Battery Backup

RST 050

Installation & User Manual

Supporting applications for:

Telephony and Data

Ship Security Alert System SSAS

BEAM

Beam Communications Pty Ltd

Installation and User Manual
Backup Battery
RST050

Beam Communications Pty Ltd

8 Anzed Court, Mulgrave,
Victoria, 3170, AUSTRALIA

Product name: RST050
Manual revision: 05
Part Number USRMAN000405
Release date: Jan 2008

Contents

Safety Information

Note: Read the following information before installing and using the BEAM RST 050.

Your RST 050 is a low power electronic device.

When it is ON, it stores and supplies energy to the attached Beam equipment.

The design of your RST 050 system complies with international safety standards.

Warning: Do not open equipment. There are no user-serviceable parts inside. Return product to manufacturer for servicing.

If a DC power supply is to be used, its output must comply with the Safety Extra Low Voltage (SELV) requirements of IEC60950.

All connectors must only be connected to equipment ports which comply with the Safety Extra Low Voltage (SELV) requirements of IEC60950."

Ensure adequate ventilation. Do not use equipment in a gas-tight chamber.

Do not short circuit output.

About BEAM Communications

Beam Communications, is an authorised manufacturer of Iridium Satellite products.

Beam develops subscriber products that utilise the Iridium satellite network of Low Earth Orbit satellites, known as LEOs. The Iridium network is extensively used around the world by commercial enterprises and defence agencies.

Beam products address the needs of individuals, communities, government agencies and the corporate sector, providing voice and data access without the need for traditional wire-line or mobile phone infrastructure.

As the Iridium satellite network is global, Beam's products address global markets, across the spectrum of rural and remote users, including households, motor vehicles, telemetry, maritime and emergency services.

Beam Communications Pty Ltd

8 Anzed Court, Mulgrave,
Victoria, 3170, AUSTRALIA

Web:	**www.beamcommunications.com**
Info:	**info@beamcommunications.com**
Support:	**support@beamcommunications.com**
Tel:	**+61 3 8851 0400**
Fax:	**+61 3 9560 9055**

Welcome

Congratulations on purchasing a Beam Standby Battery RST 050!

This user manual contains all the information you need to use the Beam RST 050 and discover the advantages of Beam Communications and Iridium Network technology.

What is the RST 050?

The RST 050 is a complementary product to the Remote Satellite Terminal RST100 or RST200 that provides intelligent standby power for telephony, data, geo-location alert/monitoring, telemetry and advisory function for special applications.

The RST050 is used where the requirement is for full functionality to be provided by the Beam installation in the absence of normal power.

Figure 1 - The RST 050

The RST050 Backup Battery is a simple product to install using the same mounting procedure and accessories as other Beam products. DC power from an acceptable external AC or DC supply is connected to the RST050 and the supplied interconnection cable is used to connect the Backup battery to the attached terminal.

Getting Started

Connecting the RST050

The RST050 is easily connected to a compatible Beam Satellite Terminal. Follow the simple step by step directions below:

Step 1

Using the connector cable supplied with the RST050 connect the Battery terminal to the Beam Satellite terminal as shown in figure 1. The AC power supply from the main terminal will now be used to supply power to the Battery Backup

Figure 1

Step 2

Using the power supply that was supplied with the Beam Satellite terminal, connect this to the ‘Power Input” connector of the RST050 Battery Backup as shown in figure

Step 3

In order for the Battery Backup to charge the connector cable must be connected to at least the battery terminal. Therefore, it is not possible to charge the battery simply by having the mains power input terminal connected on its own.

The battery cells inside the RST050 are disconnected from the Battery status sensing circuitry when the 4 pin output cable is not plugged in. Therefore, when the cable is plugged in, the battery is then linked in circuit ready for use or charging.

Battery Status Indication

The RST050 Battery Back up has been designed with an intelligent charging system to ensure correct and efficient operation of the battery terminal. The following information is important to understand how the Battery Back up effectively operates and in what state the LEDS will appear.

Status LED

If the Battery Status LED is red (with AC power connected), this means that the battery is flat, and charging is required. The jumper cable MUST be plugged in to the RST050 for the battery to be charged. Once charged, and if the RST050 is going to be shelved (not connected to a system until required), it is recommended to un-plug the 4-pin cable, so that there is no idle current draining the battery.

Three indicator lights provide information about the operation of the RST050 Battery Backup unit:

LED	Off State	On State	Flashing State
Input Power	No Input Power	Power connected and charging available	N/A
Output Overload	Normal Operation	Output has been short circuited and /or battery unit has activated protection	N/A
Battery Status	Battery Disconnected	Green – Fully Charged and is charging in standby mode. Amber – Boost charging Red – Flat battery & charging	Green – Charged OK Red – Not charged; battery low

Power Information

The RST050 Battery Backup power requirements are detailed as follows:

Parameter	Specification
Supply Voltage Range	11 to 16v DC
Supply Voltage (Nominal)	12v DC
Supply Current (Maximum)	3A at 12v DC
Supply Current (Average)	0.3A at 12v DC

The RST050 is solar-cell compatible. The solar cell rating must meet or exceed the power requirements of the supplied plug pack, allowing the RST050 to provide the same operation during backup as provided by the plug pack installation. The use of self-regulating cells is recommended.

Battery Maintenance

The RST050 is designed to maximise the life of the batteries used whilst also maximising service availability to the user in the event of a normal supply interruption.

No special maintenance is required by the user apart from observing the environmental requirements for the unit.

Battery Charge Modes

The RST050 uses a 3-stage charge algorithm (voltages quoted are at 25Celsius, and are temperature compensated):

- Under initial charge, the RST050 provides a **constant current** (boost) charge until the battery voltage reaches 24.7Vdc.
- The RST050 will then provides **constant voltage** charging at this 24.7Vdc voltage, until either:
    - The current the batteries draw drops to C/100 (50mA for the 5Ah cells used) after which the charger switches to standby-charge-mode, or
    - A total charge time of 7.5 hours has lapsed, after which the charger switches to standby-charge-mode.

In standby-charge-mode the charge voltage drops to approximately 22Vdc and the batteries are left in this charge mode, continually topping up charge.

Battery Charging - RST050 / RSTx00 Interconnect cable

The RST050 / RSTx00 interconnect cable includes a battery connection link inside the connector at the RST050 end. The purpose of this connection link is to minimize the effects of battery self-discharge when the RST050 is being stored for any length of time. The battery cells inside the RST050 are isolated from all loads including the battery status sensing circuitry when the RST050 / RSTx00 interconnect cable is unplugged from the RST050.

Charging can only occur when the RST050 / RSTx00 interconnect cable is plugged into the RST050. Once charged, and if the RST050 is going to be shelved (not connected to a system until required), it is recommended to un-plug the RST050 / RSTx00 (4-pin) interconnect cable.

Having a green battery status LED when this cable is un-plugged, DOES NOT indicate the current charge level of the battery. The RST050 / RSTx00 interconnect cable must be plugged in to give current battery status.

The picture shows the RST050 / RSTx00 interconnect cable plugged in to the RST050, which allows the battery to be charged.

NOTE: If storing the RST050 on shelf for very long periods, it is recommended to re-charge the battery every 2 months.

Customisation

Design Information for Customized Power Systems

The information in this section is intended for special purpose applications such as the design of solar powered supplies in remote applications.

Power Requirements

The RST100 for example draws 140mA in standby and 440mA in-call at 20Vdc input. In terms of power consumption this is 2.8W and 8.8W respectively and an average power requirement of:

(2.8W x 22 / 24 = 2.57W) + (8.8W x 2 / 24 = 0.733W) = 3.3W.

Over the operating voltage range of the batteries, the RST100 input approximates a constant power load.

Battery Sizing

The batteries used in the RST050 are sized to reach their end-point voltage at the end of a 22+2 discharge cycle for the RSR100, starting from a fully charged state. That is, it is considered that the batteries are discharged after delivering:

3.3W x 24h = 79.2Wh.

Charging Efficiency

Under a 0.2C constant-current only charging scheme, the batteries used in the RST050 would recover 80% of their lost capacity in 4 hours and 90% in 5 hours. As the batteries reach 90% charge however, the rate at which they take up energy decreases. To make up the final 10% of charge may take as long as 12 hours from start of charge.

The use of the three-stage charging scheme employed by the RST050 means that the batteries return close to 100% of charge within 8 hours for a 22+2 discharge *whilst supplying a 22+2 load*. Thus the effective average battery charge take-up efficiency is:

(79.2Wh / 8h = 10W) / 30W = 33%.

Operational Time for Defined Charge Periods

The backup operational time of the RST050 assuming 22+2 duty cycles may be calculated for a range of charge times given the charge take-up efficiency and the load power. It is assumed that the supply to the RST050 is capable of supplying 30W during the whole charge period. The results tabulated below indicate the sustainable operational time allowed. That is, the time the RST100 may be operated for no overall energy loss by the RST050.

This information is of use where the RST050 is installed as a UPS for the RST100, and the backup time is to be estimated at times subsequent to a power outage.

Charge Period (hours)	Total Energy Supplied to RST050 (Wh)	Energy Returned to Batteries (Wh)	Backup Time (hours)	Total Operational Time (hours)
1	30	10	3.03	4.03
2	60	20	6.06	8.06
3	90	30	9.09	12.09
4	120	40	12.12	16.12
5	150	50	15.15	20.15
6	180	60	18.18	24.18
7	210	70	21.21	28.21
8	240	80	24.24	32.24

The Total Operational Time is the sum of the Backup Time and the Charge Period.

Cumulative Discharge

The following is applicable to installations where the RST050 is only charged for a portion of every day such as would be available with solar power.

Should the RST050 be operated in such a manner that the energy withdrawn from the batteries exceeds the energy required to replace the lost charge, the batteries will continue to discharge over several cycles. Whilst this may seem obvious, it may not be apparent to the operator and or installer until some time after commissioning.

The batteries do not supply energy to the load while the power source to the RST050 is present .

The following table shows the remaining operating hours at the end of each day for the RST050 under conditions of permanent 22+2 RST100 load for different charge periods. It is assumed that the RST050 starts the first day with 100% charge and that charging takes place around the middle of the day.

		Elapsed Days				
		1	**2**	**3**	**4**	**5**
Charge Period (Hours)	**1**	4.5	-	-	-	-
	2	8	-	-	-	-
	3	12	(0)	-	-	-
	4	16	(8.5)	-	-	-
	5	20	16.5	(12.5)	(8.5)	-
	6	24	24	24	24	24

In the above table:

- Bracketed quantities indicate that the battery was over-discharged,
- The minus sign indicates operation that has insufficient charge to return to zero net energy loss at the start of the day.

The above table shows that at *least* 6 hours of charging is required *each* and *every* day to meet 22+2 load requirements for the RST100. Longer operational time, at the expense of standby time will require an increase in charge time.

Excessive Discharge and Undercharge

Caution: Discharging the batteries below the end-point voltage levels or leaving the batteries connected to a load in a discharged state may impair the ability of the batteries to accept a charge.

Batteries undercharged in cyclic applications will fail, often in less than 30 cycles.

Over Discharge Safety Cut-out

When input power is absent, the RST050 employs an automatic safety cut-off from the battery load if the battery voltage falls below 18 volts. If the safety cut-off is activated, the load effectively becomes disconnected from the battery.

The automatic cut-off is only released if:

1. The input power is re-applied or,
2. If the 4-pin connector is removed and then re-applied after 10 seconds.

Using the RST050 with other BEAM products

The RST050 may be used with other BEAM products such as the RST200 and RST600. Both of these products have lower power requirements than the RST100 and a proportional increase in backup time can be obtained.

The table below shows the power consumed by different Beam equipment. In normal applications, the RST050 will supply power on a 22+2 basis i.e. 22 hours of standby and 2 hours of talk time for the RST100 and 42+4 for the RST200.

Power Requirements Matrix							
RST200		**Receive Mode**		**Transmit Mode**		**22+2 Average**	**UPS Backup**
		Current (A)	**Power (W)**	**Current (A)**	**Power (W)**	**Power (W)**	**Time (h)**
	Data Call	0.075	1.5	0.205	4.1	1.7	46.5
	DSC Handset	0.15	3.0	0.325	6.5	3.3	24

RST600		**Receive Mode**		**Transmit Mode**		**22+2 Average**	**UPS Backup**
		Current (A)	**Power (W)**	**Current (A)**	**Power (W)**	**Power (W)**	**Time (h)**
	Data Call	0.05	1.0	0.12	2.4	1.1	72

All measurements taken at 20Vdc with Precision Current Shunt, RMS time-averaged. Results are typical values, some variation will be encountered.

Solar Cell Sizing

The following exercise provides sample calculations for a typical installation where power is provided only by a solar cell.

These calculations assume:

- Nominal location Rockhampton, Queensland, Australia
- Solar cell conversion efficiency 15%
- 22+2 operation (see above tables)

Using the approximate location of Rockhampton, of Latitude -24 / Longitude 150 yielded a worse case Insolation (kWh/m2/day) of 3.3 in May using the 10 Year Average Minimum.

With a conversion efficiency of 15% this is approximately 500Wh/m^2/day.

Total requirement is 180Wh/day.

Dividing the energy requirement by the available energy gives

180Wh/day / 500Wh/m^2/day = 0.36m^2.

(Note that this energy is only available for around 6 hours a day worst case (May)).

It is advisable to factor in a 50% margin for extra-ordinary weather conditions and cell ageing. This yields a solar cell with an area of 0.54 square metres.

Safety Issues

Introduction

There are two main considerations relative to the application of the RST050 Battery Backup that should be recognized to ensure that the usage is safe and proper. These are gassing and shorting and are discussed in detail in the following sections.

Gassing

All Lead-acid batteries produce Hydrogen and Oxygen gases internally during charging. The gases released or diffused must not be allowed to accumulate. An explosion could occur if a spark or flame were to be introduced.
During normal charging operation, some hydrogen gas is released (vented) or diffused through the RST050 battery cells container walls. The pure Lead–Tin grid construction as well as the extremely high purity of Lead Oxides and Sulfuric acid used in the manufacture of the RST050 battery cells all serve to minimize the amount of Hydrogen gas produced.

The minute quantities of gases that are released or diffused from the RST050 under charge conditions will normally dissipate rapidly into the atmosphere.
Hydrogen gas is difficult to contain in anything but a metal or glass enclosure. It can permeate a plastic container at a relatively rapid rate.

Because of the characteristics of gases and the relative difficulty in containing them, most applications will allow for their release into the atmosphere. If the RST050 is required to be installed in a gas-tight container, precautions must be taken so that the gases produced during charge can be released into the atmosphere. If Hydrogen is allowed to accumulate and mix with the atmosphere at a concentration ranging from 4% to 96% by volume, an explosive mixture is formed that would be ignited in the presence of a flame or spark.

Another consideration is the potential failure of the charger. Although the RST050 has inbuilt current limited charging, if the charger malfunctions, causing higher-than-recommended charge rates, substantial volumes of Hydrogen and Oxygen will be vented from the RST050 battery cells. This mixture is explosive and should not be allowed to accumulate. Therefore, the RST050 should *never* be installed in a gas-tight container.

Shorting

The RST050 incorporates an output current limit circuit to limit current to a safe limit under output short-circuit conditions. The battery cells used in the RST050 however, have very low internal impedance and thus are capable of delivering high currents if externally short circuited should the current limit mechanism fail. The resultant heat can cause severe burns and is a potential fire hazard. Particular caution should be used when the person working near the open connector terminals of the RST050, such as during installation, is wearing metal rings or watchbands.

Inadvertently placing these metal articles across the connector terminals could result in severe skin burns. It is a good practice to remove all metallic items such as watches, bracelets and personal jewelry when working on or around the RST050 output connections.
As a further precaution, when installing the RST050, insulating gloves should be worn and only insulated tools should be used to prevent accidental short circuits.

Mounting the RST050

The RST050 comes with two (2) standard right angle mounting brackets that allow indoor and outdoor mounting for mobile and fixed positioning.

Note: To ensure sturdy mount attachment:

1. Clean the mount surface of the RST050.
2. Use the correct type of screws.
3. Mount the RST050 on a clean, even surface.
4. If mounting the RST050 on brick or poured concrete surface, let the cement completely dry before you mount the RST050.
5. The RST050 is heavy. If mounting on a wooden surface, make sure the wood is structurally sound.
6. Leave enough room around the RST050 to allow unhindered access to the rear panel.
7. Do not install the unit in a permanently concealed recess. You must be able to access and remove the unit should future service be required.

Mounting methods

The mounting brackets allow two mounting methods: drop-in (inside corner) mount and flush (outside corner) mount.

Flush Mount

Drop-in Mount

Figure 2 - Mounting methods

To install the RST050 unit:

1. Attach the two (2) mounting brackets securely to a suitable structure making sure the space between the brackets is wide enough to smoothly slot in the RST050.

2. Secure the RST050 unit to the mounting brackets using supplied screws.

3. Carefully slot the RST050 between the two mounting brackets and secure with the retaining screws.

Specification Data

Key Features			
Backup for Remote Satellite Terminal RST100 family.		Up to 22 hours Standby, 2 hours Talk (RST100)	
Easily mountable		High Performance Power system	
Various Installation Applications		Full Diagnostic LEDs	
Solar Cell Operation			
Function	**Description**	**Type**	**Location**
Input Power		11 – 16Vdc 2.5A	Rear Panel
Visual Indicators	Input Power	LED	Front Panel
	Output Overload	LED	Front Panel
	Battery State	LED	Front Panel
Connectors	Power Input	Ring-type (2-pin)	Rear Panel
	Power Output	Ring-type (4-pin)	Rear Panel
Backup Time	RST100	22 Hours Standby	2 Hours Call (talk)
	RST200	42 Hours Standby	4 Hours Call (data)
	RST600	66 Hours Standby	6 Hours Call (data)
Protection	Over-current / Short Circuit Protection	> 1A for > 0.3 second, then resumes after 10 seconds.	
	Over-discharge cell cut-out	Disconnects load when battery < 18v	

Physical	
Size	225x271x45mm
Weight	5 Kg
Operating Temperature	0C to +55C
Storage Temperature	-30C to +70C
Operating Humidity	85% non-condensing

Beam Warranty Conditions

Beam Communications gives this express warranty (along with extended warranty endorsements, where applicable) in lieu of all other warranties, express or implied, including (without limitation), warranties of merchantability and fitness for a particular purpose. This constitutes our sole warranty and obligation with regard to our products as well as the Customer's sole remedy.

Beam Communications expressly disclaims all liability and responsibility for any special, indirect or consequential damages or any further loss of any kind whatsoever resulting from the use of our product(s). The Customer's sole and exclusive remedy and the limit of Beam's liability for any loss whatsoever, shall not exceed the purchase price paid by the Customer for the product to which a claim is made.

All products manufactured by Beam Communications are warranted to be free from defects in material and workmanship in accordance with and subject to the following terms and conditions:

1. This warranty is limited to the original Customer only. It cannot be transferred or assigned to third parties unless the intent to transfer to a third party is expressly indicated in a purchase order and/or warranty-processing arrangements have been agreed upon in writing by Beam.
2. Beam Communications does not warrant any installation, maintenance or service of the Products not performed by Beam, nor does it warrant the use of Products with unapproved ancillary products.
3. Beam Communications will correct any defects in material or workmanship of products manufactured by Beam which appear within (12) months, from the date of shipment by Beam Communications to the Customer. Beam Communications will repair or replace, at our option, any defective product, provided that our analysis and/or inspection discloses that such defects developed under normal and proper use.
4. This warranty does not extend to goods subjected to liquid or particulate ingress, extreme humidity, misuse, neglect, accident or improper installation, or to maintenance or repair of products that have been altered or repaired by anyone except Beam Communications unless otherwise stated in writing.
5. The warranty is a return-to-base warranty and freight is paid by the sender.
6. A charge of USD150 including return freight will be made for testing returned product which is not defective or is found to be defective as the result of improper use, maintenance or neglect.
7. Beam Communications will not accept responsibility for any invoiced goods or services that are not covered by a Beam Communications written purchase order. Under no circumstances does Beam Communications agree to pay for labour or other related expenses associated with the troubleshooting and/or repair of our product without prior specific written authorization.
8. Information in our descriptive literature is based on product specifications that are current at the time of publication. Product specifications, designs and descriptive literature are subject to change as improvements are introduced. Although we announce changes as they occur, we cannot guarantee notification to every Customer. Beam Communications warrants delivered product to conform to the most current specifications, designs and descriptive literature.
9. This warranty policy may be expanded or limited, for particular categories of products or Customers, by information sheets published as deemed appropriate by Beam Communications. In particular, the warranty for third party Products is that of the third party and not Beams warranty.