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**Signals Management**
**Transportation Mobility and Safety Division**
**North Carolina Department of Transportation**

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### Flashing Yellow Arrows
- 2070 FYA Signal Head Wiring
- 2070 FYA Flasher Circuit Modification
- 2070 Oasis FYA Overlaps
- 2070 Oasis FYA Logic Processor
- 2070 Oasis FYA Output Remapping
- 2070 Oasis 4-Section FYA Alternate Phasing
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- ASC/3-2070 FYA Overlaps
- ASC/3-2070 FYA Output Remapping
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### Leading Pedestrian Intervals
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- Timed Overlaps

## STD. NO. 10-18

Sheet 1 of 1
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Signal Plan I.D. Box

Every electrical detail must have a Signal Plan I.D. Box. The purpose of this box is to positively identify the signal plan that the electrical detail is designed to implement. The box has four data fields:

Signal Inventory Number - An inventory number is assigned to each signalized intersection. That number is found in the bottom right corner of the signal plan and should be entered in the first data field.

Design Date - This date is found on the signal plan in the area labeled 'Plan Date'. It should be duplicated in the second data field.

Seal Date - The third data field should contain the date that the signal plan was sealed.

Revision Date - If a signal plan has been revised, the date of the revision is shown in the bottom data field and a revision reference number is shown. If the signal plan has no revisions, the data field should be designated as 'N/A'. If a signal plan has been revised more than once, the I.D. box should be expanded to show all revision dates and the revision text should be edited to read 'REVISED1', 'REVISED2', as required.
Equipment Information

Controller - Gives the controller model.

Cabinet - Gives the cabinet model (332 for a base mount cabinet, or 336 for a pole mount cabinet).

Software - Gives the local software package to be used at a particular location. If the signal design includes railroad preemption, the specific version of the software will be listed.

Cabinet Mount - Specifies whether the traffic signal cabinet is a base mount or pole mount design.

Output File Positions - Lists the number of load switch sockets available in the output file. Also specifies, if applicable, the presence of an auxiliary output file.

Load Switches Used - Indicates which load switches are to be used on the design.

Phases Used - Lists the phases used by the controller, including any phases used for timing only that have no field display.

Overlaps - Lists the parent phases for any overlaps being used.
### SIGNAL HEAD HOOK-UP CHART

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<tr>
<th>LOAD SWITCH NO.</th>
<th>S1</th>
<th>S2</th>
<th>S3</th>
<th>S4</th>
<th>S5</th>
<th>S6</th>
<th>S7</th>
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<th>S10</th>
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</table>

**NU = NOT USED**

**Features:**

- **A** Load Switch No. - Displays the load switch designation.
- **B** CMU Channel No. - Displays the conflict monitor unit channel number for each corresponding load switch position.
- **C** Phase - Lists the function of the load switch. The load switch function can be reassigned in the controller programming. The default settings are shown at left.
- **D** Signal Head No. - Lists the signal heads that should have connections made to the field terminals for this load switch. Note that a 4- or 5-section head may appear in two different columns because the red, yellow, and green balls are controlled by one load switch while the arrow indications are controlled by another.
- **E** Red, Yellow, Green - Lists the field terminal number to which the red, yellow, and green ball indications for the signal heads listed in the row above should be tied.
- **F** Red, Yellow, and Green arrows - Red, yellow, and green arrow indications for the signal heads should be tied to the field terminals that appear in these rows.
- **H** Extra column - if more than one type of signal head is attached to the same load switch, a second column is added to the chart as shown above. In this example, both a 3-section all left arrow head and the arrow portion of a 5-section head are to run on phase 1.

(continued on next page)

**2070 Signal Head Hook-Up Chart**

**Signs Management**

**Transportation, Mobility, and Safety Division**

**North Carolina Department of Transportation**

**STD. NO. 3.0**

**Sheet 1 of 2**
## SIGNAL HEAD HOOK-UP CHART

<table>
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- RED ✶ 128 101 134 ✷ 107 A121 A124 A114
- YELLOW 129 102 135 ✷ 108 A122 A125 A115
- GREEN 130 103 136 ✷ 109 A123 A126 A116
- RED ARROW 126 132
- YELLOW ARROW 127 124
- GREEN ARROW 127 124

**NU = NOT USED**
* Denotes install load resistor, see load resistor installation detail this page.

### Features (cont.):

1. **Load Resistor note** - If there is not a field indication for each of the three outputs on a given load switch, a note referring to the load resistor installation detail should appear below the field hook-up chart. An asterisk is to be placed in the chart to show where a load resistor needs to be installed. If only the green and yellow indications of the load switch are used (common with 5-section heads on protected/permisive left turns), an asterisk referring to the note should be placed in the 'red' row. If only the green arrow indication is used, the asterisk should appear in the 'yellow' row. This scenario can occur when a 4-section head is used to display a left turn that is only used during a preemption. See STD. NO. 4.0 for more information.

2. **Auxiliary Output file** - If overlaps are used, an auxiliary output file is installed providing additional load switch capacity for up to six overlaps. The default load switch to function relationships for the auxiliary output file are as follows:

   - AUX S1 ——— OVERLAP A
   - AUX S2 ——— OVERLAP B
   - AUX S3 ——— SPARE (OVERLAP E)
   - AUX S4 ——— OVERLAP C
   - AUX S5 ——— OVERLAP D
   - AUX S6 ——— SPARE (OVERLAP F)
2070 Signal Head Hook-Up Chart

The chart shown at left appears on all 2070 electrical details. Its purpose is to provide a user friendly reference on connecting the signal heads to the cabinet field terminals.

Features:

1. Auxiliary Output file - The cabinet must be wired such that for each Flashing Yellow Arrow (FYA) approach, the solid green protected arrow is driven by a load switch monitored on channels 1, 5, and 7. The associated solid red arrow, solid yellow arrow, and flashing yellow arrow (overlap phase) must be driven by a load switch monitored on channels 9, 10, 11, and 12 respectively. The signal monitor makes the following associations when FYA monitoring is enabled for each approach:

   Channel 1 with 9
   Channel 3 with 10
   Channel 5 with 11
   Channel 7 with 12

   Overlaps are used to drive the solid red arrow, solid yellow arrow, and flashing yellow arrow. The display sequence is further controlled by logic statements programmed in the controller.

2. Any load switch that only drives the solid green arrow on a 4-section FYA head will have a load resistor installed on its associated yellow field terminal on the output file. Additionally, the SSM switch for that channel will remain in the OFF position on the conflict monitor.

3. In addition to the hook-up information shown in this chart, every electrical plan utilizing FYA heads will have a FYA signal wiring detail showing a pictorial relationship of the signal head to output file wiring.

(continued on next page)
### SIGNAL HEAD HOOK-UP CHART FOR 4-SECTION FYA PPLT SIGNAL HEADS USED IN A CABINET OPERATING IN COMPACT MODE

<table>
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<th>SIGNAL HEAD HOOK-UP CHART</th>
<th>LOAD SWITCH NO.</th>
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</tbody>
</table>

**Features (cont.):**

3. Load switch outputs that drive the solid red arrow, solid yellow arrow, and flashing yellow arrow will have to be remapped to function as vehicle overlaps.

Unused ped yellow load switch outputs will have to be remapped to drive the left turn green arrows.

4. FYA operation when using a cabinet in compact mode. The FYA compact mode switch on the conflict monitor must be set to the ON position. Further details are found in STD. NO. 7.0. The cabinet must be wired such that the (unused) ped yellow load switch outputs are wired to the conflict monitor as follows:

- 2-PY to Channel 9 Green (CMU pin 13, logical Channel 9)
- 4-PY to Channel 9 Yellow (CMU pin 16, logical Channel 10)
- 6-PY to Channel 10 Green (CMU pin R, logical Channel 11)
- 8-PY to Channel 10 Yellow (CMU pin U, logical Channel 12)

For all cabinets, this is accomplished through a keyed plug connection found on the inside panel of the output file. Plug together the two connectors labeled as shown below:

```
1.2PY          1-CMU-13
2.4PY          2-CMU-16
3.6PY          3-CMU-R
4.8PY          4-CMU-U
```

5. Connecting the keyed ped yellow connector in 'E' above will make it appear to the conflict monitor that the Ped Yellow indications are "ON" when a ped load switch is installed. If the design has a ped movement, its load switch Ped Yellow output must have a load resistor to prevent a conflict. If a ped load switch is installed for FYA reasons but there is no ped movement, its load switch Walk output must have a load resistor to prevent a conflict.

---

* Denotes install load resistor. See load resistor installation detail this sheet.

★ See pictorial of head wiring in detail below.

**NOTE:** Load switches S1, S3, S7, S9, S10, and S12 require output remapping. See sheets x through y for details.

---

**2070 Signal Head Hook-Up Chart For FYA**

**SIGNALS MANAGEMENT**

**TRANSPORTATION MOBILITY AND SAFETY DIVISION**

**NORTH CAROLINA DEPARTMENT OF TRANSPORTATION**

STD. NO. 3.1

SHEET 2 OF 2
Load Resistor Installation Detail

In all traffic signal installations, the signal head displays are switched 'ON' and 'OFF' by solid state load switches. These load switches take a logic level input from the controller and switch AC power to the signal heads through a triac device. The triac is protected from transient voltages by a snubber circuit. In the 'OFF' condition there is a small leakage current through the snubber circuit. As long as there is a load across the circuit, such as a bulb or LED module, this leakage current goes unnoticed. If there is no load, however, the conflict monitor will see an 'OFF' condition as an active signal, resulting in either a false conflict or a dual indication fault.

If there is not a field indication for each of the three outputs on a given load switch, a load resistor needs to be installed. The load resistor takes the place of a bulb or LED indication and provides a load for the channel red or yellow monitor input preventing the problems with unwarranted faults.

If only the green and yellow indications of the load switch are used (common with 5-section heads on protected/permissive left turns), a resistor needs to be installed on the red field terminal as shown above left.

If only the green arrow indication is used, the resistor should be installed on the yellow field terminal as shown lower left. This situation can occur when a 4-section head is used to display a left turn that is only used during a preemption, or when a 4-section flashing yellow arrow head is used to display a protected left turn. In either case, no resistor is needed on the red terminal as the signal sequence monitoring capability is not used. See STD. NO. 3.0 and 7.0 for more information.
(This page is intentionally left blank)
(OPTION #1)

DYNAMIC BACKUP CONTROL PROGRAMMING

(program controller as shown below)

1. FROM MAIN MENU PRESS ‘2’ (PHASE CONTROL), THEN ‘1’ (PHASE CONTROL FUNCTIONS). SCROLL TO THE BOTTOM OF THE MENU AND ENABLE DYNAMIC/BACKUP CONTROL FUNCTIONS 1 AND 2.

2. FROM PHASE CONTROL FUNCTIONS MENU PRESS ‘2’ (DYNAMIC/BACKUP CONTROL FUNCTIONS).

   DYNAMIC/BACKUP CONTROL FUNCTION #01
   OVERLAPS: ABCDEFGHIJKLMNOP
   IF OVERLAPS ARE ACTIVE:
   OR PHASES: 123456789101112131415 16
   IF PHASES ARE ON: X
   OMIT PHASES: X
   CALL PHASES: X

   PRESS 'NEXT'

   BACKUP PROTECTION PROGRAMMING COMPLETE

(OPTION #2)

BACKUP PROTECTION NOTE

(program controller as shown below)

From Main Menu press ‘2’ (Phase Control), then ‘1’ (Phase Control Functions). Program phase 2 for 'Backup Protect'. Make sure the Red Revert times shown on the Signal Design Plans are programmed in the 'Phase Timing' menu.

Oasis Backup Protection Programming Details

When a signal design requires the use of backup protection to eliminate a yellow trap situation, two options are available.

Option #1 uses the Dynamic Backup function. The upper left image is an exact duplication of the dynamic backup programming display found on a 2070 controller running Oasis control software.

The controller accomplishes dynamic backup protection by omitting the left turn phase while the opposite through movement is "ON". Phase "ON" is a controller function that is active during the phase green, yellow change, and red clearance intervals.

Below is a brief explanation of dynamic backup protection features and functionality:

(A) Activation note - This note directs the installer to the phase control page of the controller programming. At the bottom of this page there is a parameter listed called "Dynamic/Backup". The installer is directed to flag the Dynamic/Backup functions that will be in use, otherwise the backup programming will not function. See function number below in note (E).

(B) Phases On row - Phases selected here determine when an omit is placed during the signal sequence.

(C) Omit Phases row - Phases selected here determine where an omit is placed during the selected phase "ON".

(D) Call Phases row - Phases selected here determine the phase that the omitted phase detectors will call while that phase is omitted. The call placed is a special dynamic call that will be released when the selected phase switches to green. This dynamic call produces a minimum recall type operation (dynamic call will not max out a phase).

(E) Function number - The controller is capable of up to sixteen dynamic functions. For normal backup protection, one function should be used for each left turn that is being omitted. The example shown to the left shows phases 1 and 5 being omitted by phases 2 and 6 respectively. The phase calls will cycle the controller through the side street through movements before serving phases 1 and/or 5. Please note that each left turn omit is accomplished in a separate function.

Option #2 uses the Backup Protect function. This function puts the through phases in all Red before serving the left turns. This function is typically used in conjunction with increased Red Revert times on the concurrent through phase.
Econolite ASC/3-2070 Backup Protection Programming Details

When a signal design requires the use of backup protection to eliminate a yellow trap situation, a dynamic approach as well as a red revert approach are both available from one programming screen as shown to the left.

Use the notes shown beneath the screen shot to interpret the backup protection requirements that may be shown on a signal design plan.

- **TMG Row** - Determines the phase when an omit is placed during the signal sequence.
- **BKUP Column** - Determines the phase where an omit is placed while the TMG row phase is "ON". Also used to determine the phase that will be called while the TMG row phase is "ON" and the programmed omit phase has a call.
- **Example 1**: The controller will back up from phase 2 to phase 1 after first going to all Red and timing the Red Revert times programmed in the controller. See Note 1.
- **Example 2**: Omits phase 3 when phase 4 is "ON" (the controller will not back up directly from phase 4 to phase 3). See Note 3.
- **Example 3**: When phase 6 is "ON" and the controller receives a call on phase 5, the controller will omit the phase 5 call and call phase 4. Phase 5 will be served when the controller recrosses the barrier after phase 4 clears. The controller will not back up directly from phase 6 to phase 5. See Note 2.
- **Example 4**: Omits phase 7 when phase 8 is "ON" (the controller will not back up directly from phase 8 to phase 7). See Note 3.

**NOTES**

1. 'B' without a 'C' programmed for the 'TMG' [row] phase inhibits the controller from servicing the 'BACKUP' [column] phase when the 'TMG' [row] phase is active, or next, until the controller goes through Red Revert and Red Clear. Make sure the proper Red Revert and Red Clear times shown on the Signal Design plan are programmed in the controller phase timing.

2. 'B' with a 'C' programmed for the 'TMG' [row] phase places a demand on that 'BACKUP' [column] phase. The controller will then service the called phase and proceed normally.

3. 'X' inhibits the controller from servicing the 'BACKUP' [column] phase when the 'TMG' [row] phase is active or next.
SE-PAC2070 Backup Protection Programming Details

When a signal design requires the use of backup protection to eliminate a yellow trap situation, dynamic backup protect is available as shown to the left.

① PHASE row - Determines the phase where an omit is placed while the programmed OMIT phase is "ON".

② OMIT row - Phases programmed here determine when an omit is placed during the signal sequence.

③ OCAL row - Phases programmed here determine the phase that will be called while the programmed OMIT phase is "ON" and the phase in the PHASE row has a call.

④ Example 1: Omits phase 1 when phase 2 is "ON" (the controller will not back up directly from phase 2 to phase 1).

⑤ Example 2: When phase 6 is "ON" and the controller receives a call on phase 5, the controller will omit the phase 5 call and call phase 4. Phase 5 will be served when the controller recrosses the barrier after phase 4 clears. The controller will not back up directly from phase 6 to phase 5.

Special Sequence programming complete.
Naztec Apogee Backup Protection Programming Details

When a signal design requires the use of backup protection to eliminate a yellow trap situation, dynamic backup protection is available as shown to the left.

- **Phase column** - Determines the phase when an inhibit (omit) is placed during the signal sequence.
- **Inhibit Phase row** - Determines the phase where an inhibit (omit) is placed while the phase in the 'Phase' column is "ON".
- **From-To column** - Phase programmed in the 'From' column will have calls redirected to the phase programmed in the 'To' column while the phase in the 'Phase' column is "ON".

**Example 1:** Call Inhibits - This programming will inhibit (omit) phase 1 when phase 2 is "ON" and will inhibit (omit) phase 5 when phase 6 is "ON". The controller will not back up directly from phase 2 to phase 1 or from phase 6 to phase 5.

**Example 2:** Call Redirects - A call redirect can work in conjunction with a call inhibit. When phase 6 is on and the controller receives a call on phase 5, the controller will inhibit (omit) the phase 5 call as per Example 1. To serve phase 5, the controller will first redirect phase 5 calls to phase 4 and phase 5 will be served when the controller recrosses the barrier after phase 4 clears. The controller will not back up directly from phase 6 to phase 5.

**Operational Note**

This programming will omit phase 1 when phase 2 is "ON" and omit phase 5 when phase 6 is "ON". Also, calls will be redirected from phase 5 to phase 4 during phase 6.
1. To prevent “flash-conflict” problems, insert red flash [program blocks for all unused vehicle load switches in the output file. The installer shall verify that signal heads flash in accordance with the signal plans.]

2. Program phases 4 and 8 for Dual Entry.

3. Enable Simultaneous Gap-Out for all phases.

4. Program phases 2 and 6 for Variable Initial and Gap Reduction.

5. Program phases 2 and 6 for Startup In Green.

6. Program phases 2, 4, 6 and 8 for Startup Ped Call.

7. Program phases 2 and 6 for Yellow Flash, and overlaps 1 and 2 as Wag Overlaps.

8. The cabinet and controller are part of the (insert) System.

Notes

All electrical details have a section of notes. A typical set for an Oasis 2070 design is shown above. Unneeded notes should be removed. Additionally, if there is a need to highlight an unusual setting or feature about the signal design that is not covered elsewhere on the electrical detail, a custom note can be added to this space.
NOTES

1. To prevent "flash-conflict" problems, insert red flash ————① program blocks for all unused vehicle load switches in the output file. The installer shall verify that signal heads flash in accordance with the Signal Plans.

2. Program phases 4 and 8 for Dual Entry. ————②

3. Program controller to start up in phase 2 Green and 6 Green. ————③

4. The cabinet and controller are part of the (insert) ————④

ASC/3-2070 Notes

① Flash setup note - The first sentence, concerning flash color setup on unused load switches, may be omitted if all load switches are used. The second sentence is always used.

② Dual Entry note - Directs that the indicated phases be programmed for Dual Entry. The 'ASC/3-2070 Timing Chart' on the signal plan will specify which phases require this feature.

③ Controller Start Up note - In general, the controller should be programmed to start up in the phase or phases that flash yellow. If no phases flash yellow, the controller needs to be programmed to start up in a red clearance interval. If this is the case, consult the signal plan designer to see if there is a preference about what phase(s) should be served first. If the the startup phase also has a ped movement, it should be programmed to start in 'Walk' instead of 'Green'.

④ System note - If the signal is part of a closed loop or urban traffic control system, the system type and/or name (if available) is listed here.
NOTES

1. To prevent "flash-conflict" problems, insert red flash —— A —— program blocks for all unused vehicle load switches in the output file. The installer shall verify that signal heads flash in accordance with the Signal Plans.

2. Program controller to start up in phases 2 and 6 green. —— B ——

3. Enable simultaneous gap-out feature, on controller unit, —— C —— for all phases.

4. Program phases 4 and 8, on controller unit, for dual entry. —— D ——

5. Program phases 2 and 6, on controller unit, for volume density operation. —— E ——

6. The cabinet and controller are part of the (insert) —— F —— System.

SE-PAC 2070 Notes

① Flash setup note - The first sentence, concerning flash color setup on unused load switches, may be omitted if all load switches are used. The second sentence is always used.

② Controller Start Up note - In general, the controller should be programmed to start up in the phase or phases that flash yellow. If no phases flash yellow, the controller needs to be programmed to start up in a red clearance interval. If this is the case, consult the signal plan designer to see if there is a preference about what phase(s) should be served first.

③ Simultaneous Gap-Out note - Directs that all phases be programmed for Simultaneous Gap-Out. This note always appears and never requires modification.

④ Dual Entry note - Directs that the indicated phases be programmed for Dual Entry. The 'SE-PAC 2070 Timing Chart' on the signal plan will specify which phases require this feature.

⑤ Volume Density Operation note - Directs that the indicated phases be programmed for the following timing features if indicated on the 'SE-PAC 2070 Timing Chart' on the signal plan: 'Added Initial', 'Maximum Initial', 'Time Before Reduction', 'Time To Reduce', 'Minimum Gap'.

⑥ System note - If the signal is part of a closed loop or urban traffic control system, the system type and/or name (if available) is listed here.
1. To prevent "flash-conflict" problems, insert red flash program blocks for all unused vehicle load switches in the output file. The installer shall verify that signal heads flash in accordance with the Signal Plans.

2. Initialize database in Naztec 2070 local software (Apogee) as FULL-CALTRANS. This initialization should be done prior to programming controller.

3. Initialize I/O "C1-C11-ABC ID Mode" to USER (MM 1-8-6).
   Then set "Init 2A" to MODE 5 (MM 1-8-9-3).

4. Program phases 2 and 6 for Start Up in Green.

5. Program "Start Up Flash" for 0 sec. The conflict monitor will govern start-up flash time.

6. Ensure "Local Flash Start" feature is set to "DRK".

7. Ensure "InhFYARedSt" feature is set to "ON".

8. Program controller to provide a 1 second delay on the Flash Sense/Local Flash input. Use the following logic statement to provide this functionality:

   FROM MAIN MENU-1=2=5 (TO LOGIC) Result Src.Fnn TimeUp Time
   2028 = 02028 JLY 1

9. Program phases 2, 4, 6, and 8 for Dual Entry.

10. The cabinet and controller are part of the (insert) System.

---

Apogee Notes

- Flash setup note - The first sentence, concerning flash color setup on unused load switches, may be omitted if all load switches are used. The second sentence is always used.

- Initialize Database note - loads controller with defaults required to run standard eight phase with CALTRANS I/O mapping.

- Initialize I/O - Loads the I/O map with the NCDOT I/O mapping that might not be identical to CALTRANS I/O mapping.

- Controller Start Up note - In general, the controller should be programmed to start up in the phase or phases that flash yellow. If no phases flash yellow, the controller needs to be programmed to start up in a red clearance interval. If this is the case, consult the signal plan designer to see if there is a preference about what phase(s) should be served first. If the the startup phase also has a ped movement, it should be programmed to start in 'Walk' instead of 'Green'.

- Start Up Flash - Determines how long a controller will remain in flash following a power interruption.

- Local Flash Start - Set to 'DRK' in a 170 type cabinet so the controller indications initialize in the DRK state when the controller resets and the flash transfer relays are energized.

- InhFYARedSt - FYA's can be programmed to be inhibited or allowed to run immediately following controller startup by programming this feature.

- Dual Entry note - Directs that the indicated phases be programmed for Dual Entry. The Controller Timing Chart on the signal plan will specify which phases require this feature.

- System note - If the signal is part of a closed loop or urban traffic control system, the system type and/or name (if available) is listed here.
2018 Conflict Monitor Programming

The conflict monitor typically used in all NCDOT 2070 installations is the EDI model 2018ECL-NC. (See note 1 on sheet 2) The representation at the left is found in the top left corner on all the 2070 start drawings.

The 2018ECL-NC has 18 monitor channels. The default channel to load switch to function relationships are as follows:

Channel 1  ---  S1  ---  Phase 1
Channel 2  ---  S2  ---  Phase 2
Channel 3  ---  S4  ---  Phase 3
Channel 4  ---  S5  ---  Phase 4
Channel 5  ---  S7  ---  Phase 5
Channel 6  ---  S8  ---  Phase 6
Channel 7  ---  S10  ---  Phase 7
Channel 8  ---  S11  ---  Phase 8
Channel 9  ---  AUX S1  ---  Overlap A
Channel 10  ---  AUX S2  ---  Overlap B
Channel 11  ---  AUX S4  ---  Overlap C
Channel 12  ---  AUX S5  ---  Overlap D
Channel 13  ---  S3  ---  Phase 2 PED
Channel 14  ---  S6  ---  Phase 4 PED
Channel 15  ---  S9  ---  Phase 6 PED
Channel 16  ---  S12  ---  Phase 8 PED
Channel 17  ---  AUX S3  ---  Spare (Overlap E)
Channel 18  ---  AUX S6  ---  Spare (Overlap F)

The channel to load switch relationship is fixed in the cabinet hardware. The load switch function can be changed in the controller software. Load switches AUX S1-AUX S6 are on the auxiliary output file.

Features:

Remove diode jumper note - For any two movements to be allowed to run concurrently, the corresponding diode jumper must be removed on the monitor card. This includes not only phases that can run concurrently, but also any ped or overlap that can run concurrently.

Any permissible combination that does not have the corresponding jumper removed will result in an unwarranted conflict fault and place the intersection in flash. Conversely, removing a jumper representing a movement that should not be allowed creates a dangerous scenario where a true conflict can go undetected. This note lists the jumpers that should be removed on the monitor card.
Features (cont.):

1. Monitor card programming - The electrical detail provides a graphic representation of the monitor card after the appropriate diode jumpers have been removed as described above. This drawing should always match the remove diode jumper note directly above.

2. Option switches - These dip switches control a variety of optional settings for the 2018ECL-NC monitor. The settings shown at left should be used for all electrical details. For more information on these options, refer to the manufacturer's operations manual.

3. FYA switches - These switches are used to enable flashing yellow arrow monitoring for 3-section and 4-section FYA's using overlaps. Refer to the manufacturer's operations manual for more information on these switches.

4. SSM switches - These switches are used to enable dual indication, red fail, and minimum yellow clearance monitoring on individual monitor channels. In general, any channel that has both a green and a yellow indication in the field should have its SSM switch set to the 'ON' position. Channels used to monitor pedestrian movements, or the green arrow exclusively for a four-section head or four-section FYA head, should be set to the 'OFF' position.

5. Watchdog enable - Enables the controller watchdog monitoring feature. If the monitor fails to sense the logic level signal being toggled by the controller, a 'WDT Error' fault will be triggered. Should always be shown in the 'ON' position.

6. Yellow disable jumpers - This feature allows the minimum yellow change monitoring to be disabled for a channel being used for a pedestrian movement. Since NCDOT also does not monitor dual indication for peds, the SSM switches for those channels should be set to 'OFF', making the use of the yellow disable jumpers unnecessary.

Notes - These notes should appear with the conflict monitor programming detail on all 2070 electrical details. For more information on these options and conflict monitor functionality, refer to the manufacturer's operations manual.

For signal systems using Ethernet communications, use Note 4 (Option 2) and change the monitor model to "2018ECLip-NC".
**2070 Input File Layout (332)**

NCOT uses 2070 controllers in type 170 cabinets. The base mounted 332 cabinet has two input files labeled 'I' and 'J' that accept inputs for traffic detection, pedestrian push buttons, preemt calls or other functions deemed necessary.

Each input file has 14 slots. Each slot can hold a 2-channel inductive loop detector, AC isolator or DC isolator. Each slot has two input terminals, but not every input terminal is independently connected to the controller. Slots 1, 4, 5 and 8 have the two input pins jumpered together and wired to a single controller harness pin. Neither of the input pins for slot 10 are connected to the controller.

Two examples of the input file layout for the base mounted 332 cabinet are shown left. The upper example shows how the rack is represented on the start drawings. The functions shown for slots 1-6 and 12-14 correspond to the default input assignments in the Econolite Oasis software. The controller detectors for slot 9 are assigned as local detectors by default but NCOT reserves them for system detectors instead. Slot 10 is not wired to the controller and is therefore unused. The upper and lower channels of slot 11 in the I-File are assigned to Manual Advance and Manual Control Enable, respectively. The upper channel of slot 11 in the J-File is a spare and the lower slot is the Door Ajar input to the controller.

Features:
- Inductive Loop Detectors - Input file slots 1-9 are set up for inductive loop detector cards. Each card has two channels. Each channel is represented on the electrical detail by a block in the layouts shown on the left. For each channel, the function of the loop is shown in the upper half of the block while the loop name is shown in the lower half. A channel can be assigned to a local detector, a system detector, or both. While the default phase settings should be followed as much as practical, controller detectors can be easily reassigned as needed.

(continued on next page)
Detector Test Switches - There are eight detector test switches in the cabinet labeled 1-8 that can be used to test eight different phase approaches. They are wired, in order, to the controller Ct pin for slots 1, 4, 5, and 8 of the "I" file and the "J" file. When any of the aforementioned slots are used for detector inputs, it is recommended that the assigned phase match the default phase of the slot so a test switch activation will place a call to the correct phase.

Features (cont.):

6. Slots 1, 4, 5, and 8 have only one controller input pin. The lower channel is normally unused. However, the lower channel of these slots may be used if neither the loop on the upper channel nor the loop proposed for use on the lower channel have any associated delay timing and all other settings for both loops are identical. The controller will view the two loops as if they are one.

7. Loops That Call Two Phases - Sometimes a left turn loop will call both the left turn phase and the adjacent through movement with different timings or attributes for each. In this case, two detector channels are needed for the single loop. Utilize the default programmed detector settings. Populate the turn phase detector slot with a detector card. Then jumper the turn phase controller input pin to the through movement controller input pin that is associated with slot(s) 4 or 8. The through movement slot is not populated with a detector card as shown in the example at left.

8. System Detectors - Detector cards for system loops are normally placed in slots J9 and J10. If more than four dedicated system loops are needed, an unused channel from slots 1-8 may be used. A detector may also serve both a local and a system detector, as shown in slot J3 in the example at left.


10. Preempt Inputs - The default setup can accommodate six preempt inputs. Preempts 1 and 2 interface the controller through an AC isolator card in slot J14. Preempt 1 is normally reserved for railroad preemption, while preempt 2 can be used for a second railroad preempt or (more commonly) for push button style emergency vehicle preemption. Preempts 3-6 are normally reserved for vehicle initiated EV preemptions and interface the controller through DC isolator cards. For more information on preemption see STD. No. 9.0.

11. Slot I14 is reserved for flash sense and stop time. This DC isolator card is equipped from the factory and this slot always appears on electrical details without modification.

* Using any of these slots for purposes other than those shown here may require reassignment of inputs in the controller software and/or modification of the surge protection on the cabinet input panel.
## 2070 Input File Connection & Programming Chart

### INPUT FILE CONNECTION & PROGRAMMING CHART

<table>
<thead>
<tr>
<th>LOOP NO.</th>
<th>LOOP TERMINAL</th>
<th>INPUT FILE NO.</th>
<th>PIN</th>
<th>PIN ASSIGNMENT</th>
<th>DETECTOR NO.</th>
<th>NEMA PHASE</th>
<th>CALL EXTEND</th>
<th>FILE TIME DELAY</th>
<th>START TIME</th>
<th>END TIME</th>
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<tr>
<td>6A</td>
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<td>J2L</td>
<td>71</td>
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<td>6B</td>
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<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
</tbody>
</table>

**Note:** Install DC isolators in input file slots 112 and 113.

**System Detector Only:** Remove the vehicle phase assigned to this detector in the default programming.

**Pedestrian Push Buttons:**

- **Add jumper from 11-1 to J4-W on rear of input file.**
- **Add jumper from 15-1 to J8-W on rear of input file.**
- **Add jumper from 1-1 to J4-W on rear of input file.**
- **Add jumper from 5-1 to J18-W on rear of input file.**

---

**2070 Input File Connection & Programming Chart – 332 (Oasis)**

The purpose of the 2070 Input File Connection & Programming Chart is to provide the installer with a convenient reference for connecting inductive loops and pedestrian push buttons to the cabinet as well as for programming controller detectors. The example shown at left is set up to match the example shown in the 2070 Input File Layout section (STD. No. 8.0 sheet 2, feature “C”).

The key value to each row is the input file position (third column from the left). The first six values in the row should be considered attributes of the input file position. The relationship of the input file position with a specific inductive loop (first column) is decided during the preparation of the input file layout. Also, once the input file layout is established, all rows corresponding to unused input file positions can be deleted.

The relationship of the input file position with the loop terminal and pin numbers is fixed in the cabinet hardware. Changing these values entails rewiring the cabinet and should be avoided. The relationship of the input file position with the input assignment and controller detector numbers is set in the controller software. The values shown on the start drawings are the controller defaults. Changing them is only necessary if the detector is to be reassigned to another function.

The remaining (right-most) six columns contain attributes that apply to the specific loop associated with the input file position in question. These values can be found in the ‘2070 Loop Detector and Installation’ chart on the signal plan and should be duplicated in this chart.

**Additional Features:**

- **Pedestrian Push buttons:** If the design utilizes pedestrian push buttons, an extension is added to the Input File Connection & Programming Chart that contains the appropriate values for those detector channels. The values in the last five columns of the main chart do not apply to pedestrian detectors. The CADD cell containing the pedestrian detectors also includes a note reminding the installer to equip the appropriate slots with a DC isolator.

- **Jumper Note:** If a single loop requires two controller detector inputs (see STD. NO. 8.0 sheet 2), a note is placed below the chart detailing which controller input pins should be jumpered together.

- **System Detector Note:** If a detector channel is to serve as a system detector only, this note is included to remind the installer to remove the vehicle phase assigned to that detector in the default programming.
### INPUT FILE CONNECTION & PROGRAMMING CHART

<table>
<thead>
<tr>
<th>LOOP NO.</th>
<th>LOOP TERMINAL</th>
<th>INPUT FILE PG.</th>
<th>PIN NO.</th>
<th>DETECTOR NO.</th>
<th>NEMA PHASE</th>
<th>CALL</th>
<th>EXTEND TIME</th>
<th>DELAY TIME</th>
<th>ADDED INITIAL</th>
<th>DETECTOR TYPE</th>
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</thead>
<tbody>
<tr>
<td>1A</td>
<td>TB5-12</td>
<td>J1U</td>
<td>56</td>
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<td>15</td>
<td></td>
<td></td>
<td>S</td>
</tr>
<tr>
<td></td>
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<td></td>
<td></td>
<td>G</td>
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<tr>
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<td></td>
<td></td>
<td>X N</td>
</tr>
<tr>
<td>2B</td>
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<td>JSL</td>
<td>43</td>
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<td></td>
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<tr>
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<td>J1L</td>
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<td></td>
<td>S</td>
</tr>
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<td>3A</td>
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<td></td>
<td>S</td>
</tr>
<tr>
<td>6A</td>
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<td>48</td>
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<td>X N</td>
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<tr>
<td>6B</td>
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<td>J2L</td>
<td>44</td>
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<td>X N</td>
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<td>8</td>
<td>YES</td>
<td></td>
<td></td>
<td></td>
<td>S</td>
</tr>
</tbody>
</table>

**NOTE:**
- INSTALL DC ISOLATORS IN INPUT FILE SLOTS 112 AND 113.

**FILE POSITION LEGEND:**
- JSL: LOWER
- J2L: SLDT 2

**ADDITIONAL FEATURES:***
- **A** See STD. No. 8.1 Sheet 1
- **B** See STD. No. 8.1 Sheet 1
- **C** See STD. No. 8.1 Sheet 1
- **D** ADDED INITIAL - loops that are designed for volume density. Put an 'X' in this column if a corresponding 'X' exists on the detector installation chart on the signal plan.
- **E** DETECTOR TYPE - this column is where the exact detector type is programmed. Examples could be 'G', which allows delay during green, or 'S' for standard detector features. The detector type for each loop is found on the signal plan.

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**2070 Input File Connection & Programming Chart - 332 (ASC/3-2070)**

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**TRANSPORTATION MOBILITY AND SAFETY DIVISION**
**NORTH CAROLINA DEPARTMENT OF TRANSPORTATION**

**STD. NO. 8.1**

**SHEET 2 OF 2**
## 2070 Input File Layout (336)

NCDOT uses 2070 controllers in type 170 cabinets. The pole mounted 336 cabinet has one input file labeled ‘I’ that accepts inputs for traffic detection, pedestrian push buttons, preempt calls or other functions deemed necessary.

The input file has 14 slots. Each slot can hold a 2-channel inductive loop detector, AC isolator or DC isolator. Each slot has three input terminals, ‘F’, ‘W’, and ‘SP’ that are independently connected to the controller by way of a C1 pin.

Two examples of the input file layout for the pole mounted 336 cabinet are shown left. The upper example shows how the rack is represented on the start drawings. The functions shown for slots 1-14 correspond to the default input assignments in the Econolite Oasis software. The ‘SP’ pin in slot 19 is the Door Ajar input to the controller, and the ‘SP’ pin in slot 14 is the Manual Advance input to the controller.

### Features:

- **Inductive Loop Detectors** - Input file slots 1-8 are set up for inductive loop detector cards. Each card has two channels. Each channel is represented on the electrical detail by a block in the layouts shown on the left. For each channel, the function of the loop is shown in the upper half of the block while the loop name is shown in the lower half. A channel can be assigned to a local detector, a system detector, or both. While the default phase settings should be followed as much as practical, controller detectors can be easily reassigned as needed.

### INPUT FILE POSITION LAYOUT

(front view)

<table>
<thead>
<tr>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
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<th>9</th>
<th>10</th>
<th>11</th>
<th>12</th>
<th>13</th>
<th>14</th>
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<tbody>
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<td>φ3</td>
<td>φ4</td>
<td>φ5</td>
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<tr>
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<td>4A</td>
<td>5A</td>
<td>6A</td>
<td>7A</td>
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<td>10A</td>
<td>11A</td>
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<td>φ10</td>
<td>φ11</td>
<td>φ12</td>
<td>φ13</td>
<td>φ14</td>
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<td>4B</td>
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<td>6B</td>
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<td>8B</td>
<td>9C</td>
<td>10C</td>
<td>11C</td>
<td>12C</td>
<td>13C</td>
<td>14C</td>
</tr>
</tbody>
</table>

- **FS**: FLASH SENSE
- **ST**: STOP TIME
- **PRE**: PREEMPT

(continued on next page)
Features (cont):

5) System Detectors - Detector cards for dedicated system loops may be placed in any unused detector slot. If space in the I-File runs out and additional system detectors are called for, a detector may also serve as both a local and a system detector as shown in slot I2 in the example at left.

6) Preempt Inputs - The default setup can accommodate six preempt inputs. Preempts 1 and 2 interface the controller through an AC isolator card in slot 49. Preempt 1 is normally reserved for railroad preemption, while preempt 2 can be used for a second railroad preempt or (more commonly) for push button style emergency vehicle preemption. Preempts 3-6 are normally reserved for vehicle initiated EV preemptions and interface the controller through DC isolator cards. For more information on preemption see STD. No. 9.0.

7) Ped Detectors - Pedestrian push buttons interface to the controller through DC isolator cards in slots I12 and I13.

8) Slot I14 is reserved for flash sense and stop time. This DC isolator card is equipped from the factory and this slot always appears on electrical details without modification.

9) Loops That Call Two Phases (2006 Spec. cabinets) - Loops that call two phases in a 336 pole mounted cabinet require special wiring. A jumper must be added from the controller input pin of the first phase to the controller input pin of the second phase in the same slot that the loop detector is installed. Also, the second channel for the loop detector plugged into the slot must be turned OFF so that the detector can not inadvertently place a call to the controller on the second channel.

Loops That Call Two Phases (2012 Spec. cabinets) - Loops that call two phases in a 336 pole mounted cabinet require special wiring. Typically a jumper is added from the controller input pin of the first phase to a spare controller input pin of the second phase located in the same slot that the loop detector is installed.

* Using any of these slots for purposes other than those shown here may require reassignment of inputs in the controller software and/or modification of the surge protection on the cabinet input panel.
### INPUT FILE CONNECTION & PROGRAMMING CHART

<table>
<thead>
<tr>
<th>LOOP NO.</th>
<th>LOOP TERMINAL</th>
<th>INPUT FILE POS</th>
<th>PIN NO.</th>
<th>INPUT ASSIGNMENT NO.</th>
<th>DETECTOR NO.</th>
<th>NEMA PHASE</th>
<th>CALL EXTEND</th>
<th>FULL TIME DELAY</th>
<th>STRETCH TIME DELAY</th>
<th>DELAY TIME</th>
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</thead>
<tbody>
<tr>
<td>1A</td>
<td>T021-1,2</td>
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<td>56</td>
<td>19</td>
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</tr>
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<td>2A</td>
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<td>Y</td>
<td>4</td>
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<td>Y</td>
<td>10</td>
<td></td>
</tr>
</tbody>
</table>

**NOTE:** INSTALL DC ISOLATORS IN INPUT FILE SLOTS 112 AND 113.

**SYSTEM DETECTOR ONLY:** REMOVE THE VEHICLE PHASE ASSIGNED TO THIS DETECTOR IN THE DEFAULT PROGRAMMING.

---

**2070 Input File Connection & Programming Chart - 336 (Oasis)**

The purpose of the Input File Connection & Programming Chart is to provide the installer with a convenient reference for connecting inductive loops and pedestrian push buttons to the cabinet as well as for programming controller detectors. The example shown at left is set up to match the example shown in the 2070 Input File Layout section (STD. No. 8.2 sheet 2, feature "F", 2012 Spec. cabinet).

The key value to each row is the input file position (third column from the left). The first six values in the row should be considered attributes of the input file position. The relationship of the input file position with a specific inductive loop (first column) is decided during the preparation of the input file layout. Also, once the input file layout is established, all rows corresponding to unused input file positions can be deleted.

The relationship of the input file position with the loop terminal and pin numbers is fixed in the cabinet hardware. Changing these values entails rewiring the cabinet and should be avoided. The relationship of the input file position with the input assignment and controller detector numbers is set in the controller software. The values shown on the start drawings are the controller defaults. Changing them is only necessary if the detector is to be reassigned to another function.

The remaining (right-most) six columns contain attributes that apply to the specific loop associated with the input file position in question. These values can be found in the '2070 Loop Detector and Installation' chart on the signal plan and should be duplicated in this chart.

**Additional Features:**

- **Pedestrian Push buttons:** If the design utilizes pedestrian push buttons, an extension is added to the Input File Connection & Programming Chart that contains the appropriate values for those detector channels. The values in the last five columns of the main chart do not apply to pedestrian detectors. The CADD cell containing the pedestrian detectors also includes a note reminding the installer to equip the appropriate slots with a DC isolator.

- **Jumper Note:** If a single loop requires two controller detector inputs (see STD. NO. 8.2 sheet 2, a note is placed below the chart detailing which controller input pins should be jumpered together.

- **System Detector Note:** If a detector channel is to serve as a system detector only, this note is included to remind the installer to remove the vehicle phase assigned to that detector in the default programming.

---

**For 2006 Spec. cabinet:**

1. Add jumper from 11-F to 11-W, on rear of input file.
3. Add jumper from 15-F to 15-W, on rear of input file.
4. Add jumper from 17-F to 17-W, on rear of input file.

**For 2012 Spec. cabinet:**

1. Add jumper from 11-F to 11-SP, on rear of input file.
2. Add jumper from 13-F to 13-SP, on rear of input file.
3. Add jumper from 15-F to 15-SP, on rear of input file.
4. Add jumper from 17-F to 17-SP, on rear of input file.
### 2070 Input File Connection & Programming Chart - 336 (ASC/3-2070)

The purpose of the Input File Connection & Programming Chart is to provide the installer with a convenient reference for connecting inductive loops and pedestrian push buttons to the cabinet as well as for programming controller detectors. The example shown at left is set up to match the example shown in the 2070 Input File Layout section (STD. No. 8.2 sheet 2, feature “F”, 2012 Spec. cabinet).

The key value to each row is the input file position (third column from the left). The first five values in the row should be considered attributes of the input file position. The relationship of the input file position with a specific inductive loop (first column) is decided during the preparation of the input file layout. Also, once the input file layout is established, all rows corresponding to unused input file positions can be deleted.

The relationship of the input file position with the loop terminal and pin numbers is fixed in the cabinet hardware. Changing these values entails rewiring the cabinet and should be avoided. The relationship of the input file positions with the controller detector numbers is set in the controller software. The values shown on the start drawings are the controller defaults. Changing them is only necessary if the detector is to be reassigned to another function.

The remaining (right-most) five columns contain attributes that apply to the specific loop associated with the input file position in question. These values can be found in the '2070 Loop Detector and Installation' chart on the signal plan and should be duplicated in this chart.

### Additional Features:

- **For 2006 Spec. cabinet:**
  - Add jumper from 11-F to 11-W, on rear of input file.
  - Add jumper from 13-F to 13-W, on rear of input file.
  - Add jumper from 15-F to 15-W, on rear of input file.
  - Add jumper from 17-F to 17-W, on rear of input file.

- **For 2012 Spec. cabinet:**
  - Add jumper from 11-F to 11-W, on rear of input file.
  - Add jumper from 13-F to 13-W, on rear of input file.
  - Add jumper from 15-F to 15-W, on rear of input file.

### Loop Table

<table>
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<th>LOOP NO.</th>
<th>LOOP TERMINAL</th>
<th>INPUT FILE POS.</th>
<th>PIN NO.</th>
<th>DETECTOR NO.</th>
<th>NEMA PHASE</th>
<th>CALL</th>
<th>EXTEND TIME</th>
<th>DELAY TIME</th>
<th>ADD. INITIAL</th>
<th>DETECTOR TYPE</th>
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</tbody>
</table>

### Ped Push Buttons

- **P21/P22 T282-4.18**
- **P21/P22 T282-13.12**

**NOTE:**
- INSTALL DC ISOLATORS IN INPUT FILE SLOTS 112 AND 113.

**INPUT FILE POSITION LEGEND:**

- **FILE 1**
- **SLOT 2**
- **LOWER**

---

**For 2006 Spec. cabinet:**
- Add jumper from 11-F to 11-SP, on rear of input file.
- Add jumper from 13-F to 13-W, on rear of input file.
- Add jumper from 15-F to 15-W, on rear of input file.
- Add jumper from 17-F to 17-W, on rear of input file.

- **For 2012 Spec. cabinet:**
- Add jumper from 11-F to 11-SP, on rear of input file.
- Add jumper from 13-F to 13-SP, on rear of input file.
- Add jumper from 15-F to 15-SP, on rear of input file.
- Add jumper from 17-F to 17-SP, on rear of input file.
2070 RR Preemption and Blankout Sign Control Box

The 2070 Preemption and Blankout Sign Control Assembly/Box provides the following functionality:

1. Provides the interface between the railroad crossing signal equipment and the traffic signal equipment, which includes termination points for the interconnect cable, surge protection, and termination points for blankout signs.
2. Provides an output which directs the controller to begin the preemption sequence. A test switch is present to manually test this output.
3. Provides the control circuitry for the operation of any blankout signs required by the preemption sequence. This circuitry allows the blankout signs to operate normally, even when cabinet is in the flash mode.

Explanation of major components:

A. Cabinet wiring termination points - Tells the installer where to make the connections in order to interface the box with the cabinet. These connections supply AC power to the box, as well as tie the preemption relay output to an AC isolator.
B. Notes section - Describes the component types and part numbers used in the box. Any special wiring instructional notes are placed here.
C. Preempt relay - The coil of this relay (K1) is tied to the RR cabinet contacts which, when opened, indicate the presence of a train. When the RR contacts open, this relay de-energizes and removes AC+ from the isolator card, thus causing a preemption input to be placed to the controller. The other set of contacts on this relay cause AC+ to be applied to the input of SSR1 which illuminates any blankout signs being used.
D. Blankout sign relay - This relay is a SPST solid state relay which controls the illumination of the blankout signs. When this relay is activated by the preemption relay (K1), the signs will be switched "ON".
E. Field wiring termination points - Tells the installer where the connections are made in order to interface the preemption box with the RR crossing signal equipment. Terminations for blankout sign AC+ and AC- are included here as well.
Emergency Vehicle Preemption Push Button 
And Indicator Lamp Wiring Detail

This wiring detail gives the installer the information needed to interface the controller/cabinet assembly with a firehouse push button. The function of this button is to generate a controller input to initiate the EV preemption sequence.

Usually there is also an indicator (pilot) lamp to be installed in the firehouse. The purpose of this lamp is to give the user positive feedback from the controller that the traffic signal has been preempted. The wiring for the indicator lamp is also shown on this detail.

Major components:

1. Preemption Control Box - This box essentially serves the same purpose in fire preemption applications as it does in railroad preemption applications. See STD. NO. 9.0 sheet 1 for a detailed description of the preemt control box.

2. Cabinet wiring termination points - Tells the installer where to make the connections in order to interface the box with the cabinet. These connectors supply AC power to the box, as well as tie the preemp relay output to an AC isolator.

3. Firehouse Push Button - This is a momentary, normally closed, push button switch. The contacts of this switch are opened when the button is pressed, causing preemption to be activated.

4. Indicator Lamp - The function of this lamp is described above. This lamp is normally controlled by the yellow circuit of a pedestrian load switch. The function of the C1-pin associated with this lamp will have to be changed to operate this lamp correctly. A load resistor is normally tied in parallel with the lamp to drain off any induced voltage. Special programming notes are necessary to alert the installer if these changes. If delay before preempt interval is used, special logic processor programming is necessary for proper operation.

5. When the push button in the fire station is pressed, the preempt relay in the preemption control box de-energizes and removes AC+ from the AC isolator card. As such, the AC isolator card needs to have its switches set to the inverted position for Channel 2.
2070 Oasis Preemption Programming Detail

The image to the left is an exact duplication of the preempt programming display found on a 2070 controller running Oasis control software.

When a signal plan requires Railroad or Emergency Vehicle preemption, this detail is to be used on the electrical detail to instruct the installer on setting the different operational parameters required to operate the preempt sequence per the signal design plans.

Below is a brief description of the most commonly used features:

Interval programming - This is the section in which interval phase selection and timing are programmed. Each interval consists of green, yellow clear, and red clear times. A section where phases are selected for each interval are positioned to the right of each set of timing. An interval time of 255 sec. is a special flag to the controller instructing it to use that interval as the "dwell" interval. The exit interval is designated when a 1 sec. green is selected following the dwell interval. Always use interval 5 as the exit interval.

Dwell interval - The dwell interval is the interval that the controller will rest in until the following two events occur:
1. The dwell minimum timer has expired, and
2. The preempt call is removed.

Priority settings - There are four priority settings:
1. OFF - indicates the preemptor is not used.
2. LOW - use for low priority preempts such as transit vehicle preempts.
3. MED - use for emergency vehicle preempts.
4. HIGH - use for railroad preempts.

Railroad preempt should always be set to be the highest priority. If multiple preempts are set to the same priority, preempts will be served on a first come, first served basis.

Dwell hold-over timer - This timer begins to time after the preempt call is removed. If this timer expires, the dwell interval will be released. If this timer does not expire before a second preempt call is received, the dwell interval will be retimed. Normally used with vehicle initiated EV preemption systems.

Latch call - Used in conjunction with the delay timer. The application for this feature is normally the fire house push button style of preempt. These types of preempts normally have a delay interval. This feature will allow the preempt call to latch and not release until the preempt is served.

Hold clear 1 phases during delay - This feature is used in conjunction with the delay interval. If clear 1 phases are used in normal operation, and those phases just happen to be served during the delay interval, this feature will apply a hold on the clear 1 phases during the remainder of the delay interval.

(continued on next page)
2070 Oasis Preemption Programming Detail

Inhibit overlap green extension - Affects how green extension overlaps (a.k.a. timed overlaps) transition into preemption. If a green extension overlap will not be used in the preemption, this setting is typically "YES". This will inhibit the overlap green extension from timing and allow transition to preemption to be accomplished in the quickest possible time. This is most important in RR preemption applications. If the overlap is used in the first interval of the preemption, the setting should be programmed as "NO".

Service during software flash - This allows the controller to come out of software flash in order to serve the EV preemption.

Rest in red during dwell interval - If the signal plan calls for the preemption dwell to be an all red rest state, this feature should be enabled. In addition, do not select any phases for the dwell interval.

Re-time dwell interval - Used in conjunction with dwell hold-over timer. Allows the controller to re-time the dwell interval if a second preemption call is received before the hold-over timer times out. Normally used with EV preemption. Do not use this feature with railroad preemption unless there are special circumstances.

Omit overlaps - This feature allows overlaps to be omitted during preemption when the overlap parents are active during preemption, but the overlap is not desired. Overlaps will return during exit interval 5.

---

Note: Description of features is not complete. This section is intended to address applications use. Consult the Signal Design Section of this design manual and/or the Econolite Oasis manual for more details.

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2070 OASIS Preemption Programming Detail

Signals Management
Transportation Mobility and Safety Division
North Carolina Department of Transportation

STD. NO. 9.2

Sheet 2 of 3
2070 Oasis Firestation Pilot Lamp Logic Programming Detail

For firestation preemption designs that utilize a push button inside the firestation with a pilot lamp, use the logic processor to turn the lamp "ON" when the button is pressed and "OFF" at the end of the preempt sequence. The example shown to the left uses PRE2 for the fire preempt and the PED 2 Yellow output to light the pilot lamp. Make sure to install load resistors as described in STD. NO. 9.1 sheet 1.

Firestation preempts are usually always latched calls because the push button is a momentary input and there may be delay time programmed. When the firestation push button is pressed, the preempt call is latched and both statements of command #1 will evaluate TRUE in the order they are shown. This turns on the load switch that drives the pilot lamp in the firestation.

When the Dwell and/or Cycle intervals end, the actual preempt input (the push button) is already FALSE so both statements will evaluate FALSE, at which point the pilot lamp will turn off.
ASC/3-2070 Preemption Programming Detail

The image to the left is an exact duplication of the preemption programming display found on a 2070 controller running Econolite ASC/3-2070 software.

When a signal plan requires Railroad or Emergency Vehicle preemption, this detail is to be used on the electrical detail to instruct the installer on setting the different operational parameters required to operate the preemption sequence per the signal design plans.

Below is a brief description of the most commonly used features:

A Preempt Plan - this setting is used to select the preemption plan as well as establish preemption priority. Preemptor 1 is the highest priority preemption controller and should always be used for railroad preemption.

B Interval programming - these settings describe which phases run when the controller transitions into preemption, dwells, and exits. All entrance, dwell, and exit timing is shown in another section of the programming display.

   - TRKCLR V/O are vehicle phases and overlaps that run during the track clearance interval of the preemption sequence.
   - ENA TRL enables or disables the trailing G/Y/R overlap timing during preemption (often referred to as a timed overlap).
   - DWEL VEH/PED/OLP are the vehicle, pedestrian, and overlaps that are first served following the TRKCLR interval of the preemption sequence.

C PMT OVRISE - When enabled allows this preemtion to override all higher numbered preemptions.

D DELAY - The time between receipt of the preemtion call and initialization of preemption. Delay is typically used in firestation preemption applications where a push button in the firestation initiates the preemption call a set DELAY time after the press of the button.

E OVERIDE FL - Allows the preemtion to override automatic flash and time the preemption sequence, after which the controller returns to automatic flash.

(continued on next page)
ASC/3-2070 Preemption Programming Detail (continued)

- TERM OLP (ASAP) - Forces overlaps to terminate immediately with their included phases and ignore any existing Lagging Overlap programming.

- PC>YEL - Allows the Yellow Change indication to time with the completion of Pedestrian Clearance interval.

- TERM PH - Terminate all timing phases and force an All Red condition before starting the activated preemption. Phases will NOT be terminated if the current Green phases exactly match the preemption’s entry phase(s) and a yellow trap will not be caused for conflicting PPLT overlap programming.

- TC RESERV - Allows the preemperor to reservice the track clearance phases when the preemption call goes away and returns before the preemption sequences terminate. When enabled, the PREEMPTION EXTEND option is disabled.

Timing Parameters - these settings describe the controller operation as it transitions from normal operation into preemption, dwells, and then exits from preemption back to normal operation.

- ENTRANCE TM - describes the minimum green, pedestrian walk and clear, and yellow and red clearance times for the phases currently timing when the preemperor receives a call and transitions from normal operation into preemption. The values 25.5 and 255 are special values used by the controller that allow the phase minimum times of the phases currently running to be timed by the controller. There is no way for the phase indication time to be larger than their programming when entering preemption any time these values are used.

- TRACK CLEAR times are used for the track clearance phases and time after the entrance timing. Programming clearance times to 25.5 allows the phase minimum times to be used.

- DWL/CYC-EXIT times determine the minimum dwell, preempt extend, max time, and preempt exit clear times. The controller will serve any programmed dwell phases before serving cycle phases. Programming clearance times to 25.5 allows the phase minimum times to be used. Preemption advances to the exit sequence when the preempt input is removed and the preempt sequence is no longer active once all exit phases are timing.
1. From Main Menu select 1. CONFIGURATION
2. From CONFIGURATION Submenu select 8. LOGIC PROCESSOR
3. From the LOGIC PROCESSOR Submenu select 2. LOGIC STATEMENTS

ENTER A "1" IN THE LPN FIELD: PRESS "ENTER" AND PROGRAM AS SHOWN.

```
LPN: 1 COPY FROM: 1 ACTIVE: N (Y/N)
IF PREEMPT ACTIVE 1 IS OFF
THEN CTRL OMIT PHASE 3 ON
ELSE
END PROGRAMING
```

1. From Main Menu select 1. CONFIGURATION
2. From CONFIGURATION Submenu select 8. LOGIC PROCESSOR
3. From the LOGIC PROCESSOR Submenu select 1. LOGIC STATEMENT CONTROL

ENABLE LOGIC PROCESSOR STATEMENT 1 BY POSITIONING THE CURSOR OVER THE FIELD SHOWN BELOW AND USING THE TOGGLE KEY TO ENABLE IT.

```
LOGIC STATEMENT CONTROL
  1 2 3 4 5 6 7 8 9 12 3 4 5 6
LP 1-15  - - - - - - - - - - - - - -
LP 16-30  - - - - - - - - - - - - - -
LP 31-45  - - - - - - - - - - - - - -
LP 46-60  - - - - - - - - - - - - - -
LP 61-75  - - - - - - - - - - - - - -
LP 76-90  - - - - - - - - - - - - - -
```

END PROGRAMING

ASC/3-2070 Preempt Only Phase Omit Programming Detail

In designs with a phase that is only run during preemption, e.g. a four section head with a protected left turn arrow that is only served during the preemption track clearance interval, ASC/3-2070 uses the logic processor to suppress the omitted phase. Use the programming detail shown to the left to omit the desired phases as necessary when the controller starts up or is not in preemption.
ASC/3-2070 Pilot Lamp Logic Programming Detail

For firestation preemption designs that utilize a push button inside the firestation with a pilot lamp, use the logic processor to turn the lamp "ON" when the button is pressed and "OFF" at the end of the preemption sequence. The example shown to the left uses PRE2 for the fire preemption and the PED 2 Yellow output to light the pilot lamp. Make sure to install load resistors as described in STD. NO. 9.1 sheet 1.
Wireless Emergency Vehicle Preemption (EVP) Push Button Detail

The detail shown on STD. NO. 9.4 sheet 2 gives the installer the information needed to interface the controller/cabinet assembly wirelessly via a multi-contact closure radio with a firehouse push button. The function of the push button is to generate a controller input that initiates an EV preemption sequence.

Typically there is also an indicator (pilot) lamp to be installed in the firehouse used to give the user positive feedback from the controller that the traffic signal has been preempted, but in this application a front panel lamp on the firehouse radio serves as the pilot lamp. The unused ped yellow output of a pedestrian loadswitch is used to energize a relay which sends a confirmation signal back to the firehouse radio for the duration of the preemption interval.

For the wireless emergency vehicle pushbutton preempt shown on the next sheet, preempt 3 is used as the controller preempt input and the cabinet is assumed to be a 332 base mount. The ped yellow output from ped loadswitch 4 ($6) is used to energize the relay for the confirmation signal for the pilot lamp in the firehouse. The radios that are used are capable of transmitting and receiving and have multiple contact closures. The notes shown on the detail contain additional information about the relay and the DC isolator used for the EV preemption application.
Emergency Vehicle Preemption (Push Button Wireless) Detail

RELAY DETAIL BASE TERMINAL LOCATIONS

FIRE STATION

CONTROLLER CABINET

NOTES:
1. Relay K1 is an enclosed SPDT general purpose relay with a 120 VAC coil, 10A contacts, and octal style stud (DOT NO. 6250286001).
2. The RC network is valued at 0.1 microfarad, 100 ohm (DOT NO. 106018075).
3. Make sure lock switch 56 is installed.
**Advance Beacons - Continuous Flash**

ADVANCE BEACONS that flash continuously can be wired directly to the flasher unit outputs in the cabinet. Flasher outputs are wired from the power distribution assembly to the output file. Each flasher unit has two circuits, each of which flashes 180 degrees out of phase with the other. Single flashing beacons, side by side, or WIG WAG type beacons can all be wired directly to the cabinet flasher outputs. This type of ADVANCE BEACONS will continue to flash even when the cabinet is in flash.

1. Cabinet flasher terminal block output reference.

2. WIG WAG ADVANCE BEACON - This diagram illustrates a beacon that has two heads that flash out of phase with each other. One head flashes with flasher unit #1 circuit #1, and the other head flashes with flasher unit #1 circuit #2. To maintain proper phasing, it is important that a WIG WAG flasher use the outputs of the same flasher unit.
Oasis Single Programmable/Actuated Advance Beacons

Any output may be programmed as an ADVANCE BEACON and programmed to flash at variable frequencies and duty cycles when turned on. The unused ped yellow load switch outputs are typically chosen for advance beacon outputs and most often turned on and off by the logic processor.

ADVANCE BEACON OUTPUT PROGRAMMING - The four normally unused ped yellow outputs are typically chosen first for ADVANCE BEACON outputs. Their outputs are set up to flash at 1Hz with a 50% duty cycle when turned on. The ADVANCE BEACON is assigned a unique index number from 1-4 as shown.

ADVANCE BEACON WIRING - When using a ped yellow load switch output to drive a beacon, a load resistor must be used on the ped green output to prevent a conflict on the monitor. The wire that connects the yellow signal to the conflict monitor must also be disconnected.

ADVANCE BEACON PROGRAMMING - A typical Advance Beacon is controller by a trigger phase. The beacon will be "OFF" whenever the trigger phase is not in its green interval.

Oasis Advance Beacons – Single Programmable / Actuated

Signals Management
Transportation Mobility and Safety Division
North Carolina Department of Transportation
Advance Beacon Output
Assignment Programming Detail

(Programming controller as shown below)

Display will now show the specified output assigned as "Advance Beacon" as shown below:

**Advance Beacons**

Any output may be programmed as an ADVANCE BEACON and programmed to flash at variable frequencies and duty cycles when turned on. Any output may be programmed as an OUT OF PHASE FLASHER and programmed to flash 180 degrees out of phase with an ADVANCE BEACON. Unused ped yellow load switch outputs are typically used for this application and WIG WAG Beacons that are actuated by pavements loops and auxiliary equipment are the most common application.

**Advance Beacon Output Programming** - The four normally unused ped yellow outputs are typically chosen first for ADVANCE BEACON outputs. Their outputs are set up to flash at 1Hz with a 50% duty cycle when turned on.

**Out of Phase Flasher** - An output may be programmed to flash 180 degrees out of phase with an existing output that has already been programmed to flash its output. Typically the OUT OF PHASE FLASHER will be paired with an ADVANCE BEACON. The actual output that the OUT OF PHASE FLASHER is to be paired with must be specified in the programming. Unused ped yellow load switch outputs are typically used for OUT OF PHASE FLASHER outputs.

(continued on next page)
Oasis Wig Wag Programmable/Actuated
Advance Beacons

(1) ADVANCE BEACON WIRING - For a typical WIG WAG ADVANCE BEACON application, two unused ped yellow load switch outputs are used to drive the beacons. One beacon is programmed as an ADVANCE BEACON while the other is set up to flash as an OUT OF PHASE FLASHER. To prevent conflicts, load resistors and wiring modifications must be made in the cabinet as shown to the left.

(2) HOOK-UP CHART WITH ADVANCE BEACON - For any location where an ADVANCE BEACON is deployed, the signal head hook-up chart will show which load switches drive the beacon signal heads and other pertinent installation requirements.

### SIGNAL HEAD HOOK-UP CHART

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</tbody>
</table>

**IMPORTANT**

1. Remove tape and label conflict monitor wire and terminate to the rear on terminal 124 (2PY) and terminals 123 (2PY), 125 (2PY), 127 (2PY), 129 (2PY), 131 (2PY), 133 (2PY), 135 (2PY), 137 (2PY), 139 (2PY), 141 (2PY) and 143 (2PY).
2. Install load switches in output file slots S3 and S9.
3. Make sure load resistors are in place as shown in load resistor installation detail on this sheet.
4. To activate advance beacon operation as indicated on the signal plan, reverse outputs 33 and 34 as shown on this sheet.

**LOAD RESISTOR INSTALLATION DETAIL**

- **Acceptable Values**
  - **Value (ohms)**
  - **Wattage**
  - **Color**
  - **Color - Code**
  - **Rating**

- **Phase 6 Way Field Terminal** (120)

- **Nu** - Not used
- **I** - Standard load resistor. See load resistor installation detail on sheet x.
- **II** - Special advance beacons will be wired to SSX and SSY. See wiring and programming details on sheets x and y of this sheet/last detail.
Oasis Wig Wag Advance Beacons
With Stop Time Hold

STOP TIME HOLD - ADVANCE BEACONS are typically programmed to turn "ON" and "OFF" using trigger phases. The beacon will be "OFF" when the trigger phase is green. Some signal designs also specify that the beacon turn "ON" a specified amount of time prior to the end of green on a specified phase. The STOP-TIME HOLD setting specifies the interval that the beacon will turn back "ON" prior to the trigger phase turning yellow. The interval is served as additional green time given to the trigger phase beyond the gap or max termination point. In the illustration to the left, the beacon will turn "ON" two seconds prior to the end of phase 2 green and will flash until the time at which phase 2 turns green again.

STOP TIME HOLD FOR DUMMY BEACON - In a situation where there are opposing approaches and one is equipped with an ADVANCE BEACON that is programmed with STOP-TIME HOLD and the other does not have a beacon, it is necessary to create a dummy ADVANCE BEACON with the same amount of STOP-TIME HOLD on the approach with no beacon. Without the dummy beacon, the approach would clear while the opposing move would be held green for the duration of STOP-TIME HOLD which could create a yellow trap. The dummy programming ensures the two approaches clear simultaneously.

(continued on next page)
Oasis Wig Wag Advance Beacons
With Stop Time Hold and FYAs

Special consideration must be taken into account when a three or four section flashing yellow arrow opposes a beacon that has stop time hold programmed. Because the flashing yellow arrow has the opposing through movement as a parent, it will clear at the end of the opposing green while the controller turns on the beacon and times the stop time hold. This means the flashing yellow arrow clears while the opposing through movement stays green, and this creates a yellow trap. To eliminate the yellow trap, green extension time equal to the stop time hold time has to be added to the flashing yellow arrow overlap programming to hold the flashing yellow arrow on for the same duration as its parent.

Signal design example showing an ADVANCE BEACON with two WIG WAG heads on one approach where the opposing approach has a four section flashing yellow arrow.

Four section flashing yellow arrow with typical overlap and protected turn output assignments.

ADVANCE BEACON programming detail with a phase 2 trigger phase and two seconds of stop time hold programmed.

Overlap programming showing the green extension time for overlap A equal to the stop time hold specified for beacon #1. This means at the end of green when the controller starts flashing the beacon and extends the green time of the trigger phase, the overlap will begin timing its green extension which keeps the flashing yellow arrow flashing for the same amount of time before clearing. The 'VEH OV'L GRN EXT' parameter is the phase that starts the green extension timer at the end of green for the specified phase. Typically only the opposing through move parent phase extends green for a four section FYA signal head because the protected turn is often allowed to lag. If the protected turn lags and the through move is not programmed exclusively to start the green extension timer, each of the parent phases could start the timer and cause it to time twice, which is unnecessary.
ASC/3-2070 Single Programmable/Actuated Advance Beacons

Any output may be used to drive an ADVANCE BEACON. The unused red/yellow load switch outputs are typically chosen for ADVANCE BEACON outputs and are most often turned on and off by the logic processor. The example illustrated on this page turns ADVANCE BEACON 23 "ON" whenever phase 2 is not green.

ADVANCE BEACON WIRING - When using a red/yellow load switch output to drive a beacon, a load resistor must be used on the red/green output to prevent a conflict on the monitor. The wire that connects the yellow signal to the monitor must also be disconnected.

LOGIC PROCESSOR PROGRAMMING - The controller tests to see that phase 2 is not green and the controller is not in flash. When these two statements are true, the beacon will begin to flash on and off at 1Hz with a 50% duty cycle.

1. From Main Menu select 1. CONFIGURATION
2. From CONFIGURATION Submenu select 8. LOGIC PROCESSOR
3. From the LOGIC PROCESSOR Submenu select 1. LOGIC STATEMENT CONTROL

ENABLE LOGIC PROCESSOR STATEMENT 1 BY POSITIONING THE CURSOR OVER THE FIELD SHOWN BELOW AND USING THE TOGGLE KEY TO ENABLE IT.

<table>
<thead>
<tr>
<th>LOGIC STATEMENT CONTROL</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 2 3 4 5 6 7 8 9 10 12 3 4 5 6</td>
</tr>
<tr>
<td>LP 1-15 E E E E E E E E E E E E</td>
</tr>
<tr>
<td>LP 16-30 E E E E E E E E E E E E</td>
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<tr>
<td>LP 31-45 E E E E E E E E E E E E</td>
</tr>
<tr>
<td>LP 46-60 E E E E E E E E E E E E</td>
</tr>
<tr>
<td>LP 61-75 E E E E E E E E E E E E</td>
</tr>
<tr>
<td>LP 76-90 E E E E E E E E E E E E</td>
</tr>
</tbody>
</table>

ECONOLITE ASC/3-2070 LOGIC PROCESSOR PROGRAMMING
(to turn on advance beacon)

(Shown controller as shown)
1. From Main Menu select 1. CONFIGURATION
2. From CONFIGURATION Submenu select 8. LOGIC PROCESSOR
3. From the LOGIC PROCESSOR Submenu select 2. LOGIC STATEMENTS

END PROGRAMMING

ASC/3–2070 Beacons – Single Programmable /Actuated

SIGNALS MANAGEMENT
TRANSPORTATION MOBILITY AND SAFETY DIVISION
NORTH CAROLINA DEPARTMENT OF TRANSPORTATION

STD. NO. 10.2 SHEET 1 OF 3
ASC/3-2070 Wig Wag Programmable/Actuated
Advance Beacons

Any output may be used to drive an ADVANCE BEACON. The unused ped yellow load switch outputs are typically chosen for ADVANCE BEACON outputs and are most often turned on and off by the logic processor. The example illustrated on this page turns on ADVANCE BEACONS 23 and 24 in a WIG WAG pattern whenever phase 2 is not green by driving them with two different ped yellow load switch outputs.

ADVANCE BEACON WIRING - When using a ped yellow load switch output to drive a beacon, a load resistor must be used on the ped green output to prevent a conflict on the monitor. The wire that connects the yellow signal to the monitor must also be disconnected.

(continued on next page)
ASC/3-2070 Wig Wag Programmable/Actuated Advance Beacons

LOGIC PROCESSOR PROGRAMMING: The controller tests to see that phase 2 is not green and the controller is not in flash. When these two statements are true, the beacons will begin to flash on and off at 1Hz with a 50% duty cycle in a WIG WAG pattern.

END PROGRAMMING
FYA SIGNAL WIRING DETAIL FOR 332 BASE MOUNTED CABINET

(wire signal heads as shown)

2070 FYA 332 Signal Head Wiring

Flashing Yellow Arrow signals may consist of 4-section heads where there is both a protected and permitted vehicle movement, or they may be 3-section heads that are permitted movements only. Each type has unique wiring requirements that vary depending on whether the cabinet type being used is a 332 base type or a 336 pole type.

A. Four section FYA signal - Equipped with four signal faces required to implement the protected/permitted flashing yellow arrow vehicle movement.

B. Green signal face used for the protected turn and is typically wired to the load switch associated with the protected turn phase.

C. Flashing yellow, solid yellow, and red arrows that comprise the permitted turn portion of the protected/permitted FYA signal sequence. These signal faces are driven by overlaps.

D. Three section FYA signal - Equipped with three signal faces required to implement a permitted only flashing yellow movement. This signal head has no protected turn associated with it but does require a correctly configured overlap with a parent to run correctly.

E. Bi-Modal FYA signal - Serves the same purpose as a four section FYA signal head. The bi-modal signal face has wiring for both the protected green turn and the flashing yellow arrow and will display either of those two signals in the correct color when they are active.

NOTE
The sequence display for signal heads 11, 31, and 51 requires special logic programming. See sheet 2 for programming instructions.

NOTE
The sequence display for signal head 11 requires special logic programming. See sheet 2 for programming instructions.
2070 FYA 336 Signal Head Wiring

Flashing Yellow Arrow signals may consist of 4-section heads where there is both a protected and permitted vehicle movement, or they may be 3-section heads that are permitted movements only. Each type has unique wiring requirements that vary depending on whether the cabinet type being used is a 332 base type or a 336 pole type.

A. Four section FYA signal – Equipped with four signal faces required to implement the protected/permitted flashing yellow arrow vehicle movement.

B. The green signal face used for the protected turn when using a 336 cabinet must be connected to the PED yellow output of a PED load switch. This is because there are a limited number of load switches due to the fact that there is no auxiliary output file in the cabinet. To use this output as a vehicle phase, it must first be remapped as a vehicle phase and assigned the appropriate phase.

C. Flashing yellow, solid yellow, and red arrows that comprise the permitted turn portion of the protected/permitted FYA signal sequence. These signal faces are driven by overlaps. Before being used as an overlap, the load switch in use must first be remapped as the appropriate vehicle overlap.
2070 FYA Flasher Circuit Modification

The 170 type signal cabinets, both base and pole mount styles, are equipped with two flasher units that are designed to flash signal heads on the various spans of a design per the signal design plan. All signal heads on a span shall flash in unison, but when dealing with flashing yellow arrow designs the default flasher wiring found in the cabinet does not always readily facilitate this requirement. When faced with heads that do not flash in unison with default cabinet flasher wiring, it becomes necessary to modify the cabinet flasher wiring to ensure all heads on their respective spans will flash in unison. The chart shown to the left illustrates where the flasher circuits originate, where they terminate, and which phases and overlaps they are associated with.

1. This diagram shows where the flasher circuits originate and terminate in the cabinets and which phases and overlaps are associated with each flasher circuit. Each flasher unit has two flasher circuits that flash 180 degrees out of phase with each other at a 1Hz 50% duty cycle rate. Each flasher unit operates independently. This diagram can be used to compare which signal heads on a span are being driven by which flasher unit in an effort to determine whether they flash in unison.

2. Flasher Circuit Modification - Often times when FYAs are used on a signal design, the heads on a span will not flash in unison. This happens more often than not on side streets where an overlap flashes out of phase with a through move phase on the same span. When this is the case and flashing all heads on a single flasher unit will remedy the problem, put the note shown to the left on the electrical detail.

FLASHER CIRCUIT MODIFICATION DETAIL

In order to ensure that signals flash concurrently on the same approach, make the following flasher circuit changes:

1. On rear of PDA - remove wire from term. T2-4 and terminate on T2-2.
2. On rear of PDA - remove wire from term. T2-5 and terminate on T2-3.
3. Remove Flasher Unit 2.

The changes listed above ties all phases and overlaps to flasher unit 1.
OVERLAP PROGRAMMING DETAIL
(program controller as shown below)

FROM MAIN MENU PRESS 'B' (OVERLAPS), THEN '1' (VEHICLE OVERLAP SETTINGS).

PAGE 1: VEHICLE OVERLAP 'A' SETTINGS
PHASE: 112345678910111213141516
VEH OVL PARENTS:XX
VEH OVL NOT VEH:;
VEH OVL NOT PED:;
VEH OVL GRN EXT:;
STARTUP COLOR: RED - YELLOW - GREEN
FLASH COLORS: RED - YELLOW - GREEN

SELECT VEHICLE OVERLAP OPTIONS: [Y/N]
FLASH YELLOW IN CONTROLLER FLASH?...Y
GREEN EXTENSION (0-255 SEC)...0
YELLOW CLEAR (D=PARENT, 3-25.5 SEC)...0.0
RED CLEAR (D=PARENT, 0.1-25.5 SEC)...0.0
OUTPUT AS PHASE # (D=NONE, 1-16)...0

PRESS '+' TWICE

PAGE 1: VEHICLE OVERLAP 'C' SETTINGS
PHASE: 112345678910111213141516
VEH OVL PARENTS: XX
VEH OVL NOT VEH: ;
VEH OVL NOT PED: ;
VEH OVL GRN EXT: ;
STARTUP COLOR: RED - YELLOW - GREEN
FLASH COLORS: RED - YELLOW - GREEN

SELECT VEHICLE OVERLAP OPTIONS: [Y/N]
FLASH YELLOW IN CONTROLLER FLASH?...Y
GREEN EXTENSION (0-255 SEC)...0
YELLOW CLEAR (D=PARENT, 3-25.5 SEC)...0.0
RED CLEAR (D=PARENT, 0.1-25.5 SEC)...0.0
OUTPUT AS PHASE # (D=NONE, 1-16)...0

OVERLAP PROGRAMMING COMPLETE

2070 Oasis FYA Overlap Programming

Flashing Yellow Arrow designs utilizing three and four section heads to run protected/ permitted sequences require overlaps to properly run the protected and the permitted movements. The protected turn is assigned a parent phase that is associated with the usual turning phase. The permitted move is assigned a parent phase that is the opposing through movement of the protected turn. In cases where FYA designs are permitted turns only (three section heads), there is only one parent for the overlap and it is normally the opposing through move phase.

1) VEH OVL PARENTS: - Overlaps will be allowed to run when any of the phases selected in this row are active. Most times the odd phases are the turning phases and the even phases are the opposing through phases.

2) FLASH COLORS: - When selected, the controller will flash the selected color at 1Hz with a 50% duty cycle when it is timing. For FYAs, the flashing yellow arrow is wired to the overlap load switch green output so flashing the green is what produces the flashing yellow arrow.

3) FLASH YELLOW IN CONTROLLER FLASH - When programmed with a 'Y', the controller will flash the overlap yellow output if the controller goes into controller flash.
2070 Oasis FYA 332 Logic Processor Programming

The Logic Processor contained in the Oasis software is required to produce the proper protected/permitted vehicle sequence when running FYAs that use four section heads.

1. When the protected turn phase is being serviced, this logic forces the flashing yellow arrow section of the FYA "OFF".

2. When the protected turn phase is transitioning through yellow clear, this logic forces the four section FYA to display a solid yellow indication.

3. When the protected turn phase is transitioning through red clear, this logic forces the four section FYA to display a solid red indication while ensuring the solid yellow indication is "OFF".

4. Reference Schedule that defines the controller output assignment to overlap/signal face relationship.

OUTPUT REFERENCE SCHEDULE

- OUTPUT 2 = Overlap C Red
- OUTPUT 3 = Overlap C Yellow
- OUTPUT 4 = Overlap C Green
- OUTPUT 50 = Overlap A Red
- OUTPUT 51 = Overlap A Yellow
- OUTPUT 52 = Overlap A Green
2070 Oasis FYA 336 Logic Processor Programming

The Logic Processor contained in the Oasis software is required to produce the proper protected/permitted vehicle sequence when running FYAs that use four section heads.

A. When the protected turn phase is being serviced, this logic forces the flashing yellow arrow section of the FYA "OFF".

B. When the protected turn phase is transitioning through yellow clear, this logic forces the four section FYA to display a solid yellow indication.

C. When the protected turn phase is transitioning through red clear, this logic forces the four section FYA to display a solid red indication while ensuring the solid yellow indication is "OFF".

D. Reference Schedule that defines the controller output assignment to overlap/signal face relationship.

Note: All outputs shown above have been manipulated. See sheets 3 and 4 of this electrical detail.

2070 Oasis FYA for 336 Pole Mounted Cabinets – Logic Processor

Transportation Mobility and Safety Division
North Carolina Department of Transportation

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2070 Oasis FYA 336 Output Remapping

When using four section heads to implement protected/permission FYA sequences in a 336 cabinet, the protected turn is driven by a PED yellow output that has been remapped as a vehicle green phase and the permitted move is driven by a vehicle load switch whose outputs have been remapped as vehicle overlaps.

Vehicle Phase load switch outputs which have been remapped as Vehicle Overlap A red, yellow, and green.

Phase 2 Ped yellow output remapped as vehicle phase 1 green.

2070 Oasis FYA for 336 Pole Mounted Cabinets – Output Remapping

TRANSPORTATION MOBILITY AND SAFETY DIVISION
NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
2070 Oasis 4-Section FYA Alternate Phasing

Often times a signal plan will call for alternate phasing where the protected and permitted turning movements of a four section flashing yellow arrow signal are run as the default phasing but the protected only movement is run during an alternate phasing period. This section illustrates the steps needed to run the protected and permitted turning movements of a four section flashing yellow arrow signal during default phasing and only the protected turn during the alternate phasing. Also shown are loop detector programming changes that are implemented during the alternate phasing period.

Default and Alternate phasing diagrams from the signal plan showing that the permitted turn on flashing yellow arrow signal head 11 does not run during alternate phasing 2+6.

Input File Chart - Information contained here is taken directly from the signal plan. The detector call to phase 6 on loop 1A is turned off during alternate phasing period and the delay time on loop 1A is reduced. Programming required to implement this is found on subsequent sheets of the electrical detail as shown in the footnote.

Overlap Programming - To ensure the permitted flashing yellow arrow signal face does not run during the alternate phasing, its parent overlap must be omitted and it should not be programmed to flash green. This is programmed on overlap "PAGE 2" for use during alternate phasing.

(continued on next page)
Input Assignment and Detector programming provides the programming steps necessary to disable a phase 6 call on loop 1A, reassign the detector number assigned to loop 1A's input, and reduce the delay. This is all programmed on input "PAGE 2" for use during alternate phasing.
**ALTERNATE PHASING ACTIVATION DETAIL**

To run Alt. Phasing during **Coordination** - select all page changes (as shown below) within Coordination Plan Programming.

To run Alt. Phasing during **Free Run** - program page changes (shown below) in separate time of day events. If page 1 is used, no event programming is necessary for that particular page.

<table>
<thead>
<tr>
<th>Phasing</th>
<th>Inputs Page</th>
<th>Overlaps Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Active pages required to run Default Phasing</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Active pages required to run Alternate Phasing</td>
<td>2</td>
<td>2</td>
</tr>
</tbody>
</table>

**NOTE:** Pages not shown (i.e. sequence, phase control, etc.) should remain as "1", or as defined by Timing Engineer.

**IMPORTANT:** If Alt. Phasing is used during Free Run and Coordination, do not operate time of day page change events concurrently with Coordination Plan Events in the Event Scheduler. (Ex: Free Run page change event should end before Coordination plan event starts and vice-versa).

**F** Alternate Phasing Page Change Summary - This area is used to describe in detail how the programming changes made to the different controller programming pages affect the phasing operation during the alternate phasing period. The loop delay reduction time of "0" seconds shown in this example is taken from the signal design plan, and that value may vary.

**2070 Oasis 4-Section FYA Alternate Phasing**

2070 Oasis 4—Section FYA Alternate Phasing

Signals Management

Transportation Mobility and Safety Division

North Carolina Department of Transportation

10-18

STD. NO. 11.5

Sheet 3 of 3
PED YELLOW CONFLICT MONITOR WIRING DETAIL

In order to use FYA COMPACT mode with the 2018ECL-NC Monitor, the cabinet must be wired such that the (unused) Ped Yellow load switch outputs are wired to the conflict monitor as follows: From 2 PY (field term. 114) to chan. 9 green (monitor pin 13), from 4 PY (field term. 105) to chan. 9 yellow (monitor pin 16), from 6 PY (field term. 120) to chan. 10 green (monitor pin R), and from 8 PY (field term. 111) to chan. 10 yellow (monitor pin U).

Follow the instructions below to make the appropriate connections:

STEP 1: Fold down rear panel of output file.

STEP 2: Find unused wiring harness from conflict monitor card edge connector (which should be tied and bundled together).

STEP 3: Find the conductors that correspond to the following conflict monitor card edge pins and solder wire to the appropriate terminal on the rear of the output file as shown below:

CMU-13 ___________ 2PY (term. 114)
CMU-16 ___________ 4PY (term. 105)
CMU-R ___________ 6PY (term. 120)
CMU-U ___________ 8PY (term. 111)

NOTE: Some cabinet manufacturers use keyed connectors to accomplish this wiring configuration. If connectors are used, fold down the rear panel of the output file and find the set of 3 keyed connectors and connect them as shown below:

1-2PY ------ 1-CMU-13
2-4PY ------ 2-CMU-16
3-6PY ------ 3-CMU-R
4-8PY ------ 4-CMU-U

2070 Oasis FYA 336 Conflict Monitor Wiring Detail

When using four section heads to implement protected/permitted FYA sequences in a 336 cabinet, the protected turn is driven by a PED yellow output that has been remapped as a vehicle green phase and the permitted move is driven by a vehicle load switch whose outputs have been remapped as overlaps. For the monitor to be able to see the protected turn indication on the remapped PED yellow output, special wiring must be made between the output file and the conflict monitor.

PED Yellow Conflict Monitor Wiring Detail giving the monitor visibility of the protected turn that is output on the remapped PED yellow load switch output.
ASC/3-2070 4-Section FYA Overlap Programming

Flashing Yellow Arrow designs utilizing four section heads to run protected/ permitted sequences require overlaps to properly run the protected and the permitted movements. ASC/3-2070 has an overlap mode designed specifically for protected/ permitted FYA applications that takes care of sequencing the signal face outputs on the four section FYA signal heads.

1. Toggle through the overlap selections in the overlap programming and select PPLT FYA when using four section FYA signal heads. A compliant conflict monitor is required to monitor FYA/s when using this type of overlap.

2. PROTECTED LEFT TURN - Represents the protected turning movement of the protected/ permitted FYA sequence.

3. OPPOSING THROUGH - Represents the opposing through movement during which the left turn movement is permitted for the protected/ permitted FYA sequence.

When using a 332 base mounted cabinet...

4. FLASHING ARROW OUTPUT - Toggle through the selections to select ISOLATE, which refers to the isolated green indication of the protected turn channel. The appropriate output channel for the assigned protected and permitted phases will be displayed as shown in a read only field.

When using a 336 pole mounted cabinet...

5. FLASHING ARROW OUTPUT - Toggle through the selections to select YEL PED in order to assign the permitted turn channel to a PED yellow output channel. The appropriate PED channel for the assigned protected and permitted phases will be displayed as shown in a read only field. Output remapping is required to satisfy the conflict monitor FYA channel monitoring requirements. Refer to STD 11.8, sheet 1 of 2 for remapping details.
ASC/3-2070 3-Section FYA Overlap Programming

Flashing Yellow Arrow designs utilizing three section heads to run permitted only sequences require overlaps to properly run the permitted movements. ASC/3-2070 has an overlap mode that will flash the flashing yellow arrow signal face during the permitted phase movement.

1. Toggle through the overlap selections in the overlap programming and select OTHER/ECONOLITE when using three section FYA signal heads. A compliant conflict monitor is required when using this type of overlap to monitor the FYA’s.

2. INCLUDED - Select the phases in which the permitted move is allowed to run for the permitted FYA sequence.

3. FLASH GRN - Defines the rate at which the overlap will flash during the green interval of each included phase. Toggle this setting to ‘1’ to flash the flashing yellow arrow signal face at a 1Hz 50% duty cycle rate.
ECONOLITE ASC/3-2070 I/O PIN REMAPPING

The ASC/3 Configurator utility program must be used to remap the I/O pins as shown below. Consult the ASC/3 Configurator User Guide for specific instructions on software use.

1. Run the Configurator utility. Load a file as the Current DB.
2. Choose the C1-out tab to change the I/O mapping as needed. Use the drop down list within the program to select the assigned function for the pins shown below.
3. Save the database file and download it to the controller.

<table>
<thead>
<tr>
<th>PIN #</th>
<th>DEFAULT FUNCTION</th>
<th>ASSIGNED FUNCTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>PIN 18-PHASE 1 GREEN</td>
<td>PHASE 2 PED CLEAR</td>
<td>NOTE: FOR FYA 1-8 COMPACT MODE</td>
</tr>
<tr>
<td>PIN 35-PED 2 YELLOW</td>
<td>PHASE 1 GREEN</td>
<td></td>
</tr>
<tr>
<td>PIN 9-PHASE 3 GREEN</td>
<td>PHASE 4 PED CLEAR</td>
<td>NOTE: FOR FYA 9-10 COMPACT MODE</td>
</tr>
<tr>
<td>PIN 7-PHASE 4 YELLOW</td>
<td>PHASE 3 GREEN</td>
<td></td>
</tr>
<tr>
<td>PIN 34-PHASE 5 GREEN</td>
<td>PHASE 6 PED CLEAR</td>
<td>NOTE: FOR FYA 5-11 COMPACT MODE</td>
</tr>
<tr>
<td>PIN 36-PED 6 YELLOW</td>
<td>PHASE 5 GREEN</td>
<td></td>
</tr>
<tr>
<td>PIN 26-PHASE 7 GREEN</td>
<td>PHASE 8 PED CLEAR</td>
<td>NOTE: FOR FYA 7-12 COMPACT MODE</td>
</tr>
<tr>
<td>PIN 38-PED 8 YELLOW</td>
<td>PHASE 7 GREEN</td>
<td></td>
</tr>
</tbody>
</table>

NOTE: The steps below can be used to view changes to I/O pins within the controller. Any I/O pins that have been remapped will display and show their default function in addition to the current assigned function.

1. From Main Menu select 7. STATUS DISPLAY
2. From STATUS DISPLAY Submenu select 8. INPUTS/OUTPUTS
3. From INPUT/OUTPUT Submenu select 9. I/O DIFFERENCES

ASC/3-2070 4-SECTION FYA for 336 Pole Mounted Cabinets – Output Remapping

By default, when "YEL PED" is selected as the flashing arrow output during overlap programming, the ASC/3-2070 software outputs the flashing yellow arrow on a PED yellow channel and the protected turn on the green load switch channel of the protected turn phase. This arrangement places the protected turn and the flashing yellow arrow on the wrong conflict monitor input channels and as such these two outputs must be swapped with each other to satisfy the conflict monitor requirements. The ASC/3-2070 Configurator is used to remap these two outputs.

By selecting the C1 pin associated with the phase 1 green output and changing its function to "PHASE 2 PED CLEAR" from the drop down menu, and by selecting the C1 pin associated with the Ped 2 yellow output and changing its function to "PHASE 1 GREEN", the flashing yellow arrow will now be output on the overlap A green output and the solid green arrow will be output on the Ped 2 yellow output. These same actions are repeated as needed for any four section FYA in use.
ECONOLITE ASC/3-2070
LOAD SWITCH ASSIGNMENT DETAIL
(program controller as shown)

To assign load switches S1 and S5 as OLA and OLC, program LD SWITCH 1 as OVL "1" TYPE "0" and LD SWITCH 5 as OVL "3" TYPE "0" as shown below.

1. From Main Menu select 1. CONFIGURATION
2. From CONFIGURATION Submenu select 3. LOAD SW ASSIGN

LD SWITCH ASSIGN
PHASE DIMMING ---FLASH---
/ OVL TYPE R Y G D PWR AUT TGR

LD SWITCH ASSIGN - This column represents 16 load switches that are typically found in a 170 type cabinet. Numbers 1-8 are vehicle load switches, 9-12 are overlap load switches located in an auxiliary output file if the cabinet were so equipped, and 13-16 are pedestrian load switches. This is a read only field.

TYPE - This column defines the output type of the load switch. The four assignment types can be toggled between Vehicle, Overlap, Pedestrian, or the load switch can be turned OFF with no selection being shown in this column.

PHASE/OVL - This column defines the Vehicle or Pedestrian phase number assigned to type "V" and type "P" load switches. For load switches reassigned as type "0", the OVL numbers range from 1-16 which represents overlaps A-P. In the screen shown to the left, load switches 1 and 5 have been reassigned as overlaps "A" and "C" respectively.

AUT - This column defines the load switch Automatic Flash color, which can be set to Red, Yellow, or dark. In the screen shown to the left, overlap A and overlap C will flash yellow when the controller goes into automatic flash.

ASC/3-2070 FYA Load Switch Reassignment

The function of a load switch can be reassigned using ASC/3-2070 software. To implement permitted turn movements using three section FYA signal heads, vehicle load switches must be reassigned as vehicle overlaps. This is accomplished by reassigning the required load switches using the programming screen shown to the left.
ASC/3-2070 4-Section FYA Alternate Phasing

Occasionally a signal plan will call for alternate phasing where the protected and permitted turning movements of a four section flashing yellow arrow signal are run as the default phasing but the protected only movement is run during an alternate phasing period. This section illustrates the steps needed to run the protected and permitted turning movements of a four section flashing yellow arrow signal during default phasing and only the protected turn during the alternate phasing. Also shown are loop detector programming changes that are implemented in the alternate phasing period.

Default and Alternate phasing diagrams from the signal plan showing that the permitted turn on flashing yellow arrow signal head 11 does not run during alternate phasing 2+6.

Input File Chart - Information contained here is taken directly from the signal plan. The detector call to phase 6 on loop 1A is turned off during the alternate phasing period and the delay time on loop 1A is reduced. Programming required to implement this is found on subsequent sheets of the electrical detail as shown in the footnote.

Overlap Programming - ASC/3-2070 has special function bits that can be entered in the overlap programming and be used to disable the permitted left turn of a four section flashing yellow arrow during alternate phasing. Enable the selected special function bit to disable the permitted turn during alternate phasing.

(continued on next page)
ECONOLITE ASC/3-2070 VEHICLE DETECTOR SETUP
PROGRAMMING DETAIL FOR ALTERNATE PHASING LOOP 1A

(program controller as shown)

IMPORTANT!

Program detectors per the input file connection and programming chart shown on sheet 1 before proceeding.

1. From Main Menu select 6. UTILITIES
2. From UTILITIES Submenu select 1. COPY/CLEAR
3. Copy from DETECTOR PLAN "1" to DETECTOR PLAN "2".

4. From Main Menu select 6. DETECTORS
5. From DETECTOR Submenu select 2. VEHICLE DETECTOR SETUP
6. Place cursor in VEH DET PLAN | | position and enter "2".
- Place cursor in VEH DETECTOR [ ] position and enter "1".
- Set delay time to "0".

- Place cursor in VEH DETECTOR [ ] position and enter "26".
- Set assigned phase to "0".

(continued on next page)

ASC/3-2070 4-Section FYA Alternate Phasing

Vehicle Detector Setup provides the programming steps necessary to disable a phase 6 call on loop 1A and reduce the delay. This is all programmed on vehicle detector plan 2 for use by an action plan during alternate phasing operation.
### 4-Section FYA Alternate Phasing

The Action Plan programming detail shows that vehicle detector plan 2 and special function bit 1 will be enabled in action plan 1, both of which are required to run protected only turns during alternate phasing operation. Action plan 1 typically runs during a scheduled day plan or during coordination.

---

#### Pattern Diagram

<table>
<thead>
<tr>
<th>Pattern</th>
<th>Sequence</th>
<th>Seq</th>
<th>Etl</th>
<th>Gtl</th>
<th>Edt</th>
<th>Gtd</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- Pattern: 1
- Sequence: 0
- Etl: No
- Gtl: No
- Edt: None
- Gtd: No

**Action Plan**

1. From Main Menu select 5. TIME BASE
2. From TIME BASE Submenu select 2. ACTION PLAN

**Pattern**

- Pattern: 1
- Sequence: 0
- Etl: No
- Gtl: No
- Edt: None
- Gtd: No

**Phase**

- Phase: 1
- Phase: 2
- Phase: 3
- Phase: 4
- Phase: 5
- Phase: 6

**Priority**

- Priority: 1
- Priority: 2

**Delay**

- Delay: 1
- Delay: 2
- Delay: 3
- Delay: 4
- Delay: 5
- Delay: 6

**Controller**

- Controller: 1
- Controller: 2
- Controller: 3
- Controller: 4
- Controller: 5
- Controller: 6

**Function**

- Function: 1
- Function: 2
- Function: 3
- Function: 4
- Function: 5
- Function: 6

**Delay**

- Delay: 1
- Delay: 2
- Delay: 3
- Delay: 4
- Delay: 5
- Delay: 6

**Controller**

- Controller: 1
- Controller: 2
- Controller: 3
- Controller: 4
- Controller: 5
- Controller: 6

**Function**

- Function: 1
- Function: 2
- Function: 3
- Function: 4
- Function: 5
- Function: 6

(continued on next page)
**Alternate Phasing Activation Detail**

To run Alt. Phasing during Free Run - Program changes (shown below) in a time based Action Plan. Schedule a day plan that includes the action plan programmed to select Veh Det Plan 2 and enable SF bit 1.

To run Alt. Phasing during Coordination - Select the time based Action Plan that is programmed to select Veh Det Plan 2 and enable SF bit 1.

<table>
<thead>
<tr>
<th>Phasing</th>
<th>Veh Det Plan</th>
<th>SF Bits Enabled</th>
</tr>
</thead>
<tbody>
<tr>
<td>Actions Required To Run Default Phasing</td>
<td>1</td>
<td>None</td>
</tr>
<tr>
<td>Actions Required To Run Alternate Phasing</td>
<td>2</td>
<td>1</td>
</tr>
</tbody>
</table>

**Important:** If Alt. Phasing is used during Free Run and Coordination, do not operate time of day events concurrently with coordination plan events in the event scheduler. (i.e., Free Run event should end before Coordination plan event starts and vice-versa.)

**Alternate Phasing Change Summary**

The following is a summary of what takes place when SF bit 1 and Veh Det Plan 2 activate to call the "Alternate Phasing":

- SF Bit 1: Modifies overlap parent phases for need to run protected turn only.
- Veh Det Plan 2: Discourages phase 6 call on loop 1A and reduces delay time for phase 1 call on loop 1A to 0 seconds.

**ASC/3-2070 4-Section FYA Alternate Phasing**

Alternate Phasing Activation Detail is a legend that outlines which vehicle detector plan, special function bits, and other relevant programming is required to run during normal operation or during alternate phasing operation.

Alternate Phasing Page Change Summary - This area is used to describe in detail how the programming changes made to the different controller programming pages affect the phasing operation during the alternate phasing period. The loop delay reduction time of "0" seconds shown in this example is taken from the signal design plan, and that value may vary.
SE-PAC2070 FYA Overlap Programming

Flashing Yellow Arrow designs utilizing three and four section heads to run protected/permitted sequences typically require overlaps to properly run the protected and the permitted movements. When using SE-PAC2070 software, the protected/permitted overlap phase relationship is programmed in a special overlap portion of the software so care must be taken to ensure no standard overlaps are programmed for overlaps that are to be used for the protected/permitted sequence.

- SE-PAC OVERLAP - A: Overlap being used for the protected/permitted or permitted only flashing yellow arrow movement.
- OVL CHN(S) - This represents the signal driver output for the designated overlap. Make sure this channel is correct for the SE-PAC OVERLAP, e.g. OVL CHN 13 = SE-PAC OVERLAP A, and ensure no overlap phases are assigned.
SE-PAC2070 FYA Protected/Permissive Phases

Flashing Yellow Arrow designs utilizing three and four section heads to run protected/permitted sequences typically require overlaps to properly run the protected and the permitted movements. When using SE-PAC2070 software, the protected/permitted overlap phase relationship is programmed in a special overlap portion of the software shown to the left. The -G/Y entry defines the protected move and the +GRN entry defines the permissive move. Both of the phases must be in the same ring for the software to consider them valid entries.

When three section flashing yellow arrow signal heads are used to run permitted only movements, there is no protected phase. In spite of this, the protected phase that would normally be associated with the permissive must still be entered in the -G/Y field to make the signal head function correctly. This protected phase is turned “OFF” in the INIT & N.A RESPONSE programming.
INIT & N.A. RESP PROGRAMMING DETAIL
(program controller as shown below)

From Main Menu, press '3' (Phase Data)

SE-PAC PHASE DATA  PRESS # DESIRED
1-VEHICLE TIMES       6-N. LOCK MISC
2-DENSITY TIMES       7-SPEC. SEQUENCE
3-PERMIT TIMES        8-SPEC. DETECTOR
4-INIT & N.A. RESP     9-PHASE COPY
5-V & P RECALLS       0-MISC PED OPTIONS
F-PRIOR MENU

INIT & N.A. RESP programming complete.

SE-PAC2070 FYA Init & N.A Response Programming

When using SE-PAC2070 software to implement a permitted only flashing yellow arrow movement using a three section signal head, care must be taken to ensure that the protected phase programmed in the PROTECTED AND PERMISSIVE PHASES FOR FYA is not an enabled phase in the Init & N.A. Resp Programming.

① INITIAL - Entering a "0" will turn the load switch outputs "OFF" for the selected phase. This is required for the protected phase that is programmed in the protected/permissive programming when using a three section flashing yellow arrow signal head that has no protected turn move.
Leading Pedestrian Interval

Some signal designs call for a pedestrian movement that precedes its associated vehicle movement in the phase interval, i.e. the pedestrian move leads the phase interval in question. The controller will serve the pedestrian walk for a designated time while at the same time holding the associated vehicle move red, thus giving the pedestrian a "head start" into the crosswalk.

There are potential vehicle/pedestrian conflicts that may arise, depending on the exact signal design, that remove the "protection" the leading pedestrian interval is designed to offer a pedestrian. These conflicts are remedied in different ways depending on the exact configuration of the signal design and signal heads used, and the software being used in the controller.

Oasis Advanced Walk - Oasis software refers to the leading pedestrian interval as Advanced Walk. The absolute total pedestrian walk time is shown in the timing chart as the Walk 1 entry. The Walk Advance Time is the amount of walk time that will display on the ped head while its associated vehicle movement is being held in red. After the walk advance time has expired, the controller will display the remaining balance of Walk 1 on the ped head before timing the don't walk time. The Advance Walk Time should never be greater than Walk 1.

Oasis Advanced Walk Note - Include this note on the electrical detail for any design utilizing Oasis software that has leading pedestrian intervals.

ASC/3-2070 Delayed Green - ASC/3-2070 software refers to the leading pedestrian interval as Delayed Green. The absolute total pedestrian walk time is shown in the timing chart as the Walk entry. The Delayed Green Time is the amount of walk time that will display on the ped head while its associated vehicle movement is being held in red. After the delayed green time has expired, the controller will display the remaining balance of Walk on the ped head before timing the ped clear time. The Delayed Green time should never be greater than Walk.
Leading Pedestrian Interval - No Startup Ped Call
With Actuated Peds

Oasis software provides a phase control option that allows pedestrian movements to be called for service one time at controller startup even when no demand may exist. This applies to pedestrian moves that are push button actuated as opposed to those that may be programmed for ped recall. Specific programming instructions are found in the ‘NOTES’ section of the electrical detail and specify which phases should be served at startup, if any.

Pedestrian phases that have advanced walk time and are specified as the startup in green phases should NOT be programmed for startup ped calls. The reason for this is that when the controller is powered on and is coming out of flash, or if the controller is running in controller flash and is coming out of controller flash, a leading pedestrian interval on the startup phase will cause the startup phase to transition from a flashing yellow indication to a solid red indication as the leading ped interval is being timed. This transition from flashing yellow to solid red is in violation of the MUTCD and is avoided by not programming the pedestrian movement for a startup ped call.

OASIS 2070 TIMING CHART

<table>
<thead>
<tr>
<th>FEATURE</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Walk Green 1</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Extension 1</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Max Green 1</td>
<td>90</td>
<td>90</td>
<td>90</td>
<td>90</td>
</tr>
<tr>
<td>Yellow Clearance</td>
<td>4.2</td>
<td>4.0</td>
<td>4.0</td>
<td>4.0</td>
</tr>
<tr>
<td>Red Clearance</td>
<td>1.6</td>
<td>1.6</td>
<td>1.6</td>
<td>1.6</td>
</tr>
<tr>
<td>Walk 1</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Don't Walk 1</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Walk Adverse Time</td>
<td>-</td>
<td>-</td>
<td>12</td>
<td>-</td>
</tr>
<tr>
<td>Seconds For Adverse</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Max Vehicile Initial</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Time Before Reduction</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Time To Reduce</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Minimum Gap</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>BackAlignd</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Vehicle Code Memory</td>
<td>{}</td>
<td>{}</td>
<td>{}</td>
<td>{}</td>
</tr>
<tr>
<td>Dual Entry</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Green-Non.pres. Code</td>
<td>ON</td>
<td>ON</td>
<td>ON</td>
<td>ON</td>
</tr>
</tbody>
</table>

* These values may be field adjusted. Do not adjust Min Green and Extension times for phases 2 and 4 lower than what is shown. Min Green for all other phases should not be lower than 4 seconds.

Phase diagram from the signal plan illustrating the pedestrian movement on one of the main street phases, phase 6 in this example.

One of the notes in the standard notes section specifies all of the phases that should be programmed for a ped call at controller startup. In order to prevent the MUTCD flash to right of way violation, this is where startup phases with ped movements that have leading pedestrian intervals should have no startup calls specified. If there is more than one pedestrian phase in use, only the phases causing a violation should be deleted from the note.

Oasis timing chart from the signal chart showing that the pedestrian phase should be programmed for advance walk.
Leading Pedestrian Interval - No Startup Ped Call
With Pretimed Peds

Pretimed systems with non actuated ped movements are programmed to
serve the pedestrian movement during every interval with a ped recall,
and the ped movements are also served at startup. For startup ped
phases with leading pedestrian intervals, the only way to omit the
startup ped call is through a special phase override function and a
series of logic processor statements.

- Phase diagram from the signal plan illustrating the pedestrian movement
  on one of the main street phases, phase 6 in this example.
- Oasis timing chart from the signal chart showing that the pedestrian
  phase should be programmed for advance walk and ped recall.

(continued on next page)
1. OMIT PHASE AT “STARTUP” Detail - The programming detail illustrates the steps required to override the PED 6 pedestrian movement at controller startup.

2. Input Assignment - This is any controller input that is not in use that can be assigned as a 'phase override' that will be used by the logic processor to omit the PED 6 movement at controller startup.

3. OVERRIDE PHASE CONTROL FUNCTION - When this selection is made, the phase control screen will appear. The diagram below represents a portion of that screen where the 'OMIT PEDESTRIAN' entry is made for the desired phase.

4. After the omit pedestrian programming phase has been entered, the programming may be verified by observing that the input function displays "OVERRIDE PHASE CONTROL" and that the "OVERRIDE PHASE CONTROL FUNCTION" has a 'Y' entered.

(continued on next page)
In order to implement the phase control override that was programmed to omit the pedestrian movement at startup, a series of logic processor steps must be programmed. The controller will check to see if flash sense is "ON" (cabinet flash) or controller flash is "ON", and if so the controller will turn input 64 "ON" so that the desired pedestrian movement will be omitted when the controller comes out of flash and starts running. A delay is built in to hold input 64 "ON" for three seconds after the controller starts to prevent the controller from possibly skipping the ped omit due to a controller internal race condition.
Leading Pedestrian Interval - Opposing Dummy Ped Phase

When an adjacent through vehicle movement is being held red during a leading ped interval, care must be taken to ensure that no other vehicle movement could encroach upon a pedestrian in the crosswalk. In the phase diagram shown to the left, phase B vehicles will be held in red during the advanced walk period but a phase 4 vehicle would not be held in red. This means a phase 4 vehicle could potentially make a permitted left turn into the crosswalk during the advanced walk period.

The remedy for this situation is to create a dummy ped movement for phase 4. All phase 4 ped times will be identical to those of phase 8, including the walk advance time. There will be no actual ped signal heads for phase 4. The ped push buttons for ped 8 will have to be programmed to call ped 4 and ped 8 when pressed. What this does is hold vehicle phase 4 red for the same walk advance time as phase 8 giving the pedestrian a leading ped interval without the possibility of vehicle interference. The vehicle phase 4 heads will turn green at the end of the walk advance time just like the phase 8 vehicle heads.

- Phase diagram from the signal plan illustrating the pedestrian movement on phase 8 on the side street, and the opposing vehicle move phase 4 with a permitted left turn and no ped movement.
- Oasis timing chart from the signal chart showing that the pedestrian phase should be programmed for advance walk.
- Dummy ped times assigned to phase 4, identical to those for phase 8.
- Pedestrian Detector Assignment Programming Detail - This programming screen assigns the specific ped phases that will be called by the ped detector buttons. For ped detector 8, be sure to include ped phase 4 to run the dummy ped phase.
Leading Pedestrian Interval - Opposing Ped Phase

When an adjacent through vehicle movement is being held red during a leading ped interval, care must be taken to ensure that no other vehicle movement could encroach upon a pedestrian in the crosswalk. In the phase diagram shown below, if one ped move is being served but the other is not, vehicles with the advance walk will be held in red for the advance walk period. The opposing vehicle move, however, would be free to make a permitted left turn and possibly encroach upon a pedestrian during the leading ped interval.

The remedy for this situation is to program the ped buttons to call their respective phases and to also call the opposing ped phase. The result is that both vehicle moves will be held in red during the advance walk time whenever a ped call is placed even if the ped call is not on the same approach as the vehicle move.

Oasis timing chart from the signal plan showing that the pedestrian phases should be programmed for advance walk.

Pedestrian Detector Assignment Programming Detail - This programming screen assigns the specific ped phases that will be called by the ped detector buttons. Each ped detector is programmed to call its own ped phase as well as the opposing ped phase.

Phase diagram from the signal plan illustrating the pedestrian movements on phases 4 and 8 on the side street, and the opposing vehicle moves that each have a through move and a permitted left turn move.

2070 Oasis Leading Pedestrian Interval Exceptions - Opposing Ped Phases
Leading Pedestrian Interval - Five Section Heads

When an adjacent through vehicle movement is being held red during a leading ped interval, care must be taken to ensure that no other vehicle movement could encroach upon a pedestrian in the crosswalk. In the phase diagram shown to the left, phase 6 vehicles will be held in red during the advanced walk period but a phase 2 vehicle would not be held in red. This means a phase 2 vehicle could potentially make a permitted left turn into the crosswalk during the advance walk period.

The remedy for this situation is to create a dummy ped movement for phase 2. All phase 2 ped times will be identical to those of phase 6, including the walk advance time. There will be no actual ped signal heads for phase 2. Logic is used to place a call to ped 2 when there is a call on ped 6.

In this phasing arrangement, phase 5 must always lag and all red backup protect for phase 2 must be programmed. This ensures that the leading pedestrian interval will run correctly.

Phase diagram from the signal plan illustrating the pedestrian movement on phase 6 on the main street, and the opposing vehicle move phase 2 with five section protected and permitted left turn head and no pedestrian movement.

Oasis timing chart from the signal chart showing that the pedestrian phase should be programmed for advance walk.

Dummy ped times assigned to phase 2, identical to those for phase 6.

Backup Protection Note - Make sure this note is on the electrical detail when five section heads are used in this type of leading pedestrian interval application.

(continued on next page)
LOGICAL I/O PROCESSOR PROGRAMMING TO CALL —— (E)
PHASE 2 DUMMY PED WHEN PHASE 6 PED IS CALLED

(program controller as shown below)

1. FROM MAIN MENU PRESS '2' (PHASE CONTROL), THEN '1' (PHASE CONTROL FUNCTIONS). SCROLL TO THE BOTTOM OF THE MENU AND ENABLE ACT LOGIC COMMAND 1.

2. FROM MAIN MENU PRESS '6' (OUTPUTS), THEN '3' (LOGICAL I/O PROCESSOR).

   LOGICAL I/O COMMAND #1 (+/-COMMAND#1)
   IF PED CALL ON PHASE #5 IS ON
   AND NEXT PHASE #6 IS ON
   THEN:
   SET INPUT ASSIGNMENT #29 ON

   LOGIC I/O PROCESSOR PROGRAMMING COMPLETE

Leading Pedestrian Interval - Five Section Heads

(E) Logic processor programming to call the phase 2 dummy ped. This logic ensures the dummy ped call on phase 2 is served at the appropriate time. Without this logic, the dummy ped call on phase 2 could be served before the ped call on phase 6.

OUTPUT REFERENCE SCHEDULE

INPUT 29 = Phase 2 PED Call
**Leading Pedestrian Interval - Flashing Yellow Arrows**

When an adjacent through vehicle movement is being held red during a leading ped interval, care must be taken to ensure that no other vehicle movement could encroach upon a pedestrian in the crosswalk. When flashing yellow arrows are being used for the vehicle approach that opposes the ped move, care must be taken to suppress the flashing yellow arrow output, which is the permitted movement, during the leading ped interval. The logic processor is used to accomplish this as shown on this sheet. The same logic is applied to main street and side street three section permitted only flashing yellow arrows. The phase diagram shown to the left is used for the explanation.

1. Phase diagram from a signal plan illustrating the pedestrian movement on phase 6 on the main street, and the opposing vehicle move phase 2 with no ped and a protected/permitted left turn via the flashing yellow arrow. Note that the ped 6 movement can be omitted at startup by omitting it as a startup ped call, thus avoiding the MUTCD startup violation.

2. Signal head 51 is a protected and permitted flashing yellow arrow that has overlap parent phases of 5+6 (phase 6 is the opposing through move).

3. To suppress the signal head 51 flashing yellow arrow during the leading pedestrian interval, the logic processor is required. When ped 6 is timing the advanced walk, the phase 6 vehicle move is held red. When the logic processor sees that the ped 6 movement is “ON” and the phase 6 vehicle move is “OFF”, it prevents the flashing yellow arrow from turning on by holding the overlap red (head 51) while at the same time allowing the phase 2 through movement (head 22) to be served. After the walk advance time has expired, the logic statement is no longer TRUE and the phase 6 vehicle movement will turn “ON”, at which time the flashing yellow arrow signal face will also turn “ON” and begin to flash.

This logic is used whenever a flashing yellow signal head opposes a pedestrian movement that has a leading pedestrian interval whether it happens to be a three section permitted only or a four section protected and permitted head.

**2070 Oasis Leading Pedestrian Interval Exceptions – Flashing Yellow Arrows**

**Signals Management**

**Transportation Mobility and Safety Division**

**North Carolina Department of Transportation**

10-18
Leading Pedestrian Interval - Startup in Green
With Actuated Peds

ASC/3-2070 software provides a startup option that allows the controller to start in the specified phases either in Green or Walk if there are associated ped movements. This applies to pedestrian moves that are push button actuated as opposed to those that may be programmed for ped recall. Specific programming instructions are found in the 'NOTES' section of the electrical detail and specify which phases should start in Green, if any.

Controllers running ASC/3-2070 software will serve pedestrian movements on the second interval instead of the first interval even for phases programmed to start in walk. This virtually eliminates the possibility of a MUTCD startup violation when coming out of flash at startup, but in spite of this, startup phases with ped movements should be programmed to start in Green and not in Walk.

NOTE THAT PHASE 6 DOES NOT START IN WALK!

5. Program controller to start up in phase 2 Green and 6 Green.

A Phase diagram from the signal plan illustrating the pedestrian movement on one of the main street phases, phase 6 in this example.

B One of the notes in the standard notes section specifies how the startup phases should be programmed. In order to prevent the MUTCD flash to right of way violation, this is where startup phases with ped movements that have leading pedestrian intervals should be programmed to start in Green and not in Walk. If there is more than one pedestrian phase in use, only the phases causing violation should be specified to start in Green. Do this for both actuated and pretimed locations.

C ASC/3-2070 timing chart from the signal chart showing that the phase 6 should be programmed for delayed green.

### TIMING CHART

<table>
<thead>
<tr>
<th>PHASE</th>
<th>B1</th>
<th>B2</th>
<th>B3</th>
<th>B4</th>
<th>B5</th>
<th>B6</th>
</tr>
</thead>
<tbody>
<tr>
<td>INTERW. GREEN</td>
<td>12 SEC</td>
<td>7 SEC</td>
<td>7 SEC</td>
<td>12 SEC</td>
<td>7 SEC</td>
<td></td>
</tr>
<tr>
<td>VEH. 6</td>
<td>6.0 SEC</td>
<td>2.0 SEC</td>
<td>1.5 SEC</td>
<td>1.0 SEC</td>
<td>1.0 SEC</td>
<td></td>
</tr>
<tr>
<td>VEH. 6 XO</td>
<td>9.0 SEC</td>
<td>2.0 SEC</td>
<td>1.5 SEC</td>
<td>1.0 SEC</td>
<td>1.0 SEC</td>
<td></td>
</tr>
<tr>
<td>SH FL RANGE</td>
<td>No FLANGE</td>
<td>No FLANGE</td>
<td>No FLANGE</td>
<td>No FLANGE</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SH RANGE</td>
<td>1.8 SEC</td>
<td>1.2 SEC</td>
<td>3.0 SEC</td>
<td>1.8 SEC</td>
<td>3.0 SEC</td>
<td></td>
</tr>
<tr>
<td>PDC</td>
<td>10.0 SEC</td>
<td>3.0 SEC</td>
<td>3.0 SEC</td>
<td>3.0 SEC</td>
<td>3.0 SEC</td>
<td></td>
</tr>
<tr>
<td>PDC TIME</td>
<td>100 SEC</td>
<td>300 SEC</td>
<td>300 SEC</td>
<td>300 SEC</td>
<td>300 SEC</td>
<td></td>
</tr>
<tr>
<td>RECALL PHASE</td>
<td>PRECAL</td>
<td>NONE</td>
<td>NONE</td>
<td>PRECAL</td>
<td>NONE</td>
<td></td>
</tr>
<tr>
<td>END DET.</td>
<td>ON</td>
<td>OFF</td>
<td>OFF</td>
<td>ON</td>
<td>OFF</td>
<td></td>
</tr>
<tr>
<td>CREATED GREEN</td>
<td>OFF</td>
<td>OFF</td>
<td>OFF</td>
<td>ON</td>
<td>OFF</td>
<td></td>
</tr>
<tr>
<td>SH RANGE</td>
<td>1.8 SEC</td>
<td>1.2 SEC</td>
<td>1.2 SEC</td>
<td>1.2 SEC</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PDC</td>
<td>10.0 SEC</td>
<td>3.0 SEC</td>
<td>3.0 SEC</td>
<td>3.0 SEC</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*These values may be held adjusted. Do not adjust Green and Pedestrian times for phases 2 and 6 less than 1.25 times, set Green for all other phases should not be less than 4 seconds.

---

ASC/3-2070 Leading Pedestrian Interval Exceptions – Startup in Green

10-18

Signals Management
Transportation Mobility and Safety Division
North Carolina Department of Transportation

STD. NO. 12.6

Sheet 1 of 1
Leading Pedestrian Interval - Opposing Dummy Ped Phase

When an adjacent through vehicle movement is being held red during a leading ped interval, care must be taken to ensure that no other vehicle movement could encroach upon a pedestrian in the crosswalk. In the phase diagram shown to the left, phase 8 vehicles will be held in red during the delayed green period but a phase 4 vehicle would not be held in red. This means a phase 4 vehicle could potentially make a permitted left turn into the crosswalk during the delayed green period.

The remedy for this situation is to create a dummy ped movement for phase 4. All phase 4 ped times will be identical to those of phase 8, including the delayed green time. There will be no actual ped signal heads for phase 4. The ped push buttons for ped 8 will have to be programmed to call ped 4 and ped 8 when pressed. What this does is hold vehicle phase 4 red for the same delayed green time as phase 8 giving the pedestrian a leading ped interval without the possibility of vehicle interference. The vehicle phase 4 heads will turn green at the end of the delayed green time just like the phase 8 vehicle heads.

---

**ECONOLITE ASC/3-2070**

**PED 8 PROGRAMMING ASSIGNMENT DETAIL**

(program controller as shown)

1. From Main Menu select 6. DETECTORS
2. From DETECTOR Submenu select 3. PED DETECTOR INPUT ASSIGNMENT

---

**ASC/3-2070 Leading Pedestrian Interval Exceptions – Opposing Dummy Ped Phase**

**10-18**

**SIGNALS MANAGEMENT**

**TRANSPORTATION MOBILITY AND SAFETY DIVISION**

**NORTH CAROLINA DEPARTMENT OF TRANSPORTATION**

**STD. NO.**

**12.7**

**SHEET 1 OF 2**
**Leading Pedestrian Interval - Opposing Ped Phases**

When an adjacent through vehicle movement is being held red during a leading ped interval, care must be taken to ensure that no other vehicle movement could encroach upon a pedestrian in the crosswalk. In the phase diagram shown below, if one ped move is being served but the other is not, vehicles with the delayed green will be held in red for the delayed green period. The opposing vehicle move, however, would be free to make a permitted left turn and possibly encroach upon a pedestrian during the leading ped interval.

The remedy for this situation is to program the ped buttons to call their respective phases and to also call the opposing ped phase. The result is that both vehicle moves will be held in red during the delayed green whenever a ped call is placed even if the ped call is not on the same approach as the vehicle move.

---

**ASC/3-2070 timing chart from the signal plan showing that the pedestrian phase should be programmed for delayed green.**

**Pedestrian Detector Assignment Programming Detail - This programming screen assigns the specific ped phases that will be called by the ped detector buttons. Each ped detector is programmed to call its own ped phase as well as the opposing ped phase.**

**Phase diagram from the signal plan illustrating the pedestrian movements on phases 4 and 8 on the side street, and the opposing vehicle moves that each have a through move and a permitted left turn move.**

---

**ASC/3-2070 Leading Pedestrian Interval Exceptions - Opposing Ped Phases**

**Signals Management**
**Transportation Mobility and Safety Division**
**North Carolina Department of Transportation**

10-18
Leading Pedestrian Interval - Five Section Heads

When an adjacent through vehicle movement is being held red during a leading ped interval, care must be taken to ensure that no other vehicle movement could encroach upon a pedestrian in the crosswalk. In the phase diagram shown to the left, phase 6 vehicles will be held in red during the delayed green period but a phase 2 vehicle would not be held in red. This means a phase 2 vehicle could potentially make a permitted left turn into the crosswalk during the delayed green period.

The remedy for this situation is to create a dummy ped movement for phase 2. All phase 2 ped times will be identical to those of phase 6, including the delayed green time. There will be no actual ped signal heads for phase 2. Logic is used to place a call to ped 2 when there is a call on ped 6.

In this phasing arrangement, phase 5 must always lag and all red backup protect for phase 2 must be programmed. This ensures that the leading pedestrian interval will run correctly.

Phase diagram from the signal plan illustrating the pedestrian movement on phase 6 on the main street, and the opposing vehicle move phase 2 with five section protected and permitted left turn head and no pedestrian movement.

ASC/3-2070 timing chart from the signal chart showing that the pedestrian phase should be programmed for advance walk.

Dummy ped times assigned to phase 2, identical to those for phase 6.

(continued on next page)
Leading Pedestrian Interval - Five Section Heads

1. Backup Protection Note - This programming will ensure that the controller will not progress from 2+5 to 2+6 without first going to all red.

2. Logic processor programming to call the phase 2 dummy ped. This logic ensures the dummy ped call on phase 2 is served at the appropriate time.

ASC/3-2070 Leading Pedestrian Interval Exceptions - Five Section Heads
Leading Pedestrian Interval - Flashing Yellow Arrows

When an adjacent through vehicle movement is being held red during a leading ped interval, care must be taken to ensure that no other vehicle movement could encroach upon a pedestrian in the crosswalk. When flashing yellow arrows are being used for the vehicle approach that opposes the ped move, care must be taken to suppress the flashing yellow arrow output, which is the permitted movement, during the leading ped interval. The logic processor is used to accomplish this as shown on this sheet. The same logic is applied to main street and side street three section permitted only flashing yellow arrows. The phase diagram shown to the left is used for the explanation.

A. Phase diagram from a signal plan illustrating the pedestrian movement on phase 6 on the main street, and the opposing vehicle move phase 2 with no ped and a protected/permited left turn via the flashing yellow arrow. Ped 6 is not served at startup and no MUTCD startup violation will occur because phase 6 is programmed to start in green. Refer to STD 12.6 sheet 1.

B. Signal head 51 is a protected and permitted flashing yellow arrow that has overlap parent phases of 5+6 (phase 6 is the opposing through move).

C. To suppress the signal head 51 flashing yellow arrow during the leading pedestrian interval, the logic processor is required. When ped 6 is timing the delayed green, the phase 6 vehicle move is held red. When the logic processor sees that the ped 6 movement is "ON" and the phase 6 vehicle move is "OFF", it prevents the flashing yellow arrow from turning on by holding the overlap red (head 51) while at the same time allowing the phase 2 through movement (head 22) to be served. After the delayed green time has expired, the logic statements are no longer TRUE and the phase 6 vehicle movement will turn "ON", at which time the flashing yellow arrow signal face will also turn "ON" and begin to flash.

This logic is used whenever a flashing yellow signal head opposes a pedestrian movement that has a leading pedestrian interval whether it happens to be a three section permitted only or a four section protected and permitted head.
Optical Emergency Vehicle Detection (Opticom)

Opticom optical detection systems are typically used for emergency vehicle detection. The detector cards plug into the "I" file and "J" file of the 336 pole mounted and 332 base mounted 170 cabinets respectively. Cards are available in both two channel and four channel configurations. The two channel cards can be used in either of the designated emergency vehicle preemption slots of the 332 or 336 cabinets but are normally used in the leftmost slot. The four channel cards come equipped with a doublewide faceplate and must plugged into the rightmost preemp slot. See STD. NO. 8.0 sheets 1 and 2 to see the preemp slot locations in the input files for the 332 and 336 cabinets.

336 Pole Mounted Cabinet (uses "I file")

332 Base Mounted Cabinet (uses "J File")

TYPICAL OPTICOM FIELD WIRE DETAIL
(input file, rear view)

TYPICAL OPTICOM FIELD WIRE DETAIL
(input file, rear view)

Detection – Typical Optical Emergency Vehicle (Opticom)

SIGNALS MANAGEMENT
TRANSPORTATION MOBILITY AND SAFETY DIVISION
NORTH CAROLINA DEPARTMENT OF TRANSPORTATION

STD. NO. 13.0

SHEET 1 OF 3
Optical Emergency Vehicle Detection (Tomar)

Tomar optical detection systems are typically used for emergency vehicle detection. The detector cards plug into the "I" file and "J" file of the 336 pole mounted and 332 base mounted 170 cabinets respectively. Cards are equipped with four preemption inputs and have a doublewide faceplate for use with 170 cabinets. As such, the card should always be plugged into the rightmost preemption slot whether it is used in a 332 or a 336 cabinet. See STD NO. 8.0 sheets 1 and 2 to see the preemption slot locations in the input file for the 332 base mounted cabinet and 336 pole mounted cabinet.

336 Pole Mounted Cabinet (uses "I File")

TYPICAL TOMAR FIELD WIRE DETAIL
(input file, rear view)

FIELD

CABINET

Ch. 3 Yellow (PRE-3)
Ch. 4 Yellow (PRE-5)

Ch. 3 Jumper 50-20 Oranje (PRE-3)
Ch. 4 Jumper 50-20 Oranje (PRE-5)

wrap bare wire with insulting tape

wrap bare wire with insulting tape

110 111

CH. 3 CH. 1
PRE 3 UNUSED

CH. 4 CH. 2
PRE 5 UNUSED

(output file, front view)

4 CHANNEL TOMAR CARD
INSERT CARD INTO SLOT 111
FOR USE WITH PRE3 & PRE5

332 Base Mounted Cabinet (uses "J File")

TYPICAL TOMAR FIELD WIRE DETAIL
(input file, rear view)

FIELD

CABINET

Ch. 3 Yellow (PRE-4)
Ch. 4 Yellow (PRE-5)

Ch. 3 Jumper 50-20 Oranje (PRE-4)
Ch. 4 Jumper 50-20 Oranje (PRE-5)

wrap bare wire with insulting tape

wrap bare wire with insulting tape

J12 J13

CH. 3 CH. 1
PRE 3 PRE 4

CH. 4 CH. 2
PRE 5 UNUSED

(output file, front view)

4 CHANNEL TOMAR CARD
INSERT CARD INTO SLOT J13
FOR USE WITH PRE3, 4, 5
GPS Emergency Vehicle Detection

GPS systems can be used for emergency vehicle detection. The detector system is installed in the "J" file in a 332 base mounted cabinet and in the "I" file in a 336 pole mounted cabinet. The diagram below shows the typical representation of the GPS emergency vehicle preemption system deployed in a 332 base mounted cabinet in slots 12 and 13 of the "J" file. The same typical application in a 336 pole mounted cabinet would have the preempt input interface installed in slots 10 and 11 of the "I" file.

**INPUT FILE POSITION LAYOUT**

*(front view)*

<table>
<thead>
<tr>
<th>FILE &quot;I&quot;</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
<th>11</th>
<th>12</th>
<th>13</th>
<th>FS</th>
</tr>
</thead>
<tbody>
<tr>
<td>&quot;U&quot;</td>
<td>ø1</td>
<td>ø2</td>
<td>ø3</td>
<td>ø4</td>
<td>ø4</td>
<td>ø4</td>
<td>SYS.</td>
<td>DET.</td>
<td>S1</td>
<td>S1</td>
<td>S1</td>
<td>S1</td>
<td>Φ2PED</td>
<td>Φ6PED</td>
</tr>
<tr>
<td>NOT USED</td>
<td>2A</td>
<td>2C</td>
<td>2E</td>
<td>3A</td>
<td>4A</td>
<td>4C</td>
<td>4E</td>
<td>DET.</td>
<td>S1</td>
<td>S1</td>
<td>S1</td>
<td>Φ2PED</td>
<td>Φ6PED</td>
<td>FS</td>
</tr>
<tr>
<td>&quot;L&quot;</td>
<td>NOT</td>
<td>USED</td>
<td>NOT</td>
<td>USED</td>
<td>NOT</td>
<td>USED</td>
<td>SYS.</td>
<td>DET.</td>
<td>S2</td>
<td>S2</td>
<td>S2</td>
<td>S2</td>
<td>Φ4PED</td>
<td>Φ8PED</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>FILE &quot;J&quot;</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
<th>11</th>
<th>12</th>
<th>13</th>
<th>14</th>
</tr>
</thead>
<tbody>
<tr>
<td>&quot;U&quot;</td>
<td>ø5</td>
<td>ø6</td>
<td>ø7</td>
<td>ø8</td>
<td>ø8</td>
<td>SYS.</td>
<td>DET.</td>
<td>S3</td>
<td>S3</td>
<td>S3</td>
</tr>
<tr>
<td>NOT USED</td>
<td>5A</td>
<td>6A</td>
<td>6C</td>
<td>6E</td>
<td>7A</td>
<td>8A</td>
<td>8C</td>
<td>8E</td>
<td>S3</td>
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<tr>
<td>&quot;L&quot;</td>
<td>ø6</td>
<td>ø6</td>
<td>ø6</td>
<td>ø8</td>
<td>ø8</td>
<td>SYS.</td>
<td>DET.</td>
<td>S4</td>
<td>S4</td>
<td>S4</td>
</tr>
<tr>
<td>NOT USED</td>
<td>6B</td>
<td>6D</td>
<td>6B</td>
<td>8B</td>
<td>8D</td>
<td>S3</td>
<td>S3</td>
<td>S3</td>
<td>S3</td>
<td>S3</td>
</tr>
</tbody>
</table>

Ex.: 1A, 2A, etc. = LOOP NO.'S
* See GPS Preemption Installation note below.

FS = FLASH SENSE
ST = STOP TIME

**GPS PREEMPTION INSTALLATION NOTE**

Install a GPS preemption system. Perform installation according to manufacturer’s directions and NC DOT engineer approved mounting locations to accomplish the detection schemes shown on the Signal Design Plans.
Microwave Pulse Detection

Microwave motion detectors can be used for vehicle pulse detection. When a vehicle enters the detection zone defined by the microwave head, the equipment will trigger a single momentary input to a DC isolator located in the input file and register a true input to the controller. Based on the requirements of the signal design, the controller might use the input to lock a vehicle call, extend a phase, register a system count, or similar. The following sheets illustrate a typical pulse detection application.

INPUT FILE POSITION LAYOUT
(from view)

![Diagram of input file layout]

INPUT FILE LAYOUT - In this example the DC isolator used with the pulse detector is located in slot J2-U and is used for loop 6A.

Notes:
1. Install a model 242 DC isolator in slot J2 for use with microwave detector.
2. See the Microwave Detector Wiring Details on sheet 2.
3. IMPORTANT: For proper operation of the microwave detector, remove surge protection from TB3-5 and TB3-6, and from TB3-7 and TB3-8.

INPUT FILE CONNECTION & PROGRAMMING CHART

![Diagram of input file connection chart]

INPUT FILE CONNECTION - Details for loop 6A are found in this chart. When a vehicle enters the microwave zone, a phase 6 call is placed, phase 6 is extended if it is timing, and stretch detection is implemented.

Notes:
1. Microwave pulse detector. See wiring and programming details on sheet 2.

(continued on next page)
ECONOLITE OASIS LOGICAL I/O PROCESSOR PROGRAMMING

DETAILED FOR MICROWAVE DETECTOR INPUT PROCESSING

(program controller as shown below)

1. FROM MAIN MENU PRESS '5' (INPUT CONTROL). THEN '1' (PHASE CONTROL) 1200 TO THE BOTTOM OF THE MENU AND EMULATE AT LOGIC COMMAND 1 AND 2.

2. FROM MAIN MENU PRESS '8' (OUTPUTS). THEN '3' (LOGICAL I/O PROCESSOR).

Microwave Pulse Detection

OUTPUT REFERENCE SCHEDULE

INPUT 2 = Pedestrian Physical Input (not programmed)

INPUT 64 = Dummy Detector Input (Detector 6)

TYPICAL MICROWAVE PULSE DETECTOR WIRING DETAIL

(FILE AS SHOWN)

CONTROLLER CAGEEN

TO DETECTOR UNIT:

FULL LENGTH 3000 V, 250 MA, 115 VAC

TRANSMITTER SECONDARY COAX WIRES

PRIMARY (RED WIRE)

AC- 120 V

TO DETECTOR UNIT:

MICROWAVE DETECTOR WIRE LIST

COLOR FUNCTION

BLACK 12V to 24V AC/DC (no polarity)

ORANGE 12V to 24V AC/DC (no polarity)

WHITE Output Relay Normally Open

GREEN Output Relay Normally Closed

NOTES:

1. Sensor is a microwave motion detector mounted on poles as indicated on the Signal Design Plans.

2. Microwave wiring shown above will cause a permanent call unless the Input Assignment Programming and Logical I/O Processor Programming details are entered as shown on this sheet.

3. These programming details will cause a call to be placed upon opening the Normally Closed contact on the microwave detector.

4. Important: For proper operation of the microwave detector, remove surge protection from TB3-5, TB3-6, TB3-7, and TB3-8 and insert 24V DC Isolator in Slot 2.

INPUT ASSIGNMENT PROGRAMMING DETAIL FOR MICROWAVE DETECTOR INPUT

(program controller as shown below)

PAGE 1 C1 PIN 40 NOT ENABLED

INPUT ASSIGNMENT #1 = 1200

DELAY TIME 0-25.5 SEC.

PREVENT #5 = 1200

INADEQUATE PREVENT #5 = 1200

ENTER 'YES' for

INPUT 64

NOT Enabled

7. FROM MAIN MENU PRESS '5' (INPUTS). THEN '4' UNTIL INPUT 64 (PIN 40) IS SELECTED. WRITE DEFAULT CONDITIONS AS INDIcATED BY ARROWS.

Detection – Microwave Pulse (Oasis)

SIGNALS MANAGEMENT

TRANSPORTATION MOBILITY AND SAFETY DIVISION

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION

10-18

STD. NO. 13.1

SHEET 2 OF 4
Microwave Pulse Detection (ASC/3-2070)

Microwave motion detectors can be used for vehicle pulse detection. When a vehicle enters the detection zone defined by the microwave head, the equipment will trigger a single momentary input to a DC isolator located in the input file. Using the logic processor, and based on the requirements of the signal design, the controller might then use the input to lock a vehicle call, extend a phase, register a system count, or similar. The following sheets illustrate a typical pulse detection application.

### INPUT FILE POSITION LAYOUT

![Input File Layout Diagram](image)

- **INPUT FILE LAYOUT** - In this example the DC isolator used with the pulse detector is located in slot J9-U, which by default is detector 15. It will have no phase assigned.

### INPUT FILE CONNECTION & PROGRAMMING CHART

<table>
<thead>
<tr>
<th>LOOP NO.</th>
<th>LOOP TERMINAL</th>
<th>INPUT FILE POS.</th>
<th>PIN NO.</th>
<th>DETECTOR NO.</th>
<th>NEMA PHASE</th>
<th>CALL</th>
<th>EXTEND TIME</th>
<th>DELAY TIME</th>
<th>ADDED INITIAL</th>
<th>DETECTOR TYPE</th>
</tr>
</thead>
<tbody>
<tr>
<td>1A</td>
<td>1B2-7.5</td>
<td>1 IDL 45 12</td>
<td>1 YES</td>
<td>5</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1B</td>
<td>1B2-1.5</td>
<td>1 IDL 83 32</td>
<td>1 YES</td>
<td>5</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2A-2B</td>
<td>1B2-1.12</td>
<td>1 IDL 76 42</td>
<td>2 YES</td>
<td>1.2</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>2C-2D</td>
<td>1B2-1.12</td>
<td>1 IDL 47 22</td>
<td>2 YES</td>
<td>5</td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>4A</td>
<td>1B4-4.1A</td>
<td>1 IDL 41 4</td>
<td>4 YES</td>
<td>5</td>
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<td></td>
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<td></td>
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</tr>
<tr>
<td>4B</td>
<td>1B4-11.12</td>
<td>1 IDL 45 14</td>
<td>4 YES</td>
<td>15</td>
<td>5</td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>5A</td>
<td>1B3-1.5</td>
<td>1 IDL 51 16</td>
<td>6 NO</td>
<td>1.2</td>
<td>5</td>
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<td></td>
</tr>
<tr>
<td>6A,6C</td>
<td>1B3-1.5</td>
<td>1 IDL 64 36</td>
<td>6 YES</td>
<td>5</td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
</tbody>
</table>

* Microwave pulse detector. See wiring and programming detail on sheet 2.

**INPUT FILE CONNECTION LEGEND**

- **FILE**
- **SLOT**
- **LOWER**

(continued on next page)
ECONOLITE ASC/3-2070 LOGIC PROCESSOR PROGRAMMING

DETAIl FOR MICROWAVE DETECTOR INPUT PROCESSING

(program controller as shown)

1. From Main Menu select 1. CONFIGURATION
2. From CONFIGURATION Submenu select 8. LOGIC PROCESSOR
3. From the LOGIC PROCESSOR Submenu select 2. LOGIC STATEMENTs

ENTER A "1" IN THE LOW FIELD; PRESS "ENTER", AND PROGRAM AS SHOWN:

LOWI 1 COPY FROM 1 ACTIVES M TYPE1
  IF OFF VS IS ON
  THEN DEF SET VEH 1-15 6 OFF
  ELSE...

ENTER A "2" IN THE LOW FIELD; PRESS "ENTER", AND PROGRAM AS SHOWN:

LOWI 2 COPY FROM 2 ACTIVES M TYPE1
  IF OFF VS IS ON
  THEN DEF SET VEH 1-15 6 ON
  ELSE...

END PROGRAMMING

ECONOLITE ASC/3-2070 VEHICLE DETECTOR SETUP

PROGRAMMING DETAIl FOR DETECTOR 15

1. From Main Menu select 6. DETECTORS
2. From DETECTOR Submenu select 2. VEHICLE DETECTOR SETUP

- Place cursor in VEH DETECTOR [15] position and enter "15".
- Set PR to "0" and CALL OPTION to "NOT"

TYPE: N-MAT
TS2 DETECTOR: [ ] GND [ ] NO
DEF PLAN - 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6

IN 0 =
0

CALL NO

USE ADDITIONAL CROSS SWITCH PW...

TYPICAL MICROWAVE PULSE DETECTOR WIRING DETAIL

(same as shown)

CONTROLLER CAVIETY

TO DETECTOR UNIT

Transformer primary
AC 110V

Transformer supplied
with microwave sensor

DC ISOLATOR WIRE LIST

<table>
<thead>
<tr>
<th>COLOR</th>
<th>FUNCTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>black</td>
<td>12V to 24V AC/DC (no polarity)</td>
</tr>
<tr>
<td>red</td>
<td>12V to 24V AC/DC (no polarity)</td>
</tr>
<tr>
<td>orange</td>
<td>Output Relay Normally Open</td>
</tr>
<tr>
<td>white</td>
<td>Output Relay Normally Closed</td>
</tr>
<tr>
<td>green</td>
<td>Output Relay Common</td>
</tr>
</tbody>
</table>

NOTES:

1. Sensor is a microwave motion detector mounted on poles as indicated on the Signal Design Plans.
2. Microwave wiring shown above will cause a permanent call unless the Input Assignment Programming and Logical I/O Processor Programming details are entered as shown on this sheet. These programming details will cause a call to be placed upon opening the Normally Closed contact on the microwave detector.
3. DC Isolator's LED will be ON when no call is present and will be OFF when a call is present.
4. Important: For proper operation of the microwave detector, remove surge protection from TB7-9, TB7-10, TB7-11, and TB7-12 and Insert 242 DC Isolator in slot J9.

Detection – Microwave Pulse (ASC3-2070)

SIGNALS MANAGEMENT
TRANSPORTATION MOBILITY AND SAFETY DIVISION
NORTH CAROLINA DEPARTMENT OF TRANSPORTATION

STD. NO. 13.1

SHEET 4 OF 4
Microwave Presence Detection

Microwave (radar) motion detectors can be used for vehicle presence detection. When a vehicle enters the detection zone defined by the microwave head, the equipment will send a presence signal to the detection equipment located in the input file and register a true input to the controller for as long as the vehicle remains in the detection zone. Based on the requirements of the signal design, the controller might use the input to lock a vehicle call, extend a phase, register a system count, or similar. The following illustrates a typical presence detection application.

INPUT FILE POSITION LAYOUT

(INPUT file 1)

- FILE “I”
- FILE “J”

EX: 1A, 2A, ETC., LOOP NO’S
FS = FLASH SENSE
ST = STOP TIME

INPUT FILE CONNECTION & PROGRAMMING CHART

<table>
<thead>
<tr>
<th>LOOP NO.</th>
<th>LOOP TERMINAL</th>
<th>INPUT FILE POS.</th>
<th>PIN NO.</th>
<th>ASSIGNMENT NO.</th>
<th>DETECTOR NO.</th>
<th>PHASE</th>
<th>CALL</th>
<th>Extended</th>
<th>DELAY TIME</th>
<th>STRETCH TIME</th>
<th>DELAY TIME</th>
</tr>
</thead>
<tbody>
<tr>
<td>2C</td>
<td>183-13L</td>
<td>IJ</td>
<td>43</td>
<td>25</td>
<td>2</td>
<td>Y</td>
<td>Y</td>
<td>2</td>
<td>3</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>4A</td>
<td>183+13L</td>
<td>IJ</td>
<td>41</td>
<td>3</td>
<td>4</td>
<td>Y</td>
<td>Y</td>
<td>5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4B</td>
<td>183+11L</td>
<td>IJ</td>
<td>45</td>
<td>7</td>
<td>4</td>
<td>Y</td>
<td>Y</td>
<td>15</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6C</td>
<td>185+12L</td>
<td>JU</td>
<td>64</td>
<td>26</td>
<td>6</td>
<td>Y</td>
<td>Y</td>
<td>3</td>
<td></td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>6A</td>
<td>185+12L</td>
<td>JU</td>
<td>62</td>
<td>4</td>
<td>8</td>
<td>Y</td>
<td>Y</td>
<td>5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6B</td>
<td>185+11L</td>
<td>JU</td>
<td>66</td>
<td>8</td>
<td>8</td>
<td>Y</td>
<td>Y</td>
<td>15</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

SPECIAL DETECTOR NOTE

Install a radar detection system for vehicle detection for zones 2A, 2B, 6A, and 6B. Perform installation according to manufacturer’s directions and NCDOT engineer-approved mounting locations to accomplish the detection schemes shown on the Signal Design Plans.

Detection – Microwave Presence

SIGNALS MANAGEMENT
TRANSPORTATION MOBILITY AND SAFETY DIVISION
NORTH CAROLINA DEPARTMENT OF TRANSPORTATION

STD. NO. 13.2

SHEET 1 OF 3
Multizone Microwave Detection

Multizone Microwave Detectors can be used for vehicle pulse or presence detection. When multizone microwave detectors are used for presence detection and a vehicle enters the detection zone defined by the microwave head, a signal is sent to the detection equipment located in the cabinet and registers a true input to the controller for as long as the vehicle remains in the detection zone. Depending on the requirements of the signal design and the microwave equipment configuration, the controller might use the input to lock a vehicle call, extend a phase, register a system count, or similar.

INPUT FILE POSITION LAYOUT
(front view)

INPUT FILE CONNECTION & PROGRAMMING CHART

INPUT FILE LAYOUT - In this example the loop and detector installation chart on the signal plan showed microwave presence detection zone on a bridge deck labeled as "Q1" and all other detectors were inductive loops in the pavement. The electrical detail shows no specific placement or installation instructions for the microwave equipment, but instead instructs the installer to follow manufacturer and engineer approved guidelines via a Special Detector Note.

INPUT FILE CONNECTION - Details for the multizone microwave detection system setup are found on the signal plan and not on the electrical detail. Installation and setup is left to field personnel, the manufacturer, the manufacturer's representative, and NCDOT engineering.

SPECIAL DETECTOR NOTE - Refers the installer to the manufacturer for specifics regarding installation and setup of the equipment, and to the NCDOT engineering staff for other operational guidance.

SPECIAL DETECTOR NOTE

Install a multizone microwave detection system for vehicle detection for zone Q1. Perform installation according to manufacturer's directions and NCDOT engineer-approved mounting locations to accomplish the detection schemes shown on the Signal Design Plans.

Detection – Multizone Microwave Presence

Signals Management
Transportation Mobility and Safety Division
North Carolina Department of Transportation

10-18

STD. NO. 13.2

SHEET 2 OF 3
Video Detection

Video Detectors can be used for vehicle pulse or presence detection. When video detectors are used for presence detection and a vehicle enters the detection zone defined by the video equipment, a signal is sent to the detection equipment located in the cabinet and registers a true input to the controller for as long as the vehicle remains in the detection zone. Depending on the requirements of the signal design and the video equipment configuration, the controller might use the input to lock a vehicle call, extend a phase, register a system count, or similar.

INPUT FILE POSITION LAYOUT

INPUT FILE CONNECTION & PROGRAMMING CHART

INPUT FILE POSITION LEGEND

SPECIAL DETECTOR NOTE

Install a video detection system for vehicle detection for zone Q1. Perform installation according to manufacturer’s directions and NCDOT engineer-approved mounting locations to accomplish the detection schemes shown on the Signal Design Plans.

Detection – Video Presence

SIGNS MANAGEMENT
TRANSPORTATION MOBILITY AND SAFETY DIVISION
NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
Presence Detection and Wired Inputs

Loops and/or zones that are referred to as "wired inputs" typically place a call for a protected turning movement and also place a call to the adjacent through movement. While installation instructions and zone locations in the Input File are not usually provided on an electrical detail for Multizone Microwave or Video detection systems, the location of detectors for wired input programming to function properly is critical for wired inputs. As such, a set of special Detector Notes is provided on electrical details for signal plans that have wired inputs to ensure proper detector operation and timing. Certain slots are "reserved" for proper functionality and are shown in the layout, programming chart, and notes. More information about wired inputs and the jumpers is found in STD. NO. 8.1.

For the example shown below, all detection was accomplished using a video detection system where the signal plan had default phasing only. Detection zones 1A and 5A each call two phases and are installed as a wired input. Their specific locations in the Input File need to be as shown so the detector programming is correct and the phasing runs properly.

![Input File Position Layout Diagram](image)

**INPUT FILE POSITION LAYOUT**

(front view)

**INPUT FILE CONNECTION & PROGRAMMING CHART**

<table>
<thead>
<tr>
<th>LOOP NO.</th>
<th>LOOP TERMINAL</th>
<th>INPUT FILE POS. PIN NO.</th>
<th>INPUT ASSIGNMENT NO.</th>
<th>DETECTOR NO.</th>
<th>NEMA PHASE</th>
<th>CALL EXTEND</th>
<th>CALL TIME DELAY</th>
<th>STRETCH TIME</th>
<th>DELAY TIME</th>
</tr>
</thead>
<tbody>
<tr>
<td>1A</td>
<td>TB1-12</td>
<td>JU5 56 18</td>
<td>1</td>
<td>1</td>
<td>Y T Y</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>100</td>
</tr>
<tr>
<td>5A</td>
<td>TB1-12</td>
<td>JU5 56 18</td>
<td>1</td>
<td>1</td>
<td>Y T Y</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>100</td>
</tr>
</tbody>
</table>

1. Add jumper from J1-8 to J4-8, on rear of input file.
2. Add jumper from J1-8 to J4-8, on rear of input file.

**Special Detector Note**

Install a video detection system for vehicle detection. Perform installation according to manufacturer's directions and NCDOT engineer-approved mounting locations to accomplish the detection schemes shown on the Signal Design Plans.

For Detection Zones 1A and 5A, the equipment placement and slots reserved for wired inputs are typical for a NCDOT installation.

Detection - Presence Detection and Wired Inputs (Default Phasing)

**Signals Management**

Transportation Mobility and Safety Division

North Carolina Department of Transportation

10-18

STD. NO. 13.3
Presence Detection and Wired Inputs

For the example shown below, all detection was accomplished using a video detection system where the signal plan had both default phasing and alternate phasing. Detection zones 1A and 5A each call two phases and are installed as a wired input. Their specific locations in the Input File need to be as shown so the detector programming is correct and the phasing runs properly during the default and alternate phasing periods. The Special Detector Notes and the programming chart are different than those shown for the electrical detail that only runs default phasing due to the fact that detector operation is reprogrammed during the alternate period and the notes make a reference to instructions found on other sheets of the electrical detail.

**INPUT FILE POSITION LAYOUT**

(for front views)

**INPUT FILE CONNECTION & PROGRAMMING CHART**

LOOP NO. | LOOP TERMINAL | INPUT FILE POS. | PIN NO. | INPUT ASSIGNMENT NO. | DETECTOR NO. | NEMA PHASE | CALL EXTEND | FULL TIME DELAY | STRETCH TIME | DELAY TIME |
---|---|---|---|---|---|---|---|---|---|---|
1A | - | JU | 18 | 1 | 1 | Y | Y | 15 |
- | - | JU | 18 | 18 | 1 | 26 | 6 | Y | Y | 3 |
5A | - | JU | 26 | 17 | 5 | 5 | Y | Y | 15 |
- | - | JU | 26 | 22 | 5 | 2 | Y | T | Y | 3 |

1) Add jumper from J1-1 to J4-1, on rear of input file.
2) Add jumper from J1-5 to J4-5, on rear of input file.
*See Input Page Assignment programming details on sheets 3 and 4.

**SPECIAL DETECTOR NOTES**

1) Install a video detection system for vehicle detection. Perform installation according to manufacturer's directions and NCDOT engineer-approved mounting locations to accomplish the detection schemes shown on the Signal Design Plans.

2) For detection zones 1A and 5A, detector card placement and slots reserved for wired inputs are typical for a NCDOT installation. Inputs associated with these slots are compatible with time of day instructions located on sheets 3 and 4 of this electrical detail.
In Pavement Wireless Detection

In pavement wireless detection systems make use of wireless sensors, repeaters, an access point, and special contact closure cards to implement a vehicle detection system. Wireless sensors are installed beneath the pavement surface and transmit detector information to repeaters that communicate the information to the cabinet via an access point mounted on a pole in the intersection. Each system must have one master CC contact closure card in the input file. Expansion contact closure cards (EX) are available in two and four channel configurations. The details shown below illustrate how a typical pavement wireless detection system would be represented on an electrical detail.

**INPUT FILE POSITION LAYOUT**

(front view)

**INPUT FILE CONNECTION & PROGRAMMING CHART**

<table>
<thead>
<tr>
<th>LOOP NO.</th>
<th>LOOP TERMINAL</th>
<th>INPUT FILE POS.</th>
<th>PIN NO.</th>
<th>INPUT ASSIGNMENT NO.</th>
<th>DETECTOR NO.</th>
<th>NEMA PHASE</th>
<th>CALL EXTENDS</th>
<th>FULL TIME DELAY</th>
<th>STRETCH TIME</th>
<th>DELAY TIME</th>
</tr>
</thead>
<tbody>
<tr>
<td>IA</td>
<td>JIU</td>
<td>56</td>
<td>16</td>
<td>1</td>
<td>1</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>15</td>
<td>32</td>
</tr>
<tr>
<td>4A</td>
<td>JBU</td>
<td>41</td>
<td>3</td>
<td>4</td>
<td>4</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>15</td>
<td>32</td>
</tr>
<tr>
<td>5A</td>
<td>JBU</td>
<td>55</td>
<td>17</td>
<td>5</td>
<td>5</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>15</td>
<td>32</td>
</tr>
<tr>
<td>7A</td>
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<td>7</td>
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<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>15</td>
<td>32</td>
</tr>
<tr>
<td>8A</td>
<td>JBU</td>
<td>42</td>
<td>4</td>
<td>8</td>
<td>8</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>15</td>
<td>32</td>
</tr>
<tr>
<td>8B</td>
<td>JEL</td>
<td>46</td>
<td>8</td>
<td>18</td>
<td>8</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>15</td>
<td>32</td>
</tr>
</tbody>
</table>

* WIRELESS DETECTION SYSTEM

1. Install a Wireless Vehicle Detection System for vehicle detection. Perform installation according to manufacturer's directions and NCDOT Engineer-approved mounting locations to accomplish the detection schemes shown on the signal design plans.

2. Ensure that the Wireless Vehicle Detection System is fully compatible with equipment manufactured in accordance with the specifications for the type 2010 controller.

**SENSYS ACCESS BOX WIRING DETAIL**

**Detection – In Pavement Wireless**

**TRAFFIC SIGNALS MANAGEMENT**

**TRANSPORTATION MOBILITY AND SAFETY DIVISION**

**NORTH CAROLINA DEPARTMENT OF TRANSPORTATION**

STD. NO. 13.4

SHEET 1 OF 1
Detection - GPS Clock Reference

Some systems must derive a clock reference from a satellite by using a GPS antenna. A typical GPS antenna wiring reference that would be shown on an electrical detail is shown below.

CONNECTOR WIRING DETAIL FOR ACUTIME GPS ANTENNA
WITH RS-422 INTERFACE

(make connections as shown)

<table>
<thead>
<tr>
<th>CABINET</th>
</tr>
</thead>
<tbody>
<tr>
<td>DC +24</td>
</tr>
<tr>
<td>GND VDC</td>
</tr>
<tr>
<td>(T3-4)</td>
</tr>
<tr>
<td>(T3-2)</td>
</tr>
</tbody>
</table>

TO ACUTIME UNIT
(FEMALE)

<table>
<thead>
<tr>
<th>ACUTIME</th>
<th>CONVTERMER</th>
</tr>
</thead>
<tbody>
<tr>
<td>SIGNAL</td>
<td>WIRE</td>
</tr>
<tr>
<td>PORT B: RECEIVE-</td>
<td>VIOLET</td>
</tr>
<tr>
<td>PORT B: RECEIVE+</td>
<td>ORANGE</td>
</tr>
<tr>
<td>PORT B: TRANSMIT-</td>
<td>BROWN</td>
</tr>
<tr>
<td>PORT B: TRANSMIT+</td>
<td>YELLOW</td>
</tr>
</tbody>
</table>

Note: All unused wires in the Acutime cable should be tied off.

Configure the Com Port used by the Acutime unit in the Oasis software using the settings below:

* 9600 Baud
* 8 Data Bits
* 1 Stop Bit
* Odd Parity
* Trimble TSIP GPS Protocol

Be sure to enable the “GET TIME FROM GPS” option under 0-1 (Set Clock) menu.
Timed Overlap

A timed overlap is a movement that has additional green time added and will continue to run after its parent phase(s) have timed out or gapped out. Timed overlaps are typically used where upstream traffic needs additional time to move downstream in order to clear out a zone between signals to make room for vehicles coming from side streets, or to give vehicles moving from freeway ramps time to clear a downstream signal before it clears. When the side street is served, the upstream signal(s) on the main street begin their clearance while the downstream signal(s) time their additional green time so the zone between the two signals can be cleared of vehicles before the side street begins moving. Once the extended green time has been served, the overlap clears to yellow and red.

In the example shown to the left, overlap ‘A’ is a vehicle through move on the main street located between the upstream and downstream signal. Its parent phases are 2 and 4 and the overlap is active whenever parent phase 2 or 4 is the active phase.

Whenever either parent phase clears, the vehicle move that is “Timed Overlap A” (TOL A) will begin to time the extended green time as the parent phase(s) clear from yellow to red. After the extended green time is up, the overlap will time its programmed yellow and red clear times and the controller will proceed to the next phase in the sequence.

Programming details for Oasis and ASC/3-2070 for example shown to the left can be found on sheets 2 and 3 of STD. NO. 14.
OVERLAP PROGRAMMING DETAIL
(program controller as shown below)

FROM MAIN MENU PRESS '8' (OVERLAPS), THEN '1' (VEHICLE OVERLAP SETTINGS).

PAGE 1: VEHICLE OVERLAP 'A' SETTINGS
PHASE: 12345678910111213141516
VEH OVL PARENTS: X X
VEH OVL NOT VEH:
VEH OVL NOT PED:
VEH OVL GRN EXT: X X
STARTUP COLOR: _ RED _ YELLOW _ GREEN
FLASH COLORS: _ RED _ YELLOW _ GREEN
SELECT VEHICLE OVERLAP OPTIONS: (Y/N)
FLASH YELLOW IN CONTROLLER FLASH?...Y
GREEN EXTENSION (0-255 SEC)...5
YELLOW CLEAR (0=PARENT, 3-25.5 SEC)...3.4
RED CLEAR (0=PARENT, 0.1-25.5 SEC)...2.0
OUTPUT AS PHASE # (0=None, 1-16)...0

OVERLAP PROGRAMMING COMPLETE

① VEH OVL PARENTS will provide service when any of the selected parent phases are active. When the last active parent phase terminates, the overlap will terminate. Overlaps will time the Green extension, Yellow clearance, and Red clearance specified in the overlap programming detail. If one of these elements is not specified, the overlap will use the same clearances as the terminating parent as shown on the timing chart on the signal plan.

② VEH OVL GRN EXT designates which phase(s) will start the extension timer when the parent phase(s) terminates.

③ GREEN EXTENSION designates the time the overlap will extend its green interval beyond the green termination of the parent phase(s) designated in the VEH OVL GRN EXT field.

④ YELLOW CLEAR designates the yellow clearance interval for the overlap.

⑤ RED CLEAR designates the red clearance interval for the overlap.
ECONOLITE ASC/3-2070
OVERLAP PROGRAMMING DETAIL
(program controller as shown)

1. From Main Menu select 2. CONTROLLER
2. From CONTROLLER Submenu select 2. VEHICLE OVERLAPS

OVERLAP A
Select TMG VEH OVL...[A] and ‘OTHER/ECONOLITE’

| TMG VEH OVL...[A] TYPE: 'OTHER/ECONOLITE' |
| PHASES: 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 |
| INCLUDED: X X X X X X X X X X X X X X |
| PROTECT: .............................. |
| PED PRTE: .............................. |
| NET OVL: .............................. |
| FLSM GRN: .............................. |
| LAG X PH: X X X X X X X X X X X X X X |
| LAG 2 PH: .............................. |
| LAG GRN 5.0 YEL 3.4 RED 2.0 ADV GRN 0.0 |

END PROGRAMMING

② INCLUDED phases specify the phases whose timing state is used to derive the state of the overlap. Generally, when any included phase is timing its green interval or the controller is advancing from one included phase to another included phase, the overlap will be green.

③ LAG (Trailing) X PH identifies which phases are to time programmed trailing green, yellow, and red. If trailing phases are defined, only those phases will time trailing green, yellow, and red when they advance to yellow change and no other included phase is timing or a phase next selection. If no trailing phases are defined, then trailing green, yellow, and red are disabled.

Normally, if an included phase is terminating and no other included phase is timing or a phase next selection, the terminating included phase’s yellow and red are also output to the overlap.

LAG (Trailing) Green, Yellow, Red times provide a means of extending the overlap’s green and then timing a specified yellow and red. When the last timing overlap included phase begins its yellow change, the overlap’s green interval is extended by the specified Trailing Green time. After Trailing Green has timed, Trailing Yellow and Trailing Red times are used to time the overlap’s yellow change and red clearance intervals.
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