APPLICATION GUIDE

AG010911

Data Communications Reference

Working With 32-Bit Numbers

Objective: To resolve 32-bit numerical values stored in 16-bit Modbus registers.

Equipment:
- Milltronics EnviroRanger ERS500 (or other 32-bit field instrument using Modbus protocol)
- Host device (Modbus compatible PC or PLC)
- Any necessary links, modems, or converters

Overview:

Some field instruments store large numerical values as 32-bit numbers. These numbers are represented in the Modbus memory map as two 16-bit registers. Data conversion requirements vary depending on the host device used.

Common Data Conversion Requirements:

Two conditions must be addressed before performing data conversion: Word Order and Signed Integers.

Word Order

To represent a 32-bit number as two 16-bit bit numbers, the word order must be established to define whether the higher order word is first or second. By default, the first register is the MSW (most significant word) and the second register is the LSW (least significant word).

Example: If Modbus register R41,442 is read as a UINT32 (unsigned 32-bit integer), the 32-bits would look like this:

R41,442			R41,443		
16	MSW	1	16	LSW	1
32	32-bit integer value (UINT32)				1

If a reversed word order is required, change the word order flag (R40,062 in most Siemens Milltronics instruments).

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Siemens Milltronics Process Instruments Inc.
1954 Technology Drive, P.O. Box 4225, Peterborough, ON. Canada K9J 7B1
Tel: (705) 745-2431 Fax: (705) 741-0466 www.milltronics.com
E-mail: techpubs@milltronics.com

Signed Integers

A signed integer uses the last bit to indicate if the number is negative. The formulas given in this document require that the integers be unsigned.

To convert a signed integer N to an unsigned integer:

If N < 0 then N = N + 65536

To convert an unsigned integer N to a signed integer:

If N > or = 32768 then N = N - 65536

Data Conversion:

Some programs will do the conversion as part of the setup. If not, perform the following calculations.

For two unsigned 16-bit registers, N1 and N2 (with N1 being the MSW and N2 being the LSW).

1. To convert them to one number, use this formula:

   N = N1 * 65536 + N2

2. To convert back to two 16-bit integers, use these formulas:

   N1 = Int (N / 65536)

   N2 = N - N1 * 65536

   The Int function truncates (removes the decimal part of) the number. Example: 3.9 becomes 3.

NOTE:

Some Siemens Milltronics instruments store 32-bit numbers with a fixed decimal place of 3 digits. (Refer to the corresponding instruction manual for register format details.)

To convert these numbers to a floating point value:

F = N / 1000

Where N is the 32-bit integer representation of N1 and N2, and F is the floating point value.

Example:

For an Allen-Bradley PLC-5, prepare the code as follows to convert two 16-bit numbers (N9:11 and N9:12) into a floating point number (F8:1).