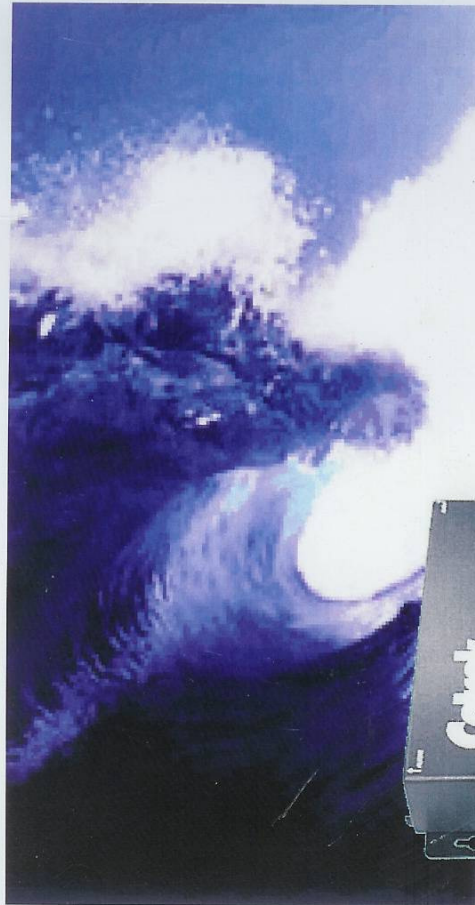




Installation Guide, for Pilot Computers 930609 and 930619



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BS EN ISO 9001:1994
Certificate No. Q5072

930609/619
Pilot Computer

Installation Guide
Issue 06
for software version 3.0 or later



Welcome to



All of us at Cetrek would like to welcome you to the reliable world of Cetrek Autopilot systems.

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.



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

Document
Reference:
806190
Issue 06
April 1999

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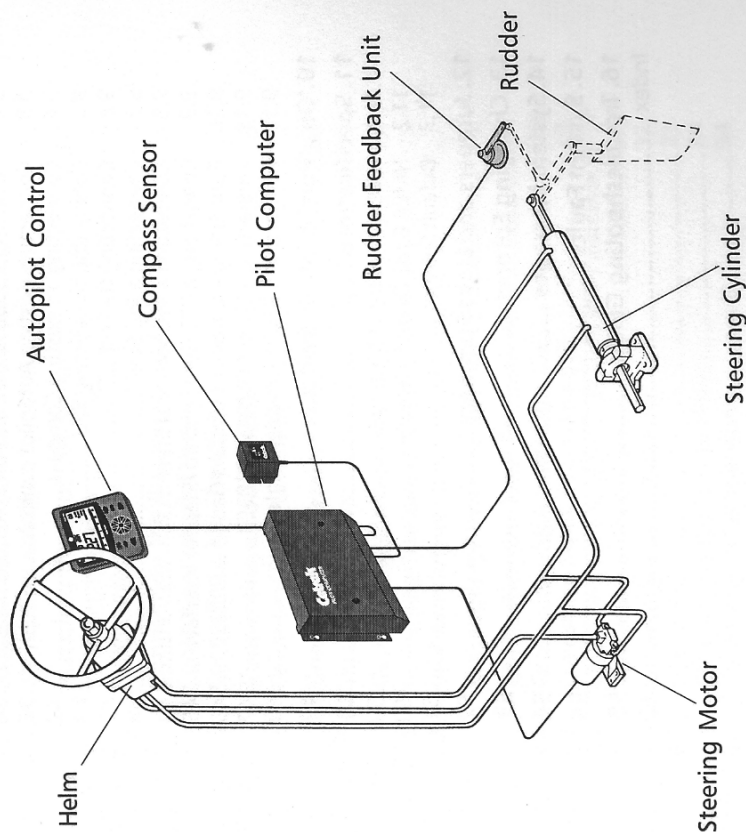
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A Typical System



1. Introduction

The Cetrek Pilot Computer is the heart of the autopilot system.

Two versions exist, the 930609 and the 930619. They both look the same from the outside but the 930619 has an extra Printed Circuit Board (PCB) inside to give it greater functionality.

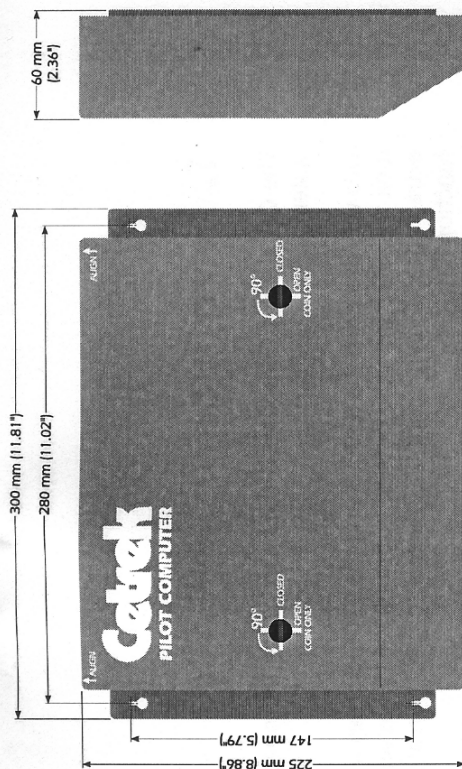
Both units have the capability of steering to a compass course, to a waypoint or to a constant wind angle.

The helmsman uses the autopilot control head to tell the Pilot Computer what he wants it to do. The Pilot Computer is told heading information by an electronic compass sensor and is told the position of the vessel's rudder by a Rudder feedback unit.

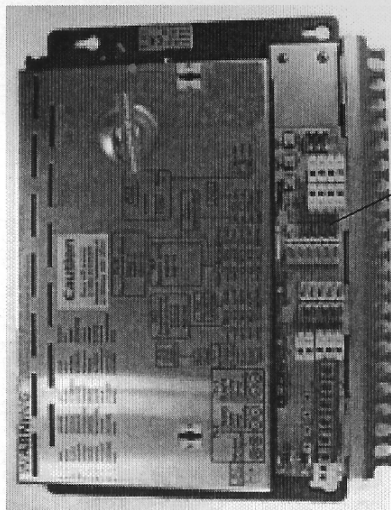
The computer then processes the information available and holds the straightest possible course. The software is 'adaptive' which means it can be set to automatically correct for changing sea conditions and for the vessels own characteristics.

The system can have multiple navigator sources and instrument data connected via its NMEA ports, and the helmsman can quickly view and/or select from the Autopilot Control.

This Guide explains how to install the Pilot Computer and where to connect the system components, optional equipment and navigators. System components will have installation instructions supplied with them.

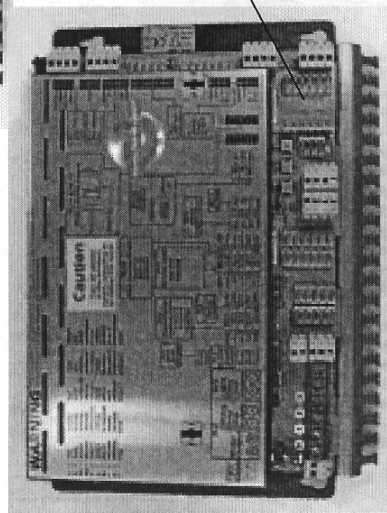


The Pilot Computer with its cover off.



930609 version has one PCB

930619 version has this additional PCB



An Expansion Kit to convert a 930609 to a 930619 is part number 930298.

Installation Step 1

1.1 Before you start installation

Before commencing the installation of the new system please carry out the following checks:

- that the items delivered are correct and undamaged ?
- that the drive unit is the correct voltage for the vessel ?
- 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 power cables of a suitable gauge to supply power to the system?
- that you have Circuit Breakers to suit the system?

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

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 document and any installation information supplied with the individual units before you install the system.

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



Installation Step

1.2 Suggested Installation Steps

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

- 1** **Read the documentation**, then select the best positions for the units, then install the units in the following order:
 - 2** **Pilot Computer** page 12
 - 3** **Autopilot Control**, route the cable to the Pilot Computer and connect it page 14
 - 4** **Compass Sensor**, route the cable to the Pilot Computer and connect it page 18
 - 5** **Rudder Feedback Unit**, route the cable to the Pilot Computer and connect it page 20
 - 6** **Drive Unit**, route the cable to the Pilot Computer and connect it page 22
 - 7** **Route the power supplies** to the Pilot Computer (but do not apply power) page 24
 - 8** **Optional Equipment**, route the cables to the Pilot Computer and connect them page 26
- Carry out dockside settings and sea trials** - see the User's Guide for the Autopilot Control being used.



1.3 Wiring Hints and Tips

Ensure that the Power is disconnected, before removing the Component Cover.

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 1M (3 ft.) clearance is advised. Take particular care to ensure the maximum clearance from radio transmitting equipment.

If it is necessary to extend any of the cables, the same type of cable must be used. Screened cables must be bonded at the Pilot Computer as shown on page 13.

Just in case



Why not record the serial numbers of the units on page 61 while they are easy to get at.

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.

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

Two separately switched and fused power supplies must be connected to the Pilot Computer. 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 or motor supply cables, together or in the same conduit, with control and compass cables. This helps reduce the risk of interference.

It is good practice to cleat all cables to fixed points (not greater than 0.5 m (18") apart) and where cables pass through bulkheads, protect the cable with a suitable grommet or sleeve.

If the vessel has a "clean" earthing system (i.e. using a dyna plate or similar system) then the case of the Pilot Computer may be connected to it using a heavy duty cable or copper strip, this will usually improve RFI rejection. If it does not, leave the case isolated.

The negative of the battery system is not normally a clean earth and the case of the Pilot Computer should not under any circumstances be connected to it.

2. Installing the Pilot Computer

This is the heart of the autopilot system and all units connect to it.

Mount this on a vertical bulkhead in a dry, accessible position. Keep the heavy duty cable runs to the battery and the drive unit as short as possible, but at least 1M (3ft) long. Short runs are particularly important on sailing vessels where battery life is an important factor.



2 'Keyhole' mounting slots each side.

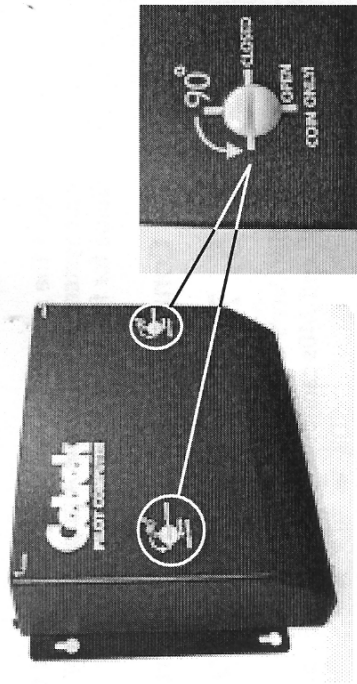
If mounted in an engine room, ensure the area is well ventilated to avoid high ambient temperatures and abnormal condensation levels.

This equipment is capable of generating sparks and should therefore be mounted away from any area where there is risk of inflammable gases or materials.



2.1 Removing the Cover

¼ turn the fasteners to release the cover, then lift it off.

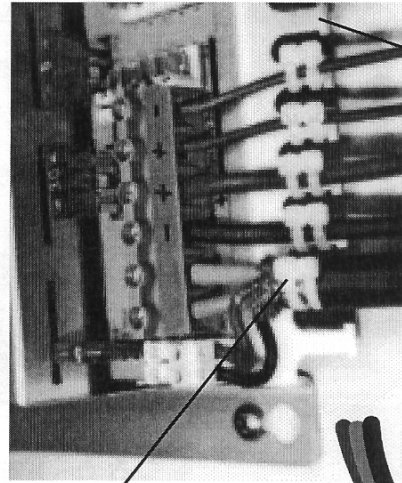


2.2 Fixing Cables

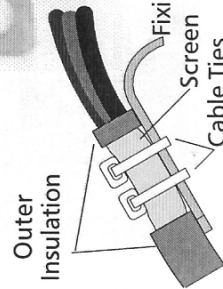
This shows the recommended method of attaching cables and their screens.

Screened cables must be bonded by stripping the outer insulation then clamping the screen to a fixing 'tongue'.

The 775 Cable Screen MUST be isolated from the fixing 'tongue', as the screen is connected to pin 6.



2 Cable Ties per 'Tongue' Recommended



Fixing 'Tongues'

3. Connecting the Autopilot Control.

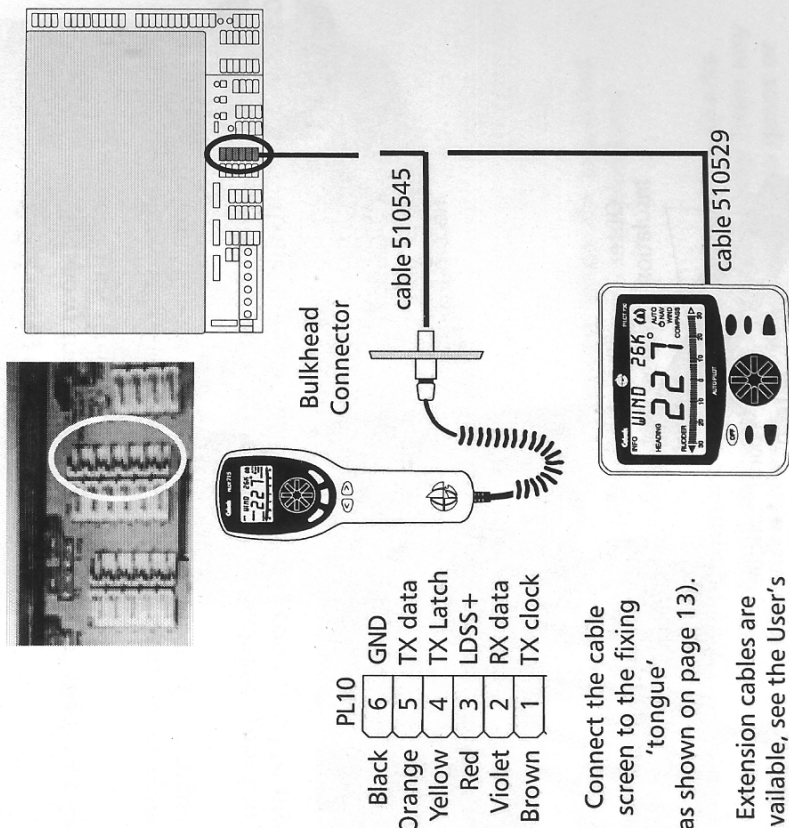
Select the section for the Autopilot Control to be fitted to your system. Refer to the Autopilot Control's own User's Guide for full installation advice.

3.1 Connecting Autopilot Controls

715, 730, 740 or 731, 741

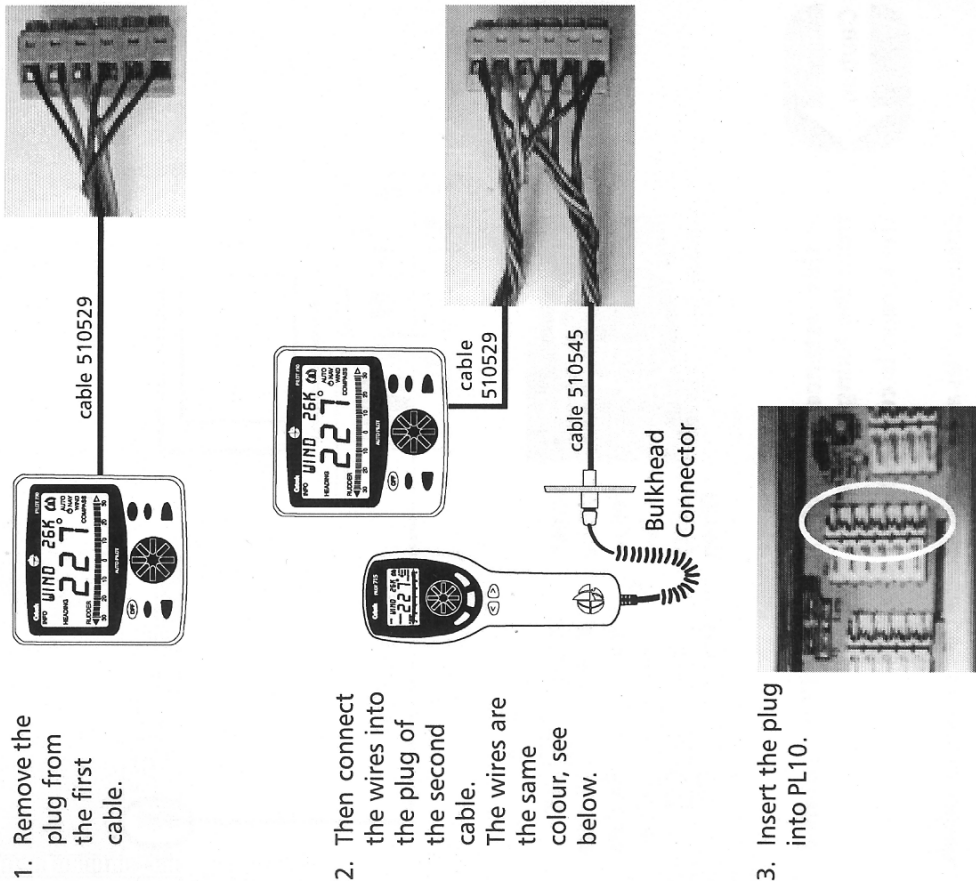
See the User's Guide for installation advice.

- 730 and 740s cannot be mixed with 731 or 741s.



Connecting two or three Autopilot Controls

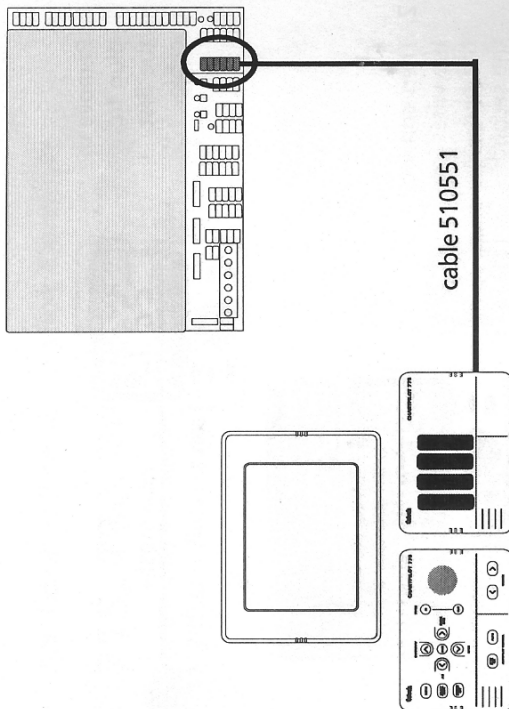
- The controls must be wired in parallel (into the same plug).



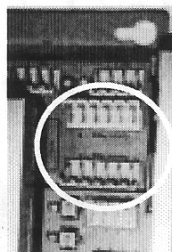
3.2 Connecting a 775 Chartpilot

See the 930775 User's Guide for installation advice.

Connect the cartridge reader to PL14 (a second 775 connects to the cartridge reader via its LCD).



PL14	
Screen	6 GND
White	5 TX data
Yellow	4 RX data
Red	3 LDSS+
Grey	2 OFF
Green	1 ON

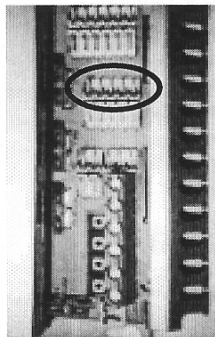
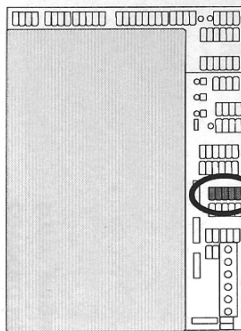


In this instance the cable screen MUST be isolated from the fixing 'tongue'
The screen is connected to pin 6.

Extension cables are available, see the User's Guide for details.

4. Connecting a 580 Compass

See the units documentation for installation advice.
Connect Compass Units to PL8.



PL8	5	Red
	4	Green
	3	Blue
	2	White
	1	Black
		GND
		Ref.
		Cos
		Sine
		+8V

Connect the cable screen to the fixing 'tongue' (as shown on page 13).



It is important to calibrate the 580 Compass Sensor before the autopilot is put into full use.

Please refer to the Autopilot Control's User's Guide for details of how to carry out this procedure, known as 'Automatic Deviation correction'.

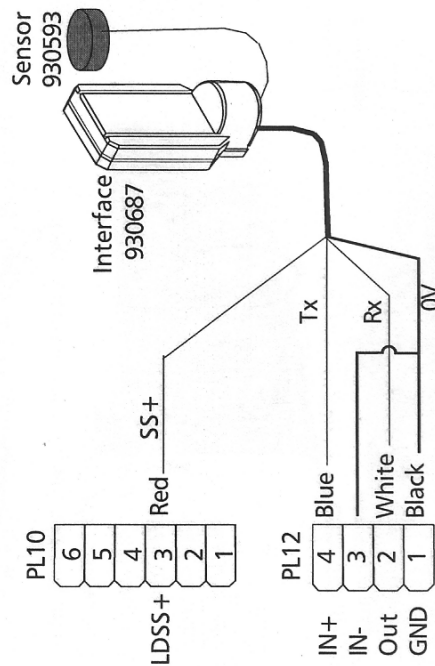
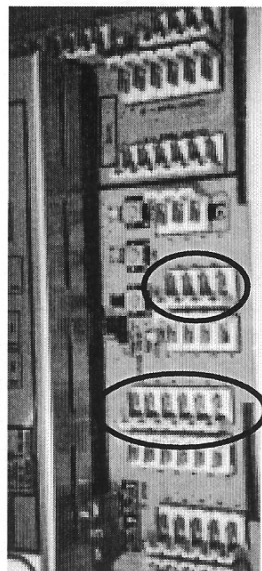
4.1 Connecting a Pick-Off Coil System

The 930687 consists of a 587 Interface with a 593 Sensor.

See the units documentation for installation advice.

Connect the Interface to PL10 and to PL12. If there is an Autopilot Control connected to PL10, the red wire from the Pick-Off Coil interface should be wired into the same connector.

A 930581 Rate sensor must not be fitted with this compass system.

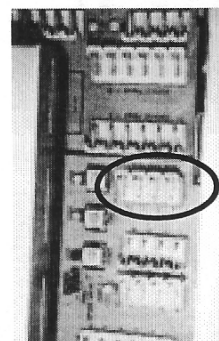
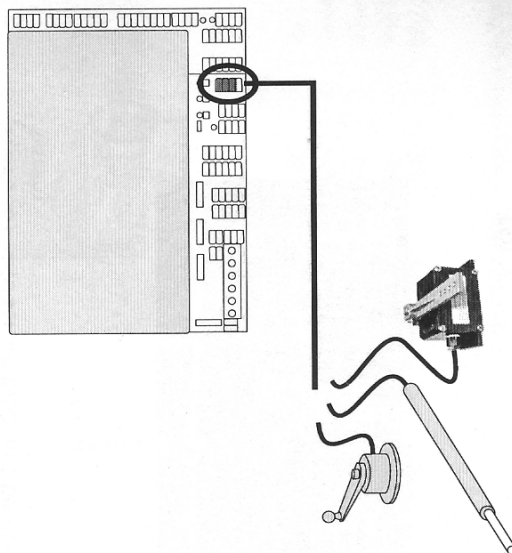


Connect the cable screen to the fixing 'tongue' (as shown on page 13).

5. Connecting a Rudder Feedback Unit

See the units documentation for installation advice.

Connect the Rudder Feedback Unit to PL13.



White	1	Signal
Red	2	+5V
Black	3	GND
PL13		

Connect the cable screen to the fixing 'tongue' (as shown on page 13).

5.1 Signal Amplification

To allow the use of a wide range of Rudder Feedback Units, the signal can be amplified or un-amplified as required.

Un-amplified for	Amplified (factory default) for
930807	930809
930837	930819
930801	930877
930538	
Linear drive with RFU	
930130	
930132	
930180	
930182	



715,730,740 and 731,741 systems allow the selection of un-amplified signals by software from the Autopilot Control providing the link J1 is in the factory default (amplified) position.

Refer to their User's Guide for instructions.

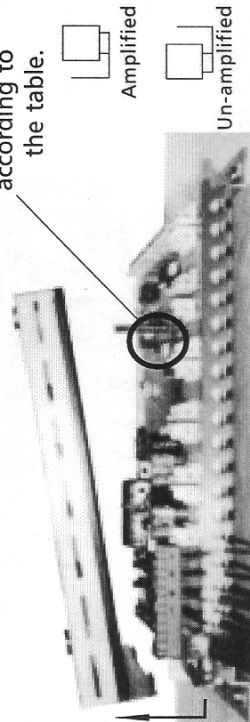
Systems that do not allow software selection require link J1 in the Pilot Computer to be moved, as shown below.

If the Jumper needs to be repositioned:

Disconnect the Power.

Remove the thumb nut then lift the Component cover up and left.

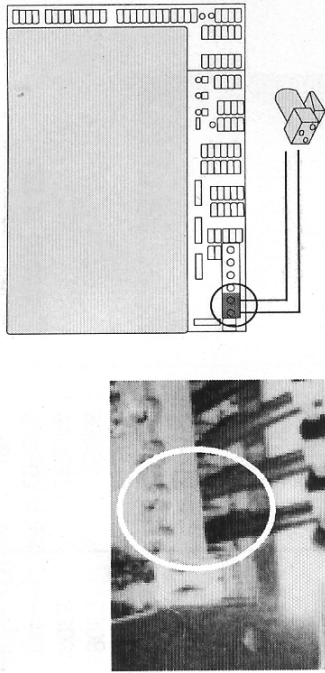
Set J1 according to the table.



Refit the Component Cover on completion.

6. Connecting a Drive Unit

See the documentation that came with your drive unit for installation advice.

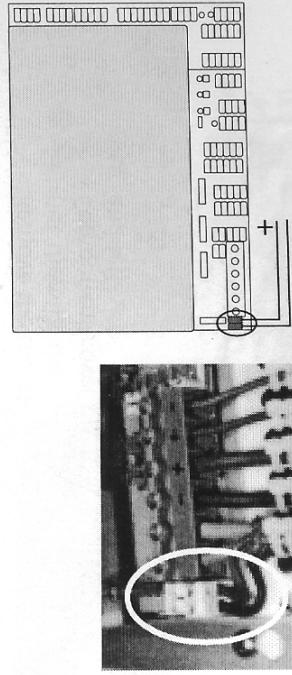


Two wires from the drive unit motor connect to PL2. Polarity is not important at this stage.

If the cables need to be extended, ensure that the correct cable rating is used.

The table on page 24, for the heavy duty supply, can be used as a guide in case of uncertainty

If a clutch solenoid needs controlling, connect it to PL1, as shown below.

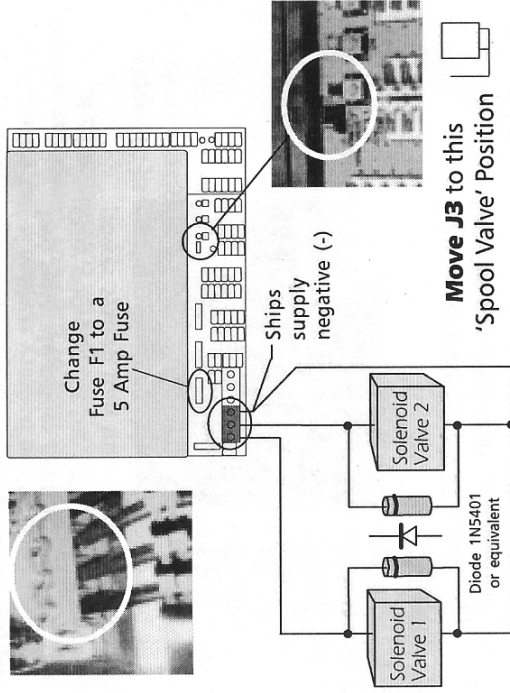


Connect any cable screens to the fixing 'tongue' (as shown on page 13).

6.1 Connecting Solenoid Operated Spool Valves

If solenoid operated spool valves need controlling, connect them to PL2 and move the Jumper J3 to the right.

Change Fuse F1 to the 5 Amp fuse supplied.

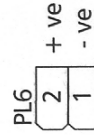
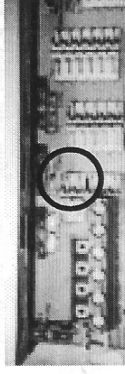


Diodes are required across the solenoids, sometimes they are built in, if not, fit 1N5401's or equivalents, as close as possible to the solenoids.

The solenoids are wired 'common ground', ensure all other equipment wired to the solenoids is also common ground, otherwise damage may occur.

6.2 Dual Rate Output

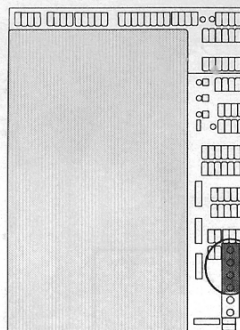
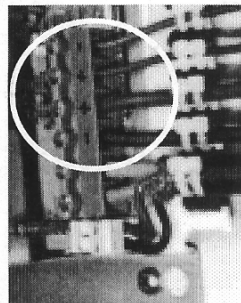
When the autopilot applies more than 10° of rudder, PL6 outputs a signal. This can be up to 5 amps at the heavy duty supply voltage. It is intended for hydraulic systems configured for dual rate operation.



7. Connecting Power to the Pilot Computer

Wire the power to the 609/619 from the ships electrical distribution box circuit breakers, or via switches and anti-surge fuses, but do not apply any power yet.

Two separate cables need to be used, one for the heavy duty and one for the light duty, even though on a low power system they may come from the same source.



PL2=Heavy Duty Supply
fused to suit Drive Unit

PL5=Light Duty Supply
fused at 5 Amp.

It is important that the Heavy Duty Supply cables are of a greater current rating than the Drive Unit motor.

RECOMMENDED MINIMUM CABLE SIZE for the HEAVY DUTY SUPPLY

Copper Area	Cable Type	If 2 Core Rated at,	If 1 Core Rated at,	Cable Gauge
Up to 10 metres = 2.5mm ²	50/0.25mm	20A	30A	14AWG
Up to 15 metres = 4.0mm ²	56/0.3mm	27A	40A	12AWG
Up to 20 metres = 6.0mm ²	84/0.3mm	35A	53A	10AWG

Maximum system performance and minimum cable losses are ensured by using a cable size bigger than the minimum recommended.

For example, if your motor is rated at 10 amps, the cable run is 4 metres (12 feet), use at least 20 amp 2 core cable or 30 amp single core cable.



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

If no such system is available, leave the Pilot Computer isolated.

The negative of the battery system is not normally a clean earth and the case of the Pilot Computer should not under any circumstances be connected to it.

The power supply cables should not be used to supply both the autopilot and other electronic equipment as switching transients can be very troublesome and this practice can cause RF interference.

Before applying power, connect any peripheral equipment as explained in section 8. When first applying power, follow the sequence for Dockside settings as explained in the Autopilot Control User's Guide.



Installation Step 8. Connecting Optional Equipment

8.1 Connecting NMEA devices to a 609

The 609 version has one NMEA input/output port, NMEA1 (PL11).

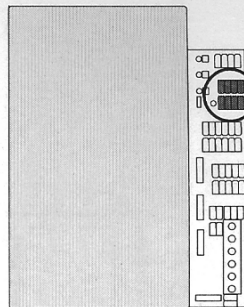
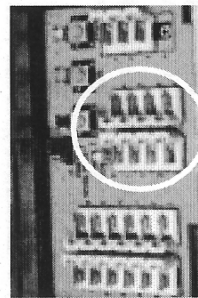
An LED adjacent to the NMEA connector will flash about once a second as input data is detected. If it is on most of the time and flickering, the input signal polarity is probably wrong.

PL12 can be used as an input for Instrument data.

NMEA output is from pins 3 and 4 of PL11.

All NMEA sentences supported are listed on Page 50.

Ensure that you observe signal polarity.

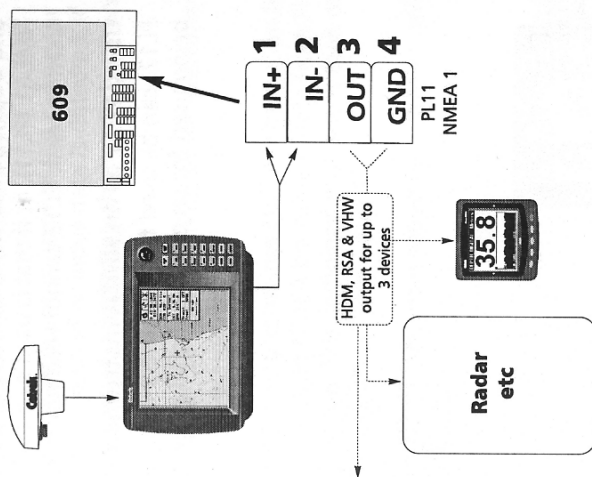


PL11	PL12
IN+	4
IN-	3
OUT	2
GND	1

Connect any isolated cable screens to the fixing 'tongue' (as shown on page 13).

Connecting a Navigator or GPS

This is the usual and preferred method:



Otherwise there are three basic configurations of navigator output:

1. Serial data type 1 :
Signal +ve (0183) connect to pin 1 of NMEA1 (PL11).
Signal -ve (or Return) connect to Pin 2 of NMEA1.
2. Serial data type 2 :
Signal +ve (0183) connect to pin 1 of NMEA1 (PL11).
Ground connect to Pin 2 of NMEA1.
3. RS 422 based output :
Signal TX- connect to pin 1 of NMEA1 (PL11).
Signal TX+ connect to Pin 2 of NMEA1.
Use a separate 2 wire shielded cable for these two connections.

Set the output format of all navigators to NMEA 0183, preferably version 2, but version 1.5 will work.

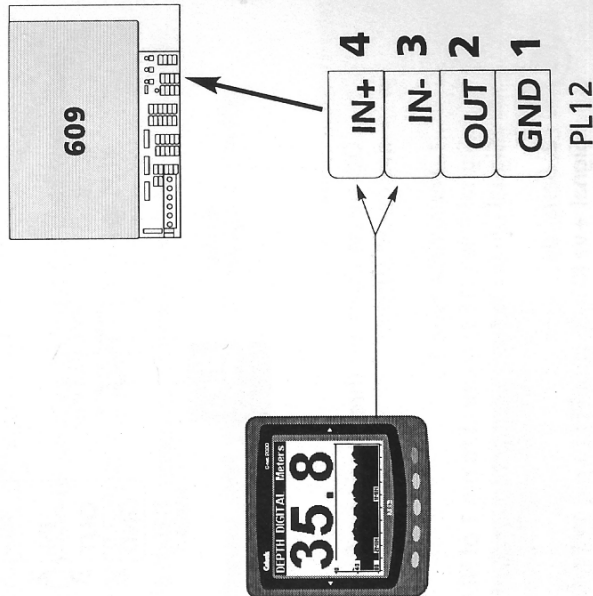
If the output sentences can be selected, RMB, RMC or APB are suitable options.

Connecting other NMEA Devices

NMEA instrument inputs, such as a Windvane or Speed and Depth Instruments, connect to pins 1 and 2 of NMEA1 (PL11), or if that is used by a navigator, PL12 pins 3 & 4 can be used. PL12 cannot read navigator messages.

Using PL12 as an NMEA Instrument data input.

PL12 can be used for instrument data, provided it is not being used for an external digital magnetic compass.



8.2 Connecting NMEA devices to a 619

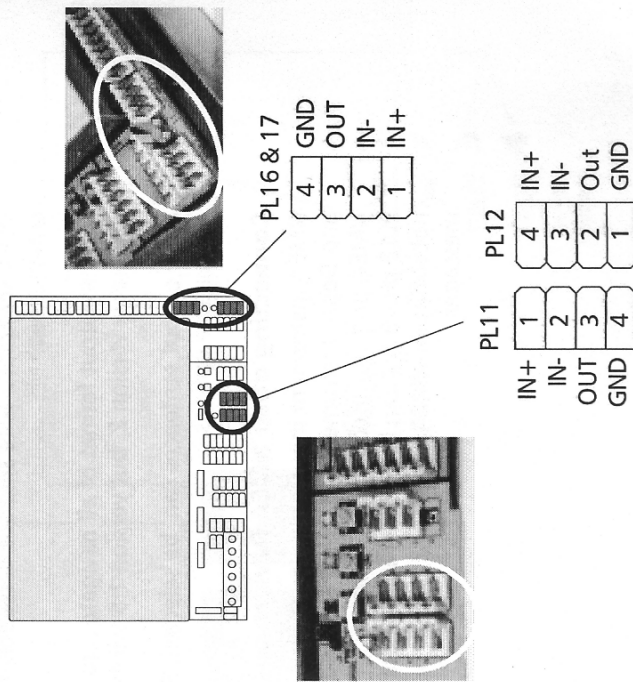
The 619 version has three NMEA ports, NMEA1 (PL11), NMEA2 (PL17) and NMEA3 (PL16).

An LED adjacent to each NMEA connector will flash about once a second as input data is detected. If it is on most of the time and flickering, the input signal polarity is probably wrong.

PL12 can be used as an input for Instrument data, but not for navigator data.

The 930619 combines NMEA information from the 3 NMEA inputs with NMEA Instrument data from PL12, into one message. This combined message is then output from NMEA3 (PL16) pins 3 and 4.

All NMEA sentences supported are listed on Page 50.



Connect any isolated cable screens to the fixing 'tongue' (as shown on page 13).

Connecting a Navigator or GPS

Connect the navigator or GPS antenna to pins 1 and 2 of NMEA1 (PL11). If there is a second navigator, connect it to NMEA2 (PL17), a third navigator would connect to NMEA3 (PL16).

There are three basic configurations of navigator output:

1. Serial data type 1 :
Signal +ve (0183) connect to pin 1 of NMEA1 (PL11).
Signal -ve (or Return) connect to Pin 2 of NMEA1.
2. Serial data type 2 :
Signal +ve (0183) connect to pin 1 of NMEA1 (PL11).
Ground connect to Pin 2 of NMEA1.
3. RS 422 based outputs :
Signal TX- connect to pin 1 of NMEA1 (PL11).
Signal TX+ connect to Pin 2 of NMEA1.
Use a separate 2 wire shielded cable for these two connections.

Set the output format of all navigators to NMEA 0183, preferably version 2, but version 1.5 will work.

If the output sentences can be selected, RMB, RMC or APB are suitable options.

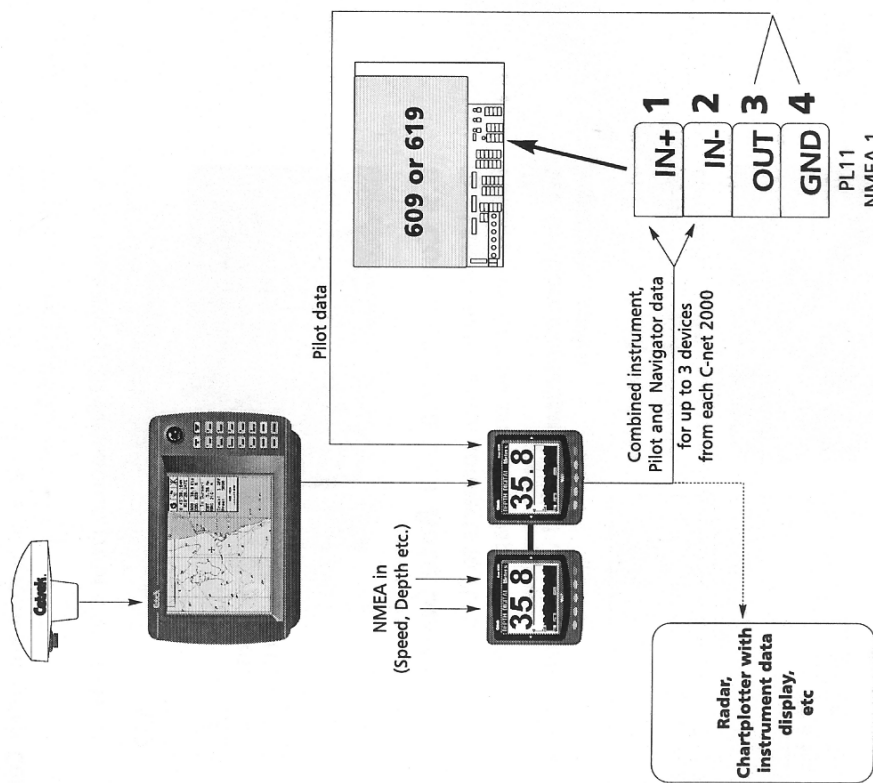
Connecting other NMEA Devices

NMEA instrument inputs, such as a Windvane or Speed and Depth Instruments, connect to pins 1 and 2 of any NMEA port not used by a navigator.
PL12 pins 3 & 4 can be used for instrument data if there are not sufficient NMEA ports. PL12 cannot read navigator messages.



8.3 Connecting systems with C-net 2000 Multi instruments.

This method is the most common used. It enables the maximum sharing of data, including Pilot data on the C-net 2000s.



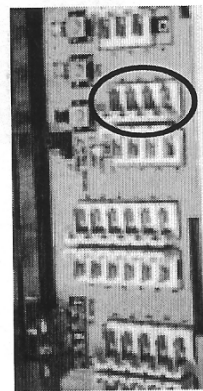
8.4 Connecting a Digital Compass

The Pilot Computer can accept heading data from an external compass connected to PL12 pins 3 & 4.

It will accept the following NMEA magnetic heading messages: HDM, HDG, VHW

The repetition rate of the sentence needs to be better than 5 per second. The port will accept Cetrek Heading Data from a 930687 Pick-Off Coil System and other Cetrek compass (see pages 19 and 42).

Do not use a 930581 Rate sensor with a compass connected to PL12.



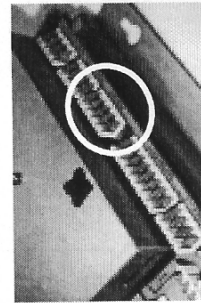
PL12	4
IN +	3
IN -	2
Out	1
GND	

8.5 Connecting a 581 Rate Sensor

The 930581 Rate Sensor connects to PL19. 930609 Pilot Computers need adaptor kit 930534.

See the documentation supplied with the equipment for installation advice.

The 581 will only work in conjunction with a 930580 compass.



PL19	5	Black
AGND	4	White
SIG	3	Red
+5V	2	
	1	

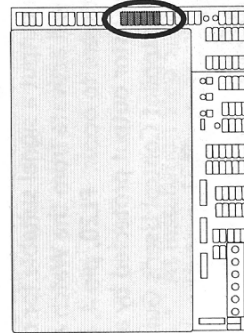
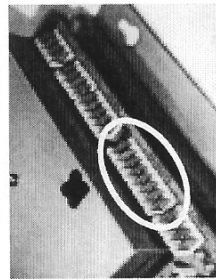
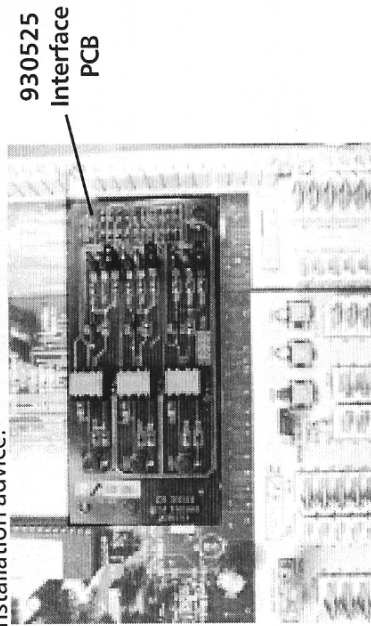
Connect the cable screen to the fixing 'tongue' (as shown on page 13).

8.6 Gyro Input

Gyro interfaces that output the 'HDT' NMEA message must be connected to PL16 or 17 of a 619, as explained in section 8.2.

Alternatively the 930619 Pilot Computer can accept gyro stepper signals (1:360, 180 or 90) on user port PL18, via a plug-in adaptor 930525.

See the documentation supplied with the adaptor for installation advice.



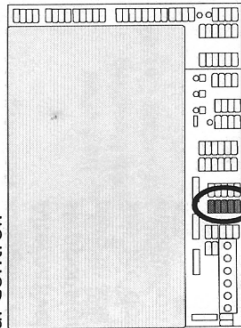
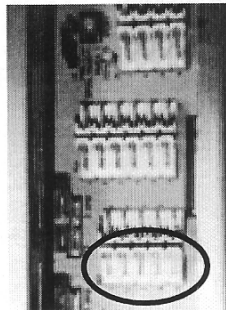
PL18	8	Common (+ve)
	7	Step 1
	6	Step 2
	5	Step 3
	4	
	3	
	2	
	1	

Connect the cable screen to the fixing 'tongue' (as shown on page 13).

To change direction, swop any two step lines.

8.7 Connecting a Proportional Steer

such as:
930729, Bulkhead Proportional Control.

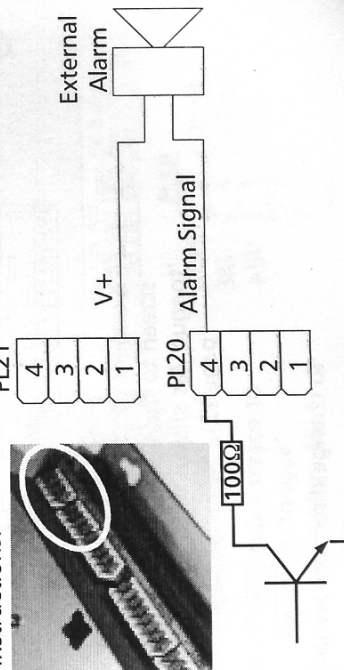


Black	1	AGND
Red	2	+5V LD
Blue	3	PSSEL
White	4	PSSIG
Yellow	5	PSLED

Connect the cable screen to the fixing 'tongue' (as shown on page 13).

8.8 Connecting an External Alarm

The 619 will output a signal suitable for driving an External Alarm. This will activate from the Watch Alarm, or if a serious fault were to occur. PL20, pin 4, is an open collector transistor output protected by a series resistor. Refer to the Autopilot Control User's Guide for setting instructions.



9. Updating Existing Systems

9.1 Replacing a 930670 and 930683

The 930609 version of the Pilot Computer and a 930580 Compass Sensor can replace both the 930683 Steering System Power Interface and the 930670 Compass Controller in an existing system.

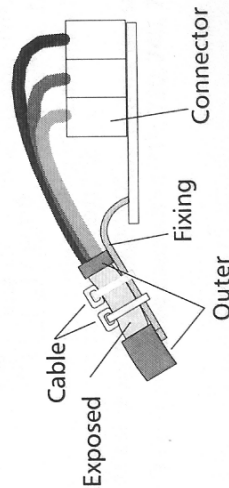
Follow the Installation Steps 2 to 8 starting at page 12 but note the following points:

- At Installation Step 3, connecting the Autopilot Control, the 700 or 770 cables that connected the Autopilot Control to the Compass Controller must have the moulded plugs at the Compass Controller end cut off. The cable ends should then be prepared for the 609, as shown below.

Treat a 770 as a 700. The cable can then be wired to PL10. Page 14 shows the usual colouring but a few units have the following colouring:

Blue	6	GND
White	5	TX data
Yellow	4	TX Latch
Red	3	LDSS+
Black	2	RX data
Green	1	TX clock

- At Installation Step 5, connecting the Rudder Feedback Unit, the plug that connected to the 683 must be cut off, the end prepared as shown below, and the cable wired to PL13 as shown on page 20. Jumper J1 should not need changing from the factory set position.



9.2 Replacing a 930618 Distribution Box

The 930619 version of the Pilot Computer can replace a 930618 Distribution Box in an existing system providing the Autopilot Control has a 6 core cable.

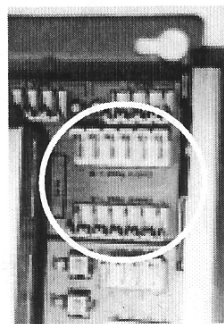
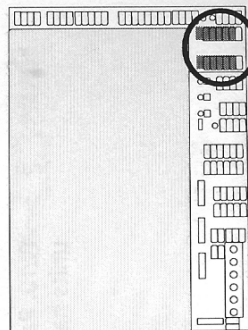
Follow Installation Step 2, on page 12, to mount the Pilot Computer. Connect the components as explained in the following pages.

9.3 Connecting existing Autopilot controls.

Installation Step 3 is the connection of the Autopilot Control.

727, 737, 747 or 757 Autopilot controls

727, 737, 747 and 757 Autopilot Controls are connected to PL14, or to PL15 if it is the second station, as shown below.

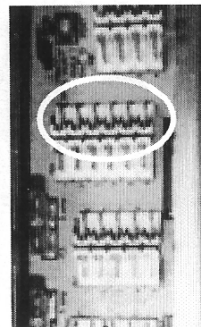
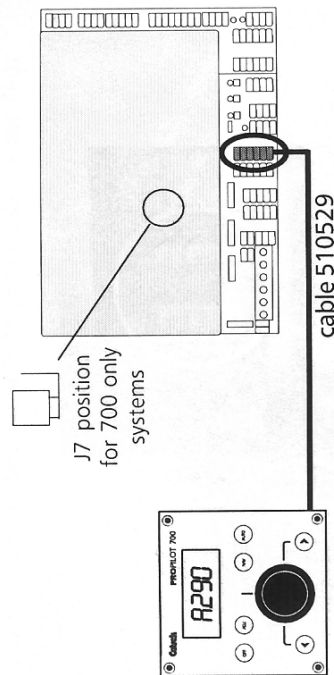


PL14					
Black	6	GND	Brown	1	ON
White	5	TX data	Violet	2	OFF
Blue	4	RX data	Red	3	LDSS+
Red	3	LDSS+	Blue	4	RX data
Violet	2	OFF	White	5	TX data
Brown	1	ON	Black	6	GND

Shorten cables as required and connect the screen to the fixing 'tongue' (as shown on page 13).

700 or 770 autopilot controls

Existing 700 and 770 Autopilot Controls connected to the 930618 Distribution Box, do not use the 930276 interface cable, prepare the cable as shown below.



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

Connect the cable screen to the fixing 'tongue' (as shown on page 13).

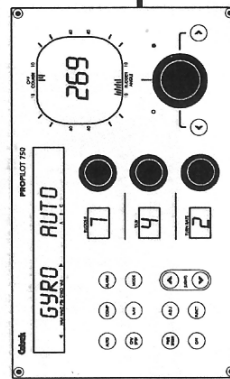
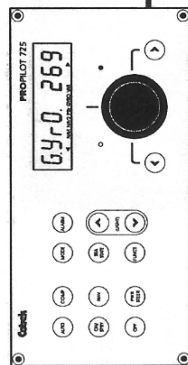
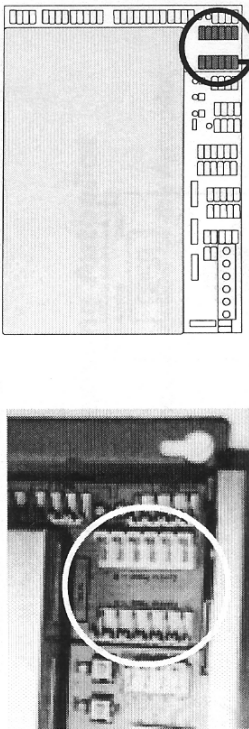


The 700 and 770 do not have an On/Off switch, therefore:

- systems with only 700/770s, move J7 to the 'Auto Power On' position.
- If the 700/770 is used as a second station with an Autopilot Control that has an on/off switch, J7 must not be moved, the other Autopilot Control's must be used to turn the autopilot on or off.
- Two 700/770s can be wired in parallel (into the same plug).
- A 700/770 cannot be used with a 715, 730, 740, 731 or 741.

725 or 750 Autopilot Control

Connect the Autopilot Control to PL14, use PL15 if it is a second station.



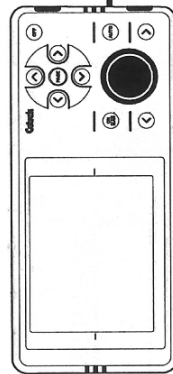
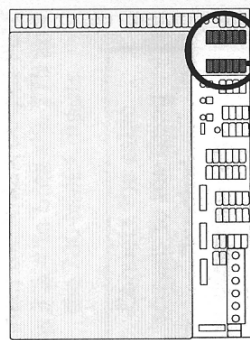
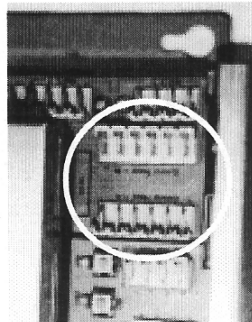
PL14						PL15					
Black	6	GND	Brown	1	ON	Black	6	GND	Brown	1	ON
Orange	5	TX data	Violet	2	OFF	Orange	5	TX data	Violet	2	OFF
Yellow	4	RX data	Red	3	LDSS+	Yellow	4	RX data	Red	3	LDSS+
Red	3	LDSS+	Yellow	4	RX data	Red	3	LDSS+	Yellow	4	RX data
Violet	2	OFF	Orange	5	TX data	Violet	2	OFF	Orange	5	TX data
Brown	1	ON	Black	6	GND	Brown	1	ON	Black	6	GND

Connect the cable screen to the fixing 'tongue' (as shown on page 13).

780 autopilot controls

Connect to PL14, use PL15 if it is a second Autopilot Control.

To display instrument data (such as Speed or Depth) on your 780, you will need an NMEA connection. This may be from the instruments direct, or preferably via the Pilot Computer.

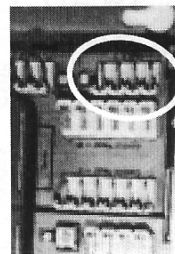
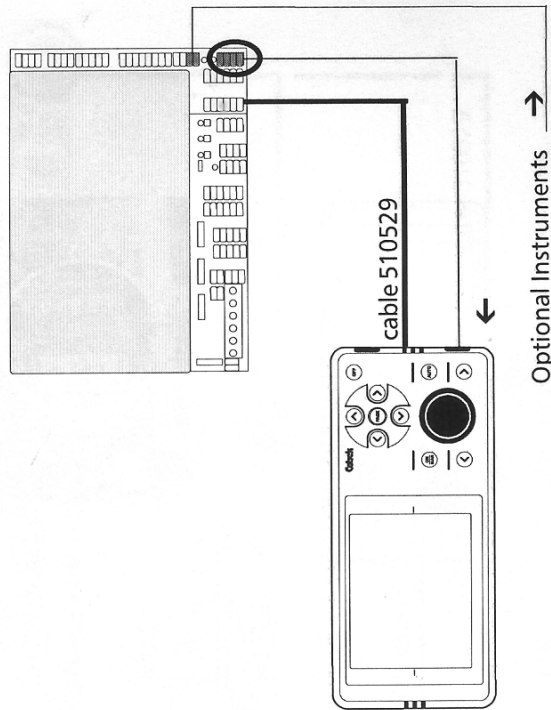


PL14						PL15					
Black	6	GND	Brown	1	ON	Black	6	GND	Brown	1	ON
Orange	5	TX data	Violet	2	OFF	Orange	5	TX data	Violet	2	OFF
Yellow	4	RX data	Red	3	LDSS+	Yellow	4	RX data	Red	3	LDSS+
Red	3	LDSS+	Yellow	4	RX data	Red	3	LDSS+	Yellow	4	RX data
Violet	2	OFF	Orange	5	TX data	Violet	2	OFF	Orange	5	TX data
Brown	1	ON	Black	6	GND	Brown	1	ON	Black	6	GND

Connect the cable screen to the fixing 'tongue' (as shown on page 13).

The Pilot Computer combines the NMEA information from its 3 NMEA Inputs and PL12's input. It combines this into one NMEA message which it outputs from NMEA3 (PL16).

To feed this output to the 780, connect pins 3 and 4 of PL16 to the NMEA Input of the 780.



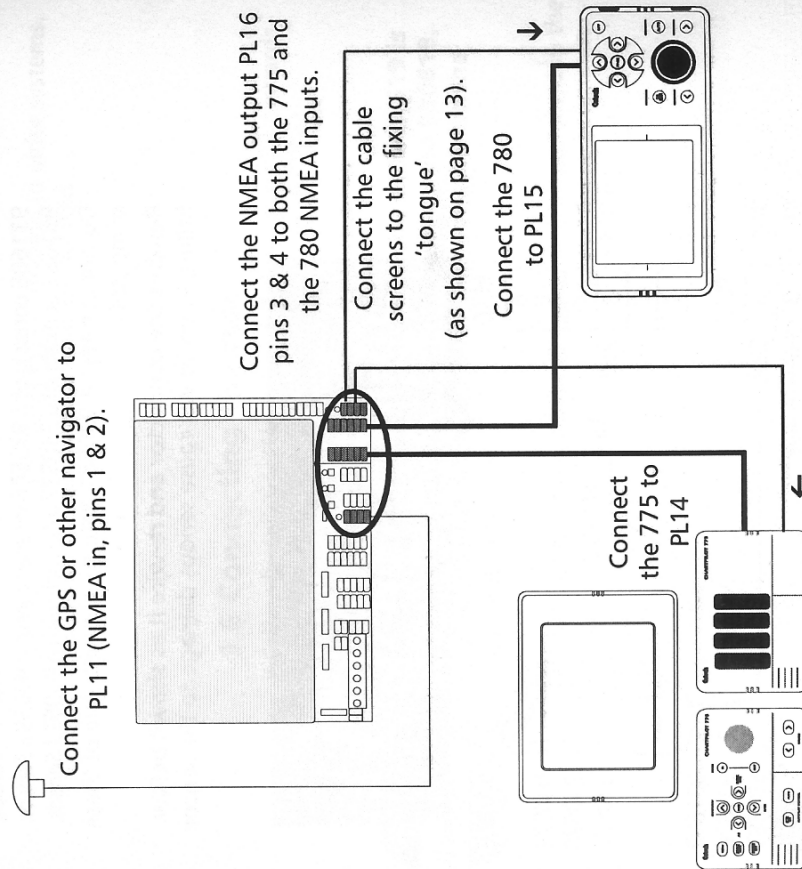
PL16	
4	GND (-)
3	OUT (+)
2	
1	

Connect the cable screens to the fixing 'tongue' (as shown on page 13).

775 with a 780 autopilot control

Existing 775 and 780 Autopilot Controls are connected as shown.

See the 930775 and 930780 User's Guide for installation advice. This is the preferred connection method.



Connect the NMEA cable screen to the fixing 'tongue' (as shown on page 13).

The 775 cable screen MUST be isolated from the fixing 'tongue'. The screen is connected to pin 6.

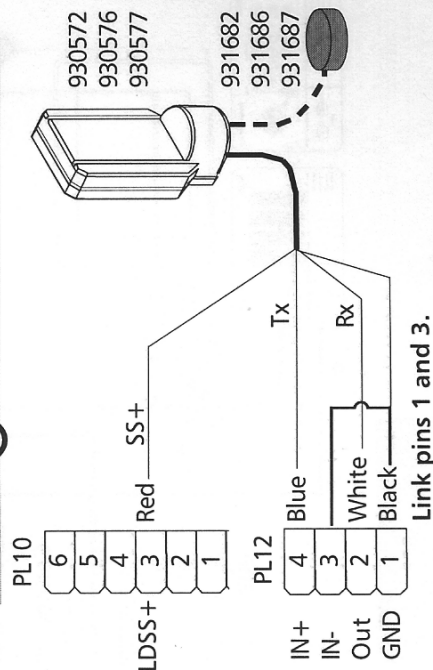
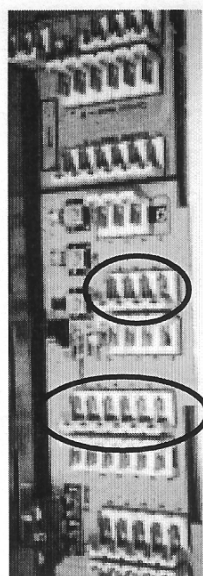
9.4 Connecting an existing Compass

572, 576, 577, 682, 686 or 687

Installation step 4, connecting the compass.

931682 consists of a 930582 Interface with a 930593 Sensor,
931686 consists of a 930586 Interface with a 930593 Sensor.
931687 consists of a 930587 Interface with a 930593 Sensor.
Do not connect a 930581 Rate sensor with one of these
compasses

Remove the connector and re-wire it as shown below.
Failure to do so will cause serious damage to the sensor.



Connect the cable screen to the fixing
'tongue' (as shown on page 13).



9.6 Connecting the rest

Follow Installation Steps 6 and 7, from page 23 onwards,
to connect the Drive Unit and Power to the Pilot
Computer.

**When connecting Spool Valves, the 930609/619 is
common negative and is different to the 930618,
which is common positive. See page 24 for the
correct setup.**

Finally connect any optional equipment as explained in the
following pages.

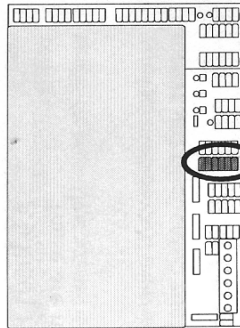
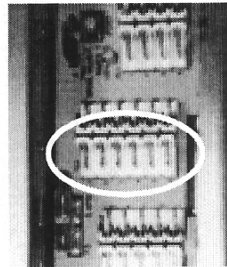
9.5 Connecting the existing RFU

Installation Step 5, connecting the Rudder Feedback Unit
(RFU). If an 807 or 801 RFU is to be used, J1 will have to be
moved to the un-amplified position. Follow the
instructions on page 22.

A 930801 has extra wires for connecting to older systems.
These are not used and should be isolated.

9.7 Connecting a Jog Steer

930705 Jog steer
930706, ProJOG Control.
930797, Portable Dodge & Course Control.



705	797	706	PL9
link to Green	Black	Black	1 GND
	N/C	N/C	2 +5V
	Yellow	Green	3 REMSW
	Green	White	4 REMP
	White	Blue	5 REMS
	Black	N/C	6 REMLED
	N/C		
	Red		

Connect the cable screen to the fixing 'tongue' (as shown on page 13).



Do not fit more than one 705, 706 or 797 to the same Pilot Computer.

9.8 Connecting a Proportional Steer

such as:
930717, Portable Proportional Control.
930787, Flush mount Proportional Control.
930788, ProSTEER Bulkhead Control.
connect to PL7.

PL7	Black	1	AGND
	Red	2	+5V LD
	Blue	3	PSSEL
	White	4	PSSIG
	Yellow	5	PSLED

9.9 Connecting a 523 Gyro Synchro / Stepper Interface

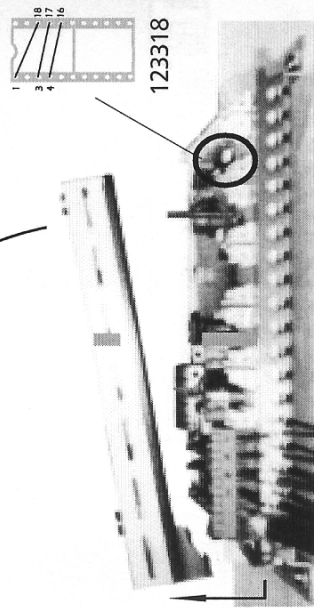
The 930523 Gyro Synchro / Stepper Interface connects to PL18 and PL21 of a 930619. Interface 123318 is required, fitted into SK3 located under the Component Cover.

To fit the interface:

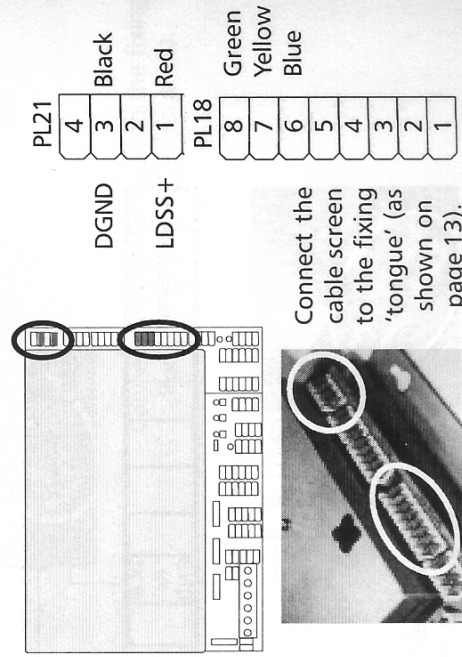
Ensure that the Power to the Pilot Computer is disconnected.

Remove the thumb nut then lift the Component Cover up and left.

Insert the Interface Plug into SK3 on the 930619 PCB observing polarity



Refit the Component Cover on completion



9.10 Connecting a C-power Compass Gauge

such as:

930460, C-power Digital Compass.

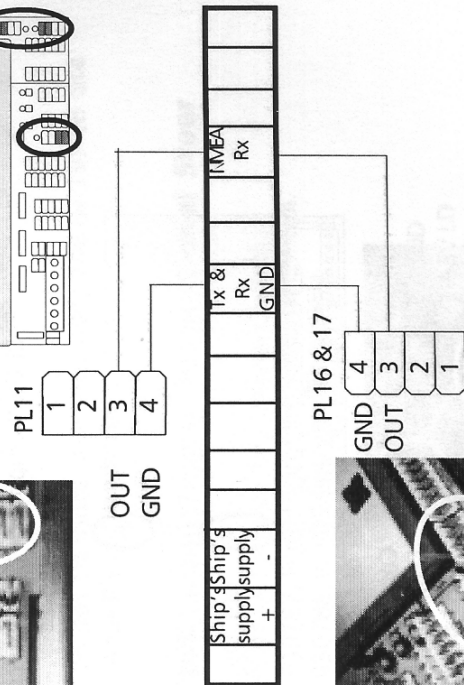
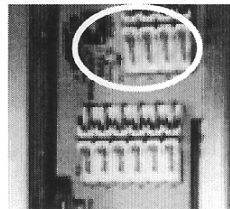
930462, C-power Analogue Compass.

See the documentation supplied with the equipment for installation advice.

To receive compass heading data from the Pilot Computer connect the C-power Compass to either PL11, PL17 or PL16.

Connect pin 3 OUT to NMEA Rx

Connect pin 4 GND to Tx & Rx GND



Connect the cable screens to the fixing 'tongue' (as shown on page 13).

9.11 Connecting a C-net COMPASS 930383

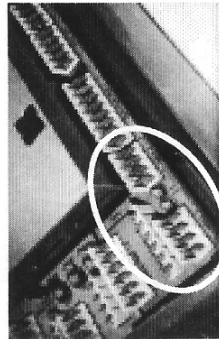
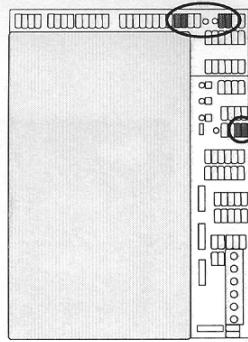
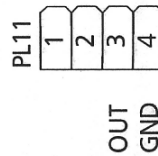
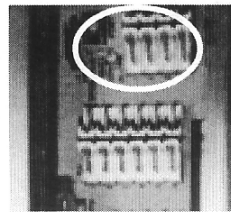
See the documentation supplied with the equipment for installation advice.

To receive compass heading data from the Pilot Computer connect the C-net COMPASS to either PL11, PL17 or PL16, but please note, only PL16 outputs the full navigator messages.

Connect pin 3 OUT to NMEA Rx +

Connect pin 4 GND to NMEA Rx -

Set the Product Type on the C-net COMPASS to 4.



Connect the cable screens to the fixing 'tonque' (as shown on page 13).

9.12 Connecting a 930319 Rudder Angle Gauge.

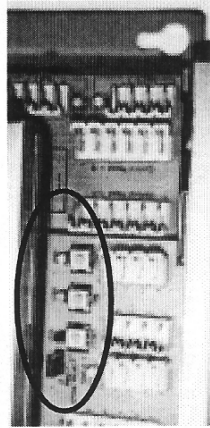
The 930319 Rudder Angle Gauge is an NMEA device. Connect it to PL16 (NMEA2) pins 1 & 2.



10. 'On', 'Port' & 'Stbd' Switches

Once the basic installation is complete, the 3 switches above PL12 and PL13 can be used to power the drive unit and to aid bleeding a hydraulic system.

Be sure that the rudder can move from hard-over to hard-over without damage. Rudder limits and phasing are ignored so use the switches with EXTREME CAUTION.



An Autopilot Control does not need to be present.

Applying power for the first time.

Switch on both light and heavy duty supplies to the Pilot Computer. **If the rudder starts to move, switch off at the breakers immediately.** Re-check the wiring.

Once power is applied, the middle switch turns the Pilot Computer ON. Before turning it on, ensure that the rudder is midships.

It will NOT turn the unit Off, the power must be isolated to do that.

Powering up with the On and Port button held down for at least five seconds, overrides the rudder settings and alarms. This allows the motor to be run before doing the Dockside settings rudder setup.

The other two switches activate the motor output to drive the rudder to port or starboard.



11. Specifications

Supply Voltage: nominal 12/24V DC
maximum 32V DC
minimum 10.5V DC

NMEA Voltage: Output 0 to +5V DC
Input -15V to +15V DC

Maximum continuous drive current: 26 Amp Limit

Storage Temperature: -20 to +75°C

Operating Temperature: 0 to 55°C

Weight: 1.5 Kg

Compass Safe Distance: Grade 1 (1/4°) 1350 mm (53")
Grade 1 (1°) 800 mm (32")

Fuses - Automotive Type Blade Fuses

- FS1 30 Amp Heavy Duty Ships Supply Input
- FS2 5 Amp Light Duty Ships Input
- FS3 5 Amp Dual Rate Output
- FS4 5 Amp Clutch

11.1 NMEA 0183 Input Messages

NMEA 1, 2 & 3 Input Messages that can be read:

Autopilot & Navigation: APA, APB, BOD, BWC, BWR, RMA, RMB, RMC, XTE, VHW, VLR.

(HDT = NMEA2 & 3 only)

Navigation: GGA, GLL, VTG, ZDA.

Instrumentation: DBT, DPT, MTW, MWV, VHW, VLW, WDC.

PL12 Input Instrument Messages that can be read:

Instrumentation: HDM, HDG, VHW, DBT, DPT, MTW, MWV, VTG, RMA, RMC, VWR, WDC.

11.2 NMEA 0183 Output Messages

NMEA 1(PL11) Output Messages: 100ms repetition rate.

HDM, RSA, VHW (also Cetrek proprietary message \$PCETP).

NMEA 2 (PL17) Output Messages: 100ms repetition rate.

HDM, RSA, VHW.

NMEA3 (PL16) Output Messages:

HDM, RSA, VHW,
plus (if the information is available)
APA, APB, BOD, BWC, BWR, HDG, HDT, RMA, RMB, RMC, XTE, GGA, GLL, VTG, ZDA, DBT, DPT, MTW, MWV.

11.3 Default Settings

Default settings (no Pilot uses all settings)

Compass Damping 0 (Auto Compass Damping)
Dodge limit 10
Motor Speed Control 100
Nav Gain 5
Power Steer Gain 5
PWM ON
Response A (Adaptive) *
RFU signal AMPLIFIED
Rudder Deadband 3
Rudder Limit 7 *
Motor Ramp 2
Transition Speed 0 (Off)
Trim 4 *
Turn Rate 20 *
Waypoint Sequence AUTO
Wind Gain 1
Boat Type (Hull Type) PLANING
Pilot A
Rudder Ratio 4 *
Counter Rudder 1 *

619 Pilot Computers have two additional Pilot sets, B and C. The setting marked * above can be different in each set.

These are the default values that change when other boat types are selected:

Pilot A

Displacement
Rudder Ratio 10
Counter Rudder 4

Semi-displacement

Rudder Ratio 7
Counter Rudder 3

Sailboat

Rudder Ratio 10
Counter Rudder 4

12. Jumpers and Links

Summary

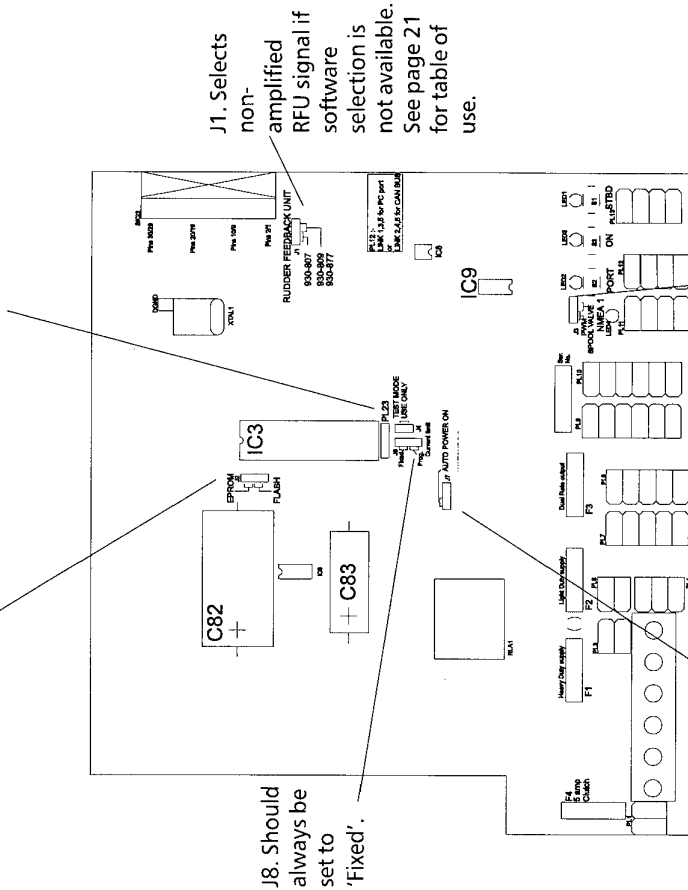


Disconnect the Power, before removing the Component Cover to adjust the Jumpers and Links.

J2 should always be set to 'Eprom'.



J4. Test Mode for factory use only. Fitting this link will seriously damage your drive system.



J7. Move to 'Auto power on' for systems with only 770 or 700 Control Heads.

J3. PWM or Spool valve. Only move to 'Spool Valve' if driving solenoid operated spool valves. Automatically turns the PWM off.

J8. Should always be set to 'Fixed'.

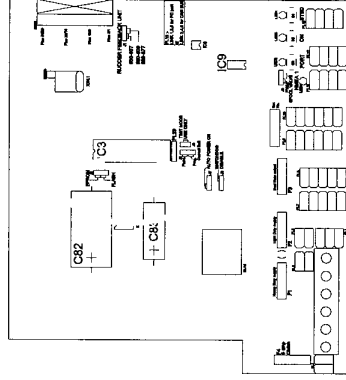
J1. Selects non-amplified RFU signal if software selection is not available. See page 21 for table of use.

13. Changing Eproms

The software is stored in the EPROM IC3.

EPROMS are Static Sensitive Devices. Take suitable precautions when handling them. Fitting the EPROM reversed will cause permanent damage to the new EPROM.

- Disconnect the Power.
- Release the quarter turn fasteners and remove the cover.
- Release the retaining screw, then remove the Component Cover.



- IC3 is located in the centre of the PCB. Carefully prise the EPROM from its socket with a small screwdriver. Be sure that you do not damage any tracks under the chip.
- Align the indent on the new EPROM with the indent marked on the PCB. Check that all pins are over the individual IC sockets, then push down firmly in the centre of the EPROM. Ensure no pins are bent or have failed to enter the socket.

the PCB. Check that all pins are over the individual IC sockets, then push down firmly in the centre of the EPROM. Ensure no pins are bent or have failed to enter the socket.

- Re-assemble the covers.
- Restore the Power supplies
- Turn the autopilot on. If system fault 'SFLT 002' is displayed, switch the Autopilot Control off and on again, this should clear the condition (this must be done at the Autopilot Control, not the circuit breaker).
- If the system will not stay powered up when the Standby key is pressed, it is almost certain that the EPROM has not been fitted correctly. Check and retest.
- If the display remains blank but the system has power, then check the EPROM is correctly fitted.

14. 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 Mode (Manual Control). 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.

NAVIGATOR ALARM

This will be shown if any of the following occur:

- The autopilot has received no Navigator Data
- The autopilot has received an error code from the Navigator
- 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 the same as the autopilot is set to receive (see Users Guide).
- That NAV is selected correctly.
- On the PCB inside the Pilot Computer there are LED's beside each NAV port (PL11, 16 & 17). 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.

WIND ALARM

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

- Check the Data output from the Wind instrument.

15. System Faults

The System faults are identified by numbers as indicated below. For safety reasons, some faults will result in the autopilot automatically switching to Standby (manual) mode.

NOVRAM CHECKSUM ERROR

- This fault may indicate that the Autopilot's stored parameters are no longer valid, these should be checked before further use.

COMPASS SIGNAL ERROR

- Sine or Cosine voltage levels are too high. Resite the compass.

COMPASS SIGNAL ERROR

- Sine or Cosine voltage levels are too low. Resite the compass.

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.

PORT MESSAGE OVERRUN ERROR

- The messages received by the Pilot Computer 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 loose 619 interface PCB (100285).

PORT READ CHECKSUM ERROR

- The messages received by the Pilot Computer 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.

PL14 TIMEOUT

- The alarm will occur if the Autopilot Control connected to PL14 in the Pilot Computer is incorrectly selected or if a control unit fails to respond. Check the wiring to the plug.

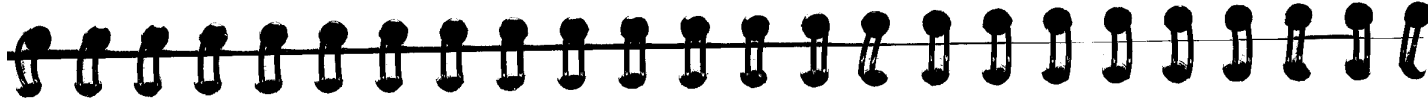
PL15 TIMEOUT

- The alarm will occur if the Autopilot Control connected to PL15 in the Pilot Computer is incorrectly selected or if a control unit fails to respond. Check the wiring to the plug.



Some warning messages are accompanied by audible (if the unit has one), visual alarms, and the autopilot will have switched 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.
- 131** 700 CONTROL HEAD ALARM.
- Indicates that data from the 700 Autopilot Control is not present. Check the cable and connections.
- 134** PL10 CONTROL HEAD ALARM.
- Indicates that data from the Autopilot 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. Check the wiring. If a 580 Compass Sensor is connected, check PL8, pins 2, 3 and 4. Their voltage should be $2.5V \pm 1.5V$, if they are not, the 580 Compass is faulty. This fault can be caused by a strong magnetic field close to the compass sensor.
- 167** EXTERNAL DIGITAL COMPASS ALARM
- The repetition rate of the NMEA input to the 619 from the compass is too slow ($> 200ms$).
- 176** RATE GYRO 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'.



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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 software setting in the Control Head) is set incorrectly. Check that the Rudder Feedback Unit has been correctly installed.

200

MOTOR PHASING CHECK

- This indicates that the rudder setting data is wrong. Repeat the rudder setting routine detailed in the control head User's Guide.

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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.

16. Troubleshooting Guide

After installing the system according to this manual it should work faultlessly. In the unlikely event of a fault occurring, here are some notes that might get you out of trouble.

General Principles & Cautions

1. Ensure all supplies are turned off before connecting or disconnecting wiring. Certain components will be seriously damaged if inadvertently shorted out. Damage caused in this manner is not covered by warranty.
2. When first installing or when changing the wiring always double check the colour coding before switching on the power.
3. Check all wiring is correctly connected.
4. Do not use a simple voltmeter to attempt to check powered up digital logic lines or signal lines.
5. Ensure that all cable screens are properly earthed.
6. Check the fuses and replace blown ones with direct equivalents. Most units have one internal fuse, the Pilot Computer has 4.
7. Take suitable precautions when handling PCB's with Static Sensitive Devices.
8. Read the 'Wiring hints and tips' advice on page 10.

Symptom

1. The system will not power up.

Possible cause and remedy.

Check the breaker and both heavy and light duty power supplies to the Pilot Computer.
In the Pilot Computer:
Check Fuses F1 and F2. Check the supplies from the Pilot Computer to the Control head.
For control heads connected to PL14 or PL15, check that pin 1, (normally 4 to 5V) changes to 0V when you try to turn the autopilot on, if not, then suspect a fault in the Pilot Computer.
Check that pin 2 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 Pilot Computer PCB is likely.

If new software has just been fitted, check the IC legs. Damaged legs will probably mean a damaged eprom.

The heavy duty supply and motor output cables are swapped over. Switch off immediately.

2. The motor drives hard over when power is applied at the breaker, without switching the pilot on.

The Fail Safe Watchdog is causing system power down. A fault has been detected on the Pilot Computer PCB. Remove the top cover and component cover from the Pilot Computer. Visually check that the socketed IC3 Eprom is installed securely. Check for any loose material that may cause shorts.

3. The display works momentarily then blanks and the system powers down.

See 1 and 2 above.

4. System powers down for no apparent reason and cannot be restarted

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 standing wave ratio (SWR) can cause dangerous conditions and in the interest of operator safety the radio installation should be inspected immediately.

5. System powers down when radio Transmitter or other RF device is keyed; or when a device needing current is operated (electric windlass, etc.)

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 that where possible the autopilot is supplied with power from a different battery to the other auxiliary requirements.

6. 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.

7. The autopilot powers up but displays a System Fault which cannot be reset.

Normally this can be traced to a wiring error. System fault messages are explained and action to be taken is given, in "System Messages" on page 52.

8. Autopilot displays 'AUTO' but motor does not drive

Check the heavy duty supply to the Pilot Computer.
In the Pilot Computer:
Check fuse F1.

If you suspect a faulty motor, test it by powering the motor directly from a suitable battery.

9. Motor drives one way only

Centre the helm and retry to ensure you are inside the electronic limits.
Check that J1 is securely fitted.
Check the RFU cable and its connections.
Check the RFU or its linkage has not come loose.
Otherwise suspect a drive FET or logic failure on the Pilot Computer PCB.
Low battery voltage.

10. Motor drives both ways but lacks power.

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.

11. Motor drives hard over when autopilot is engaged

Indicates a rudder phasing or motor phasing error.
Check that J1 is set correct and not loose.
Check that the Rudder Feedback Unit arm has not become disconnected.
Carry out the rudder setting procedure again.

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 all of the units in your system:

- Model Numbers:
- Serial Numbers:
- Software Version Numbers:
- A description of the failure.

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