

# Meter Installation

*2018 Version 1.1*

# 1. Introduction

This document outlines the procedure for the installation of new metering. It covers:

- a) the connection and registration of new supplies with fiscal meters for electricity, gas and water, and
- b) the requirements for non-fiscal metering in buildings (downstream of the supply point).

Section 2 is a process chart outlining the steps required to arrange connections and install new metering. Communication and approval by stakeholders is essential, as is the provision of complete handover documentation.

It is the responsibility of the project team to arrange new fiscal supplies with the correct supplier for that utility. These contacts and more information are given in Section 3.

Building level metering of all utilities must be provided for new buildings, and for existing buildings metering must be retained (or provided if not currently installed) when major works take place which affect the building level electrical or mechanical services. In addition it is strongly encouraged that where electrical or mechanical works take place at a sub-building level, services are sub-metered as appropriate and practical. Section 4 gives the specification of all non-fiscal metering and requirements for connection to the University's database.

Section 5 describes the information required at handover. Metering for a project will not be considered as complete until:

- 1) any fiscal supplies are correctly registered
- 2) non-fiscal meters are feeding data into the UoR Energy management database
- 3) supporting handover documentation is received.

The guidelines and specifications in this document are in line with the University's ISO50001 Energy Management System. Monitoring, measurement and analysis is an essential part of good energy management. Reliable and well understood metering allow us to develop a robust understanding of where utilities are used in the estate, and enables identification and implementation of energy saving opportunities.

## Definitions

**AMR** – automatic meter reading. It is now common practice for fiscal and sub meters to be connected to a data logger. This reports meter reading information back to a web portal for use by the University in tracking consumption.

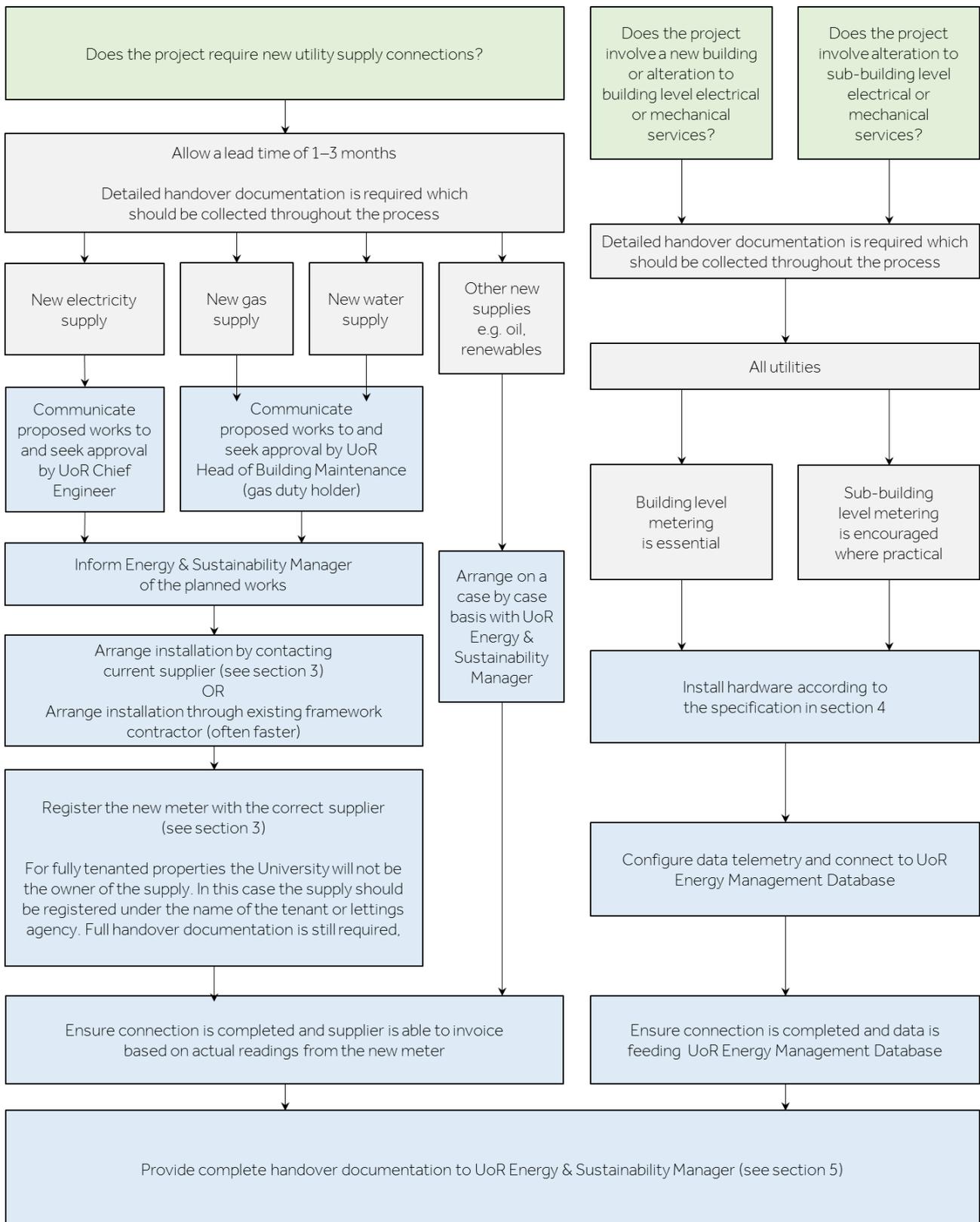
**Fiscal supply/ meter** – a registered utility supply or meter for which we receive a bill from a utility company.

**MPAN** – Meter Point Administration Number, unique 21 digit identifier for an electricity supply. An MPAN must be obtained for an electrical supply to become live.

**MPR** – Meter point reference, the unique identifier for a gas supply. An MPR must be obtained prior to a gas supply being used.

**SPID** – Supply Point Identification Number, the unique identifier for a water supply. A SPID must be obtained prior to a water supply being used.

## 2. Process chart for new meter installations



### 3. Current utilities supply contracts

Different organisations have different requirements for application, installation and registering of new supplies, and disconnection and removal of old supplies. Due to the variety of situations and options it is not practical to describe each process in detail in this document. When applying for a new supply, relevant contacts from the following table should be consulted and they can provide further detail on the process and requirements.

Utility	Organisation	Function	Contact	Further information
Electricity	British Gas Business	Electricity supplier	0800 316 1957	<a href="https://www.britishgas.co.uk/business/help-and-support/connections-meters-readings/getting-a-new-connection-meter">https://www.britishgas.co.uk/business/help-and-support/connections-meters-readings/getting-a-new-connection-meter</a>
	SSE Metering Ltd	Meter Operator Provider	0800 048 3516	<a href="https://www.ssepd.co.uk/Connections/">https://www.ssepd.co.uk/Connections/</a>
Gas	Engie	Gas supplier	Alex Munnery Account Manager alex.munnery@engie.com 0113 284 5429	<a href="http://www.engie.co.uk/">http://www.engie.co.uk/</a>
Water	Castle Water	Commercial water supplier	Sharon Donaldson Key Account Manager Support Sharon.donaldson@castlewater.co.uk 01250 718700	<a href="https://www.castlewater.co.uk/new-connections/">https://www.castlewater.co.uk/new-connections/</a>
	Thames Water	Residential water supplier	key.customers@thameswater.co.uk	<a href="https://developers.thameswater.co.uk/domestic-and-small-commercial/water-supply/new-or-replacement-water-supply/how-to-get-a-quote">https://developers.thameswater.co.uk/domestic-and-small-commercial/water-supply/new-or-replacement-water-supply/how-to-get-a-quote</a>

It is important to note that for electricity, the 'meter operator' is not necessarily the 'electricity supplier', and further, a 'data collector' and 'data aggregator' have to be appointed. Unless specifically agreed otherwise, the University requires:

- The electricity supplier to be registered as per the prevailing supplier details above
- The meter operator, data collector and data aggregator to be registered with SSE Metering Ltd

The University pays standing charges to the supplier for all live meters, therefore it is essential that old supplies which have been replaced as part of a project are properly disconnected and removed in line with the relevant organisation's processes. As with installation of new meters this should be arranged using the contacts above.

# Non-fiscal metering specifications

This section specifies what meters should be used for University of Reading (non-fiscal / non-supply) meters at building or sub-building level. These specifications are generic and not related to any specific manufacturer, but aim to provide consistency while supporting evaluation of alternative models.

In summary, the installed meters should provide MODBUS outputs and be hard-wired to a LAN point via a RS485 to Ethernet gateway, where necessary or 'piggybacked' on another suitable meter connected to the LAN point over Ethernet via a suitable gateway device. In turn, data loggers should be connected to the LAN via an Ethernet connection for the purpose of collating and transmitting all meter data. These data loggers will be addressable over the LAN.

Following installation of the correct hardware, meters must be properly configured and connected to the University's Energy Management Software. In most cases this is via the BCP database managed by Carnego Systems. Contact William Box on 07809769530 support@carnegosystems to connect the meters to BCP. Other routes may be considered if agreed in advance with the Energy & Sustainability Manager, provided half hourly data can be fed automatically at least daily to the University's System.

Historically, utilities consumption data has been sent to the BMS system, however this has proved an unreliable way of recording utilities data.

## Electrical metering

The specification will cater for three key scenarios:

1. Building with existing whole building metering which includes telemetry.

This should include a main meter at the building level in addition to sub-meters for individual circuits and/or equipment. The electrical meters should have MODBUS outputs as standard, though by exception with the prior agreement of the Sustainability Team, pulse output meters may also be considered, in which case a MODBUS gateway device would be required to convert pulse counts to MODBUS signal. The meter should be connected to the LAN and associated with a data logger, either directly or via a suitable gateway device, or 'piggybacked' on another suitable meter connected to the LAN point over Ethernet either directly or via a suitable gateway device.

2. Building without metering or with metering which does not have telemetry.

In cases where there are no meters in a building or any existing meter has no Automatic Meter Reading (AMR) device, steps must be taken to install one or more sub-meters on circuits with significant energy consumption or at a very minimum install a single meter to measure the total electrical consumption for that building. See electrical meter specification.

All meters within the building should be connected to the LAN and associated with a data logger, either directly or via a suitable gateway device, or 'piggybacked' on another suitable meter connected to the LAN point over Ethernet either directly or via a suitable gateway device. See data logger specification.

3. Sub-metering of building areas or systems

To sub-meter a stand-alone system or any areas within a building, an electric meter should be installed on the circuit feeding that area or system. An estimate of the maximum current on that circuit is required to size the Current Transformer (CT) (one on each phase). The output from the electrical sub-meter should be connected to the LAN and associated with a data logger, either directly or via a suitable gateway device, or 'piggybacked' on another suitable meter connected to the LAN point over Ethernet either directly or via a suitable gateway device. See electrical meter specification.

## Electrical Meter Specifications

The following performance parameters must be met for all electrical meters provided for energy management purposes.

- Support single or 3-Phase (3 or 4 wire) network
- Must provide at least one output as electricity consumption (Active Power kWh) measurement
- Support for MODBUS outputs. Pulsed output may be considered with prior agreement by the Sustainability Team, in which case they will require a MODBUS gateway. If pulse meter is selected, configurable pulse value and width must be specified and configured.
- Programmable current transformer ratios (support for up to 1000A/5)
- Display measurement (consumption kWh, Voltage and Current)
- Must meet Class 2 accuracy requirements of one of the following standards:
  - BS EN62053-21:2003
  - BS 8431:2010
- Meters must be capable of connection to a LAN point over Ethernet or be accompanied by a suitable gateway device.
- Data should be at least half hourly.

## Gas metering

The specification will cater for three key scenarios:

1. Building with existing whole building metering which includes telemetry.

In this scenario, the pulse output from the existing gas meter on the main feed to the building as well as other sub-meters, should be connected to the existing data logger in that building via a MODBUS gateway. The meter should be connected to the LAN and associated with a data logger, either directly or via a suitable gateway device capable of transmitting MODBUS data via a LAN point, or 'piggybacked' on another suitable meter connected to the LAN point over Ethernet via a suitable gateway. See gas meter specifications.

2. Building without metering or with metering which does not have telemetry.

In a building where gas is supplied but no gas meters installed or the meters have no pulse outputs, then steps should be taken to ensure that at the very least a main gas meter is fitted on the main feed to the building. This main meter as well as other gas sub-meters in this building must be fitted with a pulse generator. For those older gas meters which do not support any kind of pulse generator, the options are:

- replace existing gas meter with a modern meter with pulse output (same max flow rate)
- or, a secondary gas meter with pulse output should be installed just downstream from the existing meter (same max flow rate).

The pulse output from each gas meter should be connected to the LAN and associated with a data logger, either directly or via a suitable gateway device, or 'piggybacked' on another suitable meter connected to the LAN point over Ethernet either directly or via a suitable gateway device. See gas meter specifications.

3. Sub-metering of building areas or systems

To sub-meter a stand-alone system or any areas within a building with significant gas consumption, a gas sub-meter (sized to match the max flow rate) should be installed on the feed pipe to that area or the system. Any gas sub-meter fitted for this purpose must have a pulse output which should be connected to the LAN and associated with a data logger, either directly or via a suitable gateway device, or 'piggybacked' on another suitable meter connected to the LAN point over Ethernet either directly or via a suitable gateway device. See gas meter specifications.

## Gas Meter Specifications

The following performance parameters must be met for all gas meters provided for energy management purposes.

- Diaphragm meters – flow rate of up to 60 m<sup>3</sup> per hour
- Rotary displacement meter – flow rate 25 to 1000 m<sup>3</sup> per hour
- Turbine meter – flow rate 80 to 1600 m<sup>3</sup> per hour
- Pulse output ( 1 pulse = 0.01, 0.1, 1.0 m<sup>3</sup>/h)
- Must meet the accuracy requirements of one of the following standards:
  - BS EN1359:1999 "Gas Meters - Diaphragm gas meters"
  - BS EN12480:2002 "Gas Meters - Rotary displacement gas meters"
  - BS EN12261:2002 "Gas Meters - Turbine gas meters"
- Meters must be capable of connection to a LAN point over Ethernet or be accompanied by a suitable gateway device.
- Data should be at least half hourly.

## Heat (energy) metering

Where a building/area is supplied with heat rather than gas, heat meters will be required, which should comply with the following performance standards:

- Heat meters shall meet the Class 2 requirements in Annex MI-004 of the EU Measuring Instruments Directive (MID) 2004 and shall consist of:
  - a flow sensor (or meter) rated for continuous flows and suitable for the anticipated flow and return temperatures
  - a matched pair of temperature sensors (such as two thermocouples) – the two temperature sensors shall have been calibrated together as a pair to make sure the temperature difference between the input and output of the system is measured to the stated accuracy level, and;
  - a calculator/digital integrator – the integrator shall be provided with MODBUS output, capable of connection to a LAN point over Ethernet or be accompanied by a suitable gateway device or 'piggybacked' on another suitable meter connected to the LAN point over Ethernet and associated with a data logger via a suitable gateway device.
- Digital integrators shall have an integral display which allows recorded parameters to be viewed locally.
- Digital integrators shall also be provided with MODBUS outputs, capable of connection to a LAN point over Ethernet or be accompanied by a suitable gateway device.
- Data should be at least half hourly.

Flow meters being provided in new installations shall in all cases be fitted within pipework rather than being clamp on types. Where flow meters are fitted to existing installations, clamp on types may be acceptable if agreed with the Sustainability Team prior to installation. In all cases, flow meters shall be sized to ensure all flows (including periods of low volume flows) will be captured accurately. In particular, flow meters shall be installed within pipework such that they are a suitable distance from fittings (such as bends, junctions and so on) to prevent excessively turbulent flow and oriented to ensure correct operation. The installation shall be in full accordance with the manufacturer's installation instructions.

In every case, the heat meter installation shall be capable of recording and transmitting the following data at a minimum regularity of every 30 minutes:

- Heat (energy) consumed (kWh)
- Flow temperature
- Return temperature
- Flow rate (m<sup>3</sup>/hr)

## Water metering

The specification will cater for three key scenarios:

1. Building with existing whole building metering which includes telemetry.

In this scenario, the pulse output from the existing water meter on the main feed to the building as well as other sub-meters, should be connected, via a MODBUS gateway. This will be connected to the LAN point over Ethernet and associated with a data logger via either a suitable gateway device or 'piggybacked' on another suitable meter, connected to the LAN point over Ethernet via a suitable gateway device.

2. Building without metering or with metering which does not have telemetry.

In a building where water is supplied but no water meters installed or the meters have no pulse outputs, then steps should be taken to ensure that at a very least a main water meter is fitted on the main feed to the building. This main meter as well as other water sub-meters in this building must be fitted with a pulse generator. For those older water meters which do not support any kind of pulse generator, the options are;

- replace existing water meter with a modern meter with pulse output (same max flow rate)
- or, a secondary water meter with pulse output should be installed just downstream from the existing meter (same max flow rate).

The pulse output from each water meter should be connected, via a MODBUS gateway to the LAN point over Ethernet and associated with a data logger via either a suitable gateway device or 'piggybacked' on another suitable meter connected to the LAN point over Ethernet via a suitable gateway device.

3. Sub-metering of building areas or systems

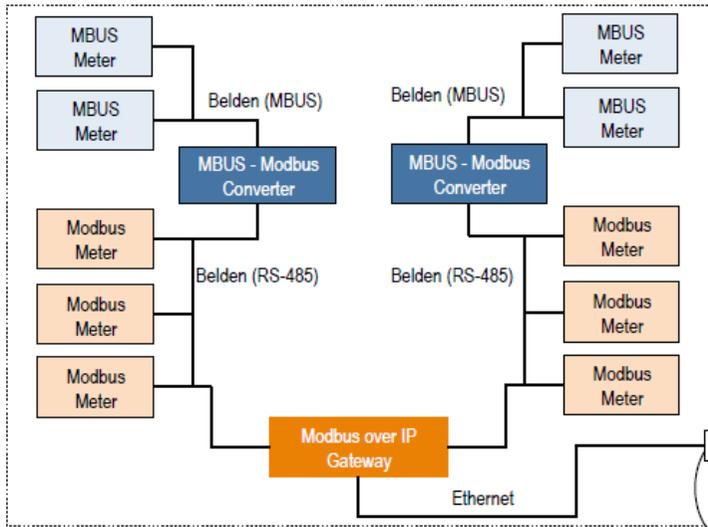
To sub-meter a stand-alone system or any areas within a building with significant water consumption, a water sub-meter (sized to match the max flow rate) should be installed on the feed pipe to that area or the system. Any water sub-meter fitted for this purpose must have a pulse output which should be wired via a MODBUS gateway to the LAN point over Ethernet and to a data logger via either a suitable gateway device or 'piggybacked' on another suitable meter connected to the LAN point over Ethernet via a suitable gateway device.

## Data loggers

The following performance parameters must be met for all data loggers provided. Data loggers should be connected directly to the LAN and should have sufficient port capacity to service the installed meter points and provide capacity to limit the number of installed data loggers.

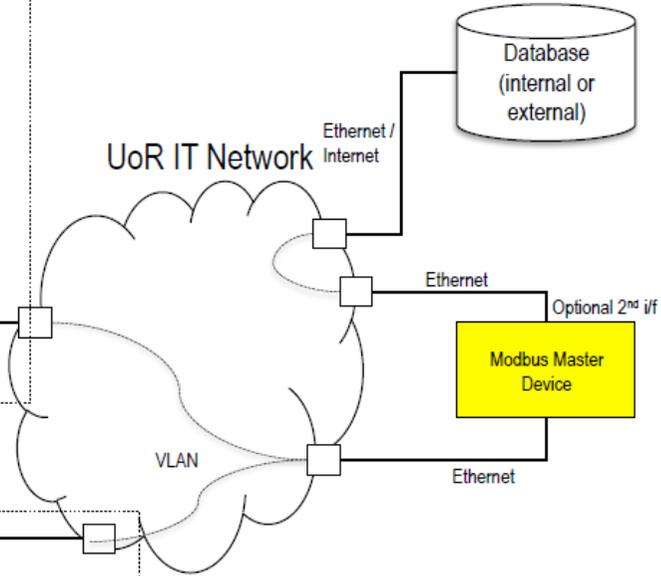
- RJ45 Ethernet output for connection to local ICT network
- Internal clock with date/time stamp
- Internal memory for storage of data samples
- Battery backup for memory storage
- Optional Pulse and Analogue input channels
- Data upload to server every 30 minutes
- Interrogation of meters over LAN at least every 30 minutes
- Open source outputs not restricted to use with specific software

Building A (with MBUS as well as Modbus meters)

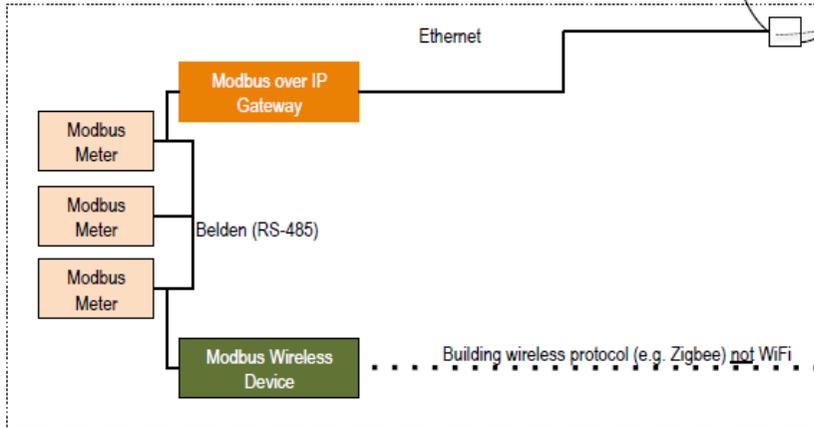


Generic UoR Modbus Metering Schematic

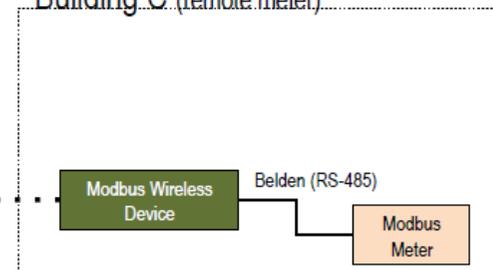
Drawn by: William Box, Carnego Systems  
Version: 3 Date : 9<sup>th</sup> May 2014



Building B (with wireless link to remote meter)



Building C. (remote meter)



## 5. Handover requirements

No viable information can be obtained from a meter without an understanding of what it is measuring. The following checklist must be completed for each meter, whether a fiscal supply meter or a non-fiscal University meter, and the information sent to the Energy & Sustainability Manager. It is strongly recommended that this is populated as an ongoing exercise during the connection and installation process and that photos are taken of the meter and its opening read(s).

Information required	Example for electricity fiscal supply meter	Example for non-fiscal building level heat meter
Building / WREN code	W084	W026
Utility	Electricity	Heat
Meter specification met (Y/N/provided by supplier)	Provided by supplier	Y
Estimated annual consumption	50,000 kWh	200,000kWh
Meter location (inc. room number)	Basement switch room B08	Ground floor plant room G20
Area(s)/Service(s) fed by meter	Foxhill House	Palmer heating & hot water
MPAN (electricity) MPR (gas) SPID (water)  For fiscal meters only	2000052524656	N/A
Meter serial number	E10BG25784	69524068
Parent supply MPAN/MPR/SPID  For non-fiscal meters only	N/A	Fed from Whiteknights district heating
Units recorded (kWh/MWh/m <sup>3</sup> /ft <sup>3</sup> )	kWh	MWh
Opening reading	0	0
Date of opening reading	01/01/16	01/04/15
Photograph of reading attached (Y/N)	Y	Y
Confirmation received from Sustainability Services that supply is correctly registered  For fiscal meters only	Y	N/A
Confirmation received from Sustainability Serviced that data is feeding into UoR Energy Management Database  For non-fiscal meters only	N/A	Y