GMX Micro-20™

Manual Addenda for the
UniFLEX® Operating System
User's Manuals

UniFLEX Manual Addenda

Revision	Date	Changes
A	02/12/86	First general release.
B	02/25/86	Add support for streaming tape and 8-port serial boards.

GMX Micro-20 Manual Addenda
for the UniFLEX® Operating System User's Manuals

CONTENTS

INTRODUCTION

This manual contains information on the GMX Micro-20 version of Technical Systems Consultants' UniFLEX Disk Operating System. The information is specific to the GMX Micro-20 version of the operating system, and is intended to be used in conjunction with the manuals supplied by Technical Systems Consultants.

First time users should study the operating systems manuals to familiarize themselves with its basic concepts and features before reading this manual. Once the user is familiar with the basics, this manual can be used as a guide to initial system configuration and operation.

Users who are already familiar with the operating system should study this manual to familiarize themselves with the details of this implementation.

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SECTION 1: HARDWARE REQUIREMENTS

        This section describes the basic hardware configuration supported
by the GMX Micro-20 version of the UniFLEX Disk Operating System.

        A minimum configuration requires a terminal, one 5 1/4" floppy
disk drive, a hard disk controller, and a hard disk drive. The
UniFLEX operating system is supplied on several 5 1/4" floppy disks
which are used to initialize the hard disk and install the operating
system. Once the system is installed, the floppy disk drive(s) are
used for program transfer, data storage, and backup; while the
operating system runs off the hard disk.

                    1-1: Console Terminal

        The system console terminal configuration is the same as the
configuration used for the 020Bug monitor/debugger package in the
Support ROM. Refer to the "GMX Micro-20 Hardware Setup Manual" for
information on console terminal configuration.

                    1-2: Floppy Disk Drives

        The system requires one 80 track (96 TPI) double-sided,
double-density floppy disk drive capable of stepping at 3 milliseconds
per step. This drive must be configured as drive #0 per the drive
manufacturers documentation, and is referred to as device "fd0".

        A second drive, configured as drive #1 may also be used. This
drive may be either 40 (48 TPI) or 80 (96 TPI), single or double
sided, and single or double density. The drive used must be capable
of stepping at 6 ms. per step if a 40 track drive is used or 3 ms.
if an 80 track drive is used. The second drive is referred to as
device "fd1"

Note: If a second floppy disk drive is used, switch S1-4 must be set
to match the track density of the drive used. See the section on
DIP-Switch settings for more information.

        If two drives are used, be sure that only the last drive on the
cable has its terminating resistors installed. Refer to the "Hardware
Setup Manual for more information on drive configuration.

                    1-3: Hard Disk Controllers

        A hard disk controller and at least one hard disk drive must be
used. A second hard disk drive may be used if desired.

        The operating system currently supports the following hard disk
controllers on the SASI interface: the OMTI 20C-1 (OMTI, Campbell CA)
or the XEBEC 1410/1410A (XEBEC SYSTEMS Inc., Sunnyvale CA).

Note: The OMTI 5000 series controllers can not be used due to timing restrictions on the SASI interface.

OMTI 20C-1 controllers must be configured as controller #0 on the SASI interface, and must be programmed for 512 byte sectors.

XEBEC 1410/1410A controllers must be configured as controller #1 on the SASI interface, and must be programmed for 512 byte sectors.

Refer to the "GMX MICRO-20 HARDWARE SETUP MANUAL" and the controller documentation for more information on configuration.

1-4: Hard Disk Drives

The operating system will support one or two drives, which may be any combination of drives that are compatible with the controller used. The characteristics of each drive are given to the operating system during the system initialization procedure.

The first drive must be programmed as drive #0 (LUN 0), per the drive manufacturers documentation, and is referred to as device "w0" The second, if used, is programmed as drive #1 (LUN 1), and is referred to as device "w1". If two drives are used, be sure that the terminating resistor is removed from one of the drives. The drive with terminators should be the last drive on the cable.

1-5: Streaming Tape Controller

The Operating System supports a Streaming Tape device for mass storage backup. The streaming tape subsystem shares the SASI interface with the hard disk controller.

The operating system currently supports only one type of tape controller: the Emulex Model MT02 (Emulex Corporation, Cost Mesa, Ca). This controller interfaces to a variety of 1/4" streaming tape drives through a "QIC-36" interface.

The tape controller connects to the GMX Micro-20 through the same 50-pin cable as the hard disk controller. The tape controller must be programmed for device address 02 and the parity check option on the board must be disabled. Figure 1-1 shows the proper configuration of the DIP-Switch (SW1) on the tape controller. (Refer to the Emulex MT02 Technical Manual for further configuration information.)

Emulex MT02 – Switch SW1

1	.2	3	4	5	6	7	8
OFF	ON	OFF	OFF	X	X	X	OFF
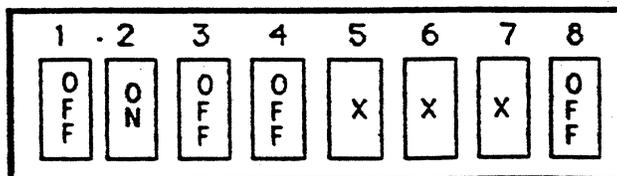
X = Set as required for drive used.

Figure 1-1

When more that one device is connected to the SASI interface, the bus terminators on all but one of the devices must be removed. Only the last controller on the interface cable should have terminators installed. Since the terminators are not easily removed from some hard disk controllers, and since the MT02 does not normally have terminators installed (terminators are provided, but not installed), the easiest way to arrange the boards is to locate the MT02 in the middle of the cable, and the hard disk controller at the end. Note: Before connecting the controllers, check to be sure that the terminators are not installed on the MT02.

1-6: Streaming Tape Drives

The operating system is capabe of supporting any tape drive that is compatible with the Emulex MT02 controller. Compatible drives include the Archive Scorpion (Archive Corp., Costa Mesa, Ca), and the Kennedy 6500 (Kennedy Co, Monrovia, Ca). For information on other compatible drives, refer to the MT02 documentation.

. The drive and controller should be configured and connected in accordance with the manufacturer's documentation.

SECTION 2: SUPPORT ROM

The GMX Micro-20 Support ROM for the UniFLEX operating system includes the GMX version of Motorola's 020Bug monitor/debugger, hardware diagnostic firmware, and the necessary firmware to bootstrap the disk operating system from either the floppy or hard disks.

This section describes the functions of the operating system portion of the Support ROM. Refer to the "020Bug User's Manual" and the "GMX Micro-20 Hardware Setup Manual" for information on 020Bug and the diagnostics.

2-1: DIP-Switch Options

There are several Support ROM options that are selected by DIP-Switch S1 on the GMX Micro-20. Control can be passed to the operating system in one of two ways. If 020Bug is enabled (S1-1 ON), control is passed by executing the 020Bug command "OS". If 020Bug is disabled (S1-1 OFF), control passes directly to the operating system on power-up or reset. Figure 2-1 lists the functions of each section of DIP-Switch S1. Refer to the "Hardware Setup Manual" and the "020Bug User's Manual" for more information on switches S1-1 and S1-2.

DIP-Switch S1-3 is not used by the current version of the operating system.

DIP-Switch S1-4 determines the track density and stepping rate of the second floppy disk drive if two drives are used. Setting S1-4 OFF selects the 80 (96 TPI) mode and sets the stepping rate to 3 milliseconds per step. Setting S1-4 ON selects the 40 track mode and a stepping rate of 6 ms. per step.

Note: S1-4 does not affect the first drive, "fd0", which must be an 80 track drive, capable of stepping at 3 ms. per step.

DIP-Switch S1-5 selects the operating mode for the operating system bootstrap loader. If S1-5 is OFF, the "manual mode" is enabled. If S1-5 is ON, the "auto-boot mode" is enabled.
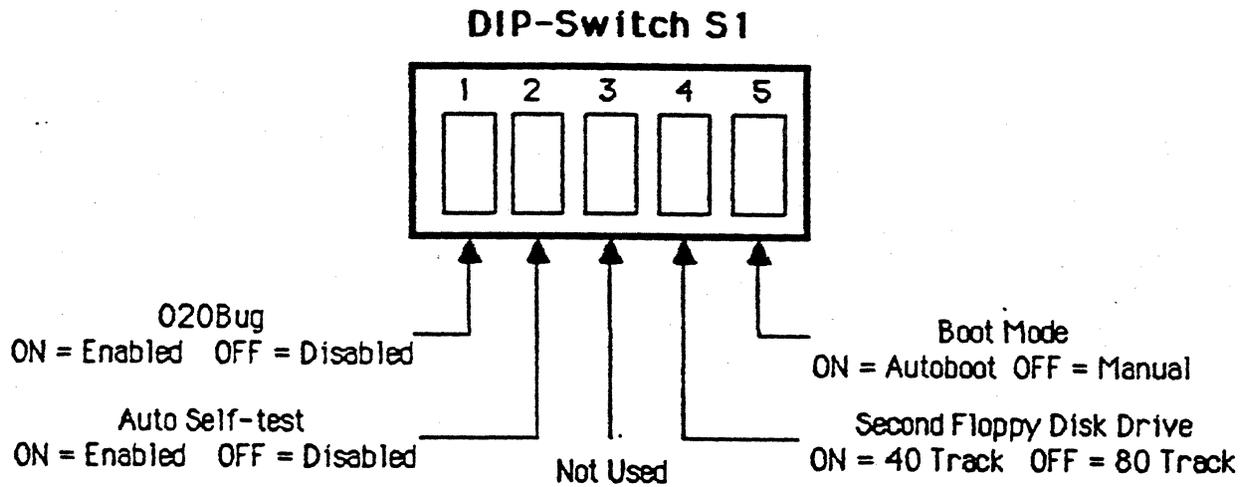
DIP-Switch S1

| 1 | 2 | 3 | 4 | 5 |

020Bug
ON = Enabled   OFF = Disabled

Auto Self-test
ON = Enabled   OFF = Disabled

Not Used

Boot Mode
ON = Autoboot OFF = Manual

Second Floppy Disk Drive
ON = 40 Track OFF = 80 Track

Figure 2-1

2-2: Manual Bootstrap Mode

In the "manual mode" the user chooses the device from which to load the operating system, or one of the other options listed below, by entering commands from the console terminal. Commands are entered by typing the character or characters shown in the list. This mode is used initially to load the operating system from the supplied floppy disks. The following commands are available in the "manual mode":

Command	Action
D	Switch to the 020Bug monitor/debugger
M	Display the amount of RAM found
<esc>B	Load from disk

This command prompts for a
device name and the name of
the file to load, entered in
the following form:

dev:filename

A carriage return, in response
to the file name prompt, is the
equivalent of entering:

w0:uniflex

| ctrl-A | Begin execution of the program
loaded by the "<esc>B" command |

2-3: Auto-Boot Mode

The "auto-boot mode" mode is the normal mode of operation, once the system has been initialized on the hard disk. In this mode the system will automatically boot from the hard disk (device "w0") on power-up or reset; unless interrupted by entering a "control-C" from the console terminal.

Interrupting the auto-boot sequence with a ctrl-c, causes the system to enter the "manual mode" of operation.

SECTION 3: SYSTEM CHECKOUT AND INITIALIZATION

This section describes the procedures for initializing the hard disk with the operating system software. Once the hard disk has been initialized, the system is re-booted from the hard disk and the remainder of the software is transferred to the hard disk.

3-1: Hardware Checkout

Before the operating system is initialized, the basic functions of the hardware should be checked, using the diagnostic firmware in the Support ROM. The diagnostic procedures are described in the "Hardware Setup" and "020Bug" manuals. Figure 3-1 shows the recommended initial configuration of DIP-Switch S1 for the checkout and initialization procedures.

Recommended Initial DIP-Switch Settings

S1

```
┌───┬───┬───┬───┬───┐
│ 1 │ 2 │ 3 │ 4 │ 5 │
├───┼───┼───┼───┼───┤
│ O │ O │   │   │ O │
│   │ F │ X │ X │ F │
│ N │ F │   │   │ F │
└───┴───┴───┴───┴───┘
```
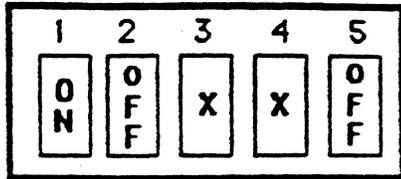
1 = ON   020Bug Enabled
2 = OFF   Auto-selftest Disabled
3 = X   Don't Care
4 = OFF   If second floppy is 80 track
    ON   If second floppy is 40 track
5 = OFF   Manual Boot Mode

Figure 3-1

Once the diagnostics have been completed, use the 020Bug command "OS", or turn switch S1-1 OFF and reset the system, to begin initialization of the operating system. If the hardware fails any of the diagnostics, the cause of the failure must be located and corrected before proceeding.

3-2: Operating System Initialization

On entering the "manual mode" of operation, the following message is displayed:

MICRO20 UniFLEX ROM xx/xx/xx

The ROM then waits for a command input. Entering an upper-case "M" should display the amount of RAM in the system which is 2 Megabytes.

Insert the disk labeled "UniFLEX Floppy System Disk" in drive #0 and enter the command "<esc>B" (escape key followed by an upper-case "B"). The system will display:

$Boot from disk
File name?

Enter the following in response to the prompt, followed by a carriage return:

        fd0:uniflex

The operating system will now load from the floppy disk. As it is loading, three lines of information will be displayed. After the third line is displayed, the load is complete and the ROM waits for another command. Enter the command control-A to start the operating system.

     The operating system will display its sign-on messages, followed by the prompt "++". The next step is to format the hard disk and transfer the operating system to it. A shell script called "crdisk" is provided to simplify the initialization procedure.

     The shell script "crdisk" formats the hard disk and then builds an initial file system on the disk. It requires two command line parameters. The first parameter is passed to the "format" utility to indicate the type of hard disk used; the second specifies the amount of space to be reserved on the disk for paging.

     In the following command, the "M" option causes "format" to prompt for the disk drive model with the option of examining a list of pre-defined models. Information for drive models that are not pre-defined can be determined from the drive manufacturers documentation and entered manually. The second parameter specifies the number of cylinders to be reserved on the disk for paging space. Refer to the section on memory usage for information on determining the amount of paging space required and replace "xxx" with the desired amount.

     Enter the command: *to avoid media format use crdisk1*

        /etc/crdisk M xxx   (xxx = paging space, see text)

     When "crdisk" has finished, and the "++" prompt is again displayed, stop the system by entering the following command:

        /etc/stop

The system will display:

        MICRO20 UniFLEX ROM xx/xx/xx

At this point the system is ready to be booted from the hard disk. The remaining floppy disks are then copied to the hard disk to complete the initialization procedure. To boot from the hard disk either turn switch S1-5 ON (to enable auto-boot mode) and reset the system, or enter the command "<esc>B", followed by a carriage return (which selects the default file "w0:uniflex") and, after the system is loaded, enter a control-A.

The operating system will prompt for the insertion of the floppy disks containing the rest of the operating system files. Follow the prompts, inserting each disk as requested. When all of the disks have been copied, the system will request configuration information for each of the serial ports.

At the completion of the configuration procedure, the system will "shutdown" automatically, and is ready for normal operation. If the auto-boot mode is enabled (S1-5 ON) the system will reboot after a slight delay (approximately 30 seconds). If switch S1-5 is not already ON, it can be turned ON so that the system will boot automatically on power-up or reset.

Any additional software can now be installed using the information provided with the disks and in the operating system manuals.

SECTION 4: SYSTEM SHUTDOWN PROCEDURES

Normally, the system should NEVER be reset or powered down while the operating system is running, as damage to the data and/or file structure on the disk(s) may occur. Before the system is reset or powered-down the operating system should be shut down using the procedures described in the manuals.

When the operating system is shut down, and the "auto-boot" mode is enabled, the system will automatically reboot; unless the boot is aborted by a control-C. If the system is to be powered down, use control-C to abort the auto-boot process, and turn the power off after the "MICRO20 UniFLEX ROM" message is displayed.

When the system is shut down in the "manual boot" mode, the power can be turned off when the "MICRO20 UniFLEX ROM" message is displayed.

SECTION 5: SERIAL PORTS

Up to three terminals or other devices (in addition to the console terminal) can be connected to the serial ports on the GMX Micro-20. Up to sixteen additional serial ports (20 ports total) can be provided by using one or two GMX SBC-8S 8-port Serial Interface boards.

The baud rates and other characteristics of the serial ports are determined by the "ttyset" parameters in the operating system. Ports 0, 1, 2, and 3 on the GMX Micro-20 correspond to devices "tty00",

"tty01", "tty02", and "tty03" respectively.

The supplied "ttylist" only includes the four ports on the GMX Micro-20. If SBC-8S expansion ports are used, the appropriate devices must be added to the list. From lowest to highest adddress, the expansion ports correspond to devices "tty04", "tty05", ..., "tty19".

All of the serial ports support hardware flow control (handshake) for output from the computer. Handshake can be implemented by connecting the "CTS" input on the GMX Micro-20 serial interface to the appropriate output (usually "DTR" or RTS") on the terminal. Hardware flow control for input to the computer is not supported. If input control is required, XON/XOFF must be used. Refer to the hardware manuals for more information on serial port connections.

Software flow control (XON/OFF) is also supported for both input and output from the computer.

SECTION 6: PARALLEL PRINTER PORT

The operating system supports a parallel printer through the parallel I/O port on the GMX Micro-20. The interface is compatible with most printers that use a "Centronics-type" parallel protocol. The parallel printer is device "ppr".

SECTION 7: MEMORY USAGE

7-1: Task Size Limitations

Because the GMX Micro-20 does not have hardware memory management facilities, the operating system uses a software memory management scheme that divides the 2 megabyte RAM space into two sections.

The lower 512K bytes of RAM are reserved for user task execution. Individual user tasks must fit within this area and are therefore limited to a maximum of 512K bytes each. Depending on the amount of paging space reserved on disk, up to 128 user tasks of 512K bytes each can be run simultaneously. (Refer to the "Disk Paging Space" section.)

Of the remaining 1.5 megabytes of RAM, the operating system itself occupies approximately 200K bytes. This leaves approximately 1.3 megabytes of RAM, which the operating system uses to "page" user tasks. As each user task becomes the "current" task, it is moved from the paging space into the lower 512K execution area. When the task's time-slice expires, it is moved back to the paging space, and the next task is moved into the execution area.

If the combined size of the user tasks exceeds the 1.3 megabyte RAM paging space, tasks are swapped to and from disk as required. A special area on the disk is reserved at format time for paging space.

7-2: Disk Paging Space

The ultimate size and number of active user tasks is determined by the amount of paging space reserved on the hard disk. (Up to the maximum of 128 tasks of 512K bytes each.) The amount of paging space allocated on the disk, combined with the 1.3 megabytes of RAM paging space, must be large enough to hold all of the user tasks which are expected to be run simultaneously.

For example, if the user expects to run sixteen tasks, and each task requires 128K bytes of memory, then 16 * 128K (2 megabytes) of paging space are required. Subtracting the 1.3 megabytes of RAM paging space leaves .7 megabytes (640K) which is the minimum amount of paging space that must be reserved on the disk.

The amount of paging space reserved on the disk is determined by a parameter passed to the "format" command when the disk is initialized. The parameter specifies the paging space in "cylinders". The size (in bytes) of a "cylinder" depends on the characteristics of the hard disk drive used.

To calculate the size of a disk "cylinder", the following formula is used:

<Sector Size>*<Sectors/Track>*<Number of Heads> = <Cylinder Size>

The operating system uses 512 byte sectors, and there are 17 sectors per track so the formula becomes:

512 * 17 * <Number of Heads>

    or:

8704 * <Number of Heads> = <Cyl. size>   (in bytes)

The number of heads on a particular drive can be determined from the drive manufacturer's documentation.

Once the size of a "cylinder" has been determined as described above, the number of cylinders that must be reserved is determined by calculating the expected total amount of paging space required, subtracting the 1.3 megabytes of RAM paging space, and dividing the result by the cylinder size.

(<Space Needed> - <1.3 Mbyte>) / <Cyl. Size> = <Cylinders Needed>

Since the amount of paging space on the disk is not easily changed (currently, the disk must be reformatted), sufficient paging space should be reserved to allow for possible future needs. However, space reserved for paging can not be used for other purposes and excess paging space should be minimized to provide the maximum amount of usable disk space.