WOOD FREEMAN®

AUTOMATIC PILOTS

500 SERIES

INSTALLATION & SERVICE MANUAL

PLEASE LEAVE ON VESSEL

HOLDS THE COURSE YOU GIVE IT

PRINTED IN U.S.A.

Manufactured by

METAL MARINE PILOT, INC. / 2119 Mildred St. West (67th Ave. West) Tacoma, Washington 98466, U.S.A.

A/C 206 564-5902

WOOD FREEMAN® AUTOMATIC PILOTS

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****
500 SERIES
INSTALLATION & SERVICE MANUAL

TABLE OF CONTENTS

METAL MARINE PILOT, INC.
2119 MILDRED STREET WEST
TACOMA, WASHINGTON 98466
(206) 564-5902

WOOD FREEMAN®
AUTOMATIC PILOTS

WARNING

A qualified **MAN ON WATCH** is **LEGALLY REQUIRED** whenever vessel is **UNDERWAY.**

WOOD FREEMAN Autopilots are **NAVIGATIONAL AIDS** designed (when installed in accordance with instructions furnished), to assist the man on watch to maintain the average course which he selects.

These Autopilots are NOT designed nor approved to replace the man on watch, nor relieve him of the responsibilities required by the Rules of the Road for maintaining a good lookout or for continual safe navigation of the vessel.

Activate autopilot only in open waters, well clear of other vessels or obstructions, and monitor heading at all times.

Be prepared to resume manual steering and inactivate autopilot immediately in the event that
(a) Chosen heading is not maintained.
(b) An unscheduled change of heading occurs. (See Par. VIII (3) of Limited Warranty)
(c) Any situation arises wherein continuing set course might put vessel in jeopardy.

LIMITED WARRANTY

LIMITED WARRANTY APPLIES TO ALL PRODUCTS OF METAL MARINE PILOT, INC.

I. The Warrantor is **METAL MARINE PILOT, INC.**, of 2119 Mildred Street West, (67th Avenue West), Tacoma, Washington 98466: Telephone (206) 564-5902

II. This warranty shall extend only to the original purchaser of the equipment.

III. 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

IV. This warranty applies to all equipment manufactured by or bearing the nameplate of Metal Marine Pilot, Inc., and Warrantor warrants all such equipment to be free from defects in workmanship or material under normal use and service.

V. This warranty is in effect for a period of twelve (12) months from the date the equipment is shipped from the factory.

VI. 1. If any part of the equipment proves to be defective in workmanship or material, the Warrantor will examine said equipment after it is returned to Warrantor as hereinafter stated, and

2. 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 of 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.

3. Only persons expressly authorized by Warrantor shall be permitted to perform warranty service.

VII. 1. If purchaser believes any part of the equipment is defective, he shall return said part within twelve (12) months of the date of purchase to the Metal Marine Pilot, Inc. factory at the address herein provided.

2. The expense of transporting the defective equipment to the Warrantor's factory and the expense of returning the repaired or replaced equipment shall be paid in advance by the purchaser.

VIII. 1. 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 representatives. All statutory or implied warranties, other than title, are hereby expressly excluded. This warranty will not apply where the purchaser or others have misused or abused or failed to normally service the equipment and Warrantor will not be liable for any damages of any kind caused by such misuse, abuse or lack of service.

2. 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, and equipment so designated is warranted as set forth in Paragraph VI herein.

3. 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 designed 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.

4. There is no warranty for model Nos. 11, 15, 150 and 420 if they are used on any hydraulic steering gear.

5. The sole remedy available to the purchaser if there is a defect in material or workmanship of the equipment is as set forth in Paragraph VI.

6. The Warrantor assumes no liability for incidental or consequential damages of any kind.

IX. The Purchaser's obligation in the event of defect are to:

1. Prepare a written detailed statement of the defect;

2. Deliver the written statement to Warrantor's factory at the above indicated address;

3. Deliver or arrange for the delivery of the equipment to Warrantor's factory; and

4. Arrange for the return of the equipment from Warrantor to purchaser by either agreeing to pick up the equipment at Warrantor's factory or by depositing with Warrantor sufficient funds to pay to have the equipment delivered to purchaser by means of commercial transportation.

X. Purchaser hereby agrees that he has read the above and understands that the above Warranty sets forth the exclusive warranty for this equipment.

January, 1978

METAL MARINE PILOT, INC.
2119 Mildred Street West (67th Ave. West)
Tacoma, Washington 98466
Telephone: Area Code 206 564-5902
R. M. Freeman, President

RETURN TO:
METAL MARINE PILOT, INC.
2119 MILDRED STREET WEST
TACOMA, WASHINGTON 98466
(206) 564-5902

WOOD FREEMAN® AUTOMATIC PILOTS

VESSEL EVALUATION DATA

	SECTIONS REQUIRED	SECTIONS OPTIONAL
ALL PILOT ORDERS	A D E	C
ALL HYDRAULIC STEERING	A B* D* E*	C
RUDDER STEERING EVALUATION	A B D E	C

* ON REPEAT ORDERS FOR STOCK VESSELS FOR WHICH MANUFACTURER'S SPECIFICATIONS HAVE BEEN FURNISHED, THESE ITEMS MAY BE OMITTED BY GIVING NAME OF MANUFACTURER, MODEL NAME, AND HULL NUMBER IN SECTION A.

SECTION A
REQUIRED FOR ALL PILOTS

MODEL REQUIRED _____ DATE _____

DEALER'S NAME:_____ CITY, STATE:_____

PO #:_____

CUSTOMER'S NAME_____ ADDRESS_____ CITY, STATE & ZIP_____

VESSEL'S LENGTH_____FT. BEAM_____FT. DRAFT_____FT. TOP SPEED_____KNOTS POWER_____ SAIL___

VESSEL'S NAME OR MFG. HULL NUMBER_____ MANUFACTURER_____

MODEL_____ SHIPBOARD VOLTAGES AVAILABLE: 12V DC_____ 24V DC_____ 32V DC_____ 115V AC_____

TYPE OF STEERING: MECHANICAL:_____ HYDRAULIC:_____ (COMPLETE SEC. B) OTHER (SPECIFY):_____

HARDOVER - WHEEL TURNS _____ DEGREES OF RUDDER TRAVEL._____

CHECK IF FIXED KORT NOZZLE. _____ NOZZLE DIAMETER (INCHES)

SECTION B

PLEASE RECOMMEND HYDRAULIC STEERING SYSTEM. REQUIRED FOR ALL HYDRAULIC STEERING.

(X) BRAND NAME OF STOCK STEERING SYSTEM:_____
(X) MODEL # OR SERIES # OF CYLINDERS:_____ (X) NUMBER OF CYLINDERS:_____

COMPLETE THE FOLLOWING - IF SYSTEM IS CUSTOM OR IF ANY OF THE ABOVE MARKED WITH (X) ARE BLANK:

RUDDER CYLINDER - BORE _____IN. OR OUTSIDE DIAMETER·_____IN. STROKE:_____IN. ROD DIAMETER:_____IN.

TILLER ARM - FROM CENTER OF RUDDER STOCK TO CYLINDER CLEVIS PIN·_____IN.

HELM UNIT - MFG._____ MODEL OR SERIES #_____

IF VESSEL HAS POWER STEERING - AUXILIARY PUMP UNIT - GPM MIN._____ GPM MAX._____

SECTION C

REQUESTED TO COMPLETE OUR RECORDS:

IS REMOTE COURSE CHANGE REQUIRED? YES_____ NO_____

IS 500 SERIES AUTOPILOT COMPASS WANTED FOR A STEERING COMPASS? YES_____ NO_____

NEW VESSEL_____ EXISTING VESSEL_____
VESSEL'S USE: COMMERCIAL_____ PLEASURE_____
VESSEL'S MATERIAL: WOOD____ GLASS____ STEEL____ ALUMINUM____ CEMENT____
PILOT HOUSE MATERIAL: WOOD____ GLASS____ STEEL____ ALUMINUM____ CEMENT____

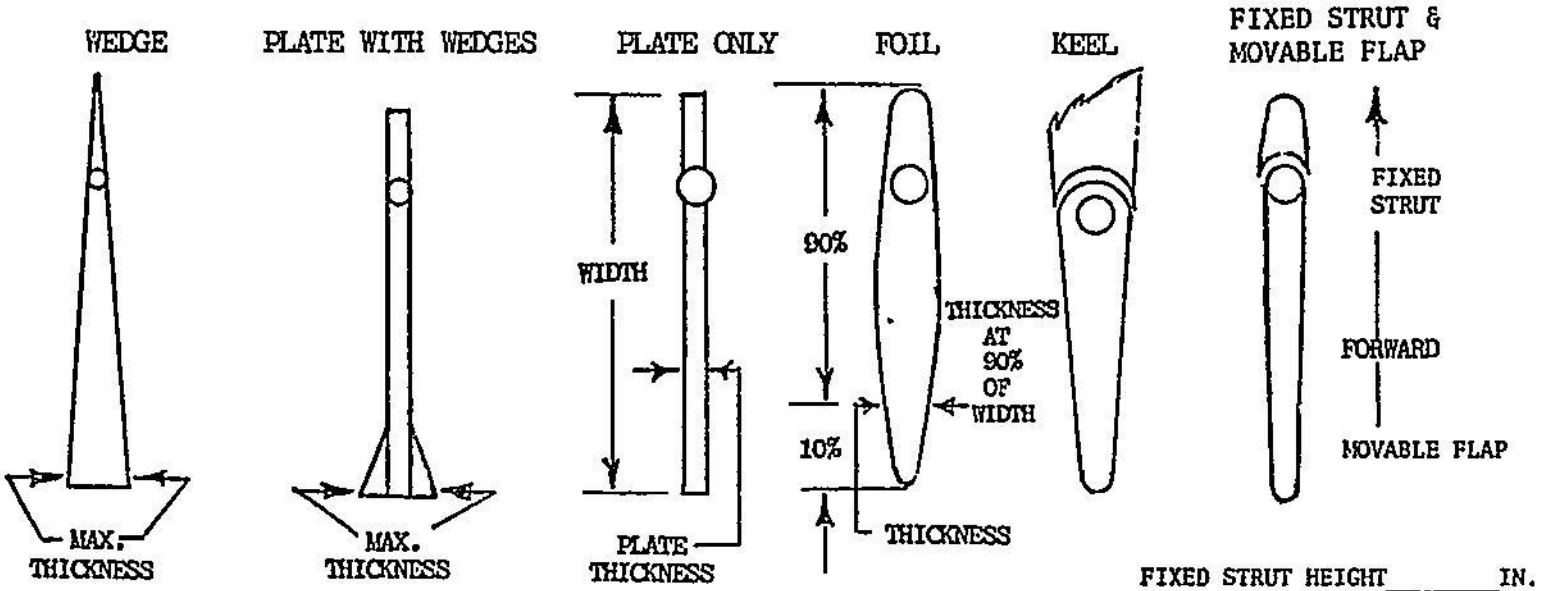
PRIMARY REQUIREMENT FOR AUTOPILOT:
CRUISING____ COURSE HOLDING____ RAPID MANEUVERING____ CRABBING____ GILLNETTING____ SEINING____ TROLLING____
DRAGGING____ LONGLINING____ LOBSTERING____ OTHER (SPECIFY)_____

MAKE AND MODEL OF EXISTING AUTOPILOT_____ NONE_____

SECTION D

REQUIRED FOR ALL PILOT ORDERS OR IF RUDDER EVALUATION IS DESIRED.

CROSS SECTIONAL SHAPE OF RUDDER (TOP VIEW) CIRCLE ONE: -



_____IN. _____IN. _____IN. _____IN.

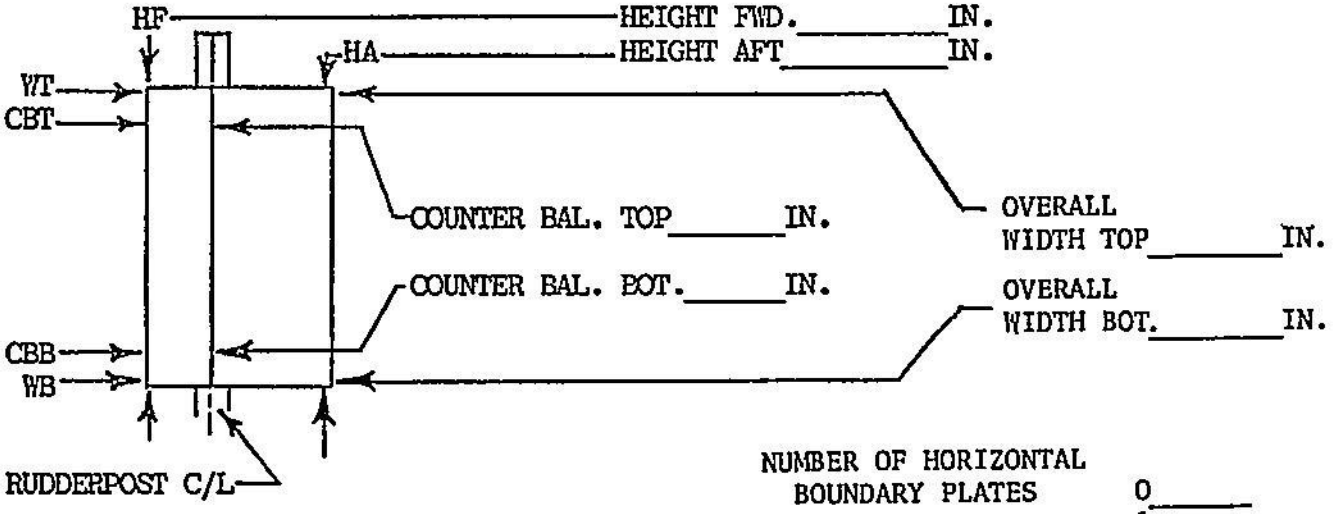
FIXED STRUT HEIGHT _____ IN.
FIXED STRUT WIDTH _____ IN.
FLAP HEIGHT _____ IN.
FLAP WIDTH _____ IN.

SECTION E

REQUIRED FOR ALL PILOT ORDERS OR IF RUDDER EVALUATION IS DESIRED.

NUMBER OF RUDDERS _____

RUDDER DIMENSIONS IN INCHES:



POST DIAMETER _____ IN.

NUMBER OF HORIZONTAL BOUNDARY PLATES
0 _____
1 _____
2 _____

← FORWARD

RUDDER STOCK EXTENDS ACROSS THE RUDDER PLATE:

0% _____ 25% _____ 50% _____ 75% _____ 100% _____

DESCRIPTION OF WOOD FREEMAN® 500 SERIES AUTOMATIC PILOTS

SECTION B

Reference Block Diagram 5006008

The Model 500 WOOD FREEMAN® AUTOMATIC PILOT is steered by a magnetic compass. Magnetically sensitive Hall-Effect crystals are used for sensing a vessel's deviation from the set course on the magnetic compass, and also, for detecting movement of the rudder from the center line position. There is no reaction of the sensing system to disturb the compass magnets. The information sensed by Hall-Effect crystal HGC-1 passes through course error amplifier I.C.401. Crystal HGC-2 information passes through Rudder Angle amplifier I.C.201. Outputs of I.C.401 and I.C.201 are compared in a two-channel amplifier (Left-Right Rudder Servo Driver) which triggers steering engine to produce Right or Left Rudder movements until rudder signal matches the compass signal.

A "RUDDER DIAL" system on the Console and remotes allows direct dialing of rudder position for power steering. The final output drive to the steering engine gives a Left-Stop-Right signal from mercury relays L-5 and L-6 capable of handling 20 amps D.C. Automatic provision is made for sensing and correcting for vessel's turn rate. Sensitivity, permanent helm, rudder follow-up ratio, and "anti-hunt" controls allow operator adjustments of these features when required.

VESSEL HEADING CIRCUITS

Turns of the vessel from the pre-set compass course (compass magnets) develop in HGC-1 a D.C. voltage which is proportionate to the course error angle. The polarity of the voltage is determined by the direction of turn from the course. This signal is linearly amplified by course error amplifier.

A portion of I.C.401 output passes to the rate of change of the vessel's heading with respect to the set course (the rate of the vessel's swing). The amplified course error information from I.C.401 passes through "Rudder" Amplitude Control (RV803) and this is combined with the rate information from I.C.402 through "Counter Rudder" Amplitude Control (RV804) and fed to the two-channel amplifier as a compass control signal. The combined position and rate command signal from the compass circuits provide automatic course correction without overswing, even in a following sea. "RUDDER" amplitude control proportions the compass signal to produce a variable coupling ratio between the compass and the rudder. "COUNTER RUDDER" amplitude control proportions the rate signal. The rate signal then recombines with error signal to produce the compass command signal.

RUDDER POSITION CIRCUITS

A voltage corresponding to rudder angle is generated by HGC-2 in the Encoder. This voltage is amplified by the rudder angle amplifier and enters the feedback input of the two-channel Amplifier (Left-Right Rudder Servo Driver and NULL DAMPER). A portion of the output from the rudder angle amplifier is fed through a resistor to an optional Rudder Angle Indicator which provides a continuous, accurate indicator of the rudder position.

Rudder Position Circuits - continued

When compass command voltage exceeds the rudder feedback voltage by more than the "NULL" voltage (set by "NULL" control), a "left rudder" signal is sent through L-1 and L-6 to steering engine. Conversely, if command signal is positive, a "right rudder" signal occurs. In this manner a control of the rudder position which is a function of vessel's course error and rate and direction of swing is obtained.

"RUDDER DIAL" POWER STEERING

A "RUDDER DIAL" potentiometer (RV802) is furnished on the Console for a manually controlled "command" input thus producing full-followup power steering. The Control Console function switch provides this change of function and also allows transfer of control to a remote "RUDDER DIAL".

NULL DAMPER
Steering Engine "Anti-Hunt"

Since no steering engine stops immediately on signal, and "coasting" will increase as speed increases, a circuit called a "NULL DAMPER", which ordinarily is adjusted at the time of installation, provides compensation for the speed of the steering engine so that fast steering engines are prevented from "hunting" (overtravelling the "NULL" and continually oscillating from side to side). With proper steering engines of adequate horsepower, it is possible to obtain speeds of 15 degrees to 18 degrees per second in rudder rotation with excellent control - both for direct rudder dialing and automatic control from the compass.

PERMANENT HELM ADJUSTMENT

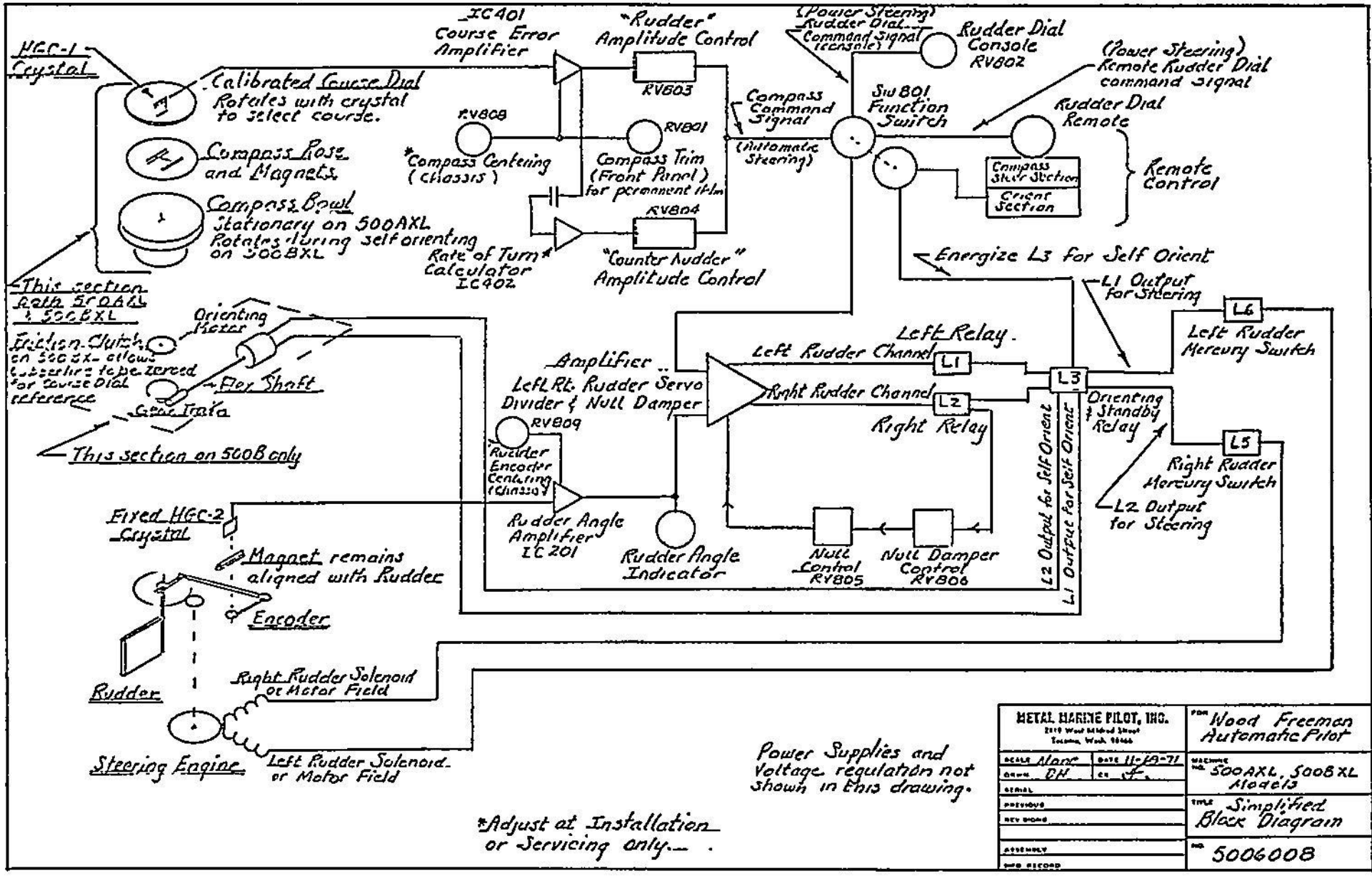
On the front panel of the Console, "COMPASS TRIM" Control (RV801) trims the compass course for permanent helm effect.

ADJUSTMENTS FOR WIDE RANGE OF VESSEL SPEEDS

"RUDDER" Amplitude Control (RV803) for adjusting the rudder throw for a given amount of course displacement allows the operator to immediately adjust for a continuous range of vessel speeds from 2 knots to 30 knots.

VARIABLE RATE COUPLING

"COUNTER RUDDER" Amplitude Control (RV804) or rate coupling on the front panel is adjustable to suit the needs of the particular vessel or the sea conditions existing. The "COUNTER RUDDER" allows the Pilot to "anticipate" future actions of the vessel by sensing rate of turn and making corrections as necessary.



METAL MARINE PILOT, INC. 2919 West Mildred Street Tacoma, Wash. 98466	FOR Wood Freeman Automatic Pilot
SCALE None / DATE 11-19-71	MACHINE NO. 500AXL, 500BXL Models
DRAWN DH / CK	
SERIAL	
PREVIOUS	TITLE Simplified Block Diagram
REV SIGNS	
ASSEMBLY	NO. 5006008
SHIP RECORD	

DIFFERENCES BETWEEN 500-A-XL & 500-B-XL MODELS

The 500-A-XL Model Pilot uses a compass on which the course is dialed directly. The 500-B-XL Model uses an identical system with the addition of a gear-driven compass base and gear-motor which allows orienting of the compass bowl by the electric motor to permit a permanent change of course from a remote station.

B-1 Compasses having a 4 1/2" card are used on A-1 and B-1 models. These are best used as standby or remote compasses because the size of their card and the necessity for reading the actual heading from above the compass limits their utility for primary steering compasses. Compasses having a 6" card are used on the A-2 and B-2 models. These compasses are suitable for primary steering compasses or master compass, having an easily read card, with excellent stability and accuracy. The B-2 model, in addition to its remote course changing capability, has a locking feature which locks the lubber line in the reference (dead ahead) position when using the compass for navigation or direct course dialing.

Remote controls are available for both units. In the case of the 500-A-XL model, the remote control will allow "RUDDER DIAL" power steering function and switching between power steering and compass steering. It is not possible to make a permanent compass course change by remote control, but it is necessary to dial the compass directly each time a permanent course change is desired. The "STANDBY" - "SELF-ORIENT" position of the remote gives only "STANDBY" on this model. (Vessel may be steered by wheel without autopilot interference.)

The remote control of the 500-B-XL model, on the other hand, allows not only the "RUDDER DIAL" power steering function and return to the pre-set compass course; but also, allows a change in the permanent course by means of the self-orienting feature. "SELF-ORIENTING" for new course occurs when function switch is in "STANDBY" - "SELF-ORIENT" position, during which time vessel may be steered by wheel. Direct course dialing at the compass top is also possible.

While the 500-B-XL compass is quite useful as secondary steering compass, use of the "B-1" model compass as a master steering compass is not recommended because the "lubber line" is rotated through 360 degrees while self-orienting. However, a friction clutch in the gear train allows the compass bowl to be rotated manually to a preset reference point when "lubber line" steering is required.

On radar equipped vessels locating the 500 Compasses adjacent to the radar console (unless the magnetron is in the console) is recommended to allow direct course dialing when navigating by radar. The accurate course holding of the 500 Series pilot stabilizes the heading of the vessel and thus provides a sharp picture free of the scope "smudging" which occurs with the heading variations of hand steering. The course dial feature then allows the operator to make exact heading changes while watching the radar.

REMOTE CONTROLS

All models incorporate the "RUDDER DIAL" on the Console and in the remote control. This "RUDDER DIAL" allows full follow-up power steering and causes the steering engine to match the rudder to the angular position dialed, either on the Console or the remote rudder dial. Remote is standard on 500-B1-XL, optional on 500-A1-XL.

REMOTE CONTROLS - continued

A lever steering accessory is available for both models. This lever steering accessory is in a cast brass case, is waterproof, and can be mounted in any exposed location such as a trolling hatch, at the rail of the vessel, or at the flying bridge. Multiple remote controls are also possible by using the suitable junction box. In going from one remote control to another, it is necessary to leave each remote in the "COMPASS STEER" position when going to the next remote, then full control is obtained at the next remote station. When the function switch on the front panel is set to "REMOTE", then any one of the remotes can function in the manner noted above. However, when the function switch is turned to any other position besides "REMOTE", all of the remotes are inoperative.

Reprint of:
December, 1974 text

Metal Marine Pilot, Inc.
2119 Mildred Street West
Tacoma, Washington 98466
Phone - Area 206 564-5902

WOOD FREEMAN® AUTOMATIC PILOTS

SECTION C

WOOD FREEMAN® AUTOMATIC PILOTS
****
500 SERIES
INSTALLATION INSTRUCTIONS

TABLE OF CONTENTS

* ADDITIONAL INFORMATION ON SELECTION OF COMPASS MOUNTING LOCATION AND COMPASS ADJUSTMENT AVAILABLE ON REQUEST FROM FACTORY...."NAUTICAL - COMPASSES, 1978"

** SEE APPENDIX FOR ADDITIONAL CABLING INFORMATION.

- WARNING -

Cutting or splicing connecting cables of this system (except as noted below), is an improper installation procedure, voids the limited warranty, and makes the installer liable to the owner for subsequent cable replacement. Splices corrode, are subject to moisture leakage, R.F.I., shorts, opens and misconnections that can damage components.

EXCEPTIONS:

Encoder cable plug (8-pin) may be unsoldered in order to pull cable forward from rudder post area and then resoldered carefully and correctly. DO NOT REMOVE SOCKET, (potted) from aft end of cable.

2-conductor power cable from ship's power to XL Power Supply may be extended in accordance with wire sizes and lengths shown on Table 1 - below.

3-conductor motor cord on power pack (or limit switch assembly on -511LS units) may be extended in accordance with sizes and lengths shown on Table 1.

TABLE 1

FOR #12 MOTOR WIRE EXTENSIONS - (In stock)

Voltage	-531 (A Motor)	-531 (Std.Motor)	-521 (Std.Motor)	-531 (D, S, T or K Motor)
12	6'	8.5'	13'	-
24	-	32'	50'	8.5'
32	-	55'	85'	8.5'

FOR #10 MOTOR WIRE EXTENSIONS - (Customer Furnished)

12	9'	13'	20'	-
24	-	48'	75'	13.5'
32	-	82'	128'	13.5'

FOR #8 MOTOR WIRE EXTENSIONS - (Customer Furnished)

12	14'	20'	30'	-
24	-	73'	114'	20'
32	-	124'	194'	20'

April 1978

Metal Marine Pilot Inc.
2119 West Mildred Street,
Tacoma, Washington 98466
Telephone (206) 564-5902

WOOD FREEMAN® AUTOMATIC PILOTS

* 500 SERIES *

INSTALLATION INSTRUCTIONS

* GENERAL NOTES *

Connect all cables to components as shown on Component Layout Drawing #5006010-B-2. If longer cables are required, be certain to use shielded cables where specified on Drawing #5006010-B-2, or use standard WOOD FREEMAN® extension cables. DO NOT CUT, SPLICE, or OTHERWISE MODIFY, including use of terminal connectors: ENCODER, COMPASS, 12 CONDUCTOR, RUDDER ANGLE INDICATOR or REMOTE CONTROL cables. Failure to use shielded cables may cause temporary malfunction of the AUTOPILOT when strong radio-frequency fields are present, such as transmitting on the vessel's radio phone.

If it is necessary to remove the PLUG end of any cable in order to pass the cable through conduit or a bulkhead, be sure to reattach the wires to the correct pins on the plug. Incorrect connections or cold solder joints may cause malfunctions and may cause component failure.

NOTE: CUTTING, SPLICING, OR OTHERWISE MODIFYING CONNECTING CABLES IS CONSIDERED ABUSE OF THE SYSTEM AND VOIDS THE LIMITED WARRANTY.

Although grounding of components is not generally required, when strong radio - frequency fields are present the following should be followed:

Allow a minimum mounting distance of 3 feet between the radio and any of the autopilot components.

Route all connecting cables for the Autopilot at least 12 inches from the radio's antenna cable and the radio's power cable.

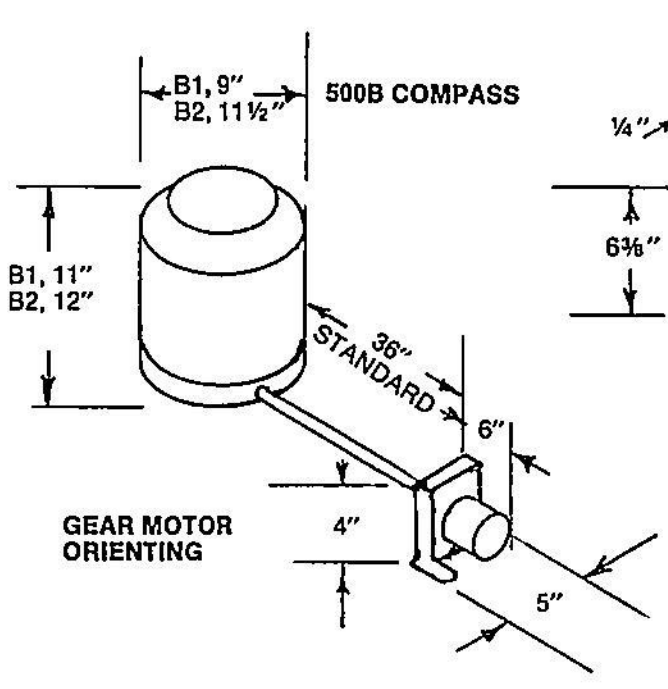
Connect a separate ground, #8 cable or 1 inch or wider bonding strap, to the back of the Control Console and to the XL Power Supply.

The XL Power Supply will accommodate 12, 24, or 32 volts DC primary inputs (32 volts up to 37 volts maximum), switching the primary input voltage through 20 amp mercury relays to the split field series motor or solenoid valve of the steering engine (Power Pack). All computer voltages are automatically regulated at 14 volts or less.

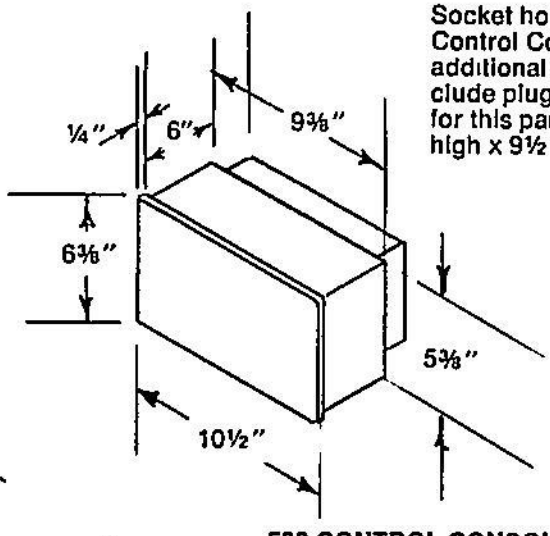
Adjustment for the primary input voltage is accomplished by shifting two (2) taps on the input terminal strip of the power supply. Proper connections are shown both on the XL Power Supply nameplate and on the terminal strip label.

If 115 volts AC single phase power is required as the primary source, the Model 35-B Rectifier (available as an extra cost accessory), must be used to provide a suitable DC input to the XL Power Supply.

IF ANY QUESTIONS ARISE AS TO THE PROPER INSTALLATION PROCEDURE, PLEASE CALL THE FACTORY FOR A SPECIFIC RECOMMENDATION.

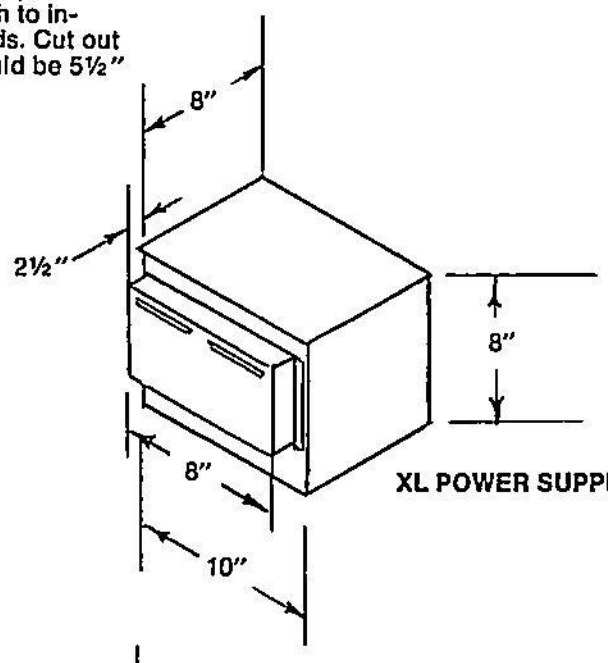


GEAR MOTOR ORIENTING

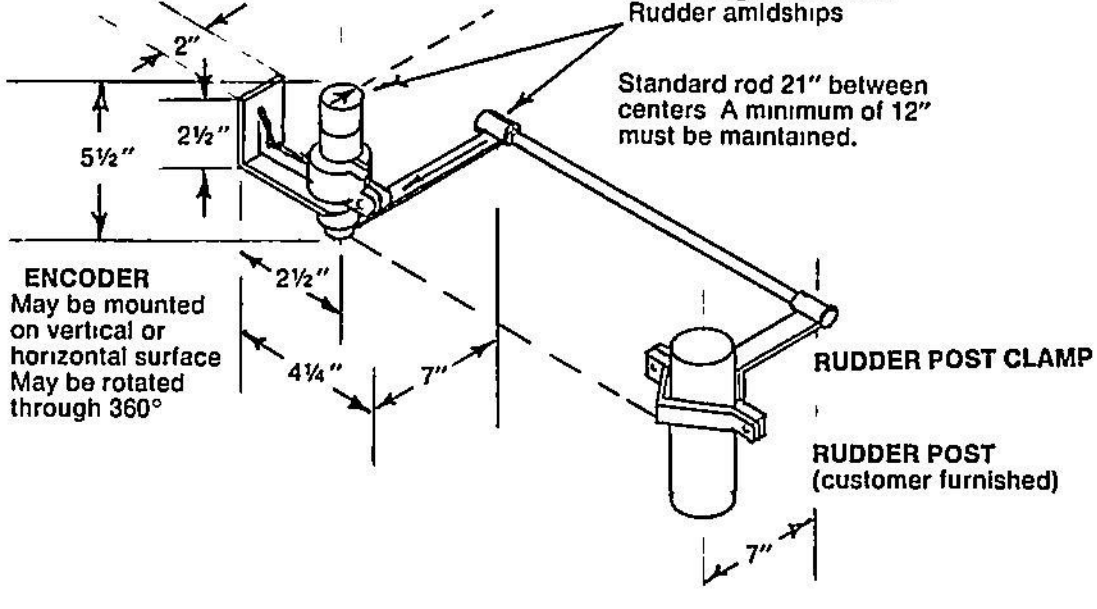


500 CONTROL CONSOLE

Socket housing on rear of Control Console requires an additional 5" depth to include plugs & cords. Cut out for this panel should be 5½" high x 9½" wide



XL POWER SUPPLY



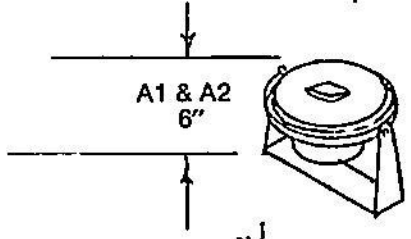
Arrow alignment when Rudder amidships

Standard rod 21" between centers A minimum of 12" must be maintained.

ENCODER
May be mounted on vertical or horizontal surface
May be rotated through 360°

RUDDER POST CLAMP

RUDDER POST
(customer furnished)



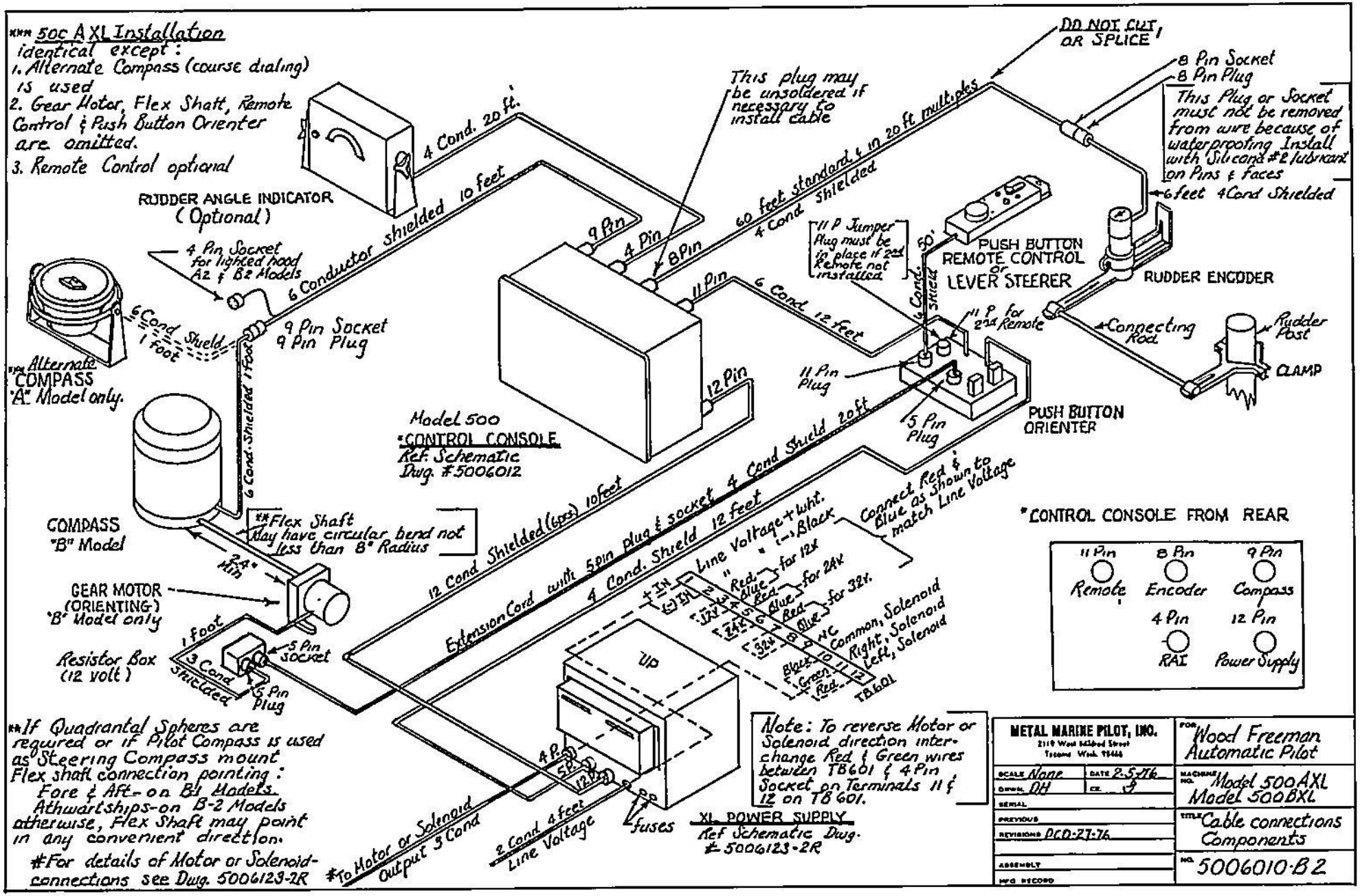
MODEL 500A COMPASS
500A is identical to 500B except. 500A Course Dial Compass is used, and no Gear Motor is required.

A1, 8½"
A2, 10"

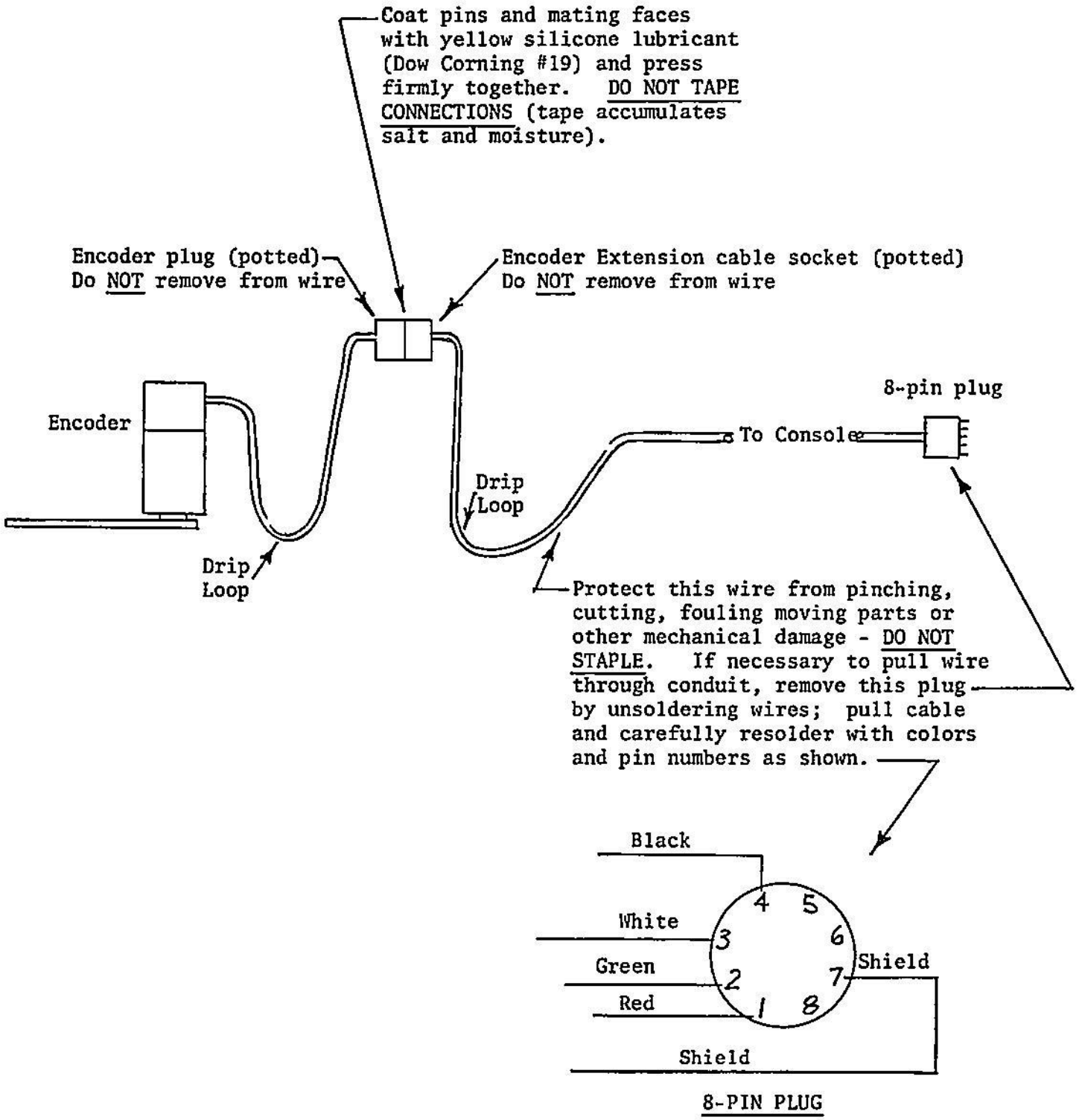
WOOD FREEMAN AUTOMATIC PILOTS

MITRA MARINE PILOT INC.
2119 MILDRED STREET WEST TACOMA WASHINGTON 98466 U.S.A.
Telephone (206) 564-6902

MODEL 500 Series	SCALE None	DATE 3-29-79
	DRWN DH	CK
	ASSEMBLY	
TITLE Installation Dimensions	SERIAL	
	PREVIOUS 5001000B	
	NO. 5001000-B-1	


*** 50c AXL Installation identical except:
1. Alternate Compass (course dialing) is used
2. Gear Motor, Flex Shaft, Remote Control & Push Button Orienter are omitted.
3. Remote Control optional
RUDDER ANGLE INDICATOR (Optional)
4 Cond. 20 ft.
6 Conductor shielded 10 feet
4 Pin Socket for lighted hood A2 & B2 Models
6 Cond. Shield 1 Foot
9 Pin Socket 9 Pin Plug
** Alternate COMPASS "A" Model only.
6 Cond. Shielded 1 Foot
COMPASS "B" Model
** Flex Shaft May have circular bend not less than 8" Radius
24" Min.
GEAR MOTOR (ORIENTING) "B" Model only
1 Foot
3 Cond Shielded
5 Pin Socket
6 Pin Plug
Resistor Box (12 volt)
Model 500 CONTROL CONSOLE
Ref. Schematic Dwg. #5006012
9 Pin
4 Pin
8 Pin
11 Pin
12 Pin
This plug may be unsoldered if necessary to install cable
60 feet standard, 4 in 20 ft multiples
4 Cond Shielded
DO NOT CUT OR SPLICE
8 Pin Socket
8 Pin Plug
This Plug or Socket must not be removed from wire because of waterproofing. Install with Silicone #2 lubricant on Pins & faces
6 feet 4 Cond Shielded
11 P Jumper Plug must be in place if 2nd Remote not installed
50'
4 Cond. Shield
PUSH BUTTON REMOTE CONTROL or LEVER STEERER
RUDDER ENCODER
6 Cond. 12 feet
11 P for 2nd Remote
Connecting Rod
Rudder Post
CLAMP
11 Pin Plug
5 Pin Plug
PUSH BUTTON ORIENTER
12 Cond Shielded (tops) 10 foot
Extension Cord with 5 pin plug & socket
4 Cond. Shield 12 Feet
4 Cond Shield 20 ft
Line Voltage + wht.
" - Black
Red
Blue
for 12v
for 24v
for 32v.
Common, Solenoid
Right, Solenoid
Left, Solenoid
Green
TB601
Connect Red & Blue as shown to match Line Voltage
* CONTROL CONSOLE FROM REAR
11 Pin Remote
8 Pin Encoder
9 Pin Compass
4 Pin RAI
12 Pin Power Supply
UP
4 P.
5 P.
12 P.
To Motor or Solenoid Output 5 Cond
2 Cond 4 feet Line Voltage
fuses
XL POWER SUPPLY
Ref Schematic Dwg. #5006123-2R
Note: To reverse Motor or Solenoid direction interchange Red & Green wires between TB601 & 4 Pin Socket on Terminals 11 & 12 on TB601.
** If Quadrantal Spheres are required or if Pilot Compass is used as Steering Compass mount Flex shaft connection pointing: Fore & Aft - on B1 Models. Athwartships - on B-2 Models otherwise, Flex Shaft may point in any convenient direction.
# For details of Motor or Solenoid connections see Dwg. 5006123-2R
METAL MARINE PILOT, INC.
2119 West Mildred Street
Tacoma Wash. 98466
SCALE None
DATE 2-5-76
DRWN. DH
CK.
SERIAL
PREVIOUS
REVISIONS DCO-27-76
ASSEMBLY
MFG RECORD
FOR Wood Freeman Automatic Pilot
MACHINE NO. Model 500 AXL Model 500 BXL
TITLE Cable connections Components
NO. 5006010-B2

RECOMMENDED METHOD OF WATERPROOFING ENCODER PLUG CONNECTIONS WHEN INSTALLING ENCODER IN WET LAZARETTE AREAS



8-PIN PLUG

October, 1972

WOOD FREEMAN® AUTOMATIC PILOTS

* SPECIAL INSTRUCTIONS FOR COMPASS ADJUSTMENT *

BEST STEERING IS OBTAINED WITH A COMPENSATED COMPASS !!!

ON STEEL VESSELS the Pilot compass MUST be adjusted within 5 degrees of correct magnetic heading on North, South, East and West, and must have any heeling error compensated.

TURN ON PILOT -	Models 11, 15	- clutch disengaged.
	Models 420, 4210	- clutch disengaged with selector on "Automatic".
	Models 423, 423-B	- selector on "Change Course".
	Model 500 series	- function switch either "OFF" or "RUDDER INDICATOR ONLY".

Bring the boat on a known magnetic East or West course using either landmarks or corrected steering compass. If the Pilot compass is more than 5 degrees out of agreement, place a magnet on either side of compass, red end forward if compass reads to the North, and red end aft if compass reads to the South of what it should. Move the magnet near or far until compass reads correct course.

Bring the boat on the known magnetic North or South course. Place a magnet in front or back of compass with red end to right if compass reads to the West of the course, and red end to left if it is to the East. Move near or far until correct adjustment is obtained. This compass need not be adjusted within the same degree of precision necessary for the steering compass, but in any case it should not be more than 5 degrees out. Often, when the Pilot is installed and the compass has not been properly compensated, the Pilot will operate and hold the boat perfectly on certain courses, but on other courses the steering will be erratic. This is due to lack of compensation of the Pilot compass.

ADEQUATE COMPENSATION OF THE COMPASS IS USUALLY IMPOSSIBLE IF THERE ARE HORIZONTAL OR VERTICAL STEEL RODS, PIPES OR STACKS ENDING WITHIN 24 INCHES OF THE COMPASS. (See diagram on reverse side of this sheet)

Poor compass adjustment is usually shown by failure of the Pilot to maintain some headings while steering well on others.

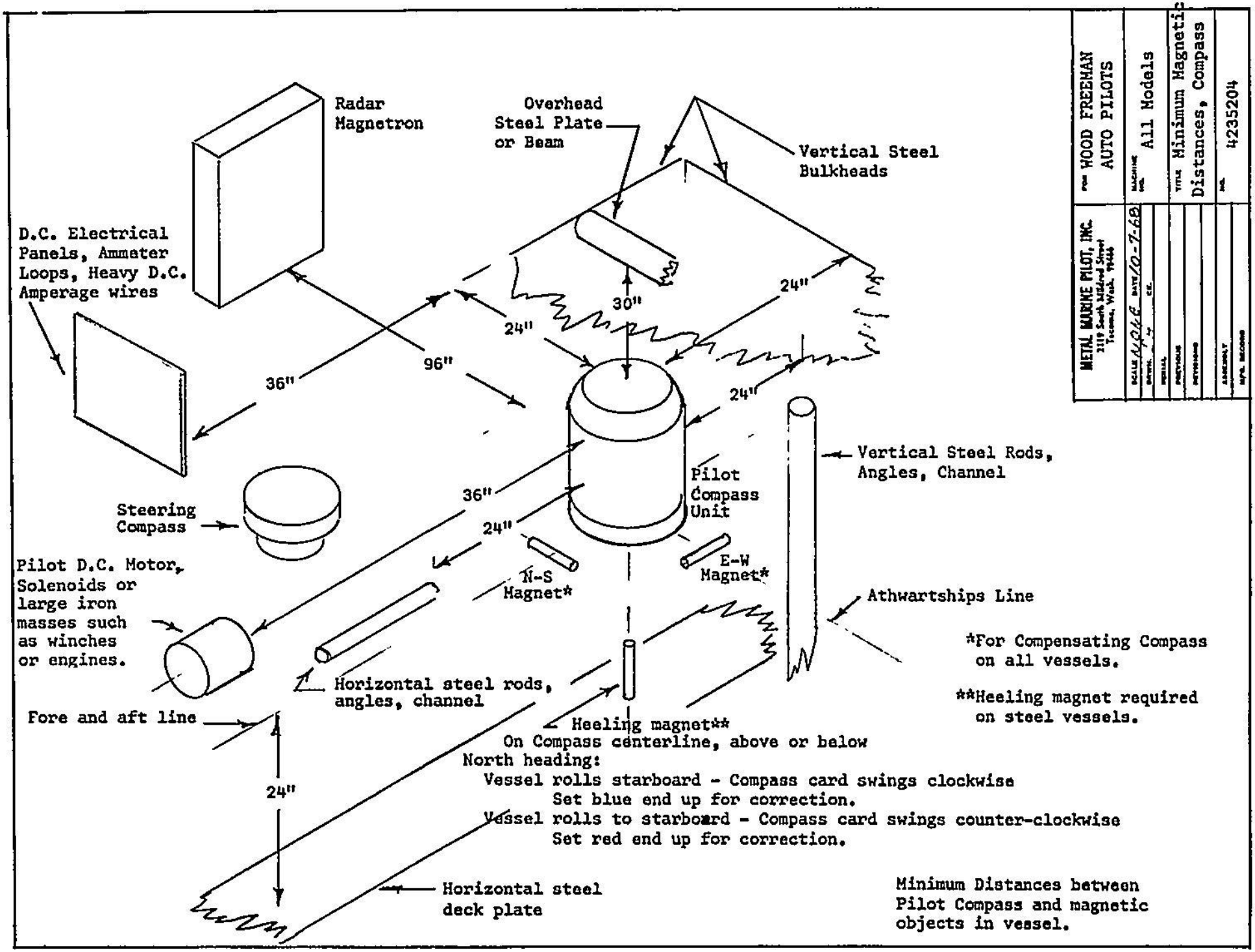
STEEL VESSELS

Compass compensation on steel vessels, while more exacting, is usually not difficult if simple rules are observed:

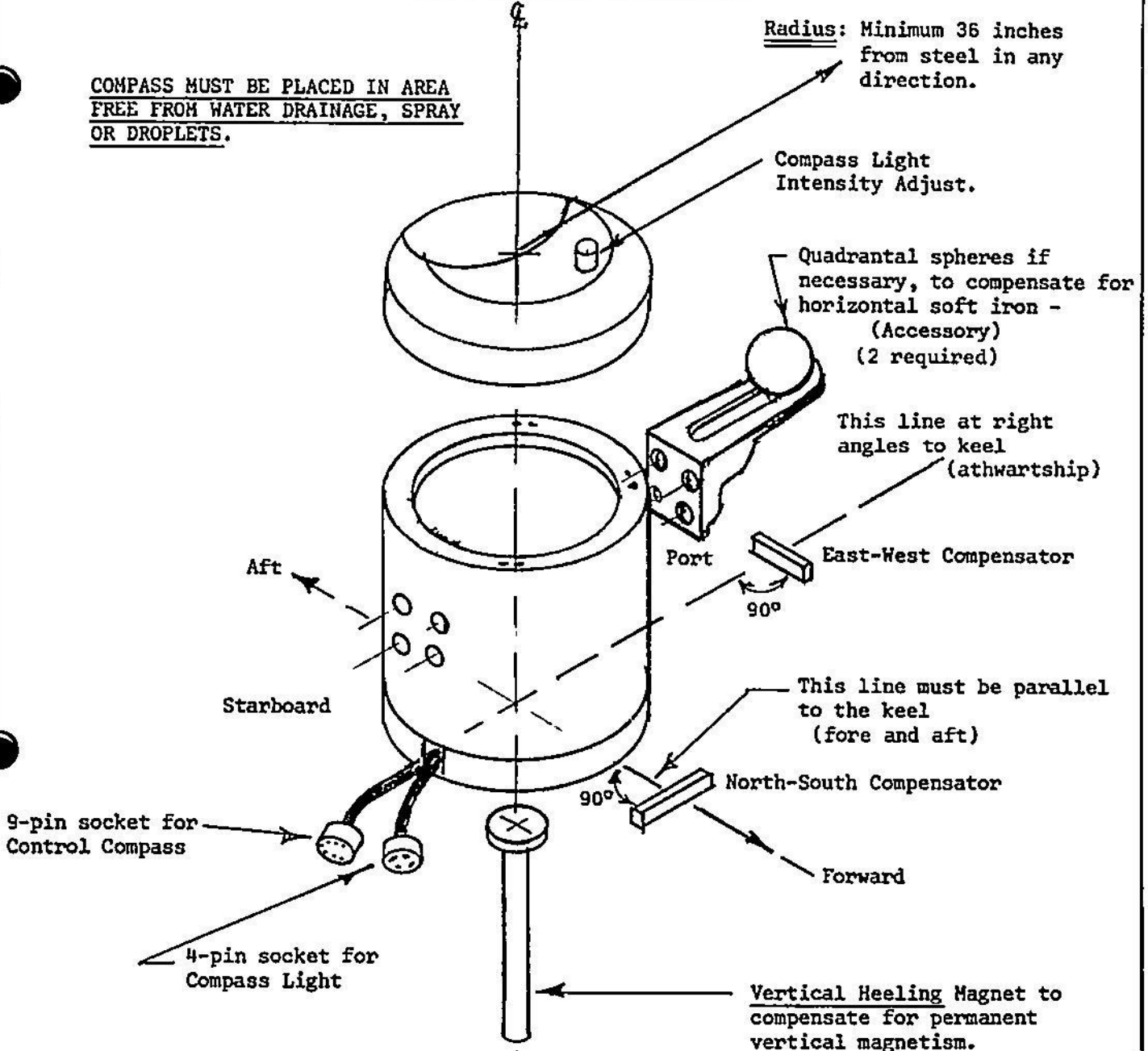
(1) The distance between the compass and steel portions of the vessel is at least 24 inches and preferably 36 inches.
(2) North, South and East, West compensation is done as above.
(3) The vertical magnetism of the ship is compensated by a "heeling" magnet, placed above or below the exact center of the compass. The "red end" of the magnet is usually up in the Northern Hemisphere and down in the Southern Hemisphere, but welded steel vessels may have residual vertical magnetism in either direction.

The vertical position of the magnet is selected to neutralize swinging of the compass card as the vessel rolls while on northerly headings (Northern Hemisphere) or southerly headings (Southern Hemisphere). It is usually desirable to "overcorrect" the normal dip of the earth's magnetic field.

The compass is best mounted above decks or in a house with glass windows. However it may be mounted below decks if the above three rules are observed.


Radar Magnetron
Overhead Steel Plate or Beam
Vertical Steel Bulkheads
D.C. Electrical Panels, Ammeter Loops, Heavy D.C. Amperage wires
30"
24"
24"
36"
96"
24"
Vertical Steel Rods, Angles, Channel
Pilot Compass Unit
36"
Steering Compass
24"
Pilot D.C. Motor, Solenoids or large iron masses such as winches or engines.
N-S Magnet*
E-W Magnet*
Athwartships Line
*For Compensating Compass on all vessels.
**Heeling magnet required on steel vessels.
Horizontal steel rods, angles, channel
Fore and aft line
Heeling magnet**
On Compass centerline, above or below
North heading:
Vessel rolls starboard - Compass card swings clockwise
Set blue end up for correction.
Vessel rolls to starboard - Compass card swings counter-clockwise
Set red end up for correction.
24"
Horizontal steel deck plate
Minimum Distances between Pilot Compass and magnetic objects in vessel.
METAL MARINE PILOT, INC.
2119 South Mildred Street
Tacoma, Wash. 98465
FOR WOOD FREEMAN AUTO PILOTS
All Models
Minimum Magnetic Distances, Compass
4235204

500-A-2 COMPASS INSTALLATION



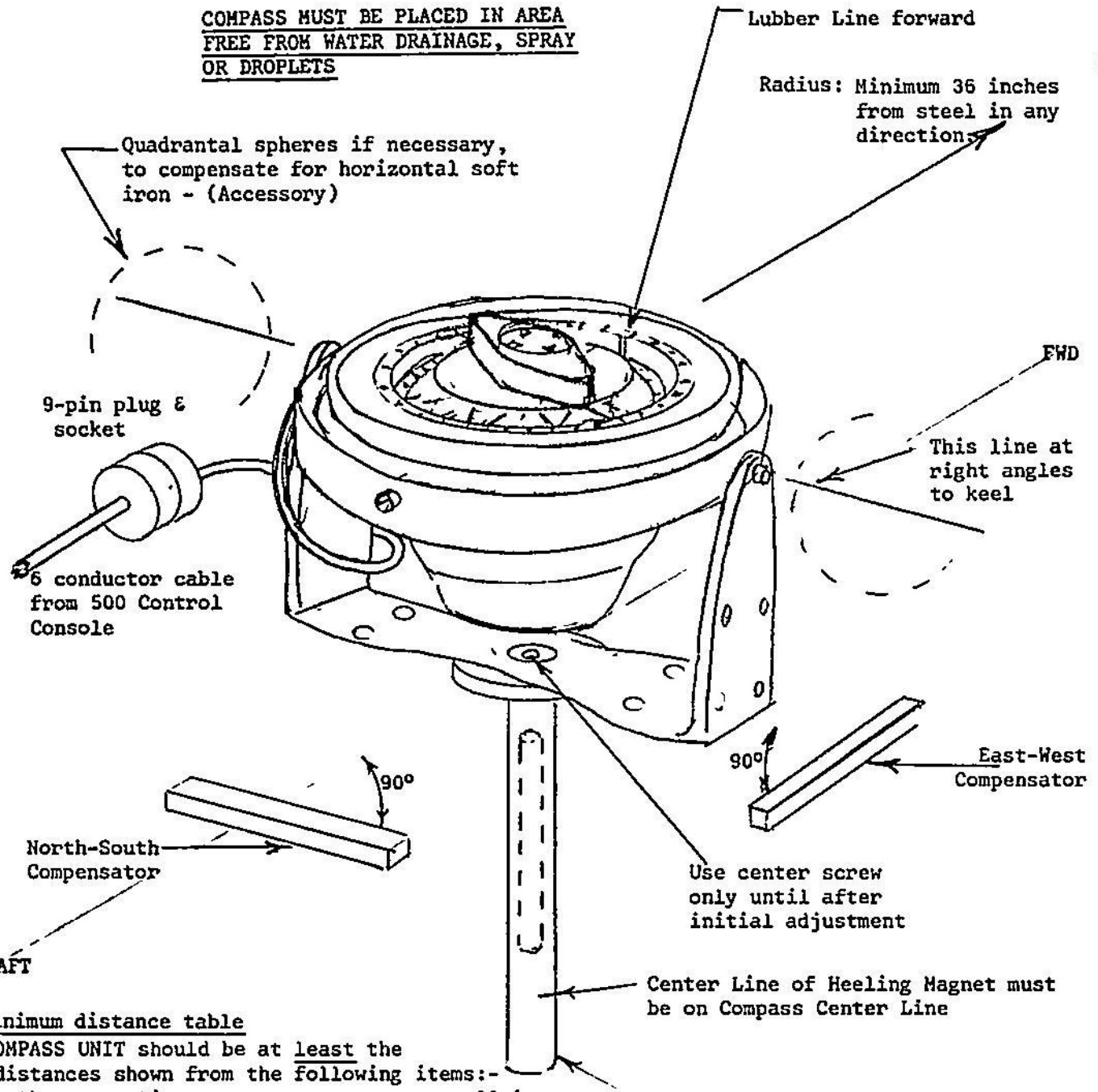
Minimum Distance Table

COMPASS UNIT should be at LEAST the distances shown from the following items:-

Another magnetic compass	36"
Motor Unit or Power Pack	36"
Relay Unit	36"
Solenoids	36"
Large iron mass (winch or engine)	36"
Iron rods or shafts (either horizontal or vertical)	24" from end of rod
Radar Modulators (Magnetrons)	96"
Vertical or horizontal steel bulkheads	24"
Steel decks or overheads	36"

METAL MARINE PILOT, INC. 7149 West Mildred Street Tacoma, Wash. 98466	FOR WOOD FREEMAN AUTOMATIC PILOTS
SCALE None. DATE 4-8-74	MACHINE NO. 500-A-2 Compass Installation
DRWN DH CK	
SERIAL	
PREVIOUS	TITLE 500 Series Auto Pilots
REVISIONS Update 4-1-76	
ASSEMBLY	NO 5005009-A2
MFG. RECORD	

COMPASS MUST BE PLACED IN AREA FREE FROM WATER DRAINAGE, SPRAY OR DROPLETS



Minimum distance table

COMPASS UNIT should be at least the distances shown from the following items:-

Another magnetic compass	36 in.
Motor unit or power pack	36 in.
Relay unit	36 in.
Solenoids	36 in.
Large iron mass (winch or engine)	36 in.
Iron rods or shafts (either horizontal or vertical	24 in. from end of rod
Radar Modulators (Magnetrons)	96 in.
Vertical or horizontal steel bulkheads	24 in.
Steel decks or overheads	36 in.

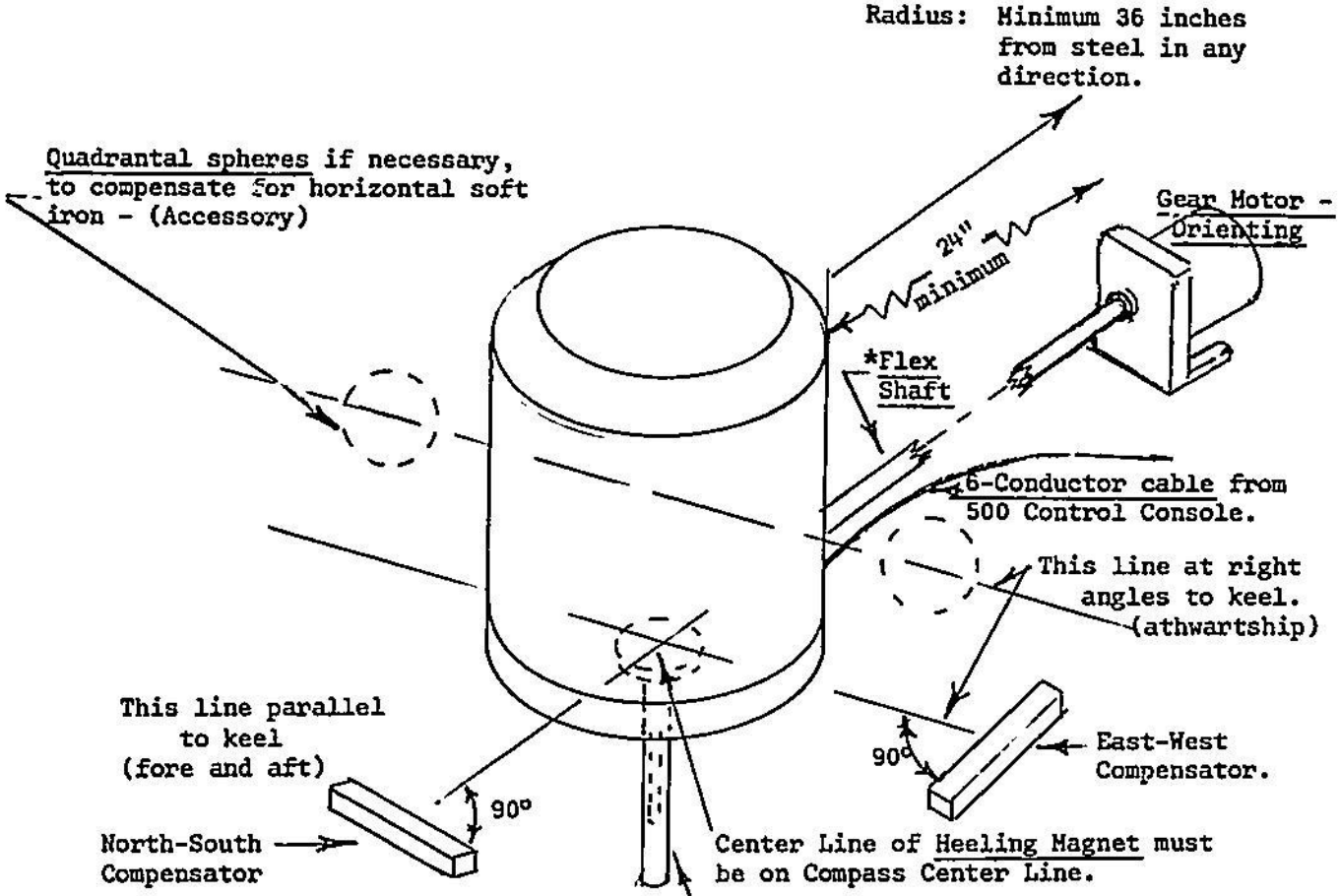
Vertical Heeling Magnet to compensate for permanent vertical magnetism. Necessary on steel vessels to prevent change in deviation as vessel rolls. (Accessory)

METAL MARINE PILOT, INC. 2119 West Mildred Street Tacoma, Wash. 98466	FOR WOOD FREEMAN AUTO PILOT
SCALE / DATE 12/7/70	MACHINE NO. MODEL 500A
DRWN. RMF / CK.	
SERIAL	
PREVIOUS REVISIONS	TITLE COMPASS INSTALLATION
ASSEMBLY MFG. RECORD	NO. 500C001

MODEL 500 B

COMPASS INSTALLATION

COMPASS MUST BE PLACED IN AREA FREE FROM WATER DRAINAGE, SPRAY OR DROPLETS



Minimum Distance Table

COMPASS UNIT should be at LEAST the distances shown from the following items:-

Another magnetic compass	36"
Motor Unit or Power Pack	36"
Relay Unit	36"
Solenoids	36"
Large iron mass (winch or engine)	36"
Iron rods or shafts (either horizontal or vertical)	24" from end of rod
Radar Modulators (Magnetrons)	96"
Vertical or horizontal steel bulkheads	24"
Steel decks or overheads	36"

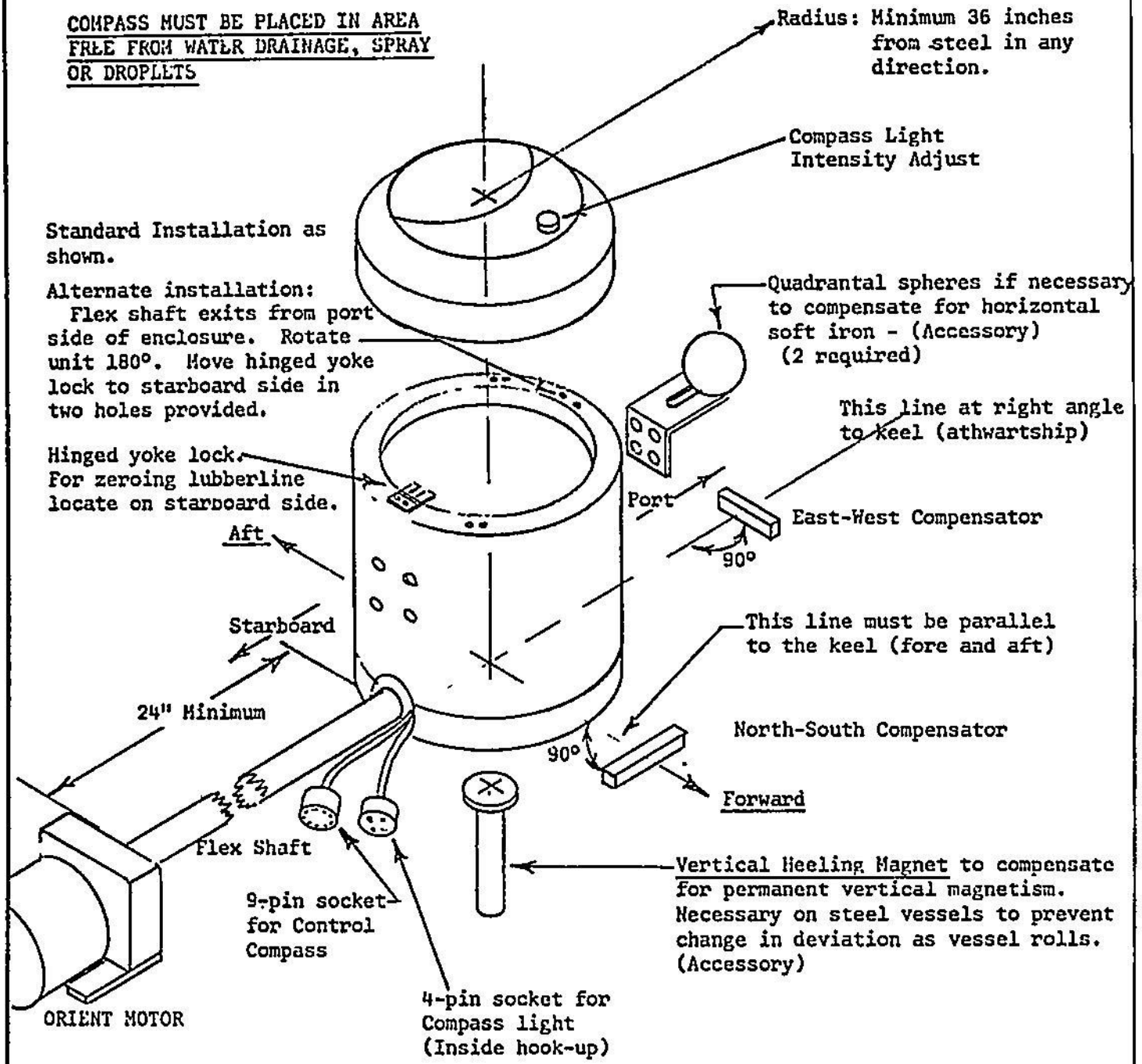
* IF- Quadrantal spheres are required - (steel vessels only), mount flex shaft connection pointing FWD or AFT. Otherwise compass unit may be mounted with flex shaft connection in any convenient direction.

Drawing #5005001-B

August, 1971

(Revised January 1976)

500-B-2 COMPASS INSTALLATION



Minimum Distance Table

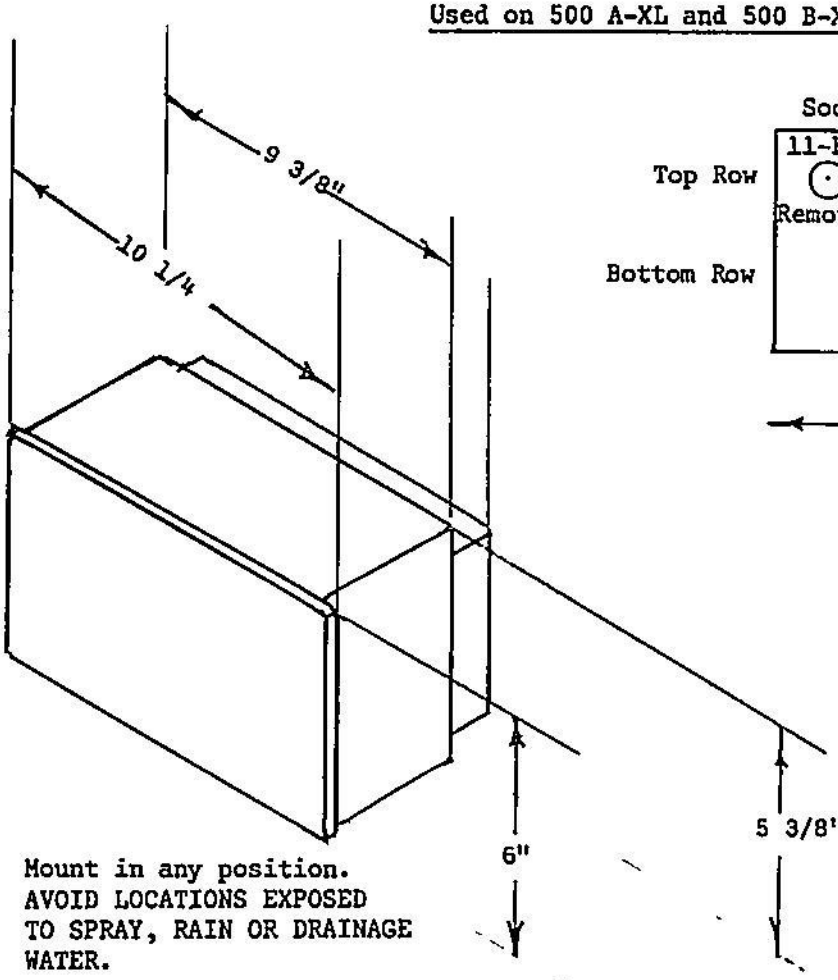
COMPASS UNIT should be at LEAST the distances shown from the following items:-

Another magnetic Compass	36"
Motor Unit or Power Pack	36"
Relay Unit	36"
Solenoids	36"
Large iron mass (winch or engine)	36"
Iron rods or shafts (either horizontal or vertical)	24" from end of rod
Radar Modulators (Magnetrons)	96"
Vertical or horizontal steel bulkheads	24"
Steel decks or overheads	36"

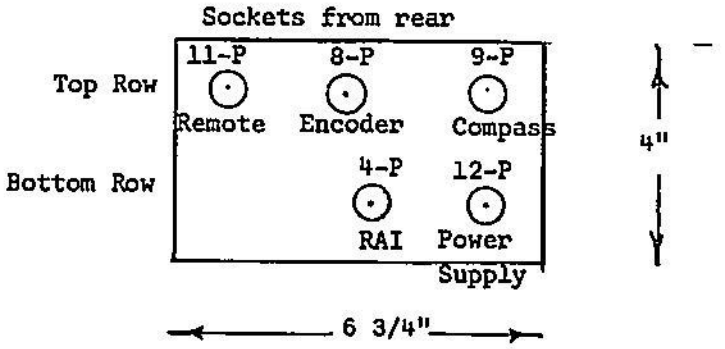
METAL MARINE PILOT, INC. 2119 West Marfred Street Tacoma Wash. 98466	FOR WOOD FREEMAN AUTOMATIC PILOTS
SCALE None DATE 4-9-74	MACHINE NO. 500-B-2 Compass Installation
DRAWN CH CK	
SERIAL	
PREVIOUS	
REVISIONS Updated 2-2-76	TITLE 500 Series Auto Pilots
ASSEMBLY	NO. 5005009-B2

MODEL 500 CONTROL CONSOLE

Used on 500 A-XL and 500 B-XL

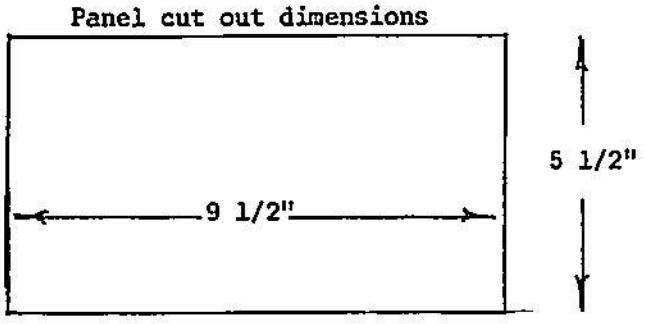


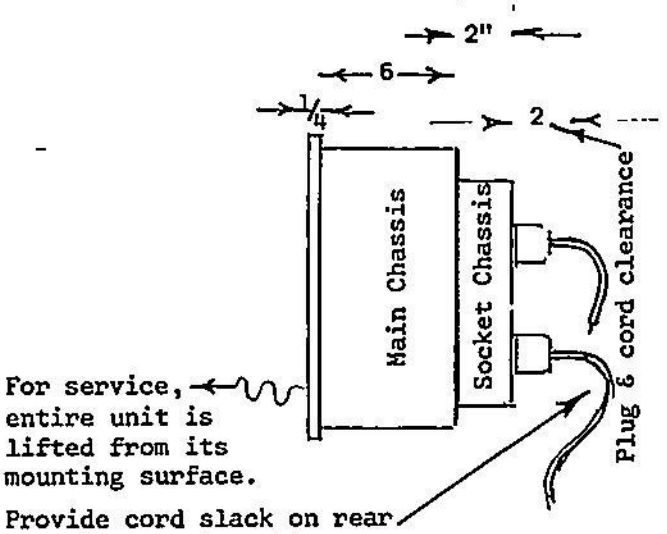
Mount in any position.
AVOID LOCATIONS EXPOSED TO SPRAY, RAIN OR DRAINAGE WATER.



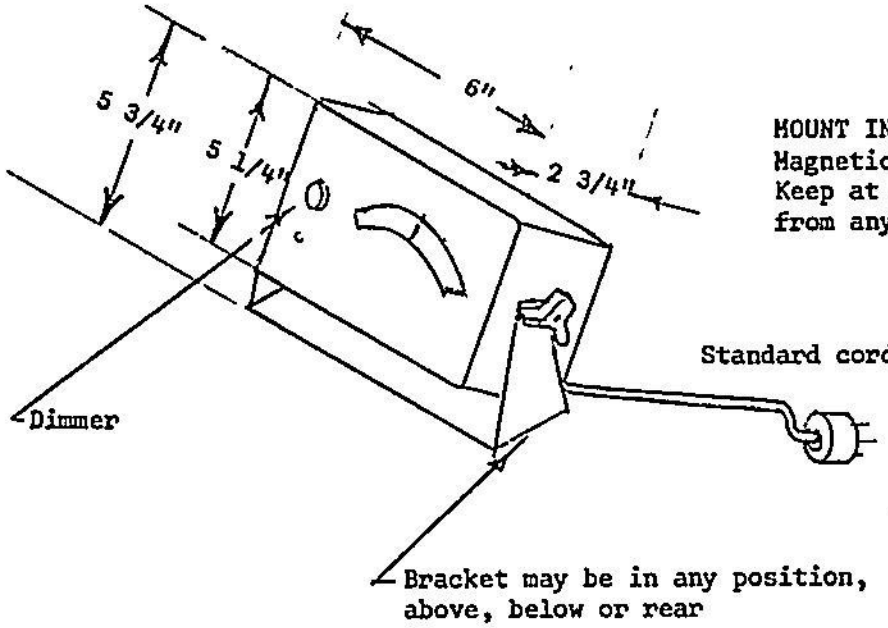
Magnetic influence - NONE.

May be mounted at any convenient distance to 500 Compass or other compass.





RUDDER ANGLE INDICATOR
Part #8350



MOUNT IN ANY POSITION.
Magnetic influence: Slight
Keep at least 6 inches away
from any compass.

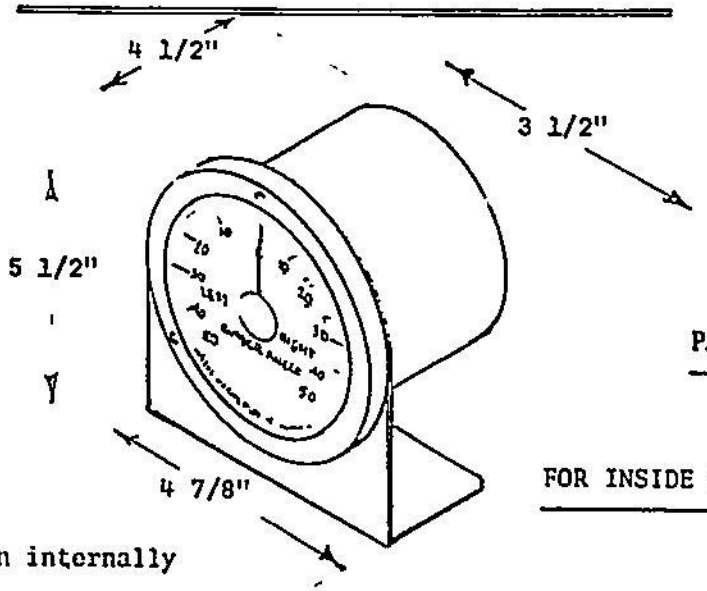
Standard cord length - 10 ft.

4-pin plug directly to 500 Control Console or appropriate multi-unit junction box.

Bracket may be in any position, above, below or rear

RUDDER ANGLE INDICATOR
For unexposed locations (Part #8350)
Non-waterproof, lighted with dimmer.

WATERPROOF RUDDER ANGLE INDICATOR



PART #8350-P

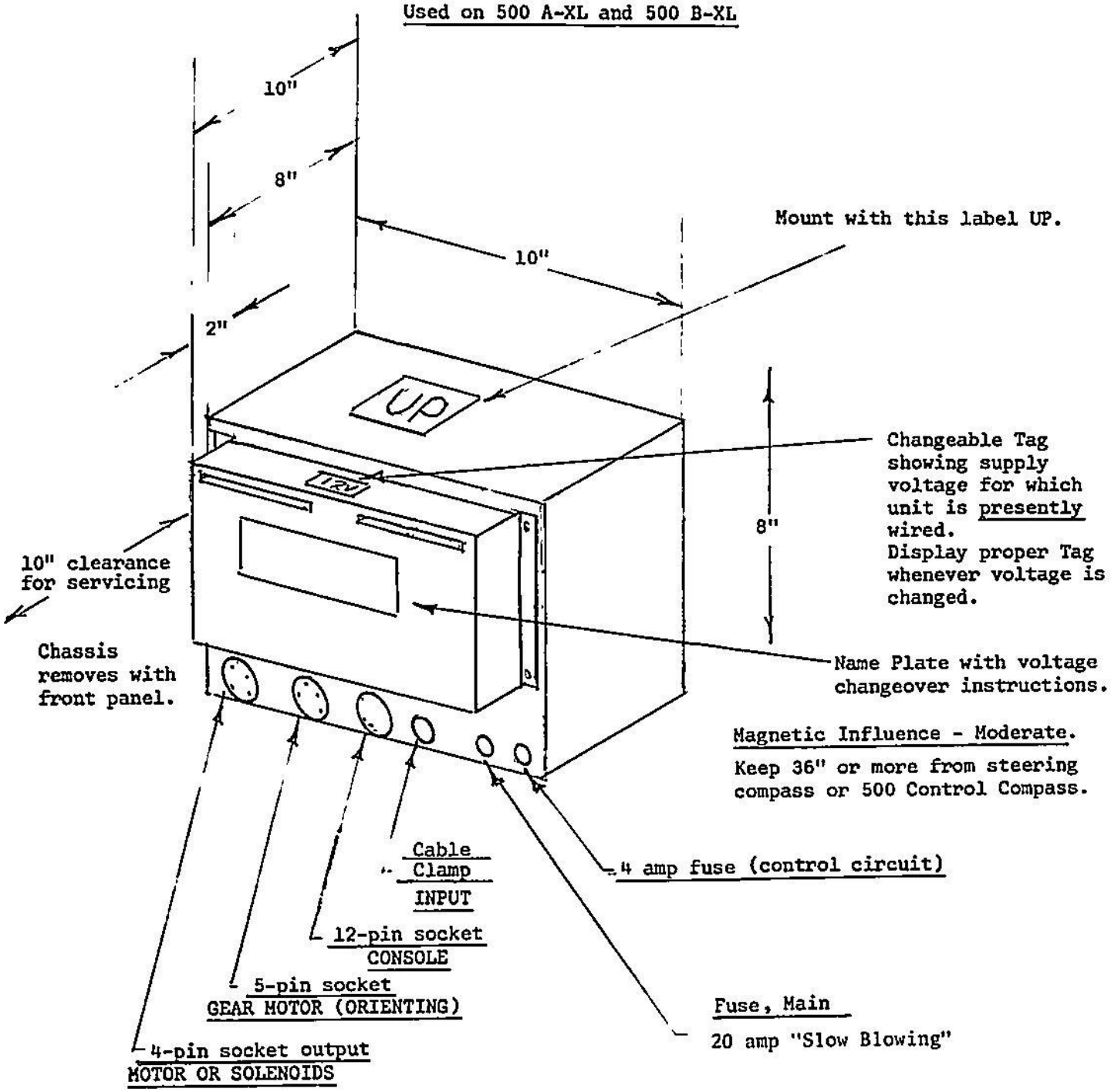
FOR INSIDE OR EXPOSED LOCATIONS

SPECIFICATIONS:

- 3 inch face
- Indirect illumination internally
- 235° Meter movement
- Does not affect steering compass if more than 12 inches distant
- Flush mounts from front or back of panel or on free standing bracket

XL POWER SUPPLY

Used on 500 A-XL and 500 B-XL



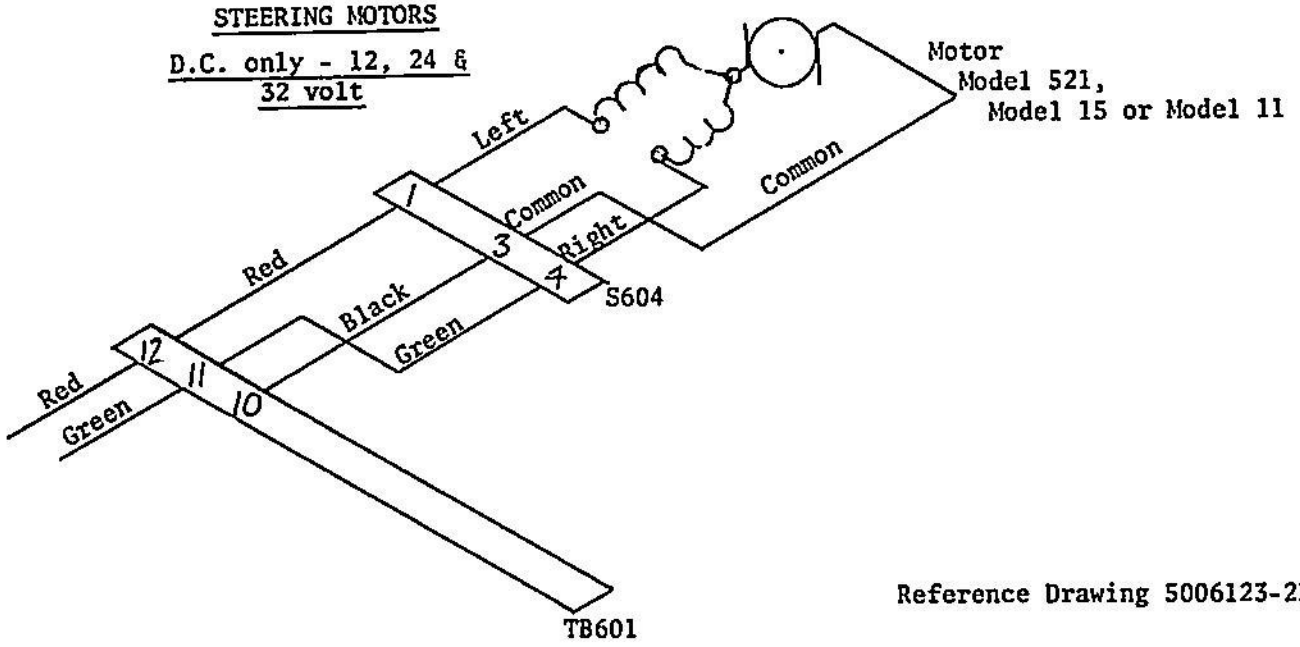
August, 1971
(Revised January, 1980)

XL POWER SUPPLY OUTPUT

Used on 500 A-XL and 500 B-XL

STEERING MOTORS

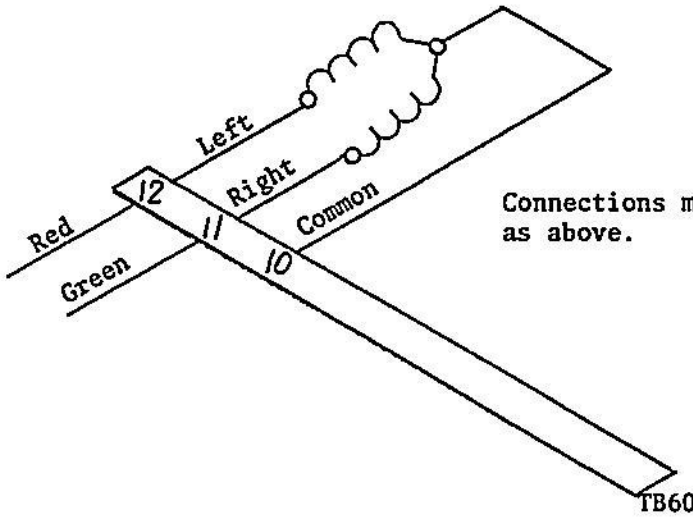
D.C. only - 12, 24 & 32 volt



Reference Drawing 5006123-2R-2

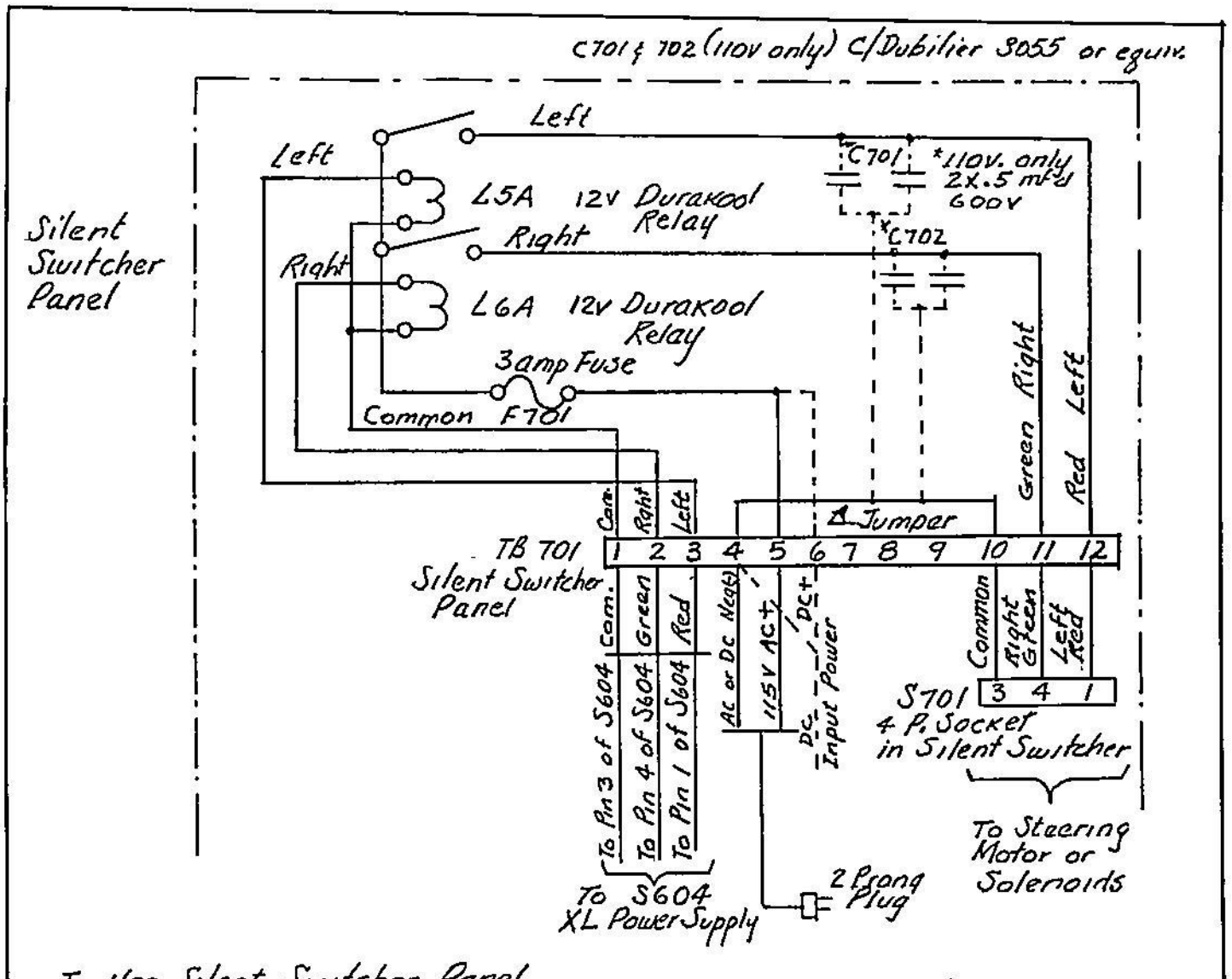
INTERNALLY POWERED SOLENOIDS (*DC only)

Rated at primary input voltage to Power Supply. (12, 24 or 32 volt D.C.)



Connections may be made to S604 as above.

* IMPORTANT NOTE: For AC Solenoids and all externally powered Solenoid Units use additional Silent Switcher Unit to insure isolation of computer circuits from destructive voltages.

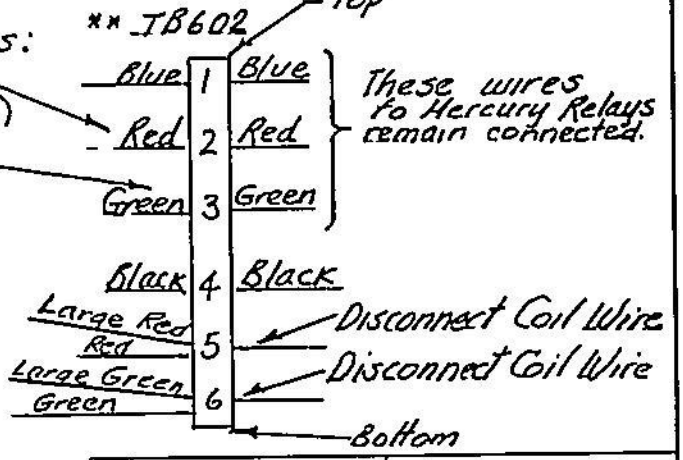


To Use Silent Switcher Panel

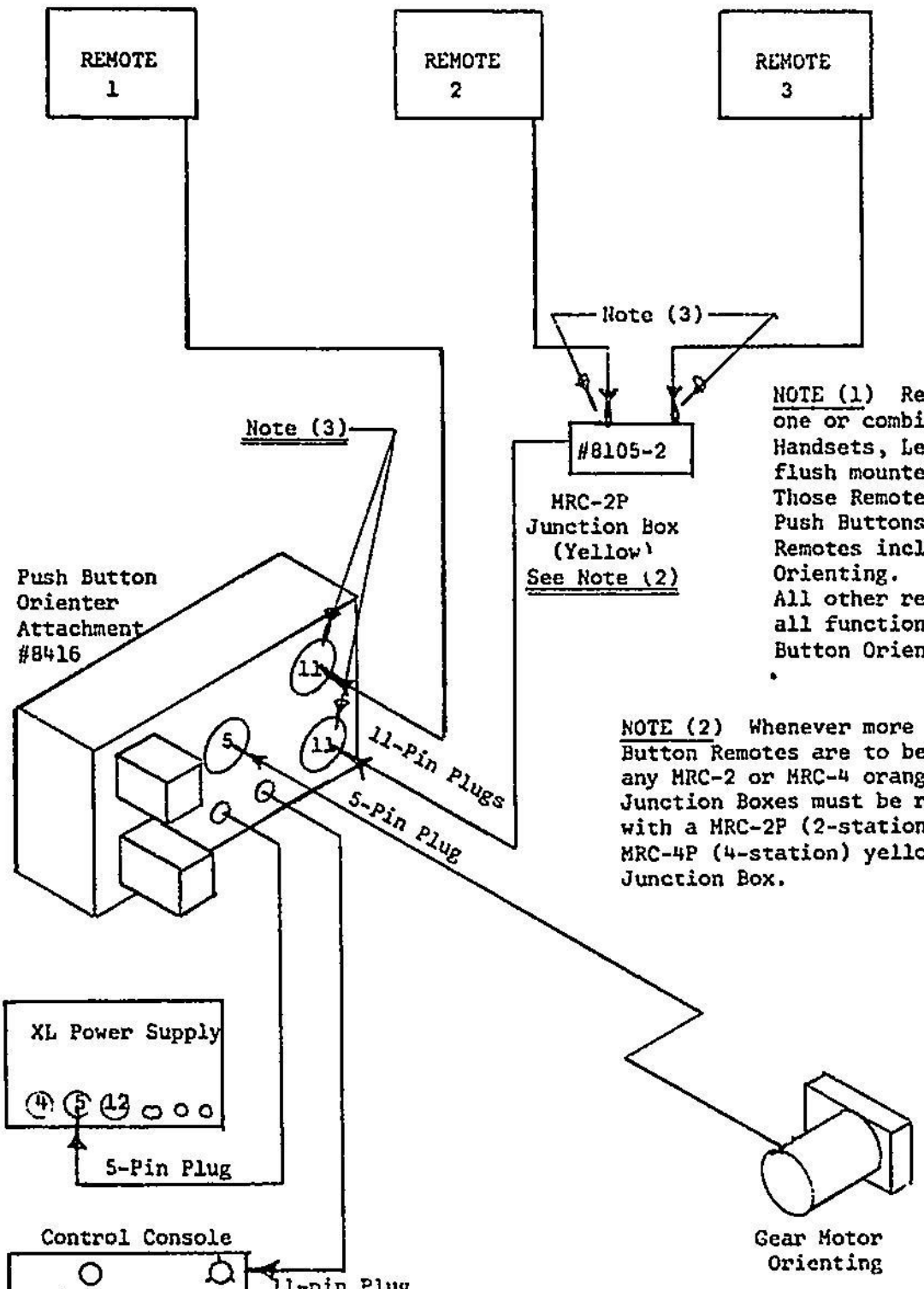
Change connections of **TB602 as follows:

1. Disconnect large Red wire from Pin 2 of TB602 & connect to Pin 5 (as shown)
2. Disconnect Large Green from Pin 3 of TB602 & connect to Pin 6 (as shown)
3. Disconnect Coil Wires from TB602.

Effect: Control of Mercury Relay Coil (L5A & L6A) in Switcher is from (L1 & L2) 6A19 Relays in XL Unit on 12v. L5 & L6 in XL are by passed.



METAL MARINE PILOT, INC. 2119 West Mildred Street Tacoma, Wash. 98466	FOR Wood Freeman Auto Pilot
SCALE N.C.L.C. DATE 10-22-62	MACHINE NO. 500 Series
DRWN. J.H. CK.	
SERIAL	
PREVIOUS REVISIONS	TITLE Silent Switcher
ASSEMBLY MFG. RECORD	NO. SCC6123-1A

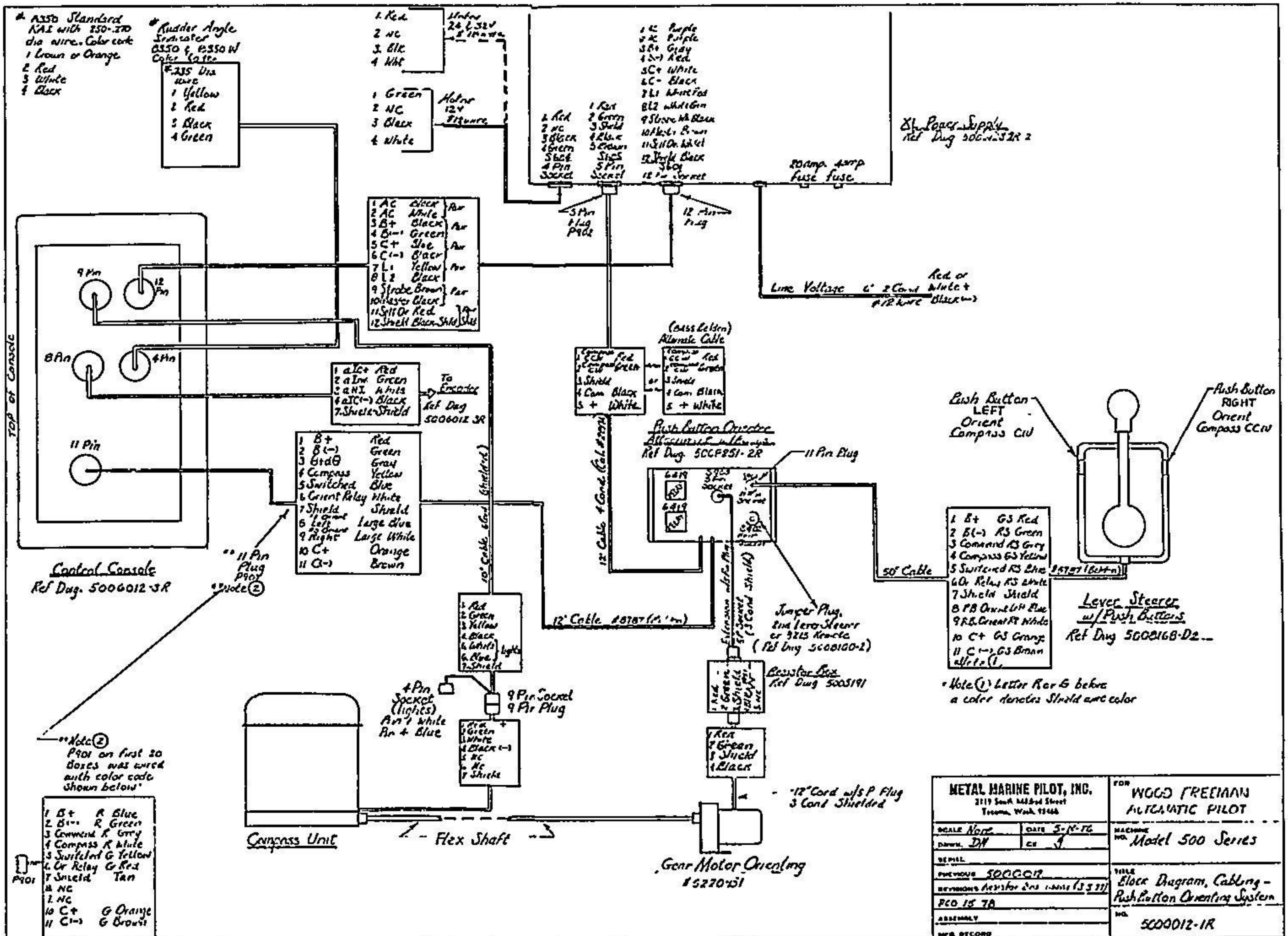


NOTE (1) Remote may be any one or combination of Remote Handsets, Lever Steerers or flush mounted Remotes. Those Remotes having Orienting Push Buttons will provide all Remotes including Push Button Orienting. All other remotes will provide all functions except Push Button Orienting.

NOTE (2) Whenever more than 2 Push Button Remotes are to be used then any MRC-2 or MRC-4 orange painted Junction Boxes must be replaced with a MRC-2P (2-station) or a MRC-4P (4-station) yellow painted Junction Box.

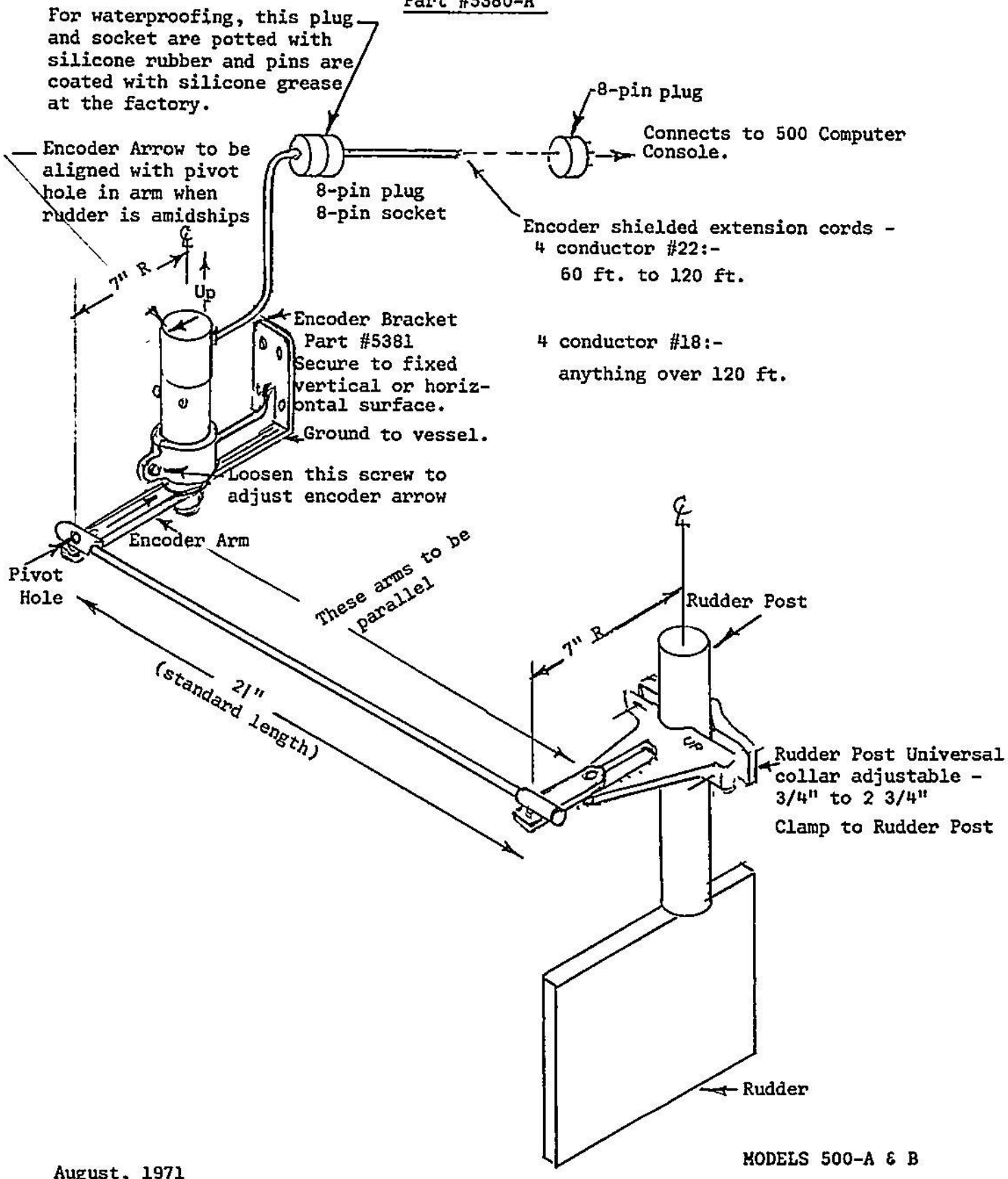
NOTE (3). All of the 11-pin sockets must have either a Jumper Plug (orange) or a Remote plugged in in order for remainder of Remotes to function.

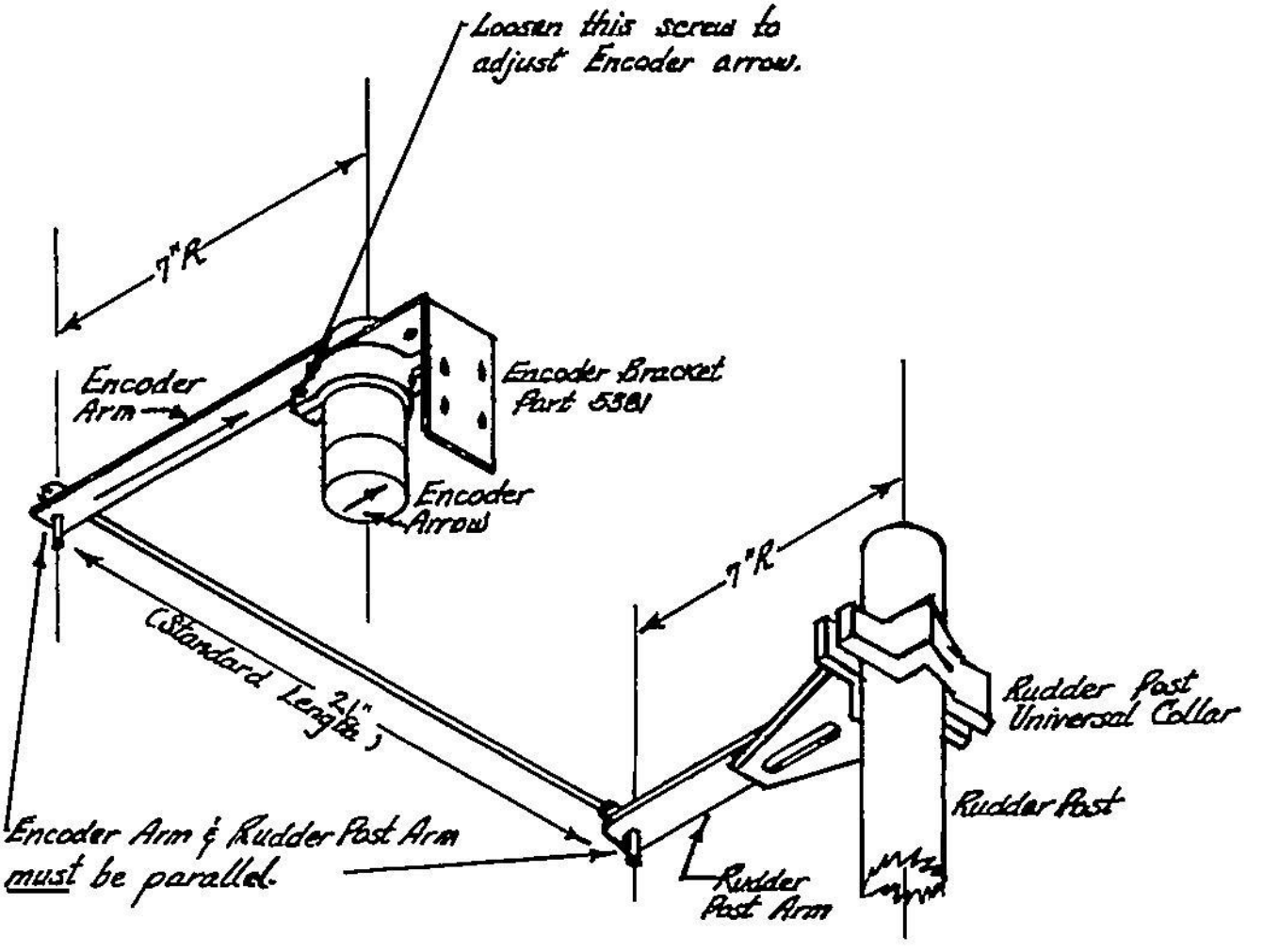
METAL MARINE PILOT, INC.	WOOD FREEMAN AUTOMATIC PILOT
SCALE None DATE 12-10-7	INSTALLATION
DRAWN MHF	
	500 Series Push Button Orienter
	5008253-1



TOP of Console
9 Pin
12 Pin
8 Pin
4 Pin
11 Pin
Control Console
Ref Dwg. 5006012-3R
A350 Standard RAI with 250-270 dia wire. Color code
1 Brown or Orange
2 Red
3 White
4 Black
Rudder Angle Indicator B350 & B350W Color Code
1 Yellow
2 Red
3 Black
4 Green
1 Red
2 NC
3 Blk
4 Wht
1 Green
2 NC
3 Black
4 White
Motor 12V
1 AC Black
2 AC White
3 B+ Black
4 B(-) Green
5 C+ Blue
6 C(-) Black
7 L1 Yellow
8 L2 Black
9 Strobe Brown
11 Sl/Or Red
12 Shield Black-Shield
To Encoder
Ref Dwg 5006012-3R
1 B+ Red
2 B(-) Green
3 Grd Gray
4 Compass Yellow
5 Switched Blue
6 Orient Relay White
7 Shield Shield
9 Right Large White
10 C+ Orange
11 C(-) Brown
11 Pin Plug P901
Note 2
XL Power Supply
Ref Dwg 500 ... 2R 2
20 Amp. fuse
4 amp fuse
5 Pin Socket
4 Pin Socket
12 Pin Socket
5 Pin Plug P902
12 Pin Plug
Line Voltage 6' 2 Cond #12 Wire
Red or White + Black (-)
(Bass Belden) Alternate Cable
3 Shield
4 Com Black
5 + White
12' Cable 4 Cond.
Push Button Orienter
Ref Dwg. 5CCF851-2R
11 Pin Plug
50' Cable
1 B+ GS Red
2 B(-) RS Green
3 Command RS Grey
4 Compass GS Yellow
5 Switched RS Blue
6 Or. Relay RS White
7 Shield Shield
10 C+ GS Orange
11 C(-) GS Brown
Note (1)
Push Button LEFT Orient Compass CW
Push Button RIGHT Orient Compass CCW
Lever Steerer w/Push Buttons
Ref Dwg 5008168-D2
Note (1) Letter R or G before a color denotes Shield and color
10' Cable 6 Cond (Shielded)
12' Cable #8787
Jumper Plug, 2nd Lever Steerer or 9215 Knocker (Ref Dwg 5008160-2)
Resistor Box
Ref Dwg 5005191
1 Red
2 Green
3 Shield
4 Black
12" Cord w/5 P Plug 3 Cond Shielded
4 Pin Socket (lights)
9 Pin Socket
9 Pin Plug
1 Red
2 Green
3 White
4 Black (-)
5 NC
6 NC
7 Shield
Compass Unit
Flex Shaft
Gear Motor Orienting
#5220451
Note 2
P901 on first 20 boxes was wired with color code shown below
1 B+ R Blue
2 B(-) R Green
3 Command R Grey
4 Compass R White
5 Switched G Yellow
6 Or Relay G Red
7 Shield Tan
8 NC
9 NC
10 C+ G Orange
11 C(-) G Brown
P901
METAL MARINE PILOT, INC.
2119 South 443rd Street
Tacoma, Wash.
FOR WOOD FREEMAN AUTOMATIC PILOT
SCALE None
DATE 5-14-76
DRAWN DW
MACHINE NO. Model 500 Series
PREVIOUS 5000012
TITLE Block Diagram, Cabling - Push Button Orienting System
ECO 15 7A
NO. 5000012-1R

500 ENCODER
Part #5380-A





If absolutely necessary because of space limitations, Encoder may be mounted inverted. In this case the point of the arrow on the cap must point away (180°) from the Encoder arm, when rudder is amidships (centered rudder).

per RMF
6-8-72

METAL MARINE PILOT, INC. 2119 West Mildred Street Tacoma, Wash. 98466	FOR Wood Freeman Automatic Pilot
SCALE None DATE 6-8-72	MACHINE NO. 500 Series
DRWN. DH. CK.	
SERIAL	
PREVIOUS	TITLE Mounting Encoder Inverted.
REVISIONS	
ASSEMBLY	NO. Sec. C - Page 2A
MFG. RECORD	

Model 500-B

* COMPASS INSTALLATION *

Locate Compass in best possible magnetic location so IT IS NOT EXPOSED to RAIN, SALT SPRAY OR DRAINAGE WATER. If Compass is to be used for standby steering Compass, pick best possible magnetic location ahead of normal helmsman position, but at least three feet from primary steering compass.

OBSERVE TABLE OF MINIMUM DISTANCES FROM OTHER MAGNETIC OBJECTS
(See Drawing #4235204)

Move Compass in circle of about 1 foot radius from selected location and watch compass card. If card swings less than 15 degrees, compass location selected is satisfactory. However, larger swings indicate some trouble may be encountered in compensating the compass, and another site should be selected if possible.

The Compass must be carefully compensated, so that maximum error is 2 degrees or less on N, S, E and W headings. If compass is always compensated to steering compass standards, it will also give best performance for Autopilot steering. Optional Quadrantal Spheres may be added if large errors are present on inter-cardinal points (NW, NE, SW, SE) and a heeling tube is available to compensate for the "heeling" effect of vertical permanent magnetism in steel ships that develops as a horizontal magnetic effect as the ship rolls.

See separate sheet for compass compensating instructions.

Connect compass cable to console, 9-pin socket, as shown on Component Layout Drawing #5006010-B-2.

TABLE OF CONTENTS

SECTION D

* POWER PACK INSTALLATIONS *
* * 500 SERIES * *

* * For systems not listed contact the factory . * *

GENERAL INFORMATION

* 500 SERIES - LIMIT SWITCHES *

The 500 SERIES AUTOPILOTS have rudder movements proportional to the command signal under "COMPASS DIAL" control and movements equal to dial movements under "RUDDER DIAL" control. There is no provision for unmetered rudder movements under the operator's command. Under normal operation, therefore, no additional limit switches are required. In the event of an electronic malfunction, it is possible for the steering engine to put the rudder hardover at maximum steering engine force. This second situation, emergency in nature, is handled by one of the following provisions in the steering engine: -

* MECHANICAL STEERING *

Power Pack Code -511LS - Factory installed limit switches in motor circuit. Limit Switches must be adjusted after installation and before operation underway.
Refer to page 4.

* HYDRAULIC STEERING *

FOR SAFETY, WE RECOMMEND THAT ONLY CONTINUOUS-PUMP MECHANICAL TYPE HELM UNITS BE USED WHEN THE PILOT IS INSTALLED. THIS PREVENTS THE HELM UNIT FROM "BOTTOMING", AND INSURES THAT EMERGENCY OVERRIDE OF THE AUTOPILOT WILL BE AVAILABLE AT THE HELM.

Power Pack Code -521-MC - Has built-in pressure relief, thermal pressure and "make up" valves. May be used on manual or power hydraulic systems with or without existing relief valves.

Power Pack Code -531 - Used on manual hydraulic systems; this unit has built-in relief valves that act as limit switches.

Power Pack Code -00 - For use with customer's hydraulic system and solenoid valves - customer to furnish suitable relief valves.

When used to convert Model 11 and Model 15 on mechanical steering systems, use existing limit switches.

POWER PACK 511LS (LIMIT SWITCH)

REVERSING POWER PACK MODEL

CLUTCH AND CHAIN DRIVE TO WHEEL

Similar to Model 11 Motor Unit, but has 521 motor (split field series wound) of approximately 1/6 H.P.

1) FASTEN THE LARGE SPROCKET (usually 8") to the steering wheel shaft. Use pins or keys, but do not depend on set screws. When necessary, split sprockets can be supplied (at additional cost). When split sprockets are required, exact shaft size (to closest .001") must be given.

   The large sprocket should be placed so that the driving sprocket on motor unit can be lined up with it. If that is impossible, a countershaft may be used and the motor unit may be placed at some other location. Standard sprockets have a 1" minus .050 (approximately) "as cast" bore to allow for final boring to fit 1" shaft or larger. Other sizes may be furnished on special order.

   The DRIVING SPROCKET ON MOTOR UNIT is on the CLUTCH DRUM, is of steel, and is 5 inches from one end and 7 inches from the other end of motor unit. The thin sprocket on clutch drum drives limit switch only.

2) MOTOR UNIT. Mount the Motor Unit on the floor so that the wide sprocket closest to the clutch drum will align properly with sprocket on steering wheel assembly (or intermediate countershaft). There are four holes molded in the glass-reinforced nylon base of motor unit for convenience. No other holes should be drilled. If mounting surface is irregular, put a pad of plywood, at least 3/4 inch thick under base.

3) Before making fast, place the #41 Chain around the sprockets, letting ends meet on large sprocket, and move Motor Unit until chain comes to about the right degree of tightness. Do not have chain too tight, as it will cause excessive wear. With a little care, Motor Unit can be placed so that it will not be necessary to use an offset or half-link.

4) GROUND MOTOR UNIT TO VESSEL'S GROUND.
   (This is to prevent electrical shocks from suppressors in motor.)

* LIMIT SWITCH ADJUSTMENT (-511LS POWER PACK) *

Used on Mechanical steering gear only.
Do not use Limit Switch with hydraulic steering as it will cause a malfunction.

1) Remove limit switch cover.

2) Disengage pilot clutch.

3) Turn steering wheel hardover to the left as far as it will go, then back off from the hardover position in the amount as shown in the table below:

Total turns of wheel Hardover to Hardover	Number of turns to be Backed off from Hardover
1 - 2	1/4
2 - 3	1/3
3 - 4	1/2
4 - 5	1/2
5 - 6	2/3
6 - 7	3/4
7 - 8	3/4
8 - 9	3/4
9 - 10	1
10 - 11	1
11 - 12	1
12 - 13	1 1/4
13 - 14	1 1/2

Note the direction the limit switch cams turn when the wheel is being turned hardover to left.

4) Turn Function Switch on Console to "RUDDER DIAL", set Rudder Dial at 35 degrees Left. Motor unit will now commence to rotate Left and will continue to do so. While motor is rotating, depress each limit switch tongue in turn to determine the switch which breaks the circuit when motor is rotating to the left.

5) The set screw on the cam which operates this switch is loosened and the cam is rotated in the direction that it was turning when the wheel was rotated to the left until the micro-switch tongue is depressed sufficiently to cause the switch to click. Now tighten the set screw to lock the cam in this position.

6) Rotate the steering wheel hardover to the right and back off from hardover the number of turns shown in the table above. Loosen the set screw of the other cam and rotate cam in the direction it was turning when the wheel was rotated to the right until the micro-switch tongue is depressed sufficiently to cause the switch to click. Now lock the cam in this position.

7) Replace the cover on the micro-switch.

Limit switch cams may be set for wheel turns less than the actual hardover to hardover turns if desired, but in any case, the cam must not be set forward to where it releases the micro-switch tongue before the wheel comes hardover.

GENERAL INFORMATION

* FITTINGS, HOSES & PIPING *

*** * WARNING * ***

Use WOOD FREEMAN® hydraulic power packs only with hydraulic steering systems employing METALLIC connecting lines, fittings and components having minimum working pressure ratings of at least 900 PSI, except for short lengths of connecting hose (see HOSES specified below).

*** STANDARD FITTINGS ***

All WOOD FREEMAN® hydraulic components are furnished with standard JIC #8-37 degree flare fittings (3/4" -16 thread). Reducer fittings are supplied with -531 units which allow connection with #6-37 degree flare fittings.

*** HOSES ***

Power packs should be connected to steering systems with double steel braided hose (3500 PSI rating)- 2' minimum, 6' maximum. The hoses must have JIC #8-37 degree swivel nuts, on one end, to match the power pack fittings. The fittings on the other end of the hose should match up to the shut off valves. (JIC #6-37 degree fittings may be used with -531 units.)

*** SHUT OFF VALVES ***

Shut off valves shown in the drawings are ball valves rated at least 1500 PSI (Worcester 3/8"-411YB-SE or equivalent).

*** BLEED VALVES ***

Bleed valves shown in the drawings are 1/4" needle valves rated at least 1500 PSI (Hoke 3722 M4B or equivalent).

*** COPPER TUBING ***

We recommend 3/8" TYPE K copper tubing (1/2 inch OD .049 inch wall). Larger tubing sizes may be used if it is comparable to the 3/8" tubing in pressure ratings. The larger tubing will reduce steering efforts in long runs.

Sweated fittings are unsatisfactory and should not be used.

*** STEEL PIPE ***

In installations where steel pipe is to be used, the pipe should be rated as schedule 80 and must be "pickled".

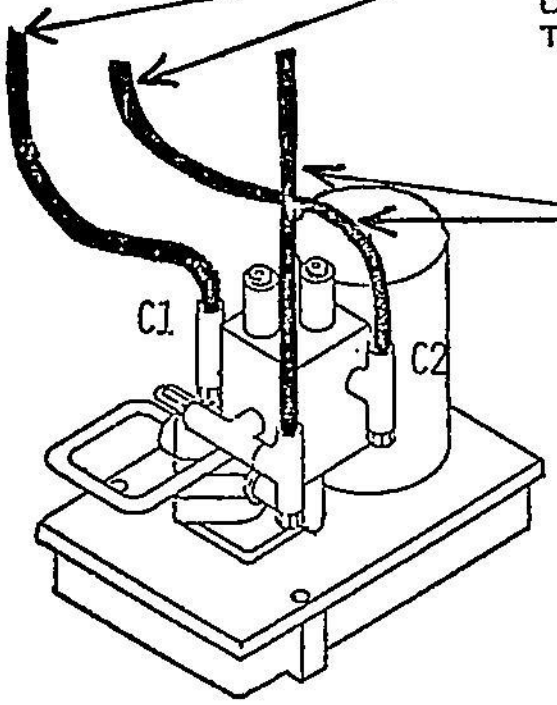
****** DO NOT USE TEFLON TAPE ******

*** * * * NOTICE * * * ***

ALL HYDRAULIC UNITS BEFORE INSTALLING:

1) Be certain that all hydraulic lines are clean and free of debris.
2) If in doubt, purge system well with hydraulic fluid and discard fluid (or run through a filter of 40 micron mesh or less).
3) Be careful that no foreign material such as sand, wood chips, gasket material, thread sealer, rust, water, or copper cuttings from tube ends enters the system.

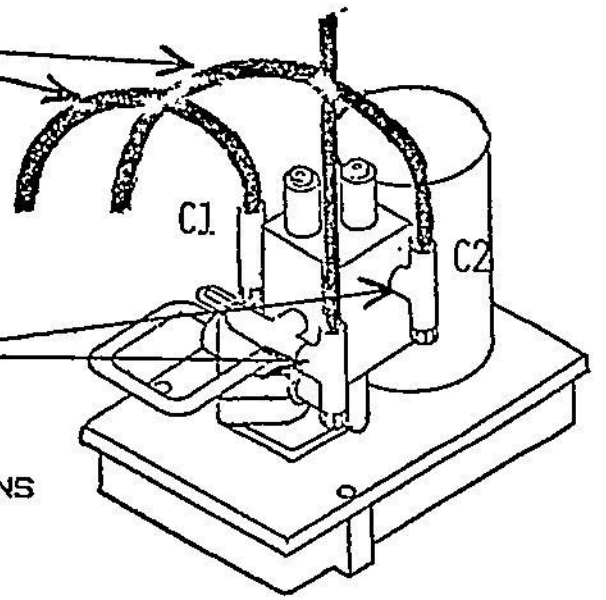
DO NOT USE TEFLON TAPE



CORRECT !
PUMP LINES LEAD CONTINUOUSLY UPWARD TO CYLINDER LINES.

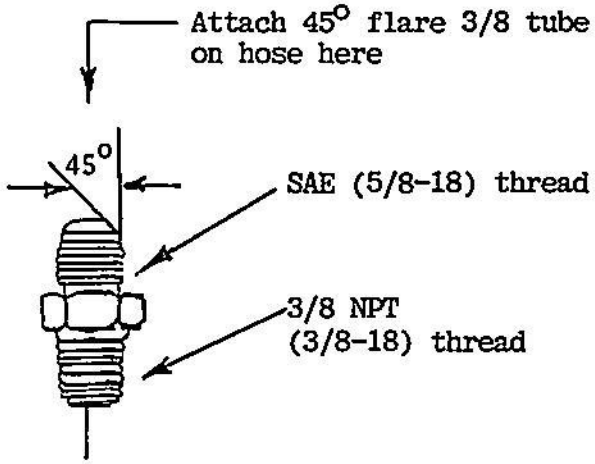
MINIMUM 2 FT. HOSE (DOUBLE BRAID) FOR NOISE ISOLATION AND EASE OF SERVICING.

WRONG !
AVOID LOOPS IN PUMP LINE TO PREVENT TRAPPED AIR.

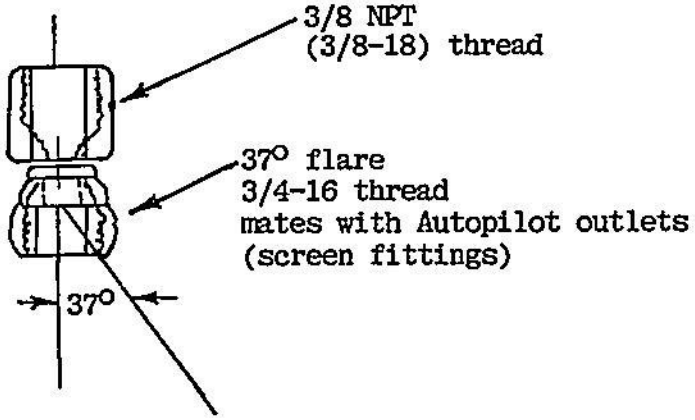


DO NOT REMOVE SCREEN "T" FITTINGS ON MOTION CONTROL VALVE.
(FOR CLEANING SCREENS SEE DWG. 4232213-3)

ADAPTERS FOR COUPLING 37° JIC FITTINGS TO 45° SAE FITTINGS ON POWER PACKS CODE -30 & -531



Aeroquip
Part #2000-6-6B



Aeroquip
Part #2242-6-8S

WOOD FREEMAN AUTOMATIC PILOTS

METAL MARINE PILOT, INC.
2119 MILDRED STREET WEST, TACOMA, WASHINGTON 98466 U.S.A
Telephone (206) 564-5902

MODEL POWER PACKS -30 & -531	SCALE None	DATE 5-9-73
	DRWN D.H.	CK
	ASSEMBLY	
TITLE Coupling 37° JIC to 45° SAE Fittings	SERIAL	
	PREVIOUS	
	NO. 4232114	

TECHNICAL TIP

There seems to be some confusion about 'Light Oil' Hynautic Steering systems recently, especially when interfacing some autopilots. Since 1961 Hynautic has recommended Light Oil in ALL our steering systems.

Why a light oil? Very simply, reduced wheel effort. A heavy, viscous oil resists flowing through the system's piping, ports and fittings. This resistance increases with cooler temperatures.

A wide range of suitable fluids are available. The points to remember in selecting a fluid are:

1. Petroleum Base - Compatible with our Buna N and Nitrile seals.

2. Viscosity Index - The higher the number, the better. High viscosity index fluids change less with temperature change.

3. Flash Point - Higher flash point fluids are preferred for safety. The USCG specifies 200 degrees F. (open cup) minimum.

4. Color - Some of the clear fluids have the necessary requirements above, but they are hard to see in the sight buttons which makes it difficult to ascertain fluid level in the reservoir.

5. An anti-foam ingredient will reduce the amount of air that can be saturated into the fluid.

BEST CHOICE MIL-H-5606A aviation hydraulic fluid. *

It is available wherever aircraft are serviced, from most petroleum bulk distributors, and from Hynautic (Part #MCO-02). Savings can be effected by purchasing in bulk (55 gal. drums) from your local petroleum supplier if your usage is high. It is red in color, has an anti-foam ingredient, viscosity is low (66 SUS at 100 degrees F.), viscosity index is 226, and flash point (open cup) is 220 degrees F. Also, it is compatible with ATF, Dexron approved type A, should an emergency require it. Dexron ATF is carried aboard most boats for their hydraulic transmissions, and it is available almost everywhere fuel is sold.

* INDICATES A MODIFICATION OF ORIGINAL TEXT

REPRINTED FROM "THE BOSUN" APRIL 1979 WITH PERMISSION FROM HYNAUTIC, INC.

ALTERNATIVES ARE:

BRAND	VISCOSITY SUS at 100 deg. F.
SHELL TELLUS OILS	
15	60
21	105
MOBILE DTE 10 SERIES	
DTE 4	90
DTE 13	150
CASTROL HYSPIN (UNITED KINGDOM)	
AWS 10	55
AWS 15	80
AWS 22	110
GULF HARMONY	
AW 41	105
AW 43	150
AMERICAN OIL CO.	
RYKON 11	105
RYKON 15	150
SAE 5W MOTOR OIL	100
SAE 10W MOTOR OIL	150
AUTOMATIC TRANSMISSION FLUID, DEXRON APPROVED, TYPE A (ATF)	180-200

TYPE F (FORD) AUTOMATIC TRANSMISSION FLUIDS SHOULD NOT BE USED.

We have recorded decreases in dockside rim effort of 20% to 50% by simply draining heavy fluids and refilling and purging with MIL-H-5606A.

REPRINTED FROM "THE BOSUN" APRIL 1979 WITH PERMISSION FROM HYNAUTIC, INC.

* POWER PACK - 531 *

REVERSING PUMP MODEL

Direct reversing gear pump unit, using -521 split field series wound motor.

1) Locate pump unit in any convenient location, free of possible bilge water immersion so that:

   (A) The motion control valve is below the level of the highest bleeding point in the system.

   (B) The unit is on horizontal surface with motion control valve uppermost.

   (C) The connecting lines from ports C2 "LEFT RUDDER PRESSURE" and C1 "RIGHT RUDDER PRESSURE" of Motion Control valve to steering system lines, lead continuously upward without loops or dips.

2) Secure unit to vessel with shock mounts provided.

* HYDRAULIC CONNECTIONS (Power Pack -531) *

1) The Pump Unit may be used with reservoirs either vented or pressurized at not over 50 psi.

2) Connect ports C1 (labelled "Right Rudder Pressure") and C2 (labelled "Left Rudder Pressure") with 2 to 6 feet of 1/2" or 3/8" double steel braided hose (3500 PSI min.) to tee connections in steering system as shown in appropriate drawing. (See table of contents)

3) Connect "T" port of Motion Control valve with 2 to 6 feet of 3/8" or 1/2" hose to bottom of system reservoir with at least one quart capacity. Usually the helm pump is used as a reservoir, such as Wagner and Capilano.

   IN CONNECTING DIRECTLY TO THE HELM UNIT RESERVOIR, IT IS ADVISABLE TO PROVIDE A SURGE TANK OF CAPACITY AT LEAST TWICE THE DISPLACEMENT OF THE RUDDER RAM, CONNECTED TO THE UPPER FITTING OF THE RESERVOIR, VENTED, AND LOCATED WITH BOTTOM OF RESERVOIR AT OR ABOVE LEVEL OF TOP OF HELM UNIT. The surge tank decreases tendency of the helm seal to leak. A clear vinyl line between surge tank and top helm may serve as low oil warning indicator.

4) Shut off valves are recommended in all three hydraulic lines to facilitate trouble shooting and servicing. (Refer to FITTINGS, HOSES, AND PIPING)

* POWER PACK -521 *

TORQUE BOOST METERING PUMP MODEL

* INSTALLATION *

1) Type A "Dexron" Automatic transmission fluid is recommended with this unit. It is readily available at automobile service stations as well as marine oil dealers. (Refer to recommended oils)

2) Locate -521 unit in an area free of water submersion danger so that the left and right pressure lines from the motion control valve lead continuously upward to the rudder cylinder lines. The engine room is frequently the best place.

3) Mount unit on horizontal surface, gear case down, by 3 point suspension, using standoffs and the 3 mounting lugs on gear case.

4) Replace the red plastic plug in the gear case with the vented plastic plug provided.

5) Connect the five ports of the -521 in accordance with the appropriate drawing (see table of contents) using 2 to 6 feet of 1/2" double steel braided hose.

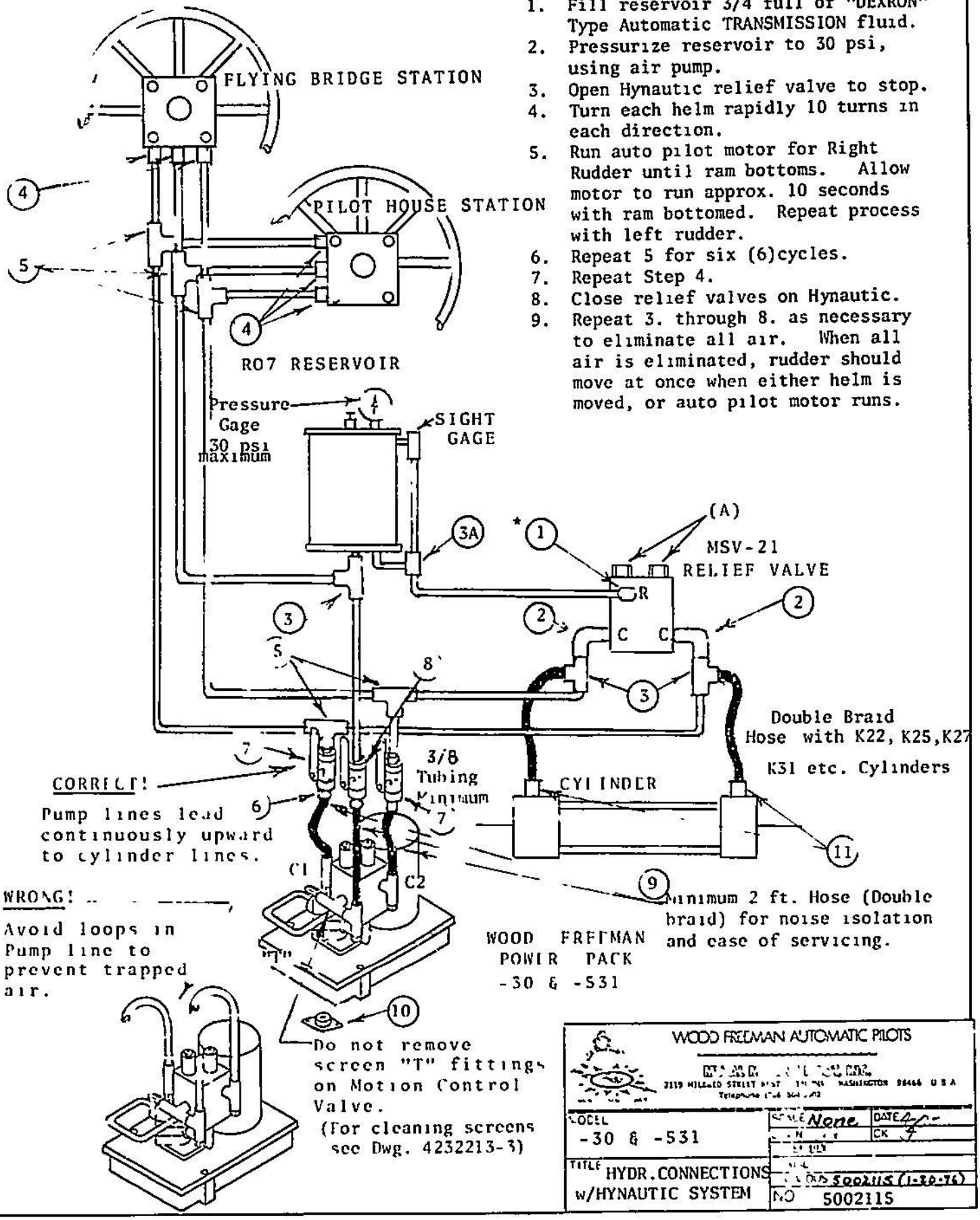
   Shut-off valves in the left and right pressure lines and the "T" port line are desirable to enable removal of -521 unit for servicing without disabling the hydraulic steering system or causing excessive oil loss.

   The Emergency bypass provision in pressure line is required to isolate a damaged unit, while maintaining pressure on other power steering stations.

6) The full flow filter, provided, must be used between the hydraulic pressure source and the -521 "IN" port.

FOR:	REFER TO:	DRAWING #
ELECTRICAL CONNECTIONS	Cable connecting Components	5006010-B-2
	"XL" Power Supply	5006123-2R-2

* Circled numbers refer to Fittings Kit for Hynautic System. Chart on reverse page.



BLEED PROCEDURE:

1. Fill reservoir 3/4 full of "DEXRON" Type Automatic TRANSMISSION fluid.
2. Pressurize reservoir to 30 psi, using air pump.
3. Open Hynautic relief valve to stop.
4. Turn each helm rapidly 10 turns in each direction.
5. Run auto pilot motor for Right Rudder until ram bottoms. Allow motor to run approx. 10 seconds with ram bottomed. Repeat process with left rudder.
6. Repeat 5 for six (6)cycles.
7. Repeat Step 4.
8. Close relief valves on Hynautic.
9. Repeat 3. through 8. as necessary to eliminate all air. When all air is eliminated, rudder should move at once when either helm is moved, or auto pilot motor runs.

WOOD FREEMAN AUTOMATIC PILOTS

2119 HILLARD STREET [illegible] WASHINGTON 98466 U.S.A.

MODEL -30 & -531	SCALE None	DATE 4-[illegible]
	DRN [illegible]	CK [illegible]
TITLE HYDR. CONNECTIONS w/HYNAUTIC SYSTEM	[illegible] DWG 5002115 (1-30-76)	
	NO 5002115	

STANDARD FITTINGS FOR HYNAUTIC SYSTEM

SINGLE HELM INSTALLATION

1) 90 Degree elbow (4-4CBTXS)# 1/4 NPT - 1/4 Tube

2) Street L (C3409X4# Cad. Pltd.) (2 required)

3) Running Tee (6RBTX-S)# 1/4 NPT x 3/8 Tube x 3/8 Tube (3 required)

3A) Straight Brass Connector

* 4) Connectors (6FBTX-S)# 1/4 NPT x 3/8 Tube (3 required)

* 5) Union Tee (6JBTX-S)# 3/8 Tube x 3/8 Tube x 3/8 Tube (2 required)

6) Tube Connector (6FBTX-S)# 3/8 NPT x 3/8 Tube (6 required)
(1 on each side of Worcester Valve)

7) Worcester Shut-Off Valve (3/8-411YBB) 3000 psi (2 required)

8) Shut Off Valve (CBC-3/8) 400 psi (1 required)
(Apollo Ball Valve or equivalent)

9) 3/8 Double Braided 3500 psi Hose, Female swivel nut each end

10) Noise Isolation Mounts (3 required) furnished with -531

11) Straight Connector 3/8 Pipe to 1/2 Hose

* For each additional Helm, add Items (4) and (5)

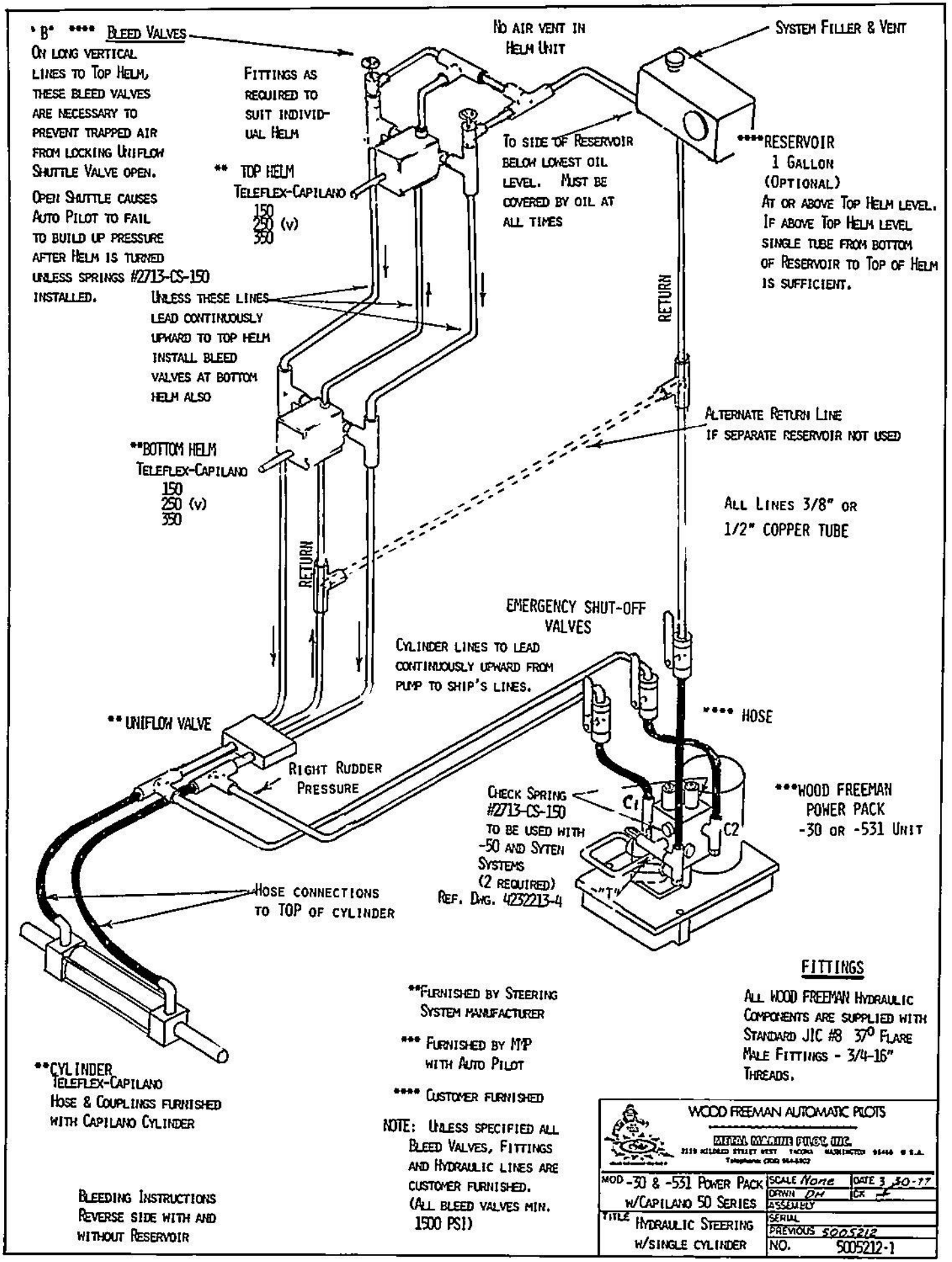
NOTE: If "B" is in the part number, nut and sleeve are included.

Refers to Parker fitting number.
Equivalent fitting of other manufacturers may be used.

METAL MARINE PILOT, INC.
2119 West Mildred Street,
Tacoma, Washington 98466

Phone (206) 564-5902

NOTICE - - - DO NOT USE TEFLON TAPE ON THIS SYSTEM - - - NOTICE



WOOD FREEMAN® -30 & -531 POWER PACKS WITH CAPILANO 50 SERIES

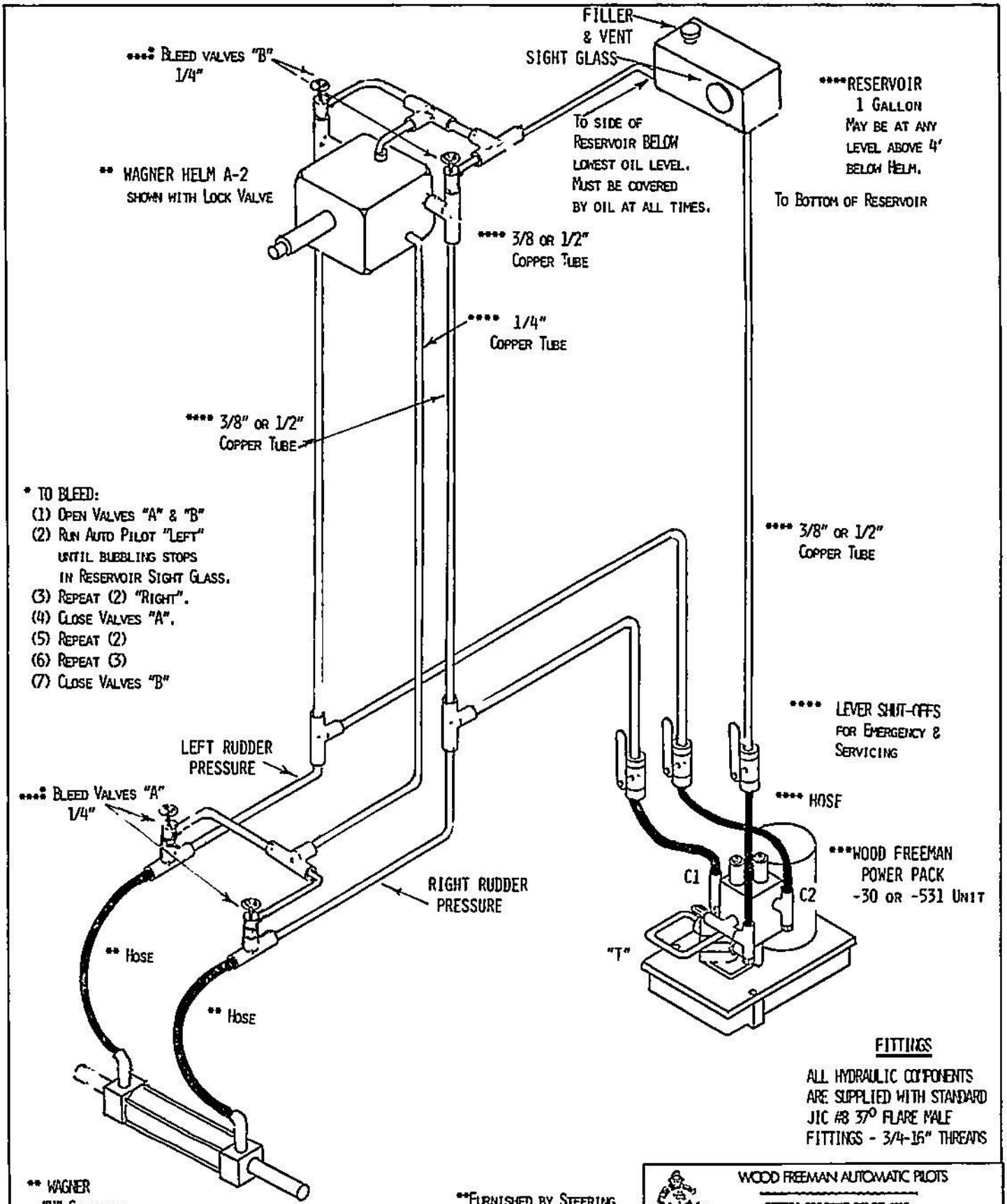
FILLING SYSTEM WITH OIL & PURGING AIR - USE AUTOMATIC TRANSMISSION FLUID "DEXRON" TYPE "A"

1) Fill Reservoir 3/4 full of proper oil - "Dexron" Type A.
2) Open Bleed Valves "B" and Emergency shut-off valves (at Autopilot).
3) Run Autopilot "left" until bubbling stops in reservoir sight glass.
4) Repeat (3) "Right".
5) Rotate lower helm clockwise 10 turns.
6) Repeat (5) counterclockwise.
7) Repeat (5) and (6) with upper helm.
8) Close Bleed Valves "B"; then open one turn.
9) Repeat Steps (5) through (7).
10) Close Bleed Valves "B".
11) After one week of operating, open Bleed Valves "B" one turn and repeat Steps (5) through (7).
12) Close Bleed Valves "B".

METAL MARINE PILOT, INC.
2119 West Mildred Street,
Tacoma, Washington 98466

Telephone (206) 564-5902

NOTICE - - - DO NOT USE TEFLON TAPE ON THIS SYSTEM - - - NOTICE



FITTINGS

ALL HYDRAULIC COMPONENTS ARE SUPPLIED WITH STANDARD JIC #8 37° FLARE MALE FITTINGS - 3/4-16" THREADS

** WAGNER "H" CYLINDER OR "T" HOSE FURNISHED "H"

**FURNISHED BY STEERING SYSTEM MANUFACTURER

***FURNISHED BY MFP WITH AUTO PILOT

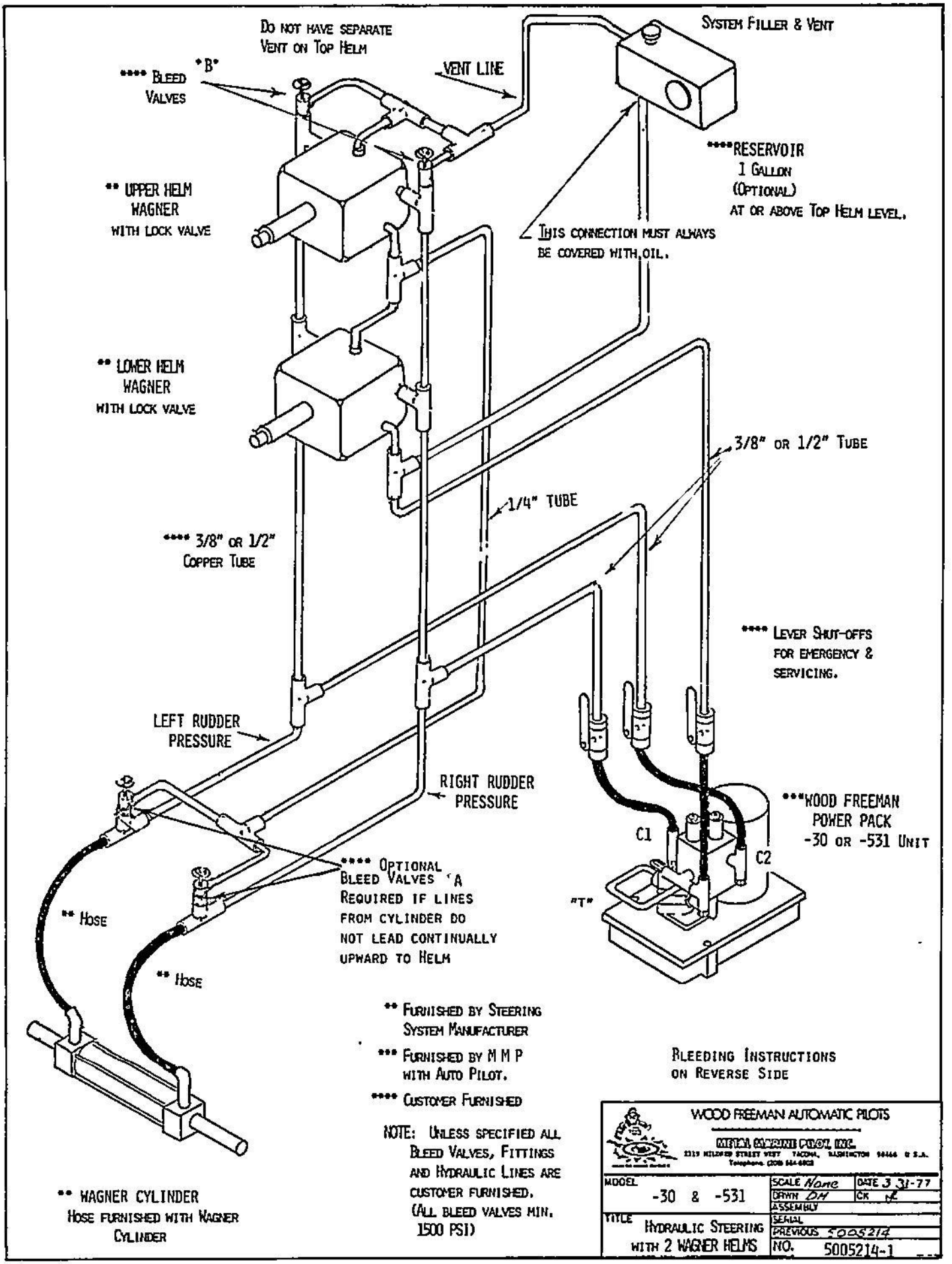
****CUSTOMER FURNISHED

WOOD FREEMAN AUTOMATIC PILOTS

WOOD FREEMAN PILOT, INC.
2119 KILDEER STREET WEST TACOMA, WASHINGTON 98466 U.S.A.
Telephone (206) 564-6962

MODEL -30 & -531 WITH WAGNER SYSTEM	SCALE None	DATE 3-30 77
	DRWN DH	CK
	ASSEMBLY	
TITLE RAPID BLEEDING & SELF-BLEEDING CONVERSION	SERIAL	
	PREVIOUS 5005218	
	NO 5005213-1	

NOTICE - - - DO NOT USE TEFLON TAPE ON THIS SYSTEM - - - NOTICE



INSTRUCTIONS FOR PURGING AIR FROM SYSTEM
DRAWING 5005214-1
WAGNER - DUAL HELM -30 OR -531 POWER PACK

1) Fill reservoir to top of sight gage with either #9 Turbine oil; or Type A "Dexron" Automatic Transmission Fluid.

2) Open Bleed valves "A" and "B" (if fitted).

3) Open shut off valves to power pack.

4) Rotate lower helm slowly to right for at least 20 turns or until resistance is felt.

5) Repeat (4) to left.

6) Repeat (4) and (5) with upper helm.
Refill Reservoir to upper level of sight gage.

7) Run Autopilot power pack for right rudder for 30 seconds.

8) Repeat (7) to left.

9) Close Valves "B".

10) Rapidly rotate bottom helm alternately hardover left and right until no more bubbles appear in reservoir sight gage.

11) Repeat (10) with top helm.

12) Close bleed valves "A".

13) Refill reservoir as necessary.

14) System should now be ready for service.

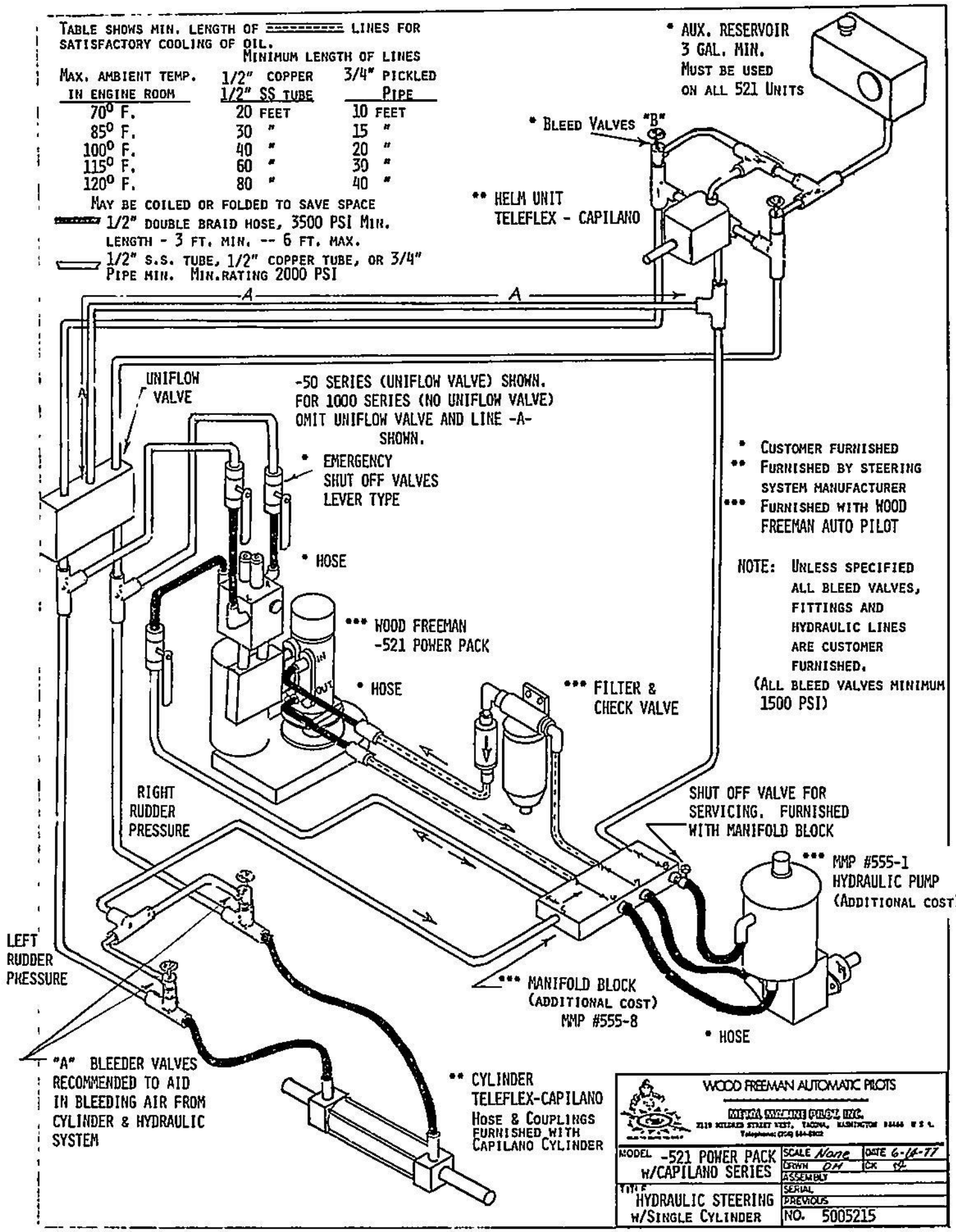
15) Within the next 10 days, operate the system for about an hour underway, hand steering with bleed valves "A" opened 1/4 turn -
Close bleed valves.

16) Repeat (15) whenever system appears "spongy" or if work has been done on the hydraulic system.

METAL MARINE PILOT, INC.
2119 Mildred Street West,
Tacoma, Washington 98466

Telephone (206) 564-5902

NOTICE - - - DO NOT USE TEFLON TAPE ON THIS SYSTEM - - - NOTICE



WOOD FREEMAN AUTOMATIC PILOTS

MEDINA MARINE PROD. INC.

MODEL -521 POWER PACK W/CAPILANO SERIES	SCALE None	DATE 6-14-77
	DRWN DH	CK
	ASSEMBLY	
TITLE HYDRAULIC STEERING W/SINGLE CYLINDER	SERIAL	
	PREVIOUS	
	NO. 5005215	

WOOD FREEMAN® -521 POWER PACK WITH TELEFLEX-CAPILANO -50 SERIES HYDRAULIC STEERING GEAR

FILLING SYSTEM WITH OIL AND PURGING AIR - USE AUTOMATIC TRANSMISSION FLUID "DEXRON" TYPE A.

1) Remove cover from hydraulic pump reservoir (WOOD FREEMAN® 555-1 Pump only) - Fill Reservoir to top and replace cover.

2) Fill Auxiliary reservoir.

3) Open manifold block valve at position #8 to allow flow between Helm Pump (or reservoir) and hydraulic pump.

4) Open all emergency shut-off valves on -521 Power Pack.

5) Open Bypass and bleeder valves at rudder cylinder and bleed valves at helm. On -50 and Syten Series Teleflex-Capilano helms, external bleed valves shown are recommended to prevent air trapping in helm lines.

6) Operate engine (or electric motor drive) to run hydraulic pump.

7) Selector Switch on 500 Console on "RUDDER DIAL".

8) Dial 35 Degrees left rudder on Console, and hold for 30 sconds, then 35 Degrees right rudder for 30 seconds.

9) Repeat Step (8) 4 times.

10) Close Bleed and Bypass valves at cylinder.

11) Turn helm pump hardover port and continue turning for 10 extra turns.

12) Repeat (7) to starboard.

13) Replenish oil level in reservoir as necessary.

METAL MARINE PILOT, INC.
2119 West Mildred Street,
Tacoma, Washington 98466

Telephone (206) 564-5902

NOTICE - - - DO NOT USE TEFLON TAPE ON THIS SYSTEM - - - NOTICE

TABLE SHOWS MIN. LENGTH OF ═══ LINES FOR SATISFACTORY COOLING OF OIL.

MAX. AMBIENT TEMP. IN ENGINE ROOM	MINIMUM LENGTH OF LINES 1/2" COPPER 1/2" SS TUBE	3/4" PICKLED PIPE
70° F.	20 FEET	10 FEET
85° F.	30 "	15 "
100° F.	40 "	20 "
115° F.	60 "	30 "
120° F.	80 "	40 "

MAY BE COILED OR FOLDED TO SAVE SPACE

═══ 1/2" DOUBLE BRAID HOSE, 3500 PSI MIN. LENGTH - 3 FT. MIN. -- 6 FT. MAX.

═══ 1/2" S.S. TUBE, 1/2" COPPER TUBE, OR 3/4" PIPE MIN. MIN. RATING 2000 PSI

* AUX. RESERVOIR 1 GAL. MIN. MUST BE USED ON ALL 521 UNITS

* BLEED VALVES "B"

** WAGNER HELM

LEFT

RIGHT

RIGHT RUDDER PRESSURE

* EMERGENCY SHUT OFF VALVES LEVER TYPE

* HOSE

*** WOOD FREEMAN -521 POWER PACK

* HOSE

*** FILTER & CHECK VALVE

SHUT OFF VALVE FOR SERVICING. FURNISHED WITH MANIFOLD BLOCK

*** MMP #555-1 HYDRAULIC PUMP (ADDITIONAL COST)

*** MANIFOLD BLOCK (ADDITIONAL COST) MMP #555-8

* HOSE

LEFT RUDDER PRESSURE

** HOSE

** HOSE

"A" BLEEDER VALVES RECOMMENDED TO AID IN BLEEDING AIR FROM CYLINDER AND HYDRAULIC SYSTEM

** WAGNER CYLINDER

* CUSTOMER FURNISHED

** FURNISHED BY STEERING SYSTEM MANUFACTURER

*** FURNISHED WITH WOOD FREEMAN AUTO PILOT

NOTE: UNLESS SPECIFIED ALL BLEED VALVES, FITTINGS AND HYDRAULIC LINES ARE CUSTOMER FURNISHED. (ALL BLEED VALVES MINIMUM 1500 PSI)

WOOD FREEMAN AUTOMATIC PILOTS

MARINE MACHINE PRODUCTS, INC.

2119 ALLRED STREET WEST TACOMA, WASHINGTON 98466 U.S.A.

Telephone (206) 564-6902

MODEL -521 WITH WAGNER SYSTEM		SCALE None	DATE 6/77
		DRWN DM	CK
		ASSEMBLY	
TITLE SINGLE HELM UNIT		SERIAL	
		PREVIOUS	
		NO. 5005216	

* FILLING AND AIR PURGING INSTRUCTIONS *

WOOD FREEMAN -521 POWER PACK WITH WAGNER HYDRAULIC SYSTEM AND CAPILANO 1000 SERIES SINGLE HELM SYSTEMS

For rapid and complete purging of air without loss of fluid, component connections and the use of bleed valves and auxiliary reservoir (customer furnished), shown on Drawing 5005216 are recommended.

The following procedure is based on the configuration of Drawing 5005216, using MMP #555-1 engine driven pump.

The recommended fluid for maximum pump and -521 Power Pack life is A.T.F. (Automatic Transmission Fluid), Dexron Type A, available at all service and marine stations.

FILLING AND PURGING MANUAL STEERING (HELM) SYSTEM (Engine not running)

1 - Open bypass and bleeder valves at cylinder.

2 - Fill auxiliary reservoir to 3/4 mark, and add oil to maintain this level during filling and purging.

3 - Rotate helm right 30 turns rapidly - (Bottom helm followed by top helm on dual helm).

4 - Repeat (3) for helm left - (Bottom helm followed by top helm on Dual helm).

5 - Repeat (4) and (5) until oil level in reservoir remains constant.

6 - Close bleeder valves at cylinder.

7 - Open bleed valves at helm one turn.

8 - Slowly rotate helm right 30 turns.

9 - Slowly rotate helm left 30 turns.

10 - Close helm bleed valves.

11 - Bring oil level in auxiliary reservoir to full level.

Continued on next page.

* FILLING AND AIR PURGING INSTRUCTIONS * CONTINUED

FILLING AND PURGING POWER STEERING (-521) SYSTEM

12 - Close reservoir shut off valve on manifold block.

13 - Remove cover from pump reservoir and fill reservoir.

14 - Open bleed valves "A" at cylinder.

15 - Start engine and operate at idle speed.

16 - Add oil to hydraulic pump reservoir as needed to maintain oil level at vent hole in side of reservoir.

17 - When oil level remains steady, increase engine speed to 1000 R.P.M. adding oil to reservoir as necessary to maintain level.

18 - Open emergency shutoff valves on -521 Power Pack, if closed.

19 - Unplug 500 encoder plug (8 pin) from rear of 500 control console.

20 - Turn 500 Autopilot Function Selector to "RUDDER DIAL".

21 - Turn "RUDDER DIAL" full left.

22 - Replenish oil in pump reservoir as necessary.

23 - Repeat (21), and (22), but with "RUDDER DIAL" full right

24 - Repeat (21), (22) and (23) until oil level remains constant in pump reservoir.

25 - Replace cap on pump reservoir.

26 - Open shutoff valve on Manifold Block.

27 - Close bleed valves "A" at cylinder.

28 - Plug 500 Encoder cable (8 pin) into rear of 500 Control Console.

FOLLOW UP PURGING FOLLOWING INITIAL PURGE

29 - After 10 to 30 hours of underway operation, purge manual system by:
- (A) Stop engine.
- (B) Open top helm bleed valves.
- (C) Turn helm right 5 turns, then left 5 turns.
- (D) Repeat (C) 3 times.
- (E) Close helm bleed valves.
- (F) Fill auxiliary reservoir to 3/4 full level.

CAUTION: DO NOT RUN ENGINE DRIVEN PUMP WITH HELM BLEED VALVES OPEN.

NOTICE - - - DO NOT USE TEFLON TAPE ON THIS SYSTEM - - - NOTICE

* CUSTOMER FURNISHED
** FURNISHED BY STEERING SYSTEM MANUFACTURER
*** FURNISHED WITH WOOD FREEMAN AUTO PILOT

NOTE: UNLESS SPECIFIED ALL BLEED VALVES, FITTINGS AND HYDRAULIC LINES ARE CUSTOMER FURNISHED. (ALL BLEED VALVES MINIMUM 1500 PSI)

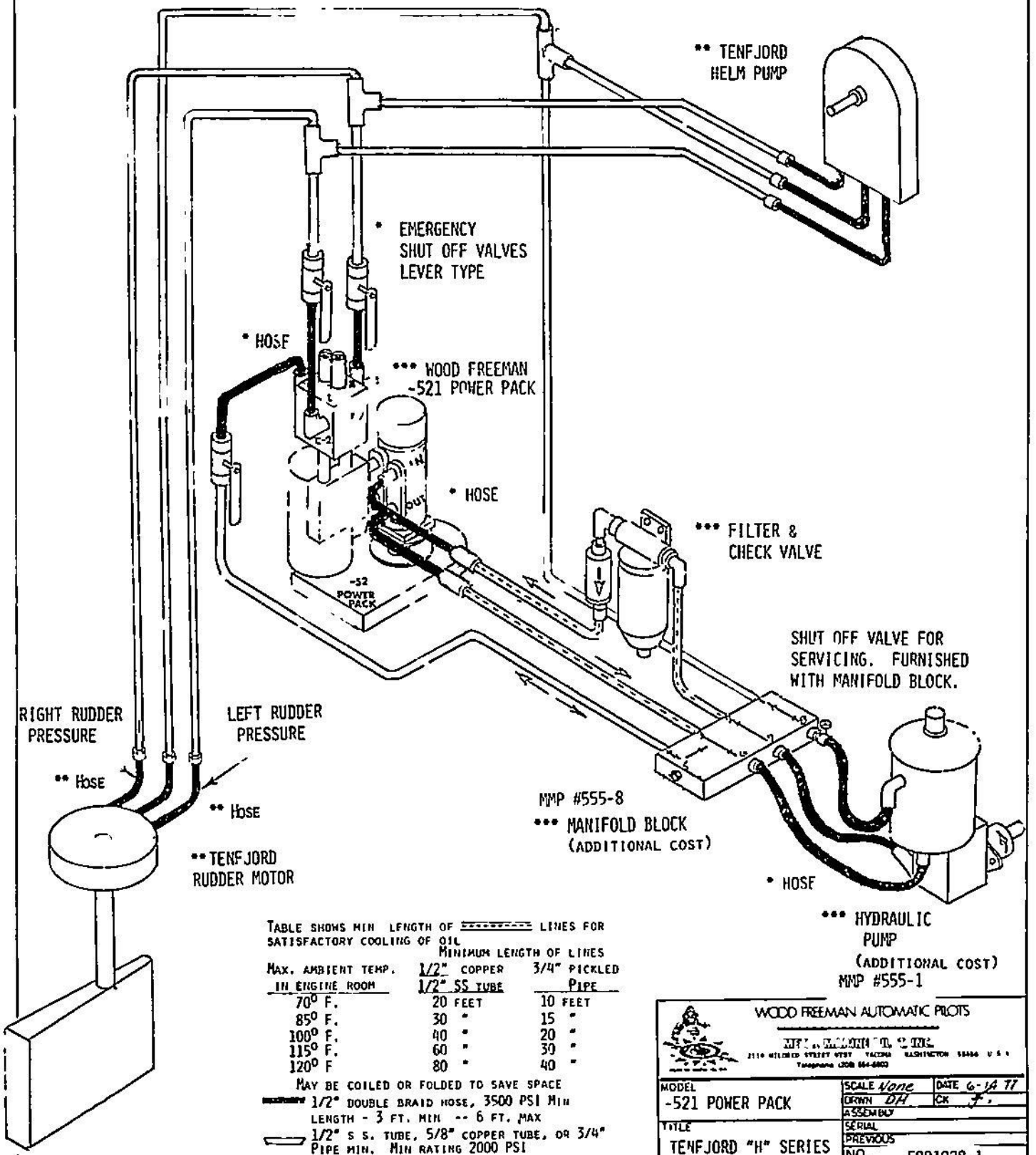


TABLE SHOWS MIN LENGTH OF ▭▭▭▭ LINES FOR SATISFACTORY COOLING OF OIL

MAX. AMBIENT TEMP. IN ENGINE ROOM	MINIMUM LENGTH OF LINES 1/2" COPPER 1/2" SS TUBE	3/4" PICKLED PIPE
70° F.	20 FEET	10 FEET
85° F.	30 "	15 "
100° F.	40 "	20 "
115° F.	60 "	30 "
120° F	80 "	40 "

MAY BE COILED OR FOLDED TO SAVE SPACE

▬▬ 1/2" DOUBLE BRAID HOSE, 3500 PSI MIN LENGTH - 3 FT. MIN -- 6 FT. MAX

▭ 1/2" S S. TUBE, 5/8" COPPER TUBE, OR 3/4" PIPE MIN. MIN RATING 2000 PSI

WOOD FREEMAN AUTOMATIC PILOTS

MFG. by [illegible]

MODEL -521 POWER PACK	SCALE None	DATE 6-14-77
	DRWN DH	CK F.
	ASSEMBLY	
TITLE TENFJORD "H" SERIES	SERIAL	
	PREVIOUS NO.	5001028-1

WOOD FREEMAN® -521 POWER PACK WITH TENFJORD "H" SERIES

FILLING SYSTEM WITH OIL AND PURGING AIR - USE AUTOMATIC TRANSMISSION FLUID "DEXRON" TYPE A.

1) Remove cover from hydraulic pump reservoir (WOOD FREEMAN® 555-1 Pump Only) - Fill Reservoir to top and replace cover.

2) Fill Tenfjord Helm pump.

3) Open manifold block valve at position #8 to allow flow between Helm pump and Hydraulic pump (engine-driven).

4) Open all emergency shut-off vlaves on -521 Power Pack.

5) Operate engine (or electric motor drive) to run hydraulic pump.

6) Turn helm pump hardover port and continue turning for 10 extra turns.

7) Repeat (6) to starboard.

8) Replenish oil level in helm pump to maintain high level.

9) With Pilot Console selecting "RUDDER DIAL", move RUDDER DIAL full right. Crank helm to left as rapidly as possible for 20 turns.

10) Repeat (9), but with RUDDER DIAL full left and helm cranked to right.

11) Replenish oil level in helm pump as necessary.

12) Remove encoder cable plug (8-pin) from back of 500 Pilot Console.

13) RUDDER DIAL 35 degrees right for 20 seconds.

14) Repeat (13) to left.

15) Replace encoder cable plug in back of Console (8-pin)

16) Replenish oil in Helm pump as necessary.

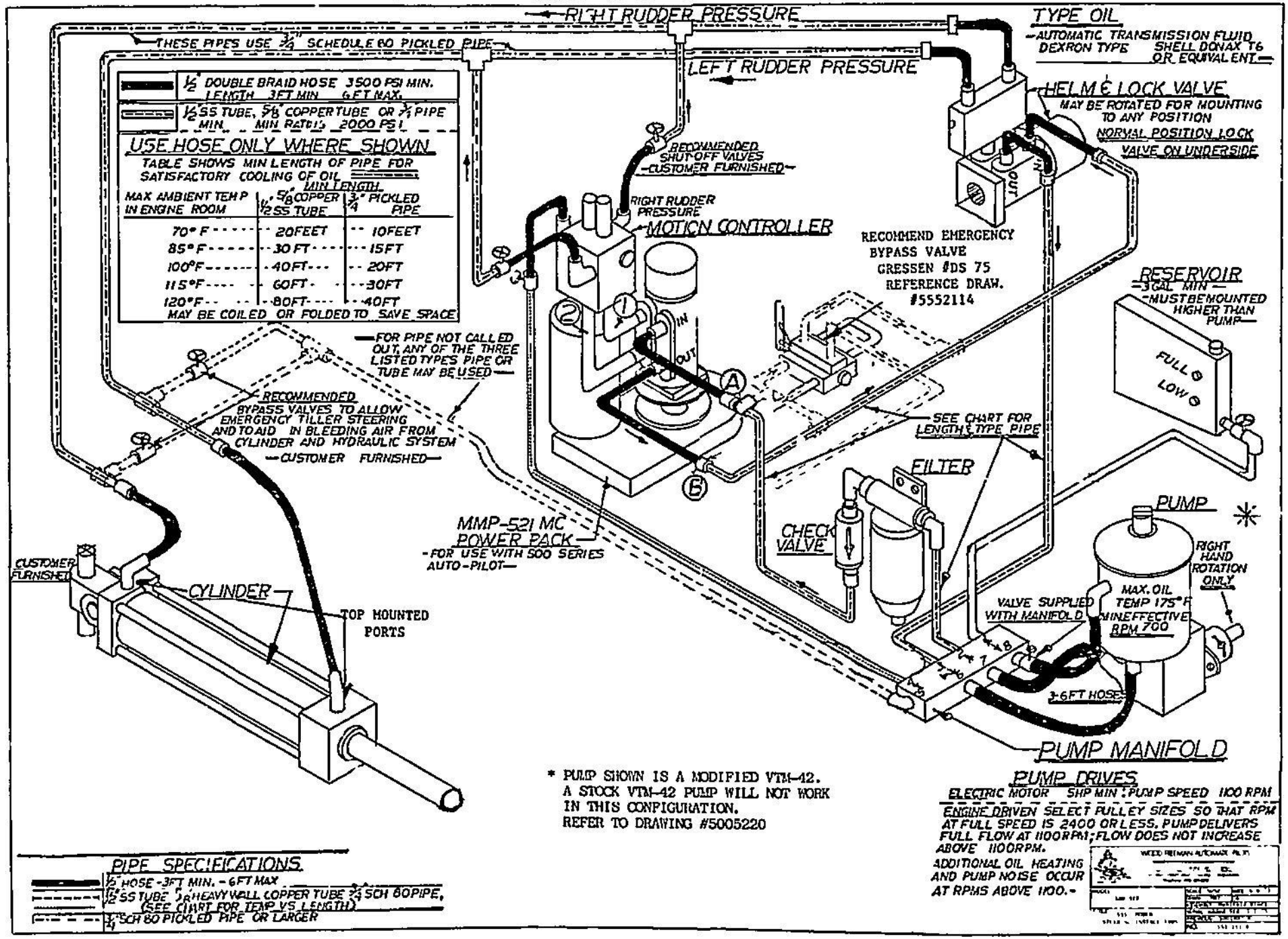
17) Repeat Steps (12) through (16) whenever system feels "spongy" on hand steering or autopilot appears to be continually oscillating or "hunting".

18) Repeat Steps (1) through (16) whenever componenets are relaced or piping connections are disconnected in the hydraulic circuit.

METAL MARINE PILOT, INC.
2119 West Mildred Street
Tacoma, Washington 98466

Telephone (206) 564-5902

NOTICE — DO NOT USE TEFLON TAPE — NOTICE



* PUMP SHOWN IS A MODIFIED VTM-42. A STOCK VTM-42 PUMP WILL NOT WORK IN THIS CONFIGURATION. REFER TO DRAWING #5005220

PUMP DRIVES

ELECTRIC MOTOR 5HP MIN - PUMP SPEED 1100 RPM

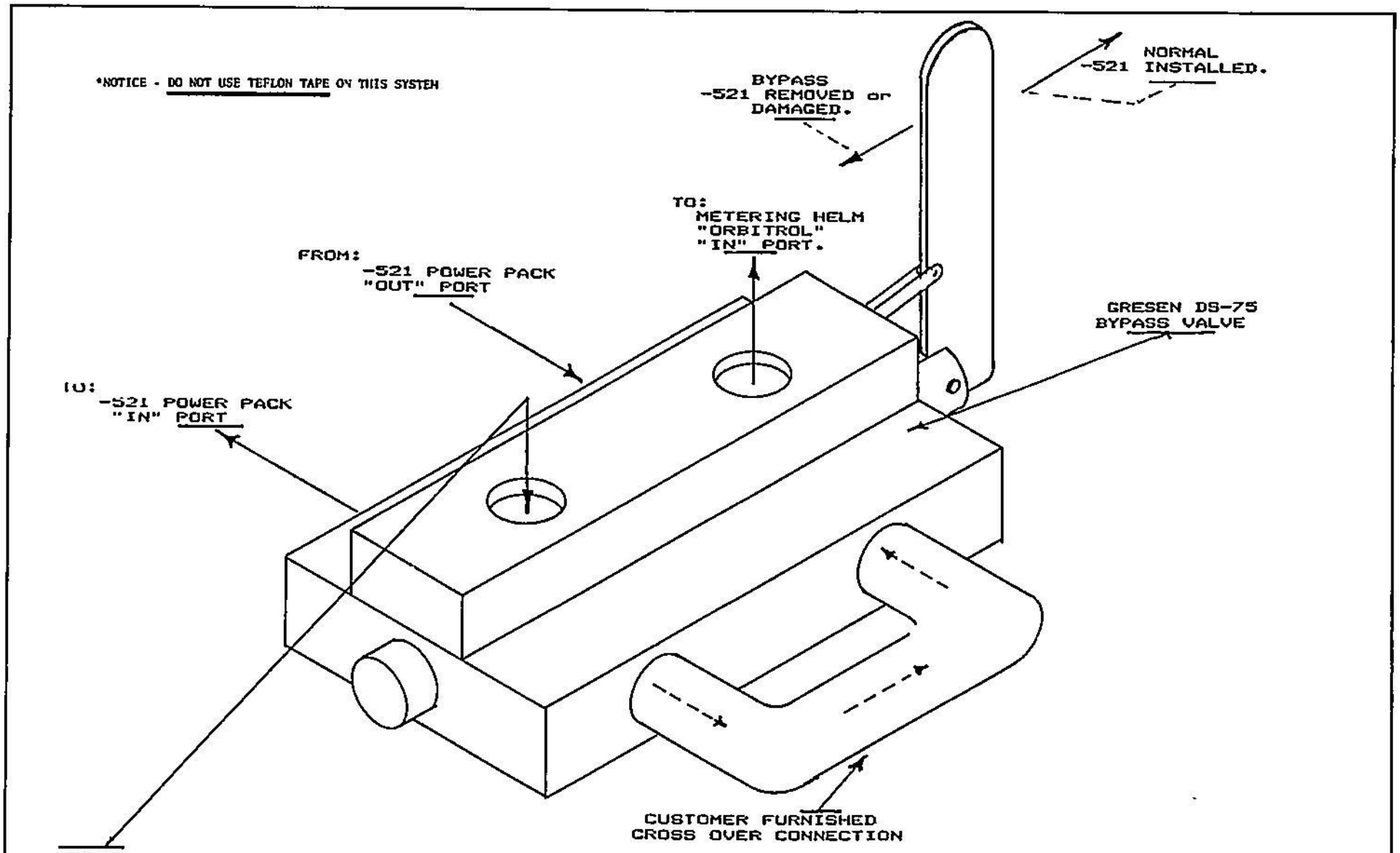
ENGINE DRIVEN SELECT PULLEY SIZES SO THAT RPM AT FULL SPEED IS 2400 OR LESS. PUMP DELIVERS FULL FLOW AT 1100 RPM; FLOW DOES NOT INCREASE ABOVE 1100 RPM. ADDITIONAL OIL HEATING AND PUMP NOISE OCCUR AT RPMS ABOVE 1100.

PIPE SPECIFICATIONS

½" HOSE - 3FT MIN. - 6FT MAX

½" SS TUBE ⅝" HEAVY WALL COPPER TUBE ¾" SCH 80 PIPE, (SEE CHART FOR TEMP VS LENGTH)

¾" SCH 80 PICKLED PIPE OR LARGER



NOTE:
When -521 removed or closed out of system, the 3 shut off valves on the Left, Right and "T" ports of the motion control valve must also be closed.

WOOD FREEMAN AUTOMATIC PILOTS

METAL MACHINE PILOT, INC.

MODEL GRESEN DS75 BYPASS VALVE	SCALE NONE	DATE 5-9-79
	DRWN MHF	CK
	ASSEMBLY	
TITLE -521 POWER PACK EMERGENCY BYPASS	SERIAL	
	PREVIOUS	
	NO. 5552114	

RECOMMENDED SHUT OFF VALVES

FOR SERVICING

** 1500 PSI MIN.

(CUSTOMER FURNISHED.)

*NOTICE - DO NOT USE TEFLON TAPE ON THIS SYSTEM

POWER PACK	GPM REQUIREMENTS			CYLINDER DISPLACEMENT
-521-6	1	TO	6	18cu.in. TO 50 cu.in.
-521-10	2	TO	6	35cu.in. TO 90 cu.in.
-521-23	4	TO	12	75cu.in. TO 220cu.in.
-521-47	8	TO	12	145cu.in. TO 370cu.in.

FOR ADDITIONAL INFORMATION CONTACT METAL MARINE PILOT INC.

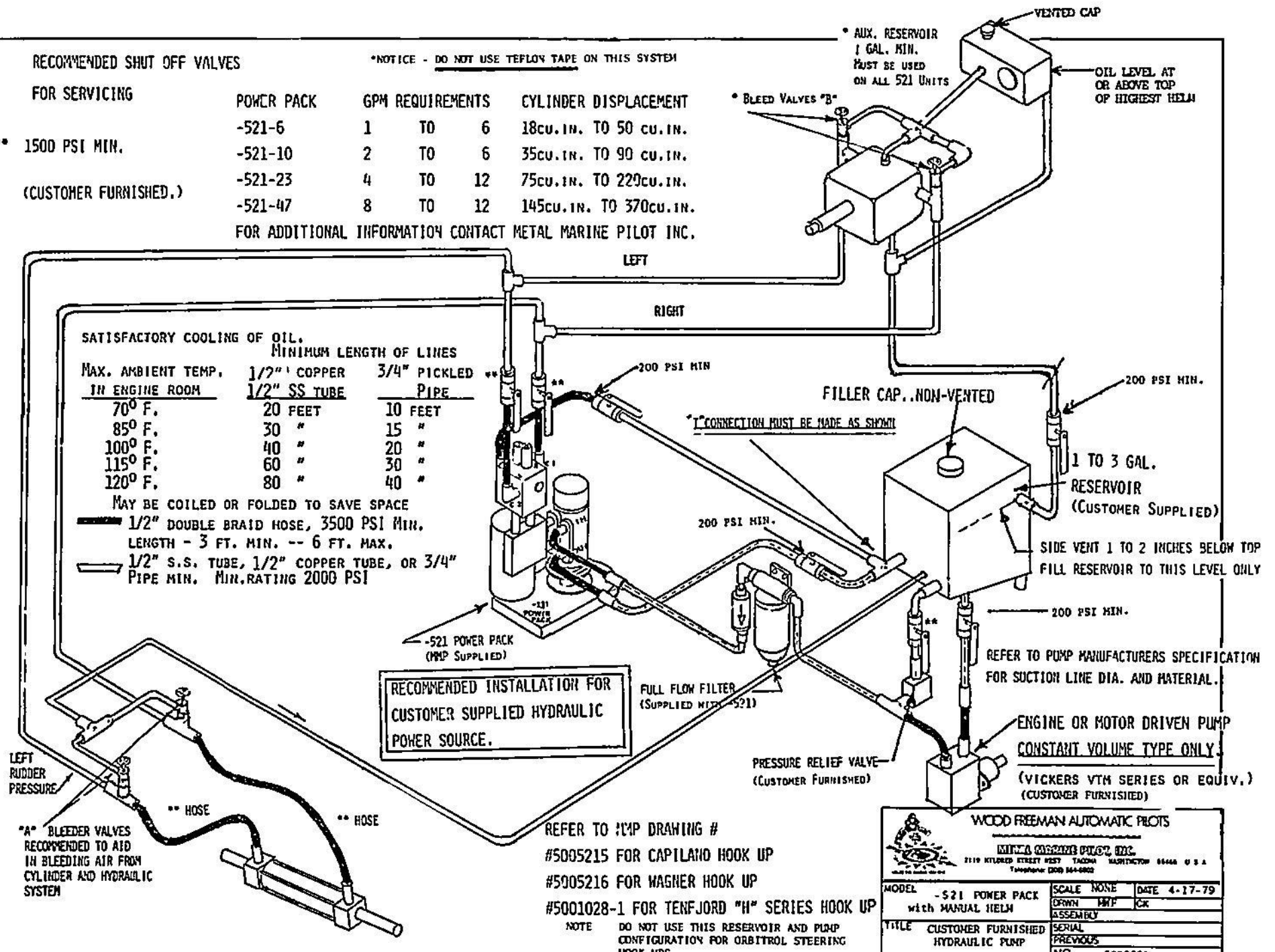
SATISFACTORY COOLING OF OIL.

MAX. AMBIENT TEMP. IN ENGINE ROOM	MINIMUM LENGTH OF LINES 1/2" COPPER 1/2" SS TUBE	3/4" PICKLED ** PIPE
70° F.	20 FEET	10 FEET
85° F.	30 "	15 "
100° F.	40 "	20 "
115° F.	60 "	30 "
120° F.	80 "	40 "

MAY BE COILED OR FOLDED TO SAVE SPACE

1/2" DOUBLE BRAID HOSE, 3500 PSI MIN. LENGTH - 3 FT. MIN. -- 6 FT. MAX.

1/2" S.S. TUBE, 1/2" COPPER TUBE, OR 3/4" PIPE MIN. MIN.RATING 2000 PSI



REFER TO PUMP DRAWING #

#5005215 FOR CAPILANO HOOK UP

#5005216 FOR WAGNER HOOK UP

#5001028-1 FOR TENFJORD "H" SERIES HOOK UP

NOTE DO NOT USE THIS RESERVOIR AND PUMP CONFIGURATION FOR ORBITROL STEERING HOOK UPS

WOOD FREEMAN AUTOMATIC PILOTS

MINA MARINE PILOT INC.

2119 KITSILANO STREET WEST TACOMA WASHINGTON 98466 U.S.A.

Telephone (206) 564-6802

MODEL -521 POWER PACK with MANUAL HELM	SCALE NONE	DATE 4-17-79	
	DRWN MMP	CK	
	ASSEMBLY		
TITLE CUSTOMER FURNISHED HYDRAULIC PUMP	SERIAL		
	PREVIOUS		
	NO. 5005221		

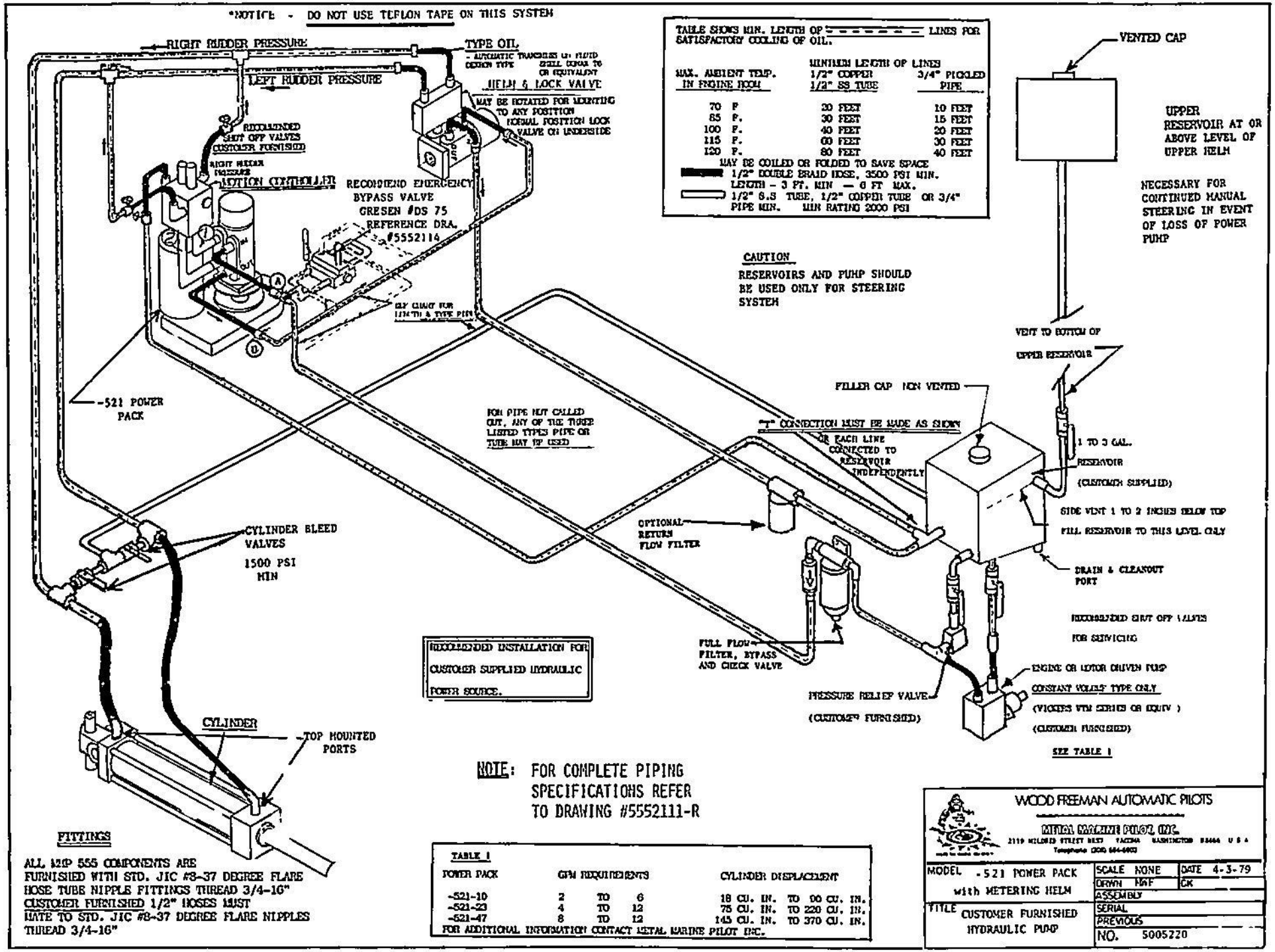


TABLE SHOWS MIN. LENGTH OF ═══ LINES FOR SATISFACTORY COOLING OF OIL.

MAX. AMBIENT TEMP. IN ENGINE ROOM	MINIMUM LENGTH OF LINES 1/2" COPPER 1/2" SS TUBE	3/4" PICKLED PIPE
70 F	20 FEET	10 FEET
85 F.	30 FEET	15 FEET
100 F.	40 FEET	20 FEET
115 F.	60 FEET	30 FEET
120 F.	80 FEET	40 FEET

MAY BE COILED OR FOLDED TO SAVE SPACE
1/2" DOUBLE BRAID HOSE, 3500 PSI MIN. LENGTH - 3 FT. MIN — 6 FT MAX.
1/2" O.D. TUBE, 1/2" COPPER TUBE OR 3/4" PIPE MIN. MIN RATING 2000 PSI

CAUTION

RESERVOIRS AND PUMP SHOULD BE USED ONLY FOR STEERING SYSTEM

RECOMMENDED INSTALLATION FOR CUSTOMER SUPPLIED HYDRAULIC POWER SOURCE.

NOTE: FOR COMPLETE PIPING SPECIFICATIONS REFER TO DRAWING #5552111-R

FITTINGS

ALL M2P 555 COMPONENTS ARE FURNISHED WITH STD. JIC #8-37 DEGREE FLARE HOSE TUBE NIPPLE FITTINGS THREAD 3/4-16" CUSTOMER FURNISHED 1/2" HOSES MUST MATE TO STD. JIC #8-37 DEGREE FLARE NIPPLES THREAD 3/4-16"

TABLE 1

POWER PACK	GPM REQUIREMENTS	CYLINDER DISPLACEMENT
-521-10	2 TO 6	18 CU. IN. TO 90 CU. IN.
-521-23	4 TO 12	75 CU. IN. TO 220 CU. IN.
-521-47	8 TO 12	145 CU. IN. TO 370 CU. IN.

FOR ADDITIONAL INFORMATION CONTACT METAL MARINE PILOT INC.

WOOD FREEMAN AUTOMATIC PILOTS

METAL MARINE PILOT INC.

2119 MILDRED STREET WEST TACOMA WASHINGTON 98466 U.S.A.

MODEL -521 POWER PACK with METERING HELM	SCALE NONE	DATE 4-3-79
	DRWN MWF	CK
	ASSEMBLY	
TITLE CUSTOMER FURNISHED HYDRAULIC PUMP	SERIAL	
	PREVIOUS	
	NO. 5005220	

WOOD FREEMAN® AUTOMATIC PILOTS

LIMITATION OF SOLENOID VALVES

WHEN USED WITH AUTOPILOT CONTROLS

An 8 second hardover time for 90 degrees of rudder is within the control capability of the 500 Series WOOD FREEMAN AUTOMATIC PILOT when using continuous duty solenoid valves.

Provided:

1 - All entrapped air is removed from the steering system.
2 - The steering linkage is tight, without slack in pin or mountings.
3 - No internal leakage is present in components.

However, our experience has been that hardover to hardover times of 12 seconds or less produce unwanted noise and shock loads in the hydraulic system. If intermittent duty solenoids are used, a hardover to hardover time of 13 seconds or more should be used. The rudder should not be allowed to continually oscillate if over-heating and failure of the solenoid valves is to be prevented.

The following should be observed when using solenoid valves for best service and performance:

1 - Use continuous duty, oil immersed, D.C. solenoids.
2 - Limit the maximum rudder rotation rate to 7 degrees per second or less. Generally 12 to 16 seconds hardover to hardover.
3 - A three (3) port pressure compensated flow control valve must be used with engine driven pumps to regulate the rudder rotation rate.
4 - If solenoid valves are controlled by devices other than the autopilot, such as a "jog" control, an isolation switch must be installed. Refer to drawing #5006135.
5 - Each helm unit must be connected with a lock valve.

If hardover to hardover times desired are less than 13 seconds, we recommend our Code -521 Power Pack in place of solenoid valves and flow control valves. Under the control of the 500 Series Auto Pilot, the -521 Power Pack meters the oil from an external hydraulic source to the rudder cylinders silently and without shock loads.

In addition, the -521 Power Pack features pressure relief to the tank and across the line, thermal expansion and contraction relief, and dual Auto Pilot lock valves.

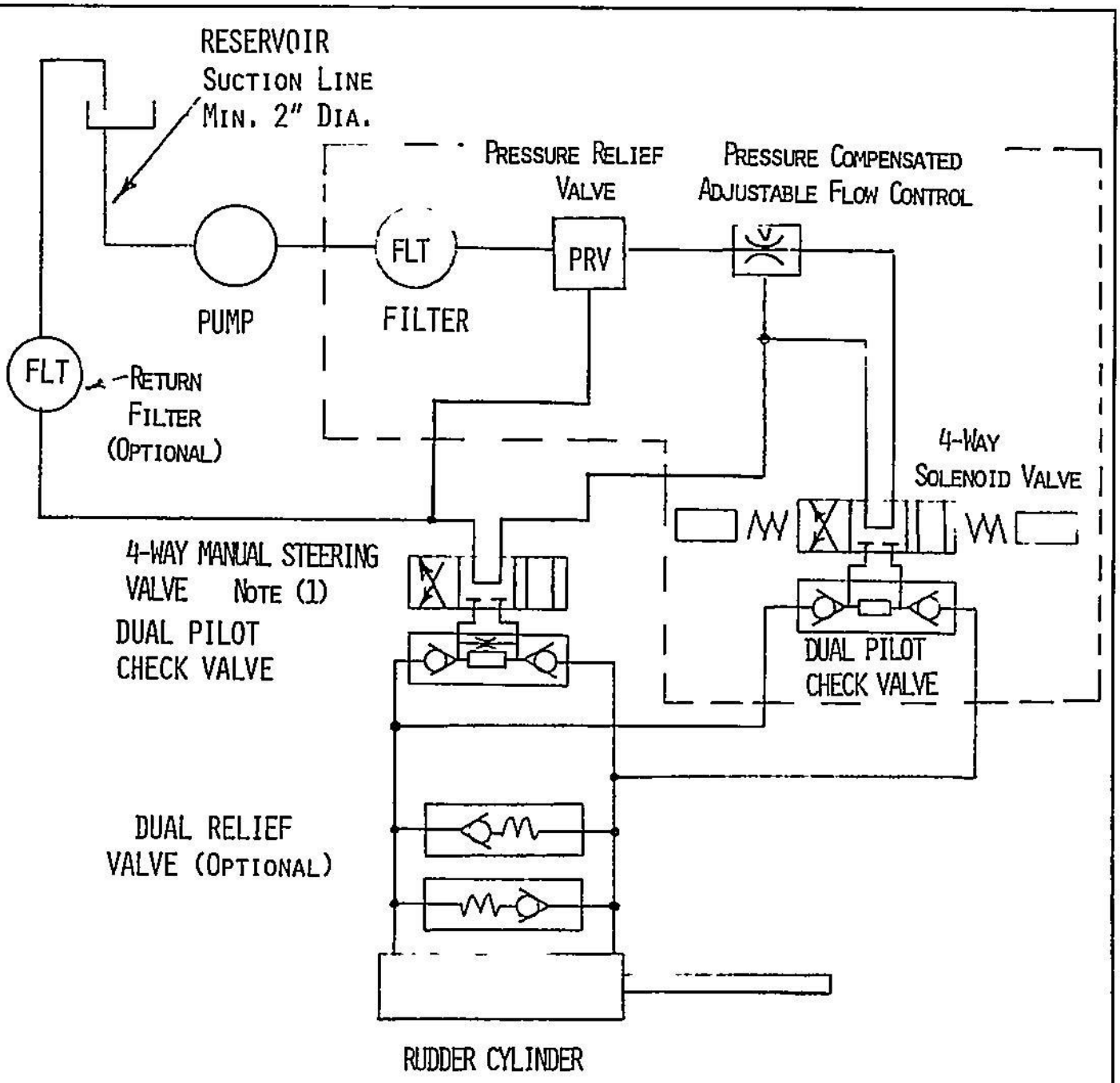
Requirements for external hydraulic source are:

	Rudder Cyl. Displacement		GPM Flow *	
Time h.o. - h.o.	6 seconds	16 seconds	min.	max.
500-B XL-521-10MC	18 cu. in.	90 cu. in.	2	6
500-B XL-521-23MC	75 cu. in.	220 cu. in.	4	12
500-B XL-521-47MC	145 cu. in.	370 cu. in.	8	12

* Pump pressure relief valve required - 1000 PSI Min. 1500 PSI Max.

METAL MARINE PILOT, INC. 2119 MILDRED STREET WEST, TACOMA, WA., 98466
(206) 564-5902

Revised May 1979



NOTE (1) VALVE MAY BE EITHER LEVER OPERATED OR ROTARY METERING VALVE TYPE BLEED PORT RECOMMENDED AS SHOWN ON DUAL PILOT CHECK VALVE

WOOD FREEMAN AUTOMATIC PILOTS

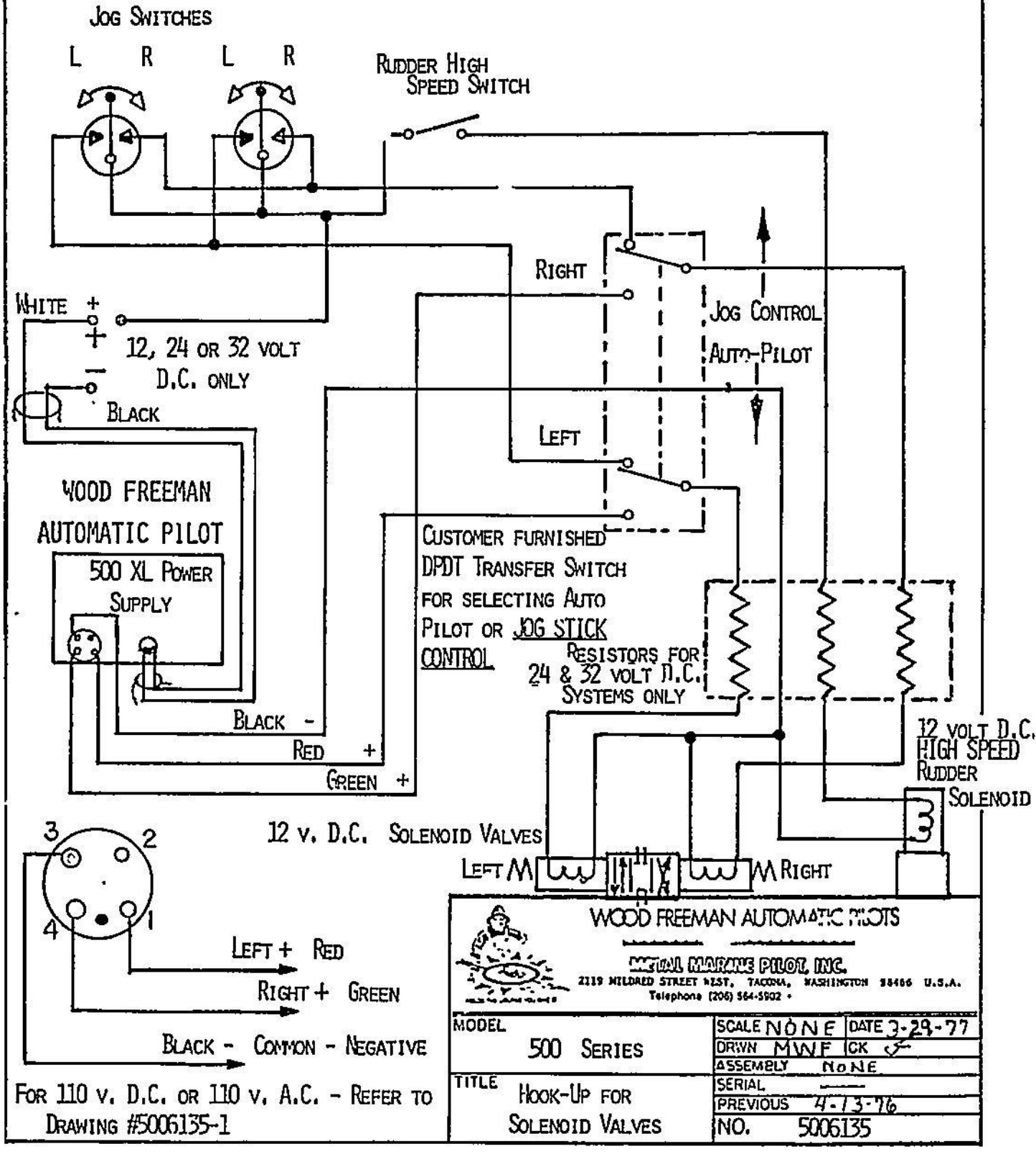
METAL MARINE PILOT, INC.
2119 HILDRED STREET WEST, TACOMA, WASHINGTON 98466 U.S.A.
Telephone (206) 564-5902

MODEL POWER STEERING WITH SOLENOID VALVES	SCALE None	DATE 4-6-77
	DRWN DH	CK
	ASSEMBLY	
TITLE TYPICAL HYDRAULIC LAYOUT	SERIAL	
	PREVIOUS	
	NO. 4241116-R	

Wiring Diagram

for

Selective Operation of Solenoid Valve 12 volt D.C. by Jog Sticks (Wagner type) and Wood Freeman 500 Series Auto Pilot on 12, 24 or 32 volt D.C.



For 110 v. D.C. or 110 v. A.C. − Refer to Drawing #5006135-1

Wood Freeman Automatic Pilots

Mutual Marine Pilot Inc.

2119 Mildred Street West, Tacoma, Washington 98466 U.S.A.

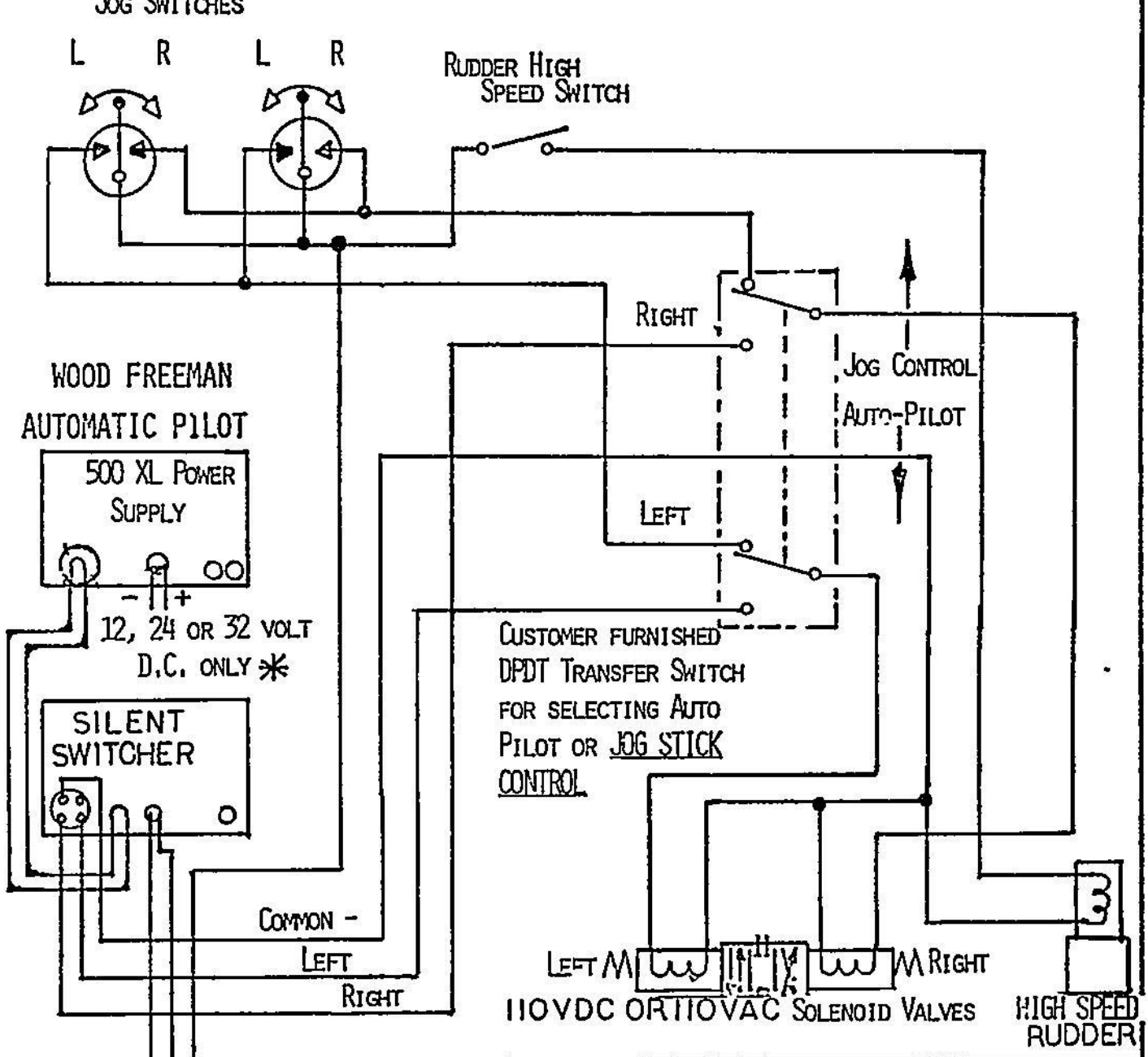
Telephone (206) 564-5902

Model: 500 Series	Scale: None	Date: 3-29-77
	Drwn: MWF	Ck:
	Assembly: None	
Title: Hook-Up for Solenoid Valves	Serial:	
	Previous: 4-13-76	
	No. 5006135	

Wiring Diagram

for

Selective Operation of Solenoid Valve 110 v. D.C. or 110 v. A.C. by Jog Sticks (Wagner type) and Wood Freeman 500 Series Auto Pilot on 12, 24 or 32 volt D.C.



* 110VAC to 24 or 32VDC for Auto-Pilot; use 35B Rectifier Unit

For 12, 24, or 32 volt DC solenoid valves - refer to drawing no. =5006135=

Wood Freeman Automatic Pilots

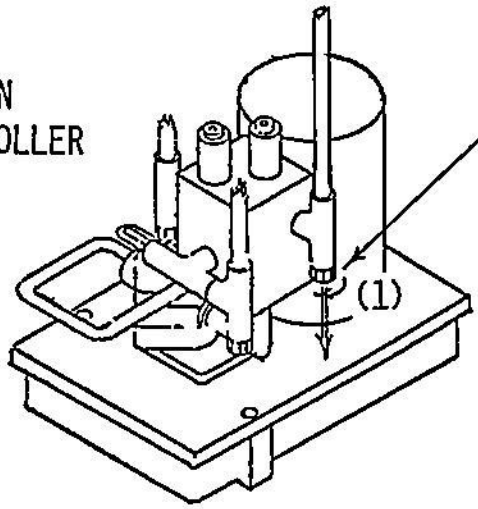
Metal Marine Pilot, Inc.

2119 Mildred Street West, Tacoma, Washington 98466 U.S.A.

Telephone (206) 564-5902

Model	500 Series	Scale None	Date 3-29-
		Drwn MWF	Ck
		Assembly None	
Title	Hook-Up for Solenoid Valves	Serial	
		Previous	
		No.	5006135-1

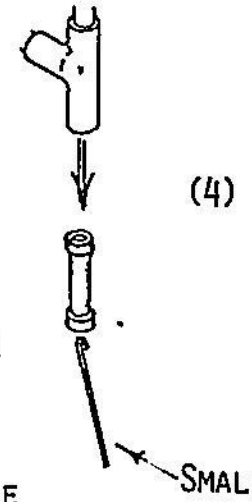
MOTION CONTROLLER



(1) REMOVE CAP NUT ON LOWER SIDE OF "T" FITTING

(2) HOOK SMALL PIECE OF WIRE INSIDE SCREEN AND WITHDRAW SCREEN

(3) FLUSH SCREEN WITH KEROSENE OR CLEANING SOLVENT



(4) REPLACE SCREEN* AND CAP NUT

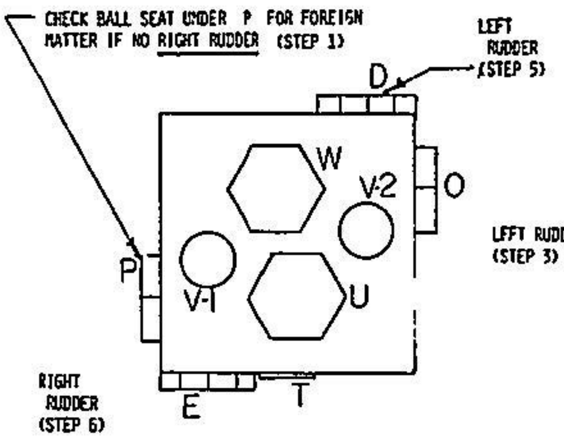
*NOTE: WITH SCREENS HAVING A SINGLE FLANGE, INSTALL WITH FLANGE ON BOTTOM.

WITH SCREENS HAVING A FERRULE ON BOTH ENDS, EITHER END MAY BE INSERTED.

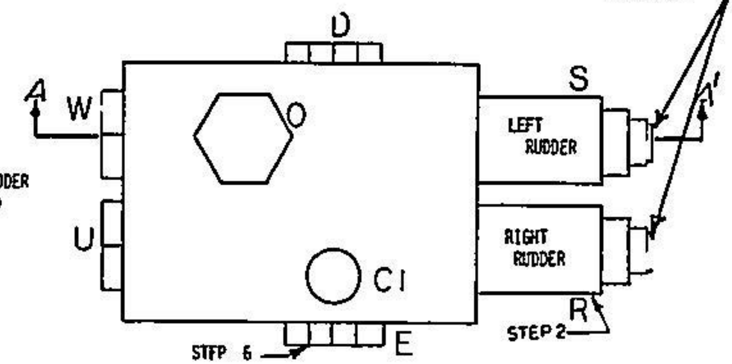
WOOD FREEMAN AUTOMATIC PILOTS
METAL MARINE PILOT, INC.
2119 MILDRED STREET WEST, TACOMA, WASHINGTON 98466 U.S.A.
Telephone (206) 564 5902

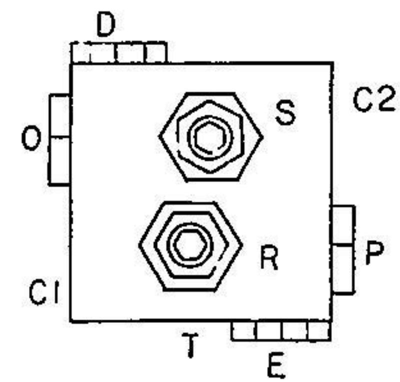
MODEL POWER PACKS -30 & -531	SCALE None	DATE 4-12 77
	DRWN DH	CK
	ASSEMBLY	
TITLE FILTER SCREEN REMOVAL	SERIAL	
	PREVIOUS 10-20-72	
	NO. 4232213-3	

USE THIS DRAWING FOR -531 POWER PACKS WITH SERIAL NUMBERS 1445 AND BELOW AND FOR ALL -521 POWER PACKS



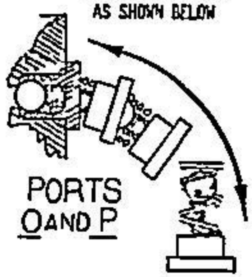
LEFT RUDDER (STEP 3)

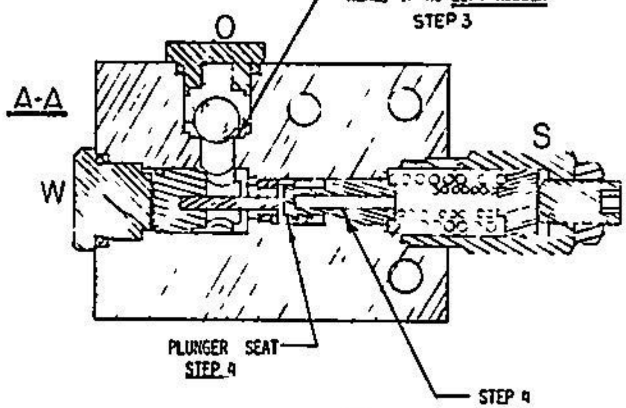




CAUTION

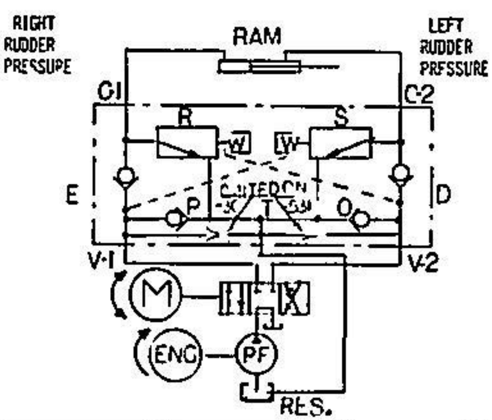
TO PREVENT THE CHECK BALL FROM FALLING FROM OUTER RETAINER SPRING AND POSSIBLE LOSS OF THE BALL INTO THE VALVE BODY REMOVE & REPLACE AS SHOWN BELOW





REMOVE THIS PLUNGER BY GENTLY WEDGING 1/16" NAIL PUNCH IN HOLE AND WITHDRAWING

SYMPTOM	NO RIGHT RUDDER
	1. REMOVE P, CLEAN ANY FOREIGN MATTER FROM BALL CHECK SEAT. ---SEE CAUTION
--	STILL NO RIGHT RUDDER
	2. REMOVE R, REMOVE PLUNGER, CLEAN FOREIGN MATTER FROM PLUNGER SEAT
SYMPTOM	NO LEFT RUDDER
	3. REMOVE O, REPEAT NO. 1 CLEANING
	STILL NO LEFT RUDDER
	4. REMOVE S, REPEAT NO 2 CLEANING
SYMPTOM	RUDDER CREEPS RIGHT WITH AUTO PILOT OFF
	5. REMOVE D, REPEAT NO. 1 CLEANING
SYMPTOM	RUDDER CREEPS LEFT WITH AUTO PILOT OFF
	6 REMOVE E, REPEAT NO 1 CLEANING



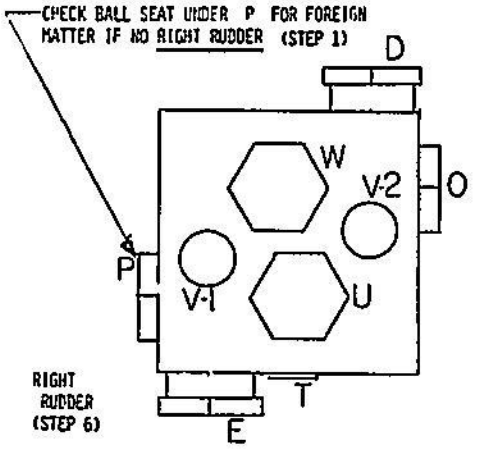
	PRESSURE SIDE					RETURN SIDE					
FOR RUDDER TO MOVE	FROM PUMP	IN PORT IS	WHICH CONNECTS THROUGH	TO OUT PORT	FROM RAM / TO RAM	IN PORT IS	WHICH CONNECTS THROUGH	AND THROUGH	TO OUTPORT	TO PUMP RETURN	UNBALANCED RAM - MAKE OR EXCESS THROUGH
RIGHT		V1	E	C-1		C2	S	O	V-2		T
		V-2	D	C-2		C-1	R	P	V-1		T
	PRESSURE SIDE					RETURN SIDE					

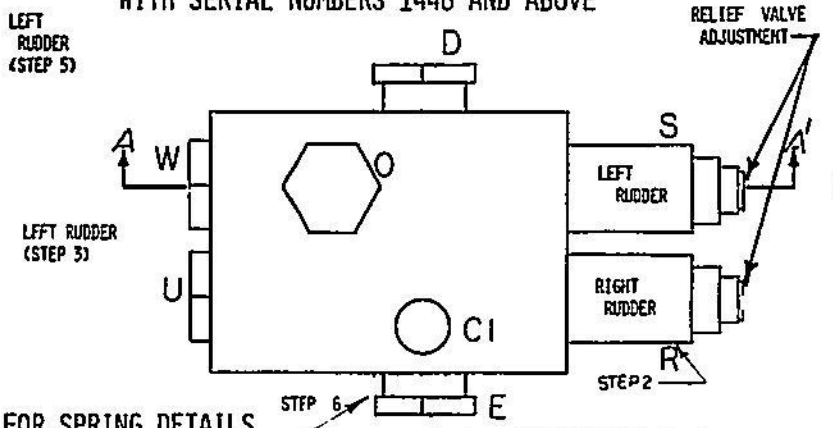
MOTION CONTROL VALVE USED ON MODEL

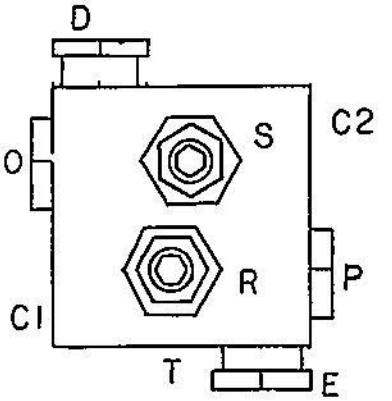
423	-30 PUMP UNIT (UNLOCK... OMITTED)
500	-521 PUMP UNIT
500	-531 PUMP UNIT (...- OMITTED)
555	POWER STEERING SYSTEM, LESS AUTO PILOT

METAL MARINE PILOT, INC. 2119 South Mildred Street Tacoma, Wash. 98466	FOR Wood Freeman Automatic Pilot
SCALE FULL — DATE -/-/77	MACHINE NO. ALL -521 POWER PACKS. -531 POWER PACKS NO.1445 & BELOW
DRWN. WWF — CK.	
SERIAL	TITLE MOTION CONTROL VALVE - SERVICING -
PREVIOUS 5552111	
REVISIONS	
ASSEMBLY	NO. 5552112
MFG. RECORD	

USE THIS DRAWING FOR -531 POWER PACKS WITH SERIAL NUMBERS 1446 AND ABOVE



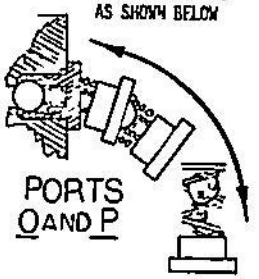


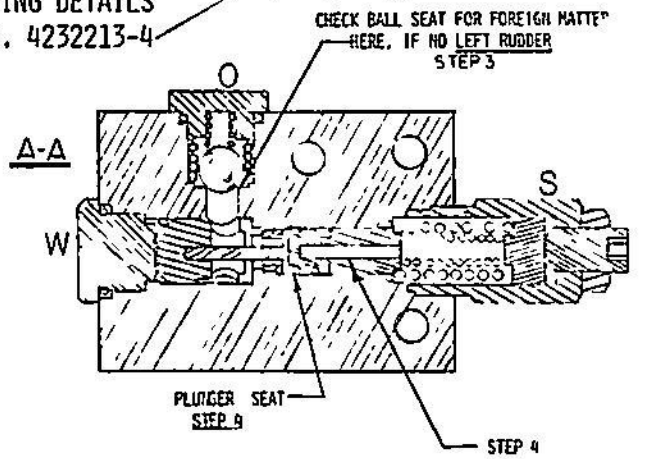


FOR SPRING DETAILS SEE DWG. 4232213-4

CAUTION

TO PREVENT THE CHECK BALL FROM FALLING FROM OUTER RETAINER SPRING AND POSSIBLE LOSS OF THE BALL INTO THE VALVE BODY REMOVE & REPLACE AS SHOWN BELOW



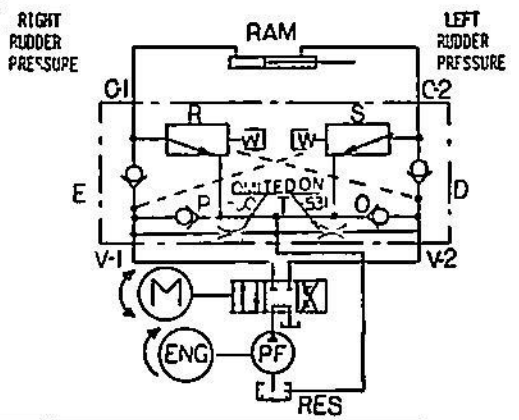


SYMPTOM NO RIGHT RUDDER
1. REMOVE P, CLEAN ANY FOREIGN MATTER FROM BALL CHECK SEAT. ---SEE CAUTION
-- STILL NO RIGHT RUDDER
2. REMOVE R, REMOVE PLUNGER, CLEAN FOREIGN MATTER FROM PLUNGER SEAT.

SYMPTOM NO LEFT RUDDER
3. REMOVE O, REPEAT NO 1 CLEANING
STILL NO LEFT RUDDER
4. REMOVE S, REPEAT NO. 2 CLEANING

SYMPTOM RUDDER CREEPS RIGHT WITH AUTO PILOT OFF
5. REMOVE D, REPEAT NO. 1 CLEANING

SYMPTOM RUDDER CREEPS LEFT WITH AUTO PILOT OFF
6. REMOVE E, REPEAT NO. 1 CLEANING



FROM PUMP FOR RUDDER TO MOVE		PRESSURE SIDE				RETURN SIDE					
	RIGHT	V-1 IN PORT IS	E WHICH CONNECTS THROUGH	C-1 TO OUT PORT	FROM RAM	C-2 IN PORT IS	S WHICH CONNECTS THROUGH	O AND THROUGH	V-2 TO OUTPORT	TO PUMP RETURN	T UNBALANCED RAM - MAKE OR EXCESS THROUGH
	LEFT	V-2	D	C-2	TO RAM	C-1	R	P	V-1		T
		PRESSURE SIDE				RETURN SIDE					

MOTION CONTROL VALVE USED ON MODEL

423	-30 PUMP UNIT (ORIFICE OMITTED)
500	-521 PUMP UNIT
500	-531 PUMP UNIT (ORIFICE OMITTED
555	POWER STEERING SYSTEM, LESS AUTO PILOT

METAL MARINE PILOT, INC. 2119 South 62nd Street Tacoma, Wash. 98408	FOR Wood Freeman Automatic Pilot
SCALE FULL DATE 3-3-77	MACHINE NO. -- -531 POWER PACKS SERIAL NO. 1446 & ABOVE
DRWN. MVF CK.	TITLE MOTION CONTROL VALVE - SERVICING -
SERIAL	
PREVIOUS	
REVISIONS	
ASSEMBLY	NO. 5552112-1
MFG. RECORD	

FIG. 1 - POWER PACK SERIAL #1445 AND LOWER WITH SHORT PLUGS (.750" LONG), CHECK SPRING - BALL RETAINER SPRING IN PORTS D & E. SEE COL. A

NOTE: PILOT SHOULD BE TURNED "OFF" AT LEAST 2 MINUTES BEFORE PLUGS ARE REMOVED

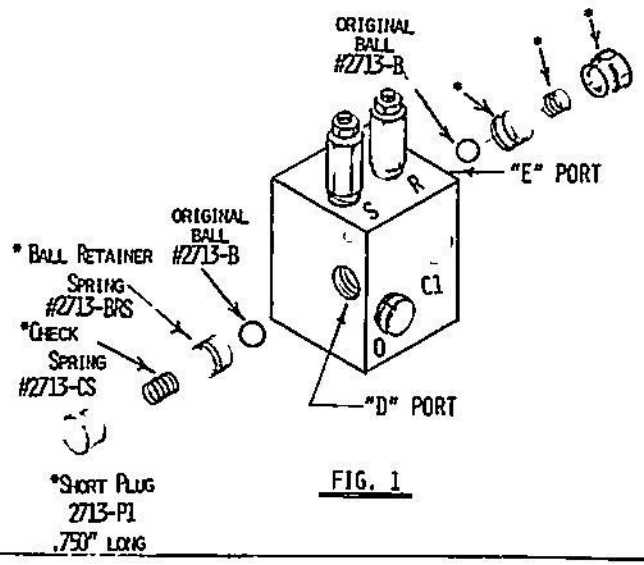


FIG. 1

FIG. 2 - POWER PACK SERIAL #1446 & HIGHER WHICH HAVE LONG PLUGS STANDARD FROM FACTORY IN PORTS D & E AND POWER PACK SERIAL #1445 & LOWER WHICH HAVE BEEN FIELD CONVERTED TO LONG PLUGS IN PORTS D & E, PROCEED TO COL. C.

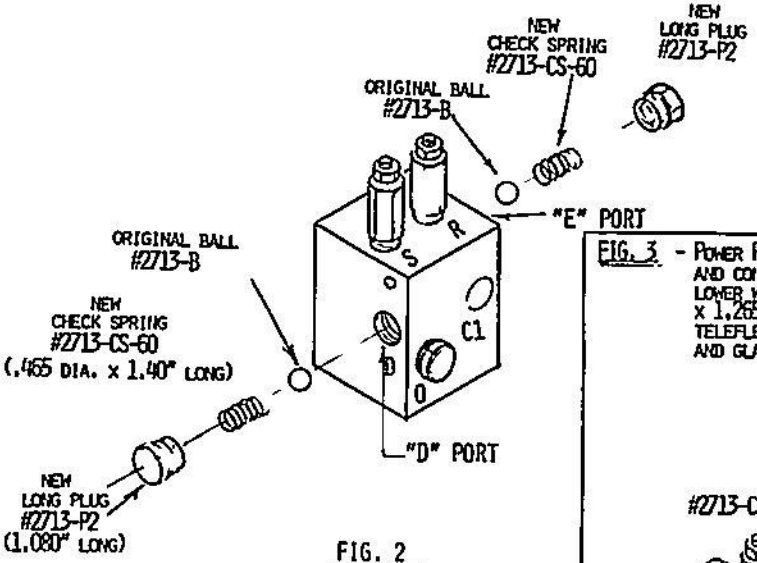


FIG. 2

FIG. 3 - POWER PACK SERIAL #1446 & HIGHER AND CONVERTED SERIAL #1445 & LOWER WITH 150# SPRING (.325" DIA. X 1.265" LONG) ADDED FOR USE WITH TELEFLEX-CAPILAND 50 SERIES, SYTEN AND GLASER

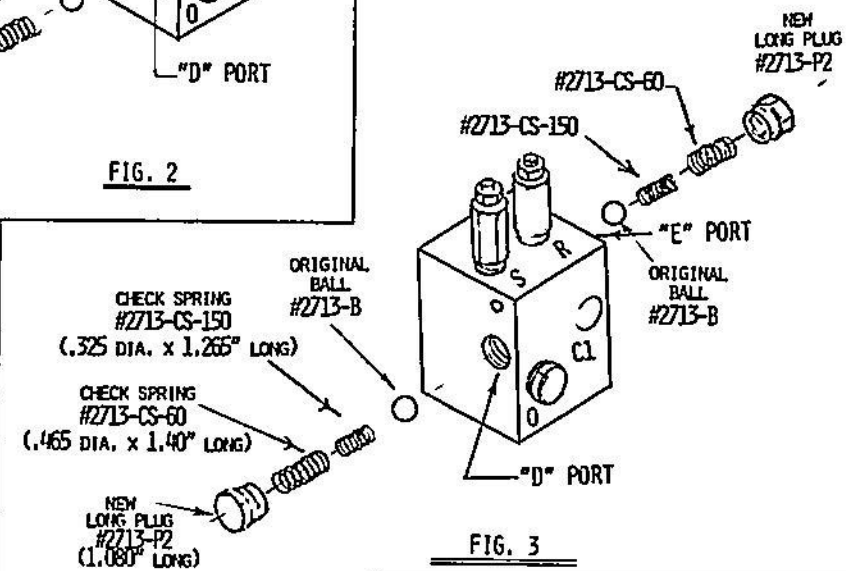


FIG. 3

COL. A (FIG. 1)	COL. B (FIG. 2)	COL. C (FIG. 3)
1. REMOVE ALL PARTS FROM PORT D & E EXCEPT BALL. RETURN *PARTS TO FACTORY FOR CREDIT. 2. INSTALL: LONG PLUG (1.080") #2713-P2 CHECK SPRINGS 60# (.465 DIA. X 1.40" LONG) #2713-CS-60 IN PORTS D & E. THIS CONVERTS FIG. 1 TO FIG. 2.	FIG. 2 SHOWS SPRING (CS-60) & LONG PLUG (1.080") IN PORTS D & E. USED ON ALL MOTION CONTROL BLOCKS EXCEPT CAPILANO 50 SERIES, SYTEN SYSTEM HAVING UNIFLOW ® VALVES & GLASER SYSTEMS WHICH REQUIRE FIG. 3	TO FIG. 2 MOTION CONTROL VALVE, ADD SPRING #2713-CS-150 (.325 DIA. X 1.265" LONG) AS SHOWN IN FIG. 3. FOR USE ONLY ON: (1) TELEFLEX-CAPILANO ® 50 SERIES AND SYTEN SERIES WITH UNIFLOW ® VALVES AND (2) GLASER STEERING

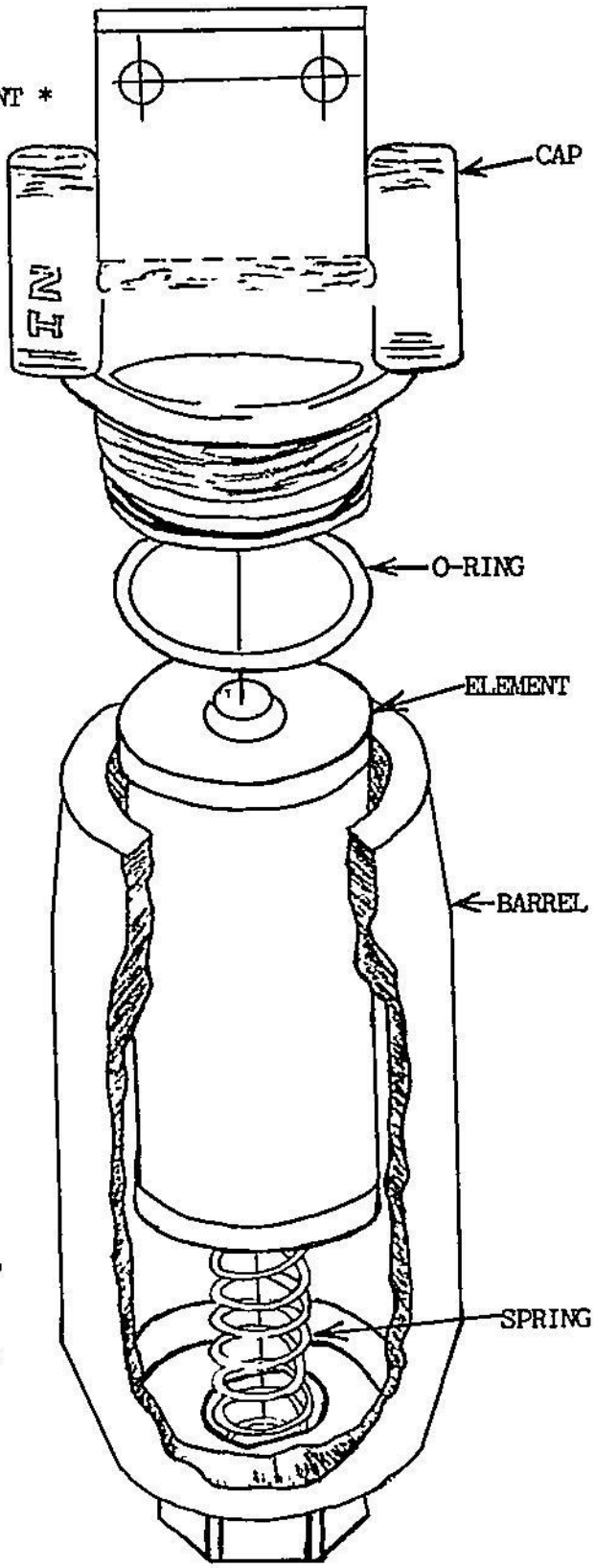
WOOD FREEMAN AUTOMATIC PILOTS

KING MARINE PILOT, INC.
3119 KILLED STREET WEST TACOMA, WASHINGTON 98466 U.S.A.
Telephone: (206) 564-5302

MODEL -30 & -531 POWER PACKS	SCALE None	DATE 4 12 77
	DRWN DH	CK
	ASSEMBLY	
TITLE #2713 MOTION CONTROL BLOCKS, CHECK SPRING CONFIGURATION	SERIAL	
	PREVIOUS 4 13 75	
	NO. 4232213-4	

SERVICE INSTRUCTIONS

555-2 FULL FLOW FILTER
* REPLACING FILTER ELEMENT *



WHEN TO REPLACE FILTER ELEMENT

The filter element should be replaced after the first 25 to 50 hours of operation of a new system. Then every 2000 hours thereafter.

The process should be repeated each time the steering system is opened for service or repair.

TOOLS REQUIRED:

1 - Adjustable wrench up to 1-3/4 inch.

PARTS REQUIRED:

1 - Filter element kit #2756-1.

PROCEDURE:

1 - Rotate barrel clockwise using wrench on hex at bottom of housing.

2 - Spring will push element upward for easy removal.

3 - Replace O-ring.

4 - Empty all oil from the barrel. Flush barrel with clean oil to clean out any debris from inside the barrel.

CAUTION: DO NOT USE CLOTH OR PAPER TOWEL TO WIPE OUT BARREL.

5 - Insert new element into the barrel.

6 - Screw barrel back onto cap.

WOOD FREEMAN® AUTOMATIC PILOTS

* 500 SERIES *

DOCKSIDE AND UNDERWAY CHECKOUT

TO USE:
The following steps are in numerical order. Proceed with each step in sequence, DO NOT JUMP STEPS unless instructed to do so. Faults and corrective measures will be indented from the margin and preceded by a number and followed by a letter. i.e. 9A.

IN CASE OF DIFFICULTIES:
If you should encounter difficulties during the checkout procedure,
Review and Recheck component installation.
Repeat all previous checkout steps.
If difficulties persist,
Go to STEPS IN TROUBLE-SHOOTING *
SERVICE II OR SERVICE III

NOTE: SERVICE III is available from factory upon request.

You may also contact the factory for telephone assistance -
Monday through Friday - between 8:30 AM and 5:00 PM. (Pacific local time).
(206) 564-5902 - (Please - no collect calls)

NOTE:
The DOCKSIDE CHECKOUT and UNDERWAY CHECKOUT must be used to complete an initial installation.
They should also be used after completing the trouble shooting guides, SERVICE II or SERVICE III.

TOOLS REQUIRED:
The following tools are required to do the DOCKSIDE and UNDERWAY CHECKOUT:

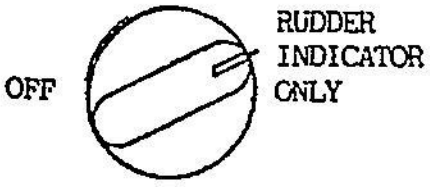
1 - Small to medium size bit, flat blade, screw driver.
1 - Set of Jumper Plugs - 1, 8-pin & 1, 9-pin with pins 2 & 3 jumpered together (supplied with the AUTOPILOT).
1 - WOOD FREEMAN® Rudder Angle Indicator,
or
1 - WOOD FREEMAN® 500 SERIES Field Test Meter,
or
a volt/ohm meter with a 3 to 5 volt scale,
or
a 500-0-500 micro amp meter.
(These instructions do not detail the use of the last 2 types of meters.)

METAL MARINE PILOT, INC.
2119 MILDRED STREET WEST
TACOMA, WASHINGTON, 98466
TELEPHONE (206) 564-5902

JANUARY 1979

STEP 1 - Set the Control Console FUNCTION SWITCH to:
"RUDDER INDICATOR ONLY".

NOTE: For initial installations or replacement of the XL POWER SUPPLY, complete STEPS 2 and 3.
For subsequent checkouts - go to STEP 4.



FUNCTION SWITCH

* XL POWER SUPPLY CHECKOUT *

STEP 2 - Remove the 4 corner screws from the front panel of the XL POWER SUPPLY. Remove the chassis from the housing.

CAUTION: DO NOT TILT CHASSIS OR HOUSING MORE THAN 30 DEGREES to prevent mercury relays from energizing.

STEP 3 - Locate the two mercury contactors, L5 & L6, mounted side by side on the inside of the front plate. (FIG. 1)
Both contactors have a BLUE common wire.
L5, (RIGHT rudder), has a GREEN wire.
L6, (LEFT rudder), has a RED wire.

Using a short piece of insulated wire, (at least #14) or an insulated screw driver, momentarily jumper across the GREEN and BLUE wires on top of mercury contactor L5.

If the POWER PACK energizes to the RIGHT, then go to STEP 4.

If the POWER PACK energizes to the LEFT, then go to STEPS 3A through 3D.

3A - Remove the 20 amp fuse from the XL POWER SUPPLY front panel.
3B - Turn the XL POWER SUPPLY upside down
3C - Interchange the RED and GREEN wires (#11 & #12) on the 4 pin socket side of the 12 pin terminal strip, TB 601, (FIG. 2).
3D - Turn unit right side up - replace 20 amp. fuse - go to STEP 3

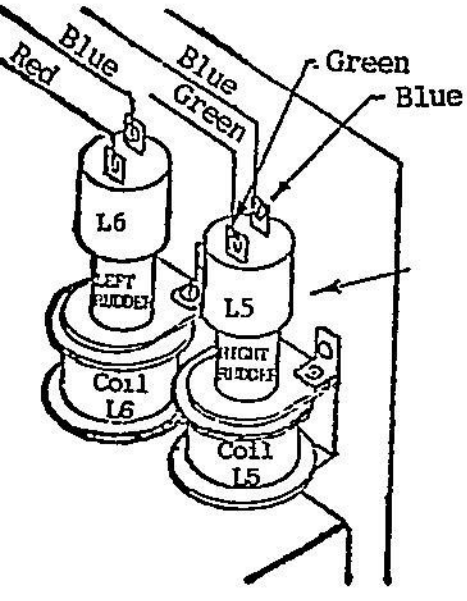


FIG. 1

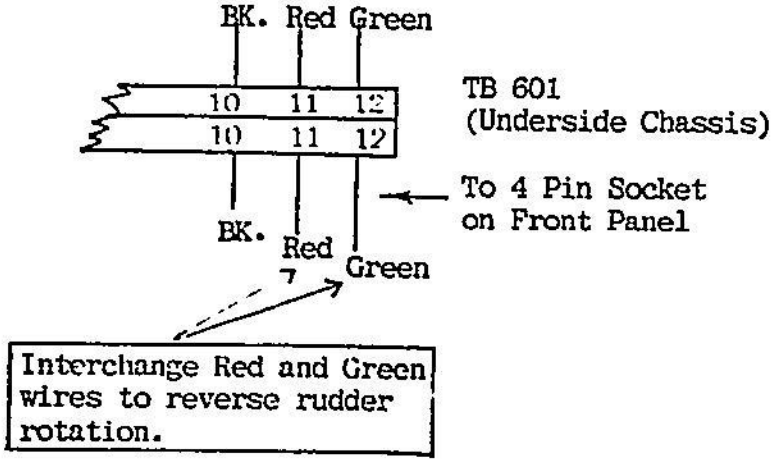
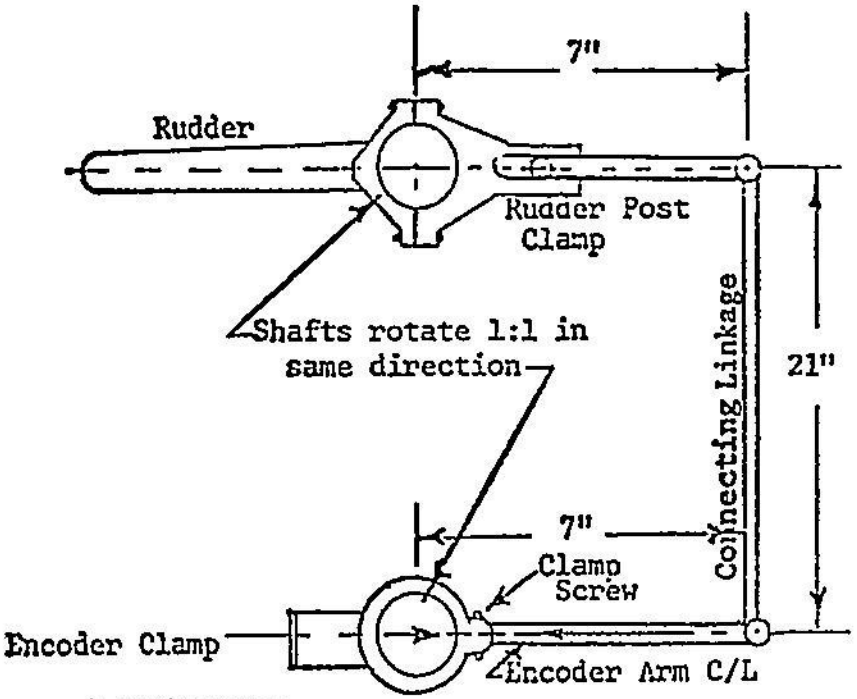


FIG. 2

* ENCODER CHECKOUT *

STEP 4 - Center the rudder with the wheel or tiller.

STEP 5 - Inspect the mounting configuration of the ENCODER and CONNECTING LINKAGE. Opposite sides must be equal and parallel. (FIG. 3)
Adjust RUDDER POST CLAMP and LINKAGE ROD as necessary.



* IMPORTANT *

OPPOSITE SIDES MUST BE OF EQUAL LENGTH (+/- 1/8")
OPPOSITE SIDES MUST BE PARALLEL

FIG. 3

STEP 6 - Loosen Encoder Clamp Screw (7/16 hex head).
Rotate Encoder body to align ARROW on top of Encoder with the CENTER LINE of the ARM (arrow on encoder points at arrow in arm).

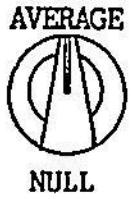
This is a preliminary adjustment. Final adjustment will be made in the UNDERWAY CHECKOUT section.

NOTE: FIG. 3 shows a standard mounting configuration.

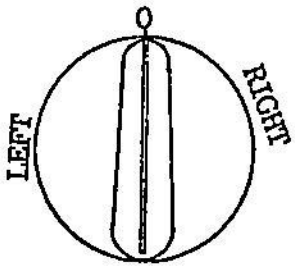
If Encoder is mounted inverted, the Arrows must point AWAY from each other. For any other Encoder mounting refer to ENCODER Installation Instructions for correct configuration of components.

* RUDDER DIAL CHECKOUT *

STEP 7 - Set the NULL knob to:
Straight up "AVERAGE".

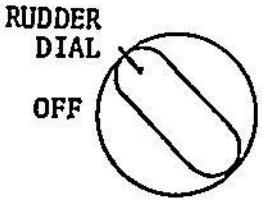


STEP 8 - Set the "RUDDER DIAL" pointer (knob) to:
"0" (zero).



RUDDER DIAL

STEP 9 - Set the FUNCTION SWITCH to:
"RUDDER DIAL".



FUNCTION SWITCH

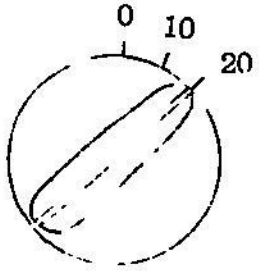
If the rudder remains centered,
go to to STEP 10.

NOTE: Disregard any "hunting", (continual oscillation of the rudder), which may occur now.

If the Rudder goes hardover left or right,
go to STEPS 9A through 9B.

9A - Go to ENCODER INSTALLATION Instruction for proper component configuration.
9B - Go to STEPS 1 through 6 inclusive.

STEP 10 - Set "RUDDER DIAL" pointer to:
"20" degrees RIGHT.



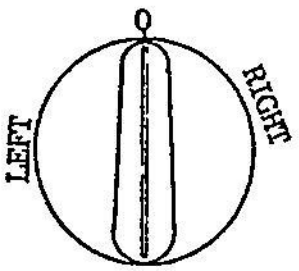
If the Rudder moves to approximately 20 degrees RIGHT,
go to STEP 11.
If the Rudder moves hardover LEFT,
go to STEPS 10A through 10C.

10A - Go to Cable Installation Instructions for proper connections.
10B - Inspect ALL CABLING for cuts, splices or other modifications.
10C - Go to STEP 2 & STEP 3.

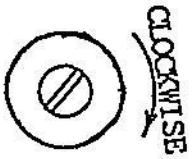
* DAMPER & NULL ADJUSTMENTS *

Note: If a WOOD FREEMAN® RUDDER ANGLE INDICATOR is not installed, connect one of the alternative meters. See appendix for meter connections.

STEP 11 - Set "RUDDER DIAL" pointer to: "0" (zero).



RUDDER DIAL



DAMPER

STEP 12 - Remove the black cover plug from the DAMPER.
Rotate the DAMPER control full COUNTERCLOCKWISE.
Slowly rotate the DAMPER control clockwise until the continual oscillation of the rudder, ("hunting"), stops.

If the "hunting" of the rudder stops before the DAMPER is full clockwise, go to STEP 13.

If the Damper is rotated fully clockwise and the rudder "hunting" does not stop,
go to STEPS 12A through 12D.

12A - Recheck STEP 5 - then go to STEP 12.
12B - Check Steering system for "mechanical slack" and correct as required to eliminate slack - go to STEP 12.
12C - On hydraulic steering, bleed steering system, (refer to steering system TROUBLE-SHOOTING GUIDE) - go to STEP 12
12D - Rotate NULL knob to the 9 o'clock, "BROAD" position - go to STEP 12.

NOTE: If "hunting" persists,
review the installation.
Check for any connecting cables that may be CUT, SPLICED, BROKEN, OR OTHERWISE MODIFIED.
If there are no apparent modifications,
go to TROUBLE-SHOOTING * SERVICE II or SERVICE III.

STEP 13 - Rotate the RUDDER DIAL pointer (knob) in 10 separate increments to 10 degrees RIGHT. (1 increment is approximately the width of the white line on the pointer knob.)

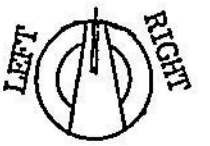
If the rudder responds to each increment of RUDDER DIAL pointer motion with equal travel and comes to rest at 10 degrees right,
go to STEP 14.

If the RUDDER DIAL pointer must be rotated several increments before the rudder will respond,
go to STEP 12.

NOTE: If STEP 12 appears to be correct and there is still a "sensitivity" problem in STEP 13, refer to the APPENDIX - COMPONENT SENSITIVITY TESTS.

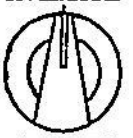
* COMPASS CHECKOUT *
(ALL MODELS)

STEP 14 - Set TRIM knob (Compass Course) to:
straight up.



COMPASS TRIM

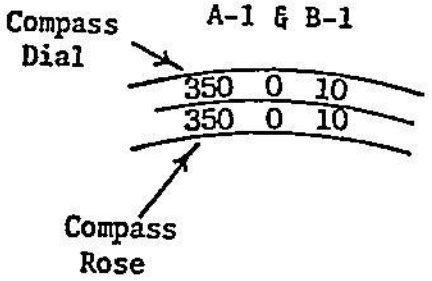
STEP 15 - Set RUDDER knob to:
straight up - "AVERAGE".

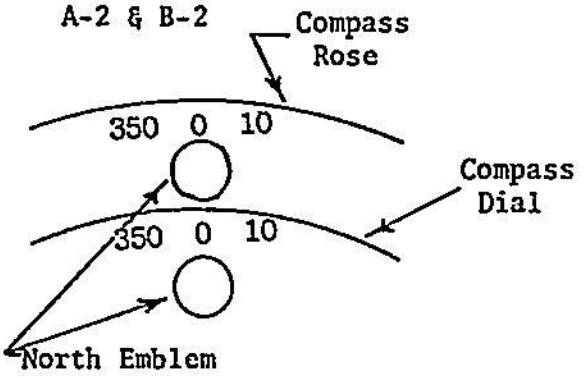


RUDDER

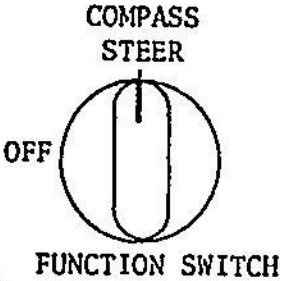
STEP 16 - Rotate the COMPASS COURSE DIAL (on the top of the compass unit) 5 complete turns to be sure of good slip ring contact. (On "B" units also rotate the YOKE 5 turns.)

STEP 17 - Rotate the COMPASS COURSE DIAL so the COURSE DIAL numbers match with the COMPASS ROSE: "0" aligned with "0".





STEP 18 - Set the FUNCTION SWITCH to:
"COMPASS STEER".



FUNCTION SWITCH

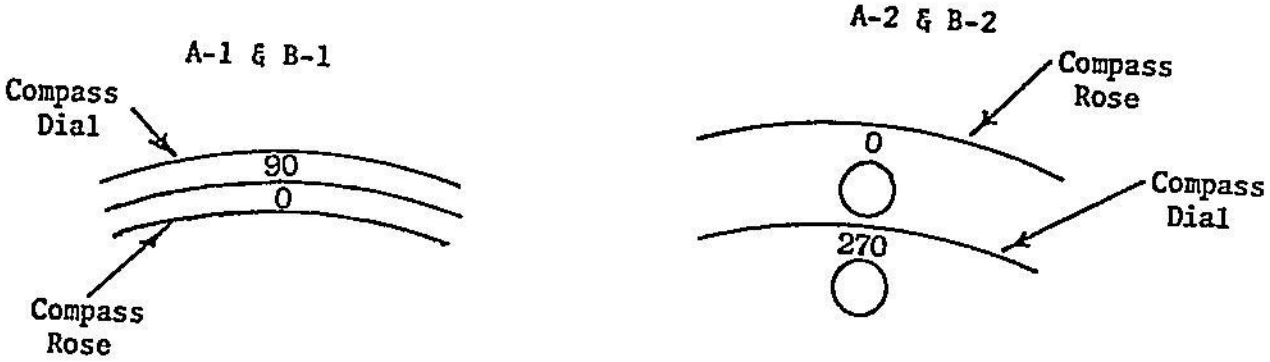
If the Rudder Angle Indicator needle centers
or
If the rudder centers to the same position as in STEP 4, go to STEP 19.

If the RAI needle does not center (or rudder does not center), go to STEPS 18A & 18B.

18A - Reset the TRIM knob (Compass course) to: "straight up" - go to STEP 18.

18B - Go to TROUBLE-SHOOTING * SERVICE II or SERVICE III.

STEP 19 - Rotate COMPASS COURSE DIAL disk 90 degrees counterclockwise.



If rudder moves RIGHT 15 to 20 degrees,
go to STEP 20.

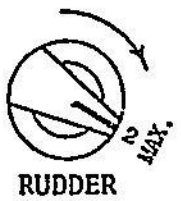
If rudder moves LEFT or rudder does not move,
go to TROUBLE-SHOOTING * SERVICE II or SERVICE III.

STEP 20 - Rotate COMPASS COURSE DIAL disk 180 degrees.
(90 degrees from original matching position)

If rudder moves LEFT 15 to 20 degrees,
go to STEP 21.

If rudder does not move LEFT,
go to TROUBLE-SHOOTING * SERVICE II or SERVICE III.

STEP 21 - Set the RUDDER knob to:
"2 KNOTS" - full clockwise.



If the rudder moves further LEFT approximately
30 to 45 degrees,
go to STEP 22.

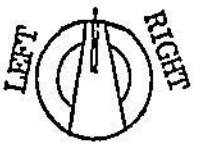
If rudder travel is not increased,
go to TROUBLE-SHOOTING * SERVICE II or SERVICE III.

STEP 22 -
If you have an "A" series pilot - (Compass not self-orienting),
go to STEP 31 UNDERWAY CHECKOUT.

If you have a "B" series pilot - (Compass self-orienting).
go to STEP 23.

* STANDBY-Self Orient CHECKOUT *
(B1 & B2 SERIES ONLY)

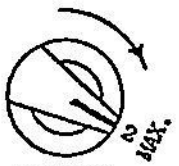
STEP 23 - Remove the 8-pin ENCODER plug and cable from the rear of the CONTROL CONSOLE (top center position). Insert the 8-pin RED coded JUMPER PLUG.



COMPASS TRIM

STEP 24 - Set the TRIM knob (Compass Course) to: straight up.

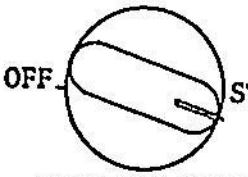
STEP 25 - Set the RUDDER knob to: "2 KNOTS" - full clockwise.



RUDDER

STEP 26 - Rotate COMPASS COURSE DIAL so the numbers on the COMPASS COURSE DIAL and the COMPASS ROSE differ 90 degrees. (Unlock Compass Yoke on B2 models.)

STEP 27 - Set FUNCTION SWITCH to: "STANDBY-self orient".



FUNCTION SWITCH

If the orient motor rotates the compass bowl so the COMPASS COURSE DIAL and the COMPASS ROSE match * (some "hunting", up to 1 to 2 degrees may be present), go to STEP 28.

If Orienting occurs but COMPASS COURSE DIAL and COMPASS ROSE do not match *, then go to TROUBLE-SHOOTING * SERVICE II or SERVICE III.

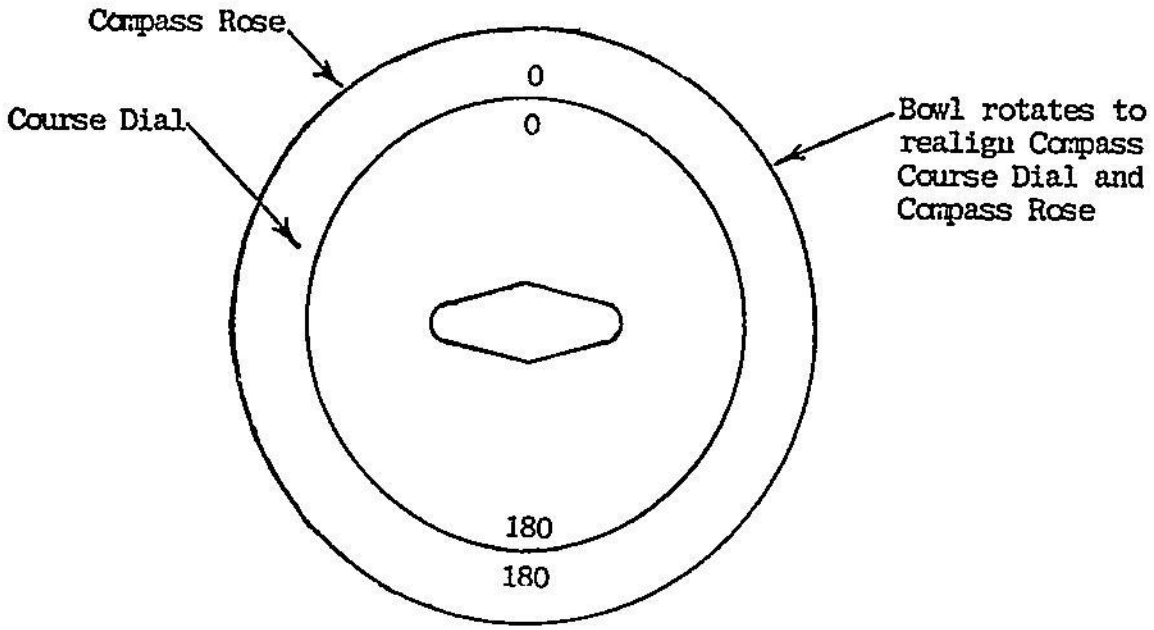
If Orient Motor does not run, go to STEPS 27A through 27D.

27A - Inspect compass base and yoke for compass wire stuck in gears - SEE NOTE.
27B - Inspect flex shaft for tight bends or kinks - correct as necessary - go to STEP 27.
27C - Inspect orient motor pinion gear and drive gear for binding - correct as necessary - go to STEP 27.
27D - Go to GEAR MOTOR Installation Instructions.

NOTE: IF COMPASS CABLE INSULATION HAS BEEN BROKEN THEN CONTACT FACTORY FOR A REPLACEMENT COMPASS, or send Compass, doubly packed, to the factory for repair.

* - On B1 models + or (-) 3 degrees.
On B2 models + or (-) 2 degrees.

STEP 28 - Rotate COMPASS COURSE DIAL
clockwise 90 degrees and release.



If the Compass bowl rotates back to matching position within 15 seconds, repeat STEP 28 4 to 5 times.
Go to STEP 29.

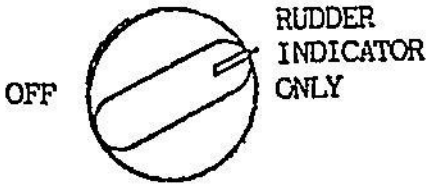
If the response time to realign the COMPASS COURSE DIAL & COMPASS ROSE is longer than 15 seconds, go to STEPS 27A through 27D.

STEP 29 - Repeat STEP 28 rotating COMPASS COURSE DIAL counterclockwise,
go to STEP 30.

STEP 30 - Remove 8-pin JUMPER PLUG from back of the CONTROL CONSOLE.
Plug in the 8-pin ENCODER plug and cable (top center socket).
Go to STEP 31 - UNDERWAY CHECKOUT.

* UNDERWAY CHECKOUT *

STEP 31 - Set FUNCTION SWITCH to:
"RUDDER INDICATOR ONLY".



FUNCTION SWITCH

STEP 32 - Steer the vessel in a normal manner with the steering wheel or tiller.
Hold a steady course with all engines ahead equally (perform this operation with as little wind or tide acting against the vessel as possible).

STEP 33 - Bring the vessel to a full stop.
DO NOT MOVE THE RUDDER from the dead ahead underway position.

If the vessel is equipped with a WOOD FREEMAN® Rudder Angle Indicator,
or
If a WOOD FREEMAN® Field Test Meter is available,
or
If a volt/ohm meter is available (with a qualified user),
go to STEP 34.

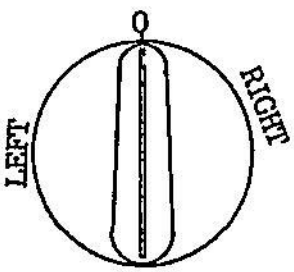
If NO meter is available,
go to STEP 36.

STEP 34 - Connect available meter to 4-pin RAI socket on the back of the CONTROL CONSOLE (bottom center socket).
(To use a volt/ohm meter, set the meter to a scale range between 3 and 6 volts DC.)
(Connect the meter leads to pins 1 and 2 of the RAI socket.)

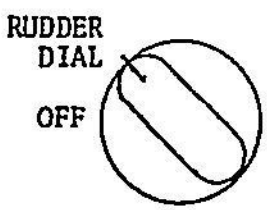
STEP 35 - Loosen the ENCODER CLAMP SCREW (7/16 hex head) (Fig. 3 - Page 2).
Rotate the ENCODER BODY to center the meter.
(On a volt/ohm meter rotate ENCODER BODY to indicate "zero" voltage.)

Tighten ENCODER CLAMP SCREW (This is the Final ENCODER adjustment) -
go to STEP 38.

STEP 36 - Mark position of rudder or rudder actuating mechanism.
Set the RUDDER DIAL pointer knob to:
"0" - (zero).



RUDDER DIAL



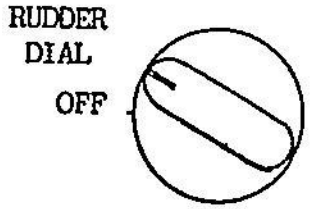
FUNCTION SWITCH

Set FUNCTION SWITCH to:
"RUDDER DIAL".

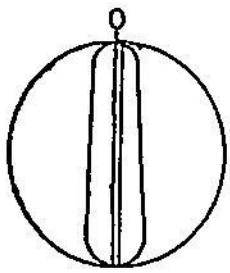
STEP 37 - Loosen the ENCODER CLAMP SCREW (7/16 hex head).
Rotate the ENCODER BODY until the rudder or actuating mechanism returns to mark made in STEP 36.
Tighten ENCODER CLAMP SCREW.

* RUDDER DIAL OPERATION *

STEP 38 - Set FUNCTION SWITCH to:
"RUDDER DIAL".
This will allow direct control of the rudder position with the RUDDER DIAL pointer (NON-AUTOMATIC).



FUNCTION SWITCH



RUDDER DIAL

STEP 39 - Set the RUDDER DIAL pointer to:
"0" - (zero).

Bring the vessel underway -
Ahead - 2 to 4 knots.

If the vessel steers a straight course (not turning), go to STEP 40.

If the vessel starts to turn even slightly, go to STEP 31 (alignment).

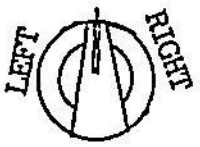
STEP 40 - Steer the vessel with the RUDDER DIAL pointer.
Set the RUDDER DIAL pointer to a desired rudder angle.
The rudder will maintain the selected angle shown by the pointer.
Set the pointer to "0" for amidships rudder.

* COMPASS STEERING *
(ALL MODELS)

NOTE : Adjusting the CONTROL COMPASS is advised for all vessels before beginning this section. Adjustment of the CONTROL COMPASS will probably be required for steel vessels. Without proper compass adjustment, surrounding magnetic influences may cause the compass card to be unstable. This unstable condition will cause erratic COMPASS STEER operation.

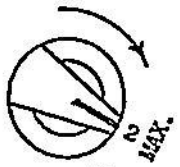
STEP 41 - Adjust the vessel's speed to between 3 and 8 knots.

STEP 42 - Set TRIM (Compass Course) to:
Straight up.



COMPASS TRIM

STEP 43 - Set the RUDDER knob to:
"2 KNOTS" - full clockwise.



RUDDER

STEP 44 - Set the COUNTER RUDDER knob to:
"AVERAGE" - straight up.

COUNTER RUDDER

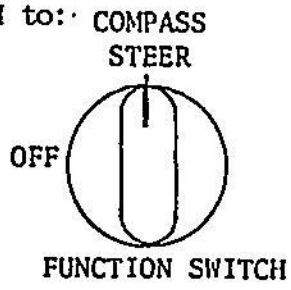
If the CONTROL COMPASS is accessible to the operator, A or B series, go to STEP 45.

If the CONTROL COMPASS is not accessible to the operator, go to STEP 52.

* COMPASS STEERING *
(When compass is accessible to operator)

STEP 45 - Rotate COMPASS COURSE DIAL to a CARDINAL heading i.e. N, E, S, or W. ("B" Models will require Compass bowl to be manually rotated. Align center of compass with lubber line to a line parallel to the keel.)

STEP 46 - Set the FUNCTION SWITCH to: "COMPASS STEER".



FUNCTION SWITCH

STEP 47 - Allow the vessel to steady down on course.

If the COMPASS COURSE DIAL and the COMPASS ROSE match, go to STEP 48.

If the COMPASS COURSE DIAL and the COMPASS ROSE do not match, BUT are not more than 10 degrees different, go to STEPS 47A and 47B.

47A - Rotate the TRIM (Compass course) knob slowly left or right until the COMPASS COURSE DIAL and the COMPASS ROSE match. Go to STEP 48.

47B - Go to STEPS IN TROUBLE-SHOOTING * SERVICE II or SERVICE III.

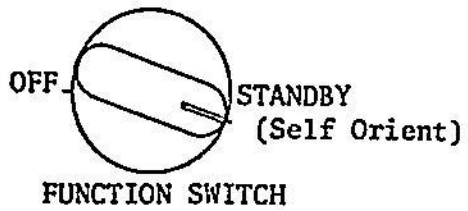
NOTE: Step 47B will only be necessary if the internal trim controls have been readjusted since leaving factory.

STEP 48 - Repeat STEPS 46 and 47 for each CARDINAL heading - N, E, S, and W.

* COMPASS STEERING *

(When compass is not accessible to operator)
(B SERIES ONLY)

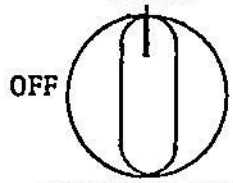
STEP 49 - Set the FUNCTION SWITCH to:
"STANDBY - self orient".



FUNCTION SWITCH

STEP 50 - Steer the vessel to one of the CARDINAL headings,
i.e. N, E, S, or W.

STEP 51 - Set the FUNCTION SWITCH to:
"COMPASS STEER".



FUNCTION SWITCH

STEP 52 - Repeat STEPS 50 and 51 for each CARDINAL heading,
i.e. N, E, S, and W.

If difficulties arise in holding some courses,
go to STEP 52A and 52B.

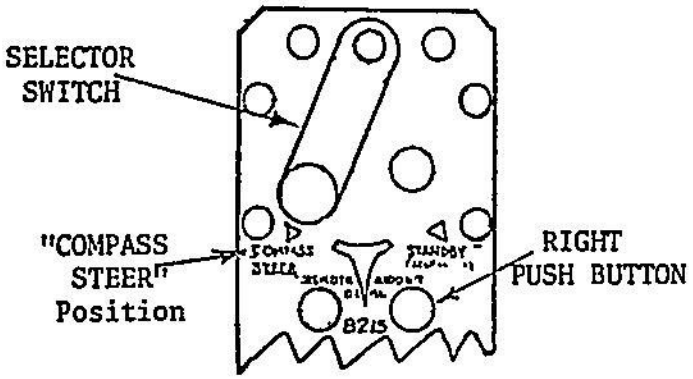
52A - Go to Compass Installation Instructions.
52B - Recheck CONTROL COMPASS magnetic adjustment,
refer to Compass Adjustment section.

* REMOTE CONTROL FUNCTIONS *

0 (For all Series Pilots with Remote Controls)

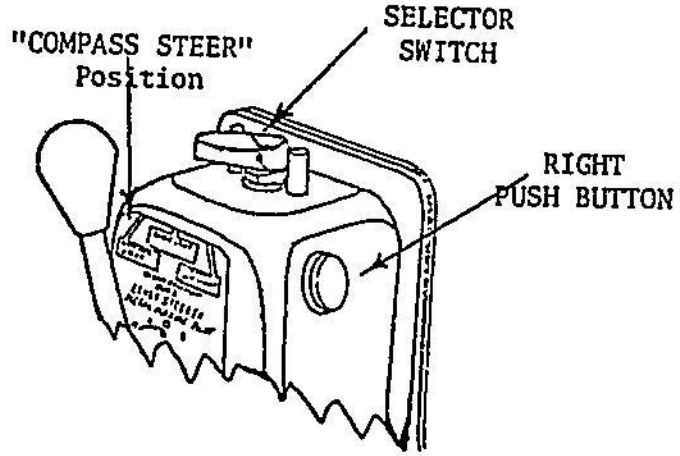
STEP 53 - Set COMPASS COURSE as described in:
Underway Checkout - * COMPASS STEERING *

STEP 54 - Set ALL Remote Control Units to:
"COMPASS STEER".



8215 & 8215-P
REMOTE HANDLE

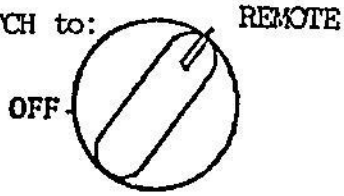
FIG. 4



8405-C LEVER STEERER

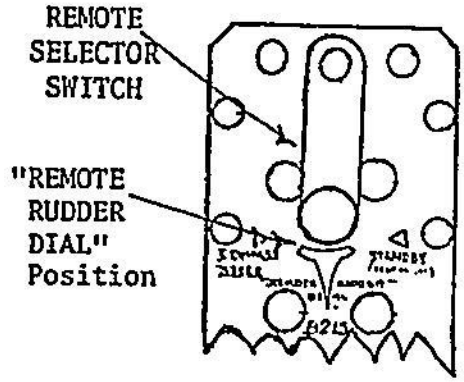
FIG. 5

STEP 55 - Set the Control Console FUNCTION SWITCH to:
"REMOTE".



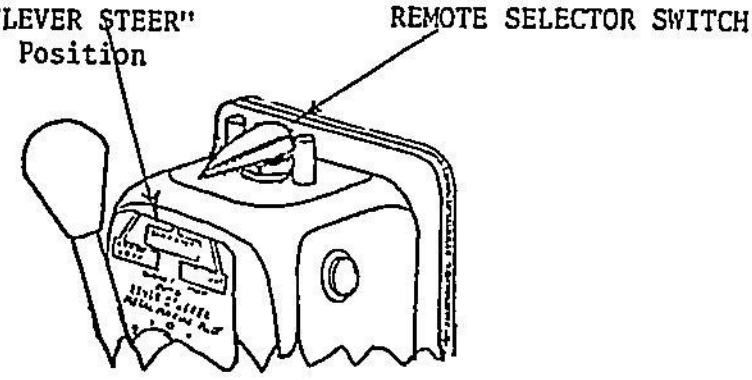
FUNCTION SWITCH

STEP 56 - Set the REMOTE SELECTOR SWITCH to:
"RUDDER DIAL" (on a Lever Steerer "LEVER STEER").



8215 & 8215-P
REMOTE HANDLE

FIG. 6



8405-C LEVER STEERER

FIG. 7

STEP 57 - Set the Remote RUDDER DIAL or (LEVER STEERER) to:
"0" - straight up.

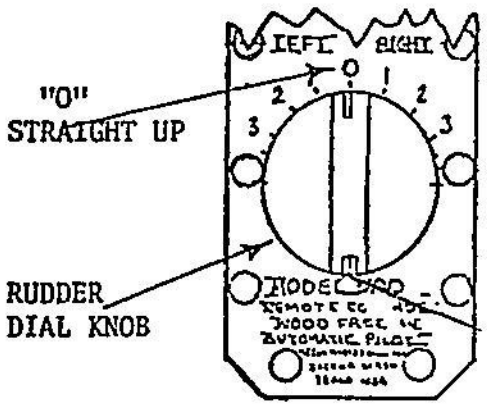


FIG. 8

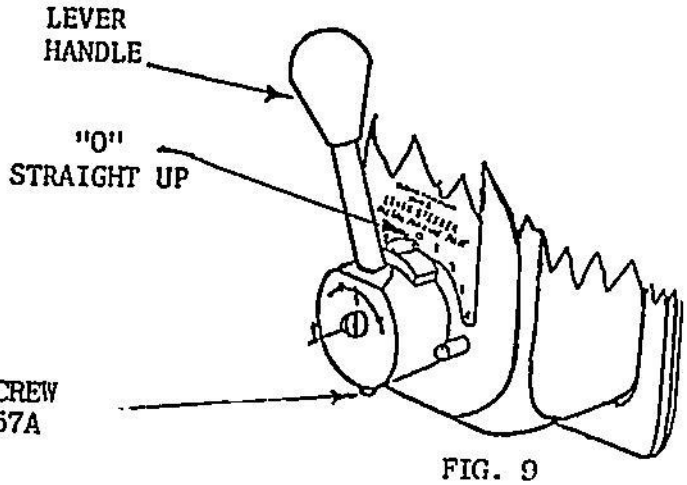


FIG. 9

If the vessel steers straight,
set the Remote SELECTOR SWITCH to:
"COMPASS STEER".

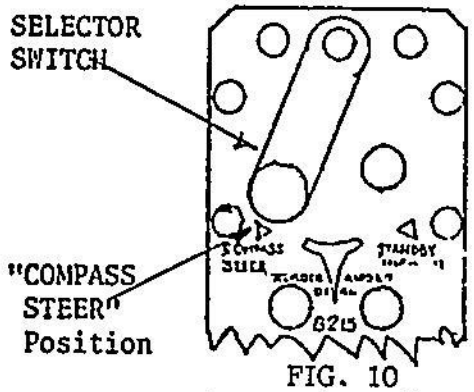


FIG. 10

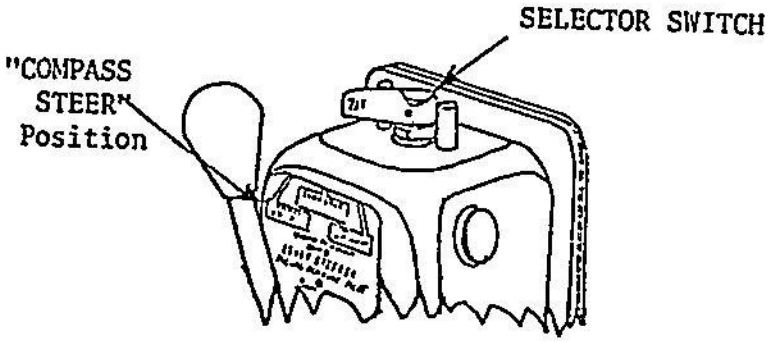


FIG. 11

Repeat STEP 57 for each Remote unit installed.

If the vessel does not steer straight,
go to STEP 57A & 57B.

57A - Rotate Remote RUDDER DIAL until vessel steers straight.
Loosen the knob screw on the remote (Fig 8 and Fig 9).
Rotate the knob to "0" (zero).
Tighten the knob screw.

57B - Go to STEP 60.

STEP 58 -
If this is an A SERIES PILOT (Non Orienting Compass),
go to STEP 63.

If this is a B SERIES PILOT (Orienting Compass),
go to SDEP 59.

STEP 59 - Test Remote RUDDER DIAL functions as described in STEP 39 & STEP 40.

STEP 60 - Test Remote COMPASS STEER and STANDBY - self orient functions as described in STEPS 49 through 52.

* PUSH BUTTON ORIENTING *
(B SERIES ONLY)

8215 & 8215P REMOTE HANDLES
8405-C LEVER STEERER

STEP 61 - Set the Remote SELECTOR SWITCH to:
"COMPASS STEER".

STEP 62 - Depress the RIGHT push button for 2 seconds.

If the vessel changes course 14 to 16 degrees to the RIGHT, go to STEP 62 (depress LEFT button).
Go to STEP 63.

If vessel does not change course,
go to Component Installation Instructions
(Push Button Orienter connections).

* 8530 STEERING STATIONS *
(flush mounted)

STANDBY - self orient: Same as above.
COMPASS STEER : Same as above.
RUDDER CENTERING:
Selector Switch on "RUDDER DIAL" -
Rudder centers.
Depressing RIGHT or LEFT push button will now produce 15 degrees to 20 degrees rudder in selected direction.

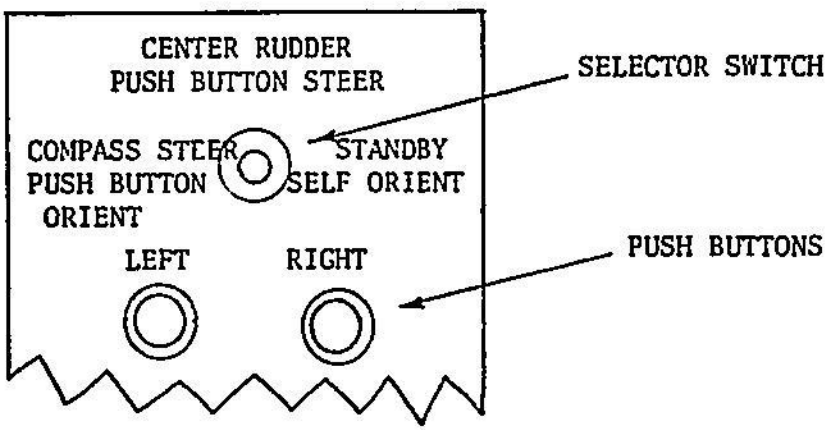


FIG. 12

STEP 63 - Fill out and MAIL the LIMITED WARRANTY CARD.

STEP 64 - Leave on board:
1 - Operator's manual.
1 - Complete Installation and Service manual.
1 - Compass cleaning kit and jumper plugs.

STEP 65 - Initial installation checkouts complete.

Complete operating instructions will be found in the:
* OPERATOR'S MANUAL *

* APPENDIX *

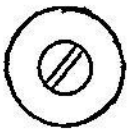
SENSITIVITY TEST FOR CONTROL CIRCUIT

STEP 1 - Unplug the 5 pin plug (ORIENTER) from the XL Power Supply.

STEP 2 - Unplug all cables from the back of the Control Console.
EXCEPT the 12 pin cable to the XL Power Supply.

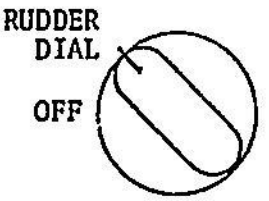
STEP 3 - Plug the RED 8-pin jumper plug and the
GREEN 9-pin jumper plug into the Control Console.

STEP 4 - Rotate the DAMPER control to:
Full counterclockwise.



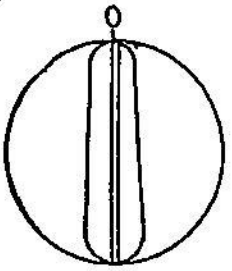
DAMPER

STEP 5 - Set the Control Console FUNCTION SWITCH to:
"RUDDER DIAL".



FUNCTION SWITCH

STEP 6 - Set the RUDDER DIAL pointer to:
"0" (zero).



RUDDER DIAL

STEP 7 - Slowly rotate the RUDDER DIAL pointer clockwise (RIGHT)
until the Power Pack energizes.
NOTE: Power Pack may pulse to the right,
full "on" should occur after 5 degrees.

If the Power Pack energizes within 1 to 2 degrees
of pointer travel,
go to STEP 8.

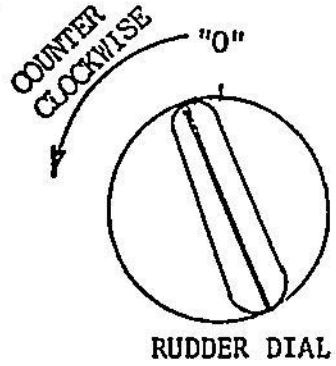
If the Power Pack DOES NOT energize within 1 to 2 degrees
of pointer travel,
go to STEPS 7A through 7C.

7A - Recheck DAMPER for full counterclockwise rotation.
7B - Replace the 300 board in Control Console.
7C - Go to STEPS IN TROUBLE-SHOOTING * SERVICE III
or
Contact the Factory for telephone assistance.

* APPENDIX *

SENSITIVITY TEST FOR CONTROL CIRCUIT (cont'd)

STEP 8 - Slowly rotate the RUDDER DIAL pointer counterclockwise (LEFT) until the Power Pack energizes.



RUDDER DIAL

If the Power Pack energizes within 1 to 2 degrees of pointer travel,
Basic Control Circuit is O.K.

NOTE: Power Pack may pulse to the LEFT, full "on" should occur after 5 degrees.

If the Power pack DOES NOT energize within 1 to 2 degrees of pointer travel,
go to STEP 7B and 7C.

Any problem with uncontrollable "hunting" could be due to one of the following:

1) - Wet or grounded (+ or -) Encoder or Encoder cable.

2) - Wet or grounded Compass cable, or Compass base.

3) - Wet or grounded Remote Control or Junction box.

If the above are found to be in good condition, the problem is caused by the steering system.

Some additional telephone assistance may be obtained by calling the Factory.
8:30 A.M. to 5:00 P.M. Monday - Friday: Pacific Local time.
(Please - No collect calls.)

METAL MARINE PILOT, INC.
2119 MILDRED STREET WEST
TACOMA, WASHINGTON 98466
TELEPHONE (206) 564-5902

WOOD FREEMAN® AUTOMATIC PILOTS

* 500 SERIES *

TROUBLE-SHOOTING * SERVICE II

TO USE:
The following steps are in numerical order. Proceed with each step in sequence, DO NOT JUMP STEPS unless instructed to do so. Faults and corrective measures will be indented from the margin and preceded by a number followed by a letter. i.e. 9A.

IN CASE OF DIFFICULTIES:
If you should encounter difficulties during the service procedure,
Review and Recheck component installation.
Repeat all previous checkout steps.
If difficulties persist,
Go to STEPS IN TROUBLE-SHOOTING *
SERVICE III.

Note:
SERVICE III is available from factory upon request.

You may also contact the factory for telephone assistance -
Monday through Friday - between 8:30 AM and 5:00 PM. (Pacific local time).
(206) 564-5902 - (Please - no collect calls)

Please have vessel name and serial number of pilot when contacting the factory for assistance.

NOTE:
The DOCKSIDE CHECKOUT and UNDERWAY CHECKOUT, Feb. 1979, should be used after completing the trouble-shooting guides.

TOOLS REQUIRED:
The following tools are required to do SERVICE II:

1 - Small to medium size bit, flat blade, screw driver.
1 - Set of Jumper Plugs - 1, 8-pin & 1, 9-pin with pins 2 & 3 jumpered together (Supplied with the Autopilot).
1 - Pair Snap Ring Pliers (#2) (Supplied with the Autopilot)
1 - WOOD FREEMAN® 500 SERIES Field Test Meter, (Optional Accessory)
(See Appendix, page 11)
or
a volt/ohm meter with a 3 to 5 volt scale,
or
a 500-0-500 micro amp meter.
(See Appendix, page 9, for alternate meter connections.)

METAL MARINE PILOT, INC.
2119 MILDRED STREET WEST
TACOMA, WASHINGTON 98466
(206) 564-5902

JULY 1979

GENERAL INSPECTION OF INSTALLATION

****

Before trouble-shooting the pilot, it is important to inspect the physical installation of the components. ALL COMPONENTS MUST BE INSTALLED ACCORDING TO FACTORY RECOMMENDATIONS. Any deviation from recommended procedures should be noted and corrected. Special attention should be given to the following:

Non-waterproof components mounted in exposed locations.

Cut, spliced, or otherwise modified cables, including plug ends that have been removed and replaced.

Hydraulic POWER PACKS connected directly with copper tubing or pipe, or without shut off valves.

Mechanical POWER PACKS mounted other than horizontally having the Gear Case higher than the motor.

Long power leads from the battery to the XL POWER SUPPLY.

XL POWER SUPPLY mounted with labels other than 'UP'.

CONTROL COMPASS mounted within three (3) feet of anything magnetic or that will deflect a compass card.

* INITIAL SET UP FOR ALL TESTING *

STEP 1 - Unplug all cables from back of the CONTROL CONSOLE, leaving only the 12 conductor cable in place (socket #4). (Fig. 1)

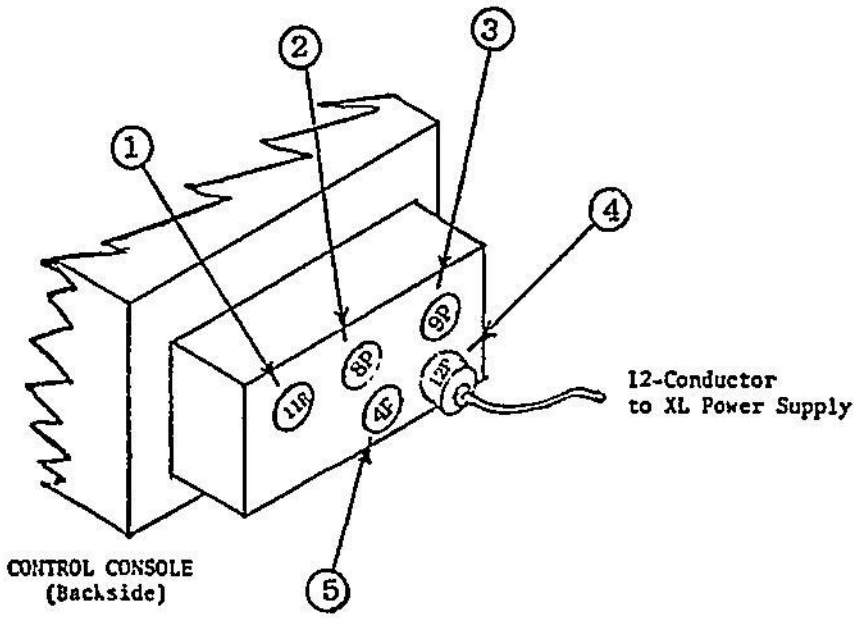


Fig. 1

STEP 2 - Plug the 8-pin RED Encoder Test Plug and the 9-pin GREEN Compass Test Plug into the 8 and 9-pin console sockets respectively (sockets #2 and #3).

STEP 3 - Plug the FIELD TEST METER (or connect equivalent meter) into the 4-pin RUDDER ANGLE INDICATOR socket and the 11-pin REMOTE CONTROL socket (#1 and #5). (Fig. 2)

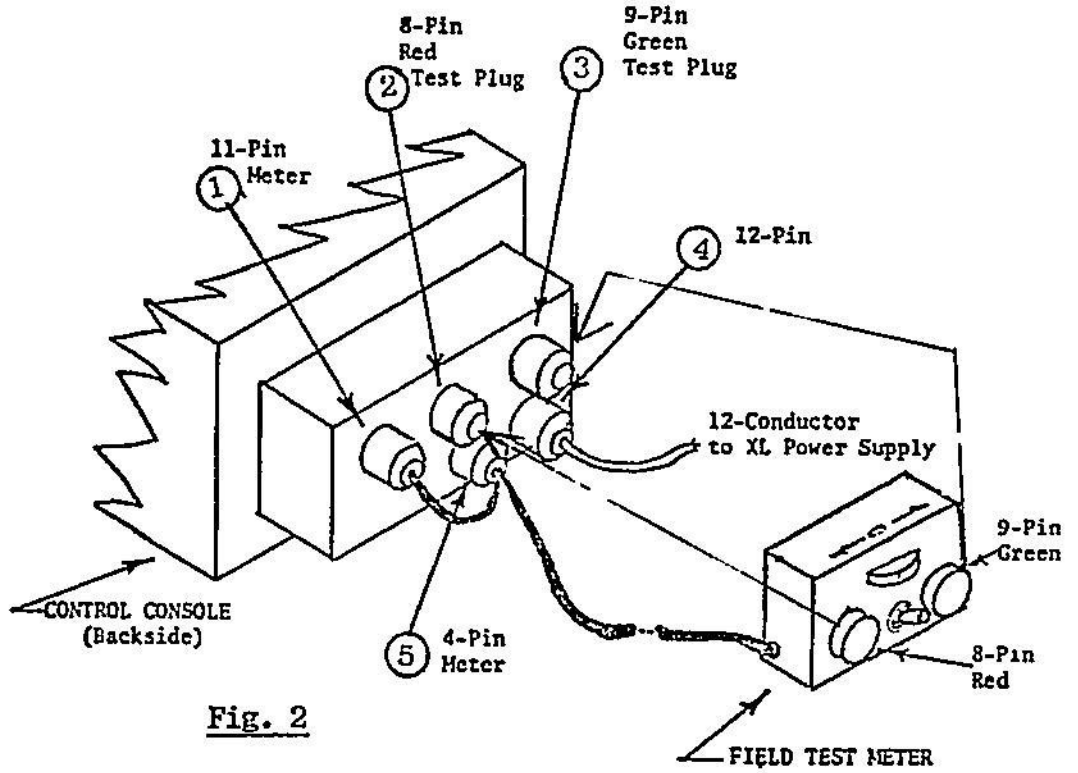
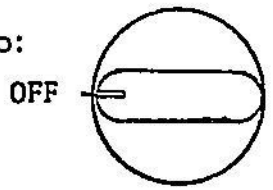


Fig. 2

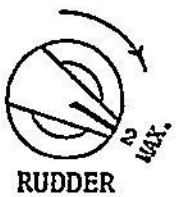
CAUTION ..The FIELD TEST METER is sensitive to magnetic fields DO NOT place the meter near magnets or magnetized tools when using the meter.

STEP 4 - Set the FUNCTION SWITCH to: "OFF".



FUNCTION SWITCH

STEP 5 - Set the RUDDER knob to: "2 KNOTS" - Full Clockwise.



RUDDER

STEP 6 - Set all other knobs on the CONTROL CONSOLE: straight up.

* XL POWER SUPPLY TESTS *

STEP 7 - Unplug the 4-pin POWER PACK plug from the XL POWER SUPPLY.
Unplug the 5-pin "ORIENTER" plug from the XL POWER SUPPLY.

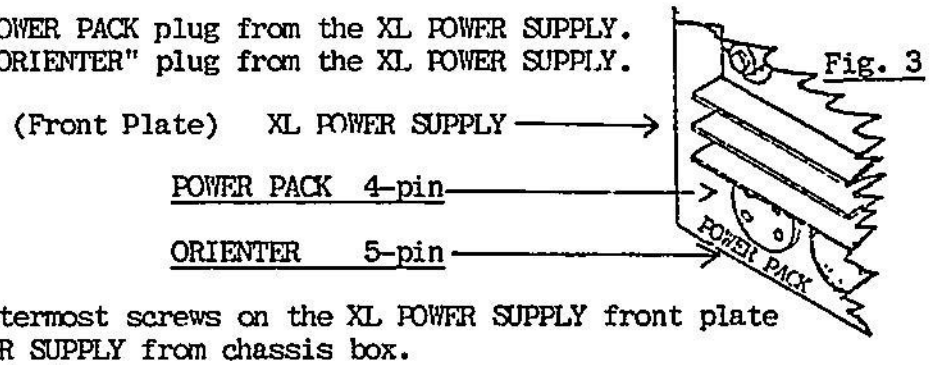


Fig. 3

STEP 8 - Remove the four outermost screws on the XL POWER SUPPLY front plate and remove XL POWER SUPPLY from chassis box.
Turn the unit upside down.
Locate TB 601 (a 12 position terminal strip). (Fig. 4)

STEP 9 - INPUT VOLTAGES

If the RED and BLUE voltage taps are on the correct terminals to match the ship's supply voltage (12,24 or 32 VDC), go to STEP 10.

If the voltage taps are not on the correct terminals, move the taps to correct terminals as shown in table below.

SHIP'S VOLTAGE	TB 601 TERMINAL # RED	BLUE
12	3	4
24	5	6
32	7	8

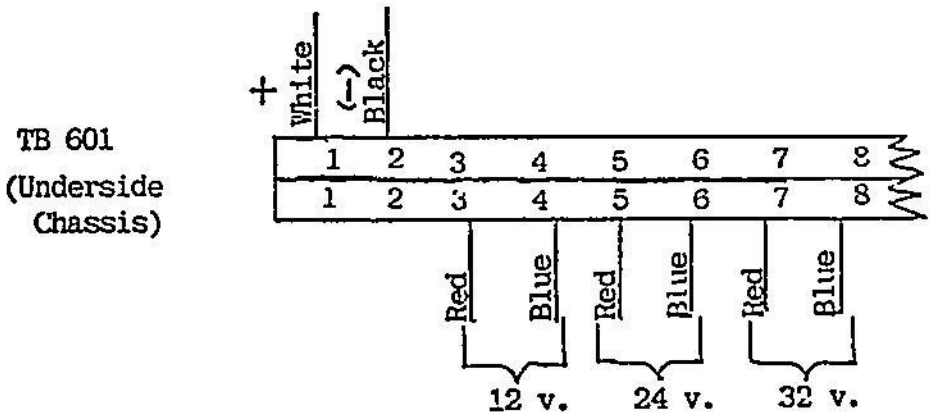
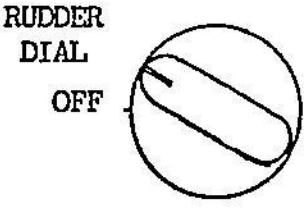


Fig. 4

>>> Tighten all unused screws on terminal strip <<<

STEP 10 - Return the unit to the RIGHT SIDE UP position and reconnect cables.

STEP 11 - Set the FUNCTION SWITCH to: "RUDDER DIAL".



FUNCTION SWITCH

If a click and a low 1200 to 1300 cycle tone are heard in the XL POWER SUPPLY,
go to STEP 12.

If no click or tone is heard in the XL POWER SUPPLY,
go to STEPS 11A - 11C.

11A - Check the power cable from the XL POWER SUPPLY to the Ship's D.C. supply for splices and wire size (see manual).
11B - Check the polarity of the XL Power Cable connection. (white is positive and connects to pin 1 of TB601).
11C - Replace the fuses on the XL POWER SUPPLY front panel. (4 amp (4AGC) - 20 amp (20MDL)) - go to STEP 11.

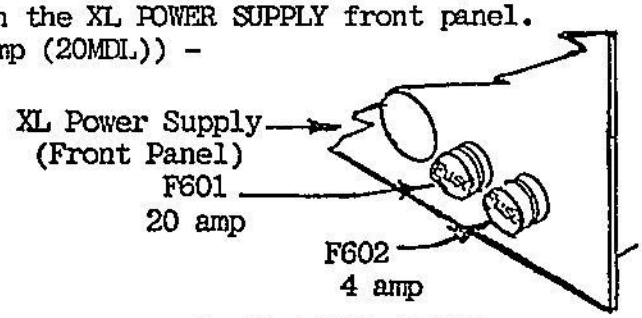


Fig. 5

STEP 12 - Unplug the three (3) 6419 RELAYS from the XL POWER SUPPLY.

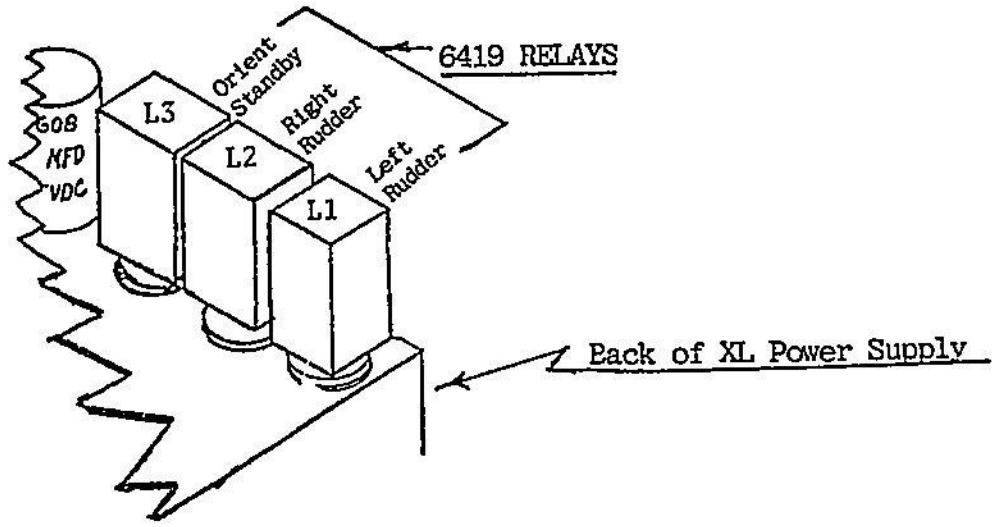
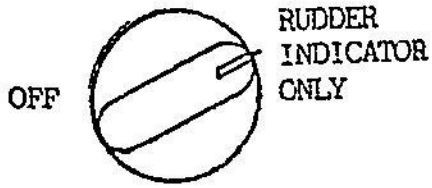


Fig. 6

STEP 13 - Set the FUNCTION SWITCH to: "RUDDER INDICATOR ONLY".



FUNCTION SWITCH

STEP 14 - Plug the 4-pin POWER PACK plug into the XL POWER SUPPLY.
(See Fig. 3, Page 4)

If the POWER PACK does not energize,
go to STEP 15.

If the POWER PACK energizes to the RIGHT or LEFT,
go to STEPS 14A and 14B.

14A - Locate the two mercury contactors (black tubes) mounted to the inside of the front panel plate.
14B - Remove the green wire from contactor L5. (Fig. 7)

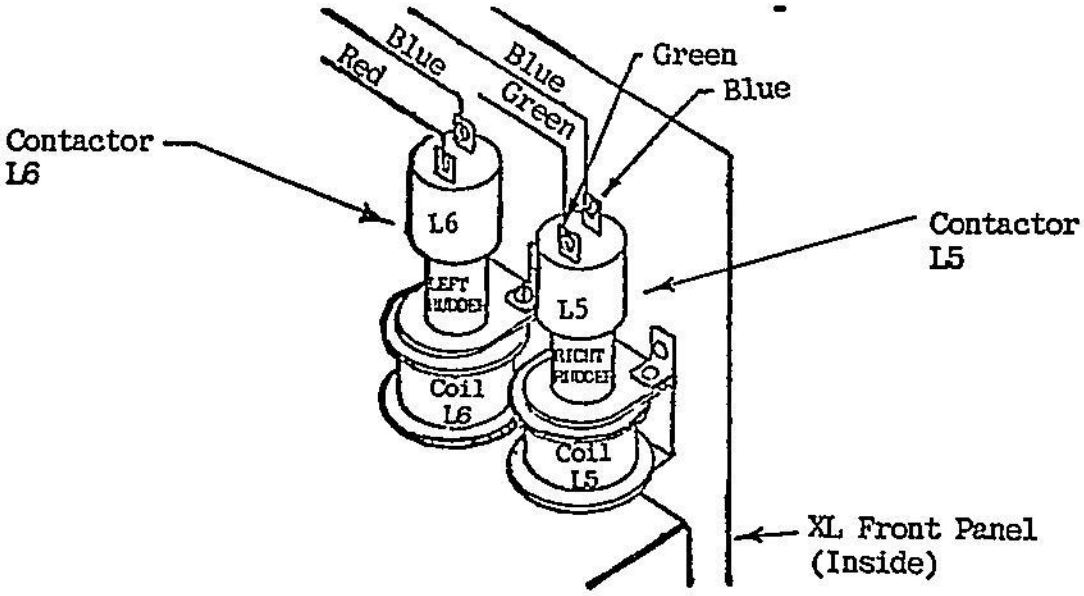


Fig. 7

If the POWER PACK stops running,
go to STEPS 14C and 14D.

14C - Replace mercury contactor L5.
14D - Go to STEP 14.

If the POWER PACK continues to run,
go to STEPS 14E and 14F.

14E - Replace mercury contactor L6.
14F - Go to STEP 14.

NOTE: IN AN EMERGENCY, INTERCHANGE THE DEFECTIVE CONTACTOR WITH THE MASTER RELAY CONTACTOR.
(SEE APPENDIX FOR LOCATION)

STEP 15 - Plug all 6419 relays into their sockets.
(Fig. 6)

If POWER PACK does not energize,
go to STEP 16.

If POWER PACK energizes to the LEFT,
go to STEP 15A.

15A - Interchange relays L1 and L3.

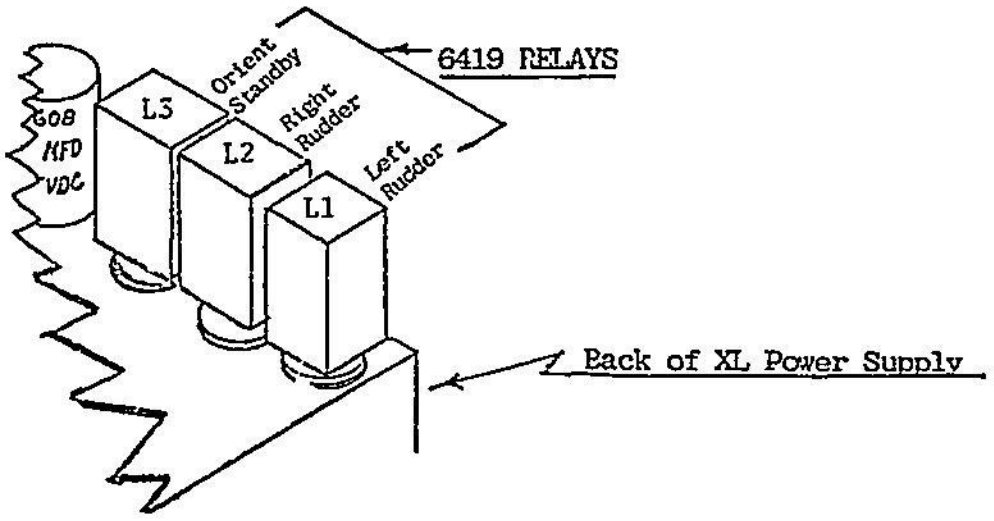
If the POWER PACK continues to run,
go to STEP 15B.

If the POWER PACK stops running,
replace the 6419 relay now in the L3 position.
Go to STEP 15.

15B - Interchange relays L2 and L3.

If the POWER PACK stops running,
replace the 6419 relay now in the L3 position.
Go to STEP 15.

If the POWER PACK continues to run,
replace the 6419 relays in both the L2 and L3 position.



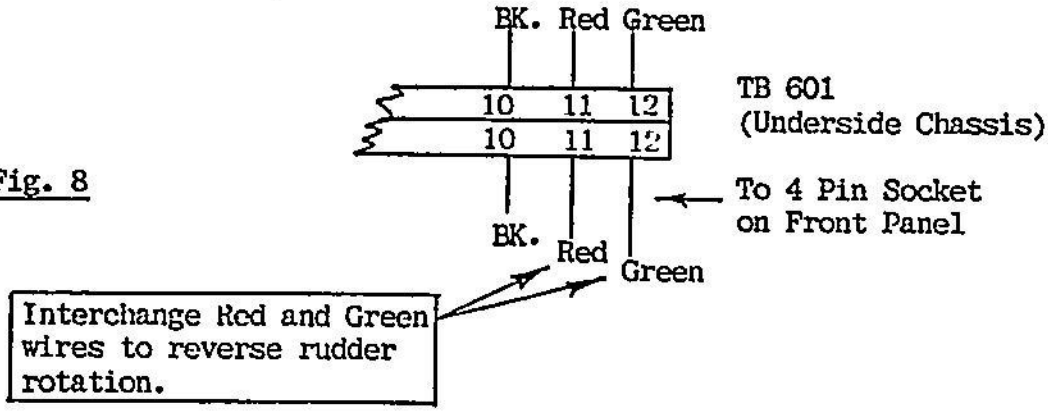
STEP 16 - Jumper across the GREEN and BLUE wires on top of mercury contactor L5. (Fig. 7, Page 6)

If the POWER PACK energizes to the RIGHT,
go to STEP 17.

If the POWER PACK energizes to the LEFT,
go to STEPS 16A - 16D.

16A - Unplug the 4-pin POWER PACK plug from the XL POWER SUPPLY (Fig. 3, Page 4)
16B - Turn the XL POWER SUPPLY upside down.
16C - Interchange the RED and GREEN wires (#11 & #12) on TB 601, the 12 position terminal strip. (Fig. 8)
NOTE : Interchange only the leads on the 4-pin socket side of the terminal strip.

Fig. 8



16D - Turn unit right side up - plug in 4-pin POWER PACK plug, go to STEP 16.

If POWER PACK does not energize,
go to STEPS 16E - 16G.

16E - Check the motor leads and brushes.
16F - If a solenoid valve is used, check for a stuck or defective solenoid.
16G - Recheck line voltage connections - go to STEP 16.

STEP 17 - Jumper RED and BLUE wires on mercury contactor L6. (Fig. 7, Page 6)

If the POWER PACK energizes to the LEFT,
unplug 4-pin POWER PACK plug.
go to STEP 18.

If the POWER PACK does not energize,
go to STEPS 17A - 17C.

17A - Check the motor leads and brushes.
17B - If a solenoid valve is used, check for a stuck or defective solenoid.
17C - Recheck line voltage connections.
Go to STEP 17.

* CONTROL CONSOLE TESTS *

CAUTION ..The FIELD TEST METER is sensitive to magnetic fields DO NOT place the meter near magnets or magnetized tools when using the meter.

STEP 18 - Place the FTM Meter selector switch in the middle position. Using a coin, (not a steel screw driver) adjust the meter for "ZERO".

STEP 19 - Place the METER SELECTOR SWITCH to the "left" or ENCODER TEST position. (Fig. 9)

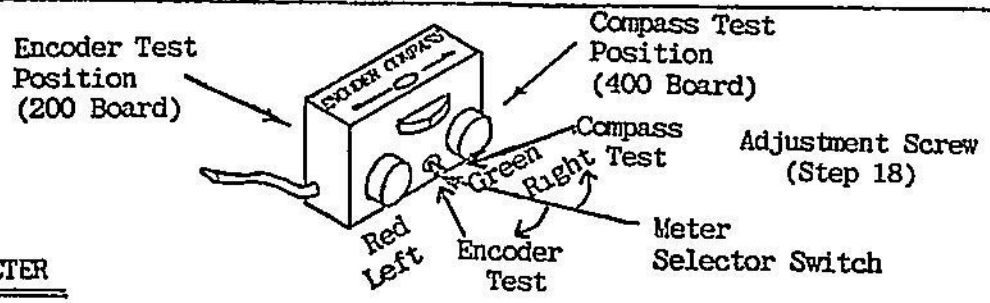


Fig. 9

FIELD TEST METER

STEP 20 - Remove the 4 outermost screws on the back of the CONTROL CONSOLE. Slide the back section of the unit from the front panel. (Fig. 10)
NOTE: Boards are shown removed for clarity. Do not remove unless instructed to do so.

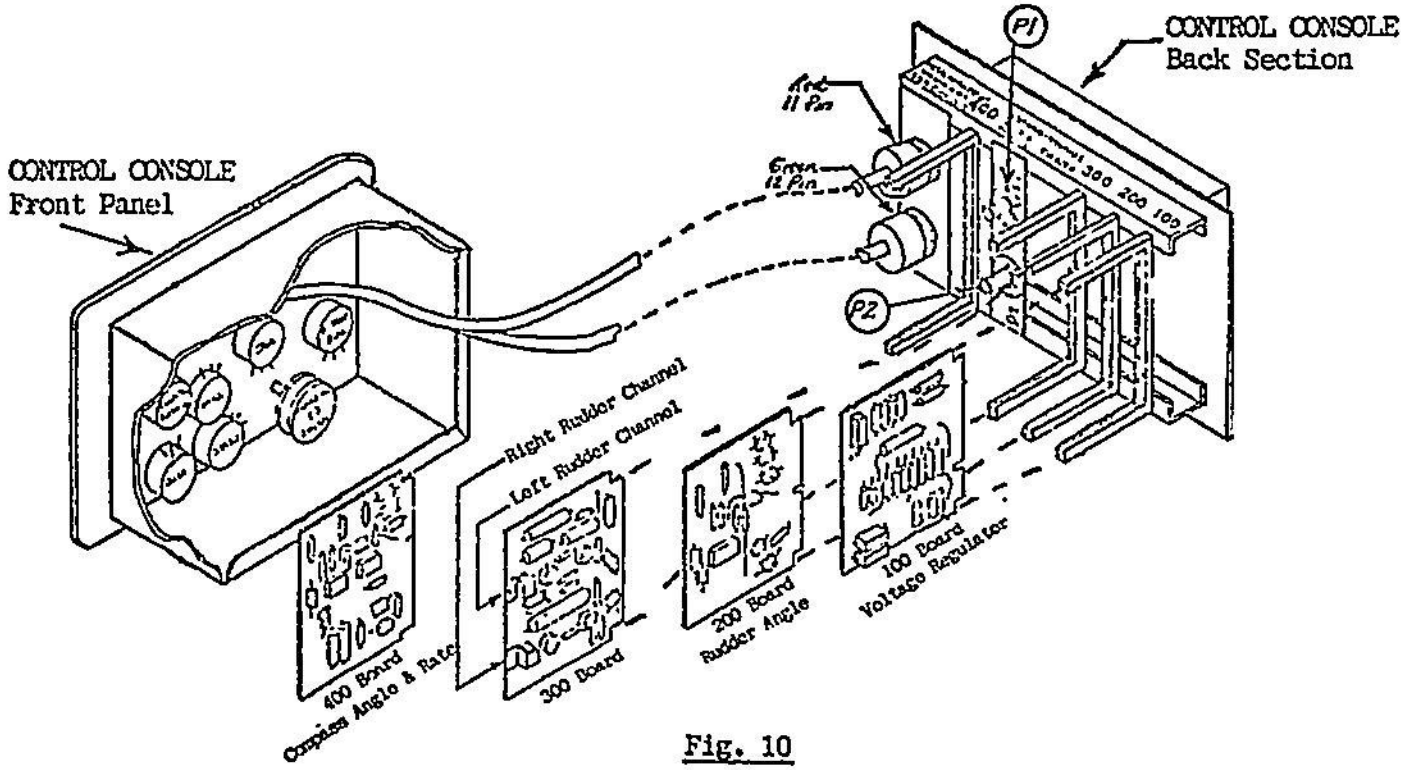


Fig. 10

* 200 BOARD *

STEP 21 - Rotate the ENCODER TRIMMER adjustment, P2, clockwise and counterclockwise for the full travel of the adjustment. (Fig. 11). This test can also be done with RUDDER ANGLE INDICATOR only if installed.

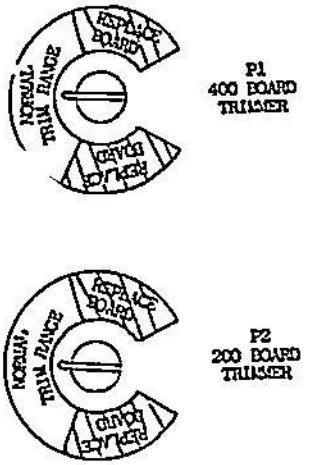


Fig. 11

If the Meter needle swings smoothly to full scale deflection in both directions, go to STEP 22.

If the Meter needle does not move, replace the 200 board. (Fig. 10, Page 9) Go to STEP 21.

If the Meter needle does not swing smoothly to full deflection on both sides of ZERO or is erratic, replace the 200 board. Go to STEP 21.

If replacing the 200 board does not correct fault, refer to IN CASE OF DIFFICULTIES, Page 1.

STEP 22 - Rotate ENCODER TRIMMER adjustment, P2, as required to ZERO the Meter needle. (Fig. 11)

If the Trimmer adjustment is within the middle 50% of travel marked on the plate as 'NORMAL TRIM RANGE' (for units without the labeled plate refer to the appendix.), go to STEP 23.

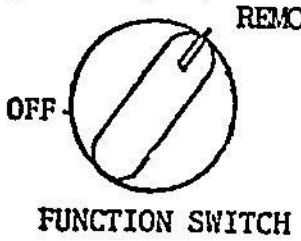
If the Meter needle will not ZERO, replace the 200 board. (Fig. 10, Page 9) Go to STEP 21.

If the Meter needle zeros but, the Trimmer adjustment is outside of 'NORMAL TRIM RANGE', replace the 200 board. Go to STEP 21.

If replacing the 200 board does not correct fault, refer to IN CASE OF DIFFICULTIES, Page 1.

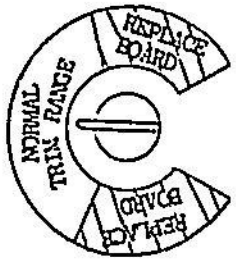
* 400 BOARD *

STEP 23 - Place the FIELD TEST METER selector switch to the "right" side - COMPASS TEST position. (Fig. 9. Page 9)
Set FUNCTION SWITCH to: "REMOTE".



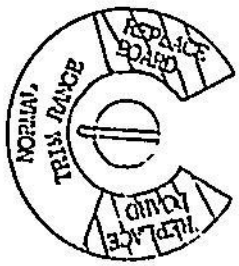
FUNCTION SWITCH

STEP 24 - Rotate the COMPASS TRIMMER adjustment, P1, clockwise and counterclockwise slowly, for the full travel of the adjustment. (Fig. 12)



P1
400 BOARD
TRIMMER

Fig. 12



P2
200 BOARD
TRIMMER

If the Meter needle swings smoothly to full scale deflection,
go to STEP 25.

If the Meter needle does not move,
replace the 400 board. (Fig. 10, Page 9)
Go to STEP 24.

If the Meter needle does not swing to full deflection on both sides of ZERO or is erratic,
replace the 400 board.
Go to STEP 24.

STEP 25 - Rotate Trimmer adjustment, P1, as required to ZERO the Meter needle. (Fig. 12)

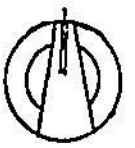
If the Trimmer adjustment falls within the middle 50% of travel marked on the plate as 'NORMAL TRIM RANGE' (for units without the labeled plate refer to the appendix.),
go to STEP 26.

If the Meter needle will not ZERO,
replace the 400 board. (Fig. 10)
Go to STEP 24.

If the Meter needle zeros, but the Trimmer adjustment is outside of the 'NORMAL TRIM RANGE',
replace the 400 board.
Go to STEP 24.

If replacing the 400 board does not correct fault,
refer to IN CASE OF DIFFICULTIES, Page 1.

STEP 26 - Rotate COMPASS TRIM knob (Control Console Front Plate) to: full counterclockwise.

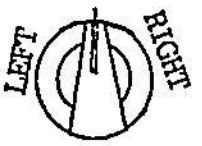


COMPASS TRIM

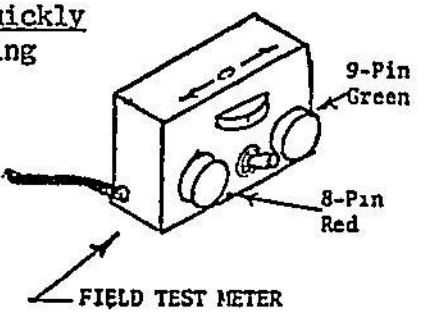
STEP 27 - Set the COUNTER RUDDER knob to: "AVERAGE" - straight up.

COUNTER RUDDER

STEP 28 - Rotate the COMPASS TRIM knob quickly back to the center while watching the FIELD TEST METER.



COMPASS TRIM



If the Meter needle swings past zero and then returns SLOWLY to zero, go to STEP 29.

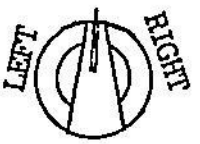
If the Meter needle does not swing past zero, but stops on zero - go to STEPS 28A and 28B.

28A - Check to see that COUNTER RUDDER knob is: "AVERAGE" - straight up.

28B - Replace 400 board - go to STEP 24.

COUNTER RUDDER

STEP 29 - Re-zero the Meter needle by rotating the COMPASS TRIM knob.

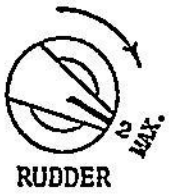


COMPASS TRIM

* COMPASS TESTS *

STEP 30 - Unplug 9-pin GREEN test plug. (Fig. 2, Page 3)

Set RUDDER knob to:
"2 KNOTS" - full clockwise.
Remove COMPASS from mounting bracket
by squeezing the flexible gimbal ring.
(Do not remove the gimbal screws.)
Plug 9-pin cable directly into
socket #3 on CONTROL CONSOLE back. (Fig. 2)



STEP 31 - Rotate COMPASS DIAL SLOWLY through 360 degrees. (Fig. 13)

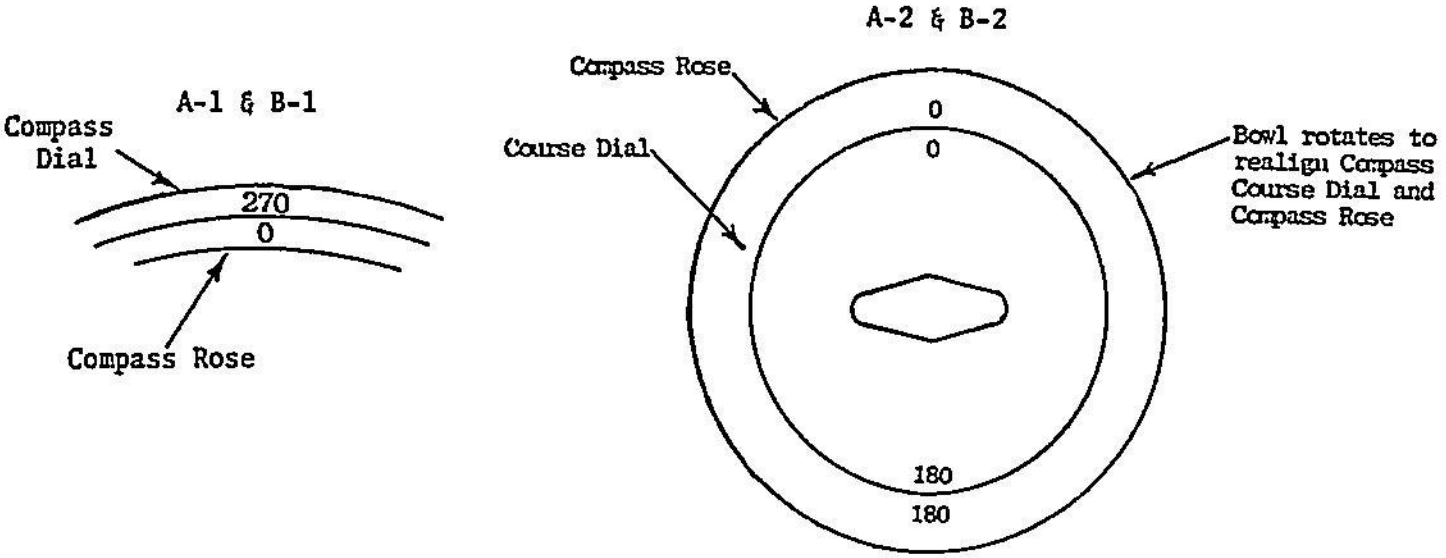


Fig. 13

If Meter needle swings SMOOTHLY both left and right,
go to STEP 32.

If Meter needle does not swing smoothly,
clean slip rings - (See Appendix).
Go to STEP 31.

If Meter needle does not swing,
go to STEPS 31A and 31B.

31A - Clean slip rings.
31B - Replace Compass crystal (See appendix)
then go to STEP 31.

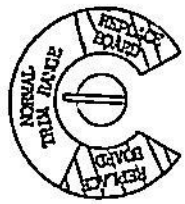
STEP 32 - Align COMPASS COURSE DIAL so that it matches COMPASS ROSE.
Slowly rotate COMPASS COURSE DIAL
until Meter needle zeros. (Fig. 13, Page 13)

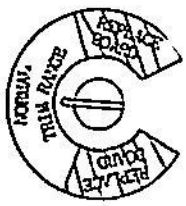
If COMPASS COURSE DIAL and COMPASS
ROSE match within 10 degrees,
go to STEP 33.

If COMPASS COURSE DIAL and COMPASS
ROSE differ by more than 10 degrees,
replace COMPASS crystal.
Go to STEP 31.

STEP 33 - Align COMPASS COURSE DIAL and COMPASS ROSE.
(Fig. 13, Page 13)

Rotate COMPASS Trimmer, P1,
until Meter needle zeros.





Rotate COMPASS DIAL 45 degrees clockwise.
(Fig. 13, Page 13)

If Meter needle swings 30 degrees or more left,
repeat STEP 33 counterclockwise.

Results should be 30 degrees or more right -
go to STEP 34.

If Meter needle does not swing 30 degrees
either left or right,
go to STEPS 33A and 33B.

33A - Clean slip rings. (See appendix)
33B - Replace Compass crystal - (See appendix)
go to STEP 33.

STEP 34 - Unplug COMPASS from back of CONSOLE and plug it into the Compass extension cable. Plug extension cable into CONSOLE.

(On "B" models with motor driven orienting base, do not plug into the yoke yet - only into the extension cord.)
Align the inner and outer compass dials. (Fig. 13, Page 13)

If Meter needle reads zero,
go to STEP 35.

If Meter needle does not read zero,
replace extension cable.
Go to STEP 34.

STEP 35 - Rotate COMPASS COURSE DIAL 45 degrees right and 45 degrees left from where dials match. (Fig. 13)

If Meter needle swings 30 degrees or more left,
repeat STEP 35 counterclockwise.
Results should be 30 degrees or more right -
go to STEP 36.

If Meter needle does not swing 30 degrees either left or right,
replace extension cable.
Go to STEP 35.

STEP 36 - On "B" models, plug the COMPASS into the COMPASS YOKE and plug the COMPASS BASE into the extension cable.
Align the COMPASS COURSE DIAL with COMPASS ROSE. (Fig. 13)

If Test Meter needle reads zero,
go to STEP 37.

If Meter needle does not read zero,
go to STEPS 36A and 36B.

36A - Clean Compass Yoke slip rings. (See Appendix)
36B - Replace COMPASS YOKE -
then go to STEP 36.

STEP 37 - Rotate COMPASS COURSE DIAL 45 degrees right and 45 degrees left from where COMPASS COURSE DIAL and COMPASS ROSE match. (Fig. 13, Page 13)

If Meter needle swings 30 degrees or more left,
repeat STEP 37 counterclockwise.
Results should be 30 degrees or more right -
go to STEP 38.

If Meter needle does not swing 30 degrees either left or right,
go to STEPS 37A and 37B.

37A - Clean Compass Yoke slip rings. (See appendix)
37B - Replace COMPASS YOKE -
go to STEP 37.

* ENCODER TESTS *

STEP 38 - Disconnect one end of connecting linkage.
Rotate ENCODER ARM through 180 degrees.

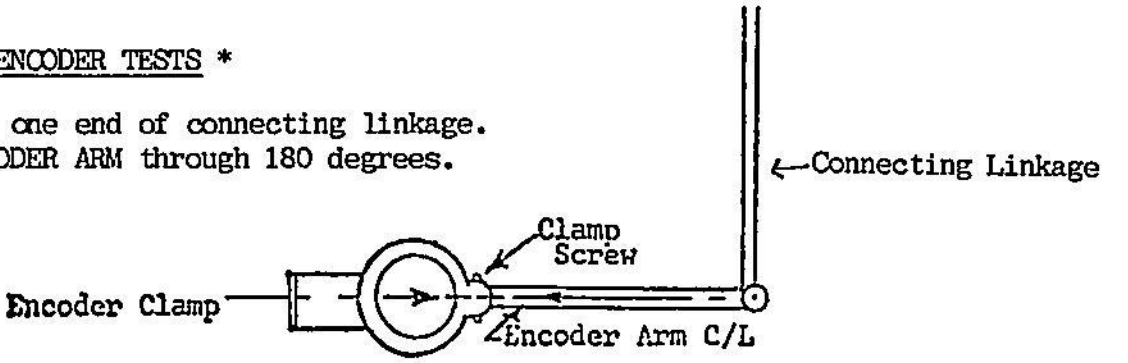
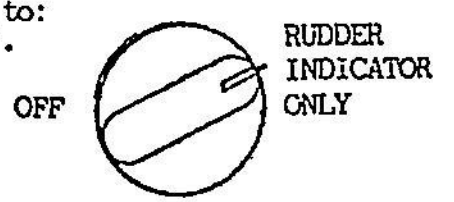


Fig. 14

If ENCODER ARM and shaft move freely,
go to STEP 39.

If arm does not move freely,
replace ENCODER.
Go to STEP 38.

STEP 39 - Remove ENCODER from stern.
Unplug 8-pin RED test plug from CONTROL CONSOLE.
Set the Field Test Meter switch to the left side.
Set the FUNCTION SWITCH to:
"RUDDER INDICATOR ONLY".



FUNCTION SWITCH

Plug ENCODER into CONTROL CONSOLE - top center socket.
Align arrows on the encoder cap and arm so they are pointing at each other. (Fig. 14)

If Meter needle reads within 15 degrees of zero,
go to STEP 40.

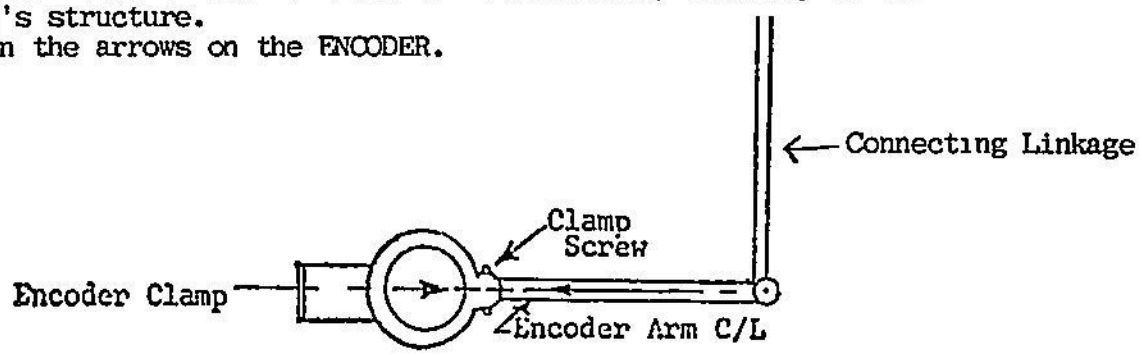
If Meter needle does not read within 15 degrees of zero,
replace encoder.
Go to STEP 39.

STEP 40 - Swing ENCODER ARM approximately 30 degrees left and right. (Fig. 14)

If Meter needle swings 30 degrees or more both left and right,
go to STEP 41.

If Meter needle does not swing,
replace ENCODER.
Go to STEP 40.

STEP 41 - Return ENCODER to the stern and plug into extension cable, but do not remount it yet. Keep it insulated electrically from any of the ship's structure.
Align the arrows on the ENCODER.



If the readings on the Meter needle are the same as when the ENCODER was plugged directly into the console,
go to STEP 42.

If Meter needle reading is not the same,
41A - Dry Encoder plug and extension socket with an air dryer.
41B - Replace Encoder extension cable.

NOTE: WHENEVER REPLACING ENCODER OR CABLE, BE SURE PLUG AND SOCKET CONNECTION IS DRY AND REPACKED WITH SILICONE GREASE.

STEP 42 - Install ENCODER. Arrows should be approximately lined up when rudder is at center position. Refer also to appendix for Installation Drawings.
Align arrows on ENCODER.

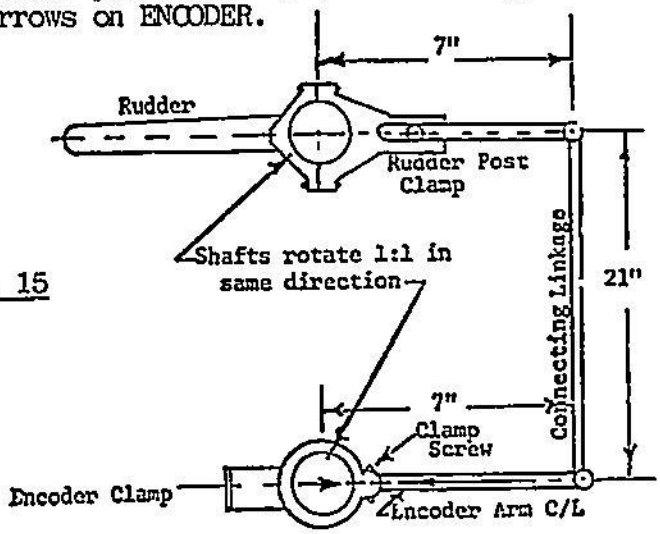


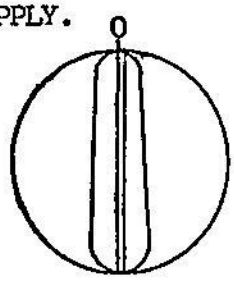
Fig. 15

If Meter needle readings are still the same,
go to STEP 43.

If Meter needle reading is different,
ENCODER must be electrically isolated from ship's structure.

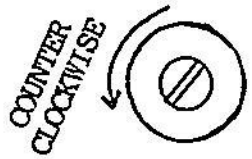
FUNCTION TESTS

STEP 43 - Plug POWER PACK into XL POWER SUPPLY.
Set RUDDER DIAL knob to:
STRAIGHT UP - "0"



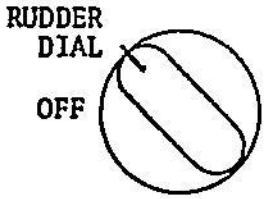
RUDDER DIAL

STEP 44 - Remove the black cover plug from the DAMPER.
Rotate the Damper control full COUNTERCLOCKWISE.



DAMPER

STEP 45 - Set FUNCTION SWITCH on CONTROL CONSOLE to:
"RUDDER DIAL".

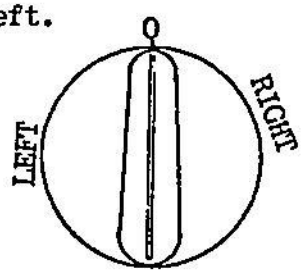


FUNCTION SWITCH

If POWER PACK energizes to left or right and continues to run hardover in one direction,
replace 300 board.
Go to step 45

>> If replacing the 300 board does not correct the fault,
replace 12 conductor cable to XL POWER SUPPLY.
If replacing the 12 conductor cable does not correct the fault
refer to IN CASE OF DIFFICULTIES, Page 1.

STEP 46 - Rotate RUDDER DIAL hard left.

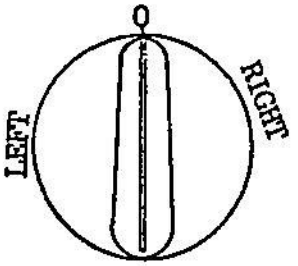


RUDDER DIAL

If rudder moves to the left,
go to Step 47.

If rudder will not move to the left,
replace 300 board.
Go to step 44

STEP 47 - Rotate RUDDER DIAL hard right.



RUDDER DIAL

If rudder moves to the right,
go to step 48.

If rudder will not move to the right,
replace 300 board.
Go to step 44.

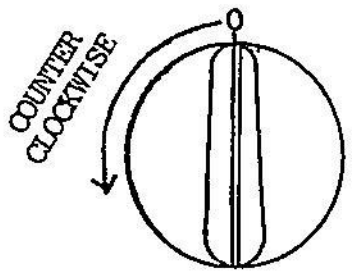
>> If replacing the 300 board does not correct the fault, replace 12 conductor cable to XL POWER SUPPLY.
If replacing the 12 conductor cable does not correct the fault, refer to IN CASE OF DIFFICULTIES, Page 1.

SENSITIVITY TEST FOR CONTROL CIRCUIT

STEP 48 - Unplug 9-pin Compass cable and 8-pin Encoder cable from the back of the CONTROL CONSOLE. (Fig. 1, Page 2)

STEP 49 - Plug the RED 8-pin jumper plug and the GREEN 9-pin jumper plug into the CONTROL CONSOLE. (Fig. 2, Page 3)

STEP 50 - Set the RUDDER DIAL pointer to:
full counterclockwise - hardover left.
(the POWER PACK will energize to the left)

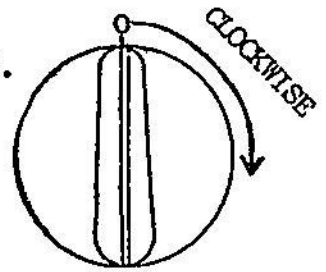


RUDDER DIAL

STEP 51 - Slowly rotate RUDDER DIAL pointer clockwise (right) until the POWER PACK reverses direction and runs to the right.

Note the position of the RUDDER DIAL pointer.

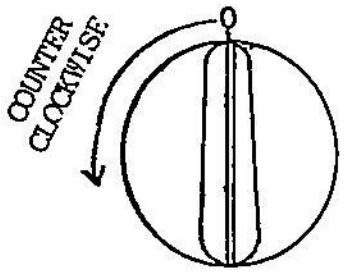
NOTE: POWER PACK MAY PULSE TO THE RIGHT, FULL "ON" SHOULD OCCUR AFTER 5 DEGREES.



RUDDER DIAL

STEP 52 - Rotate the RUDDER DIAL pointer counterclockwise (left) until the POWER PACK reverses direction and runs to the left.

NOTE: POWER PACK may pulse to the left, full "ON" should occur after 5 degrees.



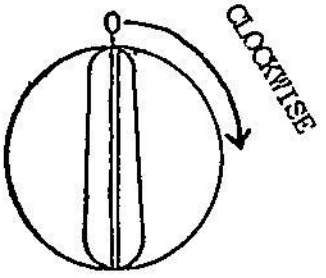
RUDDER DIAL

If the pointer is less than 3 degrees from the position noted in STEP 51, go to STEP 53.

If the pointer is greater than 3 degrees from the position noted in STEP 51, go to STEPS 52A through 52E.

52A - Recheck DAMPER for full counterclockwise rotation - go to STEP 50.
52B - Replace the 300 board in CONTROL CONSOLE - go to STEP 50.
52C - Replace the 12 conductor cable XL POWER SUPPLY to CONTROL CONSOLE - go to STEP 50.
52D - Replace CONTROL CONSOLE BACK section & boards - go to STEP 50.
52E - Refer to IN CASE OF DIFFICULTIES, Page 1.

STEP 53 - Slowly rotate the RUDDER DIAL pointer clockwise (RIGHT) until the POWER PACK energizes.



RUDDER DIAL

NOTE: POWER PACK MAY PULSE TO THE RIGHT, FULL "ON" SHOULD OCCUR AFTER 5 DEGREES.

If the POWER PACK energizes within 1 to 2 degrees of pointer travel, go to STEP 54.

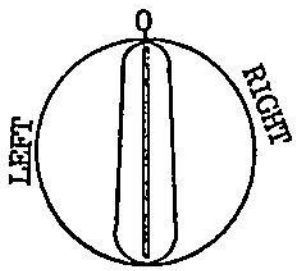
If the POWER PACK DOES NOT energize within 1 to 2 degrees of pointer travel, go to STEPS 52A through 52E.

STEP 54 - If the current position of RUDDER DIAL pointer is within a pointer's width of "0",
go to STEP 55.

If the current position of RUDDER DIAL pointer is more than a pointer's width of "0",
go to steps 54A and 54B.

54A - Rotate RUDDER DIAL to point where POWER PACK reverses direction.
54B - Loosen RUDDER DIAL pointer, move pointer to indicate "0" and tighten knob.

Slowly rotate the RUDDER DIAL pointer counterclockwise (LEFT) until the POWER PACK energizes.



RUDDER DIAL

If the POWER PACK energizes within 1 to 2 degrees of pointer travel,
BASIC CONTROL CIRCUIT is O.K.
Go to STEP 55.

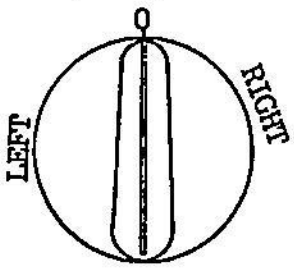
NOTE: POWER PACK MAY PULSE TO THE LEFT,
FULL "ON" SHOULD OCCUR AFTER 5 DEGREES.

If the POWER PACK DOES NOT energize within 1 to 2 degrees of pointer travel,
go to STEP 52A - 52E.

* DAMPER & NULL ADJUSTMENTS *

STEP 55 - Remove 8-pin jumper and insert 8-pin Encoder Cable.

STEP 56 - Set RUDDER DIAL pointer to:
"0" (zero).

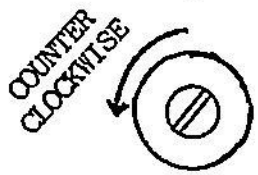


RUDDER DIAL

Set NULL knob to:
"AVERAGE" straight up.

NULL

STEP 57 - Remove the black cover plug from the DAMPER.
Rotate the Damper control full COUNTERCLOCKWISE.
Slowly rotate the Damper control clockwise until the continual oscillation of the rudder, ("hunting"), stops.



DAMPER

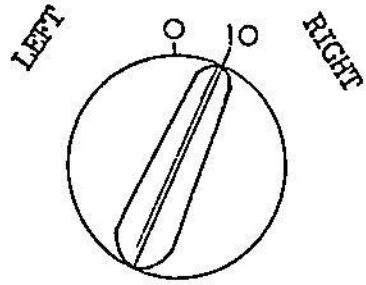
If the "hunting" of the rudder stops before the DAMPER is full clockwise - go to STEP 58.

If the DAMPER is rotated fully clockwise and the rudder "hunting" does not stop -
go to STEPS 57A through 57C.

57A - Check steering system for "mechanical slack" and correct as required to eliminate slack - go to STEP 57.
57B - On hydraulic steering, bleed steering system, (refer to steering system TROUBLE-SHOOTING GUIDE) - go to STEP 57
57C - Rotate NULL knob to the 9 o'clock, "BROAD" position - go to STEP 57.

NOTE: If "hunting" persists, review the installation.
Check for any connecting cables that may be CUT, SPLICED, BROKEN, OR OTHERWISE MODIFIED. Check also for charring of the boards or resistors.
If there are no apparent modifications, refer to IN CASE OF DIFFICULTIES, Page 1.

STEP 58 - Rotate the RUDDER DIAL pointer (knob) in 10 separate increments to 10 degrees RIGHT. (1 increment is approximately the width of the white line on the pointer knob.)



RUDDER DIAL

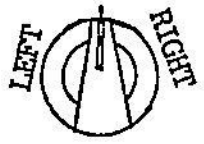
If the rudder responds to each increment of RUDDER DIAL pointer motion with equal travel and comes to rest at 10 degrees right, go to STEP 59.

If the RUDDER DIAL pointer must be rotated several increments before the rudder will respond, go to STEP 57.

NOTE: If STEPS 50 - 54 are o.k. and there is a sensitivity problem, refer to IN CASE OF DIFFICULTIES, Page 1.

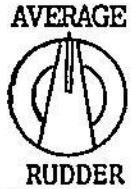
* COMPASS CHECKOUT *
(ALL MODELS)

STEP 59 - Remove 9-pin jumper and insert 9-pin Compass cable. Set TRIM knob "COMPASS COURSE" to: straight up.



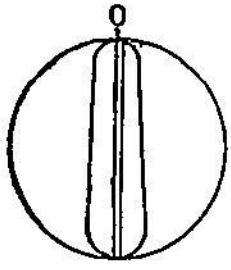
COMPASS TRIM

STEP 60 - Set RUDDER knob to: straight up - "AVERAGE".



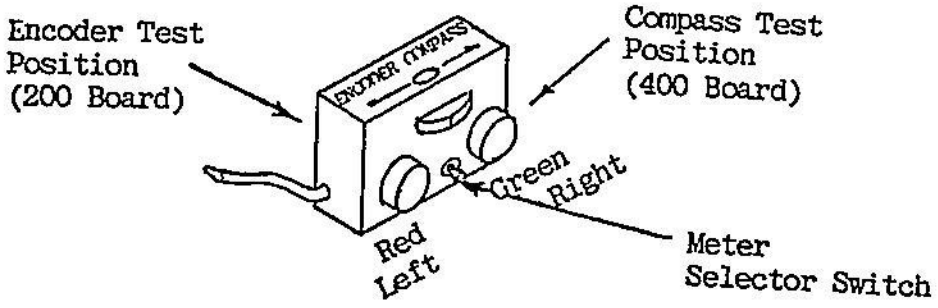
RUDDER

STEP 61 - Set RUDDER DIAL pointer to: "0".



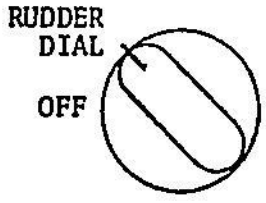
RUDDER DIAL

Set FIELD TEST METER selector switch to:
left, or red side.



FIELD TEST METER

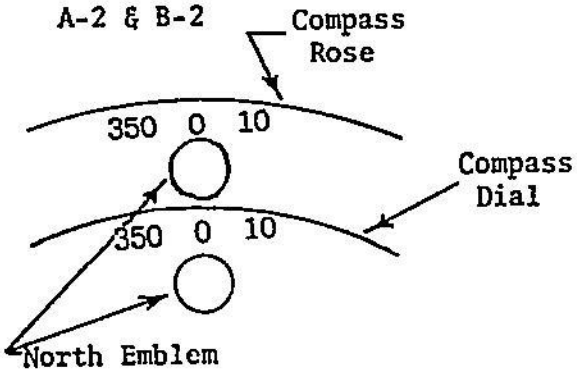
Set FUNCTION SWITCH to:
RUDDER DIAL

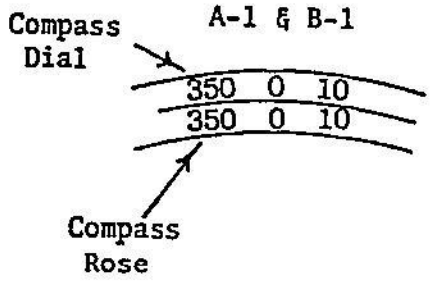


FUNCTION SWITCH

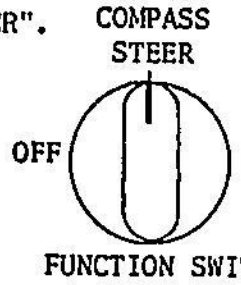
STEP 62 - Rotate the COMPASS COURSE DIAL (on the top of the compass unit) 5 complete turns to be sure of good slip ring contact. (On "B" units also rotate the YOKE 5 turns).

STEP 63 - Rotate the COMPASS COURSE DIAL so the COURSE DIAL numbers match with the COMPASS ROSE. "0" aligned with "0".





STEP 64 - Set the FUNCTION SWITCH to:
"COMPASS STEER".

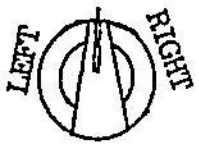


FUNCTION SWITCH

If the RUDDER ANGLE INDICATOR remains centered,
go to STEP 65.

If the RAI needle does not center (or rudder does not center),
go to STEPS 64A & 64B.

64A - Reset the TRIM knob "COMPASS COURSE" to:
"straight up" -



COMPASS TRIM

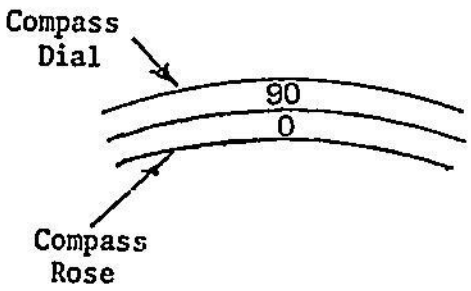
go to STEP 64.

64B - Refer to IN CASE OF DIFFICULTIES, Page 1.

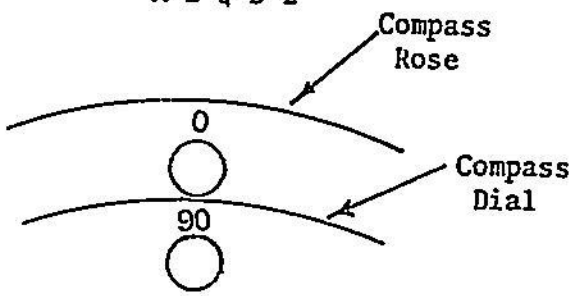
STEP 65 - Rotate RUDDER knob to:
"15 knots" - straight up.

Rotate COMPASS COURSE DIAL disk 90 degrees
counterclockwise.

A-1 & B-1



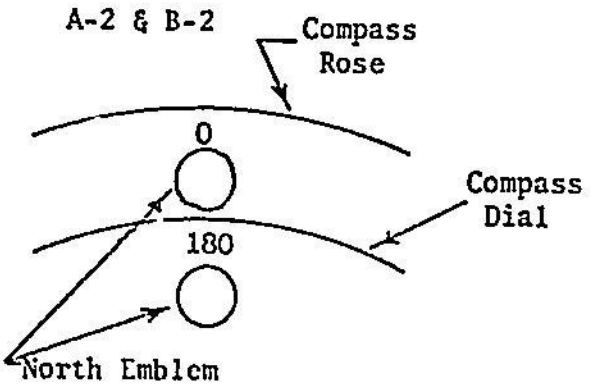
A-2 & B-2

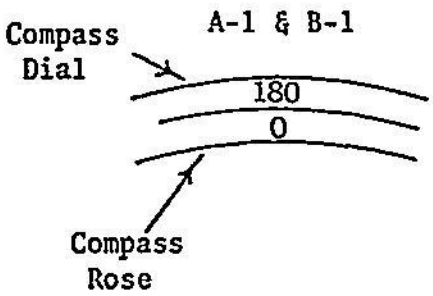


If rudder moves RIGHT 15 to 20 degrees,
go to STEP 66.

If rudder moves LEFT or rudder does not move,
refer to IN CASE OF DIFFICULTIES, Page 1.

STEP 66 - Rotate COMPASS COURSE DIAL disk 180 degrees.
(90 degrees from original matching position)

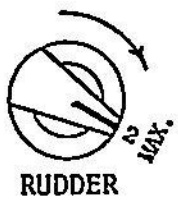




If rudder moves LEFT 15 to 20 degrees,
go to STEP 67.

If rudder does not move LEFT,
refer to IN CASE OF DIFFICULTIES, Page 1.

STEP 67 - Set the RUDDER knob to:
"2 KNOTS" - full clockwise.



If the rudder moves further LEFT approximately
30 to 45 degrees,
go to STEP 68.

If rudder travel is not increased,
refer to IN CASE OF DIFFICULTIES, Page 1.

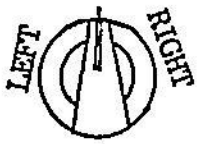
STEP 68 - If you have an "A" series pilot - (Compass not self-orienting),
go to DOCKSIDE AND UNDERWAY CHECKOUT IN INSTALLATION MANUAL.
(Feb. 1979)

If you have a "B" series pilot - (Compass self-orienting),
go to STEP 69.

* STANDBY-Self Orient CHECKOUT *
(B1 & B2 SERIES ONLY)

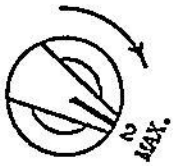
STEP 69 - Remove the 8-pin Encoder plug and cable from the rear of the CONTROL CONSOLE, (top center position).
Insert the 8-pin RED coded jumper plug.
Plug the 5-pin Gear Motor plug into the XL POWER SUPPLY.

STEP 70 - Set the TRIM knob "COMPASS COURSE" to: straight up.



COMPASS TRIM

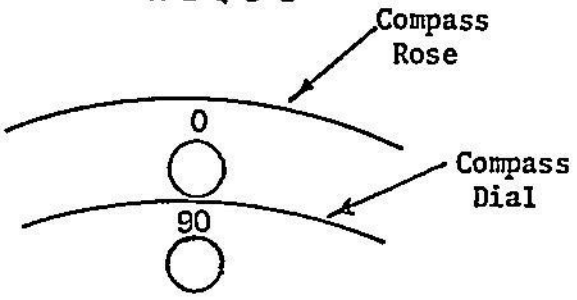
STEP 71 - Set the RUDDER knob to:
"2 KNOTS" - full clockwise.



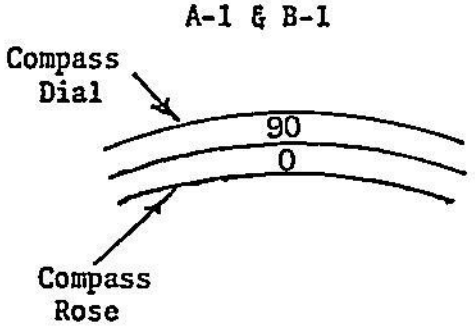
RUDDER

STEP 72 - Rotate COMPASS COURSE DIAL so the numbers on the COMPASS COURSE DIAL and the COMPASS ROSE differ 90 degrees.
(Unlock COMPASS YOKE on B2 models.)

A-2 & B-2



A-1 & B-1



STEP 73 - Set FUNCTION SWITCH to:
"STANDBY-self orient".

FUNCTION SWITCH

If the GEAR MOTOR rotates the Compass bowl so the COMPASS COURSE DIAL and the COMPASS ROSE match * (some "hunting", up to 1 to 2 degrees may be present), go to STEP 74.

If orienting occurs but COMPASS COURSE DIAL and COMPASS ROSE do not match *, refer to IN CASE OF DIFFICULTIES, Page 1.

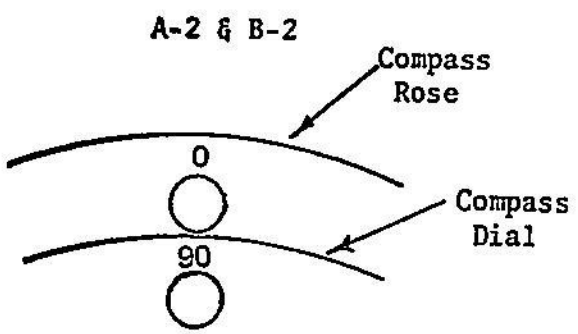
If GEAR MOTOR does not run, go to STEPS 73A through 73D.

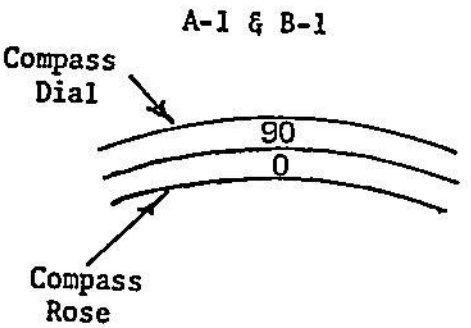
73A - Inspect Compass base and yoke for compass wire stuck in gears. SEE NOTE.
73B - Inspect flex shaft for tight bends or kinks - correct as necessary - go to STEP 73.
73C - Inspect Gear Motor pinion gear and drive gear for binding - correct as necessary - go to STEP 73.
73D - Go to Gear Motor Installation Instructions.

NOTE: IF COMPASS CABLE INSULATION HAS BEEN BROKEN, CONTACT FACTORY FOR A REPLACEMENT COMPASS, or send COMPASS, doubly packed, to the factory for repair.

* - On B1 models + or (-) 3 degrees.
On B2 models + or (-) 2 degrees.

STEP 74 - Rotate COMPASS COURSE DIAL clockwise 90 degrees and release.

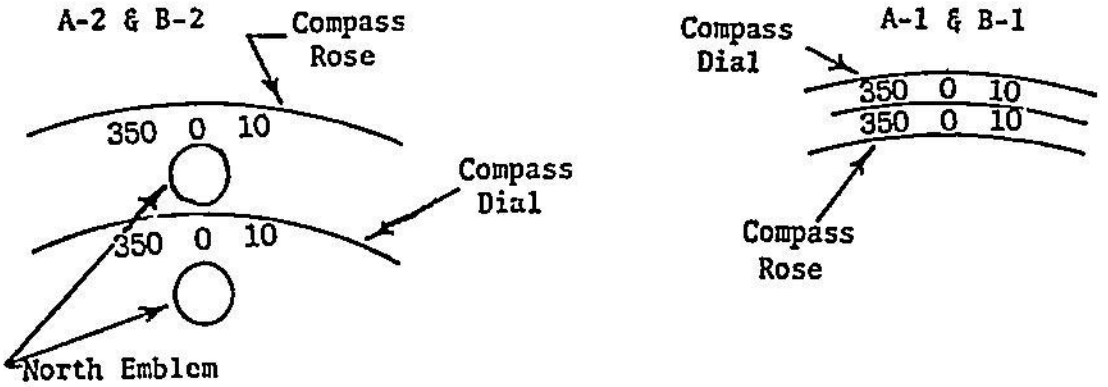




If the Compass bowl rotates back to matching position within 15 seconds, Repeat STEP 74 4 to 5 times. Go to STEP 75.

If the response time to realign the COMPASS COURSE DIAL & COMPASS ROSE is longer than 15 seconds, go to STEPS 73A through 73D.

STEP 75 - Repeat STEP 74 rotating COMPASS COURSE DIAL counterclockwise.



STEP 76 - Remove 8-pin jumper plug from back of the CONTROL CONSOLE. Plug in the 8-pin Encoder plug and cable. (top center socket)
Go to DOCKSIDE AND UNDERWAY CHECKOUT IN INSTALLATION MANUAL. (Feb. 1979)

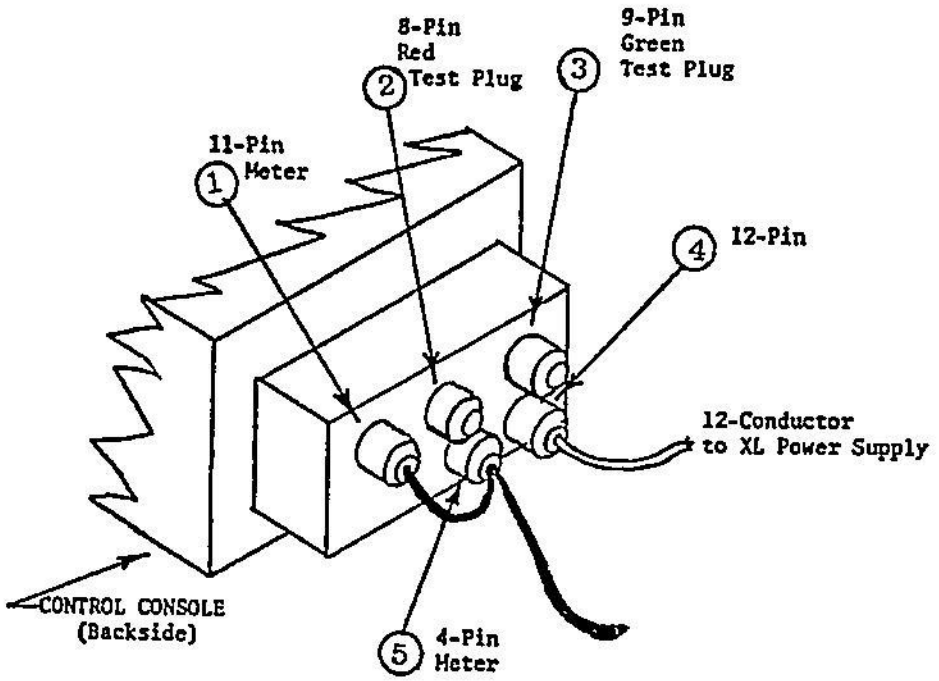


TABLE OF CONTENTS
APPENDIX

ALTERNATE ENCODER INSTALLATIONS

In some instances it will be necessary to mount the ENCODER in a "NON-STANDARD" configuration.

Standard configuration:

Both ENCODER ARM & RUDDER POST CLAMP face same direction.
ENCODER is mounted with arrow on top.

** Arrow on cap points at arrow on ENCODER ARM.

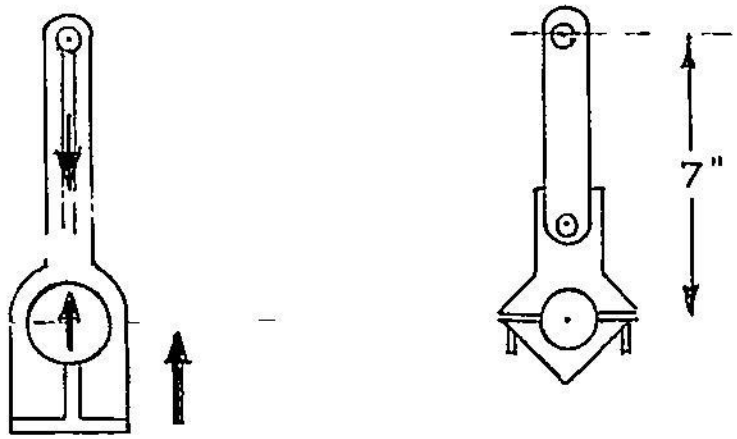


FIG. 1

Some alternate configurations are shown below:

1. ENCODER INVERTED:
Both ENCODER ARM & RUDDER POST CLAMP face same direction.
ENCODER is mounted with arrow on bottom.

** Arrow on cap points away from arrow on ENCODER ARM.

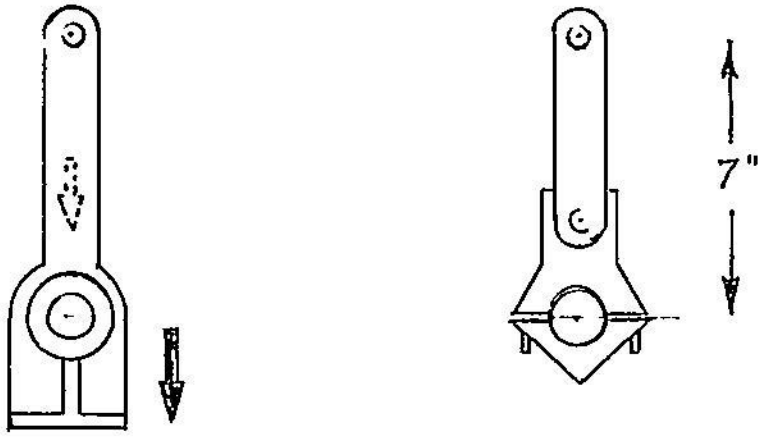


FIG. 2

2. OPPOSING ARMS:
ENCODER ARM mounted forward and RUDDER POST CLAMP ARM mounted aft (or any other opposing configuration).
ENCODER is mounted with arrow on top.

** Arrow on cap points away from arrow on ENCODER ARM.

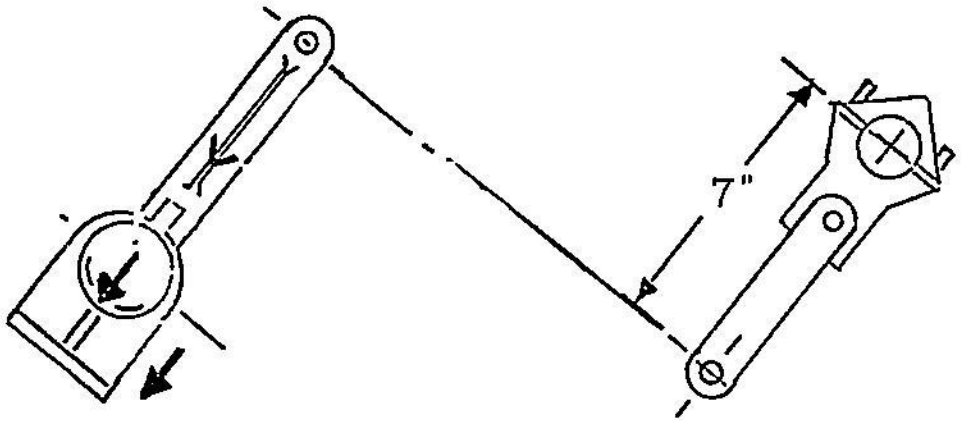


FIG. 3

3. INVERTED ENCODER & OPPOSING ARMS
ENCODER ARM mounted forward and RUDDER POST CLAMP ARM mounted aft (or any other opposing configuration).
ENCODER is mounted with arrow on bottom.

** Arrow on cap points at arrow on ENCODER ARM.

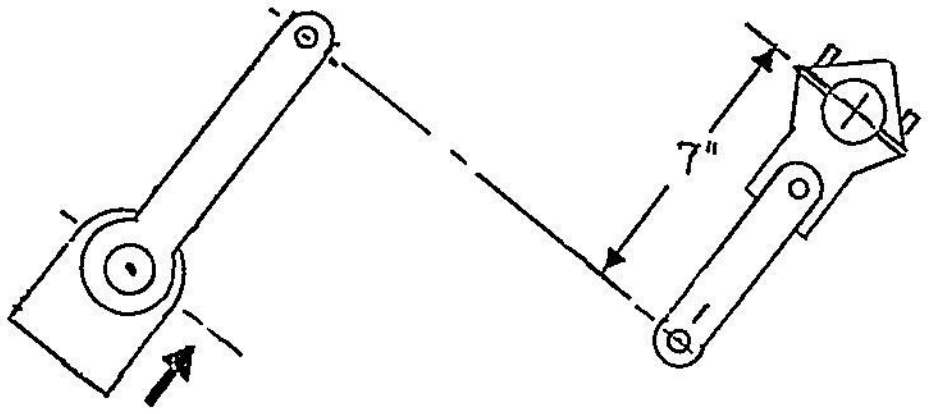
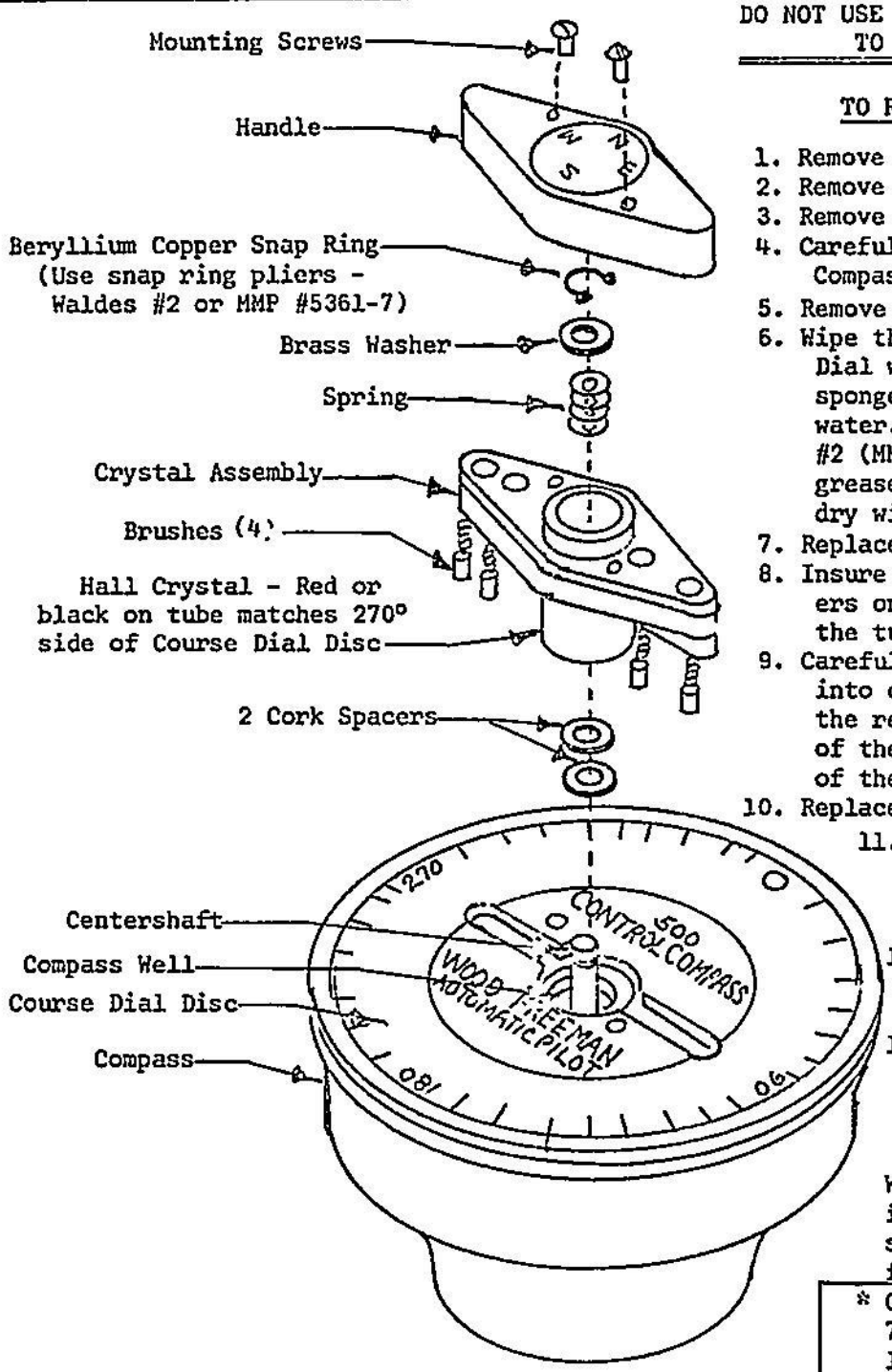


FIG. 4

IN ALL CONFIGURATIONS IT IS IMPORTANT THAT OPPOSITE SIDES OF THE "BOX" BE OF EQUAL LENGTH.

THE STANDARD MOUNTING ARM ON THE ENCODER IS 7 INCHES.

THE LENGTH OF THE RUDDER POST CLAMP ARM MUST BE 7 INCHES FROM THE CENTER OF THE RUDDER POST TO THE CENTER OF THE HOLE IN THE ARM.



DO NOT USE ABRASIVES OR PENCIL ERASERS TO CLEAN SLIP RINGS

TO REPLACE CRYSTAL ASSEMBLY

1. Remove 2 mounting screws from handle.
2. Remove handle.
3. Remove snap ring, washer and spring.
4. Carefully lift crystal assembly from Compass Course Dial disc.
5. Remove Course Dial disc from Compass.
6. Wipe the slip ring disc and Course Dial with clean cloth or cellulose sponge moistened with clean, fresh water. Apply Dow Corning #19 or #2 (MMP cleaning compound) silicone grease to slip ring disc and polish dry with a soft clean cloth.
7. Replace Course Dial disc.
8. Insure that there are two cork spacers on center stem and none inside the tube of the crystal assembly.
9. Carefully insert crystal assembly into compass well. Be sure that the red or black square on the side of the tube is facing the 270° side of the Course Dial disc.
10. Replace spring, washer and snap ring.
11. Replace handle and 2 mounting screws. The "N" on the handle points toward the "Zero" on the Course Dial disc.
12. Rotate compass dial through 360° and insure that no binding occurs.
13. Rotate compass dial about 10 turns to insure that brushes are seated and slip rings are polished.

Whenever gold (or silver*) plating on slip rings has worn thru showing copper base, return to factory for replate.

* Compasses having serial numbers 75-xxxx or higher or having lower serial number followed by "A" have silver slip rings AND silver brushes and rarely need cleaning or replating.

TO CLEAN DIAL & SLIP RINGS - Use foregoing procedure, except that original parts are retained at reassembly.

SELF CLEANING SLIP RINGS

1. When Pilot has not been used for several days, rotate compass dial through 3 or 4 turns to polish slip rings, before setting course.
2. In daily operation, action of slip ring brushes during course dialing will keep slip rings polished.

KEEP CLEAR VINYL COVER ON COMPASS AT ALL TIMES FOR LONGER INTERVALS BETWEEN CLEANING.

METAL MARINE PILOT, INC. 2119 West Waddell Street Tacoma, Wash. 98466	FOR WOOD FREEMAN AUTOMATIC PILOT
SCALE NONE DATE 1-28-76	MACHINE NO. REPLACEMENT PROCEDURE
DRWN. MWF CK	
SERIAL	
PREVIOUS	TITLE 500 SERIES COMPASS CRYSTAL
REVISIONS	
ASSEMBLY	NO.
W.O. RECORD	

Place Compass in Yoke

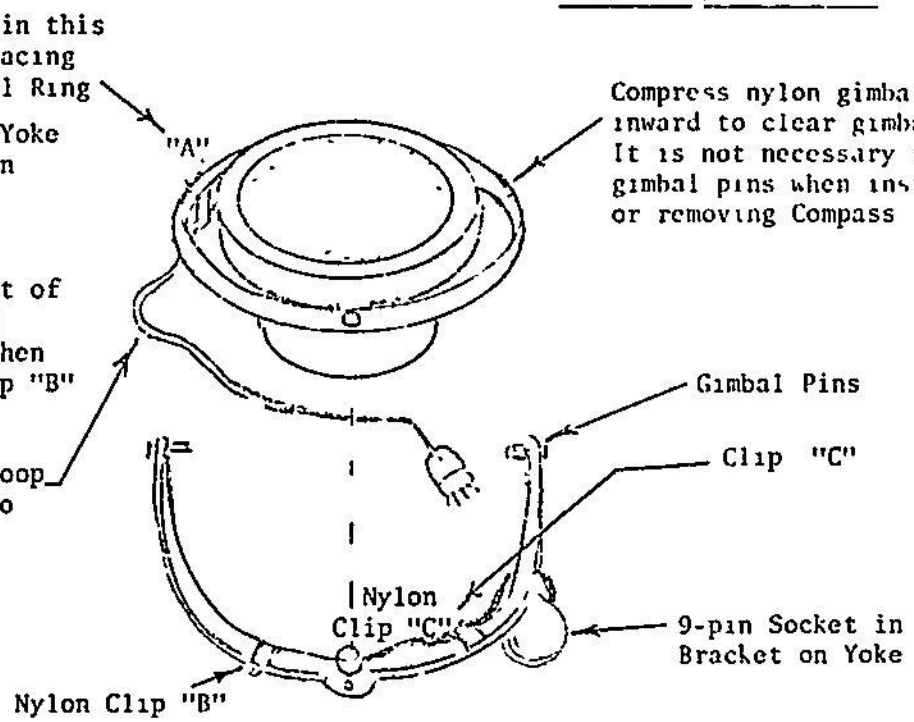
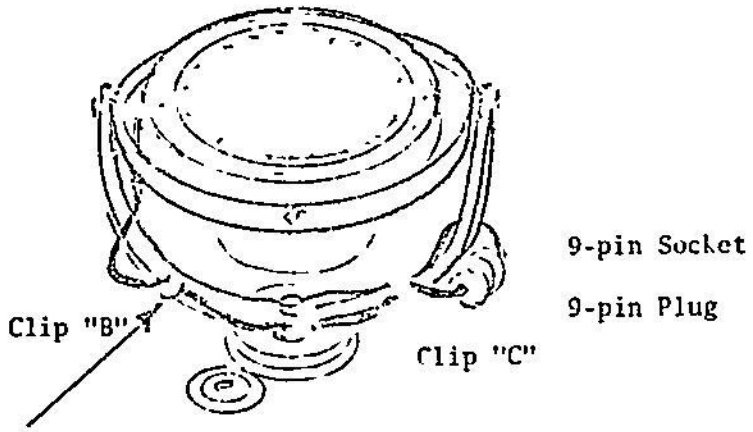


FIG. 1



Secure under Clip "B" and Clip "C" to prevent cord from engaging gears. Plug into Socket as shown above.

FIG. 2

METAL MARINE PILOT, INC.	FOR WOOD FREEMAN AUTOMATIC PILOT
SCALE None DATE 8-25-71	MACHINE NO. 500-B COMPASS
DRAWN JH CK	
SERIAL	
PREVIOUS	TITLE Installing Compass in Yoke
REVISIONS 7-27-77	
ASSEMBLY	NO. 5005002-B

REMOTE MASTER SWITCH

GENERAL DESCRIPTION

The REMOTE MASTER SWITCH option is provided for those installations which have more than one control station.

The REMOTE MASTER SWITCH provides a means to turn off all electrical power to the autopilot control and motor circuit (same as the FUNCTION SWITCH on the CONTROL CONSOLE).

In the event of a malfunction of the pilot control circuit, a mercury contactor causing a hardover motor command, the REMOTE CONTROLS would not be able to override the signal. The REMOTE MASTER SWITCH will disconnect power to the motor and allow normal wheel steering (-511 power packs must declutch before wheel steering).

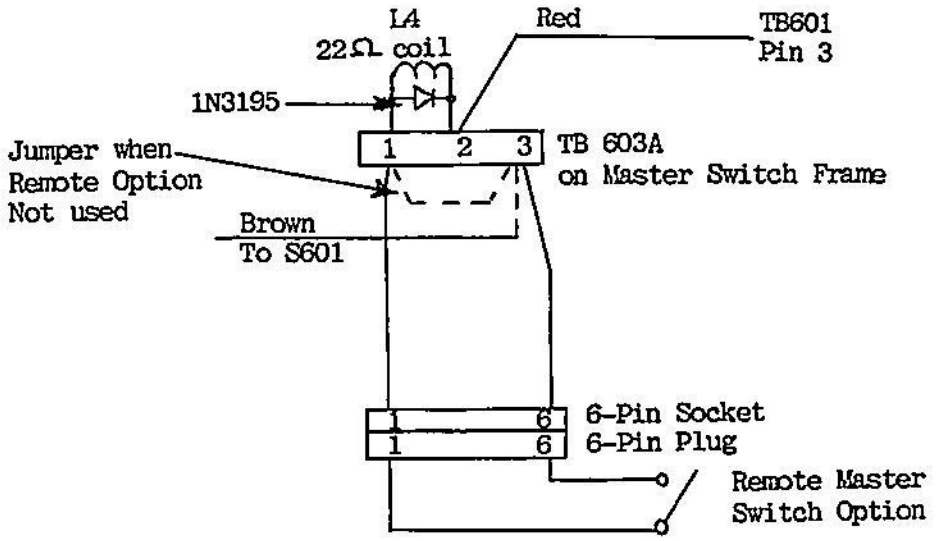
ELECTRICAL CONNECTIONS

XL POWER SUPPLYS (serial #5400 and up) are provided with a 6-pin socket on a short pigtail protruding from the front panel with the POWER CABLE.

Connect REMOTE MASTER SWITCH PANEL #8370 in series with pins 1 and 6 of the 6-pin socket.

Disconnect the jumper lead between pins #1 & 3 on Terminal Board #603A inside the XL POWER SUPPLY.

** Refer also to Drawing #5006123-2R-2 and #5001503B-1RA-1



OPERATION

Turn the FUNCTION SWITCH on the CONTROL CONSOLE to the desired position.

When you are ready for the pilot to be energized, turn on the REMOTE MASTER SWITCH.

NOTE: BOTH SWITCHES MUST BE IN THE "ON" POSITION TO COMPLETE CIRCUIT.

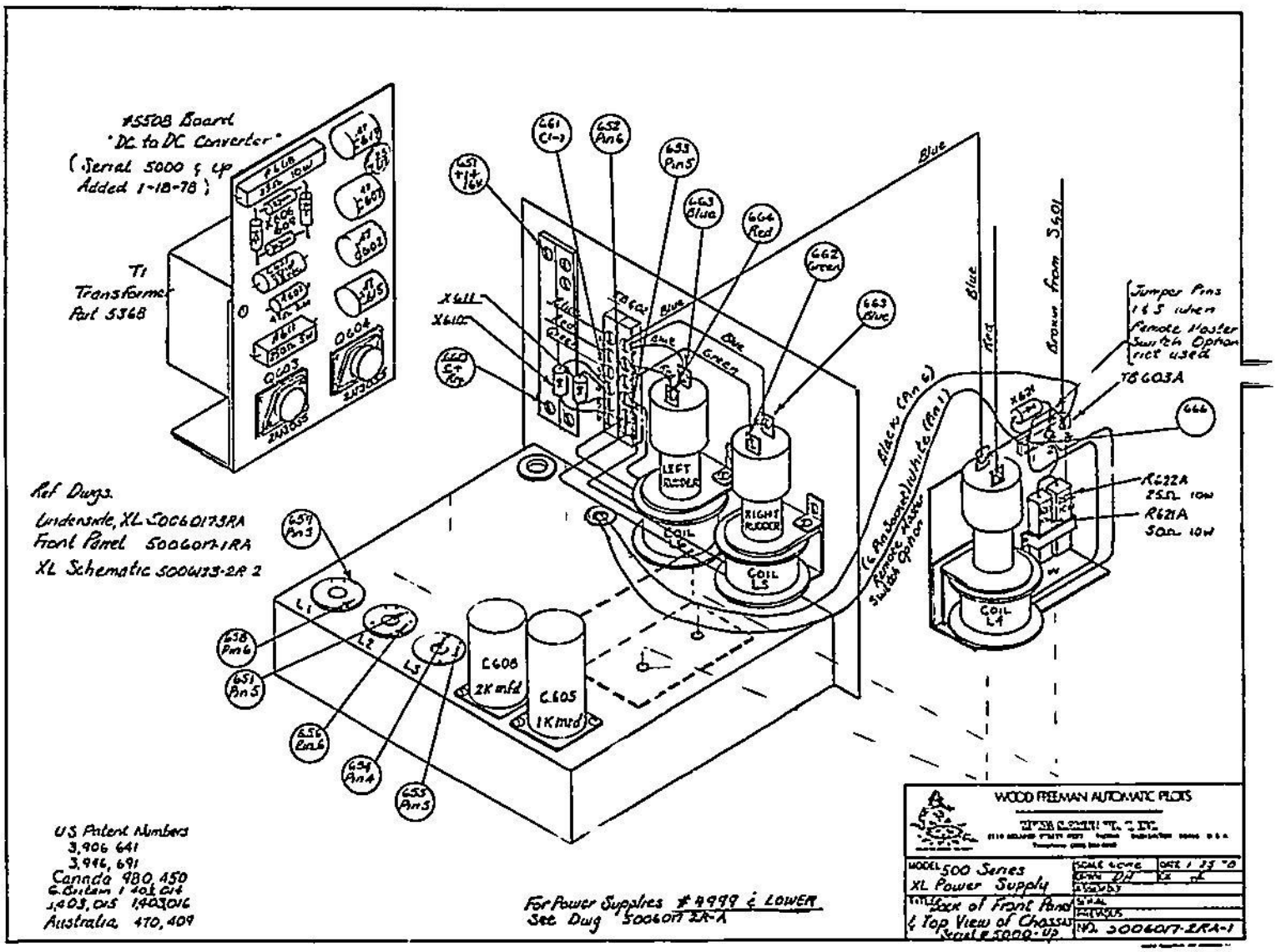
TO SHUT DOWN THE PILOT

Turn off either the REMOTE MASTER SWITCH or the FUNCTION SWITCH on the CONTROL CONSOLE.

MASTER RELAY

The Master Mercury Relay located in the XL POWER SUPPLY may be used in an emergency to replace either the LEFT or RIGHT mercury contactor.

Generally if a mercury contactor malfunctions it will cause a hardover condition (refer to SERVICE II). This is the "ON" position of the contactor. By replacing the malfunctioning contactor in the MASTER RELAY position, the pilot will remain on all of the time even when the FUNTION SWITCH is "OFF".



SPECIAL XL POWER SUPPLY VOLTAGE TROUBLE-SHOOTING

In some cases it is necessary to perform some special tests to the XL POWER SUPPLY. The following steps are done separately from all other TROUBLE-SHOOTING.

THIS TEST SEQUENCE REQUIRES A VOLT METER WITH BOTH A.C. & D.C. SCALES;
And, a working knowledge of a volt meter and proper solder technique.

STEP 1 Unplug all of the cables with plugs from the front of the XL POWER SUPPLY.

STEP 2 Remove the four(4) outermost screws from the front panel.

STEP 3 Remove the chassis from the box.

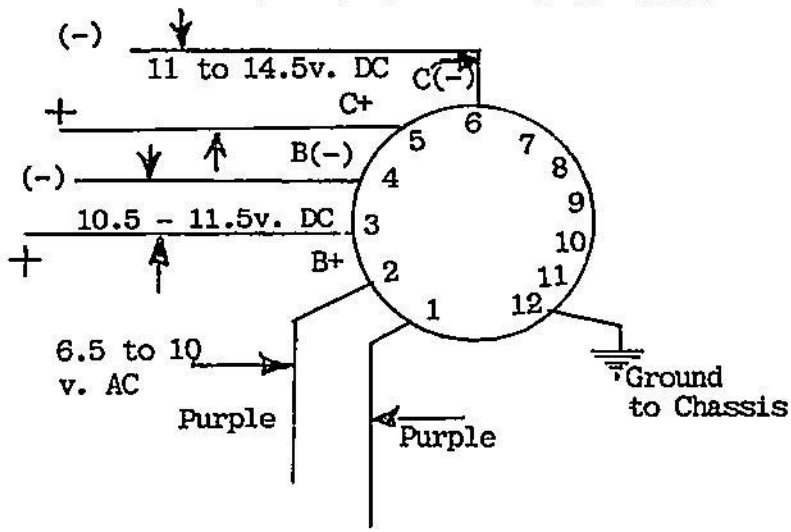
STEP 4 Turn the chassis upside down:
a. A whine should be heard coming from the unit.

b. If no whine is heard, replace both front panel fuses. Go to STEP 4.

STEP 5 Set the VOLT METER to 50v. D.C. scale or greater.
Connect + lead to PIN #1 of TB 601.
Connect - lead to PIN #2 of TB 601.

SHIP'S VOLTAGE	VOLTAGE AT TB 601 TERMINAL # PIN 1	PIN 2
12	12 DC	14 DC
24	24 DC	28 DC
32	32 DC	38 DC

STEP 6 Set the VOLT METER to 12 - 15v. A.C. scale or greater.
Connect one lead to Pin #1 of the 12-pin socket.
Connect the other lead to Pin #2 of the 12-pin socket (purple wires).
The Meter should read between 6.5 and 10 volts.



STEP 7 Set the VOLT METER to 12 - 15v. D.C. scale or greater.
Connect + lead to Pin #3 of the 12-pin socket.
Connect - lead to Pin #4 of the 12-pin socket.
The Meter should read 10.5 to 11.5 volts D.C.

STEP 8 Set the VOLT METER to 50 v. D.C. scale or greater.
Connect + lead to Pin #5 of the 12-pin socket.
Connect the - lead to Pin #6 of the 12-pin socket.
The Meter should read 11 volts D.C.

STEP 9 If any of the voltages in STEPS 6, 7, or 8 are out of the indicated range, proceed to STEP 11.

STEP 10 Set XL POWER SUPPLY chassis right side up.
Replace chassis into box.
Replace four outermost screws.
Plug all cables into the XL POWER SUPPLY.

If problems still persist with the pilot, refer to IN CASE OF DIFFICULTIES, Page 1.

* COMPONENT REPLACEMENT *

STEP 11 Disconnect XL POWER SUPPLY from the ship's D.C. voltage source.
Set the chassis to right side up.
Remove four (4) innermost screws on front plate and remove false cover plate.

STEP 12 Remove two (2) nylon locknuts and dismount heat sink.
Remove Zener Diode X1 (1N3313B) from heat sink.
Unsolder wire from top of diode.
Solder wire onto top of replacement diode. Use pliers as heat sink on stem of diode while soldering to prevent damage to the Diode by overheating. Use only rosin core solder!
CAUTION: GENERAL REPLACEMENT DIODES MAY NOT HOLD UP IN THIS APPLICATION. It is best to obtain a replacement from the factory.

STEP 13 Recoat base of new diode with silicon grease.
Install diode into heat sink.
Replace false cover and screws.

STEP 14 Reconnect XL POWER SUPPLY to ship's power source.
Repeat STEPS 6, 7, & 8 for correct voltage range.
If voltage is still out of range, return XL POWER SUPPLY to factory.

END OF TESTS.

ALTERNATE

ALTERNATE TEST METER HOOKUPS

VOLT METERS (20,000 ohms/volt)

To use SERVICE II with a volt meter the following changes will have to be observed:

1 - All testing of the console is done in the "RUDDER INDICATOR ONLY" position. The REMOTE position is not used for compass testing.

2 - Internal test points will be used instead of plugging into the CONSOLE back.

A. 200 board & Encoder test points -
Common TEST POINT 151 on 100 board.
Signal output + & - TEST POINT 251 on 200 board.

B. 400 & Compass test points -
Common TEST POINT 151 on 100 board.
Signal output + & - TEST POINT 852 inside of CONSOLE.

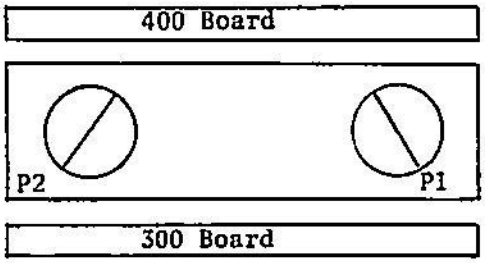
REFER TO SERVICE TEST POINT ELSEWHERE IN APPENDIX.

C. Rate test in STEP 28 will not function.
Bypass STEP 28, proceed with STEP 30.

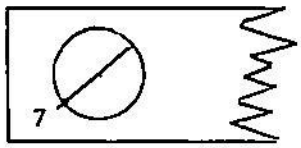
D. Leave CONTROL CONSOLE open until STEP 76 (Sec. G, page 29) is completed.

ADJUSTMENT OF TRIMMER POTS P1 & P2 without engraved plates.

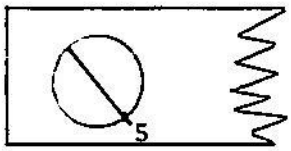
1. Place console back in a vertical position.
2. Mark trimmer pot on left P2 encoder & 200 board.
3. Mark trimmer pot on right P1 compass & 400 board.



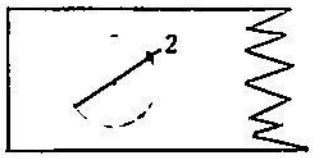
4. Rotate P1 full counterclockwise.
5. Place a mark on the plate at the 7 o'clock position in line with the slot in the pot shaft.



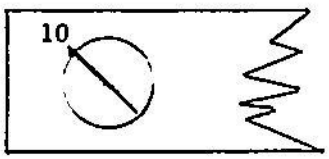
6. Rotate P1 full clockwise.
7. Place a mark on the plate at the 5 o'clock position in line with the slot in the shaft.



8. Rotate the shaft counterclockwise until the slot in the shaft points to 2 o'clock.
9. Mark the plate in line with the slot in the shaft.

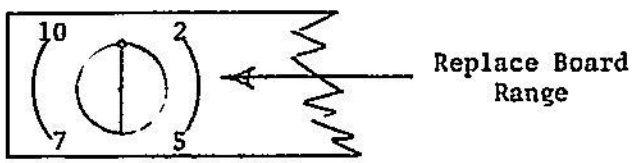


10. Rotate the shaft counterclockwise until the slot in the shaft points to the 10 o'clock position.
11. Mark the plate in line with the slot in the shaft.



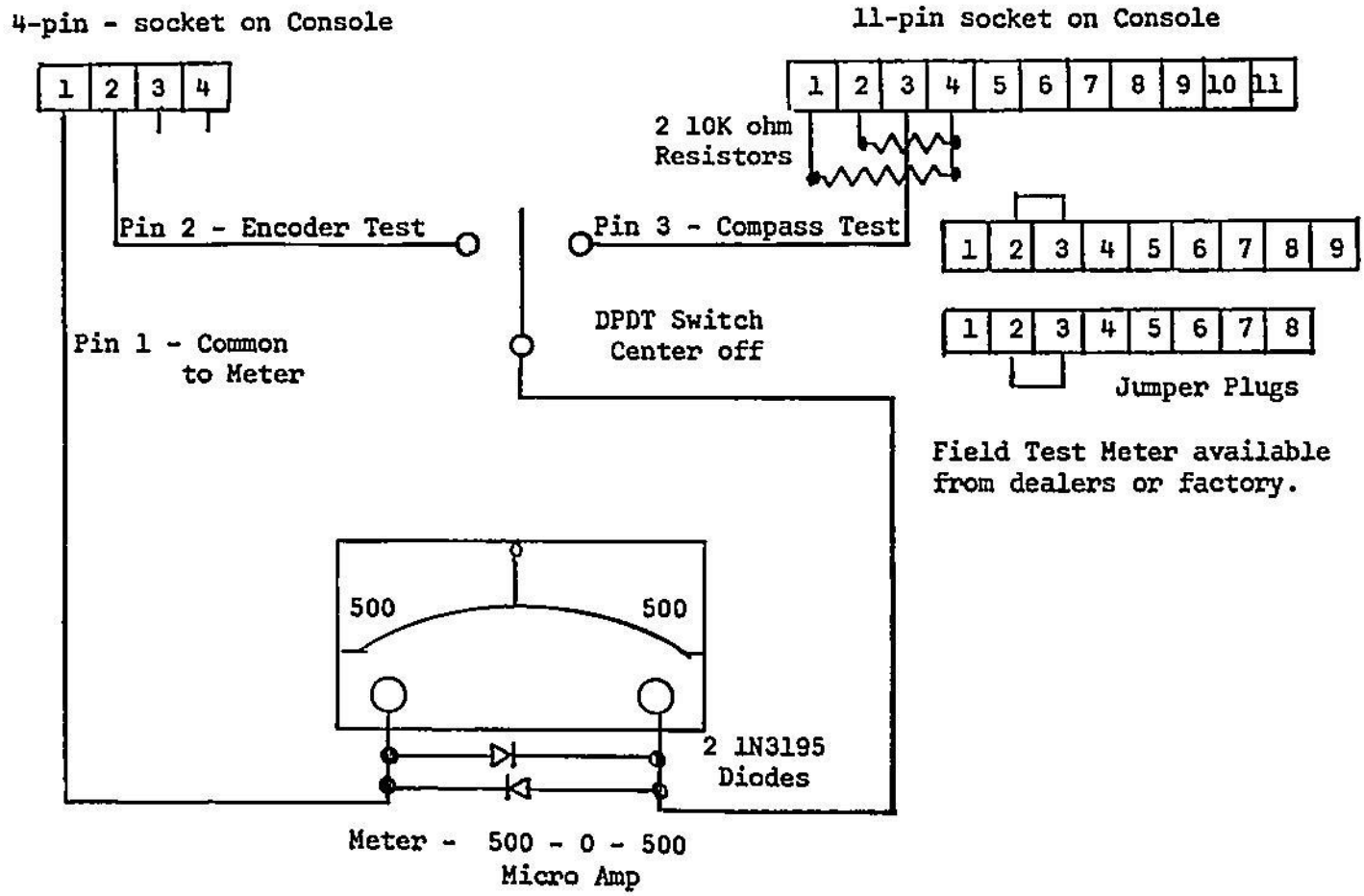
12. Repeat the above steps for trimmer pot P2.

The acceptable range for the board trim is within the 10 o'clock to 2 o'clock position.



Now Service II tests may be used to check out the boards and other circuits.

WOOD FREEMAN® AUTOMATIC PILOTS



Series 500 Field Test Meter
Available Assembled from Factory

WIRING DIAGRAMS & CABLE PIN CONNECTIONS

DESCRIPTION	DRAWING #
CABLE MODIFICATIONS ALLOWED. .(WARNING).	- - - - -
BLOCK DIAGRAM CABLING w/pin connections	5000012-1R
SCHEMATIC DIAGRAM CONTROL SYSTEM	5001503B-1RA-1
SCHEMATIC - PLUG IN CONFIGURATIONS	5006003
SCHEMATIC - PLUG IN RESISTOR BOX (gear motor). . .	5006003-2R
SCHEMATIC - CONTROL CONSOLE.	5006012-3R
SCHEMATIC - XL POWER SUPPLY & SILENT SWITCHER PANEL	5006123-2R-2
SCHEMATIC - SILENT SWITCHER PANEL.	5006123-1A
WIRING DIAGRAM - PUSH BUTTON ORIENTER ATTACHMENT .	5008251-2R
WIRING DIAGRAM - LEVER STEERER w/push buttons. . .	5008168-D2
SERVICING POINTS - CONTROL CONSOLE & BOARDS . . .	5006106-R
SERVICING POINTS - XL POWER SUPPLY	5006017-1RA

*** NOTICE ***

THE DIAGRAMS PROVIDED HEREIN ARE FOR GENERAL REFERENCE ONLY - THEY ARE NOT INTENDED FOR TROUBLE-SHOOTING.

PLEASE USE THE TROUBLE-SHOOTING GUIDES PROVIDED WITH THIS MANUAL .

****

- WARNING -

Cutting or splicing connecting cables of this system (except as noted below), is an improper installation procedure, voids the limited warranty, and makes the installer liable to the owner for subsequent cable replacement. Splices corrode, are subject to moisture leakage, R.F.I., shorts, opens and misconnections that can damage components.

EXCEPTIONS:

Encoder cable plug (8-pin) may be unsoldered in order to pull cable forward from rudder post area and then resoldered carefully and correctly. DO NOT REMOVE SOCKET, (potted) from aft end of cable.

2-conductor power cable from ship's power to XL Power Supply may be extended in accordance with wire sizes and lengths shown on Table 1 - below.

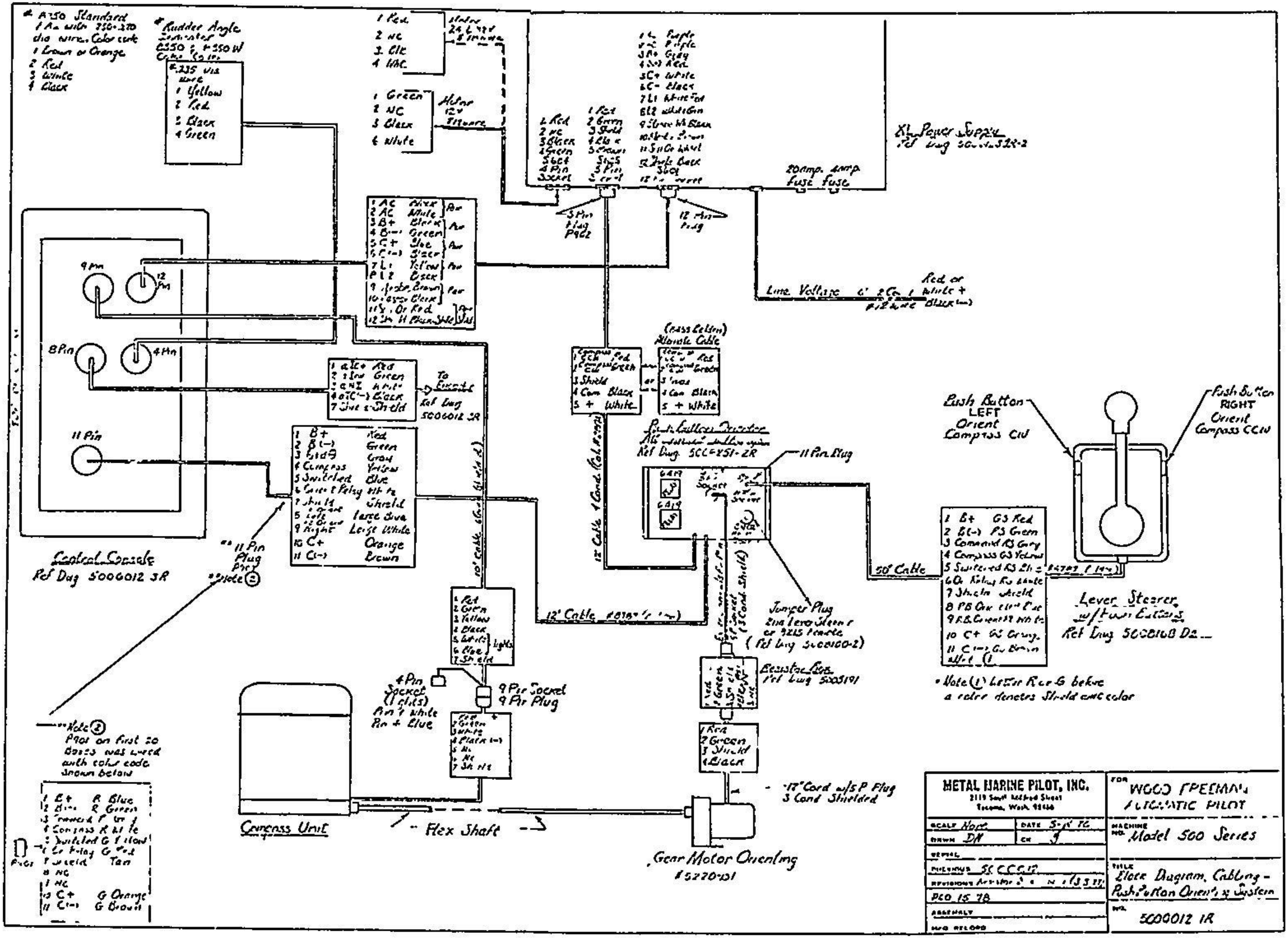
3-conductor motor cord on power pack (or limit switch assembly on -511LS units) may be extended in accordance with sizes and lengths shown on Table 1.

TABLE 1

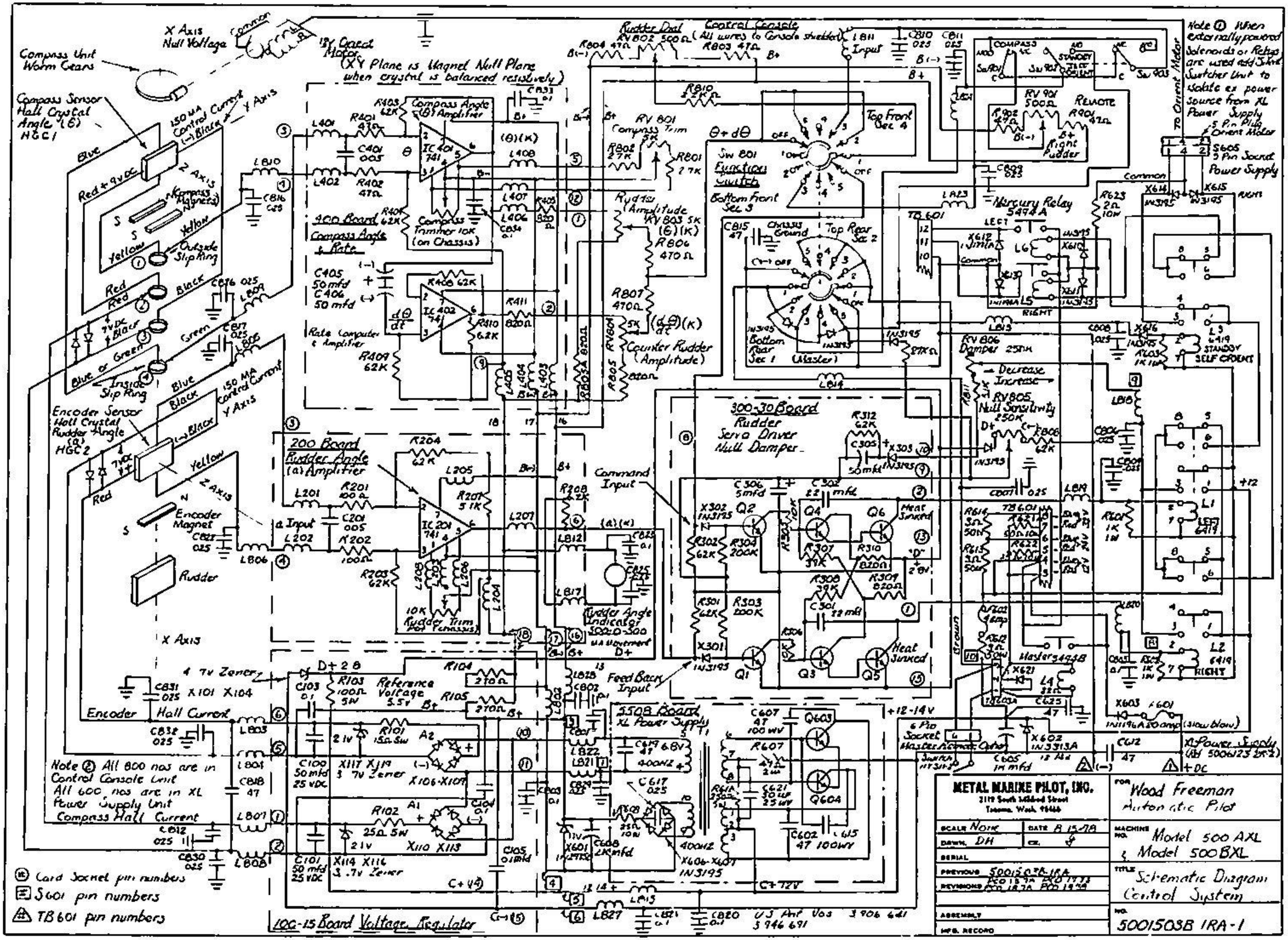
Voltage	-531 (A Motor)	-531 (Std.Motor)	-521 (Std.Motor)	-531 (D, S, T or K Motor)
	FOR #12 MOTOR WIRE EXTENSIONS - (In stock)			
12	6'	8.5'	13'	-
24	-	32'	50'	8.5'
32	-	55'	85'	8.5'
	FOR #10 MOTOR WIRE EXTENSIONS - (Customer Furnished)			
12	9'	13'	20'	-
24	-	48'	75'	13.5'
32	-	82'	128'	13.5'
	FOR #8 MOTOR WIRE EXTENSIONS - (Customer Furnished)			
12	14'	20'	30'	-
24	-	73'	114'	20'
32	-	124'	194'	20'

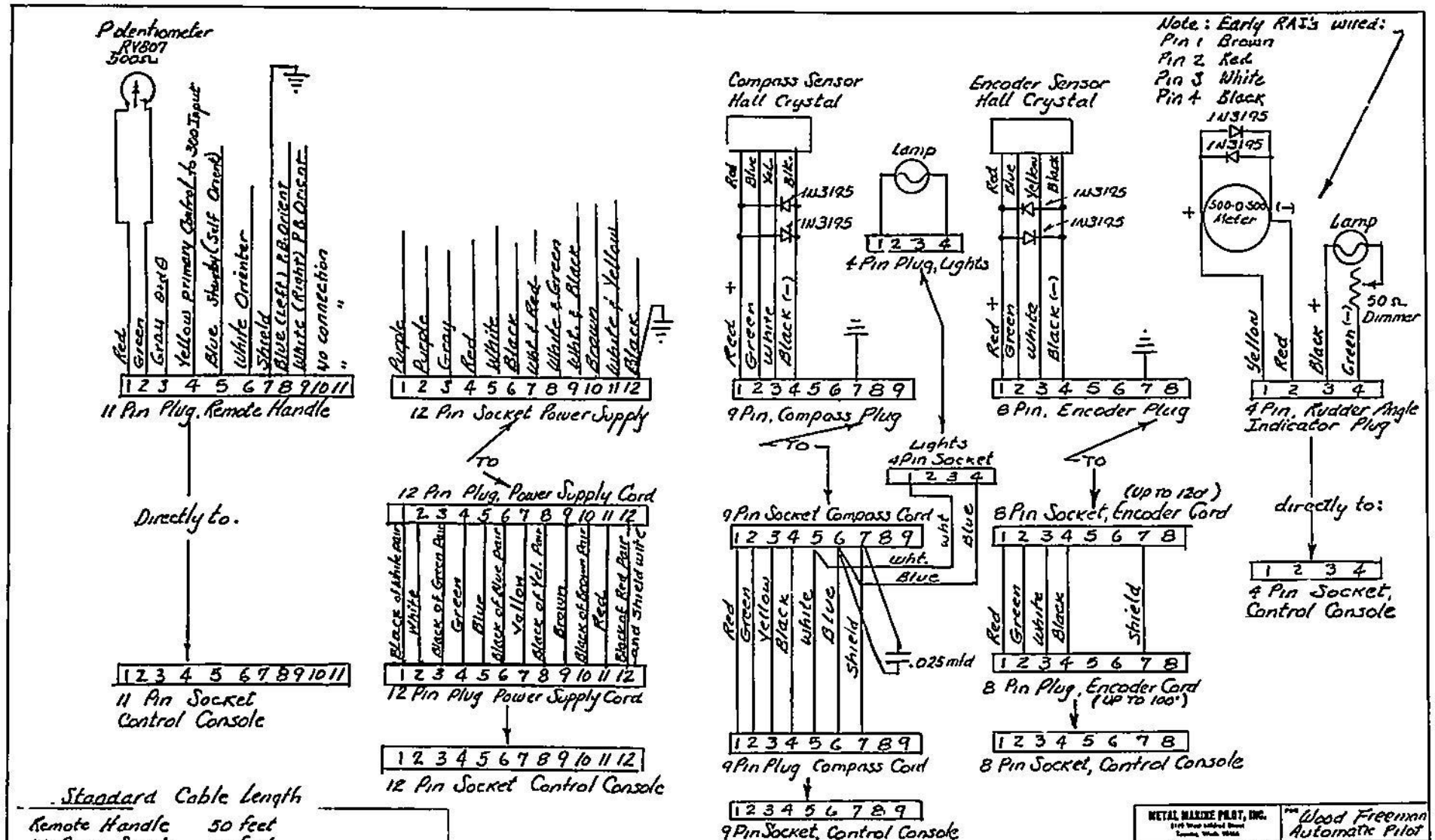
April 1978

Metal Marine Pilot Inc.
2119 West Mildred Street,
Tacoma, Washington 98466
Telephone (206) 564-5902



METAL MARINE PILOT, INC.
FOR WOOD FREEMAN AUTOMATIC PILOT
MACHINE NO. Model 500 Series
TITLE Elect Diagram, Cabling - PushButton Orient'g System
NO. 5000012 1R
SCALE None
DRAWN DN
PLO 15 78
Central Console
Ref Dwg 5006012 3R
9 Pin
12 Pin
8 Pin
4 Pin
11 Pin
XL Power Supply
20amp. amp Fuse Fuse
Line Voltage
Red or White +
Black (-)
5 Pin Plug P902
12 Pin Plug
Rudder Angle Indicator
A250 Standard
1 Brown or Orange
2 Red
3 White
4 Black
1 Yellow
2 Red
3 Black
4 Green
1 Green
2 NC
3 Black
4 White
1 AC
2 AC
3 B+
4 B-
5 C+
6 C(-)
7 L1
P L2
1 B+ Red
2 B(-) Green
4 Compass Yellow
5 Switched Blue
6 Cancel Relay White
7 Shield Shield
9 Right Large White
10 C+ Orange
11 C(-) Brown
11 Pin Plug
Note 2
P901 on first 20 boats was wired with color code shown below
To Remote
12' Cable
10' Cable
12' Cable 4 Cond.
Alternate Cable
1 Compass CCW Red
2 Compass CW Green
3 Shield
4 Com Black
5 + White
Push Button Orienter
Ref Dwg. SCC-X51-2R
11 Pin Plug
Jumper Plug
Resistor Box
Ref Dwg 5005191
50' Cable
1 B+ G3 Red
2 B(-) P3 Green
3 Command R3 Gray
4 Compass G3 Yellow
5 Switched R3 White
7 Shield Shield
10 C+ G2 Gray
11 C(-) G2 Brown
Lever Steerer w/Four Buttons
Ref Dwg 5008168 D2
Push Button LEFT Orient Compass CW
Push Button RIGHT Orient Compass CCW
Note (1) Letter R or G before a color denotes Shield and color
1 Red
2 Green
3 Yellow
4 Black
5 White
6 Blue
7 Shield
4 Pin Socket (lights)
Pin 1 White
Pin 4 Blue
9 Pin Socket
9 Pin Plug
Compass Unit
Flex Shaft
1 Red
2 Green
3 Shield
4 Black
17' Cord w/5P Plug
3 Cond Shielded
Gear Motor Orienting
#5220-131


METAL MARINE PILOT, INC.
For Wood Freeman Automatic Pilot
Machine No. Model 500 AXL & Model 500 BXL
Title Schematic Diagram Control System
No. 5001503B IRA-1
Scale None
Date 8-15-78
Drawn DH
Note ① When externally powered Solenoids or Relays are used add Switcher Unit to isolate ex power Source from XL Power Supply
Note ② All 800 nos are in Control Console Unit. All 600 nos are in XL Power Supply Unit
Card Socket pin numbers
S601 pin numbers
TB 601 pin numbers
400 Board Compass Angle & Rate
200 Board Rudder Angle (a) Amplifier
300-30 Board Rudder Servo Driver Null Damper
550B Board XL Power Supply
10C-15 Board Voltage Regulator
Compass Unit Worm Gears
Compass Sensor Hall Crystal Angle (θ) HGC1
Encoder Sensor Hall Crystal Rudder Angle (a) HGC2
X Axis Null Voltage
(XY Plane is Magnet Null Plane when crystal is balanced resistively)
Rudder Dial
Control Console
Sw 801 Function Switch
Mercury Relay 5474 A
Rudder Angle Indicator
Reference Voltage 3.5v
Command Input
Feed Back Input
XL Power Supply
US Pat Nos 3 906 641, 3 946 691



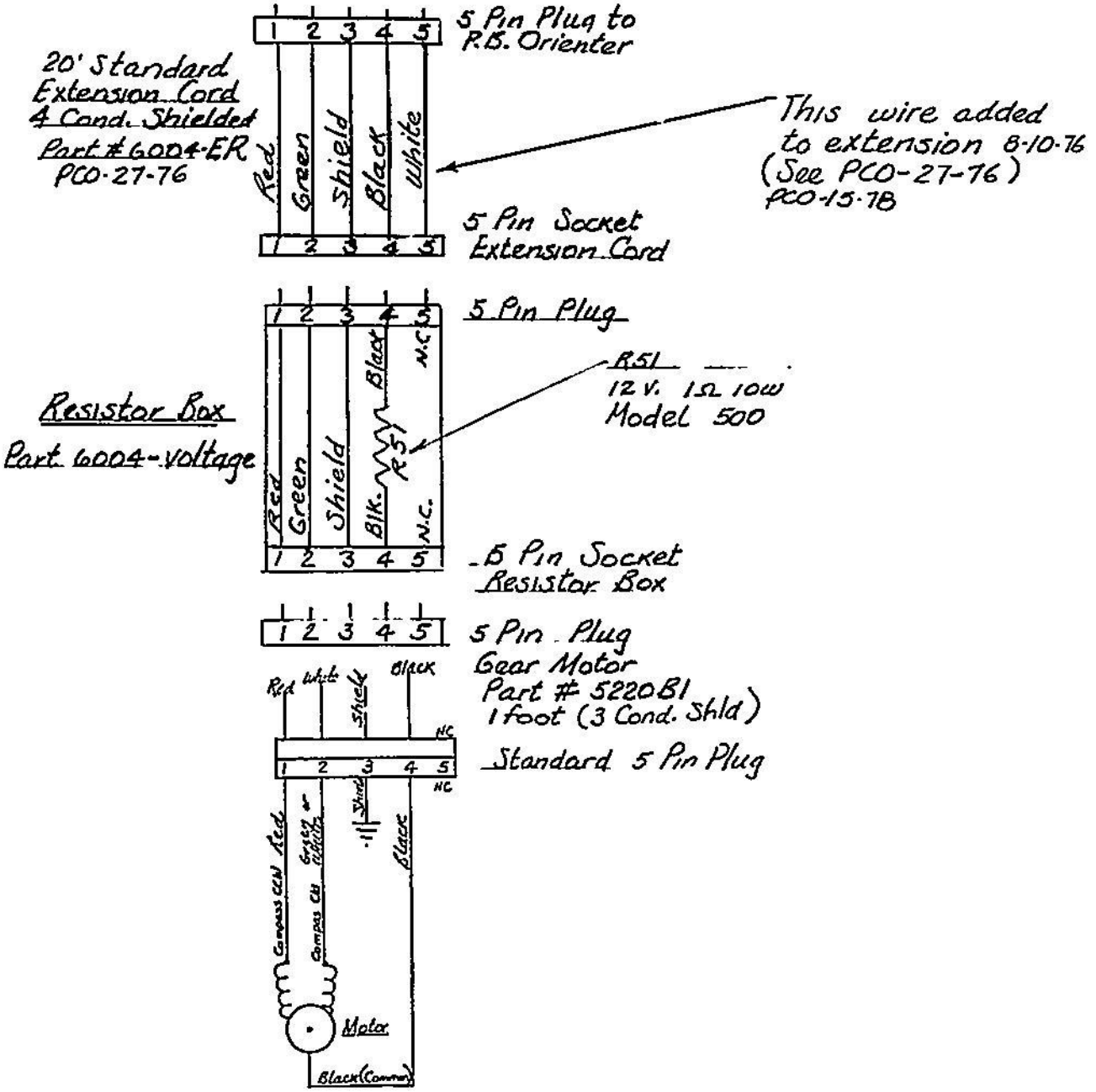
Standard Cable Length

Remote Handle	50 feet
XL Power Supply	10 feet
Compass	10 feet
Encoder	60 feet
Rudder Angle Ind.	20 feet

See 5006003-2R for Gear Motor & Resistor Box (Reverse side)

METAL MARINE PILOT, INC.

Wood Freeman Automatic Pilot	
500 Series	
Schematic, plug-in Connection	
5006003	



Rotation of Shafts in Gear Motor Unit when energizing Pins 1 & 4:

1. Universal Motor # 5220B

Shaft Motor C.C.W. (seen from Gear end)

*Drive Shaft Gear Box C.C.W. Out put

2. L/Neville # 5220B-1

Shaft Motor C.W. (seen from Gear end)

*Drive Shaft Gear Box C.C.W Out put

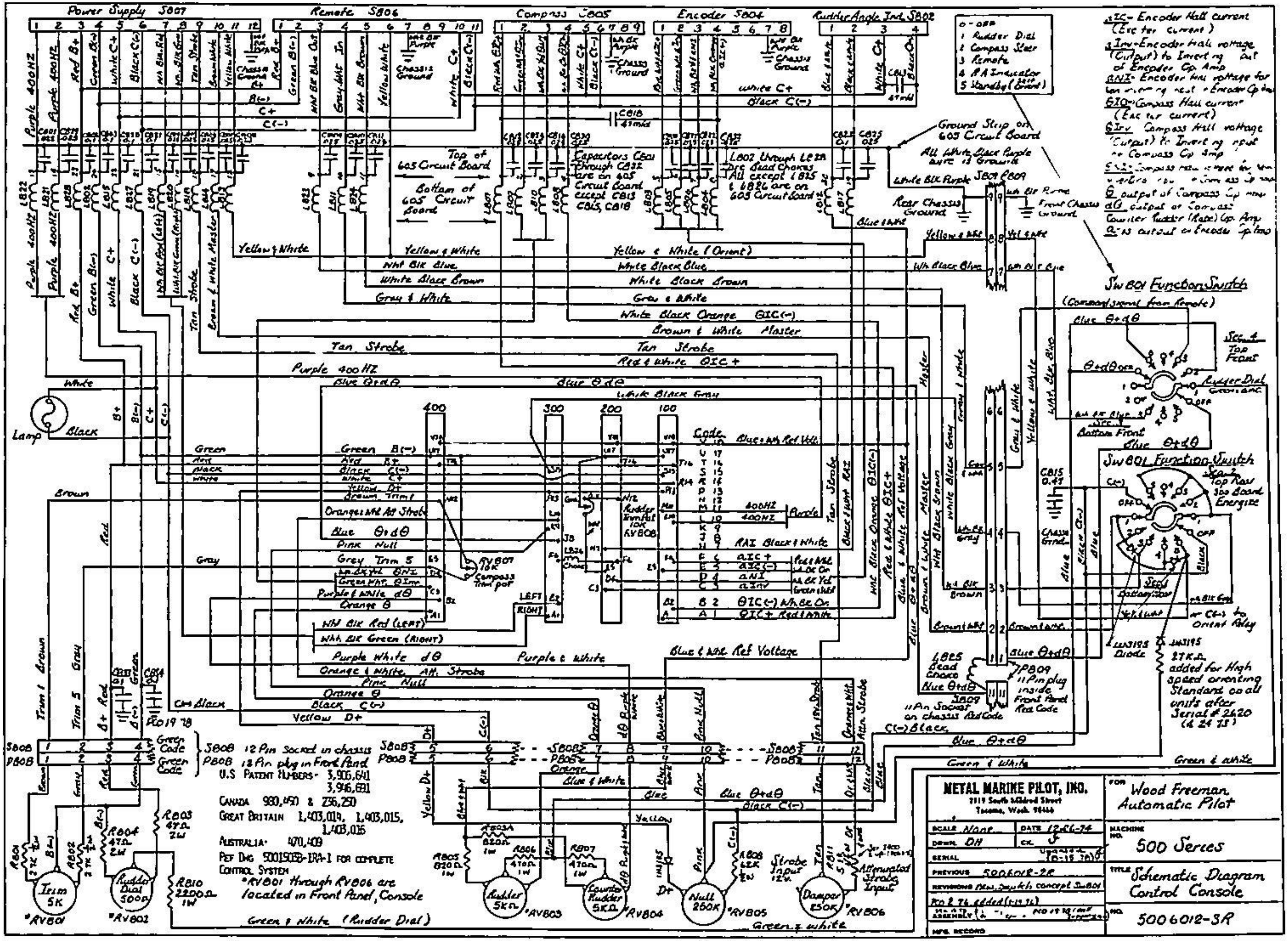
3 Dayton # 5220B-1

Shaft Motor C.W. Seen from Gear end

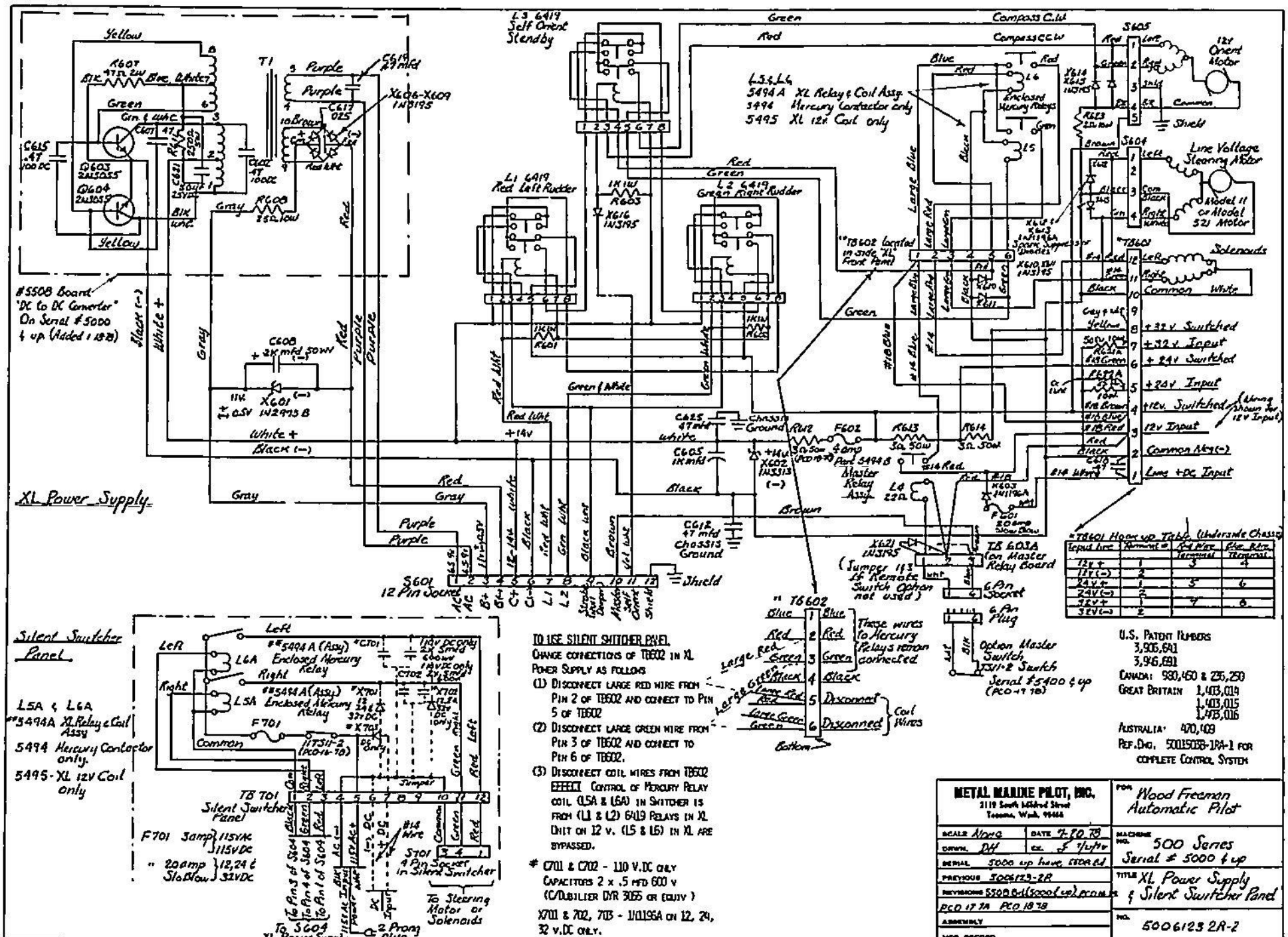
*Drive Shaft Gear Box C.C.W Output

*Drive Shaft on Gear Box must turn in same direction on 5200B & 5220 B1 when Pins 1 & 4 are energized.

METAL MARINE PILOT, INC. 2119 West Gilford Street Tacoma, Wash. 98466	FOR Wood Freeman Auto Pilot
SCALE None DATE 3-3-77	MACHINE NO. 500 Series
DRWN. DH CK.	
SERIAL	
PREVIOUS 5006003-2	TITLE Schematic, Plug In, Resistor Box
REVISIONS PCO-27-76 PCO-15-78	
ASSEMBLY	NO. 5006003-2R
MFR. RECORD	



Power Supply S807
Remote S806
Compass S805
Encoder S804
Rudder Angle Ind. S802
0 - OFF
1 Rudder Dial
2 Compass Steer
3 Remote
4 R A Indicator
5 Standby (Orient)
Ground Strip on 605 Circuit Board
All White Black Purple wire is Ground
Top of 605 Circuit Board
Bottom of 605 Circuit Board
Capacitors CB01 through CB32 are on 605 Circuit Board except CB13 CB15, CB18
L802 through L828 are Bead Chokes All except L825 & L826 are on 605 Circuit Board
Rear Chassis Ground
Front Chassis Ground
SW801 Function Switch
(Command signal from Remote)
SW801 Function Switch
Lamp
U.S PATENT NUMBERS - 3,906,641 3,946,691
CANADA 980,450 & 236,250
GREAT BRITAIN 1,403,014, 1,403,015, 1,403,016
AUSTRALIA 470,409
REF DWG 5001503B-IRA-1 FOR COMPLETE CONTROL SYSTEM
*RV801 through RV806 are located in Front Panel, Console
S808 12 Pin Socket in chassis
P808 12 Pin plug in Front Panel
27K Ω added for High speed orienting Standard on all units after Serial # 2620 (4 24 75)
METAL MARINE PILOT, INC.
2219 South Mildred Street
Tacoma, Wash. 98466
FOR Wood Freeman Automatic Pilot
MACHINE NO. 500 Series
TITLE Schematic Diagram Control Console
SCALE None
DATE 12-26-74
DRWN. DH
PREVIOUS 5006012-2R
NO. 5006012-3R



Input Line	Terminal #	Red Wire Terminal	Blue Wire Terminal
12v +	1	3	4
12v (-)	2		
24v +	1	5	6
24v (-)	2		
32v +	1	7	8
32v (-)	2		

"TB601 Hook up Table (Underside Chassis)

TO USE SILENT SWITCHER PANEL

Change connections of TB602 in XL Power Supply as follows

(1) Disconnect large red wire from Pin 2 of TB602 and connect to Pin 5 of TB602

(2) Disconnect large green wire from Pin 3 of TB602 and connect to Pin 6 of TB602.

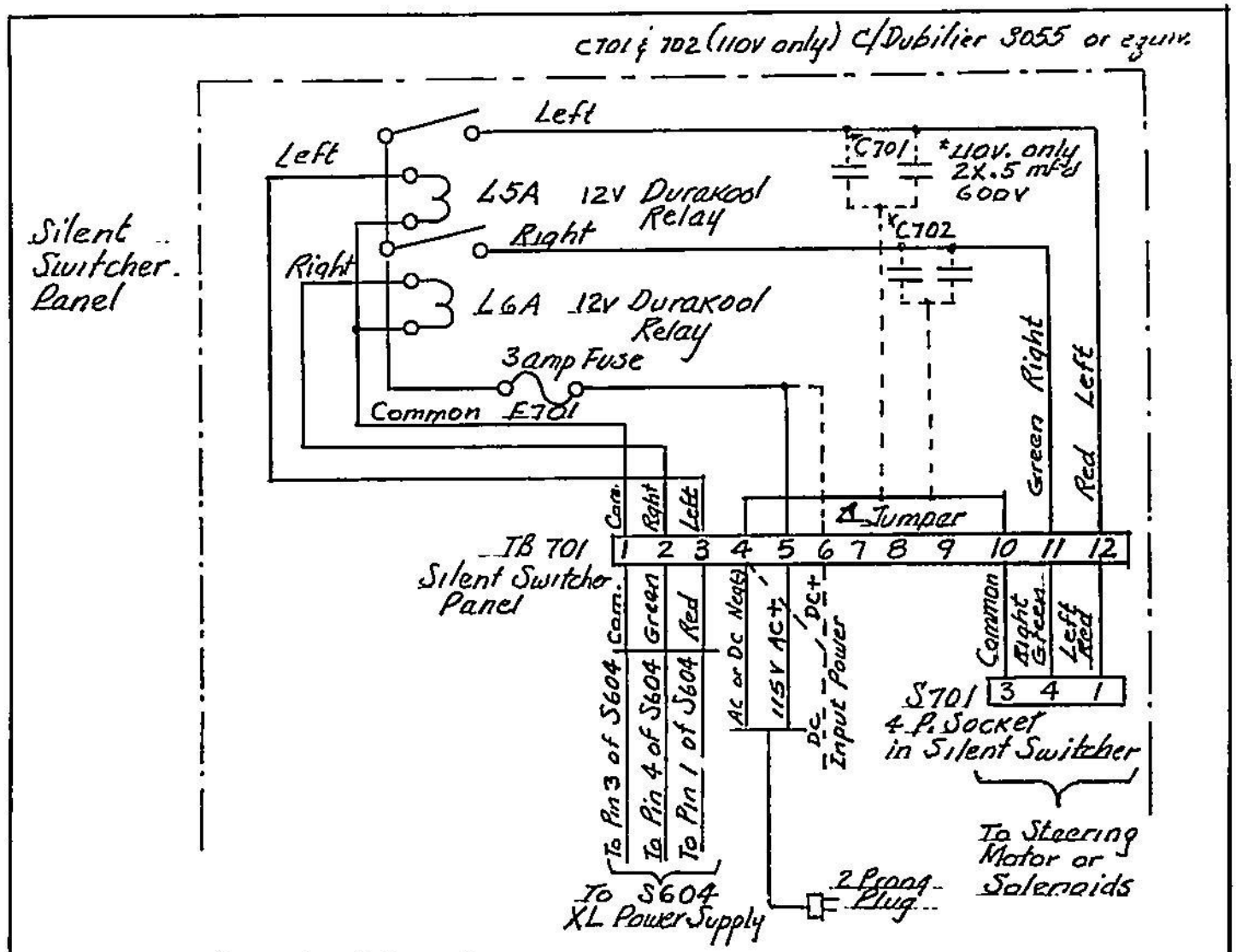
(3) Disconnect coil wires from TB602 EFFECT Control of Mercury Relay coil (L5A & L6A) in Switcher is from (L1 & L2) 6419 Relays in XL Unit on 12 v. (L5 & L6) in XL are bypassed.

* C701 & C702 - 110 V.DC only
Capacitors 2 x .5 mfd 600 v
(C/Dubilier DYR 3055 or equiv)

X701 & 702, 703 - 1/0195A on 12, 24, 32 v.DC only.

U.S. Patent Numbers
3,905,691
3,946,691
Canada: 930,450 & 935,250
Great Britain 1,403,014
1,403,015
1,403,016
Australia: 470,409
Ref. Dwg. 50015088-1R4-1 for complete Control System

METAL MARINE PILOT, INC. 3119 South Mildred Street Tacoma, Wash. 98466	For Wood Freeman Automatic Pilot
Scale None Date 7-20-78	Machine No. 500 Series
Drwn. DH Ck. JF 7/20/78	Serial # 5000 & up
Serial 5000 up have ECO #17	Title XL Power Supply & Silent Switcher Panel
Previous 5006123-2R	
Revisions 5508 Bd (5000 & up) ECO #18	
ECO 17 7A ECO 18 78	No. 5006123 2R-2
Assembly	
Mfg. Record	

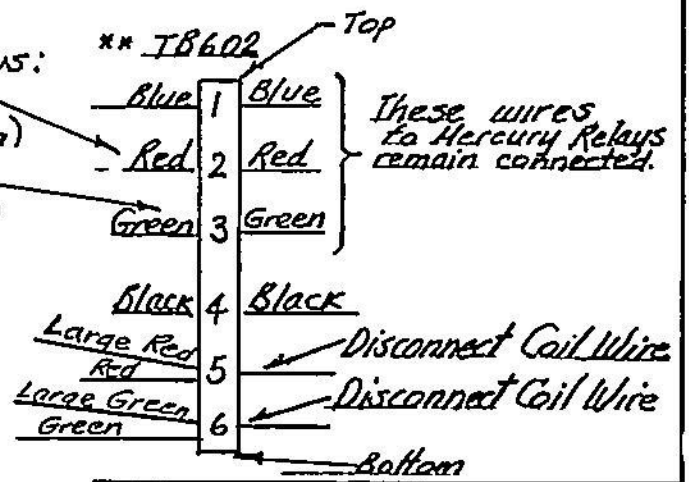


To Use Silent Switcher Panel

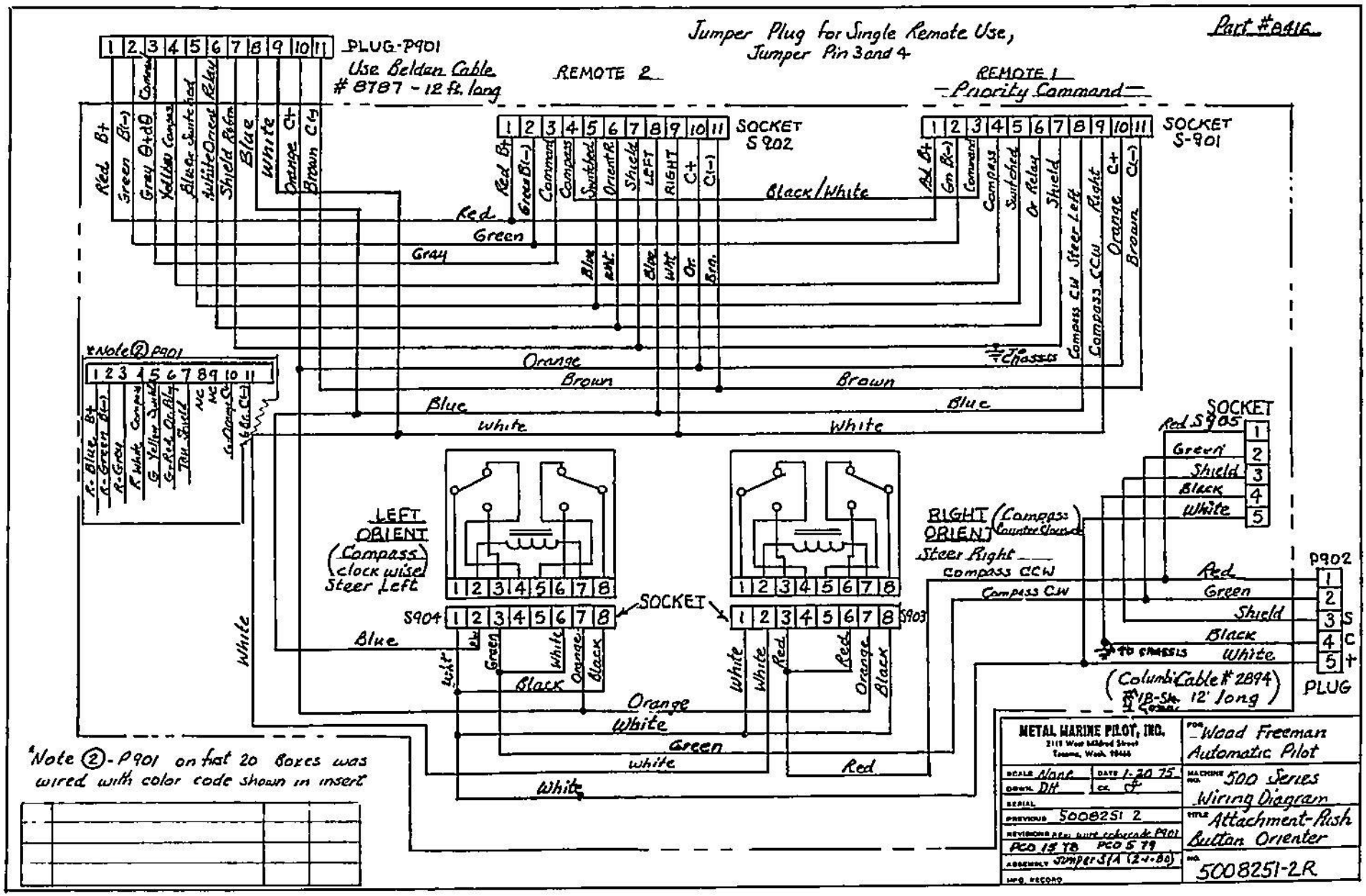
Change connections of ** TB602 as follows:

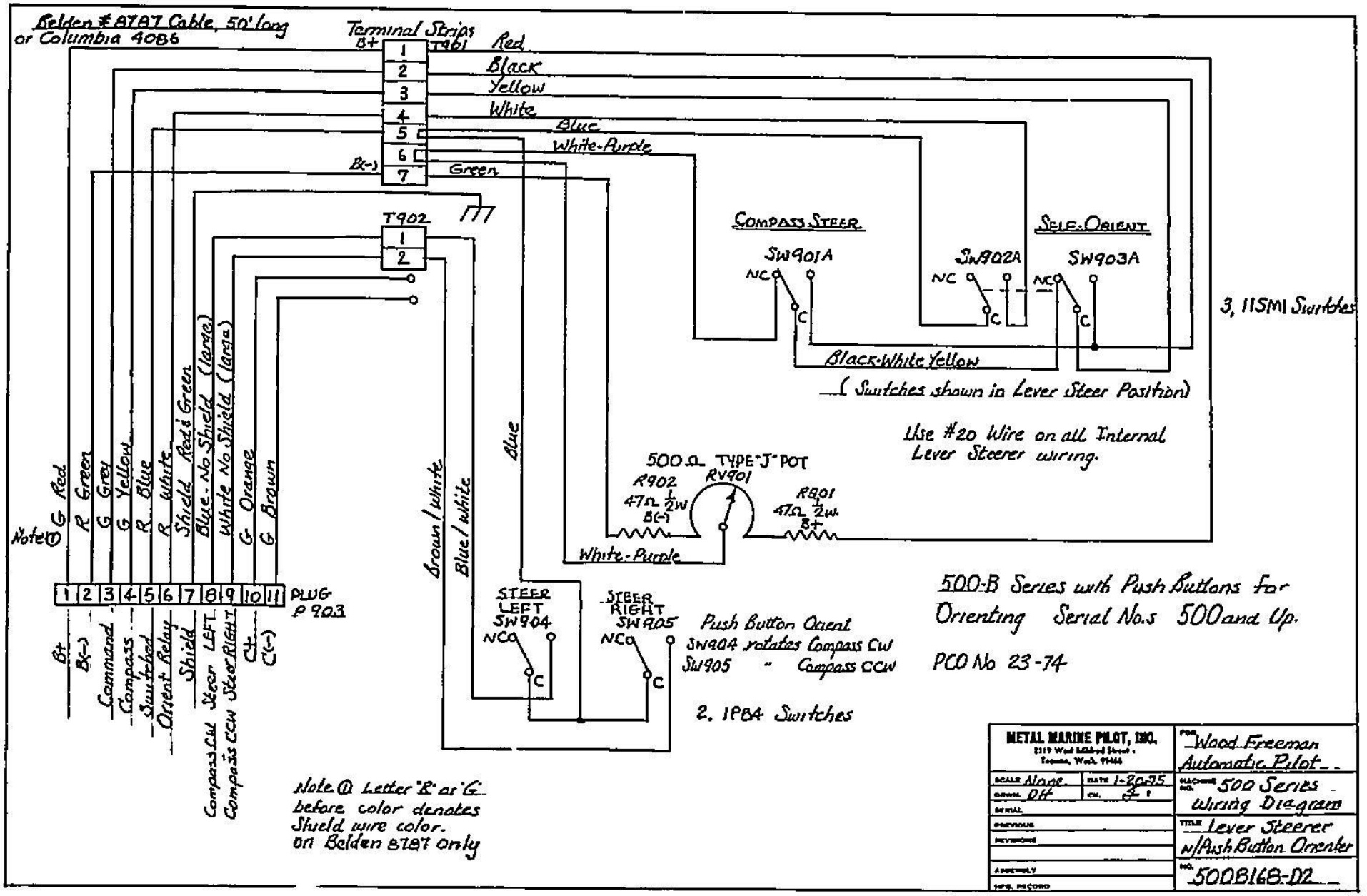
1. Disconnect Large Red wire from Pin 2 of TB602 & connect to Pin 5 (as shown)
2. Disconnect Large Green from Pin 3 of TB602 & connect to Pin 6 (as shown)
3. Disconnect Coil Wires from TB602.

Effect: Control of Mercury Relay Coil (L5A & L6A) in Switcher is from (L1 & L2) 6A19 Relays in XL Unit on 12V. L5 & L6 in XL are by passed.

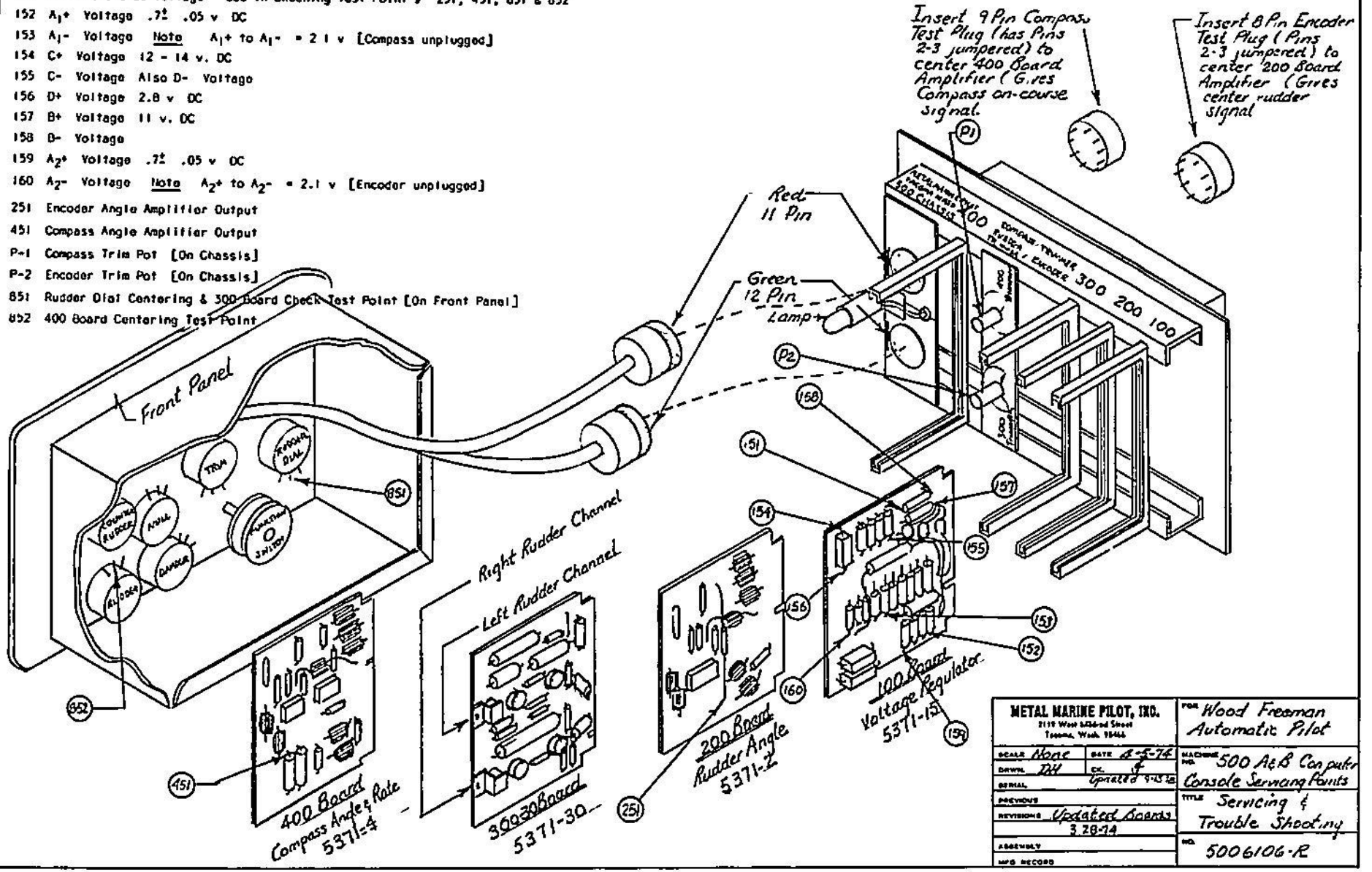


METAL MARINE PILOT, INC. 2119 West Hilliard Street Tacoma, Wash. 98466	FOR Wood Freeman Auto Pilot
SCALE None DATE 10-27-72	MACHINE NO. 500 Series
DRWN. DH CK.	
SERIAL	
PREVIOUS REVISIONS	TITLE Silent Switcher
ASSEMBLY MFG. RECORD	NO. 5006123-1A

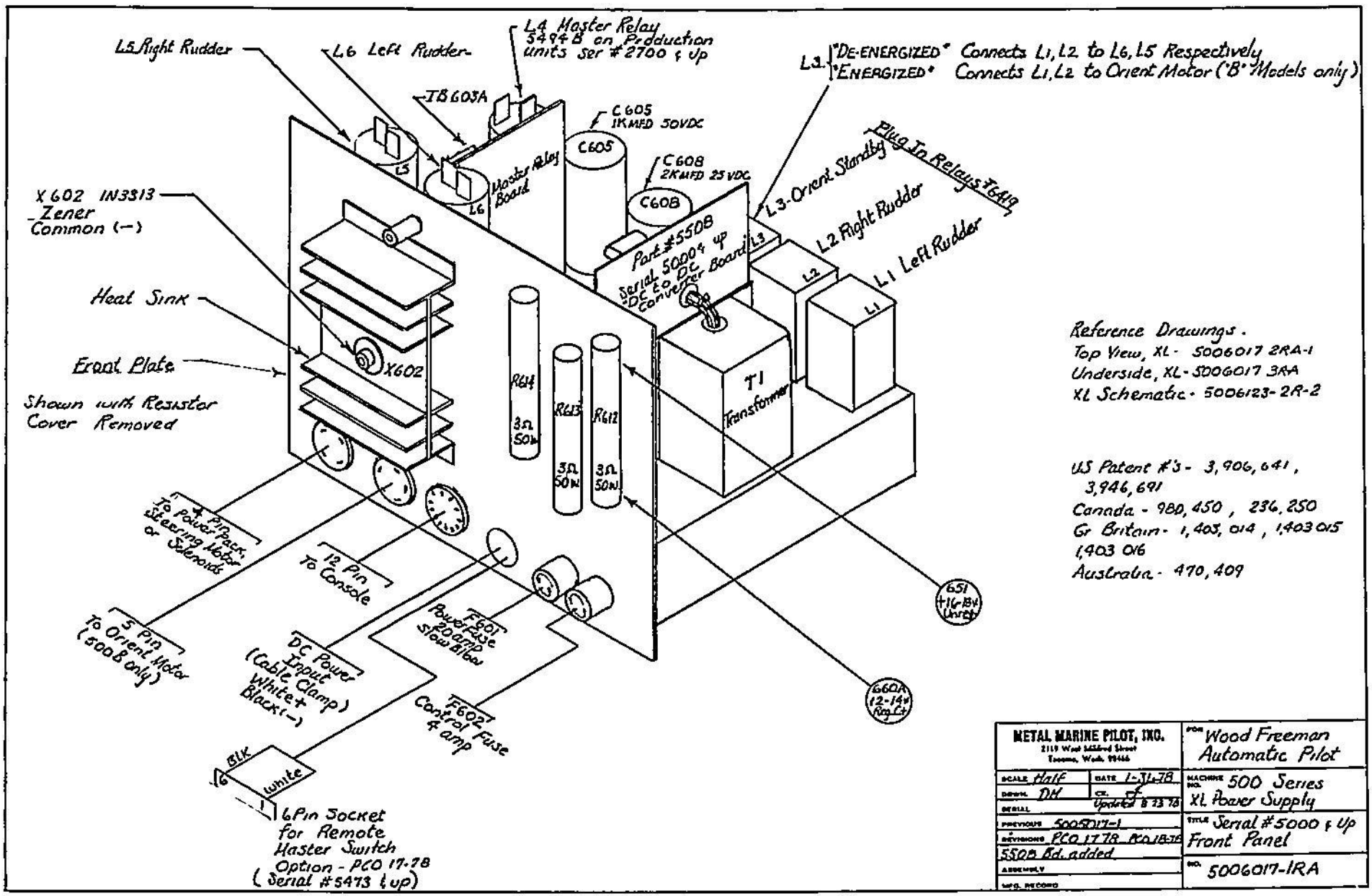

Part #8416
Jumper Plug for Single Remote Use,
Jumper Pin 3 and 4
PLUG-P901
Use Beldan Cable
8787 - 12 ft. long
REMOTE 2
REMOTE 1
Priority Command
SOCKET S-902
SOCKET S-901
Red
Green
Gray
Black/White
Orange
Brown
Blue
White
Chassis
*Note (2) P901
SOCKET
Red S905
Green
Shield
Black
White
P902
PLUG
LEFT ORIENT (Compass clock wise) Steer Left
RIGHT ORIENT (Compass Counter Clock wise) Steer Right
Compass CCW
Compass CW
SOCKET
S904
S903
TO CHASSIS
(Columbi Cable # 2894 12-Str. 12' long)
*Note (2) - P901 on that 20 Boxes was wired with color code shown in insert
METAL MARINE PILOT, INC.
2119 West Mildred Street
Tacoma, Wash. 98466
For Wood Freeman Automatic Pilot
SCALE None
DATE 1-30-75
DRWN DH
CK
SERIAL
PREVIOUS 5008251 2
REVISIONS PCO 15 TB PCO 5 79
ASSEMBLY Jumper 3 & 4 (2-4-80)
MFG. RECORD
MACHINE NO. 500 Series
Wiring Diagram
TITLE Attachment-Push Button Orienter
NO. 5008251-2R


Belden #8787 Cable, 50' long
or Columbia 4086
Terminal Strips
B+
T901
1
2
3
4
5
6
7
B(-)
Red
Black
Yellow
White
Blue
White-Purple
Green
T902
1
2
COMPASS STEER
SW901A
NC
C
SELF-ORIENT
SW902A
SW903A
3, 11SM1 Switches
Black-White Yellow
(Switches shown in Lever Steer Position)
Use #20 Wire on all Internal Lever Steerer wiring.
500Ω TYPE "J" POT
RV901
R902
47Ω 1/2W
B(-)
R901
47Ω 1/2W
B+
White-Purple
Blue
Brown/white
Blue/white
Note① G Red
R Green
G Grey
G Yellow
R Blue
R white
Shield Red & Green
Blue - No Shield (large)
White No Shield (large)
G Orange
G Brown
1 2 3 4 5 6 7 8 9 10 11
PLUG P 903
B+
B(-)
Command Compass Switched
Orient Relay
Shield
Compass CW Steer LEFT
Compass CCW Steer RIGHT
C+
C(-)
STEER LEFT SW904
STEER RIGHT SW905
Push Button Orient
SW904 rotates Compass CW
SW905 - Compass CCW
2, 1PB4 Switches
500-B Series with Push Buttons for Orienting Serial No.s 500 and Up.
PCO No 23-74
Note① Letter "R" or "G" before color denotes Shield wire color. on Belden 8787 Only
METAL MARINE PILOT, INC.
2119 West Kilbourd Street
Tacoma, Wash. 98465
FOR Wood Freeman Automatic Pilot
SCALE None
DATE 1-20-75
DRWN. DH
CK.
MACHINE NO. 500 Series
Wiring Diagram
DETAIL
PREVIOUS
REVISIONS
TITLE Lever Steerer w/Push Button Orienter
ASSEMBLY
MFG. RECORD
NO. 500B168-D2

151 Zero Reference Voltage Use in checking Test Point # 251, 451, 851 & 852
152 A_1+ Voltage .7± .05 v DC
153 A_1- Voltage Note A_1+ to A_1- = 2.1 v [Compass unplugged]
154 C+ Voltage 12 - 14 v. DC
155 C- Voltage Also D- Voltage
156 D+ Voltage 2.8 v DC
157 B+ Voltage 11 v. DC
158 B- Voltage
159 A_2+ Voltage .7± .05 v DC
160 A_2- Voltage Note A_2+ to A_2- = 2.1 v [Encoder unplugged]
251 Encoder Angle Amplifier Output
451 Compass Angle Amplifier Output
P-1 Compass Trim Pot [On Chassis]
P-2 Encoder Trim Pot [On Chassis]
851 Rudder Dial Centering & 300 Board Check Test Point [On Front Panel]
852 400 Board Centering Test Point



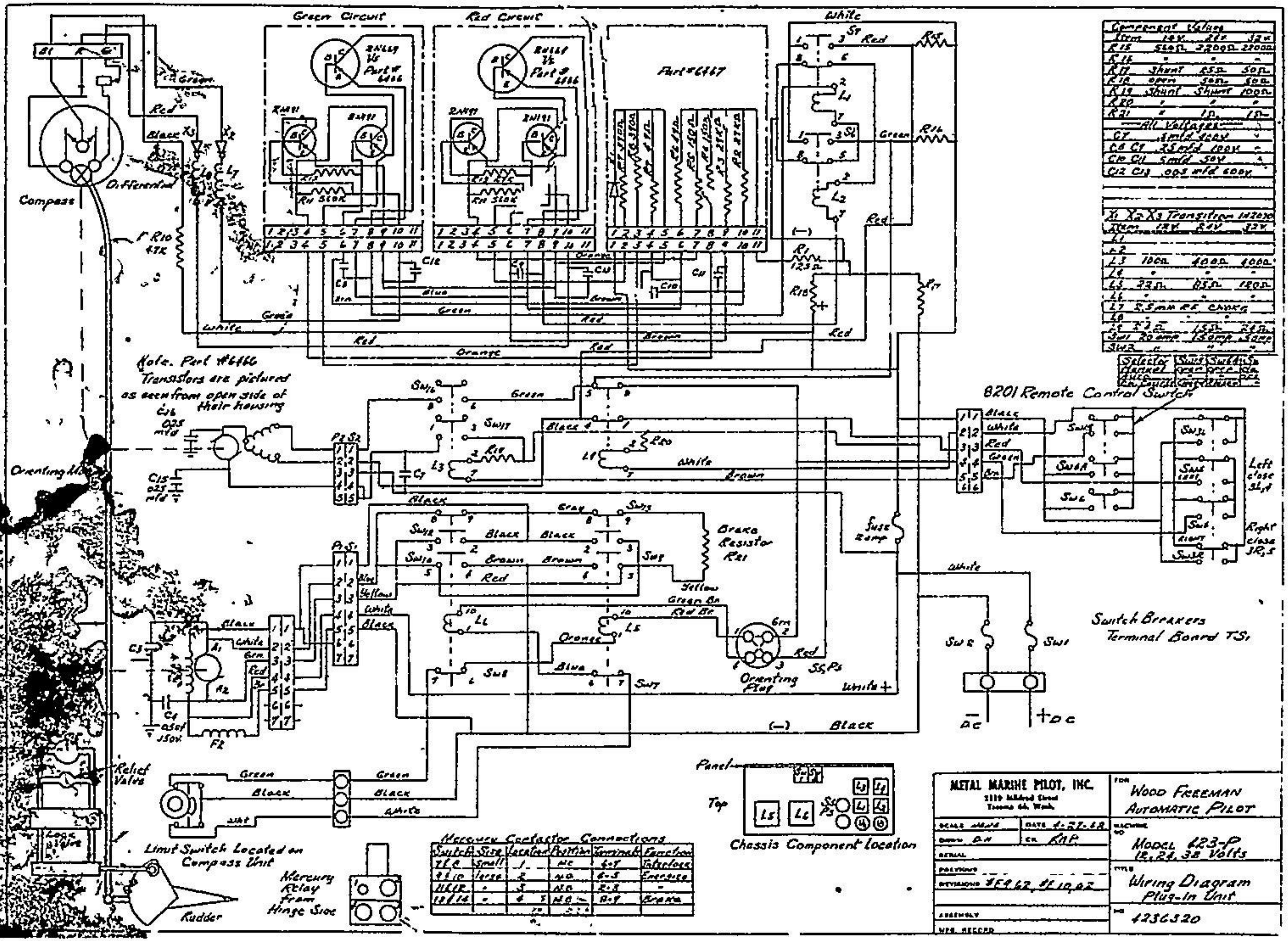
METAL MARINE PILOT, INC. 2119 West Mildred Street Tacoma, Wash. 98466	FOR Wood Freeman Automatic Pilot
SCALE None DATE 8-5-74	MACHINE NO. 500 A & B Computer
DRWN. DH CK. Updated 9-15-78	Console Servicing Points
SERIAL	
PREVIOUS REVISIONS Updated Boards 3.28.14	TITLE Servicing & Trouble Shooting
ASSEMBLY	
MFG RECORD	NO. 5006106-R



Reference Drawings.
Top View, XL - 5006017 2RA-1
Underside, XL - 5006017 3RA
XL Schematic - 5006123-2R-2

US Patent #'s - 3,906,641, 3,946,691
Canada - 980,450, 236,250
Gr Britain - 1,403,014, 1,403 015
1,403 016
Australia - 470,409

METAL MARINE PILOT, INC. 2119 West Mildred Street Tacoma, Wash. 98466		FOR	Wood Freeman Automatic Pilot
SCALE Half	DATE 1-31-78	MACHINE NO.	500 Series
DRWN. DH	CK.		XL Power Supply
SERIAL	Updated 8 23 78	TITLE	Serial #5000 & Up
PREVIOUS 5005017-1			Front Panel
REVISIONS PCO 17 78 PCO 18-78 5508 Bd. added		NO.	5006017-1RA
ASSEMBLY			
MFG. RECORD			


Green Circuit
Red Circuit
White
Part #6467
Compass
Differential
Note. Part #6466 Transistors are pictured as seen from open side of their housing
8201 Remote Control Switch
Orienting Plug
Brake Resistor R21
Fuse 2amp
Switch Breakers Terminal Board TS1
Left close 3L,4
Right close 3R,5
Relief Valve
Limit Switch Located on Compass Unit
Mercury Relay from Hinge Side
Rudder
Chassis Component Location
Panel
Top
Mercury Contactor Connections
Component Values
Item 12V 24V 32V
R15 560Ω 2200Ω 2200Ω
R17 Shunt 25Ω 50Ω
R18 open 50Ω 50Ω
R19 Shunt Shunt 100Ω
R21 1Ω 1Ω
All Voltages
C7 .5mfd 200V
C8 C9 .25mfd 100V
C10 C11 5mfd 50V
C12 C13 .005 mfd 600V
X1 X2 X3 Transitron 1N2070
Item 12V 24V 32V
L3 100Ω 400Ω 400Ω
L5 22Ω 85Ω 120Ω
L7 2.5mh RF choke
Sw1 20amp 15amp 5amp
METAL MARINE PILOT, INC.
For Wood Freeman Automatic Pilot
Date 4-27-62
Machine No Model 623-P 12, 24, 32 Volts
Revisions #F9 62, #F10 62
Title Wiring Diagram Plug-In Unit
No 4236320