# Appendix D
Application Examples

D

In This Appendix. . . .
— Allen-Bradley SLC 5/03 & SLC 5/04 Example

Understanding the Example Programs

The following example program uses a Cement Kiln System to demonstrate the ladder logic required to support the various OP-panel features. The program provides ladder logic which supports controlling pushbuttons, lamps, messages and menu operations.

For training purposes the example program controls the items listed in the figure below, such as Hopper Selection, Kiln Speed, Start/Stop/Run controls, and Kiln Zone Temperatures.
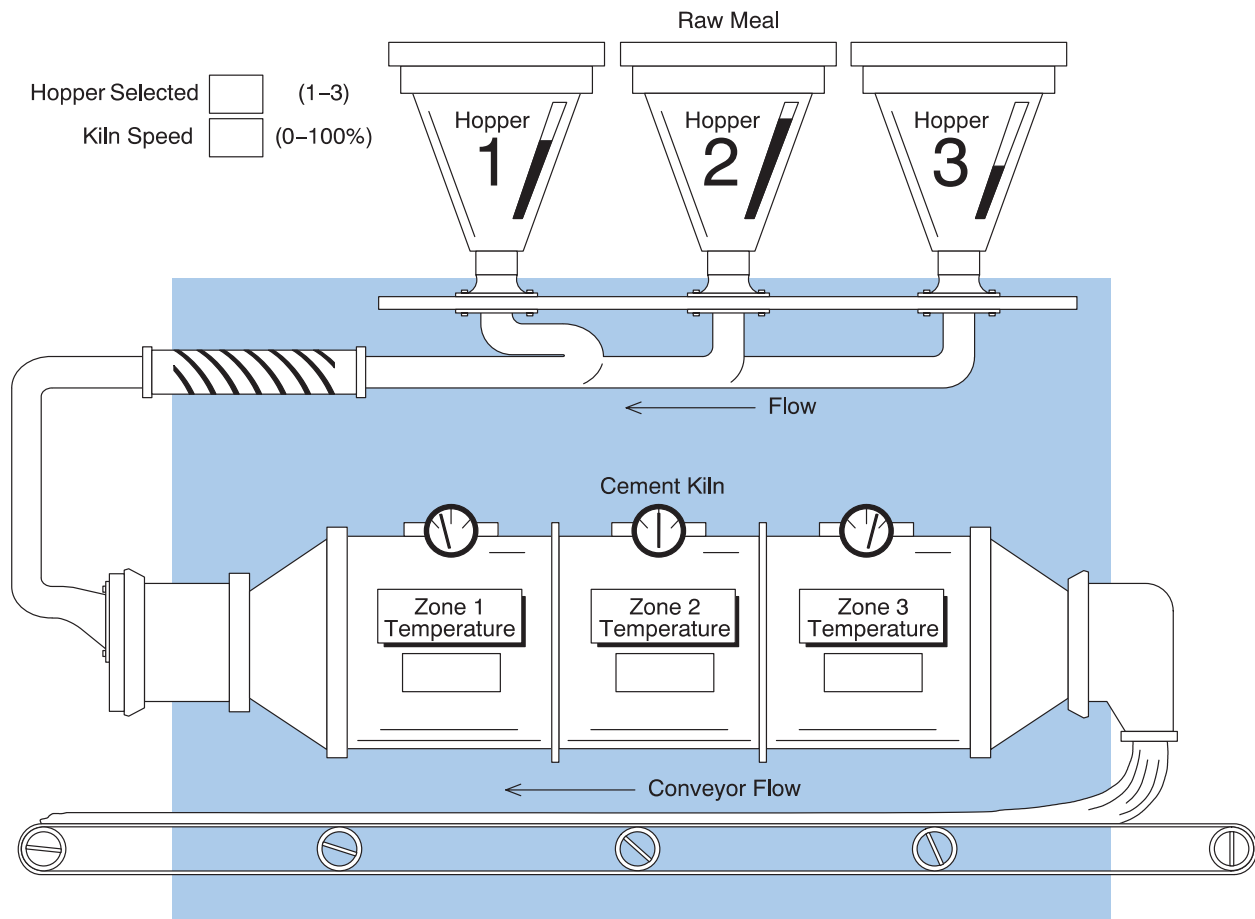
These same example programs and additional technical support information may be accessed on PLC*Direct* 's **worldwide web** site:

http:\\www.plcdirect.com   (website for general info/file transfers)

You may also find these programs on our 24–hour per day **BBS** system at:

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Allen-Bradley Example Program

The example program listed on the following pages is designed for Allen-Bradley SLC 500 5/03, and 5/04 PLC systems. The program supports the OP-1510 Kiln Demo application. This program is included on the 3 1/2 disk labeled "OP-1500/OP-1510 Example Disk" which is provided with this manual.
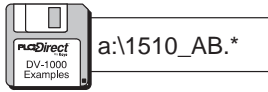
a:\1510_AB.*

This example PLC program (1510_AB.*) must be used with the OP-1510 configuration file 1510_AB.OCF. Load these program files to the PLC and OP-panel for connection and operation of the Kiln Demo application. You may also refer to the Appendix A "Example Worksheets" to help understand how the OP-panel is configured.

OP-1510 Kiln Demo

This program is designed to be used with the Allen-Bradley SLC500 5/03 and 5/04 PLC systems. The following program is intended for training purposes and *may not* resolve all possible OP-panel applications. Some PLC programming knowledge is required to fully understand and implement the following program examples.

RUNG 1

If the CPU power cycles or machine and operator conditions are idle this rung will initialize the OP-panel and display message #1 and message #2.
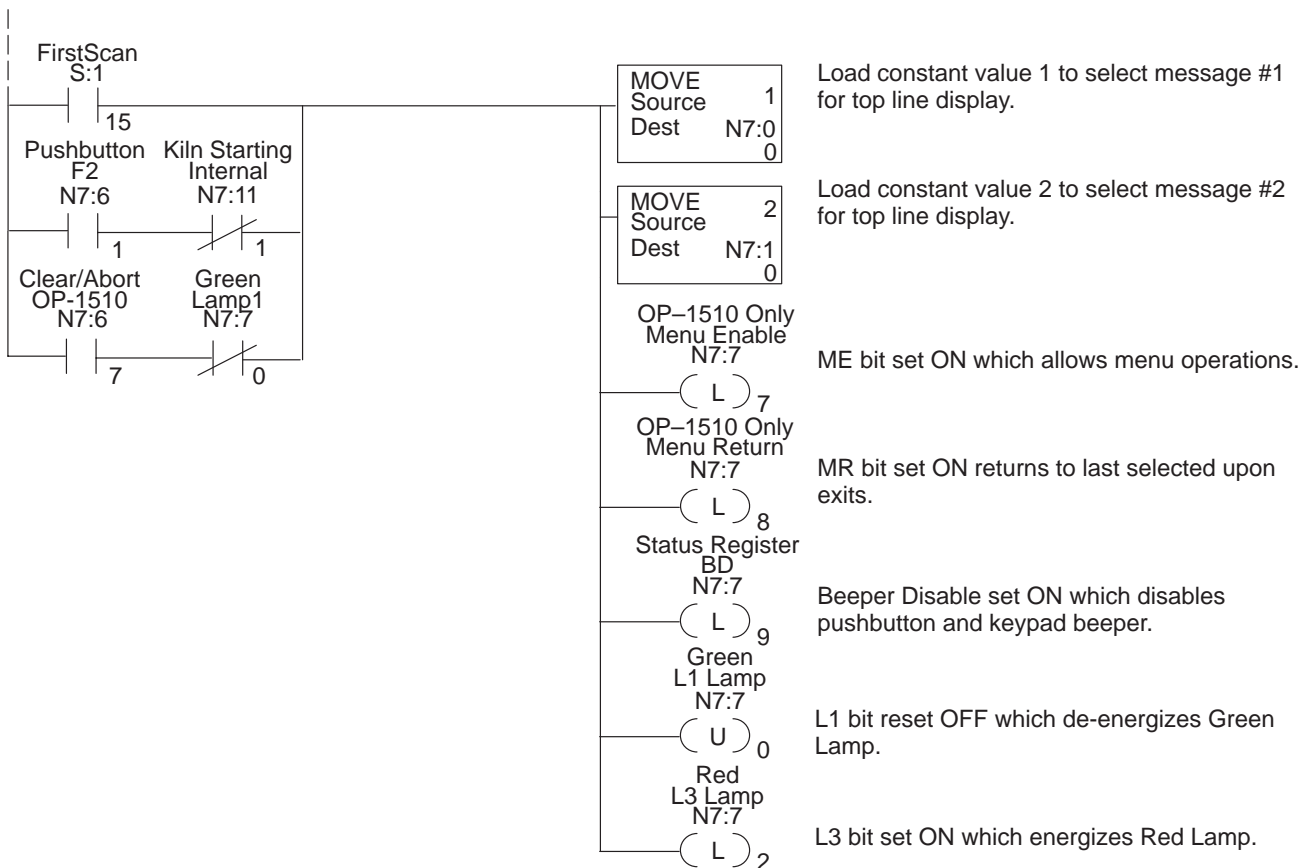
RUNG 2   **Kiln Start Control**

This rung controls starting a machine or process. The internal control relay Kiln Start (C51) is used to start the Startup Delay Timer, and will remain ON until the L1 control register bit is energized turn ON.

```
Pushbutton      Green                                    Internal
   F1          L1 Lamp                                  Kiln Start
  N7:6          N7:7                                      N7:11
 --| |--------|/|----------------------------------------( )------      Kiln Start signal is energized (ON) if start
    0           0                                          1            pushbutton F1 pressed.
Internal
Kiln Start
  N7:11
 --| |--
    1
```
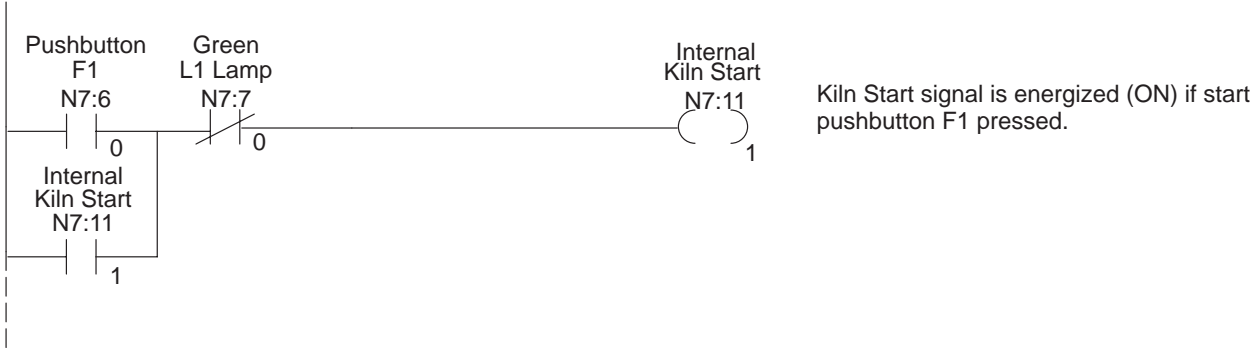
RUNG 3   **Kiln Starting Lamp Control**

This rung controls the annunciator lamps during startup mode.

```
Internal                                                 Yellow
Kiln Start                                               L2 Lamp
  N7:11                                                   N7:7
 --| |---------------------------------------------------( L )------     Yellow Lamp (L2) set ON.
    1                                                      1
                                                         Yellow
                                                        L2F Flash
                                                          N7:7
                                                         ( L )------     Yellow Flash (L2F) set ON.
                                                           4
                                                          Red
                                                        L3 Lamp
                                                          N7:7
                                                         ( U )------     Reset Red Lamp (L3) OFF.
                                                           2
```
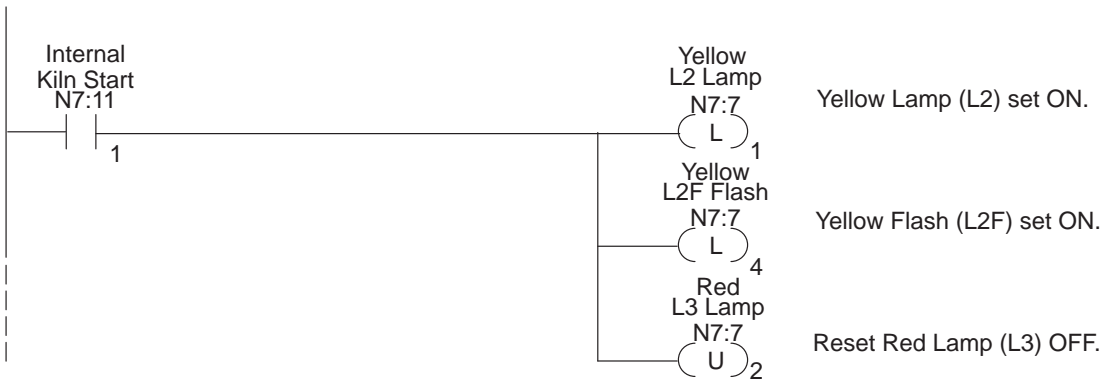
RUNG 4   **Startup Delay Timer**

This rung is the delay timer signal for the System Start control relay.

```
                            System
  Kiln       Pushbutton     Startup
 Starting        F2        Delay Timer                                  Kiln Starting input starts Delay Timer.
  N7:11        N7:6          T4:0          +-----------------------+
 --| |--------|/|----------|/|-----------| Timer On Delay         |
    1           1            DN          |                        |---( EN )
                                          | Timer        T4:0      |
                                          | Time Base    0.01      |---( DN )
                                          | Preset       200       |
                                          | Accum        0         |
                                          +-----------------------+
```
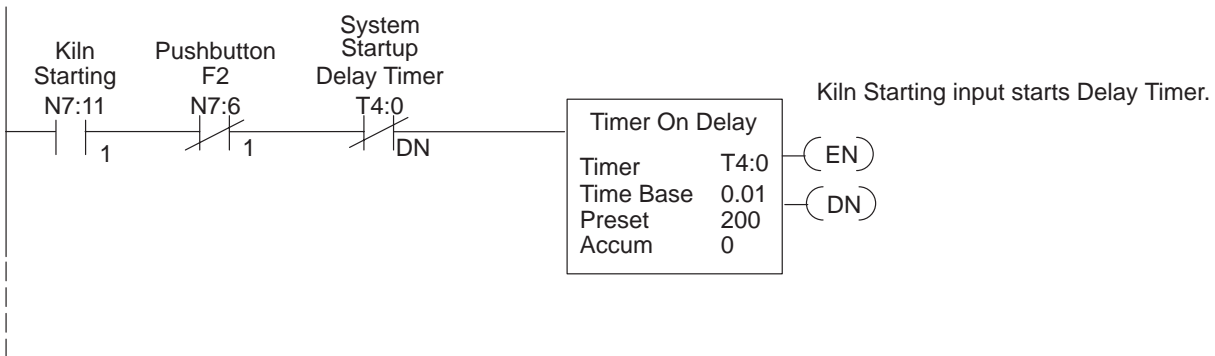
RUNG 5　　　　　　　**System Running**
This rung sets the internal control relay C52 System Running.

```
System Startup
  Delay Timer
     Done                                    Internal
     T4:0                                System Running
                                             N7:11          Set ON when timer T4:0 accumulative =
  ┤ ├─────────────────────────────────────( L )─ 2         preset.
    DN
```
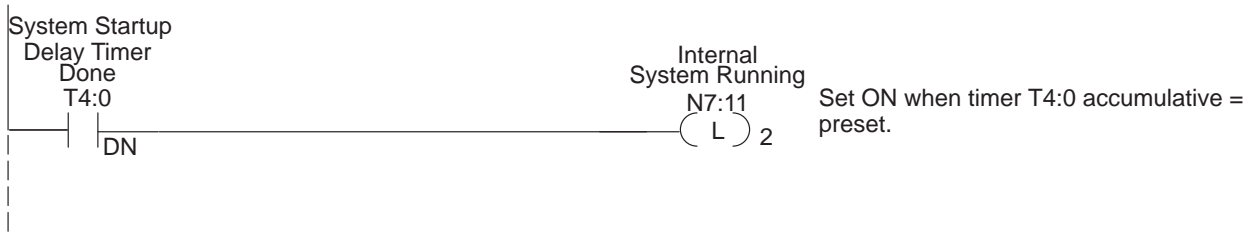
RUNG 6　　　　　　　**System Running Lamp Control**
This rung controls the annunciator lamps during startup mode.

```
    Internal                                  Green
System Running                               L1 Lamp
    N7:11                                      N7:7          Kiln running sets Green Lamp (L1) ON.
  ┤ ├──────────────────────────────────┬───( L )─ 0
     2                                  │    Yellow
                                        │   L2 Lamp
                                        │     N7:7          Resets Yellow Lamp (L2) OFF.
                                        ├───( U )─ 1
                                        │    Yellow
                                        │   L2 Flash
                                        │     N7:7          Reset Yellow Flash (L2F) OFF.
                                        └───( U )─ 4
```
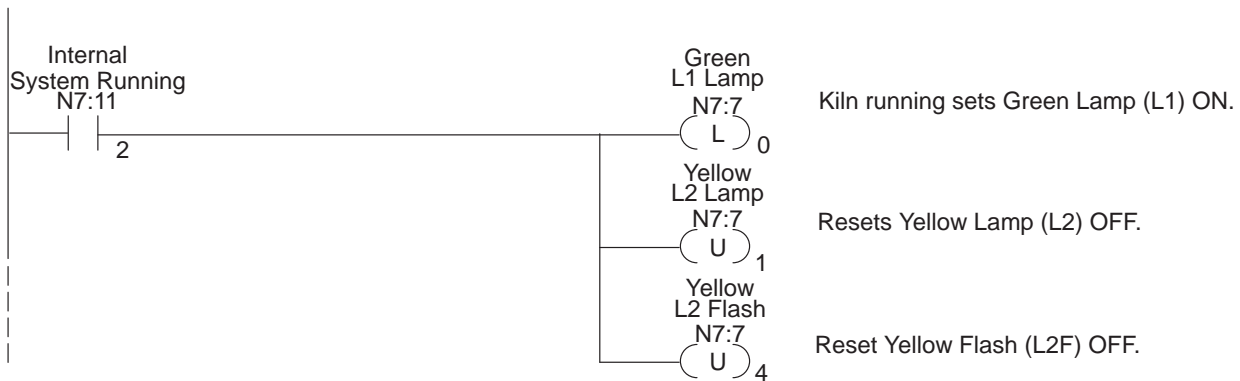
RUNG 7

This rung resets internal control relay (N7:11/2) System Running when alternating
pushbutton 2 (F2) is OFF.

```
Pushbutton  System Startup                   Internal
    F2       Delay Timer                  System Running
   N7:6         T4:0                          N7:11          Reset N7:11/2 System Running control relay.
  ┤/├─────────┤/├──────────────────────────( U )─ 2
    1           DN
```
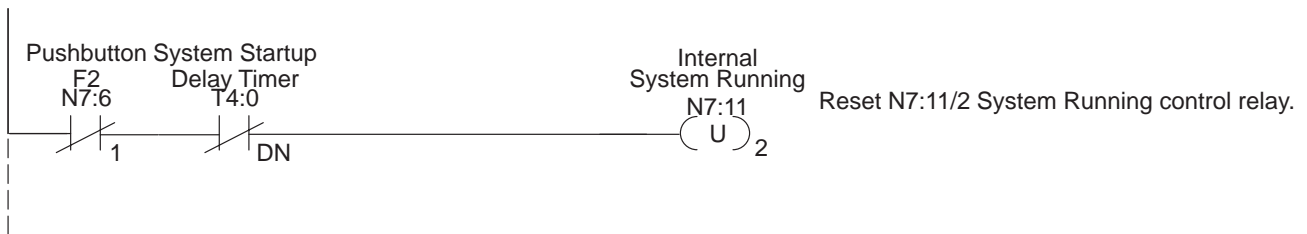
RUNG 8   **Kiln Starting Message**
This rung displays "Kiln Starting" message.

Kiln Starting
Internal
N7:11
—| |—
1

MOVE	
Source	3
Dest	N7:0
	0
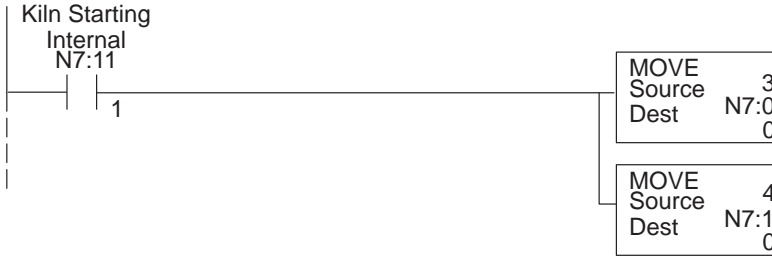
Load message #3 for top line display register m+0.

MOVE	
Source	4
Dest	N7:1
	0

Load message #4 to bottom line display register m+1.

RUNG 9   **System Running Message**
This rung displays "System Running" message.

System Running
Internal
N7:11
—| |—
2

MOVE	
Source	5
Dest	N7:0
	0

Load message #5 to top line display register m+0.

MOVE	
Source	6
Dest	N7:1
	0

Load message #6 to bottom line display register m+1.

RUNG 10   **Kiln System Stopped Message**
This rung displays "Kiln System Stopped".

Kiln Starting
Internal
N7:11
—|/|—
1

Pushbutton
F2
N7:6
—| |—
1

System Running
Internal
N7:11
—|/|—
2

MOVE	
Source	7
Dest	N7:0
	0
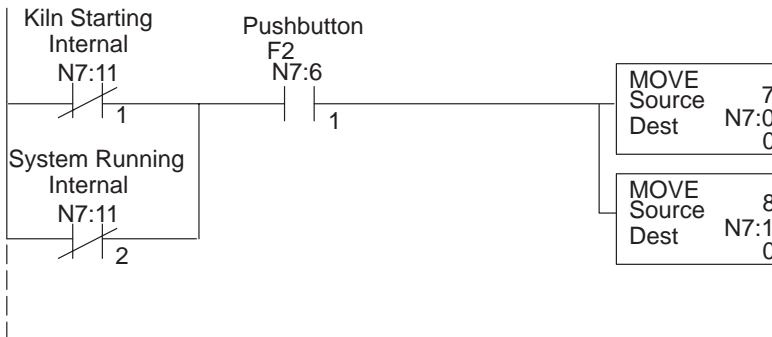
Load message #7 to top line display register m+0.

MOVE	
Source	8
Dest	N7:1
	0

Load message #8 to bottom line display register m+1.

RUNG 11   **Setpoint #1 Message Controls**
This rung is executed when the Function Select Bit and Menu Enabled are ON and
compare statement is equal such as menu function 1 has been selected.
The output displays the message.   "Meal Hopper (1–3):—"
                                                     "Arrow UP/DOWN =—"

Function Select Bit N7:6	Menu Enable (OP-1510) N7:7	Top Line Entry/Menu EQUAL SourceA N7:20 SourceB 1		

MOVE
Source   9
Dest   N7:00
Load integer value in K9=9.
Output top line message #9 selection.

MOVE
Source   10
Dest   N7:10
Load integer value K10=10.
Output bottom line message #9 selection.

MOVE
Source N7:210
Dest   N7:20
Load value in storage register for Setpoint #1
Output top line data for SP1 current value.

SP1 in Process
N7:10
(L)1
Set operator entry internal SP1 in Process.

Menu Enable
N7:7
(U)7
Reset ME control bit OFF.

RUNG 12   **Setpoint #1 Data Storage**
This rung stores the up/down arrow value selected for Setpoint #1 when the ENTER
key is pressed and Data Available status bit is ON.

SP1 In Process N7:10	Data Available DA N7:6		

MOVE
Source   N7:40
Dest   N7:210
Load bottom line data entry value.
Output to Setpoint #1 strorage register N7:21.

MOVE
Source   N7:40
Dest   N7:20
Load bottom line data entry value.
Output top line data for SP1 in process.

SP1 in Process
N7:10
(U)1
Reset operator entry internal control relay SP1 in Process.

Internal Entry Complete
N7:10
(L)0
Sets Data Entry Complete internal control relay ON.

RUNG 13   **Setpoint #2 Message Controls**
This rung is executed when the Function Select Bit and Menu Enabled bit are ON
and the compare statement is equal such as menu function 1 has been selected).
The output displays the message   "Kiln Speed (%):   "
                                          "New Kiln Speed=   "

Function Select Bit N7:6	Menu Enable (OP-1510) N7:7	Top Line Entry/Menu EQUAL SourceA N7:20 SourceB 2		

MOVE Source 11 Dest N7:00 — Load integer value in K11=11. Output top line message #11 selection.

MOVE Source 12 Dest N7:10 — Load integer value K12=12. Output top line message #12 selection.

MOVE Source N7:220 Dest N7:20 — Load value in storage register for Setpoint #2. Output top line data for SP2 current value.

MOVE Source 1 Dest N7:30 — Load value in storage register for Setpoint #2. Output top line data for SP2 decimal point.

SP2 In Process N7:10 (L) 2 — Set operator entry internal SP2 in Process.

Menu Enable N7:7 (U) 7 — Reset ME control bit OFF.

RUNG 14   **Setpoint #2 Data Storage**
This rung stores the keypad entry value selected for Setpoint #2 after the ENTER
key is pressed and Data Available status bit is ON.

SP2 in Process N7:10	Data Available DA N7:6	

MOVE Source N7:40 Dest N7:220 — Load bottom line data entry value. Output to Setpoint #2 storage register N7:22.

MOVE Source N7:40 Dest N7:20 — Load bottom line data entry value. Output top line data for SP2 in process.

SP2 in Process N7:10 (U) 2 — Reset operator entry internal SP2 in Process.

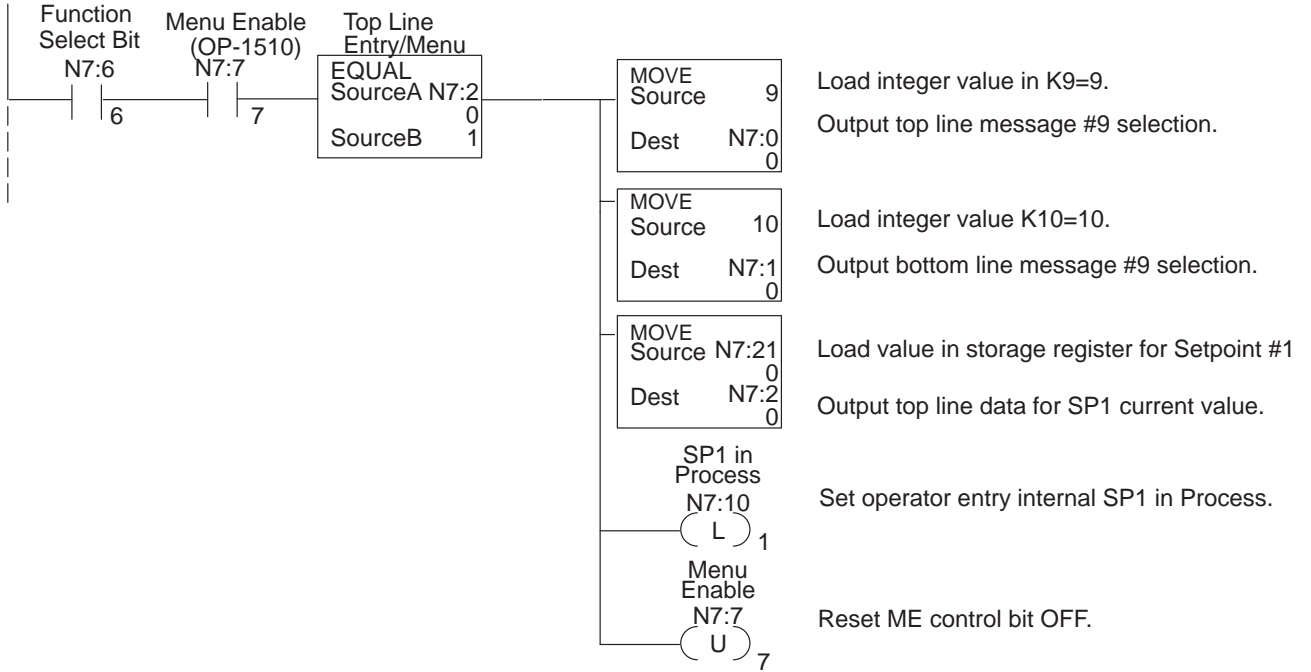Entry Complete Internal N7:10 (L) 0 — Set Entry Complete internal bit ON.

RUNG 15   **Setpoint #3 Message Controls**
This rung is executed when Function Select Bit and Menu Enabled BIT are ON and
THE compare statement is equal such as menu function 3 has been selected.
The output displays the message   "Zone1 Temp SP: "
                                      "Enter New Temp.=   "

Function Select Bit N7:6	Menu Enable (OP-1510) N7:7	Top Line Entry/Menu EQUAL SourceA N7:20 SourceB 3		
⊣⊢ 6	⊣⊢ 7		MOVE Source 13 Dest N7:00	Load integer value in K13=13 Output bottom line message #13 selection.
			MOVE Source 14 Dest N7:10	Load integer value K14=14. Output top line message #14 selection.
			MOVE Source N7:230 Dest N7:20	Load value in storage register for Setpoint #3 Output top line data for SP3 current value.
			SP3 Process N7:10 (L) 3	Set operator entry internal SP3 in Process.
			Menu Enable N7:7 (U) 7	Reset ME control bit OFF.

RUNG 16   **Setpoint #3 Data Storage**
This rung stores the keypad entry value selected for Setpoint #3 after the ENTER
key is pressed and Data Available status bit is ON.

SP3 In Process N7:10	Data Available DA N7:6		
⊣⊢ 3	⊣⊢ 5	MOVE Source N7:40 Dest N7:230	Load bottom line data entry value. Output to Setpoint #3 strorage register N7:23.
		MOVE Source N7:40 Dest N7:20	Load bottom line data entry value. Output top line data for SP3 in process.
		SP3 In Process N7:10 (U) 3	Resets operator entry internal SP3 in Process.
		Entry Complete Internal N7:10 (L) 0	Sets Data Entry Complete internal ON.

RUNG 17   **Setpoint #4 Message Controls**

This rung is executed when Function Select Bit and Menu Enabled bit are ON and the compare statement is equal such as menu function 4 has been selected.
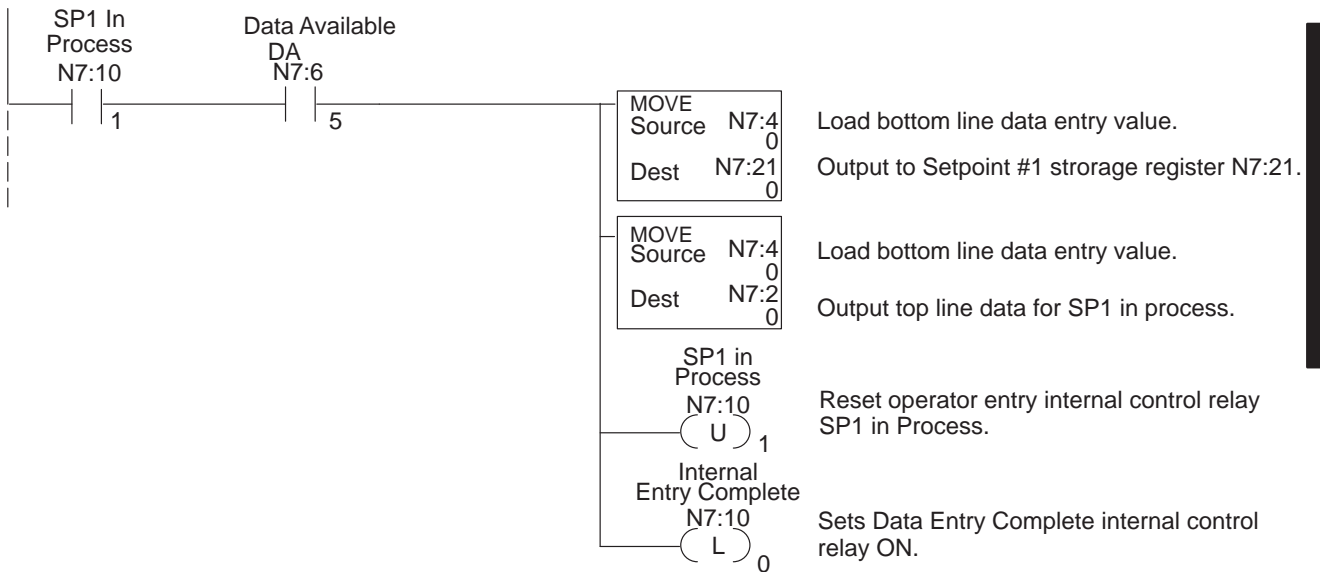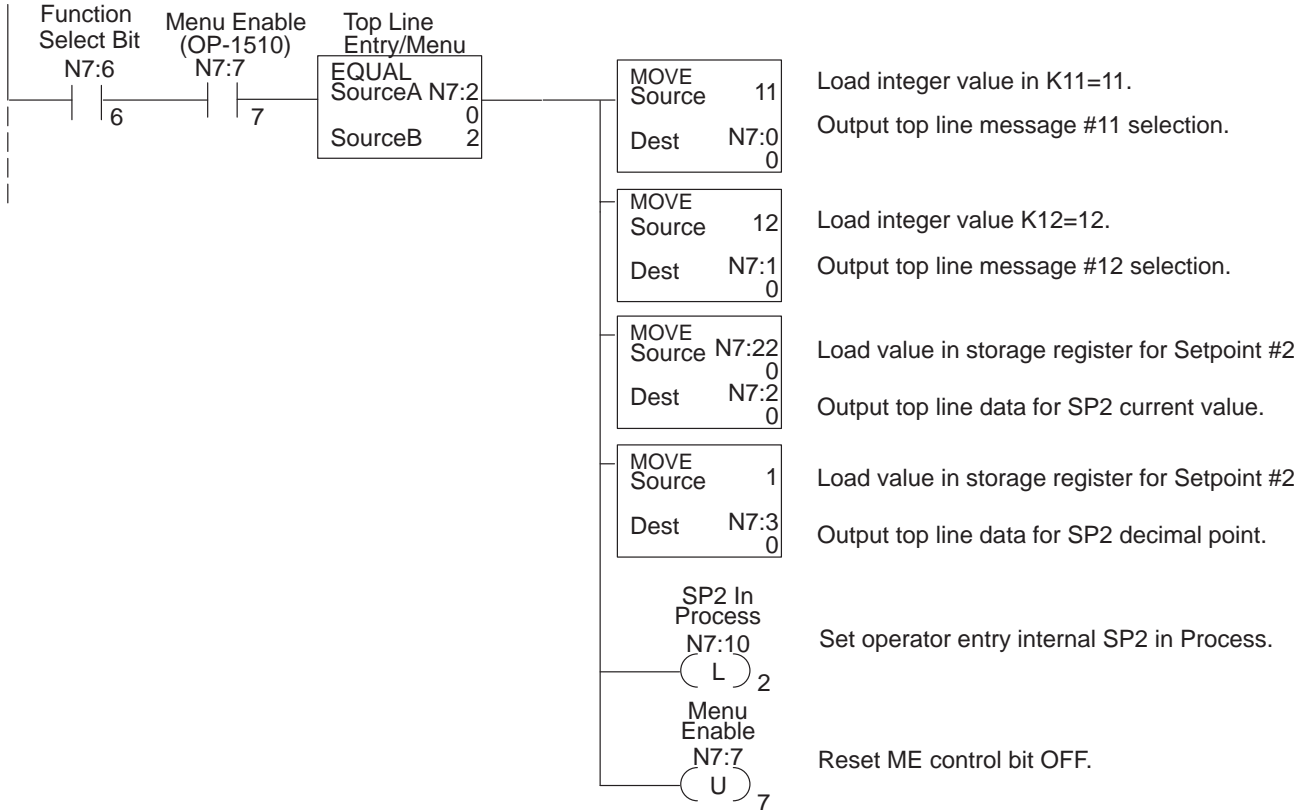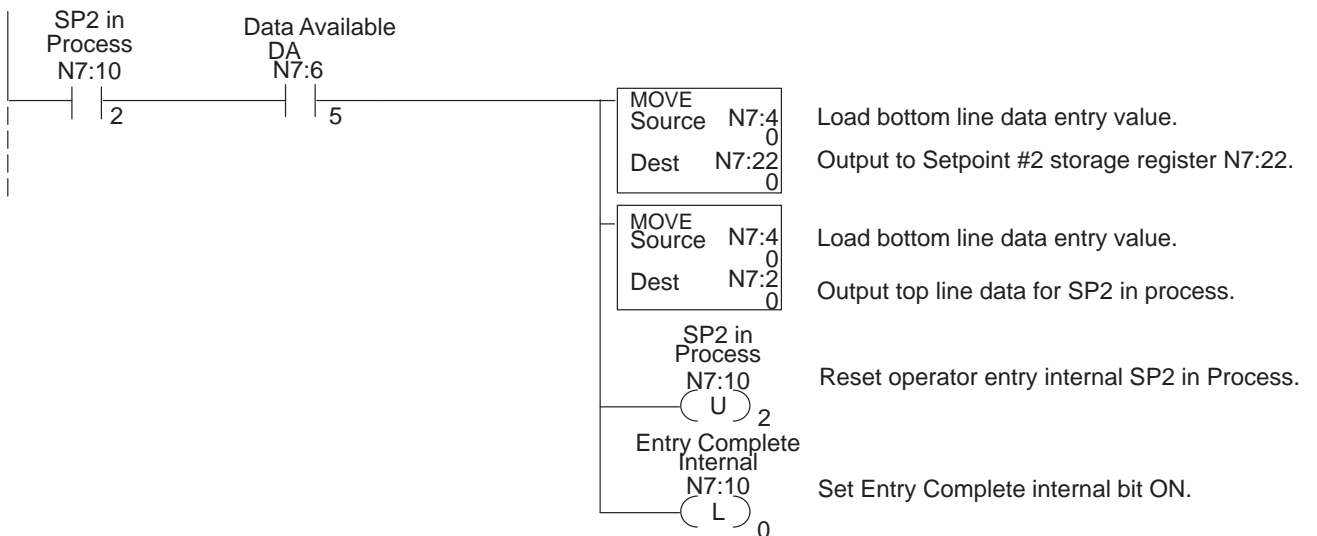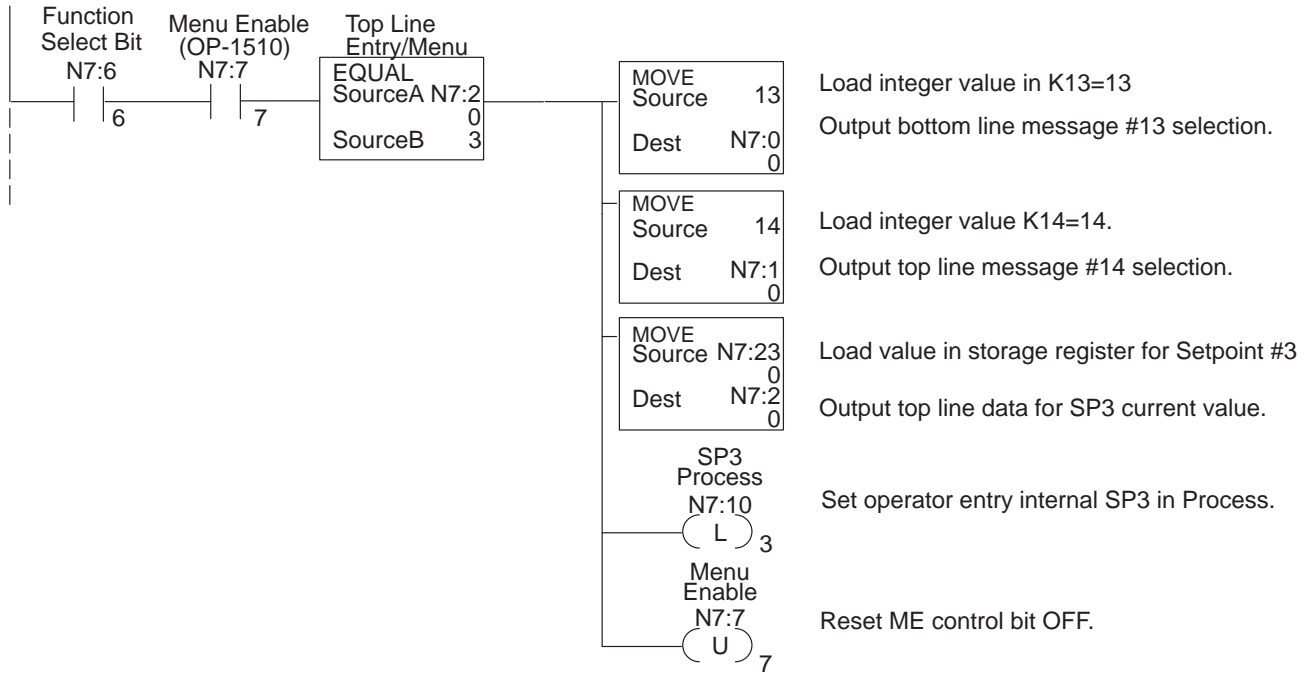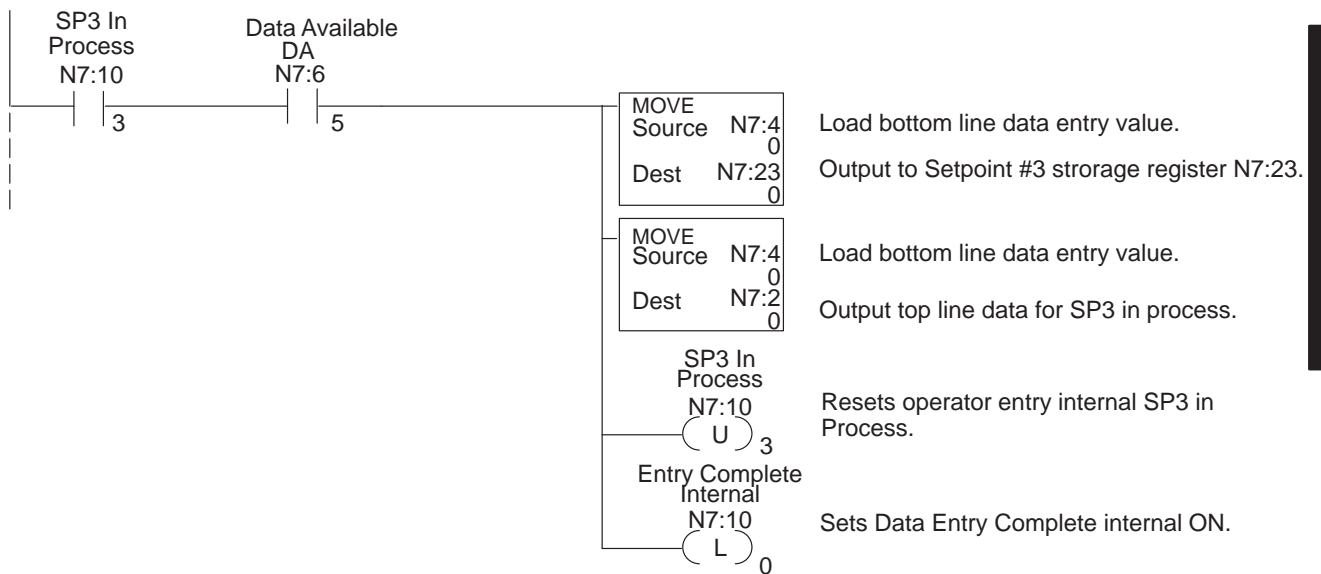
The output displays the message   "Zone2 Temp SP: "
                                          "Enter New Temp.=   "

```
Function      Menu Enable   Top Line
Select Key    (OP-1510)     Entry/Menu
N7:6          N7:7          EQUAL               MOVE
  | |           | |         SourceA N7:20       Source    15      Load integer value in K15=15
   6             7          SourceB    4
                                                Dest    N7:0      Output top line messae #15 selection.
                                                          0

                                                MOVE
                                                Source    16      Load integer value K16=16.

                                                Dest    N7:1      Output bottom line message #16 selection.
                                                          0

                                                MOVE
                                                Source N7:24      Load value in storage register for Setpoint#4
                                                          0
                                                Dest    N7:2      Output top line data for SP4 current value.
                                                          0

                                                SP4
                                                Process
                                                N7:10
                                                 (L)            Set operator entry internal SP4 in Process.
                                                    4
                                                Menu
                                                Enable
                                                N7:7
                                                 (U)            Reset ME control bit OFF.
                                                    7
```

RUNG 18   **Setpoint #4 Data Storage**

This rung stores the keypad entry value selected for Setpoint #4 after the ENTER key is pressed and Data Available status bit is ON.
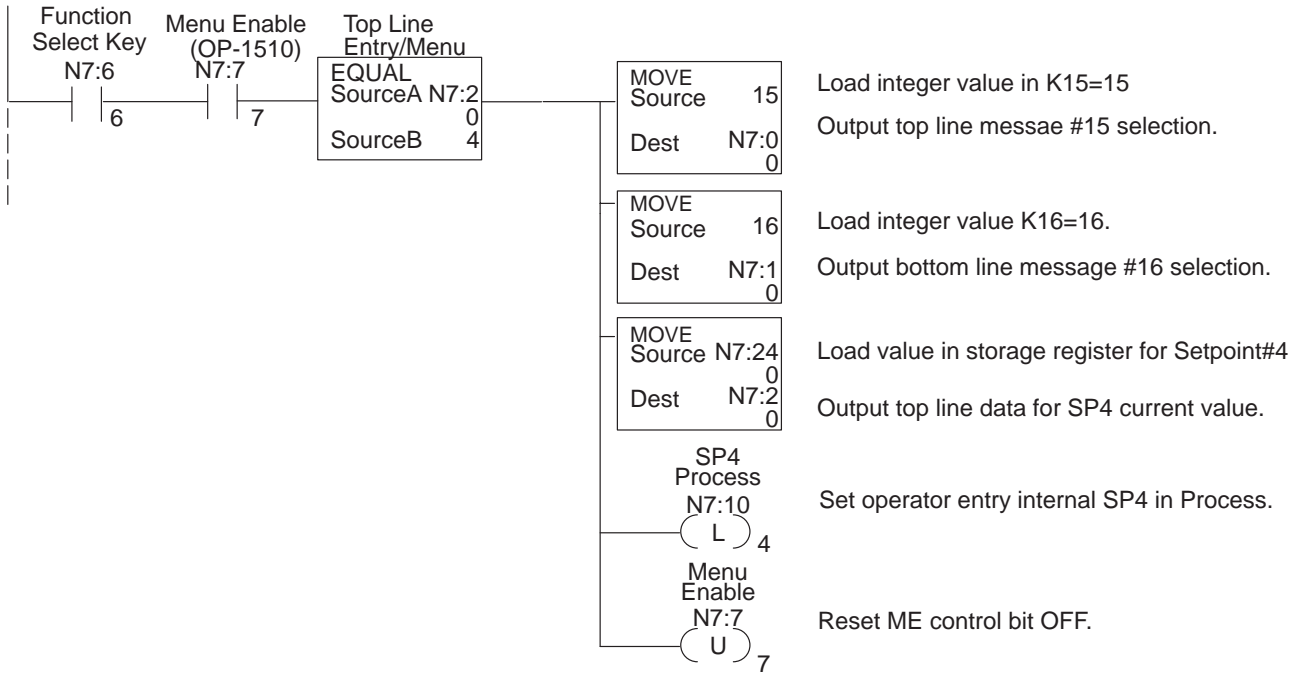
```
SP4 In        Data Available
Process       DA
N7:10         N7:6
  | |           | |               MOVE
   4             5                Source   N7:4      Load bottom line data entry value.
                                             0
                                  Dest    N7:24      Output to Setpoint #4 strorage register N7:24.
                                             0

                                  MOVE
                                  Source   N7:4      Load bottom line data entry value.
                                             0
                                  Dest     N7:2      Output top line data for SP4 in process.
                                             0

                                  SP4 In
                                  Process
                                  N7:10
                                   (U)            Reset operator entry internal SP4 in Process.
                                      4
                                  Entry Complete
                                  Internal
                                  N7:10
                                   (L)            Sets Data Entry Complete internal ON.
                                      0
```

RUNG 19   **Setpoint #5 Message Controls**

This rung is executed when Select key and Menu Enabled bit are ON and the compare statement is equal such as menu function 5 has been selected.
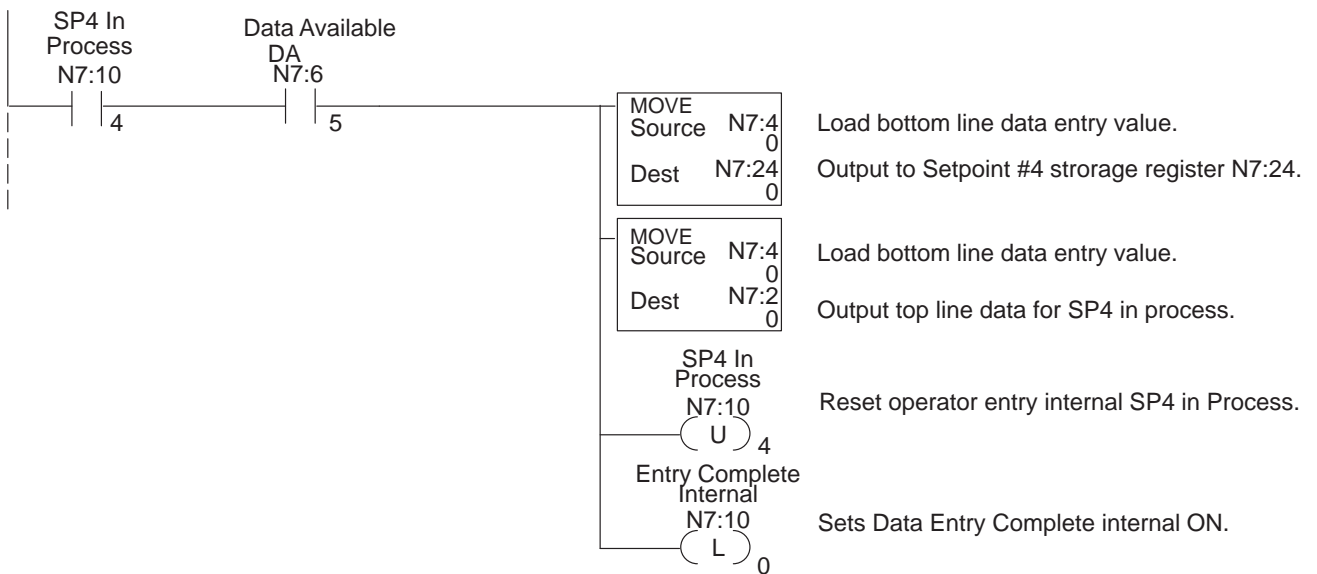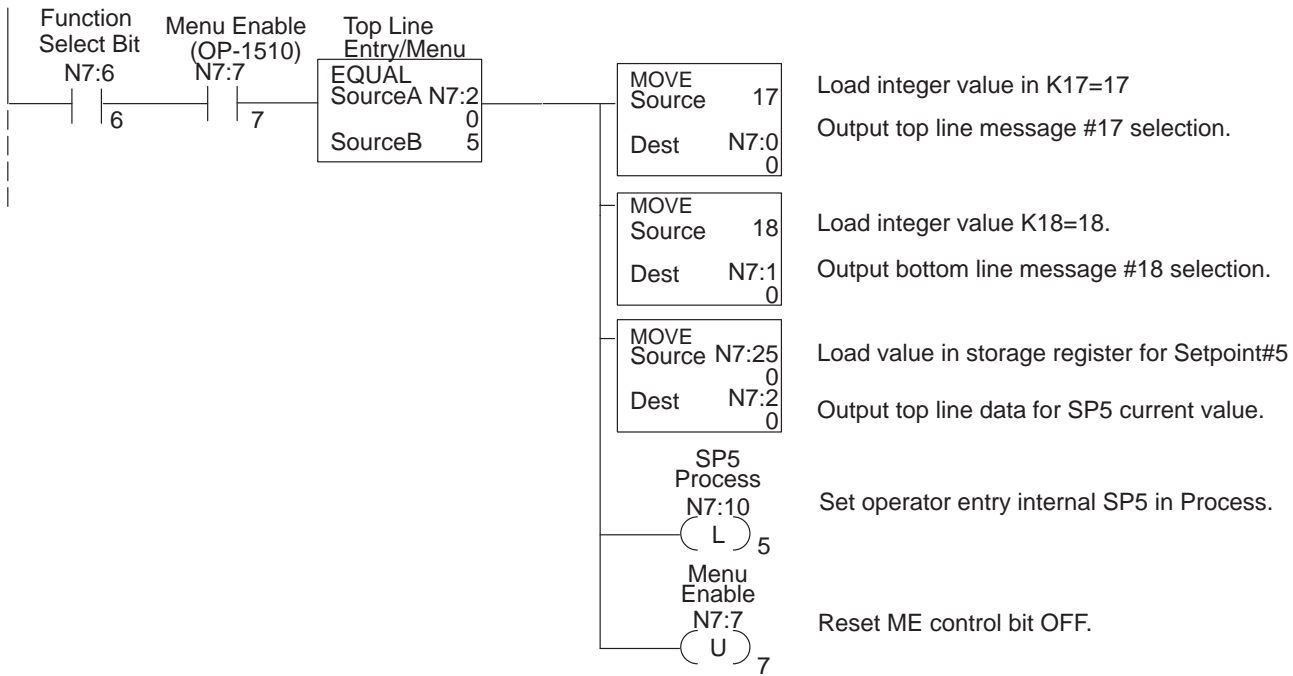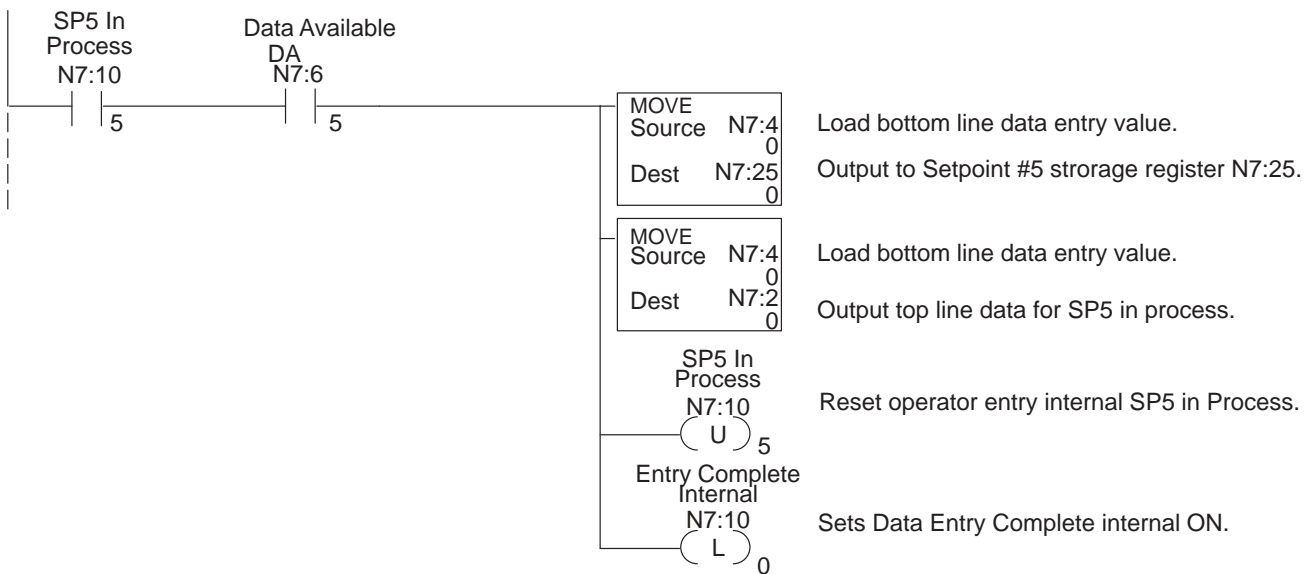The output displays the message   "Zone3 Temp SP: "
                 "Enter New Temp.=   "

```
Function      Menu Enable    Top Line
Select Bit    (OP-1510)      Entry/Menu
N7:6          N7:7           EQUAL
                             SourceA N7:20        MOVE
 ─┤ ├────────┤ ├──────────   SourceB    5     ─── Source     17
   6            7                                  Dest      N7:00
```

Load integer value in K17=17

Output top line message #17 selection.

```
                                                   MOVE
                                                   Source     18
                                                   Dest      N7:10
```

Load integer value K18=18.

Output bottom line message #18 selection.

```
                                                   MOVE
                                                   Source  N7:250
                                                   Dest     N7:20
```

Load value in storage register for Setpoint#5

Output top line data for SP5 current value.

```
                                                   SP5
                                                   Process
                                                   N7:10
                                                  ─( L )─ 5
```

Set operator entry internal SP5 in Process.

```
                                                   Menu
                                                   Enable
                                                   N7:7
                                                  ─( U )─ 7
```

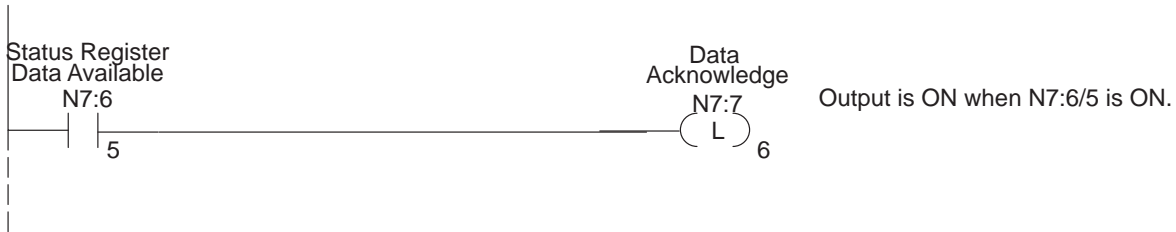Reset ME control bit OFF.

RUNG 20   **Setpoint #5 Data Storage**

This rung stores the keypad entry value selected for Setpoint #5 after the ENTER key is pressed and Data Available status bit is ON.

```
SP5 In        Data Available
Process       DA
N7:10         N7:6                                 MOVE
 ─┤ ├────────┤ ├──────────────────────────────    Source   N7:40
   5            5                                  Dest     N7:250
```

Load bottom line data entry value.

Output to Setpoint #5 strorage register N7:25.

```
                                                   MOVE
                                                   Source   N7:40
                                                   Dest      N7:20
```

Load bottom line data entry value.

Output top line data for SP5 in process.

```
                                                   SP5 In
                                                   Process
                                                   N7:10
                                                  ─( U )─ 5
```

Reset operator entry internal SP5 in Process.

```
                                                   Entry Complete
                                                   Internal
                                                   N7:10
                                                  ─( L )─ 0
```

Sets Data Entry Complete internal ON.

Appendix D

RUNG 21   **Data Entry Acknowledge**
This rung controls Data Acknowledge to the OP-panel indicating the PLC data entry and storage is complete.
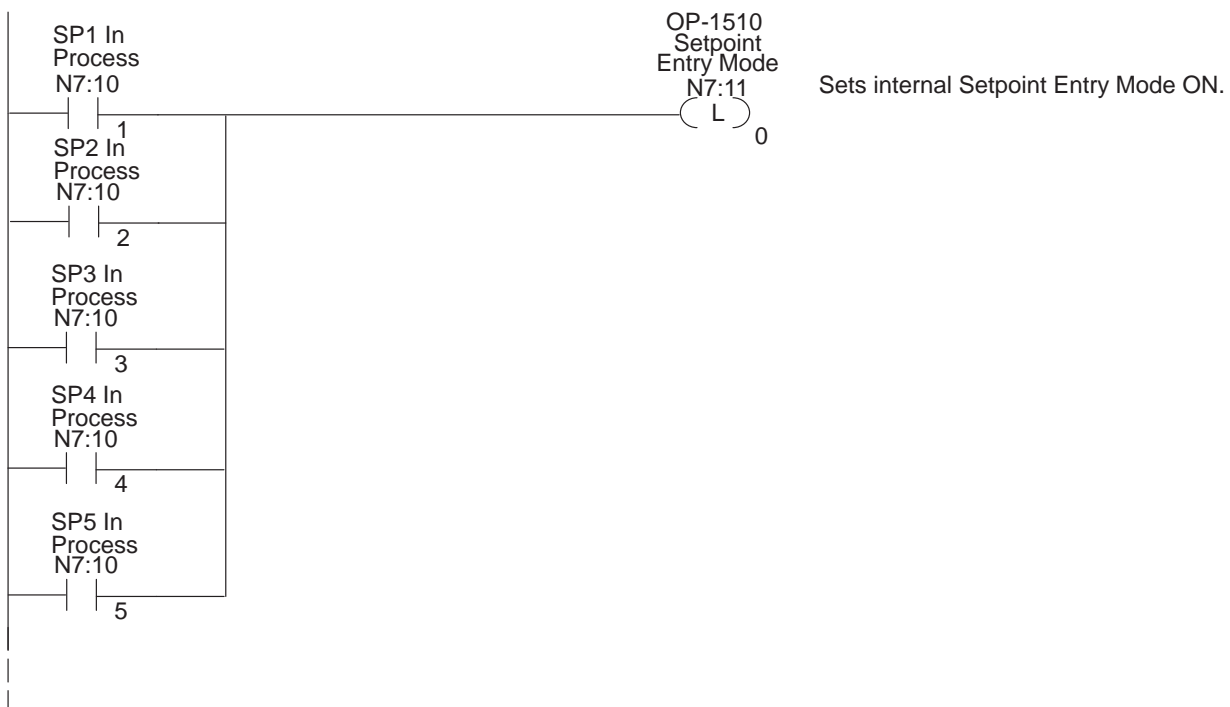
```
Status Register
Data Available                                      Data
N7:6                                            Acknowledge
 ┤ ├──────────────────────────────────────────   N7:7        Output is ON when N7:6/5 is ON.
   5                                              ─( L )─
                                                         6
```

RUNG 22   **Post Entry Control**
This rung prepares the program for the next OP-panel operation.

```
                                                       OP-1510
                                                        Menu
Internal           Data Available                      Enable
Entry Completed         DA                             N7:7        Sets ME control register bit ON.
N7:10                 N7:6                           ─( L )─
 ┤ ├───────────────┤/├──────────────────────┬──       7
   0                   5                     │
                                             │      Internal
                                             │   Entry Completeed
                                             │      N7:10        Reset internal control relay Data Entry
                                             └──  ─( U )─         Complete.
                                                         0
```
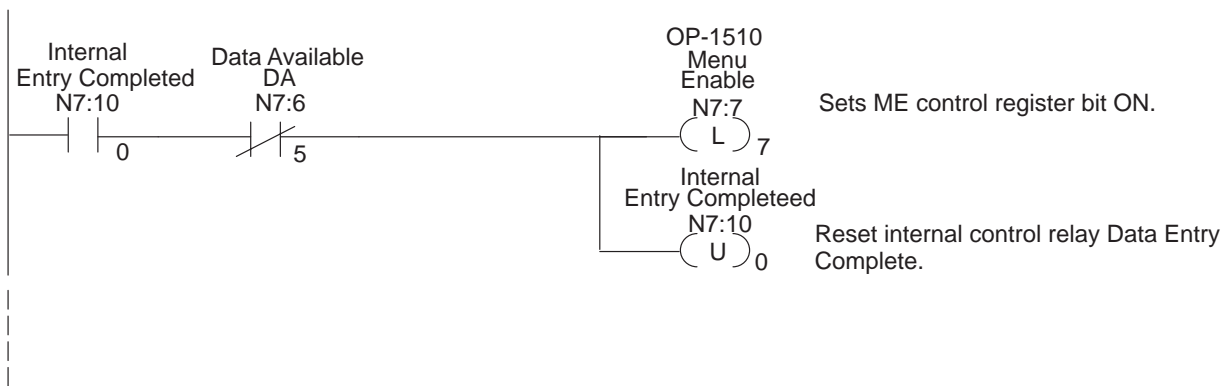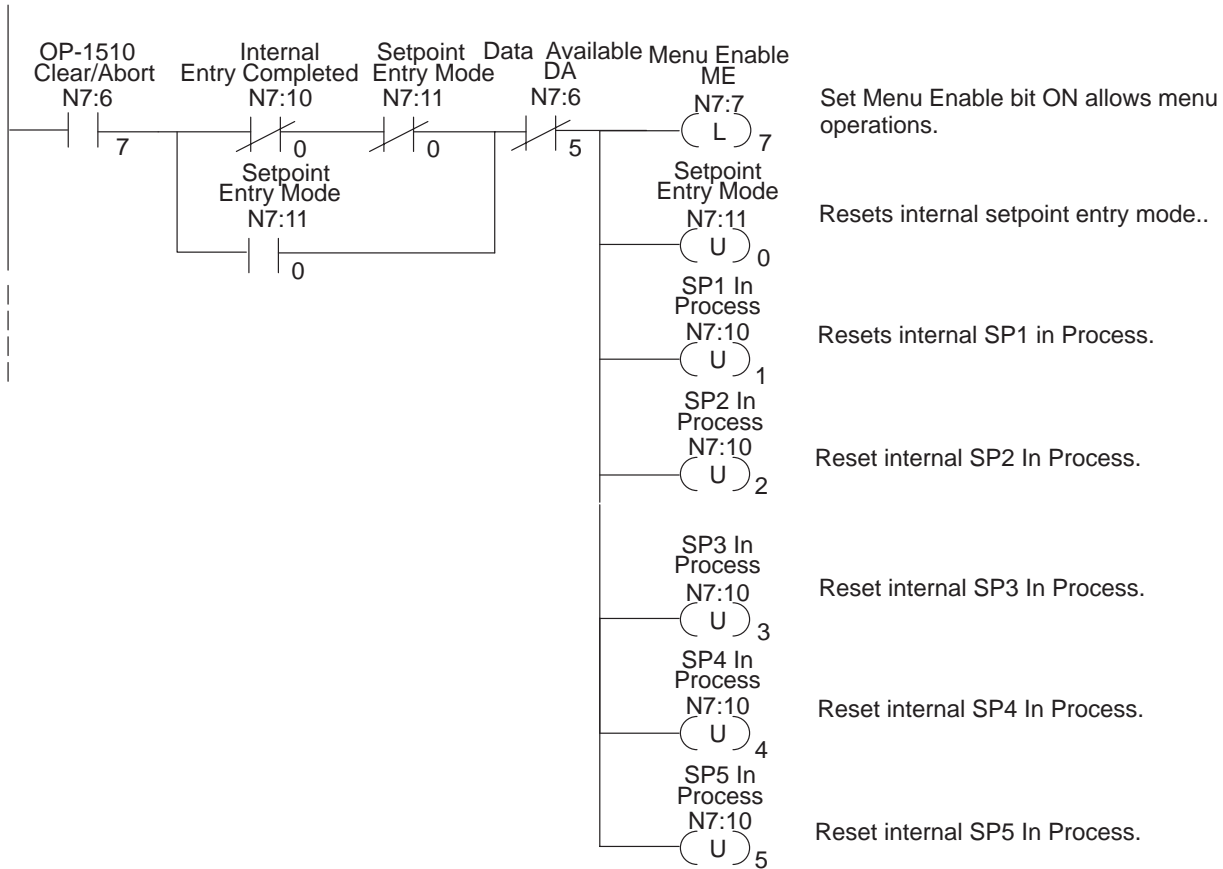
RUNG 23   **Entry Mode Interlock**
This rung sets internal Entry Mode which is used to interlock Entry Mode.

```
SP1 In                                                 OP-1510
Process                                                Setpoint
N7:10                                                Entry Mode
 ┤ ├───────────┬──────────────────────────────         N7:11      Sets internal Setpoint Entry Mode ON.
   1           │                                     ─( L )─
SP2 In         │                                            0
Process        │
N7:10          │
 ┤ ├───────────┤
   2           │
SP3 In         │
Process        │
N7:10          │
 ┤ ├───────────┤
   3           │
SP4 In         │
Process        │
N7:10          │
 ┤ ├───────────┤
   4           │
SP5 In         │
Process        │
N7:10          │
 ┤ ├───────────┘
   5
```

RUNG 24   **Entry Mode Abort**

This rung enables Menu Enable, resets Entry Mode, and Setpoint In Process control relays, which are used for OP-panel program control.

Set Menu Enable bit ON allows menu operations.

Resets internal setpoint entry mode..

Resets internal SP1 in Process.

Reset internal SP2 In Process.

Reset internal SP3 In Process.

Reset internal SP4 In Process.

Reset internal SP5 In Process.

RUNG 25   **End of program**

This rung marks the END of program.