Technical
Information
TI 135F/00/en

Limit Detection in Liquids
nivocompact FTW 131

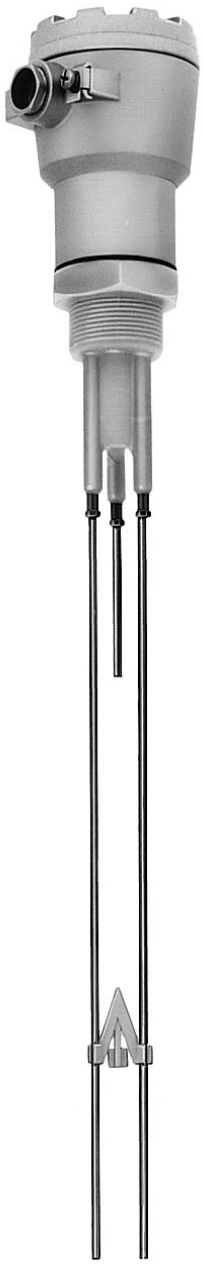
Compact conductivity level limit switch











Applications
The Nivocompact FTW 131 is used for limit detection in tanks containing electrically conductive liquids.

Limit levels (minimum or maximum) can be determined by using one instrument with two probe rods.

Two point detection (minimum and maximum) can be determined by using one instrument with 3 probe rods.

Pumps can be protected against dry running by installing a Nivocompact FTW 131 in the piping.

Also for use in the food processing industry.

It is not recommended for applications with liquids containing oil or fat which can form an insulating film on the probe rods.

Advantages:
- No calibration required;
  when normally calibrated, the Nivocompact operates in almost all electrically conductive liquids.
  – Cost-effective start-up
- No moving parts in tank
  – long operating life
  – reliable operation with no wear or blockages
- Two limit levels detected with only one instrument
  – direct two-point control with no complex circuits
- Complete unit consisting of probe with plug-in electronic probe:
  – simple mounting
  – low installation costs
  – for automation and control systems (PLC, PCS, PC, relays, contactors etc.)

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Application Examples

Water
Syrups
Sugar solutions
Vinegar
Fruit juices
and similar liquids.

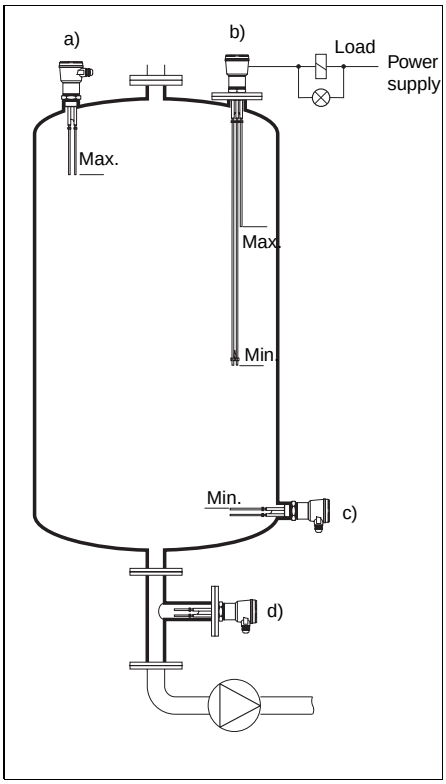
Beer
Wine
Liquors
Milk
Detergents

Acids and lyes must be compatible with propylene or steel 1.4301, 1.4401 and 1.4571 (SS 304, SS 316, SS 316 Ti)

The Complete Measuring System

The Nivocompact is an electronic switch. The entire measuring system consists of:

- Nivocompact FTW 131,
- power supply and
- connected control systems, switches, signal transmitters
  (e.g. process control systems, PLC, relays, microcontactors, lamps, sirens etc.).



The measuring system and its applications

a) Maximum limit detection

b) Two-point detection (maximum *and* minimum) with *one* Nivocompact

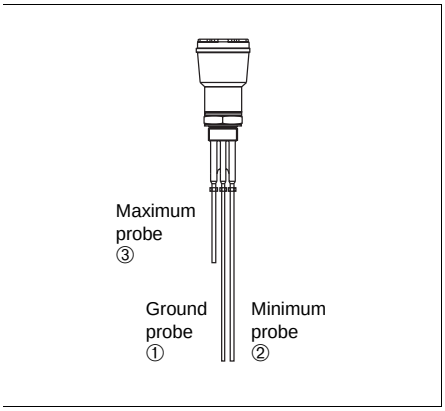
c) Minimum limit detection

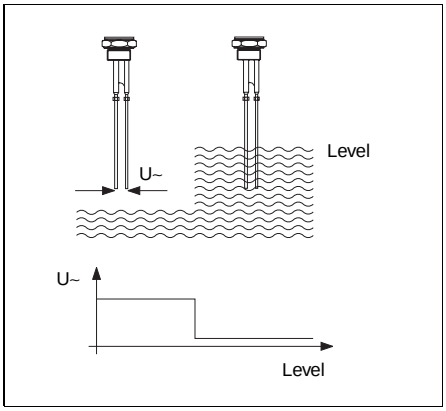
d) Pump protection

Operation

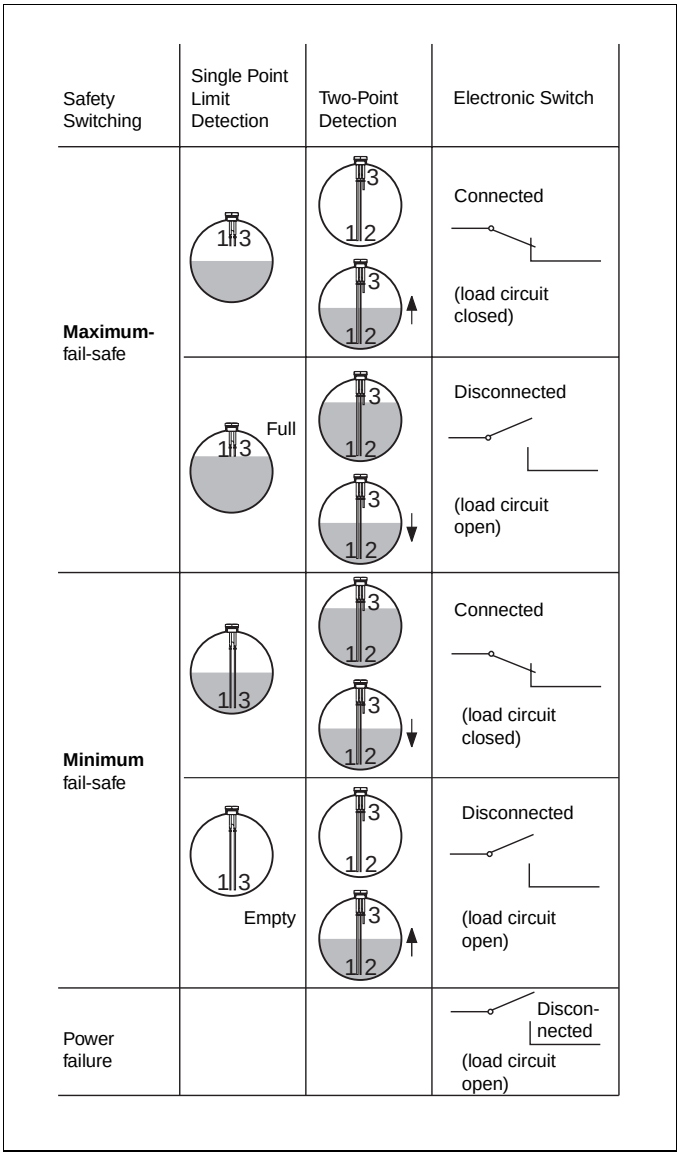
A defined AC voltage exists between the probe rods in an empty tank.
As soon as the electrically conducting liquid creates a connection between the ground and maximum probe rods, then the voltage is reduced and the Nivocompact switches.
With limit level detection, the Nivocompact switches back as soon as the liquid clears the maximum probe.
With two-point detection, the Nivocompact switches back only when the liquid clears the minimum probe.

Corrosion of the probe rods and the electrolytic destruction of the material is avoided in almost all applications by using an AC voltage.
The material used for the tank walls is not important as the system is designed as a closed potential-free circuit between the probe rods and the electronics.
There is absolutely no danger if the probes are touched while in operation.





Fail-Safe Mode



The electronic switch operates according to the fail-safe switching and the level.

Due to the built-in feature for minimum/maximum fail-safe switching, the Nivocompact can be used in all applications requiring high operational safety:

- Maximum fail-safe mode:
  The current circuit is blocked if the probe is covered or the power supply fails.
- Minimum fail-safe mode:
  The current circuit is blocked if the probe is free or the power supply fails.

A red LED on the electronic insert indicates the switching status.

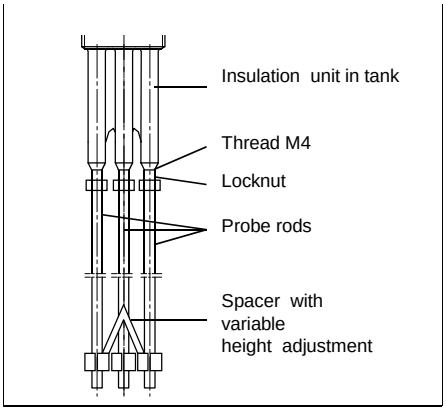
Probes

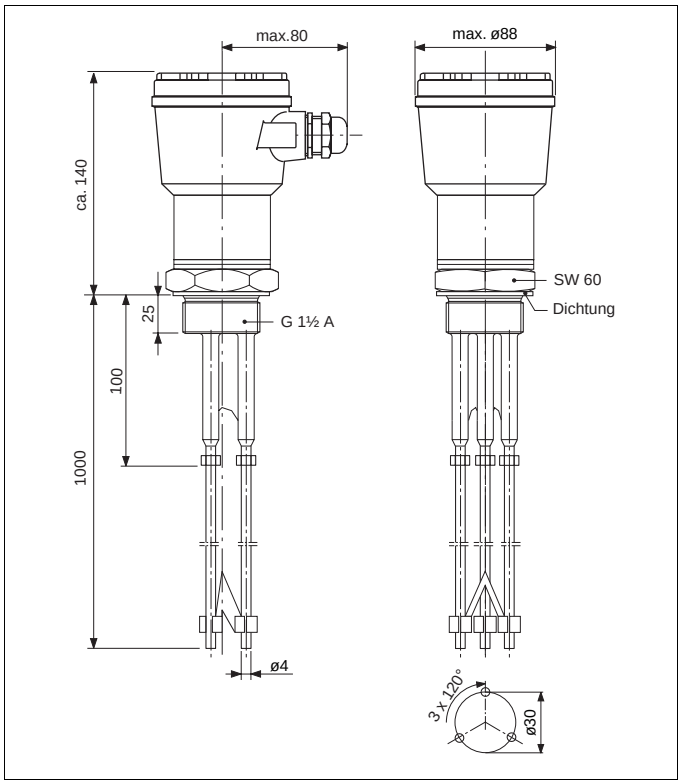
The three 900 mm long probe rods are made of acid resistant stainless steel 1.4571 and are supplied unassembled.

They can be shortened to any length and then screwed into the insulating unit.

The spacer prevents long probes from touching each other if the material is in motion.

The insulation is resistant to an operating pressure of 6 bar and an operating temperature up to +100 °C.





Dimensions of the
Nivocompact FTW 131

Installation
General Information

Material of the Tank
The Nivocompact FTW 131 can be installed in tanks (or pipes) made of electrically conductive or non-conductive materials.

Mounting in Tanks:
Liquids causing build-up
Vertical mounting in the tank from above is recommended when used with liquids which tend to cause a conductive deposit on the insulation.
Lateral mounting in a tank is possible if the liquid after clearing the insulation only leaves a layer which is a poor conductor.

Mounting point
When the tank is filling, the liquid must not touch the probe rods (error switching).
The probe rods should not touch metal walls or other electrically conductive installations (error switching).

Mounting from above
For vertical mounting, the probe lengths should be positioned according to the limit level required.
The Nivocompact switches if the probe rods are submerged a few millimeters in the liquid.

Mounting from the side
Probe rods of 20…30 mm (probe lengths 120…130 mm) are generally adequate for mounting from the side.
If the probe has to be mounted in a tank with liquid tending to cause build-up, then longer probe rods (100…200 mm) may be required for a higher contact resistance ratio between covered and free probes which have insulation with some conductivity.
If the probe is to be mounted from the side, then it should be pointed slightly downwards to enable the liquid to drip off more easily and reduce any conductive build-up on the insulation occurring.

Mounting in Pipes:
Probe lengths
The shortest possible probe length should be used (probe rods of 20…30 mm are adequate), in order not to hinder the flow and to simplify mounting.

Installation point
Take into account the maximum lateral load of the probe when determining the measuring point.
Note the flow velocity, viscosity and pipe diameter, and mount the probe when possible away from the flow.

Liquids containing solid particles
Hard solid particles in the liquid can lead to wearing away of the insulation.
Long and fibrous components can settle on the rod probes and so produce error switching in an empty pipe.

Mounting in the Open
A protective sun cover as an accessory protects the Nivocompact from excessive temperatures and from condensation which may form in the housing due to large temperature variations.

Installation Examples

Limit detection
Standard applications

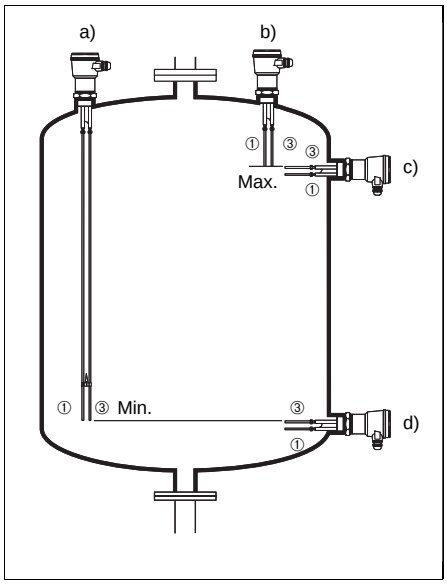
Mounting in a tank
made of plastic or metal.

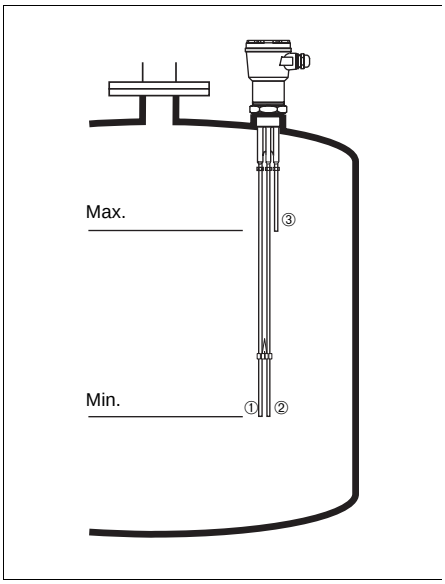
a) Vertical mounting, minimum detection; probe lengths set to the limit value required.

b) Vertical mounting, maximum detection; probe lengths set to the limit value required.

c) Lateral mounting, maximum detection; short probe rods.

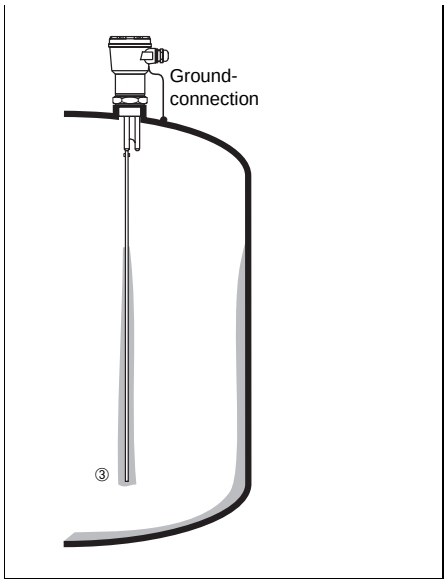
d) Lateral mounting, minimum detection; short probe rods.

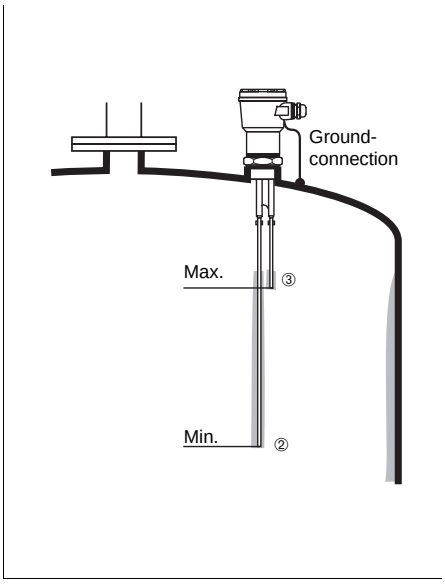




Two-point detection, standard applications. Mounting in a tank made of plastic or metal.

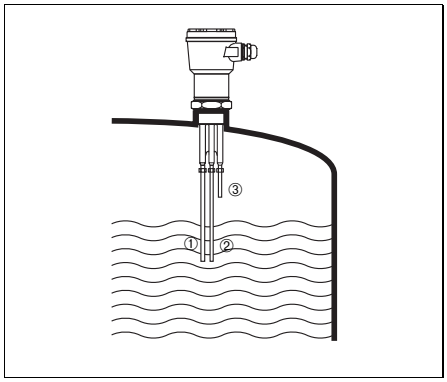
Limit detection in tanks made of metal with liquids which tend to cause conductive build-up or contain fibrous material.

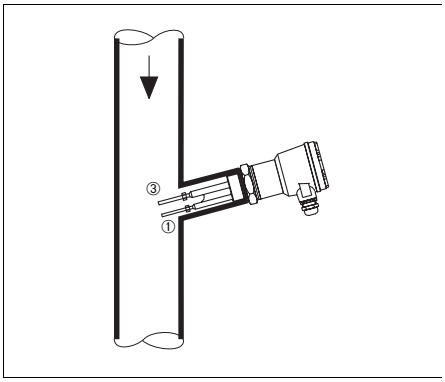




Two-point detection in tanks made of metal with liquids which tend to cause conductive build-up or contain fibrous material.

Limit detection in tanks with liquids which have pronounced rippling or splashing, mounting from above.
The difference in height between
the minimum probe ②
and
the maximum probe ③
must be greater than the maximum ripple height.





Pump protection
Ideal mounting in a vertical pipe: the threaded socket is welded pointing downwards so that liquid can run off easily. The insulating unit is kept some distance from the liquid flow by the threaded socket so that there is no pressure loss, no wear and no lateral forces acting on the probe.

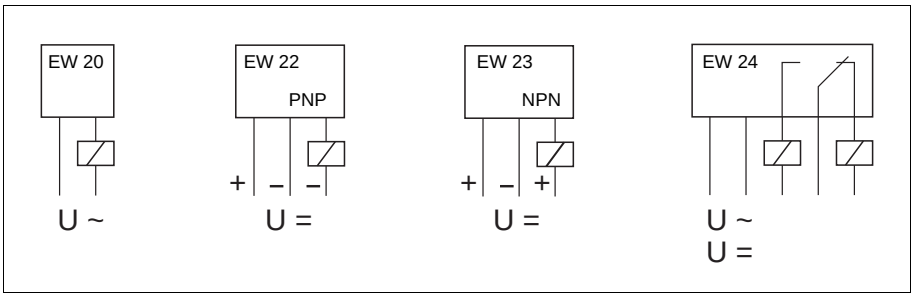
Basic Differences Between Electronic Inserts

Electronic Insert EW 20
Two-wire AC connection 19 V… 253 V,
Electronic switch, max. 350 mA

Electronic Insert EW 22
Three-wire DC connection 10 V… 55 V,
Transistor circuit,
Load connection PNP, max. 350 mA

Electronic Insert EW 23
Three-wire DC connection 10 V… 55 V,
Transistor connection,
Load connection NPN, max. 350 mA

Electronic Insert EW 24
With potential-free relay output
AC voltage operation 19 V… 253 V or
DC voltage operation 19 V… 200 V



Electrical connections available with the different electronic inserts

Wiring Connections General Information

Load Limit Values
Note the limit values of the loads to which you want to connect the Nivocompact.
Exceeding the load can destroy the electronic insert (or the relay contact in the EW 24).

Fuses
Ensure that the rating of the fine-wire fuse corresponds to the maximum load to be connected;
the fine-wire fuse does not protect the electronic insert of the Nivocompact FTW.

Diameter of Wiring
Because of the small current used, only small diameter cabling is required.
Low-cost cabling with diameters of 0.5 mm^2 to max. 1.5 mm^2 is recommended.

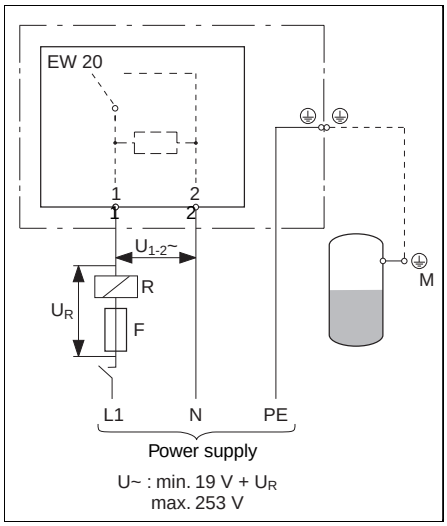
Protective Grounding
Every Nivocompact with a metal housing must be connected to the protective ground cable PE except when operating it with limited power supply.

Grounding to the Tank
The power supply and the measuring current circuit are galvanically isolated.
Both the ground cable PE and the ground probe rod (No. 1) are connected together and to the metal housing.
A ground connection to the tank is therefore only required in special circumstances (see Project Planning).

Connecting the EW 20

Connecting the Nivocompact with the electronic insert EW 20 for AC voltage (two-wire connection).

$U_{1\text{-}2}$~: 19 V… 253 V to terminals 1 and 2 of the EW 20
R: Connected (external) load, e.g. relay
F: Fine-wire fuse, load-dependent
M: Ground connection to tank, if required
U_R: Voltage drop between the load R and the fine-wire fuse F



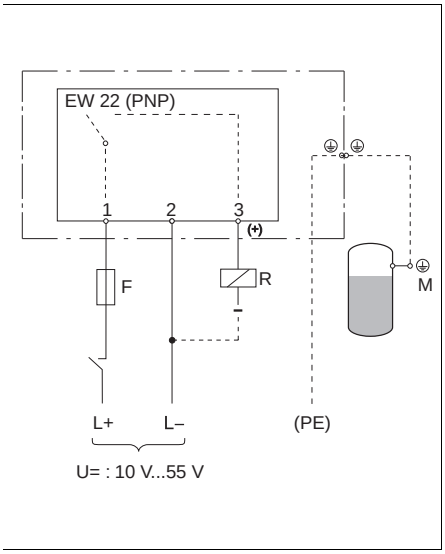
Connecting the Nivocompact with Electronic Insert EW 20 for AC Voltage (Two-Wire Connection)

Connecting in series to a load
The Nivocompact level limit switch with this electronic insert must - like all switches - be connected in series with the load (relays, micro - contactors, lamps) to the power supply.

Connection voltage
The voltage across terminal 1 and 2 of the electronic insert must be at least 19 V.
The power voltage must be correspondingly higher to compensate for the voltage drop across the connected load.

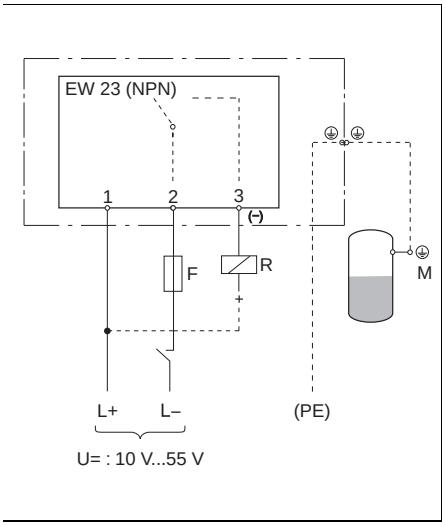
Load cutoff
Note that a load connected in series is not completely disconnected from the power supply if the electronic switch in the electronic insert of the Nivocompact »cuts off« (blocks) with the level alarm. Because of the current requirements of the electronics, a small »residual current« still flows through the external load.
When the load is a relay with a very small retaining current, then the relay may not de-energise. In this case connect an additional load in parallel to the relay e.g. a resistor or signal lamp.

Connecting the EW 22 EW 23



Connecting the Nivocompact with the electronic insert EW 22 for three-wire DC voltage (PNP).

F: Fine-wire fuse, load-dependent
R: Connected load, PLC, PCS, relay
M: Ground connection to the tank, if required



Connecting the Nivocompact with the electronic insert EW 23 for three-wire DC voltage (NPN).

F: Fine-wire fuse, load-dependent
R: Connected load, PLC, PCS, relay
M: Ground connection to the tank, if required

Connecting the Nivocompact with Electronic Insert EW 22 or EW 23 for Three-Wire DC Connection

Transistor circuit for load
The load connected to terminal 3 is switched by a transistor, contactless and therefore without bouncing.

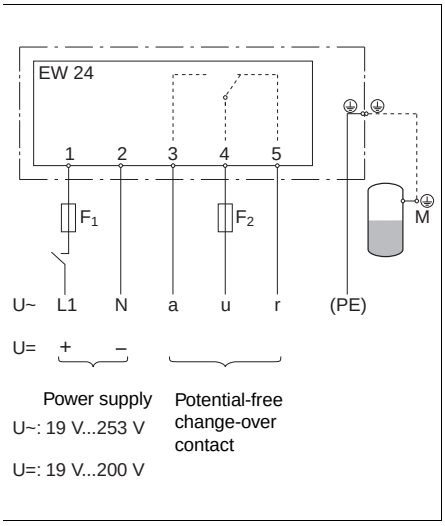
EW 22 (PNP):
Terminal 3 has a positive signal with normal switching.

EW 23 (NPN):
Terminal 3 has a negative signal with normal switching.

The transistor is blocked on level alarm (or with a power failure).

Protection against voltage peaks
Connecting to an instrument with a high inductance:
a voltage limiter should be connected.

Connecting the EW 24



Connecting the Nivocompact with the electronic insert for DC and AC voltages, with relay output.

F_1: Fine-wire fuse 200 mA, semi-time lag, recommended
F_2: Fine-wire fuse to protect the relay contact, load-dependent
M: Ground connection to the tank, if required

Connecting the Nivocompact with Electronic Insert EW 24 for DC and AC Voltages, with Relay Output

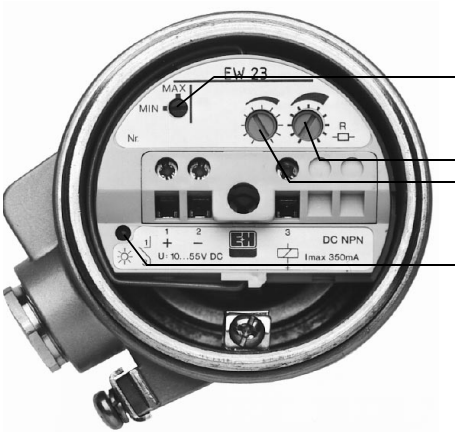
Relay contact for load
The load is connected over a potential-free relay contact (change-over contact).
The relay contact breaks the connection between terminal 3 and terminal 4 on level alarm (or with a power failure).

Protection against voltage peaks and short-circuiting
Protect the relay contact by connecting a spark barrier to instruments with high inductance.
A fine-wire fuse (load-dependent) can protect the relay contact if a short-circuit occurs.

Adjustment

You can select the fail-safe mode required for your particular application on the electronic insert of the Nivocompact FTW 131.

With two adjusters the instrument can be set to the most suitable value if the standard adjustment for the contact resistance is not optimally set for a particular application.



Rotary switch for fail-safe mode

Adjuster for transient resistance

Coarse

Fine

LED to indicate switching status

Operating elements on the electronic insert

Technical Data

Operating Data

Operating temperature in tank:
–20 °C…+100 °C

Operating pressure in tank: up to 6 bar

Resistance to lateral load:
max. 3 Nm per probe rod

Ambient temperature for housing:
–20 °C…+60 °C

Storage temperature: –40 °C…+85 °C

Probe

Process connection, design:
thread G $1^1/_2$ A conf. to DIN ISO 228/I

Process connection, material:
fibreglass-reinforced polypropylene

Insulation in tank:
fibreglass-reinforced polypropylene

Probe connections, material:
stainless steel 1.4301 (SS 304)

Probe rods, material:
stainless steel 1.4571 (SS 316 Ti)

Locking nuts, material:
stainless steel 1.4401 (SS 316)

Housing Versions

A
Aluminium housing with standard cable gland PG 16, Protection IP 55

B
Aluminium housing with »water-tight« cable gland PG 16, Protection IP 66

R
Aluminium housing with synthetic coating, for aggressive atmospheres; with »water-tight« cable gland PG 16, Protection IP 66

K
Synthetic housing in PBTP with »water-tight«-cable gland PG 16, Protection IP 66

Cable Gland

Housing IP 55: standard PG in nickel-plated brass with NBR seal for cable diameter 7…10 mm.

Housing IP 66: water-tight PG in polyamide with Neoprene-CR seal for cable diameter 5…12 mm.

Technical Data Electronics

Electronic Inserts
Connection terminals: for max. 2,5 mm^2

Compensating resistance:
approx. 300 Ω … 50 kΩ, with 2 infinitely adjustable elements

Measuring frequency: approx. 5 kHz

Probe voltage U_{pp}:
max. 7 V (square wave)

Probe circuit: galvanically separated from power supply

Switching delay: approx. 0.5 s

Minimum/maximum fail-safe switching: selectable by rotary switch

Switching indication: red LED

Electronic Insert EW 20 for AC Voltage (Two-Wire Connection)

Power supply U~:
19 V… 253 V, 50/60 Hz

Connected loads, short-term (max. 40 ms):
max. 1.5 A;
max. 375 VA with 253 V;
max. 36 VA with 24 V

Maximum voltage drop: 11 V

Connected loads, continuous:
max. 350 mA,
max. 87 VA with 253 V;
max. 8.4 VA with 24 V

Minimum load current with 253 V:
10 mA (2.5 VA)

Minimum load current with 24 V:
20 mA (0.5 VA)

Residual current (eff.): < 5 mA

Electronic Inserts EW 22 and EW 23 for DC Voltage (Three-Wire Connection)

Power supply U=: 10 V… 55 V

Superimposed AC voltage U_{pp}:
max. 5 V

Current consumption: max. 15 mA

Load connection: Open Collector:
PNP (EW 22) or NPN (EW 23)

Switching voltage: max 55 V

Connected load, short-term:
(max. 1 s): max. 1 A

Connected load, continuous:
max. 350 mA

Protected against reverse polarity

Electronic Insert EW 24 for DC and AC Voltages (Relay Output)

Power supply U=: 19 V… 200 V
or
power supply U~:
19 V… 253 V, 50/60 Hz

Current consumption (eff.): max. 5 mA

Peak inrush current:
max. 200 mA, max. 5 ms

Pulse current: max. 50 mA, max. 5 ms

Pulse frequency: approx. 1.5 s

Output:
potential-free change-over contact

Contact load capacity:
U~ max. 253 V,
I~ max. 6 A,
P~ max.1500 VA (cos φ = 1) or
P~ max. 750 VA, (cos φ ≥ 0.7)
U= max. 253 V,
I= max. 6 A,
P= max. 200 W

Operating life: min. 10^5 switchings at max. contact load

Additional switching delay:
max 1.5 s

Subject to modification

CE Mark

The device fulfils the legal requirements of the following EC Guidelines:
Guideline 89/336/EC (Electromagnetic compatibility), Guidelines 73/23/EC and 93/68/EC (Low Voltage Appliances).

Electromagnetic compatibility (EMC):
Immunity to EN 50082-1.
Emission to EN 50081-1.

For general information on electromagnetic compatibility (test methods, installation hints) see TI 241F/00/en.

Product Structure
Nivocompact FTW 131

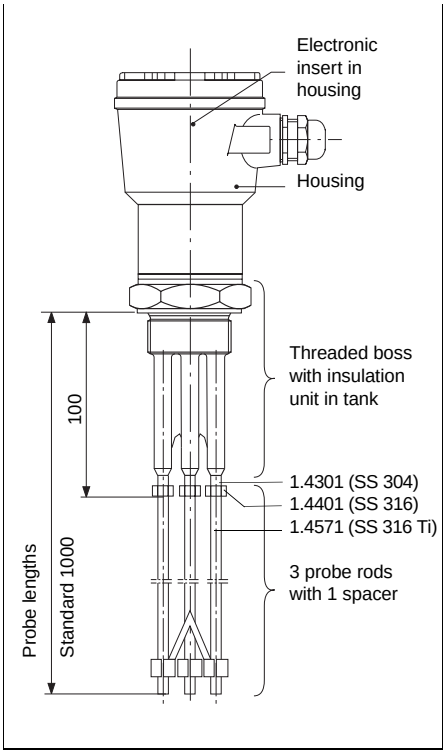
Nivocompact FTW 131, conductivity level limit switch

		Weight
	Threaded socket with insulation unit in tank	0.15 kg
	Probe	
A	1000 mm probe length, rods can be shortened	0.03 kg/dm
Y	Others on request	(for 3 rods)
	Housing	
A	Aluminium housing, IP 55	0.43 kg
B	Aluminium housing, IP 66	0.42 kg
R	Aluminium housing, coated, IP 66	0.42 kg
K	PBTP synthetic housing, IP 66	0.31 kg
Y	Others on request	
	Electronic Insert (mounted in housing)	
1	19 V… 253 V, 50/60 Hz (EW 20) Two-wire AC connection	0.17 kg
2	PNP 10 V… 55 V= (EW 22) Three-wire DC connection	0.17 kg
3	NPN 10 V… 55 V= (EW 23) Three-wire DC connection	0.17 kg
4	Relay, 19 V… 253 V AC/200 V= (EW 24) AC or DC connection with relay output (change-over contact)	0.17 kg
9	Others on request	

FTW 131 [ ][ ][ ] **Order code** **total weight** [ ] **kg**

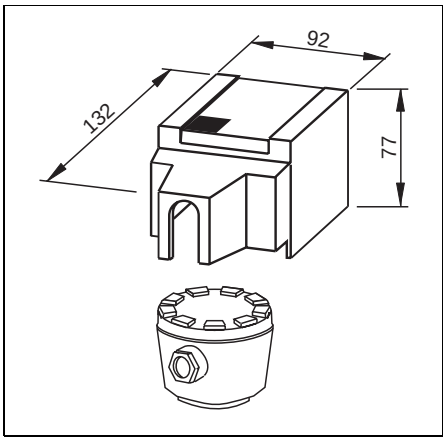
Other versions:
[ ][ ][ ][ ] Please state probe length in mm

The Nivocompact FTW 131 is designed using these basic components.



Accessories

- Seal for thread G $1^1/_2$ A:
  in elastomer/fibre (asbestos-free) supplied
- Protective sun cover
  for aluminium housing
  Material: polyamide



Dimensions of protective sun cover (accessory)
This cover prevents condensation in the housing.

Other Conductivity Level Limit Switches

- ☐ Nivotester FTW 420
  Conductivity level limit switch in row housing; separate probes; for standard applications
  Technical Information TI 176F/00/en
- ☐ Nivotester FTW 520 Z
  Conductivity level limit switch in row housing; separate probes; for explosion hazardous areas, Zone 0, and overspill protection conf. to VbF and WHG (German approvals)
  Technical Information TI 080F/00/en
- ☐ Nivotester FTW 470 Z, FTW 570 Z
  Conductivity level limit switch in Racksyst format; separate probes; for explosion hazardous areas, Zone 0, and overspill protection conf. to VbF and WHG (German approvals)
  Technical Information TI 039F/00/en

Details When Ordering

- ☐ Order code
- ☐ or special version
- ☐ Accessories
  (e.g. protective sun cover)

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08.99/MTM

TI 135F/00/en/05.96
EHF/CV4.2