SENT Signal Modifier User Manual

Contents

Revision History

Version	Date	Author	Description
5	2025-12-08	J Wisdom	- Added sections describing the SENT basics - Made connector pinouts easier to read

Overview

The SENT Signal Modifier is a tool to assist in the manipulation and monitoring of SENT-based sensors. The SENT Signal Modifier can communicate and modify two SENT channels at the same time. Supported sensors include (but are not limited to):

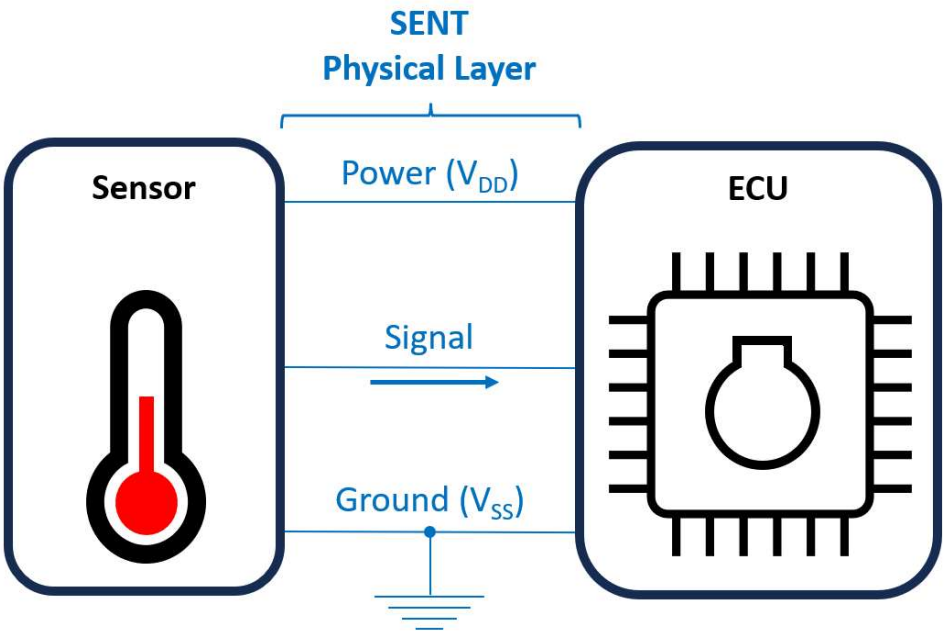
- Throttle Position
- EOP
- EGRP
- EGT
- MAF (and Multiplexed MAF)
- SP PFP and DP PFP
- EOP

Before setting up, it is important to secure the items necessary for the operation of the SENT Module. The items necessary include:

- A supported sensor
- The supplied wire harness and a USB-A to USB-B cable
- A computer with SENT software installed

Single Edge Nibble Transmission (SENT) Overview

SENT is a unidirectional communication protocol defined by the SAE J2716 standard. SENT data is organized in 4-bit "nibbles", making it a low-cost alternative for transmitting high-resolution diagnostics. The physical layer consists of 3 wires: Power, Ground, and Signal.



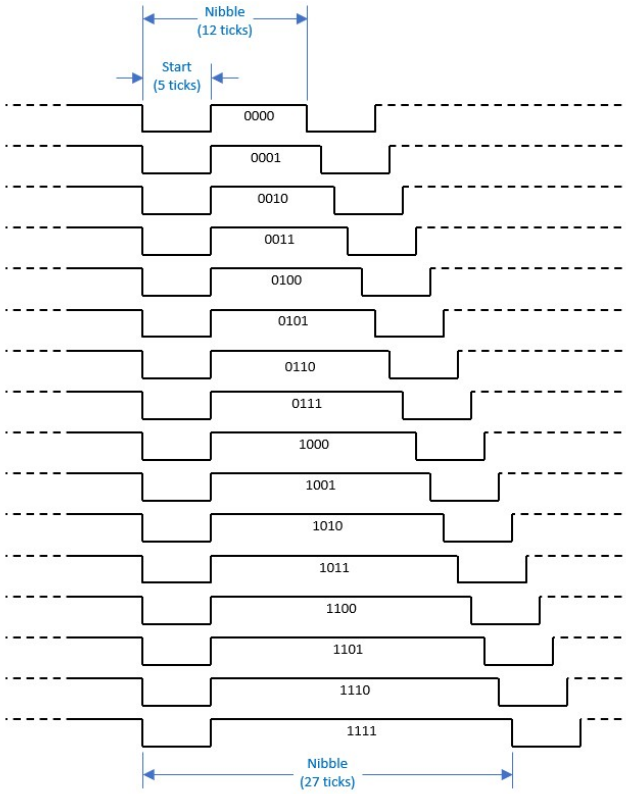
Note: Low state < 0.5V, high state > 4.1V

Signal Architecture

The basic unit of time for a SENT module is referred to as a tick which can vary between 3µs – 90µs. The tick timing is set by the user. After defining the tick timing, the SENT signal goes through a calibration pulse. The calibration pulse has a period of 56 ticks for calibration of tick length. After this stage, SENT communications are framed and communication begins. The entire signal is referred to as a frame.

Data Encoding

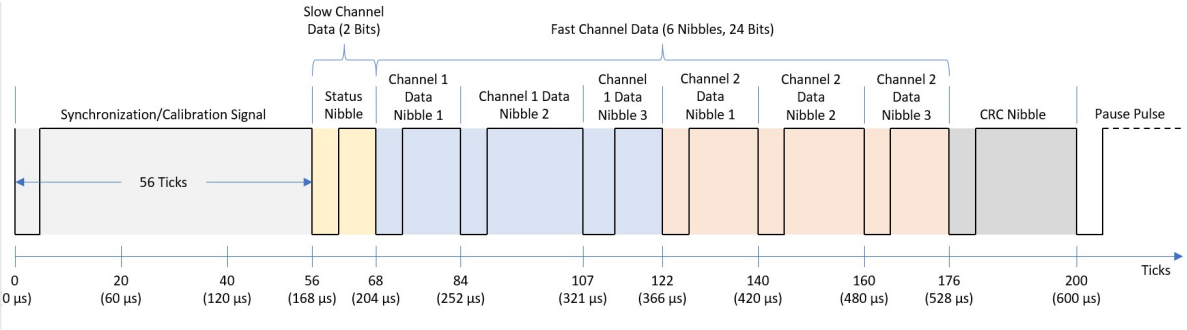
SENT data is encoded in 4-bit "nibbles" that vary from 12 ticks – 27 ticks. Regardless of size and signal, the first 5 bits are reserved for a start signal then the corresponding 7 – 22 ticks denote a binary value.



For the SENT protocol to report the value 9 in binary, it will send a 5-tick start command. After which the nibble will stay high for exactly 16 ticks.

There are six parts included in the SENT protocol:

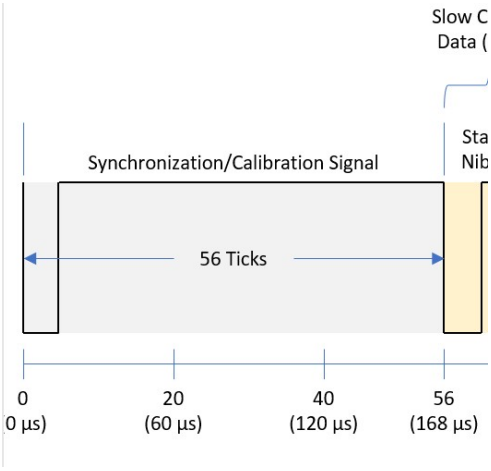
1. Synchronization/Calibration
2. Status/Identification
3. Slow Channel Communication
4. Fast Channel Communication
5. CRC
6. Pause Pulse



Synchronization/Calibration Signal

The calibration nibble is meant to define the tick timing selected by the user. In a standard SENT architecture, the synchronization signal is 56 ticks long. We can use this to define our tick timing:

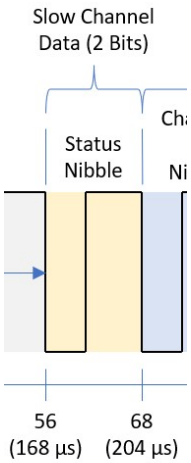
Tick Timing = Nibble Duration / 56



In this example, the calibration pulse is 168µs long. This means the tick timing is 3µs per tick (which is also the minimum allowable tick timing).

Status/Identification Nibble

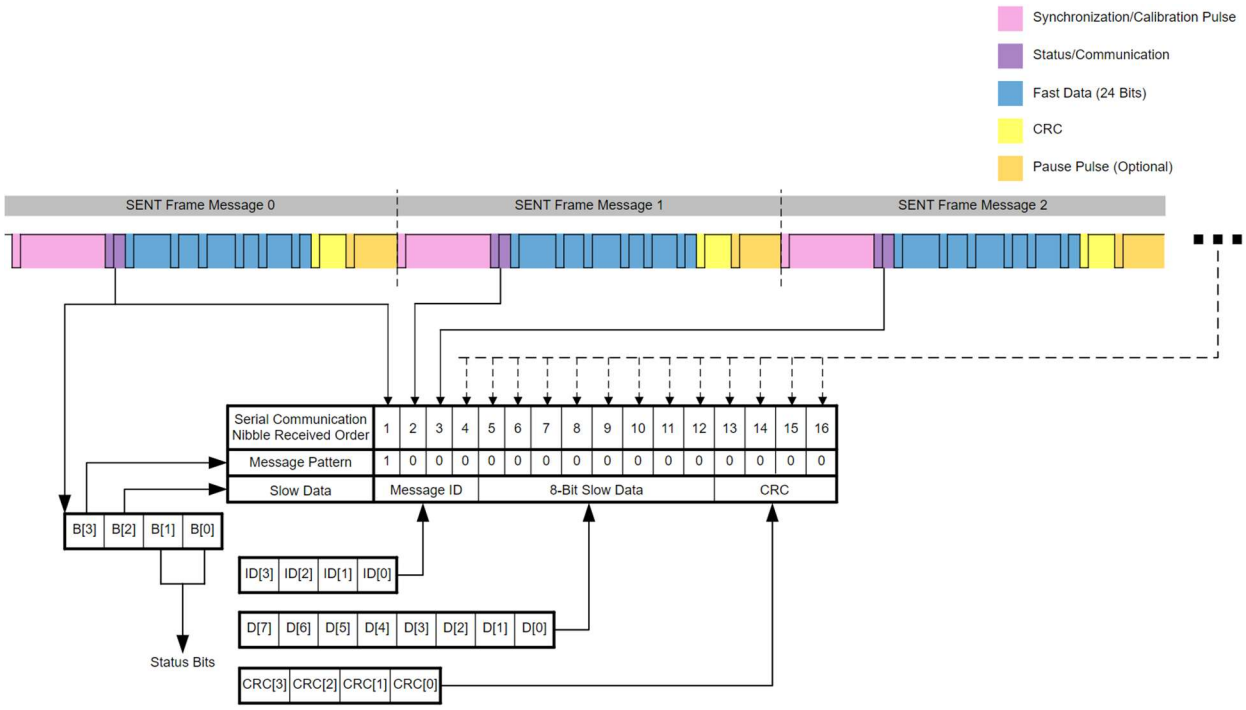
The status signal can be used as an identifier as well as a tool to process data. Using the same equation as seen in "Synchronization/Calibration Signal", the signal duration can be calculated. Since the nibble duration is 36µs and the tick timing is 3µs, this means the signal duration is 12 ticks.



A 12-tick nibble at 3µs/tick gives the user 4 bits to denote the status/identification. In a standard SENT protocol, this is used to communicate the ID of the sensor and its status. The status protocol can also be used to communicate slow channel data in the first two significant bits.

Slow Channel Communication

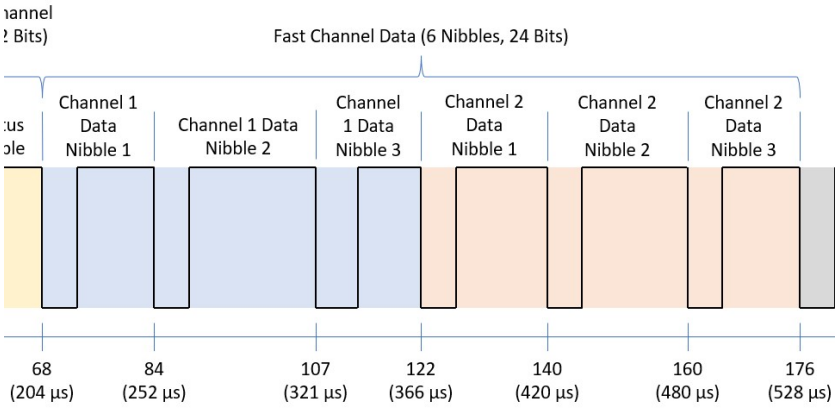
The SENT protocol supports slow channel communication, which utilizes the status frame to periodically update data. It takes 16 fast channel frames to transmit 8 bits of slow channel data.



In this example, the most significant bit is reserved for a serial message. The second bit is formatted to reserve 4 bits for the message ID, 8 bits for data, and 4 bits for a CRC. The slow channel can be configured to be 8-bit, 12-bit, or 16-bit.

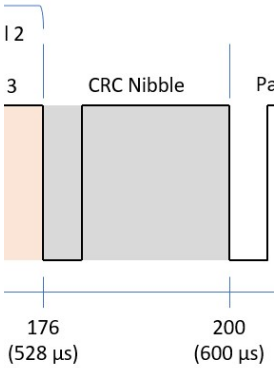
Fast Channel Communication

Most of the SENT protocol frames are fast channel data, which can vary in length and be up to 27 ticks long. One frame of fast channel data has two channels, each with 3 nibbles each. This means one sensor can output the values of two different sensors at the same time! For how data is represented in the fast channel, see the Data Encoding section.



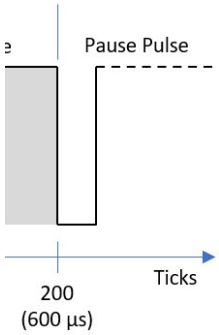
CRC (Cyclic Redundancy Check)

Upon receiving the fast channel data, the protocol requires a CRC calculation. This ensures data is being transmitted safely to its destination.



Pause Pulse

Depending on the architecture, there is an optional pause pulse. Since SENT signals are variable in length (due to the fast channel communication style), the pause pulse can be used to ensure frames occur synchronously.



User Interface Setup

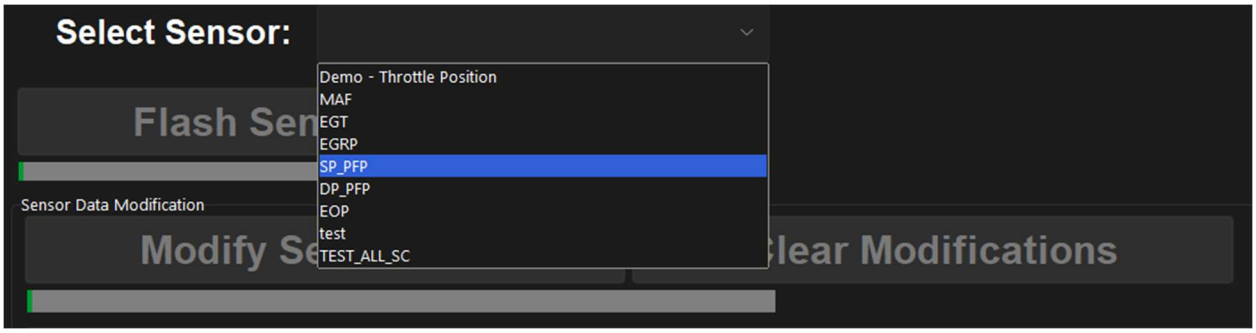
1. Connect the SENT box to the computer using the USB cable

2. Verify the green LED on the box is powered

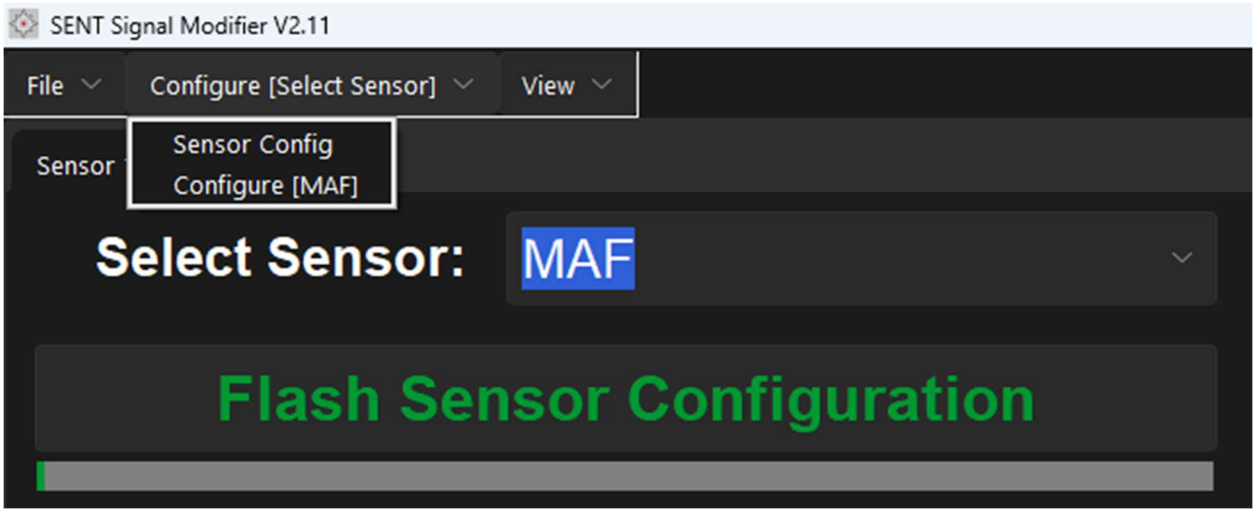
3. Connect the sensor to the box using the supplied DB9 connector

4. On the computer, navigate to the install location of the SENT software and double click on “sent_signal_modifier_v2.XX.exe”

5. In the application, locate the drop-down bar to select the correct sensor

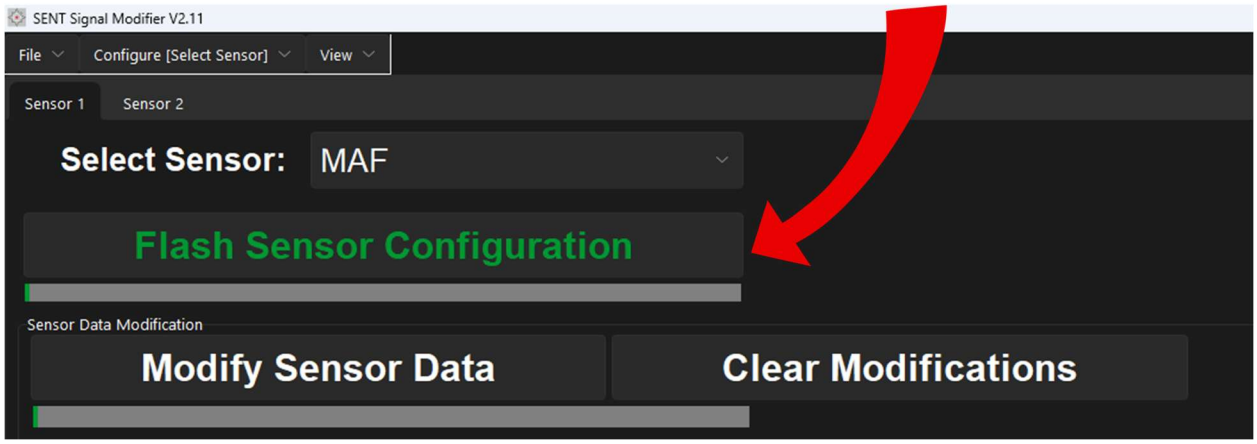


6. To change the sensor configuration, click on Configure [Select Sensor] located at the top left of the application

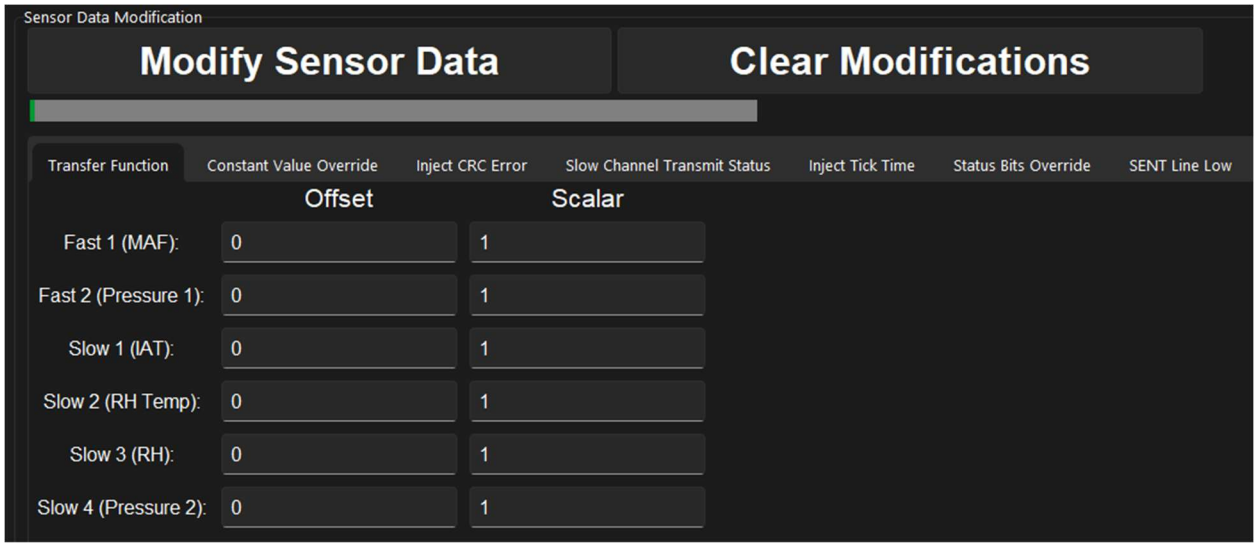


7. “Sensor Config” alters the sensor configuration across all sensors, while “Configure [MAF]” Configures settings for the specific sensor

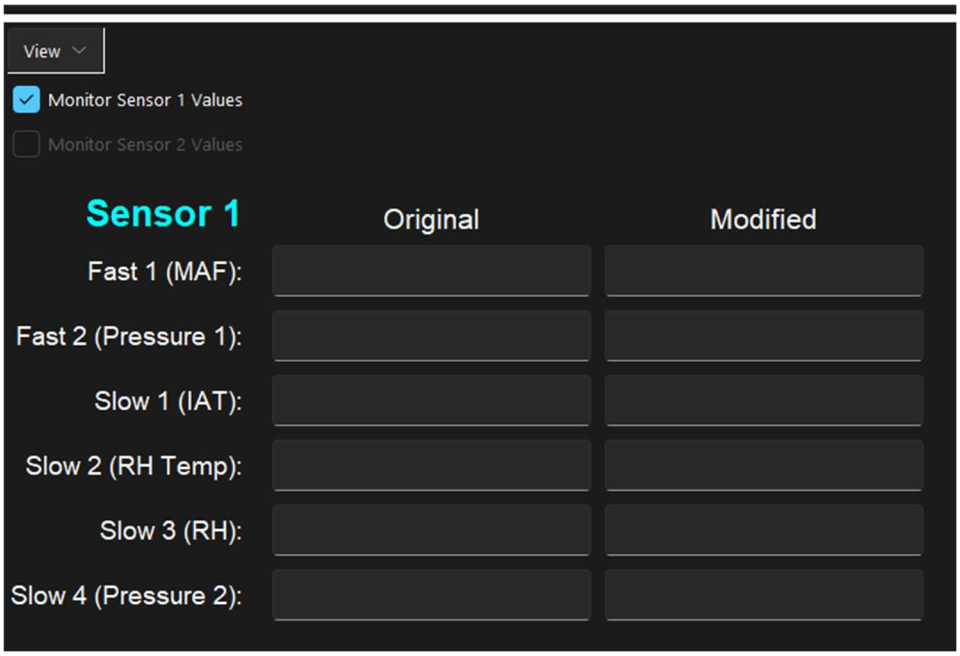
8. When done configuring, click “Flash Sensor Configuration” to flash the box with the settings given in the configuration. This process may take some time.



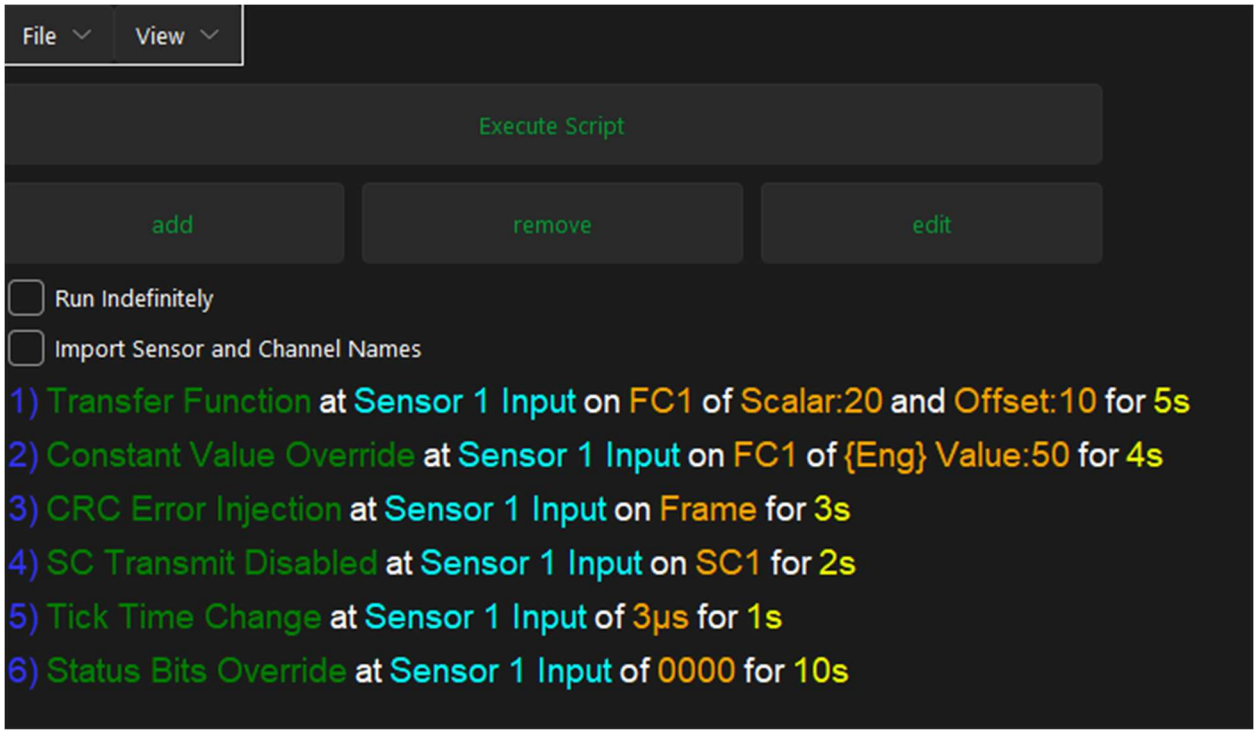
9. There is an option to modify the signal in many various ways. To upload these to the box, simply alter what is necessary then click on “Modify Sensor Data”. You can clear these settings by using the “Clear Modifications” button.



10. At the bottom-half of the application, there is a sensor monitor, check the respective box to see the various values the sensor is reading in real time.

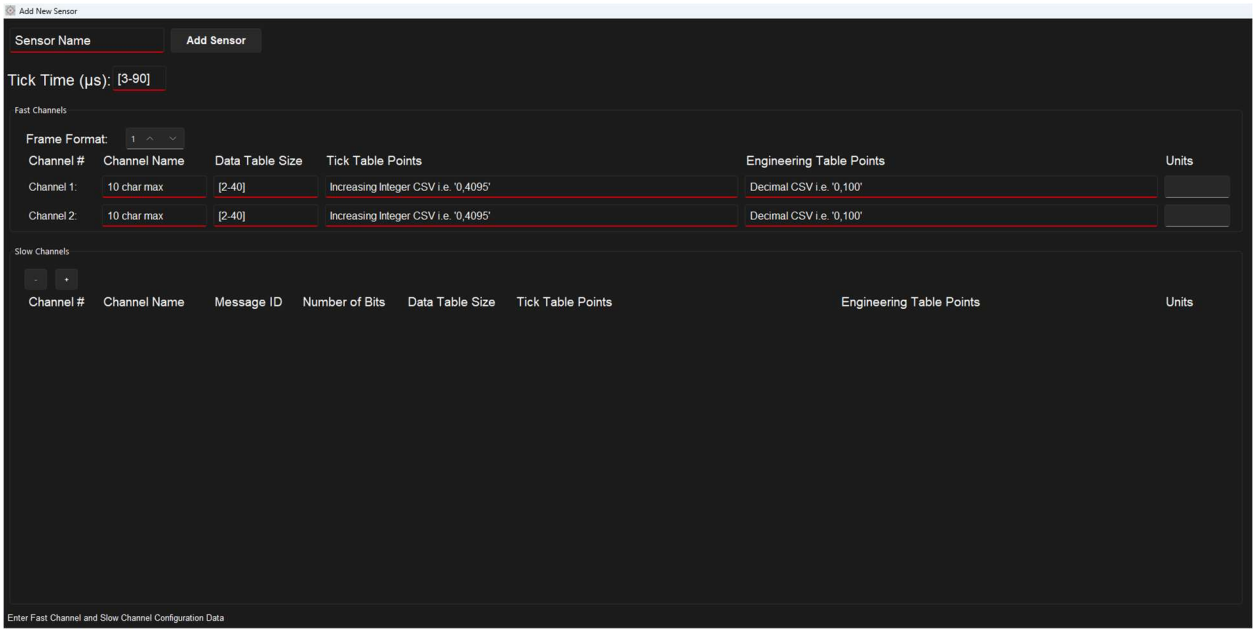


11. The right side of the user interface is reserved for scripting responses. This tool allows users to insert errors and switch between them to test the response of the sensor.



12. The script editor can load and save configurations, run indefinitely, and output what sensor it is reading from

Sensor Configuration Window



The sensor configuration window consists of 4 sections:

1. **Sensor Name:** The name of the sensor selected by the user.

2. **Fast Channels:** The number of fast channels automatically updates based on the frame format, which can be selected using the Frame Format spin box. Frame format properties are as follows:

Frame Format	Fast Channel 1	Fast Channel 2	Number of Data Nibbles
1	12 bits	12 bits	6
2	12 bits	N/A	3
3	14 bits	N/A	4
4	12 bits	Secure sensor information	6
5	12 bits	Constant 4094	6
6	14 bits	10 bits	6
7	16 bits	8 bits	6

3. **Slow Channel Selection:** To set the number of slow channels, the user can select the "+" or "-" buttons to add or remove slow channel rows

4. **Update Sensor:** Once all the sensor configuration data is properly filled out, the user can click the "Update Sensor" button to update the sensor configuration locally on the user's machine. It is highly recommended to keep a copy of the original sensor data separate from the modified version.

Sensor Channel Configuration

Each channel has data that needs to be entered. The data table size, tick table points, engineering table points, minimum tick value, and maximum tick value all pertain to the relationship of the channel data and the SENT tick points. The SENT datasheet should include data tables and/or graphs that reflect these values.

- **Data Table Size:** The number of points to be contained in “Tick Table Points” or “Engineering Table Points” respectively
- **Tick Table Points:** A comma separated list of tick values for the channel
- **Engineering Table Points:** The corresponding comma separated list of engineering values for the channel
- **Units (Optional):** The units the engineering data values represent

Slow channels include an additional two entries that are necessary for configuration:

- **Message ID:** The hex value for the slow channel ID
- **Number of bits:** Number of bits to be sent

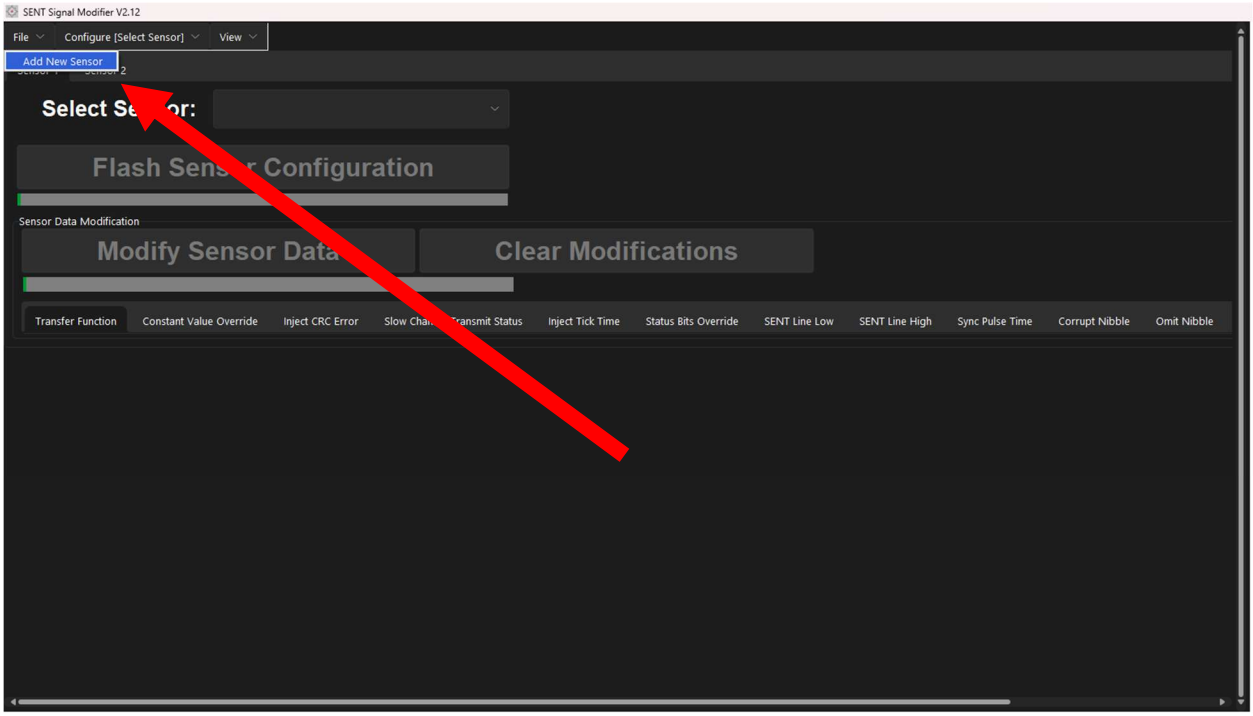
Sensor Data Manipulation

There are many ways to manipulate data from a sensor:

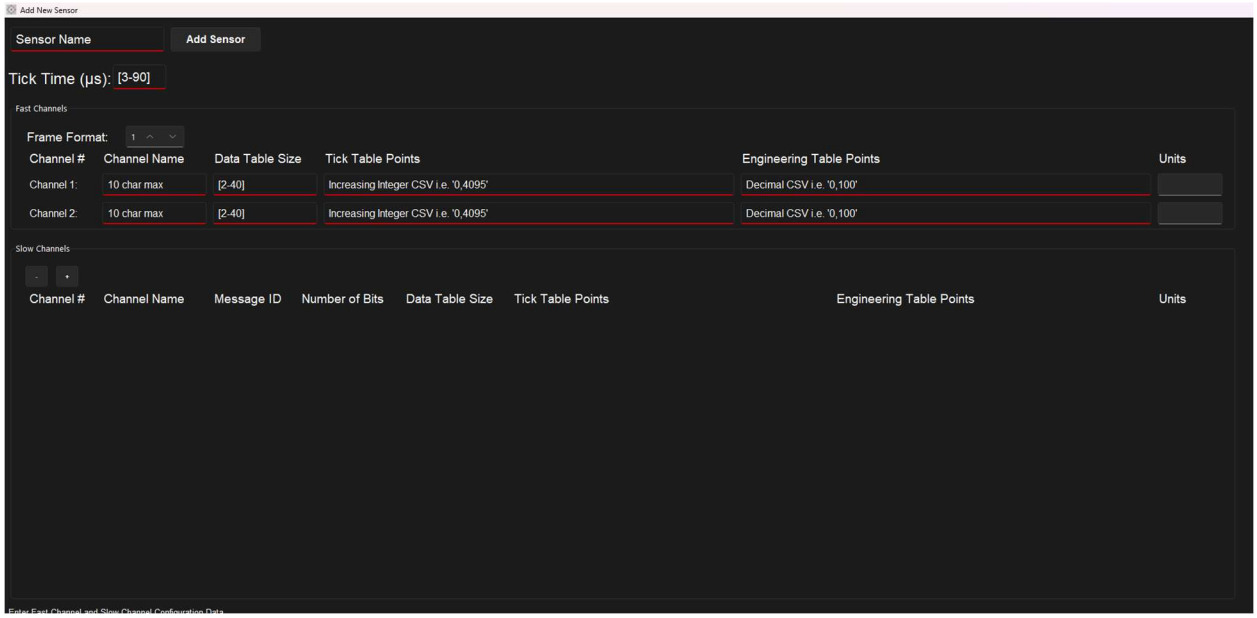
- Transfer Function
- Constant Value Override
- Inject CRC Error
- Slow Channel Transmit Status
- Inject Tick Time
- Status Bit Override
- SENT Line Low
- SENT Line High
- Sync Pulse Time
- Corrupt Nibble
- Omit Nibble
- Extra Nibble
- Set Range
- Set Clock Error

Adding a Sensor

The SENT Signal Modifier can add to the default list of sensors. Simply open the SENT Signal Modifier program, go to File (located in the top left corner of the screen, and click on “Add New Sensor”.



The new window displays all the information necessary to add a new sensor:



Note: Tick Table Points **and** Engineering Table Points must be comma-separated lists with increasing values

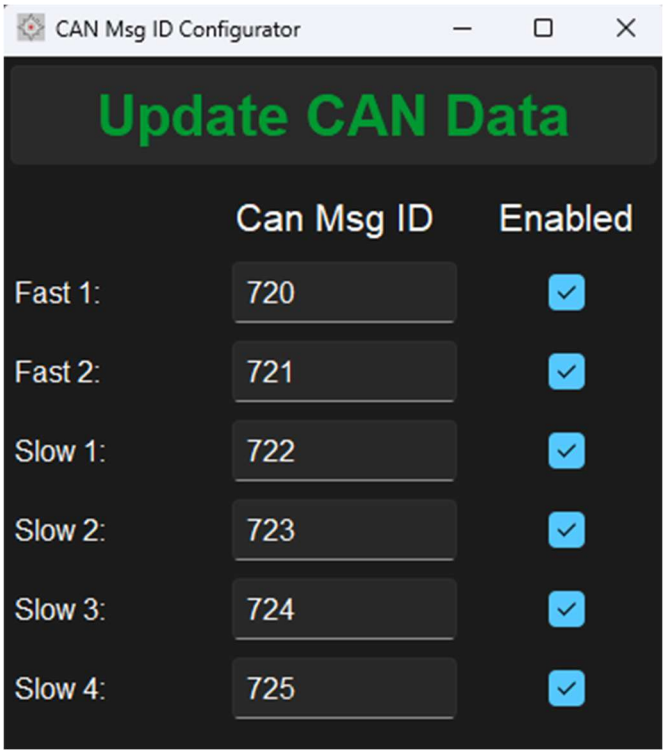
Example: 1000,2000,2500,2666…

Once all data is entered, click “Add Sensor” and the sensor will be available within the main program.

CAN Output

Important Notice: CAN is currently not available and is planned for implementation at a later date. For more information, please contact Novellus Engineering Services.

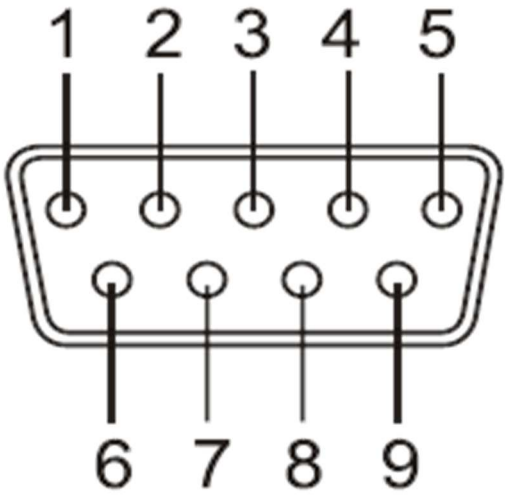
The SENT Signal Modifier is capable of outputting a CAN output. The default message ID is set to 0x720, then increments based on the amount of channels the sensor has.



DB9 Connector Specification

Signal Name	DB9 Pin Number*	Signal Description
CAN FD Low	2	CAN line low
Ground	5	Ground
CAN FD High	7	CAN line high

* Any unnamed pins have no connection

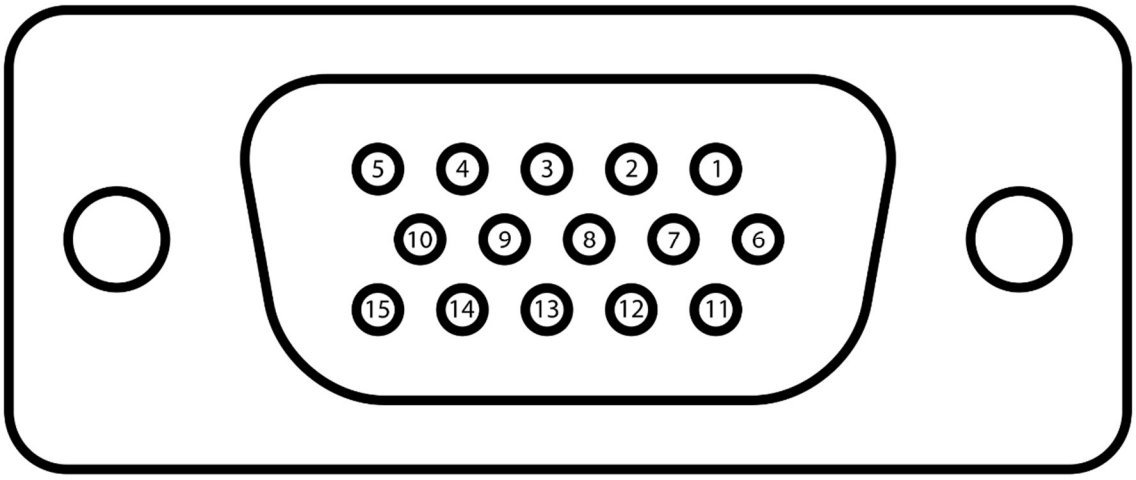


Important Notice: CAN is currently not available and is planned for implementation at a later date. For more information, please contact Novellus Engineering Services.

DB15 Connector Specification

Signal Name	DB15 Pin Number*	Signal Description
SENT Signal Out	1	Output from the SENT device
GND	2	Device ground
SENT Signal In	3	Input to the SENT device
GND	4	Device ground
+5V	13	+5V supply voltage
GND	14	Device ground
+12V Supply	15	+12V supply voltage

* Any unnamed pins have no connection



Electrical Specifications

Signal	Minimum	Typical	Maximum
Input Supply Voltage	+7 VDC	+12 VDC	+20 VDC
Input Supply Current			
Operation Temperature	-40°C		+125°C

Physical Dimensions

130 x 116 x 56 mm (Length x Width x Height)

Package Contents

- (1) SENT Signal Modifier (with serial number recorded for internal tracking)
- (1) Dual-channel sensor harness
- (1) USB-A to USB-B cable
- Software package and user manual

Contact Information

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