

Ultrasonic Flowmeter



M-2100 Series

Non-contact sensing for small line

Features

- Accuracy +/-1% of Reading
- Repeatability +/-0.5%
- All wetted parts made of New PFA (AP-201SH) Contamination free from ions or particles
- Corrosion resistant, no metal parts
- Wide rangeability of 100:1 (Typical)
- Easy installation with compact meter body
- Minute flow measurements down to 10 mL/min
- Measures viscous fluids up to $4.5 \times 10^{-5} \text{ m}^2/\text{s}$ (45cSt)
- Easy configuration in front panel with LCD display

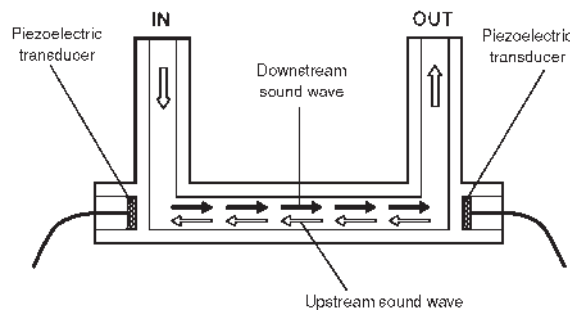
The M-2100 Series is a flowmeter designed for low flow rates and small line applications. The flowmeter consists of a Flow Detector and a Signal Converter. All the wetted parts are of PFA. There are no mechanical seals or moving parts. The flowmeter has non-contact transducers and a flow tube design without dead pockets. The M-2100 is an ideal choice for use in the semiconductor industry where extreme cleanliness and anti-corrosiveness are required.

Applications

- Pure water and ultra-pure water in semiconductor manufacturing plants.
- CMP slurries
- Chemical feeds
- Highly corrosive chemicals
- Very low flow measurement of liquid

Operating Principle

The fluid to be measured flows through the U or Z shaped tube. Two piezoelectric transducers, mounted at both ends of the measuring section, generate and receive an ultrasonic wave alternately. The wave traveling with the fluid is accelerated and the wave traveling against the fluid is slowed. The difference in transit time of the signals is proportional to the velocity of the fluid.



Specifications

Flow detector

Measurable Fluid : Liquids
 Fluid Sound Speed : 100 to 2500 m/s
 Fluid Temperature : 10 to 100°C
 Fluid Pressure : 0 to 70 psig
 Fluid Kinematic Viscosity : $0.8 \times 10^{-6} \text{ m}^2/\text{s}$ to $4.5 \times 10^{-5} \text{ m}^2/\text{s}$
 Process Connection : PFA Tube End (Refer to Table 1)
 Enclosure Classification : IP65
 Flow Range : Refer to Table 1

Table 1. Flow Range and Connecting Tube Size

Range Code	Flow Range (L/min)		Connecting Tube Size
	Min. Range	Max. Range	
03	0 - 0.025	0 - 0.1	3/8"
04	0 - 0.1	0 - 3.0	3/8"
06	0 - 0.4	0 - 8.0	3/8"

Table 3. Pressure Loss Factor

Range Code	K
03	6.28
04	3.04
06	0.537

Pressure Loss:

Pressure Loss for water(kPa) = $K \times Q^2$
 where K : Factor (refer table3)
 Q : Flowrate (L/min)

Table 2. Accuracy

Range Code	Flow Velocity < 1m/s		Flow Velocity > = 1m/s	
	Flow-rate (L/min)	Accuracy (L/min)	Flow-rate (L/min)	Accuracy (of Reading)
03	0 - 0.1	+/- 0.002	-	-
04	0 - 0.8	+/- 0.008	0.8 - 3	+/- 1%
06	0 - 1.7	+/- 0.017	1.7 - 8	+/- 1%

Note: Accuracy statement is based on a water calibration

Table 4. Materials of Flow Detector

Part Name		Material
Wetted Part	Body	New PFA
	Tube	New PFA
Housing		PTFE
Cable Fitting		PP
Signal Cable Sheath		PVC

Ultrasonic Flowmeter

Signal Converter

USC-291

Output:

- 1) 4 to 20 mA (Load resistance max. 500 ohms)
Time constant 0.1 ~ 99 seconds (programmable)
- 2) Flow rate alarm for High and Low flow rate
Open collector / Max. 30 V, 20mA DC

Freely programmable (by digital I/O)

Alarm indication by 2 LED

Response time: 0.1s std. setting

(Programmable 0.1s, 0.3 ~ 25s in 0.1 s step)

Digital I/O: RS-485, MODBUS, Max. 32 devices

Low Cut-off: 2% F.S. std. setting

(Programmable 0 to 25%)

Linearization capability: Max. 15 points

(polygonal) programmable

Power Supply: 24V DC \pm 10%,

Power Consumption: 3.6W / Approx. 150 mA

(running) Max. 0.25 A inrush current

Ambient Condition: 5 to 40°C / 30~80% RH

Installation: Plug-in type / DIN rail mounting socket

Enclosure Class: IP20 (Indoor Use)

Materials: Housing & Socket / ABS

Color: Black

Data back up: by EEPROM

Weight: Approx. 200g

EMC: EMI / EN55011, CLASS A1, EMS / EN50082-2

Connection:

Signal / BNC connector to M-2400

Power supply / Screw terminal size M4

RS-485 / Screw terminal size M2.6

USC-321

Output:

- 1) 4 to 20mA (Load resistance 0 to 500 ohms)
or 0 to 10 V
- 2) Scaled Pulse (Open collector / DC 30 V, 20mA Max.)
Pulse width :
0.5ms (Max. 1000 Hz), 50ms (Max. 10 Hz), 100ms
(Max. 5 Hz)
- 3) Flow rate alarm / Preset function
2 points (Open collector / DC 30 V, 20mA Max.)

Installation: Panel Mounting

Low Cut-off: 0 to 30% of full scale

Linearizer: 15 line-segment approximation

Display: LCD / 2 line 16 digit alphanumeric flow rate, total flow, and flow velocity.

Alarm indicator: 2 LED

Data Entry: By 4 key switches in front panel

Power Supply: DC24V \pm 10%, 150 mA (1.5 A/ starting)

Enclosure Classification: IP20 (Indoor use)

Materials: Panel - ABS, Housing - steel

Color: Panel - Gray, Housing - Black

Dimensions: 96W x 48H x 172D

Mass: Approx. 500 g

USC-731

The USC - 731 has the latest technology , **digital signal processing (DSP)**. This feature realizes reduction of the influence of bubbles in fluid which is common problem in semiconductor or chemical process. With this technology it is possible to measure flow containing bubbles*.

Output:

- 1) 4 to 20mA (Load resistance 0 to 500 ohms)
Damping Time Constant : 0.2 to 10 seconds
- 2) Scaled Pulse (Open collector / DC 30 V, 20mA Max.)

Pulse width: 0.5ms (Max. 1000 Hz),
50ms (Max. 10 Hz),
100ms (Max. 5 Hz)

(selectable depending on the pulse rate at full scale)

- 3) Flow rate alarm / Preset function
2 points (Open collector / DC 30 V, 20mA Max.)

Alarm: Relative method

Relay Action: NO or NC (Alternative choice)

Low Cut-off: 0 to 30% of full scale

Display: LCD /2 line 16 digit alphanumeric (with illuminator)

Alarm indicator: 1 LED, LCD (high/low)

Data Entry: By 4 key switches in front panel

Linearizer: 15 line-segment approximation

Power Supply: DC24V \pm 10%

Power Consumption: 2.4W/100mA (running) (1.3A / starting)

Ambient Condition: 0 to 50°C/30 -80% RH

Installation: Panel Mounting

Enclosure Classification: IP20 (Indoor use)

Materials: Panel /Acryl, Housing/Aluminum

Color: Panel: blue and yellow

Housing: Black

Mass: Approx. 530 g

USC-801 - Blind Type Converter

The USC-801 utilizes the latest **digital signal processing (DSP)** technology and features significant reduction of adverse influence of bubbles in measured fluids which is a common problem in semiconductor and chemical processes.

The USC-801 is the DSP version of the USC-291.

Features

- New signal processing has improved anti-bubbles capability of converter*.

Normally, ultrasonic flowmeter has difficulty in measuring fluid containing bubbles, because the bubbles interfere with ultrasonic signal passage. In virtue of DSP and accumulated field experience, anti-bubbles capability has been remarkably improved. (Except for fluids which contains dense, minute cloudy bubbles.)

Output:

- 1) 4 to 20 m A (Load resistance max.500 ohms)
Time constant 0.1 ~ 99 seconds (programmable)
- 2) Flow rate alarm for High and Low flow rate
Open collector / Max. 30 V, 20mA DC

Freely programmable (by digital I/O)

Alarm indication by 2 LED

Response time: 0.1s std. setting

(Programmable 0.1s, 0.3 ~ 25s in 0.1 s step)

Digital I/O: RS-485, MODBUS, Max. 32 devices

Low Cut-off: 2% F.S. std. setting

(Programmable 0 to 25%)

Linearization capability: Max. 15 points

(polygonal) programmable

Power Supply: 24V DC \pm 10%,

Power Consumption: 3.6W / Approx. 150 mA
(running) Max. 0.25 A inrush current

Ambient Condition: 5 to 40°C / 30~80% RH

Installation: Plug-in type / DI N rail mounting
socket

Enclosure Class: IP20 (Indoor Use)

Materials: Housing & Socket / ABS

Color: Black

Data back up: by EEPROM

Weight: Approx. 200g

EMC: EMI / EN55011, CLASS A1, EMS / EN50082-2

Connection:

Signal / BNC connector to M-2400

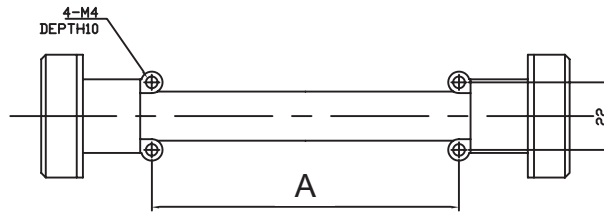
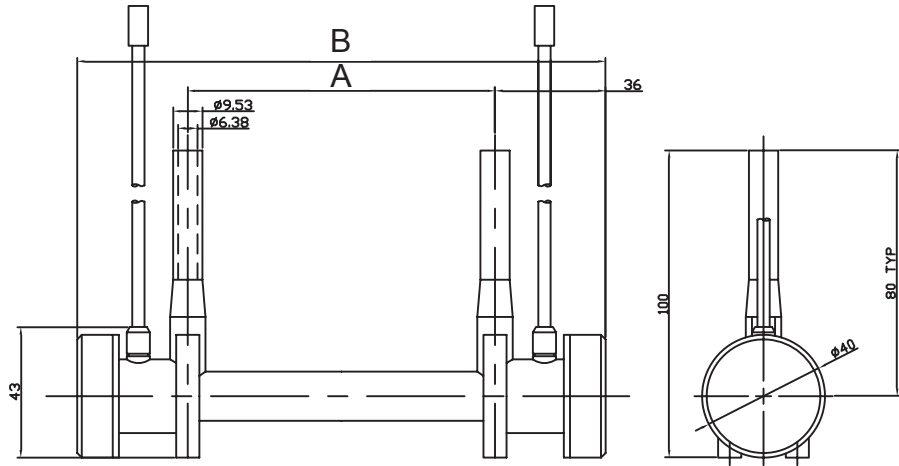
Power supply / Screw terminal size M4

RS-485 / Screw terminal size M2.6

* Product cannot work with fluids having bubbles exceeding 10% by air volume and also other limitations as advised by our Applications engineers.

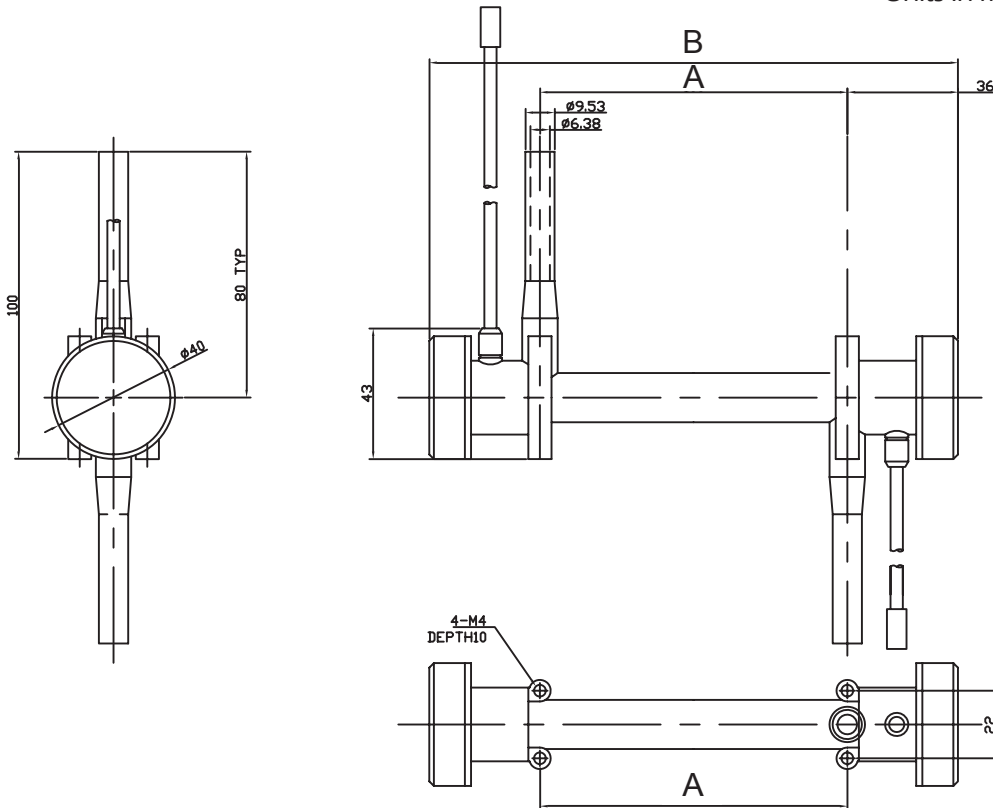
Ultrasonic Flowmeter

Dimensions (Sensor)

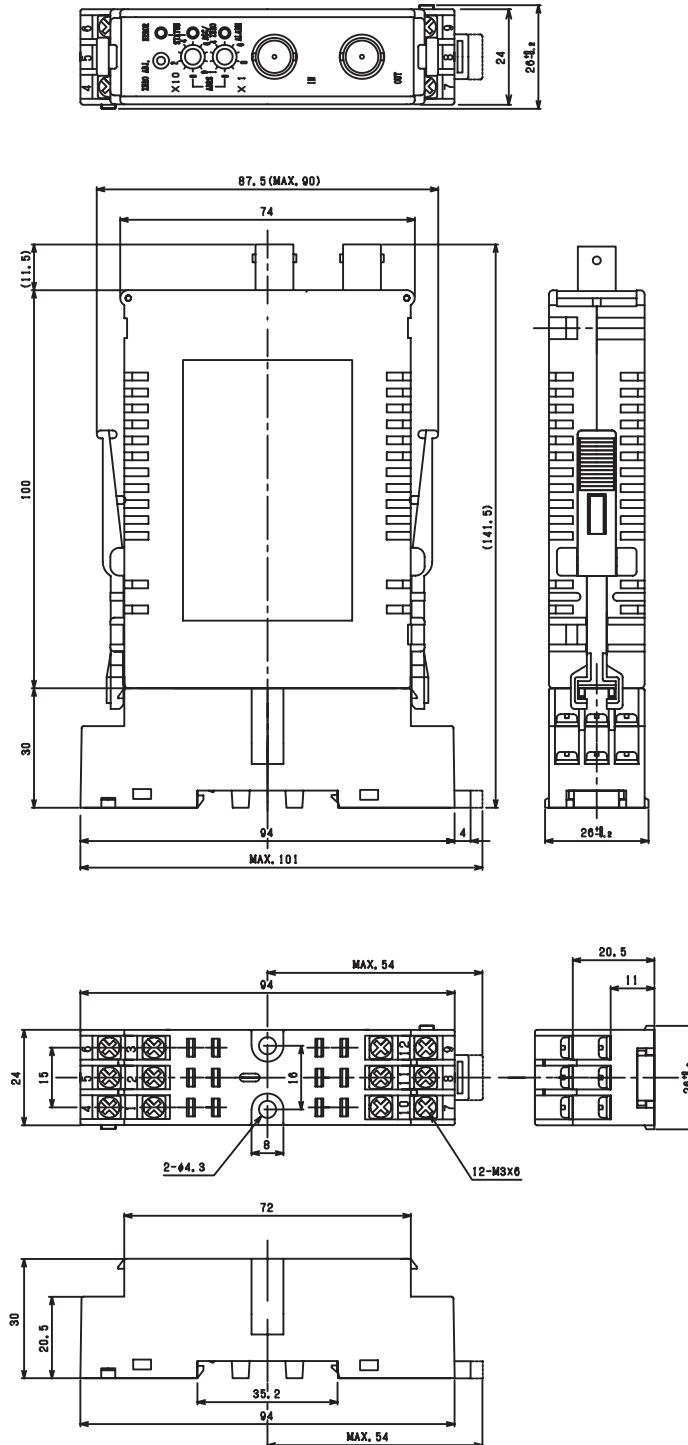


Range Code	A	B
03	80	152
04	80	152
06	100	172

Units in mm



Dimensions (Converter USC 291/801)



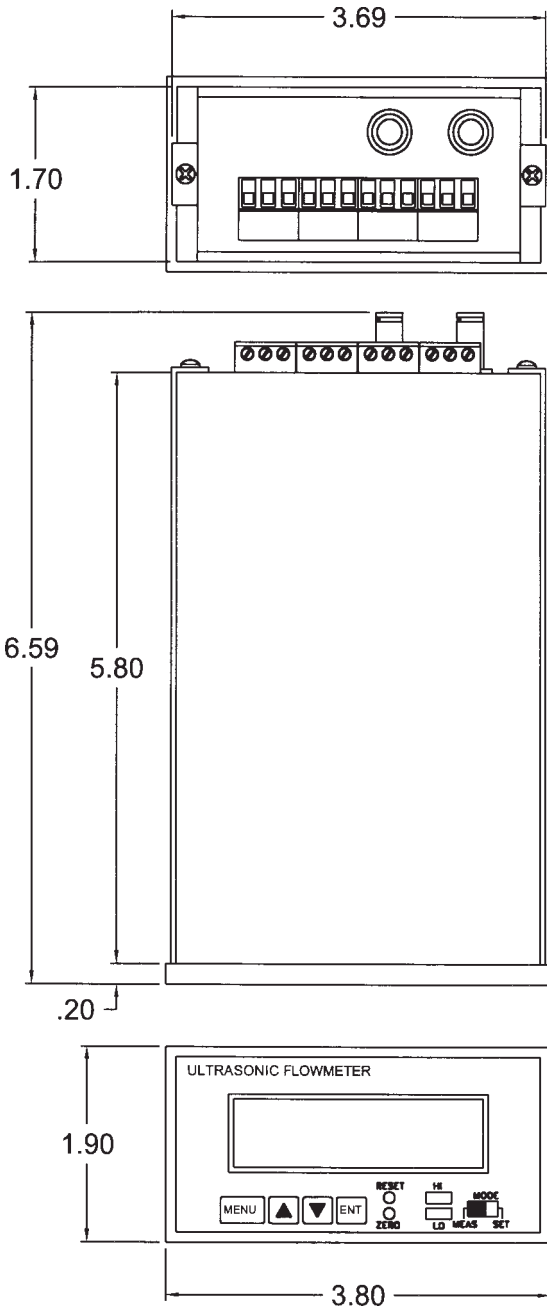
Terminal

No.	Description	No.	Description
1	AL2	7	(+) : RS485
2	AL1	8	(+) : P OUT
3	COM : (AL1/AL2用)	9	(+) : ANALOG OUT
4	Ground	10	(-) : RS485
5	Input : DV	11	(-) : P OUT
6	Input : DC24V	12	(-) : ANALOG OUT

Units in mm

Ultrasonic Flowmeter

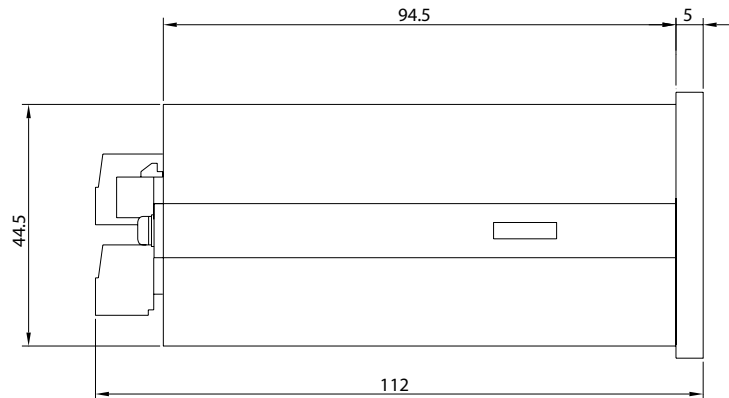
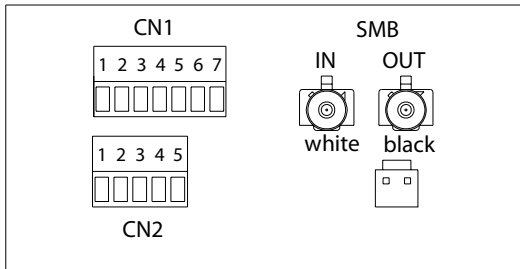
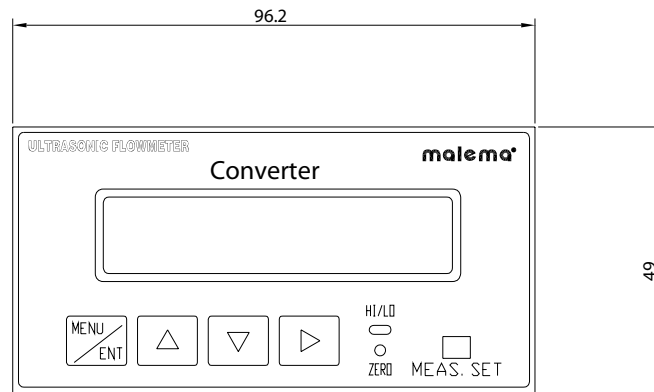
Dimensions (Converter USC 321)



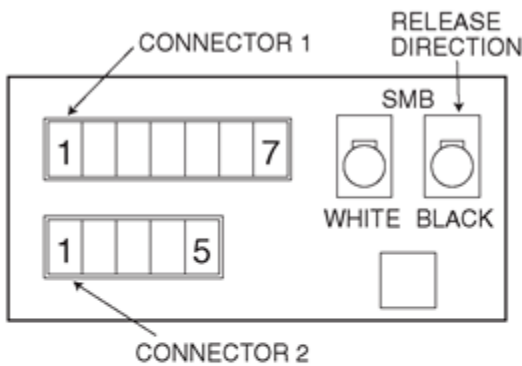
No	Polarity	Connection
1	+	Current output (4 to 20 mA)
2	-	
3	+	Pulse output (Open Collector)
4	-	
5	+	Flow rate alarm (H) or Preset total (HH) (Open Collector)
6	-	
7	+	Flow rate alarm (L) or Preset total (H) (Open Collector)
8	+	Reset total
9	-	
10	GND	Ground
11	0 V	Power supply (24 V DC)
12	24 V	

Units in inches

Dimensions (Converter USC 731)



Units in mm



CONNECTOR 1 (Removable)

Terminal	Polarity	Description
White	Inlet side	Sensor Signal (Coaxial cable connector)
Black	Outlet side	
1	+	Power supply (DC24V)
2	-	
3	⊥	FG (Grounding)
4	+	Output current 4-20mA or voltage 0-10V
5	-	
6	+	Reset pulse input for totalizer
7	-	

CONNECTOR 2 (Removable)

1	+	Pulse Output
2	-	
3	+	Alarm Hi
4	-	Alarm Common
5	+	Alarm Lo

Ultrasonic Flowmeter

Cautions On Installation

- Installation Area for Flow Detector: Select the area of pipe where no air or gas bubbles exist in the flow.
- Mounting of flow detector: Recommend to install detector vertically with upward flow, in order to prevent deposit of slurry or bubbles in low flowrate conditions.
- Location of control valve: If a flow control valve is installed in the piping, it should be located on the downstream side of the flow detector to keep the fluid pressure high. The high fluid pressure will prevent the formation of bubbles in the flow.
- Noise Suppression: All electrical noise sources near the flowmeter, such as power relays or solenoid valves, should be fitted with a surge suppressor.
- Signal Cable Wiring: Keep signal cables away from high voltage or high current power cables to avoid induced electrical noise.

Ordering Information

Model Code											Description	
M-2100	-					-			-			
	-											
Tube Material	T											PFA
Tube Size	3											3/8" OD
Connection	1											Tube ends
	2											Flare
	3											Pillar Super 300
Range Code	03*											0 - 0.1 lpm
	04											0 - 3 lpm
	06											0 - 8 lpm
	-											
Converter Model	0											Standard w/display (USC-321)
	5											DSP w/display (USC-731)
	9											Standard w/ RS485 (USC-291)
	A											DSP w/ RS485 (USC-801)
Analog Output Type	1											0 - 10 VDC
	2											4 - 20 mA
	3											0 - 5 VDC
	4											1 - 5 VDC
	-											
Geometry	U											U - shape
	Z											Z - shape
	-											
										XXX		unique PN identifier

* The 03 Range Code only accepts the USC-731 or USC-801 Converters.