

# **DURATEC d.Flow**

Manual

Version 1.1



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## **1** Safety instructions

## 1.1 General safety instructions

## Warning

This device may only be operated in accordance with the information in this documentation. This device left the factory in perfect condition in terms of safety. To maintain this condition and to ensure safe operation of the device, the following instructions must be carefully observed.



### Warning

Never open the housing of the device. The device could be damaged. There are no user serviceable or replaceable parts inside the device.



### Warning

Incorrect mains voltage can damage the device. Only operate this device with a mains voltage specified for it (see rear of device).



#### Caution

In the event of accidental liquid spillage onto the device, turn off the device and wipe it clean with sufficient disinfectant or chemical. Take characteristics of spilled liquid into account with all precautions necessary.

For control via touch panel only use fingers (also with gloves) or specially designed pens. Peaky or sharp objects can damage the touchscreen.

Do not use the system under direct sunlight, which reduces durability and function of the touchscreen.

## 1.2 Area of application

The flowmeter is especially designed for checking the accuracy and fluctuation of HPLC or dosing pumps. The device is calibrated and traceable according to DKD or NIST. The parts wetted with liquid are made of PEEK, PTFE, FEP and EPDM. Only pure and particle-free deionized water, methanol or ethanol may be used as the measuring liquid.

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## 1.3 Recycling and disposal



This product is covered by the European Directive 2002/96/EC, WEEE – Waste from Electrical and Electronic Equipment. The correct disposal of your old device will help prevent negative consequences for the environment and human health. For more information on how to dispose of your old device, contact your local authority, a waste

disposal service or your dealer.

## 2 Description

The flowmeter d.Flow determines the actual flow rate of a liquid flow. For this purpose, the time to fill a measuring tube (rising pipe) with constant volume is determined. The display shows the measured value and the filling level. The measured values could be logged or transmitted directly via RS232 to a computer or a printer.

The flowmeter is especially designed for checking the accuracy and fluctuation of HPLC or dosing pumps. The device is calibrated and traceable according to DKD or NIST. The flowmeter is supplied with a power adapter, tripod, test certificate and transport case.

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## 2.1 General Setup



1	On/Off	switch to turn on and off
2		touch display for displaying the measured values/device information and for operating the system
3	Out	outlet for emptying the measuring section (connection UNF 1/4-28")
4	Waste	fluid system overflow
5		2x screw thread (UNC ¼-20) for tripod
6		type label showing model and serial number
7	24V DC	socket for power supply via 24V plug-in power supply
8	Flow Inlet	inlet connection (for UNF 10-32 polymer high-pressure fitting)
9	RS232	9-pin Sub-D socket for connection to a PC/RS232 printer

## 2.2 Operating principle



The measurement is volumetric by opto-electronic detection of the liquid level in a rising pipe. The time that passes between reaching a lower and an upper level is being measured and the flow is being calculated. After the upper level has been reached, the rising pipe will be drained via a magnetic valve and the measurement can start again.

The cycle time and the associated time for updating the measured values depends on the supplied flow rate of the medium.

```
Time [sec]= (14,4 /flow [ml/min]) +5[sec]
```

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Example: (14,4 / flow 1 [ml/min]) +5[sec] = approx. 19 [sec]
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Density and temperature of the medium do not matter due to the volumetric measuring principle. Due to the low surface tension, water, ethanol or methanol are recommended.

The factory calibration is performed with water.

## 2.3 Functions

The flowmeter has the following functions:

- Real-time display of the measured flow rate including time stamp
- Display of the last 10 measured values including mean value and standard deviation
- Status display of the measuring section (valve, lower & upper sensor)
- Display of device specific data
- Output of the measured values and the report via the RS232 interface
- Logging of the most important test parameters
- Saving, managing and printing measurement logs (reports)

## 2.4 Specifications

Fluid path	PEEK, PTFE, FEP, EPDM
Flow range	0,05 ml/min - 20 ml/min
Measuring principle	volumetric
Measuring volume	approx. 240 μl
Accuracy	better 1% (measuring range 0,1 -10,0 ml/min)*
Reproducibility	better 1% (measuring range 0,1 -10,0 ml/min)*
Resolution	0,0001 ml/min
Display	3,5" touch display (LCD-TFT)
Output	RS232 interface
Power supply	24 V/DC (1.0A)
Dimensions	Flowmeter: W: 105 mm / H: 170 mm / D: 40 mm (w/o tripod) Case: W: 420 mm / H: 360 mm / D: 135 mm
Weight	Approx. 3,1 kg (incl. case and accessories)

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\*based on water as reference medium

## 2.5 Packing List

No.	Part no.	Description
1	792625	Flowmeter d.Flow (incl. Parts listed below)
2	792615-12-V2	Tripod
3	792615-14	d.Flow plug-in power supply
4	792615-25	Waste cup
5	792625-01	Transport case
	#	Certificate



Optional parts			
6 & 7	792615-28	Printer with plug-in power supply for charging	
8	792615-27	RS232 printer cable	
9		Paper roll for printer	



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## 3 Installation

### 3.1 Selection the proper location

Make sure the flow meter is level and secure. Place the flowmeter near the pump to be checked. Do not use the system under direct sunlight, which reduces durability and function of the touchscreen.

### 3.2 Measurement setup



The device must be placed vertically. There are two threads (use the outer one by default) on the bottom for mounting the tripod. From the rear, the outlet tubing of the pump is connected to the bulkhead fitting labeled with "Flow Inlet" with a UNF 10-32 polymer high-pressure fitting (tighten only hand-tight - no tools required). Put the waste bottle under the tubings 'out' and 'waste'. Power is supplied via a 24-volt-plug-in power supply connected at the socket "24V DC". A printer or a PC can be connected to the flowmeter via the "RS232" connection. To switch the flow meter on, set the toggle switch to the "On" position.

## **4** Operation

The flowmeter is operated via the front touch display. To operate the touch display, use your fingers (also when wearing gloves) or specially designed pens. Peaky or sharp objects can damage the touchscreen.

### 4.1 General workflow

1	Measurement setup (see 3.2)		
2	Rinse the fluid path of measuring setup at 0.5 - 1.0 ml/min (optionally water, ethanol, methanol)		
3	Set the desired flow rate on the pump		
4	Measurement		
	Option 1:	Read the measured values from the display	
	Option 2:	Send measured values directly to RS232 (printer or PC) without a report	
	Option 3:	Record measured values via report function and send to RS232 (printer or PC) at the end of the measurement series	
5	To measure other flow rates continue with 3.		
6	After the check of the pump has been completed, switch off the flow meter and the measuring section empties itself automatically		

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### 4.2 Home screen

After switching on the device you will see the following start screen.



### 4.3 Setup general parameters & device information

By pressing the "Setup" button in the start screen you reach the menu for setting general parameters and for displaying the device information.



#### "Format"

You select different settings by repeatedly pressing the "Printer Mode", "Date Format" or "Time Format" buttons.



#### **Printer Mode**

no print:

No data is sent to the RS232 during the measurement. If the report function is used to record the measured values, the report can still be sent to the RS232 (printer/PC) at the end of the series of measurements.

flow:

Measured flow rate is sent directly to the RS232 (printer or PC).

flow & time:

Measured flow rate and time stamp are sent directly to the RS232 (printer or PC).

#### **Date Format**

*dd-mm-yyyy* : E.g.: 09-02-2022

yyyy-mm-dd : E.g.: 2022-02-09

*m/d/yyyy* : E.g.: 2/9/2022

#### **Time Format:**

*hh:mm:*ss : E.g.: 13:30:51

*hh:mm:ss AM/PM* : E.g.: 01:30:51 PM

#### "Info"



### 4.4 Showing measured values

The measurement begins as soon as the pump feeds liquid into the flowmeter. The last 10 readings are shown on the display. If the setting "flow" or "flow & time" was selected in "Set up" - "Format" - "Printer Mode", the measured values are sent simultaneously to the RS232 interface (printer or PC). If the measurement series is to be created with a detailed report / log file, this is done by using the "Report" button.



### 4.5 Report Mode



#### "Report Setup"

General settings for the report are made in this menu.



#### "New Report"

With "New Report" you create a new measurement series for a flow rate.





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#### "Open Report"

Up to 100 measurement logs can be saved. As soon as the memory is full, the oldest log is deleted. The saved names of the log files result from the date and time.



## 4.6 Using the printer (optional)

General information about the printer can be found in the printer manufacturer's manual.

The printer is connected to the RS232 interface with a special connection cable (included in the scope of delivery of the printer).

The printer is set to battery operation. For charging the printer use the delivered plugin power supply.

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## 5 Maintenance and care

## 5.1 Cleaning the fluid path

The system can be flushed with deionized water, methanol or ethanol to remove foreign bodies or contamination.

## 5.2 Cleaning the surfaces

The housing of the device is moderately resistant to chemicals. However, some chemicals can discolor the surface of the device.

If spilled liquid gets on the outside of the instrument, wipe it off immediately. Clean the area in question with a damp cloth and water and soap. Then dry the area. Make sure that the liquid does not get inside the device.

## 5.3 Yearly recalibration

The supplied certificate is valid for one year and can be renewed before it expires by recalibrating the device. Information about this can be found at:



https://liquid-handling.duratec.de/de/dienstleistungen

## 6 Errors and troubleshooting

The Flowmeter d.Flow is in principle a very robust measuring device if it is used in accordance with these operating instructions. The most common cause of errors (incorrect measured values or no measured values) is the use of incorrect, impure or not particle-free measuring liquid.

This can result in:

- the light barriers of the measuring section do not correctly detect the liquid
- the measurement section does not drain properly
- the outlet valve no longer closes properly

## 6.1 General troubleshooting

The most likely cause of errors is a fluid path problem. Normally, after the liquid has reached the upper level, the rising pipe is emptied and the liquid drains through the tubing of the "Out" port. The second tubing on the bottom is the overflow of the rising pipe. If liquid leaks here ("WASTE"), either the liquid was not recognized by the sensor or there is a problem with the drain. Turn off the device. This switches off the solenoid valve in the sensor unit, and the liquid should flow out of the rising pipe. In this state, the system can be "blown empty" through the "Flow Inlet" with the help of a small bellow. Check, if air is coming out through the two tubing's on the bottom by plugging the other one. After the sensor unit has been "blown empty" in this way, it should work again.

Error	Possible causes	Corrective action
Instrument does	Disconnected power supply	Connect power supply
not power On	Faulty power supply	
	Faulty electronics resp.	Replace power supply
	On/Off switch	Contact DURATEC Support
No measured	Pump not on / not	Switch on/connect pump
values are	connected	Blowing empty with bellow
displayed	Air bubble in the rising pipe	Contact DURATEC Support
	Measuring section defective	

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#### **Error overview**

## 7 Appendix

### 7.1 RS232 interface (or USB virtual serial port)

The data transfer of the measured values or sending the report can take place via the RS232 interface.

#### Interface parameters

Baud Rate:	9600
Parity:	Ν
Data bits:	8
Stop bits:	1
Flow control:	Ν

#### Send commands

Commands consist of text strings with readable characters and are terminated with <CR> Carriage Return (ASCII character 13).

#### Response

Echo of the command + <ack> <cr></cr></ack>	command understood
Echo of the command + <nak> <cr></cr></nak>	command not understood
Echo of the command + <ack> <value> <cr></cr></value></ack>	command understood + requested value
<ack> = ASCII character 6</ack>	
<nak> = ASCII character 21</nak>	

#### **Get commands**

Command	Description	Response - Example
MM? <cr></cr>	Get Meter Model	MM? <ack>d.Flow<cr></cr></ack>
SN? <cr></cr>	Get Meter Serial Number	SN? <ack>2022-011<cr></cr></ack>
FV? <cr></cr>	Get Meter Firmware Version	FV? <ack>30.03.2022<cr></cr></ack>
CD? <cr></cr>	Get Calibration Date	CD? <ack>2022-03-31<cr></cr></ack>
CF? <cr></cr>	Get Calibration Factor	CF? <ack>223140<cr></cr></ack>
CC? <cr></cr>	Get Calibration Certificate Number	CC? <ack>22500557-1<cr></cr></ack>
FL? <cr></cr>	Get Flow Rate	FL? <ack>08:17:35 0.0995<cr></cr></ack>

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