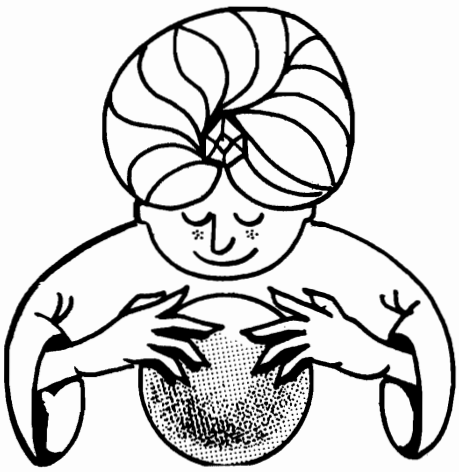

INSIDE THE PROM

By Lance Rose

Accompanying this note are two assembly language programs for North Star's double density disk-controller PROM. The first program is a disassembled North Star PROM commented by Lance Rose; the second includes Rose's modifications for I/0 port addressing, again heavily commented. A third assembly language program, a DOS modified by Rose for I/0 port addressing, is is too long to print in Compass, but will be included on the INSUA library disk for Volume II Number 1 (the present issue) of Compass. Ask for INSUA disk Number 1010.

Readers interested in I/O port addressing should consult **DISKS ON N* I/O PORT** in the previous issue of Compass (Volume I Number 4), by the same author.

```
;NORTH STAR DOUBLE DENSITY DISK CONTROLLER PROM
;
;
        ORG     0E800H
LE800:  MVI     C,0AH           ;Set retry counter to 10
        LDA     0EB15H          ;Turn on motors
        MVI     D,30H           ;Wait 48 sector times
        LXI     H,LE80D
        JMP     LE8D3
LE80D:  LDA     0EA01H          ;Select drive 1
        LXI     H,LE816         ;Wait 2 sector times
        JMP     LE84D
LE816:  MVI     B,0CH           ;Allow 12 sector times to find index hole
LE818:  LXI     H,LE81E         ;Wait for sector pulse
        JMP     LE8D1
LE81E:  LDA     0EB10H          ;Read A-status
        ANI     40H             ;Check for index hole detect
        JNZ     LE82D           ;Found it
        DCR     B               ;No, try again
        JNZ     LE818
LE82A:  JMP     LE82A           ;Didn't find index hole, stop
LE82D:  LDA     0EA21H          ;Set step direction to in
        LDA     0EA31H          ;Step in
        LDA     0EA21H
        JMP     LE84A
```

```
LE839:  LDA     0EB20H          ;Read B-status
        ANI     01H             ;Track zero?
        JNZ     LE852           ;Yes
        LDA     0EA01H          ;No, set step direction to out
        LDA     0EA11H          ;Step out
        LDA     0EA01H
LE84A:  LXI     H,LE839         ;Return to check for track zero
LE84D:  MVI     D,02H           ;Wait 2 sector times
        JMP     LE8D3
LE852:  LXI     H,LE858         ;Wait 1 sector time
        JMP     LE8D1
LE858:  LDA     0EB35H          ;Read C-status
        ANI     0FH             ;Mask off sector counter
        CPI     04H             ;Sector 4?
        JNZ     LE852           ;No, try next sector
LE862:  LDA     0EB10H          ;Read A-status
        ANI     04H             ;PLL enabled?
        JZ      LE862           ;No, keep trying
        MVI     A,09H           ;Time delay
LE86C:  DCR     A
        JNZ     LE86C
        LDA     0EB10H          ;Read A-status
        ANI     20H             ;Diskette double density?
        JNZ     LE897           ;Yes
        LDA     0EA21H          ;Set step direction to in
        LDA     0EA31H          ;Step in to track 1
        LDA     0EA21H
        LXI     H,LE887         ;Wait 2 sector times
        JMP     LE84D
LE887:  LXI     H,LE88D         ;Wait for sector pulse
        JMP     LE8D1
LE88D:  LDA     0EB35H          ;Read C-status
        ANI     0FH             ;Mask off sector counter
        CPI     08H             ;Sector 8?
        JNZ     LE887           ;No, try next sector
LE897:  MVI     B,8CH           ;Set time limit to find sync character
        LXI     D,0EB40H        ;Prepare to read data
LE89C:  LDA     0EB10H          ;Read A-status
        RRC                     ;Sync detected?
        JC      LE8AE           ;Yes
        DCR     B               ;No, try again
        JNZ     LE89C
LE8A7:  DCR     C               ;Decrement retry counter
        JNZ     LE82D
LE8AB:  JMP     LE8AB           ;Tried 10 times, stop
LE8AE:  LDAX    D               ;Read first byte in block
        MOV     H,A             ;Use it for load address
        MVI     L,01H
        MOV     M,A
        RLC                     ;Start CRC check
        MOV     B,A
LE8B5:  LDAX    D               ;Read a byte
        MOV     M,A             ;Store it
        XRA     B               ;Compute CRC
        RLC
        MOV     B,A
        INR     L               ;Increment load address
        JNZ     LE8B5           ;If first 256 bytes, continue
        INR     H               ;Go to next 256 bytes
```

```
LE8BF:  LDAX    D               ;Read a byte
        MOV     M,A             ;Store it
        XRA     B               ;Compute CRC
        RLC
        MOV     B,A
        INR     L               ;Increment load address
        JNZ     LE8BF           ;If more, load it
        LDAX    D               ;Read CRC check byte
        XRA     B               ;Compute CRC
        JNZ     LE8A7           ;If non-zero, retry
        DCR     H               ;Back up 100H for go address
        MVI     L,0AH           ;Jump to load address plus 10
        PCHL                    ;Execute
LE8D1:  MVI     D,01H           ;Wait for sector pulse
LE8D3:  LDA     0EB11H          ;Reset sector flag
LE8D6:  LDA     0EB10H          ;Read A-status
        ORA     A               ;Sector hole detected?
        JP      LE8D6           ;No, loop again
        DCR     D               ;Count # of sectors in D register
        LDA     0EB11H          ;Reset sector flag in case done
        JNZ     LE8D3           ;More sectors to go
        PCHL                    ;Done, return to address in H,L
        DB      00H,00H,00H,00H,00H,00H,00H,00H,00H,00H
        DB      00H,00H,00H,00H,00H,00H,00H,00H,00H,00H
        DB      00H,00H,00H,00H,00H,0E1H,0E9H
        END
```

```
;       North Star double density disk controller prom
;       modified for I/O port addressing
;
LE800   EQU     0E800H          ;Disk controller address
;
        ORG     0E800H
;
LE800:  MVI     C,0AH           ;Set retry counter to 10
        MVI     A,15H           ;Turn on motors
        IN      LE800/100H+03H
        MVI     D,30H           ;Wait 48 sector times
        LXI     H,LE80D
        JMP     LE8D3
LE80D:  MVI     A,01H           ;Select drive 1
        IN      LE800/100H+02H
        LXI     H,LE816         ;Wait 2 sector times
        JMP     LE84D
LE816:  MVI     B,0CH           ;Allow 12 sector times to find index hole
LE818:  LXI     H,LE81E         ;Wait for sector pulse
        JMP     LE8D1
LE81E:  MVI     A,10H           ;Read A-status
        IN      LE800/100H+03H
        ANI     40H             ;Check for index hole detect
        JNZ     LE82D           ;Found it
        DCR     B               ;No, try again
        JNZ     LE818
LE82A:  JMP     LE82A           ;Didn't find index hole, stop
```

```
LE82D:  MVI     A,21H           ;Set step direction to in
        IN      LE800/100H+02H
        MVI     A,31H           ;Step in
        IN      LE800/100H+02H
        MVI     A,21H
        IN      LE800/100H+02H
        JMP     LE84A
LE839:  MVI     A,20H           ;Read B-status
        IN      LE800/100H+03H
        ANI     01H             ;Track zero?
        JNZ     LE852           ;Yes
        MVI     A,01H           ;No, set step direction to out
        IN      LE800/100H+02H
        MVI     A,11H           ;Step out
        IN      LE800/100H+02H
        MVI     A,01H
        IN      LE800/100H+02H
LE84A:  LXI     H,LE839         ;Return to check for track zero
LE84D:  MVI     D,02H           ;Wait 2 sector times
        JMP     LE8D3
LE852:  LXI     H,LE858         ;Wait 1 sector time
        JMP     LE8D1
LE858:  MVI     A,35H           ;Read C-status
        IN      LE800/100H+03H
        ANI     0FH             ;Mask off sector counter
        CPI     04H             ;Sector 4?
        JNZ     LE852           ;No, try next sector
LE862:  MVI     A,10H           ;Read A-status
        IN      LE800/100H+03H
        ANI     04H             ;PLL enabled?
        JZ      LE862           ;No, keep trying
        MVI     A,09H           ;Time delay
LE86C:  DCR     A
        JNZ     LE86C
        MVI     A,10H           ;Read A-status
        IN      LE800/100H+03H
        ANI     20H             ;Diskette double density?
        JNZ     LE897           ;Yes
        MVI     A,21H           ;Set step direction to in
        IN      LE800/100H+02H
        MVI     A,31H           ;Step in to track 1
        IN      LE800/100H+02H
        MVI     A,21H
        IN      LE800/100H+02H
        LXI     H,LE887         ;Wait 2 sector times
        JMP     LE84D
LE887:  LXI     H,LE88D         ;Wait for sector pulse
        JMP     LE8D1
LE88D:  MVI     A,35H           ;Read C-status
        IN      LE800/100H+03H
        ANI     0FH             ;Mask off sector counter
        CPI     08H             ;Sector 8?
        JNZ     LE887           ;No, try next sector
LE897:  MVI     B,8CH           ;Set time limit to find sync character
LE89C:  MVI     A,10H           ;Read A-status
        IN      LE800/100H+03H
        RRC                     ;Sync detected?
        JC      LE8AE           ;Yes
        DCR     B               ;No, try again
        JNZ     LE89C
```