



Putting Confidence in Ultrasound

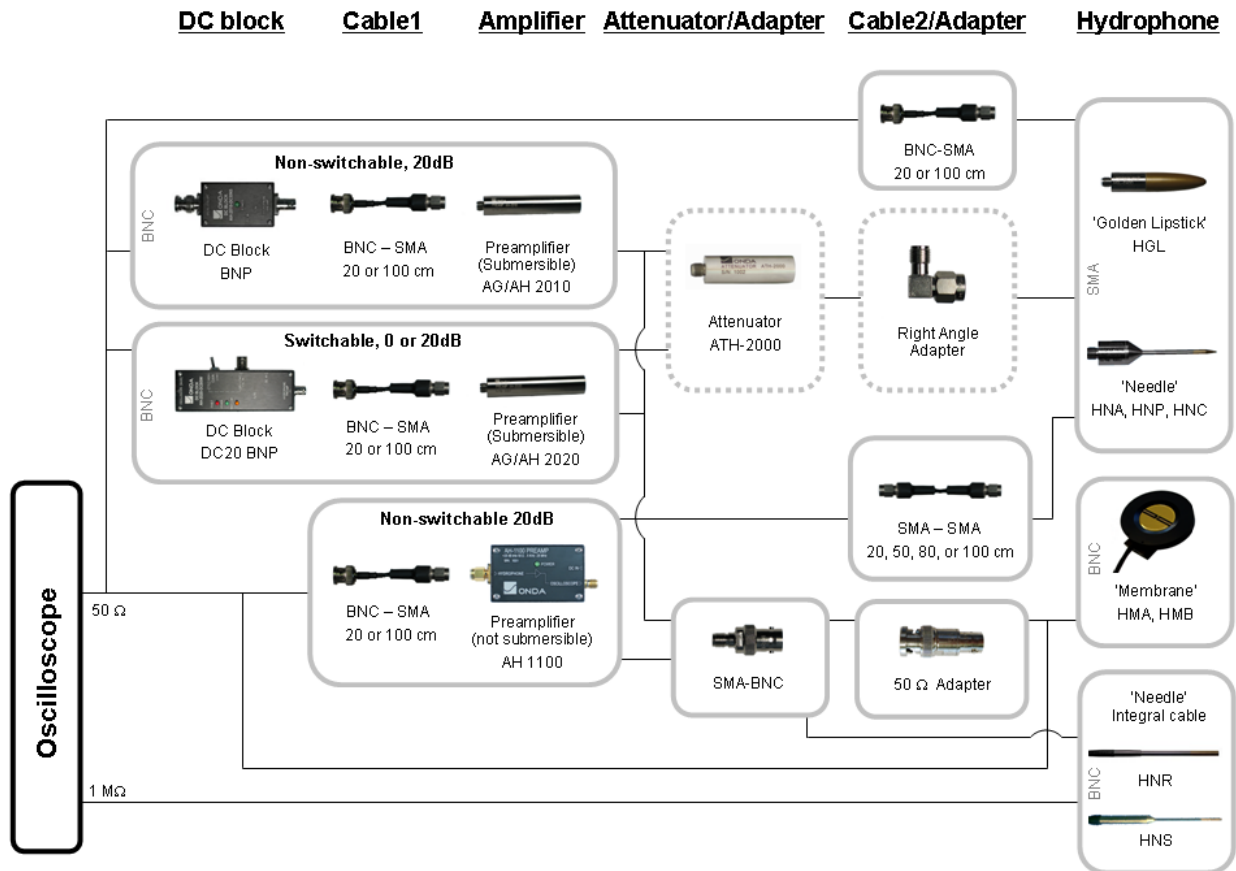
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Hydrophone Calibration Questionnaire

Company	
Contact Name	
Email	
Phone	
Date	

Hydrophone Calibration Questionnaire

1. The diagram below illustrates typical ways that the components of Onda's hydrophone measurement system can be configured. Lines connected between the boxes depict choices available. Items in boxes with dashed boundary lines are optional. **Please select the check boxes in the diagram and complete the table below to indicate your configuration.** Your measurement device will be calibrated to these specifications.



<i>Hydrophone (Model-Aperture Size-Serial Number)</i>	
<i>Cable2/Adapter (Type)*</i>	
<i>Attenuator (Model-Type-Serial Number)</i>	
<i>Pre-amplifier** (Model-Type-Serial Number)</i>	
<i>Oscilloscope (Model)</i>	

* Please specify the right-angle location if it is not configured between the hydrophone and preamplifier.

** For AG and AH20xx preamplifiers customer must supply DC block and cable, which was supplied as part of the pre-amplifier kit

Other Comments	
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2. Please choose the type of calibration you require by checking the appropriate box(es).

**Recalibration
Calibration of New Device**

Hydrophone (and Amplifier)

Order Number	Frequency			EOC ⁽¹⁾	With Onda Amp
	From	To	Step		
HC-0.25-1	250 KHz	1 MHz	50 KHz		
HC-0.25-20	250 KHz	20 MHz	50 KHz		
HC-1-20	1 MHz	20 MHz	50 KHz		
HC-20-40	20 MHz	40 MHz	2 MHz	NA	
HC-20-60	20 MHz	60 MHz	2 MHz	NA	
HC-G2 ⁽²⁾	Same as primary calibration			NA	

- (1) – EOC (open circuit) calibration applies to hydrophones without integral amplifier
- (2) – Additional calibration at 2nd gain setting for AH-2020 and AG-2020 to be carried out with the same conditions as the primary calibration.

Standalone Amplifier without Hydrophone

Order Number	Calibration
HC-AMP-1 / 2	

NOTE: amplifiers will be calibrated for gain, phase, and capacitance throughout the specified frequency range.

For custom calibrations please contact Onda.

**All calibrations are traceable to a National Reference Standard,
and are supplied with measurement uncertainties.**

Additional Notes:

- All Onda Hydrophones are supplied with a calibration from 1-20 MHz. For HMA or HMB hydrophones, which have an integral amplifier, this calibration is supplied into a 50 Ohm impedance. All other models are modular, allowing substitution of a variety of different amplifiers, and are therefore supplied with an EOC (end-of-connector, open circuit) calibration.
- For an EOC calibration, the sensitivity with a preamplifier attached may be calculated if the preamplifier gain and input impedance are known, using well-established methods (see AIUM, *Acoustic Output Measurement Standard for Diagnostic Ultrasound Equipment*, Sec. 3.3.1). Standard calibrations are performed only for Onda hydrophones, in either EOC configuration or with an Onda amplifier without additional cables or adaptors between the hydrophone and amplifier. Calibrations made with either an integral or modular amplifier are made with a 50 ohm terminating impedance. Onda may be able to calibrate other configurations or other equipment on a customized basis. Please contact us with a specification of your equipment and configuration and we will determine whether we can help.
- Calibrations will be made at room temperature (approximately 21 – 24 deg C) and the temperature will be recorded on the calibration sheet.
- Hydrophones with switchable-gain amplifiers (e.g., AH-2020 or AG-2020) will be measured at the gain setting, which Onda determines provides the maximum calibration accuracy (usually the highest gain setting). For an additional fee, Onda can provide the calibration at a second gain setting (HC-G2), by compensating the measured data for the difference in gain between the two settings.
- Standard turn around for calibrations is 2 weeks, above 20 MHz takes up to 4 weeks.
- Preamplifier calibrations without a hydrophone are carried out electronically.
- Three examples of the completed tables are shown below.

Example 1

Diagnostic Ultrasound Measurements

HGL-0200, from 1 to 20 MHz, calibrated with customer's AH-2010 amplifier with right angle adapter:

Hydrophone (<i>Model-Aperture Size-Serial Number</i>)	
Cable2/Adapter (<i>Type</i>)	
Attenuator (<i>Model-Type-Serial Number</i>)	
Pre-amplifier (<i>Model-Type-Serial Number</i>)	
Oscilloscope (<i>Model</i>)	

Recalibration Calibration of New Device

Hydrophone (and Amplifier)

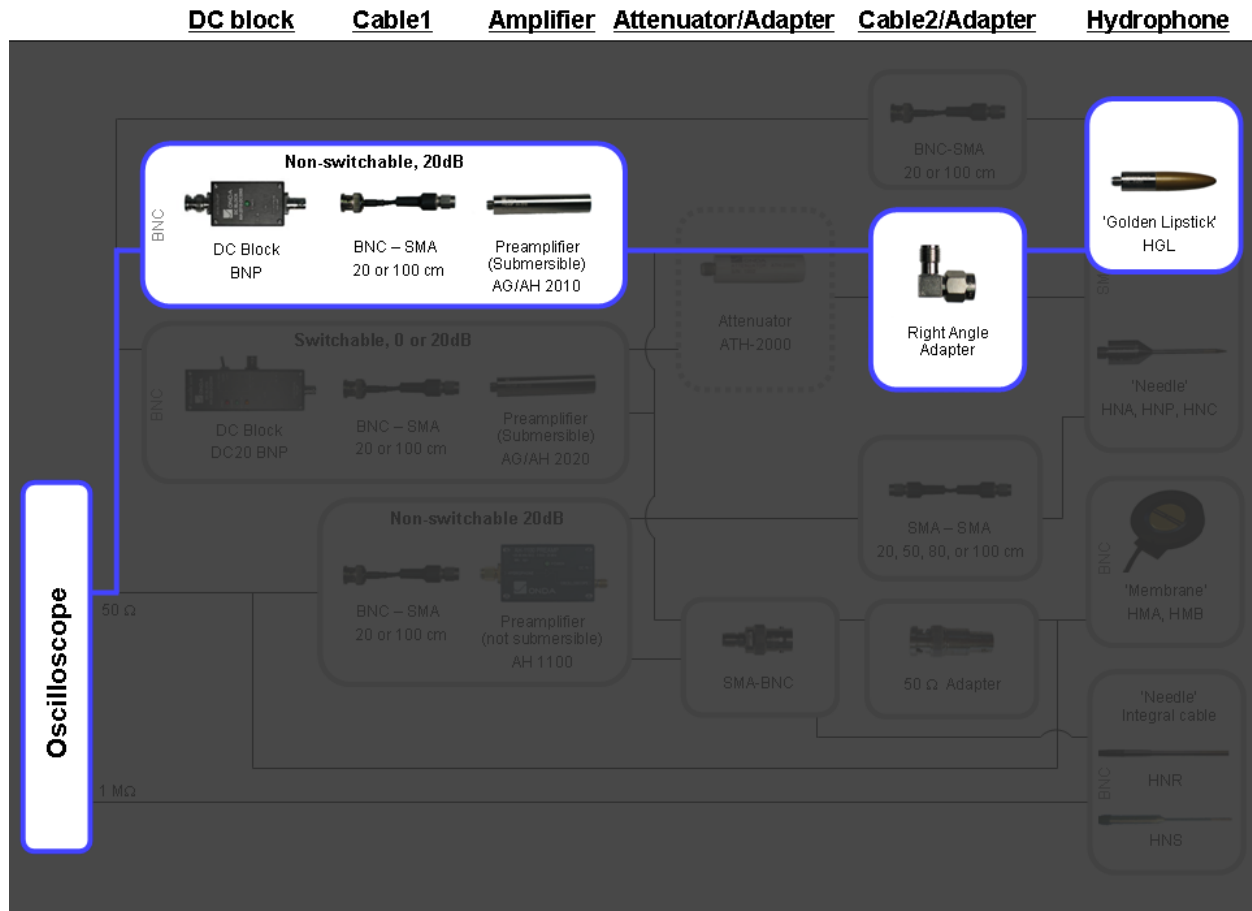
Order Number	Frequency			EOC ⁽¹⁾	With Onda Amp
	From	To	Step		
HC-0.25-1	250 KHz	1 MHz	50 KHz		
HC-0.25-20	250 KHz	20 MHz	50 KHz		
HC-1-20	1 MHz	20 MHz	50 KHz		
HC-20-40	20 MHz	40 MHz	2 MHz	NA	
HC-20-60	20 MHz	60 MHz	2 MHz	NA	
HC-G2 ⁽²⁾	Same as primary calibration			NA	

Standalone Amplifier without Hydrophone

Order Number	Calibration
HC-AMP-1 / 2	

Example 1 Continued Typical Configuration

(HGL Hydrophone + Right Angle Adapter + AH-2010 Preamp + Agilent Oscilloscope)



Example 2

Diagnostic Ultrasound Measurements (low amplitude)

HMB-0500, from 1 to 60 MHz, calibrated with customer's AH-2020 amplifier at two gain settings:

Hydrophone (<i>Model-Aperture Size-Serial Number</i>)	
Cable2/Adapter (<i>Type</i>)	
Attenuator (<i>Model-Type-Serial Number</i>)	
Pre-amplifier (<i>Model-Type-Serial Number</i>)	
Oscilloscope (<i>Model</i>)	

Recalibration Calibration of New Device

Hydrophone (and amplifier)

Order Number	Frequency			EOC ⁽¹⁾	With Onda Amp
	From	To	Step		
HC-0.25-1	250 KHz	1 MHz	50 KHz		
HC-0.25-20	250 KHz	20 MHz	50 KHz		
HC-1-20	1 MHz	20 MHz	50 KHz		
HC-20-40	20 MHz	40 MHz	2 MHz	NA	
HC-20-60	20 MHz	60 MHz	2 MHz	NA	
HC-G2 ⁽²⁾	Same as primary calibration			NA	

Standalone Amplifier without Hydrophone

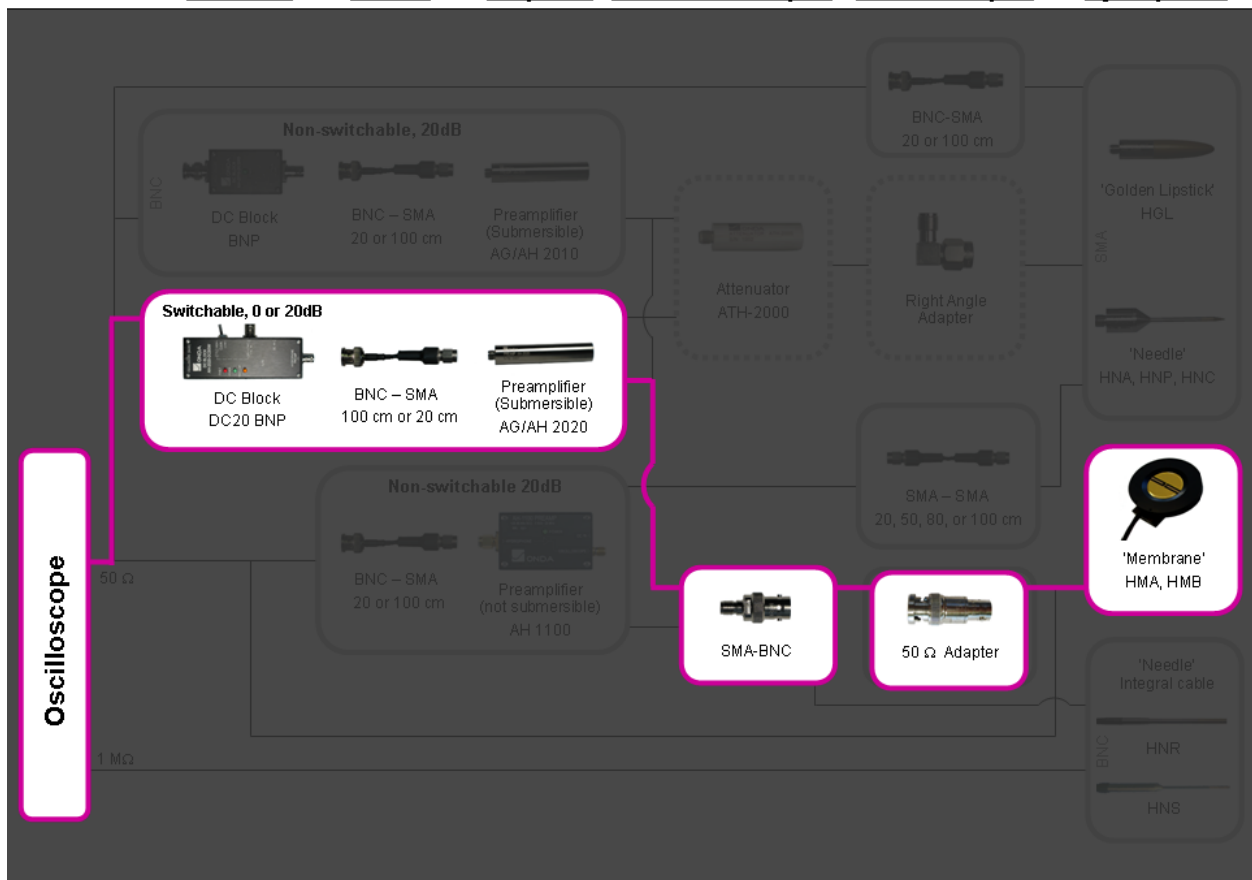
Order Number	Calibration
HC-AMP-1 / 2	

Example 2 Continued Typical Configuration

(HMB-0500 Hydrophone + AH-2010 Preamp + Agilent Oscilloscope)



DC block Cable1 Amplifier Attenuator/Adapter Cable2/Adapter Hydrophone



Example 3

High Intensity Therapeutic Ultrasound Measurements (HITU)

HNA-0400, from 1 to 20 MHz, calibrated with customer's AH-2020 amplifier and ATH-2000 attenuator with right angle adapter at two gain settings:

Hydrophone (<i>Model-Aperture Size-Serial Number</i>)	
Cable2/Adapter (<i>Type</i>)	
Attenuator (<i>Model-Type-Serial Number</i>)	
Pre-amplifier (<i>Model-Type-Serial Number</i>)	
Oscilloscope (<i>Model</i>)	

Recalibration Calibration of New Device

Hydrophone (and Amplifier)

Order Number	Frequency			EOC ⁽¹⁾	With Onda Amp
	From	To	Step		
HC-0.25-1	250 KHz	1 MHz	50 KHz		
HC-0.25-20	250 KHz	20 MHz	50 KHz		
HC-1-20	1 MHz	20 MHz	50 KHz		
HC-20-40	20 MHz	40 MHz	2 MHz	NA	
HC-20-60	20 MHz	60 MHz	2 MHz	NA	
HC-G2 ⁽²⁾	Same as primary calibration			NA	

Standalone Amplifier without Hydrophone

Order Number	Calibration
HC-AMP-1 / 2	

Example 3 Continued Typical Configuration

(HNA-0500 Hydrophone + Right Angle Adapter + ATH-2000 Attenuator + AH-2020 Preamplifier + Agilent Oscilloscope)

