



Instruction Manual

DU06

Ultrasonic flowmeter with display



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Safety Information

General Instructions

To ensure safe operation, the device should only be operated according to the specifications in the instruction manual. The requisite Health & Safety regulations for a given application must also be observed. This statement also applies to the use of accessories.

Every person who is commissioned with the initiation or operation of this device must have read and understood the operating instructions and in particular the safety instructions!

The liability of the manufacturer expires in the event of damage due to improper use, non-observance of this operating manual, use of insufficiently qualified personnel and unauthorized modification of the device.

Proper Usage

The ultrasonic flow meter Du06 are designed to measure the flow of liquids which do not attack the device materials. All other usage is regarded as being improper and outside the scope of the device.

In particular, applications in which shock loads occur (for example, pulsed operation) should be discussed and checked in advance with our technical staff.

The series DU06 flow meter devices should not be deployed as the sole agents to prevent dangerous conditions occurring in plant or machinery. Machinery and plant need to be designed in such a manner that faulty conditions and malfunctions do not arise that could pose a safety risk for operators.

Dangerous substances

For dangerous media such as e.g. Oxygen, Acetylene, flammable or toxic substances as well as refrigeration systems, compressors, etc. must comply with the relevant regulations beyond the general rules.

Qualified Personnel

The DU06 devices may only be installed by trained, qualified personnel who are able to mount the devices correctly. Qualified personnel are persons, who are familiar with assembling, installation, placing in service and operating these devices and who are suitably trained and qualified.

Inward Monitoring

Please check directly after delivery the device for any transport damages and deficiencies. Additional with reference to the accompanying delivery note the number of parts must be checked. Claims for replacement or goods which relate to transport damage can only be considered valid if the delivery company is notified without delay.

Functional Description

The DU06 detects flow and accumulated volume in pipe systems due to ultrasonic delay time mode with a time resolution of 45 pico seconds.

Different connection versions are available:

- ½“ version made of brass or stainless steel, flow max. 80 l/min
- 1” version made of stainless steel, flow max. 180 l/min
- 2” version made of stainless steel, flow max. 1000 l/min

All versions come with external thread connection for mounting in pipe systems

Medium: Water, oil, emulsion etc. with low gas rate (bubbles)

Installation location

In order to avoid turbulence and cavitation, the largest possible distance to valves, pipe bends, fittings and other flow disturbing elements must be maintained. In particular valves can disturb the flow and lead to malfunction. Therefore, they must be installed in the flow direction after the meter. Thus, the resulting interference is only generated after the DU06. To avoid pressure surges, it is important that the valves are opened as slowly as possible.

In order to maintain proper functioning of the units, it is recommended to provide a straight calming section of approx. $10 \times d$ on the inlet side and $5 \times d$ on the outlet side. (d = tube inside diameter)

Electrical Connection

Attention: Prior to the electrical connection of the device, it must be ensured that the supply voltage matches that required and the supply voltage is switched off.



Plug arrangement

Power supply, current-, voltage-, frequency output
4 pole plug (included in delivery)

- Pin 1: 4-20mA / 0-10V / Freq.Out
- Pin 2: GND
- Pin 3: GND
- Pin 4: +24VDC +/-15%

Relay outputs

6-pol plug (included in delivery)

- Pin 1: Relay 2, normally open contact
- Pin 2: Relay 2, middle contact
- Pin 3: Relay 2, normally close contact
- Pin 4: Relay 1, normally open contact
- Pin 5: Relay 1, middle contact
- Pin 6: Relay 1, normally close contact

Menu navigation

By help of a menu system the user can adapt the device to his application. The Menu has a simple structure and is easy to handle. The button <P> activates the menu. With the button <Arrow up > respectively <Arrow down > you can choose one or the four menu points

- Output ParmS
- Instrument ParmS
- Math ParmS
- Instrument Test

Pressing button <P> the menu point marked with<*>is activated. Using button<arrow up > respectively. <arrow down >Parameters can be adjusted now. By pressing <P> selected data is stored. All data is stored in a fixed memory.

Attention:

Changing of parameters have to be confirmed by pressing <P> within 5 sec. otherwise the DU06 changes back to the measuring modus without taking over the Parameters.

Advice:

Parameters which are critical to the system are protected by a code to prevent the function of the transmitter. This code is available from the manufacturer.

Output parameter <Output ParmS> Menu 1

Relay 1 –setting switch point of relay 1

Relay 2 –setting switch point of relay 2

If the actual measured flow exceeds/falls below one of the adjusted switch points the related relay is actuated. If switch point is adjusted to 0 the relay never is actuated.

Used relays are SPDT types with following switching performance:
30 VDC / 1 A respectively 120 VAC / 1 A resistive load.

U-I-F Output – Selection of current, voltage or frequency output

4-20 mA: analogue current output 4-20 mA, working resistance 0 Ohm to 1000 Ohm

0-10 V: analogue voltage output 0-10 V, Ripple ca. 1 MOhm

Freq.Out: Configurable frequency output with F_{max} up to 32 KHz, Ripple ca. 2 KOhm

Electrical connection is made at two pins of the 4 pole supply plug. All output signals are related to the device ground.

If the frequency output is selected, so it is possible to adjust the required frequency range **Fout-Max** from 125 Hz $\leq F_{out} \leq 32$ KHz . The signal shape is rectangular with an amplitude of ca. 16 Vpp at a working voltage of 24 VDC and a load of 4.7 KOhm.

Maximum flow limit - Max Flow Limit

This parameter dedicates, at which flow the max. value of the selected output signal is created. (4-20 mA, 0-10 V, Fout). So it is possible to adapt the upper limit of the measuring range to the individual requirement. If the ***Max Flow Limit*** is achieved, the selected output delivers its maximal signal.

Advice:

If the ***Max Flow Limit*** is passed, display shows <Overflow> and the different output signals react as follows:

4-20mA → 24 mA is generated

0-10V → 12 V is generated

Freq.Out → ***Fout-Max*** is shown

If flow is smaller than 0 respectively reversed output signals react as follows:

4-20mA → 4 mA is generated

0-10V → 0 V is generated

Freq.Out → 0 Hz is generated

Assignment of analog output signal

If the analogue output is used, the following assignment must be observed. 20 mA corresponds to the ***Max Flow Limit*** 4 mA corresponds to all values below the ***Low Flow Cut-Off***. The initial value of the measuring range can be calculated with the following formula.

$$X = (D / D_{\max} + 0.25) / 0.0625$$

D = measuring range initial value

D_{max.} = Full scale value

X = mA value at the start of the measuring range

For example: DU06 factory setting. Measuring range initial value 1 l/min,
full scale value 180 l/min

$$(1/180 + 0.25) / 0.0625 = 4.089 \text{ mA}$$

This means that 180 l/min corresponds to 20 mA, 1 l/min to 4.089 mA and 0.99 l/min to less than 4 mA.

0 on the remote display corresponds to 4 mA.

In this way a linear assignment of the analog signal to the flow value is achieved.

Instrument Parameter <Instrument Parm> Menu 2

DU06 Modus, Flow meter - Totalisator - DU06 Mode

Flow: the device works as flow meter

Totalize: the device works as totalizer

The added value of the totalizer is still achieved in case of power failure.
A power failure can be indicated but the function **Bat Check**.

Advice:

The totalizer always works even if the DU06 don't work in mode **Totalize**.
Within device mode **Totalize** the added sum can be deleted by pressing <arrow up>.

Flow-Units Select Flow Unit

Available Flow Units:

<i>l/sec</i>	- Litre per second
<i>l/min</i>	- Litre per minute
<i>l/h</i>	- Litre per hour
<i>m³/min</i>	- Cubic meter per minute
<i>m³/h</i>	- Cubic meter per hour
<i>gal/sec</i>	- Gallons per second
<i>gal/min</i>	- Gallons per minute
<i>gal/h</i>	- Gallons per hour
<i>%</i>	- Percent from <i>Max Flow Limit</i>
<i>m/sec</i>	- Flow speed in meter per second

Advice:

If DU06 is in measuring mode, you will see the actual speed of flow when you press <Arrow up>.
Pressing <Arrow down> the speed of sound in the media in m/sec is indicated.

Flow direction- Reverse Flow

Reverse Flow negates the prefix of flow indication

DU06 indicates no negative flow, so if there is after installation 0 flow indication while there is flow, flow direction has to be reversed by reverse flow function!

Leak flow volume cut off - Low Flow Cut-Off

If the absolute value of flow is smaller than ***Max Flow Limit * Low_Flow_Cut_Off***, indicated flow value is 0. Low flow cut off can be adjusted between 0 % and 10 % of ***Max Flow Limit***. It is recommended to adjust at least 1-2 %.

Checking power value - BatCheck

If ***BatCheck*** is activated, a possible power failure is registered. If power comes back an alert is sounding and the message <Pwr.Supply fail> is appearing. It is necessary to press <P> and <arrow up> at the same time to get back to the standard measuring mode.

This function is recommended to use when totalizator is in operation and shall inform the user that it could be that due to the power failure totalizator level is not correct because flow passing the DU06 during power failure was not counted.

Parameter protection - Pin

Pin Code is for protecting parameter of the device. Changing them without authority will be avoided. If the Pin is activated DU06 requires the 4 digit pin if anybody tries to exchange any parameter. The Pin function is working until it is de-activated

Advice:

It is recommended to make a note of the code a save location. If the Pin is forgotten user has to ask at the manufacturer for a master-pin.

Interface RS-232 or RS-485 – COM Interface

For selection of following interface standards: RS-232 or RS-485.

Following options are available:

DU06 with RS-232

DU06 with RS-485, Half Duplex

Advice:

If you use RS-485 interface , DU06 demands for a valid Bus address.

Restore of Factory Settings – Restore Factory Settings

Puts back the DU06 into the condition of delivery due to manufacturer (software adjustment).

Characteristic diagram K-Factor – K-Factor

This function is used for adaption of the characteristic diagram up to formula

$$\mathbf{Q_{korr} = Q_{ist} * K;}$$

- Q_{ist} -measured flow;
- Q_{korr} -corrected flow;
- K - absolute term (multiplicative)

It is used if flow conditions have changed referring to the original calibration

Advice:

This function is protected due to a separate Code (KO_Code). If the code is required please ask For it at the manufacturer

Characteristic diagram dynamical offset – Dynamical Offset

This function is used for adaption of the characteristic diagram up to formula:

$$\mathbf{Q_{korr} = Q_{ist} + DynOffset*(Q_{ist}/Q_{maxPhys});}$$

- With: Q_{ist} -measured flow;
- Q_{korr} -corrected flow;
- Q_{maxPhys} - max. flow in pipe at v=5m/sec
- DynOffset - absolute term (additive)

Advice:

This function is protected due to a separate Code (KO_Code). If the code is required please ask for it at the manufacturer

Integration Time

The DU06 needs for one flow measurement approx. 80 ms. It calculates the indicated flow out of a minimum of 10 und max. 100 measures. This means an adjustment range of the ***Integration Time*** of 0,8 sec until 8 sec. The average value is detected by the method of moving exponential average value.

Instrument Test Function <Instr. Test> Menu 4

Indication of supply voltage - Supply Voltage

The device works like a Voltmeter and indicates the actual supply voltage.

Push button <P> to finish the measurement.

Advice!

The allowed voltage is: 24 VDC +/-15 %, max. Ripple 100 mV

If low-grade power supply units are used, restricted function of the DU06 respectively inaccurate Measurement can appear. It is forbidden to operate inductive load with the same power supply than the DU06

4-20 mA offset of analog output - 4-20 mA Offset

This function is for special applications and protected due to manufacturers code.

4-20 mA K-value of current output - 4-20 mA K-Value

This function is for special applications and protected due to manufacturers code.

0-10 V K-value of voltage output- 0-10 V K-Value

This function is for special applications and protected due to manufacturers code.

Flow test function - Flow Test

This function simulates flow rates between zero and **Max Flow Limit**, for demonstration and test purposes during configuration of the plant. The display, the relays contacts as well as 4-20 mA, 0-10 V, Fout and the interface is operated. Thereby the DU06 works without pipe and media.

Relays Test Function – Relays Test

Relays test function operates the relays alternating (relays on/off) 5.

Error messages

Error 1: Echo Bad

Very turbulent flow, or too high air content in the medium; no measurement possible.

The reason may be that the medium generally has a high proportion of air, or the proportionate air is dispensed by turbulence in the measuring system. See point 6 (Selection of the installation location).

Error 2: No Fluid

No media in measuring pipe. No measurement is possible. Fill system with medium.

The DU06 indicates no negative flow. If there is 0 flow indication while there is flow, flow direction has to be changed in the program.

Functional check

It is the responsibility of the operator to test the function periodically and to check the device visually. periodically perform a functional test or a visual inspection.

A functional test of the contacts can be carried out in the installed or removed state, with manual displacement of the float or by filling the container. It should be noted that no functional processes are triggered by the functional test.

DU06

Ultrasonic- Flowmeter and Counter with Local Indication

- heavy duty meter, brass- and stainless steel version
- for 1/2" to 2" pipes
- very broad measurement range: 0,5...80 to 8...1000 l/min
- 2-line LCD-display for flow and total indication
- output signals: 4...20 mA, 0...10 V for flow, pulses for total



Description:

The DU06 flowmeter is fitted with two ultrasonic sensors that are facing each other. The echo travel time is a function of the flow rate. The sensors act alternately as transmitter and receiver.

The echo time difference is proportional to the flow rate. In contrast to other types of ultrasonic flowmeters, the sensors are oriented parallel to the flow stream. This results in an extremely compact meter which is highly accurate, has outstanding turndown ratio dynamics and can monitor and meter very high flow rates without any reduction in pipe cross-sectional area.

Typical applications:

The DU06 measures, monitors and totalizes liquid flow. Among the applications for this device are cooling systems (water / glycol mixtures), non-conductive products (demineralized water, low viscous oils) and chemically aggressive and caustic liquids.

Models:

DU06.M... brass version, housing made of brass 2.0401, sensors made of stainless steel 1.4571, FKM gaskets, (EPDM optional), for 1/2" pipe only

DU06.E... stainless steel version, housing made of stainless steel 1.4571, sensors made of stainless steel 1.4571, FKM gaskets, (EPDM optional), for 1/2" to 2" pipe

Measuring ranges:

Measuring range *)	Brass-version	St. steel-version	Process-connection
0,5...80 l/min	DU06.M...R015	DU06.E...R015	R 1/2 male
1...180 l/min	-	DU06.E...R025	R 1 male
8...1000 l/min	-	DU06.E...R050	R 2 male

*) Maximum ranges are specified. For a higher resolution the output can be programmed for end values < max. measuring range

Electrical Data:

Output signal: adjustable on site: 4...20 mA, 0...10 V or frequency output and 2 limit relays

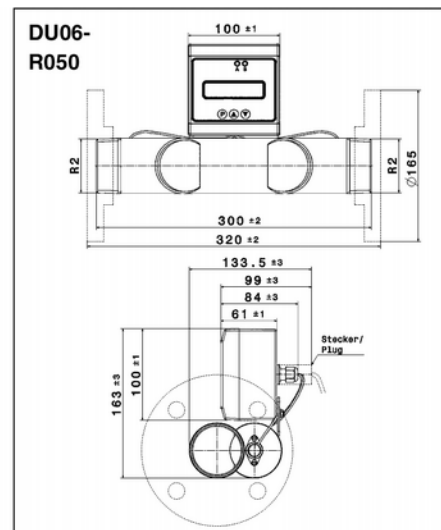
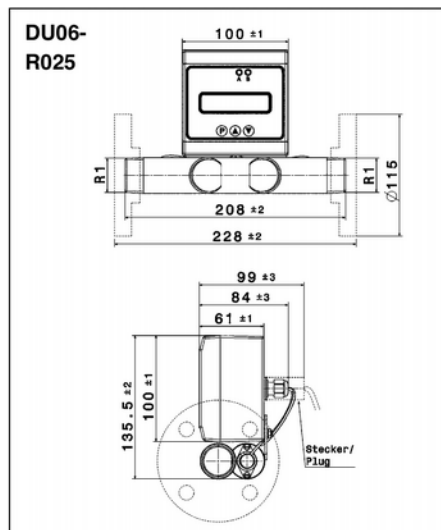
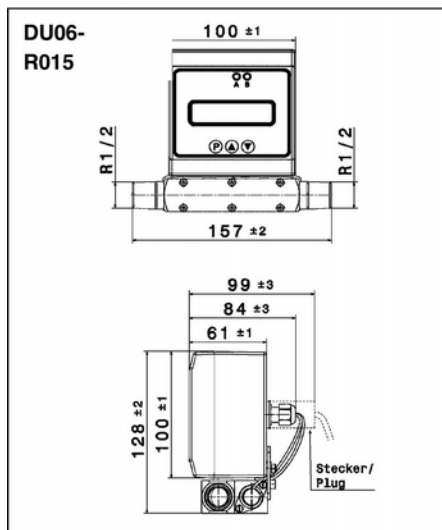
Connection 4 pin plug: Power supply, output signal

Pin 1: 4-20 mA / 0-10 V / frequency output
Pin 2: GND
Pin 3: GND
Pin 4: +24 VDC ±15%

Connection 6 pin plug: Relay output

Pin 1: relay 2, N/O contact
Pin 2: relay 2, common contact
Pin 3: relay 2, N/C contact
Pin 4: relay 1, N/O contact
Pin 5: relay 1, common contact
Pin 6: relay 1, N/C contact

Dimensions:



Order Code:

Order number: **DU06. E. V. R025. 0. 0**

Ultrasonic flowmeter and counter with local indication

Material version:

M = brass housing, sensors st. steel (with G 1/2 male connection only)
E = st. steel housing, sensors st. steel
S = special version

Gaskets:

V = FKM (standard)
E = EPDM
S = special gasket

Measuring range / Process connection:

R015 = 0,5...80 l/min, R 1/2 male
R025 = 1...180 l/min, R 1 male (only DU06.E...)
R050 = 8...1000 l/min, R 2 male (only DU06.E...)

Output signal:

0 = universal output for power, voltage or frequency, adjustable on site and 2 limit relays

Options:

0 = without
9 = please specify in plain text

Technical Data:

Max. pressure: 25 bar
Medium temperature: -20...+100 °C
Ambient temperature: -10...+60 °C
Accuracy: ± 2% of full scale
Mounting position: any, rotatable housing
Medium: acoustically conductive liquids, solids content < 10 Vol. %
Power supply: 24 VDC ± 15%
Power consumption: 200 mA max.
Outputs: 4...20 mA, 0...10 V, frequency-output (programmable, max. 32 kHz), Ri = 2 kOhm
Limit value relay: 2 x changeover cont., 30 VDC / 1 A
Display: LCD, 2 x 16 digit, illuminated
Protection class: IP65
Response time: 0,8...8 s, factory setting ca. 1,6 s
Flow direction: adjustable in device



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