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ENERGO FLOW



About the company

Energoflow AG is an ISO 9001 certified Swiss company dedicated to design, engineering and manufacture of flow metering solutions and related products based on the ultrasonic technology.

AIM

We strive to provide state-of-the-art, cost effective turnkey technical solutions to our valued clients throughout the world for fluid measurement and monitoring in related fields across a wide range of industries and applications.

Experience, Expertise & Efficiency !

Our compact team of EXPERIENCED professionals with a vast global exposure is dedicated to provide the best answer to client's requirements based on our EXPERTISE, and our business practices and management concepts are aimed to provide the highest degree of EFFICIENCY.

Energoflow AG can provide the optimal solution to all your flow metering requirements – the wide range of our products covers all the feasible fluid flow situations. And if you have an unusual, out of the way case – just contact us with the details! We love challenges and our team of Engineers will be just too happy to provide the exact flow meter corresponding to your requirements.



Ultrasonic Gas Flow meters

Ultrasonic gas flow meters ENERGOFLOW GF

Energoflow AG can provide flow metering solutions for the whole spectrum of applications required by the Gas sector.

Our flow meters can operate in a wide range of ambient conditions – we provide flow metering solution for very cold regions (ambient temperature -60 deg. C) as well as for hot locations (ambient temperature +70 deg. C). The Energoflow GF series of gas flow meters is designed to improve reliable and accurate measurement of gas flow in pipelines using the pulse-time method. These flow meters can be used for flow monitoring and measurement of air, natural gas, industrial gases, fuel gas etc. over a vast range of process conditions:

- For flow speeds as low as 0.1 m/s and as high as 70 m/s;
- For ambient temperatures as low as -65 deg. C and as high as +70 deg. C;
- In hazardous areas and hard to access locations;
- When the pressure in the pipeline is as high as 160 bar.

The major advantages of the Energoflow GF series gas flow meters are:

1. No obstruction to the flow and zero pressure loss;
2. No moving parts and no mechanical wear or tear;
3. Easy installation and simplicity of use;
4. Easy integration into all kinds of process management systems;
5. High accuracy, large turn-down ratio, reliable measurement.

Energoflow GF series flow meters can be accessed remotely via PC. Using special software, it is possible to display the following data as per customer's choice:

- Measurement results of direction and speed of flow, current flow rate, progressive total volume;
- The waveform of the signal passing through the acoustic channel;
- Configuration options and settings of the flow meter;
- Clock readings and calendar;
- Archive data.

We supply flow meters of various sizes, with different types of process connections, and for a wide range of ambient and process temperatures and pressure ratings.

The flow meters can be spool type or hot tapped type, depending on the application.



Ultrasonic Gas Flow meters



Some Specific Applications

Volumetric flow measurement of impure gases for technical purposes

Since there are no moving or protruding parts, the GF flow meters can easily handle gases with liquid droplets and suspended particles like soot. Generally flow meters GFE 211, GFE 212 with embedded sensors are recommended for such applications – the sensors can be taken out once in a while for cleaning without stopping the technical process.

Monitoring systems for pipelines, including applications where bidirectional or reverse flow may occur, eg., at pipeline junctions.

In case of complex pipelines with more than one feeder, there are cases of reverse or bidirectional flow due to pressure topography. Monitoring such flow requires highly sensitive flow meters. The GFE 212 series flow meters are capable of recording flow velocities as low as 0.1 m/s which makes them ideal for such applications.

- Accuracy better than 1%;
- Pipeline diameter 50 mm upto 400 mm;
- Range not less than 1:160;
- Working pressure from 1 to 100 bar.

Energoflow AG has recently completed the turn-key installation of a natural gas flow measurement complex comprising of four GFE 212 ultrasonic flow meters – three DN300 and one DN800 for Intergas Central Asia in Kazakhstan.

For measuring gas flow in flares at compressor stations where the flow velocities can be in the range of 0.1 m/s upto 70 m/s.

We can provide specially designed low cost flow meters GFE 201 with very wide range ability (1:160) which can accurately and reliably measure flow velocities from 0.1 m/s upto 70 m/s. The fast reaction of the electronics unit paired with this huge range ability provides the best solution to flare gas measurement.

High pressure applications

GFE 202H and GFE 202O flow meters are used for technical accounting of Gas in high pressure applications like underground storage and well measurements. These are available for pressures upto 160 bar and can operate with contaminated gas.



Under order, versions for pressures as high as 250 bar are available. They can also provide for bidirectional flow measurement and thus are suitable for process automation applications.

- Accuracy better than 1,5%;
- Pipeline diameter 50 mm upto 400 mm;
- Rangeability not less than 1:160;
- Working pressure from 1 to 160 bar (GFE 202H), 1 to 250 bar (GFE 202O).

Custody transfer applications

Our flow meters are used for custody transfer of natural gas and other industrial gases. GFE 202 Spool type flow meters are generally used for measuring gas for commercial purposes. In case if very high accuracy is required, the GFE 404 is the ideal choice. We can always provide a flow meter which exactly suits your requirements.



Ultrasonic Gas Flow meters

Ultrasonic in-line gas flowmeters Energoflow GFE 202 and GFE 201

Energoflow GFE 202 and GFE 201 are ultrasonic spool type gas flow meters designed for measuring the flow velocity V of gas in pipelines in both directions over a wide range – from 0.1 upto 25 m/s (under order, special versions for measuring flow velocities upto 35.0 m/s are available). They can be used for gas pressures as high as 160 bars and ambient temperatures from -60 upto +70 deg.C

The typical accuracy of these flow meters is 0,5 – 0,3%.

TECHNICAL CHARACTERISTICS:					
DN, mm	Demension type	Threshold Q_{thr}	Minimal Q_{min}	Transition, Q_t for Energoflow GF 1,00%	Maximal Q_{max}
50	G100	0,7	1	8	160
80	G250	1,9	2,7	20	400
100	G400	3	4	33	650
150	G1000	7	10	80	1600
200	G1600	12	17	125	2500
250	G2500	19	26	200	4000
300	G4000	28	40	325	6500
400	G6500	47	67	500	10000
500	G10000	71	100	800	16000

The flow meters are available in a wide range of sizes (from DN50 upto DN500)

The major advantages are:

- No obstruction to flow, no pressure loss;
- Reliable and highly accurate flow measurement at varying process conditions.

The Flow meters can be supplied precalibrated on Air or on Natural gas.

Energoflow GFE 202H & 201H can be accessed remotely via PC. Using special software, it is possible to display the following data as per customer's choice:

- measurement results of direction and speed flow, current flow, progressive total volume;
- the waveform of the signal passing through the acoustic channel;
- configuration options and settings of the flow meter;
- clock readings and calendar;
- archive data.

Functional capabilities of the flow meter and its setting are changed by programming the embedded microcontroller via external computer. To prevent unauthorized control access, computer software is protected by a user-defined password for working with flow meters. Flow meter is equipped with a passive generator of the frequency-pulse signal.



Ultrasonic Gas Flow meters



Energoflow ultrasonic flow meter GFE 211 and GFE 212 for in-situ installation

Ultrasonic gas flow meters Energoflow GFE 211 and GFE 212 are a brilliant example of genial engineering for achieving optimal solution for gas flow measurement in large pipes and in cases where installation of inline meters is technically or commercially not viable. The meter comprises of electroacoustic transducers hot tapped into the existing pipeline and connected to a remote electronics block.

Besides the reduction of cost, especially in the case of large pipelines where the flow meter body constitutes a major part of the cost of the device and installation calls for a capital effort, Energoflow GFE 211 and GFE 212 gas flow meters provide all the traditional advantages of pulse-time ultrasonic technology – no pressure loss, no moving parts, reliable and accurate measurement and easy servicing. They can be installed on pipelines 100 mm upto 2000 mm in size and can be used for a wide range of media like natural gas, petroleum gas, flue gas, coal gas etc.

TECHNICAL CHARACTERISTICS					
DN, mm	Demension type	Volume flowrate, cubic m/h			
		Minimal Q ₁	Transitional Q ₂	Threshold Q _{thr}	Maximal Q ₃
200	G1600	17,0	17,0	125,0	2500,0
250	G2500	19,0	26,0	200,0	4000,0
300	G4000	28,0	40,0	325,0	6500,0
400	G6500	47,0	67,0	500,0	10000,0
500	G10000	71,0	100,0	800,0	16000,0
600	G16000	111,0	160,0	1250,0	25000,0
800	G25000	177,0	250,0	2000,0	40000,0
1000	G40000	288,0	400,0	3250,0	65000,0
1200	G65000	470,0	670,0	5000,0	100000,0
1600	G100000	700,0	1000,0	8000,0	160000,0
2000	G160000	1110,0	1600,0	12500,0	250000,0





Ultrasonic Gas Flow meters

High accuracy ultrasonic flow meters Energoflow GFE 404

Four-channel ultrasonic gas flow meter Energoflow GFE 404 is specially designed for applications where very high accuracy is required, e.g. for custody transfer measurement of natural gas. The standard version provides an accuracy of 0.5%, flow meters with an accuracy of 0.3% can be supplied under order.

The flow meters provide accurate and reliable measurement of the gas flow rate in the pipeline in both directions within the range of flow velocities from 0.1 to 30 m/s at pressures upto 10 MPa and are available for line sizes 150mm, 200mm, 250mm, 300mm, 350mm and 400mm.

The Flow meters are supplied with a dedicated power supply and communication unit and can be connected to the Flowcomputer or DCS through a RS232 digital interface. Standard high frequency pulse outputs are also available.

The flow meters are supplied precalibrated on air. Under special order, the flow meters can be precalibrated on natural gas at working pressure.

The flow meters are available in a wide range of sizes.

TECHNICAL CHARACTERISTICS				
Flow velocity, m/s	Inner Diameter(DN), mm	No. of measurement beams	Maximum pressure, MPa	Accuracy, %
0.1 to 30	150; 200;250;300;350;400	4	1.6; 6.3; 10.0	0.5 (0.3)

DN mm	Volume of Flowrate, cu.m / h			
	Threshold	Minimum	Transited	Maximum
150	6,5	9,5	80,0	1900
200	11,0	17,0	125,0	3400
250	18,0	26,0	200,0	5200
300	25,0	38,0	325,0	7600
400	45,0	67,0	300,0	13400



Ultrasonic Gas Flow meters



Ultrasonic gas Flow meter GFA 202

The main technical features of GFA 202 are:

- the flow meter is powered by an built-in lithium battery having service life not less than 4 years.
- the flow meter carries out direct measurement of temperature and pressure and on basis of the measured values of these parameters calculates the kinematic gas viscosity, which is then used for calculating correction coefficients of Reynolds number.

Flow meters are designed for :

- measurement of the volumetric flow rate and volume of natural gas
- measurement of temperature of gas
- measurement of absolute pressure gas



Flow meters can be used as part of metering units of gas distribution points, industrial enterprises and communal service installation.

Flow meters are designed for use in continuous operating mode and require minimal maintenance. Flow meters can be included to the measurement networks and control systems.

Flow meters has the protection marking "1ExibIIVT4H" and can be installed indoors in explosions hazard zones.

Flow meter consists of the electronic unit (EU) and flanged in-line section, having two pairs of inserted ultrasonic transducers as well as temperature sensor and pressure sensor.

TECHNICAL CHARACTERISTICS		
Parameters		Volume
Nominal diameter (DN)		from 50 to 200 mm
Measurement range of gas flow velocity		from 0,15 to 75 m/s
Number of channels		2
Operating gauge pressure		1,6 MPa; 6,3 MPa
Limits of permissible relative error of the	from Qt to Qmax	± 1%
Flowmeter for range of flow rate	from Qmin to Qt (included)	± 2%
Pulse outputs: - two low-frequency (LF), to 20 Hz; - one high (HF), to 2 kHz;		Type "Dry Contact" Voltage from 5 to 30 V, current upto 20 mA
Temperature gas measurement		Resistive Temperature sensor Pt100, corresponding to standard DIN EN 60751 class A
Pressure measurement of gas		Tensoresistive absolute pressure sensor with temperature correction
Absolute basic error of temperature measurement		± 0,15°C
Derived basic error of pressure measurement		Not more than ± 0,2 %
Communication channels		Interface RS-232/RS-485; Data rate upto 115200 bits/s; Data transfer protocol ModBus RTU;
Power supply		Buil-in lithium battery of capacity 19 A*h (provides operation for 4 years)
Optional power supply from an external source		9 to 14 VDC; current consumption – upto 100 mA
Ingress Protection of casing as per GOST 14254		IP67
Ambient Temperature		from -30 to 55°C

Dependence of critical values of Volume flow to meter size					
DN mm	Size type	Value of flowrate, m ³ /h			
		threshold, $Q_{\text{threshold}}$	minimum, Q_{min}	transient, Q_t	maximum, Q_{max}
65	G160	0,35	1,7	12,5	250
	G250	0,35	1,7	13,3	400
80	G250	0,5	2,6	20,0	400
	G400	0,5	2,6	20,0	650
	G650	1,0	5,0	35,0	1000
100	G400	0,8	4,0	33,0	650
	G650	0,8	4,0	33,0	1000
	G1000	1,6	8,0	50,0	1600
125	G650	1,25	6,3	50,0	1000
	G1000	1,25	6,3	50,0	1600

Archive data:

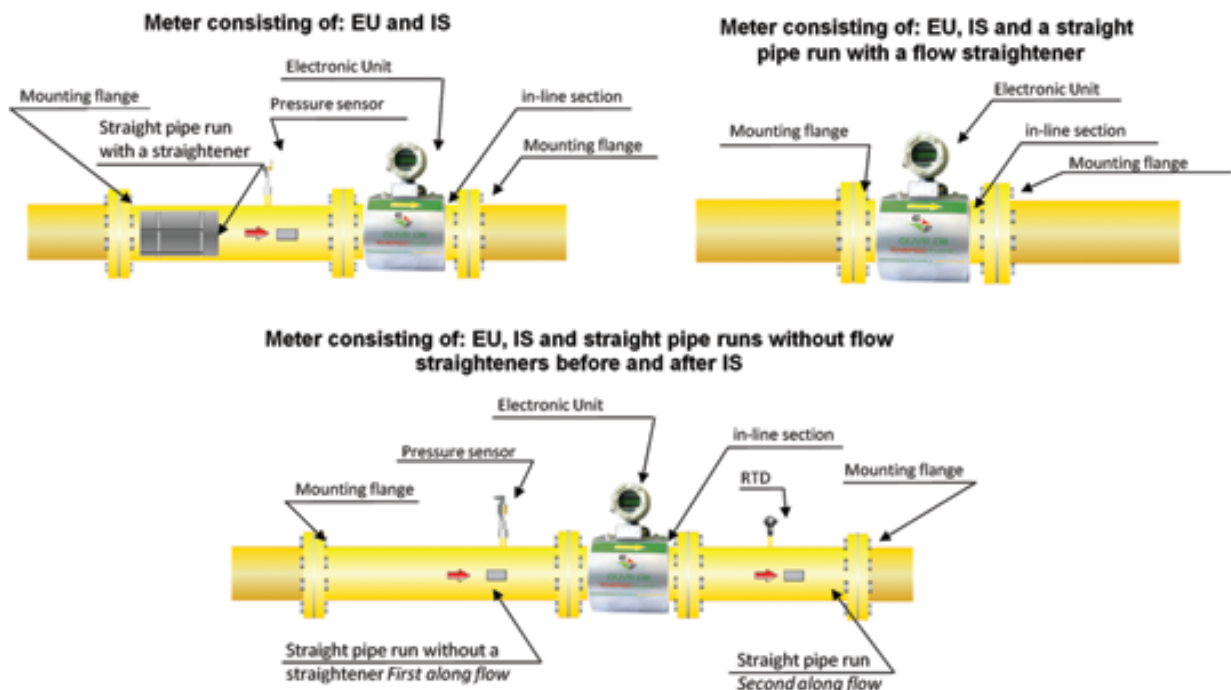
- hourly- for every preceding hour - size of archive 1488 records (62 days);
- daily- for every preceding day - size of archive 730 records;
- power on/off instances - size of archive 512 messages;
- emergency situations - size of archive 720 messages;
- intervention - changing the adjustment parameters (size of archive 889 messages).

Control software program is used for recording, viewing and changing the settings of the Flow meter , recording and viewing of measurement data, as well as for reading data archive.

This program allows you to view the archive data and modify the flow meter settings via a PC monitor and then upload the archive data to a file on the Flow meter .

The Flow meter provides protection of settings and archive data from unauthorized changing by restricting access through a system of passwords and hardware based protection of configuration from being overwritten.

Installation configurations



Ultrasonic Gas Flow meters



Gas flow meter selection guide

A - Autonomous power supply

E - External power supply

No. of measurement channels

2 – two channels of measurement

4 – four channels of measurement

0 – Flanged in-line section (IS)

1 – Embedded sensors (ES)

X – number of active EAT pairs

Standard Accuracy of measurement, %

Flow range	GF 201	GF202	GF211	GF212
Qt to Qmax	1.5	1	2.5	1.5
Qmin to Qt	3	2	5	3

Process pressure

L – upto 16 bar

N – upto 63 bar

S – upto 100 bar

H – upto 160 bar

O – Customer specific version

Factory Calibration

A – on air

G – on natural gas

W – without factory calibration

Installation data

DNxxxx – Pipe nominal diameter, mm

Process connection

N – no flanges, pipewall installed sensors

D – Flanges DIN

xxxx – PN, Bar

A – Flanges ANSI

xxxx – pressure class

O – Customer specific

Ambient temperature

L - Low temperature version (-60 +40 deg. C)

S - Standard version (-30 +55 deg. C)

H - High temperature version (-30 +70 deg. C)

Electronics block

I – integrally mounted electronics block with display

W – Electronic junction box without display

Output

S – 2 pulse outputs (upto 5 kHz); 1 RS485/232

O – 1 passive analogue output; 2 pulse outputs (upto 5 kHz); 1 RS485/232

Hazardous area certification

I – Exi certification (ATEX)

W – without certification (for non hazardous applications)

Power supply

A – 220 VAC power supply system with intrinsic barriers and communication interface

D – 24 VDC power supply system with intrinsic barriers and communication interface

X – Customer specific

W – without power supply, customer to provide required power input

Accessories (optional)

F – Meeting flanges with bolts and studs to be supplied with flow meter

Accessories (optional)

R – straight pipe-runs to be supplied with flow meter

Accessories (optional)

C – Flow conditioner to be supplied with flow meter



Calibration and proving rigs

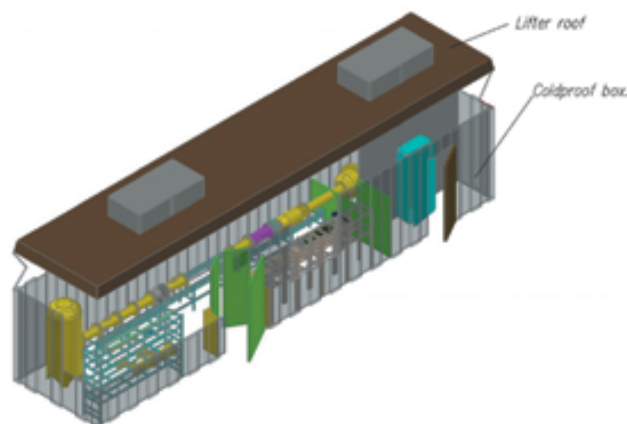
Calibration and proving rigs for gas flow meters

We at Energoflow AG have designed and developed compact and effective rigs for calibration of gas flow meters and liquid flow meters.

Parameter	TECHNICAL FEATURES	
	Proving rigs for liquids	Proving rigs for Gases
Capacity (m ³ /h)	40,80,180, 600	250, 600, 1200, 2500, 10000
DN of calibrated flow meters	DN (20, 25, 32, 40, 50, 80, 100, 150, 200, 250, 300)	DN (40, 50, 80, 100, 150, 200,250, 300)
Type of calibrated flow meters	Ultrasonic, Electromagnetic, Vane, Coriolis	Ultrasonic, Turbine, Rotary, Vortex
Relative Accuracy	±0,05 %; ±0,15 %	±0,15 %; ±0,3 %
Measurement method	Comparison with standard flow meter, weighing method	Comparison with standard flow meter
Medium used for calibration	water/liquid hydrocarbons	air/natural gas
Quantity of reference flow meters	2,3,4	2,3,4,5
Accuracy of temperature measurement	±0,15 %	±0,06 %
Accuracy of pressure measurement	±0,15 %	±0,075 %

FOR GAS FLOW METERS :

Accuracy upto 1% using air or natural gas in the range of 1...50 Bar pressure as the medium. The rig can be used for testing, calibration and verification of flow meters with nominal diameter from 50 mm upto 200 mm with Natural Gas as medium (upto 300mm on air) and flow capacity in the range of G40 upto G1600 (G4000 on air). Our design is compact, modular and corresponds to the latest innovations in the sector.



ULTRASONIC NON-INTRUSIVE PIG DETECTOR ULIS-A

ULIS-A is a non-intrusive ultrasonic pig passage indicator designed for reliable detection of all kinds of pigs used for pigging of filled liquid pipelines. It also provides indication and an estimate of accumulated debris in front of the pig and an estimate of the effectiveness of the pigging procedure. The device is certified as intrinsically safe for use in hazardous areas.

The pig detector comprises of an ultrasonic non-intrusive sensor clamped to the outside of the pipe and a remotely installed electronics unit. The clamp-on design of the sensor allows the device to be used for all pipe sizes. The electronics unit provides visual indication of pig passage as well a dry relay output signal for integration into existing control systems. Besides, the electronics unit provides archiving of up to 120 events of pig detection and automatic reset functions. With the help of specialized software provided, graphical visualization of the approach of the debris plug as well as pig/sphere passage and change in density of the fluid is possible.

The major advantages of the ULIS-A pig detector are:

- The non-intrusive design provides zero pressure drop and no obstruction to the flow or the pig and allows for all kinds of applications - high pressure, sour service etc;
- Any type of pig, sphere etc. can be detected in both directions;
- There are no mechanical moving parts - so no wear or tear, minimum servicing;
- The active nature of the ultrasonic device guarantees reliable pig detection eliminating false alarms due to outside interference.





Additional

Detectors are certified for use in hazardous area and have EC-Type Examination certificate number FTZU 11 ATEX 0144X.

EASY INSTALLATION

1. Transducers of the detector should be installed on the pipelines for detection of the large-size objects (including pigs, separating balls, gauges, diagnostics devices etc.), propelled by the liquid flow in the pipelines under the pressure, for determination of the moment when the object is crossing the pipeline section under control. A corresponding warning signal is sent to the data collection system or to the Advanced Communications System (ACS).
2. Detector also provides the detection of the so-called «paraffin plugs» (referred as plugs) in the oil pipelines.
3. Detector is designed for the pipelines with passage diameter DN from 150 upto 500 mm and from 350 upto 1200 mm, and wall thickness up to 60 mm.
 - a. Detector consists of a system unit (SU) and an electroacoustic active transducer (EAT), attached to the pipeline surface by a mounting tool. EAT is connecting to the SU by a 4-wire cable.
 - b. EAT transmits and receives an ultrasonic signal.
 - c. ULIS-A SU is intended for installation indoor and outdoor of explosion hazard zones.

Parameters of the indicator	Value
Diameter of the pipeline, mm	150 – 1200
Speed of movement of the device of clearing on the pipeline, km/h	1 – 8
Length of the device of clearing, m	1 – 2
Environment temperature	- 40 ... +60 °C
Voltage of device	220 V, 50 Hz
Power consumption, Wt, no more	6
1. "Dry contact" "Event"	30V, 200mA
2. "Dry contact" "Fuse"	30V, 200mA
3. Current output	4 – 20 mA
4. Serial interface	RS-232/RS485
Distance from the gauge up to the electronic block, m, no more	150
Certification	Sensor: II 2G Ex ib IIB T4 Electronics block : II (2)G [Ex ib] IIB

EAT is designed in explosion safe enclosure and can be installed indoors and outdoors in explosion hazard zones according to rules, regulating electrical equipment application in the explosion hazard zones.

Skid design and fabrication

Keeping in line with our principle of 3 E's – Experience, Expertise & Efficiency, Energoflow AG provides its customer's with individually designed, prefabricated and pretested instrumentation skids for various applications.

A typical skid supply project comprises of the following stages:

Design – Our team of engineers provides complete skid design services starting from a conceptual study of the technical assignment and through finished drawings ready for fabrication. The design process includes detailed analysis of electrical, instrumentation, programming and fabrication aspects. In close interaction with the client, we devise optimal solutions for the client's requirements.

Fabrication – At our facilities, our technicians and engineers provide fabrication of skids from a wide range of materials and instruments as per our own design or as per drawings provided by the client. The strict quality control procedures and use of latest technologies guarantees the best results.

Calibration and Controls – Before shipping, our engineers make sure that all the instruments included in the skid are correctly calibrated and properly wired and the control systems are adequately programmed. The client gets a "Plug and Play" module which provides full functionality and best performance.

Testing – All skid systems are vigorously tested at our facilities to ensure proper operation in the field and conformance to the highest international quality standards.

Commissioning – Our team of technicians will assist you with the commissioning of the supplied module at your facility until you are completely satisfied with the skid's operation. We can also provide extensive training of customer's personnel.



Design, Installation and commissioning of flow metering and monitoring systems

Energoflow AG can provide services for turnkey installation of flow metering and flow monitoring systems for various applications. Taking into account the wide range of flow metering solutions developed by us, we can offer the client systems incorporating the latest developments in technologies and data transfer for virtually all types of fluids and process conditions; be it communal water supply systems, leak detection systems for pipelines, custody transfer solutions for hydrocarbons – you name it and we will do it.

Beginning from design, our team works in close collaboration with the client to develop a tailor made solution exactly as per the client's requirements and executes the whole project to the client's utmost satisfaction. We can also provide economically optimized solutions for modernization, development and extension of already existing systems.



Hot-tapping installation and commissioning of ultrasonic flow meters for pipelines upto 6000 mm diameter

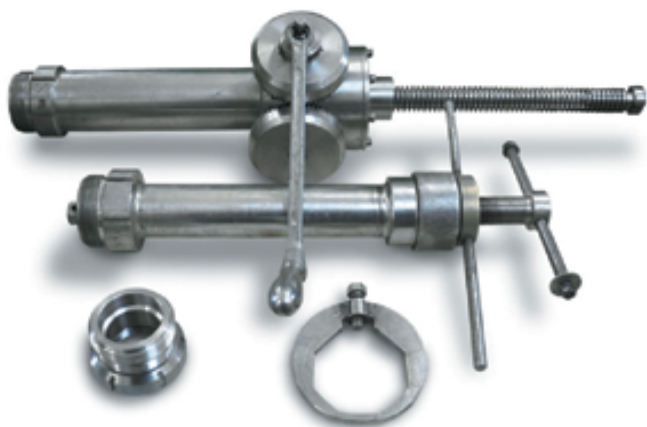
Energoflow AG offers its services for design, installation and commissioning of flow metering units for liquids and gases in-situ on existing pressurized pipelines with diameters as large as 6000mm. The method involves the use of specific techniques and instruments and does not require stopping the fluid flow.

The method is especially effective for large diameter pipelines and in cases where flow metering is required in an existing pipeline while stopping the flow or draining the pipe is not feasible.

The method takes into account the actual geometry of the pipeline at the installation site, process conditions and other local factors, thus providing highly accurate and reliable results.



Hot-tapping device for installation of sensors in pipelines under pressure Energoflow HSID-01



To create metering stations on large diameter pipelines as well as for on-the-site monitoring (eg. during repairs) of flow rate in pipelines in field using standard flow meters, the specialists of Energoflow AG have developed the technology (methodology, tools and gadgets) for installation of insertion-type electroacoustic transducers (EAT) into pipeline walls, which can then be connected to the standard electronics block of the corresponding Energoflow GF or LF series flow meters, thus creating a full fledged flow meter in-situ without stopping the technological process.

HSID-01 is used for high-precision spacing of input/output points of acoustic channels on the surface of the pipeline, for drilling work without depressurization of the pipeline and for hermetic installation and removal of EATs.

The device can be used for installation of sensors in round pipelines as well as those with an expressed ellipticity without stopping the flow or emptying the pipeline.

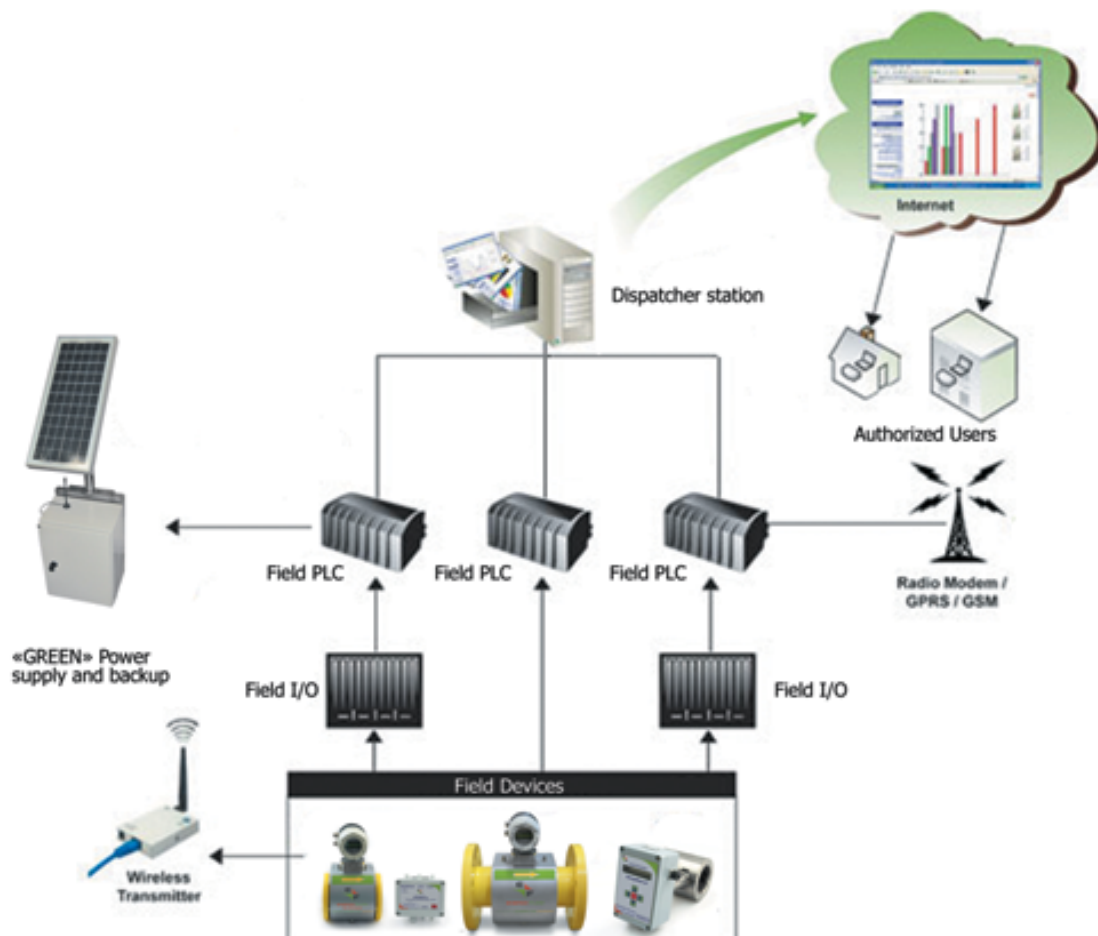
Integrated metering and monitoring systems

Being the supplier of a vast range of fluid monitoring and measurement equipment, Energoflow AG can also design integrated systems tailor-made for your requirements. The purpose of such a system is to collect process data from various remotely located sites and provide access to the consolidated data for analysis to authorized users.

Typically, an integrated system includes:

- field instrumentation for measuring various process parameters at site;
- field PLCs for data accumulation and monitoring of field devices at the site;
- field power supply and backup units;
- site data transmission units;
- dispatcher stations with SCADA system for collecting data from various sites and collating it for user access.

Such systems are indispensable for oil and natural gas pipelines, irrigation systems, municipal water and wastewater networks and other facilities having a number of sites to be monitored spread over relatively large areas.





Additional

Green Power Solutions

Energoflow AG is dedicated to spread the idea of creating a better environment by using ecologically clean solutions.

All our devices can be supplied with "Green Power Solutions" - solar energy based autonomous power supply units capable of providing the full functionality of the equipment. Our engineers can also provide for such solutions for equipment supplied by other manufacturers.

Typically, such a solution would comprise of three major parts:

1. A solar panel of the required size for converting solar energy into the required amount of electrical power.
2. An accumulator battery for storing the generated power.
3. An intelligent controller for smooth operation of the whole system - for regulating the power output and for monitoring the status of the solar panel, the accumulator battery as well as the ambient conditions. The controller can be equipped with a LCD screen for displaying the data. It is also possible to connect to a SCADA system via GPS/GPRS or other networks for remote monitoring of the unit.

In order to design such a solution, the following data would generally be required:

- a detailed specification of the technical characteristics of the equipment to be deployed and powered;
- meteorological data on the site of installation;
- facilities for mounting the solar panel.





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