Technical Information
TI 376F/00/en

Capacitive Level Measurement
FEC 14 Electronic Insert

Transmitter for Multicap T and Multicap E/A Probes DC..TE/TA and DC..E/A. Transmitter with PROFIBUS PA Protocol with Optional Local Operation









Application
The FEC 14 electronic insert is a PROFIBUS PA transmitter for capacitive level measurement.
Its compact design allows installation in the housing of the Multicap T or Multicap E/A probes DC..TE/TA and DC..E/A.

Your benefits

- Comfortable and easy operation
- Operation and monitoring via local FHB 20 display
- Communication and commissioning via PROFIBUS PA
- Settings can be locked
- Linearisation can be selected for horizontal, cylindrical containers
- Ex connection data correspond to FISCO model

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Inhaltsverzeichnis

Function and system design

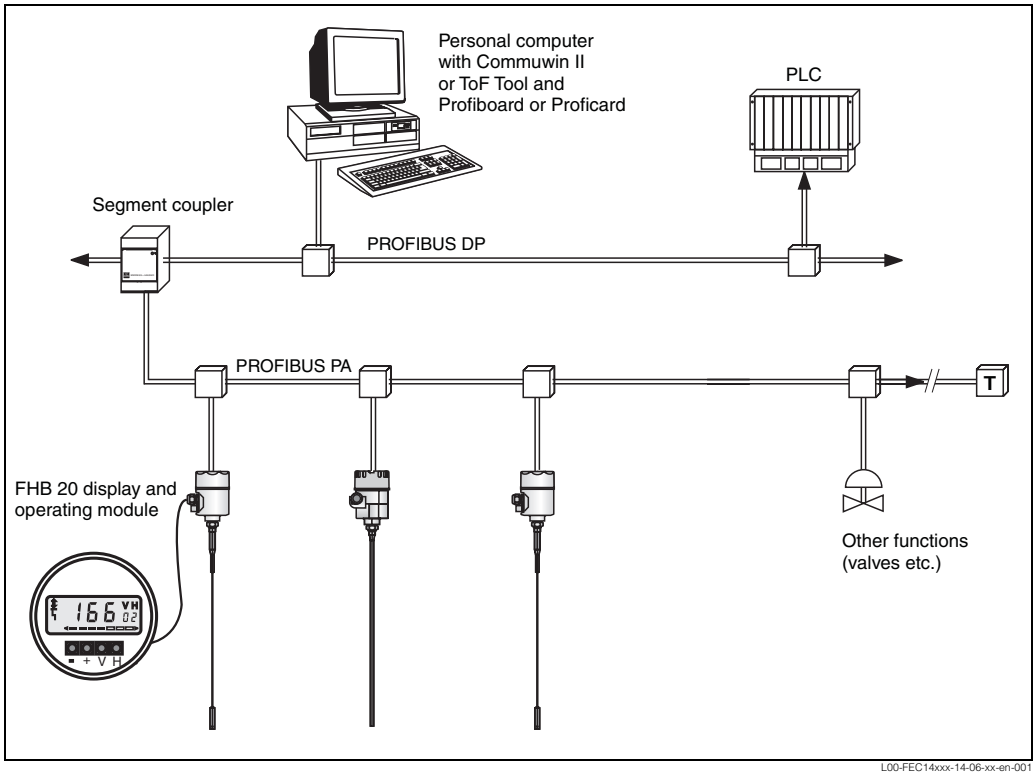
Measuring principle

In the capacitance method of measurement, the probe and the container wall form a capacitor. Depending on the level in the container, there is either air (empty container) or medium (full container) in the space between the probe and container wall. The impedance between the probe and the container wall is measured.

Measuring system

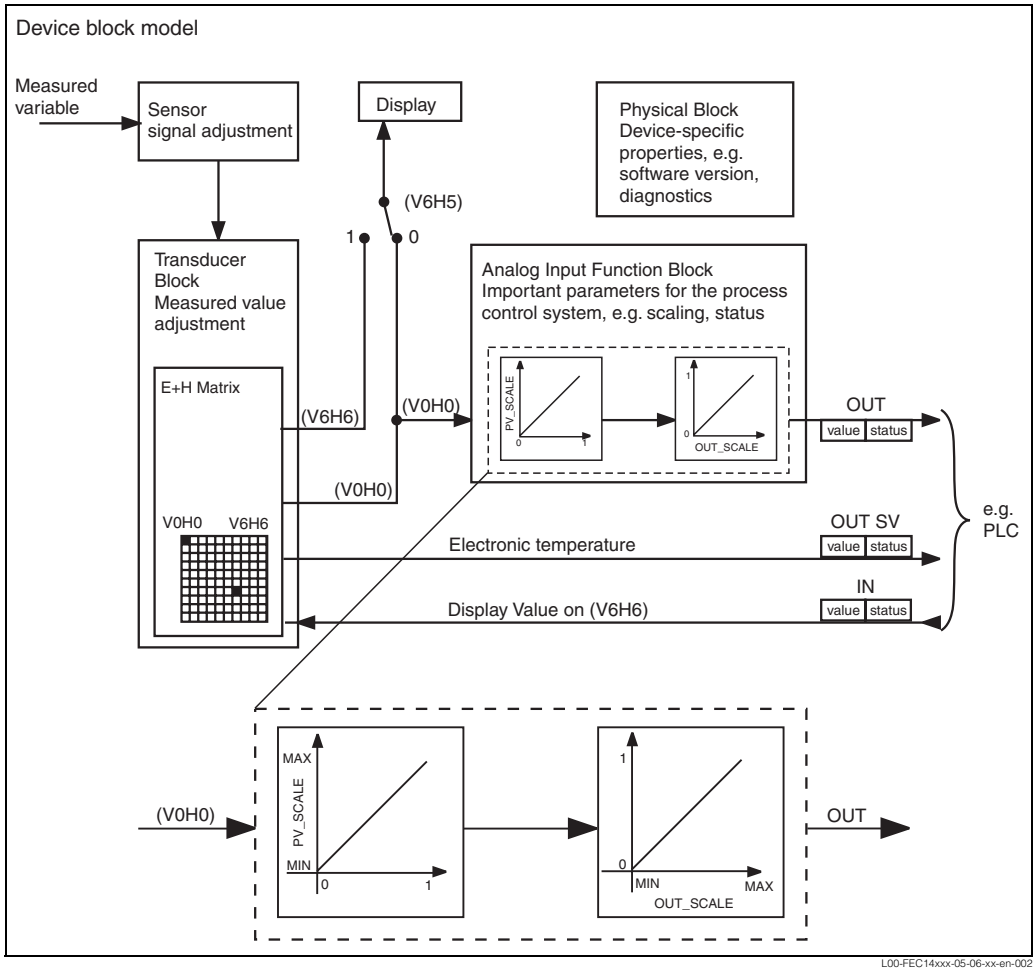
The FEC 14 electronic insert is a compact transmitter. In the basic version, the entire measuring system consists of:

- The FEC 14 electronic insert
- a Multicap T or Multicap E/A probe DC..TE/TA or DC..E/A
- a PROFIBUS PA segment coupler and
- a process control system connected to the segment coupler and/or operating computer with appropriate software



The optional FHB 20 local display allows access to the most important device functions. Basic calibration can be carried out using the FHB 20 or Commuwin II.

Function diagram



Input

Measured variable

Level (continuous level measurement)
The level is calculated from the measured capacitance.

Measuring range

Initial capacitance: C_A = 0 pF…2000 pF
Change in capacitance: ΔC = 5 pF…2000 pF
Final capacitance: C_E = max. 2100 pF
Conductive media limit the measuring length.

Output

Output signal

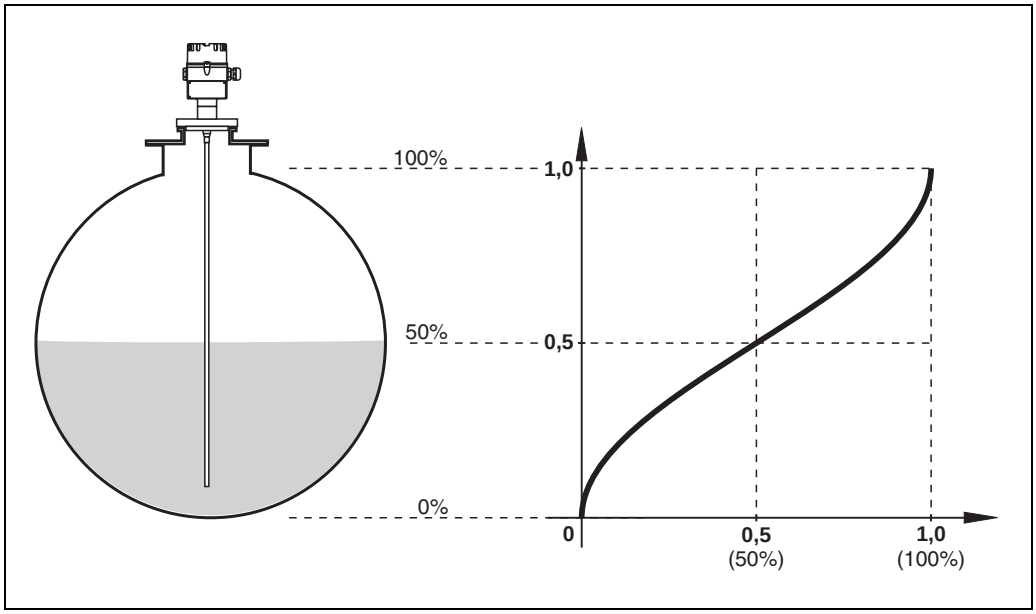
PROFIBUS PA

Signal on alarm

Failure information can be called up via a local display (error symbol, error code) and via a digital interface (PROFIBUS PA).

Linearisation/ transmission behaviour

Linearisation can be selected for horizontal tanks.



The type of linearisation can be adjusted with a parameter.

- If the value is 0, the level is in proportion to the volume, i.e. the container cross-section remains constant over the level.
- If the value is 1, a horizontal, cylindrical container is linearised so that the measured value returned corresponds directly to the volume in %.

Galvanic isolation

Probe and supply lines are galvanically isolated from one another.

PROFIBUS PA

Standard

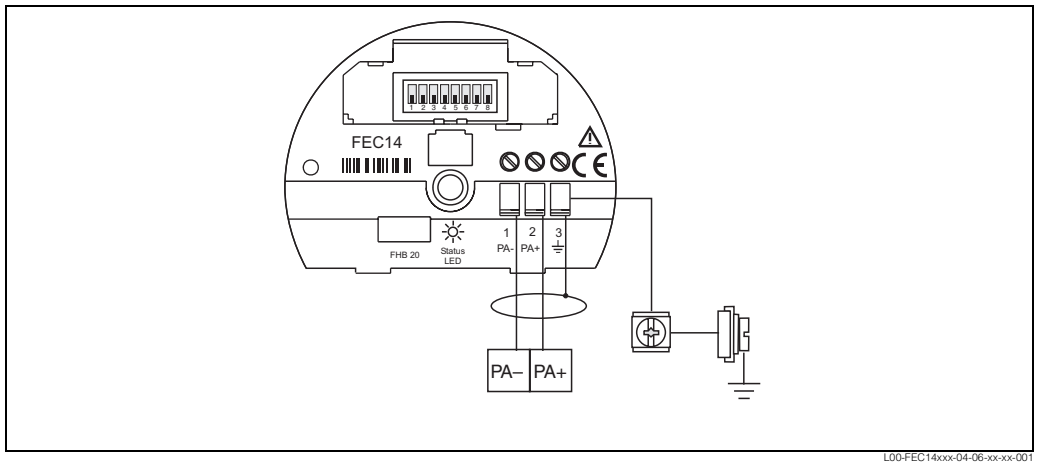
PROFIBUS PA is an open fieldbus standard. It allows several sensors and actuators to be connected to a bus line, even in hazardous areas. Via PROFIBUS PA, energy is supplied to the devices in two-wire technology and the process information from the sensor is transmitted digitally. The following can be operated on one bus segment:

- up to 10 devices for EEx ia applications (with 10 mA current consumption)
- up to 32 devices for non-Ex applications

Please refer also to illustration on Page 3.

Power supply

Electrical connection (wiring diagram)



The FEC 14 electronic insert with PROFIBUS PA is a two-wire transmitter which is connected to a PROFIBUS display unit or a PROFIBUS interface.
It is used for continuous level measurement of liquids with capacitive Multicap probes.

Supply voltage

Non-Ex: U = 9…32 V DC
Ex: U = 9…17,5 V DC (FISCO model)
Reverse polarity proof

Current consumption

Max. current consumption of 13 ±1 mA per electronic insert

Performance characteristics

Response time

- Slave: approx. 20 ms
- PLC: 300 ... 600 ms (with approx. 30 devices and appropriate segment coupler type)

Reference operating conditions

20 °C

Measured value resolution

Measuring capacitance	Resolution
≤ 100 pF	± 0,01 pF
≤ 1000 pF	± 0,2 pF
≤ 2100 pF	± 0,5 pF

Measuring frequency

500 kHz

Maximum measured error

≤ 1 % of full scale value,
range: 0…2000 pF

Repeatability

0,25 % of full scale value,
range: 0… 100 pF

Influence of ambient temperature

T_K 0…70 °C, ≤ 0,02 %/K of full scale value,
range: 0…100 pF

Operating conditions

Installation

Installation instructions	**Orientation** Depends on probe installation location

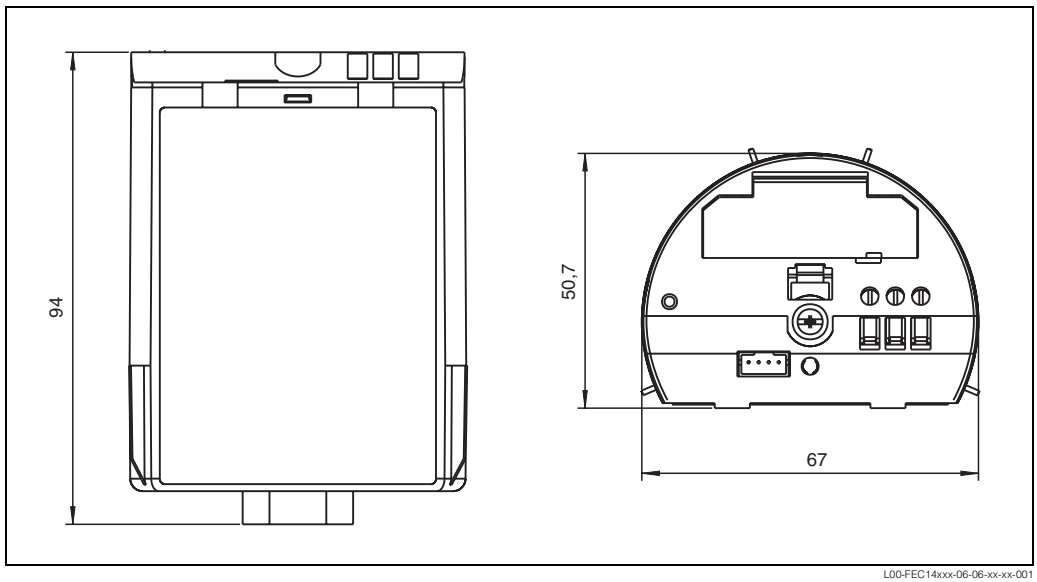
Environment

Ambient temperature range	0 °C…+ 70 °C
Ambient temperature limits	–40 °C…+ 80 °C
Storage temperature	–40 °C…+ 85 °C
Degree of protection	IP20
Vibration test	Test to EN 60068-2-64 • Frequency range: 20 - 2000 Hz • Spectral acceleration density: $0{,}01g^2/Hz = 1.0(m/s^2)^2/Hz$ • Type of acceleration spectrum: straight, horizontal pattern • Load time: 100 min/axis, all three axes
Electromagnetic compatibility	Electromagnetic compatibility • Interference Emission to EN 61326, Electrical Equipment Class B. Interference Immunity to EN 61326, Annex A (Industrial) and NAMUR Recommendation NE 21 (EMC) • Use screened line between probe and switching unit. Please refer also to TI 241F for installation instructions for screened lines and general notes on EMC test requirements for E+H devices.

Mechanical construction

Design, dimensions

Compact transmitter



Weight

0,26 kg

Material

Plastic

Connections

Terminals

3 screw terminals: PA (–); PA (+); functional earth

Connection for local operation

FHB 20

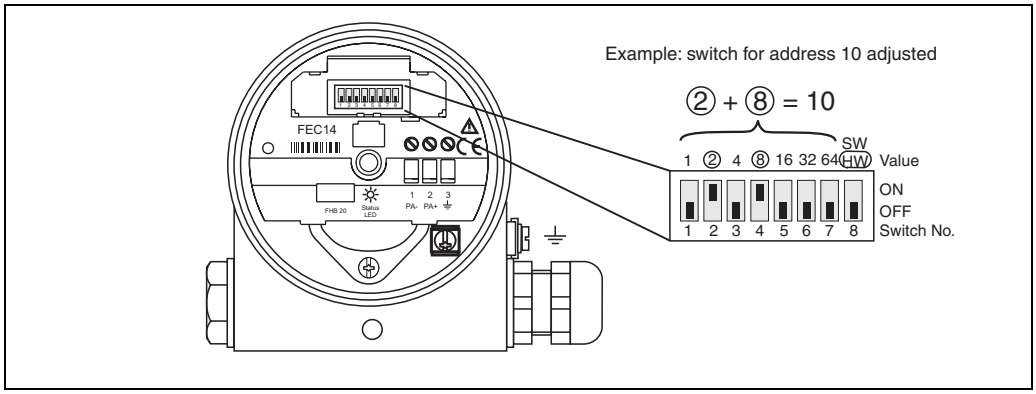
Human interface

Display elements

Status LED, red

Device address

DIP switch for setting device address



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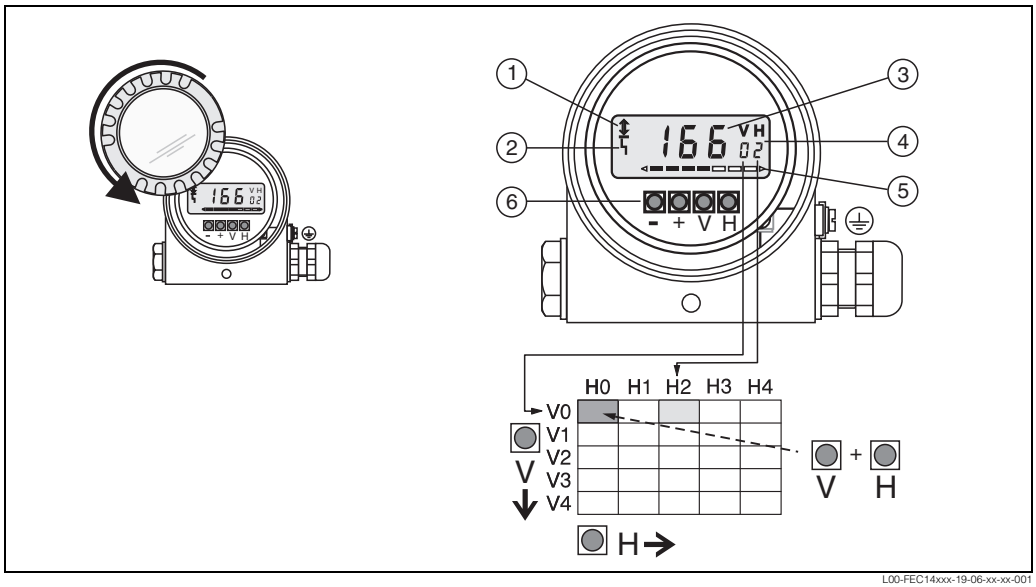
Operating elements

Optional: FHB 20 display



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User interface of electronic insert with FHB 20 display and operating module

1. Communication signal: flashes when operated via PA interface
2. Signal for error message
3. 4 ½-digit display of measured values and input parameters
4. Current matrix position
5. Bar graph of measured value
6. Operating keys

Remote operation

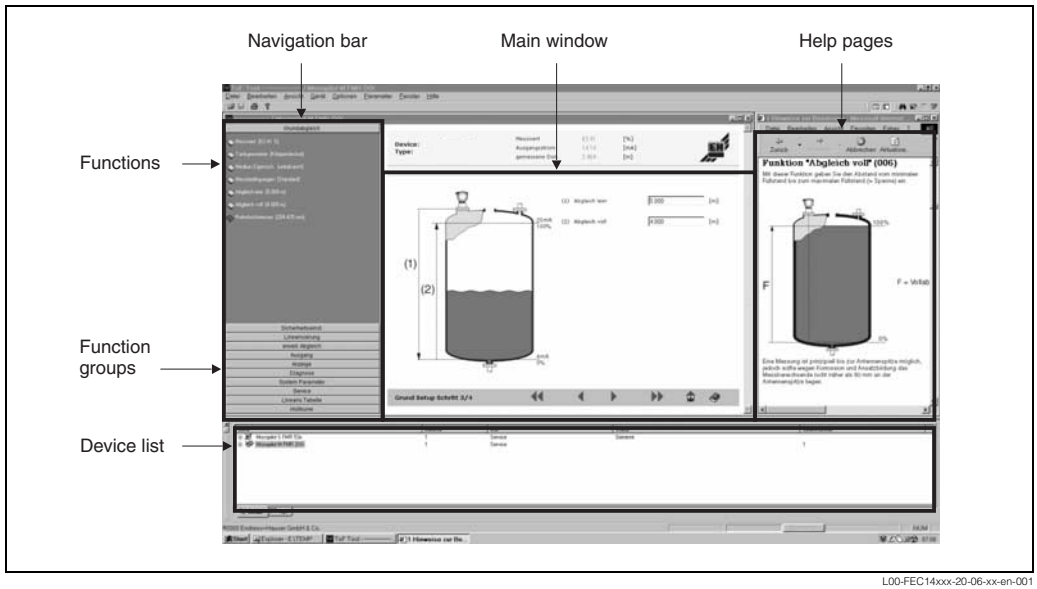
Operation with ToF Tool

The ToF Tool is a graphic operating program for Endress+Hauser measuring devices. It is used to aid commissioning, configuration and documentation of the measuring point. It runs on Win95, Win98, WinNT4.0 and Win2000.

The ToF Tool supports the following functions:

- Transmitter configuration in online mode
- Device calibration via PA interface
- Measuring point documentation

Menu-guided commissioning:



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Connection options
- PROFIBUS PA (see Page 3)

Operation with Commuwin II (PROFIBUS PA)

Commuwin II is a graphically supported operating program (MS Windows) for intelligent measuring devices with Rackbus, Rackbus RS 485, HART and PROFIBUS PA communication protocols. Commuwin II supports the following functions:
- Transmitter configuration in online mode
- Device calibration via PA interface
- Transparent visualisation of measured values and limit values
- Measured value display and recording with a line recorder

Connection options
- PROFIBUS PA (see Page 3)

Certificates and approvals

CE mark	The measuring system is in conformity with the statutory requirements of the EC Directives. Endress+Hauser confirms successful testing of the device by affixing the CE mark.
Ex approval	ATEX II 1/2 G, EEx ia IIC T6 (FISCO model) ATEX II 3 G, EEx nA II T6 (in preparation)
Overspill protection	WHG
Certification PROFIBUS	applied for
Other standards and guidelines	**EN 60529** Degrees of protection by housing (IP code) **EN 61326** Electromagnetic compatibility (EMC requirements) **NAMUR** Association for Standards for Control and Regulation in the Chemical Industry

Ordering information

Order number

FEC 14 electronic insert (PA)

L00-FEC14xxx-21-06-06-xx-001

TN: 52013775

Accessories

FHB 20 operating module

FHB 20 display (accessory)

L00-FEC14xxx-00-06-xx-xx-001

TN: 942512-0100

Supplementary Documentation

- Field communication PROFIBUS PA: Guidelines for planning and commissioning
  BA 198F/00
- Electronic Insert FEC 14
  BA 261F/00
- Multicap T (DC 12 TA; DC 11/16/21/26 TAN; DC 11/16/21/26 TAS)
  TI 239F/00
- Multicap T (DC 12 TE; DC 11/16/21/26 TEN; DC 11/16/21/26 TES)
  TI 240F/00
- Multicap A (DC 11/16/21/26 AN; DC 11/16/21/26 AS)
  TI 243F/00
- Multicap E (DC 11/16/21/26 EN; DC 11/16/21/26 ES)
  TI 242F/00

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