Status interpretation for C40 Google car devices

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1 Interpreting statuses

An instrument status code is intended to indicate the working condition of the device during the time of measurement. For example, a status code may include alarms to indicate that a flow or temperature is lower or higher than the device's working range. Most status codes are represented as eight-character hex words.

To interpret the status code, the hex word will have to be converted to binary. Once in binary format, the different bits (individually or in combination) indicate the state of each alarm. Table 1 gives an example of interpreting the status code `A00249C1`.

A0								02								49								C1							
1	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	1	0	0	1	1	1	0	0	0	0	0	1
31 ← 24								23 ← 16								15 ← 8								7 ← 0							

Table 1: Example of a hex status code interpretation. Row 1: The 8-character hex status code. Row 2: Binary representation. Row 3: Bit numbering

When two or more bits interpreted together, the least significant bit is on the left. Example, from the example shown in Table 1, the result of bits 5 and 6 (`10`) would be equal to one, and the result of bits 0 and 1 (`01`) would be equal to two.

The following sections give the status code bitmap and examples of status code interpretations for the instruments used in the C40 project. In addition, the bitmap tables show a validation flag for each status. The flag descriptions are as follows; **0** Valid. These statuses usually give information. **1** Can be valid, depending on other values. **2** Invalid.

2 Palas Fidas 100

Table 2 gives the bitmap interpretation of the Fidal 100 status code. An example status code for this device is `20810000`. In this example, the device is set to idle (bits 29-30), Operation mode is not auto (bit 23) and there is a sensor flow error (bit 16).

20								81								00								00							
0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
31 ← 24								23 ← 16								15 ← 8								7 ← 0							

Bit	Flag	Description
0-15	/	Not used
16	1	Sensor flow error
17	1	Particle coincidence
18	1	Suction pump error
19	1	Weather station error
20	1	IADS error
21	1	Calibration
22	1	LED temperature
23	2	Operating mode; 0: auto, 1: anything else
24-28	/	Not used
29-30	2	Mode of operation; 0: auto, 2: idle, 3: calibration
31	/	Not Used

Table 2: Bit map for the Palas Fidas 100 status code.

3 Naneos Partector

Table 3 gives the bitmap interpretation of the Partector status code. An example status code for this device is `00000004`. In this example, the relative humidity is >80 % (bit 2).

00	00	00	04
0 0 0 0 0 0 0 0	0 0 0 0 0 0 0 0	0 0 0 0 0 0 0 0	0 0 0 0 0 1 0 0
31 ← 24	23 ← 16	15 ← 8	7 ← 0

Bit	Flag	Description
0	2	Pulse low error: non-zero Charging current when high voltage is off (contamination in the charger)
1	2	Pulse high error: Setpoint diffusion current (normally 2.0 nA) is not reached when the charger is on (corona wire contaminated, or grid separating corona and aerosol flow contaminated)
2	2	High RH: the humidity sensor reports a value larger than 80 %
3	2	Electrometer offset high (> 5 or 10 mV depending on instrument version), may indicate contamination of electrometer insulators
4	1	Flow low. The flow is calculated from auxiliary signals, not measured directly. This may not be accurate as error message.
5	0	Buffer overflow: internal data processing too slow to handle data, may happen if writing to the SD-card is excessively slow (e.g. with a nearly full, large SD card)
6	0	Generic error (no specific condition), currently used for SD card missing
7	2	nstrument calibrating (only PCB rev 2.3 and greater)

Table 3: Bit map for the Partector status code.

4 LiCor Li-

Table 4 gives the bitmap interpretation of the LiCor LI-7200RS status code. An example status code for this device is `00001fff`. In this example, the LI-7200RS is used (Bit 12) and everything is OK.

00								00								1f								ff							
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1
31 ← 24								23 ← 16								15 ← 8								7 ← 0							

Bit	Flag	Description
0-3	1	Signal Strength. Value × 6.67 = Signal Strength.
4	/	Sync. Always set to 1 (OK)
5	1	PLL. Lock bit, indicates that optical wheel is rotating at the correct rate.
6	1	Detector temperature. 1 indicates OK
7	1	Chopper wheel temperature. 1 indicates OK
8	1	Differential pressure. 1 indicates OK
9	/	Aux input. 1 indicates OK
10	1	T inlet thermocouple. 1 indicates OK
11	1	T outlet thermocouple. 1 indicates OK
12	0	Sensor head type. 1 = LI-7200RS and LI-7200
13-31	/	Not used

Table 4: Bit map for the Serinus 40 status code.

5 Ecotech Serinus 40

Table 5 gives the bitmap interpretation of the Serinus 40 status code. An example status code for this device is `00024047`. In this example, the devices has a flow fault (bit 14) and is set to volumetric units (bit 17).

00								02								40								47							
0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	1	0	0	0	1	1	1
31 ← 24								23 ← 16								15 ← 8								7 ← 0							

Bit	Flag	Description
0-7	/	Not documented
8	2	Reference voltage failure
9	2	Cell temperature failure
10	2	Cooler failure
11	2	Converter failure
12	/	Correlation wheel failure
13	2	Lamp source failure
14	1	Flow fault
15	1	Any system error (the red instrument panel light is on)
16	2	Currently in warmup process
17	/	Volumemetric units (ppm); otherwise gravimetric units (mg/m3)
18	1	Performing a background
19	2	Currently in Span mode
20	2	Currently in Zero mode
21	2	Instrument Out of Service (or in Diagnostic mode, PTF compensation or control loop disabled, or Comms debugging enabled)
22	2	High Voltage failure
23	2	System power failure (not actually possible to report)
24-31	/	Not used

Table 5: Bit map for the Serinus 40 status code.

6 Magee

Table 6 gives the bitmap interpretation of the Magee AE33 status code. An example status code for this device is `00000004`. In this example, the devices has a flow fault (bit 2).

00								00								00								04							
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
31 ← 24								23 ← 16								15 ← 8								7 ← 0							

Bit	Flag	Description
0-1	/	Not used
2	1	Flow status
3-4	/	Not used
5	1	LED status
6	1	Chamber status
7-8	1 (3=2)	Filter status; 0: OK, 1 or 2: Few spots left, 3: No filter left
9-12	/	Not used
13	/	External device status
14	/	Auto clean air test status
15	0	CF card failure
16	0	Database size warning

Table 6: Bit map for the Magee AE33 status code. Bit 0 is the least significant bit

7 2BTechnologies

Table 7 gives the bitmap interpretation of the 2BTechnologies Model 211-G status code. An example status code for this device is `00080000`. In this example, the devices has a low scrubber temperature (bits 18-19).

00								08								00								00							
0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
31 ← 24								23 ← 16								15 ← 8								7 ← 0							

Bit	Flag	Description
18-19	2	Scrubber temperature alarm; 0: OK, 1: low, 2: high
28-29	1	Cell B flow; 0: OK, 1: low, 2: high
30-31	1	Cell A flow; 0: OK, 1: low, 2: high

Table 7: Bit map for the 2BTechnologies Model 211-G status code. Bit 0 is the least significant bit

8 Aerodyne

The status for this device does not require converting to binary. Status is a five digit number `abcde` and each digit is interpreted separately as described below.

(a) Pump and Filter Valve. In normal operation, only 1 and 3 will appear in the status code. Flag: 0

0 Pump Off, No Filter

1 Pump On, No Filter

2 Pump Off, Filter In

3 Pump On, Filter In

(b) Baseline Status. Flag: 2

0 Normal Operation - No Baseline

1 Baseline On - Flush Period

2 Baseline On - Measurement Period

(c) LED Status. Flag: 2

0 LED is On

1 LED is Off (Used only for PM_{SSA} Monitor)

(d) Monitor type. Flag: NA

0 NO_2 monitor

1 Gas phase absorption

2 Aerosol Extinction

3 Single Scattering Albedo Monitor

4 Multi-cell Monitor

(e) Wavelength. Flag: NA

0 Blue (450 nm)

1 Green (530 nm)

2 Red (630 nm)

3 Far Red (660 nm)

4 Near IR (760 nm)