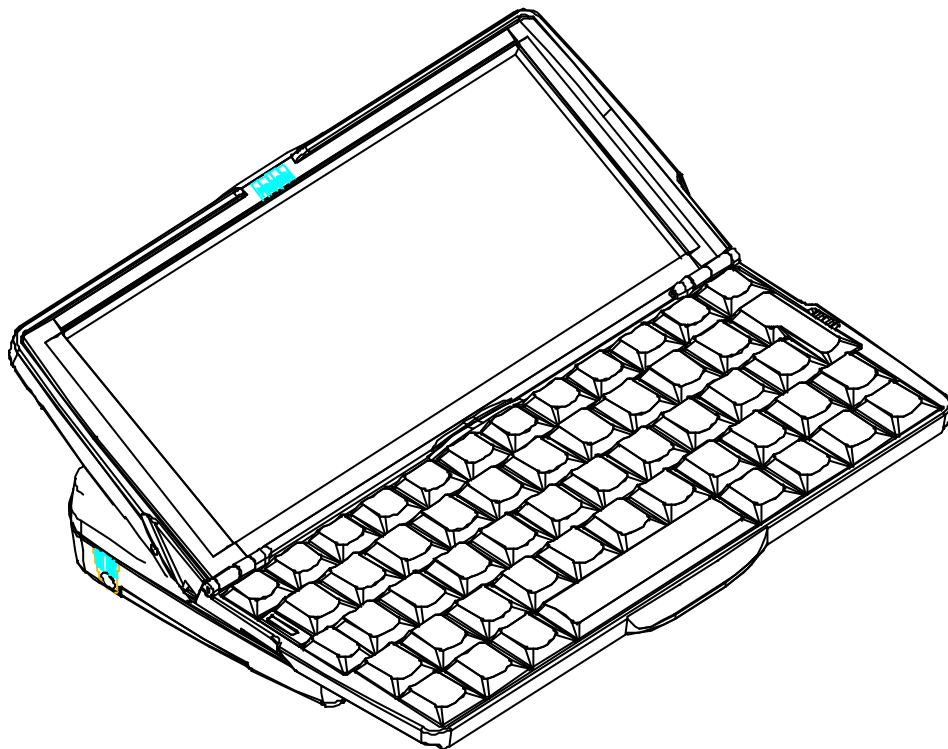




S E R **5^{mx}** I E S



Service Manual

1999

Confidentiality & Service Support



Series 5MX Service Manual

The Series 5MX Service Manual will not be made available as bound and printed copy. It will be made available exclusively as an Adobe Acrobat PDF file. This manual is available as a viewable, printable and downloadable file from the Psion Computers closed World-wide Web site.

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Series 5MX Service Engineering Information Updates

Engineering Updates will be issued when necessary. All future Updates will be distributed through the closed World-wide Web site.

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Introduction

The Series 5MX is a revolutionary handheld computer which enables the functionality of desktop applications in a handheld form. It combines innovative design and new technology, incorporates a full VGA width back-lit screen, a pen for navigation and a patented touch-type keyboard. The 32 bit Series 5MX features a windows-style interface and PsiWin V.2 (Windows 95/98/Nt4.0) connectivity software to provide total integration and compatibility with office and home computer systems.

The Series 5MX uses a powerful 32 bit open operating system named EPOC, developed by Symbian, and the ARM7TDI core processor, providing a high level of processing power while preserving battery life. EPOC is optimised for low-power, portable machines and is equally at home in a smart-phone, mobile network computer or handheld computer.

The purpose of this service manual is to give an overview of the service procedures that may need to be performed on the Series 5MX by an approved service centre. It has been designed to be used by the service and repair technicians who have the responsibility of maintaining the products.

The Series 5MX uses both conventional component and high-density surface mount component technology which requires specialist servicing techniques and prohibitively expensive test and verification equipment. We therefore recommend that repairs are carried out at a *circuit board* level, rather than at *component* level. We also encourage service centres to carry a stock of spare parts to allow immediate servicing of Series 5MX components should they need to be replaced. Details of the Series 5MX spare parts kits can be found in the Spare Parts Catalogue and in the **Spare Parts** section of this document.

Final test Equipment

A final test unit is essential to service a Series 5MX effectively, it is a requirement for all approved Psion service centers. The final test unit is used within Psion during the manufacturing process to run a final check on the assembly.

The Series 5MX main PCB contains an EEPROM, known as E2 or the 'e squared' chip, this device is used to store certain configuration settings for the device's hardware. Some of these options are hard coded during the manufacturing circuit and function testing, these settings cannot be changed and include the electronically stored version of the serial number. The remaining settings are coded by the Series 5MX Final Test Unit and once set cannot be changed.

As the FTU settings include language and keyboard indexes, replacement PCBs are shipped in a generic form, this means that a replacement PCB **MUST** be tested correctly in order that the Series 5MX functions correctly.

Failure to correctly test a Series 5MX with a new PCB can result in:-

- Digitiser drift.
- Incorrect keyboard driver selection.
- Erratic electrical activity.

Therefore it is essential to understand the use of the Series 5MX FTU in order to perform effective repairs. Also note that replacing the PCB can only be carried out if you have a Final Test Unit.

- See ***Series 5MX Final Test manual*** for more information.

Approvals



CE Logo - This shows the product complies with the requirements for shipping to any country within the European Union and indicates that the Series 5MX complies with both the EMC and Low Voltage Directives. The EMC Directive ensures that the product complies with the emissions requirements of EN55022 Class B, and the Immunity requirements of EN50082-1. The latter document covers static testing to +8kV, radiated RF testing and surviving 1kV Electrical Fast Transients into the mains adapter inputs. The Low Voltage Directive ensures the product complies with the requirements of the European safety standard for Information Technology Equipment - EN60950.



The C-tick logo is a requirement for products shipped to Australia and NZ. The logo shows that the product complies with the emissions standard for Information Technology Equipment, i.e. AS/NZS 3548



FCC Logo - This shows that the product complies with the requirements for shipping products to the USA. The product has been tested to show compliance with USA Federal Communications Commission requirements as detailed in US Government handbook CFR Part 15. This document covers the requirements for digital devices designed for use in residential and commercial environments (known as Class B devices). A further requirement of the US regs is to display the model number (e.g. 16MB) and the words 'Tested to Comply with FCC Standards for Home or Office Use'. The Canadian Requirements are covered by displaying the wording 'This Class B Device complies with Canadian ICE regulations. Tested to comply with FCC standards for home or office use.' (The French translation "Cet appareil CL B se conforme au reglement sur le materiel brouilleur du Canada"). They show the product complies with the Industry Canada requirements specified in the Canadian Interference Causing Equipment (ICE) regs. These are currently met by testing the product to ICE-003 (currently identical to USA CFR 15 Class B).



EPOC is the built-in, highly optimized, C++, multi-tasking, 32-bit operating system of the Series 5MX, which includes a fully featured suite of Personal Information Management, productivity and communications applications. The platform is entirely modular and supports embedded graphics and voice as well as pen and keyboard input. The real-time performance of EPOC allows it to run telephony protocol stacks and makes it suitable for communications enabled devices.



The ARM7TDI is a high-integration, application specific microcontroller which meets the needs of next generation electronic organizers and PDA's providing the combination of features and performance to cope with the increasing software demands of friendlier user interfaces, increased functionality and advanced communication protocols. The ARM7TDI is the microcontroller component of the unique hardware and software open architecture employed by the Series 5MX.



IR Logo - This shows that the Series 5MX complies with the requirements of the Infrared Data Association standards, and indicates that data may be transferred to other products that display this logo.



CompactFlash (CF) is an ultra-small removable data storage system. CF provides complete PCMCIA-ATA functionality and compatibility and has built-in, industry-standard compatibility as the 50-pin CF cartridge can be easily slipped into a passive 68 pin Type II adapter card that fully meets PCMCIA electrical and mechanical interface specifications. CF is widely used in digital cameras, cellular phones, personal digital assistants and personal communicators.

Service Precautions

A Series 5MX can be disassembled quickly into specific sub-assemblies allowing the accurate replacement of faulty components. The Series 5MX promotes simple servicing procedures and it can be dismantled quickly using only a small number of tools.

Servicing is carried out at modular level and not at component level, and as such this disassembly procedure explains servicing in line with the spares modules detailed in this manual.

The Series 5MX hand-held computer contains CMOS devices that may be damaged by electro-static discharge (ESD). The following steps to minimise ESD must be taken before the unit is dismantled. To prevent any damage that could result if the unit or its parts are not handled properly, observe the following precautions during any handling procedures:

- Minimise all handling of static-sensitive components and assemblies.
- Transport and store static-sensitive components and assemblies in their original containers or in anti-static bags.
- Label accordingly any package that contains static-sensitive components or assemblies.
- Discharge static electricity from the body by wearing a grounded antistatic wrist strap while handling these components.

Servicing static-sensitive components or assemblies should be done only at a static-free work station by qualified service technicians. Increasing the humidity in the work area minimises static electricity problems.

- Do not allow anything that can generate or hold a static charge on the work station surface.
- Pick up components by their bodies, never by their leads.
- Do not slide components over any surface.
- Avoid handling components in areas with a floor or work-surface covering that can generate static charge.

Before commencing the disassembly procedure be sure to remove any batteries including the lithium dry cell. To remove the lithium dry cell open the battery door to expose the it and use the stylus to release the cell from its location. The stylus should be inserted beneath the cell next to the voltage details in the base moulding. (Refer to the User Guide for further instructions) Do not use a metallic tool to do this as it may short the cell.



Caution:

Danger of explosion if lithium battery is incorrectly replaced.

Replace only with the same or equivalent type of lithium battery and dispose of used batteries as recommended in the Series 5MX User Guide

When removing the internal workings from the case, care should be taken not to damage the LCD module. Do not bend the module, as the circuit board is prone to fracturing.

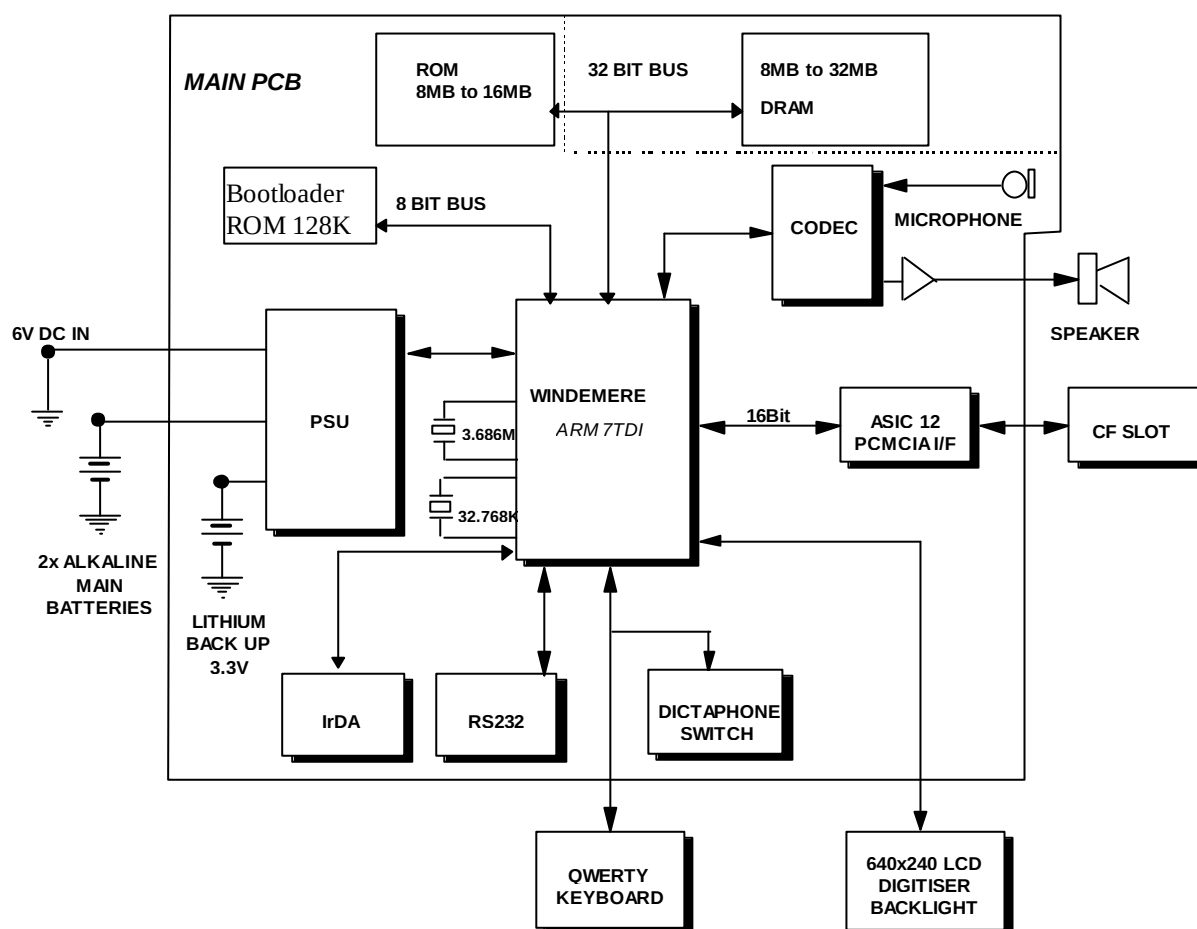
If the LCD breaks, be careful not to get any liquid crystal in your mouth or eyes. In the event of any liquid crystal getting on skin or clothes, wash off immediately with soap and plenty of water.

Do not remove both the lithium dry cell and main batteries without first ensuring that the data contained in The Series 5MX's internal memory has first been backed up. Removal of both the battery sources, without previously attaching an external power supply, will erase all information stored on the internal memory.

Circuit Description

Introduction

The electronic design for the Series 5MX handheld computer product makes use of the ERA architecture based around the WINDEMERE cpu. The product hardware supports optional Mask ROM builds of 2 to 16 Mbytes (with an alternative 2 or 4 Mbyte Flash extension), optional DRAM builds of 8 to 32 Mbytes and an optional bootstrap loader build of up to 512 Kbytes. It features a 640x240 monochrome display with back lighting, a button operated dictaphone function, a pen activated digitised screen, full travel keyboard switches and a Compact Flash (CF) socket.



The Series 5MX electronics are all contained on one main PCB. The main p.c.b. design is made up of the following functional areas.

CPU and POR generator

The Series 5MX cpu (IC1) is the WINDEMERE device, which integrates an ARM7TDI 32 bit RISC core with Psion specific peripherals. Its main clock input frequency is 3.6864 MHz (+/- 50 ppm), provided by crystal X2 working in fundamental mode. This signal is internally multiplied up in frequency by a factor of 20 and then divided by 2 for a 50/50 Mark/Space ratio of 36.864 MHz (27.12 ns).

Circuit Description

An internal control register then allows a further divide by 2 of the system clock to operate at 18.432 MHz, which is the default setting on Power Up. An expansion clock of this frequency is available as an output from WINDEMERE, and is used on Series 5MX by the Compact Flash interface device, ASIC12 (IC2).

A Power-On-Reset (cold reset) signal to WINDEMERE is provided by a Ricoh RN5VLR20AA open drain FET output, voltage detector device, IC4. WINDEMERE is reset during power-on by IC4, which detects when VDD crosses a set point voltage. This threshold voltage is set to $2.0\text{ V} \pm 2.5\%$ ($2.0\text{V} \pm 50\text{mV}$). An RC circuit stretches the low state signal, to allow sufficient time for WINDEMERE to reset. Power-On-Reset erases all data held in volatile storage, and is an indication that all power has been lost and subsequently re-applied.

A User Reset (warm reset) signal is available on Series 5MX via a switch. The switch forms part of the Lithium backup battery negative contact, and would normally be accessible to the user only by opening the backup battery case cover and using a pointed instrument. The user reset signal is normally held inactive high by a pull up resistor, R63. A small value capacitor, C113, provides a measure of noise bypass in order to protect the system from inadvertent resets during ESD events and other electrically noisy periods. Operating this switch vectors the CPU to a warm restart and all user data should be recovered in this process.

Keyboard interface

The Series 5MX keyboard contains a total of 53 keys, organised in a conventional QWERTY arrangement. The electrical connection between the keyboard and the main Series 5MX PCB is achieved by means of a 22 way Flat Flexi Cable (only 20 ways are used for keys), fitted to a 22 way ZIF connector, J7. The outside pins on the flexi are grounded to allow a ground ring on the keyboard membrane to improve ESD protection.

LCD Module

The LCD module used in Series 5MX is a ready assembled unit consisting of the Backlight luminescent, a 640 by 240 pixel passive matrix LCD (normally white pixels) and a Touch Resistive panel. These are constructed into one piece and contained within a metal jacket to provide ESD protection and greater mechanical strength. One 26 way flat flexi connects all these components to the main PCB. All the LCD data, clock and synchronisation signals are provided by the WINDEMERE device.

The passive resistive digitiser consists of a glass lower plate and a hardened plastic top plate which is assembled over the LCD screen. Resistive ink is printed on the inside of the digitiser faces and four electrical connections provide the means for sensing resistance across the x- and y- axes. The electrically conductive internal faces of the digitiser are kept apart by means of very small bumps manufactured into the plastic member. Four of the 26 way flat flexi Cable signals carry the Resistive Digitiser planes to the Series 5MX main PCB.

The LCD requires a number of power/voltage rails, which have to be enabled and disabled in a defined sequence, in order to ensure that at no time no residual DC is presented across the LCD panels. This DC would cause drift in the liquid crystal and would eventually irreversibly damage its light polarisation characteristics.

By using a number of positive and a negative bias rails the LCD maintains lower toggling voltages across the display, which therefore reduces the drive current required.

Battery usage

The life of a set of batteries should be viewed in terms of “time between battery changes” in conjunction with “time on batteries” to judge if the machine is performing correctly.

A heavy user would have a high “time on batteries” but have to change batteries more frequently.

A light user may only have a couple of hours of “time on batteries” but then the time between battery changes would be greatly increased. A large proportion of the battery power consumption will be due to the standby current keeping the machine “alive” in standby mode than that used when the machine was on.. The power consumption in standby mode is not included in the battery information screen “time on batteries” figure.

Removing the batteries and replacing them with the same (or different) set that are not fully charged would distort the data viewed in the battery information screen.

The Series 5MX draws a standby current at all times even when the machine is turned off. This standby current varies across the product range, but is typically 1% of battery life/day.

Failure to keep the machine powered through batteries or mains adapter will result in the loss of all data held on the machine.

There is software in the machine designed to inform you of :

- The power level of the main and backup batteries.
- Time on batteries when the machine is switched on. (power consumption whilst the machine is in standby mode is not included in the battery information screen)
- Average and real time battery current during the time that the machine is switched on.

The software also has certain safety mechanisms to reduce the risk of allowing all power to the machine being lost.

As the voltage output from the main batteries drops to certain levels the following occurs

1. The backlight will not turn on and a warning appears in the screen informing you of insufficient power to use the backlight facility.
2. A “Replace Main Batteries” warning appears in the screen.
3. The machine will not turn on and appears “dead” (this is to conserve the remaining power for keeping the data stored in the machine “alive” .)
4. The machine switches from using main battery power to the backup battery.
5. The power remaining in the backup battery is unable to keep the machine “alive” and the machine “dies” with the loss of all data.

Due to the power consumed when the machine is in standby mode, it is possible for steps 1 to 5 above to occur when the machine is turned off and left for a period of time. The length of time between steps 1 to 5 depends on the machine usage pattern during this period, the quality and type of main batteries used and the voltage of the backup battery.

PSION RECOMMEND THE USE OF GOOD QUALITY ALKALINE BATTERIES TO MAXIMISE THIS WARNING PERIOD.

All machines are final tested before leaving the Factory or Repair Centre. This test includes the measurement of the “Standby current” and “On current”. It is extremely rare for a machine that has passed this test to later develop a high current fault in the field and then the batteries would only last a few days at most.

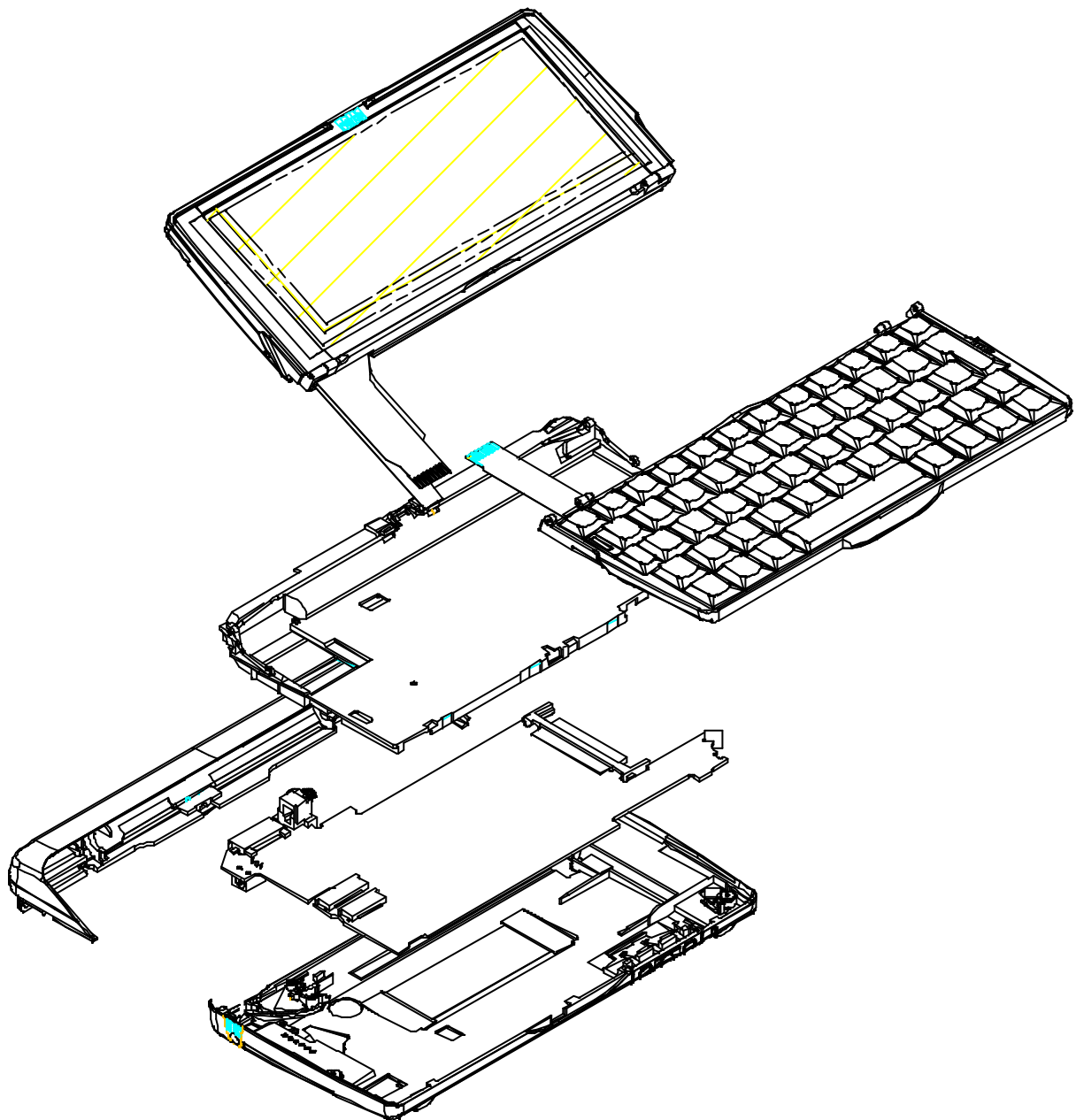
Psion Recommends the use of Duracell Ultra batteries in the Series 5mx



Disassembly of the Series 5mx

Introduction

The following exploded diagrams show the construction of the sub-assemblies that comprise the Series 5MX. The structure of the diagrams attempts to reflect the assembly stages employed at the point of manufacture.



Dissassembling the Series 5MX

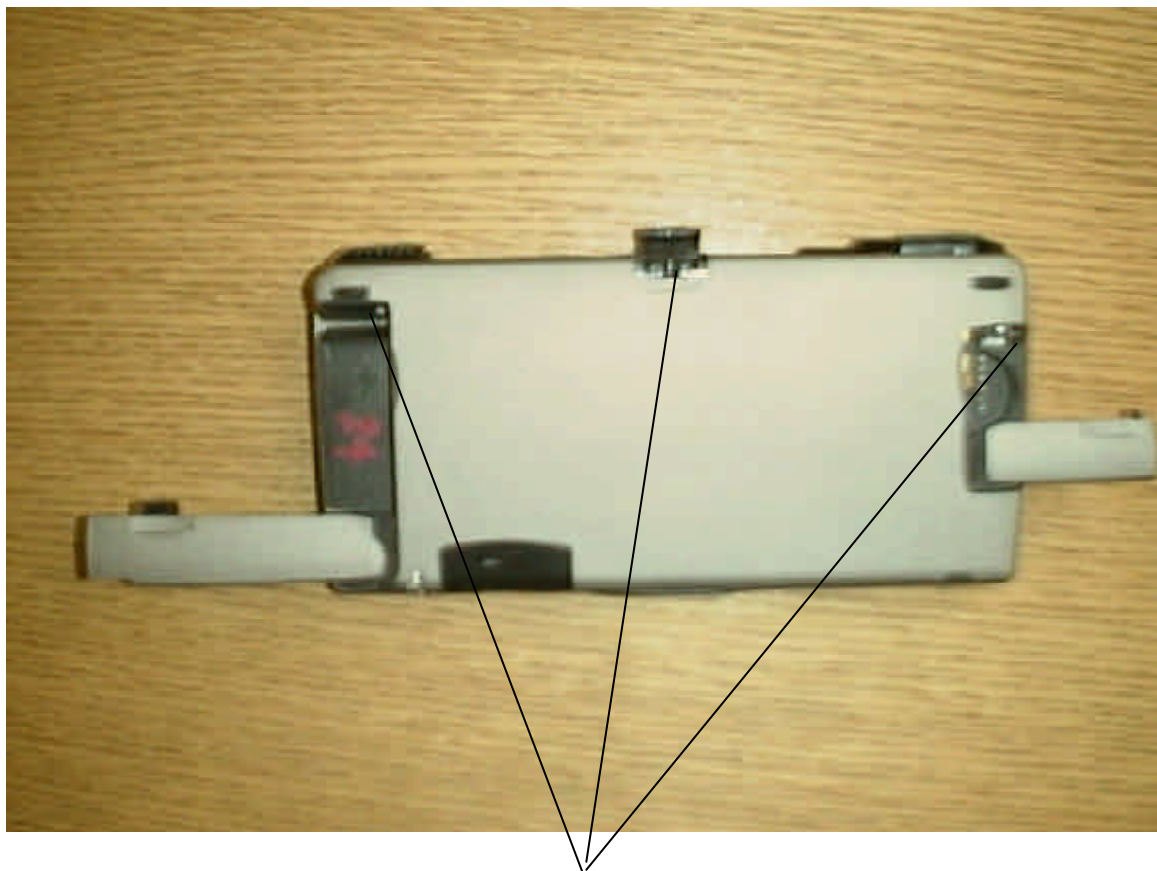
First remove the stylus then remove the 3 case screws from the base moulding which are located as shown in the following photograph.

(The "Warranty Void if Removed" label will be destroyed during this procedure).

Once the screws have been removed the Base moulding can be lifted off the main assembly.

First ensure that the Memory Disk and lithium battery doors are open as this will free locating clips between the PCB and the base moulding.

The moulding should then be eased upwards from its front edge to disengage it from the hinge moulding. Ensure that the moulding is lifted clear without damaging any of the locating details along the bottom edge of the base moulding.

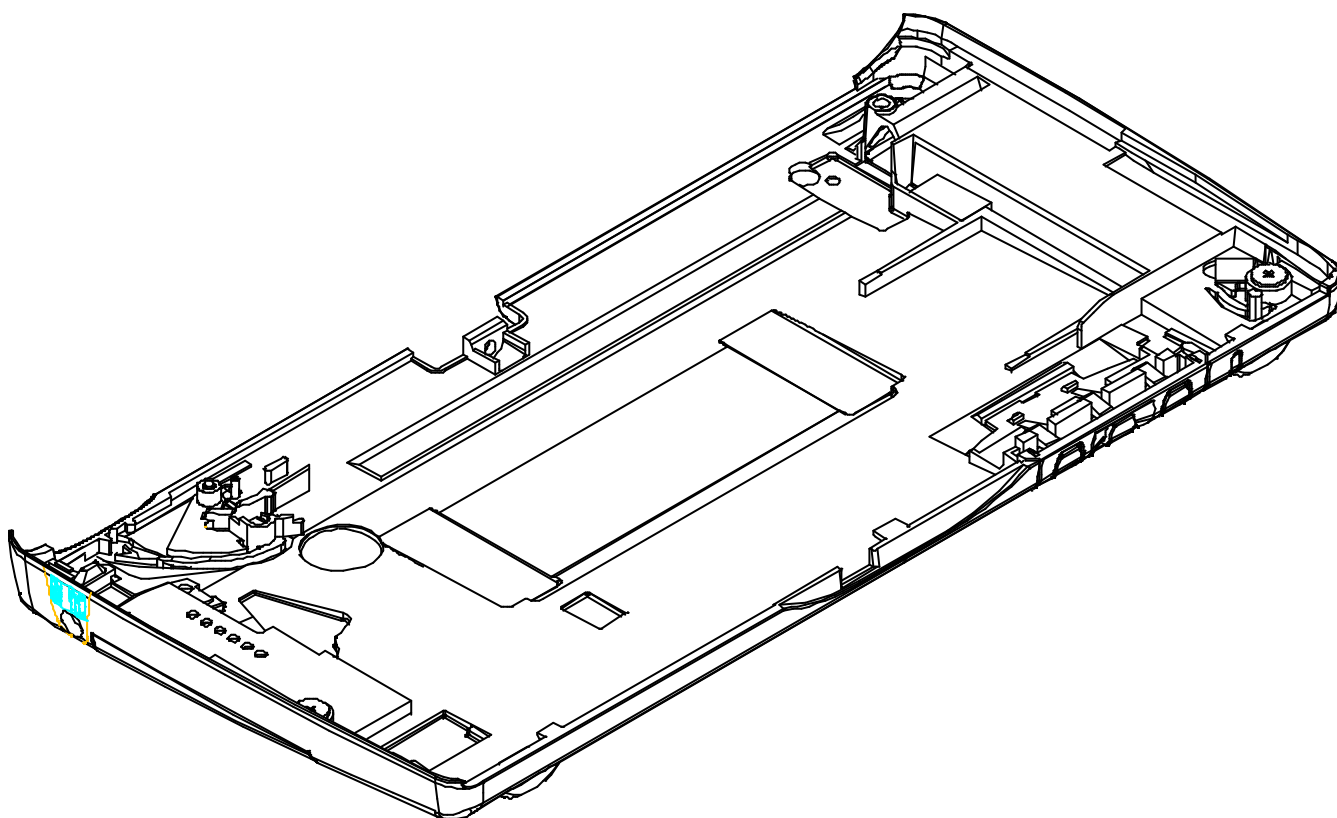


3 M2x4 Panhead Screws

Exploded Views

Base Moulding Assembly

Base moulding assemblies are available in packs of five from the spare parts catalog. All 5 base mouldings are pre assembled with pen catch mechanism, dictaphone buttons and Cf/lithium battery doors attached.



Dissassembling the Series 5MX

The hinge cover moulding should now be removed.

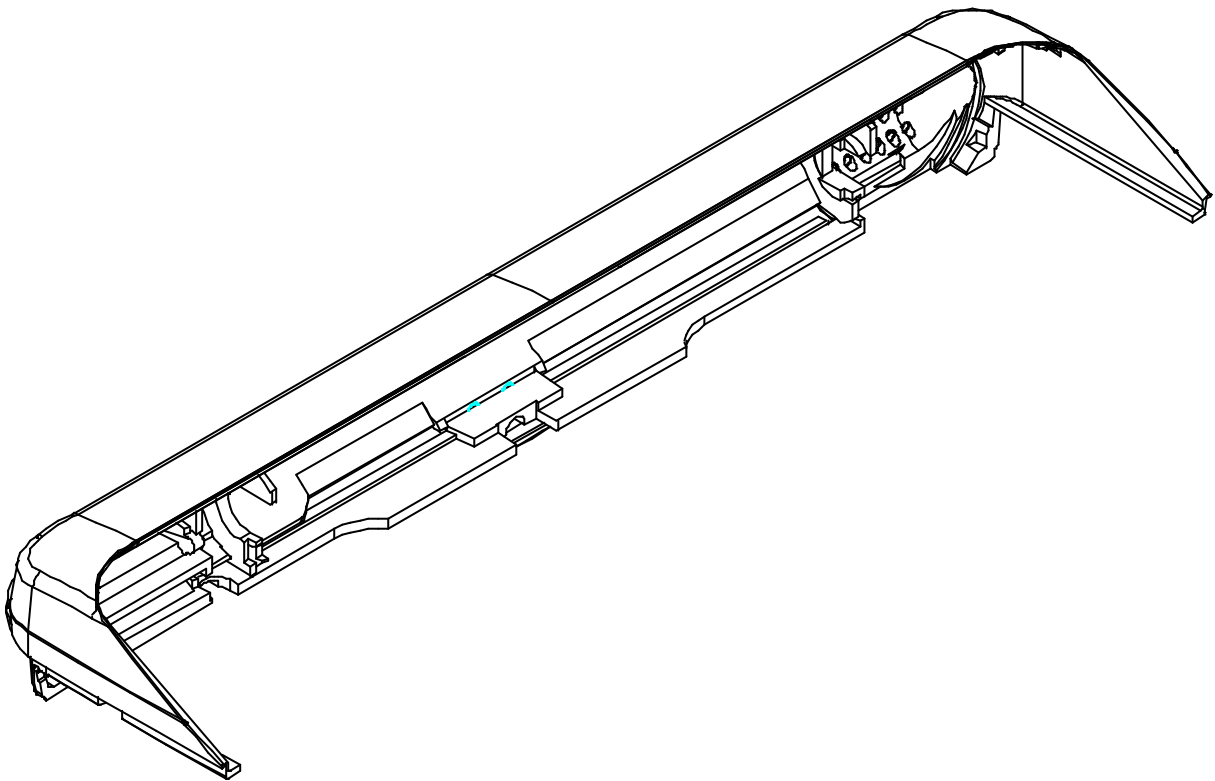
This can be done by inserting a blunt pointed instrument (such as a spare Series 5MX stylus) into the centre of the hinge moulding and gently levering the moulding out of its locating clips on the chassis as shown in the photograph below.

Note that the battery housing door needs to be closed to facilitate the removal of the hinge cover moulding assembly.



Exploded Views

Hinge cover assemblies are available from the spare parts catalog.
Supplied in fives, the hinge cover comes with battery door, Ir window and comms door pre assembled.



Dissassembling the Series 5MX

The Main PCB can now be removed.

First unscrew the 3 retaining screws and disconnect the Speaker Flexi as shown in the following photographs:

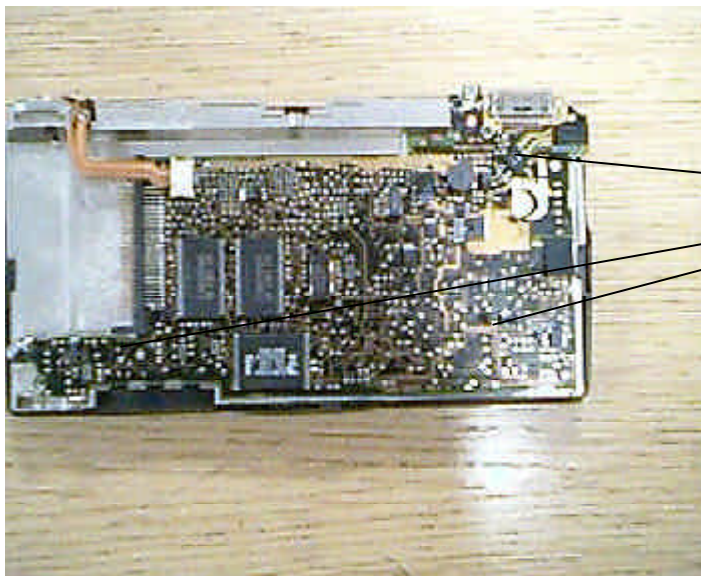
Open the keyboard and gently lift the PCB up to pull the LCD (orange) and Keyboard (blue) flexi connectors out from the recess in the chassis moulding.

These should be removed from their respective LIF sockets on the main PCB.

The Main PCB can now be replaced if necessary.

When replacing the PCB ensure that the same language variant PCB is used and ensure that the damaged PCB is stored in an anti-static bag.

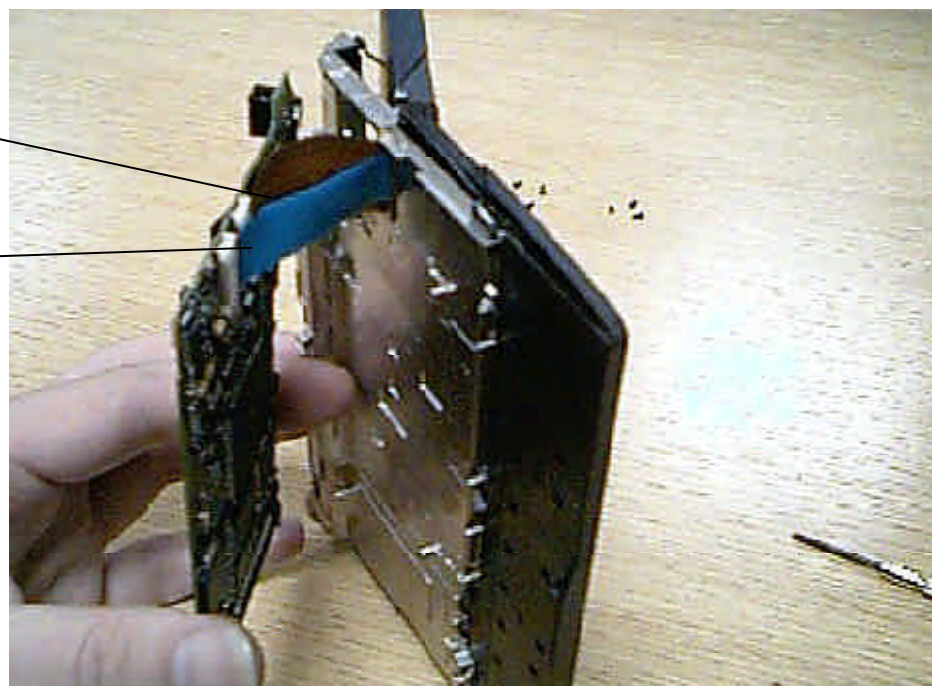
Take care not to damage the LCM Flexi protector when removing or replacing the PCB, it is easily creased.



3 M2x4 Panhead screws

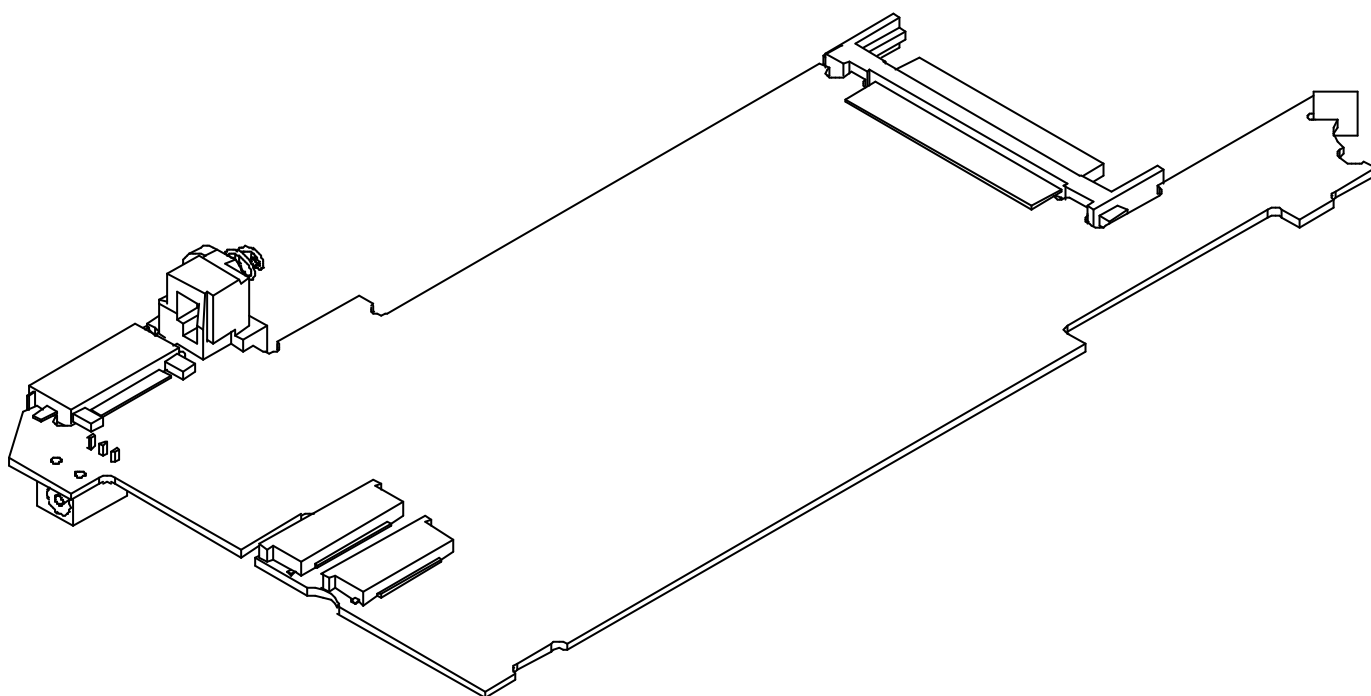
LCD Connector

Keyboard Connector



Exploded Views

PCBs are supplied in each language variant, available for order in single quantities.



Dissassembling the Series 5MX

The Chassis and LCD/Keyboard assembly can now be separated.

The hinge pins that hold the two assemblies together can be removed by using the hinge pin removal tool Which can be made from the hinge pivot wire and should be shaped as shown using pliers .

Insert the tool into the hinge pins and remove by flexing the tool and pulling the pins out of the LCD outer moulding.

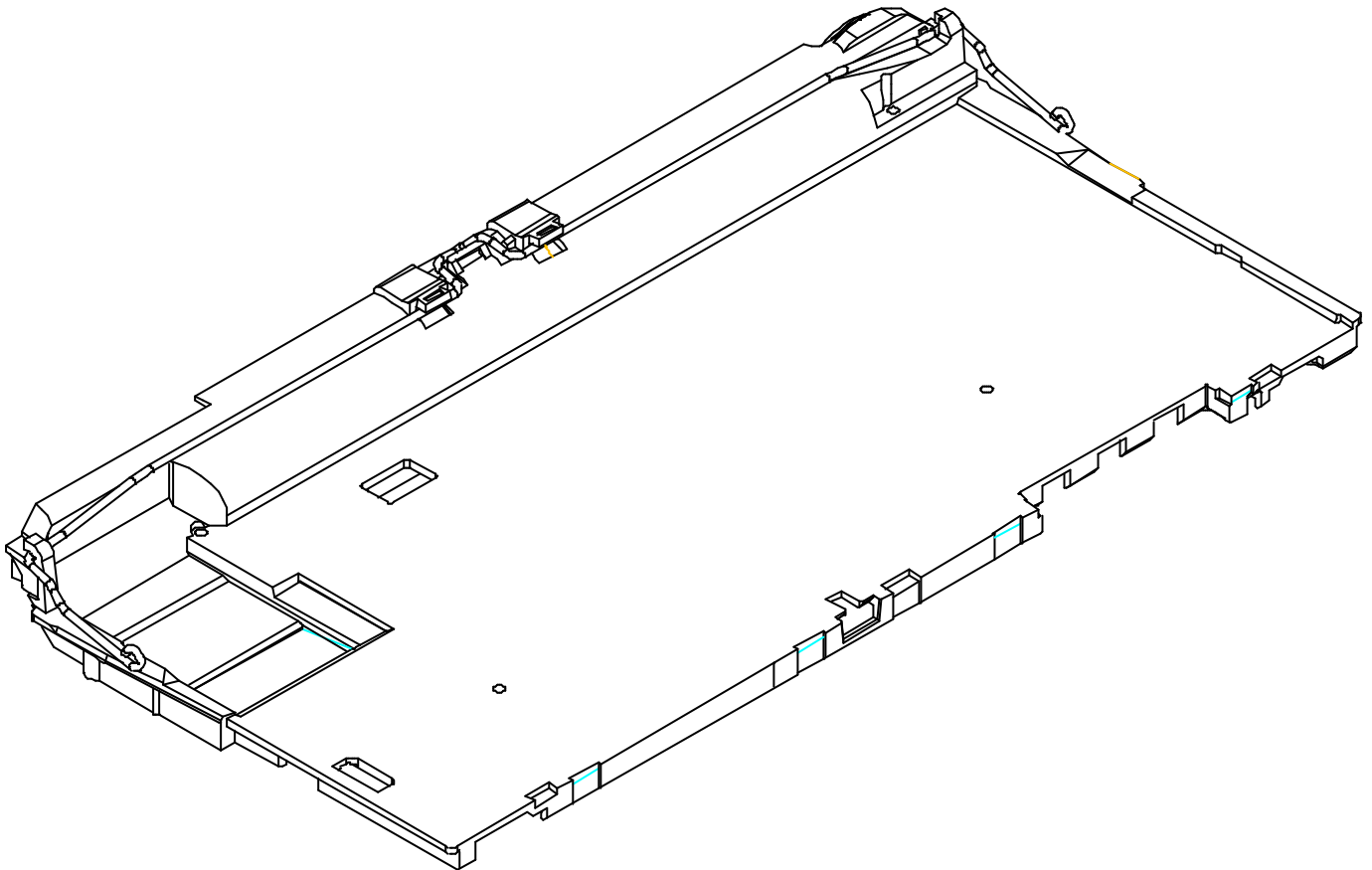
Take care not to damage the painted finish on the LCD outer moulding whilst removing the hinge pins.

The LCD/Keyboard assembly can now be slid off the chassis moulding as shown in the photograph below.



Exploded Views

Supplied in packs of 5 the chassis assembly comes with speaker, speaker flexi, +ve battery support and hinge wires pre assembled.



It is possible to make your own pivot arm hinge pin removal tool. You will need the pivot arm from an old Chassis assembly. You should cut the ends from the hinge wire and then, using pliers, bend the wire to the shape shown in Fig 4 below. A slight kink at the end of the tool will increase it's efficiency.

Fig 4



Dissassembling the Series 5MX

The LCD and Keyboard assemblies can now be separated.

Lever the hinge pin out of the hinge assembly, a sharp knife or scalpel is ideal for this, take care not to damage the painted surfaces of the keyframe and LCD outer mouldings.

The LCD and keyboard assemblies can now be separated.

Replacement keyboards are supplied as complete assemblies.

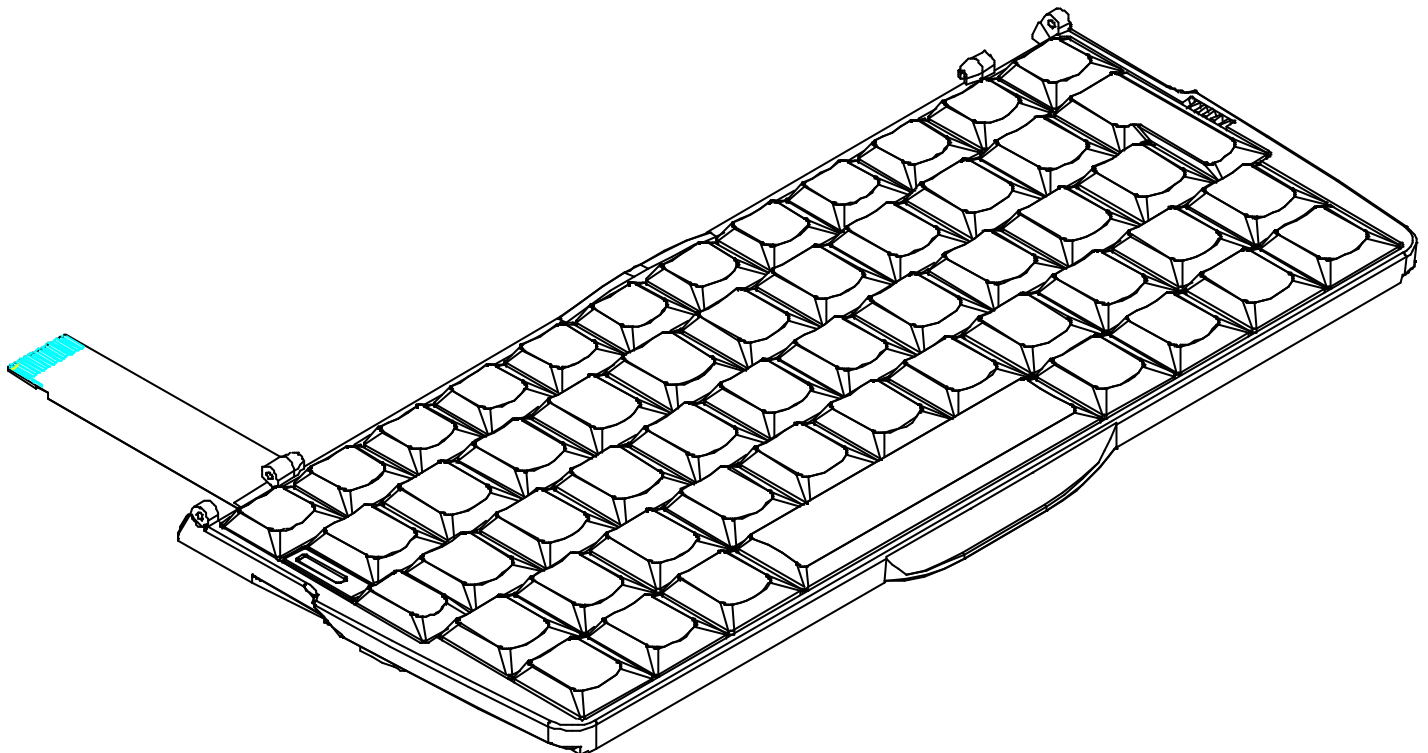
Ensure that the replacement keyboard assembly is of the same language as the keyboard being replaced.

NOTE The hinge pins used in the series 5mx are NOT the same as those used in the standard Series 5, care must be taken not to mix the types, they look similar, but the pins for the 5mx are tapered, whereas those used in Series 5 are straight and will not be retained by the hinge in the 5mx.



Exploded Views

Keyboards are supplied pre-assembled in packs of 5. You should not spend time disassembling the keyboard, it is more cost efficient to replace this as a module. Each language variant has it's own kit.



Dissassembling the Series 5MX

The LCD assembly can be removed from the LCD outer moulding by carefully sliding the LCM assembly out of the moulding.

Grip the LCM as shown in the diagram below and ensure that the LCM assembly remains level as it is removed, as the assembly will not slide out of the moulding if it is at all out of line. The inner LCD moulding unclips from the lower leading edge of the LCD, it can be replaced without removing the LCM from the outer moulding.

On the lower edge of the LCM there are 2 rubber spacers (see below), these are prefitted in the factory and should not be removed, they are already present in the LCM spare parts kit. Inside the outer LCD moulding, behind the LCM there is a transparent LCM spacer, this should not be removed as it protects the LCM in the event of impact (i.e. the unit is dropped).

Ensure that the same LCD outer moulding is used during reassembly (if it is undamaged) to ensure that no colour differences exist between mouldings.

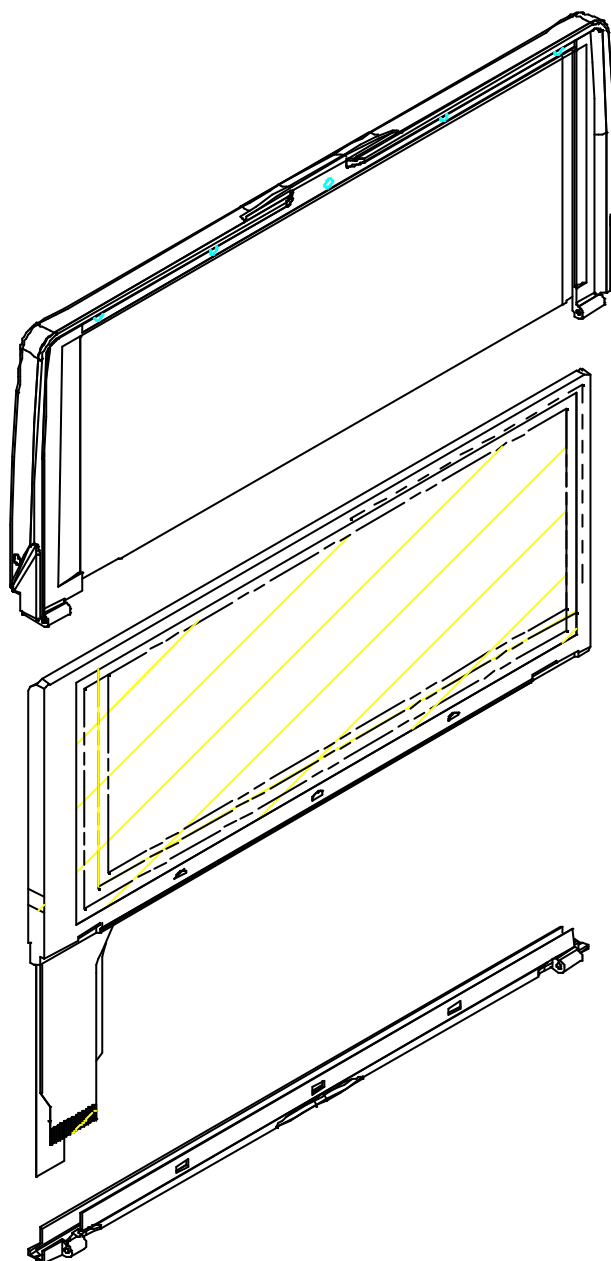


2x Rubber spacer

Exploded Views

The LCD assembly is supplied in packs of 5. The LCD module is encased in a protective metal casing. If the LCD or digitiser are damaged you should replace the entire module. The module sits inside the outer LCD moulding and is supported from below by the inner LCD moulding, which also has the application name label attached.

LCD outer moulding kits, with outer and inner LCD labels and a transparent LCM compression spacer, are available in packs of 5. Inner mouldings with application label in packs of 50 are also available separately in the spares catalog and should be used when the unit under repair has a damaged moulding, you should not replace the LCD assembly if the fault is only in the moulding.



Tools Required

Recommended tools.

You will need

a 2mm philips screwdriver

a 1mm flat screwdriver

A hinge pin removal tool (pivot arm wire)

a scalpel or craft knife

pliers and wire cutters

Additional Spare parts

Other spare parts for the repair of the Series 5MX are available separately, these include:

M2x4 Black panhead screws

Pivot arm Hinge pins

Keyboard/LCD Hinge pins

Replacement stylus

There are also separate kits containing 50 sets of labels for the Series 5MX, available in different language based kits.

Reassembly Instructions

Reassembly is essentially a reversal of the disassembly procedure.

However, take note of the following points.

- Exercise caution whilst re-inserting the FFC's into the ZIF sockets.

Inserting FFC's into the connectors at an angle can cause short or open circuits.

Ensure that the bends in the FFC's are retained to ensure correct alignment of all components on the main PCB.

- Replace any labels that have been removed in the disassembly procedure with new labels.

Do not attempt to re-fit labels that have previously been removed from the Series 5MX.

- Extreme caution is required when replacing the LCD assembly in the outer moulding.

If the screen is not wholly centered it is very easy to damage the LCD or digitiser.

When replacing the base moulding as part of the final stage of assembly, ensure that the pen eject mechanism has not become dislodged.

The spring that operates the pen eject can drop out if care is not taken whilst replacing the base assembly.

When replacing both the main PCB and the slim base assembly ensure that the Series 5MX is open. This will ensure that the switches that operate the machine on/off and door opening warnings will not be fouled as the base is replaced.

Ensure that the Memory Disk and lithium doors on the base assembly are also open.

To replace the slim base assembly align along the bottom edge of the Series 5MX assembly, ensuring that the dictaphone buttons have located and lever the moulding down into place.

The base should snap into place along the back edge where it meets the hinge moulding assembly.

Ensure that the base is located correctly before re-screwing it down using the 3 case screws. These case screws should not be over tightened as they purchase into the chassis moulding and can strip easily.

When the Series 5MX is fully reassembled check that the colour of each of the mouldings tie up and that no colour differences exist between mouldings.

It is important to note that the Series 5MX can occasionally experience a software crash which can be rectified by enacting a soft reset - see User Guide.

However it is possible that a crash can be caused by an intermittent hardware fault, and therefore it is advisable to fully test any unit that has experienced a crash.

Faults such as failure to read links, power supplies or batteries can be caused by the peripherals themselves and these faults should be determined only using a Series 5MX that is known to work.

Some brands of batteries are shorter in length than the European average and as such can give poor contact, which can result in the unit giving incorrect low battery warnings.

Also, rechargeable batteries have a very low usage time and as such can give the false impression that the Series 5MX is draining them too quickly.