

Miniature Communication Transducer: Toroidal Beam

BII7510 Series Miniature Transducers: Low to Medium Qm, 180 to 190 dB $\mu Pa,$ 50 to 400 kHz.

BII7510 series are broadband (Low to Medium Q_m) miniature transducers with toroidal directivity pattern for uses in underwater communication especially in the horizontal plane, and in material study and medical research as ultrasonic sources and sensors. Frequencies of 50 to 400 kHz and sound levels of 180 to 190 dB μ Pa support short to long range sound propagation in water, liquids, rubber-like material, and solids. Their miniature sizes make them be suitable to be embedded in materials.

Modulations for Communications

Pulsed FSK, Chirp-type FSK, Frequency Hopping	DSSS	PSK	CDMA/DSSS

Typical Applications

Underwater Communication and Positioning	Hydrophones, AE Sensors, Ultrasonic Sources, Acoustic Elements for Arrays
Acoustic Beacons: Pingers, Locator, Transponder and Tags	Material Study and Medical Research

Specification

Acoustic Element	BII7510-60	BII7510-80	BII7510-100	BII7510-130	BII7510-185	BII7510-240	BII7510-360
Signal Type:	Pulsed SINE, Chirp	o, PSK, FSK, etc.; Puls	sed Square Wavefor	rm.			
Directivity Pattern:	Toroidal Beam at f_s ; Omnidirectional at $f \le f_{omni}$.						
f _{omni} :	27 kHz	34 kHz	40 kHz	50 kHz	75 kHz	110 kHz	110 kHz
-3dB Beam Width:	Horizontal x Vertical = Omni x 75° at fs						
Side Lobe Level:	No side lobes					•	-
Free Capacitance C _f :	0.8 nF 0.8 nF 0.56 nF 0.47 nF 0.22 nF 0.1 nF 0.053 nF						
(Tolerance ±10%)	Capacitance of a 1	ransducer = C _h + Ca	ble Capacitance. Ca	ble Capacitance = 1	00 pF/meter genera	illy.	1
Dissipation D:	0.015	0.012	0.005	0.005	0.005	0.005	0.01
Resonant Frequency fc:	60 kHz	80 kHz	100 kHz	130 kHz	185 kHz	240 kHz	360 kHz
± 5%	1. Efficiency is low	v in the frequency r	ange far from f _s , so	it is NOT recomme	nded to operate tra	insducer at freque	ency far from fs.
	2. Transducer can	operate in low pov	ver at frequency fa	r from fs, the input	power P _i should be	much less than 1	% MCIP at f _s .
Quality Factor Om at fs:	3.4	6.5	6.0	4.0	2.0	2.8	3.0
	-3dB bandwidth Δ	$f = f_s/Q_m$. Qm deter	mines the transient	response or the rise	and fall rings of ste	ady-state respon	se.
Efficiency η at f _s :	0.85	0.71	0.75	0.73	0.74	0.76	0.70
Power Factor at f _s :	0.68	0.84	0.82	0.80	0.26	0.8	0.7
TVR at f_s (µPa/V at 1m):	135.5 dB	138.1 dB	135.6 dB	136.5 dB	130.5 dB	130.0 dB	130.6 dB
Radiation Sound Level SL:	$SL = 20*logV_i + TV$	′R, dB μPa@1m. Driv	ving Voltage V _i is in	unit of V _{rms} .			
Admittance or Impedance:	Refer to G-B Grap	h.					
Driving Voltage V _i at f _s :	Pulsed Driving Signal and Duty Cycle D < 100%: Maximum V _i , V _{imax} = 600 V _{rms} .						
Input Power P _i :	$P_i = V_i^2 * G$. Refer to G-B Graph: G is conductance, G_{max} is maximum G at f_s .						
MIPP at fs:	Maximum Input P	ulse Power at fs: Pi =	= Vi ² * G _{max} .				
MPW:	Maximum Pulse V	Vidth 150 mS at f _s aı	nd Maximum Drive	Voltage, Continuous	Operation at 30 Vr	ms.	
Maximum Duty Cycle:	10% at f _s and Maximum Drive Voltage, Continuous Operation at 30 Vrms.						
	-188.1 dB	-189.0 dB	-193.5 dB	-196.6 dB	-203.7 dB	-205.0 dB	-207.5 dB
FFVS at f _s :	Sensitivity Loss over extension cable at $f_s(dB) = 20 * \log \{ (1 + 2\pi f_s C_c / B) / \sqrt{[G^2 + (B + 2\pi f_s C_c)^2] / (G^2 + B^2)} \}$						
	G: Conductance at f _s ; B: Susceptance at f _s ; C _c : Capacitance of Extension Cable. Cable is of 100 pF/meter roughly.						
Receiving Sound Level SL:	SL = 20*logV _o - FFVS, dB μPa. Receiving Voltage V _o is in unit of V _{rms} .						
Operating Depth:	Maximum 300 m	and limited by the c	able length if the ca	ble has wire leads o	r a non-waterproof	connector.	
	1. Default: Free H	anging (FH)					
	2. Thru-hole Mou	nting with Single O-	ring (THSO)				
Mounting Options:	3. Thru-hole Mou	nting with Double O	-ring (THDO)				
	4. Bolt Fastening Mounting (Stainless Steel) (BFMSS)						
	Please refer to on	line document Acou	usticSystem.pdf for	a complete list of M	ounting Options an	d more details.	
	1. Two Conductor	Shielded Cable (SC)	, Rubber or PVC Jac	ket.			
2. 50 Ω RG58 Coax (RG58)							
	3. 50 Ω RG174/U Coax (RG174)						
4. 50 Ω RG178/U Coax (RG178) (Operating Temp				Range: -70°C To +20	0°C)		
cubic.	5. Shielded Cable with Twisted Pair and Teflon (PTFE) Jacket, ΦD=3.2 mm (SC32), up to 200°C, AWG26 Conductors (Not Water-						
	prooted, ONLY for Dry Air Use).						
	Handling: Do not use the cable to support transducer weight in air and water if the transducer has a mounting part. Do not bend						
	the cable.						
Cable Length:	1. Default: 1 m. 2.	Custom.					
	1. Default: Wire L	eads (WL)					
_	2. Male BNC (BNC	C) (Max. Diameter Φ	14.3 mm)				
Connector:	3. SMA (Plug, Male Pin) (SMA), Voltage Rating: 335 VRMS Continuous. (Max. Diameter Φ9.24 mm)						
	4. SMC (Plug, Female Socket) (SMC), Voltage Rating: 250 VRMS Continuous. (SMC) (Max. Diameter Φ6.4 mm)						
	SMA with RG17	8 Coax. Service Tem	perature: up to 155	5°C or 311°F.			



Benthowave Instrument Inc.

SE=SL-TL+AG-NL	Underwater Sound Solutions www.benthowave.com					
	 MIL-5015 Style (pin) (MIL) (Ma Underwater Mateable Connec Note: Underwater Mateable Co waterproofed. 	x. Diameter Φ30 mm v tor (pin) (UMC) (Max. I nnector is for uses ur	with 3 contacts) Diameter Φ21.5 to 0 nderwater. Other co	D35 mm) onnectors and wire	leads are for d	y uses and are not
	Ф20.5 х 49 Ф17.3 х 48	Ф15.7 x 44.5	Ф12.6 х 30	Ф9.4 х 18.5	Ф7.4 х 16	Ф7.4 х 16
Size (WDXL, mm):	Actual length depends on Mount	ing Parts.		•		
Mainht (in sin).	34.5 grams 27.5 grams	15 grams	11 grams	8 grams	8 grams	8 grams
Weight (in air):	Actual weight depends on Cable	Types and Length. Gen	erally, 65.5 g/m of s	hielded cable.		
Operation Temperature:	1. Default: -10 °C to +60 °C or 14 °F to 140 °F. 2. Bespoke High Temperature Transducer: -10 °C to 120 °C, or 14 °F to 248 °F. Append -HT to part number.					
Storage Temperature:	-20 °C to +60 °C or -4 °F to 140 °F.					
Power Amplifier:	BII5000 Power Amplifiers for SOI	NAR, NDT, HIFU. Order	Separately as stand	alone devices.		
Impedance Matching:	BII6000 Bespoke Impedance Matching between transducers and power amplifiers. Order Separately as standalone devices, or append -IM to the part number for integrating BII6000 into the transducer, and specify impedance in Ω. For example, BIIxxxxIM8Ω: BIIxxxx transducer with built-in Impedance Matching unit as a 80 load.					
TR Switch:	BII2100 Transmitting & Receiving Switch. Order Separately as standalone devices.					
Temperature Sensor:	1. Default: No built-in temperature sensor. 2. Built-in temperature sensor. Append -TS to part number (BlixxxxTS) for integrating a temperature sensor in the transducer.					
Potable Transmitter:	BII8030 series portable acoustic	transmitters.				
Portable T/R System:	BII8080 series portable transmit and receive systems.					
WARNING: DANGER - HIGH	VOLTAGE on wires. Wires shall be	insulated for safety. DC	NOT TOUCH THE W	IRES BEFORE THE D	RIVING SIGNAL IS	SHUT DOWN. Cable
shield must be grounded fir	mly for safety.					
for 50Ω BNC/SMA/SMC con safety before hooking up tra	nector, it is buyer's sole responsibili ansducer/hydrophone to the signal s	ty to make sure that th source. Coax with BNC/	e BNC/SMA/SMC sł 'SMA/SMC is not int	nield of the signal so ended for hand-held	ource is firmly gro duse at voltages	unded for operating above 30Vac/60Vdc
Wiring:	Shielded Cable/Wire Leads	Coax/BNC	Unde	rwater Connector	MIL-50	15 Connector
Signal:	White or Red	Center Contact	Conta	act 2	Contac	t C
Signal Common:	Black	Shield	Conta	act 1	Contac	t B
Shielding and Grounding:	Shield	Shield	Conta	act 3	Contac	t A
Note:	Wire Leads: Dry Use.	Drv Use	Unde	rwater Use	Drv Us	c

How to Order Transducer

Part Number	-Mounting Part	-Cable Length in Meter	-Cable Type	-Connector Type	
Example:	Description				
BII7510-185-FH-6m-SC-UMC	BII7510-185 Transducer, Free Hanging, 6m Shielded Cable, Male Underwater Mateable Connector.				
DUTE 10 19E LIT ELL CM DC179 SMC	BII7510-185 Transducer, Service Temperature: -10 °C to 120 °C, or 14 °F to 248 °F. Free Hanging, 6m RG178 Coax, SMC				
BI1/310-183-H1-FH-0III-R01/8-SIVIC	(Plug, Female Socket).				
BII7510-185-IM50Ω-FH-10m-RG58-BNC	BII7510-185 Transducer, Built-in Impedance Matching Network to 50Ω , Free Hanging, 10m RG58 Coax, Male BNC.				
BII7510-185-IM8Ω-FH-10m-SC-WL	BII7510-185 Transducer, Built-in Impedance Matching Network to 8Ω, Free Hanging, 10m Shielded Cable, Wire Leads.				
	BII7510-185 Transducer, Built-in Temperature Sensor, Built-in Impedance Matching Network to 8 Ω , Free Hanging, 10m				
DI12270-102-12-101007-LU-1011-2C-AAF	Shielded Cable, Wire Leads.				

Physical Size (Dimensional Unit: mm): The overall length varies with the length of the mounting part.



Transmitting Voltage Response (TVR)



Typical Admittance Graph





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Underwater Sound Solutions









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SE=SL-TL+AG-NL Directivity Pattern



