



*fεx*21

Battery Reference Manual
for 129Mhz fεx21 with Li-Ion battery

Issue B
03 Sept 2001

1. Introduction

This document provides battery management, charging and usage information related to fex21 129MHz units with **Lithium Ion** (Li-Ion) battery. For fex21 setup and general information, please reference the fex21 Getting Starting guide. For additional fex21 Lithium Ion related information, please read the fex21 Getting Started Guide (or the Li-Ion Battery Addendum leaflet) as follows. If you do not have these documents, please contact your system provider.

Part Number	Description
DMA7200-080-02a	fex21 Getting Started guide
Or refer to the previous issue guide, plus the Li-Ion addendum:	
DMA7000-080-05	fex21 Getting Started guide
DMA7200-322-01	Li-Ion Battery Addendum

2. Initial fex21 Battery Charge

Note: Use only Itronix Li-Ion battery packs with your fex21 129MHz.

2.1 Li-Ion Battery

After installing the battery pack in a new fex21 for the first time, the battery should be charged to 100% before using it. This ensures that the battery pack power calculations (“gas gauge”) will be correct.

2.2 Backup Battery

The internal fex21 backup battery is charged from the main battery or when external power is applied. It requires 48 hours to fully charge. It's purpose is to back up RAM during battery pack swap-out. You should not rely on the backup battery to maintain your data, but should keep the main battery pack charged.

The backup battery can retain data for up to 48 hours if the main battery pack is removed or discharges fully. The backup battery is topped up from the main battery pack or external power (e.g. the AC adapter) whenever the fex21 is ON (not suspended).

If the backup battery is fully discharged, such as when the unit is new, it may take up to 48 hours to recharge fully when the fex21 is ON (not suspended) and is connected to a battery pack or to external power. In extremes of heat or cold, it may take longer. To ensure a fully charged standby battery we recommend initially connecting the fex21 to an AC Adapter for 48 hours, or alternatively ensure that several overnight charging sessions are carried out.

3. Battery Management

Whenever you are working near an available charging source, use it to conserve the battery pack. The charging source will keep the battery pack topped up and also supply a maintenance charge to the backup battery. You should fully charge your battery pack

after each working day. Proper charging practice will also keep the backup battery in good condition. Remember that the unit must be on to allow charging. If your application allows, suspend the fex21 when not in use to further conserve battery power. It is recommended that you configure the fex21 to automatically suspend after the designated time to conserve battery power.

3.1 Charging Li-Ion Packs

Lithium Ion batteries maintain capacity better if they are regularly recharged. Charge the fex21 whenever possible during use throughout the workday. At the end of the work shift, fully recharge the battery so the power calculation or “gas gauge” is accurately re-calibrated. Note that frequent incomplete charges will lead to progressively larger errors in the calculations, which only a full charge will remedy.

There are two ways the fex21 Li-Ion battery pack can be recharged:

- With the pack installed in the fex21 and using an appropriate charging method (i.e. fex21 AC Adapter or vehicle power cable, or via an fex21 Desk Mount or Vehicle Mount)
- Externally with the off-line battery pack charger.

See the Offline Battery Charger document for additional information related to externally charging fex21 battery packs.

Note: Before carrying out a battery pack swap out, ensure the fex21 is suspended (OFF) and the **stylus is removed** from the storage silo. Follow directions for battery removal in the Getting Started guide.

Avoid allowing the fex21 to remain without a charged battery pack fitted for any extended period of time.

Note: If the battery pack is too hot or too cold, charging is disabled.

3.2 Pre-Charging

If a Li-Ion battery pack is severely discharged, or stored for a prolonged period without re-charging, its low terminal voltage can be low (between 3V and 6V). Under these conditions the fex21 must carry out a pre-charge at a slower rate until the battery voltage reaches 6V. After this the normal 3 hour fast charge can commence. The time required for pre-charge can be up to 90 minutes for a very discharged battery pack.

Battery packs can sometimes even be below 3V. In this case the gas gauge cannot be read by the fex21, and the fex21 will provide an initial charge until 3V is reached. This should only take one or two minutes. Then the pre-charge will commence automatically.

During the initial charge and pre-charge the message “Wake up” is shown against Main Battery Status on the Husky fex21 Power tab screen. During initial charge to 3V, the indicator will be steady orange, changing to the normal steady flashing orange “charging” indication during pre-charge.

Note: On fex21 129MHz units with older versions of firmware (1D42x or earlier), there is a different indication of pre-charge. The indicator will be steady orange and the Battery Status will show Very Low.

3.3 Battery Charge Indication

The battery charge indication can be identified via the clear IrDA (infrared) window located at the bottom right-hand side of the case. A regular orange flash rate indicates battery charging in progress. A solid orange indicates a full charge and an irregular orange flash rate indicates a battery error.

Note: Battery charging in the fex21 will not commence if the fex21 is suspended (off) or if the gas gauge is above 96% or above.

You can also obtain a general battery charge-state indication through one of the Windows status icons in the System Tray located at the bottom left of the display. The possible battery status related icons presented are listed below.



3.4 Battery Storage

Stored Li-Ion battery packs will gradually deteriorate, particularly if they are not stored in ideal conditions, and their life expectancy will decrease. When storing Li-Ion battery packs for extended periods, you should consider these factors:

- Fully charged Li-Ion battery packs deteriorate faster than partly-discharged ones. For ideal storage, charge the packs to 100% and then discharge them to 50% charge before storing (this can be easily done using the “preparation for storage” function of the fex21 Offline Battery Charger).
- Do not allow stored Li-Ion packs to discharge completely, as this may permanently damage them. Stored packs should be recharged to 50% capacity every six (6) months.
- Avoid storing packs at temperatures greater than 30°C (86°F), as this hastens self-discharge and battery aging.
- Storing packs at temperatures near 0°C (32°F) retards self-discharge and battery aging; packs that are to be stored for a long period are best kept at low temperatures where practical.

If you store battery packs at normal ambient temperatures, use the following charging policy to maintain battery pack condition:

- Charge installed packs every 21 days to maintain their charge capacity.
- Charge uninstalled packs every 6 months.

When you bring an fex21 out of storage, you should charge it for at least 48 hours so that both the main battery pack and the standby battery are fully charged.

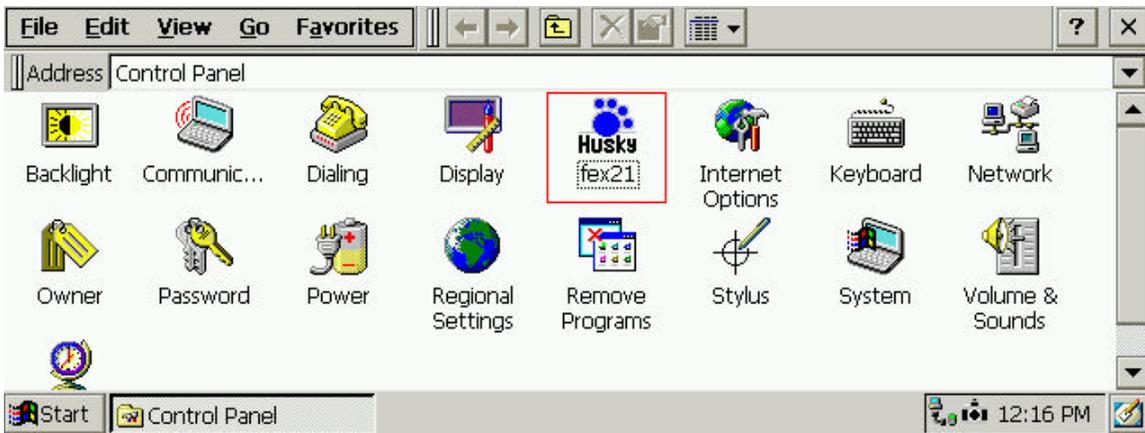
3.5 Battery Management Tips

- Avoid allowing the Li-Ion battery pack to completely discharge.
- Avoid exposure to extreme temperatures for long periods, which can shorten battery charge life and potentially damage the battery.

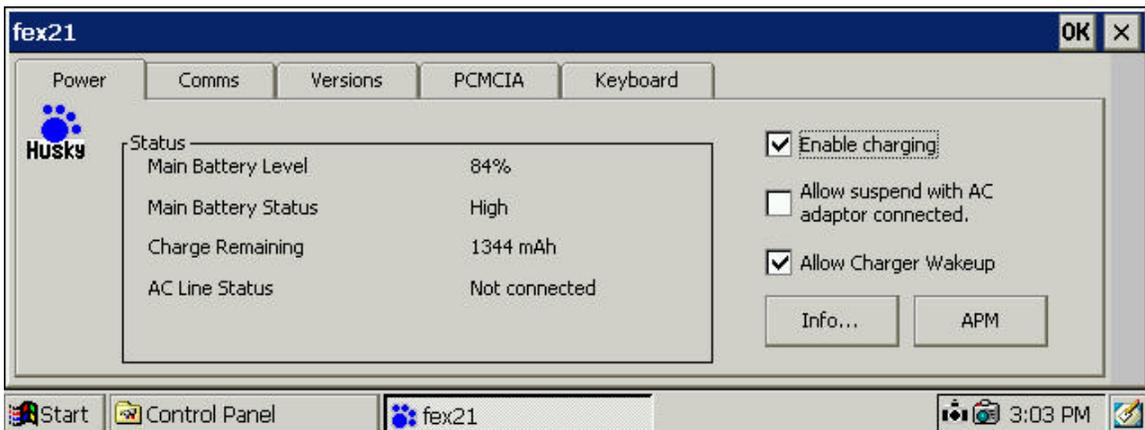
- Provide charge to the fex21 whenever possible during the workday.
- Connect the fex21 to a charging source and fully charge at the end of day. This ensures the “gas gauge” is accurate and provides a charged battery for the next work day.
- If your system provider has already configured the fex21 battery settings, we suggest you check before altering them.

4. Obtaining Battery Charging Information

The “Husky fex21” applet utility provides additional battery information and configuration detail, such as the battery gas gauge, to the user. The utility is accessible via Start->Control Panel. The utility is located in the Control Panel as indicated below. Double tap on the Husky fex21 icon to open.



Once the utility is launched, the screen below will appear. Detailed information such as remaining battery charge percentage is provided. Unless instructed by your provider, do not alter the check boxes for Enable charging.



The status panel indicates the Main Battery Level (or gas gauge). We recommend that you charge the battery as soon as you can when it is below 40%.

A “?” displayed after the percentage figure, this advises that the battery level is only approximate. The “?” is a reminder to charge the unit to full charge, after which the gas gauge is accurate again. The question mark is explained in more detail in 5(d) below.

On completion of charge, a level of 100% is shown. However, this will decrement to 99% as soon as any power is actually drawn from the battery. 99% can be considered a fully charged battery.

For normal operation the boxes “Enable charging” and “Allow Charger Wakeup” should be checked. The later ensures that the fex21 automatically turns on and starts charging when the external power source is connected.

5. Frequently Asked Questions

a) Does it harm the Li-Ion battery pack to frequently “top off” the batteries?

No. Connect the fex21 to a charging source whenever available.

b) What constitutes a charge cycle?

A charge to full termination, i.e. 100%. This occurs when the battery has been fully recharged.

The fex21 battery status screen indicates the number of charge cycles the battery has received. This counter is incremented every time the battery is charged fully to 100%, irrespective of its initial gas gauge reading (unless the battery was already at 96% or above, or it is less than 24 hours since the last charge, in which case this is not counted as a charge cycle).

c) Where can general battery charge state information be obtained?

Refer to the section above “Obtaining Battery Charging Information”, or refer to the section “Checking the batteries” in the fex21 Getting Started guide.

d) Sometimes there is a “?” displayed after the status Main Battery Level. Why is this?

The question mark is a reminder to the user that a full charge cycle is recommended.

The question mark indicates that the gas gauge percentage may be approximate. It is recommended that you only use the gas gauge value as a guide. Giving the battery a full charge to 100% will clear the question mark, and ensure that the gas gauge is accurate again.

There are several reasons why the question mark will be shown:

- If the fex21 has been stored without a main battery (or until the main battery is fully discharged), and the standby battery has also discharged.
- If the battery has completely discharged to below 3V, the gas gauge will have reset.
- If the battery is only given a partial charge, the gas gauge calculation can become less accurate. This effect becomes more significant at high levels of partial charge. If you add 50% or more of charge **without reaching full charge**, a question mark will be displayed. For example an fex21 at, say, 30% charged to 80% will show the question mark. Note: On fex21 129MHz units with older versions of firmware (1D42x or earlier), additional charge of 25% or more will produce the question mark.

- Note: On fex21 129MHz units with older versions of firmware (1D42x or earlier), if the battery is not the one previously charged in that unit, a question mark will be displayed. This feature was more appropriate to NiMH batteries, and has been deleted from later versions of firmware.

e) What effect will temperature have on battery life and performance?

Using the fex21 at very low temperatures will reduce the battery performance, and you may not achieve as many working hours on a full charge as at more normal temperatures. The battery performance will recover when the fex21 returns to a higher temperature.

Note that for storage, Li-Ion batteries prefer low temperature, as this reduces Li-Ion aging effects.

f) How long does it take to fully charge the battery pack?

Up to 3 hours depending on charge-state of the battery when connected to charging source.

g) What is the expected battery life per charge?

This depends very much on the usage of the fex21, and it is difficult to answer this question without knowledge of the usage profile. For most users, a full working day or more will be achieved with a fully charged battery. However, where the fex21 includes an integrated radio or other high power peripheral, it may be necessary to carry a spare fully charged battery or to provide top-up charges during the day (e.g. using a vehicle charging cable).

h) When should the battery be considered worn and be replaced?

As batteries age, the normal symptom is a loss of charge capacity. When the capacity has reduced to 70% of the original new capacity, this is typically taken to be a reasonable time to renew the battery. If for example the battery is being used every working day, recharged each day, you could expect about 12 to 18 months life from the battery pack – more if the usage is lighter.

The fex21 battery status screen also indicates the number of charge cycles the battery has received. This counter is incremented every time the battery is charged fully to 100%, irrespective of its initial gas gauge reading (unless the battery was already at 96% or above, or it is less than 24 hours since the last charge, in which case this is not counted as a charge cycle). However, for Li-Ion batteries which prefer frequent top-up charges, this counter is only a very general guide to how far through its useful life the battery may be. Typically 300-500 full charge-discharge cycles could be expected.

j) What happens to the fex21 if I remove the main pack, say for exchanging battery packs?

When the main battery pack is removed from the fex21, an internal backup battery maintains the unit's memory (RAM). Although the fex21 is designed to cope with sudden power loss, it is nevertheless good practice to ensure the fex21 is suspended (switched off) prior to removing the battery pack.

k) Sometimes the display on my fex21 turns off momentarily every minute.

This is not an error, but is an interaction between Microsoft CE and how the fex21 power management is designed to operate. The occurrence of this has been reduced on later versions of fex21, but may still be seen.

l) What if a battery error indication appears during charging?

An error is shown by irregular orange flashing of the charging indicator. A battery charging error can occur for several reasons, but should be a rare or infrequent occurrence.

In the first instance, we suggest you soft reset the fex21. This may clear the error state. If this does not help, briefly remove the battery pack and reinsert it, and soft reset again if appropriate.

Note: Avoid Hard Resetting the fex21 or your application software will need to be reloaded.

If none of these clear the error, the battery pack may be faulty. Try a different fex21 Li-Ion battery. Sometimes the error is because the battery pack gas gauge has lost synchronization. A full charge cycle to 100% in the offline battery charger can rectify this. If difficulties continue, contact your designated support channel.

! Important Safety Information !

CAUTION: Do not attempt to open, puncture or dispose of the battery pack in fire. The battery pack can burst or explode releasing hazardous chemicals. Replace or maintain your battery pack as described in the fex21 Getting Started booklet (or Li-Ion battery addendum).

Observe the safety instructions printed on the battery.

Only use Itronix Li-Ion battery packs with your fex21. Your fex21 does not support other battery chemistry. Use of non-approved battery packs may be hazardous and also cause damage to your fex21.

- Replace the battery pack only with the approved Itronix part.
- Dispose of or recycle used batteries in accordance with the manufacturer's recommendations and local customs.
- Do not abuse, deliberately pierce, or subject the battery pack to excessive impact.
- Immediately discontinue use of the battery if it appears damaged or abnormal in any way, consult your local provider for advice.
- Do not immerse the battery pack in liquid.
- Do not subject the battery pack to temperatures in excess of 60°C (140°F).
- Do not short together the battery connections. Do not store the battery pack with metallic objects due to the risk of short circuit.
- Battery chemical leakage is harmful. In the unlikely event of battery leakage DO NOT TOUCH. In case of accidental contact with the eyes or skin, immediately wash with running water and seek medical advice. In the case of accidental ingestion, seek immediate medical attention.
- Keep batteries out of children's reach.