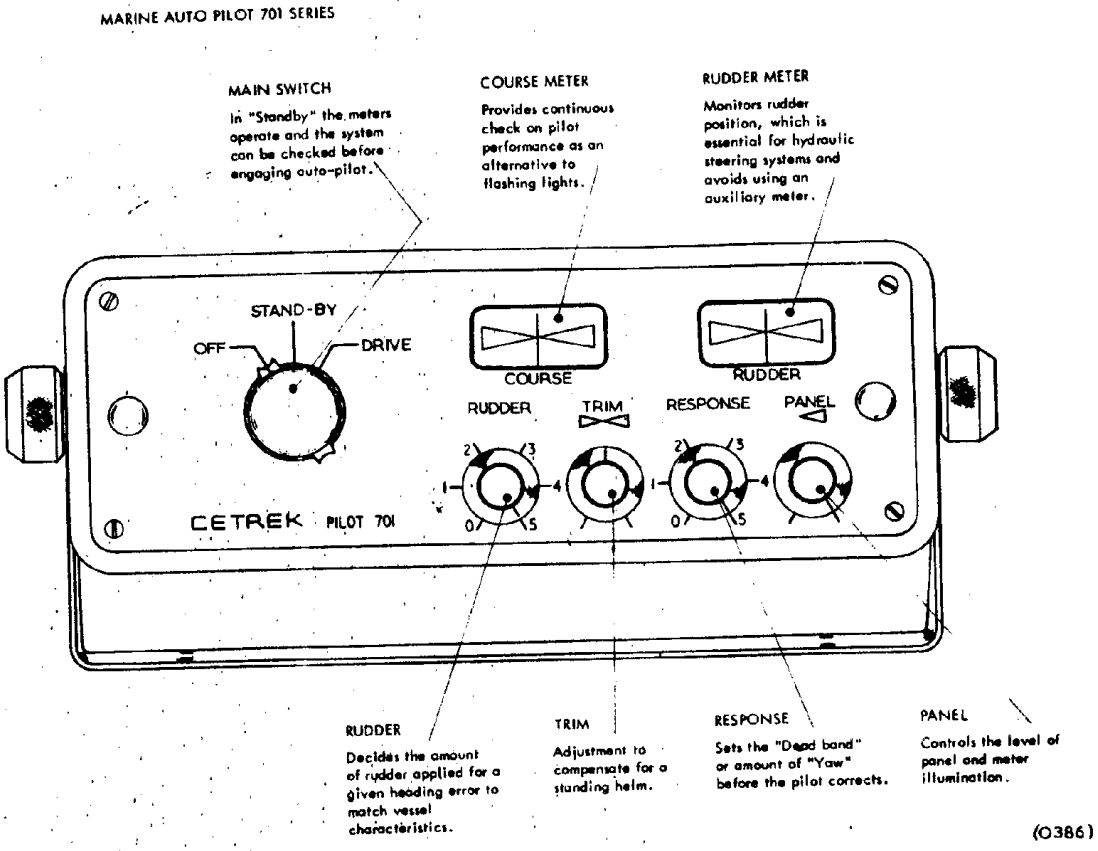
It is important before taking the vessel out on sea trials that the installation has been thoroughly checked out and correctly aligned.
The helmsman should be completely conversant with the operating procedures before any trials are attempted.

OPERATING PROCEDURE - 701 SERIES



Operating Sequence with Course Selectors 502 Mk II, 503, 506,

(a) Check that external power switches are ON.

(b) If fitted, check that the remote controls 702 & 707 are switched to DRIVE, and in the case of the 702, that the course trim is vertical.

(c) If fitted, check the remote power steer units 703 and 704 are switched to AUTO.

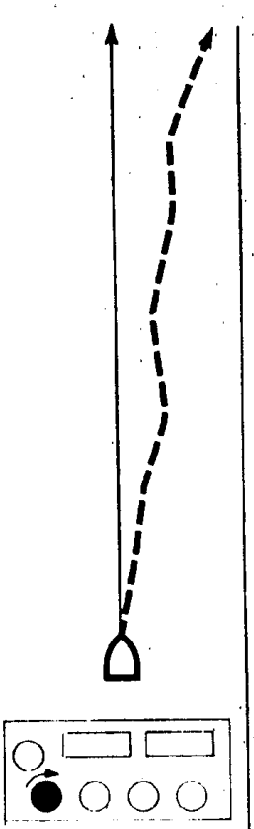
(d) Set the heading required on the course selector.

(e) Switch control unit 701 to STANDBY and with TRIM in the mid position steer the boat manually until the course meter is steady at approximately mid position.

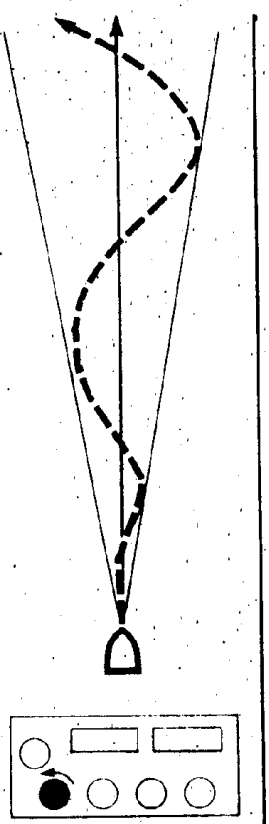
(f) Switch to DRIVE and the autopilot will take control.

(g) If a subsequent change of course is required this can be done by slowly moving the course selector scale to the new heading.

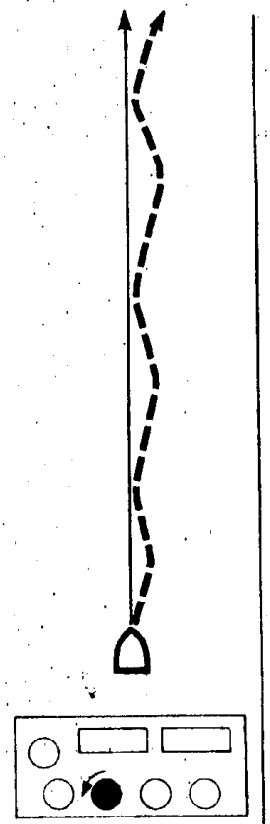
PERFORMANCE ADJUSTMENTS AT SEA



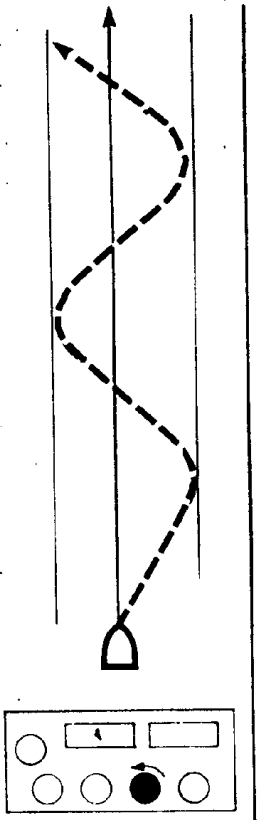
Boat understeers i.e. repeatedly drifts off-course to one side and is only loosely controlled by the pilot.
REMEDY Turn rudder control clockwise, to increase amount of rudder applied by pilot.



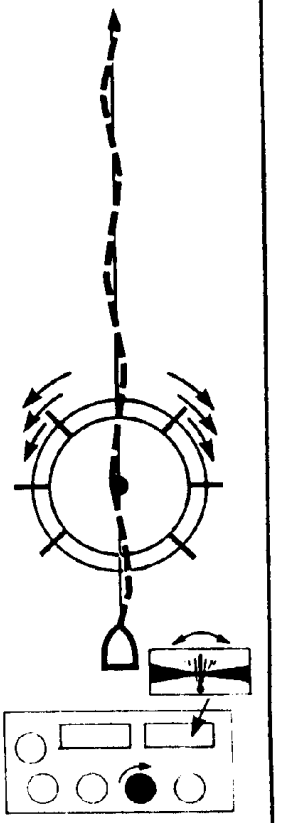
Boat oversteers, i.e. builds up oscillations from side to side of the required course.
REMEDY Turn rudder control anti-clockwise to reduce amount of rudder applied by pilot.



Boat repeatedly pulls to one side and the autopilot has to keep correcting.
REMEDY Adjust the trim control to apply a standing helm.



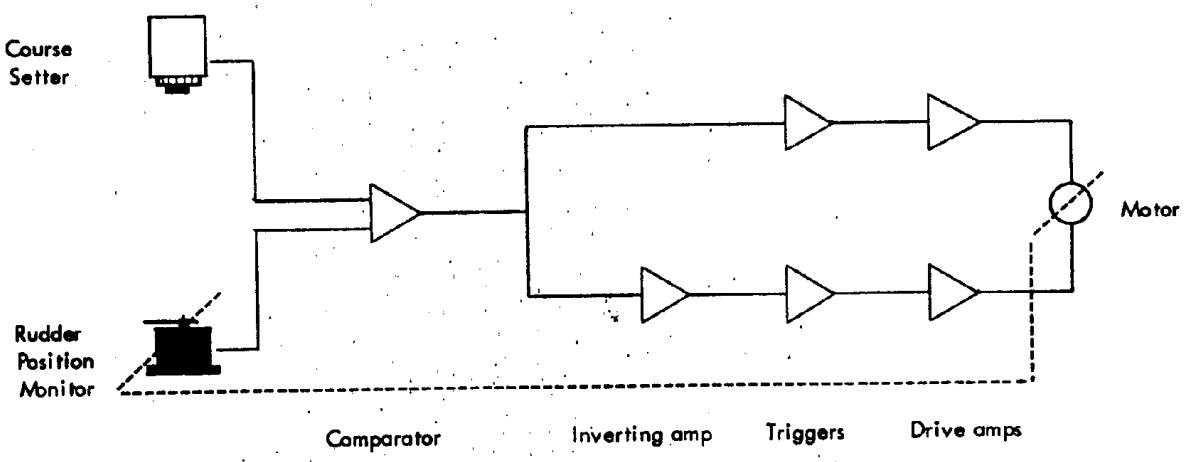
Boat yaws in a wide deadband.
REMEDY Turn response control anti-clockwise.
N.B. Proper setting of this control has a marked effect on steering system wear and tear and in sailing craft also upon battery life.
Aim to set this control so that the autopilot-controlled helm movements are of roughly the same frequency and magnitude as those performed by hand when steering manually.



Boat holds course well, but helm is switching rapidly backwards and forwards (rudder meter will indicate this on hydraulic systems).
REMEDY Turn response control clockwise.
This is the pilot's "weather" control. You will need to open the "deadband" (i.e. turn control clockwise) in heavy seas, and close it (i.e. turn control anticlockwise) in calm seas.

BASIC AUTOPILOT SYSTEM OUTLINE

The 701 autopilot is a closed loop DC servo system, of which the principal active components are represented in the diagram below.



The primary heading information is derived from a magnetic compass unit (the Course Setter) and is compared with the moment-to-moment position of the boat's rudder. With the boat on course and the rudder midships the two signals are equal; There is thus a balanced condition at the comparator and no activity in the following circuitry.

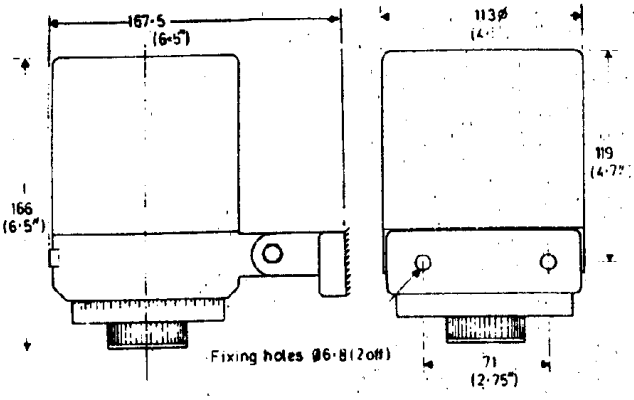
Let us suppose now that the boat goes off course. The signal from the course setter will change proportionally (it is a linear function of the degree of course error) and there will be an imbalance at the comparator, whose output will move up or down accordingly (dependent upon whether the course error is to left or right of the desired heading). The signal is now split into two chains and inverted in one of them, so that as one chain tends to go high the other goes low by an equal amount and vice versa. Each chain then contains a switch similar to a Schmitt trigger; A rising signal has no effect on these, but a falling one causes switching to take place and to turn on the following drive amp, the effect of which is to apply power in one direction or the other to a drive motor attached to the steering system and thus to turn the rudder.

The rudder continues to move until the signal from the rudder position monitor (rudder reference unit) balances the error signal from the course setter, at which point the drive switches off. The boat will now be begining to turn back on to course, and as it does so the signal from the course setter moves back towards its original mid-rail position, once again causing an imbalance at the comparator. The drive process now operates in the reverse direction so as to take-off rudder, until the boat is once more on course with the rudder midships.

In the interests of efficiency and safety a number of refinements have been incorporated into the basic system, and these are summarised briefly below.

1. Rudder Ratio Control The amount of rudder needed to bring any given boat through a change in heading is a function of many factors, some of which (e.g. the vessel's speed) may change from time to time. For this reason the ratio of rudder-angle-applied to course error angle is made adjustable on the front panel.
2. Response The angle through which the boat turns before the pilot applies correction is also made adjustable. This is the sea-state or 'yaw' control, and is the single most useful adjustment in the system.
3. Phase advance An R/C impedance is introduced into the compass signal line. When a heavy sea or skittish hull design causes the boat to go off course more quickly than normal, the fast rising edge of the compass signal sees a reduced impedance and rudder is thus applied more heavily than usual. This simple device has enabled the Cetrek pilot to control perfectly boats that were previously considered uncontrollable.
4. Limit Switches In circumstances where a boat is a long way off its desired heading the pilot will want to apply maximum rudder. Without some means of limiting rudder excursion however the pilot's drive motor could well drive the tiller arm into its end stops with the very real possibility of damage as a result. The rudder reference unit therefore incorporates a pair of limit switches which are adjusted at the factory to limit rudder travel under power to about 30 degrees either side of midships. This adjustment may be varied by the installation engineer if necessary, and does not of course interfere in any way with the amount of rudder movement available under manual steering.
5. Trim Control Under some conditions of sea and weather a boat will tend repeatedly to go off course in the same direction. A helmsman will counteract this by applying standing rudder, (i.e. by moving his 'neutral' position several degrees towards the weather), and a front panel control is provided to enable the pilot to do exactly the same thing.
6. The final drive motor may be a mechanical motor/gearbox assembly, a reversing motor/hydraulic pump assembly, a continuously running hydraulic pump with pilot-operated spool valves, or an engine-driven pump with spool valves. The final drive amps are contained in a Distribution Box and a variety of output modules is available to cater for these widely different loads.
7. Logic Interlocks The Distribution Box also incorporates logic circuits to prevent any possibility of the pilot drive motor being told to go in both directions at once!
8. Optional Extras Various optional accessories may be added to the basic system.

9. Course Setters A feature of the Cetrek pilot is the range of Course Setters available. There are three kinds of manual course setter (where the chosen course is dialled by hand) and an autofollowing model (which continuously aligns itself to the boat's heading in standby mode, and then holds that heading when switched to 'drive'). There is in addition an interface available with the new Cetrek solid state repeater compass sensor, enabling one sensor unit to both steer the boat and simultaneously to provide heading information to repeater compass heads mounted anywhere in the boat.



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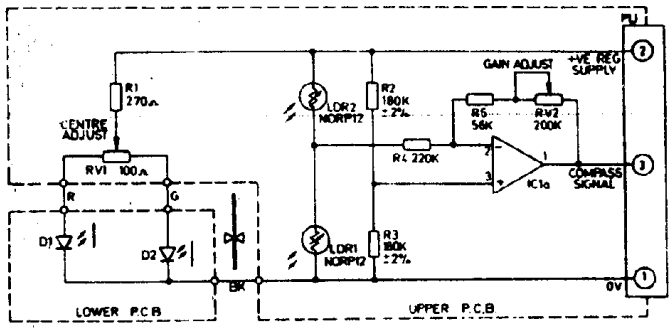


Supply Voltage: 10.5v stabilised. Weight: 1.3Kg: Cable Supplied: 4m 3way x 16/0.2;
Compass Safe Distance: Grade1 ($\frac{1}{4}^0$) 600mm (24ins); Grade 2 (1^0) 350mm (14ins);
Environmental Classification: Not splashproof and should be protected from direct spray.

DESCRIPTION

The 502 Mk11 Course Setter incorporates a precision magnetic compass which is gimballed internally to 25^0, and is fully externally gimballed. The compass card pivots upon a jewelled bearing and floats in an oil bath. The card itself is manufactured from transparent polaroid material and two LEDs are mounted below the card in such a way that their light shines through two small pieces of fixed polaroid material, and then through the compass card on to two light dependant resistors mounted on the top face of the compass. As the compass card rotates, or more correctly as the compass body rotates about the card, so the light reaching one LDR increases and the light reaching the other is attenuated. The two LDRs form a potential divider whose output is amplified and fed to the control unit of the pilot system. Two pre-set potentiometers control the light balance of the LEDs and the gain of the output amplifier; These are accurately set at the factory and should need no further adjustment.

INSTALLATION

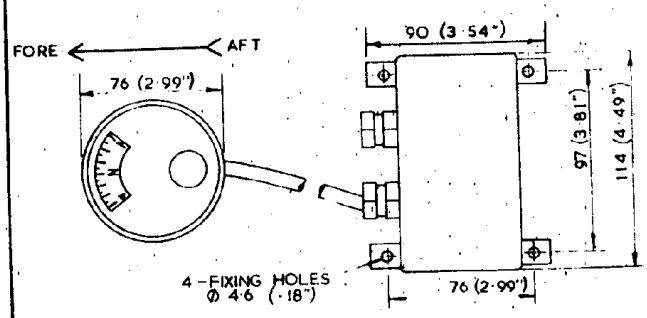
Mount the course setter on a solid member as free of vibration as possible, and clear of any magnetic interference. Minimum distances from likely sources are given below:-
Radar Scanners, 7-25Kw, 3.7m (12ft); Ship's Engines, Radar Scanners 3-7Kw, PSUs, Cables carrying RF, 2.6m (8ft); Radar Displays, Small Motors, Autopilot Drive Motors & Pumps, and heavy current LT cables, 1.3m (4ff); Autopilot Control Unit & Distribution Box, Panel Meters, Metal Structure Ends, 0.8m ($2\frac{1}{2}$ft); Echo Sounders, Other Autopilot Units, Steel Objects, 0.7m (2ft).
Survey the proposed site with a hand bearing compass; Any deviation should not exceed 7^0. Turn on and operate all electrical equipment on the boat (don't forget the windscreen wipers) and check again. Any observeable interference is too much. And remember to look for sources of interference above and below the site which will move with the boat and give rise to heeling error.
With the Course setter in place, take off the top cover and check that all bubbles are contained in the bubble trap. On a high speed planing craft leave the gimbal locking screws in place, but on a displacement or semi-displacement boat THESE SCREWS MUST BE REMOVED. They are made of nylon and are located in each of the two outer arms of the gimbal assembly. Keep them handy in case the unit is removed at some time in the future. Replace the top cover and wire-up.

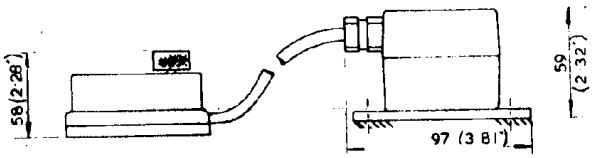
Connection Chart

502 MK11	COLOUR	600 BOX
1	BLUE	A9
2	BROWN	A10
3	GREEN/YELLOW	A8

Black	goes to	Blue
Red	"	Brown
Green	"	Gn/Y
Rear Connector Block		

To align the calibrated scale, first switch to STANDBY at the control unit. Turn the scale knob until the 701 course meter reads centre scale, and then hold the scale knob steady and turn the scale itself until it reads the same as the heading shown on the ship's compass.





NOTE
COIL UNIT IS MOUNTED WITH CABLE OUTLET FACING AFT AND THE SCALE FACING FORWARD.

(0321)

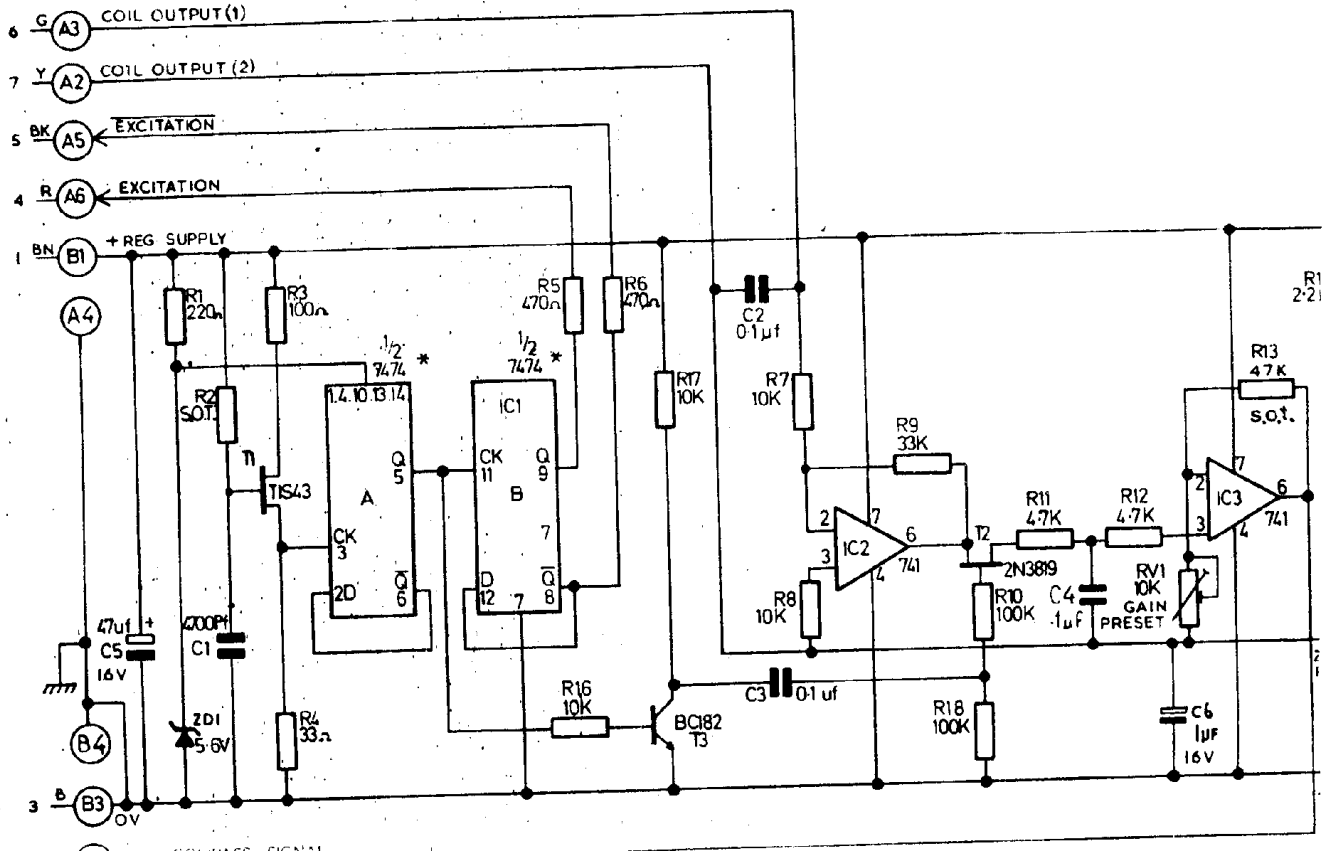
Supply Voltage: 10.5v stabilised; Weight: 1.0Kg; Cable Supplied: 1m to connector box, 4 way x 7/0.1mm; 2m main cable, 3 way x 16/0.2mm; Environmental Classification: Not splashproof, and should be mounted under cover from direct spray. Compass Safe Distance: Coil Unit - Not applicable; Box: Grade1, 300mm (12 ins); Grade 2, 300mm (12 ins).

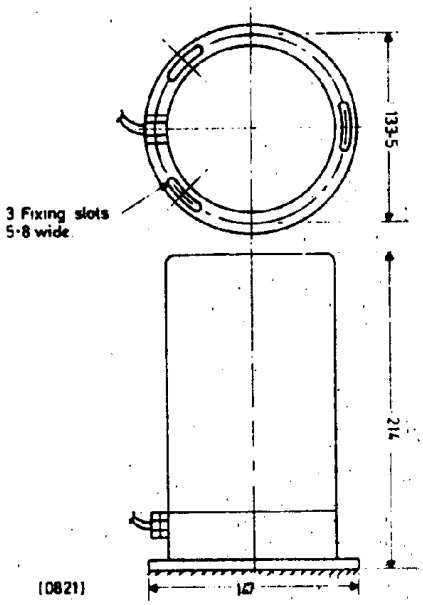
DESCRIPTION

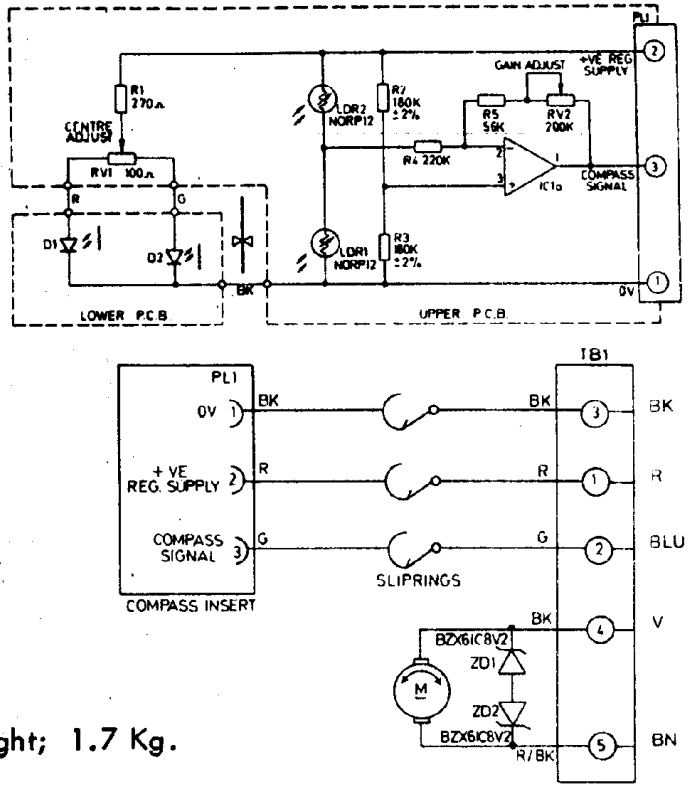
The 503 Course Setter is a fluxgate device suitable for mounting directly on the top glass face of a fully gimballed steering compass. Course selection is achieved by turning the small knob until the desired course is shown on the scale, and the design is such that the vessel responds in the sam sense as the rotation of the control knob. A flexible lead from the course setter connects to a small cast metal box containing the electronics, and this connects directly into the system distribution box.

When correctly installed the fluxgate unit has no measurable effect whatever on the steering compass and a certificate to this effect with the coil coupled to a Class A compass has been issue by the Admiralty Compass Observatory.

The fluxgate unit has a diameter of 76mm (3 ins) and will mount satisfactorily on a wide range of compasses; The compass card should be of approximately 180mm (7 ins) diameter if the 503 is not to obscure the scale.







Supply Voltage: 10.5v stabilised. Weight; 1.7 Kg.
Cable Supplied: 5m 5way x 7/0.2.
Environmental Classification: Weatherproof.
Compass Safe Distance: Grade 1, 600mm (24 ins); Grade 2, 350mm (14 ins).

INSTALLATION

Mount the Course Setter on a solid member as free of vibration as possible, and clear of any magnetic interference. The 504 is weatherproof and can if necessary be in an exposed position. As a general rule try to get the unit aft of midships, and certainly in a planing craft avoid the wave-bounce point in the bow. Minimum distances from likely sources of interference are given below and should be strictly adhered to:-

Radar Scanners (7-25Kw), 3.7m (12ft); Ship's engines, Radar Scanners (3-7Kw), PSUs, Cables carrying RF, 2.6m (8ft); Radar Displays, Small Motors, Autopilot Drive Motors and Pumps, and Heavy Current LT Cables, 1.3m (4ft); Autopilot Control Unit and Distribution Box, Panel Meters, Metal Structure Ends, 0.8m (2½ft); Echo Sounders, Othet Autopilot Units, Steel Objects, 0.7m (2ft

Survey the proposed site with a hand bearing compass; Any deviation should not exceed 7°. Turn on and operate all electrical equipment on the boat (don't forget the fridge) and check again. Any observable interference is too much. And remember to look for any sources of interference above and below the site, which will roll with the boat and give rise to heeling error.

With the Course Setter in place, take off the top cover. There are three small screws retaining this, and although the spinning is a tight fit on its base it really is not necessary to use a tin opener, as the author witnessed on one occasion. The trick is to remember to undo the cable gland nut so as to allow air to enter the unit; The top cover can then be removed with a firm pull upwards.

Check that all bubbles are contained in the bubble trap. On a high speed planing craft leave the two gimbal locking screws in place, but on a displacement boat THESE SCREWS MUST BE REMOVED. They are made of nylon and are located in each of the two outer arms of the gimbal assembly. Keep them handy in case the unit is removed at some time in the future. Replace the top cover and wire up

Connection Chart

504	CABLE COLOUR	600 BOX
(4)	VIOLET	A7
(5)	BROWN	A6
(1)	RED	A10
(2)	BLUE	A8

DESCRIPTION

The 600 Box consists of a Distribution Board located in the base of the unit, and a combination of assemblies in the lid. The Distribution Board and Regulator Boards are common to all systems, the remainder are options.

Distribution Board

The 600 Distribution Board forms the basis of the distribution box used in the 701 autopilot system. It is essentially a printed wiring board routing the various signals to and from the constituent units of the system via six terminal blocks and two mechanical relays.

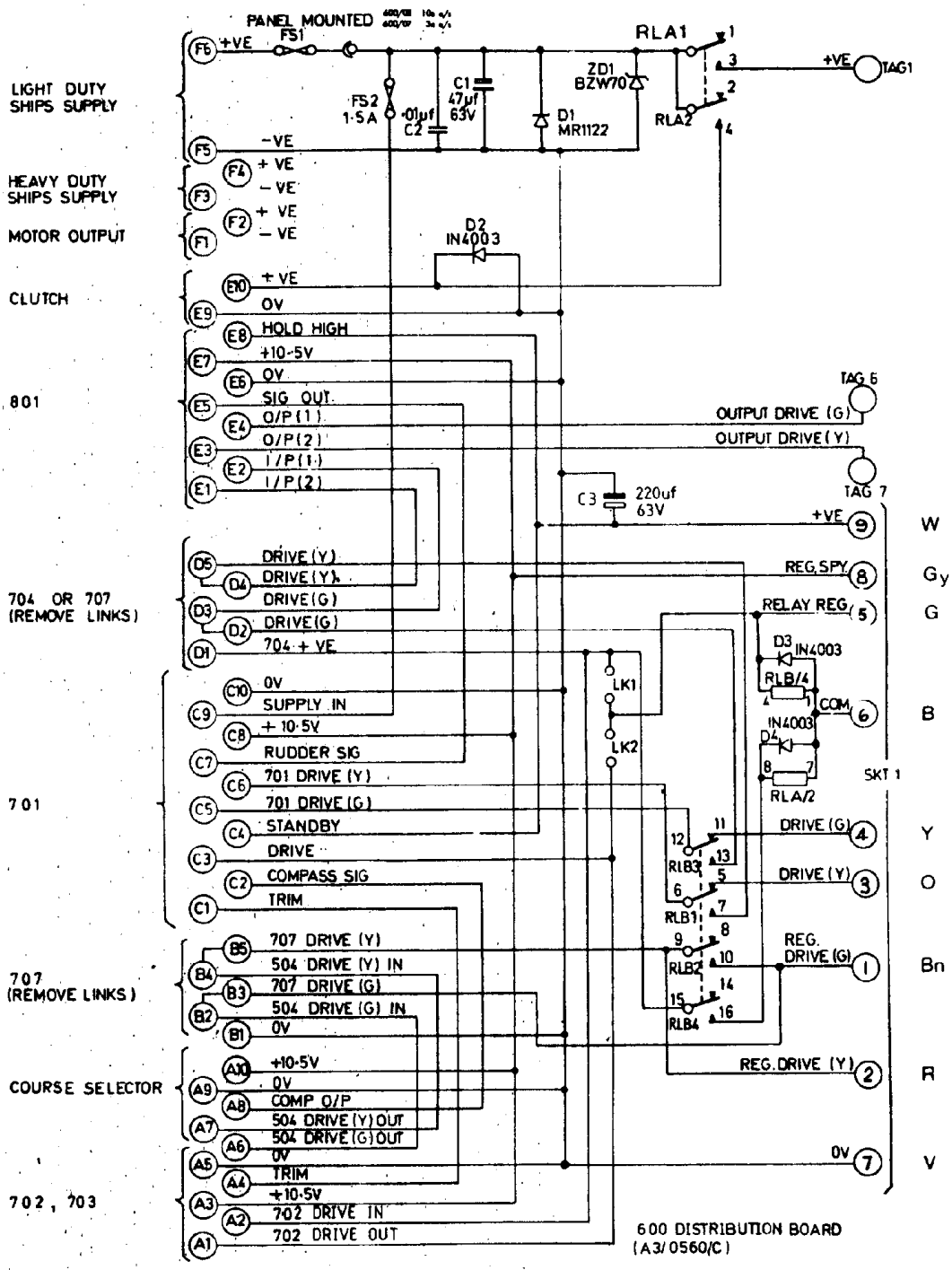
The LIGHT DUTY SHIPS SUPPLY (F6, F5) is used exclusively for feeding all the electronic circuitry and the 600/3 drive boards, whereas the HEAVY DUTY SHIPS SUPPLY (F4, F3) is required for the 600/7 drive relays. The LIGHT DUTY supply is fused with FS1 (main) and FS2 (electronic) and C2/C1/ZD1 provide limited transient suppression protection. Diode D1 provides reverse supply protection. The light duty supply is fed out to the control switch (in the 701 unit) via C9. With the 701 switched to STANDBY the light duty supply is returned via C4 and routed to E8(801 HOLD HIGH) and SKT-1/9 (+VE). The output from SKT-1/8 (REG SPY) is the +10.5V regulated supply input and this is routed out to the various units via E7, C8, A10, A3.

With the 701 still in STANDBY relays RLA and RLB are de-energised and the helm select signals from the 701 (701 DRIVE (Y) on C6 and 701 DRIVE (G) on C5) are fed via the normally closed contacts of RLB1 (pins 6 and 5) and RLB3 (pins 12 and 11) to drive the course selector motor in the 504(if fitted) (DRIVE (G) on SKT-1/4 and DRIVE (Y) on SKT-1/3 via the regulator board).

When DRIVE is selected on the 701 unit the light duty ships supply is enabled through to terminal C3 on the loom board to energise relays RLA and RLB. This is effected by the two links LK1 and LK2. Normally both links are fitted and whenever drive is selected the light duty ships supply is fed to one side of RLB coil and out to the regulator board via SKT-1/5 (RELAY REG). The regulated return enters the board at SKT-1/6 (RELAY COM) and is fed to both relay coils (RLA and RLB). Immediately RLB is energised RLB4 contacts (pins 15 and 16) apply ships supply to RLA coil and consequenty cause relay RLA to be energised. The relays may be de-energised by an option switch connected between terminals A1 and A2, as found in the 702 and 707 Remote Control units. In this case LK2 is omitted. When a 504 and one of the Remote Control units are fitted, either LK2 is omitted to give a Course Reset facility, or LK1 is omitted to give a Course Memory facility. In the former case RLB is de-energised to allow autofollowing to take place during manual steering, but in the latter case RLB remains energised during manual steering and autofollowing is inhibited.

Relay RLB4 is a safety precaution which prevents relay RLA (drive relay) from being energised in a fault condition when RLB is de-energised. The drive outputs to the 504 servo motor, which are still at the level of the ships supply, leave the loom board via SKT-1/4 (DRIVE (G)) and SKT-1/3 (DRIVE (Y)) and are fed to the regulator board. The regulated drive signals return to the board via SKT-1/1 and SKT-1/2 and are routed to terminals B3 and B5. Relay RLB2 (pins 9 and 10) applies dynamic braking to the course selector motor by shorting together the two drive signals.

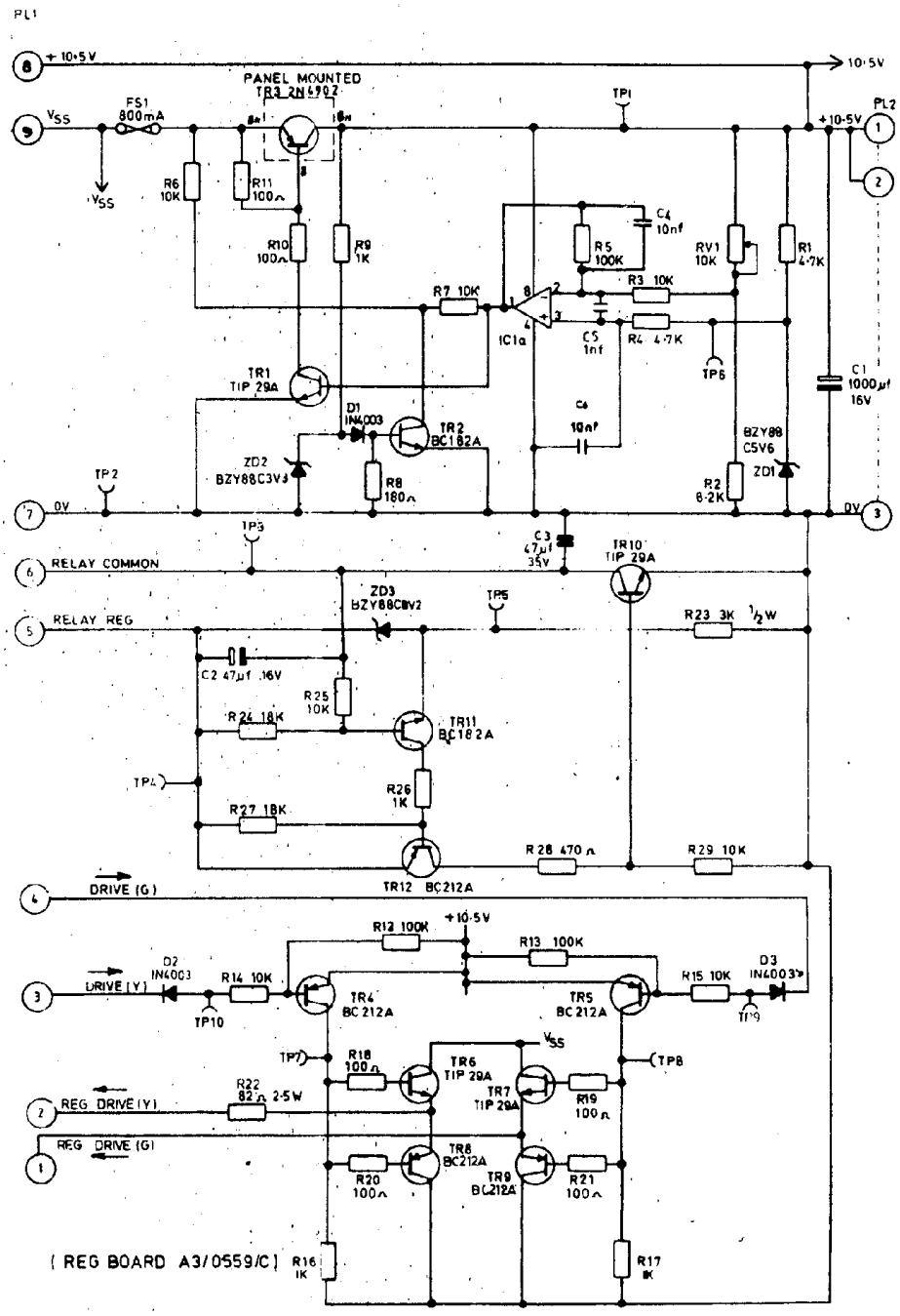
All other connections on the loom board provide the necessary interconnections for the 701 autopilot system. When the 704 or 707 options are not required, shorting links are connected between terminals D5 and D4, D3 and D2, B5 and B4, B3 and B2.



600 BOX DISTRIBUTION BOARD

CIRCUIT DIAGRAM

Regulator Board



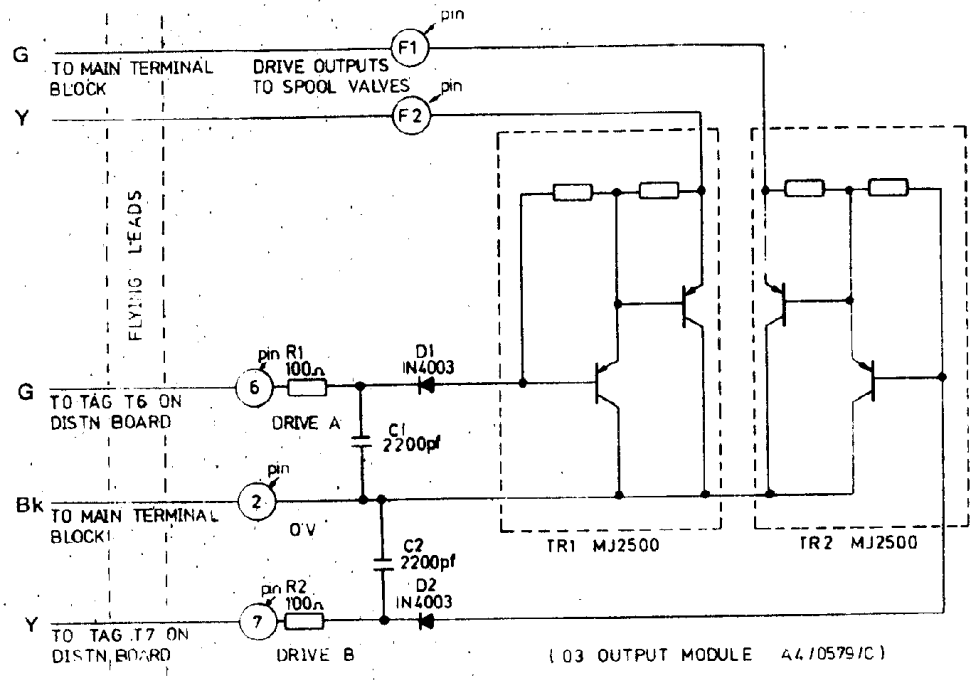
The regulator PCB consists of three independent regulator circuits:-

(1) +10.5v stabilised line, which is the basic voltage reference for the system and appears at PL1/8 and in plug PL2/1&2. The level is set by potentiometer RV1.

(2) +12v rough regulation for relays RLA and RLB on the distribution board. This appears at PL1/5 and 6.

(3) +8.5v supply for the 504 servo motor. The drive inputs originate from the 701 control unit and appear at PL1-3 and PL1-4. These are normally high (at ship's supply) but one or the other goes low in the drive mode. TR4 and TR5 covert the signals to 10.5v for drive, and 0v for no drive, and these appear at PL1/ 1&2.

Output Module 03



The 03 Output Module assembly consists of a PCB mounted on a heatsink chassis. It is used to drive hydraulic spool valves.

The drive inputs enter the board on PIN 6 and flying lead (drive A) and PIN 7 and flying lead (Drive B). When these inputs are positive the darlington transistors TR1 and TR2 are turned off and no energisation takes place via flying lead outputs F1 and F2. When either one or other drive input (PIN 6 or PIN 7 and flying leads) is taken low (to 0V) the appropriate darlington transistor is turned on causing current to flow from negative rail (PIN 2 and flying lead) through the transistor and relevant output energising one of the two spool valves.

The return path is via terminal E10, which is high only when the 701 is switched to DRIVE.
Thus for Phasing A :-
Port Spool Valve connects between terminal F2 and E10
Starboard Spool Valve connects between terminal F1 and E10.
Reverse connections for Phasing B.

Output Module 07

The 600/7 drive board assembly consists of a PCB mounted to a heatsink chassis. It is used to drive the coils of heavy duty relays and solenoids.

Refer to Circuit Diagram A3/0574/C

The drive command inputs enter the board at PIN 6 and flying lead (DRIVE A IN) and PIN 7 and flying lead DRIVE B IN). These are generated by the 701 control unit. Each channel is identical and operation of one channel only will be described in detail. The circuit references in parenthesis refer to the opposite channel.

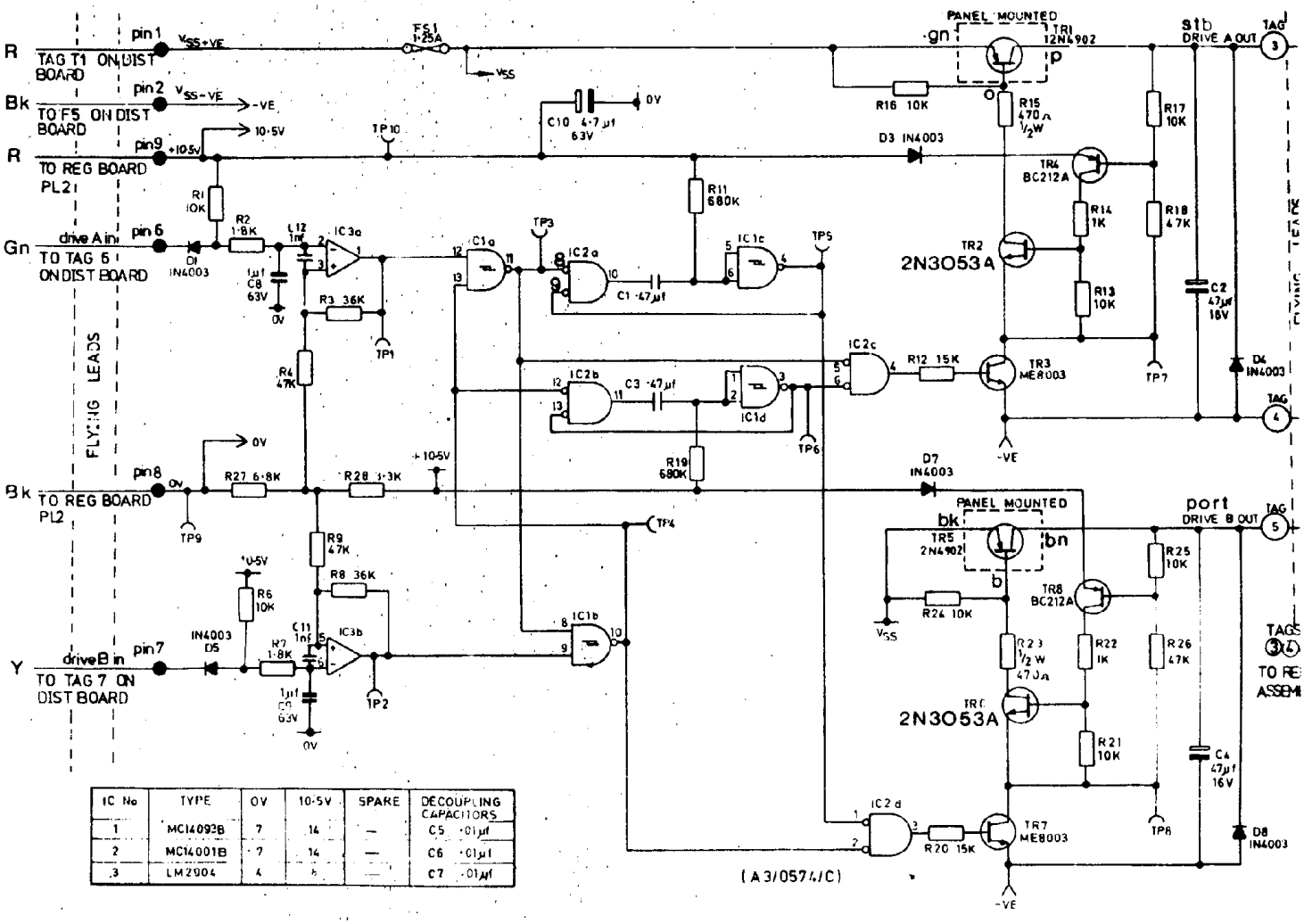
An input network shapes the 701 drive output to a CMOS compatible level and prevents switching transients from the 701 causing mistriggering of the drive output.

Diode D1 (D5) and resistor R1 (R6) limit the input high level (12 - 40V) to the system regulated supply of +10.5V. R2 and C8 (R7, C9) form a simple low pass filter which effectively filters high frequency parasitic pulses. IC3a (IC3b) is an inverting op-amp schmitt trigger which triggers at 8.5V when the inverting input is positive going and at +3V when the inverting input is negative going. Integrated circuits IC1a and IC1b are cross-coupled NAND schmitt triggers. The schmitt action shapes the output from the previous stage and by being cross coupled both channels are prevented from being activated simultaneously. Consider both inputs "off". With DRIVE A IN (PIN 6 flying leads), positive input pin 12 of IC1a is low, forcing IC1a output high and enabling input 8 of IC1b. Similarly with DRIVE B IN (PIN 7 and flying lead) positive input pin 13 of IC1a is also enabled.

When DRIVE A IN (PIN 6 and flying lead) goes low (i.e. a-drive command) pin 12 of IC1a goes high and provided DRIVE B IN is still positive the output of IC1a goes low. This low disables IC1b blocking drive command signals on channel B. Similarly, the output of IC1b goes low disabling IC1a when DRIVE A IN is positive and DRIVE B IN is low.

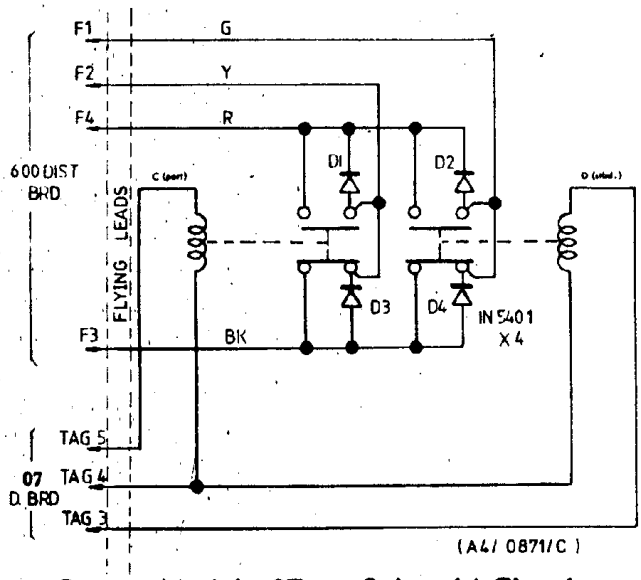
IC2a, IC1c, C1, R11 and IC2b, IC1d, C3, R19 form two monostables whose outputs are normally low enabling one input of IC2c and IC2d. When the output of IC1a (IC1b) goes low the other input of IC2c (IC2d) is enabled, forcing the output of IC2c (IC2d) high and switching on TR3 (TR7). When the drive command ceases and the output of IC1a(IC1b) goes high, monostable IC2a/C1/R11/IC1c (IC2b/C3/R19/IC1d) is fired and the output of IC1c (IC1d) goes high for approximately 200 mS disabling IC2d (IC2c) and preventing the other channel from switching on for this time period. This prolongs the life of the relay contacts.

When TR3 (TR7) is switched on by the output of IC2c (IC2d) going high, a 0V reference is applied to the output regulating circuitry. At the instance of "switch-on" TR4 (TR8) is switched hard on causing TR2 (TR6) and in turn TR1 (TR5) to start to conduct. When TR1 (TR5) begins conduction the base of TR4 (TR8) rises to Vref on D3 (D7), causing the transistor to conduct less. This then has the effect of reducing conduction in TR2 (TR6), which in turn causes TR1 (TR5) to begin to turn off. An equilibrium point is reached regulating the output at approximately +12v.

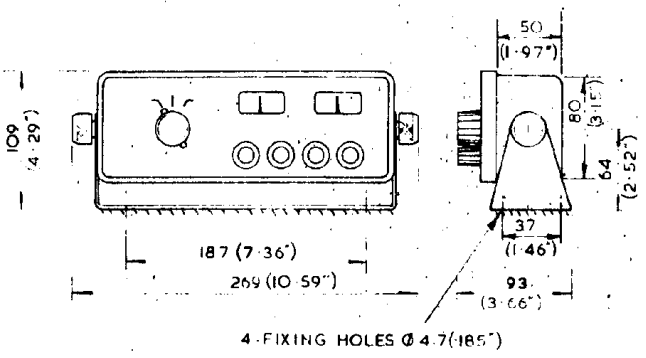


IC No	TYPE	0V	10·5V	SPARE	DECOUPLING CAPACITORS
1	MC14093B	7	14	—	C5 ·01µf
2	MC14001B	7	14	—	C6 ·01µf
3	LM2904	4	8	—	C7 ·01µf

Output Module 07 - Drive Board Circuit



Output Module 07 - Solenoid Circuit



(0350)

701			
TB No	CABLE COLOUR	SIGNAL NAME	600 BOX
1	GREEN	HELM SELECT A	C5
2	BLUE	COMPASS SIGNAL	C2
3	WHITE	RUDDER SIGNAL	C7
4	PINK	TRIM INPUT	C1
5	BROWN	+ 10·5V	C8
6	ORANGE	STANDBY	C4
7	RED	SHIPS SUPPLY	C9
8	BLACK	0V	C10
9	YELLOW	HELM SELECT B	C6
10	VIOLET	DRIVE	C3

CONNECTION CHART (0479)

Supply Voltage: Ship's supply 12v-40v, Stabilised line 10.5v; Weight: 2.0 Kg; Cable Supplied: 7m 10way x 7/0.2mm; Compass Safe Distance: Grade 1 ($\frac{1}{4}^{\circ}$) 1600mm (63"), Grade 2 (1°) 950mm (37"); Environmental Classification: Not Splashproof, and should be protected from direct spray.

DESCRIPTION

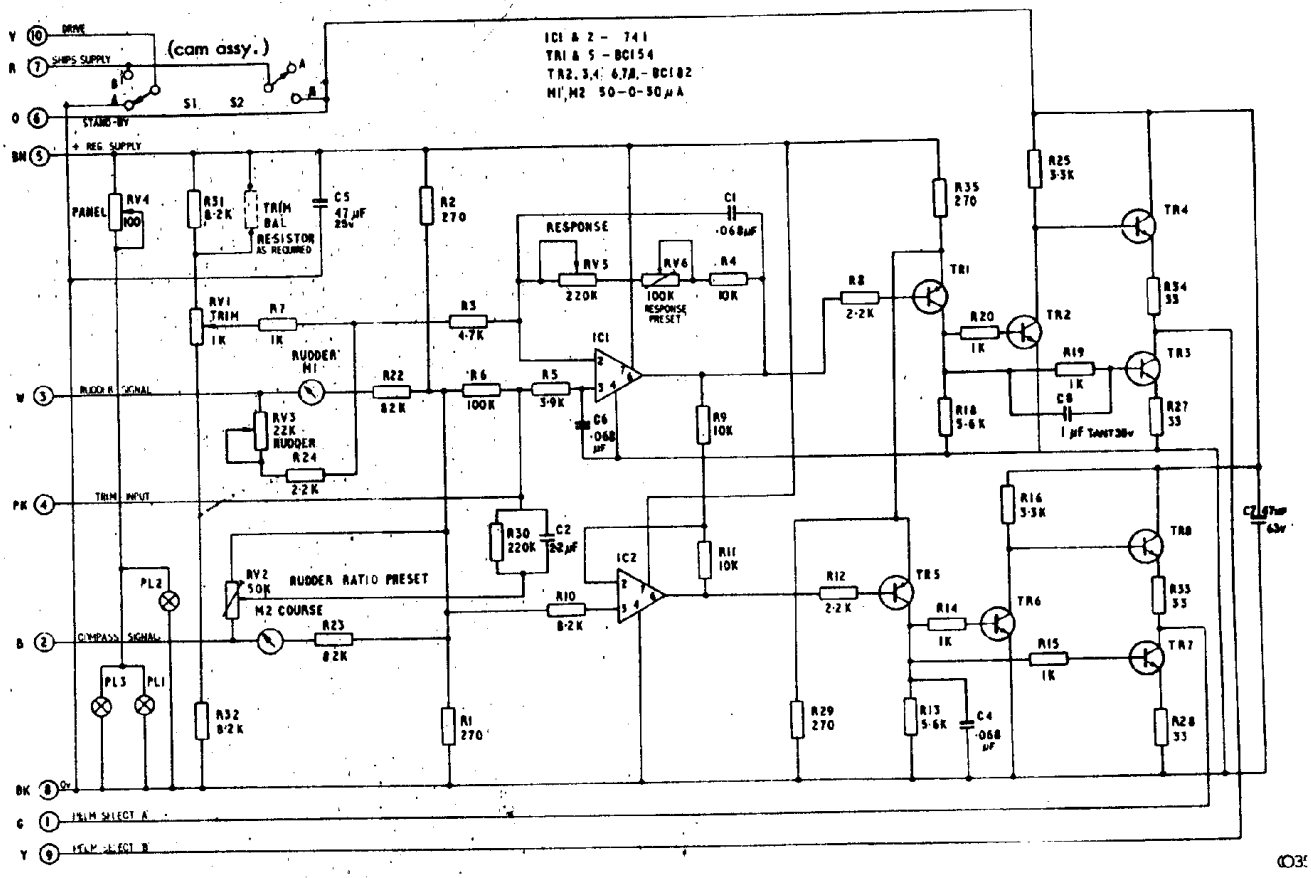
The 701 is the main control unit for all 701 Autopilot systems. It incorporates the master function switch, two panel meters which indicate rudder position and course deviation respectively, and four control knobs for rudder ratio, trim, response, and panel illumination.

The master function switch has three positions: OFF, STANDBY, and DRIVE. In the OFF position the system is completely dead and the boat must be steered by hand. In the STANDBY position power is applied to the voltage regulator board in the 600 Distribution Box so as to produce the 10.5v stabilised line which is the system reference voltage. This line powers not only the control electronics in the 701 but also all the ancilliary electronic components in the system, so that the whole autopilot is operational except for two relays in the 600 Box. Relays RLA and RLB are de-energised until DRIVE is selected, whereupon RLA operates to switch on the motor and clutch supplies and RLB operates to connect the helm select signals to the rudder drive switching circuits.

The stabilised line appears at terminal 5 on the connector block; With the vessel on course and the rudder midships the signal inputs at terminals 2 and 3 are exactly mid-rail, (5.25v), and the helm select outputs at terminals 1 and 9 will both be high (at or near ship's supply voltage). Both meters will indicate centre zero. Each signal input can swing through the range 1.5v (approx.) to 9.5v (approx.) with a corresponding deflection of the appropriate panel meter.

Standing rudder is achieved electronically by biassing the voltage into the summing input of IC1 (comparator) with potential divider RV1 (TRIM control on the front panel). The amount of rudder applied by the pilot when steering the boat is set by the two potentiometers RV2 (internal pre-set) and RV3 (RUDDER control on the front panel), which together alter the proportion of rudder feedback signal applied to maintain balance conditions at IC1. RV2 has the effect of setting the range of RV3. The amount of course deviation necessary before the rudder responds is known as deadband or yaw; It is equivalent to the amount of unbalance at comparator 1 inputs before the output deviates sufficiently to effect switching, and is controlled by RV5 (RESPONSE control on the front panel) and RV6 (internal pre-set).

The output of comparator IC1 divides into two chains, one going directly to the switching network formed by TR1, 2, 3, 4, and the other being inverted by IC2 before going to the other switching network formed by TR5, 6, 7, 8. In the balance condition each channel output is at or near ship's supply voltage, and goes low to around 1v when drive takes place.



INSTALLATION

In power boats and motor sailers the 701 is usually installed near the inside helm position. On a sail boat with a single helm position, the choice is frequently by the chart table with a 702 remo control by the helm. Observe the compass safe distance carefully and do not forget that strong magnets (e.g. in windscreen wiper motors) will pull the panel meters if too close.

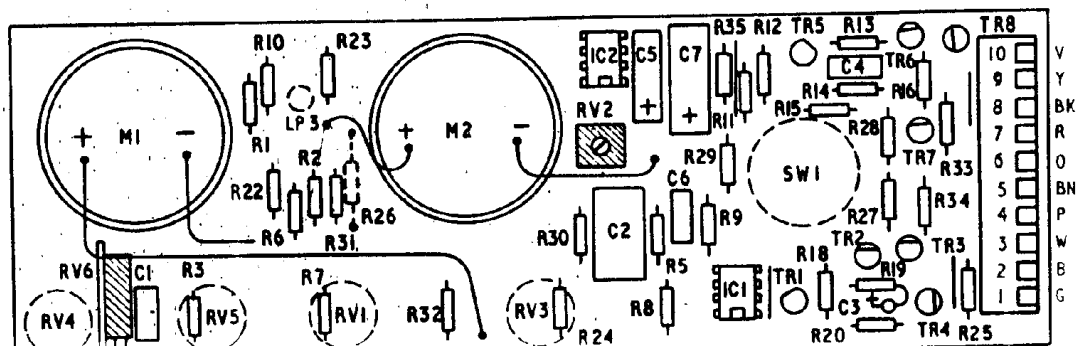
ALIGNMENT

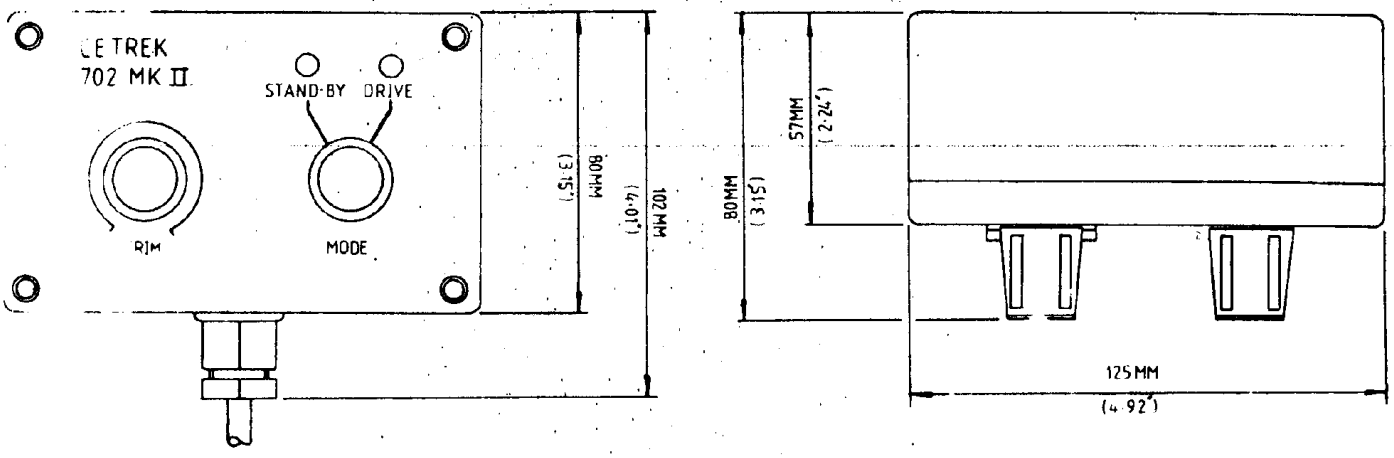
The following checks should be carried out when the rest of the system is installed, and MUST NOT BE OVERLOOKED.

(1) On a displacement boat, turn RV6 (RESPONSE pre-set) fully anti-clockwise. On a fast planing boat, adjust RV6 so that with the front panel RESPONSE control in its mid position a change of not more than three degrees on the course setter operates the drive motor.

(2) Check that the TRIM control drives the rudder in the correct direction by approximately ten degrees of course change for full trim. (Set RV3 to '4' and RV5 to '2' for this).

(3) Adjust RV2 (RUDDER pre-set) so that with the front panel RUDDER control in position 5 a ten degree course setter change produces about the same amount of rudder movement (as will be indicated by the panel meters deflecting by equal angles from the vertical). If a sea trial shows further adjustment to be necessary, decrease rudder by turning RV2 clockwise and increase by turning anti-clockwise.





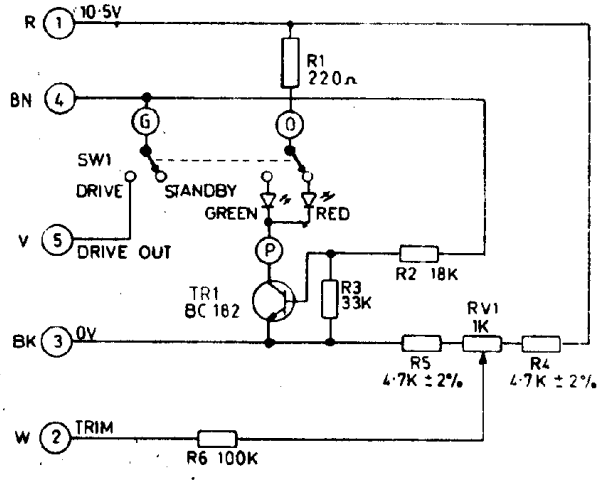
Voltage Supplied: 10.5v stab & s/s. Weight 0.75Kg; Cable Supplied: 5m 5way x 7/0.2mm; Compass safe distance: Grade 1 ($\frac{1}{4}^{o}$) 300mm (12"), Grade 2 (1^{o}) 300mm (12"); Environmental Classification: Weatherproof, may be mounted in exposed positions.

DESCRIPTION

The 702 is a remote control unit especially designed for use in the cockpit area of sailing craft or on the flying bridge of a power craft. It incorporates a switch which has the effect of putting the pilot into STANDBY mode so that manual control of the steering becomes possible. It is considered that this is an essential safety feature on any boat where there is a helm position from which the main 701 control unit is not quickly accessible. The 702 also incorporates a TRIM control, which enables the user to modify his selected course by up to $\pm 15^{o}$.

	702, 702 MK II	
No	CABLE COLOURS	600 BOX
1	RED	A3
2	WHITE	A4
3	BLACK	A5
4	BROWN	A1
5	VIOLET	A2

CONNECTION CHART (0477)



INSTALLATION

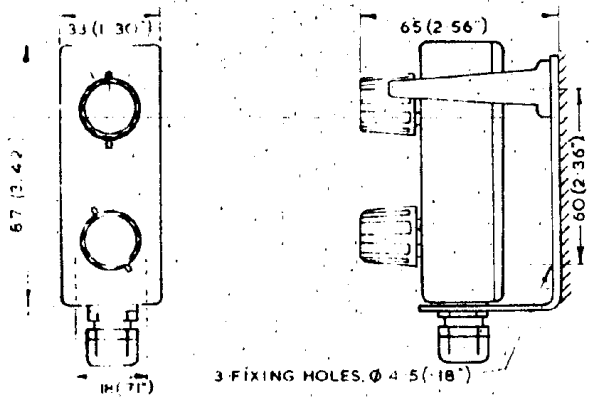
Installation of the 702 is straightforward, and connections to the 600 box should be made as per the connection chart above. Where the system includes the autofollowing compass model 504 there are two modes of operation possible, namely:-

(1) Course Memory, whereby when the 702 is switched into STANDBY so that the boat can be steered manually, and then later is returned to DRIVE so that the pilot resumes control, the pilot 'remembers' its previous heading and returns to it. This is achieved by removing link 1 from the 600 box which has the effect of interrupting the drive to the 504 servo motor;

(2) Course Reset, whereby when the 702 is switched into STANDBY as above, and then back again into DRIVE, the pilot resets itself to whatever new course has been steered in the meantime. This is achieved by removing link 2 in the 600 box.

When any of the other Cetrek course setter models is fitted in the system only the Course Memory mode is possible of course, and link 1 should be removed from the 600 box.

There is one other thing involved in fitting a 702; The TRIM potentiometer is effectively in parallel with the rudder ratio pre-set in the 701 control unit, and has the effect of reducing the rudder ratio. RV2 will therefore need to be readjusted to compensate for this by turning anti-



(0356)

Voltage Supplied: 10.5v stabilised; Weight: 1 Kg; Cable Supplied: 10m 3way x 16/0.2mm;
Compass Safe Distance: Grade 1 ($\frac{1}{4}^{\circ}$) 300mm (12"), Grade 2 (1°) 300mm (12");
Environmental Classification: Weatherproof, may be mounted in exposed positions.

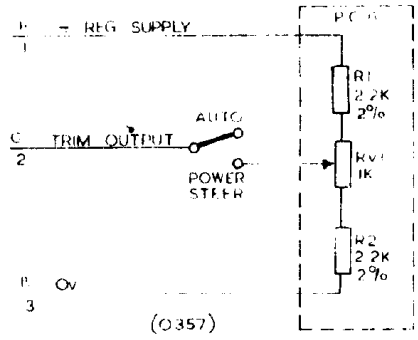
DESCRIPTION

The 703 is a hand-held remote control unit on a long wander lead, which enables the user to assu full control over the steering from any position on the boat. The power steering is of the full foll up type; That is to say the rudder follows exactly the position of the helm knob on the 703.

The unit comes complete with a mounting bracket, and finds many applications on workboats and amongst those who sometimes sail single-handed.

703		
No	CABLE COLOUR	600 BOX
1	RED	A3
2	GREEN	A4
3	BLUE	A5

CONNECTION CHART (0480)



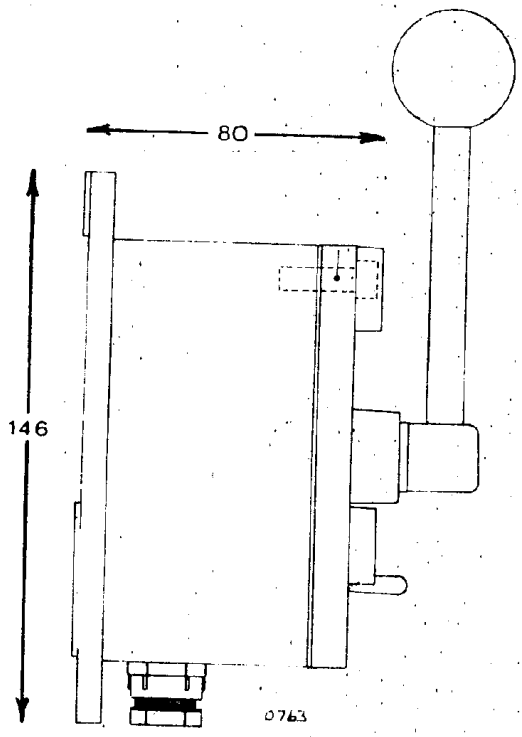
(0357)

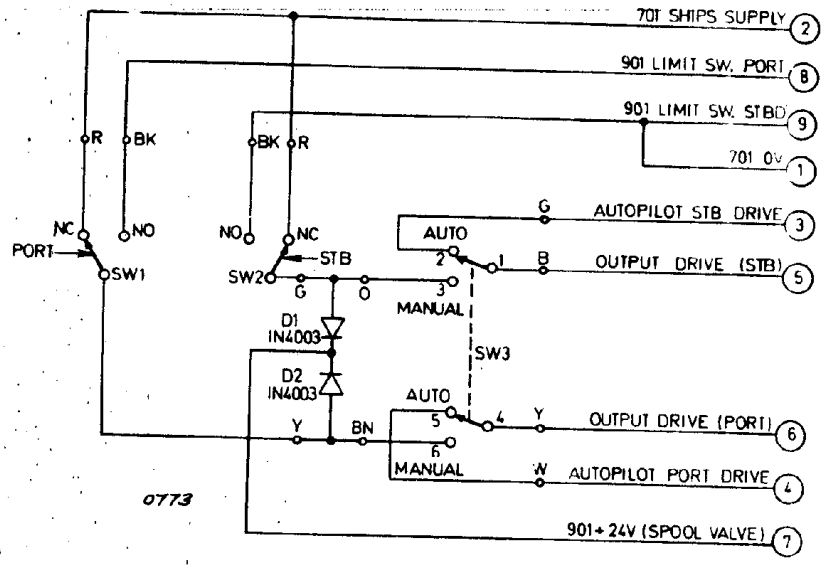
INSTALLATION

Installation of the 703 is very straightforward and only involves screwing the mounting bracket to a suitable surface, running the cable to the 600 box, and wiring up in accordance with the chart above.

The 703 is fully weatherproof and may be put in an exposed position (eg. on the fore deck), but following the principle that it never does any harm to get as much under cover as possible, some users mount the unit inside a hatch or locker to be pulled out when required. This does have the advantage of keeping the cable tidy, which should be borne in mind wherever the 703 is placed.

Adequate strain relief should be provided for the cable, so that in the event of a sudden pull there is no danger of damage at the distribution box.





Voltage Supplied: Ship's Supply; Weight: 1.5 Kg; Cable Supplied: None.
Compass Safe Distance: Grade 1 ($\frac{1}{4}^{\circ}$) 300mm (12"), Grade 2 (1°) 300mm (12");
Environmental Classification: Waterproof, may be mounted in exposed positions.

DESCRIPTION

The 704C is a jog-steer control designed particularly, but not exclusively, with the requirements of the commercial user in mind. It is most usually mounted on the bridge or well of a fishing boat. When the unit is switched from AUTO to MANUAL the user can operate the rudder by means of the jog lever. The rudder drives over as long as the lever is depressed.

704C		
TB No	SIGNAL NAME	600 BOX
1	701 0V	B1
2	701 SHIPS SUPPLY	D1
3	AUTOPILOT STB DRIVE	D2 †
4	AUTOPILOT PORT DRIVE	D5 †
5	OUTPUT DRIVE STB	D3 †
6	OUTPUT DRIVE PORT	D4 †
7	(901 HOLD HIGH)	N/C
8	(901 LIMIT SWITCH)	N/C
9	(901 LIMIT SWITCH)	N/C

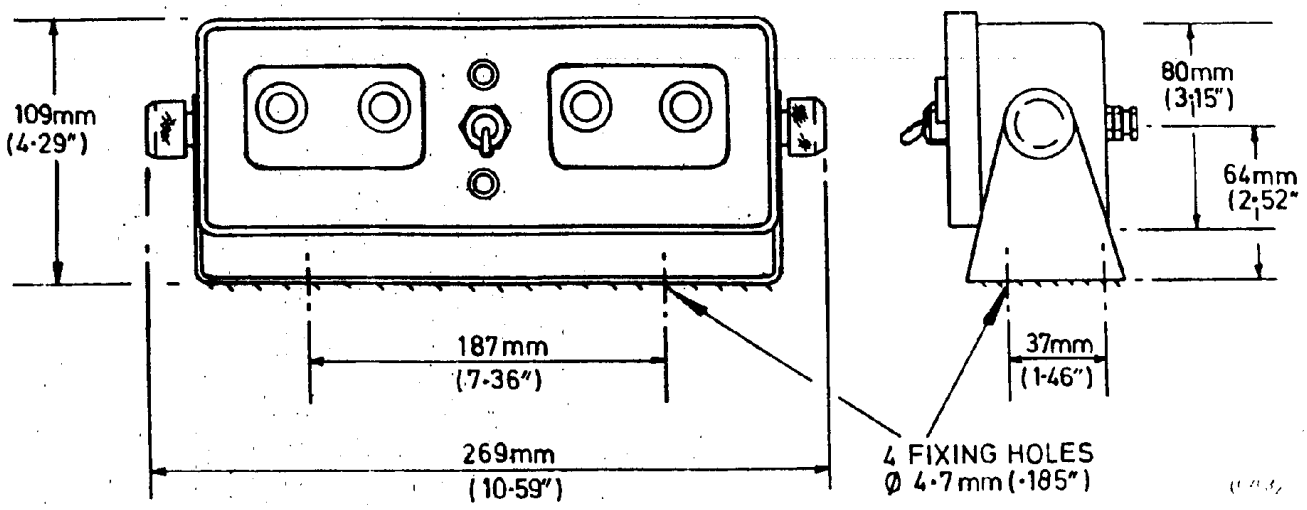
CONNECTION CHART

† REMOVE LINKS FITTED BETWEEN D2 & D3, D4 & D5.

(0476)

INSTALLATION

Installation of the 704C consists only of bolting the unit to a suitable surface and running a cable to the 600 distribution box. As requirements vary so much from boat to boat no cable is supplied with the unit, and you will therefore need to provide yourself with a suitable length of 6way x 7/0.2mm. The 704C was designed originally for use with Cetrek's commercial pilot model 901 and a small modification is necessary for use with 701 systems; You should fabricate a wire link between terminals 8 and 9 of the connector strip, and remove the wirelinks in the 600 box between terminals D2 & D3, and D4 & D5.



Voltage Supplied: Ship's Supply; Weight: 2.0 Kg; Cable Supplied: 10m 12way x 7/0.2mm
Compass Safe Distance: Grade 1 ($\frac{1}{4}$°) 300mm (12"), Grade 2 (1°) 300mm (12");
Environmental Classification: Waterproof, may be mounted in exposed positions.

DESCRIPTION

The 707 is a remote control unit which is used in conjuction with the 504 autofollowing course setter. It incorporates two pairs of push buttons, a single toggle switch, and two signal LEDs whose functions are as follows:-

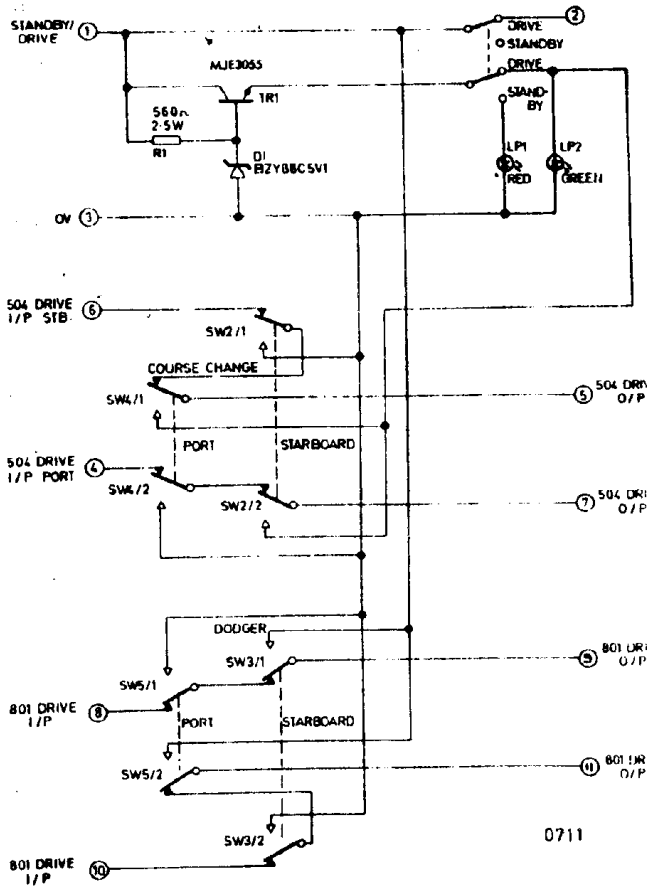
The toggle switch performs the same function as that in the 702 unit, namely to put the pilot in STANDBY mode without having to touch the 701 control unit so that manual control of the steering becomes possible.

One pair of push buttons enables the user to re-set the vessel's course, to port by pushing one button, and to starboard by pushing the other.

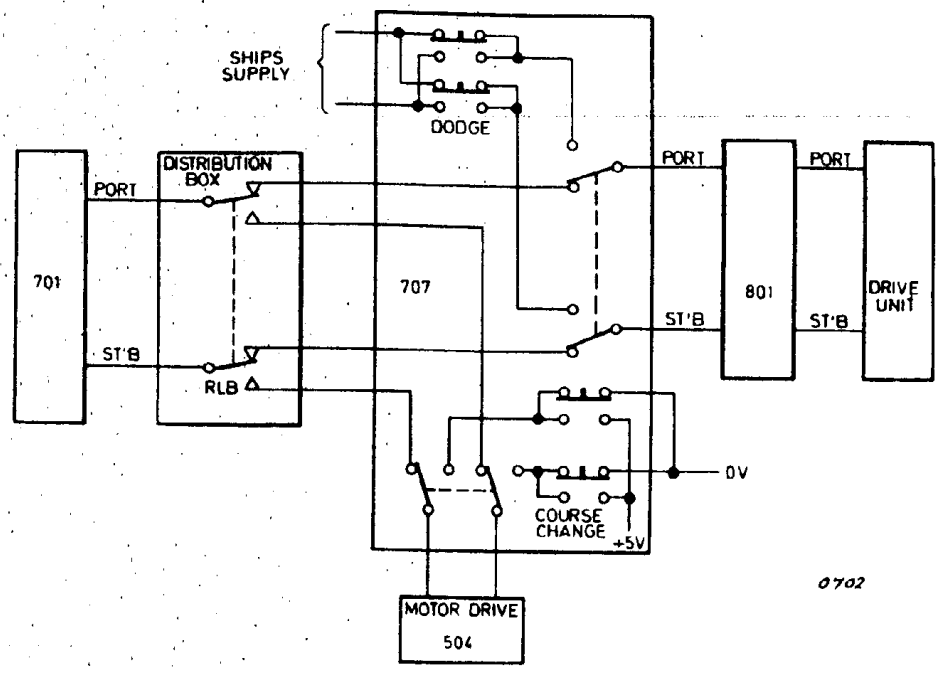
The other pair of buttons gives a DODGE facility; The boat drives hard over as long as the appropriate button is pressed, but returns to its previous heading as soon as it is released. Pressing both buttons at once holds the rudder stationary.

The unit functions by driving the servo motor inside the 504 course setter and can only be used therefore with this model. The 707 incorporates a voltage regulator whose output is approximately 5v, and it is this that is applied to the 504 motor rather than the system line voltage.

The 707 finds many applications on flying bridges and tuna towers, where it makes a very economical alternative to a second helm unit.



Schematic Representation of the 707 in circuit



INSTALLATION

The 707 may be mounted on its trunnion or, as is often done, flush mounted in a control panel etc. The unit is waterproof, but it is only common sense to give it some protection if possible.

Run the cable to the 600 box and connect up as per the connection chart.

The 707 can be wired in one of two ways:-

(1) Course Memory, whereby when the 707 is switched into STANDBY so that the boat can be steered manually, and then later is returned to DRIVE so that the pilot resumes control, the pilot 'remembers' its previous heading and returns to it. This is achieved by removing link 1 from the 600 box, which has the effect of interrupting the drive to the 504 servo motor;

(2) Course Reset, whereby when the 707 is switched into STANDBY as above, and then back again into DRIVE, the pilot resets itself to whatever new course has been steered in the meantime. This is achieved by removing link 2 in the 600 box.

707			
PIN No	CABLE COLOUR	SIGNAL NAME	600 BOX
1	RED	STANDBY/DRIVE	A1
2	ORANGE	DRIVE	A2
3	BLACK	0V	B1
4	VIOLET	504 DRIVE IN (P)	B5 †
5	PINK	504 DRIVE OUT	B2 †
6	BROWN	504 DRIVE IN (S)	B3 †
7	GREY	504 DRIVE OUT	B4 †
8	BLUE	801 DRIVE IN	D5 †
9	YELLOW	801 DRIVE OUT	D4 †
10	WHITE	801 DRIVE IN	D2 †
11	GREEN	801 DRIVE OUT	D3 †

(0478)

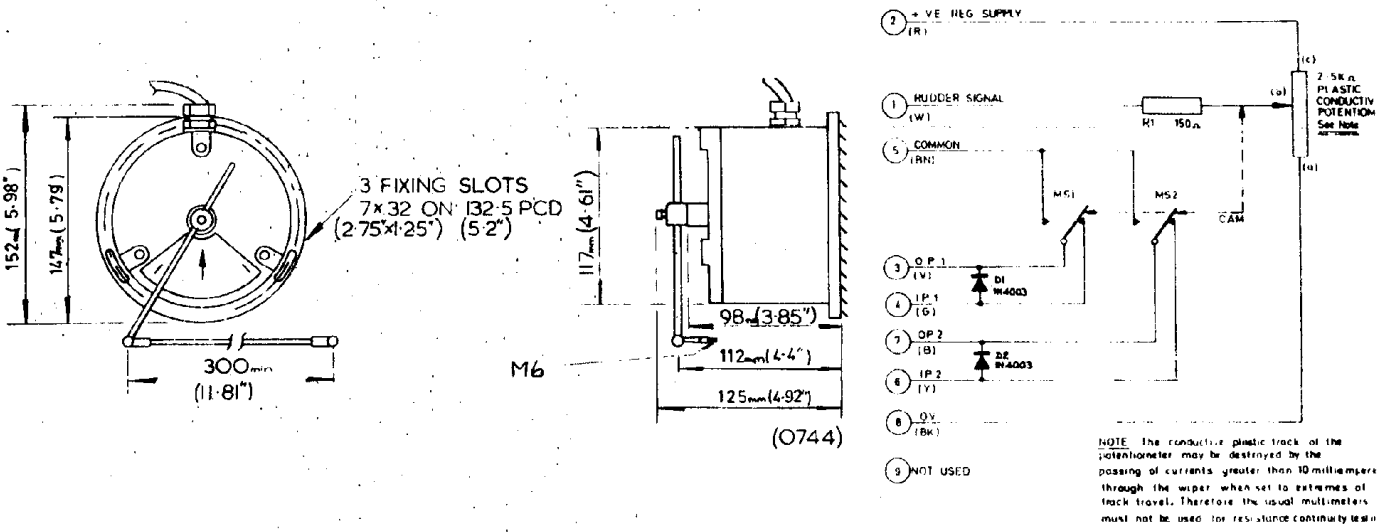
† REMOVE LINK FITTED BETWEEN B2 & B3, B4 & B5, D2 & D3, D4 & D5

1 FOR COURSE MEMORY REMOVE LINK 1 FROM 600 BOX
FOR COURSE RESET REMOVE LINK 2 FROM 600 BOX

One or other of these two possible modes must be chosen, and the choice is a matter of the customer's personal preference. A self-adhesive label is provided which should be afixed in the cut-out area of the front panel, so that there is no possibility of any future user not knowing how the unit is installed.

The wire links fitted between terminals B2 & B3, B4 & B5, D2 & D3, D4 & D5, in the 600 box should also be removed.

The installation is now complete.



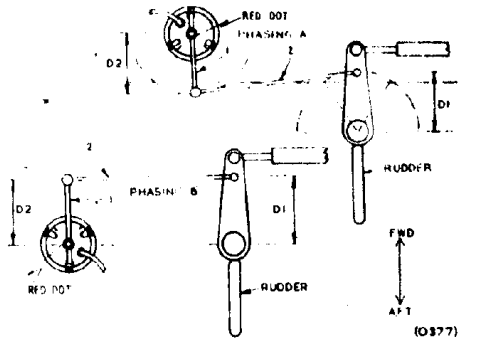
Voltage Supplied: 10.5v Stabilised; Weight: 2.1 Kg; Cable Supplied: 8m 8way x 7/0.2mm; Compass Safe Distance: Grade 1 ($\frac{1}{4}^{0}$) 300mm (12"), Grade 2 (1^{0}) 300 mm (12"); Environmental Classification: Waterproof, may be mounted in exposed positions.

DESCRIPTION

The 801 rudder feedback unit comprises a robust metal casting, environmentally sealed against bilge water etc, and having a linkage assembly for connection to the rudder tiller arm or tie bar. Inside the casting are a military specification potentiometer and a limit switch assembly comprising two micro-switches and an actuating cam.

INSTALLATION

The unit should be mounted near the rudder in such a way that when the linkage arm is connected the movement of the 801 shaft will be a faithful copy of the movement of the rudder stock (see diagram right). The sense of the rotation is unimportant as this will be taken care of when wiring-up, but the distances D1 and D2 must be as nearly as possible the same, so that the rudder and the 801 arm move in parallel with each other. The Allen screw surmounting the 801 shaft may be slackened to allow the arm length to be adjusted. A platform of some kind will usually have to be made to support the body of the unit, which should be mounted in such a way that the red spot on the rotating shaft lies on the same side as the label. The unit will not work if this is reversed.



Before wiring-up, determine whether you should use Phasing A or Phasing B by applying starbord rudder and observing the movement of the 801 shaft from directly above the unit: If the shaft moves clockwise wire as Phasing A, and if it moves anti-clockwise wire as Phasing B. Connections are shown in the chart opposite.

801		600 BOX	
CONNECTOR CIRCUIT No AND SIGNAL	CABLE COLOUR	PHASING A	PHASING B
(6) DRIVE INPUT 2	YELLOW	E1	E2
(4) DRIVE INPUT 1	GREEN	E2	E1
(7) DRIVE OUTPUT 2	BLUE	E3	E4
(3) DRIVE OUTPUT 1	VIOLET	E4	E3
(1) RUDDER STGNAL	WHITE	E5	E5
(8) 0V	BLACK	E6	E7
(2) +REG	RED	E7	E6
(5) SHIPS SUPPLY	BROWN	E8	E8

When the rest of the system is installed, switch to STANDBY at the 701 and check that the rudder meter moves into the green sector with starboard helm applied and into the red with port helm. If it doesn't, re-check your phasing (not forgetting the limit switches).

Use a multimeter to check that the limit switches operate before the rudder arm reaches its end sto The approximate points of operation are marked on the silver label. Adjust if necessary by remov