



# **ENERGOUCHET**

**Ultrasonic Technologies**

## ABOUT THE COMPANY

Our company was established in 1991 and in 1997 was transformed into PJSC "Energouchet". Several well-known enterprises-developers of electronic equipment eg. joint-stock company "Tahion" became a part of PJSC "Energouchet". Design, development and application of microprocessor based measuring devices and systems were chosen as the main areas of activity. More than 30 various measuring devices were developed and introduced since 1991 till 2011.

Today, more than 10 000 devices made by "Energouchet" are successfully used at many enterprises in Ukraine and CIS countries, as well as overseas. The major fields of application include petrochemical industry, utilities sector, water supply and treatment industry, oil and gas pipelines, power sector and metallurgy.

Today, PJSC Energouchet is an established leader in its field, corresponding to the requirements of ISO 9001 and ISO 14001 certifications and employing a staff of more than 300 experienced specialists.

## OUR DEVELOPMENTS

All our developed and produced devices are modern multipurpose microprocessor equipment. Electronic components from leading manufacturers - Analog Devices, Maxim, Intel, Altera, Atmel, Phillips and others are used in devices of PJSC «Energouchet» which guarantees high reliability and durability of products. Long-term experience of our company is used for continuous improvement of the operational and metrological characteristics of our products.

We manufacture accurate and reliable flow meters and accessories based on ultrasonic technology for a wide range of applications including custody transfer.

Presence of a certificated test laboratory in-house and the rigid control throughout the manufacturing procedure allow us to supply reliable and high quality products to the client. We provide guarantee (1 - 2 years) and after guarantee service of our devices throughout their all operational life (not less than 10 years). We are ready to offer the client additional services, including training at the Customer's site, dedicated additional software, technical support hot line , etc.



## COMPANY STRUCTURE

Production Department		Domestic Sales Department	International Sales Department		Administrative Section
PJSC Tahion	Research and Metrology Department		Support desks	Partners	
Manufacturing & Assembly	Design Bureau	Oil applications team	Russia & CIS	LLC«Rosenergouchet», Belgorod	Accounting & Audit
Quality Control & HS	Calibration facilities	Gas applications team	Europe	«Asiaflow group», «Energouchet Kazakhstan» Kazakhstan	Financial Planning
Repairs & workshop		Water & Municipal applications team	MENA & India	LLC«MatritsaK», Georgia, Tbilisi	Legal department
Site installation group		Metallurgy applications team		Al Massoud Oil Industry Supplies and Services Co., Abu Dhabi	Manpower & recruiting
		Miscellaneous applications team		«I.C. Intercomplect Limited» Company, Moscow, Ashgabat.	Logistics

## THE MOST IMPORTANT DIRECTIONS FOR DEVELOPMENT

Ultrasonic liquid flow meters with clamped and inserted sensors can be used for flow measurement of all kinds of liquids - hot and cold water, wasteater, petroleum, mineral oil, milk, oil, acids, alkalis, spirit, etc. The limiting error - from 2 % up to 0,15 %.

Ultrasonic gas flow meters with cut-in sensors for various types of gases, including natural gas, steam, oxygen, argon, compressed air, etc. The limiting error - from 1 % up to 0,25 %.

Ultrasonic level gauges for contactless measurement of liquid level and loose products stored both in reservoirs and in the open trays. The limiting error - from 1 % up to 0,25 %.

Gas flow meters based of standard narrowing devices (diaphragms, nozzles etc.) for measurement of volume of gas, steam and calculation of the same at normal conditions. Algorithms of calculations - according to normative documents (RD-50-213, etc.). The limiting error - from 1 % up to 0,25 % in a range of 50:1 and more.

Telemetric equipment for pipelines: Pig signallers, Voltage transducers for protective potential of major oil and gas pipelines with standard output signal 4...20mA, Ammeters for anode cable circuits with standard output 4...20mA, devices for controlling the integrity of anode cable.

Calibrators for verification and calibration in field as well as in laboratory of digital and dial meters and setpoints for current , voltage and resistance, thermoelectric temperature and resistance transducers.

Heat counters UVR-T modification V which are meant for measuring the flow of heat carrier and consumption of of thermal energy in open as well as closed heating networks which use liquids as heating agent. These are recommended for use in communal networks.

## REPRESENTATIVES

PJSC "Energouchet" has gained a considerable experience in international cooperation with CIS countries, central Asia, European Union and other countries.

Today more than 3000 units of measuring equipment manufactured by PJSC "Energouchet" are installed outside Ukraine in more than 10 countries in CIS, Europe, Central Asia and Transcaucasus.

For more effective entry to the foreign markets PJSC «Energouchet» is actively forming new representative offices outside Ukraine and establishing partnership relationships with companies and firms which expressed the desire to represent interests of PJSC «Energouchet» in other countries.

Presently, the following companies are representing PJSC «Energouchet» outside Ukraine:

- MENA region – Al Massoud Oil Industry Supplies and Services Co., Abu Dhabi
- Georgia–LLC«MatritsaK», Tbilisi;
- Kazakhstan-LLP«KazEnergoUchet», Temirtau, Karagandaregion;
- Russia- LLC«Rosenergouchet», Belgorod;
- Turkmenistan - «I.C. Intercomplect Limited» Company, Moscow, Ashgabat.

According to the signed Agreements on cooperation, Dealer agreements and other documents on cooperation the official Representatives are authorized to:

- negotiate with heads and directors of Ministries, Government agencies, Committees, Groups of companies, Companies, Enterprises, Organizations, Establishments and other legal bodies regarding distribution of PJSC«Energouchet» production;
- bid for tenders and other competitions on purchase of measuring equipment;
- effect sales of production manufactured by PJSC «Energouchet» and provide its servicing and maintenance;
- take part in exhibitions, conferences, forums, advertise and present the PJSC "Energouchet" equipment etc.

## GREEN POWER SOLUTIONS

PJCS "Energouchet" 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



## ULTRASONIC LIQUID FLOW METERS UVR-011

Liquid flow meter UVR-011 is designed to perfection for reliable and accurate measurement of liquid flow in filled pipelines using the pulse-time method. These flow meters can be used for flow monitoring and measurement of potable, technical or river water, oil and petroleum products, heat-transfer agent, solutions of alkalis and acids, warmed fuel oil, heavy oil, stable gas condensate and liquified petroleum gas, effluents, etc. at pressures upto 250 bar. A special version capable of working at fluid pressures upto 400 bar is available for applications like measurement of stratal water from oil wells.

The flow meters of the series are manufactured in various versions for application over a vast range of process conditions:

- for pipelines from DN25 upto DN7000
- for flow speeds as low as 0.1 m/s and as high as 10 m/s
- for ambient temperatures as low as  $-65^{\circ}\text{C}$  and as high as  $+70^{\circ}\text{C}$  and at 100% humidity
- for liquid temperatures in the range of  $-20^{\circ}\text{C}$  upto  $150^{\circ}\text{C}$
- in hazardous areas and hard to access locations
- for clamp-on installation, the process pressure is not a consideration, inline versions are available for liquid pressures as high as 400 bar
- for fluids with a considerable amount of suspended solid particles and bubbles (upto 5% by volume)

The major advantages of the liquid 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 and fast reaction to changes in process conditions



Certificate of conformity



Explosion-proof certificate for  
UVR-011A, UVR-011A-G  
(electrical device) № 2432



Explosion-proof certificate for  
UVR-011 (electrical device)  
№ 2168



Certificate of conformity  
№ UA-MI / 2p-2835-2009



## LIQUID FLOW METER UVR-011 MODIFICATION A1.1/IS FOR HIGH PRESSURE APPLICATIONS

For applications where the medium pressure is very high, eg. measuring the flow of stratal water, we have developed the model UVR-011 A1.1/IS. The device can be used for bidirectional measurement of flow of mediums at pressure as high as 40 Mpa.

These flow meters are available in two versions - with an integrally mounted Electronics unit having a built-in battery which provides full autonomous functionality of the flow meter for more than one year (designation UVR-011A1.1/IS), or with a standard remotely installed Electronics unit(designation UVR-011A1.1/IS-G).

The UVR-011 flow meters are widely used in the downstream applications in the Oil & Gas industry, eg. at extraction wells since they are rugged and can handle aggressive liquids at such high pressure. They are also used for applications like cementing of wells and measurement of flow of chemicals injected into wells at high pressure.

TECHNICAL CHARACTERISTICS			
Parameters	Nominal inner diameter of the pipeline, DN, mm		
	50	80	100
Liquid temperayure, °C	0...150		
Gauge pressure, MPa	16 , 25		
Maximum flow $Q_{max}$ , m³/h	71	180	285
Transitional flow $Q_t$ , m³/h	4,2	6,8	8,5
Minimum flow $Q_{min}$ , m³/h	0,7	1,8	2,8
Threshold flow $Q_{Threshold}$ , m³/h	0,15	0,35	0,35
Relative error of measurement of flow and volume			
$Q_t \dots Q_{max}$ , %	± 1		
$Q_{min} \dots Q_t$ , %	± 4		
$Q_{threshold} \dots Q_{min}$	calculation is conducted with non standardized accuracy		
For the flows less $Q_{threshold}$	volume is not accumulated (Flow is taken as equal to zero)		



## ULTRASONIC LIQUID FLOW METERS UVR-011 MODIFICATION A1

Ultrasonic liquid flow meters UVR-011 A1 provide monitoring and measurement of flow of liquids in one or two of pipelines with the use of in-line sections or inserted sensors.

The flow meter can also be used as a full fledged stand alone liquid flow meter. The flow meters are designed for single channel and two-channel operation ( four channels under special order). They consist of the electronic unit (EU) and one or two pairs of EAT: inserted sensors or sensors positioned into the in-line section. These EAT are connected to the EU by signal cables.

TECHNICAL CHARACTERISTICS									
Volume flow rate m <sup>3</sup> /h	Pipe nominal diameter, mm								
	32	40	50	80	100	150	200	250	300
Q <sub>max</sub>	30	45	75	180	285	640	1130	1770	2550
Q <sub>t</sub>	2,0	2,5	3,0	5,0	6,0	9,0	12	15,0	18,0
Q <sub>min</sub>	0,20	0,35	0,5	1,3	2,0	4,0	8,0	12,4	17,8
Q <sub>threshold</sub>	0,015	0,025	0,035	0,1	0,15	0,35	0,6	0,9	1,3

These flow meters are designed in two versions:

- UVR-011A1/I(IS)- powered by a galvanic battery.
- UVR-011A1/I(IS)-G- powered by remotely installed Power Supply and Communication Unit (PSU).



EU of UVR-011A1/I(IS) is equipped with the interface RS-232 for connection with computer.

Flow meters UVR-011A1/I(IS)-G are equipped with the interface RS-232 for connection with computer. Flow meter forms pulse-frequency signal and signal of direct current 4... 20 mA. Modification A1 is equipped with interface Hart.

EU of UVR-011A1.1(2)/I(IS) flow meters is equipped with keypad and LCD display (hereinafter – LCD).

EU of UVR-011A1.1(2)/I(IS)-G flow meters is designed as hermetic - without controls and display unit. Data reading from the hermetic EU is performed by PSU ((PSU) is equipped with the interface RS-232/RS-485 ). PSU with the LCD display are included in the set of UVR-011A1.1(2)/I(IS)-G flow meter and connected by two-wire connection to the EU.

The flow meters are also available with a built in battery on board for installation at sites where power is not available. The lifetime of the battery is more than one year.

### ADVANTAGES :

- Simplicity and reliability in the operation;
- Wide range of the measurements of volumetric flow rate (1:150);
- The created archives contained hourly data for past 1024 hours (more than 42 days);
- Adjustment of flow meter in the complete set with in-line section is carried out on manufacturer;
- There is no contraction inside the in-line section;
- Therefore flow meter does not create the resistance to the flow of liquid and does not introduce disturbances into the flow;
- Automatic adjusting of the signal level;
- Flow meter is equipped with pulse-frequency output, analog output (on order), **and interface RS-232**;
- Flow meter with the autonomous power supply works up to 4 years without the replacement of battery;
- Flow meter can be easily integrated into automated SCADA systems and existing control systems.

## ULTRASONIC LIQUID FLOW METERS UVR-011 MODIFICATION A2

The flow meters of modification A2 are manufactured in various versions – in-line sections, inserted sensors installation and clamp-on type.

**Flow meters UVR-011 A2 with clamp-on sensors, inserted sensors and in-line sections** are designed for use in field conditions for monitoring and measurement of flow of liquids eg. portable, technical or river water, heat-transfer agent, solutions of alkalis and acids, oil and petroleum products, heated fuel oil, tar, energy oil, coke-chemical raw material, stable gas condensate and liquefied gas, effluents, and also liquid ammonia, saltpeter, etc.

Flow meters are designed for single channel and two-channels( four channels under special order). Each channel can be used independently to account for liquid in different pipelines.

With each channel of flow meter two sensors are used. Sensors are placed in a straight part of pipeline, which is protected from precipitations.

**Clamp-on sensors** (they are mounted on the surface of the pipe), **inserted sensors** (which are inserted into apertures, made in the pipe wall) can be used for larger pipe diameters (upto pipe DN 4m, larger sizes under special order).

MAXIMUM PERMISSIBLE RELATIVE ERROR OF MEASUREMENT OF FLOW RATE AND FLUID VOLUME		
Type EAT	For each chann	
	$Q_3 \geq q \geq Q_2$	$Q_2 > q \geq Q_3$
In-line sections,	$\pm 1,5\%$	$\pm 4\%$
inserted sensors	$\pm 1\%$	$\pm 4\%$

INNER DIAMETER OF THE PIPELINE	
Type EAT	DN,mm
Clamp-on sensors	From 50 upto 3000
inserted sensors	from 300 upto 7000
in-line sections	from 25 upto 1600

TECHNICAL CHARACTERISTICS		
Parameter	Clamp-on sensors	Inserted sensors
Inner diameter of the pipeline, mm	70...3200	25...4000
Accuracy of flow measurement, %	$\pm 1,0; \pm 1,5$	$\pm 0,5; \pm 1$
Range of flow velocity measurement, m/s	0,1 -10	0,1 -10
Range of operating temperatures for the sensors, °C	- 20...120(250)	- 20...150(250)
Range of operating temperatures for the electronic unit, °C	- 20...60(75)	- 20...60(75)
Range of operating temperatures for PSU, °C	5... 40(75)	5... 40(75)
Supply voltage, V	»220;10±24	»220; 10±24
Required power is not more, W	10	10

Power supply and communication unit (PSU) is equipped with the interface RS-232/RS-485 for connection with computer. Cable length upto 300m and should be connected from sensors to EU. Flow meter forms pulse-frequency signal and signal of direct current 0...5 or 4... 20 mA, proportional to volumetric flow rate.

### ADVANTAGES :

**In-line sections** are intended for medium gauge pressure upto 1,6 MPa, with liquid temperature from 0°C... 150 °C, for inner pipeline diameter (DN) from 200...1600 mm and can be installed in places, exposed to climatic influences (damp basements, wells).

Limits of permissible main relative error for flow measurement and fluid volume is:  
( from  $Q_1$  to  $Q_2$  )-  $\pm 0,25\%$  / ( from  $Q_2$  to  $Q_3$  ) -  $\pm 0,15\%$

The relative measurement error of charge and volume lays in limits: from  $Q_1$  up to  $Q_2$  - 4 %, from  $Q_2$  up to  $Q_3$  - 1 %.

At volumetric measurements from threshold flow  $Q_{\text{Threshold}}$  up to  $Q_1$  are not normed.

At flowrates less than  $Q_{\text{Threshold}}$  volume is not calculated (the flowrate is taken to be zero).

- Simplicity and reliability in the operation;
- Wide range of the measurements of volumetric flow rate (1:150);
- The created archives contained hourly data for past 1024 hours (more than 42 days);
- Adjustment of flow meter in the complete set with in-line section is carried out on manufacturer
- There is no contraction inside the in-line section;
- Therefore flow meter does not create the resistance to the flow of liquid and does not introduce disturbances into the flow;
- Automatic adjusting of the signal level;
- Flow meter is equipped with pulse-frequency output, analog output (on order), **and interface RS-232, RS-485;**
- Flow meter with the autonomous power supply works up to 4 years without the replacement of battery;
- Flow meter can be easily integrated into automated SCADA systems and existing control systems;

## PORTABLE ULTRASONIC LIQUID FLOW METER UVR-011 MODIFICATION A2-K-M

The portable flow meter UVR-011 A2-K-M with clamp-on sensors is designed for use in field conditions for monitoring and measurement of flow of liquids eg. water, petroleum and petroleum products, industrial chemicals, solvents, etc. in fully filled pipelines. The set comes in a handy, easy to carry durable case and can be used for:

- single channel ( accuracy  $\pm 1.5\%$ ) and twin channel ( accuracy  $\pm 0.5\%$  ....  $\pm 1\%$  ) flow measurements on a single pipeline
- real-time comparison or summation of flows in two adjacent pipelines (single channel mode per pipeline)

TECHNICAL CHARACTERISTICS		
Parameter		Value
Pipe inner diameter, mm		70-3200
Accuracy of flow measurement, %		$\pm 1,0$ ; $\pm 1,5$ ( $\pm 0,5\%$ )
Range of flow velocity measurement, m/s		0,1-10
Range of operating temperatures for the sensors, °C		-20...+120
Range of operating temperatures for the electronic unit, °C		+5...+45
Relative error of measurement of expenditure and volume, mm		$\pm 0,2$
Supply voltage, V		220 or 6,5
Required power is not more, W		100

This set is a boon for repair teams and field engineers. The built-in digital oscillograph facility and inline calibration function make installation and commissioning very fast, simple and easy.

The flow meter can also be used as a fullfledged stand alone liquid flow meter for in-situ installations in remote places.

THE COMPLETE SET COMPRISES OF THE FOLLOWING:		
1	LF 2P2 – Electronic unit (twin channel) with LCD display and keyboard	1 pc.
2	Electroacoustic transducer	4 pcs.
3	Removable plates (for clamp-on installation)	16 pcs.
4	Power unit / Battery charger 5V, 1A	1 pc.
5	Thickness gauge	1 pc.
6	Water-resistant grease	1 pc.
7	Accumulator charger	1 pc.
8	Tapping hammer with screwdriver	1 pc
9	Measuring roulette	1 pc
10	Standards strip for calibration of thickness gauge	1 pc
11	Connecting cables for transducers with connectors, 2 x 10 m	2 sets
12	Carrying case	1 pc
13	Accessories for installation on pipes (chains and clamps)	1 set

Manufacturer's warranty certificate, instruction manual and software CD with cable (for connecting the electronic unit to PC for data transfer and configuration) are provided with each set.



## ULTRASONIC HEAT&WATER COUNTER UVR-T M2

Ultrasonic Heat&Water Counter UVR-T M2 is intended for measurement of the thermal power and quantity of heat energy in accordance with current regulations at industrial enterprises and communal service installations:

- volume, mass, volumetric and mass flowrate of heat carrier in supply, reverse and feeded pipelines;
- operating time and downtime;
- temperatures, difference of temperatures
- pressures

Heat&Water Counters are designed for commercial and technological accounting of the thermal power, water and other fluids, can be included to the measuring system, ACS system and etc.

TECHNICAL CHARACTERISTICS	
Name	Parameter
The type and quantity of measurement channels:	
- channel of flow measurement	1 or 2
- channels of pressure measurement	upto 3
- channels of temperature measurement	upto 3
Number of controlled of heat supply systems	1
Temperature measurement range	from 0 upto 150 °C
Temperature difference measurement range	from 5 до 145 °C
Nominal diameter of pipeline (DN):	
- inserted EAT	from 300 upto 4000 mm
- inserted section	from 25 upto 600 mm
- clamp-on EAT	from 70 upto 3200 mm
Range of flow rate measurement	from 0,1 upto 10,0 m/s
Relative error of flow measurement	±1% - for inserted EAT; ±1,5% - for clamp-on EAT;
Gauge pressure in a pipeline for inserted EAT	not more than 2,5 or 6,3 MPa
Channels of signal input RTD:	
Number of Channels / Sensor Type	upto 3 / RTD-Pt100
Input channels of continuous signals DC:	
- number of Channels	upto 3
- ranges	4÷20 mA /Rinput ≤500 Ohm; 0÷5 mA /Rinput ≤2 kOhm;
- power Supply of sensors	built-in power supply 24V
Absolute error of the RTD signal conversion	not more than ±0,1 °C
The reduced basic error of signal conversion of pressure sensors	not more than ±0,02 %
Indicator	graphical, LCD, size 128 x 64 pixels
Keyboard	membranes, 20 keys
Node of pulse-frequency output	pulse-frequency signal, type "dry contact"
Power generator	up to 15 V, current 0.05 A; not less than 0.25 W;
Node of the current output:	Standardized DC signal proportional to the momentary flow rate
Measurement range	4 ÷ 20 mA or 0 ÷ 5 mA
Communication Channel:	Interface RS-232 или RS-485
exchange protocols	ModBus RTU
speed of exchange	4800; 9600; 19200; 38400; 57600; 115200 bit/s;
Power Supply:	~220 V; 50 Hz; 5 VA / = 12 V; 3,5 W;
Cable from RTD to EU	PK-50; PK-75; MKESHv 1x2x0,75 or analog
capacitance / inductance line	not more than 15 nF / not more than 0,2 mHz
cable length	not more than 300m
Cable from RTD to EU	PVCe 2x2x0,75 or analog; length not more than 100m
Operating conditions: EU	Temperature from 5 upto 50 oC; humidity upto 80%;
EAT	Temperature from - 25 upto 150 oC; humidity upto 100%;
Ingress Protection EU/EAT	IP56 / IP57

## Features:

Heat&Water Counter implements the ultrasonic time -pulse method of flow measurement. Configuration is performed with built-in keyboard or via RS-232/485 from PC. The settings parameters and archive data are protected from unauthorized changes with the help of a password system and hardware protection of configuration from changes. Occurance and time of change is recorded in the interventions archive in the non-volatile memory of the counter.

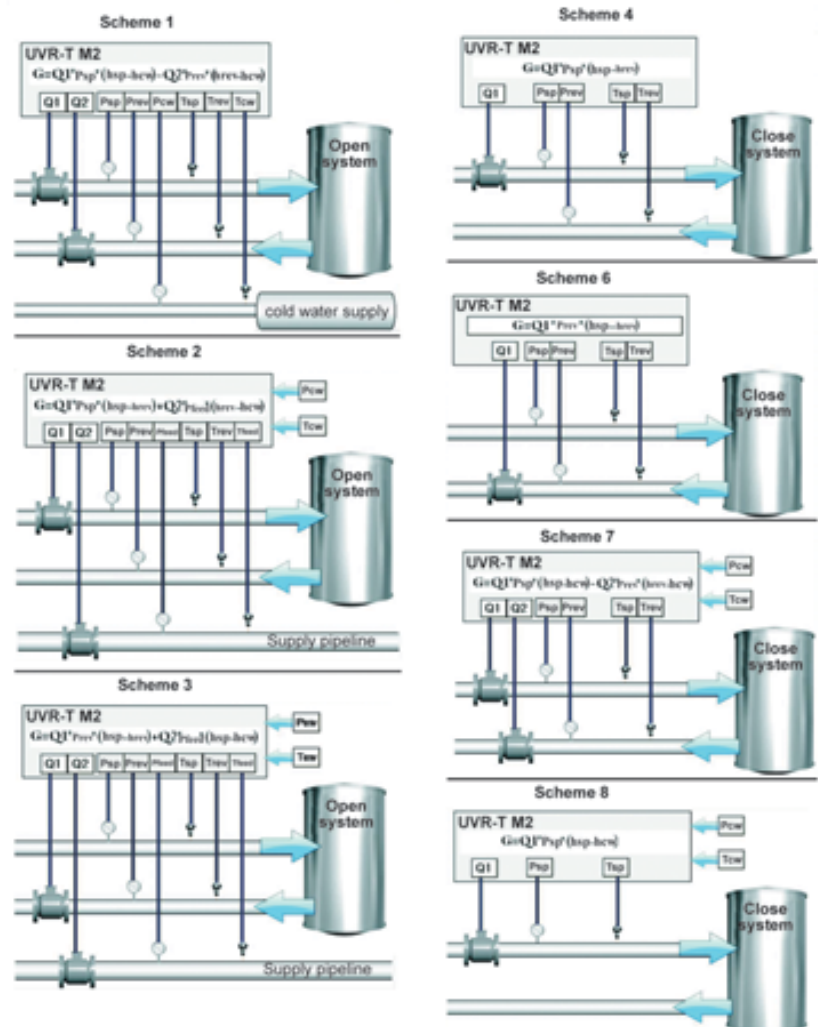
Following data is stored in the nonvolatile memory of Heat&Water Counter :

- quantity of thermal power;
- quantity of thermal energy;
- volume and mass of heat carrier;
- average values of pressures and temperatures of heat carrier;
- operating time, downtime and lack of power;
- events archive.

Heat&Water Counter is equipped with software for data readout, formation and report output in the form of protocols, diagrams and charts.

## LIMITS OF RELATIVE ERROR OF HEAT&WATER COUNTER DURING THE MEASUREMENT OF THE QUANTITY OF HEAT DEPENDING ON THE TEMPERATURE DIFFERENCE IN THE FLOW AND REVERSE PIPELINES

Heat metering scheme	Interval of the temperature difference $\Delta T$ °C
For single-line heat counters, Scheme 4,6,8	from 5 (on) upto 10
	from 10 (on) upto 20
	from 10 (on) upto 20
For dual-line heat counters, Scheme 1...3, 7	from 5 (on) upto 10
	from 10 (on) upto 20
	from 20 (on) upto 145

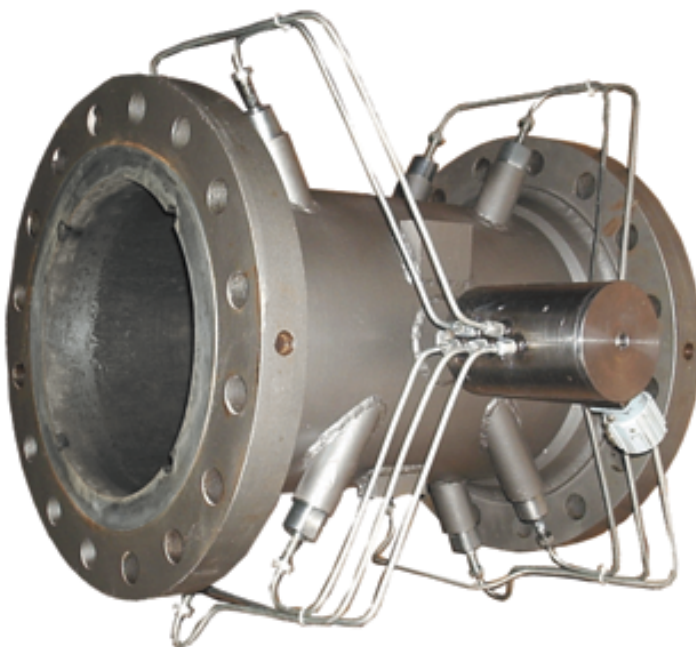


## ULTRASONIC FLOW METERS UVR-011 MODIFICATION A5

For applications requiring very high accuracy, we can offer the UVR-011 modification A5 liquid flow meter. The device can be used for reliable and accurate measurement of speed of the fluid, flow rate and total flow in filled pipelines having a nominal inner diameter in the range of 100 upto 300 mm and at pressure upto 1.6 MPa. The device is equipped with an RS232 interface for data output as well as a pulse output.

The flow meters are precalibrated on water. Under special order, they can be precalibrated on liquid hydrocarbons or other media as per the client's requirement.

TECHNICAL CHARACTERISTICS:					
Parameter	Inner diameter of Pipeline, mm				
	100	150	200	250	300
Accuracy of flow measurement, %, not less than					
+/- 0.15 % for flow range	280-140	600-300	1200-600	1800-900	2500-1250
+/- 0.25 % for flow range	280-28	600-60	1200-120	1800-180	250-250
Repeatability, %	0,04				
Medium temperature, deg. C	-30...+150				
Medium pressure, MPa	1,6				
Supply voltage, V	220				
Distance between electronics unit and Inline section, m, not more than	150				



## ULTRASONIC (DOPPLER) LIQUID FLOW METER UDR-011

Ultrasonic Flow meters UDR-011 are designed for measuring flow velocity, volumetric flow rate and liquid volume, transported through pipelines in the forward or reverse direction using the Doppler effect. They can be used for measuring acoustically opaque fluids – slurries, liquids with suspended particles and other contamination.

The flow meter comprises of two clamp-on electroacoustic transducers and a remotely installed electronics unit and can be used to measure bidirectional flow of fluids containing not less than 0.1% of suspended particles or gas bubbles.

These flow meters can be installed on pipes having wall thickness of 2 to 20 mm made of various acoustically transparent materials: steel, cast iron, cement, plastic etc.

TECHNICAL CHARACTERISTICS	
Parameter	Value
Inner diameter of the pipeline, mm	40-1600
Range of velocity measurement, m/s	0,1-6
Accuracy of the measurement, %	2
Range of operating temperatures for the sensors, °C	-20...+100
Supply voltage, V	220 or 12
Consumed power, W	12
Distance between sensors and electronic unit, m, not more	70

The major advantages of the Ultrasonic Flow meters UDR-011 are:

- Easy installation and simplicity of use;
- Applicable for measurements in pipelines even if the pipe walls are greatly corroded or have a thick layer of sediment;
- Easy integration into all kinds of process management systems;
- Reliable and accurate measurement

Flow meters UDR-011 are produced according to TU U 24487975.003-97.

Flow meters are registered in the State Register of measuring devices, approved for use in Ukraine, under the number U872-12

These Explosion proof Flow meters meet the requirements of DSTU 7113, GOST 22782.5.



Certificate of conformity  
№UA-MI / 2p-396-2000  
dated 7 March 2000



Certificate of conformity  
№UA-MI / 1-213-98  
January 4, 1998



Certificate of conformity  
№ UA-M1 /1-213-2003

## SECONDARY DEVICE - FLOW COMPUTER VK-011 MODIFICATION 7

VK-011 calculates the flow rate and volume of fluid flowing in the standard weirs.

VK 011 computer receives and processes signals from the transmitter with digital HART protocol signal or standardized current output 4 ... 20 mA.

VK-011 provides:

- converting output signals from the transducers or pressure level with a periodicity not more than 1s, calculation of value of pressure;
- time measurement and indication;
- automatic transition to "winter", "summer" time, as per configuration;
- registration of alarms and emergency situations, the formation of the corresponding archives;
- registration of configuration changes and settings, the storage of these records in the archive "operator intervention";
- accumulation of archives that contain information on the volumes of fluid that have passed through the weir, spillway or pipeline;
- display on a liquid crystal display (LCD) by choice of the operator any of menu items of the instrument;
- displayed on the LCD: liquid flow rate; fluid level; the archives: time, date, settings, the error flags.



VK-011 is adapted for operation in the ACS and can be connected to PC (either directly or through a modem connection).

The metrological characteristics of the VK-011 controller:

The permissible absolute error limit for measurement of time is  $\pm 2$  s per day.

The permissible basic relative error limit when working with primary transducers having a digital output signal  $\pm 0,02\%$

The permissible basic relative error limit of converting the DC signals from gauges or pressure transducers, measuring time and calculating the flow rate and volume of fluid are equal.

- for level range from  $0,2 \cdot h_{MAX}$  up to and including  $h_{MAX} - \pm 0,1\%$ ;
- for level range from  $0,1 \cdot 0,2 \cdot h_{MAX}$  to  $h_{MAX} - \pm 0,2\%$ .

## LIQUID FLOW METER FOR WEIRS (CHANNELS)

Wastewater in treatment plants is usually transported by open channels, in which water flow by force of gravity at low speed. For measuring of the flow of wastewater in this case PJSC "Energouchet" recommends the "method of variable level". The meter is a combination of the primary device – a level gauge, which measure the level of wastewater, and the secondary device, which calculates flow of waste water based on the level measurement taking into account information about the metering section – built in channels, Venturi and Parshall weirs etc.

The primary instrument - Radar sensor VEGAPULS WL61

Level gauge VEGAPULS WL 61 is designed for continuous level measurement. It can also be used to measure the level at the pumping stations and overflow basins, for flow measurement in open channels, as well as to control the level of water pond. High degree of housing protection provides the ability for outdoors installation.

A view of level gauge VEGAPULS WL61 is shown in figure below:



Main technical characteristics and advantages:

- measuring range up to 15 m;
- high metrological characteristics - liquid level measurement error:  $\pm 2$  mm or 0.2% of the set measuring range;
- measurement accuracy does not depend on the process conditions and the environment;
- Easy installation and simplicity of use;
- Easy integration into all kinds of process management systems by HART Protocol (standard), 4...20 mA;
- housing version IP68;
- using of non-contact measurement method which minimizes the need for servicing;
- quick installation for operation;
- Operating temperature  $-40$  to  $+80$  ° C.

## 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:

1. 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.
2. Any type of pig, sphere etc. can be detected in both directions.
3. There are no mechanical moving parts - so no wear or tear, minimum servicing.
4. The active nature of the ultrasonic device guarantees reliable pig detection eliminating false alarms due to outside interference.



## EASY INSTALLATION

- 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).
- Detector also provides the detection of the so-called «paraffin plugs» (referred as plugs) in the oil pipelines.
- 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.
- 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.
- EAT transmits and receives an ultrasonic signal.
- ULIS-A SU is intended for installation indoor and outdoor of explosion hazard zones.

TECHNICAL CHARACTERISTICS	
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.



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

## ULTRASONIC GAS FLOW METERS GUVR-011

Ultrasonic flow meters GUVR-011 are designed to measure the operating conditions of the flow rate, volume flow rate and the volume of natural gas and other gases, which are transported through pipelines of circular cross section in the forward or reverse direction, as well as to measure the operating time and downtime.

Flow meters GUVR-011 are manufactured by company "Tahion", Ukraine, Kharkov, in accordance with technical requirements TU U33.2-24487975-024: 2010

Flow meters are registered in the State Register of measuring devices approved for use in Ukraine under the number U3038-12.



UA-MI / 1-2636-2010 Certificate of approved type of measuring instruments for ultrasonic gas flow meters GUVR-011



Permission to start the operation at site №1215.08.30-31.62.4. Valid from 12.05.2008 to 12.05.2011

PJSC "Energouchet" 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  $-60^{\circ}\text{C}$ ) as well as for hot locations (ambient temperature  $+70^{\circ}\text{C}$ ).

The 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  $-65^{\circ}\text{C}$  and as high as  $+70^{\circ}\text{C}$
- In hazardous areas and hard to access locations
- When the pressure in the pipeline is as high as 160 bars

Flow meters are approved for use in hazardous areas by Gosgorpromnadzor, Ukraine № 312.12.63-26.51

The major advantages of the gas flow meters are:

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



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.

FLOWRATE OF FLOW METERS WITH AN IN-LINE SECTIONS						
DN, mm	Demension type	Volume flowrate, m³/h				Maximal Q <sub>max</sub>
		Threshold Q <sub>thr</sub>	Minimal Q <sub>min</sub>	Transition, Qt		
				1,00%	0,50%	
50	G100	0,7	1	8	11	160
80	G250	1,9	2,7	20	27	400
100	G400	3	4	33	44	650
100	G650	3	4	33	50	1000
150	G1000	7	10	80	110	1600
150	G1600	7	10	80	125	2500
200	G1600	12	17	125	170	2500
200	G2500	12	17	125	200	4000
250	G2500	19	26	200	270	4000
250	G4000	19	26	200	325	6500
300	G4000	28	40	325	440	6500
300	G6500	28	40	325	500	10000
400	G6500	47	67	500	670	10000
400	G10000	47	67	500	800	16000



FLOWRATE OF FLOW METERS WITH AN INSERTED SENSORS					
DN, mm	Demension type	Volume flowrate, m <sup>3</sup> /h			Maximal Q <sub>max</sub>
		Threshold Q <sub>thr</sub>	Minimal Q <sub>min</sub>	Transition, Q <sub>t</sub>	
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
600	G16000	111	160	1250	25000
700	G16000	111	160	1250	25000
800	G25000	177	250	2000	40000
1000	G40000	288	400	3250	65000
1200	G65000	470	670	5000	100000
1600	G100000	700	1000	8000	160000
2000	G160000	1110	1600	12500	250000
2500	G250000	1900	2700	20000	400000
3000	G400000	2800	4000	32500	650000
4000	G650000	4700	6700	50000	1000000



LIMITS OF PERMISSIBLE MAIN RELATIVE ERROR OF FLOW METERS				
Value of flowrate	Limits of permissible main relative error, %			
	In-line section		Inserted sensors	
	Two pair	One pair	Two pair	One pair
from Q <sub>min</sub> upto Q <sub>t</sub>	± 1*(2)	± 3	± 4	±5
from Q <sub>t</sub> upto Q <sub>max</sub>	± 0,5*(1)	± 1,5	± 2	±3

\*- for variation GUVR -011 A2.2/BC/.../0,5%

## GAS FLOW METERS GUVR-011 FOR HIGH PRESSURE

A special version of ultrasonic gas flow meters GUVR-011 has been designed for measuring flow velocity, volumetric flow rate and volume of gaseous substances (gases) transported through pipelines in the forward or reverse direction at high pressure (upto 16 Mpa), eg. at gas wells and underground gas reservoirs.

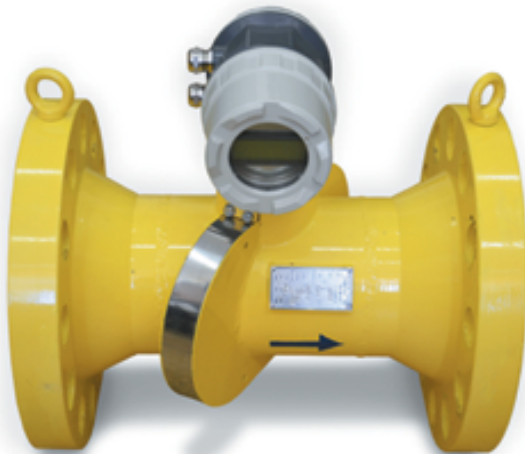


Appearance of ultrasonic gas flow meter GUVR-011 for high pressure (up to 16 MPa)

## HIGH ACCURACY ULTRASONIC FLOW METERS GUVR-011 A4.4

Four-channel ultrasonic gas flow meter GUVR-011 A4.4 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 / c. 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 COUNTER GUVR-011 A2.2/IS/314 WITH AUTONOMOUS POWER.

The main technical features of GUVR-011 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 as per GOST 5542 for density range 0.67 to 1 kg/m<sup>3</sup> and other gases with density not less than 0.4 kg/m<sup>3</sup>
- 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 are certified intrinsically safe as per GOST 22782.0-81, GOST 22782.5-78 and has the protection marking "1ExibII VT4H" 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%
Flow meter for range of flow rate	from Qmin to Qt (included)	± 2%
Pulse outputs:		Type "Dry Contact" Voltage from 5 to 30 V, current upto 20 mA
	- two low-frequency (LF), to 20 Hz;	
	- one high (HF), to 2 kHz;	
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 transfer protocol ModBus RTU; Data rate upto 115200 bits/s;
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

## SKID MOUNTED GAS ACCOUNTING UNITS

Measurement station of flow rate and volume of gas (hereinafter referred as the measurement station or PIRG) execution platform is a prefabricated factory product and is designed for measurement of flow rate and volume of natural gas, calculated to standard conditions, registration, archiving and remote data transmission to dispatcher or remote operator during gas transfer to the consumer. PIRG is mounted at the inlet of the gas distribution station.

Structurally PIRG consists of two platforms with the equipments:

- Platform with a fine mesh filter of gas (hereinafter referred as filter platform or PF, fig. 1)
- Platform with two ultrasonic counters, that provided measuring of flow rate and volume of gas in the "winter" and "summer" periods (hereinafter referred as measurement platform or PI, fig. 2)

Measurement stations can be manufactured for pipelines with diameter from 80 upto 300 mm, with pressure upto 6,3 MPa and throughput from 1 upto 6500 m<sup>3</sup>/hour.

Three versions of filter platforms have been developed:

- Platform, type PF-30-30/30 (nominal diameter DN300, isolation armature DN300, external connection flanges DN300);
- Platform, type PF-20-20/20 (filter- DN200, stopvalves – DN200, external flanges – DN200);
- Platform, type PF-20-15/15 ( filter – DN200, stopvalves – DN150, external flanges – DN150).

Four modifications of measurement platform, viz.:

- Platform, type PI-30/15-30 ( counter for "winter" period G4000-DN 300, counter for "summer" period G1000-DN150, external connection flanges DN300);
- Platform, type PI-25/80-20 ( counters "winter"/"summer"-G2500-DN250/G250-DN80, external flanges DN200);
- Platform, type PI-25/50-20 (counters "winter"/"summer"-G2500-DN250/G100-DN50, external flanges DN200);
- Platform, type PI-15/80-20 (counter "winter"/"summer"- G1000-DN150/G250-DN80, external flanges DN150).

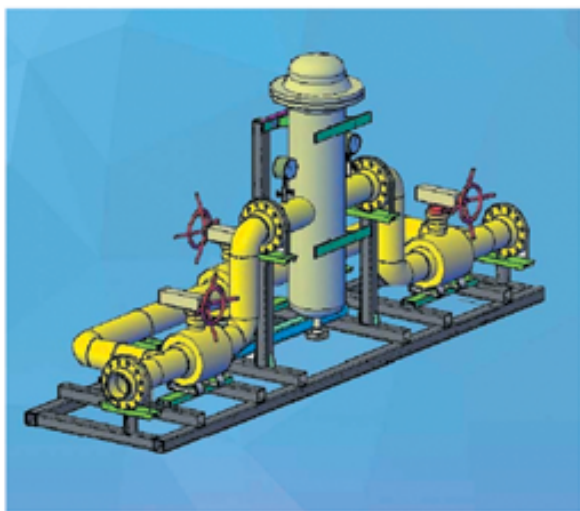


Figure 1. Filter Platform

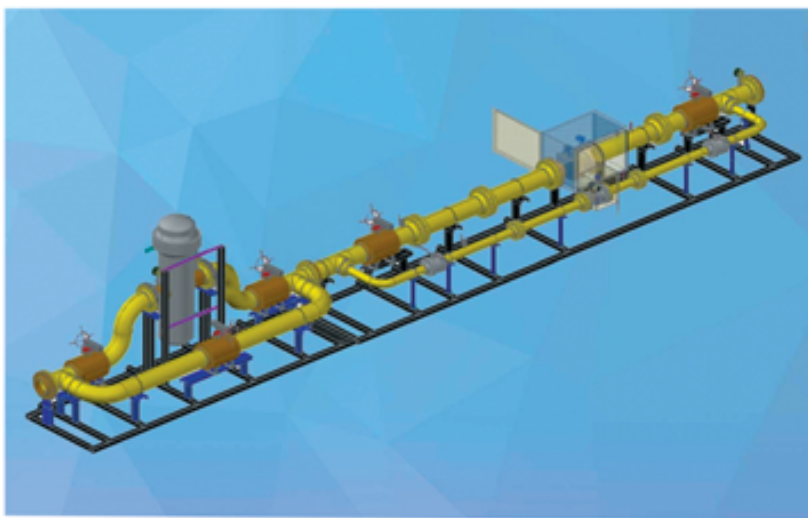


Figure 2. Measurement Platform for gas flow rate

Measurement Platform includes:

- Base (platform) of welded steel structure
- Gas counters: the basic for the "winter" costs and the counter for small "summer" flows.
- Measuring lines with straight runs are located immediately before and after the counters in compliance with requirements of SOU 49.5-30019801-2014, DSTU GOST 8.586.1 and DSTU GOST 8.586.2.
- Four ball valves, type CTK-2.1.1 at the input and output of each counter.
- Set of standard mounting products (pipes, tees, adapters, tapping)
- Two sets of pressure and temperature transducers with isolation and mounting armature .
- Additional equipment and facilities (Flow preparation device«Zanker», control and measurement equipment, protective cabinets).

## CALIBRATION AND PROVING RIGS APU-G FOR GAS FLOW METERS

Calibration and proving rigs intended for calibration and verification of turbine, rotary, ultrasonic and vortex flow meters, flow meters and counters of natural gas, air, other gases and mixtures with a pulse output signal.

Set to UVR-011A2-k-m			
Modification	Name	the upper limit of measurement, m <sup>3</sup> /h, not more	the lower limit of measurement, m <sup>3</sup> /h, not more
PU-G-105/6,0-T	for verification of household meters	6	0,016
APU-G-105/10	for verification of household meters	10	0,05
APU-G-110/650M	closed contour installation	650	0,1
APU-G-110/1000B	closed contour installation	1000	0,16
APU-G-110/1600B	closed contour installation	1600	0,25
APU-G-110/2500B	closed contour installation	2500	0,5
APU-G-011/650	for verification of industrial meters	650	0,1
APU-G-011/2500	for verification of industrial meters	2500	0,5
APU-G-011/6500	for verification of industrial meters	6500	1,6
APU-G-011/10000	for verification of industrial meters	10000	2,0

### 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.

TECHNICAL FEATURES	
Parameter	Proving rigs for Gases
Capacity (m <sup>3</sup> /h)	250, 600, 1200, 2500, 10000
DN of calibrated flow meters	DN (40, 50, 80, 100, 150, 200, 250, 300)
Type of calibrated flow meters	Ultrasonic, Turbine, Rotary
Relative Accuracy	±0,15 %; ±0,3 %
Measurement method	Comparison with standard flow meter
Medium used for calibration	air/natural gas
Quantity of reference flow meters	2,3,4,5
Accuracy of temperature measurement	±0,06 %
Accuracy of pressure measurement	±0,075 %

The principle of the functioning of the rig is as follows:

By switching on one or more fans a flow of the medium is generated in the piping of the rig. The flowrate and pressure of the medium is regulated by controlling the pump, the fan and a diaphragm valve. The flow thus generated is measured by the reference flow meter as well as the flow meter being verified or calibrated. Reference pressure and temperature transmitters are used for determining the working conditions. The accumulated pulse quantity over a number of cycles is recorded and the total measured volume at standard temperature and pressure is calculated for both the flow meters. The comparison of the results gives a reliable measurement of the accuracy of the meter under verification. Different reference flow meters are used for different ranges of measurement which also improves the accuracy and reliability of the results.



## CALIBRATION AND PROVING RIGS APU FOR LIQUID FLOW METERS

- APU-011/40 with flow rate from 0,085 upto 40 m<sup>3</sup>/h
- APU-011/80 with flow rate from 0,085 upto 80 m<sup>3</sup>/h
- APU-011/180 with flow rate from 0,3 upto 180 m<sup>3</sup>/h
- APU-011/600 with flow rate from 0,5 upto 600 m<sup>3</sup>/h

TECHNICAL FEATURES	
Parameter	Proving rigs for Gases
Capacity (m <sup>3</sup> /h)	40,80,180, 600
DN of calibrated flow meters	DN (20, 25, 32, 40, 50, 80, 100, 150, 200, 250, 300)
Type of calibrated flow meters	Ultrasonic, Electromagnetic, Vane, Coriolis
Relative Accuracy	±0,05; ±0,15
Measurement method	Comparison with standard flow meter, weighing method
Medium used for calibration	Water
Quantity of reference flow meters	2,3,4
Accuracy of temperature measurement	±0,15 %
Accuracy of pressure measurement	±0,15 %

Designed for automated testing, grading and calibration of meters, flow meters and mass meters of liquid using two measurement methods:

- method of comparison with standard flow meter (mode 1);
- method of static weighing (mode 2).

**In mode 1** counters and flow meters with relative accuracy of volumetric flowrate and volume measurement ±0,3 % and more are tested or calibrated.

**In mode 2** the flow meters including mass meters with relative accuracy ±0,05% and more are tested and calibrated.

**In mode 3** is used in the calibration of reference flow transducers.



## SKID DESIGN AND FABRICATION

PJSC “Energouchet” 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

PJSC “Energouchet” 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

PJSC “Energouchet” 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.

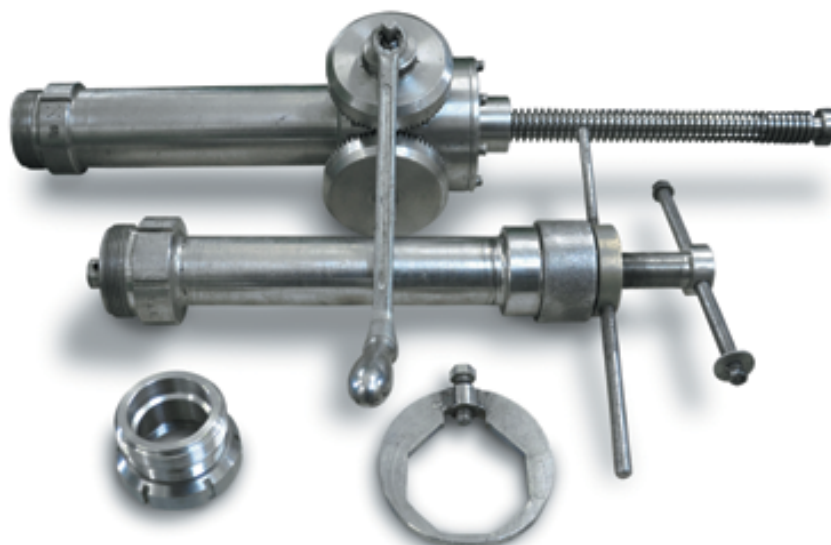


### HOT-TAPPING DEVICE FOR INSTALLATION OF SENSORS IN PIPELINES UNDER PRESSURE PJSC “ENERGOUCHET” HSID-01

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 PJSC “Energouchet” 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 thus creating a fullfledged 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 elasticity without stopping the flow or emptying the pipeline.



# FLOW METERING COMPLEXES FOR CUSTODY TRANSFER OF GASES BASED ON ULTRASONIC FLOW METERS

The complex comprises of the following:

- a high accuracy two channel ultrasonic gas flow meter with straight meter runs and flow conditioner;
- a Flow computer for volume correction as per customer's requirements;
- absolute pressure sensor/transmitter (accuracy not worse than 0,075%);
- temperature sensor Pt100/temperature transmitter;
- Cabinet mounted uninterrupted power supply with communication interface for installation in nonhazardous zone;

The complex can be used for reliable measurement of volumetric data of various gaseous media for custody transfer applications, for example:

- natural gas;
- fuel gases;
- industrial gases;
- air.

The major attractive features of such a flow measurement complex are:

- High overall accuracy 0,75%, special version with overall accuracy 0,5% available on order
- Ability to measure bidirectional flows
- No moving parts
- No pressure loss;
- presence of the built - in calibrator, which makes possible in-situ metrological verification of the flow meter by imitation method.

TECHNICAL CHARACTERISTICS	
Parameter	Value
Diameter, mm	35-3500
Working environments	air, natural gas
Quantity of beams	2
Minimal speed, m/s	0,1
Maximal speed, m/s	35
Accuracy class %	From $\pm 0,5$ up to $\pm 2$
Maximal pressure MPa	1,6
Maximal temperature °C	150
Temperature °C	- 25... +60
Power	AC 220V, 50 Hz DC 24 V 10 W



## PORTABLE STANDARD (LIQUID & GAS)

Portable standard (standard of comparison, the transported standards) is a secondary standard designed for comparisons of standards and verification of measuring instruments.

Portable standard (PS) - high precision measuring instruments (MI) are used to transmit units of physical quantities on the primary standards to MI being certified (under test), with the capability to transport them directly to the place of installation of MI for verification (certification).

Figure. 1 shows a general view of the Portable standard unit of liquid flow, developed and manufactured by the company PJSC "Energouchet" for the National Institute of Metrology of the Republic of Moldova.



Fig. 1 Portable standard unit of liquid flow (in the open state)

Figure. 2 shows a part of the Portable standard: four measurement sections (for different nominal diameters of pipeline) with pressure and temperature sensors.

Figure. 3 shows a part of the Portable standard unit of liquid flow - the standard meter, manufactured by ABB type HygienicMaster FEH521

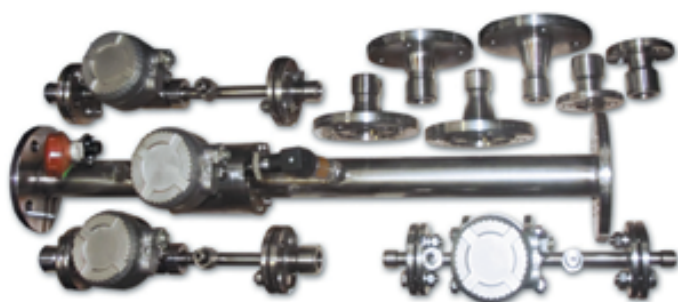


Fig. 2 - Measuring sections from the



Fig. 3 - Exterior part of Portable standard unit of liquid flow - Portable standard the standard meter, manufactured by ABB type HygienicMaster FEH521

The table shows the main characteristics of the standard meter of the Hygienic Master FEH521, used in the composition of the Portable standard unit of liquid flow.

CHARACTERISTICS STANDARD METERS OF HYGIENIC MASTER FEH521				
	Standard 1	Standard 2	Standard 3	Standard 4
Nominal diameter of the pipeline, Dn	50	15	15	2
Minimum flow rate, m <sup>3</sup> / h	6,0	0,6	0,12	0,012
Maximum flow rate, m <sup>3</sup> / h	60	6,0	1,2	0,12
Systematic error, not worse, %	0,15	0,15	0,15	0,15
Points of the strait, m <sup>3</sup> / h	6,0; 13,0; 20,0; 6,0; 33,0; 40,0; 46,0; 53,0; 60,0	0,6; 1,3; 2,0; 2,6; 3,3; 4,0; 0 4,6; 5,3; 6,0	0,12; 0,25; 0,40; 0,50; 0,65; 0,80; 0,95; 1,05; 1,20	0,012; 0,025; 0,04; 0,05; 0,065; 0,08 0,095; 0,105; 0,12

The main features of PS are:

1. PS completely "conjugates" as with the equipment of primary standard as well as with typical MS, calibration and proving rigs, and additional equipment, which used for calibration.
2. PS have high technical characteristics (such as: reliability, transportable, small weight and size characteristics, etc.) and specific metrological properties (eg, "Save" metrological characteristics of PS after transportation).
3. Using the EP there are fundamental differences in the process of meteorological provision: the event of this type provisions are carried out, tend to directly in the field of exploitation of verifiable MS. This excludes the long delays, and even (in some cases) a stop of production processes and testing of different products and types of equipment, i.e., the system of metrological provision "adapts" to the requirements and conditions of the consumer.
4. High "promptness" obtaining results verification of SI.
5. Service capability of measuring equipment, which is part of different equipment and systems.

## ELECTRONIC TEMPERATURE TRANSDUCER PTE-011

Electronic Temperature Transducer PTE -011 is a primary transducer designed for measuring temperature of non-corrosive, nonflammable gas, located indoors, in a container or transported through the pipeline. It can convert the temperature readings to a digital value for transmission to the data acquisition system, or automation system.

PTE-011 is designed to be installed outside hazardous areas for indoor and outdoor installations.



Fig. 1 Product view PTE-011

### Technical Characteristics:

- gas temperature measuring range - from  $-15^{\circ}\text{C}$  to  $60^{\circ}\text{C}$ ;
- absolute error of temperature measurement  $0,06^{\circ}\text{C}$ ;
- gas flow Velocity in the measurement gas temperature from 0 to 50 m / s;
- time set at 0.9 T, with spasmodic changing temperature and flow rate of 2 m / s, not more than 15 seconds;
- operation mode setup time, not more than 15 minutes after powered. Operating mode - round-the-clock;
- type of digital output - RS-485. Data Exchange Rate with computer via RS-485 or via MODBUS protocol- 115200 bit / s.

Transducers PTE-011 can be connected to the network. The maximum number of transducers in a network is 32 units. Power is supplied with DC voltage 9 - 15 V. The current consumed from the power supply is not more than 50 mA. All the converters that are included in network can be connected to a common power source. Type of communication lines for connection to the computer is "twisted pair" with wave resistance of 100 - 120 Ohm. Length of communication lines up to 120 m. Recommended type of cable for powering thermometers and connection to the computer - UTP 5.

## ULTRASONIC POINT LEVEL SENSOR SUU-011

SUU-011 is designed for mounting on various stationary and moving objects, industrial or other conditions, for use in alarm systems of technological and emergency levels of fluids environments, in automatic control systems of technological processes, in systems protect the pumps from running dry and in systems that can detect the presence of liquid in the premises.

The device can be used indoors and outdoors over a wide range of climatic conditions. The device has no moving parts, resistant to vibration or impact, and do not require any adjustment during operation. The device can be used in conventional and hazardous installations and premises.

### Operating conditions:

- Ambient temperature of electronic unit - from minus 40 to  $70^{\circ}\text{C}$ ;
- Ambient temperature of sensitive element - from minus 40 to  $125^{\circ}\text{C}$ ;
- Pressure in the tank of device installation - up to 6.4 MPa.

Protection Level of against dust and water - IP67.

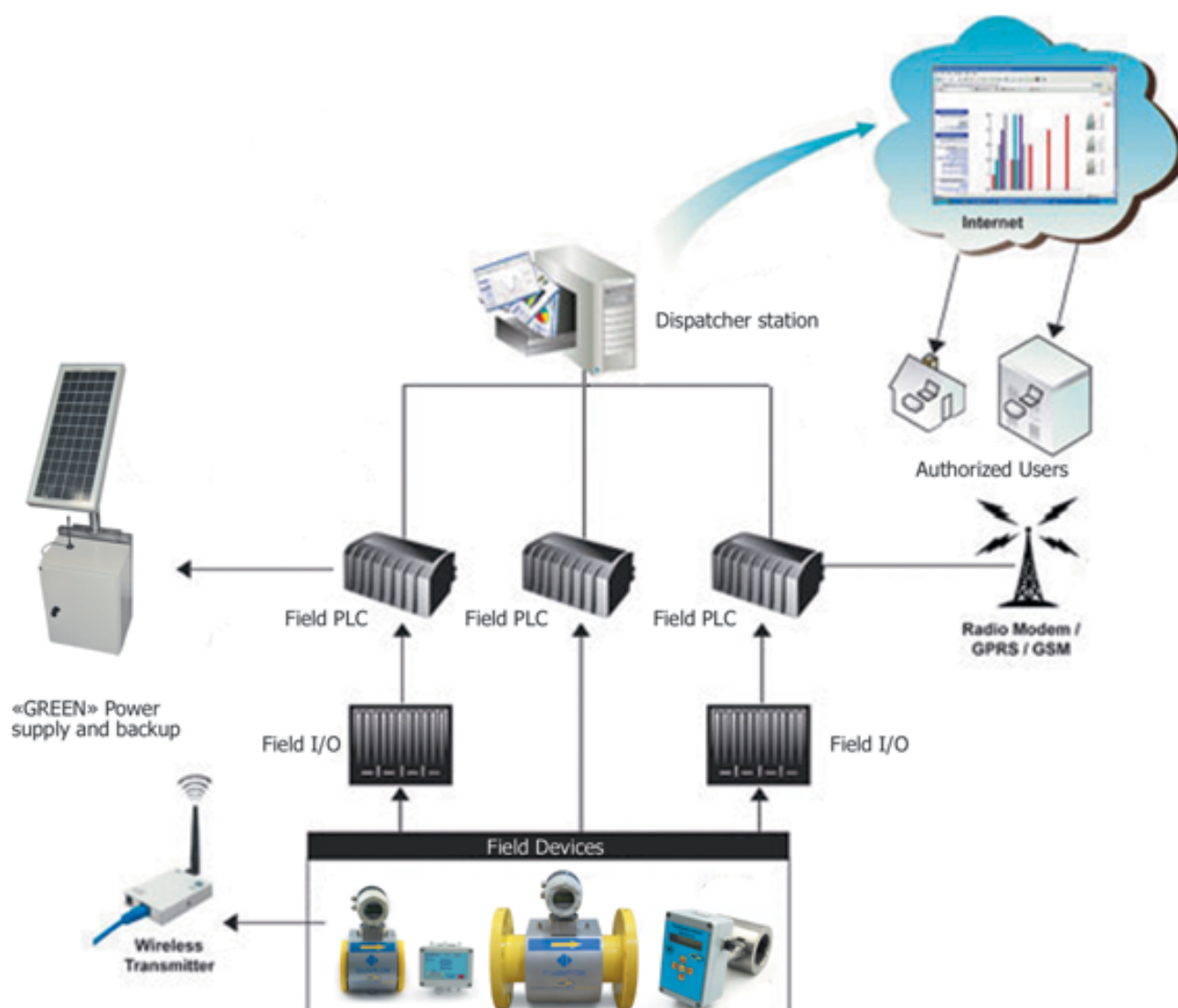
## INTEGRATED METERING AND MONITORING SYSTEMS

Being the supplier of a vast range of fluid monitoring and measurement equipment, PJSC "Energouchet" can also design integrated systems tailormade 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..





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