



TI-P324-02-E
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Colima TOR Series Magnetic Level Switches

Description

Magnetic-activated level switches for controlling liquid levels in most industrial applications.
 Instruments with rigid rod for vertical installation.
 Used for full automation of control management, including pressurised tanks, tubs, boilers and for the control of pumps, valves and alarm systems.

Standards and certifications

Instruments compliant with the European Directive ATEX 2014/34/EU. RINA, Lloyd Register and M.M.I. and Gost R approved.

Available types



Type **TOR A** made entirely of stainless steel, with weatherproof housing and thread connection.

| | | |
|---|--|-----------------|
| <p>TOR A</p>  | <p>Type A is recommended for most industrial applications. All wetted parts are made totally of stainless steel. Type A is equipped with reed switches, which allows control of up to six switching points with a single instrument. Type A is equipped with a potentiometer transmitter allowing continuous reading of liquid level.</p> | <p>A</p> |
|---|--|-----------------|

| | | |
|---|---|-----------------|
| <p>TOR B</p>  | <p>Type B is recommended for liquids with low specific weight such as hydrocarbons and mineral oils. Floats are made of BUNA N, the other wetted parts are made entirely of stainless steel. Type B is equipped with reed switch contacts, which allows the control of up to six switching points with a single instrument. Type B is equipped with a potentiometer transmitter allowing the continuous reading of the liquid level.</p> | <p>B</p> |
|---|---|-----------------|

| | | |
|---|---|------------------|
| <p>TOR PC</p>  | <p>Type PC is recommended for corrosive liquids, such as acids and brines, where the use of stainless steel is not recommended. All wetted parts are made entirely of PVC-Polyvinylchloride. Type PC is equipped with reed switch contacts, which allows the control of up to six switching points with a single instrument. Type PC is equipped with a potentiometer transmitter allowing the continuous reading of the liquid level.</p> | <p>PC</p> |
|---|---|------------------|

| | |
|---|------------------|
| <p>TOR PP</p>  <p>Type PP is recommended for corrosive liquids, such as acids and brines, where the use of stainless steel is not recommended. All wetted parts are made entirely of PP-Polypropylene. Type PP is equipped with reed switches, which allow control of up to six switching points with a single instrument. Type PP is equipped with a potentiometer transmitter allowing continuous reading of liquid level.</p> | <p>PP</p> |
| <p>TOR PF</p>  <p>Type PF is recommended for corrosive liquids, such as acids and brines, where the use of stainless steel is not recommended. All wetted parts are made entirely of PVDF-Polyvinylidene fluoride. The PF is equipped with reed switch contacts, which allows control of up to six switching points with a single instrument. The PF is equipped with a potentiometer transmitter allowing continuous reading of liquid level.</p> | <p>PF</p> |
| <p>TOR CD</p>  <p>The compact type CD is recommended for applications in hydraulic control units. It can also be used with liquids with low specific weight such as hydrocarbons and mineral oils. The floats are made of stainless steel or BUNA N, the other wetted parts are made of stainless steel. The compact type CD can be equipped with reed switch contacts, allowing control of up to two switching points with a single instrument. In place of the housing, a three-pin DIN connector with flying plug is used.</p> | <p>CD</p> |

Mounting

The TOR series level switches are installed vertically on the top of the tank or externally in a chamber connected to the tank.

Manufacturing characteristics

Materials and sizing are defined in relation to the characteristics of the liquid and the project conditions.

Housings

Protection degree IP67 and IP68 on request.
 For general applications in weatherproof execution.
 For hazardous areas in explosion-proof execution ATEX  II 1/2 G EEx d IIC T6, T5 resp. T4 certified.
 Only for TOR CD DIN IP64 connector.

Electrical equipment

SPST SPDT
 DPDT (two simultaneous SPDT contacts)

Potentiometer transmitter

Reed switch chain transmitter with divisions reading every 5, 10, 20 mm. Converter for output signal 4+20 mA, Available for safe areas or ATEX EEx-i certified approved for plants. Also available with Hart® protocol, suitable for intrinsically safety, ATEX EEx-ia certified.
 Can only be used with types A - B - PC - PP - PF.

Operating principle

One or more magnetic contacts (reed switches) or a reed switch 'chain' potentiometer transmitter are placed inside a sealed vertical tube, joined to the locking system.

Contacts

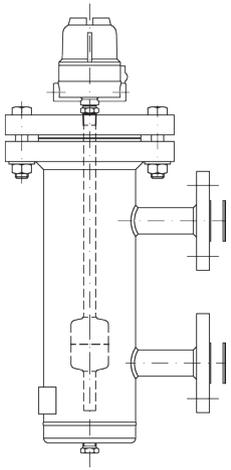
One or more floats, free to slide along the guide tube depending on the liquid level inside the tank, acting magnetically on contacts placed at the operation point, switching their status from normally open (NO) to normally closed (NC) position or vice versa.
 Switching points are always field adjustable.

Transmitter

A float, free to slide along the guide tube depending on the liquid level inside the tank, acts magnetically on the transmitter.
 The level is continuously transmitted.

Length of rod

Minimum length 100 mm
 Maximum length 5000 mm

| | | | |
|---|------------------|--|-----------------|
| <p>TOR FL (Free Wires)</p>  <p>Model FL is designed for naval applications. Float built in stainless steel or BUNA N; other wetted parts built in stainless steel. Model FL can be fitted only with reed switch contacts, with a single tool allows to control up to three fixed switching points. The FL is not equipped with housing. A sheath of heat-shrinkable material protects the output cable. The enclosure rating is IP67.</p> | <p>FL</p> | <p>TOR M (Metric)</p>  <p>Model M is designed for applications on tanks that are not provided with level gauge and which requires manual and visual reading of the level. The level reading is achieved using a scale tape inserted into the rod: slowly pulling out the tape, it is possible to detect the liquid level through the interaction of the magnet of the float and the magnet on the bottom of the graduated tape. Floats are built in stainless steel or BUNA N, other wetted parts built in stainless steel.</p> | <p>M</p> |
| <p>TOR C (in Chamber)</p>  <p>Version C is provided with restraint chamber, for installations external to the tank, according to PED 2014/68/EU. The C type is designed to show local fluid level is also available a sight glass, on request. Floats are built in stainless steel or BUNA N, connections to the process and chamber camera in ASTM or AISI 316. Fittings with reed switch contacts, to control up to three switching points with a single tool. The C type is fitted with potentiometric transmitter, allows the continuous reading of the liquid level. On request, it is possible the simultaneous presence of reed-switches and transmitter, placed on two separate rods.</p> | <p>C</p> | | |

Wetted parts

| | Flanged or threaded | | | | | | Float | | | | | | | |
|---------|---------------------|---|--------|---|--------|---|--------|---|----------|---|-------|---|-----------|---|
| Steel | A105 | 1 | 304LSS | 2 | 316LSS | 3 | 316LSS | A | Titanium | B | Monel | C | Hastelloy | D |
| Plastic | PVC | 4 | PP | 5 | PVDF | 6 | PVC | E | PP | F | PVDF | G | Buna N | H |

Float diameters to be used with flanged connection

| | | | | | | |
|---------|-----|----|---------------------------------|-----|----|----------------------------------|
| Steel | Ø44 | 44 | Flanges ≥ DN50 - 2" ASME (ANSI) | Ø55 | 55 | Flanges ≥ DN65 - 2½" ASME (ANSI) |
| | | | | Ø72 | 72 | Flanges ≥ DN80 - 3" ASME (ANSI) |
| Buna N | Ø44 | 44 | Flanges ≥ DN50 - 2" ASME (ANSI) | Ø58 | 58 | Flanges ≥ DN65 - 2½" ASME (ANSI) |
| Plastic | Ø70 | 70 | Flanges ≥ DN80 - 3" ASME (ANSI) | Ø55 | 55 | Flanges ≥ DN65 - 2½" ASME (ANSI) |

Float diameters to be used with threaded connections

| | | | | | | |
|---------|-----|----|---------------------------------------|-----|----|--------------------------------------|
| Steel | Ø44 | 44 | Thread ≥ G 1½" M (NPT not applicable) | Ø55 | 55 | Thread ≥ G 2" M (NPT not applicable) |
| | Ø30 | 30 | Thread ≥ G 1" M | Ø72 | 72 | Thread ≥ G 3" M |
| Buna N | Ø30 | 30 | Thread ≥ G 1" M | Ø58 | 58 | Thread ≥ G 2½" M |
| | Ø44 | 44 | Thread ≥ G 1½" M | | | |
| Plastic | Ø70 | 70 | Thread ≥ G 2½" M | Ø55 | 55 | Thread ≥ G 2" M (NPT not applicable) |

Note: the size of the float is subject to fluid specific gravity; the sizes shown are for standard floats. Other sizes can be made on request.

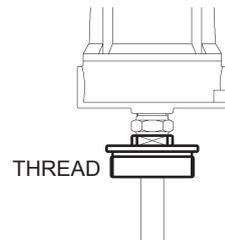
Process connections

UNI and ASME (ANSI) flanges **FL**

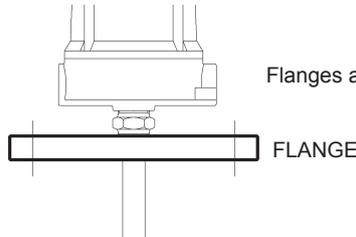
| UNI | PN6 | PN10/PN16 | PN40 | PN64 |
|-------|-----|-----------|------|------|
| DN50 | UA | UB | UC | UD |
| DN65 | UE | UF | UG | UH |
| DN80 | UI | UL UM | UN | UO |
| DN100 | UP | UQ | UR | US |
| DN125 | UT | UU | UV | UZ |

| ASME | 150 | 300 | 600 |
|------|-----|-----|-----|
| 2" | AA | AB | AC |
| 2½" | AD | AE | AF |
| 3" | AG | AJ | AH |
| 4" | AI | AL | AM |
| 5" | AN | AO | AP |

Threads **FI**



| G M | |
|-----|----|
| 1" | F |
| 1½" | FA |
| 2" | FB |
| 2½" | FC |
| 3" | FD |
| 4" | FE |



Flanges and threads are available in other sizes on request.

TOR C connections (With LL and LF chamber)

UNI and ANSI flanges (FL)

| UNI | CA | DN 20 | PN16 |
|-----|----|-------|-------|
| | CB | DN 20 | PN40 |
| | CC | DN 20 | PN64 |
| | CD | DN 20 | PN100 |
| | CE | DN 25 | PN16 |
| | CF | DN 25 | PN40 |
| | CG | DN 25 | PN64 |
| | CH | DN 25 | PN100 |
| | CI | DN 40 | PN16 |
| | CL | DN 40 | PN40 |
| | CM | DN 40 | PN64 |
| | CN | DN 40 | PN100 |

| ANSI | DA | ¾" | 150 |
|------|----|-----|-----|
| | DB | ¾" | 300 |
| | DC | ¾" | 600 |
| | DD | 1" | 150 |
| | DE | 1" | 300 |
| | DF | 1" | 600 |
| | DG | 1½" | 150 |
| | DH | 1½" | 300 |
| | DI | 1½" | 600 |

Screwed (FI)

| | | |
|-------|----|-----|
| GK M | GA | ½" |
| | GB | ¾" |
| | GC | 1" |
| | GD | 1½" |
| NPT-M | NA | ½" |
| | NB | ¾" |
| | NC | 1" |
| | ND | 1½" |

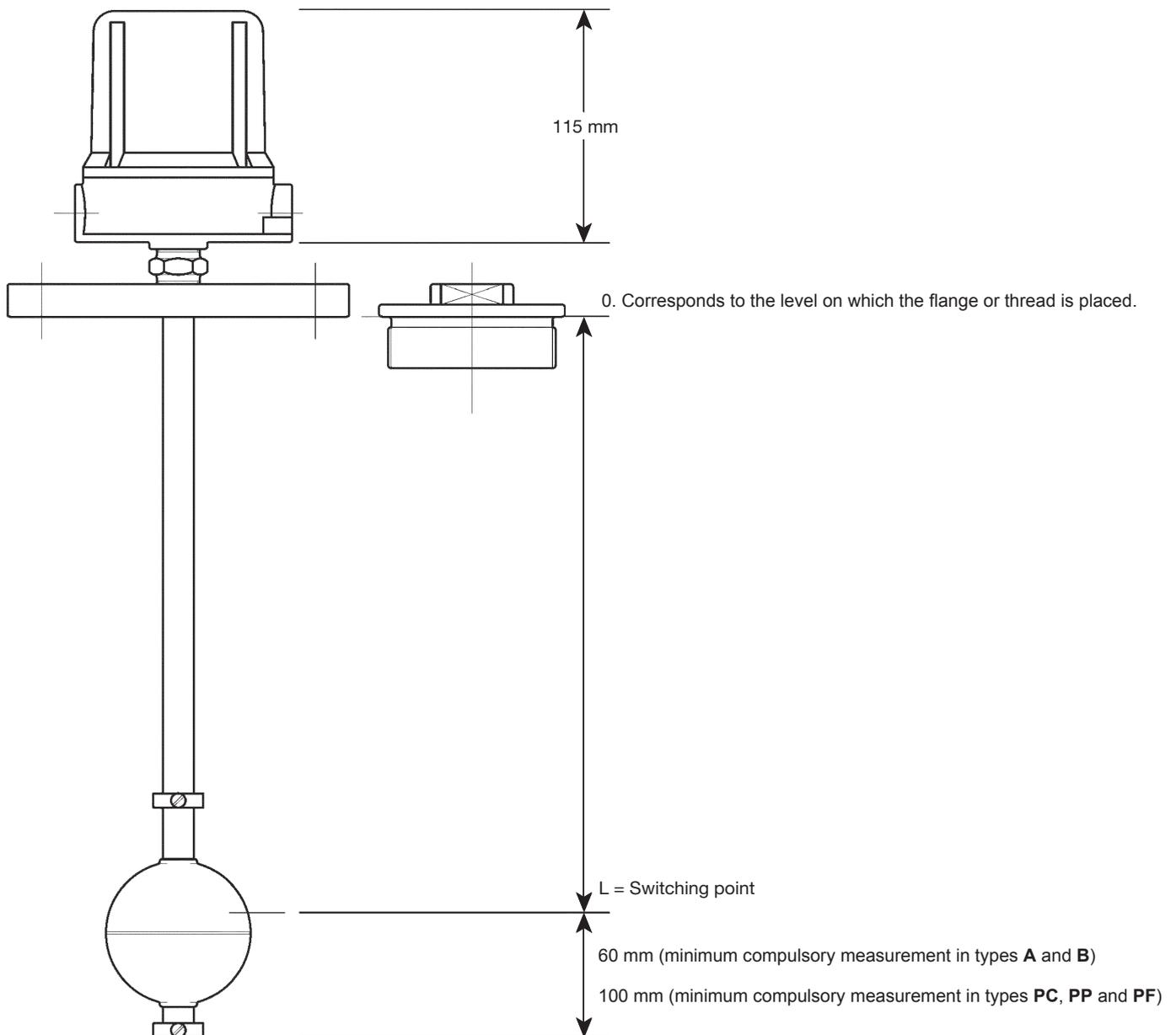
Welded

| | | |
|----|----|-----|
| SW | SA | ½" |
| | SB | ¾" |
| | SC | 1" |
| | SD | 1½" |
| BW | BA | ½" |
| | BB | ¾" |
| | BC | 1" |
| | BD | 1½" |

Design conditions

| | | | | |
|-------------------------------------|-------------------|-------------|-----------|-----------|
| TMA - Maximum allowable temperature | Steel | -110 | to +200°C | |
| | Buna N | -20 | to +80°C | |
| | Plastic | PVC | -20 | to +70°C |
| | | PP | -20 | to +105°C |
| | | PVDF | -20 | to +130°C |
| PMA - Maximum allowable pressure | Steel | < 100 bar g | | |
| | Buna N | < 16 bar g | | |
| | Plastic | < 16 bar g | | |
| Fluid specific gravity | Steel and plastic | > 0.8 kg/l | | |
| | Buna N/Titanium | > 0.5 kg/l | | |
| Differential | | fixed 8 mm | | |

Type **TOR A** with weatherproof housing, steel float and a reed switch contact



Colima electrical equipment and housings for Colima TOR series magnetic level switches

Description

The electrical equipment in TOR series magnetic level switches comprises one or more reed switch contacts, fitted inside a sealed stainless steel tube.

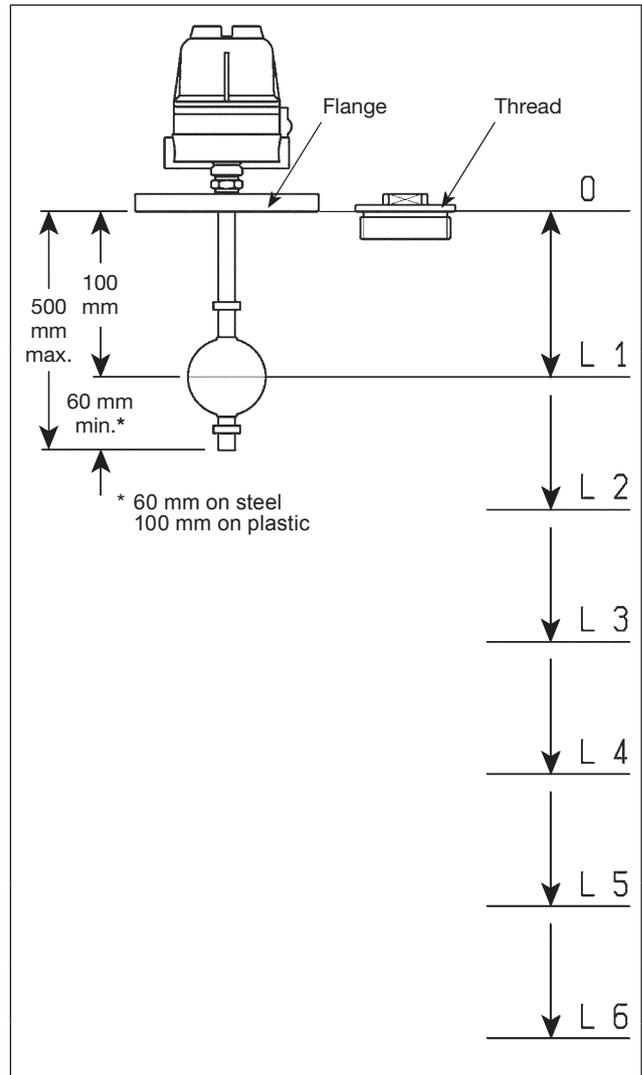
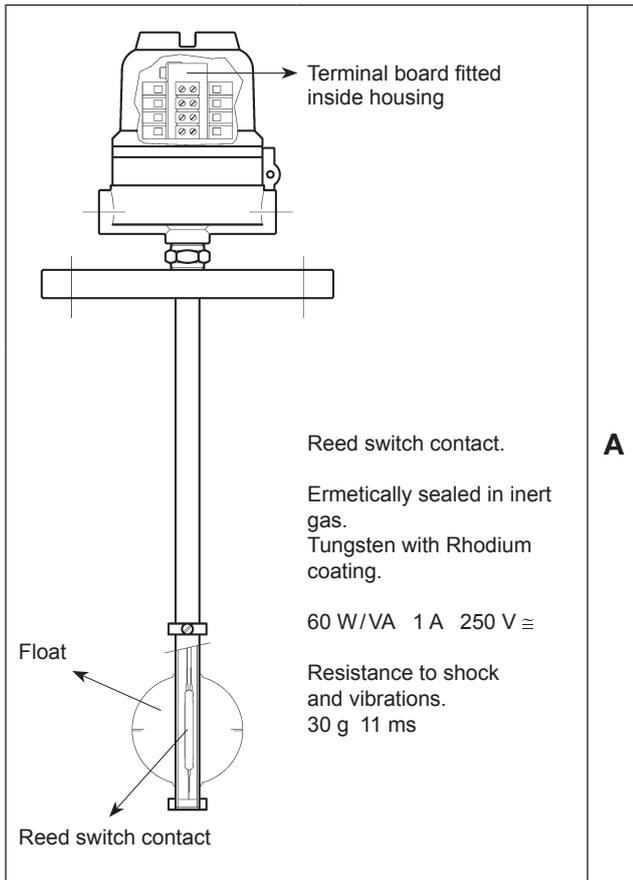
Wires are welded to the contacts connected to the terminal board inside the housing.

Contacts are activated by floats that slide along the tube. The floats contain a magnetic system that, when the level of liquid rises or falls, switch the state of each contact quickly and reliably.

The position of the contacts at the required switching points are set in the factory but is always field adjustable.



Reed switch contact characteristics



| | |
|---|---|
| SPDT execution | 1 |
| DPDT execution (two simultaneous SPDT contacts) | 2 |

Wiring diagram

Maximum number of contacts per instrument

The terminal board inside the housing can connect a maximum number of 18 cables.

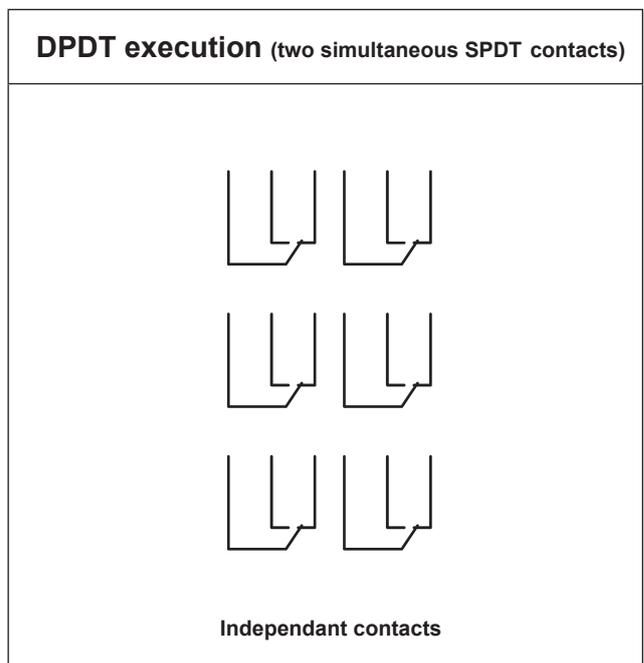
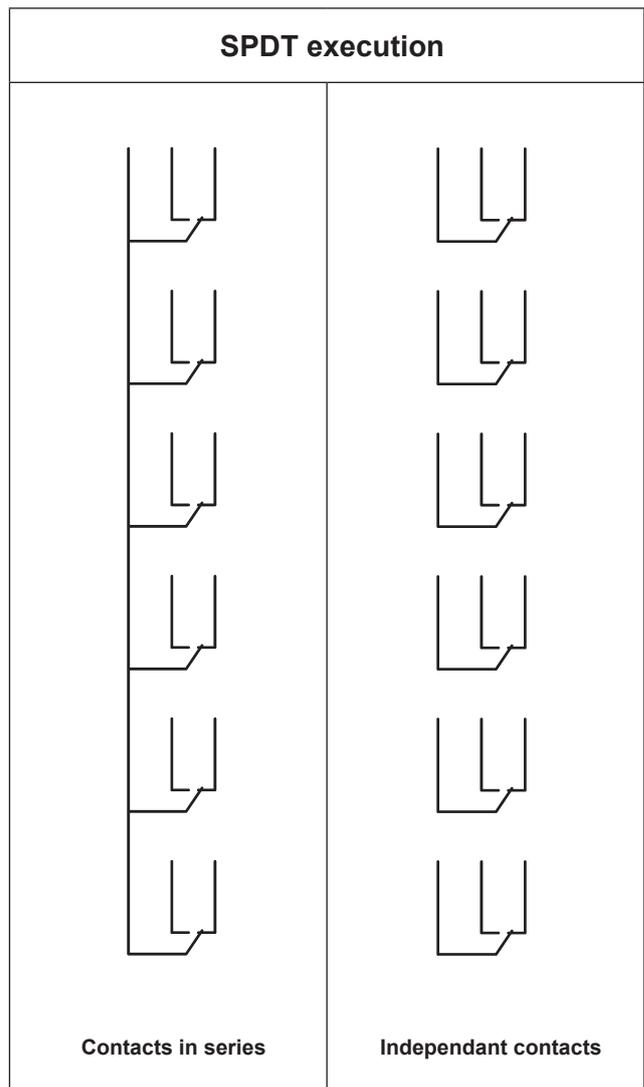
Each contact has the following number of wires:

- 3 wires in **SPDT** contacts
- 6 wires in **DPDT** contacts

The various possible combinations of contacts must be taken into account:

(Example of how many contacts can be installed in one instrument:

- 6 SPDT or
- 2 SPDT + 2 DPDT or
- 5 SPDT or
- 4 SPDT + 1 DPDT etc.).



Potentiometer transmitter characteristics

A potentiometer, a device comprising a printed circuit board on which a reed / resistance chain is welded, is placed inside the float's vertical guide tube.

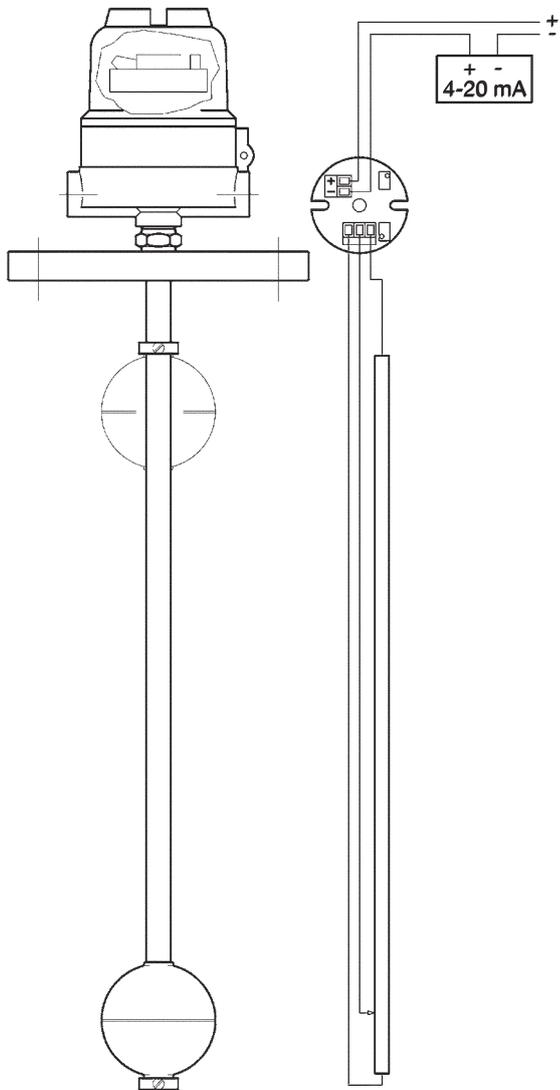
The total resistance of a known value is measured at the ends of this potentiometer.

The float, following the liquid level trend, activates the potentiometer's reed contact chain through its own magnetic field, locally closing the signal.

The total value of the resistance, is measured 100% at its maximum level and 0% at its minimum level.

The end poles of the potentiometer are connected to a converter that transforms the input value into Ohm and the output into mA.

Reading resolution available: 5, 10, 20 mm
Resistance input 1 k ± 100 k Ohm.



Converter characteristics

The Ohm-mA signal converters are inside the housing.

Three types of converter are available:

- Converter for safe zone
- Converter for inbuilt safety zone, ATEX certified.
- Converter suitable for HART® protocol, intrinsically safe, ATEX certified

Resistance input 1 k ± 100 k Ohm

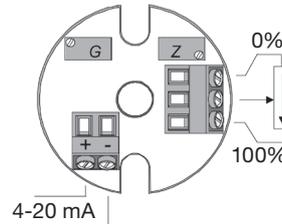
Current output 4÷20 mA

Type 1 and 2 converters can be field set using two trimmers [for the Z (zero) gauging and G (Gain) gauging], without resorting to interconnecting systems.

The type 3 converter must be regulated with an interconnection cable.

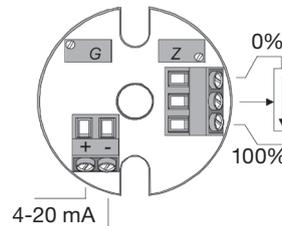
C

Converter for safe zone



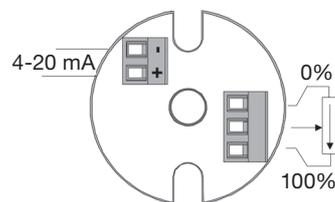
1

Converter for inbuilt safety zone



2

Converter for HART® protocol



3

The TOR series magnetic level switch housings are available in various forms to meet all possible application needs and are suited to most environmental and safety conditions. They are available in the normal version for general use and the explosion-proof version for use in hazardous areas.

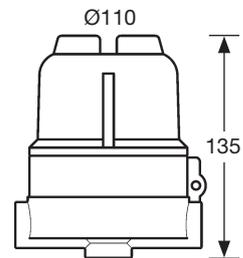
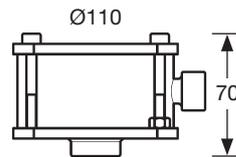
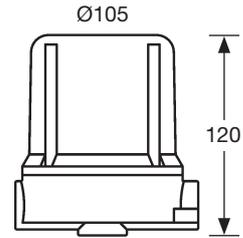
| | |
|--|-----------------|
| <p>Weatherproof housing</p>  <p>Type 1 is designed for use on general purpose industrial applications. Manufactured using pressure die-cast aluminium and protected with polyamide paint. Protection degree IP67. Up to two cable entrances.</p> | <p>1</p> |
| <p>Weatherproof housing</p>  <p>The type 2 has been designed for lower temperature applications, installation in high concentration saline environments and for use in the food industry. Manufactured entirely in stainless steel. Protection degree IP67. On request IP68. Up to two cable entrances.</p> | <p>2</p> |
| <p>Explosion-proof housing</p>  <p>The type 3 has an explosion-proof housing - ATEX certified $\text{II 1/2 G EEx d IIC T6, T5}$ resp. T4 for use in hazardous areas. Manufactured using pressure die-cast aluminium with a polyamide paint. Protection degree IP67. Up to two cable entrances.</p> | <p>3</p> |

Electrical connections

The housings allow for two cable entry points which are available as follows:

| | | |
|-----------------|------------|----------|
| Standard | G 1/2" F | A |
| Explosion-proof | Gk 1/2" F | B |
| On request | 1/2" NPT F | C |
| | M20 x 1.5 | D |
| | PG 13.5 | E |

Dimensions (approximate) in mm



Product selection and order placement

Each unit is identified by a unique alphanumeric code that defines the manufacturing characteristics that best suits the application. Please confirm the following information before commencement of the product configuration.

Process pressure = _____ Process temperature = _____
 Design pressure = _____ Design temperature = _____
 Fluid type = _____
 Specific gravity of fluid = _____
 Viscosity of fluid = _____

| Range | Colima | Colima |
|---|---|--------|
| Model | T TOR | T |
| Type | A Wetted parts stainless steel | A |
| | B Wetted parts stainless steel, float BUNA N | |
| | PC Wetted parts PVC | |
| | PP Wetted parts PP | |
| | PF Wetted parts PVDF | |
| | CD Miniature type without housing, DIN connector with plug | |
| Rod length | Insert length (100 to 5000 mm) CD Model (100 to 1500 mm) | |
| Option | T Anti-turbulence tube | T |
| Housing | 1 IP67 General purpose | 1 |
| | 2* IP67 Stainless steel (2 SPDT max) *economic version | |
| | 3 ATEX certified (ATEX 2014/34/EU) | |
| Electrical connections | 1 G ½" F | 1 |
| | 2 Gk ½" F | |
| | 3 ½" NPT F | |
| | 4 M20 x 1.5 | |
| | 5 PG 13.5 | |
| Connections | F Flanged connection | F |
| | T Thread connection | |
| | X Chamber L/L | |
| | Y Chamber L/F | |
| Flange or thread material | 1 A 105 stainless steel | 2 |
| | 2 304 stainless steel | |
| | 3 316L stainless steel | |
| | 4 PVC | |
| | 5 PP | |
| | 6 PVDF | |
| Flange or thread rating | Refer to page 4 | UA |
| Float material | A 316 stainless steel (-25°C to 350°C) | B |
| | B Titanium (-25°C to 350°C) | |
| | C Monel (-25°C to 350°C) | |
| | D Hastelloy (-25°C to 350°C) | |
| | E PVC (-20°C to 70°C) | |
| | F PP (-20°C to 105°C) | |
| | G PVDF (-20°C to 130°C) | |
| | H BUNA N (-20°C to 80°C) | |
| Float diameter | 30 Ø 30 BUNA N / Steel | 72 |
| | 44 Ø 44 BUNA N / Steel | |
| | 58 Ø 58 BUNA N | |
| | 55 Ø 55 Steel / Plastic | |
| | 70 Ø 70 Plastic | |
| | 72 Ø 72 Steel | |
| Float number | from 1 up to 6 | 2 |
| Electrical equipment switches | 1 SPDT | 2 |
| | 2 DPDT | |
| SPDT contact number | from 1 up to 6 | |
| DPDT contact number | from 1 up to 3 | |
| Electrical equipment transmitter | T5 5 mm | T10-C3 |
| | T10 10 mm | |
| | T20 20 mm | |
| | C3 Converter for safe area | |
| | C4 Converter for in built safe area | |
| | C5 Converter Hart® protocol | |

How to order example: 1 off Spirax Sarco Colima T-A-T-1-1-F-2-UA-B-72-2-2-T10-C3.