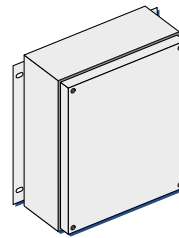
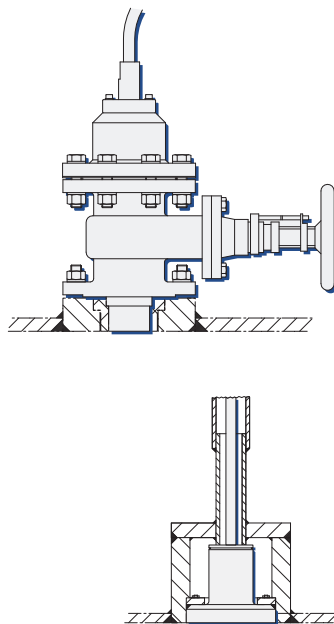


**Doppler Transducers, Gate Valve and Tank Mount
and
Preamplifier Type 5005
for
Doppler Speed Log Systems
NAVIKNOT**



**Installation, Maintenance and Service Instructions
005005-0125-001; Rev. E
06 Dec 2011**

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Revision Record

Rev.	Date of Issue	Remarks
E	06 Dec 2011	revised for transducer type 5020
D	04 Jun 2010	revised transducer installation instructions, added software update procedures, minor corrections
C	11 Apr 2008	new part designations on preamplifier processing PCB, revised service instructions; this document is valid for units equipped with processing PCB 20701 Rev. B and later
B	30 Jan 2008	minor corrections/additions, first official release
A	17 Dec 2007	initial version, not officially released

Safety Instructions

General Safety Information

WARNING



FOR ALL TRANSDUCER INSTALLATION, MAINTENANCE AND SERVICE PROCEDURES:

Do not enter any confined space on a ship without being trained on safety procedures and work practices relating to confined spaces. As a minimum, ensure that the atmosphere in the confined space is safe and breathable. Sperry Marine recommends that a competent person test the atmosphere for oxygen deficiency, combustible gases, hydrogen sulfide, and other hazardous gases that are reasonable to expect in that area. Vent the area, as necessary, to provide a safe, breathable atmosphere.

Do not enter a confined space unaccompanied and without a third person's constant supervision from a safe distance or from the entrance to the confined space. Ensure that both persons carry working flashlights with fresh batteries.

Safety Notice Conventions

Additional safety notes are presented within the individual sections of this document. The following safety conventions are followed:

DANGER



A **Danger** notice contains an operating or maintenance procedure, practice, condition, statement, etc., which, if not strictly observed, **will result in injury or death of personnel.**

WARNING



A **Warning** notice contains an operating or maintenance procedure, practice, condition, statement, etc., which, if not strictly observed, **could result in injury or death of personnel.**

CAUTION



A **Caution** notice contains an operating or maintenance procedure, practice, condition, statement, etc., which, if not strictly observed, **could result in damage to, or destruction of equipment.**

Note



A **Note** contains an essential operating or maintenance procedure, a condition or a statement, which is considered important enough to be highlighted.

Special safety symbols may be used in this document to indicate:



Risk of electrical shock.

Used in conjunction with a **Danger** or **Warning** notice.



Electronic components sensitive to electrostatic discharge.

Used in conjunction with a **Caution** notice.

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Appendix

A Drawings

1 Introduction

1.1 Description

The Doppler transducer is a flow sensor used to determine a vessel's longitudinal speed through the water in the Sperry Marine Doppler speed log systems NAVIKNOT.

The transducer is available in two mounting configurations, a gate valve and a tank mount version respectively.

The gate valve version is suited for installation in single bottom steel or aluminium vessels, while the tank mount version is suited for single or double bottom steel vessels.

The transducer transmits and receives high frequency sound pulses in the forward and aft directions respectively.

It is connected to the Preamplifier D, Type 5005, which generates the transmission pulses and detects the return echo from the water. A time delay between pulse transmission and the detection of the return signal ensures that echoes are received from undisturbed water outside the boundary layer at the hull. The return signals are processed to determine the vessel's fore/aft speed vector. The preamplifier transmits the sensed speed ("raw speed") to the NAVIKNOT electronics unit, using the NMEA 0183/IEC 61162-1 protocol.

The preamplifier may also serve to replace the discontinued Sperry SRD 331 electronics unit in existing SRD 331, NAVIKNOT IIID or NAVIKNOT 400 systems. In this case, the preamplifier transmits raw speed using the Sperry SRD 331 protocol.

The transducer contains two impedance matching transformers, two transmit/receive crystal elements and a plastic transducer lens mounted in an epoxy-filled fiberglass housing. The transducer forms an integral assembly with its connecting cable.

The hardware delivered with the gate valve transducer comprises the sea chest, consisting of a spool piece to be welded to the hull with a gate valve mounted to it. The top of the valve is sealed by a sea chest cap. The transducer stem protrudes through the cap, sealed by O-rings. The gate valve permits to exchange the transducer from inside the hull, while the vessel is afloat.

The tank mount transducer is installed in a cofferdam tank. The tank is welded to the hull and a conduit is attached to it to extend above the vessel's waterline. The tank mount transducer can only be replaced from outside the vessel, i.e. in drydock or by a diver, if the vessel is afloat.

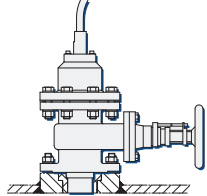
1.2 Technical Data

Doppler Transducers

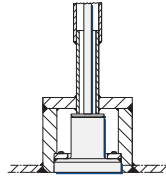
Common Operational Data

speed range	-50 to +50 kn
radiated power (electrical)	10 W max.
signal mode	pulse
frequency	2 MHz
number of beams	2
beam width	1.5°
beam angle	15° from vertical
minimum required bottom clearance	1.8 m

Transducer with Gate Valve

transducer for steel or aluminium vessels, single bottom	
installation method	from inside vessel, through sea chest
ambient temperature, operation	-2 to +40 °C
protection grade	IP 68 to DIN EN 60529; submersible to 35 m
cable length	18 m (PN 74893) or 40m (PN 74894) or 60m (PN 74895)
dimensions and weight	see drawings 4983-0112-01 and 5020-0112-01

Tank Mount Transducer

transducer for steel vessels, single or double bottom	
installation method	from outside vessel; transducer can be exchanged without dry-docking by a diver
ambient temperature, operation	-2 to +40 °C
protection grade	IP 68 to DIN EN 60529; submersible to 35 m
cable length	18 m (PN 73494) or 36 m (PN 73496)
dimensions and weight	see drawing 4978-0112-01

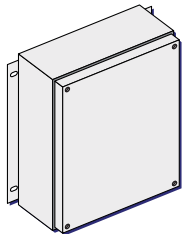
Doppler Preamplifier, Type 5005**Environmental Requirements**

ambient temperature, operation	-15 to +55 °C
ambient temperature, storage	-25 to +70 °C
protection grade	IP 65 to DIN EN 60529
environmental conditions / EMC	in accordance with IEC 60945

Power Supply

supply voltage	24 VDC (18 - 36 V)
power consumption	24 W max.

Dimensions and Weight

width	239 mm	
height	285 mm	
depth	83 mm	
weight	3.0 kg	

2 Transducer Location

2.1 Determining the Transducer Location

As early as possible, contact Sperry Marine engineering to receive specific recommendations for the location of the transducer. These recommendations will be based upon the principal requirements and general guidelines given below and upon the particular properties of the vessel.

Once possible transducer locations have been determined, contact Sperry Marine engineering to obtain location approval. Include drawings of the vessel that show the shape of the bow and that have legible frame numbers and frame spacing. Typical drawings to provide include general arrangement drawings, lines drawings, cross sectional drawings and plan view drawings.

If available, information showing the flow lines of the water past the hull, including pictures of the basin model, should also be provided.

Note

Warranty Note

Proper speed log performance can be expected only if the transducer is located per Sperry Marine's recommendations and installed according to the instructions given in the dimension/installation drawing.

Sperry Marine will not accept responsibility for unsatisfactory speed log performance, for ship modifications required to improve speed log performance or for the removal of the system if it fails to perform satisfactorily as a result of improper transducer location or equipment installation.

Principal Requirements

While the transducer is mounted flush with the hull, it is not affected by boundary layer effects, because return echoes are received from undisturbed water outside the boundary layer at the hull.

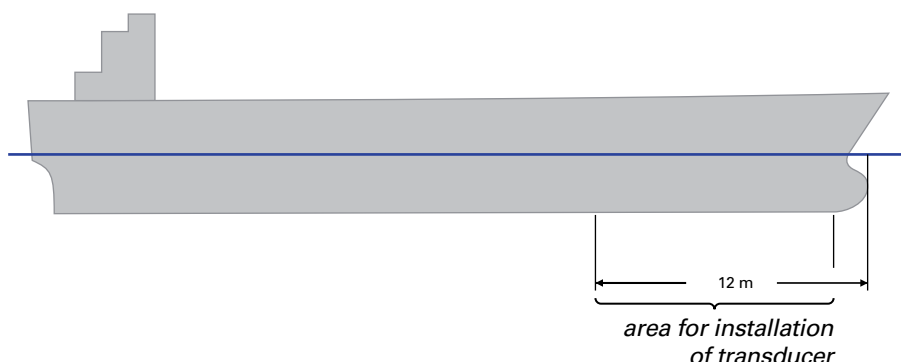
However, in common with other sonar devices, the performance of transducer is adversely affected by aeration.

Air bubbles block acoustic energy from either being transmitted to the water or being received by echoes from reflectors in the water. If enough acoustic energy is blocked, the speed log operation will be erratic and unreliable. Proper speed log operation depends upon a transducer location that provides a clear sonar path in water that is free from sound blocking air bubbles.

Typical causes for aeration are, e.g., bow wave sweep down, cavitation from hull cavities such as bow thruster tunnels, water in- and outlets and cavitation from hull protrusions such as hull zincs, rivets, weld beads, etc.

The transducer is to be installed as close to the forward perpendicular of the bow as possible. The maximum aft distance from the forward perpendicular for a flush mounted transducer is 12 metres. Greater distances than 12 metres require the transducer to be installed in a pod that positions the face of the transducer to a minimum of 300 mm below the hull surface.

Figure 2-1:
area for installation
of transducer



General Guidelines

- Install the transducer within 500 mm of the vessel's centerline.
- If possible, the install the transducer on a flat section of the hull. The transducer lens must be flush with the hull surface. If the desired location is in the up-rake of the bow or a suitably flat surface does not exist, i.e. on a bulbous bow, the transducer must still maintain a vertical orientation.
However, any exposed edges of the transducer sea chest or tank must be faired appropriately with the surrounding hull surface, to effect a smooth laminar (non-aerated) flow of water over the transducer lens.
- Preferably, the transducer is to be mounted vertically at keel level. If the situation dictates, it may be mounted at an angle in the athwartship direction to keep the transducer face flush with the surface of the hull. The angle may only be in the athwartship direction

and must not exceed 45°.

The transducer stem must still be perpendicular to the fore-and-aft axis. If the transducer stem is tilted relative to the fore-and-aft axis, a calibration error will result, proportional to the tilt angle.

- Locate the transducer forward of any abrupt protrusions or cavities in the hull that could cause cavitation and aeration.
Protrusions or cavities on the hull forward and above the transducer are of concern as they may cavitate and create aeration that may sweep back and down over the transducer face.
- Locate the transducer forward of and at least 2 metres away from bow thrusters or fire water intakes.
It is acceptable to locate the transducer immediately aft of, but not below, a standard bow thruster tunnel. The transducer may be located at the bottom, centerline of the ship as long as it is forward of the streamlines emanating from the bow thruster tunnel.
- In the case of a bulbous bow, locate the transducer at the bottom of the bow - Depending on the shape of the bulbous bow and the ship's minimum draft, a pod may be required to position the face of the transducer to a minimum of 300 mm below the hull.
- In the case of a box type keel, wide skeg, protruding counterkeel, or keelson, the sea chest is to be located inside the box keel if the available space accommodates the size of the equipment and if the installation will not compromise the structural integrity of the keel.
If necessary, the sea chest is to be faired into the keel to create the installation and maintenance space required.
- Locate the transducer as far away as possible from equipment operating at a frequency of 2 MHz \pm 100 kHz. Maintain a minimum distance of 10 metres between the transducer and Doppler preamplifier and any other equipment and cables operating at 2 MHz \pm 100 kHz.
- Locate the transducer cable at least 50 mm away from other sonar or high power devices or cables. Maintain a distance of at least 300 mm between the transducer cable and other cables or equipment operating at 2 MHz \pm 100 kHz or power cables that carry voltages above 220 V, such as the cables of bow thrusters, fire pumps, or anchor windlass motors.
- In case of the gate valve transducer, sufficient headroom is necessary for the transducer to be fitted and removed. Approximately 770 mm are required, measured from the ship's bottom (refer to drawing 4983 -0112-01).

3 Gate Valve Transducer Installation

In most cases, field service will attend a vessel only after installation of the sea chest has been carried out by the shipyard. The vessel is likely to be afloat then.

The manufacture of yard-supplied parts, welding work and the assembly and installation of the sea chest as described below, are to be carried out by the shipyard according to dimension drawing 4983-0112-01 and other relevant documents provided by Sperry Marine.

The mechanical installation of the transducer may also be carried out completely by the shipyard. Before commencing electrical installation, field service should verify that all parts supplied by the yard have been manufactured, welding has been carried out and all parts have been installed correctly, according to dimension drawing 4983-0112-01 and any other relevant documents provided by Sperry Marine.

3.1 Shipyard-supplied Parts and Welding

CAUTION



All welding must be carried out by a qualified welder, examined according to the rules of the relevant classification society.

If the transducer is installed in a floodable compartment, all applicable safety regulations must be observed.

Spool Piece

A spool piece (attachment collar), as shown in dimension drawing 4983-0112-01, is to be welded to the vessel's bottom at the sensor location.

A spool piece for installation in steel vessels is included with the sea chest hardware as delivered by Sperry Marine.

For installation in aluminium vessels, such a spool piece is to be manufactured by the shipyard from the same material as the vessel's hull.

The spool piece must be welded to the vessel's bottom flush with the outer skin of the hull (± 2 mm) and mounted horizontally to within $\pm 0.5^\circ$. The spool piece must be so oriented that, when the gate valve is attached, convenient access to the handwheel is provided. The weld seam must be ground flush with the hull and painted.

3.2 Installation of the Sea Chest and Transducer

The installation of the sea chest and transducer will normally be carried out by qualified shipyard personnel.

The sea chest with gate valve must be installed in drydock, before the launching of the vessel

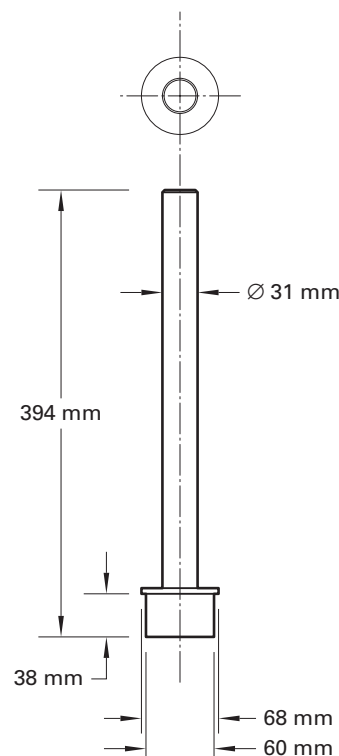
The transducer itself may either be installed at the same time as the sea chest or later, either in drydock or when the vessel is afloat.

If the transducer is not available during installation of the sea chest, the shipyard must manufacture a dummy transducer as an aid for the assembly and alignment of the sea chest components.

Materials and Tools Required

- The sea chest with installation material, 73500, as supplied by Sperry Marine
- The transducer, 74893 (18 m cable), 74894 (40 m cable) or 74895 (60 m cable), as supplied by Sperry Marine.
If the transducer is not available during sea chest installation, a dummy transducer must be manufactured by the shipyard as an aid for the assembly and alignment of the sea chest.
- 24 mm open-ended spanners
- A 5 mm hex-key
- Cable cutters
- Wire strippers
- Silicone grease (included in the sea chest installation kit)
- Anti-seize thread lubricant

Figure 3-1:
dummy transducer
(shipyard supply)
for drydock installation
of sea chest
without transducer



Installing the Sea Chest and Transducer in Drydock

The following instructions apply if the sea chest and transducer are to be installed at the same time.

1. Insert the plastic waster piece into the spool piece, with the larger diameter section at the top end.
2. Lightly coat a gasket with silicone grease and place it on top of the spool piece.
3. Place the gate valve onto the gasket and spool piece.
4. Apply a light coat of anti-seize thread lubricant to the threads of the eight spool piece studs.
5. Attach the gate valve to the spool piece with the studs, nuts and washers. Do not fully tighten the nuts until the various parts are correctly aligned.
6. Turn the handwheel of the gate valve to the fully open position. The gate wedge must be clear of the inside diameter of the valve body.
7. Lightly coat a gasket with silicone grease and place it on top of the gate valve.
8. Lightly coat the upper half of the transducer stem with silicone grease.

CAUTION



Do not let the face of the transducer come into contact with grease. Contamination of or damage to the surface finish of the transducer face will alter the acoustic effectiveness of the transducer and degrade the system accuracy.

9. Insert the transducer into the gate valve so that it is fully seated against the inside shoulder of the plastic waster piece.
10. Lightly coat the two O-rings with silicone grease and install them into the sea chest cap.
11. Draw the transducer cable through the hole in the sea chest cap and slide the cap over the transducer stem.
12. Attach the sea chest cap to the gate valve with the eight bolts and nuts with washers. Do not yet fully tighten the nuts.
13. Align the sea chest components, making sure that the transducer can be easily removed by raising it to its fully extracted position. Shift the sea chest cap and gate valve on their flanges until they are properly aligned and any binding on the transducer is eliminated.
14. Lower the transducer into the sea chest so that it is fully seated against the shoulder of the plastic waster piece. Wiggle the transducer back and forth while pushing it down to dislodge false seating.
15. Check for proper seating of the transducer by measuring the length of the transducer stem projecting from the top of the sea chest cap. The stem must project 77 mm (± 2 mm) from the top of the cap.
16. Thoroughly tighten all nuts and bolts which fasten the gate valve to the spool piece and the sea chest cap to the gate valve.
17. Rotate the transducer so that the alignment flat faces forward and is perpendicular to the vessel's fore-and-aft line to within $\pm 2^\circ$.

Note

Correct alignment of the transducer is critical for the accuracy of the system and must be carried out as precisely as possible.

18. Place the transducer clamp halves around the transducer stem and attach the clamp to the stem with the two shorter hex-socket screws and washers. Do not yet tighten the screws, so that the clamp is free to move on the transducer stem.
19. Insert the screws and washers which attach the transducer clamp to the sea chest cap. Do not yet fully tighten the screws.
20. Re-check seating and alignment of the transducer. With the transducer clamp installed, the stem must project 57 mm (± 2 mm) from the top of the cap.
21. First tighten the screws that attach the clamp to the transducer stem, then tighten the screws that attach the clamp to the sea chest cap.
22. Lay the transducer cable to the preamplifier. Do not shorten the transducer cable but absorb excess cable length in a loop.

The installation of the sea chest and transducer is now complete.

If the preamplifier is already installed mechanically, the transducer cable may now be connected by authorized service personnel.

CAUTION

Do not operate the preamplifier if the vessel is still drydocked. If the vessel is not going afloat soon after the installation of the transducer, take the precautions described in the drydock maintenance sections to protect the transducer from damage in drydock.

Installing the Sea Chest without Transducer in Drydock

The following instructions apply if the transducer is not available at the time when the sea chest is installed.

In this case, the shipyard must manufacture a dummy transducer to be used as an aid for the assembly and alignment of the sea chest components. The gate valve will be closed and the sea chest fitted with a blind plug to allow the vessel to be launched.

The transducer will then be fitted to the sea chest at a later point in time.

1. Insert the plastic waster piece into the spool piece, with the larger diameter section at the top end.
2. Lightly coat a gasket with silicone grease and place it on top of the spool piece.
3. Place the gate valve onto the gasket and spool piece.
4. Apply a light coat of anti-seize thread lubricant to the threads of the eight spool piece studs.
5. Attach the gate valve to the spool piece with the studs, nuts and washers. Do not fully tighten the nuts until the various parts are correctly aligned.
6. Turn the handwheel of the gate valve to the fully open position. The gate wedge must be clear of the inside diameter of the valve body.
7. Lightly coat a gasket with silicone grease and place it on top of the gate valve.
8. Lightly coat the upper half of the dummy transducer stem with silicone grease.
9. Insert the dummy transducer into the gate valve so that it is fully seated against the inside shoulder of the plastic waster piece.
10. Lightly coat the two O-rings with silicone grease and install them into the sea chest cap.
11. Slide the sea chest cap over the dummy transducer stem.
12. Attach the sea chest cap to the gate valve with the eight bolts and nuts with washers. Do not yet fully tighten the nuts.
13. Align the sea chest components, making sure that the dummy transducer can be easily removed by raising it to its fully extracted position. Shift the sea chest cap and gate valve on their flanges until they are properly aligned and any binding on the dummy transducer is eliminated.
14. Lower the dummy transducer into the sea chest so that it is fully seated against the shoulder of the plastic waster piece. Wiggle the dummy transducer back and forth while pushing it down to dislodge false seating.
15. Thoroughly tighten the nuts and which fasten the gate valve to the spool piece.
16. Remove the sea chest cap and dummy transducer from the top of the gate valve. Do not to remove the gasket from the gate valve.
17. Remove the dummy transducer from the sea chest cap.
18. Insert the plastic blind plug from the installation kit into the sea chest cap, so that the flange at the plug's bottom rests against the bottom of the cap.

19. Place the transducer clamp halves around the blind plug and firmly tighten the clamp to the plug with the two shorter hex-socket screws and washers provided.
20. Secure the clamp to the sea chest cap with the two longer hex socket screws provided.
21. Reattach the sea chest cap to the gate valve with the eight bolts and nuts with washers.
22. Thoroughly tighten the nuts.
23. Close the gate valve.
Check that the handwheel is in the fully closed position.

The installation of the sea chest is now complete and the vessel may be launched. The installation of the transducer may be take place at a later point in time, either in drydock or when the vessel is afloat.

Installing the Transducer in the Sea Chest

The installation of the transducer in the sea chest may be carried out either in drydock or when the vessel is afloat.

WARNING



Make sure that the gate valve is fully closed before removing the sea chest cap from the sea chest when the vessel is afloat.

If the sea chest cap is removed while the gate valve is not fully closed, water under pressure will exit from the valve, leading to flooding of the transducer compartment.

1. Make sure that the gate valve is closed and the handwheel is in the fully closed position.
2. Loosen the bolts and nuts attaching the sea chest cap to the top of the gate valve. Some water may spill out from the valve at this point. If the water is under pressure, however, the valve is not completely closed. In this case, re-tighten the bolts and nuts of the sea chest cap, fully close the gate valve and loosen the bolts again.
3. Remove the bolts with their nuts and washers and remove the sea chest cap from the top of the gate valve.
4. Remove the gasket from the gate valve. Clean the gasket and the top flange of the gate valve and apply a fresh coat of silicone grease to the gasket. Put the gasket back onto the top of the gate valve.
5. Loosen and remove the screws that fasten the transducer clamp to the blind plug and the sea chest cap, then remove the clamp from the cap.
6. Remove the blind plug from the sea chest cap. Check that the two O-rings are properly seated in the cap and apply a fresh coat of silicone grease to the rings.
7. Lightly coat the transducer stem with silicone grease.

CAUTION



Do not let the face of the transducer come into contact with grease. Contamination of or damage to the surface finish of the transducer face will alter the acoustic effectiveness of the transducer and degrade the system accuracy.

8. Draw the transducer cable through the hole in the sea Chest cap and slide the cap over the transducer stem.
9. Attach the sea chest cap to the gate valve with the eight bolts and nuts with washers. Check that the cap is properly aligned with the gate valve. Thoroughly tighten the nuts before proceeding.

WARNING



Do not open the gate valve until the sea chest cap is firmly attached to it. If the valve is opened while the sea chest cap is not firmly attached, water under pressure will exit from between the valve and cap, leading to flooding of the transducer compartment.

10. Open the gate valve. Make sure that the handwheel is in the fully open position.
11. Push the transducer down into the sea chest until it seats. Wiggle the transducer while pushing down to dislodge false seating.

12. Check for proper seating of the transducer by measuring the length of the transducer stem projecting from the sea chest cap. The stem must project 77 mm (± 2 mm) from the top of the cap.

CAUTION



Water pressure can push up the transducer in the sea chest after it is seated. Until the transducer clamp is tightened, hand pressure is necessary to keep the transducer seated.

13. Rotate the transducer so that the alignment flat faces forward and is perpendicular to the vessel's fore-and-aft line to within $\pm 2^\circ$.

Note



Correct alignment of the transducer is critical for the accuracy of the system and must be carried out as precisely as possible.

14. Attach the transducer clamp to the transducer stem but do not yet tighten the screws, so that it is free to move on the transducer stem.
15. Insert the screws and washers which attach the transducer clamp to the sea chest cap. Do not yet fully tighten the screws.
16. Re-check seating and alignment of the transducer. With the transducer clamp installed, the stem must project 57 mm (± 2 mm) from the top of the cap.
17. First tighten the screws that attach the clamp to the transducer stem, then tighten the screws that attach the clamp to the sea chest cap.
18. Lay the transducer cable to the preamplifier. Do not shorten the transducer cable but absorb excess cable length in a loop.

The installation of the transducer is now complete.

If the preamplifier is already installed mechanically, the transducer cable may now be connected by authorized service personnel.

CAUTION



Do not operate the preamplifier if the vessel is still drydocked. If the vessel is not going afloat soon after the installation of the transducer, take the precautions described in the drydock maintenance sections to protect the transducer from damage in drydock.

4 Tank Mount Transducer Installation

In most cases, field service will attend a vessel to install the sensor only after the tank mount transducer has been installed by the shipyard. The vessel is likely to be afloat then.

The manufacture of yard-supplied parts, welding work and the installation of the transducer as described below, are to be carried out by the shipyard according to dimension drawing 4978-0112-01 and other relevant documents provided by Sperry Marine.

Before commencing electrical installation, field service should verify that all parts supplied by the yard have been manufactured, welding has been carried out and the transducer has been installed correctly, according to dimension drawing 4978-0112-01.

4.1 Shipyard-supplied Parts and Welding

CAUTION



All welding must be carried out by a qualified welder, examined according to the rules of the relevant classification society.

If the sensor is installed in a floodable compartment, all applicable safety regulations must be observed.

Cofferdam Tank

The cofferdam tank as supplied by Sperry Maine is to be welded to the vessel's hull by the shipyard.

Verify that the tank is correctly aligned with the vessel's fore-and-aft axis, within the tolerances specified in the dimension drawing.

The tank must be welded to the vessel's bottom flush with the outer skin of the hull. The weld seam must be ground flush with the hull.

Cable Conduit (Steel Pipe)

A steel pipe is to be manufactured and welded between the cofferdam tank and the first deck above the waterline, as shown in dimension drawing 4978-0112-01.

Verify that the pipe's dimensions are within the tolerances specified in the dimension drawing and that the pipe runs upright with a minimum of bends (bend radius not smaller than 1 m).

If required, a cable gland is to be fitted to the end of the pipe.

CAUTION



The top end of the pipe must be at least 1 m above the waterline.

The welding seams must hermetically seal off the inside of the pipe from the compartment(s) through which the pipe is routed.

4.2 Transducer Installation in Drydock

Materials and Tools Required

- The cofferdam tank with transducer (18 m cable) and installation kit, 73494, or the cofferdam tank with transducer (36 m cable) and installation kit, 73496, as supplied by Sperry Marine
- A hex key for the transducer mounting bolts and nylon plugs
- A dragline to pull the transducer cable through the conduit
- Anti-seize thread lubricant

Installing the Transducer in the Cofferdam Tank

1. Remove the four transducer mounting bolts with flat washers and lockwashers from the inside of the cofferdam tank.
2. Drop a dragline down the cable conduit and attach it to the end of the transducer cable.
3. Pull the cable up through the conduit.
4. Apply a light coat of anti-seize thread lubricant to the threads of the transducer mounting bolts.
5. Insert the transducer into the tank and rotate it until the keying bolt in the tank engages in the keying hole in the transducer.

CAUTION



Do not let the face of the transducer come into contact with grease or other lubricants.

Contamination of or damage to the surface finish of the transducer face will alter the acoustic effectiveness of the transducer and degrade the system accuracy.

6. Install the transducer mounting bolts with flat washers and lockwashers. Fasten them with a torque of 8.5-17 Nm.
7. Install the nylon plugs provided in the threads. The heads of the plugs should be flush with the face of the transducer.
8. Remove the protective seal from the end of cable.
9. Install the cable gland on the end of the cable conduit, if required.
10. Lay the transducer cable to the preamplifier

The installation of the transducer is now complete.

If the preamplifier is already installed mechanically, the transducer cable may now be connected by authorized service personnel.

CAUTION



Do not operate the preamplifier if the vessel is still drydocked.

If the vessel is not going afloat soon after the installation of the transducer, take the precautions described in the drydock maintenance sections to protect the transducer from damage in drydock.

5 Doppler Preamplifier Installation

5.1 Mechanical Installation

The preamplifier is to be installed at a dry location in the vicinity of the sensor. Preferably, it is to be installed above the vessel's water line, to make sure that in case of the sensor suffering mechanical damage, no water will be forced through the cable into the preamplifier housing.

The preamplifier is to be attached to a level surface with four M6 screws (or nuts and bolts). For the dimensions of the housing, refer to drawing 5005-0112-01. The preamplifier may be installed vertically, horizontally or inclined. Although the preamplifier generates only little heat, the housing may not be painted or covered in any other way.

WARNING



Avoid locating the preamplifier in hazardous areas. If it is necessary to install the equipment in a hazardous area, contain the preamplifier inside an explosion proof housing and the interconnecting cables inside an explosion proof conduit.

5.2 Electrical Installation

For the location of the terminals, trimpots, jumpers and dip-switch block mentioned in the following paragraphs, refer to Figure 8-1 .

WARNING



Hazardous voltage is present at the transducer terminals located on the fore and aft channel transmit/receive PCBs in the Preamplifier D. Danger of electrical shock or burn when the transducer terminals are touched while power is applied to the preamplifier. Do not touch the transducer terminals and do not connect or disconnect the transducer cable while power is applied to the preamplifier.

CAUTION



When wiring up the system, make sure that the power supply for the NAVIKNOT system is switched off and is safeguarded against accidental switching-on.

CAUTION



Components on the devices' PCBs are sensitive to static discharge. Take the necessary precautions to prevent electrostatic discharges.

Wiring Up the Preamplifier

CAUTION



Before connecting the transducer cable, make sure that the adjustment trimpots (R64) on the fore and the aft channel transmit/receive PCBs are set to the fully clockwise position (minimum transmit power). The trimpots are accessible from above through cutouts in the preamplifier processing PCB.

The preamplifier housing possesses four cable glands for feeding the transducer, data and power cables to the preamplifier PCBs.

The transducer cable is to be inserted through the larger gland. Power and data lines are to be inserted through the smaller glands.

All cables from and to the preamplifier must be grounded through the cable glands. This requires that the cable shields are cut back and clamped inside the glands. The gland nuts must be firmly tightened to establish solid connections between the cable shields and the glands.

Proper grounding also requires that a ground strap (> 10 mm² dia.) is installed between the earthing point at the preamplifier housing (M6 stud) and a bare metallic surface at ship's ground potential.

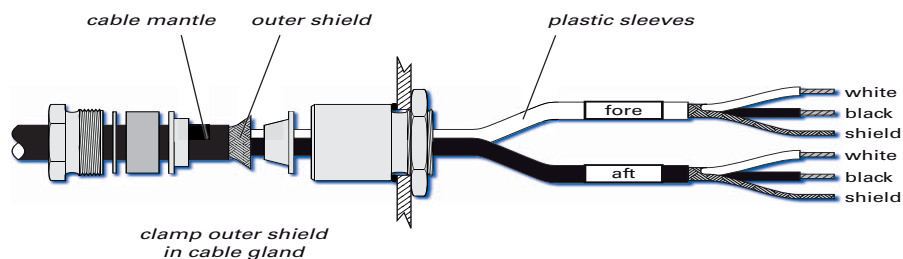
The length of cabling between the preamplifier and the NAVIKNOT electronics unit should not exceed 500 m. To ensure proper sealing, it is recommended to run both the data and power lines within in a common shielded cable, with a minimum wire cross section of 1.5 mm². The remaining two glands normally remain unused and are to be sealed off with blind caps. These glands are provided to accommodate cabling to peripheral equipment when retrofitting the preamplifier to an existing SRD 331 system.

Installing and grounding the transducer cable

As delivered from the factory, the Doppler transducer's cable end is pre-confectioned as required. The two pairs of signal wires are covered with plastic sleeves and are marked "fore" (white sleeve) and "aft" (black sleeve), respectively. Each pair consists of a black and a white coloured wire and a shield.

The wires and shields are connected to the fore channel analogue board (TB3) and the channel analogue board (TB4) inside the preamplifier.

To properly ground the transducer cable, clamp the outer shield, which surrounds the two sleeves, inside the cable gland, as shown below.



Note

Connect the transducer fore/aft channel shields to terminals TB 3.3 (fore channel gnd) and TB 4.3 (aft channel gnd) only. Make sure that the channel's shields do not make contact with ship's ground.

Note

In case of retrofitting or replacing a transducer, Sperry Marine now strongly disapproves the splicing of a replacement transducer's cable to the existing cable from the old transducer. Make sure to obtain a transducer with the required length of cable to replace the existing transducer. Run the new cable all the way to the preamplifier without splicing. Also, do not shorten the replacement transducer's cable but absorb excess cable length in a loop.

Checking Transducer Resistance

Before connecting the transducer to the preamplifier, check for the following resistance values with an ohmmeter:

- fore channel (white pair), black to white: $< 10 \Omega$ (typically 2Ω)
aft channel (black pair), black to white: $< 10 \Omega$ (typically 2Ω)
- fore channel shield to any black or white wire: $> 2 \text{ M}\Omega$
aft channel shield to any black or white wire: $> 2 \text{ M}\Omega$

Deviations from the above values indicate that the transducer is defective and must be replaced.

Adjusting Fore/Aft Channel Transmit Power

At the installation of the preamplifier and when one or both transmitter/receiver PCBs have been exchanged, the fore and aft channel transmit power must be checked and adjusted.

Materials and Tools Required

- Oscilloscope, 2 MHz frequency response min.

Note



Adjusting the transmit power requires “floating” measurement of the transmit signals. Do not use a single-channel oscilloscope powered from ship’s mains, as this will ground one of the signal lines through the probe ground. Either use a battery-powered service oscilloscope or, if a 2-channel oscilloscope is available, use the „invert” and „add signal” methods to measure the balanced differential signal.

- Small screwdriver or pot adjusting tool

Adjustment Procedure

The following adjustments are to be made with the actual transducer connected. As the load impedance presented to the preamplifier may vary considerable between individual transducers, it is not permitted to use dummy loads instead of the transducer.

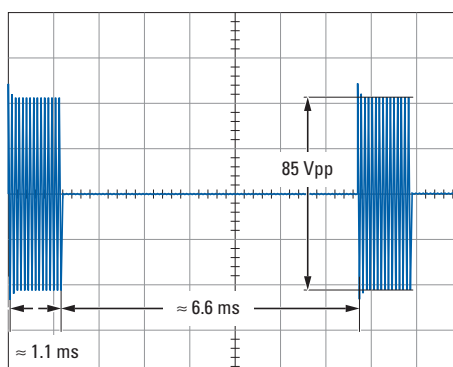
1. Place jumper J14 across pins 2 and 3 of its jumper bay, to operate the preamplifier in the SRD 331 mode. This prevents the NAVIKNOT system from switching off the transducer when no signal is received.
2. Make sure that jumper J12 is placed across pins 1 and 2 of its jumper bay (transmit enable).
3. Make sure that the trimpots R64 on both the fore and the aft channel transmit/receive PCBs are set to the fully clockwise position (minimum transmit power).
4. Switch on the power supply to the preamplifier.
5. Connect the oscilloscope leads across terminals TB 3.1 and TB 3.2 (fore channel transmit/receive signals).
6. Set the oscilloscope input for AC and set the oscilloscope’s input parameters as follows:

vertical: 20 V/division

horizontal: 1 ms/division

A pattern of pulse trains and pauses should now be observed, similar to the one shown in Figure 5-1 below.

Figure 5-1:
Transmit pulses



Note

The transmitters generate short trains of 2 MHz transmit pulses. These are approx. 1.1 ms long and are followed by pauses of approx. 6.6 ms. It will be required to manually set the oscilloscope's trigger parameters to observe the envelope of pulse trains and pauses. When using "auto trigger", the oscilloscope will trigger on the much faster 2 MHz pulses themselves.

7. Adjust trimpot R 64 on the fore channel transmit/receive PCB for a transmit power between 85 and 90 Vpp during the 1.1 ms long transmission periods (87.5 Vpp recommended). The trimpot is accessible from above through a cutout in the preamplifier processing PCB.
 8. Connect the oscilloscope leads across terminals TB 4.1 and 4.2 (aft channel transmit/receive signals).
 9. Adjust trimpot R 64 on the aft channel transmit/receive PCB for the same transmit power as set for the fore channel.
-

Note

Make sure to adjust both channels for exactly the same transmit voltage. The symmetry of the channels is critical for the log's accuracy and a stable indication.

10. Switch off the power supply to the preamplifier.
 11. If the preamplifier is part of a NAVIKNOT 450 D, NAVIKNOT 600 SD or NAVIKNOT 600 SDD system, place jumper J14 across pins 1 and 2 of its jumper bay, to set the operating mode to "NMEA".
 12. If the preamplifier is retrofitted to an SRD 331 or a NAVIKNOT 400 system, leave jumper J14 placed across pins 2 and 3 of its jumper bay, to keep the preamplifier operating in the "SRD 331" mode.
 13. The transducer cable is now properly grounded and the transmit power set as required for proper operation.
-

CAUTION

Should the fore and aft channel pairs have accidentally been connected to the wrong transmit/receive PCBs (direction of speed reversed), do not just swap the pairs between the PCBs. Instead, set back trimpots R64 on both PCBs to the fully clockwise position (minimum transmit power). Then, swap the pairs between the PCBs and repeat the transmit power adjustment.

Disabling the Transmit Circuits during Installation/Service

When installing or servicing the preamplifier while the vessel is dry-docked, the Doppler pulse transmit circuits should be disabled to prevent the transducer from operating in free air.

To disable the transmit circuits, place jumper J 12 across pins 2 and 3 of its jumper bay (transmit disable).

Transmit Protocol Selection

The Doppler preamplifier may be configured to transmit raw speed data using either the NMEA 0183/IEC 61162-1 or the Sperry SRD 331 protocol.

The transmit protocol is determined by the position of jumper J 14 on the preamplifier processing PCB.

NMEA 0183/IEC 61162-1

If the preamplifier is part of a NAVIKNOT 450 D or 600 SD system, it is to be configured for the NMEA 0183/IEC 61162-1 output protocol.

To activate the NMEA 0183/IEC 61162-1 protocol, place J 14 across pins 1 and 2 of its jumper bay. This is the factory default setting.

Sperry SRD 331 Protocol

If the preamplifier is used to replace the Sperry SRD 331 electronics unit within an existing SRD 331, NAVIKNOT IIID or NAVIKNOT 400 system, it is to be configured for the SRD 331 output protocol.

To activate the SRD 331 protocol, place jumper J 14 across pins 2 and 3 of its jumper bay.

Speed Adjustment Dip-Switch Settings (SRD 331 protocol)

If configured for the SRD 331 protocol, the preamplifier's raw speed output may be altered by up to $\pm 10\%$ through the setting of dip-switch contacts J 11.1 through J 11.6 on the processing PCB.

The function assignment of dip-switch contacts J 11.1 through J 11.6 is identical to that of switch contacts S 1 through S 6 of the Sperry SRD 331 electronics unit with software version 1813192 and higher.

When retrofitting the preamplifier to an existing Sperry SRD 331 system, the speed output must be calibrated through the setting of the dip-switch contacts, according to the calibration instructions given in the SRD 331 operation, service and installation manual (Sperry JA13-4169).

When retrofitting the preamplifier to an existing NAVIKNOT IIID or NAVIKNOT 400 system, all switch contacts should be set to the "closed" position (0% correction) and the NAVIKNOT's own table-based calibration facility should be used instead to calibrate the transducer.

Note

The speed adjustment dip switch settings are not effective if the preamplifier is configured for the NMEA_0183/IEC 61162-1 protocol.

6 Regular Maintenance

6.1 Cleaning the Transducer Lens

To prevent corrosion and marine buildup, the transducer lens should be cleaned each time it is removed from the water.

At the first sign of any accumulation of foreign matter, clean the lens, using a cleaning or polishing agent which contains as little abrasive material as possible.

Under conditions of heavy marine growth, more frequent cleaning is required and should be performed by a diver. Special maintenance instructions apply when the vessel is drydocked (see 6.2).

CAUTION



Do not scrape, chip, sandblast, grind, sand, or use acid when cleaning the transducer lens. The lens is a precision shape and any damage to its surface will affect the operation characteristics of the system.

Do not paint the transducer assembly. If the transducer lens is accidentally painted, clean the paint off the lens with paint thinner, such as turpentine, then clean as regular, to ensure that no solvents remain.

Do not use acetone, gasoline or cleaners containing aromatic or chlorinated hydrocarbons (benzene, toluene, carbon tetrachloride and similar substances) to remove paint and other materials from the lens.

6.2 Transducer Drydock Maintenance

When the vessel is drydocked, maintenance should be performed to clean and prevent damage to the transducer, overhaul the gate valve, if applicable, and ensure that the transducer can be easily replaced at sea.

Transducer Inspection and Cleaning

Directly after drydocking the vessel, visually inspect the transducer for any signs of damage or improper installation.

- If the transducer face is deeply scratched, such as from grounding of the vessel, it must be replaced.
- If a gate valve transducer is protruding from the hull or is recessed more than 3 mm, it must be raised or lowered in the sea chest to make it flush with the hull.
- Any roughness on the hull area around the transducer must be made smooth and flush.

When the transducer is found to be in sound condition and properly installed, clean the transducer lens in accordance with the instructions given above (see 6.1).

After cleaning the transducer, take the precautions described in the following sections to protect the transducer from damage during the remaining drydocking period.

Gate Valve Transducer Drydock Precautions

When drydocked, the gate valve transducer should always be raised in its sea chest and the gate valve closed to protect the transducer from damage. After leaving the drydock, the gate valve must be opened again and the transducer lowered into its operating position.

Materials and Tools Required

- A 5 mm hex-key
- A measuring device (ruler, measuring tape)
- Prying tools
- Silicone grease
- Anti-seize thread lubricant

Raising the Transducer

1. Unscrew and remove the two screws and washers which attach the transducer clamp to the sea chest cap.
2. Loosen the two screws which attach the two halves of the clamp to the transducer stem until the clamp is free to move on the stem.

CAUTION



Do not pull on the transducer cable when trying to raise the transducer. Do not use slip-joint pliers or other means of attaching to the transducer stem. This could damage the glass epoxy stem.

3. Raise the clamp a few centimetres (one or two inches) upon the transducer stem and re-tighten the screws.
4. With a turning motion, pull up the transducer in the sea chest. Use prying tools if mechanical assistance is needed between the clamp and the sea chest cap.
5. Continue raising the transducer using a combination of steps 2, 3 and 4 until approximately 25 cm (10 inches) of the transducer stem is showing above the sea chest cap.
6. Close the gate valve. If the gate hits the transducer, continue raising the transducer until the valve can be closed.
7. Re-tighten the transducer clamp to the transducer stem.
8. Insert and tighten the screws and washers to re-attach the transducer clamp to the sea chest cap.

Lowering the Transducer

1. Unscrew and remove the two screws and washers which attach the transducer clamp to the sea chest cap.
2. Loosen the transducer clamp.
3. Open the gate valve.
4. Lubricate the transducer stem with silicone grease.
5. Push the transducer down into the sea chest until it seats. Wiggle the transducer while pushing down to dislodge false seating.

CAUTION



Water pressure can push up the transducer in the sea chest after it is seated. Until the transducer clamp is tightened, hand pressure is necessary to keep the transducer seated.

6. Rotate the transducer so that the alignment flat faces forward and is perpendicular to the vessel's fore-and-aft line to within $\pm 2^\circ$.

Note



Correct alignment of the transducer is critical for the accuracy of the system and must be carried out as precisely as possible.

7. Re-insert the screws and washers which attach the transducer clamp to the sea chest cap. Do not yet fully tighten the screws.
8. Re-check seating and alignment of the transducer. Then, first tighten the screws that attach the clamp to the transducer stem, and second, tighten the screws that attach the clamp to the sea chest cap.

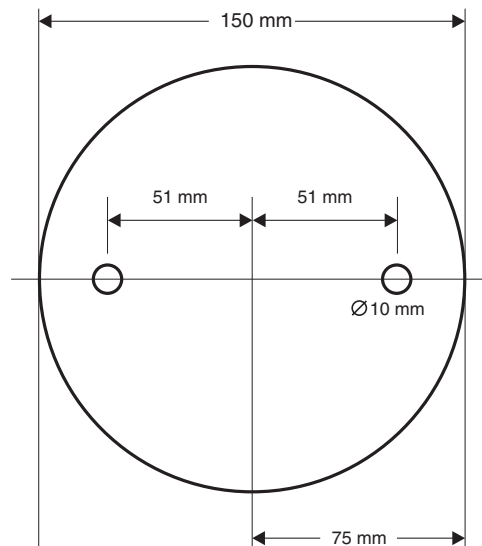
Tank Mount Transducer Drydock Precautions

Protecting the Transducer Face

Always protect the face of the transducer before performing any maintenance on a drydocked vessel.

Fabricate a cover plate as shown below and attach it to the transducer using two M 8 bolts.

Figure 6-1:
Transducer cover plate



Hardware Refurbishment

While the vessel is drydocked, the transducer hardware should be refurbished to make sure it can be easily removed by a diver if the transducer must be replaced.

1. Remove the four nylon plugs and the four mounting bolts with flat washers and lockwashers. Inspect the parts for damage. Replace any damaged bolts. The parts are made of a special non-corrosive material. Replacements should only be obtained from Sperry Marine.
2. Coat the mounting bolts with anti-seize compound and reinstall the bolts with flat washers and lockwashers. Fasten them with a torque of 8.5-17 Nm.
3. Reinstall the nylon plugs in the threads. The heads of the plugs should be flush with the face of the transducer.

7 Corrective Maintenance

7.1 Gate Valve Transducer Replacement

The gate valve transducer may be replaced while the vessel is afloat.

Before removing the existing transducer, obtain a replacement transducer with the required cable length and the replacement parts kit 25749, which contains a new valve gasket, O-rings, silicone grease etc.

Note

Sperry Marine now strongly disapproves the splicing of a replacement transducer's cable to the existing cable from the old transducer. The transducer replacement kit no longer contains a splicing kit. Make sure to obtain a transducer with the required length of cable to replace the existing transducer. Also, do not shorten the replacement transducer's cable but absorb excess cable length in a loop.

Materials and Tools Required

- A replacement transducer 74893 (18 m cable), 74894 (40 m cable) or 74895 (60 m cable)
- The transducer replacement parts kit 25749
- 24 mm open-ended spanners
- A 5 mm hex-key
- A measuring device (ruler, measuring tape)
- Prying tools
- Cable cutters
- Wire strippers
- Silicone grease (included in the replacement kit)
- Anti-seize thread lubricant

Removing the existing transducer

1. Power down the NAVIKNOT system.
2. If the existing transducer cable is not to be spliced to the replacement transducer's cable, disconnect the cable at the preamplifier and draw the cable into the transducer compartment.
3. Unscrew and remove the two screws and washers which attach the transducer clamp to the sea chest cap.
4. Loosen the two screws which attach the two halves of the clamp to the transducer stem until the clamp is free to move on the stem.

CAUTION

Do not pull on the transducer cable when trying to raise the transducer. Do not use slip-joint pliers or other means of attaching to the transducer stem. This could damage the glass epoxy stem.

5. Raise the clamp a few centimetres (one or two inches) upon the transducer stem and re-tighten the screws.
6. With a turning motion, pull up the transducer in the sea chest. Use prying tools if mechanical assistance is needed between the clamp and the sea chest cap.
7. Continue raising the transducer using a combination of steps 4, 5 and 6 until approximately 25 cm (10 inches) of the transducer stem is showing above the sea chest cap.
8. Close the gate valve. If the gate hits the transducer, continue raising the transducer until the valve can be closed.
Check that the handwheel is in the fully closed position.
9. Remove the transducer clamp. Put the clamp, screws and washers aside for later reuse.
10. Loosen but do not remove the bolts, nuts and washers attaching the sea chest cap to the gate valve.
11. Wiggle the transducer to break the seal between the sea chest cap and the sea chest.

WARNING

Make sure that the gate valve is fully closed before removing the sea chest cap from the sea chest.
If the sea chest cap is removed while the gate valve is not fully closed, water under pressure will exit from the valve, leading to flooding of the transducer compartment.

12. If water under pressure exits from the gate valve, retighten the bolts, nuts and washers attaching the sea chest cap to the gate valve.
Work the gate valve to remove sediments from the valve seat. It may take several attempts to clear all sediments from the gate valve seat so that it closes properly.
Check that the handwheel is in the fully closed position.
 13. With the gate valve closed, remove the bolts, nuts and washers and remove the sea chest cap from the top of the gate valve.
 14. If the replacement transducer cable is to be spliced to the existing cable, cut the cable above and close to any previous splice.
Otherwise, disconnect and remove the transducer cable from the preamplifier.
 15. Remove the transducer from the sea chest cap. Cut the cable stub close to the transducer to facilitate removal from the sea chest cap.
- Continue now with the installation of the replacement transducer.

Installing the Replacement Transducer

1. Replace the O-rings on the inside of the sea chest cap. Lightly coat the new O-rings with silicone grease before inserting them into their grooves in the sea chest cap.
If the O-ring grooves are corroded or damaged, the sea chest cap should be replaced.
2. Clean the sea chest cap as necessary for the installation of a new gasket.
3. Lightly coat a gasket with silicone grease and place it on top of the gate valve.
4. Lightly coat the transducer stem with silicone grease.

CAUTION



Do not let the face of the transducer come into contact with grease. Contamination of or damage to the surface finish of the transducer face will alter the acoustic effectiveness of the transducer and degrade the system accuracy.

5. Draw the transducer cable through the hole in the sea Chest cap and slide the cap over the transducer stem.
6. Attach the sea chest cap to the gate valve with the eight bolts and nuts with washers. Check that the cap is properly aligned with the gate valve. Thoroughly tighten the nuts before proceeding.

WARNING



Do not open the gate valve until the sea chest cap is firmly attached to it. If the valve is opened while the sea chest cap is not firmly attached, water under pressure will exit from between the valve and cap, leading to flooding of the transducer compartment.

7. Open the gate valve. Make sure that the handwheel is in the fully open position.
8. Push the transducer down into the sea chest until it seats. Wiggle the transducer while pushing down to dislodge false seating.
9. Check for proper seating of the transducer by measuring the length of the transducer stem projecting from the sea chest cap. The stem must project 77 mm (± 2 mm) from the top of the cap.

CAUTION



Water pressure can push up the transducer in the sea chest after it is seated. Until the transducer clamp is tightened, hand pressure is necessary to keep the transducer seated.

10. Rotate the transducer so that the alignment flat faces forward and is perpendicular to the vessel's fore-and-aft line to within $\pm 2^\circ$.

Note



Correct alignment of the transducer is critical for the accuracy of the system and must be carried out as precisely as possible.

11. Attach the transducer clamp to the transducer stem but do not yet tighten the screws, so that it is free to move on the transducer stem.
12. Insert the screws and washers which attach the transducer clamp to the sea chest cap. Do not yet fully tighten the screws.

13. Re-check seating and alignment of the transducer. With the transducer clamp installed, the stem must project 57 mm (± 2 mm) from the top of the cap.
14. First tighten the screws that attach the clamp to the transducer stem, then tighten the screws that attach the clamp to the sea chest cap.
15. Conduct a resistance check of the transducer (see "Checking Transducer Resistance" on page 25).
16. Power up the NAVIKNOT system and adjust the fore/aft transmit power (see "Adjusting Fore/Aft Channel Transmit Power" on page 26).
17. Carry out a complete function check of the speed log system.

CAUTION



Should the fore and aft channel pairs have accidentally been connected to the wrong transmit/receive PCBs (direction of speed reversed), do not just swap the wire pairs between the PCBs. Instead, set back trimpots R64 on both PCBs to the fully clockwise position (minimum transmit power). Then, swap the wire pairs between the PCBs and repeat the transmit power adjustment.

18. A previously compiled calibration table is to be regarded invalid. As soon as possible, carry out a new transducer calibration.

7.2 Tank Mount Transducer Waterborne Replacement

The tank mount transducer may be replaced by a diver when the vessel is afloat.

Personnel Required

- A commercial diver (DV)
- A diver surface support unit (SU), on a dive boat or dock side
- An authorized field service engineer onboard the vessel (SE)

The engineer, diver and support unit must familiarize themselves with the exact sequence of actions to be carried out. All personnel should coordinate their activities via a permanent voice communication link.

For the following procedure, it is assumed that a transducer is installed in the vessel, the vessel is moored and prepared for the diver to enter the water.

Materials and Tools Required

- A hex key for the transducer mounting bolts and nylon plugs
- Two M 8 x 30 eyebolts
- A small wire brush
- A wire pulling grip
- 60 metres of braided nylon cord, approx. 10 mm dia.
- A dragline from the SU

Replacing the Transducer

1. SE: Inspect the new transducer cable to ensure that the gasket is not damaged and the waterproof sleeve is installed on the end of the cable.
2. SE: power down the NAVIKNOT system. Make sure that the power to the preamplifier is switched off.
3. SE: Disconnect the transducer cable at the preamplifier.
4. SE: If a cable gland is installed at the end of the cable conduit, remove the gland.
5. SE: Attach the wire pulling grip to the cable. Attach the nylon cord to the wire pulling grip. Secure the other end of the cord to prevent it from being pulled into the conduit.
6. SE: Establish communications with the DV and SU.
7. DV: Remove the two nylon plugs from the transducer and install the eyebolts in the threads.
8. DV: Remove the four bolts securing the transducer in place.
9. DV: Using the eyebolts as a handle, pull the transducer from the tank. If the transducer is stuck, insert a bar through the eyebolts and pull or pry against the hull.

10. DV: Attach the dragline from the SU to an eyebolt. Inform the SU and SE when ready to remove the old transducer.
11. DV: Pull the transducer cable through the conduit while the SU pulls the old transducer up with the dragline.
12. DV: Inform the SU and SE when the end of the cable is clear of the transducer housing.
13. DV: Disconnect the wire pulling grip from the old transducer cable.
14. DV: With the wire brush, clean any rust and debris from the transducer mounting pads and the seating surface on conduit extension in the top of the cofferdam.
15. SU: Remove the eyebolts from the old transducer and attach them to the new transducer. Lower the new transducer and cable on the dragline to the DV.
16. DV: Install the wire pulling grip on the new transducer cable. Inform the SE and SU when ready to feed the cable up the conduit.
17. SE: Pull on the nylon cord to draw the cable up through the conduit. If the cable binds, coordinate with the DV to work the cable back and forth to free it.
18. DV: When the transducer is approximately 150-250 mm from the housing, have the SE stop pulling on the cable.
19. DV: Using the eyebolts to assist in handling, rotate the transducer until the arrow points forward. While the SE pulls on the cable slowly, guide the transducer into the cofferdam until the gasket contacts the conduit extension. Make sure that the guide slots in the transducer mate with the mounting pads in the cofferdam.
20. DV: Install the transducer mounting bolts and washers. Fasten them with a torque of 8.5-17 Nm.
21. DV: Remove the eyebolts and install nylon plugs in the threads. The heads of the plugs should be flush with the face of the transducer.
22. SE: Remove the protective seal from the end of cable.
23. SE: Install the cable gland on the end of the cable conduit, if required.
24. SE: Lay the transducer cable to the preamplifier.
25. SE: If the transducer cable must be spliced to the existing cable from the preamplifier, cut the cable to the required length and splice it to the existing cable according to the instructions provided with the inline splice kit. Make sure to establish a solid conductive connection between the new and old cables' armatures.
Otherwise, lay the transducer cable to the preamplifier, prepare the cable end and ground the cable at the preamplifier (see "Installing and grounding the transducer cable" on page 24).
26. SE: Conduct a resistance check of the transducer (see "Checking Transducer Resistance" on page 25).
27. SE: Power up the NAVIKNOT system and adjust the fore/aft transmit power (see "Adjusting Fore/Aft Channel Transmit Power" on page 26).
28. SE: Carry out a complete function check of the speed log system.

CAUTION



Should the fore and aft channel pairs have accidentally been connected to the wrong transmit/receive PCBs (direction of speed reversed), do not just swap the pairs between the PCBs. Instead, set back trimpots R64 on both PCBs to the fully clockwise position (minimum transmit power). Then, swap the pairs between the PCBs and repeat the transmit power adjustment.

29. A previously compiled calibration table is to be regarded invalid. As soon as possible, carry out a new transducer calibration.

7.3 Updating the Firmware with SUSI

The Doppler preamplifier's firmware may be updated in the field using the Sperry Universal Software Instrument application (SUSI).

Note

SUSI is provided to authorized service personnel only and is generally not available to end-customers.

For general information and installation instructions, refer to the SUSI Installation Guide for Field Service Personnel, document 056358.

The preamplifier supports the uploading of firmware files, which allows to selectively update either the actual system software ("MCU-Application"), the bootloader ("MCU-Bootloader") or the firmware for the FPGA chip inside the preamplifier ("FPGA Application").

Compared to simply overwriting ("flashing") the memory, as necessary with older devices, the file upload is a much safer method to update a device's firmware, as SUSI is able to validate the provided files before the upload. In case an upload should fail for any reason, the preamplifier will remain fully functional, continuing to run the previous firmware.

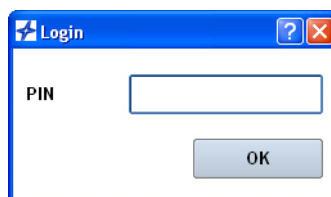
When new firmware is released for the preamplifier, authorized field service personnel will be provided with the required files upon request.

Firmware files issued by Sperry Marine will usually be named such that the filename identifies the device type and the firmware revision. The file extension used for firmware files is ".upd".

To update the preamplifier firmware:

1. If the preamplifier is currently powered up, switch off the power first.
2. Open the preamplifier housing and locate the USB service port receptacle, J9, on the PCB. Make sure that the port is freely accessible for plugging and unplugging the USB cable.
3. At the PC, start up the SUSI application.

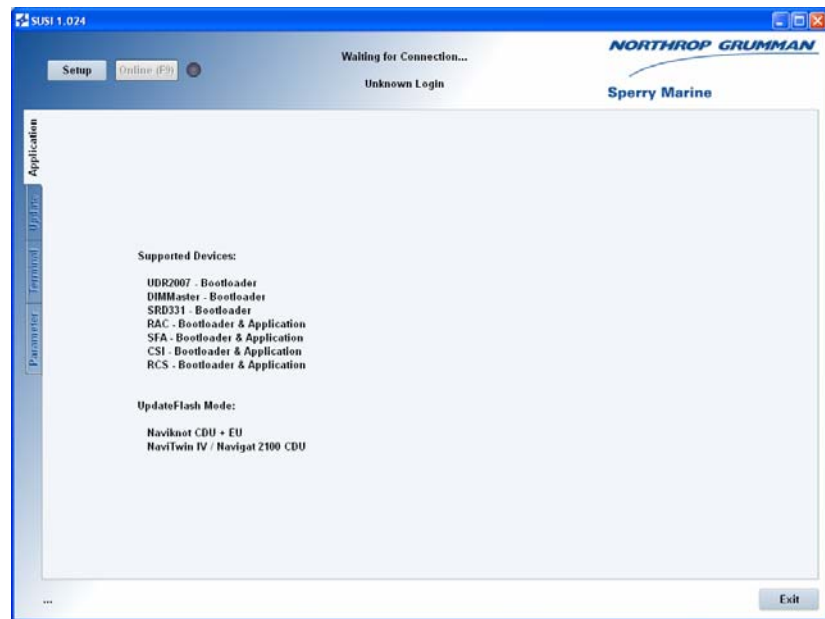
A login dialog pops up:



4. Leave the PIN empty.
This starts up SUSI in the "unknown login" mode, which provides sufficient access rights to update the preamplifier firmware.

Click  to continue.

5. SUSI's main window now opens, with the "Application" tab displaying a list of supported devices:



6. Plug in the USB cable at the PC and at the preamplifier's service port.



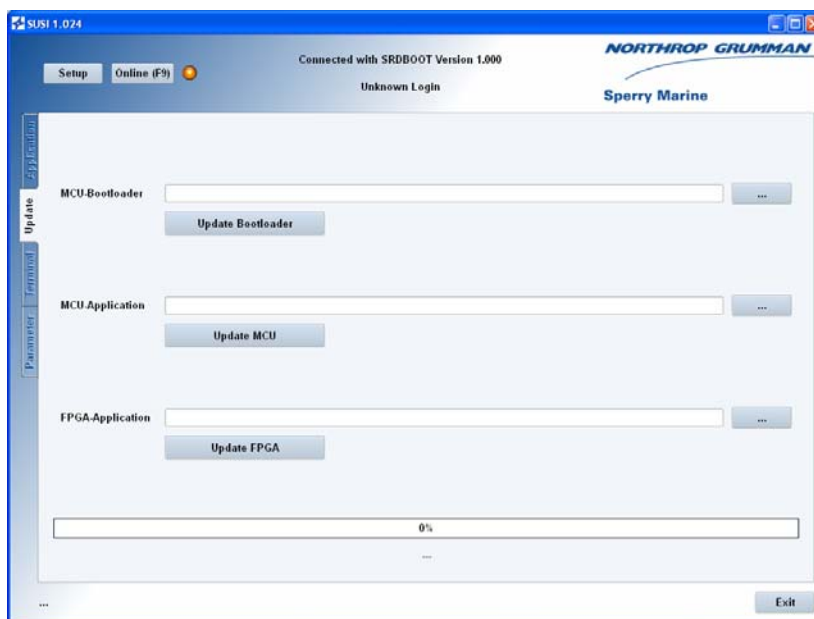
7. Power up the preamplifier.
The "Online" button should now become clickable (not greyed-out), indicating that SUSI has found a device to connect to:



The LED icon next to the button will remain grey, as no connection has been made yet.

8. Click **Online (F9)** to connect to the preamplifier.
The LED icon should now change to orange and the status line should read "Connected with SRDBOOT".

Upon connecting, SUSI opens the update tab:



The update tab provides file browsers to select firmware update files for the system software ("MCU-Application"), the bootloader ("MCU-Bootloader") and the FPGA ("FPGA-Application").


9. Depending on whether you intend to update the MCU bootloader, the MCU application or the FPGA application, click the respective **...** button to call up the file open dialog. Then, navigate to the firmware update file, select it in the dialog and click **Open**.

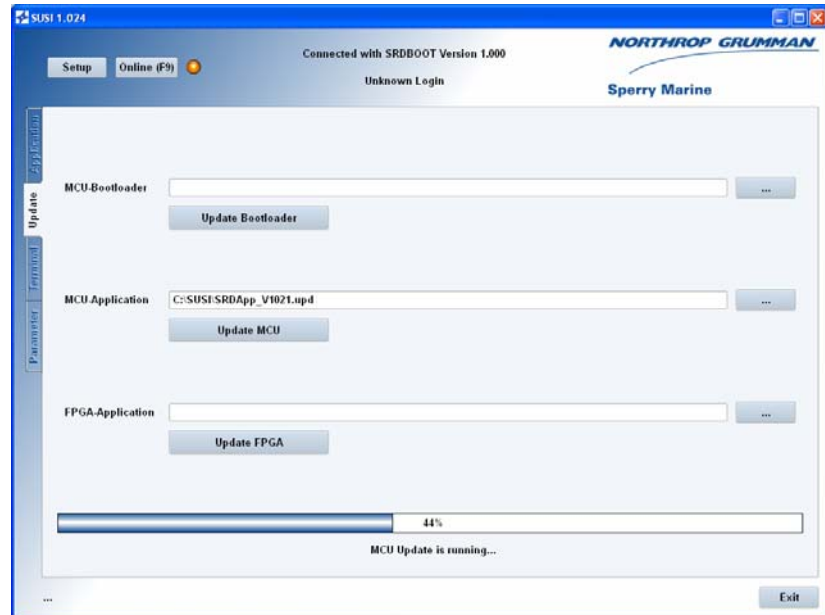


Note



The file open dialog searches for files with the extension ".upd" only. In case the update file has been given another extension for any reason, the filename, including the complete access path, must be entered manually in the respective text box of the update tab.

10. Click  ,  or  respectively to initiate the actual file upload. The bargraph at the bottom of the screen indicates the progress of the update:



11. When the update is complete, unplug the USB cable at the PC and at the preamplifier's service port.



12. The preamplifier now reboots with the new firmware.

8 Troubleshooting

WARNING

Hazardous voltage is present at the transducer terminals located on the fore and aft channel transmit/receive PCBs in the preamplifier D. Danger of electrical shock or burn when the transducer terminals are touched while power is applied to the preamplifier. Do not touch the transducer terminals and do not connect or disconnect the transducer cable while power is applied to the preamplifier.

CAUTION

Components on the preamplifier PCBs are sensitive to static discharge. Take the necessary precautions to prevent electrostatic discharges.

8.1 Resistance Check of the Transducer

A basic resistance check of the transducer may be easily carried out by qualified shipboard or service personnel:

1. Switch off the power to the preamplifier.
2. At the preamplifier, disconnect the transducer:
 - TB 3.1: fore channel (white pair), white
 - TB 3.2: fore channel (white pair), black
 - TB 3.3: fore channel, shield
 - TB 4.1: aft channel (black pair), white
 - TB 4.2: aft channel (black pair), black
 - TB 4.3: aft channel, shield
3. Using an ohmmeter, check for the following resistance values.
 - fore channel (white pair), black to white: $< 10 \Omega$ (typically 2Ω)
 - aft channel (black pair), black to white: $< 10 \Omega$ (typically 2Ω)
 - fore channel shield to any black or white wire: $> 2 \text{ M}\Omega$
 - aft channel shield to any black or white wire: $> 2 \text{ M}\Omega$

Deviations from the above values indicate that the transducer is defective and must be replaced.

8.2 Location of Parts on the Preamplifier PCBs

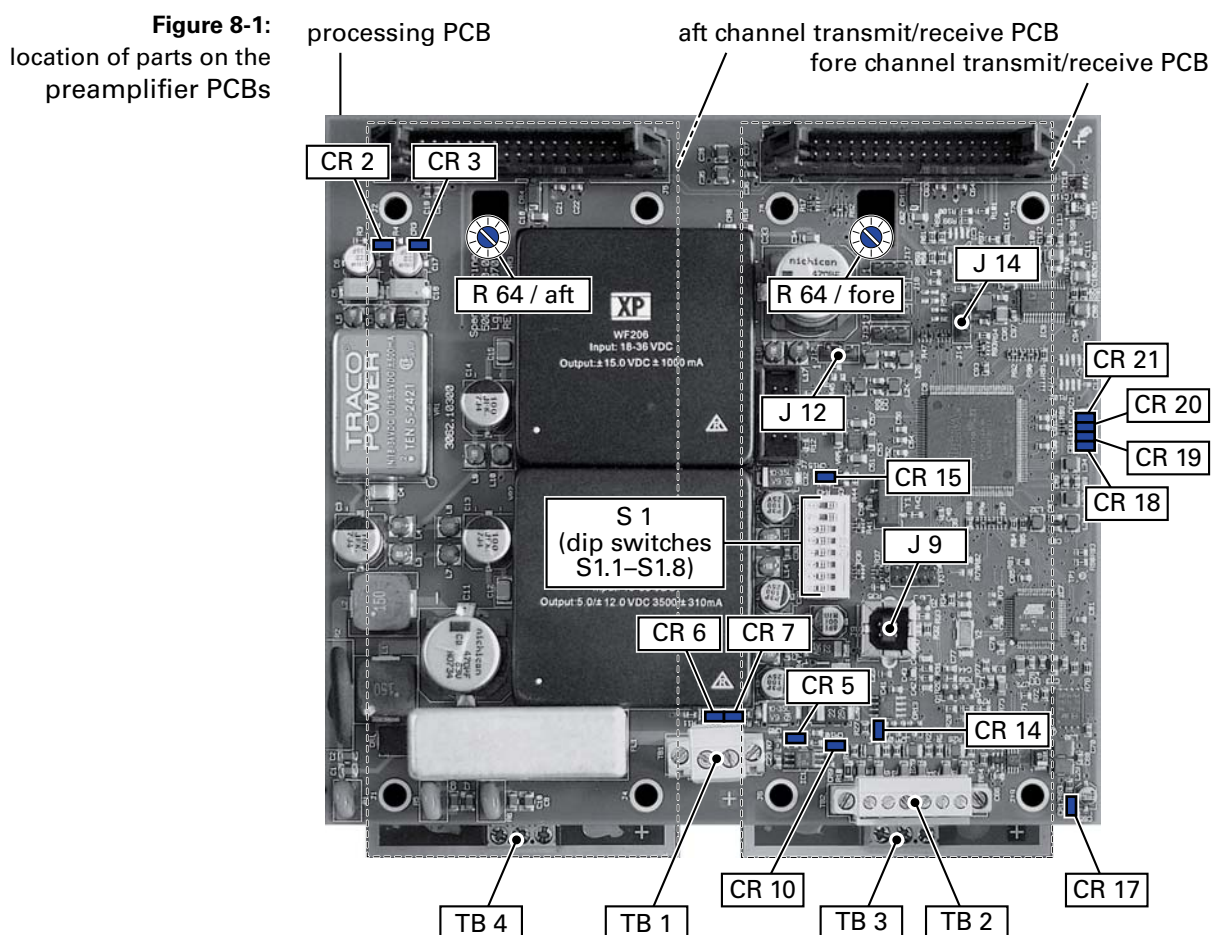
The preamplifier processing PCB and the fore and aft channel transmit/receive PCBs are equipped with surface-mount components. Therefore, the boards are generally not field-serviceable.

However, a number of diagnostic LED indicators are provided on the processing PCB, indicating the presence of supply voltages and activities of the I/O lines. Together with a detailed description of the problem at hand, these may allow to identify the probable cause of malfunction.

If malfunction can be traced down to a defective processing PCB, the complete processing PCB, 20702 is to be exchanged.

If malfunction can be traced down to a defective transmit/receive PCB, the complete transmit/receive PCB (fore or aft), 20713, is to be exchanged.

Figure 8-1 below shows the locations of components, connectors and diagnostic LED indicators on the preamplifier PCBs.



Diagnostic LEDs

Table 1-1:
Diagnostic LEDs

LED	Colour	Indication
CR 2	green	internal +5 VDC analogue power present
CR 3	green	internal -5 VDC analogue power present
CR 5	green	activity on Rx line, TB 2.1/2.2
CR 6	green	internal -12 VDC supply power present
CR 7	green	internal +12 VDC supply power present
CR 10	green	internal +3.3 VDC supply power present (Vcc)
CR 14	green	activity on Tx line, TB 2.3/2.4
CR 15	green	internal +1.2 VDC reference present
CR 17	green	internal +5 VDC supply power present
CR 18	red	all flashing rapidly (some may appear solid on) = normal operation, no faults all flashing irregularly with short interruptions: = normal operation, receiving poor/faulty signal all flashing slowly in sync (1 Hz): = test mode active; all flashing slowly in binary counting sequence = no transducer connected or hardware fault CR 18 and CR 21 flashing slowly and alternately: = software/watchdog fault
CR 19	red	
CR 20	red	
CR 21	red	

Terminal Blocks and Connectors

Table 1-2:
Terminal blocks
and connectors

	Function
TB 1	24 VDC supply power in/out
TB 2	serial data I/O, analogue voltage output
TB 3	Transducer terminals (fore channel transmit/receive PCB)
TB 4	Transducer terminals (aft channel transmit/receive PCB)
J 9	USB service connector

Dip-Switches, Jumpers and Trimpots

Table 1-3:
Dip-switches,
jumpers and trimpots

	Function
S 1	Speed adjustment/configuration dip-switch block
J 12	Transmit circuit activation: jumper across pins 1 and 2 = transmit circuits enabled jumper across pins 2 and 3 = transmit circuits disabled
J 14	Output protocol selection: jumper across pins 1 and 2 = NMEA 0183/IEC 61162-1 jumper across pins 1 and 2 = SRD 331
R 64 fore	Trimpot fore channel transmit power (located on fore channel transmit/receive PCB)
R 64 aft	Trimpot aft channel transmit power (located on aft channel transmit/receive PCB)

Appendix

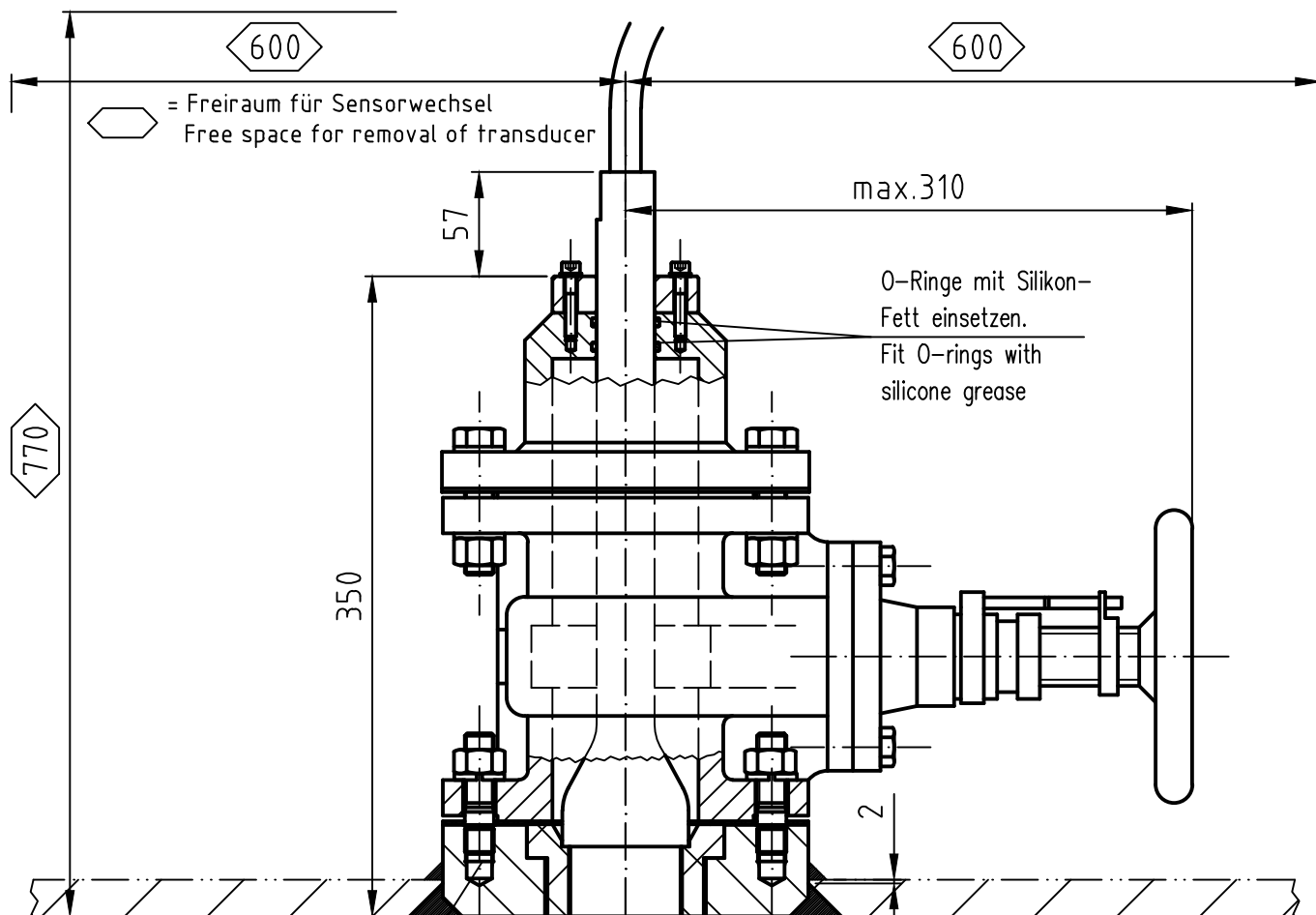
A Drawings

The following drawings are appended to this document:

Designation	Drawing No.
Dimension Drawing Doppler Speed Log Transducer and Sea Chest	4983-0112-01
Dimension Drawing Doppler Speed Log Transducer D for Gate Valve Installation	5020-0112-01
Dimension Drawing Doppler Speed Log Transducer and Tank Mount	4978-0112-01
Doppler Preamplifier 5005 Dimension Drawing	5005-0112-01
Doppler Preamplifier 5005 Wiring Diagram	5005-0115-01

Note

All appended drawings are revision-controlled separately at Sperry Marine. In case of doubt, verify the current revision status of the drawings with Sperry Marine. This document's revision status does not change when the revision of an appended drawing changes.



Stahl-Verstärkungsring
SPERRY MARINE Lieferung.
Aluminium-Verstärkungsring
siehe Bl.2.

Steel attachment collar
SPERRY MARINE delivery.
Aluminium attachment
collar see sheet 2.

Bohrungs-ø200 +1
Hull penetration

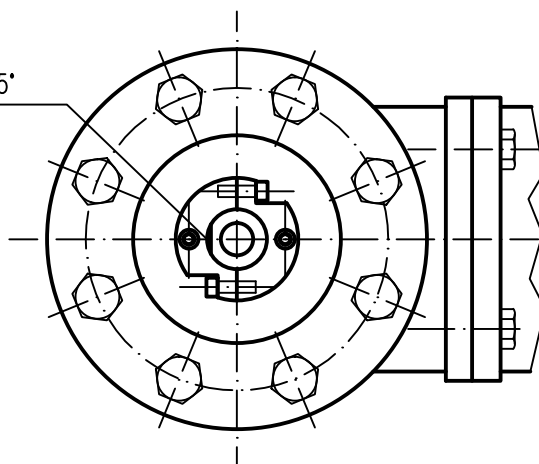
Ohne Sensor und Kunststoffeinsatz
geschweißt und lackiert.
Schweißnaht sauber verputzt und
der Bodenkontur angepaßt.

Welded and painted without
transducer and plastic insert.
All welds should be ground smooth
and flush with hull contour.

Sensor senkrecht (max. Abweichung $\pm 5^\circ$)


zur Vorausrichtung) in der
Kiellinie (max. Abweichung 0,5 m)
montieren. Anflächung nach
Schiffsvoraus ausrichten.

Mount the transducer vertically
(max. deviation to the for/aft
axis $\pm 5^\circ$) on the centerline of
the ship (max. deviation 0,5m).
Position transducer so that flat
on stem is forward.



Lage des Seeventils
beliebig.
Sea chest may be
positioned as required.

Gewicht Seeventil: 40 Kg
Weight Sea Chest:

				<i>NORTHROP GRUMMAN</i>		DATE	NAME	DIMENSION DRAWING Doppler Speed Log Sensor und Bodenzubehör für Stahl- und Aluminiumschiffe Transducer and sea chest for steel and aluminium vessels v ≤ 50 kn	SCALE /	
				Sperry Marine	DRAWN	29.01.2002	Kie		SHEET 1	
					CHD	see ECO				SHEETS 2
E	983281	13.10.2011	Ebe	HAMBURG GERMANY	DOS	4983-0112-011				
D	982669	19.10.09	Ebe	DRAWING No.				REPLACEMENT FOR:	FREE SCALE: DIN ISO 2768 mH	
C	982666	29.07.09	Kie	4983-0112-01						
B	982609	28.05.09	Kie							
AA	980368	13.09.02	Kie							
					FIRST ANGLE PROJECTION	DIMENSIONS IN MILLIMETERS				
REV	ECO-No.	DATE	NAME	STOCK No. 73500						

Sensor Lager Nr (alt). Transducer Stock No. (old)	Sensor Lager Nr (NEU). Transducer Stock No. (NEW)	Kabellänge Length of cable	Gewicht Weight
60232 oder/or 22228	074893	18,3 m	10 kg
60296	074894	40 m	16 kg
	074895	60 m	19 kg

Vorschlag für Aluminium-Verstärkungsring
(Werftbeistellung)

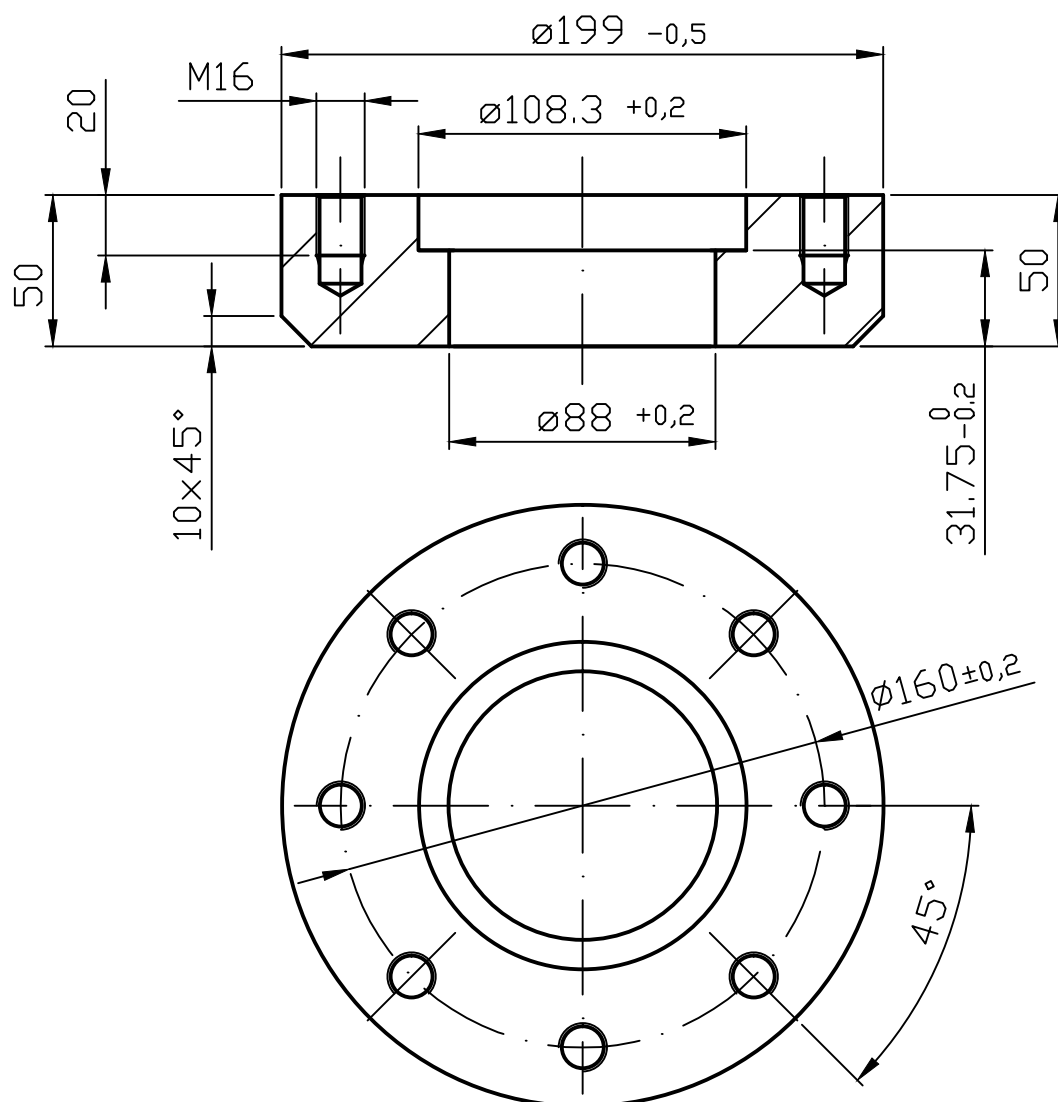
Material entsprechend Schiffsboden.


Für den Fall, daß der Sensor in
flutbare Räume (z.B. Ballasttanks,
Doppelböden) eingebaut wird, müssen
die entsprechenden Sicherheits-
vorschriften eingehalten werden.

Suggestion for aluminium attachment collar
(Yard supply)

Use same material for the collar
as ships bottom.

If the sensor is installed in a
floodable compartment (e.g. ballast-
tanks, double bottom) the applicable
safety regulations are to be observed.



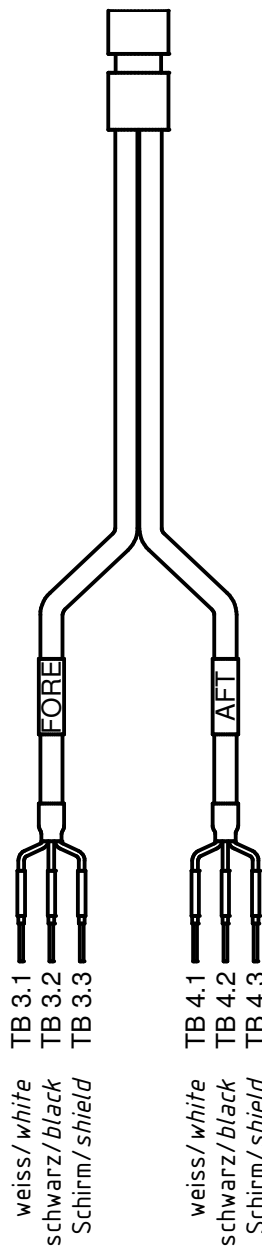
				<i>NORTHROP GRUMMAN</i>		DATE	NAME	DIMENSION DRAWING Doppler Speed Log Sensor und Bodenzubehör für Stahl- und Aluminiumschiffe Transducer and sea chest for steel and aluminium vessels v ≤ 50 kn	SCALE /	
				Sperry Marine	DRAWN	29.01.2002	Kie			SHEET 2 SHEETS
					CHD	see ECO			2	
E	983281	13.10.2011	Ebe	HAMBURG GERMANY	DOS	4983-0112-012				
D	982669	19.10.09	Ebe	DRAWING No.				REPLACEMENT FOR:	FREE SCALE: DIN ISO 2768 mH	
C	982666	29.07.09	Kie	4983-0112-01						2
B	982609	28.05.09	Kie		FIRST ANGLE PROJECTION	DIMENSIONS IN MILLIMETERS	SHEETS			
AA	980368	13.09.02	Kie							
REV	ECO-No.	DATE	NAME	STOCK No. /						

Fäche nach Schiffsvoraus
ausrichten.
*Align flat face towards
ship ahead.*

406,4

Ø31,75

Ø60,5



Der Sensor ist mit Kabel kalibriert.
Kürzen oder Spleißen des Kabels
ist nicht zulässig.
*The Sensor is calibrated with its
cable. Do not cut or splice cable.*

Sensorkabel ist halogenfrei und
schwer entflammbar,
erfüllt DIN EN 50265-2-1.
*Sensor cable is free of halogens
and flame retardant, complies
DIN EN 50265-2-1.*

Bei der Installation sind alle
relevanten Brandschutz-
bestimmungen zu beachten.
*Regarding installation all
relevant fire regulations
have to be followed.*

Bodenzubehör und Installation
siehe 4983-0112-01.
*For Gate Valve and Installation
see 4983-0112-01.*

Table 1

Type	Stock.No.	Cable Length	Weighth
5020-AA	074893	18m	10kg
5020-AB	074894	40m	16kg
5020-AC	074895	60m	19kg

NORTHROP GRUMMAN

Sperry Marine

HAMBURG GERMANY

DRAWING No.

5020-0112-01

STOCK No.

see Table 1

DATE

17.10.2011

see ECO

DOS

NAME

Ebe

DIMENSION DRAWING

Doppler Speed Log
Transducer D

for

Gate Valve Installation



FIRST ANGLE
PROJECTION

DIMENSIONS IN
MILLIMETERS

REPLACEMENT FOR:

SCALE

1:2

A4

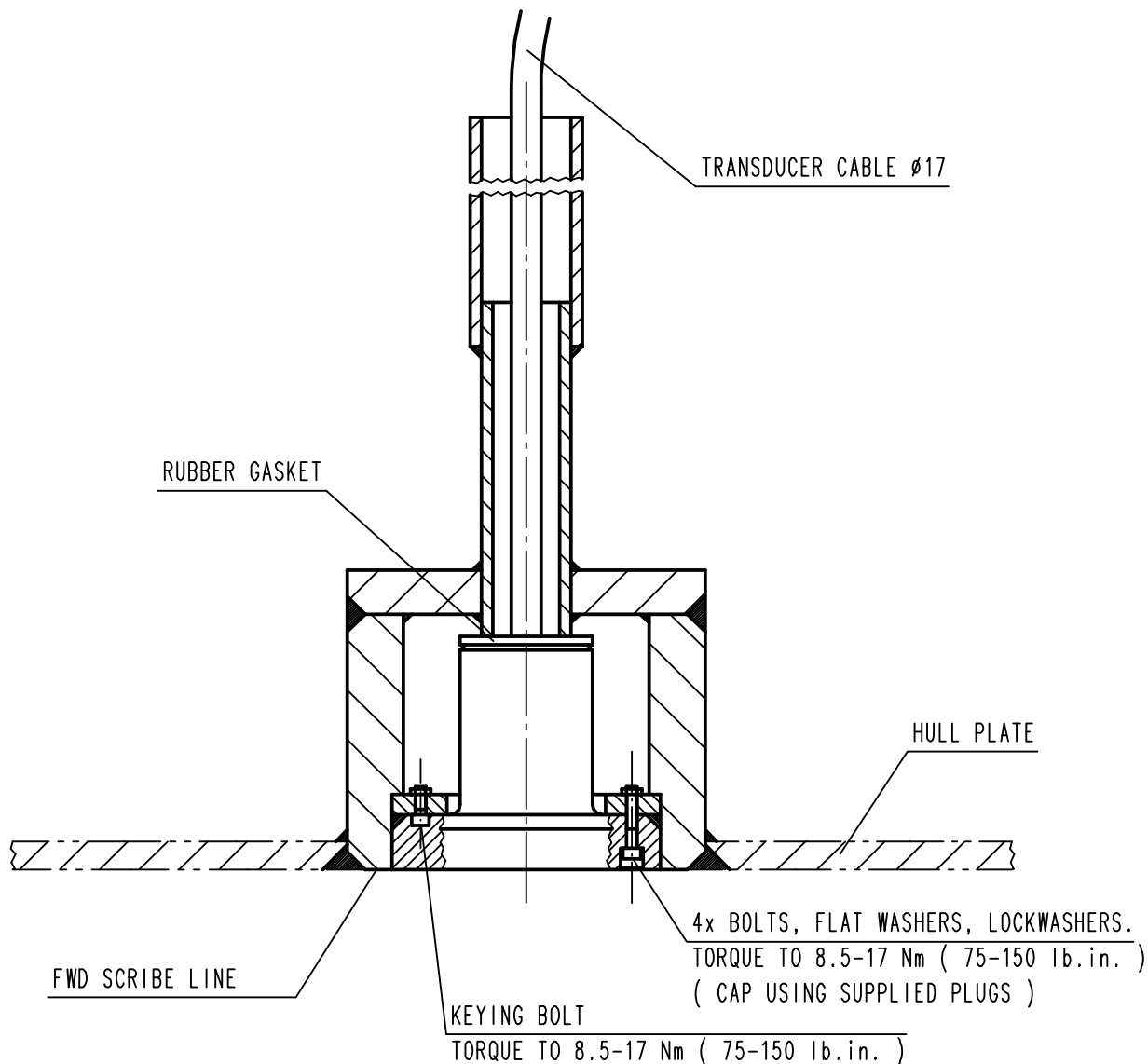
SHEET

1

SHEETS

1

B	983291	28.10.2011	Ebe
A	983281	17.10.2011	Ebe
REV	ECO-No.	DATE	NAM



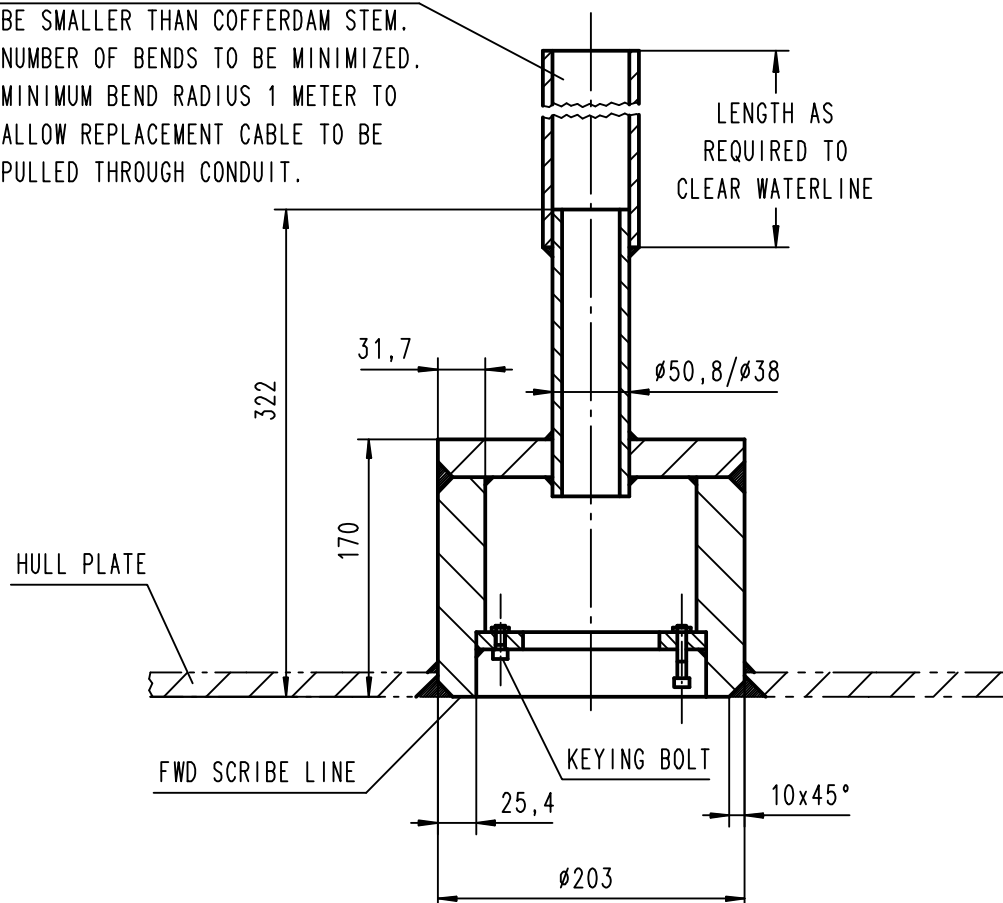
NOTES:

APPLY THREAD LUBRICANT (REYNOLDS METEL CO. MRL-5-74-38 OR EQUIVALENT) LIGHTLY TO ALL THREADS. ROTATE TRANSDUCER HOUSING UNTIL IT SEATS OVER KEYING BOLT.
 THE TRANSDUCER CABLE CARRIES LOW LEVEL SIGNALS. IT SHOULD NOT BE BUNDLED WITH OTHER CABLES WHICH MIGHT CAUSE INTERFERENCE.
 DO NOT ALLOW FACE OF TRANSDUCER TO BE SCRATCHED.
 DO NOT EXPOSE FACE TO OIL OR SILICON BASE COMPOUNDS.
 FACE SHOULD NOT BE PAINTED.

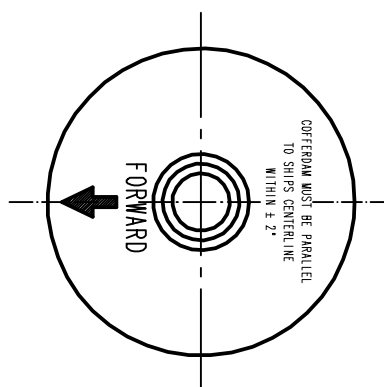
Type		Lager Nr.		Kabellänge		Ersatzsensor Lager Nr.	
		Stock No.		Length of cable		Replacement transducer Stock No.	
4978		73494		18m		73497	
4978-AA		73495		25m		73498	
4978-AB		73496		36m		73499	

				NORTHROP GRUMMAN			DATE	NAME	DIMENSION DRAWING Doppler Speed Log Sensor und Bodenzubehör für Stahlschiffe Transducer and tank mount for steel vessels $v \leq 50 \text{ kn}$	SCALE /
				Sperry Marine		DRAWN	12.02.2002	Kie		SHEET 1 SHEETS
						CHD	see ECO			
B1	982203	12.11.07	Kie	HAMBURG	GERMANY	DOS	4978-0112-011			
B	981513	04.03.05	Ho.	DRAWING No. 4978-0112-01					REPLACEMENT FOR: FREE SCALE: DIN ISO 2768 mH	2
AB1	98998	14.03.02	Kie							
AB	98966	27.02.02	Kie	FIRST ANGLE PROJECTION DIMENSIONS IN MILLIMETERS						
AA	98927	12.02.02	Kie	STOCK No. see above						
REV	ECO-No.	DATE	NAME							

SHIPYARD SUPPLIED I.D. SHALL NOT BE SMALLER THAN COFFERDAM STEM. NUMBER OF BENDS TO BE MINIMIZED. MINIMUM BEND RADIUS 1 METER TO ALLOW REPLACEMENT CABLE TO BE PULLED THROUGH CONDUIT.




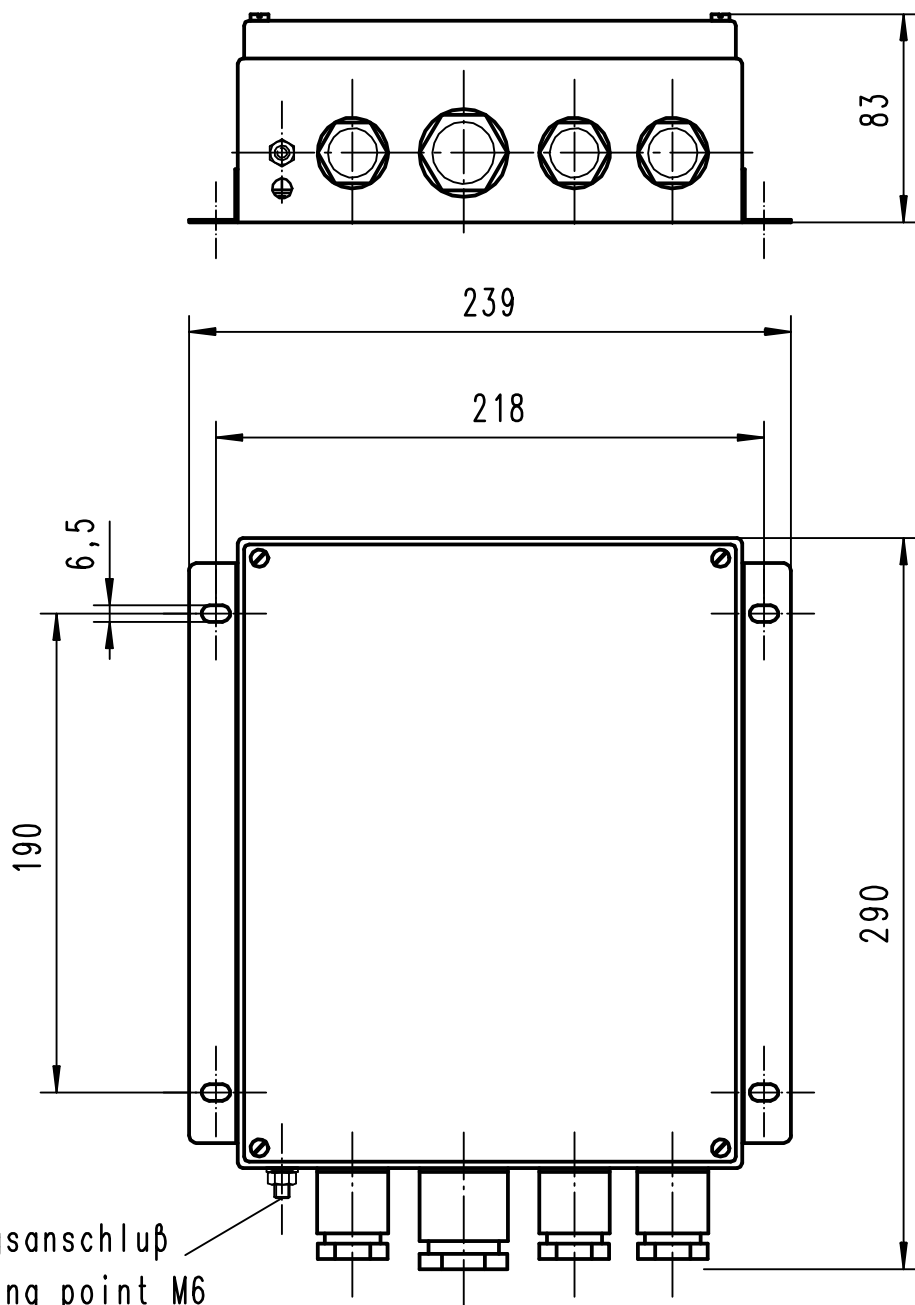
INSTALL COFFERDAM WITH FORWARD ARROW ALIGNED WITHIN 2' OF VESSELS CENTERLINE.



NOTES:

BEFORE INSTALLING THE TRANSDUCER, GRIND WELD FLUSH WITH HULL ALL AROUND AND PAINT.
COFFERDAM MATERIAL IS CARBON STEEL TYPE ASTM A519 OR EQUIVALENT.
BOLTS INCLUDED, REMOVE BEFORE INSERTING TRANSDUCER.
COFFERDAM MUST BE PROPERLY LOCATED IN THE HULL SUCH THAT THE TRANSDUCER CONTINUOUSLY OPERATES IN NON-AERATED WATER.
NO HULL APPENDAGES OR CAVITIES WHICH WILL DISTURB THE WATER FLOW UNDER THE TRANSDUCER SHOULD BE PRESENT.

				<div>NORTHROP GRUMMAN</div>		DATE	NAME	DIMENSION DRAWING	SCALE		
				<div>Sperry Marine</div>	DRAWN	12.02.2002	Kie			Doppler Speed Log Sensor und Bodenzubehör für Stahlschiffe Transducer and tank mount for steel vessels $v \leq 50 \text{ kn}$	/
					CHD	see ECO					
B1	982203	12.11.07	Kie	HAMBURG GERMANY	DOS	4978-0112-012		SHEET 2 SHEETS 2			
B	981513	04.03.05	Ho.	DRAWING No. 4978-0112-01							
AB1	98998	14.03.02	Kie	<div> FIRST ANGLE PROJECTION</div> <div>DIMENSIONS IN MILLIMETERS</div>							
AB	98966	27.02.02	Kie								
AA	98927	12.02.02	Kie								
REV	ECO-No.	DATE	NAME	STOCK No. /			REPLACEMENT FOR:	FREE SCALE: DIN ISO 2768 mH			



Magnetischer Schutzabstand/Magnetic clearance: 0,3m
 Schutzart/Protection grade: IP65
 Gewicht/Weight: 3kg

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