Ultrasonic Flowmeter Product Analysis

This section of the Living Database contains an analysis of ultrasonic flowmeters by supplier. Representative photos of each company's ultrasonic flowmeters are provided, and a list of specifications is given for the main types of meters offered by each supplier. This information is as complete as possible; however, in some cases, either photos or certain specification information were unavailable.

The following suppliers are included in this section:

American Sigma
Automated Sonix
Caldon
Controlotron
Danfoss
Daniel
Datam Flutec
D-Flow
Durag
Dynasonics
Eastech Badger
EES
Elis Plzen
Emco
Endress & Hauser
Flexim
Flotec
Fluenta
FMC Measurement Solutions
Fuji Electric
Greyline
Honda Electronics
Instromet
Kaijo
Krohne
Laaser
Matelco
Mesa Labs
Micronics
Monitor Labs
Nanomaster
Panametrics
Polysonics
Rittmeyer
Sick
Siemens
Solartron
Sparling
Teksco
Thermo MeasureTech
Tokimec
Tokyo Keiso
Ultraflux
Ultrasound Research Center
Venture Measurement

American Sigma

American Sigma offers both open channel and Doppler flowmeters. The open channel flowmeters include a line of area velocity flowmeters (904, 910, 920, & 930), a permanent ultrasonic flow and water quality flowmeter (970), and a portable velocity meter (PVM).

American Sigma purchased the line of Doppler flowmeters formerly manufactured by EIT of Exton, Pennsylvania. This line consists of the following Doppler meters:

- 2400 permanent closed pipe Doppler flowmeter
- 2410 permanent closed pipe Doppler flowmeter
- 2450 portable closed pipe Doppler flowmeter

Figure 3-1 American Sigma Ultrasonic Flowmeters

Photo 3-1 American Sigma 2400

Photo3-2 American Sigma 2410

Photo 3-3 American Sigma 2450

Table 3-1
American Sigma Doppler Ultrasonic Flowmeters

Product Name	Model 2400/2410	Model 2450
Applications	Clamp-on Dedicated Water	Clamp-on Portable Water
Diameter Range	0.5-300 in	0.5-300 in
Flow Range	0.2-25 ft/sec	0.1-36 ft/sec
Temp Range	-40 to +250 F	-40 to +300 F
Pressure Range		
Connection		
Number of Paths	1	1
Output	LCD Two current or voltage outputs Three pulse outputs Data logger (2410 only)	LCD 100K data logger 4-20 mA RS232
Mode	Doppler	Doppler

www.americansigma.com

Automated Sonix

Automated Sonix offers a clamp-on and an insertion style transit time flowmeter. The meter is called SonoFlo. The output is 4-20 mA, and it has an optional RS232C output.

SonoFlo is made to measure a variety of fluids, including acid, oils and fuels, water, paints, glues, milk, latex, and slurries.

Table 3-2
Automated Sonix Ultrasonic Flowmeters

Product Name	Sono-Flow
Applications	Liquids Acids/bases, petroleum, water, emulsions, slurries Thread-in or spoolpiece
Diameter Range	1-120 in
Flow Range	0.25-60 fps
Temp Range	-40 to +300 F
Pressure Range	To 250 psig
Connection	Flange (spoolpiece)
Number of Paths	1
Output	4-20 mA RS232C
Mode	TT

URL: **www.automatedsonix.com**

Caldon

Caldon is a supplier of multipath ultrasonic flowmeters that specializes in nuclear applications. Caldon's flowmeters are as follows:

- LEFM 200
- LEFM 2000

For nuclear applications, Caldon's flowmeters are used to measure feedwater flow. In many cases, these flowmeters replace Venturi nozzles that have become fouled from use. Caldon's flowmeters have eight transducers that provide a four-path configuration.

Caldon has recently been positioning itself to offer ultrasonic flowmeters to the petroleum and gas industries. Some of the measurements provided include flow rate, viscosity, fluid temperature, density, and interface detection.

Figure 3-2 Caldon Ultrasonic Flowmeters

Photo 3-4 Caldon LEFM 200

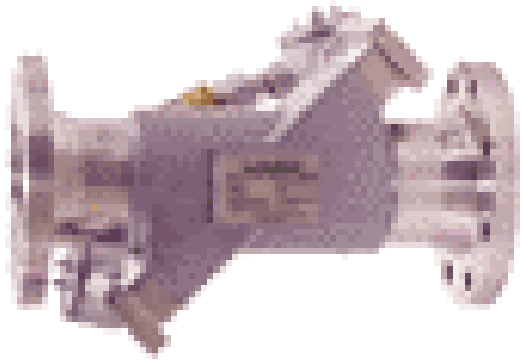

Photo 3-5 Caldon LEFM 2000

Table 3-3
Caldon Ultrasonic Flowmeters

Product Name	LEFM 200	LEFM 2000
Applications	Petroleum Custody transfer, leak detection Spoolpiece	Feedwater Nuclear Clamp-on
Diameter Range	4-16 in	
Flow Range	To 4560 cubic meters/hr	
Temp Range	-20 to +250 F	
Pressure Range	To 1440 psi	
Connection	Flange	
Number of Paths	4	4
Output	LCD 4-20 mA and pulse outputs * Self-diagnosing	Self-diagnosing
Mode	TT	TT

**Can indicate flow rate, density, viscosity, and temperature.*

www.caldon.net

Controlotron

Controlotron's comprehensive ultrasonic flowmeter line includes the following categories:

- Portable Clamp-on and Optional InLine Products: 1010P, DP, WP, WDP, EP and EWDP
- Dedicated Clamp-on Products: 1010EN, EDN, N, DN, MN, X, DX
- Multifunction Products: 1010AN, ADN
- Dedicated Flow Tube Products: 1010 FTN, FTDN, FTMN, FTX, FTDX
- Dedicated Clamp-on Spool Products: 1010SN, SDN, SX, SDX, SIX

These products are designed to measure flow of liquids, compressed gases or hot or cold water. They can measure volumetric flow, mass flow or thermal energy. The number of channels (or paths) varies from one to four. They operate in Doppler or transit time modes; some models can use either. Controlotron uses their proprietary Reflexor ® Doppler technology, which is fast Fourier transform technique.

Data about some representative products from these families is tabulated in Table 3-4.

Figure 3-3 Controlotron Ultrasonic Flowmeters

Photo 3-6 Controlotron 1010 Spoolpiece

Photo 3-7 Controlotron 1010WP

Photo 3-8 Controlotron 1010G Spoolpiece

Photo 3-9 Controlotron 1010G Hot Tap Spool

Photo 3-10 Controlotron 1010P

Photo 3-11 Controlotron 1010 Energy Meter

Table 3-4
Controlotron Ultrasonic Flowmeters

Product Name	1010N/X	1010P/WP*	1010E
Applications	Dedicated/clamp-on	Portable	Energy meter
Diameter Range	0.5 to 360 in	0.5 to 360 in	0.25-360 in
Flow Range, fps	1-40	0-40	0-60
Temp Range, F	To 450	To 450	-40 to +450
Pressure Range, psig			
Transducer Materials			
Number of Paths	1 or 2	1	1
Liner Material			
Mode	TT or Doppler	TT	TT

**P is for light-duty; WP is for heavy-duty.*

Table 3-4
Controlotron Ultrasonic Flowmeters… Cont.

Product Name	1010DN	1010SN/SX
Applications	Dedicated Clamp-on	Clamp-on Spoolpiece *
Diameter Range	0.5-360	2-48 in
Flow Range, fps	0-40	0-40
Temp Range, F	To 450	
Pressure Range, psig		
Transducer Materials		
Number of Paths	2 or 4	1 or 2
Liner Material		None
Mode	TT	TT

*Spoolpiece available in steel, stainless steel or special alloys

Danfoss

Danfoss offers several lines of transit time ultrasonic flowmeters used for water & wastewater, energy, and industrial applications. These flowmeters include the following:

- Sonoflo 3100
- Sonoflo 3300
- SonoKit

Both the Sonoflo 3100 and 3300 are spoolpiece meters.

In addition to the industrial meters, Danfoss offers a line of ultrasonic heat meters for district heating. These meters are as follows:

- Sonocal 2000 threaded
- Sonocal 2000
- Sonocal 3000

These heat meters are used to measure the flow of water in industrial district heating plants.

Some ultrasonic district heating meters are also used to measure energy in residential plants. These meters are low in cost relative to the industrial meters. Kamstrup and Siemens are the main suppliers of the residential energy meters, although Kamstrup also supplies industrial energy meters. Danfoss and Kamstrup had a cooperative sales agreement that ended in July 2000 when the companies began competing more directly with each other. While Danfoss' meters are used for industrial applications, the company is beginning to make meters that could also be used for residential applications.

Figure 3-4 Danfoss Ultrasonic Flowmeters

Photo 3-12 Danfoss Sonoflow 3100

Photo 3-13 Danfoss Sonoflo 3300

Photo 3-14 Danfos Sonokit

Table 3-5
Danfoss Ultrasonic Flowmeters

Product Name	SONOFLO 3100	SONOFLO 3300	SONOKIT
Applications	Dedicated Spoolpiece	Dedicated Spoolpiece	Retrofit Spoolpiece
Diameter Range	DN 10-2000	DN 50-300	DN 200-400
Flow Range			0.2 –450,000 cubic meters/hr
Temp Range	-20 to +200 C	-10 to +160 C	-20 to +200 C
Pressure Range	To PN 160	To PN 50	To PN 40
Connection	Flange or wafer	Flange	
Number of Paths	1	1	1,2 or 4
Output			
Mode	TT	TT	TT

**Spoolpieces are made of mild or stainless steel*

www.danfoss.com

Daniel

Daniel offers two ultrasonic flowmeters for measuring the flow of natural gas (see Table 3-6):

- SeniorSonic
- JuniorSonic

The SeniorSonic is designed for custody transfer measurement of natural gas. The SeniorSonic is a four-path ultrasonic flowmeter. In addition to custody transfer, it is used for transmission systems, underground storage sites, natural gas power plants, and alternative check metering.

The JuniorSonic is designed for check metering, offshore metering, storage measurement, and wet gas applications. It is not approved for custody transfer applications. The JuniorSonic is either a single-path or a dual-path meter.

Both the SeniorSonic and JuniorSonic are designed for use in pipelines from 4 through 36 inches in diameter. These units provide 4-20 mA output signals (RS485 or RS232 interfaces).

Figure 3-5 Daniel Ultrasonic Flowmeters

Photo 3-15 Daniel SeniorSonic Meter

Photo 3-16 Daniel Hot Tap Meter

Table 3-6
Daniel Ultrasonic Flowmeters

Product Name	JuniorSonic	SeniorSonic
Applications	Spoolpiece Check metering	Spoolpiece Custody transfer, etc. (meets AGA 9)
Diameter Range, in	4-24	6-36
Flow Range, fps	3-100	3-110
Temp Range, F	-5 to +185	-4 to +140
Pressure Range, psig	To 1200	To 2000
Transducer Materials		
Number of Paths	1 or 2 *	4
Liner Material		
Mode	Transit time	Transit time

Note: Model 3410: 1 centerline bounce. Model 3420: 2 centerline bounces

Datam Flutec

Datam Flutec offers both a fixed and a portable version of its ultrasonic flowmeters. These meters are as follows:

- DFU-10
- DFU-10p

Both meters use the transit time principle.

Figure 3-6 Datam Flutec Ultrasonic Flowmeters

Photo 3-17 Datam Flutec DFU 10

Photo 3-18 Datam Flutec DFU 25e

Photo 3-19 Datam Flutec DFU 10p

Table 3-7
Datam Flutec Ultrasonic Flowmeters

Product Name	DFU-10*	DFU-10P
Applications	Dedicated	Portable
Diameter Range	15-5000 mm	15-5000 mm
Flow Range	5-20 cm/sec	
Temp Range		To 80C
Pressure Range		
Attachment		
Number of Paths	1 or 2	
Output	LCD 0-20 or 4-20 mA Pulse Totalizer RS232	LCD Supplied with two sets of sensors: 80-5000 mm dia 15-80 mm dia
Mode	TT	TT

**Can use with DFU-25e insertion probes.*

www.datamflutec.com

D-Flow

Rather than selling completed ultrasonic flowmeters, D-Flow sells components of ultrasonic flowmeters. D-Flow offers these components to companies that manufacture ultrasonic meters, in hopes that they will choose to integrate D-Flow's products in their meters. These products include the "sing around" transducers, and D-Flow's integrated circuit, called the UFO ASIC.

The term "sing-around" refers to the looping pattern in which the ultrasonic transmission bursts occur. Transducer 1 sends an ultrasonic burst to transducer 1. This signal is processed by the electronics of transducer 2, and this excites another burst of ultrasonic sound from Transducer 1.

Figure 3-7 D-Flow Ultrasonic Transducer

Photo 3-20 D-Flow "Sing Around" Transducer

Table 3-8
D-Flow Ultrasonic Flowmeters

Product Name	Orion/Gemini*
Applications	
Diameter Range	8-50 mm (Orion) 25-1525 mm (Gemini)
Flow Range	0.9-15 m/sec
Temp Range	-40 to +140 C
Pressure Range	
Connection	
Number of Paths	1
Output	Pulse RS232
Mode	TT

These devices use the proprietary “sing-around” process, by which one transmitter can serve many sensors

**Orion has 1 path. Gemini has 2 paths (for larger pipes)*

www.d-flow.com

Durag Group

Durag offers the DFL 200 ultrasonic transit time flowmeter. This flowmeter is intended for the monitoring of pollutant emissions from industrial plants. The meter can detect when limit values in exhaust gases are reached, so that necessary action can be taken to insure compliance with environmental regulations.

Figure 3-8 Durag Group Ultrasonic Flowmeter

Photo 3-21 Durag DFL 200

Table 3-9

Durag Group Ultrasonic Flowmeter

Product Name	D-FL200-10
Applications	Gas Ducts and flue stacks Welded-in
Diameter Range	To 1000 mm
Flow Range	0-40 m/sec
Temp Range	To 200 C
Pressure Range	
Connection	
Number of Paths	1
Output	4-20 mA
Mode	TT

www.durag.de

Dynasonics

Dynasonics offers the following ultrasonic flowmeters:

- Series TFXD transit time
- Series 900 Doppler
- Series 902 Portable

Figure 3-9 shows these three types of flowmeters. Table 3-10 provides the specifications. More information is available at www.dynasonics.com.

Figure 3-9 Dynasonics Ultrasonic Flowmeters

Photo 3-22 Dynasonics TFXD Transit Time

Photo 3-23 Dynasonics 900 Doppler

Photo 3-24 Dynasonics 902 Portable

Table 3-10
Dynasonics Ultrasonic Flowmeters

Product Name	Series TFXD*	Series TFXP	Series 901/902**
Applications	Dedicated Clamp-on Clean liquids: can tolerate some solids or bubbles	Portable Clamp-on Clean liquids: can tolerate some solids or bubbles	Clamp-on Liquids: sewage, slurries, etc.***
Diameter Range, in	1-100	1-100	0.125-120
Flow Range, fps		0-40	0.5-20
Temp Range, F			-40 to +400
Pressure Range, psig			
Number of Paths	1	1	1
Output	4-20 mA RS232 or 485	4-20 mA RS232 or 485 200K event data logger LCD	4-20 mA LCD
Mode	TT	TT	Doppler

**TFXD1: blind. TFXD2: with LC display*

***901: dedicated. 902: portable*

****Proprietary circuitry allows meter to operate at very low solids concentrations*

Eastech Badger

Eastech Flow Controls, dba Eastech Badger, has purchased the ultrasonic flowmeter line from Badger Meter. This transaction took place in January 2001. Eastech also sells a line of vortex flowmeters. Eastech Badger is still selling the ultrasonic models previously sold by Badger Meter. These meters include the following:

- Series 4500 Compu-Sonic
- Model 7000

The Series 4500 is a fixed transit time ultrasonic flowmeter. The Model 7000 is a portable transit time ultrasonic flowmeter.

Table 3-11
Eastech Badger Ultrasonic Flowmeters

Product Name	Series 4500 Compu-Sonic	Model 7000
Applications	Spoolpiece or strap-on Water, wastewater, industrial process fluids Dedicated	Strap-on Water, wastewater, industrial process fluids Portable
Diameter Range	>2 inches	4-54 inches
Flow Range		
Temp Range	-30 to +150 F (300F available)	-30 to +180 F
Pressure Range	To 150 PSI	
Connection	Flanged (spoolpiece)	
Number of Paths	1	1
Output	LCD 4-20 mA RS232 or 485 Modbus	Vacuum fluorescent display 4-20 mA Data logger
Mode	TT	TT

EES

EES offers three models of clamp-on flowmeters. These meters are as follows:

- EES Portable Clamp-on Flowmeter
- EES Dedicated Clamp-on Flowmeters (two models)

Figure 3-10 EES Ultrasonic Flowmeters

Photo 3-25 EES Dedicated Flowmeter

Photo 3-26 EES Portable Flowmeter

Table 3-12
EES Ultrasonic Flowmeters

	Portable	Dedicated	Dedicated
Applications	Portable Clamp-on Liquids	Dedicated Clamp-on Liquids	Dedicated Clamp-on Liquids
Diameter Range	0.25-256 in	0.5-256 in	6-6500 mm
Flow Range	.01-25 m/sec	.01-25 m/sec	.01-25 m/sec
Temp Range	-30 to +540 C (with high-temp sensors)	-30 to +300 C	-30 to +300 C
Pressure Range			
Connection			
Number of Paths	1	1	1
Output	2 channels LCD 0 or 4-20 mA Datalogger RS232	1-2 channels LCD 0 or 4-20 mA Totalizer RS485 (opt)	4 channels LCD 0 or 4-20 mA Datalogger RS232/485 Optional temperature sensors
Mode	TT and Doppler	TT and Doppler	TT and Doppler

www.flowmeters.f2s.com

Elis Plzen

Elis Plzen offers a range of ultrasonic flowmeters under the SonoElis name, including the following:

- SonoElis SE 1.0
- SonoElis SE 2.0
- SonoElis SE 404x
- SonoElis SE 405x

Elis Plzen’s flowmeters are designed for measuring both conductive and non-conductive liquids, including chemically aggressive liquids.

Figure 3-11 Elis Ultrasonic Flowmeters

Photo 3-27 SonoElis SE 404X

Photo 3-28 SonoElis SE 405X

Table 3-13
Elis Ultrasonic Flowmeters

Product Name	SONOELIS SE 1.0	SONOELIS SE 2.0	SONOELIS SE 404/406X*
Applications	Liquids Spoolpiece	Liquids "Direct assembly"**	Liquids Spoolpiece
Diameter Range, DN	25-300	200-2000	32-300
Flow Range, cubic meters/hr	0.25-5000		
Temp Range, C	-20 to +180	-20 to +180	0-150
Pressure Range	To PN 40	To PN 40	To PN 40
Attachment	Flange	NA	Flange
Number of Paths	1	1	1
Output	LCD Pulse, frequency RS485 4-20mA (optional)	LCD Pulse, frequency RS485 4-20mA (optional)	LCD Pulse, frequency RS485 4-20mA (optional)
Mode	TT	TT	TT

**SE 406 X is a dual beam instrument*

***Sensor housings to be welded into existing pipes*

Table 3-13
Elis Ultrasonic Flowmeters… Cont.

Product Name	SONOELIS SE 405X
Applications	Liquids Spoolpiece
Diameter Range, DN	25-32
Flow Range, cubic meters/hr	2.5-15
Temp Range, C	0-150
Pressure Range	To PN 40
Attachment	Threaded or flanged
Number of Paths	1
Output	Pulse, frequency Optional: RS485, 4-20 mA
Mode	TT

**Sensor housings to be welded into existing pipes*

www.elis.cz

Emco

Emco's ultrasonic flowmeter is called the Sono-Trak. This meter is a transit time meter that uses clamp-on transducers. The Sono-Trak can be used on pipe sizes from 2 to 100 inches.

Figure 3-12 Emco Ultrasonic Flowmeter

Photo 3-29 Emco Sono-Trak

Table 3-14
Emco Ultrasonic Flowmeter

Product Name	Sono-Trak
Applications	Dedicated Clamp-on Liquids
Diameter Range, in	2-100
Flow Range, m/sec	
Temp Range, C	
Pressure Range, psig	
Transducer Materials	
Number of Paths	1
Output	LCD Options: pulse, analog, RS232/485, BTU and data logger
Mode	TT

www.emcoflow.com

Endress & Hauser

Endress & Hauser has recently entered the ultrasonic flowmeter market with the Prosonic Flow DMU 93. This meter is intended to measure the flow of water and wastewater, corrosive and abrasive liquids, and hydrocarbons. The Prosonic Flow is a transit time meter with clamp-on transducers.

Users have a choice of communication methods with the Prosonic Flow meter. These include HART, using a hand-held, and Endress & Hauser's own communication protocol, Commuwin II, using a personal computer.

Figure 3-13 Endress & Hauser Ultrasonic Flowmeter

Photo 3-30 E&H ProSonic DMU93

Table 3-15
Endress & Hauser Ultrasonic Flowmeters

Product Name	ProSonic Flow DMU93
Applications	Dedicated Clamp-on Liquids: wastewater, hydrocarbons, corrosives, abrasives
Diameter Range, in	2-120
Flow Range, CM/hr	
Temp Range, F	-40 to +175
Pressure Range, psig	
Number of Paths	1
Output	LCD 4-20mA HART interface
Mode	TT

**Proprietary helical path signal routing*

www.endress.com

Flexim

Flexim offers several ultrasonic flowmeter models called Fluxus, including the following:

- Fluxus ADM 7807
- Fluxus ADM 6725

Both are transit time clamp-on meters.

Figure 3-14 Flexim Ultrasonic Flowmeters

Photo 3-31 Flexim Fluxus ADM 6725

Photo 3-32 Flexim Fluxus ADM 7807

Table 3-16
Flexim Ultrasonic Flowmeters

Product Name	Fluxus ADM 6725	Fluxus ADM 7807/7907
Applications	Liquids Portable Clamp-on	Liquids Dedicated Clamp-on
Diameter Range, mm	100-6500	25-6500
Flow Range, m/sec	.01-25	.01-25
Temp Range, C	-30 to +200	-30 to +200
Pressure Range, psig		
Transducer Materials		
Number of Paths	1	1
Output	30K data logger, LCD, 4-20 mA, R232 (R485 optional)	30K data logger, LCD, 4-20 mA, R232 (R485 optional)
Mode	TT	TT

** Consists of FS595 sensor kit and FT-555 transmitter*

www.flexim.de

Flotec

Flotec's ultrasonic flowmeter is called the CO-DTTF. This is a clamp-on transit time flowmeter. It is intended for monitoring wastewater and sewage, control and monitoring of coolant water in industrial plants, for measuring water flow at hydroelectric power plants, and for leak detection.

Figure 3-15 Flotec Ultrasonic Flowmeter

Photo 3-33 Flotec CO-DTTF

Table 3-17
Flotec Ultrasonic Flowmeter

Product Name	DTTF*
Applications	Liquids Clamp-on
Diameter Range	15-5000 mm
Flow Range	To 18 m/sec
Temp Range	
Pressure Range	
Connection	
Number of Paths	1
Output	LCD Digital or 4-20 mA RS232/285
Mode	TT

**Available in dedicated and portable versions*

www.flotec-uk.com

Fluenta

Fluenta offers the FGM 130 flare gas meter. This meter is designed to measure flare gas in pipes with large diameters, a wide range of velocities, and low pressures. The FGM 130 is a transit-time insertion-style ultrasonic flowmeter. The insertion style transducers are mounted at an angle to the pipe. One transducer acts as a sender and the other as a receiver, just as they do in a spoolpiece meter. The insertion style makes it possible to measure flow in a variety of large pipes.

In February 2001, Roxar ASA acquired Fluenta. Roxar established a new company called Roxar Flow Measurement, consisting of Fluenta and the metering division of Roxar. Roxar specializes in multiphase flowmeters.

Figure 3-16 Fluenta Ultrasonic Flowmeter

Photo 3-34 Fluenta FGM-130

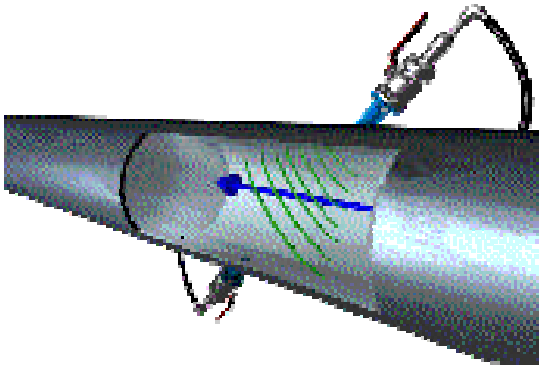

Table 3-18
Fluenta Ultrasonic Flowmeters

Product Name	FGM 130*
Applications	Dedicated Flare gas
Diameter Range	6-72 in
Flow Range	To 100 m/sec
Temp Range	-70 to +150 C
Pressure Range	0.8 to 10 bar (absolute)
Connection	Hot tap
Number of Paths	1
Output	4-20 mA (8 signals)** RS232, 422, 485 MODBUS
Mode	TT

**Has BASEEFA Certification*
***Can measure velocity, density, molecular weight, mass flow rate, temperature, and pressure*

www.fluenta.com

FMC Measurement Solutions

FMC Measurement Solutions has purchased the six-path transit time ultrasonic flowmeter from Kongsberg Offshore in Kongsberg, Norway. This flowmeter is called the MPU 1200. Its purpose is for measuring the custody transfer of natural gas. FMC has entered the fastest-growing segment of flow, but is competing against two well-established companies: Instromet and Daniel.

Later in 2001, FMC will introduce the MPU 600. This is a three-path meter that is claimed to have custody transfer accuracy when it is combined with a flow conditioner.

Figure 3-17 FMC Measurement Solutions Ultrasonic Flowmeter

Photo 3-35 FMC Kongsberg MPU1200

Table 3-19 FMC Measurement Solutions Ultrasonic Flowmeter

Product Name	Kongsberg MPU1200*
Applications	Dedicated Spoolpiece Gases: custody transfer, etc. AGA9-compliant
Diameter Range, in	6-36
Flow Range, fps	1.3-98
Temp Range, F	-45 to +158
Pressure Range, psig	145-2900
Number of Paths	6
Output	Many options
Mode	TT

**Digital signal processing for improved noise resistance*

www.fmcenergysystems.com

Fuji Electric

Fuji Electric offers a variety of transit time clamp-on ultrasonic flowmeters. These include:

- CompuFlow
- Portaflow-X
- Time Delta Flexible Type

The CompuFlow is a compact, light-weight flowmeter. The Portaflow-X is a portable transit time ultrasonic flowmeter. The Time Delta Flexible Type is a fixed ultrasonic transit time flowmeter.

Figure 3-18 Fuji Electric Ultrasonic Flowmeter

Photo 3-36 Fuji Electric Portaflow-X

Table 3-20
Fuji Electric Ultrasonic Flowmeters

Product Name	CompuFlow*	Portaflow-X	Time Delta Flexible Type
Applications	Clamp-on Sludges and slurries	Clamp-on Portable Homogeneous liquids	Clamp-on Fixed Homogeneous liquids
Diameter Range, in	0.5-300	0.5-235	0.75-235
Flow Range, fps	0.5-50	.06-105	
Temp Range, F	-40 to +300	-40 to +390	-40 to +390
Pressure Range, psig			
Number of Paths	1	1	1
Output	LCD 4-20 mA	LCD 0.8-20 mA, 4-20mA, or 20-4-20 mA 40K data logger	LCD 4-20 mA
Mode	Doppler	TT	TT

**FDPD: dedicated. FDPP: portable*

www.fujielectric.co.jp

Greyline

Greyline is a Canadian-based company that offers the following Doppler ultrasonic flowmeters:

- DFM-IV
- PDFM-IV

The DFM-IV has clamp-on transducers that strap onto pipes from ½inch and larger. This meter is intended for liquids that are difficult to measure, including wastewater, sludge, chemicals slurries, and abrasives. The PDFM-IV is a portable version of the same meter.

Figure 3-19 Greyline Ultrasonic Flowmeters

Photo 3-37 Greyline DFM-IV

Photo 3-38 Greyline PDFM-IV

Table 3-21
Greyline Ultrasonic Flowmeters

Product Name	DFM-IV
Applications	Wastewater, sludge, chemicals, viscous or abrasive fluids Clamp-on Dedicated*
Diameter Range	0.5-180 in
Flow Range	0.2-40 fps
Temp Range	
Pressure Range	
Connection	
Number of Paths	1
Output	LCD 4-20 mA 50,000 point data logger Totalizer
Mode	Doppler

**Also offer portable version (PDFM-IV)*

www.greyline.com

Honda Electronics

Honda Electronics is a Japanese company that specializes in ultrasonic products, including fish finders, fish counting systems, ultrasonic cleaners, and ultrasonic consumer goods. The company's ultrasonic flowmeter is called the USF 100 A-K. It is a clamp-on transit time ultrasonic meter.

Table 3-22
Honda Electronics Ultrasonic Flowmeters

Product Name	USF 100 A-K
Applications	Dedicated Semiconductors, medical, pharma, food & beverage
Diameter Range	6-16 mm
Flow Range	.05-50 ltr/min
Temp Range	0-50 C
Pressure Range	To 0.5 MPa
Attachment	Clamp
Number of Paths	1
Output	4-20 mA
Mode	TT

Note: wetted parts are made of PFA

www.nanomaster.com (US distributor)
www.tsc.co.jp/~honda-el/index_e.html

Instromet Ultrasonic Flowmeters

The Instromet ultrasonic flowmeter line consists of seven models, all of which are transit time models and are designed to measure the flow of natural gas. These units, which are described in Table 3-23, can be used in pipes ranging from 4 to 64 inches in diameter. Instromet's flowmeters provide 4-20 mA output signals (RS485 interface. Instromet's flowmeters are as follows:

- CheckSonic-H (hot tap)
- CheckSonic-S
- FlareSonic
- Q-Sonic-2S (spoolpiece)
- Q.Sonic-3S (spoolpiece)
- Q.Sonic-3S Compact
- Q.Sonic-5S (spoolpiece)

The CheckSonic-H is a hot tap (insertion-style) meter that comes in either single path or dual path models. The CheckSonic-S is a spoolpiece meter that is available in either single or dual path models. Both CheckSonic models are designed for check metering.

The FlareSonic is a single path meter designed to measure the flaring of natural gas.

The Q.Sonic 2S has two double reflected paths that cross the gas flow six times. This gives coverage equal to a four-path meter, according to Instromet.

The Q.Sonic 3S has three reflected paths with eight crossings. This meter is designed for custody transfer.

The Q.Sonic 3S Compact is a compact model that integrates the transmitter with the spoolpiece.

The Q.Sonic 5S has five reflected paths with 12 crossings of the gas flow. This is Instromet's top-of-the-line meter, and is used for custody transfer of natural gas.

Figure 3-20 Instromet Ultrasonic Flowmeters

Photo 3-39 Instromet CheckSonic

Photo 3-40 Instromet FlareSonic

Photo 3-41 Instromet Q.Sonic-3S

Photo 3-42 Instromet Q.Sonic-5S

Table 3-23
Instromet Ultrasonic Flowmeters

Product Name	CheckSonic-H	CheckSonic-S	FlareSonic
Applications	Hot tap Check metering	Spoolpiece Check metering	Hot tap Flare gases
Diameter Range, in	8-64	4-64	4-64
Flow Range, CM/hr	30-210,000	20-210,000	25-210,000
Temp Range, C			
Pressure Range, psig	To 1450	To 6530	To 30
Transducer Materials			
Number of Paths	1-2	1-2	1
Liner Material			
Mode	Transit time	Transit time	Transit time

Table 3-23
Instromet Ultrasonic Flowmeters… Cont.

Product Name	Q.Sonic 2S	Q.Sonic 3S
Applications	Spoolpiece Custody Transfer	Spoolpiece Custody Transfer (meets AGA9)
Diameter Range, in	4-64	4-64
Flow Range, CM/hr	40-210,000	40-210,000
Temp Range, C		
Pressure Range, psig	To 6530	To 6530
Transducer Materials		
Number of Paths	*	**
Liner Material		
Mode	Transit time	Transit time

**Two double-reflected paths crossing the fluid flow 6 times*
***Three reflected paths (8 crossings)*

Table 3-23
Instromet Ultrasonic Flowmeters… Cont.

Product Name	Q.Sonic 3S	Q.Sonic 5S
Applications	Spoolpiece Custody Transfer	Spoolpiece Custody Transfer (exceeds AGA 9)
Diameter Range, in	4,6 and 8	4-64
Flow Range, CM/hr	40-3000	160-210,000
Temp Range, C		
Pressure Range, psig	To 1440	To 6530
Transducer Materials		
Number of Paths	Multi	*
Liner Material		
Mode	Transit time	Transit time

**Five reflected paths (12 crossings)*

www.instromet.com

Kaijo

Kaijo is a Japanese company that offers the following ultrasonic flowmeters:

- GF-520 (gas spoolpiece)
- LF-700 (liquid clamp-on)
- SGF-100 (gas spoolpiece fixed)
- SLF-100 (liquid spoolpiece fixed)

Figure 3-21 Kaijo Ultrasonic Flowmeters

Photo 3-43 Kaijo GF-520

Photo 3-44 Kaijo LF-700

Table 3-24
Kaijo Ultrasonic Flowmeters

Product Name	GF-520	LF-700	SGF-100	SLF-100
Applications	Gas Spoolpiece Dedicated	Liquid Clamp-on Dedicated	Gas Spoolpiece Dedicated	Liquid Clamp-on Dedicated
Diameter Range, in				
Flow Range, fps				
Temp Range, F				
Pressure Range, psig				
Number of Paths	1	1	1	1
Output				
Mode	TT	TT	TT	TT

**TFXD1: blind. TFXD2: with LC display*
***901: dedicated. 902: portable*
****Proprietary circuitry allows meter to operate at very low solids concentrations*

www.kaijo.co.jp

Krohne

In the highly diversified, fragmented, ultrasonic flowmeter market, Krohne is an exception to the rule. While the market leaders in ultrasonic flow are not truly instrumentation companies, Krohne is a bona fide instrumentation company that offers a range of ultrasonic flowmeters to measure both liquid and gas flow. These meters are as follows:

- UFM 400 K and F (spoolpiece)
- UFM 500 K and F (spoolpiece)
- UFM 600 T (clamp-on)
- UFM 610P (clamp-on)
- GFM 700 K and F (gas)
- Altosonic V (five-beam meter for liquids)

All of Krohne's flowmeters are of the transit time variety. The UFM 400 series meters are single path meters for measuring liquid flow. The UFM 500 K and F series meters are dual path meters for measuring liquid flow. The UFM 600 T is a fixed single path meter for measuring liquid flow. The UFM 610P is a portable single path meter for measuring liquid flow.

The GFM 700 K and F meters are dual path meters for measuring gas flow. The (K) model is an integral (compact) meter, while the (F) model is remote.

Krohne's Altosonic V is a five-path ultrasonic transit time flowmeter for measuring liquids, including hydrocarbons. Krohne has applied for approval from the American Petroleum Institute (API) for approval for using this meter for custody transfer applications.

Figure 3-22 Krohne Ultrasonic Flowmeters

Photo 3-45 Krohne UFM 610P

Photo 3-46 Krohne UFM500

Photo 3-47 Krohne Altosonic V

Table 3-25
Krohne Ultrasonic Flowmeters

Product Name	UFM 400/500	UFM 610P
Applications	Liquids Fats, sludges, water, petroleum Spoolpiece	Liquids Clamp-on Portable
Diameter Range	25-3000 DN	13-5000 mm
Flow Range	To 18 m/sec	
Temp Range	-50 to +170 C	-20 to +200 C
Pressure Range	To 580 psig	
Connection	Flange	
Number of Paths	UFM 400: 1 UFM 500: 2	1
Output	LCD HART 4-20 mA Pulse	LCD Current and pulse
Mode	TT	TT

Table 3-25
Krohne Ultrasonic Flowmeters… Cont.

Product Name	UFM 600T	Altosonic V*
Applications	Liquids Clamp-on Wall-mounted Water, oils, acids/alkalis	Liquids Spoolpiece Custody transfer Petroleum, water, etc.
Diameter Range	50-3000 mm	DN 100-1000
Flow Range		280-28,000 cubic meters/hr
Temp Range	-25 to +120 C	-20 to +120 C
Pressure Range		To PN 100 (250 bar available)
Connection	Altoclamp	Flange
Number of Paths	1	5
Output	LCD Current and pulse	4-20 mA and pulse/frequency RS422/485
Mode	TT	TT

**Meets OIML R-117 guidelines*

www.krohne.com

Laaser

Laaser offers the Laaser EARL Type 560v, a single path Doppler clamp-on ultrasonic flowmeter.

Figure 3-23 Laaser Ultrasonic Flowmeter

Photo 3-48 Laaser EARL Type 560v

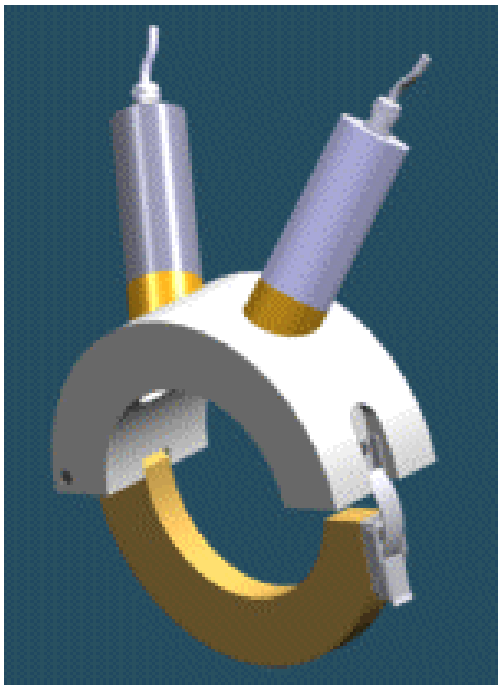

Table 3-26
Laaser Ultrasonic Flowmeters

Product Name	EARL Type 560v
Applications	Pneumatically conveyed particles or fibers Clamp-on
Diameter Range	DN50- 400
Flow Range	1-25 m/sec
Temp Range	+10 to +30 C
Pressure Range	To 0.2 bar (gauge)
Connection	
Number of Paths	1
Output	0-5 v or 0,4-20 mA RS232C
Mode	Doppler

www.laaserberlin.de

Matelco

Matelco, which is located in Spain, has a cooperative agreement with Ultraflux. Matelco manufactures the UF-321 ultrasonic flowmeter in Spain, under the guidance of Ultraflux. In addition, Matelco manufactures the UF-96. The UP-321 is available in either insertion or clamp-on models, while the UP-96 is a spoolpiece meter.

Figure 3-24 Matelco Ultrasonic Flowmeters

Photo 3-49 Matelco UF-321

Photo 3-50 Matelco UF-96

Table 3-27
Matelco Ultrasonic Flowmeters

Product Name	UF-321	UF-96
Applications	Liquids Insertion or clamp-on	Liquids Spoolpiece
Diameter Range	10-4000 mm	100-500 mm
Flow Range		
Temp Range	-10 to +65 C	
Pressure Range	To 25 kg/cm2	To 16 bar
Connection		
Number of Paths		
Output	LCD 4-20 mA	
Mode	TT	TT

Note: Matelco manufactures these flowmeters in Spain under license from Ultraflux.

www.matelco.com

Mesa Labs

Mesa Labs, Nusonics division, offers the following ultrasonic flowmeters:

- CM-800 (transit time)
- MF90 (transit time)
- 1081/1181 (Doppler)

The CM-800 is a fixed, insertion-style transit time meter. The MF90 is a portable, clamp-on transmit time meter.

Models 1081 and 1181 are Doppler meters. The 1081 is a portable Doppler flowmeter, while the 1181 is a fixed Doppler flowmeter.

Figure 3-25 Mesa Laboratories Ultrasonic Flowmeters

Photo 3-51 Mesa 1081 Doppler

Photo 3-52 Mesa vf-2000

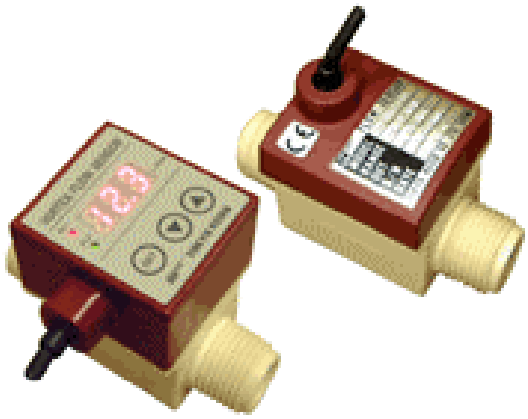

Photo 3-53 Mesa CM8000

Table 3-28
Mesa Laboratories Ultrasonic Flowmeters

Product Name	CM800	MF90	1081/1091*
Applications	Insertion Fixed Homogeneous liquids	Clamp-on Portable Homogeneous liquids	Clamp-on Slurries and sludges
Diameter Range, in	2-200	2-48	>1
Flow Range, fps		0-40	
Temp Range, C		+40 to +150	
Pressure Range, psig			
Number of Paths			
Output	LCD 4-20 mA RS232	LCD 4-20 mA	LCD 4-20 mA
Mode	TT	TT	Doppler

**1081: dedicated. 1181: portable*

www.mesalabs.com

Micronics

Micronics, which is based in the United Kingdom, offers the following ultrasonic flowmeters:

- Portaflow 300
- Portflow 204
- Ultraflow 2000
- Portaflow SE
- Portaflow 216

All of Micronics flowmeters are clamp-on, transit time meters. All the ones with 'Porta' in their name are portable, while the Ultraflow 2000 is a fixed transit time meter. Micronics emphasizes the low cost of its meters.

Figure 3-26 Micronics Ultrasonic Flowmeters

Photo 3-54 Micronics Portaflow 204

Photo 3-55 Micronics Portaflow 300

Photo 3-56 Micronics Ultraflow 2000

Table 3-29
Micronics Ultrasonic Flowmeters

Product Name	Portaflow 216CE	Portaflow SE	Portaflow 204 & 208
Applications	Clear liquids Clamp-on, portable	Clear liquids Clamp-on, portable	Clear liquids Clamp-on, portable
Diameter Range	50-400 mm	50-1000 mm	13-215 mm
Flow Range	0.5 to 8 m/sec	0.5 – 12 m/sec	0.02 – 8 m/sec
Temp Range	-20 to +125 C	-20 to +200 C	-20 to +100 C
Pressure Range			
Connection			
Number of Paths	1	1	1
Output	Pulse Totalizer LCD	LCD 0 or 4-20 mA Totalizer Data logger RS232	Pulse Totalizer LCD
Mode	TT	TT	TT

Table 3-29

Micronics Ultrasonic Flowmeters… Cont.

Product Name	Ultraflow 2000 CE*	Portaflow 300 & 204 CE
Applications	Clamp-on Dedicated	Clamp-on Portable
Diameter Range	13-5000 mm	13-5000 mm
Flow Range	.02 to 12 m/sec	.02 to 8 m/sec
Temp Range	-20 to +220 C	-20 to +200 C
Pressure Range		
Connection		
Number of Paths	1	1
Output	LCD 4-20 mA	LCD 4-20 mA Pulse Data logger RS232C
Mode	TT	

**Model 2000 HM includes temperature sensors*

www.micronicsltd.co.uk

Monitor Labs

Monitor Labs is a supplier of the Ultraflow 100 transit time ultrasonic flowmeter. This meter is designed to measure the velocity of flue gas. This measurement is made independent of the pressure, temperature, and density of the gas. The Ultraflow 100 is an insertion-style meter, allowing it to measure gas flow in very large pipes.

Figure 3-27 Monitor Laboratories Ultrasonic Flowmeter

Photo 3-57 Monitor Laboratories Ultraflow 100

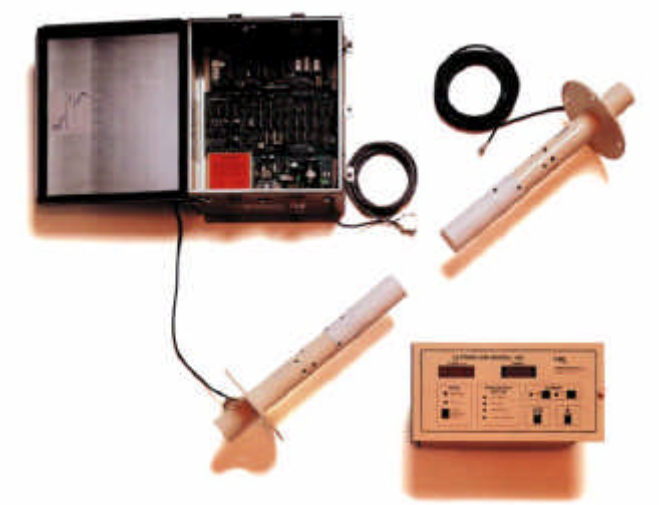

Table 3-30
Monitor Laboratories Ultrasonic Flowmeters

Product Name	Ultraflow 100*
Applications	Gas Stacks – Insertion Style
Diameter Range	Up to 45 feet duct diameter
Flow Range	0-150 ft/sec/
Temp Range	-40º to 550º F
Pressure Range	- 10 to 20 inches H_2O
Connection	
Number of Paths	
Output	RS232C
Mode	TT

**Can indicate composition, pressure and temperature*

www.monitorlabs.com

Nanomaster

Nanomaster offers the following flowmeters:

- ESF-20-N
- EST-15

These flowmeters are transit time flowmeters used to measure liquids. They are designed for laboratory applications.

Nanomaster also serves as a distributor in the United States for the ultrasonic flowmeters manufactured by Honda Electronics. These meters are sold as the following models:

- USF 100 A-K.

www.nanomaster.com

Table 3-31
Nanomaster Ultrasonic Flowmeters

Product Name	ESF-20-N*	ESF-15*	USF 100A-K**
Applications	Liquids: Laboratory applications	Liquids: Laboratory applications	Liquids: Laboratory applications
Diameter Range, DN			
Flow Range, liters/min	To 44	To 18	.05-50
Temp Range, C	5-70	5-70	0-50
Pressure Range			To 0.5 MPa
Attachment	Compression fittings		
Number of Paths	1	1	1
Output	4-20 mA, pulse	4-20 mA, pulse	4-20 mA
Mode	TT	TT	TT

**Wetted material: PFA*
***Includes Models K10, K15 and K20; these are produced by Honda Electronics*

Panametrics

Panametrics offers an extremely broad line of ultrasonic flowmeters, as shown in Table 3-32. Instruments designed for liquids, gases or steam are included. The line includes both portable and fixed units.

These instruments employ Panametrics' proprietary TransFlection® and/or Correlation Transit Time® technologies. As an alternative to Doppler-based methods, TransFlection can be used to measure the flow of dirty or multiphase fluids, for which conventional transit time measurement works poorly or not at all. .

Panametrics' ultrasonic flowmeters can operate in pipes, tubes, stacks and ducts ranging from 0.5 in to 25 ft in diameter and can measure flow rates up to 275 fps. Many of these units are available in either clamp-on or wetted transducer variants.

These flowmeters can provide a variety of output signals. For example, the DF868 includes a highly flexible dual LC display, a 43,000-point datalogger, up to twelve 4-20 mA analog signals, up to six alarm relays, and up to twelve frequency/totalizer output signals.

Figure 3-28 Panametrics Ultrasonic Flowmeters

Photo 3-58 Panametrics DF868

Photo 3-59 Panametrics GF868

Photo 3-60 Panametrics XMT868

Table 3-32
Panametrics Ultrasonic Flowmeters

Product Name	XMT868*
Applications	Dedicated Clamp-on or wetted transducer
Diameter Range	0.5-200 inches
Flow Range	-40 to +40 fps
Temp Range	
Pressure Range	
Connection	
Number of Paths	1
Output	Optional data logger 0,4-20 mA RS232 (485 optional) LCD
Mode	TT/Doppler

**One or two channel operation*

Table 3-32
Panametrics Ultrasonic Flowmeters… Cont.

Product Name	DF868*	PT868**	GM868
Applications	Dedicated installations Liquids: with bubbles or solids, multiphase.	Portable Liquids: with bubbles or solids, multiphase	Dedicated GP gas
Diameter Range	0.5-200 in		0.5 in to 25 ft
Flow Range, fps	0.1-40	0.1-40	
Temp Range, F	-190 to +500		
Pressure Range, psig	0-3000	0-3000	
Transducer Materials	Standard: 316L Optional: Ti, Hastelloy, Monel, Duplex, CPVC, PVDF, other	Standard: 316L Optional: Ti, Hastelloy, Monel, Duplex, CPVC, PVDF, other	
Number of Paths	1-2**		
Liner Material			
Mode	Transit time & TransFlection ®	Transit time & TransFlection ®	Transit time

**Wetted and clamp-on versions available*
***1- and 2-channel models available*

Table 3-32
Panametrics Ultrasonic Flowmeters… Cont.

Product Name	GN868	GF868	IGM868**
Applications	Fixed installations Natural gas pipelines	Flare gas	Natural gas Industrial and custody transfer
Diameter Range	3-48 in	Up to 120 in	4-40 in
Flow Range, fps		0.1-275	
Temp Range, F			
Pressure Range, psig			
Transducer Materials			
Number of Paths	1 or 2*		1 or more
Liner Material			
Mode	Transit time	Transit time	Transit time

** 1- or 2-channel models available*
*** Features removable transducers*

Table 3-32
Panametrics Ultrasonic Flowmeters… Cont.

Product Name	UPT868	GS868/XGS868	CEM68
Applications	Clamp-on Sanitary applications: semiconductors, food/beverage	Saturated or superheated steam	Continuous stack emissions
Diameter Range	0.375-2 in	2-48 in	
Flow Range, fps	To 40 fps	1-150	
Temp Range, C		To 450	
Pressure Range, psig		To 1500	
Transducer Materials		Ti	
Number of Paths	1*	1 or 2*	
Liner Material			
Mode	Transit time	Transit time	

**1- or 2-channel models available*
***Features removable transducers*

www.panametrics.com

Polysonics

Polysonics offers an ultrasonic flowmeter line consisting of six models: three Doppler and three transit time meters. See Table 3-36. This supplier uses a proprietary dual frequency Doppler technology that they indicate reduces the effects of signal noise. Their transit time meters employ another proprietary technology,
Digital Correlation Transit Time, which is said to increase the capability of these instruments to measure flow of fluids containing suspended solids or bubbles.

They also offer the dual channel MSP90, which is designed to calculate flow and detect screen blockages in open channels by measuring relative or absolute liquid levels. This device is marketed for water and sewage applications.

These units all feature LC displays and 4-20 mA output signals (RS232 serial interface). Some of them also offer 40,000 to 90,000 point data logging capabilities.

Figure 3-29 Polysonics Ultrasonic Flowmeters

Photo 3-61 Polysonics DCT 6088

Photo3-62 Polysonics DCT 7088

Table 3-33
Polysonics Doppler Ultrasonic Flowmeters

Product Name	SX30	SX40	DDF5088
Applications	Portable, clamp-on Slurries, sludge, etc.	Dedicated, clamp-on Slurries, sludge, etc.	Dedicated Slurries, sludge, etc.
Diameter Range, in	.25-200	.25-200	.25-300
Flow Range, fps	0.2-18	0.2-32	.05-32
Temp Range, F	-40 to +250	-40 to +250	-40 to +250
Pressure Range, psig			
Transducer Materials			
Number of Paths			
Liner Material			
Mode	Dual frequency Doppler & DSP	Dual frequency Doppler & DSP	Doppler

Table 3-34
Polysonics Transit Time Ultrasonic Flowmeters

Product Name	DCT7088	DCT6088	DCT1088
Applications	Clamp-on, portable Clean liquids*	Clamp-on, dedicated HVAC, potable water, petroleum, waste management	Low-cost; clamp-on, dedicated HVAC, potable water, petroleum, waste management
Diameter Range, in	1-200	1-200	1-200
Flow Range, fps	0-50	0-50	0-50
Temp Range, F	-40 to +300	-40 to +300	-40 to +300
Pressure Range, psig			
Transducer Materials			
Number of Paths			
Liner Material			
Mode	Transit time and DSP	Transit time and DSP	Transit time and DSP

**Can tolerate solids or bubbles*

Note: Polysonics Ultrasonic Flowmeters

www.polysonicsinc.com

Rittmeyer

Rittmeyer is a supplier of the Risonoc 2000 ultrasonic transit time flowmeter. This flowmeter is designed for water flow measurement. It is sold to the hydropower, hydrography, water supply, and wastewater industries.

Figure 3-30 Rittmeyer Ultrasonic Flowmeter

Photo 3-63 Rittmeyer Risonic 2000

Table 3-35
Rittmeyer Ultrasonic Flowmeter

Product Name	Risonic 2000
Applications	Water
Diameter Range	250-14000 mm
Flow Range	To 20 m/sec
Temp Range	-30 to +70 C
Pressure Range	To 80 bar
Connection	Threads or screws*
Number of Paths	1-8
Output	RS232 LCD 4-20 mA
Mode	TT

**The supplier can furnish transducers designed for access either from outside or inside the pipe; those designed for external mounting are threaded, while those designed to be mounted inside the pipe are screwed to the pipe wall.*

www.rittmeyer.com

Sick

Sick is a supplier of the following ultrasonic flowmeters:

- Flowsic 101/102
- Flowsic 106
- Flowsic 107

All these meters are transit time meters designed to measure gas flow. The Flowsic 107 is an insertion-style meter.

Figure 3-31 Sick Ultrasonic Flowmeter

Photo 3-64 Sick Flowsic 100

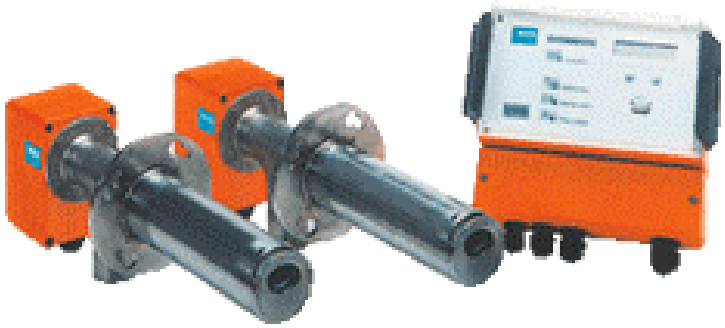

Table 3-36
Sick Ultrasonic Flowmeters

Product Name	FLOWSIC 107	FLOWSIC 101/102	FLOWSIC 106
Applications	Gas Insertion-type	Gas	Gas
Diameter Range		0.3-4.0 m	0.5-10 m
Flow Range	0-30 m/sec	0-40 m/sec	-40 to +40 m/sec
Temp Range	0-220 C	0-350 C	0-220 C
Pressure Range	-0.9-2.0 bar		-0.9-2.0 bar
Connection		Welded-in flanges	Welded-in flanges
Number of Paths	1	1	1
Output	0,2, or 4-20 mA LCD RS232 RS422 (opt)	0,2, or 4-20 mA LCD RS232 RS422, 485	0,2, or 4-20 mA LCD RS232 RS422, 485
Mode	TT	TT	TT

Note: These instruments also measure temperature

www.sick.de or www.sickoptic.com

Siemens

Siemens is a supplier of two very different types of ultrasonic flowmeters:

- Sitrans FUS
- Ultraheat

The Siemens FUS is an ultrasonic transit time flowmeter designed for chemical applications and other cases in which a magnetic flowmeter could also be used. This meter was introduced in 1997.

Siemens Ultraheat meters are sold primarily in Europe for district heating. District heating is widely used in Europe as a method for heating (and cooling) houses, apartment buildings, and industrial plants. In many cases, the heat used in district heating is a byproduct of the power generation process. Heated water is used to heat buildings, instead of being discarded into the ocean. This makes it a very efficient and environmentally friendly method of heating and cooling.

Siemens has been in the district heating business for a number of years. Their involvement in district heating was expanded due to their purchase of Landis & Gyr. As a result of this purchase, Siemens produced an ultrasonic energy meter called the Sonogyr. Siemens' own product is called the Ultraheat 2WR4. In February 2001, Siemens announced the introduction of the Ultraheat 2WR5. This meter is a combination of the Sonogyr and the Ultraheat 2WR4, and is intended to be Siemens main offering in this area.

The inclusion of the Ultraheat, as well as the energy meters from Kamstrup and Danfoss, in this study is problematical. Ultrasonic energy meters are ultrasonic flowmeters, but they are very low cost (some as low as $200). As a result, the number of units is quite large, relative to the dollar volume. Many of these energy meters are used to heat individual houses, and therefore are not part of the industrial markets included in this study. On the other hand, many are used to heat large industrial buildings, and are used in the power generation process.

After extensive discussions with representatives of Danfoss, Kamstrup, and Siemens, it was determined that the difference between residential energy meters and industrial energy meters can be drawn in terms of the measurement power of the meters. Energy meters that measure flowrates of 3 cubic meters per hour or less are residential/consumer meters. Energy meters that measure above this rate are considered to be industrial meters.

Using this criterion, it was possible to determine the extent to which Siemens' Ultraheat meters should be included in this study. While the large majority of Siemens' energy meters are residential/consumer, they also have some industrial meters. Siemens' Ultraheat 2WR5 ultrasonic energy meter measures flowrates from 0.6 to 60 cubic meters per hour.

A similar criterion was applied to Kamstrup's energy meters. All of Danfoss' ultrasonic flowmeters are industrial meters. Some of these are traditional transit time meters, and others are energy meters used in industrial environments.

The district heating market exists primarily in Europe, but the market in Asia is growing. Some district heating meters are also sold in Canada. Today there is very little district heating in the United States.

Figure 3-32 Siemens Ultrasonic Flowmeter

Photo 3-65 Siemens Sitrans FUS

Table 3-37
Siemens Ultrasonic Flowmeter

Product Name	SITRANS FUS*
Applications	Dedicated Spoolpiece Liquids: chemical, petrochemical, pharma, power
Diameter Range, in	1-4
Flow Range, CM/hr	To 300
Temp Range, C	-20 to +180
Pressure Range, psig	PN40(DN25-DN100) PN16 (DN100)
Spoolpiece Material	316Ti SS
Number of Paths	1
Output	LCD 4-20mA (digital output optional); HART or PROFIBUS PA
Mode	TT

**Proprietary helical path signal routing*

www.siemens.com

Solartron

Solartron offers the AC600 Series ultrasonic flowmeter. This is a hybrid meter that employs both the transit time and Doppler methods of measurement. The AC605L is a fixed model, while the AC615 is portable. Both models are clamp-on meters, and used to measure the flow of liquids.

In addition to the AC600 series, Solarton sells the A500 flowmeter from Sparling Instruments. The A500 is a transit time meter used in the process industries. It is available both in spoolpiece and insertion models.

Figure 3-33 Solartron Ultrasonic Flowmeter

Photo 3-66 Solartron AC600

Table 3-38
Solartron Ultrasonic Flowmeters

Product Name	AC605L	AC615*
Applications	Clamp-on Liquids Dedicated	Clamp-on Liquids Portable
Diameter Range	10-6500 mm	10-6500 mm
Flow Range	.01-25 m/sec	.01-25 m/sec
Temp Range	-30 to +130 C	-30 to +130 C
Pressure Range		
Connection		
Number of Paths	1 or 2	2
Output	LCD 0,4-20 mA Frequency 1-2 channels RS485 (opt) Data logger (opt)	LCD 0,4-20 mA Frequency 2 channels RS232 Data logger
Mode	TT/Doppler	TT/Doppler

**This meter also measures temperature*

www.solartron.com

Sparling Instruments

Sparling offers the following ultrasonic flowmeters:

- FS-555
- FS-595

Both meters are ultrasonic transit time meters. The FS-555 is a fixed model, while the FS-595 is an insertion-style meter in kit form.

Figure 3-34 Sparling Ultrasonic Flowmeter

Photo 3-67 Sparling FS-555

Table 3-39
Sparling Ultrasonic Flowmeters

Product Name	Series 555	FS-595*
Applications	Dedicated Liquids Spoolpiece	Dedicated Liquids Welded-on
Diameter Range, in	4-48	
Flow Range	To 16,200 gpm	
Temp Range, F	-32 to +180	-20 to +130
Pressure Range, psig		
Transducer Materials		
Number of Paths	1	1
Output	LCD, totalizer, 4-20mA	LCD, totalizer, 4-20mA
Mode	TT	TT

**Consists of FS595 sensor kit and FT-555 transmitter*

www.sparlinginstruments.com

Teksco

Tekcso offers the Compuflow C5 ultrasonic Doppler flowmeter. Both fixed and portable models are available. It is available in both clamp-on and insertion styles.

Figure 3-35 Teksco Ultrasonic Flowmeter

Photo 3-68 Teksco Compu-Flow C5

Table 3-40
Teksco Ultrasonic Flowmeter

Product Name	Compu-Flow Model C5*
Applications	Clamp-on Clean or dirty liquids
Diameter Range	0.25-300 in
Flow Range	0.2-50 fps
Temp Range	
Pressure Range	
Connection	Clamp-on or welded
Number of Paths	1
Output	Digital, 4-20 mA LCD Totalizer Voltage signal
Mode	Doppler

**Available in dedicated (D) and portable (P) versions*

www.compuflow.com

Thermo MeasureTech

Thermo MeasureTech is a new company formed by Thermo Electron of Waltham, Massachusetts. Thermo MeasureTech incorporates TN Technologies, Kay Ray, and Sensall brand products. The ultrasonic flowmeters carried by Thermo MeasureTech belong to TN Technologies.

Thermo MeasureTech is a supplier of the VersaFlo ultrasonic flowmeter. The VersaFlo is a clamp-on Doppler ultrasonic flowmeter. It is available in both portable and fixed versions.

Figure 3-36 Thermo MeasureTech Ultrasonic Flowmeter

Photo 3-69 Thermo MeasureTech Portable VersaFlo

Table 3-41
Thermo MeasureTech Ultrasonic Flowmeter

Product Name	VersaFLO ™*
Applications	Clamp-on Liquids
Diameter Range	1.25-72 inches
Flow Range	
Temp Range	-40 to +350 F
Pressure Range	
Connection	
Number of Paths	1
Output	4 totalization channels 4-20 mA Pulse LCD
Mode	Doppler

**Dedicated and portable models are available*

www.tnksi.com

Tokimec

Tokimec offers a very wide variety of ultrasonic flowmeters. These include the following:

- UF-800 (Fixed clamp-on transit time for large pipes)
- UFM-200/300 (Fixed clamp-on transit time for small pipes)
- UFL-10A (Fixed clamp-on transit time for exporting)
- MM 1-A/MM-2 (Fixed clamp-on transit time for large/small pipes)
- UFP-10 (Portable clamp-on transit time)
- UVH-1000K (Fixed Doppler open channel)
- UDF-500 (Fixed Doppler for pumping stations)
- UGF-100/MGF-100 (Ultrasonic gas meters)
- UF-860/UHQ-100 (Open channel meters)

Tokimec was the first company to introduce ultrasonic flowmeters to the commercial market. This occurred in 1964.

Figure 3-37 Tokimec Ultrasonic Flowmeters

Photo 3-70 Tokimec UFL-20

Photo 3-71 Tokimec UFP-10

Table 3-42
Tokimec Ultrasonic Flowmeters

Product Name	UFL-20S	UFL-20L	UFP-10
Applications	Dedicated Liquids Clamp-on	Dedicated Liquids Clamp-on	Portable Liquids Clamp-on
Diameter Range, mm	25-300	300-600	
Flow Range, fps			
Temp Range, F			
Pressure Range, psig			
Number of Paths	1*	1*	1
Output	LCD	LCD	LCD/data logging
Mode	TT	TT	TT

**Can arrange instrument to generate multiple passes*

www.tokimec.co.jp

Tokyo Keiso

Tokyo Keiso offers the following ultrasonic flowmeters:

- UCUF
- UL500K
- UL600N
- UL610P

The UCUF and the UL600N are ultrasonic transit time meters. The UCUF is a spoolpiece meter designed for low flow measurement. The UL600N is a clamp-on meter designed to measure the flow of ultraclean liquids.

Figure 3-38 Tokyo Keiso Ultrasonic Flowmeters

Photo 3-72 Tokyo Keiso UCUF-10

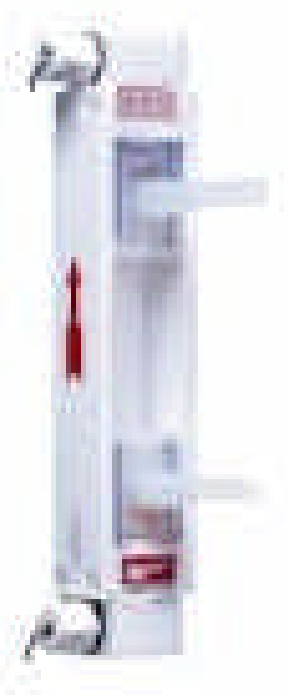

Photo 3-73 Tokyo Keiso UCUF-4

Photo 3-74 Tokyo Keiso UL600N

Table 3-43
Tokyo Keiso Ultrasonic Flowmeters

Product Name	UCUF*	UL600N
Applications	Liquids: corrosives, pure water Low flow Spoolpiece**	Ultraclean liquids Clamp-on
Diameter Range	0.375-1.0 inch	25-1000 mm
Flow Range	To 80 liters/min	To 10 m/sec
Temp Range	+10 to +60 C	To 90 C
Pressure Range	To 0.5 MPa	
Connection		
Number of Paths	1	1
Output	4-20 mA Pulse LCD	4-20 mA Pulse LCD
Mode	TT	TT

Note: Specifications of Models UL500K and UL610P were unavailable

**All wetted parts are made of PFA*
***Tube is U-shaped*

www.tokyokeiso.co.jp

Ultraflux

Ultraflux is a supplier of the following ultrasonic flowmeters:

- Minisonic 600/2000
- UF322L

Both meters are fixed, and are available in either clamp-on or insertion style. Both meters use the transit time principle, and are designed to measure the flow of liquids.

Figure 3-39 Ultraflux Ultrasonic Flowmeters

Photo 3-75 Ultraflux Minisonic

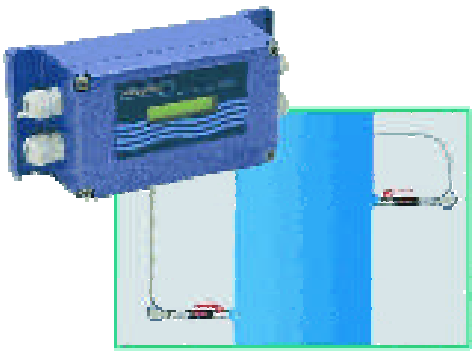

Photo 3-76 Ultraflux UF322

Table 3-44
Ultraflux Ultrasonic Flowmeters

Product Name	UF322L	Minisonic 600/2000
Applications	Dedicated Clamp-on or Insertion Liquids	Dedicated Clamp-on or Insertion Liquids
Diameter Range, mm	8-1000	*
Flow Range, m/sec	.001-20	
Temp Range, C		
Pressure Range, psig		
Transducer Materials		
Number of Paths	1	1
Output	LCD 2356K data logger 4-20mA RS232 or 485	LCD 2356K data logger 4-20mA RS232 or 485
Mode	TT	TT

**Minisonic 600 to 600 mm; Minisonic 2000 to 2200 mm*

www.ultraflux.fr

Ultrasound Research Center

Ultrasound Research Center offers the following flowmeters:

- US1000 (ultrasonic clamp-on for cold water)
- US1100 (ultrasonic clamp-on for hot water)
- US2000 (ultrasonic heat energy meters)

All three meters use the transit time principle. All three models are designed for use in district heating applications.

Ultrasound Research Center is located at the Kaunas University of Technology in Kaunas, Lithuania.

Figure 3-40 Ultrasound Research Center Flowmeter

Photo 3-77 Ultrasound Research Center US 2000

Table 3-45
URC Ultrasonic Flowmeters

Product Name	US1100	US1000	US2000
Applications	Hot water Clamp-on	Cold water Clamp-on	Water Energy-sensing* Welded-in
Diameter Range			DN 40-1500
Flow Range			0.15-10 m/sec
Temp Range			+5 to +150 C
Pressure Range			
Connection			
Number of Paths	1	1	1
Output	LCD RS232 Analog & frequency outputs	LCD RS232 Analog & frequency outputs	0-5 or 4-20 mA Frequency RS232
Mode	TT	TT	TT

**Measures heat flow by multiplying flow rate by temperature difference between supply ands return legs*

http://vingis.ktu.lt/ultrasound/flow.htm

Venture Measurement

Venture Measurement ultrasonic flowmeters are more commonly known under the brand name Aaliant. The Aaliant ultrasonic flowmeter is a transit time clamp-on flowmeter. It is available in both portable and fixed models.

NOTE: Venture Measurement discontinued further development of their ultrasonic flowmeters as of November 2001.

Figure 3-41 Venture Measurement Ultrasonic Flowmeter

Photo 3-78 Venture Measurement Ultrasonic Flowmeter

Table 3-46
Venture Measurement Ultrasonic Flowmeters

Product Name	Aaliant Ultrasonic Flowmeter*
Applications	Clamp-on Liquids: corrosives, hydrocarbons, inks
Diameter Range, in	0.5-236
Flow Range, gpm	4-4,350,000
Temp Range, F	-40 to +176
Pressure Range, psig	
Number of Paths	1
Output	LCD 4-20 mA RS232
Mode	TT

**Available in dedicated and portable models*

www.aaliant.com