Anton Paar

L-DENS 7000
DENSITY SENSOR SERIES

Member of the New Generation of
Concentration Measurement

Overview

- L-Dens 7000 Density Sensor Series
- Process connections and adapters
- Sampling systems for L-Dens 7000 series

New Generation | Configuration

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Instrument

Sensor with Evaluation Unit

Electronics Housing +
Sensor Electronics

Sensing Element

mPDS 5
Option: Davis 5

Sensor with Transmitter

Electronics Housing +
Sensor Electronics +
Transmitter Pico 3000

Sensing Element

Sensor with Transmitter incl. HMI

Electronics Housing +
Sensor Electronics +
Transmitter Pico 3000 +
Human Machine Interface Pico 3000 HMI

Sensing Element

Sensor with Remote Control incl. Transmitter and HMI

Electronics Housing +
Sensor Electronics

Sensing Element

Remote Control:
Transmitter Pico 3000 +
Pico 3000 RC Housing
incl. Pico 3000 HMI

Option: Pico 3000 Product Selection

L-Dens 7000 Series | Introduction

The L-Dens 7000 density sensor series represents the new generation of Anton Paar's process density sensors and is offering two accuracy classes –

4-digit accuracy **L-Dens 7400** and 5-digit accuracy **L-Dens 7500**.

The Sensors consist of an oscillating U-shaped tube in a outer diameter of 7 mm, an excitation and pick-up system, and temperature sensors. The sensor electronics is built into the electronics housing.

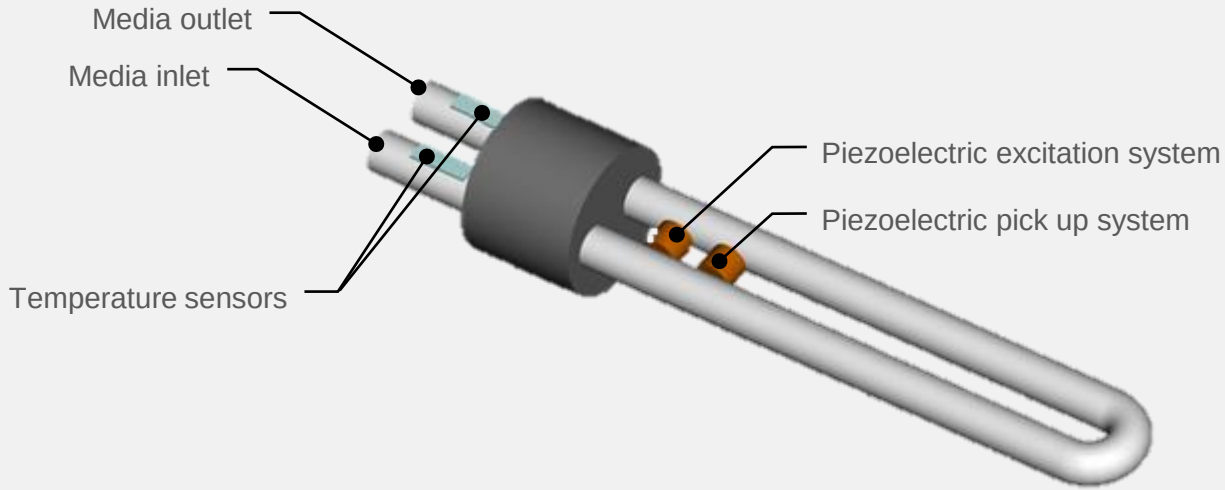
The density is directly calculated by the sensor electronics and can either be transferred to the new Process instrumentation Controller **Pico 3000** which can be directly installed in the electronics housing or the **mPDS 5**.

L-Dens 7400

L-Dens 7500

Measuring Principle

The medium flows through the U-tube which oscillates at its natural frequency.
The natural frequency depends on the density of the medium. It is measured and used for the density calculation together with the measured temperature.



L-Dens 7000 Series | Designation

L-Dens 7000 Series	
7	Outer diameter of the oscillating tube 7 mm
Feature	
4	Accuracy $1x10^{-4}$ g/cm³
5	Accuracy $5x10^{-5}$ g/cm³
Generation	
00	Generation 1

Versions	
Material of the wetted parts	
SST	Stainless steel 1.4404 (316L)
HAS	Hastelloy C-276
TAN	Tantalum
INC	Incoloy 825
Special Feature	
HP	High pressure version
Explosion protection	
Ex d	Ex d approval
NPT	½“ NPT threads for the cable glands

Example:

L-Dens 7400 VERSION HAS HP

L-Dens 7000 Series | Overview and mechanical Configuration

L-Dens 7000 Series

L-Dens 7400

$1x10^{-4}$ g/cm³

L-Dens 7500

$5x10^{-5}$ g/cm³

Wetted Parts

L-Dens 7400				L-Dens 7500
SST Stainless Steel 1.4404 (316L)	**HAS** Hastelloy C-276	**TAN** Tantalum	**INC** Incoloy 825	**HAS** Hastelloy C-276

Special Features

HP High pressure version (only available for HAS)	**Ex d** Explosion approval version Option: **NPT** 1/2" NPT threads for the cable glands

Cable Glands

Non-Ex: 4 pcs. Cable glands M16X1.5 IP 68 are part of each delivery
NPT and Ex: Cable glands are not part of the delivery. They can be ordered optionally. They have to comply with the national regulations.

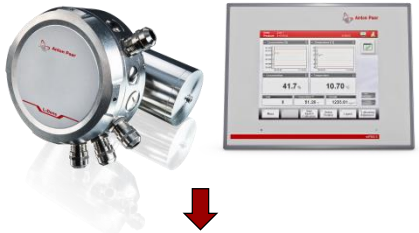
Adapter

Process adapter suitable for the application

L-Dens 7000 Series | Communication

L-Dens 7000 Series

User Interface

L-Dens 7400/7500 + mPDS 5	L-Dens 7400/7500 + Pico 3000	L-Dens 7400/7500 + Pico 3000 + Pico 3000 HMI	L-Dens 7400/7500 + Pico 3000 + Pico 3000 RC Housing incl. HMI
			
Davis 5			

Option

Pico 3000 Product Selection

Communication

PLC / Flow Computer

L-Dens 7000 Series | Features

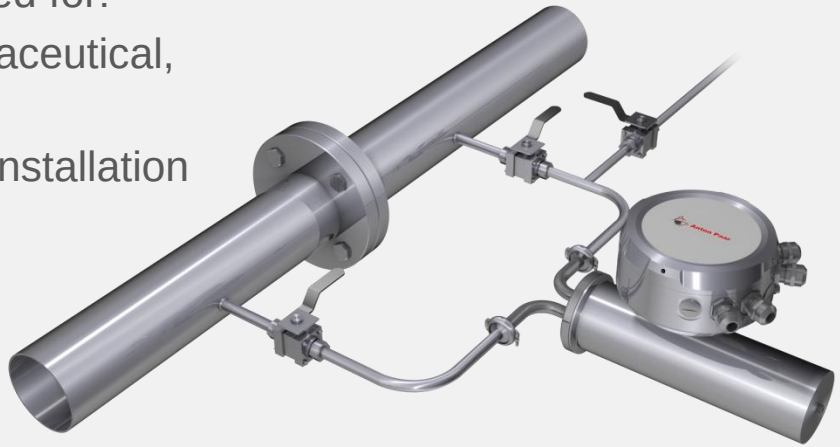
Highest precision –
reliable measurement under changing process conditions

- Powerful digital signal processing
- Integrated high-precision temperature sensors
- Hermetically sealed U-tube

L-Dens 7000 Series | Features

Minimized integration efforts and costs

- Compact and modular design
- Full flow, inline, bypass or tank installation for
- The L-Dens 7000 density sensor series with its wetted parts and adapters is prepared for:
  - The petroleum, chemical, pharmaceutical, ethanol, or beverage industry
  - Full flow, inline, bypass, or tank installation



L-Dens 7000 Series | Features

The simple operating concept with Pico 3000 saves your time and training expenses

- New Pico 3000 transmitter integrated at the sensor or as separate remote control unit
- Human machine interface Pico 3000 HMI
- Common industrial fieldbus standards supported:
  HART, Modbus RTU, PROFIBUS DP, PROFINET IO
- Backup and restore function
- Data and error log function
- USB interface at the electronics housing for configuration with a laptop

Fit and forget

- Configured and adjusted in the factory
- Application formulas integrated
- Quick start-up and commissioning

L-Dens 7000 Series | Features

Operating cost at a minimum

- Maintenance-free
- Stainless steel housing
- No consumables

	L-Dens 7400	L-Dens 7500
Process density	max. 3000 kg/m3	max. 2000 kg/m3
Standard adjustment range	600 kg/m³ to 1200 kg/m³	
Material of the wetted parts	Stainless steel 1.4404 (316L) Hastelloy C-276 Tantalum Incoloy 825	Hastelloy C-276
Accuracy in adjusted range: **Repeatability** **Density measurement** **Temperature**	 0.02 kg/m³ (2 x 10^{-5} g/cm³)* 0.1 kg/m³ (1 x 10^{-4} g/cm³)** 0.1 °C	 0.01 kg/m³ (1 x 10^{-5} g/cm³) 0.05 kg/m³ (5 x 10^{-5} g/cm³) 0.1 °C
Process temperature	-40 °C to 125 °C	
CIP/SIP temperature and duration	145 °C for max. 30 min.	
Ambient temperature (for non Ex versions)	-40 °C to 70 °C without Pico 3000 -40 °C to 70 °C*** with Pico 3000 -20 °C to 60 °C with Pico 3000 and Pico 3000 HMI	
Process pressure absolute	max. 50 bar High-pressure version (only available in Hastelloy C-276): max. 180 bar @ $T_{process}$ ≤ 70 °C max. 140 bar @ $T_{process}$ ≤ 145 °C CRN: max. 170 bar	max. 50 bar
Recommended flow rate	100 L/h to 500 L/h	
Communication	Pico 3000: Analog/Digital, Analog, HART, Modbus RTU, PROFIBUS DP, PROFINET IO, Frequency mPDS 5: PROFIBUS DP, PROFINET IO, Devicenet, Ethernet/IP, Modbus TCP, I/O Board	
Process connections	Options for integration: Full flow, Inline, Bypass Flange: DIN/EN, ANSI, Tri-Clamp, VARIVENT® N Tube End: OD 12 mm, OD 1/4” Thread: G 3/8”	
Dimensions: **Non-Ex version (L x W x H)** **Ex version (L x W x H)**	 245 mm x 145 mm x 185 mm 245 mm x 160 mm x 205 mm	 190 mm x 145 mm x 185 mm 190 mm x 160 mm x 205 mm

* Tantalum: 0.05 kg/m³ (5 x 10^{-5} g/cm³)
** Tantalum: 0.5 kg/m³ (5 x 10^{-4} g/cm³)
*** Pico 3000 PROFINET IO: 60 °C
Explosion-proof versions according to ATEX / IECEx / CSA / UL / FM

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L-Dens 7000 Series Technical Specifications

L-Dens 7000 series | Ex approval

L-Dens 7000 series has a flameproof Ex d concept and is available in following standards

- ATEX: Ex II 2G Ex db IIB T4/T5 Gb
- IECEx: Ex db IIB T4/T5 Gb
- CSA/UL/FM: Class I Division 1 Gr CD T4/T5
Ex db IIB T4/T5 Gb
Class I Zone 1, AEx db IIB T4/T5 Gb

L-Dens 7400 Ex d

L-Dens 7500 Ex d

Pico 3000 | Introduction

Pico 3000 –
Transmitter for process sensors

- Pico 3000 integrated or as separate remote control unit Pico 3000 RC
- Human machine interface Pico 3000 HMI
- Optional Product Selection Mode
- Common industrial fieldbus standards supported
  - Modbus RTU, HART, PROFIBUS DP, PROFINET IO
- Backup and restore function
- Data and error log function
- USB interface for configuration via Pico 3000 Software

Pico 3000 | Designation and interfaces for L-Dens 7000 series

Pico – Transmitter Type	
3	For integration in the sensor electronics housing or remote control housing
Transmitter Type	
0	Standard Version
Generation	
00	Generation 1

Versions (different input and output interfaces)	
Analog/Digital	2 x analog out, 1 x analog in, 5 x digital in, 1 x relay
Analog	2 x analog out
HART	HART and 1 x analog out
Modbus RTU	Modbus RTU
PROFIBUS DP	PROFIBUS DP and 1 x relay
PROFINET IO	2 x PROFINET IO
Frequency	Frequency and analog out

Example:
Pico 3000 VERSION Analog

Pico 3000 | Software

Pico 3000 Software

- Download of Software from the Anton Paar website
- Available for all Pico 3000 versions with or without HMI

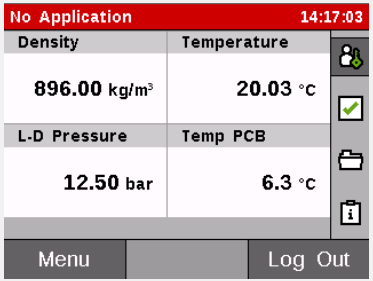
Capability of the Pico 3000 Software

- Adjustment and configuration of the instrument
- Backup and restore the configuration
- Read and export the measured data
- Read and export the logging information
- Read and export the error log
- Firmware updates

Pico 3000 | Accessories

Human Machine Interface Pico 3000 HMI

- Displays up to 4 values
- Capacitive keys
- TFT color display



Remote Control Pico 3000 RC

- Consisting of:
  - Pico 3000 Transmitter
  - Pico 3000 RC housing incl. HMI
- Options for mounting:
  - wall mounting
  - cabinet mounting

Pico 3000 RC wall mounting

L-Dens 7000 series | Typical Applications

Industries

- Beverage
- Petroleum
- Chemical
- Pharmaceutical
- Ethanol

Determined Parameters

- Online concentration measurement
- Online measurement of density (at measuring temperature) and temperature-compensated density
- Determination of mass flow by upgrading an existing flow meter with a density sensor
- Product detection
- Interface detection
- Product blending
- Fiscal measurement

L-Dens 7000 series | Typical Applications

Liquids to be measured

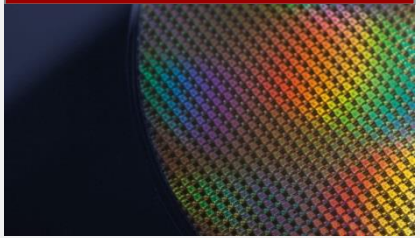
- **Low-viscous liquids** to which the oscillator is resistant
- **Fuels** (regular-grade petrol, premium, diesel, extra light heating oil, Jet-A1...)
- **Low viscous petroleum products**, intermediate and end products of refineries (e.g. LPG)
- **Chemicals** (acetic acid, citric acid, formic acid, calcium hydroxide, acetone, glycerin, ammonium nitrate, ammonia, boric acid, hydrogen peroxide, acetone, sodium carbonate ...)
- **Ethanol / Bioethanol**

L-Dens 7000 series | Typical applications by industry

Petroleum Industry

- Tank Farm | Pipeline | Ship unloading
- Custody transfer
- Upgrade volume to mass low
- LPG
- Product detection
- Drilling fluid monitoring
- Multiproduct pipeline
- Aircraft fuelling

Chemical Industry



- Acids
- Bases
- Salts
- Solvents
- Interface detection

Refrigerants Ethanol / Bioethanol

- Refrigerants:
  - OCR measurement
- Ethanol / Bioethanol:
  - after distillation column
  - after molecular sieve

L-Dens 7000 series | Typical applications by industry

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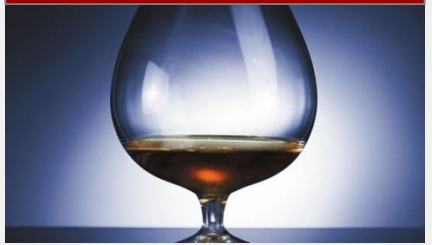
Beer

- Extract at lauter tun
- Hot wort measurement
- Cold wort measurement

Softdrinks

- Syrup concentration
- Blending control

Spirits



- After distillation column before spirit safe
- Distillation monitoring
- Dilution control
- Final blending monitoring
- Before bottling

L-Dens 7000 series | Typical Applications for each wetted part

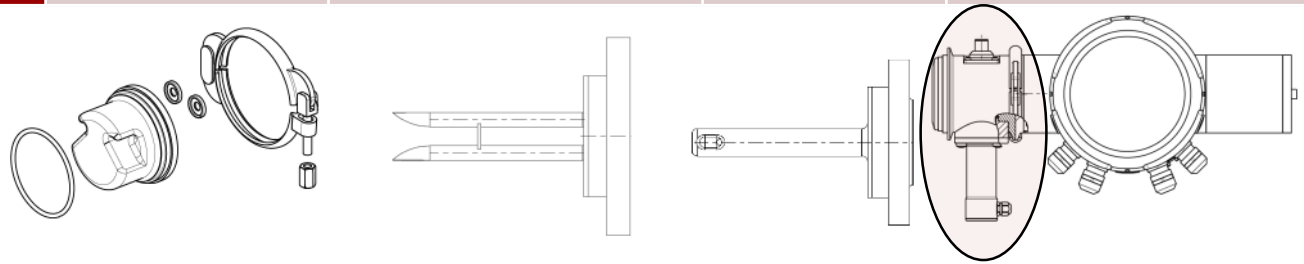
L-Dens 7400 / L-Dens 7500 (only HAS)

SST Stainless steel		**HAS** Hastelloy C-276	**TAN** Tantalum	**INC** Incoloy 825
Boric acid	Ethanol	Sodium carbonate	Sulfuric Acid	Caustic Soda
Calcium hydroxide	Petroleum	Acetic acid	Hydrochloric acid	Sodium Chloride
Ammonia	Naphtha	Formic acid	Phosphoric Acid	
Glycerin	Gasoline	Citric acid	Nitric Acid	
Hydrogen peroxide	Diesel	Ethanol		
Ammonium nitrate	Fuels	Calcium chloride		
Urea		Acetone		

PROCESS CONNECTIONS & ADAPTERS FOR L-DENS 7000

Process connections: inline

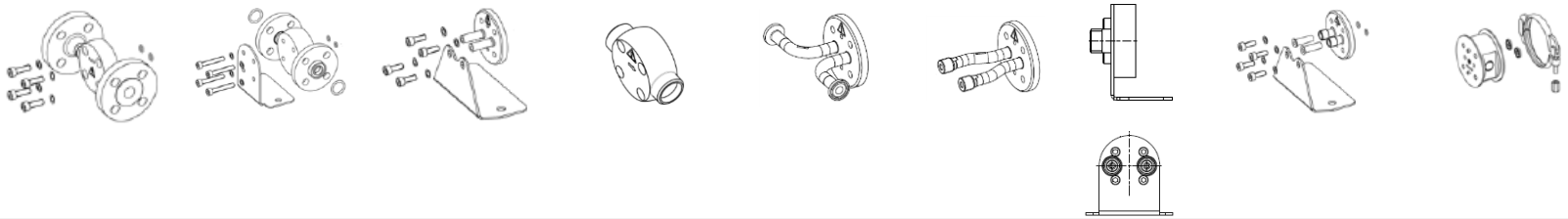
Please review the PDL for differences between L-Dens 7400 and L-Dens 7500				
Flange	VARIVENT® Inline: DN40/DN50 > DN65	EN/DIN ANSI Pitot Tube	EN/DIN ANSI Inline	VARIVENT® Pump adapter
Material	Stainless steel	Stainless steel	PVDF	Stainless steel
Typical industry	Beverage	Petro Chemistry	Chemistry	Beverage: Syrup Wort



Process connections: full flow or bypass adapters

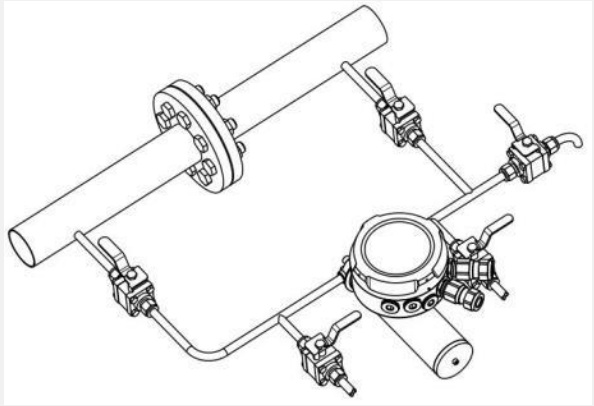
Please review the PDL for differences between L-Dens 7400 and L-Dens 7500

Flange	DIN/EN: DN15/DN25 ANSI: 1/2”/1”	DIN/EN: DN15/DN25 ANSI: 1/2”/1”	Tube end: OD: 12 mm/ 1/4"	Venturi: OD 33.5 mm welding adapter	Tri-Clamp: 1/2”/1”	G3/8” (suits for 1:1 ex-change of DPRn)	SYGEF	3/8” for TAN or INC	Cut Off adapter
Material	Stainless steel	PVDF	Stainless steel	Stainless steel	Stainless steel	Stainless steel	PVDF	TAN or INC	Stainless steel
Typical industry	Petro Chemical Ethanol	Chemical	Petro Chemical Ethanol Automotive Refrigerant	Petro Chemical	Beverage Pharma	Beverage Chemical	Chemical	Chemical	Beverage



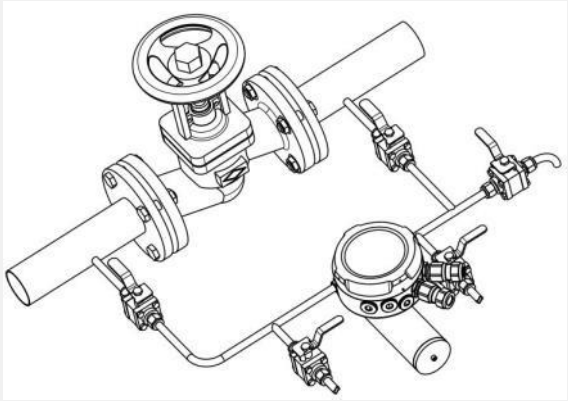
Bypass installation

Bypass with an orifice



- Pipe diameter min. ½”
- Bypass horizontally aligned
- Constant flow in the main pipe

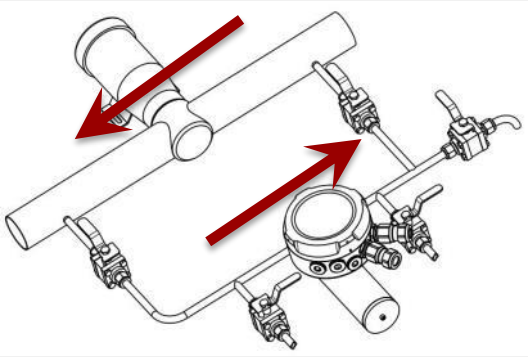
Bypass with a valve



- Pipe diameter min. ½”
- Bypass horizontally aligned
- Constant flow in the main pipe
- Needle valve recommended

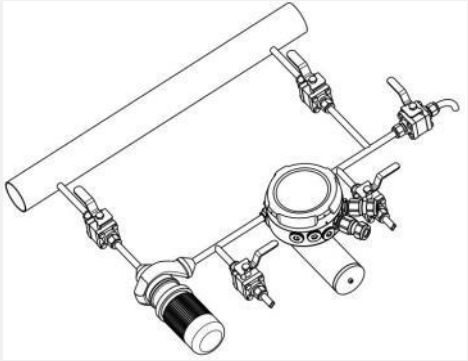
Bypass installation

Bypass across a pump



- Pipe diameter min. ½”
- Bypass horizontally aligned
- Constant working of the pump

Bypass with a pump

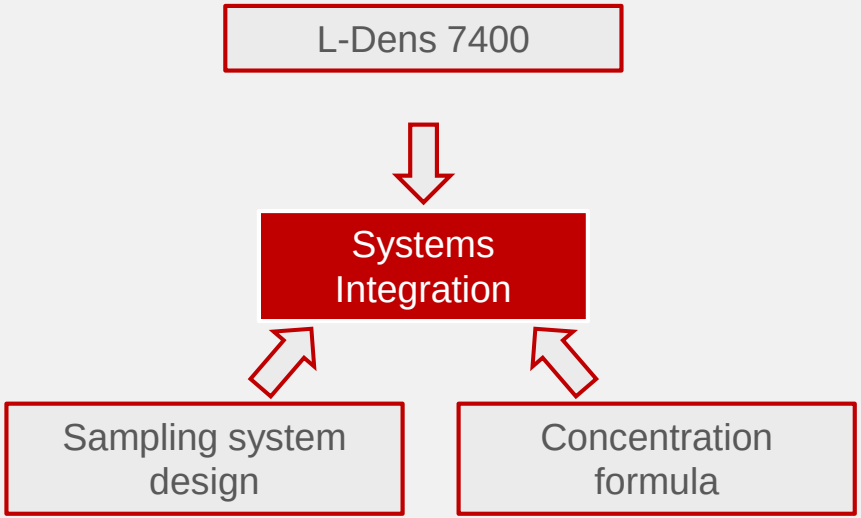


- Pipe diameter min. ½”
- Bypass horizontally aligned
- Recommended solution

SAMPLING SYSTEMS FOR L-DENS 7000

All in one solutions, combining measuring know-how and process/plant engineering

- Ready-to-go solutions
- Minimum implementation effort
- Flexible and open
- Solutions for all environments
- One-stop-shop for systems and services



General Features

- Operating modes by cut-off and sample valves
  - Measuring
  - Cleaning (rinsing without dismounting)
  - Sample drawing (for calibration purpose)
  - Maintenance of the optional pump
- Flanges and insertion depth according to customer specification
- Wetted parts: Stainless steel 1.4404, FKM, FVMQ or other materials on request
- High pressure versions and versions for hazardous environment available

Benefits

- Negligible pressure drop in the main line
- Modifications of pumps in the main line are not necessary
- Cleaning can be performed without interruption of the production
- Easy installation via one- or two-flange mounting
- Compact and space saving design for use at location with limited space resources
- Modular design which can be optionally adapted with additional features on customer’s request

In-line Adapter System

- In-inline installation in horizontal or vertical main pipes
- Sight glass for sample check
- Main applications:
  - Product detection for on- and offloading procedures in terminals
  - Quality monitoring of ship unloading
  - Automatic mass calculation during fuelling
  - Custody transfer measurement in tank terminals and pipelines

Bypass System (1/2”, w/o pump)

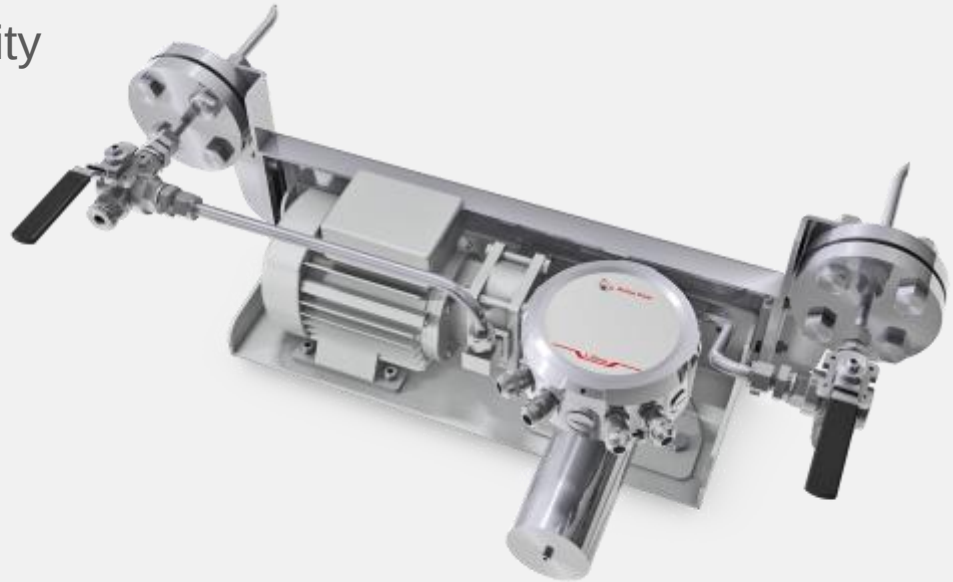
- Installation of an L-Dens 7400 density sensor in a bypass to the main pipe
- Main applications:
  - Concentration measurement
  - Phase detection
  - Process quality monitoring

Bypass System (1”, w/o pump)

- Installation of an L-Dens 7400 density sensor in a bypass to the main pipe
- Main application downstream petroleum pipelines:
  - Product detection
  - Quality monitoring
  - Mass metering/calculation
  - Custody transfer
  - Upgrade of dated 1” density sensors

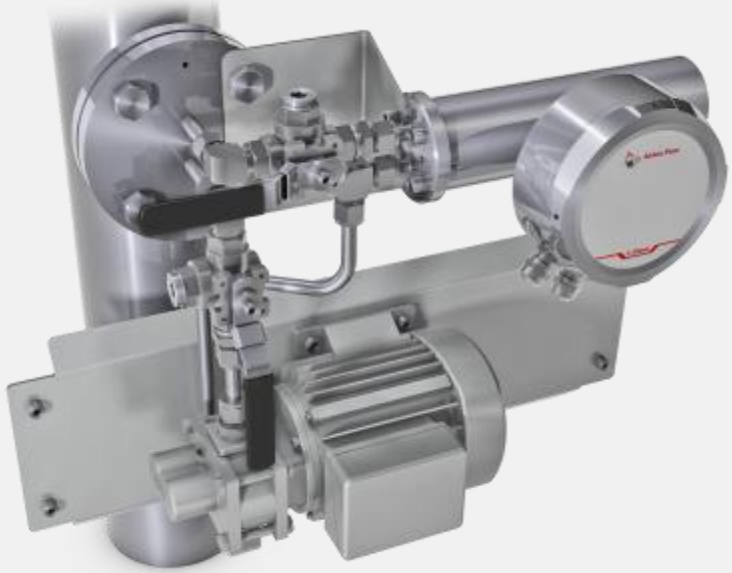
Bypass System w/ Pump (horizontal)

- Installation of an L-Dens 7400 density sensor in a bypass to the main pipe
- Use at low flow rates and/or high viscosity products
  - Concentration measurement
  - Phase detection
  - Process quality monitoring



Bypass System w/ Pump (one-flange mounting)

- One-flange installation of an L-Dens 7400 density sensor in the main pipe or a tank
- Use at low flow rates and/or high viscosity products
  - Concentration measurement
  - Phase detection
  - Process quality monitoring



Customization (example)

- Components like pumps, filters, flow monitors can be integrated according to customer request
- Integration of customer provided components
- Special solutions for hazardous and explosive environments
- Used materials according to customer specification

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