KONGSBERG

OPERATION & MAINTENANCE MANUAL OE1148A UNDERWATER PAN AND TILT

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REVISION RECORD

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C	June 98	Revised & Converted to Word 97 Standard Format. Add Option 030.	CTT
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G	Feb 05	See CRN 10414, 9168 & 10488	AC

KONGSBERG MARITIME, INC. Standard Conditions of Warranty

(These Conditions form part of the Company's Conditions of Trading)

Instruments sold by Kongsberg Maritime, Inc. (hereinafter called "the Company") are warranted only as stated below:

Subject to the exceptions and upon the conditions specified below, the Company agrees to correct, either by repair or at its election, by replacement, any defect of material or workmanship which develops within one year after delivery of the instrument to the original purchaser by the Company or by an authorized representative, provided that investigation and factory inspection by the Company discloses that such defect developed under normal and proper use. The exceptions and conditions mentioned above are the following:

(a) If any component or accessory manufactured by the Company such as glassware, optical components, light bulbs or cable, fails to give reasonable service for a reasonable period of time, the Company will, at its election, replace or repair such component or accessory. What constitutes reasonable service and what constitutes a reasonable period of time shall be determined solely by the Company after the Company is in possession of all the facts concerning operating conditions and other pertinent factors and after such component or accessory has been returned to the Company, transportation prepaid.

(b) The Company makes no warranty concerning components or accessories not manufactured by it. However, in the event of the failure of any component or accessory not manufactured by the Company, the Company will give reasonable assistance to the purchaser in obtaining from the respective manufacturer whatever adjustment is reasonable in the light of the manufacturer's own warranty.

(c) The Company shall be released from all obligations under its warranty in the event of repairs or modifications made by persons other than its own or authorized service personnel, unless such repairs by others are made with the prior written consent of the Company.

(d) The Company expressly disclaims liability to its customers, dealers and representatives, and to users of its products, and to any other person or persons for special or consequential damages of any kind and from any causes whatsoever arising out of or in any way connected with the manufacture, sale, handling, repair, maintenance, or replacement of or arising out of or in any way connected with the use of said products.

(e) Except as stated above, the Company makes no warranty, express or implied (either in fact or by operation of law), statutory or otherwise; and, except to the extent stated above, the Company shall have no liability under any warranty, express or implied (either in fact or by operation of law), statutory or otherwise.

(f) Representations and warranties made by any person, including dealers and representatives of the Company, which are inconsistent or in conflict with the terms of the warranty (including but not limited to the limitations of the liability of the Company as set forth above), shall not be binding upon the company unless reduced to writing and approved by a Director of the Company.

(g) This warranty shall be governed by the laws of California.

GENERAL INFORMATION

Specifications - The Company reserves the right to change specifications and time without notice and without incurring any obligation to incorporate new features in instruments previously sold.

Damage In Shipment The Company's instrument is carefully examined and checked before it is shipped. It should be visually and operationally checked as soon as it is received. If it is damaged in any way, a claim should be filed with the Carrier. New or repaired instruments damaged in transit should not be returned to the manufacturer without first obtaining specific shipping instructions.

Repairs Should any fault develop the Company or its appointed service agents, must be notified immediately giving full details of the difficulty. Include in the notification the model number and serial number of the affected instrument. On receipt of this information the Company, or its service agent, will send service instructions or shipping data.

Upon receipt of shipping instructions, the instrument must be forwarded, carriage prepaid, and repairs will be made by the Company or its service agents at their premises. If the instrument is not covered by warranty, or if it is determined that the fault is caused by misuse, repairs will be billed to the customer, and an estimate submitted for customer approval before the commencement of repairs.

NOTICE

Kongsberg Maritime Inc. supercedes the following company references in this and related publications:

Simrad Inc.

Kongsberg Simrad Inc

Osprey Subsea Inc.

Sub-Sea Systems Inc.

Photosea Systems Inc.

Hydro Products

Hydro Vision International Inc.

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DEFINITIONS

The following definitions apply to WARNINGS, CAUTIONS or NOTES found throughout this manual.

WARNING

AN OPERATION OR MAINTENANCE PROCEDURE, PRACTICE, CONDITION, STATEMENT, ETC. WHICH, IF NOT STRICTLY OBSERVED, COULD RESULT IN INJURY, DEATH OR LONG-TERM HEALTH HAZARDS TO PERSONNEL.

CAUTION: An operating or maintenance procedure, practice, statement, etc. which, if not strictly observed, could result in equipment damage or reduction of equipment effectiveness.

NOTES: Notes call attention to certain facts or features that may be of significant interest to the operator or service technician.

1. INTRODUCTION

1.1 GENERAL DESCRIPTION

The OE1148A Pan and Tilt is a remotely controlled, two-axis positioning device designed for use underwater in depths to 20,000 feet (6,096 meters). The unit has a stainless steel housing that is oil filled and pressure compensated for use at extreme ocean depths. The OE1148A features two continuous duty motors with built-in brakes and positive gear drive assemblies. The motors operate on 115 VAC, 60 Hz power. Limit switches control the maximum movements within a ±170° range on each axis. The unit delivers from 50 to 70 lb-ft of torque on each axis. Usable torque may be de-rated depending on applied radial load. A built-in ball bearing ratchet clutch assembly protects the unit from over-torque.

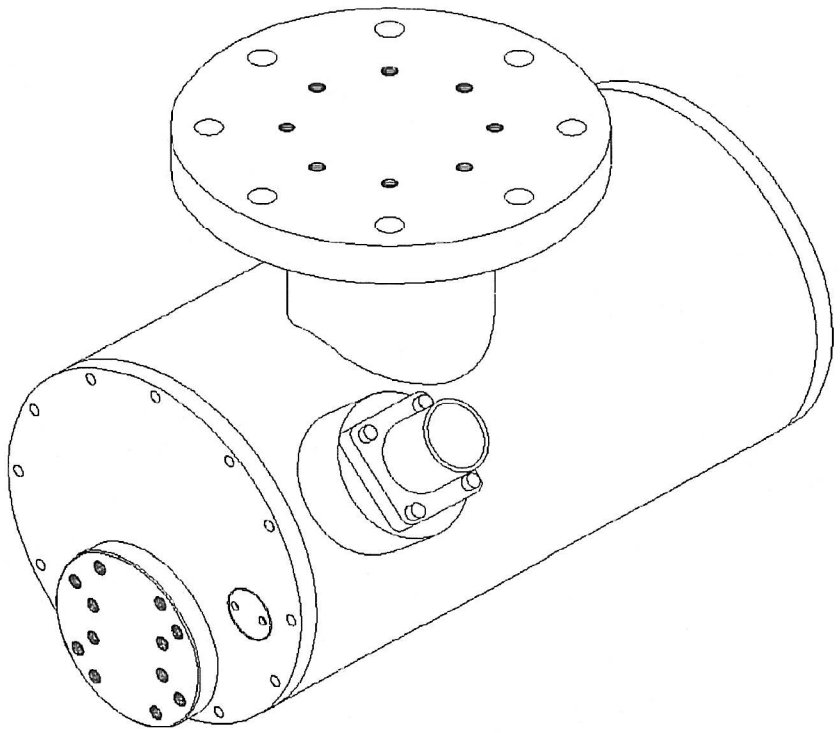


Figure 1 OE1148A Pan and Tilt

Figure 1 is an illustration of the OE1148A Pan and Tilt, and Table 1-1 at the rear of this section presents leading specifications for the unit. Refer to Part 2 for installation instructions and Part 3 for operating instructions.

1.2 APPLICATION

The OE1148A Pan and Tilt is typically used to position moderate loads such as Kongsberg Maritimeunderwater cameras and lights in water depths to 20,000 feet (6,096 meters). The maximum recommended load attached to the tilt flange is 75 lbs with the center of load no more than two inches from the flange face. (This equates to a maximum recommended moment of 53 ft-lb applied parallel to the pan axis.) In underwater applications the moment relates to the in-water mass of the load.

CAUTION: The OE1148A is often used on remotely operated vehicles, subsea plows, and similar marine applications where the environment is harsh and equipment is subjected to rough handling. It is therefore recommended that the unit be mounted in such manner as to protect it from impact loads applied to the pan and/or tilt shafts including, where necessary, protective cages around the pan and tilt, its loads, and associated cables.

1.3 OPTIONS

The basic OE1148A is fitted with a 6-pin connector. Two alternate configurations are available.

Option 020 - Position Feedback

This option provides position feedback from single turn wire wound potentiometers coupled to the pan and tilt output shafts. A ten-pin connector accommodates the additional four conductors necessary to excite the potentiometers and provide position signals.

Option 030 – Replacement for Model RP-5 Pan and Tilt

This option permits substitution of an OE1148A for the obsolete Hydro Products or Hydro Vision Model RP-5 Pan and Tilt. The OE1148A is fitted with a 5-pin receptacle compatible with existing Hydro Products or Hydro Vision spider cables.

CAUTION: The Option 030 connector is made from glass/epoxy and may be damaged if the Pan & Tilt is allowed to roll onto the side with the connector. When not in use, the Pan & Tilt should be supported so that it cannot rotate, or it should be stored on its side with the connector facing up.

Table 1-1 Specifications	
PERFORMANCE	
Scan Range: Pan Axis Tilt Axis	 Internal limit switches preset for any desired scan angle up to ±170° Internal limit switches preset for any desired scan angle up to ±90°.
Torque: Pan Axis Tilt Axis	 Limited by clutch to 50-70 lb-ft. Limited by clutch to 50-70 lb-ft.
Rotation Speed: Pan Axis Tilt Axis	 6 ± 1 degree per second, (approx. 1 rpm) both axes.
Brake:	Positive braking action automatically applied when power is removed. No power required to hold each axis at rated torque.
Operating Depth:	Up to 20,000 feet (6,096 m)
ELECTRICAL	
Input Power:	115 Vac, 50/60 Hz, 0.75 amp/axis while operating.
Connector: Standard Option 010 Option 020	 6 pin bulkhead (Burton 5507-2006) 5 pin SSS Style (046-0011-00) 10 pin bulkhead (Burton 5507-2410)
Motors:	Continuous duty, instantaneous reversing induction motor on each axis.
Limit Switches:	10 amp 10 million cycle rating.
MECHANICAL	
Overall Size: Inches Centimeters	 15.05 L x 11.42 H x 8.0 Dia. 38.2 L x 29.0 H x 20.3 Dia.
Housing: Inches Centimeters	 14.38 L x 8.0 Dia. 36.5 L x 20.3 Dia.

Table 1-1 Specifications	
Weight: In air In water	 92 lbs (42 kg) 62 lbs (29 kg)
Housing: Material Finish Oil	 Type 304 Stainless Steel Passivated Dow Corning DC-200
ENVIRONMENTAL	
Pressurization:	Oil-filled, pressure compensated to 20,000 ft.
Corrosion:	Corrosion resistant in sea water or industrial solutions.
Temperature: Operating Non-Operating	 14 to 122°F (-10 to +50°C) -22 to 149°F (-30 to +65°C)

2. INSTALLATION

2.1 INTRODUCTION

This part describes installation procedures for the OE1148A Pan and Tilt. Orientation and electrical connection information for the OE1148A (including Option 020) may be found in Outline and Installation (O&I) drawing 011-0195 and assembly drawing 011-0677 in Section 7.

2.2 INSTALLATION

CAUTION: The standard OE1148A weighs approximately 92 pounds (42 Kg). Be sure to use appropriate precautions when attempting to lift the pan and tilt unit from the packing container.

2.2.1 General Preparatory Procedures

NOTE: It is suggested that an isolation transformer be incorporated in the control console to reduce the hazards of high voltage in a marine environment.

Use the following procedure for a pre-installation test.

a. Remove the protective cap from the pan and tilt and interconnecting cable assembly. Retain the cap(s) for future use.
b. Inspect the connector mating surfaces closely for signs of foreign matter, nicks, cuts, abrasions or other imperfections that may cause an operating problem. If cleaning is required, wipe the immediate surfaces using a cloth with isopropyl alcohol.
c. Carefully connect the appropriate cable connector to the pan and tilt unit. Be sure that the index key and keyway are properly aligned.
d. Connect the opposite end of the cable to the control console.
e. Connect the control console power cable to the primary power source.
f. Apply power to the control console, verify operation of both pan, and tilt axes. Take into consideration the mounting orientation (flange up or down). If the limit stop settings prove unsatisfactory they may be reset as described in 2.3.
g. At test completion de-energize all equipment, disconnect the cable and install protective caps on the connectors.

2.2.2 Mechanical Installation

Refer to Outline/Installation drawing number 011-0195 in Section 7 for mounting details.

2.2.3 Cables And Connections

Note that the control cable is connected to the body of the pan and tilt, and it moves with the panning motion of the unit. The cable should therefore be mounted in such a way as to assure adequate strain relief and freedom of movement over the entire pan range. The same should be applied to any cable connecting to a camera, lamp or other electrical device fastened to the tilt flange.

2.3 LIMIT STOP ADJUSTMENT

The OE1148A Pan and Tilt is preset at the factory for scan ranges of ±170° on the pan axis and ±90° on the tilt axis. The limit stops may be adjusted as desired using the following procedure.

2.3.1 Tilt Limit Switches

a. Using a 9/64" Allen wrench remove the six screws from the tilt end plate.
b. Refer to drawing 011-0059 in Section 7 to locate the tilt limit switch positions and determine which switch ring requires adjustment.
c. Using a 0.050 Allen wrench loosen the three set screws on the appropriate switch ring. (Activation of the tilt motor will be required for this operation.)
d. Rotate the switch ring until the limit switch is activated at the desired position.
e. Tighten the three set screws. (Do not over tighten.)
f. Inspect the tilt endplate O-ring groove, mating surface and O-ring for defects.
g. Assemble the tilt endplate onto the housing.

2.3.2 Pan Limit Switches

a. Using a 9/64" Allen wrench remove the six screws from the tilt end plate.
b. Refer to Section 7, drawing 011-0055 (Items 11 & 16) to locate the pan switch rings and 011-0057 to locate the pan limit switch positions, and determine which switch ring requires adjustment.
c. Using a 0.050 Allen wrench loosen the three set screws on the appropriate switch ring. (Activation of the pan motor will be required for this operation.)
d. Rotate the switch ring until the limit switch is activated at the desired position.
e. Tighten the three set screws. (Do not over tighten.)
f. Inspect the tilt endplate O-ring groove, mating surface and O-ring for defects.
g. Assemble the tilt endplate onto the housing.

2.4 OPTION 020 POSITION READBACK

The Option 020 model (011-0677-02) with position readback has the same external configuration as the basic model except for the electrical connector that is a 10pin unit. See sheet 2 of schematic 011-0633 in Section 7 for pin connections. The potentiometer excitation voltage should not exceed 50 Vdc. The potentiometers are 5k Ohm.

2.5 OPTION 030 RP-5 REPLACEMENT

The Pan & Tilt Assembly Option 030 (011-0677-03) provides a connector for interface to existing HVI RP-5 installations. The assembly has a right angle connector adapter for installing an XSK-5-BCL 5-pin connector to mate with the HVI Spider Cable.

3. OPERATION

3.1 INTRODUCTION

The OE1148A Pan and Tilt is designed to work with a control unit such as the Kongsberg MaritimeOE1236 which provides the switched AC power required to operate the unit. The OE1236 provides the operator with individual push button switches that control the four motions: pan right, pan left, tilt up and tilt down. Hazardous area applications use the Kongsberg MaritimeSCU-5 purged control unit that features a four-position joystick control.

3.2 OPERATION

Operation consists simply of applying 115 VAC power to the selected pin (i.e. motor winding) at the pan and tilt connector. The pan and tilt motors may be operated simultaneously. Refer to Figure 2 in Part 3 for appropriate connections.

Limit switches interrupt current to the proper motor winding at the extremes of motion. Further movement requires that the motor run in the opposite direction.

4. THEORY OF OPERATION

4.1 DRIVE TRAIN

Each axis is powered by an identical 115 Vac motor and gear train. The motor drives the respective output shaft at approximately 1 rpm through a reduction gear assembly with a ratio of about 1600:1.

A brake stops the output shaft instantly whenever power is removed. This brake is an integral part of the 115 Vac motor, and it does not require a separate power source for its operation.

The drive trains are protected from over-torque by a clutch assembly that is mounted on the worm gear shaft. This ball bearing ratchet clutch assembly slips when stressed beyond a torque of 50 to 70 lb-ft. This prevents damage in the event that an external force is exerted on the unit to stop its motion.

4.2 ELECTRICAL SYSTEM

AC power is supplied to the OE1148A Pan and Tilt via an underwater connector mounted on the housing. When power is applied to either axis, the selected motor drives the output shaft until either power is removed or a limit switch is activated. The limit stops for each axis consist of a pair of adjustable limit switch rings mounted on the output shafts. Slots in the rings activate the limit switches. The limits are factory set and are user adjustable as described in Section 2. The only other electrical components are two capacitors that provide the phase shift needed for operation of each motor.

4.3 SEALS

O-rings are used to seal the endplates and connector to the housing. O-rings have also been incorporated as dynamic rotary seals on both the pan and tilt output shafts.

4.4 PRESSURE COMPENSATION

The extreme depth capability of this unit is possible due to a pressure compensation system. A diaphragm assembly allows the unit's internal pressure to equalize with ambient (external) pressure. Ambient pressure is transmitted through two holes in the end plate and applied to a diaphragm. The diaphragm in turn transmits the pressure to the oil that completely fills the unit. The diaphragm is protected from mud and debris by a set of baffle plates immediately inside the end plate.

4.5 OPTION 020 - POSITION READBACK

Single turn wire wound potentiometers are directly coupled to each output shaft. The potentiometers are factory positioned to be at the electrical median resistance when the output shafts are at 0°. The potentiometers are 5,000 Ohm, 1 Watt. Option 020 units are supplied with a Burton 5507-2410 ten-pin bulkhead connector.

5. MAINTENANCE

Information necessary to troubleshoot and maintain the OE1148A Pan and Tilt is presented in this section. The Pan and Tilt requires minimal preventive maintenance. This involves keeping the unit reasonably clean and removing any sediment or marine organisms from the pan and tilt and associated brackets and cables. It is recommended that the unit be disassembled, cleaned and have new O-rings installed throughout every two years (sooner if subjected to extremely harsh use).

5.1 TROUBLESHOOTING

The troubleshooting procedures help the service technician locate a fault in the pan and tilt. If replacement of a principle part is necessary, refer to paragraph 5.2.2. The following table lists symptoms and possible causes.

Table 5-1 Troubleshooting

SYMPTOM	POSSIBLE CAUSE
Pan or tilt motor not running.	Faulty capacitor, faulty motor, limit switch moved or faulty. Loose or missing connection.
Pan or tilt not functioning in one direction.	Faulty limit switch or problem with limit switch ring. Loose or missing connection.
No position readback signal.	Loose shaft coupler. Loose or missing connection on readback pots.
Erroneous position readback signal.	Loose pot-retaining screws. Faulty pot.

5.1.1 Motor Not Running

Determine whether supply voltage is reaching the capacitor. Verify that the capacitance is 6 ±1 øF. If not, replace the capacitor. If the capacitor checks out verify that power appears on the motor side of the capacitor. If power is present, replace the motor.

5.1.2 Motor Functions In Only One Direction

If the motor operates in only one direction, check the associated limit switch for position. If out of position readjust as described in paragraph 5.2. If the switch position is OK verify that the switch is operational.

5.1.3 Position Readback Incorrect (Option 020)

A malfunction of the position readback potentiometers could result from a loose mechanical connection to a shaft or to loosening of the fasteners that retain a potentiometer body. In either case the unit must be opened and inspected. Electrical failure of a potentiometer calls for replacement.

5.2 MAINTENANCE

Information necessary to maintain the OE1148A Pan and Tilt is presented in this section.

5.2.1 Preventive Maintenance

The OE1148A Pan and Tilt is a solid, dependable unit that requires only minimal preventive maintenance. This involves keep the unit reasonably clean and removing any sediment or marine organisms from the pan and tilt unit and associated cables. The unit and connecting cables should be rinsed thoroughly with fresh water as often as possible. The connecting cable should be thoroughly inspected for damage following an underwater operation. Repair minor nicks, cuts and abrasions when noticed.

If a cable should flood, the OE1148A may suffer some damage. The extent of the damage will depend on the length of operating time, the particular conductors that are short-circuited by water, and the potentials on these conductors. Whether there is damage to the internal components or not, water hosing through the cable to a connector will set up electrolysis between the connector contacts. This corrosive process can completely erode away a connector pin making it necessary to replace the connector. This includes the receptacle on the OE1148A as well as the mating cable connector.

5.2.2 Corrective Maintenance

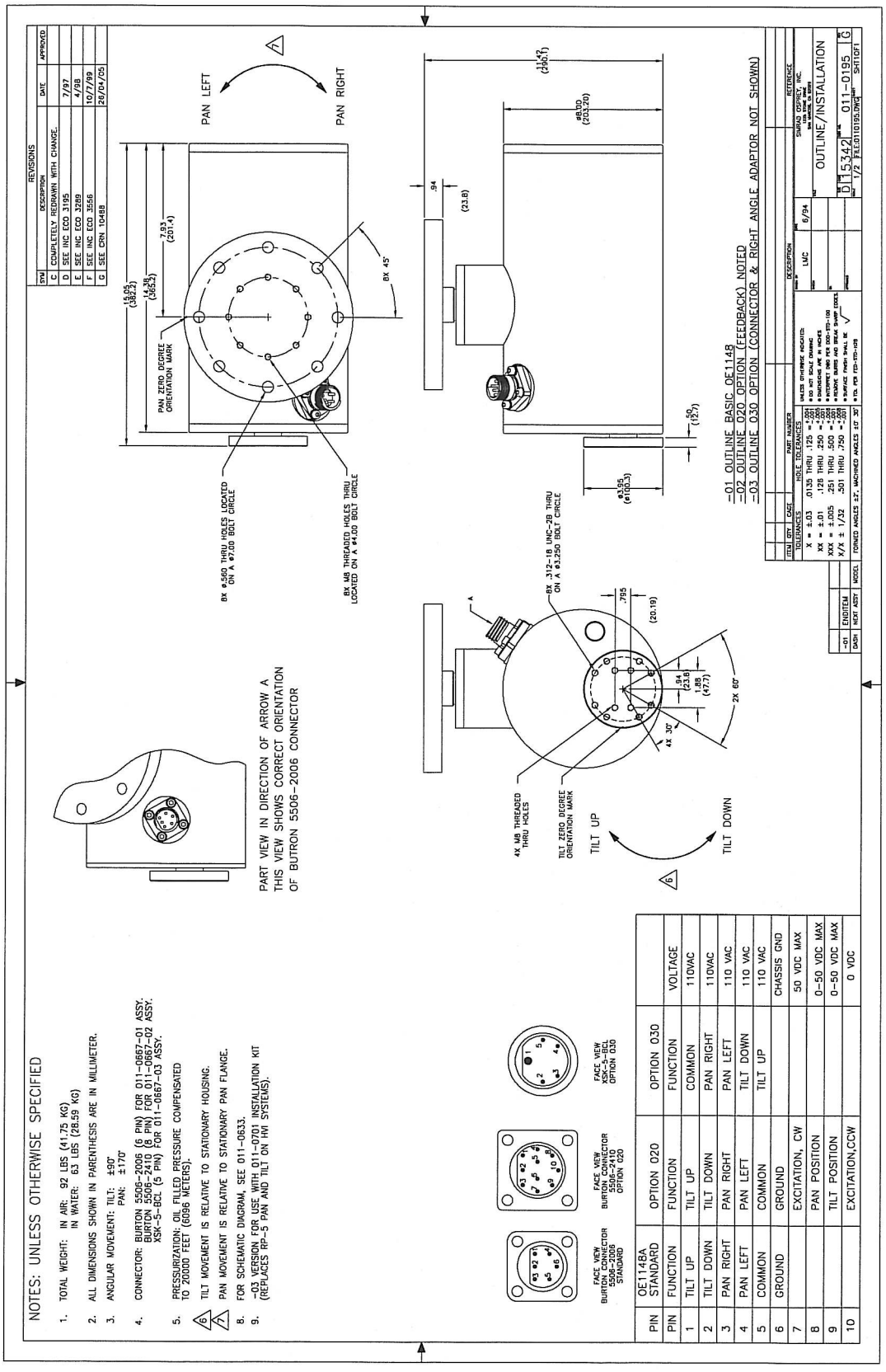
Corrective maintenance includes all activities undertaken to correct an operative shortcoming or fault. The most common corrective maintenance to these units is the replacement of a large brass gear that is mounted on the output shaft.

Damage to this gear is usually caused by a severe external impact or from incorrect and careless disassembly or assembly procedures. Refer to drawing 011-0677, 011-0057 and 011-0059 for the location of parts.

5.2.2.1 Draining & Opening The Housing

The oil must be drained from the housing prior to performing any maintenance on the unit. Use the following procedure.

a. Rinse the unit with fresh water and dry thoroughly. Rough-dry cables within 3 feet of any connectors to be disconnected.
b. Apply power and align the tilt axis with the 0-index mark on the end plate.
c. Remove power and disconnect the control cable.
d. Install the protective caps on the cable connectors.
e. Lay the unit on a table or bench with the tilt axis end plate protruding over the edge and rotate the unit so that the fill plug is at the lowest point.
f. Place a container (at least 9-quart capacity) under the edge of the table to catch the oil.
g. Slightly loosen the fill plug using a spanner wrench.
h. Slightly loosen the eleven socket head screws that retain the tilt axis end plate.
i. Remove the fill plug and nine of the socket head screws, leaving the two lower screws in place (one on either side of the fill port).
j. Break the seal by pulling lightly on the upper edge of the end plate. Loosen the remaining socket head screws if necessary. Oil will drain freely from the fill port.
k. After the oil had drained, remove the two remaining socket head screws and the end plate. Exercise care to avoid damage to the wiring.
l. Remove ground lugs and unplug Molex connectors. Note: the option 010 version has no ground lugs. The internal printed wiring assemblies may be separated from the connector boss by removing the three 4-40 screws.
m. Pour the remaining oil from the housing.



PIN	OE1148A STANDARD	OPTION 020	OPTION 030	
PIN	FUNCTION	FUNCTION	FUNCTION	VOLTAGE
1	TILT UP	TILT UP	COMMON	110VAC
2	TILT DOWN	TILT DOWN	PAN RIGHT	110VAC
3	PAN RIGHT	PAN RIGHT	PAN LEFT	110 VAC
4	PAN LEFT	PAN LEFT	TILT DOWN	110 VAC
5	COMMON	COMMON	TILT UP	110 VAC
6	GROUND	GROUND		CHASSIS GND
7		EXCITATION, CW		50 VDC MAX
8		PAN POSITION		0-50 VDC MAX
9		TILT POSITION		0-50 VDC MAX
10		EXCITATION,CCW		0 VDC