Standard Specification for
Controller Build

TTS 809.220.01   SCOPE

This specification covers the requirements for building controller cabinets – this includes the population of an empty cabinet with all necessary equipment required for the cabinet to function as indicated by the timing card – programming, configuration, testing and where applicable, temporary storage of City supplied un-programmed traffic signal controllers.

Designer to amend specification as required by the operations, this includes including of pre-emption, interconnection, communications, schematics, advanced flashing/warning beacons, and so on.

TTS 809.220.02   REFERENCES

This document refers to the following standards, specifications, or publications:

City of Toronto

Traffic Signal Operations; Policies and Strategies; Transportation Services
City of Toronto: Specifications for Traffic Control Devices

TTS 809.220.03   DEFINITIONS

For this specification, the following definitions and acronyms apply:

APS means Accessible Pedestrian Signal. APS advise pedestrians who are blind, visually impaired, or deaf-blind when they have the right-of-way to cross at a signalized intersection and in which direction they may cross the intersection.

CU means Control Unit also known as CCU. This device is the power supply and signalling interface between the intersection's Traffic Control Unit, or Controller and the APS pushbuttons.

TSP means Transit Signal Priority.

SRM means Streetcar Relay Module.

TTS 809.220.04   DESIGN AND SUBMISSION REQUIREMENTS

TTS 809.220.04.01   DOCUMENTATION

The Contractor shall be responsible for providing the following documentation:

- Controller programming sheets

- APS wiring diagram and programming sheets
- Malfunction Monitoring Unit configuration sheet

Copies of the above shall be included in the associated cabinet's storage pouch, along with the timing card and a USB memory stick containing the most recent controller database.

Additionally, copies of all of the above shall be provided to the City on a USB memory stick along with the controller database. Documentation such as programming sheets shall be provided in Microsoft Excel (.xlsx) format.

TTS 809.220.05   MATERIALS

**Designer to amend to note material supplied by the Contractor

TTS 809.220.06   EQUIPMENT – NOT USED

TTS 809.220.07   CONSTRUCTION

The Work under this item shall include:

- Pick up of City provided materials from City facilities;
- Populating the controller cabinet with all equipment such as BIUs, MMU, Detector cards, load switches, power supply, APS CCU, detection interfaces, Street Car Relay Modules and so on required to perform the functions of the timing card, this includes interconnection of all equipment;
- Programming/configuring the timer;
- Programming/configuring the modem;
- Wiring, installing and configuring APS;
- Configuring/Populating the MMU and its Compatibility Card;
- Wiring all devices within the controller cabinet (power, interface and communications); and
- Wiring the cabinet and associated equipment to meet the operational requirements of the intersection timing card.

TTS 809.220.07.01   Controller Programming

Prior to starting controller build activities, the Contractor shall meet with the City to review timing cards, review the intersections intended operation and highlight potential issues.

In addition to meeting requirements of the timing card, the Contractor shall adhere to the following:

- Min Flash (including start-up):   5
- Phases 2 and 6 should flash yellow/amber on start-up
- Auto Ped Clear/Pedestrian Clearance Protect: On
- NTCIP Back-up Time: 900
- Red Revert: 2
- Auto/Program Flash Parameters: Entry and Exit into flash operation shall be after/before phases 2 and 6 respectively. Phases 2, 4, 6 and 8 shall flash during flash operation, Phases 2/6 and 4/8 cannot flash simultaneously

- Anti-Backup/Backup Prevent shall be programmed
- Coordination Force Mode   Fixed (for fixed operations)

                                                                       Floating (for semi-actuated operations)

- Coordination Max Mode   Max inhibit

The Contractor shall program any logic scripts required for the operation and shall include the logic script in the programming sheets. The Contractor may be required to modify the above, and other controller parameters to meet the requirements of the timing cards.

APS – As required by the timing card, the Contractor shall be responsible for wiring and configuration of the City supplied CCU and interface (I/O card and harness) within the controller cabinet. The contractor shall be responsible for installation, wiring, programming and configuration of the CCU and controller to ensure requirements of the timing card are met.

All wiring, installation and configuration shall be as per manufacturer requirements.

Contractor shall provide APS wiring information as shown in the example below.

Bicycle Signals – Where bicycle signals are included as overlaps, the Contractor shall be responsible for ensuring that the cabinet is wired such that the bicycle signals switch to flash operation to correspond with flash operations of phases 1 to 8.
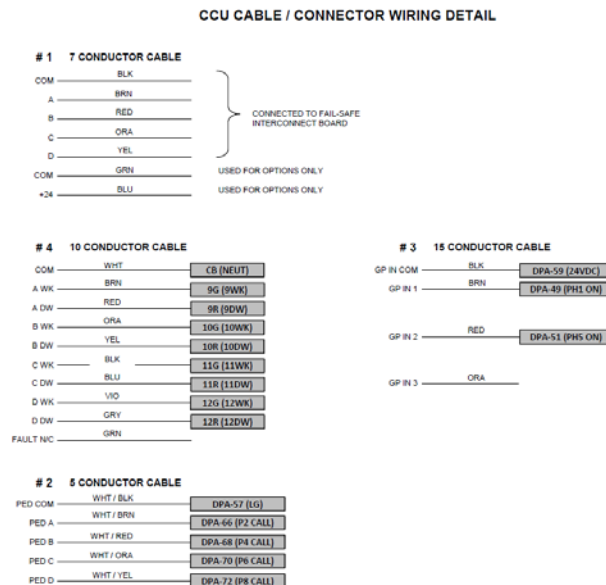
Figure 2 – CCU cable / connector wiring detail example

Contractor shall provide APS configuration sheets as shown in the Figure 3 example below.

DEFAULT and FIELD SETTINGS

CANCEL ON CLEARANCE	STREET:	N/S	N/S	E/W	E/W	N/S	N/S	E/W	E/W
	CORNER:	SEC	NEC	SWC	SEC	NWC	SWC	NEC	NWC
	ID:	A1	A2	B1	B2	C1	C2	D1	D2
	PHASE:	2	2	4	4	6	6	8	8

DEFAULTS (EFFECTIVE WITH CONFIGURATOR v1.12, Nav2 v1.17 and Nav4 v1.15)

	DEFAULTS	Field
LOCATE VOL MIN	10%	5% →
LOCATE VOL MAX	50%	40% →
INFO MSG VOL MIN	60%	
STD WALK VOL MIN	40%	
STD WALK VOL MAX	70%	
EXT WALK VOL MIN	70%	50% →
EXT WALK VOL MAX	80%	
VOL OVER AMBIENT	0 dB	
WALK MODE SOUND	STG MSG	NS NS EW EW NS NS EW EW
WALK SOUND PAUSE	.5 SEC	1SEC →
WALK SOUND TRIG	ANY PUSH	EXT. PUSH →
SOUND / VIB TIMER	FULL WALK	FULL →
SOUND / VIB RETRIG	BTN PUSH	NEW WALK →
CANCEL ON CLEARANCE	YES	
CLEAR MODE SOUND	TONE 1	
CLEAR MODE PAUSE	1 SEC	
LOCATE SOUND	TONE 1	
LOCATE TONE TIME	1 SEC	
PLEASE WAIT MSG	NO	
DIRECTION MSG	NORTH	
INFO MSG	NONE	
CANCEL ON WALK	YES	
EXT PUSH TIME	1.0 SEC	3 SEC →
SECOND LANGUAGE	NO	
THIRD LANGUAGE	NO	
EXT PUSH PRIORITY	NO	
WALK PING PONG	NO	
CLEAR PING PONG	NO	

CCU SETTINGS

	DEFAULTS	Field		DEFAULTS	Field
INPUT#1 FUNCTION	NONE	MUTE ALL	INPUT#3 FUNCTION	NONE	
INPUT#1 CONTROLS	ALL (ABCD)	C	INPUT#3 CONTROLS	ALL (ABCD)	
IN#1 VOL O-R MIN	5%	0%	IN#3 VOL O-R MIN	5%	
IN#1 VOL O-R MAX	80%	0%	IN#3 VOL O-R MAX	80%	
INPUT#1 TRIGGER	NORM OFF		INPUT#3 TRIGGER	NORM OFF	
INPUT#2 FUNCTION	NONE	MUTE ALL			
INPUT#2 CONTROLS	ALL (ABCD)	A			
IN#2 VOL O-R MIN	5%	0%			
IN#2 VOL O-R MAX	80%	0%			
INPUT#2 TRIGGER	NORM OFF				

Figure 3 – Default and field settings example

Contractor shall ensure that APS is muted when conflicting turning phases are on/active as shown in the Figure 4 example below.
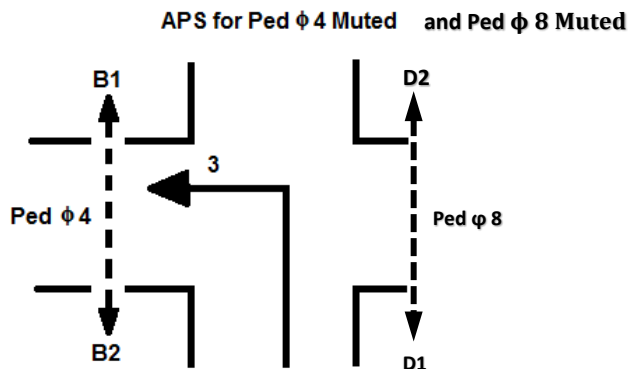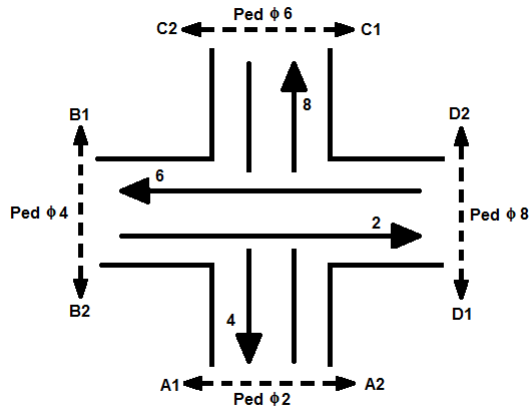

Figure 4 – APS for Ped muted 4 and 8 diameter example

Pushbuttons shall be wired/assigned as shown in the Figure 5 below – A1, A2, B1, B2, C1, C2, D1, D2 indicate pushbuttons. Note that this is a typical setup and the number of buttons may vary based on intersection configuration.

Figure 5 – Pedestrian push buttons example

TTS 809.220.07.02   Non-intrusive Detectors

As required by the timing card, the Contractor shall be responsible for wiring and configuration non-intrusive interface/detector cards within the controller cabinets. The cabinet equipment/hardware shall be tested with the non-intrusive detectors to ensure proper functionality such as wiring, installation and testing according to the manufacturer's requirements and guidelines.

TTS 809.220.07.03   Cellular Communications

The Contractor shall install the modem's antenna on the top-rear of the controller cabinet. The Contractor shall seal all holes drilled in the controller cabinet to ensure watertight connection. The Contractor shall terminate the cable (mini-coaxial) and leave 2 m of cable coiled on the top shelf of the controller cabinet.

The Contractor shall also be responsible for programming both the communications settings in the timer and in the cellular modem provided. The City shall provide the standard communications settings required to configure both the timer and the cellular modem. The City reserves the right to change the type of modem throughout the duration of the contract however, for bidding purposes; the Contractor may assume that the City is currently using the following modem make/models:

- Sierra GX400/440 series
- SixNet BT-6800 series
- MicroHard VIP4Gb
- Red Lion SN/RAM-6921-AM (5 port)

In the event that the City should change to a different model of modem, the City shall provide the Contractor with the instructions and details to program the new product accordingly at no extra cost to the City.

TTS 809.220.07.04   MMU

In addition to meeting operational and safety requirements, the following shall be adhered to:

- A green, walk or yellow cannot be on with a red on the same channel.
- A green or walk cannot be on with a yellow on the same channel.
- Field check monitoring for red, yellow and green shall be enabled.
- Red fail check shall be enabled.
- Minimum yellow plus red interval and clearance shall not be disabled.

TTS 809.220.07.05   MMU Compatibility Card

The Contractor shall wire/jumper the MMU compatibility card that is say permissive program card as described in the NEMA TS2 standards and to match the requirements of the timing card. Jumpers shall be provided and soldered as per manufacturer requirements. Jumpers shall be soldered from the back of the card.

Where jumpers have not been installed, the solder pads and holes shall be free of solder.

The Contractor shall ensure the minimum flash time is 7.

The Contractor shall disable minimum yellow change/clearance for pedestrian phases.

The Contractor shall provide documentation showing Conflict Monitor check requirements.

TTS 809.220.07.06   Wiring

The signal bus shall not be used for provision of 120VAC to cabinet equipment.

With the exception of the cellular modem, no cabinet equipment shall be powered via the cabinet's 120VAC receptacles.

Any wiring modifications to the controller cabinet required shall be approved by the City. The cabinet wiring diagram showing the modifications shall be provided to the City in editable electronic format. A copy of the modified schematic shall also be stored in the controller cabinet.

All wiring shall be neatly trained and secured, using cable ties, along the cabinet interior walls. Sufficient slack/strain relied shall be provided.

TTS 809.220.08   QUALITY ASSURANCE

TTS 809.220.08.01   Bench/Shop Testing

Prior to field installation, the Contractor shall be responsible for testing the controller cabinet and its operations with City staff. The completed cabinet shall be setup and energized at the Contractor's facilities so that City staff may attend to inspect the cabinet. The Contractor shall label the timers and modems accordingly based on the City assigned PX #.

Completed cabinet shall include established communications between the cabinet (timer) and the City head-end Traffic Control Software TransSuite.

The Contractor shall provide the City with minimum two (2) weeks-notice of when the cabinet will be made available for City to inspect.

The Contractor shall have qualified staff present for assistance in any testing, programming modifications or inspection required during the activation.

TTS 809.220.09 MEASUREMENT FOR PAYMENT

TTS 809.220.09.01 Controller Cabinet

For measurement purposes, a count shall be made of controller cabinet installed.

TTS 809.220.09.02 Controller

For measurement purposes, a count shall be made controller installed.

TTS 809.220.10 BASIS OF PAYMENT

TTS 809.220.10.01 Controller Cabinet – Item
Controller – Item

Payment at the Contract Price shall be full compensation for all labour, Equipment, and Material to do the work.