



Application Note #TBD

Maximum Polling Rate for Modbus Networks

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Purpose

Achieve the highest possible polling rate on a serial network with FGRIO radios in a point-to-multipoint network without repeaters.

Background

A polling network is configured such that the flow of information occurs from the slave radios to the master radio. The network should be contained in a relatively small geographical area to eliminate the need for a repeater (i.e. all slave radios within line of site and 60 miles radius of master radio). Adopting a repeater into a network halves the available bandwidth for master and slave communication.

Maximizing the polling rate and maximizing successful Modbus polls are competing goals. The reliability of communication decreases as the upper limit of polling rate is reached. The user must determine the acceptable failure rate and adjust network settings accordingly. Although Modbus poll failure rates of 0% are easily attainable, a failure rate of one poll failed per hundred (i.e. 1%) was used as a reasonable limit for this test.

Results

The fastest polling rate for multiple radios while keeping the failure rate below 1% is slightly greater than 16 slaves per second. There is no apparent increase in poll failure rate as more slave radios are added. The data sampled from each slave includes both analog inputs, both digital inputs (expressed as analog voltage), radio temperature and radio power supply voltage.

Table 1. Maximum polling rates achieved on point-to-multipoint networks.

Slave radios	Polls/slave/second	Equivalent slaves/second	Failure rate
2	8.4	16.4	0.2%
3	5.5	16.6	0.9%
4	4.2	16.8	0.4%
8	2.1	16.8	0.5%

Table 1 summarizes the fastest reliable polling rates achieved with a single master radio polling a number of slave radios. Repeaters are disabled for this test. The polls/slave/second metric is obtained by running a real point-to-multipoint network over a period of time rather than a theoretical calculation. The failure rate is obtained by



dividing the number of failed polls by the total number of polls issued. The equivalent slaves/second metric was used to determine whether the relative performance decreased as more radios were added. In Modbus protocol, the failed polls return a timeout error.

Important Note

The user must determine the acceptable failure rate for his or her application. The biggest impacts to poll failure rate in this test are the master packet repeat setting and the background RF noise.

Procedure

By following the steps listed below, the user can expect to reach the highest possible polling rate.

1. Network Parameters:

- A. Set “baud rate” on all radios to 115,200.
- B. Set “Modbus RTU” on all radios to 2.
- C. Set “retry odds” on all radios to 0.
- D. Set “master packet repeat” on all radios to 0.

i. Important Note: Setting “master packet repeat” to 0 will result in some Modbus poll losses due to spurious RF interference and subtle timing differences. To achieve close to a 0% failure rate, change “master packet repeat” to 1 on the master and 0 on the slave radios. This will decrease the failure rate significantly at the expense of reducing the total polls by roughly 25% or 30%.

- E. Set “minimum packet size” to 2 on all radios.
- F. Set “maximum packet size” to 2 on all radios.

2. Modbus Polling Host:

- A. Set the delay between polls to 20ms, or greater if polling speed is met.
- B. Set the Modbus response timeout to 140ms, or greater if polling speed is met.
- C. To sample all inputs on the FGRIIO Slave radios, a 12-byte (6-word) register poll should be created starting from register address 30,018.

i. Important Note: The fastest way to obtain all inputs from a FGRIIO-S radio is to read all desired information in a single poll. Starting at protocol address 30,018, read 12 bytes (6 words) with Modbus command 3.

- 1. Analog input 1 is located at protocol address 30,018.
- 2. Analog input 2 is located at protocol address 30,020.
- 3. Analog voltage of digital input 1 is located at protocol address 30,022. Compare the voltage to 1.5V to obtain logic 1 or 0.
- 4. Analog voltage of digital input 2 is located at protocol address 30,024. Compare the voltage to 1.5V to obtain logic 1 or 0.
- 5. Radio supply voltage is located at protocol address 30,026.
- 6. Radio temperature is located at 30,028.

Higher Poll Rates

It is possible to increase the polling rate further by adding another FGRIIO Master radio on a second serial port. For every FGRIIO Master that is added, the number of total slaves polled per second increases by 16. If another serial port is not available on the host machine, an RS232 switch can be added to the system. This requires a Modbus polling host capable of polling more than one serial port concurrently.