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# atrato

## Ultrasonic Inline Flow Meter Range

### A breakthrough in flowmeter technology from Titan Enterprises Ltd.

Utilizing patented technology that enables it to operate with excellent accuracy over very wide flow ranges, across the whole span, the Atrato range of inline flowmeters is a genuine breakthrough in flowmeter technology. Its rugged, clean bore construction makes the Atrato ideal for a whole range of low flow applications and its USB port allows software connectivity at literally the touch of a button. Its signal processing system permits flow measurement across the whole range of the Reynolds number, allowing both viscous and non-viscous products to be metered accurately. The Atrato can handle low flows from laminar to turbulent and is largely immune from viscosity. It has excellent turndown, repeatability and linearity and can monitor flow over a range of 200:1. Accuracy is better than  $\pm 1.5\%$  of reading.



The USB connection permits the user to directly monitor the rate and total on their laptop as well as altering some of the operating parameters, such as the pulse resolution and units. The time of flight measuring system measures both the upstream and downstream flight times and half the difference is the velocity of the fluid. The patented system measures these time differences to an accuracy of better than 250 picoseconds, giving the excellent meter performance. As the pipe geometry is known, the resulting pulse output is accurate for the volume passed. This performance is further enhanced by the primary signal to noise ratio, which is typically 1000:1 and at times as high as 3000:1.

## Features

- Measurement down to 2 ml/min (0.032 gph)
- Accuracy better than  $\pm 1.5\%$  of reading over entire flow range
- Repeatability  $\pm 0.1\%$  over 25 - 100% of the flow range
- Turndown ratio 200 : 1
- Through bore, no moving parts
- Wetted materials PEEK<sup>®</sup> / 316 Stainless Steel or PEEK<sup>®</sup> / Borosilicate Glass
- Pulse and analogue outputs, hardwired relay and liquid crystal display
- USB interface for configuration and real-time view
- Pressure rating 10 bar (145 psi) and 30 bar (435 psi)
- Temperature rating up to 100 °C (212 °F)





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## How it works

The Atrato system uses the well-proven time of flight measuring method, which is far more reliable and accurate than Doppler shift measurement, where reflected signals are required from irregularities in the liquid. The Atrato crystals are plain disks with a hole in the center forming a washer, which are excited in such a way that they oscillate radially as opposed to the normal mode of excitation, which is across the thickness of the ceramic. This strong radial signal sends symmetrical pulses directly into the tube.

Because of these annular ring crystals, the sound travelling down the pipe can be considered as a plain wave. The signal to noise ratio is remarkable as there is little background noise and high signal strengths. At times, the signal to noise ratio is as high as 3000:1. As the system is fully balanced at zero flows, the two signals are identical and cancel each other out. This gives a very stable zero flow condition and is the basis of the flowmeters high ratio between minimum and maximum flows. As the flow increases these signals go out of phase and this phase shift is measured to an accuracy equivalent to 250 picoseconds.

In addition, the sound waves travelling down the tube in the Atrato operating system are symmetrical and as a result any changes in the fluid's velocity profile across the pipe diameter will be averaged out by the signal as it passes from the transmitter to the receiver. It is therefore irrelevant whether the fluid velocity profile is fully formed with turbulent flow or completely laminar with a classic parabolic profile. In practice this gives the Atrato an excellent immunity to Reynolds number changes and a good high viscosity performance.

## Technical Specifications

- Accuracy:  $\pm 1.5\%$  of reading over entire flow range
- Repeatability:  $\pm 0.1\%$  over 25 - 100% of the flow range  
 $\pm 0.5\%$  over 0 - 25% of the flow range
- Flow ranges: see table 1
- K-factor: see table 1, adjustable with configuration software
- Pulse output: NPN, PNP and relay – 24 Vdc / 100 mA, non-inductive
- Analogue output: 4 – 20 mA, 0 – 5 V and 0 – 10 V selectable
- Display: Liquid Crystal, 6 x 18 mm characters, 2.5 mm enunciators (optional)
- Temperature range: -10 – +60 °C (14 – 140 °F) – non-condensing  
-10 - +100 °C (14 – 212 °F) – separate enclosures, max. 5 m (16 ft) cable
- Pressure range: up to 10 bar (145 psi) and 30 bar (435 psi) for stainless steel fittings only
- Flow tube material: PEEK® / 316 Stainless Steel or PEEK® / Borosilicate Glass <sup>1)</sup>
- Seal: Viton, Nitrile, EPDM or Silicon
- Process connections: 3/8" John Guest or 1/2" BSP in PEEK® - pressure rating 10 bar (145 psi)  
1/2" NPT Stainless Steel – pressure rating 30 bar (435 psi) <sup>1)</sup>
- Enclosure: aluminum and PEEK® end caps; IP54 / NEMA 3
- USB Interface: incl. software and cable; Windows XP or later
- Power supply: 10 – 24 Vdc (15 – 24 Vdc with use of analogue outputs)
- Calibration: for water @ 20 °C (68 °F), incl. calibration certificate with K-factors

<sup>1)</sup> pressure rating 30 bar (435 psi) for PEEK® / 316 Stainless Steel flow tube with stainless steel fittings only!!



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## Flow Ranges and Pulses

Model	Range liter/min	Range gal/min	Max. Freq. Hz	Max / Set K-factor 1/liter *)	Max / Set K-factor 1/gallon *)
710	0.002.....0.500	0.0005.....0.132	400	48000 / 40000	181700 / 151400
720	0.007.....1.70	0.0018.....0.450	400	14000 / 11500	52000 / 43300
740	0.02.....5.00	0.0053.....1.32	400	4800 / 4000	18170 / 15140
760	0.1.....20.0	0.026.....5.28	400	1200 / 1000	4540 / 3785

\*) the flowmeter will be set for the K-factor as listed; can be adjusted by the user up to the max. K-factor.

Table 1

## Outputs, Display and Engineering Units

The Atrato provides standard for a scalable analogue output, a hardwired relay and in addition for NPN and PNP pulse outputs. The pulse outputs are available in case the Atrato has to replace and mimic a standard turbine or other flowmeter with pulse output. The K-factor – the number of pulses per unit of volume – can be set for the desired value, up to the listed maximum in Table 1. A pull-up resistor must be used with a current sinking output (NPN) and a pull-down resistor for a current sourcing output (PNP). The transistors can also be used as a flow switch.

The free-scalable analogue output can be selected to be 0 – 5 V, 0 – 10 V or 4 – 20 mA. The minimum and maximum value of the output can be set with the standard configuration software for any flow rate within the range.

The hardwired relay is suitable for 24 Vdc, 100 mA, non-inductive and as a flow switch, it allows for an adjustment of the set point and the hysteresis for any flow rate within the range. Alternatively, the relay can be set to operate in batch mode, allowing switching at a total value of the volume flow.

The large liquid crystal display is an optional feature. The software allows the setting of the display mode to be rate, total, both or batch. Any selection will alter the dialog box accordingly to the available settings and selections.

The software allows for the selection of a time base and of one of the most common engineering units for volume and mass flow; if the engineering unit of choice is not available, “Custom Units” can be selected.

## Considerations

The Atrato is an ultrasonic flowmeter using the time of flight measuring method, which puts limits on the presences of particles and gas bubbles. A rule of thumb is a maximum of 5 – 10 % in volume. The Atrato is a true bore, there are no moving parts, no obstacles; however, a certain pressure drop is created by the increase resp. decrease of the connected process pipes or tubing. See guide lines for the pressure drop [www.jlcinternational.com/atrato.htm](http://www.jlcinternational.com/atrato.htm).

If there is no back pressure (an open connection downstream) the vapor pressure will create elongated gas bubbles in the flow tube attenuating the ultrasound and resulting in faulty measurements. To avoid the creation of gas bubbles a backpressure must be introduced. A rule of thumb is to have a backpressure of 2 times the vapor pressure plus 4 psi. E.g., the vapor pressure of water at ambient conditions is approx. 0.33 psi, what leads to a backpressure of approx. 5 psi. Please note, temperature can influence the vapor pressure considerably and the vapor pressure of different liquids can differ a lot. If it looks like water, it does not mean it has the same properties.



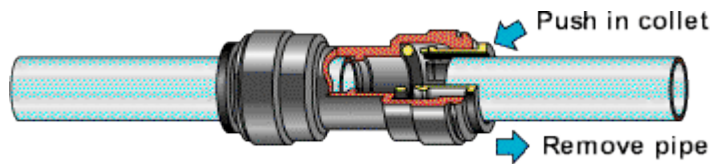
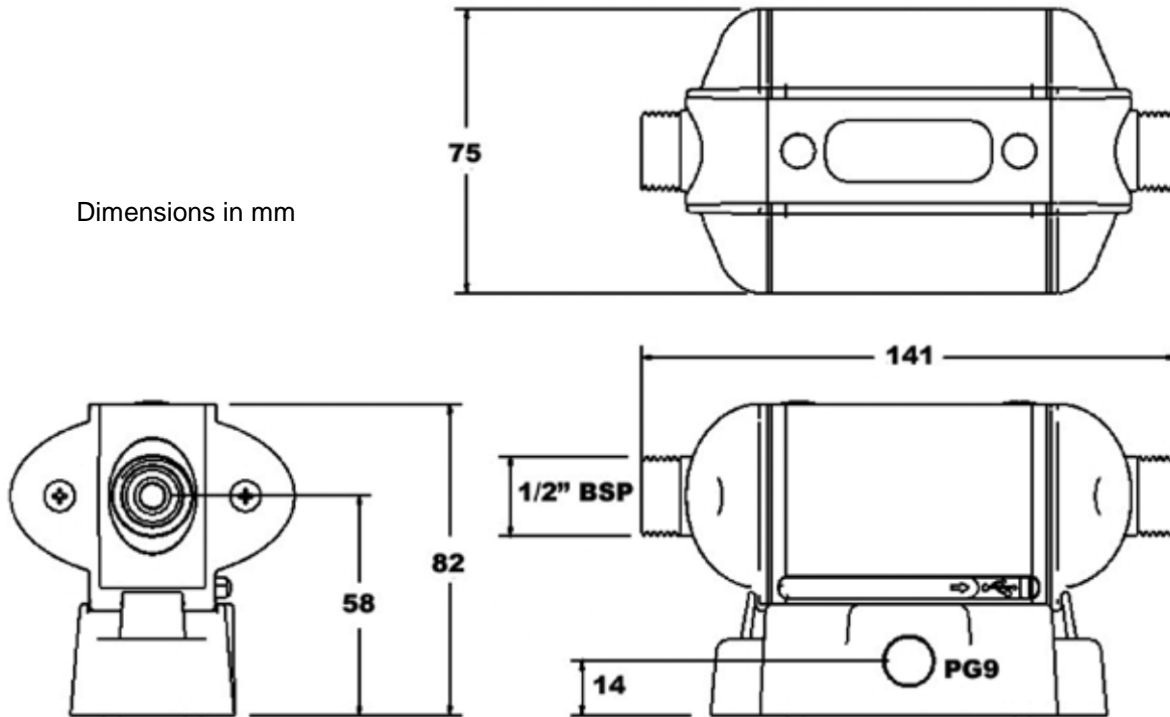
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## Dimensions and Connections



John Guest fittings





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## Model Numbering System

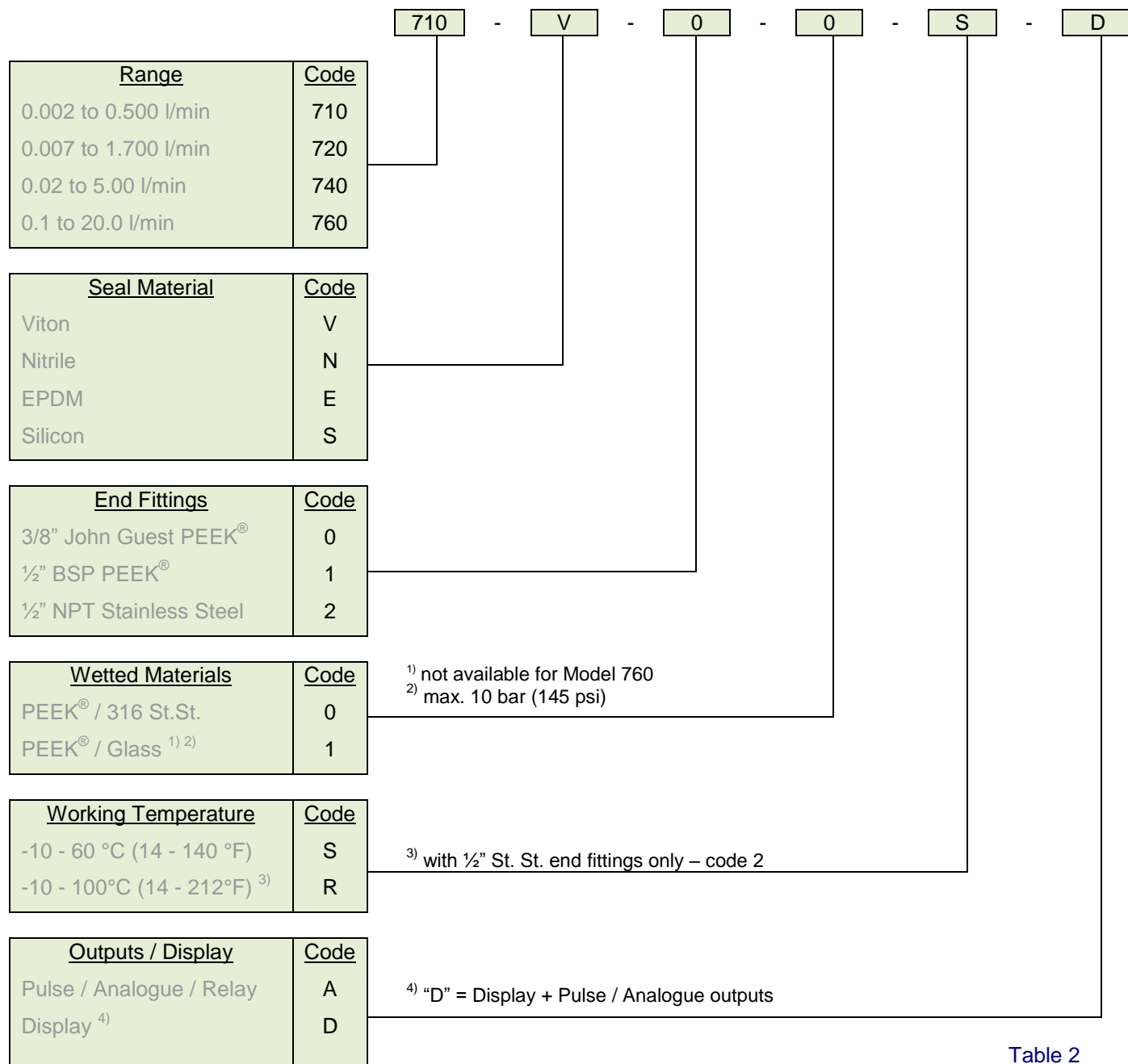


Table 2

### Order example: 760-V-0-0-SD

Range 0.1 to 20 lpm, with Viton seal, 3/8" John Guest fittings, PEEK<sup>®</sup> / 316 St.St. wetted material, standard temperature range and pulse / analogue outputs and liquid crystal display.