OPTIMASS / 400

Supplementary Instructions

1000 / 2000 / 3000 / 6000 / 7000 series of meters and
MFC 400 converter

Hazardous areas

KROHNE

1.1 Scope of the document

These instructions are applicable only to the explosion protection version of the meter. For all other data, use the Quick Start and Handbook. If you do not have these documents, please contact the nearest sales office or download them from the manufacturer's website.

INFORMATION!
The information in these supplementary instructions only contains the data applicable to explosion protection. The technical data for the non-Ex version in the Handbook shall be valid in its current version, provided that it is not rendered invalid or replaced by these supplementary instructions.

1.2 General

The OPTIMASS flowmeter system consists of a mass flow sensor and a flow converter, or a mass flow sensor and associated equipment.

The separate mass flow sensor with a mass flow converter is identified as:

- OPTIMASS 1000F flow sensor with MFC 400F flow converter
- OPTIMASS 2000F flow sensor with MFC 400F flow converter
- OPTIMASS 3000F flow sensor with MFC 400F flow converter
- OPTIMASS 6000F flow sensor with MFC 400F flow converter
- OPTIMASS 7000F flow sensor with MFC 400F flow converter

The flowmeter in a compact configuration is identified as:

- OPTIMASS 1400C (OPTIMASS 1000 + MFC 400)
- OPTIMASS 2400C (OPTIMASS 2000 + MFC 400)
- OPTIMASS 3400C (OPTIMASS 3000 + MFC 400)
- OPTIMASS 6400C (OPTIMASS 6000 + MFC 400)
- OPTIMASS 7400C (OPTIMASS 7000 + MFC 400)

The OPTIMASS x000 is the general terminology for the OPTIMASS x000F

1.3 Standards compliance

As part of the hazardous areas approval, the OPTIMASS flowmeter system satisfies the requirements of the following standards:

- 2014/34/EU - Explosive Atmospheres Directive
- SI 2016 No. 1107 - Equipment and Protective Systems Intended for Use in Potentially Explosive Atmospheres (Amended by SI 2019 No. 696)
- IEC 60079-0:2018 - Explosive atmospheres. Equipment - General requirements
- IEC 60079-1:2014 - Explosive atmospheres. Equipment protection by flameproof enclosures "d"
- IEC 60079-7:2015+A1:2018 - Explosive atmospheres. Equipment protection by increased safety "e"
- IEC 60079-11:2012 - Explosive atmospheres. Equipment protection by intrinsic safety "i"
- IEC 60079-26:2021 - Explosive atmospheres. Equipment with Separation Elements or combined Levels of Protection
- IEC 60079-31:2014 - Explosive atmospheres. Equipment dust ignition protection by enclosure "t"

1.4 Hazardous areas approvals

The hazardous areas approvals for the OPTIMASS flowmeter system, relating to this supplementary manual, are as follows:

	Certificate type	Certificate number
Sensor	ATEX	CML 22ATEX2464X
	IECEx	IECEx CML 22.0066X
	UKEX	CML 22UKEX2354X
	DNV INMETRO	DNV 23.0001 X
Remote converter	ATEX	CML 22ATEX1465X
	IECEx	IECEx CML 22.0067X
	UKEX	CML 22UKEX1355X
	DNV INMETRO	DNV 23.0003 X
Compact meter (sensor and converter)	ATEX	CML 22ATEX1466X
	IECEx	IECEx CML 22.0068X
	UKEX	CML 22UKEX1356X
	DNV INMETRO	DNV 23.0002 X

1.5 Ex markings

Sensor and Converter markings

	Hazard type	Ex marking
Sensor	Gas	II 1 G Ex ia IIC T6...T1 Ga
	Dust	II 2D/1G Ex ia IIIC Txxx °C Db/Ga ①
Remote converter	Gas ②	II 2(1) G Ex db [ia Ga] IIC T6 Gb
	Gas ③	II 2(1) G Ex db eb [ia Ga] IIC T6 Gb
	Dust	II 2 (1G) D Ex tb [ia] IIIC T75°C Db
Compact meter (sensor and converter)	Gas ②	II 1/2G Ex db ia IIC T6...T1 Ga/Gb
	Gas ③	II 1/2G Ex db eb ia IIC T6...T1 Ga/Gb
	Dust	II 1/2G Ex tb ia IIIC Txxx°C Db/Ga ①

① see table 1 below
② with Ex d terminal compartment
③ with Ex e terminal compartment

Table 1 maximum surface temperature (dust)

Sensor type	Temperature °C
1000F	T185
1400C	T165
2x00x	T160
3x00x	T165
6x00x (+150°C and cryogenic)	T190
6x00x (+230°C)	T270
6000F (+400°C)	T440
7x00x	T165

1.6 Identification of OPTIMASS flowmeter systems

The complete OPTIMASS flowmeter system is identified by the models of the flow sensor and the flow converter.

The VE codes are unique and are used to identify the models and variants of the OPTIMASS flow sensor and flow converter and therefore the complete flowmeter system; through the original order specification and manufacture of the system. The VE code for each flowmeter system is included on the product nameplate/s. Please refer to the nameplates section.

On integral / compact systems, where the converter is mounted directly to the sensor, the nameplate is on the converter housing. On remote systems, where the converter housing is separate to the sensor and linked by a dedicated cable, the nameplate is on the remote converter housing and essential data is duplicated on the junction box of the sensor.

Not all elements of the VE codes are Ex safety relevant. The following tables describe the VE code structure and defines the hazardous area relevant options.

1.7 Flow sensor VE code

The flow sensor variant is identified by the VE code number on the nameplate:

①	VE	ab	c	d	e	fg	h	j	k	l	m	n	p	q	r	s	t	u	v	w
②	1-2	3-4	5	6	7	8-9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
③	x	√	x	x	x	x	√	√	√	√	x	√	x	√	x	√	√	x	x	x

① Code
② Position
③ Hazardous areas relevant?

Code	Description
VE	Prefix to code
ab	Flow sensor type and size
c	Manufacturer specific
d	Wetted part material
e	Surface finish
fg	Flange size and rating
h	Flange sealing face
j	Outer case material / secondary containment / operating pressure / stem length
k	Options
l	Hazardous area approval
m	Sanitary and material approvals
n	Configuration
p	Calibration
q	Cleaning / degreasing / process requirements / process temperature
r	Extended options / custody transfer approval
s	"0"
t	Converter type
u	Destination
v	Functional safety
w	Spare

1.8 Flow converter VE code

The flow converter variant is identified by the VE code number on the nameplate:

①	VE	ab	c	d	e	f	g	h	j	k	l	m	n	p	q	r	s	t	u	v	w
②	1-2	3-4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
③	x	√	x	√	√	√	x	x	x	x	x	√	√	√	√	x	x	√	x	x	x

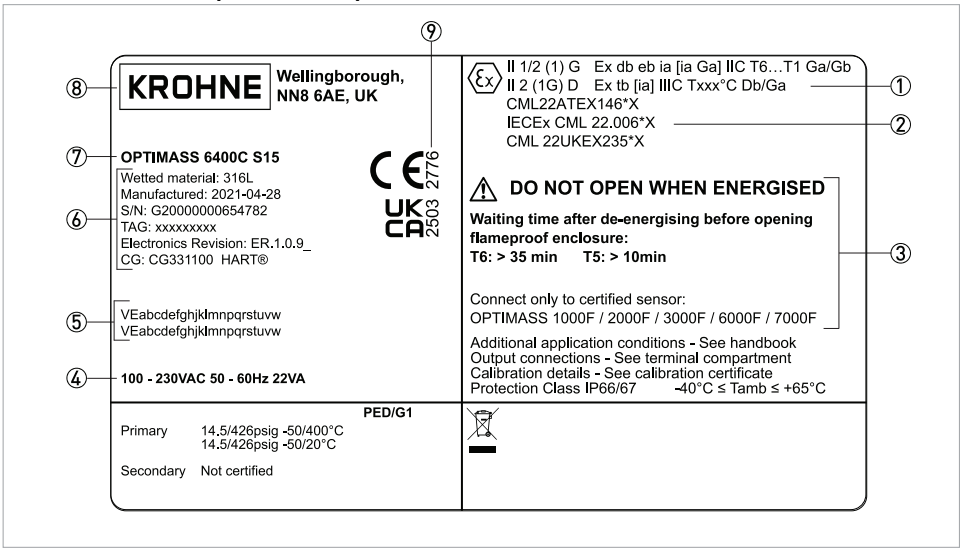
① Code
② Position
③ Hazardous areas relevant?

Code	Description
VE	Prefix to code
ab	Converter type
c	Manufacturer specific
d	Type
e	power supply
f	Hazardous areas approval
g	Cable connection
h	Languages
j	Custody transfer
k	Process diagnostics
l	Converter housing
m	"0"
n	Outputs (base I/O module)
p	Outputs (first I/O module)
q	Outputs (second I/O module)
r	measuring functions
s	Manuals
t	Remote option: signal cable
u	Destination
v	Sensor type
w	Spare

1.9 Nameplates

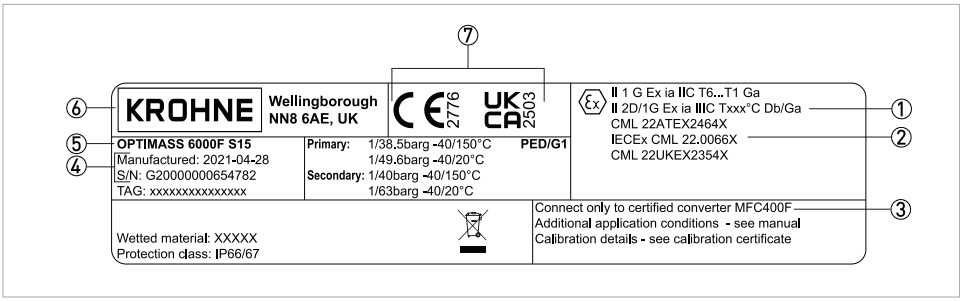
The nameplate contains information about the sensor and converter. Below are examples of both compact and field versions of the nameplate.

Converter nameplate (compact and remote versions)



① Ex marking
② Certificate number
③ Ex specific requirement
④ Power supply data
⑤ VE Codes for sensor and converter
⑥ Year of manufacture / serial number / electronics revision
⑦ Model type (OPTIMASS x400 C or OPTIMASS x400C - painted)
⑧ Logo and address of manufacturer
⑨ Identification numbers of the notified / approved bodies

Sensor nameplate (remote version only)



① Ex marking
② Certificate number
③ Ex specific requirement
④ Year of manufacture / serial number
⑤ Model type (OPTIMASS x000F or OPTIMASS x000F -- painted)
⑥ Logo and address of manufacturer
⑦ Identification numbers of the notified / approved bodies

INFORMATION!
The nameplates shown above are for illustration purposes. The information on the actual device nameplate might be different, depending on country and / or territory.

1.10 Warnings and symbols used

Safety warnings are indicated by the following symbols.

DANGER!
This warning refers to the immediate danger when working with electricity.

DANGER!
This warning refers to the immediate danger of burns caused by heat or hot surfaces.

DANGER!
This warning refers to the immediate danger when using this device in a hazardous atmosphere.

DANGER!
These warnings must be observed without fail. Even partial disregard of this warning can lead to serious health problems and even death. There is also the risk of seriously damaging the device or parts of the operator's plant.

WARNING!
Disregarding this safety warning, even if only in part, poses the risk of serious health problems. There is also the risk of damaging the device or parts of the operator's plant.

CAUTION!
Disregarding these instructions can result in damage to the device or to parts of the operator's plant.

INFORMATION!
These instructions contain important information for the handling of the device.

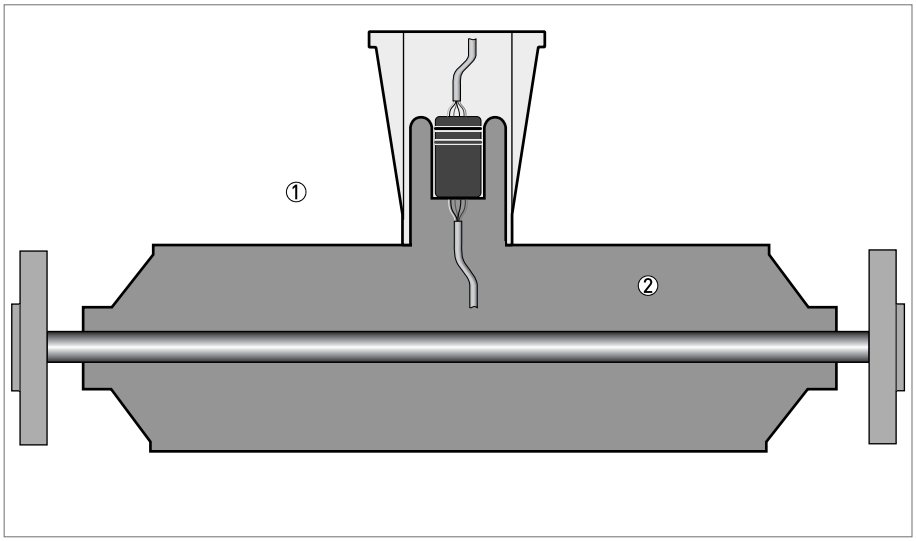
LEGAL NOTICE!
This note contains information on statutory directives and standards.

- HANDLING
  This symbol designates all instructions for actions to be carried out by the operator in the specified sequence.

➲ RESULT
This symbol refers to all important consequences of the previous actions.

2.1 Separation Elements

The body of the meter can form a partition wall between EPL Ga and EPL Gb / Db zones. The partition wall is made from Stainless Steel ≥ 1mm.



① Zone EPL Ga
② Zone EPL Gb / Db

2.2 Equipotential bonding

The MFC 400F (field)(remote) converter and the OPTIMASS X400C (compact) must be included in the equipotential bonding of the installation. Use the bonding terminal on the converter housing, wall bracket or mass flow meter housing mounting stem.

In separated systems, a screened cable is used and is earthed at the meter and converter ends. Fit an equalisation cable with a minimum cross section area of $4mm^2$ to the equipotential bonding terminals on the mass flow converter housing bracket and the mass flow sensor electronics stem.

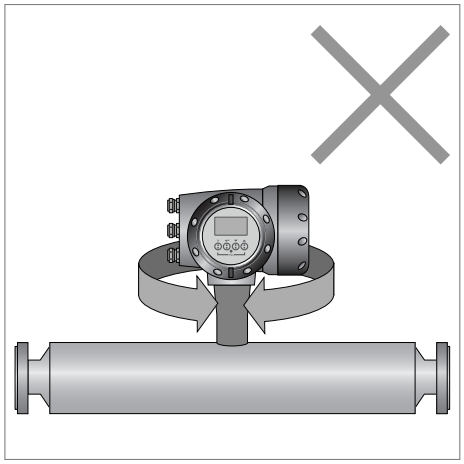
2.3 Electrostatic charge

To reduce the ignition hazard caused by an electrostatic charge collecting on the instrument, you must obey the following instructions:

- DO NOT clean the meter and / or converter with a dry cloth.
- DO NOT install the meter and / or converter near to any process that uses an electrostatic charge, for example a dry powder coating system.
- DO NOT use the meter for applications where the process can generate a strong electrostatic charge.
- DO NOT install the meter in an area where it will be in contact with airborne particles that can cause an electrostatic charge.

DANGER!
Electrostatic charging of the meter and / or converter housing MUST be avoided.

2.4 Converter orientation (compact version)



DO NOT rotate the converter housing on the meter stem. Rotating the converter housing can cause damage to the internal wiring.

DANGER!
Damage to the internal wiring could effect the Ex integrity of the meter.

2.5 Temperature limits

2.5.1 Introduction

Because of the effect that the process temperature has on the meter, mass flow sensors and compact mass flow meters are not given a fixed temperature class. The tables in this section give details of the temperature class for each meter.

Notes

- Make sure that the flowmeter is installed and operated as shown in the relevant Handbook.
- Make sure that the flowmeter is not exposed to a source of heat (for example direct sunlight or heat from adjacent equipment) that causes the ambient temperature to rise above the ambient temperature range for the meter.
- Make sure that insulation is not preventing ventilation of the meter housing.

2.5.2 Heating jacket / insulation

On compact meters with a process temperature above 130°C and where a heating jacket is fitted, you must also use thermal insulation with a maximum depth of 50mm.

2.5.3 Compact configuration

When a compact meter configuration is selected, the converter housing material affects the temperature range of the meter. For converter housing material codes, please refer to the converter VE code section.

2.5.4 MFC 400F converter

MFC 400F with aluminium housing.

VE	ab	c...k	l	m...w
	53...54		1	

	Ambient temp. T_{amb} °C	Temp. class	Max. Surface temp. °C
Standard	-40...+65	T6	T75
SIL capable	-40...+55	T6	T75

MFC 400F with Stainless Steel housing.

VE	ab	c...k	l	m...w
	53...54		2 or 3	

	Ambient temp. T_{amb} °C	Temp. class	Max. Surface temp. °C
Standard	-40...+60	T6	T75
SIL capable	-40...+55	T6	T75

2.5.5 OPTIMASS 1000F / 1400C

OPTIMASS 1000F

VE	ab	c...m	n	p...w
	83...86		1 or 2	

OPTIMASS 1000F

Ambient temp. T_{amb} °C	Max. process temp. T_m °C	Temp. class	Max. surface temp. °C
-40...+60	60	T6 - T1	T80
-40...+65	75	T5 - T1	T95
	110	T4 - T1	T130
	130	T3 - T1	T185
Minimum process temperature: $T_{amb} \geq$ -35°C T_m = -50°C, T_{amb} <-35°C T_m = -40°C			

OPTIMASS 1400C with aluminium converter housing

VE	ab	c...m	n	p...w
	83...86		0	

Ambient temp. T_{amb} °C	Max. process temp. T_m °C	Temp. class	Max. surface temp. °C
-40...+40	45	T6 - T1	T80
-40...+50	60	T5 - T1	T95
	95	T4 - T1	T130
	130	T3 - T1	T165
-40...+65	65	T4 - T1	T100
Minimum process temperature: $T_{amb} \geq$ -35°C T_m = -50°C, T_{amb} <-35°C T_m = -40°C			

OPTIMASS 1400C with Stainless Steel converter housing

VE	ab	c...m	n	p...w
	83...86		0	

Ambient temp. T_{amb} °C	Max process temp. T_m °C	Temp. class	Max. surface temp. °C
-40...+40	45	T6 - T1	T80
	130	T3 - T1	T165
-40...+50	95	T4 - T1	T130
-40...+60	60	T5 - T1	T95
Minimum process temperature: $T_{amb} \geq$ -35°C T_m = -50°C, T_{amb} <-35°C T_m = -40°C			

2.5.6 OPTIMASS 2000F / 2400C

OPTIMASS 2000F

VE	ab	c...m	n	p...w
	87...90		1 or 2	

Ambient temp. T_{amb} °C	Max. process temp. T_m °C	Temp. class	Max. surface temp. °C
-40...+65	65	T6 - T1	T80
	80	T5 - T1	T95
	115	T4 - T1	T130
	130	T3 - T1	T160
Minimum process temperature: $T_{amb} \geq$ -35°C T_m = -50°C, T_{amb} <-35°C T_m = -40°C			

OPTIMASS 2400C with aluminium converter housing

VE	ab	c...m	n	p...w
	87...90		0	

Ambient temp. T_{amb} °C	Max. process temp. T_m °C	Temp. class	Max. surface temp. °C
-40...+50	50	T6 - T1	T80
	130	T3 - T1	T160
-40...+55	100	T4 - T1	T130
	120	T3 - T1	T150
-40...+60	90	T4 - T1	T120
-40...+65	65	T5 - T1	T95
Minimum process temperature: $T_{amb} \geq$ -35°C T_m = -50°C, T_{amb} <-35°C T_m = -40°C			

OPTIMASS 2400C with Stainless Steel converter housing

VE	ab	c...m	n	p...w
	87...90		0	

Ambient temp. T_{amb} °C	Max. process temp. T_m °C	Temp. class	Max. surface temp. °C
-40...+40	130	T3 - T1	T160
-40...+45	100	T4 - T1	T130
	110	T3 - T1	T140
-40...+50	50	T6 - T1	T80
	90	T4 - T1	T120
-40...+55	65	T5 - T1	T95
	75	T4 - T1	T105
-40...+60	60	T5 - T1	T90
Minimum process temperature: $T_{amb} \geq$ -35°C T_m = -50°C, T_{amb} <-35°C T_m = -40°C			

2.5.7 OPTIMASS 3000F / 3400C

OPTIMASS 3000F

VE	ab	c...m	n	p...w
	01, 03 or 04		1 or 2	

Ambient temp. T_{amb} °C	Max. process temp. T_m °C	Temp. class	Max. surface temp. °C
-40...+55	150	T3 - T1	T165
-40...+60	145	T3 - T1	T155
-40...+65	70	T6 - T1	T80
	85	T5 - T1	T95
	120	T4 - T1	T130
	130	T3 - T1	T160
Minimum process temperature: $T_{amb} \geq$ -35°C T_m = -50°C, T_{amb} <-35°C T_m = -40°C			

OPTIMASS 3400C with aluminium converter housing

VE	ab	c...m	n	p...w
	01, 03 or 04		0	

Ambient temp. T_{amb} °C	Max. process temp. T_m °C	Temp. class	Max. surface temp. °C
-40...+50	150	T3 - T1	T165
-40...+55	115	T4 - T1	T130
-40...+60	80	T5 - T1	T95
	90	T4 - T1	T105
-40...+65	65	T6 - T1	T80
Minimum process temperature: $T_{amb} \geq$ -35°C T_m = -50°C, T_{amb} <-35°C T_m = -40°C			

OPTIMASS 3400C with Stainless Steel converter housing

VE	ab	c...m	n	p...w
	01, 03 or 04		0	

Ambient temp. T_{amb} °C	Max. process temp. T_m °C	Temp. class	Max. surface temp. °C
-40...+30	150	T3 - T1	T165
-40...+35	145	T3 - T1	T160
-40...+40	115	T4 - T1	T130
	125	T3 - T1	T140
-40...+45	110	T4 - T1	T125
-40...+50	80	T5 - T1	T95
	90	T4 - T1	T105
-40...+55	65	T6 - T1	T80
	75	T5 - T1	T90
-40...+60	60	T6 - T1	T75
Minimum process temperature: $T_{amb} \geq$ -35°C T_m = -50°C, T_{amb} <-35°C T_m = -40°C			

2.5.8 OPTIMASS 6000F / 6400C +150°C

OPTIMASS 6000F

VE	ab	c...i	j	k...m	n	p	q	r...w
	71...79		0		1 or 2		0 or 1	

Ambient temp. T_{amb} °C	Max. process temp. T_m °C	Temp. class	Max. surface temp. °C
-40...+55	55	T6 - T1	T80
	150	T3 - T1	T190
-40...+60	145	T3 - T1	T170
-40...+65	70	T5 - T1	T95
	105	T4 - T1	T130
	135	T3 - T1	T175
Minimum process temperature: $T_{amb} \geq$ -35°C T_m = -50°C, T_{amb} <-35°C T_m = -40°C			

Table 2-1:

OPTIMASS 6400C with aluminium converter housing

VE	ab	c...i	j	k...m	n	p	q	r...w
	71...79		0		0		0 or 1	

Ambient temp. T_{amb} °C	Max. process temp. T_m °C	Temp. class	Max. surface temp. °C
-40...+40	40	T6 - T1	T80
-40...+45	150	T3 - T1	T190
-40...+50	145	T3 - T1	T185
-40...+55	55	T5 - T1	T95
	120	T3 - T1	T160
-40...+60	90	T4 - T1	T130
-40...+65	65	T4 - T1	T105
Minimum process temperature: $T_{amb} \geq$ -35°C T_m = -50°C, T_{amb} <-35°C T_m = -40°C			

Table 2-2:

OPTIMASS 6400C with Stainless Steel converter housing

VE	ab	c...i	j	k...m	n	p	q	r...w
	71...79		0		0		0 or 1	

Ambient temp. T_{amb} °C	Max. process temp. T_m °C	Temp. class	Max. surface temp. °C
-40...+30	150	T3 - T1	T190
-40...+35	145	T3 - T1	T185
-40...+40	40	T6 - T1	T80
	125	T3 - T1	T165
-40...+45	110	T3 - T1	T150
-40...+50	90	T4 - T1	T130
-40...+55	55	T5 - T1	T95
	75	T4 - T1	T115
-40...+60	60	T4 - T1	T100
Minimum process temperature: $T_{amb} \geq$ -35°C T_m = -50°C, T_{amb} <-35°C T_m = -40°C			

Table 2-3:

2.5.9 OPTIMASS 6000F / 6400C +230°C

OPTIMASS 6000F

VE	ab	c...i	j	k...m	n	p	q	r...w
	71...79		K		1 or 2		0 or 1	

Ambient temp. T_{amb} °C	Max.process temp. T_m °C	Temp. class	Max. surface temp. °C
-40...+50	230	T2 - T1	T270
-40...+55	55	T6 - T1	T80
	225	T2 - T1	T250
-40...+60	200	T2 - T1	T225
-40...+65	70	T5 - T1	T95
	105	T4 - T1	T130
	170	T3 - T1	T195
	175	T2 - T1	T200
Minimum process temperature: $T_{amb} \geq$ -35°C T_m = -50°C, T_{amb} <-35°C T_m = -40°C			

Table 2-4:

OPTIMASS 6400C with aluminium converter housing

VE	ab	c...i	j	k...m	n	p	q	r...w
	71...79		K		0		0 or 1	

Ambient temp. T_{amb} °C	Max. process temp. T_m °C	Temp. class	Max. surface temp. °C
-40...+40	40	T6 - T1	T80
	230	T2 - T1	T270
-40...+45	155	T3 - T1	T195
	225	T2 - T1	T265
-40...+50	185	T2 - T1	T225
-40...+55	55	T5 - T1	T95
	145	T3 - T1	T185
-40...+60	90	T4 - T1	T130
	105	T3 - T1	T145
-40...+65	65	T4 - T1	T105
Minimum process temperature: $T_{amb} \geq$ -35°C T_m = -50°C, T_{amb} <-35°C T_m = -40°C			

Table 2-5:

OPTIMASS 6400C with Stainless Steel converter housing

VE	ab	c...i	j	k...m	n	p	q	r...w
	71...79		K		0		0 or 1	

Ambient temp. T_{amb} °C	Max process temp. T_m °C	Temp. class	Max. surface temp. °C
-40...+30	230	T2 - T1	T270
-40...+35	210	T2 - T1	T250
-40...+40	40	T6 - T1	T80
	155	T3 - T1	T195
	180	T2 - T1	T220
-40...+45	150	T3 - T1	T190
-40...+50	120	T3 - T1	T160
-40...+55	55	T5 - T1	T95
	90	T4 - T1	T130
-40...+60	60	T4 - T1	T100
Minimum process temperature: $T_{amb} \geq$ -35°C T_m = -50°C, T_{amb} <-35°C T_m = -40°C			

Table 2-6:

2.5.10 OPTIMASS 6000F / 6400C cryogenic

OPTIMASS 6000F cryogenic with insulation

VE	ab	c...i	j	k	l...m	n	p	q	r...w
	71...79		K	2		1 or 2		C or D	

Ambient temp. T_{amb} °C	Min. process temp. T_m °C
-30...+65	-120
-25...+65	-160
-20...+65	-200
For max. process temperature, temp. class and max. surface temperature, see table 2-4	

OPTIMASS 6000F cryogenic without insulation

VE	ab	c...i	j	k	l...m	n	p	q	r...w
	71...79		K	0		1 or 2		C or D	

Ambient temp. T_{amb} °C	Min. process temp. T_m °C
-25...+65	-100
-20...+65	-120
-10...+65	-160
0...+65	-200
For max. process temperature, temp. class and max. surface temperature, see table 2-4	

OPTIMASS 6400C cryogenic with aluminium converter housing, without insulation

VE	ab	c...i	j	k	l...m	n	p	q	r...w
	71...79		K	0		0		C or D	

Ambient temp. T_{amb} °C	Min. process temp. T_m °C
-35...+65	-80
-30...+65	-120
-25...+65	-160
-20...+65	-200
For max. process temperature, temp. class and max. surface temperature, see table 2-5	

OPTIMASS 6400C cryogenic with aluminium converter housing, with insulation

VE	ab	c...i	j	k	l...m	n	p	q	r...w
	71...79		K	2		0		C or D	

Ambient temp. T_{amb} °C	Min. process temp. T_m °C
-35...+65	-140
-30...+65	-200
For max. process temperature, temp. class and max. surface temperature, see table 2-5	

OPTIMASS 6400C cryogenic with Stainless Steel converter housing, without insulation

VE	ab	c...i	j	k	l...m	n	p	q	r...w
	71...79		K	0		0		C or D	

Ambient temp. T_{amb} °C	Min. process temp. T_m °C
-35...+60	-70
-30...+60	-100
-20...+60	-160
-15...+60	-180
-10...+60	-200
For max. process temperature, temp. class and max. surface temperature, see table 2-6	

OPTIMASS 6400C cryogenic with Stainless Steel converter housing, with insulation

VE	ab	c...i	j	k	l...m	n	p	q	r...w
	71...79		K	2		0		C or D	

Ambient temp. T_{amb} °C	Min. process temp. T_m °C
-35...+60	-120
-30...+60	-200
For max. process temperature, temp. class and max. surface temperature, see table 2-6	

2.5.11 OPTIMASS 6000F / 6400C cryogenic short stem

OPTIMASS 6000F cryogenic short stem

VE	ab	c...i	j	k	l...m	n	p	q	r...w
	71...79		0	0		1 or 2		C or D	

Ambient temp. T_{amb} °C	Min. process temp. T_m °C
-30...+65	-60
-20...+65	-80
-10...+65	-100
0...+65	-120
10...+65	-140
20...+65	-160
30...+65	-180
40...+65	-200
For max. process temperature, temp. class and max. surface temperature, see table 2-1	

OPTIMASS 6400C cryogenic short stem with aluminium converter housing

VE	ab	c...i	j	k...m	n	p	q	r...w
	71...79		0		0		C or D	

Ambient temp. T_{amb} °C	Min. process temp. T_m °C
-30...+65	-90
-25...+65	-100
-20...+65	-140
-15...+65	-170
-10...+65	-200
For max. process temperature, temp. class and max. surface temperature, see table 2-2	

OPTIMASS 6400C cryogenic short stem with Stainless Steel converter housing

VE	ab	c...i	j	k...m	n	p	q	r...w
	71...79		0		0		C or D	

Ambient temp. T_{amb} °C	Min. process temp. T_m °C
-30...+60	-70
-20...+60	-105
-10...+60	-140
-5...+60	-160
0...+60	-170
+10...+60	-200
For max. process temperature, temp. class and max. surface temperature, see table 2-3	

2.5.12 OPTIMASS 6000F / 6400C +400°C

OPTIMASS 6000F +400°C with aluminium junction box

VE	ab	c...i	j	k	l...m	n	p	q	r...w
	71...79		K	1, 3 or 5		1		T	

Ambient temp. T_{amb} °C	Max.process temp. T_m °C	Temp. class	Max. Surface temp. °C
-40...+55	55	T6 - T1	T80
-40...+60	400	T1	T440
-40...+65	70	T5 - T1	T95
	105	T4 - T1	T130
	170	T3 - T1	T195
	265	T2 - T1	T290
	375	T1	T400
	400 ①	T1	T440
Minimum process temperature: $T_{amb} \geq$ -35°C T_m = -50°C, T_{amb} <-35°C T_m = -40°C			

① Use high temperature accessory cable or suitable alternative as specified.

OPTIMASS 6000F +400°C with Stainless Steel junction box

VE	ab	c...i	j	k	l...m	n	p	q	r...w
	71...79		K	1, 3 or 5		2		T	

Ambient temp. T_{amb} °C	Max.process temp. T_m °C	Temp. class	Max. Surface temp. °C
-40...+55	55	T6 - T1	T80
	400	T1	T440
-40...+60	375	T1	T440
-40...+65	70	T5 - T1	T95
	105	T4 - T1	T130
	170	T3 - T1	T195
	265	T2 - T1	T290
	315	T1	T340
	400 ①	T1	T440
Minimum process temperature: $T_{amb} \geq$ -35°C T_m = -50°C, T_{amb} <-35°C T_m = -40°C			

① Use high temperature accessory cable or suitable alternative as specified.

2.5.13 OPTIMASS 7000F / 7400C

OPTIMASS 7000F

VE	ab	c...m	n	p...w
	11...47		1 or 2	

Ambient temp. T_{amb} °C	Max. medium temp. T_m °C	Temp. class	Max. Surface temp. °C
-40...+55	150	T3 - T1	T165
-40...+60	145	T3 - T1	T155
-40...+65	70	T6 - T1	T80
	85	T5 - T1	T95
	120	T4 - T1	T130
	130	T3 - T1	T140
Minimum medium temperature: $T_{amb} \geq$ -35°C T_m = -50°C, T_{amb} <-35°C T_m = -40°C			

OPTIMASS 7400C with aluminium converter housing

VE	ab	c...m	n	p...w
	11...47		0	

Ambient temp. T_{amb} °C	Max. medium temp. T_m °C	Temp. class	Max. Surface temp. °C
-40...+50	150	T3 - T1	T165
-40...+55	115	T4 - T1	T130
	120	T3 - T1	T135
-40...+60	80	T5 - T1	T95
	90	T4 - T1	T105
-40...+65	65	T6 - T1	T80
Minimum medium temperature: $T_{amb} \geq$ -35°C T_m = -50°C, T_{amb} <-35°C T_m = -40°C			

OPTIMASS 7400C with Stainless Steel converter housing

VE	ab	c...m	n	p...w
	11...47		0	

Ambient temp. T_{amb} °C	Max. medium temp. T_m °C	Temp. class	Max. Surface temp. °C
-40...+30	150	T3 - T1	T165
-40...+35	145	T3 - T1	T160
-40...+40	115	T4 - T1	T130
	130	T3 - T1	T145
-40...+45	110	T4 - T1	T125
-40...+50	80	T5 - T1	T95
	90	T4 - T1	T105
-40...+55	65	T6 - T1	T80
	75	T5 - T1	T90
-40...+60	60	T6 - T1	T75
Minimum medium temperature: $T_{amb} \geq$ -35°C T_m = -50°C, T_{amb} <-35°C T_m = -40°C			

2.5.14 Painted options

A painted finish helps to prevent corrosion in aggressive environments.
The following meters are available with a painted finish

OPTIMASS	1000F
	1400C
OPTIMASS	2000F
	2400C
OPTIMASS	3400F
	3000C
OPTIMASS	6000F
	6400C
OPTIMASS	7000F
	7400C

Temperature limits

	Ambient temp. T_{amb} °C	Max. medium temp. T_m °C
Meter	-40...+40	110
Stainless Steel converter	-40...+40	110

Note

These temperature limits are subject to the maximum temperature class / limit of the meter, which might be lower.

2.6 Electronics compartment

Let the electronics de-energise before opening the electronics compartment. Please wait for the following times according to the temperature class of the meter.

Temp. class	Time required to de-energise
T6	35 minutes
T5	10 minutes

2.7 Certified cable glands

Meters supplied with an Ex d terminal compartment ("f" = 1) are also supplied with one Ex d stopping plug and two temporary plugs for shipping and storage. When installing the meter, remove the temporary plugs and use suitable Ex d certified cable glands, plugs or conduit.

All unused openings must be closed with suitable, certified plugs.

2.8 Cable protection

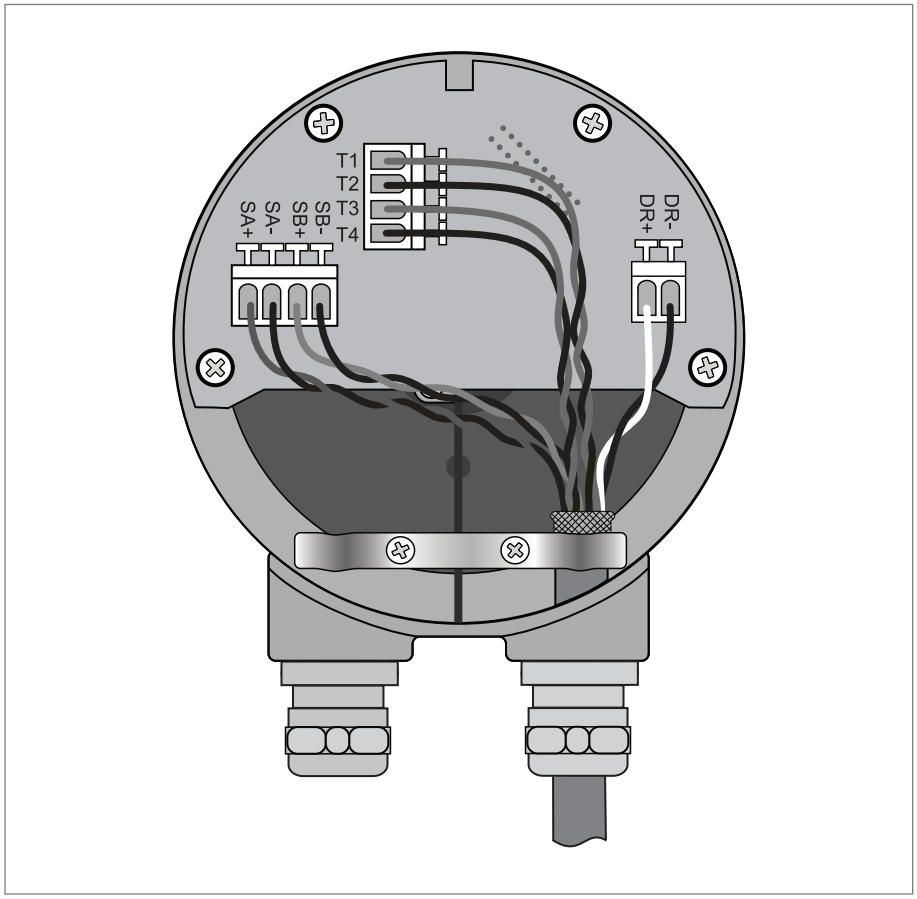
Install the connecting cables as fixed wiring so that they are protected from damage.

2.9 Aluminium junction box

If the meter has an aluminium junction box and if it has been installed in an area classified as Zone 0, then you MUST protect the meter from ignition hazards caused by impact and / or friction.

3.1 Remote / field terminal connections

The information below is based on cable supplied by the manufacturer.



Cable pair / terminal block configuration.

Circuit	Terminal	Cable colour
Signal	SB-	Black
	SB+	Green
	SA-	Black
	SA+	Yellow
Strain Gauge and temperature sensor	T1	Blue
	T2	Black
	T3	Red
	T4	Black
Driver	DR+	White
	DR-	Black

Screening

Fit the cable screen as shown in the above illustration.

3.1.1 Separated systems

In the case of field and remote meters, the sensor and converter are connected using a cable that has five pairs and an outer screen. Each pair of cables carries an intrinsically safe circuit

When using cable not supplied by the manufacturer, the following points should be noted:

- The cable MUST NOT have capacitance and / or inductance levels higher than those shown in the cable parameters section.
- You MUST obey IEC / EN 60079-14 when installing an OPTIMASS meter.

3.1.2 Cable parameters

For applications where the temperature gradient means that the standard cable is not suitable, an alternative (accessory) cable is available from the manufacturer. The cable is available as either (GSWA) armoured or non-armoured. If the armoured cable option is ordered, a suitable dual rated cable gland is also available.

For more information, please contact the manufacturer.

Cable supplied by the manufacturer		
	Standard cable	Accessory cable
Cable type	Type A acc. to IEC60079-14:2014 Cl, 16.2.2.8	
Capacitance	<78 ρF/m	<78 ρF/m
Inductance	<0.8 µH/m	<0.8 µH/m
Temperature range	-40°C...+85°C	-75°C...+105°C
Maximum length	20 meters ①	20 meters ①
Cable supplied by the customer		
Cable type	Type A acc. to IEC60079-14:2014 Cl, 16.2.2.8	
Capacitance	90 nF (for total cable length)	②
Inductance	36 µH (for total cable length)	
Temperature range	≥ Max temperature range of the installation ③	
Test voltage	≥ 1000 VAC	≥ 1000 VAC
Insulation thickness	≥ 0.2mm (IEC / EN 60079-14 S. 12.2.2.7)	
Casing colour	Blue	Blue

① No further intrinsic safety analysis is necessary if the cable length is not more than the maximum
② No further intrinsic safety analysis is necessary if the cable used is within maximum limits
③ When calculating the temperature range, give consideration to the flow sensor temperature gradients. Please refer to the Temperature limits section.

3.2 Electronics and I/O terminal compartments

When working on the MFC 400 converter electronics and / or the I/O terminal compartments, the following points must be noted:

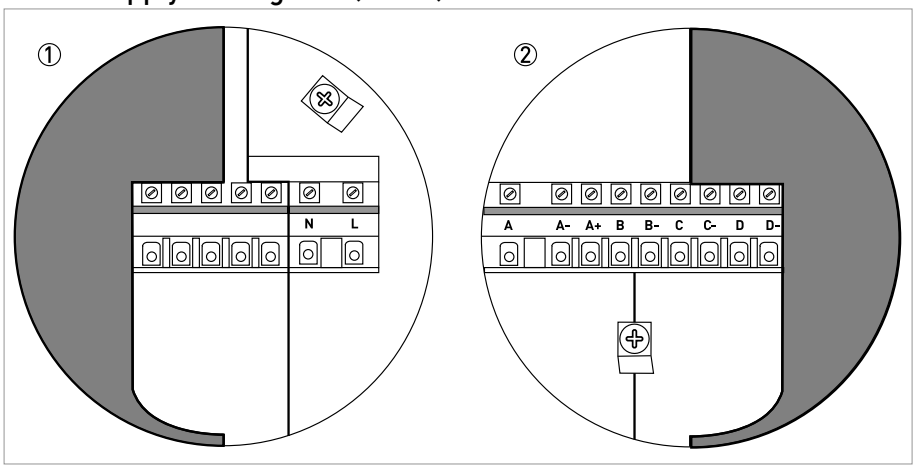
- The covers on the electronics compartment have a flameproof thread that is a tight fit. When removing / re-fitting the covers, take care and do not use a lot of force.
- Keep the threads clean and apply Teflon grease (for example NONTRIBOS® type Li EP) before re-fitting the cover. The grease will help to prevent corrosion that will cause the threads to lock together.
- To open the compartment covers, first remove the hexagonal retention lock using a 2.5mm hex-head tool. After re-fitting the cover, you MUST re-fit the retention lock.

3.2.1 I/O terminal compartment

The I/O terminal compartment can be opened for a short period of time, where the electronics are energised and the meter is in a hazardous area. For example, to check the wiring configuration. However the following conditions MUST all be met:

1. the I/O terminal compartment has an "increased safety" ignition protection type (standard), and;
2. the I/O circuits have an "intrinsic safety" protection type, and;
3. the touch guard (cover) for the power supply terminals (L,N) is closed (see illustration).

Power supply touch guard (cover)



① Touch guard (cover) open
② Touch guard (cover) closed

Work on I/O terminals A...D can be done with the electronics energised, but you MUST follow the regulations regarding intrinsically safe circuits.

When the work has been finished, replace the cover. You MUST re-fit the retention lock.

Terminal	Function / electrical data
L, N L+, N-	Connection for main supply. Always non-Ex i
	100...230 VAC, +10% / -15%, 22VA
	12...24 VDC, +30% / -25%, 12W
	24 VAC +10% / -15%, 22VA
	24 VDC +30% / -25%, 12W
	U_m = 253V
A, A-, A+ B, B- C, C- D, D-	Intrinsic safety of I/O circuits is determined by the I/O options chosen by the customer. I/O configuration of the MFC 400 is defined in the converter VE code VE5 where "b" = 3 or 4. See below for details.

3.2.2 Converter VE code for I / O options

The converter VE number is defined in the Introduction section at the beginning of this Handbook.

Overviews of the converter VE code I / O option defined by “n”, “p” and “q” can be found in the following section. However, the overviews do not show all details. The exact connection diagram can be found on the label on the inside cover of the connection compartment.

If the meter is being installed in a gas hazardous area, the terminal compartment cable glands must have the appropriate protection type: increased safety (Ex e) or flameproof (Ex d).

Meters supplied with an Ex e terminal compartment (“f” = 2) are also supplied with two Ex e certified cable glands and one Ex e / Ex d stopping plug.

All wiring must comply with current, relevant national or regional standards for electrical installations (for example IEC / EN 60079-14). If you are using IEC / EN 60079-14 please pay attention to sections: 9 and 10

The torque settings for the terminals is 0.7 Nm. Maximum conductor or ferrule size is 4mm^2

"p" and "q" functions

Option code	Function "p"	Function "q" ①
0	Without, no module possible	Without, no module possible
8	Without I/O module	Without I/O module
A	Current output: active	Current output: active
B	Current output: passive	Current output: passive
C	Current output: active, high current	Current output: active, high current
E	Current output: passive, high current	Current output: passive, high current
F	Current output: passive, Namur	Current output: passive, Namur
G	Control input: active, high current (only with "n" = F)	Control input, active high current
H	Control input: active, Namur (only with "n" = F)	Control input: active, Namur
K	Control input: passive, high current (only with "n" = F)	Control input: passive, high current

① unless otherwise stated only with "n" ≠ F

3.2.3 Converter VE code I / O overviews

Non intrinsically safe I/O connections

I/O PCB	Input / output functions (U_n<32 VDC, I_n <100 mA U_m = 253 V)
Basic I/O	Active / passive current output with HART
	Status output / control input
	Status output
	Pulse / status output
Modular I/O	Active or passive current output with HART (according to options selected)
	Active or passive pulse status output, highC or Namur (according to options selected)
Modular carrier with 1 or 2 I/O modules	Each module can have one of the three following I/O functions: • Active or passive current output • Active or passive status / pulse output, high current or Namur • Active or passive control input, high current or Namur
Profibus DP I/O	Profibus DP, active
Fieldbus I/O	Profibus PA or Foundation Fieldbus
RS485 Modbus	Modbus, with or without termination

Overview of possible combinations					
Character "n", "p" and "q"	Name I/O circuits	Terminals A, A-	Terminals B, B-	Terminals C, C-	Terminals D, D-
000	Basic I/O ①	SO	SO / CI	CO	PO / SO
100	Basic I/O ②	CO (CO (a) over A+)	SO / CI	SO	PO / SO
100	Basic I/O ①	SO	SO / CI	CO (a)	PO / SO
4pq	Modular I/O ③	"p" ④	"q" ④	CO (a)	PO(a) / SO
6pq					PO / SO
6pq					PO (Namur) / SO
8pq				CO	PO(a) / SO
Bpq					PO / SO
Cpq					PO (Namur) / SO
D88	Fieldbus I/O Profibus PA	Not connected	Not connected	PA	PA
Dpq	Fieldbus I/O Profibus PA ③	"p" ④	"q" ④	FF	FF
E88	Fieldbus I/O Foundation Fieldbus	Not connected	Not connected	FF	FF
Epq	Fieldbus I/O Foundation Fieldbus ③	"p" ④	"q" ④	FF	FF
F00	Profibus DP I/O	Not connected	DP(a)	DP(a)	DP(a)
Fp0	Profibus DP I/O with one module	"p" ④	DP(a)	DP(a)	DP(a)
Gpq	RS485 Modbus	"p" ④	"q" ④	RS485	RS485
Hpq	Modbus with one or two modules				
M00	Ethernet IP ①	⑤	⑤	⑥	⑥

① VE54 only
② VE53 only
③ With module carrier and with one or two modules
④ See section on converter VE codes above.
⑤ Ethernet IP Port 2
⑥ Ethernet IP Port 1

Key: CO = current ouput, CI = control input, PO = pulse output, FF = Foundation Fieldbus, SO = status output

Intrinsically safe I/O connections

Ex I/O	I/O functions	
Ex i I/O	Passive current output plus HART Pulse/ status output	Ex ia IIC U_i = 30 V, Ii = 100 mA (130 mA for VE54),P_i = 1.0 W, C_i = 10nF, Li = not significant
	Active current output plus HART	Ex ia IIC linear characteristics: Uo = 21 V, I_o = 90 mA, P_o = 0.5 W C_o = 90 nF, L_o = 2.0 mH C_o = 110 nF, L_o = 0.5 mH
Ex i option or Ex i option 2	Passive current input Current output Pulse / status output / control input	Ex ia IIC Ui = 30 V, Ii = 100 mA (130 mA for VE54), P_i = 1.0 W Ci = 10 nF, L_i = not significant
	Active current output	Ex ia IIC linear characteristics: U_o = 21 V, I_o = 90 mA, P_o = 0.5 W C_o = 90 nF, L_o = 2.0 mH C_o = 110 nF, L_o = 0.5 mH
	Active current input	Ex ia IIC linear characteristics: U_o = 24.1 V, L_o = 99 mA, P_o = 0.6 W C_o = 75 nF, L_o = 0.5mH
Fieldbus I/O	Profibus PA Foundation Fieldbus	Ex ia IIC U_i = 24 V, Ii = 380 mA, P_i = 5.32 W, C_i = 5 nF, L_i = 10 µH Intrinsically safe Fieldbus complies with the FISCO model.

Overview of possible combinations

Character "n", "p" and "q"	Name I/O circuits	Terminals A, A-	Terminals B, B-	Terminals C, C-	Terminals D, D-
200	Ex i I/O	Not connected	Not connected	CO (a)	PO /SO
300		Not connected	Not connected	CO	PO /SO
210	Ex i I/O with Ex i options	CO (a)	PO / SO / CI	CO (a)	PO /SO
220		CO	PO / SO / CI	CO	PO /SO
310		CO (a)	PO / SO / CI	CO	PO /SO
320		CO	PO / SO / CI	CO	PO /SO
D00	Profibus PA	Not connected	Not connected	PA	PA
D10	Profibus PA (with Ex i options)	CO (a)	PO / SO / CI	PA	PA
D20		CO	PO / SO / CI	PA	PA
E00	Foundation Fieldbus	Not connected	Not connected	FF	FF
E10	Foundation Fieldbus (with Ex i options)	CO (a)	PO / SO / CI	FF	FF
E20		CO	PO / SO / CI	FF	FF

The output connections to the mass flow sensor have the values shown in the table below. No further intrinsic safety evaluation is required if: a) cable length provided by manufacturer is not exceeded, or b) it is within maximum limits. See section on cable parameters.

Maximum converter values

VE53 type converters		
Driver circuit, intrinsically safe. Type of protection intrinsic safety: Ex ia IIC		
Terminals PCB Board	Maximum values	
DR+, DR-	U_o	11.8 V
	I_o	1325 mA
	P_o	0.53 W
	C_o	500 nF
	L_o	36 µH
Sensor circuit, intrinsically safe. Type of protection intrinsic safety: Ex ia IIC		
Terminals PCB Board	Maximum values	
SA+, SA-, SB+, SB-	U_o	11.8 V
	I_o	13 mA
	P_o	39 mW
	C_o	90 nF
	L_o	100 mH
	Linear characteristic	
RTD / DMS circuit, intrinsically safe. Type of protection intrinsic safety: Ex ia IIC		
Terminals PCB Board	Maximum values	
T1, T2, T3, T4	U_o	11.8 V
	I_o	9 mA
	P_o	27 mW
	C_o	310 nF
	L_o	1 mH
	Linear characteristic	

VE54 type converters		
Driver circuit, intrinsically safe. Type of protection intrinsic safety: Ex ia IIC		
Terminals PCB Board	Maximum values	
DR+, DR-	U_o	11.8 V
	I_o	1325 mA
	P_o	0.53 W
	C_o	1000 nF
	L_o	36 µH
Sensor circuit, intrinsically safe. Type of protection intrinsic safety: Ex ia IIC		
Terminals PCB Board	Maximum values	

SA+, SA-, SB+, SB-	U_o	11.8 V
	I_o	13 mA
	P_o	39 mW
	C_o	90 nF
	L_o	100 mH
	Linear characteristic	
RTD / DMS circuit, intrinsically safe. Type of protection intrinsic safety: Ex ia IIC		
Terminals PCB Board	Maximum values	
T1, T2, T3, T4	U_o	11.8 V
	I_o	10.5 mA
	P_o	31 mW
	C_o	340 nF
	L_o	100 mH
	Linear characteristic	

Notes:

- Options separated with "/" are set by the user in the converter.
- Options separated with "or" are hardware options and must be ordered.
- All outputs are passive unless marked differently.
- I/O circuits shown as Ex i are always in the intrinsically safe (Ex ia) protection category. Fieldbus I/O, Profibus, Fieldbus I/O and Foundation Fieldbus can all be in the intrinsically safe category.
- A maximum of four intrinsically safe (Ex ia) I/Os are possible. All intrinsically safe circuits are galvanically insulated, with respect to earth and each other. To prevent the possible hazard of combined voltages and currents, the wiring of Ex ia circuits must be separated and where applicable, local legislation / regulations should be followed. For example: IEC/EN 60079-14 clause 12.2.
- The Ex ia signal I/Os can only be connected to other Ex ia or ib certified devices (for example intrinsically safe isolation amplifiers) even if such devices are installed in the non-hazardous area.
- Connection to non Ex i devices will mean that the meter is no longer intrinsically safe.
- Terminals L and N (or L+ and L-) for power supply connection are not intrinsically safe. To achieve the required separation between the non-Ex i and the Ex i circuits (IEC / EN 60079-11) the power supply terminals have a touch guard (cover) that can be closed and secured with a snap-in lock. The touch guard (cover) MUST be in the closed position before power is supplied to the converter.
- Do not try to repair flameproof joints. For more information regarding flameproof joints, please contact the manufacturer.

4.1 General

The manufacturer recommends that flowmeters installed in hazardous areas should be inspected at regular intervals. As part of the inspection procedure, check the flameproof converter housing and covers for any signs of damage or corrosion.

4.2 Replacing the power supply fuse

DANGER!
Work on the signal converter electronics may only be performed when disconnected from the power supply.

DANGER!
Observe the waiting period for Ex devices.

WARNING!
Observe without fail the local occupational health and safety regulations.
Any work done on the electrical components of the measuring device may only be carried out by properly trained specialists.

- Remove the front panel. Use a small screwdriver to open the plastic clips that hold the display.
- Remove the 2 locking screws.
- Carefully pull the electronics out of the housing.
- When the unit is almost removed from the converter housing, disconnect the rectangular (10 way) blue connector at the back of the unit. This connector is for the flow sensor circuits.
- The power supply fuse is contained in a fuse holder located at the back of the electronics unit.
- The table below gives the specifications for the correct fuse.

Cartridge fuse size 5 x 20mm (type H according to IEC 60127-2/V)		
Power supply	**Time lag**	**KROHNE part No**
12...24 VDC	250 V / 2 A	5060200000
24 VAC	250 V / 2 A	5060200000
100...230 VAC	250 V / 1.6 A	5080850000

4.3 Returning the device to the manufacturer

4.3.1 General information

This device has been carefully manufactured and tested. If installed and operated in accordance with these operating instructions, it will rarely present any problems.

WARNING!
Should you nevertheless need to return a device for inspection or repair, please pay strict attention to the following points:

- *Due to statutory regulations on environmental protection and safeguarding the health and safety of the personnel, the manufacturer may only handle, test and repair returned devices that have been in contact with products without risk to personnel and environment.*
- *This means that the manufacturer can only service this device if it is accompanied by the following certificate (see next section) confirming that the device is safe to handle.*

WARNING!
If the device has been operated with toxic, caustic, radioactive, flammable or water-endangering products, you are kindly requested:

- *to check and ensure, if necessary by rinsing or neutralising, that all cavities are free from such dangerous substances,*
- *to enclose a certificate with the device confirming that it is safe to handle and stating the product used.*

4.3.2 Form (for copying) to accompany a returned device

CAUTION!
To avoid any risk for our service personnel, this form has to be accessible from outside of the packaging with the returned device.

Company:		Address:
Department:		Name:
Telephone number: Fax number:		Email address:
Manufacturer order number or serial number:		
The device has been operated with the following medium:		
This medium is:		radioactive
		water-hazardous
		toxic
		caustic
		flammable
		We checked that all cavities in the device are free from such substances.
		We have flushed out and neutralized all cavities in the device.
We hereby confirm that there is no risk to persons or the environment caused by any residual media contained in this device when it is returned.		
Date:		Signature:
Stamp:		

4.3.3 Disposal

LEGAL NOTICE!
Disposal must be carried out in accordance with legislation applicable in your country.

Separate collection of WEEE (Waste Electrical and Electronic Equipment):

According to the directive 2012/19/EU or UK Regulation 2013 No. 3113, the monitoring and control instruments marked with the WEEE symbol and reaching their end-of-life **must not be disposed of with other waste**.
The user must dispose of the WEEE to a designated collection point for the recycling of WEEE or send them back to our local organisation or authorised representative.

KROHNE – Products, Solutions and Services

- Process instrumentation for flow, level, temperature, pressure measurement and process analytics
- Flow metering, monitoring, wireless and remote metering solutions
- Engineering, commissioning, calibration, maintenance and training services

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