Honeywell

Honeywell Process Solutions

Survey Instrument Point (SIP-CB)
Cellular/Battery

Application Note
Estimating Battery Life

November 2010

Revision B
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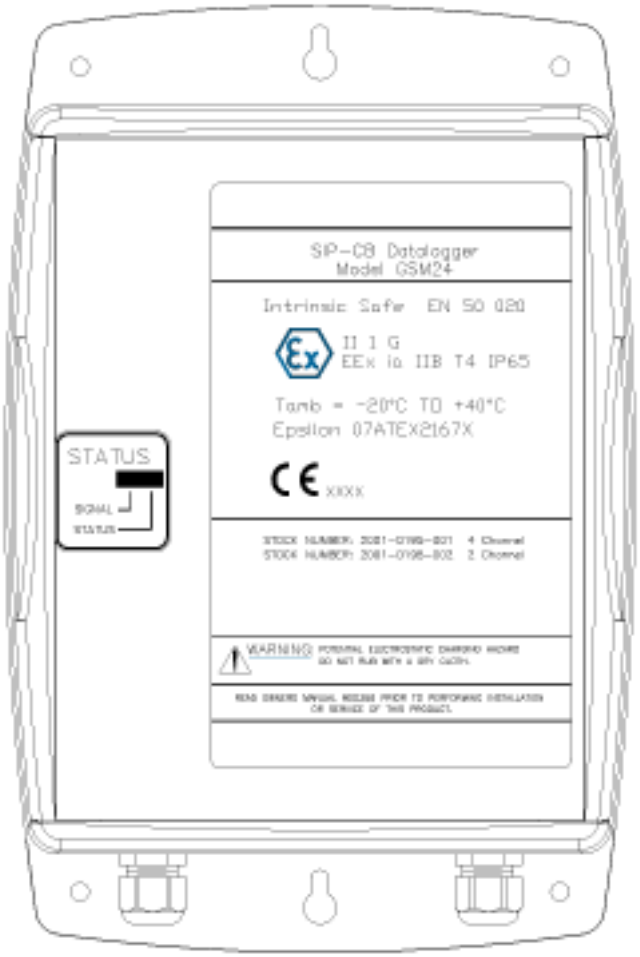
SIP-C8 Datalogger
Model GSM24
Intrinsic Safe EN 50 020
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INTRODUCTION

The SIP-CB is a battery-operated wireless data logger. This document will help estimate the useful life of the battery pack. See the User's Manual 900366 for a full description of the SIP-CB.

BATTERY TYPES

The SIP-CB is designed to be powered by a 3.6V lithium battery pack. The SIP-CB is rated for use in hazardous locations and carries an ATEX certification. With this rating only certain approved battery packs can be used. If the SIP-CB will not be used in a hazardous location then other power options are available, including the use of full-time power supplies or solar equipment.

BATTERY RATINGS

One of the most important battery ratings is the *amp-hour (A/hr) capacity*. This is the total amount of current that can be delivered over a period of time until the battery voltage reaches a particular "end-of-life" voltage level. For 1.5V alkaline or carbon batteries this is usually considered to be 0.9V. For a 3.6V lithium battery this is usually 3.0V.

The A/hr rating can be misleading. Most batteries are current-limited, whether intentionally or as an inherent property of the chemistry. For instance a battery rated for 10 A/hr does not necessarily mean that it can deliver 10 amps for 1 hour. If this particular battery can only deliver ½ amp maximum, it will be able to supply ½ amp for 20 hours, or ¼ amp for 40 hours, and so on.

Another important rating is *self-discharge*. This is the amount of current lost internally due to "leakage" current or chemical deterioration. This rating is usually stated in terms of a percentage per time period. For lithium batteries this is typically 1% per year. In other words, after 10 years a lithium battery can still deliver 90% of its original A/hr capacity. By comparison, a typical rechargeable NiCd battery can lose as much as 3% per day. This is why your old camcorder was never ready to use when you wanted to use it.

LOW BATTERY ALARM POINT

The SIP-CB will report a LOW BATTERY ALARM when the battery voltage reaches a particular level. This is usually set to 1.9V to 2.2V for the battery pack approved for use in hazardous locations. This battery pack is current-limited by a resistor within the battery assembly. When there is little or no load on the battery the terminal voltage should be nearly 3.6V for a new battery or 3.4V for one that has been in service for a while. However during a cellular call the load increases dramatically and the terminal voltage may drop as low as 2.5V for a new battery or 2.3V for one that has been in service for a while.

Also the terminal voltage will drop as the temperature gets colder, but will return to normal when it warms up again. Therefore an alarm trip point around 1.9V will give adequate warning without generating too many false alarms during colder weather.

WHAT AFFECTS BATTERY LIFE IN THE SIP-CB?

- The wireless (cellular) radio consumes the most current. On average the radio requires 350 mA (0.35A) during a call. A typical call lasts 1 minute. This represents about 0.006 A/hr of battery capacity per call.

- The SIP-CB consumes 150 µA (0.00015A) on a continuous basis. This directly translates to 0.00015 A/hr of battery capacity, or 1.3 A/hr per year.

- The SIP-CB can accommodate up to 8 Form-A or Form-B switch inputs for alarms and pulse counting. The "wetting current" is the amount of current drawn from the battery whenever a switch is in the closed position. For the SIP-CB this is 100 µA (0.0001A) *per input*. The SIP-CB can be configured to reduce this load by using a *pulsed sampling* method, which is discussed in detail in the User's Manual 900366 and in Application Note 600068.

- Extremely cold or hot temperatures can reduce the longevity of batteries due to chemical changes. But it is difficult to calculate. Therefore it is best not to wait until the very last A/hr to replace a battery. As a rule of thumb add 10% to your calculations if the unit is going to be subjected to less than 10ºF (-12ºC) or above 90ºF (32ºC) for months at a time.

A TYPICAL SCENARIO

The battery pack approved for use in hazardous locations has a capacity rating of 38 A/hr.

Let's assume the SIP-CB places two calls per day. It has four active pulse inputs that have a 50% duty cycle (the switches are on half the time and off half the time). The SIP-CB has been programmed for continuous wetting current (no pulsed sampling) on all four inputs.

1) Each 1-minute call consumes 0.006 A/hr. In one year this would consume about 4.4 A/hr from the battery (0.006 A/hr per call x two calls per day x 365 days). If a call is unsuccessful for any reason the SIP-CB will repeat the call at a later time. If we assume that 5% of all calls have to be repeated then we should increase the consumption to **4.6 A/hr** for the whole year.

2) The SIP-CB consumes 150 µA (0.00015 A/hr) on a continuous basis. In one year this amounts to **1.3 A/hr** per year (0.00015 A/hr x 24 hours per day x 365 days).

3) The four inputs will be drawing a total of 400 µA, but only for half of the time because they are closed for only half of the time. So in reality this is 200 µA, or (0.0002 A/hr) on a continuous basis. In one year this amounts to **1.8 A/hr** per year (0.0002 A/hr x 24 hours per day x 365 days).

4) The lithium battery loses 1% per year due to self-discharge or **0.38 A/hr**.

5) The total current consumed in 1 year is roughly **8 A/hr**, or approximately 20% of the total capacity of the battery. We could reasonably expect a 4.5-year service life from the standard battery pack, or at least 4 years if we consider the effects of extreme temperatures.

SUGGESTIONS FOR INCREASING BATTERY LIFE

- Minimize the number of calls per day.
- Calls may fail often if the SIP-CB is located in a marginal signal area or is experiencing interference from nearby equipment or metal objects. Every failed call will result is one or more repeated calls, each one consuming power. You may have to find a better location for the unit.
- Calls may fail often if many SIP-CBs are scheduled to call in at the same time. The computer system or the cellular network may not be able to handle the load and some of the SIP-CB's will have to repeat their calls. Try spreading the call schedule out, or increase the number of units allowed to call the computer system at the same time.
- For the alarm and pulse inputs try to use Form-A (normally-open) contacts when possible. Current is consumed only when the contacts are closed. In some applications the contacts may only be closed for a short period of time, say 25% of the time. But if you were to use a Form-B (normally-closed) switch, it would consume current 75% of the time.
- For the alarm and pulse inputs try to use the *pulsed-sampling* method if possible. This can lead to a significant reduction in current consumption. See the User's Manual 900366 and Application Note 600068 for more details.
- Whenever possible mount the SIP-CB in a temperature-controlled environment or shaded area.

Find Out More:
To learn more about Mercury Instruments products, contact your Honeywell Process Solutions representative, visit **www.mercuryinstruments.com** or call **513-272-1111**.

Automation and Control Solutions
Honeywell Process Solutions
3940 Virginia Ave.
Cincinnati, OH 45227
513-272-1111
www.honeywell.com

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