

## New: Elster's commercial diaphragm meter measures the standard volume

# Themis<sup>plus</sup> – the Swiss army knife of gas measurement

In the first edition of Profiles this year, we reported on Smart Metering activities in Italy. The final instruction from the regulatory authority has now stated that all gas meters must be read remotely by 2016. Directive ARG155/08 issued for this purpose classifies the gas meters to be converted. Work started on all meters in classes A and B which cover all gas meters from size G65. These meters will be fitted with classical volume conversion devices with a separate or integral communications module.

Work is now starting on the conversion of meter class A1 which covers size G10 to G40 meters. In addition to the gas temperature, the gas pressure must also be measured for these meters. Thus the classic function of a volume conversion device is required to supplement the volume recording function. From a technical point of view, this is not a problem – but from a commercial point of view, this has not yet been feasible.

But Elster has now come up with a solution to this, namely Themis<sup>plus</sup> – the first industrial and commercial diaphragm gas meter in the world which directly measures and displays the standard volume and sends the data for billing every day using an integral GPRS modem.

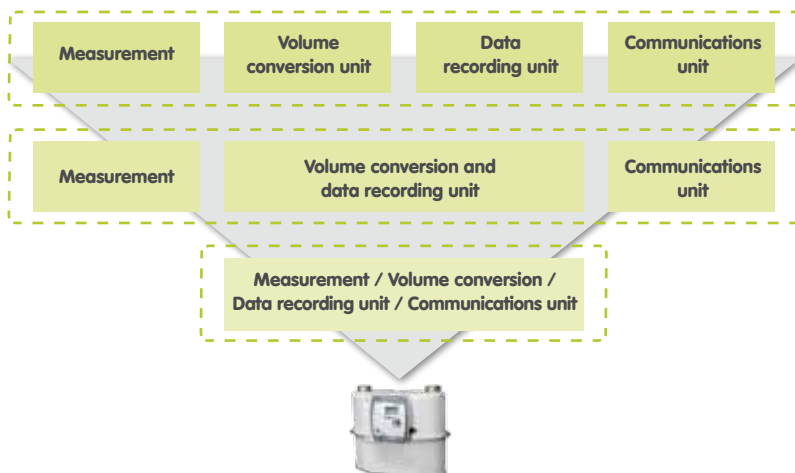
Directive ARG155/08 defines a measurement system which comprises the components of a volume meter, volume conversion device, data logger and communications unit. At the same time, the Directive deliberately allows for the possibility of combining individual or all components and functions in one or several devices. The Themis<sup>plus</sup> gas meter makes full use of this design freedom and also integrates the communications unit into the meter (Fig. 2). This means that the device measures the standard volume, saves the data according to various tariffs and supplies the data to an MDMS once per day. This transfer is done using a GPRS modem.

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Fig. 1: Themis<sup>plus</sup> – the new generation of diaphragm gas meters

Fig. 2: ARG155/08 – Definition of a measurement system



### The concept

Themis<sup>plus</sup> is the logical development of the Themis<sup>alpha</sup> diaphragm gas meter which features an electronic index. The electronic index is equipped with a graphics display and a ready-to-activate flexible data logging and tariff function, as well as a communications module. This provided an ideal basis for satisfying the ambitious requirements of the Italian regulatory authority in a single device. Special mention should be made in this respect of the modular design of the electronic index. The communications module

Fig. 3: The modularity of the electronic index



and metrological unit are kept completely separate. Both the communications module and the batteries can be replaced if necessary, even while the meter is in operation (Fig. 3).

**Metrological approval**

The gas meter features a temperature sensor and a pressure sensor to determine the gas pressure and temperature values required for volume conversion. The sensors are connected to the main circuit board of the electronic index via a patented gas-tight grommet, which is naturally fire-resistant (HTB) up to 0.1 bar according to EN 1359. The volume is recorded by Hall sensors. This information allows the meter to determine the standard volume which is then displayed. With reference to the international Measuring Instruments Directive (OIML R137, Parts 1 and 2 – Chapter 5.3.5), the measuring instrument has been submitted for MID approval as a meter which measures and displays the standard volume, whereby the volume measurement and volume conversion functions are metrologically combined and are not assessed separately. Consequently, the meter in the field is regarded as such and the regular inspections normally required for volume conversion devices can be dispensed with. This is a massive advantage which results in drastic reductions both in the purchase and commissioning costs and also the operating costs of the meter over its service life. This is guaranteed by the use of high-precision digital high-resolution sensors which demonstrated the required long-term stability in the tests stipulated by EN 1359 with ease (Fig. 4).

**Explosion-protection approval**

The meter Themis<sup>plus</sup> has ATEX approval for installation and use in Zone 1. There are therefore no restrictions on the use of the meter even in difficult ambient conditions.

**Display and operation**

The meter's user interface is a clearly structured dot matrix graphics display with three user keys. The display is activated by pressing any key and is illuminated. This means that the meter reading and other information can be taken even in poor light conditions. In addition to the current meter reading for the standard volume and the current tariff, consumption during

the various tariff periods under the Italian regulations set out in UNI TS 12191-5 can also be displayed. Operation of the meter using the keys is explained on the display which means that no user manual is required (Fig. 5).

**Data communication**

For local communication (e.g. commissioning or maintenance), the meter index provides an optical interface in accordance with IEC 62056-21. Data communication to a headend system is ensured by a battery-operated GPRS modem. The antenna is fully integrated in the housing. If the reception level at the metering site is not sufficient, an external antenna can be used.

The readout session is initiated by the device which logs on to the GPRS network and then connects to a head end. After reading the requested data, the modem is set back to low-power mode immediately. This is the most energy-efficient communications mode. The device may also be parameterized by the headend system, allowing for remote configuration of tariff programs and installation settings. Data communication is based on the DLMS/COSEM specification. The possibility of remote firmware upgrade in accordance with WELMEC Guide 7.2 guarantees future-proof functionality following installation.

**Data security and privacy**

The meter Themis<sup>plus</sup> forms part of a system and offers end-to-end security

Fig. 4: Results of the rapid ageing test of the pressure sensor

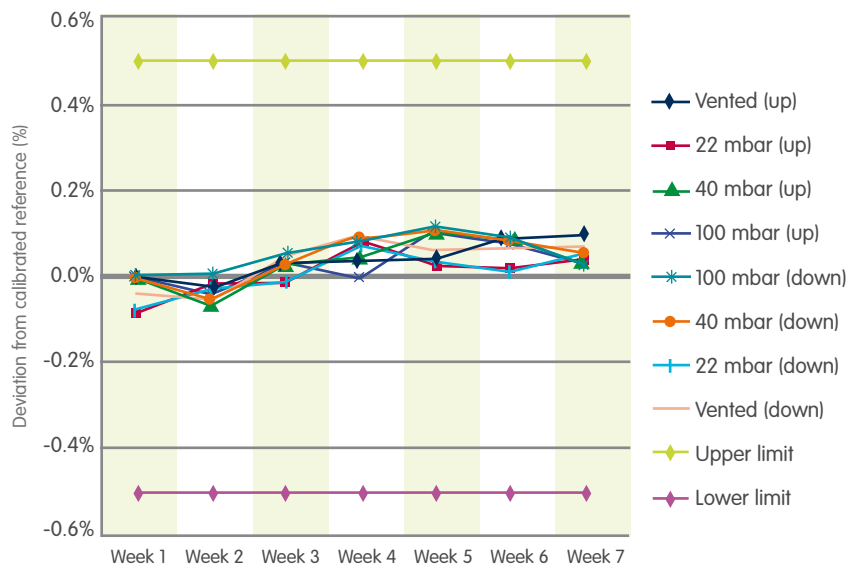
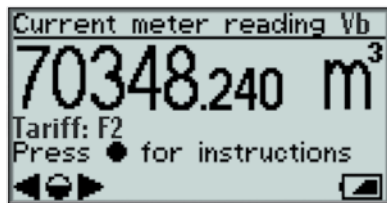
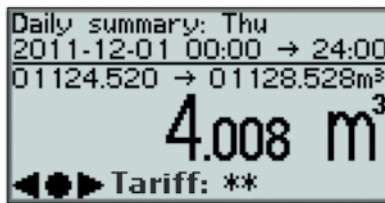


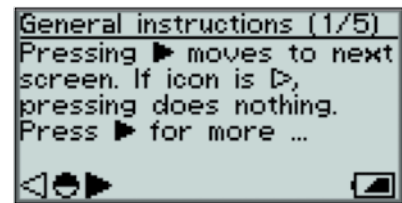
Fig. 5: Display – self-explanatory user interface (examples)



**Basic default display** showing the current meter reading Vb and the active tariff



**Daily summary:** this screen shows the date and time range for a single day



**Instructions** which explain the principles of navigating the user interface

by utilizing the latest industry standards given by the security suite of the DLMS Companion Specification to DLMS/COSEM. Data encryption is based on the Advanced Encryption Standard (AES-128) using the Galois/Counter Mode (GCM). In addition, Themis<sup>plus</sup> supports message authentication and key wrapping. This method also ensures that there is a suitable level of privacy and thus offers excellent protection against fraud or tampering.

#### Power supply

In the electronic index, the metering electronics (including data archiving) and the GPRS modem are powered by separate batteries. This guarantees functioning of the meter at all times, with or without modem operation. The host battery ensures a service life of at least 15 years. The service life of the battery for operating

the GPRS modem depends on the mode of operation, the frequency of data transmission and the reception field strength at the metering point. Assuming daily readout and a standard reception level, a battery life of at least 5 years is possible.

#### Future-proof investment

Elster diaphragm gas meters stand for measurement accuracy, reliability and long-term stability. With the modular electronic index, the well established and proven measuring principle will be supplemented by these functionalities which comply with today's and tomorrow's requirements.

The possibility of remote firmware upgrade and the exchangeable communications module ensure the meter can be upgraded in the event of new regulations or when

new technologies for data communication become available or necessary.

Whenever new developments are made, planning does not stop at local requirements. In view of this, we are quite sure that the Themis<sup>plus</sup> and other developments based on the electronic index will also prove very interesting for other markets.

All in all, Themis<sup>plus</sup> is a new generation of gas meters, which guarantees a future-proof investment and reduces the total cost of ownership ... and in our point of view, these benefits are not limited to Italy alone.

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Events not to be missed:

**E-world, Essen, Germany, 7 – 9 February 2012**

International trade fair on Smart Metering,  
[www.e-world-2012.com](http://www.e-world-2012.com)

**IFAT Entsorga, international trade fair, Munich, 7 – 11 May 2012**

World's leading trade fair for water, sewage,  
waste and raw materials management, [www.ifat.de](http://www.ifat.de)

We would be very happy to see you there!