µFLOW 100LSE-QAL

compact calculator for gas applications

Instruction manual

Valid from software version LSE-QAL-211

content

Explanations of symbols

Warning of a danger place (caution: consider documentation)
ISO 3864, No. B.3.1

Warning of dangerous electrical voltage
ISO 3864, No. B.3.6

General Hints

For reasons of clarity this manual does not contain detailed information about all types of products and cannot take into account every conceivable case of installation, operation or maintenance.
If you require further information or should problems occur which are not sufficiently explained in the manual, you can consult us directly to obtain the necessary information.

CAUTION

This equipment is a Limit Class A once. It can cause radio disturbance in residential. On this case costumer has to take care appropriate measure.

This equipment should only be installed and operated after qualified personnel have ensured that suitable power supply (see name plate) will be used and that during normal operation or in case of a defect in the system or in components no hazardous situation can occur. Therefore serious injuries and/or considerable material damage cannot be ruled out in the event of improper handling of the device.

The perfect and safe operation of this equipment is conditional upon proper transport, proper storage, installation and assembly as well as on careful operation and commissioning.

May we also draw your attention to the fact that the contents of the manual are not part of a previous or existing agreement, approval or legal relationship or an amendment thereof. All obligations of the S.K.I. GmbH result from the contract of purchase which also contains the full and solely valid warranty agreement. These contractual warranty conditions are neither extended nor restricted by the contents of the manual.

Qualified Personnel

are persons familiar with the installation, assembly, commissioning and operation of the product and who have the appropriate qualifications for their activities such as:

- Training or instruction or authorization to operate and maintain devices/systems according to the standard of safety technology for electrical installations.
- Training or instruction in the proper care and use of protective equipment in accordance with appropriate safety practices.
- Rendering first aid.

attention

During start up no buttom on the front panel must be pressed

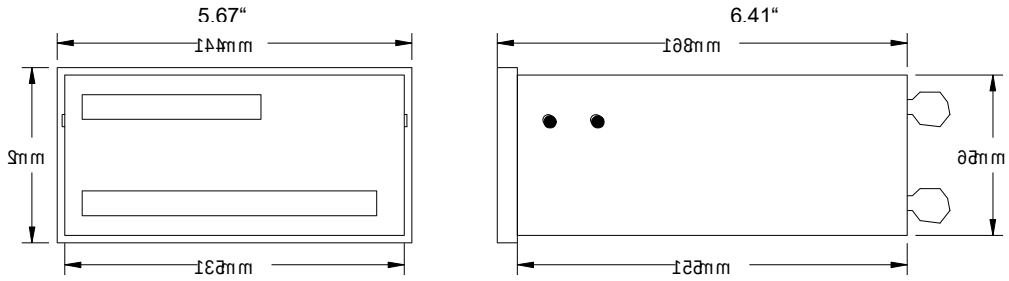
Technical data

indication:	LC-Display, 2 lines with 16 signs
nominal voltage:	230 VAC (±10%) 115 VAC (optional) 24 VDC (optional)
frequency range:	50 Hz ±10%
nominal current:	65 mA @230/115V 50Hz 500 mA @24 VDC
nominal power	15 VA @230/115V 50Hz 12 VA @24 VDC
maximum main interference:	150 V/20 ms, followed by automatic RESET by integrated monitoring module with backup of the count
EMV tests:	according to EN 55011/ 55011-A1; EN 61326-1/ 61326-A1 and EN 50082-1/2
Functional test:	Watchdog, FAIL function with drop-out contact in the event of fault
Available auxiliary power:	24 VDC/160 mA for transmitter supply (with auxiliary power 115/230 VAC only) No transmitter supply is possible with auxiliary power 24 V DC
analog inputs:	5x 0/4-20 mA switchable via software 1x switchable to Pt100 direct input measuring range for Pt100: –200°C....+500°C Internal resistance 24 Ohm per current input, >10 MΩ for Pt100
Analog/Digital converter	16 bit resolution with integrated 50Hz-suppression; complete electrical isolation from the computer and all outputs(except in the case of transmitter supply)
Frequency input:	0,1 up to 10kHz
Analog outputs:	1x 0/4-20 mA, optional 2x 0/4-20 mA max. load: 500 Ohm
Contact (open collector):	max. 1W, max 30 V
resolution of the outputs:	14 bits, completely electrically isolated from the computer and all inputs
relay outputs:	1x free configurable, 1x Fail-relay, 1x service relay max. load of the contacts: 250VAC/8A

*__Caution:__ Before installation and operation costumer has to check the nominal voltage. Only the declaration on the type plate is guilty!

Dimensions

enclosure:	glass-fibre-reinforced Noryl, front panel 144x72 mm^2 (DIN)
material:	Noryl SE1 GFN2
protection class:	IP 20 (enclosure); IP64 (display unit)
depth:	ca. 170 mm
panel cut-out:	5.45“ x 2.7“ (138 x 68 mm²)



Mechanical mounting

The standard µflow is a panel mounting unit. After preparing the panel cut-out, costumer has to mount the µFlow while using the delivered mounting brackets. Please pay attention to use the delivered seal between panel and µFlow-housing.

Cleaning

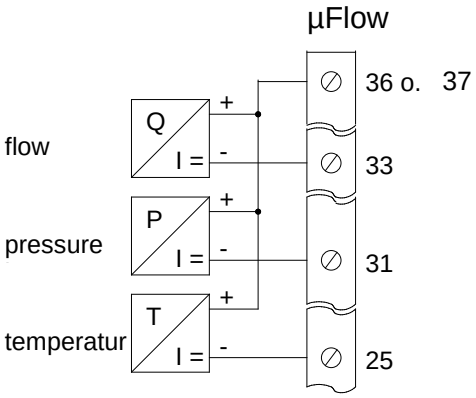
The µFlow has to be cleaned only with a dry duster.

General hints for Electrical connection

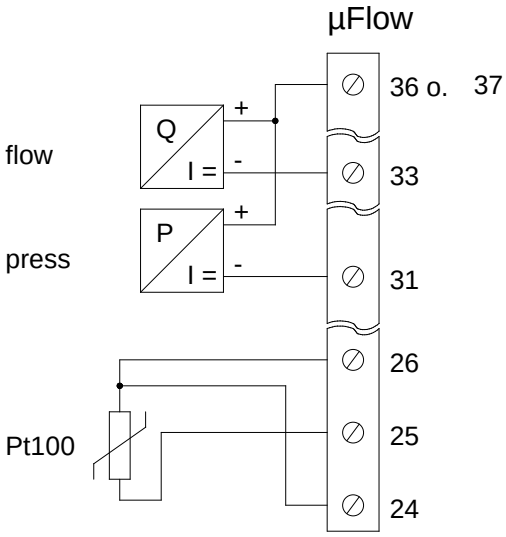
Signal leads must be shielded, one end of the shield has to be connected to mass. Signal and main leads have to be layed separately.
For electrical installation following determinations are to be observed:

- power supply wiring has to be designed for nominal current
- power supply has to be installed, so that the power supply of µFlow can be switched off
- switch off power supply before opening the µFlow

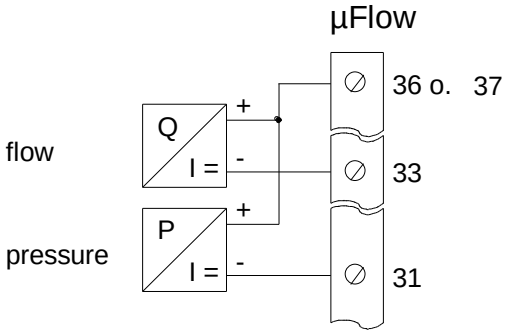
Connection examples for inputs



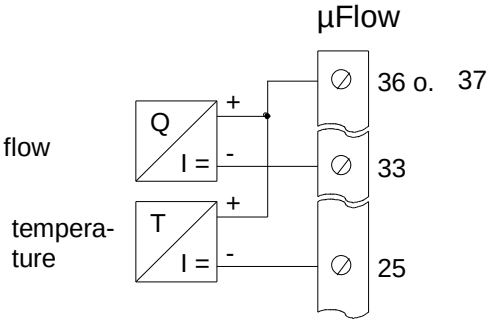
picture1: passive current inputs, the µFlow powers the transmitters



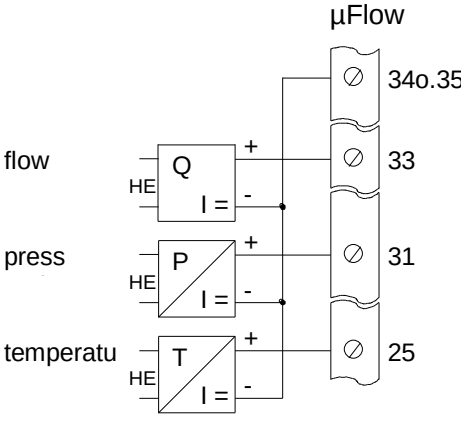
picture 2: passive current inputs, with Pt100 direct connection instead of using a temperature transmitter



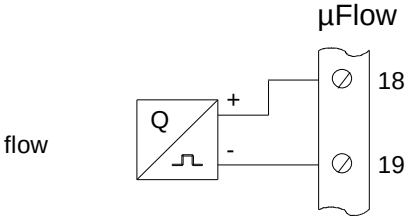
picture 3: without temperature measurement



picture 4: without pressure measurement

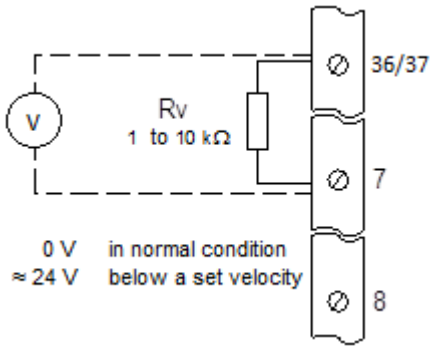


Picture 5: active signals, the transmitters are powered by an external supply.
HE = auxiliary power

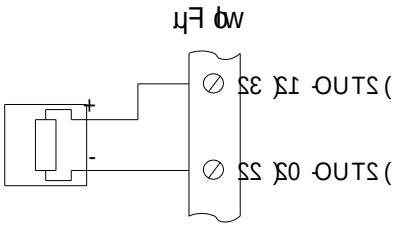


picture 6: frequency input for the flow signal

Connection examples for outputs



picture 7: contact (open collector) for indicating that the flow velocity is smaller than the chosen value of the –Alarm (menu tree, level 8a).
In this case the voltage drop at the resistance rises to appr. 24 volts.



picture 8: analog output
outputs are active, there is no need for an external power supply. The max. load is 500 Ω

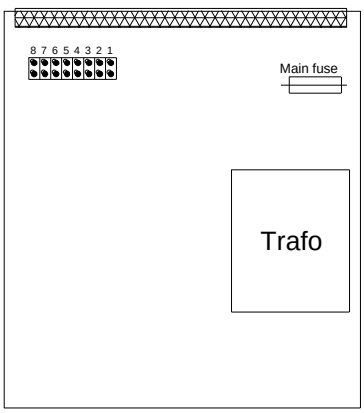
The terminals in detail

Long terminal row

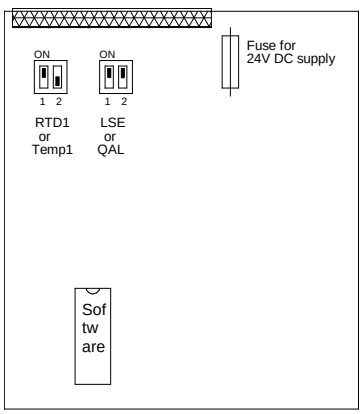
terminal	name	use
1	L/DC+	Power supply, (24 V DC + optional)
2	N/DC-	Power supply, (24 V DC - optional)
3	PE	mass
4	RXD	Transmit Data
	TXD	Receive Data
6	DGND	Data Ground
7	CNT	contact NPN Open collector
8	DGND	GND for pulse output
9	CO	Relay 1 (purging relay)
10	NO	
11	NC	
12	CO	Relay 2 (maintenance relay)
13	NO	
14	NC	
15	CO	Fail-Relay
16	NO	
17	NC	
18	Freq+	Frequency input
19	Freq-	
20	OUT2-	Analog output 2 (Option)
21	OUT2+	
22	OUT1-	Analog output 1
23	OUT1+	

short terminal row

terminal	name	use
24	B	Current input T1 or Pt100
25	A/IN5	
26	b	
27	B	Limit switches 2 – 4 (purging)
28	A/IN6	Limit switch 1 (operating)
29	b	Power supply for limit switches
30	IN4	Not used
31	IN3	Current input pressure
32	IN2	Current input Flow 2
33	IN1	Current input Flow 1
34	GND	GND for transmitters
35	GND	GND for transmitters
36	24V	Auxiliary power for transmitters
37	24V	Auxiliary power for transmitters



Picture 11: main circuit board with Jumpers for the frequency input



Picture 12: CPU circuit board with the DIP-switches for the temperature input and QAL/LSE

Choosing the signal for the temperature input (Pt100 or current)
Choosing the software function

Picture 12 shows the location of the DIP switches for the adjustment of the temperature input and the software function. The switches are reachable after dismounting the back panel. Additional setting for QAL-Software: Level 54 in the menu tree has to be changed to “extern”.

switch	1	2
Pt100	off	on
Current	on	off

switch	1	2
LSE	off	off
QAL	on	on

Exchange of the fuses

The main fuse is located on the main circuit board (see picture 11). The fuse for the 24 V auxiliary power is located on the CPU circuit bord (see picture 11. The fuses are reachable after dismounting of the back panel. The type of fuse to be used is depending on the power supply

Power supply	Main fuse	Fuse for 24V
230V AC	250V/80 mAT	250V/160 mAT
115V AC	250V/80 mAT	250V/160 mAT
24V DC	250V/0,5 AT	-

Status displays and status signals

Operating

On the next page the displays that can be chosen during a trouble-free operation are shown. The fail-relay is energized and the maintenance relay is de-energized.

Disabled state

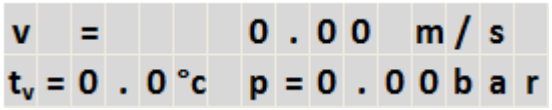
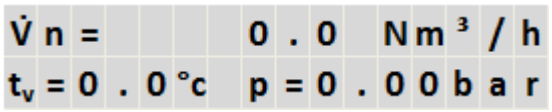
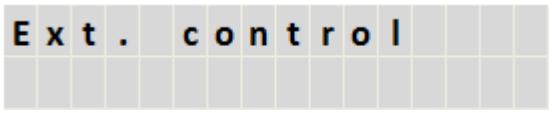
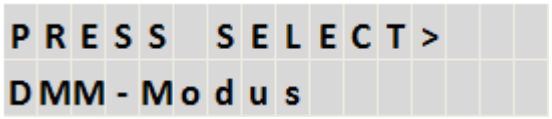
The function of the device is monitored permanently by a „Watch dog”. In case of a malfunction the fail-relay de-energizes. E.g.: If the supply voltage falls below a permissible value the fail-relay de-energizes and the display will be darker.

Maintenance

Before carrying out a maintenance both “Prog"-keys have to be pressed simultaneously. The Maintenance Relay energizes and the following display will be shown:

The displays

The following table show the different displays. By pressing the "🡻" key, it is possible to switch between the displays in descending order of the table. By pressing the "🡹" key, it is possible to switch in the opposite direction. After pressing the SELECT key, the TAG-no., which can be programmed by the user, will be indicated. After pressing the SELECT key again, you get back to the normal display mode.

standard volumetric flow and Actual volumetric flow	
flow velocity, temperature and pressure	
standard volumetric flow, temperature and pressure	
air purging device (ext. switch or time control)	
branching of subdisplays for value reading only available with access for Laboratory, OEM or Factory	

Menu tree

attention: For some parts of the menu the access is denied.

Level	A	B	C	D	Input / indication	comments
1	Info	Version			Ver. GAS-1.9917ff	Indication of the software version, no input possible
2		Ser.No..			SN:	Indication of the serial number, no input possible
3	Params	Flow1	dp	dP1.min	Input of dP-value for 0/4mA	Does not appear, if a velocity sensor is chosen
4				dP1.max	Input of dP-value for 20mA	
5				dp2.min	*Input of dP-value for 0/4mA*	Attention: if no second dp- transmitter is connected, the values for dp2.min + dp2.max must be set to zero
6				dP2.max	*Input of dP-value for 20 mA*	
7				k-factor	*Input of value*	Specification of the k-factor
8				density	Input of value	in kg/Nm³
8a				-Alarm	Input of value	0-60 m/s
9			*velocity*	*Puls/V*	*Input of value*	Does not appear, if a dp-sensor is chosen
10				*Vmin*	*Input of value*	Zero point in m³/h
11				*Vmax*	*Input of value*	span in m³/h
12			Pipe-ID		Input of value	Internal pipe diameter
13			cutoff		Input of value	cutoff in %
14		Temp	T1.min		temperature according to 0/4mA	
15			T1.max		temperature according to 20mA	
16		*COMP 1*	*G1min*		*Input of value*	in Vol. %
17			*G1max*		*Input of value*	in Vol. %
18		*COMP 2*	*G2min*		*Input of value*	in Vol. %
19			*G2max*		*Input of value*	in Vol. %
20		*LIMIT*			*Input of value*	in Vol. %
21		*density*	*Rho1*		*Input of value*	in kg/Nm³
22			*Rho2*		*Input of value*	in kg/Nm³
23			*Rho3*		*Input of value*	in kg/Nm³
24		press	p.min		Pressure according to 0/4 mA	
25			p.max		Pressure according to 20 mA	
26		*RG_DAT*	*CO2-CON*		*Input of value*	in %
27			*N2-CON*		*Input of value*	in %
28			*Ho,n*		*Input of value*	in MJ/m³
29			*density*		*Input of value*	in kg/Nm³
30		Signal	Damping		Input of value	
31			Timebas		Hours, minutes, seconds,	choosing the timebase
32			UNIT	V_N	Nm³, Nl	Unit for standard volumetric flow
33				* $\sum V_N$	Nm³, Nl	Unit for summation of V_N
34				m	kg, t, lbs	Unit for mass flow
35				* $\sum$m	Kg, t, kt	Unit for summation of m
36				t	°C, K, F	Unit for temperature
37				p	bar, kPa, hPa, psi	Unit for pressure
38		Outputs	Relay1	fnction	V_N, V.akt, m, t., p	Function of Relay
39				Charact	min, max	Characteristic of Relay
40				value	Input of value	
41			Relay2	fnction	V_N, V.akt, m, t., p	Function of Relay
42				Charact	min, max,	Characteristic of Relay
43				value	Input of value	
44			Analog1	fnction	V_N, V.akt, m, t., p	Function of analog output
45				Charact	4-20, 0-20	Current characteristic
46				Lo-Val	Input of value	Value for 0/4 mA

Only available, if the process GASKOMP is chosen in level 75

Only available, if the process AGA is chosen in level 75

Level	A	B	C	D	Input / indication	comments
47				Hi-VAL	Input of value	Value for 20 mA
48			Analog2	fnction	V_N, V.akt, m, t., p	Function of analog output
49				Charact	*4-20, 0-20*	Current characteristic
50				Lo-Val	*Wert eingeben*	Value for 0/4 mA
51				Hi-VAL	Input of value	Value for 20 mA
52						
53						
54						
55			RS232	Cycle	Input of value	
56				Baud	4800, 9600	Baud rate
		Purging		Wait	1… 120 sec	Waiting for signal of position indicator
				Cycle	0… 6000 min	Duration between purging cycles
				Duration	5… 60 sec	Duration of purging
				Extern	Extern/timer	External or time triggered control
				Level	High/Low	Level for external signal
				Pulse Length	1… 20 *10 ms	Pulse length for external signal
57		Tag.No.			Input of signs	Specification of TAG-No
58	calibrt	inputs	IN1	Lo-VAL	Connect 4mA to input, press ENTER o. Reset	Calibration of current input 1 low value
59				Hi-VAL	Connect 20mA to input, press ENTER o. Reset	Calibration of current input 1high value
60			IN2	see IN1	see IN1	see IN1
61			IN3	see IN1	see IN1	see IN1
62			IN4	see IN1	see IN1	see IN1
63			IN5	see IN1	see IN1	see IN1
64			IN6	see IN1	see IN1	see IN1
65			RTD1	LO-VAL	Connect 0 Ω to input, press ENTER o. Reset	Calibration or Pt100 input low value
66				HI-VAL	Connect 330 Ω to input, press ENTER o. Reset	Calibration or Pt100 input high value
67			RTD2	see RTD 1	see RTD 1	
68		outputs	OUT1	DAU-LO	adjustment: 4,0 mA	Output calibration for 4 mA
69				DAU-HI	adjustment: 20,0 mA	Output calibration for 20 mA
70			OUT2	see OUT1	see OUT1	
71	Config	Remote			Remote Control	To leave remote control press the RESET keys
72		Usernam			Input of value	Input of a username by using the arrow keys
73		Languag			Deutsch, English	Choose language
74		Struct	Sensors		Input of value	Choosing the sensor structure
75		Process			Ideal, AGA, Ethyl, Gaskomp	Calculation basis for the density
76		Reset			SW-Res, HW-Res, both, none	Reset of parametrisation and/or Structure **ATTENTION**! new calibration and parametrisation required
77		Acc_Cnt			N.o.acc.: 21	Account counter
78		In-Byte			Input of value	Choosing inputs as 0..20 or 4..20 mA
79	Factory	SERIAL.			Input of value	Serial number
80		Access			Reset of account counter	
81		HW-Byte			Input of value	Selecting the outputs
82		Name			Input of signs	Startup message
83	∑-Reset					Reset of summations
84	Access	ID-No.			Input of value	Choosing the access
85		Level			list	Choosing the access
86	Measure					Back to normal operation

* internal adders do not have a run over, that means that depending on configuration the value of the counter can be so high, that it is not possible to indicate the unit and the formula sign. For this reason it is necessary to reset the adders in time.

Short example for changing parameter value

It is necessary for you to change the value of temperature for 20 mA. Follow the short instruction below:

Press simultaneously both PROG-keys. If flow computer has a password, you have to set ID-no.. Programm „2552“. Now you allowed to change most of all menu points (see table below „Access“). Now press →-key. „PARAMS“ is indicated on the left side of display. Press SELECT-key. Press →-key as long as „TEMP1“ is shown on left side of display. Press SELECT-key. Press →-key as long as you can read „TEMP1,max“ on left side of display. Press SELECT-key. Now you can change value of temperature while using ← -, ↑-, → - and ↓ -key. Finish parameter setting while pressing SELECT-key. Press →-key as long as „ENDE“ is shown on left side of display. Press SELECT-key. Press →-key as long as „MEASURE“ is shown on the side of display. Press SELECT-key. Now the flow computer save parameter changing and starts measuring mode. If you want to protect parameter mode press both PROG-keys. Then press →-key as long as „ACCESS“ is shown on the left side of display. Press SELECT-key. Press one time →-key. Now „LEVEL“ is indicated. Press SELECT-key. Now „locked“ is shown on the left side of display. Now press SELECT-key. Go to menu-point END and then MEASURE to leave parameter mode. Now the flow computer is protected to not authorized programming.

***warning**: RESET-keys are only in use for factory setting*

Access

The following table shows the most important ID-codes with the available parts of the menu.

Code / Menu	0000 blocked	1508 worker	2552 Eng.	xxxx Labor.	xxxx OEM	xxxx Factory
INFO		x	x	x	x	x
PARAMS			x	x	x	x
CALIBRG				x	x	x
CONFIG					x	x
FACTORY						x
∑-RESET		x	x	x	x	x
ACCESS		x	x	x	x	x
MEASURE		x	x	x	x	x

Sensorbyte – menu point SENSORS (Level C/65)

The sensorbyte indicates, which inputs are available and how they can be used.. The following table should enable you to choose the correct sensorbyte.

inputs	**criteria: 0**	**criteria 1**	**choose 0 or 1**	**Bit**	
temperature 1	Transmitter	PT 100	0	1	0
Temperature 2	Transmitter	PT 100	0	2	0
pressure	Gauge pressure	abs pressure	1	4	4
Flow input 1 kind of sensor	velocity	dp	1	8	8
Flow input 1 signal	rad/current	lin/frequency	0	16	0
Flow input 2 kind of sensor	velocity	dp	0	32	0
Flow input 2 signal	rad/current	lin/frequency	0	64	0
				Sensorbyte =	12

k-Factor – Menu point k-factor (level D/7)

By using an averaging pitot tube, the k-factor of the dp-sensor can be taken from the differential pressure calculation sheet. For unknown k-factors the value can be calculated by using the following equation.

$$k = \sqrt{\frac{\rho_N * T_A}{\Delta p * p_A}} * \frac{15,23 * V_N}{D_i^2}$$

used units:

$V_N = \frac{Nm^3}{h}$	Standard volumetric flow	$\rho_N = \frac{kg}{Nm^3}$	Density at T=273,13K and p=101,325 kPa
$D_i = mm$	Internal diameter of the pipe	$\rho = \frac{kg}{m^3}$	Density under operation conditions
$\Delta p = mbar$	Full scale differential pressure	$p_A = kPa$	Design medium pressure
		$T_A = K$	Design medium temperature

The transfer characteristic

A square rooted or a linear characteristic can be chosen. The µFLOW offers the possibility to link a second differential pressure transmitter for the extension of the measuring range by measuring point switching. Under the menu options dp.min. and dp.max. the measuring range boundaries for this second transmitter can be indicated in the same way as it is already described above for the first transmitter.

Application of the RS232 Interface

The RS232 interface supports data logging.

Link and control of the µFLOW with a PC

The connection between µFLOW and PC is made by a three-core cable with max. 10 m length. The TxD clamp at the µFLOW is to be connected with the RxD line at the PC interface and the RxD clamp at the µFLOW with the TxD line of the PC.
The terminal software of the selected COM interface should be adjusted to operation without protocol or with XON / XOFF protocol. Only if a hardware protocol is intended, the appropriate handshake lines at the serial interface are to be short circuited.

Adjusting the Baud rate - menu option BAUD (level D/46)

Possible are 4800 and 9600 Baud.

Adjusting the duration of the transmission cycle - menu option CYCLE (level D/45)

The transmission cycle influences directly the developing data flood. Since it concerns with currents in all rule slow processes, the quantity of data which can be stored should be reduced to a meaningful measure. The µFLOW therefore supports a minimum interval of 5 seconds.

Parameters

According to the transfer parameters selected in the very most applications the µFLOW transmits with

- 8 data bits
- 1 stop bit
- without parity
- with XON / XOFF log

The Baud rate as well as the time between two transfers are adjustable, other parameters are not adjustable.

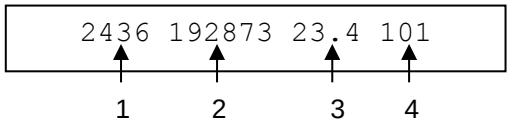
Protocol

Due to the low absolute transfer rates it should not come to any conflict in the communication between µFLOW and PC. Therefore a protocol is actually unnecessary. Nevertheless the transmission activity of the µFLOW can be controlled by transmitting XOFF by the PC and be continued with XON afterwards again for all cases. If the interruption should last longer than a transmission cycle, then the data resulting in the meantime are ignored.

Data format

The µFLOW transmits text character sequences (ASCii) with information about the momentary flow, the status of the totalizer as well as the primary status data pressure and temperature. The individual values are separated by blank (ASCii code 32).

A typical line read from left to right could look as follows:



1. actual value of the flow in adjusted unit
2. totalizer in adjusted unit
3. temperature in adjusted unit
4. pressure in adjusted unit

The entry and the processing of the measuring data is made according to the standard of the used hard- and software on the PC.

Trouble shooting

Description of the failure	Possible reason
No indication on thr display	Auxiliary power is missing
	Main fuse is defective (see page 8)
Instrument does not react on the current inputs	Sensorbyte chosen wrong (see page 12)
Instrument does not react on the frequency input	Sensorbyte chosen wrong (see page 12)
	Setting of the jumper does not fit to the signal (see page 6)
Instrument does not react on the Pt100 input	Sensorbyte chosen wrong (see page 12)
	DIP-switches in wrong position (see page 8)
Auxiliary power for the sensors is missing	Fuse for 24VDC defective (see page 8) There is no fuse from SN1001
	External short circuit
Indicated measured and calculated values are not realistic	Wrong parametrisation
Output current wrong	Wrong structure 0..20 mA instead of 4..20 mA or the other way round
	Zero or span value wrong

Of course this listing can not be complete. If any mistake occurs, which is not described here, please do not hesitate to contact us.

EC-Declaration of Conformity
according to Article 10.1 of the Directive 2007/108/EEC (EMC-Directive)

We,

S.K.I. Schlegel & Kremer Industrieautomation GmbH,
Hanns-Martin-Schleyer-Str. 22, 41199 Mönchengladbach

declare in the whole responsibility that the product:

Sensor Unit

Product

µFLOW

Type designation and (if necessary) serial number

the requirements under the Council Directive 2004/108/EC to compliance with the laws of Member States relating to electromagnetic compatibility fulfilled.
The product complies with the requirements of the following guidelines:

- **EMISSION**

EN 55011: 2009 – Limit Class A
(Limits and methods for the determination of electromagnetic radiations of industrial, scientific and medical (ISM) equipment)

- **IMMUNITY**

EN 61326-1: 2006
(Electrical equipment for measurement, control and laboratory use - Part 1 General Requirements)

- use of the product in residential and industrial areas -

This declaration is based on:

The above mentioned standards have been harmonized and published into the official journal of the EC Nbr. C59/2011

29.03.2011

Friedhelm Kremer
General Manager

S.K.I. Schlegel & Kremer Industrieautomation GmbH

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