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Instruction Manual

Compact Capacitance Level Switch CapFox® ENT 7

ENT 7 with rod probe PP	# 52701
ENT 7 with rod probe PTFE	# 52707
ENT 7 with flexible probe	# 52708
ENT 7 HT	# 52709

-  Read manual before use!
-  Observe all safety information!
-  Keep manual for future use!



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1 About this instruction manual

This instruction manual is part of the product.

- ▶ Read this manual before using the product.
- ▶ Keep this manual during the entire service life of the product and always have it readily available for reference.
- ▶ Always hand this manual over to future owners or users of the product.

1.1 Structure of warning

WARNING TERMThe type and source of danger is shown here.



- ▶ Precautions to take in order to avoid the danger are shown here.

There are three different levels of warning:

Warning term	Meaning
DANGER	Imminent danger! Failure to observe the information will result in death or serious injuries.
WARNING	Possible imminent danger! Failure to observe the information may result in death or serious injuries.
CAUTION	Dangerous situation! Failure to observe the information may result in minor or serious injuries as well as damage to property.

1.2 Explanation of symbols and typeface

Symbol	Meaning
<input checked="" type="checkbox"/>	Prerequisite for an activity
▶	Activity consisting of a single step
1.	Activity consisting of several steps
↪	Result of an activity
•	Bulleted list
Text	Indication on a display
Highlighting	Highlighting



2 Safety

2.1 Intended use

The level switch CapFox® ENT 7 may only be used for continuous level monitoring in metal containers, silos and tanks for the storage of the following media, provided such media can be detected with a capacitance probe (see chapter 3.2, page 7).

- Liquids
- Granulated materials
- Powdered materials

Any use other than the application explicitly permitted in this instruction manual is not permitted.

2.2 Predictable incorrect application

The CapFox® ENT 7 level switch The 7 must never be used in the following cases:

- Hazardous area (Ex)
If the device is operated in hazardous areas, sparks may cause deflagrations, fires or explosions.

2.3 Safe handling

This product represents state-of-the-art technology and is made according to the pertinent safety regulations. Each device is subjected to a function and safety test prior to shipping.

- ▶ Operate the product only when it is in perfect condition. Always observe the operating instructions, all pertinent local and national directives and guidelines as well as the applicable safety regulations and directives concerning the prevention of accidents.

WARNING

Severe burns or death caused by mains voltage (AC 230 V, 50 Hz) in the control unit.

- ▶ Do not expose the control unit to water.
 - ▶ Interrupt the mains voltage supply before opening the control unit or before performing maintenance and cleaning work and make sure it cannot be switched on by accident.
 - ▶ Do not tamper with the control unit in any way whatsoever.
-



2.4 Staff qualification

The product may only be mounted, commissioned, operated, maintained, shut down and disposed of by qualified, specially trained staff.

Electrical work may only be performed by trained electricians and in compliance with all applicable local and national directives.

2.5 Modifications to the product

Changes or modifications made to the product by unauthorised persons may lead to malfunctions and are prohibited for safety reasons.

2.6 Usage of spare parts and accessories

Usage of unsuitable spare parts and accessories may cause damage to the product.

- ▶ Use only genuine spare parts and accessories of the manufacturer (refer to chapter 11, page 20).

2.7 Liability information

The manufacturer shall not be liable in any form whatsoever for direct or consequential damage resulting from failure to observe the technical instructions, guidelines and recommendations.

The manufacturer or the sales company shall not be liable for costs or damages incurred by the user or by third parties in the usage or application of this device, in particular in case of improper use of the device, misuse or malfunction of the connection, malfunction of the device or of connected devices. The manufacturer or the sales company shall not be liable for damage whatsoever resulting from any use other than the use explicitly permitted in this instruction manual.

The manufacturer shall not be liable for misprints.

3 Product description



*Fig. 1: ENT 7
with rod probe*



*Fig. 2: ENT 7
with flexible probe*



*Fig. 3: ENT 7 HT,
high temperature version*

Table 1: Type description

Part no.	Probe type	Active probe length [mm]	
		Standard	Min./max.
52701	Rod probe, PP partly insulated	300	300-1000
52707	Rod probe, PTFE fully insulated	300	300-1000
52708	Flexible probe	3000	1000-6000
52709	High-temperature version (HT) up to max. 220 °C	300	---

3.1 Design

The CapFox® ENT 7 limit switch consists of a capacitance probe, a screw-in thread and a control unit. The components form a permanently connected unit. The probe extends into the tank whose level is to be monitored.

Capacitance probe

The probe consists of a rigid electrode embedded in insulation material. Different probes are available for a wide range of applications in terms of geometry and materials.

- ▶ Please contact the manufacturer if you have questions.

Screw-in thread

The screw-in thread is used to mount the level switch to the tank. Depending on the probe used, ENT 7 features a G1 or a G1½ screw-in thread.

Control unit

The control unit contains the following elements in an impact-resistant plastic housing: calibration and adjustment elements as well as all electronic components for signal processing and conversion of the probe signal.

3.2 Application area

Stored medium

The stored medium must be suitable for the application of the limit switch in terms of its electrical, chemical and mechanical properties.

► Please contact the manufacturer if you have questions.

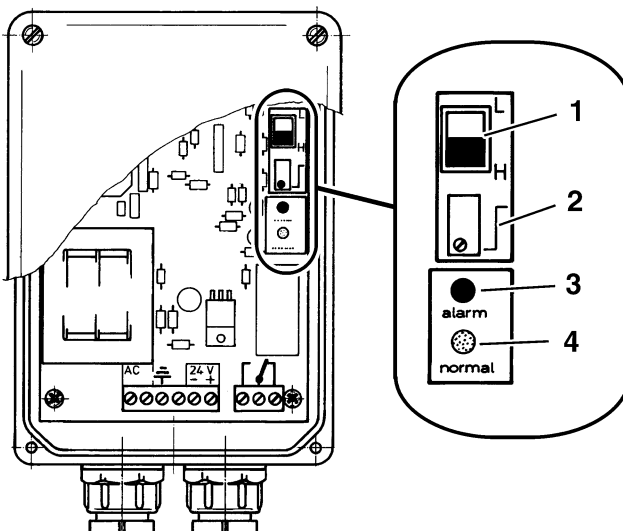
Tank

ENT 7 is suitable for use with metal containers. It is mounted by means of a metal screw-in thread.

Different probe designs are available for a wide range of applications in terms of chemical, thermal and mechanical resistance.

► Please contact the manufacturer if you have questions.

3.3 System components, controls and display elements



- 1 "Operating Mode" switch
- 2 "Sensitivity" potentiometer
- 3 Red indicator "Alarm"
- 4 Green indicator "Normal"

Fig. 4: ENT 7 PCB



3.4 Function

ENT 7 is used for continuous capacitance level monitoring in containers.

Probe

The capacitance measuring principle uses the probe electrode and the metal container wall to form an electrical capacitor whose capacitance depends on the medium that surrounds the capacitor. In air, the capacitance is low; it increases when the probe electrode is submerged in the storage medium.

The deeper the probe is submerged in the stored medium and the higher the material-dependent dielectric constant ϵ_r of the stored medium, the greater the capacitance change.

Control unit

The control unit contains the power supply unit and the components for signal evaluation and conversion as well as device calibration.

3.5 Operating modes

ENT 7 features an output relay that switches when the probe comes into contact or loses contact with the stored medium. The relay is used to control additional equipment such as pumps, valves, visual and audible alarm units, telecommunication devices, building control systems, etc.

Two operating modes can be selected for the switching function (fail-safe principle). The settings are made via a switch on the PCB of the control unit. The relay state is indicated by means of two indicators in the control unit:

- Green indicator "Normal" is on: Relay is energised.
- Red indicator "Alarm" is on: Relay is de-energised.

Maximum fail-safe mode (switch setting "H")

The relay is de-energised (alarm) when the probe comes into contact with the stored medium. The relay is energised again (normal operation) once the probe is no longer in contact with the stored medium.

Minimum fail-safe mode (switch setting "L")

The relay is energised (normal operation) when the probe is in contact with the stored medium. The relay is de-energised (alarm) when the probe is no longer in contact with the stored medium.



3.6 Application examples

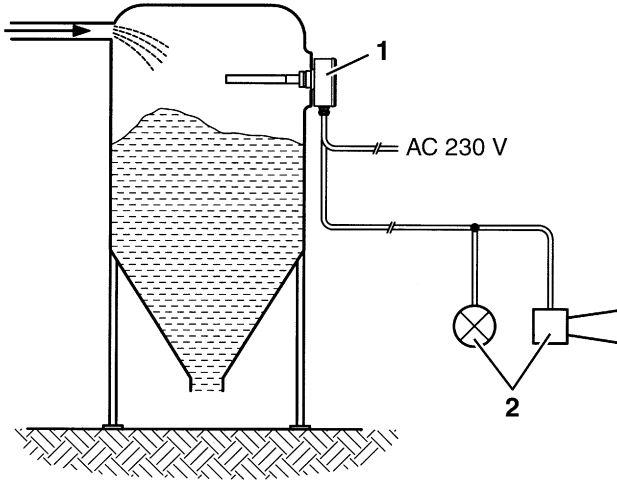


Fig. 5: ENT 7 in maximum fail-safe mode with rod probe

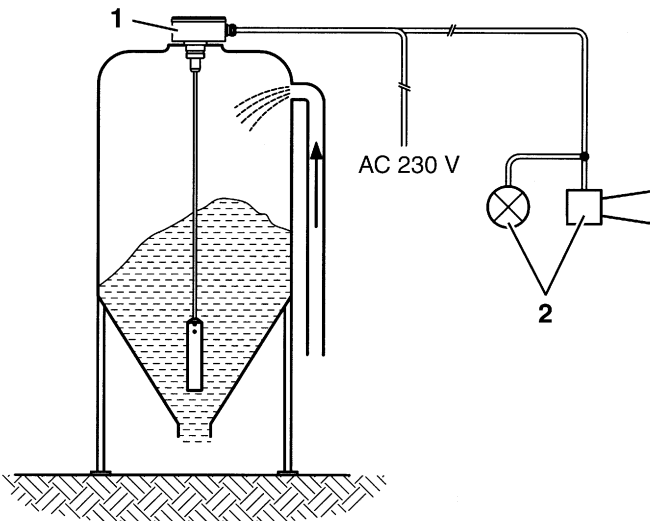


Fig. 6: ENT 7 in minimum fail-safe mode with flexible probe

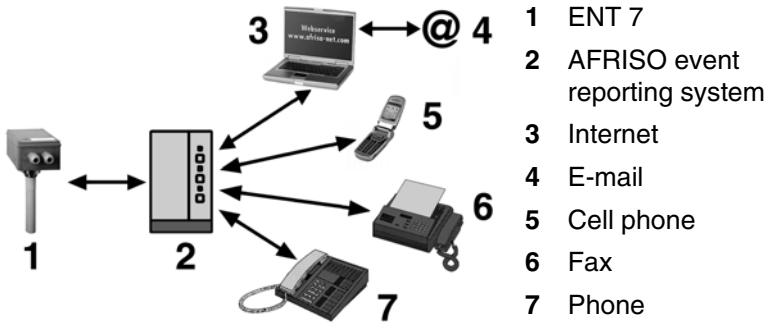


Fig. 7: AFRISO event reporting system for remote reporting of leaks



4 Technical specifications

Dimensions in mm

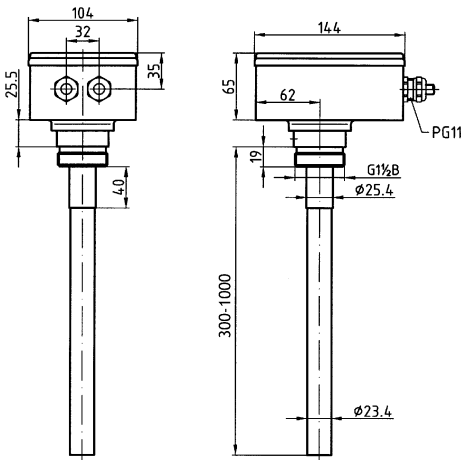


Fig. 8: ENT 7 with rod probe
PP partially insulated

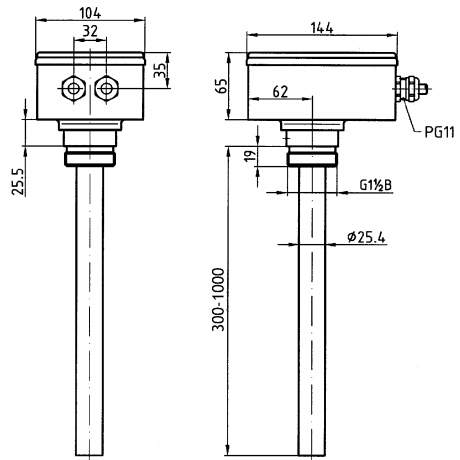


Fig. 9: ENT 7 with rod probe
PTFE fully insulated

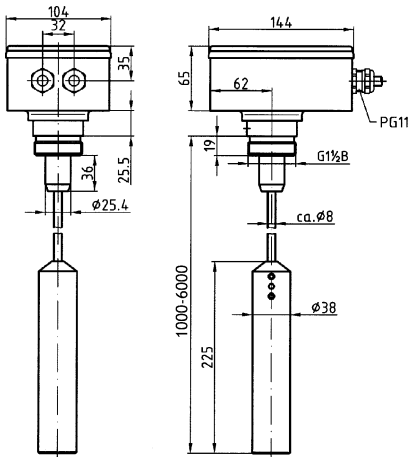


Fig. 10: ENT 7 with flexible probe

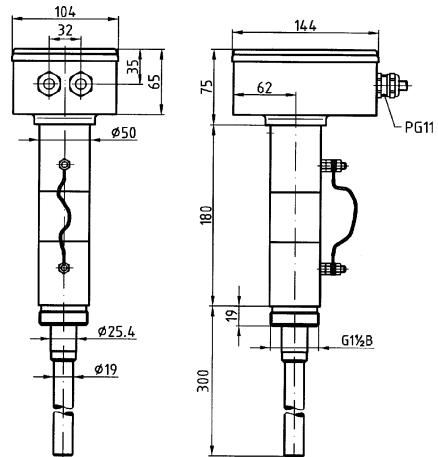


Fig. 11: ENT 7 HT



Table 2: Technical specifications

Parameter	Value
General specifications	
Dimensions control unit (W x H x D)	104 x 144 x 65 mm
Weight	With rod probe approx. 1.5 kg
Material rod/flexible probe	Stainless steel 1.4571, PP partially insulated or PTFE fully insulated
Capacitance range	0-200 pF
Process pressure	0/0.5 bar
Response delay	Approx. 0.5 s
Output relay	1 x changeover contact, voltage-free
Breaking capacity output relay	Max. 250 V/4 A, resistive load
Temperature range	
Ambient	-20 °C to +60 °C
Medium	-20 °C to +80 °C, ENT 7 HT: -20 °C to +120 °C
Storage	-10 °C to +60 °C
Voltage supply	
Nominal voltage	AC 230 V + 10/-15 % or DC 24 V ±15 %
Rated power	AC : 4 VA, DC: 2 W
Electrical safety	
Electrical safety	According to EN 61010
Degree of protection	I EN 60730
Protection	IP 65 EN 60529 (with correctly tightened cables entries)
Electromagnetic compatibility (EMC)	
Interference	EN 61000-6-3
Noise immunity	EN 61000-6-2

4.1 Approvals, tests and conformities

ENT 7 complies with the EMC Directive (2004/108/EU) and the Low Voltage Directive (2006/95/EU).

5 Transport and storage

CAUTION Damage to the device due to improper transport.



- ▶ Do not throw or drop the device.
 - ▶ Protect from wetness, humidity, dirt and dust.
-

CAUTION Damage to the device due to improper storage.



- ▶ Protect from wetness, humidity, dirt and dust.
 - ▶ Store the device in a clean and dry environment.
 - ▶ Only store the device within the permissible temperature range.
-

6 Mounting and commissioning

6.1 Safety precautions at the installation site

The level switch may only be installed and commissioned by trained personnel.

ENT 7 must be installed via a suitable mounting flange at the container.

- ▶ Verify electrically conductive connection between screw-in thread and container.
- ▶ The connection must be firm and tight.
- ☑ Do not install ENT 7 in hazardous areas (EX areas).
- ☑ The control unit must not be exposed to water or splash water.
- ☑ Protect the control unit from direct sunlight and other heat sources.
- ☑ The maximum ambient temperature at the control unit must not be exceeded, see table 2, page 12.
- ☑ Protect the control unit from direct atmospheric influences if it is installed outdoors.
- ☑ The cable entries of the control unit must be properly tightened.
- ☑ The control unit must be accessible and visible at all times.



6.2 Mounting the device

- ▶ Screw the screw-in thread into a corresponding flange of the container. Do not apply forces at the control unit, but only at the screw connection.

Depending on the probe, the thread is a G1 or a G1½ thread.

A protective cover approximately 200 mm above the probe may be required if the device is mounted horizontally or used with bulk materials.

6.3 Electrical connection

- ☑ Mains voltage is interrupted and cannot be switched on by accident.
 1. To open the housing of the control unit, loosen the four cover screws and remove the cover of the housing.
 2. Pull the plug terminals from the connector vertically with reference to the printed circuit board. Note the terminal assignment.
 3. After connection, plug the terminal back tightly onto the PCB.
 4. Tighten the cables entries. Seal unused cable entries or replace them with blind plugs.

Power supply

Connect the level switch to mains by means of a permanently installed cable such as NYM-J 3 x 1.5 mm².

1. Route the power supply cable through the left cable gland into the control unit.

Operation via AC 230 V:

2. Connect the phase L1 and the neutral conductor N to the terminal AC Supply.
3. Plug the two jumpers directly next to them to 230V.
4. Connect the protective conductor PE to the terminal designated with the earth symbol.

Operation via DC 24 V:

2. Connect to the two 24 V terminals. Observe the polarity specified!

The level switch supply cable should be able to be switched off and have a separate fuse (max. 16 A).

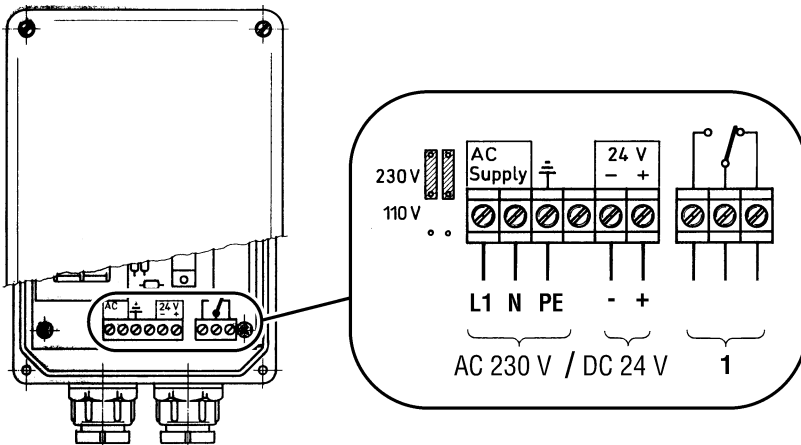
Relay output

1. Route the permanently installed cable into the control unit through the cable gland at the right.



2. Connect the line to the terminals at the right (changeover contact).

During normal operation, the relay is energised; it is de-energised when the adjusted limit value is reached or in the case of a power failure.



- 1 Voltage-free change-over contact

Fig. 12: Electrical connection

CAUTION



Electrical systems may be impacted and the switching contact may be destroyed by voltage peaks when inductive consumers are switched off.

- ▶ Use commercially available standard RC combinations such as 0.1 μ F/100 Ohm for inductive consumers.



6.4 Commissioning the device

- The level switch has been installed as per chapter 6.2, page 14.
- The unit has been connected electrically as described in chapter 6.3, page 14.
- The unit has been connected to mains.
- The output relay has been connected.
- The connection terminals have been plugged onto the PCB.
- The control unit housing has been closed with screws.

If all prerequisites are met, the device is ready for operation.

- ▶ Switch on the power supply.

7 Operation

7.1 Settings

The settings are made via the controls in the control unit when the power supply is on.

WARNING

Severe burns or death caused by mains voltage (AC 230 V, 50 Hz) in the control unit.

- ▶ Adjustments may only be performed by trained electricians.
-

The controls are located at the right side of the PCB.

- ▶ After switching on, allow for a **heat-up phase of at least 5 minutes** before you make settings.

Operating mode

Two operating modes can be selected for the switching function of the output relay (fail-safe principle).

- "H": Maximum fail-safe mode
- "L": Minimum fail-safe mode

The settings are made via a switch on the PCB of the level switch.

Sensitivity

- Container is empty.

The sensitivity of ENT 7 is set via the potentiometer on the PCB. To set the sensitivity, you can use the smaller screwdriver

The two indicators "Alarm" and "Normal" indicate the switching state of the output relay.



Maximum fail-safe mode:

- The green indicator "Normal" is on.
- 1. Turn the potentiometer to the left until the red indicator "Alarm" lights up.
- 2. Slowly turn the potentiometer to the right until the indicator "Normal" lights up.
- 3. Keep on turning for a full turn (normal sensitivity) or a ½ turn (high sensitivity).

Minimum fail-safe mode:

- Red indicator "Alarm" is on:
- 1. Turn the potentiometer to the left until the green indicator "Normal" lights up.
- 2. Slowly turn the potentiometer to the right until the indicator "Alarm" lights up.
- 3. Keep on turning for a full turn (normal sensitivity) or a ½ turn (high sensitivity).

8 Maintenance

Table 3: Maintenance times

When	Activity
Depending on the operating conditions at least once per year	<ul style="list-style-type: none"> ▶ Perform a function test and balance the system.
At regular intervals	<ul style="list-style-type: none"> ▶ Make sure that the ENT7 and its environment are always clean, accessible and easy to oversee. ▶ Remove encrustation from polluted probe.

9 Troubleshooting

Repairs may only be performed by specially trained, qualified staff.

Table 4: Troubleshooting

Problem	Possible reason	Repair
Switching state does not change when probe is submerged in stored medium.	Sensitivity setting incorrect.	▶ Set the sensitivity, see chapter 7.1, page 17.
	Stored medium not suitable for capacitance measurement,	▶ Check stored medium, see chapter 3.2, page 7.
	Container not made of metal.	▶ Use container made of metal.
	No conductive connection between device and container.	▶ Verify electrically conductive connection between screw-in thread and container.
Device switches at random.	Sensitivity setting incorrect.	▶ Set the sensitivity, see chapter 7.1, page 17..
	Perturbation caused by horizontal installation and use with bulk materials.	▶ Mount a protective cover 200 mm above the probe.
Other malfunctions	–	▶ Send the device to the manufacturer.

10 Shutting down, disposal

1. Switch off the supply voltage.
2. Dismount the device (see chapter 6, page 13, reverse sequence of steps).
3. To protect the environment, this device must **not** be disposed of together with the normal household waste. Dispose of the device according to local directives and guidelines.

This device consists of materials that can be reused by recycling firms. The electronic inserts can be easily separated and the device consists of recyclable materials.

If you do not have the opportunity to dispose of the used device in accordance with environmental regulations, please contact us for possibilities to return it.



11 Spare parts and accessories

Part	Part no.
Event reporting system Phone Alarm SD1	90003
Event reporting system GSM Alarm	90002
EMS 220 event reporting system	90220
EMS 442 event reporting system	90442
RC combination (0.1 μ F/100 Ohm)	618 001 5100

12 Warranty

The manufacturer's warranty for this product is 24 months after the date of purchase. This warranty shall be good in all countries in which this device is sold by the manufacturer or its authorised dealers.

13 Copyright

The manufacturer retains the copyright to this manual. This manual may not be reprinted, translated, copied in part or in whole without prior written consent.

We reserve the right to technical modifications with reference to the specifications and illustrations in this manual.

14 Customer satisfaction

Customer satisfaction is our prime objective. Please get in touch with us if you have any questions, suggestions or problems concerning your product.

15 Addresses

The addresses of our worldwide representations and offices can be found on the Internet at www.afriso.de.