

# POWERS LITHIUM AMR

LITHIUM BATTERIES ALLOW FOR LONG SERVICE AND CALIBRATION INTERVALS IN AMR APPLICATIONS.

By Dr Thomas Dittrich

“For successful use of a battery, cooperation between supplier and customer must commence at the earliest possible point: at times it is simply more economical to design a circuit for the characteristics of the best suitable energy supply, rather than having to forgo its advantages because it is too late for changes”

Many AMR applications require standalone electric power where the current requirement – apart from a small background current – ranges from a few milliamperes for handheld reading equipment to an ampere or two in fixed GSM equipment. Lifetimes of 10 years and more without charging or replacement are common in this field.

Batteries are usually needed to power end point devices for gas, heat, electricity and water meters, using RF or GSM communication. Large quantities have been sold to customers like Datamatic, Hexagram, Neptune, Sensus and ATR Ramar.

Table 1: System related data of primary Sonnenschein Lithium batteries

Electrochemical system	LTC
Nominal voltage	3.6 Volts (optional 3.9 V, LSC)
Energy density	1280 Wh/dm <sup>3</sup>
Construction	Bobbin
Temperature range	-40...+85°C
Typical life expectation	10 years
Self-discharge	0.5 percent per year (storage)
Reliability	Hermetical sealing (glass-to-metal seal, laser welded can)
Safety	UL-recognised (user replaceable) non-flammable electrolyte
Environmental compatibility	No heavy metals

Table 2: Technical data of hybrid layer capacitors (HLC)

Size	Model	Nominal capacity	Pulse current capability	Equivalent series resistance (ESR)	Dimensions in mm
1/3 AA	HLC-1520	140 As	2 A	0.25Ω	ø15x20
AA	HLC-1550	560 As	5 A	0.1Ω	ø15x50

Table 3: Characteristics of the PulsesPlus battery

The PulsesPlus Design	Combines an LTC battery with a hybrid layer capacitor
Basic characteristics	LTC battery see table 1
Additional characteristics	Pulse current capability typically 2A/5A
	No passivation, no voltage delay
	More than 90 percent of nominal capacity available above 3V
	Standalone, maintenance free solution

**BATTERY REQUIREMENTS**

Requirements for the battery are determined by the circuit design (voltage level, current profile, etc.), by the environment (temperature profile, etc.) and other constraints (for example calibration intervals or maintenance intervals). Calibration intervals in Europe are usually five years. Often the battery can work for two or more calibration intervals. Water meters with AMR functionality installed in the US have up to 20 years of battery life, corresponding to the expected life of the water meter itself.

**LITHIUM BATTERIES**

Sonnenschein Lithium batteries are an ideal answer to the challenge. The lithium thionyl chloride (LTC) technology offers a high cell voltage of 3.6V, high energy density, low self-discharge and a wide range of temperatures (Table 1). The PulsesPlus series has recently been introduced to meet the combined requirements of high energy and high power with virtually no self-discharge, which are typical for GSM communication. The PulsesPlus battery is a combination of one or more primary lithium cells with one or more hybrid layer capacitors (HLC) (Table 2). The HLC allows for pulse current capability up to a few amperes, while also increasing the available capacity to more than 90 percent of the nominal capacity under these demanding conditions (Table 3).

# INNOVATION & Quality and Continuity

**PulsesPlus™**  
Lithium Batteries **The new 3.6 V battery for high pulse currents**

This new battery generation combines the proven bobbin type Lithium/ Thionyl Chloride technology with a novel hermetically sealed Hybrid Layer Capacitor (HLC). It is the unique solution for applications requiring low background currents combined with high current pulses and a long operation time.



**Sonnenschein Lithium batteries**

- Highest energy density
- Wide temperature range
- Wide product spectrum
- Customer specific solutions

**Sonnenschein Lithium GmbH stands for:**

- Quality**  
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Table 4: Water meter with integrated RF module, battery size 2/3 AA with capacitor support

Device	Water meter with RF module
Quiescent current	4 µA
Measurement	3mA, 1ms per s
Receiver active	3.5mA, 10 ms every 2s
Receives wake-up	3.5mA, 1.3s every hour
Transmission	60mA, 64ms every day
Consumption	115mAh per year
Temperature profile	10°C...50°C
Battery	SL-761
Nominal voltage	3.6V
Minimum voltage	3.0V
Space requirement	Ø 16 mm² 60mm with capacitor
Capacitor support	6800µF
Expected life	> 6.5 years

Table 5: Gas meter with GSM module, PulsesPlus battery

Device	Gas meter with GSM module
Quiescent current	20µA
Measurement	9mA, 10ms every 8s
Micro controller	15 mA, 1s per hour
SMS transmitter, GSM	2000 mA, 8s per day, duty cycle 1:7
Current consumption	513mAh per year
Minimum voltage	3.2V
Temperature profile	-10°C...+55 °C
Battery	<i>PulsesPlus</i> SL-770 + HLC-1550
Nominal voltage	3.6V
Nominal capacity	7.2 Ah
Pulse current capability	2A
Space requirement	27 x 41 x 53 mm²
Life expectancy	10 years

To select the right battery and predict its life, it is necessary to evaluate the influence of various parameters on the battery voltage and life

**DESIGN EXAMPLE: RF WATER METER**

A typical water meter with an integrated RF module has a quiescent current of 4µA. In a fixed data collection network, it goes into reception mode every two seconds during 10 hours each weekday, resulting in a current consumption of 3.5 mA for 0.01s. It receives a wake-up call from a nearby relay station once per hour and transmits data once per day. The transmission pulse is 60mA for 64ms. To select the right battery and predict its life it is necessary to evaluate the influence of various parameters on the battery voltage and life. In this case, a 6800µF capacitor is used to support the battery. It serves two functions: it keeps the voltage above three volts and it makes most of the nominal capacity available for the application. An SL-761 (size 2/3AA) battery has a life of more than 6.5 years in this application (Table 4).

**DESIGN EXAMPLE: GAS METER WITH GSM MODULE**

A typical GSM gas meter transmits data once per day by means of a short message (eight seconds). During transmission, the circuit draws 2A pulses from the battery at a duty cycle of 1:7 (577µs every 4.615ms). The average current during transmission is typically 250mA. In order to supply this current for >10 years at a minimum voltage of 3.2 volts, a PulsesPlus battery is necessary. For the design of the correct battery size and life, it is necessary to consider the influence of the application conditions on the battery parameters. In this case, a battery combining a C-size cell with an HLC-1550 is the correct choice (Table 5).

Sonnenschein Lithium offers free support during the design-in of the battery. A battery questionnaire can be downloaded from the internet. For successful use of a battery, cooperation between supplier and customer must commence at the earliest possible point: at times it is simply more economical to design a circuit for the characteristics of the best suitable energy supply, rather than having to forgo its advantages because it is too late for changes. ■

Dr Thomas Dittrich studied physics and physical chemistry at the University of Bonn. He joined Sonnenschein in 1980. As manager of Quality Assurance, he led Sonnenschein Lithium GmbH to ISO 9001 certification in 1993. Since 2002, he has been Manager of Applications Engineering.