Open Protocol and Modbus

For any Transmission/Distribution Utility 100% Metering is effective only if equal efforts are taken for collection of the Metered Data. Hence, Meter Reading Systems, devised by any Utility should essentiallyhave a Scalable and Open Architecture.

1.0 Introduction

" How open is an Open Protocol ?" – This is a question which apparently is haunting, confusing and its answer was more dependent on the Equipment Manufacturer during the last 3 decades than the User. In order to explain "OPENESS" through a User's point of view, let us take a small example:

The standard telephone plug is an example of a standard and open approach. Equipment manufactured during a period spanning many decades, using a variety of technologies, can connect to this interface and exchange information. For example, a modem or a fax machine can be installed on a telephone jack that was placed in service years before the modem or fax was invented. The system requires no knowledge of the application or information at either end; it delivers the message regardless of content. This allows a system to be tailored for present needs to be designed around the interface, while allowing for new services to be added after initial deployment.

However ,it is a hard fact today that, Current technologies are based on vendor proprietary communication interfaces, which inhibit the development of an open system and the use of devices, which are interchangeable and interoperable.

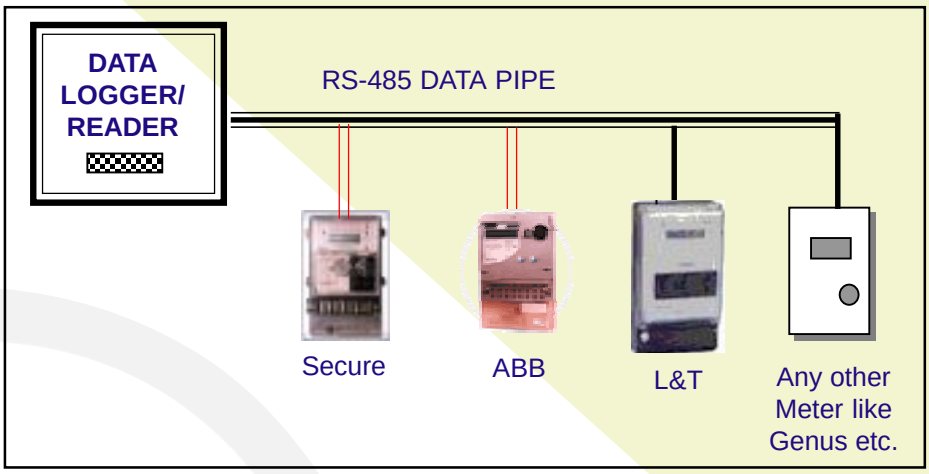
2.0 OpenProtocol-An overview

The Basic underlying fact for any OPEN System is interchangeability and interoperability. There are three benefits to the approach of standardizing services and interfaces:

a. First, users need not concern themselves with the details of operation of the system. For example, the "interface" to the Postal system requires recipient name, street, city, state, zip code and a return address for reply to the query sent. Thus, if the letter is addressed properly (i.e., meets the interface specifications), the user can be confident that the message will be delivered and the reply will reach him only.

b. Second, the technology of any level can be changed without effecting the rest of the system. For example, whether mail actually goes by truck, plane, or train does not matter. Thus, if the Protocol is standardized, then Communication channel i.e. RS232, RS485, Ethernet and others only define the speed of the system.

c. Third, this system can be designed to carry discrete packets of information that can have any desired content; i.e. given that the basic characters of A,B,C,D.....Z are defined, the system can deliver love letters in French or utility bills in English.



3.0 The Present Situation:

To have a clearer picture, let us look at a typical Automatic Meter Reading System:

Ideally once the above RS485 system is designed, all the METERS (Present & Future) should be able to communicate to the Local PC Interface or the Remote Computer with any modification of the system. The system consists of a Data Concentrator/Multiplexer which interface the meters to a LOCAL PC Interface or directly to a PSTN / GSM Network.

However, today, it is a reality that we have different types of meters available in a Substation and, though, it is defined that the DATA PIPE is RS485, the protocol is not defined at all. This has resulted in a situation where, we have:

a. Secure Meters that communicates through RS485 Data Pipe but the Protocol is PACT and is proprietary.

b. We have L&T Meters that communicates through RS485 Data Pipe but the Protocol is MODBUS.

c. ABB Meter that communicates through RS485 Data Pipe but the Protocol is ANSI and is proprietary.

d. And other meters with their proprietary Protocol.

The result is that the Protocol of each METER is non-standard and the need of connecting all meters on a common data pipes i.e. RS485 becomes impossible. Hence, even though the Data Pipe is standard, the above system results in multiple Proprietary Systems that can be integrated by the Meter Manufacturer only and replacement of Meter in such a system is restricted to that Meter Manufacturer only.

Thus, the need to define standard open interface is essential and towards this effect it is required to migrate / use Protocols which are interoperable and open. Such a system also facilitates interchangeability of equipment.

In order that " Openness" is ensured for the system, the following needs to defined:

1. The medium of communication i.e. RS485,
2. The Protocol of the Meter i.e. MODBUS and,
3. The Memory Map of the Protocol should be made available.

4.0 MODBUS Protocol-A *Defacto* Industry Standard

MODBUS® is today the most widely recognized Open Protocol in the Industry and the preceding paragraph illustrates its openness:

4.1 What is MODBUS® protocol?

MODBUS® Protocol is a messaging structure developed by Modicon in 1979, used to establish master-slave/client-server communication between intelligent devices. It is a de facto standard, truly open and the most widely used network protocol in the industrial manufacturing environment. It is literally implemented by hundreds of vendors on thousands of different devices in order to transfer discrete/analog I/O and register data between control devices. It's really a lingua franca or common denominator between different manufacturers. One report called it the "de facto standard in multi-vendor integration".

4.2 Where MODBUS® is being used?

MODBUS® is used to monitor and program devices; to communicate intelligent devices with sensors and instruments like Energy Meters; to monitor field devices using PCs and HMIs. MODBUS® is also an ideal protocol for RTU applications where wireless communication is required, and hence used in uncountable Gas and Oil and substations applications. Apart from being industrial applications; building, infrastructure, transportation and energy applications are also making use of its benefits.

4.3 Is MODBUS® proprietary or open?

MODBUS® protocol is a simple way for transferring control data between controllers and sensors using an RS232/ 485 port. Since it's creation it has become a de-facto industry standard used by multiple control and sensor companies. Today MODBUS® protocol is the single, most supported protocol amongst automation devices.

As seen above, though MODBUS is OPEN and defacto Industry Standard, the speed of the system is 19.2 kbps. With the advent of faster technologies it is essential that any Open Protocol should be scalable upwards with the next generation technological advances. Here again MODBUS® scores over any other Protocol.

So the next question *"Is MODBUS Scalable upwards (?), and if so, does it still remain Open ?".* The answer is "*MODBUS TCP/IP"* which uses *"ETHERNET"* the most open technology universally adopted today.:

4.4 What is MODBUS® TCP/IP protocol?

TCP/IP is the common transport protocol of the Internet and is actually a set of layered protocols, providing a reliable data transport mechanism between machines. Ethernet has become the de facto standard of corporate enterprise systems, so it comes as no surprise that it has also become the de facto standard for factory networking. Ethernet is not a new technology; in fact, it has matured to the point that the cost of implementing this network solution has been dropping to where its cost is commensurate with those of today's field-buses. Using Ethernet TCP/IP in the factory allows true integration with the corporate Intranet and MES systems that support that factory.

In order to move MODBUS® protocols into the 21st century, an open MODBUS® TCP/IP specification has been developed in 1999.

Combining a versatile & scaleable universal physical network (Ethernet-TCP/IP) and a vendor-neutral data representation (MODBUS®) gives a truly open, accessible network for exchange of process data. It is also extremely simple to implement for any device that supports TCP/IP sockets.

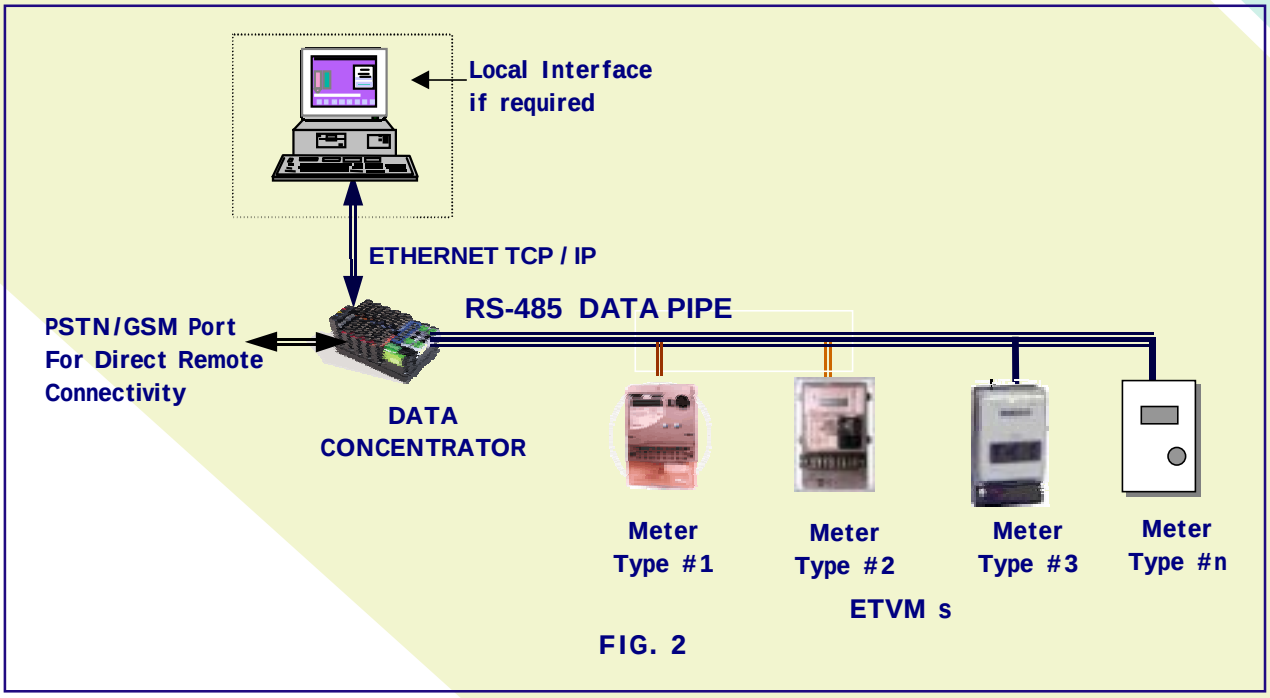


FIG. 2

4.5 Where MODBUS® TCP/IP is being used?

MODBUS® TCP/IP has became an industry de facto standard because of its openness, simplicity, low cost development, and minimum hardware required to support it.

At this moment there are more than 200 MODBUS® TCP/IP devices available in the market. It is used to exchange information between devices, monitor and program them. The manufacturers of this type of devices also use it to manage distributed I/Os, being the preferred protocol.

4.6 What are the benefits of using MODBUS® TCP/IP?

- Openness. No license fees.
- Broad devices availability. Interoperability among multi vendor devices.
- Simplicity. Low cost development. Multiple sources of knowledge.
- Compatibility with MODBUS® installed base.
- Minimum hardware platform required. Inexpensive.
- Easy to develop in under any operating system.

4.7 Can existing MODBUS® devices communicate over MODBUS TCP/IP?

MODBUS® TCP/IP is simply MODBUS® protocol with a TCP wrapper. It is therefore extremely simple for existing MODBUS® devices to communicate over MODBUS® TCP/IP. To do this a gateway device is required to achieve the following:

- Convert from the current physical layer (RS232, RS485 or others) to Ethernet.
- Convert MODBUS protocol to MODBUS TCP/IP

Such a gateway device could be implemented using a PC as a basis. Alternatively commercial products are available from several different manufactures like the Data Concentrator.

5.0 Conclusion:

As a conclusion to the Opening Statement, ***" SYSTEMS WHICH COMPLY IN TOTALITY TO INTERCHANGEABILITY AND INTEROPERABILITY ARE TRULY OPEN"***. Our recommendation as System Integrators for achieving this goal is that Utilities should essentially define their Communication requirement for Meter Equipment as **" RS485-MODBUS with required Memory Map"**.

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