Appendix D
Application Examples

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 PLCDirect’s worldwide web site:

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

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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.

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.

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.

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 1

- **FirstScan S:1**
  - **15**
  - **Pushbutton P2 N7:6**
  - **Clear/Abort OP-1510 N7:6**
  - **Kiln Starting Internal N7:11**

- **MOVE Source 1 Dest N7:0 0**
  - Load constant value 1 to select message #1 for top line display.

- **MOVE Source 2 Dest N7:1 0**
  - Load constant value 2 to select message #2 for top line display.

- **OP–1510 Only Menu Enable N7:7**
  - ME bit set ON which allows menu operations.

- **OP–1510 Only Menu Return N7:7**
  - MR bit set ON returns to last selected upon exits.

- **Status Register BD N7:7**
  - Beeper Disable set ON which disables pushbutton and keypad beeper.

- **L1 Lamp N7:7**
  - L1 bit reset OFF which de-energizes Green Lamp.

- **L3 Lamp N7:7**
  - L3 bit set ON which energizes Red Lamp.
**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.

- **Kiln Start signal is energized (ON) if start pushbutton F1 pressed.**

**RUNG 3**

**Kiln Starting Lamp Control**

This rung controls the annunciator lamps during startup mode.

- **Yellow Lamp (L2) set ON.**
- **Yellow Flash (L2F) set ON.**
- **Reset Red Lamp (L3) OFF.**

**RUNG 4**

**Startup Delay Timer**

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

- **Kiln Starting input starts Delay Timer.**
**RUNG 5**  
**System Running**  
This rung sets the internal control relay C52 System Running.

- **System Startup**  
  - Delay Timer
  - Done
  - \( T4:0 \)
  - \( \text{DN} \)

- **Internal System Running**
  - \( N7:11 \)
  - \( L \)
  - \( 2 \)

Set ON when timer \( T4:0 \) accumulative = preset.

**RUNG 6**  
**System Running Lamp Control**  
This rung controls the annunciator lamps during startup mode.

- **Internal System Running**
  - \( N7:11 \)
  - \( 2 \)

- **Green Lamp**
  - \( L \)
  - \( N7:7 \)

Kiln running sets Green Lamp (L1) ON.

- **Yellow Lamp**
  - \( U \)
  - \( N7:7 \)

- **Yellow Flash**
  - \( U \)
  - \( N7:7 \)

Reset Yellow Lamp (L2) OFF.

Reset Yellow Flash (L2F) OFF.

**RUNG 7**  
This rung resets internal control relay (N7:11/2) System Running when alternating pushbutton 2 (F2) is OFF.

- **Pushbutton System Startup**
  - \( F2 \)
  - \( N7:6 \)

- **Delay Timer**
  - \( T4:0 \)

- **Internal System Running**
  - \( N7:11 \)
  - \( U \)
  - \( 2 \)

Reset N7:11/2 System Running control relay.
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Allen Bradley SLC 5/03 and 5/04 Application Example

**RUNG 8**

**Kiln Starting Message**
This rung displays “Kiln Starting” message.

```
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.

```
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”.

```
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.
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 =—”

**RUNG 11**

```
Function Select Bit N7:6
Menu Enable (OP-1510) N7:7
Top Line Entry/Menu

EQUAL SourceA N7:2
SourceB 1

MOVE Source 9
Dest N7:0

MOVE Source 10
Dest N7:1

MOVE Source N7:21
Dest N7:2

SP1 in Process N7:10
Menu Enable N7:7

```

Load integer value in K9=9.
Output top line message #9 selection.
Load integer value K10=10.
Output bottom line message #9 selection.
Load value in storage register for Setpoint #1
Output top line data for SP1 current value.
Set operator entry internal SP1 in Process.
Reset ME control bit OFF.

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.

**RUNG 12**

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

MOVE Source N7:4
Dest N7:21

MOVE Source N7:4
Dest N7:2

SP1 in Process N7:10
Internal Entry Complete N7:10

```

Load bottom line data entry value.
Output to Setpoint #1 storage register N7:21.
Load bottom line data entry value.
Output top line data for SP1 in process.
Reset operator entry internal control relay SP1 in Process.
Sets Data Entry Complete internal control relay ON.
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**Allen Bradley SLC 5/03 and 5/04 Application Example**

**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= "

**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.

---

**Diagram and Code Details**

- **RUNG 13**
  - **Function Select Bit** N7:6
  - **Menu Enable** (OP-1510) N7:7
  - **Top Line Entry/Menu**
    - **EQUAL** SourceA N7:2
    - **SourceB** 2
  - **MOVE Source 11**
    - **Dest N7:0**
    - **Load integer value in K11=11.**
    - **Output top line message #11 selection.**
  - **MOVE Source 12**
    - **Dest N7:1**
    - **Load integer value K12=12.**
    - **Output top line message #12 selection.**
  - **MOVE Source N7:22**
    - **Dest N7:2**
    - **Load value in storage register for Setpoint #2**
    - **Output top line data for SP2 current value.**
  - **MOVE Source 1**
    - **Dest N7:3**
    - **Load value in storage register for Setpoint #2**
    - **Output top line data for SP2 decimal point.**
  - **SP2 In Process**
    - **L N7:10**
    - **Menu Enable** N7:7
    - **U**
    - **Set operator entry internal SP2 in Process.**
  - **Reset ME control bit OFF.**

- **RUNG 14**
  - **SP2 in Process** N7:10
  - **Data Available** DA N7:6
  - **MOVE Source N7:4**
    - **Dest N7:22**
    - **Load bottom line data entry value.**
    - **Output to Setpoint #2 storage register N7:22.**
  - **MOVE Source N7:4**
    - **Dest N7:2**
    - **Load bottom line data entry value.**
    - **Output top line data for SP2 in process.**
  - **SP2 In Process**
    - **L N7:10**
    - **Entry Complete Internal** N7:10
    - **U**
    - **Reset operator entry internal SP2 in Process.**
  - **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.= ”  

<table>
<thead>
<tr>
<th>Function Select Bit</th>
<th>Menu Enable (OP-1510)</th>
<th>Top Line Entry/Menu</th>
</tr>
</thead>
<tbody>
<tr>
<td>N7:6</td>
<td>N7:7</td>
<td></td>
</tr>
</tbody>
</table>

- **MOVE**  
  - **Source** 13  
  - **Dest** N7:0

  Load integer value in K13=13  
  Output bottom line message #13 selection.

- **MOVE**  
  - **Source** 14  
  - **Dest** N7:1

  Load integer value K14=14.  
  Output top line message #14 selection.

- **MOVE**  
  - **Source** N7:23  
  - **Dest** N7:2

  Load value in storage register for Setpoint #3  
  Output top line data for SP3 current value.

Set operator entry internal SP3 in Process.

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.

<table>
<thead>
<tr>
<th>SP3 In Process</th>
<th>Data Available</th>
</tr>
</thead>
<tbody>
<tr>
<td>N7:10</td>
<td>N7:6</td>
</tr>
</tbody>
</table>

- **MOVE**  
  - **Source** N7:4  
  - **Dest** N7:23

  Load bottom line data entry value.  
  Output to Setpoint #3 storage register N7:23.

- **MOVE**  
  - **Source** N7:4  
  - **Dest** N7:2

  Load bottom line data entry value.  
  Output top line data for SP3 in process.

Reset operator entry internal SP3 in Process.

Sets Data Entry Complete internal ON.
**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.= 
```

**LENG**

<table>
<thead>
<tr>
<th>Function Key (OP-1510)</th>
<th>Menu Enable</th>
</tr>
</thead>
<tbody>
<tr>
<td>N7:6</td>
<td>N7:7</td>
</tr>
</tbody>
</table>

**Top Line**

<table>
<thead>
<tr>
<th>EQUAL SourceA N7:2</th>
<th>SourceB 4</th>
</tr>
</thead>
</table>

**Dest**

Load integer value in K15=15
Output top line message #15 selection.

```
MOVE Source 15 
Dest N7:0 0
```

Load integer value K16=16.
Output bottom line message #16 selection.

```
MOVE Source 16 
Dest N7:1 0
```

Load value in storage register for Setpoint#4
Output top line data for SP4 current value.

```
MOVE Source N7:24 
Dest N7:2 0
```

Set operator entry internal SP4 in Process.

```
SP4 Process N7:10 
L 4
```

Reset ME control bit OFF.

```
Menu Enable N7:7 
U 7
```

**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 N7:10 
L 4
```

```
Data Available DA N7:6 
U 5
```

**Dest**

Load bottom line data entry value.
Output to Setpoint #4 storage register N7:24.

```
MOVE Source N7:4 
Dest N7:24 0
```

Load bottom line data entry value.
Output top line data for SP4 in process.

```
MOVE Source N7:4 
Dest N7:2 0
```

Reset operator entry internal SP4 in Process.

```
SP4 In Process N7:10 
U 4
```

Sets Data Entry Complete internal ON.

```
Entry Complete Internal N7:10 
L 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.= "

```
MOVE  Source 17
Dest  N7:0 0
```

Load integer value in K17=17  
Output top line message #17 selection.

```
MOVE  Source 18
Dest  N7:1 0
```

Load integer value K18=18.  
Output bottom line message #18 selection.

```
MOVE  Source N7:25
Dest  N7:2 0
```

Load value in storage register for Setpoint#5  
Output top line data for SP5 current value.

```
SP5 Process
N7:10
```

Set operator entry internal SP5 in Process.

```
Menu Enable
N7:7
```

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.

```
MOVE  Source N7:4
Dest  N7:25 0
```

Load bottom line data entry value.  
Output to Setpoint #5 storage register N7:25.

```
MOVE  Source N7:4
Dest  N7:2 0
```

Load bottom line data entry value.  
Output top line data for SP5 in process.

```
SP5 In Process
N7:10
```

Reset operator entry internal SP5 in Process.

```
Entry Complete Internal
N7:10
```

Sets Data Entry Complete internal ON.
**RUNG 21**  
**Data Entry Acknowledge**
This rung controls Data Acknowledge to the OP-panel indicating the PLC data entry and storage is complete.

![Diagram for Data Entry Acknowledge]

Output is ON when N7:6/5 is ON.

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

![Diagram for Post Entry Control]

Sets ME control register bit ON.

**RUNG 23**  
**Entry Mode Interlock**
This rung sets internal Entry Mode which is used to interlock Entry Mode.

![Diagram for Entry Mode Interlock]

Sets internal Setpoint Entry Mode ON.
**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.