Technical
Information
TI 062F/00/en

Ultrasonic Level Measurement *nivosonic FMU 671, FMU 676*

Commutec transmitters for continuous, non-contact level measurement



FMU 676



FMU 671

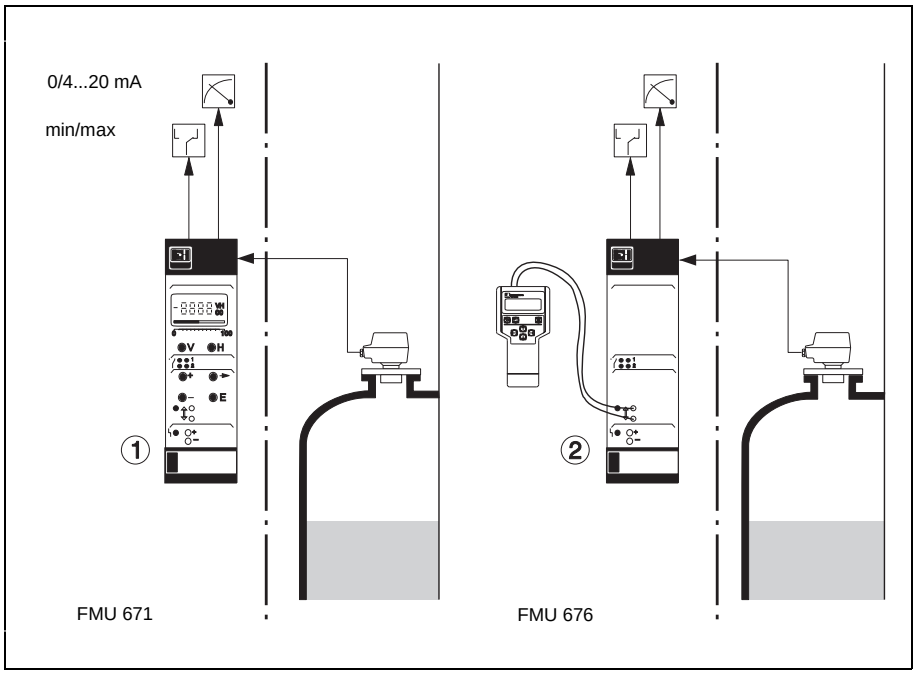
Application
The Nivosonic FMU 671/676 is designed for continuous, non-contact level and volume measurement of both solids and liquids in vessels of any shape

- The Nivosonic FMU 671 can be calibrated directly at the front panel or by remote dialogue
- The Nivosonic FMU 676 is operated by handheld terminal and for remote dialogue only

Features and Benefits
- Simple commissioning and operation using addressable application parameters
- Standardised current, voltage and relay outputs
- Designed as a stand-alone unit and for dialogue with supervisory automation control systems (using Rackbus gateways)
- Self-monitoring with status of measurement system continuously displayed
- Standard installation cabling.

Endress+Hauser
Nothing beats know-how

Measuring System



① Nivosonic FMU 671 as an independent transmitter

② Nivosonic FMU 676 configured with the Commulog VU 260 Z handheld terminal

The measuring system comprises:

- the Nivosonic FMU... transmitter
- the DU... ultrasonic sensor with integrated temperature sensor

The following ultrasonic sensors can be connected to the Nivosonic FMU 671 or 676:

- DU 40, DU 41, DU 42 S, DU 42 C, DU 43 S, DU 43 C, DU 44 Z, DU 46 Z DU 73 S, DU 73 C

The Nivosonic can be remotely configured by using:

- the Commulog VU 260 Z handheld terminal or
- a computer and ZA 67… Rackbus gateway

Function

Measuring Principle
The sensor emits an ultrasonic pulse towards the surface of the material which then reflects it back to the sensor. The level is calculated by measuring the run time taken for the echo to return.

Signal Processing
The Nivosonic receives a series of digital signals from the ultrasonic sensor. A microprocessor-controlled analysis is carried out in the Nivosonic intelligent transmitter to filter out the “correct level echo” from all the other signals received.

The use of fuzzy elements allows an application-orientated analysis. All incoming echo signals (echo run time and amplitude) are statistically evaluated, digitized and then stored in memory. Only the true echoes originating from the material are identified using specially designed software.

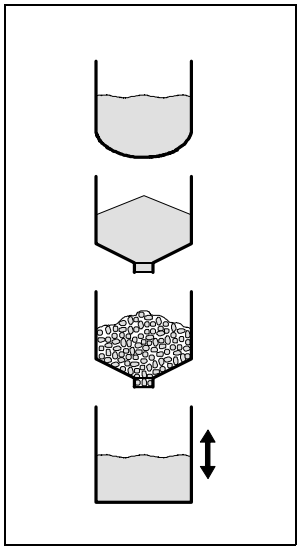
The ultrasonics software:

- filters out sporadic echoes (e.g. from agitators)
- identifies interference echoes from fittings and edges
- recognises multiple reflections
- includes data such as signal strength and temperature in the analysis.

Output Signals
The analogue output signals are standard 0/4 ... 20 mA currents and 0/2...10 V voltages. These are proportional to either the level or the volume in the vessel. A linearisation curve to determine the volume of any shaped vessel can be simply programmed.

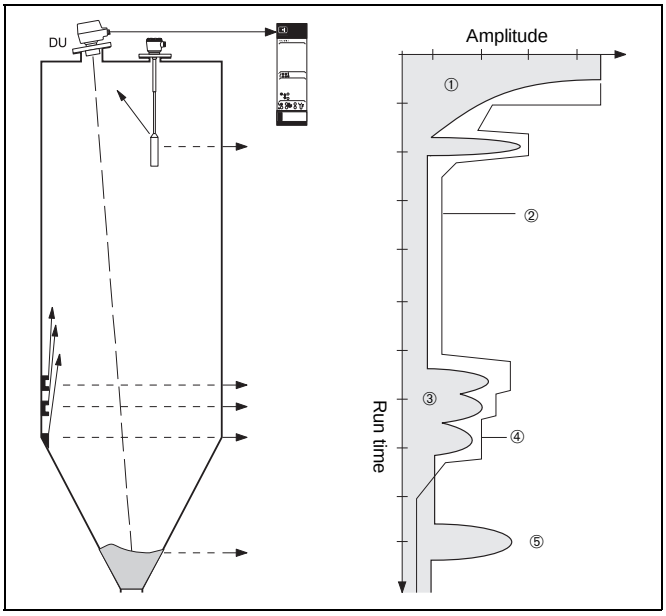
On fault condition, the unit can also be programmed such that the analogue signal switches to the – 10 % or + 110 % level or to hold the last measured value.

Intelligent Signal Processing



Simple Commissioning
Commissioning and accurate calibration of the ultrasonic measuring line are extremely simple. By selecting just one parameter, the measuring line can be set to one of five applications:

- liquids
- fine-grained solids
- coarse-grained solids
- process vessels with rapid changes in levels
- conveyor belts

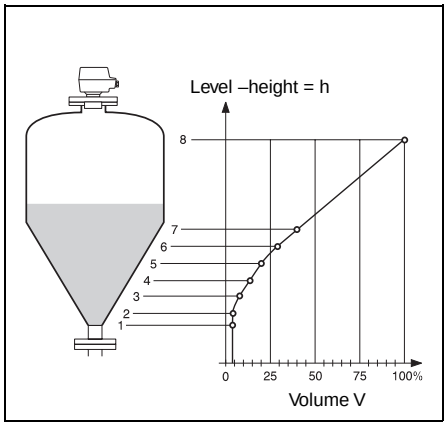


Suppression of echoes from fittings
① signal decay of the sensor
② time-dependent threshold which an echo must exceed to be identified by the evaluating electronics
③ interference echo
④ echo suppression
⑤ working signal from the surface of the material

Fixed Target Suppression
The Nivosonic suppresses echoes which can be caused by, e.g. struts, welded seams and fittings in the vessel.

For a short interval, the detection threshold is raised just enough to ensure that the interference signal is not evaluated. When the product level reaches the level of the interference source, however, the working signal (the echo from the surface of the material) can still be determined provided it is larger than the interference signal.

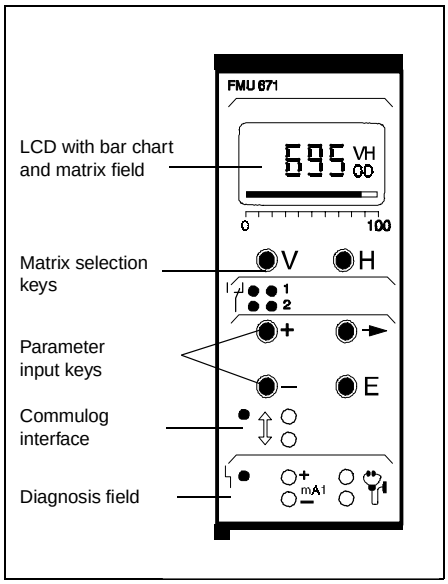
The threshold can be set manually or automatically and the entire envelope curve from the sensor to outlet can be stored.



Vessel characteristics are determined by the FMU 671/676 using up to 30 reference points. These are obtained by either filling the vessel or from drawings.

Vessel Linearisation.
The linearisation curve describes the relationship between the height h and the volume V of the vessel. The most common characteristic curve – for a horizontal cylindrical tank – is programmed as a standard feature.

Operation



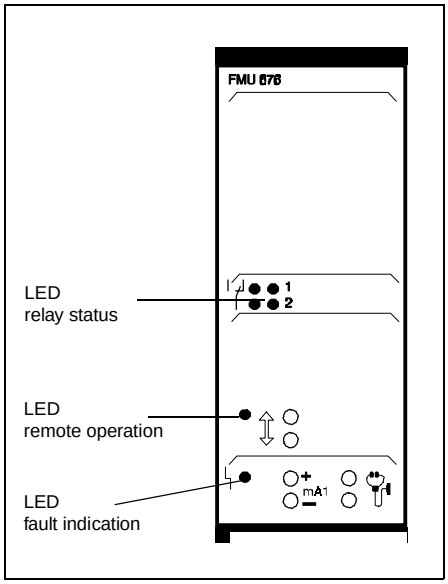
Nivosonic FMU 671 transmitters are operated from the front panel

Direct calibration
Parameters can be entered and measured values addressed directly from the front panel of the Nivosonic FMU 671.

- The matrix field required is selected by using the V and H keys. The other keys are used for entering data.
- The matrix field selected is clearly indicated in the display to prevent input and reading errors.
- During operation, the LCD shows level or volume (temperature, echo damping, signal/noise ratio or output current).
- An LCD bar strip indicates level or volume as a function of the current output.

On-Line Diagnosis
Three methods are available:

- the analogue current is measured
- an oscilloscope is connected
- a personal computer is connected (service software package available).



Nivosonic FMU 676 transmitters are operated via the Commulog VU 260 Z or a process control system

Operational Status
The operational status is indicated by 6 LEDs which are clearly seen at a distance:

- The green and red LEDs in the central field indicate whether the limit relay is energised or de-energised.
- The green LED below lights up when the instrument is in dialogue with the ZA 67... or the Commulog VU 260 Z handheld terminal.
- A fault or warning is indicated by the red LED at the bottom. The red LED lights up on fault and flashes to indicate a warning.

Technical Data

Plug Connection:
- Multipoint plug conforming to DIN 41612, Part 3, Type F (30-pole)

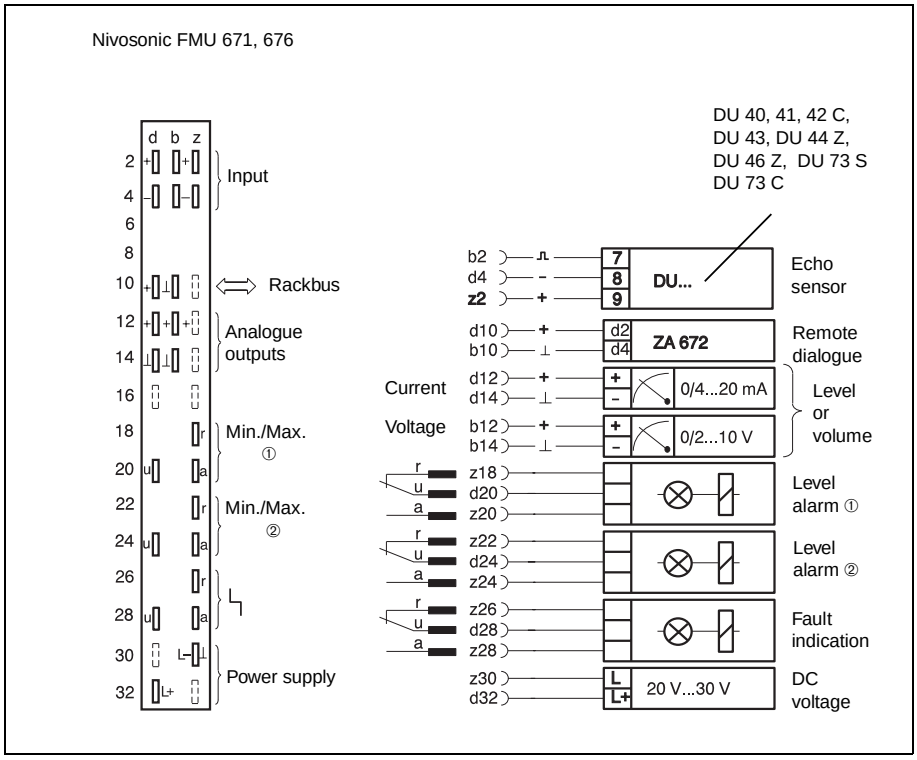
Power Supply:
- DC voltage 24 V (20 V ... 30 V)
  Tolerance: – 4 V, + 6 V
- DC current:
  approx. 90 mA, max. 125 mA
  Integrated fine-wire fuses

Signal input:
- The following ultrasonic sensors can be connected to the Nivosonic FMU 671 and 676:
  DU 40, 41, DU 42 S, DU 42 C,
  DU 43 S, DU 43 C, DU 44 Z, DU 46 Z,
  DU 73 s, DU 73 C
- Electrically isolated from other circuits

Sensor Connection
- The connection cable between the DU ultrasonic sensor and the Nivosonic FMU 671, 676 transmitter can be common three-core installation cable (2-wire for DU 43 S) or three cores of a multicore, general purpose cable.
- Cable resistance max. 25 Ω per core
- If the connection cable is to be laid in areas of strong magnetic or electrical fields, then screened, twisted cable is recommended. Connect the screening to the sensor only

Signal Output:
- Current output: 4 ... 20 mA
  can be switched to 0 ... 20 mA,
  R_L max. 500 Ω
- Voltage output: 2 ... 10 V
  can be switched to 0 ... 10 V
  R_L min 2 kΩ
- Limit switch outputs:
  2 independent relays each with one potential-free change-over contact, switching point and switching hysteresis: fully adjustable
- Fail-safe mode:
  minimum or maximum, selectable
- Alarm indication:
  one relay with potential-free change-over contact
- Relay switching capacity:
  AC: max. 2.5 A, max. 250 V (for CSA max. 125 V), max. 300 VA at cos φ 0,7,
  DC: max. 100 V, max. 90 W
- Display elements:
  6 LEDs for function control

Subject to modification



Connection diagram for the contact strip