Measurement, volume conversion and data communication – three functions in a single device

themis^{plus} – measuring gas effectively and at low cost

While the (seemingly endless) discussions continue in Germany about the requirements for measuring equipment based on the Energy Industry Act and the technical features of the Smart Meter Gateway, things are already much further on in other EU countries.

We have already reported several times on activities in neighbouring countries. In this edition, we unveil a new commercial and industrial gas meter which we have initially developed for the Italian market. This example demonstrates the excellent performance, effectiveness and cost efficiency gas measuring instruments can feature today as long as the outline conditions are right.

With reference to the EU Directive on energy end-use efficiency and energy services 2006/32/EC, the Italian regulatory authority issued mandatory specifications for gas measuring instruments in the form of national Directive ARG 155/08. This defines that all gas meters must be read remotely. In addition to the gas temperature, as from a meter size of G10 the gas pressure should also be included in the measurement process. Thus the classic function of a volume conversion device is required to supplement the volume measurement. From a technical point of view, this is not a problem – but from a commercial point of view, it has not yet been feasible.

Elster has now developed the solution to this problem: themis^{plus} – the Swiss army knife for gas measurement. The first commercial and industrial diaphragm gas meter in the world which measures and displays the standard volume. In addition, it transmits the billing data every day using an integrated battery-powered GPRS modem.

3 functions in a single device: themis^{plus} – the new generation of diaphragm meters

Directive ARG 155/08 defines a measurement system which comprises the components of a volume meter, volume conversion device, data logger and communications module. At the same time, the Directive deliberately allows for the possibility of combining individual or all components and functions in one or several devices. Elster has taken full advantage of this design freedom by creating the gas meter themis^{plus} and has also included the communications unit in the meter. This means that the device measures the standard volume, records the data according to various tariffs and supplies the data to a Meter Data Management System once per day.

Fig.1: The modular electronic index –
the batteries and communications module can be replaced

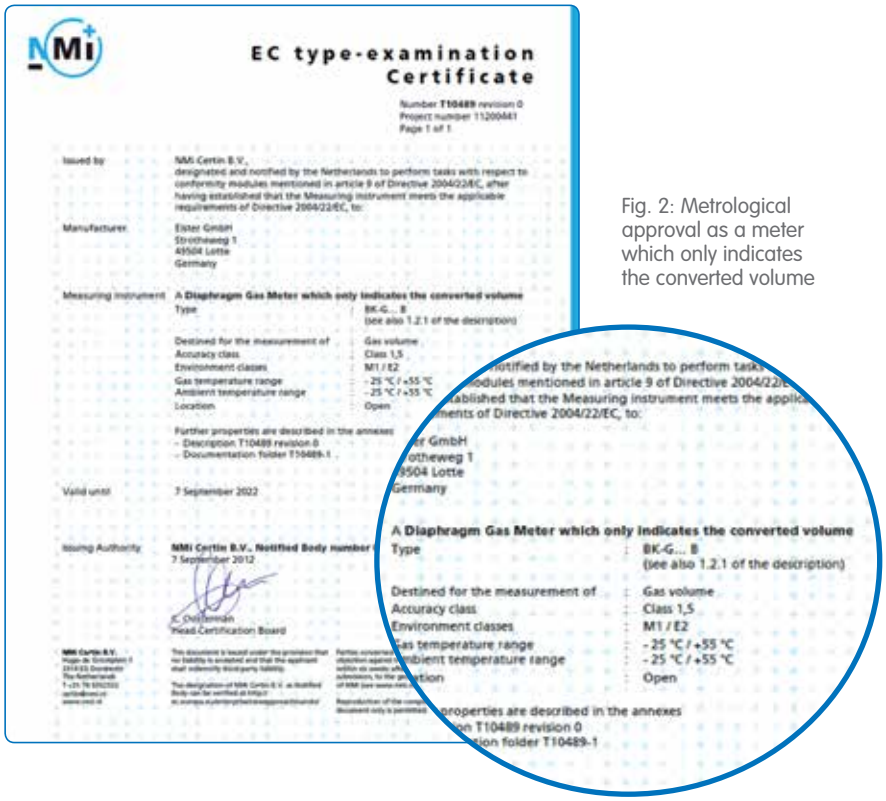
themis^{plus} is the logical development of the diaphragm gas meter with electronic index, the themis^{alpha}. The electronic index is equipped with a graphics display and a ready-to-activate flexible data logging and tariff function, as well as a communications module. This provided an ideal basis for 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 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. 1).

The gas meter features high-precision, high-resolution digital sensors to measure the gas pressure and temperature. These sensors passed the long-term stability test stipulated by EN 1359 with ease. 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. 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 R 137, Parts 1 and 2 – Chapter 5.3.5), we have been granted MID approval for the meter which only indicates the converted volume (Fig. 2).

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 (every four years in Italy) normally required for volume conversion devices can be dispensed with. This means for the meter themis^{plus} and its use in Italy that the meter can remain in the grid for up to 15 years without having to be inspected.

In these circumstances, this is a massive benefit which drastically reduces the purchasing, installation and commission costs and also the operating costs for the meter over its service life. Figure 3 shows this clearly.

The conditions for taking advantage of these benefits are not always as favourable as in Italy. In some cases, battery-powered measuring equipment must be inspected at shorter intervals. However, the replacement of a diaphragm gas meter is a comparatively simple and quick job compared to replacing or recalibrating a volume conversion device at the metering point. In addition, there is no need for authorized testing agency personnel. This is a good enough reason to consider the regular replacement of the gas meter at shorter intervals so that the added value


EC type-examination Certificate

Number T10489 revision 0
Project number 11200441
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Issued by: NMi Certin B.V., designated and notified by the Netherlands to perform tasks with respect to conformity modules mentioned in article 9 of Directive 2004/22/EC, after having established that the Measuring instrument meets the applicable requirements of Directive 2004/22/EC, to:

Manufacturer: Elster GmbH, Strotheweg 1, 49504 Lotte, Germany

Measuring instrument: A Diaphragm Gas Meter which only indicates the converted volume

Type	BK-G... B (see also 1.2.1 of the description)
Destined for the measurement of	Gas volume
Accuracy class	Class 1,5
Environment classes	M1 / E2
Gas temperature range	- 25 °C / +55 °C
Ambient temperature range	- 25 °C / +55 °C
Location	Open

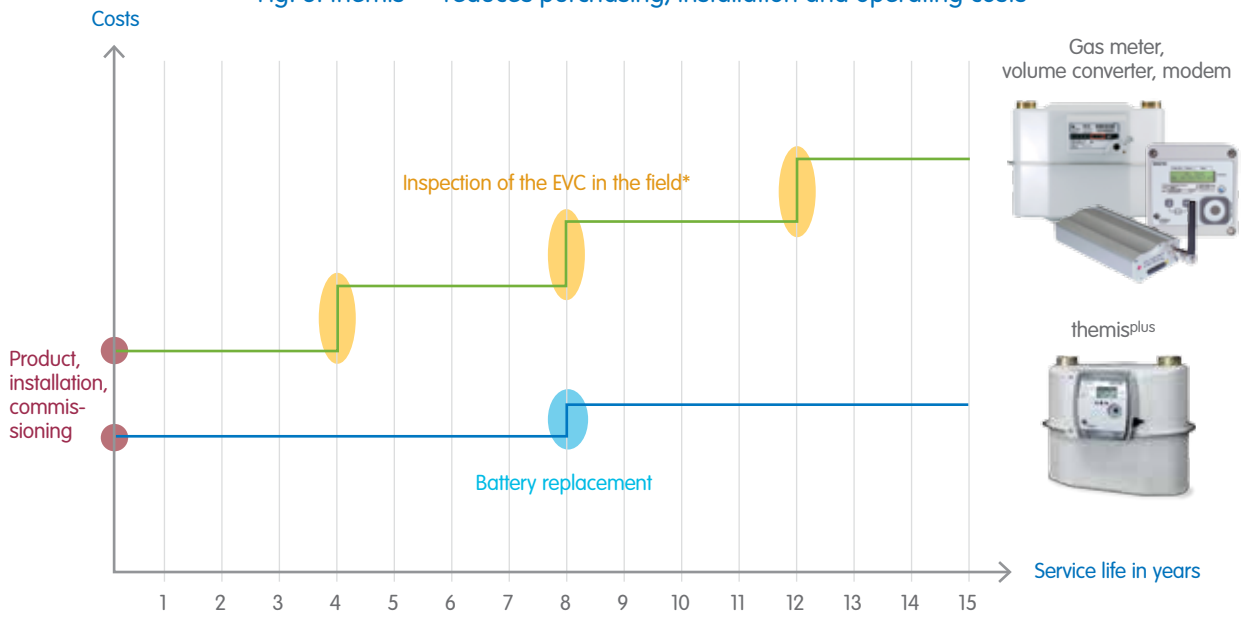
Further properties are described in the annexes
- Description T10489 revision 0
- Documentation folder T10489-1

Valid until: 7 September 2022

Issuing Authority: NMi Certin B.V., Notified Body number
7 September 2012
C. Oosterwijk
Head Certification Board

Fig. 2: Metrological approval as a meter which only indicates the converted volume

Fig. 3: themis^{plus} reduces purchasing, installation and operating costs



* The frequency of inspection is specified by the national metrological authority (4 years in Italy).

of the volume conversion and regular data transfer can be exploited.

Furthermore, the meter also sets new standards as far as data transfer is concerned. The reading process is initiated by the device itself. The modem registers in the GPRS network once per day and logs on to the MDM system, which then reads the consumption data. If necessary, the MDM system can also set parameters or transfer new tariff profiles to the meter. The power supply to the modem is then shut down again. This is the most energy-efficient method of transferring data in battery mode.

A separate battery module is used to supply power to the modem. When data is transferred every day, this module must be replaced after eight years at the latest. From a technical point of view, we use the international standard for meter data communication DLMS/COSEM and the data are encrypted using the AES-128 algorithm. The facility to complete firmware updates using the modem in compliance with WELMEC Guide 7.2 makes the meter future-proof. It will thus be up to date at all times.

Elster diaphragm gas meters are renowned for accuracy, reliability and durability. Extra functions have been added to the established, time-tested measuring principle combined with the modular electronic index to satisfy the new requirements of today and the future.

The new gas meter themis^{plus} from Elster is a future-proof investment and reduces total costs throughout its service life. And if the right conditions are created, this will not be restricted to Italy alone.

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Technical data

Metrological approval	MID class 1.5 (NMIT10489) in accordance with EN 1359 and based on the guideline OIML R 137
ATEX approval	Zone 1, Ⓔx II-/2G IIA T4
Meter sizes	G10 – G40
Protection class	IP 65
Ambient conditions	Temperature: -25°C to +55°C Relative humidity: ≤ 93%, non condensing
Gas pressure	0 to 500 mbar gauge
Gas temperature	-25°C to +55°C
Output	Low-frequency pulse output (volume at reference conditions) U_{max} 30 V DC, I_{max} 250 mA, F_{max} 4 Hz, min. pulse width: 125 ms
User interface	Monochrome backlit dot-matrix LCD display, 128 pixels wide, 64 pixels high, keypad with 3 keys
Interface	Optical interface in accordance with IEC 62056-21
Communications module	Integrated battery-operated GPRS modem with internal antenna, external antenna (option)
Communications protocol	DLMS Companion Specification to DLMS/COSEM Data encryption based on AES-128 using the Galois/Counter Mode (GCM) Firmware download in accordance with WELMEC Guide 7.2