PEAK System: PCAN-View

ATI F/T CAN Bus for NETCANOEM Guide

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THIS DOCUMENT IS NOT CONTROLLED

Engineered Products for Robotic Productivity

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OVERVIEW

This guide covers how to use PCAN View (PEAK-System CAN Viewer) to communicate with the ATI CAN BUS interface of a 9105-NETCANOEM board.

SYSTEM COMPONENTS

ATI Components

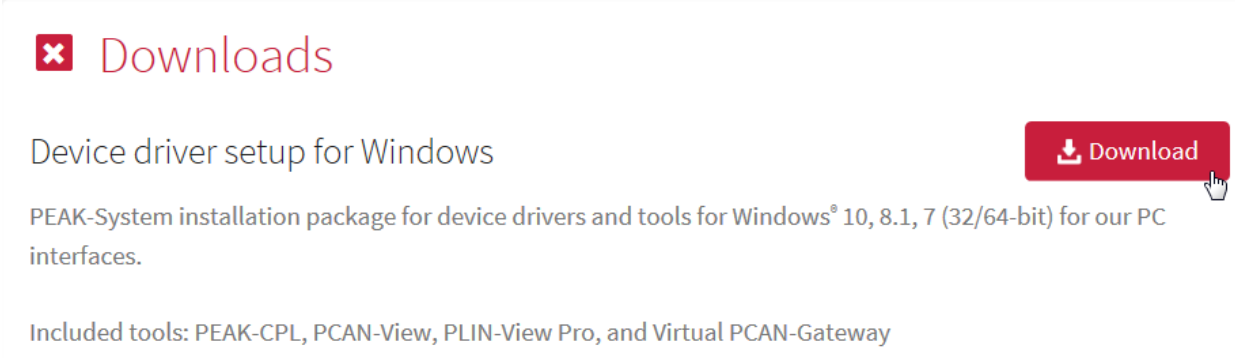
9105-NETCANOEM

PEAK System Components

The hardware used to generate the screenshots in this guide was the PCAN-USB from PEAK System. The link to the device used is below:
https://www.peak-system.com/PCAN-USB.199.0.html?&L=1

Note: There may be other compatible devices that also work.

The driver for this adaptor can be found at the same link under *Downloads*.



Software

The software tested was PCAN VIEW:

https://www.peak-system.com/PCAN-View.242.0.html

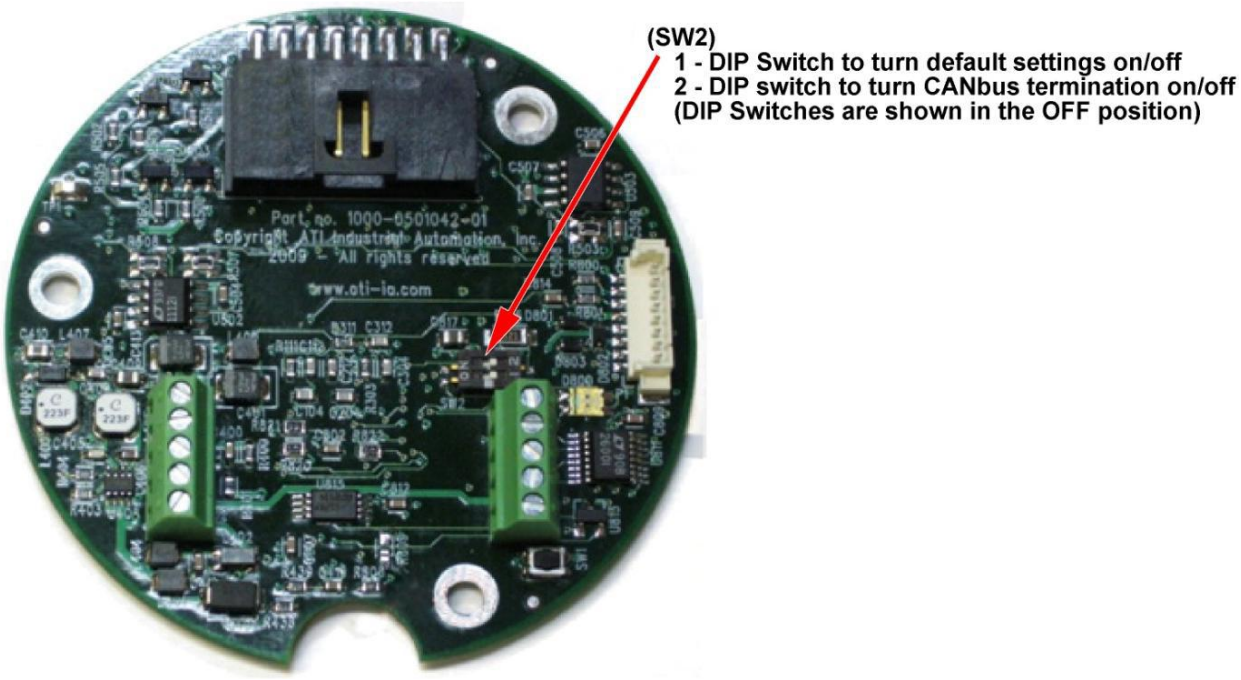
SYSTEM CONFIGURATION

Please review the 9105-NETCANOEM manual for the information required to wire and power the OEM board. The 9105-NETCANOEM manual can be found at the following link:
https://www.ati-ia.com/app_content/documents/9610-05-1030.pdf

The NETCANOEM board can be powered with a DC voltage between 12V and 24V.

Configure ATI Hardware

On the NETCANOEM board, there are 2 DIP switches for *SW2*:
Set DIP switch One to On -> Default settings
Set DIP switch Two to On -> Termination Resistor ON

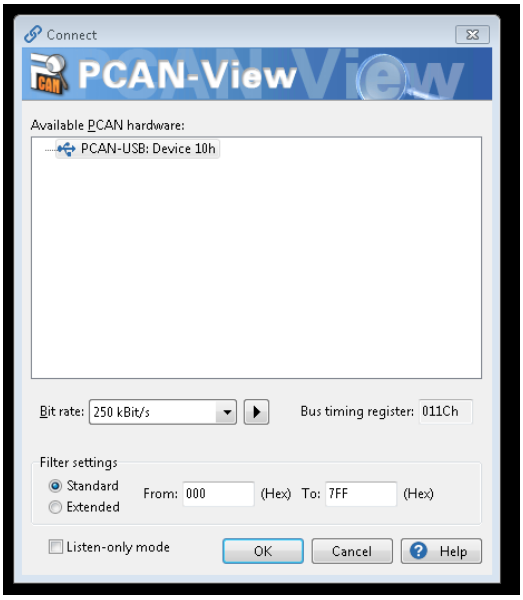


For reference, the Default settings are below:

Bit rate = 250 kBit/s
Address (hex) = 20

Configure PCAN VIEW

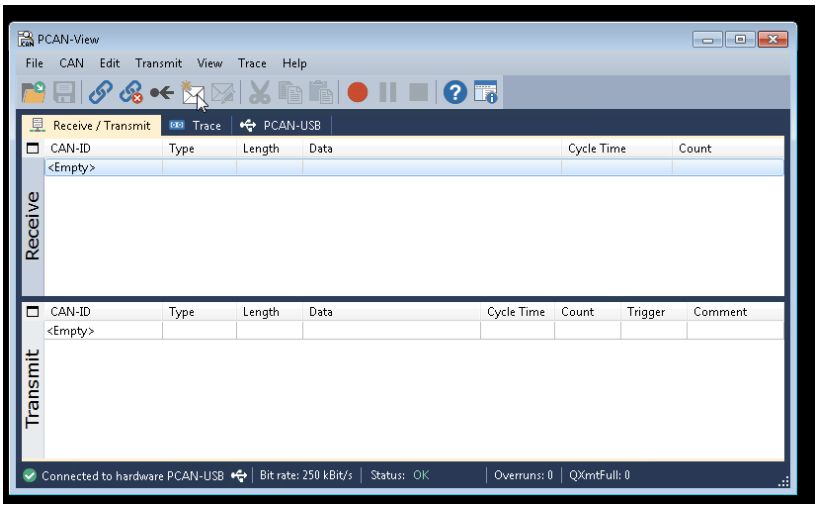
In the *Connect* window, set the Bit rate to 250 kBit/s and click *OK*.



USING PCAN TO COMMUNICATE WITH THE SENSOR

Send a Message

Click on the envelope to create a new message.

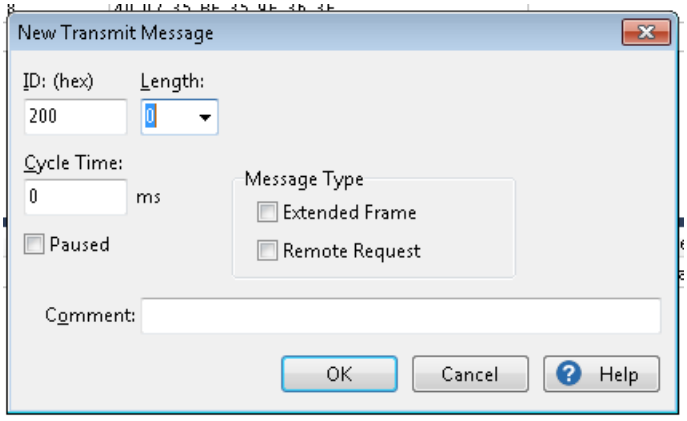


After a new message is created, it will show up under *Transmit*. To send the message, double-click on the *CAN-ID* of the message to send it.

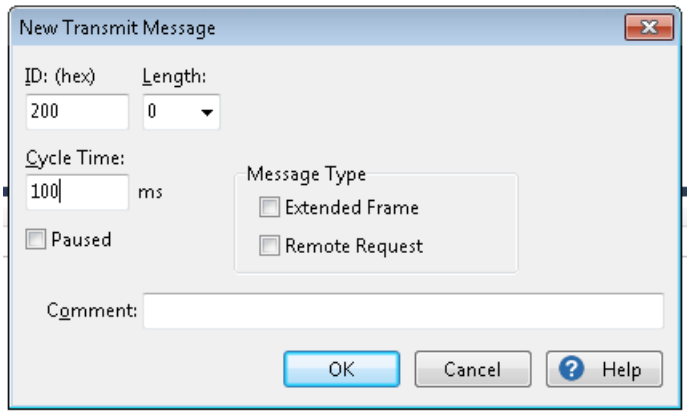
UNDERSTANDING THE SENSOR DATA

Request Sensor Data

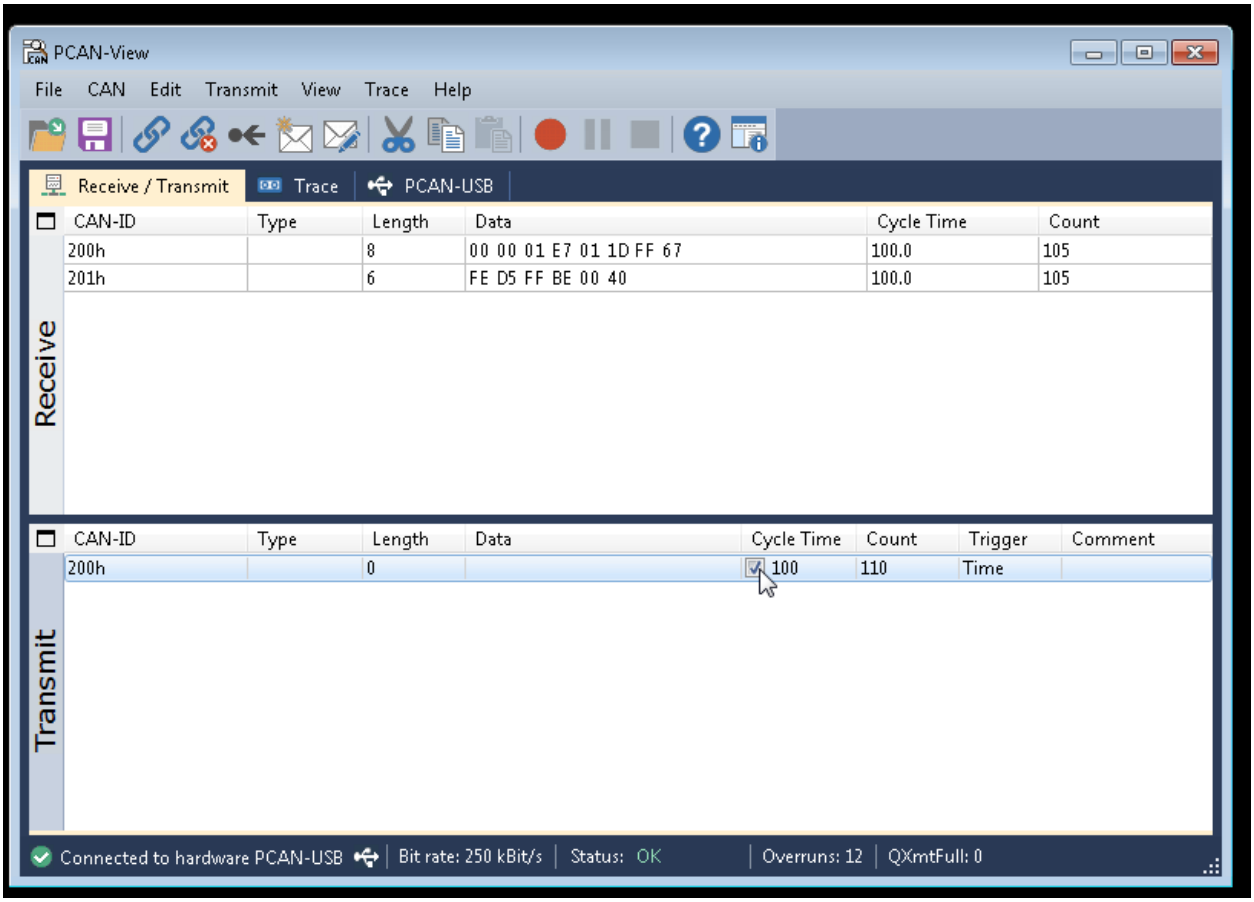
Use the following message to request one sample of data from the sensor.



In order to stream the data continuously from the sensor, set the *Cycle Time*. This will put the command in a loop every xxx ms. In the following picture, the *Cycle Time* was set to 100 ms which will request sensor data every tenth of a second.



The sensor will return two data packets, one with CAN-ID 0x200 and one with 0x201.



To stream the data, click the check box under *Cycle Time* as shown in previous picture.

Status Word

The first 2 bytes of CAN-ID 0x200 shown below are the Status Word.

CAN-ID	Type	Length	Data	Cycle Time	Count
200h		8	00 00 FF 57 00 0E FD 2C		1
201h		6	01 42 F9 43 FD 2E		1

This 00 00 indicates a healthy sensor with no status bits shown. If this is not 00 00, we recommend reviewing the *NETCANOEM Status Register* table in the NETCANOEM manual to confirm the meaning of the status bit.

Below is a link to the NETCANOEM Manual:
https://www.ati-ia.com/app_content/documents/9610-05-1030.pdf

Strain Gage Measurement

Similarly, the strain gage readings are returned when sensor data is requested. The values for SG0, SG2, and SG4 are returned in the packet for CAN-ID 0x200. The values for SG1, SG3, and SG5 are returned in the packet for CAN-ID 0x201.

SG0

CAN-ID	Type	Length	Data	Cycle Time	Count
200h		8	00 00 FF 57 00 0E FD 2C		1
201h		6	01 42 F9 43 FD 2E		1

SG2

CAN-ID	Type	Length	Data	Cycle Time	Count
200h		8	00 00 FF 57 00 0E FD 2C		1
201h		6	01 42 F9 43 FD 2E		1

SG4

CAN-ID	Type	Length	Data	Cycle Time	Count
200h		8	00 00 FF 57 00 0E FD 2C		1
201h		6	01 42 F9 43 FD 2E		1

SG1

CAN-ID	Type	Length	Data	Cycle Time	Count
200h		8	00 00 FF 57 00 0E FD 2C		1
201h		6	01 42 F9 43 FD 2E		1

SG3

CAN-ID	Type	Length	Data	Cycle Time	Count
200h		8	00 00 FF 57 00 0E FD 2C		1
201h		6	01 42 F9 43 FD 2E		1

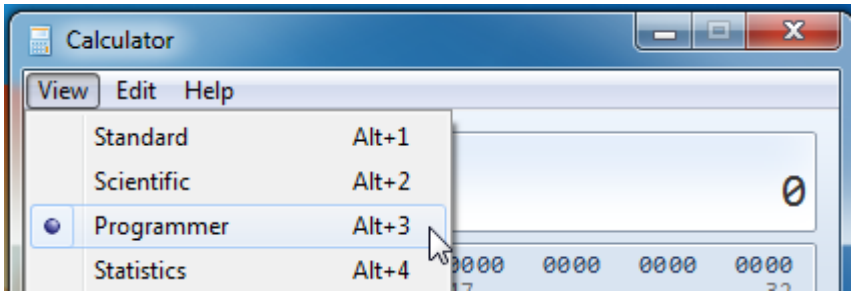
SG5

CAN-ID	Type	Length	Data	Cycle Time	Count
200h		8	00 00 FF 57 00 0E FD 2C		1
201h		6	01 42 F9 43 FD 2E		1

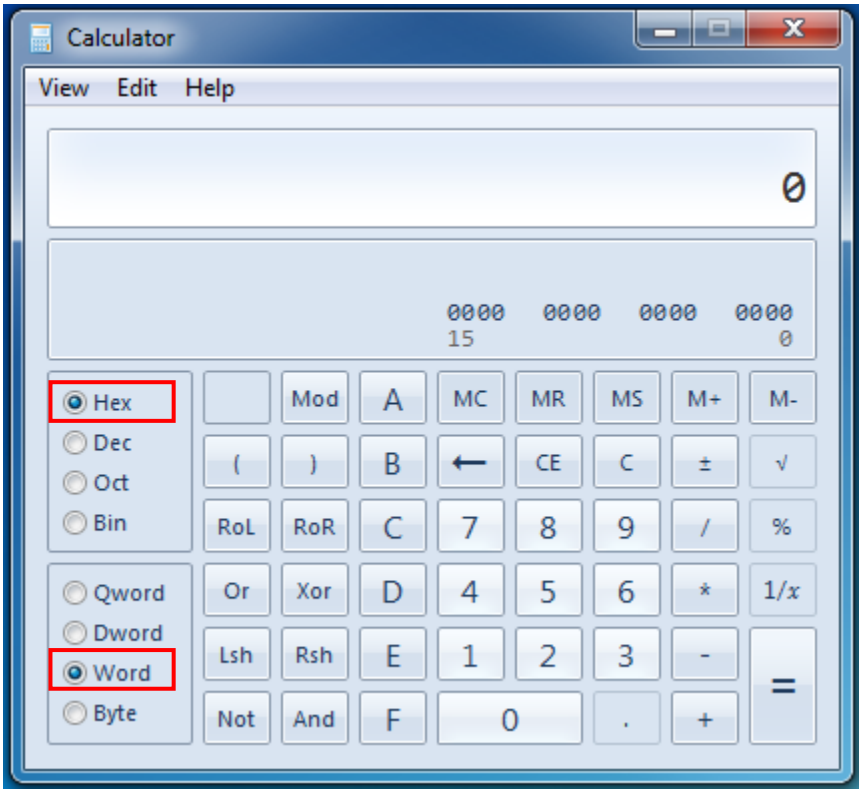
Decoding the Status Word

The Status Word is provided in Hex format. For Microsoft Calculator to convert these correctly, *Word* must be selected. The example below shows how to see which bits the word 0x01E7 corresponds to. If you are using Windows 10, please review the section *Comments About the Windows 10 Calculator* before proceeding.

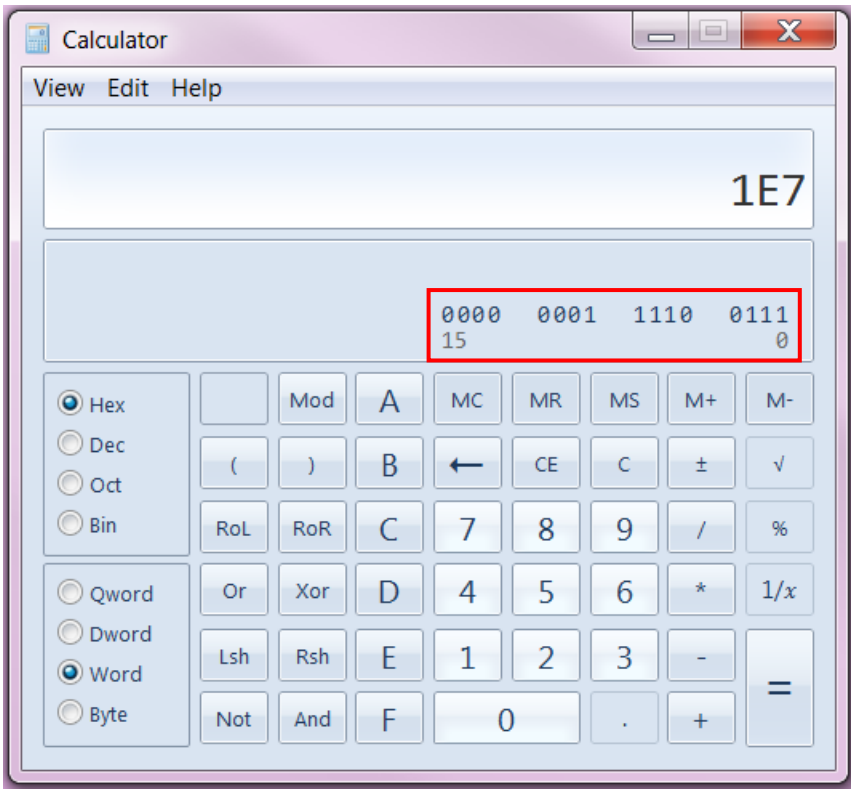
In the calculator under *View,* select *Programmer*.



Select *Hex* and *Word* as shown below.



Type in the Hex value that you wish to decode. For the example, we are decoding 0x01E7 from Hex to Binary. The Binary bits are shown below.

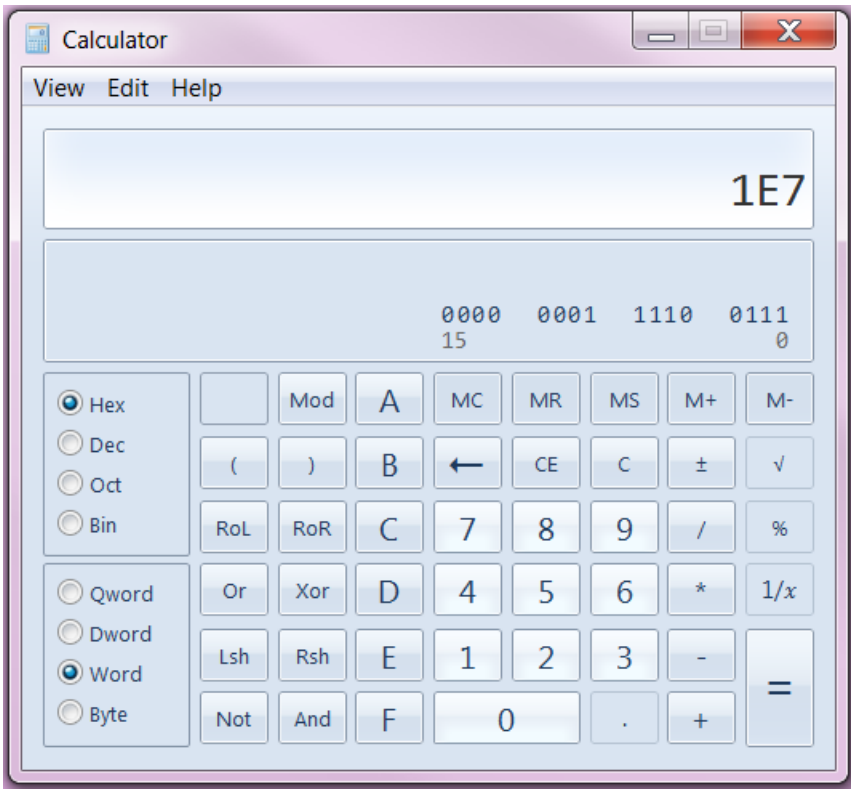


This shows that 0x01E7 = 0000 0001 1110 0111

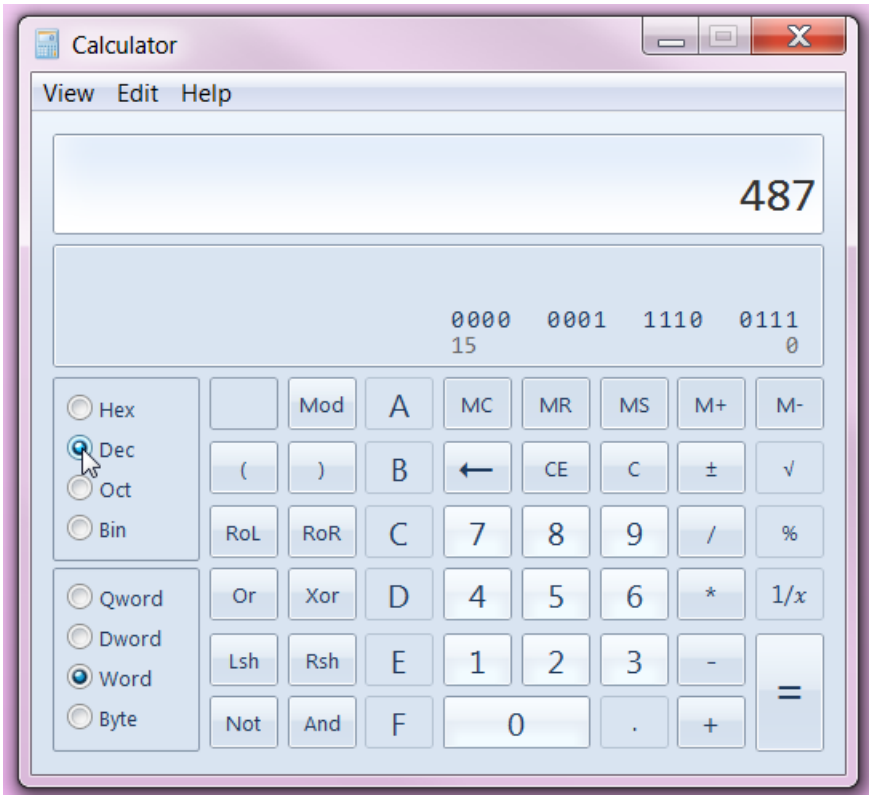
Decoding Gage Values from Hex to Counts

The gage counts are provided in signed bytes (two's compliment). For Microsoft Calculator to convert these correctly, *Word* must be selected. The example below shows how to convert the word 0x01E7 from Hex to counts. If you are using Windows 10, please review the section *Comments About the Windows 10 Calculator* before proceeding.

In the calculator select *Programmer,* then select *Hex* and *Word*. Type in the HEX that you wish to convert to counts.



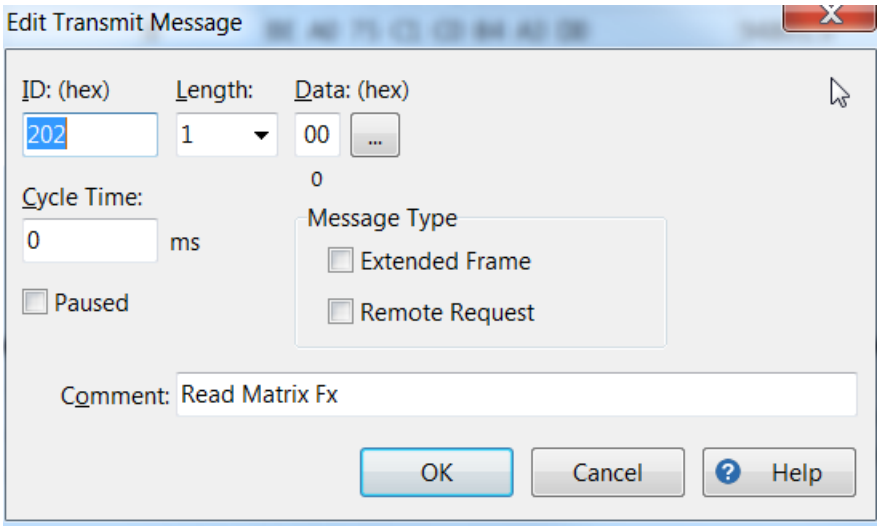
Now click on *Dec* to convert to decimal format.



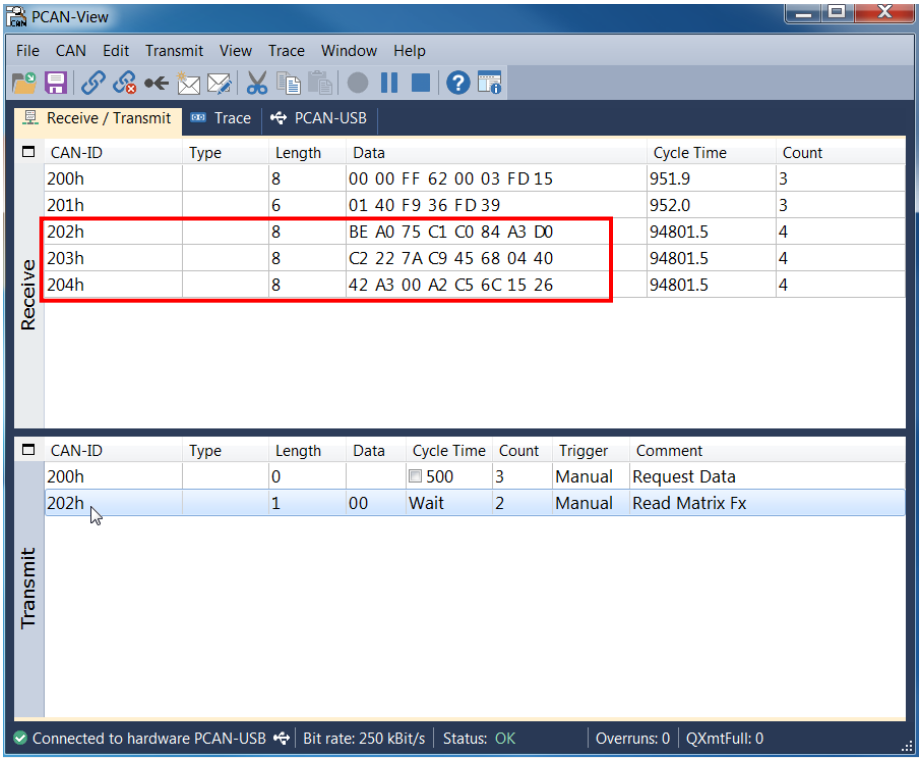
This shows that 0x01E7 = 0000 0001 1110 0111 = 487 counts (or a signed integer value of +487).

HOW TO READ MATRIX COEFFICIENTS

To read the coefficients for Fx of the currently selected calibration, send a message to CAN-ID of 0x202 with a *Length* of 1(one data byte) containing the *Data* value of 00.

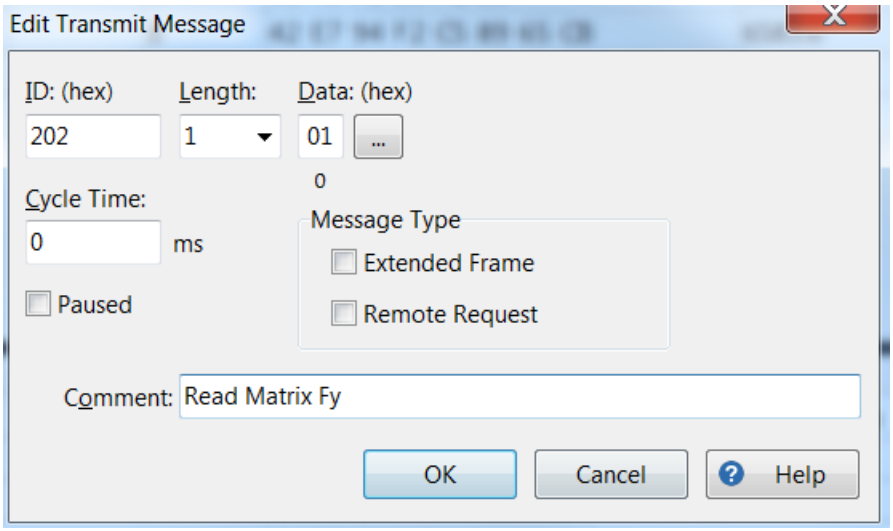


This will return 3 packets of data from 0x203, 0x204, and 0x205 as shown below.

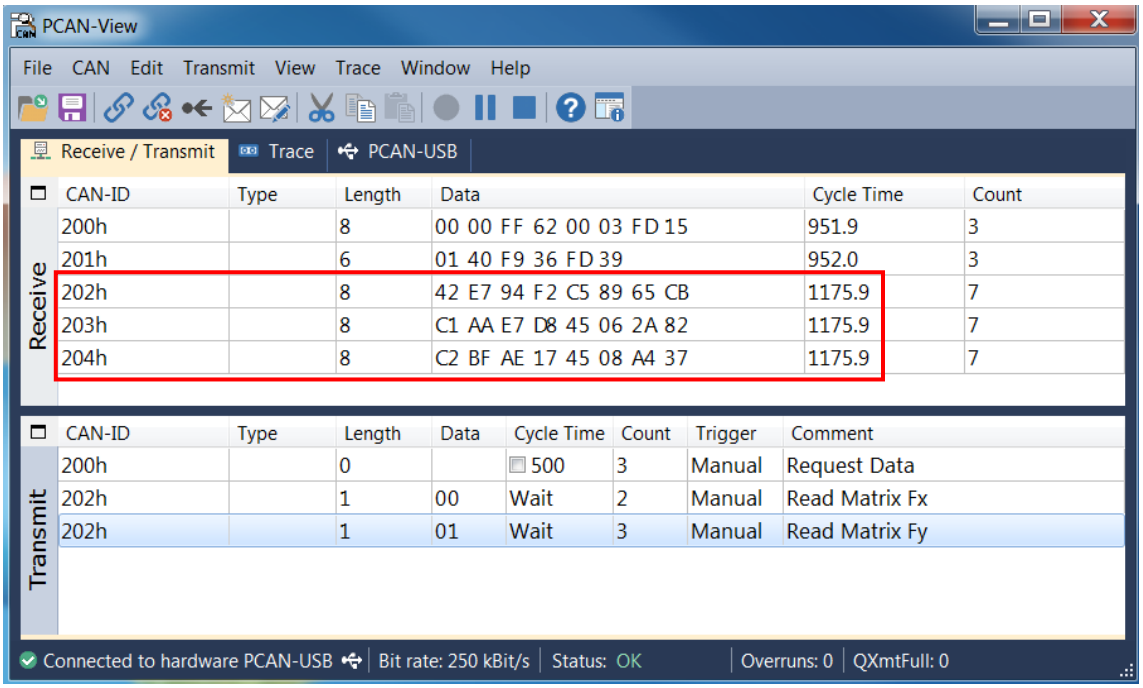


Note: To send the message, under *Transmit* double click on the *CAN-ID* of the message you wish to send.

To read the coefficients for Fy, send a message to CAN-ID of 0x202 with a *Length* of 1(one data byte) containing the *Data* value of 01.



Notice that the values returned under 0x202, 0x203, and 0x204 are now updated. These correspond to Fy.



The *Data* pattern continues for Fz, Tx, Ty, and Tz coefficients as shown below:
Fx=00 Tx=03
Fy=01 Ty=04
Fz=02 Tz=05

Using the Matrix Coefficients

The Six coefficients for the Six strain gages of the Fy example are shown below. Please note that the values for your sensor will be different.

SG0 Coefficient

Receive						
	202h		8	42 E7 94 F2 C5 89 65 CB	1175.9	7
	203h		8	C1 AA E7 D8 45 06 2A 82	1175.9	7
	204h		8	C2 BF AE 17 45 08 A4 37	1175.9	7

SG1 Coefficient

Receive						
	202h		8	42 E7 94 F2 C5 89 65 CB	1175.9	7
	203h		8	C1 AA E7 D8 45 06 2A 82	1175.9	7
	204h		8	C2 BF AE 17 45 08 A4 37	1175.9	7

SG2 Coefficient

Receive						
	202h		8	42 E7 94 F2 C5 89 65 CB	1175.9	7
	203h		8	C1 AA E7 D8 45 06 2A 82	1175.9	7
	204h		8	C2 BF AE 17 45 08 A4 37	1175.9	7

SG3 Coefficient

Receive						
	202h		8	42 E7 94 F2 C5 89 65 CB	1175.9	7
	203h		8	C1 AA E7 D8 45 06 2A 82	1175.9	7
	204h		8	C2 BF AE 17 45 08 A4 37	1175.9	7

SG4 Coefficient

Receive						
	202h		8	42 E7 94 F2 C5 89 65 CB	1175.9	7
	203h		8	C1 AA E7 D8 45 06 2A 82	1175.9	7
	204h		8	C2 BF AE 17 45 08 A4 37	1175.9	7

SG5 Coefficient

Receive						
	202h		8	42 E7 94 F2 C5 89 65 CB	1175.9	7
	203h		8	C1 AA E7 D8 45 06 2A 82	1175.9	7
	204h		8	C2 BF AE 17 45 08 A4 37	1175.9	7

For this example, the sensor output value for Fy can be constructed using the following expression, where FP(" ") indicates the floating point conversion of the data:

SG0*FP(42 E7 94 F2)+SG1*FP(C5 89 65 CB)+SG2*FP(C1 AA E7 D8)+…+SG5*FP(45 08 A4 37)

Your programming language should have a way to do this conversion.

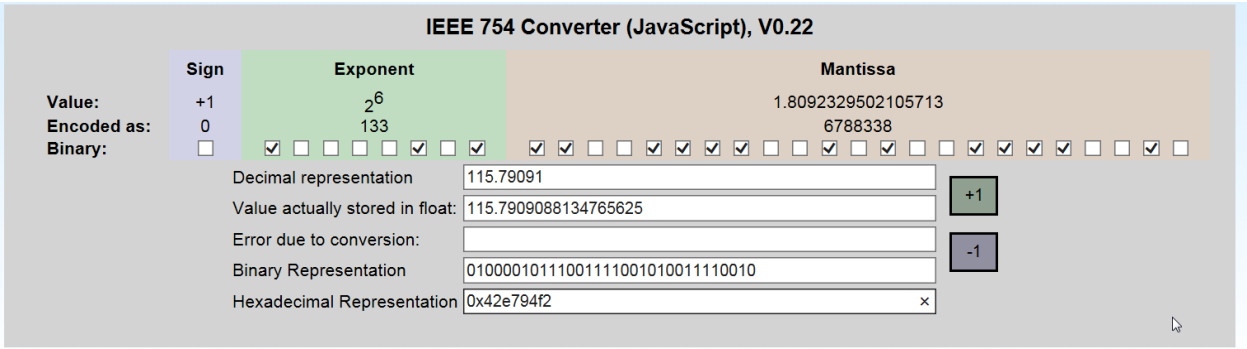
Matrix Coefficients Diagnostics

It is a good idea to see if you are converting these numbers correctly.

There is an online converter at the following link:
https://www.h-schmidt.net/FloatConverter/IEEE754.html

This converter lets you enter a decimal number to see the corresponding hexadecimal and binary representation. Alternatively, you can enter a sequence of hexadecimal bytes to see what the decimal value is. Try entering the byte values you are reading into the converter to see if it matches your program's output.

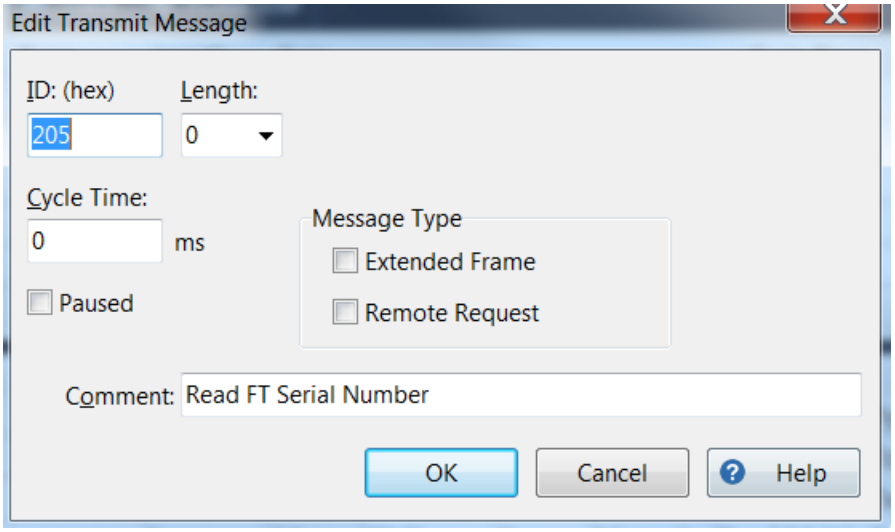
Below, is an example using the converter to convert a 4 byte floating point Hex (42 E7 94 F2) into decimal format.



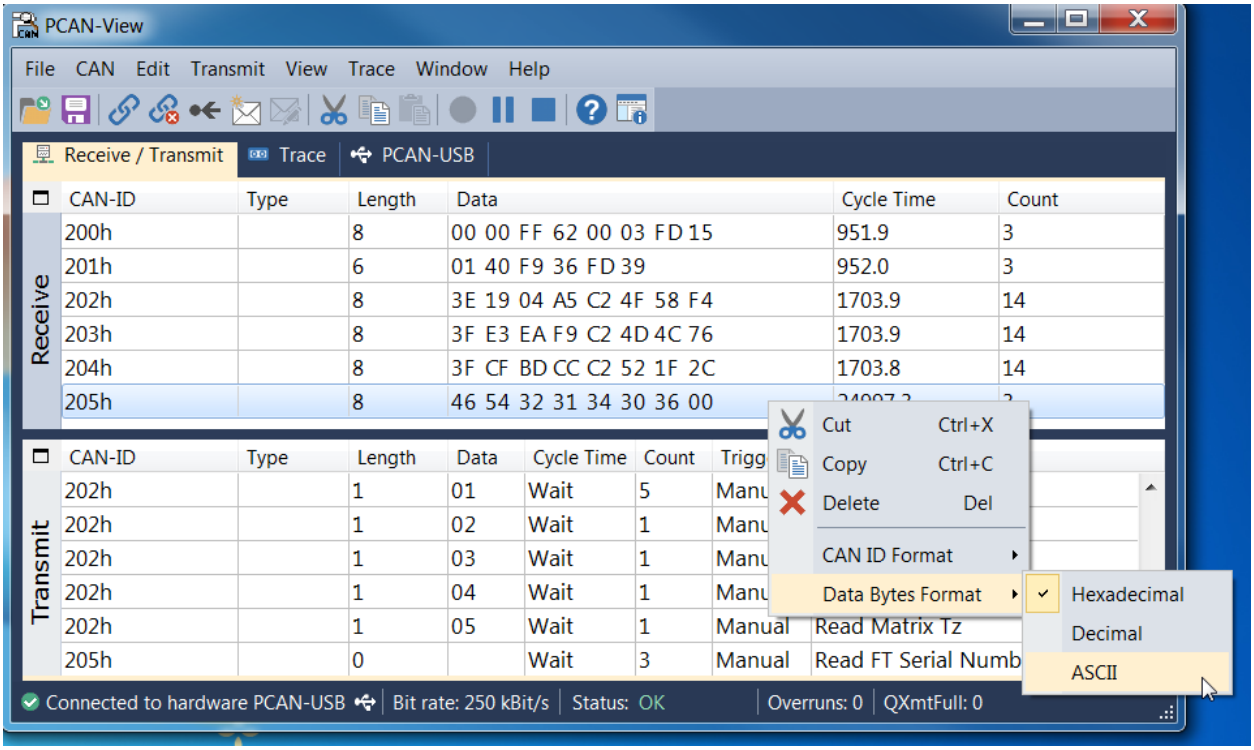
FP(42 E7 94 F2) = 115.79

READ FT SERIAL NUMBER

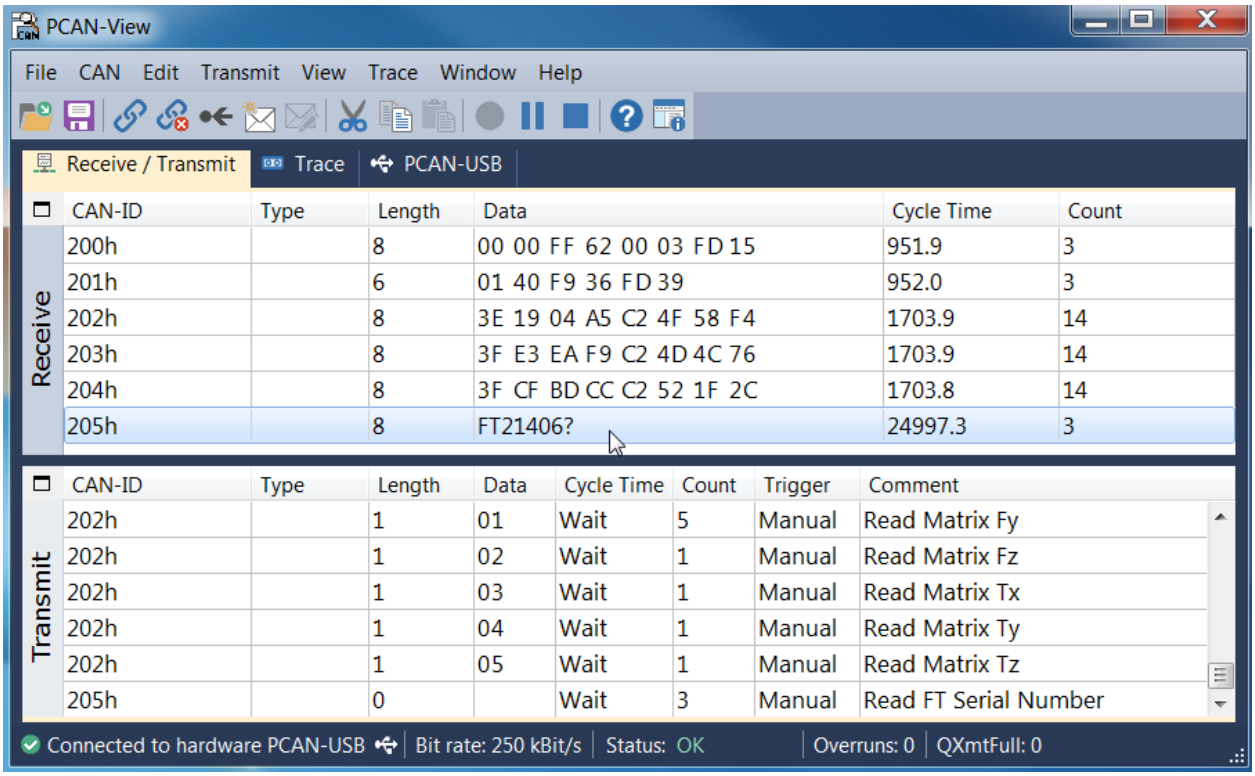
Use the following message to read the FT Serial Number.



This will return a message with a CAN-ID of 0x205. Right click on the message and select *Data Bytes Format* of *ASCII* to change the output to an easy to read format.

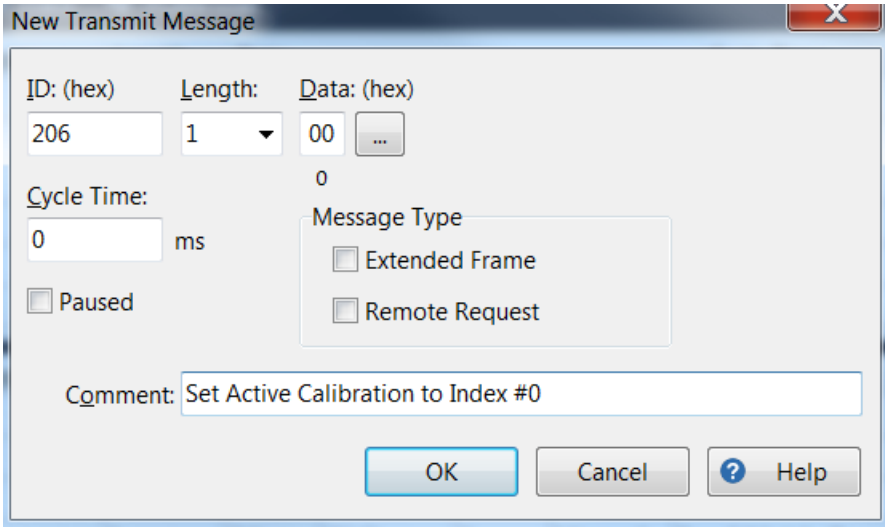


Notice that the FT serial number (in this case FT21406) is now displayed.

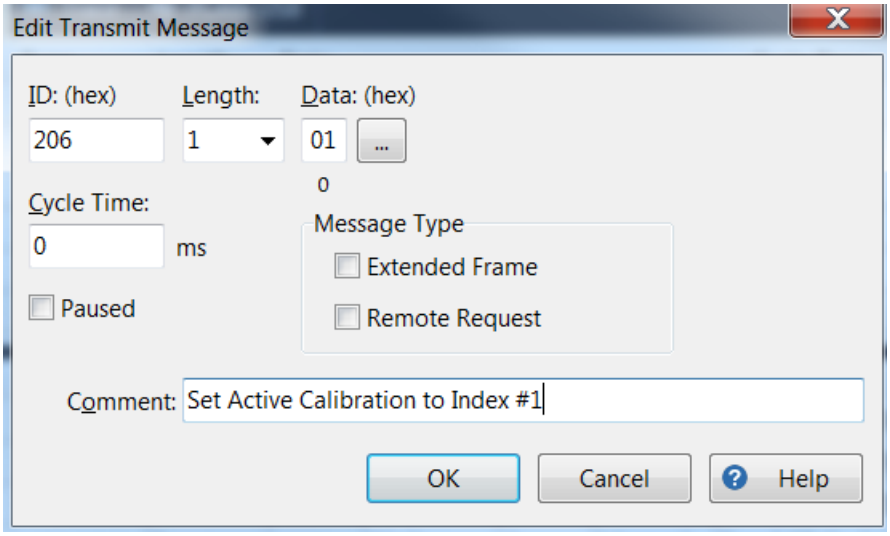


SET ACTIVE CALIBRATION

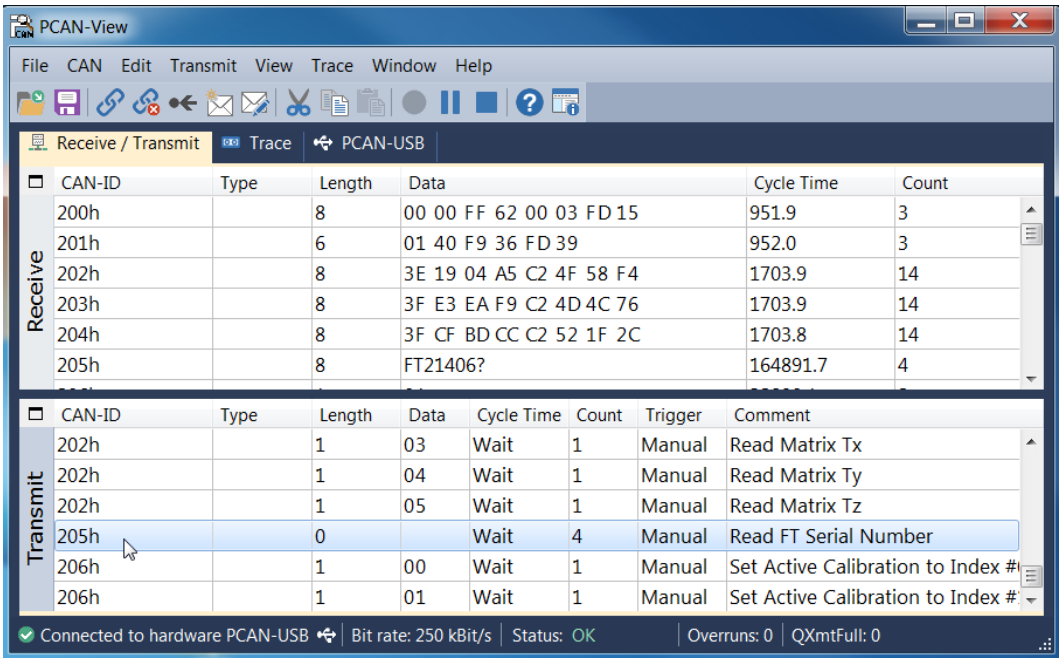
The active calibration is set to the first slot using the following message.



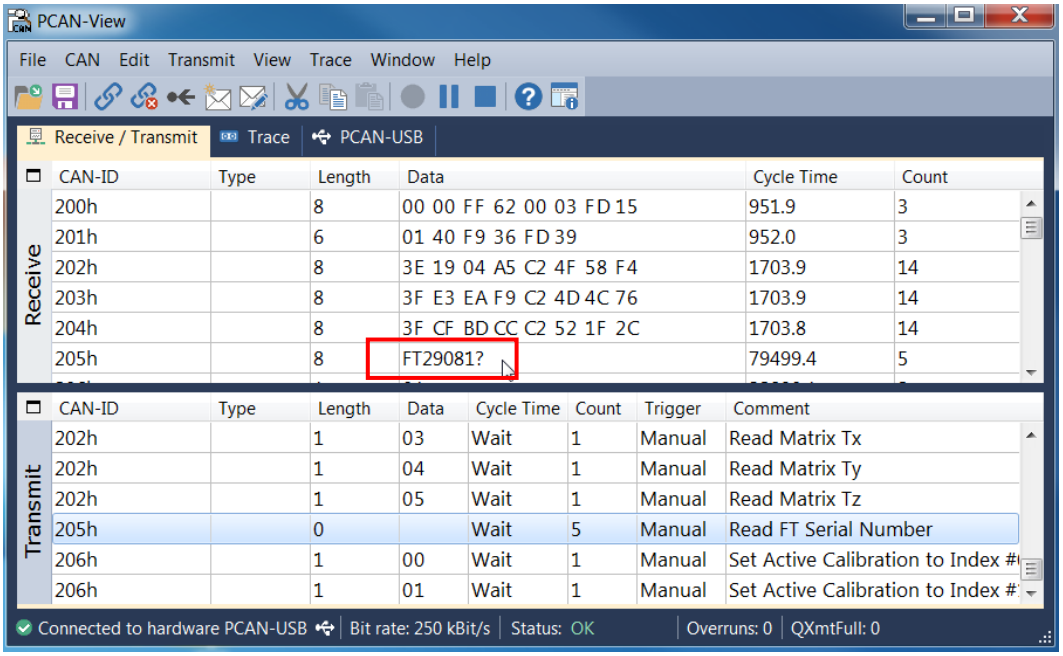
The active calibration is set to the second slot using the following message.



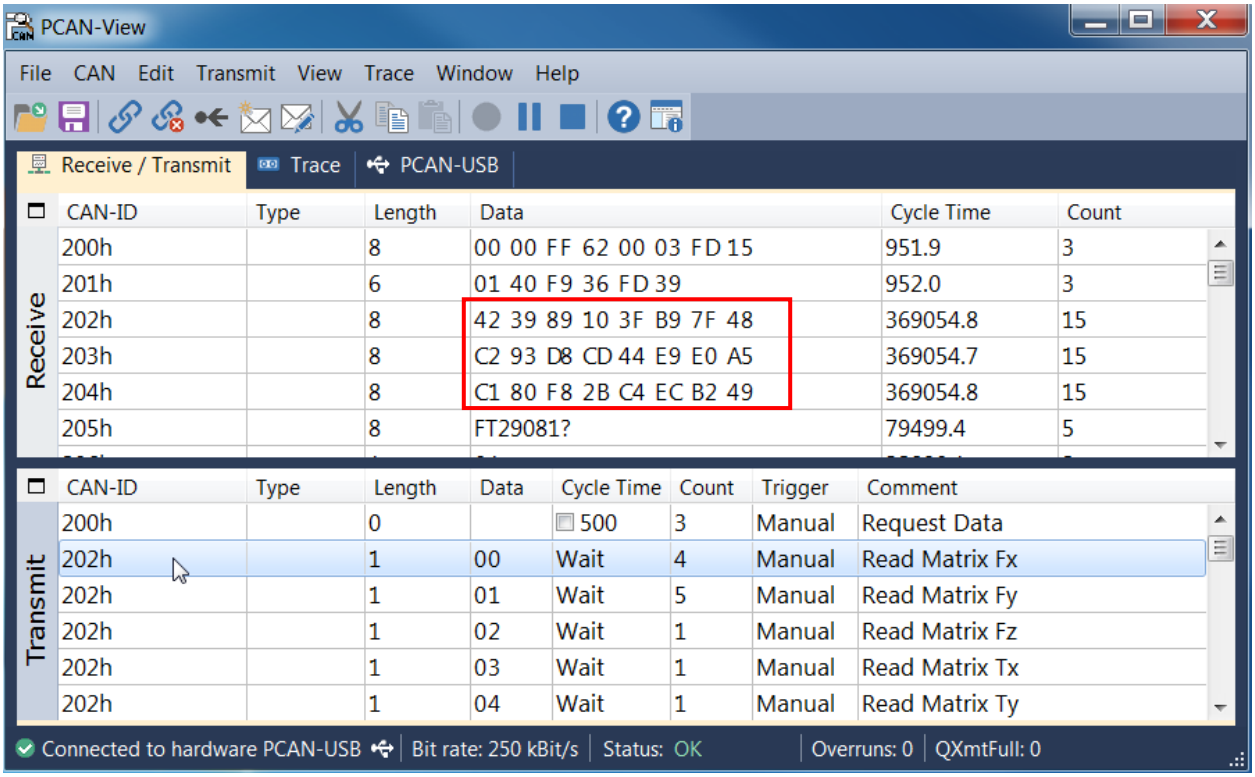
After sending a message with a new calibration slot, double click on the *CAN-ID* 205h message to resend, this will refresh the serial number data.



Notice a new serial number is now loaded.

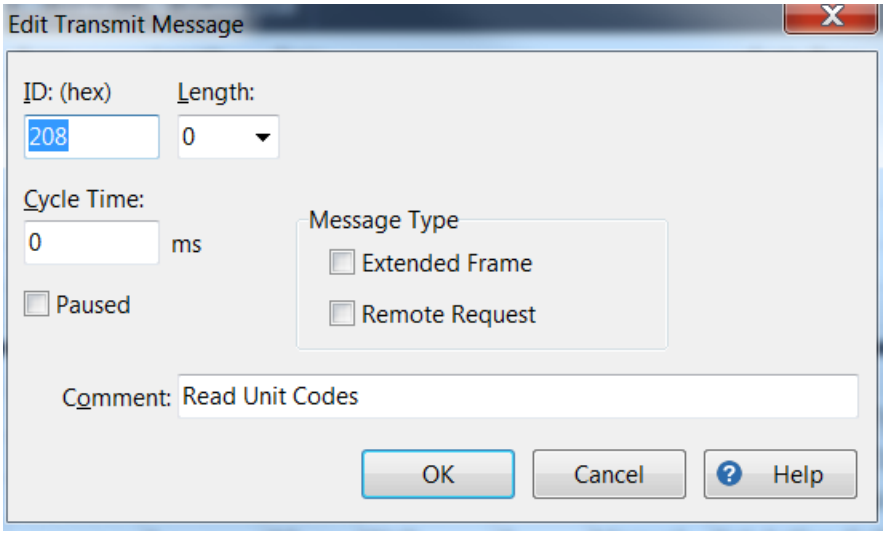


Re-send the messages requesting the matrix coefficients. With a new active calibration loaded, the coefficients for the matrix are now different. The active calibration must be selected before the coefficients for that serial number can be retrieved.

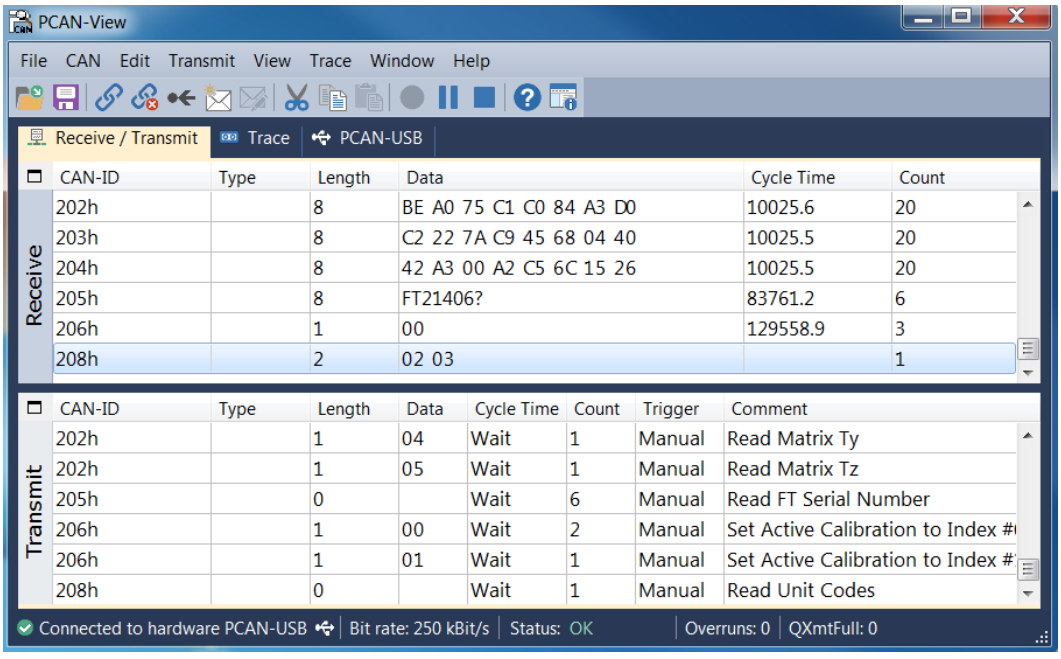


READ UNIT CODES

The following message is used to read the unit codes from the sensor for the current calibration.



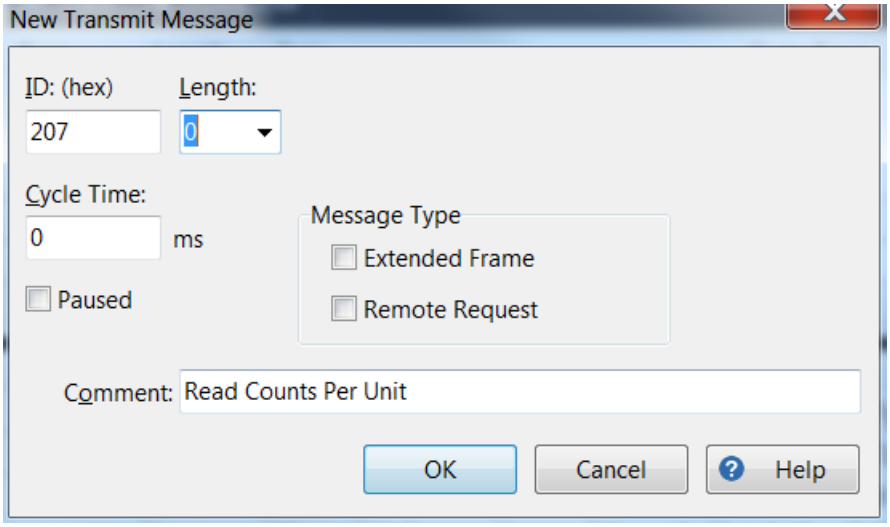
For this sensor, note that 02 and 03 in table 5.1 of the NETCANOEM manual correspond to N and Nm.



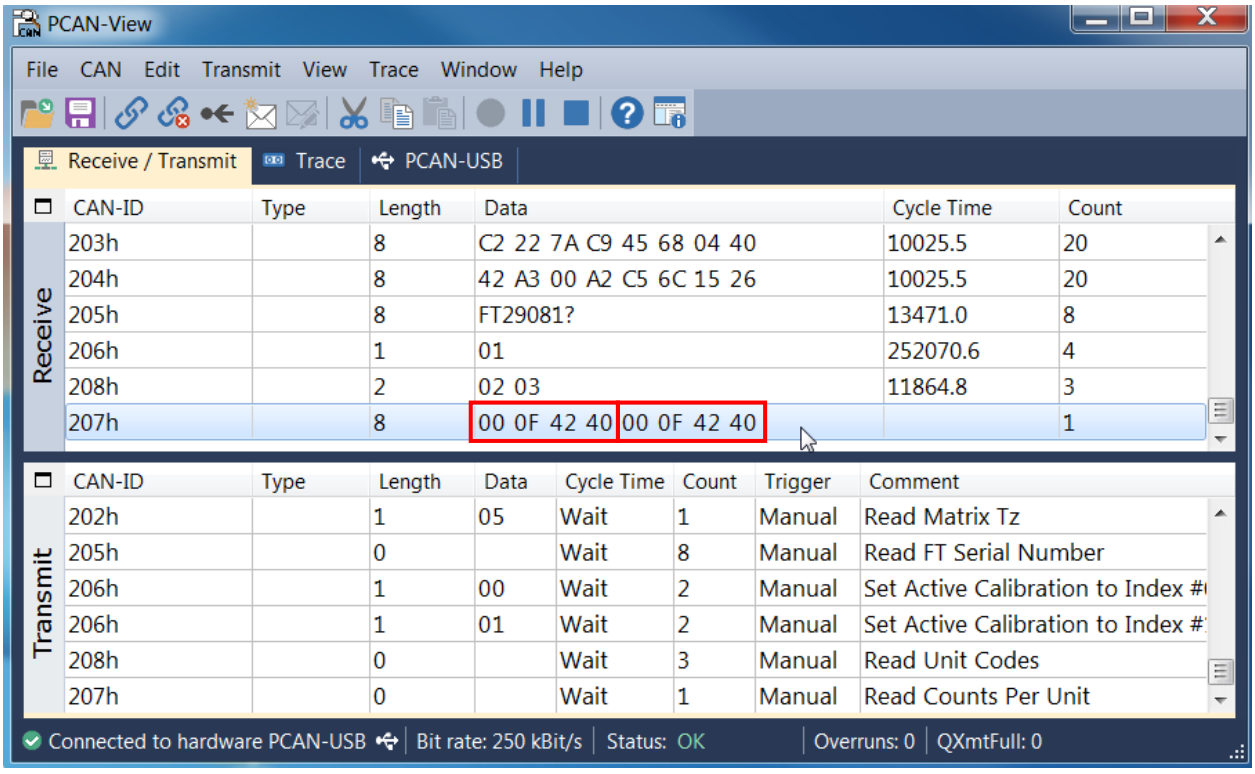
Below is a link to the NETCANOEM Manual:
https://www.ati-ia.com/app_content/documents/9610-05-1030.pdf

READ COUNTS PER UNIT

The following message is used to read the *Counts Per Unit* for the current calibration.



This returns a message with a CAN-ID of 0x207. The first 4 bytes are the *Counts Per Unit* of force. The second 4 bytes are for the *Counts Per Unit* of torque.

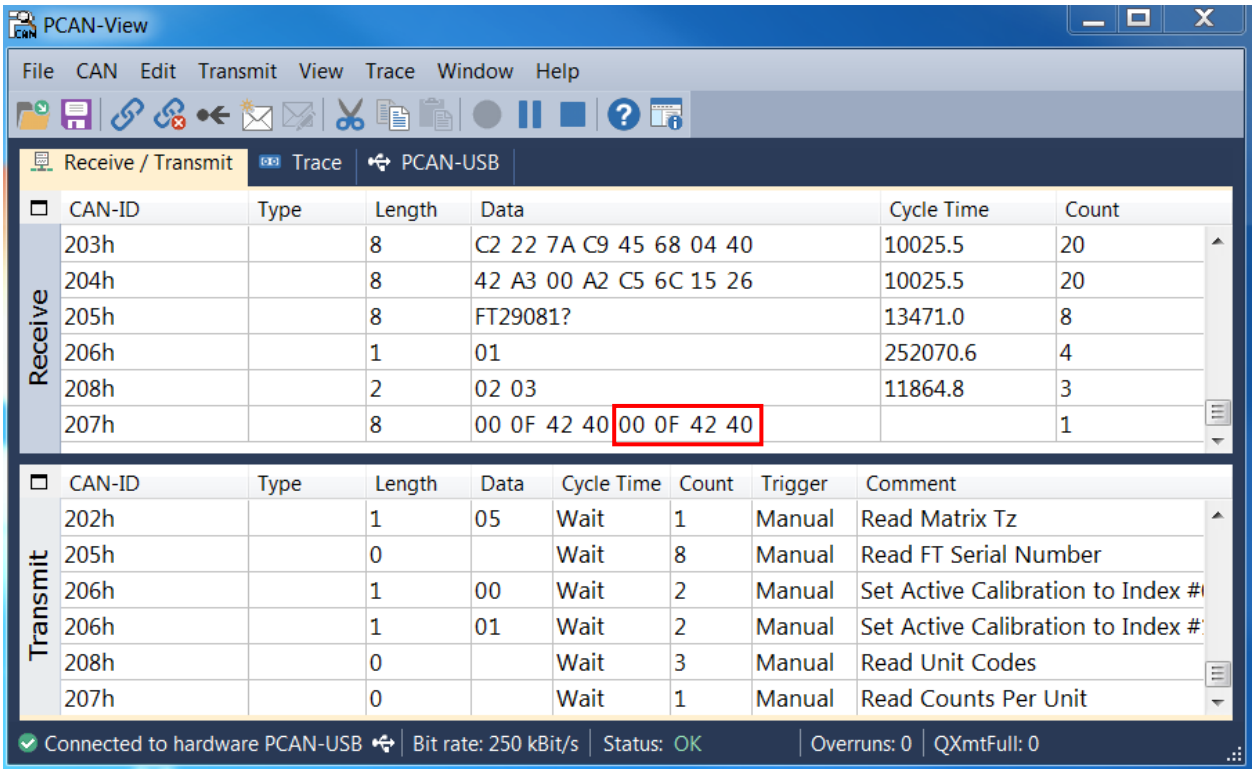


The *Counts Per Unit* are provided in a *4 bytes integer* format. Below is an example using Microsoft Calculator to convert these.

In the calculator, first select *Programmer,* then select *Hex* and *DWord*. Type in the Hex that you wish to convert to counts.

Notice that this shows 1,000,000 *Counts Per Unit*, since the force unit is N, this is 1,000,000 counts/N.

To find the *Counts Per Unit* of torque, use the second 4 bytes. Notice that for this sensor and calibration, this is the same value which indicates 1,000,000 counts/(Nm)



EXAMPLE CALCULATION

Below we show how to calculate Fy from the following strain gage data and matrix coefficients that were retrieved for Fy. In order to calculate a different sensor output (Fx, Fy, Fz, Tx, Ty, Tz), request the corresponding coefficients as shown in the *How to read matrix coefficients* Section of this guide.

Fy matrix coefficients: (Please review *How to Read Matrix Coefficients* for more information)

Receiv						
	202h		8	42 E7 94 F2 C5 89 65 CB	1175.9	7
	203h		8	C1 AA E7 D8 45 06 2A 82	1175.9	7
	204h		8	C2 BF AE 17 45 08 A4 37	1175.9	7

Strain gage data: (Please review *Understanding the Sensor Data* for more information)

CAN-ID	Type	Length	Data	Cycle Time	Count
200h		8	00 00 FF 57 00 0E FD 2C		1
201h		6	01 42 F9 43 FD 2E		1

Fy is calculated using the following equation:

Fy = SG0*SG0_Coefficient + SG1*SG1_Coefficient + SG2*SG2_Coefficient + SG3*SG3_Coefficient + SG4*SG4_Coefficient + SG5*SG5_Coefficient

Here is the raw data:

SG0 = FF 57 SG0 Coefficient = FP(42 E7 94 F2)
SG1 = 01 42 SG1 Coefficient = FP(C5 89 65 CB)
SG2 = 00 0E SG2 Coefficient = FP(C1 AA E7 D8)
SG3 = F9 43 SG3 Coefficient = FP(45 06 2A 82)
SG4 = FD 2C SG4 Coefficient = FP(C2 BF AE 17)
SG5 = FD 2E SG5 Coefficient = FP(45 08 A4 37)

Converting the data into Signed Integer and Floating point results in the following:

SG0 = -169 SG0 Coefficient = 115.79091
SG1 = 322 SG1 Coefficient = -4396.724
SG2 = 14 SG2 Coefficient = -21.363205
SG3 = -1725 SG3 Coefficient = 2146.6567
SG4 = -724 SG4 Coefficient = -95.84002
SG5 = -722 SG5 Coefficient = 2186.2634

Fy is calculated to be the following:

Fy = -169*115.79091 + 322*(-4396.724) + 14*(-21.363205) + (-1725)*2146.6567 + (-724)*(-95.84002) + (-722)*2186.2634

Fy = - 6647689.7 counts

Earlier, for this example sensor, we determined that the unit for Fy was N, and the *Counts Per Unit* of force was 1,000,000 counts/N.

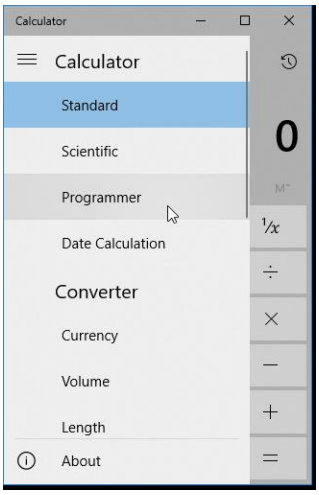
Fy = - 6,647,689.7 counts / 1,000,000 (counts/N) = - 6.64 N

COMMENTS ABOUT THE WINDOWS 10 CALCULATOR

Please note there are some differences between the calculator program in Windows 7 and Windows 10. The functionality is the same, but there are differences in appearance.

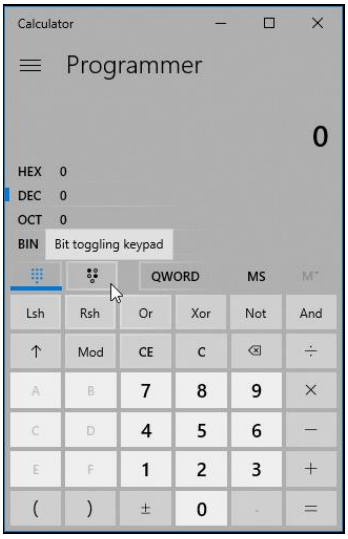
Below we will go over how to perform operations shown earlier, but using the Windows 10 calculator instead.

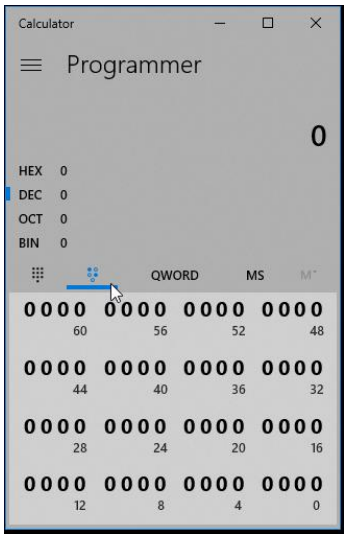
In Windows 10 under settings select *Programmer*.

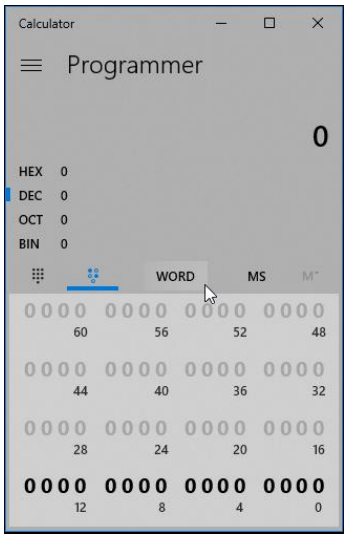


Word and *Dword* are accessed by clicking on the following to toggle between data types.

The Windows 10 calculator has the *Bit toggling keypad* which can be useful in troubleshooting.

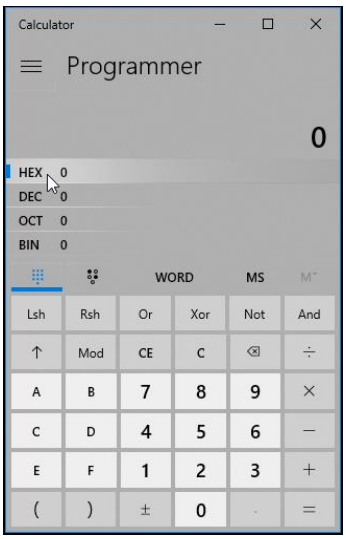




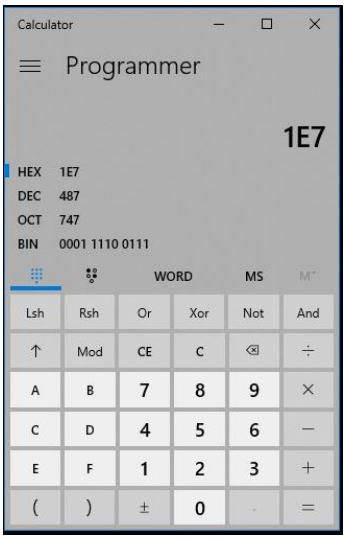


Notice that when *WORD* is selected the top 3 rows of bits are greyed out.

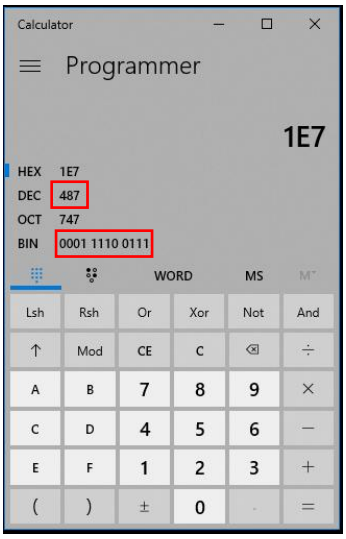
To convert Hex to either Binary or Decimal, first select Hex input mode and use the *Full keypad*.

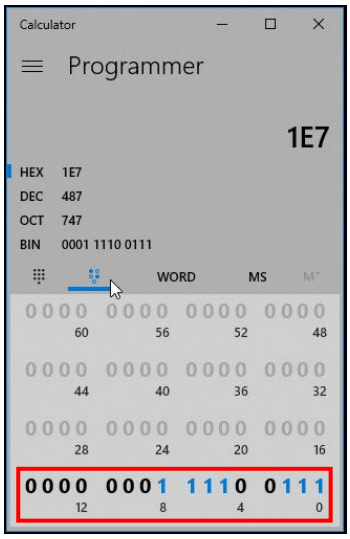


In the following example, we will convert 0x01E7 from Hex to Binary and to Dec(two's compliment signed integer). On the Keypad with Hex selected, input 01E7.



Notice that the calculator did not allow us to input the leading 0 of the 01E7, but the conversion is still the same. The calculator convieniently shows all conversions to other formats at a glance. If reviewing a status word, clicking on the *Bit toggling keypad* allows to quickly confirm which individual status bits are ON.





0x01E7 = 487 = 0000 0001 1110 0111

Word vs DWORD/QWORD

The gage counts are provided in signed bytes (two's compliment). For Microsoft Calculator to convert these correctly, *Word* must be selected. In the screenshots below notice that the *Dec* conversion for 0x81E7 changes when *Word* is selected.