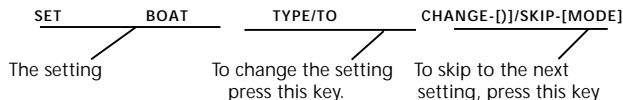
While in standby, press and hold the **(INFO)** and **(MODE)** keys until "DOCKSIDE-[(J) / SEATRIAL - (J)]" is displayed.

Press the **(←)** key to select the Dockside settings menu.

Press the **(→)** key to select the Sea Trial settings menu.

Using the settings menus

The settings use self prompting, scrolling messages, giving details on how to change the setting or to skip to the next option:



Do not engage Auto mode until the Dockside Settings have been completed.

To exit, at any time, press and hold the **(INFO)** and **(MODE)** keys.

To save any changed settings, turn the Pilot OFF by pressing and holding the **(AUTO)** key.

There are two summary cards supplied for these settings. It may be more convenient to use them after having read this User's Guide.

Dockside Settings

Summary of steps:

- 1 Powering up for the first time.
- 2 Setting the Rudder Feedback type.
- 3 Setting boat type.
- 4 Rudder settings routine.
- 5 Aligning the compass.
- 6 Checking the settings.

Step 1

7.1 Powering up for the first time

Ensure that all units are installed correctly, that the correct size fuses or circuit breakers are fitted and that the ship's batteries are adequately charged. Check that all the system connections are correctly made and return the rudder to the midships position before the power is applied.

Switch the Pilot system supply ON (both Heavy Duty and Light Duty Supplies).

If the pilot starts to move the rudder, switch off at once and re-check the connections.

Press the **(AUTO)** key. If all is correct the Pilot displays a startup sequence (fully explained on page 10) finishing with a heading display, which may not be accurate at this stage.

HEAD ***

The Info line will display "ERROR" if a 730 or 740 and a ProPilot are connected on the same system.

FAULT 165

A 619 system with Gyro and no magnetic compass will give a fault 165 (no compass) message when first powered up. Refer to section 8, page 48 and set the gyro settings, 8.24 to 8.27, then restart the unit.

Step 2

7.2 Setting the Rudder Feedback type.

The system comes from the factory set to Amplified for the 930809 or 930819 Rudder feedback unit (RFU). If a 930837 or other RFU is to be used, please refer to sections 8.0, page 48 and 8.12, page 55 if you need to change the signal amplification.

With the amplification correct, set the rudder to midships, if the Rudder Position display is 5 degrees or less, it will be corrected during the rudder settings routine. If over 5 degrees, mechanically re-adjust the Rudder feedback unit (refer to its Installation Instructions).

Depending on how the Rudder Feedback Unit is mounted, the direction of the pilot's rudder information may be reversed, this will be automatically corrected later.

Step 3

7.3 Setting the Boat Type.

With the Pilot in Standby, press and hold the **INFO** and **MODE** keys until "DOCKSIDE-[(I)/SEATRIAL-(I)]" is displayed. Press the **◀** key to select the Dockside settings menu, the display scrolls the message "SET BOAT TYPE/TO CHANGE-(I)/SKIP-[MODE]".

In the Autopilot's memory there are 4 boat types to choose from. Press the **▶** key to display the current Boat Type and then press the **▶** key repeatedly to scroll through the boat types, the setting left displayed will be the one used.

PLANING

PLANING hull (high speed power boat, 20+ knots)

SAILBOAT

SAILING vessel

DISPLACE

DISPLACEMENT hull (up to 10 knots)

SEMI DISP

SEMI-DISPLACEMENT hull (10 to 20 knots)

Setting the Boat type to "SAILBOAT" enables the extra facilities of Wind course control and its Tack function.

The Boat type selection restricts pilot settings as below:

Setting	Response	Trim
Planing	2 max	10 max
Sailboat	20 max	20 max
Displacement	20 max	10 max
Semi-displacement	5 max	10 max

Step 4

Caution

7.4 Rudder settings routine

Press the **MODE** key, the display shows "RUDDER SETTINGS - [(I)] / SKIP - [MODE]". During the Rudder settings routine the rudder will be moved under autopilot control. It is therefore important to ensure the rudder and steering gear can move safely from hardover to hardover without hitting anything. Check that the steering moves freely from lock to lock without undue stiffness and that it can move to its full travel without the Rudder Feedback arm fouling the steering.

The Rudder settings routine will set:-

- **Rudder Phasing** sets the rudder signal polarity so that the Pilot displays the correct direction of rudder movement.
- **Motor Phasing** sets the correct direction of rudder movement when commanded by the autopilot.
- **Rudder Limits** sets the maximum rudder movement, either side of midships, useable under autopilot control.
- **Center Rudder** sets the rudders midships position.


Press the **▶** key to start the Rudder settings routine.

First the Pilot scrolls the message "CENTER THE RUDDER-[(I)]". Position the rudder at midships by viewing the actual rudder, then press the **▶** key.


The display will now scroll "RUDDER TO STARBOARD END STOP-[(I)]". Turn the helm to starboard, to a position just before the mechanical end stop and with it held in this position press the **▶** key again.


A default value of 30° appears in the Heading Display and the Information line scrolls "ENTER THIS RUDDER ANGLE - [(I)] / SKIP - [MODE]". Using the Rudder Angle Template on page 67 estimate the current angle of the vessel's rudder just before the mechanical end stop. Use the **◀** and **▶** keys to alter the default value to the estimated angle. Press the **MODE** key to enter this information.



The display scrolls "RUDDER TO PORT END STOP-DJ". Turn the helm to port, to a position just before the mechanical end stop and with it held in this position, press the  key again.

To prevent possible damage to your steering gear; if the Port and Starboard positions that you select were different angles the Pilot will set both Rudder Limits to the smaller angle.

Now the Pilot asks you to "CENTER THE RUDDER-DJ", centre the rudder again by viewing the actual rudder and with it held in this position, press the  key.

The display scrolls "NOW PRESS AUTO-[AUTO]". Ensure the rudder is free to move, press the  key, which engages the motor and drives the rudder from hard over to hard over four times:


H-OVER	1	from the centre rudder position to a Rudder Limit
H-OVER	2	then across to the other Rudder Limit
H-OVER	3	the rudder is returned to first Rudder Limit
CENTERING		and finally the rudder is centred again



"RUDDER IS NOW SET-[MODE]" is displayed to confirm that the Rudder Phasing, Motor Phasing, Rudder Limits and Center Rudder settings have all been completed successfully.


Step 5


7.5 Align Compass


Not all compass' support this feature. The 930580 and 930687 do. For other compass' see the documentation that comes with them.

Press the  key, the display will show "ALIGN COMPASS - [()] / SKIP - [MODE]".

Using the  and  keys or Course control knob, set the heading display of the LCD to the vessel's approximate heading (this is set more accurately during the Sea Trials).

Press the  key, "DOCKSIDE SETTINGS COMPLETE [MODE]" will be displayed.


Press the  key to exit the Dockside Settings menu.

Save the settings by holding down the  key to turn the Pilot OFF.

The Dockside settings are now complete.

Step 6


7.6 Checking the settings

Press the  key to turn the pilot back on.

Check that there are no bars present in the Rudder Position Indicator when the rudder is in the midships position.

Turn the helm to Starboard until the rudder position scale flashes. Check that the rudder has not quite reached the mechanical limit of rudder movement.


Repeat for Port helm.


Re-centre the rudder. Switch the Pilot into Auto mode, by pressing the  key. Very little or no rudder movement should occur.




If the rudder drives continuously to one side, switch off the power at the breaker at once. Check the mechanical and electrical installation. There is a Troubleshooting Guide in the 930609/619 Installation Guide which may help.


If the rudder continuously 'hunts' about midships, turn the Pilot off and remove as much freeplay as possible from the steering and Rudder feedback unit linkage. This also occurs on Power Steering systems particularly if the steering is plumbed with flexible hose. If that does not stop it, increase the Rudder Deadband setting, see section 8.9, page 54.

With the pilot in Auto mode, check that when you press and hold the  key, the motor drives the rudder so that it close too but doesn't touch the Starboard end stop. Check that the rudder display segments flash. The rudder should centre when the key is released.

Press and hold the  key, and repeat for Port rudder.

Hardover times can now be checked. Refer to sections 8.6 Motor speed and 8.7 Motor ramp, to set DC reversing motors.

Press the  key to return to Standby mode.

Save any changed settings by holding down the  key to turn the Pilot OFF.

You are now ready to start the Sea Trials.

Sea Trials




The next stage of installation is to set-up the Pilot at sea.





It is essential that your compass is properly corrected.

Summary of Steps

- 7 Automatic deviation correction of Cetrek compass'.
- 8 Compass alignment for Cetrek compass'.
- 9 Center the rudder
- 10 Final Sea trial and fine tuning

Steps 7 & 8 below correct the Cetrek compass' 580 and 687. For other compass' or Gyros, follow the documentation that comes with them then carry out steps 9 and 10.

To access the Sea Trials menu, with the pilot in standby, press and hold the  and  keys simultaneously, then press the  key.

Press the  key to step through the settings. To exit, at any time, press and hold the  and  keys. To save any change settings, press and hold the  key which also turns the Pilot off.

Step 7

7.7 Automatic Compass Deviation Correction for 930580 and 930687 compass'.

The 930580 and 930687 compass have facilities to automatically measure and compensate for the majority of compass deviation found on board a vessel. The compass sensor must be mounted clear of strong magnetic fields, caused by heavy duty cables, motors, speakers etc.

Before continuing, ensure you have a method of obtaining an accurate heading, i.e. GPS, transits or a corrected magnetic compass.

This must be performed in a calm sea, away from large iron structures. It is dangerous to carry out these trials in restricted or busy waters.



Turn the vessel through a full 360° with the Pilot in Standby mode and note the amount of error at the eight Cardinal and Inter cardinal points.

The deviation correction requires the vessel to turn CLOCKWISE approximately 2½ times, in a smooth turn.

Turn the system on. In Standby mode, press and hold the **INFO** and **MODE** keys until “DOCKSIDE-[]/SEATRIAL-[]” is displayed. Press the **SE** key to select the Sea Trial settings.

The Pilot will now display “COMPASS CORRECTION-[]/SKIP-[MODE]”.

Press the **SE** key
“COMPASS UNCORRECTED CALIBRATE
NOW-[]/SKIP-[MODE]” is displayed.

Begin your turn, then press the **SE** key to start the sequence running, the Pilot displays “TURNBOAT”.

The display then shows “KEEP TURNING”.

After approximately 2½ turns the display shows “COMPASS CORRECTED-CALIBRATE NOW-[]/SKIP[MODE]”, the automatic deviation correction routine has been completed.

If the pilot displays “COMPASS CORRECTED-CALIBRATE NOW-[]/SKIP[MODE]” it means that the autopilot already has correction values stored. Press the **SE** key to erase previous information and “COMPASS UNCORRECTED-CALIBRATE NOW-[]/SKIP-[MODE]” is displayed.

If “ERROR 7” or “8” is displayed, the compass has a strong magnetic field too close to it. Remove the source or relocate the compass to a more suitable position.

To abort the routine, press the **SE** and **SE** keys together. The display returns to “COMPASS UNCORRECTED-CALIBRATE NOW-[]/SKIP-[MODE]”. Turn the Pilot off by pressing the **QAUTO** key.

Step 8

The Pilot must have been turned off before the start of every deviation correction run.

7.8 Compass alignment (Cetrek compass)

Having completed the Automatic deviation correction procedure the compass must be ‘electronically’ aligned with the vessel’s bow.

Press the **MODE** key “ALIGN COMPASS-[]/SKIP-[MODE]” is displayed. Hold the vessel on a steady heading. The compass heading is displayed. Using the **SE** or **SE** keys, or the Course control knob, change the value until it is the same as the vessel’s true heading. When correct, press the **MODE** key.

Checking the compass settings

Comparison checks against known headings should be carried out to verify the accuracy of the compass.

Turn the vessel again through a full 360° with the Pilot in Standby mode. The live heading is displayed in larger numbers in the Heading display, note the amount of error at the eight Cardinal and Inter cardinal points. The error should now have reduced to less than +/- 3° at each point.

If this accuracy cannot be achieved, the compass will probably need to be moved and corrected again.

619 Only. If two compass’ have been fitted on a 619 system, both will need selecting, then calibrating and aligning, separately.

Step 9

7.9 Center Rudder

Press the **(MODE)** key until "CENTER RUDDER-[]]/SKIP-MODE]" is displayed.

This routine will set the electronic center rudder position more accurately than that set in the dockside settings.

Steer the vessel on a straight heading, at normal cruising speed (ensure that there is no cross wind or similar requiring Standing Helm). Press the **(➤)** key to set the current rudder position as the new midships position.

The message "CENTER RUDDER-[]]/SKIP-MODE]" is displayed to allow the setting to be done again if needed.

If the position is correct, press the **(MODE)** key and the Pilot will exit the Sea trial settings mode.

Check and readjust the motor speed (section 8.6) and motor ramp (section 8.7) if necessary.

Set sensible Dodge limits, see section 8.11 on page 54.

619 only, set Pilot B and C values, although they may need to wait for different sea states to fully check them.

The Pilot installation is now complete.

Save any changed settings by holding down the **(AUTO)** key to turn the Pilot OFF.

Step 10

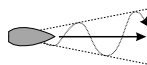
7.10 Final Sea Trial and Fine Tuning

Steer the vessel in a straight line at normal cruising speed and press the **(AUTO)** key.
The vessel should now hold a steady course.

If the vessel does not hold a steady course, change the Sea State adjustment Rudder Ratio to set the pilot for optimum performance, as you would on any voyage (see section 5, page 25).



If the vessel drifts off course to one side, increase the rudder ratio setting by one.



If the vessel oscillates from side to side, decrease the rudder ratio setting by one.

Change it one step at a time.

Press the **(INFO)** key repeatedly until "RuddeR" is displayed for Rudder Ratio and change the setting by using the **(◀)** or **(➤)** keys.

Press the **(AUTO)** key to regain Manual Control.

8. Pilot configuration reference

This section contains details of the Pilot configuration settings. They rarely need adjustment, but might be needed to fine tune the Pilot for an unusual vessel, or for setting peripheral equipment options.

To access the Pilot Configuration menu, with the Pilot in standby, press and hold the **MODE** key until

"CHANGE SETTING-{}"/FORWARD-[MODE]/BACKWARD-[INFO]" is displayed.

Pressing the **MODE** key steps forwards through the list of settings. Pressing the **INFO** key steps back through the list of settings.

Pressing and holding the **MODE** key now exits the menu, then re-enters it at the last viewed setting.

To save changed settings, turn the Pilot OFF by pressing and holding the **GAUTH** key.

8.1 Rudder ratio

RUDDER 5

The Rudder ratio setting is usually altered from the information display, see section 5, page 25. This is an alternative place to change the value. Press the **MODE** key, "RUDDER" is displayed. Change the setting by using the **◀** or **▶** keys.

The range is from 0 (Minimum movement) to 20 (Maximum movement).

8.2 Response

RESP A 2

The Response setting is usually set to Adaptive but can be turned on and altered from the Information display, see 'manual control', section 5, page 26. This is an alternative place to change the value. Response sets the amount that the vessel is permitted to move off course before rudder is applied to bring it back onto its set heading.

Press the **MODE** key, "RESP" is displayed. Change the setting by using the **◀** or **▶** keys.

The range of settings is: Adaptive (A0 to A5) then from 1 (Very responsive) to 20 (Least responsive). Planing boat types are limited to a maximum setting of 2, Semi-displacement boat types to a maximum of 5, Sailboat and Displacement boat types to 20.

8.3 Counter Rudder

C-RUD 8

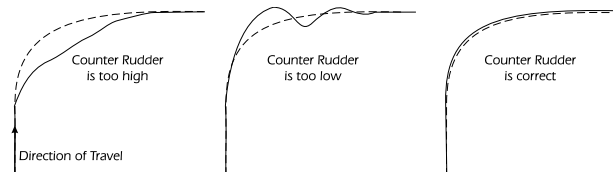
To prevent the vessel from overshooting at the end of a large course change, the amount of applied rudder is reduced as the vessel approaches the new heading.

If the vessel is turning fast, the applied rudder needs to be reduced earlier than if the vessel was turning slowly.

This setting balances the rate that the vessel is turning against the rate at which the reduction of applied rudder occurs.

If this is set too high the vessel will not settle on to the new heading quickly enough.

If the Counter Rudder is set too low the vessel will overshoot and the pilot will have to correct with opposite helm accordingly, possibly causing the vessel to oscillate from side to side, before settling to the new heading.



Press the **MODE** key "C-RUD" is displayed. Change the setting by using the **◀** or **▶** keys.

The range is from 0 (No Counter Rudder) to 20 (Maximum Counter Rudder).

This setting can be turned on, then viewed and adjusted in the Info list.

8.4 Turn Rate *(619 Pilot Computers only)*

TURNR 16

This sets the minimum radius of turn that is allowed when under Pilot control. When set to 0 (off) the rate of turn is not limited and small radius turns are allowed. The range is from 0 (off), then 1 (large radius turns only) to 20 (small radius turns allowed).

This setting can be turned on, then viewed and adjusted in the Info list.

8.5 Trim

TRIM 4

Normally, if the rudder is amidships the vessel will travel in a straight line. Sometimes something will cause the vessel to drag to one side, for example the wind, towing something or current. To counteract this, a few degrees of rudder will be applied, this is termed Trim or Standing Helm. This setting adjusts the rate at which that standing helm is applied.

The higher the setting, the faster the standing helm is applied. This should be set so that the Pilot will trim the vessel within 60 seconds. On single screwed vessel's or sailing yachts it is only possible to check the Trim setting while using the craft when, for example, the prevailing conditions cause the vessel to steer with offset rudder. The correct Trim adjustment setting for these types of vessel is therefore best found by experience.

To check the Trim adjustment with twin engine vessel's, run the boat under Pilot command with both engines running, then close down one engine. The vessel will initially go off course but should return to course in less than 60 seconds. If the vessel takes a longer period of time to return to course then increase the value set for Trim.

Press the **MODE** key, "TRIM" is displayed. Change the setting by using the **◀** or **▶** keys.

The range is from 0 (No Trim) to 10 (Maximum Trim) although if the Boat type is set to SAILBOAT, the maximum is increased to 20.

This setting can be turned on, then viewed and adjusted in the Info list.

8.6 Motor Speed *(DC reversing motors only)*

MOTSP100

Motor Speed limits the drive motor speed to give a hard-over to hard-over time suitable for the vessel. This is especially useful if the vessel has a high steering inertia.

PWM (Pulse Width Modulation) is the method used to control the speed of the motor.

The Motor Speed setting starts at 100%, which is the maximum motor speed the drive unit can provide. Press the **◀** key to reduce the speed (increasing the Hard-over time), to achieve the Hard-over to Hard-over time calculated for your vessel.

Hard-over time is double at 50% power.

As a guide, the Hard-over to Hard-over time should be approximately:

Planing vessel's	8 - 12 seconds
Semi-Displacement vessel's	11 - 16 seconds
Displacement and Sailing vessel's	15 - 18 seconds

Press the **MODE** key, "MOTSP" or "PWM OFF" is displayed. Change the setting by using the **◀** or **▶** keys.

The range is from PWM OFF, then 100% to 50% in increments of 5%.

The default is 100%.

PWM OFF

There are a few conditions when PWM is a disadvantage, such as running down wind with a large following sea. To switch PWM off, press the **▶** key until "PWM OFF" is displayed.

PWM is automatically turned off when J3 in the Pilot Computer is set for spool valve operation.

8.7 Motor Ramp *(DC reversing motors only)*

MOTRAMP 2

This setting is to achieve a smooth acceleration and deceleration in motor speed as it moves the rudder.

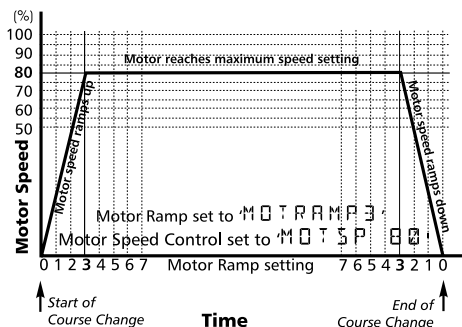
Planing vessel's are sensitive to sea conditions and can easily be moved off course. Decrease the Motor Ramp value so that the rudder moves quicker, returning the vessel back onto its course faster.

Mechanical drive systems with high inertia, need to operate the rudder more slowly when small adjustments are needed, increasing the Motor ramp value will provide this effect.

Press the **MODE** key, "MOTRAMP" is displayed. Change the setting by using the **◀** or **▶** keys.

The range is from 0° to 7°, in increments of 1°.

The default setting is 2.



8.8 Transition Speed *(for Rudder Ratio)*

NO TRSPD

The Transition Speed setting indicates to the Pilot when to increase rudder ratio, to give you greater rudder movement for manoeuvring at slower speeds. As your speed changes, the software creates a gradual adjustment of Rudder ratio, instead of using the fixed Rudder ratio value. This obviously requires NMEA speed information to be available to the Pilot Computer.

This setting is most beneficial for planing vessel's which need increasing rudder movement to maintain steering control when not on the plane.

Establish at what point, in knots, your vessel is comfortably on the plane. Enter the Pilot Configuration menu and use the **▶** key to increase the Transition Speed setting to this value.

Above this value the Pilot will use the Rudder ratio setting. Below it, the amount of Rudder ratio is gradually increased, up to double, giving more control at slower speeds.

Press the **MODE** key, "NO TRSPD" is displayed. Change the setting by using the **◀** or **▶** keys.

The range is from NO TRSPD (no transition speed) to 50 knots in increments of 1 knot.

If there is no speed data available, set this to NO TRSPD.

The Pilot can use speed data from an NMEA 0183 speed or velocity message, refer to the 930609/619 Pilot Computer Installation Guide for more details.

8.9 Rudder Deadband

RDBND 3

Some steering systems have slack in them, owing to wear or system design, which gives a few uncontrolled degrees of rudder movement. Hydraulic drive and power steering systems often have some overshoot.

To stop the Pilot trying to correct these small movements which it can never do, the rudder deadband setting allows a small course error movement without the pilot applying rudder.

Press the **MODE** key, "RDBND" is displayed. Use the **◀** or **▶** keys to set this to the minimum value that avoids hunting of the rudder. The range is from 0 (0°) to 20 (2°).

Too much slack in the steering system will affect Pilot performance.

8.10 Rudder Limits

RUDLIM 7

This allows adjustments to the maximum rudder movement, either side of midships, obtainable under autopilot control. The Dockside Settings automatically calculated this value, however Rudder Limits allows manual override.

Press the **MODE** key, "RUDLIM" is displayed. Change the setting by using the **◀** or **▶** keys.

The range is from 4 (16°) to 10 (40°).

Ensure the limit setting does not allow the rudder to touch its mechanical end stops.

8.11 Dodge Limits

DGELIM 10

This limits the maximum rudder movement, either side of midships, that the dodge function can use. It should be set so that the vessel will not execute a dangerous turn at full speed.

Press the **MODE** key, "DGELIM" is displayed. Change the setting by using the **◀** or **▶** keys.

The range is from 1 (4°) to 10 (40°). It cannot be set greater than the Rudder Limit.

8.12 Amplified Rudder Feedback Unit

AMPFD FB

This setting is the software equivalent of moving J1 in the Pilot computer. Some Rudder feedback units require the signal amplifier to be turned off. Provided the jumper J1 in the Pilot computer is in the factory default position (amplified), this setting turns the amplifier off or back on.

Set to Amplified for

930809

930819

set to Non-amplified for

930837

Linears with integral RFU

Press the **MODE** key, the current setting is displayed. Change the setting by using the **◀** or **▶** keys.

The choice is "AMPFD FB" amplifier on (factory default) or "NOAMP FB" No amplification.

8.13 Rudder Gauge Type

C E T R E K

This setting is not used yet.

8.14 Wind Gain

Wind Gain is only used when "SAILBOAT" is selected as the Boat Type.

WNDGN 1

This sets the gain of the signal from the NMEA Windvane. If the vessel does not respond to wind shifts fast enough, increase the setting.

Press the **MODE** key, "WNDGN" is displayed.

Change the setting by using the **◀** or **▶** keys.

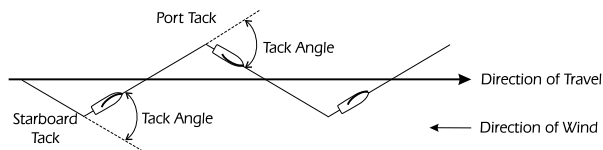
The range is from 0 (no Wind Gain) to 10 (maximum Wind Gain).

8.15 Tack Angle

Tack Angle is only used when "SAILBOAT" is selected as the Boat Type.

TACKA 100

This is the angle through which the vessel will tack when a Port or Starboard Tack is initiated **under Compass control**. The tack function uses the compass heading and subtracts or adds the tack angle to create the new course to Port or Starboard, respectively. Manually calculate the Tack Angle in the normal way and enter it here.



Tack Angle

Press the **MODE** key, "TACKA " is displayed. Change the setting by using the **◀** or **▶** keys.

The range is from 60° to 110° in increments of 10°.

8.16 Off Course Alarm (619 Only)

An Off Course Alarm can be turned on. It can be set from 1° to 20° in 1° steps.

Oca off

As soon as the vessel has been Off Course by the set amount for a period of 30 seconds the alarm will be triggered.

The alarm will be triggered instantly if the vessel becomes off course by more than twice the set amount.

Once the vessel is back on course the alarm will cancel. It cannot be manually cancelled.

The range is from OFF, then 1 (1°) to 20 (20°).
The default is OFF.

Press the **MODE** key, "OCA OFF" is displayed. Change the setting by using the **◀** or **▶** keys.

8.17 External Alarm (619 Only)

XALM ON

This allows any external alarm system connected to User Port 2 in the 930619 Pilot Computer to be turned on or off.

Press the **MODE** key until "XALM OFF" is displayed. Turn the alarm on or off by using the **◀** or **▶** keys.
The default is on.

8.18 Power Steer Gain

PSTEER 5

This adjusts the sensitivity of the steering when it is controlled by a remote Cetrek Proportional steer. Press the **MODE** key, "PSTEER" is displayed. Change the setting by using the **◀** or **▶** keys.

The range is from 1 (least sensitive) to 10 (most sensitive).
The default is 5.

8.19 Navigator Gain

NAVGN	5
-------	---

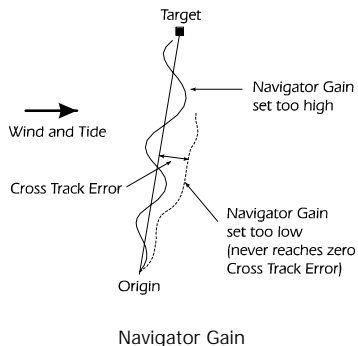
If your Pilot is working with a Navigator, adjustment of Navigator Gain will be available. The speed of the vessel affects the Navigator Gain, high speed requires less Navigator Gain and slow speed requires higher Navigator Gain

Set the navigator's output data to minimum damping (1 second intervals) and set the Navigator Gain to 5 (this is suitable for most applications).

If this is set too high the pilot will trim the vessel's course too much causing the vessel to oversteer either side of the desired track. If the Navigator Gain is set too low the vessel is pushed off track, the pilot will not bring the vessel to the desired track "XTE 000".

Press the **MODE** key, "NAVGN" is displayed.

The range is from 0 (No Gain) to 9 (Maximum Gain).
The default setting is 5.



8.20 Waypoint Sequence

When following a route, prepared on a navigator or plotter, there are two options: the Pilot can follow the whole route automatically or to require manual acceptance of a change of course.

AUTO	WPT
------	-----

When Automatic Waypoint Sequence is selected, the Pilot on reaching a waypoint will flash the bearing to next waypoint, for 7 seconds, but turn onto it automatically after the first 2 seconds.

MAN	WPT
-----	-----

When Manual Waypoint Acceptance is selected, the Pilot, on reaching a waypoint, will scroll the message "NEW WPT PRESS AUTO" for 10 seconds. The vessel will not turn onto the new course unless the **AUTO** key is pressed.

If the **MODE** key has NOT been pressed, after 7 seconds the Pilot will switch to Compass control and continue on its present heading until new instructions are received.

In the Pilot Configuration Menu, press the **MODE** key until "AUTO WPT" or "MAN WPT" is displayed. Change the setting by using the **◀** or **▶** keys.

8.21 Navigator Name

NAV1NAME

Change the Navigator Name to reflect the type of navigator connected to NMEA 1: "NAV", "DECCA", "LORAN", "GPS" or "PLOT".

Additional ports, NMEA 2 and NMEA 3 are available with a 930619 Pilot Computer. Change the NAV2 and NAV3NAME, in the same manner, if other navigators are fitted.

Change the setting by using the **◀** or **▶** keys.

8.22 Compass Damping *(580 compass Only)*

AUTO CD

The Pilot will automatically calculate a suitable damping setting for the compass display to correspond with sea conditions, using the Automatic Compass Damping routine.

The normal setting is Automatic Compass Damping, this may only need to be changed if the compass has been mounted high above the waterline.

Press the **(MODE)** key, "AUTO CD" or "CDAMP" is displayed. Change the setting by using the **(◀)** or **(▶)** keys.

The range of settings is: Automatic Compass Damping; then from 1 minimum to 10 maximum damping. The default is Automatic.

8.23 Compass source

(619 systems only, when Compass Type 8.27 is 'Magnetic')

COMP AUTO

This allows selection between two magnetic compass'. The options are 'AUTO', 'INTERNAL' or 'EXTERNAL'. When "AUTO" is selected, at power up, the 619 will look for a 580, if it cannot find one it will look for a HDM or Cetrek Data message on PL12 and use that.

'INTERNAL' forces the 619 to use the 580 compass.

'EXTERNAL' forces the use of the compass connected to PL12.

Press the **(MODE)** key, "COMP AUTO", "COMP INT" or "COMP EXT" is displayed. Change the setting by using the **(◀)** or **(▶)** keys.

If this is changed incorrectly an alarm message shows. Press the **(MODE)** key to suppress the alarm and let the setting be corrected.

If an external compass is being used, when the info line displays the heading, the character after 'HEAD' blinks its top bar as a reminder.

8.24 Gyro Type

(619 systems only, when Compass Type 8.27 is 'Gyro')

GYRO STEP

Selects between Stepper and HDT gyro types. Change the setting by using the **(◀)** or **(▶)** keys.

If this is changed incorrectly an alarm message shows. Press the **(MODE)** key to suppress the alarm and let the setting be corrected.

If an HDT gyro is being used, when the info line displays the heading, the character after 'GYRO' blinks its top bar as a reminder.

8.25 Gyro Cal

(619 systems only, when Compass Type 8.27 is 'Gyro' and Gyro Type 8.24 is Stepper)

GYRO CAL

This calibration aligns the Gyro with the vessels heading. Press the **(◀)** and **(▶)** keys simultaneously. The heading will flash. Use the **(◀)** and **(▶)** keys or rotate the Course control knob until the LCD displays the ships heading. Press the **(◀)** and **(▶)** keys simultaneously to accept the setting.

If the system is set to startup in Gyro Stepper mode, calibration will be displayed whenever the system is powered up. Set the heading as above, then the Pilot will switch to normal mode.

8.26 Gyro ratio

(619 systems only, when Compass Type 8.27 is 'Gyro' and Gyro Type 8.24 is Stepper)

GYRAT360

When first installing the gyro stepper it will be necessary to tell the pilot the gyro rate. It can be 90, 180 or 360. Press the **(◀)** and **(▶)** keys simultaneously to change the setting.

8.27 Gyro or Magnetic compass *(619 systems only)*

MAGNETIC

This allows switching between a Magnetic and a Gyro compass.

Change by pressing the **(◀)** and **(▶)** keys simultaneously.

If this is changed incorrectly an alarm message shows. Press the **(MODE)** key to suppress the alarm and let the setting be corrected.

Press and hold the **(MODE)** key to exit the Pilot Configuration menu.

Save any changed settings by turning the Pilot OFF by pressing and holding the **(CAUTO)** key.

It is advisable to record the optimised settings, in case they are accidentally changed at any time.

Be cautious about using these next two settings.

8.28 Restore

r E s t o r e

When this message is displayed, pressing the **(◀)** and **(▶)** keys simultaneously will return the default values to all settings (including boat type to Planing) apart from the Rudder Settings and Compass Calibration and Alignment values.
The display will flash once when the values have been reset.
Reset the boat type, unless it is a Planing hull, as described in section 7, step 3, page 38.

8.29 Reset All

R E S E T A L L

When this message is displayed, pressing the **(◀)** and **(▶)** keys simultaneously will clear all values. It will also reset the default values to all other settings.
The pilot will switch off once the reset has been done.

8.30 Pilot Configuration menu summary

From standby, press and hold **(MODE)** key to enter or exit this menu.

Key	Display	Function	See Section
↓	R U D D E R	Rudder Ratio (0-20)	5.1 and 8.1
	R E S P	Response (A1-5, then 1-2, 5 or 20)	5.2 and 8.2
	C - R U D	Counter Rudder (0-20)	8.3
	T U R N R	* Turn Rate (0-20)	8.4
	T R I M	Trim (0-10 but Sailboat 0-20)	8.5
	M O T S P	Motor Speed Control, or PWM Off	8.6
	M O T R A M P	Motor Ramp Control(0-7)	8.7
	T R S P D	Transition Speed, 0 to 50 knots	8.8
	R D B N D	Rudder Deadband (0-20)	8.9
	R U D L I M	Rudder Limits (4-10)	8.10
	D G E L I M	Dodge limit (1-10)	8.11
	A M P F D	Rudder Feedback amplifier (On/Off)	8.12
	C E T R E K	Spare setting, not used.	8.13
	W N D G N	Wind Gain.(0-10)	8.14
	T A C K A N G	Tack Angle.(60-110)	8.15
↑	O C A	* Off Course Alarm.(OFF, 1°-20°)	8.16
↑	X A L M	* External Alarm. (ON or OFF)	8.17
	P S T E E R	Power Steer Gain (1-10)	8.18
	N A V G N	Navigator Gain (0-9)	8.19
	A U T O W P T	Waypoint Sequence (Auto or Manual)	8.20
	N A V N A M E	Navigator Name	8.21
	A U T O C D	Compass Damping, (Auto or 0-5)	8.22
	COMPAUTO	* Magnetic Compass Source (Auto,Int,Ext)	8.23
	STEPPER	* Gyro Type (Stepper or HDT)	8.24
	GYRO CAL	* Gyro Calibration (set heading)	8.25
	GYRORATE	* Gyro Ratio (90, 180 or 360)	8.26
	MAGNETIC	* Compass Selector (Magnetic or Gyro)	8.27
	R E S T O R E	Restore defaults (not Rudder & Compass)	8.28
↑	R E S E T A L L	Clear Rudder & Compass , restore all defaults.	8.29

(* = not always seen, dependant on Pilot computer and configuration) 63

9. System Messages

If your autopilot detects a problem with the system it will display a warning on the LCD. For safety, a very serious problem will also turn the autopilot to Standby (manual steering) mode. Here are the messages that we hope you will never see, along with some explanations and some tips on what to do before you call your Cetrek dealer.

System Alarms

LOW BATTERY The battery voltage is low.

- Clear the alarm by pressing any key except the OFF key. Once cleared the alarm will not trigger again until the autopilot has been turned off and back on again. If the voltage drops too low, autopilot operation may be impaired. Check the vessel's charging system.

WIND ALARM The autopilot has "timed out" after not receiving expected Wind Instrument Data.

- Check the Data output from the Wind instrument.

NAVIGATOR ALARM

- The autopilot has received more Navigator Data than it expected or
- The autopilot has "timed out" because it has not received expected Navigator Data within a predetermined length of time.

Make the following checks:

- That the Navigator is turned on.
- That the Data output format from the Navigator is NMEA 0183.
- That NAV is selected correctly.
- On the PCB inside the Pilot computer there are LED's beside each NAV port (PL11 in 609, PL11, 16 & 17 in 619). The LED for each port will flash if data is being received by that port.
- Check the Navigator for bad reception or faulty equipment.
- Check the data output from the Navigator.

10. System Faults

The System faults are identified by numbers as indicated below. A full list of system faults can be found in the Pilot Computer Installation Guide.

For safety reasons, some faults will result in the autopilot automatically switching to Manual mode.

002

NOVRAM CHECKSUM ERROR

- This fault may indicate that the Autopilot's stored parameters are no longer valid, these should be checked before further use. It may appear immediately after a software update. If so, switch the unit off at the Pilot Control head and back on again to clear it.

036

EXTERNAL COMPASS MESSAGE FAULT

- The compass message has not been received correctly by the Pilot Computer.

If this occurs repeatedly then the compass should be repaired.

Warning messages 128 and above are accompanied by a visual alarms, and the autopilot will switch to standby (manual) mode.

130

STACK OVERFLOW

- Indicates that the software has crashed. This may be due to excessive electrical noise near the pilot computer. Remove any sources of electrical noise then power OFF and back ON again to clear the fault. If the problem persists, consult your local Cetrek dealer or distributor.

134

CONTROL HEAD ALARM.

- Indicates that data from the Pilot Control connected to PL10 is not present. Check the cable and connections.

165

COMPASS TIMEOUT

- The Pilot computer is not receiving heading information from the compass/gyro. Check the supply and wiring. If a 580 sensor is connected, check PL8, pins 2, 3 and 4. Their voltage should be $2.5V \pm 1.5V$, if they are not, the compass is faulty.

176

RATE SENSOR ALARM

- Indicates that the data signal from the optional Rate Gyro is no longer present (PL19 pin4 is at 5V). PL19 pin4 should be at a nominal 2.5V when data is present.

192

GYRO STEPPER ALARM

- Indicates that the data signals from the Gyro stepper are faulty, all high or all low
Check LEDs on 930525 PCB.

198

RUDDER FEEDBACK FAULT

- This may be caused by a fault in the Rudder Feedback Unit, wiring, excessive travel on the Rudder Feedback Arm or the link J1 (or the software setting) is set incorrectly.
Check that the Rudder Feedback Unit and its linkage has not been knocked or damaged.

200

MOTOR PHASING CHECK

- This indicates that the rudder setting data is wrong. Repeat the rudder setting routine detailed in section 7.4.

224

RUDDER DRIVE FAULT

- The Pilot computer has sent a drive command to the drive unit but the Rudder Feedback Unit has not detected a change in the rudder position.

Check that the Rudder Feedback has not become disconnected from the Rudder Arm, also check that the steering system, especially the motor, is operating the rudder gear correctly.

Ensure that the drive unit cables have not become disconnected or loose.

If You Need Assistance

If you do ever need to contact your Cetrek Dealer or Distributor, it would save time if you could make a note of the following details for them:

For each unit in the system:

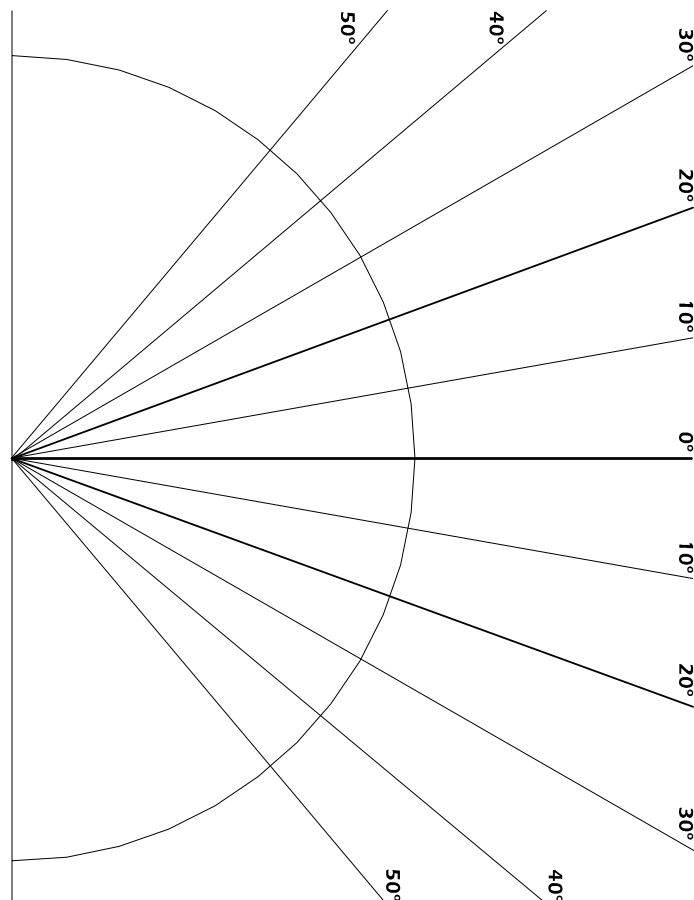
Model number:

Serial number:

Software version:

A description of the failure.

11. Rudder Angle Template



12. Default settings

Pilot Settings

Boat type	Planing
Rudder Ratio	4
Response	Adaptive
Counter Rudder	1
Turn Rate (619 only)	20
Trim	4
Motor Speed Control	100%
Motor Ramp	2
Transition Speed	no trspd
Rudder Deadband	3
Rudder Limits (Set at Dockside settings)	
Dodge Limits	10
Amplified RFU	AMPFD FB
Rudder Gauge Type	CETREK
Wind gain	1
Tack Angle	100°
Off Course Alarm (619 only)	OFF
External alarm (619 only)	ON
Power Steer Gain	5
Navigator Gain	5
WPT Sequence	Auto
Navigator Name 1	Name
Navigator Name 2 (619 only)	Name
Navigator Name 3 (619 only)	Name
Compass Damping	AUTO CD
Compass Type	AUTO
Gyro Type (619 Gyro only)	Stepper
Gyro Cal (619 Stepper only)	00
Gyro Ratio (619 stepper only)	360
Magnetic or Gyro (619 only)	Magnetic
Restore	not relevant
Reset All	not relevant

Boat type variations:

609s use Pilot A settings.

<i>Planing boat type</i>	<i>Pilot A, B, C</i>
Rudder Ratio	4, 6, 6
Counter Rudder	1, 2, 2
<i>Semi disp. boat type</i>	<i>Pilot A, B, C</i>
Rudder Ratio	7, 10, 10
Counter Rudder	3, 4, 4
<i>Disp. boat type</i>	<i>Pilot A, B, C</i>
Rudder Ratio	10, 12, 12
Counter Rudder	4, 6, 6
<i>Sailboat boat type</i>	<i>Pilot A, B, C</i>
Rudder Ratio	10, 12, 12
Counter Rudder	4, 6, 6

INFO list	609	619
Live Heading	ON	ON
Lighting	ON	ON
<i>Pilot A, B, C (619 only)</i>	<i>ON</i>	<i>ON</i>
Rudder Ratio	ON	ON
Response	OFF	OFF
Counter Rudder	OFF	OFF
<i>Turn Rate (619 only)</i>	<i>OFF</i>	<i>OFF</i>
Trim	OFF	OFF
WPT Name	ON	ON
XTE	ON	ON
Bearing	ON	ON
Distance	ON	ON
Speed	ON	ON
Depth	ON	ON
Wind angle	ON	ON
Wind speed	ON	ON
SOG	ON	ON
COG	ON	ON
Water Temperature	ON	ON
Battery Voltage	ON	ON
Dig. Rudder Angle	OFF	OFF

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