

UVP Transducers



TX 0,5 MHz transducer with stainless steel casing and standard BNC connector

Standard line TX features

- ✓ High sensitivity
- ✓ Accurate acoustic signals generation for optimized spatial resolution
- ✓ Compact and sturdy stainless steel casing with precise finish
- ✓ High mechanical and pressure resistance
- ✓ Tough and low-loss shielded cable
- ✓ Robust cable attachment to the transducer body
- ✓ Robust standard BNC connector
- ✓ RoHS compliant

Met-Flow transducers are high quality products, custom designed for pulsed ultrasonic velocimetry with the latest technology available.

As transducers are key elements of the UVP measuring chain, we have been optimizing and refining their designs since our beginnings in the early nineties, thanks to a close and lasting partnership with a pioneer and expert in the field of ultrasound.

The latter prepares for us sophisticated and exclusive designs based on our specifications and experience, integrating its latest transducers technology. It results in high performance transducers, with high sensitivity and accurate acoustic signal generation. We propose standard models that fit most applications, as well as tailor-made designs upon our users' specific requests.

Acoustic Concept

TX line is our standard transducer design, used in regular measurement conditions with temperature from 10°C up to 60°C and pressure up to 3 bars.

Frequency

TX line is available at the five standard emitting frequencies 0,5 - 1 - 2 - 4 - 8 MHz of our UVP profilers.

Each frequency requires a specific transducer's active diameter to keep similar acoustic beam divergence over the whole frequency set, with optimized spatial resolution. The probe diameter is thus increased while frequency decreases to keep its divergence angle constant.

This is why low frequency transducers have larger diameters, and are ideally used for large measurement depths and large velocities, with the following features:

- Higher emitted power
- Limited acoustic attenuation over distance
- Coarser spatial resolution and larger velocity range

In contrast, high frequency transducers with smaller dimensions and reduced emitted signals are ideal for confined flows and small velocities, with:

- Smaller emitted power (less echo from walls)
- More compact to access confined measurement locations
- Higher spatial and velocity resolutions



TX 8 - 4 - 2 - 1 - 0,5 MHz
standard transducer line



Performances

- **High sensitivity**

Thanks to a special piezo-composite technology used for the transducers active element, Met-Flow transducers show higher electro-acoustic efficiency than similar transducers made with ordinary components, useful for applications with limited echo generation or on the contrary with high acoustic attenuation.

- **Accurate acoustic signals generation**

High sensitivity can be tricky for our specific transducers used in pulsed emission, as it may affect their bandwidth and then spoil the shape of the emitted signals, with direct bad consequences on the spatial resolution of UVP measurement. With the smart combination of a special acoustic absorber and electrical impedance matching specific to each frequency, a clean acoustic signal with still high amplitude can be generated.

- **Precise transducer mounting**

Besides the design itself, manufacturing has a crucial influence on the transducer final performances. A precise production and mounting of all transducers components is essential to ensure the coaxiality between the emitted signals and the transducer casing. An axis offset would be obviously harmful for the measurement consistency.

For all above aspects and challenges to guarantee the high performances of our transducers, we take advantage of our long-standing collaboration with our partner Imasonic and its high expertise in that field.

Applicability

Selecting the right frequency, TX line can thus be used for most research applications, from very confined organic flows to large hydraulic models.

Our standard TX line is acoustically optimized for a use in water-based liquids or liquids with similar acoustic impedance, such as water suspensions, oil, alcohol, organic liquids, which represent most of UVP applications. Although TX line has sometimes been used successfully in liquids with different acoustic impedance, tailor-made designs with specific acoustic optimization can be proposed on request.

Design

Casing

Material: Our TX transducers have a stainless steel casing for a high resistance to shocks, scratching, clamping, aggressive chemicals and pressure.

Size: The casing size has been minimized to the smallest possible dimensions necessary to hold all inner components. Its outer diameter is fixed by the active element diameter, in principle a few millimeters larger. Length is 40 mm standard, but longer casings can be manufactured upon request, with additional costs. Special casing diameter in imperial unit is also possible.

A special threaded probe casing can be done on request.

Cable & connection

All our transducers are connected to the UVP profiler through a shielded coaxial cable with standard BNC male connector. Our TX line is equipped with RG 316 cable, which provides excellent noise insulation with limited line loss, while showing excellent resistance to bear laboratory sometimes harsh environment.

Special care has been taken to design robust cable outlet on the transducer casing and at the BNC connector attachment, as these elements used to be the weak parts of the device.

Standard cable length is 4 meters, being from experience the best compromise between flexible transducer installation and reduced signal attenuation. As our selected cable type RG 316 combined with an impedance matching element inside the transducers shows excellent performance, we propose optional cable lengths up to 20 meters, at a small surcharge.

Nevertheless we recommend to minimize cable length in any case for a more successful UVP operation, especially in clear liquid flows with weak echo generation.

Separate cable extensions are also available, with non-watertight BNC connection.

Long range TX transducers

To complement our TX line we propose two "long range" low frequency transducers at 0,5 MHz and 1 MHz, with increased active diameters.



The latter are ideal for long distance measurement, typically around 1 meter and beyond, as they feature larger focal distance together with reduced beam divergence angle, resulting in an enhanced spatial resolution over larger distances.

Their large active diameter also generate higher acoustic energy released in the probed liquid, for a better sensitivity at greater measurement depths.

TX 0,5 and 1 MHz long range transducer line with large active diameter

Special transducers

To address special measurement conditions, we propose special transducer lines, which are produced on request. Some are already designed, such as our high temperature TH line, while others are designed on request, typically our high pressure TP and focused TF lines, which often require other special arrangement.



TF 4 MHz focused transducer line with spherical front face

High temperature line TH

We propose a set of high temperature transducers TH line, which can measure liquid flows up to 150°C, to complement TX line withstanding up to 60°C.

The main challenge designing such a high temperature transducer is the alteration of its acoustic properties and the dilatation of its inner components that can lead to poor performances and the sensor destruction respectively.

To solve those aspects TH line integrates specific inner components with minimized dilatation and specific Curie temperatures. Additionally, a special casing designed to absorb dilatation effects and a special cable with high thermal insulation are used.



TF 4 MHz focused transducer line with spherical front face

High pressure transducers TP

Upon request, we can propose specific transducers designs withstanding up to 150°C, to complement our standard TX line usable up to 3 bars.

We do not propose a standard line for this type of transducer, as most of the time additional characteristics are required, such as a thread or resistance to specific aggressive environment.



TF 4 MHz focused transducer line with spherical front face

Focused line TF

We propose a set of transducers with a focused acoustic beam, obtained with a spherical active element, to complement our TX line that has a flat or plane active element.

This is useful for some UVP applications requiring a narrower measuring volume to optimize spatial resolution in confined flows, or focusing the acoustic energy at a specific depth in a liquid with high acoustic attenuation.

Technically, all plane narrow beam transducers show a "natural focus" effect, having their beam converging to a focal point, referred below in the specifications tables as the "natural focal distance". This is where its diameter is at minimum and the acoustic energy at highest. This distance can be then reduced by giving the active element a spherical shape.

Technical specifications

Reference	Central Frequency [MHz]	Active Diameter [mm]	Overall Diameter [mm]	Overall Length [mm]	Focal Distance [mm]	Divergence Half-angle [deg]
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Standard line TX

TX05-19-23	0,5	19	23	40	30,5	4,6°
TX1-13-16	1	13	16	40	28,5	3,4°
TX2-10-13	2	10	13	40	33,8	2,2°
TX4-5-8	4	5	8	40	16,9	2,2°
TX8-2.5-8	8	2,5	8	40	8,5	2,2°

Long range line TX

TX05-40-45	0,5	40	45	40	135,1	2,2°
TX1-20-24	1	20	24	40	67,6	2,2°

High temperature line TH

TH05-19-23	0,5	19	23	60	30,5	4,6°
TH1-13-16	1	13	16	60	28,5	3,4°
TH2-10-13	2	10	13	60	33,8	2,2°
TH4-5-8	4	5	8	60	16,9	2,2°
TH8-2.5-8	8	2,5	8	60	8,5	2,2°

High pressure line TP

TP4-5-8	4	5	8	60	16,9	2,2°
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Reference	Central Frequency	Active Diameter	Overall Diameter	Overall Length	Natural Focal Distance	Minimum Possible Focal Distance
	[MHz]	[mm]	[mm]	[mm]	[mm]	[mm]

Focused line TX

TF05-19-23	0,5	19	23	40	30,5	20,3
TF1-13-16	1	13	16	40	28,5	17,4
TF2-10-13	2	10	13	40	33,8	15,2
TF4-5-8	4	5	8	40	16,9	10,8
TF8-2,5-8	8	2,5	8	40	8,5	5,0

Note: Focused transducers can be ordered with focus point from listed minimum length up. Active element curvature point varies according to selected focus point.

Options

- Specific probe acoustic design for non-water based liquids (mercury, liquid metal, etc.)
- Specific casing design (larger length, diameter in imperial unit, etc.)
- Thread on casing outer diameter
- Specific cable length from 1 meter to 20 meters (reliable operation guaranteed up to standard 4 meters)
- Cable extensions with BNC connectors at both ends, length on request