How to Program Countdown Signals
as used in Guangzhou, China
ASC/3 Controller
Date: 10 September 2014
Document Number: AN2148

Purpose

This document first explains how Red and Green Countdown signals operate as used in the Guangzhou (Canton) Panyu District of China and then gives you some example procedures to implement this operation with the Logic Processor in an ASC/3 Controller.

Introduction

The city of Guangzhou specifies its Traffic Signals to count down the last 9 seconds of Green and the last 9 seconds of Red before going to Green. The 9-second Green countdown is divided into 2 intervals of 6 seconds solid Green and 3 seconds of Flashing Green before the signal changes to Yellow.

To show the countdown, the Yellow LED Signal includes an integrated bi-color single-digit numeric display. Counted on a cycle-by-cycle basis, the timer logic in the signal head “learns” the actual time between a Trigger Pulse and the end of the signal color—and the current cycle uses the value learned on the previous cycle. When the time from the trigger pulse to the end of the selected color is greater than 9 seconds, the count display remains OFF until the 9-second mark and then turns ON to start its count.

A 0.1 second (100 ms) interruption of the related phase color output to the signal triggers both Red and Green countdown functions:

- To initiate the Red Countdown function for Phase 3, the Phase 3 Red output must be turned OFF for 100 ms at an applicable time (9 to 19 seconds before the end of Red).
- The Green countdown function is similarly triggered by interrupting the Green Phase output to the traffic signal.
- Drivers see both interruptions as an OFF/ON blink of the respective light.

The operation of this Guangzhou application is similar to the Flashing Green before Yellow function described in application note AN2077 except that the normal Yellow Interval is divided into 3 logical portions: Green, Flashing Green and Yellow. For this Guangzhou application:

- Three Logic Processor Steps are necessary for each Phase.
- The Red countdown function is also implemented as part of the Logic Processor.
- The Green Countdown counts 6 seconds of solid Green followed by 3 seconds of Flashing Green (9 seconds total) before the 3-second Yellow signal powers ON.
- You must program a total of 12 seconds in the controller for each Phase Yellow interval.
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Notes about the Example Procedures

Example Procedure
The notes in this section refer to Logic Processor screens in the Example Procedure section that follows.

LP #1 thru LP #24 in the Example Procedure below program the Green and Red Countdown Signal operation as implemented in the city of Guangzhou. The programming shown is for a standard 8-phase intersection using the standard Phase Sequence / Ring Structure (R1: 1, 2 B 3, 4; R2: 5, 6 B 7, 8). The actual programming is specific for each intersection because it depends on the Ring structure and specific Phase Sequence used at each location.

For this programming, the controller must operate in Minimum Recall for all Phase Sequences to make sure that the Red Countdown operates correctly.

Note: You could implement a more versatile operation in which it is not necessary to "guarantee" the Phase Sequence via Minimum Recall, but this operation would use two times the number of Logic Steps and Logic Flags.

LP #25 thru LP #28 in the Example Procedure below program the International Pedestrian Clearance operation in which the Walk signal is flashed during Pedestrian Clearance (unlike the standard used in the U.S.A. that flashes the Dont Walk signal). This programming assumes that Pedestrian movements use Phases 2, 4, 6 and 8. But you can also use the indicated programming with other phases by changing the COB numbers and PED ON PH PED CLEAR on their Phase Walk and Dont Walk signals.

LP #1 thru LP #8, one step per phase, test the applicable Ring Yellow Timer to determine if the controller is in a clearance mode in which it is necessary to turn OFF the Green and Red outputs for 100 ms (0.1 seconds). When the Ring Timer is Greater than 3 seconds, a Logic Flag is SET to indicate the changed Clearance Interval and the controller turns OFF the applicable Red output for 100 ms to trigger the Red Count Down of the next phase.

LP #9 thru LP #16 test the Ring Yellow Timer to determine if a solid Green output is necessary and sets the applicable Green Output ON.

LP #17 thru LP #24 test the Ring Yellow Timer to determine if a Flashing Green output is necessary and flashes the applicable Green output based upon the ½ Hz COB signal.

Example Procedure for a Two-Phase Red Countdown
For this procedure, refer to the last page of this application note.
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Example Procedure

To program the controller to implement the Red and Green Countdown signals as used in the city of Guangzhou, go to MM-1-8-2 and program the Logic Processor statements LP #1 thru LP #28 as shown below.

LP #1 thru LP #8 test if it is necessary to turn OFF the Green and Red outputs for 0.1 second.

For clarity, the fields COPY FROM: ACTIVE: M FALSE in the first row are not shown in the other screens.

In each series of screens with the same programming (for example, LP #1 thru LP #8), use the COPY FROM: field to copy the first screen in the series to the other screens, then edit the values.

<table>
<thead>
<tr>
<th>LP # 1</th>
<th>COPY FROM: ACTIVE: M FALSE</th>
</tr>
</thead>
<tbody>
<tr>
<td>IF VEH YELLOW TMR R1 &gt; 3</td>
<td></td>
</tr>
<tr>
<td>AND VEH YEL ON PHASE 1 IS ON</td>
<td></td>
</tr>
<tr>
<td>THEN LP SET LOGIC FLAG 1 ON</td>
<td></td>
</tr>
<tr>
<td>SIG SET PH YELLOW 1 OFF</td>
<td></td>
</tr>
<tr>
<td>SIG SET PHASE RED 2 OFF</td>
<td></td>
</tr>
<tr>
<td>LP DELAY FOR 0.1 SECONDS</td>
<td></td>
</tr>
<tr>
<td>SIG SET PHASE RED 2 ON</td>
<td></td>
</tr>
<tr>
<td>ELSE LP SET LOGIC FLAG 1 OFF</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>LP # 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>IF VEH YELLOW TMR R1 &gt; 3</td>
</tr>
<tr>
<td>AND VEH YEL ON PHASE 2 IS ON</td>
</tr>
<tr>
<td>THEN LP SET LOGIC FLAG 2 ON</td>
</tr>
<tr>
<td>SIG SET PH YELLOW 2 OFF</td>
</tr>
<tr>
<td>SIG SET PHASE RED 3 OFF</td>
</tr>
<tr>
<td>LP DELAY FOR 0.1 SECONDS</td>
</tr>
<tr>
<td>SIG SET PHASE RED 3 ON</td>
</tr>
<tr>
<td>ELSE LP SET LOGIC FLAG 2 OFF</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>LP # 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>IF VEH YELLOW TMR R1 &gt; 3</td>
</tr>
<tr>
<td>AND VEH YEL ON PHASE 3 IS ON</td>
</tr>
<tr>
<td>THEN LP SET LOGIC FLAG 3 ON</td>
</tr>
<tr>
<td>SIG SET PHellow 3 OFF</td>
</tr>
<tr>
<td>SIG SET PHASE RED 4 OFF</td>
</tr>
<tr>
<td>LP DELAY FOR 0.1 SECONDS</td>
</tr>
<tr>
<td>SIG SET PHASE RED 4 ON</td>
</tr>
<tr>
<td>ELSE LP SET LOGIC FLAG 3 OFF</td>
</tr>
</tbody>
</table>
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LP# 4
IF VEH YELLOW TMR R1 > 3
AND VEH YEL ON PHASE 4 IS ON
THEN LP SET LOGIC FLAG 4 ON
  SIG SET PH YELLOW 4 OFF
  SIG SET PHASE RED 1 OFF
  LP DELAY FOR 0.1 SECONDS
  SIG SET PHASE RED 1 ON
ELSE LP SET LOGIC FLAG 4 OFF

LP# 5
IF VEH YELLOW TMR R2 > 3
AND VEH YEL ON PHASE 5 IS ON
THEN LP SET LOGIC FLAG 5 ON
  SIG SET PH YELLOW 5 OFF
  SIG SET PHASE RED 6 OFF
  LP DELAY FOR 0.1 SECONDS
  SIG SET PHASE RED 6 ON
ELSE LP SET LOGIC FLAG 5 OFF

LP# 6
IF VEH YELLOW TMR R2 > 3
AND VEH YEL ON PHASE 6 IS ON
THEN LP SET LOGIC FLAG 6 ON
  SIG SET PH YELLOW 6 OFF
  SIG SET PHASE RED 7 OFF
  LP DELAY FOR 0.1 SECONDS
  SIG SET PHASE RED 7 ON
ELSE LP SET LOGIC FLAG 6 OFF

LP# 7
IF VEH YELLOW TMR R2 > 3
AND VEH YEL ON PHASE 7 IS ON
THEN LP SET LOGIC FLAG 7 ON
  SIG SET PH YELLOW 7 OFF
  SIG SET PHASE RED 8 OFF
  LP DELAY FOR 0.1 SECONDS
  SIG SET PHASE RED 8 ON
ELSE LP SET LOGIC FLAG 7 OFF
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**LP# 8**

**IF**  
VEH YELLOW TMR R2 > 3  
AND  
VEH YEL ON PHASE 8 IS ON  
THEN  
LP SET LOGIC FLAG 8 ON  
SIG SET PH YELLOW 8 OFF  
SIG SET PHASE RED 5 OFF  
LP DELAY FOR 0.1 SECONDS  
SIG SET PHASE RED 5 ON  
ELSE  
LP SET LOGIC FLAG 8 OFF

---

**LP# 9 thru LP#16 test if a solid Green output is necessary.**

**LP# 9**

**IF**  
LOGIC FLAG 1 IS ON  
AND  
VEH YELLOW TMR R1 > 6  
THEN  
SIG SET PH GREEN 1 ON  
ELSE

**LP# 10**

**IF**  
LOGIC FLAG 2 IS ON  
AND  
VEH YELLOW TMR R1 > 6  
THEN  
SIG SET PH GREEN 2 ON  
ELSE

**LP# 11**

**IF**  
LOGIC FLAG 3 IS ON  
AND  
VEH YELLOW TMR R1 > 6  
THEN  
SIG SET PH GREEN 3 ON  
ELSE

**LP# 12**

**IF**  
LOGIC FLAG 4 IS ON  
AND  
VEH YELLOW TMR R1 > 6  
THEN  
SIG SET PH GREEN 4 ON  
ELSE
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<table>
<thead>
<tr>
<th>LP# 13</th>
</tr>
</thead>
<tbody>
<tr>
<td>IF LOGIC FLAG 5 IS ON AND VEH YELLOW TMR R2 &gt; 6 THEN SIG SET PH GREEN 5 ON ELSE</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>LP# 14</th>
</tr>
</thead>
<tbody>
<tr>
<td>IF LOGIC FLAG 6 IS ON AND VEH YELLOW TMR R2 &gt; 6 THEN SIG SET PH GREEN 6 ON ELSE</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>LP# 15</th>
</tr>
</thead>
<tbody>
<tr>
<td>IF LOGIC FLAG 7 IS ON AND VEH YELLOW TMR R2 &gt; 6 THEN SIG SET PH GREEN 7 ON ELSE</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>LP# 16</th>
</tr>
</thead>
<tbody>
<tr>
<td>IF LOGIC FLAG 8 IS ON AND VEH YELLOW TMR R2 &gt; 6 THEN SIG SET PH GREEN 8 ON ELSE</td>
</tr>
</tbody>
</table>
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LP #17 thru LP #24 test the Ring Yellow Timer to determine if a Flashing Green output is necessary.

<table>
<thead>
<tr>
<th>LP# 17</th>
<th>IF LOGIC FLAG 1 IS ON AND VEH YELLOW TMR R1 &lt; 6 AND LP COB ON 546 THEN SIG SET PH GREEN 1 ON ELSE</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>LP# 18</th>
<th>IF LOGIC FLAG 2 IS ON AND VEH YELLOW TMR R1 &lt; 6 AND LP COB ON 546 THEN SIG SET PH GREEN 2 ON ELSE</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>LP# 19</th>
<th>IF LOGIC FLAG 3 IS ON AND VEH YELLOW TMR R1 &lt; 6 AND LP COB ON 546 THEN SIG SET PH GREEN 3 ON ELSE</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>LP# 20</th>
<th>IF LOGIC FLAG 4 IS ON AND VEH YELLOW TMR R1 &lt; 6 AND LP COB ON 546 THEN SIG SET PH GREEN 4 ON ELSE</th>
</tr>
</thead>
</table>

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LP# 21
IF LOGIC FLAG IS ON
AND VEH YELLOW TMR R2 < 6
AND LP COB ON 546
THEN SIG SET PH GREEN 5 ON
ELSE

LP# 22
IF LOGIC FLAG IS ON
AND VEH YELLOW TMR R2 < 6
AND LP COB ON 546
THEN SIG SET PH GREEN 6 ON
ELSE

LP# 23
IF LOGIC FLAG IS ON
AND VEH YELLOW TMR R2 < 6
AND LP COB ON 546
THEN SIG SET PH GREEN 7 ON
ELSE

LP# 24
IF LOGIC FLAG IS ON
AND VEH YELLOW TMR R2 < 6
AND LP COB ON 546
THEN SIG SET PH GREEN 8 ON
ELSE
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LP #25 thru LP #28 program the International Pedestrian Clearance operation.

<table>
<thead>
<tr>
<th>LP#</th>
<th>Condition</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>25</td>
<td>IF PED ON PH PED CLR 2 IS ON AND LP COB CODE ON 81 THEN LP SET COB ON 49 LP SET COB OFF 81 ELSE</td>
<td></td>
</tr>
<tr>
<td>26</td>
<td>IF PED ON PH PED CLR 4 IS ON AND LP COB CODE ON 83 THEN LP SET COB ON 51 LP SET COB OFF 83 ELSE</td>
<td></td>
</tr>
<tr>
<td>27</td>
<td>IF PED ON PH PED CLR 6 IS ON AND LP COB CODE ON 85 THEN LP SET COB ON 53 LP SET COB OFF 85 ELSE</td>
<td></td>
</tr>
<tr>
<td>28</td>
<td>IF PED ON PH PED CLR 8 IS ON AND LP COB CODE ON 87 THEN LP SET COB ON 55 LP SET COB OFF 87 ELSE</td>
<td></td>
</tr>
</tbody>
</table>
Example Procedure for a Two-Phase Red Countdown

In some Phase Sequences, it may be necessary for one Phase to trigger the Red Countdown for two phases such as with a typical 6-phase sequence, 1-5, 2-6, 3-4. In this application, it is necessary to add a Logic Statement to turn OFF and ON the applicable Red Outputs because the Logic Processor is limited to a maximum of 5 “THEN” statements.

For this example, program the Logic Processor Statements in MM-1-8-2 the same as the Example Procedure above, except change Step 4 to:

```
LP#  4
IF   VEH YELLOW TMR R1        >  3
AND  VEH YEL ON PHASE      4  IS ON
THEN LP SET LOGIC FLAG     4     ON
   SIG SET PH YELLOW     4     OFF
   LP SET LOGIC FLAG     9     ON
ELSE LP SET LOGIC FLAG     4     OFF
   LP SET LOGIC FLAG     9     OFF
   LP SET LOGIC FLAG    10    OFF
```

And add this statement:

```
LP# 29
IF   LOGIC FLAG            9  IS ON
AND  LOGIC FLAG            10 IS OFF
THEN SIG SET PHASE RED     1     OFF
    SIG SET PHASE RED     5     OFF
    LP DELAY FOR          0.1 SECONDS
    SIG SET PHASE RED     1     ON
    SIG SET PHASE RED     5     ON
ELSE
```