

# Automatic Meter Reading System

January, 1, 2011

## System Architecture

Shenitech's utility meters, such as 280T BTU meters, 280W water meters and STE101C energy meters, utilize M-Bus to communicate with a host, such as an M-Bus concentrator or a data center, for automatic meter reading (AMR).

M-Bus system is an European instrument bus standard designed for domestic metering devices, such as water meter, heat/water meter, gas meter, etc., to communicate with data center. The bus simply uses two non-polarized wires to achieve a variety of options for reliable meter reading, remote diagnosis, remote control, incremental pricing, time-based pricing, batch service, prepaid billing, and etc. This bus system is also simple and economical to wire and implement.

A simple AMR system is consisted of a number of M-Bus utility meters (280T BTU meters, 280W water meters and STE101C energy meters), an M-Bus concentrator, and a data center computer (Figure 1).

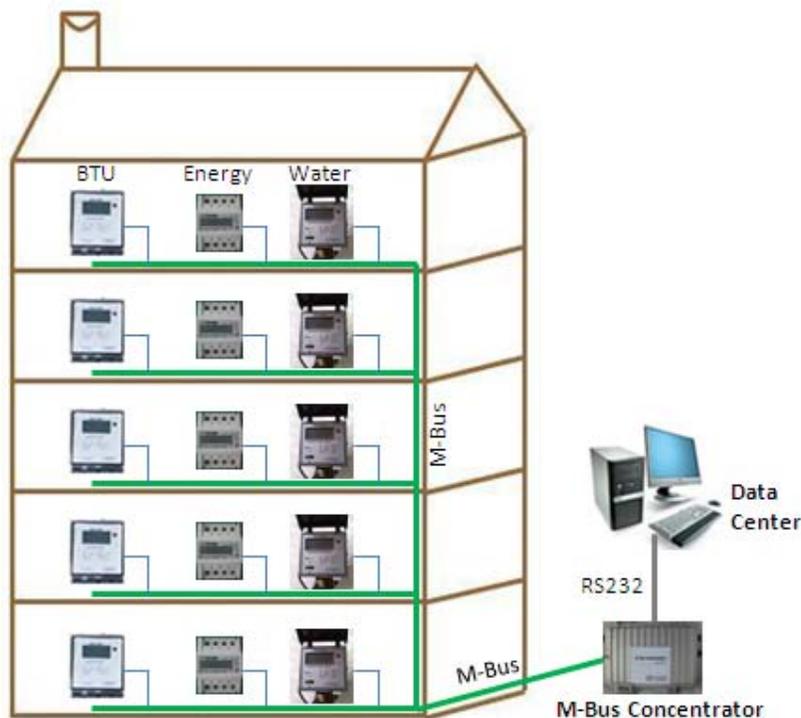


Figure 1. A simple automatic meter reading (AMR) system

# Automatic Meter Reading System

In the above simple example, all the utility meters in the building are connected to a two wire bus (green). This bus is then connected to an M-Bus concentrator (model 280C-0-1). The concentrator communicates with the data center computer through RS232 interface directly.

Data center software first sends out a meter reading command to the concentrator. When the concentrator receives the command, it interprets the command and sends query to the specified utility meter or utility meters. The utility meter(s) will then send back the requested data to the concentrator, which packs the data and sends it to the data center for saving, printing, searching, billing and etc.

The above simple system is normally limited to 250 meters. To construct a larger metering system, one needs to use a number of concentrators. The following figure illustrates a system which could have more than 10k units of M-Bus utility meters. The 2-wire M-Bus is routed across several buildings. In each building, the bus wires are normally routed through a vertical riser conduit from the first floor up to the top floor. The M-Bus meters on each floor can be connected together to the vertical bus directly, or, can be connected to an M-Bus concentrator, which is then connected to the vertical bus. A concentrator can be connected to another concentrator to further expand the system.

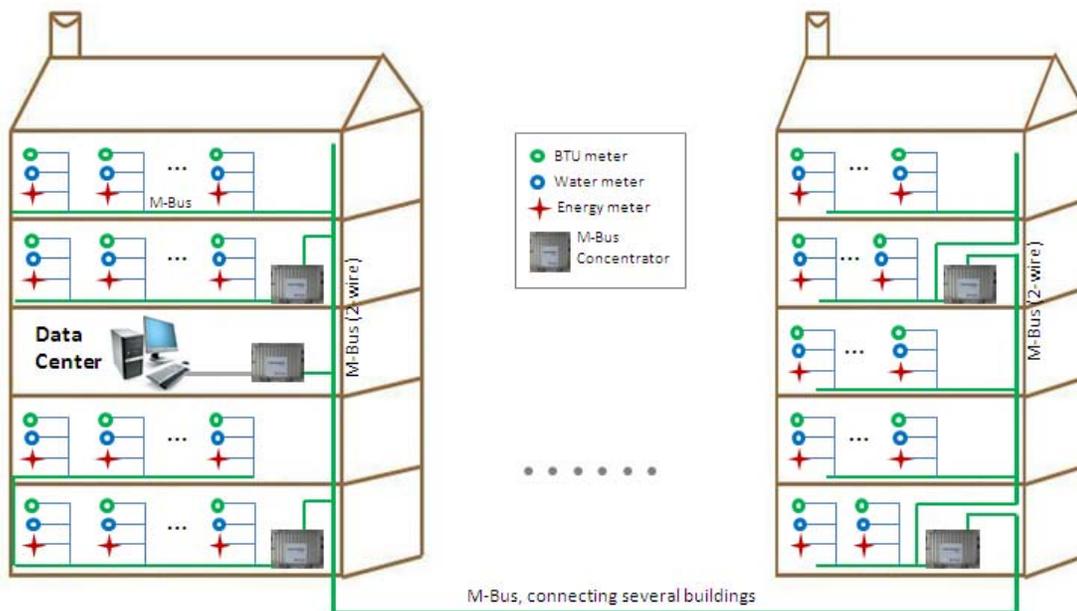


Figure 2. A typical M-Bus based (AMR) system

The topology of the above system is shown in Figure 3. As you may find there, the system is of hierarchy structure. The top layer is the data center computer, the next layer is a master concentrator (280C-0-1), the third layer has sub-concentrators (280C-0-0) and M-Bus meters, the further layer has also sub-concentrators and M-Bus meters. The layers could keep going deeper as much as needed. The basic rule is that, under each concentrator, the total number of M-Bus meters and sub-concentrators should not exceed 250 units.

# Automatic Meter Reading System

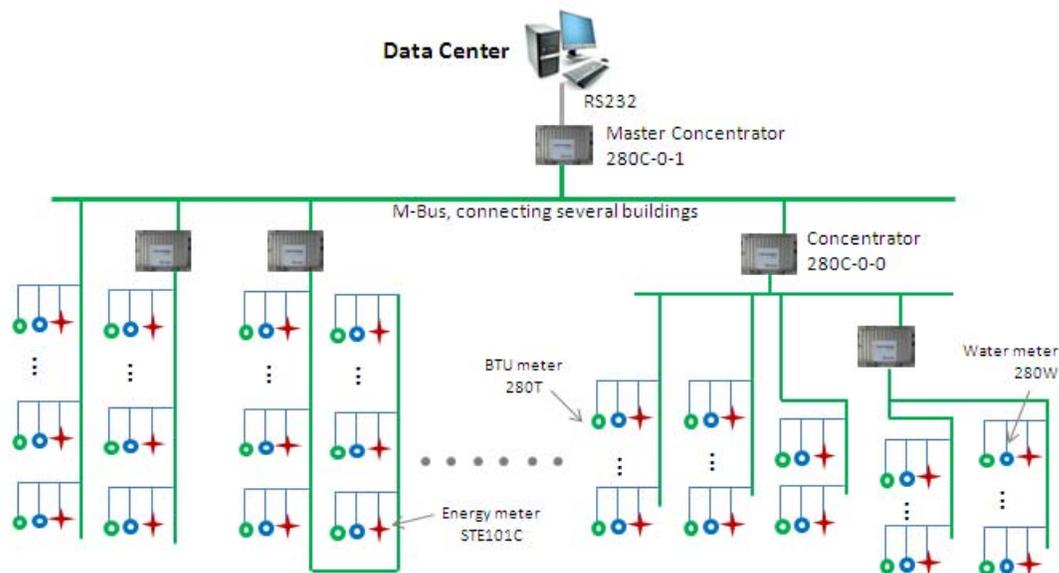


Figure 3. Topology of the AMR system shown in Figure 2.

According to M-Bus standard, each M-Bus meter should have a primary address and a secondary address. The primary address is one from 1 to 250. The secondary address is an 8 bytes number. For a simple system such as the one in Figure 1, one can use primary M-Bus address to communicate with each utility meter. The data center software will read from each primary address one after another.

For larger system such as the one in Figure 2, the total number of utility meters exceeds 250. Therefore, the secondary address might be used to address each utility meter. The data center software will read from each secondary address one after another.

When the number of utility meters is significant, it might be too slow to read the meters one at a time. In this case, we recommend to use the 280C-1 intelligent M-Bus concentrator. This concentrator can automatically read up to 250 meters at a programmed schedule. As such, the data center can get all the 250 meters' data at once, which largely increases the meter reading speed.

What we have discussed so far are all based on M-Bus network. Some buildings may not have dedicated two wires for M-Bus. Rather, there might be other network available, such as INTRANET, BACnet or even Wireless. In such circumstances, Shenitech also offers reliable and easy to implement solutions. Please see the Appendix for more details.

## M-Bus Concentrator

The 280C Concentrators are used for an AMR system to facilitate the communication between the data center and the M-Bus utility meters of the AMR system. It supports Shenitech 280T BTU meters, 280W water meters and STE101C electricity energy meters.

# Automatic Meter Reading System

The 280C comes with four variations:

- (1) 280C-0: This is a transparent M-Bus concentrator. It provides M-Bus power to M-Bus meters, and passes the M-Bus protocol between M-Bus meter and upper layer device.  
The interface to the upper layer device could be M-Bus (280C-0-0), RS232 (280C-0-1) or Ethernet (280C-0-2).
- (2) 280C-1: This is an intelligent M-Bus concentrator. It has a microprocessor and large storage for scheduled meter reading. It not only provides M-Bus power to M-Bus meters, but also automatically reads data from those M-Bus meters, stores those data, and transmits those data to upper layer upon request.  
The interface to the upper layer device could be M-Bus (280C-1-0) or RS232 (280C-1-1).
- (3) 280C-2: This is a BACnet concentrator for M-Bus meters. It not only provides power to M-Bus meters, but also converts M-Bus protocol to BACnet protocol and vice versa.

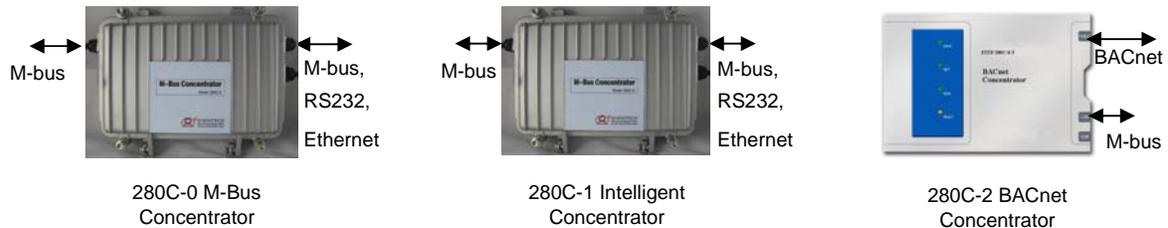


Figure 4. M-Bus Concentrators for AMR system

## Data Center Manager Software

Based on many years' meter reading experiences, we established a hierarchy utility management system architecture which is flexible, scalable, reliable and robust (Figure 5.) This architecture has been fully implemented in our Data Center Manager (DCM) software.

There are four layers in this software topology, the top later is district or area management, the second layer is for building management, the third later is for client management, and the further later is for utility meter management. A district or an area could have many buildings, a building could have many clients, and a client could have one to four utility meters.

The DCM software can run in a Windows XP or higher version computer. It allows user to discover the utility meters in the network by a simple click (Figure 6). It also allows user to build his client database (Figure 7), and sign the discovered utility meters to the corresponding clients. After building up the meter base and client base, the user can set up the meter reading schedule (Figure 8) so that the software will automatically read the selected meters at the time specified by the schedule. All the data will be saved in

# Automatic Meter Reading System

SQL database. User can review the meter data or generate report on the utility usage during a specified period of time (Figure 9). Together with Shenitech's billing software, the user can get all the bills ready for his clients without quickly and easily. Or, he may even have the billing software to send the bills to his clients by email automatically.

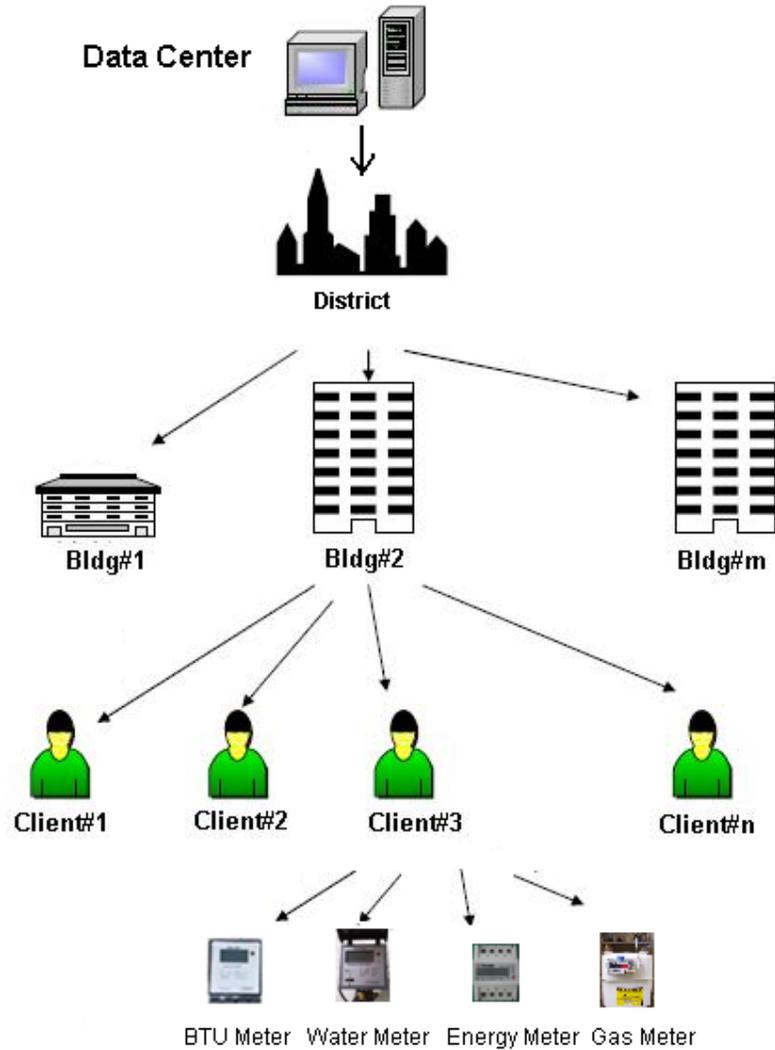


Figure 5. Layered customer/meter management system

# Automatic Meter Reading System

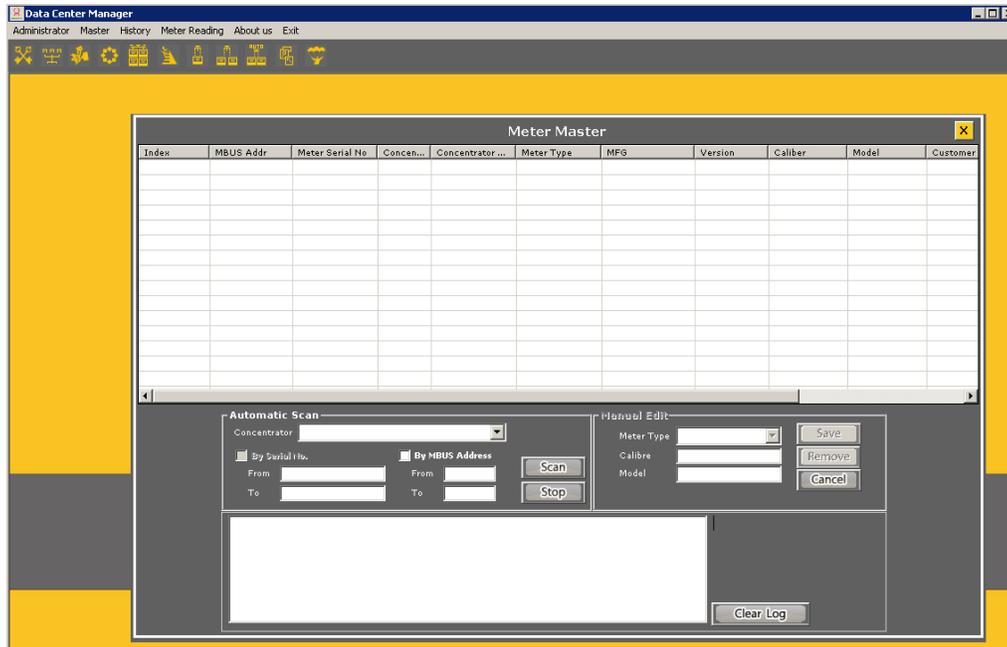


Figure 6. AMR Software is able to discover the M-Bus utility meters installed on the network.

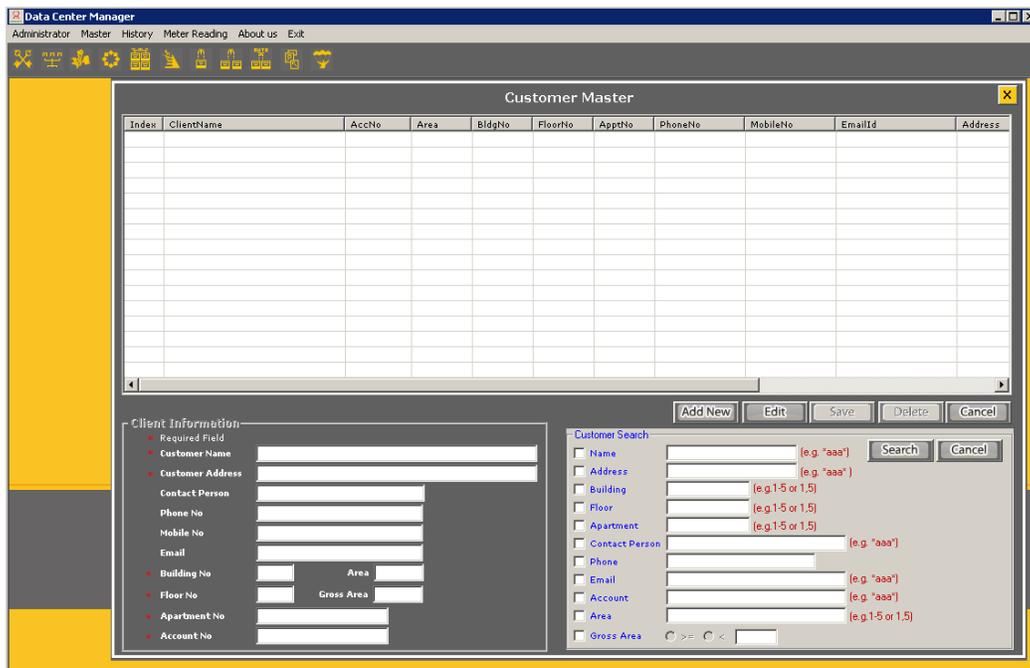


Figure 7. AMR software allows user to build client data base easily.

# Automatic Meter Reading System

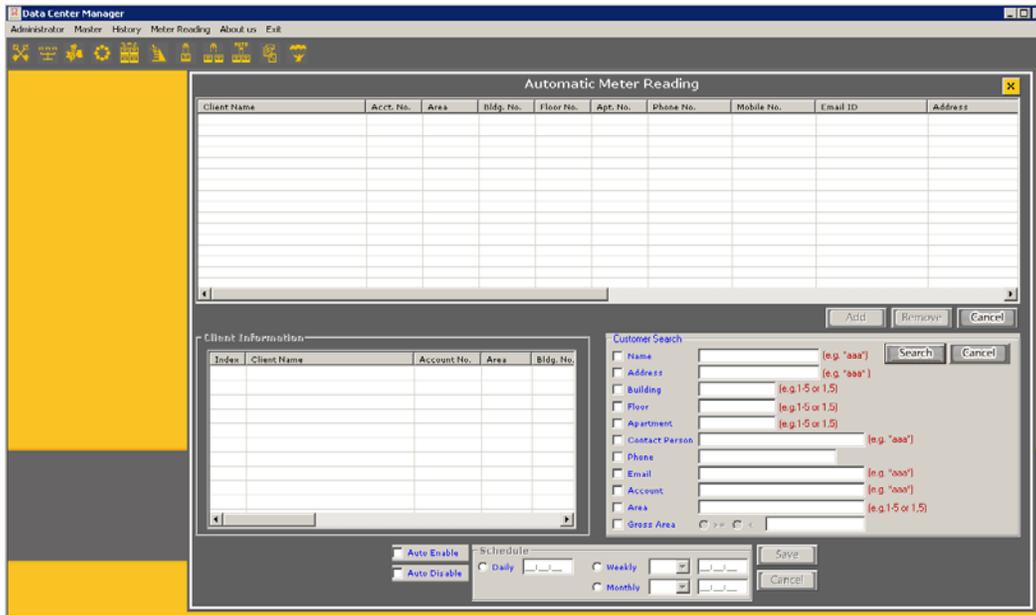


Figure 8. AMR software allows user to set up a schedule for automatic meter reading.

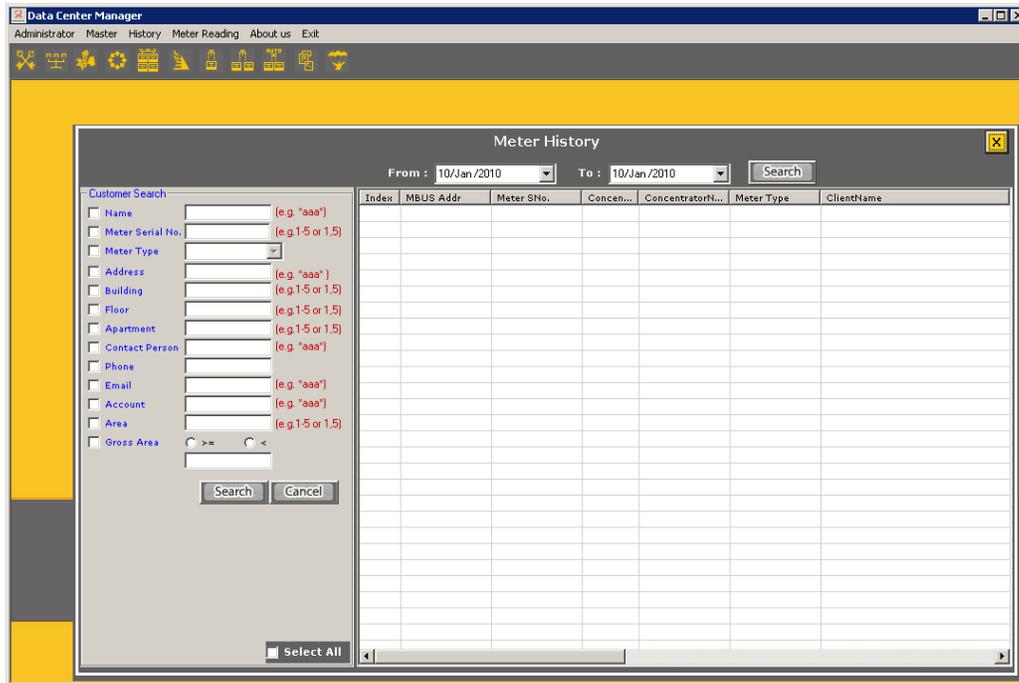


Figure 9. AMR software allows user to review data and generate report.

Shenitech can customize the software according to our customer's specifications.  
For other software, such as billing software, please contact Shenitech at [support@shenitech.com](mailto:support@shenitech.com).

# Automatic Meter Reading System

Appendix

## Commonly Used AMR Topologies

Depending on the physical layout of those utility meters, one may consider using pure M-Bus network, M-Bus together with INTRANET, M-Bus together with BACnet, or, M-Bus together with wireless. The following lists a few commonly used AMR system architectures.

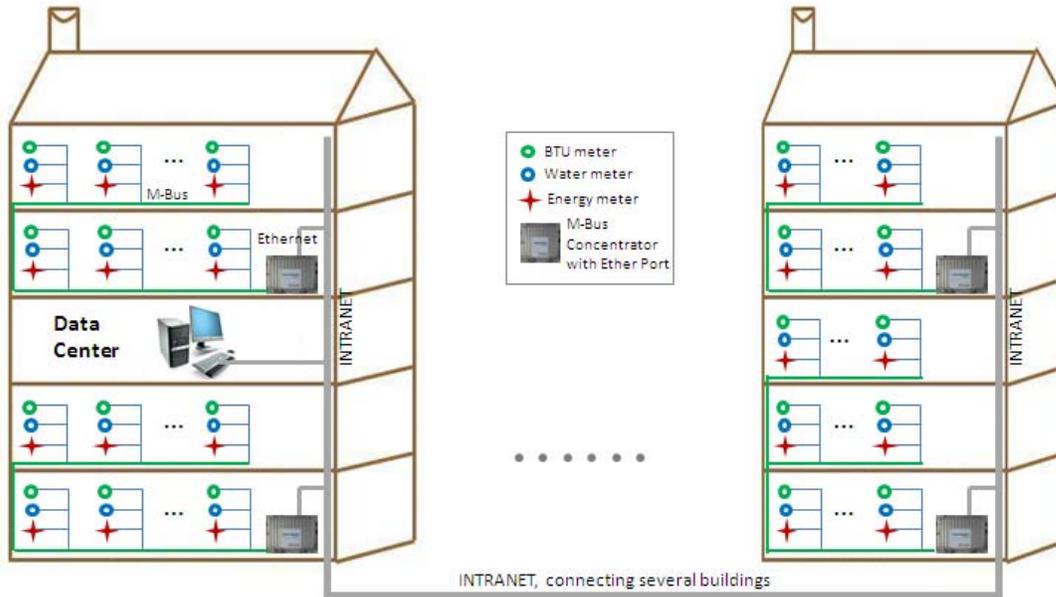


Figure A1. An AMR system with M-Bus and INTRANET

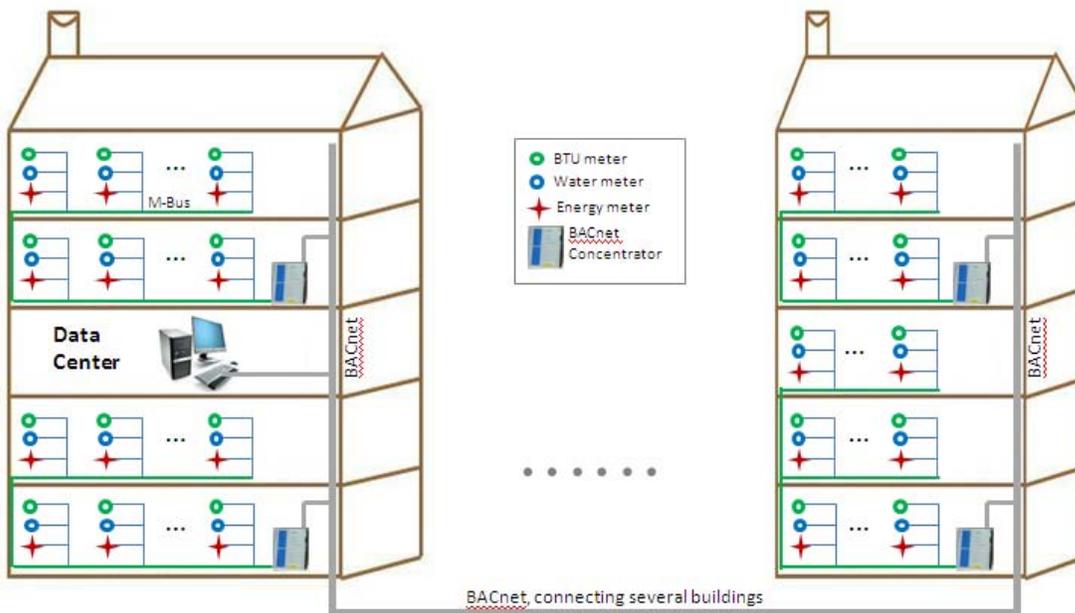


Figure A2. An AMR system with M-Bus and BACnet

## Automatic Meter Reading System

A typical remote automatic meter reading system (RAMR) system is consisted of a number of M-Bus utility meters, several M-Bus concentrators, a DTU GPRS transceiver for each M-Bus concentrator, and a data center.

The M-Bus Concentrator communicates with the data center computer through GPRS network. The data center first issues a meter reading command and sends it to the network. The DTU receives the command and forwards it to the concentrator. The following process is similar to the one explained in the main test.

To expand the RAMR system, you may deploy a number of DTUs and have a single data center to manager those DTUs and their subsystems. Our Data Center Manager PC software is designed for this purpose.

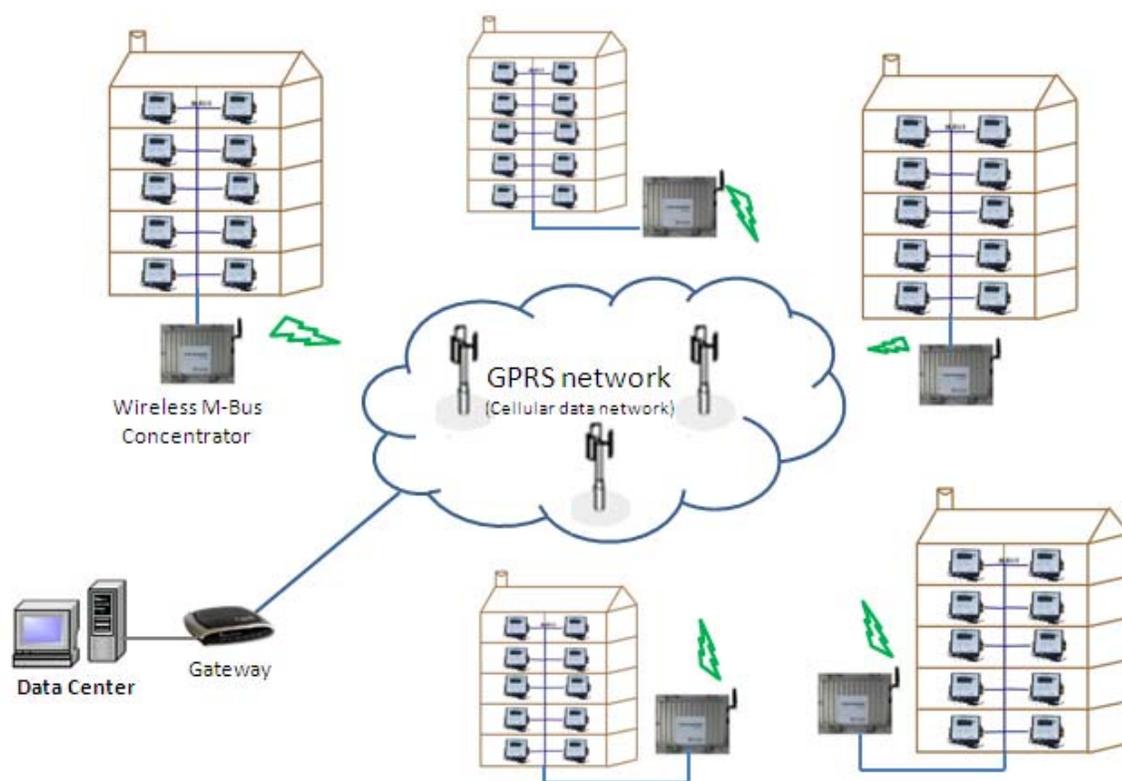


Figure A3. A typical remote automatic meter reading system

Note: Wireless AMR based on RF is also available. Please contact [support@shenitech.com](mailto:support@shenitech.com) for details.