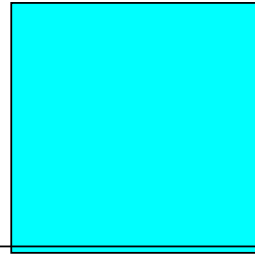


**KROHNE**

03/99



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**CORIMASS G-Class**

**Enclosure to  
Operating Manual  
for  
Ex Instruments**

**MFM 4085 K/F**



**IMPORTANT!**

These instructions should be used in conjunction with the Standard Installation and Operating Instructions for the MFM 4085 K/F.  
If you have not received a copy or require a copy, please contact your nearest Krohne Office or representative or Product Management in Duisburg, Germany.

**Product liability and warranty**

The CORIMASS mass flowmeter MFM 4085 is designed for the direct measurement of mass flow rate, product density and product temperature, and also indirectly enables measurement of parameters such as total mass, concentration of dissolved substances and the volume flow.

For **use in hazardous areas**, special codes and regulations are applicable which are specified in the special "Ex installation and operating instructions" (supplied only with hazardous-duty equipment).

**Responsibility** as to suitability and intended use of our instruments rests solely with the purchaser.

Improper installation and operation of the flowmeters may lead to **loss of warranty**.

In addition, the "**general conditions of sale**" forming the basis of the purchase agreement are applicable.

If you need to return CORIMASS flowmeters to KROHNE, please complete the form on the **last page** of the Installation and Operating manual and return it with the meter to be repaired. **Krohne regrets that it cannot repair or check your flowmeter unless accompanied by this completed form.**

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## 1. Description

The mass flowmeter MFM 4085 K EEx and MFM 4085 F EEx consists of two main components:

The Signal Converter, which calculates and displays the measured values and the transducer which supplies the converter with the analog signals.

A Cable Seal, which is screwed into the converter housing, leads the electric signals from the transducer to the converter. The signal cable between the transducer and converter are intrinsically safe.

The converter housing is permanently screwed onto the transducer and must not be removed at any time.

### Cenelec Approvals

PTB approves the conformity of the mass flow meter acc. to the harmonized European Standards:

**EN50018** (Pressure tight housing 'd')  
for the electronics housing and the terminal compartment

**EN50019** (Increased safety 'e')  
for the standard termination compartment

**EN50020** (Intrinsically Safe 'ib')  
for the Zener barriers and all electrical circuits inside the transducer

The approval number PTB Ex-94.C. 2054 X, PTB Ex-97.D.2194 X, Ex-97.D.2195 X and the Addendums covers the meter sizes 10 G, 100 G, 300 G, 800 G, 1500 G and 3000 G.

The meters are identified with the code EEx de [ib] II C T6...T3 or  
EEx de [ib] II C T6...T3  
or with intrinsic. safe outputs EEx de [ia/ib] II C T6...T3 or  
EEx de [ia/ib] II C T6...T3

### Factory Mutual approvals

The G-Series is also approved for use in Div 1 and Div 2 hazardous locations.

The equipment is suitable for use in the following areas:

Class I	Div 2	Groups A, B, C and D
Class II	Div 2	Groups F and G
Class III	Div 2	
Class I, II, III	Div 1	Groups A, B, C, D, E, F and G

The approvals and the various addendums is applicable to the meter sizes: 10 G, 100 G, 300 G, 800 G, 1500 G and 3000 G.

## 1.1 Description of the Transducer

The transducer MFS 4000-Ex is an intrinsically safe unit and contains three separated safe circuits. These are:

- Driver Circuit
- Sensor Circuit
- PT500 / Strain Gauge Circuit

The cables of these circuits are fed through the transducer housing via a special seal. There are various transducer sizes available with different end connection options. Although standard and EEx transducers appear the same, in fact the EEx version has a longer converter mount (neck) and also contains specific clamping diodes fitted across the driver coil. Therefore, it is essential to **avoid** using a standard converter with EEx transducer and vice versa.

In order to fulfil the Ex certification requirements, it is absolutely necessary to comply with the technical data which is enclosed in this document. Under no circumstances should the process fluid exceed 130°C, optional 150°C ( for instruments with zirconium tubes the max. temp. is 100°C) .

## 1.2 Description of the Converter

The Ex converter is available in two different versions:

a) The 'de' version

The electronics are placed in a pressure tight section of the converter housing, while the termination compartment is not pressure tight. The converter housing may be fitted with different cable glands such as NPT, PG16 or NPF glands for the mains supply and the input/output cables. The protection class of the termination compartment is 'e'.

b) The 'd' version

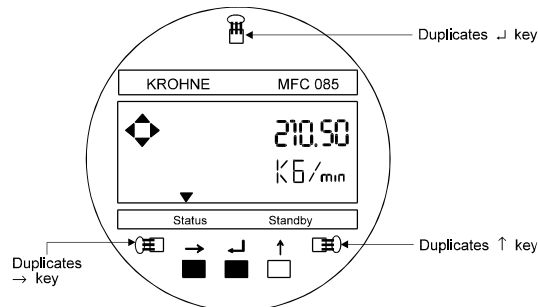
The electronics as well as the termination compartment are placed in a pressure tight housing.

The termination compartment is not fitted with any gland for the mains supply or the input/output cables. The customer is responsible for fitting an Ex approved cable gland into the PG16 thread of the housing. There are various suppliers for such cable glands on the market. The protection class of the termination compartment is 'd'.

For both cases the required waiting time between switching off the electronics and opening the housing has to be considered. The waiting time is mentioned on the data plate of the system and amounts to 25 minutes for T6 and 10 minutes for T5.

The Ex protection of the system is not valid if the electronics housing is not closed securely. Make sure after opening the converter housing, to close it fully with the enclosed wrench.

The programming of the converter may also be performed with a closed lid by using the enclosed magnet. Three magnet sensors are assembled on the display board, which allow the user to operate the converter without touching the display itself.



After opening the converter housing as described above, one of the following operations may be performed by the local KROHNE service engineer :-

- Replace supply fuse F9
- Changing electronics
- Changing supply voltage setting
- Changing EPROM's

These operations are to be performed in an identical manner to the standard converter. (Please refer to the standard operation manual).

Make sure the correct main fuse (right value, ceramic body, 1500A) and the corresponding fuse label on the fuse housing is used. Fuses and labels may be ordered from KROHNE.

**Using wrong fuses violates the Ex approval and may damage the system.  
The earthing metal sheet of the electronic must be fastened firmly with the screw onto the converter housing!**

The converter should be 'high pot' tested according to a specific procedure. Therefore, it is not permitted to change output modules or any other hardware components (except the list mentioned above by the local service engineer) without repeating the 'high pot' test. Please contact KROHNE for advice.

### **1.3 Installation of the MFM 4085 K EEx and MFM 4085 F EEx**

In order to get the highest possible accuracy, the user is advised to carry out the pipework installation as described in the standard manual.

Further requirements / differences are listed below :

- The ideal installation factor of an EEx unit is much higher than of a standard system. The high installation factor does not mean less accuracy. Due to Zener barriers and clamping diodes the EEx system consumes more power during running.

The installation factor should have a value as indicated in the following table.

Meter Size	Installation factor
10 G	200
100 G	150
300 G	400
800 G	300
1500 G	300
3000 G	400

The correct operation of the Zener barriers inside the converter are only guaranteed with a ridged and safe connection of the converter housing with potential earth (potential compensation PA). Please use the outer earthing connector at the square flange of the converter housing for earthing.

In case the converter housing has a pressure tight termination compartment, make sure the connected cable glands / adapters have an Ex certification.

## 2. Electrical installation

### 2.1 Location and connecting cables

#### Location

Do not expose the compact flow meter to direct sunlight. Install a sunshade if necessary.

#### Connecting cables

To conform to protection category requirements, observe the following recommendations:

- Fit blanking plug PG 16 and apply sealant to unused cable entries.
- In case if the terminal area is Eed, please use approved blanking plug.
- Do not kink cables directly at cable entries.
- Provide water drip point (U bend in cable).
- Do not connect rigid conduit to cable entries.
- If cables are a tight fit, enlarge inside diameter of cable gland by removing the appropriate ring(s) from the seal.

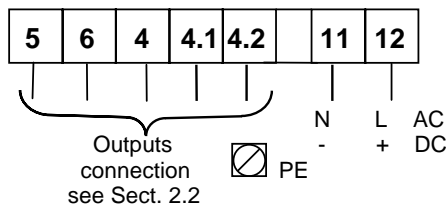
### 2.2 Electrical Connection on converter without intrinsically safe outputs

Please ensure that the information about power given on the dataplate corresponds to the locally available mains voltage.

- Note information given on the instrument dataplate (voltage, frequency)!
- **Electrical connection in conformity with IEC 364** or equivalent national standard.
- Special regulations apply to installation in **hazardous areas**. Please refer to separate "Ex" installation instructions.
- The **PE protective ground conductor must** be connected to the separate U-clamp terminal in the terminal box of the signal converter.
- Do not cross or loop the **cables in the terminal box** of the signal converter. Use separate (PG or NPT) cable glands for power and output cables.
- Ensure that the **screw thread of the round cover** on the terminal box is well greased at all times.

**NOTE:** The grease used must be non-corrosive to aluminium; typically it must be resin- and acid-free.

- Protect **sealing ring** from damage.



Power and signal connections for MFC 085 K

The tables below show the possible input output connection for the converter. The exact configuration depends on which optional output modules were fitted in the factory.

**Table of input/output connections**

No	Option 1* (Current, pulse, alarm and input )	Option 2* (2x current, not galvanically isolated)
5	Common (-)	Common (-)
6	Current output (+)	Current output 1 (+)
4	Control input	Control input
4.1	Pulse output	Current output 2 (+)
4.2	Status output (active)	Status output (passive)

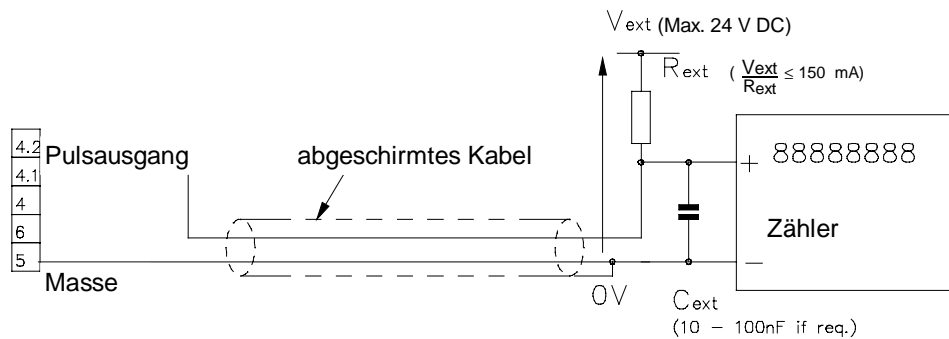
- The inputs/outputs share a common signal ground which is galvanically isolated from the ground (PE)

For the standard converter, the pulse output is passive and requires an external voltage source for operation. In addition, the signal may need protection from external interferences. The use of screened cables and a filter capacitor next to any counter is recommended.

It is possible to connect the pulse output without an external voltage supply. However to do this the function of the status output must be sacrificed. (Fig. b)

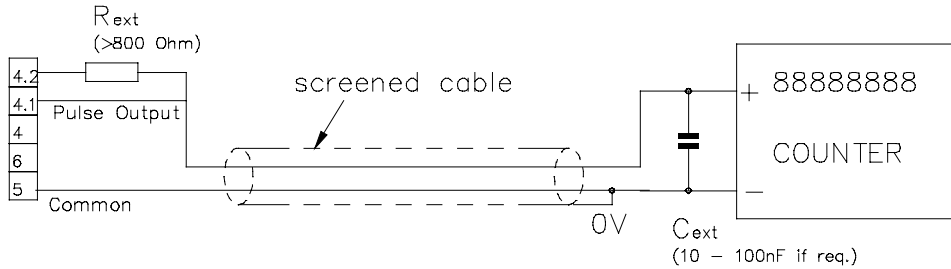
If the alarm output is used to power the pulse signal then the following settings **must** be made in the menus:

- Fct. 3.5.1 ALARM FUNCTION must be set to OFF
- Fct. 3.5.2 ALARM ACTIVE LEVEL must be set to ACTIVE LOW.



**Fig. a Preferred connections to an external counter with separate power supply (Example). For correct wiring see tables of input/output connections**





**Fig. b Connection without external voltage source (Example). For correct wiring see tables of input/ output connections**

**Additional input/output options**

No.	Option 4* (Current and RS485)	Option 5* (Current and Modbus)	Option 6 (1 Current, 1 Dual phase pulse output and input)	Option C (2 current, pulse and input)	Option D (3 current and pulse)	Option E (3 current and input)	Option F (3 current and alarm)
5	Common (-)	Common (-)	Common (-)	Common (-)	Common (-)	Common (-)	Common (-)
6	Current output 1 (+)	Current output 1 (+)	Current output 1 (+)	Current output (+)	Current output 1 (+)	Current output 1 (+)	Current output 1 (+)
4	TX/RX	TX/RX	Control Input	Current output 2 (+)	Current output 2 (+)	Current output 2 (+)	Current output 2 (+)
4.1	TX/RX	TX/RX	Pulse Output A	Control Input	Current output 3 (+)	Current output 3 (+)	Current output 3 (+)
4.2	+5V	+5V	Pulse Output B	Pulse Output	Pulse output	Control Input	Status output (passive)

The pulse output and status outputs where are passive outputs.

\* Refer to separate RS 485 or Modbus manual

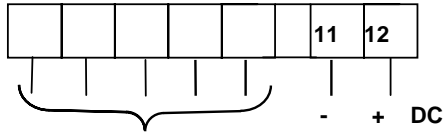
**2.3 Electrical connection on converter with intrinsically safe outputs**


Please ensure that the information about power given on the data plate corresponds to the locally available mains voltage.

- Note information given on the instrument data plate (voltage,frequency)!
- **Electrical connection in conformity with IEC 364** or equivalent standard.
- **The PE ground conductor must** be connected to the separate U-clamp terminal in the terminal box of the signal converter.
- **Do not cross or loop the cables** in the back of the converter. Please use separate cable entries (PG or NPT) for power and signal cables.

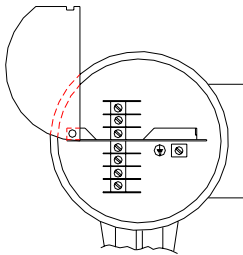
Ensure that the screw thread of the round cover on the terminal box is well greased at all times.

- **NOTE:** The grease used must be non corrosive to aluminium; typically it must be resin- and acid free.
- Protect the **sealing ring** from damage.



Coding of the Outputs acc. to following  PE  
Table:

Term. No.	Variant G (1 current, 1 puls intrinsic.safe)	Variant H (1 current, 1 status output. intrinsic.safe)	Variant K (1 current, 1 control inp. intrinsic.safe)	Term. No.	Variant L (2 current, intrinsic.safe)	Term. No.	Variant M 1current, 1 Bus intrinsic.safe)
I 1	current output (+)	current output (+)	current output (+)	I 1	current output 1 (+)	I 1	current output 1 (+)
I 1⊥	current output (-)	current output (-)	current output (-)	I 1⊥	current output 1 (-)	I 1⊥	current output 1 (-)
B	puls output (+)	status output. (+)	control input. (+)	I 2	current output 2 (+)	D	Bus
B⊥	puls output (-)	status output. (-)	control input. (-)	I 2⊥	current output 2 (-)	D⊥	Bus



Please note, that the power supply terminals are behind a lid. To connect, shift lid upwards, connect power and close lid again.

### 2.3.1 Technical information of the Intrinsically safe outputs

Variant G,H K,L type of protection intrinsically safe EEx ia IIC bzw.EEx ib IIC to connect with intrinsically safe circuits with following maximum values:

$U_i \leq 30 \text{ V}$	$C_i = 5 \text{ nF}$
$I_i \leq 250 \text{ mA}$	$L_i = 0$
$P_i \leq 1,0 \text{ W}$	

Variante M type of protection intrinsically safe EEx ia IIC bzw.EEx ib IIC to connect with intrinsically safe fieldbus with following maximum values (FISCO): I

Connection	
$U_i \leq 30 \text{ V}$	$C_i = 5 \text{ nF}$
$I_i \leq 250 \text{ mA}$	$L_i = 0$
$P_i \leq 1,0 \text{ W}$	






### 2.4 Overview PTB and FM Approvals

System configuration		PTB Cenelec	FM Div 1	FM Div. 2
MFM 4085 K	10G - 300 G	✓, Ex 94.C.2054 X	✓, J.I.1Y6A2.AX	✓, J.I.4Y0A5.AX
	800 G, 1500 G	✓, Ex 94.C.2054 X 1. Addendum	✓, J.I.5B2A9.AX	✓, J.I.5B3A0.AX
	3000 G+	✓, Ex 94.C.2054 X 3. Addendum	J.I.3003000	Approved-no J.I. number assigned
	Fluidheating	✓, Ex 94.C.2054 X 2. Addendum	in preparation	in preparation
	Multi I/O Converter	✓	in preparation	in preparation
	Intrinsically safe output	✓, Ex 94.C.2054 X 4. Addendum	in preparation	in preparation
	PROFIBUS PA	✓, Ex 94.C.2054 X 4. Addendum	in preparation	in preparation
MFM 4085 F	10G+ - 3000 G	✓, Ex-97.D.2195 D Ex-97.D.2194	J.I.3003000	Approved-no J.I. number assigned
	Fluidheating	✓, Ex-97.D.2195 D Ex-97.D.2194	in preparation	in preparation
	Multi I/O Converter	✓	in preparation	in preparation
	Intrinsically safe output	in preparation	in preparation	in preparation
	PROFIBUS PA	in preparation	in preparation	in preparation






### 3. Certification

## 4. Data Plates

### 4.1 Ex PTB

 <b>KROHNE</b> FLOW TECHNOLOGY Co. Ltd.  UNITED KINGDOM	
TYPE- <input type="text"/> Typ- <input type="text"/>	
EEX d <input type="checkbox"/> b <input type="checkbox"/> T6...T3 SEE CERTIFICATE OF CONFORMITY FOR MAX MEDIUM- AND AMBIENT TEMPERATURES Zulässige Meßstoff- und Umgebungstemperaturen siehe Konformitätsbescheinigung 	
PTB Nr. Ex-94.C.2054X	
INTRINSICALLY SAFE CIRCUITS: ONLY INTERNAL CIRCUITS Eigensichere Stromkreise: Nur innere Stromkreise WAITING TIME BEFORE OPENING FLAMEPROOF ENCLOSURE: T6: 825min, T5: 810min Wartezeit vor Öffnen der druckfesten Kapselung:	
COM-NO. <input type="text"/> Kom.-Nr. <input type="text"/> TAG-NO. <input type="text"/> Meßt.-Nr. <input type="text"/>	
MAINS Hilfsenergie <input type="text"/> V <input type="checkbox"/> + <input type="text"/> % - <input type="text"/> % <input type="text"/> Hz max. <input type="text"/>	
C.F. 1-2 <input type="text"/> <input type="text"/>	
C.F. 3-5 <input type="text"/> <input type="text"/> <input type="text"/>	
TERMINALS	Klemmen DESCRIPTION Beschreibung
<input type="text"/>	<input type="text"/>
<input type="text"/>	<input type="text"/>
<input type="text"/>	<input type="text"/>
<input type="text"/>	<input type="text"/>
MAX. W.PRESSURE / Druck <input type="text"/> WETTED/Benetzes MATERIAL <input type="text"/>	
 PROTECTION CLASS/Schutzklasse IP67 	

### 4.2 Ex PTB with Custody Transfer

 <b>KROHNE</b> FLOW TECHNOLOGY Co. Ltd.  UNITED KINGDOM	
TYPE- <input type="text"/> Typ- <input type="text"/>	
EEX d <input type="checkbox"/> b <input type="checkbox"/> T6...T3 SEE CERTIFICATE OF CONFORMITY FOR MAX MEDIUM- AND AMBIENT TEMPERATURES Zulässige Meßstoff- und Umgebungstemperaturen siehe Konformitätsbescheinigung 	
PTB Nr. Ex-94.C.2054X	
INTRINSICALLY SAFE CIRCUITS: ONLY INTERNAL CIRCUITS Eigensichere Stromkreise: Nur innere Stromkreise WAITING TIME BEFORE OPENING FLAMEPROOF ENCLOSURE: T6: 825min, T5: 810min Wartezeit vor Öffnen der druckfesten Kapselung:	
<input type="text"/>	MIN. TEMP. <input type="text"/> MAX. TEMP. <input type="text"/> Min. Temp. Max. Temp.
<input type="text"/>	MIN. DENSITY <input type="text"/> MAX. DENSITY <input type="text"/> Min. Dichte Max. Dichte
Meßgut <input type="text"/>	
Min. Durchfluß <input type="text"/>	Max. Durchfluß <input type="text"/>
Min. Meßmenge <input type="text"/>	
COM-NO. <input type="text"/> Kom.-Nr. <input type="text"/> TAG-NO. <input type="text"/> Meßt.-Nr. <input type="text"/>	
MAINS Hilfsenergie <input type="text"/> V <input type="checkbox"/> max. <input type="text"/>	
C.F. 1-2 <input type="text"/> <input type="text"/>	
C.F. 3-5 <input type="text"/> <input type="text"/> <input type="text"/>	
MAX. W.PRESSURE   Max Druck <input type="text"/>	BUILD DATE   Baujahr <input type="text"/>
WETTED/Benetzes MATERIAL: <input type="text"/>	
 PROTECTION CLASS/Schutzklasse IP67 	

4.3 Ex PTB with intrinsically safe outputs

<b>KROHNE</b> KROHNE Ltd. UNITED KINGDOM	
TYPE: _____ UP: _____	
EX: <input type="checkbox"/> [n/A] IC: [n/A] SEE CERTIFICATE OF CONFORMITY FOR MAX. MEDIAN- AND AMBIENT TEMPERATURES Zulässige Weisstoff- und Umgebungstemperaturen sichtbar Kennzeichnungsschutzklasse	
SERIAL-NO: _____ MFRS-NO: _____ PTB Nr. Ex-04-C.2024X	
<small>IC: 100% FOR KROHNE GROUP CUSTOMER PROTECTION</small> <small>Approved for use in Ex zones</small> <small>T<sub>50</sub> &gt; 20 min, T<sub>55</sub> &gt; 10 min</small> <small>Approved for use in Ex zones</small> <small>Approved for use in Ex zones</small>	
INTRINSICALLY SAFE OUTPUT - approved digital outputs	
<input type="checkbox"/> R / 0.1 <input type="checkbox"/> R / 0.1 <input type="checkbox"/> R / 0.1	PASSIVE OUTPUT - precision 2-wire signaling <small>Ex: Ia IC</small> PASSIVE REDUNDANT PUL 1.5V <small>Ex: Ia IC</small> Output: 1.5V 0
<input type="checkbox"/> R / 0.1	PASSIVE OUTPUT - precision 2-wire signaling <small>Ex: Ia IC</small> UNDER REDUNDANT PUL 4.5V <small>Ex: Ia IC/II</small> Output: 4.5V 0
CID-NO: _____ Korr-NO: _____ TAG-NO: _____ Modul-NO: _____	
RANGE: _____ V    + _____ %    - _____ % Resolution: _____ Hz    max: _____	
C.F. 1-2: _____ C.F. 3-8: _____	
MAX. PRESSURE / Druck: _____      METED/Overdruck: MAXIMAL	
○ PROTECTION CLASS/Schutzklasse IP67 ○	

4.4 FM Class 1 Div 1

**KROHNE** FLOW TECHNOLOGY Co. Ltd. UNITED KINGDOM

CORIMASS MFM4085K-AExDiv1-

SERIAL-NO. \_\_\_\_\_

COM-NO. \_\_\_\_\_

TAG-NO. \_\_\_\_\_

POWER  V  + % - %  
 Hz max.

COEFFICIENTS  
 C.F. 1-2 \_\_\_\_\_  
 C.F. 3-5 \_\_\_\_\_

TERMINALS	DESCRIPTION
_____	_____
_____	_____
_____	_____
_____	_____

MAX W.PRESSURE \_\_\_\_\_ MAX PROCESS TEMP \_\_\_\_\_

U.S. PATENTS: 5,052,231 WETTED MATERIAL \_\_\_\_\_  
 5,291,792 5,365,794 5,476,013

EXPLOSION PROOF WITH INT. SAFE DRIVER AND SENSOR COILS  
 CLASS I DIV 1 GPs. ABCD NEMA 4X  
 CLASS II DIV 1 GPs. EFG  
 CLASS III DIV 1 HAZARDOUS LOCATIONS

KROHNE AMERICA, INC. **Factory Mutual System Approved**  
 PEABODY, MA. 01960 508-535-6060

4.5 FM Class 1 Div 2

**KROHNE** FLOW TECHNOLOGY Co. Ltd. UNITED KINGDOM

CORIMASS MFM 4085K-

SERIAL-NO. \_\_\_\_\_

COM-NO. \_\_\_\_\_

TAG-NO. \_\_\_\_\_

POWER  V  + % - %  
 Hz max.

COEFFICIENTS  
 C.F. 1-2 \_\_\_\_\_  
 C.F. 3-5 \_\_\_\_\_

TERMINALS	DESCRIPTION
_____	_____
_____	_____
_____	_____
_____	_____

MAX W.PRESSURE \_\_\_\_\_ MAX PROCESS TEMP \_\_\_\_\_

U.S. PATENTS: 5,052,231 WETTED MATERIAL \_\_\_\_\_  
 5,291,792 5,365,794 5,476,013

NONINCENDIVE FOR  
 CLASS I DIV 2 GPs. ABCD NEMA 4X  
 CLASS II DIV 2 GPs. FG  
 CLASS III DIV 2 HAZARDOUS LOCATIONS

KROHNE AMERICA, INC. **Factory Mutual System Approved**  
 PEABODY, MA. 01960 508-535-6060