Welcome

All of us at Cetrek would like to welcome you to the world of Cetrek Propilot Systems.

Your Safety

THE USE OF AN AUTOPILOT DOES NOT AVOID THE NEED FOR NORMAL WATCHKEEPING.

EMC Directive 89/336/EEC

CE

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 (Draft)

ISO- International Standards Organisation

807-252-10-96

CONTENTS

THE SYSTEM

A basic system consists of the following:

- a Distribution Box (930 618) to collect, process and output information.
- a Compass Sensor (930 577) to provide heading information.
- an Autopilot Control (930 725) for the helmsman to control the autopilot.
- a Rudder Feedback Unit (930 807) to provide rudder position information.

The system also requires a Drive Motor (hydraulic or mechanical) to activate the vessel's steering system.

SYSTEM ACCESSORIES

Your system may have some of these accessories as well:

- Dodge and Course Change remote controls.
- Power steer remote controls.
- Rudder Position Indicators and Repeaters.
- Compass Repeaters.
- External Audible Alarms.
- Windvane Sensors.
- A Navigator.
- A Gyro Compass.
- A second station Autopilot Control.

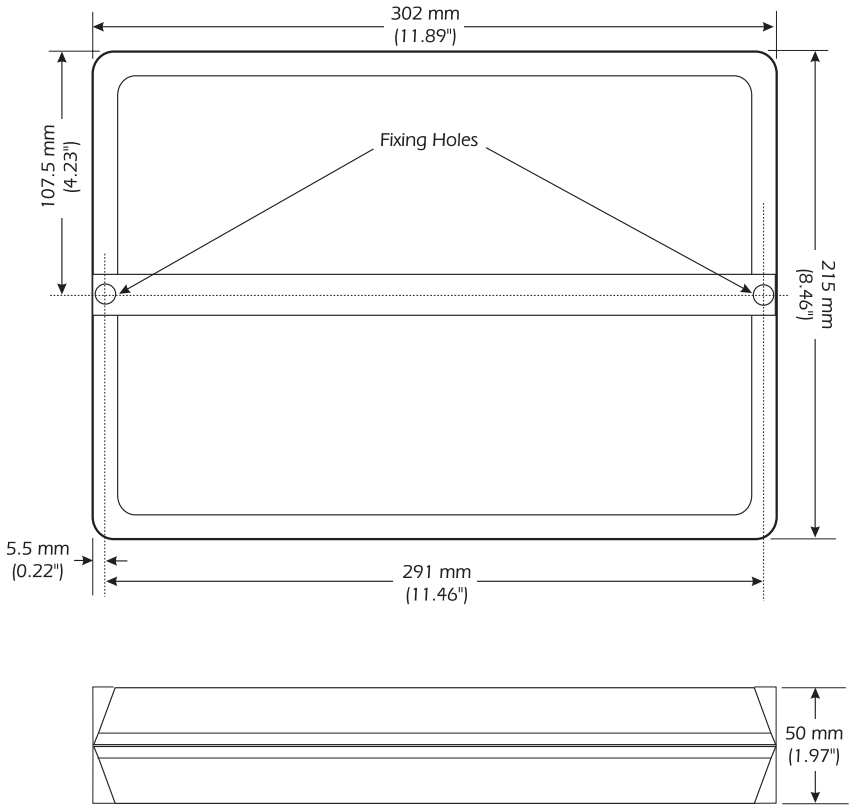
A Brief Overview

The Distribution Box is the heart of the system and everything connects to this. It contains the computer section that reads the data from the sensors, i.e. the rudder position from the Rudder Feedback Unit, the vessel's heading from the Compass. It reads the helmsman's orders from the Autopilot Control or a Navigator, then calculates, using the sea state and configuration settings and moves the rudder, via the Drive Motor to maintain a course.

Propilot 725 Dimensions

Hole positions 113 x 238 mm (4.45" x 9.37")
Cut-out for back 110 x 237 mm (4.33" x 9.33"), corners 13 mm (0.51") x 45°
NOTE: Also allow adequate clearance for cable connections to ensure cables are not unduly stressed.

930 618 Distribution Box Dimensions



INSTALLING YOUR PROPILOT 725

Before you Start

Before commencing the installation of your new pilot please carry out the following initial checks:

- that the correct items have been delivered ?
- that the units are undamaged ?
- that the correct voltage drive unit has been supplied ?
- if using a Mechanical Drive Unit, that the correct chain and sprocket is available ?
- if you are using a hydraulic pump, that you have the correct size fittings available to connect the pump ?
- that you have the correct type of hydraulic fluid to top up the steering system once the pump is installed ?
- that you have a power cable of a suitable gauge to supply power to the system?
- that you have a Circuit Breaker of suitable size for your system?

If you find an error please contact the supplier of the product immediately.

Caution!
All exposed moving parts must be sufficiently guarded to prevent accidental damage to persons or clothing

Before the drilling or cutting of any holes takes place, please consider the exact location and cable routing that is required for each unit. Please read this installation section and any installation information supplied with your units before you install the system.

Suggested Procedure

We suggest that the following procedure will allow you to install the system encountering the least problems.

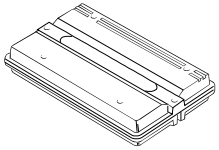
- Read this section then select the best positions for the units.
- Install the Distribution Box.
- Install the Autopilot Control and route the cable to the Distribution Box.
- Install the Compass Sensor and route the cable to the Distribution Box.
- Install the Rudder Feedback Unit and route the cable to the Distribution Box.
- Install the drive unit. Route the cable to the Distribution Box.
- Route the light and heavy duty power supplies to the Distribution Box.
- Then proceed to connect all the cables to the Distribution Box as per the Installation Schematic.

Finally:

- Connect the light duty supply fused at 5 amps.
- Connect the heavy duty supply, see the Drive Unit

information for fuse ratings.

Distribution Box

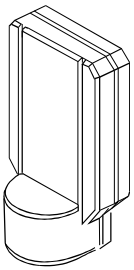


This is the heart of the system and must be installed in a DRY, accessible position.

Ideally the box should be positioned so that the heavy duty power supply cables from the batteries to the distribution box and from the distribution box to the drive unit are kept to a minimum length. This is particularly important on sailing vessels where often you are operating on batteries which are not fully charged.

If the distribution box has to be installed in the engine room please ensure that the area is properly ventilated to avoid high ambient temperatures and abnormal condensation levels.

Compass Sensor



The Compass Sensor needs to be carefully located. The optimum position is to mount it on a convenient (vertical) bulkhead, as low and as close to the centre line of the boat as possible. On fast vessels, it is advisable to fit the compass sensor at least half way back along the centre line.

On steel vessels it is necessary to mount the sensor 2 to 3 metres above the superstructure or to use a Gyro or Pick-off coil system working from the vessel's main steering compass.

The compass sensor must be installed away from sources of magnetic interference, such as:

Radios, RDF, Depth Recorders, etc:	at least 1 metre clearance
Power cables carrying more than 0.5 amp:	at least 1 metre clearance
Radar Magnetrons:	at least 3 metre clearance
Ship's engines, large mass steel (soft iron) etc:	at least 1 metre clearance

Also, do not install the compass in a position where magnetic material i.e. tool boxes, drink cans, chain etc. may be stowed at any time.

Check the proposed location with a hand bearing compass. This will indicate whether there is a large deviation that may cause problems. Switch on any electrical equipment that may cause deviation and check the hand-bearing compass to see if there has been any change on heading. If a change is observed the Sensor should not be installed in this position as the compass heading may not reflect the true heading of the craft, therefore making autopilot control inaccurate.

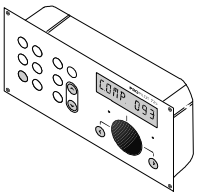
Once the Compass Sensor is installed the transit screw in the base of the unit should be shortened or removed.

The compass does not have to physically align with the bow of the vessel because it will be 'electronically' aligned later during the Installation Settings.

The Automatic Deviation Correction routine is explained later in the Sea Trials section.

Further instructions on the location of the compass sensor are included with each compass sensor despatched from Cetrek's factory.

Autopilot Control

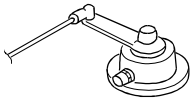


This should be installed in a position convenient for the helmsman to operate it.

These units must be flush mounted to maintain their weatherproof quality.

If the front panel of this unit is removed the gasket must be replaced to maintain the watertight seal. To order the gasket quote part number 132-150.

Rudder Feedback Unit



The Rudder Feedback Unit is connected directly to the Rudder Arm, which may be a tiller, quadrant or tie bar, of the steering system. It may be necessary to construct a mounting base for this unit.

As the steering gear is often exposed and in an area which is used for stowage, ensure that the Rudder Feedback Unit cannot be jammed by ropes, buckets, fenders etc.

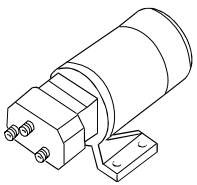
You can mount the Rudder Feedback Unit on either side of the Rudder Stock as changing the "Phasing" so that the Feedback Unit indicates Port and Starboard correctly is done electronically. This procedure is described later, in the Installation Settings.

The rudder amidships position of the Rudder Feedback Unit can be mounted up to 10° out. As mentioned this can then be compensated for electronically, see Installation Settings.

For commercial vessels it is best to use the 930-801 Heavy Duty Rudder Feedback Unit.

Drive Units

Mechanical Drive Units connect into existing mechanical steering systems.



The size and position of a Rotary Drive Unit should have been specified when originally ordering the Pilot System. The unit will have to be positioned to align with the sprocket which will be fitted to the existing mechanical steering system. It is essential to ensure that a strong mechanical mounting is provided for these units as considerable loads are developed when under use.

The heavy duty supply should be fused according to the drive unit fitted:

930 403, 404, 415	30A Antisurge
930 413, 414	20A Antisurge

Hydraulic Drive units connect into existing manually operated

hydraulic steering systems. Hydraulic pumps should be mounted on a rigid base to avoid unnecessary vibration and noise.

The heavy duty supply should be fused according to the drive unit fitted:

930 100, 101, 130, 132, 135, 160, 161, 162	30A Antisurge
930 110, 111, 155, 170, 171, 172, 180, 182	20A Antisurge
930 146	10A Antisurge
930 102, 112 (Continuous Running Pumps)	5A Antisurge

For other continuously running pumps use a fuse rating of a suitable size for the solenoids.

For either system it is acceptable to use a Fused switch or a Circuit breaker. Changing the Phasing to reverse the rotation of the motor can be done electronically after it is wired. This is explained later in the Installation Settings.

Big Ship Links

There are two links on the PCB inside the Distribution Box that are particularly useful for installations on large vessels.

These links are located in the top right area of the 930-618 Distribution Box PCB, alongside the 8 way DIL switch 'S1'. They are labelled 'P2' and 'P4'.

The Link P2, if shortened, allows the Power Steer facility to override the 30° rudder limit that the autopilot uses and apply up to 45° of rudder.

The Link P4, if shortened, does two things;

- it increases the amount of counter rudder used at the end of a course change.
- it extends the time constant for the trim rate so that the rudder is applied about 75% slower.

Good Wiring Practice

Having decided on the location and position of each unit it is essential to check the cable runs to ensure that there are no problems.

All cable runs should be kept as clear as possible from other cables carrying RF (radio frequency), pulsed signals or heavy

currents (such as winches etc.). At least 3 ft. clearance is advised. Take particular care to ensure the maximum clearance from radio transmitting aerials.

If it is necessary to extend any of the cables, the same type of cable must be used and the screens must be connected. Screened cables should be earthed at the Distribution Box using the clamping bars provided.

If it is necessary to extend the Drive Unit cables, they should be extended using a heavy duty cable, by the shortest possible route, to avoid unnecessary power loss.

If the vessel has a "clean" earthing system (ie using a dyna plate or similar system) then the case of the Distribution Box may be connected to it using a heavy duty cable or copper strip, this will usually improve RFI rejection.

Note: The negative of the battery system is not normally a clean earth and the case of the Distribution Box should not under any circumstances be connected to it.

All DC supply cables should be kept as short as possible, and should be taken from the battery via a switch/fuse or circuit breaker of a suitable rating for the system being installed.

Two separately switched and fused power supplies must be connected to the Distribution Box. The first is for the light duty primary supply for the electronic control system. The second is for the heavy duty supply for the drive unit.

Avoid running power and motor supply cables together or in the same conduit with control and compass cables to help reduce the risk of interference.

It is good practice to cleat all cables to fixed points at no less than 0.5 m (18") spacing and where cables pass through bulkheads, protect the cable with a suitable grommet or sleeve.

Connecting the Autopilot

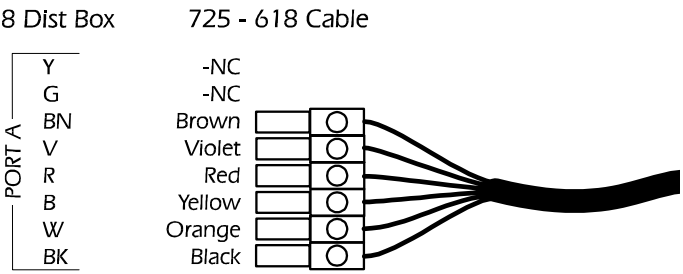
All the connections for the system are made to the PCB in the Distribution Box which is clearly marked to make connections easy and straightforward.

Most Cetrek systems use a plug and socket interconnect system that allow the plugs to be simply removed if the cable needs to

pass through a bulkhead.

The autopilot is connected to the Distribution Box using the 6 way cable supplied with the unit. The cable colours on early models match those shown on Ports A, B and C on the Distribution Box (with the yellow and green wires not connected). However, due to cable changes, current models should be connected as shown in the diagram below.

Spare plugs are supplied for the connection of navigators etc. Additional ones are available from your Cetrek distributor.



Key to the Colour Coding of Cables

R	Red	Rouge	Rot	Rojo
B	Blue	Bleu(e)	Blau	Azul
BK	Black	Noir(e)	Schwarz	Negro
BN	Brown	Marron	Braun	Marron
V	Violet	Violet(te)	Violett	Violeta
G	Green	Vert(e)	Grun	Verde
W	White	Blanc(he)	Weiss	Blanco
GY	Grey	Gris(e)	Graua	Gris
Y	Yellow	Jaune	Gelb	Amarillo
O	Orange	Orange	Orange	Naranja
NC	No connection	Pas de lien	Kein anschluss	No conectar

The Installation Schematic on page 14 shows the location of the connectors on the PCB and the relevant cable connections.

Caution!

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

WARNINGS

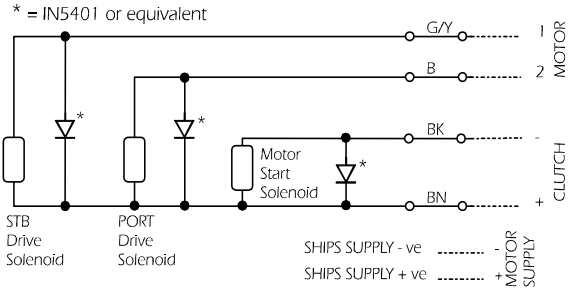
i) Do not connect or disconnect wiring with power applied.
ii) Ensure cable screens are suitably connected.
iii) Always check colour codes before applying power. Older units may have plugs incorrectly wired for use with the 930-618 unit.

NOTES

1. Motor Connections Ensure L4 is in the 'PWM' position. The 930-618 can be connected with any of the drives that Cetrek supplies. Phasing can be reversed electronically once the system is installed. See "Installation Settings" for further details.

2. Motor Supply The Heavy Duty Motor Supply and Light Duty Supply must be run independently. Fuse the Light Duty at 5 amps. See "Drive Units" in the Installing Section for the Heavy Duty fuse rating.

3. Solenoid Drives Should be connected as shown in the diagram below. Links L1 & L3 must be cut, L4 must be moved to the 'Spool' position. Also ensure that adequate diode protection is fitted to the Spool Valves to prevent reverse spikes damaging the FET's in the 930-618. A suitable diode is IN5401 or equivalent. Cetrek units 930-102, 930-112 have this protection built in.



4. Set SW2 to OFF for 930-700, 930-770 or no console connected to Port B, otherwise to ON. If a 930-700 or 930-770 is connected as a second station the third station is not available.

5. Set SW3 to OFF if no console connected to Port C, otherwise to ON. Neither a 930-700 nor a 930-770 can be used as a third station and the third station is not available if either of these is connected to the second station.

6. If the C-net Compass (930-383) is used as a Compass Repeater DO NOT connect the white wire to this unit. It is advisable to check your C-net Compass Manual for details of the connections into the Compass unit.

7. 930-528 General Purpose Analogue Interface, see data sheet for connection details.

8. Navigator Inputs: Set SW7 for NAV1, SW8 for NAV2, ON for single wire output, OFF for two wire output. Connect Digital Windvane- NMEA 0183 to NAV2. See the System Description Section for SW7 & SW8 settings.

9. Set SW5 & SW6 to ON for 930-807 and to OFF for 930-801. There is no connection for the brown wire on the 930-801. If connecting a 930-305 Rudder Indicator, follow instructions supplied with the unit for phasing a, regardless of the Rudder Feedback phasing.

10. See data sheet for connecting Gyro to Gyro Interface.

INSTALLING OPTIONAL EQUIPMENT

Cetrek Equipment

Your Cetrek equipment will have Installation and Operation Instructions with each individual unit as is appropriate for the equipment. The Installation Schematic in this manual covers the wiring connections of optional equipment.

Non Cetrek equipment will usually interface with your Autopilot if you follow these instructions.

NAVIGATORS

The autopilot can be controlled with data received from a radio navigator (Sat Nav, Loran, Decca or GPS) which has a compatible output format.

The marine industry has generally adopted the data output formats as specified by the National Marine Electronics Association of North America (NMEA). Your autopilot will accept any of the three data formats in common use for autopilot control:-

NMEA 0180
NMEA 0182
NMEA 0183

The data format available from your navigator will affect the method in which your autopilot can be operated with your navigator. In order for the navigator to output the required information, it first has to be programmed with your required destination or waypoints. The basic information used for autopilot control is:-

- Cross track error. This is expressed in units of one hundredth of a nautical mile (60ft.) and whether the error is to port or starboard of track.
- Alarm condition. This indicates if information received from the navigator is valid.
- Heading to the next waypoint.
- Next waypoint Number.

The data available for your Autopilot depends on the data format, provided by the Navigator, see following table:

Data available	Data Format					
	NMEA 0180		NMEA 0182		NMEA0183	
Cross Track Error	✓		✓		✓	
Alarm Condition	✓		✓		✓	
Heading to Waypoint			✓		✓	
Waypoint Number					✓	
Waypoint Arrival			✓		✓	

Note: Some implementations of 0183 do not output Waypoint number or Heading to Waypoint.

In order to get full use of the interface facility from your equipment, it is important to understand the principles of control used. It would of course be very simple to use the heading to the next waypoint calculated by the navigator.

However, this would be a dangerous method to use when in the proximity of land as a stray tidal offset could put the vessel in a position when it will run aground.

The use of Cross Track Error to control the autopilot heading enables the vessel to be held on track to the next waypoint. The autopilot is actually controlled by its own compass output and the Cross Track Error information is used to calculate the Trim required to keep your craft on track.

When the waypoint is reached (provided the navigator is programmed for the next waypoint) Cross Track Error would not be sufficient information to turn the vessel on to the next track. To do this it is necessary for the navigator to output the heading to the next waypoint and indicate that a new waypoint has

been selected. Because of this, the operation when waypoints are reached will depend on the type of data received from your navigator.

NMEA 0180

Unless there is only a small (say 15° or less) change in required track, it is necessary to turn the vessel to the new track using the course select control or by placing pilot in standby mode and manually steering to the new track.

NMEA 0182 & NMEA 0183

Most 0182 and 0183 data outputs have all the information required for the craft to turn automatically on to the next track without any action on your part. If your craft does not do this, check with the supplier of your navigator to see if the data contains one of the sentences containing Heading to Waypoint and Waypoint Number. If not, you may have to operate your autopilot as if it were NMEA 0180 (or 0182) depending on data available.

Navigators with 0182 and 0183 output True Heading, Magnetic Heading or both. If only True heading is available the local variation should be entered into the autopilot (see the Installation Settings Section).

NMEA 0183

The Autopilot is capable of processing the following NMEA 0183 messages. To obtain full use of the interface at least one message containing Cross Track Error, Heading to Waypoint and Waypoint number must be present in the data received from the Navigator.

MESSAGE	CROSS TRACK ERROR	HEADING TO WAYPOINT	WAYPOINT NUMBER	WIND ANGLE
APA	✓	✓	✓	–
APB	✓	✓	✓	–
BOD	–	✓	✓	–
BWC/BWR	–	✓	✓	–
XTE	✓	–	–	–
RMB	✓	✓	✓	–
VWR	–	–	–	✓

✓ Indicates that the data should be present in the given message according to the NMEA 0183 specification.

However, please note that not all navigator manufacturers provide all the data required by a given message.

Navigators can be connected to the Distribution Box using the NAV1 or NAV2 ports. If only one Navigator is to be connected then use the NAV1 port.

If the Navigator has a single wire output then connect it to the terminal marked 'SIG+'. Switch SW7 to ON if the NAV 1 port is used, switch SW8 to ON if the NAV2 port is used.

If the navigator has a two wire output then connect the positive signal to the 'SIG+' terminal and the negative signal to the 'SIG-' terminal. Switch SW7 to OFF if the NAV1 port is used, switch SW8 to OFF if the NAV2 port is used.

The Installation Settings explain how to select the Interface formats and signal gain values.

Windvane Equipment

A Windvane that outputs data in the NMEA format (such as C-net Wind - Part No: 931 384) can be connected to the Distribution Box via NAV2 position. Connect it to the 'SIG+' and 'SIG-' terminals and set SW8 to the OFF position. The Installation Settings explain how to set the Interface formats and signal gain values. Analogue Windvanes connect to the Analogue Windvane position in the Distribution Box.

Gyro Equipment

You will need a Cetrek 930-523 Gyro Interface to enable you to connect a Gyro compass. Full instructions come with the kit which connects to the Distribution Box via the 'COMPASS B' port.

PROPILOT 725 FRONT PANEL (KEY) FUNCTIONS

Key	Primary Function	Secondary Function
⊙⊙	1. Adjust LCD backlighting	When within a function used to switch functions ON/OFF or to adjust settings.
⊜	1. Dodge to Port	
⊜	1. Dodge to Starboard	
AUTO	1. Select Autopilot Mode	1. Rudder Position & Off Course Indicator 2. Cross Track Error (only if a Navigator is fitted)
ON/ST'BY	Switches Autopilot on 1. Selects Standby Mode	1. Rudder Position 2. Cross Track Error (only if a Navigator is fitted)
OFF	1. Power off Autopilot	None
COMP	1. Select Compass Control	With LCD displaying COMP ON/OFF press & hold for: 1. VAR--E00 Compass Variation 2. DAMP--07 Compass Damping 3. GYRO--ON Gyro Selection If Gyro is ON press again for: GCAL--XXX Gyro Calibration (Must be switched OFF after calibration) RATIO 0 Gyro Ratio (Gyro Type)
	2. Selects Windvane Control	With LCD displaying WIND ON/OFF press & hold for: 1. WIND-0 Windvane Interface Format 2. WTRM-05 Wind Trim
NAV	1. Selects NAV1	Press & hold for: 1. NAV1-0 Navigator Interface Format 2. NMG1-05 Navigator Gain
	2. Selects NAV2	Press & hold for: 1. NAV2-0 Navigator Interface Format 2. NMG2-05 Navigator Gain
Pwr STEER	1. Switches Power Steer on/off P/S xxx	

PROPILOT 725 FRONT PANEL (KEY) FUNCTIONS (cont..)

Key	Primary Function	Secondary Function
MODE	1. Cycles through Sea State Adjustments - Pilot A, B or C PILOT A	
SEA STATE	1. RUD--05 Rudder Ratio 2. RESP--07 Response (Yaw) 3. PWM--ON Pulse Width Modulation	Press & hold to enter Configurations: CONFIG 1. C/R--03 Counter Rudder 2. TRIM--04 Trim 3. GAIN--03 Rudder Ratio Gain 4. RDB--03 Rudder Deadband 5. RLIM--07 Rudder Limit 6. TURN--20 Max Turn Rate 7. PSG--07 Power Steer Gain 8. AUTO-DEV Auto-deviation
FUNCT	1. PREV xxx Previous Course 2. 180 TURN 180° Turn 3. NEXT xxx Next Course 4. PORT TRN Port Turn 5. STBD TRN Starboard Turn	
ALARM	1. Clear Alarm	Press & hold to enter Alarm settings: 1. OCAL--00 Off Course Alarm 2. WATCH AL Watch Alarm 30 mins 60 mins 2 hours 4 hours 3. XALM--ON External Alarm

XXX Denotes the heading displayed

INSTALLATION SETTINGS

There are four installation settings which are as follows:

- Rudder phasing of the Rudder Feedback Unit.
- Motor phasing.
- Rudder Feedback Unit offset.
- Magnetic Compass offset for all compatible compass units.

Note: These settings are not available if the Distribution Box has software earlier than V7.0.

To access the settings, turn the Autopilot Control ON using the following sequence:

SPECIAL

While holding down the ⌃ key, turn the unit ON by pressing the ON/ST'BY key then release the ON/ST'BY key but keep the ⌄ key held while the unit cycles through the start up and self check routines until the LCD displays "SPECIAL". The unit is now in Special Function mode.

Once you are in Special Function mode, the SEA STATE key allows you to step through the Installation settings.

Rudder Phasing

This selects which signal from the Rudder Feedback Unit indicates Port and which indicates Starboard movement of the rudder.

RUDPHA A

The first press of the SEA STATE key brings up the Rudder Phasing message. The right hand digit will be an A or B depending on which phasing has been selected. Press either the ⌃ or ⌄ key to change the phasing. There is no need to change any wiring.

Motor Phasing

This selects which direction the motor drives so that the rudder moves to Port and Starboard correctly.

MOTPHA A

The second press of the SEA STATE key brings up the Motor Phasing message. The right hand digit will be an A or B depending on which phasing has been selected. Press either the ⌃ or ⌄ key to change the phasing.

Rudder Feedback Unit Offset

This allows a rudder offset of 10° maximum to be input so that the rudder amidships position signal from the Rudder Feedback Unit can be fine tuned without physically moving the Rudder Feedback Unit.

OFFSET R

The third press of the SEA STATE key brings up the Offset message. Manually position the rudder in the amidships position then press either the ⌃ or ⌄ key. The autopilot will now treat this position as rudder amidships.

Note:

Compass Alignment

The fluxgate compass bearing can be aligned with the bow of the vessel without having to physically rotate the compass.

MAGC 123

The fourth press of the SEA STATE key brings up the magnetic compass message. Rotate the Course Select knob until the vessels heading is displayed by the right-hand three characters, then press either the ⌃ or ⌄ key to store the amount of offset.

Reset

The fifth press of the SEA STATE key brings up the Reset message. This gives you the ability to reset the installation settings to their default values, the phasings to A and the offsets to zero.

RESET

Press the ⌃ or ⌄ keys to achieve this.

To Exit

To Exit from the Installation Settings routine at any stage, press the OFF key. This ensures that the autopilot remembers the settings you have just programmed in.

Compass Variation and Compass Damping

Compass Variation

VAR--E00

This is the window to enter a local compass variation to give a true compass heading. Press the COMP key until the LCD displays COMP ON (or COMP OFF) and then release. With this message still showing press and hold the COMP key until the Compass variation is displayed. Use the ⊙ and ⊙ keys to enter a variation from East 45° (E45) to West 45° (W45). If a variation has been entered, decimal points will be displayed under any bearing reading.

Compass Damping

DAMP--07

This sets the amount of damping applied to the readings from the heading sensor to avoid rapid changes of the heading display. The range is from 01 minimum damping to 10, maximum damping. Generally, the higher the sensor is above the waterline, the more damping is required.

Compass Damping is one element of the standard configurations preprogrammed into the autopilot's memory (Pilot A, B and C). As with the other configurations the damping can be fine tuned as you become more familiar with the Autopilot. To access the settings window press the COMP key until COMP ON (or comp OFF) is displayed, then press and hold the COMP key for three seconds. This will take you into the Compass Variation window. A further press of the COMP key brings up the damping option, the value can then be altered using the ⊙ and ⊙ keys.

The Pilot A, B and C values will always be the same. If you change one it will change the other. Further details of the Configuration Settings are given on page 28.

Settings for Optional Equipment

These next settings are used to set the parameters for any optional equipment that may have been fitted, such as Navigators, Windvane, SFIA External Alarm or Gyro Compass.

Windvane Interface Format

This is the window to set the interface format for any Windvane fitted. To enter the settings window press the COMP key twice until the LCD displays WIND ON (or wind OFF). Then press and hold the COMP key until the Windvane interface message is shown.

WIND-0

Use the ⌃ and ⌄ keys to select:

0 - for Cetrek Analogue format.
1 - for Cetrek Analogue (Reversed Phase) format.
2 - for a NMEA 0183 format
3 - Not used.

If an NMEA Windvane is connected to the NAV2 position both the NAV2 and the WIND formats must be set to NMEA 0183. Setting the NAV2 format is explained below.

Wind Trim

WTRM-05

This window is used to set the Gain of the signal from the Windvane. The range is from 01 to 10, set it to 5 on installation then fine tune it during Sea Trials. If the vessel does not respond to wind shifts fast enough, increase the setting. To alter the settings press the COMP key twice until the LCD displays WIND ON (or WIND OFF). Then press and hold the COMP key until the Windvane interface message is shown, then release and press once again to access the Wind Trim setting. This may then be altered by using the ⌃ and ⌄ keys.

Navigator Interface Format

This is the window to select the Interface format suitable for the Navigator connected to the NAV1 position in the Distribution box. To enter this window select NAV1 using the NAV key. Having made this selection press and hold the NAV key to enter the settings display.

NAV1-0

Use the ⌃ and ⌄ keys to select:

0 - for a NMEA 0180 format - 1200 Baud Rate.
1 - for a NMEA 0182 format - 1200 Baud Rate.
2 - for a NMEA 0183 format - 4800 Baud Rate.
3 - for a NAVSTAR format - 110 Baud Rate.

NAV2-0

This window sets the interface format of a second Navigator or a Windvane connected to the NAV2 position of the Distribution Box. Select the format as for the NAV1 options.

Navigator Gain

This is the window to set the signal Gain for the navigator connected to NAV1. Its value can be between 01 and 10. Initially set it to 05 then fine tune it during Sea Trials. To enter the settings window press the NAV key once until the LCD displays "NAV 1". Then press and hold the NAV key to enter the back Navigator display. Once these have been accessed a further press of

the NAV key will bring up the Navigator Gain settings which can then be altered using the ⌃ and ⌄ keys.

NMG1-05

If the navigator gain control is set too high the vessel, when under navigator control, will make large step corrections to return the vessel to track. The gain of the navigator should be set as high as possible without this effect being induced.

NMG2-05

Similarly this window sets the signal Gain for a Navigator connected to NAV2.

External Alarm

XALM-OFF

This is the window for switching an External alarm on or off. Simply press and hold the ALARM key to enter the alarm menu and press the key repeatedly until the External Alarm display is shown. The ⌃ and ⌄ keys are used to switch the alarm on and off.

Gyro Compass Control

Note:

Although the Autopilot Control will access the following gyro displays, the autopilot can only be operated under gyro control if the necessary interface (930 523) is fitted to the 930 618 Distribution Box.

The Autopilot can be set to take its heading information from a Gyro Compass instead of a compass sensor.

When used in this way, whenever the autopilot is switched on, the Gyro reading must be calibrated to the correct compass heading. To do this:

VAR--E00

Press the COMP key until COMP OFF (or COMP ON) is displayed, press and hold the COMP key until the compass variation message is shown. Then release the key and press it twice more to enter the Gyro menu. Use the ⌃ or ⌄ keys

GYRO--ON

to switch the Gyro on or off.

GCAL--OFF

With the Gyro switched on, press the COMP key to enter the Gyro calibration option.

GCAL--000

Use the ⌃ or ⌄ keys to instigate Gyro calibration.

GCAL--120

Dial in the ship's heading by turning the Course Selector knob.

GCAL--OFF

Press the ⌃ or ⌄ keys to complete the calibration of Gyro to Autopilot.

GYRO--120

When under Gyro control, the Autopilot will display GYRO instead of HEAD in Standby mode, and GYRO instead of COMP in Auto mode.

Note:

Gyro Type or Gyro Ratio

Since Gyro Compass' vary in their output it is necessary when first installing the Gyro to select the correct Gyro Ratio. Most use a 360:1 ratio but some use a 180:1 or 90:1 ratio.

GCAL--OFF

RATIO 0

To set the correct ratio use the COMP key to enter the Gyro calibration window, a further press of the COMP key will then display the Gyro Ratio option. The settings are:

0 - 360:1
1 - 180:1
2 - 90:1

Use the ⌃ and ⌄ keys to change the setting to the correct ratio. Turn the Propilot 725 off to store the setting.

CONFIGURING YOUR PROPILOT 725

Because no two vessels are quite the same, your autopilot will need to be configured for the characteristics of your boat. This is done initially when the system is installed but you may be able to fine tune it later.

The Propilot 725 has default settings for three types of boat, Planing, Semi-displacement and Displacement. For each of these boat types there is a standard configuration preprogrammed into the autopilot's memory.

Each configuration has three sets of sea state values called Pilot A, Pilot B and Pilot C which enable the autopilot to be tuned for differing speeds and sea conditions. The Helmsman can then choose between the three settings.

Select the configuration (boat type) most suited to your vessel, then fine tune the individual Pilot A and B settings as you become familiar with the autopilot.

THE SETTINGS EXPLAINED

Counter Rudder

C/R--03

At the end of a large course change the amount of rudder is reduced as the vessel approaches the new heading to prevent the vessel from overshooting. This may even result in opposite helm being applied for a short time. The rate at which the reduction in the amount of rudder occurs is known as Counter Rudder.

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 accordingly, possibly causing the vessel to oscillate from side to side, before settling to the new heading.

This setting will have a greater effect on heavier displacement vessels but must obviously be customised according to the characteristics of individual craft. Adjust to give approximately 10° of overshoot for a 90° change of course.

The range is from 00 (No Counter Rudder) to 20 (Maximum Counter Rudder). The setting can be set at different levels for each choice of Pilot A, B or C.

Trim

TRIM--04

Theoretically if the rudder is amidships the vessel will travel in a straight line. Often 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 autopilot will trim the vessel to the correct course within 60 seconds.

On single screwed vessels 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 vessels, run the boat under Auto 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.

The range is from 00 (No Trim) to 20 (Maximum Trim). The setting can be set at different levels for each choice of Pilot A, B or C.

Rudder Ratio Gain

GAIN--03

This setting adjusts the Gain of the Rudder Ratio setting. It rarely needs adjusting, but should be adjusted so that in average conditions the Rudder Ratio setting used is between 5 and 10. If the settings are generally higher, increase the Gain, if lower, decrease the Gain.

The range is from 01 minimum Gain, to 10 maximum Gain.

The Pilot A, B and C values will always be the same. If you change one it will change the other.

Rudder Deadband

RDB--03

Some steering systems have slack in them due to wear or system design which gives a few uncontrolled degrees of rudder movement. To stop the autopilot trying to correct these small movements, which it can never successfully do, the rudder deadband setting allows a small rudder displacement from the required position without the autopilot trying to correct the error.

Set this to the minimum value that avoids hunting of the rudder. The range is from 00, (0°) to 20 ,(2°). The Pilot A, B & C values will always be the same. If you change one it will change the other.

Rudder Limit

RLIM--07

This sets the maximum rudder movement, either side of amidships, obtainable under autopilot control. The range is from 01 (=3°) to 10 (=30°). Set the limit so that the rudder does not quite touch its end stops.

The setting can be set at different levels for each choice of Pilot A, B or C.

Max Turn Rate

TURN--20

This sets the maximum rate of turn that is allowed when under autopilot 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) to 20 (small radius).

The Pilot A, B and C values will always be the same. If you change one it will change the other.

Power Steer Gain

PSG--07

This adjusts the sensitivity of the steering when it is controlled by a remote device such as a 930 717 or 930 729 Proportional Control. The range is from 01 (least sensitive) to 10 (most sensitive).

The Pilot A, B and C values will always be the same. If you change one it will change the other.

Auto-deviation

AUTO-DEV

This allows access to the automatic deviation correction procedure for the heading sensor and is explained in the following section, Sea Trials.

Compass Damping

This sets the amount of damping applied to the readings from the heading sensor to avoid rapid changes of the heading display. For further details on this setting please refer to page 24.

PRESET CONFIGURATIONS

The following is a list of the values that the Preset Configurations will set the Autopilot to, including those for equipment that you may not have connected. Notice that the Rudder Ratio, Response, PWM and Alarm settings also change. These settings are only intended as a general guide.

The preset values are as follows:-

These settings are constant in all of the preset configurations.

Response	01
Trim	04
Gain	01
Rudder Deadband	03
Rudder Limit	07
Damp	01
Wind Trim	01
Watch Alarm	OFF
PWM	ON
NMEA Gain 1	05
NMEA Gain 2	05
Variation	00
Power Steer Gain	05

The configuration settings enable the Propilot 725 to be adjusted according to sea state, speed, the vessel's load, etc. The table overleaf shows the factory settings for each configuration where, for example, Pilot A could be for faster speeds or a calmer sea state, Pilot B for slower speeds or heavier seas and so forth.

These settings vary, depending on the hull configuration selected:

		FACTORY SETTINGS		
		PILOT A	PILOT B	PILOT C
Planing Configuration	Rudder Ratio	06	08	08
	Counter rudder	01	03	03
Semi-Displacement Configuration	Rudder Ratio	08	10	10
	Counter rudder	03	04	04
Displacement Configuration	Rudder Ratio	10	12	12
	Counter rudder	04	06	06

Installing a Preset Configuration

PILOT B	Press the MODE key to select PILOT A, PILOT B or PILOT C settings.
CONFIG	Press and hold the SEA STATE key until the LCD displays the Configuration message (approximately 3 seconds).
	Press either the ⌃ or ⌄ key to display the selection window. Only one Preset can be switched ON. When you select one, the other two are automatically turned OFF.
PLAN OFF	Press either the ⌃ or ⌄ key at this display to select the Planing presets.
	Press the SEA STATE key to display the next selection window or OFF to exit this routine and store the settings.
SEMI ON	Press either the ⌃ or ⌄ key at this display to select the Semi-displacement presets.
	Press the SEA STATE key to display the next selection window or OFF to exit this routine and store the settings.
DISP OFF	Press either the ⌃ or ⌄ key at this display to select the Displacement presets.
	Press the SEA STATE key to display the Restore selection window or OFF to exit this routine and store the settings.

RESTORE	Press either the ⌃ or ⌄ key at this display to select the values that were stored when the autopilot was last switched off. This is useful if you are experimenting with different settings.
	Press the SEA STATE key to return you to the Configuration window or OFF to exit this routine and store the settings.

Adjusting Individual Configuration Settings

PILOT B	Press the 'MODE' key and select PILOT A, PILOT B or PILOT C settings.
CONFIG	Press and hold the SEA STATE key until the LCD displays the Configuration message (approximately 3 seconds).
TRIM--06	Press the SEA STATE key repeatedly to select the required setting (The TRIM setting in this example).
TRIM¦09	Press the ⌃ key and the value will increase, an arrow confirms that it is increasing.
TRIM§07	Press the ⌄ key again and the value will decrease, an arrow confirms that it is decreasing.
	The SEA STATE key will step through the other Configuration adjustments or the AUTO or ON/ST'BY keys will take you back to their displays.
	For all settings, the value displayed is the one that the Autopilot will use but...REMEMBER changed settings will only be stored if the Autopilot is turned off by the OFF key being pressed.

SEA TRIALS

With the installation completed, it is strongly advised that the following Sea Trials are carried out.

Checks at the Dockside

Ensure 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 arms fouling the steering.

Return the rudder(s) back to the amidships position.

Switch the autopilot ON, if the steering operates, *switch off at once* and re-check the connections. Continue when the fault has been corrected.

Check that no system faults appear after the self test routine has been completed.

Check that the autopilot has been configured for the vessel, e.g. displacement, semi-displacement or planing.

Check that the Rudder Position display indicates the rudder moving to the left when the helm is turned to Port and to the right when it is turned to Starboard. If not, reverse the Rudder Feedback Unit phasing (see the Installation Settings earlier).

Check that the rudder position indicator displays "||" when the rudder is in the position normally required to steer the vessel in a straight line. Also check that the display flashes, indicating that it has reached the Rudder Limit, *before* it reaches the end of rudder movement (in both directions).

Switch the autopilot from Standby mode into Autopilot mode. Very little or no rudder movement should occur. If the rudder drives continuously to one side, *switch off at once* and reverse the motor phasing. If the rudder continuously 'hunts' about amidships, increase the rudder Response setting.

Check that when you rotate the Course Control Knob clockwise, the motor drives the rudder to Starboard and when you rotate the Course Control Knob anticlockwise, the rudder drives to Port. If the Rudder moves in the wrong direction, reverse the motor and the rudder phasing (see the Installation Settings earlier).

Ensure that the transit screw in the base of the compass sensor has been removed, shortened or replaced if it has been exposed to the elements and check that the compass heading agrees with the ship's heading.

Finally check that the 'OFF' and 'STANDBY' keys of any additional Control Unit's function correctly.

Sea trials can now be carried out to set the compass deviation corrections and to determine the best settings for optimum autopilot performance.

Checks at Sea

It is dangerous to carry out these trials in restricted or busy waters.

Calm sea conditions are required to carry out the Automatic Deviation Correction procedure, average sea conditions are preferable for the rest of the sea trials.

The following order is recommended for carrying out the Sea Trials.

Carry out the Automatic Deviation Correction routine.

Check that the selected Configuration settings give the best performance for the vessel in this order:-

a. Rudder adjustments.
b. Counter rudder.
After carrying out this adjustment, check the steering characteristics and adjust the Rudder and Response as required.
c. Trim adjustment. If conditions allow.
d. Compass Damping.

Set the Navigator Gain if a navigator is fitted (see Installation Settings earlier).

Set the Wind Trim Gain if a windvane is fitted (see Installation Settings earlier).

WARNING

Changed values are not automatically stored until the autopilot is turned off by the OFF key. Therefore switch the autopilot off as soon as it is practical and safe to do so.

It is also advised that the optimised settings are recorded, in case they are accidentally changed at any time.

AUTOMATIC DEVIATION CORRECTION

The compass has a facility to automatically measure and compensate for the majority of hard and soft iron deviation found on board a vessel.

The compass sensor requires the vessel to turn approximately 2¼ times to complete the deviation correction. The first turn corrects for hard iron errors, the second for soft iron errors.

It is not necessary to turn the boat at a constant rate nor will momentarily stopping the rotation affect the deviation correction procedure. Turning the vessel in an anticlockwise direction during the correction procedure should be avoided as this can lead to erroneous correction values.

The deviation correction facility is not accessible until 10 seconds after power up of the compass sensor.

Procedure

Find an area of calm water where it is safe to perform slow CLOCKWISE turns.

CONFIG	Press and hold down the SEA STATE key for approximately 3 seconds until the configuration message appears.
AUTO-DEV	Press the SEA STATE key repeatedly until the LCD displays Auto deviation message.
	Press the ⌃ or ⌄ keys and the LCD will display either *CLEAR* or CORRECT.
CORRECT	If CORRECT is displayed it means that the autopilot already has correction values stored. Press the ⌃ or ⌄ keys again so that previous information is erased and *CLEAR* is displayed.
CLEAR	Once the LCD displays *CLEAR* set the vessel on a slow clockwise turn and press the ⌃ or ⌄ keys.
INIT'D	The display will inform you that the auto deviation correction routine has been initialised.

RUNNING

After 60° of turn the LCD will change to display RUNNING. Continue the slow clockwise turn until the LCD changes to display CORRECT, usually 2¼ turns.

If the display still indicates RUNNING then the vessel has been turned too quickly and requires an additional turn at a slower rate.

CORRECT

This completes the Auto deviation correction routine. Press the ON/ST'BY or AUTO key to return to the mode you require.

You should now check that the compass heading agrees with the vessel's true heading and does not need realigning. The compass should also be checked against known headings to check the accuracy of the compass (known headings could be obtained either from an accurate magnetic compass or from transits).

WARNING

Changed values are not automatically stored until the autopilot is turned off by the OFF key. Therefore switch the autopilot off as soon as it is practical and safe to do so.

SYSTEM DESCRIPTION

Block Diagram of Distribution Box Showing Primary Data Paths

An Installation Schematic showing all possible connection options is shown on page 14.

Fuses

FS1-3 amp, QB, Ø5mm x 20mm cartridge, (Light Duty Ships Supply Input).
FS2-5 amp, QB, Ø5mm x 20mm cartridge, (Clutch output).
FS3-1,25 amp, QB, Ø5mm x 20mm cartridge, (Motor Supply logic).

Absolute Maximum Ratings over Operating Temperature Range

(Operation at or above the Absolute Maximum ratings may cause permanent damage to the equipment.)

Maximum Supply Voltage:	32 volts DC
All input voltages (except NAV Ports):	-0.7 to +5.5 volts DC
NAV Ports:	-15 to + 15 volts DC (Nominal 0 to 5v)
Maximum motor drive current limit	Factory preset to 26Amp
Storage Temperature:	-30 to +75°C

Operating Temperature (Ambient): 0 to 55°C

Changing Software Eproms

The software is stored in the EPROM, IC 11. To change the eprom, first disconnect any power to the Distribution Box. Remove the cover and internal RFI shield. IC11 is located in the centre of the PCB, replace the existing eprom with the new one, being certain that pin 1 is in the correct position (away from the motor connection block) and that no pins are bent or miss their socket. Refit the RFI shield and cover.

Caution!
Eproms are Static Sensitive Devices. Take suitable precautions when handling them.

Restore the power supplies and turn the autopilot on. The display may show system fault 'F002' to start with. If it does, switch the autopilot Off then On again and this should clear the condition. If it does not then almost certainly the eprom has not been fitted correctly.

Switches

There is an eight way DIL switch on the PCB which is used to change the way the Distribution Box functions. It is situated in the top right quadrant of the PCB with switch one (SW1) being nearest the centre of the board. The ON position is defined as when the switch is pushed towards the FET's.

The functions of the switches are as follows:

SW1 Leave in ON position. (First 930 725 or 930 750 must be connected to Port A.)

SW2 Switch to the ON position when a 930 725 or 930 750 is connected to Port B.

Switch to the OFF position when Port B is not connected or when a 930 700 or 930 770 is connected to Port B.

SW3 Switch to the ON position when a 930 725 or 930 750 is connected to Port C. Not available if a 930 700 or 930 770 is connected to Port B.

Switch to the OFF position when Port C is not connected.

SW4 Leave in OFF position.

SW5 Switch to the ON position when using a Rudder Feedback Unit that has no integral limit switches, i.e. 930 807.

Switch to the OFF position when using a Rudder Feedback Unit that has integral limit switches, i.e. 930 801.

SW6 Switch to the ON position when using a Rudder Feedback Unit that has no integral limit switches, i.e. 930-807.

Switch to the OFF position when using a Rudder Feedback Unit that has integral limit switches, i.e. 930-801.

SW7 Switch to the ON position when a Navigator with a single wire output is connected to the NAV1 port.

Switch to the OFF position when a Navigator with a two wire output is connected to the NAV1 port.

SW8 Switch to the ON position when a Navigator with a single wire output is connected to the NAV2 port.

Switch to the OFF position when a Navigator with a two wire output is connected to the NAV2 port.

NMEA Messages Supported BOD, XTE, APB, APA, GLL, VTG, WDC, WDR, RMA, RMB, RMC, GGA, VWR, BWC, BWR

TROUBLESHOOTING GUIDE

In an EMERGENCY

Press the OFF key to regain manual control.

General Principles & Cautions

1. Do not connect or disconnect wiring to the terminal blocks without first ensuring that the supply is turned off. Certain components will be seriously damaged if shorted out inadvertently.
2. When first installing or when changing the wiring always double check the colour coding before switching on the power.
3. Do not use a simple voltmeter to attempt to check powered up Digital logic lines or signal lines unless specifically described in the following discussion.
4. Ensure that all cable screens are properly earthed.
5. Check the fuses and replace blown ones with direct equivalents. Most units have one internal fuse, the Distribution Box has 3.
6. Take suitable precautions when handling PCB's with Static Sensitive Devices.
7. Read the 'Good Wiring Practice' advice in the 'Installing Your Propilot 725' section earlier.

Faults

Possible cause and remedy.

1. The system will not power up.

Check the power supplies to the Distribution Box.
In the Distribution Box PCB:
Check Fuse 1. Check the supplies from the Distribution Box (Brown and Violet wires at PORT A). Check that the Brown wire, (normally 4 to 5V) changes to 0V when you try to turn the autopilot on, if not, then suspect fault in the Distribution Box.
Check that the Violet wire is normally 0V and changes to +5V when you try to turn the autopilot on. If this is not so then a fault with the Distribution Box PCB is likely.
If new software has just been fitted, check the IC legs. Damaged legs will probably mean a damaged eprom.

2. The display works momentarily then blanks and the system powers down.	The Fail Safe Watchdog is causing system power down. A fatal fault has been detected on the Distribution Box PCB. Remove the top cover and internal RFI shield from the Distribution Box. Visually check that the socketed IC's (IC13 MPU, IC11 Eprom, and IC9 PGA) are installed securely. Check for any loose material that may cause shorts.
3. System powers down for no apparent reason and cannot be restarted	See 1 and 2 above.
4. System powers down when radio Transmitter or other RF device is keyed; or when a device needing current is operated (electric windlass, etc)	This could occur if RF energy is being injected into the power cables or by radiation injection into the pilot system components at very high levels. The autopilot has been exhaustively tested to withstand RF injection and radiation at levels far above those considered safe to personnel. Antenna mismatch yielding high SWR can cause dangerous conditions and in the interest of operator safety the radio installation should be inspected immediately. A more normal problem to occur is that a Radio transmitter, or other high current unit, is being supplied from the same battery as the autopilot. When the device is operated, it may be causing the battery voltage to drop below that required to maintain the autopilot operation. Once power loss has occurred, the fail-safe watchdog has been designed to power down the system automatically. This would be particularly noticeable if the battery had a bad cell or corroded connections. It is recommended to supply the autopilot with power from a different battery to the other auxiliary requirements.
5. The autopilot powers up but displays System Faults which can be reset and do not immediately recur	This may happen very occasionally due to a momentary loss of synchronization during power up. The self test software reports all errors of this type to help anticipate potential problems. Unless this happens repeatedly it is of little concern. Normally this can be traced to a wiring error. System fault messages are explained and action to be taken is given, in "Error

6. The autopilot powers up but displays a System Fault which cannot be reset.	and Fault Messages" after this. Check the heavy duty supply to the Distribution Box. In the Distribution Box:
7. Autopilot engages but motor does not drive	Check fuse FS3. Check that the relay (left rear of PCB) switches when going from STANDBY to PILOT (it can be heard). If it does not, suspect a relay fault or Regulator (REG2) fault. If it does, suspect a drive FET or logic failure on the Distribution Box PCB. If you suspect a faulty motor, test it by powering the motor directly from a suitable battery.
8. Motor drives one way only	Centre the helm and retry to ensure you are inside the electronic limits. If using a Rudder Feedback Unit without integral limit switches, check that the DIL switches 5 & 6 in the Distribution Box are switched ON. If using a Rudder Feedback Unit with integral limit switches , check that the switches are working. Otherwise suspect a drive FET or logic failure on the Distribution Box PCB.
9. Motor drives both ways but lacks power.	Low battery voltage. Motor cable or supply cable too small. Motor faulty. Check brushes etc. On hydraulic systems check hydraulic fluid level. On mechanical systems check that the Clutch output and Motor Clutch are working.
10. Motor drives hard over when autopilot is engaged	Indicates a wiring error on either the Rudder Feedback Unit or the motor drive connections, probably in the Distribution Box and possibly the Phasing of them. Also check that the Rudder Feedback Unit arm has not become disconnected.

ERROR AND FAULT MESSAGES

If your autopilot detects a problem with the system it will display a warning on the LCD. The more serious problems will be accompanied by the autopilots internal audible alarm. The very serious problems will also return the autopilot to Standby 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.

REMEMBER — In an EMERGENCY press the 'OFF' key to regain manual control

WARNING MESSAGES ONLY

NO DATA

The Autopilot control has received No Data from the 618 Distribution Box.

• Check the white wire carrying data between the Autopilot control and the Distribution Box. Check that the DIL switches on the Distribution Box PCB are correctly set

DATA OVF

Corrupted Data has been received by the Autopilot control.

BAD CKSM

• Press the OFF key then the ON/ST'BY key. If this does not clear the fault then the data is still being corrupted. External 'noise' or faulty connections may be the cause of the corruption.

NO RTS

WARNING MESSAGES ACCOMPANIED BY AN AUDIBLE AND VISUAL ALARM

MOT SUPP

The steering motors supply has failed.

• Check the supply fuses, circuit breakers and wiring to the motor. This can also occur if the Light Duty Supply and the Motor supply do not share a common negative.

BATT ALM

The battery voltage is low.

• Clear the alarm by pressing the ALARM 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 vessels charging system.

ERROR 4	This means that there is a Back-up memory fault. Switch the unit off and start again. If this recurs then the Compass Sensor PCB has developed a fault. This message only appears in the Deviation Correction page.
ERROR 6	This means that the supply voltage is too low, below 10.4 volts. This message only appears in the Deviation Correction page.
NO NAVGR	The Autopilot control has received No Navigator Data. • Check that the Data output format from the Navigator is the same as the autopilot is set to receive (see Installation Settings). • Check that NAV1 or NAV2 is selected correctly (see Section A, Navigator Control). • There are two LED's on the PCB inside the Distribution Box, one for each NAV port. They will flash if data is being received.
NAV DATA	The Autopilot has received an error code from the Navigator. • Check the Navigator for bad reception or faulty equipment.
NAV OVFL	The Autopilot has received more Navigator Data than it expected. • Clear the alarm by pressing the ALARM key (will not affect the autopilots operation). Often caused by not selecting the correct data formats.
NAV TIME	The Autopilot has "timed out" because it has not received expected Navigator Data within a predetermined length of time. • Check the Data output from the Navigator
WND TIME	The Autopilot control has timed out after not receiving expected Wind Instrument Data. • Check the Data output from the Wind instrument.

If any of these following System faults are displayed:-

Press the ALARM key. This can clear the condition if it is only a temporary fault. If this fails to clear the fault, revert to compass control or power off.

The system faults are indicated by numbers indicated below. Faults with a number greater than 128 will result in the pilot being switched automatically to 'Standby'.

SFLT 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.

SFLT 033	PORT 'A' HANDSHAKE ERROR

• This is likely to indicate that the port A handshake has been incorrectly selected. Check the correct position of switch 1 inside the 618 Distribution Box. Only set switch 1 down if the yellow and green connections are used on port A

SFLT 036	COMPASS MESSAGE FAULT

• The compass message has not been received correctly by the 618 Distribution Box.
If this occurs repeatedly then the compass should be repaired.

SFLT 065	PORT MESSAGE OVERRUN ERROR

• The messages received by the 618 Distribution Box for the Autopilot Control is longer than expected.
It could be caused by excess electrical noise interfering with the data cables of the Autopilot Control or by a faulty IC9 in the Distribution Box.

SFLT 066	PORT READ CHECKSUM ERROR

• The messages received by the 618 Distribution Box for the Autopilot Control is longer than expected.
It could be caused by excess electrical noise interfering with the data cables of the Autopilot Controls or by faulty IC9 in the Distribution Box.

SFLT 070	PORT A TIMEOUT

• The alarm will occur if port A in the Distribution Box is incorrectly selected or if a control unit fails to respond. Check the Distribution Box for the position of switch 1, wiring of Port A connections or a faulty IC9.

SFLT 071	PORT B TIMEOUT

• The alarm will occur if port B in the Distribution Box is incorrectly selected or if a control unit fails to respond. Check the Distribution Box for the position of switch 2 and the wiring of Port B connections.

SFLT 072	PORT C TIMEOUT

• The alarm will occur if port C in the Distribution box is incorrectly selected or if a control unit fails to respond. Check the Distribution Box for the position of switch 3 and the wiring of Port C connections.

WARNING MESSAGES ACCOMPANIED BY AUDIBLE AND VISUAL ALARMS AND THE AUTOPILOT SWITCHED TO STANDBY MODE

SFLT 128	RAM FAULT

• This indicates a serious hardware malfunction, if it persists and cannot be cleared a Cetrek Distributor should be consulted.

SFLT 129	EPROM FAULT

• This indicates a serious hardware malfunction, if it persists and cannot be cleared a Cetrek Distributor should be consulted.

SFLT 165	COMPASS TIMEOUT

• The 618 Distribution Box is not receiving heading information from the compass unit.
(On systems using gyro input only, this alarm will sound until the gyro input has been selected).

SFLT 198	RUDDER FEEDBACK FAULT

• This may be caused by a fault in the Rudder Feedback Unit, wiring or excessive travel on the Rudder Feedback Arm.
Check that the Rudder Feedback Unit has been correctly installed.

SFLT 224	RUDDER DRIVE FAULT

• The 618 Distribution Box 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.

SFLT 225	RUDDER FEEDBACK AMPLIFIER FAULT

• This indicates a serious hardware malfunction, if it persists and cannot be cleared a Cetrek Distributor should be consulted.

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:

Model Number:

Serial Number:

Software Version Number:

A description of the failure.

Installation Code of Practice

In addition to the installation information contained within this manual, the "Code of Practice for Electrical and Electronic Installations in Boats", produced by the BMEA, is recommended as a useful guide.

BMEA - British Marine Electronics Association
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