Ultrasonic Level Measurement
nivosonic FMU 673 Z, FMU 678 Z

Commutec instruments in Racksyst design for non-contact level measurement. Approved for explosion hazardous areas.

Nivosonic FMU 678 Z transmitters are designed for operation via Commulog or supervisory control systems

Nivosonic FMU 673 Z transmitters (here in Monorack housing) have a LC-Display and controls

Principle Features
- Designed for use as stand-alone units or for integration into process control systems.
- Intrinsically safe circuit acc. to ATEX II (1) GD [EEx ia] IIC/IIB.
- Provide standard current, voltage and limit relay outputs.
- Measure independent of material properties, pressure, temperature and nitrogen layers in the vessel.
- Self-monitoring with immediate indication of fault condition.

Applications
- Continuous, contact-free measurement of liquids or bulk solids in silos and tanks of all shapes and sizes.
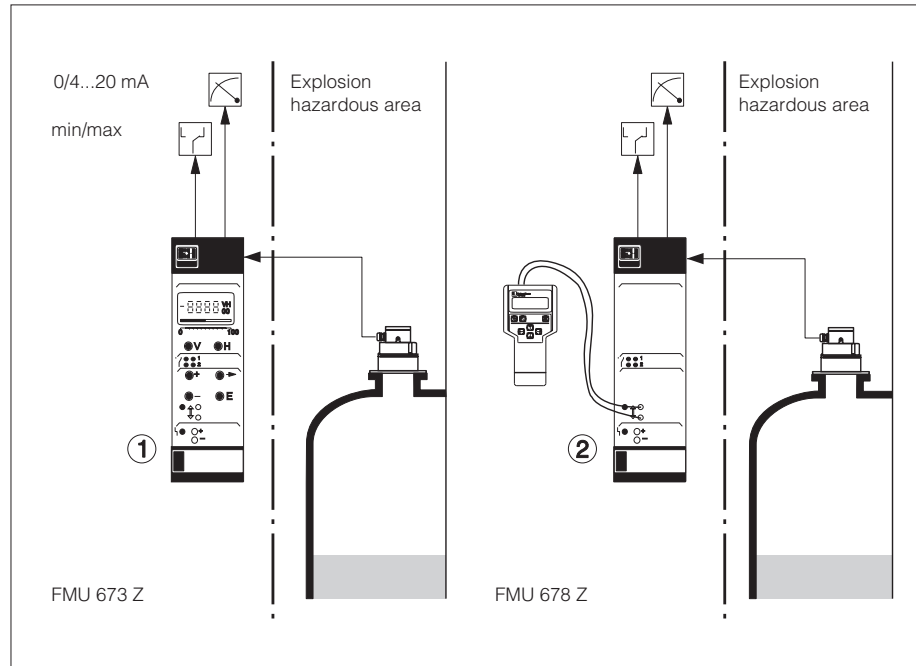- Measures levels up to 12 m or 20 m in liquids with DU 60 Z or DU 61 Z ultrasonic sensors.

Endress+Hauser
The Power of Know How

Measuring System

FMU 673 Z   FMU 678 Z

① The Nivosonic FMU 673 Z transmitter as an independent controller
② The Nivosonic FMU 678 Z transmitters are configured via the Commulog VU

Input Signal

A three-core installation cable connects the Nivosonic FMU to the DU .. Z ultrasonic sensor. The Nivosonic supplies power and the sensor sends back a digital echo signal. This is converted to a level or volume indication. The measured value
- is displayed
- or can be read by a Commulog or supervisory system.

Signal evaluation

Standard 0/4...20 mA and 0/2...10 V outputs, proportional to level or volume, are provided.
- Any initial or end of range value can be accurately set.
- Two limit relays can be operated independently of each other in minimum or maximum fail-safe mode. The relays de-energise when the level falls below or rises above the switch point.
- Programmable hysteresis of relay switching points provides two point control between any two levels.

Vessel Linearization

Volume is calculated from level via the vessel characteristic which describes the shape of the vessel. The most common shape, a horizontal cylinder is programmed as a standard feature.

Function Monitoring

The Nivosonic FMU continuously monitors all signal lines from sensor to analogue outputs and fails to safe if a fault is detected.
- A potential-free change-over contact de-energises on fault condition.
- The analogue signal switches to -10 % or +110 % level or holds the last measured value.
- The output relays de-energise or follow the analog output signal, depending on the programmed setting.

It is possible to enter vessel characteristics for up to 30 break points. These are obtained by filling the vessel or from drawings provided by the user.

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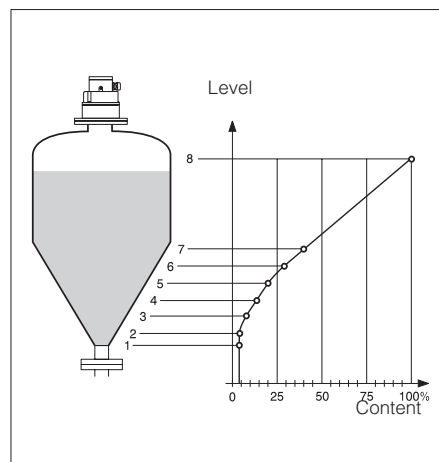
Measurement Principle

Principle of ultrasonic
level measurement
D = Distance sensor-
      product surface
B = Blocking distance
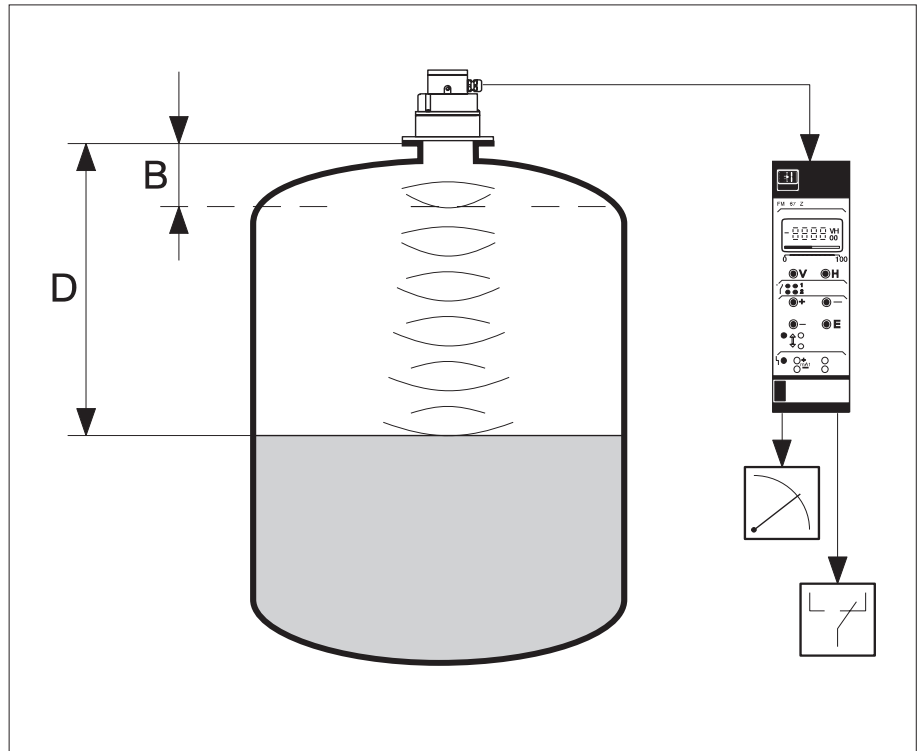
Ultrasonic Level Measurement

The ultrasonic principle relies on the measurement of the time elapsing between the output of an initial pulse and the reception of its echo from the product surface.

- The measurement is independent of product properties such as specific gravity, conductivity, viscosity, and dielectric constant.
- The measurement is unaffected by changes in ambient temperature within the silo or tank: the Nivosonic compensates by using the temperature information delivered by the sensor.
- Depending on sensor, the measuring range is up to 12 m, 15 m or up to 20 m in liquids: the resolution of the measurement is 1.7 cm.
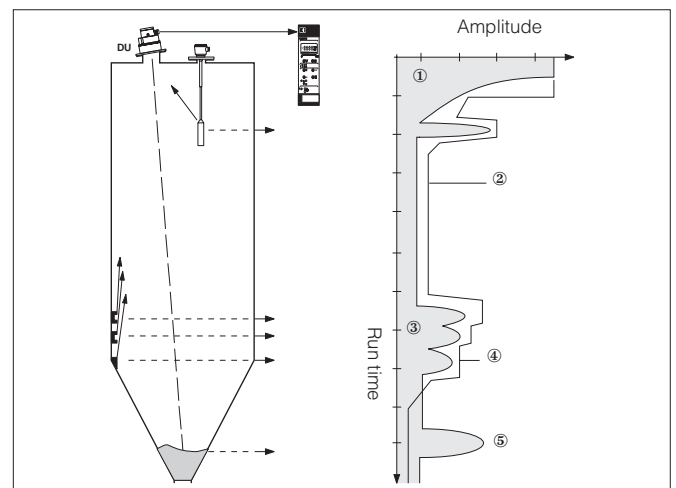
Signal Processing

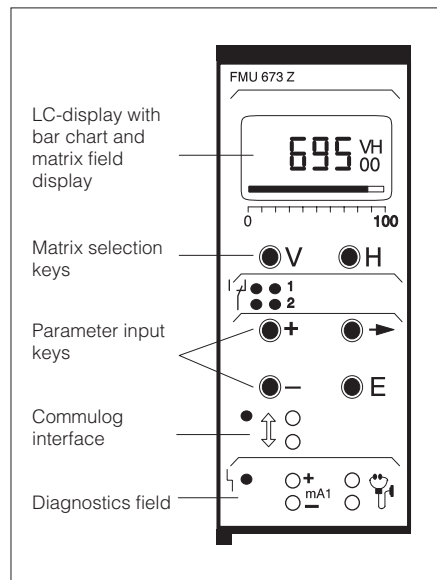The measurement method relies on an echo from the surface of the product.

- Spurious echoes from fittings within the tank, falling solids etc. are eliminated by setting a time-dependent detection threshold.
- The product echo must be stronger than any spurious echoes, so that a signal is received when the product reaches the level of any spurious echo source.
- This is the case for e.g. small fixtures and good reflecting products since the reflecting surface is greater than that of the fixture .

Suppression of spurious
echoes from fittings:
① transmission pulse and signal decay
② time-dependent identification threshold
③ interference echo
④ echo suppression by temporary increase of threshold
⑤ strong echo from

Operation

FMU 673 Z

695 VH 00

0   100

LC-display with bar chart and matrix field display

Matrix selection keys

Parameter input keys

Commulog interface

Diagnostics field

Nivosonic FMU 673 Z transmitters are programmed from the front panel.

Direct Programming

The Nivosonic FMU 673 Z can be directly programmed and interrogated at the front panel.

- Six keys access a parameter matrix, defined by a vertical (V) and horizontal (H) position, in which the relevant data can be entered.
- The selected matrix field is indicated in the LC-display preventing entry and reading errors.
- During operation level, volume, temperature, echo damping, signal/noise ratio, and output current parameters are available for continuous display.
- A horizontal 10-step LCD bar strip indicates level or volume as a function of the current output.

On-line Diagnosis

There are three possibilities for on-line diagnosis:

- the current output can be monitored,
- an oscilloscope can be connected to monitor the echo signal.
- the transmitter can be connected to a personal computer (special software packet available)

FMU 678 Z

LED relay status

LED remote operation

LED fault condition
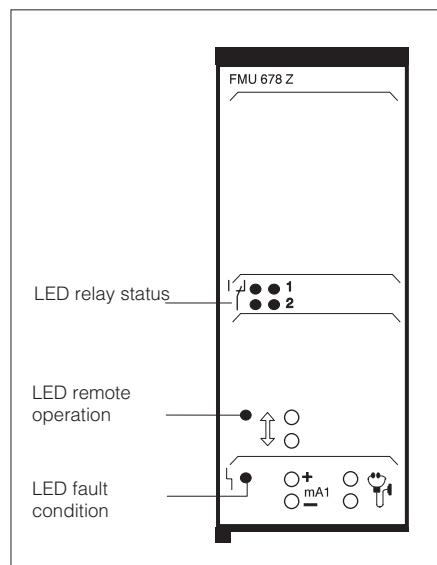
Nivosonic FMU 678 Z transmitters are programmed via the Commulog VU 260 Z or ZA 672 interface.

Operational Status

The operational status of the transmitter is indicated by means of 6 LEDs, which can be clearly seen from a distance.

- The green and red LEDs in the central field indicate the output relay status: red de-energised, green energised.
- The green LED below lights when the Nivosonic is communicating with the ZA 672 or the Commulog VU 260 Z.
- The red LED in the diagnostics field flashes to indicate a warning or lights for a fault condition.

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Remote Control

0/4 ... 20 mA

Min./Max..

Rackbus

PC,
SPS
PLS

ZA 670
Interface

Explosion hazardous area

The Nivotester FMU communicates with a supervisory controller via the two-core Rackbus and ZA 670/ZA 672 computer interface.
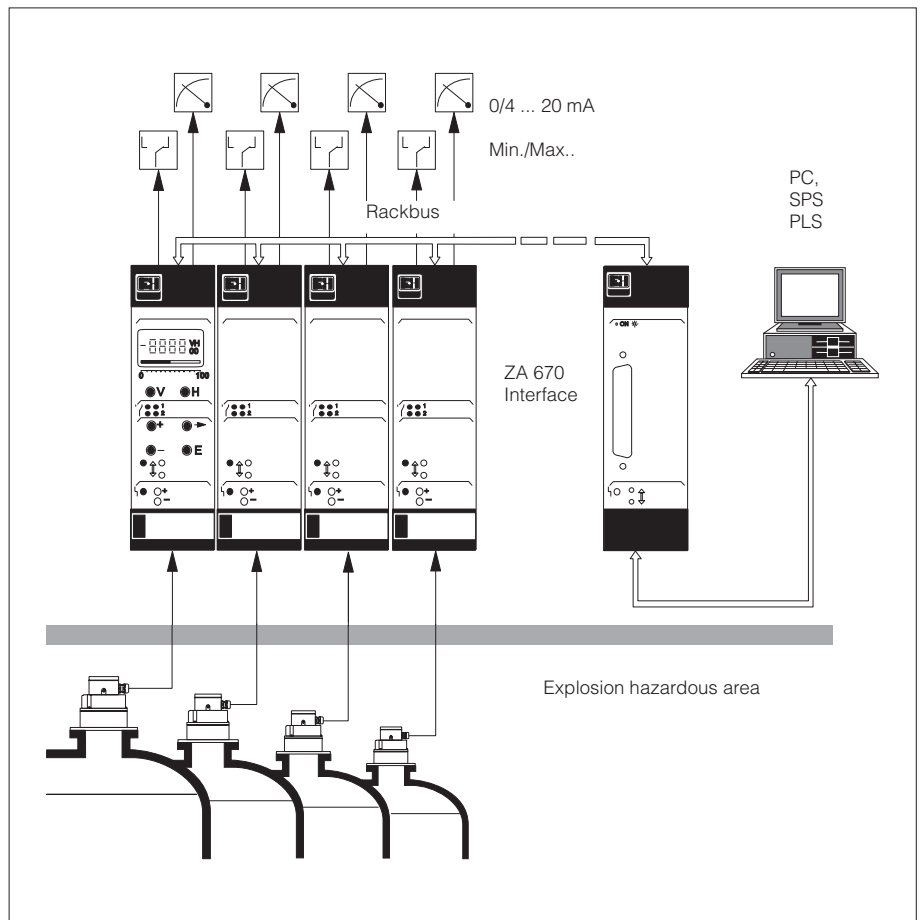
Automatic Systems

Nivosonic transmitters are easily integrated into automatic control systems.

- Signals from the Nivosonic trans-mitters are passed via the Rackbus to a ZA 670/ZA 672 computer interface module which converts them into standardised RS-232C interface signals.
- Up to 64 transmitters can be individually controlled and operated on-line from the control room. Each is accessed via a unique address.

- Hardware modules and operating programs are available for a variety of programmable logic controllers (PLC) process control systems (PCS) and personal computers. (PC).

The resulting dialogue between supervisory controller and subordinate transmitters makes for a safer and more flexible plant organisation.

The Commulog VU 260 Z provides instant access to measurement data.
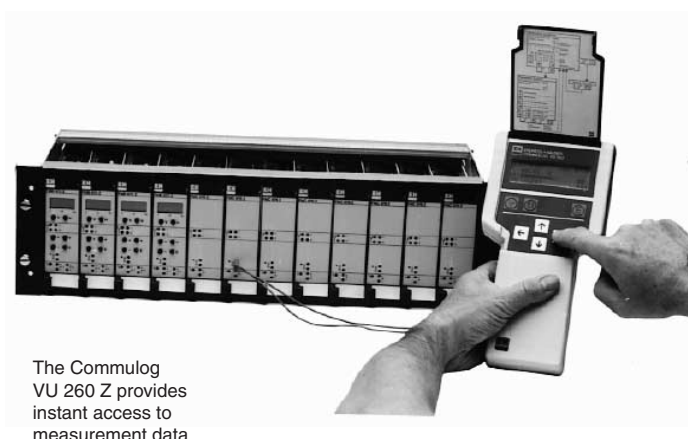
Field Communications

Alternatively, Nivosonic FMU transmitters can be programmed and interrogated on-line via the Commulog VU 260 Z.

- The Commulog is plugged into the the front panel.
- The data exchanged are displayed with supplementary information in plain language on the large LC-display.

Installation

Technical Data: Racksyst Plug-in Card

- Format: conforming to DIN 41494 (Eurocard format)

- Front panel: black synthetic with blue field inlay, grip and markings

- Protection: Front panel IP 20, board IP 00 (DIN 40050)

- Weight: approx. 0.3 kg

- Operating temperature: 0°C...+70°C
  Storage temperature:
 −20°C...+85°C
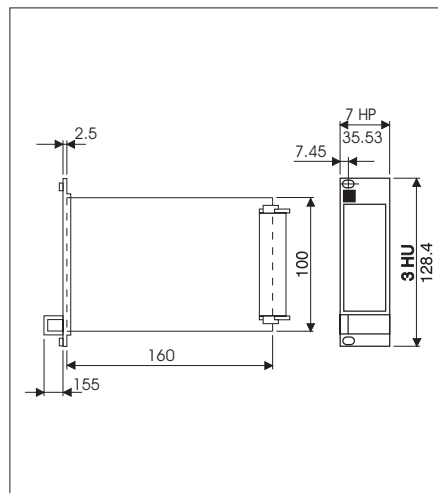
Dimensions (mm) of
plug-in card

Monorack housing

Mounting

Racksyst plug-in boards must be installed outside explosion hazardous areas in a rack or in a protective housing. Endress+Hauser can provide the following alternatives:

- 19" rack (84 HP wide) for mounting up to 12 Nivosonic FMU transmitters in the control room.
- Half 19" wide field housing with Protection IP 65.
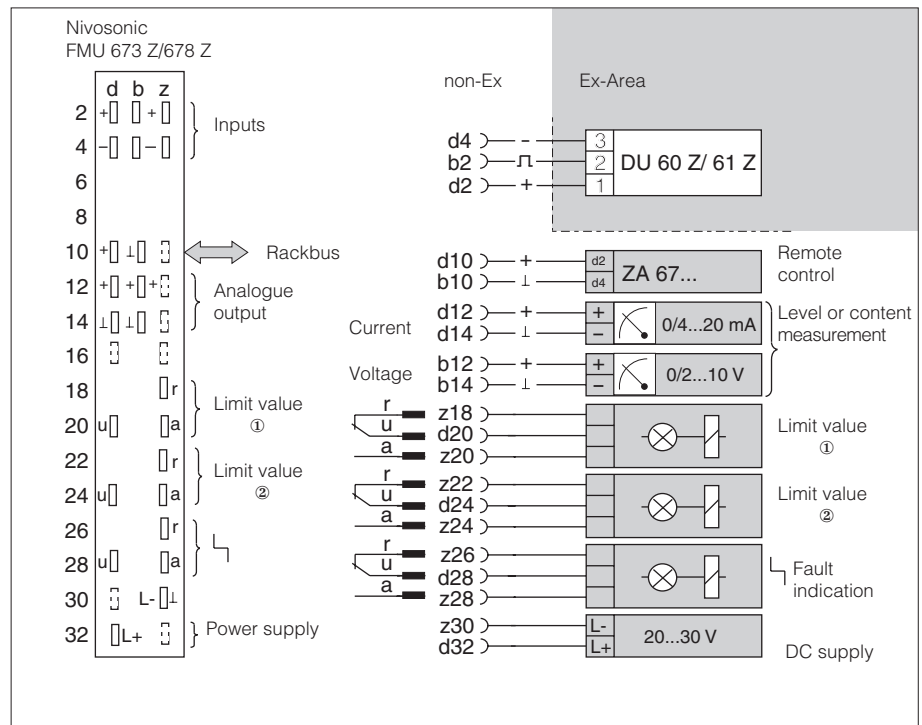- Monorack housing (7 HP) for single or multiple mounting in the control panel.

Field housing

19" rack

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Technical Data

Nivosonic FMU 673 Z/678 Z
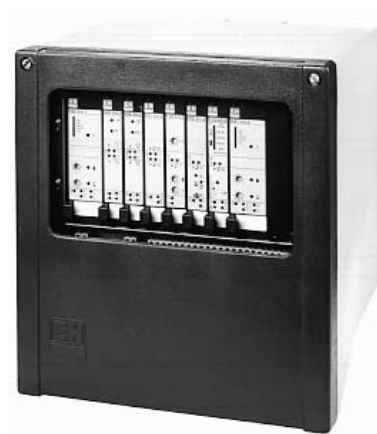
non-Ex   Ex-Area

Connection diagram for
Nivotester FMU

Plug connection
- Multipoint plug: conforming to
  DIN 41612, Part 3, Type F (30-pole)
- Coding pins in the multipoint strip:
  FMU 673 Z/678 Z in Position 1 and 28

Power Supply
- DC voltage: 24V (+6V...-4V)
- Current: approx. 90 mA, max. 110 mA,
  integrated fine-wire fuses

Signal Inputs
- Intrinsically safe, electrically isolated
  from the rest of the circuitry.
- Probes:
  DU 60 Z and DU 61 Z for FMU 673 Z/
  678 Z

Sensor Connection
- Power supplied by Nivosonic
- Commercial 3-core installation cable.
- Max. line resistance 25 W/core.
- When installing in explosion
  hazardous areas, observe relevant
  regulations (s. XA 227F-A).

Electromagnetic Interference
In case of electromagnetic interference:
- use shielded cable
- connect shielding to the DU... internal
  ground terminal, not to the Nivosonic
- connect any potential equalization
  cable to the DU... external ground
  terminal.

Signal outputs
- Current output:
  0...20 mA/4...20 mA selectable,
  RL max. 500 Ω
- Voltage output:
  0...10 V/2...10 V selectable,
  RL min. 2 kΩ
- Limit switches
  Two independent relays each with a
  potential-free change-over contact,
  switching point and switching
  hysteresis fully adjustable
- Fail-safe mode:
  Minimum or maximum, selectable
- Fault / Warning Indication:
  relay with potential-free change-over
  contact
- Switching capacity:
  max. 2.5 A, max. 250 V a.c. (CSA max.
  125 V)
  max. 300 VA at cos φ = 0.7
  max. 100 V d.c., max. 90 W
- Rackbus: Baudrate 19 200 bit/s
  2-core, bidirectional cable

Certificates
- ATEX II (1) GD
  [EEx ia] IIC/IIB
  (s. XA 227F-A)

Subject to change

Ordering Information

Probes
- DU 60 Z, Range max. 12 m, in liquids
- DU 61 Z, Range max. 20 m, in liquids

The maximum range depends upon the application.

- Accessories (rack, Monorack, field housing, multipoint strip)

Supplementary Documentation

❑ Project Planning for Racksyst racks or Racksyst field housing with self-adhesive labels for wiring (state instrument version)

❑ Racksyst
System Information SI 008F/00/en

❑ Monorack
Technical Information TI 047F/00/en

❑ DU 60 Z and DU 61 Z
Technical Information TI 129F/00/en

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