INSTALLATION AND OPERATION MANUAL

MODEL P-2 AUTOPILOT SYSTEM

W-H AUTOPILOTS, INC.

INDEX

W-H AUTOPILOTS, INC.

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P-2 AUTOPILOT SPECIFICATIONS

TYPE: Adjustable deadband, non-hunting, solid state integrated circuits.

CONTROLS ON PHC:

YAW (Deadband), adjustable from .5 to 11° (minimum internally set from .5 to 1.5°).

RUDDER GAIN (Boat speed adjustment), adjustable from .5 to 2 (degrees of rudder/degrees compass).

CC (Course Change), changes course any amount at approximately 5° per second when activated.

RUDDER LIMIT Limits rudder travel when under autopilot control. (Adjustable from 4 to 18°). Second electronic limit system controls rudder in power steering mode. (Adjustable from 20 to 45°).

DIM (Illumination adjustment), adjusts brightness of all pilot lights.

DODGE BUTTONS (Port and Starboard), when pressed the boat will turn and continue to turn until the button is released, then it will return to the original course. These buttons also are red and green pilot lights which are on whenever the rudder is moving under power.

BLUE LIGHT This pilot light is on whenever the vessel is under autopilot control. It goes off when in the power steering mode. It is located in the pilot on button.

POWER REQUIREMENTS: The electronic portions require between 1/2 and 3/4 amp of power at 12vdc. The exact amount depends on the number of Rudder Angle Indicators and Remote Controllers installed and if the lights are dimmed or bright. Converters are available for operation from 24 or 32vdc and from 115vac.

The hydraulic power pack consumes from 5 to 12.5 amps (1/8 HP unit) or from 5 to 22 amps (heavy duty 1/4 HP unit) at 12vdc. This power consumption occurs only when the motor is running. Average power consumption can be as little as 1 or 2 amps.

HYDRAULIC POWER PACK:

MODEL HPP-1:

Oil Output, .5 to 2 in^2 sec flow rate up to 1000 psi pressure. (Flow and max pressure adjustable by pulley size and electronic speed control).

Ram Sizes Suitable, 6.5 to 35 in^2 (balanced type only).

Motor Rating, 1/8 HP continuous duty, 12.5a at full load. Permanent magnetic field.

MODEL HPP-2:
(Heavy Duty)

Oil Output, .5 to 4 in^2 sec flow rate up to 1500 psi pressure. (Flow and max pressure adjustable by pulley size and electronic speed control).

Ram Sizes Suitable, 10 to 50 in^2 (Balanced type only).

Motor Rating, 1/4 HP continuous duty 144 in oz torque at 1750 rpm. 22 amps at full load. Permanent magnetic field.

COMMON AUTOPILOT TERMS AND CONCEPTS

PHC (Pilot House Control): The main control unit with all controls.

DPHC (Dual Pilot House Control): A remote station with all or nearly all the controls of a PHC. Usually used on the flying bridge.

"JOG" Power Steering: A method of steering using two buttons which activate the pilot power pack. The rudder moves as long as a button is held down. A rudder angle indicator is a must to indicate the rudder position. A popular method for commercial vessels.

PPS (Proportional Power Steering): A method of power steering using the pilot power pack where the rudder position is proportional to the knob position. The rudder goes to whatever position the knob is at and stays there until the knob is repositioned. In general this is a better way of steering than jog steering, particularly for fast, quick responding boats.

RANDOM ON-OFF REMOTES: A new technique devised by W-H to allow the autopilot to be turned on or off from any remote or from the PHC. No remote then depends upon any other station for its ability to completely function. Without this system one always had to turn on the main PHC, then turn the PHC to remote 1 or 2 and then proceed to the remote station.

"COURSE GRABBER" FEATURE: Another new concept devised by W-H to make autopilot operation easier. All W-H pilots can be turned on (no need to be on standby) and expected to immediately control the vessel on its existing course. Competitive pilots require course dials to be set, two or three switches to be turned on in sequence, or warm up periods of from 1/2 to 1 minute. If one does not operate these old style pilots, the vessel may take a quick turn when the pilot is activated. W-H pilots never deviate from the existing course when turned on. They operate instantaneously without any waiting periods.

HPP (Hydraulic Power Pack): A unit normally supplied with autopilots which consists of a reversible DC motor coupled to a bi-directional hydraulic gear pump. It is connected into the main steering lines of a boat with manual hydraulic steering. It provides the power to move the rudder while the autopilot or power steering is activated.

RAT (Rudder Angle Transmitter): A small waterproof unit which connects to the rudder arm and connects the rudder angle to an electrical signal which operates rudder indicators and supplies rudder angle data to the autopilot computer. It is also used when in the PPS mode.

RAI (Rudder Angle Indicator): An electrical meter calibrated in degrees port and starboard which indicates to the helmsman where the rudder is. A highly recommended optioned for all autopilot installations.

COMMON AUTOPILOT TERMS AND CONCEPTS (continued)

DCD (Digital Compass Display): An electronic display unit which has three digits which read from 000 to 359°. It indicates the vessel's heading when under pilot or manual operation.

POWER HYDRAULIC STEERING: A hydraulic steering system found on many larger commercial vessels. A hydraulic pump is usually connected to the main engine and the helm units only direct the oil flow. Common trade names are Orbitrol and Sperry. To use an autopilot with such a system only requires the installation of electrically operated 4-way valves. Usually one valve for port-starboard and one fast-slow speed valve. The valve solonoids usually are either 12, 24 or 32 volts DC or 115 vac. W-H builds solid state relay boxes to accomodate all these voltages. No HPP is required for this system.

MANUAL HYDRAULIC STEERING: A common system for pleasure boats and commercial boats under 50 feet. This system uses energy applied to the helm unit to pump oil to the cyclinder (or Ram) on the rudder arm. Commonly used systems included Hynautics, Capalano, Wagner, Glasser. A HPP with electric motor must be used for autopilot operation.

CEB (Compass Electronics Box): A small (4"x5"x2") box which comes with all W-H pilots which contains the electronics to operate the compass pickup system. It must be mounted within 2 feet from the compass.

M C (Motor Controller): A medium sized (5"x5"x8") box which is supplied with all W-H pilots which have a hydraulic power pack. It contains the solid state circuitry to control the motor direction and speed. It is normally mounted within 3 feet of the hydraulic power pack.

H C (Hand Controller): A small portable box which has the ability to control some autopilot functions away from the pilot house. Referred to as "Dodgers" by some. W-H builds a variety of H C units. Most have the ability to dodge (temporary course change) and C C (permanent course change.) Some turn the autopilot off and on or provide a power steering function. (Either PPS or Jog Units with the latter function have built-in rudder angle indicators. All W-H H C units are waterproof.

C C (Course Change): A small lever switch on most W-H autopilot systems which when pushed to the left or right changes the autopilot course. How far the course is changed depends upon how long the lever is held left or right.

DODGE: A temporary course change. When a "Dodge" button is pressed the boat will turn and continue to circle until it is released. (It then comes back to the original course.)

COMMON AUTOPILOT TERMS AND CONCEPTS (continued)

YAW: How far a vessel swings to Port and Starboard because of wave action. The Yaw control on an autopilot adjusts it to how far off course the boat will go before the autopilot starts turning the rudder to bring it back. W-H autopilots are adjustable from 1 to 11° (1/2 to 11° is optional.)

RUDDER GAIN: Is the number od degrees of rudder applied for the number of degress of compass error. W-H autopilots normally are adjusted for a 1 to 3 o/o range (1/2 to 2 o/o optional.) Some of our competitors call this a speed control as one normally turns it to higher numbers as boat speed decreases.

RUDDER LIMIT: Is the maximum amount the rudder will turn, irregardless of how far off course the vessel is. Making this adjustable provides a useful adjustment to keep the pilot from working harder than it needs to in heavy seas (particularly following seas.) W-H autopilots are adjustable from 3° to 20° for pilot operation and from 20° to 45° for power steering.

4.0 Operating Instructions

4.1 Check both YAW and rudder dials for "1" setting (fully counter-clockwise.)

4.2 With vessel on desired course, press "Pilot On" button (blue). The blue light should come on. (Turn "dim" control fully clockwise if it doesn't.)

4.3 If the water is rough and the red and green lights flash on and off more than every 10 seconds, turn the YAW control clockwise to higher numbers until the time between flashes is about 10 seconds.

4.4 Changing Course: If a small course changed is needed, one can press the course change (CC) knob on the controller. Press it left or right for only a fraction of a second for small changes and for 1 to 2 seconds for larger changes. Wait to see where the vessel ends up. If it hasn't gone far enough, give it another quick shot. Don't hold the CC lever down for more than 2 seconds at a time. If a larger course change is needed, it is easier to just push the white off button, turn the vessel by hand to the new course and push the pilot on button when on course.

4.5 Dodging (temporary course change): Both PHC units and remotes have red and green dodge buttons. When pressed, the rudder goes to a predetermined position and stays there until the button is released. (The original course is then resumed.)

4.6 Rudder Gain Control (right side knob with number 1 to 6): This control determines the amount of rudder applied for a given course error. Always leave it on "1" except for very slow speeds.

4.7 Dual Pilot House Control (DPHC, usually on flying bridge): With the exclusive W-H random "On-Off" system, this second controller can turn the entire system on or off or take command away from the PHC. The main PHC can also perform all these functions. Pressing the "Pilot On" button (blue) on either unit turns the system on. If the DPHC is on and in command, the PHC unit must first be pressed off and then on to take command. If the PHC unit is on and under control, the DPHC "Pilot On" button need only be pressed to turn the DPHC on.

4.8 Model HC-2-2 Remote Hand Controller: With the exclusive W-H rando "On-Off" system, this remote can turn the entire system on or off at anytime. When the boat is on the proper course, one merely presses the "Pilot On" button to activate the autopilot. If one wishes to dodge (temporary course change) one presses one of the two "Dodge" buttons. For small permanent course changes, one

4.8 Model HC-2-2 Remote Hand Controller (continued)

presses the "CC" lever momentarily, either left or right. For large course changes, one should press the pilot "Off" button, change course manually and then activate the pilot.

This unit also has a power steering (jog type) mode. When the power steering button is pressed, the "Dodge" buttons become jog steering buttons. The built-in rudder angle meter tells one where the rudder is at all times.

5.1 PHC and RAI Installation

The PHC is normally supplied with a stainless steel trunnion mount bracket. To mount the unit, first remove the two plastic wing screws and fasten the bracket with two #6-3/4" stainless sheet metal screws. Then plan where the output cable (or cables in the case of Model P-10) will go through the deck or bulkhead. The connectors will all go through a 3/4" diameter hole. The black plastic hole plugs supplied are then installed to complete the job. The optional RAI is mounted in a similar fashion. Remember that the RAI must be at least 1 foot away from the steering compass. The PHC is completely non-magnetic and can be placed anywhere.

5.2 Junction Box Installation

W-H Models P-1, P-2 and P-20 all have external junction boxes. (The Model P-10 has an internal junction box built into it.) These are mounted with four #6 sheet metal screws. A typical location would be behind an instrument panel or under a shelf. It should be in an open enough area so that the plugs and cables can easily be installed.

5.3 RAT Installation (Rudder Angle Transmittor)

The RAT must be mounted in the stern within two feet of the rudder arm. It must be mounted so that the arm points parallel to the arrow on the case when the rudder is centered. It can be mounted upside down, if necessary. A hole should be drilled in the rudder arm to attach to stainless steel activating cable. A #36 drill hole tapped 6-32 is ideal for attaching this cable to a stainless 1/2" x 6-32 screw. The distance from the rudder post to the hole must be the same as corresponding distance on the RAT arm. (See diagram # 5.06). Bend the wire around the screw on the rudder arm with both units centered. Crimp the small bronze lug with an electrical crimping tool or a pair of pliers to secure it. If you lose the bronze lugs, obtain more from your nearest deep sea fishing supply house. (They are 200 lb. test stainless steel line fittings.) The cable should be so installed that it doesn't bend as the rudder turns. The RAT is normally secured with four #6 x 1/2" stainless sheet metal screws.

5.41 Power Unit Installation

W-H builds two hydraulic power units, the Model I for light duty and the Model II for commercial vessels and pleasure boats over 40 feet in length. The units are similar except for the motor and bracket sizes. Copper tube fittings are supplied for 3/8" tube size with 1/4" drain lines. Also required is a lock valve and a solid state motor control unit which are normally supplied with the system.

5.42 Mounting

The preferred placement for the power pack components is in the stern near the hydraulic cylinder (or ram). The hydraulic power unit can be mounted in any position. Close proximity to the main hydraulic lines is usually the first priority in chosing a location. Remember that the pulleys and belts may have to be changed after installation. Four 3/16" and 1/4" lag screws of 1" or 1-1/4" length are normally used to mount this unit. The unit should be mounted high enough to avoid bilge water. The motor controller box is usually mounted within a foot or two of the power pack but larger distances are permissible. It is usually secured with four 1/2" #6 stainless steel metal screws. It must be mounted so that the fuse post, idle speed control and terminal strips are easily accessable.

The lock valve can be hung by its four connecting copper tubes (in mid air) or be secured with two screws to a timber. If hung in mid air, be sure that the tubing support is rigid enough to avoid excessive vibration.

5.43 Electrical Connections

Connect the two wires from the motor to the proper terminals on the large terminal strip. (See diagram #5.03). Connect the five smaller wires which come from the junction box to their proper positions on the smaller terminal strip. Bring two wires directly from the ship's batteries or main fuse box to the motor controller box. For short runs #12 wire is adequate (for Model I units.) Model II heavy duty units should be wired with #10 wire. If the main power wires are more than 12 feet long, then use wire one or two numbers smaller (larger wire.) These cables should be fused at their source for a minimum of 20 amps for Model I units and 30 amps for Model II units (12 v units.)

5.44 Hydraulic Connections

The Golden Rules of Hydraulic Installations:

1. Don't use a hacksaw to cut copper tubing. Use a standard wheel type tubing cutter which won't produce cuttings and chips which can completely paralyze the entire hydraulic system.
2. Don't use teflon tape on pipe or tube fittings. If a small piece gets into the lock valves, it can render them completely non-operative. Use teflon paste type sealer or vasoline.
3. Don't use compression fittings or plastic tubing for main hydraulic lines. Flared tube fittings are more reliable. The drain lines on most systems don't operate at large pressures and could be of plastic, if necessary. (W-H still recommends 1/4" copper tubes with flared fittings for drain lines, however.)

5.44 Hydraulic Connections continued

Cut the main steering lines and install tees to connect them to the hydraulic power pack (via the lock valve.) It is not important which line goes to which side since the motor rotation can be reversed electrically at a later time. Run a 1/4" copper tube drain line to the nearest system reservoir (in helm units on most systems.)

CAUTION! Do not connect the lock valve backward! (See diagram # 5.05).

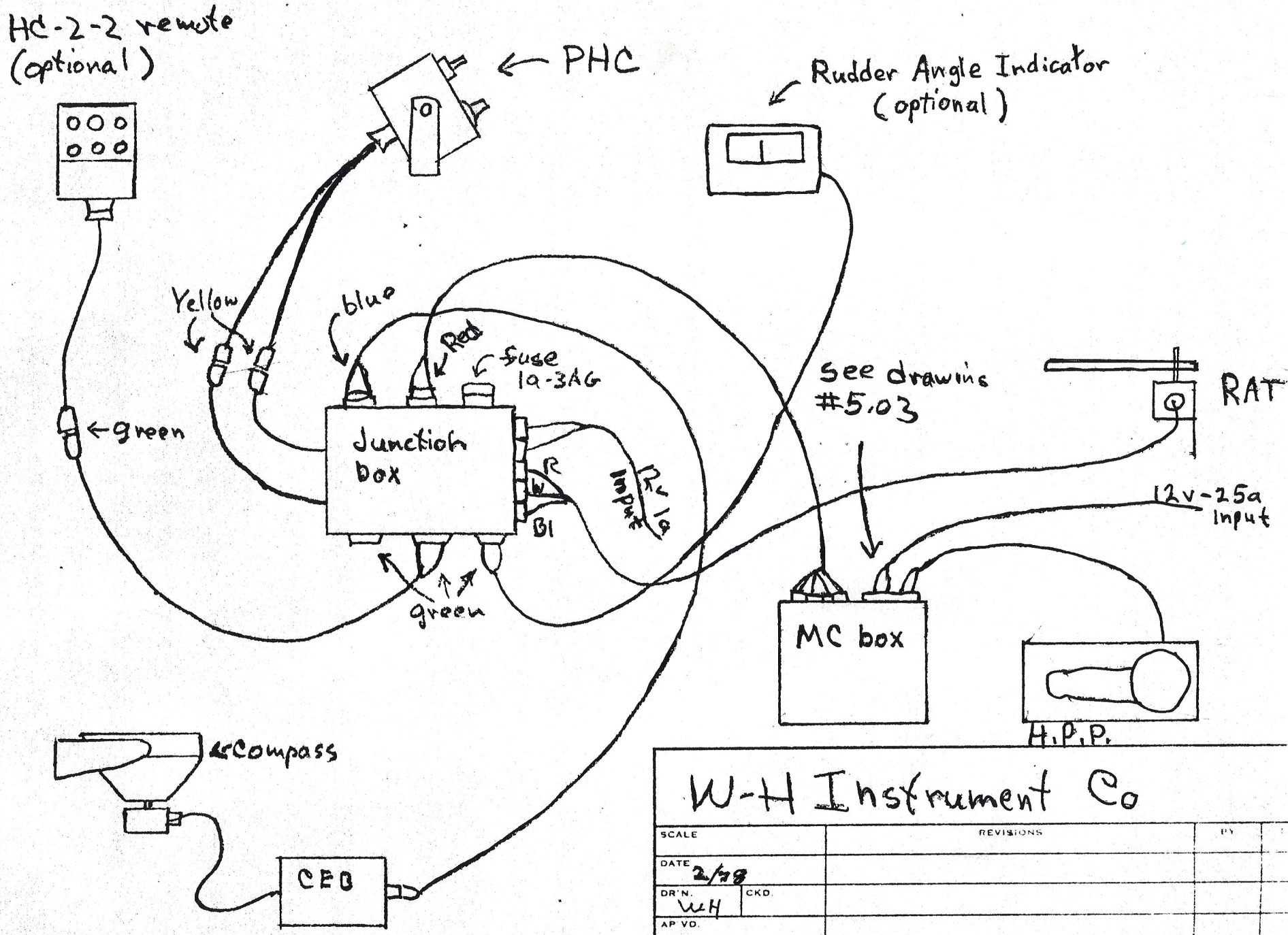
5.5 Compass Installation

W-H compass systems are all completely remote controlled so that they may be placed in the best possible location for steering the vessel. In wooden and fiberglass boats, a location close to the waterline has the advantage of providing the least horizontal travel and acceleration as the boat rolls. It should be mounted in a place where iron objects are not likely to be placed nearby. (A galley closet location usually works fine until someone fills it with canned goods.) It also must be at least 2 feet from the nearest steel object, 3 feet from electric motors, other compasses, or other large machinery. Radar Magnetrons (in use or spares) must be kept 8 to 10 feet away. W-H compass systems consist of a magnetic compass with a magnetic sensing system built-in under the bowl and a small compass electronics box (CEB) which is mounted near the compass. The CEB is totally non-magnetic and can be mounted close to the compass. The compass bracket is normally mounted to either a side wall or an overhead beam. (Use two #6-5/8" stainless steel sheet metal screws to fasten it.) It can be mounted in any direction or orientation, providing it hangs straight down and doesn't hit any other object when it swings in its gimbals. The CEB can be mounted in any position with four #6 stainless steel sheet metal screws. Try to leave room under the compass for a heeling magnet. Some wooden/glass boats need these, all steel boats should have them. They require about 7 inches directly below the compass. (See diagram #5.07).

5.6 Installation of Remote Units

Remote units comprise several remote controllers, (HC-1, HC-2, DPHC, HC-2-2, HC-12-2) and a waterproof RAI Model RA-10W. All these remote units are of waterproof construction and are suitable for permanent outdoor installation. Models DPHC and RA-10W have stainless trunnion mount brackets and are mounted just like the indoor PHC's with #6 screws. The other remote units are basically handheld and are normally placed in holders which are optionally available from W-H. Any of these units can be bolted down if the top cover is first removed to expose the screw hole "wells" which are outside the sealed area of the box. Number 6 or 8 screws can be then installed using a long-handled holding screw driver.

To run the wires into the hull, one must only drill 3/4" diameter holes for the connectors to pass through. A waterproof lexan plastic feedthrough is normally supplied on the cords for an easy waterproof installation. If the remote unit is to be moved around to different locations, W-H can supply a military type A-N connector with waterproof cover for outdoor installation. If the standard cable length are not long enough. order an optional extension cord from W-H. It has the proper connectors for plugging into the system without any cable splicing or soldering.



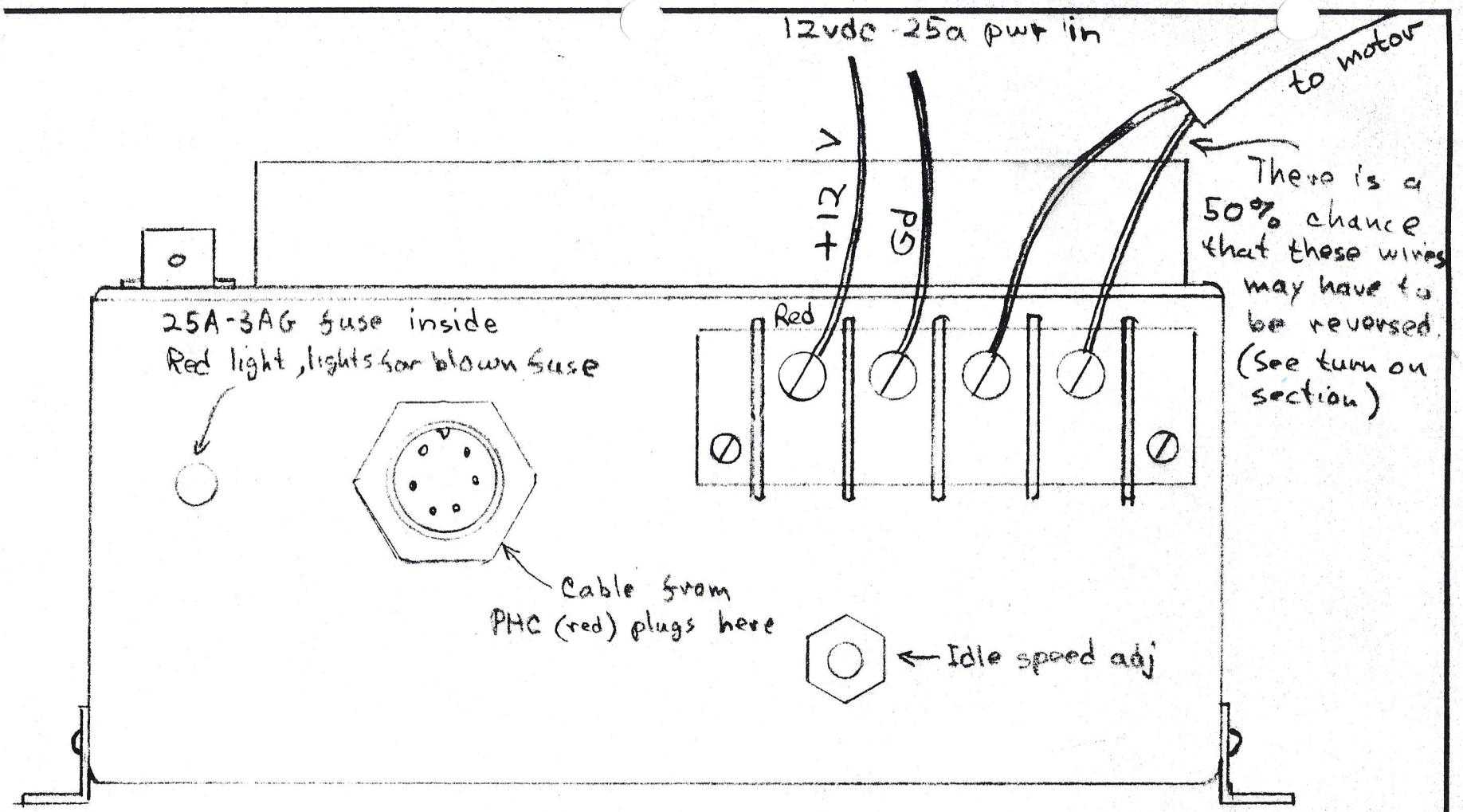
W-H Instrument Co

SCALE	REVISIONS	BY	
DATE 2/78			
DR'N. WH CKD.			
APVD.			

TITLE- P2 - P20 Autohelm Layout

NO P-2-20

ING 40-105



If the power in wires are reversed, the fuse will blow!

Motor Controler Wiring

SCALE: None	APPROVED BY:	DRAWN BY WHI
DATE: 12-1-79		REVISED

W-H Instrument Co - Seattle Wa

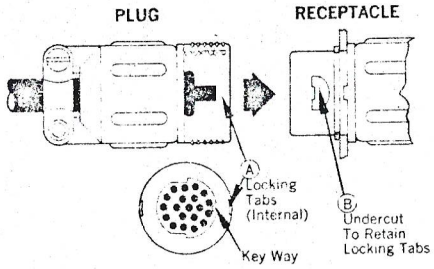
DRAWING NUMBER 5.03A

Function	Pins	color
Compass sig	7	blue
Output to MC	7	red
PHC to Junct. box	12	yellow
Remotes	12	green
RAI meter	7	brown

All plugs and receptacles are color coded. Plug plugs into sockets with the same color only.

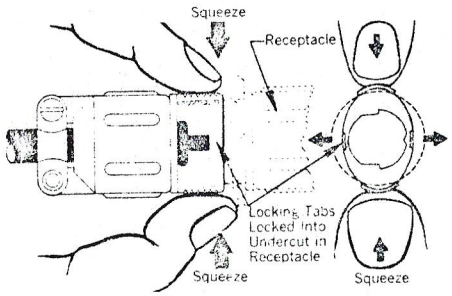
How To Use Thorkom Posi-Lok Connectors

To Mate



1. Turn plug so "keyed" insulator faces align.
2. Push plug onto receptacle until locking tabs (A) snap into undercuts (B).

To Disengage



DON'T TURN OR TWIST. DON'T USE HAND TOOLS.

1. Squeeze finger grips to flex plastic coupling area. The locking tabs will deflect outward and unlock.
2. Pull plug from receptacle.

REVISIONS		
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2		
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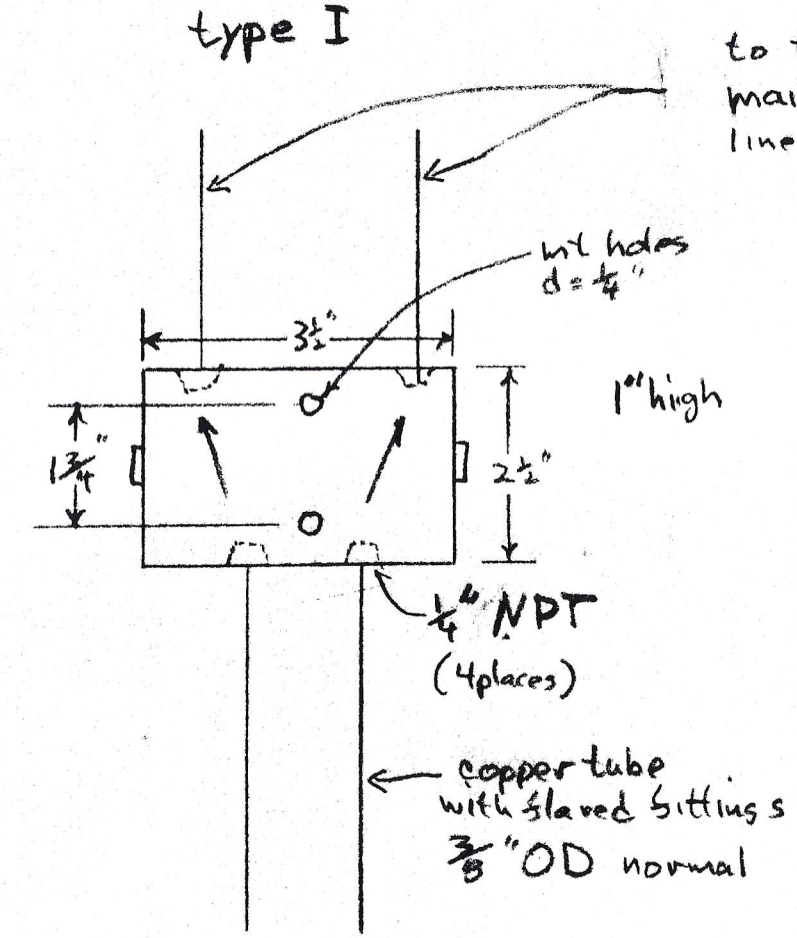
5		

Plug & receptacle data

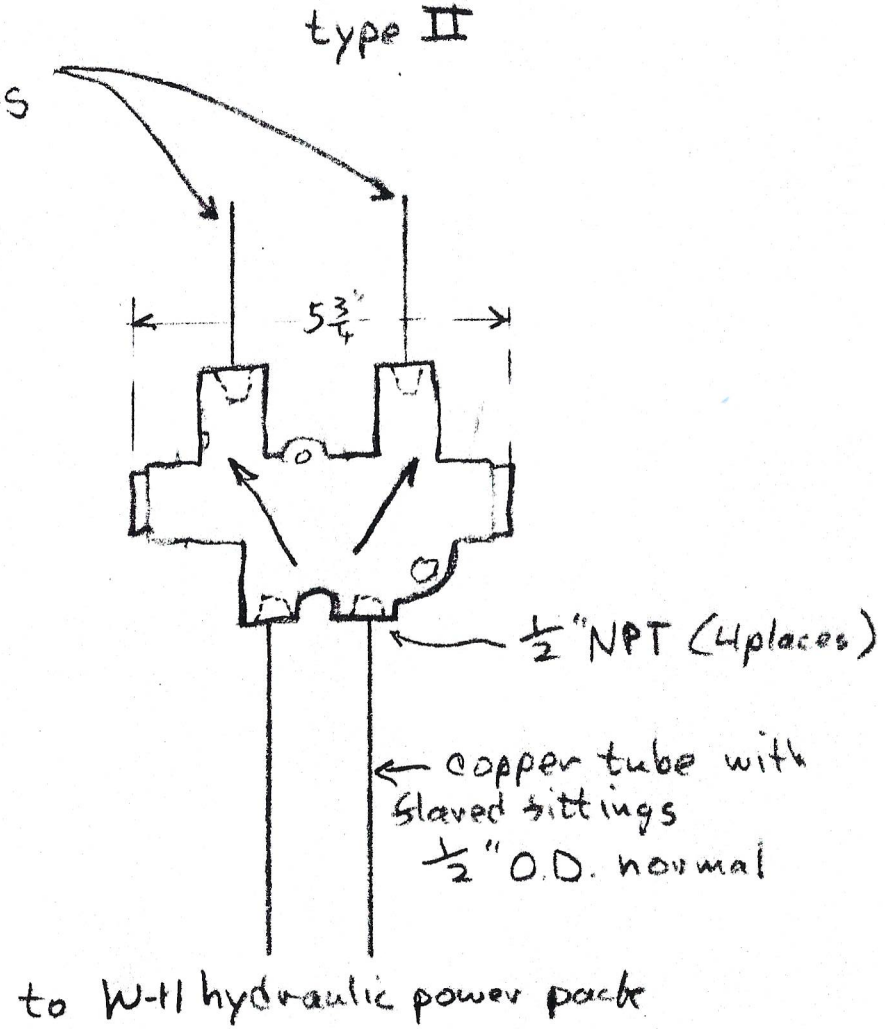
W-H Instrument Co

DRAWN BY	SCALE	MATERIAL
CHK'D	DATE 2/26/78	DRAWING NO. 5.04
TRACED	APP'D	

type I



type II



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Lock Valves

W-H Instrument Co

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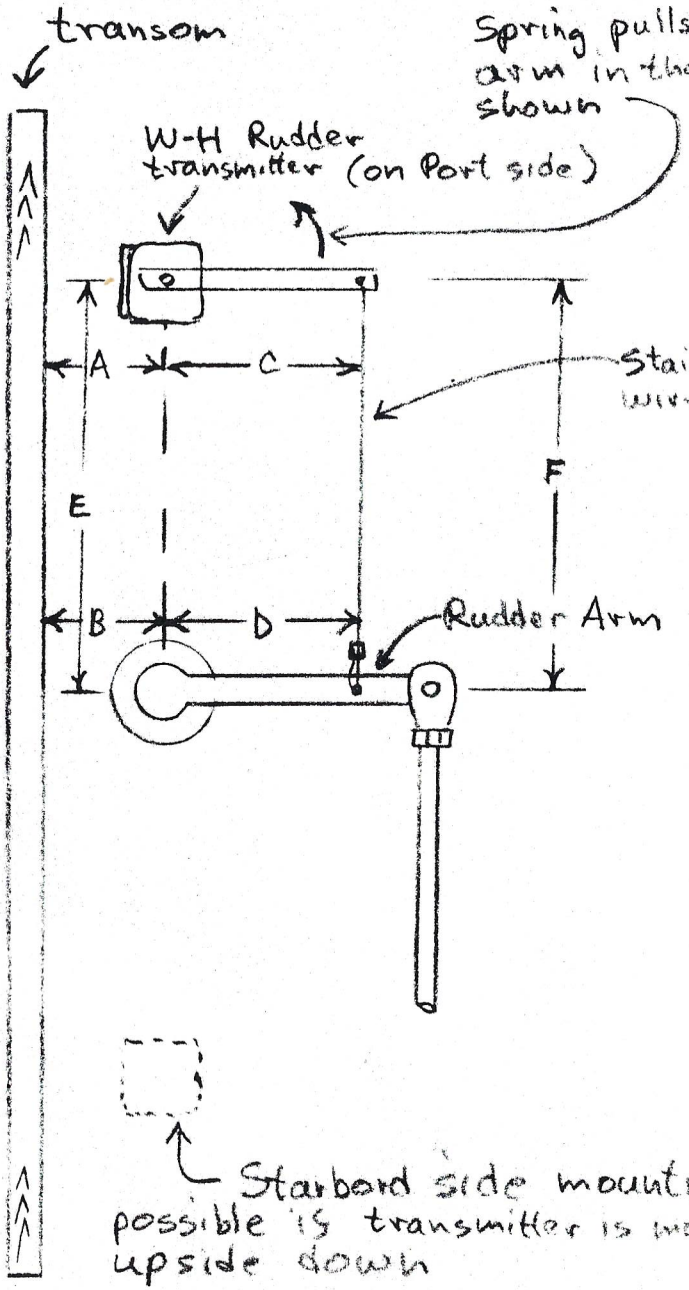

Distance A should equal distance B
" C " " " D
" E " " " F

C is 6½ or 4½ inches on standard RAT's.

W-H Instrument Co Seattle

SCALE NONE	REVISIONS	BY	DATE
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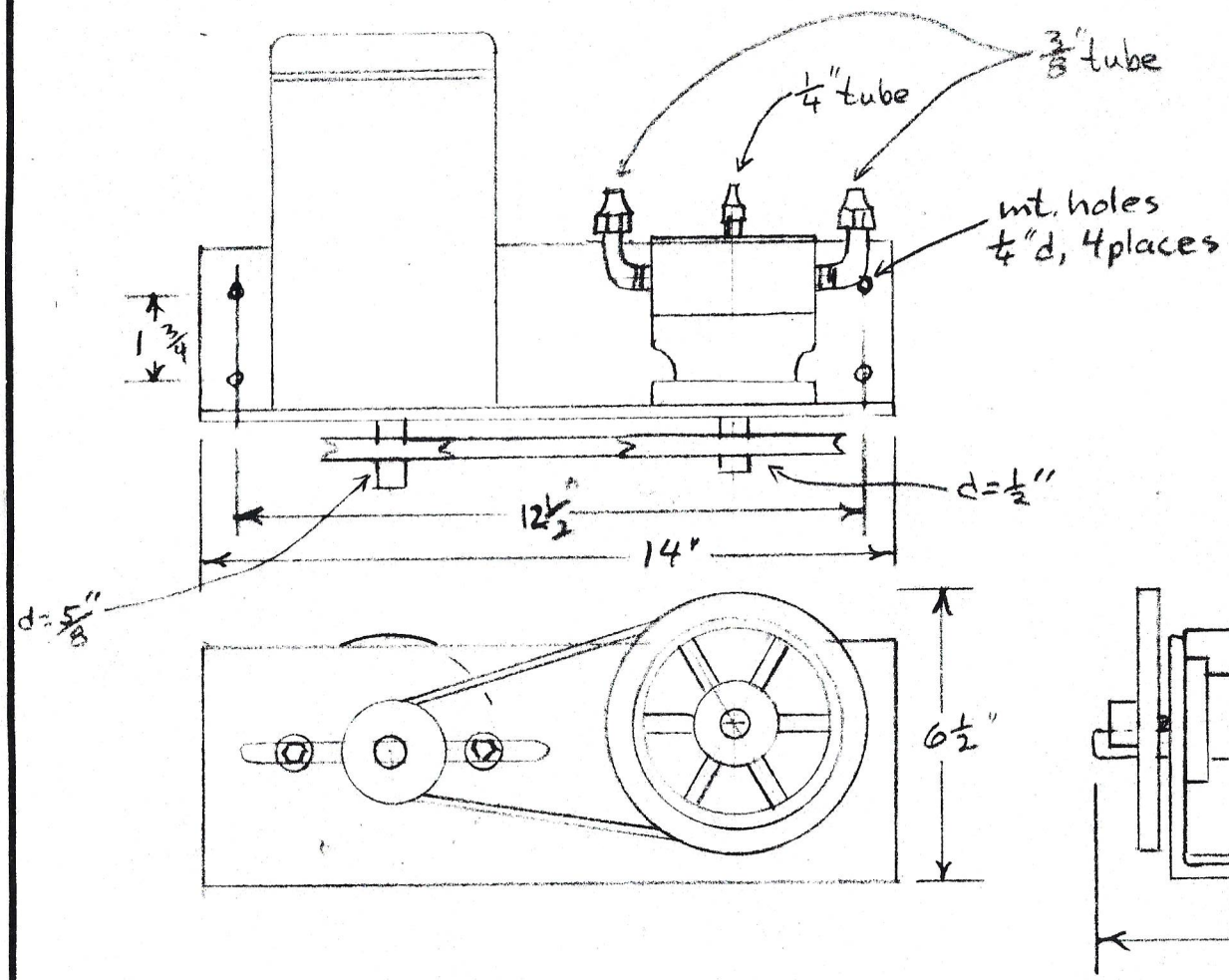
DR'N. WH CKD.			
AP'VD. WH			

TITLE RAT (Rudder Angle Transmitter) NO. 506

DRAWING 40-100



Motor: .24hp @ 1760rpm, cont
.54hp @ 1080 rpm, int.
9 lb-in cont. (22a)
30 lb-in int.
Permenent magnet field
Totally enclosed, no vents

Pump: .147 cu in rev, 300 rpm max
2500 psi max

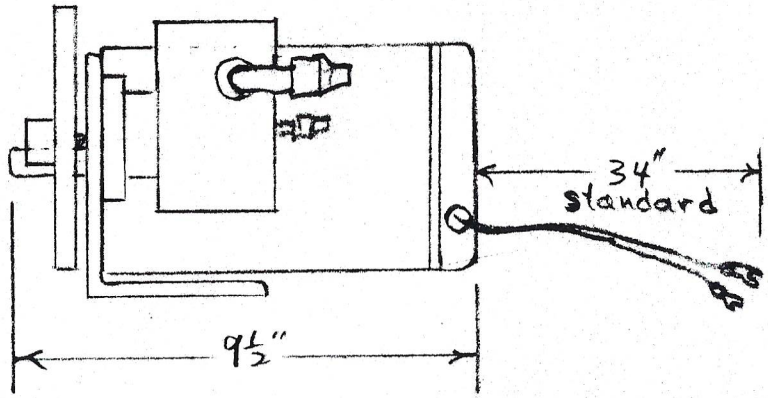
Pulleys: motor, 1½", 2", 3" } Normal sizes
pump, 6", 4" }

Bolt: 3L, 24, 26, 26" length, 4L opt.

Wieght: 21.5 lbs

Speed range: ~300 to 1700 rpm
(electronic speed control)

Current: ~4.5a (slow) to 22a max



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W-H Instrument Co

Heavy duty HPD

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6.0 Adjustment & Testing

Model P-2 Autopilot Initial Turn-On Procedure

6.1 Turn the "Yaw" control fully counter clockwise (to #1 on the dial), "Rudder Gain" fully counter clockwise, the "Rudder Limit: and "Dimmer" fully clockwise. Have all the cords connected, except the compass (blue plug.) Have it disconnected at either the CEB or Junction Box end. Press the "Pilot On" button. The blue light should come on and rudder should come to approximately its center position. If it isn't centered, turn the yellow adjustment Pot. inside the PHC until it is.

6.2 If a HC-2-2 remote is present, proceed as follows:

Press the orange power steering (PS) button. The meter lights should come on. Now turn the steering wheel to Port and watch the rudder angle meter to see that it goes Port also. If the meter goes backwards (this can only happen if the RAT is mounted upside down) then reverse the black and red lead on the Junction Box which comes from the RAT. Now press the red (Port) Dodge button and note that the Rudder Angle Meter also goes to Port. If it doesn't, reverse the two leads from the hydraulic pump motor at the MC box. If either the RAT or motor leads were reversed, go back to step 6.1 and recenter the rudder with the yellow screw driver control inside the PHC

6.2A If a HC-2-2 remote is not present, use this procedure in place of 6.2 above:

Remove the cover on the PHC and turn the yellow screw driver Port. until the rudder is centered. If this doesn't work smoothly, the motor polarity is probably backwards. Go to the hydraulic power pack and reverse the two motor leads on the MC box. Turn the pilot on again and short the small green wire (#3 on the smaller terminal strip) to ground (#2 on the large terminal strip) and observe that the helm is moving so as to make the boat turn to starboard (right.) If the yellow Pot. still doesn't move the rudder smoothly, the RAT signal may be backwards. (This can only happen if the RAT is mounted upside down.) If the RAT signal is backwards, it can be connected by reversing the red and black RAT wires on the Junction Box.

6.3 Press the orange PS button on the HC-2-2 and hold the red Port Dodge button down until the rudder stops moving. Then turn the steering wheel to see if it goes a little farther. (It should.) If the electronic limit system limits either too soo or too late, turn the green adjustment screw inside the PHC. Turning this clockwise gives more rudder, turning it counter clockwise gives less rudder.

6.4 If the rudder hunts (oscillates back and forth) when the pilot is on, try reducing the minimum Yaw by turning the red screw driver control in the PHC clockwise until it just barely stops. If this Pot. has to be turned more clockwise than its center position, try again to bleed air from the hydraulic system. If this doesn't stop the hunting, try a larger pulley size on the hydraulic pump. Hunting on some boats will occur when the boat is at dockside, but not when it is moving. (Due to the water pressure on the rudder.)

6.5 Take the boat away from the dock and bring it to normal cruising speed, away from other boats and the shore. With the compass cable still disconnected, turn the pilot on and adjust the yellow Pot. inside the PHC until the boat goes exactly dead ahead. Turn the pilot off, install the cover on the PHC and reconnect the blue plug. (Put airplane glue or cement on the adjustment controls in the PHC if possible.)

6.6 With the boat going in a straight line, turn the pilot on and observe an occasional red or green light indicating normal course correction. Watch the ship's main compass, it should stay within $\pm 1^{o}$ or so.

6.7 Try going N, S, E and W. If the boat doesn't steer as well going North (in the Northern Hemisphere) refer to the heeling magnet instruction sheet (diagram #5.07).

6.8 If the optional hand held controller is installed try both the "Dodge" and "Course Change" functions. If the "Dodge" buttons turn the boat too fast, turn the "Rudder Limit" Pot. (on the from of the PHC) counter clockwise until it turns less.

W-H AUTOPILOTS, INC.

655 NE Northlake Place Seattle WA 98105 (206) 633-1830

LIMITED TWO YEAR WARRANTY

1. This warranty applies to all autopilots and accessories manufactured by or bearing the nameplate of W-H Autopilots, Inc.. The warrantor warrants all such equipment to be free from defects in workmanship or material under normal use and service.

2. The warranty registration card must be returned to Warrantor at the address indicated above before there will be any warranty coverage service for the equipment.

3. This warranty shall extend only to the original purchaser of the equipment (or end user, if sold by a dealer).

4. There is no warranty coverage of any kind for defects or damage due to water immersion or salt spray, except for equipment which is designated as waterproof. Warranty is void if waterproof unit has been submerged in more than 2 feet of water for more than 30 minutes.

5. Only person expressly authorized by Warrantor shal be permitted to perform warranty service. Warranty work is normally performed at the Warrantor's factory at the address indicated above.

6. This warranty is in effect for twenty-four (24) months from the date of purchase from the factory or from one of its authorized dealers.

7. The expense of transporting the defective equipment to the Warrantor's factory shall be paid in advance by the purchaser. The Warrantor shall pay for return shipping costs (by UPS, within the continental USA only) for all equipment repaired or replaced for the first 12 months of the warranty period. During the last 12 months of the 24 month warranty period, the repaired or replaced equipment will be returned freight collect. Parts found not to be defective during any part of the Warranty will also be returned freight collect.

8. W-H Autopilots, Inc. extends no warranty on fuses or pilot lights. All hydraulic pumps, hydraulic cylinders, pulleys and belts will be covered for only the first 12 months of this warranty.

9. If the returned equipment is found by the Warrantor to be defective in workmanship or material, the equipment will be repaired or replaced at the above address or Warrantor's place of business without charge, except for transportation charges as herein provided, and there will be no option for the purchaser to receive a refund of the purchase price until after a reasonable number of attempts to remedy the defect have been made by the Warrantor.

10. The purchaser's obligation in the event of defect is to:

    1. Contact the Warrantor by letter or by phone describing the problem in detail and receiving instructions for which components to send for repair.

    2. Deliver the defective items freight pre-paid to the Warrantor.

11. There is no warranty and Warrantor shall not be held liable for any damages incurred as a result of a malfunction of any part of Warrantor's products if said damages occur during or as a result of the autopilot being left unattended by the operator. Warrantor will not be liable for any damages arising from collisions with other vessels or objects. The autopilot product, including parts thereof, is designated to assist the operator or the man on watch to navigate accurately by maintaining an average course selected by the man on watch. The Warrantor's product is not designed to, and does not, replace the man on watch. Due to the potential of a collision with an object in the vessel's path, or of an electrical, mechanical, or hydraulic malfunction of the parts of the autopilot or the associated equipment of the vessel, the energized pilot should never be left unattended when the vessel is moving. Remote control units should only be used in situations where mechanical or hydraulic steering controls are near at hand on in situations where a steering failure would not cause damage before the operator could reach manual controls.

12. This warranty applies only to properly installed new equipment operated and maintained to the manufacturer's ratings and recommendations and does not cover any defect in installation. There are no warranties which extend beyond the description on the face hereof. This warranty is expressly in lieu of all other warranties, guarantees, obligations or liabilities expressed or implied, by the Warrantor or its representative. All statutory or implied warranties, other than title, are hereby expressly excluded. An owner's remedy is limited exclusively to obtaining the repair and replacement of the non-conforming goods or parts in accordance with this warranty. This warranty specifically excludes W-H Autopilots, Inc. and its dealers shall have no liability for any consequential damages including but not limited to the loss or damage to any vessel, structure, or to any person or persons or any delay suffered in connection with the use of the equipment. This warranty cannot be altered or modified in any way and shall be construed in accordance with the laws of the state of Washington.