OVAL INSTRUCTIONS

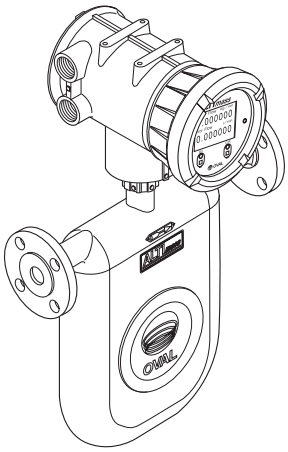
Ins. No. L-740FS-2-E

ALTI*mass* -Coriolis Flowmeters- Functional Safety Manual

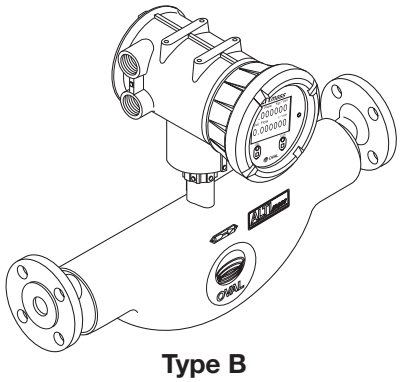
■ **Type U/Sophisticated Models:** CA00A, CA001, CA003, CA004, CA006, CA010
CA015, CA025, CA040, CA050, CA080, CA100
CA150, CA15H, CA200, CA20H, CA250

■ **Type B/Low Price, General Purpose Models:**
CB006, CB010, CB015, CB025, CB040, CB050

■ **Transmitter** : PA0K



Type U



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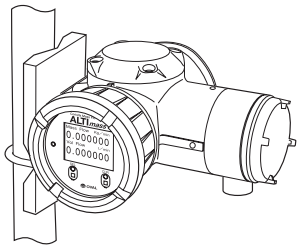
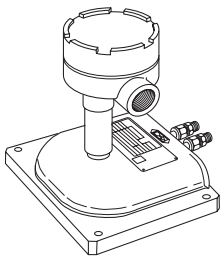
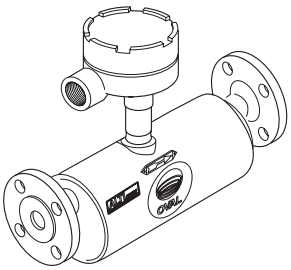


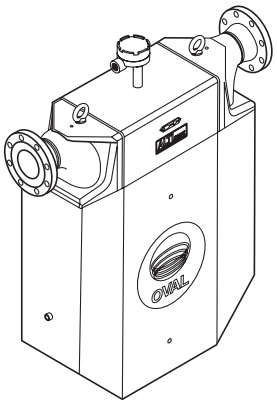
Separately mounted transmitter



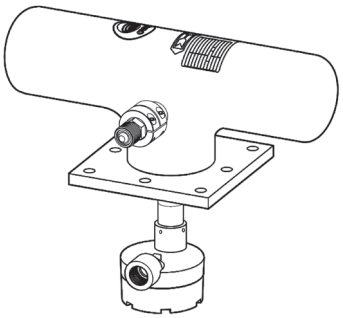
Type U
Extra low flows



Type U
Low flows



Type U
Large size



Extra-high pressure

This instruction manual reflects functional safety information for the ALTImass series. Please refer to instruction manual No. L-740 for general information such as installation, wiring, specification, operation, etc.

CONTENTS

1. PRODUCT IDENTIFICATION

Functional safety product code can be identified by "Transmitter construction".

Current product code: Can be identify by ⑱ digits.

⑱
CXXXX－XXXXX－XXX－1□XXXX－X
→ 4：Integral type
→ 5：Separate type
"Functional safety" compliant products.

Previous product code: Can be identify by ⑪ digits.

⑪
CXXXXXXX□XXXXXXXX
→ 4：Integral type
→ 5：Separate type
"Functional safety" compliant products.

2. FUNCTIONAL SAFETY CERTIFICATE

2.1 SEMA

SEMA

Functional Safety Certificate of Conformity

1	Certificate Number	19SEMA00004C (E)	2	Date	2019/March/28
3	Manufacturer	OVAL Corporation Yokohama Operation Center			
4	Address	1-9-5, Fukuura, Kanazawa-Ku, Yokohama, 236-8645, Japan			
5	Product and Type/Model No.	Mass Flow Meter "ALTImass CA and CB Series" See attached sheet for detail model designation			
6	Applicable Standards	2016 MHLW Notification No. 353, Technical guideline on machinery safety by functional safety IEC 61508-1: 2010, IEC 61508-2: 2010, IEC 61508-3: 2010,			
7	Application and Specification	Process automation measuring equipment (Mass flow) Safety Integrity Level: SIL 2(HFT=0), SIL3(HFT=1) Type B, route 2_H, 2_S			
8	Terms of Use	Operation location : Zone1 and Zone2 Power supply: AC100~240V 50/60Hz, DC20~30V Input: Sensor signal (Sine wave and Pt100 register) Output: Analog output 2 (4-20mA) Mass flow Operation temperature range:-200℃ to +200℃ For details, refer to the specification, No. GBN120-E-XX and GBN121-XX.			
9	Validity	2025/March/31			

To: OVAL Corporation Yokohama Operation Center

石田豊

Yutaka ISHIDA
Representative Director
Safety Environment Management Association
1-8-27 Kusune, Higashiosaka-shi, Osaka 577-0006

0	2019/03/28	Issue
1	2020/02/27	OB closed
2	2022/03/31	Renewal

2.2 Sira

FUNCTIONAL SAFETY CERTIFICATE

This is to certify that the

ALTImass

manufactured by

OVAL Corporation
10-8, Kamiochiai 3-chome Shinjuku-ku,
Tokyo,
161-8508 Japan

have been assessed by Sira Certification Service with reference to the CASS methodologies and found to meet the requirements of

IEC 61508-2:2010
Routes 1_H & 1_S
Systematic Capability (SC3)

as an element/subsystem suitable for use in safety related systems performing safety functions up to and including

SIL 2 capable with HFT=0 (1oo1)*

when used in accordance with the scope and conditions of this certificate.

* This certificate does not waive the need for further functional safety verification to establish the achieved Safety Integrity Level (SIL) of the safety related system

Certification Decision:

James Lynskey

Initial Certification : 09/12/2019
This certificate re-issued : 09/12/2019
Renewal date : 08/12/2024

Certificate No.: Sira FSP 19002/01
Form 7016 issue 4
Page 1 of 7

0011

Sira Certification Service
Part of CSA Group UK
Unit 6 Hawarden Industrial Park,
Hawarden, CH5 3US, United Kingdom
Tel: +44 (0) 1244 670900
Email: ukinfo@csagroup.org
Web: www.csagroupuk.org

3. SUBJECT EQUIPMENT

Sensor ：All CA, CB series
Transmitter：PA0K (Version U)

4. SAFETY FUNCTION: (DEFINITION OF SIL AND SC)

- Analog Output 2: (4 - 20mA) = mass flow rate.
- Analog Output Range: From 4.00 mA at min. to 21.6 mA at max.
- Effective safety function: function to monitor mass flow rate of ±5% of FS.
- Error detected: Hold when Analog Output 2 is below 2.4mA.

※ Safety devices to be connected to this flowmeter by each customer need to be configured so as to recognize low alarm (down scale) as detection of malfunction. Therefore, lower alarm limit is required to be set on the receiving instrument.

4.1 Definition of dangerous failure

	Failure Mode	Failure rate (FR)
λ_{DU}	When mass flow analog output fluctuates by ±5% or more from actual measurement.	1.78E-07
λ_{DD}	Failure detection function: Sensor error (coil and temperature sensor disconnection, tube failure), transmission error, parameter setup error, cable disconnection or wiring error. Process abnormality detecting function: contamination with foreign matter or bubble within the sensor, zero-point adjustment error, excessive flow, effect of excessive disturbance vibration or improper use.	1.48E-06

4.2 Self-diagnostic interval: Conduct every time at power-on

5. FUNCTIONAL SAFETY SPECIFICATION

5.1 FMEA result of ALTImass in the single mode (1oo1)

Summary of IEC61508-2 Clauses 7.4.2 and 7.4.4	ALTImass reliability FMEA result
Hardware safety integrity achieved	SIL 2 Capability
Systematic Capability	SC 3
HFT	HFT=0
Type of product A/B	Type B
Mode of operation	Low demand mode
SFF	95%
Recommended time interval for proof-testing T1	1 year
PFDavg for PTI=8769h, MTTR=8h	7.83E-04
Diagnostic Coverage	89%
λ_{SD}	1.03E-06
λ_{SU}	1.11E-06
λ_{DD}	1.48E-06
λ_{DU}	1.78E-07

5.2 Usage record (returned goods data base) evaluation result

Parameter name	Symbol	Equation/source	ALTImass
			1oo1
Proof Test Interval（h）	T1		8760
Mean Time to Repair（h）	MTTR		8
Type A/B			Type B
Undiagnosed dangerous failure	λ_{DU}		8.40E-7
PFD_{AVG}	PFD_{AVG}	λ_{DU}（T/2+MTTR）	3.73-E03
Systematic Capability	SC		SC 3
SIL Capability (Low demand mode)			SIL 2 Capability

5.3 Limitations in functional safety

When used as a functional safety equipment, there are additional limitations besides the rated values or acceptable ranges described in the general specification sheet. Conditions to use as a functional safety equipment are described as follows.

Following output signals, communication, display and connected sensors are not applicable.

1）Output signal:
   ① Analog output 1(4-20mA)
   ② Pulse output 1 and 2
   ③ Status IN and Status OUT signal
   ④ Communication signal (Modbus, FOUNDATION fieldbus and Profibus-PA)
2）Display items (instantaneous flow rate, cumulative total, temperature, density and errors)
3）Connected sensor: All series of CS sensors

When used as a functional safety equipment, following functions are not useable (not selectable).

1） Bidirectional output of analog output 2
2）Setting of analog output 2: volume flow rate, density, temperature, and drive output

When used as a functional safety equipment, “write protect” hard switch is ON.

When write protect is ON, the user can not adjust or change parameters in the field. Adjustment of zero point or changing parameter in the field, our service engineer are necessary required to do the adjustment. Please contact our nearest sales or service office for assistance.

Parameters for functional safety equipment products

Mode	Item	Description
Flow	Mass flow unit	Mass flow rate
	Flow direction	“Forward” or “Reverse”
Analog output 2	Assign	“Mass Flow”
	URV	Mass flow rate correspond to 20mA
	LRV	“0”
	Low cut	“0.3%”
	Added damp	“0.0sec”
Error output	Downscale	“Downscale”
Error select	Sensor failure	On
	Transmitter failure	On
	Calibration failure	On
	Saturated alarm	On
	Parameter alarm	On
	Transmitter alarm	On
	Slug flow alarm	On
	Calibration in progress	On
	Fixed output	Off

Above are default set. When an "Error select" related Error occurs, analog output signal will be 2.4mA.

Parameter setting method:
Use PC with “Link Top” (service version) installed.
Link Top version：
※In case of a safety functional equipment, user cannot adjust or change parameters in the field.
(Link Top user version cannot be used.)

5.4 Checking interval (interval of proof test): 1 year

This flowmeter can self-diagnose abnormalities and failures; however, it is difficult to verify the safety in the field. Because of this periodic check by returning the meter to us is recommended for functional safety equipment.

6. CAUTIONS

For separate type flowmeter, when the sensor is completely covered with a heat insulating material, the sensor may not be identified afterward. Therefore, make sure the serial number (or tag number) can be seen for the identification when heat insulation is applied.

Functional safety can be affected when wrong combination or transmitter and sensor are used. Cable glands must be connected to the conduit connection when used as an explosion proof equipment. Cable gland is not required for non-explosion proof equipment but waterproof measures on the conduit connection must be taken to avoid rainwater or moisture to intrude the transmitter. Functional safety can be affected when water intrude to the equipment.

2022.03 Revised△
2020.05 Released
L-740FS-2-E(1)

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