

## "Shadow" Modification for iCOM Interface Card

The following modification will enable you to "shadow" the ROM and RAM portions of your iCOM interface card over another RAM board, allowing you to expand your RAM beyond the current limit of 48K. In addition to the following modifications to the iCOM interface card, you must use a RAM card which has the "Phantom" feature in the part of memory which overlaps the iCOM card. The modification is compatible with all iCOM software (as long as the ROM remains enabled) and version 2.0 and later of Computer Mart of New Jersey's CP/M for the iCOM Frugal Floppy. Note that CP/M version 2.0 does not require this mod, but the combination of this mod with CP/M version 2.0 will enable you to expand beyond 48K of RAM. The modification adds one I.C. in one of the two unused "footprints" on the iCOM card, and may be disabled by simply unplugging the added chip. The modification results in the following features:

1. Whenever the iCOM PROM or RAM is selected, the S-100 bus line "PHANTOM/" (pin 67) will be pulled low, disabling any other memory board at this address.
2. After power-up or reset, the iCOM PROM and RAM behave exactly as they did before the modification. That is, they are selected whenever they are addressed.
3. The first time a memory write occurs within the range of the iCOM PROM, the PHANTOM/ line will be released and the RAM and PROM sections of the iCOM card will be disabled until the system is reset. Any RAM card which occupies addresses overlapping the iCOM card will function normally, as if the iCOM RAM and PROM were not present.

By making this modification, it becomes possible to create and use up to a full 64K CP/M version 2.0 system with your iCOM disks. The modification is made as follows:

1. Cut the trace between pins 1 and 2 of U2 (74LS30) on the iCOM S-100 interface card.
2. Carefully clean out the solder fill from one of the two unused I.C. "footprints" near the regulators. Install a 14 pin socket in this footprint. Connect pin 7 to the adjacent ground trace, and pin 14 to the adjacent power trace. (Depending on which 14 of the 16 holes here you use, one of these connections will already be made).
3. Interconnect the following pins on the added socket:
  - Pin 1 to pin 5
  - Pin 4 to pin 8
  - Pin 6 to pin 10
  - Pin 9 to pin 13
  - Pin 11 to pin 12

4. Make the following connections between the added socket (Ux) and the indicated I.C.'s on the iCOM card. (Note: "Ux/5" means "Ux pin 5"):
  - U17/8 to Ux/2
  - U10/2 to Ux/3
  - U2/2 to Ux/4
  - S-100 bus pin 75 (RESET/) to Ux/11&12
5. Connect a 1N270, 1N277 or similar **Germanium** switching diode with its cathode to U17/6 and its anode to S-100 bus pin 67 (PHANTOM/). If you like, you can mount the diode across two pins of the second spare footprint and run wires to U17/6 and S-100 pin 67. (This may be more esthetic than just letting the diode hang on the back of the board).
6. Plug a 74LS02 into the added socket. If this chip is omitted, the board should function as if it were not modified.

This completes the modifications to the board. It may be plugged back in now and tested. As was previously mentioned, the board should behave normally unless a memory write occurs in the range of the iCOM PROM (normally C000 to C3FF). After a memory write in this range, the iCOM RAM and PROM should seem to disappear. They should return when the system reset button is pressed.

The modification works as follows: U17/6 goes low during any read operation on the iCOM RAM or PROM. This pin is connected via a diode to S-100 PHANTOM/, thus allowing a "wired or" connection with any other board in the system which generates PHANTOM/. A Germanium diode is required because its low voltage drop is needed to ensure that a valid TTL "low" is produced when the diode is in series with a TTL output (as it is in this case). This will disable overlapping RAM during any memory read of the iCOM card. Two sections of Ux form an R-S latch which is set by the S-100 RESET/ line. The output of this latch is brought to a previously-unused pin of U2. All 8 inputs of U2 must be high for the iCOM RAM or PROM to be selected. The latch is cleared by the simultaneous occurrence of Chip Select for the PROM with S-100 MWRITE. This sends U2/2 low, disabling any further selection of the iCOM card. If Ux is removed, U2/2 should float high, causing the card to operate normally. If you plan on removing Ux for any length of time, a 3.3K pullup resistor should be placed from U2/2 to U2/14 (5 volt supply) for greater reliability.

In deciding to make this modification, be forewarned that this or any other hardware modifications to the iCOM hardware will void iCOM's warranty (if it is still in effect). While the modification described here has been thoroughly field-tested, Computer Mart of New Jersey assumes no responsibility for any consequences of its use.