

ULTRASONIC FLOWMETER



The Bradford Engineering Ultrasonic Flowmeter (UFM) provides a highly accurate direct and rapid measurement of the propellant mass flowrate consumption in e.g. satellite bi-propellant propulsion systems. Because of its non-intrusive nature, the unit imposes negligible pressure losses.

The Ultrasonic Flowmeter principle is based on the so-called propagating or transit-time flow measurement method, which is the most suitable method for accurate measurements with liquid media. Two transducers are both used to send an ultrasonic signal and to receive the signal propagated through the fluid. Since the fluid is moving, the signal transit time in the downstream direction is shorter than the transit time in the upstream direction. This difference is proportional to the flow velocity, from which in turn the volume flow rate can be derived. The measurement is independent of the sound velocity of the liquid, hence is medium independent. Because of the fast response time, both steady-state Liquid Apogee Engine massflow and Reaction Control Thruster pulses can be recorded.

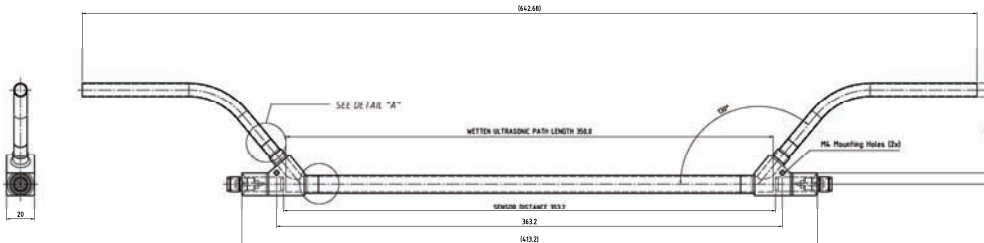
PERFORMANCE CHARACTERISTICS

Medium compatibility	Hydrazine, MON, MMH, IPA, GHe, GN ₂ , GAr, De-ionised H ₂ O
Flowrate measurement range	0 ... 300 g/s (adaptive to customer requirements)
Operating pressure range	> 26 barA
Proof pressure factor	2 x MEOP
Burst pressure	4 x MEOP
External leakage	< 10 ⁻⁸ scc/s GHe
Measurement accuracy	± 0.05 % FS
Power supply voltage	12 ... 100 Vdc, single or dual
Power consumption	< 3.5 W
Output signals	Digital: DS16, RS232 (optional analogue -5 / +5 Vdc)
Mass	< 200 g (flow tube) < 700 g (electronics box)
Fluidic interface	Weldable 3/8" tube stub or screwed AS4395 fitting, customer adaptive
Wetted materials	Ti6Al4V or AISI 316L
Environmental temperature range	-40 ... +75 °C non-operating -20 ... +70 °C operating
EMC requirements	According MIL-STD-461E

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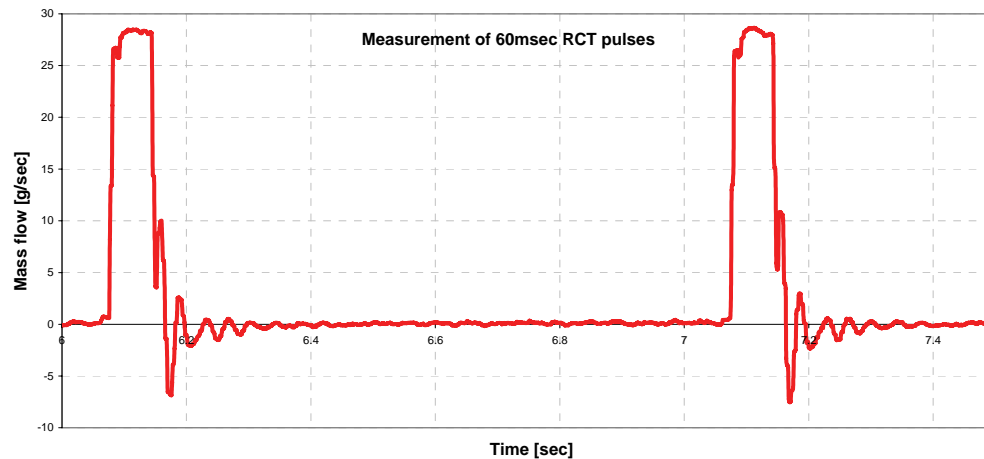
TYPICAL ULTRASONIC FLOWMETER INTERFACES

(customer adaptive)

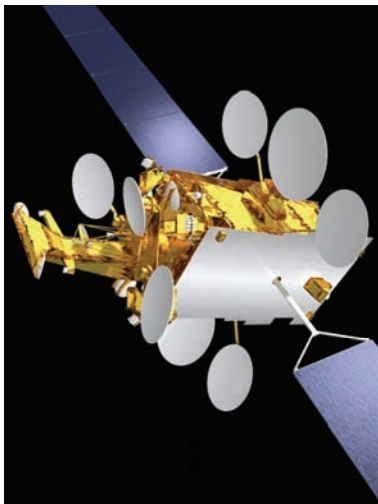


SIGNAL CONDITIONING

The electronics design consists of two major parts: On the one hand, there is the analogue front-end (Pre-Processor); on the other hand, there is the digital part (Signal Processor) which enables state-of-the-art time stretching technology. With this technology, delay time resolution down to 0.2 nsec can be achieved.



DESIGN HERITAGE



The Ultrasonic Flowmeter has been successfully subjected to qualification testing under an ESA development programme, and has found several applications in Ground Support Equipment and thrusters firing test facilities.

During the qualification campaign, a life propellant test has been performed successfully at the P1.0 facility in Lampoldshausen with MON-1 to verify the satellite propellant measurement capability of the unit. The Ultrasonic Flow Meter has been selected for use in the Alphaspace CPS propellant and oxidiser feedlines.

Bradford Engineering

Bradford Engineering B.V. is specialised in engineering, design and development, production and testing of spaceflight components, systems and subsystems for a multitude of satellite and human spaceflight applications.

We are a hundred percent Dutch company and internationally considered to be one of the leading space engineering companies in The Netherlands. Bradford's quality system is certified according to the EN-9100:2003 standard for aerospace quality management systems. Having our own development, mechanical and electronics engineering as well as test facilities, our company is an efficient and cost-conscious partner in realising your goals.

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