

DESCRIPTION

In the frame of the ESA TRP Piezo Valve for Space Applications, CEDRAT TECHNOLOGIES has developed a Proportional Piezo Valve PPV200M for Cold gas micro propulsion. This type of propulsion is a relevant choice for space missions that require extreme stabilization, pointing precision, non-magnetism, or contamination free operation.

The developed active valve is a normally closed piezo actuated valve, based on an Amplified Piezo Actuator APA200M pulling a needle. Without voltage supply to the APA, the needle is pressed against the valve seat, which blocks the flow. With an applied voltage order, the valve opens allowing a proportional flow Control. The concept of APA-based valve is patented by CTEC.

Tests of a prototype were done with Nitrogen but other applicable inert gas are possible including Xenon. It can even be adapted to incompressible fluids.

These tests have demonstrated both possible functions:

- a low noise proportional valve, ensuring Proportional Gas Flow Control (PGFC) in a cold / warm gas thruster system for a fine and smooth attitude and control spacecraft sub – system
- the generation of repeatable Minimum Impulse Bits in the range of 0.1 – 1 μ N.s, that are desirable for some small micro – spacecraft's.

Measured performances requested for Cold gas micro propulsion are given in the next table, noting these are far from the limit: The bandwidth can be easily increased. Higher Maximum Expected Operating Pressure can also be achieved.

SPACE EVALUATION PROGRAM

The PPV200M followed a space evaluation program including

- Functional tests,
- Lifetime test (10^6 open/close cycles),
- Thermal vacuum test (-10 / 75 °C).

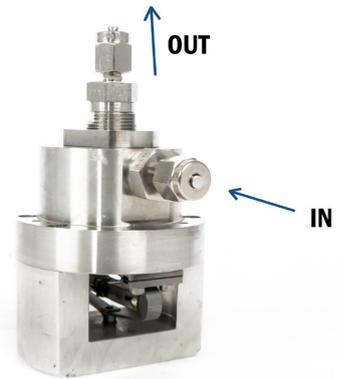


Fig. 1.a: view of the PPV200M



Fig. 1.b: PPV200M with CA45 electronics

SPACE HERITAGE

One Engineering Qualification Model (EQM) has been realised and tested. Sets of APA200Ms have been delivered for space flight applications.

REFERENCES	UNIT	PPV200M
> Notes		> Space product
Fonction		Proportional valve
Sensors option		Strain gauges Flowmeter
Max. no load displacement	µm	200
Max. flow	sccm	250
Fluid		N2, Ar, air
Maximum Expected Operation Pressure	bar	2
Voltage Range	V	-20 ... 150
Internal leakage	sccs@Ghe	4.0 ⁻⁰⁶
External leakage	sccs@Ghe	2.0 ⁻⁰⁸
Resolution	nm	13
Mass	g	250
Unloaded resonance frequency (in the actuation's direction)	Hz	2100
Bandwidth	Hz	200
Capacitance		3.5
Mechanical interfaces		3xM2 at 120°
Dimensions	mm	Ø : 60 Heigh : 70
Fluid interfaces		Swagelock 1/8" connector
Electrical interfaces		2 PFTE AWG30 wires
Temperature range	°C	-20/65

Table 1. Performances of PPV200M