

Chapter 20

CABINET PRINT

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20 CABINET PRINT

The cabinet print is a schematic representation of the components that are inside the controller cabinet. This schematic is used mainly by TSSU, Region Electrical Crew, and Region signal timers.

A hard copy of the cabinet print is required to be in the controller cabinet at all times.

20.1 When is a Cabinet Print Required?

A cabinet print is required for all new signals, the first stage for temporary signals, and any modification to an existing traffic signal that will require a change (addition, deletion, or modification) to the components inside the controller cabinet. The cabinet print must be accurate for proper maintenance and timing of the intersection.

20.2 Who is Responsible for Creating a Cabinet Print?

The signal designer is responsible for creating the initial cabinet print(s). The initial cabinet print should be submitted at DAP, when the basic signal equipment layout and normal phase rotation are known. It is critical that the signal timer has adequate time to review and comment on the detector unit placement/zones and provide zone configuration information (shown on Sheet 7) as early as possible in the design process. The cabinet print should be revised as necessary during the design phase based on comments received and completed before the equipment arrives at TSSU for testing (during construction).

The Traffic Signal Standards Unit is responsible for creating the final version of the cabinet print from the red-line as-builts provided by TSSU after installation.

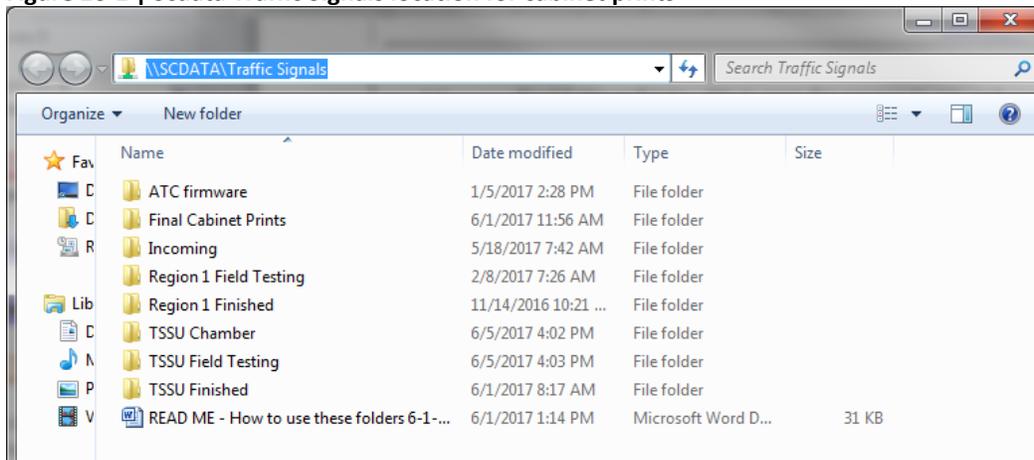
A Cabinet print reflects the conditions shown in the sealed plan sheets and therefore does NOT require a P.E. Stamp.

20.3 Procedure for Producing Cabinet Prints

An internal ODOT folder has been set up to process the various stages of the cabinet print (from start to final version). The location is: [\\scdata\Traffic Signals](#). Within this server folder there are seven subfolders, listed in the order they are used in the process. The process for using the subfolders is explained in the READ ME document. See Figure 20-1:

1. **Incoming** – This is open to anyone: read, write, delete, etc.
2. **TSSU Chamber** – This is open to anyone to see and copy files, but only TSSU can write, delete, etc.
3. **TSSU Field Testing & Region 1 Field Testing** – these are open for anyone to see and copy files, but only TSSU can write, delete, etc.
4. **TSSU Finished & Region 1 Finished** – these are open for anyone to see and copy files, but only TSSU can write, delete, etc.
5. **Final Cabinet Prints** – this is open for anyone to see and copy files, but only Traffic Standards can write, delete, etc.

Figure 20-1 | Scdata Traffic Signals location for cabinet prints



Key information for the Traffic Signal Designer:

1. The cabinet print files (both DGN and PDF) are required in the appropriate INCOMING subfolder **at DAP**. The signal designer should address all comments received on cabinet print before the equipment arrives at TSSU (this is typically 2 to 6 months after the project plans are approved). However, a fast track project may reduce that time to 4 to 8 weeks. Non-ODOT designers should e-mail the files to the Traffic Signal Engineer who will then place the files in the subfolder. Plan accordingly, as failure to produce the cabinet prints in a timely manner may impact the design and construction schedule.
2. The Traffic Signal Designer must contact the Region Signal Timer and request they place the signal timing files within the appropriate INCOMING subfolder. The same time frame described above applies.

If modifications to the cabinet print DO NOT match the conditions shown on the most current, sealed plan sheet(s) for the intersection, a new plan sheet is required (as-built).

20.4 Creating the Cabinet Print

Each intersection should have its own cabinet print file. The file name should begin with the TSSU ID number and abbreviated intersection name using the highway route number, for example “04023_99W_LewisburgRd”.

The cabinet prints are created in microstation. There are five different types of cabinet print base files available on the Traffic Signal Standards website depending on what type of cabinet is used. Select the correct base file for each intersection on the project:

- 332S cabinet print
- 332 cabinet print
- 336 cabinet print
- 334 ramp meter cabinet print
- 334 count (ATR) cabinet print

The base files are available at: <http://www.oregon.gov/ODOT/Engineering/Pages/Signals.aspx> under “MicroStation cabinet prints”.

An excel file “Detector Configuration” for each cabinet is also required to complete the input file (page 2) and the detection drawing (page 7). The signal timer is responsible for filling out the information correctly in the excel file and the signal designer will import that information into the microstation file. These excel files and information on how to import the excel file using Axiom Office Importer is found at the website mentioned above for base files.

The Signal Designer should also look in the FINAL CABINET PRINTS folder for existing information before starting a new cabinet print file: <\\scdata\Traffic Signals\Final Cabinet Prints>. A copy of the existing files may be used and modified for the project. However, creating a new cabinet print file will be necessary for a new traffic signal or when replacing an existing cabinet with different style cabinet (e.g. replacing a 332 with a 332S). For signal Designers outside of ODOT, contact the Traffic Signal Standards Unit to obtain existing cabinet print information.

In the microstation base files, the areas that can be modified are typically shown in red. They are populated with the standard phase layout. There are different levels that can be turned on or off depending on the equipment that is installed (see the additional instructions for using the DGN files on the website). The typical areas that require modification include:

- The title block identifying information (i.e. intersection name, City, Hwy, MP, TSSU ID number, date and revision remarks)The input file (front view and side view)
- The Input and Output file (front view and back view)
- The intersection drawing and the intersection detection drawing

The cabinet print needs to show what is actually used and its intended function. If an area is unused, it should be blank. The other information contained in the cabinet print shows standard electrical schematics that apply to each type of cabinet and are generally not modified.

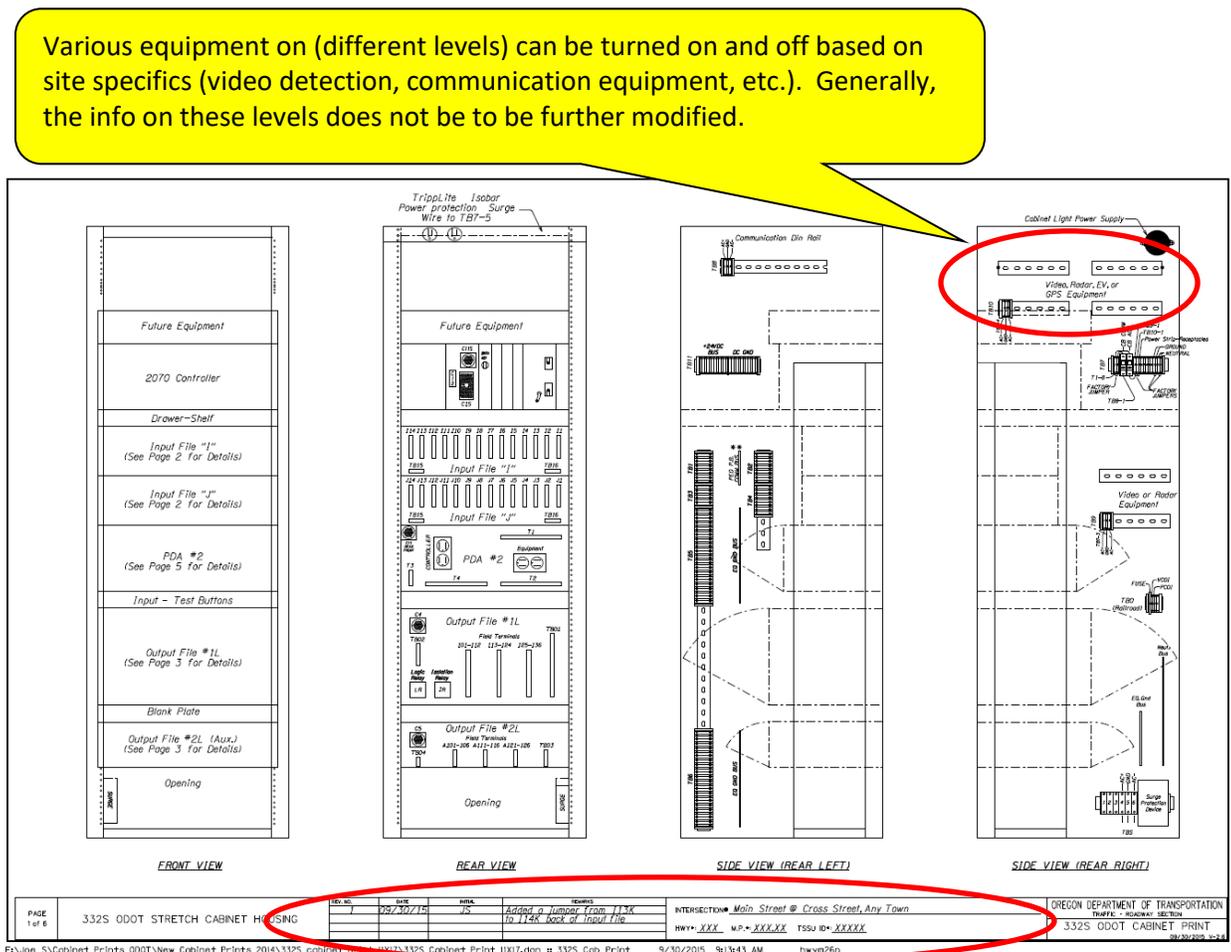
Cabinet prints are formatted for printing on 11x17 paper.

NOTE! All figures in this manual show a 332S cabinet with a C11 connector. The cabinet print layout for the 332 without a C11 connector, 336, and 334 cabinet will be slightly different, but all contain similar elements. The basic information in this manual can be used in conjunction with the appropriate base file.

20.5 332S Cabinet Print (Page 1 – cabinet layout)

Page 1 of the 332S cabinet print shows the front, rear, and both side views of the cabinet. There is not a lot to modify on this sheet, but certain levels and/or references will need to be turned-on or off to show the correct site specific equipment, (i.e. communication equipment, battery back-up, etc.). See Figure 20-2.

Figure 20-2 | 332S Cabinet Print (page 1)



Title block area needs to be filled out as directed

20.6 332S Cabinet Print (Page 2 – Input File)

Page 2 of the 332S cabinet print shows the input file. This sheet requires filling in the information for all the input equipment used. The signal timer is responsible for filling out the majority of the input file information in the Detection Configuration Excel file which is then imported into the microstation cabinet print by the Signal Designer. The basic input equipment (i.e. loop amplifiers, video rack cards, radar rack cards, DC isolators, AC isolators, fire preemption, etc.) that needs to be filled in is shown in Figure 20-3, with the signal timer's responsibility shown shaded in blue. Each bubble note in Figure 20-3 is numbered and described in more detail in the next sections. **Important additional information about the input file is in section 20.6.8.**

Figure 20-3 | 332S Cabinet Print (page 2 – Input File)

1.) Detector input location (fill in equipment and modify phase if necessary)

2.) AC Isolator location (for RxR preemption)

3.) DC Isolator location (for pedestrian detectors)

4.) Ped detector termination (fill in phase)

Signal Timer is responsible for providing info (#1, #2, #3, and #5) in excel file. Signal Designer then imports excel info into microstation

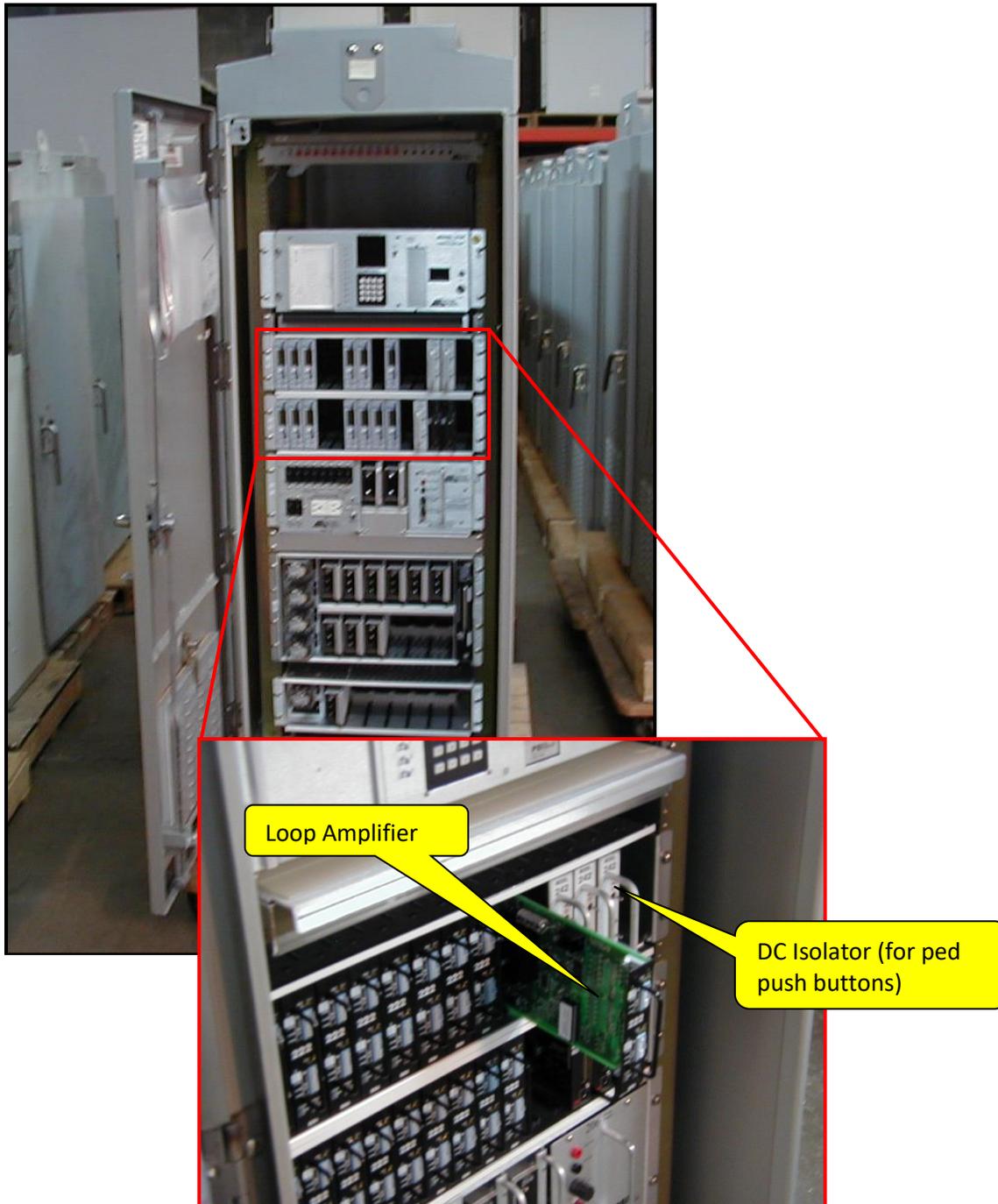
5.) Fire Preemption detectors

6.) Fire Preemption detector termination (fill in phase)

7.) Detector input termination (fill out phase and loop detector number). If loops are not used, leave this area blank.

For reference, Figure 20-4 shows the actual front view of the input file in a 332 cabinet.

Figure 20-4 | 332 Cabinet – Input File (Front View) Actual View



20.6.1 Detector Input Location (Signal Timer Responsibility – Use Excel File)

This spans slots one to slot ten (with the possibility of slot eleven and twelve of the “I” file used as needed). When SDLC connection is used, slots 1 thru 10, I11, and I12 will be blank. When SDLC is not used, equipment will be placed in the input file (for loops, video, radar, etc.). The example below shows where the signal timer will fill in the information (using the Detector Configuration excel file which automates the majority of items shown below). See Chapter 20 for more information on completing the cabinet print.

Equipment goes in the first row below the slot location. The 4 I/O for camera C spans two slots

Check mark the box if the slot/channel is being used. I6U is shown as being used

I1	I2	I3	I4	I5	I6	I7	I8	I9	I10	I11	I12	I13	I14
4 I/O :C		VIP :B & F			4 I/O :D		VIP :A					242	242
φ 1 C1-56 VD1 VD2 C1-60 φ 1	φ 1 C11-16 VD29 VD30 C11-20 φ 1	φ 2 C1-39 VD9 VD10 C1-43 φ 2	φ 2 C1-63 VD11 VD12 C1-76 φ 2	φ 2 C1-47 VD13 VD31 C11-10 φ 2	φ 3 C1-58 VD3 VD4 C1-62 φ 3	φ 3 C11-18 VD32 VD33 C11-22 φ 3	φ 4 C1-41 VD14 VD15 C1-45 φ 4	φ 4 C1-65 VD16 VD17 C1-78 φ 4	φ 4 C1-49 VD18 VD34 C11-12 φ 4	SPARE C11-23	SPARE C11-24	2 PED C1-67	6 PED C1-68
J1	J2	J3	J4	J5	J6	J7	J8	J9	J10	J11	J12	J13	J14
4 I/O :F		VIP :C & E			2 I/O :C		4 I/O :A		VIP :D			752	752
φ 5 C1-55 VD5 VD6 C1-59 φ 5	φ 5 C11-15 VD35 VD36 C11-19 φ 5	φ 6 C1-40 VD19 VD20 C1-44 φ 6	φ 6 C1-64 VD21 VD22 C1-77 φ 6	φ 6 C1-48 VD23 VD27 C1-11 φ 6	φ 7 C1-57 VD7 VD8 C1-61 φ 7	φ 7 C11-17 VD38 VD39 C11-21 φ 7	φ 8 C1-42 VD24 VD25 C1-46 φ 8	φ 8 C1-66 VD26 VD27 C1-79 φ 8	φ 8 C1-50 VD28 VD29 C11-13 φ 8	SPARE C1-54	PCOI C1-51	EVA C1-71	EVB C1-72

Equipment goes in the first row below the slot location. The 2 I/O for camera C spans one slot

Signal Designer will import entire input file from excel (signal timer configures the excel file)

The default phase will be shown here – make sure to modify this if the default phase is not being used (i.e. slot J10U will be reprogrammed to phase 7, not phase 8). Note: The maxtime number and the C1 pin number NEVER change.

Equipment used in the detector input location:

- 222 = Loop detector amplifier
- VIP: T = Video Image Processor (for camera “T”)
- 4 I/O: T = 4 channel input/output module (for camera “T”)
- 2 I/O: T = 2 channel input/output module (for camera “T”)
- RAD:T = Radar unit (for radar unit “T”)

20.6.2 AC Isolator Location (Signal Timer Responsibility – Use Excel File)

This is located in slot J12 (J12U is for the PCOI input and J12L is for the VCOI Input). This location is used for railroad preemption. The equipment module number is 255 (a 252 is used in 332 cabinets). The example below shows where you fill in the equipment.

Equipment goes in the first row below the slot location. The AC isolator for a 332S cabinet is 255

I1	I2	I3	I4	I5	I6	I7	I8	I9	I10	I11		I13	I14
4 I/O :C		VIP :B & F				4 I/O :D		VIP :A				242	242
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
φ 1 C1-56 VD1 VD2 C1-60 φ 1	φ 1 C11-16 VD29 VD30 C11-20 φ 1	φ 2 C1-39 VD9 VD10 C1-43 φ 2	φ 2 C1-63 VD11 VD12 C1-76 φ 2	φ 2 C1-47 VD13 VD31 C11-10 φ 2	φ 3 C1-58 VD3 VD4 C1-62 φ 3	φ 3 C11-18 VD32 VD33 C11-22 φ 3	φ 4 C1-41 VD14 VD15 C1-45 φ 4	φ 4 C1-65 VD16 VD17 C1-78 φ 4	φ 4 C1-49 VD18 VD34 C11-12 φ 4	SPARE C11-23	SPARE C11-25	2 PED C1-24 4 PED C1-26	6 PED C1-67 8 PED C1-68 C1-70
J1	J2	J3	J4	J5	J6	J7	J8	J9	J10	J11	J12	J13	J14
4 I/O :F		VIP :C & E		2 I/O :C	4 I/O :A		VIP :D				255	752	752
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
φ 5 C1-55 VD5 VD6 C1-59 φ 5	φ 5 C11-15 VD35 VD36 C11-19 φ 5	φ 6 C1-40 VD19 VD20 C1-44 φ 6	φ 6 C1-64 VD21 VD22 C1-77 φ 6	φ 6 C1-48 VD23 VD37 C11-11 φ 6	φ 7 C1-57 VD7 VD8 C1-61 φ 7	φ 7 C11-17 VD38 VD39 C11-21 φ 7	φ 8 C1-42 VD24 VD25 C1-46 φ 8	φ 8 C1-66 VD26 VD27 C1-79 φ 8	φ 8 C1-50 VD28 VD40 C11-13 φ 8	SPARE C1-54 GPS	PCOI C1-51 VCOI C1-52	EVA C1-71 EVC C1-73	EVB C1-72 EVD C1-74

INPUT FILE I & J (FRONT VIEW)

(NOT TO SCALE)

Signal Designer will import entire input file from excel (signal timer configures the excel file)

Check mark the box if the slot/channel is being used. Both the PCOI and VCOI inputs are being used

20.6.3 DC Isolator Location (Signal Timer Responsibility – Use Excel File)

This is located in slots I13 and I14 and is used for push button detection. The standard phasing is shown in the diagram. The equipment module number is 242.

Equipment goes in the first row below the slot location. The DC isolator equipment number is 242

I1	I2	I3	I4	I5	I6	I7	I8	I9	I10	I11	I12	I13	I14
4 I/O :C		VIP :B & F			4 I/O :D			VIP :A				242	242
<input checked="" type="checkbox"/>		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>		<input checked="" type="checkbox"/>		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>				<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
φ 1 C1-56 VD1 VD2 C1-60 φ 1	φ 1 C11-16 VD29 VD30 C11-20 φ 1	φ 2 C1-39 VD9 VD10 C1-43 φ 2	φ 2 C1-63 VD11 VD12 C1-76 φ 2	φ 2 C1-47 VD13 VD31 C11-10 φ 2	φ 3 C1-58 VD3 VD4 C1-62 φ 3	φ 3 C11-18 VD32 VD33 C11-22 φ 3	φ 4 C1-41 VD14 VD15 C1-45 φ 4	φ 4 C1-65 VD16 VD17 C1-78 φ 4	φ 4 C1-49 VD18 VD34 C11-12 φ 4	SPARE C11-23 ---	SPARE C11-24 ---	2 PED C1-67 ---	6 PED C1-68 ---
<input checked="" type="checkbox"/>		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>		<input checked="" type="checkbox"/>		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>				<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
J1	J2	J3	J4	J5	J6	J7	J8	J9	J10	J11	J12	J13	J14
4 I/O :F		VIP :C & E		2I/O:C	4 I/O :A		VIP :D					752	752
<input checked="" type="checkbox"/>		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>				<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
φ 5 C1-55 VD5 VD6 C1-59 φ 5	φ 5 C11-15 VD35 VD36 C11-19 φ 5	φ 6 C1-40 VD19 VD20 C1-44 φ 6	φ 6 C1-64 VD21 VD22 C1-77 φ 6	φ 6 C1-48 VD23 VD37 C11-11 φ 6	φ 7 C1-57 VD7 VD8 C1-61 φ 7	φ 7 C11-17 VD38 VD39 C11-21 φ 7	φ 8 C1-42 VD24 VD25 C1-46 φ 8	φ 8 C1-66 VD26 VD27 C1-79 φ 8	φ 8 C1-50 VD28 VD40 C11-13 φ 8	SPARE C1-54 ---	PCOI C1-51 ---	EVB C1-72 ---	EVB C1-74 EVD
<input checked="" type="checkbox"/>		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>		<input checked="" type="checkbox"/>		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>				<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>

INPUT FILE I & J (FRONT VIEW)

(NOT TO SCALE)

Signal Designer will import entire input file from excel (signal timer configures the excel file)

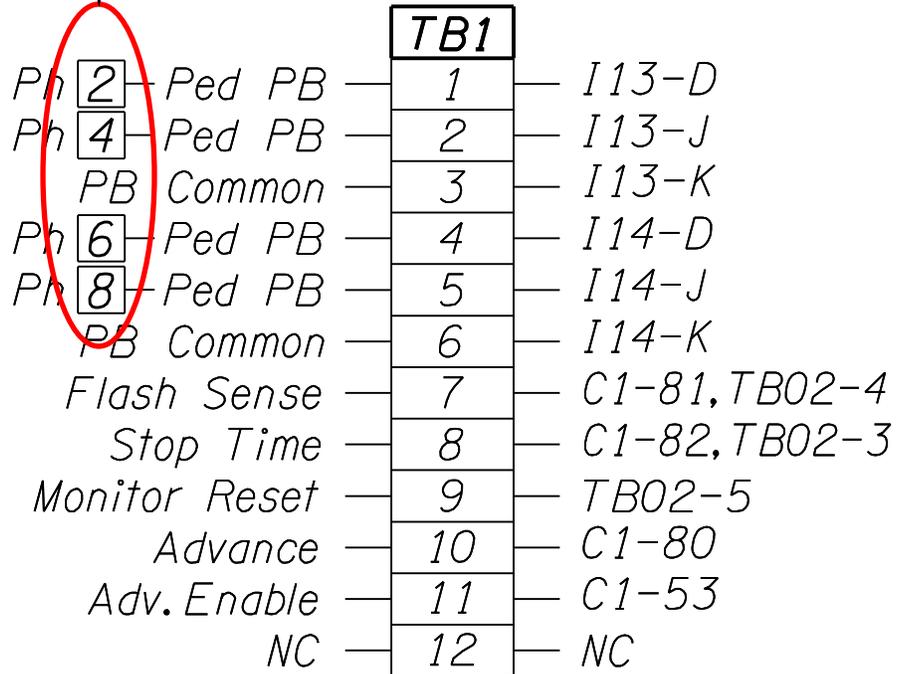
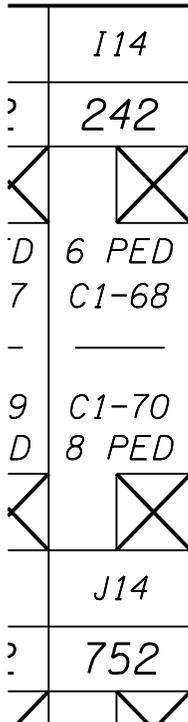
Check mark the box if the slot/channel is being used. All 4 ped phases are used in this example.

20.6.4 Pedestrian Detector Termination

This shows the terminal block where the pedestrian detectors are wired. Fill in the phase for the pedestrian pushbuttons being used.

Fill the box with the phase. Standard phases are shown here. Leave blank if ped phase is not used.

NOTE
 USE PED P.B.COMM.BUS FOR MORE
 THAN 2 PED P.B.COMM.WIRES.(SEE
 PAGE 1 SIDE VIEW REAR LEFT FOR



20.6.5 Fire Preemption Detectors (Signal Timer Responsibility – Use Excel File)

This is located in slots J13 and J14 and is used to provide the input for fire preemption. The equipment modules for fire preemption detectors are 752 (Opticom phase selector) and 2140 (Tomar Stobecom II O.S.P.).

Equipment goes in the first row below the slot location. The equipment number is either 752 or 2140

I1	I2	I3	I4	I5	I6	I7	I8	I9	I10	I11	I12	I13	I14
4 I/O :C		VIP :B & F			4 I/O :D			VIP :A				242	242
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
φ 1 C1-56 VD1 VD2 C1-60 φ 1	φ 1 C11-16 VD29 VD30 C11-20 φ 1	φ 2 C1-39 VD9 VD10 C1-43 φ 2	φ 2 C1-63 VD11 VD12 C1-76 φ 2	φ 2 C1-47 VD13 VD31 C11-10 φ 2	φ 3 C1-58 VD3 VD4 C1-62 φ 3	φ 3 C11-18 VD32 VD33 C11-22 φ 3	φ 4 C1-41 VD14 VD15 C1-45 φ 4	φ 4 C1-65 VD16 VD17 C1-78 φ 4	φ 4 C1-49 VD18 VD34 C11-12 φ 4	SPARE C11-23 C11-25 SPARE	SPARE C11-24 C11-26 SPARE	2 PED C1-67 C1-69 PED	6 PED C1-68 C1-70 8 PED
J1	J2	J3	J4	J5	J6	J7	J8	J9	J10	J11	J12	J13	J14
4 I/O :F		VIP :C & E		2 I/O :C	4 I/O :A		VIP :D					752	752
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
φ 5 C1-55 VD5 VD6 C1-59 φ 5	φ 5 C11-15 VD35 VD36 C11-19 φ 5	φ 6 C1-40 VD19 VD20 C1-44 φ 6	φ 6 C1-64 VD21 VD22 C1-77 φ 6	φ 6 C1-48 VD23 VD37 C11-11 φ 6	φ 7 C1-57 VD7 VD8 C1-61 φ 7	φ 7 C11-17 VD38 VD39 C11-21 φ 7	φ 8 C1-42 VD24 VD25 C1-46 φ 8	φ 8 C1-66 VD26 VD27 C1-79 φ 8	φ 8 C1-50 VD28 VD40 C11-13 φ 8	SPARE C1-54 C1-75 GPS	PCOI C1-51 C1-52 VCOI	EVA C1-71 C1-73 EVC	EVB C1-72 C1-74 EVD

INPUT FILE I & J (FRONT VIEW)

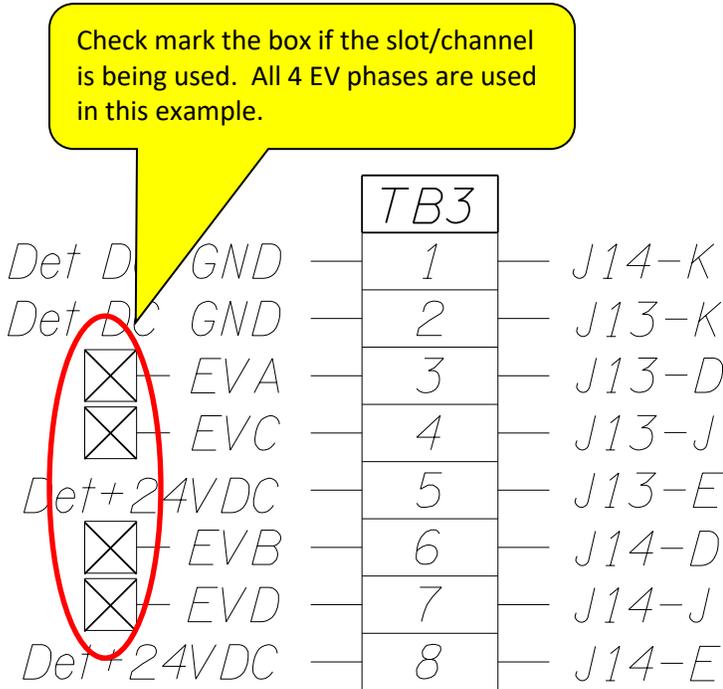
(NOT TO SCALE)

Signal Designer will import entire input file from excel (signal timer configures the excel file)

Check mark the box if the slot/channel is being used. All 4 EV phases are used in this example.

20.6.6 Fire Preemption Detection Termination

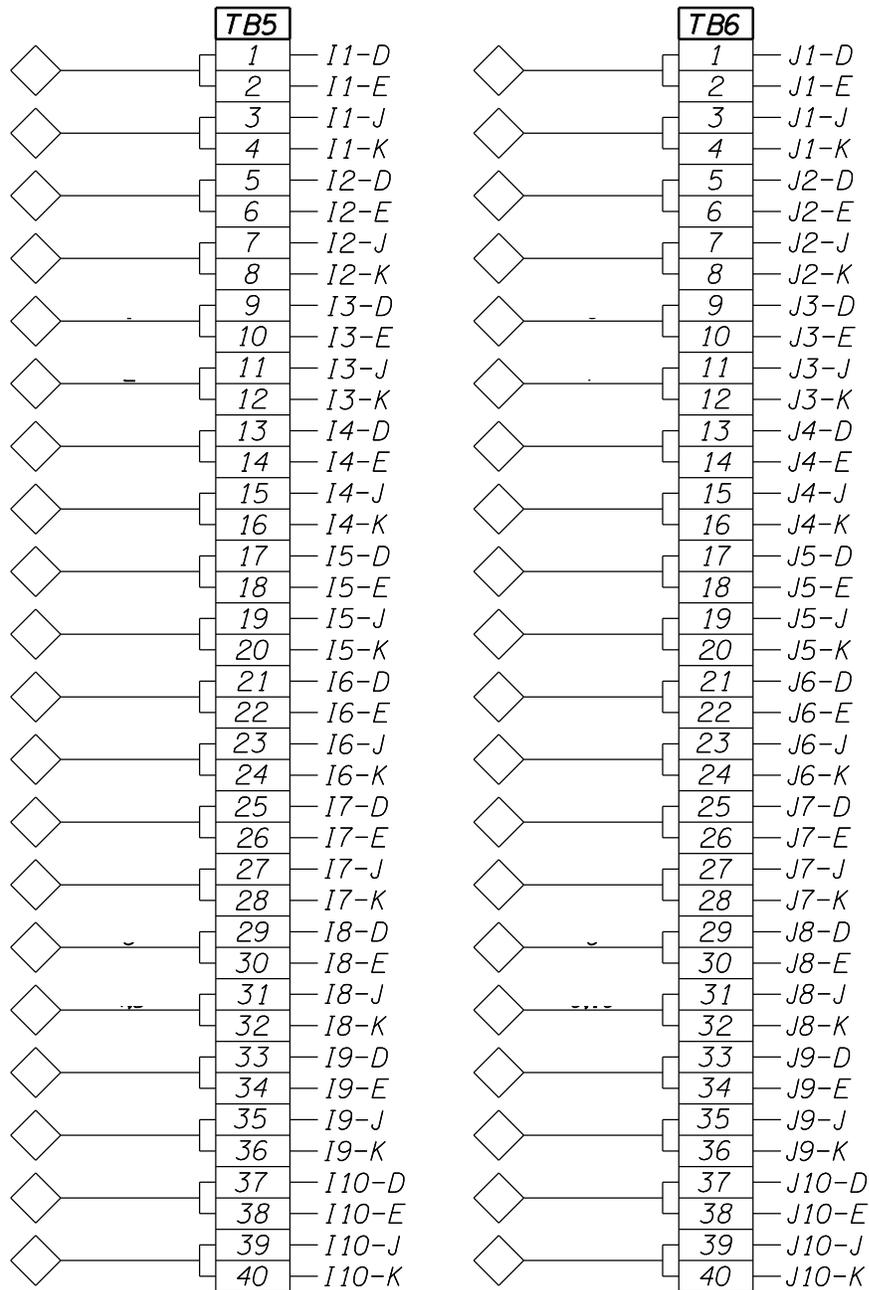
This shows the terminal block where the fire preemption is wired. Mark the check box if the EV channel is being used.

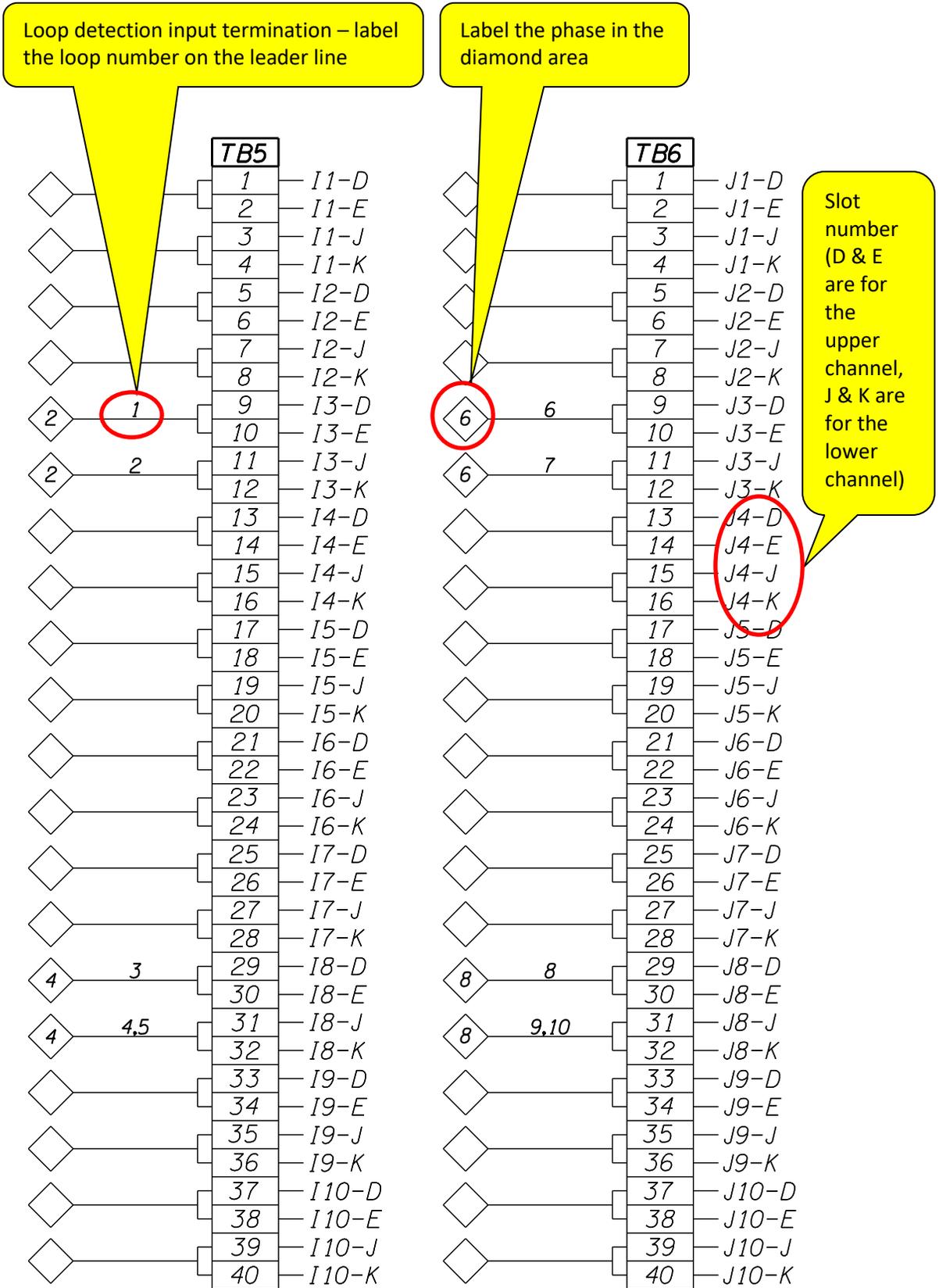


20.6.7 Detector Input Termination

This shows the terminal block where the vehicle detection is wired (TB5 and TB6). In a 332s cabinet, this location should remain blank when using video, radar or SDLC as shown in the first example below (display the proper models as per the microstation base file instructions). Loop detection is the only type of detection that requires entering info and is shown in the second example on the following page.

Leave TB5 and TB6 Blank if using Video, Radar or SDLC





20.6.8 Additional Information about the Input File

1. The 332 cabinet without a C11 connector has 28 vehicle inputs using 9 slots and 2 input files that is wired to accommodate:
 - 2 vehicle detection inputs to the controller for each odd numbered phase
 - 5 vehicle detection inputs to the controller for each even numbered phase
 - 4 pedestrian detection inputs (Slot I12 and I13)
 - 4 emergency preemption inputs (Slot J12 and J13)
 - 2 railroad preemption inputs (Slot J11: indirect via 4 C1 pins using a 252 AC Isolator)
 - 0 spares

Each input file slot has (2) channels associated with it, the upper and the lower. The slot may have one or two controller inputs wired to it. Slots 1, 4, 5, and 8 have one controller input. Slots 2, 3, 6, 7, 9, 12, and 13 have two controller inputs. Slot 10, I11 and 14 have no inputs and are not used (i.e. no C1 pin).

If a viewcom module is used, it will go in slot I10 and I11.

2. The 332S cabinet with a C11 connector uses has 40 vehicle inputs using 10 slots and 2 input files that is wired to accommodate:
 - 4 vehicle detection inputs to the controller for each odd numbered phase
 - 6 vehicle detection inputs to the controller for each even numbered phase
 - 4 pedestrian detection inputs (Slot I13 and I14)
 - 4 emergency preemption inputs (Slot J13 and J14)
 - 2 railroad preemption inputs (Slot J12: direct via inverting a 255 AC isolator)
 - 1 GPS (J11L)
 - 5 spares (Slot I11U, I11L, J11U, J12U, and J12L)

Each input file slot has (2) channels associated with it, the upper and the lower. All slots have two controller inputs wired to it (assigned to the C1 or C11 connector).

If a viewcom module is used, it will go in slot I11 and I12. The C11 pins need to be disconnected for the viewcom module to function.

20.7 332S Cabinet Print (Page 3 – Output File)

Page 3 of the 332S cabinet print shows the output file and conflict monitor. This sheet requires filling in the information for all the output equipment used. The basic output equipment (i.e. load switches, flash transfer relays, flash plugs, etc.) that needs to be filled in is shown in Figure 20-5. Each bubble note in Figure 20-5 is numbered and described in more detail in the next sections. **Important additional information about the output file is in section 20.7.5.**

Figure 20-5 | 332S Cabinet Print (page 3 – Output File)

1.) Main Output File (front view) - check mark boxes that are used, label phase and flash plug color

2.) Main Output File (back view) - label phases

3.) Conflict Monitor Diode Card

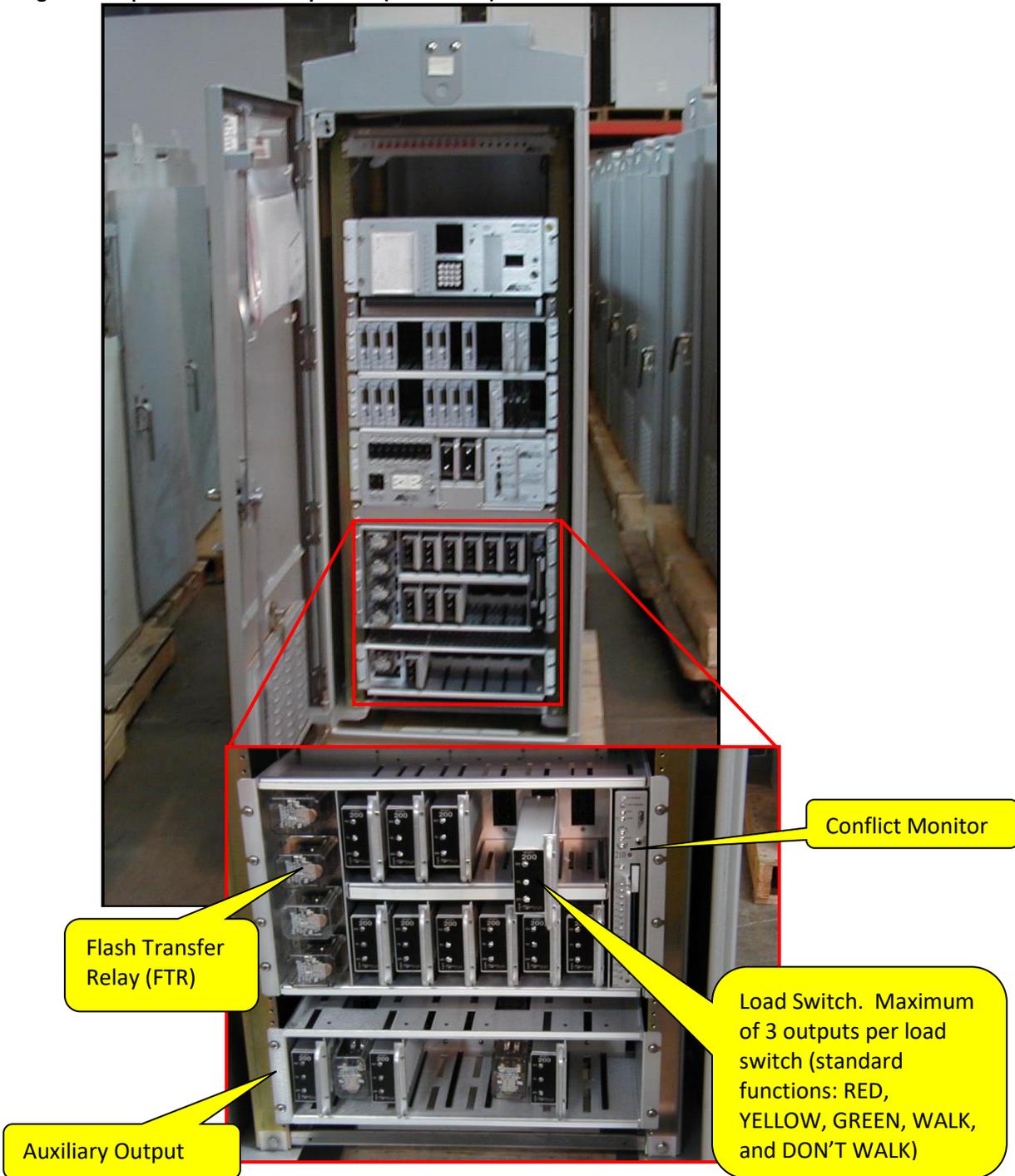
4.) Auxiliary Output File (front and back) – If used, mark and label the same as Main Output File front and back.

The figure contains several technical diagrams and tables:

- Conflict Monitor:** A grid with columns labeled FTR-1 through FTR-4 and rows labeled Ph, Ph, Ph, Ph, Ph, Ph. It includes a 'Conflict Monitor' label on the right.
- MONITOR DIODE CARD:** A table with columns for Channel Assignment (Ch.5 to Ch.16) and Yellow Inhibit Jumpers (1 to 16). It also includes a section for Diodes (Diode Removed Means Movement Allowable (Diode M4148)) with columns 1-2 through 1-16.
- CONFLICT MONITOR - TYPICAL CONNECTOR PIN ASSIGNMENTS:** A table with columns for Pin, Function, and Term. It lists various components like SPB-W, SPB-Y, SPB-G, SPB-B, SPB-R, SPB-O, SPB-P, SPB-T, SPB-U, SPB-V, SPB-W, SPB-X, SPB-Y, SPB-Z, SPB-AA, SPB-AB, SPB-AC, SPB-AD, SPB-AE, SPB-AF, SPB-AG, SPB-AH, SPB-AI, SPB-AJ, SPB-AK, SPB-AL, SPB-AM, SPB-AN, SPB-AO, SPB-AP, SPB-AQ, SPB-AR, SPB-AS, SPB-AT, SPB-AU, SPB-AV, SPB-AW, SPB-AX, SPB-AY, SPB-AZ, SPB-AA, SPB-AB, SPB-AC, SPB-AD, SPB-AE, SPB-AF, SPB-AG, SPB-AH, SPB-AI, SPB-AJ, SPB-AK, SPB-AL, SPB-AM, SPB-AN, SPB-AO, SPB-AP, SPB-AQ, SPB-AR, SPB-AS, SPB-AT, SPB-AU, SPB-AV, SPB-AW, SPB-AX, SPB-AY, SPB-AZ.
- CONFLICT MONITOR - TYPICAL WIRING:** A diagram showing a grid with columns labeled A1 through A6 and rows labeled FTR-5 through FTR-6. It includes a 'Conflict Monitor' label on the right.
- OUTPUT FILE #1 (FRONT VIEW):** A table with columns for Phase (T01, T02, T03, T04, T05, T06, T07, T08, T09, T10, T11, T12, T13, T14, T15, T16, T17, T18, T19, T20, T21, T22, T23, T24, T25, T26, T27, T28, T29, T30, T31, T32, T33, T34, T35, T36, T37, T38, T39, T40, T41, T42, T43, T44, T45, T46, T47, T48, T49, T50, T51, T52, T53, T54, T55, T56, T57, T58, T59, T60, T61, T62, T63, T64, T65, T66, T67, T68, T69, T70, T71, T72, T73, T74, T75, T76, T77, T78, T79, T80, T81, T82, T83, T84, T85, T86, T87, T88, T89, T90, T91, T92, T93, T94, T95, T96, T97, T98, T99, T100, T101, T102, T103, T104, T105, T106, T107, T108, T109, T110, T111, T112, T113, T114, T115, T116, T117, T118, T119, T120, T121, T122, T123, T124, T125, T126, T127, T128, T129, T130, T131, T132, T133, T134, T135, T136, T137, T138, T139, T140, T141, T142, T143, T144, T145, T146, T147, T148, T149, T150, T151, T152, T153, T154, T155, T156, T157, T158, T159, T160, T161, T162, T163, T164, T165, T166, T167, T168, T169, T170, T171, T172, T173, T174, T175, T176, T177, T178, T179, T180, T181, T182, T183, T184, T185, T186, T187, T188, T189, T190, T191, T192, T193, T194, T195, T196, T197, T198, T199, T200, T201, T202, T203, T204, T205, T206, T207, T208, T209, T210, T211, T212, T213, T214, T215, T216, T217, T218, T219, T220, T221, T222, T223, T224, T225, T226, T227, T228, T229, T230, T231, T232, T233, T234, T235, T236, T237, T238, T239, T240, T241, T242, T243, T244, T245, T246, T247, T248, T249, T250, T251, T252, T253, T254, T255, T256, T257, T258, T259, T260, T261, T262, T263, T264, T265, T266, T267, T268, T269, T270, T271, T272, T273, T274, T275, T276, T277, T278, T279, T280, T281, T282, T283, T284, T285, T286, T287, T288, T289, T290, T291, T292, T293, T294, T295, T296, T297, T298, T299, T300, T301, T302, T303, T304, T305, T306, T307, T308, T309, T310, T311, T312, T313, T314, T315, T316, T317, T318, T319, T320, T321, T322, T323, T324, T325, T326, T327, T328, T329, T330, T331, T332, T333, T334, T335, T336, T337, T338, 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T2004, T2005, T2006, T2007, T2008, T2009, T2010, T2011, T2012, T2013, T2014, T2015, T2016, T2017, T2018, T2019, T2020, T2021, T2022, T2023, T2024, T2025, T2026, T2027, T2028, T2029, T2030, T2031, T2032, T2033, T2034, T2035, T2036, T2037, T2038, T2039, T2040, T2041, T2042, T2043, T2044, T2045, T2046, T2047, T2048, T2049, T2050, T2051, T2052, T2053, T2054, T2055, T2056, T2057, T2058, T2059, T2060, T2061, T2062, T2063, T2064, T2065, T2066, T2067,

For reference, Figure 20-6 shows the actual front view of the output file in a 332 cabinet (which is very similar to the 332S).

Figure 20-6 | 332 Cabinet – Output File (Front View) Actual View

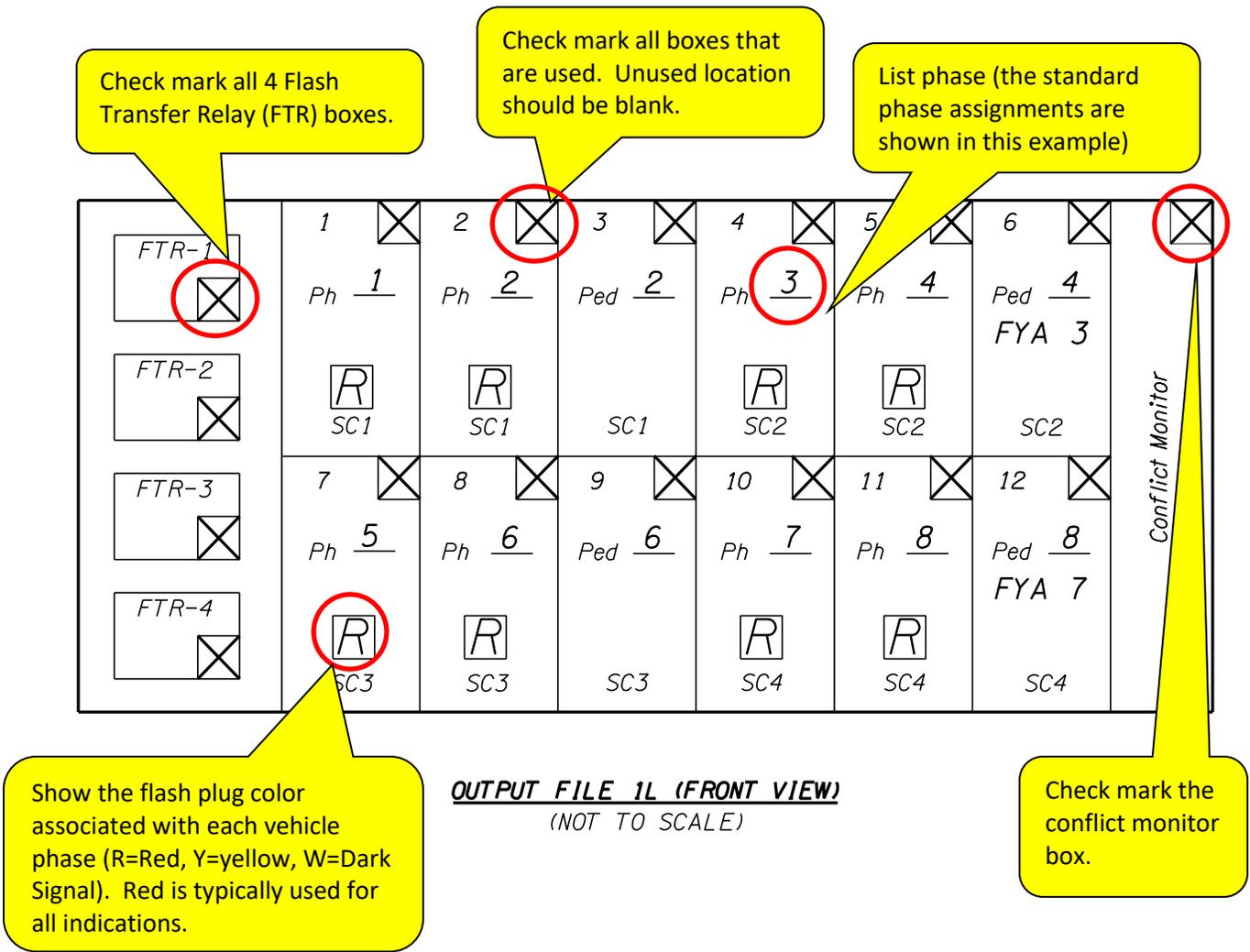


20.7.1 Main Output File (Front View):

This location shows the load switches that are used to power the field indications (vehicle signals: RED, YELLOW, GREEN and pedestrian signals: WALK, FLASHING DON'T WALK). Other types of powered indications, such as PTR signs or advance flashing beacons may be wired to a load switch. Each load switch that corresponds to a vehicle phase will have a flash plug (RED, YELLOW, or WHITE).

The flash transfer relays (FTR) are used to switch power from the load switches to the flasher units during cabinet flash. All four flash transfer relays should be included.

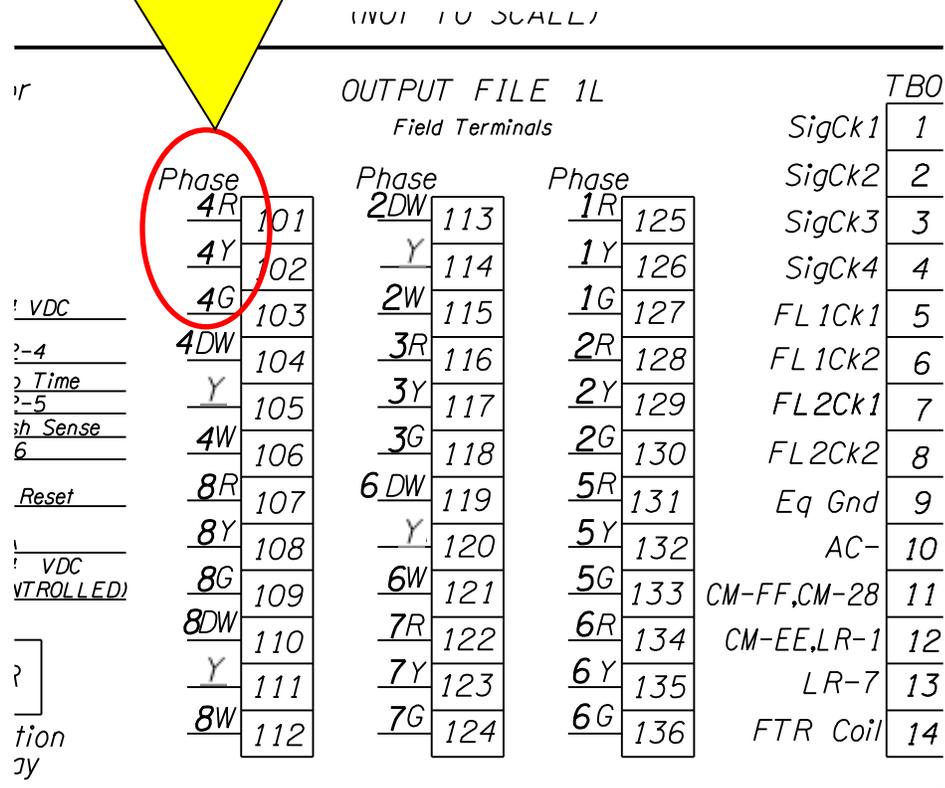
The conflict monitor checks the green indications, Flashing Yellow Arrow and WALK indications (and a few other items, such as voltage, connection to the controller, etc.) and causes the signal to go into cabinet flash if any conflicting indications come up together.



20.7.2 Main Output File (Back View)

This shows the terminal blocks for the output file. Fill in the phases being used.

Fill in the phase for the Red (R), Yellow (Y), Green (G), Walk (W), and Flashing Don't Walk (DW) indications. Standard phasing is shown in the example.



OUTPUT FILE 1L (REAR VIEW)

(NOT TO SCALE)

20.7.3 Conflict Monitor Diode Card

The signal designer will complete the conflict monitor diode card. It will be reviewed and approved by TSSU and/or Traffic Standards. By default, the conflict monitor is configured such that ALL phases are conflicting (all diodes are intact). The diodes for non-conflicting phases will be removed, leaving the diodes for conflicting phases intact. Only the phases that are actually used will determine the monitor configuration (i.e. if phase 3 and 7 are not used, those diodes will remain intact, even though phase 3 and phase 7 are typically non-conflicting phases).

CONFLICT MONITOR DIODE CARD

CHANNEL ASSIGNMENT

Ch.1 <i>ph 1</i>	Ch.5 <i>ph 5</i>	Ch.9 <i>NU</i>	Ch.13 <i>ped2</i>
Ch.2 <i>ph 2</i>	Ch.6 <i>ph 6</i>	Ch.10 <i>NU</i>	Ch.14 <i>ped4</i>
Ch.3 <i>ph 3</i>	Ch.7 <i>ph 7</i>	Ch.11 <i>NU</i>	Ch.15 <i>ped6</i>
Ch.4 <i>ph 4</i>	Ch.8 <i>ph 8</i>	Ch.12 <i>NU</i>	Ch.16 <i>ped8</i>

YELLOW INHIBIT JUMPERS

2	3	4	5	6	7	8	
9	10	11	12	13	14	15	16

DIODES - Diode Removed Makes Movement Allowable (Diode IN4148)

1-2	2-3	3-4	4-5	5-6	6-7	7-8	8-9
1-3	2-4	3-5	4-6	5-7	6-8	7-9	8-10
1-4	2-5	3-6	4-7	5-8	6-9	7-10	8-11
1-5	2-6	3-7	4-8	5-9	6-10	7-11	8-12
1-6	2-7	3-8	4-9	5-10	6-11	7-12	8-13
1-7	2-8	3-9	4-10	5-11	6-12	7-13	8-14
1-8	2-9	3-10	4-11	5-12	6-13	7-14	8-15
1-9	2-10	3-11	4-12	5-13	6-14	7-15	8-16
1-10	2-11	3-12	4-13	5-14	6-15	7-16	9-16
1-11	2-12	3-13	4-14	5-15	6-16	10-16	9-15
1-12	2-13	3-14	4-15	5-16	11-16	10-15	9-14
1-13	2-14	3-15	4-16	12-16	11-15	10-14	9-13
1-14	2-15	3-16	13-16	12-15	11-14	10-13	9-12
1-15	2-16	14-16	13-15	12-14	11-13	10-12	9-11
1-16	15-16	14-15	13-14	12-13	11-12	10-11	9-10

CONFLICT MONITOR DIODE CARD CUTOUT
(NOT TO SCALE)

These are the channels that are used (channels that are not used are marked "NU")

Yellow inhibit jumpers allow the yellow indication to be monitored when removed (normally these will NOT be removed. In the past, these were only removed to allow for monitoring of the FYA)

Ch. 1 (assigned to ph.1) and Ch. 6 (assigned to ph. 6) are shown as non-conflicting phases (the diode line string has been deleted) and a circle is drawn around it to make it stand out

All of the phase combinations that are possible each have a diode. If the diode is removed, then the two phases can run concurrently.

Ch. 7 (assigned to ph. 7) and Ch. 8 (assigned to ph. 8) are shown as conflicting phases (the diode line string is still intact)

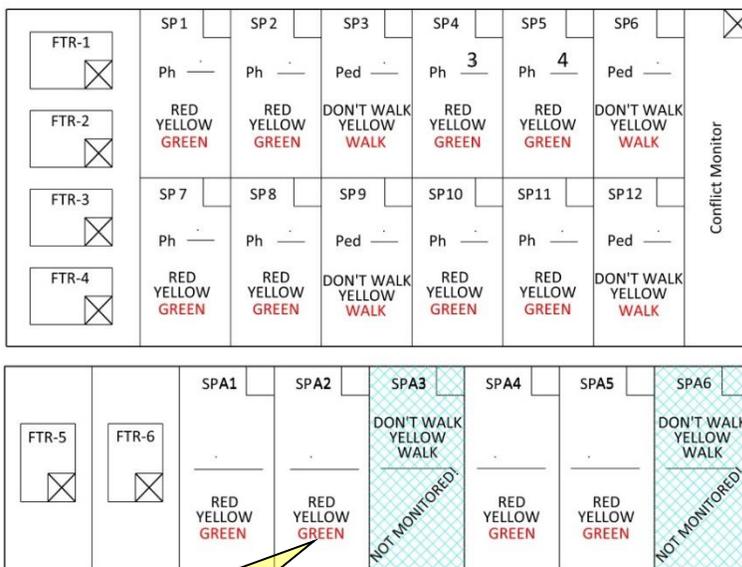
Outputs That Are Monitored

All GREEN, WALK and FLASHING YELLOW ARROW outputs for each phase shall be monitored by the conflict monitor. These are critical indications for each phase because they inform the driver or pedestrian when it is OK to enter or precede through the intersection. Monitoring these outputs for conflict ensures that a driver or pedestrian will never be incorrectly informed when it is OK to enter the intersection.

The GREEN and WALK outputs are always wired to the conflict monitor by the manufacturer as per the Standard Specification for Microcomputer Signal Controller. See Figure 20-7 with the monitored channels shown in red. **ANY OUTPUT ASSIGNED TO ONE OF THESE LOCATIONS WILL BE MONITORED. Do NOT reassign an output that shouldn't be monitored to one of these locations.**

The YELLOW indication can be monitored by removing the Yellow Inhibit Jumpers on the diode card (note: this was used in the past for monitoring Flashing Yellow Arrows), but it does not operate independently of the GREEN indication on the same load switch. For example, if ped phase 2 YELLOW is monitored by removing the yellow inhibit jumpers, it will have the exact same conflicts as ped phase 2 WALK. This can be advantageous for monitoring the Flashing Yellow Arrow, as the opposing pedestrian phase typically has the same conflicts (e.g. Ped phase 2 WALK has the same conflicts as Ph. 1 Flashing Yellow Arrow), but widespread use of not-ped phasing, overlaps, and Type 3LCF signal heads resulted in problems when monitoring the FYA via the YELLOW indication. Therefore, this method is no longer allowed. See Section 20.12.1 for more info.

Figure 20-7 | Monitored Outputs



The YELLOW can be monitored by removing the yellow inhibit jumpers on the diode card. Note: THIS IS NO LONGER USED FOR FYA.



Outputs shown in red are always monitored

Each Switch Pack Location has a load switch with three outputs:
 For vehicle phases: RED, YELLOW, and GREEN
 For ped phases: FLASHING DON'T WALK, YELLOW, and WALK

Not all outputs require conflict monitoring as they are not as critical to eliminating the crash potential associated with being incorrectly informed. For example the YELLOW and RED outputs for each phase inform the driver or pedestrian that they must stop. If a driver is shown one of these indications erroneously, the action the driver is informed to take (stop) should not result in a crash with a conflicting vehicle that has been informed by a GREEN indication.

Outputs that are not monitored include:

- RED outputs
- YELLOW outputs
- FLASHING DON'T WALK outputs
- PTR sign outputs*
- Fire signal confirmation indication outputs* (this does not apply to tattle-tail lights which are not assigned to an output and are directly wired to the RED signal indication)

*It is important to note that PTR sign output and Fire signal confirmation indication outputs always require an output reassignment (as they do not have a standard output location). Do not reassign these outputs to a load switch location that is monitored (See Figure 20-7. e.g. GREEN or WALK).

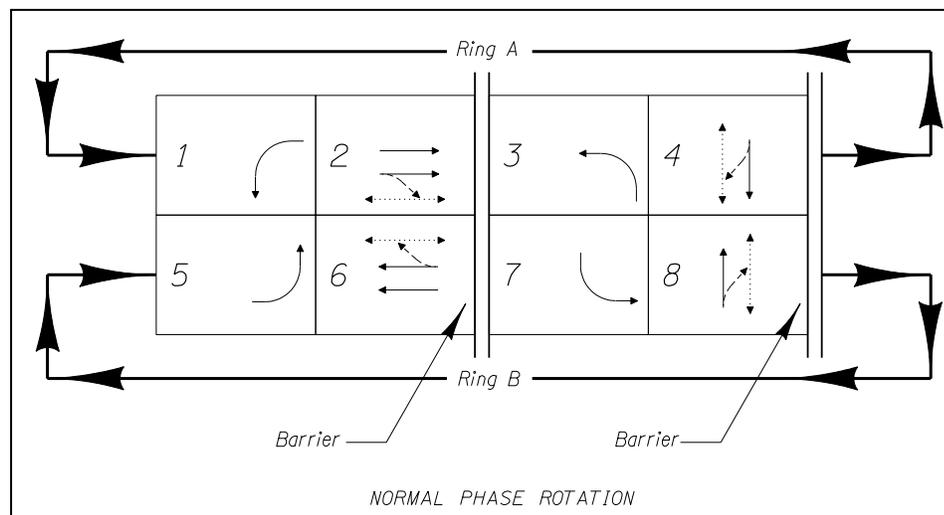
The conflict monitor also monitors other critical aspects of the how the traffic signal is functioning (watchdog, voltages, etc.) as per the Standard Specification for Microcomputer Signal Controller. Unlike the Diode Card, these aspects do NOT require a custom configuration for each intersection.

Rules for Standard Signal Timing Configurations

When using a standard ring and barrier configuration (see Figure 20-8 and Chapter 3 for more information on ring and barrier configuration), the following rules apply:

- An active phase is defined as a movement whose GREEN, WALK, or FLASHING YELLOW ARROW intervals are being timed by the controller.
- Only ONE active phase per ring at a time
- A phase can be active with the phase vertically opposite or diagonal from it as long as it exists on the same side of the barrier. These are called compatible phases (i.e. Phase 1 and Phase 5, Phase 1 and Phase 6)
- Both rings must cross the barrier at the same time

Figure 20-8 | Standard 8 Phase Ring and Barrier Diagram



When using overlap phases the following rules apply:

- An overlap phase may be assigned with any phase or number of phases. These are called the parent phase(s).
- An overlap phase will be permitted by every phase compatible with the assigned parent phase. For example, if Figure 20-8 had an OLA = phase 2, then OLA will also be permitted with ped phase 2, phase 5, phase 6, ped phase 6.
- Any phase can have a pedestrian phase assigned to it, limited by the available outputs from the controller.

When using flashing yellow arrow the following rules apply (for additional background information see Section 20.12.1):

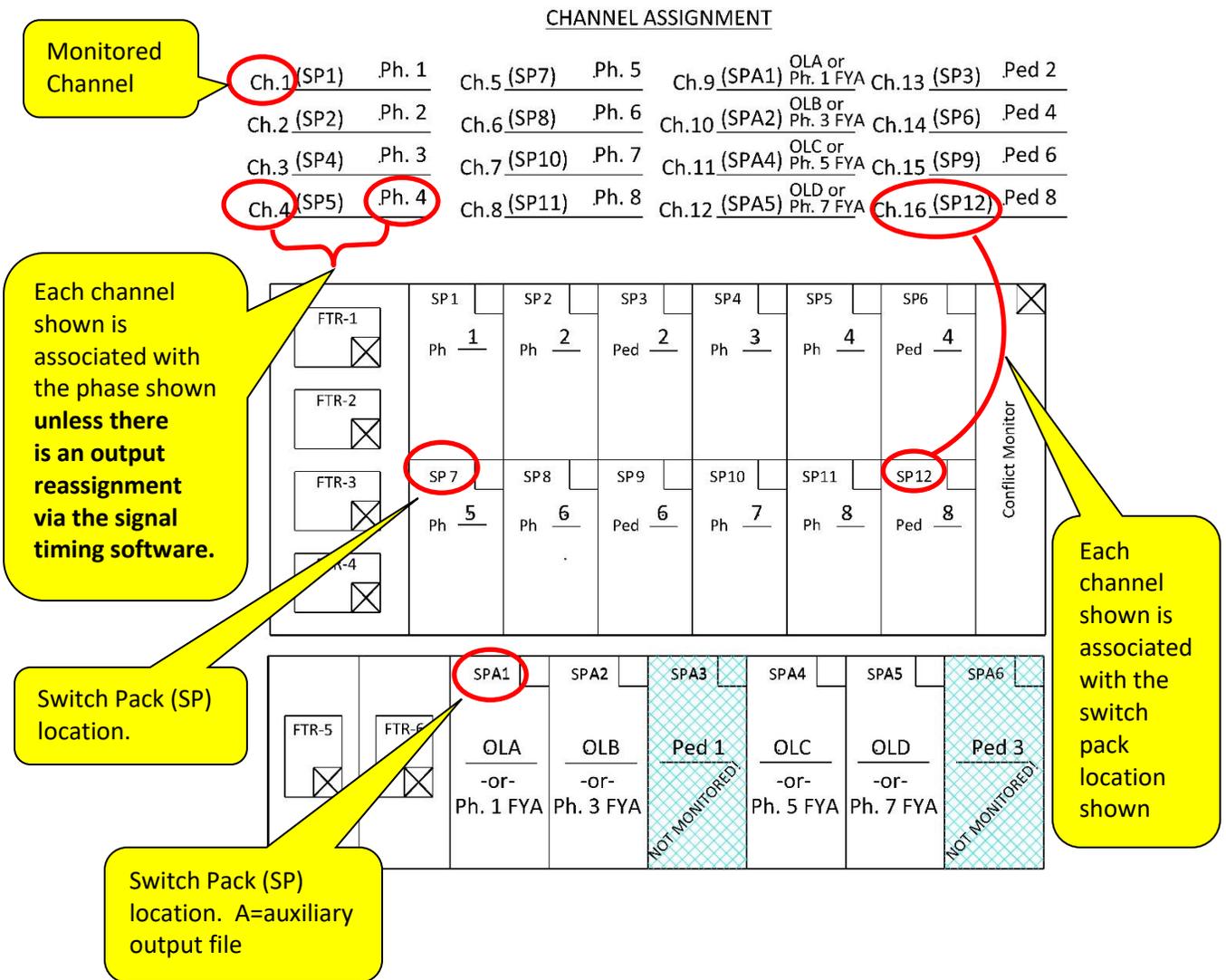
- The flashing yellow arrow signal head type shall be a Type 3LCF
- Phase 1 FYA = Channel 9
 - RED arrow terminated on ph. 1 RED
 - FYA/solid YELLOW arrow terminated on OLA GREEN
 - GREEN arrow terminated on ph. 1 GREEN

- Phase 3 FYA = Channel 10
 - RED arrow terminated on ph. 3 RED
 - FYA/solid YELLOW arrow terminated on OLB GREEN
 - GREEN arrow terminated on ph. 3 GREEN
- Phase 5 FYA = Channel 11
 - RED arrow terminated on ph. 5 RED
 - FYA/solid YELLOW arrow terminated on OLC GREEN
 - GREEN arrow terminated on ph. 5 GREEN
- Phase 7 FYA = Channel 12
 - RED arrow terminated on ph. 7 RED
 - FYA/solid YELLOW arrow terminated on OLD GREEN
 - GREEN arrow terminated on ph. 7 GREEN

Channel Assignment - Standard

On a standard Model 210 conflict monitor, there are 16 channels that can be monitored. Each active phase (GREEN, WALK, or flashing yellow arrow) shall be assigned to a channel on the conflict monitor. The standard channel and phase assignment is shown in Figure 20-9. Switch Packs A3 and A6 are NOT wired to the conflict monitor. Each monitored channel is ALWAYS directly wired to Switch Pack location as shown in Figure 20-9. For example, Channel 1 (regardless of what phase channel 1 is associated with) is ALWAYS wired to Switch Pack 1. Each channel is associated with phase shown in Figure 20-9, unless there are output reassignments (done via the signal software).

Figure 20-9 | Standard Channel Assignment



Channel Assignment – Output Reassignments

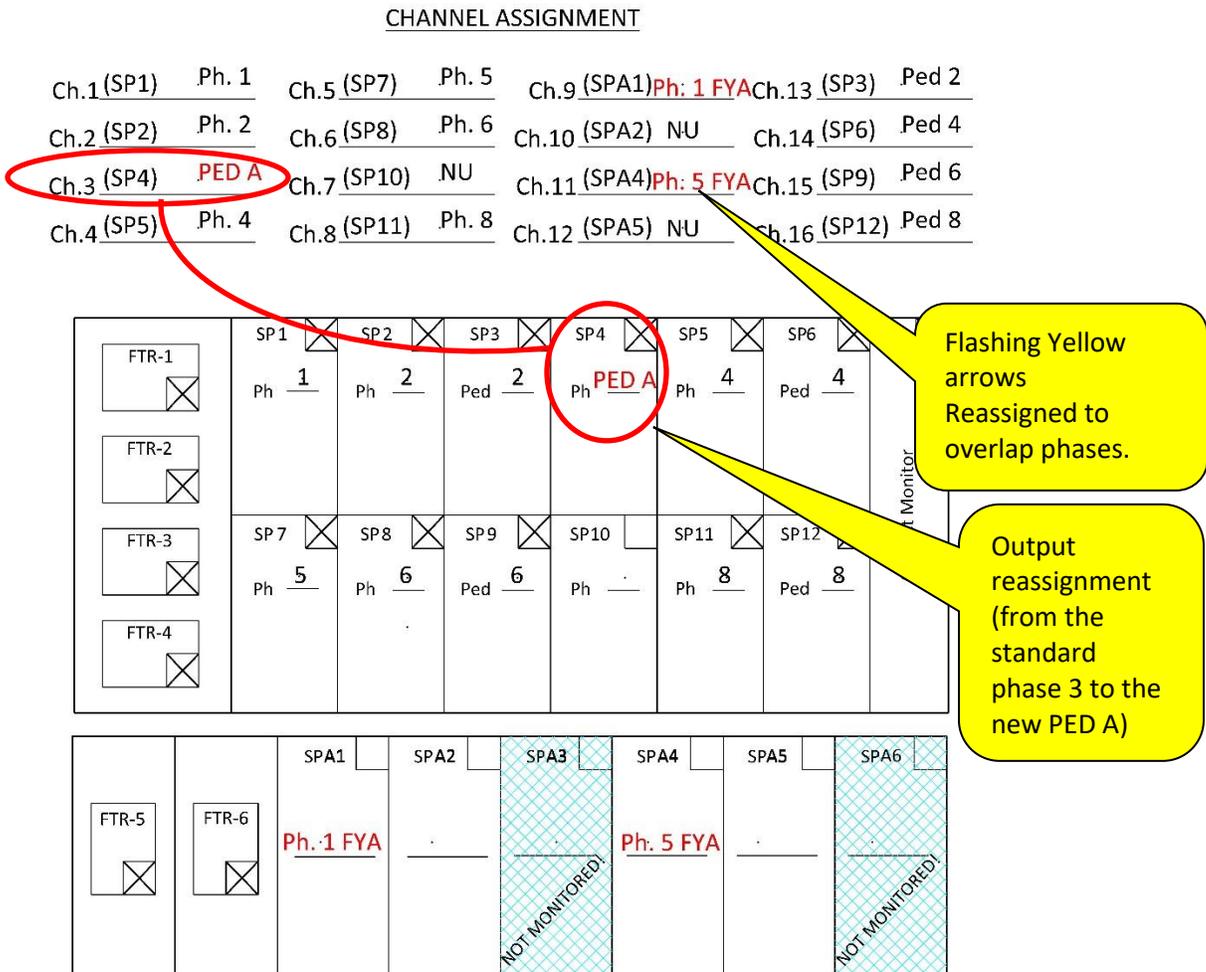
There are cases where it is necessary to reassign the output because a standard designation does not exist in the output file, such as:

- an odd numbered ped phase
- a flashing yellow arrow
- a ped overlap phase

In the past, output reassignments for vehicle overlap phases were commonly done to avoid installing an auxiliary output file. Auxiliary output files are now installed standard in 332S cabinets so this practice is no longer required for new installations.

Output reassignments are done via the signal timing software. **Always verify with the Signal Timer any output reassignments.** Figure 20-10 shows an example where the Channel 3, switch pack location SP4 has been reassigned to Ped A. Flashing yellow arrows have been reassigned to the unused overlap phase switch packs.

Figure 20-10 | Channel Assignment – Output Reassignments



Determining Compatible Phases for the Diode Card

Collect all information about the intersection that will be needed in order to determine the compatible phases, such as:

- Vehicle phases in use
- Pedestrian phases in use
- Parent phase assignments of overlaps
- Exclusive phase assignments
- Output reassignments from signal timing
- Load switches in use
- Existing cabinets: verify cabinet is wired as per standard with TSSU

Step 1: Assign phases to the channels. If a channel is not used, write “NU” next to it.

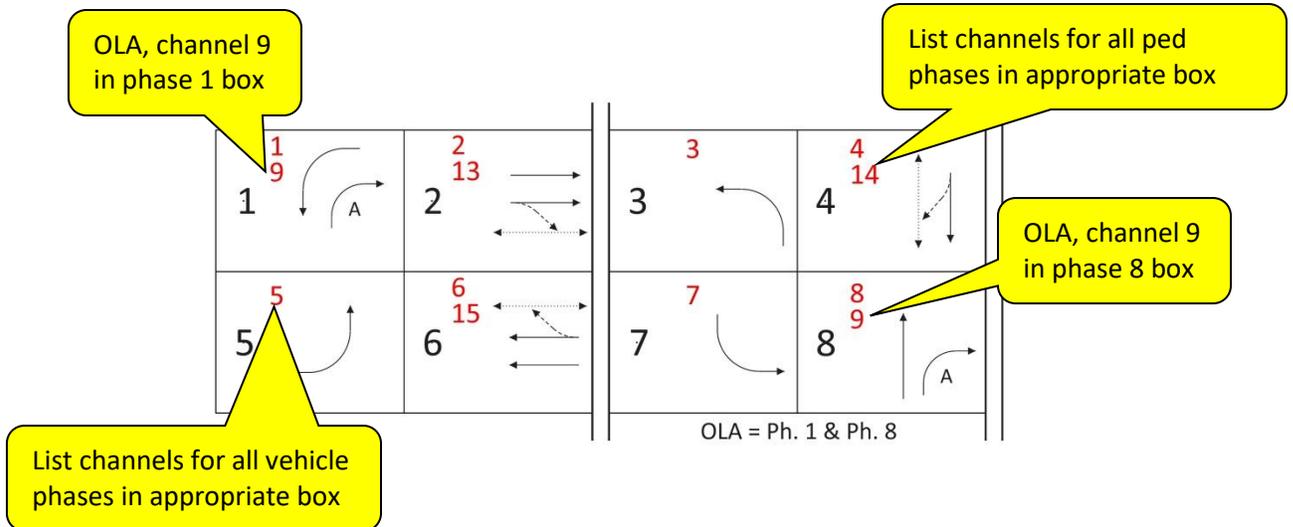
Based on intersection info, assign each phase used to a monitor channel

CHANNEL ASSIGNMENT

Ch.1 (SP1) Ph. 1	Ch.5 (SP7) Ph. 5	Ch.9 (SPA1) OLA	Ch.13 (SP3) Ped 2
Ch.2 (SP2) Ph. 2	Ch.6 (SP8) Ph. 6	Ch.10 (SPA2) NU	Ch.14 (SP6) Ped 4
Ch.3 (SP4) Ph. 3	Ch.7 (SP10) Ph. 7	Ch.11 (SPA4) NU	Ch.15 (SP9) Ped 6
Ch.4 (SP5) Ph. 4	Ch.8 (SP11) Ph. 8	Ch.12 (SPA5) NU	Ch.16 (SP12) NU

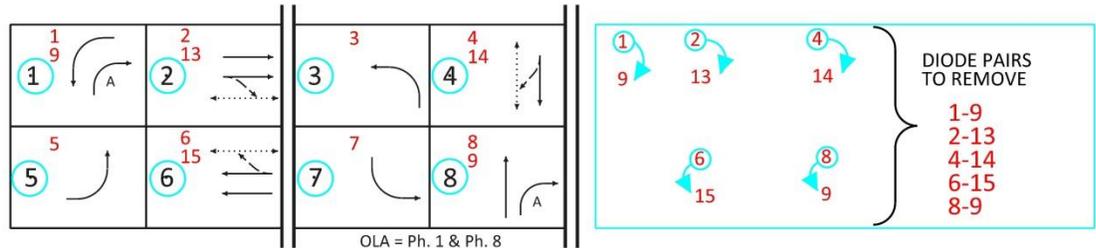
Step 2: Write the monitor channels in the ring and barrier diagram for (pay close attention to outputs that have been reassigned):

- Each vehicle phase used.
- Each pedestrian phase used.
- Each parent phase assigned to an overlap. For example, if OLA = ph. 1 and ph. 8, and OLA is assigned to channel 9, then write 9 in the phase 1 box and 9 in the phase 8 box of the ring and barrier diagram.

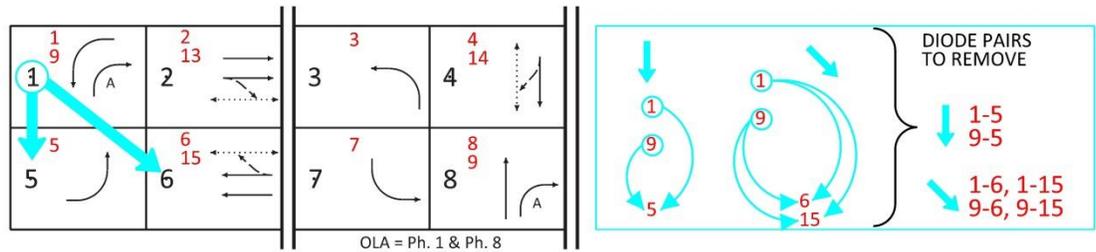


Step 3: Determine the compatible phases (diode pairs that need to be removed). The following procedure will ensure that all correct diodes are removed. There are likely to be a few duplicate diode pairs for phases with overlaps. This is OK, since a diode can only be removed once.

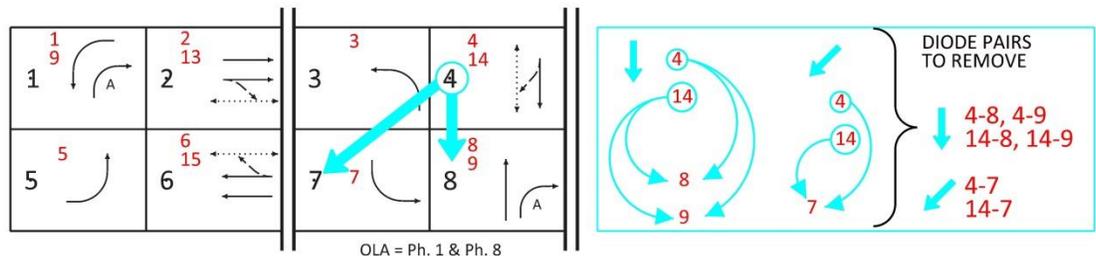
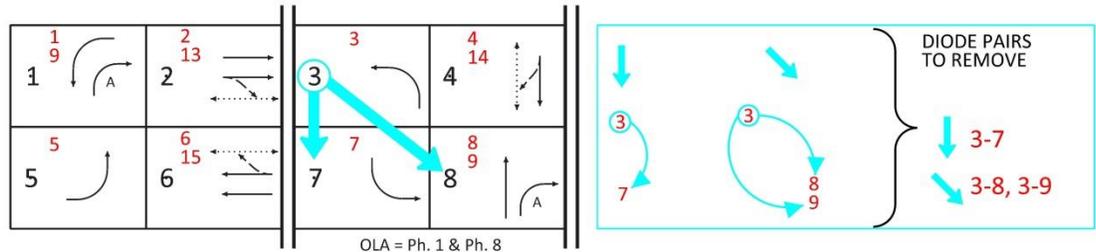
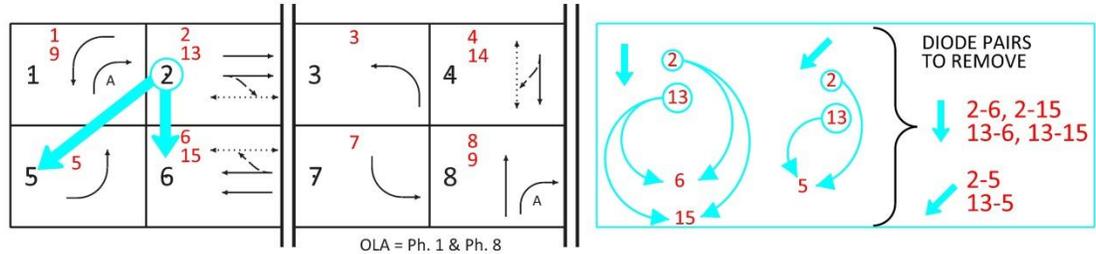
STEP 3A: LIST ALL DIODE PAIRS FOR EACH MONITOR CHANNEL IN THE SAME BOX



STEP 3B: START IN UPPER LEFT BOX OF THE DIAGRAM. LIST ALL DIODE PAIRS FOR EACH MONITOR CHANNEL THAT IS VERTICALLY OR DIAGONALLY OPPOSITE THE BOX (EXCEPT ANY EXCLUSIVE PHASES).



STEP 3C: REPEAT STEP 3B FOR EACH BOX ON THE UPPER ROW OF THE DIAGRAM.



When an intersection has a type 3LCF signal head for PPLT **AND** has any overlap phases, the conflict monitor diode configuration shall be determined by using the standard ring and barrier diagram method (shown on the previous page) *PLUS a separate ring and barrier diagram showing only the overlap green movements (vehicle and pedestrian) and the solid yellow left turn arrow of the type 3LCF signal head.* See Figure 20-11.

Figure 20-11 | Determining Compatible Phases – FYA (Type 3LCF signal head) and Overlap Phases

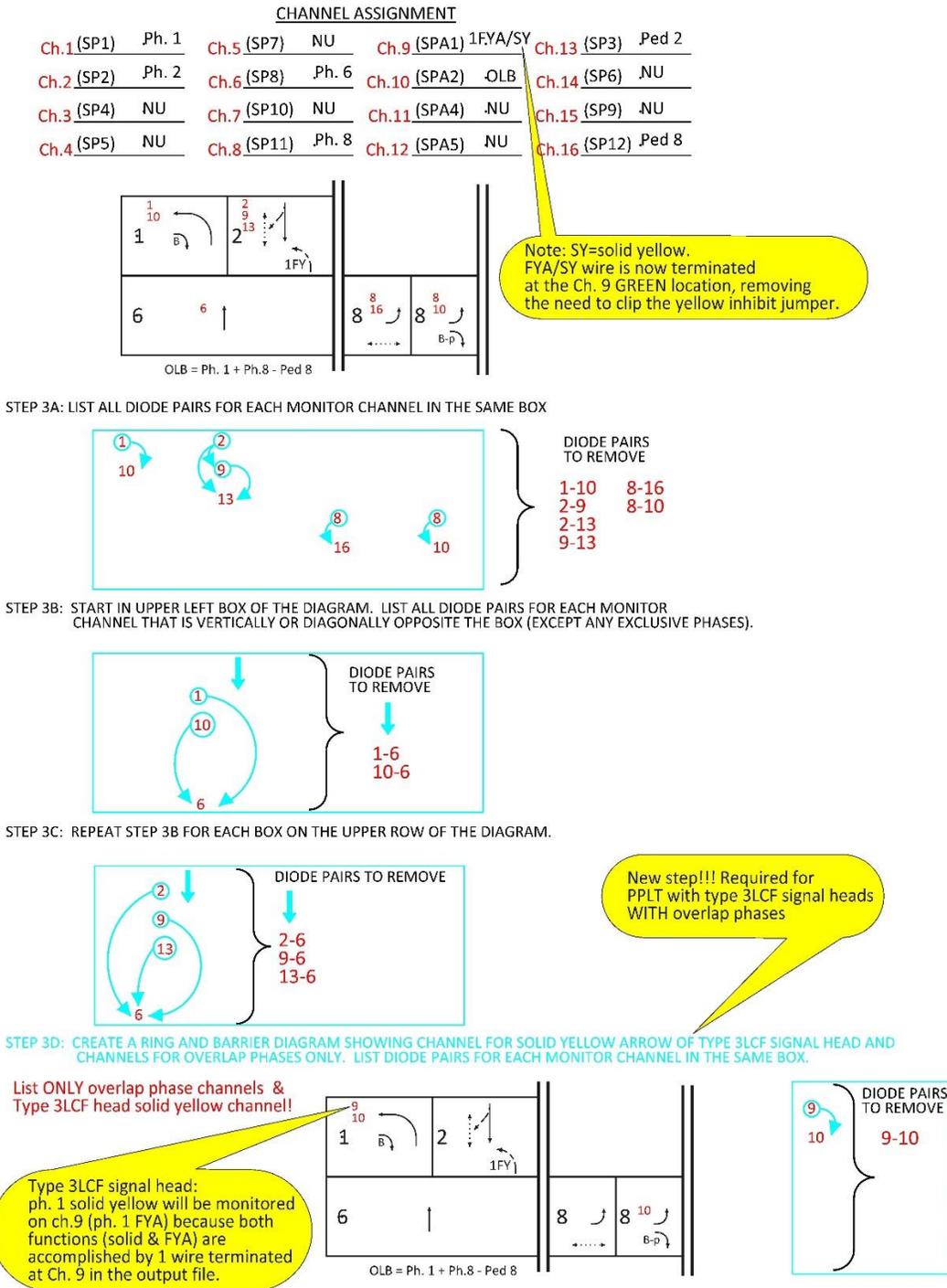
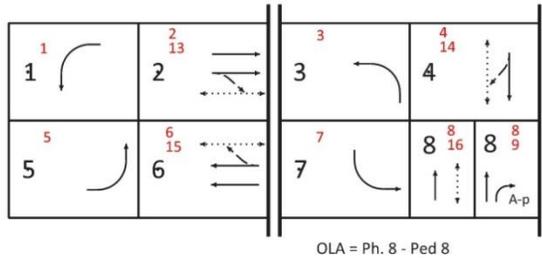


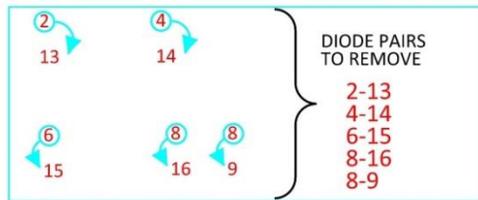
Figure 20-12 thru Figure 20-15 show common examples of determining compatible phases.

Figure 20-12 | Determining Compatible Phases – Example 1: Not-Ped Overlap

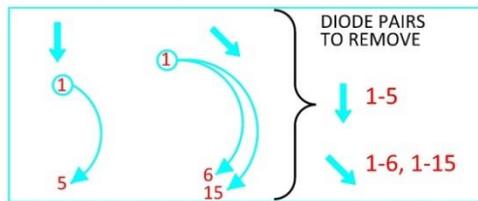
CHANNEL ASSIGNMENT							
Ch.1 (SP1)	Ph. 1	Ch.5 (SP7)	Ph. 5	Ch.9 (SPA1)	.OLA	Ch.13 (SP3)	Ped 2
Ch.2 (SP2)	Ph. 2	Ch.6 (SP8)	Ph. 6	Ch.10 (SPA2)	NU	Ch.14 (SP6)	Ped 4
Ch.3 (SP4)	Ph. 3	Ch.7 (SP10)	Ph. 7	Ch.11 (SPA4)	NU	Ch.15 (SP9)	Ped 6
Ch.4 (SP5)	Ph. 4	Ch.8 (SP11)	Ph. 8	Ch.12 (SPA5)	NU	Ch.16 (SP12)	Ped 8



STEP 3A: LIST ALL DIODE PAIRS FOR EACH MONITOR CHANNEL IN THE SAME BOX



STEP 3B: START IN UPPER LEFT BOX OF THE DIAGRAM. LIST ALL DIODE PAIRS FOR EACH MONITOR CHANNEL THAT IS VERTICALLY OR DIAGONALLY OPPOSITE THE BOX (EXCEPT ANY EXCLUSIVE PHASES).



STEP 3C: REPEAT STEP 3B FOR EACH BOX ON THE UPPER ROW OF THE DIAGRAM.

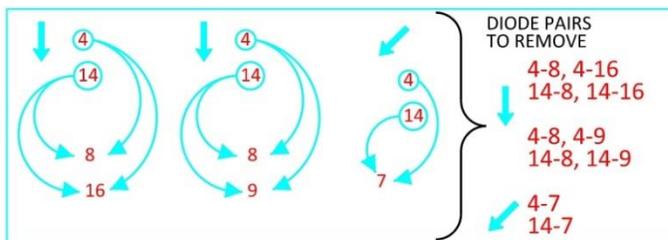
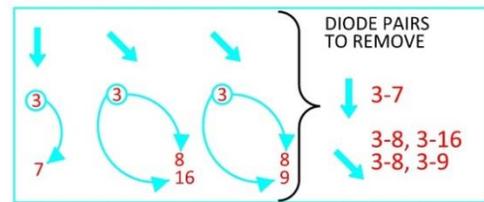
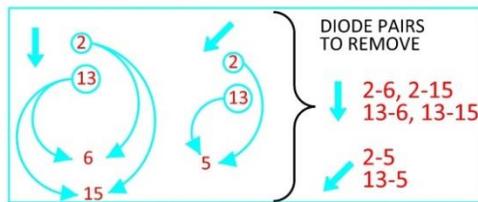
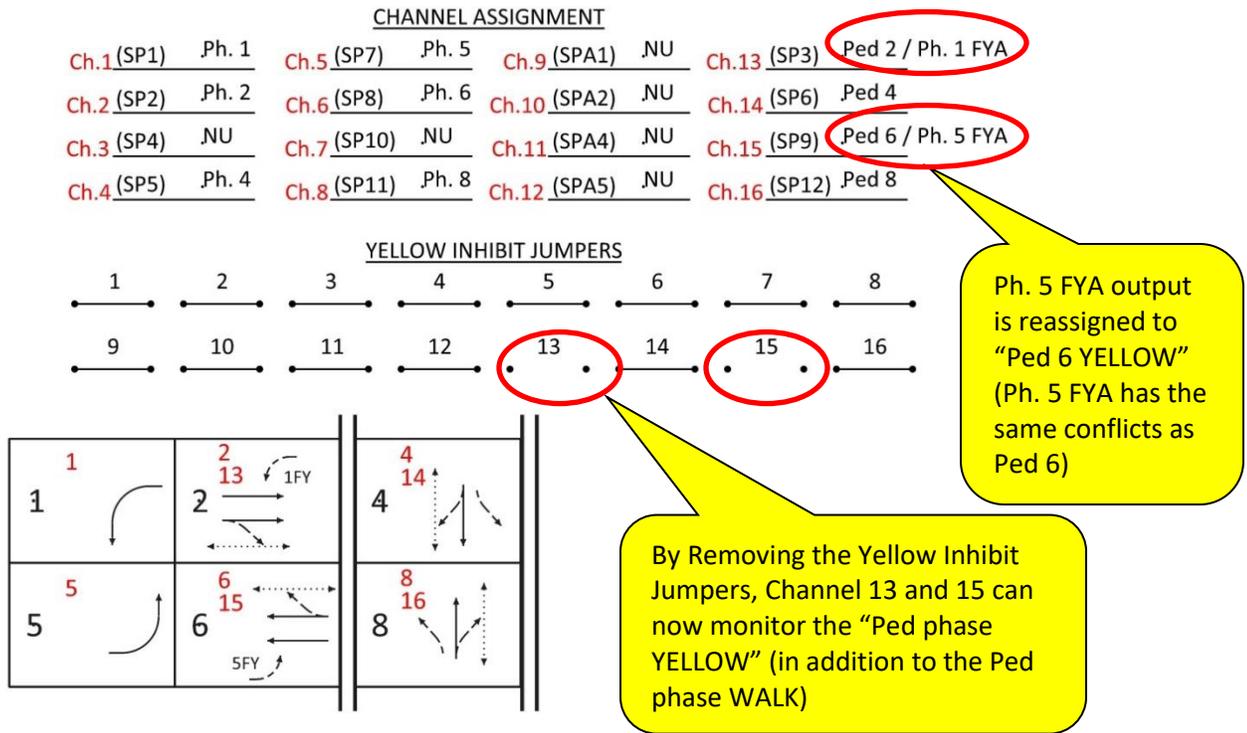
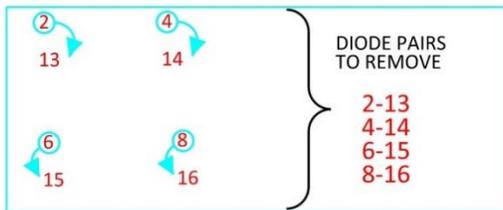


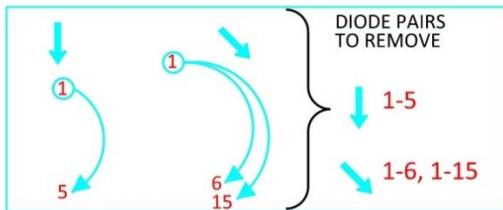
Figure 20-13 | Determining Compatible Phases – Example 2: Flashing Yellow Arrow (OLD METHOD – DO NOT USE PED YELLOW FOR NEW FYA INSTALLATIONS. SEE Figure 20-11 INSTEAD)



STEP 3A: LIST ALL DIODE PAIRS FOR EACH MONITOR CHANNEL IN THE SAME BOX



STEP 3B: START IN UPPER LEFT BOX OF THE DIAGRAM. LIST ALL DIODE PAIRS FOR EACH MONITOR CHANNEL THAT IS VERTICALLY OR DIAGONALLY OPPOSITE THE BOX (EXCEPT ANY EXCLUSIVE PHASES).



STEP 3C: REPEAT STEP 3B FOR EACH BOX ON THE UPPER ROW OF THE DIAGRAM.

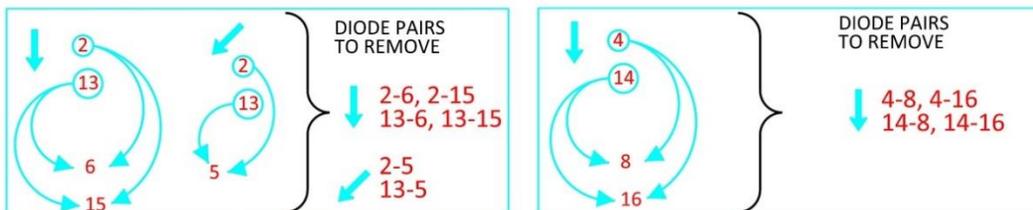
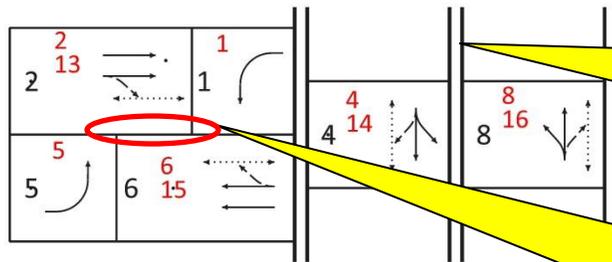


Figure 20-14 | Determining Compatible Phases – Example 3: Exclusive Phases

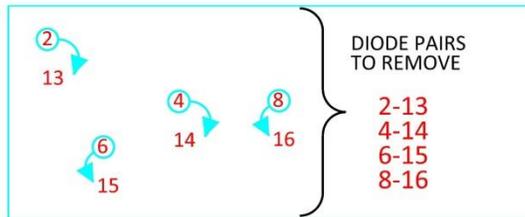
CHANNEL ASSIGNMENT					
Ch.1 (SP1) Ph. 1	Ch.5 (SP7) Ph. 5	Ch.9 (SPA1) .NU	Ch.13 (SP3) Ped 2		
Ch.2 (SP2) Ph. 2	Ch.6 (SP8) Ph. 6	Ch.10 (SPA2) .NU	Ch.14 (SP6) Ped 4		
Ch.3 (SP4) .NU	Ch.7 (SP10) .NU	Ch.11 (SPA4) .NU	Ch.15 (SP9) Ped 6		
Ch.4 (SP5) Ph. 4	Ch.8 (SP11) Ph. 8	Ch.12 (SPA5) .NU	Ch.16 (SP12) Ped 8		



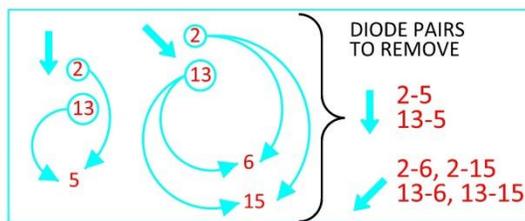
Phase 4 and phase 8 are exclusive phases (There are no compatible phases located vertically or diagonally on the same side of the barrier).

Phase 1 and 5 are NOT compatible as drawn (a diagonal line would not go directly from phase 1 to 5 without passing thru the phase 2 or phase 6 boxes). See Chapter 3 for more info.

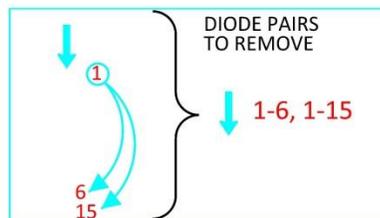
STEP 3A: LIST ALL DIODE PAIRS FOR EACH MONITOR CHANNEL IN THE SAME BOX



STEP 3B: START IN UPPER LEFT BOX OF THE DIAGRAM. LIST ALL DIODE PAIRS FOR EACH MONITOR CHANNEL THAT IS VERTICALLY OR DIAGONALLY OPPOSITE THE BOX (EXCEPT ANY EXCLUSIVE PHASES).



STEP 3C: REPEAT STEP 3B FOR EACH BOX ON THE UPPER ROW OF THE DIAGRAM.

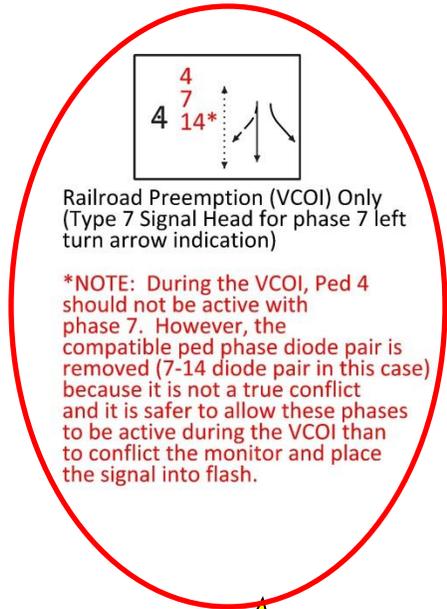
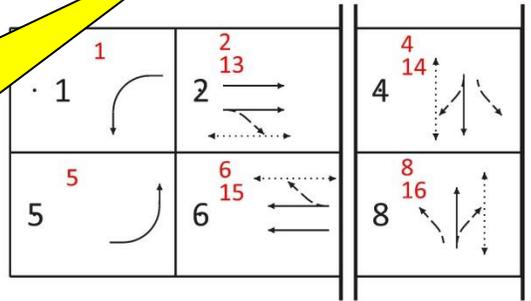


Phase 4 and phase 8 are exclusive phases (no other phases are compatible).

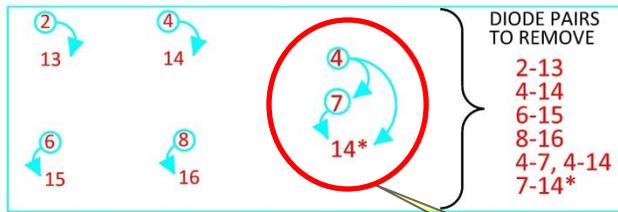
Figure 20-15 | Determining Compatible Phases – Example 4: Railroad Preemption Type 7 Signal Head

CHANNEL ASSIGNMENT					
Ch.1 (SP1) Ph. 1	Ch.5 (SP7) Ph. 5	Ch.9 (SPA1) NU	Ch.13 (SP3) Ped 2		
Ch.2 (SP2) Ph. 2	Ch.6 (SP8) Ph. 6	Ch.10 (SPA2) NU	Ch.14 (SP6) Ped 4		
Ch.3 (SP4) NU	Ch.7 (SP10) Ph. 7	Ch.11 (SPA4) NU	Ch.15 (SP9) Ped 6		
Ch.4 (SP5) Ph. 4	Ch.8 (SP11) Ph. 8	Ch.12 (SPA5) NU	Ch.16 (SP12) Ped 8		

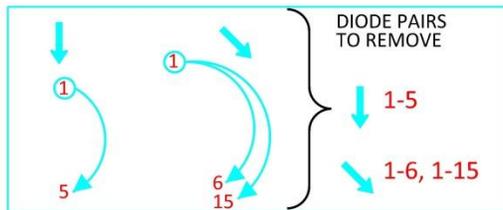
Don't forget to include the phase that is only active during the VCOI!



STEP 3A: LIST ALL DIODE PAIRS FOR EACH MONITOR CHANNEL IN THE SAME BOX

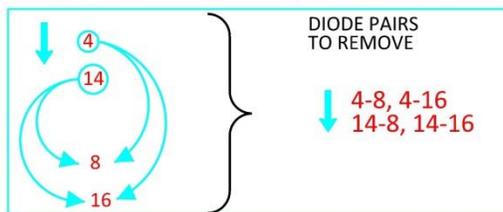
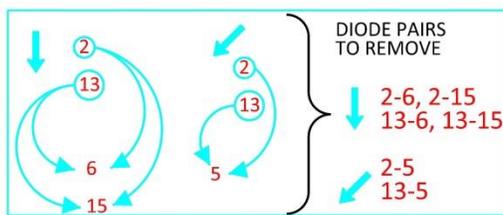


STEP 3B: START IN UPPER LEFT BOX OF THE DIAGRAM. LIST ALL DIODE PAIRS FOR EACH MONITOR CHANNEL THAT IS VERTICALLY OR DIAGONALLY OPPOSITE THE BOX (EXCEPT ANY EXCLUSIVE PHASES).



Don't forget to include the phase that is only active during the VCOI!

STEP 3C: REPEAT STEP 3B FOR EACH BOX ON THE UPPER ROW OF THE DIAGRAM.



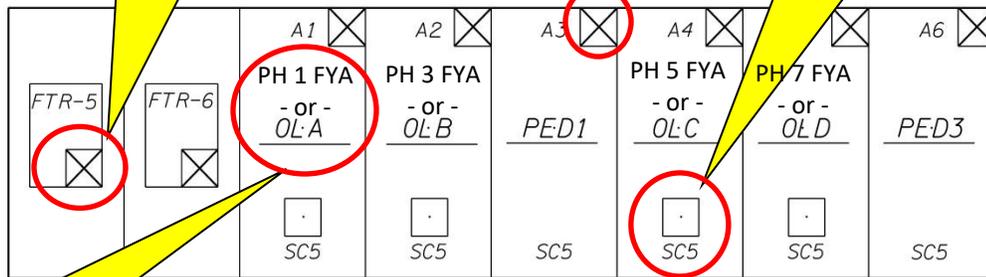
20.7.4 Auxiliary Output File (Front and Back View)

This location comes standard in 332S cabinets (optional in 332 cabinets) and provides additional outputs if more are needed. Unused locations should be left blank. It is filled out the same way as the main output file.

Check mark both Flash Transfer Relay (FTR) boxes (even if the Aux file is not used).

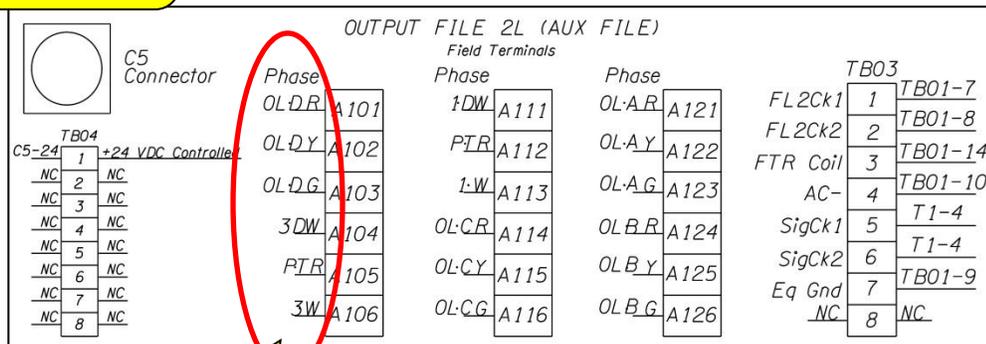
Check mark all boxes that are used. Unused location should be blank.

Show the flash plug color associated with each vehicle phase (R=Red, Y=yellow, W=Dark Signal). Red is typically used for all indications.



List phase (the standard phase assignments are shown in this example)

OUTPUT FILE 2L (AUX FILE)
FRONT VIEW - (NOT TO SCALE)



OUTPUT FILE 2L (AUX FILE)
REAR VIEW - (NOT TO SCALE)

Fill in the phase for the Red (R), Yellow (Y), Green (G), Walk (W), Flashing Don't Walk (DW), Flashing Yellow Arrow (FYA), and Part Time Restriction signal (PTR) indications. Standard indications are shown in the example.

20.7.5 Additional Information for the Output File

- The standard 332S (and 332 and 336) cabinets can accommodate 8 vehicle phases and 4 pedestrian phases (a total of 12 load switches). An additional 4 vehicle phase and 2 pedestrian phases (a total of 6 additional load switches) are available if needed in the auxiliary output file of the 332S and 332 cabinet (The auxiliary output file comes standard in the 332S cabinet, and is optional in the 332 cabinet). There is a standard phase layout for the output file. However, most intersection software programs allow the flexibility to assign any phase, pedestrian phase, overlap or special use output to any output location in the output files.
- Sixteen (of the 18 total) load switches are conflict monitored. The load switches in the auxiliary file slot A3 and A6 are not monitored.
- Pedestrian output locations will always be in load switch location 3, 6, 9, and 12 of the main output file and A3 and A6 of an auxiliary output file. The reason for this is that the flash power is not routed to these load switch locations, which allows the pedestrian signal indications to remain dark while the signal is operating in emergency flash mode. Vehicle signal indication should not be reassigned to these slots as they should not remain dark in flashing mode.
- PTR signs should terminate on the phase 1 ped yellow output of the auxiliary output file, switch pack location A3. Note: in the past, PTR signs for rail preemption (the typical installation) were normally terminated on the phase 4 ped yellow output (or any other unused ped yellow output if the phase 4 ped didn't exist) to avoid installation of an auxiliary file.

- The conflict monitor is limited to a total of 16 channels which limits the number of phases that can be used at an intersection. The flashing yellow arrow indication (for a protected/permitted left turn phase) is assigned to the channels normally reserved for overlap phases. As such, the number of protected/permitted left turn phases and vehicle overlap phases at an intersection will be limited to a combined total of four. For example, typical maximum combinations an intersection can have:
 - PPLT for phases 1, 3, 5, and 7 with NO overlap phases
 - Four overlap phases with NO PPLT
 - PPLT for phases 1 and 5 with two overlap phases
 - PPLT for phases 3 and 7 with two overlap phases

Exceptions to combined total of four may be acceptable in the rare circumstance where there is an unused vehicle phase output that an overlap phase can be reassigned to (channels 1 thru 8). The flashing yellow arrow indications should only be wired to channels 9 thru 12 as shown in Figure 20-9.

Assigning flashing yellow arrow to pedestrian yellow outputs will no longer be allowed as it can result in problematic conflict monitoring when used in conjunction with overlaps, not-ped phasing and type 3LCF signal heads. See Section 20.12.1 for additional background/reference info.

- Flash plugs are used with the output file to enable the correct indication to flash while the signal is operating in emergency flash mode (i.e. cabinet flash). RED flash plugs enable the red indication to flash, and YELLOW flash plugs enable the yellow indication to flash. WHITE flash plugs shall be used to bypass the flash power if a standard vehicle phase output (Switch pack locations 1, 2, 4, 5, 7, 8, 10, 11, A1, A2, A4, and A5) has been reassigned to a pedestrian phase so that the pedestrian indications will remain dark while the signal is operating in emergency flash mode. The default standard is to use RED flash plugs for all load switch locations that serve vehicle phases; standard pedestrian phase load switch locations do not use flash plugs and are already wired to bypass the flash power. The major through phase may have YELLOW flash plugs under certain conditions (See the Traffic Signal Policy and Guidelines, Chapter 9 for more information). The Region Traffic Signal Operations Engineer is responsible for making this determination. If something other than RED flash plugs are required, it shall be noted on the switch pack location as “Y” (for yellow) or “W” (for no-flash).

20.8 332S Cabinet Print (Page 4 – C1 Pin Assignments & Test Switch)

Page 4 of the cabinet print shows the C1 pin assignments and test switch details. This sheet generally doesn't require any modification. See Figure 20-16.

Figure 20-16 | 332S Cabinet Print (page 4 – C1 pin assignments & test switch)

Program Assigned Functions	C1 Connector		C4 Connector			Field Term.
	Pin	Termination	Pin	In Position	Out	
DC Gnd	1	DC Gnd Bus	-	-	-	-
Ø 2 DWALK	2	C4-1	1	6	6-DW	3 104
Ø 4 WALK	3	C4-2	2	10	6-W	7 106
Ø 4 RED	4	C4-3	3	6	5-R	3 101
Ø 4 YELLOW	5	C4-4	4	8	5-Y	5 102
Ø 4 GREEN	6	C4-5	5	10	5-G	7 103
Ø 3 RED	7	C4-6	6	6	4-R	3 116
Ø 3 YELLOW	8	C4-7	7	8	4-Y	5 117
Ø 3 GREEN	9	C4-8	8	10	4-G	7 118
Ø 2 DWALK	10	C4-9	9	6	3-DW	3 113
Ø 2 WALK	11	C4-10	10	10	3-W	7 115
Ø 2 RED	12	C4-11	11	6	2-R	3 128
Ø 2 YELLOW	13	C4-12	12	8	2-Y	5 129
Input Gnd	14	T015-4"1"	-	-	-	-
Ø 2 GREEN	15	C4-13	13	10	2-G	7 130
Ø 1 RED	16	C4-14	14	6	1-R	3 125
Ø 1 YELLOW	17	C4-15	15	8	1-Y	5 126
Ø 1 GREEN	18	C4-16	16	10	1-G	7 127
Ø 0 DWALK	19	C4-17	17	6	10-DW	3 110
Ø 0 WALK	20	C4-18	18	10	10-W	7 112
Ø 0 RED	21	C4-19	19	6	11-R	3 107
Ø 0 YELLOW	22	C4-20	20	8	11-Y	5 108
Ø 0 GREEN	23	C4-21	21	10	11-G	7 109
Ø 7 RED	24	C4-22	22	6	10-R	3 122
Ø 7 YELLOW	25	C4-23	23	8	10-Y	5 123
Ø 7 GREEN	26	C4-24	24	10	10-G	7 124
Ø 6 DWALK	27	C4-25	25	6	9-DW	3 119
Ø 6 WALK	28	C4-26	26	10	9-W	7 121
Ø 6 RED	29	C4-27	27	6	8-R	3 134
Ø 6 YELLOW	30	C4-28	28	8	8-Y	5 135
Ø 6 GREEN	31	C4-29	29	10	8-G	7 136
Ø 5 RED	32	C4-30	30	6	7-R	3 131
Ø 5 YELLOW	33	C4-31	31	8	7-Y	5 132
Ø 5 GREEN	34	C4-32	32	10	7-G	7 133
Ø 3 FLTYA	35	C4-33	33	8	3-Y	5 114
Ø 3 FLTYB	36	C4-34	34	8	3-Y	5 120
Ø 3 FLTYA	37	C4-35	35	8	6-Y	5 105
Ø 3 FLTYB	38	C4-36	36	8	12-Y	5 111

Program Assigned Functions	Pin	Termination	Input Files		Field Term.
			Out	In	
Ø 2 DET	39	13-1	F	DME	T85-9810
Ø 6 DET	40	23-1	F	DME	T85-9810
Ø 4 DET	41	18-1	F	DME	T85-29830
Ø 8 DET	42	Ø-1	F	DME	T85-29830
Ø 2 DET	43	13-2	W	JMK	T85-11812
Ø 6 DET	44	Ø-2	W	JMK	T85-11812
Ø 4 DET	45	18-2	W	JMK	T85-31832
Ø 8 DET	46	Ø-2	W	JMK	T85-31832
Ø 2 DET	47	15-1	F	DME	T85-17818
Ø 6 DET	48	Ø-1	F	DME	T85-17818
Ø 4 DET	49	110-1	F	DME	T85-37838
Ø 8 DET	50	110-1	F	DME	T85-37838
VEOI	51	118-1	F	D	T80-3
ADV ENABLE	53	-	-	-	T81-11
SPARE	54	111-1	F	DME	T85-9810
Ø 5 DET	55	11-1	F	DME	T85-182
Ø 1 DET	56	11-1	F	DME	T85-182
Ø 7 DET	57	Ø-1	F	DME	T85-21822
Ø 3 DET	58	16-1	F	DME	T85-21822
Ø 5 DET	59	11-2	W	JMK	T85-384
Ø 1 DET	60	11-2	W	JMK	T85-384
Ø 7 DET	61	Ø-2	W	JMK	T85-23824
Ø 3 DET	62	16-2	W	JMK	T85-23824
Ø 2 DET	63	14-1	F	DME	T85-13814
Ø 6 DET	64	14-1	F	DME	T85-13814
Ø 4 DET	65	19-1	F	DME	T85-33834
Ø 8 DET	66	Ø-1	F	DME	T85-33834
Pin 2 Ped	67	113-1	F	D	T81-1
Pin 6 Ped	68	114-1	F	D	T81-4
Pin 4 Ped	69	113-2	W	J	T81-2
Pin 8 Ped	70	114-2	W	J	T81-5
EVA	71	113-1	F	D	T83-3
EV8	72	114-1	F	D	T83-6
EV3	73	113-2	W	J	T83-4
EV9	74	114-2	W	J	T83-7
Ø 2 DET	76	14-2	W	JMK	T85-15816
Ø 6 DET	77	14-2	W	JMK	T85-15816
Ø 4 DET	78	19-2	W	JMK	T85-35836
Ø 8 DET	79	19-2	W	JMK	T85-35836
Advance	80	-	-	-	T81-10
Flash Sense	81	-	-	-	T81-7
Stop Time	82	-	-	-	T81-8

Program Assigned Functions	Pin	Termination	CS Connector			Field Term.
			Pin	In Position	Out	
Ø 3 DWALK	83	CS-1	1	6	A6-DW	3 A104
Ø 3 WALK	84	CS-2	2	10	A6-W	7 A106
Ø 3 RED	85	CS-3	3	6	A5-R	3 A101
Ø 3 YELLOW	86	CS-4	4	8	A5-Y	5 A102
Ø 3 GREEN	87	CS-5	5	10	A5-G	7 A103
Ø 3 RED	88	CS-6	6	6	A4-R	3 A114
Ø 3 YELLOW	89	CS-7	7	8	A4-Y	5 A115
Ø 3 GREEN	90	CS-8	8	10	A4-G	7 A116
Ø 1 DWALK	91	CS-9	9	6	A3-DW	3 A111
DC Gnd	92	DC Gnd Bus	-	-	-	-
Ø 1 WALK	93	CS-10	10	10	A3-W	7 A113
Ø 3 RED	94	CS-11	11	6	A2-R	3 A124
Ø 3 YELLOW	95	CS-12	12	8	A2-Y	5 A125
Ø 3 GREEN	96	CS-13	13	10	A2-G	7 A126
Ø 3 RED	97	CS-14	14	6	A1-R	3 A121
Ø 3 YELLOW	98	CS-15	15	8	A1-Y	5 A122
Ø 3 GREEN	99	CS-16	16	10	A1-G	7 A123
PRF SIGN	100	CS-17	17	8	A6-Y	5 A105
PRF SIGN	101	CS-18	18	8	A3-Y	5 A112
FLASH OUT	102	T815-3"1"	-	-	-	-
Monitoring	103	C4-37	-	-	-	-
Input Gnd	104	T815-4"1"	-	-	-	-

Program Assigned Functions	Pin	Termination	C11 Connector		Input Files		Field Term.
			Pin	In Position	Out	Terminals	
NOT ASSIGN	1,8	T&B	-	-	-	-	-
DC Gnd	9	DC Gnd Bus	-	-	-	-	-
Ø 2 DET	10	15-2	W	JMK	T85-19820	-	-
Ø 6 DET	11	Ø-2	W	JMK	T85-19820	-	-
Ø 4 DET	12	110-2	W	JMK	T85-39840	-	-
Ø 8 DET	13	110-2	W	JMK	T85-39840	-	-
DC Gnd	14	DC Gnd Bus	-	-	-	-	-
Ø 5 DET	15	12-1	F	DME	T85-586	-	-
Ø 1 DET	16	12-1	F	DME	T85-586	-	-
Ø 7 DET	17	17-1	F	DME	T85-25826	-	-
Ø 3 DET	18	17-1	F	DME	T85-25826	-	-
Ø 5 DET	19	Ø-2	W	JMK	T85-788	-	-
Ø 1 DET	20	Ø-2	W	JMK	T85-788	-	-
Ø 7 DET	21	17-2	W	JMK	T85-27828	-	-
Ø 3 DET	22	17-2	W	JMK	T85-27828	-	-
SPARE	23	111-1	F	DME	T82-182	-	-
SPARE	24	112-1	F	DME	T82-586	-	-
SPARE	25	111-2	W	JMK	T82-384	-	-
SPARE	26	112-2	W	JMK	T82-788	-	-
NOT ASSIGN	27,30	T&B	-	-	-	-	-
DC Gnd	31	DC Gnd Bus	-	-	-	-	-
NOT ASSIGN	32,36	T&B	-	-	-	-	-
DC Gnd	37	DC Gnd Bus	-	-	-	-	-

REV. NO.	DATE	BY	CHKD.	APP'D.	DESCRIPTION
1	09/30/15	AK			Added a J115X and J115K

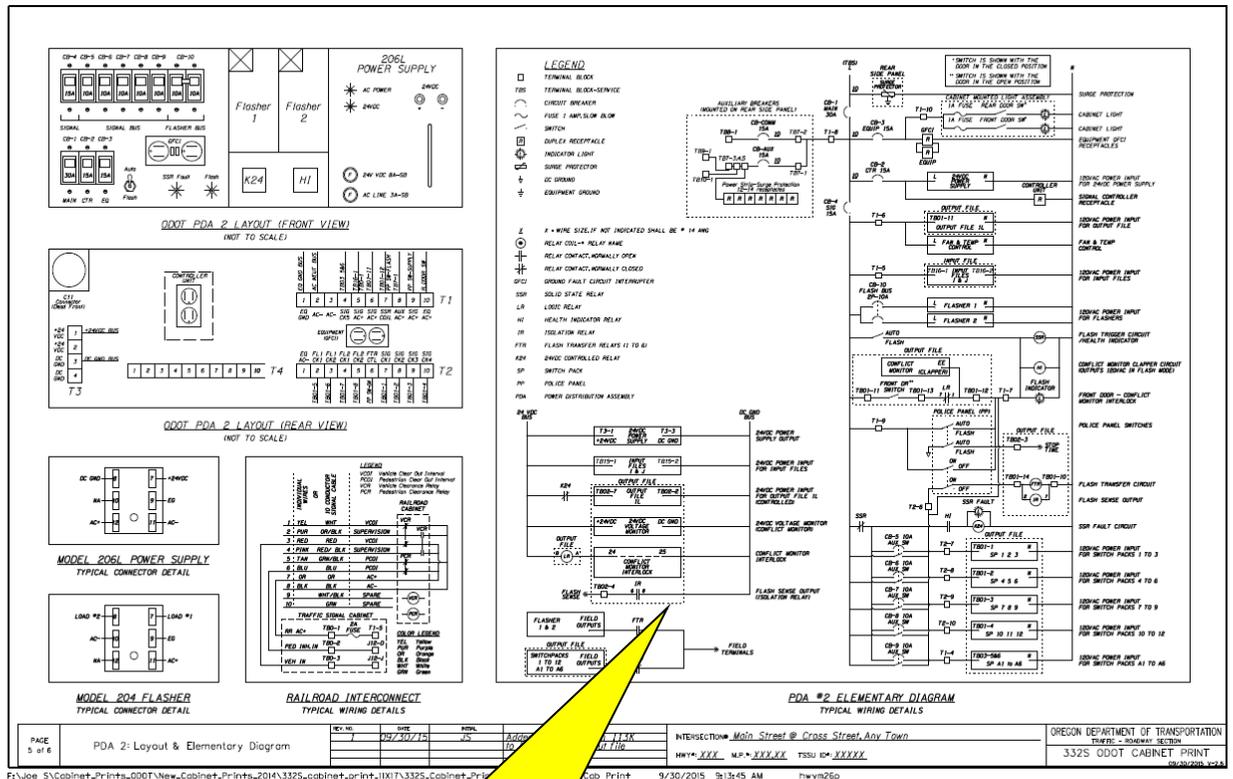
PAGE 4 of 6	CONTROLLER (C1), (C11) WIRING DETAILS	INTERSECTION: Main Street @ Cross Street, Any Town	OREGON DEPARTMENT OF TRANSPORTATION
		HWY: XXX, WP: XXX, YX TSSU ID: XXXXX	THREAT: 0000000000
			332S CDOT CABINET PRINT

This sheet should not be modified

20.9 332S Cabinet Print (Page 5 – Electrical Diagrams)

Page 5 of the cabinet print shows the electrical diagram details. This sheet generally doesn't require any modification. See Figure 20-17.

Figure 20-17 | 332S Cabinet Print (page 5 – electrical diagrams)



This sheet should not be modified

20.10 332S Cabinet Print (Page 6 – Intersection Drawing)

Page 6 of the cabinet print shows the intersection drawing. The intent of the intersection drawing is to provide a simplified illustration of critical signal equipment and operations to allow the field tech to quickly determine the orientation and location of equipment during routine maintenance and troubleshooting. It may seem redundant to provide an intersection drawing as part of the cabinet print given the contract plan sheet(s) contain the same (plus additional) info, but it is very valuable to highlight only the relevant maintenance information on a single sheet (or two sheets if necessary) for efficient fieldwork. **THIS SHEET NO LONGER SHOWS DETECTION INFO. THIS INFORMATION IS NOW SHOWN ON SHEET 7.**

The intersection drawing is created from the design file and is copied into the cabinet print file. This is to allow for easy future modification and archiving of the cabinet print file without having to reference other files.

The intersection drawing should include the following. See Figure 20-18 to Figure 20-20:

- Plan view of intersection, oriented correctly for a person standing at the front of the controller cabinet (i.e. “you are here” map orientation. Note this is probably different than the plan sheet orientation)
- North arrow
- Street Names
- Operation items:
 - Lanes and lane use arrows
 - Phasing, labeled in each lane
 - Crosswalks, labeled in each crosswalk
 - Phase rotation diagram
 - Fire preemption diagram
- Equipment:
 - Signal poles with mast arms/span wires
 - Pedestals
 - Pushbutton posts
 - Other poles that contain signal equipment controlled by the cabinet (i.e. a remote fire preemption unit, advance flashing beacons, etc.)
 - Signal heads and pedestrian heads
 - Emergency preemption devices, labeled per device
 - Controller cabinet, labeled
 - Communications gear located on TB8, TB9, or TB10
- Railroad items (see Figure 20-19):
 - Railroad controller cabinet, labeled
 - Railroad tracks, labeled
 - Railroad preemption site specific constraints (from the rail matrix text)
 - PTR signs, labeled per device
- Reference to all relevant contract plan sheets related to the intersection
- List of intersections that are interconnected

The intersection drawing should be simple, uncluttered and easy to read. To achieve this, do NOT include the following:

- Detection information
- Right-of-way lines
- Conduit
- Utilities
- Stationing
- Bubble notes & legend

The scale of all features shown on the intersection drawing is flexible to maximize readability while still containing all the information needed. TSSU and Region Electricians may request modifications to what is included or not included on the intersection drawing depending on the intersection complexity, uniqueness, or staff preference. In general, modifications are allowed, but are reviewed and informally approved by Traffic-Roadway Unit.

Figure 20-18 | 332S Cabinet Print (page 6 – Intersection Drawing) Example 1

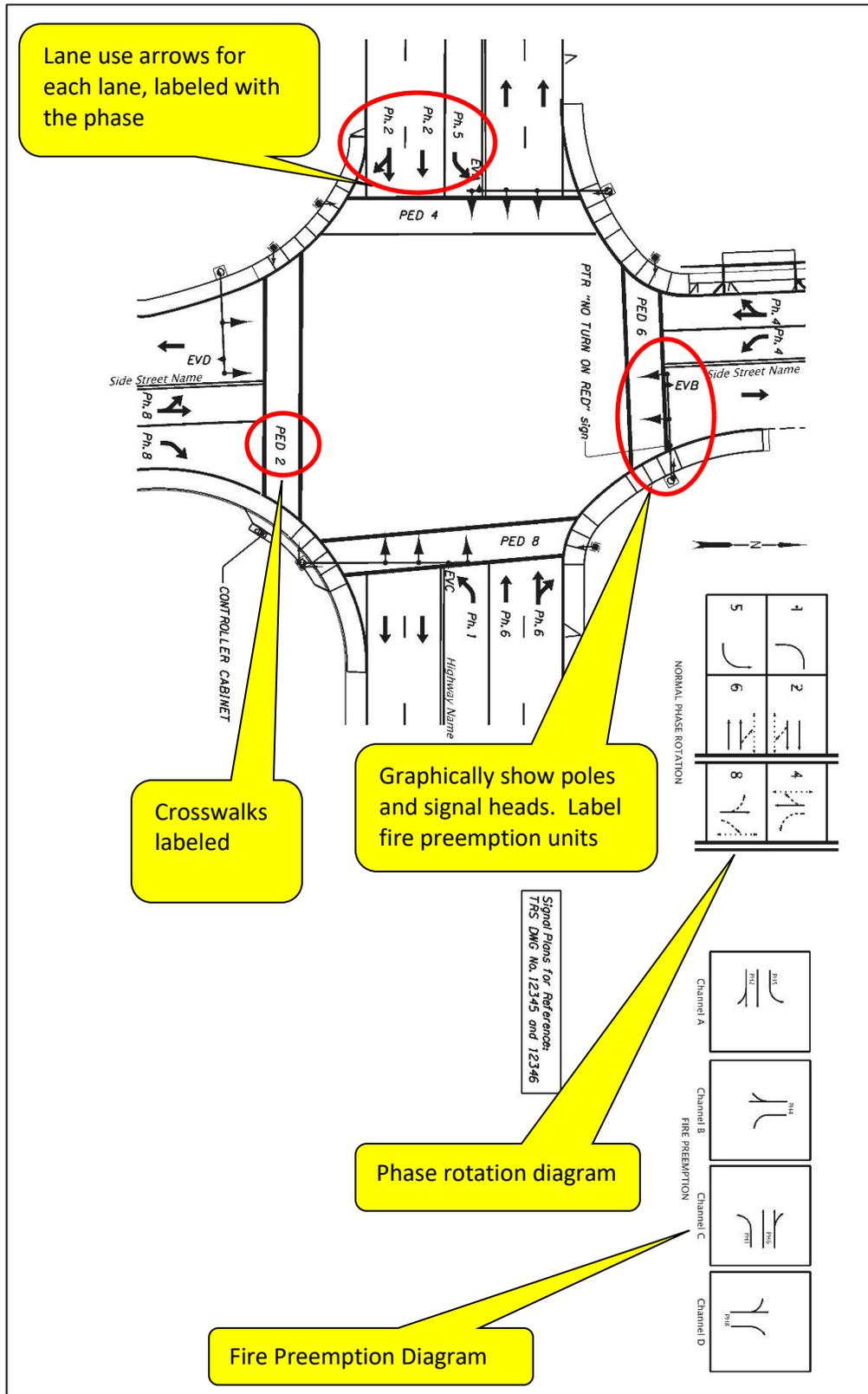


Figure 20-19 | 332S Cabinet Print (page 6 – Intersection Drawing) Example 2

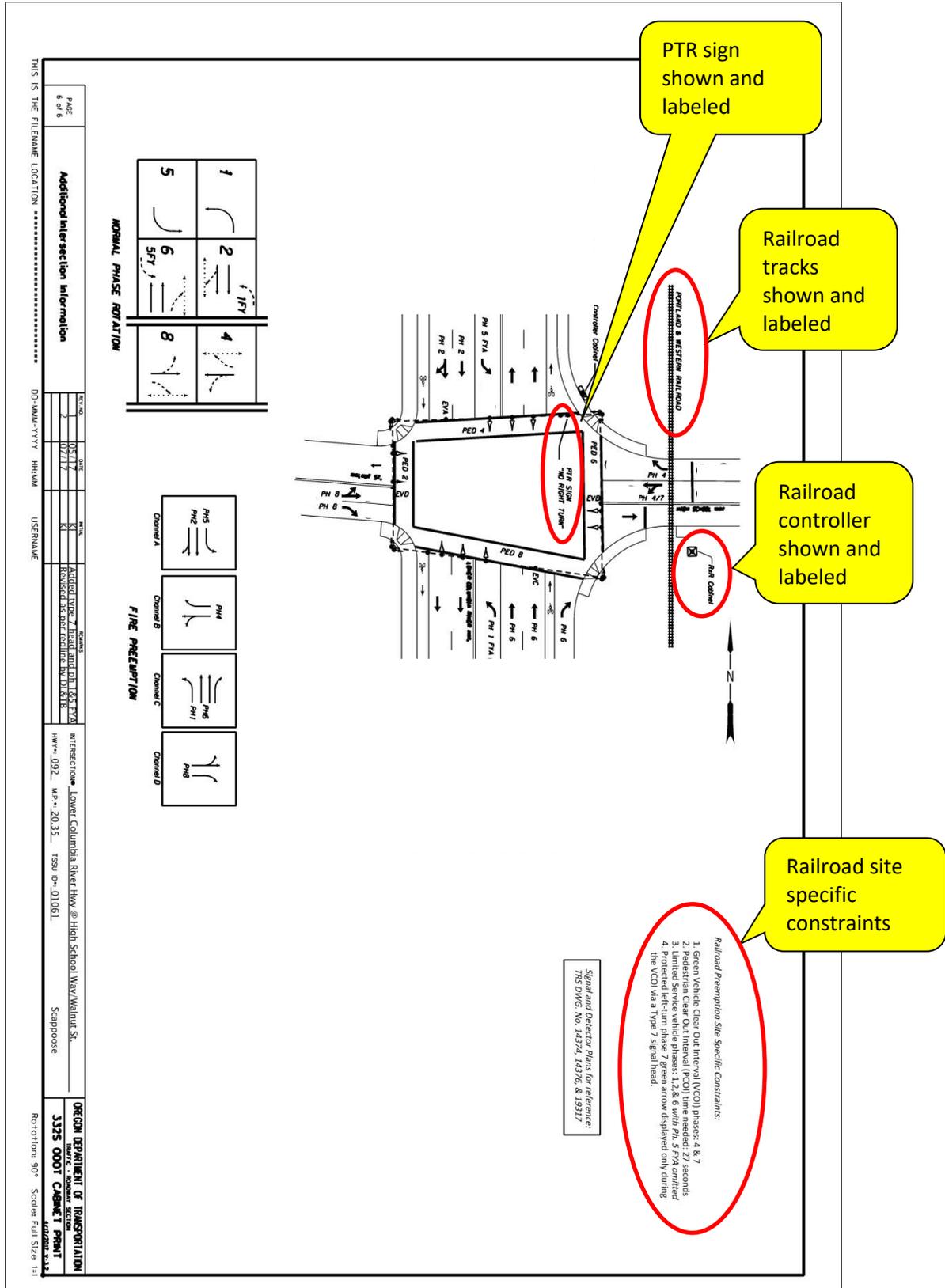
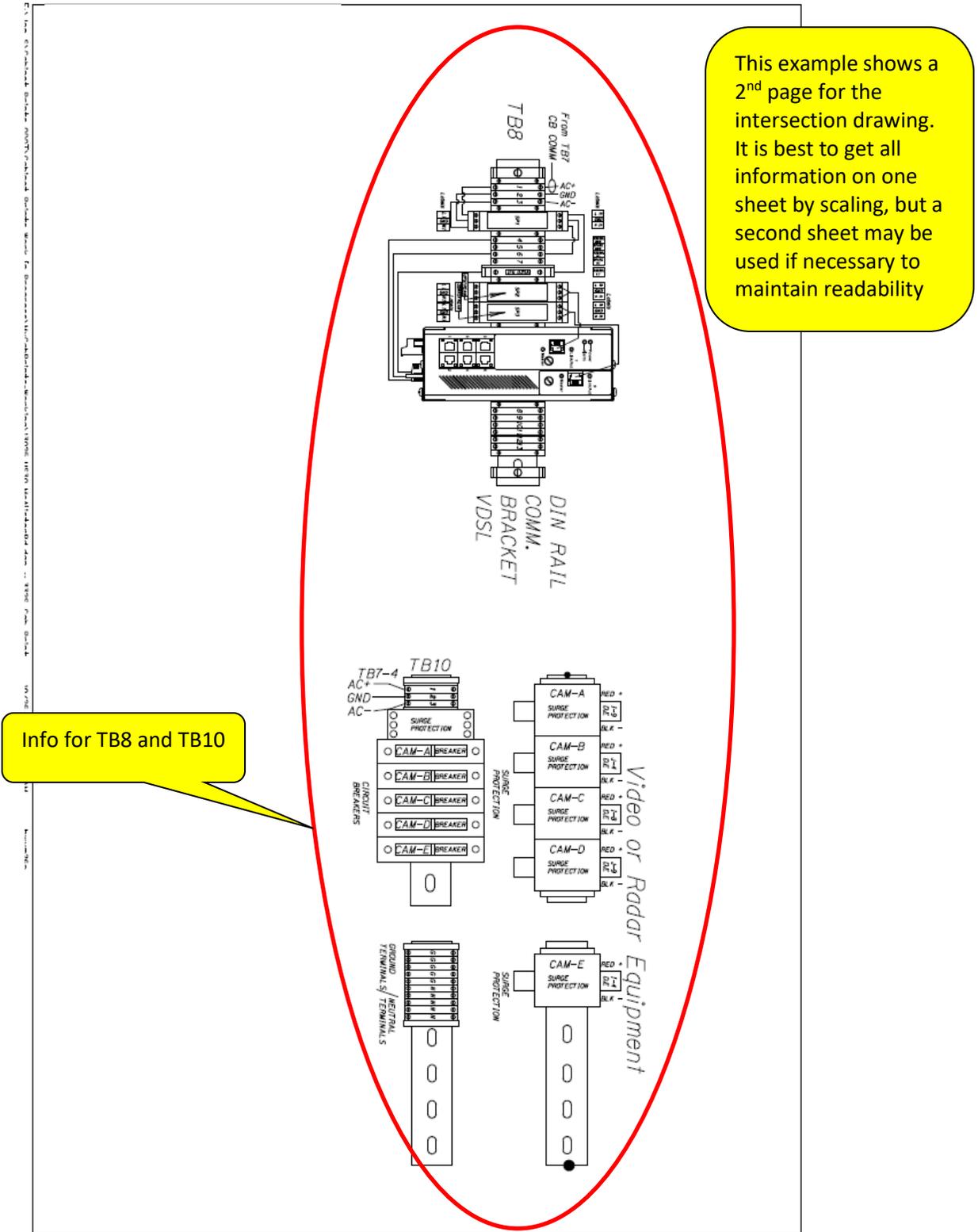


Figure 20-20 | 332S Cabinet Print (page 6 – Intersection Drawing) Example 3



This example shows a 2nd page for the intersection drawing. It is best to get all information on one sheet by scaling, but a second sheet may be used if necessary to maintain readability

Info for TB8 and TB10

20.11 332S Cabinet Print (Page 7 – Detection Drawing)

Page 7 of the cabinet print shows the detection drawing. The intent of the detection drawing is to provide a general illustration of detection units, coverage areas, and/or zones and software detection configuration information to allow efficient maintenance and troubleshooting. Showing the detection info on a separate sheet from the intersection drawing helps with readability and field workflow.

The detection drawing is created from the design file and is copied into the cabinet print file. This is to allow for easy future modification and archiving of the cabinet print file without having to reference other files.

The detection drawing should include the following. See Figure 20-21 to Figure 20-22:

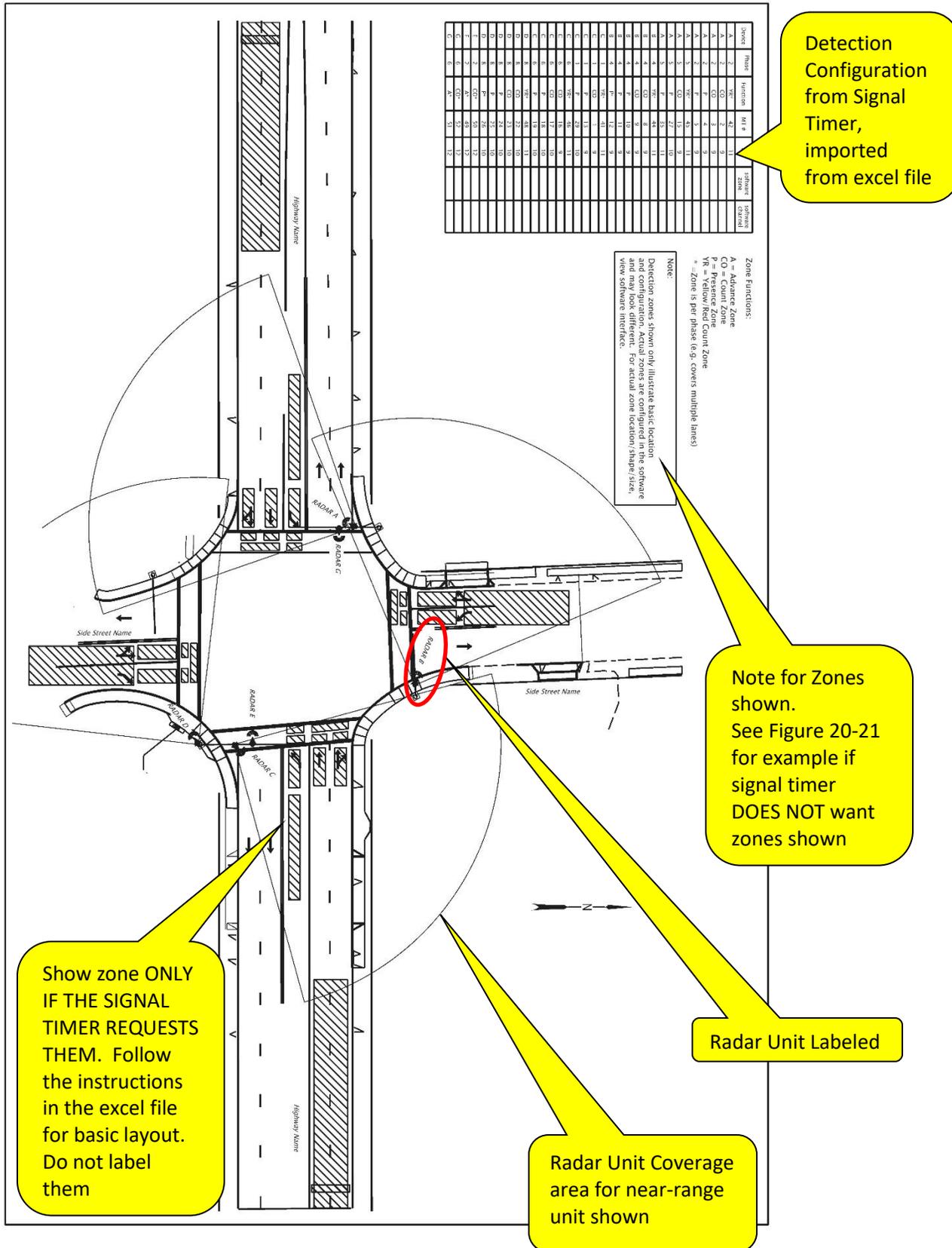
- Plan view of intersection, oriented correctly for a person standing at the front of the controller cabinet (i.e. “you are here” map orientation. Note this is probably different than the plan sheet orientation)
- North arrow
- Street Names
- Note on detection zones (one for if zones are shown, one for if they are not)
- Function legend
- Operation items:
 - Lanes and lane use arrows
 - Near-side radar coverage area (cone shape), labeled
 - **Detection zones, not labeled – ONLY IF REQUESTED BY THE SIGNAL TIMER!**
 - **Import excel file of detector configuration from signal timer**
- Equipment:
 - Signal poles with mast arms/span wires or pedestals where detector units are mounted
 - Detector Units, labeled
 - Controller cabinet, labeled
 - Loops with loop numbers (for advance loops only indicate the distance from stop line)
- Railroad items:
 - Railroad tracks

The detection drawing should be simple, uncluttered and easy to read. To achieve this, do NOT include the following:

- Information shown on the intersection drawing
- Right-of-way lines
- Conduit
- Utilities
- Stationing
- Bubble notes & legend

The scale of all features shown on the intersection drawing is flexible to maximize readability while still containing all the information needed. TSSU and Region Electricians may request modifications to what is included or not included on the detection drawing depending on the intersection complexity, uniqueness, or staff preference. In general, modifications are allowed, but are reviewed and informally approved by Traffic-Roadway Unit.

Figure 20-22 | 332S Cabinet Print (page 7 – Detection Drawing) Example 2



20.12 Background/Reference Information

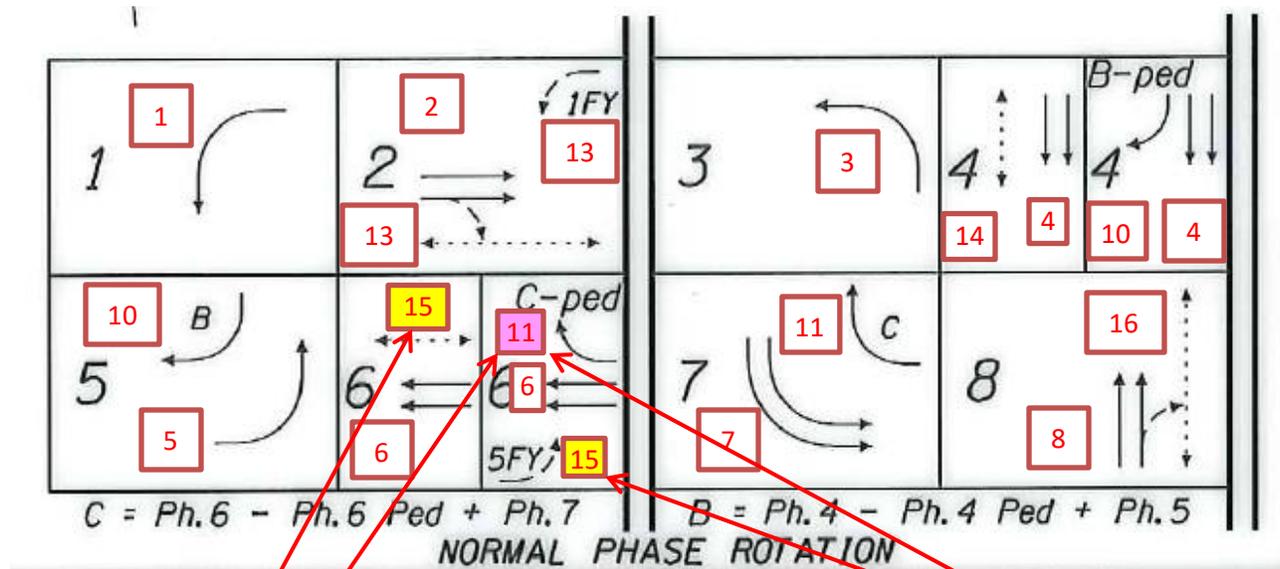
This section contains more in-depth information to aid in understanding guidance presented in this chapter.

20.12.1 Flashing Yellow Arrow and Conflict Monitoring

Two problems with using pedestrian yellow outputs for FYA were identified when troubleshooting several signals that went into cabinet flash after installing not-ped overlap phases and/or Type 3LCF signal heads. The results of this investigation led to changing the FYA output and conflict monitoring standard from ped YELLOW with yellow inhibit jumpers to overlap GREEN (ch. 9 thru 12).

Problem 1: Using a Ped Yellow output for the FYA will not work if the FYA has different conflicts than the ped WALK. For example, Figure 20-23 shows that OLC is not compatible with ped 6 which would require conflict monitor diode 11-15 to remain intact. However, OLC is compatible with ph. 5 FYA which would require conflict monitor diode 11-15 to be removed. If diode 11-15 remains intact, the signal will go into cabinet flash when OLC and phase 5 FYA are served together, resulting in signal phasing that will fail every cycle. If diode 11-5 is removed, the signal will NOT go into cabinet flash if OLC and ped 6 are served together, resulting in unsafe operation.

Figure 20-23 | Problem 1: FYA and WALK phase have different conflicts



Ped 6 (Ch 15) is NOT compatible with OLC (Ch 11)

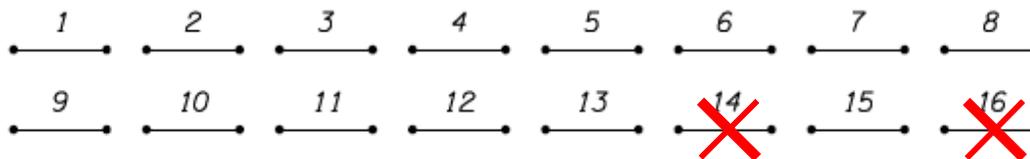
CONFLICT MONITOR DIODE CARD

Ph. 5 FYA (Ch 15) is compatible with OLC (Ch 11)

CHANNEL ASSIGNMENT

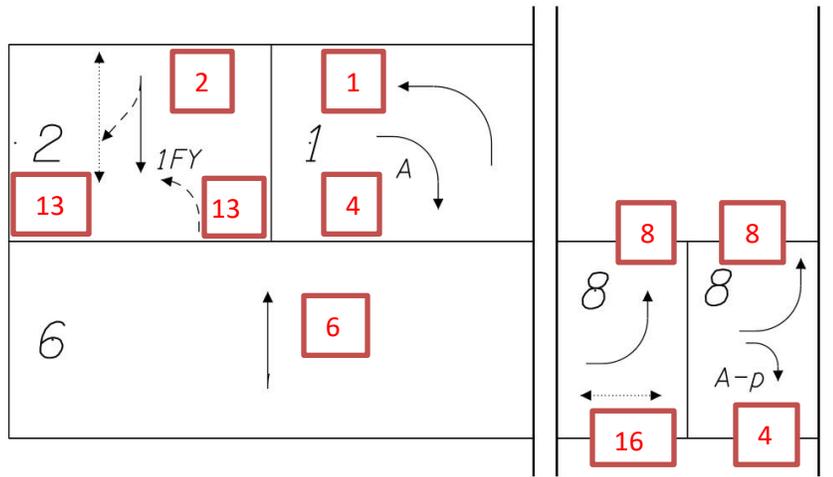
Ch.1	Ph. 1	Ch.5	Ph. 5	Ch.9		Ch.13	Ped2/1FYA
Ch.2	Ph. 2	Ch.6	Ph. 6	Ch.10	OLB	Ch.14	Ped4
Ch.3	Ph. 3	Ch.7	Ph. 7	Ch.11	OLC	Ch.15	Ped6/5FYA
Ch.4	Ph. 4	Ch.8	Ph. 8	Ch.12		Ch.16	Ped8

YELLOW INHIBIT JUMPERS



Problem 2: Using a Ped Yellow output for the FYA will not work with a Type 3LCF signal head and overlap phase. The type 3LCF signal head uses only one wire terminated at the yellow indication which will provide both the solid yellow and the flashing yellow function. The solid yellow will be monitored because the FYA is required to be monitored and both functions are driven by the same wire/output in the controller cabinet. The solid yellow has different conflicts than the FYA which will cause the signal to go into cabinet flash when the complementary overlap phase stays green while the protected left turn phase is solid yellow. For example, Figure 20-24 shows the conflict monitor channel assignment and Figure 20-25 shows where this phasing sequence creates a conflict monitoring problem with the solid yellow and overlap phase.

Figure 20-24 | Problem 2: FYA and solid yellow have different conflicts – Conflict monitor channel assignment



OLA = Ph. 1 & Ph. 8 - Ped 8

NORMAL PHASE ROTATION

CONFLICT MONITOR DIODE CARD

CHANNEL ASSIGNMENT

Ch.1 Ph. 1	Ch.5 _____	Ch.9 _____	Ch.13 Ped2/1FYA
Ch.2 Ph. 2	Ch.6 Ph. 6	Ch.10 _____	Ch.14 _____
Ch.3 _____	Ch.7 _____	Ch.11 _____	Ch.15 _____
Ch.4 OLA	Ch.8 Ph. 8	Ch.12 _____	Ch.16 Ped8

YELLOW INHIBIT JUMPERS

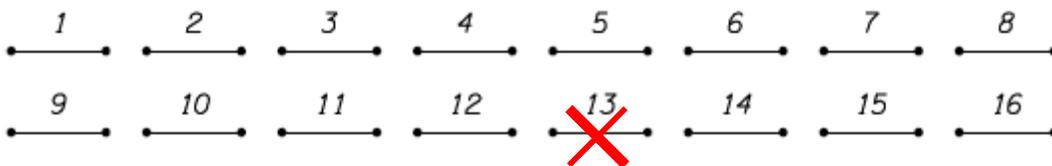


Figure 20-25 | Problem 2: FYA and solid yellow have different conflicts – phasing sequence

For a 3-wire system, solid yellow is monitored with the FYA

For a 3-wire system, solid yellow is monitored with the FYA

Phase	Indication color, sequence going from left to right									
1	-	-	-	-	G 1	Y 13	R	R	-	-
1 FYA	FYA 13	FYA 13	Y 13	R	-	-	-	-	-	FYA 13
2	G	G	Y	R	R	R	R	R	R	G
Ped 2	W	FDW	DW	DW	DW	DW	DW	DW	DW	W
6	G	G	G	G	G	Y	R	R	G	G
8	R	R	R	R	R	R	G	Y	R	R
Ped 8	DW	DW	DW	DW	DW	DW	DW	DW	DW	DW
OLA	R	R	R	R	G 4	G 4	G 4	Y	R	R

In this column, diode 4-13 would need to be removed (compatible phases). However, OLA (ch 4) and ped 2 (ch 13) are conflicting phases requiring diode 4-13 to remain intact.

If diode 4-13 is removed, the signal will NOT go into cabinet flash if OLA (ch 4) and ped 2 (ch 13) are served together, resulting in unsafe operation. If diode 4-13 remains intact, the signal will go into cabinet flash when OLA remains green when phase 1 is followed by phase 8.

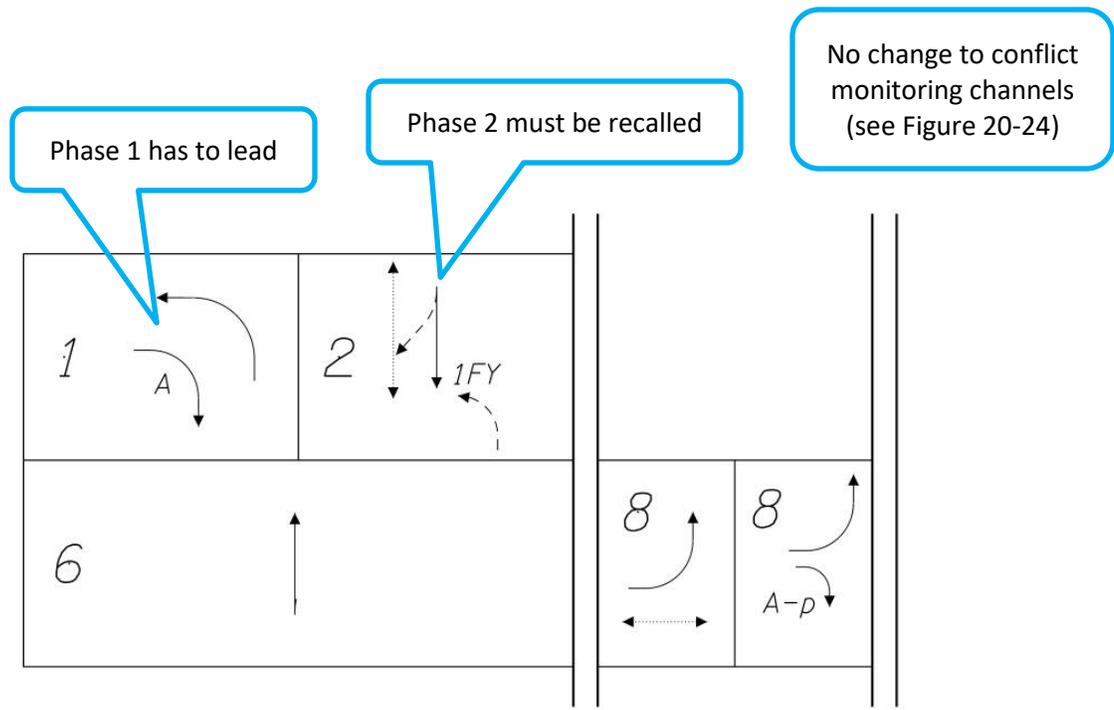
Various solutions to these two problems, listed below, were thoroughly vetted by Traffic-Roadway Section, TSSU, Region Traffic and Local Agency staff:

- Do not monitor the flashing yellow arrow:** Several local agencies do not monitor the flashing yellow arrow because the software controlling the flashing yellow arrow sequence has a high level of reliability and there are a limited number of conflicts that can be monitored using the standard conflict monitoring equipment. On the same principle, ODOT does not monitor the flashing don't walk portion of the pedestrian phase (only the walk phase is monitored). However, ODOT has a long standing history of requiring monitoring of the flashing yellow arrow as it provides the same function as a circular green indication for a permissive left turn and we monitor all green

indications. At this point in time, this option was dismissed due to the importance of ensuring the flashing yellow arrow does not run concurrent to any conflicting phase.

- **Restrict signal phasing options:** Allow the overlap phase and remove the FYA or allow the FYA and remove the overlap phase. One of the original benefits of the standard conflict monitoring using pedestrian yellow outputs for FYA was to “free-up” the overlap channels (ch 9 thru 12) for use. In the past, when overlap phases used Type 2 programmed signal heads or closed conflicting pedestrian crossings, those “available” channels could be used without a conflict monitoring problem. This changed when overlap phases started to use Type 3R signal heads and not-ped phasing, basically making those previously “available” overlap channels unusable if pedestrian yellow outputs were being used for FYA. Restricting the desired operation at the intersection was also met with widely varying opinions about what phases are truly needed. This option was dismissed because agreement could not be reached that prioritizing the conflict monitoring standard (ped yellow FYA monitoring) over desired operations (when operational analysis indicates certain phases are not needed for acceptable V/C and queue lengths) was a viable solution and an original benefit of using ped yellow monitoring was negated.
- **Problem 2 only – use a Type 6L signal head (separate wire and termination for solid yellow and flashing yellow):** This option allows the solid yellow indication to be unmonitored. This option was dismissed because ODOT is moving away from using Type 6L signal heads for new PPLT installations. The type 3LCF signal head has many advantages over the type 6L signal head, such as reduced structural loading, less wiring, reducing the number of signal head types for maintenance to stock, and far easier ability to retro-fit existing installations.
- **Problem 2 only - Restrict signal phasing to ensure overlap phase green and solid yellow are never served together:** By restricting the sequencing of the left turn phase (lead/lag) and recalling other phases, the solid yellow and overlap green will always terminate at the same time. See **Figure 20-26** for example. This option was dismissed due to being overly complicated to determine the correct sequencing and because changing from a left turn phase from leading to lagging shouldn't require a change to the conflict monitor.

Figure 20-26 | Problem 2 potential solution: Restricted signal phasing sequence



OLA = Ph. 1 & Ph. 8 - Ped 8

NORMAL PHASE ROTATION

Phase	Indication color, sequence going from left to right										
1	G 1	Y 13	R	-	-	-	-	-	-	-	G 1
1 FYA	-	-	-	FYA 13	Y 13	R	R	R	R	-	-
2	R	R	G	G	Y	R	R	R	R	R	R
Ped 2	DW	DW	W 13	FDW	DW	DW	DW	DW	DW	DW	DW
6	G	G	G	G	Y	R	R	R	R	G	G
8	R	R	R	R	R	G	G	G	Y	R	R
Ped 8	DW	DW	DW	DW	DW	W	FDW	DW	DW	DW	DW
OLA	G 4	Y	R	R	R	R	R	G 4	G 4	G 4	G 4

Phase 1 solid yellow will never be on with OLA GREEN because phase 1 is always followed by phase 2, which will terminate OLA GREEN and phase 1 GREEN at the same time.

Phase 1 solid yellow will never be on with OLA GREEN