



Differential Flow Metering System



with
Temperature
Compensation



DIFFERENTIAL FLOW COMPUTER with temperature compensation for corrected liquid volume

General information

The flowcomputer MICF127 has been developed to calculate the temperature corrected differential liquid volume. A typical application is the measurement of fuel consumption by engines on board ships where the total flow can be displayed in kg/hr . The usual difficulties encountered in such applications include: pulsating flows, low consumption readings, vibration and high ambient temperatures. These are all well catered for in the design and operation of the MICF127. The MICF127 will accept most input signals for flow and temperature. The corrected flow information is displayed as well as re-transmitted via the 4-20mA output signal. All process data and settings can be read and modified through the RS232 or RS485 Modbus communication link. For hazardous area applications, the unit has been certified intrinsically safe EExia IIB / IIC T4 with an allowed operational temperature of -30...+70°C .

Measured variables

Uncorrected volumetric flow and temperature in both the supply and return lines.

Calculated variables

Corrected volumetric flow in each line using the thermal expansion coefficient algorithm stored in the flowcomputer. The reference temperature can be defined as desired, e.g. 15°C or 60°F.

Input variables

Supply and return line flow and temperature.

Output variables

Corrected volumetric flowrate: differential, supply line and return line.
Resetable and non-resetable totalisers for differential corrected volume

Features

- displays differential compensated total, flowrate and accumulated total..
- supply line: displays temperature and compensated flowrate.
- return line: displays temperature and compensated flowrate.
- resetable compensated differential total.
- selectable on-screen engineering units.
- environmental protection to IP65 (NEMA4).
- very compact design for panel mount or wall-mount applications.
- many power supply options, including battery powered.
- operational temperature -30°C up to +80°C (-22°F up to 178°F)

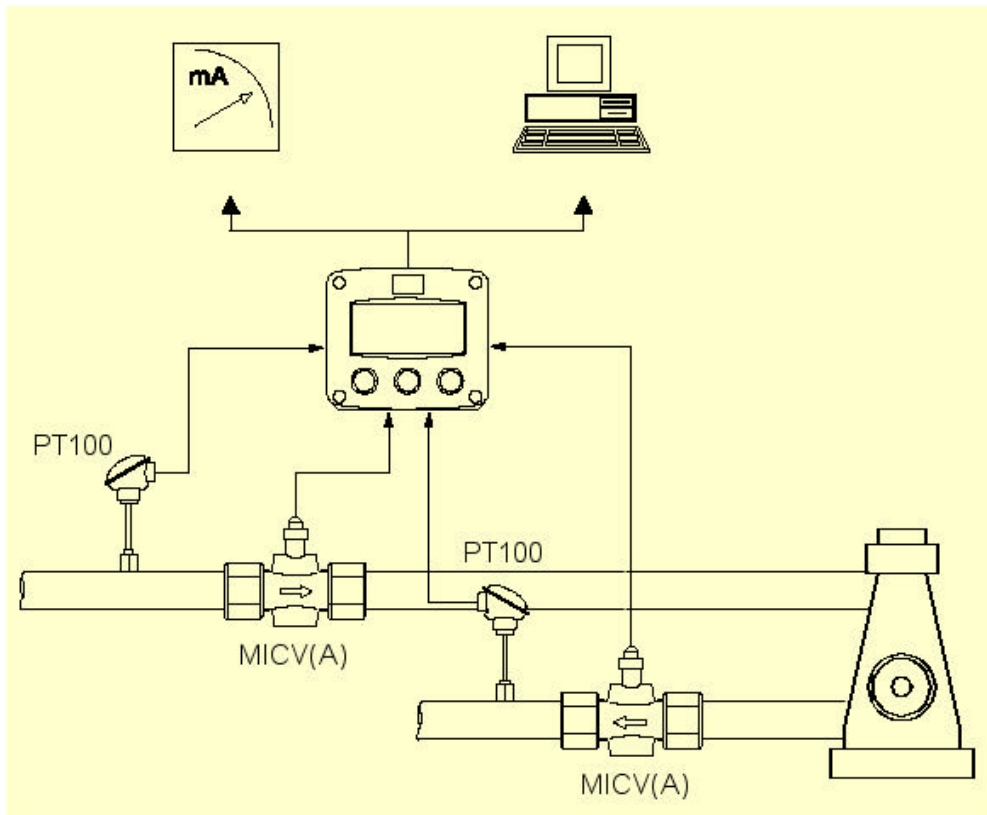
Options

- rugged aluminium enclosure IP67/NEMA4X.
- Intrinsically Safe EExia IIB / IIC T4.
- full Modbus communication.
- sensor supply 8 - 12 - 24V DC.
- Isolated or active 4-20mA output signal.

Input options

Flow	Temperature
• reed-switch	• PT100 - 2 or 3 wire
• NAMUR	• 0-20mA / 4-20mA
• NPN/PNP pulse	• 0-10V / 2-10V
• coil (sine wave)	
• 0-20mA / 4-20mA	
• 0-10V / 2-10V	

Application overview



Main display information



For the Operator, the following information and functions are available:

- calculated differential flowrate and calculated differential total,
- calculated differential accumulated total,
- line temperature and calculated flowrate supply line,
- line temperature and calculated flowrate return line,
- reset calculated differential total by pressing clear button twice.

Totals in : kg, L, m³, GAL, USGAL, lb, bbl, no unit in 1-2-3 decimals

Accumulated totals in: KG, L, m³, GAL, USGAL, lb, bbl, no unit in 1-2-3 decimals

Flowrate in: kg, mL, L, m³, Gallons, Ton, lb, bl, cf, RND, ft³, scf, Nm³, no unit in 1-2-3 decimals

Time in: /sec /min /hour /day

Temperature in: °C, °F, °K

Flowmeter Operation

The measuring chamber consists of only live basic parts; the top head, bottom head, cylinder, division plate, and piston. So simple in design that it can be readily taken apart and reassembled by any competent mechanic. The only moving part in the measuring chamber is the piston which oscillates smoothly in a circular motion between the two plane surfaces of the top and bottom heads.

With the piston the only moving part of the measuring element, long service life and sustained accuracy are attained through less wear. The division plate separates the inlet ports (A) and the outlet ports (B). The piston is slotted to clear the division plate, which also guides the travel of the piston in its oscillating motion.

The oscillating movement of the ring piston is transformed by a driver into a rotating movement. The permanent magnets built into the driver transmit the rotary motion through the closed wall of the measuring chamber to the adjustment gear.

The following illustrations show the four steps of a ring piston cycle.



DIAGRAM 1 Spaces 1 and 3 are receiving liquid from the inlet port (A) and spaces 2 and 4 are discharging through the outlet port (B).

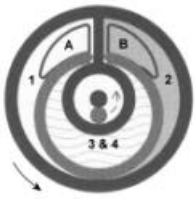


DIAGRAM 2 The piston has advanced and space 1, in connection with the inlet port, has enlarged; and space 2, in connection with the outlet port, has decreased, while spaces 3 and 4, which have combined, are about to move into position to discharge through the outlet port.



DIAGRAM 3 Space 1 is still admitting liquid from the inlet port and space 3 is just opening again to the inlet port, while spaces 2 and 4 are discharging through the outlet port.



DIAGRAM 4 Liquid is being received into space 3 and discharged from space 4, while spaces 1 and 2 have combined and are about to begin discharging as piston moves forward again to occupy position as shown in Diagram 1.

Fuel Oil Meters in every size and for every application



MICV with threaded connections



MICV with pulser

		DN15	DN20	DN25	DN40	DN50
Nominal diameter	mm	15	20	25	40	50
	inches	1/2	3/4	1	1 1/2	2
Nominal pressure	Thread bar	16				
	Flange bar	25,40				
Temperature	°C	70, 130, 180				
Maximum flow rate	l/h	600	1,500	3,000	9,000	30,000
Continuous flow rate	l/h	400	1,000	2,000	6,000	20,000
Minimum flow rate	l/h	10	30	75	225	750
Start-up at approx.	l/h	4	12	30	90	3000
Version with remote sensor:						
Reed pulser		*	*	*	*	*
Inductive pulser		*	*	*	*	*

Advantages

- Extremely high measuring precision
- unaffected by interference from non-uniform velocity distribution in the pipe flow. E.g. due to valves and pipe bends.
- Inspection and cleaning of the measuring chamber is no problem

Measuring Precision

For fluids with viscosity's from 1 to 20 mPa the precision is better than $\pm 0,5\%$ of the actual value over the entire measuring range. For uniform flow conditions, with constant pump delivery, the measuring error can even be reduced to $\pm 0\%$.

Adjustment gear

All Fuel oil meters are fitted with an adjustment gear with which they are adjusted in the factory to the guaranteed precision and afterwards sealed. It permits step-less correction of the counter and pulse transmitter over a range of $\pm 3\%$. Neither counter nor incorporated ancillaries need to be removed for this purpose. The planetary differential gear with torque splitting is combined with a friction wheel in such a way that only about 10% of the torque is carried by the wheel itself. This avoids both slipping and wear of the friction wheel. The whole unit is enclosed in a vacuum-sealed housing and thus protected against condensation, water and dust. The drives both to and from the adjustment gear are via central magnetic couplings.

Calibration

In case of special working conditions (p.E . Q=Constant), the Fuel oilmeter can be re-adjusted. Access to the regulation spindle is obtained after removal of the lead-sealed plug. If the meter has a minus error, i.e. too low count or too high discharge, the spindle is rotated in the direction marked '+' and vice versa. Correction is progressive, and the adjustment per revolution lies in the range of 0.1 to 0.6%.

Roller Counter

The six-position roller mechanical counter is contained in a casing with a transparent, oil-proof cover and is vacuum-sealed. The roller register is protected from dust and condense. To ensure easiest reading the counter can be rotated through 360° when required. Adjacent to the roller counter are two additional pointer scales with a centrally mounted pointer star to indicate flow start. The drive is taken via a central magnetic coupling.


Pulse transmitter

The roller counter can be equipped with an integrated pulser RV with reed-contact, whereas the inductive transmitter IN is installed as an additional element between adjustment gear and roller counter. This increases the overall height of the meter by 39 mm. All pulse transmitters, both the RV and the IN types, operate without any detrimental effect on the measuring precision of the meter.

Installation

The fuel oil meter can be installed in any desired position; no straight flow stretches are required up- or downstream of the meter. Care should be taken to provide good access for reading the meter.


Technical data

		Type MICR				
Type		MICR 15	MICR 20	MICR 25	MICR 40	MICR 50
DN	mm	15	20	25	40	50
	inch	1/2	3/4	1	1 1/2	2
Flanges		acc. DIN 2501 (SN21843)				
Overall Length	mm	165	165	190	300	350
Nominal Pressure	bar	25 (threaded connection 16bar)				
Operating temperature	°C	130 (180 as option available)				
Mounting position meter-head						
Forward/backward metering		yes				
Q _{max.}	l/h	400	1500	3000	9000	30000
Q _{max. Continuous}	l/h	200	750	1500	4500	15000
Q _{min.}	l/h	10	30	75	225	750
Accuracy	%	≤ ± 0.5 (of actual flow-rate)				
Repeatability	%	≤ ± 0.1				
Measuring Chamber Vol.	cm ³	12	36	100	330	1200
Smallest registered value	l	0.01	0.1	0.1	0.1	1
Registration Capacity	m ³	1000	10000	10000	10000	100000
Pulse Values:						
- RV K*=1		0.10	01.0	01.0	01.0	10
K=0.1		1.00	10.0	10.0	10.0	100
- IN inductive (NAMUR)	l / impulse					
K= 10		0.01	0.01	0.10	0.10	1.0
K= 1		0.10	0.10	1.00	1.00	10.0
Filter mesh	µm	400		400		800
Recommended dirt trap	µm	100		250		250
Weight appr.	kg	4	5.5	7	23.0	45.0
Body paint		Enamelled yellow RAL 1007 OIL-RESIST				

K = Number of pulses per revolution of the smallest (left) dial.

Technical data

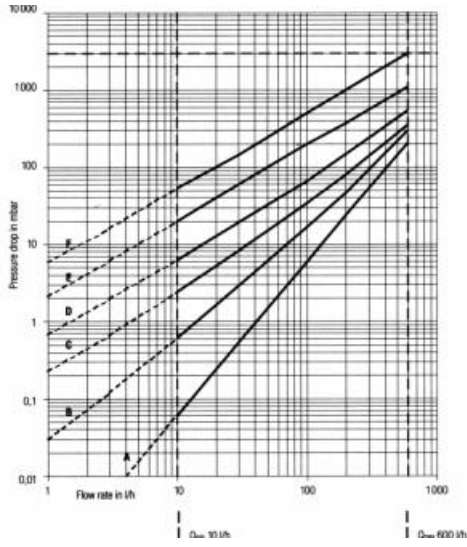
Type MICV / MICVA

Type		MICV 15	MICV 20	MICV 25	MICV 40	MICV 50
DN	mm	15	20	25	40	50
	inch	1/2	3/4	1	1 1/2	2
Flanges		acc. DIN2501 (SN218643)				
Overall Length	mm	165	165	190	300	350
Nominal Pressure	bar	25 (16 for threaded ends)				
Operating temperature	°C	130				
Mounting position meter-head						
Forward/backward metering		yes				
Q _{max.}	l/h	600	1500	3000	9000	30000
Q _{max. Continuous}	l/h	400	1000	2000	6000	20000
Q _{min.}	l/h	10	30	75	225	750
Accuracy	%	≤ ± 1 (of actual flowrate)				
Repeatability	%	≤ ± 0.2				
Measuring Chamber Vol.	cm ³	12	36	100	333	1200
Smallest readable amount	l	0.01	0.1	0.1	0.1	1
Registration Capacity	m ³	1000	10000	10000	10000	100000
Pulse Values:						
- IN inductive (NAMUR)		0.01	0.01	0.10	0.10	1.00
- RV K*=1	l / impulse	0.10	1.00	1.00	1.00	10.00
K=0.1		1.00	-	-	10.00	100.0
Filter mesh	µm	400		400		800
Recommended dirt trap	µm	100		250		250
Weight appr.	kg	3.8	4.5	7.7	20.5	40.0
Body paint		RAL 3013 OIL-RESIST				

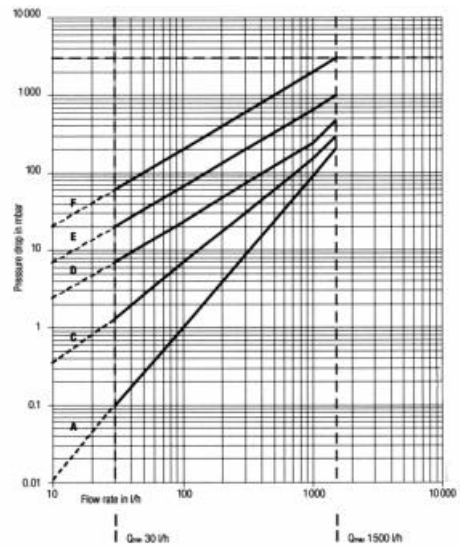
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Pressure Drop Curves

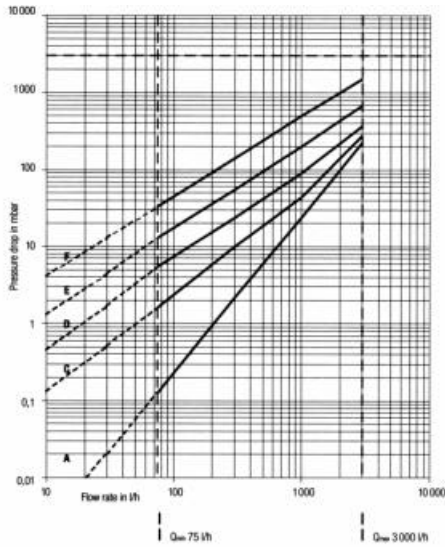
MICV / MICR 15



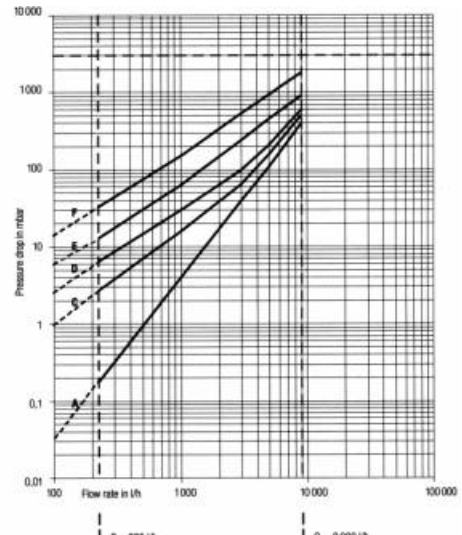
MICV / MICR 20



MICV / MICR 25



MICV / MICR 40



MICV / MICR 50

