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Pitch Indication Assembly Manual



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Revisions List

Rev	Date	Revision Description

1.0 INTRODUCTION

1.1 *THIS MANUAL*

Keep this Manual on the vessel for future reference.

Throughout the manual special attention should be paid to the following boxes:

NOTE: Contains Helpful Information

CAUTION: Damage to the equipment could occur if this message is disregarded.

WARNING: Personal Injury could occur if this message is disregarded.

Appendix A contains the Drawing. During Installation and Testing, take special care to verify all wiring is to specifications, terminations are correct, and that all Notes in the Drawing are followed.

1.2 *PITCH INDICATION ASSEMBLY*

The Pitch Indication Assembly is provided for a visual indication of Pitch using:

- A Pitch Drive Circuit, which will be located in the Engine Room
- A Pitch Indicator, which will be located at each Remote Station. (Maximum 4 Remote Stations)

Optional Pitch Position Output is available for connection to a Dynamic Positioning System.

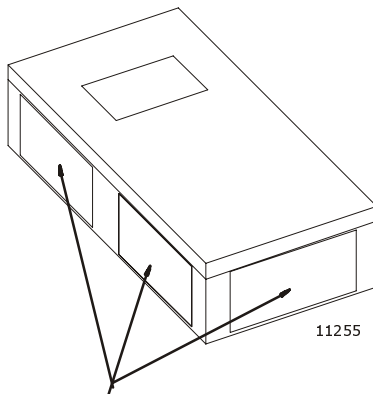
2.0 REQUIRED PARTS AND TOOLS

2.1 TOOLS

- Anti-static Wrist Strap (provided)
- Wire cutter, stripper, and crimper (Recommend Thomas & Betts WT-2000)
- Screwdriver – med. Phillips #2
- Screwdriver – med. straight slot
- Screwdriver -- small straight slot
- Drills -- 9/32 inch (7,2mm) and 7/32 inch (5,6mm)
- Multi meter

2.2 PITCH DRIVER CIRCUIT

2.2.1 Description



Removable Side Panels

Figure 1: Pitch Driver Circuit View

The Driver Circuit consists of a watertight enclosure with removable panels that are to have watertight cable grips installed for electrical cable penetration into the enclosure. Refer to the Drawing in Appendix A and to Figure 1:

Items included with the Driver Circuit:

- Anti-static wrist strap
- Spare fuses

Items not included with the Driver Circuit:

- Mounting hardware
- Watertight Cable Grips

2.2.2 Location

The Pitch Driver Circuit is spray proof but cannot be immersed.

Bulkhead mount preferred for ease of access for wiring and adjustments. Mount in any attitude easily accessible for electric connections. (See Drawing for mounting dimensions.)

Do not mount to the engine, or transmission, or any location that will allow excessive vibration.

The Pitch Driver Circuit uses electronic circuits that can be influenced by strong magnetic fields and static charges. Allow a minimum of 4 feet (1,2m) of clearance between the Driver Circuit and alternators or electric motors.

REQUIRED PARTS & TOOLS

Locate away from heat sources such as engine exhaust manifolds.

CAUTION: It is mandatory the Driver Circuit power source is bonded (connected) to the hull. Refer to Bonding Section.

2.3 PITCH INDICATORS

One Pitch Indicator is required for each Remote Station. Refer to the Drawing in Appendix A for Indicator requirements and information.

2.4 ELECTRIC CABLE

Three Conductor Cable (Pitch Driver Circuit to Pitch Indicator)

Supplied by the Installer. Refer to the Appendix A Drawing Notes for cable specifications

Three Conductor Cable (Pitch Driver Circuit to Pitch Feedback)

Supplied by the Installer. Refer to the Appendix A Drawing Notes for cable specifications

Two Conductor Power Cable (Pitch Driver Circuit to DC Power Supply)

14 AWG, 300V, PVC Insulated: -20 degrees C to +105 degrees C

UL VW-1 PVC Jacket. Red with purple stripe and black.

Three Conductor Cable (optional) (Pitch Driver Circuit to Pitch Position Signal Output)

Supplied by the Installer. Refer to the Appendix A Drawing Notes for cable specifications

2.5 DC POWER

The Pitch Indication Assembly requires:

- A battery source of 24 volts DC
- A 10 ampere circuit breaker with manual reset

The power for the Pitch Indication Assembly should come from the same power distribution panel as the other required engine functions. (Refer to Appendix A Drawing Notes)

3.0 INSTALLATION.

NOTE: Before starting the actual installation of the Pitch Indication Assembly, make sure you have the correct parts and tools on hand. See Section 2. Read **ALL** the instructions pertinent to each part before beginning the installation of that part.

CAUTION: Static electricity can destroy electronic components. Anytime the Driver Circuit cover is off, use the anti-static wrist strap provided and connect it to the Driver Circuit frame. This will drain any static charge you may have on your person.

CAUTION: Refer to the Wiring Diagram Sheets of the Drawing in Appendix A for specific cable connection information.

CAUTION: The shielding drain wire **MUST NOT** touch any other components.

3.1 PITCH INDICATION DRIVER CIRCUIT

3.1.1 Hardware

- A) Secure the Driver Circuit using ¼-inch or M6 fasteners. Refer to the Drawing in Appendix A.
- B) Remove the Driver Circuit cover.
- C) Connect the anti-static wrist strap to your person, and the ground connector to the Driver Circuit frame.
- D) The Shipyard is responsible for supplying watertight cable grips and machining the holes in the Driver Circuit enclosure for electrical cable installation.
- E) See Electric Cabling Section for electric cable connections.

3.1.2 Pitch Indicator Connections

- A) The electric cable enters the Driver Circuit through watertight cable grips (provided by the shipyard).
- B) Separate and strip the wires.
- C) Use a small straight edge screwdriver to depress the spring lock for the individual wire connections. (See Drawing in Appendix A)
- D) Connect the shielding drain wire as indicated on the Drawing in Appendix A.

- E) After wire connections have been made. Feed through a little slack cable, and tighten the cable grip on the electric cable.
- F) Bring the other Pitch Indicator cables in the same way and connect.
- G) Secure the wiring using tie wraps.

3.1.3 DC Power Connections

- A) Install a watertight cable grip in the enclosure for power cable entry.

CAUTION: When connecting the DC power cable to the Driver Circuit be sure the power is OFF.

- B) Connect the (+) positive lead to TB4-1 on the Driver Circuit.
- C) Connect the (-) negative lead to TB4-2 on the Driver Circuit.

3.1.4 Bonding

All boats equipped with a permanently installed electrical system must have a bonding system. The negative terminal of all batteries connect at only one point, the DC common. The DC common connects to bond system or hull.

Metal Hulled Vessels

The hull of a metal-hulled vessel may serve as the common bonding conductor. If an item is not in contact with the hull but requires bonding, run a bonding conductor to the hull.

3.1.5 Pitch Feedback Connections

- A) The electric cable enters the Driver Circuit through watertight cable grips (provided by the shipyard).
- B) Separate and strip the wires.
- C) Use a small straight edge screwdriver to depress the spring lock for the individual wire connections. (See Drawing in Appendix A)
- D) Connect the shielding drain wire as indicated on the Drawing in Appendix A.
- E) After wire connections have been made. Feed through a little slack cable, and tighten the cable grip on the electric cable.

- F) Secure the wiring using tie wraps.
- G) Connect to the Pitch Position Feedback Potentiometer as shown on the Drawing in Appendix A.

3.1.6 Pitch Position Signal Output Connections (optional)

- A) The electric cable enters the Driver Circuit through watertight cable grips (provided by the shipyard).
- B) Separate and strip the wires.
- C) Use a small straight edge screwdriver to depress the spring lock for the individual wire connections. (See Drawing in Appendix A)
- D) Connect the shielding drain wire as indicated on the Drawing in Appendix A.
- E) After wire connections have been made. Feed through a little slack cable, and tighten the cable grip on the electric cable.
- F) Secure the wiring using tie wraps.

3.2 PITCH INDICATOR

3.2.1 Hardware

Refer to the Drawing in Appendix A for mounting information.

3.2.2 Driver Circuit Connections

<p>NOTE: For an aft facing Remote Station, install the Pitch Indicator normally as described below. Then set appropriate JUMPER to convert signal for an aft facing Remote Station. Refer to Section 4.1.4.</p>
--

- A) Separate and strip the wires.
- B) Connect ring terminals for the individual wire connections. (See Drawing in Appendix A)
- C) DO NOT connect the shielding drain wire. Shielding drain wire is ONLY connected at the Driver Circuit as indicated on the Drawing in Appendix A.
- D) After wire connections have been made secure the wiring using tie wraps.

3.3 PITCH FEEDBACK

- A) Separate and strip the wires.

INSTALLATION

- B) Connect to the Pitch Feedback as indicated on the Drawing in Appendix A)
- C) DO NOT connect the shielding drain wire. Shielding drain wire is ONLY connected at the Driver Circuit as indicated on the Drawing in Appendix A.
- D) After wire connections have been made secure the wiring using tie wraps.

3.4 PITCH POSITION SIGNAL OUTPUT (OPTIONAL)

- A) Separate and strip the wires.
- B) Connect to the Pitch Position Signal Output as indicated on the Drawing in Appendix A)
- C) DO NOT connect the shielding drain wire. Shielding drain wire is ONLY connected at the Driver Circuit as indicated on the Drawing in Appendix A.

CAUTION: The shielding drain wire MUST NOT be connected at the Pitch Position Signal Output.

- D) After wire connections have been made secure the wiring using tie wraps.

4.0 ADJUSTMENTS AND TESTS [AT DOCK]

CAUTION: Static electricity can destroy electronic components. Anytime the Driver Circuit cover is off, use the anti-static wrist strap provided and connect it to the Driver Circuit frame. This will drain any static charge you may have on your person.

4.1 CALIBRATION

Refer to Drawing in Appendix C for locations and Test Points.

4.1.1 Null Adjustment

- A) Place the Pitch System to Zero Pitch and center Pitch Position Feedback Potentiometer (if possible).
- B) Measure Null Adjust using a DC voltmeter:
 - 1. Connect black lead on "GNDA" test point located on the circuit board.
 - 2. Connect red lead on "NULL" test point located on the circuit board.
- C) Adjust "NULL ADJUST" potentiometer until voltmeter reads 0.00 VDC.

4.1.2 Zero Pitch Adjustment

- A) Measure Zero Pitch using a DC voltmeter:
 - 1. Connect black lead on "GNDA (-)" test point located on the circuit board.
 - 2. Connect red lead on "OUT1 (+)" test point located on the circuit board.
- B) Adjust "ZERO1" potentiometer until voltmeter reads 2.50 VDC. Fine tune so that the Pitch Indicator reads Zero Pitch. Repeat for all Pitch Indicators.

NOTE: "ZERO1" is for Station 1, etc.

4.1.3 Range Adjustment

- A) Move Pitch System to Full Ahead.

ADJUSTMENTS AND TESTS [AT DOCK]

- B) Adjust "RANGE1" potentiometer until Station 1 Pitch Indicator reads Full Ahead Pitch. Repeat for all Pitch Indicators.

NOTE: "RANGE1" is for Station 1, etc.

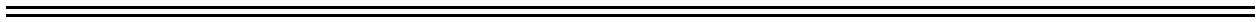
4.1.4 Aft Facing Stations

If Remote Station is an aft facing station, move the appropriate JUMPER on the circuit board to the aft position. Refer to Drawing in Appendix C for JUMPER list and location.

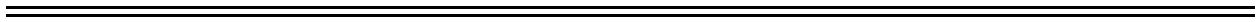
4.2 VERIFY CALIBRATION

- A) Move Pitch System to Full Ahead Pitch.
- B) Check that the Pitch Indicator at each Remote Station reads Full Ahead Pitch.
- If correct continue with the next step.
 - If incorrect repeat Section 4.1.3 and then begin with Step A) of this Section again.
- C) Move Pitch System to Zero Pitch.
- D) Check that the Pitch Indicator at each Remote Station reads Zero Pitch.
- If correct continue with the next step.
 - If incorrect repeat Section 4.1.2 and then begin with Step C) of this Section again.
- E) Move Pitch System to Full Astern Pitch.
- F) Check that the Pitch Indicator at each Remote Station reads Full Astern Pitch.
- If correct continue with the next step.
 - If incorrect repeat Section 4.1.2 and then begin with Step C) of this Section again.

CAUTION: The Pitch Indicators are only calibrated at Full Ahead and Zero Pitch. Therefore, the Full Astern Pitch position may not reach Full Astern.



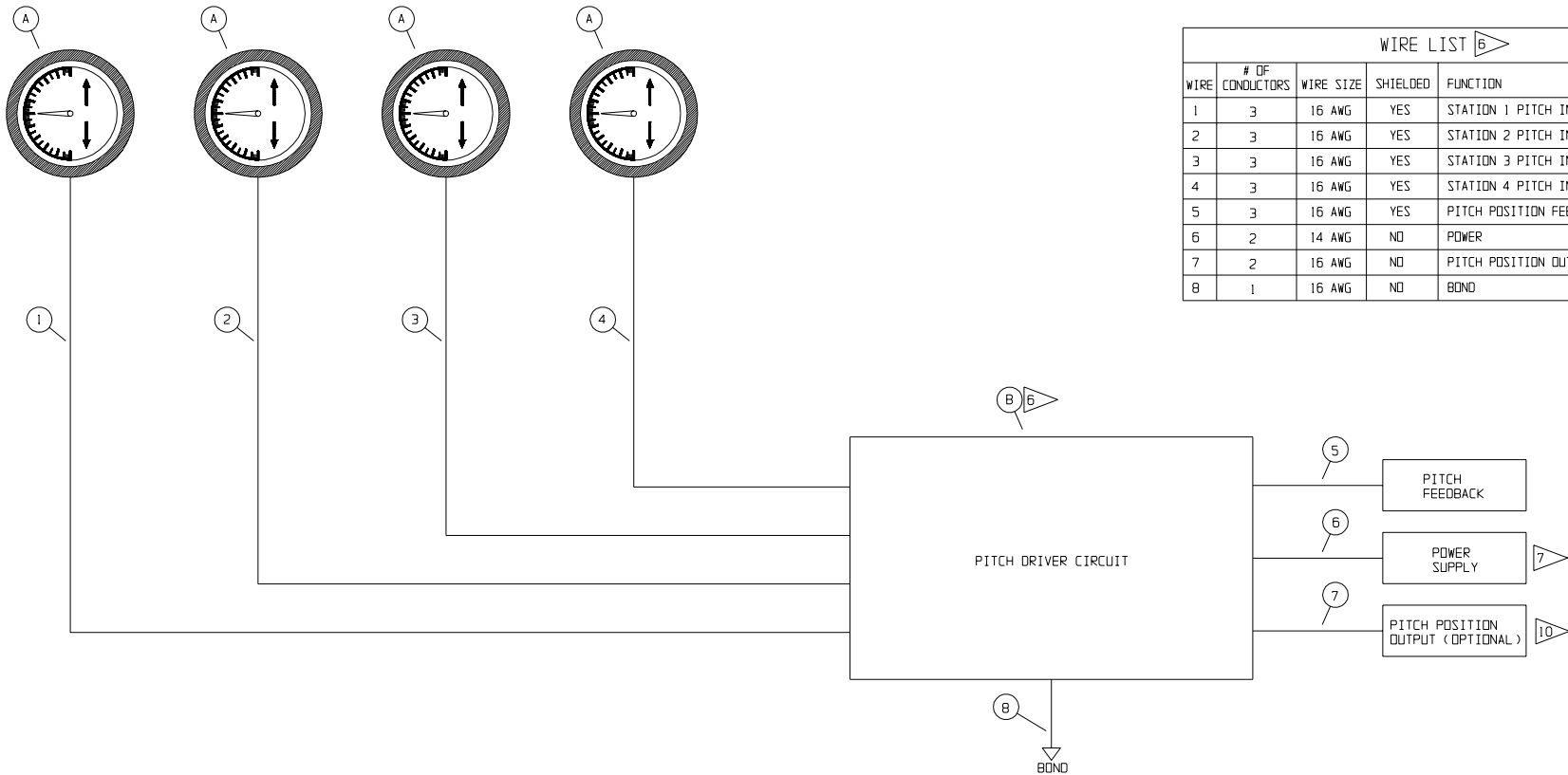
APPENDIX A.1



Drawing 11683-1

MATERIAL LIST			
ITEM	QTY	PART NUMBER	DESCRIPTION
A	4	944906	PITCH INDICATOR
B	1	14304	PITCH INDICATION DRIVER CIRCUIT

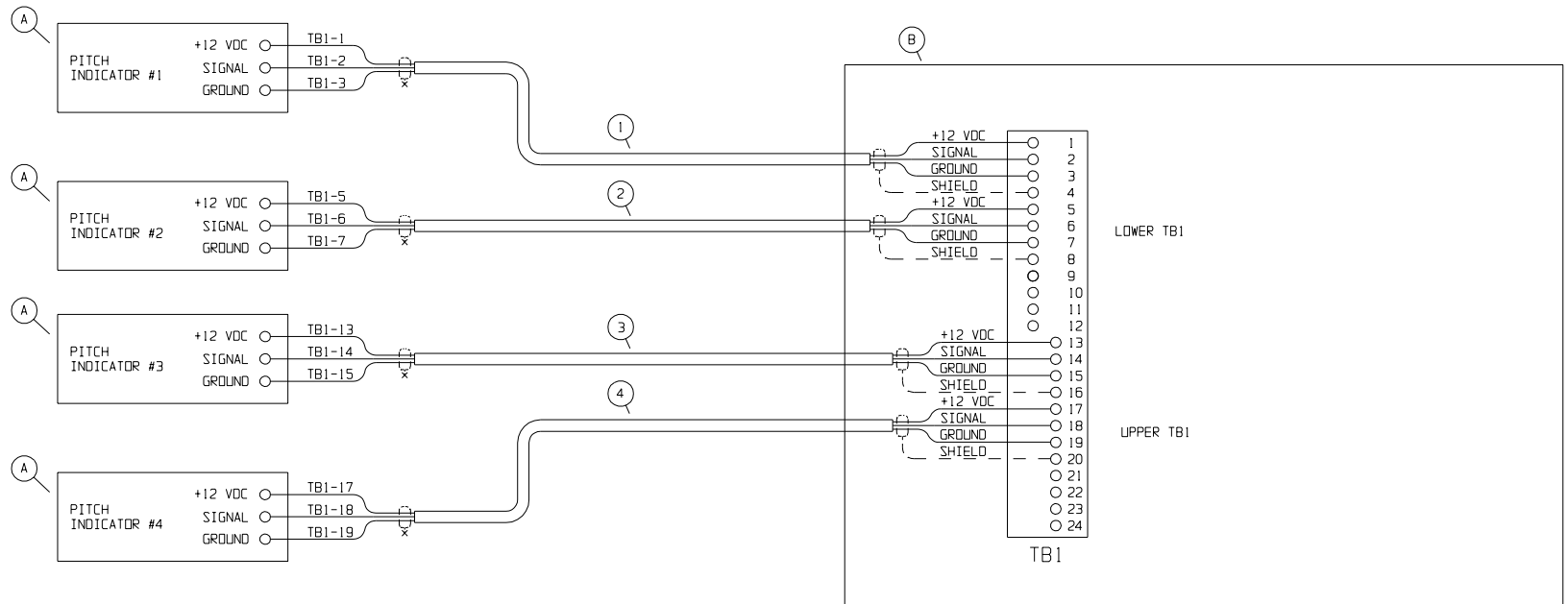
WIRE LIST ▶ 6				
WIRE	# OF CONDUCTORS	WIRE SIZE	SHIELDED	FUNCTION
1	3	16 AWG	YES	STATION 1 PITCH INDICATOR
2	3	16 AWG	YES	STATION 2 PITCH INDICATOR
3	3	16 AWG	YES	STATION 3 PITCH INDICATOR
4	3	16 AWG	YES	STATION 4 PITCH INDICATOR
5	3	16 AWG	YES	PITCH POSITION FEEDBACK
6	2	14 AWG	NO	POWER
7	2	16 AWG	NO	PITCH POSITION OUTPUT (OPTIONAL)
8	1	16 AWG	NO	BOND



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1415 PACIFIC DRIVE BURLINGTON WA 98233		
PITCH INDICATION- SYSTEM DRAWING		
4 STATION MAX		
ENG. J.H.C.	DWN. J. CASE	
CKD. T.J.	DATE 8-13-01	
SCALE: NONE	SHT. 1 OF 6	
	SIZE B	
		DWG. NO. 11683

SEE SHEET 6 FOR NOTES

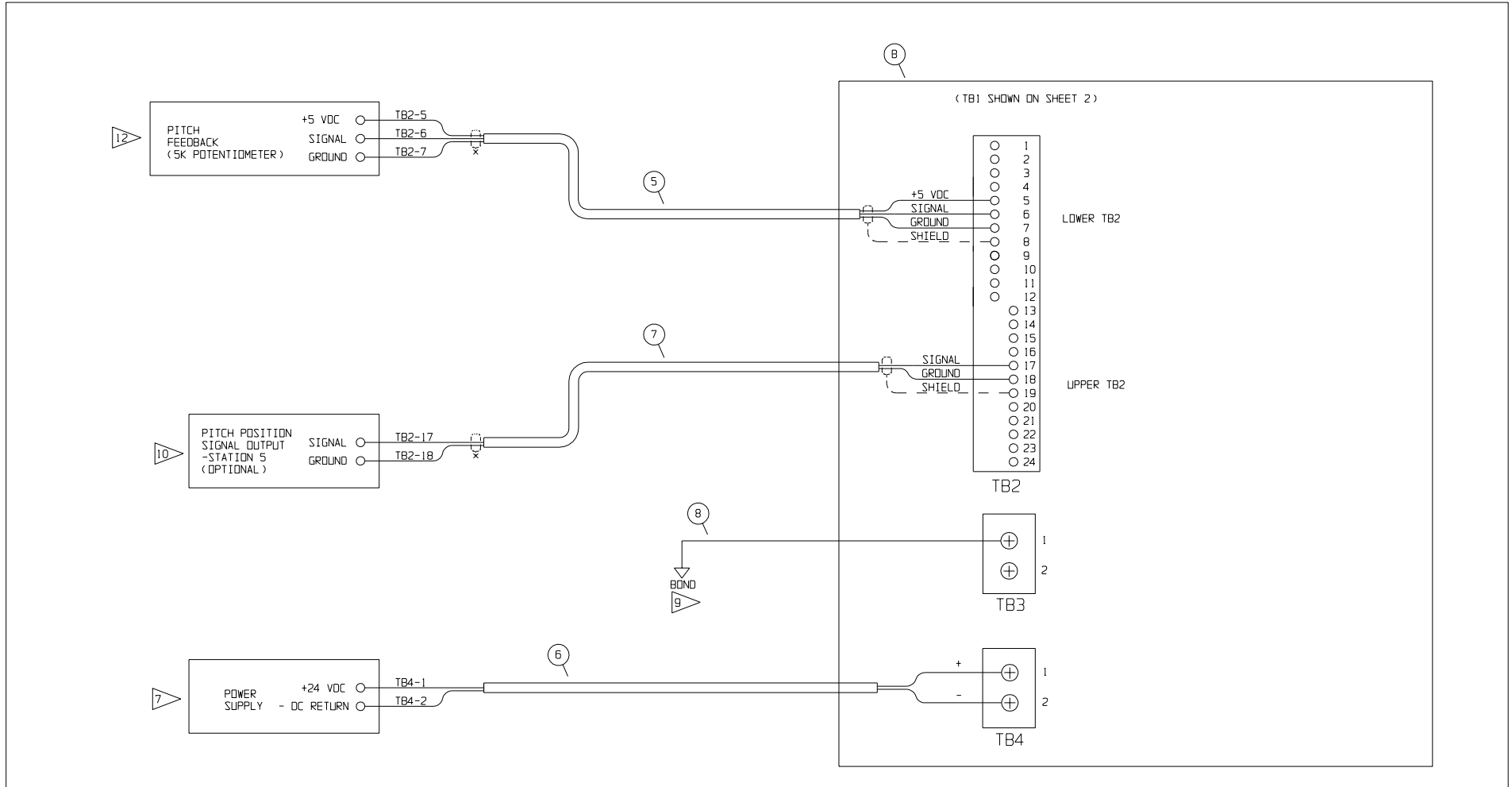
Drawing 11683-2



PITCH INDICATOR WIRING 6 11

ZF MATHERS, LLC		
1415 PACIFIC DRIVE BURLINGTON WA. 98233		
PITCH INDICATION- SYSTEM DRAWING		
4 STATION MAX		
ENG. J.H.C.	DWN. J. CASE	
CKD. T.J.	DATE 8-13-01	
SCALE: NONE	SHT. 2 OF 6	
	SIZE B	
		DWG. NO. 11683

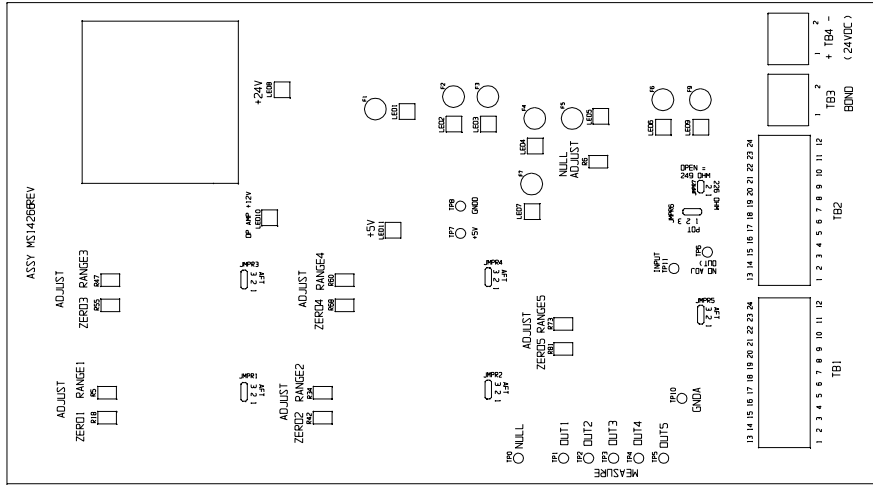
Drawing 11683-3



PITCH POSITION FEEDBACK AND OPTIONAL OUTPUT WIRING 6

ZF MATHERS, LLC			
1415 PACIFIC DRIVE BURLINGTON WA. 98233			
PITCH INDICATION- SYSTEM DRAWING			
4 STATION MAX			
ENG. J. H. C.	DWN. J. CASE	CKD. T. J.	DATE 8-13-01
SCALE: NONE	SHT. 3 OF 6	SIZE B	DWG. NO. 11683

Drawing 11683-4



CIRCUIT BOARD COMPONENT PLACEMENT

FUSE LIST		
FUSE #	FUSE SIZE	FUNCTION
F1	1 A	STATION 1- +12VDC
F2	1 A	STATION 2- +12VDC
F3	1 A	STATION 3- +12VDC
F4	1 A	STATION 4- +12VDC
F5	1 A	STATION 5- +12VDC, SPARE (TB2-21)
F6	1 A	+24 VDC FOR PITCH POSITION SENSOR
F7	250 mA	+5 VDC FOR PITCH POSITION POTENTIOMETER
F8	5 A	CIRCUIT BOARD POWER
F9	1 A	SPARE +24 VDC (TB2-22)

TRIM POT LIST	
POT #	FUNCTION
R18	STATION 1- ZERO ADJUST
R5	STATION 1- RANGE ADJUST
R42	STATION 2- ZERO ADJUST
R34	STATION 2- RANGE ADJUST
R55	STATION 3- ZERO ADJUST
R47	STATION 3- RANGE ADJUST
R68	STATION 4- ZERO ADJUST
R60	STATION 4- RANGE ADJUST
R81	STATION 5- ZERO ADJUST
R73	STATION 5- RANGE ADJUST
R6	NULL ADJUST

JUMPER LIST		
JUMPER #	JUMPER SETTING	FUNCTION
1	1-2	STATION 1 - FORWARD FACING STATION
	2-3	STATION 1 - AFT FACING STATION
2	1-2	STATION 2 - FORWARD FACING STATION
	2-3	STATION 2 - AFT FACING STATION
3	1-2	STATION 3 - FORWARD FACING STATION
	2-3	STATION 3 - AFT FACING STATION
4	1-2	STATION 4 - FORWARD FACING STATION
	2-3	STATION 4 - AFT FACING STATION
5	1-2	STATION 5 - FORWARD FACING STATION
	2-3	STATION 5 - AFT FACING STATION
6	1-2	POTENTIOMETER FEEDBACK
	2-3	4-10 mA FEEDBACK
7	OPEN	249 OHM RESISTOR
	CLOSED	226 OHM RESISTOR

TEST POINT LIST- MULTIMETER CONNECTIONS			
TEST POINTS	+	-	FUNCTION
TP0	TP10		NULL ADJUST
TP1	TP10		STATION 1 PITCH SIGNAL
TP2	TP10		STATION 2 PITCH SIGNAL
TP3	TP10		STATION 3 PITCH SIGNAL
TP4	TP10		STATION 4 PITCH SIGNAL
TP5	TP10		PITCH POSITION OUTPUT SIGNAL (STATION 5)
TP6	TP10		NON-ADJUSTABLE OUTPUT SIGNAL
TP11	TP10		INPUT SIGNAL
TP7	TP8		+5V REFERENCE

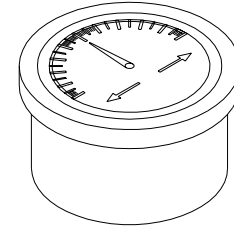
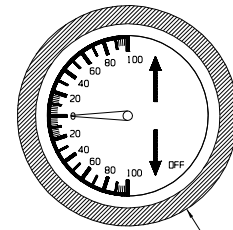
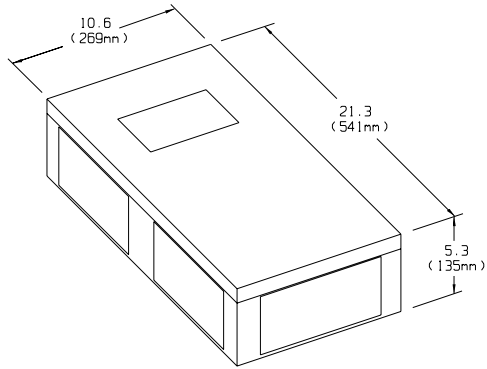
LED LIST	
FUSE #	FUNCTION
1	STATION 1 +12VDC
2	STATION 2 +12VDC
3	STATION 3 +12VDC
4	STATION 4 +12VDC
5	STATION 5 +12VDC
6	POWER FOR PITCH POSITION SENSOR
7	+5VDC FOR PITCH POSITION FEEDBACK POTENTIOMETER
8	POWER FOR CIRCUIT BOARD
9	SPARE +24VDC
10	OP AMP +12VDC
11	+5VDC (CIRCUIT BOARD)

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PITCH INDICATION- SYSTEM DRAWING
 4 STATION MAX

ENG. J.H.C.	DWN. J. CASE
CKD. T.J.	DATE 8-13-01
SCALE: NONE	SHT. 4 OF 6
	SIZE B
DWG. NO. 11683	

Drawing 11683-5



Ø 3.77
(Ø 3.40 MOUNTING HOLE)

LIGHT POWER TERMINAL (OPTIONAL)

LIGHT BULB

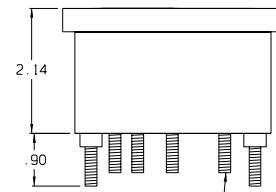
GROUND TERMINAL

MOUNTING TERMINAL (2 PLACES)

+24 VDC POWER SUPPLY

SIGNAL TERMINAL (0-5 VDC)

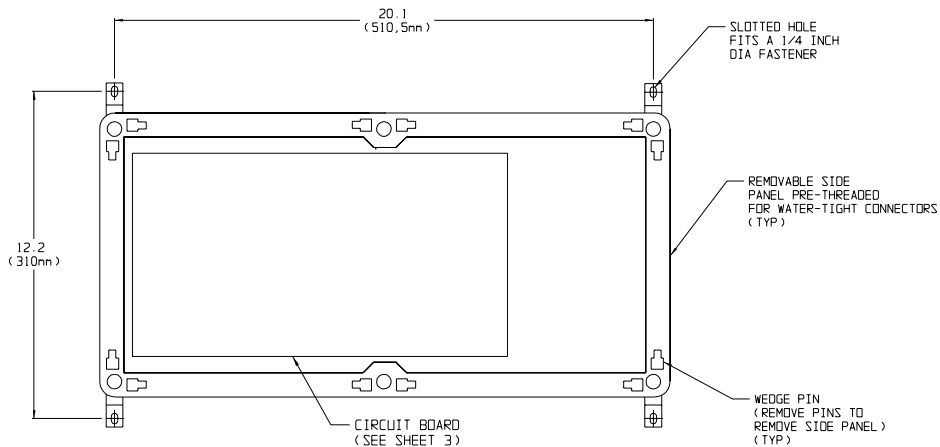
DETAIL 1
BACK OF GAUGE



MOUNTING/WIRING CONNECTIONS (SEE DETAIL 1)

P/N: 944906

PITCH INDICATOR MOUNTING AND OUTLINE DIMENSIONS.



SLOTTED HOLE FITS A 1/4 INCH DIA FASTENER

REMOVABLE SIDE PANEL PRE-THREADED FOR WATER-TIGHT CONNECTORS (TYP)

WEDGE PIN (REMOVE PINS TO REMOVE SIDE PANEL) (TYP)

CIRCUIT BOARD (SEE SHEET 3)

P/N: 14304

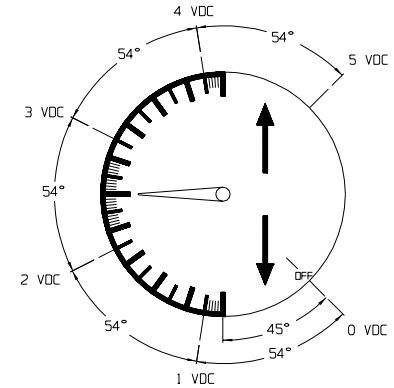
PITCH DRIVER ENCLOSURE MOUNTING AND OUTLINE DIMENSIONS. WEIGHT 17 LBS (7.7 KG)

ZF MATHERS, LLC			
1415 PACIFIC DRIVE BURLINGTON WA 98233			
PITCH INDICATION- SYSTEM DRAWING			
4 STATION MAX			
ENG. J.H.C.	DWN. J. CASE		
CKD. T.J.	DATE 8-13-01		
SCALE: NONE	SHT. 5 OF 6		
	SIZE B		
DWG. NO. 11683			

Drawing 11683-6 Notes Page

- NOTES -

1. DO NOT MOUNT CONTROL SYSTEM COMPONENTS ON ENGINE OR REDUCTION GEAR.
 2. DO NOT MOUNT CONTROL COMPONENTS NEAR SOURCES OF HIGH HEAT. (EXHAUST DUCTS, ETC.)
 3. DO NOT MOUNT CONTROL COMPONENTS NEAR SOURCES OF STRONG ELECTROMAGNETIC FIELDS. (STARTERS GENERATORS, ETC.)
 4. MOUNT CONTROL COMPONENTS IN A LOCATION ACCESSIBLE FOR CHECKOUT, MONITORING AND MAINTENANCE.
 5. ALL ELECTRICAL CABLES ARE TO BE SUITABLE FOR MARINE APPLICATION AND MEET ALL APPLICABLE REGULATORY REQUIREMENTS.
- 6 INSURE THAT DRAIN WIRE ON ALL SHIELDED CABLE IS CONNECTED ONLY AT THE PITCH INDICATION DRIVER CIRCUIT AS SHOWN ON SCHEMATIC, AND THAT THE DRAIN WIRE DOES NOT TOUCH ANY OTHER CONDUCTIVE SURFACE.
- 7 THE PITCH INDICATION DRIVER CIRCUIT WILL BE PROVIDED SHIPS SUPPLY OF 24 VDC, PROTECTED BY A 10 AMP RATED CIRCUIT BREAKER PROVIDED BY THE SHIPYARD.
- 8 CAUTION:
THIS PART CONTAINS ELECTRONIC COMPONENTS WHICH CAN BE DESTROYED BY STATIC ELECTRICITY. PERSONNEL SHOULD GROUND THEMSELVES TO DISSIPATE ANY STATIC ELECTRICITY PRIOR TO WORKING INSIDE THE PART.
- 9 CONNECT TO THE VESSELS BONDING SYSTEM.
- 10 PITCH POSITION SIGNAL OUTPUT CAN BE USED FOR OTHER SYSTEMS, SUCH AS DYNAMIC POSITIONING. THIS SIGNAL MUST BE ISOLATED BEFORE CONNECTING TO ANOTHER SYSTEM.
- SIGNAL IS ADJUSTABLE USING STATION 5 TRIMPOTS. SUGGESTED VOLTAGE OUTPUTS :
- | | |
|-------------|---------|
| FULL AHEAD | 4.1 VDC |
| ZERO PITCH | 2.5 VDC |
| FULL ASTERN | .8 VDC |
- 11 SEE DETAIL 2 FOR DEFAULT PITCH INDICATOR CALIBRATION. FOR AN AFT FACING STATION, SET APPROPRIATE JUMPER TO CONVERT SIGNAL FOR AN AFT FACING STATION.
- 12 PITCH FEEDBACK CONNECTION SHOWN USES A 5K POTENTIOMETER CENTERED AT ZERO PITCH. AN ISOLATED 4-20mA SIGNAL MAY BE USED IN PLACE OF THE POTENTIOMETER.
- OPTIONAL 4-20mA CONNECTIONS: + TB2-2, - TB2-3



DETAIL 2
PITCH INDICATOR VOLTAGE CALIBRATION

ZF MATHERS, LLC			
1415 PACIFIC DRIVE BURLINGTON WA. 98233			
CLEARCOMMAND 13123 TEST PROCESSOR			
ENG.	J.H.C.	DWN.	J. CASE
CKD.	T.J.	DATE	8-13-01
SCALE:	NONE	SHT.	6 OF 6
		SIZE	B
		DWG. NO.	11736

