Technote 27 – Modbus/RS485 Questions

Revised: January 30, 2009

What is Modbus, What is RS485?

RS485 is the hardware specification for the physical wiring and connections. Modbus is the protocol specification that each device uses to communicate over the RS485 serial line.

Modbus is a protocol specification designed for building automation equipment used to interface with various devices over RS485 serial, and TCP/IP interfaces. More information on Modbus can be found at http://www.Modbus.org

RS485 is a serial hardware specification that most Modbus devices communicate over. The AcquiSuite uses Modbus over RS485 serial to communicate with the various Modbus devices such as the Veris H8036 power meter. More information on RS485 can be found at National Semiconductor

How many Modbus devices can be placed on a single Modbus/485 loop?

It depends on the type of Modbus device you have. Many Modbus/485 devices use the Maxim 487 chip to interface with the Modbus loop. This chip supports up to 32 devices on a single RS485 loop. Most Veris products, as well as all of the current Obvius products use the Maxim 487 chip. Other manufactures products may vary. Please check with the Modbus device manufacturer to confirm the number of devices it can share a Modbus loop with.

The AcquiSuite counts as another Modbus device on the loop. The Modbus/485 interface on the AcquiSuite contains a Maxim 487 chip, and draws power from the Modbus loop the same way any other attached device does. For installations, this means that you may have one AcquiSuite and 31 other devices on a loop.

If you are using a port powered RS232 to RS485 converter (such as the Veris H8900) there is an additional limitation. The self powered converter draws power from the serial port, and does not have its' own power supply. Because of this, the converter may only have enough power to drive 20 to 24 other devices on the Modbus loop. Customers may use alternative RS232 to RS485 converters with independent power supplies if the installation requires more than 20 devices. Black Box makes a converter IC109A-R2, as well as devices from B&B and other manufacturers as well. USB powered RS485 devices are not typically affected by this issue.

One other limitation to consider is the amount of data the AcquiSuite logs from each device. For example, the Veris H8238 has 8 separate power meters on a single circuit board. This unit is only one Modbus device, however the AcquiSuite show it as 8 separate power meters, and will log 8 times as much data as a single power meter. In theory, it would be possible to attach up to 31 of the H8238 Modbus devices to the Modbus loop, for a total of 248 power meters. The AcquiSuite however would

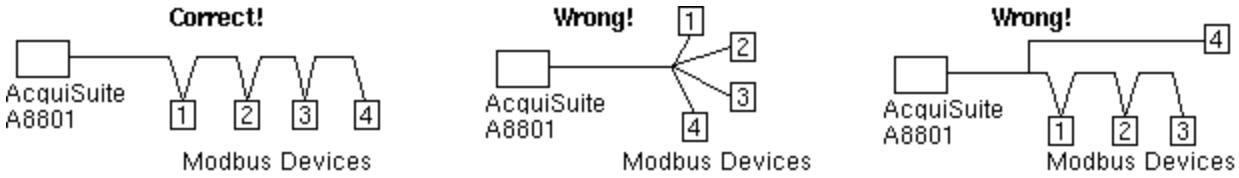
run out of flash memory in only a few hours logging all that data, and the log cycle would take many seconds to complete as the Modbus/485 loop operates at 9600bps.

How long can a Modbus/485 loop be?

Modbus/485 loops may be up to 4000ft. (The AcquiSuite operates the Modbus loop at 9600bps). Your results may vary depending on the quality of the wire, electrical noise, and the Modbus devices attached to the loop. Modbus repeaters may be used to extend the length of the loop, but introduce delay in the device response time. Using repeaters on slow devices may cause timeout problems.

How should the Modbus/485 loop be wired?

Daisy chain the devices together. Do not use 'spur' lines, or a star configuration. Terminating Resistors of 120 Ohms should be used on the ends of long Modbus/485 loops. In the first example below, the terminator should be placed at the AcquiSuite and Modbus device 4.



What type of wire is required?

Twisted Pair is required. Short runs can be 24 gauge wire, unshielded. Longer runs (+100ft) should use 18 gauge wire with shield. Shielded twisted pair should also be used if electrical noise is present, from motors, relays, etc.

When running the Modbus loop into a breaker panel, one must observe the voltage present in the panel and use wire with appropriate insulation. For example, "Belden 1120A" (18 Gauge Shielded Twisted Pair) is rated for 600V, and may be used in 480V service panels.

Are terminating resistors required?

The terminating resistor on each end of the RS485 loop is designed to match the electrical impedance characteristic of the twisted pair loop, and will prevent signal echoes from corrupting the data on the line. A 120 Ohm resistor should be installed on BOTH ends of the RS485 loop. Short and medium length Modbus/485 loops can operate without the terminating resistor. Longer runs may require the terminating resistors.

The AcquiSuite A8811 and A8812 have one terminating resistor built into the device. Only one additional terminator is required at the other end of the Modbus loop.