

UNIVERSIDAD POLITECNICA DE VALENCIA

ESCUELA POLITECNICA SUPERIOR DE GANDIA

Grado en Ing. Sist. de Telecom., Sonido e Imagen



UNIVERSIDAD
POLITECNICA
DE VALENCIA



ESCUELA POLITECNICA
SUPERIOR DE GANDIA

“Estudio de la calibración de sensores acústicos por el método de reciprocidad para diferentes geometrías. Aplicación a la evolución temporal de la sensibilidad de los hidrófonos en instalaciones *in situ*.”

TRABAJO FINAL DE GRADO

Autor:
Pablo Gómez Magenti

Tutor:
D. Juan Antonio Martínez Mora

Cotutores:
D. Ivan Felis Enguix
Dña. María Saldaña Coscollar

GANDIA, 2016

ÍNDICE DE CONTENIDOS

7. ANEXOS.....	3
7.1. Hojas de características de los fabricantes.....	3
7.1.1. SX30FR.....	3
7.1.2. SX60FR.....	6
7.1.3. ITC-1032.....	9
7.1.4. TC4034.....	10
7.2. Scripts .m desarrollados.....	13

7. ANEXOS

7.1. Hojas de características de los fabricantes

A continuación se muestran las hojas de características facilitadas por los fabricantes.

7.1.1. SX30FR



Free Flooded Rings

Sensor Technology Limited

TRANSDUCERS





FREE FLOODED RINGS

Free flooded rings are efficient transducers that provide reasonable power levels over wide range of frequencies and deep ocean capability. These transducers are simple radiators and yet have the advantage that the output is virtually independent of depth. Its radiation pattern is omni-directional in the plane perpendicular to the axis of the ring, while the directivity in the other planes depends on the length of the cylinder.

Characteristics	SX30	SX60
Resonance Frequency (kHz)	30	60
Transmit Voltage Response, TVR (dB Ref. 1 μ Pa/Volt@1 metre)	133	132
Receive Voltage Response, OCV (dB Ref. 1 Volt/ μ Pa)	-193	-200
Useable Frequency Range (kHz)	20-40	40-70
Beam Pattern - Radial - Axial	Omni Toroidal (60°)	Omni Toroidal (60°)
Efficiency (% min)	50	50
Input Power (2% Duty Cycle)	300W	300W
Operating Depth (Metres)	Unlimited	Unlimited
Cable	1N2	1N2

Sensor Technology Limited manufactures free flooded transducers from a wide range of ceramic rings and sizes. These transducers can be supplied from 10kHz to over 60kHz.

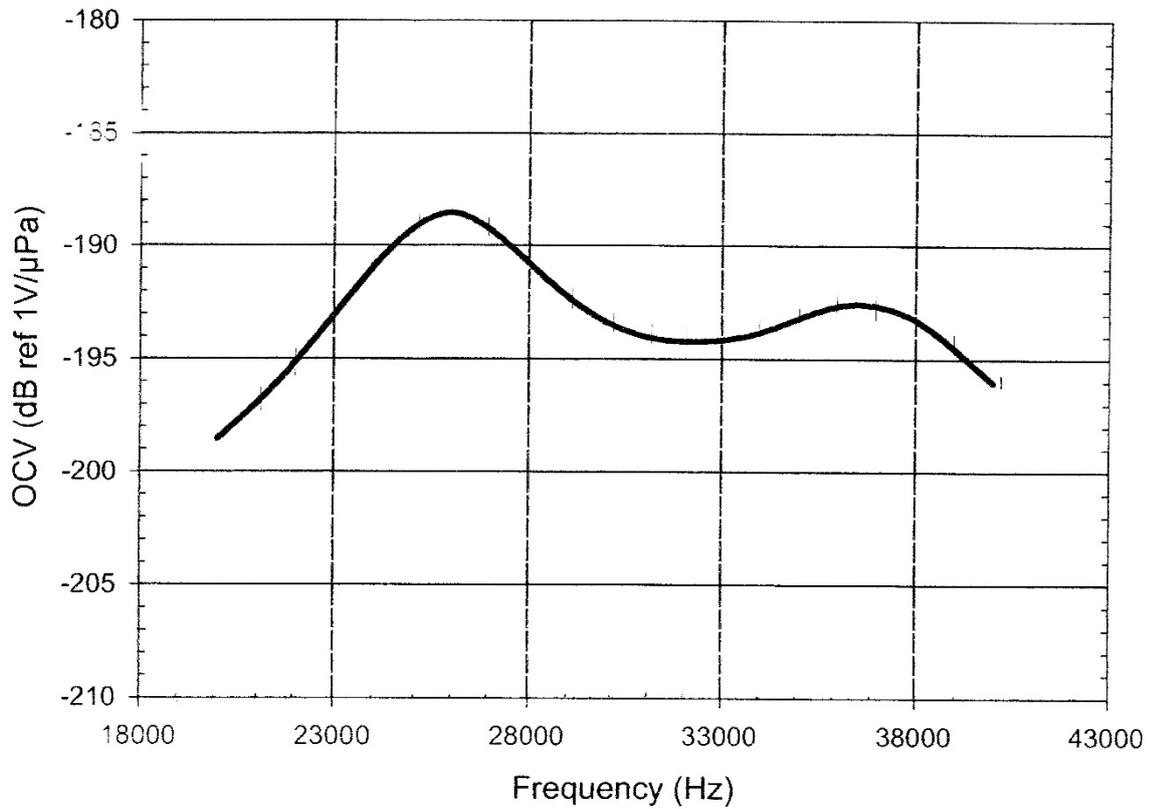
Please contact our [technical support](#) for further details or to discuss your specific needs.



20 Stewart Rd, Collingwood, ON, Canada L9Y 4K1
 Tel: (705) 444-1440 Fax: (705) 444-6787
www.sensortech.ca techsupport@sensortech.ca

EMAIL HOME ◀BACK NEXT▶

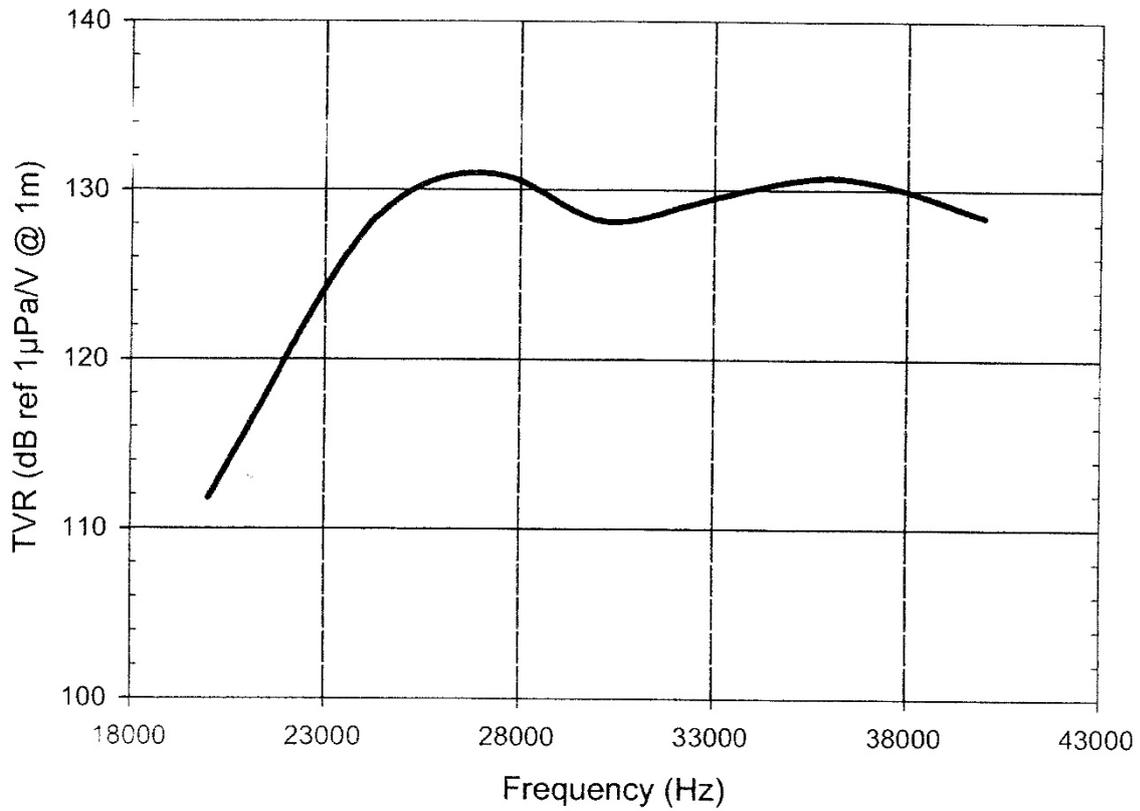
Receiving Voltage Response



Date: June 6, 2008
Acoustic Test Facility: Sensor Technology Limited
Transducer Model: SX30FR
Serial Number: 08195-530
Water Temperature: 20°C (68°F)
Test Frequency: 20 to 40 kHz
Spacing: 0.7 meters
Depth: 0.6 meters
Plane: XY

SENSOR
Sensor Technology Limited

Transmitting Voltage Response



Date: June 6, 2008
Acoustic Test Facility: Sensor Technology Limited
Transducer Model: SX30FR
Serial Number: 08195-530
Water Temperature: 20°C (68°F)
Test Frequency: 20 to 40 Hz
Spacing: 0.74 meters
Depth: 0.6 meters
Plane: XY

SENSOR
Sensor Technology Limited

7.1.2. SX60FR



Free Flooded Rings

Sensor Technology Limited

TRANSDUCERS





FREE FLOODED RINGS

Free flooded rings are efficient transducers that provide reasonable power levels over wide range of frequencies and deep ocean capability. These transducers are simple radiators and yet have the advantage that the output is virtually independent of depth. Its radiation pattern is omni-directional in the plane perpendicular to the axis of the ring, while the directivity in the other planes depends on the length of the cylinder.

Sensor Technology Limited manufactures free flooded transducers from a wide range of ceramic rings and sizes. These transducers can be supplied from 10kHz to over 60kHz.

Please contact our [technical support](#) for further details or to discuss your specific needs.

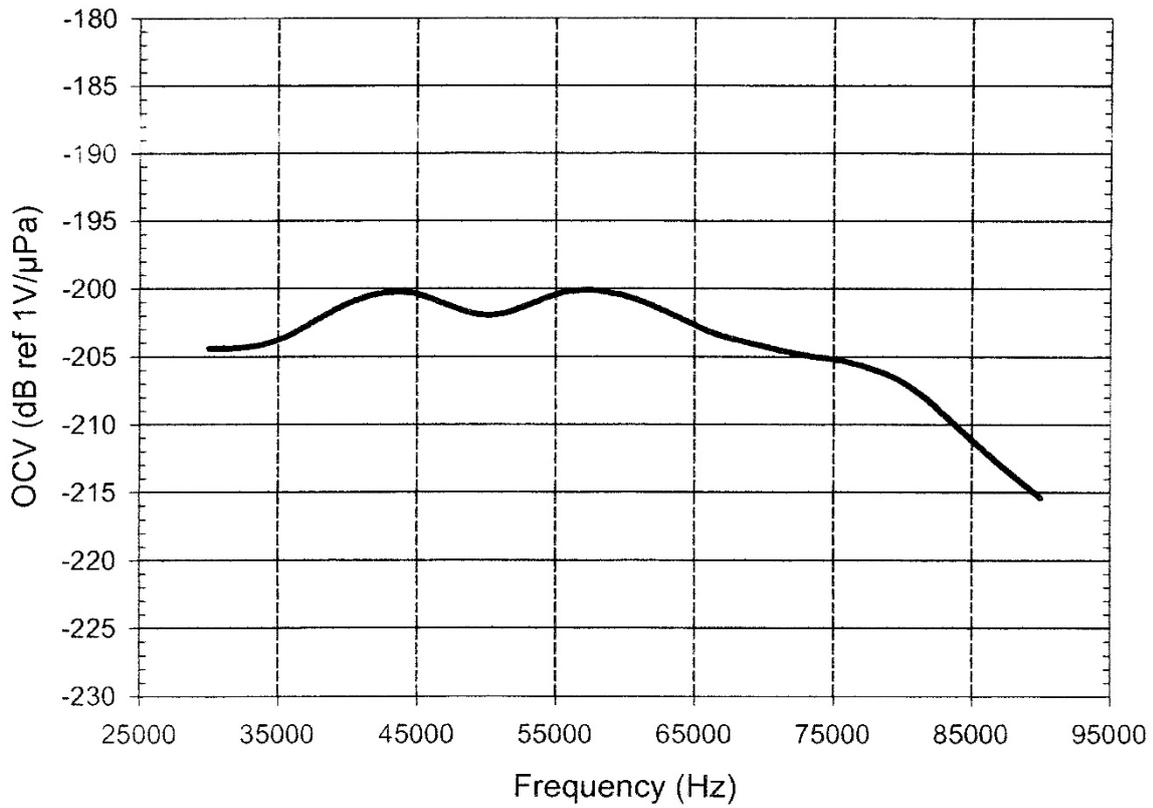
Characteristics	SX30	SX60
Resonance Frequency (kHz)	30	60
Transmit Voltage Response, TVR (dB Ref. 1 μ Pa/Volt@1 metre)	133	132
Receive Voltage Response, OCV (dB Ref. 1 Volt/ μ Pa)	-193	-200
Useable Frequency Range (kHz)	20-40	40-70
Beam Pattern - Radial - Axial	Omni Toroidal (60°)	Omni Toroidal (60°)
Efficiency (% min)	50	50
Input Power (2% Duty Cycle)	300W	300W
Operating Depth (Metres)	Unlimited	Unlimited
Cable	1N2	1N2



20 Stewart Rd, Collingwood, ON, Canada L9Y 4K1
 Tel: (705) 444-1440 Fax: (705) 444-6787
 www.sensortech.ca techsupport@sensortech.ca

[EMAIL](#) [HOME](#) [◀BACK](#) [NEXT▶](#)

Receiving Voltage Response

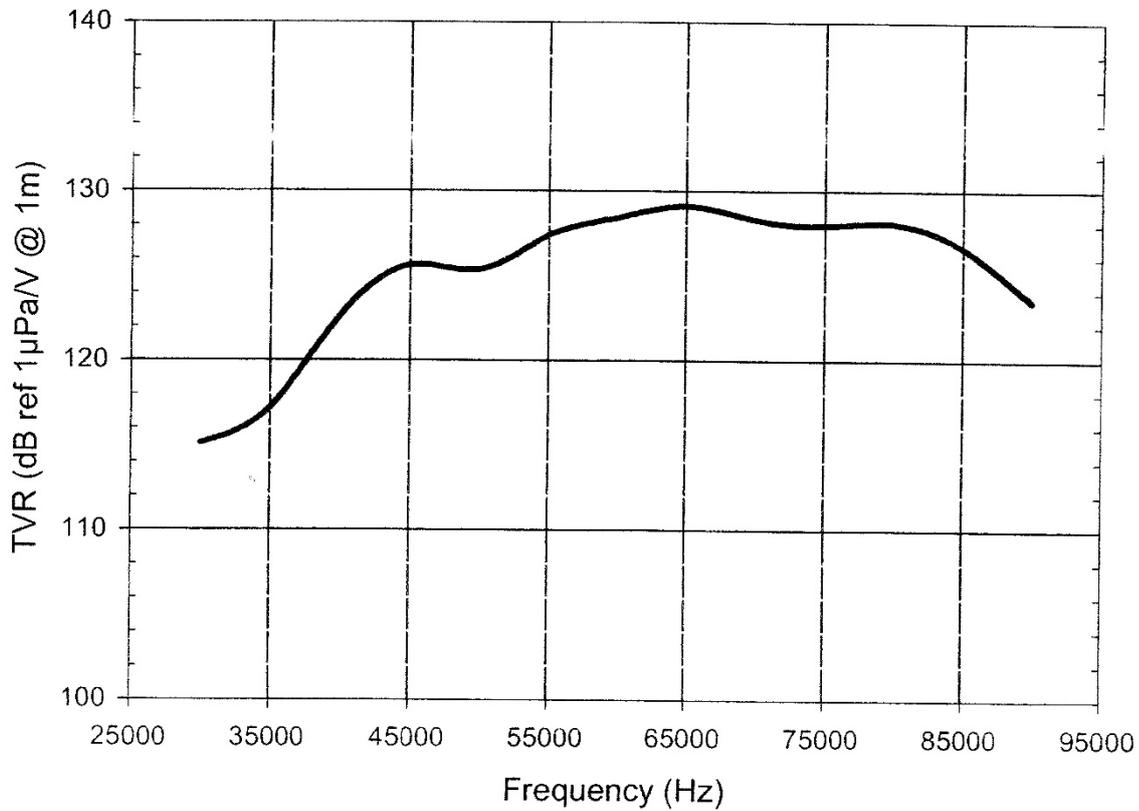


Date: June 6, 2008
Acoustic Test Facility: Sensor Technology Limited
Transducer Model: SX60FR
Serial Number: 08194-525
Water Temperature: 20°C (68°F)
Test Frequency: 30 to 90 kHz
Spacing: 0.74 meters
Depth: 0.6 meters
Plane: XY



Sensor Technology Limited

Transmitting Voltage Response



Date: June 6, 2008
Acoustic Test Facility: Sensor Technology Limited
Transducer Model: SX60FR
Serial Number: 08194-525
Water Temperature: 20°C (68°F)
Test Frequency: 30 to 90 Hz
Spacing: 0.74 meters
Depth: 0.6 meters
Plane: XY



Sensor Technology Limited

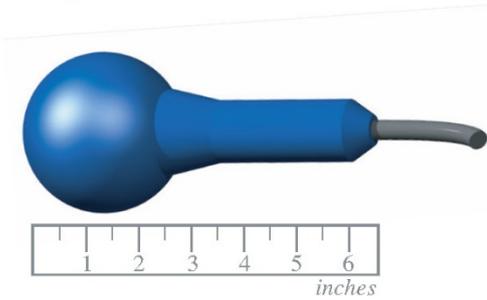
7.1.3. ITC-1032

Model ITC-1032

Deep Water Omnidirectional Transducer

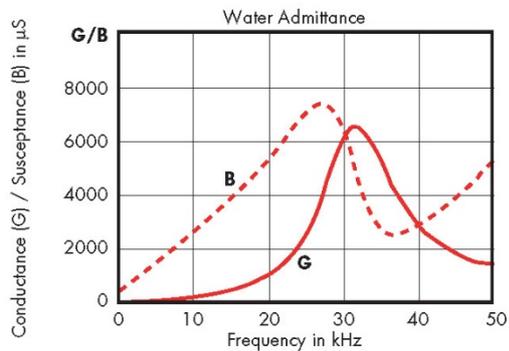
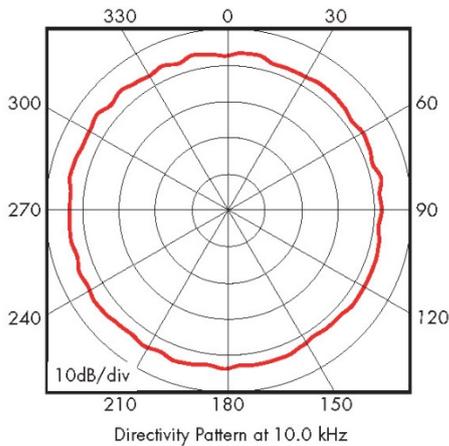
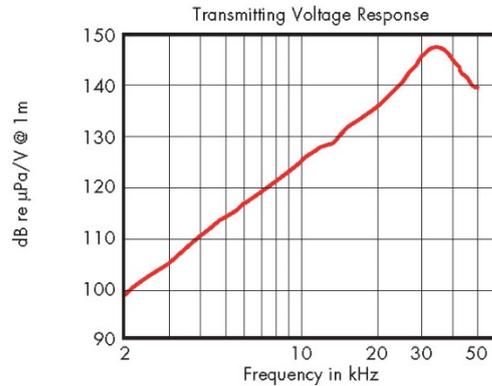
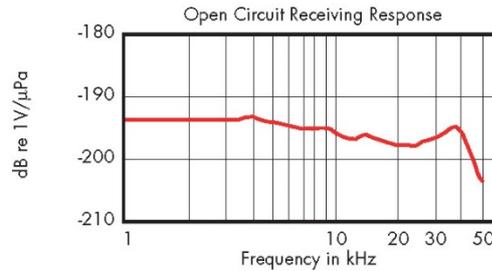
Model ITC-1032

The **Model ITC-1032** spherical transducer offers broadband omnidirectional transmitting and receiving response with efficiencies of over 50%. This transducer is fabricated of Channelite-5400 lead zirconate titanate ceramic and is particularly well suited for noise sources as a broadband hydrophone and applications where an omnidirectional response is required.



Specifications (Nominal)

Type	Projector/Hydrophone
Resonance Frequency f_r	33 kHz
Depth	1250 meters
Envelope Dimensions (in.)	2.7D
TVR at f_r	149 dB// μ Pa/V@1m
Midband OCV	-194 dB//1V/ μ Pa
Suggested Band	.01 - 50 kHz
Beam Type	Spherical
Input Power	800 watts



International Transducer Corporation

869 Ward Drive, Santa Barbara, CA 93111
805.683.2575 • 805.967.8199 FAX

www.itc-transducers.com

7.1.4. TC4034



- **Omnidirectional in the full frequency range**
- **Long term stability**
- **Extreme Wide frequency range**
- **Durable construction**
- **Individually calibrated**

TC4034

The TC4034 broad band spherical hydrophone provides uniform omnidirectional characteristics over a wide frequency range of 1Hz to 480kHz.

The overall receiving characteristics makes the TC4034 an ideal transducer for making absolute underwater sound measurements up to 480kHz. The wide frequency range also makes the TC4034 perfect for calibration purposes, particularly in higher frequencies.

TECHNICAL SPECIFICATIONS	
Usable Frequency range:	1Hz to 470kHz (+3, -10dB)
Linear Frequency range:	1Hz to 250kHz (+2, -4dB)
Receiving Sensitivity: (re 1V/μPa)	-218dB ±3dB (at 250Hz)
Horizontal directivity:	Omnidirectional ±2dB (at 100 kHz)
Transmitting sensitivity:	122dB ±3dB (typical) re 1μPa/V at 1m at 100kHz
Vertical directivity:	>270° ±3dB (at 300kHz)
Nominal Capacitance:	3nF
Operating Depth:	900m
Survival Depth:	1000m
Operating Temperature range:	-2°C to +80°C
Storage Temperature range:	-40°C to +80°C
Weight incl. cable, (in air):	1.6 kg
Cable (length and type):	Standard 10m shielded pair DSS-2MIL-C915. Optional cable length available on request
Encapsulating Material:	Special formulated NBR
Metal body:	Alu-bronze - AlCu10Ni5Fe4
Connector type:	ENC



NBR means Nitrile Rubber

The NBR rubber is first of all resistant to sea and fresh water but also resistant to oil. It is limited resistant to petrol, limited resistant to most acids and will be destroyed by base, strong acids, halogenated hydrocarbons (carbon tetrachloride, trichloroethylene), nitro hydrocarbons (nitrobenzene, aniline), phosphate ester hydraulic fluids, Ketones (MEK, acetone), Ozone and automotive brake fluid.



Documentation:

Vertical directivity:
At 250 kHz 100, 200, 300 kHz

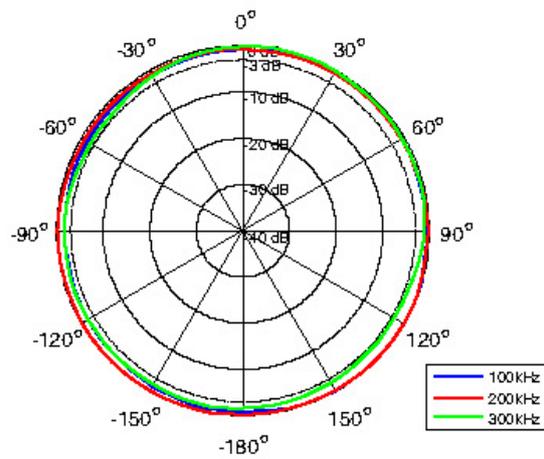
Receiving sensitivity:
5 kHz to 500 kHz

Transmitting sensitivity:
5 kHz to 500 kHz

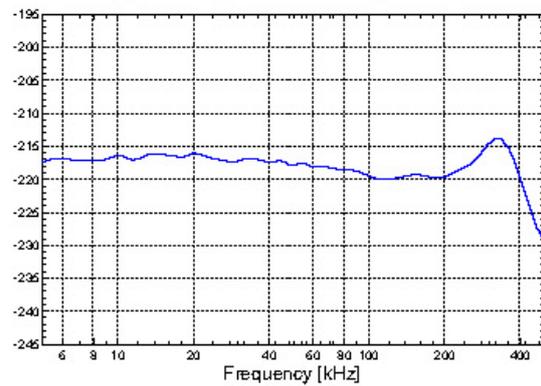
Horizontal directivity:
At 100, 200, 300 kHz

Impedance:
5 kHz to 500 kHz

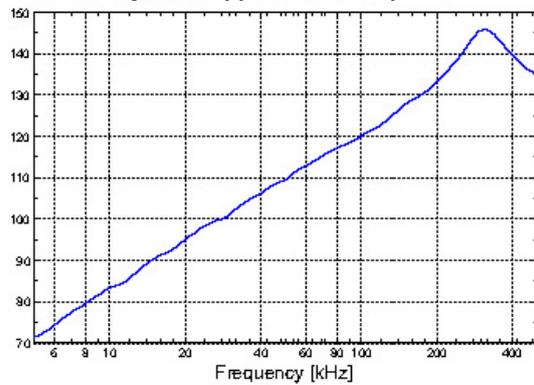
Horizontal directivity pattern



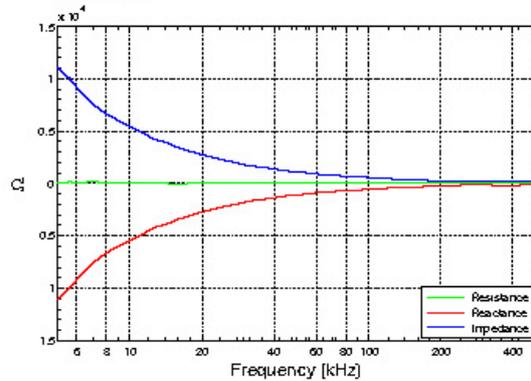
Receiving Sensitivity [dB re 1V/μPa @ 1m]



Transmitting Sensitivity [dB re 1μPa/V @ 1m]



Impedance



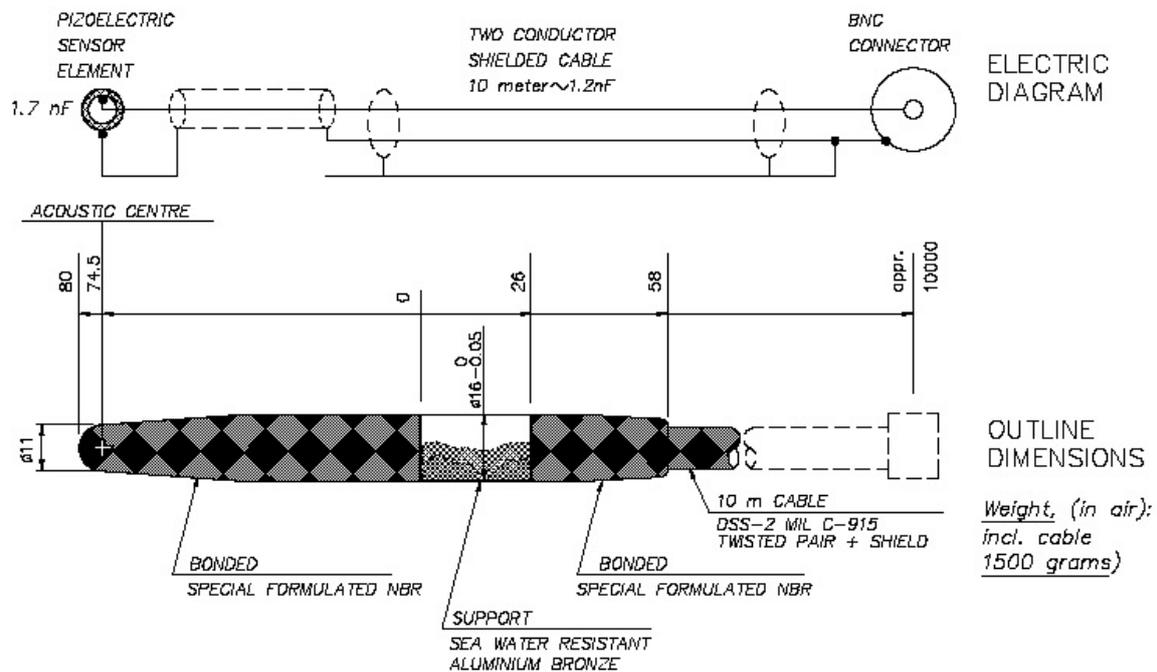
RESON Hydrophone TC4034

Ultra Broad-band Spherical

Documentation:

The hydrophone is permanently encapsulated in Special formulated NBR to provide long term reliability. The rubber has been specially compounded to ensure an acoustic impedance close to that of water.
 The TC4034 is supplied with an integral water blocked two conductor shielded cable, type DSS-2, which complies with Mil C915

Electrical Diagram and Outline Dimensions



RESON reserves the right to change specifications without notice. ©2005 RESON A/S
 For Acoustical Measurement Accuracy please refer to www.reson.com or contact sales.

RESON A/S
 Denmark
 Tel: +45 4738 0022
 E-mail: reson@reson.dk

RESON GmbH
 Germany
 Tel: +49 431 720 7180
 E-mail: reson@reson-gmbh.de

RESON Inc.
 USA
 Tel: +1 805 964-6260
 E-mail: sales@reson.com

RESON B.V.
 The Netherlands
 Tel: +31 (0)10 245 1500
 E-mail: info@reson.nl

RESON Offshore Ltd.
 United Kingdom
 Tel: +44 1224 709 900
 E-mail: sales@reson.co.uk

RESON Mediterranean SRL
 Italy
 Tel: +39-051-572-643
 E-mail: info@reson.it

www.reson.com

Version: B112 070827 /A4

7.2. Scripts .m desarrollados

Los tres scripts desarrollados se encuentran en el archivo “Ficheros anexos.zip”.