KROHNE

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GR

Installation and operating instructions

LS 4100/LS 4150

“Level-Safe” Vibrating Level Switch

- Variable area flowmeters
- Vortex flowmeters
- Flow controllers
- Electromagnetic flowmeters
- Ultrasonic flowmeters
- Mass flowmeters
- **Level measuring instruments**
- Communications engineering
- Engineering systems & solutions
- Switches, counters, displays and recorders
- Heat metering
- Pressure and temperature

Contents

Safety information

Please read this manual carefully, and also take note of country-specific installation standards (e.g. the VDE regulations in Germany) as well as prevailing safety regulations and accident prevention rules. For safety and warranty reasons, any internal work on the instruments, apart from that involved in normal installation and electrical connection, must be carried out only by qualified KROHNE personnel.

Product liability and warranty

Responsibility for suitability and intended use of these instruments rests solely with the operator. Improper installation and operation of the instruments may lead to loss of warranty.
In addition, the ”General conditions of sale” forming the basis of the purchase contract are applicable.
If instruments need to be returned to KROHNE, please note the information given on the last-but-one page of these Instructions. KROHNE regret that they cannot repair or check your instrument unless accompanied by the completed form sheet.

CE / EMC / Standards / Approvals

LS 4100/LS 4150 meet the protection requirements of **Directive 89/336/EEC** in conjunction with **EN 50081-1** (1992) and **EN 50082-2** (1995), and **Directives 73/23/EEC** and **93/68/EEC** in conjunction with **EN 61010-1,** and also bear the **CE symbol**.

CE

1 Product description

1.1 Function and configuration

LS 4100/LS 4150 detect levels of liquids with a viscosity of 0.2 up to 10.000 mPa s and a density of ≥ 0.6 g/cm^3. Modular construction enables their use in machines, plants, vessels and pipelines, even in applications severely limited in space. Typical applications are overfill and dry run protection.

LS 4100 is optionally available with threads G 1 A and 1" NPT. The stainless steel housing (1.4571) is in protection class IP 67.

LS 4150 is mainly suitable for level detection in the food processing and pharmaceutical industry. Due to the polished sensor surface (Ra ≤ 0.5 µm or Ra ≤ 1.5 µm) bacteria have no chance to collect. LS 4150 is also suitable for CIP and SIP cleaning. Many different hygienic fittings such as cone with compression nut, Tri-Clamp 1" and 2", bolting, Tuchenhagen VARIVENT or special hygienic connections are available.

Due to the simple and rugged measuring system, LS 4100/LS 4150 is virtually unaffected by the chemical and physical properties of the liquid. They work even under unfavourable conditions such as turbulence, air bubbles, foam generation, build-up or varying products. An adjustment to the medium is not necessary.

The electronics can be exchanged without problems. LS 4100/LS 4150 must not be removed.

LS 4100/LS 4150 has an integrated test switch which can be activated magnetically. It tests the sensor electronics and the connected instruments.

1.2 Principle of operation

The tuning fork is piezoelectrically energised and vibrates at its mechanical resonance frequency of approx. 400 Hz. This frequency is transferred to the electronics of LS 4100/LS 4150. When the tuning fork is submerged in the product, the frequency changes. This change is detected by the integrated oscillator and converted into a switching command.

By changing of poles of the supply voltage, the switching condition can be defined (max. detection/min. detection). With the transistor version, PNP or NPN action can be preset by a different connection of the consumer (load).

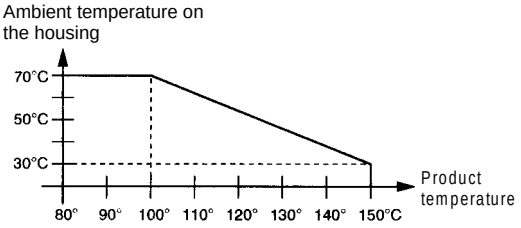
The integrated fault monitoring detects:

- interruption of the connection cable to the piezo elements
- extreme wear on the tuning fork
- break of the tuning fork
- no vibration

If one of the stated failures is determined or in case of voltage loss, the electronics takes on a defined switching condition, e.g. the output transistor blocks.

1.3 Technical data

Housing	
Housing material	stainless steel 1.4571/ 316Ti
Protection	IP 67
Torque on the hexagon	80 Nm
Plug connection	4-pole plug with status indication (illuminated ring)
Terminals	max. 1 x 1.5 mm^2
Process connection	
LS 4100	
- thread	G 1 A or 1" NPT
- material	1.4571 (316Ti)
LS 4150	
- thread	G 1 A or 1" NPT
- cone	DN 25
- Tri-Clamp	1" or 2"
- bolting	DN 40 or DN 50
- Tuchenhagen Varivent	
- hygienic connection with compression nut	F40 PN 25
- hygienic connection with tension flange	DN 32 PN 25
Tuning fork	
Material	1.4581 (stainless steel)
Weight	
Total weight	approx. 0.4 kg
Ambient conditions	
Ambient temperature on the housing	-40…+70°C
Storage and transport temperature	-40…+70°C
Product temperature	-40…+150°C



Operating pressure	max. 40 bar
Product	
Viscosity	0.2…10.000 mPa s
Density	> 0.6 g/cm^3

Electronics - General

Integration time	approx. 0.5 s
Measuring frequency	approx. 400 Hz
Hysteresis	approx. 4 mm with vertical installation
	Control lamp illuminated ring with two-colour LED for status indication
	green – output conductive
	red – output blocks

Electronics - Transistor output (SW E72 T)

Power supply	10 … 55 V DC
Power consumption	max. 0.5 W
Output	floating transistor output
	NPN/PNP selectable
Load current	max. 400 mA (output - overload and permanently short-circuit proof)
Voltage loss	max. 1 V
Turn-on voltage	max. 55 V DC
Blocking current	< 10 µA
Protection class	II
Overvoltage category	III
Mode	A - max. detection or overfill protection
	B - min. detection or dry run protection
	A/B-mode by polarisation of the power supply

Electronics - contactless electronic switch (SW E72 C)

Power supply	20 … 250 V AC, 50/60 Hz or 20 … 250 V DC
Output	contactless electronic switch
Internal current requirement	approx. 3 mA (via the load circuit)
Load current	min. 10 mA
	max. 400 mA
	(at I > 300 mA the ambient temperature can be max. 60°C) max. 4 A up to 40 ms
Protection class	I
Overvoltage category	III
Modes	A/B-mode by electrical connection in the connection plug
	A - max. detection, overfill protection
	B - min. detection, dry run protection

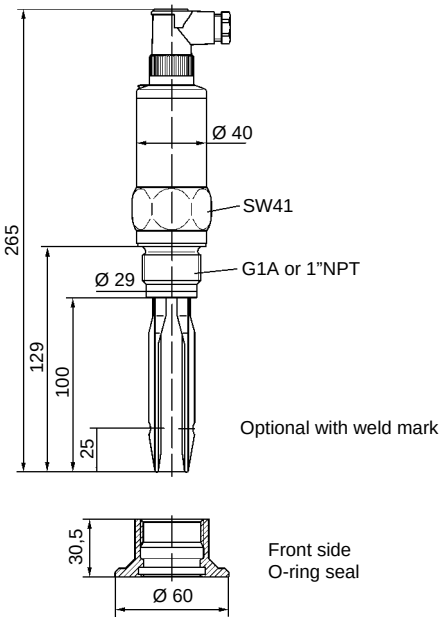
CE conformity

LS 4100/LS 4150 vibrating level switches meet the protective regulations of EMC (89/336/EWG) and NSR (73/23/EWG). Conformity has been judged acc. to the following standards:

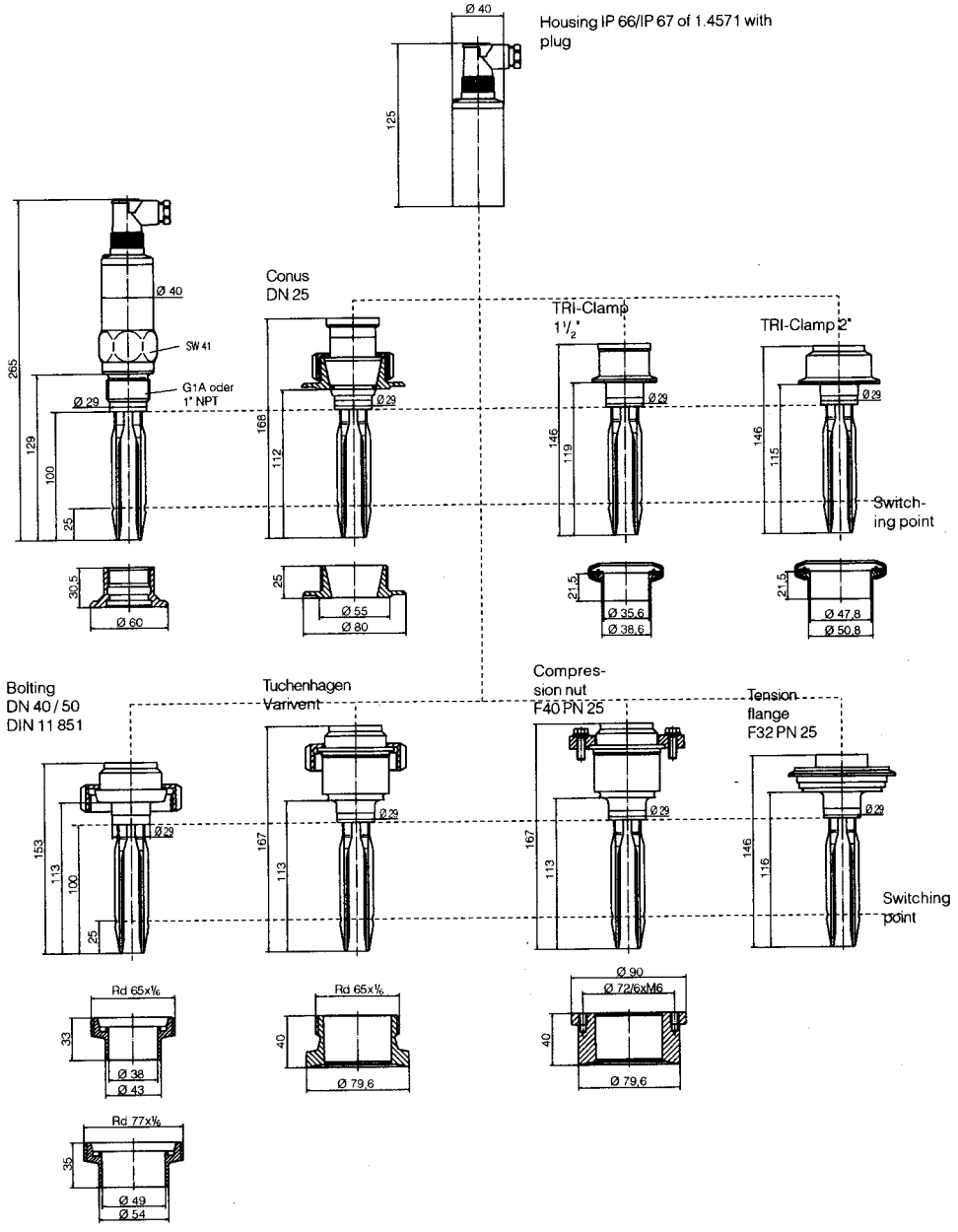
EMC	Emission EN 50 081 - 1: 1992
	Susceptibility EN 50 082 - 2: 1995
NSR	EN 61 010 - 1: 1993

1.4 Dimensions

LS 4100



LS 4100/LS 4150

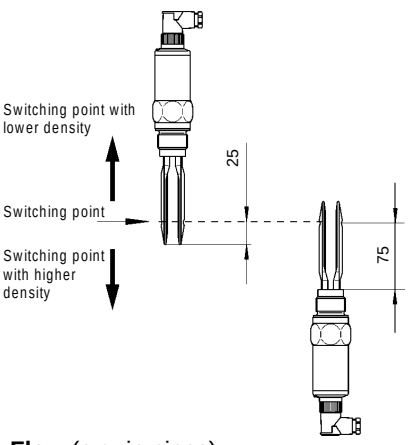


2 Mounting

2.1 Mounting instructions

In principle, the level switch can be mounted in any position. The instrument must be mounted such that the tuning fork is at the height of the required switching point. Note the following installation instructions:

Switching point
The tuning fork is provided with lateral markings (notches, 25 mm from the fork tip), marking the switching point with vertical installation for the medium water. When installing level switch note that the switching point of the instrument shifts when the medium has a density differing from water (water = 1.0 g/cm^3).



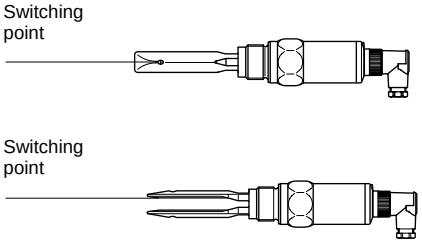


Fig. 2.1

Flow (e.g. in pipes)
When mounting in pipes or in vessels with certain flow direction, you should mount level switch such that the surfaces of the tuning fork are aligned with the direction of flow.

Adhesive products
In the case of adhesive and viscous products, the tuning fork should protrude into the vessel to avoid build-up in the mounting boss. A mounting boss should therefore not exceed a length of 30 mm.

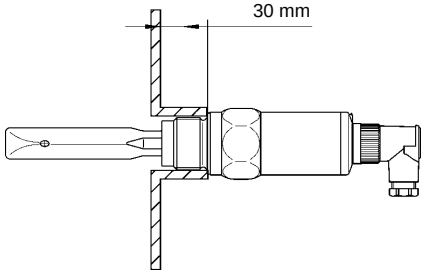


Fig. 2.2

In the case of horizontal mounting in adhesive and viscous products, the surfaces of the tuning fork should be vertical to reduce build-up on the tuning fork. The position of the tuning fork is marked by two notches on the hexagon of level switch. Therefore you can check the position of the tuning fork when screwing it in. One notch should be on top. When the hexagon touches the seal, the thread can be still turned by approx. half a turn. This is sufficient to reach the recommended installation position.

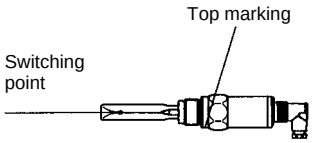


Fig. 2.3

Transport

Do not hold level switch on the tuning fork. The tuning fork can be damaged.

Polished version LS 4150

Treat instruments with polished tuning fork LS 4150 very carefully and do not touch the polished surface. Unpack LS 4150 directly before mounting. Insert LS 4150 carefully into the provided opening and avoid contact with vessel parts.

Cable entries

When mounting outside, on cooled vessels or in humid areas in which e.g. cleaning is done with steam or high pressure, the seal of the cable entry is especially important. Use cable with sufficient wire cross-section and tighten the cable entry. For cables with too small wire cross-section, a suitable reduction piece must be used to ensure tightness of the cable entry.

Two seal rings are attached to the instrument to ensure tightness also of cables with smaller diameter. Use the smallest possible seal ring.

To avoid humidity ingress, the cable entry should point downwards (see fig. 2.4).

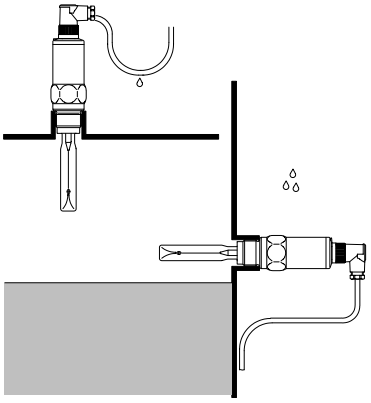


Fig. 2.4

Proceed as follows: Loosen the plug by unscrewing the knurled ring. Loosen the connection screw and remove the socket insert out of the angular housing of the plug (see also fig. 3.1 under "3.1 Connection instructions").

You can turn the angle housing of the plug in 60° steps (see fig. 2.5). With vertically mounted LS 4150, loop the connection cable to the instrument housing downwards so that rain and condensation water can drain off.

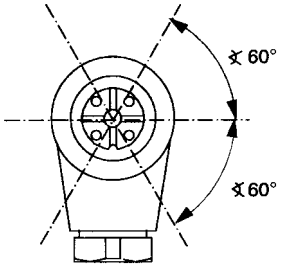


Fig. 2.5

Welded socket G 1 A

Level switch thread start is defined. This means that each is in the same position after screwing in. Therefore remove the supplied seal from the thread of LS 4100/LS 4150. This seal is not required when using a welded socket (G 1 A). Screw level switch into the welded socket.

You can determine the subsequent position of the level switch before welding (see also fig. 2.3). Mark the appropriate position of the welded socket. Before welding, unscrew level switch and remove the rubber ring from the socket.

An optional welded socket (G 1 A) is available which is already provided with a notch. Weld this socket with a marking facing up-wards.

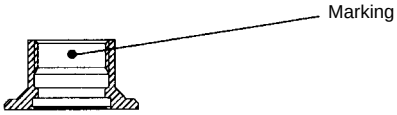


Fig. 2.6

3 Electrical connection

3.1 Connection instructions

Note

Switch off the power supply before starting connection work.

Remove the plug. Loosen the screw (7) and disassemble the plug. Lead the connection cable through the cable entry and connect the cables according to the following illustration.

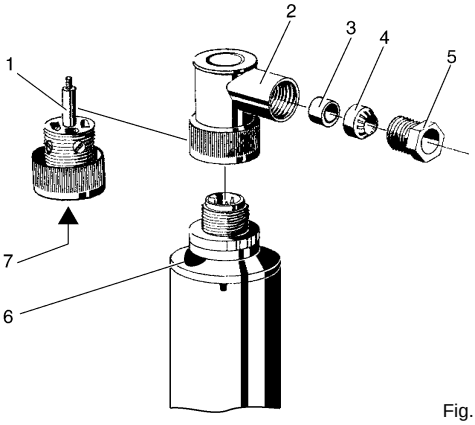


Fig. 3.1

1 Socket insert
2 Angle housing
3 Seal ring (3 pcs. for different cable ø)
4 Clamping basket
5 Pressure screw
6 Illuminated ring with LED
7 Connection screw

Plug connection

Terminals 1 - 4 are marked on the plug.

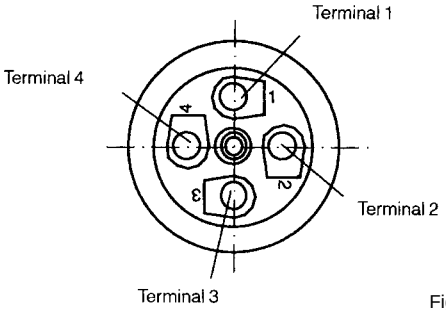


Fig. 3.2

3.2 Wiring plan

Floating transistor output (SW E72 T)

Power supply: 10 … 55 V DC (for further information see the following connection examples as well as technical data)

To determine the switching status of the transistor output (mode A/B), the supply cable (terminals 1 and 4) must be polarised respectively.

Mode A
Max. detection or overfill protection:
- terminal 1: +
- terminal 4: –

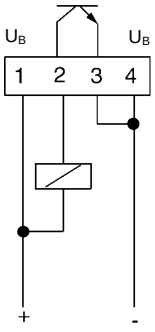
Mode B
Min. detection or dry run protection:
- terminal 1: –
- terminal 4: +

Through different connections of the consumer (load), NPN or PNP action can be preset. Take care that during connection, terminal 2 has always a more positive voltage potential than terminal 3.

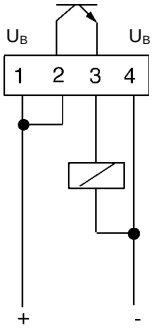
Connection examples

The transistor switches the supply voltage of the oscillator to the binary input of a PLC or to an electrical load.

Mode A

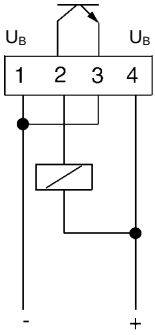


NPN action

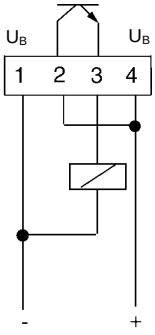


PNP action

Mode B



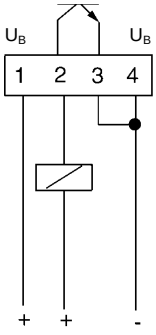
NPN action



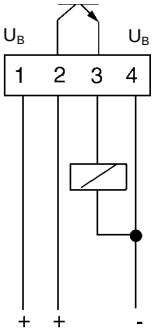
PNP action

The transistor switches a second voltage source with the same reference potential to the binary input of a PLC or to an electrical load.

Mode A

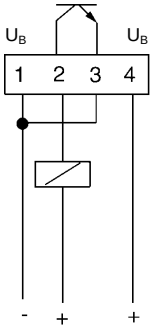


NPN action

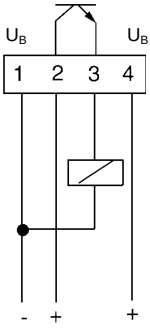


PNP action

Mode B



NPN action

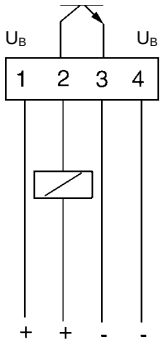


PNP action

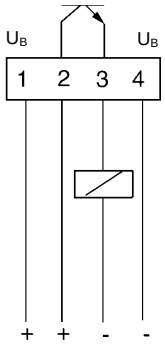
The transistor switches a second, galvanically isolated voltage source to the binary input of a PLC or to an electrical load.

Mode A

For mode B you have to switch the polarity of terminals 1 and 4.



NPN action

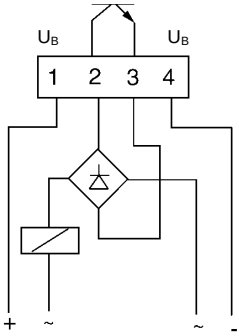


PNP action

Control of alternating current loads

The transistor switches a galvanically separated alternating voltage 10 … 42 V AC to a load.

Mode A



Note
The transistor outputs of several LS 4100/ LS 4150 can be switched in series or in parallel to connect their signals logically.
The connection must be made such that terminal 2 always has a higher voltage compared to terminal 3.

Contactless electrical switch (SW E72 C)

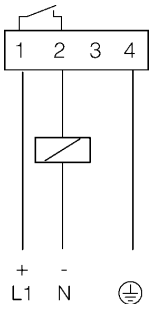
Power supply 20 … 250 V AC, 50/60 Hz or 20 … 250 V DC (for further information see the following connection examples as well as the technical data)

For direct control of relays, contactors, magnet valves, warning lights, horns etc. the instrument must not be operated without connected load (switching in series), as the oscillator can be destroyed when connected directly to mains. Not suitable for connection to low voltage PLC inputs.

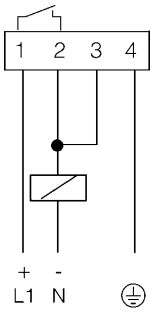
The domestic current is temporarily lowered below 1 mA after switching off the load so that contactors, the load current of which is lower than the permanently flowing domestic current of the electronics, are reliably switched off.

A/B-mode

Mode A
Max. detection, overfill protection



Mode B
Min. detection, dry run protection



In mode A, terminal 3 remains free. Therefore do not connect a cable to terminal 3, not even up to the next junction box, since the cable can pick up interfering signals.

4.1 Switching status

The switching status can be checked with closed instrument by means of the illuminated ring in the upper part of the housing.

By interchanging of the connection cables, you can modify the switching status of the transistor output (T). For the electronics version contactless electronic switch (C) you have to use a jumper in the plug between terminal 2 and 3 to modify the switching status. You can adjust the requested mode acc. to "4.3 Functions chart" (see "3.2 wiring plan").

A = max. detection or overfill protection,
B = min. detection or dry run protection.

4.2 Switching point

The switching point of LS 4100/LS 4150 is preadjusted and does not require further modifications.

The statements on the position of the switching point (see also "2.1 Mounting instructions") relate to water (density 1.0 g/cm^3). For mediums with a different density, this switching point shifts, depending on the density and the installation, in the direction of the housing or tuning fork tip.

A density change of 0.1 g/cm^3 results in a shifting of the switching point by approx. 2.5 mm.

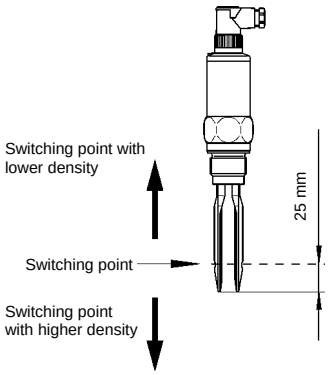
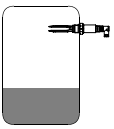
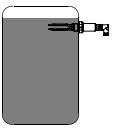
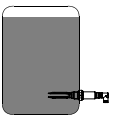
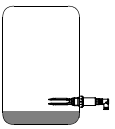


Fig. 4.1

4.3 Functions chart

The following chart provides an overview of the switching conditions dependent on the ad-justed mode and level. To set the mode, please read the information in "3.2 Wiring plan".

	Mode A		Mode B		Response of the fault monitoring	Failure of the supply voltage
Level					individual	individual
Transistor (T)	conducts	blocks	conducts	blocks	blocks	blocks
Contactless electrical switch (C)	 1 2 Switch closed	 1 2 Switch open	 1 2 Switch closed	 1 2 Switch open	 1 2 Switch open	 1 2 Switch open
Signal lamp	green 	red 	green 	red 	red 	○

5 Diagnostics

5.1 Function test

LS 4100/LS 4150 are equipped with an integrated test switch which can be activated magnetically. Proceed as follows to test the instrument:

- Make sure that the tuning fork is uncovered.
- Hold the test magnet (accessory) to the magnet symbol on the instrument housing (see fig. 5.1). The test magnet simulates a covering of the tuning fork. If the tuning fork is uncovered, the signal lamp of the level switch changes status. The electronics and the switching output of the level switch are checked now. Note that the connected instruments will be activated during the test.

If, despite several tests with the test magnet, LS 4100/LS 4150 does not switch over, check the plug connection and the connection cable and test the instrument again. If there is no switching function, the electronics is defective. In this case you have to replace the electronics (see "5.2 Replacement of the electronics") or send the instrument to our repair department.

Note:

It is absolutely necessary that you remove the test magnet after the test from the instrument housing.

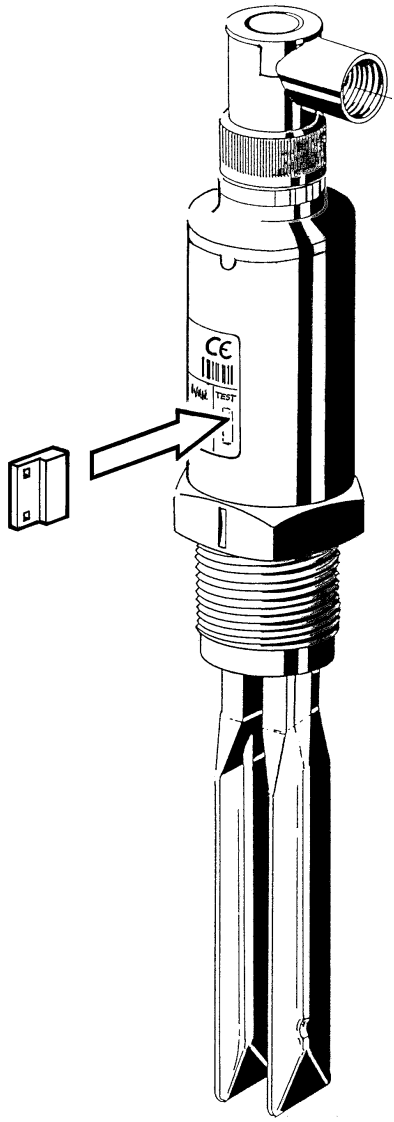


Fig. 5.1

5.2 Replacement of the electronics

The removal of the electronics unit will damage the housing seal. Therefore only open the instrument if you want to insert a new electronics unit.
To replace the electronics in case of failure, the instrument must not be removed. Proceed as follows to replace the electronics unit:

- Separate level switch from operating voltage.
- Loosen the plug (1), by screwing on the knurled ring.
- Loosen the plug insert (2) with a screwdriver on the four slots (10) and pull it carefully out of the housing (6).
- Remove the plug of the two connection cables (7) from the socket on the board (8).
- Grease (thin layer) the seal ring (4) of the new plug insert with an acid-free grease.
- Insert the connection cables (7) into socket (8) on the board of the new oscillator.
- Lower the plug insert (2) into the housing. Make sure that the locking tab (3) is approximately above the notch on the housing edge (5).
- Carefully push the plug insert (2) from above into the housing (6). Push the four snap-on hooks (9) with a screwdriver inwards so that the plug insert can be more easily inserted into the housing. Make sure that the board does not get damaged.
- Push the plug insert (2) flush to the housing (6). Make sure that the locking tab (3) snaps into the notch on the housing (5). You can hear it when the snap-on hooks (9) snap in the groove inside the housing. It is not possible to loosen the parts without damage.
- Now screw the plug (1) back onto the housing.

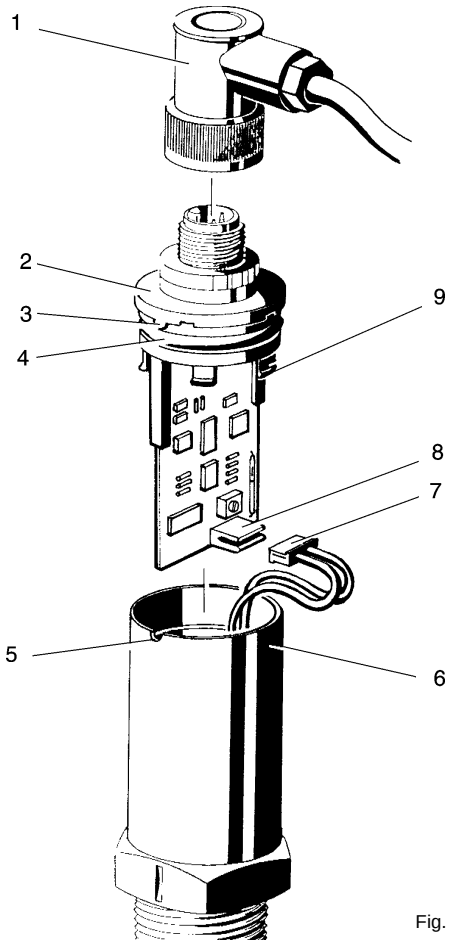


Fig. 5.2

1 Plug
2 Plug insert
3 Locking tab
4 Seal ring
5 Notch
6 Housing
7 Connection plug
8 Socket
9 Snap-on hooks (4 pcs.)
10 Slots (4 pcs.)

The level switch is again ready for use.

Note that the switching point may change slightly because of the electronics replacement.

5.3 Maintenance

LS 4100/LS 4150 are maintenance-free.

If you need to return a device for testing or repair to KROHNE

Your instrument has been carefully manufactured and tested. If installed and operated in accordance with these operating instructions, your instrument will rarely present any problems. Should you nevertheless need to return an instrument for checkout or repair, please pay strict attention to the following points:

Due to statutory regulations concerning protection of the environment and safeguarding the health and safety of our personnel, KROHNE may only handle, test and repair returned instruments that have been in contact with liquids if it is possible to do so without risk to personnel and environment.

This means that KROHNE can only service your instrument if it is accompanied by a certificate in line with the following model confirming that the instrument is safe to handle.

If the instrument has been operated with toxic, caustic, flammable or water-endangering liquids, you are kindly requested

- to check and ensure, if necessary by rinsing or neutralising, that all cavities in the instrument are free from such dangerous substances.
  (Directions on how you can find out whether the primary head has to be opened and flushed out or neutralised are obtainable from KROHNE on request.)
- to enclose a certificate with the instrument confirming that the instrument is safe to handle and stating the liquid used.

KROHNE regret that they cannot service your instrument unless it is accompanied by such a certificate.

Specimen certificate

Company: ..... Address: .....

Department: ..... Name: .....

Tel. No.: ..... Fax No.: .....

The enclosed instrument

Type: ..... .:.....

KROHNE Order No. or Series No ....

has been operated with the following process liquid .....

Because this process liquid is
water-endangering * / toxic * / caustic * / flammable*
we have
- checked that all cavities in the instrument are free from such substances *
- flushed out and neutralised all cavities in the instrument *

(* delete where not applicable)

We confirm that there is **no** risk to man or environment through any residual liquid contained in the instrument.

Date: ..... Signature .....

.....
Company stamp:

Notes

Notes