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Using GR8BIT Storage Subsystem

This KB0006 article is applicable to the storage subsystem microcode version 1.0b and above

Overview: Storage Subsystem allows you to use standard 1.44MB floppy drives to load and store information. Storage subsystem is located on the GR8BIT Integrated I/O board. GR8BIT platform *can* start up without storage subsystem installed.

Terminology:

- *MB* in this article stands for Megabyte (2^{20} bytes); *kB* stands for kilobyte (2^{10} bytes); *FS* stands for FAT Sectors; *p.c.* stands for Per Copy.
- *Standard format* refers to the 1.44MB diskette format which is made using contemporary software and hardware (e.g. Windows XP system), and utilizes diskette space to the maximal extent. Standard format features 9 sectors per FAT copy.
- *Compatible 1.44 format* refers to the 1.44MB diskette format which, while still has 1.44MB usable space, has only 3 or less sectors per FAT copy, and thus increased number of sectors per cluster.
- *Compatible 720 format* refers to the 720kB diskette format which is readable and writeable on the controllers with maximal transfer speed of 250kB/s (e.g. original MSX systems).

Support statement: Currently supported configurations include

- 1.44MB 3.5" HD drives; 5.25" drives are *not* supported
- 1.44MB formatted diskettes C:80/S:18/H:2
- 720kB formatted diskettes C:80/S:9/H:2
- Logical formats supported are:
 - ✓ Standard 1.44 (1 sector per cluster, 9 FAT sectors p.c., 14 directory sectors)
 - ✓ Compatible 1.44 (4 sectors per cluster, 3 FAT sectors p.c., 7 directory sectors)
 - ✓ Compatible 720 (2 sectors per cluster, 3 FAT sectors p.c., 7 directory entries)

GR8BIT storage subsystem can work with other logical formats, given that these formats do not exceed 9 sectors per FAT copy in Standard mode and 3 sectors per FAT copy in Compatible mode. This constraint is due to the space allocated in the upper RAM for keeping a copy of FAT (file allocation table). In Standard mode this space is $512 \times 9 = 4608$ bytes per logical drive and in Compatible mode is $512 \times 3 = 1536$ bytes per logical drive. You can see that booting your GR8BIT in Compatible mode frees 6144 bytes of the upper RAM, but makes standard 1.44 diskettes unusable.

Information about media configuration is loaded from media's boot sector.

Media descriptors: 1.44MB formatted diskettes use media descriptor 0F0h; 720KB formatted diskettes use 0F9h. These descriptors exist for compatibility reasons and they are *not* used by the GR8BIT storage subsystem driver for identification of media logical configuration.

Booting the system: when you boot the system and if GR8BIT storage subsystem ROM (disk-rom) is enabled (see position of I/O board's JP3 jumper), you will see the storage subsystem initialization screen (fig. 1). Driver checks for number of physical drives ("phy" – can be 0, 1, 2 or "error"), and number of logical drives ("log" – can be 1 or 2).

A screenshot of a text-based initialization screen. The text is white on a black background. It displays copyright information for MSX LC (1984) and E. Brychkov (2011). It provides instructions to use the GRAPH key to change mode and the CTRL key for phantom drives. It reports 1 physical drive and 2 logical drives, and sets the mode to Standard with 9FS.

```
disk ROM (c) 1984 MSX LC
Driver (c) 2011 E. Brychkov
[GRAPH] to change mode
[CTRL] for no phantom drive
Drives: 1 (phy), 2 (log)
Mode: Standard, 9FS
```

Figure 1. Storage subsystem initialization screen

Number of physical drives depends on the floppy disk drives you have physically connected to the controller. Please use standard PC FDD twisted ribbon cable for connection.

If you have only one drive number 0 connected to the floppy disk controller (FDC), number of logical drives will be 2 (two) with upper RAM space allocated for two logical drives' FAT copies. The second drive is called "phantom drive" and

will be available through drive letter "B:". When transferring data between drive "A:" and phantom drive "B:", driver will be asking to insert respective logical diskette into the single drive installed:

**Insert diskette for drive X:
and strike a key when ready**

where X is a logical drive (and thus diskette) identifier. A "key" to strike can be space bar or Enter key, please do not use control keys if you wish to continue operation.

You can disable phantom drive by holding CTRL key during driver's initialization. In this case drive letter B: will be unavailable, and there will be upper RAM space equal to one copy of FAT available for programs.

Mode can be selected by holding GRAPH key (or ALT key for PS/2 keyboard) during driver initialization. If you do not hold GRAPH key, driver will initialize all its logical drives with 9 sectors per FAT copy; if you hold GRAPH key, it will initialize with 3 sectors per FAT copy. It is not possible to change storage subsystem mode after initialization of the driver.

Important: ensure that you press CTRL and/or GRAPH keys after keyboard and its controller had finished its initialization (approximately 4 seconds after power on). Please also note that other subsystems (like GR8BIT language pack) may query these keys to identify their mode requested, thus, if you need to configure GR8BIT storage subsystem, you should use abovementioned keys at the start of subsystem initialization, and release them at the completion of its initialization.

In general, upper RAM workspace used by the driver can be summarized in the following table:

CTRL key	GRAPH key	Bytes used	Notes
Released	Released	9216	
Released	Pressed	3072	You can't use 9 FAT sectors formatted (Standard) diskettes
Pressed	Released	4608	Logical drive B: is not available
Pressed	Pressed	1536	You can't use 9 FAT sectors formatted (Standard) diskettes and logical drive B: is not available

Interoperability with other disk subsystems: GR8BIT storage subsystem uses DOS1 non-mapped kernel, and potentially can support other devices' disk drives.

Software compatibility: functionality of the disk driver is fully transparent to the user and compliant with the MSX system requirements. There

will be no issue with software which uses documented system calls to work with disk subsystem.

GR8BIT system has size of DPB was changed from 21 byte to 25 bytes to hold physical diskette configuration data, and standard system calls will return proper pointer to the specified drive's DPB.

There was application software identified which directly calls disk ROM driver by the specific address, and such software may not work properly.

Formatting diskettes for use: you can use GR8BIT to prepare your diskettes for use with GR8BIT storage subsystem (and other compatible PCs), and you can use your PC with Windows OS running; but there's a difference, which is explained below.

Important: formatting diskette will erase all the data stored on it.

You can format using Windows OS format command, using 1.44MB diskette size or 720kB diskette size.

1.44MB diskette: ***format a:/u/t:80/n:18***

720kB diskette: ***format a:/u/t:80/n:9***

but these diskettes can't be used to boot GR8BIT (and any other MSX computer) because they will have Windows x86 bootstrap code written in the boot sector, unless for load raw image onto the diskette media which contains valid boot record.

To make a bootable diskette, please use GR8BIT built-in ***format*** command

From MSX-DOS: ***format***

From BASIC: ***call format***

```
MSX BASIC Version 3.0
Copyright 1988 by Microsoft
17287 Bytes free
Disk BASIC version 1.0
Ok
call format
Drive name? (A,B) a

1 - Standard 1.44 (9FS)
2 - Compatible 1.44 (3FS)
3 - Compatible 720 (3FS)
4 - Cancel format
? ■

color auto goto list run
```

Figure 2. Disk formatting command dialog

The GR8BIT format routine dialog is shown on fig. 2. If you have only one physical drive and disabled phantom drive B: then "Drive name" section of dialog will be skipped. Selecting option (1) will format diskette with 18 sectors per track, 1 sector per cluster (logical storage unit), 9 FAT sectors per copy as it would be on your Windows OS system. Selecting option (2) will format diskette with 18 sectors per track, 4 sectors per cluster, 3 FAT sectors per copy. Selecting option (3) will format diskette with 9 sectors per track, 2 sectors per cluster, 3 FAT sectors per copy as it would be on your MSX system.

In all three cases proper bootstrap code, with respective diskette media configuration, will be loaded into the boot sector, and diskette will be bootable (options 1 and 2 – on GR8BIT only, option 3 – on GR8BIT and on MSX system).

Up to the point shown on fig. 2 you can press CTRL-STOP or CTRL-C to abort formatting command. Above this point abortion is not possible, and you should wait for diskette format completion otherwise diskette will be unreadable on any system.

End of KB0006 "Using GR8BIT Storage Subsystem".