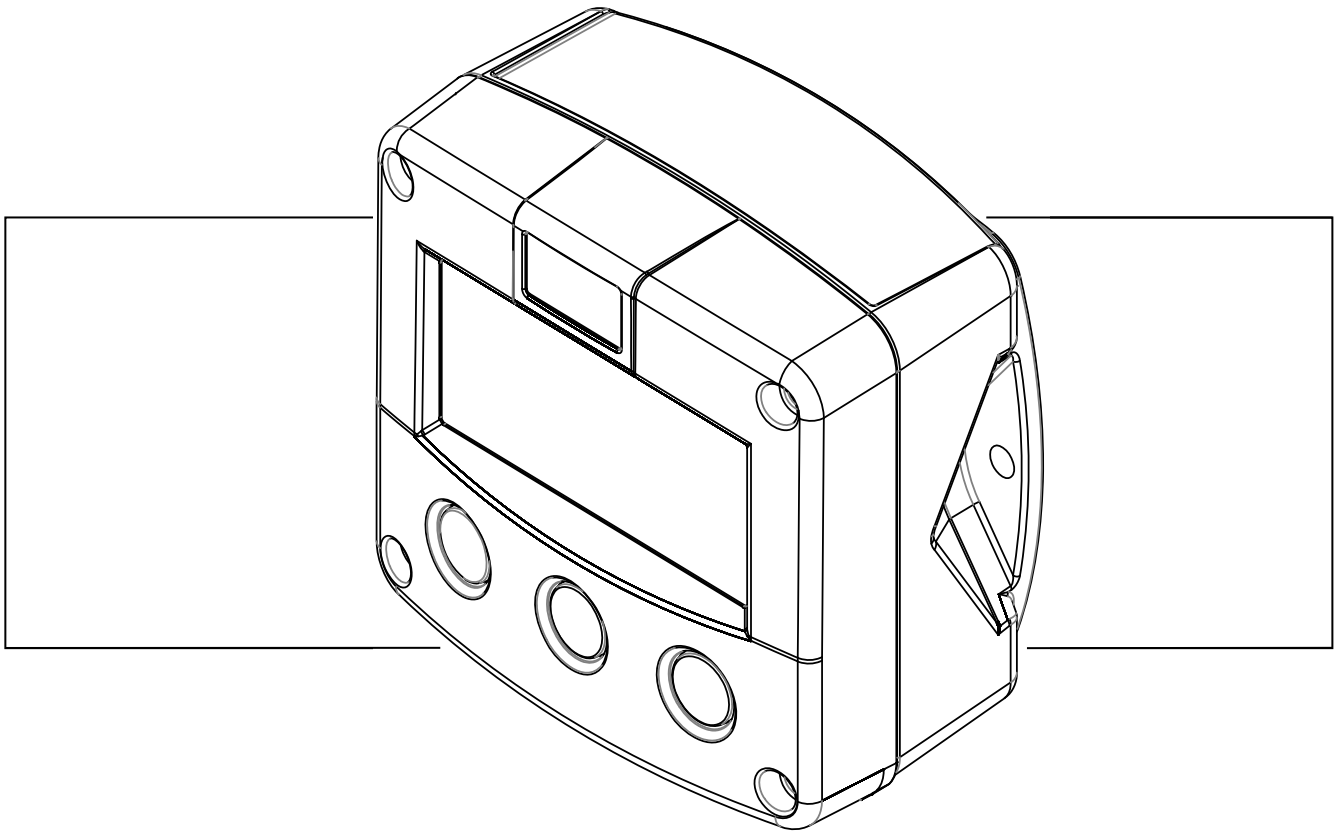
DOG-4-6 electronic option M0/N0/O0/P0

FLOW COMPUTER FOR CORRECTED GAS VOLUME



Signal input flowmeter - type P: pulse

Signal input pressure - type IA: 4-20mA

Signal input temperature - type TP: PT100 2- or 3 wire

Signal output: 4-20 mA ref. flow rate and pulse ref. volume quantity

Option: Modbus communication

CE

SAFETY INSTRUCTIONS

▪ Any responsibility is lapsed if the instructions and procedures as described in this manual are not followed.

▪ LIFE SUPPORT APPLICATIONS: The flow computer is not designed for use in life support appliances, devices, or systems where malfunction of the product can reasonably be expected to result in a personal injury. Customers using or selling these products for use in such applications do so at their own risk and agree to fully indemnify the manufacturer and supplier for any damages resulting from such improper use or sale.

▪ Electro static discharge does inflict irreparable damage to electronics! Before installing or opening the unit, the installer has to discharge himself by touching a well-grounded object.

▪ This unit must be installed in accordance with the EMC guidelines (Electro Magnetic Compatibility).

SAFETY RULES AND PRECAUTIONARY MEASURES

▪ The manufacturer accepts no responsibility whatsoever if the following safety rules and precautions instructions and the procedures as described in this manual are not followed.
▪ Modifications of the flow computer implemented without preceding written consent from the manufacturer, will result in the immediate termination of product liability and warranty period.
▪ Installation, use, maintenance and servicing of this equipment must be carried out by authorized technicians.
▪ Check the mains voltage and information on the manufacturer's plate before installing the unit.
▪ Check all connections, settings and technical specifications of the various peripheral devices with the flow computer supplied.
▪ Open the casing only if all leads are free of potential.
▪ Never touch the electronic components (ESD sensitivity).
▪ If the operator detects errors or dangers, or disagrees with the safety precautions taken, then inform the owner or principal responsible.
▪ The local labor and safety laws and regulations must be adhered to.

ABOUT THE OPERATION MANUAL

This operation manual is divided into two main sections:

- The daily use of the unit is described in chapter 2 "Operational". These instructions are meant for users.
- The following chapters and appendices are exclusively meant for electricians/technicians. These provide a detailed description of all software settings and hardware installation guidance.

This operation manual describes the standard unit as well as most of the options available. For additional information, please contact your supplier.

A hazardous situation may occur if the FLOW COMPUTER is not used for the purpose it was designed for or is used incorrectly. Please carefully note the information in this operating manual indicated by the pictograms:


Caution !

A "**caution**" indicates actions or procedures which, if not performed correctly, may lead to personal injury or incorrect functioning of the flow computer or connected instruments.


Note !

A "**note**" indicates actions or procedures which, if not performed correctly, may indirectly affect operation or may lead to an instrument response which is not planned.

Manufactured and sold by:

Kobold Messring GmbH
Nordring 22-24
D-65719 Hofheim
Tel.: +49(0)6192-2990
Fax: +49(0)6192-23398
E-Mail: info.de@kobold.com
Internet: www.kobold.com

CONTENTS MANUAL

The instruction manuals on our website www.kobold.com are always for currently manufactured version of our products. Due to technical changes, the instruction manuals available online may not always correspond to the product version you have purchased. If you need an instruction manual that corresponds to the purchased product version, you can request it from us free of charge by email (info.de@kobold.com) in PDF format, specifying the relevant invoice number and serial number. If you wish, the operating instructions can also be sent to you by post in paper form against an applicable postage fee.

1. INTRODUCTION

1.1. General notice

This operating manual provides assistance and instructions to clients of Kobold Messring GmbH for the installation and configuration of the flow computer when used in combination with a type DOG-… oscillation flowmeter.

This operating manual is a supplement to existing documents, such as the data sheet and the operating manual for the DOG-… oscillation flow meter.

This document is subject to change due to technical improvements. This version replaces all previous versions of the document.

1.2 Device description

The flow computer is a microcontroller-operated display device for the calculation of the standard volume flow and total volume flow of gases dependent on temperature and pressure. Figure 1 shows a typical application of the flow computer.

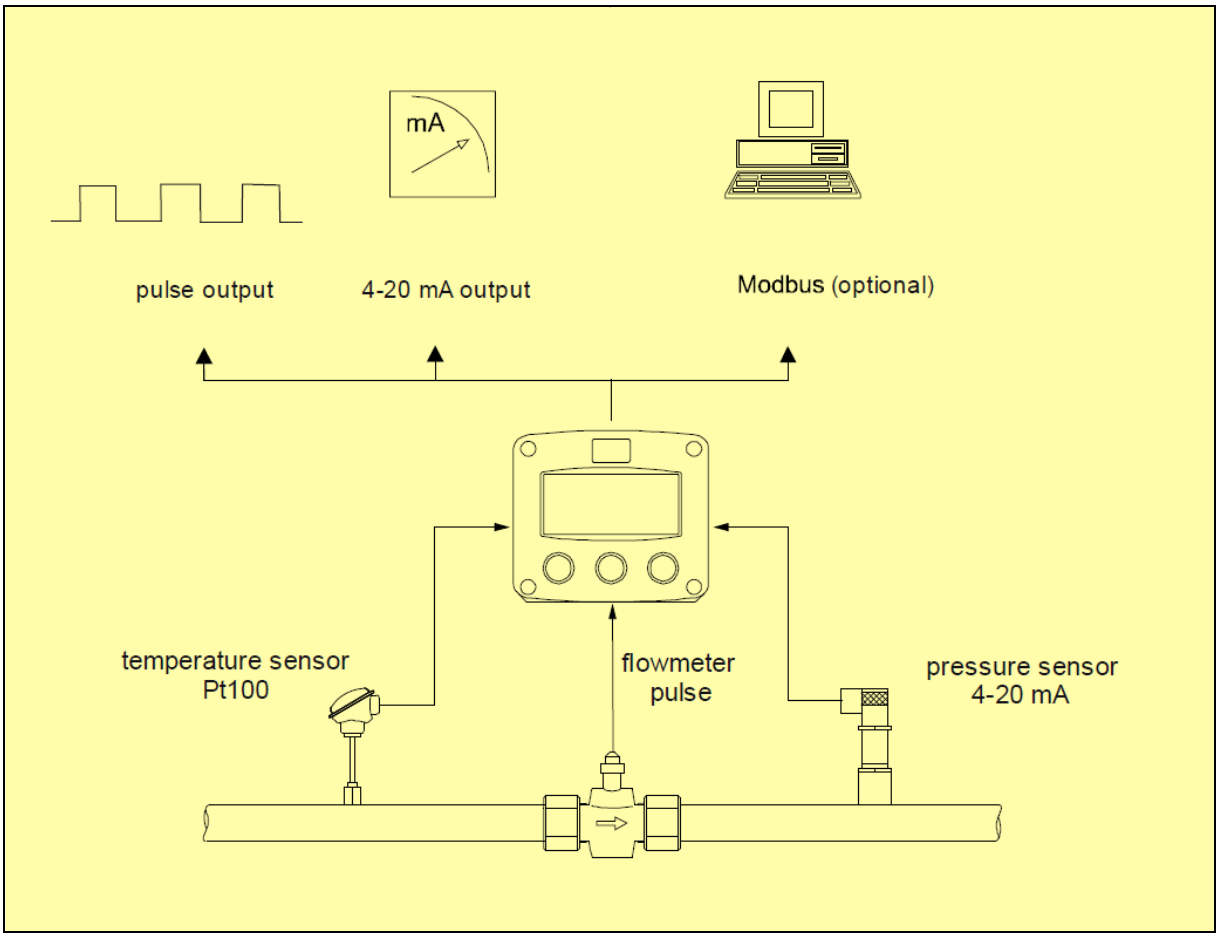


Fig. 1: Typical application for the flow computer.

The flow computer is installed together with, and pre-wired to, a DOG-… transmitter in a control box. A connector rail with all required inputs and outputs is provided for the user. The rail's connection layout is displayed on the switch box's safety cover. Electric wiring must be done in accordance with the wiring diagram following in chapter 4.

The flow computer is preconfigured by the factory. The table containing the factory settings can be found in annexure D.

The measuring range and the K-factor are pre-set according to client requirements. Linearization is switched off. The linearization settings should not be altered.

The analogue output (4-20mA) is also factory-calibrated. Please do not change the settings in menu points 95 and 96, as the calibration points will otherwise be altered.

The pulse output is scaled according to the volume quantity (for example, one pulse every 12m^3). The factory setting is one pulse per m^3. The pulse duration can be adjusted between 0.001 and 9.999 seconds. The standard setting is 0.010 seconds.

Volume flow normalization is not active upon delivery of the flow computer and it is unable to display normalized volume flow without temperature and pressure sensors.

If you wish to measure norm volume flow it is essential that you connect a pressure sensor (4-20mA) and a temperature sensor (2 or 3-wire PT100). These are not included in the scope of delivery.

1.3 Commissioning instructions

Before the DOG-… device is used with a flow computer the operator must adjust several parameters.

1. If you make use of 2-wire temperature sensors you must set "NUMBER WIRES" in menu point 61 to 2.
2. Adjust the measuring range of the analogue pressure sensor used in menu points 72 and 73. The factory setting for the measuring range is 2.5 bar.
3. If you make use of an absolute pressure sensor the input value for OFFSET in menu point 74 must be set to 0.000 bar.
4. If you enter the standard values in menu 82, 83, 84 and 85, the formula for conversion to the norm volume flow is activated. It is not essential that the unit be changed from m^3/h to the standardised unit Nm^3/h. It has no effect on the calculation of the norm volume flow.
5. You can deactivate the compressibility factor if you set one value in menu points 84 or 85 to zero. If you wish to deactivate normalization completely you must set all norm values (menu points 82, 83, 84, and 85) to zero.

2. OPERATIONAL

2.1. GENERAL

- *The flow computer may only be operated by personnel who are authorized and trained by the operator of the facility. All instructions in this manual are to be observed.*
- *Take careful notice of the "Safety rules, instructions and precautionary measures" in the front of this manual.*

This chapter describes the daily use of the flow computer. This instruction is meant for users / operators.

2.2. CONTROL PANEL

The following keys are available:

Fig. 2: Control Panel.

Functions of the keys

This key is used to program and save new values or settings.
It is also used to get access to SETUP-level; please read chapter 3.

This key is used to SELECT accumulated total.
The arrow-key ▲ is used to increase a value after PROG has been pressed or to configure the unit; please read chapter 3.

Press this key twice to CLEAR the value for total.
The arrow-key ▶ is used to select a digit after PROG has been pressed or to configure the unit; please read chapter 3.

2.3. OPERATOR INFORMATION AND FUNCTIONS

In general, the flow computer will always act function at Operator level. The information displayed is dependent upon the SETUP-settings. The signal generated by the connected flowmeter is measured by the flow computer in the background, whichever screen refresh rate setting is chosen. After pressing a key, the display will be updated very quickly during a 30 second period, after which it will slow-down again.

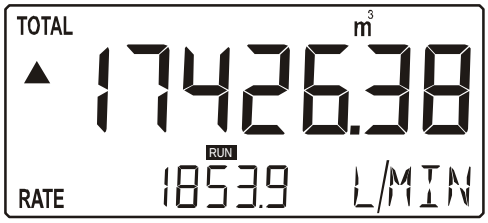


Fig. 3: Example of display information during process.

For the Operator, the following functions are available:

- **Display 'calculated flow rate / total' or only 'calculated flow rate'**
  This is the main display information of the flow computer. After selecting any other information, it will always return to this main display automatically.
  Total is displayed at the upper-line of the display and Flow rate and Accumulated Total on the bottom line.
  Possibly, only Flow rate will be displayed with the large 17mm digits; do press the SELECT-key to read the Total. When "-------" is shown, the flow rate value is too high to be displayed. The arrows ⬍ indicate the increase / decrease of the flow rate trend.

- **Clear total**
  The value for total can be re-initialized. To do so, press CLEAR twice. After pressing CLEAR once, the flashing text "PUSH CLEAR" is displayed. To avoid re-initialization in this stage, press another key as CLEAR or wait for 20 seconds.
  Re-initialization of total DOES NOT influence the accumulated total.

- **Display calculated accumulated total**
  When the SELECT-key is pressed, total and accumulated total are displayed. The accumulated total cannot be re-initialized. The value will count up to 99,999,999,999. The unit and number of decimals are displayed according to the configuration settings for total.

- **Display line pressure**
  After pressing SELECT, the actual measured pressure is displayed.

- **Display line temperature**
  After pressing SELECT, the actual measured temperature is displayed.

DISPLAY ALARMS

- **Out of Range**
  When "(-)9999" is displayed, the frequency is out of range of the low or high limit settings.

Fig. 4: Example of Out of Range alarm.

- **Alarm 01-03**
  When "alarm" is displayed, please consult Appendix B: Problem Solving.

3. CONFIGURATION

3.1. INTRODUCTION

This and the following chapters are exclusively meant for electricians and non-operators. In these, an extensive description of all software settings and hardware connections are provided.

Caution !

▪ Mounting, electrical installation, start-up and maintenance of the instrument may only be carried out by trained personnel authorized by the operator of the facility. Personnel must read and understand this Operating Manual before carrying out its instructions.
▪ The flow computer may only be operated by personnel who are authorized and trained by the operator of the facility. All instructions in this manual are to be observed.
▪ Ensure that the measuring system is correctly wired up according to the wiring diagrams. The housing may only be opened by trained personnel.
▪ Take careful notice of the "Safety rules, instructions and precautionary measures" in the front of this manual.

3.2. PROGRAMMING SETUP-LEVEL

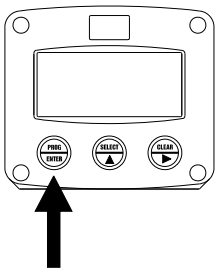
3.2.1. GENERAL

Configuration of the flow computer is done at SETUP-level. SETUP-level is reached by pressing the **PROG/ENTER** key for 7 seconds; at which time, both arrows ⬍ will be displayed. In order to return to the operator level, **PROG** will have to be pressed for three seconds. Alternatively, if no keys are pressed for 2 minutes, the unit will exit SETUP automatically.
SETUP can be reached at all times while the flow computer remains fully operational.

Note !

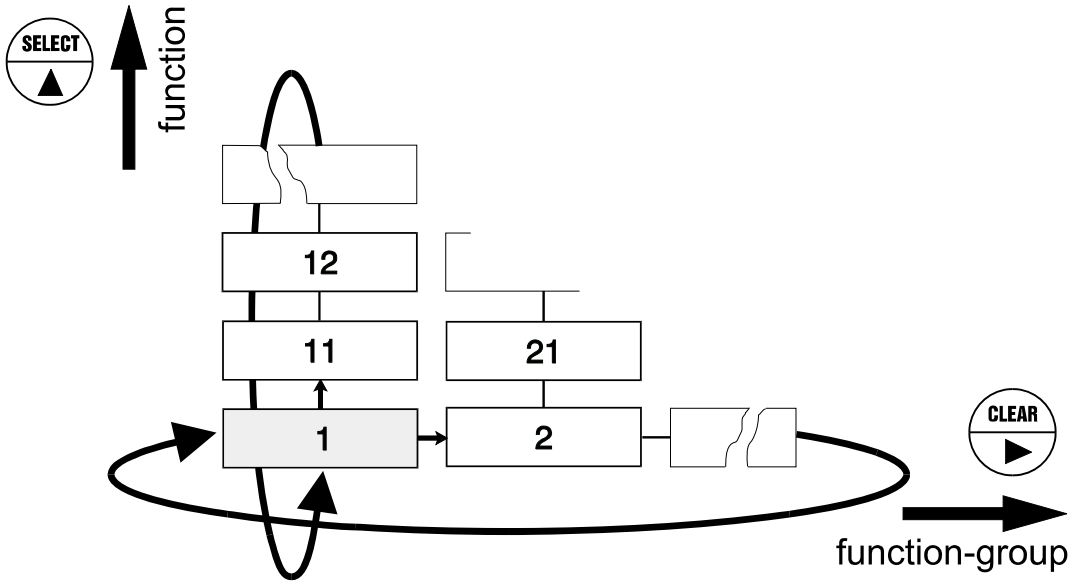
Note: *A password may be required to enter SETUP. Without this password access to SETUP is denied.*

To enter SETUP-level:



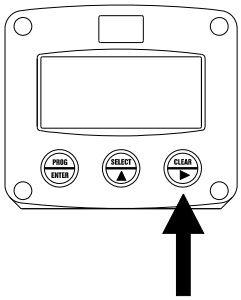
Press PROG ENTER for 7 seconds

Matrix structure SETUP-level:

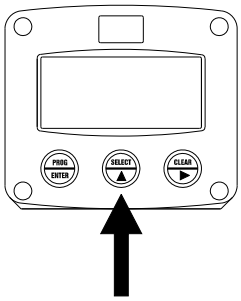


SCROLLING THROUGH SETUP-LEVEL

Selection function-group and function:
SETUP is divided into several function groups and functions.



Select function-group with CLEAR

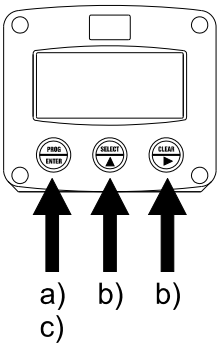


Select function with SELECT

Each function has a unique number, which is displayed below the word "SETUP" at the bottom of the display. The number is a combination of two figures. The first figure indicates the function-group and the second figure the function. Additionally, each function is expressed with a keyword.

After selecting a sub-function, the next main function is selected after scrolling through all "active" sub-functions (e.g. 1▲, 11▲, 12▲, 13▲, 14▲, 1▶, 2▶, 3▲, 31 etc.).

To change or a select a value or value:



a) press PROG ENTER briefly; **PROGRAM** will start flash

b) select or enter value with SELECT and / or CLEAR

c) press PROG ENTER to confirm the value / selection.

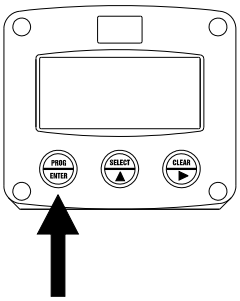
To change a value, use ▸ to select the digits and ▲ to increase that value.
To select a setting, both ▲ and ▸ can be used.
When the new value is not valid, the increase sign▲ or decrease-sign▼ will be displayed while you are programming.

When data is altered but **ENTER** is not pressed, then the alteration can still be cancelled by waiting for 20 seconds or by pressing **ENTER** for three seconds: the PROG-procedure will be left automatically and the former value reinstated.

Note !

Note: *alterations will only be set after* ***ENTER*** *has been pressed!*

To return to OPERATOR-level:



Press PROG ENTER for 3 seconds

In order to return to the operator level, **PROG** will have to be pressed for three seconds. Also, when no keys are pressed for 2 minutes, SETUP will be left automatically.

3.2.2. OVERVIEW FUNCTIONS SETUP LEVEL

SETUP FUNCTIONS AND VARIABLES			
1	**TOTAL**		
	11	UNIT	L - m3 - kg - lb - GAL - USGAL - bbl - no unit
	12	DECIMALS	0 - 1 - 2 - 3 (Ref: displayed value)
	13	K-FACTOR:	0.000010 - 9,999,999
	14	DECIMALS K-FACTOR	0 - 6
2	**FLOW RATE**		
	21	UNIT	mL - L - m3 - mg - g - kg - ton - GAL - bbl - lb - cf - REV - no unit - scf - Nm3 - NL - P
	22	TIME UNIT	sec - min - hour - day
	23	DECIMALS	0 - 1 - 2 - 3 (Ref: displayed value)
	24	K-FACTOR	0.000010 - 9,999,999
	25	DECIMALS K-FACTOR	0 - 6
	26	CALCULATION	1 - 99
3	**DISPLAY**		
	31	FUNCTION	total - rate
	32	LIGHT	) 0% – 20% - 40% - 60% - 80% - 100% (FULL BRIGHTNESS)
	33	LCD UPDATE	fast - 1 sec - 3 sec - 15 sec - 30 sec - off
	34	BATTERY MODE	operational - shelf
4	**FLOWMETER**		
	41	SIGNAL	npn - npn_lp - namur
	42	LO LIMIT	000.0 – 999.9
	43	HI LIMIT	000.0 – 999.9
5	**LINEARISATION**		
	51	FREQ. / FLOW RATE 1	0.01 – 999,99 Hz / 0000.001 – 9999999
	52	FREQ. / FLOW RATE 2	0.01 – 999,99 Hz / 0000.001 – 9999999
	53	FREQ. / FLOW RATE 3	0.01 – 999,99 Hz / 0000.001 – 9999999
	54	FREQ. / FLOW RATE 4	0.01 – 999,99 Hz / 0000.001 – 9999999
	55	FREQ. / FLOW RATE 5	0.01 – 999,99 Hz / 0000.001 – 9999999
	56	FREQ. / FLOW RATE 5	0.01 – 999,99 Hz / 0000.001 – 9999999
	57	FREQ. / FLOW RATE 7	0.01 – 999,99 Hz / 0000.001 – 9999999
	58	FREQ. / FLOW RATE 8	0.01 – 999,99 Hz / 0000.001 – 9999999
	59	FREQ. / FLOW RATE 9	0.01 – 999,99 Hz / 0000.001 – 9999999
	5A	FREQ. / FLOW RATE 10	0.01 – 999,99 Hz / 0000.001 – 9999999
	5B	FREQ. / FLOW RATE 11	0.01 – 999,99 Hz / 0000.001 – 9999999
	5C	FREQ. / FLOW RATE 12	0.01 – 999,99 Hz / 0000.001 – 9999999
	5D	FREQ. / FLOW RATE 13	0.01 – 999,99 Hz / 0000.001 – 9999999
	5E	FREQ. / FLOW RATE 14	0.01 – 999,99 Hz / 0000.001 – 9999999
	5F	FREQ. / FLOW RATE 15	0.01 – 999,99 Hz / 0000.001 – 9999999

6	**TEMPERATURE**		
	61	NR. OF WIRES	2 - 3
	62	FILTER	1 - 99
	63	DISPLAY	°C - °F - K
7	**PRESSURE**		
	71	UNIT	mbar - bar- psi
	72	SPAN	0.000001 - 9,999,999 unit
	73	DECIMALS SPAN	0 - 6
	74	OFF-SET	0.000 - 9,999.999 unit
	75	FILTER	1 - 99
	76	CALIBRATE LOW	default - calibrate - calibrate set
	77	CALIBRATE HIGH	default - calibrate - calibrate set
8	**EQUATION**		
	81	EQUATIONS TYPE	EG - (fixed)
	82	NORMAL TEMPERAT.	0.000 - 9,999.999
	83	NORMAL PRESSURE	0.000 - 9,999.999
	84	NORMAL COMPRESS.	0 - 9,999,999
	85	COMPRESSIBILITY	0 - 9,999,999
9	**ANALOG**		
	91	OUTPUT	disable - enable
	92	Rate-Min (4mA)	0000.000 - 9,999,999
	93	Rate-Max (20mA)	0000.000 - 9,999,999
	94	CUT-OFF	0.0 - 9.9%
	95	TUNE MIN - 4mA / 0V	0 - 9,999
	96	TUNE MAX- 20mA / 10V	0 - 9,999
	97	FILTER	1 - 99
A	**IMPULSE**		
	A1	PULSE WIDTH	0.000 - 9.999 sec (0 = off)
	A2	DECIMALS	0 – 1 - 2 - 3
	A3	AMOUNT	0000.001 – 9,999,999 (ref. A2)
B	**COMMUNICATION**		
	B1	SPEED / BAUDRATE	1200 - 2400 - 4800 - 9600
	B2	ADDRESS	1 - 255
	B3	MODE	rtu - off
C	**OTHERS**		
	C1	MODEL	DOG-..
	C2	TYPE	M-N
	C3	SOFTWARE VERSION	03.01.XX
	C4	SERIAL NO.	
	C5	PASSWORD	0000 - 9999
	C6	TAGNUMBER	0000000 - 9999999

3.2.3. EXPLANATION SETUP-FUNCTIONS

1 - Total	
MEASUREMENT **11**	SETUP - 11 determines the measurement unit for total and accumulated total. The following units can be selected: L - m3 - kg - lb. - GAL - USGAL - bbl - _ (no unit). Alteration of the measurement unit will have consequences for operator and SETUP-level values. Please note that the K-factor has to be adapted as well; the calculation is not done automatically.
DECIMALS **12**	The decimal point determines for total and accumulated total the number of digits following the decimal point. The following can be selected: 0000000 - 111111.1 - 22222.22 - 3333.333

K-FACTOR **13**	With the K-factor, the flowmeter pulse signals are converted to a quantity. The K-factor is based on the number of pulses generated by the flowmeter per selected measurement unit (SETUP 11), for example per cubic meter. The more accurate the K-factor, the more accurate the functioning of the system will be. **Example 1:** **Calculating the K-factor.** *Let us assume that the flowmeter generates 2.4813 pulses per liter and the selected unit is "cubic meters / m3". A cubic meter consists of 1000 parts of one liter which implies 2481.3 pulses per m3. So, the K-factor is 2481.3. Enter for SETUP - 13: "2481300" and for SETUP - 14 - decimals K-factor "3".* **Example 2:** **Calculating the K-factor.** *Let us assume that the flowmeter generates 6.5231 pulses per gallon and the selected measurement unit is gallons. So, the K-Factor is 6.5231. Enter for SETUP - 13: "6523100" and for SETUP - 14 decimals K-factor "6".*
DECIMALS K-FACTOR **14**	This setting determines the number of decimals for the K-factor (SETUP 13). The following can be selected: 0 - 1 - 2 - 3 - 4 - 5 - 6 Please note that this function influences the accuracy of the K-factor indirectly. This setting has NO influence on the displayed number of digits for total (SETUP 12)!

2 - Flow rate	
The settings for total and flow rate are entirely separate. In this way, different units of measurement can be used for each e.g. cubic meters for total and liters for flow rate. The display update time for flow rate is one second or more. ***Note:*** *these settings also influence the analog output.*	
MEASUREMENT UNIT **21**	SETUP - 21 determines the measurement unit for flow rate. The following units can be selected: mL - L - m3 - mg - g - kg - ton - GAL - bbl - lb - cf - REV - no unit - scf - Nm3 - NL - P. Alteration of the measurement unit will have consequences for operator and SETUP-level values. Please note that the K-factor has to be adapted as well; the calculation is not done automatically.
TIME UNIT **22**	The flow rate can be calculated per second (SEC), minute (MIN), hour (HR) or day (DAY). Sec – Min – Hr – Day
DECIMALS **23**	This setting determines for flow rate the number of digits following the decimal point. The following can be selected: 00000 - 1111.1 - 2222.22 - 3333.333
K-FACTOR **24**	With the K-factor, the flowmeter pulse signals are converted to a flow rate. The K-factor is based on the number of pulses generated by the flowmeter per selected measurement unit (SETUP 21), for example per liter. The more accurate the K-factor, the more accurate the functioning of the system will be. For examples read SETUP 13.
DECIMALS K-FACTOR **25**	This setting determines the number of decimals for the K-factor (SETUP 24). The following can be selected: 0 - 1 - 2 - 3 - 4 - 5 - 6 Please note that this SETUP - influences the accuracy of the K-factor indirectly. This setting has NO influence on the displayed number of digits for "flow rate" (SETUP 23)!
CALCULATION **26**	The flow rate is calculated by counting the number of pulses within a certain time, for example 1 second. The longer the time the more accurate the flow rate will be. The maximum value is 999.9 seconds. ***Note:*** *this setting does influence the update time for the analog output directly (maximum update 10 times a second). If the output response is too slow, decrease the number of pulses.* **Note:** *the shorter the time, the higher the power consumption of the unit will be (important for battery powered applications).*


Note !

3 - Display

When used with the internal battery option, the user may hold the concern of reliable measurement over a long period of time. The flow computer has several smart power management functions to extend the battery life time significantly. Two of these functions can be set:

FUNCTION **31**	The large 17mm digits can be set to display total or flow rate. • "total": both total and flow rate are displayed simultaneously. • "rate": only flow rate will be displayed with its measuring unit while total will be displayed after pressing **SELECT**.
LIGHT (BACKLIGHT BRIGHTNESS) **32**	The density of the backlight can be set in following range: 0% (OFF) – 20% - 40% - 60% - 80% - 100% (FULL BRIGHTNESS)
LCD UPDATE **33**	The calculation of the display-information influences the power consumption significantly. When the application does not require a fast display update, it is **strongly advised** to select a slow refresh-rate. Please understand that NO information will be lost; the input signal will be processed normally as well as the output-signals. The following can be selected: Fast - 1 sec - 3 sec - 15 sec - 30 sec - off. **Example** **Battery life-time** *battery life-time with a FAST update: about 2 years.* *battery life-time with a 1 sec update: about 5 years.* ***Note:*** *after a button has been pressed by the operator - the display refresh-rate will always be FAST during 30 seconds. When "OFF" is selected, the display will be switched-off after 30 seconds and will be switched-on as soon as a button has been pressed.*
BATTERY-MODE **34**	The unit has two modes: operational or shelf. After "shelf" has been selected, the unit can be stored for several years; it will not process the signal, the display is switched-off but all settings and totals are stored. In this mode, power consumption is extremely low. To wake-up the unit again; press the **SELECT**-key twice.


Note !

Note !

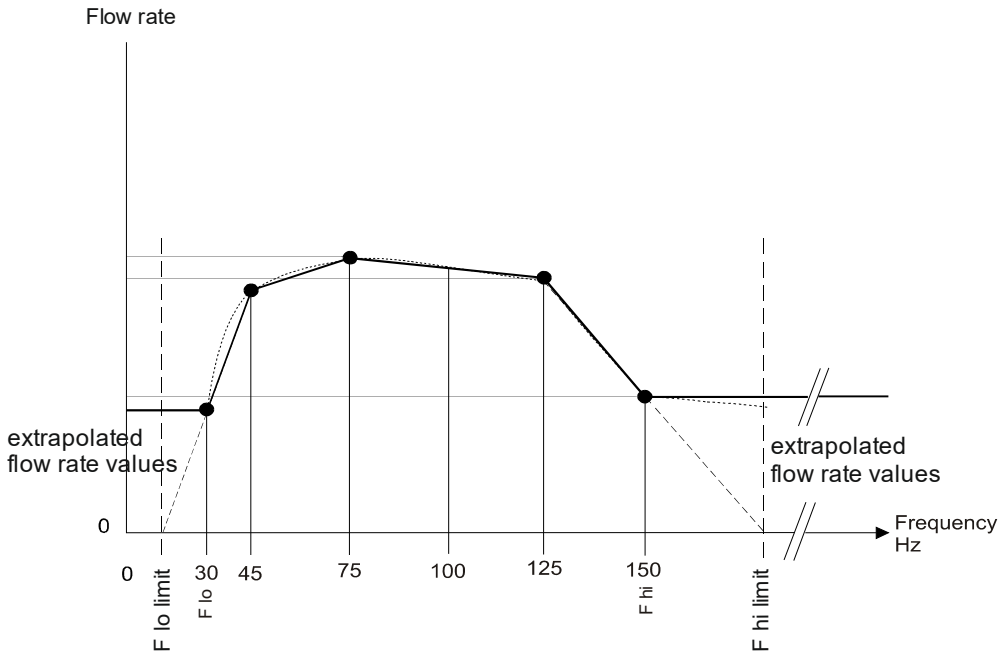
4 - Flowmeter				
SIGNAL **41**	The flow computer is able to handle several types of signals. The type of flowmeter pickup / signal is selected with SETUP 41. ***Note:*** *The selections "active pulse" offers a detection level of 50 % of the supply voltage.* Read also par. 4.4.3. Flowmeter input terminal 09-11.			
TYPE OF SIGNAL	EXPLANATION	RESISTANCE	FREQ. / mV	REMARK
NPN	NPN input	100K pull-up	6 kHz	(open collector)
NPN - LP	NPN input with low pass filter	100K pull-up	2.2 kHz	(open collector) less sensitive
NAMUR	Namur input	820 Ohm pull-down	4 kHz	External power required
LO LIMIT **42**	A low frequency limit with two decimals (12.34) can be entered. To indicate the pulse frequency is lower than the frequency lo-limit: • The flow rate will be set to its lowest possible value e.g. -9999. • The analog output will drive the lowest current possible (< 4mA). When the frequency is lower than Flo limit, the totalizer functionality is stopped, preventing any additions.			
HI LIMIT **43**	A high frequency limit with two decimals (12.34) can be entered. To indicate the pulse frequency is higher than the frequency hi-limit: • The flow rate will be set to its highest possible value e.g. 9999. • The analog output will drive the lowest current possible (< 4mA). Furthermore, totalization will continue, unless the extrapolated flow rate is <= 0.			

5 - Linearization

The linearization function is available to approach the real flowcurve better as with the general K-factor entered with setup 14 and 24. This to obtain a more accurate flow rate, total and accumulated total as well as a pulse output at any flowmeter frequency.
A maximum of 15 linearization-positions can be entered while the interpolation will calculate any other position in-between or extrapolation for any other position outside.

In each linearization entry, a frequency and its according flow rate can be entered.
When the frequency at the linearization entry is set to 0.00Hz, the entry is not used in the linearization.

The frequency ranges from 0.00Hz till 999.99Hz and is fixed on 2 decimals. It is advised to enter the frequencies in increasing order, however it is not necessary. Please have a look at following example to understand the method of linearization:



Note !

Note: *When the extrapolated flow rate is below zero (<0), the error detection is activated (this means showing -9999, analog output on minimum value, no totalizing action). The unit will never calculate with negative numbers!*

Note !

Note: *Extrapolation uses the two closest points in the linearization table.*
Frequencies between F lo – F limit lo will extrapolate using the two lowest entries in the linearization table.
Frequencies between F hi – F limit hi will extrapolate using the two highest entries in the linearization table.

Note !

Note: *The limits provided by the F limit ranges (F limit lo and F limit hi) will overrule any calculation from the linearization table. This means that when a frequency outside the F limit range is entered in the linearization table, the calculations will only support that entry until the frequency of the F limit lo or F limit hi is reached. Below or above that range, the error detection takes over.*

FREQ / FLOW RATE **1-15** **51**	The frequency is displayed at the bottom line of the display. The maximum frequency is 999.99 Hz. When the frequency at the linearization entry is set to 0.00Hz, the entry is not used in the linearization. The Flow rate is displayed at the top-line of the display. The minimum value to be entered is 0.000001 and the maximum value is 9.999999. ***Note**: The number of decimals used for the flow rate is equal to the number chosen at setup 23. Therefore always configure setup 23 before filling in the linearization entries.*

6 - Temperature

Conversion formula's temperature units:

xK = (x-273,15)°C = (9/5x-459,67)°F
x°C = (x+273,15)K = 9/5x+32°F
x°F = 5/9(x-32)°C = 5/9(x+459,67)K

NO. OF WIRES **61**	Do select here the number of wires of the two PT100 elements - two or three.			
FILTER **62**	The output signal of a sensor does mirror the actual temperature. This signal is measured several times a second. The value measured is a "snap-shot" of the real temperature as it will be fluctuating. With the help of this digital filter a stable and accurate reading can be obtained while the filter level can be set to a desired value. The filter principal is based on three input values: the filter level (01-99), the last measured analog value and the last average value. The higher the filter level, the longer the response time on a value change will be.			
FILTER VALUE	RESPONSE TIME ON STEP CHANGE OF ANALOG VALUE. TIME IN SECONDS			
	50% INFLUENCE	75% INFLUENCE	90% INFLUENCE	99% INFLUENCE
01	filter disabled	filter disabled	filter disabled	filter disabled
10	1.8 seconds	3.5 seconds	5.6 seconds	11 seconds
20	3.5 seconds	7.0 seconds	11 seconds	23 seconds
30	5.3 seconds	10 seconds	17 seconds	34 seconds
50	8.8 seconds	17 seconds	29 seconds	57 seconds
75	13 seconds	26 seconds	43 seconds	86 seconds
99	17 seconds	34 seconds	57 seconds	114 seconds
DISPLAY UNIT **63**	SETUP - 63 determines the displayed unit for the Operator The following units can be selected: °C - °F - K			

7 - Pressure

MEASURING UNIT
71

SETUP - 71 determines the measurement unit for pressure.
The following units can be selected:

mbar - bar - psi

SPAN
72

With this setting, the measurement range of the 4-20mA pressure sensor is determined according the selected measurement unit (setting 71). See also setting 73 - decimals span.

Example **Calculating the span for pressure.**
Let us assume that the sensor generates the minimum signal (e.g.4mA) at a pressure of 2.5 bar and the maximum signal (e.g. 20mA) is generated at 50 bar. Then the span is 47.5 bar. Enter for SETUP - 72: "0004750" if decimals for span are two.

DECIMALS SPAN
73

According setting 72, the number of decimals for span have to be set.

OFFSET
74

Calculations are based on absolute pressures.
The flow computer must know the measured pressure at minimum signal. (2.5 bar in above example)

- When using a gauge type pressure indicator enter an offset to compensate environmental pressure (e.g. air pressure, 1.013 bar)
- When working with a "fixed" pressure, enter the fixed line pressure here and make sure that the span is set to zero.

Value to be entered: 0.000 - 9,999.999 unit.

FILTER
75

The analog output signal of a sensor does mirror the actual pressure.
This signal is measured several times a second. The value measured is a "snap-shot" of the real temperature as it will be fluctuating.
With the help of this digital filter a stable and accurate reading can be obtained while the filter level can be set to a desired value.
The filter principal is based on three input values: the filter level (01-99), the last measured analog value and the last average value. The higher the filter level, the longer the response time on a value change will be.

FILTER VALUE	RESPONSE TIME ON STEP CHANGE OF ANALOG VALUE. TIME IN SECONDS			
	50% INFLUENCE	75% INFLUENCE	90% INFLUENCE	99% INFLUENCE
01	filter disabled	filter disabled	filter disabled	filter disabled
03	0.5 seconds	1.0 seconds	1.5 seconds	3 seconds
05	1.0 seconds	1.8 seconds	2.8 seconds	5.3 seconds
10	1.8 seconds	3.5 seconds	5.6 seconds	11 seconds
20	3.5 seconds	7.0 seconds	11 seconds	23 seconds
50	8.8 seconds	17 seconds	29 seconds	57 seconds
99	17 seconds	34 seconds	57 seconds	114 seconds

CALIBRATE LOW
76

With this setting it is possible to calibrate the input value for 4 mA as the signal from the sensor might not be exact 4.0 mA at minimum pressure.
This function will measure the real output value minimum signal.

- *Warning: be very sure that the offered signal is correct before the calibration is executed as this function has major influences on the accuracy of the system!*

After pressing **PROG**, three settings can be selected:

- CALIBRATE: with this setting, the input will be calibrated with the actual "4 mA" value. After pressing enter, CAL SET will be displayed as soon as the calibration is completed. From that moment, the analog value must be more than the calibrated value before the signal will be processed.
- DEFAULT: with this setting, the manufactures value is re-installed.
- CAL SET: to select the last calibrated value.

CALIBRATE HIGH **77**	With this setting it is possible to calibrate the input value for 20mA as the signal from the sensor might not be exact 20.0 mA at maximum signal. This function will measure the real output value at maximum signal. ▪ *Warning: be very sure that the offered signal is correct before the calibration is executed as this function has major influences on the accuracy of the system!* After pressing **PROG**, three settings can be selected: ▪ CALIBRATE: with this setting, the input will be calibrated with the actual "20mA" value. After pressing enter, CAL SET will be displayed as soon as the calibration is completed. From that moment, the analog value must be less than the calibrated value for a reliable measurement. ▪ DEFAULT: with this setting, the manufactures value is re-installed. ▪ CAL SET: to select the last calibrated value.

8 - Equation

EQUATIONS TYPE **81**	This display function describes the supplied equations. The formula used: $Q_{normal} = Q * (P / P_{normal}) * (T_{normal} / T) * (C_{normal} / C)$ where Q_{normal} = calculated volume at normal conditions Q = measured volume P = line pressure P_{normal} = normal pressure T_{normal} = normal temperature T = line temperature C_{normal} = normal compressibility factor C = compressibility
NORMAL TEMPERATURE **82**	Enter here the reference temperature T_{normal} in degrees Kelvin (K). In most applications, the gas volume has to be calculated at 0°C which is 273,15 K.
NORMAL PRESSURE **83**	Enter here the reference pressure P_{normal} in the selected pressure unit. In most applications, the volume has to be calculated at 1.013 Bar.
NORMAL COMPRESSABILITY FACTOR **84**	Enter here the compressibility factor for the gas at reference conditions.

COMPRESSABILITY FACTOR **85**	Enter here the compressibility factor for the gas at operating conditions. The C factor indicates how different a “real” gas behaves from an “ideal” gas which exactly obeys the “general gas law” (PxV/T=constant) where the C factor is 1. If SETUP 84 or 85 is set to zero: the compressibility factor is disabled.

9 - Analog output

A linear analog 4-20 mA signal is generated according to the flow rate with a 10 bits resolution. The settings for flow rate (SETUP - 2) influence the analog output directly.
The relationship between rate and analog output is set with the following functions:

DISABLE / ENABLE
91

The analog output can be disabled.

RATE MIN
92

Enter here the flow rate at which the output should generate the minimum signal (4 mA) - in most applications at flow rate "zero".
The number of decimals displayed depends upon SETUP 23.
The time and measuring units (L/min for example) are dependent upon SETUP 21 and 22 but are not displayed.

RATE MAX
93

Enter here the flow rate at which the output should generate the maximum signal (20 mA) - in most applications at maximum flow.
The number of decimals displayed depends upon SETUP 23.
The time and measuring units (L/min for example) are dependent upon SETUP 21 and 22 but cannot be displayed.

CUT-OFF
94

To ignore leakage of the flow for example, a low flow cut-off can be set as a percentage of the full range of 16 mA.
When the flow is less than the required rate, the current will be the minimum signal (4 mA).
Examples:

4MA (SETUP 92)	20MA (SETUP 93)	CUT-OFF (SETUP 94)	REQUIRED RATE	OUTPUT
0 L/min	100 L/min	2%	(100-0)*2% = 2.0 L/min	4+(16*2%) = 4.32mA
20 L/min	800 L/min	3.5%	(800-20)*3.5%= 27.3 L/min	4+(16*3.5%)=4.56mA

TUNE MIN / 4MA
95

Caution !

The initial minimum analog output value is 4 mA. However, this value might differ slightly due to external influences such as temperature for example. The 4 mA value can be tuned precisely with this setting.

- *Before tuning the signal, be sure that the analog signal is not being used for any application!*

After pressing **PROG**, the current will be about 4 mA . The current can be increased / decreased with the arrow-keys and is directly active. Press **ENTER** to store the new value.
Remark: the analog output value can be programmed “up-side-down” if desired, so 20 mA at minimum flow rate for example!

TUNE MAX / 20MA
96

Caution !

The initial maximum analog output value is 20 mA. However, this value might differ slightly due to external influences such as temperature for example. The 20 mA value can be tuned precisely with this setting.

- *Before tuning the signal, be sure that the analog signal is not being used for any application!*

After pressing **PROG**, the current will be about 20mA. The current can be increased / decreased with the arrow-keys and is directly active. Press **ENTER** to store the new value.
Remark: the analog output value can be programmed “up-side-down” if desired, so 4 mA at maximum flow rate for example!

FILTER **97**	This function is used to stabilize the analog output signal. The output value is updated every 0.1 second. With the help of this digital filter a more stable but less precise reading can be obtained. The filter principal is based on three input values: the filter level (01-99), the last analog output value and the last average value. The higher the filter level, the longer the response time on a value change will be. Below, several filter levels with their response times are indicated:			
FILTER VALUE	RESPONSE TIME ON STEP CHANGE OF ANALOG VALUE. TIME IN SECONDS			
	50% INFLUENCE	75% INFLUENCE	90% INFLUENCE	99% INFLUENCE
01	filter disabled	filter disabled	filter disabled	filter disabled
02	0.1 second	0.2 second	0.4 second	0.7 second
03	0.2 second	0.4 second	0.6 second	1.2 seconds
05	0.4 second	0.7 second	1.1 seconds	2.1 seconds
10	0.7 second	1.4 seconds	2.2 seconds	4.4 seconds
20	1.4 seconds	2.8 seconds	4.5 seconds	9.0 seconds
30	2.1 seconds	4 seconds	7 seconds	14 seconds
50	3.5 seconds	7 seconds	11 seconds	23 seconds
75	5.2 seconds	10 seconds	17 seconds	34 seconds
99	6.9 seconds	14 seconds	23 seconds	45 seconds

A - Impuls	
PULSE WIDTH **A1**	The pulse width determines the time that the output will be switched; in other words the pulse length. The minimum time between the pulses is as long as the period time (50/50 duty cycle). The pulse width is set in seconds in the range 0.001 - 9.999 sec. Value “zero” disable the pulse output. ***Note:*** *If the frequency should go out of range - when the flow rate increases for example - an internal buffer will be used to "store the missed pulses": As soon as the flow rate slows down, the buffer will be "emptied".* *It might be that pulses will be missed due to a buffer-overflow, so it is advised to program this setting within its range!*
DECIMALS **A2**	This setting determines the decimal position for setting A3. **Note:** the measuring unit is according to setting 11 (for total)
AMOUNT **A3**	A pulse will be generated every X-quantity. Enter this quantity here while taking the displayed decimal position and measuring unit into account. **Example: Calculating the time between two pulses.** **Settings for Amount = 10** This means that after each 10 m^3, one pulse will be generated, if m^3 is set for total. **Settings for total K-factor = 27000** This is number of pulses per unit volume. With **input pulse signal** of 150 Hz, it takes 1800 s until a pulse is generated. $time = \frac{(Amount) \cdot (K\_factor)}{frequency} = \frac{(10\ m^3) \cdot (2700/m^3)}{150\ Hz} = 1800\ sec = 30\ mn$

Note !

B - Communication	
Functions as described below deal with hardware that are not part of the standard delivery. Programming of these functions does not have any effect if this hardware has not been installed. Consult Appendix C and the Modbus communication protocol description for a detailed explanation.	
BAUDRATE **B1**	For external control, following communication speeds can be selected: 1200 - 2400 - 4800 - 9600 baud
BUS ADDRESS **B2**	For communication purposes, a unique identity can be attributed to every flow computer. This address can vary from 1-255.
MODE **B3**	The communication is executed according Modbus protocol RTU mode. With OFF, the communication is disabled.

C - Others	
MODEL **C1**	For support and maintenance it is important to have information about the characteristics of the flow computer. **Your supplier will ask for this information in the case of a serious breakdown or to assess the suitability of your model for upgrade considerations.**
TYPE **C2**	For support and maintenance it is important to have information about the characteristics of the flow computer. **Your supplier will ask for this information in the case of a serious breakdown or to assess the suitability of your model for upgrade considerations.**
VERSION SOFTWARE **C3**	For support and maintenance it is important to have information about the characteristics of the flow computer. Your supplier will ask for this information in the case of a serious breakdown or to assess the suitability of your model for upgrade considerations.
SERIAL NUMBER **C4**	For support and maintenance it is important to have information about the characteristics of the flow computer. Your supplier will ask for this information in the case of a serious breakdown or to assess the suitability of your model for upgrade considerations.
PASSWORD **C5**	All SETUP-values can be password protected. This protection is disabled with value 0000 (zero). Up to and including 4 digits can be programmed, for example 1234.
TAGNUMBER **C6**	For identification of the unit and communication purposes, a unique tagnumber of maximum 7 digits can be entered.

4. INSTALLATION

4.1. GENERAL DIRECTIONS

- Take careful notice of the "Safety rules, instructions and precautionary measures" at the front of this manual.
- Mounting, electrical installation, start-up and maintenance of this instrument may only be carried out by trained personnel authorized by the operator of the facility. Personnel must read and understand this Operating Manual before carrying out its instructions.
- The flow computer may only be operated by personnel who are authorized and trained by the operator of the facility. All instructions in this manual are to be observed.
- Ensure that the measuring system is correctly wired up according to the wiring diagrams. Protection against accidental contact is no longer assured when the housing cover is removed or the panel cabinet has been opened (danger from electrical shock). The housing may only be opened by trained personnel.
- Install the measuring sensor near the transducer (max.100m cable length, depending on the electrical interference zone).
- The measuring cable must be laid well away from strong sources of electrical interference and not parallel to power cables.
- The measuring cable of several DOG-… must not be laid over long distances next to one another or bundled together.
- The DOG-4A transducer must be installed outside of the Ex-zone.
- Lay the electrical cabling according to the following wiring diagram.
- Each transducer is matched specifically to the respective measuring sensor and must not be swapped over.
- The pipelines and the flange housing must be grounded.

4.2 Measuring cable in Ex areas

An Ölflex EP (without shield) or Ölflex EBCY (with shield) may be used as measuring cable between the sensor and transmitter. Alternatively a cable with comparable properties may be used.

Ölflex EB Li=0.65 mH/km Cisy=110 nF/km

Ölflex EBCY Li=0.65 mH/km Cisy=135 nF/km Ciasy=185 NF/km

The length of the cable may not exceed 100m. The maximum permitted cable inductance is Limax=65µH and the maximum capacitance Cimax=32nF.

4.3 Electronic options M0/N0

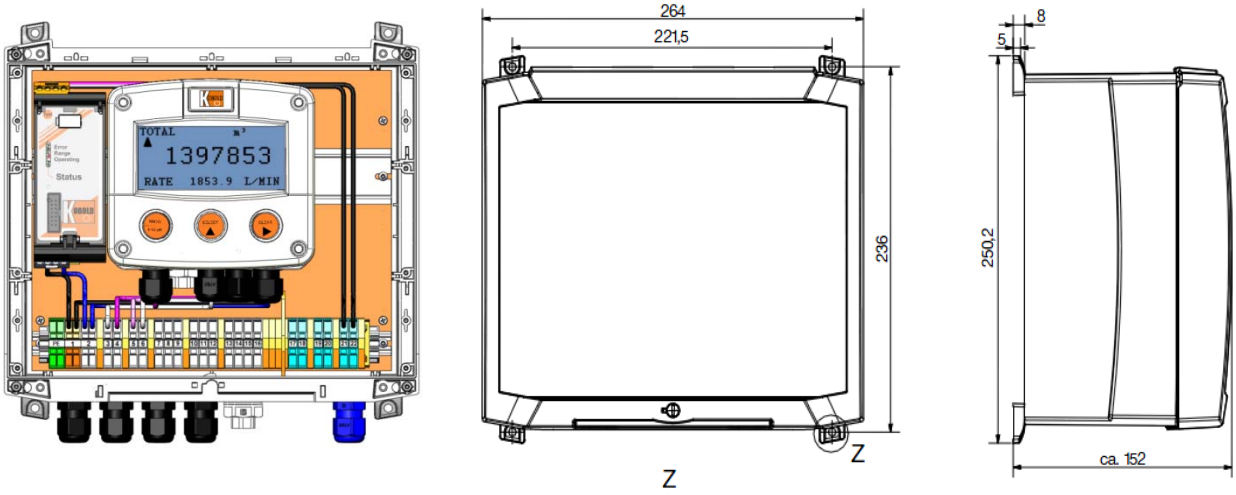


Fig. 5: Electronic options M0/N0 with dimensions

4.3.1. TERMINAL CONNECTORS

The following terminal connectors are available:

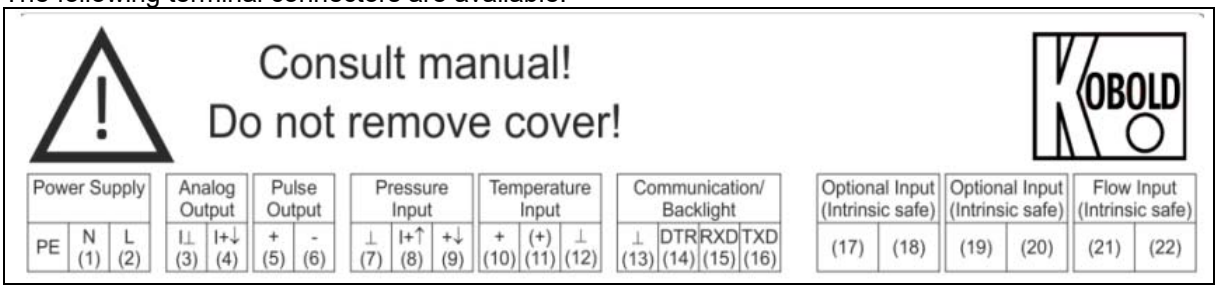
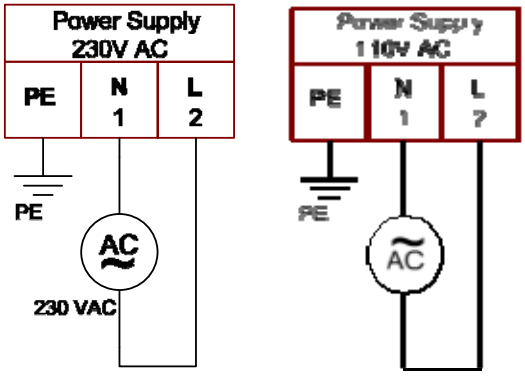


Fig. 6: Overview terminal connectors for electronic options M0/N0/O0/P0

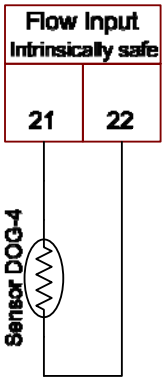
Terminal PE – 1 – 2 (power supply V AC ± 10%)

M/N: **O/P:**



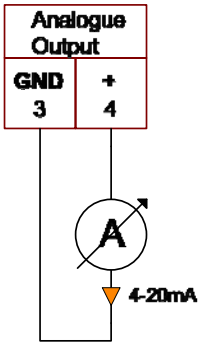
Terminal 21 – 22: Connection to the measuring sensor

Use terminal connectors 21 and 22 to connect the transmitter and the flow computer with the measuring sensor of the DOG-... flowmeter. The polarity of the sensor is not relevant.



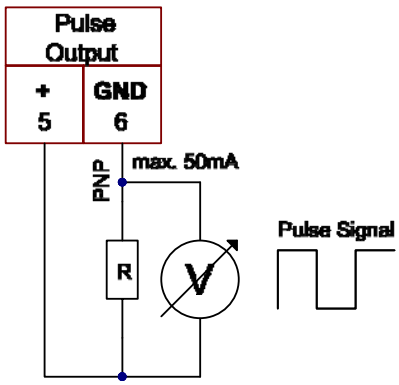
Terminal 3 – 4 (analog output signal proportional to the flow rate)

When the output is disabled, a 3.5mA signal will be generated on these terminals.
Max. driving capacity 1000Ω @ 24VDC.



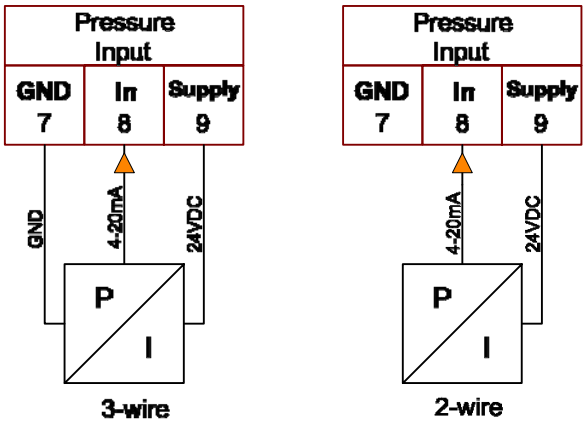
Terminal 5 – 6 (scaled pulse output according to linearised total)

Setup 8 (par. 3.2.3.) determines the pulse output function. The maximum pulse frequency of this output is 60Hz. Max. driving capacity 50mA @ 24V per output.



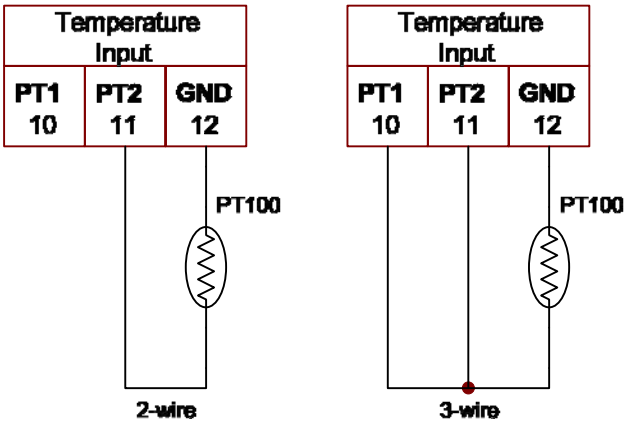
Terminal 7 – 8 – 9 (input for pressure sensor)

The Flow Computer requires a 4-20mA signal input for pressure which will be processed 4 times a second with a 14-bit accuracy. The input is not isolated. The pressure sensor can be connected in 2 or 3-wire technology.



Terminal 10 – 11 – 12 (input for temperature sensor)

Two types of PT100 elements can be connected to the flow computer: 2 or 3-wire.



Terminal 13 – 14 – 15 – 16: MODBUS communication

The following MODBUS types are available:

Type CH: Communication RS485 2-wire / Protocol MODBUS RTU **(optional)**
Type CB: Communication RS232 / Protocol MODBUS RTU **(on request)**

Full serial communications and computer control in accordance with RS485 (length of cable max. 1200 meters) or RS232 (length of cable max. 15 meters) is possible.

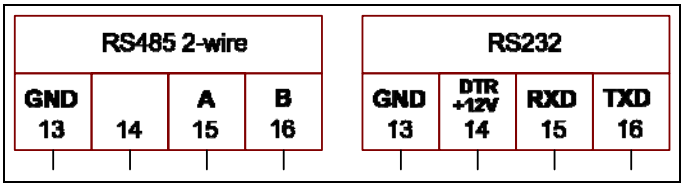


Fig.7: Overview terminal connectors for Modbus communication

When using the RS232 communication option, terminal 14 is used for supplying the interface. Please connect the DTR (or the RTS) signal of the interface to this terminal and set it active (+12V). If no active signal is available, it is possible to connect a separate supply between terminals 13 and 14 with a voltage between 8V and 24V.

Read the Modbus communication protocol and Appendix C.

5. MAINTENANCE

5.1. GENERAL DIRECTIONS

- *Mounting, electrical installation, start-up and maintenance of the instrument may only be carried out by trained personnel authorized by the operator of the facility. Personnel must read and understand this Operating Manual before carrying out its instructions.*

Caution !

- *The flow computer may only be operated by personnel who are authorized and trained by the operator of the facility. All instructions in this manual are to be observed.*
- *Ensure that the measuring system is correctly wired up according to the wiring diagrams. Protection against accidental contact is no longer assured when the housing cover is removed or the panel cabinet has been opened (danger from electrical shock). The housing may only be opened by trained personnel.*
- *Take careful notice of the "Safety rules, instructions and precautionary measures" in the front of this manual.*

The flow computer does not require special maintenance unless it is used in low-temperature applications or surroundings with high humidity (above 90% annual mean). It is customers responsibility to take all precautions to dehumidify the internal atmosphere of the flow computer in such a way that no condensation will occur, for example by placing dry silica-gel in the casing just before closing the enclosure.
Furthermore, is required to replace or dry the silica gel from time to time as advised by the silica gel supplier.

Check periodically:
- The condition of the casing, cable glands and front panel.
- The input/output wiring for reliability and aging symptoms.
- The process accuracy. As a result of wear and tear, re-calibration of the flowmeter might be necessary. Do re-enter any subsequent Span alterations.
- Clean the casing with soapy-water. Do not use any aggressive solvents as these might damage the coating.

5.2. REPAIR

This product cannot be repaired by the user and must be replaced with an equivalent certified product. Repairs should only be carried out by the manufacturer or his authorized agent.

APPENDIX A: TECHNICAL SPECIFICATION OF FLOW COMPUTER

GENERAL

Display	
Type	High intensity reflective numeric and alphanumeric LCD, UV-resistant.
Digits	Seven 17mm (0.67") and eleven 8mm (0.31"). Various symbols and measuring units.
Refresh rate	User definable: 8 times/sec - 30 secs.

Operating temperature	
Operational	-25 °C to +60 °C

Power supply	
	115-230 V AC ± 10 %. Power consumption max. 15 Watt.
	The total consumption of the sensors`, backlight and outputs may not exceed 400 mA@24 V.

Data protection	
Type	EEPROM backup of all setting. Backup of running totals every minute. Data retention at least 10 years.
Pass code	Configuration settings can be pass code protected.

INPUTS

Flowmeter	
	Coil/sine wave (minimum 20mVp-p or 80mVp-p - sensitivity selectable), NPN/PNP, open collector, reed-switch, Namur, active pulse signals 8 - 12 and 24 V.
Frequency	Minimum 0 Hz - maximum 7 kHz for total and flow rate. Maximum frequency depends on signal type and internal low-pass filter. E.g. Reed switch with low-pass filter: max. frequency 120 Hz.
K-Factor	0.000010 - 9,999,999 with variable decimal position.
Low-pass filter	Available for all pulse signals.

Temperature	
	2 or 3 wire PT100.
Standard	range: -100°C to +200°C (-148°F to 392°F) - accuracy 0.1 °C (0.18°F).
Update time	four times a second.
Note	The linearity is internally compensated.

Pressure	
	(0)4-20mA - with signal calibration feature. Resolution: 14 bit.
Accuracy	0.05%. Low level cut-off programmable.
Span	0.000010 - 9,999,999 with variable decimal position.
Off-set	0.000 - 9,999.999 unit
Update time	Four times a second.
Voltage drop	2.5 Volt @ 20mA.
Load impedance	3kOhm

OUTPUTS

Analog output	
	Active 4-20 mA output
Function	transmitting compensated flow rate.
Accuracy	10 bit. Error < 0.05% - update 10 times a second. Software function to calibrate the 4.00mA and 20.00mA levels precisely within set-up.
Load	max. 1 kOhm

Pulse output	
	Max. frequency 60 Hz; pulse length user definable between 0.001 up to 9.999 sec.
Function	One pulse output
	Active 24 V DC pulse output; max. 50 mA

Communication option	
Functions	reading display information, reading / writing all settings.
Protocol	Modbus RTU
Speed	1200 – 2400 – 4800 – 9600 baud
Addressing	maximum 255 addresses.
Interface	RS485 2-wire (optional)
Interface	RS232 (on request)

OPERATIONAL

Operator functions	
Displayed functions	• compensated total and/or compensated flow rate. • compensated total and compensated accumulated total. • line pressure. • line temperature. • compensated total can be reset to zero by pressing the CLEAR-key twice.

Total	
Digits	7 digits.
Units	L, m3, GAL, USGAL, KG, lb, bbl, no unit.
Decimals	0 - 1 - 2 or 3.
Note	total can be reset to zero.

Accumulated total	
Digits	11 digits.
Units / decimals	according selection for total.

Flow rate	
Digits	7 digits.
Units	mL, L, m3, Gallons, KG, Ton, lb, bl, cf, RND, ft3, scf, Nm3, Nl, - no units.
Decimals	0 - 1 - 2 or 3.
Time units	/sec - /min - /hr - /day.

Line temperature	
Digits	6 digits.
Units	°C, °F or K
Decimals	1
Normal temperature	default: 273.15 K - any temperature can be set.

Line pressure	
Digits	6 digits.
Units	mbar, bar, PSI
Decimals	1
Normal pressure	default: 1.013 bar - any pressure can be set.

APPENDIX B: PROBLEM SOLVING

In this appendix, several problems are included that can occur when the flow computer is going to be installed or while it is in operation.

Analog output does not function properly:
Check:
- SETUP 91 - is the function enabled?
- SETUP 92 / 93: are the flow-levels programmed correctly?
- connection of the external power-supply according specification.

The password is unknown:
If the password is not 1234, there is only one possibility left: call your supplier.

ALARM
When the alarm flag starts to blink an internal alarm condition has occurred. Press the "select button" several times to display the 5-digit error code. The codes are:

0001: irrecoverable display-data error: data on the display might be corrupted.
0002: irrecoverable data-storage error: the programming cycle might have gone wrong: check programmed values.
0003: error 1 and error 2 occurred simultaneously

The alarm condition will almost certainly be handled internally and if all mentioned values still appear correct, no intervention by the operator is needed. If the alarm occurs more often or stays active for a longer time, please contact your supplier.

APPENDIX C: COMMUNICATION VARIABLES

Remarks:

- Below, an overview of the flow computer specific variables; other common variables are described in the standard table.
- All numbers are decimal numbers, unless otherwise noted.
- Following variables of the standard table (var00-var30) are not valid for this product and will be responded with value 1: var00, 03-05, 07,08, 16-22, 24, 26-29.

CONFIGURATION VARIABLES FLOW COMPUTER - SETUP-LEVEL:				
VAR	**DESCRIPTION**	**BYTES**	**VALUE**	**REMARKS**
TOTAL				
32 (20h)	unit	1	0=L 1=m3 2=kg 3=lb 4=gal 5=usgal 6=bbl 7=none	
33 (21h)	decimals	1	0…3	
34 (22h)	K-factor	3	1....9.999.999	K-f 0000001 - K-f 0000009 is allowed when decs < 6! (VAR37)
37 (25h)	decimals K-factor	1	0…6	
FLOW RATE				
48 (30h)	unit	1	0=mL 1=L 2=m3 3=mg 4=g 5=kg 6=ton 7=gal 8=bbl 9=lb 10=cf 11=rev (revolutions for RPM) 12=none 13=scf 14=NM3 15=NL 16=p	
49 (31h)	time unit	1	0=sec 1=min 2=hour 3=day	
50 (32h)	decimals	1	0…3	
51 (33h)	K-factor	3	1....9.999.999	K-f 0000001 - K-f 0000009 is allowed when decs < 6! (VAR54)
54 (36h)	decimals K-factor	1	0…6	
55 (37h)	number of pulses	1	1..255	
56 (38h)	cut-off time	2	1 .. 9999	steps of 100ms

VAR	DESCRIPTION	BYTES	VALUE	REMARKS
DISPLAY				
64 (40h)	display function	1	0=total 1=flow rate	
68 (44h)	set flow rate monitor	1	0=operator level 1=SETUP level	
POWERMANAGEMENT				
80 (50h)	LCD update time	1	0=fast 1=1sec 2=3sec 3=15sec 4=30sec 5=off	
81 (51h)	power-mode battery	1	0=operational 1=shelf	
FLOWMETER				
96 (60h)	flowmeter signal	1	0=npn 1=npn-lp 2=reed 3=reed LP 4=pnp 5=pnp-lp 6=namur 7=coil hi 8=coil lo	
TEMPERATURE				
144 (08Dh)	No. of wires	1	0= 2 wires 1= 3 wires	
99 (063h)	filter	1	0….99	
528 (210h)	display	1	0= °C 1= °F 2= K	

VAR	DESCRIPTION	BYTES	VALUE	REMARKS
PRESSURE				
544 (220h)	unit	1	0=mbar 1=bar 2=psi 3=no unit	
546 (222h)	span	3	1....9,999,999	
549 (225h)	decimals span	1	0…6	
550 (226h)	offset	3	0.000....9,999.999	unit as var544 step 0.001
90 (5Ah)	calibration low (4mA)	1	0=default 1=calibrate 2=cal set	
91 (5Bh)	calibration high (20mA)	1	0=default 1=calibrate 2=cal set	
89 (59h)	filter	1	0….99	
FORMULA				
537 (219h)	normal temperature	3	0.00....99,999.99	step: 0.01 K
555 (229h)	normal pressure	3	0.000....9,999.999	unit as var544 step 0.001
227 (E3h)	compressibility	3	0....9,999,999	
40 (28h)	normal compress.	3	0....9,999,999	
ANALOG OUTPUT				
112 (70h)	analog output	1	0=disable 1=enable	
113 (71h)	minimum rate	3	0..9999999	unit, time, decimals acc. var48-50
116 (74h)	maximum rate	3	0..9999999	unit, time, decimals acc. var48-50
119 (77h)	cut off percentage	1	0..99	steps of 0.1%
120 (78h)	tune minimum rate	2	0..9999	
122 (7Ah)	tune maximum rate	2	0..9999	
117 (7Fh)	filter	1	0….99	
OTHERS				
01 (1h)	Model	2		read only!
06 (6h)	Software version	2		read only!
02 (2h)	Serial number	4		read only!
168 (A8h)	password	2	xxxx	read only!
170 AAh	tagnumber	3	0..9999999	Other vars: see standard table

OTHER FLOW COMPUTER VARIABLES FOR COMMUNICATION

TOTAL - variable number 566 (236h) – 6 bytes
Read total: The value of total read using communication might differ from the value that appears on the display. This is due to the fact that the display can only display up to seven digits (for example when two decimals are selected for total and total has a value of 123456,78 the display will show 23456,78 while communication will read a "total" of 12345678 and a "total decimals" of 2).
Write total: total can only be cleared. This means writing a value different from 0 will result in the reply of an error message. Only writing 6 bytes of zero's to total will be accepted.

ACCUMULATED TOTAL - variable number 560 (230h) – 6 bytes
Read acc. total: A difference between the read value and the display value, as explained for "Read total", might appear here too.
Write acc. total: Impossible.

When reading or writing total or accumulated total it should be noted that the used values are given including the decimals. This means a read/write to one of these variables should be accompanied with a read/write to the variable that holds the number of decimals for this variable:

Example: read var. 566 for total:
Read var. 33 for total decimals and calculate the real value of total by multiplying total with $10^{-(\text{total decimals})}$

FLOW RATE - variable number 572 (23Ch) – 4 bytes
Read flow rate: The value difference as mentioned with total/acc. total might appear here too.
Write flow rate: Impossible.

TEMPERATURE - variable number 540 (21Ch) – 4 bytes
Read temperature: possible.
Write temperature: Not possible.

Pressure - variable number 556 (22Ch) – 4 bytes
Read pressure: possible.
Write pressure: Not possible.

APPENDIX D: FACTORY SETTINGS FOR FLOW COMPUTER

MENU SETTINGS		FUNCTIONS	FACTORY DEFAULT SETTINGS
1	**TOTAL**		
	11	UNIT	m3
	12	DECIMALS	111111,1
	13	K-FACTOR	$K-Faktor = \frac{540000\left[\frac{Pulses}{h}\right]}{full\ scale\ flow\ value\left[\frac{m^3}{h}\right]}$ (enter with one decimal, according to 25)
	14	DECIMALS K-FACTOR	1
2	**FLOWRATE**		
	21	UNIT	m3
	22	TIME UNIT	hr
	23	DECIMALS	22222,22
	24	K-FACTOR	$K-Faktor = \frac{540000\left[\frac{Pulses}{h}\right]}{full\ scale\ flow\ value\left[\frac{m^3}{h}\right]}$ (enter with one decimal, according to 25)
	25	DECIMALS K-FACTOR	1
	26	CALCULATION	10
3	**DISPLAY**		
	31	FUNCTION	total
	32	LIGHT	100%
	33	LCD UPDATE	1
	34	BATTERY MODE	operate
4	**FLOWMETER**		
	41	SIGNAL	NPN LP
	42	LO-LIMIT	0,00
	43	HI-LIMIT	200,00
5	**LINEARISATION**		
	51	FREQ. / M-FACTOR 1	0,0 Hz / 10000000
	52	FREQ. / M-FACTOR 2	0,0 Hz / 10000000
	53	FREQ. / M-FACTOR 3	0,0 Hz / 10000000
	54	FREQ. / M-FACTOR 3	0,0 Hz / 10000000
	55	FREQ. / M-FACTOR 3	0,0 Hz / 10000000
	..	..	……..
	5F	FREQ. / M-FACTOR 15	0,0 Hz / 10000000
6	**TEMPERATURE**		
	61	NUMBER WIRES	3
	62	FILTER	0
	63	DISPLAY	°C
7	**PRESSURE**		
	71	UNIT	Bar

	72	SPAN	25 (i.e. 2,5 Bar) (Units dependent upon SETUP 71)
	73	DECIMALS SPAN	1
	74	OFFSET	1,0 13 (Bar) (Units dependent upon SETUP 71)
	75	FILTER	01
	76	CALIBRATE LOW	default
	77	CALIBRATE HIGH	default
8	**EQUATION**		
	81	EQUATION TYPE	EG (fixed)
	82	NORMAL TEMPERATURE	0 (K)
	83	NORMAL PRESSURE	0 (Bar) (Units dependent upon SETUP 71)
	84	NORMAL COMPRESSIBILITY	0
	85	COMPRESSIBILITY	0
9	**ANALOG OUTPUT**		
	91	OUTPUT	enable
	92	4 mV/0 V	0,00
	93	20 mA/10 V	Full scale flowrate value (Units dependent upon SETUP 21 and 22)
	94	CUT-OFF	1,0
	95	TUNE MIN	0296 ± 1
	96	TUNE MAX	5395 ± 1
	97	FILTER	01
A	**IMPULS**		
	A1	IMPULS	0,010 (sec)
	A2	DECIMALS	00000000
	A3	AMOUNT	1
B	**COMMUNICATION**		
	B1	SPEED/BAUDRATE	9600
	B2	ADRESS	1
	B3	MODE	BUS-RTU
C	**OTHERS**		
	C1	MODEL	F100-P
	C2	TYPE	bld1261
	C3	SOFTWARE VERSION	TT:MM:JJ
	C4	SERIAL NO.	XXXXXXX
	C5	PASS CODE	0000
	C6	TAGNUMBER	0000000

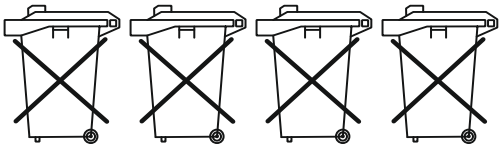
6. DISPOSAL

Note!

- Avoid environmental damage caused by media-contaminated parts
- Dispose of the device and packaging in an environmentally friendly manner
- Comply with applicable national and international disposal regulations and environmental regulations.

Batteries

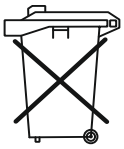
Batteries containing pollutants are marked with a sign consisting of a crossed-out garbage can and the chemical symbol (Cd, Hg, Li or Pb) of the heavy metal that is decisive for the classification as containing pollutants:



Cd[1] Hg[2] Pb[3] Li[4]

1. „Cd" stands for cadmium
2. „Hg" stands for mercury
3. „Pb" stands for lead
4. „Li" stands for lithium

Electrical and electronic equipment



7. EU DECLARATION OF CONFORMANCE

We, KOBOLD Messring GmbH, Nordring 22-24, 65719 Hofheim, Germany, declare under our sole responsibility that the product:

DOG-… electronic option M0/N0/O0/P0 (Flow computer)

to which this declaration relates is in conformity with the following EU directives stated below:

2014/30/EU	**EMC Directive**
2014/35/EU	**Low Voltage Directive**
2011/65/EU	**RoHS** (category 9)

Also, the following standards are fulfilled:

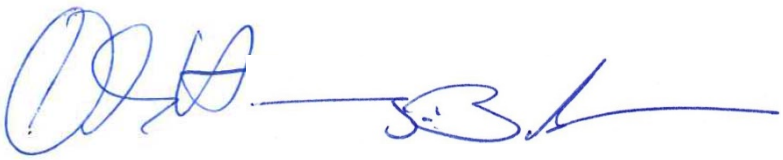
EN 61000-6-2:2005 Electromagnetic compatibility (EMC) - Part 6-2: Generic standards - Immunity for industrial environments

EN 61000-6-3:2007/A1:2011 Electromagnetic compatibility (EMC) - Part 6-3: Generic standards - Emission standard for residential, commercial and light-industrial environments

EN 61326-1:2013 Electrical equipment for measurement, control and laboratory use - EMC requirements - Part 1: General requirements

EN 61010-1:2010/A1:2019 Safety requirements for electrical equipment for measurement, control and laboratory use - Part 1: General requirements

EN IEC 63000:2018 Technical documentation for the assessment of electrical and electronic products with respect to the restriction of hazardous substances



Hofheim, 22 Feb. 2024

H. Volz	Joseph Burke
General Manager	Compliance Manager

8. UK DECLARATION OF CONFORMITY

We, KOBOLD Messring GmbH, Nordring 22-24, 65719 Hofheim, Germany, declare under our sole responsibility that the product:

DOG-… electronic option M0/N0/O0/P0 (Flow computer)

to which this declaration relates is in conformity with the following UK directives stated below:

S.I. 2016/1101	**Electrical Equipment (Safety) Regulations 2016**
S.I. 2012/3032	The Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment Regulations 2012

Also, the following standards are fulfilled:

BS EN 61000-6-2:2005 Electromagnetic compatibility (EMC). Generic standards. Immunity for industrial environments

BS EN 61000-6-3:2007/A1:2011 Electromagnetic compatibility (EMC). Generic standards. Emission standard for residential, commercial and light-industrial environments

BS EN 61326-1:2013 Electrical equipment for measurement, control and laboratory use. EMC requirements. General requirements

BS EN 61010-1:2010+A1:2019
Safety requirements for electrical equipment for measurement, control, and laboratory use. General requirements

BS EN IEC 63000:2018
Technical documentation for the assessment of electrical and electronic products with respect to the restriction of hazardous substances.

Hofheim, 22 Feb. 2024

H. Volz
General Manager

J. Burke
Compliance Manager