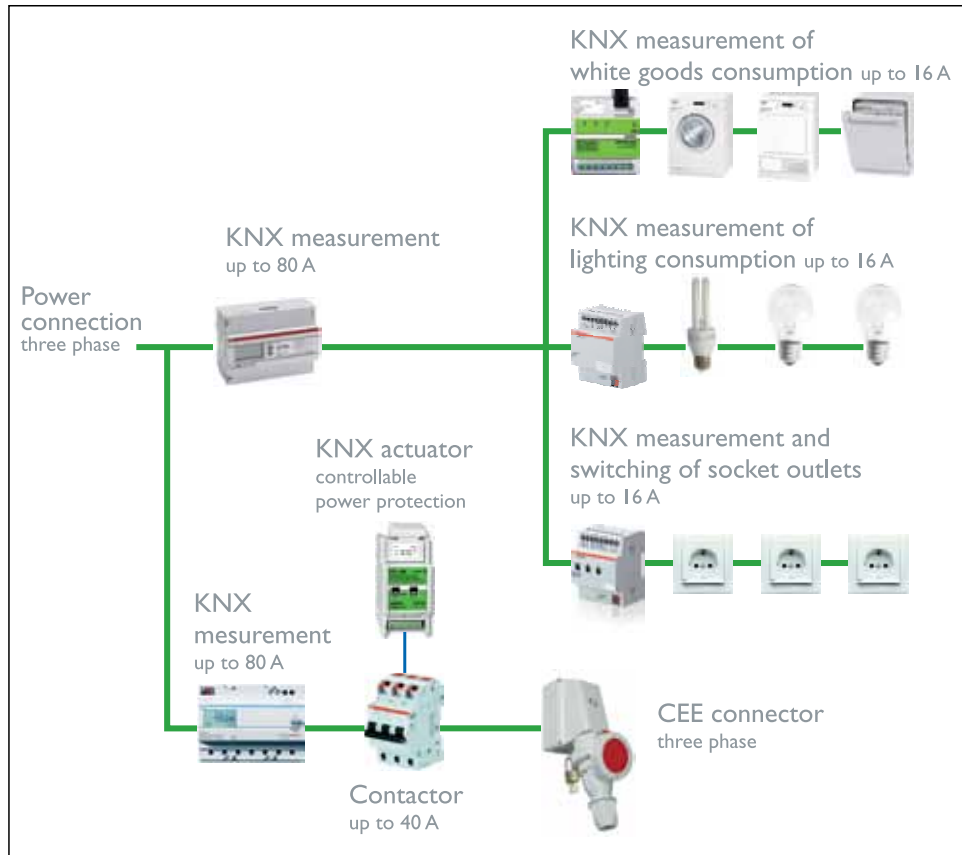# Smart Metering
with KNX

Smart Metering is the basis for KNX city
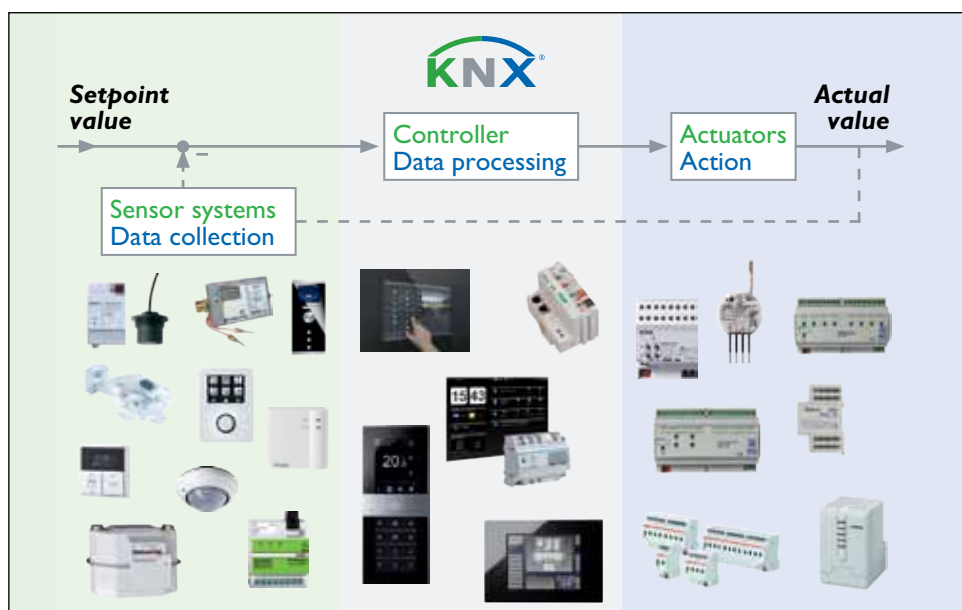
Energy efficiency in the building

Energy management can be defined differently depending on the perspective (building or city). Inside the building, energy management is a method to save final energy such as electricity, heat but also gas and water. These shall be saved whenever possible. A key for the conscious use of energy inside buildings is to inform the consumer continually about his energy consumption. KNX Smart Metering provides the necessary premise for this.

A task for KNX

The visualization of energy consumption is useful for the consumer but insufficient to actively ensure energy efficiency inside buildings. Smart electricity and heat meters of utilities help to achieve transparency of costs. But what use is to the consumer, when being informed about heating costs but not about room temperatures, the opening status of windows or the occupancy of the home? What is the use of informing the consumer about electricity costs without having any information about the currently active power circuits and the behavior of the respective electrical consumers? Better conclusions about one's pattern of consumption and saving potentials can be drawn by the consumer by providing him information on room temperatures, opening status of windows and the occupancy of rooms. KNX provides solutions for visualization and automation that can be combined with the energy monitoring of utilities. The result of this implementation is on the one hand an active energy management, visualizing energy consump-

Smart Metering of electrical energy consumption

KNX sensors, meters and actuators

tion to the consumer, on the other hand able to execute the necessary actions.
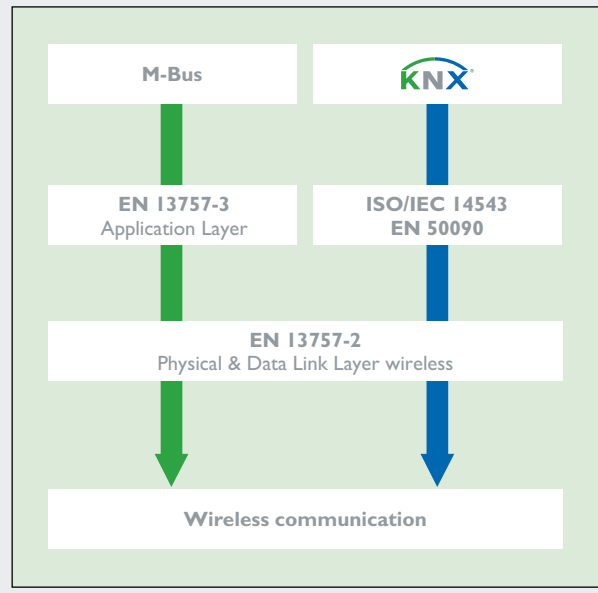
KNX solutions

KNX provides solutions (KNX city solutions) for the load management inside buildings as well as the interaction to the fields of mobility, energy generation and infrastructure. These solutions contribute significantly to the given tasks. By KNX Smart Metering, the energy challenges inside the building and around the building (mobility) are registered metrologically. This is the basis for load management. The information is processed by KNX to introduce appropriate energy efficiency measures, to not only increase the energy efficiency of the building but also the city. By its solu-

tions, KNX combines both perspectives and ensures communication exchange with the city. With the KNX Smart Metering solutions and the KNX city solutions based upon them, it is possible to consume power generated by renewables as soon as these generate energy. By doing so, it is for instance possible to charge electric vehicles or thermal storages via heat pumps, or to increase the cooling power of air conditioning systems at times of surplus renewable energy. Vice versa, charging of electric vehicles or heat pumps can briefly be interrupted at times of lacking renewable energy. Air conditioning systems can temporarily be put into economy mode. The total combined effect on the city is immense.

KNX & M-Bus

As a prominent standard for the remote reading of meters, EN13757-x 'Communication systems for meters and their remote reading' was established in Europe. The standard defines both wired and wireless (868 MHz) remote reading of meters. Both the OMS (Open Metering Specification) Group as the KNX Standard use the EN 13757-4 Standard as a basis for their wireless communication. M-Bus to KNX interfaces are already used in reality by some KNX members or are currently under development for various devices.

Smart Metering

The well-known buzzwords for these types of applications are 'Smart Home' (automation of building functions), 'Smart Grid' (increased efficiency of the grid) and 'Smart Metering' (digitalization and automation of various types of consumption metering), with Smart Metering often used as a generic term for all applications. The term Smart Metering refers to the use of intelligent energy meters and measuring instruments to make energy consumption in buildings transparent and realize an automatic energy management. In future, Smart Metering will play an increasingly important role in residential and commercial buildings. The reasons:

- to allow monthly billing, as customary in some countries (e.g. USA, Romania, Lithuania, Sweden, Denmark) and expected in the future in all European countries following the implementation of the EU Energy Performance of Buildings Directive;
- to monitor buildings for damage or non-standard conditions (e.g. burst water pipes);
- to inform tenants about their consumption patterns, e.g. to save energy costs;
- to issue energy bills at short notice, when there is a change of tenants;
- to obtain comprehensive information about the use of energy in a building for the purpose of issuing an energy certificate;

- to obtain information about the energy consumption patterns of several buildings or living units, e.g. in order optimize the distribution of energy and avoid peak loads;
- to comply with the EC Directive 2006/32/EC on Energy End-use Efficiency and Energy Services, which specifies that the energy bills for household customers have to be sufficiently detailed and issued frequently enough, in order for customers to be aware of their energy consumption and control it correspondingly.

KNX Smart metering products

KNX provides a comprehensive set of possibilities and solutions in the field of Smart Metering. In this respect it is irrelevant, whether
• KNX measuring instruments or metering devices or
• Measuring instruments or metering devices based on M-Bus

Energy meters

Direct measuring energy meters with integrated KNX interface

Energy meters with impulse outputs

Lingg & Janke
EZ-EMU-DSTD-D-FW and EZ-EMU-DSUP-D-FW

Hager
Direct measuring KNX Energy Meter TE360

Arcus-Eds
Impulse Counter Module KNX-IMPZ2

KNX measuring instruments and metering devices

KNX measuring instruments and meters allow measuring almost any physical quantity, such as electrical voltage, electrical current, active power, reactive power, apparent power, phase angle, temperature, heat, sun radiation, humidity, etc. Data is collected in the background without the consumer noticing. E.g. KNX thermostats measure the room temperature inconspicuously. The measured data is used to identify unwanted energy consumption and is evaluated automatically by KNX. Depending on the type of KNX installation, actions can be also performed automatically. E.g. thanks to KNX, during the weekend an open window in an office building can be detected and automatically closed with KNX (if equipped with a motor). As a result, the building Operator saves heating costs. In private homes, KNX thermostats can optimally control floor heating, heat pumps and air conditioning systems – even interactively. Conflicting control actions are thus avoided. The consumer saves money.

The new Lingg & Janke KNX DIN-rail meters are multifunctional three-phase energy meters of only 90 mm (5 Units) width offering exceptional flexibility and accuracy. Via direct or current transformer connection, these meters are capable of analyzing and monitoring a variety of parameters and can be employed in even the most demanding residential, commercial or industrial field of application. They combine the functions of a multimeter, energy meter and data logger in a single device. Using KNX FacilityWeb, the meters can read out and log numerous measured values, such as active and reactive energy, active and reactive power, voltage, current and power factor. Each one of the different output values can be monitored by setting two thresholds. The standard KNX meter can be used for direct measurement (75 A) or for measurements with current transformers (1 and 5A)

Contact:
www.lingg-janke.de

The energy meter TE360 is a three-phase energy meter for the direct measurement of active power and energy consumptions up to 100 A with a high accuracy (Class B, 1%). The meter can be used in all 230/400V power systems and is equipped with a suitable illuminated digital display, displaying energy and power consumption with a resolution of 7 digits including positions after the decimal point. An overall counter and a partial counter with counter reset for two tariffs are included. The total and partial consumption as well as the current consumption can be periodically sent to the KNX bus. Wiring errors and connection errors are displayed and the measuring data are saved periodically.

Contact:
www.hager.de

The impulse counter module allows the coupling of up to two meters with impulse outputs to KNX. The counter input is operated by default as an S0 interface in accordance to DIN 43864, but can be also operated with a potential-free contact. The commissioning of the KNX sensors can be done via the ETS in conjunction with the corresponding application program. When delivered, the devices are not programmed. All functions can be parameterized and programmed via the ETS. The IMPZ2 can be used as two independent counters or as one counter with tariff switching.

Contact:
www.arcus-eds.de

Energy meters with separate KNX interface

ABB Stotz Kontakt
Meter Interface ZS/S 1.1

Siemens
Expansion Module 7KNX/EIB

Energy meters for sub distribution boards

ABB Stotz Kontakt
Energy Module EM/S 3.16.1

Merten
KNX Energy Meter MEG6600-603

The meter interface Module ZS/S 1.1 allows registering and transmitting meter data and values from energy meters to KNX. The device contains an infrared interface, which supports ABB meter types DELTAplus, DELTAsingle, ODIN and ODINsingle or the new energy meters of the A-series. The read information can be used for example for cost-centre accounting, energy optimization, visualization or the monitoring of installations.

Contact:
www.abb.com/knx

The expansion module 7KNX/EIB is used to couple Siemens PAC1500 energy meters. These are used to measure the energy consumption in one or three-phase systems, such as in industrial applications, commercial buildings, offices and apartments in multiple family homes. Especially in industry, the cost pressure rises. Product life cycles are shortened and manufacturing facilities need to be often converted. The operating load of distribution boards is therefore continually monitored in order to timely avoid electrical peaks and prepare retrofitting. The devices show on a LCD display six measurement values: active energy tariff 1 and tariff 2, reactive energy tariff 1 and tariff 2, active power and reactive power. In this way, the current load of an electrical distribution board can be read.

Contact:
www.siemens.de

The new ABB i-bus KNX Energy Module EM/S 3.16.1 enables a detailed analysis of the energy consumption of all electrical consumers in a building controlled via KNX. For each of the three channels the active power, current and voltage as well as further electrical values (apparent power, reactive power, crest factor, power factor and frequency) can be measured. The measured values are made available via KNX. They can be monitored with threshold values. Should a defined threshold be exceeded or values fall below a defined threshold, a warning telegram can be sent and an assigned load can be switched.

Contact:
www.abb.com/knx

With the new KNX energy meter from Merten the energy consumption in homes as well as in offices or commercial buildings can be measured and can be reduced comfortably. For this, the device detects the energy consumption of electrical consumers such as e.g. washing machines, refrigerators or IT server cabinets. Up to three channels with a maximum load of 16 A can be used for monitoring. The KNX energy meter measures the energy consumption of the individual channels as well as the total consumption. A total energy counter and a resettable energy counter save the consumption data, so that in the event of a power failure the values are not lost. The KNX energy meter contains an intelligent energy saving feature that allows the setting of up to eight thresholds.

Contact:
www.merten.de

ABB Stotz Kontakt

Energy Actuator SE/S 3.16.1

Hager

eHz radio frequency transmitter EHZ503

Lingg & Janke

Electric energy meter EZ 162-C-FW

Lingg & Janke

eHZ KNX interface

The new Energy Actuator determines the active energy consumption per switching output. Furthermore, it provides the total consumption of all three outputs. All meter values can be sent cyclically, on request or when a start or stop event has occurred such as a time, operating period or when a defined consumption threshold is reached. Additionally, when a stop event occurs, the assigned output can be switched off. For each channel, the active power, current and voltage as well as further electrical variables (apparent power, crest factor, power factor and frequency) can be measured. The measured values are made available via KNX. They can be monitored with threshold values. Should the threshold be exceeded or fall below a set threshold, a warning can be sent or a channel switched.

Contact:
www.abb.com/knx

The radio frequency transmitter eHZ EHZ503 is based on the KNX radio standard and increases the transparency of energy consumption data by the visualization of current consumption or current feeding values as well as the visualization of historic meter data with the domovea software. In combination with a media coupler TR131A this device can be integrated into a KNX twisted pair system. The eHZ radio frequency transmitter is compatible with Hager eHZ according to FNN specifications 1.00/1.01/1.02/1.03/2.01 or Hager eHZ EDL according specifications 1.00. The battery life is in standard use 2.5 years.

Contact:
www.hager.de

The electric energy meters EZ162A-FW and EZ382A-FW(REG) of Lingg & Janke are direct connection single-phase and three-phase meters for 4-quadrant measurement. The meter EZ35IC-FW is an energy meter using current transformers for 4-quadrant measurement. The display visualizes the concerning values (counter state, current power etc.) The easy-to-read display automatically alternates between different types of readings but can also be operated manually with a push button. The fully-electronic, solid-state meters allow energy measurement unsusceptible to shock or vibration. The measurements remain accurate irrespective of the physical orientation of the meter. The KNX module stores all data every 15 minutes during one year and is fully compatible to KNX Facility Web.

Contact:
www.lingg-janke.de

Electronic utility meters (eHZ) provide the basis for smart metering. Electronic utility meters (eHZ and 3.HZ) comply with the FNN and EDL1.0 and 1.1 specifications and have an optical reading head for reading out meter values. The eHZ KNX Interface BCU-EZEHZ-D-REG-FW consists of an optical reading head with RS232 connector and a KNX interface in a housing for DIN rail mounting. The various protocols of the eHZ manufacturers can be read via the optical customer interface on the front side of the meter. Depending on the protocol of the eHZ manufacturer, meter values can be read out as T1/T2 values, A+ / A- values, power, voltage and current.

Contact:
www.lingg-janke.de

Heat meters

Water meters

Lingg & Janke KNX heat meters are based on meters of the manufacturers Kamstrup and Zenner. The corresponding KNX interfaces are provided by Lingg & Janke. The Kamstrup heat meter uses an ultrasonic sensor for measuring the flow rate. The KNX module is plugged directly into a slot on the meter. The Zenner heat meter uses a vane wheel for measuring the flow rate. The KNX module is installed in an external surface – mounting enclosure. The KNX module stores all measured data at 15-minute intervals over a period of one year and provides full FacilityWeb capability. The meter readings can be read out directly via a network coupler using a standard Internet browser. Consistent communication based on TCP/IP and KNX is the key to fast and cost-effective acquisition of operating and energy consumption data.

Contact:
www.lingg-janke.de

The SensoStar 2 heat meter measures in combination with the flow meter unit and the temperature sensors the consumed heat energy. The heat meter is calibrated as a heat meter for installation in heating circuits. The flow meter unit should be preferably used in the return flow. The heat meter can be integrated into building automation systems using a KNX module. The SensoStar 2 cold meter measures in combination with the flow meter unit and the temperature sensors the consumed cooling energy.
The SensoStar 2 cold meter is provided for mounting in cooling circuits of 5 – 20 ° C. The flow meter unit should be preferably used in the return flow (warmer area). Moreover, a condensation of the flow meter unit should be avoided!

Contact:
www.engelmann.de

The heat quantity meter consists of a calibrated "WZ-HY" meter from NZR equipped with an internal KNX bus coupling unit from Arcus-EDS GmbH and is approved by the PTB (the German national metrology institute). The electronic counting unit is equipped with a lithium battery assuring a lifetime of five years and a power reserve of one year. The bus coupling unit it mounted inside the sealed housing and nonreactively connected with the external terminal box. KNX sensors are set up using the ETS and the associated application program. The device is delivered unprogrammed. All functions are parameterized and programmed by ETS.

Contact:
www.arcus-eds.de

The CORONA-E is an electronic vane type water meter with integrated LCD display and data interface. The electronic counter guarantees long-term transmission reliability. The KNX module is installed in an external surface-mounting enclosure. The parameters allowing outputting the meter value, the status, the serial number, the meter number and the current flow. The integrated KNX data logger stores the data at 15 minute intervals over a period of one year. The data can be read out directly via the NK-FW network coupler using a standard internet browser. By using FTP, also stored data from the KNX/EIB module can be used for further processing, for example with MS Excel or Flash / Silverlight. The individual data can be transmitted cyclically to the KNX bus.

Contact:
www.lingg-janke.de

Gas meters

Lingg & Janke

**Hydrometer
Multical 61**

Arcus-EDS

**KNX In Home
Water Meter WZ_M**

Lingg & Janke

Gas Meter Elster

Lingg & Janke

Gas Meter Itron

MULTICAL 62 is an ultrasonic flow sensor, used for measurement of cold (0.1...50°C) and hot water consumption (0.1...90°C) in commercial, industrial and residential buildings. The ultrasonic sensor does not include any mechanical parts, avoiding deterioration and therefore extending its life time. The meter keeps its precision, also for low flows, during its total lifetime. The KNX module is directly plugged into a slot on the meter. The meter is MID approved.

Contact:
www.lingg-janke.de

The In Home water meter is a combination of the calibrated water meter 'Modularis WZ-M' from NZR and the impulse counting unit SK01-IMPZ1 from Arcus-EDS GmbH, the latter including a battery buffered data storage and KNX bus coupling unit. In this way, the product can be used for remote reading and monitoring.

Contact:
www.arcus-eds.de

The gas meter uses an absolute ENCODER register, which allows direct read out of the meter readings by the KNX module. This greatly facilitates meter replacement as the meter reading and the serial number are read out automatically. The Lingg & Janke KNX module can be directly plugged on to the gas meter. The KNX module stores the data at 15 minute intervals over a period of one year. The data can be read out directly via the NK-FW network coupler using a standard internet browser. Each meter can have its own home page. By using FTP, the stored data can be also used for further processing and billing. The connection of the meter via TCP/IP and KNX provides a fast and cost-effective measuring of data and energy consumption.
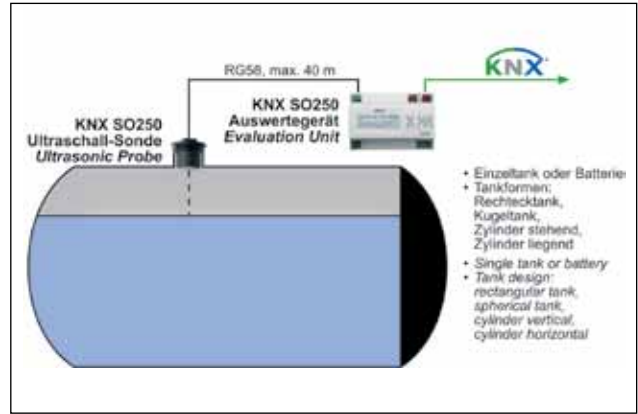
Contact:
www.lingg-janke.de

The Itron gas meter is a diaphragm gas meter. For reading out the measured values and serial number it uses its own Itron interface. The KNX module is installed in an external surface mounting enclosure. The KNX module stores the data at 15 minute intervals over a period of one year and is fully compatible to FacilityWeb. Every meter has its own homepage. The data can be read out directly via the NK-FW network coupler using a standard internet browser. By using FTP, the stored data can be also used for further processing and billing. The connection of the meter via TCP/IP and KNX provides a fast and cost-effective measuring of data and energy consumption.

Contact:
www.lingg-janke.de

Fill level meters

Elsner

tank probe KNX SO250

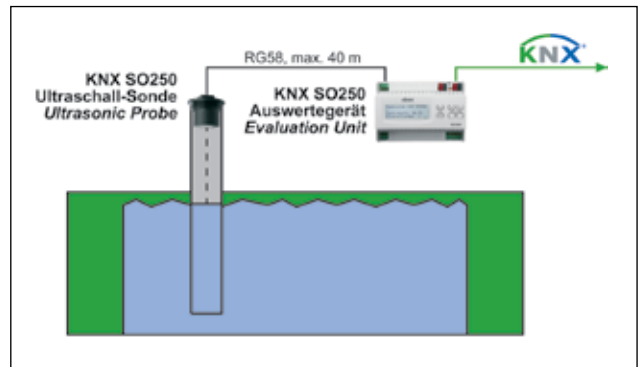*KNX SO250 Application for fill level measurement in a fuel tank*

The tank probe KNX SO250 of Elsner can be used to measure distances and check volumes in containers. It consists of an output device and an ultrasonic probe, with a range of 12 to 250 cm. The KNX S0250 has a connection to KNX and two additional outputs that can be switched when exceeding or dropping below a specified volume or distance. For this, the tank geometry, the number of tanks and the measuring interval can be set at the output device. The display shows the current distance respectively volume. Via the integrated bus coupler, information on the current distance and volume can be used in a flexible way.

Contact:
www.elsner-elektronik.de

KNX SO250 Application for water level measurement in a pond

■ M-Bus measuring instruments and meters with KNX interface

Next to KNX meters, in buildings often M-Bus Meters are used. These can be integrated into KNX via M-Bus/KNX Gateways.

KNX interfaces to M-Bus

As a prominent standard for the remote reading of meters, EN13757-x 'Communication systems for meters and their remote reading' (OMS standard) was established in Europe. The standard defines both wired and wireless (868 MHz) remote reading of meters. The M-Bus to KNX interface is already used in reality by some KNX members or is currently under development for various devices. M-Bus meters are often used in buildings next to KNX meters. They can be connected to KNX via KNX gateways.

Automations- und Steuerungstechnik GmbH
KNX/M-Bus Gateway

The KNX M-Bus gateway is used for communication between the KNX bus system and M-Bus compatible meters. The gateway takes the role of a M-Bus master, this means, it controls the communication. The data readout of the M-Bus Energy Meter can be done cyclically in particular time intervals or on request by the KNX Bus system. Different data formats can be set for each meter value. In this way, e.g. a consumption value can be sent as an integer or a temperature value can sent as a KNX floating point value to the KNX bus. The KNX M-Bus Gateway also includes various diagnostic functions for M-Bus meters such as e.g. the automatic search and the identification of connected M-Bus slaves. The transmitted responses from the meter are shown in detailed way in plain text, thus avoiding the time intensive procurement of the M-Bus telegram descriptions. The diagnostic functions can be easily used with ASCII commands.

Contact:
www.bb-steuerungstechnik.de

SMARVIS GmbH
QUNDIS AMR System

Q AMR (Automatic Meter Reading), the KNX compatible meter remote read out system from QUNDIS stands for modern radio technology of the highest standard. The water and heat consumption of a household is recorded and transmitted wirelessly to network nodes. The measured data can be read via a gateway from almost any location, e.g. in the office of the meter reading service, per radio, per modem or Ethernet interface. Q AMR enables the read out of consumption of systems of all sizes. The values are transmitted to a central point via a GSM phone network or broadband cable with a high level of data security. The data can also be used for statistics by the housing industry or t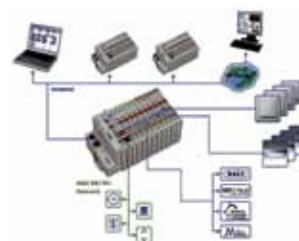o show consumption trends. Q AMR is compliant with the European KNX standard for home automation. The standardized interfaces make it easy to connect the system with other systems (heating regulation, controlling of lights and blinds). Further advantages are the simple installation of the measuring devices and network nodes as well as the self-configuring radio technology. All devices of the current generation of the Q AMR system are working with M-Bus conform to EN 13757-3 und -4 and are compatible with the KNX specification Vol. 10, part 3. Over one million households in more than 20 countries are already equipped with this technology.

Contact:
www.qundis.com

Wago
The KNX IP Controller Wago-I/O-System

The KNX IP controller of the WAGO-I/O-System, together with a serial interface and a level converter, can do much more than simply reading out M-Bus meters. The M-Bus (meter-bus) is used to read out different types of utility meters (electricity, heat, water, etc.). Using the WAGO-I/O-SYSTEM as a decentralized control system, the M-Bus is connected to the KNX/IP controller via a serial interface module and a level converter from the company RELAY. M-Bus telegrams are evaluated in the internal application via ready-made function modules. In combination with other function blocks they also allow alarm and limit values to be processed and SMS or emails to be generated. Both meter readings and all further data can be transmitted to a SCADA system by using group addresses either via KNX TP1 or via KNX/IP over Ethernet. Furthermore, an integrated web server allows information to be processed graphically, which provides direct access to the controller's web pages from any web browser and from any location.

Contact:
www.wago.com

www.knx.org