EK280

Electronic volume conversion device with optional integrated communication module and configurable data interface

Applications

- Volume conversion for billing purposes
- Data recording for various applications
- Station monitoring

Brief information

The EK280 is a compact, battery-powered volume conversion device, which can be connected to diaphragm, turbine or rotary gas meters. As an alternative to recording the flow-proportional pulses for the operating volume (LF or HF), the EK280 can also read the original meter readings from the Absolute ENCODER index of a gas meter. The volume conversion device calculates the conversion factor C and the compressibility K on the basis of the consumption data and the analogue measurements of gas temperature and pressure. The volumes and flow rates at base conditions and flow rates at measurement conditions will be calculated using this initial data.

The EK280 consists of a central unit with either an integrated or external pressure sensor and a temperature sensor which are permanently connected to the unit. The compressibility K can be programmed as a constant for all gases or calculated according to various methods of calculation.

Optionally, a 2G or 3G modem can be directly integrated into the volume conversion device for data communication. In Ex-Zone 0/1 potentially explosive atmospheres, the modem is powered by a special lithium battery module. If the device is used in Ex-Zone 2 potentially explosive atmospheres or in safe areas, a broad-range power supply unit is available to supply the modem and the volume conversion device with energy. In this version, as an alternative to the modem, an Ethernet module can also be used to connect the device to a network (LAN).

In addition, the EK280 has a flexible, configurable serial interface and four adjustable digital outputs. This allows the volume conversion device to be used in many different applications in the field of natural gas measurement and in industry.

Additional inputs for sensors and status signals also make it possible to use the volume conversion device for station monitoring. The data transfer to a remote control or SCADA system for this application can be made independently of the data transfer to a billing system. For this purpose, the interfaces of the volume conversion device function independently of each other while using different data protocols.

MAIN FEATURES

- MID approval
- Compressibility calculated by various methods
- Integrated data logging function
- Certification data logbook
- Archives with flexible configuration
- Suitable for use in Ex-Zone 0/1 potentially explosive atmospheres
- 6 digital inputs (LF, HF, encoder)
- Monitoring of power supply in combination with solar or battery power supply
- 4 freely programmable, sealable digital outputs
- Various communications protocols
- Optical interface for parameterization and readout
- Configurable serial interface RS232 / RS422 / RS485
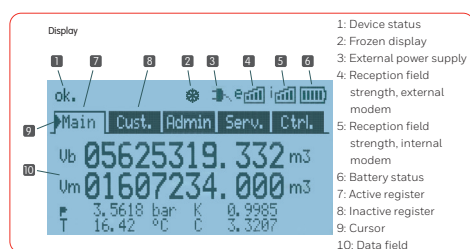- Software update based on Welmec 7.2

Options

- Integrated Modem (Ex-Zone 0/1) or Ethernet interface (Ex-Zone 2)
- Integrated power supply unit (Ex-Zone 2)
- Second pressure and temperature sensor

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Display and operation

All current values and parameters as well as all the archive data can be viewed on a large graphics display. This display is backlighted even in battery mode and therefore easy to read without an additional light source, even in adverse installation conditions. Its operation is based on Windows Explorer making navigation very straightforward. An additional function key enables the user to return to the main screen, clear the status register or freeze the display with ease. Symbols provide additional information about the remaining capacity of the device batteries and the reception field strength of the modem, for example.

1: Device status
2: Frozen display
3: External power supply
4: Reception field strength, external modem
5: Reception field strength, internal modem
6: Battery status
7: Active register
8: Inactive register
9: Cursor
10: Data field

Connection to the gas meter

In addition to the encoder index (Namur or SCR interface) and low-frequency (LF) pulse generators, high-frequency (HF) pulse generators are also supported for connection to meters, provided the volume conversion device has an external power supply. This enables precise measurement, archiving and monitoring of flow rates. If the HF pulse generator is used as an input for the conversion process, then the LF signal is automatically used as the input signal for the volume conversion process in the event of a failure of the external power supply. The pressure sensor is permanently installed in the housing, but external versions can also be supplied.

Communications interface

The volume conversion device EK280 has three serial interfaces. The design of the optical interface on the front of the device complies with the time-tested standard IEC 62056-21. This interface is generally used for commissioning and configuration purposes. The interface terminal block inside the device (configurable as RS232, RS485 or RS422) is intended for permanent connection of function extension unit FE260 or of communications components from other manufacturers. In addition, there is another interface which takes the form of a connector to allow integration an modem module iCM280-2G (GPRS) bzw. 3G (UMTS) for the wireless communication or an interface module iCE280-Ethernet PoE for the wired communication with no additional installation work (Ex-Zone 2).

The special feature of these interfaces is that they function completely independently of each other and can be operated simultaneously. Thus, for example, two different users can read data from the device, or the device can be used for both billing and station monitoring at the same time.

Communications protocols

The widely used data protocol pursuant to IEC 62056-21 is used for data transfer. Hence, the unit is downward compatible with the other volume conversion devices of the EK200 series. Moreover, DLMS/COSEM protocol is implemented in the EK280. Thus, the EK280 fulfils international standards for meter data communication and also ensures that future requirements for secure data communication using cryptography can be satisfied. Data modelling is based on the COSEM obj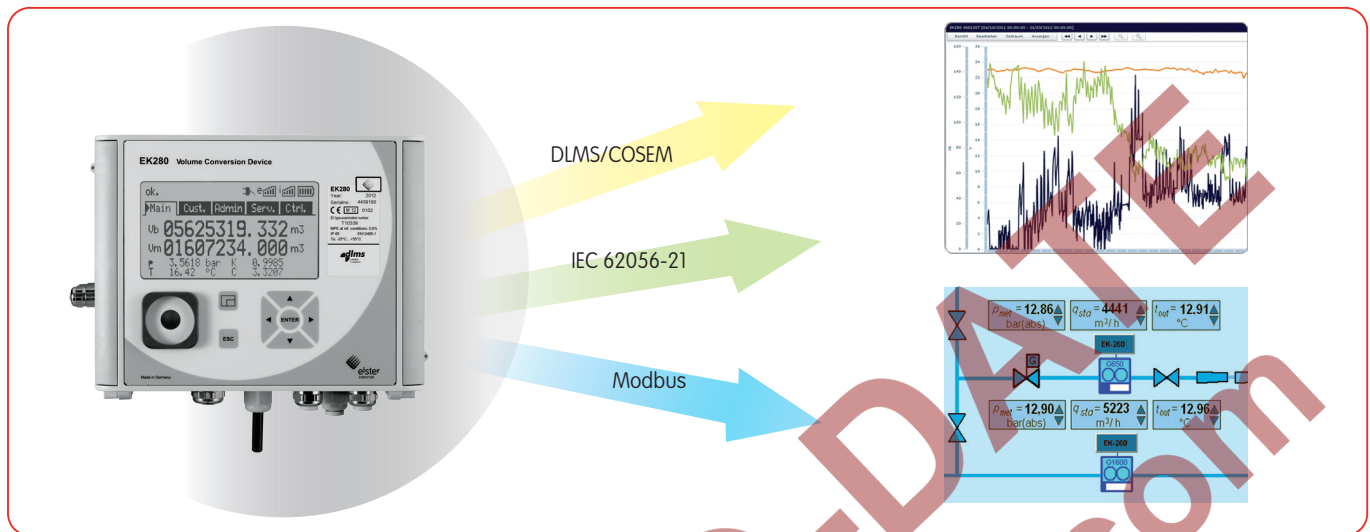ect model coupled with the OBIS identifier system. The Modbus protocol is supported in the ASCII, RTU and TCP modes for connection to a remote control or SCADA system. Not only is it possible to query the EK280, but the device can also transfer data automatically (MASTER) – and all this in battery mode as well. In order to guarantee the greatest flexibility as regards different requirements and applications, the data elements, associated indicators and data formats can thus be freely configured. The EK280 can command the described data protocols independently, without the need for additional configuration. If a remote meter reading system or SCADA system queries (PULL) the volume conversion device, it automatically identifies which data protocol to communicate with.

Software download

The EK280 supports a software download on the basis of the WELMEC 7.2 Software Guide. This can be carried out both via the optical interface or by remote data transfer using the DLMS/COSEM protocol and in compliance with security standards (using encryption). This means that the device can be kept up to date even after it has been installed.

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Automatic protocol detection with no need for additional configuration

DLMS/COSEM

IEC 62056-21

Modbus

Additional functions

Up to five additional digital inputs can be used either as pulse inputs or status inputs for various applications, such as station monitoring or pulse comparisons, for example.

Four freely programmable digital outputs enable a range of information to be transmitted. When programmed as pulse outputs, they allow the volume pulses determined for a measuring cycle to be forwarded.
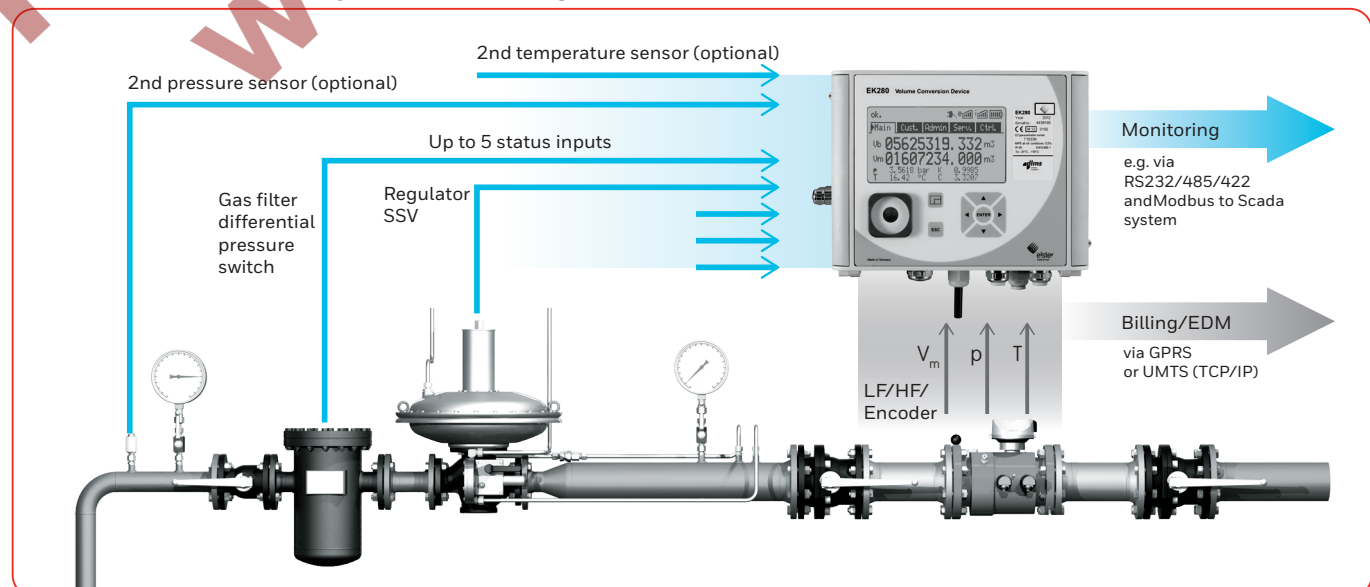
When used as status outputs, messages and warnings can be signalled on the basis of different results (e.g. exceeding the minimum or maximum consumption values or measured values, sensor errors, time synchronization signals, etc.).

Two of the outputs can emit a high-frequency signal. In conjunction with a frequency/current converter, 0/4 – 20 mA signals can also be transmitted to other systems, e.g. with regard to the current flow rate.

The outputs can be secured and sealed against unauthorized changes by either an administration or calibration lock. Optionally, the volume conversion device can be fitted with a second pressure sensor and a second temperature sensor. Depending on the system configuration, the second pressure sensor allows recording of the measuring system's inlet or outlet pressure in one of the user archives as well as monitoring of its limit values. If the volume conversion device is connected to a remote control or SCADA system via a communications channel (modem, interface), the status of the system or individual measurements or signals can be continuously monitored. This information can also be used independently for data transfer to a billing system.

Volume conversion and system monitoring with an EK280

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Data logging function

The integrated, event-triggered data logger supports different archive and logbook functions. Six archives can be freely configured, i.e. the values that are to be recorded, the events triggering registration, as well as the recording interval (measuring period), can be selected as required. Depending on an archive's configuration, the data can be saved for up to one year, or longer.

Along with the data logging archives, the volume conversion device offers three logbooks, with which the volume conversion devices operation can be monitored constantly. The event logbook saves the last 500 messages for events and status changes. The change logbook records the last 200 changes to settings and the certification data logbook documents up to 100 changes to mandatory calibration parameters and values.

Power supply

Two lithium batteries guarantee operation in the standard configuration (LF input signal) for at least 5 years. Two optional additional batteries can be used to double the battery life. The current operating state of the volume conversion device is taken into account when calculating the remaining battery capacity. A battery symbol indicates the status of the battery. If the remaining battery life is 6 months or less, a corresponding additional warning appears in the display.

Data communication with the integrated 2G or 3G modem from Ex-Zone 0/1 potentially explosive atmospheres is also possible with a separate battery module. If the device is used in Ex-Zone 2 potentially explosive atmospheres or in safe areas, a power supply unit may also be integrated into the device as an option. The batteries remain in the device in this case to provide a backup power supply to the volume conversion device in the event that the external power supply fails. It is also possible to buffer the data communication using additional batteries (option).

The batteries can be replaced without damaging the seals. All parameters and data are stored in a non-volatile memory and are retained during changing of the batteries.

Installation

The housing of the EK280 is fitted with drilled holes so that it can be mounted on a wall. Various attachment brackets are also available with which the volume conversion device can be mounted on the index head of an Elster gas meter. Alternatively, there are also mounting brackets for installing the device on the gas pipe.

In addition to the positions given in the sealing plan for attaching the adhesive seals prescribed by metrological authorities, the device has two sealing holes drilled on the outside. This allows the use of wire seals to secure the device against unauthorized opening of the housing.

Archives and logbooks

Archives	Contents Standard configuration (date / time)	Interval	Records	Flexible	LIS-200 compatible
Monthly archive 1	V_m, V_{mT}, MP_{maxVm}, $daily_{maxVm}$, V_b, V_{bT}, MP_{maxVb}, $daily_{maxVb}$, status	Monthly	24	-	x
Monthly archive 2	Q_{bmax}, Q_{mmax}, Q_{bmin}, Q_{mmin}, p_{max}, p_{min}, $pØ$, T_{max}, T_{min}, $TØ$, K value Ø, value, status	Monthly	24	-	x
Daily archive	V_m, V_{mT}, V_b, V_{bT}, $pØ$, $TØ$, K value Ø, C value Ø, status	Daily	600	-	x
Measuring period archive	V_m, V_{mT}, V_b, V_{bT}, $pØ$, $TØ$, K value Ø, C value Ø, status	1 min. – 1 month	9500	-	x
User archive 1	V_m, V_{mT}, V_b, V_{bT}, $pØ$, $TØ$, K value Ø, C value Ø, status	1 min. – 1 month [3]	[1]	x	-
Process data	V_m, V_{mD}, V_b, V_{bD}, $pØ$, $TØ$, K value Ø, C value Ø, status	1 min. – 1 hour [3]	200	x	-
User archive 2	V_m, V_b, status	2 s – 1 month [3]	[1]	x	-
User archive 3	V_{mT}, V_{bT}, status	2 s – 1 month [3]	[1]	x	-
User archive 4	p, T	2 s – 1 month [3]	[1]	x	-
User archive 5	K value, Z value	2 s – 1 month [3]	[1]	x	-
Calibration archive	V_m, V_{mRV}, V_b, V_{bRV}, $pØ$, $TØ$, K value Ø, C value Ø, Q_b, Q_m	-	[2]	x	-
Update archive	SW-Vnew, SW signatur, party, result	[5]	20	-	-
Logbooks					
Event logbook	event	Each event	500	-	x
Audit trail logbook	parameter, old value, new value, status of the locks	Each change	200	-	x
Certification data logbook	parameter, old value, new value, status of the locks	(each change) [4]	100	-	x

[1] Dependent on the configuration (interval and contents)
[2] In the standard configuration
[3] In addition or as an alternative to the periodic archiving, individual events can also be assigned for archiving of values.
[4] Archiving of the changes to parameters, which are subject to the "Technical calibration logbook" access right (can be switched off)
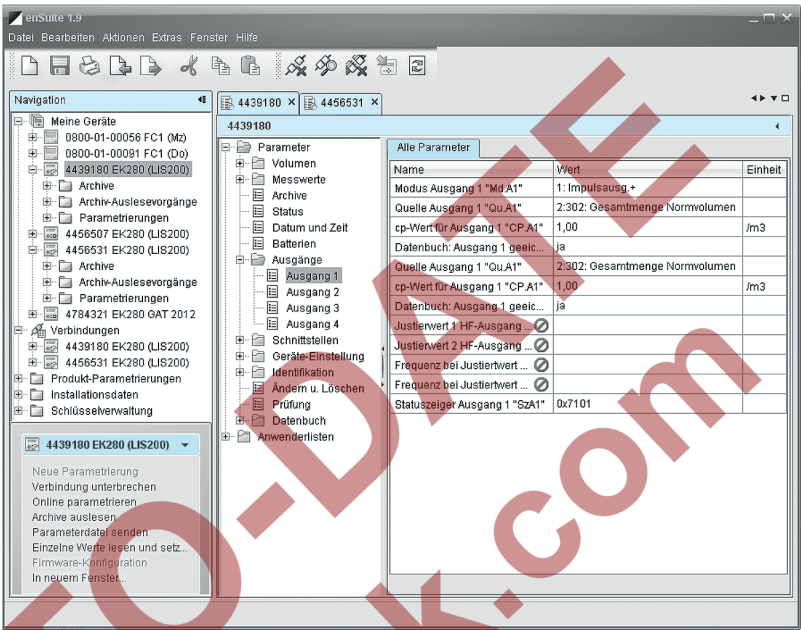[5] After each verification (Verify) of the new software and after each successful update

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Parametrierung

The "enSuite" software is used for the commissioning and parameterization of the converter. A tree structure facilitates selection of the functions or hardware options (volumes, inputs, interfaces), for which individual values and parameters can be entered or modified in a separate view. In addition, there are also freely definable user-specific lists available. Alongside individual parameterization, such lists can also be used for cyclical readout of predetermined parameters or values in order to monitor certain device functions (e.g. load monitoring). It is also possible to transfer the entire parameter profile into the EK280. Moreover, the "enSuite" software can be used for technical analysis. The archives and logbooks of the EK280 are read out and stored in a database. The evaluation is produced in tabular and/or graphic form.
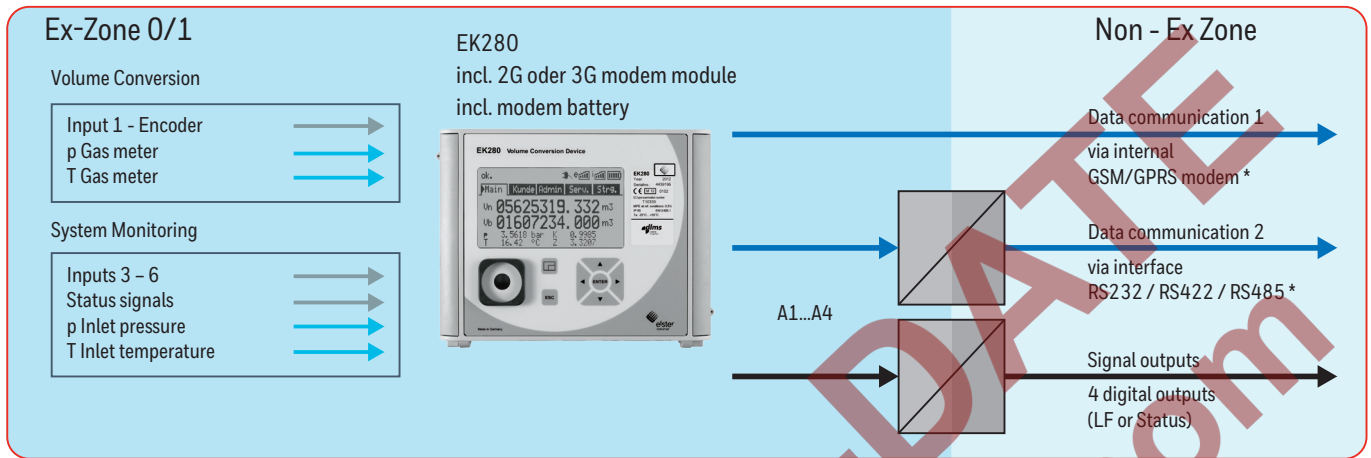
Device versions

There are two versions of the EK280. The versions for use in Ex-Zone 0/1 and for use in Ex-Zone 2 potentially explosive atmospheres (and/or in safe areas) are different. A device that is intended for Ex-Zone 2 must not be installed in Ex-Zone 0/1. This means that the use must be specified when the device is ordered. The version also determines the potential optional accessories. The integrated 2G or 3G modem module can only be installed for use in Ex-Zone 0/1 in combination with the associated ATEX approved battery module. Furthermore, certain functions are only possible in conjunction with certain accessories. So in the Ex-Zone 0/1 version, the HF sensor of the gas meter can only be connected if the EK280 is supplied with energy by the function extension unit FE260. The adjacent table gives an overview of the possible options and functions. Typical applications are shown on page 6.

Device options and functions for the various versions of the device		
	EK280 Ex-Zone 0/1 Ex ia IIB T3 - with modem Ex ia IIB T4 - without modem	EK280 Ex-Zone 2 Ex nA IIC T6 Gc Ex nA[ic] IIC T6 Gc
Device options		
Modem iCM280 2G or 3G	x	x
Interface iCE280-Ethernet PoE	-	x
Modem battery (ATEX)	x	-
Power supply unit 230V AC (iPS280)	-	x
Buffer batteries for modem	-	x
2nd pressure sensor	x[*1]	x[*1]
2nd temperature sensor	x[*1]	x[*1]
FE260 connection	x	x
Functions		
Encoder connection	x	x
LF connection	x	x
HF connection	x[*2]	x[*3]
Online data transfer	x[*2]	x[*3]
System monitoring	x	x

*1 Requires 4 batteries if the EK280 is not externally supplied
*2 Only in conjunction with FE260
*3 In conjunction with internal power supply unit iPS280

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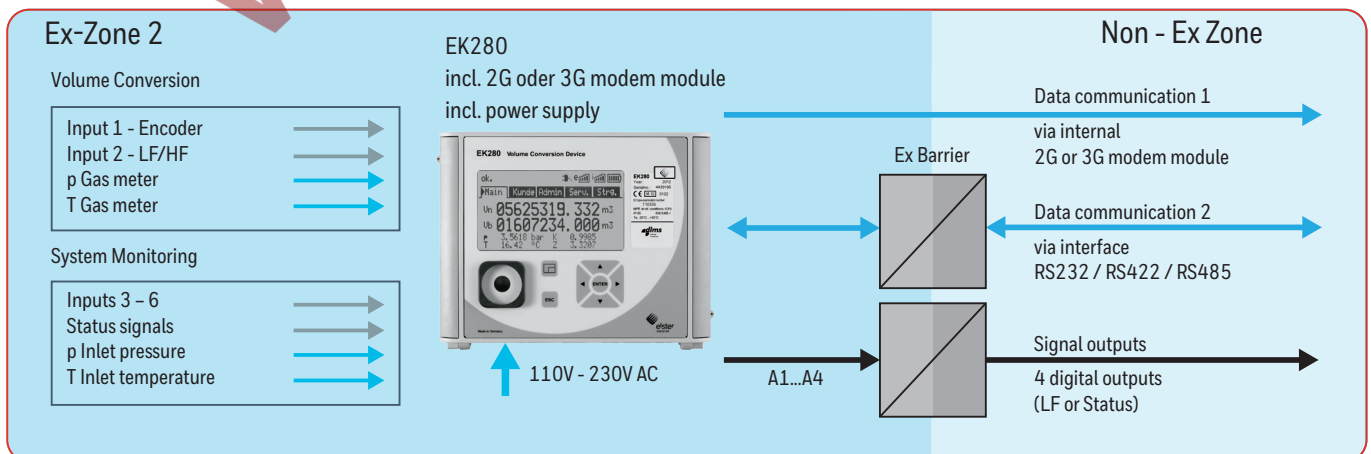
EK280 – use in Ex-Zone 0/1 with 2G oder 3G modem module (battery operation)

Ex-Zone 0/1

Volume Conversion

Input 1 - Encoder
p Gas meter
T Gas meter

System Monitoring

Inputs 3 – 6
Status signals
p Inlet pressure
T Inlet temperature

EK280
incl. 2G oder 3G modem module
incl. modem battery

A1...A4

Non - Ex Zone

Data communication 1
via internal
GSM/GPRS modem *

Data communication 2
via interface
RS232 / RS422 / RS485 *

Signal outputs
4 digital outputs
(LF or Status)

* Communication limited in time

EK280 – use in Ex-Zone 0/1 with FE260 (HF & remote data transfer in mains operation)

Ex-Zone 0/1

Volume Conversion

Input 1 - Encoder
Input 2 - LF/HF
p Gas meter
T Gas meter

System Monitoring

Inputs 3 – 6
Status signals
p Inlet pressure
T Inlet temperature

EK280

RS485

Power supply

A1...A4

FE260

Non - Ex Zone

Data communication 1
- GSM/GPRS
- UMTS
- Ethernet

Signal outputs
4 digital outputs
(HF, LF or status)

115/230 V AC
12/24 V AC

EK280 – use in Ex-Zone 2 (intrinsically safe encoder, remote data transfer in mains operation)

Ex-Zone 2

Volume Conversion

Input 1 - Encoder
Input 2 - LF/HF
p Gas meter
T Gas meter

System Monitoring

Inputs 3 – 6
Status signals
p Inlet pressure
T Inlet temperature

EK280
incl. 2G oder 3G modem module
incl. power supply

110V - 230V AC

A1...A4

Ex Barrier

Non - Ex Zone

Data communication 1
via internal
2G or 3G modem module

Data communication 2
via interface
RS232 / RS422 / RS485

Signal outputs
4 digital outputs
(LF or Status)

The system installer is responsible for completing the installation. Explosion protection must be given due consideration when connecting intrinsically safe devices.

Technical data (basic unit)		
Order number	83462850	
Housing	Cast aluminium, wall, pipe or meter mounting	
Dimensions	H 180 mm x W 280 mm x D 115 mm (including connections)	
Weight	Approx. 2.8 kg (including 2 batteries)	
Metrological approval	IMID approval (NMI T 10339) Conforms to European standard EN 12405-1:2011-04	
ATEX approval	Ex-Zone 0/1, Ex ia IIB T3 with integrated modem (LCIE 11 ATEX 3027 X) Ex-Zone 0/1, Ex ia IIB T4 without integrated modem (LCIE 11 ATEX 3027 X) In the version with power supply unit Ex-Zone 2, Ex nA[ic] IIC T6 Gc (LCIE 12 ATEX 1015 X)	
Protection class	IP 65 (suitable for outdoor installation)	
Ambient conditions	Temperature: -25 °C to +55 °C	
Battery power supply	2 lithium battery modules, capacity: 13 Ah (Elster Type 73015774 or 73020663) (service life > 5 years under standard operating conditions) 2 additional batteries as an option	
Modem battery	1 lithium battery module, capacity: 16 Ah (Elster Type 73021211), if an internal modem is to be installed	
External power supply	7,5 – 8,5 V DC, I < 40 mA power supply unit can be provided by Elster accessory FE260 or iPS280	
Control panel	Sealed keypad with 7 buttons	
Display	Dot matrix display, 192 x 80 pixels, backlit All parameters, settings and archived values can be displayed.	
Inputs	6 digital inputs for connecting pulse generators and message signals (e.g. tamper detection contact) - 1 encoder (Namur or SCR) - max. 2 HF pulsers (max. frequency 2.5 kHz) - max. 6 LF pulsers (max. frequency 10 Hz)	−Input 1 : encoder, LF, HF −Input 2: LF, HF, status −Input 3: LF, status −Input 4: LF, status −Input 5: LF, status −Input 6: LF, status
Pressure sensor for volume conversion	Absolute sensor, Type ENVEC CT30, either integrated in the housing or, as an option, provided as an external sensor (if a second pressure sensor is used, this sensor is always integrated) Connection for precision steel pipe (Ermeto 6L) or flexible pressure tube, M12 x 1.5 thread Pressure ranges* 0.7 – 2 bar / 0.8 – 5 bar / 2 – 10 bar / 4 – 20 bar / 8 – 40 bar / 14 – 70 bar *Other pressure ranges on request	
2nd pressure sensor for monitoring (option)	Absolute sensor, Type ENVEC CT30, provided as an external sensor, length of supply cable 10 m Connection for precision steel pipe (Ermeto 6L) or flexible pressure tube, M12 x 1.5 thread Pressure ranges between 0.7 and 80 bar	
Temperature sensor or 2nd temperature sensor	Pt-500 resistance thermometer to DIN 60751 Class A with protective tube, for use with thermowells. Temperature range: -30 to +60°C. Installation length 50 mm, Ø 6 mm, length of supply cable 2.5 m (optionally 10 m)	
Compressibility	Calculation in accordance with S-GERG-88, AGA 8 (GC1 or GC2), AGA 8 DC 92, AGA NX-19, AGA NX-19 in accordance with Herning & Wolowsky or programmable as a constant	
Signal outputs	4 digital transistor outputs, freely programmable and protectable via calibration lock as - Pulse output for all Vm or Vb counters max. frequency: LF – 4 Hz, HF – 1 kHz - Signal output for alarm and/or warning messages	−Output 1: LF, status −Output 2: LF, HF, status −Output 3: LF, HF, status −Output 4: LF, status

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Technical data: interfaces/data communication	
Data interfaces	- Optical interface in accordance with IEC 62056-21 (IEC 1107) (front) - Internal serial interface RS232, RS485 or RS422 (interface terminal block – configuration using enSuite parameterization software) - Internal modem module iCM280-GPRS (option)

Use of
RS485 interface
	Operating modes: RS485 2-wire (semi-duplex)
	                        RS485 4-wire (full duplex)
	Termination: no terminal resistor can be used in the connected bus stations
	Baud rate: max. 19,200 Baud
	Number of bus stations: driver rating at output: max. 16 unit loads
	                         Power consumption at input[1]
	                         - 6 unit loads (RS485, not electrically isolated)
	                         - 3 unit loads (RS485, electrically isolated)

Communications protocols	– IEC 62056-21 (IEC1107)[2] – Modbus ASCII, RTU, TCP[2] – DLMS/COSEM[2] (data encryption based on standards AES-128 and Galois/Counter Mode)

[1] Unit load: standard RS485 receiver with input resistance = 12 kOhm
[2] Details of implemented function range of the listed protocols can be provided on request

Power supply unit (iPS280)	
Power supply	Broad-range power supply unit for direct installation in volume conversion device EK280 to supply power to the volume conversion device and an optional built-in communication module
Primary	110 – 230 V AC, power consumption: 10 W
Secondary	For EK280 CPU board 7,5 ... 8,5 VDC For modem iCM280 3,3 ... 4,5 VDC
Buffer battery for modem (option)	2 lithium batteries, 13 Ah (73017964)

Modem module iCM280 2G (GPRS) or 3G (UMTS)	
Modem	Modem module iCM280-2G (GSM/GPRS) or Modem module iCM280-3G (UMTS) for direct installation in the volume converter EK280
Power supply	- Zone 1 potentially explosive atmospheres – lithium battery module, capacity: 16 Ah (Elster Type 73021211) - Zone 2 potentially explosive atmospheres – with power supply unit iPS280
Antenna	Internal antenna External antenna with 2 dB gain (cable length 3, 5 or 10 m) as an alternative

Interface module iCE280-Ethernet PoE (exclusively for use in Zone 2)	
Module	Ethernet module to connect to an IP network (LAN, DSL, LTE-Router, etc.) • Ethernet 10/100 Mbit Full/Half Duplex (Autosensing), MDIX • ACT/LNK LED on Module
Power supply	PoE (Power over Ethernet), without an addtional power supply unit if the network infrastructure provides the energy for the interface Alternatively Power supply unit iPS280 if the network infrastructure does not provide PoE
Connection	plug-in wire connection on the interface module Connection via CAT5 Cable, wire cross section minimum AWG24 (0,51mm²).

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