

CERTIFICATE OF CONFORMITY



1. **HAZARDOUS (CLASSIFIED) LOCATION ELECTRICAL EQUIPMENT PER US REQUIREMENTS**

2. **Certificate No:** FM16US0093X
3. **Equipment:** OPTIMASS 1400C, 2400C, 3400C, 6400C, 7400C, 1000F, 2000F, 3000F, 6000F and 7000F Mass Flow Meters
(Type Reference and Name)

4. **Name of Listing Company:** Krohne Ltd

5. **Address of Listing Company:** Rutherford Dr, Park Farm Industrial Estate
Wellingborough Northants NN8 6AE
United Kingdom

6. The examination and test results are recorded in confidential report number:

3046766 dated 31st July 2013

7. FM Approvals LLC, certifies that the equipment described has been found to comply with the following Approval standards and other documents:

FM Class 3600:2011, FM Class 3610:2015, FM Class 3611, FM Class 3615:2006, FM Class 3616:2011, FM Class 3810:2005, ANSI/ISA 61010-1 (82.02.01):2004, ANSI/NEMA 250:2003, ANSI/IEC 60529:2004, ANSI/ISA 60079-0:2009, ANSI/ISA 60079-1:2009, ANSI/ISA 60079-7:2008, ANSI/ISA 60079-11:20011, ANSI/ISA 60079-27:2006, ANSI/ISA 60079-31:2009, ANSI/ISA 12.27.01 2003

8. If the sign 'X' is placed after the certificate number, it indicates that the equipment is subject to specific conditions of use specified in the schedule to this certificate.

9. This certificate relates to the design, examination and testing of the products specified herein. The FM Approvals surveillance audit program has further determined that the manufacturing processes and quality control procedures in place are satisfactory to manufacture the product as examined, tested and Approved.

Certificate issued by:

J. E. Marquedant
VP, Manager - Electrical Systems

14 July 2020

Date

To verify the availability of the Approved product, please refer to www.approvalguide.com

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FM Approvals LLC. 1151 Boston-Providence Turnpike, Norwood, MA 02062 USA
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10. Equipment Ratings:

Explosionproof-Intrinsically Safe Apparatus for Class I, Division 1, Groups A, B, C, and D; Dust-Ignitionproof-Intrinsically Safe Apparatus for Class II and III, Division 1, Groups E, F, and G, Nonincendive-Intrinsically Safe Apparatus for Class I,II and III, Division 2, Groups A, B, C, D, F and G; Associated Apparatus with Intrinsically Safe Connections for Class I, II and III, Division 1, Groups A, B, C, D, E, F and G; Associated Nonincendive Field Wiring Circuit for Class I, II and III, Division 2, Groups A, B, C, D, F and G; Flameproof-Intrinsically Safe for Class I, Zone 1, Group IIC; Flameproof-Increased Safety-Intrinsically Safe for Class I, Zone 1, Group IIC; Dust Protection by enclosure-Intrinsically Safe for Zone 21, Group IIIC in accordance with drawings 8.85519.17 or 8.85519.18; hazardous (classified) locations, Type 4X, IP67, Dual Seal.

11. The marking of the equipment shall include:

For OPTIMASS Compact Mass Flow Meters and MFC 400F Converter with IS outputs, the equipment is labelled with the following marking(s).

CL I DIV1, GPS A,B,C,D
CL II DIV1 GPS E,F,G, CL III DIV1 T6...T1
CL I DIV2 GPS A,B,C,D CL II DIV2 GPS F,G, CL III DIV2 T6...T1
CL I ZN1 AEx d ia[ia] IIC T6...T1 Gb
CL I ZN1 AEx d e ia[ia] IIC T6...T1 Gb
ZN21 AEx t ia[ia] IIIC T80C...270C Db
AMBIENT TEMP, -40°C to +65°C, Type 4X, IP67, DUAL SEAL

For OPTIMASS Compact Mass Flow Meters and MFC 400F Converter without IS outputs, the equipment is labelled with the following marking(s).

CL I DIV1, GPS A,B,C,D
CL II DIV1 GPS E,F,G, CL III DIV1 T6...T1
CL I DIV2 GPS A,B,C,D CL II DIV2 GPS F,G, CL III DIV2 T6...T1
CL I ZN1 AEx d ia IIC T6...T1 Gb
CL I ZN1 AEx d e ia IIC T6...T1 Gb
ZN21 AEx t ia[ia] IIIC T80C...T270C Db
AMBIENT TEMP, -40°C to +65°C, Type 4X, IP67, DUAL SEAL

For the OPTIMASS Remote Sensor, the equipment is labelled with the following marking(s).

CL I DIV1, GPS A,B,C,D
CL I DIV2 GPS A,B,C,D CL II DIV1 GPS E,F,G, CL III DIV1 T6...T1
CL II DIV2 GPS F,G, CL III DIV2 T6...T1
CL I ZN1 AEx ia IIC T6...T1 Gb
ZN21 AEx ia IIIC T80C...T440C Db
AMBIENT TEMP, -40°C to +65°C, Type 4X, IP67, DUAL SEAL

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12. Description of Equipment:

General - The OPTIMASS 1400C, 2400C, 3400C, 6400C, 7400C, 1000F, 2000F, 3000F, 6000F and 7000F are a Coriolis Mass Flow Meter for the direct recording and display of the mass flow of liquids. The apparatus consists of the measuring converter and sensor which are connected together directly, in compact configuration (converter bolted directly onto the sensor housing) or remote configuration (converter connected via cable). All electrical connections between the sensor and the measuring converter are Intrinsically Safe.

Construction - The external connection for the power supply is of non-intrinsically safe design. The input/output circuit is either Intrinsically Safe or alternatively can be of Non-intrinsically Safe design. The mass flow meter is equipped with a type MFC400 converter. The converter is installed in a measuring converter housing type MH300 with "flameproof enclosure" protection type. Sensors of the type OPTIMASS 1000, 2000, 3000, 6000 or 7000 are used.

Ratings - The OPTIMASS 1400C, 2400C, 3400C, 6400C, 7400C, 1000F, 2000F, 3000F, 6000F and 7000F can be supplied power by a voltage source of 12 – 24 Vdc, 24Vac/Vdc or 100 – 230 Vac depending on the selected power supply board option. The maximum power consumption of the product is either 12 W or 22VA. The ambient operating temperature range of the OPTIMASS a400C is -40°C to 65°C with Aluminum Converter housing and -40°C to 60°C with Stainless Steel Converter Housing. Process temperature range is -200°C to +400°C refer to Control Drawing.

With IS outputs:

OPTIMASS a400C bc. Compact Mass Flow Meters.

a = Sensor Series: 1, 2, 3 or 7

b = Measuring tube material: T, S, A, H, D, E or U

c = Sensor size / Flow area: 01, 03, 04, 06, 08, 10, 15, 25, 40, 50, 80, 100, 150, 200, 250 or 400

*For Entity Parameters and Nonincendive Field Wiring Parameters reference control drawing 8.85519.19.
For FISCO Parameters reference control drawing 8.85519.20

VEabcdefghijklmnopqrstu. Sensor V number

ab = Sensor base model: 01, 03, 04, 11, 12, 13, 14, 15, 16, 17, 21, 22, 23, 24, 25, 26, 27, 32, 33, 34, 35, 36, 37, 43, 44, 45, 46, 47, 83, 84, 85, 86, 87, 88, 89 or 90

c = Manufacturer specific: not safety relevant

d = Measuring tube material: T, S, A, H, D, E or U

e = Tube surface finish: not safety relevant

f = Process connection size: not safety relevant

g = Process connection standard: Not safety relevant

h = Sealing face: not safety relevant

j = Secondary containment material: not safety relevant

k = Heating jacket options: 0, 1, 2, 3, 5, A, B, C, D

l = Hazardous area approvals: T

m = Hygienic / sanitary approvals: not safety relevant

n = Configuration: 0

p = Calibration: not safety relevant

q = Cleaning / degreasing: not safety relevant

r = Extended options: not safety relevant

s = Customer specific: 0, 1 or C

t = Converter type: 3 or 6

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u = Destination: Not safety relevant

VEabcdefghijklmnopqrstuv. Converter V number

- ab = Converter type / variant: 53 or 54
- c = Manufacturer specific: not safety relevant
- d = Converter type: 4
- e = Power supply: 1, 4 or A
- f = Hazardous area approvals: 7
- g = Cable connections: 4 or R
- h = Instruction manual / operating language: not safety relevant
- j = Custody transfer: not safety relevant
- k = Process diagnostics: not safety relevant
- l = Converter housing: 1 or 2
- m = Customer specific: 0, 1 or C
- n = Outputs (Base Module): 2, 3, D or E
- p = Outputs (1st I/O Module): 0, 1 or 2
- q = Outputs (2nd I/O Module): 0
- r = Measuring functions: not safety related
- s = Manuals: not safety relevant
- t = Remote option cable: 0
- u = Destination: Not safety relevant
- v = Sensor: 0, 1, 2, 3, 6, 7, A, B or C

OPTIMASS 6400C bc. Compact Mass Flow Meters.

- b = Measuring tube material: D, H or S
- c = Sensor size / Flow area: 01, 03, 04, 06, 08, 10, 15, 25, 40, 50, 80, 100, 150, 200 or 250

*For Entity Parameters and Nonincendive Field Wiring Parameters reference control drawing 8.85519.19.
For FISCO Parameters reference control drawing 8.85519.20

VEabcdefghijklmnopqrstu. Sensor V number

- ab = Sensor base model: 71, 72, 73, 74, 75, 76, 77, 78, 79 or 80
- c = Manufacturer specific: not safety relevant
- d = Measuring tube material: D, H or S
- e = Tube surface finish: not safety relevant
- f = Process connection size: not safety relevant
- g = Process connection standard: Not safety relevant
- h = Sealing face: not safety relevant
- j = Design: 0 or K
- k = Heating jacket options: 0, 1, 2, 3, 5 or A
- l = Hazardous area approvals: T
- m = Hygienic / sanitary approvals: not safety relevant
- n = Configuration: 0
- p = Calibration: not safety relevant
- q = Process Requirements: 0, 1, C, D or T
- r = Extended options: not safety relevant
- s = Customer specific: 0, 1 or C
- t = Converter type: 3 or 6
- u = Destination: Not safety relevant

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VEabcdefghijklmnopqrstuv. Converter V number

ab = Converter type / variant: 53 or 54
c = Manufacturer specific: not safety relevant
d = Converter type: 4
e = Power supply: 1, 4 or A
f = Hazardous area approvals: 7
g = Cable connections: 4 or R
h = Instruction manual / operating language: not safety relevant
j = Custody transfer: not safety relevant
k = Process diagnostics: not safety relevant
l = Converter housing: 1 or 2
m = Customer specific: 0, 1 or C
n = Outputs (Base Module): 2, 3, D or E
p = Outputs (1st I/O Module): 0, 1 or 2
q = Outputs (2nd I/O Module): 0
r = Measuring functions: not safety related
s = Manuals: not safety relevant
t = Remote option cable: 0
u = Destination: Not safety relevant
v = Sensor: 0, 1, 2, 3, 6, 7, A, B or C

Without IS outputs:

OPTIMASS a400C bc. Compact Mass Flow Meters.

a = Sensor Series: 1, 2, 3 or 7
b = Measuring tube material: T, S, A, H, D, E or U
c = Sensor size / Flow area: 01, 03, 04, 06, 08, 10, 15, 25, 40, 50, 80, 100, 150, 200, 250 or 400

VEabcdefghijklmnopqrstu. Sensor V number

ab = Sensor base model: 01, 03, 04, 11, 12, 13, 14, 15, 16, 17, 21, 22, 23, 24, 25, 26, 27, 32, 33, 34, 35, 36, 37, 43, 44, 45, 46, 47, 83, 84, 85, 86, 87, 88, 89 or 90
c = Manufacturer specific: not safety relevant
d = Measuring tube material: T, S, A, H, D, E or U
e = Tube surface finish: not safety relevant
f = Process connection size: not safety relevant
g = Process connection standard: Not safety relevant
h = Sealing face: not safety relevant
j = Secondary containment material: not safety relevant
k = Heating jacket options: 0, 1, 2, 3, 5, A, B, C, D
l = Hazardous area approvals: T
m = Hygienic / sanitary approvals: not safety relevant
n = Configuration: 0
p = Calibration: not safety relevant
q = Cleaning / degreasing: not safety relevant
r = Extended options: not safety relevant
s = Customer specific: 0, 1 or C
t = Converter type: 3 or 6
u = Destination: Not safety relevant

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VEabcdefghijklmnpqrstuv. Converter V number

ab = Converter type / variant: 53 or 54
c = Manufacturer specific: not safety relevant
d = Converter type: 4
e = Power supply: 1, 4 or A
f = Hazardous area approvals: 7
g = Cable connections: 4 or R
h = Instruction manual / operating language: not safety relevant
k = Custody transfer: not safety relevant
j = Process diagnostics: not safety relevant
l = Converter housing: 1, 2 or 3
m = Customer specific: 0, 1 or C
n = Outputs (Base Module): 1, 4, 6, 7, 8, B, C, D, E, F, G or H
p = Outputs (1st I/O Module): 0, 8, A, B, C, E, F, G, H or K
q = Outputs (2nd I/O Module): 0, 8, A, B, C, E, F, G, H or K
r = Measuring functions: not safety related
s = Manuals: not safety relevant
t = Remote option cable: 0
u = Destination: Not safety relevant
v = Sensor: 0, 1, 2, 3, 6, 7, A, B or C

OPTIMASS 6400C bc. Compact Mass Flow Meters.

b = Measuring tube material: D, H or S
c = Sensor size / Flow area: 01, 03, 04, 06, 08, 10, 15, 25, 40, 50, 80, 100, 150, 200 or 250

VEabcdefghijklmnpqrstu. Sensor V number

ab = Sensor base model: 71, 72, 73, 74, 75, 76, 77, 78, 79 or 80
c = Manufacturer specific: not safety relevant
d = Measuring tube material: D, H or S
e = Tube surface finish: not safety relevant
f = Process connection size: not safety relevant
g = Process connection standard: Not safety relevant
h = Sealing face: not safety relevant
j = Secondary containment material: not safety relevant
k = Heating jacket options: 0, 1, 2, 3, 5 or A
l = Hazardous area approvals: T
m = Hygienic / sanitary approvals: not safety relevant
n = Configuration: 0
p = Calibration: not safety relevant
q = Process Requirements: 0, 1, C, D or T
r = Extended options: not safety relevant
s = Customer specific: 0, 1 or C
t = Converter type: 3 or 6
u = Destination: Not safety relevant

VEabcdefghijklmnpqrstuv. Converter V number

ab = Converter type / variant: 53 or 54
c = Manufacturer specific: not safety relevant
d = Converter type: 4

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- e = Power supply: 1, 4 or A
- f = Hazardous area approvals: 7
- g = Cable connections: 4 or R
- h = Instruction manual / operating language: not safety relevant
- k = Custody transfer: not safety relevant
- j = Process diagnostics: not safety relevant
- l = Converter housing: 1, 2 or 3
- m = Customer specific: 0, 1 or C
- n = Outputs (Base Module): 1, 4, 6, 7, 8, B, C, D, E, F, G or H
- p = Outputs (1st I/O Module): 0, 8, A, B, C, E, F, G, H or K
- q = Outputs (2nd I/O Module): 0, 8, A, B, C, E, F, G, H or K
- r = Measuring functions: not safety related
- s = Manuals: not safety relevant
- t = Remote option cable: 0
- u = Destination: Not safety relevant
- v = Sensor: 0, 1, 2, 3, 6, 7, A, B or C

With IS outputs:

MFC 400F VEabcdefghjklmnpqrstuv. Converter.

- ab = Converter type / variant: 53 or 54
- c = Manufacturer specific: not safety relevant
- d = Converter type: H
- e = Power supply: 1, 4 or A
- f = Hazardous area approvals: 7
- g = Cable connections: 4 or R
- h = Instruction manual / operating language: not safety relevant
- j = Custody transfer: not safety relevant
- k = Process diagnostics: not safety relevant
- l = Converter housing: 1 or 3
- m = Customer specific: 0 or 1
- n = Outputs (Base Module): 2, 3, D or E
- p = Outputs (1st I/O Module): 0, 1 or 2
- q = Outputs (2nd I/O Module): 0
- r = Measuring functions: not safety related
- s = Manuals: not safety relevant
- t = Remote option cable: 1, 4 or 5
- u = Destination: Not safety relevant
- v = Sensor: 0, 1, 2, 3, 6, 7, A, B or C

*For Entity Parameters and Nonincendive Field Wiring Parameters reference control drawing 8.85519.19. For FISCO Parameters reference control drawing 8.85519.20

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Without IS outputs:

MFC 400F VEabcdefghijklmnpqrstuv. Converter.

ab = Converter type / variant: 53 or 54
c = Manufacturer specific: not safety relevant
d = Converter type: H
e = Power supply: 1, 4 or A
f = Hazardous area approvals: 7
g = Cable connections: 4 or R
h = Instruction manual / operating language: not safety relevant
j = Custody transfer: not safety relevant
k = Process diagnostics: not safety relevant
l = Converter housing: 1 or 3
m = Customer specific: 0 or 1
n = Outputs (Base Module): 1, 4, 6, 7, 8, B, C, D, E, F, G or H
p = Outputs (1st I/O Module): 0, 8, A, B, C, E, F, G, H or K
q = Outputs (2nd I/O Module): 0, 8, A, B, C, E, F, G, H or K
r = Measuring functions: not safety related
s = Manuals: not safety relevant
t = Remote option cable: 1, 4 or 5
u = Destination: Not safety relevant
v = Sensor: 0, 1, 2, 3, 6, 7, A, B or C

OPTIMASS a00F bc. Remote Sensor.

a = Sensor Series: 1, 2, 3 or 7
b = Measuring tube material: A, D, E, H, S, T or U
c = Sensor size / Flow area: 01, 03, 04, 06, 08, 10, 15, 25, 40, 50, 80, 100, 150, 200, 250 or 400

*For Entity Parameters and Nonincendive Field Wiring Parameters reference control drawing 8.85519.19. For FISCO Parameters reference control drawing 8.85519.20

VEabcdefghijklmnpqrstu. Sensor V number

ab = Sensor base model: 01, 03, 04, 11, 12, 13, 14, 15, 16, 17, 21, 22, 23, 24, 25, 26, 27, 32, 33, 34, 35, 36, 37, 43, 44, 45, 46, 47, 83, 84, 85, 86, 87, 88, 89 or 90
c = Manufacturer specific: not safety relevant
d = Measuring tube material: A, D, E, H, S, T or U
e = Tube surface finish: not safety relevant
f = Process connection size: not safety relevant
g = Process connection standard: Not safety relevant
h = Sealing face: not safety relevant
j = Secondary containment material: not safety relevant
k = Heating jacket options: 0, 1, 2, 3, 5, A, B, C, D
l = Hazardous area approvals: T
m = Hygienic / sanitary approvals: not safety relevant
n = Configuration: 1 or 2
p = Calibration: not safety relevant
q = Cleaning / degreasing: not safety relevant
r = Extended options: not safety relevant
s = Customer specific: 0, 1 or C
t = Converter type: 4 or 7

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u = Destination: Not safety relevant

OPTIMASS 6000F bc. Remote Sensor.

b = Measuring tube material: D, H or S

c = Sensor size / Flow area: 01, 03, 04, 06, 08, 10, 15, 25, 40, 50, 80, 100, 150, 200 or 250

*For Entity Parameters and Nonincendive Field Wiring Parameters reference control drawing 8.85519.19. For FISCO Parameters reference control drawing 8.85519.20

VEabcdefghijklmnopqrstu. Sensor V number

ab = Sensor base model: 71, 72, 73, 74, 75, 76, 77, 78, 79 or 80

c = Manufacturer specific: not safety relevant

d = Measuring tube material: D, H or S

e = Tube surface finish: not safety relevant

f = Process connection size: not safety relevant

g = Process connection standard: Not safety relevant

h = Sealing face: not safety relevant

j = Secondary containment material: not safety relevant

k = Heating jacket options: 0, 1, 2, 3, 5, A, B, C, D

l = Hazardous area approvals: T

m = Hygienic / sanitary approvals: not safety relevant

n = Configuration: 1 or 2

p = Calibration: not safety relevant

q = Process Requirements: 0, 1, C, D or T

r = Extended options: not safety relevant

s = Customer specific: 0, 1 or C

t = Converter type: 4 or 7

u = Destination: Not safety relevant

13. **Specific Conditions of Use:**

1. *Non-used openings shall be sealed by means of certified blind plugs.*
2. *For information on the dimensions of the flame proof joints, the manufacturer shall be contacted.*

14. **Test and Assessment Procedure and Conditions:**

This Certificate has been issued in accordance with FM Approvals US Certification Requirements.

15. **Schedule Drawings**

A copy of the technical documentation has been kept by FM Approvals.

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16. Certificate History

Details of the supplements to this certificate are described below:

Date	Description
31 July 2013	Original Issue.
2 nd June 2016	<u>Supplement 3:</u> Report Reference: – RR205076 dated 2 nd June 2016. Description of the Change: Model code option structure has been updated, new certificate format.
19 th October 2016	<u>Supplement 4:</u> Report Reference: – 3060208 dated 19 th October 2016. Description of the Change: Addition of temperature table.
1 st November 2016	<u>Supplement 5:</u> Report Reference: – 3059133 dated 1 st November 2016. Description of the Change: OPTIMASS 2000F and 2400C four tube option added.
30 th November 2016	<u>Supplement 6:</u> Report Reference: – RR207452 dated 30 th November 2016. Description of the Change: Corrections to OPTIMASS a400C and a4000F options. Also, update to temperature range for Zone 21 marking.
9 th February 2017	<u>Supplement 7:</u> Report Reference: – RR208297 dated 9 th February 2017. Description of the Change: Corrections to Remote Sensor V number for Configuration option.
5 th May 2017	<u>Supplement 8:</u> Report Reference: – RR209196 dated 5 th May 2017. Description of the Change: Added; CF-Bush, CF-Stem, LC-Bush & MFC400S electronics module.
12 th September 2017	<u>Supplement 9:</u> Report Reference: – RR210953 dated 12 th September 2017. Description of the Change: Model code option structure has been updated.
26 th November 2018	<u>Supplement 10:</u> Report Reference: – RR216362 dated 26 th November 2018. Description of the Change: Converter Type option added.
14 th July 2020	<u>Supplement 11:</u> Report Reference: – RR224156 dated 14 th July 2020. Description of the Change: Correction to model code, Sensor Options.

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