Programmable Logic Controllers

PLC Counter Functions

Outline

• Introduction
• PLC Counter Functions
• Examples of Counter Function Applications
Objectives

- Describe the PLC counter functions.
- List some of the major counting functions used in circuits and processes.
- Apply the PLC counter function and associated circuitry to process control.
- Apply combinations of counters and timers to process control.

Introduction

- PLC counters have programming formats which are similar to timer formats
- Transitions on counter input rung causes the counter to count up (or down)
- Counter reset is accomplished via the (RES) instruction
Up Counter (CTU)

- The CTU is an instruction that counts false-to-true rung transitions.
  - Rung transitions can be caused by events occurring in the program (from internal logic or by external devices) such as parts traveling past a detector or actuating a limit switch.
- When rung conditions for a CTU instruction have made a false-to-true transition, the accumulated value is incremented by one count, provided that the rung containing the CTU instruction is evaluated between these transitions.
  - The ability of the counter to detect false–to–true transitions depends on the speed (frequency) of the incoming signal.
- The accumulated value is retained when the rung conditions again become false.
- The accumulated count is retained until cleared by a reset (RES) instruction.

Up Counter Example

- Accumulated count is reset only by the (RES) instruction
- The counter will increment the accumulator value even after the preset is reached
Counter Status Bits

- /CU: count up
- /CD: count down
- /DN: counter done
- /OV: counter overflow
- /UN: counter underflow

Using Status Bits (CTU)

<table>
<thead>
<tr>
<th>This bit</th>
<th>Is Set When</th>
<th>And remains set until</th>
</tr>
</thead>
<tbody>
<tr>
<td>Count Up Overflow Bit (OV)</td>
<td>Accumulated value wraps around to -32768 (from +32767)</td>
<td>A (RES) instruction with the same address as the CTU instruction is enabled OR the count is decremented less than or equal to +32767 with a count down (CTD) instruction</td>
</tr>
<tr>
<td>Done Bit (DN)</td>
<td>Accumulated value is equal to or greater than the preset value</td>
<td>Accumulated value becomes less than the preset value</td>
</tr>
<tr>
<td>Count Up Enable Bit (CU)</td>
<td>Rung conditions are true</td>
<td>Rung conditions go false or a (RES) instruction with the same address as the CTU instruction is enabled</td>
</tr>
</tbody>
</table>
**Down Counter (CTD)**

- The CTD is an instruction that counts false-to-true rung transitions.
  - Rung transitions can be caused by events occurring in the program such as parts traveling past a detector or actuating a limit switch.
- When rung conditions for a CTD instruction have made a false-to-true transition, the accumulated value is decremented by one count, provided that the rung containing the CTD instruction is evaluated between these transitions.
- The accumulated counts are retained when the rung conditions again become false.
- The accumulated count is retained until cleared by a reset (RES) instruction.

**Down Counter Example**

- Accumulated count is reset only by the (RES) instruction
- The counter will decrement the accumulator value even after a 0 count is reached
Using Status Bits (CTD)

<table>
<thead>
<tr>
<th>Status Bit</th>
<th>Is Set When</th>
<th>And remains set until</th>
</tr>
</thead>
<tbody>
<tr>
<td>Count Down Underflow Bit (UN)</td>
<td>Accumulated value wraps around to +32,767 (from -32,768) and continues counting down from there</td>
<td>A (RES) instruction with the same address as the CTD instruction is enabled OR the count is incremented to greater than or equal to -32768 with a count up (CTU) instruction</td>
</tr>
<tr>
<td>Done Bit (DN)</td>
<td>Accumulated value is equal to or greater than the preset value</td>
<td>Accumulated value becomes less than the preset value</td>
</tr>
<tr>
<td>Count Down Enable Bit (CD)</td>
<td>Rung conditions are true</td>
<td>Rung conditions go false or a (RES) instruction with the same address as the CTD instruction is enabled</td>
</tr>
</tbody>
</table>

Counter Applications

- Straight counting in a process
  - The counter output goes on after the set count is received by repetitive pulses to the counter input.
- A process where a timed interval is started when a count reaches a preset value
- A process where a count of events is to start after a fixed time interval
Straight Counting in a Process

- After a certain number of counts occur, the output goes on.
- The output can be used to energize an indicator.
- The output status could also be utilized in the ladder diagram logic in the form of a contact.
- Either counter will function (count) if its input rung transitions from false-to-true.
- After the count input receives 18 pulses, the O:2/0 output will energize.

Time a Process after a Count has been Reached

- After a count of 5 from a sensor, a paint spray is to run for 25 seconds.
Delayed Start of the Counting Process

• In this process we do not wish to start counting until one hour after the process starts.
• A timer output contact in the timer run line closes after the time period.
• The closure then enables the counter to start counting input pulses.
• After a count of 150, the output comes on.

Ladder Logic Example

![Ladder Logic Example Diagram]