PROJECT REFERENCE NO.	SHEET NO.
I-5700	Sig. 20.3

ECONOLITE ASC/3-2070
LOAD SWITCH ASSIGNMENT DETAIL

(program controller as shown)

To assign load switches 2 and 5 as OLE and OLF,
program LD SWITCH 2 as OVLP '5' TYPE 'O' and
LD SWITCH 5 as OVLP '6' TYPE 'O' as shown below.

1. From Main Menu select [1. CONFIGURATION]

2. From CONFIGURATION Submenu select [3. LOAD SW ASSIGN]

LD SWITCH ASSIGN

	LD	PHASE /OVLP	TYPE	DIMMING R	DIMMING Y	DIMMING G	DIMMING D	FLASH PWR	FLASH AUT	FLASH TGR
	1	1	V	.	.	.	+	A	Y	X
→	2	5	O	.	.	.	+	A	Y	.
	3	3	V	.	.	.	+	A	R	X
	4	4	V	.	.	.	+	A	R	.
→	5	6	O	.	.	.	−	A	R	.
	6	6	V	.	.	.	−	A	Y	X
	7	7	V	.	.	.	−	A	R	.
	8	8	V	.	.	.	−	A	R	X
	9	2	P	.	.	.	+	A	R	X
	10	4	P	.	.	.	+	A	R	X
	11	6	P	.	.	.	−	A	R	.
	12	8	P	.	.	.	−	A	R	.
	13	1	O	.	.	.	+	A	.	.
	14	2	O	.	.	.	−	A	.	.
	15	3	O	.	.	.	+	A	.	.
	16	4	O	.	.	.	−	A	.	.

THIS ELECTRICAL DETAIL IS FOR
THE SIGNAL DESIGN: 05-1168T2
DESIGNED: March 2019
SEALED: 7/24/2019
REVISED: N/A

Electrical Detail - Temp Design 2 (TMP Phase III, Step A)
Sheet 3 of 3

ELECTRICAL AND PROGRAMMING DETAILS FOR:

SR 3015 (Airport Boulevard)
at
I-40 WB Ramps

Division 5 Wake County Morrisville

PLAN DATE: May 2015 REVIEWED BY:
PREPARED BY: S. Armstrong REVIEWED BY:

REVISIONS	INIT.	DATE

Prepared In the Offices of:
Transportation Mobility and Safety Division
ITS & Signals Management Section
State of North Carolina Department of Transportation
750 N.Greenfield Pkwy,Garner,NC 27529

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

SEAL
NORTH CAROLINA PROFESSIONAL SEAL 036833 ENGINEER RYAN W. HOUGH

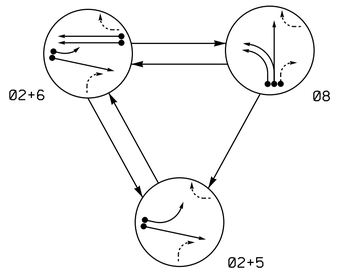
DocuSigned by:
Ryan W. Hough
430320FAA2654C3...
8/1/2019
DATE

SIG. INVENTORY NO. 05-1168T2

25-JUL-2019 13:56
.*051168_sm_ele_xxx.dgn
sarmstrong

PROJECT REFERENCE NO.	SHEET NO.
I-5700	Sig 21.0

PHASING DIAGRAM



PHASING DIAGRAM DETECTION LEGEND

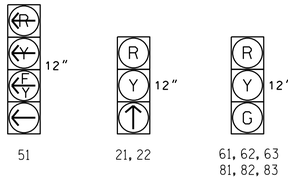
- DETECTED MOVEMENT
- UNDETECTED MOVEMENT (OVERLAP)
- UNSIGNALIZED MOVEMENT
- PEDESTRIAN MOVEMENT

TABLE OF OPERATION

SIGNAL FACE	PHASE Ø2+5	PHASE Ø2+6	PHASE Ø8	PHASE FLASH
21, 22	↑	↑	R	Y
51	←	F Y	~~R~~	~~Y~~
61, 62, 63	R	G	R	Y
81, 82, 83	R	R	G	R

SIGNAL FACE I.D.

All Heads L.E.D.



LOOP & DETECTOR INSTALLATION CHART

ASC/3-2070EN2 CONTROLLER w/ TS-2 CABINET

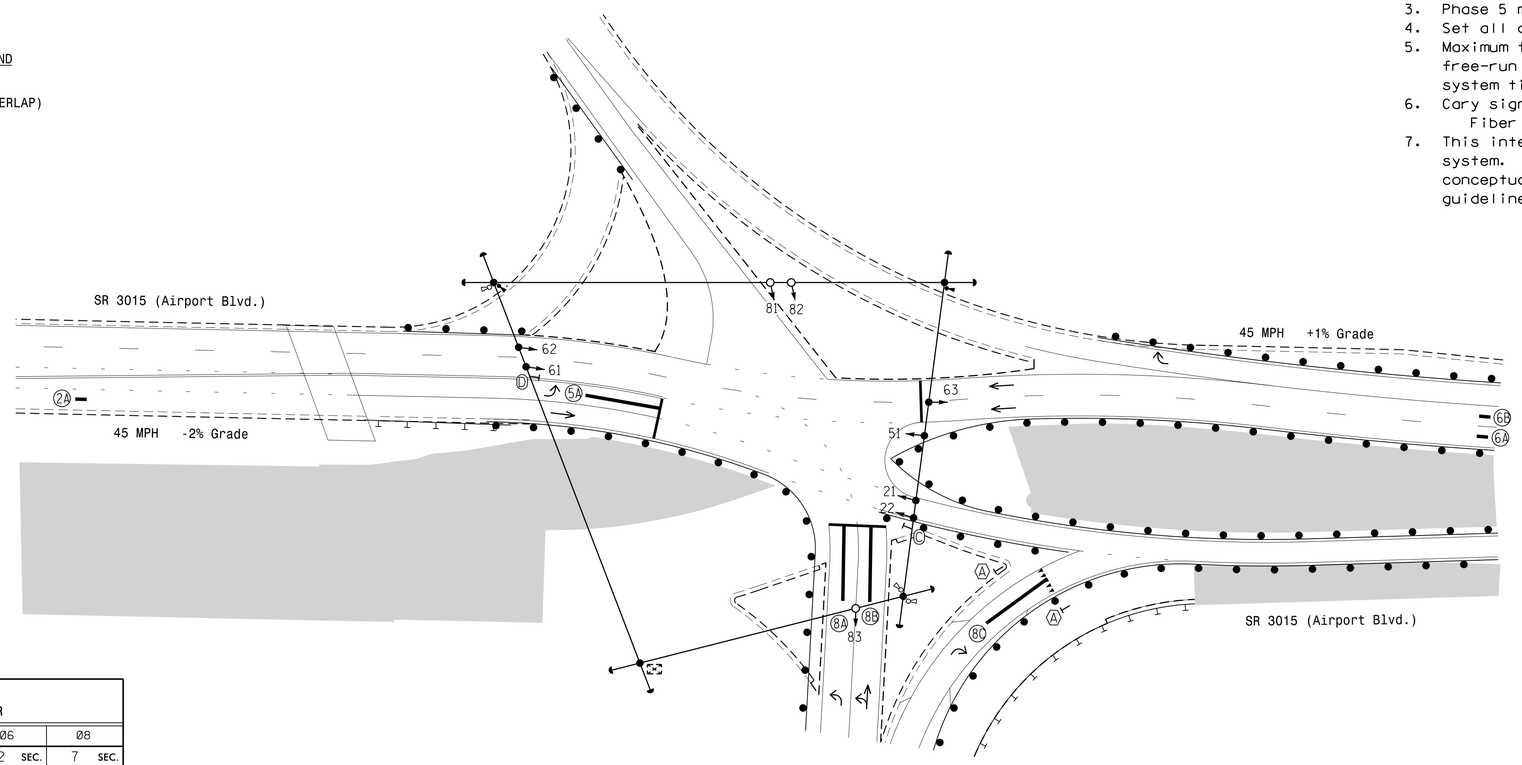
INDUCTIVE LOOPS						DETECTOR UNITS						
ZONE NO.	SIZE (ft)	DIST. FROM STOPBAR (ft)	TURNS	NEW	EXISTING	NEMA PHASE	NEW	EXISTING	TIMING FEATURE	TIMING TIME (sec)	ADDED INITIAL	DET. TYPE
2A*	6X6	300	*	X		2	*		-	-	X	N
5A*	6X40	0	*	-	X	5	-	*	DELAY	15	-	S
						2	-	*	DELAY	3	-	G
6A*	6X6	300	*	-	X	6	-	*	-	-	X	N
6B*	6X6	300	*	-	X	6	-	*	-	-	X	N
8A*	6X40	0	*	X	-	8	*	-	-	-	-	S
8B*	6X40	0	*	X	-	8	*	-	-	-	-	S
8C*	6X40	0	*	X	-	8	*	-	DELAY	20	-	S

* Video detection zone.

3 Phase
Fully Actuated
(Cary Signal System)

NOTES

1. Refer to "Roadway Standard Drawings NCDOT" dated January 2018 and "Standard Specifications for Roads and Structures" dated January 2018.
2. Do not program signal for late night flashing operation unless otherwise directed by the Engineer.
3. Phase 5 may be lagged.
4. Set all detector units to presence mode.
5. Maximum times shown in timing chart are for free-run operation only. Coordinated signal system timing values supersede these values.
6. Cary signal system data:
   Fiber channel #: 26.
7. This intersection features a video detection system. Shown locations of detectors are conceptual only. Refer to the manufacturer's guidelines for optimal detector placement.



LEGEND

PROPOSED		EXISTING
○→	Traffic Signal Head	●→
◐→	Modified Signal Head	N/A
⊣	Sign	⊣
□	Pedestrian Signal Head With Push Button & Sign	■
○	Signal Pole with Guy	●
○	Signal Pole with Sidewalk Guy	●
▭	Inductive Loop Detector	▭
⊠	Controller & Cabinet	⊠
□	Junction Box	■
- - - -	2-in Underground Conduit	- - - -
N/A	Right of Way	- - - - -
→	Directional Arrow	→
N/A	Guardrail	⊥⊥
◁	Video Detector	◀
▬	Video Detection Area	▬
●-●	Construction Zone Drums	●-●
▒	Construction Zone	▒
Ⓐ	"YIELD" Sign (R1-2)	Ⓐ
Ⓒ	No Right Turn Sign (R3-1)	Ⓒ
Ⓓ	No U-Turn / No Left Turn Sign (R3-18)	Ⓓ

TIMING CHART

ASC/3-2070EN2 CONTROLLER

PHASE	02	05	06	08
MINIMUM GREEN *	12 SEC.	7 SEC.	12 SEC.	7 SEC.
VEHICLE EXT. *	6.0 SEC.	2.0 SEC.	6.0 SEC.	2.0 SEC.
YELLOW CHANGE INT.	4.7 SEC.	3.0 SEC.	4.7 SEC.	3.8 SEC.
RED CLEARANCE	2.0 SEC.	1.9 SEC.	2.0 SEC.	2.7 SEC.
MAX. 1 *	120 SEC.	35 SEC.	120 SEC.	50 SEC.
MAX. 2 *	35 SEC.	15 SEC.	35 SEC.	90 SEC.
RECALL POSITION	MIN. RECALL	NONE	MIN. RECALL	NONE
LOCK DET.	ON	OFF	ON	OFF
WALK *	— SEC.	— SEC.	— SEC.	— SEC.
PED. CLEAR	— SEC.	— SEC.	— SEC.	— SEC.
VOLUME DENSITY	ON	OFF	ON	OFF
ACTUATION B4 ADD *	— VEH.	— VEH.	— VEH.	— VEH.
SEC. PER ACTUATION *	2.5 SEC.	— SEC.	1.5 SEC.	— SEC.
MAX. INITIAL *	34 SEC.	— SEC.	34 SEC.	— SEC.
TIME B4 REDUCTION *	15 SEC.	— SEC.	15 SEC.	— SEC.
TIME TO REDUCE *	45 SEC.	— SEC.	45 SEC.	— SEC.
MINIMUM GAP	3.0 SEC.	— SEC.	3.0 SEC.	— SEC.
DUAL ENTRY	OFF	OFF	OFF	OFF
SIMULTANEOUS GAP	ON	ON	ON	ON

* These values may be field adjusted. Do not adjust Min Green and Extension times for phases 2 and 6 lower than what is shown. Min Green for all other phases should not be lower than 4 seconds.

This plan supersedes the plan signed and sealed on 7/24/19.

Signal Upgrade - Temporary Design 3 (TMP Phase III, Step B)

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

Prepared In the Offices of:
Transportation Mobility and Safety Division
NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
Signal Design Section
750 N.Greenfield Pkwy,Garner,NC 27529

SR 3015 (Airport Boulevard)
at
I-40 WB Ramps

Division 5 Wake County Morrisville

PLAN DATE: September 2019 REVIEWED BY:
PREPARED BY: J.A. Lohr REVIEWED BY:

SCALE 0 40 1"=40'

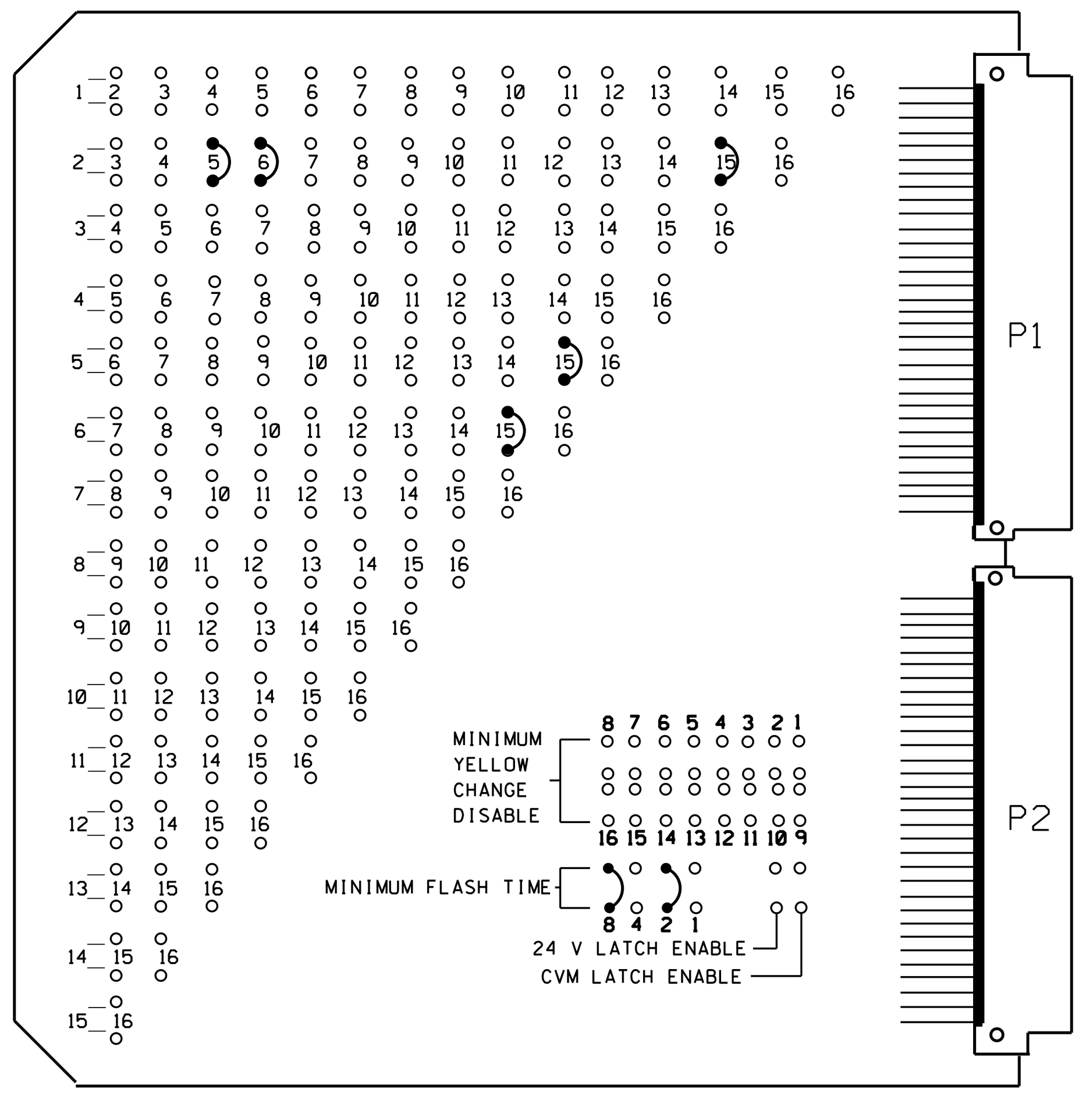
REVISIONS	INIT.	DATE

SEAL
NORTH CAROLINA PROFESSIONAL SEAL 026486 ENGINEER ROBERT J. ZIEMBA
DocuSigned by: 10/2/2019
DATE
SIG. INVENTORY NO. 05-1168T3

PROJECT REFERENCE NO.	SHEET NO.
I-5700	Sig. 21.1

EDI MODEL MMU2-16LEip MALFUNCTION MANAGEMENT UNIT PROGRAMMING DETAIL

(program card and tables as shown below)



MMU PROGRAMMING CARD

FIELD CHECK ENABLE DUAL IND ENABLE RED FAIL ENABLE	
CHANNEL NUMBER	ENABLE/ DISABLE
1	DISABLE
2	ENABLE
3	DISABLE
4	DISABLE
5	DISABLE
6	ENABLE
7	DISABLE
8	ENABLE
9	DISABLE
10	DISABLE
11	DISABLE
12	DISABLE
13	DISABLE
14	DISABLE
15	ENABLE
16	DISABLE

UNIT OPTIONS	
OPTION	SETTING
RECURRENT PULSE	ON
WALK DISABLE	OFF
LOG CVM FAULTS	ON
EXTERN WATCHDOG	OFF
24V-2=12VDC	OFF
PGM CARD MEMORY	ON
LEDguard	ON
FORCE TYPE 16	OFF
TYPE12-SDLC	OFF
VM 3x/Day Latch	ON

FLASHING YELLOW ARROW	
CONFIG MODE	B
ENABLE CHANNEL PAIR, FYA	
CH 1-13	OFF
CH 3-14	OFF
CH 5-15	ON
CH 7-16	OFF
RED/YEL INPUT ENABLE	
CH 1	OFF
CH 3	OFF
CH 5	ON
CH 7	OFF
FLASH RATE FAULT	ON
FYA TRAP DETECT	ON

MMU PROGRAMMING NOTE

ENSURE YELLOW CHANGE PLUS RED CLEARANCE MONITORING IS ENABLED FOR ALL CHANNELS.

NOTES

1. To prevent "flash-conflict" problems, wire all unused load switches to flash red. Verify that signal heads flash in accordance with the signal plans.
2. To prevent red failures on unused monitor channels, tie unused load switch red outputs 1,3,4,7,9,10,11,12,13,14, and 16 to load switch AC+ by inserting a jumper plug in the unused load switch socket from pin 1 (LS AC+) to pin 3 (RED out). Make sure all flash transfer relays are in place.
3. Program controller to start up in phase 2 Green and 6 Green.
4. Set power-up flash time to 10 seconds and implement on the Malfunction Management Unit. Set controller power-up flash time to 0 seconds.
5. Enable simultaneous gap-out feature for all phases.
6. Program detectors in accordance with the manufacturer's instructions to accomplish the detection schemes shown on the signal design plans.
7. Program detector call delay and extension timing on the controller, unless otherwise specified.
8. Set all detector card unit channels to "presence" mode.
9. Program phases 2 and 6 for volume density operation.
10. The cabinet and controller are a part of the Cary Signal System.

SIGNAL HEAD HOOK-UP CHART

PHASE	1	2	3	4	5	6	7	8	2 PED	4 PED	6 PED	8 PED	OLA	OLB	OLC	OLD
SIGNAL HEAD NO.	NU	21,22	NU	NU	51★	61,62 63	NU	82,82 83	NU	NU	NU	NU	NU	NU	51★	NU
RED		2R			✳	6R		8R								
YELLOW		2Y			✳	6Y		8Y								
GREEN						6G		8G								
RED ARROW															15R	
YELLOW ARROW															15Y	
FLASHING YELLOW ARROW															15G	
GREEN ARROW		2G			5G											
(DON'T WALK)																
(WALK)																

NU = Not Used

✳ Denotes install load resistor. See Load Resistor Installation Detail on sheet 2.

★ See pictorial of head wiring detail this sheet.

NOTE: Load switches 2 and 5 have been reassigned as vehicle load switches. See sheet 3 for programming details.

DETECTOR RACK SET-UP DETAIL

INSERT DETECTOR CARDS IN RACK ACCORDING TO THE DETAIL SHOWN BELOW. PARTICULAR DETECTOR CHANNELS WILL CALL PHASES INDICATED.

RACK #1	BIU	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY

WIRE LOOPS TO TERMINALS ON LOOP PANEL AS SHOWN IN THE CHART BELOW

LOOP NO.	LOOP PANEL TERMINALS
NU	L1A,L1B
NU	L2A,L2B
NU	L3A,L3B
NU	L4A,L4B
NU	L5A,L5B
NU	L6A,L6B
NU	L7A,L7B
NU	L8A,L8B
NU	L9A,L9B
NU	L10A,L10B
NU	L11A,L11B
NU	L12A,L12B
NU	L13A,L13B
NU	L14A,L14B
NU	L15A,L15B
NU	L16A,L16B

PROGRAM CONTROLLER DETECTORS ACCORDING TO THE SCHEDULE SHOWN IN THE CHART BELOW

CONTROLLER DETECTOR NO.	FUNCTION	TIMING	
		FEATURE	TIME(SEC)
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			
13			
14			
15			
16			

SPECIAL DETECTOR NOTE

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

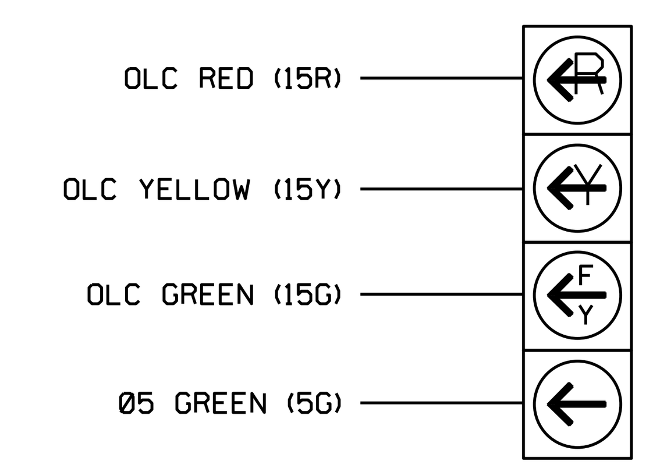
EQUIPMENT INFORMATION

CONTROLLER..............2070EN2
CABINET ....NC-8 [TS-2]
SOFTWARE ....ECONOLITE ASC/3-2070
CABINET MOUNT...........BASE
LOADBAY POSITIONS.......16
LOAD SWITCHES USED......2,5,6,8,15
PHASES USED.............2,5,6,8
OLA.....................NOT USED
OLB.....................NOT USED
OLC.....................✳
OLD.....................NOT USED

✳ SEE OVERLAP PROGRAMMING DETAIL ON SHEET 2

FYA SIGNAL WIRING DETAIL

(wire signal head as shown)



51

THIS ELECTRICAL DETAIL SUPERSEDES THE DETAIL SEALED ON 8/1/2019.

THIS ELECTRICAL DETAIL IS FOR THE SIGNAL DESIGN: 05-1168T3
DESIGNED: September 2019
SEALED: 10/2/2019
REVISED: N/A

Electrical Detail - Temp Design 3 (TMP Phase III, Step B)
Sheet 1 of 3

ELECTRICAL AND PROGRAMMING DETAILS FOR:

Prepared in the Offices of:
750 N.Greenfield Pkwy,Garner,NC 27529

SR 3015 (Airport Boulevard)
at
I-40 WB Ramps

Division 5 — Wake County — Morrisville

PLAN DATE: October 2019	REVIEWED BY:
PREPARED BY: S. Armstrong	REVIEWED BY:

REVISIONS	INIT.	DATE

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

SEAL
NORTH CAROLINA PROFESSIONAL SEAL 036833 ENGINEER RYAN W. HOUGH

DocuSigned by: Ryan W. Hough 430320FAA2654C3...
10/8/2019
DATE

SIG. INVENTORY NO. 05-1168T3

ECONOLITE ASC/3-2070 OVERLAP PROGRAMMING DETAIL

(program controller as shown)

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

Toggle Twice

OVERLAP C

Select TMG VEH OVLP [C] and 'PPLT FYA'

```
TMG VEH OVLP...[C] TYPE: .....PPLT FYA

PROTECTED LEFT TURN....   PHASE   5
OPPOSING THROUGH.......   PHASE   6

FLASHING ARROW OUTPUT.....CH15 ISOLATE

DELAY START OF: FYA..0.0 CLEARANCE..0.0
ACTION PLAN SF BIT DISABLE........... 0
```

END PROGRAMMING

OVERLAP F

Select TMG VEH OVLP [F] and 'NORMAL'

```
TMG VEH OVLP...[F] TYPE: .......NORMAL
  PHASES 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6
INCLUDED . . X . . . . . . . . . . . . .

LAG GRN 0.0 YEL 0.0 RED 0.0
```

OVERLAP E

Select TMG VEH OVLP [E] and 'NORMAL'

```
TMG VEH OVLP...[E] TYPE: .......NORMAL
  PHASES 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6
INCLUDED . . X . . X . . . . . . . . . .

LAG GRN 0.0 YEL 0.0 RED 0.0
```

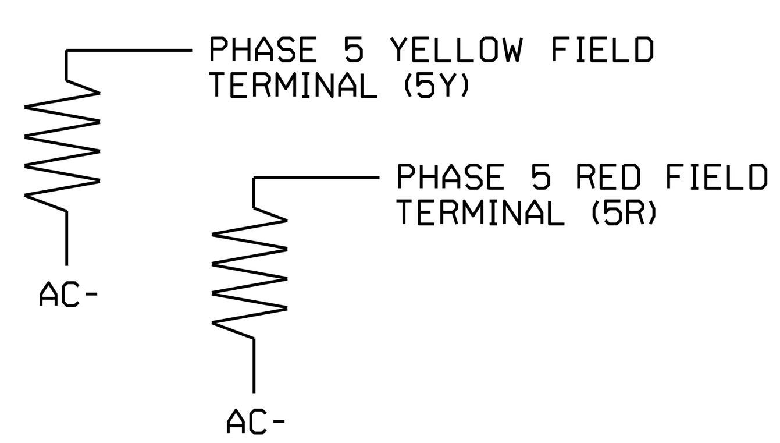
DELETE OVERLAP 'E' AND OVERLAP 'F' PROGRAMMING

LOAD RESISTOR INSTALLATION DETAIL

(install resistors as shown below)

ACCEPTABLE VALUES

VALUE (ohms)	WATTAGE
1.5K - 1.9K	25W (min)
2.0K - 3.0K	10W (min)



ECONOLITE ASC/3-2070 SPECIAL MMU PROGRAMMING

(program controller as shown)

1. From Main Menu select `1. CONFIGURATION`
2. From CONFIGURATION Submenu select `4. PORT 1 (SDLC)`
3. From PORT 1 (SDLC) Submenu select `2. MMU PROGRAM`

CAUTION!

Set intersection to Flash before attempting to enter or change any MMU programming data.

This programming and that of the MMU programming card must match exactly. If they do not, the intersection will be placed into Flash.

```
MMU PROGRAM [    MANUAL]

     CH  6 5 4 3 2 1 0 9 8 7 6 5 4 3 2
      1  . . . . . . . . . . . . . . .
      2  . X . . . . . . . . X X . .
      3  . . . . . . . . . . . . .
      4  . . . . . . . . . . . .
      5  . X . . . . . . . . .
      6  . X . . . . . . . .
      7  . . . . . . . . .
      8  . . . . . . . .
      9  . . . . . . .
     10  . . . . . .
     11  . . . . .
     12  . . . .
     13  . . .
     14  . .
     15  .
```

END PROGRAMMING

THIS ELECTRICAL DETAIL SUPERSEDES THE DETAIL SEALED ON 8/1/2019.

THIS ELECTRICAL DETAIL IS FOR
THE SIGNAL DESIGN: 05-1168T3
DESIGNED: September 2019
SEALED: 10/2/2019
REVISED: N/A

Electrical Detail - Temp Design 3 (TMP Phase III, Step B)
Sheet 2 of 3

PROJECT REFERENCE NO.	SHEET NO.
I-5700	Sig. 21.2

ELECTRICAL AND PROGRAMMING DETAILS FOR:

SR 3015 (Airport Boulevard)
at
I-40 WB Ramps

Prepared in the Offices of: Transportation Mobility and Safety Division, Signals Management Section, 750 N.Greenfield Pkwy, Garner, NC 27529

Division 5 | Wake County | Morrisville

PLAN DATE: October 2019 | REVIEWED BY:
PREPARED BY: S. Armstrong | REVIEWED BY:

REVISIONS | INIT. | DATE

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

SEAL

NORTH CAROLINA PROFESSIONAL SEAL 036833 ENGINEER RYAN W. HOUGH

DocuSigned by: Ryan W. Hough 10/8/2019
DATE

SIG. INVENTORY NO. 05-1168T3

ECONOLITE ASC/3-2070
LOAD SWITCH ASSIGNMENT DETAIL

(program controller as shown)

To assign load switches 2 and 5 as vehicle load switches, program LD SWITCH 2 as PHASE '2' TYPE 'V' and LD SWITCH 5 as PHASE '5' TYPE 'V' as shown below.

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

LD SWITCH ASSIGN

	PHASE		DIMMING				---FLASH---		
	/OVLP	TYPE	R	Y	G	D	PWR	AUT	TGR
1	1	V	.	.	.	+	A	R	X
2	2	V	.	.	.	+	A	Y	.
3	3	V	.	.	.	+	A	R	X
4	4	V	.	.	.	+	A	R	.
5	5	V	.	.	.	−	A	R	.
6	6	V	.	.	.	−	A	Y	X
7	7	V	.	.	.	−	A	R	.
8	8	V	.	.	.	−	A	R	X
9	2	P	.	.	.	+	A	R	X
10	4	P	.	.	.	+	A	R	X
11	6	P	.	.	.	−	A	R	.
12	8	P	.	.	.	−	A	R	.
13	1	O	.	.	.	+	A	.	.
14	2	O	.	.	.	−	A	.	.
15	3	O	.	.	.	+	A	.	.
16	4	O	.	.	.	−	A	.	.

THIS ELECTRICAL DETAIL SUPERSEDES THE DETAIL SEALED ON 8/1/2019.

THIS ELECTRICAL DETAIL IS FOR
THE SIGNAL DESIGN: 05-1168T3
DESIGNED: September 2019
SEALED: 10/2/2019
REVISED: N/A

Electrical Detail - Temp Design 3 (TMP Phase III, Step B)
Sheet 3 of 3

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

ELECTRICAL AND PROGRAMMING DETAILS FOR:

Prepared in the Offices of:
Transportation Mobility and Safety Division
ITS & Signals Management Section
750 N.Greenfield Pkwy,Garner,NC 27529

SR 3015 (Airport Boulevard)
at
I-40 WB Ramps

Division 5 Wake County Morrisville

PLAN DATE: October 2019	REVIEWED BY:
PREPARED BY: S. Armstrong	REVIEWED BY:

REVISIONS	INIT.	DATE

SEAL
NORTH CAROLINA PROFESSIONAL SEAL 036833 ENGINEER RYAN W. HOUGH

DocuSigned by: Ryan W. Hough 430320EAA2654C3
10/8/2019
DATE

SIG. INVENTORY NO. 05-1168T3

03-OCT-2019 07:45
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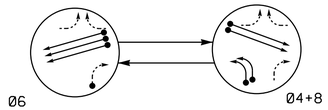
sarmstrong

PROJECT REFERENCE NO.	SHEET NO.
I-5700	Sig 22.0

PHASING DIAGRAM



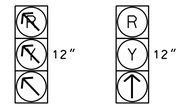
PHASING DIAGRAM DETECTION LEGEND

- DETECTED MOVEMENT
- UNDETECTED MOVEMENT (OVERLAP)
- UNSIGNALIZED MOVEMENT
- PEDESTRIAN MOVEMENT

TABLE OF OPERATION			
SIGNAL FACE	PHASE Ø6	PHASE Ø4+8	PHASE FLASH
41, 42	R	↑	R
61, 62, 63	↑	R	R
81, 82	↖	↖	↖

SIGNAL FACE I.D.

All Heads L.E.D.



81, 82

41, 42
61, 62, 63

LOOP & DETECTOR INSTALLATION CHART

ASC/3-2070EN2 CONTROLLER w/ TS-2 CABINET

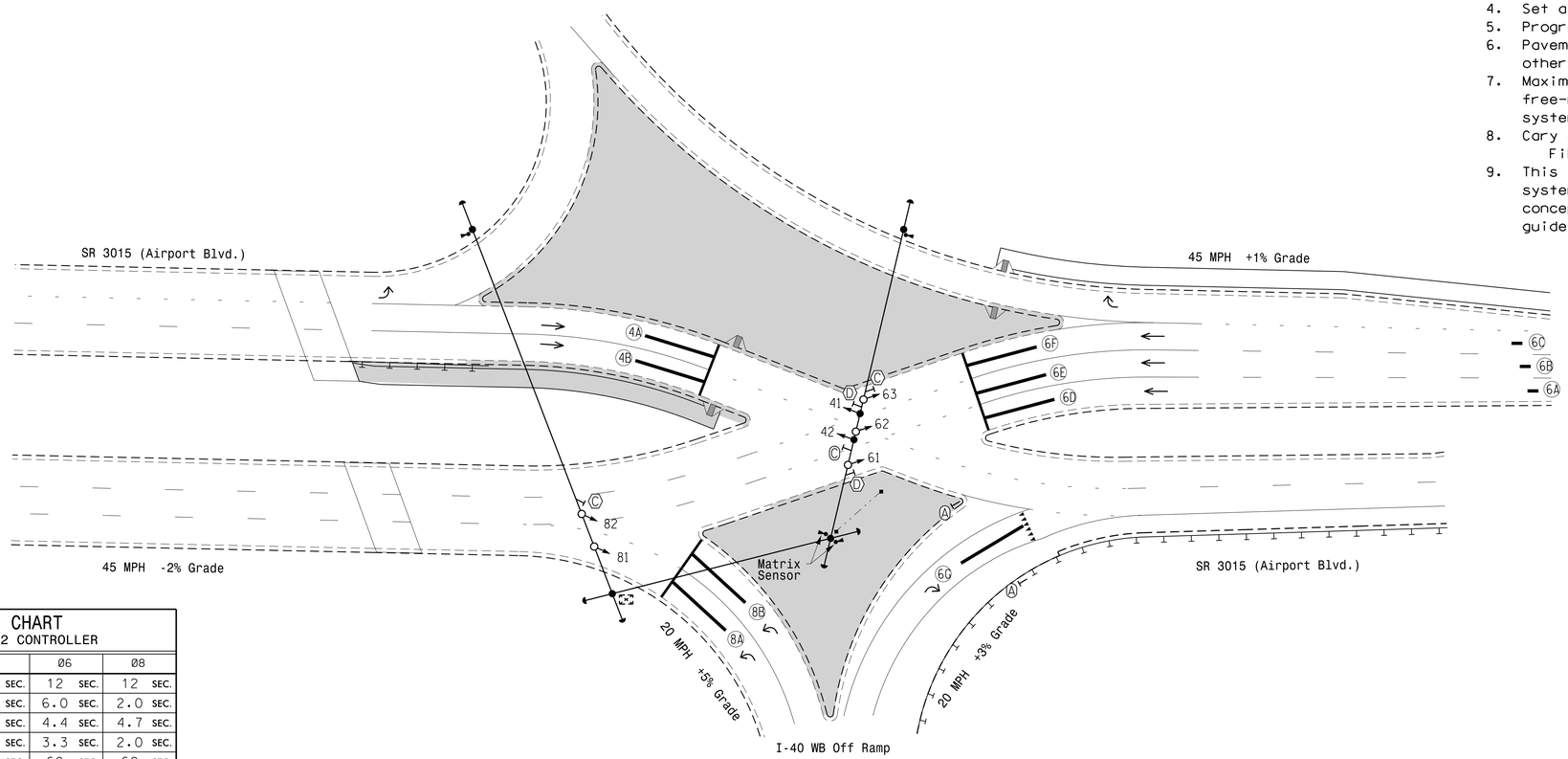
INDUCTIVE LOOPS						DETECTOR UNITS					
ZONE NO.	SIZE (ft)	DIST. FROM STOPBAR (ft)	TURNS	NEW	EXISTING	NEMA PHASE	NEW	EXISTING	TIMING FEATURE	TIMING TIME	ADDED INITIAL	DET. TYPE
4A*	6X40	0	*	X	-	4	-	*	-	-	-	S
4B*	6X40	0	*	X	-	4	-	*	-	-	-	S
6A*	6X6	300	*	X	-	6	-	*	-	-	X	N
6B*	6X6	300	*	X	-	6	-	*	-	-	X	N
6C*	6X6	300	*	X	-	6	-	*	-	-	X	N
6D*	6X40	0	*	X	-	6	*	-	-	-	-	S
6E*	6X40	0	*	X	-	6	*	-	-	-	-	S
6F*	6X40	0	*	X	-	6	*	-	-	-	-	S
6G*	6X40	0	*	X	-	6	-	*	DELAY	20	-	S
8A*	6X40	0	*	X	-	8	*	-	-	-	-	S
8B*	6X40	0	*	X	-	8	*	-	-	-	-	S

* Video detection zone.

3 Phase
Fully Actuated
(Cary Signal System)

NOTES

1. Refer to "Roadway Standard Drawings NCDOT" dated January 2018 and "Standard Specifications for Roads and Structures" dated January 2018.
2. Do not program signal for late night flashing operation unless otherwise directed by the Engineer.
3. Renumber existing signal head numbered 21 and 22 to 41 and 42, respectively.
4. Set all detector units to presence mode.
5. Program controller to start up in all red.
6. Pavement markings are existing unless otherwise shown.
7. Maximum times shown in timing chart are for free-run operation only. Coordinated signal system timing values supersede these values.
8. Cary signal system data:
   Fiber channel #: 26.
9. This intersection features a video detection system. Shown locations of detectors are conceptual only. Refer to the manufacturer's guidelines for optimal detector placement.



TIMING CHART

ASC/3-2070EN2 CONTROLLER

PHASE	Ø4	Ø6	Ø8
MINIMUM GREEN *	12 SEC.	12 SEC.	12 SEC.
VEHICLE EXT. *	2.0 SEC.	6.0 SEC.	2.0 SEC.
YELLOW CHANGE INT.	4.7 SEC.	4.4 SEC.	4.7 SEC.
RED CLEARANCE	2.0 SEC.	3.3 SEC.	2.0 SEC.
MAX. 1 *	60 SEC.	60 SEC.	60 SEC.
MAX. 2 *	– SEC.	– SEC.	– SEC.
RECALL POSITION	NONE	SOFT RECALL	NONE
LOCK DET.	OFF	OFF	OFF
WALK *	– SEC.	– SEC.	– SEC.
PED. CLEAR	– SEC.	– SEC.	– SEC.
VOLUME DENSITY	OFF	ON	OFF
ACTUATION B4 ADD *	– VEH.	– VEH.	– VEH.
SEC. PER ACTUATION *	– SEC.	1.0 SEC.	– SEC.
MAX. INITIAL *	– SEC.	34 SEC.	– SEC.
TIME B4 REDUCTION *	– SEC.	15 SEC.	– SEC.
TIME TO REDUCE *	– SEC.	30 SEC.	– SEC.
MINIMUM GAP	– SEC.	3.0 SEC.	– SEC.
DUAL ENTRY	ON	OFF	ON
SIMULTANEOUS GAP	ON	ON	ON

* These values may be field adjusted. Do not adjust Min Green and Extension times for phases 2 and 6 lower than what is shown. Min Green for all other phases should not be lower than 4 seconds.

LEGEND

PROPOSED		EXISTING
○→	Traffic Signal Head	●→
◐→	Modified Signal Head	N/A
⊣	Sign	⊣
▭↓	Pedestrian Signal Head With Push Button & Sign	■↓
○→	Signal Pole with Guy	●→
○↓	Signal Pole with Sidewalk Guy	●↓
▭	Inductive Loop Detector	▭
⊠	Controller & Cabinet	⊠
□	Junction Box	■
·····	2-in Underground Conduit	·····
N/A	Right of Way	– – – –
→	Directional Arrow	→
N/A	Curb Ramp	◢
N/A	Guardrail	⊥⊥
◇→	Video Detector	◆→
▬	Video Detection Area	▬
●–●	Construction Zone Drums	●–●
▒	Construction Zone	▒
Ⓐ	"YIELD" Sign (R1-2)	Ⓐ
Ⓒ	No Right Turn Sign (R3-1)	Ⓒ
Ⓓ	No U-Turn / No Left Turn Sign (R3-18)	Ⓓ

Signal Upgrade - Temporary Design 4 (TMP Phase IV)

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

Prepared in the Offices of:
Transportation Mobility and Safety Division
NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
Signal Design Section
750 N.Greenfield Pkwy.Garner,NC 27529

SR 3015 (Airport Boulevard)
at
I-40 WB Ramps

Division 5 Wake County Morrisville

PLAN DATE: March 2018 REVIEWED BY:

PREPARED BY: J.A. Lohr REVIEWED BY:

SCALE 0 40 1"=40'

REVISIONS	INIT.	DATE

SEAL
NORTH CAROLINA PROFESSIONAL SEAL 026486 ENGINEER ROBERT J. ZIEMBA

DocuSigned by: 7/24/2019 DATE

SIG. INVENTORY NO. 05-116814

05-AUG-2019 08:23
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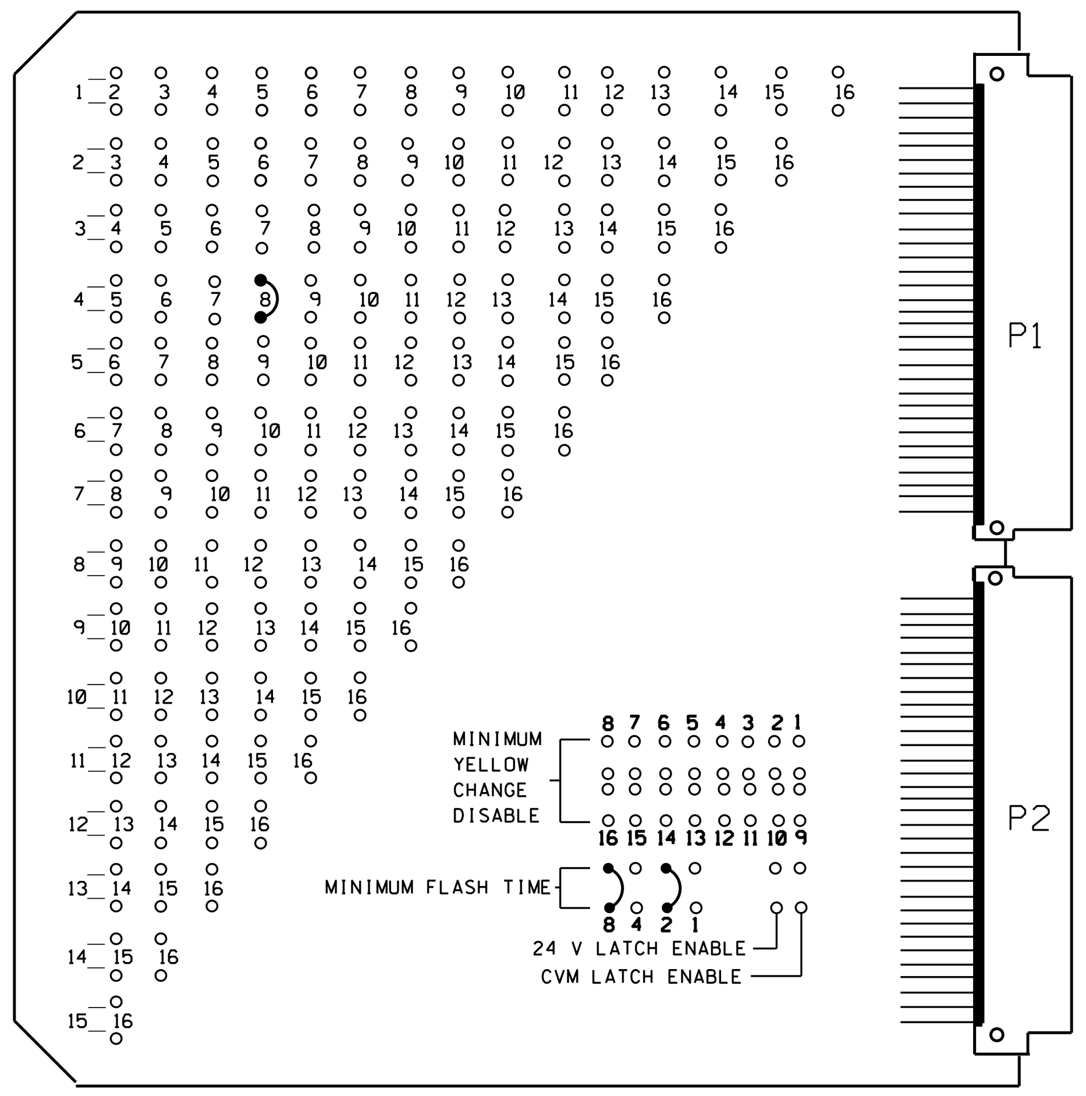
jalohr

EDI MODEL MMU2-16LEip MALFUNCTION MANAGEMENT UNIT PROGRAMMING DETAIL

(program card and tables as shown below)



MMU PROGRAMMING CARD

FIELD CHECK ENABLE DUAL IND ENABLE RED FAIL ENABLE	
CHANNEL NUMBER	ENABLE/ DISABLE
1	DISABLE
2	DISABLE
3	DISABLE
4	ENABLE
5	DISABLE
6	ENABLE
7	DISABLE
8	ENABLE
9	DISABLE
10	DISABLE
11	DISABLE
12	DISABLE
13	DISABLE
14	DISABLE
15	DISABLE
16	DISABLE

UNIT OPTIONS	
OPTION	SETTING
RECURRENT PULSE	ON
WALK DISABLE	OFF
LOG CVM FAULTS	ON
EXTERN WATCHDOG	OFF
24V-2=12VDC	OFF
PGM CARD MEMORY	ON
LEDguard	ON
FORCE TYPE 16	OFF
TYPE12-SDLC	OFF
VM 3x/Day Latch	ON

FLASHING YELLOW ARROW	
CONFIG MODE	B
ENABLE CHANNEL PAIR, FYA	
CH 1-13	OFF
CH 3-14	OFF
CH 5-15	OFF
CH 7-16	OFF
RED/YEL INPUT ENABLE	
CH 1	OFF
CH 3	OFF
CH 5	OFF
CH 7	OFF
FLASH RATE FAULT	OFF
FYA TRAP DETECT	OFF

MMU PROGRAMMING NOTE

ENSURE YELLOW CHANGE PLUS RED CLEARANCE MONITORING IS ENABLED FOR ALL CHANNELS.

NOTES

1. To prevent "flash-conflict" problems, wire all unused load switches to flash red. Verify that signal heads flash in accordance with the signal plans.
2. To prevent red failures on unused monitor channels, tie unused load switch red outputs 1,2,3,5,7,9,10,11,12,13,14,15, and 16 to load switch AC+ by inserting a jumper plug in the unused load switch socket from pin 1 (LS AC+) to pin 3 (RED out). Make sure all flash transfer relays are in place.
3. Program controller to start up as follows: Main Menu 2-5 MUTCD-> YES, ALL RED...6, Phase 2 Green, Phase 6 Green
4. Set power-up flash time to 10 seconds and implement on the Malfunction Management Unit. Set controller power-up flash time to 0 seconds.
5. Enable simultaneous gap-out feature for all phases.
6. Program detectors in accordance with the manufacturer's instructions to accomplish the detection schemes shown on the signal design plans.
7. Program detector call delay and extension timing on the controller, unless otherwise specified.
8. Set all detector card unit channels to "presence" mode.
9. Program phases 4 and 8 for dual entry.
10. Program phases 2 and 6 for volume density operation.
11. The cabinet and controller are a part of the Cary Signal System.

SIGNAL HEAD HOOK-UP CHART

PHASE	1	2	3	4	5	6	7	8	2 PED	4 PED	6 PED	8 PED	OLA	OLB	OLC	OLD
SIGNAL HEAD NO.	NU	NU	NU	41,42	NU	61,62 63	NU	81,82	NU	NU	NU	NU	NU	NU	NU	NU
RED				4R		6R										
YELLOW				4Y		6Y										
GREEN																
RED ARROW								8R								
YELLOW ARROW								8Y								
GREEN ARROW				4G		6G		8G								
(hand)																
(walk)																

NU = Not Used

DETECTOR RACK SET-UP DETAIL

INSERT DETECTOR CARDS IN RACK ACCORDING TO THE DETAIL SHOWN BELOW. PARTICULAR DETECTOR CHANNELS WILL CALL PHASES INDICATED.

RACK #1	BIU	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY

EQUIPMENT INFORMATION

CONTROLLER..............2070EN2
CABINET NC-8 TS-2
SOFTWARE ....ECONOLITE ASC/3-2070
CABINET MOUNT...........BASE
LOADBAY POSITIONS.......16
LOAD SWITCHES USED......4,6,8
PHASES USED.............4,6,8
OLA.....................NOT USED
OLB.....................NOT USED
OLC.....................NOT USED
OLD.....................NOT USED

WIRE LOOPS TO TERMINALS ON LOOP PANEL AS SHOWN IN THE CHART BELOW

LOOP NO.	LOOP PANEL TERMINALS
NU	L1A,L1B
NU	L2A,L2B
NU	L3A,L3B
NU	L4A,L4B
NU	L5A,L5B
NU	L6A,L6B
NU	L7A,L7B
NU	L8A,L8B
NU	L9A,L9B
NU	L10A,L10B
NU	L11A,L11B
NU	L12A,L12B
NU	L13A,L13B
NU	L14A,L14B
NU	L15A,L15B
NU	L16A,L16B

PROGRAM CONTROLLER DETECTORS ACCORDING TO THE SCHEDULE SHOWN IN THE CHART BELOW

CONTROLLER DETECTOR NO.	FUNCTION	TIMING	
		FEATURE	TIME(SEC)
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			
13			
14			
15			
16			

LOAD SWITCH ASSIGNMENT DETAIL

(program controller according to schedule in chart below)

LOAD SWITCH NUMBER	FUNCTION
1	ø1
2	ø2
3	ø3
4	ø4
5	ø5
6	ø6
7	ø7
8	ø8
9	ø2 PED
10	ø4 PED
11	ø6 PED
12	ø8 PED
13	OLA
14	OLB
15	OLC
16	OLD

THIS ELECTRICAL DETAIL IS FOR THE SIGNAL DESIGN: 05-1168T4
DESIGNED: March 2019
SEALED: 7/24/2019
REVISED: N/A

SPECIAL DETECTOR NOTE

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

Electrical Detail - Temp Design 4 (TMP Phase IV)
Sheet 1 of 2

ELECTRICAL AND PROGRAMMING DETAILS FOR:

SR 3015 (Airport Boulevard) at I-40 WB Ramps

Division 5 Wake County Morrisville

Prepared in the Offices of: Transportation Mobility and Safety Division, ITS & Signals Management Section
750 N.Greenfield Pkwy,Garner,NC 27529

PLAN DATE: May 2015	REVIEWED BY:
PREPARED BY: S. Armstrong	REVIEWED BY:

REVISIONS	INIT.	DATE

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

SEAL
NORTH CAROLINA PROFESSIONAL SEAL 036833 ENGINEER RYAN W. HOUGH

DocuSigned by: Ryan W. Hough 430320FAA2654C3... 8/1/2019 DATE

SIG. INVENTORY NO. 05-1168T4

ECONOLITE ASC/3-2070 OVERLAP PROGRAMMING DETAIL

(program controller as shown)

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

Toggle Twice

OVERLAP C

Select TMG VEH OVLP [C] and 'PPLT FYA'

TMG VEH OVLP...[C] TYPE: .....[PPLT FYA]

PROTECTED LEFT TURN.... PHASE 5
OPPOSING THROUGH....... PHASE 6

FLASHING ARROW OUTPUT.....CH15 ISOLATE

DELAY START OF: FYA..0.0 CLEARANCE..0.0
ACTION PLAN SF BIT DISABLE........... 0

END PROGRAMMING

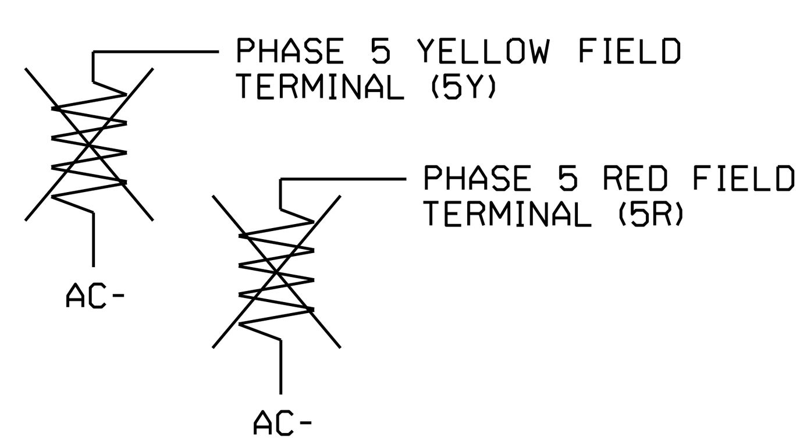
DELETE OVERLAP PROGRAMMING

LOAD RESISTOR INSTALLATION DETAIL

(install resistors as shown below)

ACCEPTABLE VALUES

VALUE (ohms)	WATTAGE
1.5K - 1.9K	25W (min)
2.0K - 3.0K	10W (min)



REMOVE RESISTORS

ECONOLITE ASC/3-2070 SPECIAL MMU PROGRAMMING

(program controller as shown)

1. From Main Menu select [1. CONFIGURATION]
2. From CONFIGURATION Submenu select [4. PORT 1 (SDLC)]
3. From PORT 1 (SDLC) Submenu select [2. MMU PROGRAM]

CAUTION!

Set intersection to Flash before attempting to enter or change any MMU programming data.

This programming and that of the MMU programming card must match exactly. If they do not, the intersection will be placed into Flash.

MMU PROGRAM [MANUAL]

CH	6	5	4	3	2	1	0	9	8	7	6	5	4	3	2
1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	
3	.	.	.	.	.	.	.	.	.	.	.	.	.		
4	.	.	.	.	.	.	.	.	X	.	.	.			
5	.	.	.	.	.	.	.	.	.	.	.				
6	.	.	.	.	.	.	.	.	.	.					
7	.	.	.	.	.	.	.	.	.						
8	.	.	.	.	.	.	.	.							
9	.	.	.	.	.	.	.								
10	.	.	.	.	.	.									
11	.	.	.	.	.										
12	.	.	.	.											
13	.	.	.												
14	.	.													
15	.														

END PROGRAMMING

THIS ELECTRICAL DETAIL IS FOR
THE SIGNAL DESIGN: 05-1168T4
DESIGNED: March 2019
SEALED: 7/24/2019
REVISED: N/A

Electrical Detail - Temp Design 4 (TMP Phase IV)
Sheet 2 of 2

ELECTRICAL AND PROGRAMMING DETAILS FOR:

Prepared in the Offices of:
Transportation Mobility and Safety Division
ITS & Signals Management Section
State of North Carolina Department of Transportation
750 N.Greenfield Pkwy,Garner,NC 27529

SR 3015 (Airport Boulevard)
at
I-40 WB Ramps

Division 5 | Wake County | Morrisville

PLAN DATE: May 2015	REVIEWED BY:
PREPARED BY: S. Armstrong	REVIEWED BY:

REVISIONS	INIT.	DATE

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

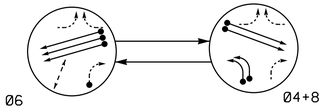
SEAL
NORTH CAROLINA PROFESSIONAL SEAL 036833 ENGINEER RYAN W. HOUGH

DocuSigned by:
Ryan W. Hough
430320FAA2654C3...
8/1/2019
DATE

SIG. INVENTORY NO. 05-1168T4

PROJECT REFERENCE NO.	SHEET NO.
I-5700	Sig 23.0

PHASING DIAGRAM



PHASING DIAGRAM DETECTION LEGEND

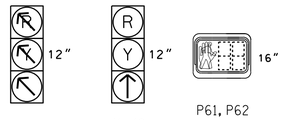
- DETECTED MOVEMENT
- UNDETECTED MOVEMENT (OVERLAP)
- UNSIGNALIZED MOVEMENT
- PEDESTRIAN MOVEMENT

TABLE OF OPERATION

SIGNAL FACE	PHASE Ø6	PHASE Ø4+8	PHASE RED REST	PHASE FLASH
41, 42	R	↑	R	R
61, 62, 63	↑	R	R	R
81, 82	↖	↖	↖	↖
P61, P62	W	DW	DW	DRK

SIGNAL FACE I.D.

All Heads L.E.D.



81, 82

41, 42
61, 62, 63

P61, P62

LOOP & DETECTOR INSTALLATION CHART

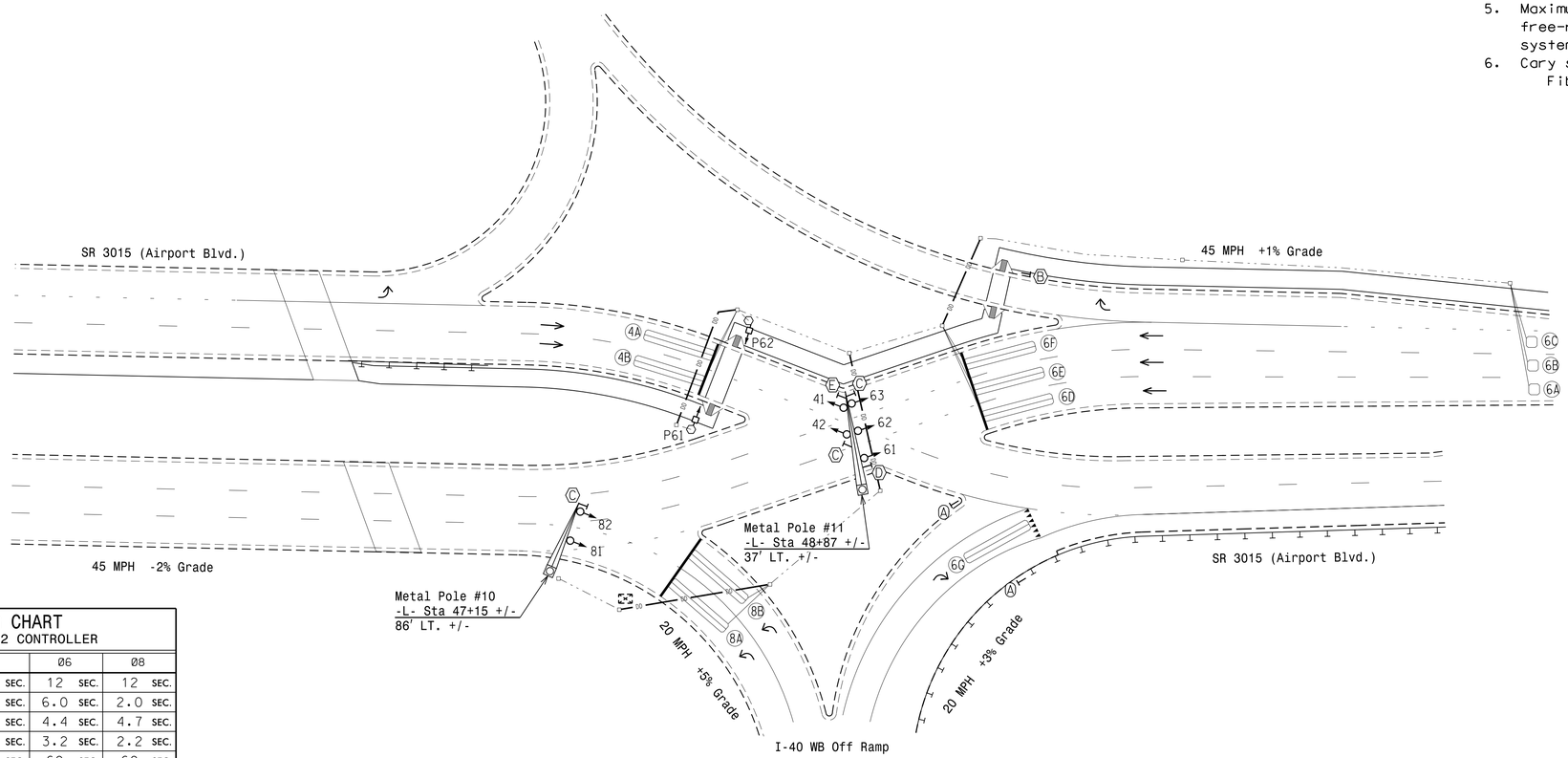
ASC/3-2070EN2 CONTROLLER w/ TS-2 CABINET

INDUCTIVE LOOPS						DETECTOR UNITS					
LOOP NO.	SIZE (ft)	DIST. FROM STOPBAR (ft)	TURNS	NEW	EXISTING	NEMA PHASE	NEW	EXISTING	TIMING FEATURE	TIMING TIME	ADDED INITIAL	DET. TYPE
4A	6X40	0	2-4-2	X	-	4	-	X	-	-	-	S
4B	6X40	0	2-4-2	X	-	4	-	X	-	-	-	S
6A	6X6	0	5	X	-	6	X	-	-	-	X	N
6B	6X6	0	5	X	-	6	X	-	-	-	X	N
6C	6X6	0	5	X	-	6	X	-	-	-	X	N
6D	6X40	0	2-4-2	X	-	6	-	X	-	-	-	S
6E	6X40	0	2-4-2	X	-	6	-	X	-	-	-	S
6F	6X40	0	2-4-2	X	-	6	-	X	-	-	-	S
6G	6X40	0	2-4-2	X	-	6	-	X	DELAY	20	-	S
8A	6X40	0	2-4-2	X	-	8	-	X	-	-	-	S
8B	6X40	0	2-4-2	X	-	8	-	X	-	-	-	S

3 Phase
Fully Actuated
(Cary Signal System)

NOTES

1. Refer to "Roadway Standard Drawings NCDOT" dated January 2018 and "Standard Specifications for Roads and Structures" dated January 2018.
2. Do not program signal for late night flashing operation unless otherwise directed by the Engineer.
3. Set all detector units to presence mode.
4. Program controller to start up in all red.
5. Maximum times shown in timing chart are for free-run operation only. Coordinated signal system timing values supersede these values.
6. Cary signal system data:
   Fiber channel #: 26.



LEGEND

PROPOSED		EXISTING
○→	Traffic Signal Head	●→
◐→	Modified Signal Head	N/A
⊣	Sign	⊣
▭↓	Pedestrian Signal Head With Push Button & Sign	■↓
○—	Signal Pole with Guy	●—
○⌒	Signal Pole with Sidewalk Guy	●⌒
▭	Inductive Loop Detector	▭
⊠	Controller & Cabinet	⊠
□	Junction Box	■
·-·-·	2-in Underground Conduit	·-·-·
N/A	Right of Way	- - - -
→	Directional Arrow	→
—DD—	Directional Drill	N/A
N/A	Curb Ramp	◢
N/A	Guardrail	⊥⊥
○—	Metal Pole with Mastarm	●—
Ⓐ	"YIELD" Sign (R1-2)	Ⓐ
Ⓑ	Pedestrian Crossing Sign (W11-2) with Diagonal Arrow Plaque (W16-7pL)	Ⓑ
Ⓒ	No Right Turn Sign (R3-1)	Ⓒ
Ⓓ	No U-Turn / No Left Turn Sign (R3-18)	Ⓓ
Ⓔ	No Left Turn Sign (R3-2)	Ⓔ

TIMING CHART

ASC/3-2070EN2 CONTROLLER

PHASE	04	06	08
MINIMUM GREEN *	12 SEC.	12 SEC.	12 SEC.
VEHICLE EXT. *	2.0 SEC.	6.0 SEC.	2.0 SEC.
YELLOW CHANGE INT.	4.7 SEC.	4.4 SEC.	4.7 SEC.
RED CLEARANCE	2.2 SEC.	3.2 SEC.	2.2 SEC.
MAX. 1 *	60 SEC.	60 SEC.	60 SEC.
MAX. 2 *	– SEC.	– SEC.	– SEC.
RECALL POSITION	NONE	SOFT RECALL	NONE
LOCK DET.	OFF	OFF	OFF
WALK *	– SEC.	7 SEC.	– SEC.
PED. CLEAR	– SEC.	5 SEC.	– SEC.
VOLUME DENSITY	OFF	ON	OFF
ACTUATION B4 ADD *	– VEH.	– VEH.	– VEH.
SEC. PER ACTUATION *	– SEC.	– SEC.	– SEC.
MAX. INITIAL *	– SEC.	– SEC.	– SEC.
TIME B4 REDUCTION *	– SEC.	15 SEC.	– SEC.
TIME TO REDUCE *	– SEC.	50 SEC.	– SEC.
MINIMUM GAP	– SEC.	3.0 SEC.	– SEC.
DUAL ENTRY	ON	OFF	ON
SIMULTANEOUS GAP	ON	ON	ON

* These values may be field adjusted. Do not adjust Min Green and Extension times for phases 2 and 6 lower than what is shown. Min Green for all other phases should not be lower than 4 seconds.

Signal Upgrade - Final Design

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

Prepared in the Offices of:
Transportation Mobility and Safety Division
NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
Signal Design Section
750 N.Greenfield Pkwy.Garner,NC 27529

SR 3015 (Airport Boulevard)
at
I-40 WB Ramps

Division 5 Wake County Morrisville

PLAN DATE: March 2018 REVIEWED BY:

PREPARED BY: J.A. Lohr REVIEWED BY:

SCALE 0 40 1"=40'

REVISIONS	INIT.	DATE

SEAL
NORTH CAROLINA PROFESSIONAL SEAL 026486 ENGINEER ROBERT J. ZIEMBA

DocuSigned by: 7/24/2019
DATE

SIG. INVENTORY NO. 05-1168

05-AUG-2019 08:25
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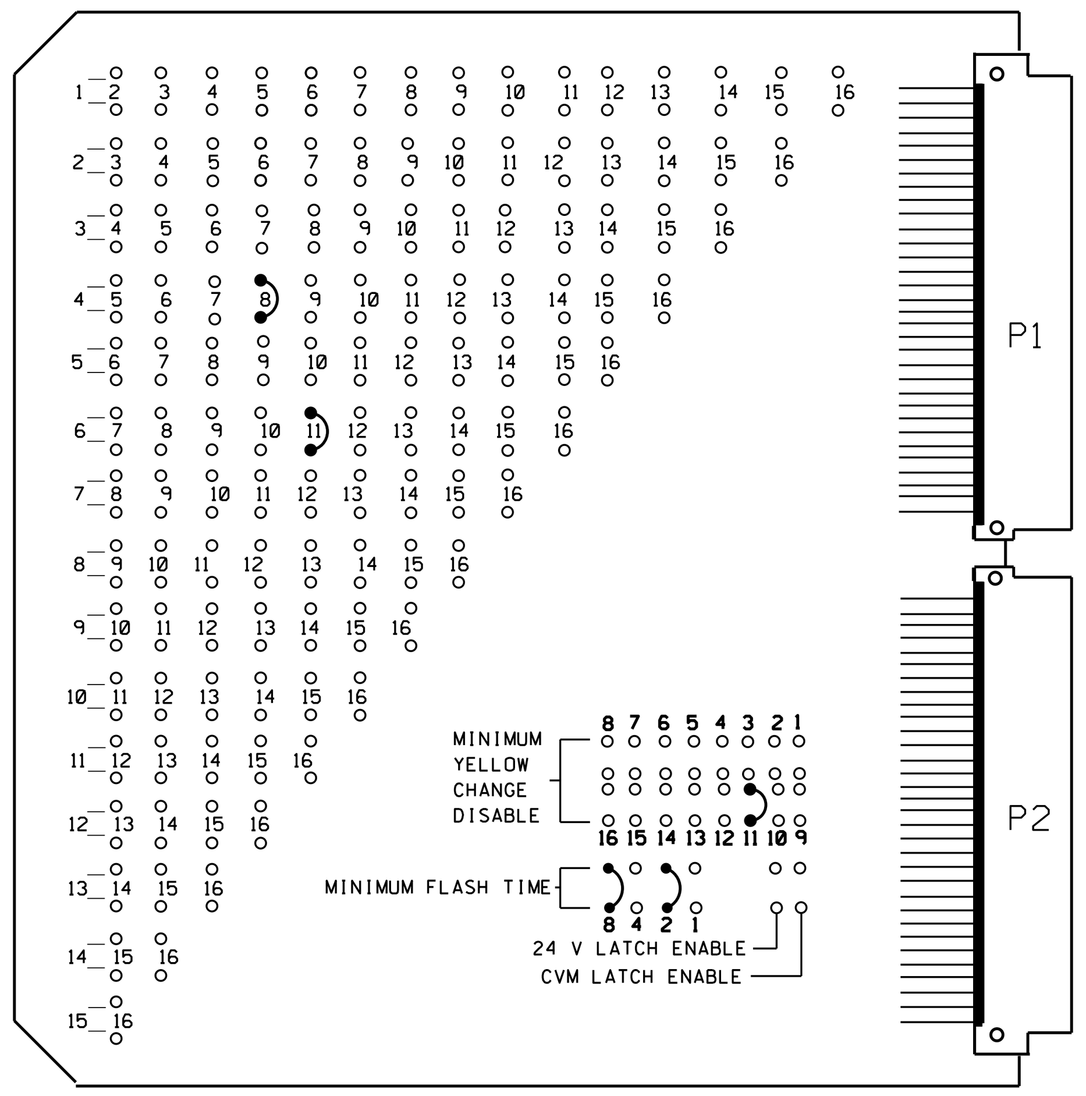
jalohr

EDI MODEL MMU2-16LEip MALFUNCTION MANAGEMENT UNIT PROGRAMMING DETAIL

(program card and tables as shown below)



MMU PROGRAMMING CARD

FIELD CHECK ENABLE DUAL IND ENABLE RED FAIL ENABLE	
CHANNEL NUMBER	ENABLE/ DISABLE
1	DISABLE
2	DISABLE
3	DISABLE
4	ENABLE
5	DISABLE
6	ENABLE
7	DISABLE
8	ENABLE
9	DISABLE
10	DISABLE
11	ENABLE
12	DISABLE
13	DISABLE
14	DISABLE
15	DISABLE
16	DISABLE

UNIT OPTIONS	
OPTION	SETTING
RECURRENT PULSE	ON
WALK DISABLE	OFF
LOG CVM FAULTS	ON
EXTERN WATCHDOG	OFF
24V-2=12VDC	OFF
PGM CARD MEMORY	ON
LEDguard	ON
FORCE TYPE 16	OFF
TYPE12-SDLC	OFF
VM 3x/Day Latch	ON

FLASHING YELLOW ARROW	
CONFIG MODE	B
ENABLE CHANNEL PAIR, FYA	
CH 1-13	OFF
CH 3-14	OFF
CH 5-15	OFF
CH 7-16	OFF
RED/YEL INPUT ENABLE	
CH 1	OFF
CH 3	OFF
CH 5	OFF
CH 7	OFF
FLASH RATE FAULT	OFF
FYA TRAP DETECT	OFF

MMU PROGRAMMING NOTE

ENSURE YELLOW CHANGE PLUS RED CLEARANCE MONITORING IS ENABLED FOR ALL CHANNELS.

NOTES

1. To prevent "flash-conflict" problems, wire all unused load switches to flash red. Verify that signal heads flash in accordance with the signal plans.
2. To prevent red failures on unused monitor channels, tie unused load switch red outputs 1,2,3,5,7,9,10,12,13,14,15, and 16 to load switch AC+ by inserting a jumper plug in the unused load switch socket from pin 1 (LS AC+) to pin 3 (RED out). Make sure all flash transfer relays are in place.
3. Program controller to start up as follows: Main Menu 2-5 MUTCD-> YES, ALL RED...6, Phase 2 Green, Phase 6 Walk
4. Set power-up flash time to 10 seconds and implement on the Malfunction Management Unit. Set controller power-up flash time to 0 seconds.
5. Enable simultaneous gap-out feature for all phases.
6. Program detectors in accordance with the manufacturer's instructions to accomplish the detection schemes shown on the signal design plans.
7. Program detector call delay and extension timing on the controller, unless otherwise specified.
8. Set all detector card unit channels to "presence" mode.
9. Program phases 6 for volume density operation.
10. Program phases 4 and 8 for dual entry.
11. The cabinet and controller are a part of the Cary Signal System.

SIGNAL HEAD HOOK-UP CHART

PHASE	1	2	3	4	5	6	7	8	2 PED	4 PED	6 PED	8 PED	OLA	OLB	OLC	OLD
SIGNAL HEAD NO.	NU	NU	NU	41,42	NU	61,62 63	NU	81,82	NU	NU	P61, P62	NU	NU	NU	NU	NU
RED				4R		6R										
YELLOW				4Y		6Y										
GREEN																
RED ARROW								8R								
YELLOW ARROW								8Y								
GREEN ARROW				4G		6G		8G								
✋											11R					
🚶											11G					

NU = Not Used

DETECTOR RACK SET-UP DETAIL

INSERT DETECTOR CARDS IN RACK ACCORDING TO THE DETAIL SHOWN BELOW. PARTICULAR DETECTOR CHANNELS WILL CALL PHASES INDICATED.

RACK #1	BIU										
		CH1 L3 Ø6 **	CH1 L1 Ø4	CH1 L7 Ø6	CH1 L5 Ø6 **	CH1 L11 Ø8	CH1 L9 Ø6	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY
		CH2 L6 Ø6 **	CH2 L2 Ø4	CH2 L6 Ø6	CH2 L6 Ø6	CH2 L12 NOT USED	CH2 L10 Ø8					

WIRE LOOPS TO TERMINALS ON LOOP PANEL AS SHOWN IN THE CHART BELOW

LOOP NO.	LOOP PANEL TERMINALS
4A	L1A,L1B
4B	L2A,L2B
6A	L3A,L3B
6B	L4A,L4B
6C	L5A,L5B
6D	L6A,L6B
6E	L7A,L7B
6F	L8A,L8B
6G	L9A,L9B
8A	L10A,L10B
8B	L11A,L11B
NU	L12A,L12B
NU	L13A,L13B
NU	L14A,L14B
NU	L15A,L15B
NU	L16A,L16B

PROGRAM CONTROLLER DETECTORS ACCORDING TO THE SCHEDULE SHOWN IN THE CHART BELOW

CONTROLLER DETECTOR NO.	FUNCTION	TIMING	
		FEATURE	TIME(SEC)
1	Ø4		
2	Ø4		
** 3	Ø6		
** 4	Ø6		
** 5	Ø6		
6	Ø6		
7	Ø6		
8	Ø6		
9	Ø6	DELAY	20
10	Ø8		
11	Ø8		
12			
13			
14			
15			
16			

** Detector Type - N

EQUIPMENT INFORMATION

CONTROLLER..............2070EN2
CABINET NC-8 TS-2
SOFTWARE ....ECONOLITE ASC/3-2070
CABINET MOUNT...........BASE
LOADBAY POSITIONS.......16
LOAD SWITCHES USED......4,6,8,11
PHASES USED.............4,6,6PED,8
OLA.....................NOT USED
OLB.....................NOT USED
OLC.....................NOT USED
OLD.....................NOT USED

LOAD SWITCH ASSIGNMENT DETAIL

(program controller according to schedule in chart below)

LOAD SWITCH NUMBER	FUNCTION
1	Ø1
2	Ø2
3	Ø3
4	Ø4
5	Ø5
6	Ø6
7	Ø7
8	Ø8
9	Ø2 PED
10	Ø4 PED
11	Ø6 PED
12	Ø8 PED
13	OLA
14	OLB
15	OLC
16	OLD

THIS ELECTRICAL DETAIL IS FOR
THE SIGNAL DESIGN: 05-1168
DESIGNED: March 2019
SEALED: 7/24/2019
REVISED: N/A

Electrical Detail - Final Design - Sheet 1 of 2

ELECTRICAL AND PROGRAMMING DETAILS FOR:

SR 3015 (Airport Boulevard) at I-40 WB Ramps

Prepared In the Offices of: ITS & Signals Management Section, Transportation Mobility and Safety Division, State of North Carolina Department of Transportation

750 N.Greenfield Pkwy,Garner,NC 27529

Division 5 Wake County Morrisville

PLAN DATE: May 2015 REVIEWED BY:
PREPARED BY: S. Armstrong REVIEWED BY:

REVISIONS	INIT.	DATE

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

SEAL
NORTH CAROLINA PROFESSIONAL SEAL 036833 ENGINEER RYAN W. HOUGH

DocuSigned by: Ryan W. Hough 430320FAA2654C3...
8/1/2019
DATE

SIG. INVENTORY NO. 05-1168

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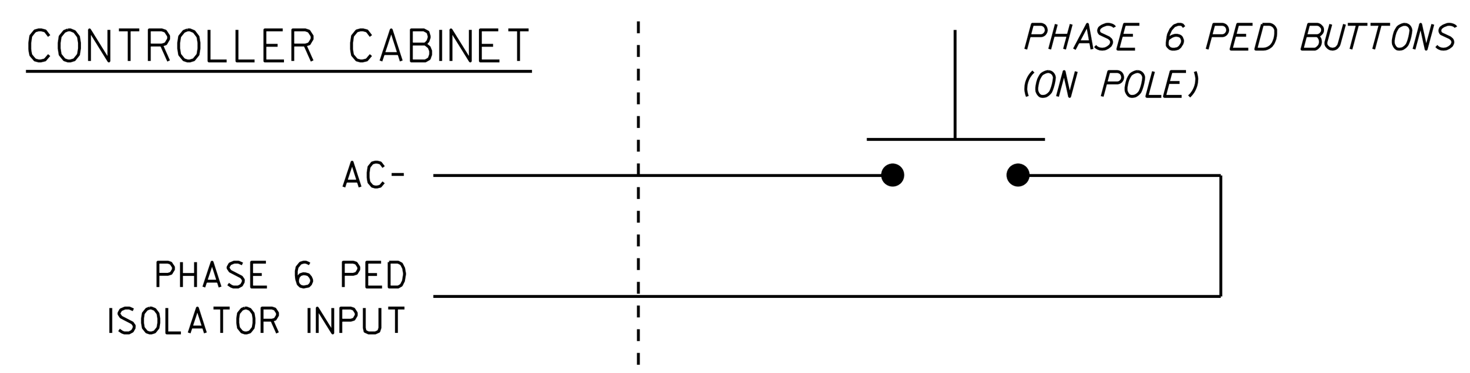
sarmstrong

PEDESTRIAN PUSH BUTTON WIRING DETAIL

(wire push buttons as shown)



COUNTDOWN PEDESTRIAN SIGNAL OPERATION

Countdown Ped Signals are required to display timing only during Ped Clearance Interval. Consult Ped Signal Module user's manual for instructions on selecting this feature.

ECONOLITE ASC/3-2070 SPECIAL MMU PROGRAMMING

(program controller as shown)

1. From Main Menu select **1. CONFIGURATION**
2. From CONFIGURATION Submenu select **4. PORT 1 (SDLC)**
3. From PORT 1 (SDLC) Submenu select **2. MMU PROGRAM**

CAUTION!

Set intersection to Flash before attempting to enter or change any MMU programming data.

This programming and that of the MMU programming card must match exactly. If they do not, the intersection will be placed into Flash.

MMU PROGRAM [MANUAL]

CH	6	5	4	3	2	1	0	9	8	7	6	5	4	3	2
1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	
3	.	.	.	.	.	.	.	.	.	.	.	.	.		
4	.	.	.	.	.	.	.	.	X	.	.	.			
5	.	.	.	.	.	.	.	.	.	.	.				
6	.	.	.	.	.	X	.	.	.	.					
7	.	.	.	.	.	.	.	.	.						
8	.	.	.	.	.	.	.	.							
9	.	.	.	.	.	.	.								
10	.	.	.	.	.	.									
11	.	.	.	.	.										
12	.	.	.	.											
13	.	.	.												
14	.	.													
15	.														

END PROGRAMMING

THIS ELECTRICAL DETAIL IS FOR
THE SIGNAL DESIGN: 05-1168
DESIGNED: March 2019
SEALED: 7/24/2019
REVISED: N/A

Electrical Detail - Final Design - Sheet 2 of 2

ELECTRICAL AND PROGRAMMING DETAILS FOR:

Prepared In the Offices of:

ITS & Signals Management Section, Transportation Mobility and Safety Division, State of North Carolina Department of Transportation

750 N.Greenfield Pkwy,Garner,NC 27529

SR 3015 (Airport Boulevard)
at
I-40 WB Ramps

Division 5 | Wake County | Morrisville

PLAN DATE: May 2015	REVIEWED BY:
PREPARED BY: S. Armstrong	REVIEWED BY:

REVISIONS	INIT.	DATE

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

SEAL

NORTH CAROLINA PROFESSIONAL SEAL 036833 ENGINEER RYAN W. HOUGH

DocuSigned by: Ryan W. Hough 430320FAA2654C3... 8/1/2019 DATE

SIG. INVENTORY NO. 05-1168

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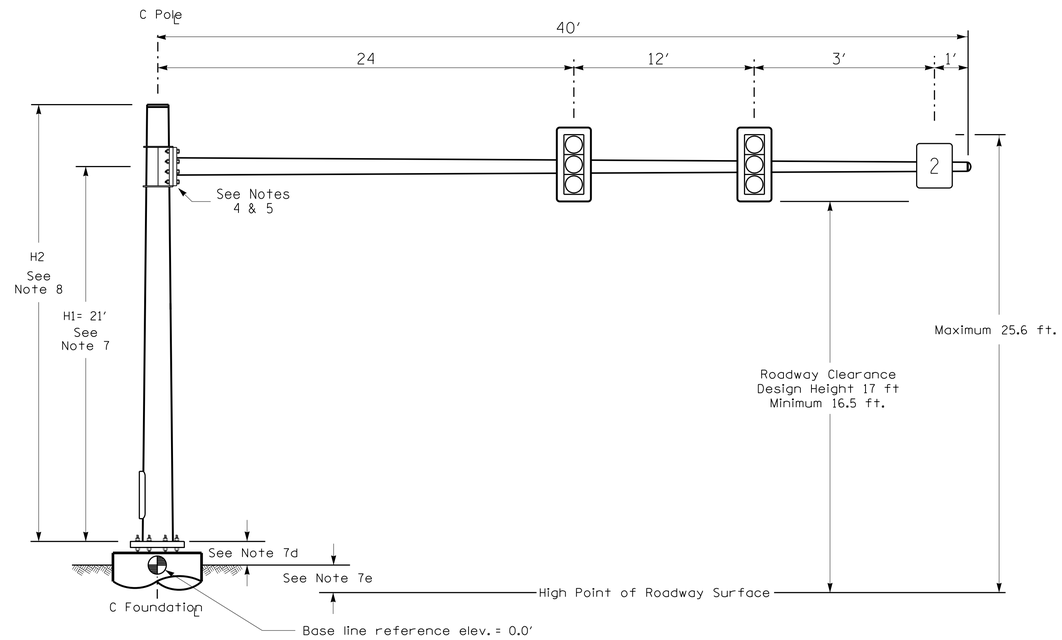
sarmstrong

METAL POLE No. 10 and 11

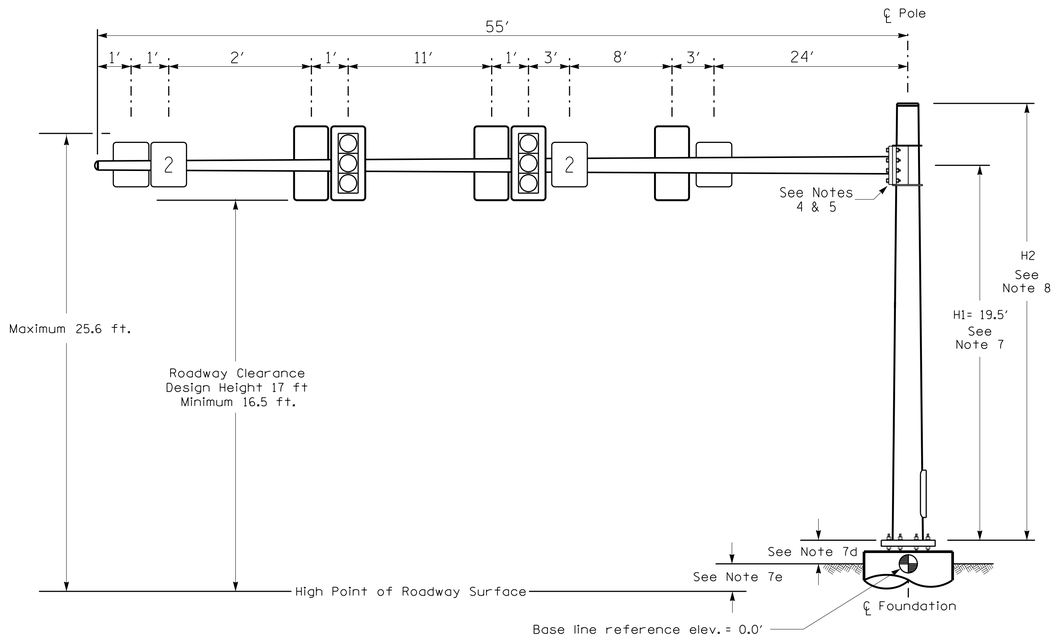
PROJECT REFERENCE NO.	SHEET NO.
I-5700	Sig 23.3

Design Loading for METAL POLE NO. 10



Elevation View

Design Loading for METAL POLE NO. 11



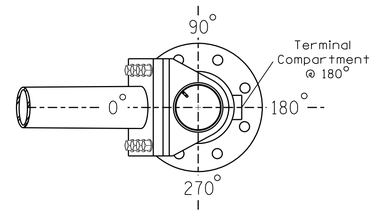
Elevation View

SPECIAL NOTE

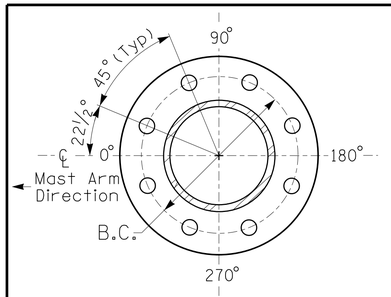
The contractor is responsible for verifying that the mast arm attachment height (H1) will provide the "Design Height" clearance from the roadway before submitting final shop drawings for approval. Verify elevation data below which was obtained by field measurement or from available project survey data.

Elevation Data for Mast Arm Attachment (H1)

Elevation Differences for:	Pole 8	Pole 9
Baseline reference point at ⊕ Foundation @ ground level	0.0 ft.	0.0 ft.
Elevation difference at High point of roadway surface	+2.4 ft.	+1.0 ft.
Elevation difference at Edge of travelway or face of curb	+1.6 ft.	+0.4 ft.

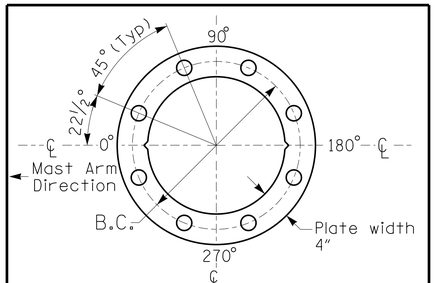


POLE RADIAL ORIENTATION



8 BOLT BASE PLATE DETAIL

See Note 6



BASE PLATE TEMPLATE & ANCHOR BOLT LOCK PLATE DETAIL

For 8 Bolt Base Plate

MAST ARM LOADING SCHEDULE

LOADING SYMBOL	DESCRIPTION	AREA	SIZE	WEIGHT
	RIGID MOUNTED SIGNAL HEAD 12"-3 SECTION-WITH BACKPLATE	9.3 S.F.	25.5" W X 52.5" L	60 LBS
2	SIGN RIGID MOUNTED	7.5 S.F.	30.0" W X 36.0" L	14 LBS

NOTES

DESIGN REFERENCE MATERIAL

1. Design the traffic signal structure and foundation in accordance with:
   - The 6th Edition 2013 AASHTO "Standard Specifications for Structural Supports for Highway Signs, Luminaires, and Traffic Signals, including all of the latest interim revisions.
   - The 2018 NCDOT "Standard Specifications for Roads and Structures." The latest addenda to the specifications can be found in the traffic signal project special provisions.
   - The 2018 NCDOT Roadway Standard Drawings.
   - The traffic signal project plans and special provisions.
   - The NCDOT "Metal Pole Standards" located at the following NCDOT website: https://connect.ncdot.gov/resources/safety/Pages/ITS-Design-Resources.aspx

DESIGN REQUIREMENTS

2. Design the traffic signal structure using the loading conditions shown in the elevation views. These are anticipated worst case "design loads" and may not represent the actual loads that will be applied at the time of the installation. The contractor should refer to the traffic signal plans for the actual loads that will be applied at the time of the installation.
3. Design all signal supports using stress ratios that do not exceed 0.9.
4. The camber design for the mast arm deflection should provide an appearance of a low pitched arch where the tip or the free end of the mast arm does not deflect below horizontal when fully loaded.
5. A clamp-type bolted mast arm-to-pole connection may be used instead of the welded ring stiffened box connection shown as long as the connection meets all of the design requirements.
6. Design base plate with 8 anchor bolt holes. Provide 2 inch x 60 inch anchor bolts.
7. The mast arm attachment height (H1) shown is based on the following design assumptions:
   a. Mast arm slope and deflection are not considered in determining the arm attachment height as they are assumed to offset each other.
   b. Signal heads are rigidly mounted and vertically centered on the mast arm.
   c. The roadway clearance height for design is as shown in the elevation views.
   d. The top of the pole base plate is 0.75 feet above the ground elevation.
   e. Refer to the Elevation Data Chart for the elevation differences between the proposed foundation ground level and the high point of the roadway.
8. The pole manufacturer will determine the total height (H2) of each pole using the greater of the following:
   - Mast arm attachment height (H1) plus 2 feet, or
   - H1 plus 1/2 of the total height of the mast arm attachment assembly plus 1 foot.
9. If pole location adjustments are required, the contractor must gain approval from the Engineer as this may affect the mast arm lengths and arm attachment heights. The contractor may contact the Signal Design Section Senior Structural Engineer for assistance at (919) 814-5000.
10. The contractor is responsible for verifying that the mast arm length shown will allow proper positioning of the signal heads over the roadway.
11. The contractor is responsible for providing soil penetration testing data (SPT) to the pole manufacturer so site specific foundations can be designed.

NCDOT Wind Zone 4 (90 mph)

Prepared in the Offices of:
Transportation Mobility and Safety Division
Signal Design Section
750 N.Greenfield Pkwy.Garner,NC 27529

SR 3015 (Airport Boulevard)
at
I-40 WB Ramps

Division 5 | Wake County | Morrisville

PLAN DATE: March 2019 | REVIEWED BY:
PREPARED BY: J.A. Lohr | REVIEWED BY:

SCALE: 0 N/A N/A

REVISIONS	INIT.	DATE

SEAL
NORTH CAROLINA PROFESSIONAL SEAL 026486 ENGINEER ROBERT J. ZIEMBA

DocuSigned by: 8/5/2019 DATE

SIG. INVENTORY NO. 05-1168

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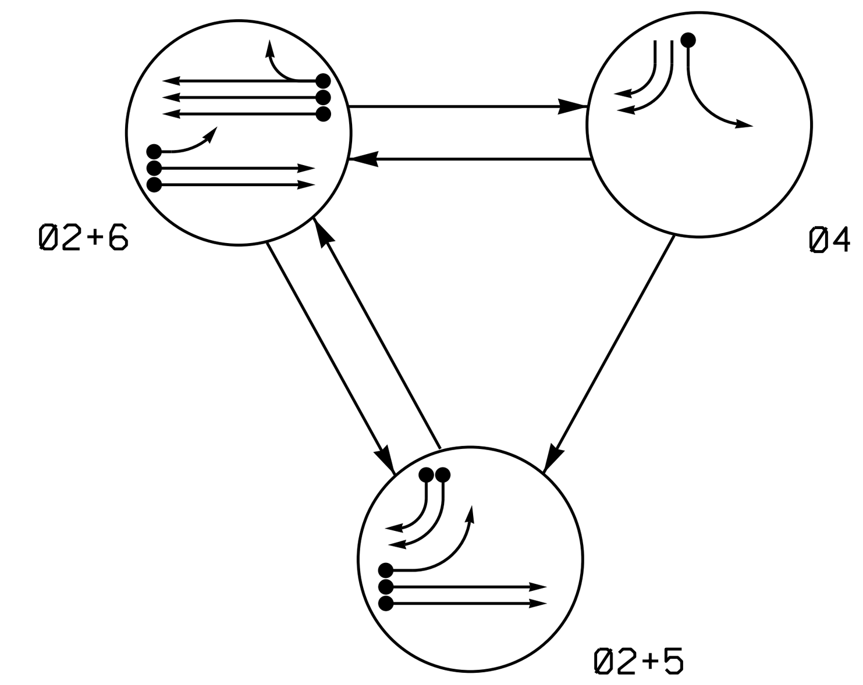
PROJECT REFERENCE NO.	SHEET NO.
I-5700	Sig 24.0

PHASING DIAGRAM



PHASING DIAGRAM DETECTION LEGEND

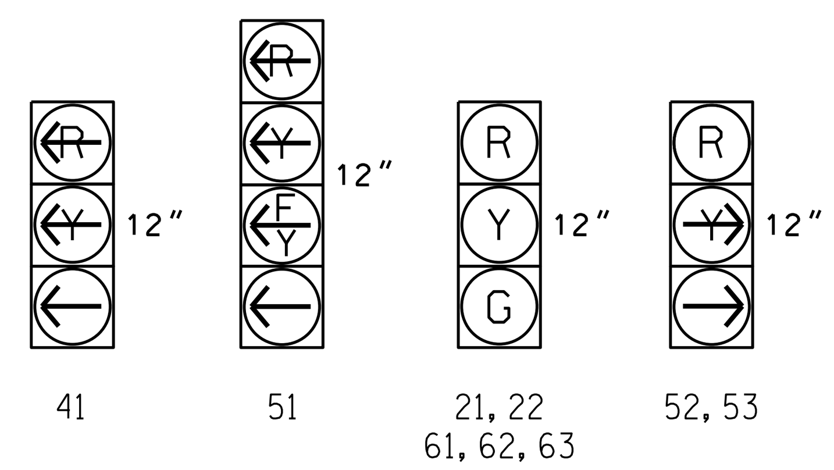
- DETECTED MOVEMENT
- UNDETECTED MOVEMENT (OVERLAP)
- UNSIGNALIZED MOVEMENT
- PEDESTRIAN MOVEMENT

TABLE OF OPERATION

SIGNAL FACE	PHASE Ø2+5	PHASE Ø2+6	PHASE Ø4	FLASH
21, 22	G	G	R	Y
41	←R	←R	←	←R
51	←	←F/Y	←R	←Y
52, 53	→	R	→	R
61, 62, 63	R	G	R	Y

SIGNAL FACE I.D.

All Heads L.E.D.



LOOP & DETECTOR INSTALLATION CHART

ASC/3-2070EN2 CONTROLLER w/ TS-2 CABINET

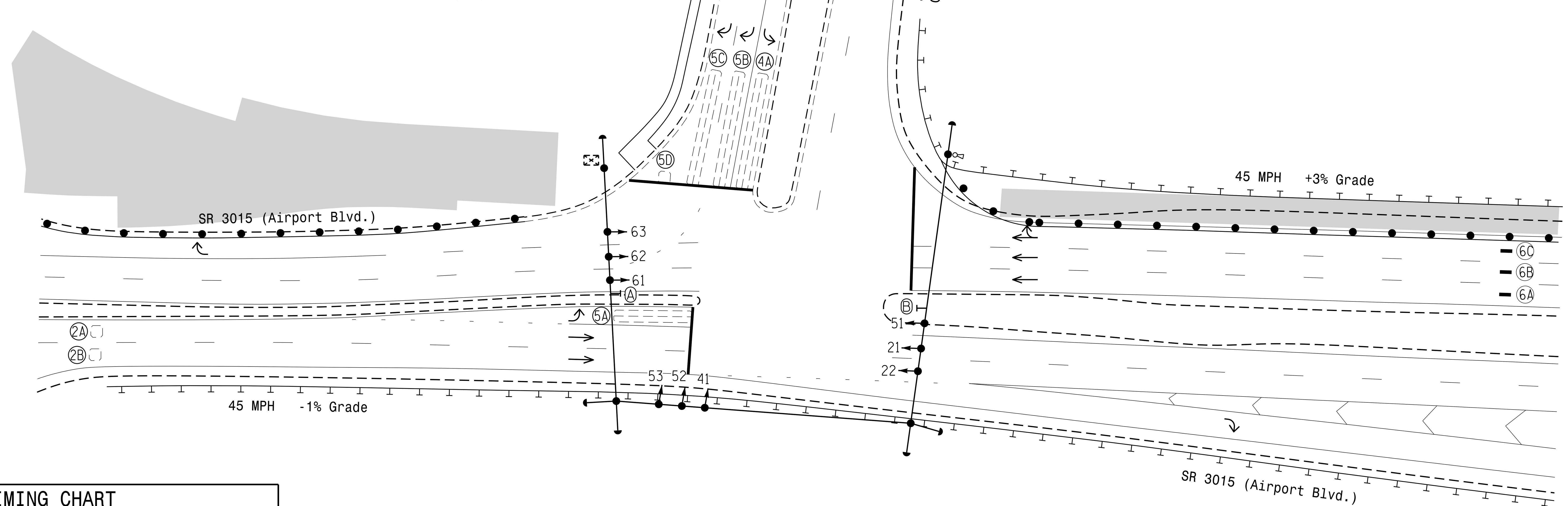
INDUCTIVE LOOPS						DETECTOR UNITS						
LOOP / ZONE NO.	SIZE (ft)	DIST. FROM STOPBAR (ft)	TURNS	NEW	EXISTING	NEMA PHASE	NEW	EXISTING	TIMING FEATURE	TIMING TIME (sec)	ADDED INITIAL	DET. TYPE
2A	6X6	300	EXIST	-	X	2	-	X	-	-	X	N
2B	6X6	300	EXIST	-	X	2	-	X	-	-	X	N
4A	6X60	0	2-4-2	-	X	4	-	X	-	-	-	S
5A	6X40	0	2-4-2	-	X	5	-	X	DELAY	15	-	S
						2	-	X	DELAY	3	-	G
5B	6X60	0	2-4-2	-	X	5	-	X	DELAY	15	-	S
5C	6X60	0	2-4-2	-	X	5	-	X	DELAY	15	-	S
5D	6X60	0	2-4-2	-	X	5	-	X	DELAY	15	-	S
6A*	6X6	300	*	X	-	6	-	*	-	-	X	N
6B*	6X6	300	*	X	-	6	-	*	-	-	X	N
6C*	6X6	300	*	X	-	6	-	*	-	-	X	N

* Video detection zone.

3 Phase
Fully Actuated
(Cary Signal System)

NOTES

1. Refer to "Roadway Standard Drawings NCDOT" dated January 2018 and "Standard Specifications for Roads and Structures" dated January 2018.
2. Do not program signal for late night flashing operation unless otherwise directed by the Engineer.
3. Phase 5 may be lagged.
4. Set all detector units to presence mode.
5. In the event of loop replacement, refer to the current ITS and Signals Design Manual and submit a Plan of Record to the Signal Design Section.
6. Pavement markings are existing.
7. Maximum times shown in timing chart are for free-run operation only. Coordinated signal system timing values supersede these values.
8. Cary signal system data:
   Fiber channel #: 26.
9. This intersection features a video detection system. Shown locations of detectors are conceptual only. Refer to the manufacturer's guidelines for optimal detector placement.



LEGEND

PROPOSED		EXISTING
	Traffic Signal Head	
	Modified Signal Head	N/A
	Sign	
	Pedestrian Signal Head With Push Button & Sign	
	Signal Pole with Guy	
	Signal Pole with Sidewalk Guy	
	Inductive Loop Detector	
	Controller & Cabinet	
	Junction Box	
	2-in Underground Conduit	
N/A	Right of Way	
	Directional Arrow	
N/A	Guardrail	
	Construction Zone Drums	
	Construction Zone	
	Out of Pavement Detector	
	Video Detection Area	
A	No U-Turn Sign (R3-4)	A
B	"U-TURN YIELD TO RIGHT TURN" Sign (R10-16)	B

TIMING CHART

ASC/3-2070EN2 CONTROLLER

PHASE	Ø2	Ø4	Ø5	Ø6
MINIMUM GREEN *	12 SEC.	7 SEC.	7 SEC.	12 SEC.
VEHICLE EXT. *	6.0 SEC.	1.0 SEC.	2.0 SEC.	6.0 SEC.
YELLOW CHANGE INT.	4.6 SEC.	3.0 SEC.	3.0 SEC.	4.6 SEC.
RED CLEARANCE	2.0 SEC.	3.3 SEC.	2.6 SEC.	2.0 SEC.
MAX. 1 *	120 SEC.	30 SEC.	15 SEC.	120 SEC.
RECALL POSITION	MIN. RECALL	NONE	NONE	MIN. RECALL
LOCK DET.	ON	OFF	OFF	ON
WALK *	– SEC.	– SEC.	– SEC.	– SEC.
PED. CLEAR	– SEC.	– SEC.	– SEC.	– SEC.
VOLUME DENSITY	ON	OFF	OFF	ON
ACTUATION B4 ADD *	– VEH.	– VEH.	– VEH.	– VEH.
SEC. PER ACTUATION *	1.5 SEC.	– SEC.	– SEC.	1.0 SEC.
MAX. INITIAL *	34 SEC.	– SEC.	– SEC.	34 SEC.
TIME B4 REDUCTION *	15 SEC.	– SEC.	– SEC.	15 SEC.
TIME TO REDUCE *	30 SEC.	– SEC.	– SEC.	30 SEC.
MINIMUM GAP	3.0 SEC.	– SEC.	– SEC.	3.0 SEC.
DUAL ENTRY	OFF	OFF	OFF	OFF
SIMULTANEOUS GAP	ON	ON	ON	ON

* These values may be field adjusted. Do not adjust Min Green and Extension times for phases 2 and 6 lower than what is shown. Min Green for all other phases should not be lower than 4 seconds.

Signal Upgrade - Temporary Design 1 (TMP Phase I)

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

Prepared in the Offices of: Transportation Mobility and Safety Division, Signal Design Section
750 N.Greenfield Pkwy,Garner,NC 27529

SR 3015 (Airport Blvd.)
at
SR 1789
(Pleasant Grove Church Rd.)

Division 5 Wake County Morrisville

PLAN DATE:	March 2019	REVIEWED BY:	
PREPARED BY:	J.A. Lohr	REVIEWED BY:	

REVISIONS	INIT.	DATE

SCALE 0 40 1"=40'

SEAL
NORTH CAROLINA PROFESSIONAL ENGINEER SEAL 026486 ROBERT J. ZIEMBA

DocuSigned by: 7/24/2019 DATE

SIG. INVENTORY NO. 05-1906T1

05-Aug-2019 08:06
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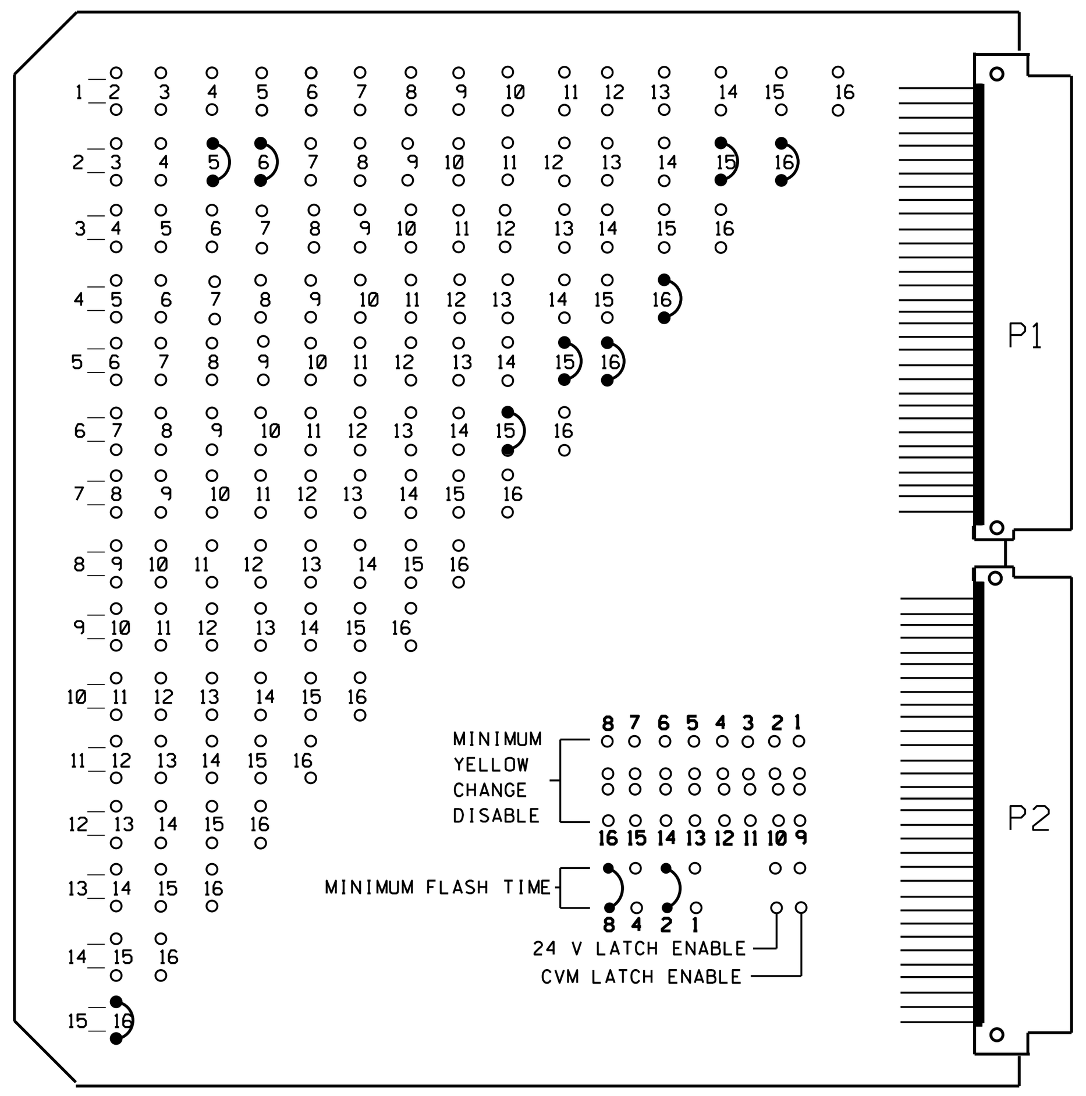
jalohr

EDI MODEL MMU2-16LEip MALFUNCTION MANAGEMENT UNIT PROGRAMMING DETAIL

(program card and tables as shown below)



MMU PROGRAMMING CARD

FIELD CHECK ENABLE DUAL IND ENABLE RED FAIL ENABLE	
CHANNEL NUMBER	ENABLE/ DISABLE
1	DISABLE
2	ENABLE
3	DISABLE
4	ENABLE
5	DISABLE
6	ENABLE
7	DISABLE
8	DISABLE
9	DISABLE
10	DISABLE
11	DISABLE
12	DISABLE
13	DISABLE
14	DISABLE
15	ENABLE
16	ENABLE

UNIT OPTIONS	
OPTION	SETTING
RECURRENT PULSE	ON
WALK DISABLE	OFF
LOG CVM FAULTS	ON
EXTERN WATCHDOG	OFF
24V-2=12VDC	OFF
PGM CARD MEMORY	ON
LEDguard	ON
FORCE TYPE 16	OFF
TYPE12-SDLC	OFF
VM 3x/Day Latch	ON

FLASHING YELLOW ARROW	
CONFIG MODE	B
ENABLE CHANNEL PAIR, FYA	
CH 1-13	OFF
CH 3-14	OFF
CH 5-15	ON
CH 7-16	OFF
RED/YEL INPUT ENABLE	
CH 1	OFF
CH 3	OFF
CH 5	ON
CH 7	OFF
FLASH RATE FAULT	ON
FYA TRAP DETECT	ON

MMU PROGRAMMING NOTE

ENSURE YELLOW CHANGE PLUS RED CLEARANCE MONITORING IS ENABLED FOR ALL CHANNELS.

NOTES

1. To prevent "flash-conflict" problems, wire all unused load switches to flash red. Verify that signal heads flash in accordance with the signal plans.
2. To prevent red failures on unused monitor channels, tie unused load switch red outputs 1,3,7,8,9,10,11,12,13, and 14 to load switch AC+ by inserting a jumper plug in the unused load switch socket from pin 1 (LS AC+) to pin 3 (RED out). Make sure all flash transfer relays are in place.
3. Program controller to start up in phase 2 Green and 6 Green.
4. Set power-up flash time to 10 seconds and implement on the Malfunction Management Unit. Set controller power-up flash time to 0 seconds.
5. Enable simultaneous gap-out feature for all phases.
6. Program detectors in accordance with the manufacturer's instructions to accomplish the detection schemes shown on the signal design plans.
7. Program detector call delay and extension timing on the controller, unless otherwise specified.
8. Set all detector card unit channels to "presence" mode.
9. Program phases 2 and 6 for volume density operation.
10. The cabinet and controller are a part of the Cary Signal System.

PROJECT REFERENCE NO.	SHEET NO.
I-5700	Sig. 24.1

SIGNAL HEAD HOOK-UP CHART

PHASE	1	2	3	4	5	6	7	8	2 PED	4 PED	6 PED	8 PED	OLA	OLB	OLC	OLD
SIGNAL HEAD NO.	NU	21,22	NU	41	51★	61,62 63	NU	NU	NU	NU	NU	NU	NU	NU	51★	52,53
RED		2R			✳	6R										16R
YELLOW		2Y			✳	6Y										
GREEN		2G				6G										
RED ARROW				4R											15R	
YELLOW ARROW				4Y											15Y	16Y
FLASHING YELLOW ARROW															15G	
GREEN ARROW				4G	5G											16G

NU = Not Used

★ See pictorial of head wiring detail this sheet.

✳ Denotes install load resistor. See load resistor installation detail on sheet 2.

DETECTOR RACK SET-UP DETAIL

INSERT DETECTOR CARDS IN RACK ACCORDING TO THE DETAIL SHOWN BELOW. PARTICULAR DETECTOR CHANNELS WILL CALL PHASES INDICATED.

RACK #1	BIU					SLOT		SLOT	SLOT	SLOT	SLOT	SLOT
		CH1 L3 Ø4	CH1 L1 Ø2 **	CH1 L7 Ø5	CH1 L5 Ø5	SLOT EMPTY	CH1 L9 Ø5	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY
		CH2 L4 NOT USED	CH2 L2 Ø2 **	CH2 L8 Ø5	CH2 L6 Ø2 ✳		CH2 L10 NOT USED					

WIRE LOOPS TO TERMINALS ON LOOP PANEL AS SHOWN IN THE CHART BELOW

LOOP NO.	LOOP PANEL TERMINALS
2A	L1A,L1B
2B	L2A,L2B
4A	L3A,L3B
NU	L4A,L4B
5A	L5A,L5B
5A	L6A,L6B
5B	L7A,L7B
5C	L8A,L8B
5D	L9A,L9B
NU	L10A,L10B
NU	L11A,L11B
NU	L12A,L12B
NU	L13A,L13B
NU	L14A,L14B
NU	L15A,L15B
NU	L16A,L16B

ADD JUMPERS FROM: L5A TO L6A, AND L5B TO L6B

PROGRAM CONTROLLER DETECTORS ACCORDING TO THE SCHEDULE SHOWN IN THE CHART BELOW

CONTROLLER DETECTOR NO.	FUNCTION	TIMING	
		FEATURE	TIME(SEC)
** 1	Ø2		
** 2	Ø2		
3	Ø4		
4			
5	Ø5	DELAY	15
✳ 6	Ø2	DELAY	3
7	Ø5	DELAY	15
8	Ø5	DELAY	15
9	Ø5	DELAY	15
10			
11			
12			
13			
14			
15			
16			

✳ Detector Type - G (remove delay from existing detector card)

** Detector Type - N

SPECIAL DETECTOR NOTE

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

EQUIPMENT INFORMATION

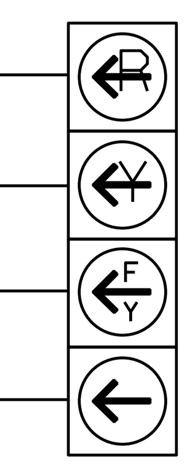
CONTROLLER.............2070EN2
CABINET NC-8 TS-2
SOFTWARE ....ECONOLITE ASC/3-2070
CABINET MOUNT..........BASE
LOADBAY POSITIONS.......16
LOAD SWITCHES USED......2,4,5,6,15,16
PHASES USED............2,4,5,6
OLA....................NOT USED
OLB....................NOT USED
OLC....................✳
OLD....................4+5

✳ SEE OVERLAP PROGRAMMING DETAIL ON SHEET 2

FYA SIGNAL WIRING DETAIL

(wire signal head as shown)

OLC RED (15R)
OLC YELLOW (15Y)
OLC GREEN (15G)
Ø5 GREEN (5G)



51

LOAD SWITCH ASSIGNMENT DETAIL

(program controller according to schedule in chart below)

LOAD SWITCH NUMBER	FUNCTION
1	Ø1
2	Ø2
3	Ø3
4	Ø4
5	Ø5
6	Ø6
7	Ø7
8	Ø8
9	Ø2 PED
10	Ø4 PED
11	Ø6 PED
12	Ø8 PED
13	OLA
14	OLB
15	OLC
16	OLD

THIS ELECTRICAL DETAIL IS FOR THE SIGNAL DESIGN: 05-1906T1
DESIGNED: March 2019
SEALED: 7/24/2019
REVISED: N/A

Electrical Detail - Temp 1 (TMP Phase I)
Sheet 1 of 2

ELECTRICAL AND PROGRAMMING DETAILS FOR:

Prepared in the Offices of:

Transportation Mobility and Safety Division, ITS & Signals Management Section

750 N. Greenfield Pkwy, Garner, NC 27529

SR 3015 (Airport Blvd.)
at
SR 1789
(Pleasant Grove Church Rd.)

Division 5 Wake County Cary

PLAN DATE: November 2015	REVIEWED BY:
PREPARED BY: S. Armstrong	REVIEWED BY:

REVISIONS	INIT.	DATE

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

SEAL

NORTH CAROLINA PROFESSIONAL SEAL 036833 ENGINEER RYAN W. HOUGH

DocuSigned by: Ryan W. Hough 430320FAA2654C3... 8/1/2019 DATE

SIG. INVENTORY NO. 05-1906T1

29-JUL-2019 09:40
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sarmstrong

ECONOLITE ASC/3-2070 OVERLAP PROGRAMMING DETAIL

(program controller as shown)

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

Toggle Twice

OVERLAP C

Select TMG VEH OVLP [C] and 'PPLT FYA'

```
TMG VEH OVLP...[C] TYPE: .....[PPLT FYA]

PROTECTED LEFT TURN....   PHASE    5
OPPOSING THROUGH.......   PHASE    6

FLASHING ARROW OUTPUT.....CH15 ISOLATE

DELAY START OF: FYA..0.0 CLEARANCE..0.0
ACTION PLAN SF BIT DISABLE........... 0
```

Toggle Once

OVERLAP D

Select TMG VEH OVLP [D] and 'NORMAL'

```
TMG VEH OVLP...[D] TYPE: .......[NORMAL]
  PHASES 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6
INCLUDED . . . X X . . . . . . . . . . .

LAG GRN 0.0 YEL 0.0 RED 0.0
```

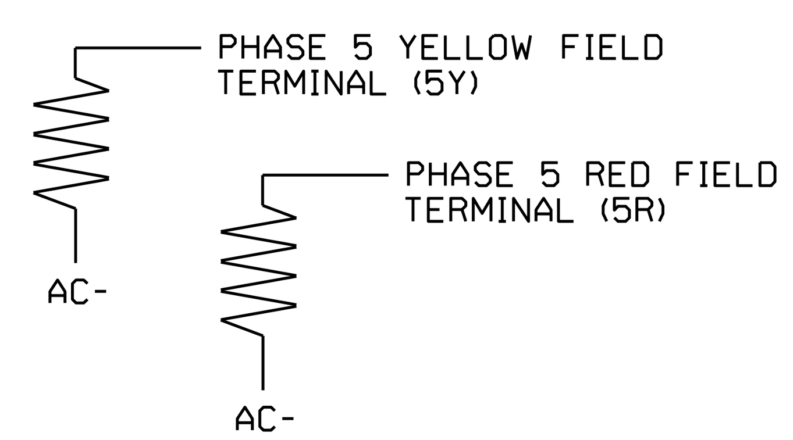
END PROGRAMMING

LOAD RESISTOR INSTALLATION DETAIL

(install resistors as shown below)

ACCEPTABLE VALUES

VALUE (ohms)	WATTAGE
1.5K - 1.9K	25W (min)
2.0K - 3.0K	10W (min)



ECONOLITE ASC/3-2070 SPECIAL MMU PROGRAMMING

(program controller as shown)

1. From Main Menu select **1. CONFIGURATION**
2. From CONFIGURATION Submenu select **4. PORT 1 (SDLC)**
3. From PORT 1 (SDLC) Submenu select **2. MMU PROGRAM**

CAUTION!

Set intersection to Flash before attempting to enter or change any MMU programming data.

This programming and that of the MMU programming card must match exactly. If they do not, the intersection will be placed into Flash.

MMU PROGRAM [MANUAL]

CH	6	5	4	3	2	1	0	9	8	7	6	5	4	3	2
1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
2	X	X	.	.	.	.	.	.	.	.	X	X	.	.	
3	.	.	.	.	.	.	.	.	.	.	.	.	.		
4	X	.	.	.	.	.	.	.	.	.	.	.			
5	X	X	.	.	.	.	.	.	.	.	.				
6	.	X	.	.	.	.	.	.	.	.					
7	.	.	.	.	.	.	.	.	.						
8	.	.	.	.	.	.	.	.							
9	.	.	.	.	.	.	.								
10	.	.	.	.	.	.									
11	.	.	.	.	.										
12	.	.	.	.											
13	.	.	.												
14	.	.													
15	X														

END PROGRAMMING

THIS ELECTRICAL DETAIL IS FOR
THE SIGNAL DESIGN: 05-1906T1
DESIGNED: March 2019
SEALED: 7/24/2019
REVISED: N/A

Electrical Detail - Temp 1 (TMP Phase I)
Sheet 2 of 2

ELECTRICAL AND PROGRAMMING DETAILS FOR:

SR 3015 (Airport Blvd.)
at
SR 1789
(Pleasant Grove Church Rd.)

Division 5 | Wake County | Morrisville

Prepared In the Offices of: ITS & Signals Management Section, Transportation Mobility and Safety Division, State of North Carolina Department of Transportation
750 N.Greenfield Pkwy,Garner,NC 27529

PLAN DATE: May 2019	REVIEWED BY:
PREPARED BY: S. Armstrong	REVIEWED BY:

REVISIONS	INIT.	DATE

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

SEAL
NORTH CAROLINA PROFESSIONAL SEAL 036833 ENGINEER RYAN W. HOUGH

DocuSigned by: Ryan W. Hough 430320FAA2654C3
8/1/2019
DATE

SIG. INVENTORY NO. 05-1906T1

26-JUL-2019 08:47
.*051906_sm_ele_xxx.dgn
sarmstrong

PROJECT REFERENCE NO.	SHEET NO.
I-5700	Sig 25.0

PHASING DIAGRAM

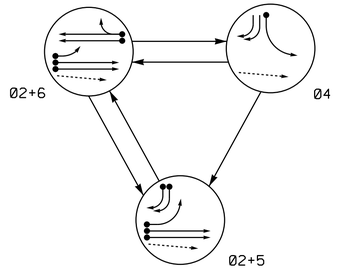
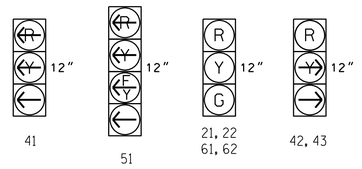


TABLE OF OPERATION				
SIGNAL FACE	PHASE Ø2+5	Ø2+6	Ø4	FLASH
21, 22	G	G	R	Y
41	~~R~~	~~R~~	←	~~R~~
42, 43	→	R	→	R
51	←	~~F~~ Y	~~R~~	~~Y~~
61, 62	R	G	R	Y

SIGNAL FACE I.D.

All Heads L.E.D.



LOOP & DETECTOR INSTALLATION CHART

ASC/3-2070EN2 CONTROLLER w/ TS-2 CABINET

INDUCTIVE LOOPS						DETECTOR UNITS					
LOOP / ZONE NO.	SIZE (ft)	DIST. FROM STOPBAR (ft)	TURNS	NEW	EXISTING	NEMA PHASE	NEW	EXISTING	TIMING FEATURE	TIMING TIME	ADDED INITIAL	DET. TYPE
2A*	6X6	300	*	X	-	2	*	-	-	-	X	N
2B*	6X6	300	*	X	-	2	*	-	-	-	X	N
4A	6X40	0	2-4-2	X	-	4	X	-	-	-	-	S
5A*	6X40	0	*	X	-	5	*	-	DELAY	15	-	S
						2	*	-	DELAY	3	-	G
5B	6X40	0	2-4-2	X	-	5	X	-	DELAY	15	-	S
5C	6X40	0	2-4-2	X	-	5	X	-	DELAY	15	-	S
5D	6X15	0	3	X	-	5	X	-	DELAY	15	-	S
6A*	6X6	300	*	X	-	6	*	-	-	-	X	N
6B*	6X6	300	*	X	-	6	*	-	-	-	X	N

* Video detection zone.

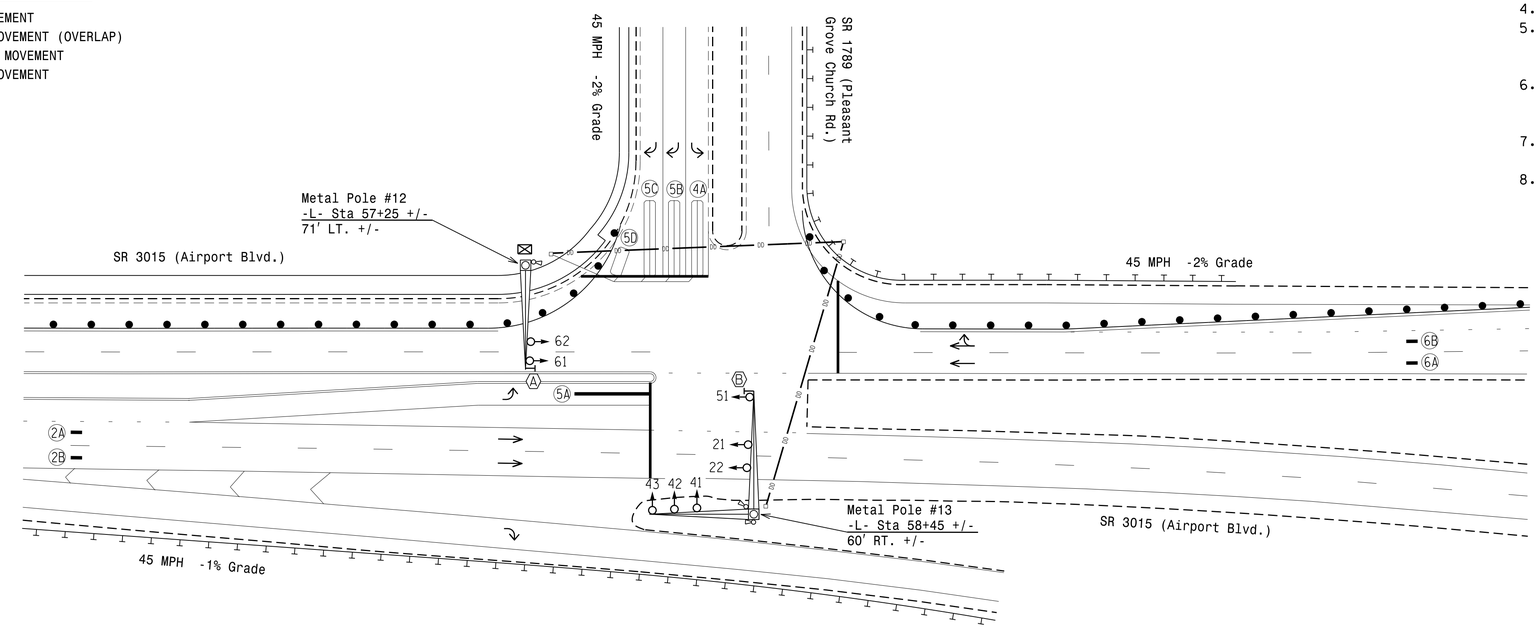
3 Phase
Fully Actuated
(Cary Signal System)

NOTES

1. Refer to "Roadway Standard Drawings NCDOT" dated January 2018 and "Standard Specifications for Roads and Structures" dated January 2018.
2. Do not program signal for late night flashing operation unless otherwise directed by the Engineer.
3. Phase 5 may be lagged.
4. Set all detector units to presence mode.
5. Locate new cabinet so as not to obstruct sight distance of vehicles turning right on red.
6. Maximum times shown in timing chart are for free-run operation only. Coordinated signal system timing values supersede these values.
7. Cary signal system data:
   Fiber channel #: 26.
8. This intersection features a video detection system. Shown locations of detectors are conceptual only. Refer to the manufacturer's guidelines for optimal detector placement.

PHASING DIAGRAM DETECTION LEGEND

- DETECTED MOVEMENT
- UNDETECTED MOVEMENT (OVERLAP)
- UNSIGNALIZED MOVEMENT
- PEDESTRIAN MOVEMENT



TIMING CHART

ASC/3-2070EN2 CONTROLLER

PHASE	Ø2	Ø4	Ø5	Ø6
MINIMUM GREEN *	12 SEC.	7 SEC.	7 SEC.	12 SEC.
VEHICLE EXT. *	6.0 SEC.	2.0 SEC.	2.0 SEC.	6.0 SEC.
YELLOW CHANGE INT.	4.7 SEC.	3.0 SEC.	3.0 SEC.	4.7 SEC.
RED CLEARANCE	1.8 SEC.	3.3 SEC.	2.3 SEC.	1.8 SEC.
MAX. 1 *	120 SEC.	30 SEC.	15 SEC.	120 SEC.
RECALL POSITION	MIN. RECALL	NONE	NONE	MIN. RECALL
LOCK DET.	ON	OFF	OFF	ON
WALK *	– SEC.	– SEC.	– SEC.	– SEC.
PED. CLEAR	– SEC.	– SEC.	– SEC.	– SEC.
VOLUME DENSITY	ON	OFF	OFF	ON
ACTUATION B4 ADD *	– VEH.	– VEH.	– VEH.	– VEH.
SEC. PER ACTUATION *	1.5 SEC.	– SEC.	– SEC.	1.5 SEC.
MAX. INITIAL *	34 SEC.	– SEC.	– SEC.	34 SEC.
TIME B4 REDUCTION *	15 SEC.	– SEC.	– SEC.	15 SEC.
TIME TO REDUCE *	30 SEC.	– SEC.	– SEC.	30 SEC.
MINIMUM GAP	3.0 SEC.	– SEC.	– SEC.	3.0 SEC.
DUAL ENTRY	OFF	OFF	OFF	OFF
SIMULTANEOUS GAP	ON	ON	ON	ON

* These values may be field adjusted. Do not adjust Min Green and Extension times for phases 2 and 6 lower than what is shown. Min Green for all other phases should not be lower than 4 seconds.

LEGEND

PROPOSED		EXISTING
○→	Traffic Signal Head	●→
◐→	Modified Signal Head	N/A
⊣	Sign	⊣
□↓	Pedestrian Signal Head With Push Button & Sign	■↓
○	Signal Pole with Guy	●
○	Signal Pole with Sidewalk Guy	●
▭	Inductive Loop Detector	▭
⊠	Controller & Cabinet	⊠
□	Junction Box	■
----------	2-in Underground Conduit	----------
N/A	Right of Way	----------
→	Directional Arrow	→
○	Metal Pole with Mastarm	○
N/A	Guardrail	⊥⊥⊥
DD	Directional Drill	N/A
○◁	Out of Pavement Detector	●◀
▬	Video Detection Area	▬
●●	Construction Zone Drums	●●
Ⓐ	No U-Turn Sign (R3-4)	Ⓐ
Ⓑ	"U-TURN YIELD TO RIGHT TURN" Sign (R10-16)	Ⓑ

New Installation - Temporary Design 2 (TMP Phase II)

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

Prepared In the Offices of:
Transportation Mobility and Safety Division
Signal Design Section
750 N.Greenfield Pkwy.Garner,NC 27529

SR 3015 (Airport Blvd.)
at
SR 1789
(Pleasant Grove Church Rd.)

Division 5 Wake County Morrisville

PLAN DATE: March 2019 REVIEWED BY:
PREPARED BY: J.A. Lohr REVIEWED BY:

SCALE 0 40 1"=40'

REVISIONS	INIT.	DATE

SEAL
NORTH CAROLINA PROFESSIONAL SEAL 026486 ENGINEER ROBERT J. ZIEMBA

DocuSigned by: 7/24/2019
DATE

SIG. INVENTORY NO. 05-190612

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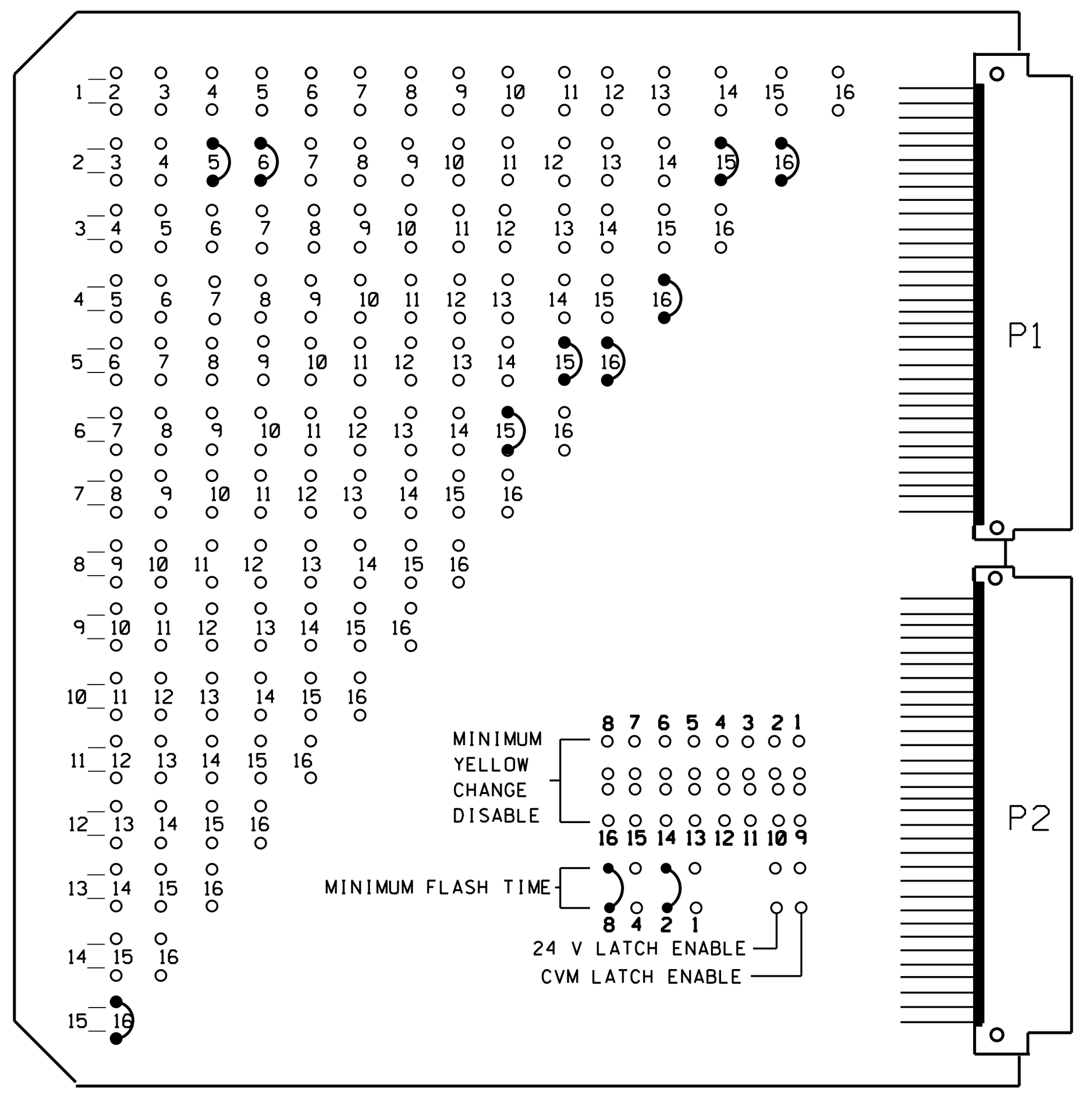
EDI MODEL MMU2-16LEip MALFUNCTION MANAGEMENT UNIT PROGRAMMING DETAIL

(program card and tables as shown below)



MMU PROGRAMMING CARD

FIELD CHECK ENABLE DUAL IND ENABLE RED FAIL ENABLE	
CHANNEL NUMBER	ENABLE/ DISABLE
1	DISABLE
2	ENABLE
3	DISABLE
4	ENABLE
5	DISABLE
6	ENABLE
7	DISABLE
8	DISABLE
9	DISABLE
10	DISABLE
11	DISABLE
12	DISABLE
13	DISABLE
14	DISABLE
15	ENABLE
16	ENABLE

UNIT OPTIONS	
OPTION	SETTING
RECURRENT PULSE	ON
WALK DISABLE	OFF
LOG CVM FAULTS	ON
EXTERN WATCHDOG	OFF
24V-2=12VDC	OFF
PGM CARD MEMORY	ON
LEDguard	ON
FORCE TYPE 16	OFF
TYPE12-SDLC	OFF
VM 3x/Day Latch	ON

FLASHING YELLOW ARROW	
CONFIG MODE	B
ENABLE CHANNEL PAIR, FYA	
CH 1-13	OFF
CH 3-14	OFF
CH 5-15	ON
CH 7-16	OFF
RED/YEL INPUT ENABLE	
CH 1	OFF
CH 3	OFF
CH 5	ON
CH 7	OFF
FLASH RATE FAULT	ON
FYA TRAP DETECT	ON

MMU PROGRAMMING NOTE

ENSURE YELLOW CHANGE PLUS RED CLEARANCE MONITORING IS ENABLED FOR ALL CHANNELS.

DETECTOR RACK SET-UP DETAIL

INSERT DETECTOR CARDS IN RACK ACCORDING TO THE DETAIL SHOWN BELOW. PARTICULAR DETECTOR CHANNELS WILL CALL PHASES INDICATED.

RACK #1	BIU	CH1 L3 Ø4	SLOT	CH1 L7 Ø5	CH1 L5 Ø5	SLOT	CH1 L9 Ø5	SLOT	SLOT	SLOT	SLOT	SLOT
		CH2 L4 NOT USED	EMPTY	CH2 L8 Ø5	CH2 L6 Ø2 *	EMPTY	CH2 L10 NOT USED	EMPTY	EMPTY	EMPTY	EMPTY	EMPTY

WIRE LOOPS TO TERMINALS ON LOOP PANEL AS SHOWN IN THE CHART BELOW

LOOP NO.	LOOP PANEL TERMINALS
NU	L1A,L1B
NU	L2A,L2B
4A	L3A,L3B
NU	L4A,L4B
5A (ADD JUMPERS FROM: L5A TO L6A, AND L5B TO L6B)	L5A,L5B L6A,L6B
5B	L7A,L7B
5C	L8A,L8B
5D	L9A,L9B
NU	L10A,L10B
NU	L11A,L11B
NU	L12A,L12B
NU	L13A,L13B
NU	L14A,L14B
NU	L15A,L15B
NU	L16A,L16B

PROGRAM CONTROLLER DETECTORS ACCORDING TO THE SCHEDULE SHOWN IN THE CHART BELOW

CONTROLLER DETECTOR NO.	FUNCTION	TIMING	
		FEATURE	TIME(SEC)
1			
2			
3	Ø4		
4			
5	Ø5	DELAY	15
* 6	Ø2	DELAY	3
7	Ø5	DELAY	15
8	Ø5	DELAY	15
9	Ø5	DELAY	15
10			
11			
12			
13			
14			
15			
16			

* Detector Type - G (remove delay from existing detector card)

SPECIAL DETECTOR NOTE

Install a video detection system for vehicle detection. Perform installation according to manufacturer's directions and NCDOT engineer-approved mounting locations to accomplish the detection schemes shown on the Signal Design Plans for zones 2A, 2B, 5A, 6A, and 6B.

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

NOTES

1. To prevent "flash-conflict" problems, wire all unused load switches to flash red. Verify that signal heads flash in accordance with the signal plans.
2. To prevent red failures on unused monitor channels, tie unused load switch red outputs 1,3,7,8,9,10,11,12,13, and 14 to load switch AC+ by inserting a jumper plug in the unused load switch socket from pin 1 (LS AC+) to pin 3 (RED out). Make sure all flash transfer relays are in place.
3. Program controller to start up in phase 2 Green and 6 Green.
4. Set power-up flash time to 10 seconds and implement on the Malfunction Management Unit. Set controller power-up flash time to 0 seconds.
5. Enable simultaneous gap-out feature for all phases.
6. Program detectors in accordance with the manufacturer's instructions to accomplish the detection schemes shown on the signal design plans.
7. Program detector call delay and extension timing on the controller, unless otherwise specified.
8. Set all detector card unit channels to "presence" mode.
9. Program phases 2 and 6 for volume density operation.
10. The cabinet and controller are a part of the Cary Signal System.

PROJECT REFERENCE NO.	SHEET NO.
I-5700	Sig. 25.1

SIGNAL HEAD HOOK-UP CHART

PHASE	1	2	3	4	5	6	7	8	2 PED	4 PED	6 PED	8 PED	OLA	OLB	OLC	OLD
SIGNAL HEAD NO.	NU	21,22	NU	41	51★	61,62	NU	NU	NU	NU	NU	NU	NU	NU	51★	42,43
RED		2R			*	6R										16R
YELLOW		2Y			*	6Y										
GREEN		2G				6G										
RED ARROW				4R											15R	
YELLOW ARROW				4Y											15Y	16Y
FLASHING YELLOW ARROW															15G	
GREEN ARROW				4G	5G											16G

NU = Not Used

★ See pictorial of head wiring detail this sheet.

* Denotes install load resistor. See load resistor installation detail on sheet 2.

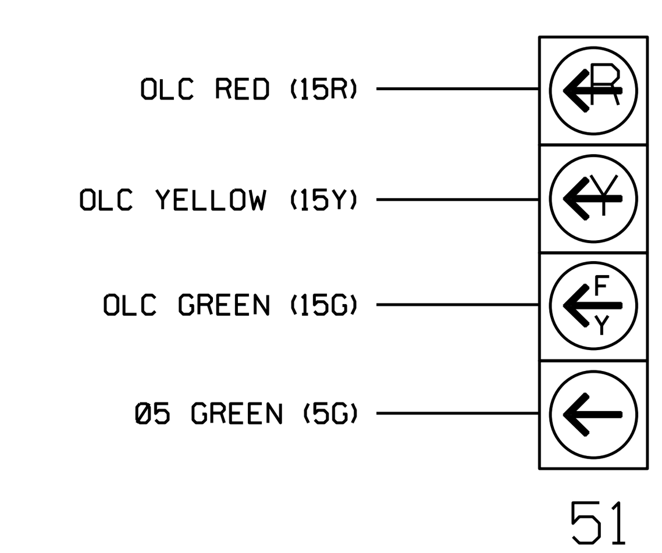
EQUIPMENT INFORMATION

CONTROLLER..............2070EN2
CABINET NC-8 TS-2
SOFTWARE ....ECONOLITE ASC/3-2070
CABINET MOUNT...........BASE
LOADBAY POSITIONS.......16
LOAD SWITCHES USED......2,4,5,6,15,16
PHASES USED.............2,4,5,6
OLA.....................NOT USED
OLB.....................NOT USED
OLC.....................*
OLD.....................4+5

* SEE OVERLAP PROGRAMMING DETAIL ON SHEET 2

FYA SIGNAL WIRING DETAIL

(wire signal head as shown)



LOAD SWITCH ASSIGNMENT DETAIL

(program controller according to schedule in chart below)

LOAD SWITCH NUMBER	FUNCTION
1	Ø1
2	Ø2
3	Ø3
4	Ø4
5	Ø5
6	Ø6
7	Ø7
8	Ø8
9	Ø2 PED
10	Ø4 PED
11	Ø6 PED
12	Ø8 PED
13	OLA
14	OLB
15	OLC
16	OLD

THIS ELECTRICAL DETAIL IS FOR THE SIGNAL DESIGN: 05-1906T2
DESIGNED: March 2019
SEALED: 7/24/2019
REVISED: N/A

Electrical Detail - Temp 2 (TMP Phase II)
Sheet 1 of 2

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

ELECTRICAL AND PROGRAMMING DETAILS FOR:

Prepared in the Offices of: ITS & Signals Management Section, Transportation Mobility and Safety Division, State of North Carolina Department of Transportation
750 N Greenfield Pkwy, Garner, NC 27529

SR 3015 (Airport Blvd.) at SR 1789 (Pleasant Grove Church Rd.)

Division 5 | Wake County | Cary

PLAN DATE: November 2015	REVIEWED BY:
PREPARED BY: S. Armstrong	REVIEWED BY:

REVISIONS	INIT.	DATE

SEAL: NORTH CAROLINA PROFESSIONAL ENGINEER SEAL 036833 RYAN W. HOUGH

DocuSigned by: Ryan W. Hough 430320FAA2654C3... DATE 8/1/2019

SIG. INVENTORY NO. 05-1906T2

29-JUL-2019 09:40
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sarmstrong

ECONOLITE ASC/3-2070 OVERLAP PROGRAMMING DETAIL

(program controller as shown)

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

Toggle Twice

OVERLAP C

Select TMG VEH OVLP [C] and 'PPLT FYA'

```
TMG VEH OVLP...[C] TYPE: .....[PPLT FYA]

PROTECTED LEFT TURN....   PHASE    5
OPPOSING THROUGH.......   PHASE    6

FLASHING ARROW OUTPUT.....CH15 ISOLATE

DELAY START OF: FYA..0.0 CLEARANCE..0.0
ACTION PLAN SF BIT DISABLE........... 0
```

Toggle Once

OVERLAP D

Select TMG VEH OVLP [D] and 'NORMAL'

```
TMG VEH OVLP...[D] TYPE: .......[NORMAL]
  PHASES 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6
INCLUDED . . . X X . . . . . . . . . . .

LAG GRN 0.0 YEL 0.0 RED 0.0
```

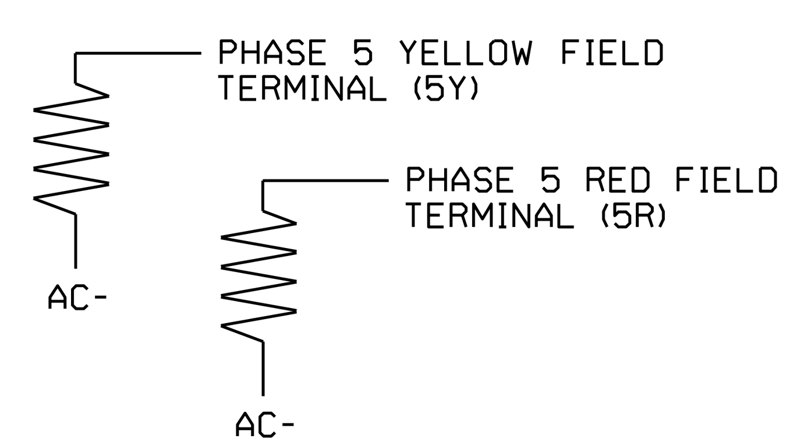
END PROGRAMMING

LOAD RESISTOR INSTALLATION DETAIL

(install resistors as shown below)

ACCEPTABLE VALUES

VALUE (ohms)	WATTAGE
1.5K - 1.9K	25W (min)
2.0K - 3.0K	10W (min)



ECONOLITE ASC/3-2070 SPECIAL MMU PROGRAMMING

(program controller as shown)

1. From Main Menu select [1. CONFIGURATION]
2. From CONFIGURATION Submenu select [4. PORT 1 (SDLC)]
3. From PORT 1 (SDLC) Submenu select [2. MMU PROGRAM]

CAUTION!

Set intersection to Flash before attempting to enter or change any MMU programming data.

This programming and that of the MMU programming card must match exactly. If they do not, the intersection will be placed into Flash.

MMU PROGRAM [MANUAL]

CH	6	5	4	3	2	1	0	9	8	7	6	5	4	3	2
1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
2	X	X	.	.	.	.	.	.	.	.	X	X	.	.	
3	.	.	.	.	.	.	.	.	.	.	.	.	.		
4	X	.	.	.	.	.	.	.	.	.	.	.			
5	X	X	.	.	.	.	.	.	.	.	.				
6	.	X	.	.	.	.	.	.	.	.					
7	.	.	.	.	.	.	.	.	.						
8	.	.	.	.	.	.	.	.							
9	.	.	.	.	.	.	.								
10	.	.	.	.	.	.									
11	.	.	.	.	.										
12	.	.	.	.											
13	.	.	.												
14	.	.													
15	X														

END PROGRAMMING

THIS ELECTRICAL DETAIL IS FOR
THE SIGNAL DESIGN: 05-1906T2
DESIGNED: March 2019
SEALED: 7/24/2019
REVISED: N/A

Electrical Detail - Temp 2 (TMP Phase II)
Sheet 2 of 2

ELECTRICAL AND PROGRAMMING DETAILS FOR:

Prepared In the Offices of:
Transportation Mobility and Safety Division
ITS & Signals Management Section
750 N.Greenfield Pkwy,Garner,NC 27529

SR 3015 (Airport Blvd.)
at
SR 1789
(Pleasant Grove Church Rd.)

Division 5 Wake County Morrisville

PLAN DATE: May 2019	REVIEWED BY:
PREPARED BY: S. Armstrong	REVIEWED BY:

REVISIONS	INIT.	DATE

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

SEAL
NORTH CAROLINA PROFESSIONAL SEAL 036833 ENGINEER RYAN W. HOUGH

DocuSigned by: Ryan W. Hough 430320EAA2654C3
8/1/2019
DATE

SIG. INVENTORY NO. 05-1906T2

26-JUL-2019 08:48
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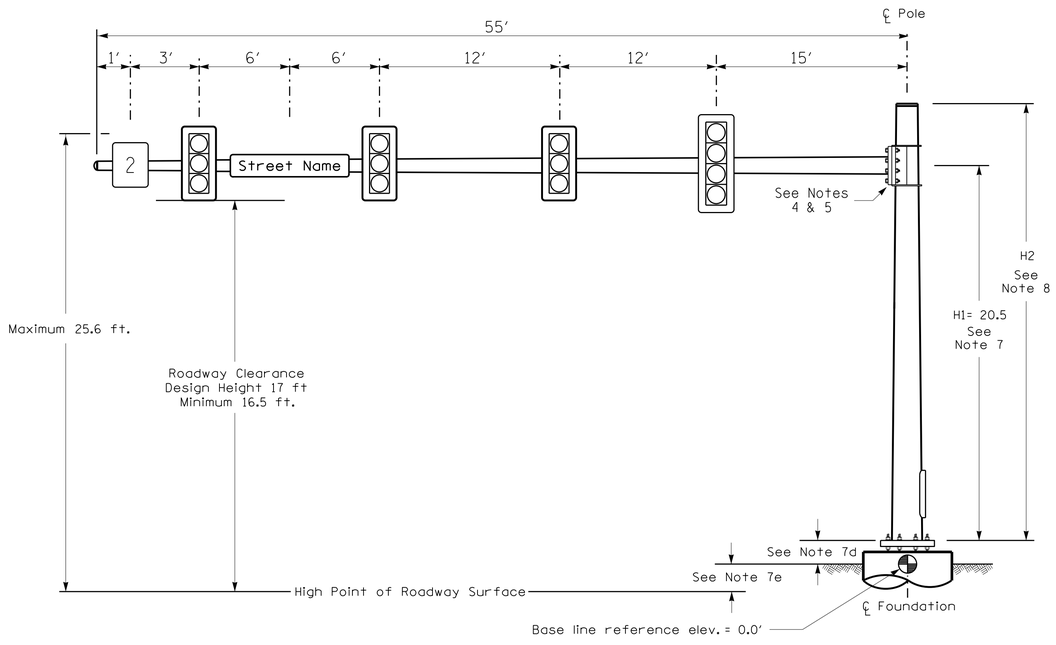
sarmstrong

METAL POLE No. 12

PROJECT REFERENCE NO.	SHEET NO.
I-5700	Sig 25.3

Design Loading for METAL POLE NO. 12



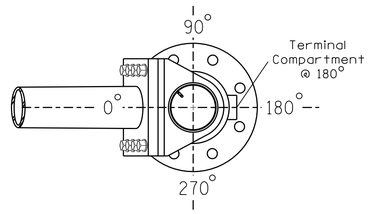
Elevation View

SPECIAL NOTE

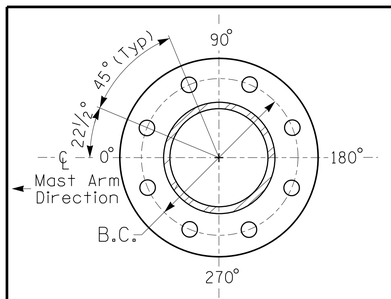
The contractor is responsible for verifying that the mast arm attachment height (H1) will provide the "Design Height" clearance from the roadway before submitting final shop drawings for approval. Verify elevation data below which was obtained by field measurement or from available project survey data.

Elevation Data for Mast Arm Attachment (H1)

Elevation Differences for:	Pole 10	
Baseline reference point at ⊕ Foundation @ ground level	0.0 ft.	
Elevation difference at High point of roadway surface	+1.9 ft.	
Elevation difference at Edge of travelway or face of curb	+1.3 ft.	

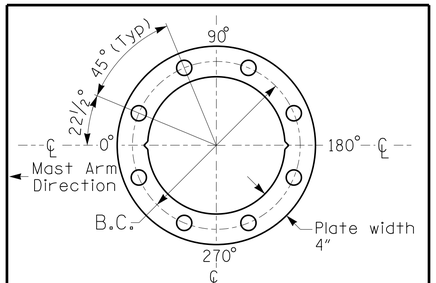


POLE RADIAL ORIENTATION



8 BOLT BASE PLATE DETAIL

See Note 6



BASE PLATE TEMPLATE & ANCHOR BOLT LOCK PLATE DETAIL

For 8 Bolt Base Plate

MAST ARM LOADING SCHEDULE

LOADING SYMBOL	DESCRIPTION	AREA	SIZE	WEIGHT
	RIGID MOUNTED SIGNAL HEAD 12"-4 SECTION-WITH BACKPLATE	11.5 S.F.	25.5" W X 66.0" L	74 LBS
	RIGID MOUNTED SIGNAL HEAD 12"-3 SECTION-WITH BACKPLATE	9.3 S.F.	25.5" W X 52.5" L	60 LBS
2	SIGN RIGID MOUNTED	7.5 S.F.	30.0" W X 36.0" L	14 LBS
Street Name	STREET NAME SIGN RIGID MOUNTED	16.0 S.F.	24.0" W X 96.0" L	36 LBS

NOTES

DESIGN REFERENCE MATERIAL

1. Design the traffic signal structure and foundation in accordance with:
   - The 6th Edition 2013 AASHTO "Standard Specifications for Structural Supports for Highway Signs, Luminaires, and Traffic Signals, including all of the latest interim revisions.
   - The 2018 NCDOT "Standard Specifications for Roads and Structures." The latest addenda to the specifications can be found in the traffic signal project special provisions.
   - The 2018 NCDOT Roadway Standard Drawings.
   - The traffic signal project plans and special provisions.
   - The NCDOT "Metal Pole Standards" located at the following NCDOT website: https://connect.ncdot.gov/resources/safety/Pages/ITS-Design-Resources.aspx

DESIGN REQUIREMENTS

2. Design the traffic signal structure using the loading conditions shown in the elevation views. These are anticipated worst case "design loads" and may not represent the actual loads that will be applied at the time of the installation. The contractor should refer to the traffic signal plans for the actual loads that will be applied at the time of the installation.
3. Design all signal supports using stress ratios that do not exceed 0.9.
4. The camber design for the mast arm deflection should provide an appearance of a low pitched arch where the tip or the free end of the mast arm does not deflect below horizontal when fully loaded.
5. A clamp-type bolted mast arm-to-pole connection may be used instead of the welded ring stiffened box connection shown as long as the connection meets all of the design requirements.
6. Design base plate with 8 anchor bolt holes. Provide 2 inch x 60 inch anchor bolts.
7. The mast arm attachment height (H1) shown is based on the following design assumptions:
   a. Mast arm slope and deflection are not considered in determining the arm attachment height as they are assumed to offset each other.
   b. Signal heads are rigidly mounted and vertically centered on the mast arm.
   c. The roadway clearance height for design is as shown in the elevation views.
   d. The top of the pole base plate is 0.75 feet above the ground elevation.
   e. Refer to the Elevation Data Chart for the elevation differences between the proposed foundation ground level and the high point of the roadway.
8. The pole manufacturer will determine the total height (H2) of each pole using the greater of the following:
   - Mast arm attachment height (H1) plus 2 feet, or
   - H1 plus 1/2 of the total height of the mast arm attachment assembly plus 1 foot.
9. If pole location adjustments are required, the contractor must gain approval from the Engineer as this may affect the mast arm lengths and arm attachment heights. The contractor may contact the Signal Design Section Senior Structural Engineer for assistance at (919) 814-5000.
10. The contractor is responsible for verifying that the mast arm length shown will allow proper positioning of the signal heads over the roadway.
11. The contractor is responsible for providing soil penetration testing data (SPT) to the pole manufacturer so site specific foundations can be designed.

NCDOT Wind Zone 4 (90 mph)

Prepared in the Offices of:
Transportation Mobility and Safety Division
Signal Design Section
750 N.Greenfield Pkwy.Garner,NC 27529

SR 3015 (Airport Boulevard)
at
SR 1789
(Pleasant Grove Church Road)

Division 5 | Wake County | Morrisville

PLAN DATE: March 2018 | REVIEWED BY:
PREPARED BY: J.A. Lohr | REVIEWED BY:

SCALE: 0 N/A N/A

REVISIONS	INIT.	DATE

SEAL
NORTH CAROLINA PROFESSIONAL SEAL 026486 ENGINEER ROBERT J. ZIEMBA

DocuSigned by: 8/5/2019
DATE

SIG. INVENTORY NO. 05-1906

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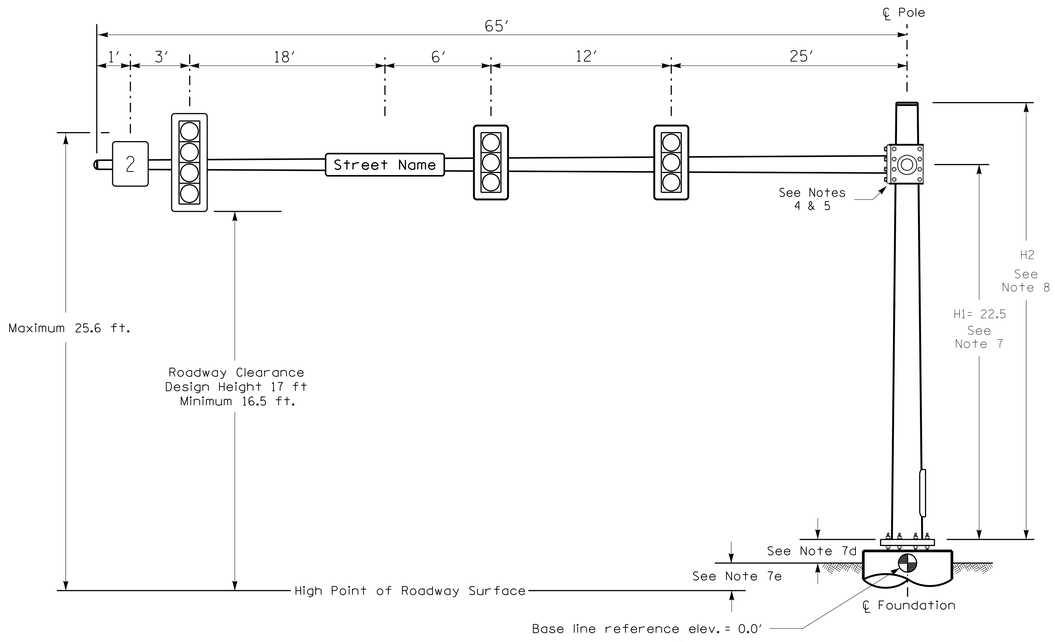
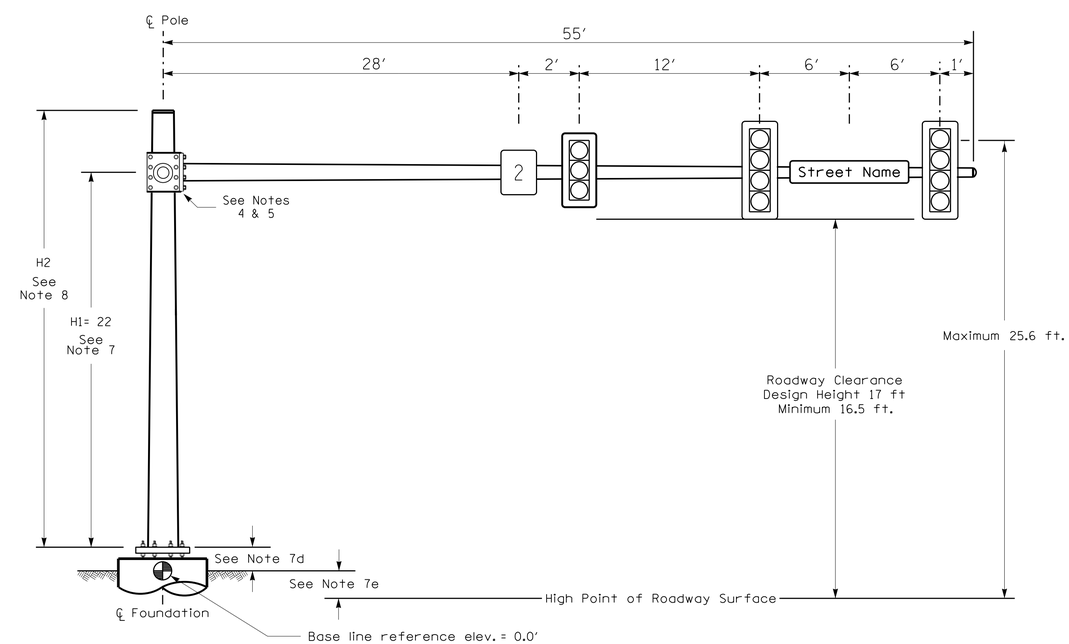
rziemba

Design Loading for METAL POLE NO. 13, MAST ARM A



Elevation View @ 270°

Design Loading for METAL POLE NO. 13, MAST ARM B



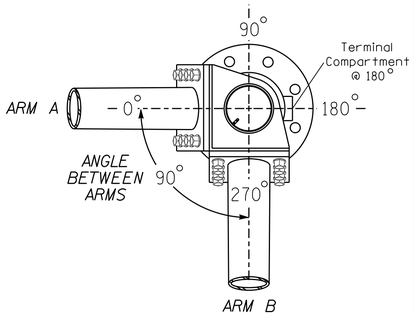
Elevation View @ 0°

SPECIAL NOTE

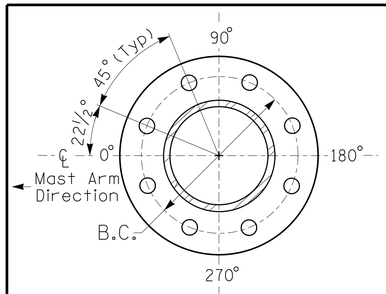
The contractor is responsible for verifying that the mast arm attachment height (H1) will provide the "Design Height" clearance from the roadway before submitting final shop drawings for approval. Verify elevation data below which was obtained by field measurement or from available project survey data.

Elevation Data for Mast Arm Attachment (H1)

Elevation Differences for:	Arm A	Arm B
Baseline reference point at ⊕ Foundation @ ground level	0.0 ft.	0.0 ft.
Elevation difference at High point of roadway surface	+3.3 ft.	+2.7 ft.
Elevation difference at Edge of travelway or face of curb	+1.5 ft.	-

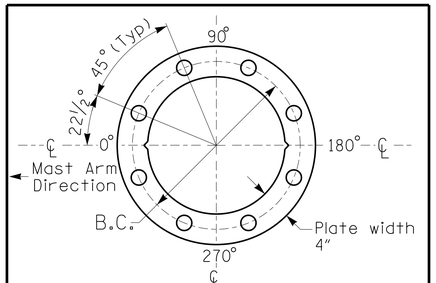


POLE RADIAL ORIENTATION



8 BOLT BASE PLATE DETAIL

See Note 6



BASE PLATE TEMPLATE & ANCHOR BOLT LOCK PLATE DETAIL

For 8 Bolt Base Plate

METAL POLE No. 13

PROJECT REFERENCE NO.	SHEET NO.
I-5700	Sig 25.4

MAST ARM LOADING SCHEDULE

LOADING SYMBOL	DESCRIPTION	AREA	SIZE	WEIGHT
	RIGID MOUNTED SIGNAL HEAD 12"-4 SECTION-WITH BACKPLATE	11.5 S.F.	25.5"W X 66.0"L	74 LBS
	RIGID MOUNTED SIGNAL HEAD 12"-3 SECTION-WITH BACKPLATE	9.3 S.F.	25.5"W X 52.5"L	60 LBS
2	SIGN RIGID MOUNTED	7.5 S.F.	30.0"W X 36.0"L	14 LBS
Street Name	STREET NAME SIGN RIGID MOUNTED	16.0 S.F.	24.0"W X 96.0"L	36 LBS

NOTES

DESIGN REFERENCE MATERIAL

1. Design the traffic signal structure and foundation in accordance with:
   - The 6th Edition 2013 AASHTO "Standard Specifications for Structural Supports for Highway Signs, Luminaires, and Traffic Signals, including all of the latest interim revisions.
   - The 2018 NCDOT "Standard Specifications for Roads and Structures." The latest addenda to the specifications can be found in the traffic signal project special provisions.
   - The 2018 NCDOT Roadway Standard Drawings.
   - The traffic signal project plans and special provisions.
   - The NCDOT "Metal Pole Standards" located at the following NCDOT website: https://connect.ncdot.gov/resources/safety/Pages/ITS-Design-Resources.aspx

DESIGN REQUIREMENTS

2. Design the traffic signal structure using the loading conditions shown in the elevation views. These are anticipated worst case "design loads" and may not represent the actual loads that will be applied at the time of the installation. The contractor should refer to the traffic signal plans for the actual loads that will be applied at the time of the installation.
3. Design all signal supports using stress ratios that do not exceed 0.9.
4. The camber design for the mast arm deflection should provide an appearance of a low pitched arch where the tip or the free end of the mast arm does not deflect below horizontal when fully loaded.
5. A clamp-type bolted mast arm-to-pole connection may be used instead of the welded ring stiffened box connection shown as long as the connection meets all of the design requirements. This requires staggering the connections. Use elevation data for each arm to determine appropriate arm connection points.
6. Design base plate with 8 anchor bolt holes. Provide 2 inch x 60 inch anchor bolts.
7. The mast arm attachment height (H1) shown is based on the following design assumptions:
   a. Mast arm slope and deflection are not considered in determining the arm attachment height as they are assumed to offset each other.
   b. Signal heads are rigidly mounted and vertically centered on the mast arm.
   c. The roadway clearance height for design is as shown in the elevation views.
   d. The top of the pole base plate is 0.75 feet above the ground elevation.
   e. Refer to the Elevation Data Chart for the elevation differences between the proposed foundation ground level and the high point of the roadway.
8. The pole manufacturer will determine the total height (H2) of each pole using the greater of the following:
   - Mast arm attachment height (H1) plus 2 feet, or
   - H1 plus 1/2 of the total height of the mast arm attachment assembly plus 1 foot.
9. If pole location adjustments are required, the contractor must gain approval from the Engineer as this may affect the mast arm lengths and arm attachment heights. The contractor may contact the Signal Design Section Senior Structural Engineer for assistance at (919) 814-5000.
10. The contractor is responsible for verifying that the mast arm length shown will allow proper positioning of the signal heads over the roadway.
11. The contractor is responsible for providing soil penetration testing data (SPT) to the pole manufacturer so site specific foundations can be designed.

NCDOT Wind Zone 4 (90 mph)

Prepared in the Offices of:
Transportation Mobility and Safety Division
Signal Design Section
750 N.Greenfield Pkwy,Garner,NC 27529

SR 3015 (Airport Boulevard)
at
SR 1789
(Pleasant Grove Church Road)

Division 5 | Wake County | Morrisville

PLAN DATE: March 2019 | REVIEWED BY:
PREPARED BY: J.A. Lohr | REVIEWED BY:

SCALE: 0 N/A N/A

REVISIONS	INIT.	DATE

SEAL
NORTH CAROLINA PROFESSIONAL SEAL 026486 ENGINEER ROBERT J. ZIEMBA

DocuSigned by: Robert J. Ziemba 8/5/2019
SIGNATURE DATE

SIG. INVENTORY NO. 05-1906

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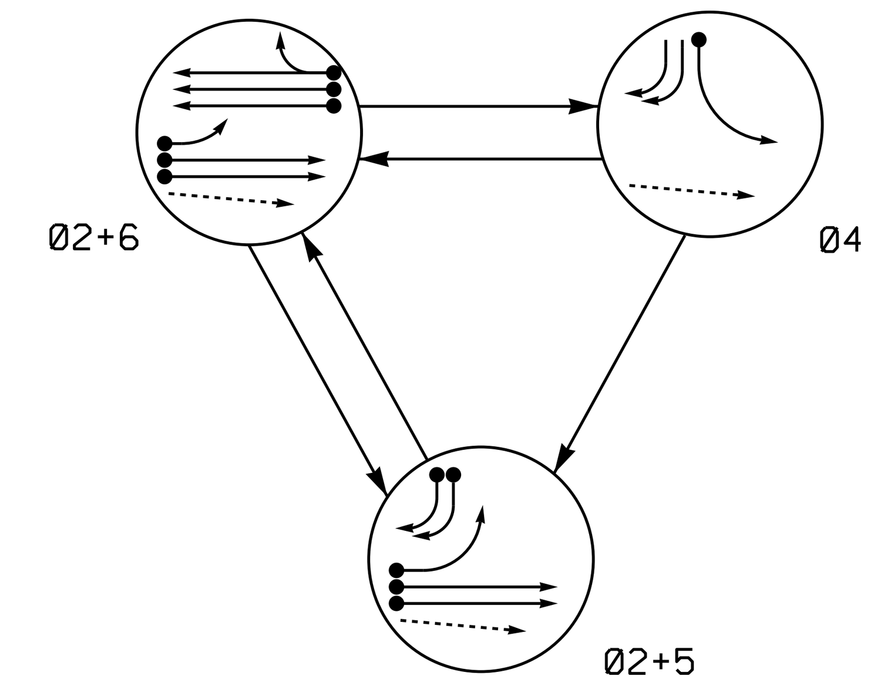
rziemba

PROJECT REFERENCE NO.	SHEET NO.
I-5700	Sig 26.0

PHASING DIAGRAM



PHASING DIAGRAM DETECTION LEGEND

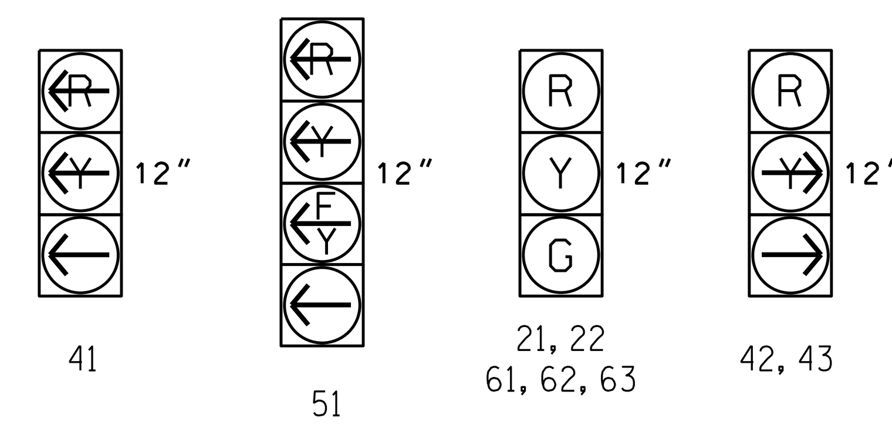
- DETECTED MOVEMENT
- UNDETECTED MOVEMENT (OVERLAP)
- UNSIGNALIZED MOVEMENT
- PEDESTRIAN MOVEMENT

TABLE OF OPERATION

SIGNAL FACE	PHASE Ø2+5	PHASE Ø2+6	PHASE Ø4	PHASE FLASH
21, 22	G	G	R	Y
41	←R	←R	←	←R
42, 43	→	R	→	R
51	←	←F/Y	←R	←Y
61, 62, 63	R	G	R	Y

SIGNAL FACE I.D.

All Heads L.E.D.



LOOP & DETECTOR INSTALLATION CHART

ASC/3-2070EN2 CONTROLLER w/ TS-2 CABINET

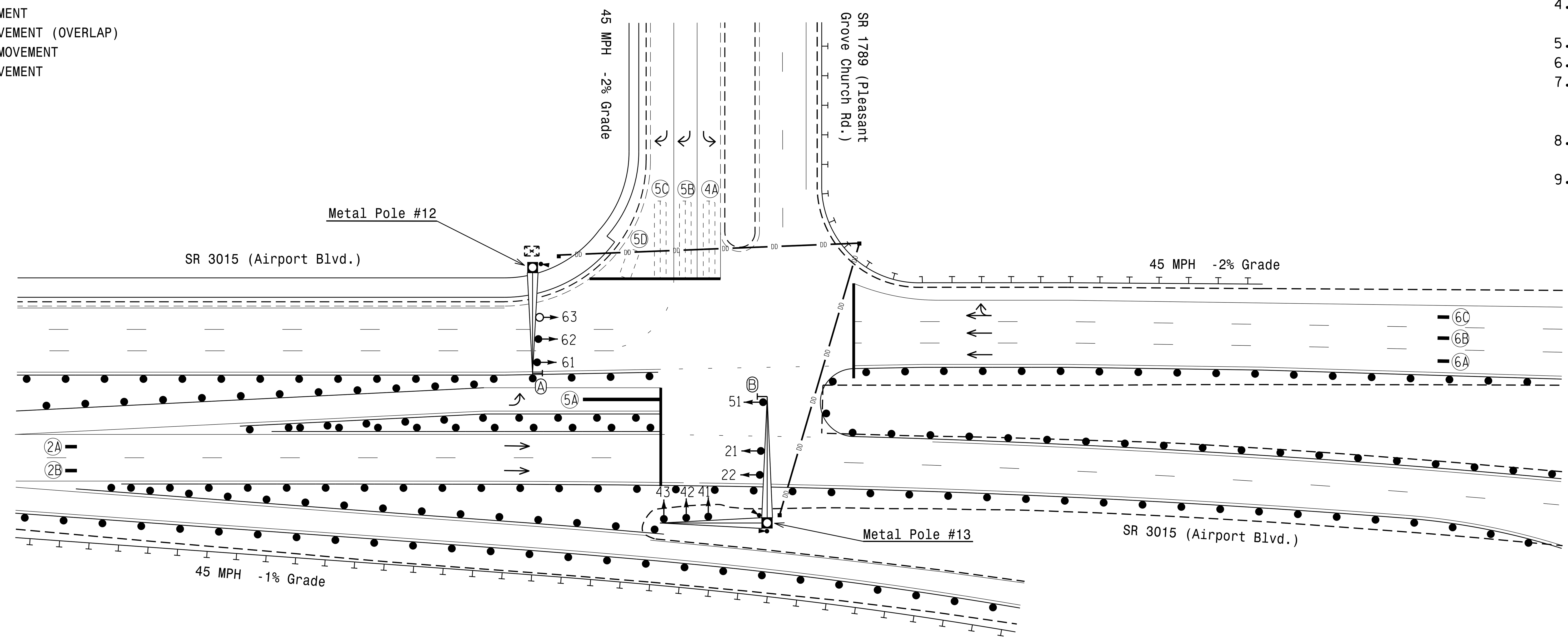
INDUCTIVE LOOPS						DETECTOR UNITS						
LOOP/ ZONE NO.	SIZE (ft)	DIST. FROM STOPBAR (ft)	TURNS	NEW	EXISTING	NEMA PHASE	NEW	EXISTING	TIMING FEATURE	TIMING TIME	ADDED INITIAL	DET. TYPE
2A*	6X6	300	*	*	-	2	-	X	-	-	X	N
2B*	6X6	300	*	*	-	2	-	X	-	-	X	N
4A	6X40	0	2-4-2	-	X	4	-	X	-	-	-	S
5A*	6X40	0	*	-	*	5	-	X	DELAY	15	-	S
						2	-	X	DELAY	3	-	G
5B	6X40	0	2-4-2	-	X	5	-	X	DELAY	15	-	S
5C	6X40	0	2-4-2	-	X	5	-	X	DELAY	15	-	S
5D	6X15	0	3	-	X	5	-	X	DELAY	15	-	S
6A*	6X6	300	*	*	-	6	-	X	-	-	X	N
6B*	6X6	300	*	*	-	6	-	X	-	-	X	N
6C*	6X6	300	*	*	-	6	X	-	-	-	X	N

* Video detection zone.

3 Phase
Fully Actuated
(Cary Signal System)

NOTES

1. Refer to "Roadway Standard Drawings NCDOT" dated January 2018 and "Standard Specifications for Roads and Structures" dated January 2018.
2. Do not program signal for late night flashing operation unless otherwise directed by the Engineer.
3. Phase 5 may be lagged.
4. Reposition existing signal heads numbered 61 and 62.
5. Set all detector units to presence mode.
6. Pavement markings are existing.
7. Maximum times shown in timing chart are for free-run operation only. Coordinated signal system timing values supersede these values.
8. Cary signal system data:
   Fiber channel #: 26.
9. This intersection features a video detection system. Shown locations of detectors are conceptual only. Refer to the manufacturer's guidelines for optimal detector placement.



LEGEND

PROPOSED		EXISTING
	Traffic Signal Head	
	Modified Signal Head	N/A
	Sign	
	Pedestrian Signal Head With Push Button & Sign	
	Signal Pole with Guy	
	Signal Pole with Sidewalk Guy	
	Inductive Loop Detector	
	Controller & Cabinet	
	Junction Box	
	2-in Underground Conduit	
N/A	Right of Way	
	Directional Arrow	
	Metal Pole with Mastarm	
N/A	Guardrail	
	Directional Drill	N/A
	Out of Pavement Detector	
	Video Detection Area	
	Construction Zone Drums	
Ⓐ	No U-Turn Sign (R3-4)	Ⓐ
Ⓑ	"U-TURN YIELD TO RIGHT TURN" Sign (R10-16)	Ⓑ

TIMING CHART

ASC/3-2070EN2 CONTROLLER

PHASE	Ø2	Ø4	Ø5	Ø6
MINIMUM GREEN *	12 SEC.	7 SEC.	7 SEC.	12 SEC.
VEHICLE EXT. *	6.0 SEC.	2.0 SEC.	2.0 SEC.	6.0 SEC.
YELLOW CHANGE INT.	4.7 SEC.	3.0 SEC.	3.0 SEC.	4.7 SEC.
RED CLEARANCE	1.8 SEC.	3.3 SEC.	2.8 SEC.	1.8 SEC.
MAX. 1 *	120 SEC.	30 SEC.	15 SEC.	120 SEC.
RECALL POSITION	MIN. RECALL	NONE	NONE	MIN. RECALL
LOCK DET.	ON	OFF	OFF	ON
WALK *	– SEC.	– SEC.	– SEC.	– SEC.
PED. CLEAR	– SEC.	– SEC.	– SEC.	– SEC.
VOLUME DENSITY	ON	OFF	OFF	ON
ACTUATION B4 ADD *	– VEH.	– VEH.	– VEH.	– VEH.
SEC. PER ACTUATION *	1.5 SEC.	– SEC.	– SEC.	1.0 SEC.
MAX. INITIAL *	34 SEC.	– SEC.	– SEC.	34 SEC.
TIME B4 REDUCTION *	15 SEC.	– SEC.	– SEC.	15 SEC.
TIME TO REDUCE *	30 SEC.	– SEC.	– SEC.	30 SEC.
MINIMUM GAP	3.0 SEC.	– SEC.	– SEC.	3.0 SEC.
DUAL ENTRY	OFF	OFF	OFF	OFF
SIMULTANEOUS GAP	ON	ON	ON	ON

* These values may be field adjusted. Do not adjust Min Green and Extension times for phases 2 and 6 lower than what is shown. Min Green for all other phases should not be lower than 4 seconds.

Signal Upgrade
Temporary Design 3 (TMP Phase III, Steps A and B)

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

Prepared in the Offices of: Transportation Mobility and Safety Division, Signal Design Section
750 N.Greenfield Pkwy,Garner,NC 27529

SR 3015 (Airport Blvd.)
at
SR 1789
(Pleasant Grove Church Rd.)

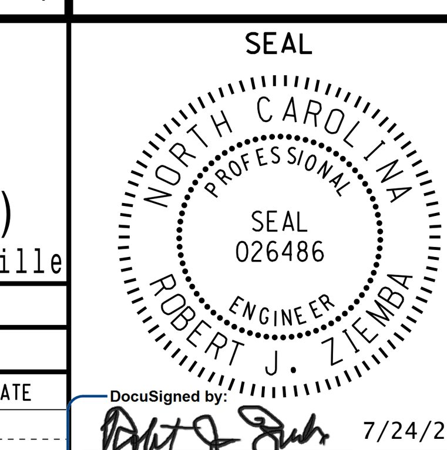
Division 5 — Wake County — Morrisville

PLAN DATE:	March 2019	REVIEWED BY:
PREPARED BY:	J.A. Lohr	REVIEWED BY:

SCALE 0 40 1"=40'

REVISIONS	INIT.	DATE

SEAL



DATE

SIG. INVENTORY NO. 05-1906T3

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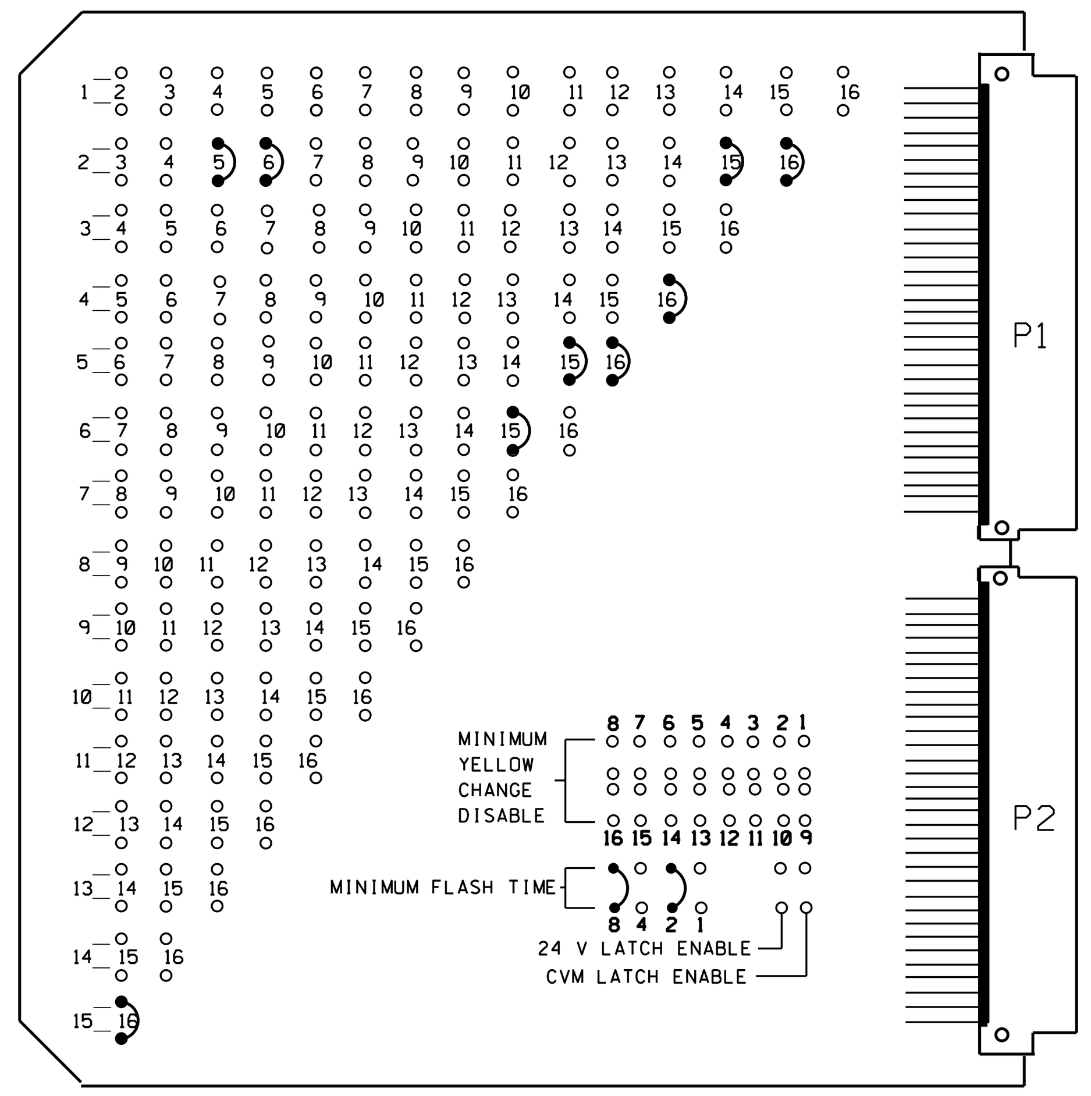
jalohr

EDI MODEL MMU2-16LEip MALFUNCTION MANAGEMENT UNIT PROGRAMMING DETAIL

(program card and tables as shown below)



MMU PROGRAMMING CARD

FIELD CHECK ENABLE DUAL IND ENABLE RED FAIL ENABLE	
CHANNEL NUMBER	ENABLE/ DISABLE
1	DISABLE
2	ENABLE
3	DISABLE
4	ENABLE
5	DISABLE
6	ENABLE
7	DISABLE
8	DISABLE
9	DISABLE
10	DISABLE
11	DISABLE
12	DISABLE
13	DISABLE
14	DISABLE
15	ENABLE
16	ENABLE

UNIT OPTIONS	
OPTION	SETTING
RECURRENT PULSE	ON
WALK DISABLE	OFF
LOG CVM FAULTS	ON
EXTERN WATCHDOG	OFF
24V-2=12VDC	OFF
PGM CARD MEMORY	ON
LEDguard	ON
FORCE TYPE 16	OFF
TYPE12-SDLC	OFF
VM 3x/Day Latch	ON

FLASHING YELLOW ARROW	
CONFIG MODE	B
ENABLE CHANNEL PAIR, FYA	
CH 1-13	OFF
CH 3-14	OFF
CH 5-15	ON
CH 7-16	OFF
RED/YEL INPUT ENABLE	
CH 1	OFF
CH 3	OFF
CH 5	ON
CH 7	OFF
FLASH RATE FAULT	ON
FYA TRAP DETECT	ON

MMU PROGRAMMING NOTE

ENSURE YELLOW CHANGE PLUS RED CLEARANCE MONITORING IS ENABLED FOR ALL CHANNELS.

NOTES

1. To prevent "flash-conflict" problems, wire all unused load switches to flash red. Verify that signal heads flash in accordance with the signal plans.
2. To prevent red failures on unused monitor channels, tie unused load switch red outputs 1,3,7,8,9,10,11,12,13, and 14 to load switch AC+ by inserting a jumper plug in the unused load switch socket from pin 1 (LS AC+) to pin 3 (RED out). Make sure all flash transfer relays are in place.
3. Program controller to start up in phase 2 Green and 6 Green.
4. Set power-up flash time to 10 seconds and implement on the Malfunction Management Unit. Set controller power-up flash time to 0 seconds.
5. Enable simultaneous gap-out feature for all phases.
6. Program detectors in accordance with the manufacturer's instructions to accomplish the detection schemes shown on the signal design plans.
7. Program detector call delay and extension timing on the controller, unless otherwise specified.
8. Set all detector card unit channels to "presence" mode.
9. Program phases 2 and 6 for volume density operation.
10. The cabinet and controller are a part of the Cary Signal System.

SIGNAL HEAD HOOK-UP CHART

PHASE	1	2	3	4	5	6	7	8	2 PED	4 PED	6 PED	8 PED	OLA	OLB	OLC	OLD
SIGNAL HEAD NO.	NU	21,22	NU	41	51★	61,62 63	NU	NU	NU	NU	NU	NU	NU	NU	51★	42,43
RED		2R			✳	6R										16R
YELLOW		2Y			✳	6Y										
GREEN		2G				6G										
RED ARROW				4R											15R	
YELLOW ARROW				4Y											15Y	16Y
FLASHING YELLOW ARROW															15G	
GREEN ARROW				4G	5G											16G

NU = Not Used

★ See pictorial of head wiring detail this sheet.

✳ Denotes install load resistor. See load resistor installation detail on sheet 2.

DETECTOR RACK SET-UP DETAIL

INSERT DETECTOR CARDS IN RACK ACCORDING TO THE DETAIL SHOWN BELOW. PARTICULAR DETECTOR CHANNELS WILL CALL PHASES INDICATED.

RACK #1	BIU		SLOT			SLOT		SLOT	SLOT	SLOT	SLOT	SLOT
		CH1 L3 Ø4	S L O T	CH1 L7 Ø5	CH1 L5 Ø5	S L O T	CH1 L9 Ø5	S L O T	S L O T	S L O T	S L O T	S L O T
		CH2 L4 NOT USED	E M P T Y	CH2 L8 Ø5	CH2 L6 Ø2 ✳	E M P T Y	CH2 L10 NOT USED	E M P T Y	E M P T Y	E M P T Y	E M P T Y	E M P T Y

WIRE LOOPS TO TERMINALS ON LOOP PANEL AS SHOWN IN THE CHART BELOW

LOOP NO.	LOOP PANEL TERMINALS
NU	L1A, L1B
NU	L2A, L2B
4A	L3A, L3B
NU	L4A, L4B
5A	L5A, L5B
	L6A, L6B
5B	L7A, L7B
5C	L8A, L8B
5D	L9A, L9B
NU	L10A, L10B
NU	L11A, L11B
NU	L12A, L12B
NU	L13A, L13B
NU	L14A, L14B
NU	L15A, L15B
NU	L16A, L16B

ADD JUMPERS FROM: L5A TO L6A, AND L5B TO L6B

PROGRAM CONTROLLER DETECTORS ACCORDING TO THE SCHEDULE SHOWN IN THE CHART BELOW

CONTROLLER DETECTOR NO.	FUNCTION	TIMING FEATURE	TIMING TIME(SEC)
1			
2			
3	Ø4		
4			
5	Ø5	DELAY	15
✳ 6	Ø2	DELAY	3
7	Ø5	DELAY	15
8	Ø5	DELAY	15
9	Ø5	DELAY	15
10			
11			
12			
13			
14			
15			
16			

✳ Detector Type - G (remove delay from existing detector card)

SPECIAL DETECTOR NOTE

Install a video detection system for vehicle detection. Perform installation according to manufacturer's directions and NCDOT engineer-approved mounting locations to accomplish the detection schemes shown on the Signal Design Plans for zones 2A, 2B, 5A, 6A, 6B, and 6C.

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

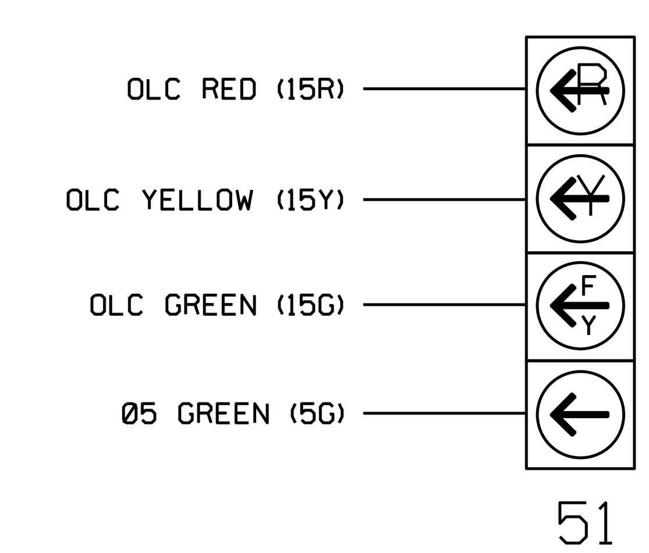
EQUIPMENT INFORMATION

CONTROLLER..............2070EN2
CABINET NC-8 TS-2
SOFTWARE ....ECONOLITE ASC/3-2070
CABINET MOUNT...........BASE
LOADBAY POSITIONS.......16
LOAD SWITCHES USED......2,4,5,6,15,16
PHASES USED.............2,4,5,6
OLA.....................NOT USED
OLB.....................NOT USED
OLC.....................✳
OLD.....................4+5

✳ SEE OVERLAP PROGRAMMING DETAIL ON SHEET 2

FYA SIGNAL WIRING DETAIL

(wire signal head as shown)



51

LOAD SWITCH ASSIGNMENT DETAIL

(program controller according to schedule in chart below)

LOAD SWITCH NUMBER	FUNCTION
1	Ø1
2	Ø2
3	Ø3
4	Ø4
5	Ø5
6	Ø6
7	Ø7
8	Ø8
9	Ø2 PED
10	Ø4 PED
11	Ø6 PED
12	Ø8 PED
13	OLA
14	OLB
15	OLC
16	OLD

THIS ELECTRICAL DETAIL IS FOR THE SIGNAL DESIGN: 05-1906T3
DESIGNED: March 2019
SEALED: 7/24/2019
REVISED: N/A

Electrical Detail - Temp 3 (TMP Phase III, Steps A and B)
Sheet 1 of 2

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

ELECTRICAL AND PROGRAMMING DETAILS FOR:

Prepared in the Offices of: Transportation Mobility and Safety Division, ITS & Signals Management Section, State of North Carolina Department of Transportation

750 N. Greenfield Pkwy, Garner, NC 27529

SR 3015 (Airport Blvd.)
at
SR 1789
(Pleasant Grove Church Rd.)

Division 5 Wake County Cary

PLAN DATE: November 2015 REVIEWED BY:
PREPARED BY: S. Armstrong REVIEWED BY:

REVISIONS	INIT.	DATE

SEAL
NORTH CAROLINA PROFESSIONAL SEAL 036833 ENGINEER RYAN W. HOUGH

DocuSigned by: Ryan W. Hough 430320FAA2654C3... 8/1/2019 DATE

SIG. INVENTORY NO. 05-1906T3

29-JUL-2019 09:41
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sarmstrong

PROJECT REFERENCE NO.	SHEET NO.
I-5700	Sig. 26.2

ECONOLITE ASC/3-2070 OVERLAP PROGRAMMING DETAIL

(program controller as shown)

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

Toggle Twice

OVERLAP C

Select TMG VEH OVLP [C] and 'PPLT FYA'

```
TMG VEH OVLP...[C] TYPE: .....[PPLT FYA]

PROTECTED LEFT TURN....   PHASE    5
OPPOSING THROUGH.......   PHASE    6

FLASHING ARROW OUTPUT.....CH15 ISOLATE

DELAY START OF: FYA..0.0 CLEARANCE..0.0
ACTION PLAN SF BIT DISABLE........... 0
```

Toggle Once

OVERLAP D

Select TMG VEH OVLP [D] and 'NORMAL'

```
TMG VEH OVLP...[D] TYPE: .......[NORMAL]
  PHASES 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6
INCLUDED . . . X X . . . . . . . . . . .

LAG GRN 0.0 YEL 0.0 RED 0.0
```

END PROGRAMMING

ECONOLITE ASC/3-2070 SPECIAL MMU PROGRAMMING

(program controller as shown)

1. From Main Menu select **1. CONFIGURATION**
2. From CONFIGURATION Submenu select **4. PORT 1 (SDLC)**
3. From PORT 1 (SDLC) Submenu select **2. MMU PROGRAM**

CAUTION!

Set intersection to Flash before attempting to enter or change any MMU programming data.

This programming and that of the MMU programming card must match exactly. If they do not, the intersection will be placed into Flash.

MMU PROGRAM [MANUAL]

CH	6	5	4	3	2	1	0	9	8	7	6	5	4	3	2
1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
2	X	X	.	.	.	.	.	.	.	.	X	X	.	.	
3	.	.	.	.	.	.	.	.	.	.	.	.	.		
4	X	.	.	.	.	.	.	.	.	.	.	.			
5	X	X	.	.	.	.	.	.	.	.	.				
6	.	X	.	.	.	.	.	.	.	.					
7	.	.	.	.	.	.	.	.	.						
8	.	.	.	.	.	.	.	.							
9	.	.	.	.	.	.	.								
10	.	.	.	.	.	.									
11	.	.	.	.	.										
12	.	.	.	.											
13	.	.	.												
14	.	.													
15	X														

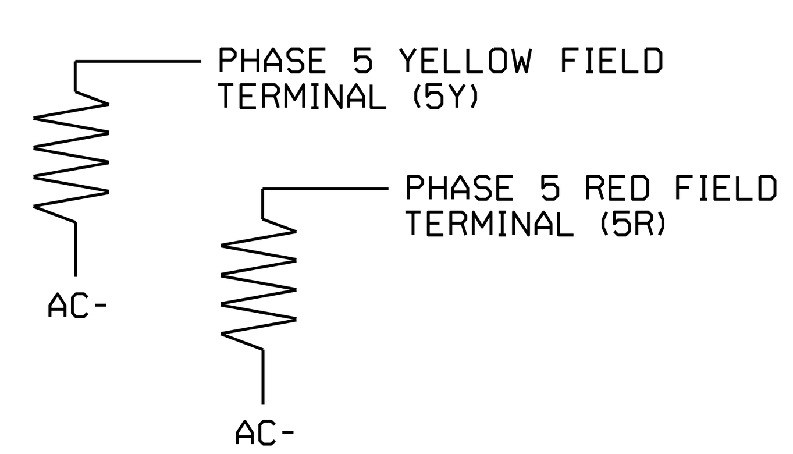
END PROGRAMMING

LOAD RESISTOR INSTALLATION DETAIL

(install resistors as shown below)

ACCEPTABLE VALUES

VALUE (ohms)	WATTAGE
1.5K - 1.9K	25W (min)
2.0K - 3.0K	10W (min)



THIS ELECTRICAL DETAIL IS FOR
THE SIGNAL DESIGN: 05-1906T3
DESIGNED: March 2019
SEALED: 7/24/2019
REVISED: N/A

Electrical Detail - Temp 3 (TMP Phase III, Steps A and B)
Sheet 2 of 2

ELECTRICAL AND PROGRAMMING DETAILS FOR:

Prepared in the Offices of:
750 N.Greenfield Pkwy,Garner,NC 27529

SR 3015 (Airport Blvd.)
at
SR 1789
(Pleasant Grove Church Rd.)

Division 5 | Wake County | Morrisville

PLAN DATE: May 2019	REVIEWED BY:
PREPARED BY: S. Armstrong	REVIEWED BY:

REVISIONS	INIT.	DATE

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

SEAL
NORTH CAROLINA PROFESSIONAL SEAL 036833 ENGINEER RYAN W. HOUGH

DocuSigned by: Ryan W. Hough 430320FAA2654C3...
8/1/2019
DATE

SIG. INVENTORY NO. 05-1906T3

26-JUL-2019 08:49
..*051906_sm_ele_xxx.dgn
sarmstrong

PROJECT REFERENCE NO.	SHEET NO.
I-5700	Sig 27.0

PHASING DIAGRAM

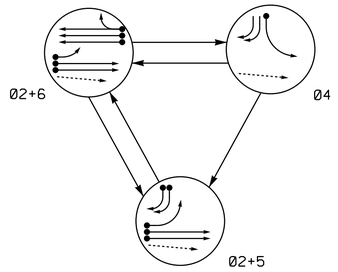
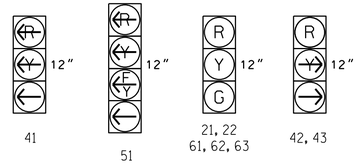


TABLE OF OPERATION				
SIGNAL FACE	PHASE Ø2+5	Ø2+6	Ø4	FLASH
21, 22	G	G	R	Y
41	~~R~~	~~R~~	←	~~R~~
42, 43	→	R	→	R
51	←	~~Y~~	~~R~~	~~Y~~
61, 62, 63	R	G	R	Y

SIGNAL FACE I.D.

All Heads L.E.D.



LOOP & DETECTOR INSTALLATION CHART

ASC/3-2070EN2 CONTROLLER w/ TS-2 CABINET

INDUCTIVE LOOPS						DETECTOR UNITS						
LOOP / ZONE NO.	SIZE (ft)	DIST. FROM STOPBAR (ft)	TURNS	NEW	EXISTING	NEMA PHASE	NEW	EXISTING	TIMING FEATURE	TIMING TIME	ADDED INITIAL	DET. TYPE
2A	6X6	300	5	X		2	-	X	-	-	X	N
2B	6X6	300	5	X		2	-	X	-	-	X	N
4A	6X40	0	2-4-2	-	X	4	-	X	-	-	-	S
5A	6X40	0	2-4-2	X	-	5	-	X	DELAY	15	-	S
						2	-	X	DELAY	3	-	G
5B	6X40	0	2-4-2	-	X	5	-	X	DELAY	15	-	S
5C	6X40	0	2-4-2	-	X	5	-	X	DELAY	15	-	S
5D	6X15	0	3	-	X	5	-	X	DELAY	15	-	S
6A*	6X6	300	*	-	X	6	-	*	-	-	X	N
6B*	6X6	300	*	-	X	6	-	*	-	-	X	N
6C*	6X6	300	*	-	X	6	-	*	-	-	X	N

* Video detection zone.

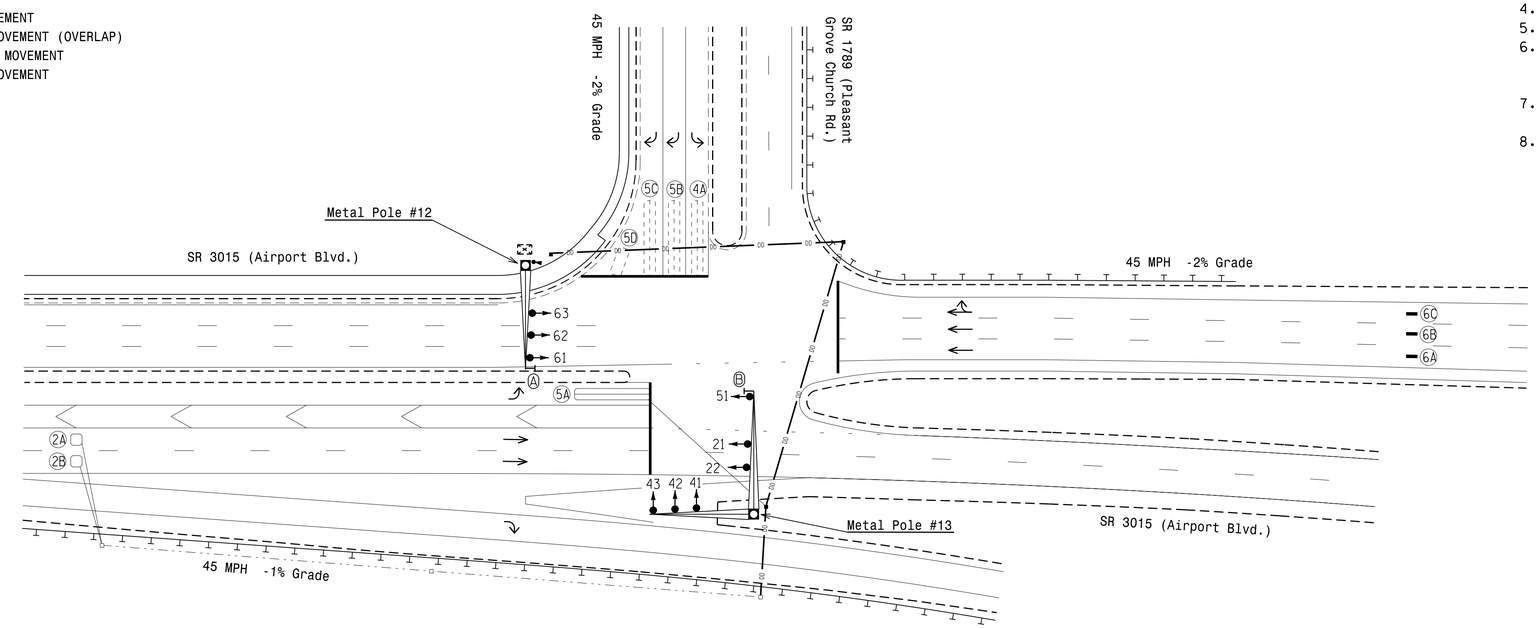
3 Phase
Fully Actuated
(Cary Signal System)

NOTES

1. Refer to "Roadway Standard Drawings NCDOT" dated January 2018 and "Standard Specifications for Roads and Structures" dated January 2018.
2. Do not program signal for late night flashing operation unless otherwise directed by the Engineer.
3. Phase 5 may be lagged.
4. Set all detector units to presence mode.
5. Pavement markings are existing.
6. Maximum times shown in timing chart are for free-run operation only. Coordinated signal system timing values supersede these values.
7. Cary signal system data:
   Fiber channel #: 26.
8. This intersection features a video detection system. Shown locations of detectors are conceptual only. Refer to the manufacturer's guidelines for optimal detector placement.

PHASING DIAGRAM DETECTION LEGEND

- DETECTED MOVEMENT
- UNDETECTED MOVEMENT (OVERLAP)
- UNSIGNALIZED MOVEMENT
- PEDESTRIAN MOVEMENT



LEGEND

PROPOSED		EXISTING
○→	Traffic Signal Head	●→
◐→	Modified Signal Head	N/A
⊣	Sign	⊣
□↓	Pedestrian Signal Head With Push Button & Sign	■↓
○→	Signal Pole with Guy	●→
○↓	Signal Pole with Sidewalk Guy	●↓
▭	Inductive Loop Detector	▭
⊠	Controller & Cabinet	⊠
□	Junction Box	■
----	2-in Underground Conduit	----
N/A	Right of Way	----
→	Directional Arrow	→
◁▭	Metal Pole with Mastarm	◁▭
N/A	Guardrail	⊥⊥
DD	Directional Drill	N/A
○◁	Out of Pavement Detector	●◀
▬	Video Detection Area	▬
●--●	Construction Zone Drums	●--●
Ⓐ	No U-Turn Sign (R3-4)	Ⓐ
Ⓑ	"U-TURN YIELD TO RIGHT TURN" Sign (R10-16)	Ⓑ

TIMING CHART

ASC/3-2070EN2 CONTROLLER

PHASE	02	04	05	06
MINIMUM GREEN *	12 SEC.	7 SEC.	7 SEC.	12 SEC.
VEHICLE EXT. *	6.0 SEC.	2.0 SEC.	2.0 SEC.	6.0 SEC.
YELLOW CHANGE INT.	4.7 SEC.	3.0 SEC.	3.0 SEC.	4.7 SEC.
RED CLEARANCE	1.8 SEC.	3.3 SEC.	2.8 SEC.	1.8 SEC.
MAX. 1 *	120 SEC.	30 SEC.	15 SEC.	120 SEC.
RECALL POSITION	MIN. RECALL	NONE	NONE	MIN. RECALL
LOCK DET.	ON	OFF	OFF	ON
WALK *	– SEC.	– SEC.	– SEC.	– SEC.
PED. CLEAR	– SEC.	– SEC.	– SEC.	– SEC.
VOLUME DENSITY	ON	OFF	OFF	ON
ACTUATION B4 ADD *	– VEH.	– VEH.	– VEH.	– VEH.
SEC. PER ACTUATION *	1.5 SEC.	– SEC.	– SEC.	1.0 SEC.
MAX. INITIAL *	34 SEC.	– SEC.	– SEC.	34 SEC.
TIME B4 REDUCTION *	15 SEC.	– SEC.	– SEC.	15 SEC.
TIME TO REDUCE *	30 SEC.	– SEC.	– SEC.	30 SEC.
MINIMUM GAP	3.0 SEC.	– SEC.	– SEC.	3.0 SEC.
DUAL ENTRY	OFF	OFF	OFF	OFF
SIMULTANEOUS GAP	ON	ON	ON	ON

* These values may be field adjusted. Do not adjust Min Green and Extension times for phases 2 and 6 lower than what is shown. Min Green for all other phases should not be lower than 4 seconds.

Signal Upgrade - Temporary Design 4 (TMP Phase IV)

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

Prepared in the Offices of:
Transportation Mobility and Safety Division
Signal Design Section
1750 N.Greenfield Pkwy,Garner,NC 27529

SR 3015 (Airport Blvd.)
at
SR 1789
(Pleasant Grove Church Rd.)

Division 5 Wake County Morrisville

PLAN DATE: March 2019 REVIEWED BY:
PREPARED BY: J.A. Lohr REVIEWED BY:

SCALE 0 40 1"=40'

REVISIONS	INIT.	DATE

SEAL
NORTH CAROLINA PROFESSIONAL SEAL 026486 ENGINEER ROBERT J. ZIEMBA

DocuSigned by: Robert J. Ziemba 7/24/2019 DATE

SIG. INVENTORY NO. 05-190614

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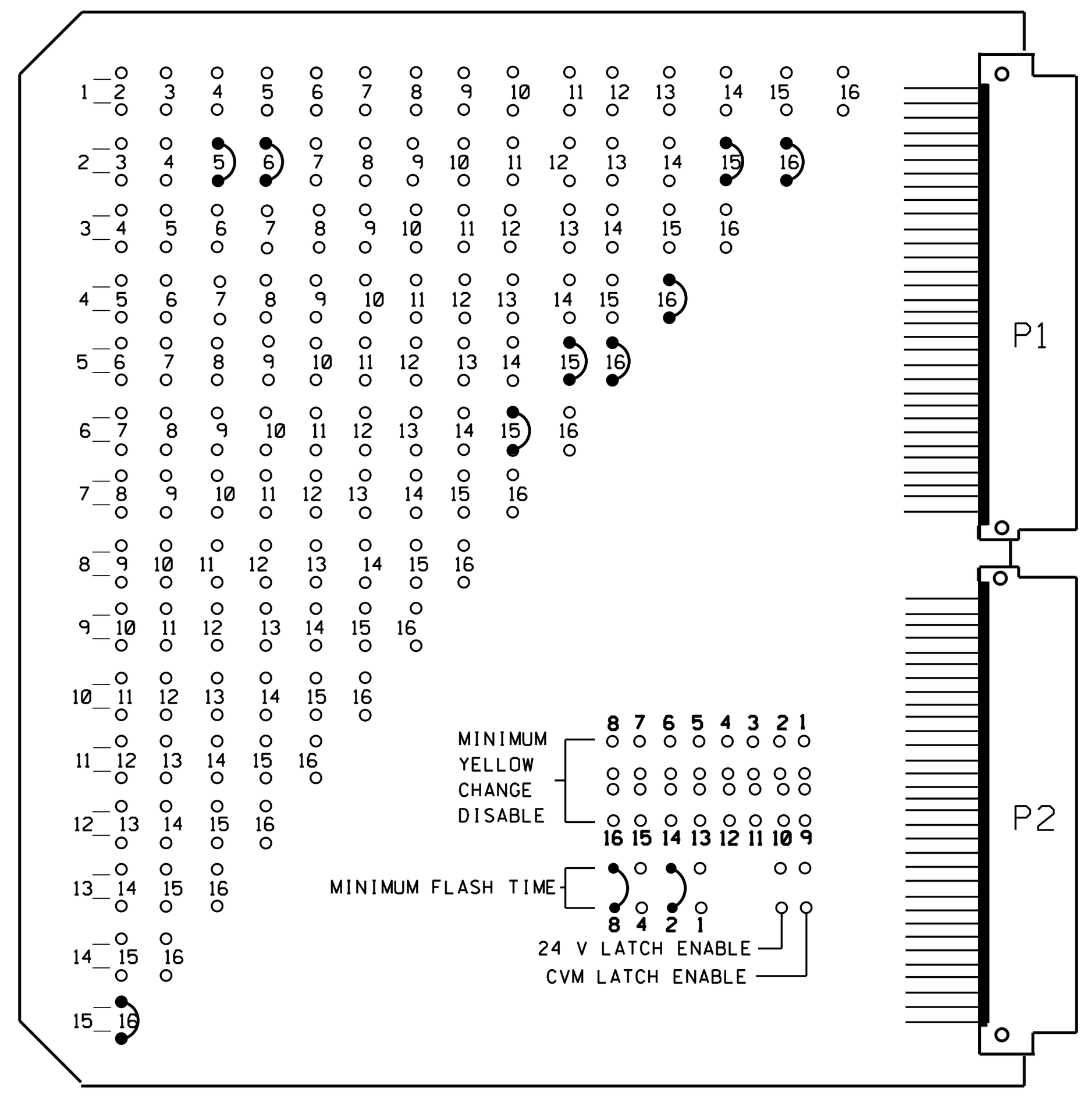
jalohr

EDI MODEL MMU2-16LEip MALFUNCTION MANAGEMENT UNIT PROGRAMMING DETAIL

(program card and tables as shown below)



MMU PROGRAMMING CARD

FIELD CHECK ENABLE DUAL IND ENABLE RED FAIL ENABLE	
CHANNEL NUMBER	ENABLE/ DISABLE
1	DISABLE
2	ENABLE
3	DISABLE
4	ENABLE
5	DISABLE
6	ENABLE
7	DISABLE
8	DISABLE
9	DISABLE
10	DISABLE
11	DISABLE
12	DISABLE
13	DISABLE
14	DISABLE
15	ENABLE
16	ENABLE

UNIT OPTIONS	
OPTION	SETTING
RECURRENT PULSE	ON
WALK DISABLE	OFF
LOG CVM FAULTS	ON
EXTERN WATCHDOG	OFF
24V-2=12VDC	OFF
PGM CARD MEMORY	ON
LEDguard	ON
FORCE TYPE 16	OFF
TYPE12-SDLC	OFF
VM 3x/Day Latch	ON

FLASHING YELLOW ARROW	
CONFIG MODE	B
ENABLE CHANNEL PAIR, FYA	
CH 1-13	OFF
CH 3-14	OFF
CH 5-15	ON
CH 7-16	OFF
RED/YEL INPUT ENABLE	
CH 1	OFF
CH 3	OFF
CH 5	ON
CH 7	OFF
FLASH RATE FAULT	ON
FYA TRAP DETECT	ON

MMU PROGRAMMING NOTE

ENSURE YELLOW CHANGE PLUS RED CLEARANCE MONITORING IS ENABLED FOR ALL CHANNELS.

DETECTOR RACK SET-UP DETAIL

INSERT DETECTOR CARDS IN RACK ACCORDING TO THE DETAIL SHOWN BELOW. PARTICULAR DETECTOR CHANNELS WILL CALL PHASES INDICATED.

RACK #1	BIU										
		CH1 L3 Ø4	CH1 L1 Ø2 **	CH1 L7 Ø5	CH1 L5 Ø5	SLOT EMPTY	CH1 L9 Ø5	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY
		CH2 L4 NOT USED	CH2 L2 Ø2 **	CH2 L8 Ø5	CH2 L6 Ø2 *		CH2 L10 NOT USED				

WIRE LOOPS TO TERMINALS ON LOOP PANEL AS SHOWN IN THE CHART BELOW

LOOP NO.	LOOP PANEL TERMINALS
2A	L1A,L1B
2B	L2A,L2B
4A	L3A,L3B
NU	L4A,L4B
5A	L5A,L5B
	L6A,L6B
5B	L7A,L7B
5C	L8A,L8B
5D	L9A,L9B
NU	L10A,L10B
NU	L11A,L11B
NU	L12A,L12B
NU	L13A,L13B
NU	L14A,L14B
NU	L15A,L15B
NU	L16A,L16B

ADD JUMPERS FROM: L5A TO L6A, AND L5B TO L6B

PROGRAM CONTROLLER DETECTORS ACCORDING TO THE SCHEDULE SHOWN IN THE CHART BELOW

CONTROLLER DETECTOR NO.	FUNCTION	TIMING	
		FEATURE	TIME(SEC)
** 1	Ø2		
** 2	Ø2		
3	Ø4		
4			
5	Ø5	DELAY	15
* 6	Ø2	DELAY	3
7	Ø5	DELAY	15
8	Ø5	DELAY	15
9	Ø5	DELAY	15
10			
11			
12			
13			
14			
15			
16			

* Detector Type - G (remove delay from existing detector card)

SPECIAL DETECTOR NOTE

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

NOTES

1. To prevent "flash-conflict" problems, wire all unused load switches to flash red. Verify that signal heads flash in accordance with the signal plans.
2. To prevent red failures on unused monitor channels, tie unused load switch red outputs 1,3,7,8,9,10,11,12,13, and 14 to load switch AC+ by inserting a jumper plug in the unused load switch socket from pin 1 (LS AC+) to pin 3 (RED out). Make sure all flash transfer relays are in place.
3. Program controller to start up in phase 2 Green and 6 Green.
4. Set power-up flash time to 10 seconds and implement on the Malfunction Management Unit. Set controller power-up flash time to 0 seconds.
5. Enable simultaneous gap-out feature for all phases.
6. Program detectors in accordance with the manufacturer's instructions to accomplish the detection schemes shown on the signal design plans.
7. Program detector call delay and extension timing on the controller, unless otherwise specified.
8. Set all detector card unit channels to "presence" mode.
9. Program phases 2 and 6 for volume density operation.
10. The cabinet and controller are a part of the Cary Signal System.

SIGNAL HEAD HOOK-UP CHART

PHASE	1	2	3	4	5	6	7	8	2 PED	4 PED	6 PED	8 PED	OLA	OLB	OLC	OLD
SIGNAL HEAD NO.	NU	21,22	NU	41	51★	61,62 63	NU	NU	NU	NU	NU	NU	NU	NU	51★	42,43
RED		2R			✳	6R										16R
YELLOW		2Y			✳	6Y										
GREEN		2G				6G										
RED ARROW				4R											15R	
YELLOW ARROW				4Y											15Y	16Y
FLASHING YELLOW ARROW															15G	
GREEN ARROW				4G	5G											16G

NU = Not Used

★ See pictorial of head wiring detail this sheet.

✳ Denotes install load resistor. See load resistor installation detail on sheet 2.

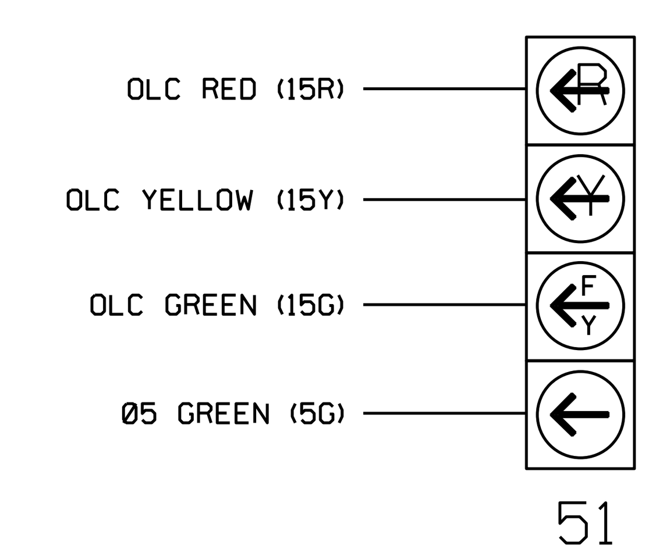
EQUIPMENT INFORMATION

CONTROLLER.............2070EN2
CABINET NC-8 TS-2
SOFTWARE ....ECONOLITE ASC/3-2070
CABINET MOUNT..........BASE
LOADBAY POSITIONS.......16
LOAD SWITCHES USED......2,4,5,6,15,16
PHASES USED............2,4,5,6
OLA....................NOT USED
OLB....................NOT USED
OLC....................*
OLD....................4+5

* SEE OVERLAP PROGRAMMING DETAIL ON SHEET 2

FYA SIGNAL WIRING DETAIL

(wire signal head as shown)



LOAD SWITCH ASSIGNMENT DETAIL

(program controller according to schedule in chart below)

LOAD SWITCH NUMBER	FUNCTION
1	Ø1
2	Ø2
3	Ø3
4	Ø4
5	Ø5
6	Ø6
7	Ø7
8	Ø8
9	Ø2 PED
10	Ø4 PED
11	Ø6 PED
12	Ø8 PED
13	OLA
14	OLB
15	OLC
16	OLD

THIS ELECTRICAL DETAIL IS FOR THE SIGNAL DESIGN: 05-1906T4
DESIGNED: March 2019
SEALED: 7/24/2019
REVISED: N/A

Electrical Detail - Temp 4 (TMP Phase IV)
Sheet 1 of 2

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

ELECTRICAL AND PROGRAMMING DETAILS FOR:

SR 3015 (Airport Blvd.)
at
SR 1789
(Pleasant Grove Church Rd.)

Division 5 Wake County Cary

Prepared in the Offices of: ITS & Signals Management Section, Transportation Mobility and Safety Division, North Carolina Department of Transportation
750 N. Greenfield Pkwy, Garner, NC 27529

PLAN DATE: November 2015 REVIEWED BY:
PREPARED BY: S. Armstrong REVIEWED BY:

REVISIONS	INIT.	DATE

SEAL: NORTH CAROLINA PROFESSIONAL ENGINEER SEAL 036833 RYAN W. HOUGH

DocuSigned by: Ryan W. Hough 430320FAA2654C3... DATE 8/1/2019

SIG. INVENTORY NO. 05-1906T4

29-JUL-2019 09:41
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sarmstrong

ECONOLITE ASC/3-2070 OVERLAP PROGRAMMING DETAIL

(program controller as shown)

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

Toggle Twice

OVERLAP C

Select TMG VEH OVLP [C] and 'PPLT FYA'

```
TMG VEH OVLP...[C] TYPE: .....PPLT FYA

PROTECTED LEFT TURN....   PHASE   5
OPPOSING THROUGH.......   PHASE   6

FLASHING ARROW OUTPUT.....CH15 ISOLATE

DELAY START OF: FYA..0.0 CLEARANCE..0.0
ACTION PLAN SF BIT DISABLE........... 0
```

Toggle Once

OVERLAP D

Select TMG VEH OVLP [D] and 'NORMAL'

```
TMG VEH OVLP...[D] TYPE: ......NORMAL
  PHASES 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6
INCLUDED . . . X X . . . . . . . . . . .

LAG GRN 0.0 YEL 0.0 RED 0.0
```

END PROGRAMMING

ECONOLITE ASC/3-2070 SPECIAL MMU PROGRAMMING

(program controller as shown)

1. From Main Menu select **1. CONFIGURATION**
2. From CONFIGURATION Submenu select **4. PORT 1 (SDLC)**
3. From PORT 1 (SDLC) Submenu select **2. MMU PROGRAM**

CAUTION!

Set intersection to Flash before attempting to enter or change any MMU programming data.

This programming and that of the MMU programming card must match exactly. If they do not, the intersection will be placed into Flash.

```
MMU PROGRAM [     MANUAL]

     CH  6 5 4 3 2 1 0 9 8 7 6 5 4 3 2
      1  . . . . . . . . . . . . . . .
      2  X X . . . . . . . . X X . .
      3  . . . . . . . . . . . . .
      4  X . . . . . . . . . . .
      5  X X . . . . . . . . .
      6  . X . . . . . . . .
      7  . . . . . . . . .
      8  . . . . . . . .
      9  . . . . . . .
     10  . . . . . .
     11  . . . . .
     12  . . . .
     13  . . .
     14  . .
     15  X
```

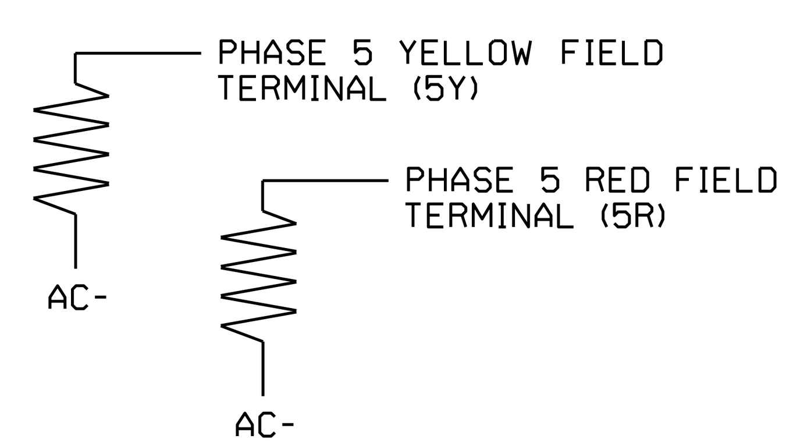
END PROGRAMMING

LOAD RESISTOR INSTALLATION DETAIL

(install resistors as shown below)

ACCEPTABLE VALUES

VALUE (ohms)	WATTAGE
1.5K - 1.9K	25W (min)
2.0K - 3.0K	10W (min)



THIS ELECTRICAL DETAIL IS FOR THE SIGNAL DESIGN: 05-1906T4
DESIGNED: March 2019
SEALED: 7/24/2019
REVISED: N/A

Electrical Detail - Temp 4 (TMP Phase IV)
Sheet 2 of 2

ELECTRICAL AND PROGRAMMING DETAILS FOR:

SR 3015 (Airport Blvd.)
at
SR 1789
(Pleasant Grove Church Rd.)

Division 5 — Wake County — Morrisville

Prepared in the Offices of: Transportation Mobility and Safety Division, ITS & Signals Management Section
750 N.Greenfield Pkwy,Garner,NC 27529

PLAN DATE: May 2019	REVIEWED BY:
PREPARED BY: S. Armstrong	REVIEWED BY:

REVISIONS	INIT.	DATE

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

SEAL
NORTH CAROLINA PROFESSIONAL ENGINEER SEAL 036833 RYAN W. HOUGH

DocuSigned by: Ryan W. Hough 430320FAA2654C3...
DATE 8/1/2019

SIG. INVENTORY NO. 05-1906T4