SFP200 CAN 2.0B Protocol Implementation

Communications

Features

- CAN 2.0b extended frame format
- 500 kbit/s or 250 kbit/s
- Polling mechanism allows host to determine the rate of incoming reports

Registers

The SFP200 provides Current, Voltage, Shunt Temperature and Coulomb-count registers, mapped in memory space as shown in Table 3. Registers can only be accessed one at a time. All other addresses are reserved; any writes outside of the defined register address range are ignored.

Message Frames

Access to the registers of the SFP200 is accomplished through polling by the host. The SFP200 listens for extended ID 0xA100201 with data length of 1. Data byte 0 of the message carries the requested register address. If the message data length is greater than 1, the message is ignored and discarded. The simple structure of the message is demonstrated in Table 1.

Host request for data

Request Message ID	*Data byte 0*
0xA100201	Register Address

Table 1

The SFP200 returns data using message ID 0xA100200. Byte 0 of the returned message is the requested register, followed by the data.

SFP200 response (Motorola byte order)

Response Message ID	Data byte 0	Data byte 1	Data byte 2	Data byte 3	Data byte 4
0xA100200	Register Address	MSB data byte	Data byte	Data byte	LSB data byte

Table 2

SFP200 response (Intel byte order)

Response Message ID	Data byte 0	Data byte 1	Data byte 2	Data byte 3	Data byte 4
0xA100200	Register Address	LSB data byte	Data byte	Data byte	MSB data byte

Table 3

Register Map

Register Address	Description	Length (bits)	Value Type	Byte Order
0x00	Reserved	32		
0x01	Part name 0	32	ASCII	Intel
0x02	Part name 1	32	ASCII	Intel
0x03	Part name 2	32	ASCII	Intel
0x04	Part name 3	32	ASCII	Intel
0x05	Version 0	32	ASCII	Intel
0x06	Version 1	32	ASCII	Intel
0x07	Version 2	32	ASCII	Intel
0x08	Serial number 0	32	ASCII	Intel
0x09	Serial number 1	32	ASCII	Intel
0x0A	Serial number 2	32	ASCII	Intel
0x0B	Serial number 3	32	ASCII	Intel
0x20	Current, μA	32	Signed	Motorola
0x40	Coulomb Count Low, μC	32	Signed	Motorola
0x41	Coulomb Count High, μC * 2^{32}	32	Signed	Motorola
0x42	Coulomb Count Low & Reset, μC	32	Signed	Motorola
0x44	Coulomb Count Charging Low, μC	32	Signed	Motorola
0x45	Coulomb Count Charging High, μC * 2^{32}	32	Signed	Motorola
0x46	Coulomb Count Discharging Low, μC	32	Signed	Motorola
0x47	Coulomb Count Discharging High, μC * 2^{32}	32	Signed	Motorola
0x60	Voltage 0, μV	32	Signed	Motorola
0x61	Voltage 1, μV	32	Signed	Motorola
0x62	Voltage 2, μV	32	Signed	Motorola
0x80	Temperature, m°C	32	Signed	Motorola

Table 4

Data Format

All data returned by the SFP200 are 32-bit packets.

If Byte Order is marked “Intel” the Least Significant Byte (LSB) follows the “Register Address” byte in the message (in position Data byte 1) as shown in Table 3. If Byte Order is marked “Motorola” the Most Significant Byte (MSB) is in position “Data byte 1” as shown in Table 2.

For signed integer format (2’s complement signed data*) representing micro units, divide the signed data by 10^6 (1000000) to get the values in Amperes, Volts or Coulombs. For Temperature, divide the signed data by 10^3 (1000) to get the values in degrees Celsius.

Coulomb counts are split into two registers, *Coulomb Count High* and *Coulomb Count Low*. The data is a combined 64-bit signed integer value (2’s complement signed data). Divide the signed data by 10^6 to get the value expressed in Coulombs. Register *Coulomb Count Low* should always be read first. Reads of this register causes *Coulomb Count High* to latch and remain unchanged until Coulomb Count Low is read again.

Reads of the *Coulomb Count Low & Reset* will force the whole 64-bit Coulomb counter to reset to zero. The read *Coulomb Count Low & Reset* operation will provide the last value of the *Coulomb Count Low* register and force the *Coulomb Count High* to latch its present value. The user may complete the read of the *Coulomb Count High* register to determine the last value of the whole Coulomb counter immediately prior to the reset.

Coulomb Count Charging Low and *Coulomb Count Charging High* registers operate the same way as the *Coulomb Count Low* and *Coulomb Count High* registers providing information on the accumulated coulomb count during charging.

Coulomb Count Discharging Low and *Coulomb Count Discharging High* registers also operate the same way as the *Coulomb Count Low* and *Coulomb Count High* registers providing information on the accumulated coulomb count during discharging.

Both *Coulomb Count Charging* and *Coulomb Count Discharging* registers are reset to zero value through the *Coulomb Count Low & Reset* command.

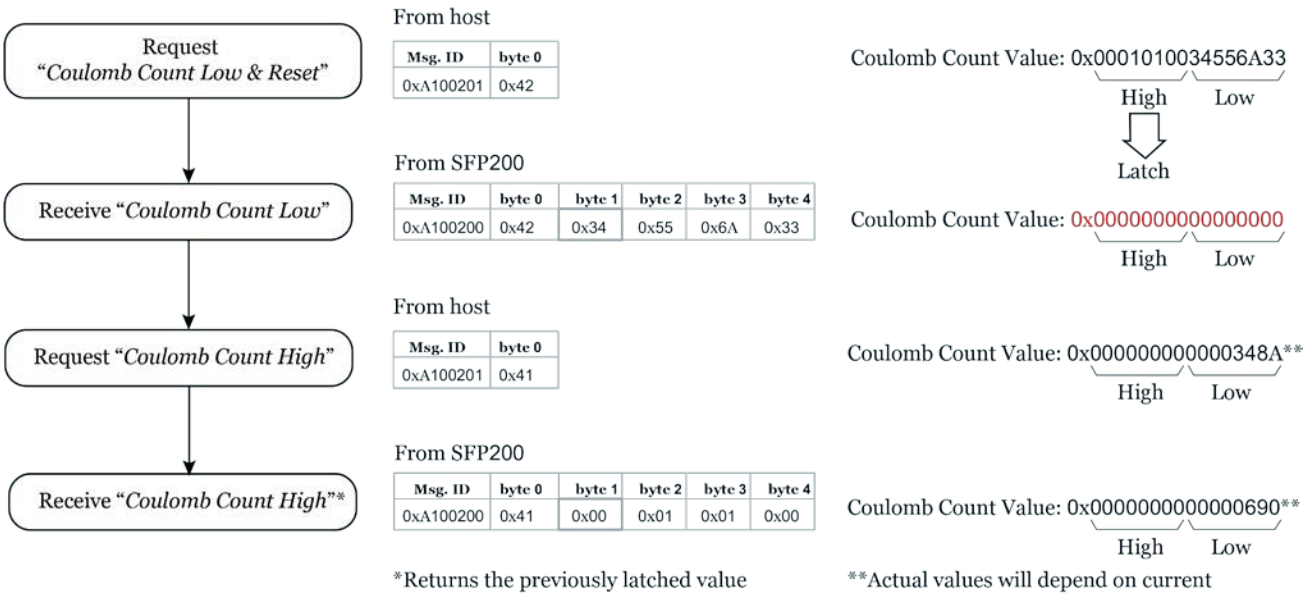
Example Communications: Read "*Voltage 0*"

Origin	Message ID	Byte 0	Byte 1	Byte 2	Byte 3	Byte 4
Host	0xA100201	0x60				
SFP200	0xA100200	0x60	0xFF	0x45	0xA1	0x34

Table 5

*For more information on 2's complement please see this Wikipedia Article.

Example of "Read Coulomb Count Low & Reset"



*Returns the previously latched value

**Actual values will depend on current

Example Walkthrough

1. Host sends a request message with ID 0xA100201 (extended), byte 0 set to 0x60 (voltage) and message length set to 1.
2. SFP200 receives the message and responds with the requested register address and contents using extended ID 0xA100200.
3. Host receives the message and checks byte 0 to determine if the correct register address has been received.
4. Host re-assembles the bytes into a signed integer, and then divides by 10^6 to scale the value.

Pseudo-code for Current and Voltage received data reassembly by the host:

```
// Example raw data from SFP module
unsigned char byte1 = 0xFF;
unsigned char byte2 = 0x45;
unsigned char byte3 = 0xA1;
unsigned char byte4 = 0x34;

// Assembling to 32 bit unsigned integer
unsigned int reassembled_data = 0;
reassembled_data |= byte1 << 24;
reassembled_data |= byte2 << 16;
reassembled_data |= byte3 <<  8;
reassembled_data |= byte4 <<  0;

// Converting to volts
float voltage = (int)(reassembled_data) / 1000000.0f;

// Calculated value is -12.213964 Volts
```

Document Revisions

Version	Date	Comments
1.6	20180911	Document Part number, Version and Serial number registers
1.5a	20180122	Minor correction. Instead of "Polling mechanism allows host to determine the rate of incoming data" change to "… the rate of incoming reports"
1.5	20171201	Provide example of Reset Coulomb Counter operation. Remove current threshold registers
1.4	20171106	Added description of Charging and Discharging Coulomb Counters as well as current thresholds for accumulating current read values into the proper Coulomb Count registers
1.3	20170822	Change name of register 0x42 to *Coulomb Count Low & Reset*
1.2	20170613	Document the Coulomb count reset register
1.1	20170525	Annotation for Two's Complement
1.0	20161213	Initial public release
0.4	20161107	Temperature reporting changed
0.3	20160930	Minor text corrections; update of reported units for Coulomb counts
0.2	20160927	First release draft

Table 6