



Technology
Solutions (UK) Ltd

APPLICATION NOTE: **USB TETHERED MODE** **OPERATION**

OVERVIEW

Technology Solutions UHF RFID readers are primarily designed to be connected wirelessly using *Bluetooth*[®]. A Micro USB port is provided for charging and this can also be used instead of the wireless connection for data transfer. If the reader is left permanently attached to the host computer over USB then this is referred to as 'tethered mode.' Care needs to be taken in tethered mode to ensure that the reader battery stays charged otherwise the reader will eventually stop operating and the USB cable will have to be unplugged and plugged back in again.

BATTERY CHARGING

The current available through the USB port is limited and is not enough to support continuous reader operation. If the RFID reader is actively reading tags at the same time as the battery is being charged then effectively the current is shared between the RFID reader and the battery meaning that the battery is charged more slowly.

The battery charger built in to the RFID readers has several features to ensure safe operation. One of these is a safety timer which stops charging after 6-10 hours. Normally a battery will be charged in a much shorter time (typically 2.5 – 3 hours). The charge time limit is intended to protect a faulty battery which never fully charges. Once the timer reaches the maximum permitted time charge is stopped. The timer is automatically reset if the battery reaches full charge and is then discharged, or if the reader is disconnected and reconnected to the host.

A second safety feature prevents the battery from being charged if its internal temperature is above 40°C. This will happen if the RFID reader is at an ambient temperature above 40°C. The over-temperature safety protection will also be activated if the heat generated by the RFID reader raises the battery pack high enough above ambient. In either case battery charging will start again once the battery pack cools down.

IMPLICATIONS OF BATTERY CHARGE TIMEOUT

If the RFID reader is used in tethered mode then the battery will be charged from the host. In most reader operating conditions the battery will reach full charge as normal long before the safety timer reaches its maximum time and stops charge. The reader will continue to draw power from the battery which will then start to discharge. This resets the safety timer and allows the charger to once again fully charge the battery. In this situation the reader can continue to operate and the battery is kept fully charged by the host.

The battery charge timeout protection can cause problems in tethered mode in two ways:

Firstly, if on average the RFID reader is drawing more current than the host can supply then there will be no current available to charge the battery. The battery will discharge and when it is fully discharged the RFID reader will stop operating. The charge timeout protection will activate at some point because the battery has never reached full charge and so even though the RFID reader will have stopped reading the battery will not be recharged.

Secondly, if a fully discharged battery is fitted and the average RFID reader current is high enough that the battery charges very slowly then it may not reach full charge before the safety timer reaches its maximum time. The charge will stop and the battery will then fully discharge and not start charging again.

IMPLICATIONS OF BATTERY OVER-TEMPERATURE PROTECTION

The battery over-temperature protection will prevent the battery from charging if ambient temperature is too high. In tethered mode this means the battery will not charge and will eventually become fully discharged and stop operating.

If the RFID reader is operated for long periods at ambient temperatures below 40°C then the heat it generates may be enough to raise the battery pack above 40°C and cause charging to stop until the battery pack cools down again. This delays the charge completion and therefore may eventually slow the charge down enough that the battery charge timeout occurs before the battery is fully charged. The charge will stop and the battery will then fully discharge and not start charging again.

ENSURING CORRECT OPERATION IN TETHERED MODE

There will be no problems in tethered mode if the RFID reader is idle or performs infrequent inventory operations. Generally if the RFID reader performs inventories for around a third of the time then there will be no problems. Good practise for reliable long term tethered mode operation includes:

- Only trigger inventories when they are required. Avoid polling the reader continuously for long periods or using the `.ps` command to give continuous operation.
- If continuous operation is required then use the longest poll interval practical. If necessary use adaptive poll rates so that the host application polls slowly, only increasing the poll rate when new tags are being found.
- If the `.ps` command is used to emulate long or continuous switch presses then use the `.sa` command to set as long as practical switch repeat delay.
- Avoid using the reader at high ambient temperatures.
- Carry out testing before deploying an application using tethered readers. A good approach is to put an almost discharged battery into a reader. Operate the reader as it will be used in the end application. Check that the battery charge level (`.bl` command) shows that the charge level is increasing and that the battery fully charges in less than six hours.

ABOUT TSL

ABOUT

TSL designs and manufactures both standard and custom embedded, snap on and standalone peripherals for handheld computer terminals. Embedded technologies include:

- RFID - Low Frequency, High Frequency & UHF
- *Bluetooth*[®] wireless technology
- Contact Smartcard
- Fingerprint Biometrics
- 1D and 2D Barcode Scanning
- Magnetic Card Readers
- OCR-B and ePassport

Utilizing class leading Industrial design, TSL develops products from concept through to high volume manufacture for Blue Chip companies around the world. Using the above technologies TSL develops innovative products in a timely and cost effective manner for a broad range of handheld devices.

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