# Appendix C
# DL 305
# Application Example

**C**

In This Appendix. . . .
— DL305 Program Example (DL330/DL340 Only)

**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 items listed in the figure below such as Hopper Selection, Kiln Speed, Kiln Zone Temperatures are monitored and controlled by the OP-panel example programs.
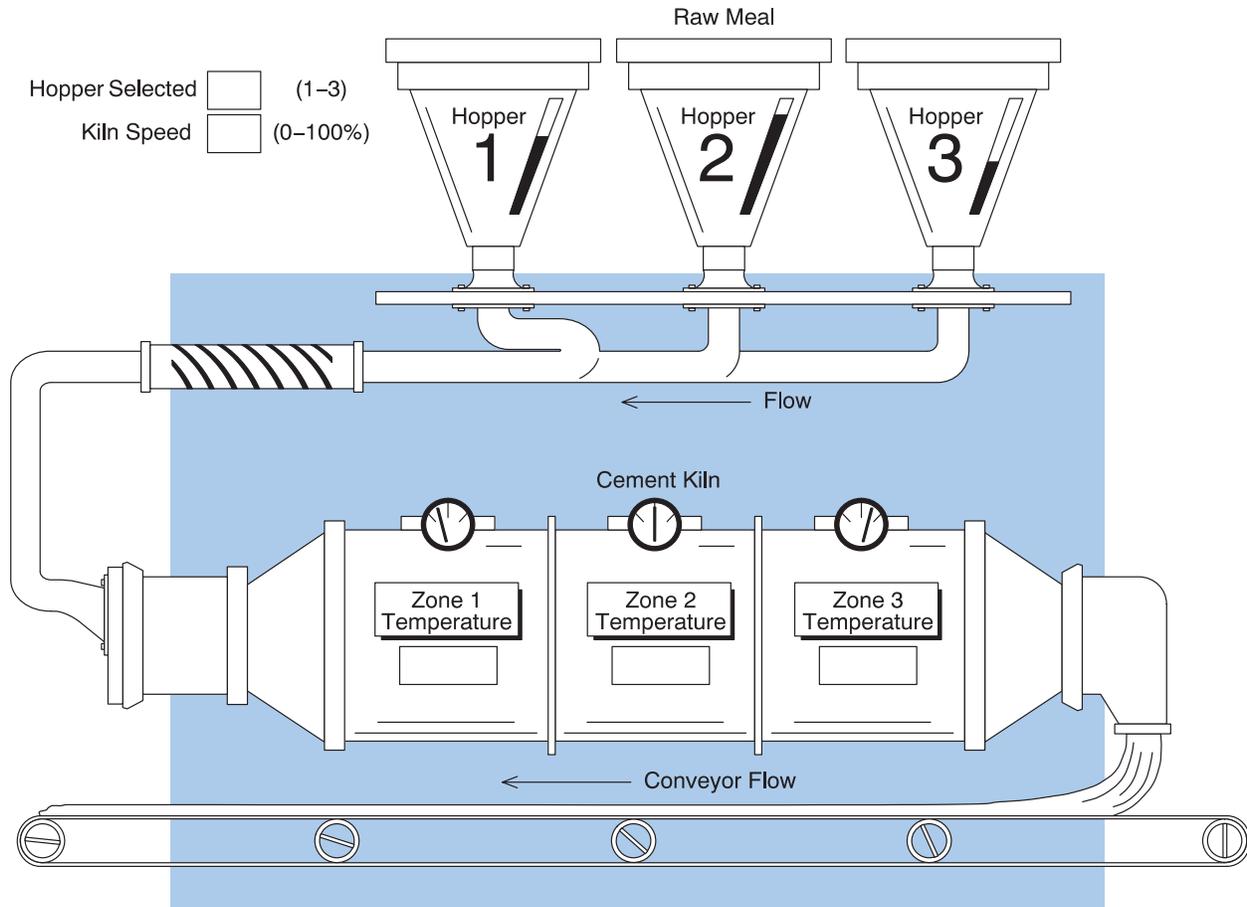


The example program listed on the following pages is designed for *Direct*LOGIC DL305 PLC systems. The program is included on the 3 1/2 inch floppy disk provided with this manual.

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:

**770–844–4209**

If you find a problem with any of our products, services, or manuals, please fill out and return the 'Suggestions' card that was shipped with this manual.

# *Direct*LOGIC DL305 Example Program

The example program listed on the following pages is designed for *Direct*LOGIC DL305 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_305.prj

This example program (1510_305.PRJ) should be used with the OP–1510 configuration file 1510_305.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 *Direct*Logic DL305 and compatible 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 OP-panel and display message #1 and message #2.



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| Instruction | Description |
|---|---|
| DSTR F50 K1 | Load constant K1 to select message #1 for top line display. |
| DOUT F60 R400 | Output to base register m+0 (R400) for top line message display. |
| DSTR F50 K2 | Load constant K2 to select message #2 for bottom line display. |
| DOUT F60 R402 | Output to base register m+1 (R402) for bottom line Message display. |
| OP–1510 Only Menu Enable C227 (SET) | ME bit set ON allows menu operations. |
| OP–1510 Only Menu Return C230 (SET) | MR bit set ON returns to last menu selected. |
| Status Register BD C231 (SET) | Beeper Disable set ON which disables pushbutton and keypad beeper. |
| Green L1 Lamp C220 (RST) | L1 bit reset OFF which de-energizes Green Lamp. |
| Red L3 Lamp C222 (SET) | L3 bit set ON which energizes Red Lamp. |

Appendix C

**RUNG 2**         **Memory Mapping**
This rung is necessary for all **Direct**LOGIC CPUs which *do not* support bit of word instructions. Mapping the Status and Control registers into internal control relays is necessary to have bit level access to this data. The Status and Control register bits are used to monitor pushbuttons, control lamps, and perform asynchronous data exchange between the OP-panel and PLC.

First
Scan
C374

| DSTR F50 R414 | Load the Status Register (m+6) R414/R415. |

| DOUT F60 RC200 | Output Status Register into Internal Control Relays C200–C217. |

| DSTR F50 RC220 | Load the Internal Control Relays C220–C237. |

| DOUT F60 R416 | Output to Control Register (m+7) R416/R417. |
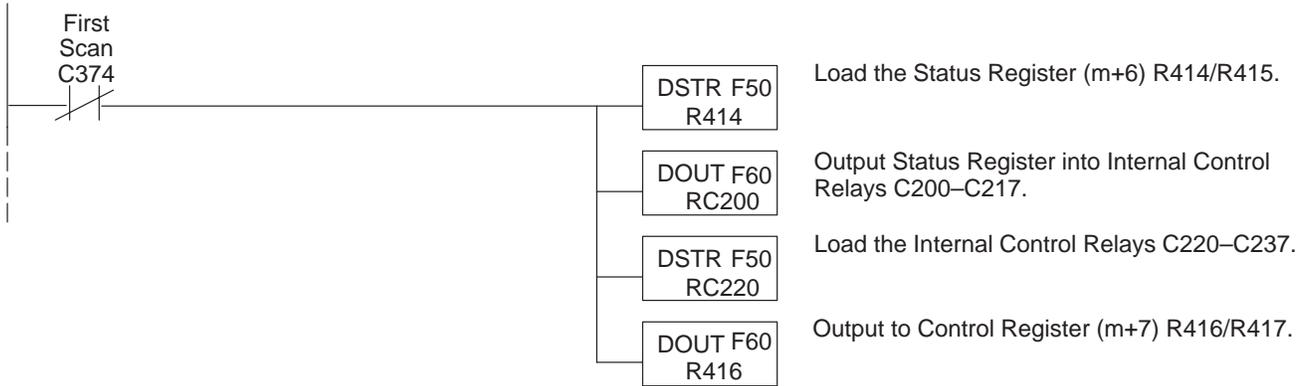
**RUNG 3**         **Kiln Start Control**
This rung starts the machine process. The internal control relay Kiln Start (C251) is used to start the Startup Delay Timer, and will remain ON until the L1 control register bit (C220) is energized.

Pushbutton
F1
C200

Green
L1 Lamp
C220

Internal
Kiln Start
C251
(OUT)

Internal
Kiln Start
C251

Kiln Start signal is energized (ON) if start pushbutton F1 pressed.
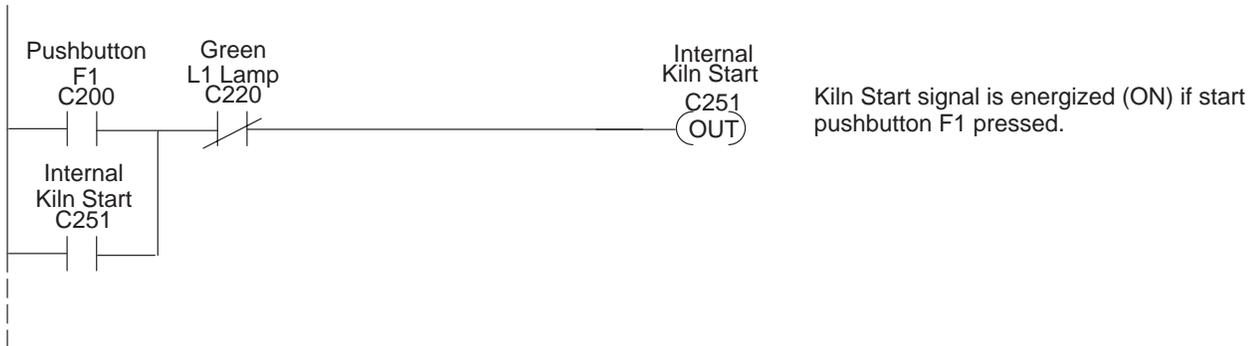
**RUNG 4**         **Kiln Starting Lamp Control**
This rung controls the annunciator lamps during startup mode.

Internal
Kiln Start
C251

Yellow
L2 Lamp
C221
(SET)

Yellow Lamp (L2) set ON.

Yellow
L2F Flash
C224
(SET)

Yellow Flash (L2F) set ON.

Red
L3 Lamp
C222
(RST)

Reset Red Lamp (L3) OFF.
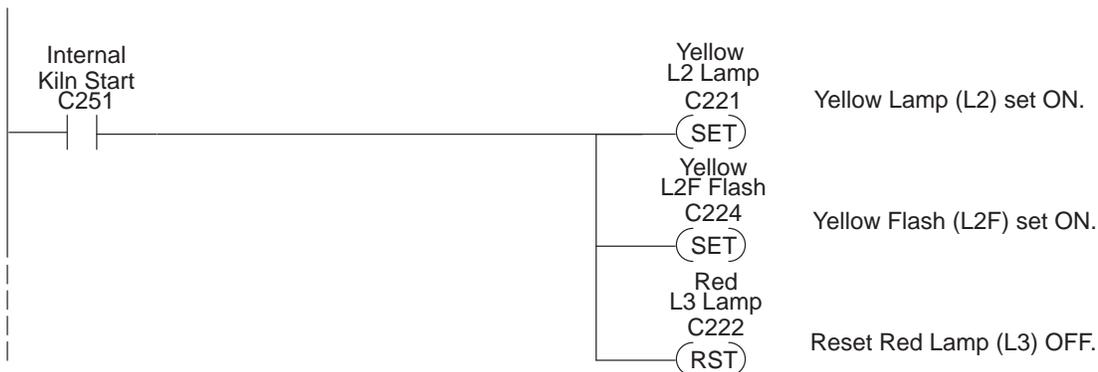
**RUNG 5**          **Startup Delay Timer**
This delay timer signals the System Running (C252) control relay.

```
  Internal    PushbuttonSystem Startup
Kiln Starting    F2     Delay Timer
   C251        C201       T600                    ┌─────────────┐   Kiln Start Delay Timer is energized (ON) if
────┤ ├──────────┤/├────────┤/├──────────────────│ TMR         │   start pushbutton F1 pressed.
                                                  │ System Startup
                                                  │ Delay Timer │
                                                  │             │
                                                  │    T600     │
                                                  │    K20      │
                                                  └─────────────┘
```
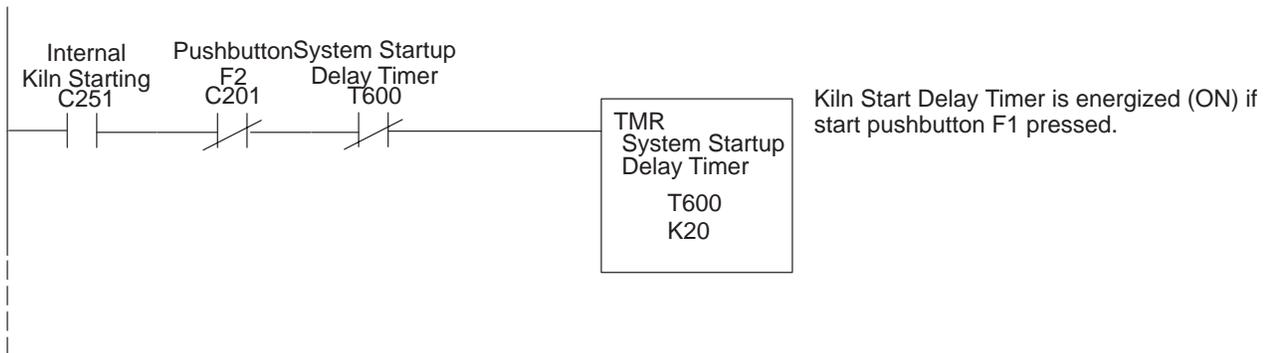
**RUNG 6**          **System Running**
This rung sets internal control relay (C252) System Running (C52) ON.

```
System Startup                                    Internal
 Delay Timer                                  System Running
    T600                                          C252           Set ON when timer T600 accumulative =
────┤ ├──────────────────────────────────────────(SET)          preset.
```
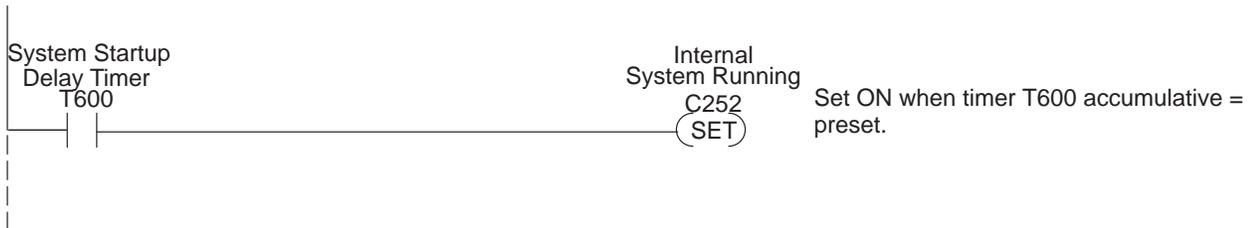
**RUNG 7**          **System Running Lamp Control**
This rung controls the annunciator lamps during startup mode.

```
  Internal                                         Green
System Running                                    L1 Lamp
   C252                                            C220          Kiln running sets Green Lamp (L1) ON.
────┤ ├──────────────────────────────────────┬────(SET)
                                              │
                                              │   Yellow
                                              │   L2 Lamp
                                              │    C221         Resets Yellow Lamp (L2) OFF.
                                              ├────(RST)
                                              │
                                              │   Yellow
                                              │   L2 Flash
                                              │    C224         Reset Yellow Flash (L2F) OFF.
                                              └────(RST)
```
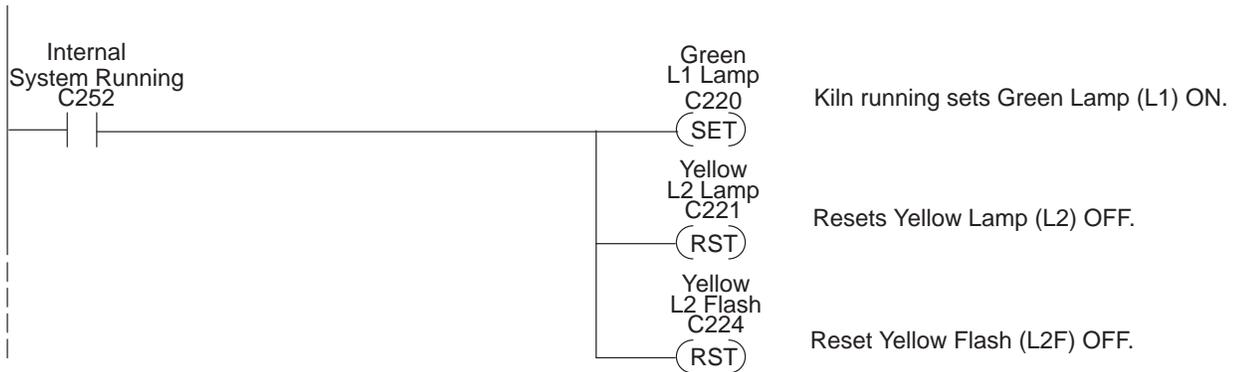
**RUNG 8**          **Reset System Running**
This rung resets internal control relay (C252) System Running when alternating
pushbutton 2 (F2) is OFF.

```
Pushbutton System Startup                          Internal
   F2     Delay Timer                          System Running
  C201       T600                                  C252          Reset C252 System Running control relay.
───┤/├────────┤/├──────────────────────────────────(RST)
```
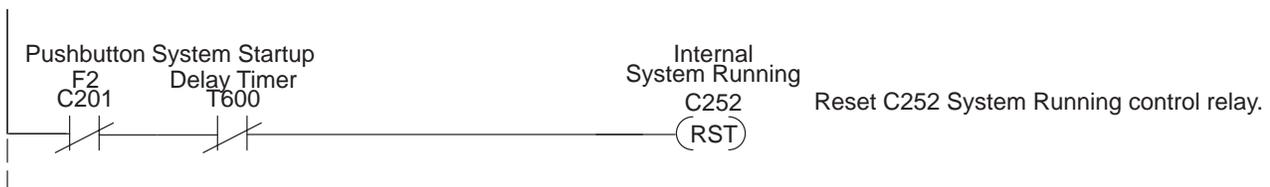
**RUNG 9**         **Kiln Starting Message**
This rung displays "Kiln Starting" message when internal (C251) is ON.

```
Internal
Kiln Starting
   C251
    ┤ ├──────────────────────┬──────────┐
                             │ DSTR  F50 │   Load integer value K3 = 3.
                             │    K3     │
                             ├──────────┤
                             │ DOUT  F60 │   Output top Line message #3.
                             │   R400    │
                             ├──────────┤
                             │ DSTR  F50 │   Load integer value K4 = 4.
                             │    K4     │
                             ├──────────┤
                             │ DOUT  F60 │   Output bottom line message #4.
                             │   R402    │
                             └──────────┘
```
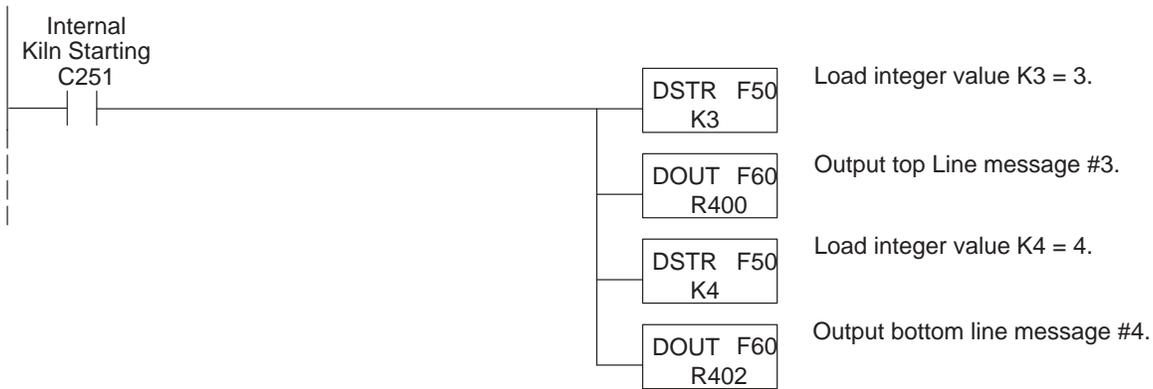
**RUNG 10**        **System Running Message**
This rung displays the "System Running" message when internal input (C252) is ON.

```
  Internal
System Running
   C252
    ┤ ├──────────────────────┬──────────┐
                             │ DSTR  F50 │   Load integer value K5 = 5.
                             │    K5     │
                             ├──────────┤
                             │ DOUT  F60 │   Output top line message #5.
                             │   R400    │
                             ├──────────┤
                             │ DSTR  F50 │   Load integer value K6 = 6.
                             │    K6     │
                             ├──────────┤
                             │ DOUT  F60 │   Output bottom line message #6.
                             │   R402    │
                             └──────────┘
```
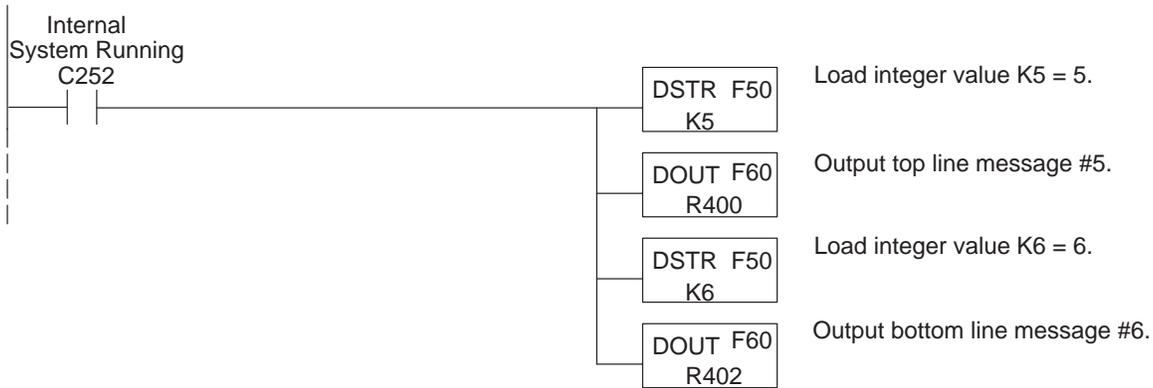
**RUNG 11**        **Kiln System Stopped Message**
This rung displays "Kiln System Stopped" when the system is *not* running or *not* starting and F2 (pushbutton 2) is pressed.

```
  Internal      Pushbutton
Kiln Running        F2
   C252            C201
    ┤/├─────────────┤ ├──────┬──────────┐
    │                         │ DSTR  F50 │   Load integer value K7 = 7.
  Internal                    │    K7     │
Kiln Starting                 ├──────────┤
   C251                       │ DOUT  F60 │   Output top line message #7.
    ┤/├──────────────         │   R400    │
                             ├──────────┤
                             │ DSTR  F50 │   Load integer value K8 = 8.
                             │    K8     │
                             ├──────────┤
                             │ DOUT  F60 │   Output bottom line message #8.
                             │   R402    │
                             └──────────┘
```
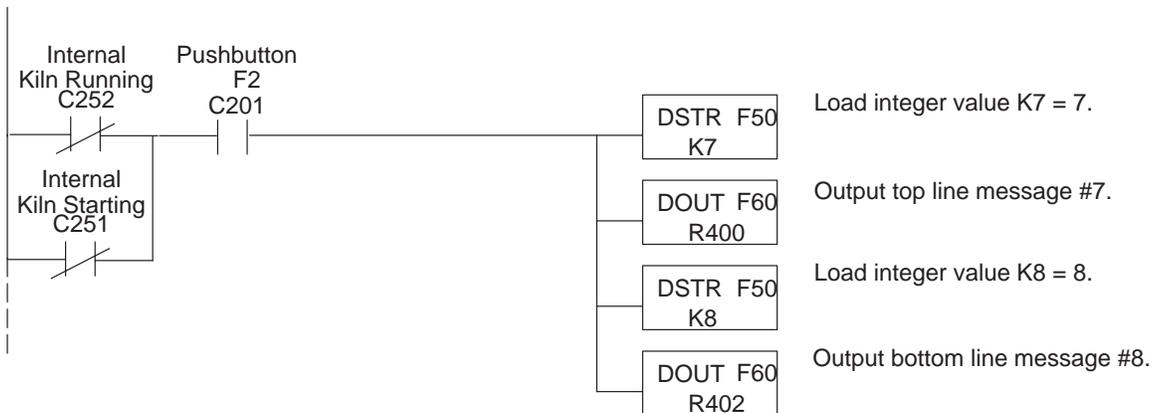
**RUNG 12**        **Maps R404 (Function Select) to R610**

The DL305 only allows the compare statement when using timer and counter registers. This rung maps the function selection number into Timer/Counter registers for compare statement.

| | | |
|---|---|---|
| Function Select Bit C206 | DSTR F50 R404 | Load function selection register value. |
| | DOUT F60 TCA610 | Output the function selection number to storage register TCA610. |
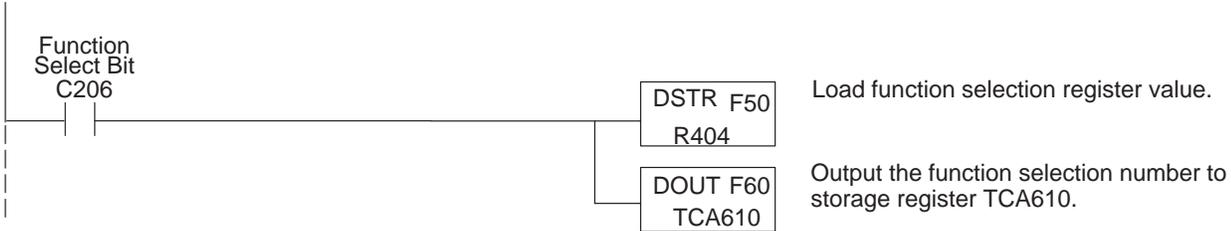
**RUNG 13**        **Setpoint #1 Message Controls**

This rung is executed when the Function Select Bit and Menu Enabled are ON and the 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 C206 | OP–1510 Only Menu Enable C227 | Top Line Data/Menu CT610 | K1 = | | |
|---|---|---|---|---|---|
| | | | | DSTR F50 K9 | Load integer value in K9 = 9. |
| | | | | DOUT F60 R400 | Output top line message #9. |
| | | | | DSTR F50 K10 | Load integer value K10 = 10. |
| | | | | DOUT F60 R402 | Output bottom line message #10. |
| | | | | DSTR F50 R500 | Load value in Storage register for Setpoint#1. |
| | | | | DOUT F60 R404 | Output top line data for SP1 current value. |
| | | | | SP1 In Process C341 (SET) | Set operator entry internal SP1 in process. |
| | | | | OP–1510 Only Menu Enable C227 (RST) | Reset ME control bit OFF. |

**RUNG 14**          **Setpoint #1 Data Storage**
This rung stores the up/down arrow value selected for Setpoint #1 after the ENTER key is pressed and Data Available status bit is ON.

```
   SP1      Data Available
In Process       DA
   C341        C205                    ┌─────────┐
  ─┤ ├─────────┤ ├──────────────────────│DSTR F50 │   Load bottom line data entry value.
                                        │  R410   │
                                        └─────────┘
                                        ┌─────────┐
                                        │DOUT F60 │   Output to Setpoint #1 storage register R500.
                                        │  R500   │
                                        └─────────┘
                                        ┌─────────┐
                                        │DOUT F60 │   Output top line data for SP1 current value.
                                        │  R404   │
                                        └─────────┘
                                         SP1 In
                                         Process
                                          C341
                                         ( RST )       Reset operator entry internal SP1 in process.

                                         Internal
                                      Entry Complete
                                          C340
                                         ( SET )       Set operator entry complete.
```
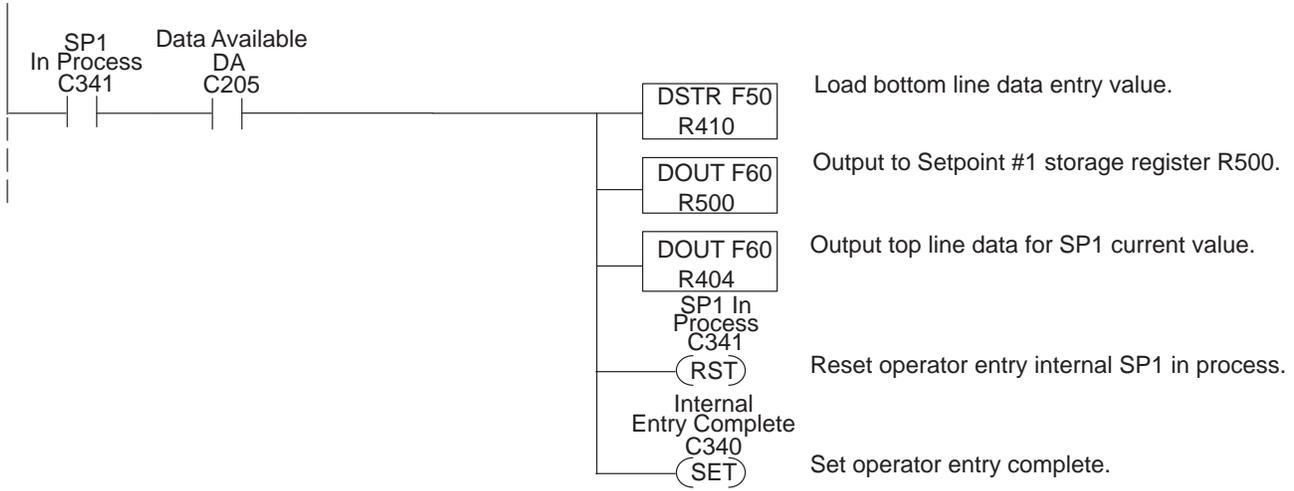
**RUNG 15** **Setpoint #2 Message Controls**

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

| | | | | | |
|---|---|---|---|---|---|
| Function Select Bit C206 | OP–1510 Only Menu Enable C227 | Top Line Data/Entry CT610 | K2 = | DSTR F50 K11 | Load integer value in K11 = 11. |
| | | | | DOUT F60 R400 | Output top line message #11 selection. |
| | | | | DSTR F50 K12 | Load integer value K12 = 12. |
| | | | | DOUT F60 R402 | Output bottom line message #12 selection. |
| | | | | DSTR F50 R502 | Load value in storage register for Setpoint #2. |
| | | | | DOUT F60 R404 | Output top line data for SP2 current value. |
| | | | | SP2 In In Process C342 (SET) | Set operator entry internal SP2 in process. |
| | | | | OP–1510 Only Menu Enable C227 (RST) | Reset ME control bit OFF. |

**RUNG 16** **Setpoint #2 Data Storage**

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

| | | | |
|---|---|---|---|
| SP2 In Process C342 | Data Available DA C205 | DSTR F50 R410 | Load bottom line data entry value. |
| | | DOUT F60 R502 | Output to Setpoint #2 storage register R502. |
| | | DOUT F60 R404 | Output top line data for SP2 current value. |
| | | SP2 In Process C342 (RST) | Reset operator entry internal SP2 in process. |
| | | Internal Entry Complete C340 (SET) | Set operator entry complete. |
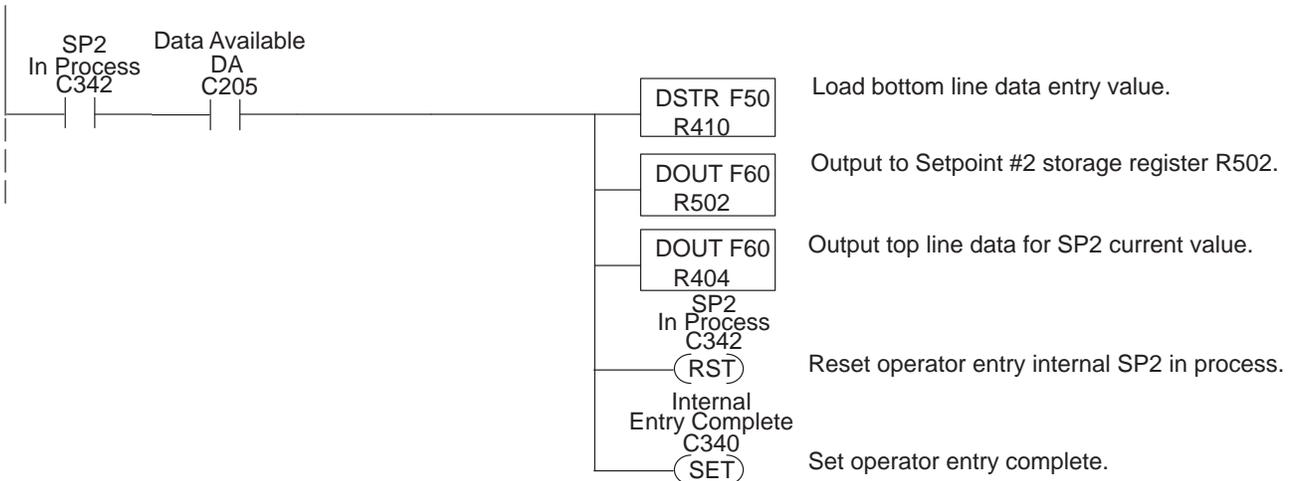
**RUNG 17**          **Setpoint #3 Message Controls**
This rung is executed when the Function Select Bit and Menu Enabled are ON and the compare statement is equal such as menu function 3 has been selected.
The output displays the message                    "Zone1 Temp SP :      "
                                                    "Enter New Temp.=     "

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Function Select Bit C206 | OP–1510 Only Menu Enable C227 | Top Line Data/Entry CT610 | K3 = | | DSTR F50 K13 | | Load integer value in K13 = 13. |
| | | | | | DOUT F60 R400 | | Output top line message selection. |
| | | | | | DSTR F50 K14 | | Load integer value K14 = 14. |
| | | | | | DOUT F60 R402 | | Output bottom line message selection. |
| | | | | | DSTR F50 R504 | | Load value in storage register for Setpoint #3. |
| | | | | | DOUT F60 R404 | | Output top line data for SP3 current value. |
| | | | | | SP3 In Process C343 (SET) | | Set operator entry internal SP3 in process. |
| | | | | | OP–1510 Only Menu Enable C227 (RST) | | Reset ME control bit OFF. |

**RUNG 18**          **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 C343 | Data Available DA C205 | | DSTR F50 R410 | | Load bottom line data entry value. |
| | | | DOUT F60 R504 | | Output to Setpoint #3 storage register R504. |
| | | | DOUT F60 R404 | | Output top line data for SP3 current value. |
| | | | SP3 In Process C343 (RST) | | Reset operator entry internal SP3 in process. |
| | | | Internal Entry Complete C340 (SET) | | Set operator entry complete. |
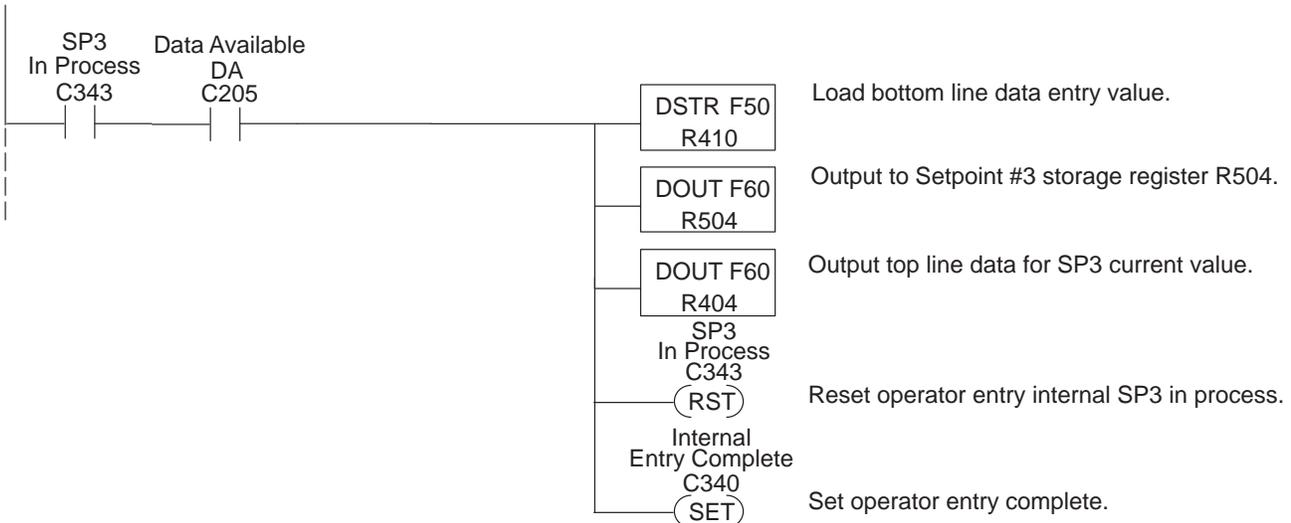
**RUNG 19**　**Setpoint #4 Message Controls**
This rung is executed when the Function Select Bit and Menu Enabled are ON and
the compare statement is equal such as menu function 4 has been selected.
The output displays the message　　　　　　"Zone2 Temp SP :　　"
　　　　　　　　　　　　　　　　　　　　"Enter New Temp.=　　"

| | | | |
|--|--|--|--|
| Function Select Bit C206 | OP–1510 Only Menu Enable C227 | Top Line Data/Entry CT610 | K4 |

DSTR F50 / K15 — Load integer value in K15 = 15.

DOUT F60 / R400 — Output top line message selection.

DSTR F50 / K16 — Load integer value K16 = 16.

DOUT F50 / R402 — Output bottom line message selection.

DSTR F50 / R506 — Load value in storage register for Setpoint #4.

DOUT F60 / R404 — Output top line data for SP4 current value.

SP4 In Process C344 (SET) — Set operator entry internal SP4 in process.

OP–1510 Only Menu Enable C227 (RST) — Reset ME control bit OFF.

**RUNG 20**　**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 Process C344 | Data Available DA C205 |

DSTR F50 / R410 — Load bottom line data entry value.

DOUT F60 / R506 — Output to Setpoint #4 storage register R506.

DOUT F60 / R404 — Output top line data for SP4 current value.

SP4 In Process C344 (RST) — Reset operator entry internal SP4 in process.

Internal Entry Complete C340 (SET) — Set operator entry complete.
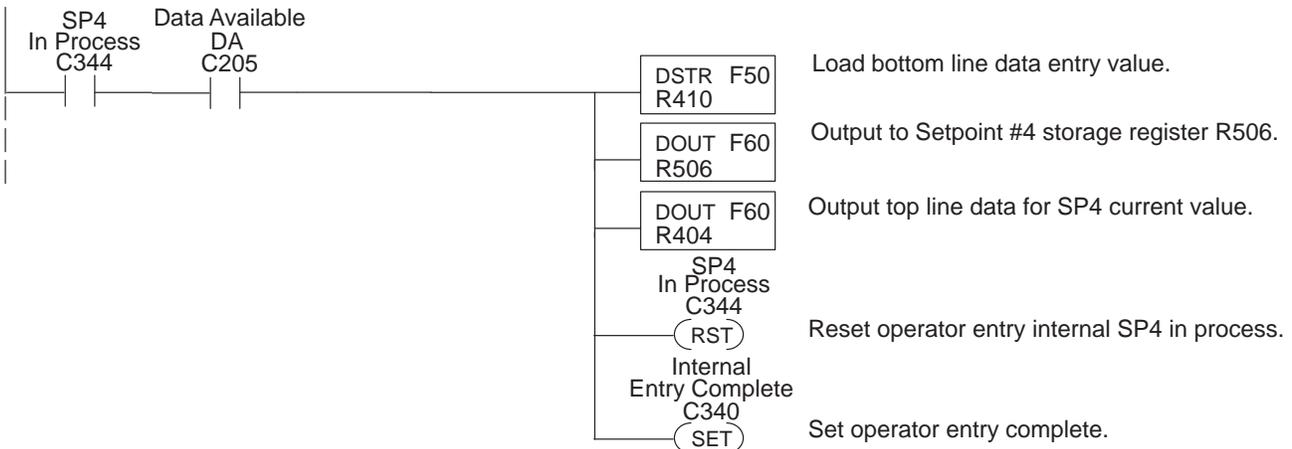
**RUNG 21**          **Setpoint #5 Message Controls**
This rung is executed when the Function Select Bit and Menu Enabled are ON and the compare statement is equal such as menu function 5 has been selected.
The output displays the message                     "Zone3 Temp SP :      "
                                                     "Enter New Temp.=    "

| | |
|---|---|
| Function Select Bit C206 — OP–1510 Only Menu Enable C227 — Top Line Data/Entry CT610 = K5 | |
| DSTR F50 / K17 | Load integer value in K17 = 17. |
| DOUT F60 / R400 | Output top line message selection. |
| DSTR F50 / K18 | Load integer value K18 = 18. |
| DOUT F60 / R402 | Output bottom line message selection. |
| DSTR F50 / R510 | Load value in storage register for Setpoint #5. |
| DOUT F60 / R404 | Output top line data for SP5 current value. |
| SP5 In Process C345 (SET) | Set operator entry internal SP5 in process. |
| OP–1510 Only Menu Enable C227 (RST) | Reset ME control bit OFF. |

**RUNG 22**          **Setpoint #5 Data Storage**
This rung stores the keypad entry value selected for Setpoint #5 after the ENTER key is pressed and the Data Available status bit is ON.

| | |
|---|---|
| SP5 In Process C345 — Data Available DA C205 | |
| DSTR F50 / R410 | Load bottom line data entry value. |
| DOUT F60 / R510 | Output to Setpoint #5 storage register R510. |
| DOUT F60 / R404 | Output top line data for SP5 current value. |
| SP5 In Process C345 (RST) | Reset operator entry internal SP5 in process. |
| Internal Entry Complete C340 (SET) | Set operator entry complete. |
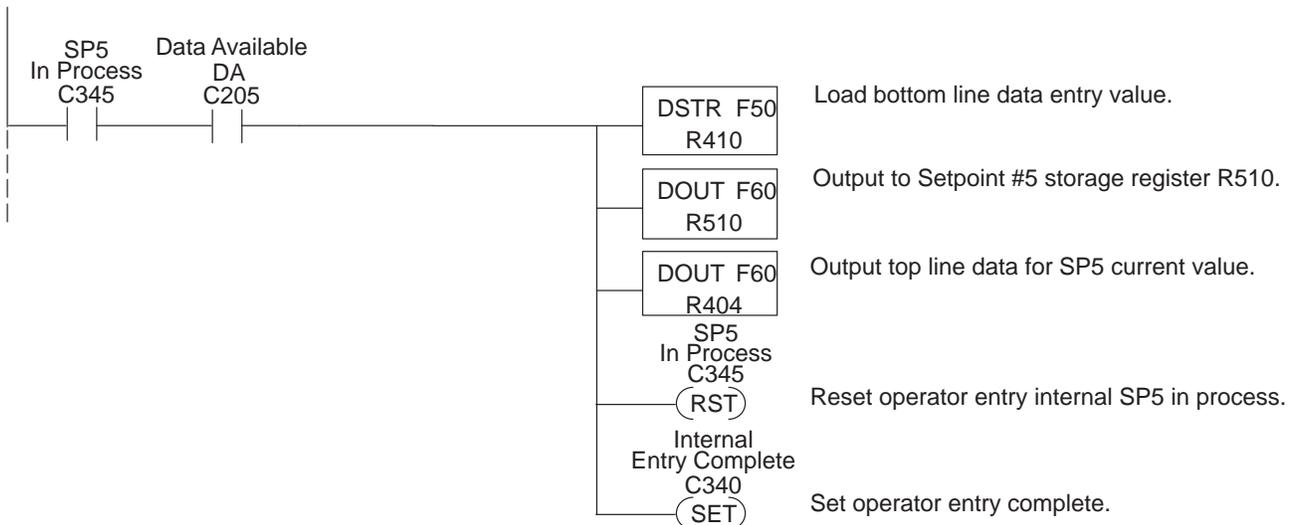
**RUNG 23**          **Data Entry Acknowledge**
This rung controls confirmation to the OP-panel that data entry and storage are complete.

```
  Status Register                          Control Register
  Data Available                           Data Acknowledge
      C205                                      C226
  ─────┤ ├───────────────────────────────────────( OUT )        Output is ON when input C5 is ON.
```
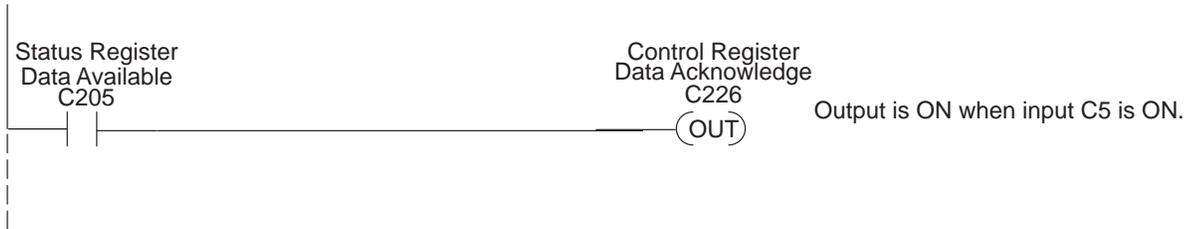
**RUNG 24**          **Post Entry Control**
This rung prepares the program for the next OP-panel operation.

```
    Internal        Data Availabe                    OP1510 Only
 Entry Complete          DA                          Menu Enable
     C340              C205                              C227
 ─────┤ ├──────────────┤/├───────────────┬────────────( SET )        Sets ME control register bit ON.
                                          │
                                          │            Internal
                                          │         Entry Complete
                                          │             C340
                                          └────────────( RST )        Resets internal control relay Data Entry
                                                                      Complete.
```
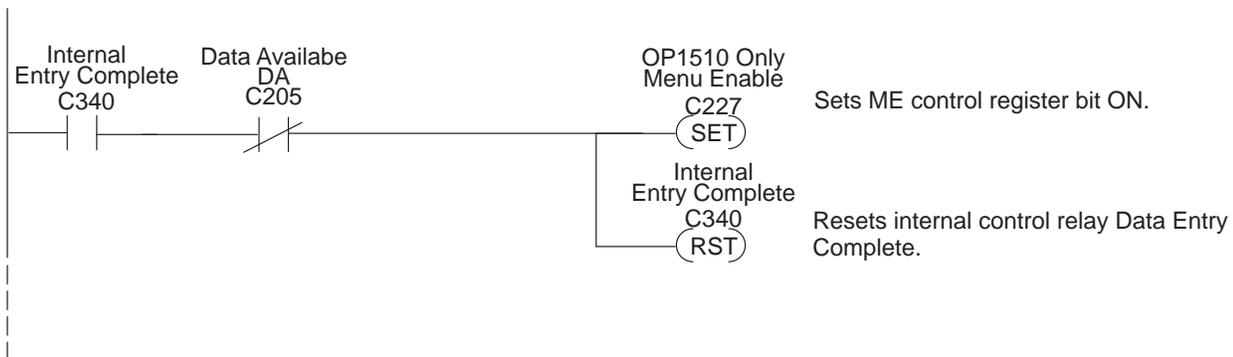
**RUNG 25**          **Entry Mode**
This rung set internal control relay for Setpoint Entry Mode interlocking.

```
  SP1 in Process                              Setpoint
      C341                                   Entry Mode
 ─────┤ ├──────┬──────────────────────────      C300
              │                              ────( SET )        Sets internal Setpoint Entry Mode ON.
  SP2 in Process│
      C342     │
 ─────┤ ├──────┤
              │
  SP3 in Process│
      C343     │
 ─────┤ ├──────┤
              │
  SP4 in Process│
      C344     │
 ─────┤ ├──────┤
              │
  SP5 in Process│
      C345     │
 ─────┤ ├──────┘
```
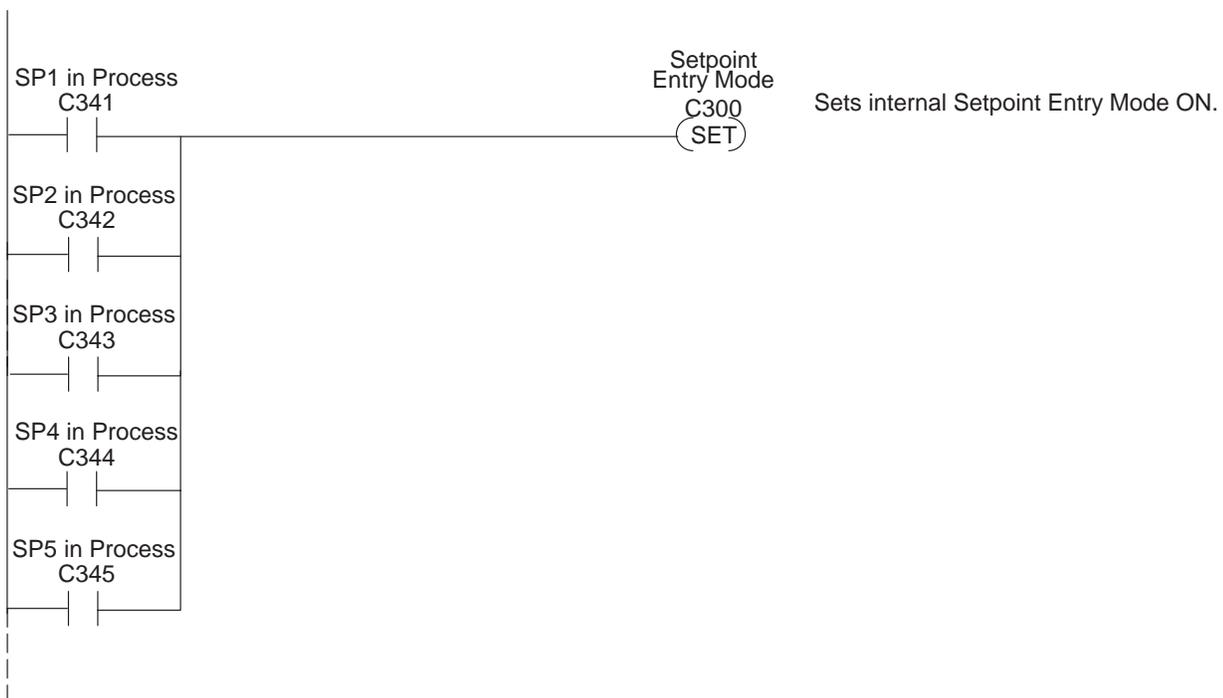
**RUNG 26**          **Entry Mode**
This rung enables the menu operation, resets setpoint in process, internal control relay for Setpoint Entry Mode interlocking.

| | |
|---|---|
| OP–1510 Clear/Abort C207 — Setpoint Entry Mode C300 — Data Available C205 — OP–1510 Only Menu Enable C227 (SET) | ME bit set ON allows Menu Operations. |
| OP–1510 Clear/Abort C207 — Setpoint Entry Mode C300 — Internal Entry Complete C340 — Setpoint Entry Mode C300 (RST) | Reset internal setpoint entry mode. |
| SP1 in Process C341 (RST) | Reset internal Setpoint #1 in Process. |
| SP2 in Process C342 (RST) | Reset internal Setpoint #2 in Process. |
| SP3 in Process C343 (RST) | Reset internal Setpoint #3 in Process. |
| SP4 in Process C344 (RST) | Reset internal Setpoint #4 in Process. |
| SP5 in Process C345 (RST) | Reset internal Setpoint #5 in Process. |

**RUNG 27**          **End of program**
This rung marks the END of program.

(END)