

LCMASS[®]

CORIOLIS MASS FLOW METER SYSTEMS



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OVERVIEW

PROVIDING PREMIER PERFORMANCE

For decades, Liquid Controls flow meters have provided customers with the most accurate and reliable fuel measurement available.



From its start in 1956, Liquid Controls, a Unit of IDEX Corporation (NYSE:IEX), has been dedicated to providing high quality flow meters and accessories for accurate liquid measurement in both custody transfer and process control applications. Continuously branching out from the original military aircraft fueling requirement which gave us our start, we now serve a wide variety of industries.

Our manufacturing team is made up of the most highly skilled craftspeople in the industry and in-house engineers to ensure that our customers around the world are supported with technology and capability tailored to industry and customer requirements.

Since 1956, Liquid Controls' meters have been the standard for fuel measurement accuracy.

PIONEER IN FLOW METER TECHNOLOGY

Liquid Controls (LC) sold their first fuel flow meter to the U.S. Air Force in 1956. Since then, LC has grown to become the leader for high quality, reliable flow meter systems and innovations that enhance metering performance, increase safety, and streamline data management.

LEADER IN MEASUREMENT ACCURACY

With proven measurement accuracy as low as 0.1%, Liquid Controls' meters are unmatched in maintaining the most accurate fluid measurement in the world.

AUTHORITY IN DATA MANAGEMENT

Liquid Controls is focused on measuring and delivering accurate fueling data wirelessly, ensuring maximum operational efficiency and data quality control.

MEASUREMENT

TECHNOLOGIES

Liquid Controls is the premier provider of meters and metering solutions for fluid measurement and the delivery of high-value liquids. Liquid Controls offers a full suite of custody-transfer approved precision flow measurement systems. The LCMass[®] meter expands the product portfolio beyond the world-class positive displacement and turbine metering technologies. The addition of LCMass[®] to the Liquid Controls metering and accessory portfolio continues to assure that the right solution is provided for any application.



CORIOLIS MASS METERING (NEW)

- Used in mass and density measurement
- Entrained gas management
- Ideal for both gases and liquids
- Low maintenance cost
- LCMass[®] 100: Sizes: ½" - 2"
Accuracy: ±0.15%
Repeatability: 0.05%
- LCMass[®] 600: Sizes: ½" - 4"*
Accuracy: ±0.05%
Repeatability: 0.05%

*consult factory for larger sizes



POSITIVE DISPLACEMENT METERING

- Used in volume measurement
- Low pressure drop
- Excellent in start / stop applications
- Resilient against adverse flow conditions
- Ideal for liquids
- Low maintenance cost
- Sizes: 1½" - 16"
- Accuracy: ±0.1%
- Repeatability: 0.02%



TURBINE METERING

- Used in volume measurement
- Low pressure drop
- Ideal for liquids, cryogenics and gases
- Lightweight and compact design
- Easy installation
- Sizes: ½" - 12"
- Accuracy: ±0.15%
- Repeatability: 0.02%

LCMASS[®] 100 SERIES

MASS & DENSITY MEASUREMENT FOR GENERAL PURPOSE APPLICATIONS



HIGH ACCURACY

The LCMass[®] 100 achieves a $\pm 0.15\%$ accuracy on liquids.

COMPACT ECONOMIC DESIGN

Straight dual tube design allows for an overall smaller installation envelope, is lighter weight, and offers a more economic device.

LOW PRESSURE DROP

Innovative flow splitter and straight dual tube design assure minimal pressure drop and higher flow rates.

RIGID OUTER HOUSING

Secondary containment ensures protection against leaks and helps isolate the measuring tubes from external vibration.

ENTRAINED GAS MANAGEMENT

State-of-the-art software monitors and manages entrained gas. This means the meter can send an alert when there is entrained gas present, all while measuring the liquid but not the gas.

DESIGN OVERVIEW

LCMASS® 100 SERIES SPECIFICATIONS				
MODEL	LC100-834	LC100-844	LC100-854	LC100-864
SENSOR SIZE	S15 (5/8")	S25 (1")	S40 (1½")	S50 (2")
MAXIMUM FLOW RATE	240 lb/min	990 lb/min	2,935 lb/min	6,235 lb/min
STANDARD TEMPERATURE RANGE	-40 to 266°F			
TEMPERATURE RANGE (HIGH TEMP OPTIONS)	-40 to 302°F			
STANDARD NOMINAL PRESSURE	1,450 psi			

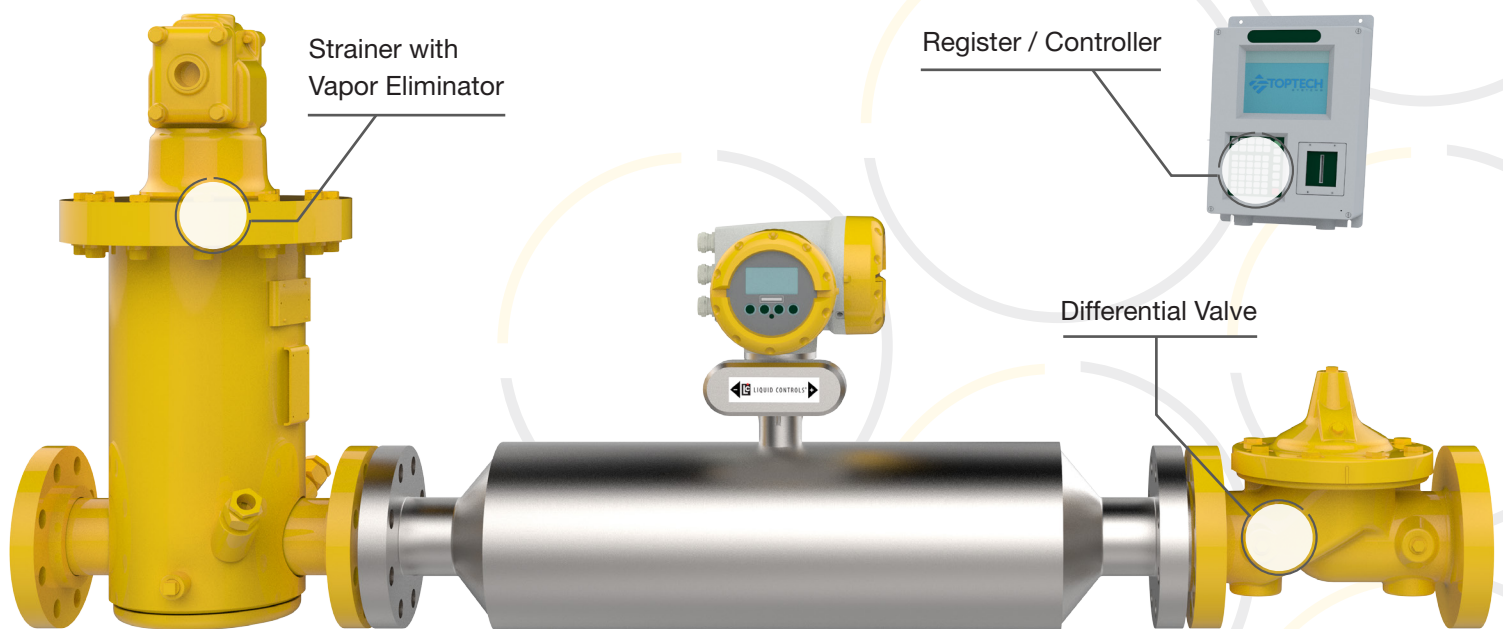
COMMON FLUID DENSITIES*	
LPG	4.22 lb/gal
GASOLINE	6.07 lb/gal
DIESEL	6.94 lb/gal
KEROSENE	6.82 lb/gal
WATER	8.35 lb/gal

*for reference only

To estimate volumetric flow rate: $\text{volumetric flow rate} = \frac{\text{mass flow rate}}{\text{density}}$

TYPICAL LPG MASS METER SOLUTION

LCMass® 100 with LCI40® Electronic Interface



LCMASS[®] 600 SERIES

FOR APPLICATIONS DEMANDING THE HIGHEST FLOW & DENSITY ACCURACY, HIGH PRESSURE, HIGH TEMPERATURE OR CRYOGENIC USE.



HIGH ACCURACY

The LCMass[®] 600 achieves a $\pm 0.05\%$ accuracy on liquids for a 10:1 flow rate turn down ratio.

HIGH TURN DOWN

The LCMass[®] 600 achieves a 20:1 flow rate turn down ratio while maintaining an accuracy of $\pm 0.1\%$.

ACCURATE DENSITY MEASUREMENT

The LCMass[®] 600 achieves a density measurement accuracy of ± 0.008 lb/gal.

WIDE TEMPERATURE RANGE

Accurately measures cryogenics at -328°F to high temperature with resistance up to 752°F .

ENTRAINED GAS MANAGEMENT

State-of-the-art software monitors and manages entrained gas. This means the meter can send an alert when there is entrained gas present, all while measuring the liquid but not the gas.

DESIGN OVERVIEW

LCMass [®] 600 SERIES SPECIFICATIONS										
MODEL	LC600-714	LC600-724	LC600-734	LC600-744	LC600-754	LC600-764	LC600-774	LC600-784*	LC600-794*	LC600-804*
SENSOR SIZE	S08 (5/16")	S10 (3/8")	S15 (5/8")	S25 (1")	S50 (2")	S80 (3")	S100 (4")	S150 (6")	S200 (8")	S250 (10")
NOMINAL FLOW RATE	22 lb/min	44 lb/min	139 lb/min	698 lb/min	1,286 lb/min	2,866 lb/min	6,430 lb/min	11,758 lb/min	20,209 lb/min	36,743 lb/min
STANDARD TEMP RANGE	-94 to 446°F									
TEMP RANGE (LOW TEMP OPTIONS)	-328 to 104°F									
TEMP RANGE (HIGH TEMP OPTIONS)	-58 to 752°F									
STANDARD NOMINAL PRESSURE	1,450 psi									
NOMINAL PRESSURE (HIGH PRESSURE VERSION)	2,900 psi									

*pending, consult factory

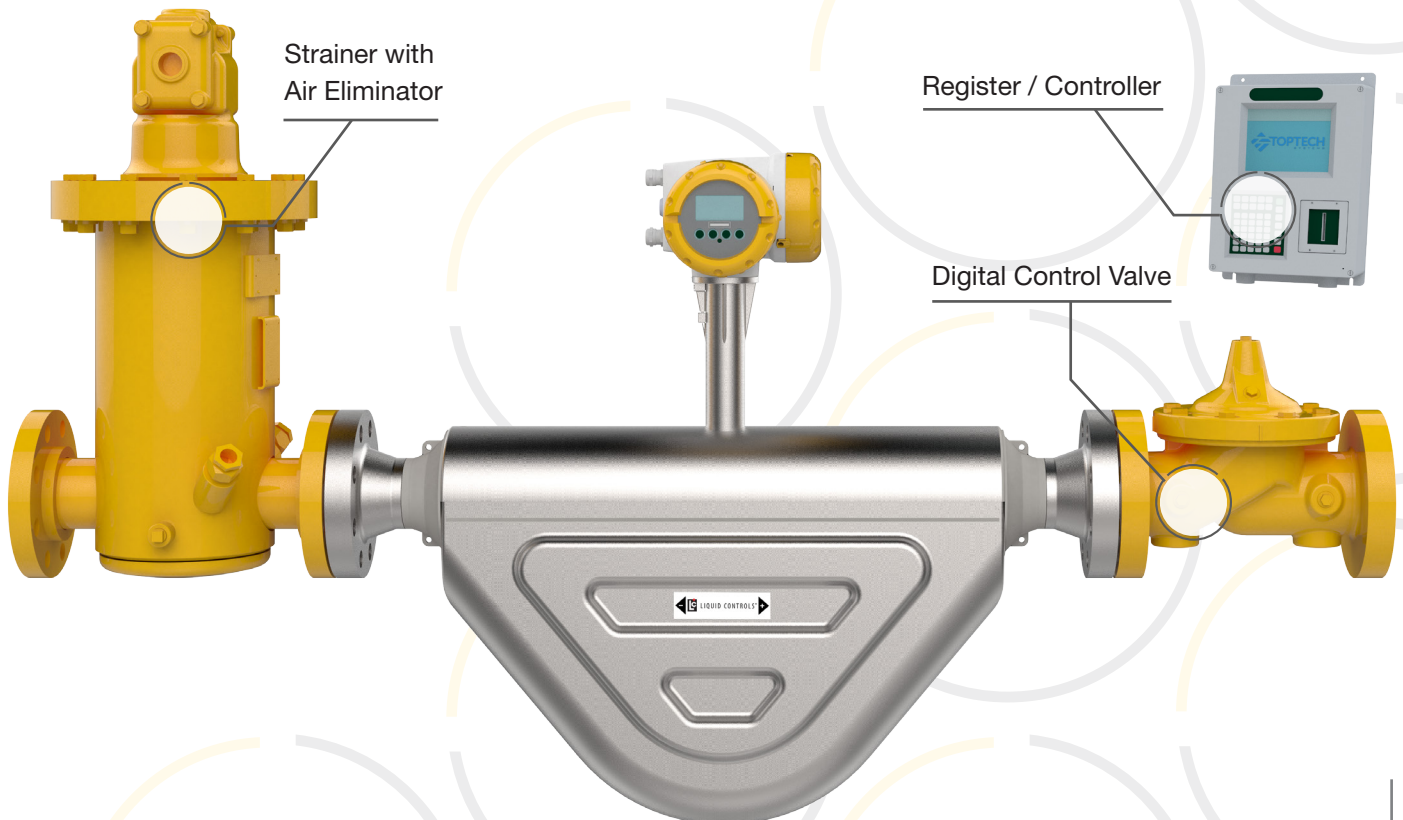
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LPG	4.22 lb/gal
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To estimate volumetric flow rate: $\text{volumetric flow rate} = \frac{\text{mass flow rate}}{\text{density}}$

TYPICAL REFINED FUEL MASS METER SOLUTION

LCMass[®] 600 with LCI40[®] Electronic Interface



LCMASS[®] CONVERTER

LCMASS[®] METER DRIVER & FLEXIBLE SIGNAL CONVERTER



POWERFUL & EASY TO USE

The LCI40[®] converter features an easy to use 4-button interface.

MULTIPLE OUTPUT VARIABLES

The LCI40[®] converter offers many different configurable outputs, including mass and volume flow rate, temperature, density, and flow total.

MULTIPLE OUTPUT SIGNAL FORMATS

The LCI40[®] converter is capable of outputting system variables in several formats: pulse, 4-20 mA, analog current, and frequency.

SENSOR DIAGNOSTICS

The LCI40[®] monitors important metering parameters for ease of troubleshooting.

ENTRAINED GAS MANAGEMENT

State-of-the-art software monitors and manages entrained gas. This means the meter can send an alert when there is entrained gas present, all while measuring the liquid but not the gas.

ACCESSORIES

FITTINGS, MOUNTINGS, ADAPTERS



AIR & VAPOR ELIMINATORS

- Assure accuracy by preventing air from being measured
- Meet weight and measure requirements



STRAINERS

- Capture foreign particles and removes them from the flow
- Prevent damage from foreign materials



VALVES

- Solenoid valves provide a low-volume dwell period to eliminate hydraulic shock and improve the accuracy of a preset delivery
- Control valves provide surge-free, fail-safe operation and limit flow to pre set maximum



ELECTRONICS & PRINTERS

- Simple to operate electronics deliver advanced features, including on-site ticket generation, improved security and audit trail
- Provide digital valve control and integrated card reader (multiload SMP)

WHY LCMASS[®]

Liquid Controls is committed to serving our customers and building strategic partnerships for success. With over 60 years of engineering and application expertise in flow meter solutions, LC continues to offer today's top measurement technology, service and customer support ensuring our customers have the right meter system for their application every time.



SOLUTIONS

- **Extensive Portfolio of Products** - The complete system solution all under one roof: flow meters, mechanical and electronic registration, and a large assortment of accessories such as strainers, air eliminators, valves, and more.
- **In-House Application Engineers** - Expertise and support from assembly to sale with faster in the field start-up, lower risk and lower total cost.

TECHNOLOGY

- **Full Range of Technologies** - Offering Volumetric, Mass, and Density Measurement ensures that the right device is provided for every application; every time.
- **Wide Variety of Applications** - For industries such as oil and gas, shipping, mining, water, and chemical.

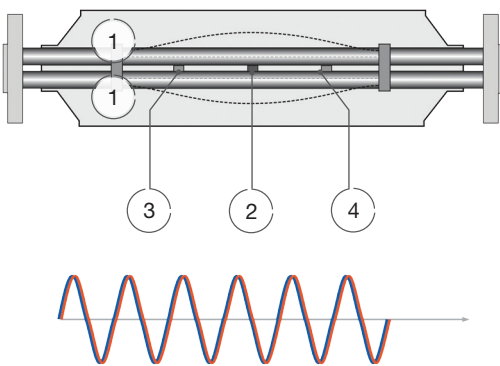
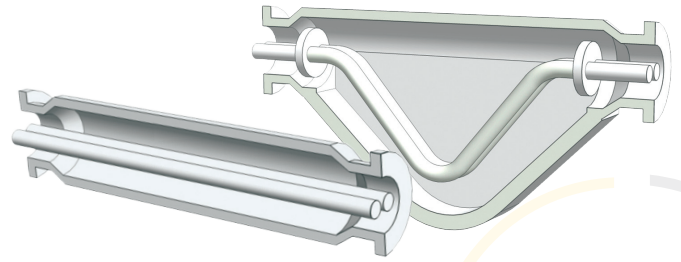
CUSTOMER SUPPORT

- **Large Global Distribution Network** - LC's certified distributors provide exceptional field service and critical troubleshooting to quickly resolve issues and minimize downtime right where you are.
- **Local Distributors** - Provide on-site customer support to assist with system design, project implementation, continued maintenance, and technical support.
- **Partnership** - Dedicated and experienced engineers and technical experts provide a team that can assist in every stage in the life of the system.

OPERATING PRINCIPLES

MASS FLOW: THE CORIOLIS EFFECT

LCMass® oscillates two equally sized tubes and measures the phase shift between two sensors along the tubes, allowing for an accurate mass flow measurement through application of Coriolis effect principles.



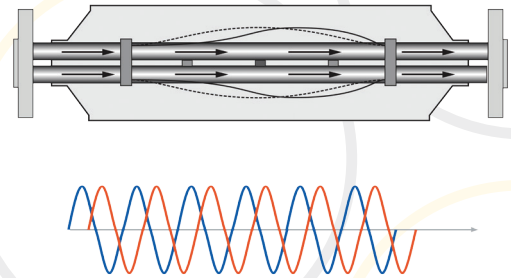
ENERGIZED METER WITH NO MASS FLOW

The driver coil induces a vibration between the two measuring tubes. The deformation of the two tubes is measured as identical sine waves by Sensor A and Sensor B. When there is no flow, these two sine waves are in-phase.

- 1 Measuring Tubes
- 2 Drive Coil
- 3 Sensor A
- 4 Sensor B

ENERGIZED METER WITH MASS FLOW

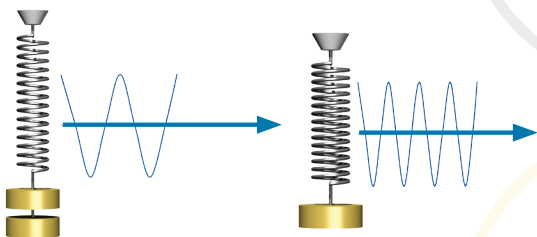
When there is mass flow through the measuring tubes, the deformation measured by each sensor is out-of-phase. The mass flow is calculated using this phase shift and the physical constants of the meter.



DENSITY MEASUREMENT: HOOKE'S LAW

LCMass® takes advantage of Hooke's law; a concept describing the frequency response of a spring system, to determine the mass in the measuring tubes.

A spring with a greater weight at its end will oscillate more slowly than a spring with a smaller weight. The same is true of the LCMass® measuring tubes. From this change in oscillation, the mass, and in turn the density, can be determined.



THE ALL NEW LCMASS[®]

CORIOLIS MASS FLOW METER SYSTEMS

The all new LCMass[®] Coriolis Flow Meter Systems offer superior performance for general purpose liquids and gases, as well as bulk flow handling with high temperatures, high pressures, or cryogenic use.



LCMass 600 (front),
LCMass 100 (behind)
in propane installation



Customer Support
On-Site Commissioning



Continued Support
Troubleshooting



Flow Components
Strainer and Air / Vapor Eliminator



Electronics
Register / Controller

RIGHT WHERE YOU ARE

METER SYSTEMS BUILT FOR YOUR SPECIFIC APPLICATION NEEDS



LPG

- Custody Transfer
- Dispensing
- Bulk Plant (Loading and Unloading)



REFINED FUELS & PETROCHEMICAL

- Bulk Plant (Loading and Unloading)
- Custody Transfer
- Dispensing



MARINE

- Barge (Loading and Unloading)
- Marine Fuel Bunkering
- Sludge / Slurries

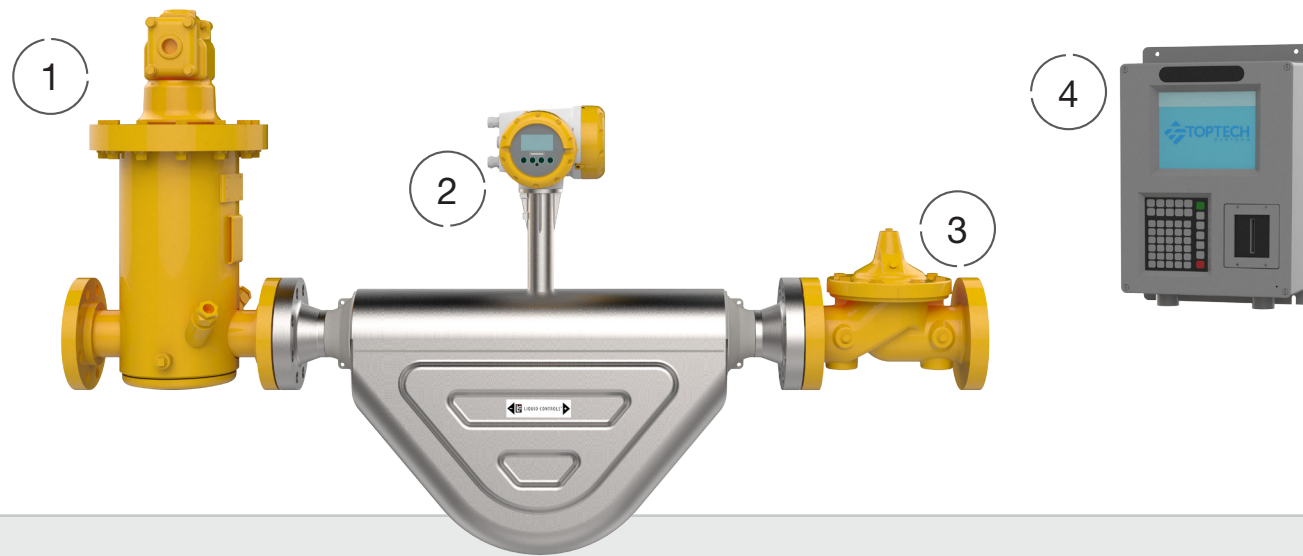


DISPENSING

- High Flow Diesel and Refined Fuels
- LPG and CNG Fleet Fueling
- Autogas Dispensers

THE LIQUID CONTROLS SOLUTION

GASOLINE



LCMass® GASOLINE

Ideal for terminal applications with high flow rates, high accuracy, and digital valve control.

- ① LC FS3 Strainer
- ② LCMass® 640 – S80
- ③ LC 540 Digital Control Valve
- ④ Single Meter Preset (SMP) Controller

SYSTEM CHARACTERISTICS

- 3" 150# ANSI RF Flange
- 250 to 2900 lb/min (66 to 766 gpm)
- ±0.1% mass flow accuracy
- ±0.008 lb/gal density measurement accuracy
- 9.387 psi pressure drop across meter at 345 gpm
- NTEP approved for custody transfer

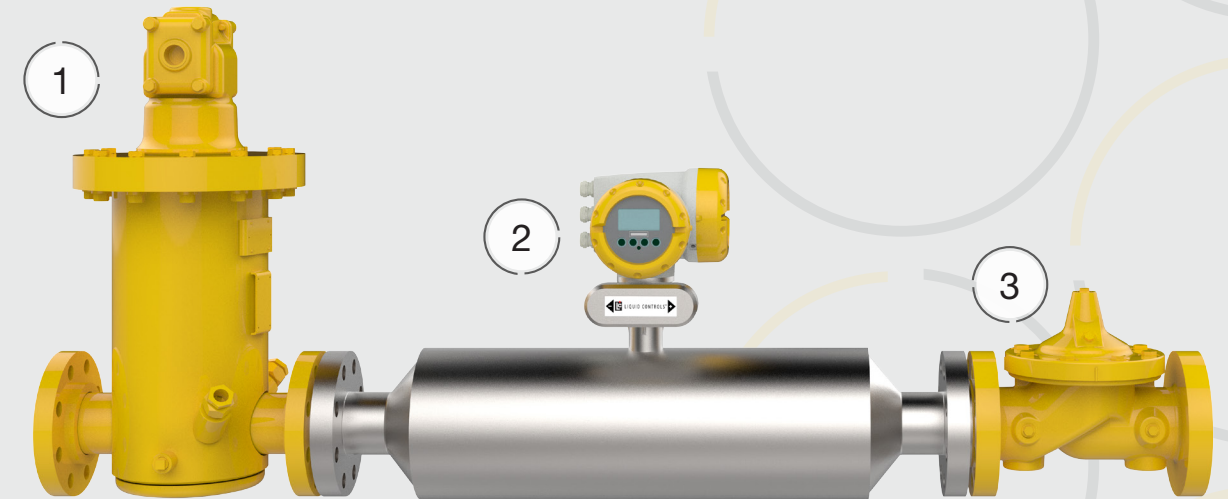
LCMass® PROPANE (LPG)

Ideal for loading LPG transports with a compact design and low pressure drop.

- ① FSA3 Strainer
- ② LCMass® 140 – S50
- ③ LC 511 Differential Valve

SYSTEM CHARACTERISTICS

- 3" 300# ANSI RF Flanges
- 765 to 3956 lb/min (178 to 920 gpm)
- ±0.3% mass flow accuracy
- ±0.13 lb/gal density measurement accuracy
- 2.36 psi pressure drop across meter at 350 gpm
- NTEP approved for custody transfer



PROPANE (LPG)

DIESEL EXHAUST FLUID (DEF)



LCMass® DIESEL EXHAUST FLUID

This all-stainless DEF dispensing system with LCR-II register is ideal to handle the caustic nature of DEF solution.

- ① LC F7 SST
- ② LCMass® 640 – S25
- ③ V7 SST with A2793 Pneumatic Actuator
- ④ LectroCount® LCR II

SYSTEM CHARACTERISTICS

- 2" 150# ANSI RF Flange
- 73 to 730 lb/min (19 to 199 gpm)
- ±0.1% mass flow accuracy
- ±0.15% density measurement accuracy
- 21.2 psi pressure drop across meter at 100 gpm
- NTEP approved for custody transfer



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