TRAFFIC CONTROLLER DESIGN MANUAL

Electrical and ITS Engineering

May 2019

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TRAFFIC CONTROLLER DESIGN MANUAL

Section 100

Policies and Procedures

Electrical and ITS Engineering

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101 TRAFFIC CONTROLLER DESIGN POLICY

101.1 INTRODUCTION

.1 This document has been prepared to clearly outline the policies related to roles and responsibilities of the various parties responsible for supplying, designing, and commissioning Ministry traffic controller equipment.

.2 Traffic controller equipment must be designed as per the appropriate standards.

101.2 DEFINITIONS

.1 For the purposes of this document, the following definitions are used:

.2 Traffic signal – consists of all of the equipment required to operate a traffic-controlled intersection as per the required standards (i.e. traffic controller assembly, signal head, poles, cabling, etc.)

.3 Traffic Controller Assembly (TCA) – consists of the traffic controller cabinet with all internal components.

.4 Traffic Controller Design – consists of the design of the traffic controller assembly to allow it to perform as per the traffic engineering operational requirements.

101.3 POLICY

.1 All designs for new traffic controller equipment and designs for modifications to existing traffic controller equipment shall be managed by Electrical and ITS Engineering.

.2 Traffic Control Designers (TCD) are personnel that are qualified and experienced with traffic controller equipment. Qualified and experienced Electrical Maintenance Contractor (EMC) may design and assemble traffic controllers on behalf of the Ministry.

.3 This policy applies to installation of new traffic signals, changing phasing at an existing signal, adding pre-emption to an existing signal, and all other situations not specifically excluded later in this document.

.4 It is recognized that when a TCA in the field is damaged due to a motor vehicle accident (MVA), the EMC may install a temporary TCA at the

intersection. This TCA is only temporary in nature and a new TCA shall be coordinated through the Manager, Electrical Services (MES).

101.4 COSTS

.1 Electrical and ITS Engineering has standardized costs for the design and supply of new and modifications to existing TCAs. Projects are responsible for funding of TCAs.

101.5 AUDITING

.1 Electrical and ITS Engineering shall audit and provide guidance for compliance to these policies.

102 MANAGING A TRAFFIC CONTROLLER PROJECT

102.1 INTRODUCTION

.1 This section outlines the procedures that shall be followed to ensure a successful implementation of a Traffic Controller project. These procedures consist of the Preliminary Project Information stage, Design stage, Construction/Assembly & Testing stage and Project Completion (project installed in the field) stage.

102.2 GENERAL PROCEDURES

.1 The Senior Traffic System Technologist from Electrical and ITS Engineering shall gather all critical design information received about a project before the commencement of design and procurement.

.2 A project shall not proceed any further until all documentation needed to complete the project has been provided to the Senior Traffic System Technologist. The list of required documents is as follows:

- Signed Contract for Services (CFS)
- Signed Traffic Engineering Check Sheet (TEC)
- Signed and sealed Signal Timing Sheet (STS)
- Signed and sealed Intersection Electrical Drawings (INTER-DWGS)

.3 Once the Senior Traffic System Technologist has received all the documentation (CFS, TEC, STS & INTER-DWGS), the project can be provided a TCA. The procurement and shipment of TCA shall be coordinated through the Senior Traffic System Technologist and Project Manager. The base configuration TCA is typically preassembled by the manufacturer, and can be shipped to the TCD's location.

.4 The Traffic Controller Construction Document (CST) shall be used by all TCDs to record all modifications needed to the internal wiring of a TCA as well as any explanation of operational features that are required and all non-standard programming requirements.

.5 If the project is a modification to an existing traffic controller that is to be constructed/assembled by the EMC, the EMC shall procure the required materials and document the modifications.

.6 All construction/assembly shall be in full accordance with the design documentation issued by the TCD. The completed documentation shall be sent via email to Electrical and ITS Engineering, c/o the Senior Traffic Systems Technologist. The design documentation package consists of the following:

- Traffic Controller Construction Document (CST)
- Loop Assignment Sheet (LAS)
- Signal Timing Sheet (STS)
- Set of TCA Schematics (DWG)

.7 The constructed/assembled project shall be fully tested in a non-operational environment as if the project is operating in the field. This is to ensure that the TCA will operate as per the Traffic Engineering Check Sheet (TEC) requirements. If at this point any changes and/or modifications are needed, then the TCD shall notify Electrical and ITS Engineering.

.8 The TCD shall update the design documentation to reflect the new requirements and then shall issue a new set of design documentation. Once the changes have been made a second full test shall be conducted to ensure that the traffic controller operates as per the Traffic Engineering Check Sheet (TEC) requirements.

.9 The EMC shall notify the Manager, Electrical Services once the project has moved from the pre-field install test to the ready to install in the field stage.

.10 The EMC shall now commission the traffic controller.

.11 The EMC shall notify Traffic Engineering and Electrical and ITS Engineering when a project has been completed and is fully operational in the field via email using the Traffic Signal Record (TSR) form.

Note: The design documentation that the Electrical and ITS Engineering has on file shall be used for the TCA audits as per Section 103. It is important that documentation at all sites and parties be identical.

103 TRAFFIC CONTROLLER ASSEMBLY AUDITS

103.1 INTRODUCTION

.1 It is the responsibility of the Electrical and ITS Engineering to conduct periodic field audits of Traffic Controller Assemblies (TCA) that are installed and operating throughout the Province. An audit shall involve the original design documents held at the Ministry, the intersection record documents held at the EMC, and record documents that reside in the TCA at the intersection.

103.2 PROCEDURES

.1 An auditor from the Electrical and ITS Engineering shall be assigned to conduct an audit in a particular region. An external qualified auditor may be contracted by the Ministry.

.2 Electrical and ITS Engineering shall notify respective Manager, Electrical Services (MES) that an audit is to be conducted in their region and arrange for an acceptable on-site date.

.3 The auditor shall assemble a list of signalized intersections that have been selected for the audit.

.4 A copy of all the design documentation held by Electrical and ITS Engineering shall be made for each of the selected signalized intersections.

.5 The auditor shall compare the intersection record documentation with the set from the Electrical and ITS Engineering. Any disparity between the documentation shall be recorded and will be used in the final audit report.

.6 The auditor shall proceed to the selected intersection where a visual record of the intersection shall be made and a comparison made between the intersection TCA documentation, the EMC documentation, the Ministry documentation and what is actually installed in the intersection. Any disparity between the documentation shall be recorded and shall be used in the final audit report.

.7 Electrical and ITS Engineering shall compile a Non Compliance Report (NCR), listing clearly any deficiencies that should be corrected with any of the documentation. The NCR shall be forwarded to the MESs for distribution to their respective EMCs.

.8 Electrical and ITS Engineering shall follow up to confirm all corrections have been made on the NCR with the MESs.

TRAFFIC CONTROLLER DESIGN MANUAL

Section 200

TRAFFIC CONTROLLER DESIGN AND DOCUMENTATION

Electrical and ITS Engineering

May 2019

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201 INTRODUCTION

201.1 SECTION SUMMARY

.1 This section describes what methods and information the Electrical and ITS Engineering uses to track and manage the life cycle of a Traffic Controller.

202 TRAFFIC CONTROLLER INTERSECTION FILE

202.1 INTRODUCTION

.1 This chapter describes the policies and procedures that the Senior Traffic System Technologist must follow in creating and implementing an intersection file. The purpose of the file is for tracking a traffic controller life cycle from its implementation, updates for timings and equipment, and decommission. Each intersection that utilizes a traffic controller will have its individual file.

202.2 POLICY

.1 The Senior Traffic System Technologist is responsible for creating and maintaining the intersection file. The file shall be created during the initial intersection design.

.2 Subsequent updates, changes, and modifications of a traffic controller specific to an intersection shall be detailed in the same file. Example: New Signal Timing Sheets (STS) and Traffic Signal Records (TSR) shall be inserted into the file.

.3 An active intersection file shall be kept for the life of the controlled intersection plus 7 years.

202.3 CONTENTS

.1 All correspondence relating to the project. Paper and electronic correspondence files.

.2 Traffic Engineering Checklist (TEC) is a Pre-requisite to project construction. (Refer to Traffic Signal Program Development and Implementation Guidelines).

.3 Financial approval is a Pre-requisite to project construction. This is in the form of a CFS authorising charges to a Regional account.

.4 Signal Timing Sheet (STS) is a Pre-requisite to project construction (signed and sealed by a Professional Engineer).

.5 Electrical Intersection Drawings (signed and sealed by a Professional Engineer) is a Pre-requisite to project construction. Note: Only Electrical

Intersection Drawings containing information relevant to the traffic signal are kept in the working file. (i.e. 1:250 Site Plan, Loop Table, Signal Display, Pole Elevations, etc.)

.6 Loop Assignment Sheet

.7 Traffic Controller Drawings

.8 Traffic Controller Construction Document

.9 Controller Unit Programming Data Capture (Data Dump)

203 STANDARD TRAFFIC CONTROLLER DRAWINGS

203.1 INTRODUCTION

.1 This section describes the types, naming conventions and descriptions of standard traffic controller drawings and drafting standards used for traffic controller design.

203.2 POLICY

.1 Drawings shall only be modified in accordance to the procedures noted in this manual or as approved in writing by Electrical and ITS Engineering.

203.3 TYPES OF TRAFFIC CONTROLLER CABINET ASSEMBLIES

203.3.1 Four Phase ('M' Cabinet)

.1 The TS1 four phase cabinet was the Ministry's traffic controller cabinet for intersections with 4 phases or less. The cabinet has associated drawing sheets as described in Section 205.10.

.2 The TS1 four phase cabinet is also known as a 'M' Cabinet.

.3 TS1 four phase cabinets have been phased out and are not available for new projects. The inclusion of four phases in this manual is for maintenance reference only.

203.3.2 Eight Phase ('S' and 'P6' Cabinet)

.1 The eight phase is the Ministry's standard traffic controller cabinet for intersections with more than 4 phases. The cabinet has associated drawing sheets as described in Section 205.9.

.2 The 'S' cabinet is TS1 only, and is no longer available for new projects. The inclusion of the 'S' cabinets in this manual is for maintenance reference only.

.3 The 'P6' cabinet is a TS2 cabinet, and is the current standard for new Ministry projects that require a cabinet. The cabinet has associated drawing sheets as described in Section 205.11.

203.4 DRAWING NAMING CONVENTIONS AND DESCRIPTIONS

203.4.1 General

.1 It is important to produce accurate drawings for ease of maintenance and future upgrades.

.2 Traffic cabinet drawings are typically modified based on existing templates.

.3 New drawings are created when a new cabinet is required for an intersection. Any future changes to that cabinet shall be represented in the current version of the drawing. Current drawings shall be kept by the maintenance contractor and the Ministry.

.4 The associated intersection drawing name will precede the designated cabinet drawing sheet designation with an underscore character. See sections below for examples.

203.4.2 Naming conventions for TS1 Four Phase Cabinet Drawings

.1 Drawing sheets for TS1 four phase 'M' cabinets consist of two drawings named as follows:

.1 FRONT.dwg - Drawing sheet details the field terminal blocks, inputs, power supply, flash circuitry, load switches and card racks.

.2 HARNESS.dwg - Drawing sheet details all harness connections, conflict monitor options, and pre-emption card options.

.3 Note that all four phase template drawings have common names (i.e. all are named FRONT.DWG and HARNESS.DWG); the only differentiating characteristic is the title blocks of the actual drawings.

.4 Example: A 'M' cabinet associated with intersection drawing 10123-1.dwg will include drawings: 10123-1_FRONT.dwg and 10123-1_HARNESS.dwg.

.5 Note: Previous standard for naming conventions used "FRO.dwg" and "HAR.dwg". This naming convention is acceptable.

203.4.3 Naming conventions for TS1 Eight Phase Cabinet Drawings

.1 Drawing sheets for eight phase ‘S’ cabinets consist of three drawings named as follows:

.1 FRONT.dwg - Drawing sheet details the field terminal blocks, inputs, power supply, flash circuitry, load switches and card racks.

.2 HARNESS.dwg - Drawing sheet details all harness connection details, conflict monitor options, and pre-emption card options.

.3 REAR.dwg - Drawing sheet details the field loop connections, power supply assembly and back panel terminal wiring.

.4 Note that all eight phase template drawings have common names (i.e. all are named FRONT.dwg, HARNESS.dwg and REAR.dwg); the only differentiating characteristic is the title blocks of the actual drawings.

.5 Example: A S cabinet associated with intersection drawing 10123-1.dwg will include drawings: 10123-1_FRONT.dwg, 10123-1_HARNESS.dwg, and 10123-1_REAR.dwg.

.6 Note: Previous standard for naming conventions used “FRO.dwg”, “HAR.dwg” and “REA.dwg”. This naming convention is acceptable.

203.3.4 Naming conventions for TS2 Cabinet Drawings

.1 Drawing sheets for eight phase ‘P6’ cabinets consist of three drawings named as follows:

.1 PRI.dwg – Primary sheet. Drawing sheet details the field terminal blocks, inputs, power supply, load switches, and BIU pinouts.

.2 SEC.dwg – Secondary sheet. Drawing sheet details the detector rack, pre-emption panel, detector loops, advance warning and test panel.

.3 Note that all P6 template drawings have common names (i.e. all are named PRI.dwg and SEC.dwg); the only differentiating characteristic is the title blocks of the actual drawings.

.4 Example: A P6 cabinet associated with intersection drawing 10123-1.dwg will include drawings: 10123-1_PRI.dwg, 10123-1_SEC.dwg.

203.4 DRAFTING STANDARDS

203.4.1 Policy

.1 Traffic Controller Drawings are to saved in the version of AutoCAD currently used by the Ministry. Contact Electrical and ITS Engineering for information on the current release in use.

.2 All drawing filenames shall follow the naming convention detailed in 203.3.

.3 Drafting standards are provided by the Ministry Senior Traffic System Technologist.

203.4.2 Drawing Sizes, Text, Layers and Colours

.1 Normally, only modifications of existing drawing components are required. If entities need to be created, copy existing entities to create new ones.

.2 Consult Electrical and ITS Engineering if new text layers and colours are required.

204 DESIGN AND DOCUMENTATION PROCESS

204.1 INTRODUCTION

.1 This chapter describes the procedures involved in the traffic controller design and documentation process.

.2 The key documents involved with the design process are the Traffic Controller Construction Document, Correspondence File, Loop Assignment Sheet, and Traffic Controller Drawings.

204.2 DOCUMENTATION ROLES AND RESPONSIBILITIES

.1 It is the responsibility of the contractor that provides the controller to complete the key documents.

.2 The Ministry provides guidelines in Section 204.3 on the recommended procedure and template for the Traffic Controller Construction Document to follow to ensure all necessary quality assurance checks are made.

.3 The Ministry shall be forwarded a version of all final versions of the key documents.

204.3 TRAFFIC CONTROLLER CONSTRUCTION DOCUMENT

204.3.1 TRAFFIC CONTROLLER CONSTRUCTION DOCUMENT SECTIONS

.1 The Traffic Controller Construction Document contains the documentation for the construction and quality control processes. The following sections and checklists included are:

.1 Wiring Modifications

.2 Installed Equipment

.3 Drawing Modifications

.4 Special Feature Programming

.5 Finishing Procedures

.6 Final Test-N-Checkout form

.7 Quality Control Check List

.2 The following five sections detail headings containing standard assembly instructions. Each heading in the document is to be expanded with the information corresponding to the project. Headings that are not applicable to the project are to be deleted from the document.

.1 Wiring Modifications – This section of the document provides step by step instructions to assemble and modify the traffic controller cabinet.

.2 Installed Equipment – This section of the document provides a description of equipment to be installed to complete assembly and modification of the traffic controller cabinet.

.3 Drawing Modifications – This section of the document provides a checklist of drawing items. These items should be used as a guide in design.

.4 Special Feature Programming – This section of the document provides notable information on the Traffic Controller Unit programming or operational requirements of any add on devices needed for this project.

.5 Finishing Procedures – This section contains labelling standards or any special consideration to project finish.

.3 Final Test-N Checkout – This section contains a Final Test-N Checkout form to be completed once traffic controller construction is complete. The purpose of the checklist is to ensure the traffic controller is operating correctly. Each item on the list shall be checked and the checklist signed when all checks are complete.

.4 Quality Control Checklist – This section contains a Quality Control Checklist form that is a peer review of the traffic controller design. Another Traffic Controller Designer will check the design for accuracy. This quality control process is carried out for each traffic controller design. The checker shall check each item on the list and sign the checklist when all checks have been completed. Note: No changes shall be signed completed without being reviewed.

204.4 CORRESPONDANCE FILE

.1 This file shall contain all correspondence relating to the project.

.2 Email correspondence may be saved in a MS Outlook file (.msg) or a saved PDF version.

.3 All email correspondence shall contain the TE number of the project, and subject of correspondence.

204.5 LOOP ASSIGNMENT PROCESS

.1 This section describes the process for assigning loops. The quantity and function of loop detectors varies at each intersection. Traffic Controller Unit inputs shall be associated with particular detectors. Loops are assigned to certain inputs and therefore, certain detectors. This assignment of loops is done for each intersection by means of a Loop Assignment Sheet. The Loop Assignment Sheet may or may not be applicable the project design or traffic Controller modification.

204.5.2 Naming Conventions

.1 Loop Assignment Sheets have file names according to the day that it was created or amended:

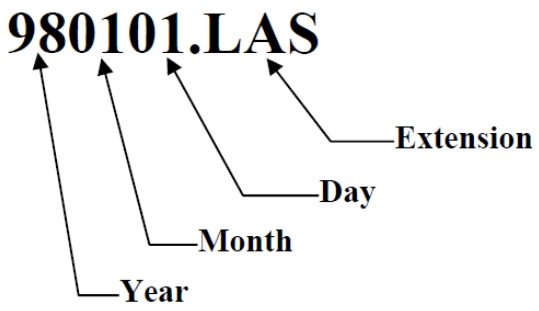


Figure 1. Loop Assignment Sheet File Naming Convention

204.5.3 General Information

.1 The designer assigns the detector, Traffic Controller Unit input, movement, phase called, phase extended, measure of efficiency (MOE) phase and delay/stretch time for each loop on the intersection electrical site plan. Dashes on the Loop Assignment Sheet represent Traffic Controller Unit defaults.

.2 Loops and loop functions are assigned based on standard NEMA phasing, the electrical site plan for the intersection, and detector arrangement in the Traffic Controller Unit.

.3 Template Loop Assignment Sheets for four (M) and eight (S and P6) phase cabinets are contained in Appendix 200C.

204.6 LOOP ASSIGNMENT SHEET

.1 The Loop Assignment Sheet (LAS) is a table consisting of columns and rows where the Traffic Controller Designer assigns vehicle detector loops to specific controller unit detector inputs. The standard Loop Assignment Sheet headings for S or M (TS1) and P6 (TS2) cabinets are shown in Figures 2 & 3 respectively. The following sections go through each heading and describe what is required to complete the LAS.

.2 The LAS title and text shall match the information and format of the traffic controller CAD drawing title block as shown in Section 204.8.1.

LOOP ASSIGNMENT SHEET
RTE A @ RTE B
CITY
Site Code 123 TE-99104-11B
Prepared YY/MM/DD for Signal Timing Sheet dated DD-MON-YY

LOOP NUMBER	DETECTOR UNIT	CU INPUT	MOVEMENT (Designation)	CALL (∅)	EXT. (∅)	MOE (∅)	COUNT (ON)	MODE (∅)	DELAY/ STRETCH (SEC)

Figure 2. S or M (TS1) Cabinet Loop Assignment Sheet Title and Headings

LOOP ASSIGNMENT SHEET
xxx @ xxx
City
TE
Prepared for timing sheet dated
(YY/MM/DD) (DD-MON-YY)

LOOP NUMBER	DETECTOR UNIT	CU INPUT	MOVEMENT (Designation)	PHASE (∅)	COUNT (ON)	DELAY (SEC)	STRETCH (SEC)

Figure 3. P6 (TS2) Cabinet Loop Assignment Sheet Title and Headings

204.6.3 Loop Number

.1 The Loop Number column is completed with the loop number labels from the intersection site plans. Loop numbers are entered as labeled on the TE series site

plans. Loops that are wired in series are entered with a forward slash between them (i.e., L1/L2).

204.6.4 Loop Assignment Example

.1 To illustrate the loop assignment process the intersection in Figure 4 will be used as an example.

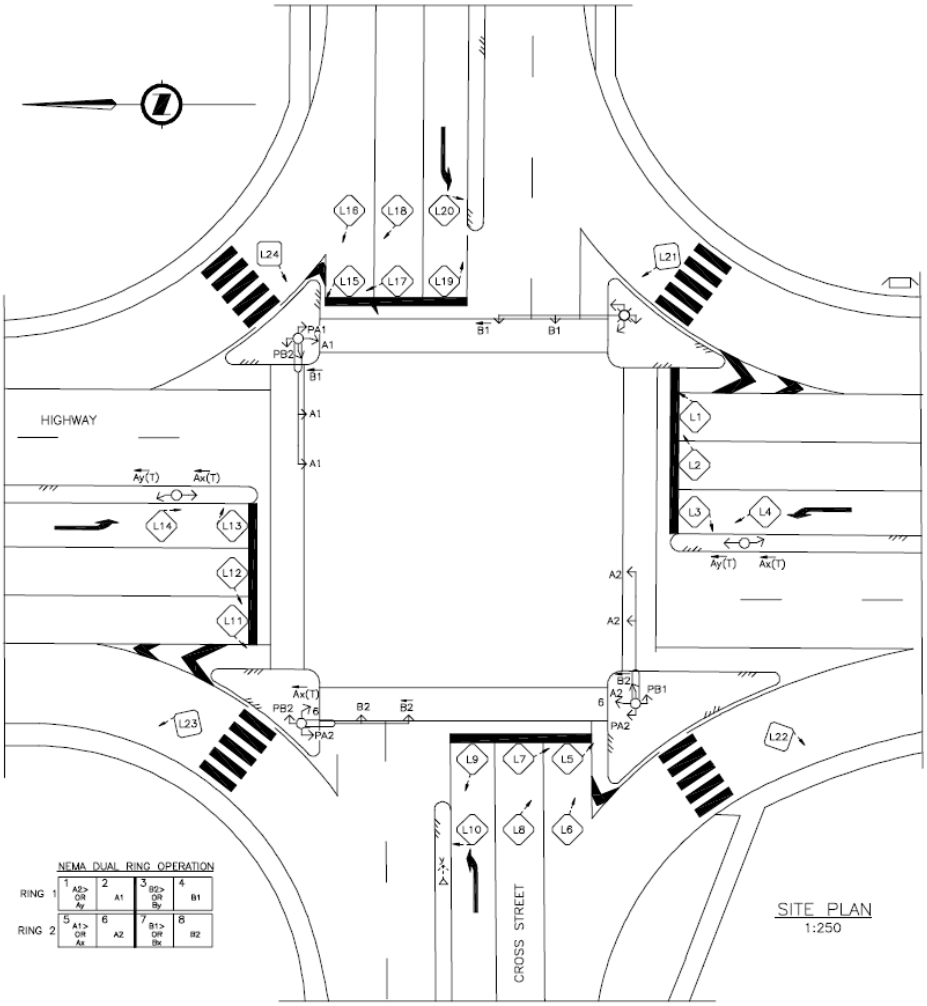


Figure 4 - Sample Intersection

.2 Completing the LAS requires associating each detector loop with the traffic movement label (A1, B1, etc. from site plan) and phase number it affects in the Traffic Controller Unit. The Signal Timing Sheet associates the traffic movements to controller phase numbers. In S or M cabinets (TS1), the first 8 controller unit detector inputs (1-8) are assigned to loops that call controller unit phases 1-8 respectively. For example, L2 would call movement A1 which is associated with phase 2 and controller unit detector input 2. In P6 cabinets (TS2), each loop label

is assigned to the same detector input, regardless of the traffic movement or phase it calls. For example, L1, L2 & L3 would be associated with controller unit inputs 1, 2 & 3 respectively.

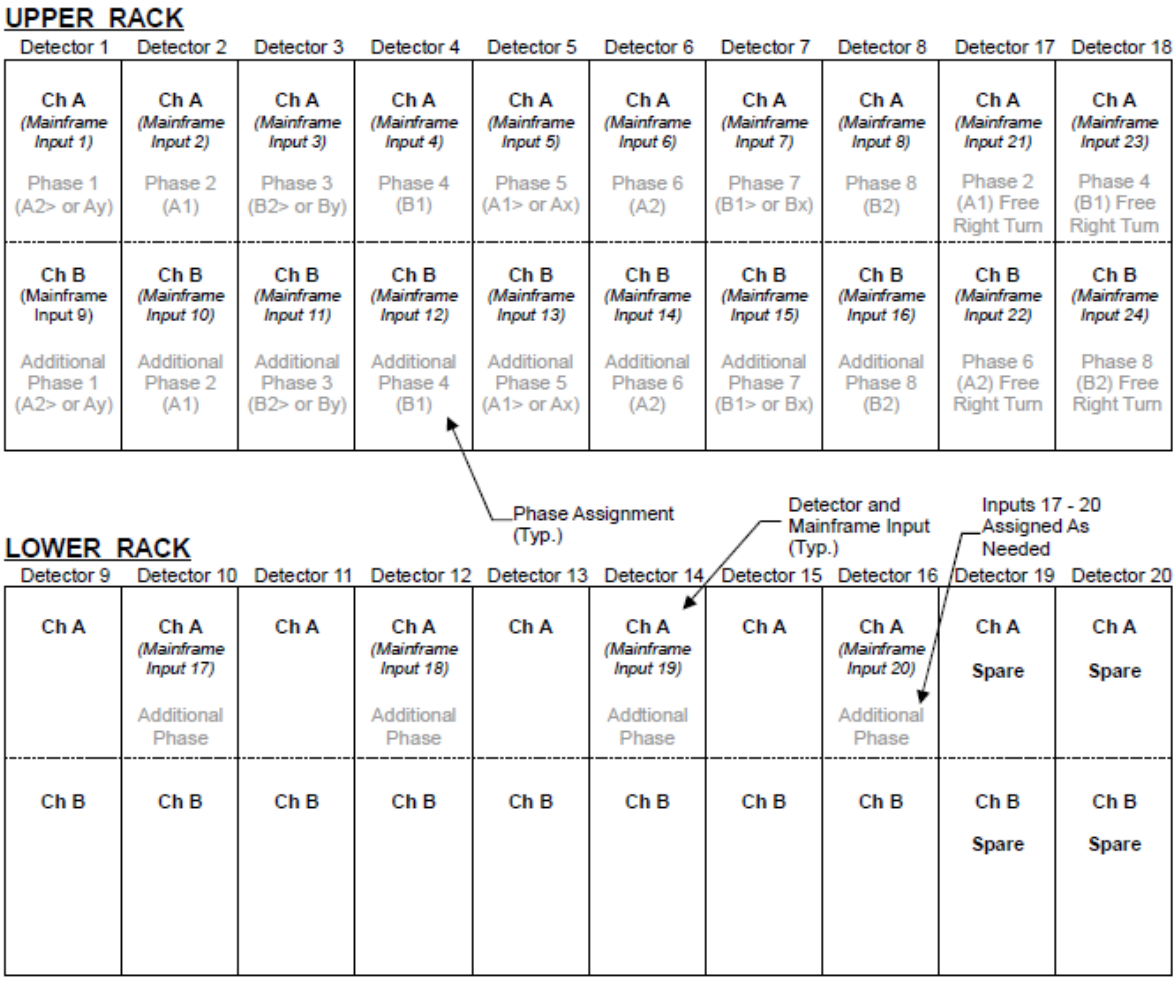


Figure 5. Eight phase TS1 ‘S’ cabinet detector racks

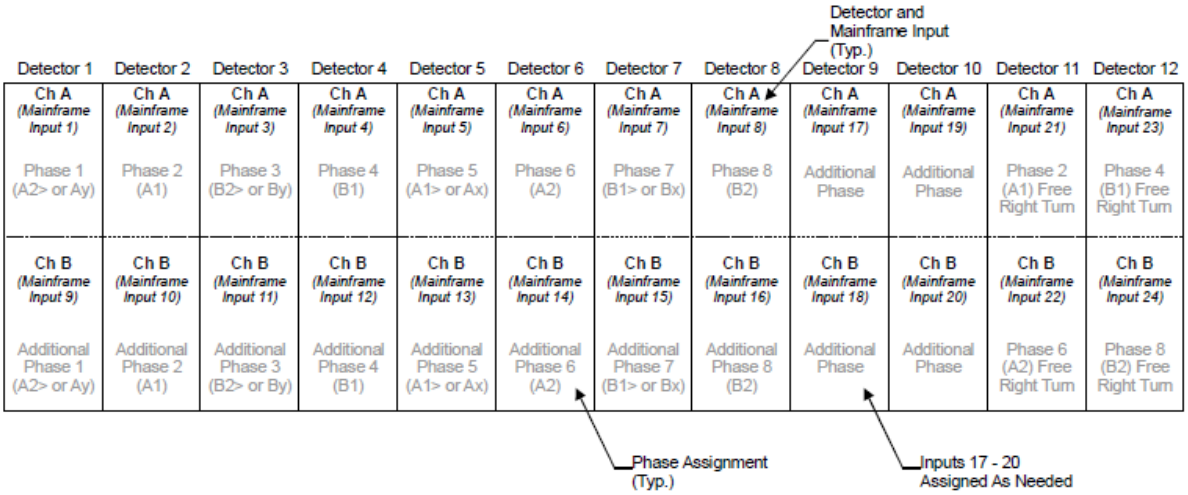


Figure 6. Four phase TS1 ‘M’ cabinet detector rack

LEFT RACK

DETECTOR 1	DETECTOR 2	DETECTOR 3	DETECTOR 4	DETECTOR 5	DETECTOR 6	DETECTOR 7	DETECTOR 8
CH. A CU INPUT 3 LOOP 3	CH. A CU INPUT 1 LOOP 1	CH. A CU INPUT 7 LOOP 7	CH. A CU INPUT 5 LOOP 5	CH. A CU INPUT 11 LOOP 11	CH. A CU INPUT 9 LOOP 9	CH. A CU INPUT 15 LOOP 15	CH. A CU INPUT 13 LOOP 13
CH. B CU INPUT 4 LOOP 4	CH. B CU INPUT 2 LOOP 2	CH. B CU INPUT 8 LOOP 8	CH. B CU INPUT 6 LOOP 6	CH. B CU INPUT 12 LOOP 12	CH. B CU INPUT 10 LOOP 10	CH. B CU INPUT 16 LOOP 16	CH. B CU INPUT 14 LOOP 14

RIGHT RACK

DETECTOR 9	DETECTOR 10	DETECTOR 11	DETECTOR 12	DETECTOR 13	DETECTOR 14	DETECTOR 15	DETECTOR 16
CH. A CU INPUT 19 LOOP 19	CH. A CU INPUT 17 LOOP 17	CH. A CU INPUT 23 LOOP 23	CH. A CU INPUT 21 LOOP 21	CH. A CU INPUT 27 LOOP 27	CH. A CU INPUT 25 LOOP 25	CH. A CU INPUT 31 LOOP 31	CH. A CU INPUT 29 LOOP 29
CH. B CU INPUT 20 LOOP 20	CH. B CU INPUT 18 LOOP 18	CH. B CU INPUT 24 LOOP 24	CH. B CU INPUT 22 LOOP 22	CH. B CU INPUT 28 LOOP 28	CH. B CU INPUT 26 LOOP 26	CH. B CU INPUT 32 LOOP 32	CH. B CU INPUT 30 LOOP 30

Figure 7. P6 Cabinet Detector Racks (DR) 1 & 2

.3 In TS1 cabinets where there is more than one loop (for a phase movement) the leftmost lane to rightmost lane would be assigned. For the intersection in Figure 4, L1 and L2 are the loops for phase 2 (A1). The leftmost is the first to be assigned therefore loop 2 would be assigned detector unit 2A (input 2) and, loop1 would be assigned to detector unit 2B (input 10).

.4 In TS1 cabinets where there are multiple loops in a lane, the front loop is assigned to a controller input before the back loop. For example, in Figure 4 loop 3 (front) is assigned to detector unit 5A (input5) and loop 4 (rear) is assigned to detector unit 5B (input13).

.5 In TS1 cabinets, if a third loop exists on phase 2, 4, 6 or 8 the loop is assigned to the detector unit in the lower card rack directly below the detector unit for that phase in the upper rack. For example, a third loop on phase 2 would be assigned to detector unit 10A and would be Traffic Controller Unit input number 17 (refer to detector unit layout - Figure 4).

.6 In TS1 cabinets, multi-lane left turn bays lanes, additional through lanes and extension ("set back") loops are examples where even more detectors may be needed for a traffic phase. If this situation arises contact Electrical and ITS Engineering for direction on how to handle the extra loops.

.7 In TS1 cabinets, loops in left turn lanes that are not protected are still connected to the detector assigned for a protected left turn. This allows a future left arrow to be added by simply re-programming the Traffic Controller Unit and not rewiring the detector input.

.8 In TS1 cabinets, Controller Unit inputs 21, 22, 23 and 24 are reserved for counting loops in free right turn lanes. Assignments for free right turn loops are shown in Table 1.

Loop or Loops	Controller unit Input	Eight phase Detector	Four phase Detector
Phase 2 A1 Free Right Turn	21	17A	11A
Phase 6 A2 Free Right Turn	22	17B	11B
Phase 4 B1 Free Right Turn	23	18A	12A
Phase 8 B2 Free Right Turn	24	18B	12B

Table 1 - TS1 Typical Free Right Turn Loop Assignments

204.6.5 Detector Unit (DU)

.1 The detector unit heading of the Loop Assignment Sheet is the detector unit card number followed by an A or B to indicate which detection channel on the card is being used. TS1 eight phase cabinets have slots for 20 detector unit cards and four phase cabinets have slots for 12 detector unit cards. P6 cabinets have slots for 16 detector unit cards. The detector card layout for TS1 eight and four phase cabinets and TS2 P6 cabinets are shown in Figures 5, 6 & 7.

204.6.6 Controller Unit Input (CU)

.1 The Traffic Controller Unit input heading states the input that the detector unit card output is connected to. The maximum number of Traffic Controller Unit inputs available for detector loops in the LMD-8000 is 24. The Naztec 980 and Econolite Cobalt have 32 inputs available. In TS1 cabinets, the detector unit cards are factory pre-wired to the units input harness.

.2 The eight phase TS1 cabinet detector unit card numbers and their corresponding Traffic Controller Unit inputs for a standard NEMA dual ring are shown in Figure 5.

.3 The four phase TS1 cabinet detector unit card numbers and their corresponding Traffic Controller Unit inputs for a standard NEMA dual ring are shown in Figure 6.

.4 The P6 cabinet's default detector unit card number, controller unit inputs and connected detector loop layout is shown in Figure 7.

204.6.7 Movement

.1 The standard Ministry movement designation is entered in the function column (i.e. A1, A2, B1, B1➢, etc.). The symbol ➢ from Wingdings font is used to indicate a Protected Permissive Left Turn Movement.

204.6.8 Phase

.1 The traffic phase as per the Signal Timing Sheet, that is called/extended by each loop is entered in the phase column of the Loop Assignment Sheet.

204.6.9 Measure of Efficiency (MOE)

.1 Measure of efficiency is assigned for every counting loop. The phase number the loop is assigned to is entered in the MOE column. For example, a loop for phase 2 that is a counting loop would have 2 entered in the MOE column. Where phase 2 is the movement to be measured.

204.6.10 Count

.1 The count function for the individual loops is assigned to ‘ON’ or ‘OFF’ for loops that count. If the loop is required to count, the word “ON” is placed in the count column. If the loop is not required to count a dash is placed in the column.

.2 The count function is assigned to ‘ON’ for highway lanes with single loops for through traffic. In dedicated left turn lanes there are 2 loops, count is assigned to ‘OFF’ for the front loop and ‘ON’ for the back loop

.3 The count function is assigned to ‘OFF’ in the leftmost cross street lane for the front loop and “ON” for the rear loop. For cross street lanes other than the leftmost lane, count is assigned to “ON” for the front loop and “OFF” for the rear loop.

204.6.11 Mode

.1 Mode is set to the phase of opposing through traffic for loops that call Protected Permissive left turns adjacent to recall phases.

204.6.12 Delay

.1 If the loop has a delay time, enter the amount of time from the Signal Timing Sheet in this heading.

204.6.13 Stretch

.1 If the loop has a stretch time, enter the amount of time from the Signal Timing Sheet in this heading.

204.7 DRAWING SELECTION

204.7.1 Selecting a Template Drawing

.1 A template drawing is selected based on the Electrical Drawings and the Signal Timing Sheet. The Traffic Controller Designer must look at the various key elements and choose a template drawing that is most similar to the project and therefore will require the least modification. The key elements to check for are Cabinet Type (TS1/TS2), Controller Type, Phasing, Advance Warning, and Pre-emption.

204.7.2 Naming Conventions

.1 See 203.4.2 to 203.3.4 for drawing naming conventions.

204.8 DRAWING MODIFICATION

204.8.1 Title Block

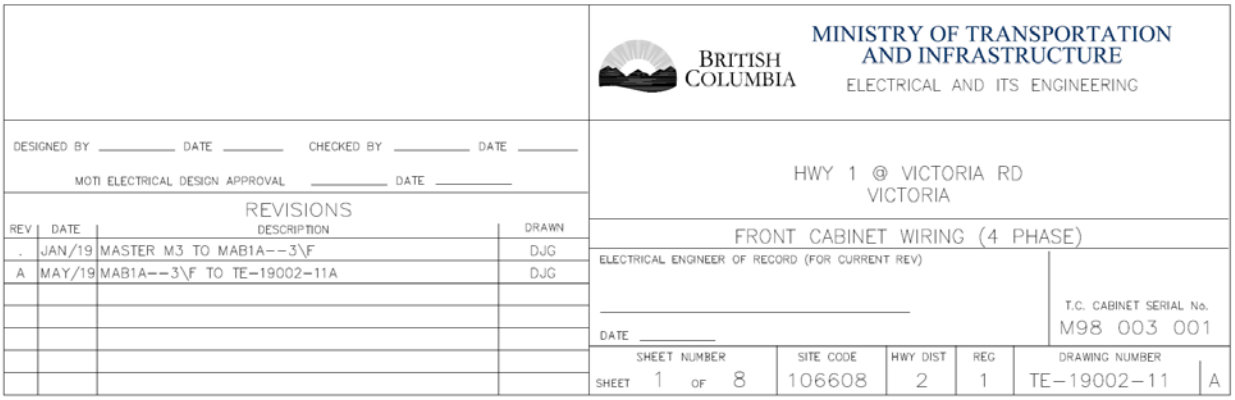


Figure 8. Sample Controller CAD Title Block

.1 The location shall be entered as follows:

.1 All capital letters

.2 No punctuation

.3 Standard location abbreviations are as shown in Table 2.

Word	Abbreviation
Hwy	HWY
At	@
Road	RD
Street	ST
Avenue	AVE
Boulevard	BLVD

Table 2 - Standard Title Block Abbreviations

.4 A "/" is used between routes or cross streets for locations with multiple routes or cross streets.

.5 The title block location should match the Signal Timing Sheet as closely as possible.

.2 A section is provided for the signature and date of the engineer of record for this revision of the traffic controller design (not in use at this time).

.3 A section is provided to be initialled and dated by the Traffic Controller Designer, Checker, and Designated Ministry Approver.

.4 A brief description of the scope of changes to the drawing is recorded in the 'Revisions' column.

.5 Complete all other sections of the title block such as the traffic cabinet serial number, Sheet Numbers, Site Code, Highway District, Region and Drawing Number if possible.

.6 Drawing file number shall match project TE number. The drawing Title Block shall contain the revision letter. All project documentation shall contain TE number and revision letter for project clarification.

204.9 TS1 EIGHT PHASE DRAWING SHEETS

204.9.1 Front Drawing

.1 Figure 9 shows a key plan of the "FRONT" drawing. The drawing is shown in sections to outline the procedure for modifying the drawing. Drawing modifications will be made based on the intersection requirements.

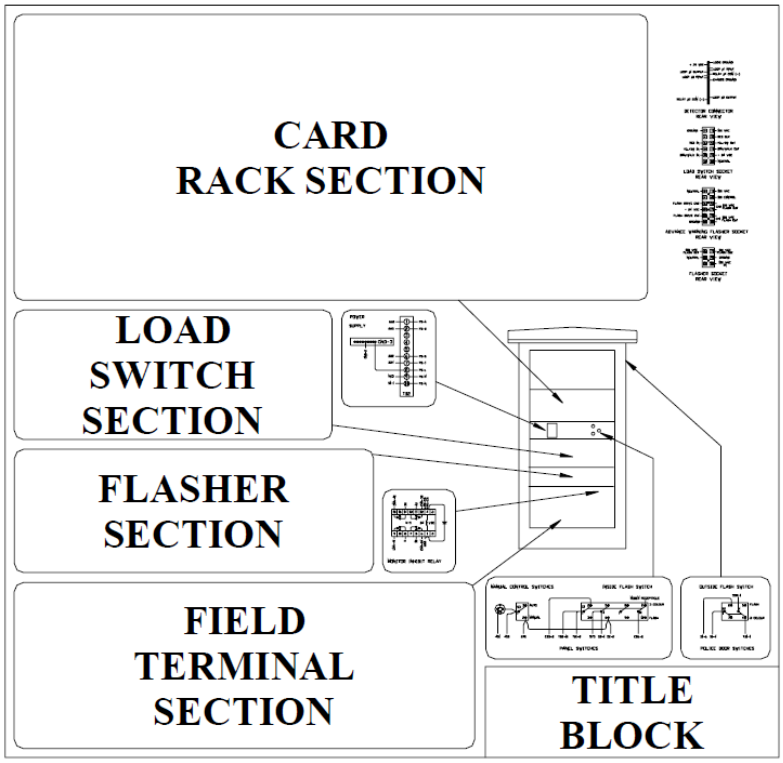


Figure 9. FRONT Drawing Key Plan

.2 Complete the **TITLE BLOCK** as described in Section 205.8.1. The drawing title should match the filename exactly.

.3 Complete the **FIELD TERMINALS** section of the drawing. Figure 10 shows a sample area of the field wiring terminal block.

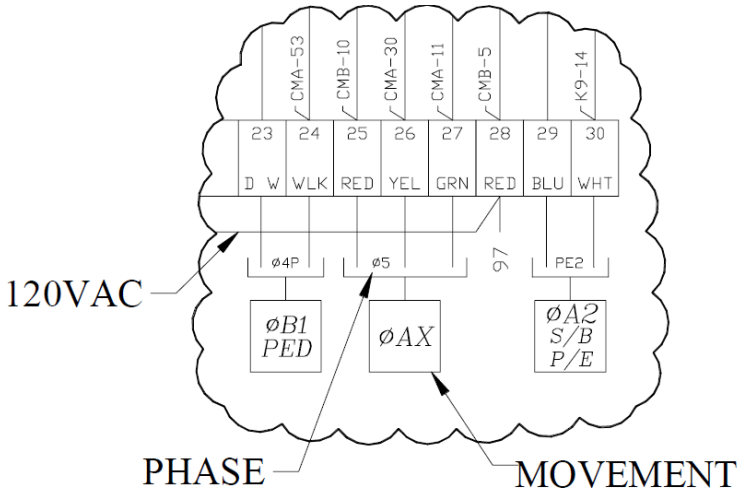


Figure 10. Field Connections

.1 The drawing changes must be consistent with standards set out in the drawing template. E.g. The text, wiring drawing procedures must be in the same context as the template. Layer colour and text must comply with current drawing standards.

.2 Elements of design in Field Connections section of drawing are:

.1 Field output wiring

.2 Unused reds to be satisfied wiring

.3 Intersection flash wiring

.4 Conflict monitor wiring

.5 Pre-emption wiring

.6 Any other field output wiring

.3 Be aware changes to wiring in drawing section must be consistent through drawing series. Example: Changes as in Figure 11. Intersection Flash Connections will reflect drawing changes in Flasher Section of drawing.

.4 The changes needed to drawing shall be concurrent with the Traffic Controller Construction Document.

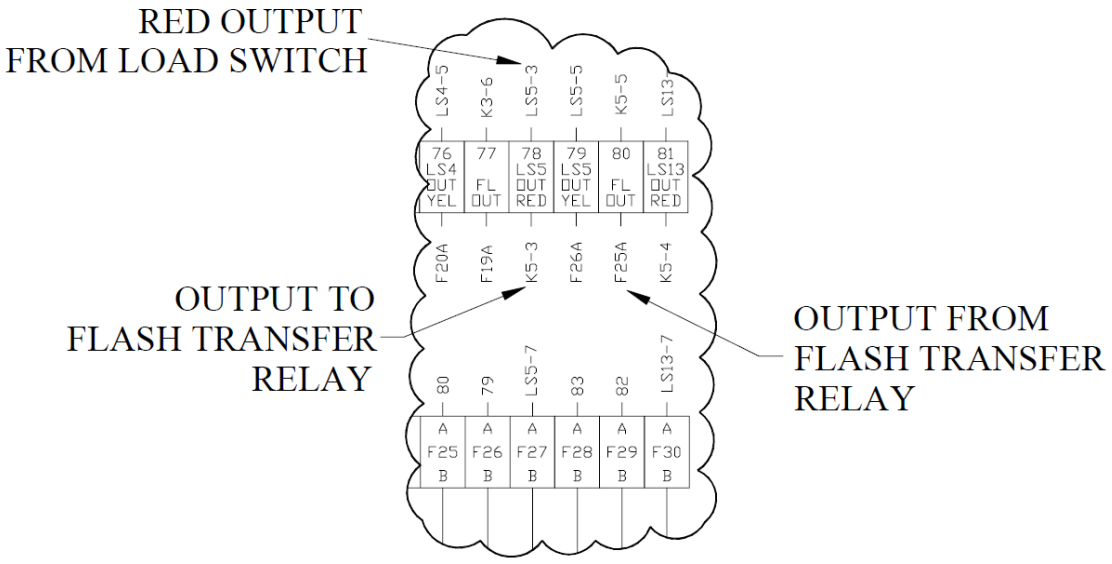


Figure 11. Intersection Flash Connections

.4 **FLASHER** section of the drawing as follows:

.1 Ensure the required Advance Warning Flashers are as per Traffic Controller Construction Document. An “X” is placed through the Advance Warning Flasher socket if it is not used as is shown in Figure 12.

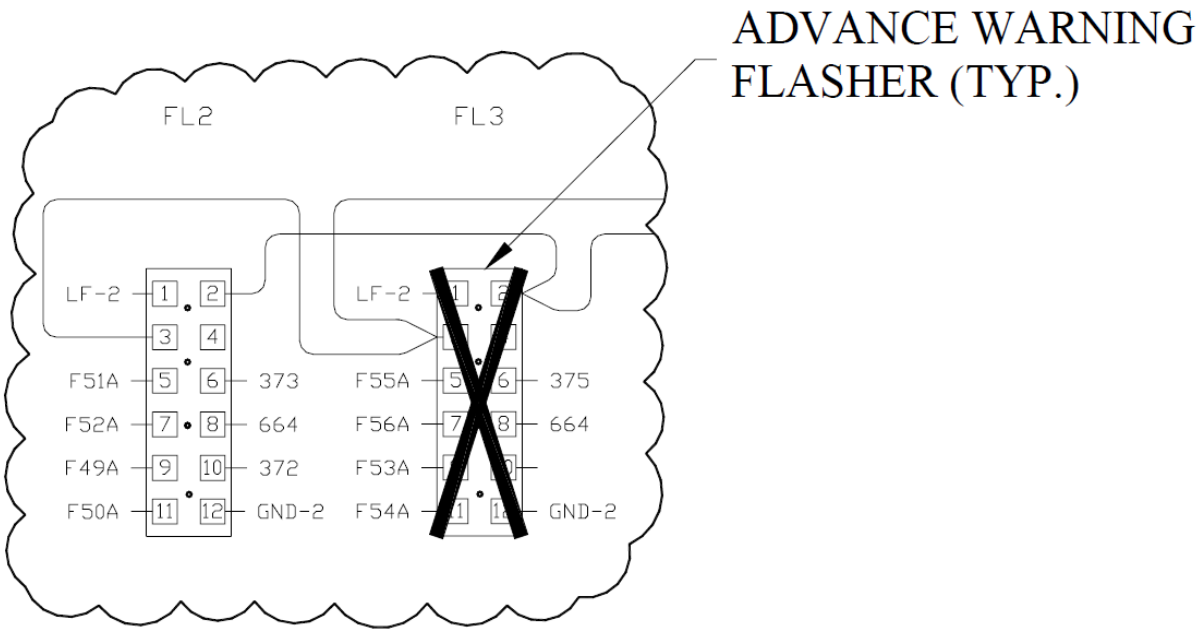


Figure 12. Advance Warning Flashers

.2 Ensure that all required Flash Transfer Relays have been connected, as per project Traffic Controller Construction Document. The Flash Transfer Relay section sample of the drawing is shown in Figure 13.

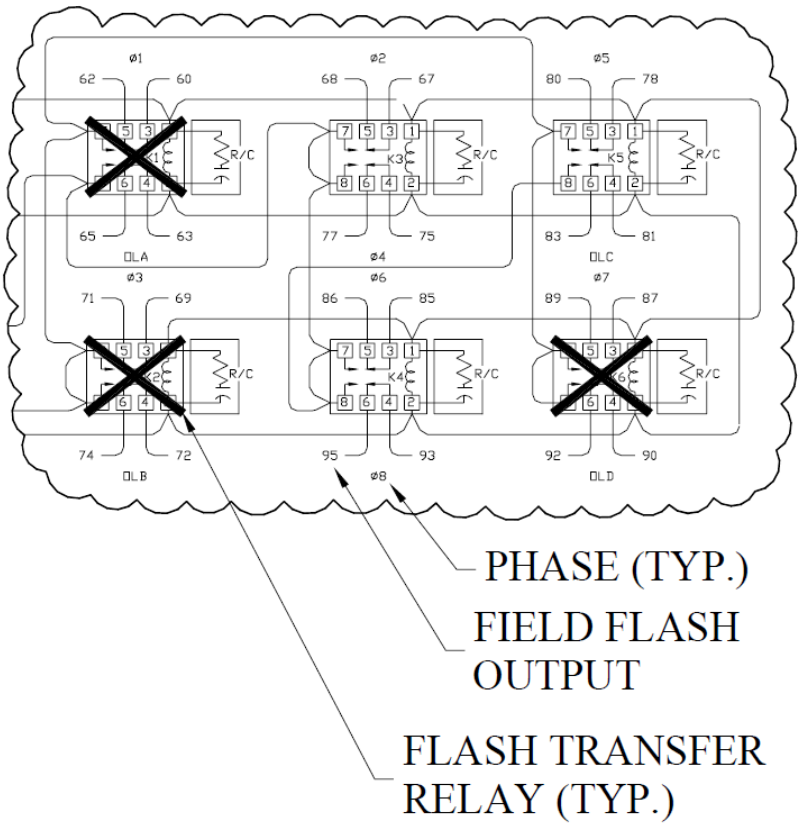


Figure 13. Flash Transfer Relays

.3 Place an “X” through the Flash Transfer Relay corresponding to the relay that is no longer required.

.4 The changes needed to drawing shall be concurrent with the Traffic Controller Construction Document.

.5 **LOAD SWITCH** section of the drawing as follows:

.1 Ensure all Load Switch sockets are marked corresponding to the Traffic Controller Construction Document. Showing an X as unused and clear as used socket.

.6 Complete the **CARD RACK** section of the front drawing. The card rack section contains the Detector Cards, Advance Warning Cards, Pre-Emption Cards, and Ped/Veh Cards.

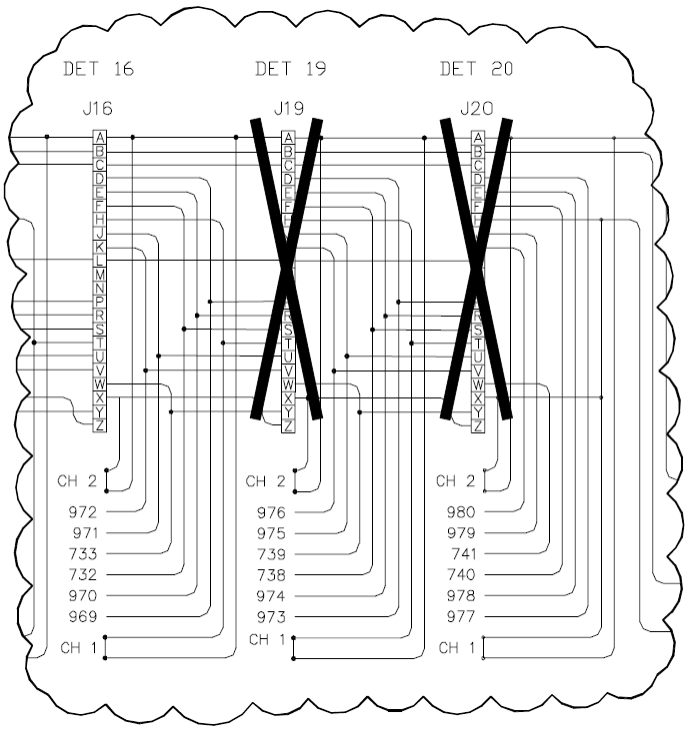


Figure 14. Detector Card Rack Wiring

.1 Ensure cards correspond to the Traffic Controller Construction Document shall have an X on connectors showing card slots not in use as in Figure 14, Figure 15, and Figure 16 showing used and unused cards as they should appear on the drawing.

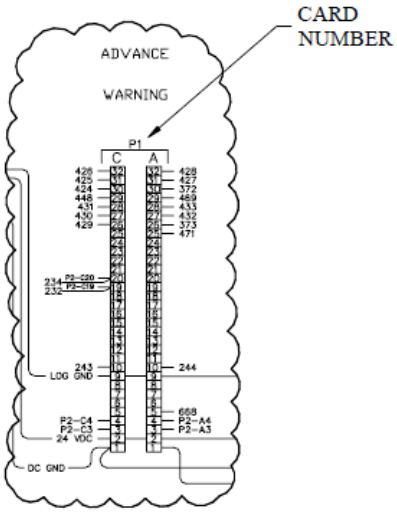


Figure 15. Advance Warning Card

.2 The Advance Warning Cards are installed based on the following channel assignments:

Card Number	Channel	Movement
P1	1	A1
	2	A2
P5	1	B1
	2	B2

Table 3. Advance Warning Channel Assignments

.7 Advance Warning and Pre-empt cards that are not used must be disabled. Disabling of the Pre-Empt Cards is done with jumpers on the backboard terminals. Procedures for disabling cards are described in Table 4. Card Disable Jumpers.

.8 K9 socket section changes shall be documented in the Traffic Controller Construction Document. An X in on the socket shall indicate a relay is not in use.

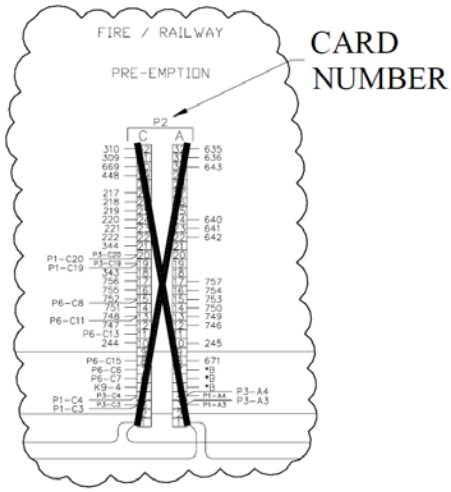


Figure 16. Pre-emption Card Rack Wiring

204.9.2 Rear Drawing

.1 Figure 17 shows a key plan of the “REAR” drawing. The section outlined will assist in the procedure for modifying the drawing.

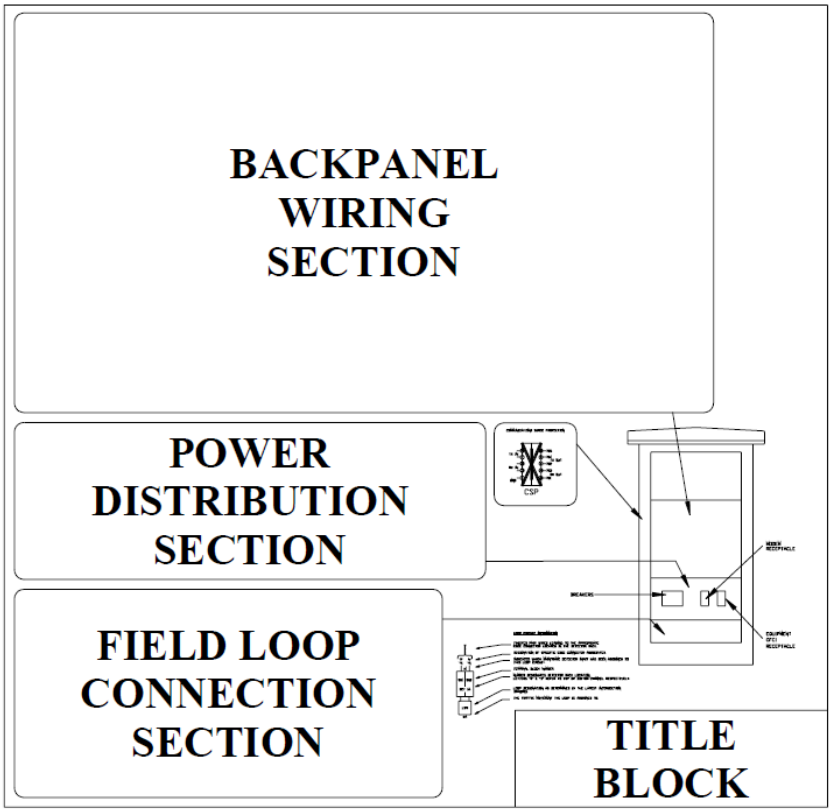


Figure 17. REAR Drawing Key Plan

.2 Complete the **TITLE BLOCK** as described in Section 205.8.1 The drawing title should match the filename exactly.

.3 Complete the **FIELD LOOP CONNECTION SECTION** of the rear drawing as follows:

.1 Ensure Field Loop Connections correspond to the assignments on the project Loop Assignment Sheet. Figure 18 shows the loop circuit information required to add and remove wiring for loops.

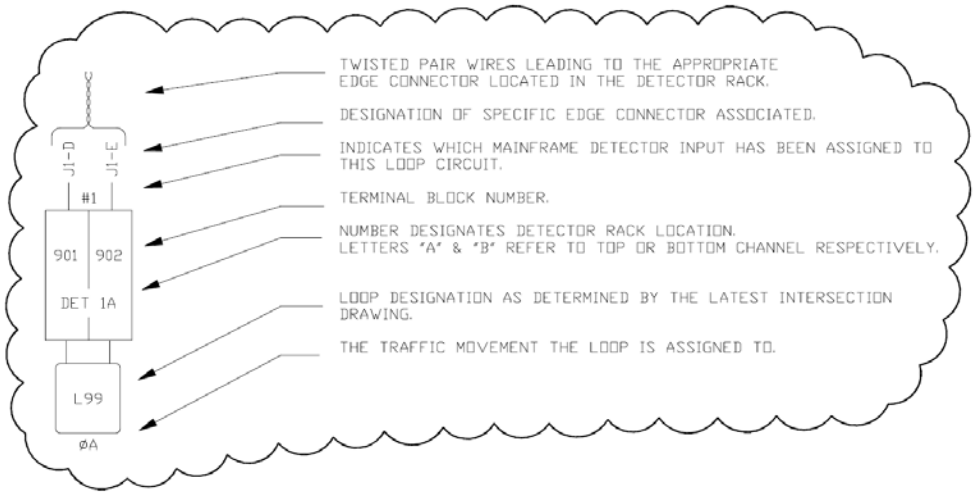


Figure 18. Field Loop Connections

.1 Only field wiring used shall be shown on drawing.

.2 Ensure connections correspond with the Traffic Controller Construction Document.

.4 Typically the **POWER DISTRIBUTION SECTION** of the drawing does not require any modification.

.5 Complete the **BACKPANEL WIRING SECTION** of the rear drawing as follows:

.1 Items of design in back panel wiring are as follows:

.1 Pedestrian Inputs as in Figure 19. Pedestrian Connections

.2 TEC card monitor jumper as in Figure 20. Card Enable/Disable Jumpers

.3 Full Operation Point (FOP) wiring

.4 Advance warning wiring

.5 Pre-emption wiring

.6 All Red Timer (ART) wiring

.7 Harness and other jumper changes as in Figure 23. TEC3 Cable Connections

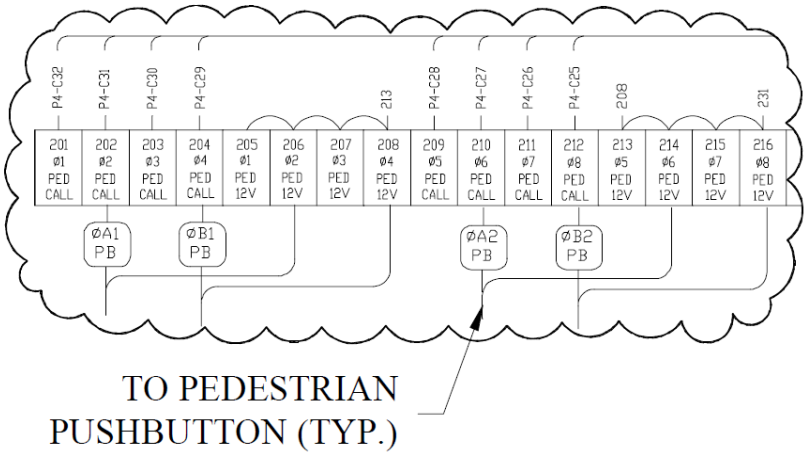


Figure 19. Pedestrian Connections

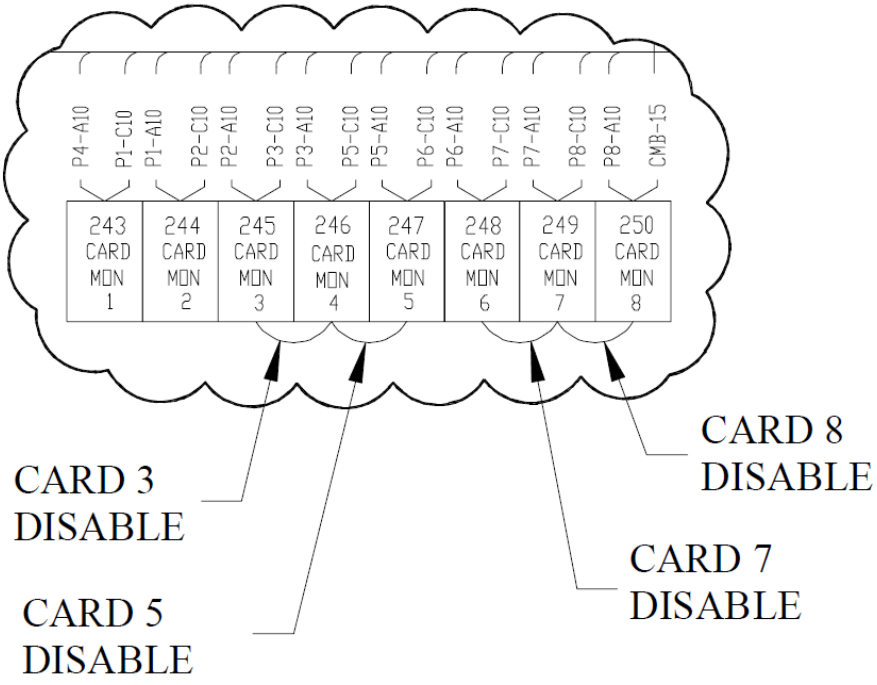


Figure 20. Card Enable/Disable Jumpers

Card Number	Disable by installing jumpers between terminals
1	243 to 244
2	244 to 245
3	245 to 246
5	246 to 247
6	247 to 248
7	248 to 249
8	249 to 250

Table 4. Card Disable Jumpers

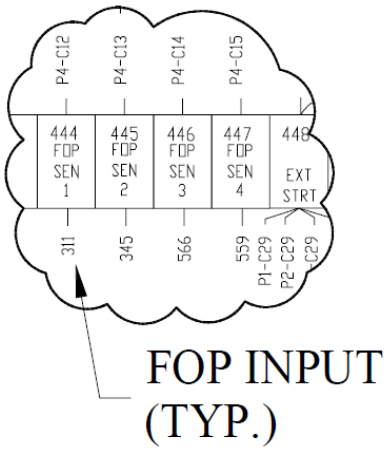


Figure 21. FOP Inputs

.2 If the FOP inputs need modification it shall be concurrent with the Traffic Controller Construction Document.

.3 If the signal is required to flash all red the All Red Timer (ART) must be enabled, otherwise it is disabled. The ART is enabled by connecting terminal block 575 to logic ground as shown in Figure 22. If terminal 575 is not connected to logic ground ART is disabled.

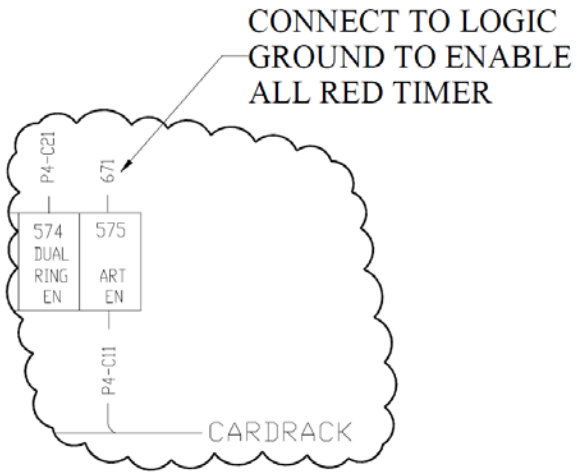


Figure 22. ART Terminal

.6 If additional detector inputs are required (i.e.more than two inputs for one phase), the TEC-3 cable inputs must be modified. The TEC-3 cable inputs that are utilised are inputs TEC3-1 to TEC3-4. These inputs are connected to the appropriate input as shown in Figure 24. TEC3 Cable Connections.

.7 CSP (Communication Surge Protection wiring)

.1 Ensure wiring and drawing indications are corresponding with the Traffic Controller Construction Document.

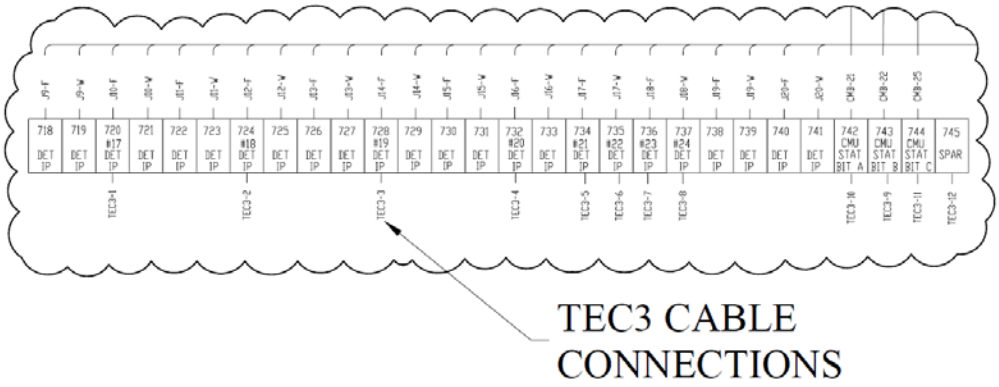


Figure 23. TEC3 Cable Connections

204.9.3 Harness Drawing

.1 Figure 24 shows a key plan of the “HARNESS” drawing. The sections outline the procedure for modifying the drawing.

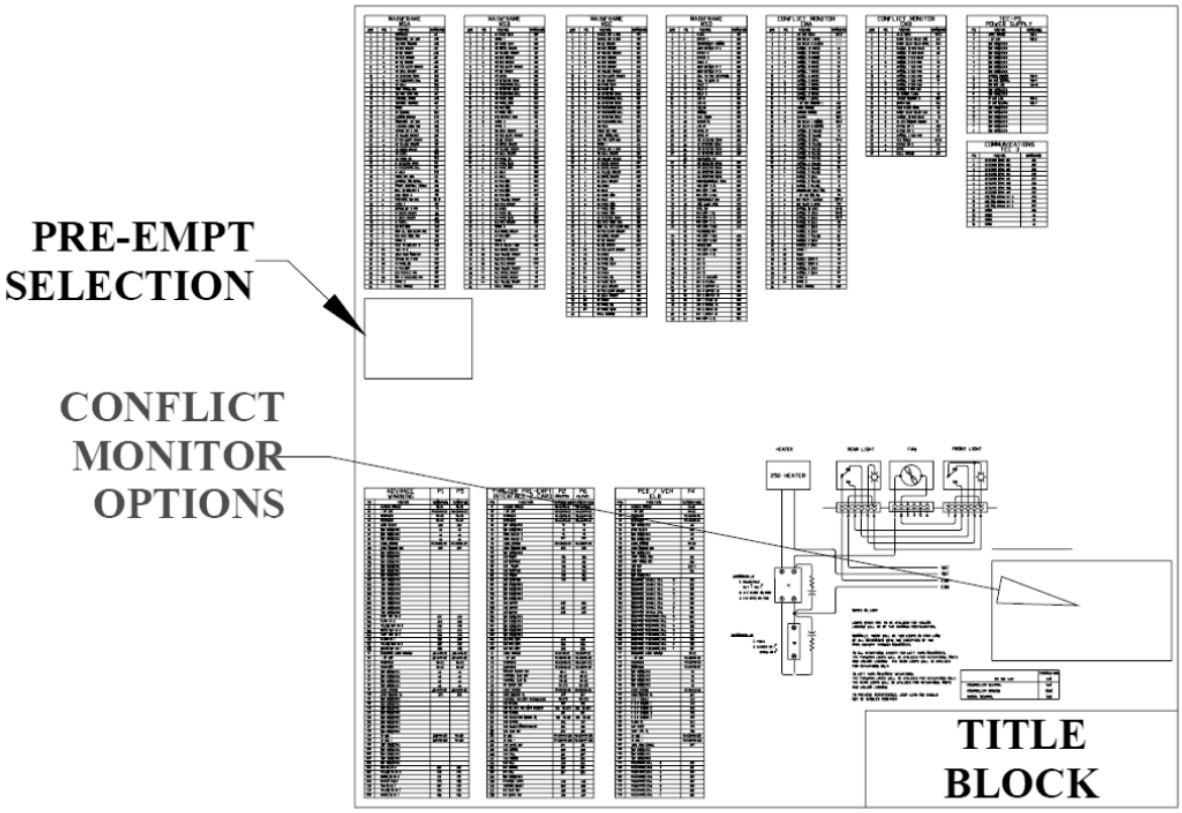


Figure 24. HARNESS Drawing Key Plan

.2 Complete the **TITLE BLOCK** as described in Section 204.8.1. The drawing title should match the filename exactly.

.3 Complete the **CONFLICT MONITOR UNIT OPTIONS** section of the drawing as follows:

.1 See Figure 25 as to lay out of table.

.2 The changes needed to drawing shall be concurrent with the Traffic Controller Construction Document.

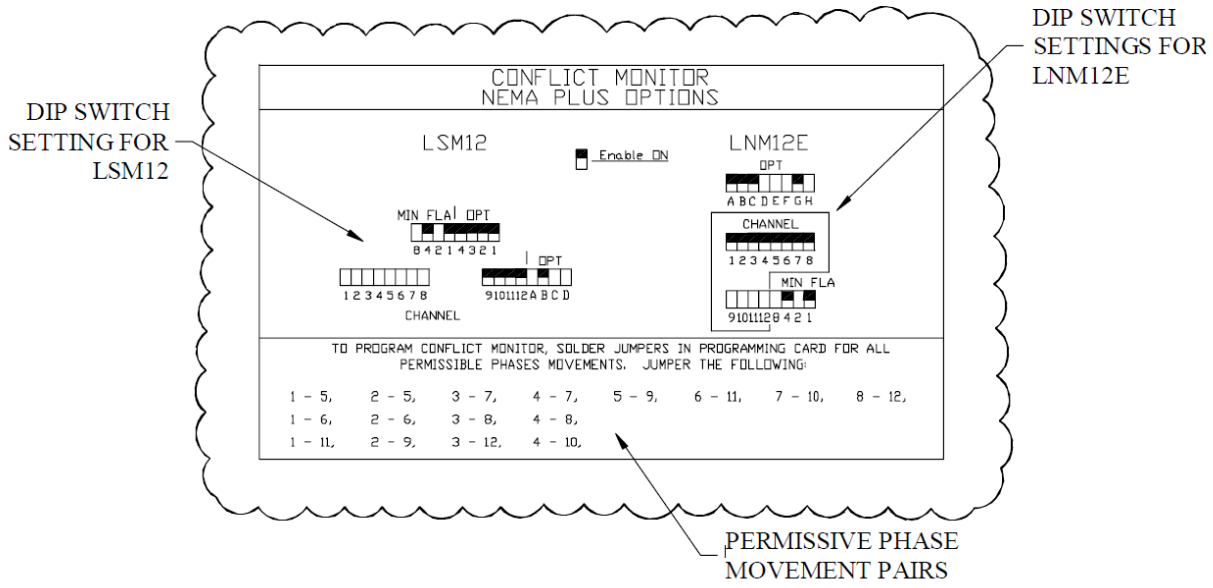


Figure 25. Conflict Monitor Unit NEMA Plus Option Settings

.4 Note in addition to traffic movements, pre-empts must also be programmed into the Conflict Monitor Unit. Pre-empts are programmed in the same way as the regular phases, pairs of phases and pre-empt phases that are permissible are entered into the bottom section of the Conflict Monitor Unit Options Table.

.4 Complete the **PRE-EMPT SELECTION** section of the drawing as follows:

.1 The changes needed to drawing shall be concurrent with the Traffic Controller Construction Document.

.2 Figure 26 shows the dip switches for Pre-Empt selection.

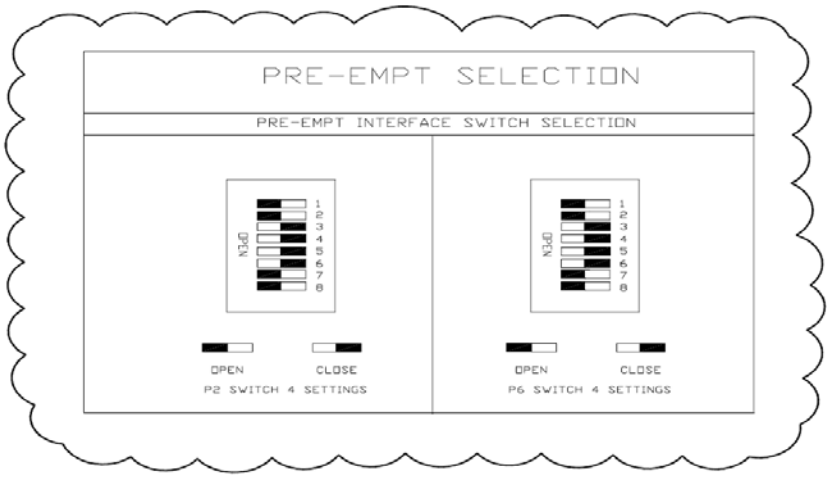


Figure 26. Pre-empt Selection Dip Switches

.3 The pre-emption dip switches are modified according to the following Table 5.

.5 Complete Harness table changes concurrent with Traffic Controller Construction Document.

Bit	On/Closed	Off/Open	Switch Function
1	CH1 Fire Mode 1	CH1 Fire Mode 2	Fire Mode Select
2	CH2 Fire Mode 1	CH2 Fire Mode 2	
3	CH3 Fire Mode 1	CH3 Fire Mode 2	
4	CH1 Normally Closed	CH1 Normally Open	Contact Mode Select
5	CH2 Normally Closed	CH2 Normally Open	
6	CH3 Normally Closed	CH3 Normally Open	
7	On/Closed	60 Seconds	Fire Mode 2 Timer Select
8	On/Closed		
7	Off/Open	90 Seconds	
8	On/Closed		
7	On/Closed	120 Seconds	
8	Off/Open		
7	Off/Open	180 Seconds	
8	Off/Open		

Note: Fire Mode 1 ⇒ Pulse
Fire Mode 2 ⇒ Hold

Table 5. Pre-emption Dip Switch Setting

204.10 TS1 FOUR PHASE DRAWING SHEETS

204.10.1 Front Drawing

.1 Figure 27 shows a key plan of the “FRONT” drawing. The sections outline the procedure for modifying the drawing.

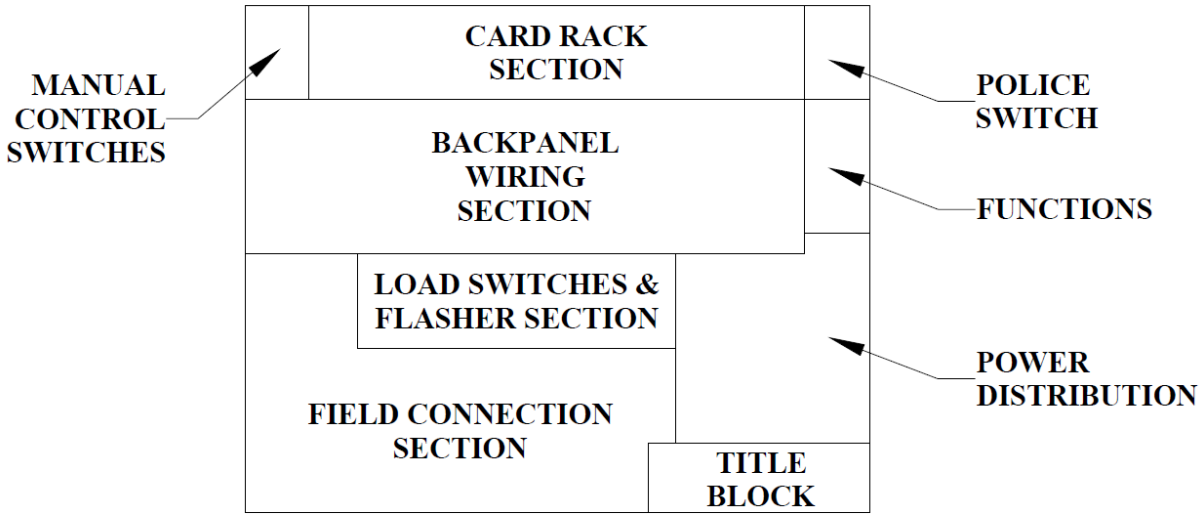


Figure 27. FRONT Drawing Key Plan

.2 Complete the **TITLE BLOCK** as described in Section 205.8.1.

.3 Complete the **FIELD CONNECTION SECTION** of the drawing as described in 205.9.1.3

.4 Complete the **LOAD SWITCHES & FLASHER SECTION** of the drawing as described in 205.9.1.4

.5 Complete the **BACKPANEL WIRING SECTION** of the drawing as described in 205.9.2.5

.6 Complete the **CARD RACK SECTION** of the drawing as described in 205.9.1.6

204.10.2 Harness Drawing

.1 Figure 28 shows a key plan of the “HARNESS” drawing. The sections outline the procedure for modifying the drawing.

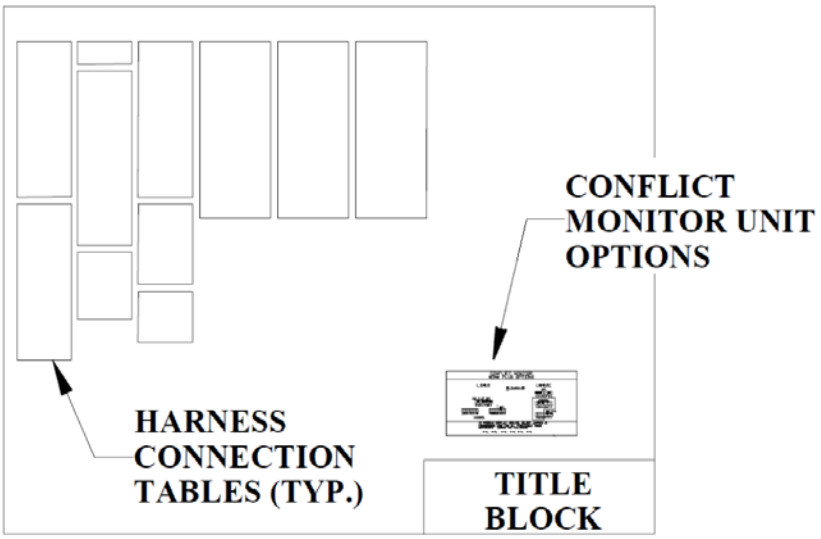


Figure 28. HARNESS Drawing Key Plan

.2 Complete the **TITLE BLOCK** as described in Section 205.8.1.

.3 Complete the **CONFLICT MONITOR UNIT OPTIONS** section of the drawing as described in 205.9.3.3

.4 Complete changes to the **HARNESS CONNECTION TABLES** as described in 205.9.3.5

204.11 TS2 DRAWING SHEETS

204.11.1 Primary Drawing

.1 Figure 29 shows a key plan of the "PRIMARY" drawing. The drawing is shown in sections to outline the procedure for modifying the drawing. The drawing modifications along with the Traffic Controller Construction Document and complete working file information will assist completing TS2 Traffic Controller Cabinet Drawings.

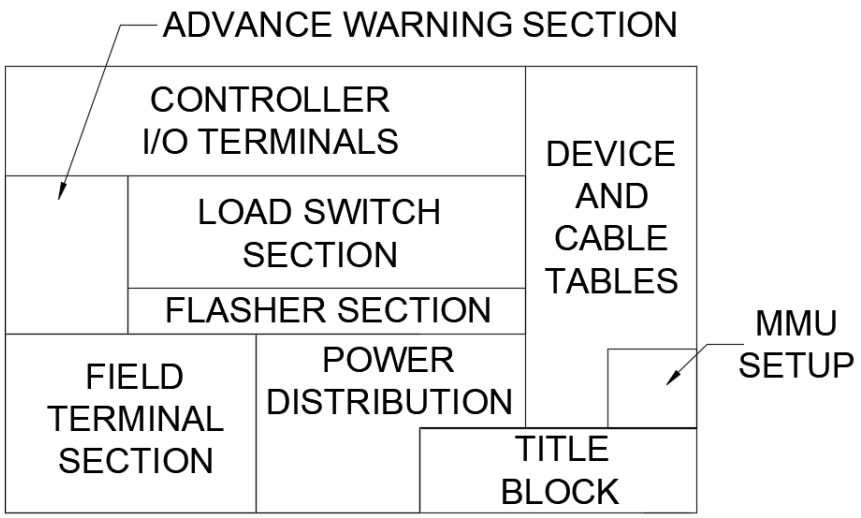


Figure 29. PRIMARY Drawing Key Plan

.2 Complete the **TITLE BLOCK** as described in Section 205.8.1. The drawing title should match the filename exactly.

.3 Complete the **FIELD TERMINAL** section of the drawing. Figure 30 shows a sample area of the field wiring terminal block.

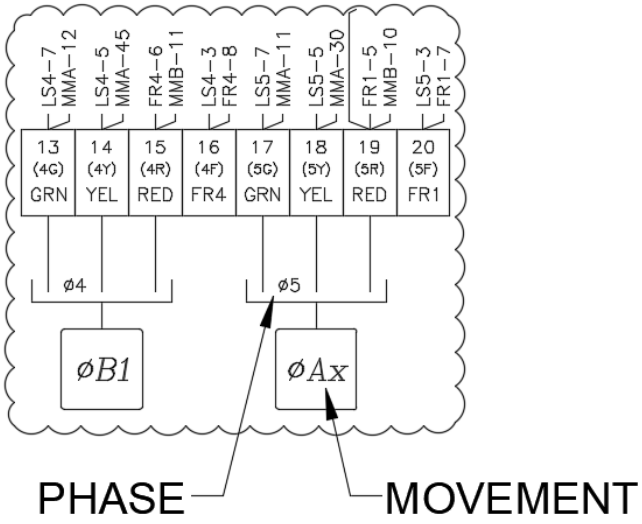


Figure 30. Field Connections

.1 The drawing changes must be consistent with standards set out in the drawing template. E.g. The text, wiring drawing procedures must be in the same context as the template. Layer colour and text must comply with drawing standards. Contact Electrical and ITS Engineering for clarification if necessary.

.2 Elements of design in Field Terminals section of drawing are:

.1 Field output wiring
.2 Intersection flash wiring
.3 Conflict monitor wiring
.4 Pedestrian pushbutton wiring

.3 Be aware changes to wiring in drawing section must be consistent through drawing series. For example, changes as in Figure 31. Intersection Flash Connections will reflect drawing changes in Flasher Section of drawing.

.4 The changes needed to drawing shall be concurrent with the Traffic Controller Construction Document.

.5 For standard set-up procedure wiring documentation contact the Ministry Traffic Control Systems Technologist.

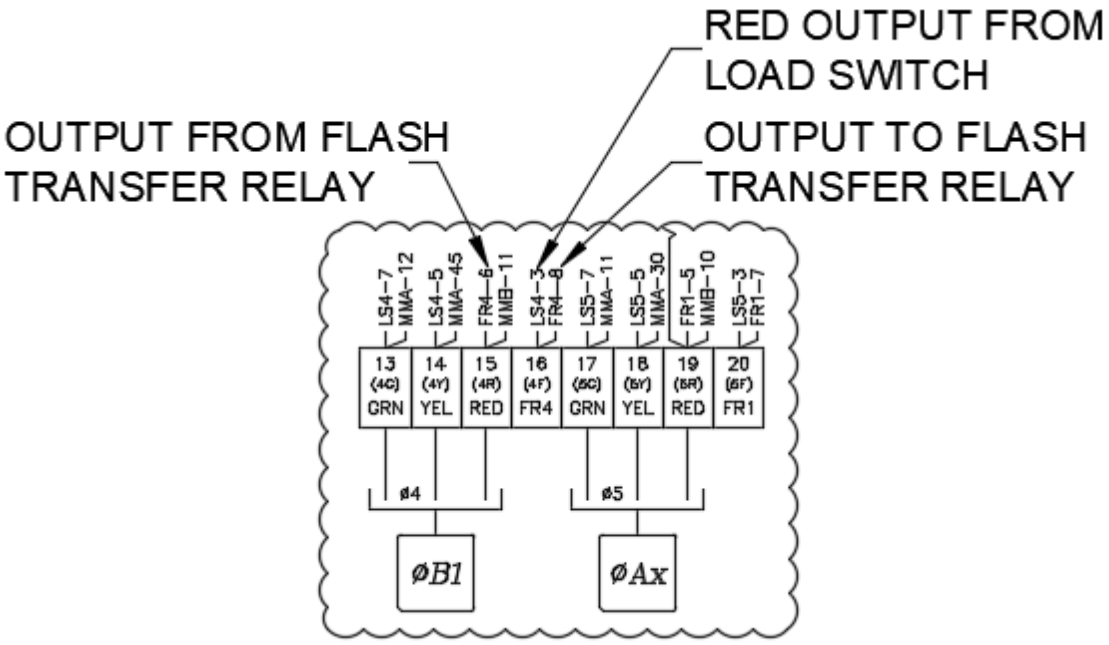


Figure 31. Intersection Flash Wiring

.6 Pedestrian pushbutton conductors from the field are terminated in the controller just above the Field Output terminals. One conductor from each pushbutton is terminated to the input terminal as shown in Figure 32. The other pushbutton conductor terminates to the cabinet neutral.

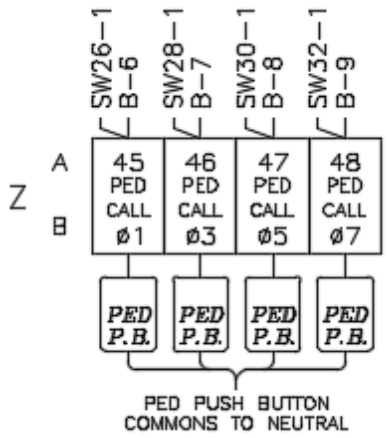


Figure 32. Pedestrian Pushbutton Wiring

.4 Complete the **FLASHER** section of the drawing as follows:

.1 Ensure the required Advance Warning Flashers are as per Traffic Controller Construction Document. An "X" is placed through the Advance Warning Flasher socket if it is not used as is shown in Figure 33. Each flasher outputs to two output terminals: FL2 to AW1, FL3 to AW2, and so on.

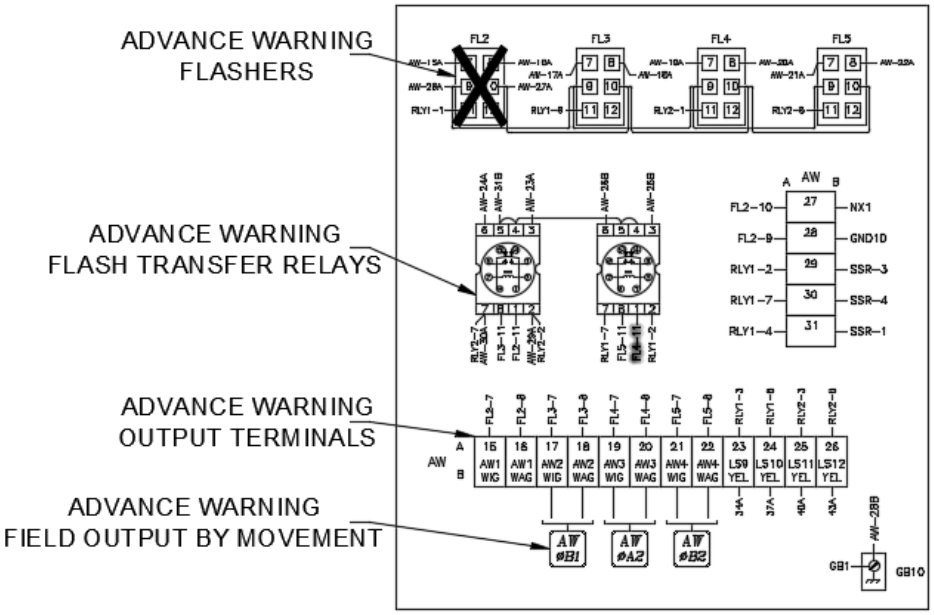


Figure 33. Advance Warning Section

.2 Ensure that both Flash Transfer Relays have been connected. The Advance Warning Flashers have their own flash transfer relays separate from the flash transfer relays for the intersection signal displays.

.3 Complete the Advance Warning field output terminal connections labeled by traffic movement.

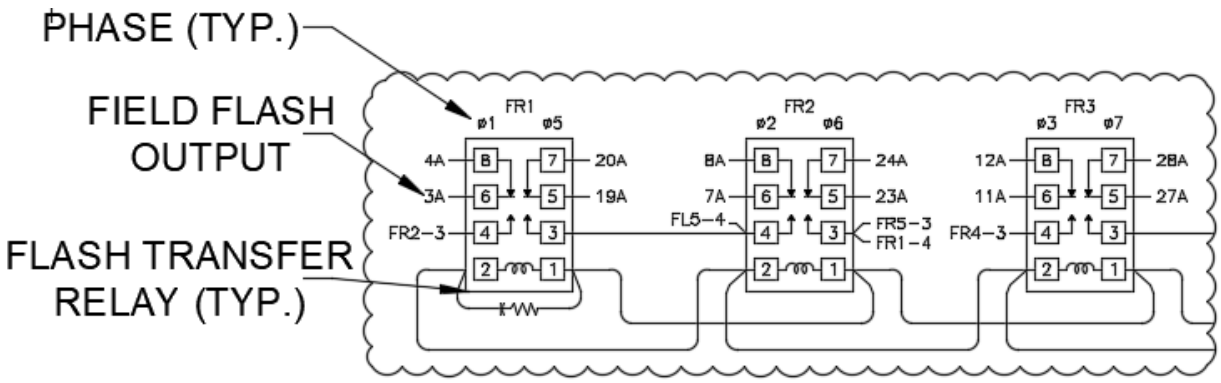


Figure 34. Flash Transfer Relays

.4 Unlike the TS1 cabinets, all flash transfer relays shall be installed in the cabinet regardless if the phase(s) they control are used or not.

.5 Complete the LOAD SWITCH SECTION of the drawing as follows:

.1 Ensure all Load Switch sockets are marked corresponding to the Traffic Controller Construction Document. Showing an X as unused and clear as used socket as in Figure 35.

.2 Typically load switch sockets 1-8 are used to output to vehicle phases 1-8. Sockets 9-12 output to ped movements 2,4,6 & 8. Sockets 13-16 output to overlaps.

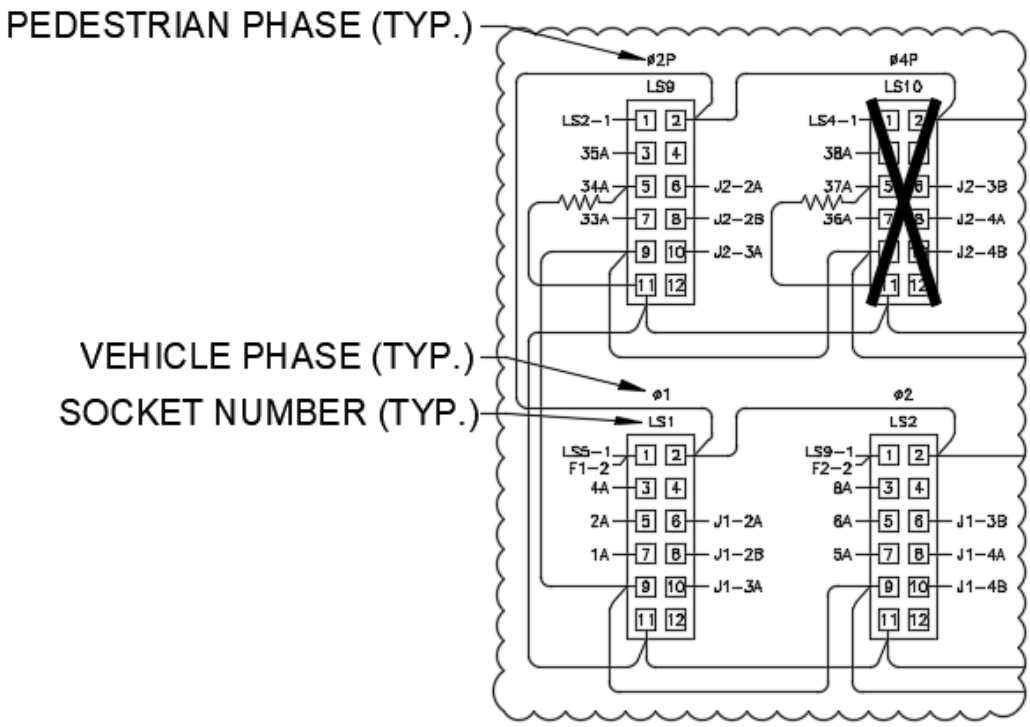


Figure 35. Load Switches

.6 Complete the **MMU SETUP** section of the drawing as follows:

.1 See Figure 36 as to lay out of table.

.2 The changes needed to drawing shall be concurrent with the Traffic Controller Construction Document.

.3 Contact Electrical and ITS Engineering for set-up procedures documentation.

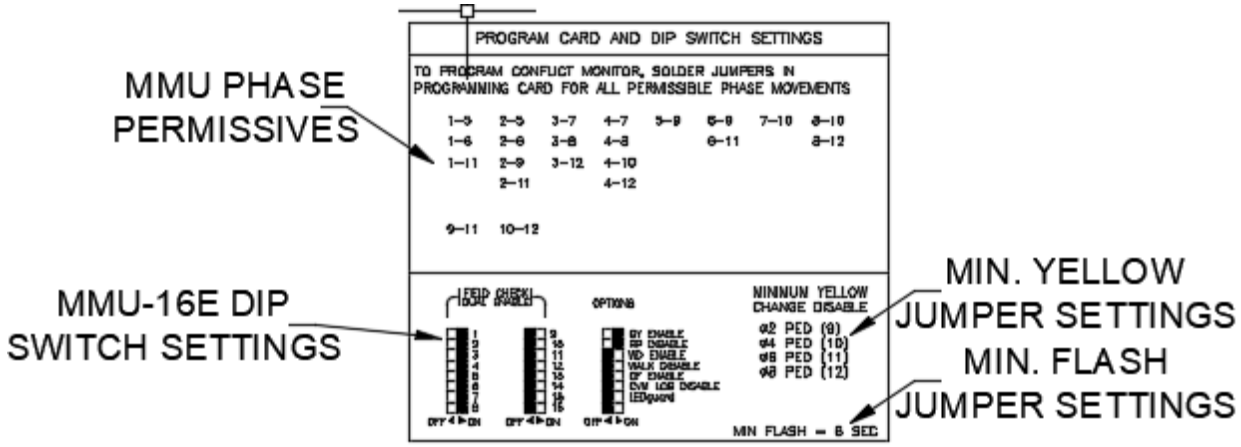


Figure 36. MMU DIP Switch & Card Jumper Settings

204.11.2 Secondary Drawing

.1 Figure 37 shows a key plan of the "SECONDARY" drawing. The section outlined will assist in the procedure for modifying the drawing.

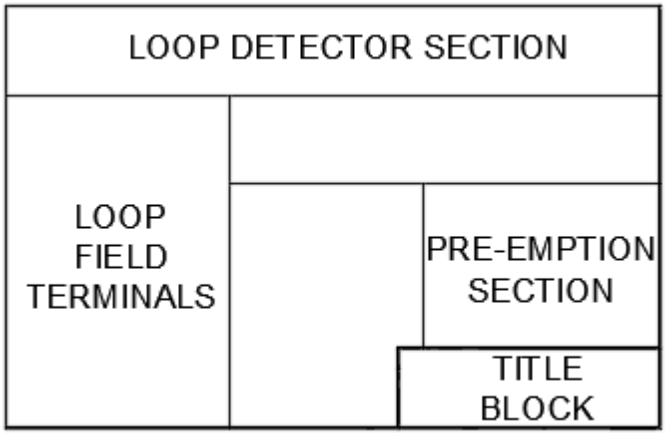


Figure 37. Secondary Drawing Key Plan

.2 Complete the **TITLE BLOCK** as described in Section 205.8.1. The drawing title should match the filename exactly.

.3 Complete the **LOOP FIELD TERMINALS** section of the rear drawing as follows:

.1 Ensure Field Loop Connections correspond to the assignments on the project Loop Assignment Sheet. Figure 38 shows the loop circuit information required to add and remove wiring for loops.

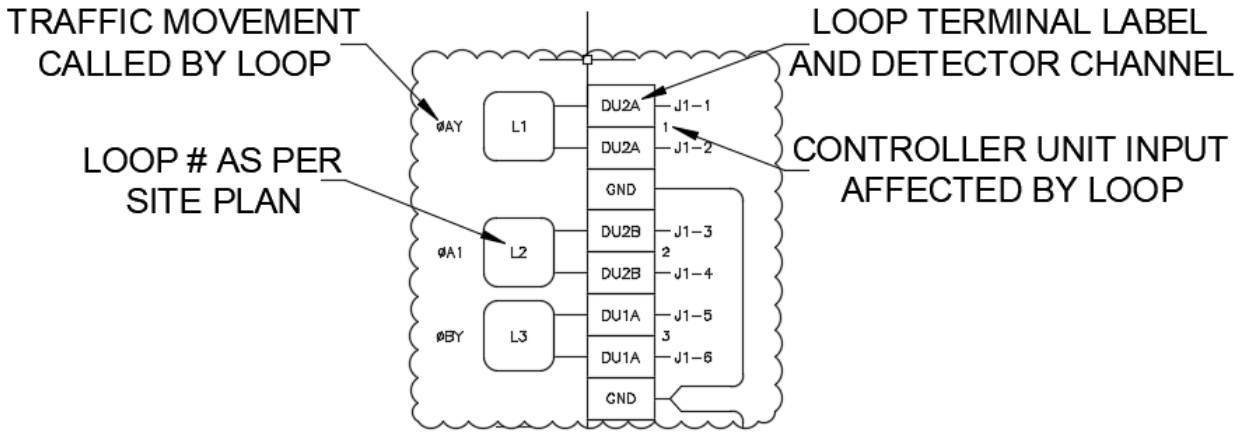


Figure 38. Field Loop Connections

.4 Complete the **LOOP DETECTOR** section of the front drawing. The card rack section contains the Detector Cards.

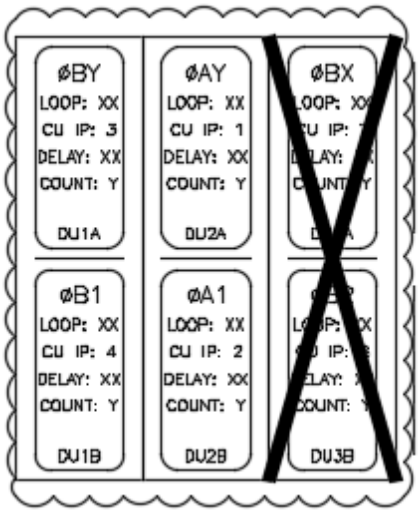


Figure 39. Detector Card Rack Wiring

.1 Ensure drawing has an X showing card slots not in use as in Figure 39.

.5 Complete the **PRE-EMPTION** section of the drawing as follows:

.1 The changes needed to drawing shall be concurrent with the Traffic Controller Construction Document.

.2 Figure 40 shows the TS2 Pre-Emption field interface. Pre-emption calls typically come from the field from other agencies' equipment. For this reason, this interface uses relays and an isolated power supply separate from the traffic controller to avoid failures in the field from adversely affecting the operation of the traffic signal.

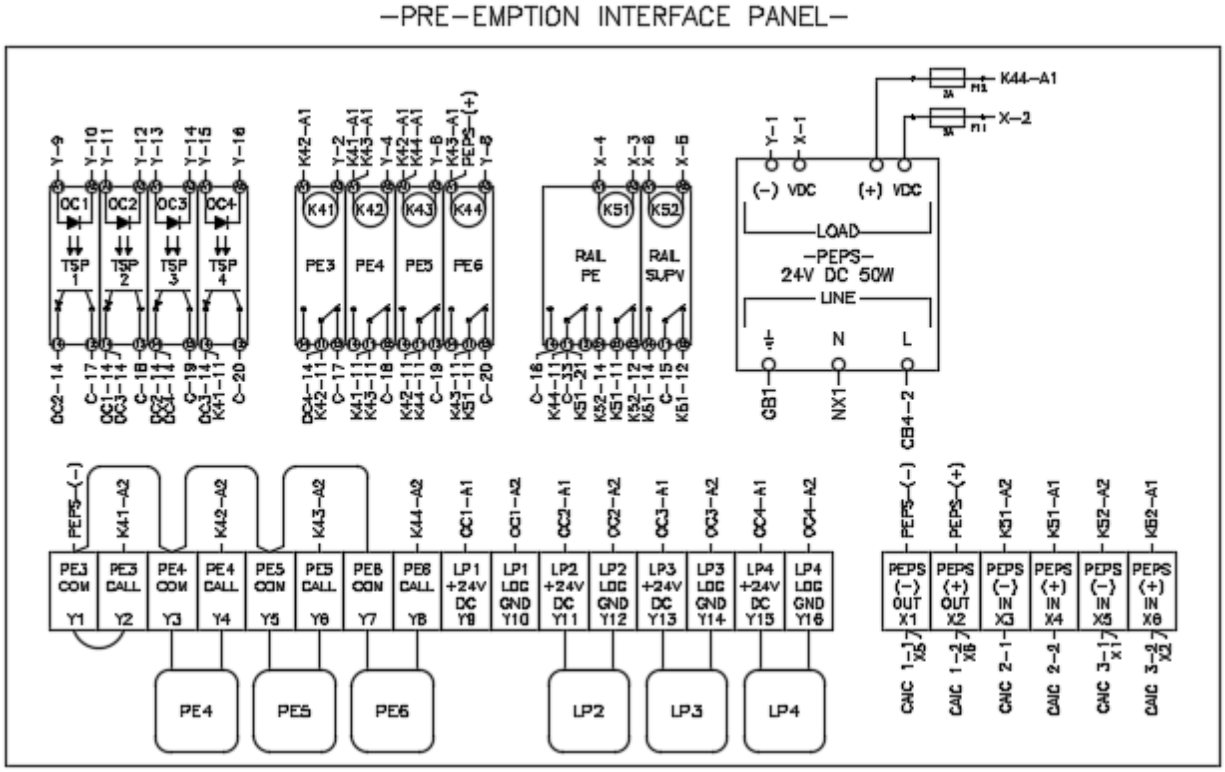


Figure 40. Pre-Emption Interface Wiring

.3 Emergency Pre-Emption (PE) field inputs #3 to #6 are terminated to terminals Y1 to Y8. They are isolated from the controller inputs by electromechanical relays PE3 to PE6. These inputs are expected to be normally-closed and only open circuit when a pre-emption call is made. For this reason, all unused emergency pre-emption inputs shall have a jumper installed across their inputs as shown for PE3 in Figure 40.

.4 Low Priority (LP) Pre-Emption field inputs #1 to #4 are terminated to terminals Y9 to Y16. They are isolated from the controller inputs by optically-isolated solid state relays TSP1 to TSP4. These inputs are expected to be normally-open so unused ones can just be left unterminated as shown for LP1 in Figure 40.

.5 The standard TS2 cabinet is configured to support a 6-wire rail interface. This utilizes both a Rail PE electromechanical relay and a Rail Supervisory relay to detect faults in the Rail Authority's equipment or interface cable (CAIC). Contact Electrical and ITS Engineering regarding how to change the standard rail pre-emption interface if the Rail Authority offers a different type of interface.

204.12 QUALITY CONTROL CHECK

.1 Once the design is complete, a Quality Control Check is performed by someone independent of the design process as follows:

.1 The individual utilises the Quality Control Checklist contained in the Traffic Controller Construction Document to review the design.

.2 If corrections are required, the working file is returned to the Traffic Controller Designer.

.3 The Quality Control Checklist is signed when all deficiencies have been corrected.

204.13 TRAFFIC CONTROLLER EQUIPMENT

.1 All components for the traffic controller are ordered by the Ministry. The Traffic Controller Technician shall go through each Traffic Controller Drawing to determine quantities of required components and will enter them on the Withdrawal Form. The Electrical Maintenance Contractor is responsible for advising the Ministry when stock of any traffic controller components are low.

204.14 TRAFFIC CONTROLLER CONSTRUCTION PACKAGE

.1 The final step in the design process is to combine all the design elements into a package. The Traffic Controller Construction Package or Working file should consist of a minimum of the following:

.1 Traffic Controller Construction Document

.2 Electrical Intersection Drawings (approved and current)

.3 Signal Timing Sheet (approved and current)

.4 Traffic Engineering Check Sheet (approved and current)

.5 Traffic Controller Drawings

.6 Loop Assignment Sheet

.7 All required electrical components as entered by the Traffic Controller Technician on the Withdrawal Form. Assembly and modification of the traffic controller is covered in Section 300 and a list of required consumables is contained in Appendix 300A.

TRAFFIC CONTROLLER DESIGN MANUAL

Appendix 200A

TS1 TRAFFIC CABINET CONSTRUCTION DOCUMENT

Electrical and ITS Engineering

May 2019

TS1 TRAFFIC CABINET CONSTRUCTION DOCUMENT

	DELIVERY Date	**TIME Sys NUMBER:**
LOCATION:	**CITY:**	
CFS NUMBER:	**PROJECT DESIGNER:**	**REGION:**

PROJECT WORK ORDER ISSUED ON:

Post this order on the outside front cabinet door when the cabinet serial number has been designated.

CABINET TYPE:

CABINET BUILDER:

MAINFRAME INCLUDED:

CONFLICT MONITOR INCLUDED:

MODEM INCLUDED:

COMMENTS FROM PRIORITY LIST:

Project's Documents

(List of information)

- Full TE- Rev.
- Controller cabinet used serial #:
- Controller cabinet template drawings used:
- Signal timing sheet date:
- Loop assignment sheet date: YY/MM/DD.
- Engineering checklist date:.

Project Profile

(Specific information, e*nter the <u>Operational</u> reason(s) for any of the wiring & programming modifications that has to be made to complete the project.)*

- Phase Sequence / Operation:

  Example – Standard single P/P three-phase operation with advance warning.

  ∅A1 =OLA (∅1+∅2)
  ∅A1 = ∅1 (set as ∅OL1).
  ∅A2 = ∅2
  ∅B = ∅4

TS1 TRAFFIC CABINET CONSTRUCTION DOCUMENT

DELIVERY Date **TIME Sys NUMBER:**

LOCATION: **CITY:**

CFS NUMBER: **PROJECT DESIGNER:** **REGION:**

Cabinet Wiring Modifications Section

(Describe in each of the following items any wiring modification that have to be done or delete if not required)

Field Inputs

(Wiring changes to cabinet - not field wiring)

Detector inputs:

☐ Describe any changes here or delete if not required.

Pedestrian inputs:

☐ Describe any changes here or delete if not required.

Pre-Emption inputs:

☐ Describe any changes here or delete if not required.

Other Inputs:

☐ Describe any changes here or delete if not required.

Back Panel

TEC Card Monitor jumpers:

- Jumper out all unused card slots:
  Example -☐ Install jumpers between the following terminals: #228-229 (P3).

Full Operation Point: For first Green Display

- Identify the correct phase(s) and interval needed to achieve the requirements shown on the STS.
  Example - As per timing sheet dated XXX, First Green Display will be ∅X and ∅X Green.
- Install a wire jumper between the following terminals:
  - ☐ Install a wire jumper between terminals #444 (FOP SEN 1) - 208 (∅2 YEL).
  - ☐ Install a wire jumper between terminals #445 (FOP SEN 2) - 444 (" ").
  - ☐ Install a wire jumper between terminals #446 (FOP SEN 3) - 205 (OLA YEL)
  - ☐ Install a wire jumper between terminals #447 (FOP SEN 4) - 446 (" ").

Advance Warning:

- Identify what phase(s) and overlap(s) need to have the advance warning treatment done to them and the wiring modifications needed.
- *Example: OLA(∅A1) = A1 Adv Warn to be operated by of Ch2 Flash Driver output*
  - ☐ Remove the wire jumper between terminals # 308 (OLA YEL) and terminal # 205 (LS2 IN YEL).
  - ☐ Remove the wire jumper between terminals # 309 (OLA GRN) and terminal # 206 (LS2 IN GRN).
  - ☐ Install a wire jumper between terminal # 307 (OLA RED) and terminal # 310(AW2 RED IP).
  - ☐ Install a wire jumper between terminal # 308 (OLA YEL) and terminal # 311 (AW2 YEL IP).
  - ☐ Install a wire jumper between terminal # 309 (OLA GRN) and terminal # 312(AW2 GRN IN).
  - ☐ Install a wire jumper between terminal # 313 (AW2 YEL OUT) and terminal # 205 (LS2 IN YEL).
  - ☐ Install a wire jumper between terminal # 314(AW2 GRN OUT) and terminal # 206 (LS2 IN GRN).

- *∅2 (∅A2) = A2 Adv Warn to be operated by Ch1 Flash Driver output.*
  - ☐ Remove the wire jumper between terminals # 316 (∅2 YEL) and terminal # 208 (LS3 IN YEL).
  - ☐ Remove the wire jumper between terminals # 317 (∅2 GRN) and terminal # 209 (LS3 IN GRN).
  - ☐ Install a wire jumper between terminal # 315 (∅2 RED) and terminal # 318 (AW1 RED IP).
  - ☐ Install a wire jumper between terminal # 316 (∅2 YEL) and terminal # 319 (AW1 YEL IP).
  - ☐ Install a wire jumper between terminal # 317(∅2 GRN) and terminal # 320 (AW1 GRN IN).
  - ☐ Install a wire jumper between terminal # 321 (AW1 YEL OUT) and terminal # 208 (LS3 IN YEL).
  - ☐ Install a wire jumper between terminal # 322 (AW1 GRN OUT) and terminal # 209 (LS3 IN GRN).

Pre-Emption:

☐ *Describe the type of Pre-emption and what phase(s) Overlap(s) are to be used.*

TS1 TRAFFIC CABINET CONSTRUCTION DOCUMENT

	DELIVERY Date	**TIME Sys NUMBER:**
LOCATION:	**CITY:**	
CFS NUMBER:	**PROJECT DESIGNER:**	**REGION:**

ALL RED TIMER (ART):

- Describe why it's needed and how to make it operate.
- *Example Required due to all red flash*

☐ Install a wire jumper between the terminals # 561 (ART ENABLE) and terminal #560 (LOG GND).

Harness and other jumpers :

☐ Describe any changes here or delete if not required.

Field Outputs

Used Reds to be satisfied:

Example ☐ Install a continuous daisy-chain jumper from terminal #1 to #4 to #13 to #29.

Intersection flash:

- *Example* Intersection to flash Yellow on the Highway, Red on the Cross St.

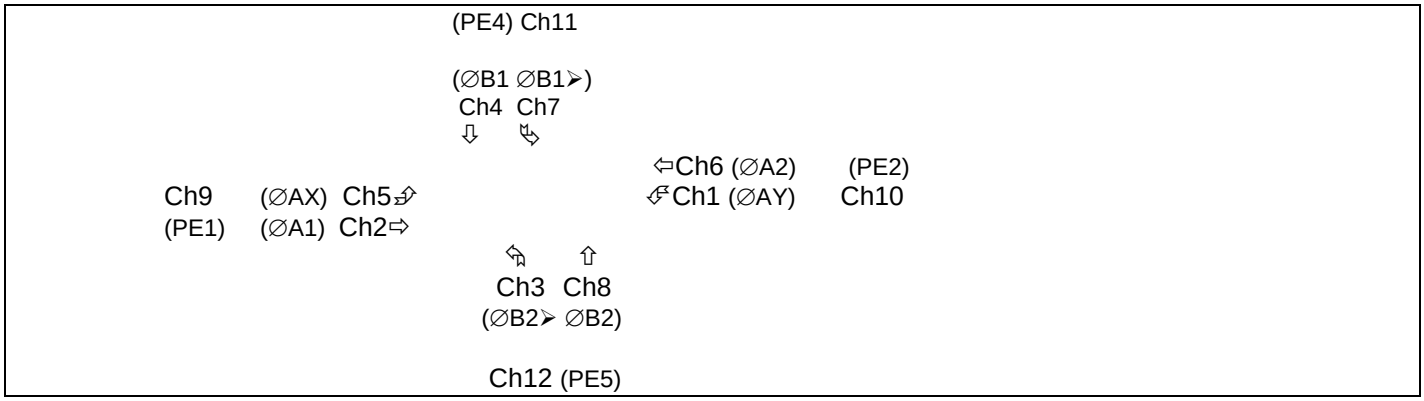
☐ Describe Flash condition and any changes here.

Monitor Inhibit Relay (K9) :

☐ Describe any changes here or delete if not required.

Conflict Monitor Program:

- List all movements and their monitoring channel number.



☐ Solder programming card jumpers as per Harness Drawing.
☐ Set dipswitch settings as per Harness Drawing.

TS1 TRAFFIC CABINET CONSTRUCTION DOCUMENT

DELIVERY Date **TIME Sys NUMBER:**

LOCATION: **CITY:**

CFS NUMBER: **PROJECT DESIGNER:** **REGION:**

Installed Equipment Section

(Indicate in each of the following items if components are required or delete if not required)

LOOP DETECTOR CARDS:

☐ Install loop detector cards in each DET slot not crossed out on the FRONT drawing..

POWER SUPPLY (TEC-PS) :

☐ Install power supply in slot PS as shown on FRONT drawing.

ADVANCE WARNING CARD (TEC-AW2) :

☐ Install an advance warning card in slot as per FRONT DWG.

☐ Set channel one to value from the signal-timing sheet dated DD-MMM-YY.

PRE-EMPTION CARD (TEC-PE) :

☐ Install a pre-emption card in slot as per FRONT DWG.

☐ Set dipswitches as per HARNESS DWG.

PEDESTRIAN/VEHICLE CARD:

☐ Install a ped/vehicle card in slot P4.

LOAD SWITCHES:

☐ Install load switches in each LS socket not crossed out as per FRONT drawing.

FLASH CONTROL RELAY (K7) :

☐ Install relay as per FRONT DWG

FLASH TRANSFER RELAYS:

☐ Install flash transfer relays in each socket not crossed out as per FRONT drawing

SYSTEM FLASHER:

☐ Install the flasher (FL1) as shown on the FRONT drawing

ADVANCE WARNING FLASHER:

☐ Install the flasher (AWFL) as shown on the FRONT drawing.

MAINFRAME:

☐ Install with programming data as per signal timing sheet dated DD-MMM-YY.

CONFLICT MONITOR:

☐ Install with dipswitch settings as per the HARNESS DWG.

CONFLICT MONITOR COMPATIBILITY CARD:

☐ Install card with soldered jumpers as per the HARNESS DWG.

.

COMMUNICATIONS :

☐ Describe any changes here or delete if not required.

OTHER:

☐ Describe any changes here or delete if not required.

TS1 TRAFFIC CABINET CONSTRUCTION DOCUMENT

	DELIVERY Date	**TIME Sys NUMBER:**
LOCATION:	**CITY:**	
CFS NUMBER:	**PROJECT DESIGNER:**	**REGION:**

Drawing Modifications Section

(delete the item if not required)

☐ Update title block on all DWGs

Field Inputs Section

☐ Loop assignments
☐ Pedestrian pushbuttons
☐ Pre-Emption
☐ Intertie

Back Panel Section

☐ Card monitor
☐ F.O.P.
☐ Advance Warning
☐ Pre-Emption
☐ A.R.T.
☐ Harness and other jumpers.

Field output Section

☐ Field terminals
☐ Reds to be satisfied
☐ Conflict Monitor
☐Intersection flash
☐ Flash transfer
☐ Monitor Inhibit Relay (K9)

Harness Drawing

☐ Conflict monitor / Program Card
☐ Harness Tables

TS1 TRAFFIC CABINET CONSTRUCTION DOCUMENT

DELIVERY Date **TIME Sys NUMBER:**

LOCATION: **CITY:**

CFS NUMBER: **PROJECT DESIGNER:** **REGION:**

Special Feature Programming

LMD Mainframe Section:

☐ Program mainframe as per signal timing sheet dated: DD-MMM-YY.
☐ Program mainframe as per loop assignment sheet dated: YY/MM/DD.

Example:
L/T ANTI-TRAP

- Terminating a thru movement on the highway to service a Hwy P/P left turn may cause the opposing permissive left-turn traffic to assume that both thru movements are terminating thereby encouraging left-turns into high speed traffic.
- To ensure that the controller terminates both thru movements before servicing a P/P left turn perform the following programming changes:
- Set Mode ∅ as the opposing thru movement associated with L/T loop detector inputs. (i.e. If P/P L/T Loop detector inputs are det i/p #1 & 9 , and associated opposing thru movement is ∅2 then those inputs mode ∅2)
- Delay Times are also needed, 10sec for L/T, 10sec for R/T 3sec for left turners clipping another movements loops as noted on the Signal Timing Sheet.

EXAMPLE :

SYSTEM: INTERSECTION: SAMPLEFILE

DETECTOR INPUT	Mode	DELAY TIME	DISCONNECT / STRETCH TIME	DETECTOR INPUT	Mode	DELAY TIME	DISCONNECT / STRETCH TIME
1	2	10	0	13	6	10	0
2	0	0	0	14	0	0	0
3	0	0	0	15	0	0	0
4	0	3	0	16	0	0	0
5	6	10	0	17	0	0	0
6	0	0	0	18	0	0	0
7	0	0	0	19	0	0	0
8	0	3	0	20	0	0	0
9	2	10	0	21	0	0	0
10	0	0	0	22	0	0	0
11	0	0	0	23	0	0	0
12	0	0	0	24	0	0	0
	[0-9]	0 - 9.9, or 0 - 127 sec.			[0-9]	0 - 9.9, or 0 - 127 sec.	

F1-HELP, F8-HANGUP 07/25/94 16:19:19

Time Clock Data - N/A.
Coordination Data - N/A.
Pre-Emption Data –N/A
Other N/A.

Finishing Procedures

☐ Cover all unused spaces with blank rack mounted plates attached to rack plate holders.

Labeling

☐ Label below each detector with the appropriate phase movement (∅A, A➢, etc.) to which the detector is assigned.

☐ Label below each switch pack with the appropriate phase movement (∅A, A➢, etc.) to which the switch pack is assigned.

☐ Label the door with the intersection name from the timing sheet, municipal name, & TE-#.

NOTE:

When construction of cabinet is complete, please notify the EEC of any errors or omissions on drawings.

For additional information contact:

Ministry of Transportation and Infrastructure

Electrical and ITS Engineering

Mailing Address:
310-1500 Woolridge St
Coquitlam BC
V3K 0B8

TS1 TRAFFIC CABINET CONSTRUCTION DOCUMENT

DELIVERY Date **TIME Sys NUMBER:**

LOCATION: **CITY:**

CFS NUMBER: **PROJECT DESIGNER:** **REGION:**

FINAL TEST - N - CHECKOUT

CABINET TYPE:	CABINET S/N:

MAINFRAME TYPE:	S/N:	SOFTWARE REV:

CONFLICT MONITOR:	S/N:	SOFTWARE REV:

MODEM TYPE:	MODEM (Configuration):

Ref. to Traffic Controller Design Manual for Items

OPERATIONAL CHECKLIST

- ☐ Check Conflict Monitor Unit dipswitch settings and compatibility card as per DWG's. Ref.305.2.2
- ☐ Check intersection flash. Ref.305.2.3
- ☐ Check inside flash control switch. Ref.305.2.3
- ☐ Check Controller Unit and Conflict Monitor Unit and other equipment for correct operation on power-up. Ref.305.2.4
- ☐ Check F.O.P and (A.R.T. operation if needed) as per Signal Timing Sheet. Ref.305.2.5
- ☐ Check Police Door Flash Switch. Ref.305.2.6
- ☐ Check Controller unit vs. Signal Timing Sheet for programming. Ref.305.2.7
- ☐ Check Advance Warning operation as per signal timing sheet. Ref.305.2.8
- ☐ Check pedestrian calls to Controller Unit from field terminals. Ref.305.2.9
- ☐ Check PED/VEH simulator to Controller Unit inputs. Ref.305.2.10
- ☐ Check Interval Advance vs. AUTO & MANUAL setting. Ref.305.2.11
- ☐ Check Pre-Emption operation in local / remote modes. Ref.305.2.12
- ☐ Check vehicle calls to Controller Unit from loops via Detector Unit channels as per DWG's and LAS. Ref.305.2.13
- ☐ Check Conflict Monitor Unit operation for conflict/red failures. Ref.305.2.2
- ☐ Check to ensure F.O.P. to control flash control circuit following manual reset of C.M.U. Ref.305.2.14
- ☐ Check communications-upload and download Controller Unit via police door to PC. Ref.305.2.16
- ☐ Check that components are labeled. Ref.305.2.15
- ☐ Check heater and fan operation. Ref.305.2.17

Document distribution: Ref.305.2.20

- ☐ Loop Assignment Sheet. - one copy each to cabinet & intersection file.
- ☐ Construction Document. - one copy each to cabinet & intersection file.
- ☐ Signal timing sheet - one copy each to cabinet & intersection file.
- ☐ Drawings distribution: Regional , two final sets, one final set laminated.
- ☐ Controller Unit Data Dump - one copy each to cabinet & intersection file.

Checked and Completed by _____ Date_____

TS1 TRAFFIC CABINET CONSTRUCTION DOCUMENT

DELIVERY Date **TIME Sys NUMBER:**

LOCATION: **CITY:**

CFS NUMBER: **PROJECT DESIGNER:** **REGION:**

QUALITY CONTROL CHECK LIST

INTERSECTION DRAWINGS

☐ Compare signal display table to site plan. ☐ Compare loop table to site plan.

SIGNALTIMING SHEET

☐ Compare site plan to loop assignment sheet.

☐ Compare with signal timing sheet for:

☐ Advance Warning	☐ Pre-Emption Fire/Railway	☐ Intersection Flash
☐ Phasing	☐ Coordination	Other

LOOP ASSIGNMENT SHEET

☐ Loop assignment sheet for accuracy ☐ Compare loops delay on signal timing sheet vs.site plan.

CABINET DRAWINGS

☐ Title block for accuracy.

Field wiring for accuracy:	☐ Phasing ☐ Loops	☐ Advance warning Other	☐Pre-emption	
Intersection flash wiring correct ID:	☐ Flash transfer relays ☐ Load switches ☐ TEC cards	☐ Field output terminals ☐ K9 relay ☐ Power Supply	☐ Advance warning flashers ☐ Flash transfer relays ☐ Advance Warning	☐ Pre-Emption
Other wiring for accuracy:	☐ TEC card monitor wiring ☐ Pre-Emption wiring	☐ F.O.P.wiring ☐ C.M.U. setup detail	☐ A.R.T. wiring ☐ Communication cables wiring	☐ Advance warning wiring

DOCUMENTS

☐ Compare construction document to controller drawings.
☐ Compare LMD data-dump to signal timing sheet and loop assignment sheet.

Traffic Controller Construction Document

Prepared by: _____ Date_____

Quality Control completed by: _____ Date_____

TS1 TRAFFIC CABINET CONSTRUCTION DOCUMENT

DELIVERY Date **TIME Sys NUMBER:**

LOCATION: **CITY:**

CFS NUMBER: **PROJECT DESIGNER:** **REGION:**

WITHDRAWAL PREPAID OLD CFS

Manufacturer	*Stock Code*	*Description*	*Quantity*
		CABINETS	
SIGMA	S7	8 Phase Base Mounted Cabinet (S7)	
SIGMA	M3	4 Phase Base Mounted Cabinet (M3)	
		MAINFRAMES	
TCT	LMD	Controller Unit (LMD 8000)	
TCT	MDM	On Street Master (MDM 100)	
		CONFLICT MONITORS	
TCT	LNM12E	12 Channel CMU (With Event Logging)	
TCT	LSM12	12 Channel CMU (No Event Logging)	
TCT		Compatibility program card	
		LOOP DETECTORS	
SARA	GP6C	2 Channel rack mounted (222)	
RENO	MOD C	2 Channel rack mounted (LCD 222)	
EDI	ORA2	2 Channel rack mounted (LCD 222)	
		INPUT MODIFIER CARDS	
TEC	PS	Power supply (TEC-PS)	
ES	DPE3	Pre-empt Interface Card (TEC-PE)	
ES	AW2	Advance Warning Card (TEC-AW)	
ES	RIC	Relay Interface Card (TEC-RIC)	
ES	PV4	Pedestrian\Vehicle Card (TEC-PV4)	
ES	PV8	Pedestrian\Vehicle Card (TEC-PV8)	
		LOAD SWITCHES	
ES	200	NEMA Load Switch Pack	
ES	204	NEMA Double Pole Flasher	
ES	AW-2	Advance Warning Flasher	
		RELAYS & TIMERS	
P&B	FCR	Flash Control Relay	
MIDTEX	FTR	Flash Transfer Relay	
P&B	K9	24v DC 4 pole Double Throw Relay	
PHOENIX	TBR1	24v DC 1 pole Double Throw Relay	
PHOENIX	TBR2	24v DC 2 pole Double throw Relay	
GE	LM90M	GE Programmable Logic Controller	
		COMMUNICATIONS	
USR	MODEM	33.6k baud Modem	
		CABLES	
CAB	TEC 1	Tec 1 (Computer to Mainframe)	
CAB	TEC2	Tec 2 (RS232 - 25' extension)	
CAB	TEC 3	Tec 3 (Detector input)	
CAB	TEC 4	Tec 4 (Police door extension)	
CAB	TEC 5	Tec 5 (Modem to Mainframe)	
CAB	TEC 6	Tec 6 (MDM 100 to Modem)	
CAB	TEC 7	Tec 7 (Conflict Monitor to Mainframe)	
		SUNDRIES	
WIHARD	SDINS	8 phase drop-in pack	
WIHARD	MDINS	4 phase drop-in pack	
ASM	CDP	Rack Plate Holders	
ASM	CDP1	Single Rack Plates	
ASM	CDP10	Ten Rack Plate	
ASM	CDP2	Double Rack Plates	
BRUNDY	KPA8C	Field Terminal Screw Lugs	

TRAFFIC CONTROLLER DESIGN MANUAL

Appendix 200B

TS2 TRAFFIC CABINET CONSTRUCTION DOCUMENT

Electrical and ITS Engineering

May 2019

TS2 CABINET CONSTRUCTION DOCUMENT

	DELIVERY Date	**TIME Sys NUMBER:**
LOCATION:	**CITY:**	
CFS NUMBER:	**PROJECT DESIGNER:**	**REGION:**

Project Information:

- Drawing:
- STS Date:
- TEC Date:
- LAS Date:
- Cabinet Serial:
- Controller Unit:

Project Scope:

- Scope

TS2 CABINET CONSTRUCTION DOCUMENT

DELIVERY Date **TIME Sys NUMBER:**

LOCATION: **CITY:**

CFS NUMBER: **PROJECT DESIGNER:** **REGION:**

Signal Sequence:

Phase to Load Switch Assignments:

ØA1 PED	*NOT USED*	ØA2 PED	ØB2 PED	*NOT USED*	*NOT USED*	*NOT USED*	*NOT USED*
LS9 = Ø2 PED	LS10 = Ø4 PED	LS11 = Ø6 PED	LS12 = Ø8 PED	L13 = Ø2	LS14 = Ø6	LS15 = OLC	LS16 = OLD
ØAY	ØA1	ØBY	ØB1	ØAX	ØA2	ØBX	ØB2
LS1 = Ø1	LS2 = OLA	LS3 = Ø3	LS4 = Ø4	LS5 = Ø5	LS6 = OLB	LS7 = Ø7	LS8 = Ø8

TS2 CABINET CONSTRUCTION DOCUMENT

DELIVERY Date **TIME Sys NUMBER:**

LOCATION: **CITY:**

CFS NUMBER: **PROJECT DESIGNER:** **REGION:**

MMU Compatibilities:

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

MMU Settings:

TS2 CABINET CONSTRUCTION DOCUMENT

	DELIVERY Date	**TIME Sys NUMBER:**
LOCATION:	**CITY:**	
CFS NUMBER:	**PROJECT DESIGNER:**	**REGION:**

Cabinet Wiring Changes:

TS2 CABINET CONSTRUCTION DOCUMENT

DELIVERY Date **TIME Sys NUMBER:**

LOCATION: **CITY:**

CFS NUMBER: **PROJECT DESIGNER:** **REGION:**

Installed Equipment:

Item	Manufacturer	Model	Serial Number	Quantity
Traffic Controller Assembly				
Controller Unit				
Malfunction Monitor Unit				
Power Supply				
Bus Interface Unit				
Loop Detector				
Load Switch				
Flash Transfer Relay				
Flash Control Relay				
System Flasher				
MMU Compatibility Card				

TS2 CABINET CONSTRUCTION DOCUMENT

	DELIVERY Date	**TIME Sys NUMBER:**
LOCATION:	**CITY:**	
CFS NUMBER:	**PROJECT DESIGNER:**	**REGION:**

Special Features:

- Special Feature

TS2 CABINET CONSTRUCTION DOCUMENT

DELIVERY Date **TIME Sys NUMBER:**

LOCATION: **CITY:**

CFS NUMBER: **PROJECT DESIGNER:** **REGION:**

Quality Control (Documentation):

Intersection Drawings:
- ☐ Compare Phase Signal Display Box to Intersection Layout
- ☐ Compare Number of Loops in Table to Intersection Layout
- ☐ Field Loops Locations

Timing Sheet noted for:
- ☐ Phasing
- ☐ Advance Warning
- ☐ Pre-Emption (Fire/Rail/Queue Detection)
- ☐ Intersection Flash
- ☐ Coordination

Loop Assignment Sheet:
- ☐ Loop Assignment checked for accuracy
- ☐ Compare loop delays on timing sheet to intersection drawings

Cabinet Drawings:
- ☐ Title Block checked for accuracy
- ☐ Field Wiring checked for accuracy (Phasing, Advance Warning, Pre-Emption, Loops, Other)
- ☐ Intersection flash wiring checked for accuracy
- ☐ Flash Transfer Relays check for correct identification
- ☐ Load Switches check for correct identification
- ☐ Advance Warning flashers for correct identification
- ☐ Advance Warning control wiring checked for accuracy
- ☐ Pre-Emption control wiring checked for accuracy
- ☐ Malfunction Monitor Unit settings checked for accuracy

Construction Document Prepared by: _____ Date: _____

Quality Control Completed by: _____ Date: _____

TS2 CABINET CONSTRUCTION DOCUMENT

DELIVERY Date **TIME Sys NUMBER:**

LOCATION: **CITY:**

CFS NUMBER: **PROJECT DESIGNER:** **REGION:**

Quality Control (Cabinet):

Ref. to Traffic Controller Design Manual for Items
OPERATIONAL CHECKLIST

- ☐ Check Malfunction Monitor Unit dipswitch settings and compatibility card as per DWG's. Ref.305.2.2
- ☐ Check intersection flash. Ref.305.2.3
- ☐ Check inside flash control switch. Ref.305.2.3
- ☐ Check Controller Unit and Malfunction Monitor Unit and other equipment for correct operation on power-up. Ref.305.2.4
- ☐ Check First Green Display and All Red Time as per Signal Timing Sheet. Ref.305.2.5
- ☐ Check Police Door Flash Switch. Ref.305.2.6
- ☐ Check Controller unit vs. Signal Timing Sheet for programming. Ref.305.2.7
- ☐ Check Advance Warning operation as per signal timing sheet. Ref.305.2.8
- ☐ Check pedestrian calls to Controller Unit from field terminals. Ref.305.2.9
- ☐ Check PED/VEH simulator to Controller Unit inputs. Ref.305.2.10
- ☐ Check Interval Advance vs. AUTO & MANUAL setting. Ref.305.2.11
- ☐ Check Pre-Emption operation. Ref.305.2.12
- ☐ Check vehicle calls to Controller Unit from loops via Detector Unit channels as per DWG's and LAS. Ref.305.2.13
- ☐ Check Malfunction Monitor Unit operation for conflict/red failures. Ref.305.2.2
- ☐ Check to ensure First Green Display to control flash control circuit following manual reset of MMU. Ref.305.2.14
- ☐ Check that components are labeled. Ref.305.2.15
- ☐ Check heater and fan operation. Ref.305.2.17

Document distribution: Ref.305.2.20

- ☐ Loop Assignment Sheet. - One copy each to cabinet & intersection file.
- ☐ Construction Document. - One copy each to cabinet & intersection file.
- ☐ Signal timing sheet - One copy each to cabinet, office & intersection file.
- ☐ Drawings distribution: One set to cabinet, one set to intersection file.

Checked and Completed by _____ Date_____

TRAFFIC CONTROLLER DESIGN MANUAL

Appendix 200C

LOOP ASSIGNMENT SHEET

Electrical and ITS Engineering

May 2019

TS1 4-PHASE LOOP ASSIGNMENT SHEET
xxx @ xxx
CITY
Site Code xxx | TE-xxx
Prepared YY/MM/DD for timing sheet dated DD-MON-YY

LOOP NUMBER	DETECTOR UNIT	CU INPUT	MOVEMENT (Designation)	PHASE (∅)	MOE (∅)	COUNT (ON)	MODE (∅)	DELAY/ STRETCH (SEC)
	1A	1						
	1B	9						
	2A	2						
	2B	10						
	3A	3						
	3B	11						
	4A	4						
	4B	12						
	5A	5						
	5B	13						
	6A	6						
	6B	14						
	7A	7						
	7B	15						
	8A	8						
	8B	16						
	9A	17						
	9B	18						
	10A	19						
	10B	20						
	CNT1A	21						
	CNT1B	22						
	CNT2A	23						
	CNT2B	24						

TS1 8-PHASE LOOP ASSIGNMENT SHEET
xxx @ xxx
CITY
Site Code xxx | TE-xxx
Prepared YY/MM/DD for timing sheet dated DD-MON-YY

LOOP NUMBER	DETECTOR UNIT	CU INPUT	MOVEMENT (Designation)	PHASE (∅)	MOE (∅)	COUNT (ON)	MODE (∅)	DELAY/ STRETCH (SEC)
	1A	1						
	1B	9						
	2A	2						
	2B	10						
	3A	3						
	3B	11						
	4A	4						
	4B	12						
	5A	5						
	5B	13						
	6A	6						
	6B	14						
	7A	7						
	7B	15						
	8A	8						
	8B	16						
	9A							
	9B							
	10A	17						
	10B							
	11A							
	11B							
	12A	18						
	12B							

TS1 8-PHASE LOOP ASSIGNMENT SHEET
xxx @ xxx
CITY
Site Code xxx | TE-xxx
Prepared YY/MM/DD for timing sheet dated DD-MON-YY

LOOP NUMBER	DETECTOR UNIT	CU INPUT	MOVEMENT (Designation)	PHASE (∅)	MOE (∅)	COUNT (ON)	MODE (∅)	DELAY/ STRETCH (SEC)
	13A							
	13B							
	14A	**19**						
	14B							
	15A							
	15B							
	16A	**20**						
	16B							
	CNT 1A	**21**						
	CNT 1B	**22**						
	CNT 2A	**23**						
	CNT 2B	**24**						
	CNT 3A							
	CNT 3B							
	CNT 4A							
	CNT 4B							

TS2 LOOP ASSIGNMENT SHEET
xxx @ xxx
CITY
Site Code xxx | TE-xxx
Prepared YY/MM/DD for timing sheet dated DD-MON-YY

LOOP NUMBER	DETECTOR UNIT	CU INPUT	MOVEMENT (Designation)	PHASE (∅)	MOE (∅)	COUNT (ON)	MODE (∅)	DELAY/ STRETCH (SEC)
	2A	1						
	2B	2						
	1A	3						
	1B	4						
	4A	5						
	4B	6						
	3A	7						
	3B	8						
	6A	9						
	6B	10						
	5A	11						
	5B	12						
	8A	13						
	8B	14						
	7A	15						
	7B	16						
	10A	17						
	10B	18						
	9A	19						
	9B	20						
	12A	21						
	12B	22						
	11A	23						
	11B	24						

TS2 LOOP ASSIGNMENT SHEET
xxx @ xxx
CITY
Site Code xxx | TE-xxx
Prepared YY/MM/DD for timing sheet dated DD-MON-YY

LOOP NUMBER	DETECTOR UNIT	CU INPUT	MOVEMENT (Designation)	PHASE (∅)	MOE (∅)	COUNT (ON)	MODE (∅)	DELAY/ STRETCH (SEC)
	14A	**25**						
	14B	**26**						
	13A	**27**						
	13B	**28**						
	16A	**29**						
	16B	**30**						
	15A	**31**						
	15B	**32**						

TRAFFIC CONTROLLER DESIGN MANUAL

Section 300

TRAFFIC CONTROLLER CABINET ASSEMBLY

Electrical and ITS Engineering

May 2019

TABLE OF CONTENTS

301 INTRODUCTION

301.1 SECTION SUMMARY

.1 This section describes the process and methods used to assemble, modify, program and test a traffic controller cabinet. This process produces a fully functional and tested traffic controller cabinet ready for field installation in an intersection.

301.2 PREREQUISITES

.1 A construction package will be sent to the assigned Traffic Controller Assembler from the Traffic Controller Designer. The Project package includes the following:

.1 Traffic Controller Construction Document including the following:

.1 Wiring Modifications

.2 Installed Equipment

.3 Drawing Modifications

.4 Special Program Features

.5 Finishing Procedures

.6 Final Test-N-Checkout form

.7 Quality Control Check List

.8 Withdrawal Form

.2 Current Electrical intersection drawings (signed and sealed by a Professional Engineer)

.3 Current Signal Timing Sheet (signed and sealed by a Professional Engineer)

.4 Traffic Controller Drawings

.5 Loop Assignment Sheet

.6 All required electrical components as listed on the withdrawal form.

.7 Consumables are not supplied as part of the construction package. A list of required consumables is contained in Appendix 300A.

.8 A sample Traffic Controller Construction Package is included in Appendix 300B.

302 ASSEMBLY AND MODIFICATION

302.1 TRAFFIC CONTROLLER CABINET ORIENTIATION

.1 The Traffic Controller Assembler must become familiar with the locations of equipment within the traffic controller cabinet.

.2 Typical traffic controller cabinet assembly layouts are shown in Figure 1 through Figure 4.

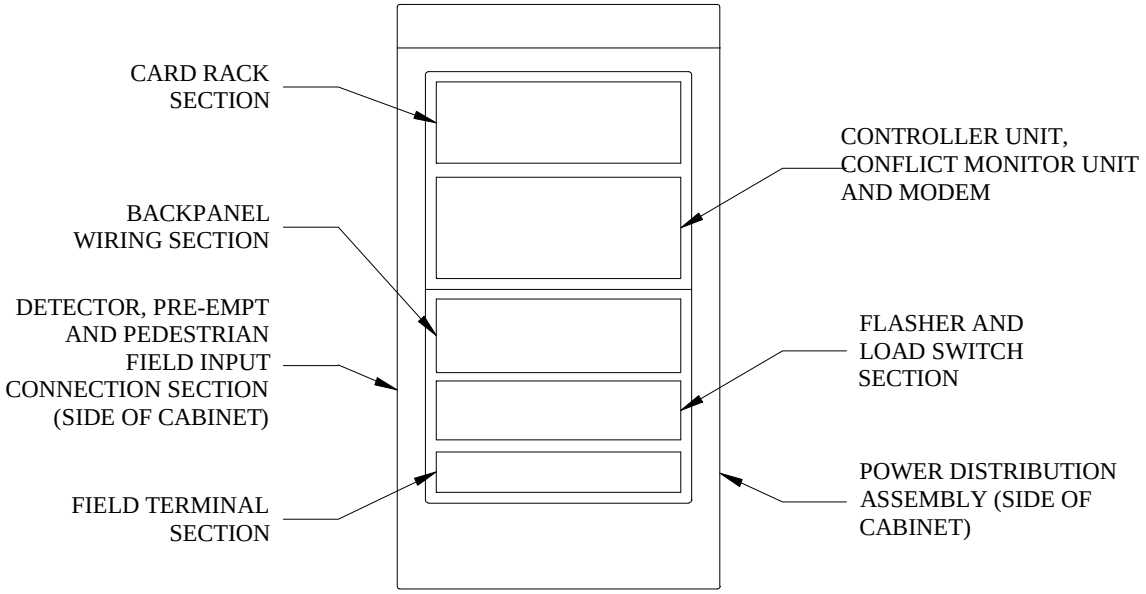


Figure 1. Layout for a TS1 Four Phase ‘M’ Cabinet

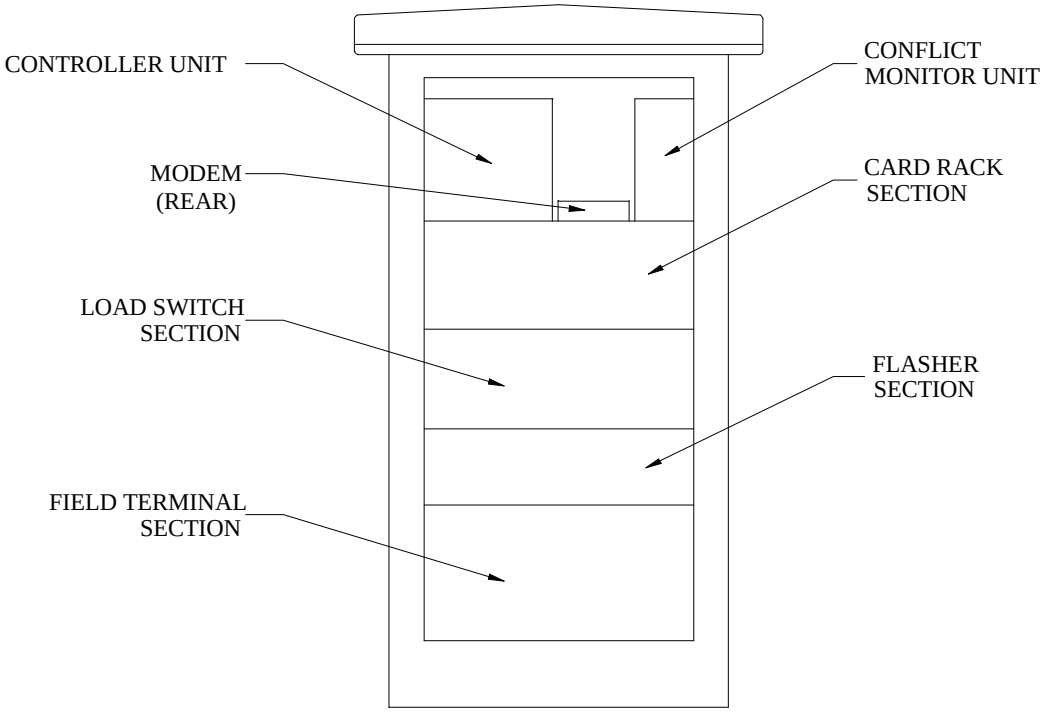


Figure 2. Front Layout of a TS1 Eight Phase ‘S’ Cabinet

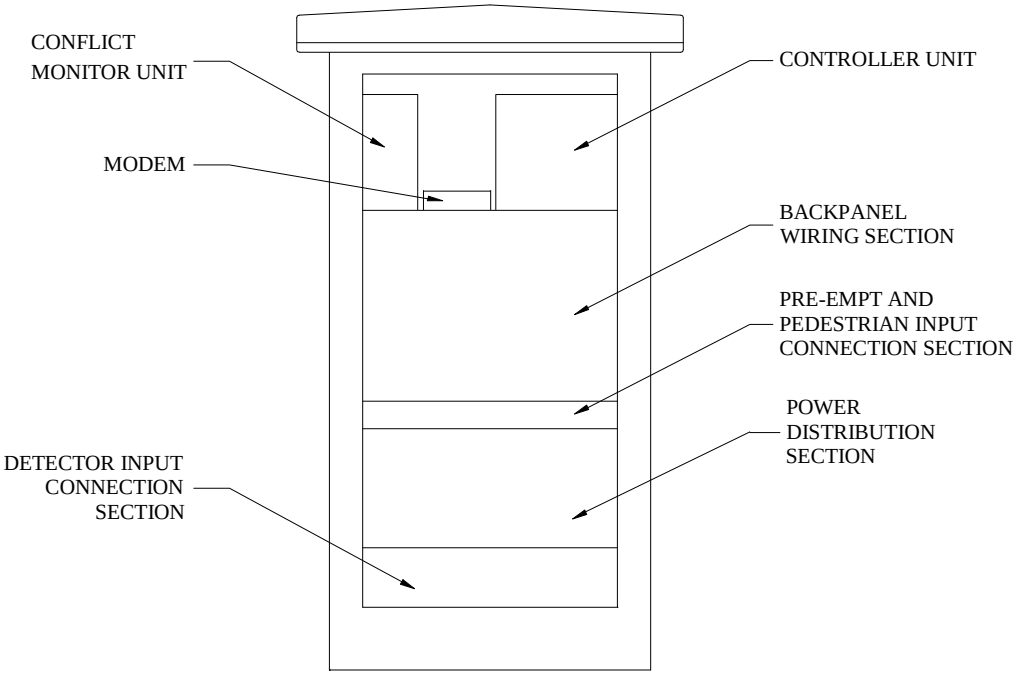


Figure 3. Rear Layout of a TS1 Eight Phase ‘S’ Cabinet

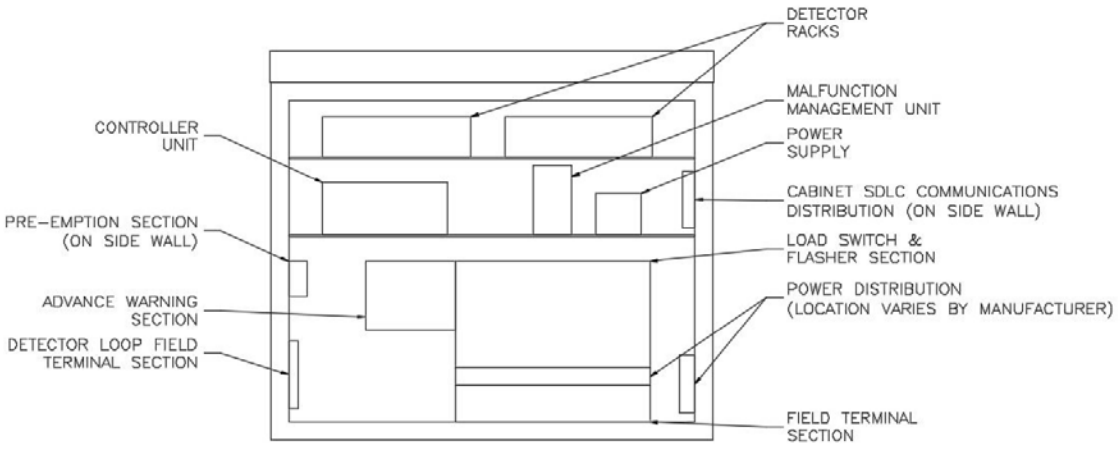


Figure 4. Layout of a TS2 P6 Cabinet

302.2 WIRING MODIFICIATIONS AND EQUIPMENT INSTALLATIONS

302.2.1 Construction Methods

.1 All wiring shall be completed in a neat and organised manner.

.2 Wire shall be bundled in with existing harnesses. Wires shall be bundled using a single tie method where possible.

.3 Any unused wire ends shall be bundled and covered in heat shrink.

.4 Crimp-on connectors shall be attached using a proper ratchet crimp tool. Check that all terminal block connections are tight.

.5 Solder and heat shrink diode connections and wire extensions as described below and as shown in Figure 5.

.1 Bind and solder wire to the diode.

.2 Heat shrink, exposed leads and solder joint covering all metal but leaving the diode body exposed so the direction can be verified

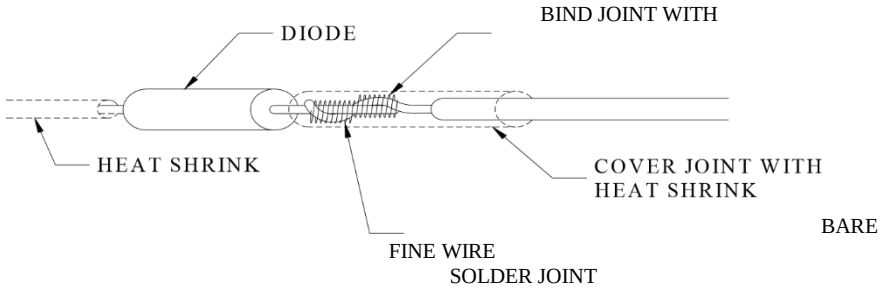


Figure 5. Diode Solder Connection

302.2.2 TS1 – Four and Eight Phase Cabinets

.1 Modifications are completed on one section of the traffic controller cabinet at a time while following the Traffic Controller Construction Document and Traffic Controller Drawings.

.2 Traffic Controller Cabinet – Wiring Modifications

.1 Power Distribution Section

.1 Typically no wiring changes are required unless otherwise noted.

.2 Field Output Section

.1 Installation of reds to be satisfied jumpers shall use red #14 AWG wire.

.2 Make wiring modifications for intersection flash requirements as noted.

.3 Install field terminal lugs as required on four phase traffic controller cabinets. A list of required consumables is contained in Appendix 300A.

.3 Backpanel Wiring Section

.1 Jumper wire shall be of #22 AWG stranded is preferred.

.2 Install CARD/MON and CARD jumpers as noted. Approved tie bars shall be used as noted in consumables list contained in Appendix 300A.

.3 Install full operation point (FOP) jumpers as noted.

.4 Install or remove the ART jumper as noted.

.5 Install wiring modifications for advance warning, pre-emption and harness connections as noted.

.6 Make wiring changes to the TEC-3 cable connection points as noted.

.7 Install TEC6 cable (Traffic Controller Unit to terminal blocks).

.4 Field Loop Connections Section

.1 Typically no wiring changes are required unless otherwise noted.

.3 Traffic Controller Cabinet – Equipment Installation

.1 Flasher Section

.1 Install Flash Transfer Relays, Flash Control Relay, Advance Warning Flashers and Intersection Flasher as noted.

.2 Check that the flash frequency switch on the front on the intersection flasher is set at 60 hertz.

.2 Load Switch Section

.1 Install load switches as noted.

.3 Card Rack Section

.1 Install PED/VEH, Pre-Emption, Advance Warning and Detector Unit Cards as noted.

.4 Power Supply Section

.1 Install TEC-PS power supply.

.5 Communications (if required)

.1 Install modem and connect TEC5 (Traffic Controller unit to modem) if required.

.2 Install Communications Surge Protector (CSP) if required.

.6 Conflict Monitor Unit

.1 Install Conflict Monitor Unit in cabinet.

.2 Set Conflict Monitor Unit dipswitches as per Traffic Controller Drawing.

.3 If a program card is required, install compatibility jumpers on the Program Card as noted. Solder jumpers from both sides of the card to ensure proper connection with all traces. Jumper wire shall be as specified in consumables list Appendix 300A.

.4 The Program Card is programmed specifically for each intersection and shall stay with the traffic controller cabinet even when the Conflict Monitor Unit is replace.

.5 Secure the program card to the MS harness as follows. Drill a 1/8" hole in the bottom outside corner of the card. Use #22 AWG stranded wire as a lanyard. Attach the card to the harness through the hole in the card and the harness connector.

.4 Blanking Plates

.1 Install blanking plates in any unused detector and/or input card slots. Blanking plates require slider plates to secure them in place. Requirements for blanking plates and slider plates are as follows:

.1 Single Space – 1 blanking plate, 1 slider plate

.2 Double Space – 1 double blanking plate, 1 slider plate

.3 Ten Spaces – 10 space blanking plate, 2 slider plates

.5 Technical operation specifications for traffic controller components are located in the Traffic Controller Cabinet Manual.

302.2.3 TS2 – P6 Controller Cabinet

.1 Modifications are completed on one section of the traffic controller cabinet at a time while following the Traffic Controller Construction Document and Traffic Controller Drawings

.2 Traffic Controller Cabinet – Wiring Modifications

.1 Power Distribution Cabinet – Wiring Modifications

.1 Typically no wiring changes are required unless otherwise noted.

.2 Field Output Section

.1 Make wiring modifications for intersection flash requirements as noted.

.3 Field Loop Connections Section

.1 Typically no wiring changes are required unless otherwise noted.

.3 Traffic Controller Cabinet – Equipment Installation

.1 Flasher Section

.1 Install Flash Transfer Relays, Flash Control Relay, Advance Warning Flashers and Intersection Flasher as noted.

.2 Load Switch Section

.1 Install load switches as noted.

.2 Install supplied red satisfier forks between terminals 1 and 3 of every unused switch socket.

.3 Detector Rack Section

.1 Install Detector Unit Cards as noted.

.4 Power Supply Section

.1 Install cabinet power supply on component shelf and connect the cabinet power supply harness to it.

.5 Communications (if required)

.1 Install modem, fiber optic transceiver, etc. to the controller unit's ethernet port with at least a CAT5 quality UTP cable.

.6 Malfunction Monitor Unit (MMU)

.1 Install MMU in cabinet.

.2 Set MMU dipswitches as Traffic Controller Drawing.

.3 Install compatibility jumpers on the Program Card as noted. Solder jumpers from both sides of the card to ensure proper connection with all traces. Jumper wires shall be as specified in consumables list Appendix 300A.

.4 The Program Card is programmed specifically for each intersection and shall stay with the traffic controller cabinet even when the Malfunction Monitor Unit is replaced.

.7 SDLC Communications

.1 Install Bus Interface Unit (BIU) Cards in the Load Switch Section (2 total) and the Detector Racks (1 for each rack used).

.2 Ensure all SDLC communications cables are connected at the SDLC Distribution Centre.

.3 Connect SDLC cables to the Port 1 connectors on: each BIU installed, the MMU and the Controller Unit.

.4 If any other non-standard Port 1 devices are installed in the cabinet, instructions on how to connect to them will be included in the Construction Document.

303 FINISHING PROCEDURES

303.1 LABELLING

303.1.1 Labelling Standards

.1 All labelling shall be adhesive tape with black lettering on a white background. Lettering shall be a minimum of 5mm high where possible and shall be as shown in the following sections. Labels shall not be hand-written. Labels for card racks shall be continuous where possible.

.2 Labelling shall be done with a Brother PT-PC computer labeller or approved equivalent.

.3 Samples of labelling locations shall be followed as near as possible.

303.1.2 Location and Drawing Number

.1 The location, city, drawing number and site code shall be labelled with 20mm tape on the inside of all doors as shown in Figure 6.

Figure 6. Typical Location Label Inside Cabinet Door

303.1.3 Pre-emption Cards and Inputs

.1 Label the pre-emption card with 20mm tape as shown in Figure 7.

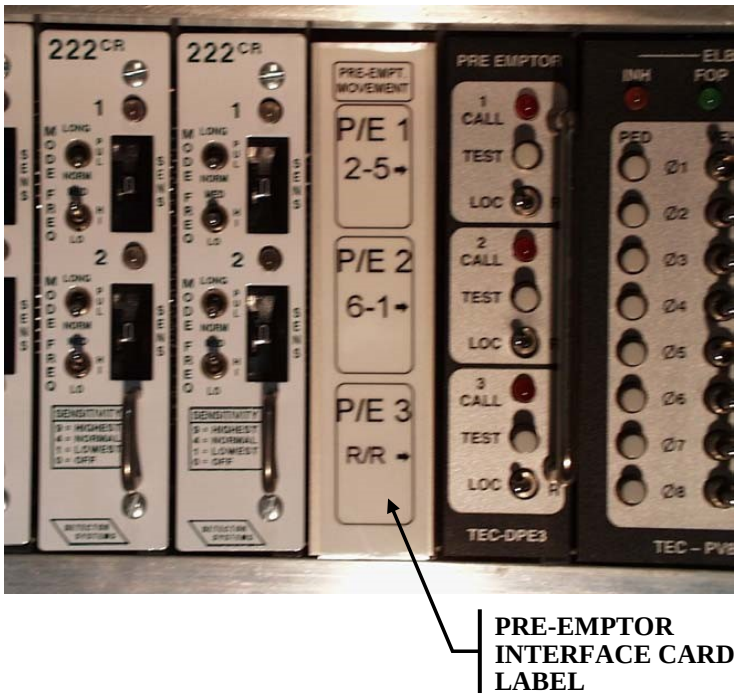


Figure 7. Typical Pre-emption Card Label

303.1.4 Detector Unit Cards

.1 Label the detector unit cards with 10mm tape as shown in Figure 8.

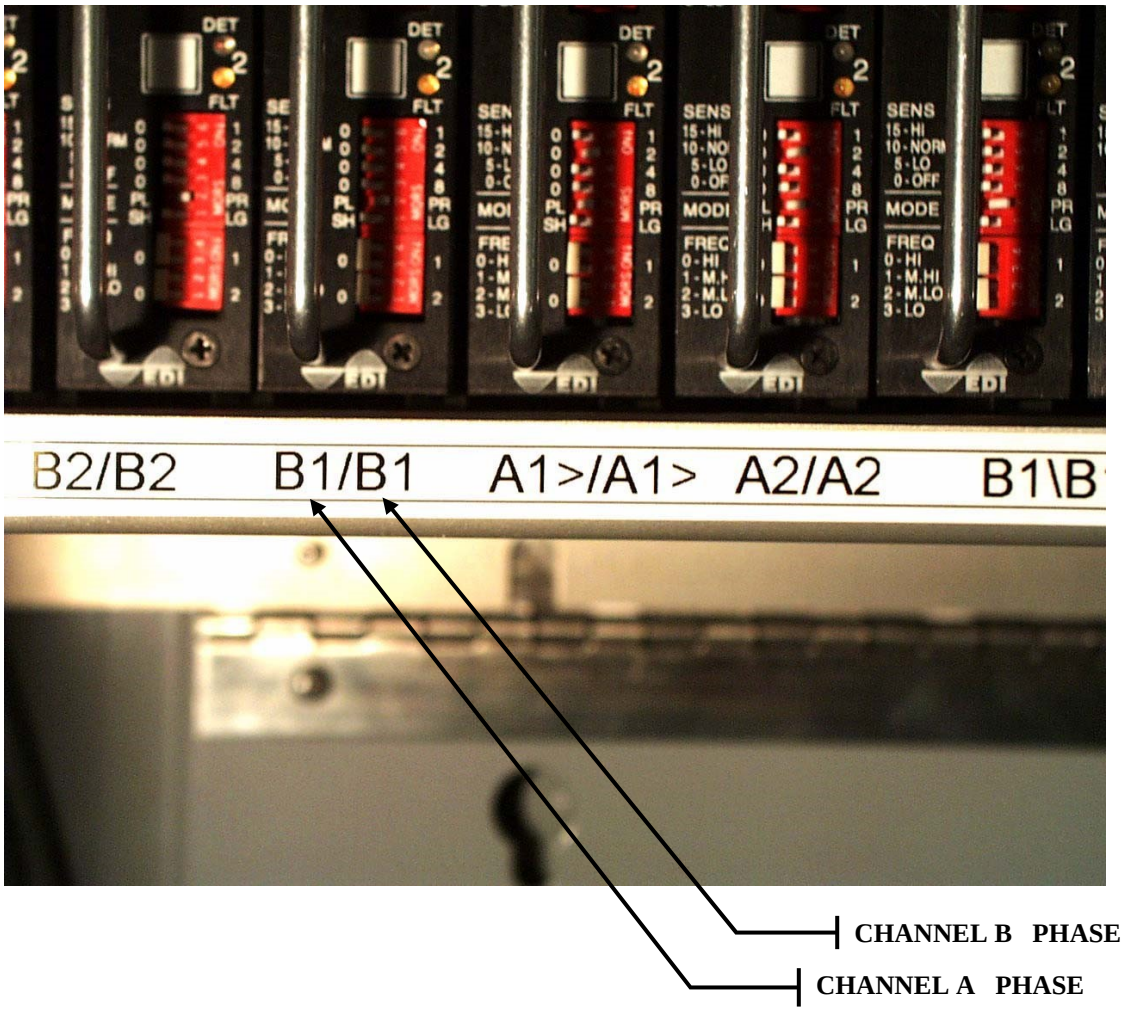


Figure 8. Typical Detector unit Card Labeling

303.1.5 Load Switches

.1 Label the load switches in TS1 cabinets as shown in Figure 9. The sockets for load switches that are not installed are labelled with an "X". Alternatively, high quality electrical tape can be used to cover the unused sockets. See consumables list Appendix A.

Figure 9. TS1 Typical Load Switch and Unused Load Switch Socket Label

303.1.6 Unused Sockets

.1 Sockets for TS1 equipment that is not installed are labelled with an "X" as shown in Figure 10. Alternatively, high quality electrical tape can be used to cover the unused sockets. See consumables list Appendix A.

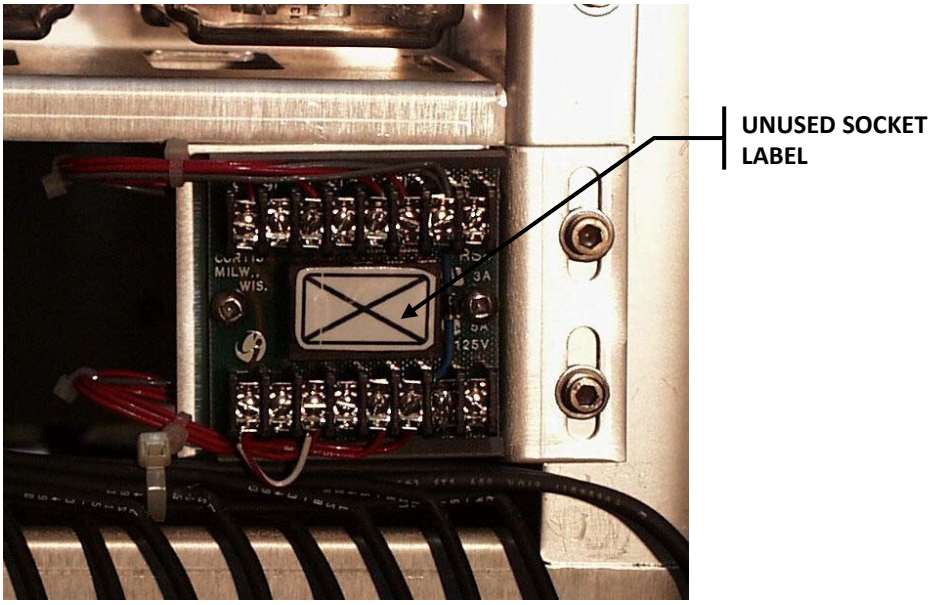


Figure 10. Typical TS1 Unused Relay Socket Label

304 TRAFFIC CONTROLLER UNIT PROGRAMMING

.1 Programming of the Traffic Controller Unit is not covered in this manual. Refer to the LMD 8000 Programming Guide, the Naztec Programming Guide or Cobalt Programming Guide for detailed programming information.

.2 Implement Traffic Controller Unit special program features. (refer to Traffic Controller Construction Document).

.3 When LMD8000 programming is complete, produce a Controller Unit Program Data Capture using the TCCSS program. Instructions for using the TCCSS software are contained in Appendix 300C. The Controller Unit Program Data Capture produced **must** be from the Traffic Controller Unit that is to be installed in the traffic controller cabinet.

.4 When Naztec 980 programming is complete, ensure the program is completed and saved in the Naztec Streetwise software. Ensure the location data within Streetwise is correct and that the programmed database name corresponds to the date of the STS programmed. The Naztec 980 to be installed in traffic controller cabinet **must** be programmed from this database.

.5 When Econolite Cobalt programming is complete, save the controller unit's .cfg file to a USB or SD Card memory device. This .cfg **must** be stored in a file system folder that clearly specifies the intersection name and the STS date of the program.

.6 A peer review of the program **must** be completed before installation.

.7 All current and superseded controller programming must be kept by the Electrical Maintenance Contractor, and be available upon request by the Ministry.

.8 Install the Traffic Controller Unit in the cabinet and record the date and time of installation. A Traffic Signal Record (TSR) Form **must** be faxed to a Ministry Traffic Engineer, the Senior Traffic System Technologist, and the Manager, Electrical Services. This form is included in Appendix 500A.

305 TESTING

305.1 INTRODUCTION

.1 When the traffic controller assembly and/or modification is complete, the Traffic Controller Assembler shall test the traffic controller cabinet and Traffic Controller Unit. Procedures for testing the traffic controller cabinet and Traffic Controller Unit are described in the following sections.

305.2 FINAL TEST-N-CHECKOUT FORM

305.2.1 General

.1 A light board to simulate each of the traffic movements in an intersection shall be connected to the field terminals of the cabinet in order to complete the traffic controller cabinet test.

.2 The following sections contain instructions for completing the Final Test-n-Checkout Form contained in the Traffic Controller Construction Document. The form is a series of operational checks to check the traffic controller is setup correctly and operating as intended. A sample of the form is contained in the Traffic Controller Construction Document in Appendix 300C.

305.2.2 CMU/MMU

.1 Check Conflict Monitor Unit or Malfunction Management Unit settings and compatibility card are as per project controller drawings.

.2 Check all conflicting channels by applying 120 volts to the field output of non-activated circuits (yellow, green, walk) and checking that the Conflict Monitor Unit trips.

.3 Check red failures by removing the 120 VAC supply to the field outputs. In TS1 cabinets this can be done by pulling output fuses. In TS2 cabinets this can be done by pulling load switches and shorting forks.

305.2.3 Intersection Flash / Inside flash control switch

.1 With the main breaker on and all other breakers and switches in the “off” or “flash” positions, check that when power is applied to the cabinet the intersection flashes according to the Signal Timing Sheet.

.2 With all breakers in the “on” position, move the inside flash switch from “flash” to “3 colour”. Check that all components power up and that in TS1 cabinets the “INB” LED on the PED/VEH card is on. Check that the Traffic Controller Unit is cycling and the intersection is still in flash.

.3 Move the police switch from the “flash” to the “3 colour” position. Check that in TS1 cabinets the “INH” LED on the PED/VEH card turns off. In TS1 cabinets the Traffic Controller Unit will cycle until the “FOP” LED comes on, the “EN” LED will come on and the intersection will go from flash to 3-colour operation. In TS2 cabinets the intersection will go straight to 3-colour operation.

.4 Check that the Advance Warning Flashers are on when the intersection is in flashing operation.

305.2.4 Controller Unit and CMU/MMU Display

.1 Check operation of the Controller unit and the CMU/MMU. The Controller Unit phase outputs should match the channel states shown on the CMU/MMU display as the signal cycles through all movements.

305.2.5 Full Operation Point (FOP)

.1 The full operation point refers to the point in time when certain conditions are met and the Traffic Controller changes from flashing operation to three colour operation.

.2 In TS1 cabinets, there are four FOP inputs to the ELB section of the PED/VEH card that must be active before the traffic controller cabinet will switch from flashing operation to three colour operation.

.3 Test the full operation point by taking the intersection in and out of flash and checking that the traffic controller cabinet switches from flash to three colour operation correctly and at the proper point in the sequence. This test shall be done from a full shut down point.

.4 In TS1 cabinets, check the full operation point indicating light on the PED/VEH card to ensure that it is operating correctly. The FOP LED should be on when the FOP inputs are true.

.5 Check that signal enters 3-colour in correct manner as per Signal Timing Sheet.

.1 If the signal uses a TS1 cabinet and flashes all red, check that the All Red Timer is applied and the first red interval is held for its allotted time plus 3 seconds. If the signal does not flash all red, the All Red Timer does not apply as noted in the Traffic Controller Construction Document.

.2 If the signal uses a TS2 cabinet and flashes all red, check that the signal stays red for its programmed all-red period.

305.2.6 Police Door Switch

.1 Check operation of police door switch.

305.2.7 Controller Unit Programming

.1 Check Traffic Controller Unit verses Signal Timing Sheet and Loop Assignment Sheet for unit to be programmed correctly for project.

.2 A peer review of any program changes to a Controller Unit shall be done.

.1 The review must be completed by a signal technician that was not involved in the initial programming of the Controller Unit. The reviewer shall not sign-off on any test form until all deficiencies found in the review have been corrected.

305.2.8 Advance Warning

.1 Check that the advance warning field outputs are active with the correct phases.

.2 Check that advance warning pre-termination intervals are correct as stated on the Signal Timing Sheet.

.3 In TS1 cabinets, check that LED’s on Advance Warning Cards are on when advance warning is on.

.4 If used, check that the cascading advance warning is operating correctly.

305.2.9 Pedestrian Calls

.1 All pedestrian inputs to the Traffic Controller Unit shall be tested.

.2 In TS1 cabinets, check the PED/VEH card to Traffic Controller Unit connections by pushing the pedestrian test buttons on the PED/VEH card and ensuring the correct Traffic Controller Unit input is actuated and the phase is serviced.

.3 For all cabinets, simulate pedestrian calls by placing a jumper between the two field terminals for each pedestrian pushbutton. Check that the correct Traffic Controller Unit input is actuated and the correct phase is serviced.

305.2.10 TS1 Cabinet PED/VEH Simulator

.1 Check the PED/VEH card pedestrian and vehicle inputs by pushing the test buttons on the PED/VEH card and ensuring the correct Traffic Controller Unit input is actuated and the phase is serviced.

305.2.11 Manual Control Switch and Interval Advance Pushbutton

.1 The manual switch is normally in the “AUTO” position.

.2 Check that the Traffic Controller Unit stops cycling once the auto/manual control switch is in the “MANUAL” position.

.3 With the manual control switch in the “MANUAL” position, check that the Traffic Controller Unit steps through the Traffic Controller Units cycle as the Interval Advance Pushbutton is depressed then released. Check that the yellow and red clearance times are preserved. Check that the Traffic Controller Unit indicates that it is under manual control on its status display.

305.2.12 Pre-emption

.1 In TS1 Cabinets, ensure dipswitches on the TEC-DPE3 pre-emptor card are set according to the Traffic Controller Drawings.

.2 On this card check the local and remote pushbutton operation as follows:

.1 Move the local/remote switch to the local position.

.2 Push the test button.

.3 Check that the proper Traffic Controller Unit pre-empt input is actuated.

.4 Check that the Traffic Controller Unit executes the correct sequence of pre-emption as per the Signal Timing Sheet and LMD Programming Guide.

.5 Check any field indications as required.

.6 Move the local/remote switch to the “REMOTE” position.

.7 Push the test button.

.8 Check that the proper Traffic Controller Unit pre-empt input is actuated.

.3 Field Terminals (for all cabinets):

.1 Install a jumper in the pre-empt field terminals.

.2 Switch the local/remote switch to the “REMOTE” position.

.3 Remove the jumper.

.4 Check that the proper Traffic Controller Unit pre-emption input is actuated.

305.2.13 Detector Unit Inputs

.1 Check each Detector Card channel by connecting a test loop to the field terminals and ensuring the proper Traffic Controller Unit detector input is actuated as per the Loop Assignment Sheet.

305.2.14 Flash Control Circuit

.1 Check to ensure that the CMU/MMU must be reset after failures.

.2 Check to ensure that after a conflict has occurred that the cabinet still starts at its programmed FOP.

305.2.15 Labeling

.1 Check that the following labels have been installed correctly:

.1 Location and drawing number on the inside of the door

.2 Pre-empt Card (TS1 only)

.3 Detector Unit Card Racks (A1/A1, A2/A2, etc)

.4 Load Switch Labels (TS1 only)

.5 Safety labels (one on each door)

305.2.16 Traffic Controller Unit Communication Ports

.1 Check the TEC4 cabling by communicating with the Traffic Controller Unit via laptop through the police door communications connector.

.2 Check the dial-up connection via a telephone line.

305.2.17 Heater and Fan

.1 Check that the heater and fan are operational by changing the set points and checking that they are operational. Cold spray should be used if the thermostats are non-adjustable.

.2 Check that the heating and cooling setpoints are set at -7°C (20°F) and 33°C (90°F) respectively.

305.2.18 General Operation Checks

.1 Check that the CMU/MMU display matches load pack indicators as the Traffic Controller Unit cycles through each phase.

.2 Put the traffic controller cabinet into three colour operation and check that the CMU/MMU display matches the light board as the Traffic Controller Unit cycles through each phase.

.3 Check that both cabinet lights and light switches are functional.

.4 Check the both the 120 VAC, 24 DC and 12 VAC power supplies are operational and supplying the correct voltages by measuring the voltages with a multimeter.

.5 Check the modem and GFCI receptacles are operating correctly.

.6 Ensure the traffic controller cabinet is mechanically operational (ie.,doors, locks, etc.).

305.2.19 Documentation

.1 Check that any changes to the Traffic Controller Drawings, which occurred during construction, are marked up and sent back to the Traffic Controller Designer.

.2 Check that all documents pertaining to the project are in the files:

.1 Loop Assignment Sheet

.2 Construction Document

.3 Signal Timing Sheet

.4 Completed office and field drawings

.5 Controller Unit Program Data Capture (Data Dump).

.3 Check that a full-sized set of Traffic Controller Drawings, the Intersection Drawings, Signal Timing Sheet, and Loop Assignment Sheet is in the traffic controller document pouch.

305.2.20 Design Changes During Assembly, Construction and Testing

.1 It is recognised that during the construction process changes from the original design may occur. It is the responsibility of the Traffic Controller Assembler to get written approval to proceed with any changes to the project. Written approval is typically a new Signal Timing Sheet from the Ministry.

.2 The Traffic Controller Assembler must send any drawing modifications back to the Traffic Controller Designer. The Traffic Controller Designer will send back a field set and office set as soon as possible. In the interim, marked up drawings may be used for Traffic Controller installation.

305.3 SIGNING

.1 When all checks have been completed and the Traffic Controller Assembler is satisfied the traffic controller is functioning as required, the check sheet shall be signed, dated, and a copy placed in the files.

TRAFFIC CONTROLLER DESIGN MANUAL

Appendix 300A

TRAFFIC CONTROLLER CONSTRUCTION CONSUMABLES

Electrical and ITS Engineering

May 2019

Traffic Controller Construction Consumables

The following is a list of typical consumables used during the traffic controller construction process that are not supplied by the Ministry:

CABINET STOCK TOOLS

Manufacturer	*Stock Code*	*Description*	*Quantity*
Panduit	GS2B	TY Rap Tie Gun	
Klien	T1710	Crimper	
Brother	PT-PC	P-Touch labeler	
Electro Sonic	10008	Heat Gun	
Klein	11076	#16-#26 wire strippers	
Electro Sonic	WTCPZ	Solder Station	
Electro Sonic	DS017	Solder Sucker	

CABINET STOCK MATERIALS

Manufacturer	*Stock Code*	*Description*	*Quantity*
WIH	4/40 x ¼ PH. FL. M/S	Rack Plate Screws	
Burndy	KPA8C	#14-#8 Screw Lugs	
Panduit		3 7/8” Cable ties	
Panduit		8” Cable ties	
Panduit		12” Cable ties	
	18-14 x #12	Insul. Male Spades	
Brother		P-Touch 12mm Tape	
Brother		P-Touch 24mm Tape	
Beldon wire&cable	8021-000 Solid Tin CU	#22 AWG Wire for CMU jumper card	
M.G.C	Cat# 403	Super cold 22 Cold Spray	
		Solder	
		Heat Shrink	
	E-IN4005	DIODES	
		#22 AWG STRANDED	
		#16 AWG STRANDED	
		#14 AWG STRANDED	
		SCOTCH 33 TAPE (BLACK)	
	C3070-09	ISOPROPYL ALCOHOL	
Burndy	P8A	PENETROX	

CABINET STOCK MATERIALS

Manufacturer	*Stock Code*	*Description*	*Controller*
Weidmuller	Q2=045670	SAK6 6mm Tie bar(2)	**CMJ S7**
Weidmuller	Q3=045680	SAK6 6mm Tie bar(3)	**CMJ S7**
Weidmuller	Q4=045690	SAK6 6mm Tie bar(4)	**CMJ S7**
Weidmuller	Q2=033640	AKZ4 Tie bar(2)	**BP S7+S5**
Weidmuller	Q3=033650	AKZ4 Tie bar(3)	**BP S7+S5**
Weidmuller	Q4=033660	AKZ4 Tie bar(4)	**BP S7+S5**
Weidmuller	Q2=045710	2F SAK6/10Tie bar(2)	**CMJ S5**
Weidmuller	Q3=045720	3F SAK6/10 Tie bar(3)	**CMJ S5**
Weidmuller	Q4=045730	4F SAK6/10 Tie bar(4)	**CMJ S5**
Weidmuller	Q2=33700	2F SAK2.5 Tie bar(2)	**CMJ M2**
Weidmuller	Q3=33710	3F SAK2.5 Tie bar(3)	**CMJ M2**
Phoenix contact	27 70 64 2	FBRI 10-5 N fixed bridge bar	**CMJ M3**

Note
CMJ is Conflict Monitor Jumper
BP is Backpanel
S7/S5/M2/M3 is cabinet Series Number

TRAFFIC CONTROLLER DESIGN MANUAL

Appendix 300B

TCCSS PROGRAM OPERATION INSTRUCTIONS

Electrical and ITS Engineering

May 2019

TCCSS Program Operation Instructions

The following provides instructions for producing a printout of LMD mainframe programming data called a data dump using the TCCSS program. TCCSS program is a custom software package designed to extract programming data from the LMD mainframe and format it for printing.

- Start the TCCSS program
- Choose selection number 1, LMD Data Printout. The next screen is the main TCCSS screen. Available functions are listed on the lower portion of the screen. Using the arrow keys select the "CAPTURE" option and press "ENTER" to proceed to the capture screen.
- Connect serial port 1 of the computer to the RS232A port on the mainframe using a TEC-1 cable.
- Follow the instructions on the screen to capture the programming data. Use a baud rate of 9600.
- Once the capture has been started, the "RECEIVE COUNTER" should increment if the program is functioning properly. If errors occur the program prompts with suggested corrections.
- The download should take 1 to 2 minutes.
- When the programming data has been downloaded the title page information will have to be entered. Enter title page information as follows:

Item	Enter
Output File	TE Drawing Number in Numerical Form
Intersection	Actual Intersection Name (i.e., "Hwy 1 @ Cross ST")

Once the title sheet data is entered the data dump can be printed for inclusion in the project documentation.

TRAFFIC CONTROLLER DESIGN MANUAL

Section 400

SIGNAL COMMISSIONING GUIDELINES

Electrical and ITS Engineering

May 2019

TABLE OF CONTENTS

401 SIGNAL COMMISSIONING PROCESS

401.1 INTRODUCTION

.1 The intent of this document is to detail the steps and processes required to commission a Ministry Traffic and Pedestrian traffic signal following construction.

.2 Special Crosswalk Signals and Fire Signals will require commissioning by the Electrical Maintenance Contractor.

.3 Other Special Signals such as One-Way Bridge Signals; Drawbridge and Lift Span Signals; Lane Control Signals, etc., will require specific inspection and commissioning unique to that project. Where these signal commissioning situations are encountered, consult the Manager Electrical Services for direction.

.4 Commissioning of signals will be required as the result of one of the three scenarios. These three scenarios are listed below and are covered under their own sections of this document:

.1 Construction of a new signal (Section 402)

.2 Modification to an existing signal where the existing controller will remain (Section 403)

.3 Replacement of the controller cabinet for an existing traffic signal (Section 404)

.5 Parties in the commissioning process will typically include the following:

.1 ***Manager Electrical Services*** – Is the Ministry representative who oversees the operation of all traffic signals within their Region or District. The Manager Electrical Services shall be the main point of contact for the Electrical Maintenance Contractor and the Electrical Installation Contractor.

.2 ***Project Manager*** – Is the Ministry representative who oversees the overall project. The Project Manager is responsible for coordinating activities for construction of the project.

.3 ***Electrical Maintenance Contractor*** – Is the contractor who is responsible for maintenance activities within the area where the signal project is taking place. The Electrical Maintenance Contractor shall inspect and commission signals as described in this document. This includes all controller programming and testing.

.4 ***Electrical Installation Contractor –*** Is the electrical contractor installing the traffic signal. The Electrical Installation Contractor shall undertake all installation of signal equipment and coordinate / schedule required activities with the Manager Electrical Services and Electrical Maintenance Contractor. In some cases, the Electrical Installation Contractor and the Electrical Maintenance Contractor is the one and the same.

.5 ***Signal Designer*** – Is the individual responsible for the traffic controller and cabinet modifications and programming, respectively. The Signal Designer will be required to undertake a "Design Adherence Review" prior to start-up. The Signal Designer may be a qualified contractor or Ministry staff. In some cases, the Signal Designer and the Electrical Maintenance Contractor is the one and the same.

.6 It is critical that the Project Manager coordinate with the Electrical Installation Contractor to define the exact start-up date for the signal. The Manager Electrical Services must be notified in advance of the start-up date. The Project Manager and Electrical Installation Contractor must coordinate and schedule the supply of the controller, all required inspections/reviews, and commissioning.

.7 Where scenarios arise which are not covered in this document the Manager Electrical Services shall be consulted for direction.

.8 Any deviations from this document must meet the written approval of the Manager Electrical Services.

.9 Any questions related to commissioning of signals shall be addressed to the Manager Electrical Services.

402 NEW SIGNALS

402.1 GENERAL

.1 This section details the process required for commissioning a new signal. This process will also apply when an existing signal undergoes a major modification which includes a replacement of the existing controller assembly.

402.2 PROCESS

.1 The process for new signal commissioning shall cover all steps described from start to finish. The main elements of the process shall be as follows:

.1 **Pre-Construction** – This stage of the process shall occur well in advance of the date when the signal is required to be completed (typically prior to construction). The Electrical Installation Contractor shall review the project schedule, including the anticipated start-up date with the Project Manager and Manager Electrical Services. The Project Manager shall arrange for the supply of the traffic cabinet and controller with Electrical and ITS Engineering. Electrical and ITS Engineering will then coordinate the supply and delivery of the traffic cabinet and controller. **It is the Project Manager's responsibility to coordinate with all parties well in advance of when the controller is required. Typically lead time for a traffic cabinet is four to eight weeks).**

.2 **Signal Installation** – The Electrical Installation Contractor will undertake the signal installation. The Project Manager shall advise the Manager Electrical Services when the controller can be installed. Throughout the installation the Project Manager shall contact the Manager Electrical Services on a regular basis with updates as to the progress of construction.

.3 **Controller Shop Programming and Testing** – The Electrical Maintenance Contractor shall undertake shop testing in accordance with the current version of Section 300 Traffic Controller Cabinet Assembly and Testing document.

.4 **Pre-Start Up** – The start-up process is as follows:

- When shop testing is complete, the Electrical Maintenance Contractor shall ship the traffic controller and cabinet to the Electrical Installation Contractor.
- The Electrical Installation Contractor shall arrange for the installation of the controller.
- When the installation of the traffic controller is complete, the Electrical Maintenance Contractor will undertake a pre-start up inspection using the "Pre Start-Up Inspection Sheet" attached. The inspection sheet shall be available upon request by the Ministry.
- Deficiencies noted shall be provided to the Manager Electrical Services who will review and pass onto the Project Manager for the Electrical Installation Contractor to correct.
- Once the review is completed and all deficiencies have been corrected the Manager Electrical Services shall contact the Signal Designer who undertook the signal design to undertake a "Design Adherence Review."
- The Signal Designer will review the signal installation and issue a list of deficiencies to the Manager Electrical Services.
- The Manager Electrical Services will review the deficiency list and pass it onto the Project Manager if further corrections are required.
- Once the review is completed and all deficiencies have been corrected, the Manager Electrical Services will issue approval for signal start-up by the Electrical Maintenance Contractor.
- At the discretion of the Manager Electrical Services, the Signal Design Adherence Review may be undertaken by Electrical and ITS Engineering personnel.

.5 **Startup** – The Electrical Maintenance Contractor shall install temporary signs as noted under Section 402.3 and put the signal into temporary 72-hour flash or directly into full 3-color operation, depending on the circumstances listed below.

The signal can go directly into full 3-color operation where:

.1 The signal is a pedestrian signal,

.2 Advance warning signs are present on the major (Highway) movement, or

.3 The signal is installed within a corridor with other signals located within 2 km on both sides of the new signal.

Regardless of the above three criteria, the Regional Traffic Engineer may require the use of 72 hour flash. The 72-hour flash period is intended to inform local motorists that the signal will soon be placed into operation.

Where a temporary flash period is required and left turn signals are present, the left turn signal shall be covered (sacked and LED's disconnected) during the flash period. The temporary flash operation may vary from the permanent controller flash mode, depending on the circumstances. For example where the signal operation calls for 4-way all red flash which would cause delays during the temporary flash period, then the controller shall be setup to operate flashing yellow on the Highway (typically 'A' phase movements) and red on the cross street (typically 'B' and/or 'C' phases) for the temporary flash period only.

Prior to going into flash or full 3-color operation the Electrical Maintenance Contractor shall complete the "Signal Start-up Check Sheet" attached. Where items are not completed the Manager Electrical Services shall be consulted for direction prior to start-up. The inspection sheet shall be available upon request by the Ministry.

The Electrical Maintenance Contractor shall submit the completed Signal Start-up Check Sheet to the Manager Electrical Services immediately upon the completion of the signal start-up.

.6 **Post-Start Up** – The Electrical Maintenance Contractor shall remove all temporary signs 90-days after the signal is in operation.

Within the first two weeks of operation, the Ministry may issue a revised timing plan to fine-tune the timings. The Electrical Maintenance Contractor shall implement the new timing plan. The contractor shall note that Commissioning includes the implementation of two sets of timing plans. No additional compensation for implementation of timing plans shall be made for these first two plans.

402.3 SIGNING

.1 In accordance with the *Ministry of Standard Traffic Signs and Pavement Markings,* permanent W-12 SIGNAL AHEAD signs may be required to warn motorist of the signals ahead. They will typically be shown on the Signing and Pavement Markings Plans for the project. The Electrical Installation Contractor shall confirm where permanent W-12 Signs will be installed. Not all approaches will warrant permanent W-12 signs.

.2 Where permanent W-12 SIGNAL AHEAD signs are not required, a temporary W-12 shall be installed.

.3 TemporaryW-329 NEW tabs shall be installed under each permanent or temporary W-12 sign.

.4 Temporary signs shall be installed in advance of the signal stop bar at the intersection. They shall be located based on posted speed in accordance with the *Manual of Standard Traffic Signs and Pavement Markings*.

.5 Temporary signs shall be mounted on luminaire poles with temporary banding, or where no poles are present then signs shall be mounted on wooden or telespar posts.

.6 After the 90-day period has expired, the W-12 signs which are not part of the permanent installation and the W-329 tabs shall be removed by the *Electrical Maintenance Contractor.* Where support posts are used the area where the post was installed shall be backfilled and restored to its original condition.

Figure 1. W-12 Sign and W-329 Tab

403 MODIFICATIONS TO EXISTING SIGNALS

403.1 GENERAL

.1 This section details the process and traffic signing required for commissioning a controller at an existing signal where the existing controller will remain.

403.2 PROCESS

.1 The process for commissioning an existing signal that requires modification shall cover all steps described below from start to finish. The main elements of the process shall be as follows:

.1 **Pre-Construction** – This stage of the process shall occur well in advance of the date when the signal modifications are required to be completed and operational. The Electrical Installation Contractor shall review the project schedule including anticipated start-up date with the Project Manager and Manager Electrical Services. Modifications to the existing cabinet and signal re-programming shall be made by the Electrical Maintenance Contractor**.** Updated cabinet drawings shall be submitted to the Senior Traffic System Technologist. **It is the Project Manager's responsibility to coordinate with all parties well in advance of when the controller modifications are required.**

.2 **Signal Modifications** – The Electrical Maintenance Contractor shall undertake the signal modifications and shall advise the Manager Electrical Services when the controller modifications are required.

.3 **Pre-Startup** – When the signal modifications are complete the Electrical Maintenance Contractor shall contact the Manager Electrical Services who will arrange for the Electrical Maintenance Contractor to undertake a pre-start up inspection using the "Pre Start-Up Inspection Sheet" attached. Deficiencies shall be forwarded to the Manager Electrical Services who will review and pass onto the Electrical Installation Contractor if corrections are required. The inspection sheet shall be available upon request by the Ministry.

Once the inspection is completed and all deficiencies have been corrected, the Manager Electrical Services shall contact the Signal Designer who undertook the signal design to undertake a Design Adherence Review. The Signal Designer will review the signal installation and issue a list of deficiencies to the Manager Electrical Services. The Manager Electrical Services will review the deficiency list and pass onto the Electrical Installation Contractor. Once the review is completed and all deficiencies

have been corrected, the Manager Electrical Services will issue approval for field/shop testing and start up.

.4 **Controller Shop/Field Testing -** The Electrical Maintenance Contractor shall undertake shop/field testing in accordance with the current version of the Ministry Section 400 Traffic Controller Cabinet Assembly and Testing document.

.5 **Startup** – The Electrical Maintenance Contractor shall complete the "Signal Start-up Check Sheet". The inspection sheet shall be available upon request by the Ministry. The Electrical Maintenance Contractor shall install temporary signs as noted below and shall put the signal modifications directly into operation. If shop testing is not required, field testing and start up shall be done simultaneously to reduce signal down time.

.6 **Post-Startup** – The Electrical Maintenance Contractor shall remove temporary signs 90 days after the modified signal is placed into operation.

Within the first two weeks of operation, the Ministry may issue a revised timing plan to fine-tune the timings. The Electrical Maintenance Contractor shall implement the new timing plan. No additional compensation for implementation of timing plans shall be made for these first two timing plans.

403.3 SIGNING

.1 Temporary C-64 Signal Operation Changed signing shall be installed in advance of each approach at an existing signalized intersection where the signal phasing has been changed. It should not be used at a new signal. Temporary C-63 Traffic Pattern Changed signs may be used instead of C-64 if the signal operation remains the same and there are only geometric changes to the intersection (i.e. adding a right turn slot; converting a through lane to a shared and through, etc.)

.2 Temporary C-64 signs shall be installed in advance of the signal stop bar at the intersection. They shall be located based on posted speed at the same distance identified for W-12 signs in the *Manual of Standard Traffic Signs and Pavement Markings*. Temporary signs shall be mounted on luminaire poles with temporary banding or where no poles are present signs shall be mounted on wooden or perforated square steel posts.

.3 After a period of 90 days, the C-64 signs and their support posts shall be removed by the *Electrical Maintenance Contractor*. Where support posts are

used the area where the post was installed shall be backfilled and restored to its original condition.

Figure 2. C-64 and C-63 Signs

404 CONTROLLER REPLACEMENT

404.1 GENERAL

.1 This section details the process and traffic signing required for commissioning a controller replacement at an existing signal. Typically, this scenario shall apply where a controller has to be replaced as a result of a motor vehicle accident (MVA) or a replacement is made as part of general rehabilitation work activities.

404.2 PROCESS

.1 The process for signal commissioning when the scope of the change is a controller replacement shall cover all steps described below from the start to finish. The main elements of the process shall be as follows:

.1 **Pre-Construction** - The Manager Electrical Services shall arrange for the supply of the controller unit with the Senior Traffic System Technologist. The Electrical Maintenance Contractor who in turn will undertake the required shop testing listed below.

.2 **Controller Shop Testing** – The Electrical Maintenance Contractor shall undertake shop testing in accordance with the current version of Ministry Section 300 Traffic Controller Cabinet Assembly and Testing document.

.3 **Pre-Start Up** – The Electrical Maintenance Contractor shall complete the "Signal Pre-Start-up Check Sheet". The inspection sheet shall be available upon request by the Ministry. When shop testing is complete, the Electrical Maintenance Contractor shall contact the Manager Electrical Services and arrange for the installation of the controller.

.4 **Startup** – The Electrical Maintenance Contractor shall complete the "Signal Start-up Check Sheet" and shall put the new controller directly into operation. The inspection sheet shall be available upon request by the Ministry.

TRAFFIC CONTROLLER DESIGN MANUAL

Appendix 400A

PRE-START UP INSPECTION

Electrical and ITS Engineering

May 2019

Signal Pre-Start Up Inspection Sheet

Location _____

Project No. _____ Drawing No. _____

Company _____ Date_____ Time _____

Electrician _____

Checked	Inspection Item	Pass	Fail	Initials
	Luminaire, Signal and Sign Poles			
	.1 Check signal pole shafts are plumb and for proper arm rises (2 to 5 degrees from horizontal)am			
	.2 Check for double nuts as per SP635 drawings			
	.3 Check any scratches in the galvanized surfaces are repaired with cold galvanizing compound			
	.4 Check nut covers are installed			
	.5 Check hand hole covers are installed			
	Traffic Signal and Pedestrian Heads			
	.1 Check all signal and pedestrian heads are properly oriented as per SP635 drawings.			
	.2 Check all signal and pedestrian heads and mounting hardware are securely attached to the pole using approved mounting hardware.			
	.3 Check all signal and pedestrian heads are bonded.			
	.4 Check signal heads are sacked (new signals)			
	Pedestrian Pushbuttons			
	.1 Check pedestrian pushbuttons and signs are securely attached to the pole.			
	.2 Check pushbuttons and signs are installed at the correct elevation and display the correct messaging.			
	.3 Check pushbutton signs are sacked			

Signal Pre-Start Up Inspection Sheet

	Luminaires and Photocells			
	.1 Check flat glass lenses are level			
	.2 Check luminaires are securely attached to the poles			
	.3 Check all photocells are aimed north			
	.4 Check all luminaires are operational			
	Signs and Pavement Markings			
	.1 Check signing and pavement markings are installed as per the design drawings			
	.2 Check all signs are installed, level and securely attached			
	.3 Check signs are visible to oncoming motorist a minimum of 100m from the sign			
	Service Equipment			
	.1 Check all service panels and conduits are securely attached to the pole			
	.2 Check wiring inside the panel is neat, correctly terminated and conforms to the requirements of the wiring diagram on the plans			
	.3 Check that ground plate or rod is installed			
	.4 Check all service connections have been made and the panel is fully operational			
	.5 Check drain screws in the bottom of the panel are removed			
	Wiring			
	.1 Check all conductors are the proper sizes and correctly color coded as indicated on the plans			
	.2 Check all conductor splices are securely connected and sealed with tape or sealant			
	.3 Check all bond conductors are green			

Signal Pre-Start Up Inspection Sheet

	.4 Check all conductors are RW90 (XLPE) stranded copper			
	.5 Check all lighting circuits are correctly fused (check fused line and load sides are correctly oriented)			
	.6 Check all conductors are neatly coiled and bundled in all junction boxes, vaults, poles hand holes, controller cabinet and service panels (conductors shall be attached to conduit support bars in junction boxes and vaults).			
	.7 Check conductors are properly tagged in all junction boxes, vaults and controllers			
	.8 Check all signal and pedestrian phases have been flashed out			
	Detector Loops			
	.1 Obtain loop check sheets from the *Electrical Installation Contractor* and review for compliance			
	.2 Check all loops are color coded and labeled in the junction boxes			
	.3 Check loop slots in asphalt are properly sealed			

TRAFFIC CONTROLLER DESIGN MANUAL

Appendix 400B

START UP INSPECTION

Electrical and ITS Engineering

May 2019

Signal Start-up Inspection Sheet

Location _____

Project No. _____ Drawing No. _____

Company _____ Date_____ Time _____

Electrician _____

Task	Yes	No	Initials
.1 Approval to start-up signal obtained from Ministry			
.2 Temporary traffic control is in place			
.3 Temporary Signs (W-12 / W-329 or C-64) installed at each approach			
.4 Uncover all signal heads and pushbuttons and check final aiming required in accordance with SP635 drawings			
.5 Confirm field connected per connection sheet			
.6 Install controller equipment and test run in full 3 color operation for 10 minutes with proper timing sheet (Record date of timing sheet here:_____)			
.7 During 10-minute test run, observe every signal head for proper operation and alignment, including pre-empt indicator lights, if installed			
.8 During 10-miniute test run, check advance warning signs			
.9 If all above items complete, go into 3 color operation or turn signal into flash operation at police door (refer to Section 402.2.1.5)			
.10 If signal is in flash wait 72 hours and put into 3 color operation (refer to Section 402.2.1.5)			
.11 Remove stop signs when signal is in 3 color operation			
.12 Provide required file documentation to Ministry Traffic Engineering, Electrical and ITS Engineering, and Manager Electrical Services.			

TRAFFIC CONTROLLER DESIGN MANUAL

Section 500

TRAFFIC OPERATION GUIDELINES

Electrical and ITS Engineering

May 2019

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501 IMPLEMENTING SIGNAL TIMING PLANS

501.1 GENERAL

.1 The Ministry will create and distribute traffic signal timing plans. Timing plans w will be created and distributed for the following situations:

.1 New Traffic Controllers or Modifications to existing Controllers

.2 Observed Operational Field Problems

.3 Scheduled Roadway Maintenance

.4 New Coordination Plans

.2 Traffic controllers shall be programmed as per the timing plans issued, the Ministry programming manual for the respective controller, controller construction document, and any other documentation that may be issued from time to time.

.3 A Traffic Signal Record (TSR) Form shall be completed for the following:

.1 All timing plan changes.

.2 All new signal installations

.3 All modifications to existing signals

.4 All replacements due to Motor Vehicle Accidents

.4 A copy of the Traffic Signal Record form is included in the Appendix 500A.

501.2 TIMING PLAN / CONTROLLER DESIGN INCONSISTENCIES

.1 The Ministry shall endeavor to provide accurate signed and sealed traffic signal timing plans and controller design documentation for each new project.

.2 If documentation inconsistencies are encountered for new projects and the timing plans cannot be implemented as provided, the inconsistency shall be immediately documented in writing and forwarded to the Manager, Electrical Services for resolution; any implementation deadlines shall be extended for a period equal to the time it takes to resolve the discrepancy.

.3 The Ministry shall typically provide a complete set of documentation for each existing traffic signal. If discrepancies between the documentation and field conditions are detected, then:

.1 **Electrical Design drawings** shall be marked in red identifying any error(s). A copy of the drawings shall be sent to the Manager, Electrical Services for forwarding to the Electrical and ITS Engineering for updating. The Ministry will decide when to update and release new electrical design drawings. Some drawings may not be electronically updated until further revisions are performed at a later date.

.2 **Traffic Controller Drawings** shall be marked in red identifying any error(s). A copy of the drawings shall be sent to the Manager, Electrical Services for forwarding to the Electrical and ITS Engineering for updating. The Ministry will decide when to update and release new traffic controller drawings. Some drawings may not be electronically updated until further revisions are performed at a later date.

.3 **Loop Assignment Sheets** shall be corrected and a copy forwarded to the Manager. Electrical Services and Electrical and ITS Engineering for their records.

.4 **Traffic Signal Timing Plans** shall be marked up in red identifying any discrepancies. A copy of the marked up timing plans shall be forwarded to the Manager, Electrical Services and a Ministry Traffic Engineer. The Ministry shall issue a revised timing plan addressing any discrepancies.

502 TEMPORARY TIMING PLAN MODIFICATIONS

502.1 GENERAL

.1 The Ministry recognizes that certain field conditions are conducive to modifying timing plans in a temporary and/or immediate manner. Typical situations would include failed loops causing traffic disruptions, or adjacent construction related work affecting intersection traffic flows.

.2 In order to allow flexibility in accommodating these types of events, the following timing parameters may be altered without a Ministry Traffic Engineer issuing a new timing plan:

.1 **Maximum Green** times from a range of 50% to 200% of permanent values.

.2 **Recall** from *Off / Extendible* to *Maximum* or *Pedestrian Recall.*

.3 **Minimum Green** increased up to *Maximum Green* time (not to be used for signals that do not have alternate *Minimum Green Entry* timings programmed during pre-emption phasing).

.3 The traffic signal may also be removed from coordination for situations where the benefits of coordination have been reduced due to adjacent construction activities or failed detection.

.4 All temporary timing plan installations and removals shall be thoroughly documented and copies forwarded to the Manager, Electrical Services and a Ministry Traffic Engineer for their information (Temporary Timing Plan Modifications do not require traffic controller programming data records to be printed). The temporary timing plans shall be monitored and any remediation work expedited to remove the temporary timing plan as soon as possible.

503 CONTROLLER VOLUME LOGS AND MOES

503.1 GENERAL

.1 Some Ministry traffic controller cabinets are capable of providing volume logs and measures of effectiveness (MOEs). The logs shall be downloaded to a laptop at the controller cabinet and submitted to the Manager, Electrical Services via email.

.1 The log submitted to Ministry shall be converted into an Excel file format, with time of day volumes recorded in 15 minute intervals, and include appropriate labelling but not limited to street name, phasing, and movement/lane group (for shared lanes). See Figure 1 for example.

	STREET NAME >																									
	PHASING >																									
DATE & TIME	MOVEMENT >	NBL	NBL	NBT	NBT	NBT	NBR	SBL	SBL	SBT	SBT	SBT	SBR	EBL	EBL	EBT	EBT	EBT	EBR	WBL	WBL	WBT	WBT	WBT	WBR
08/01/2017	7:30:00 PM	6		24	33			6		34	27		6	19		58				8		65			
08/01/2017	7:45:00 PM	2		38	39			7		37	37		7	14		70				13		75			
08/01/2017	8:00:00 PM	4		42	38			8		31	28		8	15		65				8		45			
08/01/2017	8:15:00 PM	2		31	33			6		31	34		6	7		51				10		47			
08/01/2017	8:30:00 PM	3		35	44			6		29	28		6	19		52				10		55			
08/01/2017	8:45:00 PM	0		45	32			4		23	28		4	13		46				13		44			
08/01/2017	9:00:00 PM	1		57	39			5		15	20		5	17		47				3		42			
08/01/2017	9:15:00 PM	0		31	33			3		19	16		3	9		43				7		48			

Figure 1. Volume Log Example

.2 The volume collection capabilities of the controllers must be fully functional in order to collect the necessary data. If submitted volume logs indicate loop malfunctions, the field problem must be corrected and new volume or MOE information must be resubmitted (i.e. volume log and MOE submissions are considered complete only when accurate data is submitted).

TRAFFIC CONTROLLER DESIGN MANUAL

Appendix 500A

TRAFFIC SIGNAL RECORD

Electrical and ITS Engineering

May 2019

Traffic Signal Record

To: _____
Issuing Traffic Engineer

CC: Senior Traffic Control System Technologist

Manager, Electrical Services

_____

Date: _____

Traffic Signal Information

Intersection Number: 30940 - 40 - _____ - _____
Region Number

Description: _____ @ _____ _____
Major Street Cross Street Municipality

Drawing No. & Rev: TE - _____

Type of Record: ☐ Timing Revision/Signal Modification ☐ New Signal Installation

New Timing Sheet Issued Date: _____
Date

For Timing Revisions/Signal Modifications

Timing/Modification Implemented: _____ _____
Date Time

Previous Timing Sheet Issued: _____
Date

For New Installations

Signal in Flash: _____ _____
Date Time

Signal 3 Color Operation Activated: _____ _____
Date Time

Remarks

_____
Electrical Maintenance Contractor Representative