Instruction Manual

Alfa Laval Rotacheck Sensor and Relay

Covering: Standard Instruments
Instruments delivered with ATEX Certification in accordance Directive 2014/34/EU
IM-TE91A663-EN12
First published: 2010

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Original manual
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The information herein is correct at the time of issue but may be subject to change without prior notice

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1 EC/EU Declaration of Conformity

EC/EU Declaration of Conformity

The designated company
Alfa Laval Kolding A/S
Company name
Abouen 31, 6000 Kolding, Denmark
Address
+45 79 32 22 00
Phone no.

hereby declare that

Instrument
Alfa Laval Rotacheck Sensor and Relay

Type

valid from SN: 2015 0001 and subsequent serial numbers

is in conformity with the following regulations and directives with amendments:

- FDA 21CFR§177
- The Regulation (EC) 1935/2004
- The EMC Directive 2014/30/EU
  DS/EN 61000-6-3:2007and DS/EN 61000-6-4:2007
- The Equipment Explosive Atmospheres (ATEX) Directive 94/9/EC valid until 2016-06-19
  The Equipment Explosive Atmospheres (ATEX) Directive 2014/34/EU valid from 2016-04-20
  (Applicable for equipment certified as category 1, see instrument marking label)

Relay
EC Type Examination Certificate no. Basorea1A4TE0178
Marking: Ex ia IIC T6 Ge (-20°C ≤ TA ≤ +60°C)
          Ex ia IIC T4 Ga (-20°C ≤ TA ≤ +90°C)
          Ex ia IIC T85°C Da (-20°C ≤ TA ≤ +40°C)
          Ex ia IIC 1135°C Da (-20°C ≤ TA ≤ +90°C) IP68
SGS Basorea Ltd., Certification body number 1180, Roostead Business Park
Staden Lane, Buxton, Derbyshire SK17 9RZ, United Kingdom

Sensor
EC Type Examination Certificate no. Basorea1A4TE0179X
Marking: Ex ia IIC T6 Ge (-20°C ≤ TA ≤ +60°C)
          Ex ia IIC T4 Ga (-20°C ≤ TA ≤ +90°C)
          Ex ia IIC T85°C Da (-20°C ≤ TA ≤ +40°C)
          Ex ia IIC 1135°C Da (-20°C ≤ TA ≤ +90°C) IP68
SGS Basorea Ltd., Certification body number 1180, Roostead Business Park
Staden Lane, Buxton, Derbyshire SK17 9RZ, United Kingdom

The person authorised to compile the technical file is the signer of this document:

Name
Annie Dahl
Signature

Name
Dennis Hardbro
Signature

Title
ATEX Responsible Engineer

Title

Date
2015-12-01

(This Declaration of Conformity replaces Declaration of Conformity dated September 17, 2014)
The Alfa Laval Sanitary Rotacheck System consisting of a Universal Relay and a Sensor designed for confirmation of correct functioning of the installed Jet Head tank cleaning machine and to verify that the entire internal tank surface is cleaned.

The system is protected for use in potentially explosive atmospheres according to relevant standards stated in the ATEX certificate and EC Declaration attached.

The English version of the instruction manual is the original manual. We make reservations in regard to possible mistranslations in language versions of the instruction manual. In case of doubt, the English version of the instruction manual applies.

**NOTE!**

The illustrations and specifications contained in this manual were effective at the date of printing. However, as continuous improvement is the policy of Alfa Laval Kolding A/S, we reserve the right to alter or modify any unit specification on any product without notice or any obligation.
## 3 Overview of article numbers

### 3.1 Rotacheck Sensor, Relay and Welding adapter

<table>
<thead>
<tr>
<th>Denomination</th>
<th>With ATEX</th>
<th>With ATEX and 3.1 certificate</th>
<th>With 3.1 certificate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rotacheck/Sensor w. 2m cable</td>
<td>N/A</td>
<td>TE52E067-90</td>
<td>N/A</td>
</tr>
<tr>
<td>Rotacheck/Sensor w. 10m cable</td>
<td>N/A</td>
<td>TE52E067-91</td>
<td>N/A</td>
</tr>
<tr>
<td>Rotacheck/Sensor (3/4” tread) w. 2m cable</td>
<td>N/A</td>
<td>TE52E057-90</td>
<td>N/A</td>
</tr>
<tr>
<td>Rotacheck/Sensor (3/4” tread) w. 10m cable</td>
<td>N/A</td>
<td>TE52E057-91</td>
<td>N/A</td>
</tr>
<tr>
<td>Rotacheck/Relay (AC) Universal 24 – 115 - 230 V AC</td>
<td>TE52E058</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Rotacheck/Relay (DC) Universal 12 - 36 V DC</td>
<td>TE52E059</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Rotacheck/Relay (AC)+sensor Universal, w. 2m cable 24 – 115 - 230 V AC</td>
<td>N/A</td>
<td>TE52E070-90</td>
<td>N/A</td>
</tr>
<tr>
<td>Rotacheck/Relay (AC)+sensor Universal, w. 10m cable 24 – 115 - 230 V AC</td>
<td>N/A</td>
<td>TE52E070-91</td>
<td>N/A</td>
</tr>
<tr>
<td>Welding adapter for Rotacheck sensor TE52E067</td>
<td>N/A</td>
<td>N/A</td>
<td>TE52E068-90</td>
</tr>
<tr>
<td>Welding adapter for Rotacheck sensor TE52E057</td>
<td>N/A</td>
<td>N/A</td>
<td>TE52E052-90</td>
</tr>
</tbody>
</table>
The RJH tank cleaning machine rotates on two axes during the course of the cleaning process, ensuring that the entire internal tank surface is flushed a predetermined number of times.

The water jet will hit the Rotacheck sensor membrane at uneven intervals. The impulse from the sensor membrane will trigger an electric output signal from the sensor. This is passed to the Rotacheck relay where it is converted to an "open collector" signal on terminals 28, 29 and 30, and a relay signal (switch contact) on terminals 23, 24 and 25 respectively.

### 4.1 Sensor, TE53E067 and TE52E057

<table>
<thead>
<tr>
<th>Weight of unit without cable:</th>
<th>52E067 / 167 g ; 52E057 / 216 g</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weight of cable:</td>
<td>50 g/m</td>
</tr>
<tr>
<td>Connection, electrical:</td>
<td>2 or 10 meter cable, ø6 mm, 2x0.75 mm² shielded</td>
</tr>
<tr>
<td>Pressure for sensor function:</td>
<td>min: 0.1 bar, max.: 2 bar</td>
</tr>
<tr>
<td>Overload pressure:</td>
<td>max.: 15 bar</td>
</tr>
<tr>
<td>Max. repetitions freq. for sensor function:</td>
<td>2 Hz</td>
</tr>
<tr>
<td>Duration of electrical output pulse:</td>
<td>min: 1.0 sec.</td>
</tr>
<tr>
<td>Area of diaphragm:</td>
<td>360 mm²</td>
</tr>
<tr>
<td>Operating temp., sensor:</td>
<td>-20°C to +90°C</td>
</tr>
<tr>
<td>Max. media temperature on diaphragm when not operating:</td>
<td>+140°C</td>
</tr>
<tr>
<td>Material, sensor and diaphragm:</td>
<td>AISI 316L</td>
</tr>
<tr>
<td>Enclosure:</td>
<td>IP 68</td>
</tr>
<tr>
<td>Ex-category and Ex data:</td>
<td>See marking label</td>
</tr>
</tbody>
</table>
4 Focus

4.2 Universal Relay, TE52E058

Mounting:
By clipping onto 35 mm standard rail to DIN/EN50022 or by screw fixing.

Weight:
550 g

Supply voltage, Terminals 16-17-18-19:
24-115-230V AC, 50-60 Hz

Power consumption:
<4VA

Output voltage for sensor, nominal, Terminal 1-2:
10 V

Output current for sensor, nominal:
5mA

Output f. external load, Terminal 23-24-25:
Relay switch, 250V, 2A AC

DC output: Terminal 29-30 (max. 50 mA):
24V DC

Open collector output, Terminal 28-29 (max. 50mA):
<50V DC

Operating temp., relay:
-20°C to +40°C

Enclosure:
IP 20

Ex-category and Ex data:
See marking label

4.3 Universal Relay, TE52E059

Mounting:
By clipping onto 35 mm standard rail to DIN/EN50022 or by screw fixing.

Weight:
550 g

Supply voltage, Terminals 16-19:
12 – 36V DC

Power consumption:
<4VA

Output voltage for sensor, nominal, Terminal 1-2:
10 V

Output current for sensor, nominal:
5mA

Output f. external load, Terminal 23-24-25:
Relay switch, 250V, 2A AC

DC output: Terminal 29-30 (max. 50 mA):
24V DC

Open collector output, Terminal 28-29 (max. 50mA):
<50V DC

Operating temp., relay:
-20°C to +40°C

Enclosure:
IP 20

Ex-category and Ex data:
See marking label
Power supply and signal

The Universal Relay 52E058 can be supplied from AC mains 230 V (+/- 10%), 50-60 Hz, terminal 16 and 19 or alternatively 115 V terminal 16 and 18 or 24 V terminal 16 and 17.

The Universal Relay 52E059 can be supplied with 12 to 36 V DC at terminal 16 and 19.

The relays contains the necessary zener barriers needed to make the system intrinsically safe.

The built-in electronics constitutes the power supply for the Sensor supplying the required current and voltage. Power consumption from the mains is approx. 4 VA.

The Sensor has a built-in automatic zero-adjustment, which compensates for a standing pressure without giving a signal. This enables the system to operate in tanks under pressure.

The Sensor is a 2-wire open collector that cannot be supplied from a traditional power supply. The electrical output pulse is extended to 1 sec. for normal pressure loads. The cable is shielded in order to protect the system against disturbance from electro-magnetic noise.

Outputs from the Relay are:

1. a relay switch rated at max. 250V, 2A AC (terminal 23, 24 and 25)
2. a DC output facility supplying 24 V. Max load is 50 mA (terminal 29 and 30)
3. a DC signal of open collector type for PLC link-up. Max load is 50 mA and max. voltage is 50 V (terminal 28 and 29).
6 Installation

6.1 Position of Sensor in tank with welding adapter

In order to ensure correct signals, the sensor should be placed at the correct distance from the centre line of the down pipe according to the tank cleaning machine in question:

TJ20G \( a = 75 \text{ mm} \)
TZ-74 \( a = 78 \text{ mm} \)
TZ-79 \( a = 98 \text{ mm} \)
TZ-89 \( a = 50-90 \text{ mm} \)

\(^1\) depending on size of mounting connection

Deviations from the above given positions may work, but will influence the signal sequence. It is not recommended to go closer to the centre line, as there is a risk of having no signal. If the Sensor is placed further away from the centre line, the number of times it is directly hit by a jet reduces, and if too far away, there is a risk that the sensor is not directly hit by the jets at all.

Installation of Rotacheck sensor 52E067

The Rotacheck sensor 52E067 can be mounted in the tank using welding adapter 52E068 or by using SanJet 20, 4” machine prepared for mounting of Rotacheck.

Bore hole \( 50 +0.3/-0.0 \text{ mm} \), in top flange or tank.

Remove O-ring and push in adapter. TIG-weld on both sides adding the minimum amount of filler material and heat input in order to avoid deformation of the thread.

After welding and cleaning the weld, reinsert O-ring and mount Sensor as described above.

Installation of Rotacheck sensor 52E057

The Rotacheck sensor 52E057 can be mounted in the tank using welding adapter 52E052.

Bore hole \( 38 +0.3/-0.0 \text{ mm} \), in top flange or tank.

Remove O-ring and push in adapter. TIG-weld on both sides adding the minimum amount of filler material and heat input in order to avoid deformation of the thread.

After welding and cleaning the weld, reinsert O-ring and mount Sensor as described above.
Example of installation of Rotacheck system with sensor mounted in tank, relay installed in control room.


Connecting sensor to relay

7 Precautions when installing in Explosive atmosphere, classified in zones

The Rotacheck sensor must always be supplied through the Rotacheck relay, as the system’s Ex-safety is based on the relay limiting the current and voltage to the levels acceptable within Ex zones.

The Rotacheck sensor 52E067 must be permanently mounted in the tank or SaniJet 20 machine, and always in the welded adapter TE52E068 or SaniJet 20 machine. The welding adapter can be supplied as an optional extra part.

The Rotacheck sensor 52E057 must be permanently mounted in the tank, and always in the welding adapter 52E052. The welding adapter can be supplied as an optional extra part.

The Rotacheck sensor can be mounted in tanks having Ex Zone 0 or Zone 20 when the requirements in this installation guide are met.

In an Ex environment, the sensor must be used within temperature range as specified on marking label.

The sensor is marked with the following specifications giving Ex safety:

![ROTACHECK SENSOR 52E067](image1)
![ROTACHECK SENSOR 52E057](image2)

The Rotacheck relay, which must be installed in safe area outside Ex Zone, is marked with the following specifications giving Ex safety:

![ROTACHECK RELAY 52E058](image3)
![ROTACHECK RELAY 52E059](image4)

Batch code and production date can be seen on the label for sensor and relay.
Principle diagram of electrical circuit for intrinsic safety:

![Diagram](image.png)


Technical specification for the Rotacheck cable giving Ex safety:

- \( L_c: 1\mu H \)
- \( L_c: 200pF/m \)
- \( L_i: 100\mu H \)
- \( L_i: 10nF \)

### 7.1 Special conditions for safe use

Only permanent wired cables may be entered. The user shall provide the required strain relief.

Maximum length of the cable linking the relay and sensor shall be calculated and installed according to EN60079-14 by personal fulfill the demand in Annex A.

**Example for calculation of the cable length:**

The electrical parameters \( (C_C \text{ and } L_C) \) or \( (C_C \text{ and } L_C/R_C) \) for cable used shall be determined or the follow data can be used:

- \( C_C: 200 \text{ pF/m and } L_C: 1 \mu H/m \) (with or without screen).
- \( L_i \) less than 1% of \( L_O \) and \( C_i \) less than 1% of \( C_O \), therefore the following apply:

\[
C_C = \frac{(C_O - C_i)}{C_c/m}
\]

\[
C_C = \frac{(2300nF - 10nF)}{0.2nF/m} = 11.450 \text{ m}
\]

\[
L_C = \frac{(L_O - L_i)}{L_C/m}
\]

\[
L_C = \frac{(100 \text{ mH} - 0.1\text{mH})}{0.001\text{mH/m}} = 99.900 \text{ m}
\]

It is not recommended to have a total cable length above 200 meter.

The screen is connected to the sensor and shall therefore be floating at the relay.
7 Precautions when installing in Explosive atmosphere, classified in zones

7.2 Wiring

Sensor and Relay box must always be fitted and wired according to the national regulations.

The system can be mounted with up to 200 m cable between Sensor and Relay. When extending the cable, make sure that the shield is properly connected.

Power supply to relay:

The relay 52E058 can be supplied with 24 or 115 or 230 V AC.

The relay 52E059 can be supplied with 12 - 36 V DC.

Example 1:
Relay coupled to typical PLC with “pull-up” resistance

Example 2:
Relay can be used to drive various loads, for example an external relay, a lamp, a light diode with resistance or a buzzer.
When the Tank Cleaning Machine and the Rotacheck system are installed, it is recommended to run a functional test of min. 20 min. to observe the max./min. number of hits per time window/slot of 3 minutes. This is the basis of the alarm limits to be entered into the user’s control system.

Test results are depending on several factors: Inlet pressure, down pipe length, number of nozzles and nozzle size.

The following table shows results from a similar test.

<table>
<thead>
<tr>
<th>Test no.</th>
<th>1</th>
</tr>
</thead>
<tbody>
<tr>
<td>SanJet 20 4xØ4.2 700mm</td>
<td></td>
</tr>
<tr>
<td>Date</td>
<td>42630</td>
</tr>
<tr>
<td>Start time</td>
<td>0.0639583</td>
</tr>
<tr>
<td>Stop time</td>
<td>0.654167</td>
</tr>
<tr>
<td>Test time span in minutes</td>
<td>0.014583</td>
</tr>
<tr>
<td>Inlet pressure (bar(g))</td>
<td>5</td>
</tr>
<tr>
<td>Max. Hits per 1min. slot</td>
<td>8</td>
</tr>
<tr>
<td>Min. Hits per 1min. slot</td>
<td>2</td>
</tr>
<tr>
<td>Max. Hits per 2min. slot</td>
<td>11</td>
</tr>
<tr>
<td>Min. Hits per 2min. slot</td>
<td>11</td>
</tr>
<tr>
<td>Max. Hits per 3min. slot</td>
<td>21</td>
</tr>
<tr>
<td>Min. Hits per 3min. slot</td>
<td>17</td>
</tr>
</tbody>
</table>

For the same types of machines, test results may vary due to tolerances of the machines.

In order to select useful alarm limits it is recommended to set the Min. alarm limit approx 10% lower than the test result, and the Max. alarm limit approx 20% higher than the test result.

Example of the alarm limits can be:
- Max. alarm limit = 21 + 20% (4.2 • .4) = 25
- Min. alarm limit = 17 - 10% (1.7 • 2) = 15
Alfa Laval recommends using a time slot of 3 minutes to determine the number of hits used for alarm determination. Every second the sensor relay sends a data log signal to the PLC and every second the 3 minutes time slot should move a second. In this way we will have a moving time slot that gives us a real time hit rate which is recommended by Alfa Laval.

If it is not possible to provide the PC software with the recommended 3 min. time slot it is possible to use a hit sum-up every 3 minutes. The sum-up should be of a 3 minutes period.
9.1 ATEX Certificate of Conformity

EC – TYPE EXAMINATION CERTIFICATE available on Alfa Laval Anytime: http://www.alfalaval.com/service-and-support/alfa-laval-anytime

9.2 Product repair

Product repair requires return to Alfa Laval Kolding A/S.

9.3 How to contact Alfa Laval Tank Equipment

For further information please feel free to contact:

Alfa Laval Tank Equipment
Alfa Laval Kolding A/S
31, Albuen - DK 6000 Kolding - Denmark
Registration number: 30938011
Tel switchboard: +45 79 32 22 00 - Fax switchboard: +45 79 32 25 80
www.toftejorg.com, www.alfalaval.dk - info.dk@alfalaval.com

Contact details for all countries are continually updated on our websites
How to contact Alfa Laval
Contact details for all countries are continually updated on our website. Please visit www.alfalaval.com to access the information directly.