

## Multiple (up to 4) HART<sup>®</sup> Modems (1200 BPS) with a Single Microcontroller

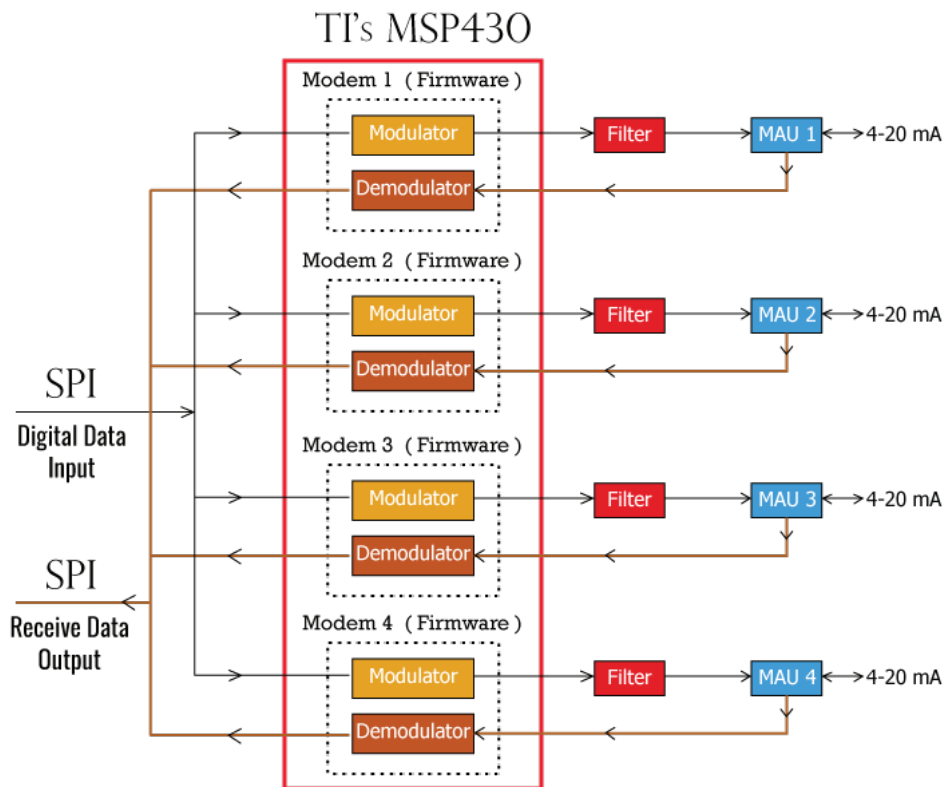
Smart Embedded Systems (SES), Inc., a Silicon Valley Company, is offering the industry first “multiple modems” (firmware based and up to 4 modems) with a single off-the-shelf microcontroller. SES is the first company to have developed a very compelling and cost effective Soft Modem technology (for single and multiple modems) for I/O applications. The multiple modems is currently offered on TI’s MSP 430 microcontroller with additional options to follow.

These modems are in full compliance with FieldComm Group HART modem standards.

There is a need to run multiple HART modems on the Input/Output (I/O) concentrator side where an I/O controller communicates with multiple HART sensor nodes and collects and consolidates information for further processing upstream in the communication channel. The current state of the art solution uses multiple chips modem.

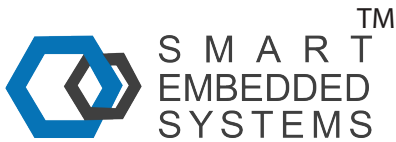
### OUR SOLUTION:

#### System Block Diagram - Quad modems on one TI’s MSP 430:



### Benefits

- Lower cost by as much as 50% as compared to using 4 modem chips.
- Increase in reliability due to a fewer component count.
- Saves Printed Circuit board space.
- Efficient use of system resources such as sine tables, filter coefficients, demodulator functions, low pass filter functions and DMA.
- Minimize process overhead such as interrupt service routines context save and restore so that the CPU utilization is optimized.
- Lower CPU speed and lower power consumption, room to run more instances with a given CPU speed.
- Communication from the I/O controller host CPU to the modems can be consolidated over a single communication channel (SPI) since now multiplier soft modems are running in one microprocessor.



## HART FSK Modem Characteristics

Binary Frequency Shift Keying  
Bits per symbol : 1  
Mark = 1200Hz; Space = 2200Hz  $\pm 1\%$

Carrier Frequency : 1700Hz.  
Data Rate : 1200 Bits Per Second  $\pm 1\%$   
Supports Normal Analog Wiring

## Modulator Characteristics

Carrier Startup : Less than 3 symbols  
Carrier Stop : Less than 3 symbols

## Demodulator Characteristics

Dynamic Range : 15 dB minimum  
(150mV – 900mV)  
Receive Filtering for Analog  
signal Interference  
rejection: 20 dB minimum

RX Signal CD On : 80mV - 120mV  
CD On time : 1ms - 4ms  
CD off time : 5ms - 10ms  
Rx Signal Level : 120mV - 1000mV

## Applications:

- A. Industrial automation
- B. Process Control
- C. Power Plants

## Board Support Package for Evaluation includes:

- A. Schematic
- B. BOM (Bill Of Materials)
- C. SOFT Modems Binary code

## SES has been awarded four patents related to its soft modem technology for HART devices:

9106488  
9184965  
9203665

9281978  
Additional patents pending.

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