JRC

ALPHATRON Marine

Rudder Feedback Unit MD/HD

Installation and Operation Manual

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I Preface

The Rudder Feedback Unit is a high quality, ruggedized, easy to install rudder feedback unit.

- Thoroughly read this instruction manual before installation and operation of the equipment.
- We recommend to keep this manual nearby the equipment to ensure ready access to it.

I.1 Revision History

Revision No.	Description	Date
V1.0	First issue	2 March 2016

I.2 Glossary

The glossary contains a list of definitions and a list of abbreviations.

I.2.1 Definitions

The meaning of standard definitions as used in this manual are explained in *Table 1: Definitions* on page 4.

Redundant	A device that is equipped with multiple part of the same type, for example a double power supply. This equipment will continue to function when one of the redundant part fails.
Heading users	Navigation equipment that uses heading/course information for functioning.
Hardware	The physical parts of the AlphaLine instrument.
LEDs	Light-emitting diodes. These are used for signaling statuses of hardware and software signals to the user.
Central alarm system / Bridge watch monitoring	System that is connected to all vital systems on a ship and that is able to give a centralized indication of the (alarm)status of all connected systems.
NMEA protocol	Protocol standard for transmitting and receiving of asynchronous serial data sentences.
Talker	Device which transmits data. This is usually called transmitter or TX.
Listener	Device which receives data. This is usually called receiver or RX.
ISO GND	Isolated Ground. This is a ground connection to be used for reference signal. It is different from EARTH and should normally not be connected to EARTH.
Grounding point/stud	Point on the chassis of the AlphaLine instrument which should be connected to the ship's mass.
Printed Circuit Board	A printed circuit board, or PCB, is used to mechanically support and electrically connect electronic components using conductive pathways, or traces, etched from copper sheets, laminated onto a non-conductive substrate.
(Galvanic) isolated	Electrical separation of two circuits. There is no current flowing directly from one circuit to another. Electrical energy and/or information can still be exchanged between the sections by other means, such as by induction or by optical means (like transformers or opto couplers).
CAN bus	Controller Area Network. This is a network based serial bus system used for exchanging information. It is the advanced version of RS485/422 serial buses.
Reverse polarity protection	This is a part of the power supply hardware that prevents any damage to the equipment when the power supply is connected to the wrong polarity.
ROT signal	Rate Of Turn (ROT) signal indicates the course change of a ship in degrees per minute. This signal can be analog using voltage or current, or can be an NMEA data signal.
Heading/bearing repeaters	Navigation type of instruments displaying the heading/course of a ship.

Baud rate	This is the transmission speed of serial interfaces in characters per second.
Transmitting interval	The frequency at which complete NMEA sentences are being transmitted in number of times per second.
Factory setting	Instrument setting for backlight color, language, number of connected apparatus, etc. as configured as a new instrument by the factory.
Flash memory	Non-volatile type of memory. This type of memory retains its contents even when the instrument is turned off.
Firmware	(Embedded) software inside the processors of the AlphaLine instrument.
Compass safe distance	The minimum distances to equipment that will not cause an unacceptable deviation of the ship's standard and steering compasses.

Table 1: Definitions

I.2.2 Abbreviations

Abbreviations as used in this manual are explained in *Table 2: Abbreviations* on page 5.

A	Ampere
ARD	AlphaLine Repeater Display
CAN	Controller Area Network
CT	Chain Transmission
DC	Direct Current
DP	Dynamic Position
ECDIS	Electronic Chart Display Information System
GPS	Global Positioning System
I/O	Inputs and Outputs
I.S.	Inter Switch
LED	Light-Emitting Diode
LT	Linkage Transmission
mA	Milliampere
mm	Millimeter
NC	Normally Closed
NMEA	National Marine Electronics Association
NO	Normally Open
OA	Operational Alarm
TAP	Type Approval Program
PCB	Printed Circuit Board
RCU	Remote Control Unit
RFU	Rudder Feedback Unit
RFU HD	Rudder Feedback Unit High Duty

RFU MD	Rudder Feedback Unit Medium Duty
ROT	Rate Of Turn
VAC	Volts Alternating Current
VDC	Volts Direct Current
VDR	Voyage Data Recorder
W	Watt

Table 2: Abbreviations

I.3 Norms and Standards

The complies with the applicable standards, norms and regulations:

- IEC 60945 (2002) including IEC 60945 Corrigendum 1 (2008)
- Standard DNV 2.4
- IEC 61162 series

II Warnings and Cautions

The signal words WARNING and CAUTION used in this manual indicate the degree of hazard that may be encountered by the user. These words are defined as:

- WARNING
- A WARNING indicates potential risk of injury or death to users of the product.

- CAUTION
- A CAUTION indicates potential risk of damage to equipment.

To safely install and operate this instrument, so as not to adversely affect the warranty, the following WARNINGS and CAUTIONS must be adhered to.

- WARNING
- Do not disassemble or modify the equipment. Failure to observe this instruction may cause a fire, electric shock, or equipment failure.

- WARNING
- Do not insert or remove the power cord or operate switches with a wet hand. Otherwise, you may suffer an electrical shock.

- WARNING
- Operate the equipment only at the power supply voltage of 24 VDC. Failure to observe this instruction can cause a fire, electric shock, or equipment failure

- WARNING
- Do not scratch, damage, modify, heat, pull, excessively bend, or heavily load the power supply cable. It may cause a fire, or electric shock.

- WARNING
- Immediately turn off the power and disconnect the power supply cable if the equipment is generating any smoke or odor, or is overheated. Immediately inform your local service agent of the symptom to have it repaired. Prolonged equipment operation under such a condition can cause a fire or electric shock.

- WARNING
- Do not place a vessel containing liquid on the equipment. It may cause a fire, electrical shock, or a failure to the equipment if knocked over.

- WARNING
- The axle of the Rudder Feedback Unit has to be zeroed before the rudder feedback unit can be operated. Damage to the rudder feedback unit, or any of its components, can occur when the axle is not properly zeroed. Moreover, without zeroing the axle the rudder readings can be completely wrong and so endanger ships operation and its personnel.

- WARNING
- The maximum angle (135 degrees) of the Rudder Feedback Unit may not be exceeded, since this will compromise the accuracy of the potentiometer output.

- CAUTION
- Any modification to this equipment without prior written permission from ALPHATRON MARINE will void the warranty.

- CAUTION
- Installation of this product shall only be done by a certified installation company approved by either ALPHATRON MARINE or by an official ALPHATRON MARINE distributor. Acting otherwise will void the warranty.

- CAUTION
- This product must be installed in accordance with the installation methods described in this manual. Acting otherwise will void the warranty.

- CAUTION

- This product contains no operator serviceable parts. Service and repair shall only be carried out by personnel trained and certified by ALPHATRON MARINE.

- CAUTION
- Do not allow the instrument to fall or immerse into water. The equipment can be damaged.

- CAUTION
- When unplugging the instrument, be sure to remove the cord terminal correctly. If the cord is pulled, the cord may get damaged resulting in a fire or an electrical shock.

- CAUTION
- If the instruments are not stored as described, it will void the warranty.

- CAUTION
- When cleaning the surface, do not use any organic solvent such as thinner or benzine. Otherwise, the paint and markings on the surface may get damaged. For cleaning the surface, remove the dust and debris and wipe with a clean dry cloth.

II.1 Warranty

Non-compliance with the installation, operation and maintenance requirements may void the warranty. Read *Warnings and Cautions* on page 7.

Contact the Alphatron dealer regarding the terms of the warranty.

II.2 Storage

The AlphaLine range of instruments are sensitive to humidity, temperature fluctuations and aggressive substances. Store them appropriately.

- CAUTION
- If the instruments are not stored as described, it will void the warranty.

III Introduction

The Rudder Feedback Unit can be used in a rudder angle indicator system and as a part of the control loop in a steering control system. There are two types of Rudder Feedback Units available: Rudder Feedback Unit MD and Rudder Feedback Unit HD.

The Rudder Feedback Unit contains a potentiometer which is proportional to the rudder angle. The output can be connected to an Analog Interface Mk.2. The Rudder Feedback Unit can be mechanically coupled to the rudder post via a RFU Chain Transmission or a RFU Linkage Transmission.

1 Installation Instructions

This chapter describes the installation of the Rudder Feedback Unit MD/HD.

1.1 Mechanical Installation

- CAUTION
- This product must be installed in accordance with the installation methods described in this manual. Acting otherwise will void the warranty.

1.1.1 Supplied Parts

The Rudder Feedback Unit MD/HD is delivered as a fully assembled product. No additional assembly is required.

1.1.2 Dimensions

Carefully check the applicable drawing(s) of the instrument. See *Mechanical Drawings* on page 23.

1.1.3 Installing Rudder Feedback Unit

Installing the Rudder Feedback Unit

The Rudder Feedback Unit should be installed so that the Linkage Transmission or the Chain Transmission is exactly horizontal. The horizontal distance between the rudder center and the center of the Rudder Feedback Unit should be between 400 to 800 mm, see *Figure 1: RFU Linkage Transmission Installation* on page 10 and *Figure 2: RFU Chain Transmission Installation* on page 10.

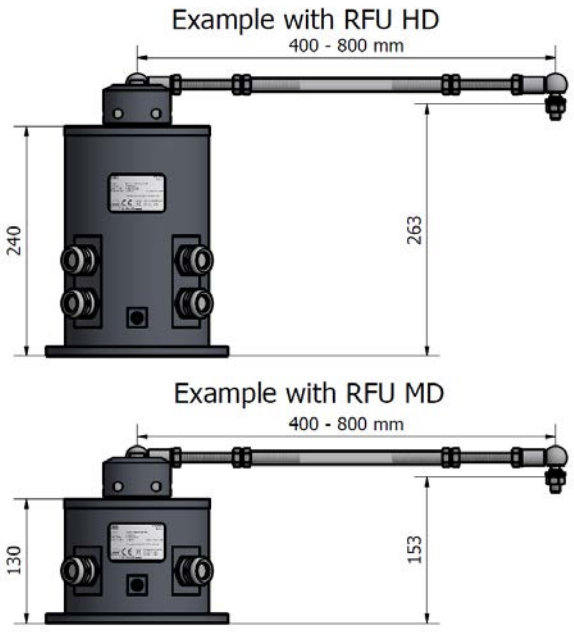


Figure 1: RFU Linkage Transmission Installation

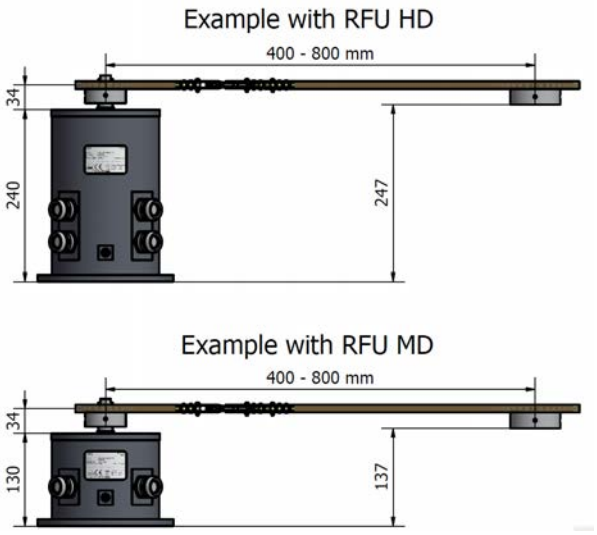


Figure 2: RFU Chain Transmission Installation

The Rudder Feedback Unit should be mounted on a foundation (yard supply), see *Figure 3: Example of a Foundation* on page 11. Use 4 M8 bolts (not included) to mount the Rudder Feedback Unit.

Put the Rudder Feedback Unit in a location and facing a direction so that the cables can be installed through the cable guides and the Rudder Feedback Unit can be easily reached for installation, calibration and service.

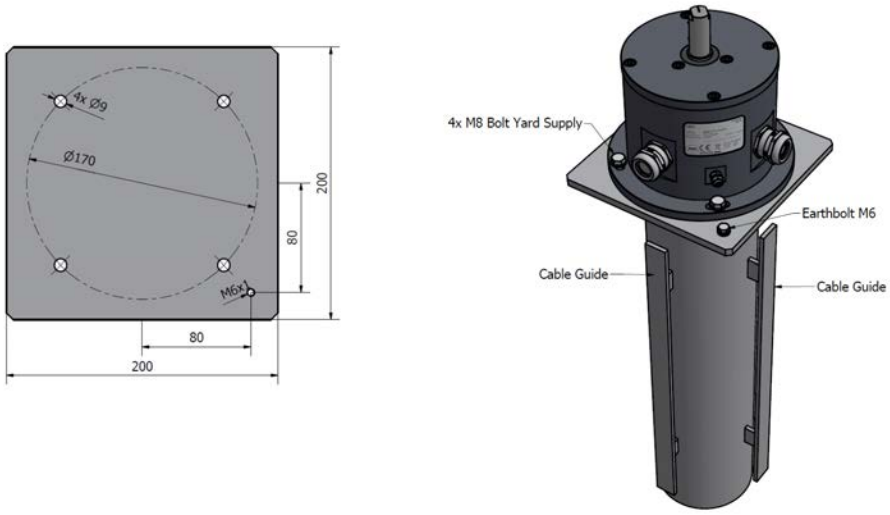


Figure 3: Example of a Foundation

Cables

Only screened cables should be used. The screen must be connected to the cable glands according to *Figure 4: Using Cable Glands* on page 11.

Figure 4: Using Cable Glands

Installing the Linkage Transmission

The Linkage Transmission is delivered with all necessary parts except for the RFU LT TUBE. This part is yard delivery. The yard should determine the proper length and weld one nut with left threat to one side and one nut with right threat on the other side.

When the Linkage Transmission is used, the angle of the rods should be exactly 90 degrees at a rudder angle of 0 degrees. The distance d2 from the center of the rudder to the ball and socket joint should be exactly the same as the distance d1 between center of the rudder feedback axle and the corresponding ball and socket joint, see *Figure 5: Rudder Example with Linkage Transmission (Top View)* on page 12.

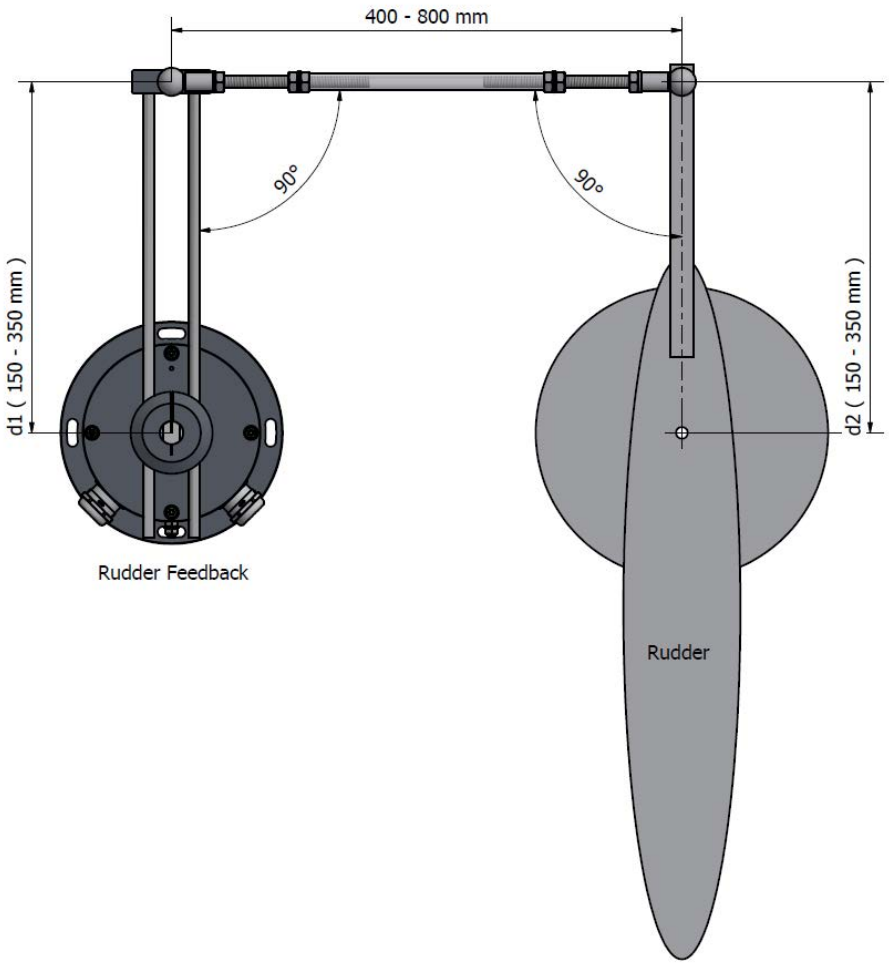


Figure 5: Rudder Example with Linkage Transmission (Top View)

Installing the Chain Transmission

The Chain Transmission is delivered complete with a sprocket with 25 teeth (Rudder Feedback Unit side) and a sprocket with 28 teeth (rudder side), and parts to create the appropriate tension. When the Chain Transmission is used, the Rudder Feedback Unit can be placed in any direction compared to the rudder as long as it is easy accessible for installation and maintenance.

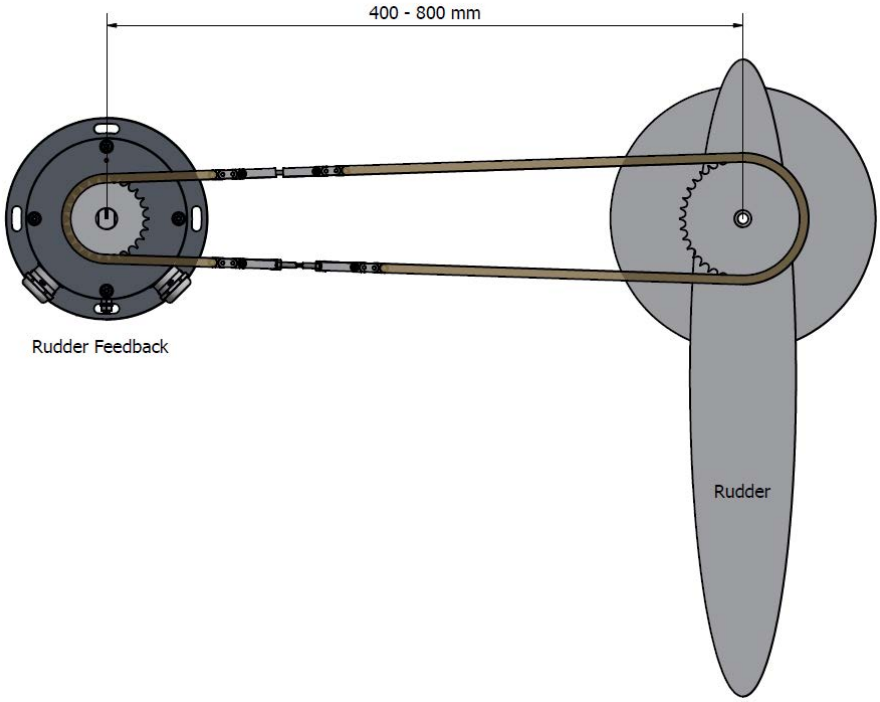


Figure 6: Rudder Example with Chain Transmission (Top View)

The chain of the Chain Transmission is delivered with a total length of 2 meters, divided in a short and a long part. The short part has to be installed at the side of the Rudder Feedback Unit. The long part can be shortened by removing links to create the desired length.

The tension of the chain can be changed by rotating the stud bolt (5) with left and right thread, see *Figure 7: Stud Bolt* on page 13.

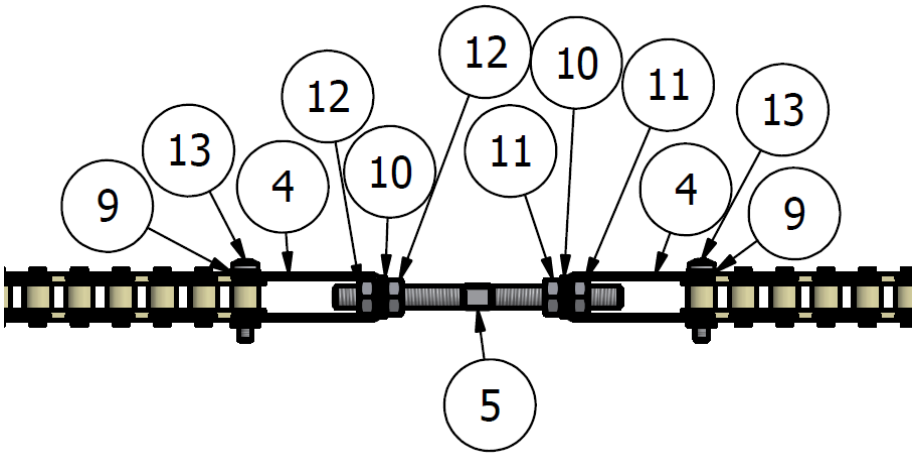


Figure 7: Stud Bolt

The proper tension (100 N) is reached when compression spring (6) is almost completely compressed.

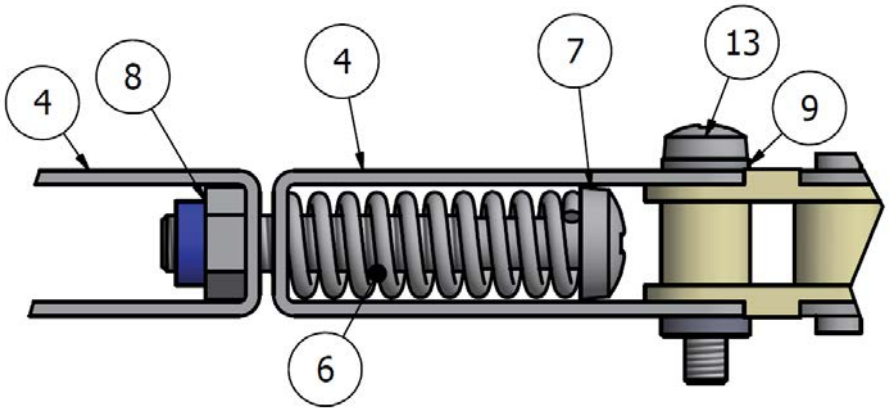


Figure 8: Compression Spring

After adjusting, nuts (11) and (12) must be secured, see *Figure 7: Stud Bolt* on page 13.

1.1.4 Module Electric Connections

The Rudder Feedback Unit needs to be opened to connect the wires, see *Opening Rudder Feedback Unit MD* on page 14 and *Opening Rudder Feedback Unit HD* on page 16.

For electric connections, see *Figure 19: Connection Diagram Rudder Feedback Unit MD* on page 28 and *Figure 20: Connection Diagram Rudder Feedback Unit HD* on page 29.

1.1.4.1 Opening Rudder Feedback Unit MD

The Rudder Feedback Unit MD needs to be opened to connect the wires.

1. Remove the four outer screws on top of the Rudder Feedback Unit MD, see *Figure 9: Rudder Feedback Unit MD Four Outer Screws* on page 14.

   INFO:

Figure 9: Rudder Feedback Unit MD Four Outer Screws

2. Gently remove the top part of the Rudder Feedback Unit MD.

INFO:

Figure 10: Removing Rudder Feedback Unit MD Top

3. Disconnect the 2 connectors and the earth connection.

   The Rudder Feedback Unit MD is now open for connection of the wires according to *Figure 19: Connection Diagram Rudder Feedback Unit MD* on page 28.

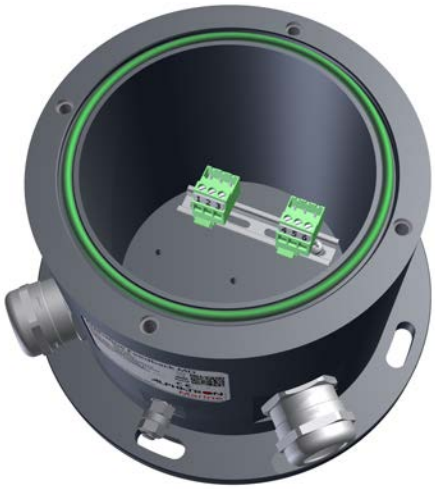


Figure 11: Rudder Feedback Unit MD Electric Connections

When the connections have been made, replace the connectors and close the Rudder Feedback Unit MD. Pay attention to the O-ring. The red zero position marking should be in the opposite direction of the earth stud.

To close the Rudder Feedback Unit MD, tighten the 4 bolts with 11 Nm.

1.1.4.1.1 Adjusting Potentiometers

Adjusting the Potentiometers

The potentiometers are aligned in the factory. The middle position of the potentiometers corresponds with the mark on top of the axle and the red dot on top of the Rudder Feedback Unit MD. When further adjustment is to be made, this has to be done in the equipment connected to the Rudder Feedback Unit MD.

1.1.4.2 Opening Rudder Feedback Unit HD

The Rudder Feedback Unit HD needs to be opened to connect the wires.

1. Remove the 10 screws of the front hatch, see *Figure 12: Rudder Feedback Unit HD Ten Front Hatch Screws* on page 16.

   INFO:

Figure 12: Rudder Feedback Unit HD Ten Front Hatch Screws

2. Remove the front hatch of the Rudder Feedback Unit HD.

   The Rudder Feedback Unit HD is now open for connection of the wires according to *Figure 20: Connection Diagram Rudder Feedback Unit HD* on page 29.

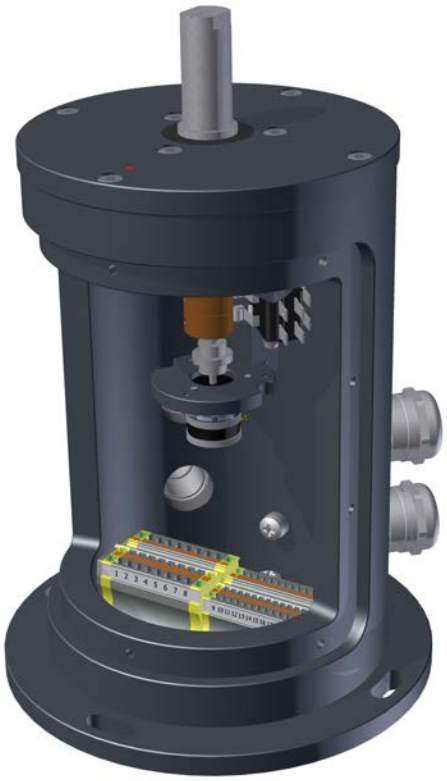


Figure 13: Rudder Feedback Unit HD Electric Connections

When the connections have been made, close the front hatch of the Rudder Feedback Unit HD. When replacing the screws, first apply the middle top and the middle bottom screw of the hatch and torque to 6,5 Nm.

After this, all other screws can be replaced and torqued to 6,5 Nm.

1.1.4.2.1 Adjusting Limit Switches and Potentiometers

Adjusting the Limit Switches

When adjustment of the limit switches of the Rudder Feedback Unit HD is needed, use an Allen key to loosen the corresponding cam and adjust it.

After adjustment, tighten the screw again to secure it. See *Figure 14: Rudder Feedback Unit HD Limit Switches* on page 18 for information on which limit switch is connected to which system and direction.

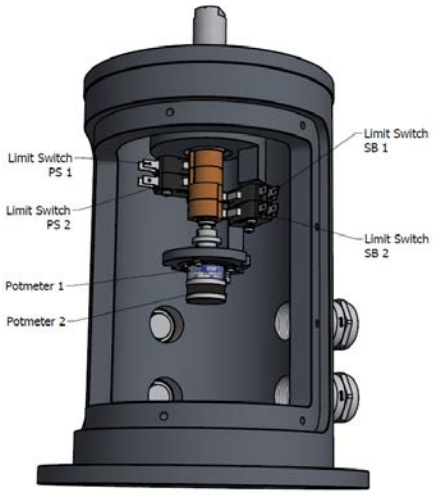


Figure 14: Rudder Feedback Unit HD Limit Switches

Adjusting the Potentiometers

The potentiometers are aligned in the factory. The middle position of the potentiometers corresponds with the mark on top of the axle and the red dot on top of the Rudder Feedback Unit HD. When further adjustment is to be made, this has to be done in the equipment connected to the Rudder Feedback Unit HD.

1.1.5 Cable

Use the following connection cables:

Name	Specification	Shield (Y/N)	Norm
Potentiometer signal	3 x 1.5 mm^2	Y	
Limit switches	4 x 1.5 mm^2	Y	

Table 3: Connection Cables

1.1.6 Grounding Modules

To function properly, the Rudder Feedback Unit must be grounded to the ship's mass.

For this purpose, the Rudder Feedback Unit has a grounding bolt. Connect the grounding bolt to the ship's mass with a low impedance connection.

2 Operation

I Operating the Rudder Feedback Unit

The Rudder Feedback Unit can be used in a rudder angle indicator system and as a part of the control loop in a steering control system. The output can be connected to an Analog Interface Mk.2. There are two types of rudder feedback units available: Rudder Feedback Unit MD and Rudder Feedback Unit HD.

The Rudder Feedback Unit MD is medium in size. It is equipped with a dual potentiometer (2 x 2KΩ) which can transfer the rudder angle to 2 different systems. There are no limit witches present in the Rudder Feedback Unit MD.

The Rudder Feedback Unit HD is larger in size. It is equipped with a dual potentiometer (2 x 2KΩ) which can transfer the rudder angle to 2 different systems. The Rudder Feedback Unit HD has two sets of limit switches.

There are two types of transmissions to choose from:

- RFU Linkage Transmission
- RFU Chain Transmission

The Rudder Feedback Unit MD and the Rudder Feedback Unit HD can each be equipped with either the RFU Chain Transmission or the RFU Linkage Transmission.

Limit Switches

The Rudder Feedback Unit HD is equipped with limit switches. There are two sets of limit switches; two for port side and two for starboard. The function of the limit switch is to open its contact once a certain position on the rudder feedback axle is reached. Utilizing this contact signal from the limit switch, the limit switch can be used to prevent the rudder from moving further than a predefined angle or to indicate that the rudder has reached its maximum position.

Note The limit switches need to be physically set. Each limit switch has an adjustment screw by which the limit switch can be set. The adjustment screw can easily be operated when the hatch of the RFU HD is removed.

Note The limit switch itself does not start or stop the rudder. The limit switch simply opens its contact at certain angle of the rudder feedback axle. It is up to third party systems to use the contact of the limit switch for controlling the rudder.

RFU Chain Transmission

The principle of the RFU Chain Transmission is quite straight forward. The Rudder Feedback Unit and the rudder are connected via a chain. The movement (turning) of the rudder is transferred to the Rudder Feedback Unit via the chain. The potentiometer of the Rudder Feedback Unit translates that movement into a potentiometer output signal. It is up to other systems to pick up the signal from the Rudder Feedback Unit and translate it in readable values for ship's personnel.

RFU Linkage Transmission

The principle of the RFU Linkage Transmission is that the Rudder Feedback Unit and the rudder itself are connected via a linkage system. The movement (turning) of the rudder is transferred to the Rudder Feedback Unit via the linkage system. At the Rudder Feedback Unit, the linkage system will turn the axle of the Rudder Feedback Unit. And so, when the axle of the Rudder Feedback Unit turns, the output of the potentiometer will change, and with that, the reading of the rudder angle. Depending on how the limit switches are set, turning the axle the limit switches will in turn open their contacts.

Important Notes

Any dead-band setting regarding the Rudder Feedback Unit needs to be set in the device that receives the potentiometer signals from the Rudder Feedback Unit. Dead-band settings cannot be made in the Rudder Feedback Unit itself.

As long as all parts of the Rudder Feedback Unit are functioning properly, no calibration of the Rudder Feedback Unit, or any of its parts, is needed. If any of the rudder readings are off and the potentiometer signal from the Rudder Feedback Unit is OK, then calibration of the rudder readings needs to be done in the device that receives the potentiometer signals from the Rudder Feedback Unit.

- WARNING
- The axle of the Rudder Feedback Unit has to be zeroed before the rudder feedback unit can be operated. Damage to the rudder feedback unit, or any of its components, can occur when the axle is not properly

zeroed. Moreover, without zeroing the axle the rudder readings can be completely wrong and so endanger ships operation and its personnel.

The maximum angle that the axle (and the attached potentiometer) of the Rudder Feedback Unit can turn, is measured from the zero position marking. The zero position marking is listed as a red dot on the top of the Rudder Feedback Unit. When the axle is aligned with the zero position marking, the axle is able to rotate 135 degrees both ways.

Note

- WARNING
- The maximum angle (135 degrees) of the Rudder Feedback Unit may not be exceeded, since this will compromise the accuracy of the potentiometer output.

3 Maintenance

- CAUTION
- This product contains no operator serviceable parts. Service and repair shall only be carried out by personnel trained and certified by ALPHATRON MARINE.

Maintenance and repair of the Rudder Feedback Unit should only be performed by personnel that is familiar with the Alphatron Rudder Feedback Unit.

- CAUTION
- When cleaning the surface, do not use any organic solvent such as thinner or benzine. Otherwise, the paint and markings on the surface may get damaged. For cleaning the surface, remove the dust and debris and wipe with a clean dry cloth.

3.1 Rudder Feedback Unit Maintenance

Before starting maintenance on the Rudder Feedback Unit, make sure the rudder is securely chained in its zero position.

Note

- CAUTION
- For safe and reliable operation of the Rudder Feedback Unit, use only specified Alphatron parts.

3.1.1 RFU Chain Transmission Maintenance

The chain used on the Rudder Feedback Unit does not need lubrication. The chain is lube-free due to its plastic rollers. The plastic of these rollers will automatically lubricate the chain and the sprockets it runs over.

Yearly maintenance tasks:

1. Check if the mounting bolts of the Rudder Feedback Unit are still properly fastened.
2. Check if the screws of the feedback sprocket, i.e. the screws that fasten the sprocket to the axle, are properly fastened.

   INFO: If the screws are loose, apply new Loctite 243 before fastening the screws.
3. Check if the screws of the rudder sprocket, i.e. the screws that fasten the sprocket to the axle, are properly fastened.

   INFO: If the screws are loose, apply new Loctite 243 before fastening the screws.
4. Check if the screws and bolts of the chain connection (tensioner) are properly fastened.

   INFO: If the screws are loose, apply new Loctite 243 before fastening the screws.
5. Check if the screws and bolts of the chain connection (spring) are properly fastened.

   INFO: If the screws are loose, apply new Loctite 243 before fastening the screws.
6. Check the chain connection for any damage and wear.
7. Check the teeth of the feedback sprocket for any damage and wear.
8. Check the teeth of the rudder sprocket for any damage and wear.
9. Check the backlash of the chain part.

3.1.2 RFU Linkage Transmission Maintenance

Yearly maintenance tasks:

1. Check if all screws and bolts are properly fastened.
2. Check if all joints are still greased properly.
3. Check if the 90 degrees angle of the rod still exists.

4 Appendix A

Appendix A contains:

1. *Specifications* on page 22
2. *Mechanical Drawings* on page 23
3. *Electric Diagrams* on page 27
4. *Thales Certificates* on page 30

4.1 Specifications

4.1.1 Specifications Rudder Feedback Unit MD/HD

Box Contents upon Delivery	
Rudder Feedback Unit MD	3109.0196
Rudder Feedback Unit HD	3109.0194

Physical Dimensions	
Dimensions (WxH)	MD: 190x173 mm (7.48x6.81") HD: 190x283 mm (6.30x11.14")
Weight	MD: 4.2 kg (9.26 lbs) HD: 6 kg (13.23 lbs)

Operating Conditions	
Operating temperature	-25° C to +55° C
Operating humidity	Up to 95% (at 40° C)
Storage temperature	-25° C to +70° C
Storage humidity	Up to 95% (at 40° C)
IP rating	IP56
Compass safe distance	Std: 10 cm / Steering: 10 cm

Environmental according to DNV 2.4 table 2.1	
Temperature	Class D
Humidity	Class B
Vibration	Class A
EMC compatibility	Class B
Enclosure	Class C

Analog Signals	
Potentiometer 1	2 kOhm 3-wire
Potentiometer 2	2 kOhm 3-wire

Analog Contacts (HD version only)	
Contact rudder PS	2 pcs NC contacts (max. 3 A-30 V DC/ AC1)
Contact rudder SB	2 pcs NC contacts (max. 3 A-30 V DC/ AC1)

Norms/Standards	
IEC 60945 (2002)	Incl. IEC 60945 Corrigendum 1 (2008)
Standard DNV 2.4	Det Norske Veritas
IEC 61162 series	NMEA Definitions

Available Accessories	
RFU Linkage Transmission	3109.0198
RFU Chain Transmission	3109.0200

4.2 Mechanical Drawings

4.2.1 Mechanical Drawing Rudder Feedback Unit MD

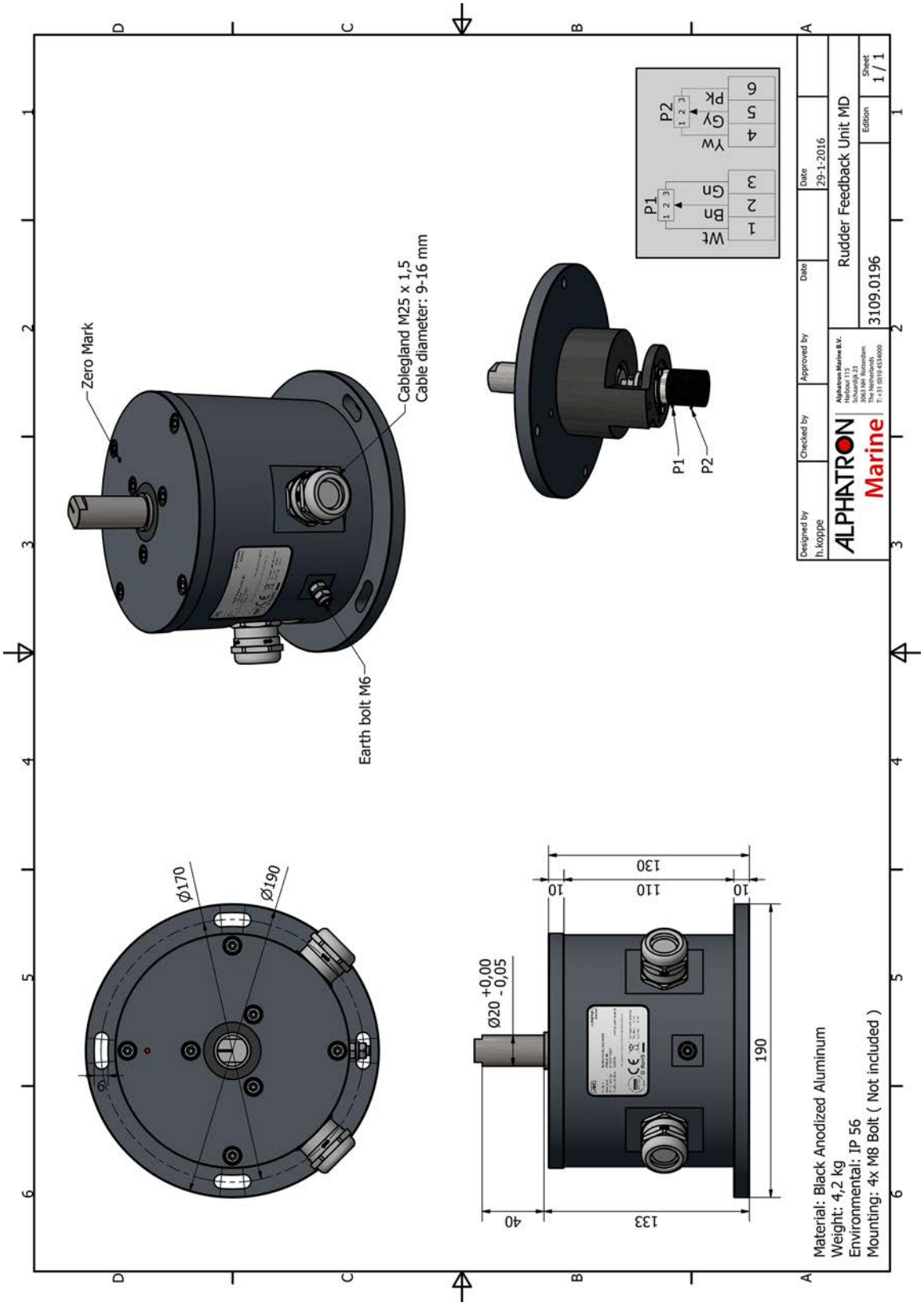


Figure 15: Mechanical Drawing Rudder Feedback Unit MD

4.2.2 Mechanical Drawing Rudder Feedback Unit HD

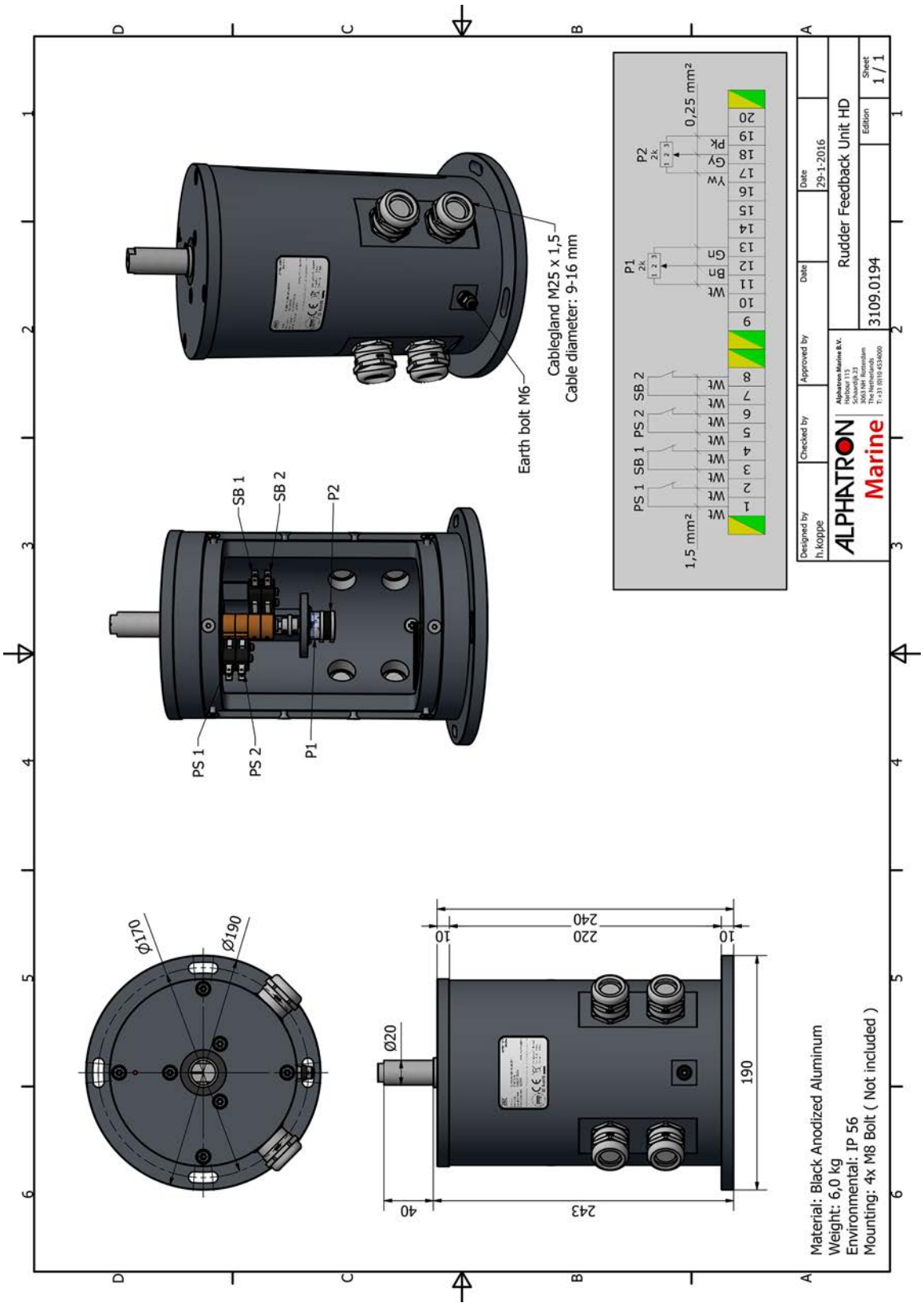
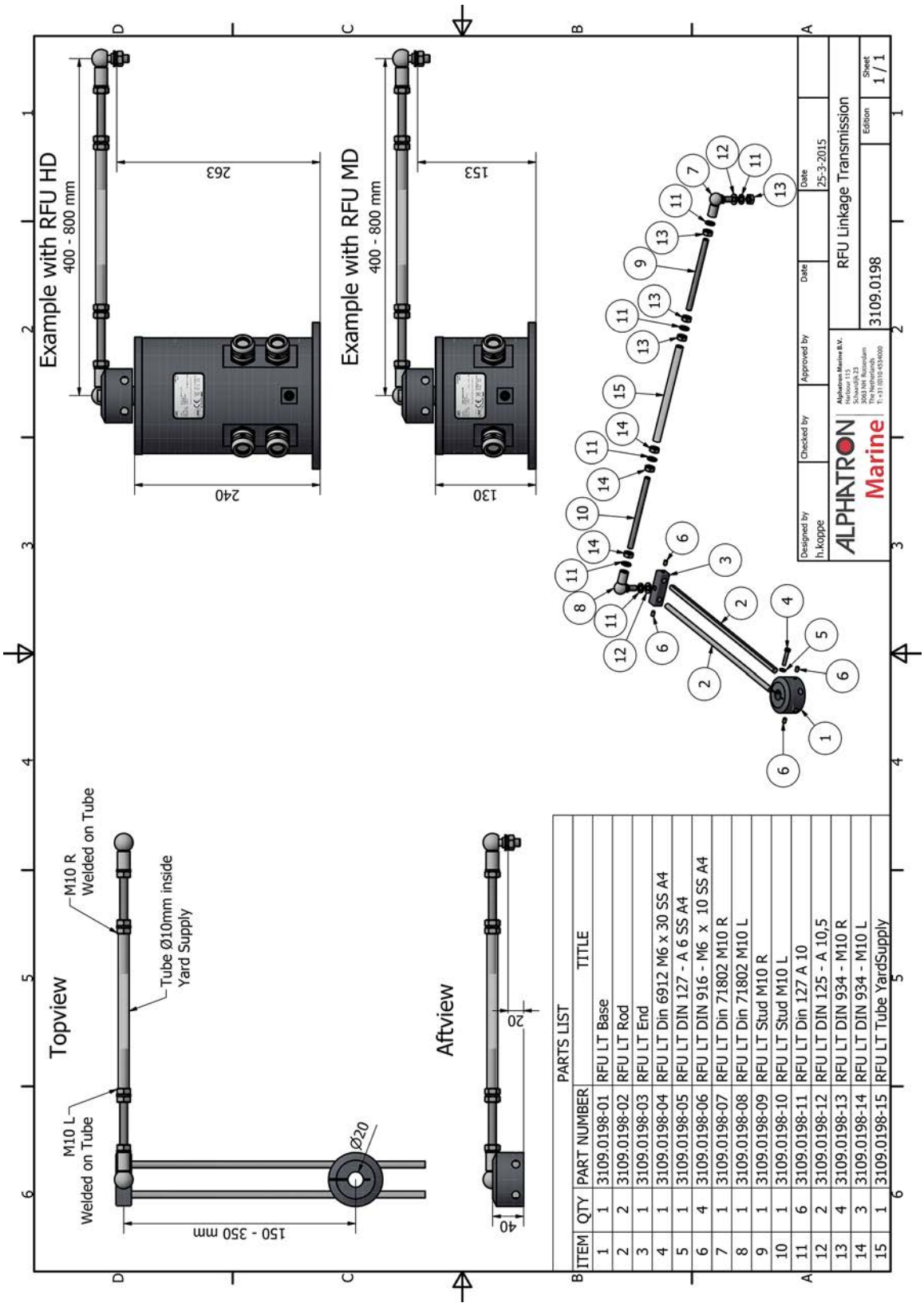


Figure 16: Mechanical Drawing Rudder Feedback Unit HD

4.2.3 Mechanical Drawing RFU Linkage Transmission



PARTS LIST

ITEM	QTY	PART NUMBER	TITLE
1	1	3109.0198-01	RFU LT Base
2	2	3109.0198-02	RFU LT Rod
3	1	3109.0198-03	RFU LT End
4	1	3109.0198-04	RFU LT Din 6912 M6 x 30 SS A4
5	1	3109.0198-05	RFU LT DIN 127 - A 6 SS A4
6	4	3109.0198-06	RFU LT DIN 916 - M6 x 10 SS A4
7	1	3109.0198-07	RFU LT Din 71802 M10 R
8	1	3109.0198-08	RFU LT Din 71802 M10 L
9	1	3109.0198-09	RFU LT Stud M10 R
10	1	3109.0198-10	RFU LT Stud M10 L
11	6	3109.0198-11	RFU LT Din 127 A 10
12	2	3109.0198-12	RFU LT DIN 125 - A 10,5
13	4	3109.0198-13	RFU LT DIN 934 - M10 R
14	3	3109.0198-14	RFU LT DIN 934 - M10 L
15	1	3109.0198-15	RFU LT Tube YardSupply

Figure 17: Mechanical Drawing RFU Linkage Transmission

4.2.4 Mechanical Drawing RFU Chain Transmission

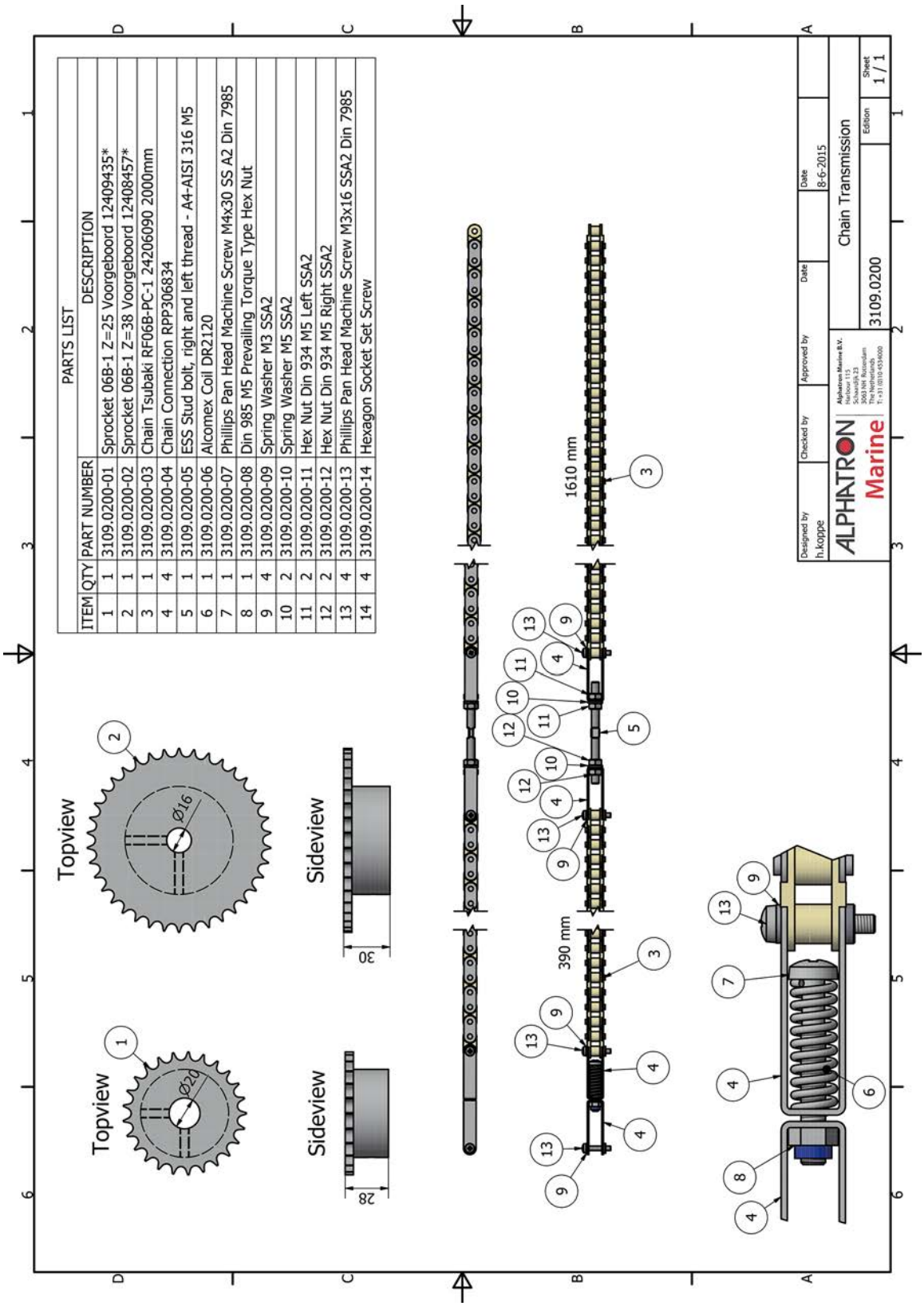


Figure 18: Mechanical Drawing RFU Chain Transmission

4.3 Electric Diagrams

The cable diagrams and connection diagrams illustrate the connections to hardware, power and other equipment.

4.3.1 Connection Diagram Rudder Feedback Unit MD

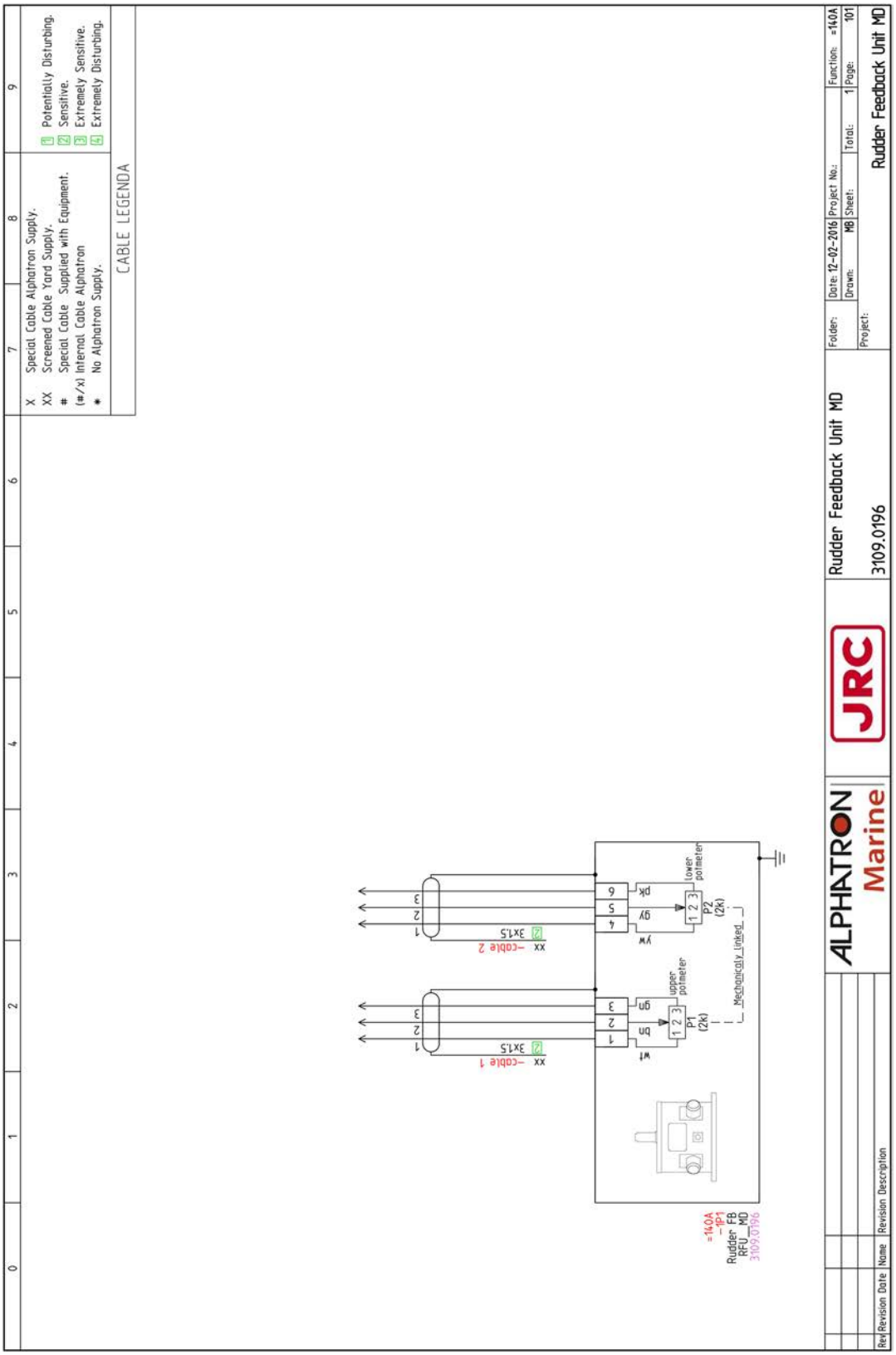


Figure 19: Connection Diagram Rudder Feedback Unit MD

4.3.2 Connection Diagram Rudder Feedback Unit HD

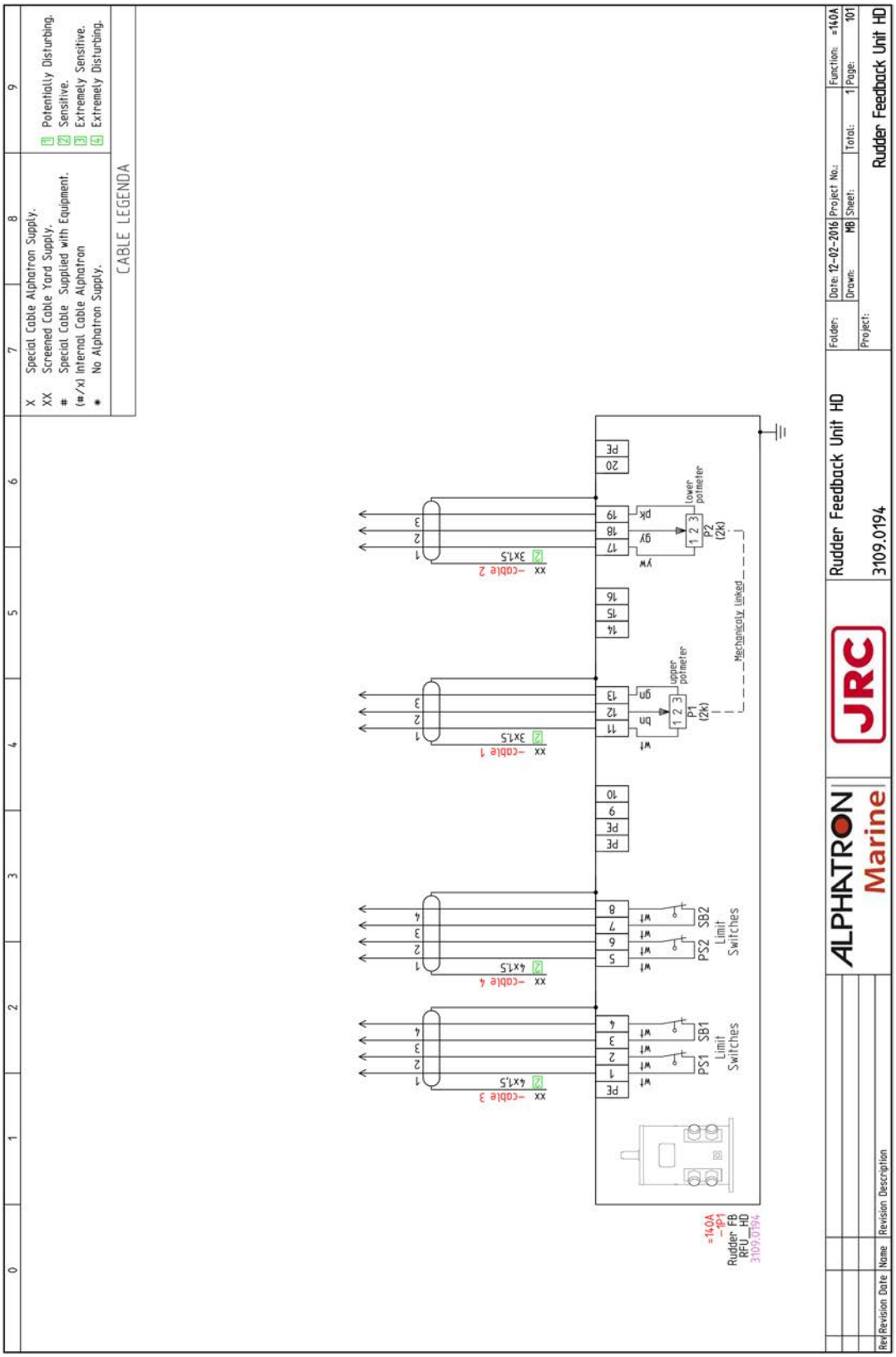


Figure 20: Connection Diagram Rudder Feedback Unit HD

4.4 Thales Certificates

4.4.1 Thales Certificate Rudder Feedback Unit MD

THALES

Certificate

Number **S000233**

The ECC of THALES Nederland B.V. hereby declares that the:

Rudder Feedback Unit MD
distributed by
Alphatron Marine B.V.
Schaardijk 23
3063NH, Rotterdam
Netherlands

was tested, and found to be compliant to:

IEC 60945, 4th ed. 2002-08 with Corrigendum 1, April 2008,

DNV 2.4, 2006 harmonized with IACS Unified Requirements E10,"Test Procedure for Electrical, Control and Instrumentation Equipment , Computers and Peripherals covered by Classification", IEC publication 60092-504,"Electrical installations in ships, part 504: Special features, control and instrumentation"; DNV Rules for Classification, Part 4 Chapter 9,"Control and Monitoring Systems". The EUT was tested for DNV according location classes:

Temperature	Humidity	Vibration	EMC comp.	Enclosure
D	B	A	A	C

start of test: 09-12-2014
test completed: 11-02-2015
test report numbers: 9505 333 670 EQR 001
9505 333 671 EQR 001

This certificate refers to the tested sample only, since product reproducibility is not within the scope of the Environmental Competence Centre.

Hengelo, **13-05-2015**
Ing. G.J.M. Grote Beverborg
Manager ECC

Environmental Competence Centre
Thales Nederland B.V.
P.O. Box 42 NL-7550 GD Hengelo
The Netherlands

Thales Nederland B.V.

Figure 21: Thales Certificate Rudder Feedback Unit MD

4.4.2 Thales Certificate Rudder Feedback Unit HD

THALES

Certificate

Page 1 of 1

Number **S000232**

The ECC of THALES Nederland B.V. hereby declares that the:

Rudder Feedback Unit HD
distributed by
Alphatron Marine B.V.
Schaardijk 23
3063NH, Rotterdam
Netherlands

was tested, and found to be compliant to:

IEC 60945, 4th ed. 2002-08 with Corrigendum 1, April 2008,

DNV 2.4, 2006 harmonized with IACS Unified Requirements E10,"Test Procedure for Electrical, Control and Instrumentation Equipment , Computers and Peripherals covered by Classification", IEC publication 60092-504,"Electrical installations in ships, part 504: Special features, control and instrumentation"; DNV Rules for Classification, Part 4 Chapter 9,"Control and Monitoring Systems". The EUT was tested for DNV according location classes:

Temperature	Humidity	Vibration	EMC comp.	Enclosure
D	B	A	A	C

start of test: 09-12-2014
test completed: 11-02-2015
test report numbers: 9505 333 668 EQR 001
9505 333 669 EQR 001

This certificate refers to the tested sample only, since product reproducibility is not within the scope of the Environmental Competence Centre.

Hengelo, **13-05-2015**
Ing. G.J.M. Grote Beverborg
Manager ECC

Environmental Competence Centre
Thales Nederland B.V.
P.O. Box 42 NL-7550 GD Hengelo
The Netherlands

Thales Nederland B.V.

Figure 22: Thales Certificate Rudder Feedback Unit HD

5 Appendix B

5.1 ISO 9001 Certificate Alphatron Marine R&D

Lloyd's Register
LRQA

CERTIFICATE OF APPROVAL

This is to certify that the Quality Management System of:

Alphatron Marine B.V.
Schaardijk 23
3063 NH Rotterdam
The Netherlands

has been approved by Lloyd's Register Quality Assurance
to the following Quality Management System Standard:

ISO 9001 : 2008

The Quality Management System is applicable to:

Sales, design, engineering, installation, surveying and servicing of ships navigation and communicaton solutions and VDR equipment. Operational and technical training for navigation and communication equipment for shipping.

Approval Certificate No: RQA666472	Original Approval	:	21 March 2013
	Current Certificate	:	21 March 2016
	Certificate Expiry	:	14 September 2018

Issued by: Lloyd's Register Nederland B.V.

MGMT. SYS.
RvA C 010

K.P. van der Mandelelaan 41a, 3062 MB Rotterdam, Nederland
This approval is carried out in accordance with the LRQA assessment and certification procedures and monitored by LRQA.

Lloyd's Register Group Limited, its affiliates and subsidiaries, including Lloyd's Register Quality Assurance Limited (LRQA), and their respective officers, employees or agents are, individually and collectively, referred to in this clause as 'Lloyd's Register'. Lloyd's Register assumes no responsibility and shall not be liable to any person for any loss, damage or expense caused by reliance on the information or advice in this document or howsoever provided, unless that person has signed a contract with the relevant Lloyd's Register entity for the provision of this information or advice and in that case any responsibility or liability is exclusively on the terms and conditions set out in that contract.

Figure 23: ISO 9001 Certificate Alphatron Marine R&D

6 Appendix C

6.1 EC Declaration of Conformity

CE

ALPHATRON Marine

DECLARATION OF CONFORMITY

We: Alphatron Marine BV
Schaardijk 23
3063NH Rotterdam
Harbour number 115
The Netherlands
Tel +31(0)10-4534000
Fax +31(0)10-4529214

declare under our sole responsibility that the product line:

Rudder feedback unit MD / HD

to which this declaration relates is in conformity with the following standard(s) or other normative document(s)

- IEC60945 (2002), including corrigendum 1 (2008) – Maritime navigation and radiocommunication equipment and systems- Methods of testing and required results
- DNV 2.4 (2006) - ENVIRONMENTAL TEST SPECIFICATION FOR INSTRUMENTATION AND AUTOMATION EQUIPMENT

On behalf of Alphatron Marine B.V

Rotterdam, the Netherlands
June 3, 2015

Quality manager
J. de Jong

Alphatron Marine B.V

Figure 24: EC Declaration of Conformity Rudder Feedback Unit MD/HD

All over the world, close to the customer

JRC/Alphatron Marine

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www.jrc.am

Document : Installation and Operation Manual
Project no. : Rudder Feedback Unit MD/HD
Version : V1.0

Centers of Excellence

Houston, Rotterdam, Singapore, Tokyo