

structions or memory-bound violations. Naturally, users cannot be permitted to execute instructions which would halt the machine or directly affect the I-O operations; similarly, a user cannot be permitted to transfer data into any memory bank other than the one in which he is currently running. On the other hand, the routines in the Executive memory bank must be able to use I-O instructions and must have access to all memory locations. Since the interrupts initiate only Executive routines, it was convenient to have the interrupt system "enable" and "disable" the privileged-instruction and memory-protection hardware. When an interrupt is honored, the protection hardware is turned off, and all instructions and all memory references are legal. As soon as debreaking occurs, the protection hardware is turned on and the machine runs in "user mode."

The privileged instructions, which a user cannot directly execute, include

- I-O instructions,
- instructions which halt the computer,
- instructions which affect the interrupt system,
- instructions which affect special registers, e.g., the rename registers, and
- instructions which refer to protected memory locations.

Instructions may make references to any address in the memory module in which the instructions themselves are located, or to any address in memory bank \emptyset (the running user's bank) except for registers \emptyset -37 in memory bank \emptyset .

The protected registers in the user bank are used by the Executive software to store information about the