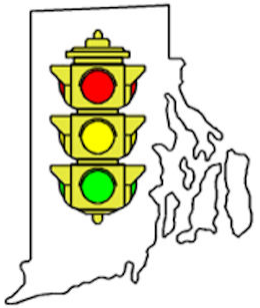
Agenda

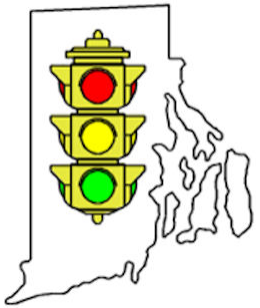


Morning

Traffic Terminology	Chuck Bluto
TS2 Cabinet Components and Operation	Chuck Bluto
Traffic Signal Phasing	Jim Decker
Ring Structure	Jim Decker
Traffic Signal Timing	Jim Decker
Understanding a Signal Plan	Gary Maccarone
Controller Programming	Gary Maccarone

Afternoon

Basic Coordination	Gary Maccarone
Basic Time of Day	Gary Maccarone
Basic Preemption/Priority	Chuck Bluto
Event/Alarm Log	Jim Decker
Troubleshooting	Jim Decker



Traffic Terminology

IDIOCY

Never Underestimate the Power of Stupid People in Large Groups.

FUTILITY

When your life reaches this juncture.

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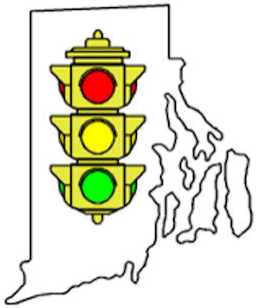
Glossary



Actuated Signal – a signal which uses vehicle detectors to vary phase timing according to demand.

Added Initial - a volume-density setting (measured in seconds), the added initial is multiplied by the number of vehicles counted during the yellow and red intervals to compute the variable initial. Typical range is 1.0 – 3.0 seconds.

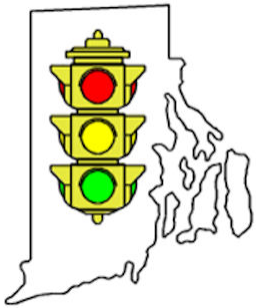
All-Red – interval during which all phases receive a red indication. The purpose of the all-red interval is to allow vehicles that entered the intersection during the yellow interval to clear the intersection before a green indication is given to a conflicting movement.

Call – a request for phase green sent to the controller by a vehicle detector or pushbutton.

Clearance Intervals – the yellow and all-red intervals after a green indication which are designed to clear the intersection of traffic before green is given to a conflicting movement.

Concurrent Phase – any phase which is allowed to be active (green) at the same time as the primary phase. Concurrent phases can not give right-of-way to conflicting movements and typically can not be located within the same controller ring (NEMA). Pedestrian phases and vehicle phases can also be concurrent provided they do not give right-of-way to conflicting movements.

Glossary



Controller - a mechanical or solid-state device which governs the operation of the signal indications.

Coordinated Operation – mode of operation whereby the phase sequencing and timing at one signal is synchronized with those of adjacent signals in order to enhance traffic flow through the system.

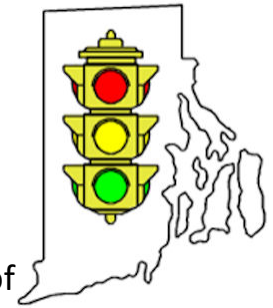
Cycle Length – the time required for a complete sequence of phases at a signal. It is typically measured as the time elapsed from the end of main street green to the end of main street green again. Cycle length remains constant with fixed-time signals but varies from cycle to cycle with actuated signals.

Detector – any hardware which detects vehicles or pedestrians and places a call for service to the signal controller. The most common type of detector is the inductive loop detector, but other types include video detection, microwave, magnetometer, and the push-button.

Detector Amplifier – a piece of hardware that detects changes in the inductance of an in-pavement loop caused by the presence of a vehicle and sends a call signal to the controller.

Detector Delay – a feature of some detector amplifiers that allows the user to program a delay period between the time a vehicle actuation is detected and a corresponding call is sent to the controller. If the vehicle vacates the detector before the delay period expires, no call will be sent to the controller. Detector delay is most commonly used in right turn lanes to allow time for vehicles to turn right on red without activating the signal phase. It should be used only with presence detectors (not passage) and with the detector memory set to “non-locking”. Detectors with delay require special cabinet wiring.

Glossary



***Detector* Switching** – the process whereby the output from a vehicle detector is re-directed from one phase to a second phase during certain portions of the cycle. The effect is that a single detector will place calls for service to different phases during different portions of the cycle. Detector switching is most commonly used on protected-permissive left turns to prevent 'back-tracking' and the creation of left turn trap.

Dilemma Zone – an area on the approach to a signal created during the yellow clearance interval in which drivers have neither enough distance to safely stop nor enough time to clear the stop line before the onset of red. The dilemma zone can be minimized through proper timing of the yellow interval.

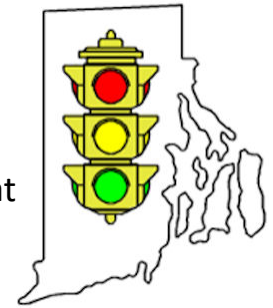
Don't Walk Interval – time period in a pedestrian phase during which no pedestrians should be in the crosswalk.

Dual Entry – Controller setting which activates a concurrent signal phase along with the called phase even if no call has been placed for the concurrent phase. For example, if dual entry is turned off and a call is placed for left turn Ø1 but no other phases, the controller will activate only Ø1. If dual entry is turned on, the controller will activate both Ø1 and the concurrent thru phase Ø6.

Flashing Don't Walk Interval - time period in a pedestrian phase which allows pedestrians already in the crosswalk to safely complete their crossing before right-of-way is given to a conflicting phase. Pedestrians should not begin a crossing during the Flashing Don't Walk interval.

Fully Actuated - A traffic signal in which all phases are equipped with vehicle detectors and activated according to demand.

Glossary



Gap - Maximum allowable time interval between vehicle actuations before the controller will terminat the green interval

Gap Out – termination of a green interval because the passage timer has reached zero. It is the termination of a green interval, before reaching the maximum green, due to lack of demand.

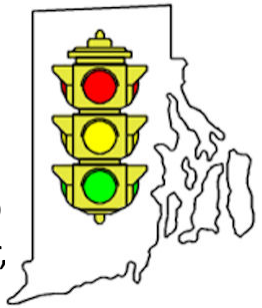
Gap Reduction – Process in volume-density module whereby the initial detector passage time is gradually reduced to a lower value (minimum gap) when there is a call on a conflicting phase. Gap reduction reduces the chance of the green being held for stragglers while vehicles wait on a conflicting phase. Gap reduction is based on passage time, minimum gap, time before reduction (TBR), and time to reduce (TTR).

Green Interval – the portion of a phase where right-of-way is given to a movement or set of movements.

Headway (Discharge) – the time interval between successive vehicles. The discharge headway for queued vehicles depends on the position of the vehicle in the queue.

Initial Green Interval – a volume-density function, it is the duration of the initial green interval provided for a given phase. The length of the Initial Green is the higher of the "Variable Initial" and "Minimum Initial" values.

Glossary



Interconnect – Hardware which allows individual signals to communicate with one another in order to facilitate coordinated operation. Typical interconnect methods include hardwire, twisted pair copper, fiber optic, and radio.

Interval - an individual green, yellow, or all-red indication within a signal phase.

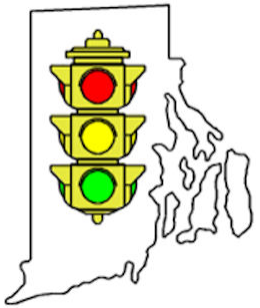
Isolated Operation – mode of operation whereby a traffic signal operates independently of any other signals in its vicinity (as opposed to coordinated operation). Signals within a coordinated system can also operate in isolated mode during certain periods of the day.

Last Car Passage – a volume-density function which allows the last vehicle to pass a detector before 'gap out' to receive the full computed passage time, even if gap reduction has reduced the passage time to less than the computed value. Last car passage should typically be set to 'active' when volume-density timing is used.

Local Controller – a unit which controls the signal indications and governs the operation of a specific signal or signals.

Locking Mode – a detector memory setting which holds calls received during the yellow and red intervals until the phase is serviced. Detector memory set to locking mode will hold a phase call even if the vehicle subsequently vacates the detector prior to receiving green. Typically used with passage detectors.

Glossary



Loop (Inductive) - continuous coil of wire installed in the pavement through which a current is run, creating an inductance. A metal object near the loop will change the inductance, allowing vehicles to be detected and a call for service placed to the controller.

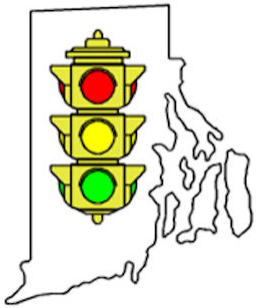
Master Controller – a unit which supervises two or more local controllers. A master controller does not perform any local signal functions (e.g., operating signal indications or controlling phase operation), but rather monitors and coordinates the operation of multiple local controllers. Typical function performed by a master controller include keeping local clocks synchronized, instructing local controllers to implement specific timing plans, monitoring overall system performance, and reporting malfunctions.

Max Green – maximum green, the programmed maximum allowable duration of a green interval. This value is programmed for each active phase. The max green period does not begin timing until a call is received on a conflicting phase.

Max2 – maximum green 2, a secondary maximum green setting which can be programmed to override the primary max green setting during certain periods of the day. It is typically used during periods of a day when significant changes in demand render the primary max green settings inefficient, such as one finds near a school or industrial facility during shift changes.

Max Recall – setting which automatically places a call on a phase whether a vehicle is present or not and causes that phase to time out to the maximum green every cycle.

Glossary



Min Recall – setting which automatically places a call on a phase whether a vehicle is present or not and causes that phase to time to at least the minimum green every cycle.

Minimum Gap - a volume–density setting, it is the minimum value to which a passage time can be reduced by the gap reduction function.

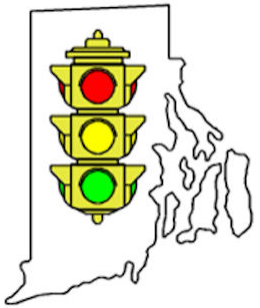
Minimum Green – the minimum duration for a green phase once it has been activated. The controller will hold a green indication for the minimum green period whether demand is present or not.

Minimum Initial - a volume-density setting, the minimum duration of green that must be displayed for a given phase. The Minimum Initial may be superseded if the computed Variable Initial value is higher, but the initial green displayed may never fall below the Minimum Initial.

Non-Locking Mode - a detector memory setting which will hold calls only while the vehicle remains on the detector. Detector memory set to non-locking mode will drop a call if the vehicle vacates the detector prior to receiving green. Typically used with presence detectors, it allows the controller to drop a call if a vehicle turns right on red or clears the intersection during the yellow.

Overlap Phasing – a signal phase which runs concurrently with other phases and is wholly dependent on those phases for its activation and duration. An overlap phase has no detectors and no phase timing parameters of its own.

Glossary



Passage Time – the amount of time the green interval is extended for a vehicle actuation. If the controller receives another vehicle actuation before the passage time has expired, the passage timer will be reset to the passage time. The passage time is programmed in the controller and typically ranges from 2.0 sec. to 6.0 sec.

Pedestrian Clearance Interval – interval during which pedestrians who have already entered the crosswalk are allowed to complete their crossing. If pedestrian heads are provided, this is the 'Flashing Don't Walk' interval. If pedestrian heads are not provided, this is a portion of the vehicle green phase.

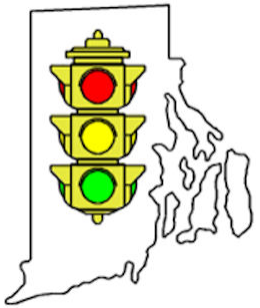
Pedestrian Recall – a controller function which activates a given pedestrian phase every cycle, whether there is pedestrian demand or not.

Phase – a complete sequence of green, yellow, and all-red intervals serving a specific movement or set of movements.

Pre-Emption – function whereby normal signal phase sequencing and timing is interrupted to give priority to the movement of specific vehicle, such as a train, emergency vehicle, or transit vehicle. Once the vehicle has passed, the signal returns to normal operation.

Pre-Timed Operation – mode of signal operation whereby the sequence and timing of phases is fixed. Pre-timed signals will operate on a cycle length that does not vary.

Glossary



Recall – actuated signal function whereby a phase (pedestrian or vehicle) is activated every cycle whether there is demand present or not.

Red Clearance Interval – interval during which all signal indications on all phases are red. It is designed to allow vehicles that have entered the intersection during the yellow clearance interval to clear the intersection before green is given to a conflicting phase.

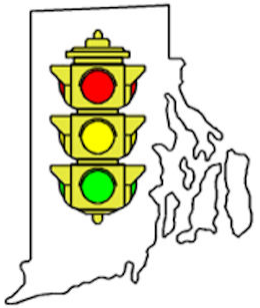
Red Revert - minimum amount of time that a red indication for a given phase must be displayed before green can be given to that same phase. When a signal is programmed to 'rest in red', it is possible for the indications on a given phase to clear directly from yellow back to green on that phase without ever having displayed red. The red revert setting prevents this from occurring. Typically set to 2.0 seconds.

Rest (Green) – period during which, in the absence of calls on a conflicting phase, a phase will remain in green without timing to the maximum green setting. A phase can rest in green indefinitely if there are no calls (or phase recalls) on conflicting phases.

Rest in Red – setting whereby in the absence of vehicle calls (or phase recalls) a signal will return all phases to red and wait for the next vehicle call. It can minimize delays during periods of low demand.

Semi-Actuated – mode of operation whereby only minor street and left turn phases are actuated. Main street thru phases are not actuated and are instead placed on recall. Typically used when mainline volumes are high and side street volumes are low.

Glossary



Signal Indication – any individual red, yellow, green, walk or don't walk indication given to vehicles or pedestrians.

Simultaneous Gap - function whereby two associated signal phases must gap out simultaneously in order to clear to yellow. It is typically used on mainline phases (2+6) in order to improve dilemma zone protection. Without simultaneous gap logic, if phase 2 gaps out before phase 6, the signal will wait for phase 6 to gap or max out, regardless of any new demand on phase 2. With simultaneous gap logic, the passage timers will be reset for any new demand until both phases gap out at the same time.

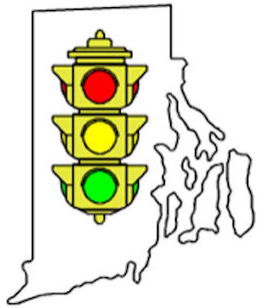
Soft Recall – controller setting whereby a phase will be activated only if there are no calls on other phases. Use of this setting is generally discouraged by ALDOT.

Split – portion of total cycle time devoted to an individual phase (expressed in percent or seconds).

Time Before Reduction (TBR) - a volume-density setting, it specifies the minimum amount of time that the full programmed passage time should be used before gap reduction is begun.

Time to Reduce (TTR) – time period over which the passage time is linearly reduced to the programmed minimum gap setting.

Glossary



Variable Initial – a volume density function, it is the initial green interval computed based on the number of vehicles which arrive on that approach during the yellow and red phase intervals. It is computed by multiplying the "Added Initial" by the number of vehicles counted during the yellow and red intervals. The higher of the "Variable Initial" and "Minimum Initial" values is used as the Initial Green.

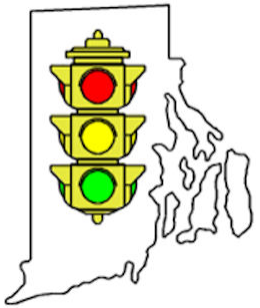
Volume-Density Mode – mode of detection which performs two functions: 1) it adjusts the initial green interval based on the number of vehicles queued on a given approach, and 2) reduces the allowable gap in traffic over time when a vehicle is waiting on a conflicting phase. The purpose is to enhance operating efficiency by setting the initial green only as long as needed, and preventing the specified phase from holding for excessively long periods when vehicles are waiting on a conflicting phase.

Walk Interval - interval during which pedestrians waiting on the curb may enter the crosswalk and begin a crossing.

Yellow Clearance Interval – interval following the phase green signaling the assignment of right-of- way to another conflicting phase.

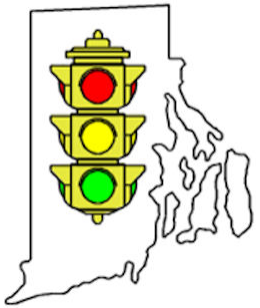
DESPAIR

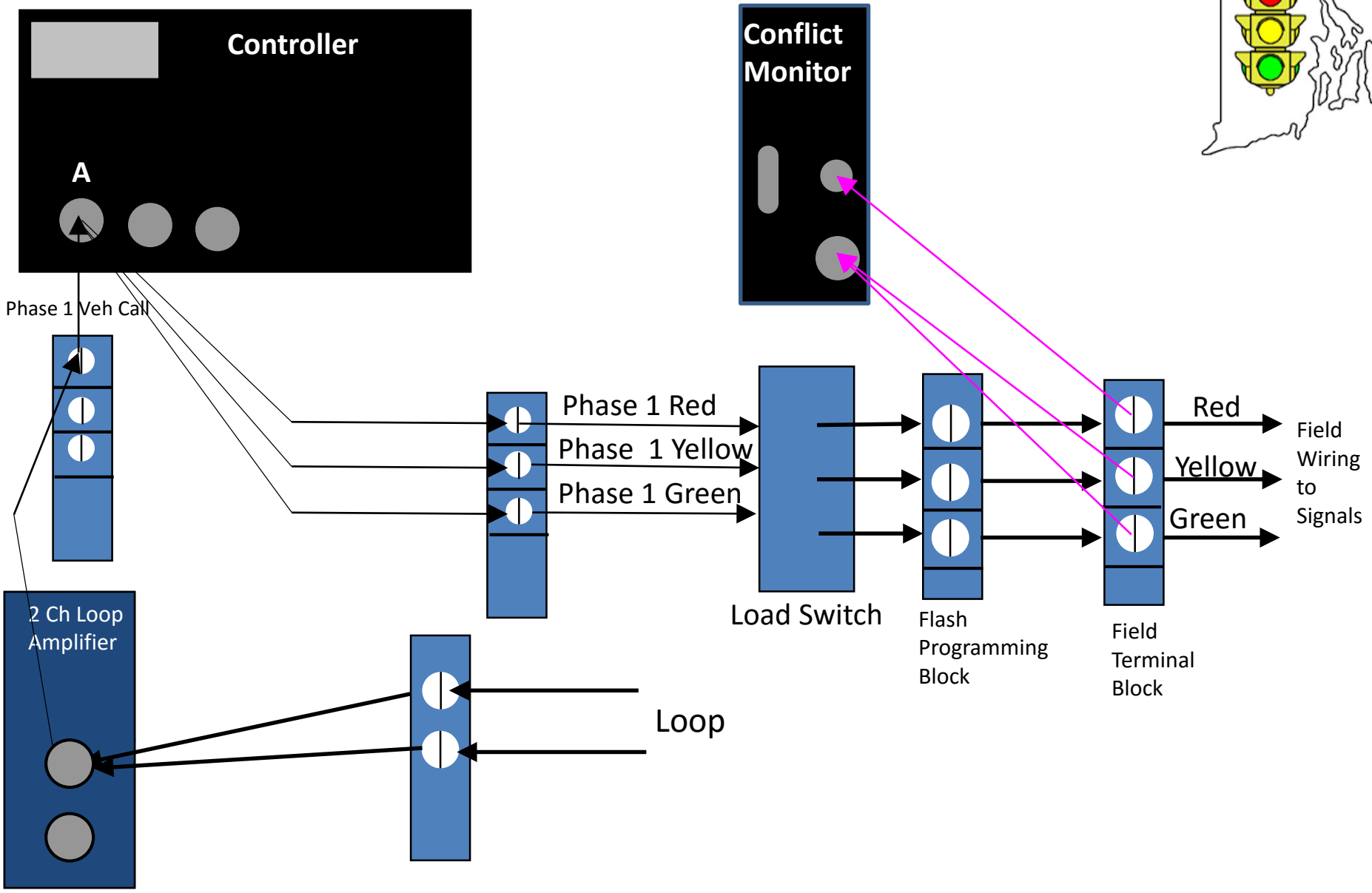
It's Always Darkest just Before it goes Pitch Black.



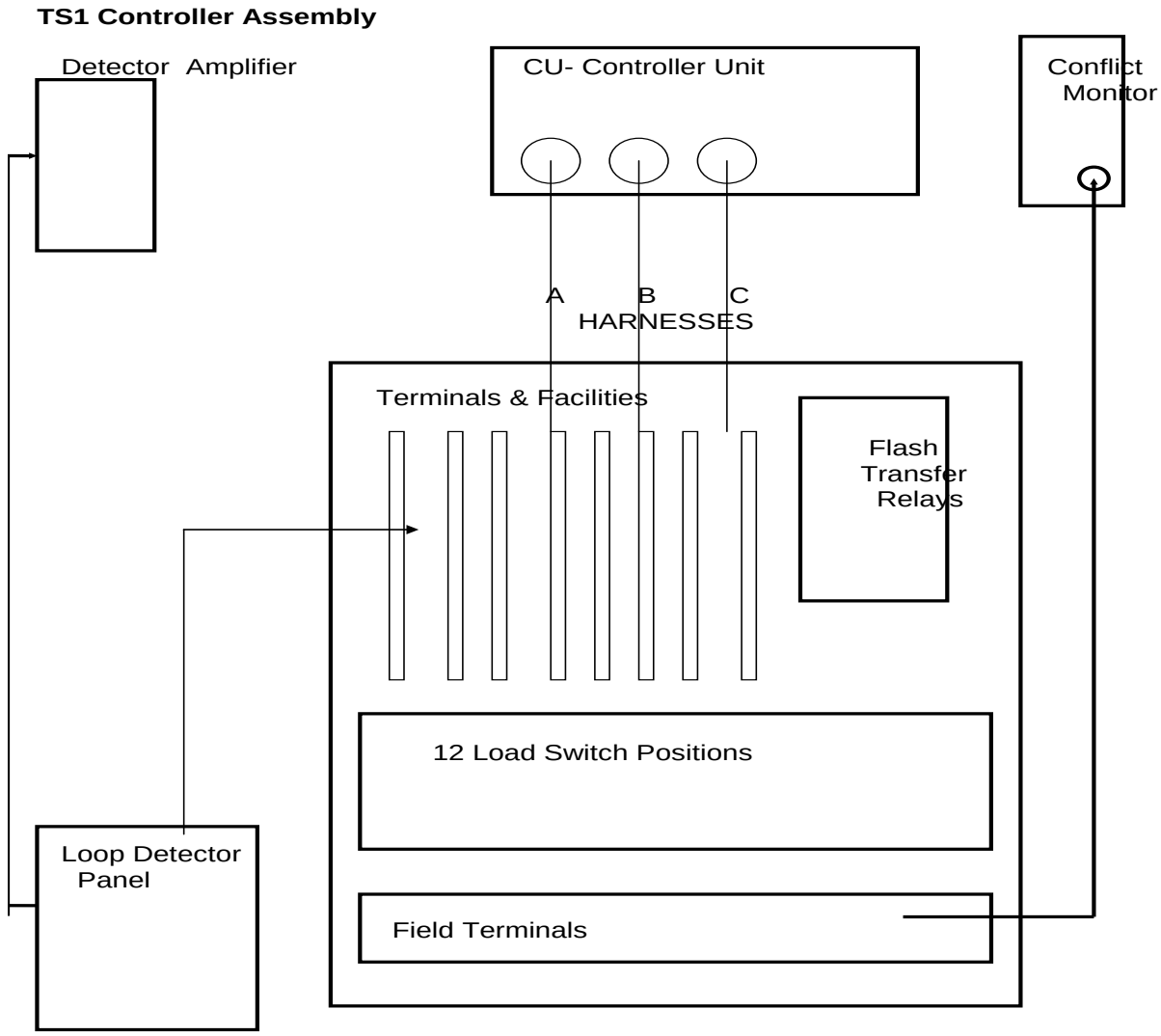
NEMA TS2 Controller Assembly

NEMA TS1 Assembly

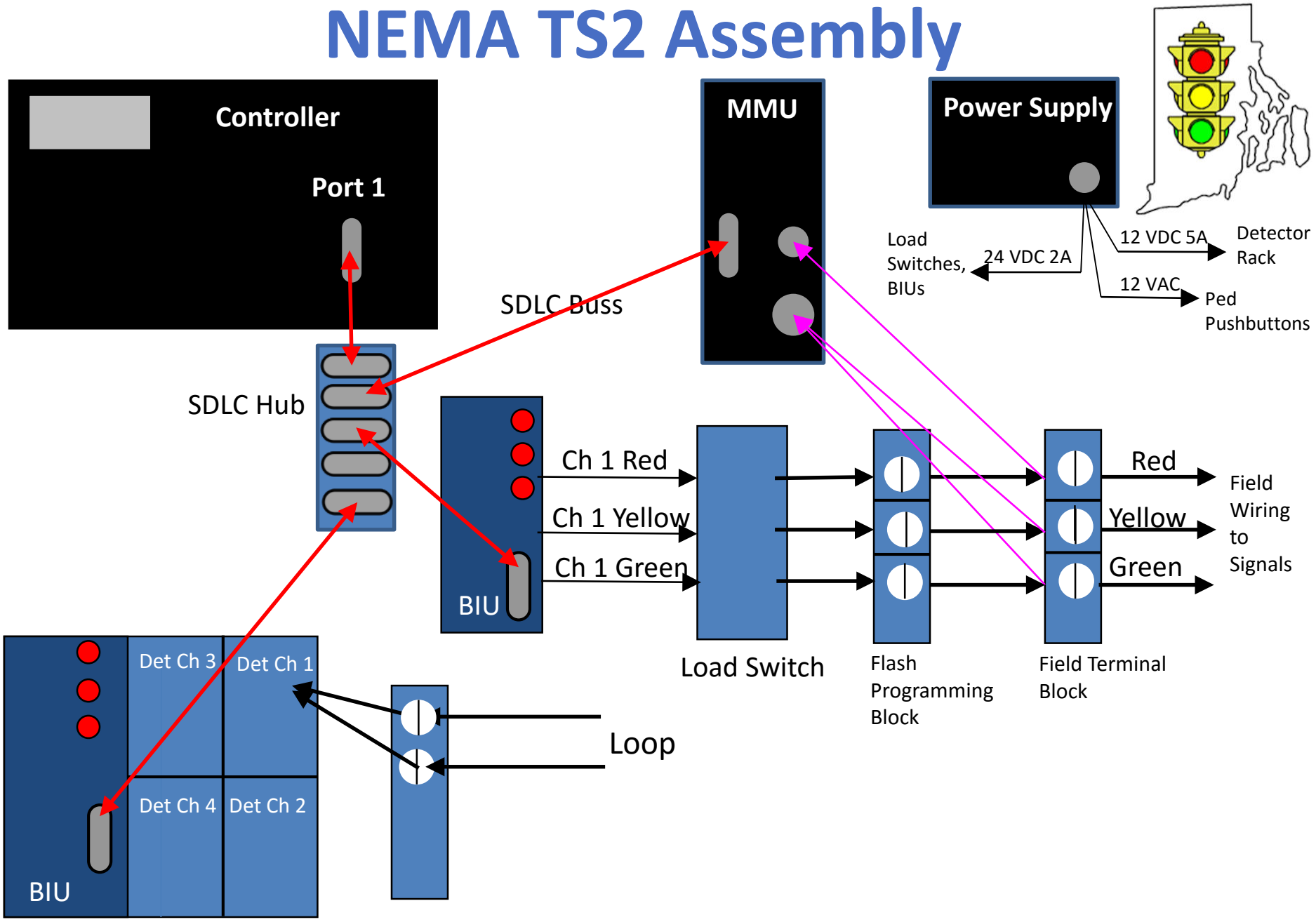




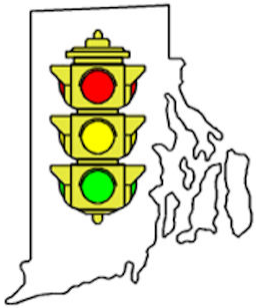
NEMA TS1 Assembly



NEMA TS2 Assembly



NEMA TS2 Addressing



Controller

Port 1

MMU

MMU Address 16

SDLC Buss

SDLC Hub

Load Switch

Flash Programming Block

Field Terminal Block

Ch 1 Red

Ch 1 Yellow

Ch 1 Green

Red

Yellow

Green

Field Wiring to Signals

BIU

Detector 1 Channels 1-16 Address 8

Detector 2 Channels 17-32 Address 9

Det Ch 3

Det Ch 1

Det Ch 4

Det Ch 2

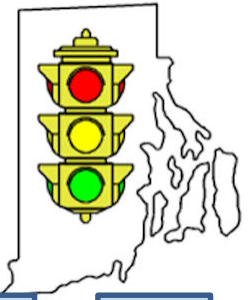
BIU

Loop

T&F # 1 Load Switches 1 through 8-Address 0

T&F # 2 Load Switches 9 through 16-Address 1

TS2 Output Channel Mapping



Vehicle Phase 1 → Output Channel 1 → Load Switch LS1
Vehicle Phase 2 → Output Channel 2 → Load Switch LS2
Vehicle Phase 3 → Output Channel 3 → Load Switch LS3
Vehicle Phase 4 → Output Channel 4 → Load Switch LS4
Vehicle Phase 5 → Output Channel 5 → Load Switch LS5
Vehicle Phase 6 → Output Channel 6 → Load Switch LS6
Vehicle Phase 7 → Output Channel 7 → Load Switch LS7
Vehicle Phase 8 → Output Channel 8 → Load Switch LS8

SDLC Buss

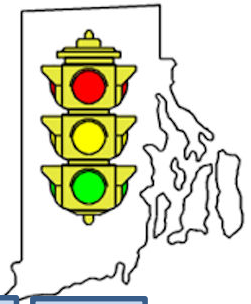
T & F #1 BIU - Address 0

Pedestrian Phase 9 → Output Channel 9 → Load Switch LS9
Not Used → Output Channel 10 → Load Switch LS10
Overlap A → Output Channel 11 → Load Switch LS11
Overlap B → Output Channel 12 → Load Switch LS12

T & F #2 BIU – Address 1

R Y G

TS2 Detector Channel Mapping



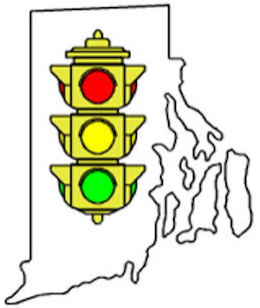
Phase 1	Phase 6	Phase 6	Phase 5	Phase 2	Phase 2	Phase 3	Phase 8	Phase 8	Phase 7	Phase 4	Phase 4	Phase 1	Phase 1
Detector Channel 1	Detector Channel 2	Detector Channel 3	Detector Channel 4	Detector Channel 5	Detector Channel 6	Detector Channel 7	Detector Channel 8	Detector Channel 9	Detector Channel 10	Detector Channel 11	Detector Channel 12	Detector Channel 13	Detector Channel 14

SDLC Buss

Detector 1 BIU - Address 8

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

TS2 Parts



Controller Unit

Malfunction Management Unit - MMU

Buss Interface Unit - BIU

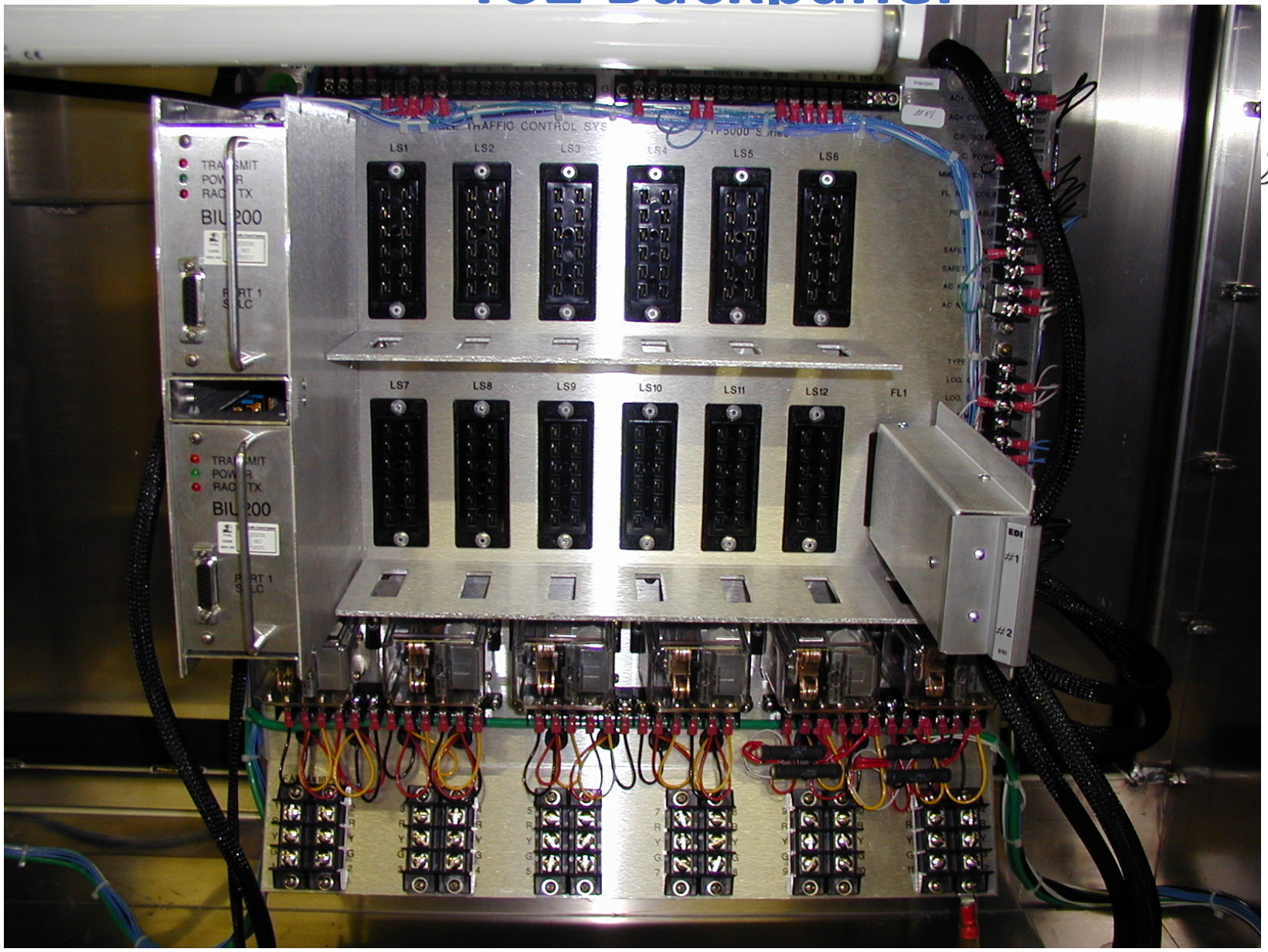
SDLC Buss/ Hub

Terminal & Facilities T&F #1

Detector Rack

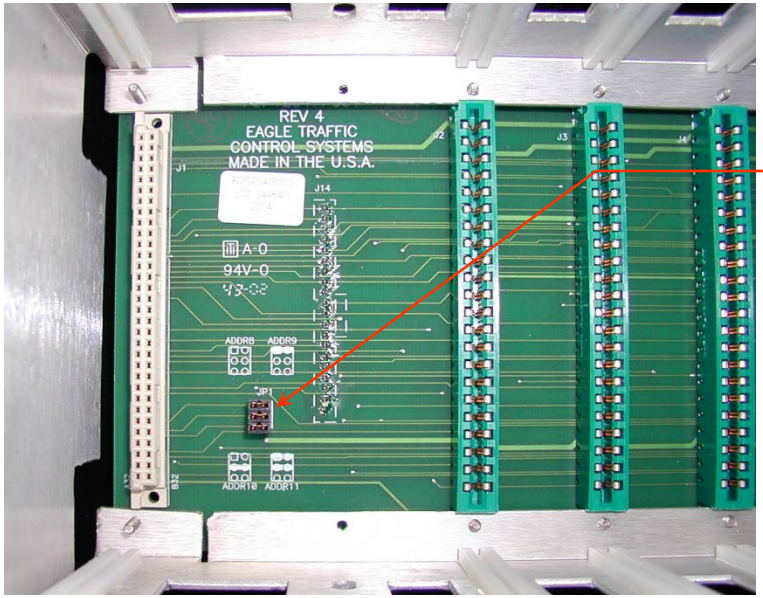
External Power Supply

TS2 Backpanel



SDLC Hub

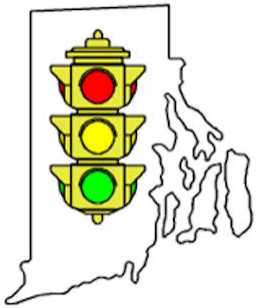
Detector Rack Addressing



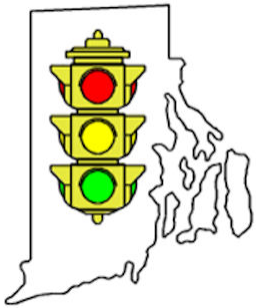
Detector Rack BIU Addressing Jumpers

Each detector rack can be set to address 8, 9, 10, or 11

Detector Rack Addressing



Questions???



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