# M-32 MAINTENANCE (MNT) DISPLAY

When the maintenance display (MNT) is selected, any PLC memory address can be monitored on the PLC I/F screen. This screen of the display is similar to, but radically different than, the diagnostic display that is found on earlier MAZATROL CNC's. On the M-32 maintenance (MNT) display you will not find reference to an 8 bit "H" address. Also missing is the "Q" function that was used to force address bits ON & OFF.

The PLC I/F screen is primarily used to check the status of the PLC memory addresses that are used in the PLC ladder sequence. It can also be used to force the memory addresses ON or OFF. How to use this screen will be explained in this section of this book.

The PLC memory addresses and their purpose in life are listed below....

). "X": INPUTS TO THE PLC (Hexi-decimal).
   ). X0 THRU XFF: INPUTS FROM MACHINE.
   ). X100 THRU X16F: INPUTS FROM OPERATING PANEL.
   ). X170 THRU X17F: MMS INPUTS. (Direct inputs to NC)
   ). X180 THRU X24F: INPUTS FROM THE NC.

). "Y": OUTPUTS FROM THE PLC (Hexi-decimal).
   ). Y0 THRU YFF: OUTPUTS TO MACHINE.
   ). Y100 THRU Y17F: OUTPUTS TO OPERATING PANEL.
   ). Y180 THRU Y20F: OUTPUTS TO NC.

). "M": PLC TEMPORARY MEMORY (Decimal).
   The status of these addresses is established during the power up sequence.

). "T": PLC TIMERS (Decimal).
   ). T0 THRU T127: TIMER INPUTS (1 Bit).
   ). T1000 THRU T1127: TIMER OUTPUTS (1 Bit).
   ). T2000 THRU T2127: SET TIME (16 Bit).
   ). T3000 THRU T3127: ACCUMULATED TIME (16 Bit).

). "D": DATA REGISTERS (Decimal).
   The machine and control status are kept current by storing the vital data at these addresses. As things change, so do the data register values. All data registers are of the 16 bit type.

). "F": FAULT; ALARMS & MIS-OPERATIONS (Decimal, F0 - F127).
   Machine side malfunctions and mis-operations are detected by the PLC. Alarms 200 thru 327 are generated by PLC addresses F0 thru F127. For alarms 328 thru 399 an alternate method is used and that will be covered in the section for ALARMS.

). "R": PLC REGISTERS (Decimal).
   These addresses are used much like the "D" addresses listed above. The main difference between the two is that the "D" registers store current status that has to be up-dated as the status changes. For the most part, the "R" addresses store permanent sequence data that will only change when you change it.

). "L": LATCHING ADDRESSES (Decimal).
   These addresses will not change status when the NC power is turned OFF/ON.

). "P": PLC or "C" LANGUAGE SUB-PROGRAMS (Decimal).

# MAINTENANCE DISPLAY; PLC I/F

## ADDRESS FORWARD/REVERSE

While the PLC I/F screen is being displayed, the two columns of memory addresses can be advanced or reversed by pressing the MENU SELECT or DISPLAY SELECT push-buttons. The MENU SELECT push-button will move the addresses forward while the DISPLAY SELECT push-button will move the addresses backwards. These push-buttons affect both columns of addresses. There is one limitation, you can not use these two push-buttons to go from one address group to another.

DISP MND1 MND2 MND3 MND4 MND5 MND6 MND7 MND8 MND9 MENU

DISPLAY SELECT (-) MENU SELECT (+)

## SHIFT FUNCTION

The cursor control and number keys serve a dual purpose in life. Under normal conditions they are what they appear to be but when the CLEAR (SHIFT) key is pressed first, they will yield either symbols or letter characters.

The relationships are as follows....

| NORMAL | AFTER SHIFT |
|---|---|
| CURSOR LEFT | LETTER "P" |
| CURSOR RIGHT | SYMBOL "+" |
| CURSOR DOWN | SYMBOL "/" |
| MINUS SIGN (-) | LETTER "A" |
| 7 | LETTER "B" |
| 8 | LETTER "C" |
| 9 | LETTER "D" |
| DECIMAL POINT (.) | LETTER "E" |
| 4 | LETTER "F" |
| 5 | LETTER "L" |
| 6 | LETTER "R" |
| 0 | LETTER "X" |
| 1 | LETTER "Y" |
| 2 | LETTER "M" |
| 3 | LETTER "T" |

## FORCING PLC ADDRESSES ON AND/OR OFF

Any PLC memory address can be forced to a "1" or a "0" on this, the PLC I/F display. Whether or not this will result in the result you expected depends entirely upon the way the address is used within the PLC ladder. The procedure....

). ENTER THE ADDRESS AT "DEVICE".
). MOVE THE CURSOR RIGHT TO "DATA".
). ENTER "1" FOR "ON" or "0" FOR "OFF".
). MOVE THE CURSOR RIGHT TO "MODE".
). ENTER 0 TO ERASE DATA, 1 TO PULSE ADDRESS, or 2 TO LATCH.
). PRESS THE INPUT PUSH-BUTTON.

After the "force" has been executed, the display will change in two ways. First, the address will now reflect the forced status, 0 or 1, in the column of binary bits. Second, the address and the forced state will appear in the upper right corner of the display. See next page....

```
<NC ALARM>              [PLC I/F]                    DIAGN 5
                              <SET DATA>                    X0002=1   X001F=0
                                                            X000C=1   Y002D=1

                              76543210 HEX                  76543210 HEX
                        X0000 00000100 04          Y0000    00000000 00
<STOP CODE>             X0008 00010101 15          Y0008    00010001 11
                        X0010 10001000 88          Y0010    11110010 F2
                        X0018 00110011 33          Y0018    11000111 C7
                        X0020 10011001 99          Y0020    10000111 87
                        X0028 10100100 A4          Y0028    01000010 42
<ALARM MESSAGE>         X0030 11100001 E1          Y0030    01010101 55
                        X0038 10000001 81          Y0038    00110100 34
                        X0040 00010001 11          Y0040    11111111 FF
                        X0048 00100010 22          Y0048    01100100 64
                        X0050 00000000 00          Y0050    10001000 88
<OPERATOR MESSAGE>      X0058 01100011 63          Y0058    10010000 90
                        X0060 00010001 11          Y0060    00100010 22
                        X0068 00010000 10          Y0068    01000100 44
                        X0070 10001000 88          Y0070    00000000 00
                        X0078 10111011 BB          Y0078    01010100 54

                        DEVICE  DATA   MODE        DEVICE   DATA   MODE
                        (     ) (    ) (  )        (     )  (    ) (  )
```

```
VERSION ! PLC ! SERVO! SPINDLE! PLC I/F! LADDER!        !        !
```

As stated on the previous page, when the force function is used to change the status of an address, the address and the new status will be displayed in the upper right corner of this display. As shown above, this area is capable of storing up to four forced changes. If a fifth change is attempted while this area is full, the results can not be predicted!

This temporary display area can be cleared by entering two slash marks (//) at DEVICE and pressing the INPUT push-button. The procedure:

). POSITION THE CURSOR AT "DEVICE".
). PRESS SHIFT (CLEAR).
). PRESS CURSOR DOWN.
). PRESS SHIFT (CLEAR).
). PRESS CURSOR DOWN.
). PRESS INPUT.

After the above procedure is carried out, the temporary message area in the upper right corner of the display will be cleared and you will be able to make predictable changes again.

## MAINTENANCE DISPLAY; PLC I/F

```
<NC ALARM>                [PLC I/F]                    DIAGN 5
                                <SET DATA>

                          76543210 HEX                 76543210 HEX
                    X0000 00000000 00          Y0000 00000000 00
<STOP CODE>         X0008 00000101 05          Y0008 00010001 11
                    X0010 10001000 88          Y0010 11110010 F2
                    X0018 00110011 33          Y0018 11000111 C7
                    X0020 10011001 99          Y0020 10000111 87
                    X0028 10100100 A4          Y0028 01000010 42
<ALARM MESSAGE>     X0030 11100001 E1          Y0030 01010101 55
                    X0038 10000001 81          Y0038 00110100 34
                    X0040 00010001 11          Y0040 11111111 FF
                    X0048 00100010 22          Y0048 01100100 64
                    X0050 00000000 00          Y0050 10001000 88
<OPERATOR MESSAGE>  X0058 01100011 63          Y0058 10010000 90
                    X0060 00010001 11          Y0060 00100010 22
                    X0068 00010000 10          Y0068 01000100 44
                    X0070 10001000 88          Y0070 00000000 00
                    X0078 10111011 BB          Y0078 01010100 54

                    DEVICE  DATA    MODE       DEVICE DATA     MODE
                    (     ) (   )   (  )       (     ) (   )   (  )
```

```
VERSION| PLC | SERVO| SPINDLE| PLC I/F| LADDER|       |       |
```

When the Maintenance (MNT) display is turned ON, the display shown above will be the first one to show up. The first column of data that appears under "SET DATA" represents inputs to the PLC at addresses X0 thru X7F. The right hand column gives you the PLC outputs at addresses Y0 thru Y7F. The address numbers should tell you that they are in hexi-decimal form. The address numbers that appear in the two columns represent the first address that show up to the right in binary form. To the right of the eight bits of binary data you will find a two digit hexi-decimal number that is the equivalent of the eight bits of binary data to the left.

A break-down of the data at X0000....

```
          76543210 HEX
X0000     00000000 00
                  ---- Hexi-decimal equivalent of bits 0-7.
                ------ X0: ISP.11 (INPUT SPARE)
              -------- X1: ISP.12 (INPUT SPARE)
            -------- X2: CONVEYOR THERMAL TRIP
          --------- X3: MOTOR THERMAL TRIP
        ---------- X4: POWER SUPPLY (HYD)
      ---------- X5: HEAD LUBE WARNING
    ---------- X6: WAY LUBE WARNING
  ---------- X7: OVER-HEAT
```

A further break-down of the "X" addresses is shown on the next page. If you don't realize by now, the bit numbers and the hex numbers do not mean diddeley squat on this display. Please proceed.

## MAINTENANCE DISPLAY; PLC I/F

As stated on the last page, a further break-down of the "X" addresses is shown below.

```
          76543210 HEX
X0008     00000101 05
                  ---- Hexi-decimal equivalent of bits 0-7.
                 ------ X8: MAGAZINE POSITION 1
                ------- X9: MAGAZINE POSITION 2
               -------- XA: MAGAZINE POSITION 4
              --------- XB: MAGAZINE POSITION 8
             ---------- XC: MAGAZINE POSITION 16
            ----------- XD: MAGAZINE POSITION +30
           ------------ XE: MAGAZINE TIMING PULSE
          ------------- XF: MAGAZINE IN POSITION
```

On the PLC I/F or the LADDER display you have no way of knowing what the individual addresses actually mean. To find out what a given address is used for, you must have the machine side elementary diagrams and/or a hard copy of the ladder diagrams with an Element List.

PERSONAL NOTES:

## MAINTENANCE DISPLAY; PLC I/F

```
<NC ALARM>                [ PLC I/F ]                DIAGN 5
                                <SET DATA>

                          76543210 HEX               76543210 HEX
                   D0000  00000000 00        T0000   00001001 09
                          00011110 1E        T0008   00110011 33
<STOP CODE>        D0001  00100011 23        T0016   10011000 98
                          01000010 42        T0024   10000001 81
                   D0002  00001111 0F        T0032   01100100 64
                          11001011 CB        T0040   00101110 2E
<ALARM MESSAGE>    D0003  00110000 30        T0048   00010001 11
                          00100010 22        T0056   10001000 88
                   D0004  00000000 00        T0064   01000010 42
                          00000000 00        T0072   00010110 16
                   D0005  00011000 18        T0080   00000000 00
                          00000000 00        T0088   10001100 8C
<OPERATOR MESSAGE> D0006  11001100 CC        T0096   00110001 31
                          00010011 13        T0104   00010100 14
                   D0007  00000000 00        T0112   00000000 00
                          00100010 22        T0120   00000000 00

                   DEVICE DATA  MODE        DEVICE   DATA  MODE
                   (    ) (   ) ( )         (    )   (   ) ( )
-------------------------------------------------------------------
VERSION| PLC| SERVO| SPINDLE| PLC I/F| LADDER|      |       |
```

On the display shown above you have eight data register (D) addresses and 127 timer (T) addresses. The data register addresses will give you the binary, and hexi-decimal, value of the data stored in the register. For a bit break-down of a data register, see the following example....

**bit 15 (F)** **bit 8**

```
D0007 00000000 00      Hexi-decimal equivalent of binary data.
      00100010 22
```

**bit 7** **bit 0**

Data registers are used to store vital machine, and control, operating data. In the example shown above, data register D7 is used to store the magazine pocket number command from the NC. Other than reading that exciting bit of information in this book, the only way to find out what information is stored in a data register is to refer to the element list that accompanies the hard copy of the ladder diagram.

For more information on the timer addresses that are shown at the top of this page, please refer to the following page.

## MAINTENANCE DISPLAY; PLC I/F

<NC ALARM> [ PLC I/F ] DIAGN 5

<SET DATA>

<STOP CODE>

<ALARM MESSAGE>

<OPERATOR MESSAGE>

| | 76543210 | HEX | | 76543210 | HEX |
|---|---|---|---|---|---|
| T0000 | 00100011 | 23 | T1000 | 00100011 | 23 |
| T0008 | 00000000 | 00 | T1008 | 00000000 | 00 |
| T0016 | 10011000 | 98 | T1016 | 10011000 | 98 |
| T0024 | 00111100 | 3C | T1024 | 00111100 | 3C |
| T0032 | 00000001 | 01 | T1032 | 00000001 | 01 |
| T0040 | 00000000 | 00 | T1040 | 00000000 | 00 |
| T0048 | 00000000 | 00 | T1040 | 00000000 | 00 |
| T0056 | 10101010 | AA | T1056 | 10101010 | AA |
| T0064 | 00010011 | 13 | T1064 | 00010011 | 13 |
| T0072 | 10001000 | 88 | T1072 | 10001000 | 88 |
| T0080 | 00000000 | 00 | T1080 | 00000000 | 00 |
| T0088 | 10011001 | 99 | T1088 | 10011001 | 99 |
| T0096 | 01000100 | 44 | T1096 | 01000100 | 44 |
| T0104 | 00100011 | 23 | T1104 | 00100011 | 23 |
| T0112 | 01100000 | 60 | T1112 | 01100000 | 60 |
| T0120 | 00000000 | 00 | T1120 | 00000000 | 00 |

| DEVICE | DATA | MODE | DEVICE | DATA | MODE |
|---|---|---|---|---|---|
| ( ) | ( ) | ( ) | ( ) | ( ) | ( ) |

VERSION! PLC! SERVO! SPINDLE! PLC I/F! LADDER! ! !

The timer addresses shown above will give you the input and output status of timers T0 thru T127. Addresses T0 thru T127 are the inputs and T1000 thru T1127 are the outputs. When a timer is turned ON the address (T0 - T127) will go to a "1". If the timer remains ON for a time interval that equals the pre-set timer value, the corresponding output address (T1000 - T1127) will go to a "1". The pre-set time interval is set by the PLC sequence program and under normal conditions can not be changed.

For a break-down of the timer addresses shown above, refer to the following examples....

| T7 | T0 (INPUTS) | | T1007 | T1000 (OUTPUTS) | |
|---|---|---|---|---|---|
| T0000 | 00100011 | 23 | T1000 | 00100011 | 23 |

Hexi-decimal equivalent of binary.

You should be able to get an idea as to the function of these timers by consulting the element list that accompanies the hard copy of the PLC ladder diagram.

For more information on the PLC timers, please refer to the following page.

NOTE: THE TIMING INCREMENT (CONSTANT) FOR TIMERS T-0 THRU T-15 IS .01 SECOND. FOR T-16 THRU T-127 THE INCREMENT IS .1 SECOND.

## MAINTENANCE DISPLAY; PLC I/F

On the previous page you got a look at the PLC timer input and output addresses. Those addresses were single bit and were used to indicate the ON/OFF status of the timers.

On this page you see additional timer addresses that give you the operational status of the same timers (T0 thru T127). The difference is that these addresses are of the binary 16 bit type

<NC ALARM> [ PLC I/F ] DIAGN 5

<SET DATA>

| | | 76543210 HEX | | 76543210 HEX |
|---|---|---|---|---|
| | T2000 | 00000000 00 | T3000 | 00000000 00 |
| | | 00001100 0C | | 00000000 00 |
| <STOP CODE> | T2001 | 00000000 00 | T3001 | 00000000 00 |
| | | 00000110 06 | | 00000110 06 |
| | T2002 | 00000000 00 | T3002 | 00000000 00 |
| | | 00001010 0A | | 00001010 0A |
| | T2003 | 00000000 00 | T3003 | 00000000 00 |
| | | 00010100 14 | | 00000000 00 |
| <ALARM MESSAGE> | T2004 | 00000000 00 | T3004 | 00000000 00 |
| | | 00111100 3C | | 00111100 3C |
| | T2005 | 00000000 00 | T3005 | 00000000 00 |
| | | 00110010 32 | | 00000000 00 |
| | T2006 | 00000000 00 | T3006 | 00000000 00 |
| <OPERATOR MESSAGE> | | 01100100 64 | | 01100100 64 |
| | T2007 | 00000000 00 | T3007 | 00000000 00 |
| | | 00011110 1E | | 00000000 00 |

| DEVICE | DATA | MODE | DEVICE | DATA | MODE |
|---|---|---|---|---|---|
| ( ) | ( ) | ( ) | ( ) | ( ) | ( ) |

VERSION! PLC! SERVO! SPINDLE! PLC I/F! LADDER! ! !

The 2000 series of "T" addresses gives you the timer pre-set value in binary form while the 3000 series will show you the accumulated time.

Example....

). The time interval of T7 is set by address T2007 (.3 sec).
). Address T7 goes to a "1" when the timer is turned ON.
). Address T3007 starts counting up when T7 turns ON.
). When T3007 = T2007, address T1007 will go to a "1".

You can change a timer setting value on this display by forcing the 2000 series address. The forced timer setting will remain valid until you change it back to the original setting or the power is turned OFF and then back ON. To alter a timer....

). Enter T2--- at DEVICE and then cursor right -->.
). Enter the new value (4 bit hex) at DATA and cursor right -->.
). Enter 2 at MODE to latch.
). Press the INPUT push-button.
). Check the T2--- address to make sure you did it right!

## MAINTENANCE DISPLAY; PLC I/F

In order to display the PLC memory addresses shown below you would first have to enter the appropriate address alpha/numeric data at the DEVICE location under each column.

The left column gives you 8 PLC "R" register addresses while the right column yields 127 single bit PLC temporary memory addresses.

```
<NC ALARM>                [ PLC I/F ]                    DIAGN 5
                                <SET DATA>

                          76543210 HEX                   76543210 HEX
                    R2100 01000010 42          M0000  00101001 29
                          00000011 03          M0008  10000110 86
<STOP CODE>         R2101 00000000 00          M0016  01010000 50
                          01100001 61          M0024  01010011 53
                    R2102 00100001 21          M0032  00000100 04
                          00000000 00          M0040  00100010 22
                    R2103 00010001 11          M0048  00000000 00
<ALARM MESSAGE>           00000001 01          M0056  01010101 55
                    R2104 00000000 00          M0064  00100001 21
                          00000000 00          M0072  10100010 A2
                    R2105 00000000 00          M0080  00110010 32
                          01011001 59          M0088  00000000 00
<OPERATOR MESSAGE>  R2106 00000001 01          M0096  01000110 46
                          00010000 10          M0104  10001100 8C
                    R2107 00000000 00          M0112  00000000 00
                          00010100 14          M0120  11111111 FF

                    DEVICE  DATA    MODE       DEVICE  DATA    MODE
                    (     ) (    )  ( )        (     ) (    )  ( )
-------------------------------------------------------------------
VERSION| PLC| SERVO| SPINDLE| PLC I/F| LADDER|       |       |
```

The data at the "R" addresses shown above represents PLC Sequence Parameter data bits. They serve the same purpose as the "SQ" parameters did on the M-1 & M-2 CNC's. The difference is that these parameters are 16 bit instead of eight and they must be changed by a hexi-decimal input instead of a decimal input. A more detailed "R" register explanation will be rendered shortly. I thank you for your support!

The "M" addresses that are shown indicate the ON/OFF status of the individual PLC temporary memory signals. These addresses will change as machine and control operating conditions change. The data at these addresses will be lost when the power is turned OFF. But not to worry, the data will be restored when the next PLC power up sequence is executed.

HELPFUL HINTS:

). PLC Temporary memory addresses M0 thru M199 represent program "M" codes M00 thru M199. Also, memory addresses M900 thru M931 represent "M" codes M900 thru M931.

). PLC Temporary memory addresses M1000 thru M1063 represent PLC bit type sequence parameters R2100 thru R2103:
R2100 bit 0 thru bit F = Memory address M1000 thru M1015, Etc.

## MAINTENANCE DISPLAY; PLC

The display shown on this page is part of the PLC screen of the maintenance (MNT) display. The status of the PLC "R" registers are monitored on this screen. These "R" registers can also be changed on this display. How, and when, to change these "R" registers will be explained in detail. Be patient!

<NC ALARM>

<STOP CODE>

<ALARM MESSAGE>

<OPERATOR MESSAGE>

[ RREG CHECK ]
<SET DATA>

| | HEX | DECIMAL |
|---|---|---|
| R2096 | 0000 | 0 |
| R2097 | 0000 | |
| R2098 | 0000 | 0 |
| R2099 | 0000 | |
| R2100 | 1100 | 594176 |
| R2101 | 0009 | |
| R2102 | 0011 | 4325405 |
| R2103 | 0042 | |
| R2104 | 0000 | 0 |
| R2105 | 0000 | |
| R2106 | 0000 | 0 |
| R2107 | 0000 | |
| R2108 | 0000 | 131072 |
| R2109 | 0002 | |
| R2110 | 0006 | 786438 |
| R2111 | 000C | |

R( ) DATA( ) MODE( )

The following list shows that there is more than one type of PLC "R" register. They are....

). LONG TYPE: (DUAL ADDRESS, 32 BIT).
). SHORT TYPE: (SINGLE ADDRESS, 16 BIT).
). BIT TYPE: (SEQUENCE PARAMETER DATA, Etc....)
). DATA TYPE: (DIMENSIONAL DATA FOR MEASURE, ATC, Etc....)

The bit type and the data type registers can be altered on this display. However, there is a > 50% chance that you will screw up if you attempt to change a bit type PLC parameter on this display. A friendly little hint, DON'T TRY TO CHANGE BIT TYPE DATA ON THIS SCREEN, USE THE PLC I/F DISPLAY INSTEAD!

On the other hand, the data (word) type registers should be changed on this display only. This is the only maintenance screen that will allow you to enter (+) & (-) decimal numbers.

To change an "R" decimal value:

). Enter the address at R( ).
). Enter the new number at DATA( ).
). Enter "0" at MODE( ).
). Press the INPUT push-button.

NOTE: The only way to change "R" addresses on this display is to enter the required address at R( ). There are no forward and reverse keys or push-buttons.

See following page for more details of the PLC display.

## PLC DISPLAY (CONT'D)

Some of the following information could be classified as "nice to know" but not too useful. However, most people (especially service) are curious types and ask questions about things that end up meaning very little as far as the real world is concerned. This is intended to head off those questions and reduce the amount of dead time in the classroom.

The following example shows the numeric break-down of these "R" register addresses. Viewed on this display, the PLC bit type, and word type, parameters will be as shown below. For this example R2100 has been designated....

<NC ALARM>

[RREG CHECK]
<SET DATA>

<STOP CODE>

| | HEX | DECIMAL |
|---|---|---|
| R2096 | 0000 | 0 |
| R2097 | 0000 | |
| R2098 | 0000 | 0 |
| R2099 | 0000 | |
| R2100 | 1100 | 594176 |
| R2101 | 0009 | |
| R2102 | 0011 | 4325405 |
| R2103 | 0042 | |

In long form (dual address), the break-down for R2100/2101 is as follows....

| | HEX BIT 3 | HEX BIT 0 | |
|---|---|---|---|
| R2100 | 1100 | 594176 | DECIMAL EQUIVALENT OF |
| R2101 | 0009 | | EIGHT BIT HEXI-DECIMAL. |

| | HEX BIT 7 | HEX BIT 4 | |
|---|---|---|---|

TO GET THE DECIMAL VALUE SHOWN ABOVE....

| | | | | |
|---|---|---|---|---|
| BIT 0: | 0 x $16^0$. | OR | 0 x 1 | = 0 |
| BIT 1: | 0 x $16^1$. | OR | 0 x 16 | = 0 |
| BIT 2: | 1 x $16^2$. | OR | 1 x 256 | = 256 |
| BIT 3: | 1 x $16^3$. | OR | 1 x 4096 | = 4096 |
| BIT 4: | 9 x $16^4$. | OR | 9 x 65536 | = 589824 |
| BIT 5: | 0 x $16^5$. | OR | 0 x 1048576 | = 0 |
| BIT 6: | 0 x $16^6$. | OR | 0 x 16777216 | = 0 |
| BIT 7: | 0 x $16^7$. | OR | 0 x 268435456 | = 0 |
| | | | | 594176 |

The addresses on this display can be changed from long form to short form by moving the cursor to MODE ( ) and entering "X" and then pressing the INPUT push-button. Please refer to the following page for examples.

## PLC DISPLAY (CONT'D)

On the previous page you were shown the bit-by-bit layout of the PLC long addresses. On this page you will be shown how the layout changes when the addresses are changed to the short form.

Once you change the PLC addresses to the short form, you will be dealing with four bits of hexi-decimal data and the decimal equivalent. In short form, address 2100 & 2101 will be as follows....

| | HEX | DECIMAL |
|---|---|---|
| R2100 | 1100 | 4352 |
| R2101 | 0009 | 9 |

BIT 3 BIT 0

In short form, the hexi-decimal bit layout returns to normal....

BIT 0 = x1
BIT 1 = x16
BIT 2 = x256
BIT 3 = x4096

To get the decimal equivalent for the data at R2100....

| | | |
|---|---|---|
| 0 x 1 | = | 0 |
| 0 x 16 | = | 0 |
| 1 x 256 | = | 256 |
| 1 x 4096 | = | 4096 |
| | | 4352 |

Normally, the only changes that you will have to make on this display will be those dealing with the PLC parameters that are set by decimal number inputs. Some of these parameters are of the "short" type while others are of the "long" type. The PLC parameter list in the front of the electrical diagrams book will normally tell you which is which. These parameters, R2110 and higher, are used to set such things as:

). Percentages. (Rapid Over-ride)
). RPM. (Gear Range 1, 2, 3)
). Dimensional data. (See note 1)

NOTE 1:

). FOR ALL HORIZONTAL M/C's AND THE LARGE VERTICAL M/Cs (SV-20 & SV-25) AND THE YMS SERIES, DIMENSIONAL DATA IS INPUT IN INCH.

). FOR AJV's, VQC's, MTV-10, & MTV-550, THE INPUT DATA IS METRIC.

** For examples of "short" and "long" PLC parameters, please refer to the following page....

## PLC DISPLAY: SHORT & LONG PARAMETERS

A section of the PLC parameter list found in the electrical diagrams book will be similar to the one on this page....

PLC DATA (SHORT TYPE) PARAMETER

| ADDRESS | COMMENT | UNIT | STANDARD |
|---|---|---|---|
| R2110 | R0 RAPID TRAVERSE OVER-RIDE % | % | 6 |
| R2111 | R1 RAPID TRAVERSE OVER-RIDE % | % | 12 |
| R2112 | R2 RAPID TRAVERSE OVER-RIDE % | % | 25 |
| R2113 | SPINDLE JOG SPEED (RPM) | RPM | 50 |
| R2114 | | | . |
| R2115 | | | . |

Now, if you go to the the PLC display and call for address R2110, you will get the following display....

<OPERATOR MESSAGE>

| | HEX | DECIMAL |
|---|---|---|
| R2108 | 0000 | 131072 |
| R2109 | 0002 | |
| R2110 | 0006 | 786438 |
| R2111 | 000C | |

R( ) DATA( ) MODE( )

When you look at addresses R2110 & 2111 on this display the data may, or may not, appear the same as what you read in the book. That is probably due to the fact that you do not readily recognize the decimal equivalent of hexi-decimal numbers. If you look at the four bits of hex data at R2110, you will see that it is set at 6. The hex value set at R2111 is set at C and by now you should know that really means 12. Damn, I love this.

The control is looking at this as a "long" address and the resultant decimal value displayed is the equivalent of the eight bits of hexi-decimal data at both addresses, R2110 & 2111.

If you move the cursor over to MODE( ) and input an "X", the display will change to "short" and the decimal equivalent of each address will be displayed as shown in the following example....

| | HEX | DECIMAL |
|---|---|---|
| R2110 | 0006 | 6 |
| R2111 | 000C | 12 |

R( ) DATA( ) MODE(X)

R2110 Now shows 6% and R2111 shows 12% as the Rapid Traverse Over-Ride settings for R0 & R1.

## PLC Vs PLC I/F DISPLAY

As stated earlier, the PLC "R" registers can be monitored and/or changed on either display. But why bother? If you call up a data (word) type register on the PLC I/F display you get a binary and hexi-decimal read-out for that register. You will not get the decimal number read-out you need. And if you call up a bit type register on the PLC display you will get the decimal and hexi-decimal read-out, but not the binary read-out you need.

The following examples show how R2100/2101 appears on both displays....

**PLC:**

If you enter 2100 at R( ) on the PLC screen, the display will be up-dated and the addresses shown will include 2100 & 2101. Those two will grouped together in a pretty red box.

| | HEX | DECIMAL |
|---|---|---|
| R2100 | 1100 | 594176 |
| R2101 | 0009 | |

The address can be split into two 16 bit addresses by moving the cursor to MODE ( ), entering "X", and then INPUT.

| | HEX | DECIMAL |
|---|---|---|
| R2100 | 1100 | 4352 |
| R2101 | 0009 | 9 |

**PLC I/F:** **HEX BIT 3** **HEX BIT 0**

On the PLC I/F display, enter R2100 at DEVICE and press INPUT. On this display you must use the shift key to enter the address letter designator.

| | 76543210 | HEX |
|---|---|---|
| R2100 | 00010001 | 11 |
| | 00000000 | 00 |
| R2101 | 00000000 | 00 |
| | 00001001 | 09 |

Numerical break-down of the "R" addresses on PLC I/F....

**Binary bit F (15)** **Binary bit 8**

R2100 0001 0001 11

--------Hex bit 2
----------Hex bit 3
0000 0000 00
--------Hex bit 0
----------Hex bit 1

**Binary bit 7** **Binary bit 0**

There should be a PLC sequence parameter table in a front section of the Electrical Circuit Diagrams book. What you will find at that location will very much like the examples on the next page....

## PLC SEQUENCE PARAMETERS; BIT TYPE

(This data was taken from an early H-400 with M32)

The following 32 bits of machine/control specification data is set by PLC register files R2100 & R2101. On Mazatrol M1 or M2 this type of data would have been set by "SQ" parameters, SQ0 thru SQF.

| R2100 BIT | PLC MEMORY ADDRESS | FUNCTION/COMMENTS |
|---|---|---|
| 0 | M1000 | NC ROTARY TABLE. 1: 4'th AXIS 0: INDEX TABLE |
| 1 | M1001 | INDEX TABLE INCREMENT. 1: 5 DEGREE 0: 1 DEGREE |
| 2 | M1002 | |
| 3 | M1003 | END MILL TLM ENABLE. 1: YES 0: NO |
| 4 | M1004 | X AXIS ABSOLUTE SYSTEM. 1: YES 0: NO |
| 5 | M1005 | Y AXIS ABSOLUTE SYSTEM. 1: YES 0: NO |
| 6 | M1006 | Z AXIS ABSOLUTE SYSTEM. 1: YES 0: NO |
| 7 | M1007 | 4'TH AXIS ABSOLUTE SYSTEM. 1: YES 0: NO |
| 8 | M1008 | MAGAZINE TOOL CAPACITY A. (See note 1) |
| 9 | M1009 | MAGAZINE TOOL CAPACITY B. (See note 1) |
| A | M1010 | MAGAZINE TOOL CAPACITY C. (See note 1) |
| B | M1011 | MAGAZINE TOOL DETECTOR. 1: USED 0: NOT USED |
| C | M1012 | EIA M06 Y/Z MOVE. 1: BY PLC SUB PROGRAM 0: BY EIA PROG. |
| D | M1013 | T CODE A. |
| E | M1014 | T CODE B. |
| F | M1015 | ZERO RETURN AT ATC. 1: BY PROGRAM 0: BY PLC |
| R2101 | | |
| 0 | M1016 | PALLET CHANGER TYPE 1. 1: 2 PALLETS 0: NO PALLET CHANGER |
| 1 | M1017 | PALLET CHANGER TYPE 2. 1: MULTI-PALLETS 0: STANDARD |
| 2 | M1018 | |
| 3 | M1019 | |
| 4 | M1020 | AUTO COOLANT SELECT AT PWR ON. 1: YES 0: NO |
| 5 | M1021 | PALLET CHANGE 1 CYCLE NEGLECT. 1: NEGLECT 0: IS USED |
| 6 | M1022 | |
| 7 | M1023 | |
| 8 | M1024 | SINGLE GEAR RANGE. 1: YES 0: NO; SHIFTER USED |
| 9 | M1025 | |
| A | M1026 | |
| B | M1027 | |
| C | M1028 | |
| D | M1029 | |
| E | M1030 | AXIS MOVE AT ATC. 1: Z, THEN OTHERS 0: SIMULTANEOUS |
| F | M1031 | AXIS MOVE AT PC. 1: Z, THEN X & 4'th 0: SIMULTANEOUS |

NOTE 1

| | 30 TOOLS | 60 TOOLS | 90 TOOLS | 120 TOOLS |
|---|---|---|---|---|
| M1008 | 0 | 1 | 0 | 1 |
| M1009 | 0 | 0 | 1 | 1 |
| M1010 | 0 | 0 | 0 | 0 |

Please refer to the following page for procedure to change these bit type parameters on the PLC I/F display.

## PLC SEQUENCE PARAMETER; BIT TYPE

In this example, assume that R2100 is already set as shown....

PLC I/F

| | 76543210 | HEX |
|---|---|---|
| R2100 | 00000001 | 01 |
| | 00000001 | 01 |

With the binary data at R2100, and looking back at the previous page, you should realize that bit 0 and bit 8 are already ON. That says that your machine is equipped with a 4'th axis and the magazine tool capacity is 60 tools. If you don't agree with my findings, I'm afraid we will have to start over.

Now that we all agree, please proceed. Leaving the other bits as they are, set the data at R2100 so that small diameters end mills can be measured by the Auto Tool Length Measure function.

Looking back at the previous page we find that bit 3 of R2100 should satisfy this requirement. All you have to do is turn it ON. We can do that quite easily, on paper, in binary form....

| | | |
|---|---|---|
| R2100 | 00000001 | 01 |
| | 00001001 | ?? |

These PLC parameters can only be input, or altered, by a four digit hexi-decimal number only. In the above example, we do not need to do anything to bits 8 thru 15 (F) so those two hex digits will remain the same, 01. However in bits 0 thru 7 we did turn on bit number 3. this will add a value of 8 to hex unit's digit. For bits 0 thru 7 we would then have, in hex, 09.

To enter 0109h at R2100:

). Using the shift key, enter R2100 at "DEVICE".
). Move the cursor to the right.
). Enter 0109 at "DATA".
). Move the cursor to the right.
). Enter "2" at "MODE".
). Press INPUT.
). Check the data at R2100 on the CRT.
). If the data is correct.... R2100 00000001 01
00001001 09
). Turn the NC power OFF.
). Whistle "Dixie".
). Turn the NC power ON.

**NOTE: When a PLC sequence parameter is changed, the Parameter disc should be re-witten. If it isn't, the PLC data will revert back to the old setting if the Parameter disc is read again.**

The next page is all yours....

## PLC SEQUENCE PARAMETER; BIT TYPE

On the previous page we left PLC sequence parameter R2100 as shown in the following example.

| | 76543210 | HEX |
|---|---|---|
| R2100 | 00000001 | 01 |
| | 00001001 | 09 |

Bits 0, 3, 8 are already ON. Leave those bits ON but turn on the bit that will allow the Zero Return at ATC to be controlled by the part program instead of the PLC. If necessary, you can read the preceding page.

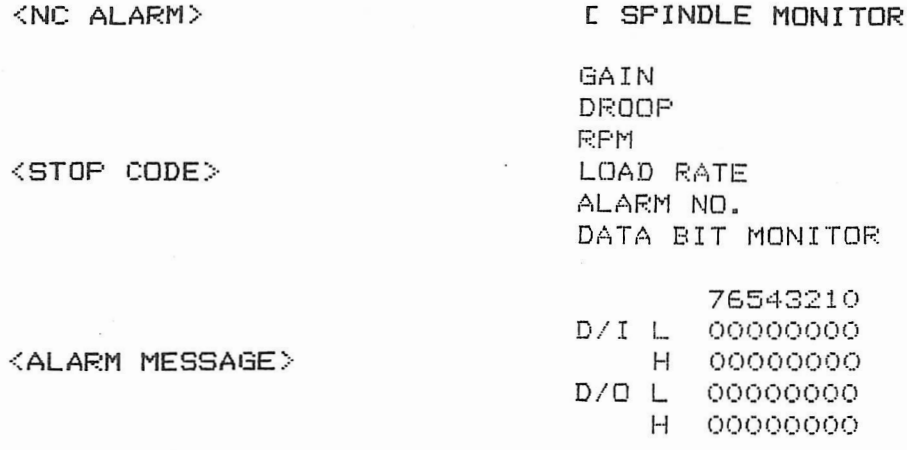
Your procedure please....

PERSONAL NOTES:

## MAINTENANCE DISPLAY; SPINDLE MONITOR

When the maintenance (MNT) display is selected, the PLC I/F screen comes ON. One of the menu selections available on that screen is labeled "SPINDLE". Pressing the MND4 push-button below the SPINDLE message will give you the display shown below.

To return to the PLC I/F screen, press the DISPLAY SELECT push-button. That's the left side green one. To return to a normal operating display, press the maintenance (MNT) display push-button to turn it OFF.




The first four items shown above will give you the dynamic operating conditions of the FR-SF spindle controller and the spindle motor.

If an alarm is displayed on this screen you will have to cross reference the alarm number to the FR-SF maintenance manual.

The Data Bit Monitor is just what it says it is, a monitor. As far as I can tell at this time, this is the communication link between the M-32 CNC and the FR-SF. Please stay tuned for further developments.

PERSONAL NOTES:

## MAINTENANCE DISPLAY; SERVO MONITOR

When the maintenance display is selected, the PLC I/F screen turns ON. One of the menu selections available on that screen is labeled "SERVO". Pressing the MND3 push-button below the "SERVO" message will result in the screen shown below.

```
<NC ALARM>                    [ SERVO MONITOR ]                DIAGN 3

                                                    X      Y      Z
                              GAIN
                              DROOP
<STOP CODE>                   RPM
                              CURR. RATE
                              LOAD RATE
                              REGEN. RATE
                              GRID
<ALARM MESSAGE>               ABS. N
                              ABS. 1x
                              ALARM NO.

                              ** Additional axis data would appear
                                 in this area, just like the data
<OPERATOR MESSAGE>               above **
```

This display will be explained in detail at a later date!

PERSONAL NOTES:

## MAINTENANCE DISPLAY; SOFTWARE VERSIONS & OPTIONS

When the Maintenance display is selected, the PLC I/F screen turns ON. The menu data 1 message on that display is VERSION. Pressing the MND1 push-button will give you the display shown below.

[ OPTION ]

1. EIA
2. DNC
3. SPIRAL INTERPOLATION
4. 3-D CUTTER COMPENSATION
5. PATTERN ROTATION
6. GEOMETRIC FUNCTION
7. SCALING
8. EXTERNAL DATA I/O
9. 3-DIMENSION
10. ADDITIONAL MEMORY 76M

[ VERSION ]

| | | | | | |
|---|---|---|---|---|---|
| 1. | MAIN | 00-B2 | 16. | LANG | ENG-B2 |
| 2. | FDD | 01-B1 | 17. | | |
| 3. | MCP | 01-A0 | 18. | | |
| 4. | IOP | 01-A1 | 19. | | |
| 5. | CHR | 99-A1 | 20. | | |
| 6. | PLC | S0-9* | 21. | MACRO | 00-B2 |
| 7. | AMP-X | | 22. | | |
| 8. | AMP-Y | | 23. | | |
| 9. | AMP-Z | | 24. | | |
| 10. | AMP-4 | | 25. | | |
| 11. | AMP-5 | | 26. | | |
| 12. | AMP-6 | | 27. | | |
| 13. | SPINDLE | | 28. | | |
| 14. | | | 29. | | |
| 15. | BOARD | 60-A1 | 30. | NC SERIAL NO. | |

M__________

The options listed above are the options that are available. They may, or may not, be active on your control. If the option is active, the option name will be in yellow. If the option is not on, the name will be in blue.

The display example shown above was taken from a first generation M-32 simulator.

PERSONAL NOTES:

## MAINTENANCE DISPLAY; GETTING TO THE LADDER

```
<OPERATOR MESSAGE>          X0060 00001111 0F   Y0060 11101010 EA
                            X0068 10000011 83   Y0068 00010100 14
                            X0070 00000000 00   Y0070 11001001 C9
                            X0078 00110110 36   Y0078 00000000 00

                            DEVICE DATA MODE    DEVICE DATA MODE
                            (    ) (  ) (  )    (    ) (  ) (  )
      XXXX  XXXX  XXXX  XXXX  XXXX LADDER

DISPL  MND1  MND2  MND3  MND4  MND5  MND6  MND7  MND8  MND9  MENU
SEL.                                                      SEL.
```

Pressing the menu data 6 push-button while the PLC I/F display is active will result in the following display turning on.

```
                        LADDER

DISPL  MND1  MND2  MND3  MND4  MND5  MND6  MND7  MND8  MND9  MENU
SEL.                                                      SEL.
```

Pressing the menu data 4 push-button below the "LADDER" message will give you the following display.

```
                     2CIRCUIT

DISPL  MND1  MND2  MND3  MND4  MND5  MND6  MND7  MND8  MND9  MENU
SEL.                                                      SEL.
```

Pressing the menu data 2 push-button below the "CIRCUIT" message will change the display to the one shown below.

```
                                                      PLC
                                                    LADDER


   1READ 2WRITE 3INSERT 4DELETE 5CONVT 6MONIT                MENU

   MND1  MND2  MND3  MND4  MND5  MND6  MND7  MND8  MND9
```

PERSONAL NOTES:

## MAINTENANCE DISPLAY; GETTING TO THE LADDER

Of all the menu data selections shown on the preceding page, you should only attempt to use the MONIT (MONITOR) or MENU function. The other functions; READ, WRITE, INSERT, DELETE, and CONVERT, are for use by people who have programming abilities and equipment.

The "MONIT" (MONITOR) function should be used when you want to search out a specific memory address in the ladder diagram. If you want to scan through the ladder diagram page-by-page you will need to select the "MENU" function and then the "SET" function. The "SET" function allows you to search out a specific PLC sequence step number.

To search to a specific point in the CRT ladder diagram you must first select the "MONIT" mode. Once you select the "MONIT" function, the following menu data selections will appear at the bottom of the ladder display....

PLC
LADDER

1 ]  [ 2 ]/[ 3 ]  [ 4 ]/[ 5 ( ) 6 [ ] 7 8 MENU

The ladder symbols that appear on this display normally need not be used by working people like you and I. Their primary purpose for being here is to be used by the goofy individuals who write and edit the ladder programs for a living.

PERSONAL NOTES:

## MAINTENANCE DISPLAY; LADDER DIAGRAM

Once the ladder "MONIT" (Monitor) mode is selected and the symbols shown on the last page appear at the bottom of the CRT display, you can search to specific points within the ladder by selecting the required PLC memory address. This can be done without selecting any of the ladder symbols shown on the last page. To call out a signal that has a memory address, all you have to do is use the "Shift" key and the appropriate number key to select the address letter designator. After the address designator, key in the address number found in the Elementary diagrams, the Ladder diagrams, or the Element list. When the address is selected, press the INPUT push-button.

Pressing the INPUT push-button will cause the control to search to the first sequence of the ladder where the selected address is found. Each time the INPUT push-button is pressed the CRT ladder will advance to the next sequence where the address is used. Eventually, pressing INPUT will do nothing but generate an alarm message "PROG. NOT FOUND".

PERSONAL NOTES:

## MAINTENANCE DISPLAY; LADDER DIAGRAM

To search to a specific sequence step number within the PLC ladder you must select the "SET" function. To do this, first follow the procedures to turn on the "MONIT" (MONITOR) mode and then press the menu data 9 push-button ("MENU").

PLC
LADDER

1 ]I[ 2 ]/[ 3 ]I[ 4 ]/[ 5 ( ) 6 [I] 7 8 MENU

Press the menu data 9 push-button (MENU)....

PLC
LADDER

9SET

Press the menu data 1 push-button (SET)....

Now you can input the sequence step number that you need to search to. If you enter "0" and then press the INPUT push-button, the ladder diagram will appear and the beginning step number will be step number "0". Pressing INPUT by itself will net the same fish! Please refer to the next page for example.

PERSONAL NOTES:

## MAINTENANCE DISPLAY; LADDER DIAGRAM

```
                                                                  PLC
                                                                LADDER
P250    M1209
0  ----] [-------------------------------------[ CALL        P313 ]

P251    Y5D
4  ----] [-------------------------------------[ CALL        P311 ]

        M385
8  ----] [-------------------------------------[ CALL        P304 ]

        M391
   -----] [--

        X8C                                              K2
12 ----] [-------------------------------------[ WAND X82 H1F D27 ]

        M206    M1008  M1009  M1010                      K2
   -----] [-----] [----] [-----]/[-----------[ WAND X82 H7F D27 ]

               M1009  M1008  M1008  X8A
             --]/[----] [----]/[----] [----[ +  D27  K30  D27 ]
```

**1READ 2WRITE 3INSERT 4DELETE 5CONVT 6MONIT** **MENU**

As long as the "SET" mode is active you can search to a specific sequence step number or you can "page" through the ladder one page at a time. To "page" forward (+), press the SHIFT key, the cursor right key, and then the INPUT key. Until otherwise specified, pressing the INPUT key will cause the ladder display to advance to the next page of the sequence. To go back through the ladder, simply press the minus sign (-) push-button on the number key-pad and then the INPUT push-button. The INPUT push-button will cause the display to back up each time it is pressed.

In the example shown above, the sequence that starts at step number 12 is not complete. That is indicated by the vertical line coming down just to the left of M1009 at the bottom line of the display. If you page forward at this point you will not be able to see the rest of that sequence because the display would advance to the beginning of the next complete sequence. If you need to see the entire sequence that starts at step number 12, simply enter the numbers 1 & 2 and then press the INPUT push-button. That will rearrange the ladder display so that sequence step number 12 appears at the top of the display. If page forward or reverse has been selected, and then interrupted by searching to a specific sequence step number, it will remain active. All you have to do is press the INPUT push-button to resume scan forward or reverse.

PERSONAL NOTES: