

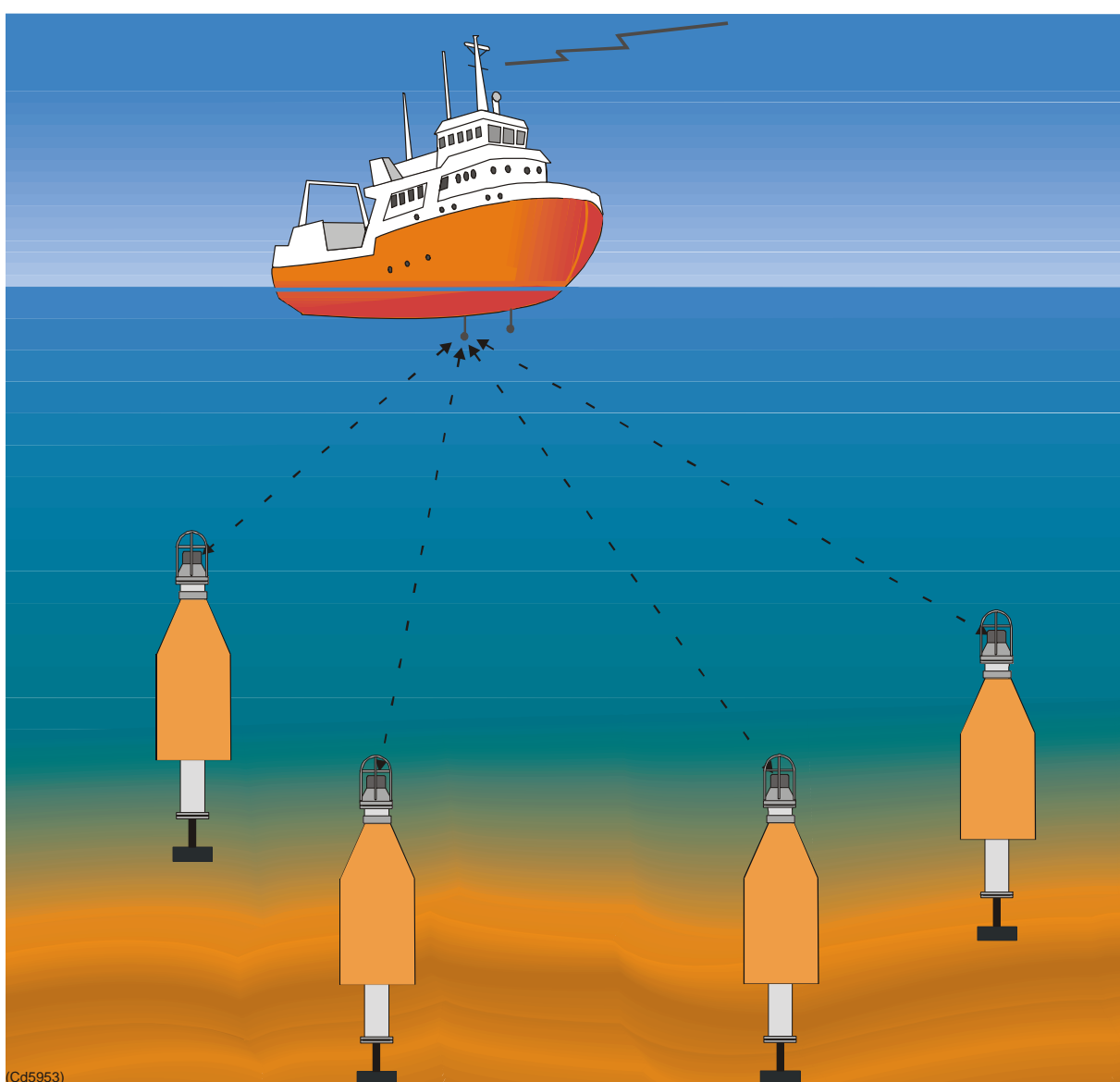


KONGSBERG

# Instruction Manual

## MPT 163 series

Multifunction Positioning Transponder (MPT)





## ***MPT 163 series***

### ***Multifunction Positioning Transponder (MPT)***

This is the Instruction manual for the Kongsberg Maritime Multifunction Positioning Transponder (MPT) 163 series.

The manual also includes important safety information regarding the lithium battery.

#### ***Warning***

***Due to safety rules, the safety information for transponder and transponder battery must be read before handling transponders or separate transponder batteries. Refer to:***

***- Safety information for transponder and transponder battery chapter on page 13.***

### **Note**

Kongsberg Maritime AS makes every effort to ensure that the information contained within this document is correct. However, our equipment is continuously being improved and updated, so we cannot assume liability for any errors which may occur.

### **Warning**

The equipment to which this manual applies must only be used for the purpose for which it was designed. Improper use or maintenance may cause damage to the equipment or injury to personnel. The user must be familiar with the contents of the appropriate manuals before attempting to install, operate or maintain the equipment.

Kongsberg Maritime AS disclaims any responsibility for damage or injury caused by improper installation, use or maintenance of the equipment.

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A	Preliminary issue.
B	Implemented TP drawings. Updated technical specifications. Implemented information about how to handle a transponder in general, battery safety instructions and rechargeable battery pack. Reorganized PCBs and battery information. Updated the Spare part section. Removed functional description. Minor corrections in the text. Ref. 857-164157B.
C	Implemented the MPT 163/SpBRspSx 110 Vac SU transponder. Removed the SPT models. Updated the battery and HPR 400 channels information. Minor corrections in the text. Ref. 857-164157C.
D	Removed Warning Transponder containing a Lithium battery page, and the battery safety / transport and storage sections. Implemented Safety information for transponder and transponder battery (new chapter). Minor corrections in the text. Ref. 857-164157D.
E	Implemented information about release-unit storage. Updated layout. Minor corrections in the text. Refer to EM 857-164157E.
F	Implemented new section, the Drawing file. Updated Technical specifications. Minor corrections in the text. Refer to EM 857-164157F.

# INTRODUCTION

## Manual contents

This manual describes all the Kongsberg Maritime low frequency (LF) MPT transponders, for deep water use - 6000 m rated.

It provides technical specifications, safety procedures, operating instructions and maintenance procedures. It also includes spare parts lists and outline dimension drawings for each of the transponder units.

## How to handle a transponder

All the transponders described in this manual contains a lithium battery (as a standard).

### **Warning**

***Due to safety rules, the transponder must be handle with care. Refer to:  
- Safety information for transponder and transponder battery chapter on page 13.***



*Figure 1 Special precautions to avoid personnel injury*

## List of abbreviations

HiPAP	High Precision Acoustic Positioning
HPR	Hydroacoustic Position Reference
LBL	Long Base Line
LF	Low Frequency
MPT	Multifunction Positioning Transponder
ROV	Remotely Operated Vehicle
SSBL	Super-Short Base Line
TP	TransPonder

## Available transponders

The MPT 163 transponder series is designed for use with the Kongsberg Maritime HPR 400 LF system. The following units are available:

- MPT 163/RSpB transponder
- MPT 163/SpBRsp Sx 110 Vac SU transponder

## General description



All models described in this manual have an acoustic telemetry link for command and data transfer.

All units are designed for ROV manipulator handling.

The transponder unit is designed with a modular construction such that the transducer, transponder electronics, battery pack and options (where applicable) can be replaced individually.

All models are encased in an aluminium cylinder.

A transponder is normally a self-contained unit, its power being provided from an internal battery pack.

The transponder may be secured to a subsea structure using mounting brackets, or fitted with an anchor weight and buoyancy collar for location on the open seabed.

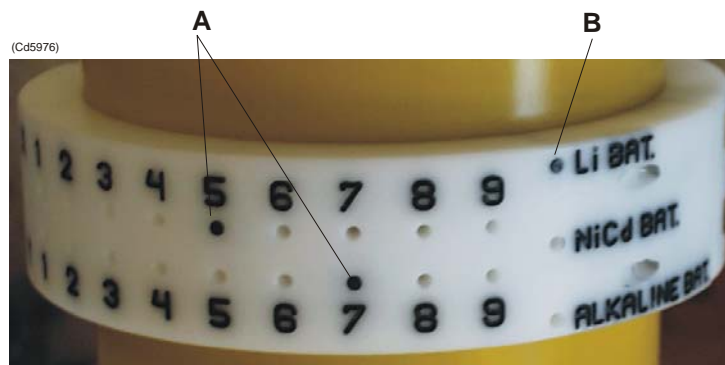
*Figure 2 Part of the MPT 163/RSpB transponder*

## Transponder identification

An identification clamp ring is tightened around the transponder body. This ring is engraved with:

- Transponder name
- TP registration number
- Unique serial number
- Frequency channel
- Type of battery

The figure shows an identification clamp ring for a transponder that uses channel 57 and includes a lithium battery. Name and serial number is engraved on the other side - see illustrations in the spare part section.



*Figure 3 Example of identification clamp ring*

If the TP configuration and battery is changed, the channel number (A) and the type of battery (B) can be altered by setting pegs into different holes in the clamp.

## Applications

On interrogation, all models will reply with either a single- or a multi-pulse response. The response information depends on the application. The MPT models can be used in the following applications:

- Dynamic position reference for surface vessels.
- LBL positioning.
- Master-slave transponder in an LBL array.
- Self positioning.
- Range measuring.

- SSBL positioning.
- Acoustic release.
- Navigation of underwater vehicles and towed bodies.
- Positioning aid for pipeline and underwater structure maintenance and construction.
- Positioning and re-entry of Blow Out Preventer's (BOP's).

## **HPR compatibility**

The MPT 163 transponders are compatible with the Kongsberg Maritime HPR 400 LF system.

## Transponder model identification principles

### General

The transponder name consists of the model name, the model number and any options included.

The name contains three letters followed by three digits. The letters after the numbers describe the option (see example below).

### Model name

MPT = Multifunction Positioning Transponder.

### Model number

The three digits describe:

Digit 1: frequency band

Digit 2: depth rating

Digit 3: beamwidth

The following are available:

1st number	2nd number	3rd number
Frequency band	Depth rating	Transducer beamwidth
1 = 12 kHz	6 = 6000 m	3 = $\pm 30^\circ$

### Options

The combination of letters after the number describes the options contained in the unit. The following options are available:

R	Release mechanism
SpB	Split Beam
RspSx 110 Vac	Responder, short tube, small backup battery and 110 Vac power supply
S	Split housing and transducer
U	Unlisted function which is custom specified

### Example: **MPT 163/RSpB**

The example given (MPT 163/RSpB) therefore indicates that the transponder unit is an Multifunction Positioning Transponder, operating in the 12 kHz band, rated to 6000 meters depth, with a  $\pm 30^\circ$  beamwidth (narrow beam), including the Release mechanism function and a Split Beam transducer. The housing material is aluminium.

## Transponder model descriptions

### General

The MPT 163 transponders operates as either an LF SSBL or LBL transponder to provide positional information. It is equipped with a  $\pm 30^\circ$  beamwidth transducer.

### MPT 163/RSpB

This transponder is fitted with a **Release mechanism (R)** and has a **Split Beam (SpB)** function.

#### **This means that this transponder:**

- is a recoverable unit fitted with an automatic release mechanism and buoyancy. This detaches the mooring sinker on request from the HPR system. Once the transponder has been released, it will float to the surface where it can be recovered.
  - You can reset the release mechanism at the surface, and you can use the same unit many times in different areas. The mooring sinker will be lost during the release operation, so it will require replacement every time.
- it works as a dual beam transponder and it has two beamwidths:
  - Wide beam is  $\pm 60^\circ$
  - Narrow beam is  $\pm 30^\circ$



## MPT 163/SpBRspSx 110 Vac SU

The **Split Beam transponder with Responder** is a combined responder and transponder with **short tube, small backup battery, 110 Vac power supply and split housing and transducer.**

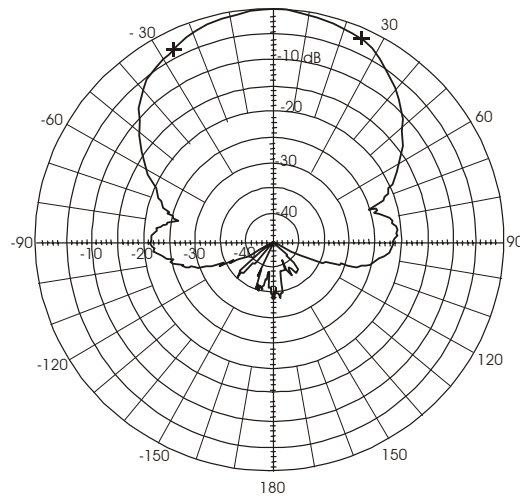
The unit has separate housing (electronics unit) and transducer. The transducer has a 5 m long cable, to connect it to the housing.



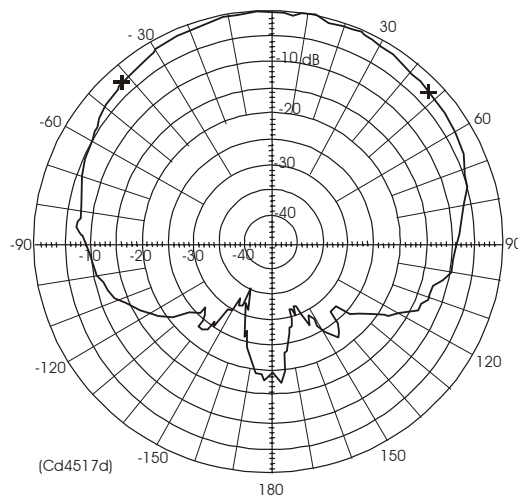
*Figure 4 Part of the MPT 163/SpBRspSx  
110 Vac Su transponder*

## Beam pattern

The figure shows beam pattern for the different transducer types;  
 $\pm 30^\circ$  and  $\pm 60^\circ$ . The beam pattern shows the transmit/receive sensitivity in the different directions.



MPT 163  
Narrow beam  $\pm 30^\circ$   
Source level = 198 dB



MPT 163  
Wide beam  $\pm 60^\circ$   
Source level = 186 dB

*Figure 5 Examples of beam pattern*

## Auxiliary equipment

Various types of auxiliary equipment are used to mount a transponder in a correct and secure way. The most common types are:

- Floating collar
- Anchor-weight

→ *For auxiliary equipment supplied by Kongsberg Maritime, refer to page 62.*

## TECHNICAL SPECIFICATIONS

### Common specifications

The technical details given in this paragraph are common for all the 6000 m transponders.

Maximum depth rating	6000 meters
Housing material	Aluminium
Flange and transducer head material	Polyurethane coated
Operation temperature	0° to +30° C
Maximum power consumption 110 Vac	7.5 W
Backup Lithium battery quiescent lifetime	130 days

### Source level and receiver sensitivity

Model series	Source level - max (4 steps of 3 dB)	Receiver sensitivity HIGH / LOW (2 steps)
MPT 163	Narrow: 198 Wide: 186	85 / 91 100 / 106

### MPT 163/RSpB

As in basic data.

→ *Outline dimension and weight, refer to page 76.*

### Release units

As in common specifications, except:

Weight in air / water	2 kg / 0.5 kg
Length	221 mm
Max diameter	138 mm

The mechanism is rated for:

Lift - safe to lift with the release mechanism	250 kg
Release load	100 kg

Note

*Kongsberg Maritime may approve higher loads upon request.*

## MPT 163/SpBRspSx 110 Vac SU

As in common specifications.

→ *Outline dimension and weight, refer to page 76.*

### Electronics unit

#### External connectors:

Connector type	7-pins Gimsa receptacle 10.00.2.07.1.10
Connector type	4-pins Gimsa receptacle 10.00.1.04.2.10

### Transducer unit

Type	Kongsberg Maritime LF standard
Material	Aluminium-bronze
Cable	5 m
Beamwidth	approx. 60 deg. at -3 dB

#### Cable connector:

Connector type	7-pins Gimsa plug 10.06.2.07.1.10
Connector type	4-pins Gimsa plug 10.06.1.04.2.00

## Floating collar

Depth rating	7000 m
Colour	orange

→ *Outline dimension and weight, refer to page 76.*

## Mounting equipment

Mounting brackets and mounting collars are not available from Kongsberg Maritime.

## External connector for/RspSx 110 Vac SU

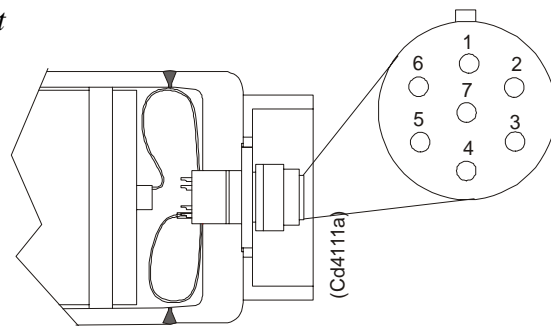
The SpBRspSx 110 vac SU transponder is are fitted with the following external connectors:

- A 7 pins connector at the base for the responder and external power functions. The connector pin no. and function are shown in table 1.
- A 4 pins connector at the top, for units interconnection. The connector pin no. are shown in the drawing on page 72.
- SU model (separate transducer and housing (electronics unit)). This model is delivered with a pigtail.

The description and layout of the connectors and a pigtail are presented in the following paragraphs.

### 7 pins connector at the base

Figure 6 7 pin external connector - layout



**Caution**

*Take care when wiring the unit. Incorrect wiring may cause irreparable damage.*

Pin no.	Function
1	External trigger line
2	External trigger GND
3	Note*
4	Note*
5	External 110 Vac
6	External 110 Vac
7	GND

Table 1 Standard external connector

**Note**

*\* Linked in the pigtail plug (pin no 3 and 4) to apply 10 V from the battery to the electronics.*

### 4 pins connector at the top

→ *The pin layout is shown in the drawing on page 72.*

# SAFETY INFORMATION FOR TRANSPONDER AND TRANSPONDER BATTERY

## Introduction

This section includes transponder safety information for the Kongsberg transponders with lithium battery and separate Kongsberg transponder lithium batteries. It also includes emergency procedures.

## Product identification

### Product name

All Kongsberg Maritime transponders with a lithium battery, and separate Kongsberg Maritime transponder lithium batteries.

→ *Refer to Kongsberg Maritime transponder instruction manuals for the actual model.*

### Battery design

A transponder lithium battery consists of several battery cells that are electrical connected, both in serial and parallel.

A transponder lithium battery consists of two separate parts:

- Receiver part (Rx)
- Transmitter part (Tx)

There are transponder batteries with different number of cells, voltages and capacity.

→ *Refer to Kongsberg Maritime transponder instruction manuals for the actual model.*

All transponder batteries include protection against short-circuits (re-settable fuses) and reverse current (diodes).

### Battery chemistry

A transponder lithium battery consists of cells with chemistry:

#### Lithium Thionyl Chloride - Li/SOCl<sub>2</sub>

- Negative electrode: Lithium metal (Li)
- Positive electrode: Thionyl chloride (SOCl<sub>2</sub>)
- Electrolyte: Solution of lithium tetrachloroaluminate (LiAlCl<sub>4</sub>) in thionyl chloride

## Battery cell manufacturers/types

A transponder lithium battery consists of cells from one or two of the following types:

- Tadiran TL-2300
- Sonnenschein SL-780
- Saft LS 33600
- Saft LSH 20
- Sonnenschein SL-760

## Hazards identification

### General

Short-circuits, overheating, mechanical damage and exposure to water can start chemical reactions and high currents inside the transponder lithium battery. This can generate noxious gases and/or danger of explosions. The chemical reactions will continue without additional supply of oxygen, as the battery cells contain the necessary ingredients for maintaining the chemical reactions.

During operation, the battery is placed inside the transponder. Water ingress into the transponder can cause dangerous situations.

### Danger of explosions

- If the cells that form the battery reach the critical temperature of 180° C, they will explode.
- **Water ingress** - The battery temperature will increase, caused by the high internal currents. The temperature can reach the critical point of 180° C.
- **Water ingress** - Electrolysis gives hydrogen. Together with oxygen, hydrogen can create oxyhydrogen gas inside the transponder (depends on the concentration). This gas is very inflammable/explosive.
- **Water ingress** - Chemical reactions in the battery will cause a pressure build-up inside the transponder. The transponder can explode if the inside pressure is high enough.
- If the transponder explodes, either the transducer or the bottom end cap will blow out, or the transponder becomes fragmented. This can cause serious damages on personnel and/or equipment.



- Some transponders have a relief valve that will prevent over-pressure. Noxious gases will then leak out of the transponder until the chemical reactions have stopped.

Note

*The relief valve can be plugged, caused by products from the chemical reactions during an emergency as described above.*

### **Noxious gases**

- Thionyl chloride (SOCl<sub>2</sub>)
- Sulphur dioxide (SO<sub>2</sub>)
- Hydrogen chloride (HCl)
- Chlorine (Cl<sub>2</sub>)

### **Signs and symptoms:**

- Corrosive fumes with pungent odour, is very irritating to skin, eyes and mucous membranes. Over-exposure can cause symptoms of non-fibrotic lung injury and membrane irritation.

### **Inhalation:**

- Lung irritant.

### **Skin contact:**

- Skin irritant.

### **Eye contact:**

- Eye irritant.

### **Ingestion:**

- Tissue damage to throat and gastro/respiratory tract if swallowed.

### **Medical conditions:**

- Eczema, skin allergies, lung injuries, asthma and other respiratory disorders may occur.

## First-aid measures

All personnel that have been exposed to the noxious gases should immediately be seen by a doctor.

### **Inhalation:**

- Remove from exposure, rest and keep warm.

### **Skin contact:**

- Wash off skin thoroughly with water. Remove contaminated clothing and wash it before reuse.

### **Eye contact:**

- Irrigate thoroughly with water for at least 15 minutes.

### **Ingestion:**

- Wash out mouth thoroughly with water and give plenty of water to drink.

## Fire-fighting measures

- **Cool down the battery with copious amounts of cold water.**
  - Transponder with lithium battery:
    - \* Immerse the transponder in the sea for 12 hours or permanent.
    - \* If this method is impossible, the transponder can be cooled down by use of a fire hose.
  - Separate transponder lithium battery:
    - \* Immerse the battery in the sea for 12 hours or permanent.
    - \* If this method is impossible, the battery can be cooled down by use of a fire hose.

Cooling down the battery with copious amount of cold water is the only way to reduce/stop the internal chemical reactions, or to limit the fire/explosions to as few battery cells as possible. The chemical reactions/fire will continue without additional supply of oxygen, so extinguisher like Lith-X will not work properly.

Applying water directly onto a battery, may develop oxyhydrogen gas, due to the possible electrolysis if the battery terminals are exposed to water. This gas is very inflammable/explosive. However, if the water cooling takes place out on deck, or in a storeroom with good ventilation, there will never be enough hydrogen gas to give oxyhydrogen gas (any gas will evaporate).

## Personals protection

### **Fire/explosion:**

- Use smoke-diving equipment.

### **Relief valve opens and noxious gasses come out:**

- Use self-contained full-face respiratory equipment, and protective equipment of rubber or plastic.

### **Opening transponder with defect/possible defect battery:**

- Use self-contained full-face respiratory equipment, and protective equipment of rubber or plastic.

### **Opening a *functioning* transponder:**

- Use protective goggles.

## Handling

### **Introduction**

All personnel that handle transponders must know the transponder's status:

**'*Functioning*' - '*Failing*' - '*Unknown*'**

A Transponder with unknown status, must be handled as a transponder that is failing.

### **Recovering a '*functioning*' transponder**

- All transponders recovered from the sea, should be placed in a safe place out on deck and controlled for minimum 2 hours:
  - Look for outer damages that could involve a water leakage.
  - The transponder housing temperature must be checked to verify a possible temperature increase in the lithium battery.

### **Recovering a '*failing*' transponder**

- Handle as possible water ingression.
- Evacuate all unnecessary people.
- Recover the transponder with great precaution. Use a crane.
- No people should be near the transponder when it is lifted up on deck.
- Place the transponder in a safe place out on deck, shielded from people and vital equipment.

- Fasten the transponder in a crane, ready to lower it into the sea again.
- Control the transponder for minimum 2 hours:
  - Look for outer damages that could involve a water leakage.
  - The transponder housing temperature must be checked to verify a possible temperature increase in the lithium battery.

#### **Failing and normal temperature:**

- Take out the battery, see *”Opening a transponder with defect/possible defect battery”*.

→ *Refer to page 19.*

#### **Failing and increasing temperature:**

- See *”Handling a heated or self-heated transponder”*.

→ *Refer to page 18.*

### **Handling a heated or self-heated transponder**

- Evacuate all unnecessary people.
- Fasten the transponder to a rope and immerse it in the sea for 12 hours or permanent.
  - If this method is impossible, the transponder can be cooled down with copious amount of cold water. Use a fire hose.
- Recover the transponder and control the temperature.
- Repeat this until the temperature is low and stable.
- The transponder can now be opened, see *“Opening a transponder with defect/possible defect battery”*.

→ *Refer to page 19.*

### **Handling a transponder if the relief valve opens**

- Evacuate all unnecessary people.
- Use necessary protection equipment.
- Fasten the transponder to a rope and immerse it in the sea for 12 hours or permanent.
  - If this method is impossible, the transponder can be cooled down with copious amount of cold water. Use a fire hose.
- Repeat this until no gases come out the check valve and the temperature is low and stable.

- The transponder can now be opened, see “*Opening a transponder with defect/possible defect battery*”.
- *Refer to page 19.*
- Wash out chemical reaction products with water.

### **Opening a transponder with defect/possible defect battery**

- The transponder is reported failing. There could have been water ingress in the transponder.
- Open the transponder in a safe place out on deck, shielded from people and vital equipment.
- Use necessary protection equipment.

#### *Caution*

*Do not stand in front of transducer or bottom end cap, when opening the transponder.*

- If there has been water ingress, and the battery is still heated:
  - Disconnect the battery from the transponder electronics, and then see “*Handling heated or self-heated separate battery*”
  - *Refer to page 19.*
- Wash out chemical reaction products with water.

### **Opening a 'functioning' transponder**

- The transponder is reported functioning.
- Open the transponder in a safe place out on deck, shielded from people and vital equipment.

#### *Caution*

*Do not stand in front of transducer or bottom end cap, when opening the transponder.*

### **Handling heated or self-heated separate battery**

- Evacuate all unnecessary people.
- Fasten the battery to a rope and immerse it in the sea for 12 hours or permanent.
  - If this method is impossible, the battery can be cooled down with copious amount of cold water. Use a fire hose.
- Wash out chemical reaction products with water.

## **Storage**

#### *Caution*

*A transponder that is failing, must be stored in a safe place out on deck, shielded from people and vital equipment.*

A transponders that is functioning, and separate batteries can be stored indoors.

- Storage temperature:
  - Recommended storage temperature lies between 0° C and +25° C (max +50° C, min -55° C).
- Storage relative air humidity:
  - Recommended relative air humidity is 40 to 70%.
- A transponder/separate battery must not be stored directly in the sunlight.
- A battery must not be exposed to water.
- For long term storage, the battery must be disconnected from the transponder electronics.
- Storeroom:
  - A solid room with study racks for transponders/separate batteries.
  - A room where no people are staying, or no vital equipment is placed.
  - Good ventilation.
  - Clearly identified.

*Caution*

*A fire station, with fire hose (water), must be placed outside the storeroom.*

## **Ecological information**

A lithium thionyl chloride battery does not present environmental hazard.

## **Disposal considerations**

- A lithium thionyl chloride battery does not contain any heavy metals, and is therefore not regarded as special waste (contains only biodegradable parts).
- A used transponder lithium battery often contains a significant amount of residual energy. It is the danger of explosion that presents a problem when disposing a battery.
  - Used batteries must therefore be handled with the same care as new ones.

*Caution*

*For safe disposal, contact a company that has been approved to collect and dispose lithium batteries.*

## Transport information

All transponders with a lithium battery and separate transponder lithium batteries must be shipped in accordance with the prevailing regulations:

**Transponder with lithium battery:**

UN no. 3091, Class 9 Miscellaneous  
(Lithium batteries contained in equipment)

**Separate transponder lithium battery:**

UN no. 3090, Class 9 Miscellaneous (Lithium batteries)

**Transport:**

Aircraft: IATA DGR

Sea Transport: IMDG Code

Railway: RID

Road transport: ADR

- Aircraft - Only new transponder lithium batteries can be transported by air.
- Aircraft - Transport of all transponders with new lithium battery and new separate transponder lithium batteries by air is only permitted onboard cargo aircraft. The goods must be clearly labelled:

**CARGO AIRCRAFT ONLY**

*Caution*

*Transponder with lithium battery - During transport the lithium battery must always be disconnected from the electronics.*

- Original transponder/battery cages must be used.

## OPERATION

### General

The transponders are designed for operation in water only.

*Caution*

*At delivery, the transponder battery is disconnected, and must therefore be connected before deployment.*

### Safety information for transponder and transponder battery

→ *Refer to chapter on page 13.*

### Connecting the battery

→ *Refer to page 37 for details.*

### Set-up of the system

For information regarding set-up of a transponder, refer to the following related manuals:

- *APOS Instruction manual / on-line help system.*

### Operation

The operation of a transponder is performed at the HPR topside operator station (APOS). For information regarding operation, refer to the following related manuals:

- *APOS Instruction manual / on-line help system.*

### Calibration

When used in LBL deep water positioning, the array calibration is performed using both the narrow and the wide beam (controlled by software).

### Position

When the calibration is completed, and the transponder is operating in the position mode, either narrow or wide beam can be used. This is controlled by the operator.

In LBL ROV / Tow fish positioning the wide beam is used.



## Telemetry / SSBL operation

For telemetry and SSBL operation, the narrow beam can be used to optimize the signal to noise ration at the HPR LF system.

## Transponder in use

*Caution* All personnel that handle transponders must know the transponder's status:

**'Functioning' - 'Failing' - 'Unknown'**

*Caution* A Transponder with unknown status, must be handled as a transponder that is failing. For more information:

→ Refer to "Handling" on page 17.

*Caution* It is very important that the release unit (if fitted) is washed properly. Salt deposits, may prevent the mechanical part's mobility.

## Pre-deployment checks

Before you deploy the transponder, you must:

- 1 Check that the battery contains sufficient power for the proposed operation.
- 2 Before deployment, perform a visual inspection of the transponder.
- 3 Lower the transponder on a rope over the vessel's side, and perform the APOS function check to ensure it operates correctly.

→ Refer to the APOS Instruction manual / APOS on-line help.  
- Ensure the transponder replies to the correct interrogation frequency.

## Mounting

A transponder may be secured to a subsea structure using mounting brackets, or fitted with an anchor weight and floating collar for location on the open seabed.

→ For more information refer to Auxiliary equipment.

## Deployment

*Caution* During deployment prevent the transponder from slamming against other solid objects.

*Caution* When you deploy the transponder, the anchor-weight must be lifted separately from the transponder. DO NOT attempt to lift both the transponder and the anchor-weight via the transponder - the transducer cage is only approved for lifting the transponder and the floating collar.

### **When you deploy the transponder:**

- The unit must be positioned with the transducer upright.
- Ensure a clear line of sight between the transponder's head and the ship's transducer.
- The transponder requires an anchor-weight/brackets to hold the transponder securely in position on the seabed / ROV.  
→ Refer to page 62.
- The transponder release mechanism must be attached to a shackle. The shackle will ensure a smooth release of the transponder when requested by the Operator Station.

## Ready for operation

Once deployed, the transponder is ready for operation. The sensors in your application will respond to requests from the HPR system, when they are enabled using telemetry.

## Positioning of a transponder

Positioning of a transponder can be done in two ways:

- 1 The normal way is that the topside send a request to the transponder, the transponder answer the request after a given time delay.
- 2 The other way is with the transponder in beacon mode, then the transponder acts as an acoustic lighthouse. It transmits pulses regularly (with a given Pulse Repetition Interval) without being interrogated.

For more information, refer to *the APOS on-line help*.

## Replacement of the battery

→ Refer to page 38 for details.

## Recovery

After recovery, wash the unit thoroughly in fresh water to dissolve any salt deposits and clean off any sand or silt. If available, an high pressure hose may be used.

→ Refer to “Handling” on page 17.

*Caution*

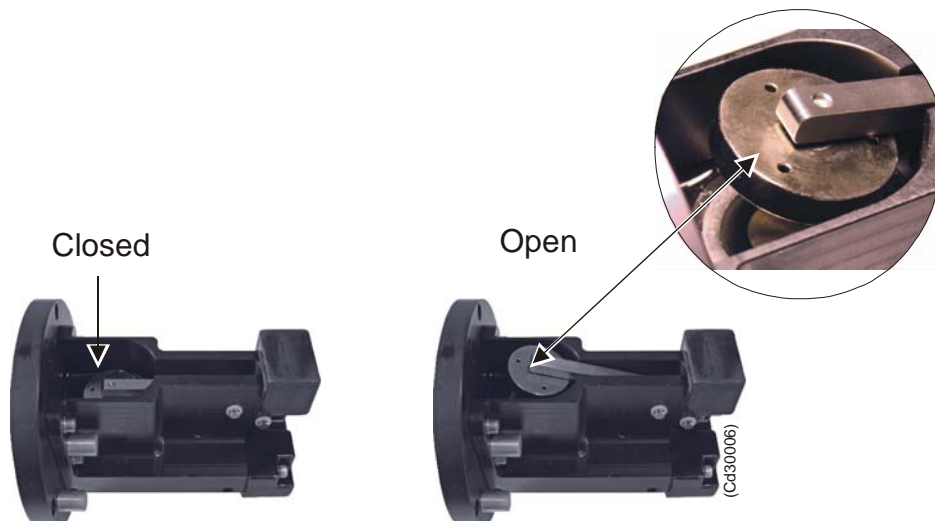
*It is very important that the release unit (if fitted) is washed properly. Salt deposits, may prevent the mechanical part’s mobility.*

## Storage

→ Refer to “Storage” on page 20.

*Caution*

*A release unit must be stored in open position (released), as illustrated in the figure below.*



*Figure 7 Release unit*

→ For information about manual release, refer to page 27.

## Release mechanism

### General

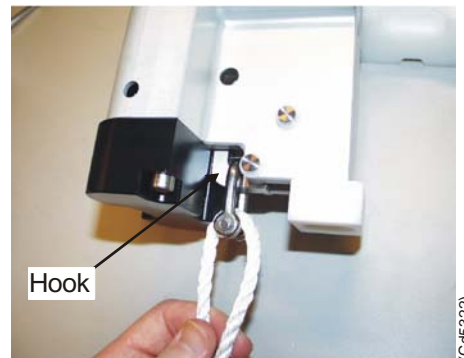
The release function is initiated at the HPR system. When activated, the transponder will float to the surface.

Note *Once the transponder reaches the surface, it can be lifted from the water by attaching a hook/rope to the transducer cage.*

The release mechanism has two moveable parts. These are:

- Hook
  - The hook sits at the bottom of the release unit, and holds the shackle to be released.

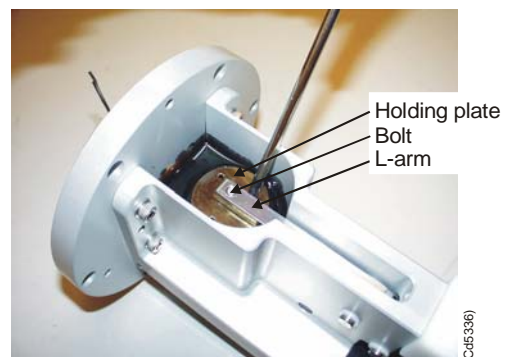
Figure 8 Release unit indicating the Hook



- L-arm
  - The L- arm is attached to the holding plate. (The holding plate has the shape of a very large coin, but much thicker).

Note *This holding plate has been adjusted during assembly and it MUST be loose. Do NOT attempt to tighten the bolt between the L-arm and the holding plate (see figure below).*

Figure 9 Release unit indicating the L-arm and holding plate



The release mechanism can be operate in one of the two following ways:

- Automatic
- Manual

**Automatic release**

Automatic release is normally used when the transponder is submerged.

- The release is performed within 10-15 seconds after the command is performed.

Note *Once the transponder reaches the surface, it can be lifted from the water by attaching a hook / rope to the transducer cage.*

**Manual release**

Manual release is normally used for testing purposes.

Note *Do NOT try to pull the L-arm or holding the plate away from magnet.*

**Manual release procedure**

- 1 Look into the small hole near the lower end of the springs.
  - The L-arm is just visible a few mm above the plastic "foot".
- 2 Insert a medium sized screwdriver between the L-arm and the plastic foot, and pry apart.
  - Refer to figure 10.
    - The mechanism will snap open.

Note *The L-arm is balanced between a strong magnet and two springs. When the mechanism is released, it kicks open with a sudden movement. Keep your fingers clear of the back of the L-arm and holding plate.*

*Figure 10 Release unit - indicating manual release*



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### Setting the release mechanism

- 1 Ensure the anchor shackle (chain link etc.) is located in the jaws.
- 2 Snap the hook back onto position.
- 3 Fasten the required load onto the shackle.
- 4 Put the shackle onto the hook.
  - Ensure right side up. The curved end **onto the hook** and the shackle bolt **away from** the hook.
- *Refer to figure on page 26.*
- 5 Swing the hook into place.
  - Ensure that the magnet face and the holding plate are free of grit and debris.
  - For proper function, ensure good parallel physical contact between the magnet and holding plate.
- 6 Push the back of the L-arm and holding plate towards the magnet until the magnet catches the holding plate.
- 7 Ensure the holding plate covers the circular face of the magnet.

## Recovery checks

- 1 After retrieval of the transponder, check for damages that could cause water leakage and hence possible temperature increase.
- 2 After recovery, wash the unit thoroughly in fresh water to dissolve any salt deposits and clean off any sand or silt. If available, an high pressure hose may be used.
- 3 If the unit is not to be re-deployed in the near future, disconnect the battery.

# BATTERIES

## General

The following battery types are available:

- Lithium (standard) (L)
- Alkaline (A)
- Rechargeable (N)

The transponders are normally self-contained with power. The standard battery is a lithium battery. It is used to ensure long life.

A battery consists of two sections, one for the receiver (Rx) and one for the transmitter (Tx).

→ *Safety information for battery, refer to the chapter on page 13.*

## Specification

The battery specification includes:

- battery type
- Rx/Tx voltage
- number of battery cells used for Rx / Tx

### **Example: L10/36 (15/40)**

The example given L10/36 (15/40), therefore indicates that this is a Lithium battery, with Rx voltage = 10 V / Tx voltage = 36 V. The Rx section comprises 15 battery cells, and the Tx section comprises 40 battery cells.



## Battery replacement

The L10/36 (15/40) Lithium battery may be replaced by:

- the Alkaline battery A10/36 (24/24),  
**or**
- the Rechargeable battery N10/36 (18/30).

An overview of the capacities of these batteries are presented in the table below. A more detailed specification is presented on the following pages.

## Battery capacity

	<b>Lithium</b>	<b>Alkaline</b>	<b>Rechargeable</b>
Battery Type no.	L10/36 (15/40)	A10/36 (24/24)	N10/36 (18/30)
Maximum continuous on-time	180 days	71 days	16 days
Quiescent time	930 days	301 days	90 days
No. of replies, low source level	6.4 million	1.44 million	0.72 million
No. of replies, max source level	1.6 million	0.36 million	0.16 million

- The Alkaline battery capacity is approx. 20% of the Lithium battery.
- The rechargeable battery capacity is approx. 10% of the Lithium battery.

## Battery lifetime at operation

The transponder has a battery monitoring function. For information on how to operate the function, see *the System operator manual*.

Note

*Two pings are required to transmit the depth information and three pings to transmit the inclinometer information.*

*When the transponder is set to HPR 400, and used for full telemetry, seven pings are required for each telegrams. The battery lifetime could therefore be much reduced from that stated in the table. However each reply is counted up and can be available to the operator.*

## Lithium battery packs

The battery status presented in the APOS window is given at **High** source level.

**To calculate the battery status, use the following equations:**

- Max source level =  $\frac{High}{2}$
- Low source level =  $High \times 2$
- Min source level =  $High \times 4$

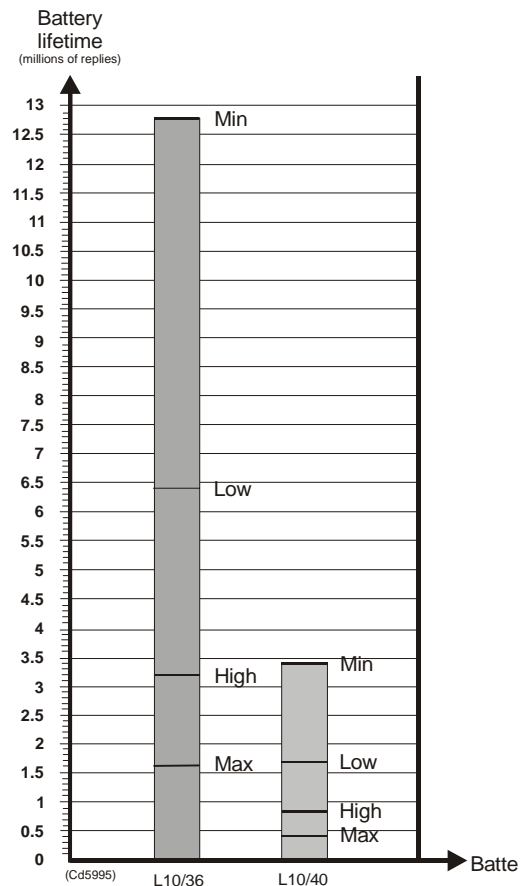
Note

*When the battery is disconnected, the battery status will be lost. When the battery is re-connected, the battery status reading will indicate 100% (as for a new battery). To keep track of the consumption, you are advised to make a note of the battery status before disconnecting.*

The figures show the lifetime based on 10 ms pulse length.

Battery type	Transponder type
L 10/36 (15/40)	MPT 163/RSpB
L 10/40 (3/11) special cabling	MPT 163/SpBRspSx 110 Vac SU

Figure 11 Battery lifetime at operation



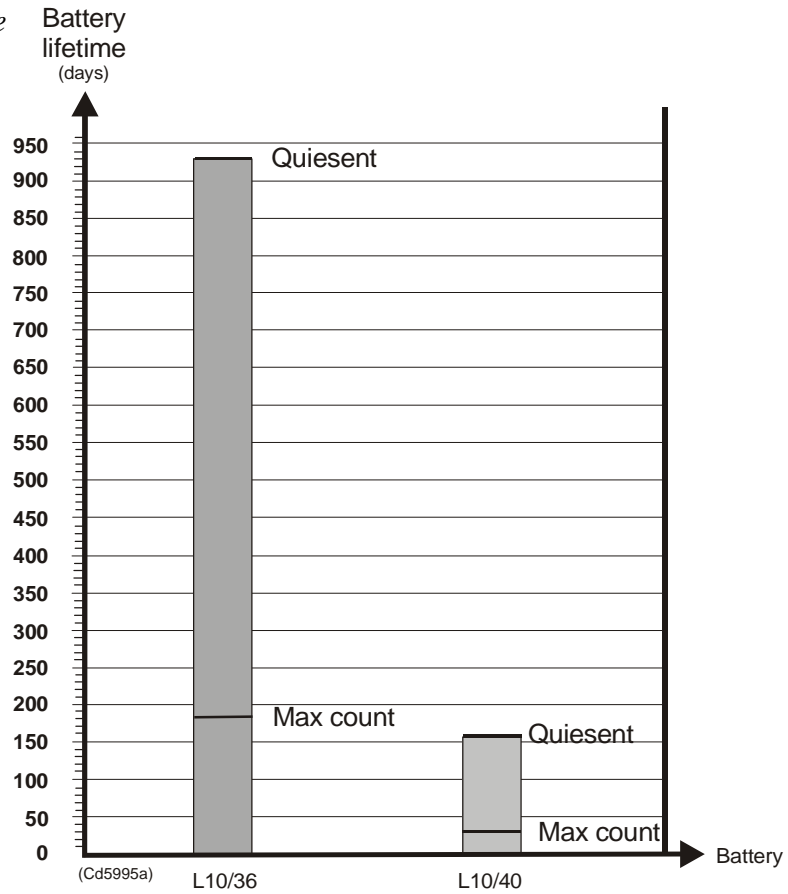
**Quiescent lifetime:**

This is the total time the transponder can listen for interrogation pulses. After this time the transponder will not be able to reply.

**Max continuous on time:**

This is the maximum time the transponder can be continuously in operation, receiving and transmitting. If a low interrogation rate is used, this time may be consumed.

Figure 12 Battery lifetime  
quiescent t state



### Lithium battery storage

→ Refer to “Storage” on page 20.

Self-discharge depends on the temperature. The higher the temperature the greater the self-discharge over time.

#### Shelf lifetime:

The batteries may be stored for up to 10 years with little loss of capacity. The losses are approximately according to the figures below (room temperature):

Capacity loss: 1st year - 3%

Next 9 years - 1.5% per year

*Caution*

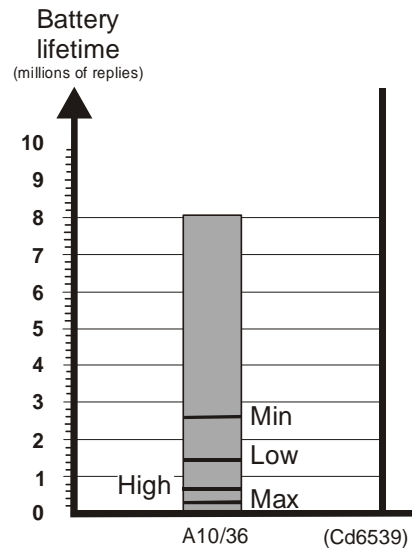
*Total capacity loss over 10 years will therefore be approximately 15%.*

## Alkaline battery pack

An Alkaline battery, the Battery Pack A10/36 (24/24) is available. This battery pack may be used as a replacement for the transponder battery, L10/36 (15/40).

→ *Battery specification, refer to page 30.*

Figure 13 Battery lifetime at operation



### Quiescent lifetime

This is the total time the transponder can listen for interrogation pulses. After this time the transponder will not be able to reply.

### Max continuous on time

This is the maximum time the transponder can be continuously in operation, receiving and transmitting. If a low interrogation rate is used, this time may be consumed.

### Battery lifetime at quiescent state

Max continuous on time:	71 days
Quiescent lifetime:	301 days

## Alkaline battery storage

If the unit is not to be re-deployed in the near future, store it in a suitable environment.

Self-discharge depends on the temperature. The higher the temperature the greater the self-discharge over time.

Recommended storage temperature is room temperature or lower.

**Shelf lifetime:**

If the battery is stored in a dry place, (relative humidity < 65%), and with room temperature between 10 to 21 deg. C, up to 80% of initial capacity is still attainable after 4 years.

*Caution*

*The batteries must be stored in an upright position.*

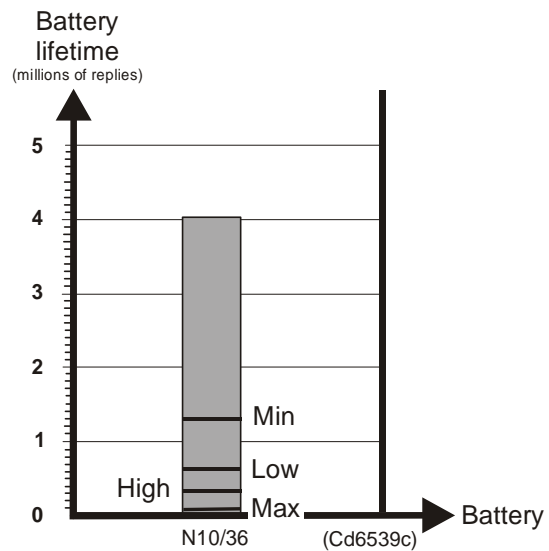
**Rechargeable battery pack**

The MPT 163 transponders can be used with a rechargeable Nickel Cadmium (NiCd) battery, the Battery Pack N10/36 (18/30) This battery pack may be used as a replacement for the standard transponder battery, L10/36 (15/40).

→ *Battery specification, refer to page 30.*

The Battery Pack N10/36 (15/40) and battery charger is described in a separate manual. The *BNC 1036 Instruction manual*.

*Figure 14 Battery lifetime at operation*



**Battery lifetime**

Quiescent lifetime	90 days
Max continuous on time	16 days
Number of charge/ discharge cycles	250

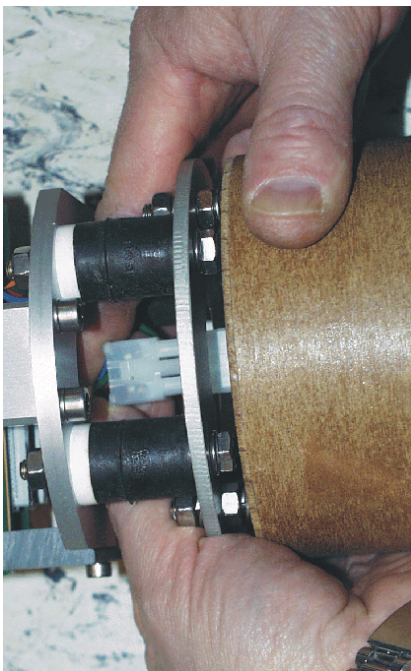
## Connecting the transponder battery

### Procedure

To connect the battery, the unit must be opened.

→ *Refer to page 44 for details.*

- 1** Grab the connector firmly using both hands. Press the connector onto the battery plug.
  - When connecting the battery, listen for the transponder initialization:
  - **Three bursts** should be transmitted **at a rate of one per second**.
  - If no **bursts** are heard, disconnect the battery immediately, and wait minimum 20 sec. before connecting / reconnecting it again.



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Figure 15 Connecting the battery

- 2** When the battery is correctly connected, assemble the transponder.
  - *Refer to page 48 for details.*
- 3** Check that the unit is correctly assembled and sealed.
- 4** Perform a functional check before deployment, to ensure it will operate correctly once it has been positioned on the seabed.
  - The functional check is performed at the Operator Station.
  - When checking, lower the transponder on a rope over the vessel's side.
  - Ensure the transponder replies to the correct interrogation frequency.

## Replacement of the transponder battery

To replace a Lithium battery / rechargeable battery, follow the procedure below:

To replace the battery, the unit must be opened.

→ *Refer to page 44 for details.*

- 5** Unplug the connector from the battery by (see figure below):
  - Support the connector with your left hand and use a screw driver to press the release knob, as you pull out the connector.

- 6** Remove the four nuts and locking washers holding the battery to the chassis.

- 7** The battery can now be removed from the chassis.

- 8** Replace the battery pack in the reverse order, as follows:

- Mount the four nuts and locking washers holding the battery to the chassis.

→ *Refer to figure on page 38.*

- 9** Connect the battery.

→ *Refer to figure on page 37.*

- 10** Assemble the transponder.

**Note** *Replace the used silica-gel bag with the new bag delivered with the battery.*

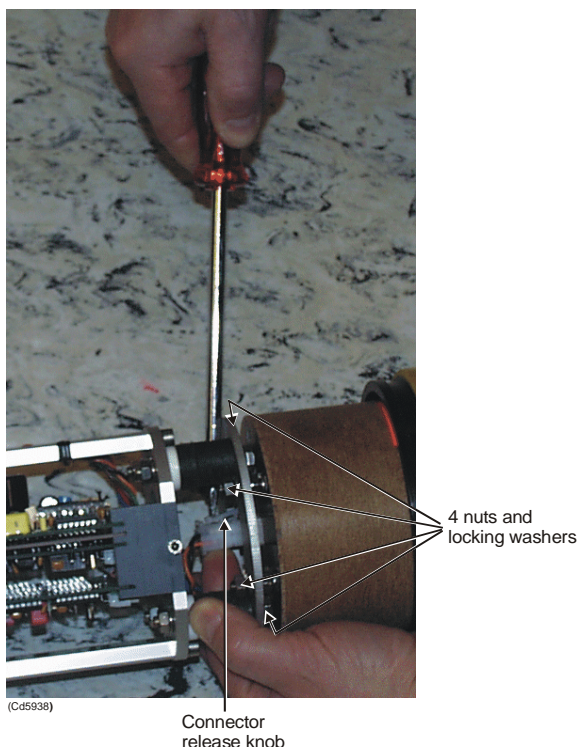
**Note** *When the battery is connected / disconnected the electronics is Reset.*

**Note** *After Hard reset / Reset, Tx power is set to:*

HPR 400 = HIGH

HPR 300 = MAXIMUM

→ *Refer to procedure on page .38.*



*Figure 16 Battery connector and mounting screws*



# TRANSPONDER CONFIGURATION

## General

All transponders are configured by the manufacturer. The configuration may be altered if required. The procedure to perform alterations will depend on the HPR LF system in use.

A transponder can operate with the following topside systems:

- HPR 400 series
- HPR 300 series
- Each transponder series is dedicated to a specific frequency band.
- Altering the configuration, switching between the operating systems or changing the channel settings is done by:
  - Acoustic telemetry. (An HPR 400 system is required.)
  - Use of internal switches. (Located on the microcontroller board.)
- A number of transponder channels are available (depending on the selected system) to prevent interference between transponders if several are located in the same area (a channel being an interrogation and reply frequency combination).

## Acoustic telemetry - basics

For information on how to use acoustic telemetry in the HPR 400 system, refer to the *Standard command reference chapter in the System operator manual/APOS On-line help*.

## Switch settings - basics

The switches for frequency and channel set-up are located on the microcontroller board. The set-up must therefore be done before unit installation, while the unit is open. The following switches are available; a 4-bit DIL switch and two 16-position rotary switches.

The set-up is described in the figure below and the switches are used as follows:

- The DIL switches (S1 - four switches) select the system of operation.
- The rotary switches S2 and S3:
  - For the HPR 400 series - select the transponder operating frequency and channel.
  - For the HPR 300 series - set the interrogation frequency and command address.

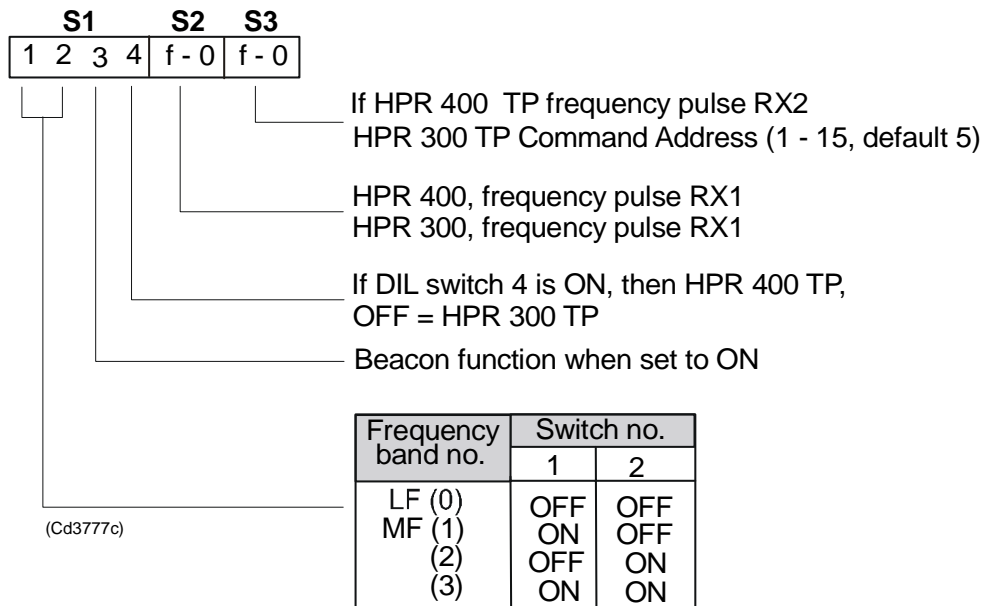


Figure 17 The microcontroller board - switch settings

## HPR 400 channels

The following paragraphs therefore describe only the principles for an HPR 400 system.

The HPR 400 channel operation is the default. When set to HPR 400, the transponder executes all the commands for LBL and SSBL operation and subsea ranging. It also has an incorporated telemetry system.

### Acoustic coding principle

The telemetry link uses a burst of seven pulses, all with different frequencies, transmitted in a sequence to make up a message. The coding principle is called “Factorial coding”, and has a total of 5040 combinations. 4096 of these are used for defining a 12-bit message, while the remaining; 4097 to 5040, are spare. The spare combinations may be used for other messages such as ASCII transmissions and special single messages.

A complete telegram is constructed by sending several messages in sequence.

## HPR 400 channels and positioning frequencies

An overview of available HPR 400 channels and operating frequencies, is given in the APOS On-line help.

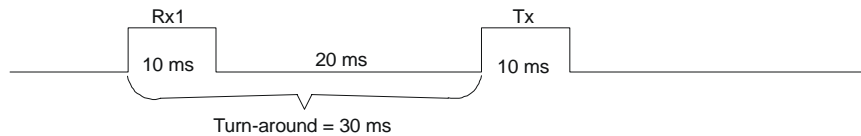
- Rx frequencies used are: 10.000 - 12.500 kHz.
- Telemetry frequencies used are: 12.125 - 12.875 kHz, at 250 Hz intervals.
- Tx frequencies used are: 13.000 - 15.750 kHz.

The HPR 400 system interrogates the transponders by transmitting two pulses with frequencies according to the protocol. The transponder reply is determined by the second interrogation pulse.

→ Refer to figure 18.

When the first interrogation pulse is an odd number (o) the reply is 250 Hz higher than it is when the pulse is an even number.

HPR 300



HPR 400

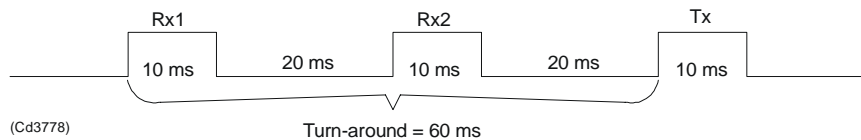


Figure 18 Transponder reception and transmission signal timing diagram

→ Referring to figure on page 40, the switch settings are:

DIP switches				
HPR	S1-1	S1-2	S1-3	S1-4
HPR 400	Off	Off	Off	On
Rotary switches				
HPR 400	S2		S3	
	Set to the first digit of the desired channel number - Rx 1.		Set to the second digit of the desired channel number - Rx 2.	

Table 2 HPR 400 switch settings

**Example, select channel A12:**

If channel A12 is to be selected, switch S2 must be set to position 1 and S3 to position 2. The first transmission frequency will then be 10,000 Hz and the second transmission frequency will be 10.500 Hz.

To find the reply frequency:

The second frequency number is 2 so go to rows Ae2/A02, and the first frequency number is odd (1) therefore the A02 row is used. The reply frequency is therefore 13.750 Hz.

→ Refer to the timing diagram, on page 41.

## HPR 300 channels

An HPR 300 system interrogates the transponders by transmitting one pulse with frequency according to the protocol. The channels available are listed in table 3.

Note

*The transponder must also be set to operate in HPR 300 when used by HPR 1507 or HPR 1530 systems.*

With the MPT 163 transponders, the HPR 300 system uses the Common Command Frequency (CCF) of 9506 Hz, and has a total of 5 channel numbers (frequency combinations) available.

Transponder channel number	Operating frequencies (kHz)	
	Interrogation (TP Rx)	Reply (TP Tx)
CCF	9.506	-
A01	9.901	13.158
A02	10.309	13.587
A03	10.707	14.045
A04	11.111	14.451
A05	11.547	14.881

Table 3 HPR 300 channel numbers and frequencies

For the transponders in HPR 300, the switch settings are:

<b>DIP switches</b>				
<b>HPR function</b>	<b>S1-1</b>	<b>S1-2</b>	<b>S1-3</b>	<b>S1-4</b>
HPR 300	Off	Off	Off	Off
HPR 300- Beacon function	Off	Off	On	Off
<b>Rotary switches</b>				
HPR 300	<b>S2</b>		<b>S3</b>	
	Set to the interrogation frequency.		Set to the command address default setting - position 5.	

*Table 4 HPR 300 switch settings*

## MAINTENANCE

### General

No maintenance is normally required, apart from washing the unit. To change the battery pack, the unit must be dismantled.

### Safety information for transponder and transponder battery

→ Refer to chapter on page 13.

### Transponder dismantling

The procedure for opening the pressure housing is identical for the all types of transponders described in this manual.

#### **Pressure housing assembly:**

The pressure housing comprises the cylinder body (housing), the transducer head and bottom end cap. The transducer head comprises of the transducer and the transducer cage. The transducer head has a screwed flange.

The transducer head and the bottom end cap are both sealed into the housing, using two O-rings and a backup ring, and secured by six socket-head screws.

→ An example of pressure housing assembly is shown in the figure on page 45.

#### Note

*The socket head screws are manufactured of stainless steel, and must only be replaced by screws of the same material.*

To remove the electronics chassis and battery pack from the housing, follow the procedure below:

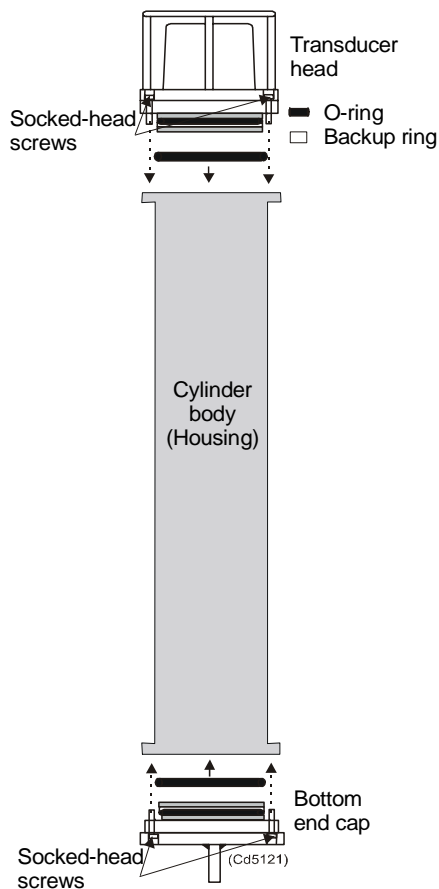


Figure 19 MPT 163  
pressure housing assembly

### Before you open the unit:

- 1 Wash the unit thoroughly in fresh water, and dry off any moisture on the outside.
- 2 Place the transponder horizontally on a flat, clean work-bench, and support it so it can not roll off.

### Opening the unit:

- 3 Remove the six socket-head screws that secure the transducer head into the housing.
- 4 Put a thin piece of plastic in the gap between the flanges to protect the flange surface.
- 5 Screw the same screws into the threaded holes in the transducer head till they meet the plastic.
- 6 Tighten the screws a little at a time to extract the transponder head out of the housing.

Note *If the transponder is fitted with a release unit or a responder trigger connector, care must be taken to ensure that the wires connected to the release unit and battery pack are not damaged when withdrawing the chassis.*

Note *DO NOT attempt to "unscrew" the transducer from the housing as the internal wiring and circuitry can be damaged.*

Note *DO NOT use a screw-driver or similar tool in an attempt to lever the transducer out. This will damage the sealing surfaces resulting in water penetration.*

- 7 Support the end cap as it is withdrawn. Once the O-ring is clear of the housing, the transducer and electronics chassis may be removed.
- 8 There is a wire from the release mechanism to the base of the battery pack. Disconnect this wire from the battery pack before attempting to remove the chassis too far from the transponder housing.

## Replacement of circuit boards

### **Rx board, Tx board and microcontroller board**

To replace one of these circuit boards, follow the procedure below:

- 1** Dismantle the transponder.  
→ *Refer to paragraph on page 44 for details.*
- 2** Short together pins 3 and 6 in the plug connected to the electronics chassis, to discharge the transmitter capacitors.
- 3** Unscrew the plastic locking devices. The appropriate board can now be removed from the chassis.

Note

*The microcontroller board and Rx board are interconnected via a flat cable.*

- 4** Mount the new circuit board and tighten the locking devices. Take care not to over-tighten the locks.
- 5** Assemble the transponder.  
→ *Refer to paragraph on page 48 for details.*

### **Rx-amplifier matching board and motherboard**

To replace one of these circuit board, follow the procedure below:

- 1** Dismantle the transponder.  
→ *Refer to paragraph on page 44 for details.*
- 2** Remove the soldering at the connections. Remember to mark the wires.
- 3** Unscrew the four screws holding the board. The appropriate board can now be removed from the chassis.
- 4** Assembling is basically the reverse of dismantling.

## Replacement of the battery pack

→ *Refer to page 38.*



## Replacement of the transducer

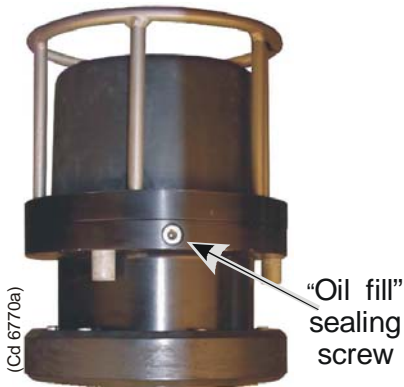


Figure 20 Transducer head, indicating the sealing screw

The transducer is sealed in the transducer cage. The transducer is a sealed unit and can not be opened. If the unit is not working, the whole unit must be replaced. To replace the transducer follow the procedure below:

**Warning**      ***Do not try to unscrew the sealing screws on the side of the transducer flange.***

### Procedure

- 1 Dismantle the transponder.  
→ Refer to paragraph on page 44 for details.
- 2 Remove the transducer cage. (The transducer cage is fitted with a screwed flange).
- 3 Remove the soldering at the connections Tp1 and Tp 2 on the Rx amplifier matching board (the Tp1 and Tp2 are clearly marked). Remember to mark the wires.
- 4 Assembly is basically the reverse of dismantling.

## Transducer handling

At transportation and storage, the transducer face and the O-ring groovers must be protected.

As a precaution at storage, short-circuit the electrical wires. This prevents unpleasant voltages, which otherwise may appear from temperature variations.

## Remove the bottom end cap/release unit

When fitted, the release mechanism forms the bottom end cap of the pressure housing. Removing a standard end cap or a release unit, is basically the same. The end cap is sealed into the transponder housing. Six socket-head screws are positioned around the release unit flange.

Six of these hold the release unit. The procedure describes how to remove the release unit:

- 1 Remove the six socket-head screws that secure the release unit into the housing.
- 2 Pull the release unit out. The unit should seal tightly into the housing, so some force will be required to withdraw it.

- Note *A 1,3 m length of cable is connected between the release unit and the battery pack. Ensure this cable is not damaged when withdrawing the unit.*
- Note *DO NOT attempt to "unscrew" the unit from the housing as the internal wiring and circuitry can be damaged.*
- Note *DO NOT use a screw-driver or similar tool in an attempt to lever the unit out. This will damage the sealing surfaces resulting in water ingress.*
- 3 The release mechanism may now be removed. Once the O-ring is clear of the housing, it will be loose.
  - 4 Disconnect the release unit from base of the battery.
  - 5 Assembly is basically the reverse of dismantling.

## Transponder assembly

To replace the electronics chassis and battery pack into the housing, follow the procedure below:

### **Before you start:**

- 1 Inspect the O-rings, backup rings and sealing surfaces for damage. If in doubt, or if they have been used for more than one year, they should be replaced.
- 2 Place the new bag of silica-gel desiccant into the housing to absorb any humidity that may have entered the unit while it was open.
- 3 Ensure the mating surfaces and O-rings and backup rings are *completely* clean, then wipe a thin film of park-o-lube over the rings and mating surfaces.

### **Assembling:**

- 1 Carefully insert the chassis into the housing. Do not allow the circuit boards to knock against the housing, and ensure no wires are trapped between the chassis and the housing or left protruding from the housing.
- 2 Ensure the bag of silica-gel is positioned such that it will not prevent the chassis from fully entering the housing.
- 3 When the O-ring on the end cap meet the lead-in chamfer at the entrance to the housing, support the base of the transponder unit and push firmly on the transducer cage. Ensure the O-ring compress easily as the end cap enters the housing, and are not crimped or damaged.
- 4 When the end cap is fully home, align the screw holes and screw the six socket-head screws into the holes. Tighten the screws using a screwdriver-handled hexagonal key.

- 5 Wipe off any excess grease and clean the unit.
- 6 Perform a final check to ensure all the screws are correctly tightened and nothing has been left out.

## Source level adjustment

For certain applications, you may require to adjust the source level. This is done at the HPR system. For information on how to adjust the source level, refer to the *Standard command reference chapter in the System operator manual / APOS On-line help*.

## MPT 110 Vac transponder-power module

Drawing of the power modules wiring diagram:

→ *Refer to page 80.*

As indicated on the drawing:

- The power unit is an AC / DC power unit.
- The 110 Vac input voltage is overvoltage protected.
- The trigger signal is overvoltage protected.
- The output voltage when using the 110 Vac power unit is:
  - \* 48 Vdc directly to the transmitter, and
  - \* the 48 Vdc is reduced to 10 Vdc in the LM317 controller.
- Tx power output is higher when using the power module (output 48 Vdc) than when using the the back up battery (output 40 Vdc).

# MAIN PARTS

## General

A transponder consists of the following main parts:

- Transducer
- Housing
- Bottom end cap/Release unit
- Circuit boards
- Battery pack (described in a separate section)

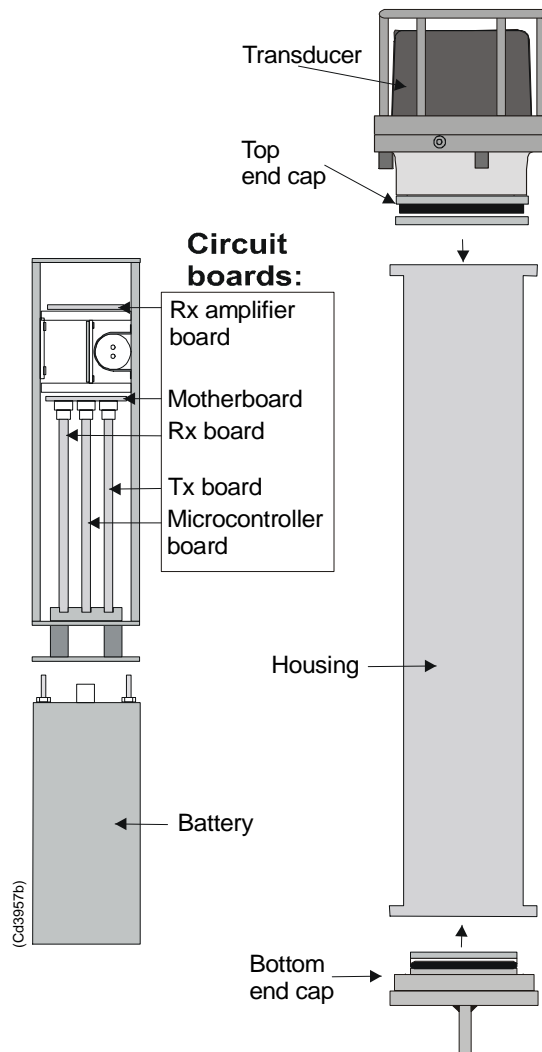


Figure 21 Example of transponder - main parts

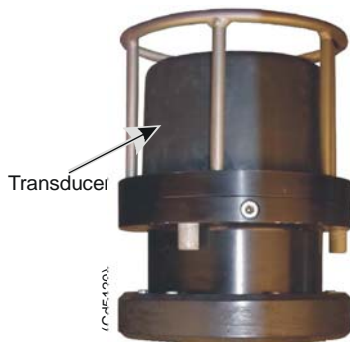


Figure 22 Transponder head

## Transducer

The transducer is mounted in one end of the cylindrical transponder. It has two beamwidths. These are:

- Narrow beam  $\pm 30^\circ$
- Wide beam  $\pm 60^\circ$

The transducer is connected to the electronics via four wires.

## Housing

For information regarding the housing, refer to *the Technical specification*.

## Bottom end cap

A standard bottom end cap includes a shackle.

The following units are supplied with special end caps:

- Units including a Release mechanism (part of the Release mechanism).

## Circuit boards

### Circuit boards

The transponder electronics comprises of the following five printed circuit boards.

→ *Refer to figure on page 51.*

- Transmitter board (Tx)
- Receiver board (Rx)
- Rx amplifier board
- Microcontroller board
- Motherboard





The board holds two voltage regulators which output the voltages required by the other boards. It also has a crystal oscillator which is used as the Tx frequency source, and a direct numerical synthesizer for generating the correct Tx frequency. Driver stages with power control, an output stage with over-current protection, and transducer matching circuits, complete the board.

Note

*The Relay is only used with the following transponders:  
- MPT 163series.*

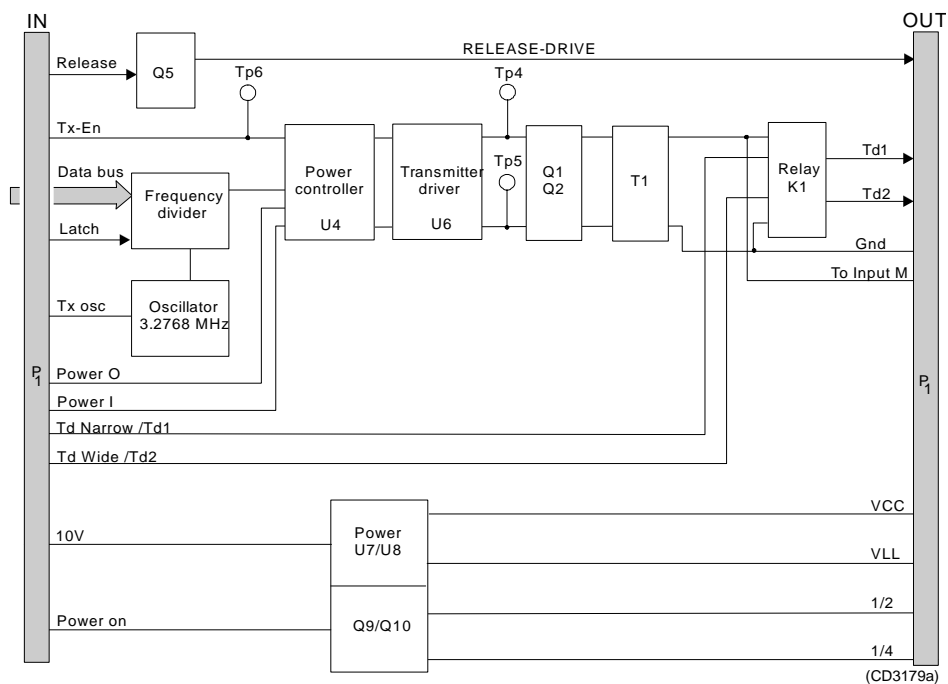


Figure 24 Transmitter circuit board - block diagram

## Receiver board (Rx)

The receiver board is designed to receive transponder interrogation signals and telemetry signals. It contains nine narrow-band channel receivers, and a WIDE-detector and phase-locked loops for generating the right modulation frequencies to the channel receivers.

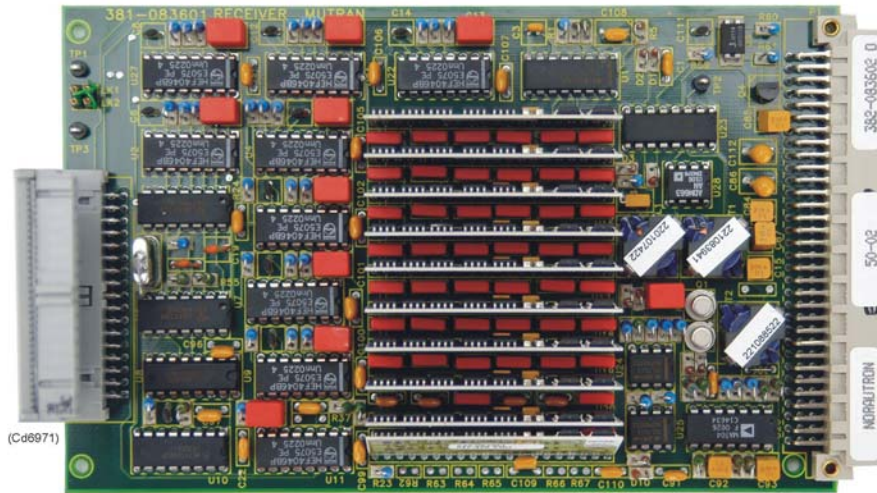


Figure 25 Receiver circuit board

→ Refer to figure on page 57 for the block diagram.

The board consists of a two stage amplifier with signal limitation and an anti-aliasing filter, two channel receiver stages for wake-up, and seven channel receiver stages for telemetry, all constructed as ceramic hybrid circuits. The channel receivers perform mixing, low-pass filtering, summing and envelope detection. The outputs from the channel receivers are fed to the microcontroller.

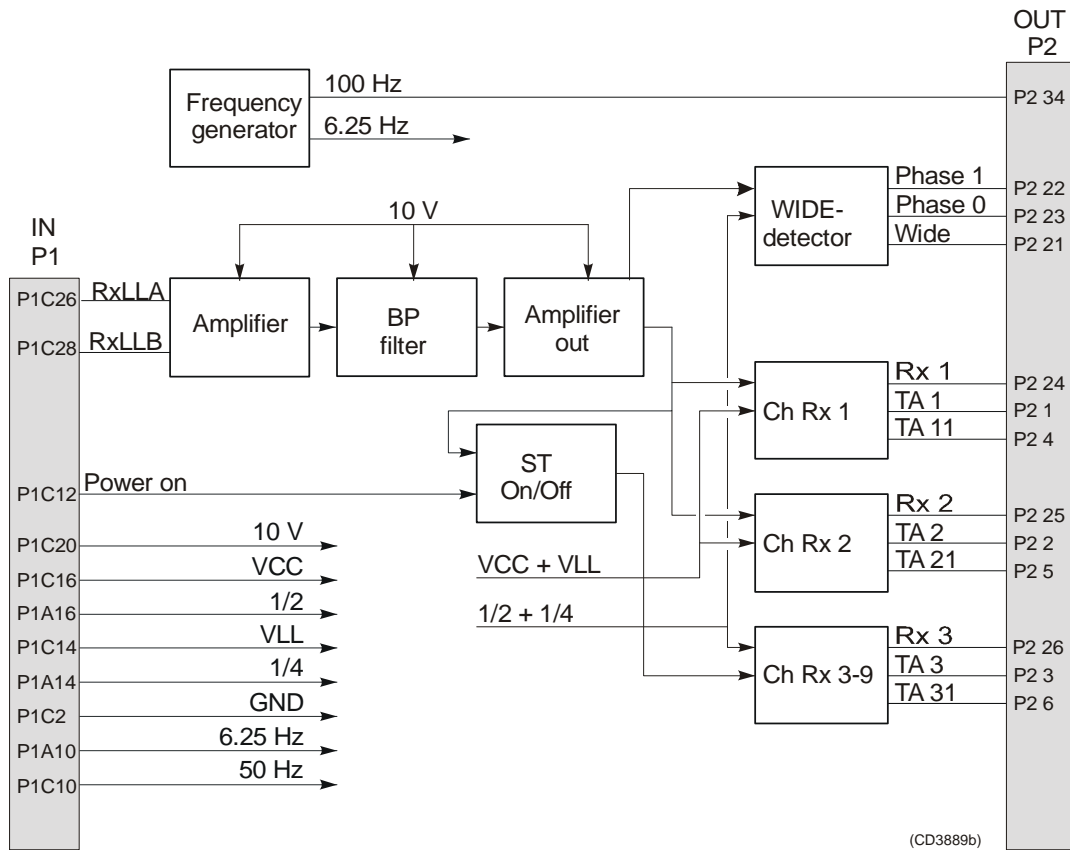


Figure 26 Receiver circuit board - block diagram

## Rx amplifier matching board

The TP-PREAMP 24K Hz acts as a matching preamplifier between the transducer and the Channel Receiver circuit board.

→ Refer to figure 27 for the block diagram.

The transducer is connected to TP1 and TP2.

The incoming signal passes through the matching component, T1. From T1, the input signal is connected to a two-step amplifier.

The first step of this amplifier is a low noise FET with a voltage gain of approximately 10 dB.

The signal then enters the micropower operational amplifier, where the gain can be altered in two steps; either 0 dB or 6 dB (approximate values). A logic “0” at TP7 causes 0dB to be achieved. A logic “1” at TP7 causes 6 dB to be achieved.

The amplifier contains a bandpass filter to reduce the input noise before the signal is connected to the output transformer T2. The output to the Rx board is on TP8 and TP9.

TP5 and TP6 are connected to the Transmitter board. When the system is transmitting, a TR-switch in the T1 block protects the input of the amplifier. Transmitted signals are transformed via T1 and leave the board from terminals TP1 and TP2.

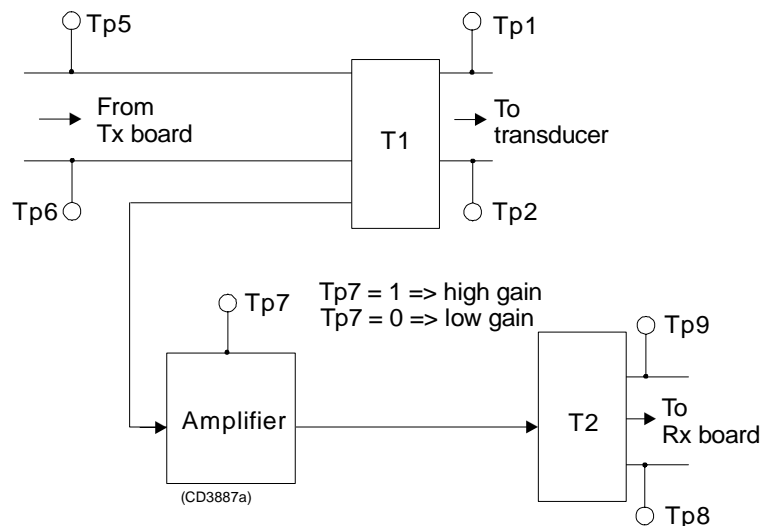


Figure 27 Rx amplifier matching board - block diagram

## Microcontroller board

The Microcontroller board is a general purpose single microcontroller board, with the main task of performing calculations and digital signal control. It uses the *87C196KC/KD Microcontroller* manufactured by Intel, and is also equipped with a number of timers, inputs and outputs.

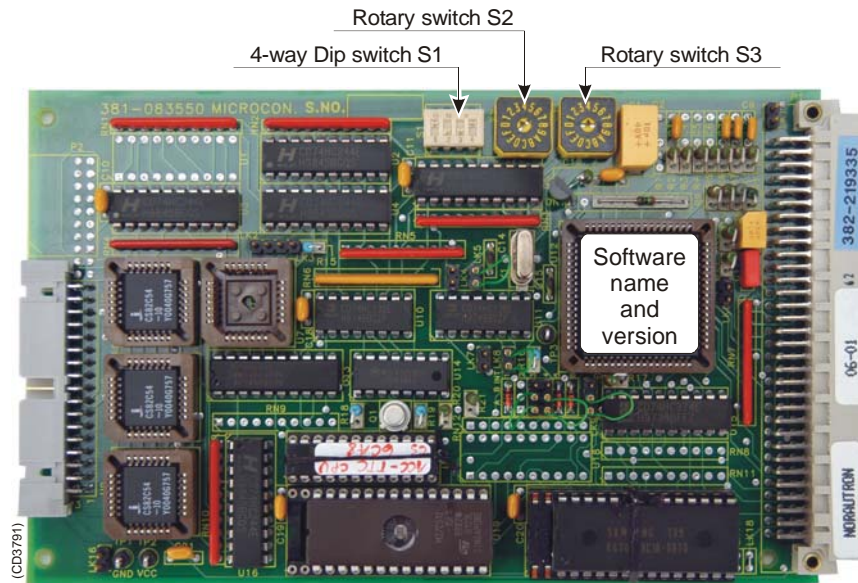


Figure 28 Microcontroller circuit board - switch locations

→ Refer to figure 29 for the block diagram.

The 87C196 microcontroller is the main component on the board. It can be run in different modes such as active, idle and power down, the inactive modes being used to save power. The microcontroller performs all the calculations and controls all the board's inputs and outputs. The timers on the board are used for dividing down the off-board Phase-Locked-Loop frequencies, controlling the receiver frequency channels.

## Switches

The board carries one 4-way Dip-switch block and two 10-position rotary switches:

- The Dip-switch block is used to set the system's operating frequency band.

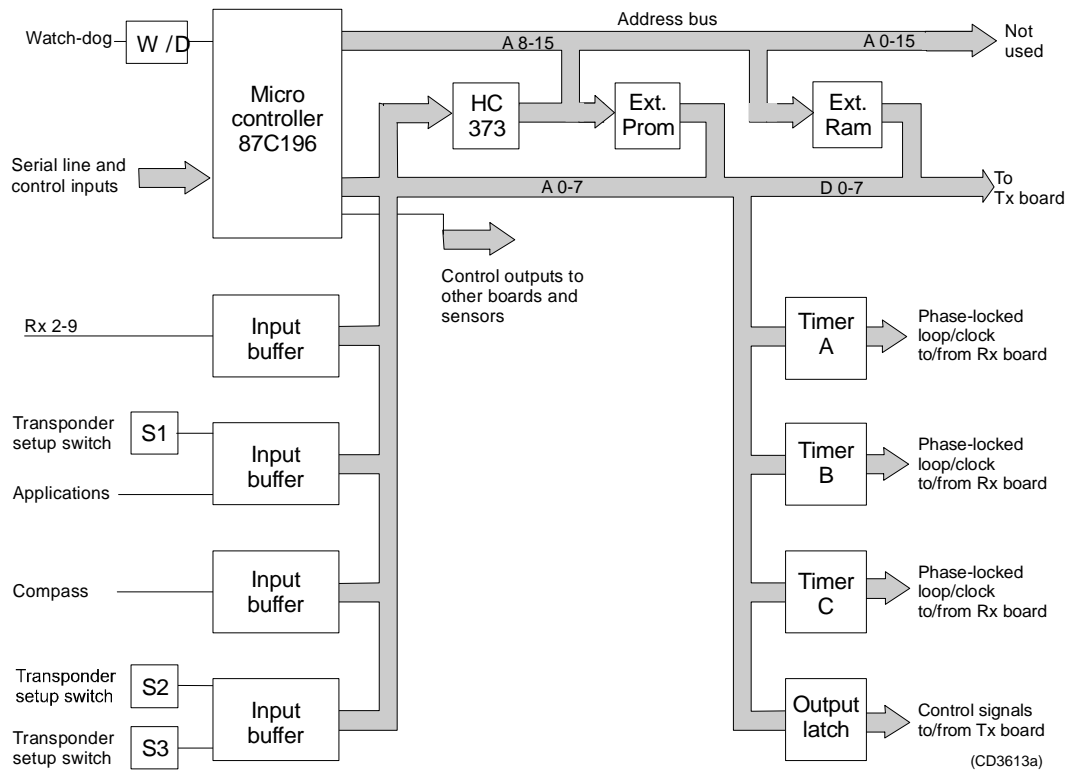


Figure 29 Microcontroller circuit board - block diagram

## **Motherboard**

The motherboard contains all the input/output interfacing for the transponder. It has an interface connection (P4) for the two inclinometers and a + 10 V supply which is turned on only during processing to conserve battery life. It also carries an interface plug (P5) for the Depth/Temp serial line. The TTL interface is buffered through U1 on the motherboard.

## **Interconnections**

The interconnections will differ from tp model to tp model.

Note

*For details of the interconnections between the circuit boards, the transducer and the electronics, and the battery and the electronics, contact Kongsberg Maritime.*

## AUXILIARY EQUIPMENT

### General

This chapter describes various types of auxiliary equipment that may be used to secure a transponder.

### Anchor-weight

A transponder requires an anchor-weight of approximately 60 to 70 kg to hold the transponder securely in position on the seabed. Use a length of rope 3 to 15 metres long to attached the anchor, and then attach a suitable shackle to the "top" of the rope. (The length of the rope depends on the transponder use).

- When using LBL with very long base lines in deep water, use up to 15 m.
- When using SSBL on a flat seabed, a 3 m rope is sufficient.

### Floating rope

A floating rope may be used when collecting the transponder by an ROV.

### Auxiliary equipment supplied by Kongsberg Maritime

Kongsberg Maritime may supply the following:

- Floating collar



## Floating collar

The collar is divided lengthwise into two parts. These parts are placed around the transponder housing and bolted together, enabling the collar to be assembled onto a transponder without removing the end cap clamping ring. The ID-clamp ring may be used to hold the collar up against the top clamping ring on the transponder.

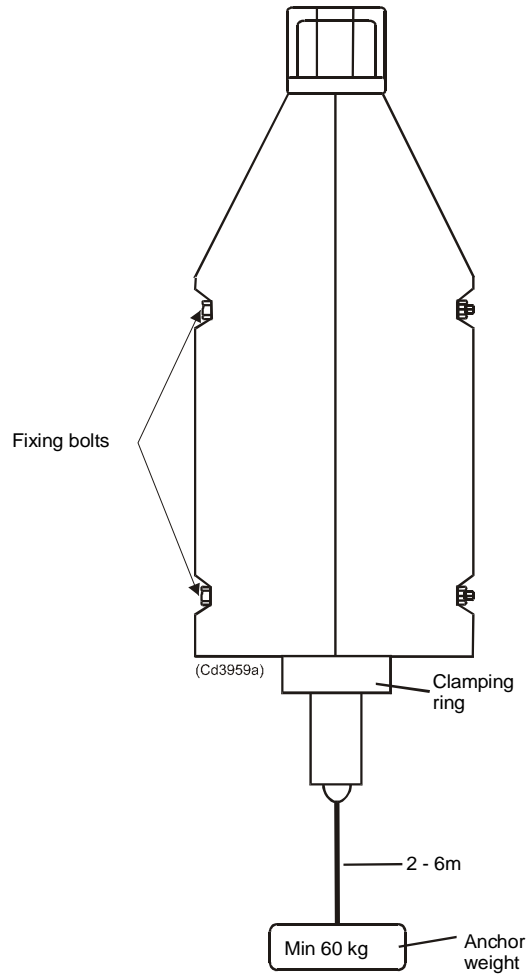


Figure 30 Transponder floating collar

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# SPARE PARTS

## Introduction

This chapter lists the parts and modules defined by Kongsberg Maritime as *Line Replaceable Units (LRUs)* for the MPT 163 transponders. These LRUs are the individual parts and items which the manufacturers considered are replaceable by the local maintenance engineer. An exploded figure is included to assist you with part identification.

## Codes used

The following codes are used in the parts lists:

**Part no.** - Kongsberg Maritime's part number.

**Item name** - The name of the item.

**Technical data** - Technical specifications and any other relevant information.

**Drw. ref.** - Reference number of the production or illustration drawing where the item is included. If a number is given here, the drawing will be included in the manual's/document's drawing file.

**Drw. pos.** - The item's position number on the drawing referenced above.

**No. in sys.** - The quantity of the item used in the system. *Note that this information is not provided for standard components such as nuts, bolts and washers.*

**Rec. spares** - The quantity of the item recommended to be carried as spares onboard the vessel. *Note that this information is not provided for standard components such as nuts, bolts and washers.*

## Accessories

This list includes the common accessories used for all transponder types. The Drw. pos. is left out.

Part no.	Item name	Drw. ref.	No. in sys.
-	Technical data	Drw. pos.	Rec.spares
540-084173	O-ring	Figures	2
-	124.3 x 5.7 MIL413B	-	2
540-021249	O-ring	Figures	2
-	101.0 x 5.34 N	-	2
549-086691	Backup ring for O-ring	Figures	2
-	101.0 x 5.34	-	2
560-017861	Socket-heads screws	Figures	6
-	-	-	6
599-089487	Plug for ID-clamp	Figures	3
-	-	-	-
Depends on model	Information clamp ring	Figures	1
	w/freq.	-	-
Depends on model	Information clamp ring	Figures	1
	w/reg. no.	-	-
380-101422	Flat cable	N/A	-
-	internal	-	-
599-089318	PCB guide	Figures	1/1
599-089320	-	-	-
654-085883	Aquva lube	N/A	-
-	-	-	-
654-077261	Silicone grease	Figures	1
-	-	-	1
659-063787	Bag of desiccant 10 g	N/A	1
-	Silica-gel	-	1
659-033480	Loctite	N/A	-
-	Type 222	-	1
119-087915	Floating collar	N/A	-
-	7000 m	-	-
857-164157	MPT 163 series Instruction manual	N/A	1
-	(This manual)	-	-

## Batteries

Note

*The Lithium battery is specified for each transponder.*

<b>Part no.</b>	<b>Item name</b>	<b>Drw. ref.</b>	<b>No. in sys.</b>
-	<b>Technical data</b>	<b>Drw. pos.</b>	<b>Rec.spares</b>
290-216804	Alkaline battery	N/A	-
-	A10/36 (24/24)	N/A	-
290-212364	Rechargeable battery	N/A	-
-	N10/36 (18/30)	N/A	-

## MPT 163/RSpB transponder

### Complete transponder

Part no.	Item name	Drw. ref.	No. in sys.
	Technical data	Drw. pos.	Rec.spares
102-213032	MPT 163/RSpB transponder complete	Figure page 69	1
-	All main modules are included	N/A	-

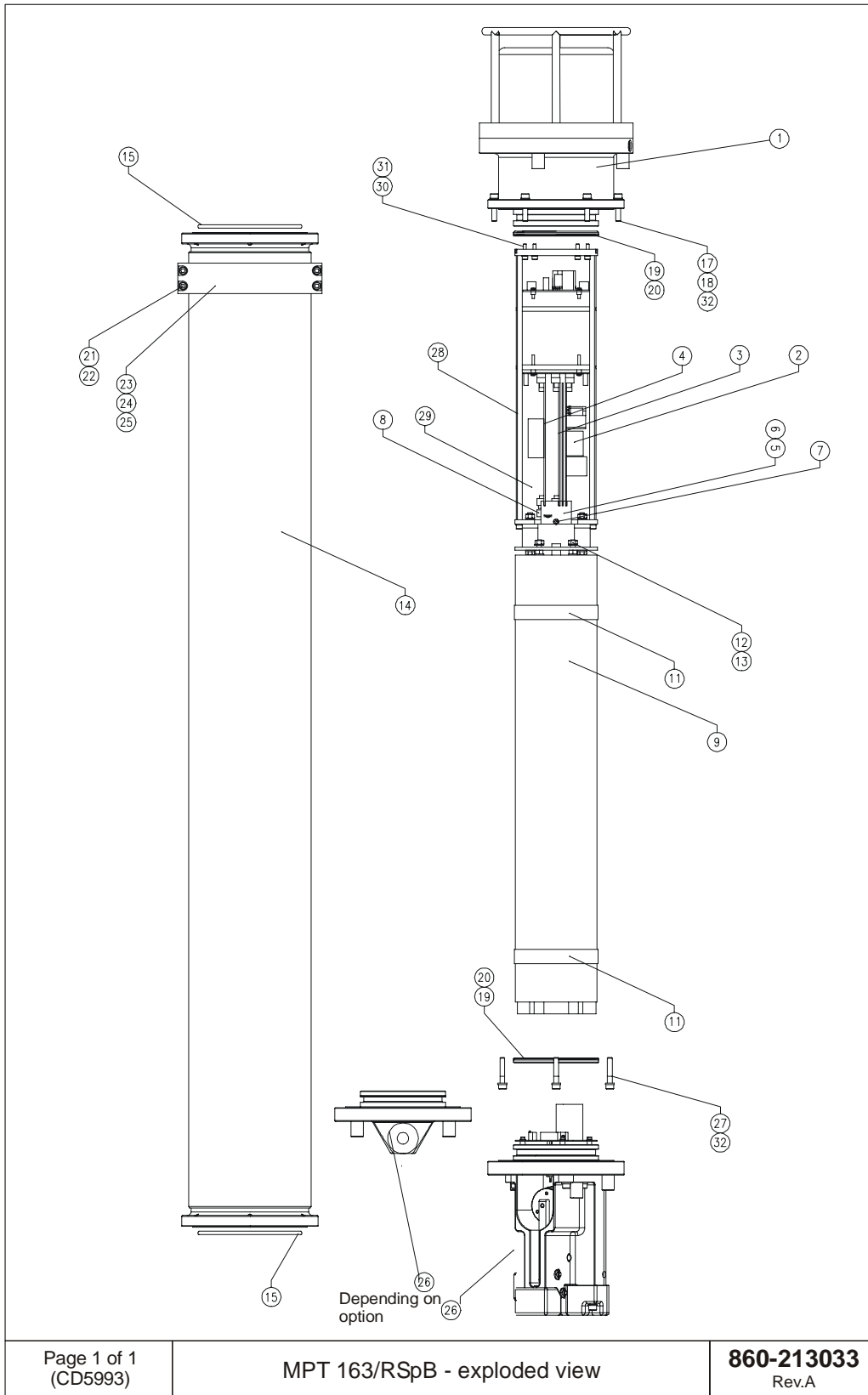
### Main modules

This list includes the main modules for the MPT 163/RSpB transponder.

Part no.	Item name	Drw. ref.	No. in sys.
-	Technical data	Drw. pos.	Rec.spares
312-213030	MPT 163 RSpB transducer	Figure page 69	1
-	-	1	-
299-213606	Electronic chassis	Figure page 69	1
-	Motherboard, Rxamp board and sensors (if used) are included	28	-
382-213608	Tx board	Figure page 69	1
-	-	2	-
382-083551	Microcontroller board	Figure page 69	1
-	-	3	-
382-089502	Rx board	Figure page 69	1
-	-	4	-
290-103053	Battery pack (lithium)	Figure page 69	1
-	L10/36 (15/40)	9	-
599-213028	Housing w/flanges	Figure page 69	1
-	-	14	-
499-215049	Bottom end cap	Figure page 69	1
-	-	26	-
499-213700	Release unit	Figure page 69	1
-	-	26	-

### Accessories

→ Refer to the table on page 66.



## MPT 163/SpBRspSx 110 Vac SU transponder

This section includes parts for the two units (housing and transducer) of the MPT 163/SpBRspSx 110 Vac SU transponder.

### Complete transponder

Part no.	Item name	Drw. ref.	No. in sys.
-	<b>Technical data</b>	<b>Drw. pos.</b>	<b>Rec.spares</b>
102-216353	MPT 163/SpBRspSx 110 Vac SU Transponder complete	Figure page 71	1
-	All main modules are included	N/A	-

### Main modules

This list includes the main modules for the MPT 163/RspSx 110 Vac SU transponder.

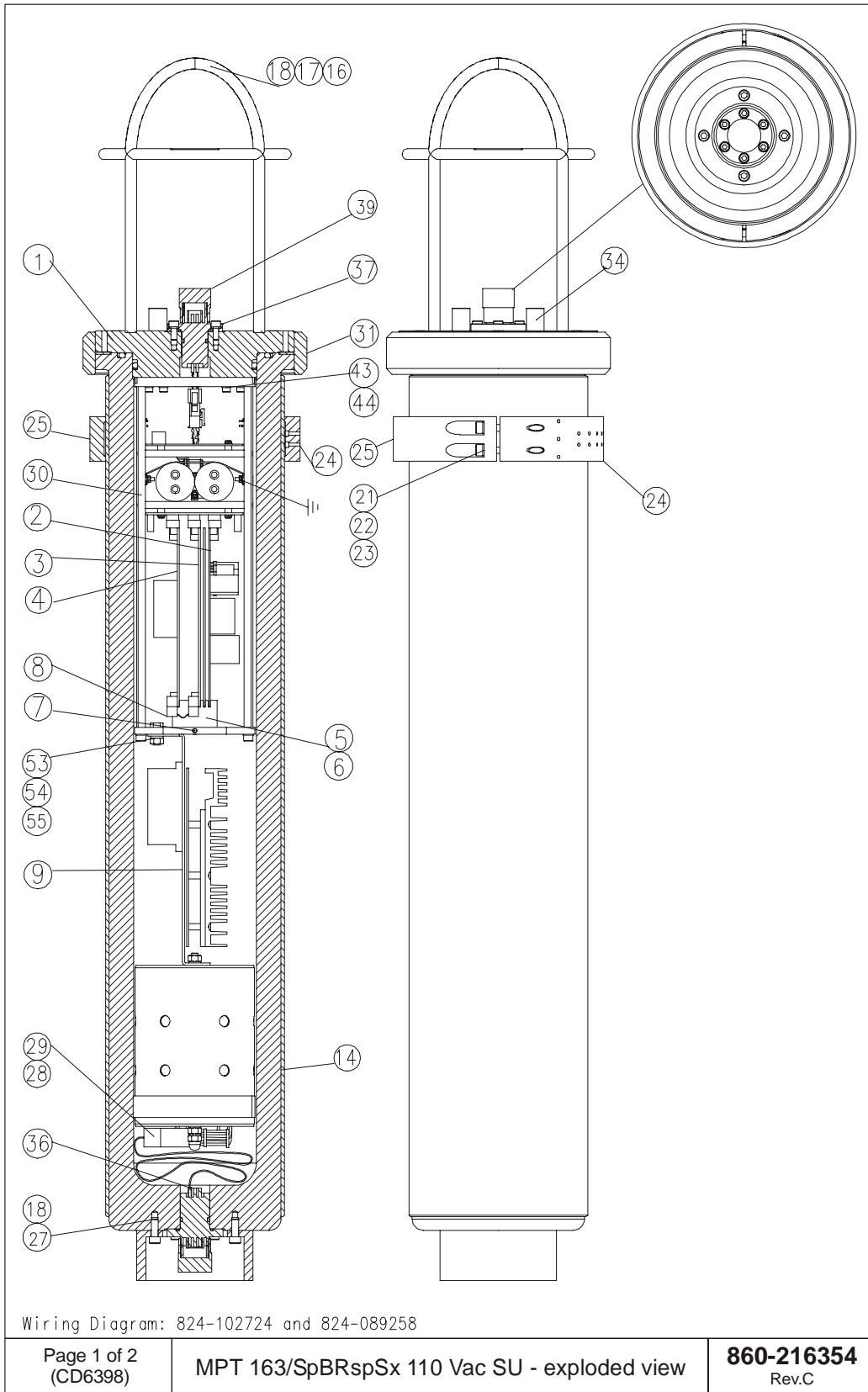
Part no.	Item name	Drw. ref.	No. in sys.
-	<b>Technical data</b>	<b>Drw. pos.</b>	<b>Rec.spares</b>
299-211002	Electronic chassis(short)	Figure page 71	1
-	Motherboard, Rxamp board and sensors (if used) are included	N/A	-
382-213608	Tx board	Figure page 71	1
-	-	2	-
382-083551	Microcontroller board	Figure page 71	1
-	-	3	-
382-089502	Rx board	Figure page 71	1
-	-	4	-
599-216351	Housing	Figure page 71	1
-	(short)	14	-
107-103000	Power module	Figure page 71	1
-	Backup battery is included <b>(1)</b>	9	-
370-087144	UW receptacle base	Figure page 72	1
-	10.00.2.07.2.10 7pins	10	-
379-087454	Protection cap	Figure page 72	1
-	10.20.2.00.01	11	-
370-086715	UW receptacle - top	Figure page 71	1
-	10.00.1.04.2.10 4 pins	37	-
379-087453	Protection cap	Figure page 71	1
-	10.20.2.00.01	39	-

1 Separate Backup battery, part. no: 290-210845

### Accessories

→ Refer to the table on page 66.







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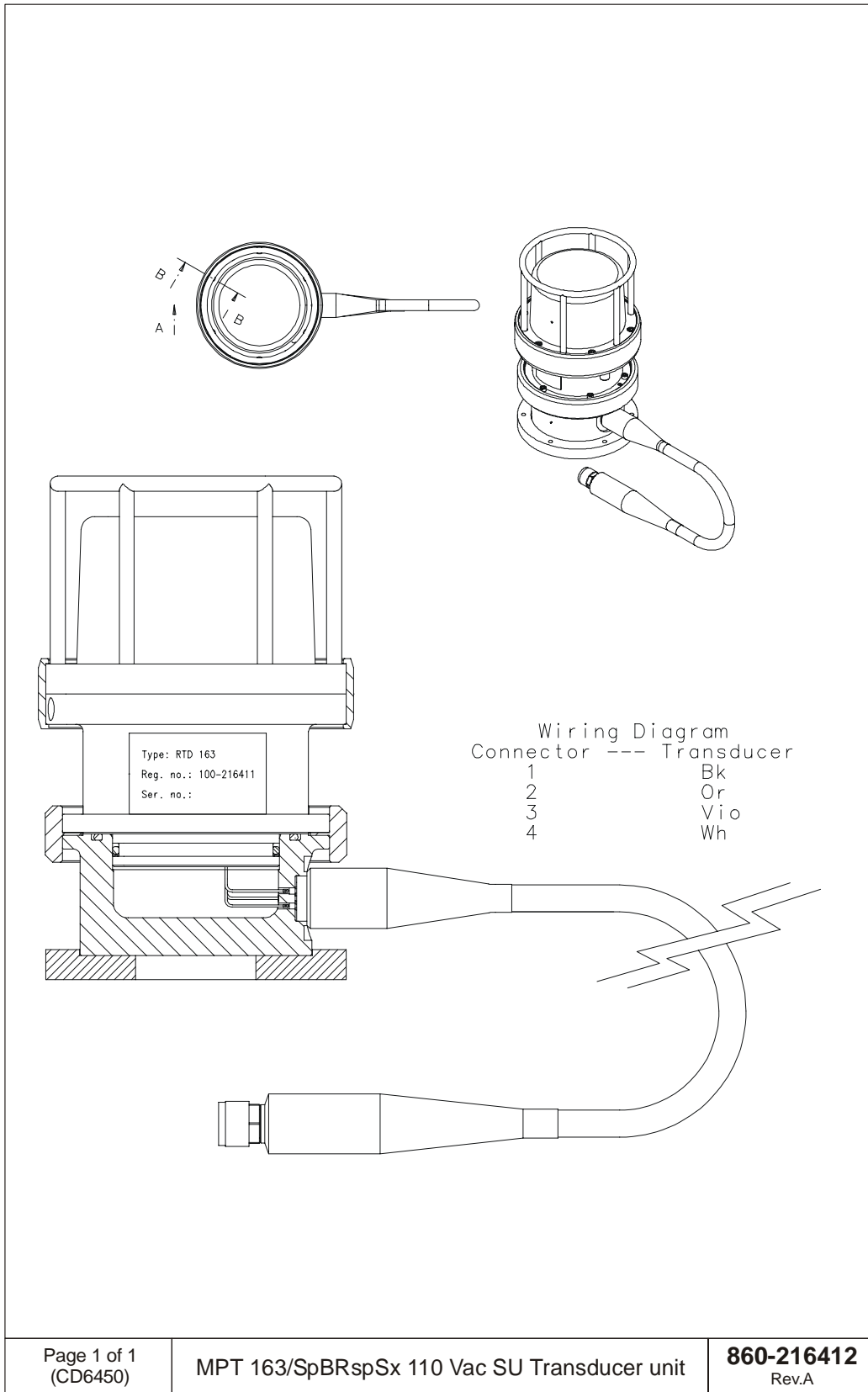
## Transducer unit

This list includes the common spare parts for the transducer unit of the MPT 163/RspSx 110 Vac SU transponder.

Part no.	Item name	Drw. ref.	No. in sys.
	Technical data	Drw. pos.	Rec.spares
100-216411	MPT 163/DTRspSx 110 Vac SU transducer unit	Figure page 75	1
-	-	N/A	-
370-086708	UW plug	-	-
-	10.06.1.04.2.00 4 pins	N/A	-

## Accessories

→ Refer to the table on page 66.



## DRAWING FILE

### Overview

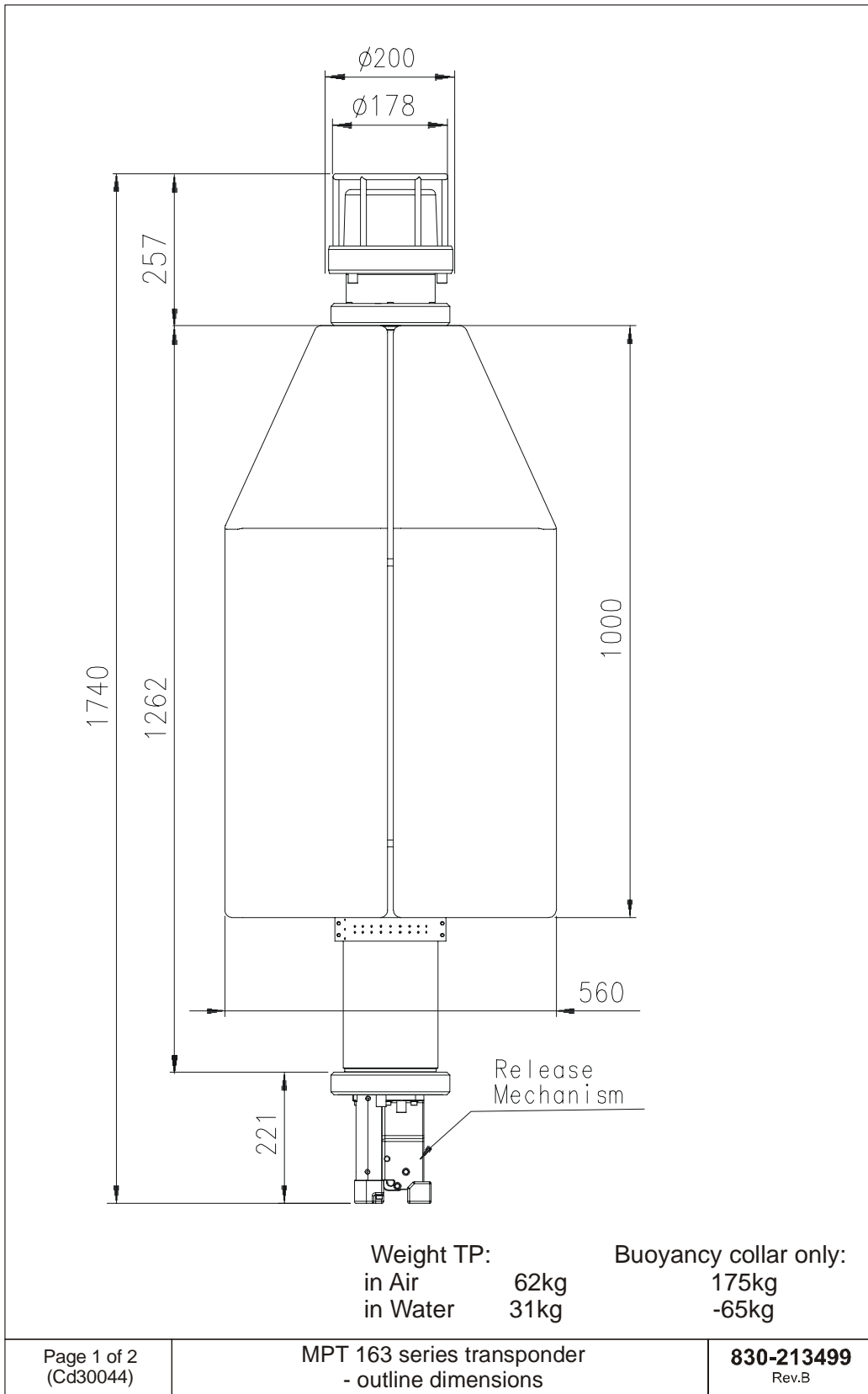
This section contains outline dimensions drawings. The illustrations are based on the original system drawings.

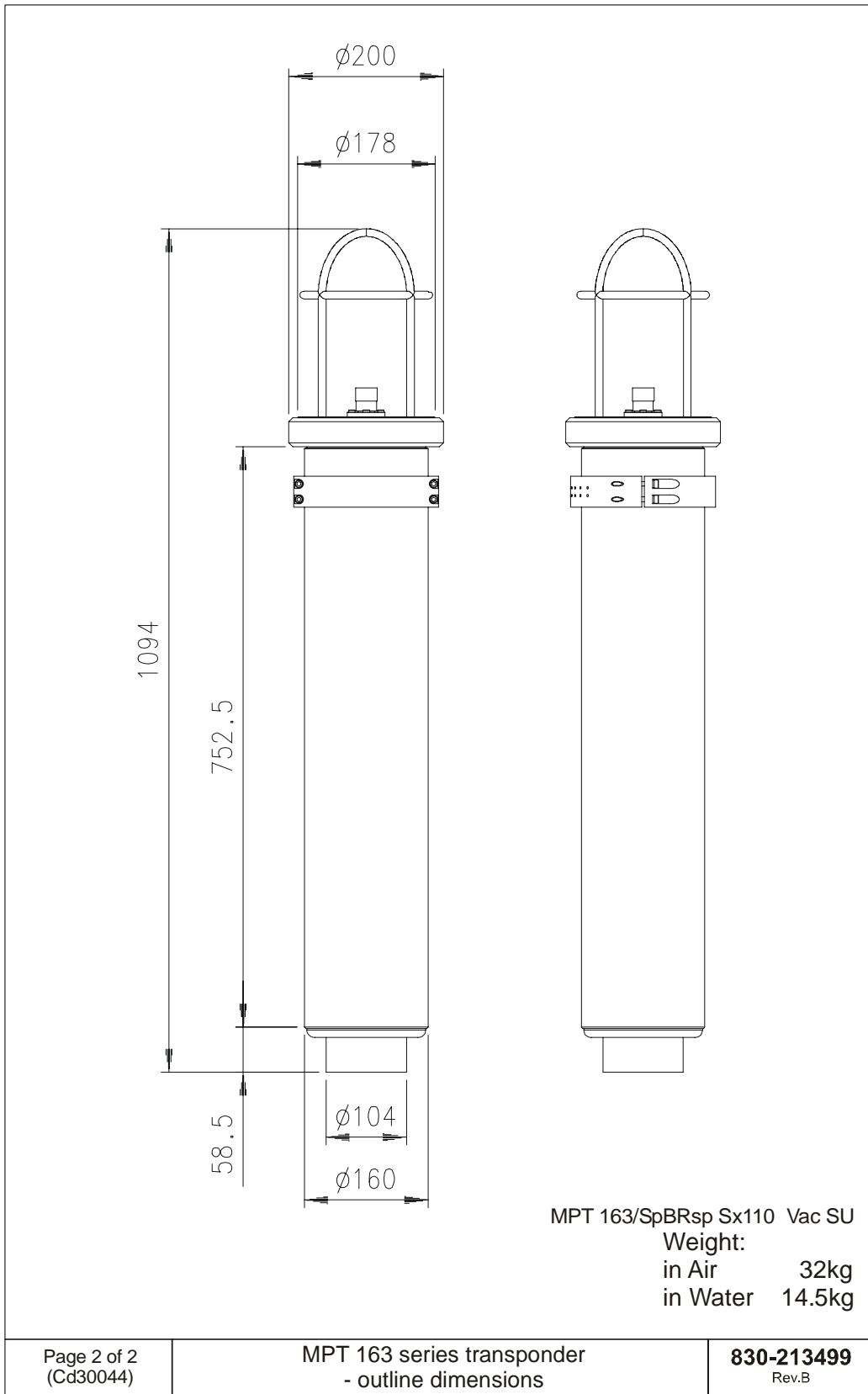
- All measurements are in mm.
- The illustrations are not in scale.
- The original drawings are available in electronic format (AutoCAD) upon request.

### Drawings

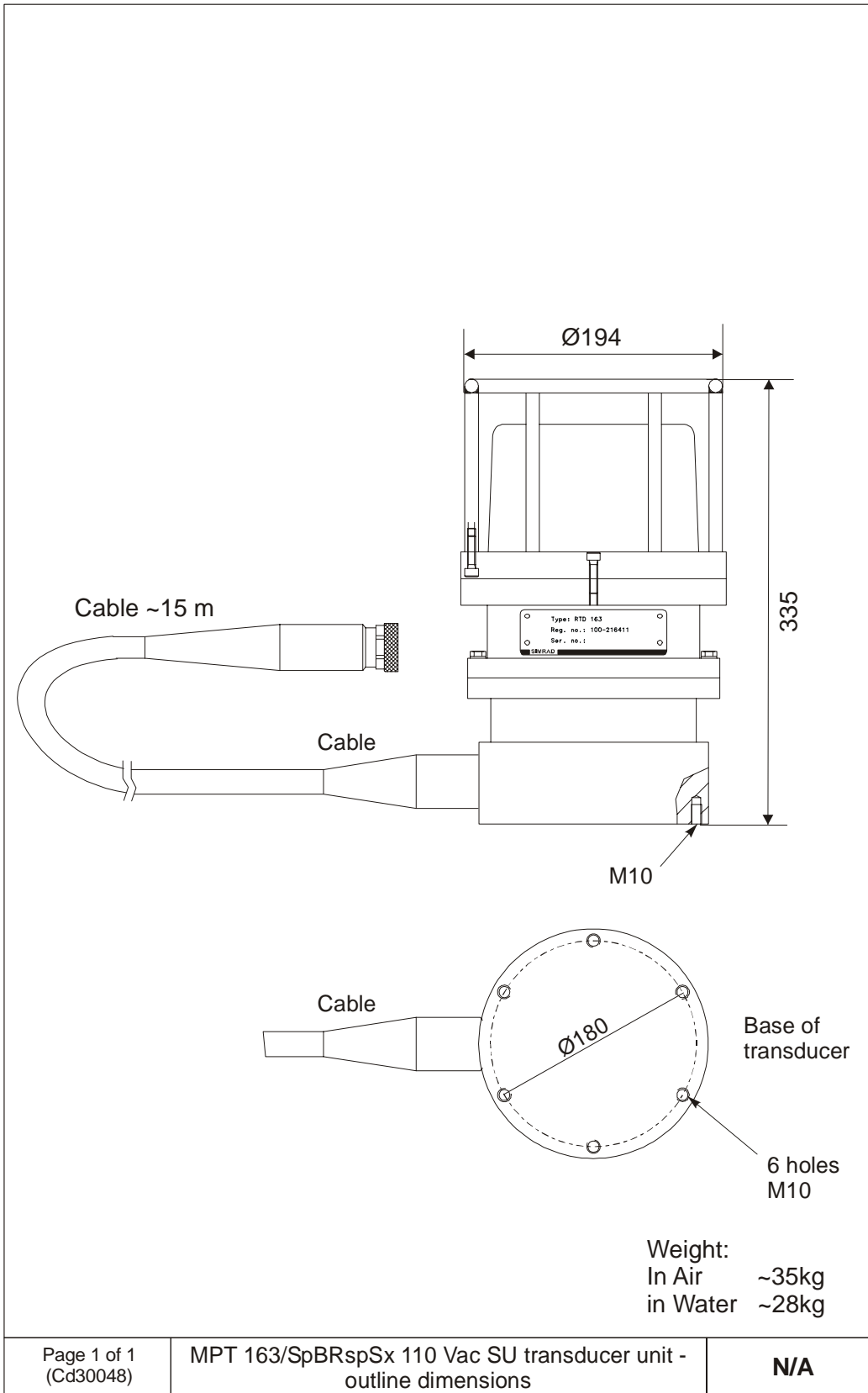
The following drawings are implemented:

- MPT 163/RSpB transponder, page 77.
- MPT 163/SpBRspSx 110 vac SU transponder, page 78.
- MPT 163/SpBRspSx 110 vac SU transducer unit, page 79.
- MPT 163/110 vac power module, page 80.
- Floating collar, page 81.

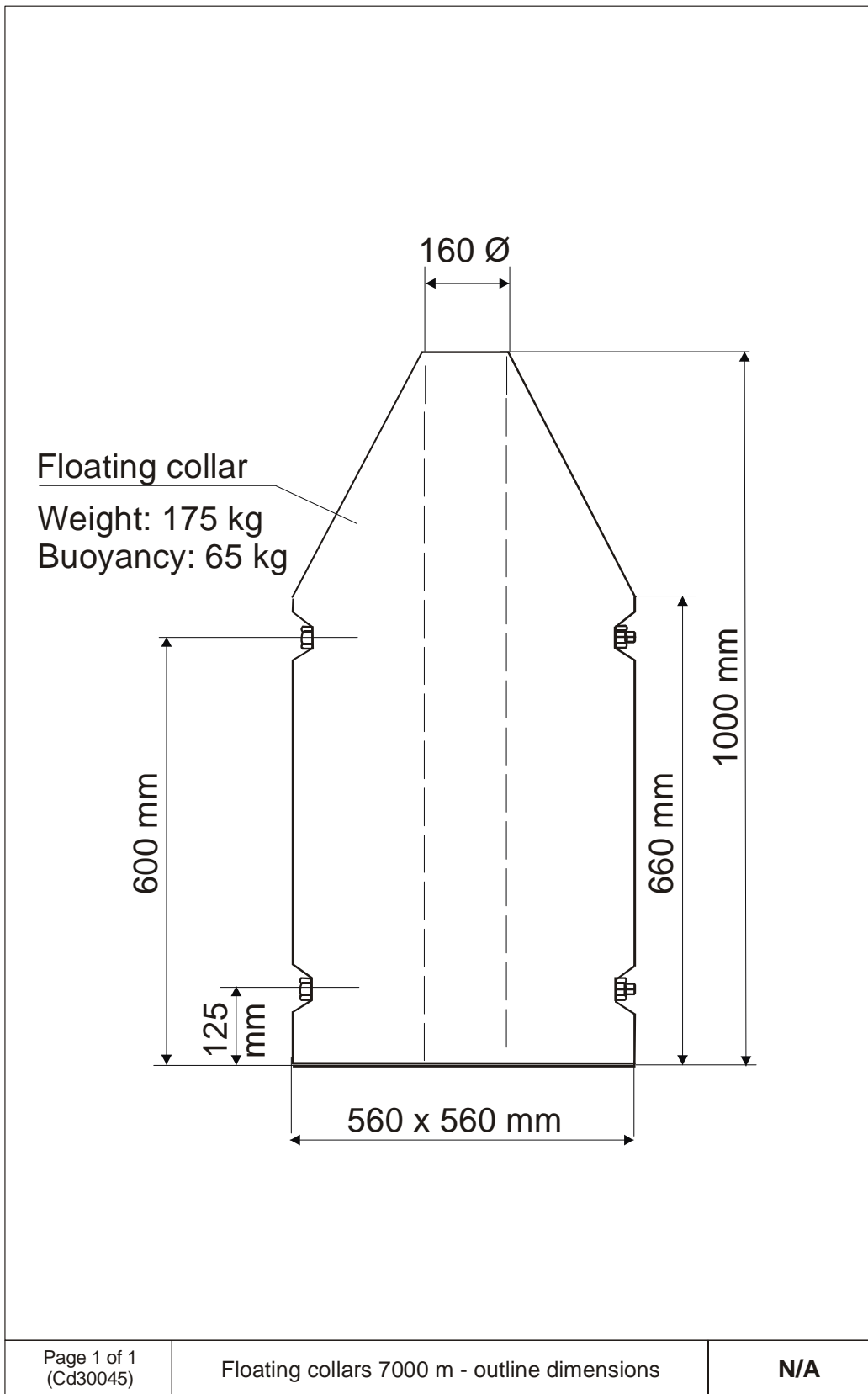












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