Chapter 24
QUICK REFERENCE

Contents

24 Quick Reference 24-1
24.1 General 24-1
24.2 Basic Wiring Guidelines 24-1
24.3 Loop Detector Information 24-2
24.4 Non-Invasive Detection Information 24-3
24.5 Input File Info 24-4
24.5.1 Input File for 332S: ATC controller with C11 Connector 24-4
24.5.2 Input File for 332: ATC controller without C11 Connector 24-5
24.5.3 Input File for 336: ATC controller 24-6
24.6 332S and 332 Cabinet Limitations – Output File 24-7
24.7 332S and 332 Cabinet Limitations – Input File 24-8
24.8 332S and 332 Cabinet Limitations – Conflict Monitor 24-9
24.9 Phasing Standards 24-10
24.10 Signal Pole & Signal Head Information 24-11
24.11 Sign Information 24-12
24.12 Junction Box & Conduit Information 24-13
24.13 Electrical Crew Preferences 24-14
24.14 QA/QC Signal Plan Sheet Checklists with Examples 24-14

24 QUICK REFERENCE

24.1 General

The quick references are comprised of information, tables, and charts that are contained within the manual. They are placed in this chapter without the accompanied explanation text for experienced signal designers to have quick reference to common design standards.

24.2 Basic Wiring Guidelines

An AC positive ("hot") wire and an AC negative ("Neutral") wire is required to complete the circuit for each piece of equipment (from the equipment to the power source).

Basic Wiring Guidelines (Individual Conductors) 120V Wiring shall be sized for a maximum 3% voltage drop			
120 Volt AC	Signal System Neutral: Poles over 4" in diameter	One #8 THWN (-)	Used to complete the circuit for indications in Vehicle or Pedestrian Signals mounted on large signal poles.
	Signal System Neutral: Pedestals 4" in diameter	One #12 THWN (-)	Used to complete the circuit for indications in Vehicle or Pedestrian Signals mounted on small pedestals.
	Vehicle Signals	Three #14 THWN (+)	Typically one wire for each indication color: Red, Yellow, & Green. Certain signal head types require a different number wires. (note: see Signal System Neutral)
	Pedestrian Signals	Two #14 THWN (+)	One wire for each indication: walk & flashing don't walk. (note: See Signal System Neutral)
	Luminaires	Two #10 XHHW* (120V = + & -) (240V = + & +)	From Service Cabinet to each luminaire (no daisy chaining). Never routed through the controller cabinet.
	Photoelectric Cells	Three #12 THWN* (+ & -)	From the Service Cabinet, for the luminaire circuit. Never routed through the controller cabinet.
	Part-Time Restriction Signs	Two #12 THWN* (+ & -)	For each sign.
	Power Supply	Two #6 XHHW* (+ & -)	From Service Cabinet to Controller Cabinet.
Low Voltage DC	Pedestrian Push Buttons	One #14 THWN (+)	For each pedestrian phase.
	Push Button Common	One #14 THWN (-)	Used to complete the circuit for Pedestrian Push Button.
	Interconnect	One 6 twisted pair cable (n/a)	Unspliced from Controller cabinet to Controller cabinet.

*Common wire is inclusive to wire count.

24.3 Loop Detector Information

Loop Detector Placement		
Location	Posted Speed (MPH)	Detector Spacing (ft.) from stop bar to center of detection
Mainline Note: If mainline has a shared thru-left turn lane, install stopbar detection in the lane at 5' & 15' in addition to the detection shown for mainline based on posted speed.	25	140
	30	180
	35	110/220
	40	160/320
	45	160/320
	50	190/380
	55	225/450
Right Turn Lane (mainline) Note: not applicable to unsignalized slip lanes		140 (115 if lane is short)
Side Street & Left Turns		5/15/75
Interchange Ramps	Low volume &/or low exit speed	5/15/75/150
	High volume &/or high exit speed	5/15/110/220
Bike Lane (mainline)	15	50
Bike Lane (side street)	10	5/50
Mainline Temporary Bridge (one lane/two-way)		5/15/100 & 65 for bypass loop in opposing lane

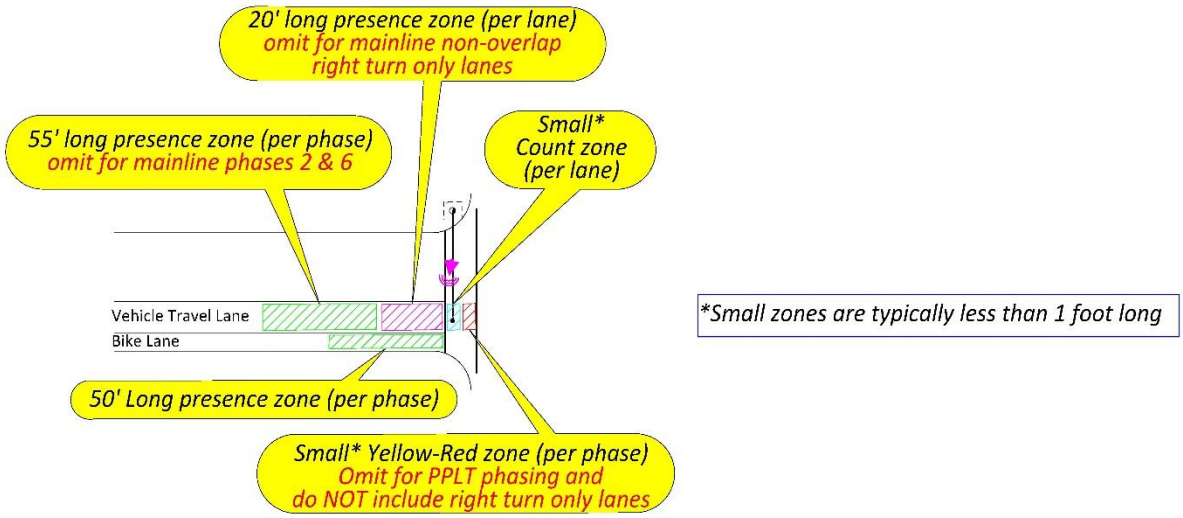
Loop Wire Entrance Type	
Region 1	Sand Pocket
Region 2	Sand Pocket
Region 3	Sand Pocket
Region 4	PVC Sleeve
Region 5	Sand Pocket

Loop Feeder Cables Allowed In Conduit	
# of Loop Feeders	**Conduit Size***
1-5	1 ½"
6-9	2"
10-13	2 ½"
14-21	3"

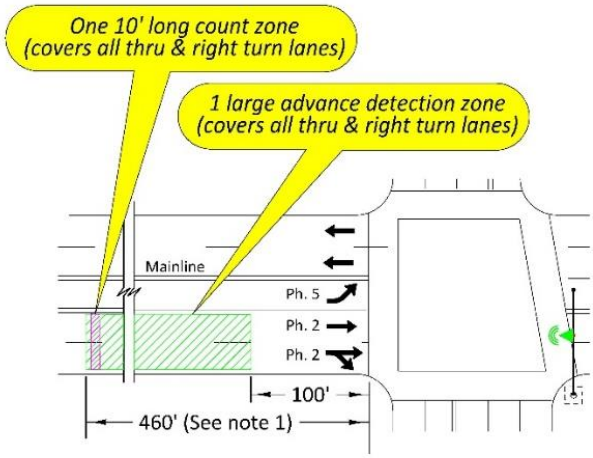
*Note: Regions may have a minimum value that is larger than the statewide minimum standard. Verify with Region Traffic and Region Electrical.

Loop Wires Allowed in Loop Wire Entrance Conduit	
Number of Loops (one loop has 2 loop wires entering the loop wire entrance conduit)	**Loop Wire Entrance Conduit Size**
1-2 Preformed Loops	2"
3-4 Preformed Loops	2 ½"
1-4 Standard Loops	2"
5-8 Standard Loops	2 ½"
Note: If more than 4 preformed loops or more than 8 standard loops are need to enter at one location, install multiple loop wire entrances.	

24.4 Non-Invasive Detection Information



STANDARD PRESENCE DETECTION (Near-Range Unit)



STANDARD ADVANCE DETECTION (Far-Range Unit)

Notes:

1. Detection that starts 100' from the stop bar and extends a minimum of 460' from the stop bar is acceptable for all posted speeds. However, the standard far-range unit is likely to start detection prior to 100' and is capable of reaching 600'. The alternative far-range unit is capable of reaching 900' if necessary (verify with Region Traffic).

2. If MaxAdapt is used (Verify with Region Traffic), add a Near-Range Unit to provide advance Count Detection Zones as shown below

24.5 Input File Info

24.5.1 Input File for 332S: ATC controller with C11 Connector

"I" File		1	2	3	4	5	6	7	8	9	10	11	12	13	14
Upper	#	14	1	21	9	16	3	23	11	18	X			25	26
	Fn	Ph 1	Ph 1	Ph 2	Ph 2	Ph 2	Ph 3	Ph 3	Ph 4	Ph 4	Ph 4	V.R.C.M.	V.R.C.M.	Ped 2	Ped 6
	C1-##	C1-56	C11-16	C1-39	C1-63	C1-47	C1-58	C11-18	C1-41	C1-65	C1-49	C11-23	C11-24	C1-67	C1-68
	VD #	VD 1	VD 29	VD 9	VD 11	VD 13	VD 3	VD 32	VD 14	VD 16	VD 18				
	XXX													PB1	PB2
Lower	#	X	5	30	X	X	7	32	X	20	X			27	28
	Fn	Ph 1	Ph 1	Ph 2	Ph 2	Ph 2	Ph 3	Ph 3	Ph 4	Ph 4	Ph 4			Ped 4	Ped 8
	C1-##	C1-60	C11-20	C1-43	C1-76	C11-10	C1-62	C11-22	C1-45	C1-78	C11-12	C11-25	C11-26	C1-69	C1-70
	VD #	VD 2	VD 30	VD 10	VD 12	VD 31	VD 4	VD 33*	VD 15	VD 17	VD 34*				
	XXX			PB6	PB6	PB6	PB6	PB6	PB6	PB6	PB6			PB3	PB4

"J" File		1	2	3	4	5	6	7	8	9	10	11	12	13	14
Upper	#	13	2	22	10	15	4	24	12	17	X		SP5	SP1	SP2
	Fn	Ph 5	Ph 5	Ph 6	Ph 6	Ph 6	Ph 7	Ph 7	Ph 8	Ph 8	Ph 8	SPARE	RR	EVA	EVB
	C1-##	C1-55	C11-15	C1-40	C1-64	C1-48	C1-57	C11-17	C1-42	C1-66	C1-50	C1-54	C1-51	C1-71	C1-72
	VD #	VD 5	VD 35*	VD 19	VD 21	VD 23	VD 7	VD 38*	VD 24	VD 26	VD 28		(PCOI)		
	XXX												SP5	SP1	SP2
Lower	#	X	6	31	X	X	8	SP7	X	19	X		SP6	SP3	SP4
	Fn	Ph 5	Ph 5	Ph 6	Ph 6	Ph 6	Ph 7	Ph 7	Ph 8	Ph 8	Ph 8	GPS	RR	EVC	EVD
	C1-##	C1-59	C11-19	C1-44	C1-77	C11-11	C1-61	C11-21	C1-46	C1-79	C11-13	C1-75	C1-52	C1-73	C1-74
	VD #	VD 6	VD 36*	VD 20	VD 22	VD 37*	VD 8	VD 39*	VD 25	VD 27	VD 40*		(VCOI)		
	XXX	PB6		PB7	PB6	PB6		SP7	PB6		PB6	PB5	SP6	SP3	SP4

#	*Slot Number*
#	*SCATS Det #*
Fn	*Slot Function*
C1-##	*C1 Pin #*
VD #	*Voyage Detector #*
XXX	*SCATS Function*

* VD # has limited functionalities (Call, Extend and Count only)

Each VD # without an astericks has full functionality (Extend, Call, Carryover, Delay, & Count)

Definitions:

V.R.C.M=Video Remote Communications Module

SCATS=Sydney Coordinated Adaptive Traffic System

DEFAULT STANDARD FOR VIDEO DETECTION EQUIPMENT LAYOUT

"I" File	1	2	3	4	5	6	7	8	9	10	11	12
Upper / Lower	4 I/O: T		VIP: T		2 I/O: T	4 I/O: T		VIP: T		2 I/O: T	V.R.C.M.	

#	*Slot Number*
Equip.	*Video Equipment*

"J" File	1	2	3	4	5	6	7	8	9	10	11	12
Upper	4 I/O: T		VIP: T		2 I/O: T	4 I/O: T		VIP: T		2 I/O: T		
Lower												

Definitions:

VIP = Video Image Processor

2 I/0 = 2 channel Input/Output Module

4 I/0 = 4 channel Input/Output Module

T = camera

V.R.C.M. = Video Remote Communications Module

24.5.2 Input File for 332: ATC controller without C11 Connector

"I" File		1	2	3	4	5	6	7	8	9	10	11	12	13	14
Upper		14	1	21	9	16	3	23	11	18			25	26	
		Ph 1	Ph 2	Ph 2	Ph 2	Ph 3	Ph 4	Ph 4	Ph 4	Ph 1	V.R.C.M.	V.R.C.M.	Ped 2	Ped 6	
		C1-56	C1-39	C1-63	C1-47	C1-58	C1-41	C1-65	C1-49	C1-60			C1-67	C1-68	
		VD 1	VD 9	VD 11	VD 13	VD 3	VD 14	VD 16	VD 18	VD 2					
													PB1	PB2	
Lower			5	30			7	32		20			27	28	
			Ph 2	Ph 2			Ph 4	Ph 4		Ph 3			Ped 4	Ped 8	
			C1-43	C1-76			C1-45	C1-78		C1-62			C1-69	C1-70	
			VD 10	VD 12			VD 15	VD 17		VD 4					
				PB6				PB8					PB3	PB4	

"J" File		1	2	3	4	5	6	7	8	9	10	11	12	13	14
Upper		13	2	22	10	15	4	24	12	17			SP1	SP2	SP5
		Ph 5	Ph 6	Ph 6	Ph 6	Ph 7	Ph 8	Ph 8	Ph 8	Ph 5		SPARE	EVA	EVB	RR
		C1-55	C1-40	C1-64	C1-48	C1-57	C1-42	C1-66	C1-50	C1-59		C1-54	C1-71	C1-72	C1-51
		VD 5	VD 19	VD 21	VD 23	VD 7	VD 24	VD 26	VD 28	VD 6					
													SP1	SP2	SP5
Lower			6	31			8	SP7		19			SP3	SP4	SP6
			Ph 6	Ph 6			Ph 8	Ph 8		Ph 7		SPARE	EVC	EVD	RR
			C1-44	C1-77			C1-46	C1-79		C1-61		C1-75	C1-73	C1-74	C1-52
			VD 20	VD 22			VD 25	VD 27		VD 8					
				PB7				SP7				PB5	SP3	SP4	SP6

#	*Slot Number*
#	*SCATS Det #*
Fn	*Slot Function*
C1-##	*C1 Pin #*
VD #	*Voyage Detector #*
XXX	*SCATS Function*

Each VD # has full functionality (Extend, Call, Carryover, Delay, & Count)

Definitions:

V.R.C.M. = Video Remote Communications Module

SCATS = Sydney Coordinated Adaptive Traffic System

DEFAULT STANDARD FOR VIDEO DETECTION EQUIPMENT LAYOUT

"I" File		1	2	3	4	5	6	7	8	9	10	11
Upper		2 I/0: T	VIP: T		4 I/0: T		VIP: T		4 I/0: T		V.R.C.M.	
		Ph. 2	Ph. 2	Ph. 2	Ph.5	Ph.5	Ph. 4	Ph. 4	Ph.4	Ph. 7		
Lower			Ph. 2	Ph. 2			Ph. 4	Ph. 4		Ph. 7		

"J" File		1	2	3	4	5	6	7	8	9	10	11
Upper		2 I/0: T	VIP: T		4 I/0: T		VIP: T		4 I/0: T			
		Ph. 6	Ph. 6	Ph. 6	Ph.1	Ph.1	Ph. 8	Ph. 8	Ph.8	Ph. 3		
Lower			Ph. 6	Ph. 6			Ph. 8	Ph. 8		Ph. 3		

#	*Slot Number*
Equip.	*Video Equipment*
Fn	*Slot Function*

Note: The phase assignment for video layout is different than the default standard phase assignment shown above.

Definitions:

VIP = Video Image Processor

2 I/0 = 2 channel Input/Output Module

4 I/0 = 4 channel Input/Output Module

T = camera

V.R.C.M. = Video Remote Communications Module

24.5.3 Input File for 336: ATC controller

	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Upper	14 **Ph 1** C1-56 VD 1	1 **Ph 2** C1-39 VD 9	16 **Ph 3** C1-58 VD 3	3 **Ph 4** C1-41 VD 14	13 **Ph 5** C1-55 VD 5	2 **Ph 6** C1-40 VD 19	15 **Ph 7** C1-57 VD 7	4 **Ph 8** C1-42 VD 24	21 **Ph 2** C1-63 VD 11	23 **Ph 4** C1-65 VD 16	SP1 **EVA** C1-71	SP2 **EVB** C1-72	25 **Ped 2** C1-67	26 **Ped 6** C1-68
Lower	18 **Ph 1** C1-60 VD 2	5 **Ph 2** C1-43 VD 10	20 **Ph 3** C1-62 VD 4	7 **Ph 4** C1-45 VD 15	17 **Ph 5** C1-59 VD 6	6 **Ph 6** C1-44 VD 20	19 **Ph 7** C1-61 VD 8	8 **Ph 8** C1-46 VD 25	22 **Ph 6** C1-64 VD 21	24 **Ph 8** C1-66 VD 26	SP3 **EVC** C1-73	SP4 **EVD** C1-74	27 **Ped 4** C1-69	28 **Ped 8** C1-70

#	*Slot Number*
#	*SCATS Det #*
Fn	*Slot Function*
C1-##	*C1 Pin #*
VD#	*Voyage Detector #*

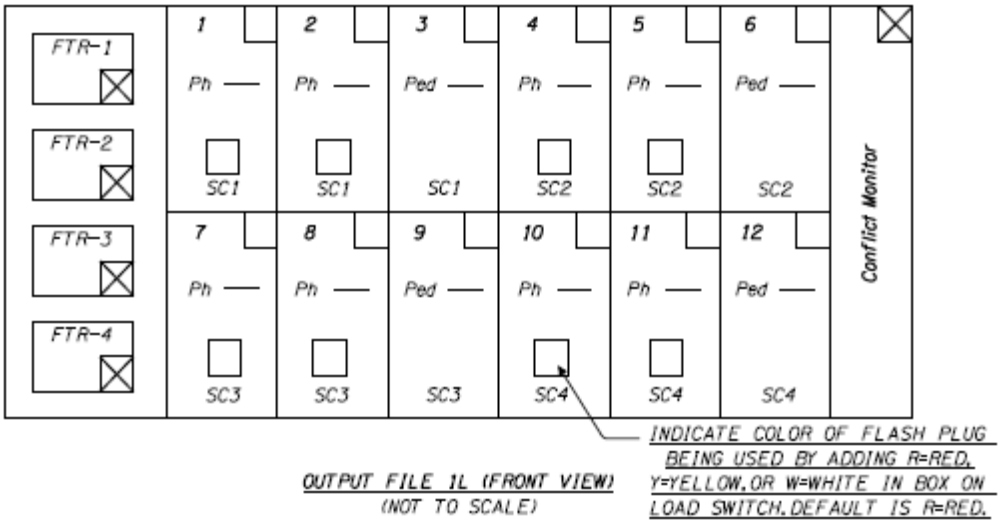
Each VD # has full functionality (Extend, Call, Carryover, Delay, & Count)

Definitions:

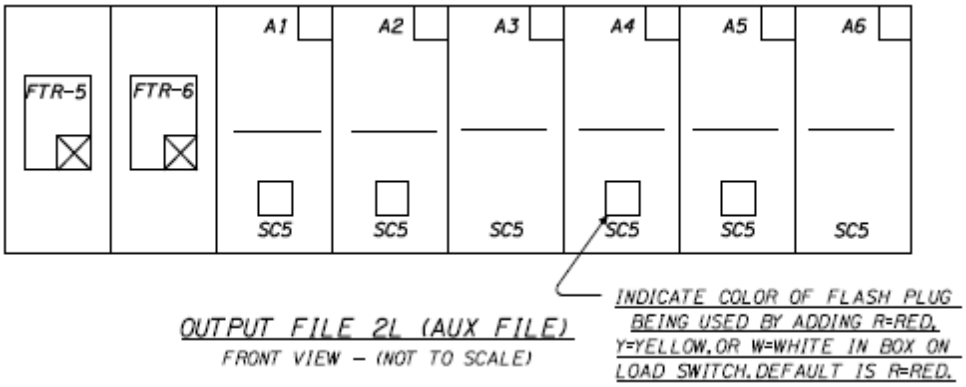
SCATS = Sydney Coordinated Adaptive Traffic System

24.6 332S and 332 Cabinet Limitations – Output File

1. 18 switch packs
2. 16 are conflict monitored
    a. Switch packs A3 and A6 are not monitored
    b. 2018 monitor can be used in extreme cases for all 18 switch packs
3. 12 have the ability to cabinet flash via flash plugs
    a. Switch packs 3, 6, 9, 12, A3, and A6 go dark in cabinet flash



OUTPUT FILE 1L (FRONT VIEW)
(NOT TO SCALE)



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

24.7 332S and 332 Cabinet Limitations – Input File

1. 28 vehicle inputs for a 332 using 9 slots and 2 input files
    a. Slots 10, I11, and 14 have no inputs
        i. Slots 1, 4, 5, and 8 have one input per slot (not two)
        ii. 4 ped
        iii. 4 EV
        iv. 2 rail – indirect via 4 C1 pins using 252 Isolator
        v. 0 spares
2. 40 vehicle inputs for a 332S using 10 slots and 2 input files
    a. All 14 slots are populated with C1 and C11 pins
        i. 4 ped
        ii. 4 EV
        iii. 2 rail – direct via inverting 255 Isolator
        iv. 1 GPS
        v. 5 spares

332 cabinet

1	2	3	4	5	6	7	8	9	10	11	12	13	14
1 E,C C1-56 VD1 1 E,C	2 E,C C1-39 VD9 VD10 C1-43 2 E,C	2 E,C C1-63 VD11 VD12 C1-76 2 E	2 C C1-47 VD13 2 C	3 E,C C1-58 VD3 3 E,C	4 E,C C1-41 VD14 VD15 C1-45 4 E,C	4 E,C C1-65 VD16 VD17 C1-78 4 E	4 C C1-49 VD18 4 C	1 E,C C1-60 VD2 VD4 C1-62 3 E,C	—	—	2 Ped C1-67 C1-69 4 Ped	6 Ped C1-68 C1-70 8 Ped	—
1	2	3	4	5	6	7	8	9	10	11	12	13	14
5 E,C C1-55 VD5 5 E,C	6 E,C C1-40 VD19 VD20 C1-44 6 E,C	6 E,C C1-64 VD21 VD22 C1-77 6 E	6 C C1-48 VD23 6 C	7 E,C C1-57 VD7 7 E,C	8 E,C C1-42 VD24 VD25 C1-46 8 E,C	8 E,C C1-66 VD26 VD27 C1-79 8 E	8 C C1-50 VD28 8 C	5 E,C C1-59 VD6 VD8 C1-61 7 E,C	—	C1-54 C1-75	EVA C1-71 C1-73 EVC	EVB C1-72 C1-74 EVD	—

332S cabinet

I1	I2	I3	I4	I5	I6	I7	I8	I9	I10	I11	I12	I13	I14
ϕ1 C1-56 VD1 VD2 C1-60 ϕ1	ϕ1 C11-16 VD29 VD30 C11-20 ϕ1	ϕ2 C1-39 VD9 VD10 C1-43 ϕ2	ϕ2 C1-63 VD11 VD12 C1-76 ϕ2	ϕ2 C1-47 VD13 VD31 C11-10 ϕ2	ϕ3 C1-58 VD3 VD4 C1-62 ϕ3	ϕ3 C11-18 VD32 VD33 C11-22 ϕ3	ϕ4 C1-41 VD14 VD15 C1-45 ϕ4	ϕ4 C1-65 VD16 VD17 C1-78 ϕ4	ϕ4 C1-49 VD18 VD34 C11-12 ϕ4	SPARE C11-23 C11-25 SPARE	SPARE C11-24 C11-26 SPARE	2 PED C1-67 C1-69 4 PED	6 PED C1-68 C1-70 8 PED
J1	J2	J3	J4	J5	J6	J7	J8	J9	J10	J11	J12	J13	J14
ϕ5 C1-55 VD5 VD6 C1-59 ϕ5	ϕ5 C11-15 VD35 VD36 C11-19 ϕ5	ϕ6 C1-40 VD19 VD20 C1-44 ϕ6	ϕ6 C1-64 VD21 VD22 C1-77 ϕ6	ϕ6 C1-48 VD23 VD37 C11-11 ϕ6	ϕ7 C1-57 VD7 VD8 C1-61 ϕ7	ϕ7 C11-17 VD38 VD39 C11-21 ϕ7	ϕ8 C1-42 VD24 VD25 C1-46 ϕ8	ϕ8 C1-66 VD26 VD27 C1-79 ϕ8	ϕ8 C1-50 VD28 VD40 C11-13 ϕ8	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)

24.8 332S and 332 Cabinet Limitations – Conflict Monitor

1. 16 channels with 32 outputs of conflict monitoring (green & yellow)
    a. Monitor all greens and flashing yellow arrows
    b. Do not monitor solid yellows
    c. Green and Yellow per channel must be the same
2. Flashing yellow arrow
    a. Use the opposing ped yellow output and yellow monitor
    b. Examples
        i. 4 section FYA signal head on Phase 1
            1. Use R Y G outputs on switch pack 1
                a. Monitor G on channel 1
            2. Use Y output on switch pack 3 for FY
                a. Monitor FY on channel 13 via yellow inhibit jumpers
        ii. 3 section FYA signal head on Phase 1 (center flash)
            1. Use R G outputs on switch pack 1
                a. Monitor G on channel 1
            2. Use Y output on switch pack 3 for FY and solid Y
                a. Monitor FY on channel 13 via yellow inhibit jumpers

CONFLICT MONITOR - TYPICAL CONNECTOR PIN ASSIGNMENTS

Term	Function	Pin	Pin	Function	Term
130	SP2-G	1	A	SP2-Y	129
115	SP3-W	2	B	SP8-G	136
135	SP8-Y	3	C	SP9-W	121
103	SP5-G	4	D	SP5-Y	102
106	SP6-W	5	E	SP11-G	109
108	SP-11Y	6	F	SP12-W	112
133	SP7-G	7	H	SP7-Y	132
114	SP3-Y (FLTYA)	8	J	SP1-G	127
126	SP1-Y	9	K	SP9-Y (FLTYA)	120
124	SP10-G	10	L	SP10-Y	123
105	SP6-Y (FLTYA)	11	M	SP4-G	118
117	SP4-Y	12	N	SP12-Y (FLTYA)	111
A123	ASP1-G	13	P	NC	–
–	NC	14	R	ASP2-G	A126
–	T&B	15	S	ASP4-G	A116
–	T&B	16	T	NC	–
–	NC	17	U	T&B	–
–	T&B	18	V	ASP5-G	A103
–	NC	19	W	NC	–
TB01-9	EQ Gnd	20	X	NC	–
TB01-10	AC-	21	Y	DC Gnd	TB02-2
C4-37	Watch Dog	22	Z	Ext. Reset	TB02-5
TB02-1	+24VDC	23	AA	T&B	–
LRCoIL	Interlock	24	BB	Stop Time	TB02-3
TB02-2	Interlock	25	CC	NC	–
–	NC	26	DD	NC	–
–	NC	27	EE	Clapper	TB01-12
TB01-11	Norm. Closed	28	FF	AC+	TB01-11

CHANNEL ASSIGNMENTS (TYPICAL)

Ch	PH
1	1
2	2
3	3
4	4
5	5
6	6
7	7
8	8
9	OLA
10	OLB
11	OLC
12	OLD
13	2PED Φ1 FLTYA
14	4PED Φ3 FLTYA
15	6PED Φ5 FLTYA
16	8PED Φ7 FLTYA

CONFLICT MONITOR DIODE CARD

CHANNEL ASSIGNMENT

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

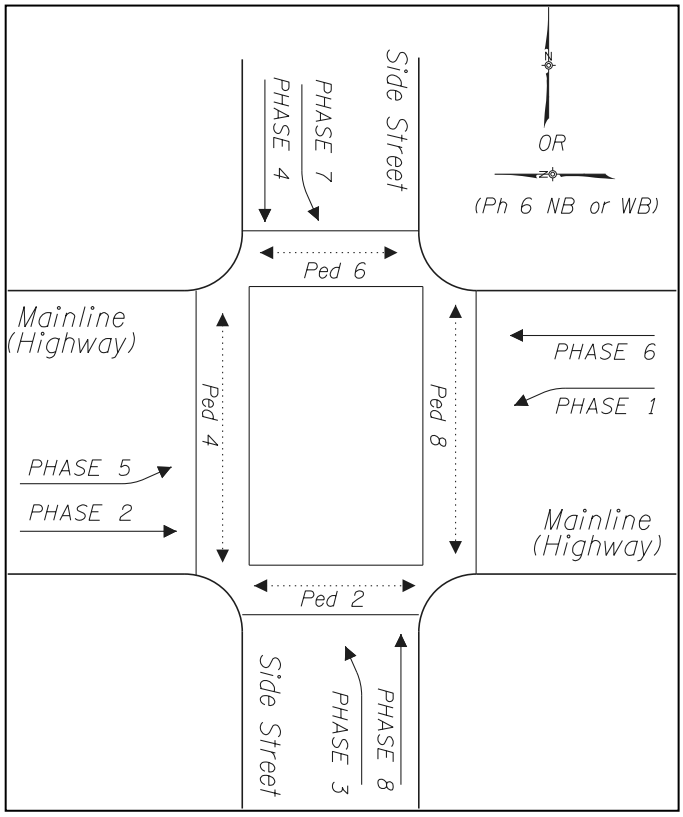
YELLOW INHIBIT JUMPERS

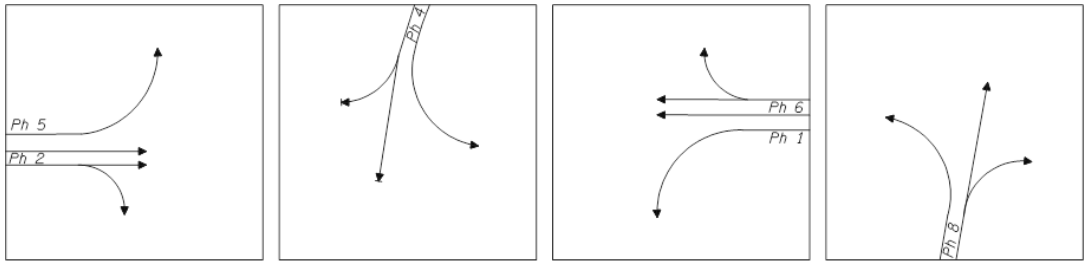
1	2	3	4	5	6	7	8
9	10	11	12	13	14	15	16

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

24.9 Phasing Standards





CHANNEL A CHANNEL B CHANNEL C CHANNEL D

FIRE PREEMPTION OPERATION

24.10 Signal Pole & Signal Head Information

Signal Head Placement/Spacing Dimensions	
From the stop line to signal face	45’ minimum
From the stop line to signal face	180’ or greater requires a near-side head
Spacing of heads for the same phase	8’ minimum, 10’ desirable
Spacing of heads to adjacent phase	6’-12’ desirable
Spacing of heads (except Type 4L head) to adjacent sign	3’ minimum
Spacing of Type 4L head to adjacent sign	4’ minimum

Signal Pole Placement
18” minimum from face of curb to any equipment mounted on pole.
5’ recommended minimum from face of curb
6’ recommended minimum from EP
5’ recommended minimum clearance on all sides of a raised island

Mast Arms		
Mast Arm Length	Std. Dwg. TM650	
	Pole Type	Pole Type w/Illum.
15’	SM1	SM1L
20’	SM2	SM2L
25’	SM2	SM2L
30’	SM3	SM3L
35’	SM3	SM3L
40’	SM4	SM4L
45’	SM4	SM4L
50’	SM5	SM5L
55’	SM5	SM5L

24.11 Sign Information

SIGN NUMBERS & SIZE (signs beginning with an "O" are Oregon specific)	SIGN TYPES: Aluminum	SIGN TYPES: Part Time Restriction	RECOMMENDED OR REQUIRED
R6-2L 30"x36"	AL 1L		Required for one-way streets. One way signs can be installed on the mast arm (R6-2L) OR ground mounted (R6-1L). See MUTCD 2B.40(P10)
R6-2R 30"x36"	AL 1R		Required for one-way streets. One way signs can be installed on the mast arm (R6-2R) OR ground mounted (R6-1R). See MUTCD 2B.40(P10)
R10-11A 30"x36"	AL 3		Region Traffic Engineer Operational Approval Required
OR3-12 30"x36"	AL 3U		
R5-2 30"x30"	AL 3T		
OR3-5TD 30"x36"	AL 4		
R3-6L 30"x36"	AL 4L		
R3-6R 30"x36"	AL 4R		
OR3-5TT 30"x36"	AL 4T		
R3-5L 30"x36"	AL 5L		Required for a trap lane (where a through lane becomes a mandatory turn lane at the intersection) if the trap lane does not have a signal head with arrow indications
R3-5R 30"x36"	AL 5R		Required for a trap lane (where a through lane becomes a mandatory turn lane at the intersection) if the trap lane does not have a signal head with arrow indications
R3-5A 30"x36"	AL 5T		
R3-3 36"x36"	AL 6		Use of appropriate lane use signs is preferred over R3-3
R3-2 36"x36"	AL 6L	PR 6L	Use of appropriate lane use signs is preferred over R3-2. PTR version used for RxR applications
R3-1 36"x36"	AL 6R	PR 6R	Use of appropriate lane use signs is preferred over R3-1. PTR version used for RxR applications
R5-1 36"x36"	AL 7		
R10-28 24"x30"	AL 8		For overhead mounting
OR20-1 24"x12"	AL 8s		
R10-6 24"x36"	AL 9		
R10-12 30"x36"	AL 11		Required with a Type 4L signal head. Recommended when a permissive left turn phase has an exclusive left turn lane. Optional otherwise.
OR10-15 30"x36"	AL 12		Required with a Type 5 signal head
W3-8 36"x36"	AL 16		
OR20-5 24"x30"	AL 17		
W3-4 36"x36"	AL 18		
W16-13p 24"x18"	AL 19		
OR3-7a 30"x9"	AL 20		

SIGNS NO LONGER USED	
OR10-10L 30"x36"	"LEFT TURN SIGNAL" sign
OR10-10R 30"x36"	"RIGHT TURN SIGNAL" sign
OR17-1 30"x36"	"LEFT TURN YIELD TO ONCOMING TRAFFIC" sign replaced by R10-12
OR22-14 30"x36"	"RIGHT TURN YIELD TO PEDS ON GREEN ball symbol" sign replaced by OR10-15

24.12 Junction Box & Conduit Information

Minimum Junction Box Type/Size	
Type/Size	**Location/use**
JB-3T: Two (Tandem) 30”x17”x12” boxes	The same quadrant as the signal controller: first access point for all signal, detector and interconnect circuits.
JB-2: Single 22”x12”x12” box	All quadrants without the signal controller: secondary access point for signal, detector, and/or interconnect circuits
JB-1: Single 17”x10”x12” box	All approach legs: detector and/or interconnect circuits

Type	Size	Total Conduit Diameters Allowed (Inches)	Remarks	Material
JB-1	17”x10”x12”	12	Non-traffic areas only	Concrete
JB-2	22”x12”x12”	18	Non-traffic areas only	Concrete
JB-3	30”x17”x12”	34	Non-traffic areas only	Concrete
JB-4	8”x6”x6”	5	No loop splices	Cast Iron
JB-5	12”x10”x6”	8	No loop splices	Cast Iron
JB-6	12”x10”x8”	8	Loop spices OK	Cast Iron
JB-7	16”x12”x6”	13	No loop splices	Cast Iron
JB-8	16”x12”x8”	13	Loop splices OK	Cast Iron

Junction Box Spacing
300’ maximum spacing. Check with the Region Electrician for the preferred spacing.

Conduit Requirements*	
Conduit crossing mainline or side street	2” minimum
Spare conduit from large signal pole to nearest junction box (if alternative detection is NOT used on project)	2”
Spare conduit from controller cabinet to nearest junction box	2”
Minimum conduit size allowed	1 ½“
Maximum conduit size allowed	3”
Max wire fill for new conduits	70% of NEC maximum
Max wire fill for existing conduits	100% of NEC maximum

*Note: Regions may have a minimum value that is larger than the statewide minimum standard. Verify with Region Traffic and Region Electrical.

24.13 Electrical Crew Preferences

It is important to ensure the electrical crew that will be maintaining the signal (ODOT or Local Agency) has a chance to review and comment on signal plans during the design phase. As such, standard documentation (specific for each region) shall be used and can be found at:

ftp://ftp.odot.state.or.us/techserv/Traffic-Engineering/Traffic_Signal_Design_Manual/ElectricalCrewPreference/

This documentation contains a list default preferences that have been approved by the Region Electrical Manager. Review this list and incorporate these preferences into the signal design. Note that for any particular project, the Region Electrical Manager may elect to change any of the default preferences. This documentation also contains a space for the electrical crew to make additional project specific comments. Follow the instructions on the documentation for use.

24.14 QA/QC Signal Plan Sheet Checklists with Examples

Before submitting plans for Traffic Standard Design review (see Chapter 2), it is recommended that the excel QA/QC file is used. This file is available on the Traffic Signal Design Manual website and contains worksheets for each type of signal plan sheet: http://www.oregon.gov/ODOT/Engineering/Pages/Signal-Design-Manual.aspx

- General
- Legend Sheet
- Signal Sheet
- Detector Sheet
- Interconnect Sheet
- Details Sheet
- Existing Utilities Sheet
- Ramp Meter Sheet
- Rail Preemption Sheet

The majority of the checklist items have hyperlinked examples to provide clarity.