Battery Specification

Document Number

TLS06F006-C Rev 2.7

Description

Rechargeable Lithium Ion 7S2P Battery Pack For PB540 / PB560 Ventilators

Customer

Covidien

Customer Part Number(s)

2982400

Accutronics Ltd Part Numbers for Batteries

46A051BE00004

Approval of Battery Specification by Customer:

Name……Position……..……Date……..

Statement of Confidentiality

Revision History

Revision	Issue Date	Revisions	Prepared By
2.7	28/05/2015	AN15-E048 Compatibility issue between Rev D batteries fitted with DS2431P+ RevB1 EEPROM plus a 2.2nf timing capacitor and older ventilator devices. EEPROM U1 changed from DS2431P+ to the automotive version DS2431P-A1+. 2.2nf capacitor removed. PCBA part number changed. Document table in section 4.1 updated to show latest document revisions: 2982400 Rev F (was Rev E) TLS06F006-C Rev 2.7 (was Rev 2.6) L6A051BE00004_DWG Rev K (was Rev J) L6A051BE00004_BOM Rev K (was Rev J) PCBA10003A01G Control Document v1.0 (was PCBA10003A01F Control Document v1.2)	PWI
2.6	06/02/15	AN15-E008 Terastat (GL0112) replaced with flexible epoxy IRS2125 (GL0202). Load testing introduced. Relevant documents updated. Document table in section 4.1 updated to show latest document revisions: 2982400 Rev E was Rev D TLS06F006-C Rev 2.6 was Rev 2.5 L6A051BE00004_DWG Rev J was Rev H L6A051BE00004_BOM Rev J was Rev H	DA
2.5	10/09/14	*Batteries now use PCB described in Revision 2.3.* AN14-E038 to update Accutronics documentation. Printed Circuit Board control document updated, to permit replacing the Vishay Si4427BDY MOSFET with their recommended Si4425DDY device. IEC62133 report amendment included.	PWI
2.4	02/04/14	*Batteries continue using PCB (lower version EEPROM) without 2.2nF capacitor fitted.* AN14-E019 to update Accutronics documentation. IEC62133 Report number added (new Section 5.8) IEC62133 information added to label (Section 4.6). Label barcode updated to include date of manufacture (as well as the serial number) Covidien drawing 2982400 Rev B (from A). New sections 0 and 5.10 added (Environmental requirements and Product Safety Datasheet) Section 2 (precautions) updated in line with common Accutronics TLS documents. Tables and Figures Indexes added.	PWI

2.3	01/10/13	(AN12-E149) Changes to documentation references and revisions due to addition of 2.2nF capacitor being added to the memory IC on the battery PCBA. *Note: This capacitor addition was authorised by Covidien but not made effective (because existing older PCB stocks remained). Batteries with Rev 2.3 on the label have not been manufactured.*	NRO
2.2	03/01/12	(AN11-E160) Various updates associated with referencing the revision of the Covidien drawing (2982400 Rev A) on the battery label instead of the revision of the Covidien battery specification (10025023 Rev F).	JME
2.1	07/10/11	(AN11-E123) Refs to 'Generation 2' removed. Refs to '540' changed to 'PB540 / PB560'. Revisions in documents in section 4.1 up-issued due to minor changes in those documents.	NRO
2.0	13/01/11	(AN10-E185) TLS06F006 Rev1.9 given a "C" suffix for G2 '540' battery and separated from other models. Change from Moltech to Accutronics Livery. MPS changed to ACC in EEPROM. Change of PCB to ESD compliant version with 5mS delay. Label format updated to match TLS06F006-A. Width dimensional tolerance amended.	

DEFINITIONS

Unless otherwise specified, the following acronyms will be used throughout this document.

C	Typical Nominal cell Capacity
CC	Constant Current
CV	Constant Voltage
EMC	Electro Magnetic Compliance
ESD	Electro Static Discharge
TBD	To Be Defined

REFERENCES

E-One Moli Energy ICR-18650J Cell Data Sheet

Covidien Specification 10025023 Rev F

Covidien Drawing 2982400 Rev F

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Introduction

1.1 Scope

This document contains an electrical and mechanical specification for a battery pack supplied by Accutronics Ltd. This specification is the interface document between Covidien and Accutronics. It is understood that Covidien have created their own internal specification, and that the Accutronics manufacturing operations create paperwork separate from this document for the purposes of producing the battery packs. However, this specification is the master document that controls the internal specifications from both Covidien and Accutronics. The battery pack produced will meet this specification.

1.2 Battery Pack Overview

This specification describes the physical, functional and electrical requirements for a Lithium Ion Rechargeable battery for Covidien PB540 / PB560 Ventilators.

The battery configurations are as follows:

- **'2982400'** consists of fourteen Lithium Ion rechargeable cells of 18650 size, assembled in a 7 series / 2 parallel (7S 2P) configuration. Each cell has an average voltage of 3.6V and a typical capacity of 2400mAh giving a battery pack of 25.2V and 4800mAh typical. Long aluminium case with black anodizing and blue plastic end-caps which are glued in place. An EEPROM is fitted to the PCB.

Protection is provided for over-charge, over-discharge, over-load and short circuit. For redundancy, passive safety devices have been integrated into the pack to protect against over current and over-temperature.

The battery cells and protection devices are housed within an extruded, anodised black aluminium case which has blue injection moulded end caps. One end cap holds the 4-way interface connector and battery protection module.

2 LITHIUM ION BATTERY GENERAL PRECAUTIONS

2.1 ⚠ DANGER!

1. Do not disassemble or modify the battery pack. The battery pack is equipped with built-in safety/protection features. Should these features be disabled, the battery pack can leak electrolyte, overheat, emit smoke, burst and/or ignite.

2. Do not connect the positive (+) and negative (-) terminals with a metal object such as wire. Do not transport or store the battery pack together with metal objects such as necklaces, hair pins, etc. Otherwise, short-circuiting will occur, over-current will flow, causing the battery pack to leak electrolyte, overheat, emit smoke, burst and/or ignite, or the metal object such as wire, necklace or hair pin can generate heat.

3. Do not discard the battery pack into fire or heat it. Otherwise, its insulation can melt down, its gas release vent or safety features will be damaged and/or its electrolyte can ignite, possibly leading to electrolyte leakage, overheating, smoke emission, bursting and/or ignition on it.

4. Do not use or leave the battery pack near a heat source such as a fire or a heater (+80ºC or higher). If the resin separator should be damaged owing to overheating, internal short-circuiting may occur to the battery pack, possibly leading to electrolyte leakage, smoke emission, bursting and/or ignition of the battery pack.

5. Do not immerse the battery pack in water or seawater and do not allow it to get wet. Otherwise, the protective features in it can be damaged, it can be charged with extremely high current and voltage, abnormal chemical reactions may occur in it, possibly leading to electrolyte leakage, smoke emission, bursting and/or ignition.

6. Do not recharge the battery pack near fire or in extremely hot weather. Otherwise, hot temperatures can trigger its built-in protective features, inhibiting recharging, or can damage the built-in protective features, causing it to be charged with an extremely high current and voltage and, as a result, abnormal chemical reactions can occur in it, possibly leading to electrolyte leakage, overheating, smoke emission, bursting and/or ignition.

7. To recharge the battery pack, use the battery charger specifically designed for the purpose and observe the recharging conditions specified by ACCUTRONICS. A recharging operation under non-conforming recharging conditions (higher temperature and larger voltage/current than specified, modified battery charger, etc.) can cause the battery pack to be overcharged, or charged with extremely high current, abnormal chemical reaction can occur in it, possibly leading to electrolyte leakage, overheating, smoke emission, bursting and/or ignition.

8. Do not pierce the battery pack with a nail or other sharp objects, strike it with a hammer, or step on it, otherwise, the battery pack will become damaged and deformed, internal short-circuiting can occur, possibly leading to electrolyte leakage, overheating, smoke emission, bursting and/or ignition.

9. Do not subject the battery pack to sudden mechanical shock. The impact might cause leakage, overheating, smoke emission, bursting and/or ignition. Also, if the protective feature in it becomes damaged, it could become charged with an extremely high current and voltage, abnormal chemical reactions can occur, which can lead to electrolyte leakage, overheating smoke emission, bursting and/or ignition.

10. Do not use an apparently damaged or deformed battery pack. Otherwise, electrolyte leakage, overheating, smoke emission, bursting and/or ignition of the battery pack may occur.

11. Do not directly solder the battery pack. Otherwise, heat can melt down its insulation, damage its gas release vent or safety features, possibly leading to electrolyte leakage, overheating, smoke emission, bursting and/or ignition.

12. Do not reverse the positive (+) and negative (-) terminals. Otherwise, during recharging, the battery pack will be reverse-charged, abnormal chemical reactions then may occur, or excessively high current can flow during discharging, leading to electrolyte leakage, overheating, smoke emission, bursting and/or ignition.

13. The positive (+) and negative (-) terminals are arranged in a particular orientation. Do not force the connection if you cannot easily connect the battery pack terminals to the battery pack charger or other equipment. Confirm that the terminals are correctly oriented. Reversing the terminals will result in reverse-charging, possibly leading to electrolyte leakage, overheating, smoke emission, bursting and/or ignition of the battery pack.

14. Do not connect the battery pack to an electrical outlet, vehicle cigarette lighter, etc. When subjected to large voltage, over-current can flow on the battery pack, possibly leading to electrolyte leakage, overheating, smoke emission, bursting and/or ignition.

15. Do not use the battery pack for a purpose other than those specified. Otherwise, its guaranteed performance will be lost and/or its service life will be shortened. Depending on the equipment in which the battery pack is used, excessively high current can flow through battery pack, possibly damaging it and leading to electrolyte leakage, overheating, smoke emission, bursting and/or ignition.

16. If the battery pack leaks and electrolyte gets into the eyes, do not rub them. Instead, rinse the eyes with clean running water and immediately seek medical attention. Otherwise, eye injury may result.

2.2 ⚠ WARNING

1. Do not use the battery pack in combination with primary battery packs (such as dry-cell battery packs) or battery packs of different capacities or brands. Otherwise, the battery pack can be over-discharged during use or overcharged during recharging, abnormal chemical reactions may occur, possibly leading to electrolyte leakage, overheating, smoke emission, bursting and/or ignition.

2. If recharging operation fails to complete even when a specified recharging time has elapsed, immediately stop further recharging. Otherwise, electrolyte leakage, overheating, smoke emission, bursting and/or ignition can occur.

3. Do not put the battery pack into a microwave oven or pressurised container. Rapid heating or disrupted sealing can lead to electrolyte leakage, overheating, smoke emission, bursting and/or ignition.

4. If electrolyte leaks from the battery pack or gives off a bad odour, remove it from any exposed flame. Otherwise, the leaking electrolyte may catch fire and the battery pack may emit smoke, burst or ignite.

5. If the battery pack gives off an odour, generates heat, becomes discoloured or deformed, or in any way appears abnormal during use, recharging or storage, immediately remove it from the equipment or battery pack charger and stop using it. Otherwise, the problematic battery pack can develop electrolyte leakage, overheating, smoke emission, bursting and/or ignition.

2.3 ⚠ CAUTION

1. Do not subject the battery pack to intense sunlight or hot temperatures, for example in a car during hot weather. Otherwise, electrolyte leakage, overheating and/or smoke emission can occur. Also, its guaranteed performance will be lost and/or its service life will be shortened.

2. The battery pack incorporates built-in safety devices. Do not use it in a location where static electricity (greater than the manufacturer's guarantee) may be present. Otherwise, the safety devices can be damaged, possibly leading to electrolyte leakage, overheating, smoke emission, bursting and/or ignition.

3. The guaranteed recharging temperature range is 10°C to +45ºC. A recharging operation outside this temperature range can lead to electrolyte leakage and/or overheating of the battery pack and may cause damage to it.

4. If electrolyte leaking from the battery pack comes into contact with your skin or clothing, immediately wash it away with running water. Otherwise, skin inflammation can occur.

5. Store the battery pack in a location where children cannot reach it. Also, make sure that a child does not take the battery pack out of the battery pack charger or equipment.

6. Before use, study carefully these Precautions. For further information contact the nearest ACCUTRONICS distributor or representative. Retain the original product literature for future reference.

7. For recharging procedures, refer to the Operation Manual of your battery pack charger.

8. If you find rust, a bad odour, overheating and/or other irregularities when using the battery pack for the first time, return it to your supplier or vendor.

2.4 ✅ Recommendations to the End Users

The following represents a typical, but not exhaustive list of good advice to be provided by the equipment manufacturer to the end-user.

- Do not dismantle, open or shred secondary cells or batteries.
- Do not expose cells or batteries to heat or fire. Avoid storage in direct sunlight.
- Do not short-circuit a cell or a battery. Do not store cells or batteries haphazardly in a box or drawer where they may short-circuit each other or be short-circuited by other metal objects.
- Do not remove a cell or battery from its original packaging until required for use.
- Do not subject cells or batteries to mechanical shock.
- In the event of a cell leaking, do not allow the liquid to come in contact with the skin or eyes. If contact has been made, wash the affected area with copious amounts of water and seek medical advice.
- Do not use any charger other than that specifically provided for use with the equipment.
- Observe the plus (+) and minus (–) marks on the cell, battery and equipment and ensure correct use.
- Do not use any cell or battery which is not designed for use with the equipment.
- Do not mix cells of different manufacture, capacity, size or type within a device.
- Keep cells and batteries out of the reach of children.
- Seek medical advice immediately if material or content from a cell or a battery has been swallowed.
- Always purchase the correct cell or battery for the equipment.
- Keep cells and batteries clean and dry.
- Wipe the cell or battery terminals with a clean dry cloth if they become dirty.
- Secondary cells and batteries need to be charged before use. Always use the correct charger and refer to the manufacturer's instructions or equipment manual for proper charging instructions.
- Do not leave a battery on prolonged charge when not in use.
- After extended periods of storage, it may be necessary to charge and discharge the cells or batteries several times to obtain maximum performance.
- Secondary cells and batteries give their best performance when they are operated at normal room temperature (20 °C ± 5 °C).
- Retain the original product literature for future reference.
- Batteries must be recycled or disposed of properly. Follow local regulations and ordinances for the disposal of the batteries. Recycle facilities may not be available in all areas.

3 ELECTRONICS SPECIFICATION

3.1 Cell Specification

Parameter	Value	Notes
Technology	Rechargeable Lithium Ion	
Manufacturer	E-One Moli Energy	http://www.molienergy.com
Manufacturer Model Number	ICR-18650J	IEC62133 certificate FR607332
Electrode Chemistry	Cobalt	
Nominal Voltage	3.6V	Based on a 0.48A discharge to 3.0V at +23°C
Nominal Capacity	2400mAh	Based on 4.2V 1.25A charge at +23°C, followed by 0.48A discharge to 3.0V at +23°C.
Typical Capacity	2370mAh	Based on 4.2V 1.25A charge at +23°C, followed by 0.48A discharge to 3.0V at +23°C.
Minimum Capacity	2300mAh	Based on 4.2V 1.25A charge at +23°C, followed by 0.48A discharge to 3.0V at +23°C.
Maximum Dimensions	18.4 x 65.2mm	Sleeved Cell
Nominal Weight	<48g	

Table 1 – Cell Specification

3.2 Battery Specification

Parameter	Value	Notes
Technology	Lithium Ion	
Configuration	7S2P	S=Series, P=Parallel
Average Discharge Voltage	25.2V	Based on 0.2C discharge to 21.0V at +23°C
Nominal Capacity	4800mAh	Based on 29.4V 1.5A charge at +23°C, followed by 0.2C discharge to 20.75V at +23°C for a new battery. Nominal Capacity is used for label rating
Minimum Capacity	4600mAh	Based on 29.4V 1.5A charge at +23°C, followed by 0.2C discharge to 20.75V at +23°C for a new battery
Charge Temperature Limit	0°C to +45°C	Humidity max 95% (non-condensing)
Maximum Charge Voltage	29.4V ±1%	Based on 4.20V per cell
Maximum Charge Current	1500mA	Charge current should not exceed 3A (limited by capability of connector)
Discharge Temperature Limit	0°C to +50°C	Humidity max 95% (non-condensing)
Maximum Continuous Discharge Current	3A	The battery will allow a start-up peak current of 20A for 1ms
End of Discharge Voltage	20.75V ± 0.25V	Voltage at which the application should disconnect from the battery
Minimum Battery Voltage	13.44V	Derived from the absolute minimum possible voltage that the battery could reach assuming the minimum tolerance of the protection circuit
Storage Temperature	-20°C to +60°C (with -40°C to +70°C allowed for transport)	See details in section 3.6
Humidity	max 95% (non-condensing)	
10K Thermistor:	Semitec 103-AT-2-1P (R25=10K±1%, B3435K±1%)	
Battery End Cap Colour	Blue RAL 5010	
IEC62133 Certification	Report Number 220590KAU-001-c Amendment #1 220590KAU-008-c	

Table 2 – Battery Specification

3.3 Connection Specification

The battery will be connected to the device using 4-way Bourns 70ADJ-4-FL connector, see Table 3 for details.

Terminal	Legend	Description
T1	+VBAT	Positive side of battery
T2	MEM	1-wire interface to battery memory
T3	CTN	10K Thermistor
T4	0V	Negative Side Of Battery

Table 3 - Connector Pin-out

The recommended interconnection mating connector for the host device is Bourns 70ADJ-4-M.

3.4 Charging

The battery should be charged using a dedicated constant voltage, current limited type charger. The current should be limited to the value in section 3.1 until the terminal voltages reaches 29.4V, at which time, the voltage should be held constant and the current allowed to taper down to 100mA, at which point the charge should be terminated.

3.5 Discharging

The battery shall be capable of continuous discharge at 3000mA across the entire discharge temperature range. The host device(s) should be designed for a controlled shutdown when the battery terminal voltage reaches 20.75V ±0.25V, prior to activation of the battery internal under voltage protection module.

3.6 Storage

The battery packs should ideally be stored in an environment with low humidity free from corrosive gas within a temperature range of -20°C to +35°C. Batteries continually stored between +35°C and +60°C risk a deterioration of battery performance, although this is still within the commercial storage tolerance set by the cell manufacturer (-20 to +60°C). Short term storage (for transport only) at temperatures between -40°C and +70°C is allowed in accordance with CHART 1.

CHART 1 - Thermal Conditioning

One cycle shown. Repeat for a total of two cycles.

Note: Time scale is not linear. Humidity uncontrolled up to Hour 31.

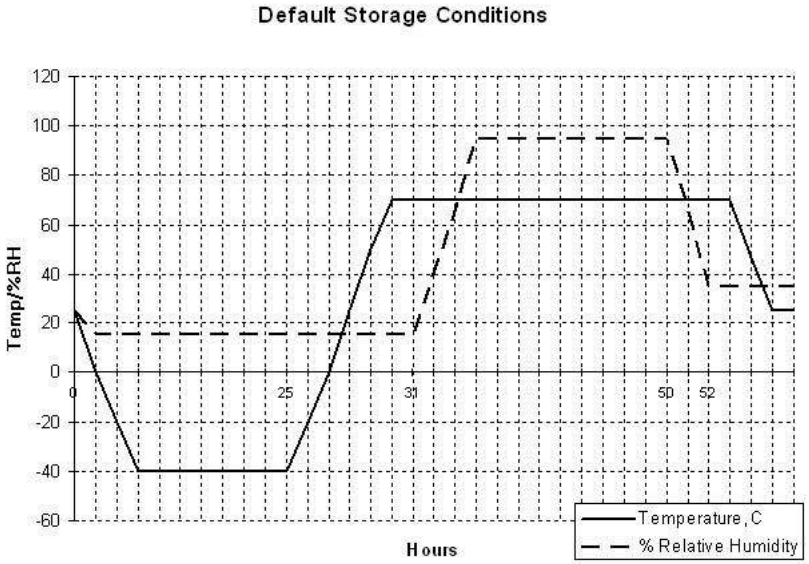

Figure 1 – Thermal Conditioning

Storage at +25°C or less will maximise shelf life. Batteries are shipped from Accutronics with ~40% capacity which will provide a minimum of 12 months storage at less than +25°C before the active cell protection will remove the cells from circuit to reduce discharge rate and prevent cell damage.

If the storage temperature exceeds +25°C over the storage period, then the shelf life will be reduced. Provision should be made for the audit of battery status every 6 months, with batteries exhibiting a capacity of <10% being recharged to 40% capacity.

3.7 Warranty

A high quality standard is maintained by Accutronics. All products are warranted against defects in design, workmanship, material and construction. The warranty period is 12 months from the date of shipment from Accutronics (indicated by the date code on the battery label).

3.8 Life Expectancy

Each battery is expected to deliver 80% or more of its initial capacity after 300 charge/discharge cycles where the charge and discharge phases are defined in section 3.2 (Nominal Capacity).

3.9 Protection Electronics

3.9.1 Overview of Operation

Electronic circuitry is permanently connected within the battery pack to prevent damage if either the charger or host device fails to function correctly. The circuitry also protects the battery if an illegal current source is placed across the battery terminals, or an illegal load is connected.

3.9.2 Over-Charge Protection

The protection circuit will prevent the battery from charging at a voltage of 4.35V ±50mV or more per cell. Then, once the battery voltage is lowered to 4.15V ±50mV or less per cell, it will allow charging again.

The overcharge delay time is 1s ±0.5s

3.9.3 Over-Discharge Protection

The protection circuit will prevent the battery from being further discharged once any cell voltage reaches 2.0V ±80mV or less per cell. Then, once the battery voltage is raised to 2.7V ±100mV or more per cell by charging, it will allow the battery to discharge again.

The over-discharge delay time is 100ms ±50ms

3.9.4 Over-Current Protection

The protection circuit will prohibit the discharge of the battery if a short-circuit is placed across the battery + / - terminals. When the battery is released from the short circuit mode, it will allow the battery to discharge again (automatically reset).

The trip levels and response times are shown in Table 4:

Protection Level	**Detection Delay Time**			**Trip Current**			**RC Time Constant**		
	Min	Typ	Max	Min	Typ	Max	Min	Typ	Max
Level 1	4.5mS	10mS	17mS	5.251S	6.061A	6.887A	4.99mS	5.60mS	6.22mS
Level 2	0.4mS	1mS	1.6mS	12.001A	15.152A	18.365A	4.99mS	5.60mS	6.22mS
Level 3	100uS	300uS	600uS	36.526A	68.182A	94.697A	N/A	N/A	N/A

Table 4 - Over-Current Trip Levels & Response Times

3.10 Passive Safety Protection

3.10.1 Overview of Operation

The battery pack is fitted with additional components to protect it against abusive charge and discharge conditions. These are in addition to the primary electronic protection.

3.10.2 Thermal Protection

Two thermal fuses are fitted in the battery pack:

1. A thermal fuse is fitted in series with the charge/discharge path to protect the battery from over temperature. This device goes open circuit if the cell case temperature reaches the fuse's temperature rating of +93°C (+0°C, -5°C). The fuse is non-re-settable rendering the battery pack non-functional.
2. A second thermal fuse is mounted in series with the charge/discharge path on the electronics protection circuit. This device goes open circuit if the MOSFET case temperature reaches the fuse's temperature rating of +128°C (+0°C, -5°C) with a holding temperature of 103°C. This thermal fuse is held in thermal contact with the four MOSFETS using a thermally conductive epoxy resin.

The thermal fuses are non-re-settable and render the battery pack non-functional.

3.10.3 Polyswitch

A polyswitch is fitted in series with the charge/discharge path to protect the battery from external short circuit.

This is a polymer device, which has a low resistance under normal operating conditions. In the event of an excessive current, the increase in heat causes the device to "Trip" to a high resistance state - reducing the current to a safe level. The device returns to the low resistance state once the short circuit is removed.

3.11 ESD Protection

The PCB includes suitable components to protect function against ESD events. The functionality has been tested and verified by Airox (Covidien) in accordance with IEC61000-402.

3.12 Memory

A DS2431 is fitted to the battery. Access to the DS2431 memory (Maxim/Dallas) is via a 1 wire interface connected to the MEM pin of connector.

ADDRESS	VALUE (UNIT)	COMMENTS	COMMENTS
0x00	0x41	Character A	AIROX identification coded by 5 characters
0x01	0x49	Character I	
0x02	0x52	Character R	
0x03	0x4F	Character O	
0x04	0x58	Character X	
0x05	0x41	Character A	Supplier's battery identification coded by 3 characters
0x06	0x43	Character C	
0x07	0x43	Character C	
0x08	MSB_CAPACITY **'2982400'** = 0x12	MSB CAPACITY=capacity/256 LSB_CAPACITY=capacity modulo 256	Nominal battery capacity in mAh
0x09	LSB_CAPACITY **'2982400'** = 0xC0		
0x0A	YEAR	Year of manufacture eg: for 2006 YEAR = 6=0x06	Unique identification of the battery by date of manufacture by 6 bytes. This date will be generated by an internal clock in the programmer. It will be loaded into battery automatically and not manually from this clock in order to guarantee the uniqueness of the battery ID.
0x0B	MONTH	Month of manufacture eg: for November: MONTH=11=0x0B	
0x0C	DAY	Day of manufacture eg: for 25th DAY=25=0x19	
0x0D	HOUR	Hour of manufacture eg: for 13hrs: Hour =13=0x0D	
0x0E	MINUTE	Minute of manufacture eg: for 56th: MINUTE=56=0x38	
0x0F	SECOND	Second of manufacture eg: for 45 seconds: SECOND=45=0x2D	
0x10	0x02	Cell Manufacturer/Type: 0x00 = LG 18650 A3 2.4Ah 0x01: Samsung ICR18650-24E.2.4Ah 0x02: Moli ICR-18650J 2.4Ah	0x02 is programmed
0x11 to 0x1F	0x00	Not used. Initialisation at 0 before protection	

Table 5 - EEPROM Memory Map

After verifying the values written in page N°0 of the DS2431 memory, it will be necessary to protect this last one by writing 0x55 to the address 0x80. Caution: the protection is not reversible

The other memory pages will not be protected thus the bytes contained in the addresses 0x81 to 0x87 inclusive will not be modified and different to 0x55 or 0xAA.

4 MECHANICAL SPECIFICATIONS

4.1 Hardware Revision

The following table lists the control documents for this battery. Note that the revision of the **Covidien Drawing** and the revision of the **Accutronics Battery Top level Specification** are shown on the battery label. See section 4.6 for details. Changes to the previous revision are highlighted below.

Covidien Drawing	Covidien Specification	Accutronics Battery Top Level Specification	Accutronics General Assembly Drawing	Accutronics Battery Main Assembly Drawing & BoM	Accutronics Battery Lead Assembly Drawing & BoM	Accutronics Battery Assembly Flowchart	Accutronics PCB Specification
2982400 Rev F	10025023 Rev F	TLS06F006-C Rev 2.7	46A051BE00004 _GA Rev E	46A051BE00004 _DWG Rev J 46A051BE00004 _BOM Rev J	L6A051BE00004 _DWG Rev K L6A051BE00004 _BOM Rev K	46A051BE00004 _FC Rev G	*PCBA10003A01G Control Document v1.0*
Previous revisions are not shown in this table. Refer to previous revisions of this document							

4.2 Weight

The weight of the battery (without packaging) shall be <1000g (Typical weight is 872g)

4.3 Packaging

Each individual battery is packed in a brown card carton. The brown carton is fitted with a paper label which is printed with *"**Rechargeable Lithium Ion Battery**", "Covidien**: 2982400", "Manufactured by Accutronics**", "**Date of manufacture:** which is **WWYY** where **WW** is **Week** and **YY** is **Year.***

4.4 Dimensions

Length	Width	Height
213.0mm +0/-1.0	34.5mm +0.5/-0.8	71.0 +0/-0.5

The flats of connector are recessed by 0.9mm ±0.3 with reference to the case front.

4.5 Mechanical Drawing

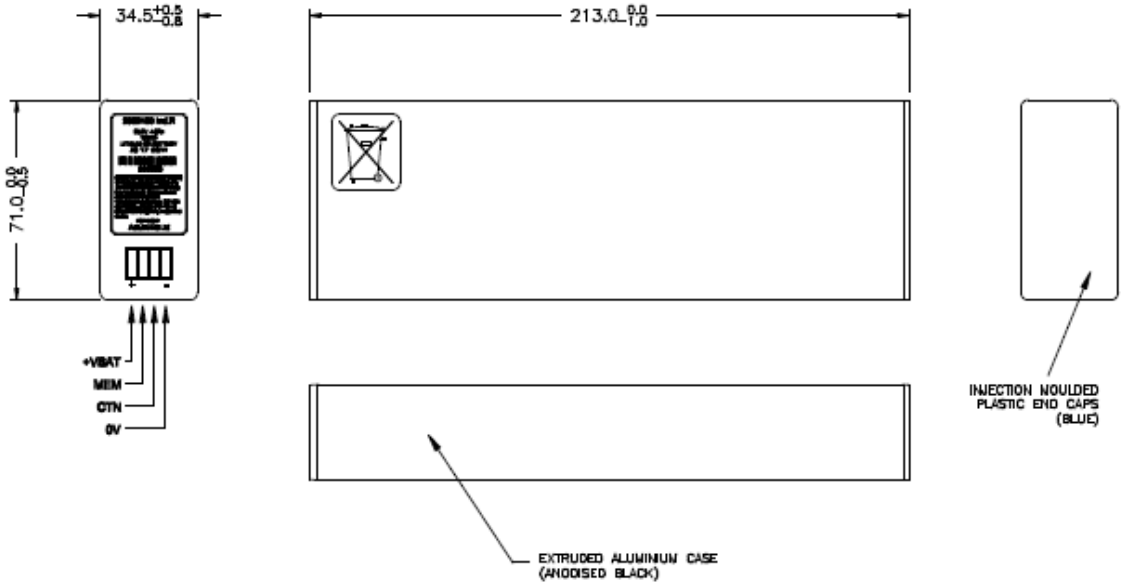

Figure 2 – Mechanical Drawing

4.6 Label Details

A label is fixed to the terminal end-cap. The label is made from silver metalized polyester and is printed with a thermal ribbon. The artwork follows the relevant template shown below:

Information	'2982400'
XXXXXXX	2982400
R	Revision of the Covidien Drawing (F)
Z.Z	Capacity in Ah (4.8)
EEE	Energy (Integer of 25.2V x Z.Z) (120)
T.T	Revision of the Accutronics Battery Top Level Specification (2.7)
WW	Week of manufacture (WW)
YY	Year of manufacture (YY)
Barcode	Consists of serial number (SSSSSS), Week (WW) and Year (YY)
SSSSSS	Unique 6 digit serial number (from 000001 to 999999)
The label includes information as required by IEC62133	

Figure 3 – Label details

A second label is attached to the side of the battery. This label displays the crossed out wheelie bin symbol required by Directive 2006/66/EC.

5 ENVIRONMENTAL/SAFETY SPECIFICATIONS

5.1 Transport Testing

The battery shall meet the requirements of testing specified in the third edition of the Recommendations on the Transport of Dangerous Goods, Manual of Tests and Criteria (ST/SG/AC.10.11/Rev. 4, Amend. 2).

Test	Test Reference	Description
Altitude	Section 38.3.4.1	Simulates air transport under low pressure conditions

Test	Test Reference	Description
Thermal	Section 38.3.4.2	Assesses cell and battery seal integrity and internal electrical connections. The test is conducted using rapid and extreme temperature changes.

Test	Test Reference	Description
Vibration	Section 38.3.4.3	Simulates vibration during transport

Test	Test Reference	Description
Shock	Section 38.3.4.4	Simulates possible impacts during transport

Test	Test Reference	Description
External Short Circuit	Section 38.3.4.5	Simulates an external short circuit

Test	Test Reference	Description
Impact	Section 38.3.4.6	Simulates an impact

Test	Test Reference	Description
Overcharge	Section 38.3.4.7	Evaluates the ability of the battery to withstand an overcharge condition

Test	Test Reference	Description
Forced Discharge	Section 38.3.4.8	Evaluates the ability to withstand a forced discharge

5.2 Drop

Test	Test Reference	Description	Pass Result
Drop	N/A	300mm onto concrete (3 faces)	Still functional and capable of being inserted

5.3 Sealing

Test	Test Reference	Description	Pass Result
Sealing	IP31	Protection from solids (3)	The object probe, 2.5mm, shall not penetrate at all
		Protection from liquids (1)	Vertically falling drops of water shall have no harmful effects

5.4 Shocks & Vibration

- Shocks: 100g, 6ms, 3 successive shocks per axis in both directions, ½ sine wave (IEC68.2.27)
- Sine vibrations: 1g, 10 cycles of sweeping per axis (thus 2h of endurance per axis) of 10Hz to 500Hz (IEC 68.2.6)
- Random vibrations: 0.02g²/Hz, of 20 to 500Hz, test duration of 9 minutes/axis (IEC 68.2.34)

5.5 Operating Pressure

- 600 to 100hPa

5.6 Components & Materials

- PCB – The PCB shall be recognized in accordance with ZPMV2
- Electrical wiring – The wiring shall be recognized in accordance with AVLV2 (UL1569)
- Connector – The internal battery to PCB connector shall be recognized in accordance with ECBT2
- Cells – The cells shall be recognized in accordance with comply with UL1642
- Components - Other electrical components shall comply with directive 2002/95/CE (RoHS)

5.7 Battery Directive

The battery meets the requirements of Directive 2006/66/EC of the European Parliament and of the Council of 6 of September 2006 on batteries and accumulators and waste batteries and accumulators and repealing Directive 91/157/EEC.

5.8 IEC62133:2002

The cells and battery meet the requirements of IEC62133:2002 (*Secondary cells and batteries containing alkaline or other non-acid electrolytes – Safety requirements for portable sealed secondary cells, and for batteries made from them, for use in portable applications*).

Report **220590KAU-001-c** / certificate **SE-75794** verifies the battery certification to this standard.

Amendment number 1 (**220590KAU-008-c / SE-75794M1**) identifies additions made to the Critical Component table.

5.9 EHS Regulations

5.9.1 Restriction of Hazardous Substances (RoHS)

The battery meets the requirements of the RoHS Recast (RoHS2) *Directive 2011/65/EU* and original RoHS *Directive 2002/95/EC.*

5.9.2 Waste Electrical and Electronic Equipment (WEEE)

The battery shall be compliant with the *Waste Electronic & Electrical Equipment Regulations 2006 (UK) and* meet the requirements of the Waste Electronic & Electrical Equipment Directive (*2002/96/EC*, Amendment *2003/108/EC* and Recast *2012/19/EU*).

The battery shall bear the cross-out wheelie bin symbol to indicate it must be disposed of as electrical waste.

5.9.3 Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH)

The battery is compliant with the *Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH) - EU directive 1907/2006*. No substances as per the European chemical Candidate List (at the time of this specification document) are present in the battery or used during its manufacture.

5.10 Product Safety Data-Sheet

A copy of the Product Safety Data Sheet (PSDS) for the battery shall be provided to the customer. Further copies shall be available on request from Accutronics.

END OF DOCUMENT