

Wireless Solutions for Automated Meter Reading (AMR) from GGES

This document describes the low power wireless telemetry communications solution that is used by GGES as part of the data delivery service. GGES offers a complete, integrated set of services, for end-to-end data collection and delivery of data to enable remote monitoring of energy, water consumption and other equipment.

Through regular monitoring, it is possible to accurately calculate energy usage, validate bills and improve operational efficiency. Key is the delivery of timely data.

GGES and our partners have accumulated significant experience over many years in working in providing telemetry data resulting in the development of innovative technologies and solutions.

A key technology, designed by GGES, is a novel low power radio (LPR) solution aimed specifically at the needs of AMR. LPR can be shown to be the most cost effective to remotely read large numbers utility and non-utility meters. Secondly, when combined with the Internet (WAN) or GPRS as the wide area network, LPR is capable of providing highly granular data providing near real time delivery.

The real-time data acquisition provides the ability have near instantaneous meters reads, on-demand billing, and load profiling and shedding in response to demand.

In the future having higher resolution data will become increasingly important to support carbon trading, conservation and environmental objectives.

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GGES exercise due diligence to ensure that the equipment is suitable for use in stated applications, but ultimate responsibility for the compliance of a complete system must rest with the prime contractor, installer and end user.

LPR technology from GGES

The GGES radio technology has been developed by experts in AMR from years of experience deploying such systems in the UK and USA. The system is especially developed to maximize range and penetration within a building. Data is transmitted in the 868 MHz ISM radio band using a technique called 'Narrow Band transmission'. This band operates at a lower frequency and data rate than other typical systems such as Wi-Fi, Zigbee and Bluetooth, using a specially developed protocol. Subject to local license conditions, it is possible, where to modify the transmission frequency.

A fundamental requirement of radio is to be able to pick out a signal from a background of random noise; the relationship between signal strength and background noise is referred to as the signal to noise ratio. A problem for typical radio systems operating at low power is that the signal level is limited so that the signal to noise ratio is low. This makes life very difficult for radios of ordinary receiver sensitivity, and limits the range over which communications can be achieved.

The traditional approach to improving range would be to increase the signal power by increasing the power of the transmitter. However this implies a more expensive transmitter and in any case the transmitter power is usually limited by regulations and shorter battery life.

However, an alternative way to improve the signal to noise ratio is to decrease bandwidth; and data rate, this is what the GGES technology does. The result is increased reliability of transmission and better immunity to local interference. The lower data rate enables communication over long distances than is possible with conventional radio technology optimised for the automated meter reading market.

The total solution comprises a cost-optimised base station and a small low cost transmitter for integration in or attachment to other equipment.

A typical system includes a 'hub', each communicating with many meters, and backhaul by GPRS or other a fixed IP network to the control centre. The technology is bi-directional, allowing smart metering so that remote devices can receive information from the network for control or load management.

Benefits are:

- Geared towards local communications such as a block of flats, schools and sites with multiple meters
- Can be massively scaled;
- The modules are ATEX approved and provide the highest level of intrinsic safety;
- Low Power Radio transmitter is low cost;
- The potential for zero cost per transmitted byte;
- Only radio can enable communication directly from different types of endpoint devices without connection to mains power supplies, cabling and trenching (through the use of battery-powered radios);
- Can be located anywhere;
- Can support multi-utility and other applications.

Depending on the application, the data can be provided monthly, daily and down to a resolution of 10 seconds (typically 5 minutes) and delivered in near real time. The technology deployed by GGES can be used to accurately monitor consumption of electricity, gas, water, steam, heat, temperature and a number of other variables. All devices are ATEX zone 0 certified, where relevant.

Wide Area Network (wan) to Deliver Data

Data is communicated back from the transmitters via a WAN. There are a number of possibilities for the WAN. Currently these are:

1. GPRS (GSM) - using GSM is an ideal solution where the meters spread over a wide geographic area or located in remote places.
2. Direction connection to the Internet - ideal where the customer permits.

Both are now globally available and provide a common means of transferring data using TCP/IP protocols and provide a means to manage frequent reporting from large numbers of endpoints distributed out into the field to aggregate, concentrate and forward the relevant information.

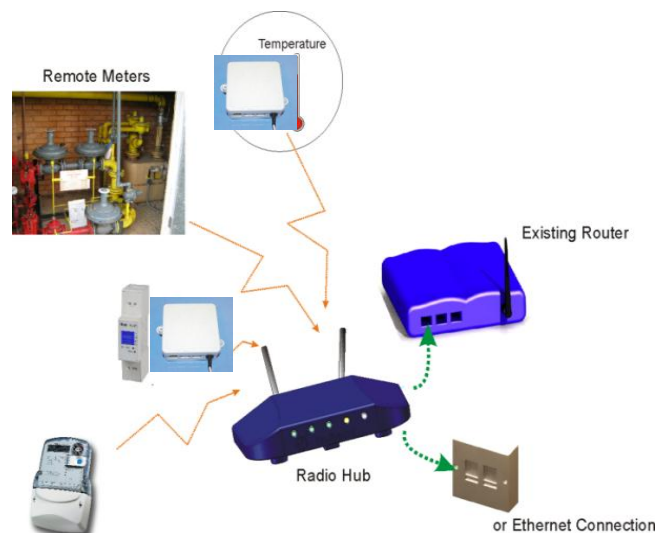
Cost of communicating data over these networks is very low cost per byte and with the Internet can be near zero.

The main data processing is pushed to the remote data centre. This is instead of the meters or loggers themselves needing to be intelligent. This architecture creates what is effectively hundreds of "virtual" advanced meters out of simple consumption meters. This basic architecture is the only effective means to offer advanced metering in scale particularly where the cost has to be lower than the value of the data produced.

Low Power Radio (LPR) to Internet

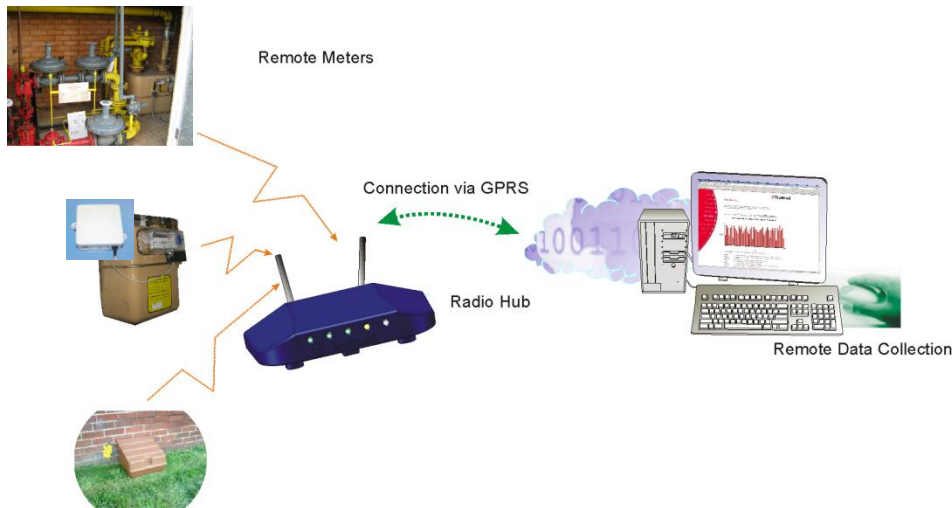
GGES also offers a technology that uses inexpensive radio devices to bridge to a local Hub connected to the Internet. The technology allows:

- Multiple transmitter nodes on a single internet-enabled Hub data collector;
- Atomic accurate time-stamp of measurements;
- Built-in temperature sensor in transmitter nodes;
- Simple plug-and-play installation;
- Internet has wide UK coverage and has very low communication charges;
- Continuous 'on-line' connection and near real time data delivery;
- Ideal solution for domestic, SME and sub metering.



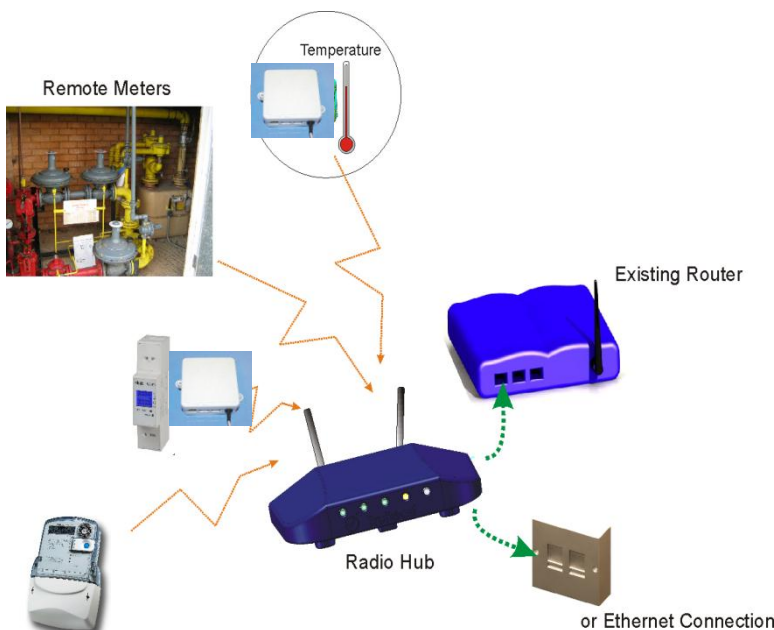
Connection via GPRS

The GPRS solution is intended in situations where a direct Internet connection is not available or certain high security application or remote areas. The radio transmitter is attached to meter as normal but Hub connected back to GGES via GPRS. The GPRS connection is then effectively shared across a number of transmitters. Data can be delivered to the same resolution, however, would typically only be delivered once a number of transmissions have been received.



Internet as a means to deliver AMR data

In a matter of very few years, the Internet has consolidated itself as a very powerful platform that has changed the way we do business, and the way we communicate. The Internet, as no other communication medium, has become the Universal source of information for millions of people, at home, at school, and at work.



Currently worldwide there are 1,565 million users and 98% of UK businesses are connected to the Internet.

Using the Internet based data hub allows energy consumption data to reach GGES quickly and economically. The hub sends data to a specific secure serve. Because the hub is dedicated to one purpose there is no opportunity for it to be used to 'hack' a network or be remotely reprogrammed. The end of the document has a FAQ on these issues.

Walk-by and Drive-by

This is an alternative to the fixed network. In this mode the data is transmitted on a defined wakeup signal and gathered as a vehicle or person passes by. This is a mode of operation available from an alternative model of transmitter and typically used in water applications. It will be necessary to contact GGES for more details.

Low Power Radio in Use



LPR Transmitters for Gas and Water (above ground)

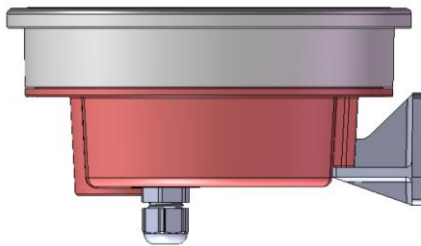
The transmitter is attached to the meter. Each transmitter has a unique identity and is powered by an internal long life battery (typically 5 years with 5 minute transmissions).

The transmitter continuously senses the flow or consumption through up to two meters and is programmed to periodically and securely transmit the consumption data. The transmitter includes a receiver that senses for collisions of transmissions and used for configuration.

Each transmitter contains an internal temperature sensor and can be used to remotely measure local temperature to an accuracy of better than 0.5°C and has a range of -55 °C and +125 °C. This facility can be used to accurately determine heat loss and efficiency of a building.

Also built in the transmitter is an output from a passive pulse repeat that can be used to provide a pulse to a second locally connected device.

IP68 LPR Transmitters for Water Logging



In applications where the unit is to collect data from a water meter there are special considerations. In many cases the water meter will be in a pit. A pit can flood and so the LPR unit has to be completely water proof.

Secondly, the radio propagation is significantly worse because the unit may be both below ground level and also under a steel cover.

For these applications we have a unit especially designed for this environment. The electronics are housed in an IP68 enclosure. This means the unit can be completely immersed under water and will not leak.

The output power is increased and aerial designed to operate underground.

LPR Transmitters for Electricity Logging

There are two options:

Either connect to a pulsing electricity meter and use the pulse counting transmitter as used in gas and water applications.

OR

GGES offer a solution that can be retrofitted to a range of Elster meters. These include single phase AS230 meters and polyphase A1140 and A1700 types. When used with these meters the radio will electronically read the internal register of the meter and deliver absolute data.

LPR Data Hub



The data transmissions from all the transmitter devices in range of a Hub, up to 300m, depending on the building, are collected.

To ensure maximum reliability and diversity of reception the Hub contains two independent radio receivers. On the front of the Hub are a number of status lights that indicate activity.

The Hub also contains a radio transmitter that is able to repeat a signal between Hubs and used to confirm installation of a new transmitter.

Power is provided from a small power pack that is connected to any local 220-240 volt supply. In the event of a power outage, the Hub includes a rechargeable, backup battery that will provide 24 hours of support.

The Hub includes an internal real time clock. This is used to time stamp data as it is received. The internal clock is synchronized to an atomic time standard and updated via the Internet, hence ensures absolute time accuracy.

Data collected from the Hub is then securely transmitted over the Internet or GPRS to GGES for further processing and delivery to the end client.

The unit is designed to fix to a wall or can be used on a desk top.



Both the Internet and GPRS versions appear the same. At the back of the unit are a power connector and two aerials to receive the LPR transmissions. If necessary the aerials can be changed for higher gain versions to extend range.

At the back of the hub is a connection for a serial communication port used for installation and diagnostics.

Depending on the version the unit will either have an Ethernet socket or additional aerial connection for the GSM aerial.

Signal Indicator Lights
indicate correct operation and receipt of a signal.

Status lights on the front of the unit

Installation and Radio Network Configuration

Configuring the LPR Transmitter

The transmitters can be configured to operate in several modes:

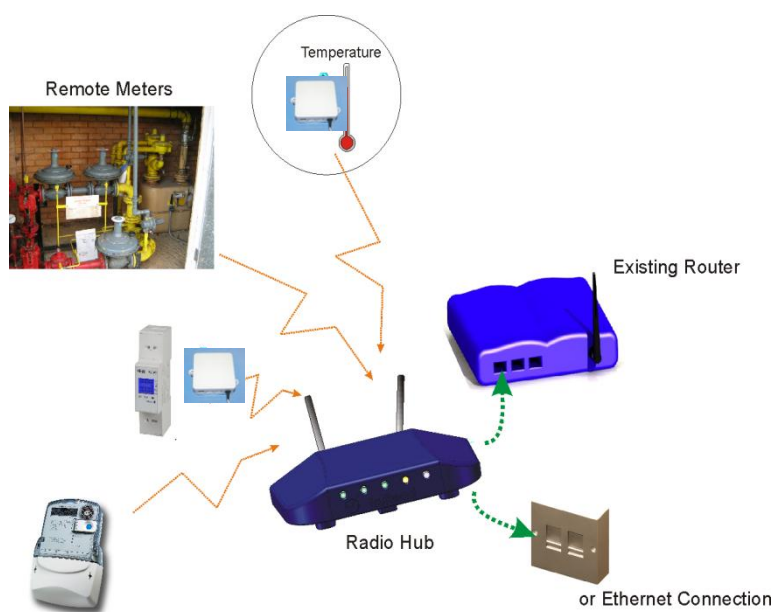
1. Two input with 32 bit resolution – at a defined period;
2. One input with four 8 bit deltas (used for gas meters on 5 minute resolution) – at a defined period;
3. One input with two 16 bit deltas (used for high speed pulse counting such as electricity meters or long periods between transmissions) – at a defined period;
4. Immediate transmit on pulse input;
5. Transmit current temperature (if hardware fitted) – at a defined period.

The transmit channels can be loaded with the current reading to ensure the count and visual meter reading are in synchronised. Removing the internal link resets the current meter reading and enables the unit for installation.

A purpose installer tool and software that runs in a PC are used to configure the transmitter.

Other parameters are configured in the factory.

Simple Network – Single Hub



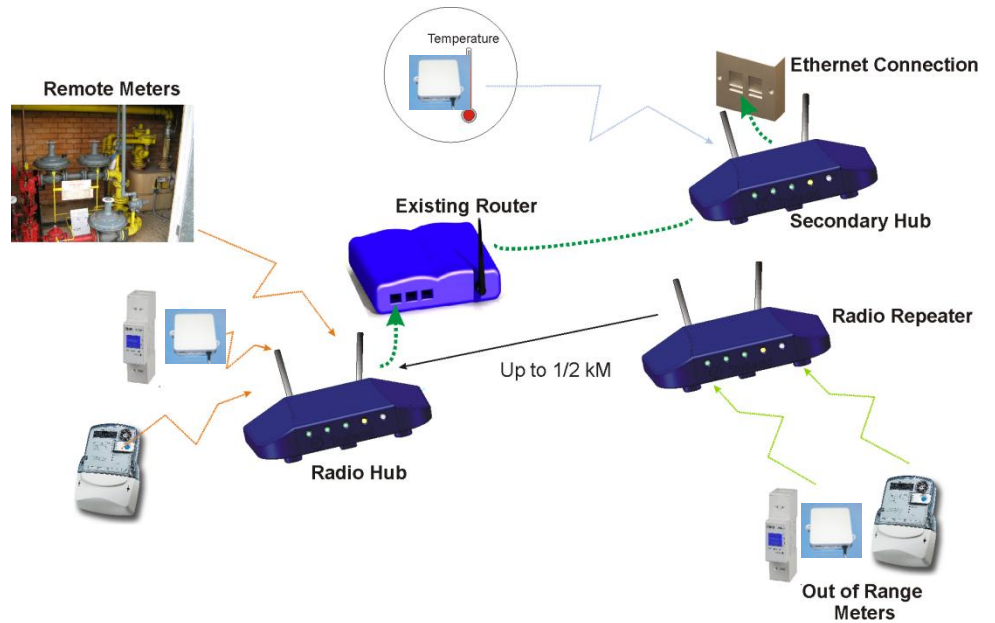
In most cases a site will require a single Hub and a number of transmitters connected to meters and equipment around a site.

Any number of additional transmitters can be added at any time and the system will automatically recognize they are present.

The limitation on number of transmitters associated with a Hub will be the maximum range between the Hub and transmitter. In open space this can be up to 300m.

Meshed Network and Repeaters – Multi Hub

In a small number of cases a site will be too large for all transmitters to be in range of a single Hub. In this case the solution is to fit multiple Hubs. These can either be connected to the Internet or to stand-alone to repeat the signal between remote meters and Hub connected to the Internet.



In this way, a large site can be completely covered.

Using the Pulse Splitter Feature

The low power radio includes a passive pulse splitter. This can be used to replicate the input pulse to a follow on device.

The pulse splitter operates without the use of a battery and can be used to share the pulse between the internal low power radio and external device.

Alternatives for Power Supply Options



The Hub requires a low voltage DC supply to operate. This can be obtained either via a small mains power pack or in the case of more remote locations via Solar Cells. The solar cells would charge a small local battery that provides power for the Hub to operate.

Powering via solar cells would be more applicable to operation in remote location when using GPRS.

FAQs

ATEX Intrinsic Safety Approval

A hazardous work environment may contain flammable gases, vapours, mists, dusts, or ignitable fibres. There are different protection concepts used in Europe and North America to classify the type of hazards present in industrial workplaces.

Intrinsic safety is a protection concept employed in potentially flammable/explosive atmospheres. Electrical devices installed near or on gas meters must be intrinsically safe.

The LPR and loggers have been designed to be intrinsically safe and conforms to ATEX Zone 0 rating i.e. designed to be explosion proof.

Security and the Internet

Is it a security risk?

Clearly there may be concerns when using the internet to transmit AMR data. This has been taken in consideration when designing the system. The Hub is designed to only receive data from the LPR devices. Data exchanged between the Hub and LPR is scrambled and would have no meaning if intercepted. Any data transactions communicated over the Internet are always initiated by the Hub and sent as an outbound message to a specific secure Website.

Can the Hub be hacked or hijacked?

No, the Hub cannot be hacked or reprogrammed via the Internet. The firmware is hardcoded in the unit and only allows data from the LPR devices to be sent to a secure location.

Can the Hub be used to introduce a virus or Trojan?

No, only the data associated with meter reading can be transferred via the Hub.

Can my network be viewed via the Hub?

No, the Hub provides no access to the associated network it is connected to.

Does the Hub collect or view any other data from my network?

No, the Hub can only send data from the purpose designed LPR devices.

Is the data safe over the Internet?

Yes, it is encrypted.

Do I need to allocate a static IP address?

No, normally the Hub is automatically configured by the network. However, if required the unit can be set to a specific IP address.

What Ports do I need enabled?

The Hub requires Port 13 to enable time synchronization and Port 80 to be open to allow outgoing traffic. Port 80 is associated with HTTP and normally provides Web browser access.

Specifics questions about the radio

What information will be transmitted and is my data secure?

Yes, only meter readings (actually, only changes to the meter reading) and unit ID are transmitted. Specific customer information is not transmitted. GGES strives to provide the best possible customer service and highest integrity of data delivery. Periodically diagnostic information is also transmitted to verify that the system is operating correctly. Where applicable, the system also provides information if a tamper event or fault has occurred.

Will the radio transmission interfere with other equipment?

No. The transmitting devices operate in compliance with EU regulations at a very low-level. The transmission will not interfere with electronic devices such as cellular phones, wireless computer network or Internet access.

Are there any potential health concerns with the radio signals?

Studies made on low-power radio frequency transmissions have revealed no negative health impacts. The signals associated with the LPR are many times less powerful than those used by mobile phones and only for a very short period of time.

Will the System act a meshed network?

Yes, at the level of the Hubs these can act as both receivers and repeaters. To maximize battery life the LPR's do not include a repeat or mesh facility.

Is the System two way?

Yes, although for most purposes the LPR acts as a transmitter only.

Why not use Zigbee or Wi-Fi?

Both of these radio technologies are not optimised for range and penetration of a building but are designed for high data rates and exchange of large volumes of data. The LPR is optimised for delivery of regular payloads of small packets of data and for range as required for meter reading.

General questions about the service and installation***Why Electronic Reading?***

When the average meter reader reads hundreds of meters a day, mistakes can happen. This can result in disputes and will not provide regular data. The accuracy gained by using an AMR system can greatly reduce errors and can provide daily or better delivery.

How do I know it is reading my meters?

The new meter or device attached to the meter has a unique identification number. This is tagged against a consumer's account and so there is no confusion as to which service address belongs to which meter.

Has this new AMR equipment been tested for accuracy and reliability?

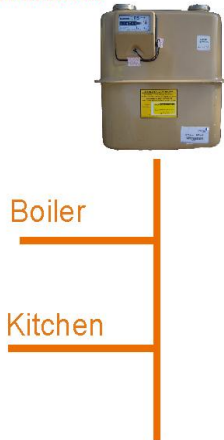
Yes, this equipment has gone through numerous tests for billing accuracy and system reliability.

Who will be installing the AMR meters and equipment?

GGES has a network of trained and appointed installers or customers may nominate an installer, if they so wish.

Understanding Metering and how to implement AMR

Primary Gas Meter
No communications



Primary Electricity Meter
No communications



Typically the only source of data is the utility company meter or the primary meter, used for billing by a utility.

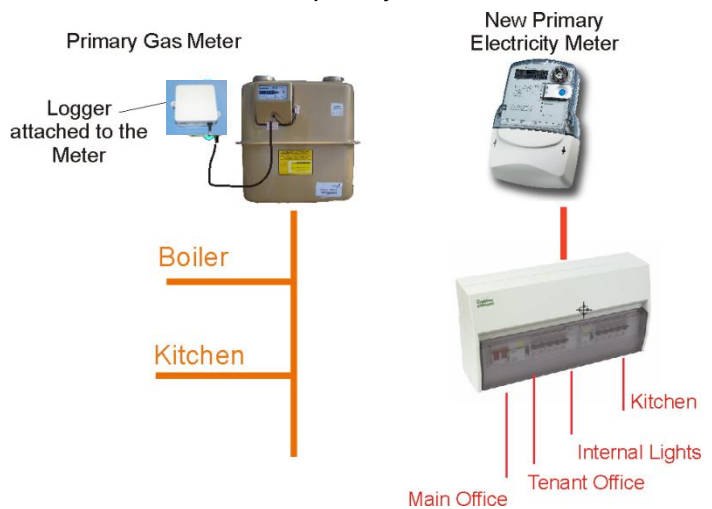
Sites with peak load electricity consumption above 100kW will have half hourly primary meters providing good quality data for energy management.

Smaller sites with a peak load below 100kW will have non-half hourly primary meters which can only be read manually. These sites will frequently have estimated bills.

AMR/Smart Metering

These meters are often old mechanical types and do not provide a means to be remotely read. Also they only monitor the whole site and are not able to provide information as to where the electrical energy, gas or water is consumed.

GGES can upgrade the metering to state of the art to Smart Metering, able to provide data suitable for AMR. Either we fit a new 'Smart Meter' or retrofit a device to an existing meter to enable these meters to be remotely read.



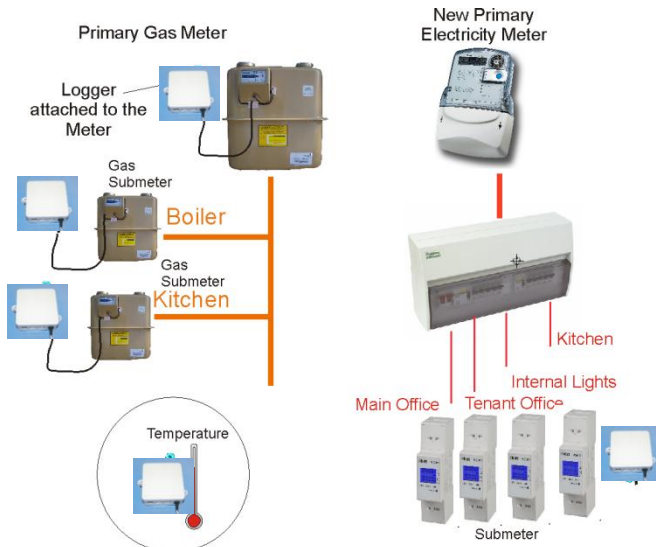
In the case of gas we can very often upgrade without the need to change the meter. The new meters enable remote reading. Similarly, water meters can be modified to provide remotely read consumption data.

Sub Metering

To allow greater understanding and better able to monitor electrical sub-circuits and downstream gas pipe work.

This is known as secondary metering and fitted after the main meter.

Having more detailed data allows identification of when and where use and potential wastage is occurring, providing the ability to closely manage consumption throughout a facility.



Data Telemetry and Machine to Machine (m2m)

Commercial and industrial processes can be made more efficient by connecting remote devices to enterprise IT systems, the Internet (or an Intranet) and other, proprietary systems. With data telemetry and m2m, widely dispersed parts of a system can be brought together into an integrated whole and a wide variety of new added value services can be created.

Wireless technology is typically used to connect a wide variety of machines or devices that need controlling or monitoring.

Several wireless technologies are available to provide solutions for different applications and each of these technologies has a particular set of characteristics that makes it more or less suitable for particular applications or markets.

Recently improved data capabilities of cellular radio systems (GSM), reduced costs and more realistic data tariff structures have led to a growth in the use of cellular infrastructures for data telemetry and m2m applications. Whilst these technologies sometimes offer an appropriate solution, the power consumption, terminal equipment cost, data transport cost and/or data rate are unlikely to all be optimal for all applications.

Other lower power wireless data transfer solutions such as Bluetooth or WiFi may offer more attractive cost models but may fall short in other ways such as achievable range, building penetration or battery life.

Example Applications

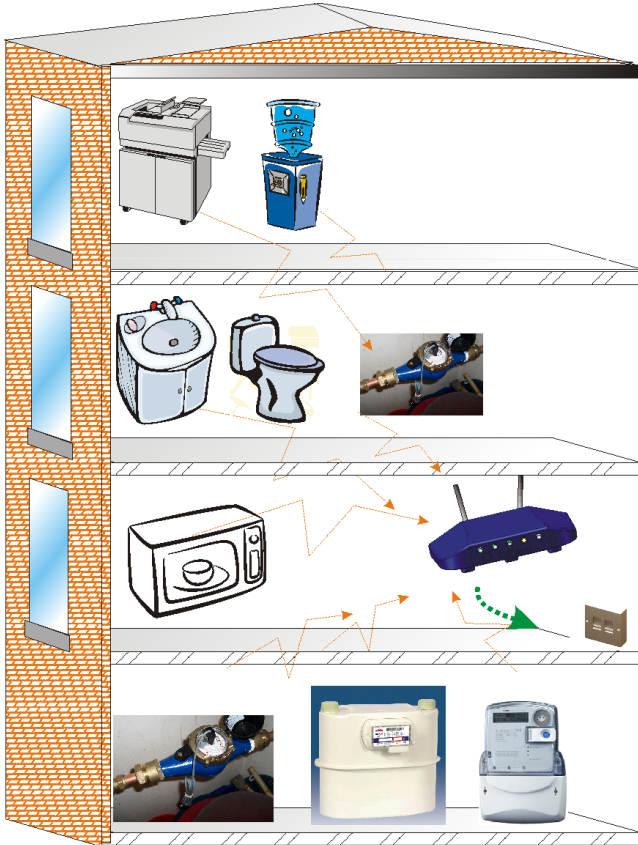
In its entirety, the product suite presents an expansive array of functionality for monitoring and logging. The components may be mixed and matched to form a complete system. The flexibility offered both regarding functionality and size of system allows use across any type or size of application or company from literally one point through to tens of thousands of points spread across multiple locations.

Primary Billing Meters

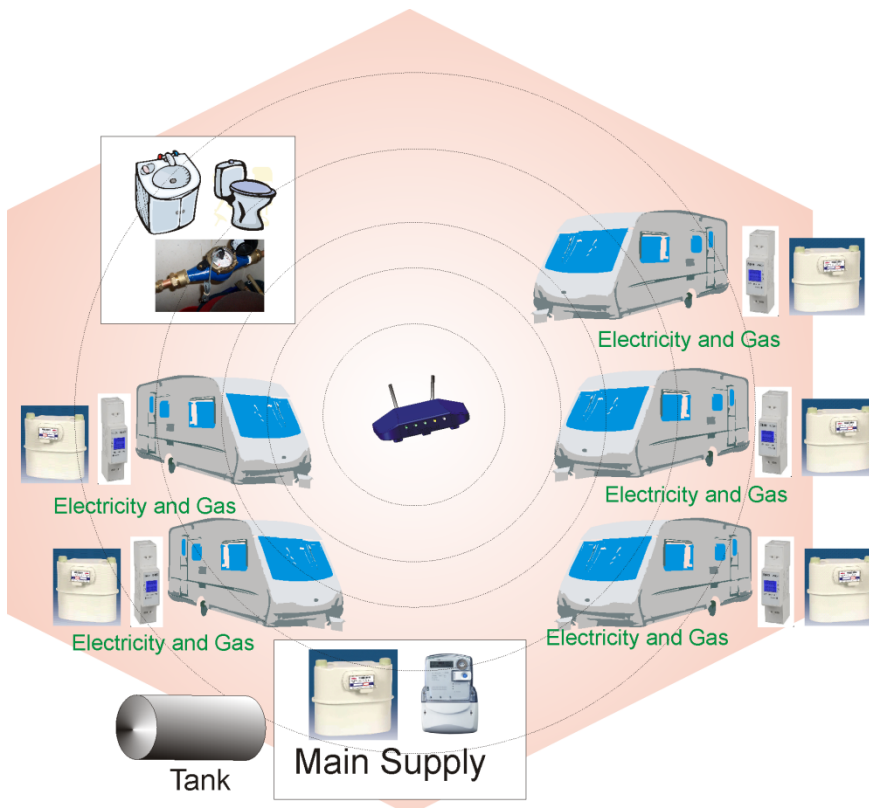


Automated Meter Reading (AMR) for Primary Metering

Sub metering of a facility or for tenant billing



Caravan and Holiday Parks



ATEX Compliance

Merlin (the equipment) is marked as suitable for installation in a hazardous zone, as defined by ATEX, and the equipment is fully approved for connection to any equipment in hazardous zones defined as Zone 0, Zone 1 and Zone 2 and any type of gaseous mixture up to and including the IIB range. Before installation, ensure the equipment is suitable for your application. **If you do not take these precautions into account, safe installation may be compromised.**

Safety Warnings:

- No user serviceable parts inside the equipment;
- Retain the safety and operating instructions for future reference;
- Observe all warnings on the equipment and in these operating instructions;
- The end user is responsible for the safe installation;
- Installation and service shall only be carried out by suitably qualified service personnel;
- Local working practices and regulations for wiring and installations must be adhered to;
- Regular periodic inspection of the equipment should be performed by suitably trained personnel in accordance with the applicable code of practice to ensure it is maintained in a satisfactory condition;
- The enclosure cover must be fully fitted;
- Do not remove the enclosure cover in explosive atmospheres;
- Do not connect or disconnect the pulse cables from inside the unit in an explosive atmosphere.

ATEX Approval

To comply with ATEX the installation of the equipment, the installer must verify that the equipment is suitable for location the equipment is to be installed in. The following information appears so as to comply with the provision of Instructions as required by the Essential Health & Safety Requirements ('EHSR) in European ATEX Directive 94/9/EC (Annex II) & European Standard EN 60079 0 & 11. Changes to other parts of this document are permitted without reference to the Approvals Authority provided the changes do not conflict with the following information. The following applies to equipment covered by INTERTEK ATEX certificate.

Certificate no: ITS09ATEX26351X

Certificate code: Ex ia IIB T4 (-20 °C ≤ Ta ≤ +60°C)



Markings

II 1 G Ex ia IIB T4 (-20 °C ≤ Ta ≤ +60°C)

Applied standards:

EN 60079-0: 2006

EN 60079-11: 2007

Electrical Ratings of internal parameters:

$U_o = 3.9 \text{ V}$; $I_o = 436 \text{ mA}$; $C_i = 0.97 \text{ } \mu\text{F}$; $L_i = 22 \text{ nH}$

Electrical Ratings for Input/Output Termination:

$U_i = 12 \text{ V}$; $I_i = 50 \text{ mA}$; $P_i = 0.25 \text{ W}$; $C_o = 99 \text{ } \mu\text{F}$; $L_o = 0.7 \text{ mH}$

Intended area under the expected operating conditions:

The equipment may be used in either:- In hazardous areas classified as Zone 0 or Zone 1 or Zone 2, with flammable

gases and vapours with apparatus groups IIB or IIA and with temperature classes T1 or T2 or T3 or T4.

Or

Non - hazardous area with connections to other approved equipment in a hazardous area with flammable gases & vapours with apparatus groups IIB or IIA via isolated equipment or to any device in the none hazardous zone.

Note: - the pulse replication is not isolated and the equipment must not be used unless connected via such isolated EX ia rated equipment.

The equipment is certified for use in ambient temperatures in the range -20 Deg. C to +60 Deg. C and should not be used outside this range.

The enclosure is designed to meet an IP rating of IP 20. High IP rating will require an additional gasket or sealing.

Installation and General Warnings:

The equipment is to be installed by suitably trained personnel in accordance with the applicable code of practice. Under certain extreme circumstances, the non-metallic parts incorporated in the enclosure of this equipment may generate an ignition-capable level of electrostatic charge. Therefore, particularly in the event of an installation in Zone 0, the equipment shall not be installed in a location where the external conditions are conducive to the build-up of electrostatic charge on such surfaces. Additionally the equipment shall only be cleaned with a damp or conductive cloth.

Putting into Service:

The equipment may only be put into service by suitably trained personnel in accordance with the applicable code of practice. Installation shall be carried out in accordance with the applicable code of practice by suitably trained personnel. Within Europe reference is also made to British & European Standards BS EN 60079-10: 2003 "Classification of hazardous areas" & BS EN 60079-14: 2003 "Electrical installation in hazardous areas".

Characteristics of tools used to fit equipment:

Conventional tools may be required to be fitted to the equipment, it is recommended the battery link is set to disconnect during installation.

Use and Environment:

If the equipment is likely to come into contact with aggressive substances, e.g. acidic liquids or gases or solvents that may affect plastic materials or attack metal part, then it is the responsibility of the user to take suitable precautions that prevent it from being adversely affected thus ensuring that the type of protection is not compromised. This should include relocation or provision of addition protective housing and means.

Assembling and dismantling:

The equipment does not require assembly or dismantling.

Checking for Correct Operation:

With regard to safety it is not necessary to check for correct operation.

Inspection:

Regular periodic inspection of the equipment and associated installation should be performed by suitably trained personnel in accordance with the applicable code of practice to ensure the equipment and installation is maintained in a satisfactory condition.

Maintenance, Servicing & Emergency Repair:

The equipment is not intended to be repaired by the user. Repair of the equipment is to be carried out **only** by the manufacturer, or their approved agents, in accordance with the applicable code of practice.

The equipment contains no customer replaceable parts.

Adjustment:

No user adjustment required.

Danger Areas of pressure relief areas:

There are no pressure relief areas.

Training Instructions:

It is expected that installers will have been trained to install the equipment and are familiar with the risk associated with this type of device and working methods.

Installation Requirements:

The installation of the equipment must also be in accordance with any local codes that may apply and should only be carried out by a competent engineer who has the necessary training and skill.

Replacing the Battery:

The battery is fixed and can only be replaced by the manufacturer.

Fixing and mounting:

- The equipment can be mounted either indoors or outdoors in a sheltered location. Indoor installation is preferable as this gives added protection from adverse weather conditions;
- If possible, try the installation before drilling any holes or fixing cable;
- The equipment must be fixed in the vertical position;
- The housing must be protected against mechanical shock;
- Make sure the housing screws are appropriately tightened;
- If the equipment is likely to come in contact with aggressive substances, then it is the responsibility of the user to take suitable precautions that prevent it from being adversely affected, thus ensuring type protection is not compromised.

Battery Disposal and Safety information:

This unit contains a Non rechargeable Lithium Thionyl Chloride Battery. Use of any battery other than that supplied by the manufacturer will invalidate applicable warranties and safety.

The battery should never be short circuited, punctured, dropped, crushed, deformed, exposed to high temperatures, incinerated, immersed or force discharged. Before dismantling the product, the battery manufacturer's COSHH information (available from MIS) should be consulted.



The battery must not be disposed of as unsorted waste & must be collected separately in order to facilitate correct environmentally sound treatment & recycling. Within the European Union, where possible, the product should be returned to the manufacturer, or their authorised agent, for disposal. However where this is not possible, prior to disposal your local Waste Disposal Authority should be contacted regarding any regulations that may be in force at the time covering waste disposal procedures in relation to Lithium Thionyl Chloride

inorganic electrolyte batteries as well as waste electrical & electronic equipment ('WEEE'). Local and International regulations regarding the transport of batteries must be complied with.

Special Conditions of Use:

Under certain extreme circumstances, the non-metallic parts incorporated in the enclosure of this equipment may generate an ignition-capable level of electrostatic charge. When used in a hazardous zone, the equipment shall not be installed in a location where the external conditions are likely to cause an electrostatic charge on such surfaces. Additionally, the equipment shall only be cleaned with a damp or conductive cloth.

User Repairable Parts:

The equipment is not intended to be repaired by the user. Repair of the equipment is to be carried out by the manufacturer, or their approved agents, in accordance with the applicable code of practice. Subject to the applicable code of practice, the enclosure may be temporarily opened whilst the equipment is powered.

Assembling:

The equipment does not require assembly or dismantling.

Instructions:

On being put into service, the equipment shall be accompanied by a translation of these instructions in appropriate language or languages of the country or end user putting the equipment into service as well as the instructions in the original language. The instructions shall contain the certification marking as detailed on the relevant certification drawing. Where applicable, the address of the importer or repairer shall be specified.

Pulse Replication:

When used in a Hazardous Zone, the pulse replication facility is intended for use with other intrinsically safe EX ia devices only.

Cable:

Only cables provided by the supplier shall be used. Suitable segregation must be maintained between the non-intrinsically safe circuit associated with the pulse input and pulse output. When routing the cable avoid sharp edges and pinches. Mechanical pressure on the cable may cause performance degradation or even a short circuit.

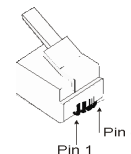
Input and Output Connections:

Subject to safe and correct installation, the MERLIN will interface to any meter i.e gas, water or electricity having a suitable pulse output. This can be any of the following:-

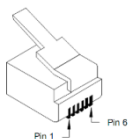
- A volt-free contact
- Reed relay
- Open collector (drain). In this case it is important that the correct polarity is observed in making the connection.

When other ia

I.S. equipment



attaching the MERLIN to intrinsically safe ('I.S.') EX equipment then the compatibility of electrical parameters for each item of must be confirmed before connection is made. All I.S. parameter values for the MERLIN are specified in this document as well as on the lid of the product itself. It may be necessary to consult the documentation from other manufacturers to determine the I.S. parameters for individual item of equipment the MERLIN is connected to.



Input in the Hazardous Area:

- Co MERLIN to be greater than Ci (Meter 1) + Cc (cable to Meter 1) + Ci (Meter 2) + Cc (cable to Meter 2).
- Lo MERLIN to be greater than Li (Meter 1) + Lc (cable to Meter 1) + Li (Meter 2) + Lc (cable to Meter 2).
- Ui MERLIN to be greater than Uo (Meter 1).
- Ui MERLIN to be greater than Uo (Meter 2).
- Po MERLIN to be greater than Pi (Meter 1) + Pi (Meter 2).

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- 1: Tamper -Ve
- 2: Pulse -Ve
- 3: Pulse +Ve
- 4: Tamper + Ve

Output Connections - Replicated Output in the Hazardous Area:

- Co MERLIN to be greater than Ci (Eqpt 1) + Cc (cable to Eqpt 1) + Ci (Eqpt 2) + Cc (Cable to Eqpt 2).
- Lo MERLIN to be greater than Li (Eqpt 1) + Lc (cable to Eqpt 1) + Li (Eqpt 2) + Lc (Cable to Eqpt 2).
- li MERLIN to be greater than lo (Eqpt 1) + lo (Eqpt 2).
- Ui MERLIN to be greater than Uo (Eqpt 1).
- Ui MERLIN to be greater than Uo (Eqpt 2).
- Pi MERLIN to be greater than Po (Eqpt 1) + Po (Eqpt 2).
- Co (Eqpt 1) to be greater than Ci MERLIN + Cc (cable from Eqpt 1 to MERLIN).

- 1: Channel 2 Pulse -Ve
- 2: Tamper
- 3: Channel 1 Pulse -Ve
- 4: Channel 1 Pulse +Ve
- 5: Tamper
- 6: Channel 2 Pulse +Ve

- Lo (Eqpt 1) to be greater than Li MERLIN + Lc (cable from Eqpt 1 to MERLIN).
- Ui (Eqpt 1) to be greater than Uo MERLIN
- Co (Eqpt 2) to be greater than Ci MERLIN+ Cc (cable from Eqpt 2 to MERLIN).
- Lo (Eqpt 2) to be greater than Li MERLIN+ Lc (cable from Eqpt 2 to MERLIN).
- Ui (Eqpt 2) to be greater than Uo (MERLIN).

Note: Connection comply with IGEM GM7 – RJ11 Connection

Support and Contact Information:

For technical support, product queries and information please contact:-

Gazprom Global Energy Solutions
2nd Floor, Castlefield House
48 Liverpool Road
Manchester
M3 4SB

Tel: 0845 260 1122
Fax: 0845 260 1133
www.gazprom-mt.com/gges
E-mail: info.gges@gazprom-mt.com

For further details regarding installation of equipment in hazardous areas consult: *IEC 60079-14: 2003*- Electrical apparatus for explosive gas atmospheres. Electrical installations in hazardous areas (other than mines).