KOBELT

7178 Panoramic Rudder Angle Indicator

Owner's Installation, Operation & Maintenance Manual

NOTES:

RECORD DATA BEFORE INSTALLATION FOR FUTURE REFERENCE	
Model #:	
Serial #:	
Date of Purchase:	
Date of Installation:	

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1 INTRODUCTION

1.1 CONTACT

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This document is intended to clearly present comprehensive product data and provide technical information to assist the end user in design applications. Kobelt reserves the right, without notice, to change the design, or construction, of any products and to discontinue or limit distribution of any products. Kobelt also reserves the right to change, or update, without notice, any technical information contained within this document.

Kobelt recommends that customers visit our website to check for updates to this Manual. Once a product has been selected for use, it should be tested by the user to ensure proper function in all possible applications. For further instructions, please contact our distributors or visit our website.

1.2 SAFETY

1.2.1 Safety Alerts

Throughout this manual, the following symbols, and their accompanying explanation, are used to alert the user to special instructions concerning a service or operation that may be hazardous if performed incorrectly or carelessly. The associated risk levels are stated below.

⚠ DANGER	This symbol indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.
⚠ WARNING	This symbol indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.
⚠ CAUTION	This symbol indicates a hazardous situation, which if not avoided, could result in minor or moderate injury.
NOTICE	This symbol informs the reader of events not related to personal injury but which there is a risk of damage to property or equipment.
SAFETY INSTRUCTIONS	This symbol informs the reader of safety-related instructions or procedures.

1.2.2 Notice to Installer

Disregarding the following safety measures can result in an accident causing severe injury to personnel and damage to material assets.

- Only use the product as directed in this manual.
- Never put the product into service if there is evidence of visible damage.
- Never put the product into service before fully completing installation and commissioning.
- Do not carry out any modifications to the product.
- Only use authentic Kobelt spare parts.
- Observe all local regulations, directives and laws during the installation of this product.
- All installation, commissioning, and maintenance work must only be conducted by qualified personnel. (For the purpose of this manual, qualified personnel are persons who are familiar with the assembly, installation, commissioning, and operation of the product and who have the qualifications necessary for their occupation.)
- Observe all specifications in this manual. If these guidelines are not followed and damage occurs, the warranty will be voided.

1.2.3 Product Hazards

⚠WARNING	**Disconnect Power:** Turn off power at distribution panel before beginning installation to protect installer from electrical hazards.

⚠CAUTION	**Voltage and Current Compatibility:** Confirm that the power source is compatible with the maximum voltage and current ratings of the product variant. Failure to do so could result in damage or fire.

NOTICE	Disassembly and repair of this electronic unit should only be performed by authorized service personal. Any modification of the serial number or attempt to repair the original equipment or accessories by unauthorized individuals will void the warranty.

2 PRODUCT DESCRIPTION

The 7178 Rudder Angle Indicator responds to signals from a Rudder Feedback Unit or alternative signal sources such as control levers. The signal commands the needle position on the Indicator. This position can be calibrated to correspond to physical rudder position or the position of an alternative signal source.

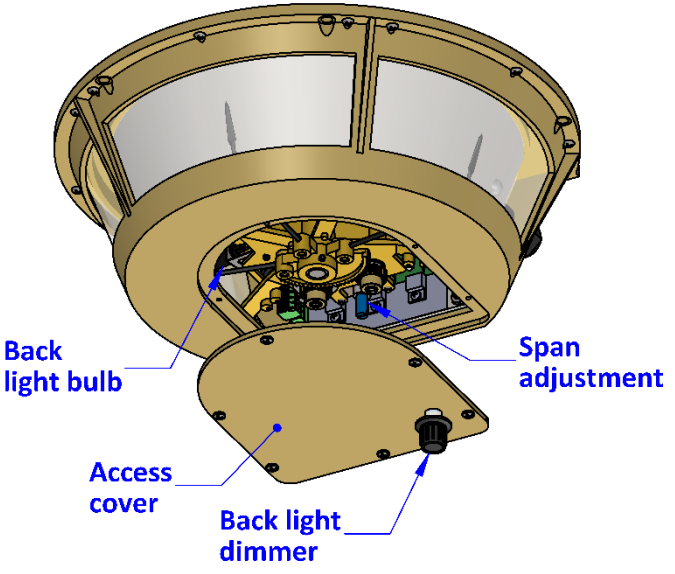


Figure 1: Rudder Angle Indicator Overview

The 7178 Analog Indicator displays rudder angle position, on three scales to provide 230 degrees of viewing angle within the Vessel's bridge. The indicator is driven by a position transducer such as the Kobelt 7163, 7168, or 7174 Rudder Feedback Units (RFU).

2.1 TECHNICAL DATA

Table 1: 7178 Technical Data

MODEL	7178 SERIES	
KOBELT P/N:	7178-DC12	7178-DC24
NOMINAL VOLTAGE	12 VDC	24 VDC
VOLTAGE RANGE	10.8-15.6 VDC	21.6-31.2 VDC
MAXIMUM CURRENT (METER)	750 mA	590 mA
INPUT	1kΩ	1kΩ
MOVEMENT RANGE	± 45°	

ILLUMINATION BULB TYPE	T3-1/4 Wedge Type	
MAXIMUM CURRENT; LIGHT BULBS	320 mA	160 mA
TERMINALS	22-16 AWG, screw clamp	
EMC EMMISIONS	per IEC 60945	
EMC IMMUNITY	per IEC 60945	
COMPASS SAFE DISTANCE	2 in [5 cm]	
ENVIRONMENTAL CATEGORY	ENV2 / class A / protected	
INGRESS PROTECTION	IP20	
OPERATING TEMPERATURE	-4°F … 131°F [-20°C … 55°C]	
ENVIRONMENTAL CONDITIONS	per DNV No. 2.4	
VIBRATION RESISTANCE	0.7 g	
EXTERIOR FINISH	Polyester powder coat, textured black	
PRODUCT WEIGHT	13.5 lbs [6.1 kg]	

3 INSTALLATION

3.1 MECHANICAL

The indicator must be mounted overhead on a flat surface strong and stiff enough to isolate the device from vessel vibrations without excessive flexing. Choose a location that has sufficient sight lines from all areas within the bridge. Allow enough space at the back of the meter to permit the cable entries.

The indicator is equipped with (4) four clearance holes for #10 (M5) screws or bolts inserted from underneath for direct mounting to the ceiling. Ensure the unit is securely fastened, preferably with an anaerobic thread locker such as Loctite 243.

Refer to Appendix A: Installation Dimensions for physical dimensions.

3.2 ELECTRICAL

The 7178 indicator is equipped with two cable glands with which to make the electrical connections. Use 0.20 inch [5 mm] to 0.47 inch [12 mm] OD cable with 18 AWG conductors for external connections to the power supply and rudder feedback unit. The RFU cable must be twisted pair, and shielded to protect the signal integrity. Use ferrules on the cable ends for all wire connections.

NOTICE	All terminal wire connections to the meter should made using crimped ferrules to ensure a secure connection for high-vibration environments.

The 7178 indicator uses a nominal supply voltage of either 12VDC or 24VDC, depending on the configuration selected. Use a regulated, clean, and reliable source to power the 7178 indicator.

Plug connectors are supplied on the board of the indicator for making the connections to the circuit board. Power connections are made at connector P4 whereas the potentiometer input from the RFU is made at connector P3. Rudder Feedback Unit signals shown in the following figures are provided by standard Kobelt RFUs. Please review the Kobelt website for all RFU options available.

⚠CAUTION	A circuit breaker of 2A is required between the vessel power supply source and the indicator(s) as shown in the example installation diagrams.

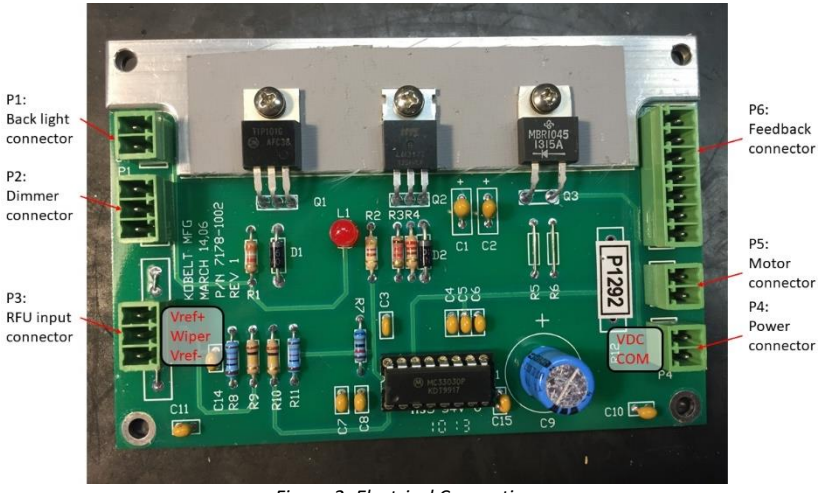


Figure 2: Electrical Connections

Table 2: P3 Wiring Connections

Pin #	Signal	Conductor
1	VREF+	WHT
2	WIPER	RED
3	VREF-	BLK

⚠WARNING	**Disconnect Power:** Turn off power at distribution panel before beginning installation to protect installer from electrical hazards.

4 COMMISSIONING

4.1 ELECTRICAL CHECK

⚠CAUTION	Ensure that the unit is properly installed and secured before powering on the 7178.

- Confirm that all electrical connections to the 7178 have been made.
- Confirm that a breaker has been installed correctly and is turned ON.

4.2 CALIBRATION AND ADJUSTMENT

The indicator may need to be adjusted to correct the overall range of the meter to align with the position of the rudder's maximum travel or the RFU may need to be adjusted to centre the pointer.

Follow these instructions to configure the zero point and span using the on-board trimpots.

SAFETY INSTRUCTIONS	To reduce the potential for electrical shock and to avoid damaging the 7178 electronics, **use a non-conductive screwdriver**, or other equivalent tool, to adjust the trimpot. Exercise caution when reaching in with the screwdriver. Do not let it touch any components other than the trimpot.

NOTICE	Ensure no oil or other contamination enters the 7178 while its cover is removed.

1. Turn OFF power to the 7178 prior to making adjustment.
2. Remove the bottom access panel.
3. Use a **non-conductive** flathead screwdriver to make adjustments.
    a. Rotate trimpot clockwise to increase
    b. Rotate trimpot counterclockwise to decrease
4. Turn ON power.
5. Move rudder through its range to verify desired response.
6. Repeat as necessary, until the 7178 functions as desired.

Default position for all configuration trimpots is at centre.

4.2.1 ❶ "ZERO" Trimpot: Adjust Midpoint

Adjustments to the meter zero point, if required, must be made at the rudder feedback unit (RFU). When the rudder is centered, adjust the feedback potentiometer to align the needle with the midpoint marking.

4.2.2 ❷ "SPAN" Trimpot: Adjust Range Size

The span adjust trimpot adjusts the range of the meter. The range reported by the RFU will vary depending on mechanical linkages. This trimpot can be used to calibrate the hard-over angles. Reference Figure 1: Rudder Angle Indicator Overview for the span trimpot location.

4.3 FUNCTIONAL TEST

Before commencing normal operations with the installed unit(s). A functional test shall be conducted to ensure proper operation of the system as per the intended application and configuration.

NOTICE	Functional testing should be done by qualified personnel only. The system functionality should be fully tested dockside before an open water sea trail is performed to ensure proper response of the system based on rudder commands.

After installation perform the following function tests:

1. Center the rudder
   a. Ensure that the meter displays 0°. If not, first adjust the RFU lever arm until it is centered at 0°. If the RFU lever arm is already centered then the potentiometer inside the RFU will require adjustment.
2. Move the rudder to hard-over
   a. Ensure that the meter displays the hard-over angle. If not, adjust the 'Span' trimpot until it is at the correct angle.

5 MAINTENANCE

5.1 PREVENTATIVE MAINTENANCE

- Quarterly (4 times per year)
  - Visually inspect all wire connections for signs of wear.
- Every year
  - Confirm all electrical connections are secure.
  - Ensure calibration and zero point of unit.

5.2 RECOMMENDED SPARE PARTS

As a minimum Kobelt recommends the following spare parts are on-hand:

Table 3: Recommended Spares

RECOMMENDED SPARES		
QTY	**ITEM**	**KOBELT PART #**
4	T3-1/4 BULB, 24 VDC* (ANSI Model: 464)	6001-3641
4	T3-1/4 BULB, 12 VDC* (ANSI Model: 193)	6001-3642

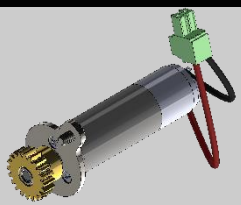
* Select the spare bulb based on the desired operating voltage. Bulbs are the same for all models of 7178 indicators (including all discontinued models)

The unit contains four T3-1/4 Miniature Wedge Base incandescent bulb holders with pre-installed bulbs.

5.3 LEGACY UNITS

Depending on the date of purchase, a retrofit motor diver chip may be required if replacing the motor. When ordering a new motor for Kobelt panoramic RAIs with serial numbers #396 or lower the following parts must be ordered:

Table 4: Legacy Motor Replacement

QTY	ITEM		KOBELT PART #
1	Motor Subassembly		7178-1003

1	Motor Driver IC		6008-3002-RF

To replace the chip, locate it on the board using Figure 3: Motor driver Chip below, gently pry out the old chip and press in the replacement.

Figure 3: Motor driver Chip

NOTICE	It is recommended that any required service work on a Kobelt unit be performed by a factory authorized service representative. Please contact the nearest Kobelt authorized distributor for assistance.

6 TROUBLESHOOTING

If you encounter problems with the operation of your product, please refer to the trouble-shooting suggestions before contacting Kobelt for assistance. If the steps below do not resolve your issue, please reach out either Kobelt directly or our Dealers in your area.

Table 5: Common Solutions

Problem (Issue encountered)	Cause (What it means)	Corrective Action (What to do)
7178 indicator(s) not operational	Blown fuse/circuit breaker	Check and replace fuse or reset circuit breaker. Cycle power to the meter.
	Wiring issue	Check for proper wiring
	Legacy motor driver	Replace motor driver chip (see sec 5.3)
7178 unit does not illuminate	Lightbulb not correctly installed	Check the lightbulb installation and ensure that all connections have been properly made
	Dimming is turned down all the way	Adjust the dimming knob until the 7178 unit is adequately illuminated.
7178 illumination too dim or too bright	Wrong voltage light installed	Change the bulb to match the system voltage of either 12 VDC or 24 VDC.
Indicator moves in opposite direction to rudder	Potentiometer power wires are reversed	Reverse the wiring at connector P3 Correct the wiring following the figure in Section 3.2.
Port and Starboard hard-over are not equal	RFU is not installed or adjusted properly	Confirm correct installation and adjustment of the rudder angle feedback unit.
Rudder center angle does not read zero	RFU is uncalibrated	Adjust RFU potentiometer as described in Section 4.2 to adjust scale.
Hard-over angle isn't correct	Span trimpot needs adjustment	Adjust span trimpot as described in Section 4.2.

7 WARRANTY

Kobelt Manufacturing Co. Ltd. (“Kobelt”) warrants the Products and Parts manufactured by Kobelt to be free from defects in workmanship or material and that said products are designed mechanically and functionally to perform to specifications.

This warranty is effective providing:

- The equipment is used within the intended operating conditions and in accordance with Kobelt recommendations
- The equipment is installed according to equipment diagrams, specifications and recommendations which Kobelt has provided

This warranty becomes invalid if the factory supplied serial number has been removed or altered on the product. This warranty does not cover cosmetic damage or damage caused by an act of God, accident, misuse, abuse, negligence or modification of any part of the product. This warranty does not cover damage due to improper operation or maintenance, connection to inappropriate equipment or attempted repair by anyone other than an authorized Kobelt representative.

Upon identification of a potential issue or defect with a Kobelt Product or Part, the Warranty Applicant (“Applicant”) must immediately contact Kobelt and describe the issue in writing, by letter, fax, email or other electronic conveyance. Kobelt will then assess the cause of the defect, and determine warranty applicability and appropriate remediation.

If any part is found to be defective, Kobelt will replace said part FOB the Kobelt factory provided that any such defective part is returned by the Buyer with freight and applicable forwarding charges prepaid by the Buyer. Kobelt’s sole obligation to the Applicant will be to repair or replace the defective part with same or similar product, to a maximum value of the list price of the product or part. The Kobelt warranty does not cover labour charges, travel or any other associated expenses.

All Products and Parts manufactured by Kobelt, are subject to a warranty against manufacturer’s defects in materials or workmanship for a period of two (2) years from the date of purchase.

Kobelt will be responsible for all Products or Parts sold by Kobelt but manufactured by 3rd party manufacturing companies. However, these products and parts are subject to applicable 3rd party warranties, and may not be the same as the Kobelt warranty.

8 APPENDIX A: INSTALLATION DIMENSIONS

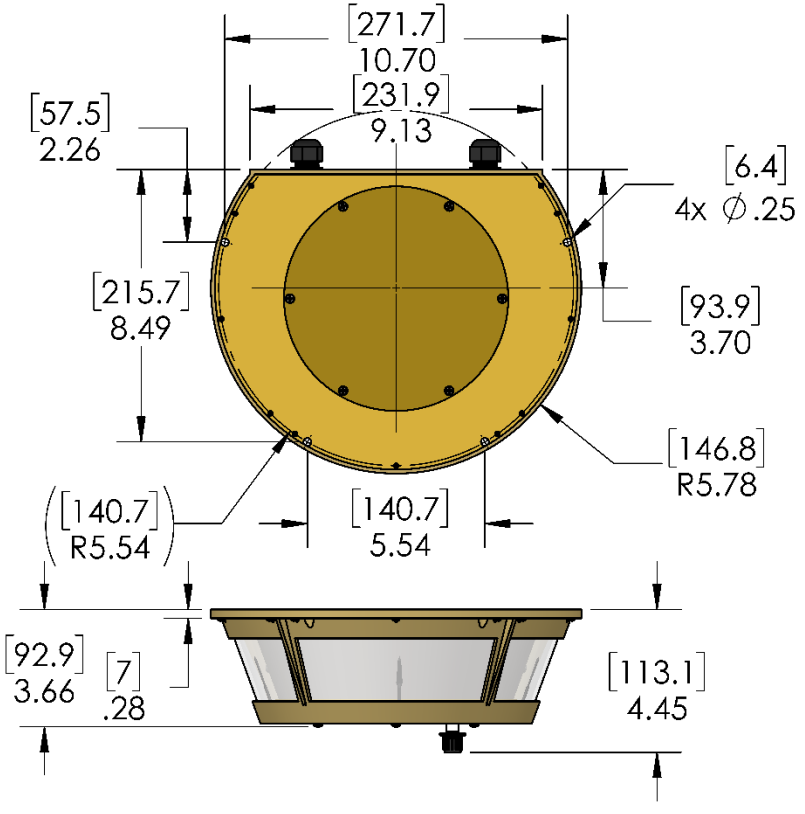
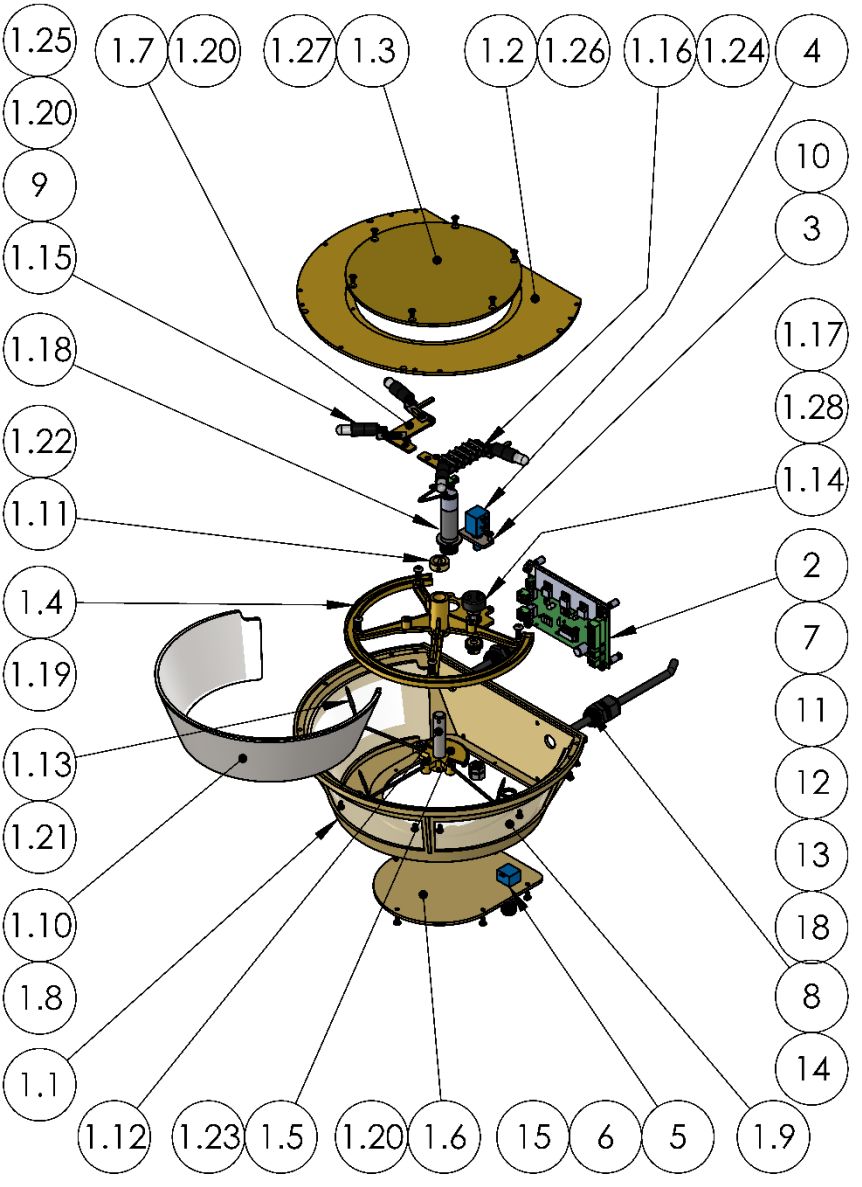


Figure 4: Mechanical Dimensions of 7178

9 APPENDIX B: PARTS LIST



ITEM	QTY	PART NUMBER	DESCRIPTION
1	1	7178-K24V-SUB	7178 MAIN SUBASSEMBLY
1.1	1	7178-0001-B	HOUSING, 7178, TEXTURED BLACK
1.2	1	7178-0002	BACK PLATE, 7178
1.3	1	7178-0003	INSPECTION COVER, BACK, 7178
1.4	1	7178-0004	SUPPORT HUB
1.5	1	7178-0005	POINTER HOLDER
1.6	1	7178-0006-B	INSPECTION COVER, FRONT, 7178, TEXTURED BLACK
1.7	2	7178-0008	BRACKET, LAMP & TERMINAL BLOCK, 7178
1.8	1	7178-0009-IN	LENS, INNER, 7178
1.9	1	7178-0009-OUT	LENS, OUTER, 7178
1.1	1	7178-0010	LABEL, SCALE, RUDDER ANGLE
1.11	1	7178-0011	SLEEVE, 7178
1.12	1	7178-0014	SHAFT, 7178
1.13	3	7178-0020	POINTER
1.14	1	POT-5	POTENTIOMETER; 22MM, 5K, 1 TURN
1.15	4	6001-0206	LAMP HOLDER, MINIATURE BAYONET
1.16	1	6009-0004	TERMINAL BLOCK, BARRIERS, 4 POSITION
1.17	1	Y-3220	SPUR GEAR - BRASS; 32P/20T/B STYLE/.250IN BORE
1.18	1	7178-1003	MICROMOTOR SUB-ASSEMBLY
1.19	4	1010-0808	SCREW, RND HD PHIL, #10-24 X 1/2, 18-8 SS
1.2	12	1012-0604	MACHINE SCREW - PAN HD PHIL;, 6-32 X 1/4, 18-8
1.21	3	1016-0804	SCREW, SET, SKT HEAD, CUP POINT, 10-24 X 1/4, 18-8
1.22	1	1024-0512	SPRING PIN, 1/8 X 3/4, AISI 420
1.23	1	1024-0516	SPRING PIN, 1/8 X 1, AISI 420
1.24	2	1012-0606	SCREW, PAN HD, PHL DRIVE, 6-32 x 3/8IN, 18-8 SS
1.25	2	1023-0106	WASHER, FLAT, #6, ANSI B18.22.1 TYPE A, 18-8 SS
1.26	11	1010-0604	MACHINE SCREW - RND HD PHILLIPS; #6-32 X 1/4, 18-8
1.27	6	1009-0604	SCREW, MACHINE, FLAT HD PHILLIPS, 6-32 X 1/4, SS
1.28	1	6639-0001	SHIM WASHER, 10MM X 2MM, AISI 304
2	1	7178-1002	CONTROL BOARD, 7178
3	1	7178-0019	BRACKET, TRIM POT, 7178
4	1	TRIMPOT-3	TRIMPOT, 1K
5	1	TRIMPOT-2	TRIMPOT, 5K
6	1	6009-7625	KNOB, 1/4 IN DIA
7	4	6009-7851	SPACER, NYLON, 3/8
8	2	6001-0248	CABLE GLAND; M16 X 1.5, .197-.394 CABLE, PA6, BLACK
9	4	6001-3641	LIGHT BULB, 1819 TYPE, 28V, T3-1/4, BA9S BASE
10	2	1012-0606	SCREW, PAN HD, PHL DRIVE, 6-32 x 3/8IN, 18-8 SS
11	2	1012-0614	SCREW, PAN HD, PHLP DR, 6-32 X 7/8IN, 18-8
12	4	1022-0106	NUT, HEX, 6-32, 18-8
13	4	1023-0304	WASHER, LOCK, #6, SS
14	2	6001-0248-W-M16	WASHER, SEALING, M16, POLYETHYLENE
15	1	6639-0001	SHIM WASHER, 10MM X 2MM, AISI 304
16	1	6002-4001	SHAFT LOCK FOR TRIM POT
17	2	6014-0318S	CABLE; 3C/18AWG/SHLD, 600V, GRY
18	2	1012-0616	SCREW, MACHINE, PAN HD PHILLIPS, 6-32 X 1, SS

10 REVISION HISTORY

Document Revision	Release Date	ECN	Author	Revision Summary
C	09/05/2025	01248	MW	• added wiring connections

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