

Installing 640K on the XT Motherboard

This section describes how to install 640K of RAM on the system board in the IBM XT and the IBM portable. IBM offers this upgrade in the form of a new Type 2 XT motherboard. IBM invented this upgrade much earlier, but they held the upgrade back for several years after the system was introduced. Many users who purchased the technical reference manual and looked at the schematic diagram did not wait for IBM. They figured out that the modification is performed by installing two banks of 256K chips and two banks of 64K chips directly on the motherboard and installing one additional multiplexer chip and a jumper wire. The jumper wire enables a decoder PAL chip (U44) to modify the chip selects and addressing as required. These modifications are easy to perform.

A memory chip is addressed by two signals called Row Address Select (RAS) and Column Address Select (CAS). These signals dictate where a value is located in a chip. These signals are modified by installing the jumper as indicated in the instructions so that the first two banks can be addressed four times deeper than originally.

Obtain the following parts from any chip house or electronics supply store:

- 18 256K-by-1-bit 200 nanosecond (or faster) memory chips
- 1 74LS158 multiplexer/decoder chip
- Small length of thin gauge jumper wire

After obtaining the parts, proceed as follows:

1. Remove the motherboard. (Instructions for removing the motherboard are provided in Chapter 6.)
2. Plug the 74LS158 chip into the socket labeled U84.

Note that all the components on the motherboard can be identified by a value, consisting of a letter and number combination. The letter usually indicates the type of component, and the number indicates the particular component of that type. This coding sometimes differs among manufacturers. Most manufacturers use a letter scheme that follows these conventions:

- U = Integrated Circuit
- Q = Transistor
- C = Capacitor

- R = Resistor
- T = Transformer
- L = Coil
- Y = Crystal
- D = Diode

The numbering of the components usually follows a pattern in which the numbers increase as you move from left to right along the first row of components and then start at the left side again, one row lower. You should be able to locate all of the IC chips, starting with U1 in the upper left corner of the board and ending with U90 in the lower right corner.

The next step involves inserting a jumper wire that modifies the memory chip select and addressing signals. The following method is the simplest way to accomplish this procedure.

3. Remove the IC installed in the socket labeled U44.
4. Install a jumper wire from pin 1 to pin 8 on U44. To avoid making any changes that cannot be removed later, the jumper can be wrapped directly onto the pins of the IC. Run this wire on the underside of the IC so that the wire is held in place. Reinstall the chip with the jumper in place. The IC may sit slightly higher in the socket, but make sure that it is seated properly.

Be careful with the U44 because this chip is a unique IBM Programmable Array Logic (PAL) chip that cannot be purchased separately. A PAL chip is burned with a unique pattern, much like a ROM chip. The only legal way to obtain this chip from IBM is to purchase a new motherboard. Some chip houses have copied this chip and offer a duplicate for sale. Some also have duplicated the PAL chip with the equivalent of the jumper modification internally programmed, so that you may purchase one of these duplicates and store your original PAL chip.

You also can solder two jumper pins into the plated holes numbered 1 and 2 in the jumper pad labeled E2. Using a standard plug-on jumper, install the jumper across these two pins. All XT Type 2 motherboards already have this modification performed, courtesy of IBM.

5. Remove the 18 64K-by-1-bit chips from banks 0 and 1. Reinstall them in banks 2 and 3 if 64K chips are not already in these banks or store them as spare chips.

6. Install the 18 256K-by-1-bit chips in banks 0 and 1.
7. Be sure that switches 3 and 4 of switch block SW1 are set off.
8. Replace the motherboard and restore all other system components, with the exception of any memory cards.

Remember that you have 640K on the motherboard and no other boards must address that space.

9. Power-up the system and test the installed memory for 640K without other memory adapter cards.

You now have an inexpensive memory upgrade that matches the Type 2 XT motherboard from IBM.

Upgrading the Disk Subsystem

This section discusses adding floppy disk drives and hard disk drives to any system. The interfacing of the different types of floppy drives to a system can sometimes be a problem because of the differences in controllers and support software.

Adding Floppy Disk Drives

If you want to add floppy drives to an existing system, you need to connect them to a controller board. Virtually every PC, XT, or AT comes equipped with at least one floppy disk controller. These controllers and system BIOS routines support different drives.

You have four types of drives to consider when adding to any system: high- and double-density 5 1/4-inch and high- and double-density 3 1/2-inch. In the case of the 5 1/4-inch drives, you may be concerned about the track width differences between 40 and 80 track drives. All 3 1/2-inch drives, however, are 80 track drives and do not share these compatibility problems. Because high-density drives can read and write at the lower density as well, a system with as few as two high-density drives, one 5 1/4-inch and one 3 1/2-inch, can read and write any disk format. When upgrading, therefore, add the high-density drives whenever possible.

A high-density drive uses a higher data rate (500 KHz) than a double-density drive (250 KHz). To properly use these higher density