OS9/68020
Installation Manual

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OS9/68020 Information Version 2.4

PT68K5 System Requirements

- 4MB DRAM
- IDE - Mass Storage Hard Disk, SSD, SD, etc
- GoTek with Flash Floppy firmware
- MK48T02 clock chip must be installed
- MC68681P Must be installed
- MC68230 PIA is required to support parallel printer

RS232 terminal connected on COM1

or

ET4000 VGA with XT keyboard or AT2XT keyboard converter

Installation of OS9/68000

1. Install the OS9 ROM in socket U1. Use caution when installing the EPROM. If installed backwards, the EPROM will be destroyed.

2. **For OS9 and REX USERS:** Your computer will start up under the MONK monitor. You may select the OS9 boot menu by selecting option 'O' on the MONK command list.

3. **FOR OS9 WITHOUT MONK:** Your computer will display the OS9 boot menu automatically on power up.

4. The OS9 boot menu will appear simultaneously on the VGA monitor and an RS232 terminal connected to COM Port 1. A sample of the boot menu is shown below.

- On power up, if J6 (On Processor Board) is shorted the system will start the OS9 Boot menu. If J6 is open the system will start the MONK monitor.

On power up, a memory map is made by the OS9 boot ROM. A message "Memory test in progress" is displayed while the amount of memory in your board is determined. While 4MB will only require a few seconds, 128MB of memory will require about 30 seconds to test. At the completion of the memory test, a boot menu will appear.

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          Peripheral Technology
OS9/68020 System Bootstrap V2.4 Rev 6

 1 = Boot from IDE Drive 0
 2 = Boot from IDE Drive 1
 3 = Boot from Floppy Drive 0
 4 = Boot from Floppy Drive 1
 5 = Boot from XT-IDE Controller-Master
 6 = Boot from partition - Master/Slave IDE/XT-IDE
 7 = Set Auto Boot
 8 = Set Default RS232 Baud rate
 C = Start/Stop/Set Clock
 D = Toggle Debugger

Enter choice?
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The boot menu will wait for about 20 seconds for you to enter a boot choice. If no choice is made, the computer will attempt to boot from the auto boot device. The auto boot option allows the computer to restart and run a program with no user intervention after a power failure. When the 'Set Auto Boot' selection is made, the choice is stored in battery backed-up RAM. If no auto boot device was set, the system will restart as if you just turned the computer on.

Choice "8 = **Set Default RS232 Baud Rate**" allows you to select 1200, 9600 or 19200 baud as the baud rate in the RS232 port on power-up. The default baud rate on your OS9 master disks is 9600. If you change the power-up baud rate, it will be necessary for you to modify the appropriate descriptor module and run 'OS9GEN' in order to change the baud rate in OS9 after booting.

Device Drivers

sc68681	RS232 device driver
dc68230	Parallel driver
rb3765	Floppy disk driver for 37C65
rbsd	Driver for PT XTIDE controller installed in XT slot
rbide16A	Driver for internal IDE controller - supports LBA mode drives
rbide16	Driver for internal IDE Controller - Old driver, provided for upgrade only
vgakbd	ET4000 VGA card and IBM keyboard driver

/term	Terminal descriptor for RS-232 COM1 or VGA - depends on files in OS9Boot
/t0	Terminal descriptor for RS232 on COM1 - only when using a VGA for /term

/t1 Terminal descriptor for RS232 on COM2
/t2 Terminal descriptor for RS232 on COM3
/t3 Terminal descriptor for RS232 on COM4
/p Parallel printer descriptor port 1 MC68230
/p1 Serial printer descriptor RS232 COM2
/h0 Hard disk descriptor (drive 0) - 4GB partition 0
/h1 Hard disk descriptor (drive 1) - 4GB Partition 0
/d0 Floppy drive 0
/d1 Floppy drive 1
/s0 Descriptor for IDE device on XTIDE controller - 4 GB
/dd Descriptor for default device

The /dd descriptor (default disk) may refer to a floppy, a hard disk, a device on the XTIDE controller or a ram disk depending on the OS9 Boot file. The descriptor will be listed in the form dd.d0, dd.h0, dd.r0, dd.s0 etc. These descriptors are located in the CMDS/BOOTOBJS directory.

OS9 can be configured to support either RS232 or an ET4000 video card as the main terminal on power up. The /TERM descriptor is the default communication device for OS9 after boot. The difference between these configurations is the assignment of the initial system terminal. Either configuration may be converted to the other by editing a list of boot files and using OS9GEN. This will create a new configuration of OS9. The RS232 system terminal if present should be connected to COM1. The terminal should be configured for 9600 baud and 1 stop bit.

New configurations of OS9 may be created by using the BOOTFLOP or BOOTWIN files found in the /h0/CMDS/BOOTOBJS directory. These files contain a list of modules that are to be included in a bootfile. The list of files may be edited and modified as the user requires. A new version of OS9 can be created by using one of the following commands:

OS9GEN -z=bootwin -b=192 -e /h0 Put new version of OS9 on Hard Drive h0
OS9GEN -z=bootflop -b=192 -e /d1 Put new version on Floppy Drive 1
OS9GEN -z=bootflop -b=192 -e /d0 Put new version on Floppy Drive 0

You must be certain to use the appropriate descriptor for the default device "/dd". That is to use dd.d0 if you want to boot from d0 or dd.d1 if you want to boot from d1. While there are several common descriptors in the BOOTOBJS directory you may need to create others. Using moded is the fastest way to create a new descriptor. Use one of the existing descriptors, copy it to a new file name and modify with moded to suit your needs.

The files that are included in the bootwin or bootflop must match your desired system configuration and the list of files may need to be modified. You may make other file lists to contain the files used for other boot configurations. Such as BootSD to have a list of boot files for use with the XTIDE controller. There may be other boot lists in the cmds/bootobjs directory. If present they will have a descriptive name to describe the configuration they are for.

Study the OS9 User's Manual to learn how the OS9GEN and MODED commands work.

XTIDE Controller

The XTIDE controller is an IDE controller that plugs into an ISA expansion slot of the PT68K5 computer. This controller works with IDE compatible drives. This includes SD memory card to IDE adapters, compact flash to IDE adapters, SSD hard drives with SATA to IDE adapters and ordinary rotational IDE drives. The drive used must support LBA mode. This should not be a problem since most drives sold since the early 2000's support LBA mode. The IDE cable should be a 40 conductor cable and not the 80 connector cable this is common today. The 80 conductor cable will switch *some* IDE drives to a bus speed that is beyond the capability of the PT68K5. The assumption is that the XTIDE controller would be used for backup purposes using an SD card to IDE adapter. This allows a cheap SD memory card to back up the main drive on the internal IDE port. However the XTIDE will transfer data faster than the IDE drives that were available when the PT68K5 was released in 1992. The OS9 boot ROM has been upgraded to allow booting from the XTIDE controller.

Software Considerations for OS9 and REX

While possible to share REX and OS9 on the same hard drive, we do not recommend doing so. It is far too easy to make a mistake in either REX or OS9 that will destroy the other. IDE devices are very cheap today, so there is no need to take the risk of trying to share a drive. In the past there were always issues when sharing a drive between REX and OS9. A reformat of the hard drive of one of them could require work to make the other bootable again.

OS9/68000 with REX

If running REX from a hard disk, the drive for REX should be installed as a "Master" on the internal IDE port. OS9 can boot as a "Slave" device by making an appropriate Boot file for OS9. Currently the only configuration of REX available is for one brand and size of compact flash card.

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Installing OS9

If you received a USB memory stick with your order**, BACK IT UP** on your PC before starting.

You will need these items:

A GoTek drive with Flash Floppy firmware update and OLED display modification
The additions to add to GoTek's IMG.CFG file for support of OS9 disk images.
The OS9 Boot image file for the GoTek
A USB memory stick to use with the GoTek
An IDE mass storage device on the internal IDE interface. This drive must be at least 4GB in size and support LBA mode.

There are two installation scripts for OS9:

install.os9.h0
install.os9.h1

Both scripts are for use with RS232 terminals. The installation script file will format a 4GB partition numbered as 0 when it is run, and then copy all files from the boot floppy to the hard drive. It will then do an OS9GEN using the 'q' option to link the appropriate OS9 Boot file. Assuming you had no error messages, OS9 is installed and bootable.

When FORMAT asks for Surface format or verify - respond no. These options don't provide any useful benefit on a modern drive and will take much longer. Instead of a few minutes, the format will take a couple of hours.

OS9 Descriptor and Partition Information

When the PT68K5 was released, 100MB drives were not common. There was no need to partition a drive for OS9 since OS9 would support drives up to 4GB on drives using 256 bytes per sector or 8GB on drives that used 512 bytes per sector. With 1TB drives being the entry point for rotating drives and 120GB being about the minimum for SSD drives, it's clear that some method must be used to allow more of the drive to be used. Fortunately there are enough parameters in the OS9 descriptor to allow supports for many partitions per drive. The rbide16a driver was written to allow this to work. LSN 0 on the drive is always reserved and can't normally be accessed. The rbide16a drivers always adds one to the LSN that is requested by OS9. LSN 0 is reserved for future use to allow for easier booting from other partitions. For system driver developers this sector can be accessed by issuing a read/write of LSN $FFFFFF. When the driver gets the LSN, it will increment it by 1. Since this is a 24 bit value, it will

become 0 after the driver adds 1 to it, and you can now read/write the reserved sector.

What parameters are required of a descriptor for the rbide16a driver?

Drive number - becomes the partition number
LSN offset - This is a 32 bit value
SCSI ID - 0 = Master 1 = Slave

OS9 uses drive numbers to allow RBF to keep track of what drives are being accessed. It is necessary to convert the drive number to a partition number to allow access of more than one partition simultaneously. The number of partitions that can simultaneously be accessed can't be unlimited and you should use no more than 8 at a time. Since the drive number can no longer be used to select the drive, the SCSI ID parameter is used to select between master and slave drives.

For LSN offset's I suggest that you use 4 GB partition sizes.

LSN offsets

Partition	Offset
0	0
1	$800000
2	$1000000
3	$1800000
4	$2000000
5	$2800000

Although any offset can be used, the boot ROM can only boot from partition numbers based on 4GB partition sizes. That is Partition 1 will boot from LSN $800000 and Partition 2 from LSN $100000 and so on. If you don't need to boot from other partitions you can use any LSN offset you want.

Partition 0 must use an LSN offset of 0 or it won't be bootable.

Do not use partition numbers greater than 10. The maximum number of drives is determined by how the drivers were linked and **OS9 does not do error checking** for an excessive drive number.

The easiest way to setup a descriptor is to copy it to a new name and use moded to modify it. Remember if you don't put a $ in front of the entered number, OS9 will assume a decimal number.

Other considerations: Format works with Heads/Sectors per track and cylinders. You must make sure that whatever numbers you enter for these parameters doesn't exceed the total LSN's you allocated for a partition. Generally you will have a few unused sectors in a partition because the math of Heads * Sectors * cylinders = LSN's won't quite match the number of LSN's in your partition.

Partition sizes: Since all modern HD's use 512 byte sectors, OS9 can support an 8GB partition. OS9 supports 24 bits of LSN's; this is 16,777,216 sectors - 1. The "-1" is because of the reserved system LSN. This works out to 8,589,934 bytes or 8GB - 512 bytes.

RBIDE16 and RBIDE16A Driver

The rbide16 drivers are included only to allow copying files from an old OS9 formatted drive to a new drive. The rbide16 driver issued a "set parameters" command before using the drive. Most modern drives do not work well or reliably or, in some cases, work at all when using this driver. The older the drive, the more likely it will work. Modern drives work by simply telling the drive what LSN to read/write. Since OS9 works by using LSN's a new driver was created getting rid of all the Heads, Sectors, cylinder parameters. Deleting all the calculation to find a sector on a Heads, Sectors, cylinders drive made the driver smaller and much faster.

You cannot boot a HD that uses RBIDE16 with a boot rom that has a 2020 or newer date.

You can have both the rbide16 and rbide16a drivers loaded at the same time. With appropriate descriptors you can use dsave to move your files from the old drive to the new.

General Notes and Information

How do I get umacs to work? I keep getting an error message 'Environment variable TERM net defined'.

You must set the environment variable. If you use a password to log-on you may set the environment variable automatically at log-on. If you are starting with the release disks it is necessary to enter the following command before using umacs:

setenv TERM V1 - the **TERM** and **V1** must be in upper case.

The V1 will work with VGA terminals. If you are using an RS232 terminal you must create a termcap file to match your terminal. NOTE: there are several terminal types supplied with OS9, and one of the types may match your terminal. See the umacs manual for more information.

The information below is outdated and no longer works since the descriptors don't have all of the entries present to create a working descriptor. You should copy a descriptor to a new name and use moded to make a modified descriptor. The information below was left for historical reasons. This was how it was done in the 90's.

I have modified the h0.a descriptor to match my drive and made a new 'OS9Boot' using OS9Gen. I still can't get OS9 to boot from the hard disk.

You probably manually assembled and linked the h0.a descriptor. You should use the 'MAKE' utility. A sample line is shown below. OS9 uses dd.h0 for the Winchester description. If you manually assemble and link h0.a you did not get the dd.h0 file that is required by OS9. The Make utility creates 'h0' and 'dd.h0' and places them in the /h0/CMDS/BOOTOBJS directory.

make h0 -u - Note the 'h0' must be entered in lower case.