MODEL 920
VERSION 21

TS-1 Traffic Controller
Operation Manual

11/23/98

Manual Part Number: 50091-9100

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1.1 SPECIFICATIONS

DESCRIPTION:

The Naztec SERIES 900-V21 Controller is based on the NEMA standard TS1-1989. The SERIES 900-V21 Controller contains the Z80180 ZILOG microprocessor operating at a speed of 9.8304 MHz. Its unique compact design, all CMOS ICs, minimal chip count and linear power supply make the SERIES 900-V21 Controller one of the most advanced, reliable, and low maintenance Traffic Controllers available.

FEATURES:

EASILY SERVICED	The compact SERIES 900-V21 contains only a Front Panel Input / Output board, a CPU board and an open frame Linear Power Supply module. The 2 board construction and socketed ICs, with Component IDs clearly printed, allows for easy access for service and trouble shooting. No special tool or extender card is needed.
BARRIERS	Unique to the Naztec traffic controller product line is the flexibility of user programmable barriers. Four (4) separate barriers allow programming for applications from one (1) to eight (8) phases in each barrier.
DATA RETENTION	All data entries, except the Real Time Clock, are stored in EEPROM so that no data is lost during power off.
DISPLAYS	A back-lighted 4 line by 40 character LCD display provides full menu screens for ease of data entry. The display maintains optimum contrast and brightness over the full NEMA temperature range by special temperature compensating circuitry. The menu-driven format and context-driven help screens eliminate the use of special codes and the need for front panel identification characters.
KEYBOARD	20 position keyboard with 4 red function keys, 6 grey cursor movement keys, and 10 white digit keys with built in audio/tactile feedback
REAL TIME CLOCK	The real time clock maintains accurate timing by utilizing a "super capacitor" which allows accuracy of 0.005% during a 24 hour time period. Retention time during power failures for the real time clock is a minimum of 14 consecutive days and can be configured to a longer period.

FLASH PROMS
1. A means to load the program into the computer using the serial port. One this is in place, all new revisons and features can be upgraded with out changing proms.

SELF TEST
1. Built in diagnostic programs allow the operator to check input and output signals on all connectors. (Including connector D for units with Preemption and Coordination.)
2. RAM and EPROM Tests
3. Built in EEPROM Eraser
4. Back Up Program Values

1.2.0 INTRODUCTION

The SERIES 900-V21 is a NEMA Traffic Controller which is designed to provide semi or full actuated control for the simplest or most complex intersections. The controller is based on the NEMA standard TS1-1989, parts 2, 13 and 14.

The SERIES 900-V21 controller is designed to be very user friendly and utilizes a four line by forty character Liquid Crystal Display that addresses the user with traffic terminology and descriptive mnemonics to describe the features and functions. The controller's data memory is EEPROM which means that all entries stored are maintained with power off. All operator entries are made through a 20 position front panel keyboard.

All SERIES 900-V21 NEMA Traffic Controllers are equipped with a set of built in diagnostics which allow the field technician to easily verify the timer's operation. The diagnostics along with wrap around connector adaptors which check for functioning of the I/O circuitry, EPROM, RAM, and internal timer operations.

The SERIES 900-V21 controller contains the capability of operating as secondary for the Naztec System Master Software Package. This would require the operation of only one of the two communication ports available on the SERIES 900-V21 controller. The controller is also capable of being configured as an arterial master in which utilization of both communication ports would be needed. One port for access to the secondaries in the system, and the other port for direct access to a modem or direct communication line to a PC. When operating as a master, the controller also controls the signals at the intersection at which it is located.

The innovative hardware and software in the Naztec SERIES 900-V21 controller provides the user with one of the most efficient and flexible traffic control systems available in todays market.

2.0 FUNCTIONAL CHARACTERISTICS

This section will describe the operational features of the controller. Parts of this Section describe the standard NEMA features under TS1-1989. Other sections describe functions in the controller which exceed the NEMA Standard. The last three sections address the operation of the controller applications not covered by the NEMA standards.

2.1 Standard NEMA Characteristics

The SERIES 900-V21 NEMA Traffic Controller contains two timing Rings with both Rings containing 4 phases. The NEMA characteristics are divided into three groups: per Phase, per Ring, and per Unit.

2.1.1 Characteristics per Phase

Time Settings

The duration of each interval is set with the front panel keyboard and has the following ranges:

TABLE 2.1
Time settings phases

Code	Interval	Range	Resolution
01	Minimum Green	0-99 sec.	1 sec
02	Preset Gap	0-9.9 sec.	.1 sec
03	Maximum I	0-99 sec.	1 sec
04	Maximum II	0-99 sec.	1 sec
05	Yellow	0-9.9 sec.	.1 sec
	(If pencil SW7 On)	3-9.9.sec.	.1 sec
06	Red	0-9.9 sec.	.1 sec
07	Walk	0-99 sec.	1 sec
08	Ped Clearance	0-99 sec.	1 sec
09	Added Initial	0-9.9 sec.	.1 sec
10	Time To Reduce	0-99 sec.	1 sec
11	Time Bef. Red.	0-99 sec.	1 sec
12	Minimum Gap	0-9.9 sec.	.1 sec
13	Maximum Initial	0-99 sec.	1 sec
14	Walk 2	0-99 sec.	1 sec
15	Ped Clearance 2	0-99 sec.	1 sec
16	Maximum III	0-99 sec.	1 sec
17	Max Extension	0-99 sec.	1 sec

Phase Intervals

Actuated Green without Density

Without density features the Green interval will vary upon vehicle actuations. The length of this interval is limited by the Maximum Green time, which begins timing when the Green of the phase is started and a serviceable conflicting call is present.

The phase can be terminated by the Maximum Green time-out if the Minimum Green interval has been completed. Three time settings are provided to determine the Green interval of an actuated phase without density features.

(1) Minimum Green - The first timed portion of the Green interval which can not be terminated before its time has timed out, even by a force off input.

(2) Preset Gap - The extendable portion of the Green interval is a function of the vehicle actuations that occur during this interval. The phase remains in this interval as long as the Gap timer does not expire. The timer is reset with each actuation and begins timing when the actuation is removed. This operation continues to extend the green, subject to the limit of the Maximum Green time.

(3) Maximum Green - This setting determines the maximum length of time the phase may be held Green in the presence of an opposing serviceable call. In the absence of a serviceable conflicting call, the Maximum Green timer remains reset.

(4) Maximum Extension - This entry allows Max 1 or Max 2 to extend to a Maximum 3 time by intervals defined under the Maximum Extension time entry. This feature is programmable on a per phase basis.

If the green of a phase is terminated on two consecutive cycles because of a vehicle extension Max-Out, then the Max time in operation is extended by the time setting in the Maximum Extension. The Max time in operation increases by the Maximum Extension time each time the phase is Maxed-Out once the Maximum Extension becomes active. The Max 3 setting limits the Maximum Extension additions. The Maximum Extension is terminated once the total time has reached the Max 3 time setting.

NOTE: In order for the Maximum Extension to operate properly, the Max 3 setting must be greater than Max 1 or Max 2.

If the phase or phases gap out on two consecutive cycles, the Max timer is reset. If the Max 3 setting is equal to zero or the Maximum Extension setting is equal to zero, then the Maximum Extension function is inactive.

Actuated Green with Density

In addition to the Minimum Green, Preset Gap, and Maximum Green timing, Density features are provided for each phase, including Variable Initial and Gap Reduction. The Initial timing may be increased as a function of the number of vehicles stored on the phase while its signal is not Green.

During the extendable portion, the allowable Gap time is decreased as a function of the time vehicles are waiting on an opposing phase.

(1) Variable Initial - The Variable Initial timing is determined by two time settings

(a) Minimum Green settings determine the minimum Variable Initial time.

(b) Added Initial (per actuation) determines the time by which the Variable Initial time is increased from zero for each vehicle actuation received during the Yellow and Red intervals.

(c) Maximum Initial settings limit the variable initial time, except that the Minimum Green time may not be shortened by this setting.

(d) The Initial green time is equal to Added Initial (per actuation) times the number of actuations received during the Yellow and Red intervals, subject to limitation by Maximum Initial, and is never less than the Minimum Green setting.

(2) Gap Reduction - The Gap Reduction feature has the following settings:

(a) The Time Before Reduction setting begins timing when the phase is Green and there is a serviceable conflicting call. During this time, the Gap is reduced.

(b) The Time To Reduce setting sets the time required to reduce from the Preset gap to the Minimum Gap.

(c) The Preset Gap is the amount of time allowed between vehicle actuations to maintain the Green interval, prior to the start of Gap Reduction.

(d) The Minimum Gap is the amount of time allowed between vehicle actuations to maintain the Green interval, at the completion of Gap reduction. The allowable Gap is linearly reduced, from the Preset Gap to the Minimum Gap in the time programmed under Time To Reduce.

Pedestrian Timing

Concurrent pedestrian timing is permitted for each phase with any mode of vehicle signal timing. Two separate pedestrian timings are available.

(1) Walk and Walk 2 - This setting controls the time duration that the Walk output is active.

(2) Ped Clear and Ped Clear 2 - This setting controls the time duration of the Pedestrian Clearance output and the flashing period of the Don't Walk output.

When a pedestrian call is stored in memory for any phase, the pedestrian timing begins when that phase enters the Green interval if the Pedestrian Omit input is not active. The pedestrian outputs can be recycled if there is no serviceable conflicting call and a Pedestrian Omit input is not active.

Non-Actuated Phase Operation

Non-Actuated operation is activated by either the Call to Non-Actuated Mode inputs having a demand placed on them or by the internal commands calling for the Non-Actuated Mode. The Non-Actuated mode is considered to have four Green states.

(1) State A is the minimum timing state. The duration of this state is determined by the Walk or Walk 2 setting. Signal indications during this state are Green and Walk.

(2) State B will immediately follow the minimum timing state. The controller will dwell in this state in the presence of the Hold input, or if the Walk Rest Modifier input is active and no serviceable call exists. Signal indications are the same as State A. The controller will not leave this state unless the Hold input is inactive, or a serviceable conflicting call exists and the Force Off input is active.

(3) State C is the Pedestrian Clearance interval, during which time the Ped Clear or Ped Clear 2 times and the Don't Walk output flashes. The duration of this state is determined by the Ped Clear or Ped Clear 2 time setting.

(4) State D is a Green Dwell/Select state from which the controller selects the next phase to be serviced. During this state, signal indications are Green and a steady Don't Walk. If a serviceable conflicting call does not exist, and the Pedestrian Recycle or Walk Rest Modifier input is active, the phase will return to State A and service the Walk or Walk 2 again. If a serviceable conflicting call does not exist and neither of these inputs are active, the controller will remain in State D. When in state D, if a serviceable conflicting call exists, the controller will terminate the phase. The duration of the Green interval is never less than the Minimum Green setting.

If the sum of the Walk or Walk 2 time setting, the duration of Hold state, and the Ped Clear or Ped Clear 2 time setting is less than the Minimum Green setting, the controller will remain in state D until the Minimum Green timer expires, and the signal indications will be Green and steady Don't Walk.

Termination of Green Timing

Termination of the Green interval occurs in response to at least one of the conditions:

(1) Application of the Interval Advance input when timing the last portion of the Green interval.

(2) Application of the Interval Advance input when Manual Control Enable is applied.

(3) Initial including variable portion completed, pedestrian service completed, a serviceable conflicting call or red rest input, and one of the following:

(a) Preset Gap timed out without Hold
(b) Reduced Gap timed out without Hold
(c) Maximum Green termination without the Hold input applied.
(d) Force Off applied.

Vehicle Clearance Intervals

Following the Green interval, the controller provides a Yellow Clearance interval, the duration of which is determined by the Yellow Clearance time setting for the phase. During this interval, the signal indications are Yellow and flashing Don't Walk.

Following the Yellow interval is a Red Clearance interval, the length of which is determined by the Red Clearance setting. During this interval, the signal indications are Red and a steady Don't Walk, and no Green indication is shown to any conflicting phase. This interval may be omitted by entering a time setting of zero in the red clearance interval for that particular phase or by activating the Omit Red Clearance input.

Phase Selection Points

The phase next to be serviced is determined at the end of the Green interval of the terminating phase, if possible. If the determination cannot be made at this time, it is not made until after the end of the vehicle clearance intervals.

Storage of Demand

A call for vehicle service may be stored when the phase is not displaying a Green indication. This memory feature may be disabled from the keyboard. A call for pedestrian service can be stored only when the phase is not displaying a Walk indication.

Maximum Recall

A keyboard entry may be made to place a call on a phase so that the Green interval is extended to the maximum. When selected, the maximum timing begins as if there is always a serviceable conflicting call, but the phase will not terminate unless there is an actual serviceable conflicting call.

Minimum Recall

A keyboard entry may be made to place a recurring demand for vehicle service on each phase when the phase is not in its Green interval.

Pedestrian Recall

A keyboard entry may be made to place a recurring pedestrian demand on each phase, which functions identical to an external pedestrian call, except that the pedestrian service is not recycled as a result of this entry until an opposing phase is serviced.

Per Phase Inputs

(1) Vehicle Detector Call - places a demand for vehicle service on the associated phase.

(2) Pedestrian Detector Call - places a demand for pedestrian service on the associated phase.

(3) Hold - This input retains the existing right-of-way and has different controller responses, dependent upon operation in the actuated or Non-Actuated mode. The operation is described in the following paragraphs:

For a Non-Actuated phase, application of the Hold will maintain the controller in the timed out Walk interval with a Green and Walk indication. Removal of the Hold input with the Walk interval timed out causes the controller to advance into the Pedestrian Clearance interval. Application of Hold during any other interval has no effect on the controller.

For an Actuated phase, application of the Hold input allows the controller to time normally but inhibits advance into the Yellow Clearance interval. Application of Hold also inhibits the recycling of the pedestrian service unless the Pedestrian Recycle input is active and a serviceable pedestrian call exists on the phase. With the Hold input applied, the controller will rest in Green and Don't Walk.

Removal of Hold allows the controller to advance into the Green Dwell/Select state when all Green portions are timed out.

Removal of Hold with all intervals timed out allows the controller to recycle the Walk interval in the absence of conflicting calls if a pedestrian call exists for the active phase. When a serviceable conflicting call exists the controller will advance to the Yellow Clearance interval.

(4) Phase Omit - This input, when active, causes the phase to be omitted even when a demand for the phase is present. The phase will be omitted until the signal is removed. The phase omitted does not present a conflicting call to any other phase.

(5) Pedestrian Omit - This input, when active, causes the pedestrian movement of the associated phase to be omitted while the vehicle movement for that phase is unaffected. It has no effect on a phase that is already timing a pedestrian movement and allows the pedestrian calls to be stored in memory.

Per Phase Outputs

(1) Vehicle Load Switch Drivers - Green, Yellow and Red output drivers are provided for each phase.

(2) Pedestrian Load Switch Drivers - Walk, Pedestrian Clearance, and Don't Walk output drivers are provided for each phase.

(3) Check - One Check output is provided per phase to indicate the call status of that phase. It is active when the controller is not in the Green interval of that phase and a call is present. Phase Omit or Pedestrian Omit has no effect on the Check output.

(4) Phase On - One Phase On output is provided per phase to indicate the controller is timing the Green, Yellow, or Red intervals of that phase.

(5) Phase Next - This output is active when the controller is committed to serve that phase and remains active until the phase becomes active.

This output becomes active at the end of the Green of the terminating phase, or, if the phase next decision cannot be made at that time at the end of the Red Clearance interval of the terminating phase.

2.1.2 Enhanced Characteristics per Phase

The SERIES 900-V21 controller contains some features which exceed the NEMA Standard. The characteristics described in this section allow the NEMA timer to execute its normal timing but modify its operating procedure slightly.

Barriers

A timing Ring contains 4 phases which have a priority sequence of 1,2,3,4,1,2, etc. for Ring 1 and 5,6,7,8,5,6, etc. for Ring 2. When concurrent timing of the two rings is allowed, a barrier is utilized to determine the compatibility of phases in ring 1 with Phases of Ring 2 since both Rings time simultaneously.

In the SERIES 900-V21 there are 4 barriers which have a sequence of priority similar to that of a Ring. Also, the barrier operates with the same Ring rules in that a barrier without a call present will be skipped. Phases programmed within a barrier still follow the Ring rotation sequence, except that when the last phase in the sequence times it will check to see if there is another barrier requesting service. If no calls exist outside the active barrier, phases inside the active barrier will continue to sequence according to the calls and the rotation. Leaving the barrier is only considered when the last phase in sequence in that barrier has timed its Green Interval and a call exists beyond the barrier.

The standard 8 phase assignment is made by placing phases 1,2 of Ring 1 in the same barrier as phases 5,6 of Ring 2. Also, phase 3,4 of Ring 1 are placed in the barrier with phase 7,8 of Ring 2. The other two barriers do not contain any phases. The standard 4 phase assignment is made by placing phase 1,2,3,4 of Ring 1 in the same barrier and none of the Ring 2 phases.

It is possible to program the same phase in multiple barriers, but the operator must be aware that a Green phase does not place an active barrier call. These programmable barriers can be overidden by fixed barriers as programmed by the setting of pencil switches 1 and 2 as described in the appendix.

Phase Omit Entry - The standard SERIES 900-V21 is either a 4 Phase or 8 Phase unit. It provides a keyboard entry to program a continuous Phase Omit. This allows phases to be omitted when less than standard number of phases are required.

Flashing Walk - In normal operation the Walk output is continuously active when in the Walk Interval. Occasionally it is desired to flash the Walk indication when the pedestrian movement is subjected to vehicular traffic turning across the crosswalk. For such cases, a keyboard entry is provided on a per phase basis.

Rest in Walk - This keyboard entry allows the controller to rest in the Walk Interval after timing the interval in the absence of a serviceable conflicting call. Programming this feature requires the timing of the pedestrian clearance interval prior to servicing a conflicting call.

Pedestrian Clearance Protect - A keyboard entry which will prevent the termination of the Pedestrian Clearance interval when the Interval Advance is applied with Manual Control Enable active unless the pedestrian clearance interval has completed its timing. When this feature is inactive, the timer responds according to TS2-1989.

Select Maximum II - This keyboard entry allows the Maximum II value to be used in the Maximum timer in place of the Maximum I time.

Last Car Passage - Last Car Passage is used in Density Operation only. When a phase terminates due to a Gap out, the phase will continue to display Green after the Gap out occurs for a time equal to the difference between the Preset Gap time and the reduced Gap time, if the Last Car Passage is enabled by the keyboard entry. This entry allows the phase to display Green for one entire Preset Gap time after the last vehicle actuation is removed from the vehicle call input. During Last car Passage, subsequent calls will not re-extend the phase, but will be retained in the vehicle detector memory. If Last Car Passage is not enabled, the Green indication will terminate when Gap out occurs.

Simultaneous Gap-Out - When operating in the Dual-Ring mode, a phase that gapped out with the next serviceable conflicting call being across the barrier will lock in a Green Dwell/Select state, and remain so until the phase timing in the other Ring reaches its Green Dwell/Select state due to Gap out or Maximum termination. Subsequent actuations on the Gapped out phase will have no effect, as long as a serviceable conflicting call exists. The SERIES 900-V21 Controller provides a keyboard entry for each phase called Simultaneous Gap-Out. With this feature enabled, a phase that has gapped out as described may be re-extended out of its Green Dwell/Select state, thus maintaining both phases in the Green interval until both phases reach the Gapped out or Max out condition simultaneously.

Dual Entry - Dual entry allows a phase with a serviceable call in one Ring to cause the programmed non-conflicting traffic movement in the other Ring to be serviced concurrently.

Dual Entry operation is selected by a keyboard entry on a per-phase basis. A phase programmed for Dual Entry is the phase that will be serviced in the absence of demand for service for any other phase within the same timing Ring and within the same barrier as the Dual Entry Phase.

No Skip Phase - An entry is present which allows a phase to be programmed as a No-Skip phase. This entry insures that the phase will be serviced in its normal Ring sequence priority even if it does not have a call present. The phase programmed for No-Skip is only activated when it is trying to be skipped in the Ring rotation. The call generated by the No Skip logic is not subject to being stored in vehicle memory and will be terminated if the reason for the call is terminated.

Soft Recall - The Soft Recall entry will place a Minimum recall on any phase programmed as a soft recall phase when there are no calls existing in the controller. This means that the controller will try to rest in a phase programmed for Soft Recall.

Conditional Service - The Conditional service entry will be activated only in standard 8 phase quad left configuration. This entry alters the barrier crossing in that if both Rings are in their barrier phases and one phase Gaps out. It allows the gapped out Ring to service the phase away from the barrier upon receipt of a call. This service takes place only if the Max timer of the other Ring has enough time remaining for the Yellow plus Red Clearance of the barrier phase and the Min Green or Walk plus Ped. Clearance of the phase to be "conditionally" serviced to be timed. This service allows the controller to "Back up".

Conditional Reservice - Conditional reservice is the feature which allows the phase in conditional service to reservice the barrier phase. This will happen if there is enough maximum time remaining in the concurrent barrier phase to service at least the Min Time / Walk and Pedestrian Clearance of the barrier phase. If reservice occurs, the detectors assigned to the re-serviced phase will be switched to the controlling barrier phase. Conditional Service will not occur from a reserviced phase.

Conflicting Phase - An entry is available which allows phases in different rings on the same side of the compatibility line to be programmed as conflicting phases. Two phases programmed as conflicting phases have the same effect on a phase as placing that phase or phases in a separate barrier. An example of the use of a conflicting phase movement would be a divided highway where the distance between the divided requires that the left turns operate in conflicting movements. This allows for a safer intersection control device.

2.1.3 Characteristics per Ring

Per Ring Inputs

(1) Force-Off - This input terminates the Green timing of an actuated phase or Walk Hold of a phase operating in the Non-Actuated mode, subject to a serviceable conflicting call. This input has no effect during the timing of Minimum, Walk, or Pedestrian Clearance. Force-Off is effective only as long as the input is applied.

(2) Red Rest - Red Rest will cause the controller to stay in an all-red condition when there are no phase calls in that Ring. An opposing demand results in the immediate advance from Red Rest to Minimum Green of the demanding phase. An opposing demand before the Red Rest state, even with this signal applied, results in termination of the active phase, and the selection of the next phase in a normal manner.

(3) Inhibit Maximum Termination - Maximum termination of all phases in the selected ring may be disabled by the application of this input. This input does not inhibit the timing of Maximum Green time.

(4) Omit Red Clearance - This input will omit the Red Clearance Interval for phases in the ring the input is active.

(5) Pedestrian Recycle - This input causes the pedestrian movement to be recycled if a serviceable pedestrian call exists on an actuated phase and Hold is applied, regardless of whether a serviceable conflicting call exists. For Non-Actuated phases, this input allows the pedestrian movement to be recycled if the phase has reached state D, the Pedestrian Omit input is not active, and a serviceable conflicting call does not exist.

(6) Stop Timing - The Stop timing input inhibits the unit Ring from timing for the duration of the input. When the input is removed, the interrupted portion continues timing. With the Stop Timing input applied, vehicle actuations on Non-Green are recognized, vehicle actuations on Green phases reset the Gap timer, and the controller will not terminate any interval or select another phase, except by application of the Interval Advance input. Application of Interval Advance with Stop Timing applied clears all stored calls on the phase if the controller is advanced through the Green interval of that phase.

(7) Maximum II - This input causes all phases within the Ring to time and extend to their Maximum II settings in place of their Maximum I settings.

Per Ring Outputs

(1) Coded Status Bits - These outputs reflect the timing state of the active phase in each ring. The logic states are given as follows:

TABLE 2.1
Coded Status Bits

State Code	C	B	A
0	+24V	+24V	+24V
1	+24V	+24V	0V
2	+24V	0V	+24V
3	+24V	0V	0V
4	0V	+24V	+24V
5	0V	+24V	0V
6	0V	0V	+24V
7	0V	0V	0V

The code numbers have the following definitions:

Green Interval

Code of Green Interval in the Actuated Mode

Code 0 - Minimum Timing - This code is active when timing the Minimum, Walk, or Pedestrian Clearance portions of the Green Interval.

Code 1 - Extension Timing - This code is active in the portion of the Green interval following the completion of the minimum timings and when timing an extension.

Code 2 - Maximum Timing - Code 2 is active during the phase timing of the Green Interval after completion of the minimum timing when not timing an extension and the Maximum Green timer is timing. (e.g., when the HOLD input is active.)

Code 3 - Green Rest - Code 3 is active in the portion of the Green interval when the minimum timings are complete and the Gap timer is timed out and Maximum Green timer is either timed out or has not started.

Code of Green Interval in the Non-Actuated Mode

Code 0 - Walk Timing - The phase is timing the Walk portion of the Green interval (State-A).

Code 1 - Walk Hold - The portion of the Green interval when the Walk output is active, Walk timing is complete, and the Hold input is active (State B).

Code 2 - Pedestrian Clearance Timing - Phase timing of the Pedestrian Clearance portion of the Green interval or the remaining portion of the Minimum Green time (State C).

Code 3 - Green Rest - The portion of the Green interval when the Pedestrian and Minimum Green timings are complete (State D).

Active Phase not in the Green Interval

Code 4 - Yellow Clearance - The phase is timing the Yellow Clearance Interval.

Code 5 - Red Clearance - The phase is timing the Red Clearance Interval.

Code 6 - Red Rest - The phase has completed all of its timing and all phases display a Red indication.

Code 7 - Undefined

2.1.4 Enhanced Characteristics

The SERIES 900-V21 has some added features which change the sequence of service for each phase pair.

Phase Reversal (Lead/Lag) - Entries can be made which will reverse the sequence of phases within a Ring. In the SERIES 900-V21 there are four such entries; Reverse 1/2, Reverse 3/4, Reverse 5/6, and Reverse 7/8.

2.1.5 Characteristics per Unit

Initialization

Initialization occurs under either of the two following conditions; Restoration of power after a defined power interruption or; Activation of the External Start input. Keyboard entries allow the timer to initialize at the beginning of the Green, Yellow, or Red interval of any phase or phase pair, or in a Red Rest condition. When initialization occurs, vehicle and pedestrian calls are placed on all phases and retained until serviced, even though the vehicle memory circuit is disabled.

Power Interruption

With a loss of AC Power of less than 1/2 second, the controller will continue timing when the power is restored. A loss of Power of 1 second or more will always result in the controller re-initializing. Time between 1/2 second and 1 second may or may not cause the controller to re-initialize.

Red Revert Timing

If a phase turns red without a phase next decision (e.g., enters Red Rest), the Red Revert time will time if a phase next decision is made to re-time the phase that just entered Red Rest. Red Revert time is entered from the Keyboard.

Per Unit Inputs

(1) AC+ - AC+ connects the controller to the line side of the 120 Volt 60 Hertz power source.

(2) AC- - AC- connects the unfused and unswitched neutral side of the power source to the controller. This input is isolated from logic or chassis ground.

(3) Chassis Ground - Chassis Ground connects only to the chassis the controller unit.

(4) Interval Advance - A complete ON/OFF cycle of this input causes immediate termination of the interval that is timing. If concurrent interval timing exists, this input will immediate terminate the interval that would terminate next without such action.

Phases without stored vehicle or pedestrian calls are omitted from the resultant phase sequencing of the controller unless External Min. recall to all vehicle phases or Manual Control Enable inputs are active.

The controller selects the next phase to be serviced in the normal manner. If the Interval Advance is activated during the Green interval and no serviceable conflicting call exists, the controller will not advance beyond the Green Dwell/Select state, unless Red Rest is active.

Application of Interval Advance during Green and Walk causes the controller to advance to Green and Pedestrian Clearance. Application of Interval Advance during Green and Pedestrian Clearance causes the controller to display steady Don't Walk and advance to the Green Dwell/Select state, select the next phase to be serviced, and immediately advance to the Yellow Clearance interval, provided a serviceable conflicting call is present.

Application of Interval Advance during Green and steady Don't Walk causes the controller to advance to the Green Dwell/Select state, select the next phase to be serviced, and immediately advance to the Yellow Clearance interval, subject to the presence of a serviceable conflicting call.

Application of Interval Advance during a Yellow or Red Clearance interval will not terminate these intervals if Manual Control Enable is applied. Also, the Pedestrian Clearance interval cannot be terminated by Interval Advance if Manual control Enable is applied and the Protect Pedestrian Clearance keyboard entry is programmed.

(5) Manual Control Enable - This input places vehicle and pedestrian call on all phases, stops controller timing in all intervals except Yellow and Red clearance intervals (and the Pedestrian Clearance Interval if Ped Protect is programmed), and inhibits operation of Interval Advance during the above intervals.

(6) Call to Non-Actuated Mode - Two call to Non-Actuated Mode inputs are provided. These are designated as Call to Non-Actuated I and Call to Non-Actuated II. When either of these are active they cause a designated phase or phases to operate in the non actuated mode. The designated phase or phases for each of the two inputs are assigned by keyboard entries.

(7) Ext Min Recall - Ext Min Recall causes a minimum recall to be placed on all phases.

(8) Indicator Lamp Control - Activation of this input has no effect on the SERIES 900-V21 Controller, as the software turns the display off automatically after 15 minutes of no keyboard activity.

(9) Walk Rest Modifier - This input affects phases operating in the Non-Actuated mode only. When active, Non-Actuated phases stay in the timed out Walk state when there are no serviceable conflicting calls, regardless of the Hold input status. With the Walk Rest Modifier input off, Non-Actuated phases rest in the timed-out Don't Walk state.

(10) External start - Activating this input causes the controller to revert to its programmed initialization phases and intervals. It will also deactivate all outputs so that the controller can be paralleled to other devices if desired. When the input is removed, the controller unit starts normal timing from its initialization phases and intervals.

Per Unit Outputs

(1) The SERIES 900-V21 controller has eight overlap phases called Overlap 1 - 8. Each overlap phase has a Green, Yellow, and Red output driver. The output state of overlaps 1-4 is determined by the overlap program board or, if desired, by a keyboard entry. Overlaps 5-8 can be programmed from the keyboard only.

Overlaps are programmed as a function of phases, phases which conflict with the overlap, and overlaps which conflict with other overlaps.

Three variations of overlap logic outputs are provided which are defined as follows: Normal, Illinois, or Florida. When programming the overlaps for the Illinois or the Florida style overlaps, the programming of a Suppression phase is allowable. The Suppression phase alters the overlap output depending on the selected style.

If Calc From Parent Phases is programmed ON the overlap clearance will be timed by the parent phase terminating the overlap.

The Florida suppression style causes the overlap output to be dark if the Suppression phase is Green or Yellow; otherwise, the overlap operates in a normal mode. This style allows the left turns to suppress the ball indications in a four or five section head if the left turn is active.

The Illinois style turns the overlap Red if the Green of the Suppression phase is active, and the overlap will remain Red if a suppression phase next call is detected during the Suppression phase Green.

The Dallas mode programs as a function of the time of day. In this mode, the overlap remains dark as long as the Green or Yellow of the Suppression phase is active. The overlap remains Red when the Red of the Suppression phase is active.

(2) Logic Ground - The isolated DC power supply common, to which all input and output logic circuits are referenced.

(3) Voltage Monitor - This output is on when all internal voltages are within their operating limits. Also, an internal Watchdog timer monitors the processor for a locked-up condition and if this condition is found will cause this output to revert to a logical off state.

(4) Flashing Logic - This output flashes at a 50% duty cycle between a logical "0" and a logical "1" at a 1 HZ rate.

(5) 24 Volts External - This voltage is a regulated positive supply at 24V +/- 2VDC. The output is fused at 1/2 Amp and is used as an external power supply.

2.1.6 Enhanced Characteristics Per Unit

Several functions exist which extend the SERIES 900-V21 Controller beyond the NEMA standards. These Functions are Coordination, Rail Preemption, Fire Preemption, Internal Flash, and Communications. All of these special features will be discussed in their own section. To control these features from the external control lines, several extra connectors are added to the standard controller.

Enhanced Per Unit Inputs

Most of the extra unit inputs are contained in connector "D". These inputs consist of the 8 bicycle inputs, special preemption inputs, 8 system detector inputs and several other special functions to be discussed later.

(1) Preemption

Five inputs allow the controller to enter into a Preemption condition as defined by section 2.4.1. Each input can be assigned a rail or emergency preemption. When an input is assigned as emergency preemption input, it can operate as a high or low priority preemption input simultaneously.

(2) System Detector Inputs

Eight inputs are assigned system detector inputs. For each input an occupancy and count value can be obtained. Also, system detector inputs 9, 10, 11, and 12 can be mapped as vehicle detectors for a phase. See the paragraph on vehicle detector mapping.

(3) Controller Address

Eight inputs are use to determine the controller address. The inputs are the standard 8 pedestrian omits as defined in NEMA. These inputs assign the address of the station I.D. as viewed under the port 1 communication parameters. The address is inputed as a binary value with phase 1 ped. omit being the least significant bit and phase 8 ped. omit being the most significant. When a master unit is involved, the Master Station Address is assigned a value of 1 plus the local controller I.D.. To activate this address assignment and change the usage of the ped omits, an entry must be made under the controller parameters.

Enhanced Per Unit Outputs

The extra unit outputs are contained in connector "D" of any SERIES 900-V21 controller and some are on the standard NEMA assigned outputs.

(1) Plan and Offset Selection

Six output lines define the current selected Plan and Offset of the local traffic controller.

(2) Command Outputs

Eight outputs are provided which can be programmed as a function of Time of Day or selected by the External Configuration if so desired. The outputs are defined in the Controller Configuration Command entry.

The eight outputs program as follows:

1. Special Outputs 1, 2, 3, 5, 6, 7, and 8 can be turned on and off.

2. Special Output 4 can be programmed to pulse for a time period of 0.0 to 9.9 seconds.

(3) A/D Selection Outputs

Four outputs are used to multiplex the A/D by selecting the data to be input on the phase omit lines.

2.2 Time Base

The internal clock is normally timed from the power line and kept to a resolution of 1/60 of a second. When AC power is removed, the clock will continued to be maintained by a super-cap backed up clock chip. Time Base for the SERIES 900-V21 allows the controller's traffic configuration to be changed as a function of time. To implement the configuration changes, 17 commands can be selected by the Real time Clock. These commands can change such things as phase recall, controller rest state, and phase detector assignments. The Time Base operation also selects the Coordination Mode as well as the Offset and Plan which are used during Coordination.

Timer Configuration and Coordination are selected by two different types of entries called Weekday and Holiday selection entries. The Weekday entries are based upon a weekly cycle and the Holiday entries are based upon a yearly cycle. Both entries designate the time of day for calling both the controllers' configuration and the coordination pattern to be used.

2.2.1 Weekday and Holiday Entries

Operation of the Time Base (TB) in the controller searches the Weekday and Holiday entries once a minute and decides which of the two types of entries is active or matches the current time of day. Once one of the entries is found to be active, the controller and coordinator configuration will remain constant as called for by the active entry until a new entry is found.

Controller configuration is defined by a Select Command Number in the active entry. Coordination is defined by the configuration found in the active entry and is defined by the acronym TMOP which stands for (Timer, Mode, Offset, Plan)

2.2.2 Controller Configuration Commands

Each of the 17 possible commands selected by the TB entries allows the function of the SERIES 900-V21 to be altered. The Command Mode will define how these commands are selected and if they are active. The following is a definition of the Command Modes:

1. OFF - Disable the use of Controller Commands

2. TBC - Allow the commands to be selected from the internal Time Base Weekday and Holiday entries.

3. EXT - Allow the commands to be selected from the External inputs.

4. AUT - Allow the commands to be selected in an automatic mode such that an when TBC is active the commands are selected from the TBC configuration and when TBC is inactive the commands are selected from the External configuration.

5. If Controller Commands are selected to be active when Coordination is active, and Coordination fails (skipped phases due to improper programming), then the default command , Command 00, will become active.

Each of the 17 commands allow the following to be selected:

Table 2.4
Controller Command Functions

1. Detector Assignment Map
2. Eight Programmable Outputs
3. Conflicting Phases
4. Recall selection and Phase Omit
5. Rest in Green, Red, or Walk
6. No skip phase
7. Soft Recall
8. Max I, Max II, and Inhibit Maximum
9. Run Ped 2 times
10. Dallas Mode for overlaps
11. Dual Entry
12. Pedestrian Omit
13 Lead/Lag, Conditional Service, Reservice

2.2.3 Coordination Configuration

Each of the Weekday and Holiday entries can select the coordination patterns as a function of Time Base. The Coordination Mode (M) of TMOCS has seven possible selections:

Table 2.2
Mode of Coordination

1. OFF - Disable Coordination
2. AUT - Auto Coordination (Close loop, Revert to TB)
3. TBC - TB selection of Offset, Plan (OP)
7. FL - Flash, Coordination off.

Also selected by the Weekday and Holiday entries are the Coordination Configuration of Offset and Plan.

2.3 Coordination

The SERIES 900-V21 coordinator will operate if the following conditions are met:

1. No Coordination failure Recorded

2. Manual Control Input is inactive

3. System input active

4. No Preemption or Flash input is active

5. Coordination Mode is not in Flash or Off.

6. All of the Primary Force Off entries are not zero for a selected Plan.

The internal Coordination Cycle counter will continue to run and keep in step even though coordination is not operational.

2.3.1 Coordination Mode

Coordination operation is determined by the Controller Coordination Mode and is determined as follows:

1. The Test Coordination Mode determines how the controller will operate. When the Test Coordination Mode is set to the RTC entry, Then the Time Base Coordination Mode will determine the coordination operation.

2. When the TBC Mode is active (above paragraph) and the TBC Mode coordination is set to off, then activation of the flash input will override the TB mode and set the Controller Coordination Mode to FL (Flash) and inhibit coordination.

3. If paragraph 2 conditions hold and the flash input is not active, then activation of the External Coordination input will set the Controller's Mode to EXT (External) and external coordination will start.

2.3.2 Coordination Timing

The coordination cycle length is selected as a function of the system plan. When in sync, the cycle length indicates the time in seconds from the last sync point.

The offset entry defines the time from the last master sync to the beginning of the local cycle counter 0 point. All permissive states and some force-off points are referenced to the local cycle counter.

2.3.3 Coordination Type

The current coordination has 7 types of coordination. These various selections allow the traffic engineer to choose a particular type that is suited for his application.

Coordination Standard - Naztec's standard type which uses selectable permissive starting points and calculated ending points. Permissive ending is based upon the entered force off.

Easy Coordination - Based upon the State of Texas requirement to only enter the split time for each phase and the coordinated phase. All force-offs, permissive starts, and permissive ending are calculated.

New Jersey - Base upon the requirement for floating force-offs. A single selectable permissive period, selectable coordinated phase, and selectable floating force-off points, one for each phase. During the permissive period, all phases are yielded to.

Permissive Mode - Four (4) different coordination types based upon the requirement for selectable dual permissive periods, selectable yield phases for each permissive period, and two selectable force off points for each phase.

1. Fixed force-offs based on the local cycle counter and timed in seconds.
2. Floating force-offs which begin when the phase is entered and timed in seconds.
3. Fixed force-offs base on the local cycle counter and timed in percent, 0 to 99.
4. Floating force-offs which begin when the phase is entered and timed in percent.

2.3.3.1 Coordination Standard

In the standard coordination package, Naztec provides the following yield entries and force-offs per plan.

Two types of yield (permissive) entries are allowed for each phase. The first is the Vehicle Yield Point and the second is the Pedestrian yield Point. Front panel entry of the Vehicle Yield point will also program the Pedestrian Yield to the same time. Therefore, it is necessary to set the vehicle first and then change the Pedestrian Yield to a different value, if desired.

Two types of Force-Off points are also programmable for each phase. The first is called the Primary Force-Off, which will apply a constant, locking force-off to a phase until the phase leaves the Green interval. The second type is a Secondary Force-Off which only applies a force-off to the phase for the duration the local cycle timer indicates the force-off is active. Again, when the Primary Force-Off is programmed, the Secondary Force-Off will be set to the same value.

With these coordination entries it is possible to generate 8 independent permissive periods per plan.

Vehicle and Pedestrian permissive periods are calculated for each phase. The vehicle permissive period begins at the Vehicle Yield Point and ends at the time determined by the following equation.

Prim. Force Off - Max Clr. (Red + Amber) - Phase Min

Where the Max Clr. (Red + Amber) is the maximum of the sum of the red and amber clearance times of any of the eight phases.

The Pedestrian Permissive period is stated at the Pedestrian Yield Point and ends at the time determined by the following equation.

Prim. F.O. - Ph. Walk - Ph. Ped Clear.

The Pedestrian Yield point must occur equal to or later in the cycle than the vehicle Yield. When setting up coordination, be aware that it is possible to set the permissive period to zero or even start the end permissive point before the yield point. Incorrect setting may cause certain phases to be skipped. (See Coordination Failure.) The controller is designed so that an entry into the vehicle yield will set the pedestrian yield to the same value. The Yield points are a function of plan for a total of 16 yield points per phase. If the yield point is set to a value greater than the cycle length, the phase will be skipped. Make sure that all phases intended to be skipped are programmed to apply an omit to the phase.

The controller will be released to operate in Free mode if the current selected plan has all of the Primary Force Offs set to zero.

In setting up coordination two other selections may be helpful. One is the option of setting the end of the pedestrian yield period equal to the end of the vehicle yield period. The other is to stop the local time base coordinator if it has reached the force off point and either a walk or pedestrian clearance interval is still timing. Both of these options help in allowing the engineer to accommodate pedestrian movements which are longer than allowed split time for the phase. I.E. the engineer knows that when a pedestrian movement occurs on the phase, the controller will not be coordinated.

2.3.3.2 Easy Coordination Software Package

Easy programming is a mode of operation that allows the controller to calculate the yield start and force off points from a single entry called Easy Split. The operator makes a single entry of each phase in a pattern that follows a simple set of rules

1. 8 Phase Quad Left Operation - The sum of the Ring Split Entries must equal the Cycle Length Entry for a given cycle split combination. Phases 1 + 2 splits must equal phases 5 + 6 splits.

2. 8 Phase Sequential - The sum of the 8 Phases splits must equal to the cycle length

3. Quad Sequential - The sum of splits for phases 1 + 2 + 3 + 4 + 7 + 8 must equal the cycle length. The sum of splits for phases 5 + 6 must equal the splits for phases 1 + 2.

4. Coordinated Phase - This is the phase that has a guaranteed beginning of green. Entries of Phases 2,4,6,8 and 2 and 6 or 4 and 8 are allowed.

A Split Entry set to zero is considered as an entry to skip a phase. All phases to be skipped should be omitted through the use of a keyboard entry or a time of day command.

2.3.3.3 New Jersey Coordination Software Package

The Naztec controller provides a special coordination package which can be activated by programming the Coordination Parameter called COOR TYPE to New Jersey. When this mode is active a floating point force-off type of coordination is activated which is defined as follows:

Permissive Start to Permissive End - Two entries which define the permissive period. When in the permissive period and in the coordinated phase(s) all omits will be dropped on all phases

Coordinated Phase(s) - Phases from both rings which define the coordinated phases which when in service apply an omit to all other phases until the start of Permissive Period.

Floating Force Off - All phases contain a floating force off point which will begin to time immediately upon entry of the green of that phase. When the force off time expires, a force-off will be applied to the phase causing the controller to leave that phase. Note that a force off will only shorten the green time.

2.3.3.4 Permissive Coordination Software Package

The Naztec controller has implemented a special type of coordination which allows the traffic engineer a degree of flexibility in selection of one of four different modes for dual permissive operation. Since this feature does not automatically calculate the end of permissive operation, the engineer must be careful in handling force-offs. Entries for the dual permissive mode of operation consists of the following:

1. Begin and End times for both permissive periods.

2. A set of yield phases for each permissive period.

3. A coordinated phase entry for each ring.

4. A primary and secondary force-off for each phase.

5. A force off all phases entry. This allows an end force off point incase the engineer calculates his points incorrectly.

6. A recycle the Walk time entry. When coordinating with a rest in walk programed, the timer will leave the walk interval at a point calculated as the force-off minus the pedestrian clearance time. If the coordinated phase reaches the green rest state and a conflicting call is not present, The timer will recycle to the walk interval at the recycle time. This calculated is done only when timing in seconds.

The permissive mode operates in four modes:

1. Time in seconds, force-off points fixed to the local cycle length.

2. Time in seconds, force-off points begin timing when the phase is entered. This mode is referred to as floating force-offs.

3. Time in percent, force-off points fixed to the local cycle length.

4. Time in seconds, force-off points are floating.

The Naztec timing display will always show the external sync pulse or the internal time base clock timing in seconds even with the selection of timing in percent.

2.3.6 Plan Selection

The Plan selection provides for selection of different parameters determined by the controller configuration during coordination. The following items are always the same for the three different types of coordination allowed.

(1) Cycle length for the local cycle counter.
(2) Percent cycle change for synchronization
(3) Dwell Time Period

The controller plan number will only change at the local cycle zero.

2.3.6.1 Plan Selection for Standard Coordination

The Plan number of the controller configuration selects the following for each phase during standard coordination.

(1) Vehicle Yield Point
(2) Pedestrian Yield Point
(3) Primary Force-Off
(4) Secondary Force-Off

2.3.6.2 Plan Selection for Easy Coordination

The Plan number of the controller configuration selects the following during easy coordination.

(1) Split Times per Phase
(2) Coordinated Phase(s)

2.3.6.3 Plan Selection for New Jersey Mode Coordination

The Plan number of the controller configuration selects the following during New Jersey Mode Coordination.

(1) Ring 1 Coordinated Phase - Phases 1 to 4 or none
(2) Ring 2 Coordinated Phase - Phases 5 to 8 or none
(3) Start of Permissive Period - value of 0 to 254
(4) End of Permissive Period - value of 0 to 254
(5) Floating Point Force Off for each phase

2.3.6.4 Plan Selection for Dual Permissive Coordination

The Plan number of the controller configuration selects the following during Dual Permissive.

(1) Ring 1 Coordinated Phase - Phases 1 to 4 or none
(2) Ring 2 Coordinated Phase - Phases 5 to 8 or none
(3) Start of Permissive 1 or 2
(4) End of Permissive 1 or 2
(5) Permissive Period 1 Yield phases
(6) Permissive Period 2 Yield phases
(7) Primary Force-off for each phase
(8) Secondary Force-off for each phase
(9) A Force-off all phases point
(10) A recycle the walk in coordinated phase entry point

2.3.7 Offset Selection

The controller configuration offset number selects the following:

(1) Offset value

The system offset selection value changes as directed by the current mode of operation such as Test, Time Base or External.

2.3.8 Coordination Failure

Coordination failure can be defined as the coordinator not servicing phase calls for two complete cycles. When this occurs, the controller will be released to operate in the free mode and the reason for failure will be stored. Using the coordination failure entry will allow the display of the phases which were involved in the failure and the system configuration at the time of the failure.

Coordination failures are usually caused by the operator programming an incorrect entry when setting up the coordination parameters. The major reason for failure is that when the local coordination cycle is speeding up, shortening the cycle length to synchronize itself, the fixed time for each phase in a Ring may not have enough time. Fixed times are those interval times which are not allowed to be shortened, such as the Minimum Green, Amber, Red, etc.

To allow for shortening cycles by as much as 25%, the operator must be cautious in setting the coordination Yield points and also in allowing enough time to properly service all fixed intervals. To aid in this problem it is possible to program the percent cycle change so that the cycle time is not allowed to be shortened.

An entry is available to inhibit coordination failure from suspending coordination. In this case the last coordination failure that occurred would be recorded and saved for displaying at the operators convenience. Once coordination is suspended, a change in the System plan Configuration will cause coordination to begin.

2.3.9 Notes about pedestrian timing during coordination

It is very easy during coordination not to allow enough time to service the pedestrian intervals, especially during short cycles. To allow the extra pedestrian timing, a Stop In Walk option exists in the Coordination Parameters Menu. This will cause the local TBC coordination to pause if it reaches the force-off point and the pedestrian clearance intervals are still timing. After the pause, the coordinator will again get in step.

2.4.0 Controller Preemption

Several special modes of preemption exist in the Naztec Controller. When a preemption mode becomes effective, it will alter the controllers operation in the following ways.

2.4.1 Preemption

Preemption is invoked when several conditions are met: Both the Manual Enable and Stop Timing inputs are not active, one or more preempts are enabled, and one of the enabled preempts has an input that is active. Once a call to preemption is recognized, a five step process begins.

(1) A programmable delay starts. Other than the timing of this delay, the controller continues to operate in the standard manner. This delay may eliminated by programming it to 0 seconds.

(2) The controller begins preempting normal operation by terminating the current phase. A Minimum Green and Minimum Walk time (both are programmable) are guaranteed before continuing to the pedestrian clearance, yellow clearance and red clearance intervals. Each preempt contains its own set of programmable, begin-clearance interval times. These times are substituted for the normal equivalent intervals of the active phase.

(3) If Track Clearance Phases are programmed, the controller enters the track clearance step. The Green, Yellow, Red, Walk, and Pedestrian Clearance times are selected from the Track Clearance row of the Preemption Times screen. At the end of the Track Clearance step, the controller begins the preemption state.

(4) In the Rail Preemption state, several options are allowed:

(a) Cycle among selected (programmable) phases, with or without pedestrian movements.

(b) Flash the intersection using a programmable flash pattern that may be unique for each available preempt. A flash pattern allows signals (phases and overlaps) to flash yellow or red or to be dark, and pedestrian signals to be steady DON'T WALK or to be dark.

(5) The last step of preemption is a return to normal controller operation. The phases to which the controller returns are selected by the operator. If the intersection has been operating in yellow flash during preemption, the Yellow and Red return intervals are timed. If it was in all- red flash during preemption, then only the red return interval is timed. If the controller has been operating in a phase cycling mode, then none of the return intervals will be timed. Finally, the controller returns to the phases programmed as the return from preemption phases.

Any of the five preempts can be used as either Railroad Preemption or as Fire or Emergency Vehicle preemption.

2.4.2 Flash

Flash operation is started when Manual Enable is inactive, Flash is enabled, and the system configuration mode is set to FL (Flash). When flash is activated the controller is forced into an all red condition and will begin flashing according to the proper programming.

Once flash is active, removing the flash condition will cause the controller to enter the special return sequence. It is the operators responsibility to insure that the return phases are compatible.

2.5.0 Communications

A mode of operation is available which allows two controllers to transfer information. When setting up communications between controllers first the baud rate must be set to the same value in both units as well as the Station I.D. Second, connect the data cable from the Comm 1 Port on the transmitting unit to either of the ports on the receiver unit. Using keyboard and the Comm menu in the transmitting controller, send the data or time of day to the receiving unit. If the security code option is enabled, the security code must be entered before beginning this operation.

Several internal timers must be set up before the communications will run properly. These definitions are as follows:

2.5.1 Communication Timer

Generally this time is set to 3.0 seconds. The communication timer sets the amount of time the controller will wait for a response from the Master or another controller.

2.5.2 Modem Timer

Generally this time is set to 30 tens of seconds which equals 300 seconds or 5 minutes. The modem time is the time that the controller waits between messages. During this wait period, the controller will test the attached modem or will test the USART to insure that communications are still established.

2.5.3 Dial Timer

Generally this time is set at 90 seconds. The dial timer is the amount of time the controller will take to re-dial if it finds the telephone line busy in order to send in an alarm.

2.6.0 Alarm Generator

The 920-TRS controller monitors numerous functions, both internal to the controller and external inputs, and can generate alarms if a monitored function changes state. Sixty four alarms are provided for in the 920-TRS, for monitoring the controllers operation

Alarms may be individually enabled by operator programming. If the controller is part of a Naztec closed-loop system, it will report its alarms to its on-street master. If the controller is not part of a closed-loop system, it may be programmed to auto-dial via a modem and report alarms to a central monitoring computer. Alarms can be programmed to be placed into the event buffer or if they are considered critical programmed to be placed into the alarm buffer and forwarded to the central system.

The functional assignment of alarms, by alarm number, in the 920-TRS are as follows:

1. Power Up - reports each time the controller unit is turned on.

2. Stop timing or Manual enable - reports each time they are activated or deactivated.

3. Cabinet Door Open (Display) - reports each time the cabinet door is opened or closed.

4. Coordinator Fail - reports each time the controller detects a coordination failure and when the failure is cleared.

5. Alarm 1 Input, pin 18 on the D connector

6. Alarm 2 Input, pin 20 on the D connector

7. Alarm 3 Input, pin 26 on the D connector

8. Alarm 4 Input, pin 27 on the D connector

9. Closed-Loop Enable - reports whenever the closed-loop enable program location is changed. This location is changed only by operator action; either through the front-panel keyboard or remotely via a Central monitoring computer and modem.

10. Alarm 5 Input, pin 28 on the D connector

11. Ring 1 Green Timing Fail Alarm - The alarm is set active when the ring 1 phase timing fails to meet the minimum programmed allowed green time.

12. Ring 1 Yellow Timing Fail Alarm

13. Ring 1 Red Timing Fail Alarm

14. Ring 2 Green Timing Fail Alarm

15. Ring 2 Yellow Timing Fail Alarm

16. Ring 2 Red Timing Fail Alarm

17 through 32. Local Detector Failures - these sixteen alarms report the occurrence of a detector failure, as determined by operator programmable parameters, for each of the sixteen vehicle detectors supported by the 920-TRS.

33. Cabinet Alarm Lamp Failure.

34. Panel Alarm Lamp Failure.

35. Alarm 6 Input, pin 36 on the D connector.

37. Down Load Request, request the permanent data base.

2.7.0 Event Buffer

Each local controller has an event buffer which stores a total of 50 of 6 different types of events. Each event contains the time of day stamp, Controller I.D. and data concerning the event.

1. Alarm Event - Each time an alarm occurs or clears, the event is placed into the event buffer if programmed to be active.

2. Preemption Event - Each preemption event is placed into the event buffer and provide information on flash, and phase cycling

3. Access type - Two types of accesses are recorded when a user either logs on through the keyboard or dials the controller from the central. The user number and user I.D. recorded as well as the time the log on was made

4. Coordination Changes - Patterns changes for the local include the plan, offset, coordination mode, command mode, command number, and the accumulated offset value.

5. Current Monitor Failures - Records the binary pattern when a lamp outage is first detected.

6. Split Study - Records the % time a phase is green during a set period of time. Lists all 8 phases and the amount of time they are green.

2.8.0 Current Monitor

Each local controller has an internal software package for controlling the Naztec Lamp Sense Board PN 10197-2000. When this board is installed in the cabinet, the Naztec controller is able to detect when one lamp is out in an entire intersection.

Some software entries that need to be set are as follows:

1. Signal Failure Limit - This entry determines the sensitivity setting on which a signal failure is determined. On a calibrated intersection, the entry setting can be related to 1 count per watt of detection. When setting the limit, be sure to allow a band of 25% for different variations of lamps.

2. Luminaire Failure Limit - This entry determines the limit at which a luminaire failure is determined. The same sensitivity setting is set.

3. Signal Offset Setting - This setting is the initial calibration point for the intersection. The setting is about 3050 for a ten ampere intersection. The value should change about +\- 400 counts per ampere. Once the intersection is operating, it will do its own calibration for the offset. Using the scan screen for the current monitor after a day will allow the traffic engineer to read the current value and adjust this initial setting

4. Luminaire Offset Setting - This offset setting should be adjusted similar to the signal setting. It is used for the external luminaire panel.

5. Sample Age - This setting limits the time the data related to a certain pattern of lamps can be used to compute lamp outage. This entry is set from 0 to 23 hours.

2.9.0 WWV Clock

The Time Source is a receiver of the WWV/WWVH radio broadcasts transmitted by the U.S. National Bureau of Standards (NBS). The clock collects the transmission on five different frequencies. The Time Source picks up the information and the NT920 timer downloads the time accurate to 100th of a second. The date is also acquired through the NBS.

2.9.1 Timer Setup

The NT920 can directly link to the Time Source hardware through ports 1 and 3. Activating the controller with the time clock requires the following setup.

1. The baud rate must be set to 2400.

2. The dial up mode must be set to WWV

3. The time zone of interest must be selected

4. The Time of Day clock in the controller must be operating

2.9.2 Time update

The NT920 controller updates the clock only when the real time clock is activated. During startup or power up, the controllers internal clock will be updated using the NBS time. Every 30 minutes the internal timer clock will be re-adjusted to the within a 100th of a second.

This update occurs at 5 minutes and 35 minutes after the hour relative to the NT920's clock.

If an improper time is submitted to the controller, the NT920 will try again three times with a 1.5 second pause between downloads. If the time is not accurate, the procedure is repeated every ten minutes until the real time is collected. At all times the real time clock within the controller is still running as usual. Therefore; if the WWV clock is not picking up a signal due to installation or weather interference, the clock within the controller is still accurate.

2.9.3 Installation

Installation of the outdoor antenna can be referenced in the Time Source manual on page 3-7. The Time Source hardware contains pencil switches within that must be maintained at a fixed setting. The following are the settings in which the Time Source must be at in order that the Time Source properly communicates to the controller. Any questions, refer to the Time Source manual page 2-5. (On is the up positon of the switch).

BANK1	BANK2	BANK3
sw1-off	sw1-on	sw1-on
sw2-off	sw2-off	sw2-on
sw3-off	sw3-off	sw3-on
sw4-off	sw4-off	sw4-on
sw5-on	sw5-off	sw5-off
sw6-on	sw6-off	sw6-on
sw7-off	sw7-off	sw7-on
sw8-off	sw8-off	sw8-off

3.0 OPERATING PROCEDURES

3.1. OVERVIEW OF OPERATION

An operator enters data into the SERIES 900-V21 by using the controller's display and keyboard. A piezoelectric "speaker" provides audible feedback as to how the controller is proceeding with what the operator instructs it to do.

Access to enterable data and status displays is based on "screens" and "menus". A screen is a grouping of enterable values, selections, text, or status information that is called up from a menu selection. Menus are special screens that contain from 2 to 9 selections, each of which calls up a screen or other menu. For the rest of this manual, the term screen is used to refer to any screen other than a menu screen.

Within a screen, the places where operator entries can be made are called "fields". Fields are from 1 to several characters long and generally contain a programmable value. A blinking cursor indicates which field will be affected by an operator entry at any particular time. Cursor movement keys permit access to any field on a screen by allowing the operator to move the cursor from one field to another. Screens also contain text that the operator cannot change. The cursor skips over these portions of the screen. Thus, access to all programmable values and status displays in the unit is accomplished by selecting appropriate screens from menus, moving the cursor to the specific field(s) of interest, and then entering the desired value into the field.

Operation of the Naztec SERIES 900-V21 controller is based on techniques proven effective in computer products and process control systems known for their ease of use. The consistent application of these techniques provide for simple and "user friendly" operation.

Overview of Operating Features

Display

Four lines of 40 characters each may be displayed simultaneously. Menus are never larger than this and so can be viewed in their entirety whenever one is displayed. Screens, on the other hand, may be many times longer than 4 lines (lines are also referred to as rows). Whenever a screen is accessed that is longer than the display, the screen may be scrolled (moved up or down) until the portion of the screen that is desired is brought into view (This is accomplished by using the cursor keys and is discussed later).

Neither screens nor menus are ever wider than 40 characters, so there is no need of horizontal scrolling --and none is provided.

There are several types of fields, but they fall into four major categories. They are:

(1) Numeric fields - Numeric fields are those that accept data as a series of numbers. The types of fields that fall into this category are whole numbers, decimal numbers, dates and times-of-day. Entries are made into numeric fields by pressing the numeric keys corresponding to the desired digits. For multi-digit fields, the left-most or most-significant digit is entered first. As each digit is pressed, the previously entered digits are shifted one position to the left so that the entire number is right-justified in the field. This entry/display sequence is identical to that of most calculators.

(2) Encoded fields - Encoded fields are those that may be set to one of a few specific choices. Examples of encoded fields are day-of-week entries, flash state settings (green, yellow, or dark), or on/off settings which are also depicted as 1 and 0. Encoded fields use traffic terminology or abbreviations to denote values. Selections for a given field are automatically cycled with each press of any numeric key; thus, there are no troublesome codes to remember or to look up.

(3) Encoded field groups - When encoded fields occur repeatedly - such as for each phase or for each ring -on the same screen, there is a special quick-entry mode that allows any of the repetitive fields on the row to be changed without first moving the cursor to the field. These multiple, encoded fields are referred to as encoded field groups and, where used, they save as many as eight cursor-movement keystrokes per entry.

When an encoded field group is encountered during operation, the cursor is positioned between the field name -- which is to the left of the first field in the group --and the first field. Each field in the row is identified by a numeric column heading, beginning with 1. The value of a particular field in the group is cycled through its possible choices by pressing the numeric key corresponding to the column identifier. For example, to display the next encoded value for the field in the third column (identified by a heading of 3), press the "3" key once.

(4) Select/Proceed fields - Select/Proceed fields are places where the cursor stops to allow the operator to issue a command to the controller. For example, each menu selection has a Select/Proceed field located at the selection number. A menu selection is made by moving the cursor to the desired selection number and pressing ENTR or directly selecting the number. Warning screens also use Select/Proceed fields to allow the operator to cancel or proceed with the command that drew the warning.

Keyboard

The keyboard consists of 20 keys divided into three groups. For easy identification, keys are color coded by group. The 10 numeric keys (0 - 9) form the first group and they are used to enter or modify data. These keys are white. The second group consists of the cursor movement keys; they are grey. The final group consists of four red function keys which are used to issue specific commands to the controller. The functions of the keys vary somewhat depending upon the type of screen and field being accessed; however, mastering the few guidelines that follow allow for easy and efficient programming and operation of the controller.

Numeric Keys

Numeric Fields - pressing a numeric key causes the digit associated with the key to be added to the current field. If the key pressed is the first key since the cursor was moved to the field, then the field will be cleared first and then the digit placed in the right-most position. The controller now considers this field as having an `edited' status. If the field already has an edited status when a numeric key is pressed (ie. a numeric key was pressed before the current one), then the digits already in the field are shifted to the left one character and the new digit is placed in the right-most position.

Encoded Fields - pressing any numeric key causes the value in this type of field to be changed to the next value in its cycle of possible values. For example, if the value of a field may be RED, YELLOW or DARK, and it is currently YELLOW, then pressing a numeric key will cause the value to change to DARK. Pressing a numeric key again (the same key or a different one) will cause the value to change to RED, and so forth.

Encoded Field Groups - these groups of 2 to 8 fields on the same row are similar to standard encoded fields except that each field in the group is changed by a different numeric key and only that key. The key that is associated with each field is determined by the column heading of that field. For example, pressing the 1 key will change the value in column 1, the 2 key in column 2 and so forth.

Select/Proceed Fields - pressing a numeric key when the cursor is located at a field of this type will have no effect. The keystroke is ignored.

Cursor Movement Keys

The action of cursor movement keys is the same for all types of fields and only changes slightly for different types of screens. Note that if a data field (numeric or encoded) has been edited, a cursor movement keystroke causes an `implied' enter to be executed as if the ENTR key had been pressed. The ENTR key, which is covered in detail below, causes data entered in the current field to be stored in the controller's memory. The implied enter of the cursor movement keys eliminates an explicit ENTR keystroke that in most cases would otherwise be needed.

RIGHT-ARROW and LEFT-ARROW keys - these keys move the cursor to the next field in the direction of the arrow. If the cursor is in the right-most field of a row, pressing the RIGHT-ARROW key will cause it to `wrap-around' to the left-most (or first) field in the same row. Similarly, if the cursor is in the first field and the LEFT-ARROW key is pressed, it will move to the last field in the row. If there is only one field in the row, these keys are ignored.

UP-ARROW and DOWN-ARROW keys - pressing these keys causes the cursor to move up or down respectively to the nearest field (horizontally) in the adjacent row. If the cursor is positioned in the first row that has an enterable field, UP-ARROW keystrokes are ignored. The same is true for DOWN-ARROW keystrokes in the last row of a screen.

In cases where the screen contains more lines (or rows) than the display so that all of the screen cannot be displayed at the same time, moving the cursor `beyond' the top or bottom of the display causes the display to be repositioned on the screen so that the cursor always remains `in view'.

Note that when appropriate, the column headings remain fixed during `scrolling' so that the fields continue to be easily identified.

PAGE-UP and PAGE-DOWN keys - these keys allow for quicker screen scrolling than is capable with the up-arrow and down-arrow keys. On screens that are larger than the display, a `page' is part of a screen equal to the size of the display excluding any header rows. Since screens usually have one header row, most of them have a page size of 3 rows.

The page keys move the cursor and the display up or down one full page. If the cursor is too close to the top (bottom) of the screen to move a full page, it moves to the top (bottom) of the screen.

Function Keys

ENTR key - The enter key instructs the Naztec controller to process the current field. In the case of data entry fields, this means that if the field has been edited, store the new value in memory. If the field is a select field, then the controller is to load the specified screen or take the desired action. If the current field is a proceed (continue?) field, an enter keystroke means `yes'.

Certain fields or menu selections have actions associated with them in addition to the standard processing for that type of field. For these fields, the additional actions are initiated along with the standard processing by the enter keystroke.

ESC key - The escape key causes the controller to exit the current screen and load the screen previously accessed. Usually, the previous screen will be a menu. Successive escape keystrokes will cause successively previous screens (menus) to be loaded until the main menu is displayed, at which point additional escape keystrokes are ignored.

In the case of a warning screen, pressing the escape key not only returns the previous screen but reinstates the conditions just prior to the keystroke that drew the warning. The most likely warning encountered is the "edited data has not been "entered";" warning which occurs if an escape is attempted that will cause edited data to be lost. Instructions as to how to proceed are included with warnings.

In the example just given, an escape from the warning screen returns the original screen to the display, the cursor to its previous location, and the edited value displayed in the field but not yet entered into memory.

The escape function is slightly different for help screens. In this case, pressing the escape key causes the previous Help screen to be loaded regardless of whether that was the previous screen displayed. Successive escape keystrokes load higher-level help menus until the main help menu is reached. Pressing the escape key while the help main menu is displayed causes the previously accessed data entry screen to be loaded with the context restored to the state from which the original "call for" help was made. Calls for help and returning from help are explained in detail in the ALT FCN key section below.

MAIN/DISP or DISP CTRL key - This key allows a quick movement back to the Main Menu. It also allows the back-light on the display to be turned on or off upon the second key stroke once in the Main Menu. If in the Main Menu and the back-light is off, pressing MAIN/DISP or DISP CTRL will turn it on. Similarly, if the back-light is on, pressing the DISP CTRL key will turn it off.

ALT FCN Key - The alternate function key signals to the controller the beginning of a two-key sequence used to invoke one of the `alternate functions' defined below. With the exception of HELP, which is invoked using an alternate function key sequence, alternate functions are not required to operate the SERIES 900-V21 controller. They are merely convenience features that allow the controller to be programmed more efficiently.

Each ALT-FCN sequence is composed of two keys and always begins with the ALT-FCN key. The sequence is two full keystrokes; that is, the ALT FCN key is pressed and released followed by pressing the second key and releasing it. The selected alternate function is executed on the down-stroke of the second key. Next to each of the ALT-FCN descriptions below, the full two-key sequence is listed.

Alternate Functions

(1) Help - ALT-FCN, ALT-FCN

If not in a help screen, invoking help causes the current action to be suspended and loads a help screen. The help screen which is loaded depends

on the screen and field being accessed. This type of help is often referred to as being "context-sensitive".

Issuing the help sequence from a help screen causes the previous non-help screen to be reloaded and the operational state of the controller at the time help was invoked to be restored.

(2) Restore/Clear Field - ALT-FCN, ESC

This alternate function restores the original value of a field that has been edited, but not `entered'. The controllers memory is not updated with a new value of a field until the ENTR key is pressed or an implied enter is performed as part of a cursor movement. If after a field is edited, the operator wishes to restore the original value, this sequence allows him to do so. Note that after an enter is performed, the original value no longer resides in memory and thus cannot be restored in this way. It must be reentered.

If the ALT-FCN, ESC sequence is issued and the current field has not been edited, the displayed value of the field will be `cleared' and the controller will consider it to have been edited (as though a series of 0 digits were entered).

(3) Back-light ON/OFF - ALT-FCN, MAIN/DISP or DISP CTRL

This alternate function allows the operator to control the back-light from any screen in the controller without having to be in the Main Menu.

(4) Print Active Screen - ALT-FCN, 0

This alternate function routine allows the operator to print out any screen on the controller display by this two key combination.

However, the keyboard is non-responsive while the controller is printing. The controller is able to print while the unit is operating in the field without affecting normal operation.

(5) Escape During Printing - ESC

The ESC key aborts the printing operation and performs the normal escape function to a previous menu or screen.

(6) Console Reset - ALT-FCN, 9

This key sequence causes the console to abort any entry sequence that may be in progress and turns the display off.

Audible Tones

Three audible tones are produced that indicate to the operator the results of each keystroke.

(1) Key Click - If no other sounds are produced in response to a keystroke, the key click provides the user with audible feedback that the keystroke was detected by the controller.

(2) Accepted Tone - Consisting of two short `beeps', the `accepted' tone indicates that a function was executed successfully. This tone is usually sounded when an entered data value has been accepted and written to the controllers EEPROM.

(3) Error Tone - This single tone that lasts about 1/3 second indicates that an operation could not be performed. It is sounded if a value that has been `entered' is out of acceptable limits and thus rejected by the controller. It is also given when a warning is displayed.

3.2.0 STEP BY STEP DATA ENTRY PROCEDURES

The SERIES 900-V21 controller may be fully programmed by using only the following procedures:

1. Select a menu item
2. Enter a number
3. Select an encoded field value
4. Select values for fields in an encoded field group
5. Exit a screen (or move to a previous screen)
6. Call Help and return from Help
7. Get help on any topic (or move around within help)

Additionally, the procedures listed below make programming the controller easier.

1. Exit a screen, go to the Main Menu
2. Restore or Clear the value of an edited field

This section provides step-by-step instructions for each of the above procedures.

3.2.1. Select a Menu Item

To select an item from a menu, do the following:

1. Move the cursor to the desired selection using the RIGHT, LEFT, UP and DOWN arrow keys.
2. When the cursor is located on the number of the desired selection, press ENTR.
3. The screen associated with the selection will be displayed.

Note: Menu screens are never larger than the display, so scrolling is not enabled.

3.2.2. Enter a Number

Numbers may only be entered into numeric fields. There are several types of numeric fields, but the differences only relate to the size of the field and the way the numbers are displayed. The types of numeric fields are listed in Table 3.1 below.

Type Numeric Field	Format	Description
Whole Number	12<u>3</u>	From 1 to 3 digits, displayed without additional characters.
Decimal Number	9.<u>9</u>	Usually two digits, displayed with a decimal point in the second position from the right.
Date	12-31-8<u>8</u>	Displayed in MM-DD-YY format; all six digits are one field; displayed with "-" characters in the third and fifth positions.
Time	23:5<u>9</u>	Displayed in HH:MM format; all four digits are one field; displayed with the ":" character in the third positions.

Note: The underscore in the right-most character indicates the cursor position when it is located at that type field.

Table 3.1 Numeric Field Types

The procedure for entering values in the above type numeric fields is as follows:

1. Locate the cursor on the desired numeric field by using the grey cursor movement keys. The cursor will rest in the right-most position of the field.

2. Use the white numeric keys (0 - 9) to enter the digits of the number. The display will shift the digits already entered to the left and add the new digit in the right-most position. This is the same entry/display method used on most calculators.

   For decimal, date and time fields, the display format characters (".", "-" and ":") are not entered. The entered digits will "skip-over" these special characters as they are shifted to the left.

3. If an error is made, simply keep entering digits until the correct number appears in the field. Extra digits are discarded when shifted out of the field to the left.

4. When the desired number appears in the field, press ENTR to instruct the controller to process it. In most cases, processing involves checking that the value is within certain limits and then storing it in EEPROM. If the value is accepted, the ACCEPTED tone is sounded. If the value was not valid, the ERROR tone is sounded to indicate that the value was NOT stored into memory.

   A cursor movement key may be pressed in instead of the ENTR key, in which case an enter function is performed as described in the preceding paragraph. If the value is accepted, the cursor will move appropriately. If the value is rejected, the cursor is not moved from the edited field.

3.2.3. Select an Encoded Field Value

Encoded fields may be set to one of a few possible values. The values may be numbers, but usually they are abbreviations of traffic terms (eg. RED, YEL for yellow, and DRK for dark).

To select a value of an encoded field, do the following.

1. Use the grey cursor movement keys to locate the cursor on the desired encoded field. The cursor will rest in the left-most position of an encoded field.

2. Press any white numeric key to cycle the field setting to the next possible value. Continue to press a numeric key (or hold it down to "repeat") until the desired setting is displayed.

3. Press ENTR to instruct the SERIES 900-V21 controller to process the new value. If the setting is accepted, an ACCEPTED tone is sounded; if rejected, an ERROR tone is sounded.

   A cursor movement key may be pressed instead of the ENTR key, in which case an enter function is performed as described in the preceding paragraph. If the value is accepted, the cursor will move appropriately. If the value is rejected, the cursor is not moved from the edited field.

3.2.4. Select Values for fields in an Encoded Field Group

Encoded field groups consist of two to eight encoded fields that are configured to be updated as a group. Programming encoded field groups is very efficient because values may be selected for individual fields within the group without first moving the cursor to the field. The procedure for updating encoded field groups follows.

1. Use the cursor movement keys to locate the cursor at the desired encoded field group. The cursor will rest on the same row as the group between the group name and the first field of the group; that is, to the right of the name and to the left of the first field.

2. To cycle the value of one of the fields in the group, press the numeric key associated with that field's column as indicated by the column heading. Continue to press the numeric key (or hold it down to "repeat") until the desired setting is displayed.

3. Press ENTR to instruct the controller to process the values in all the fields of the group. If the values are accepted, an ACCEPTED tone will sound. If the values are rejected, the ERROR tone will sound.

   A cursor movement key may be pressed instead of the ENTR key, in which case an enter function is performed as described in the preceding paragraph. If the value is accepted, the cursor will move appropriately. If the value is rejected, the cursor is not moved from the edited group.

3.2.5. Exit from a Screen

To exit a screen and proceed to the previous screen, the following procedure is used:

1. Press the ESC key.

   If processing is complete, the previously displayed screen will be loaded and re-displayed (usually this is a menu). If processing was not complete (eg. a

field was edited and not "entered"), a warning screen will be displayed with instructions as how to proceed. Usually, pressing ENTR from a warning screen ignores the warning and proceeds with the original escape. Pressing ESC from a warning screen cancels the escape command which drew the warning, returns to the original screen and restores the display to the condition just prior to the offending escape.

3.2.6. Invoke HELP and Return

"Help" screens may be called up at any time to provide information about a screen or an operation. When help is invoked, the current screen/operation is suspended and a help screen displayed. Once in the "Help" mode, other help screens may be viewed or browsed (the procedure following this one describes how to do so). Upon returning from Help, the condition of the display is restored to its state just before Help was invoked.

Help is invoked using an Alternate Function key sequence. To call help, do the following:

1. Press the ALT FCN key and release it. Other than a key-click sound, nothing will happen.

2. Press the ALT FCN key again. A help screen will be displayed that pertains to the screen, field, or operation currently accessed.

3. Use the cursor movement keys to view the entire help screen if necessary.

4. Return from Help using the same alternate function sequence described in steps 1 and 2 above.

3.2.7. Get Help on Other Topics

From within help, it is possible to view other help screens on related or completely different topics. Help screens may be accessed by Help Menu screens just as data entry and display screens are accessed by standard menus. To select and view other help screens, follow the procedure below.

1. If not viewing a help screen or help menu, invoke help using the previous procedure.

2. While viewing a help screen, press ESC to load a help menu that contains selections with related topics. If the desired topic is on the menu, select the item using the standard procedure. If the desired topic is not on the menu, press ESC again to view a "higher-level" menu which contains selections with more general topics.

3. Repeat step 2 until the Help Main Menu is displayed.

4. Return from help by pressing ALT FCN twice.

3.2.8. Alternate Function Procedures

The three procedures below involve alternate function sequences. These features are not required in order to fully utilize the capabilities of the SERIES 900-V21 controller, but they do allow some of the programming to be accomplished more efficiently.

3.2.8.1. Exit to Main Menu

This optional procedure is equivalent to pressing ESC as many times as would be necessary to reach the main menu. The procedure is:

1. Press MAIN/DISP or DISP CTRL and release it. A key-click will sound. An escape will be executed. If no warning is displayed, the main menu will be loaded and displayed. If a warning is drawn, the screen will provide instructions for proceeding.

3.2.8.2. Restore/Clear Field Value

This optional feature restores the value of an edited field to its value before it was edited. Note that once an edited field value is entered, the new value is stored in memory and its status is no longer "edited"; thus, it cannot be restored.

If the Restore/Clear sequence is issued on a field whose status is NOT edited, the field display will be cleared and the status changed to "edited". This would be equivalent to entering enough zeros to clear the field.

1. Press the ALT FCN key and release it. A key-click will sound.

2. Press the ESC key. Depending upon the edit status of the field, it will be restored or cleared as described above.

3.2.8.3. Print Active Screen

The Print Active Screen command is accomplished through a two step key stroke utilizing the ALT Function key and the numeric key 0. This command will print any screen currently being displayed by the controller.

3.3.0 DATA ENTRY SCREENS

3.3.1. SIGN-ON

Whenever power is applied to a Naztec SERIES 900-V21 NEMA Traffic Controller or after a programmed time of no keyboard activity, the controller console (display, keyboard and speaker) automatically enters the standby mode. In this mode, the display is either turned off or it displays the sign-on screen; the back-light is turned off; and the security access enable is reset (refer to section 3.3.10 for a discussion of the security feature). The sign-on screen identifies the controller by model number and software version and includes the copyright notice.

To initiate a console session from the standby mode, press any key on the keyboard. If the sign-on screen was displayed prior to the first keystroke, the main menu will replace it and the console will be in the `operating' mode. If the display was off, the first keystroke will cause the sign-on screen to be displayed. A second keystroke (again, any key will do) is then required to reach the Main Menu. In either of the above cases, the normal function of keystroke(s) is suspended until the Main Menu is displayed and the console has entered its operating mode. Note that the console operating mode is in no way associated with the timing operation of the controller which is determined by a separate control. The controller may be timing (ie. running) or not timing regardless of the console mode (standby or operating).

3.3.2 MAIN MENU

The main menu contains 9 selections, each of which causes another menu to be displayed. These secondary menus contain various selections which in turn load other menus, data entry screens, or status display screens. Menus and the selections on them are organized so that related functions appear together.

The remainder of this section of the manual is organized in the same manner as the menus.

The selections on the main menu are:

1. Controller

   Functions accessed under the controller sub-menu include basic controller programming items such as phase interval timing, ring initialization phases, flash phases, overlaps, and others.

2. Coordinate

   The coordinate sub-menu contains selections used to program coordination features such as force-offs, yields, splits, etc.

3. Preempts

   Programming of rail and fire preempts are accessed by this selection. Sub-menu functions include preempt phases, flash states and timing.

4. T.B.Coor.

   Time Based Coordination is programmed by using functions accessed under this menu selection. Specific functions include real-time clock/calendar setting, programming weekday and holiday schedules, programming TBC commands and cycle/split outputs.

5. Detectors

   The mapping of detectors to phases and setting of detector related options are accomplished under this selection.

6. Comms

   Communications parameters and utilities are found on the sub-menu under this selection.

7. Status Disps

   Selection 7 accesses a sub-menu of controller status displays. These displays show the current state of the controller timing, outputs and coordination in summary and detail.

8. Special Functions

   Special Functions include features that do not fall into any of the other general categories, such as security code entry, diagnostics, and maintenance. Diagnostics are the programs which include operator initiated self-tests and troubleshooting functions. Also found on the diagnostics sub-menu are initialization functions which allow programming of the controller to begin from a known condition of program memory.

3.3.3 MAIN MENU, Selection 1, CONTROLLER MENU

This selection under the Main Menu provides nine sub menus pertaining to the controller functions. These nine entries are as follows:

1. Phase Setup
2. Parameters
3. Ring Initialization
4. Flash
5. Overlaps
6. Alarms
7. Activate Run
8. Dimming

3.3.3.1 CONTROLLER, Selection 1, PHASE SETUP

The Phase Setup menu is a second-level sub-menu that contains functions for programming phase timing, barriers, conflicts, recalls, phase reversals and other options. Entry procedures for selections found on this sub-menu follow.

3.3.3.1.1 PHASE SET UP, Selection 1, INTVL TIMES

Use the Interval Times screen to enter phase timing values and limits. Details regarding the functions of these parameters and their limits are discussed in Section 2.0.

This entry screen is organized in a matrix of 8 columns and 17 rows. Each row pertains to one timing parameter, and each column to a phase. All of the fields on this screen are either whole numbers or decimal numbers. Following is a list of interval times and the limits of acceptable entries that are programmable under this selection.

Interval Abbrev.	Description	Acceptable Range
MIN GRN	Minimum Green	0 - 99
GAP,EXT	Extension Gap	0 - 9.9
MAX 1	Maximum 1	0 - 99
MAX 2	Maximum 2	0 - 99
YELLOW	Yellow	0 - 9.9
	(If pencil SW 7 ON)	3 - 9.9
RED	Red	0 - 9.9
WALK	Walk	0 - 99
PED CLR	Pedestrian Clearance	0 - 99
ADD INIT	Added Initial	0 - 9.9
TT REDUC	Time to Reduce	0 - 99
TB REDUC	Time before Reduction	0 - 99
MIN GAP	Minimum Gap	0 - 9.9
MX IN GRN	Maximum Initial Green	0 - 99
WALK 2	Walk 2	0 - 99
PED CLR 2	Pedestrian Clearance 2	0 - 99
MAX 3	Maximum 3	0 - 99
MAX EXT	Maximum Extension	0 - 99

3.3.3.1.2 PHASE SET UP, Selection 2, BARRIERS

This screen allows each phase to be declared active or inactive for each of the four available barriers. The screen is organized as a matrix of 4 rows and 8 columns. Each row corresponds to a barrier and each column to a phase. The entry fields are of the encoded-group type with two possible values per field; 0 indicates that a phase is inactive in the selected barrier while 1 indicates the phase is active. This programmable feature can be replaced by fixed barriers, dependent upon the setting of pencil switches 1 and 2 as described in the appendix. In order to program the barriers, the dip switch on the I/O module must have positions 1 and 2 set to "ON".(4.1.C.1). When the dip switch is so programmed, you cannot use "Easy Programming". Easy Diagnostics will give you a "EASY CONF ERROR" message.

3.3.3.1.3 PHASE SET UP, Selection 3, CONFLICTING PHASES

The SERIES 900-V21 controller allows the operator to define conflicting phases through a keyboard entry. Phases 1 and 2 may each be configured to conflict with phases 5 or 6. Phases 3 and 4 may each be configured to conflict with 7 or 8. Four encoded fields are provided, one each for phases 1 through 4, for specifying conflicting phase conditions.

3.3.3.1.4 PHASE SET UP, Selection 4, RECALL

Use this screen to set the type of recall to be applied to each of the eight phases. Recall may be set to one of eight possible types as listed in Table 3.2.

Recall Type Abbreviation	Definition
MEM ON	Memory On
MEM OFF	Memory Off
MIN	Minimum
MAX	Maximum
PED & MIN	Pedestrian and Minimum
PED & MAX	Pedestrian and Maximum

TABLE 3.2 Recall Definitions

The Recall Definitions screen contains eight fields, one per phase, organized in four rows and two columns. Scrolling is active to allow access to the last line of the screen. The entry fields are of the encoded type.

3.3.3.1.5 PHASE SET UP, Selection 5, REV and COND SERV

PHASE REVERSAL

Use this screen to reverse the phase sequence by phase pair in the SERIES 900-V21 controller. There are four fields, one per phase pair, each with possible values of NO and YES. NO indicates phase sequence is NOT reversed for a pair; YES indicates phase sequence is reversed. The fields are of the encoded type.

CONDITIONAL SERVICE

This entry is identical to Phase Reversal. Conditional Service is only active in the standard NEMA 8 phase Quad Left configuration. A phase can be reserviced if one of the Rings contains a barrier phase resting in green, and the other Ring barrier phase which is timing contains enough Maximum time to allow the resting phase to "backup" and service the first phase of it's Ring. As long as a call exists on the other side of the barrier, the Ring will not reservice the barrier (forward) phase, but will gap out and cross the barrier. A phase can be programmed to service the barrier phase and this is call the reservice option.

CONDITIONAL RESERVICE

This entry is again identical to Phase Reversal. Conditional reservice is only active once a phase has been reserviced and the entry is active. Reservice is activated if there is enough maximum time remaining in the concurrent barrier phase to service the minimum or walk + ped. clearance if a ped. call is present for the forward phase and the yellow and red clearance time of the current phase. Also the phase to be reserviced cannot have been serviced twice.

INHIBIT BACKUP

This entry allows the inhibit of phase pair backup. If the backup of pair 1/2 is active, and if phase 2 is the barrier phase, then the controller will not back up from phase 2 to phase 1 even if these are the only two phases with calls. The machine must service a phase in the other barrier to be able to again service phase 1.

3.3.3.1.6 PHASE SET UP, Selection 6, OPTIONS

This screen allows 13 optional features to be invoked on a per phase basis. The screen is organized in 13 rows and 8 columns; one row for each optional feature and one column for each phase. The entry fields are of the encoded-group type with two possible values per field; a 0 value indicates that the optional feature is not active for the associated phase while a value of 1 indicates

that the feature is active. A description of each of the phase options follows.

(1) PED PROTECT - Pedestrian Protected Phases

This feature allows a phase to act in a protected pedestrian mode in which the manual control enable and interval advance have no effect on the pedestrian clearance interval. Each phase is capable of operating in a protected pedestrian mode.

(2) NON ACTUATED 1 - Call to Non Actuated 1

This feature will allow a call to Non Actuated 1 to be applied on a per phase basis, phases 1 - 8. When this feature is active, the phase will operate in a call to

Non Actuated mode when the NEMA input call to Non Actuated Mode 1 (CNA I) is active.

(3) NON ACTUATED 2 - Call to Non Actuated 2

This feature will allow a call to Non Actuated 2 to be applied on a per phase basis, phases 1 - 8. When this feature is active, the phase will operate in a call to Non Actuated mode when the NEMA input call to Non Actuated Mode 2 (CNA II) is active.

(4) LAST CAR PASSAGE

This feature will enable the Last Car Passage feature to operate on a per phase basis. This feature is used in Volume Density Operations. Consult manual under Functional Characteristics.

(5) REST IN WALK

This entry is available on a per phase basis. The Rest in Walk entry allows the controller to rest in the Walk interval after the timing of that interval in the absence of a serviceable conflicting call.

(6) NO SKIP PHASE

This entry is available on a per phase basis. The No Skip Phase entry allows the controller to operate a phase as a No Skip Phase in its normal Ring sequence. A No Skip Phase will be serviced in the correct priority in its appropriate Ring even if no call is present. However, the phase programmed as a No Skip Phase is only activated when the controller tries to skip the phase in a Ring rotation.

The call generated by the No Skip logic is not subject to being stored in vehicle memory, and will be dropped if the reason for the call is terminated.

(7) SOFT RECALL

The Soft Recall entry will place a Minimum recall on any phase programmed as a soft recall phase when there are no calls existing in the controller. This means that the controller will rest in a phase programmed for Soft Recall in the absence of any calls. This feature provides for a more efficient means of programming the controller to rest in Main Street Green. The controller will rest in Main Street Green on two conditions only: No vehicle calls or a real vehicle call on the main street. The advantage is that the phase can be skipped if the controller has calls on other phases and no calls on the main street, but will rest in the main street green with no calls at all.

This feature is available for every phase; however, if Soft Recall is used on every phase its purpose will be defeated.

(8) SELECT MAX II

This feature will enable the Max II timer on a per phase basis. The Max II timer will time in place of the Max I timer when activated.

This feature also operates in conjunction with the Apply Hold input on a per phase basis. Apply Hold is referenced under Coordination Parameters.

(9) SEL. PED TIMING 2 - Select Pedestrian Timing 2

This feature enables the Pedestrian 2 timer on a per phase basis. The Walk 2 and Ped Clear 2 will time in the defined phase in place of the Walk and Ped Clear timer when activated through the keyboard.

(10) FLASHING WALK - Flashing Walk Phases

This feature defines which phase(s) will cause the walk output to flash during the walk interval.

(11) OMIT PHASES

The SERIES 900-V21 controller contains 8 phases. For applications that require less than 8 phases this keyboard entry omits the unused phases.

An omit will be applied to the defined phase when the omit feature is ON - "1". The phase is allowed when the omit feature is OFF - "0".

(12) DUAL ENTRY PHASES

In Dual Ring operation of an 8 Phase Quad Left Turn, a call on a single phase of the controller will cause the

phase to time by itself as the controller crosses the barrier. The other Ring which does not have a phase call will go to Red Rest. This operation is defined as Single Entry.

Dual Entry causes a call to be placed on a selected phase of the Ring which would normally go to Red Rest. The controller will only place a call and service the phase when no other calls are present in that Ring as the controller crosses the Barrier.

(13) SIMUL. GAP PHASES - Simultaneous Gap Phases

As described in Section 2, Simultaneous Gap Out is related to a standard 8 Phase Quad Left Turn Operation. When two phases are timing concurrently with a call across the barrier, a phase that Gaps Out due to no demand will normally enter a green dwell state. The phase in which this occurs will remain in that state until the phase in the other Ring terminates.
With Simultaneous Gap Out programmed, the first phase to Gap Out will be allowed to re-enter and leave the green dwell state. The controller will continue to re-extend both phases until the phases simultaneously Gap Out, Max Out, or Force Off.

(14) RESERVICE

As described in Section 2, Reservice allows a conditional serviced phase to be reserviced again.

3.3.3.1.7 PHASE SET UP, Selection 7, COPY TIMING

Copy timing is a function which allows sixteen timing parameters of one phase to be copied to another phase including the recall setting. Only Max 3, the extendable Max time, and Bicycle timing is not transferred Under the copy timing menu. First enter the phase number of the "phase from" entry. Now enter the phase number of the "phase to" entry and press the enter key. When the timer indicates that the entry is accepted, the transference of data contained in the "from" phase to the "to" phase has occurred.

3.3.3.1.8 PHASE SET UP, Selection 8, FAIL TIMES

Fail Times consists of a green, yellow, and red per ring. Each timer keeps track of the amount time spent in each phases major interval. If the amount of interval time is less than that programmed under the fail time entry and the alarm number is active, an fail time event will be activated. When the alarm forwarding is active, then the failure will be placed into the alarm buffer.

3.3.3.1.9 PHASE SET UP, Selection 9, SKIP YELLOW

Skip yellow phasing is designed to meet the 5 section head logic used in the state of Illinois. When phases 2, 4, 6, or 8 terminate and the corresponding left turn terminates, then the yellow arrow should not be displayed. To accomplish this, a programming feature was implemented that will cause the corresponding left turn phase to skip its yellow clearance time when the thru movement terminates. Programming is accomplished by placing pencil switch 4 on the I/O board to the on position. Listed in the selection menu are the through movement phases. Make a selection next to the through movement phase, the phase that is to skip yellow when it terminates with the through movement. As an example, if phase 5 is to skip its yellow movement when terminating with phase 2, then next to phase 2 select phase 5.

3.3.3.2 CONTROLLER, Selection 2 - PARAMETERS

This screen is reserved for programming miscellaneous parameters that affect the operation of the controller. Their function is described below.

(1) Red Revert Time

Red revert timing can occur during the Red Rest mode if a call is placed on a Phase during its clearance interval in the absence of any conflicting calls. The phase receiving the call cannot re-enter the Green interval until after the timing of the clearance intervals, and the phase must then enter the Red Rest interval and time the Red Revert time. One entry is used for all eight (8) phases and cannot be programmed for less than 2.0 seconds.

One decimal field is provided for setting red revert time. An acceptable value is from 2.0 to 9.9 seconds.

(2) Volume/Occupancy Sample Time

This entry represents the Volume/Occupancy Timer. The range is from 000 to 255 in increments of 1 minute. This time represents the time period for one (1) volume or occupancy sample.

(3) # of Samples

This entry represents Number of Sample periods which the controller will record. The range is from 00 to 99 samples.

AVAILABLE INPUTS / TEST A AND B

These two entries allow the operator to define two extra inputs located on the "A" connector to be defined from the list below:

1. NONE
2. DIM - Signal Head Dimming
3. FLASH - Flash
4. PRE 1 - Preempt 1, usually Rail Preemption

(4) Test A

Test Input A is capable of operating under one of the above four functions with a reference to logic ground.

(5) Test B

Test Input B is capable of operating under one of the above four functions with a reference to logic ground.

(6) Exclusive Pedestrian

An On entry along with the continued activation of phase 1 pedestrian call input will enable the 9th phase called the exclusive pedestrian phase. During this phase all of the walk signals for the eight phases will come on simultaneously and will time the Walk and Don't Walk time as programmed for phase one.

The 9th phase is serviced whenever a ped call is detected on any of seven (7) phases with the exception of phase 1, which must be held low to enable this feature. Note that the exclusive pedestrian phase is to be used in standard NEMA operation only and will occur when the controller leaves the left side barrier i.e. phases 1,2,5,6.

(7) Volume/Occupancy Stop On Full.

An entry that will not allow the volume/occupancy sample buffer to roll over to the first sample position until the computer master has read the data of all samples taken.

(8) Transmit Alarms

This entry, when ON, will cause the timer to transmit the alarm number of the active alarm to the computer master via direct wire or Hayes Modem. Normally OFF in a closed loop system unless the controller is On Street Master or stand- alone monitor application.

(9) Rec Pat Evts - Record Pattern Events

This entry, when active, will allow the timer to input into the event buffer changes in all of the timers system configuration.
(10) % Green Sample Time 00 to 255 minutes

Setting this sample time between 01 and 254 minutes will allow the controller to accumulate the % of time each

phase was in green over the total amount of time. Once this calculation is made, 8 events are stored in the event buffer which contain the phase number and the percent of green activity time. Setting the timer to 255 will activate a logic condition in the timer that will allow the calculation to take place only during coordination and starting each time a system pattern event takes place. Setting the entry to zero (0) deactivates the % green calculation.

(11) Hardware Station I.D.

If this entry is turned "on", the Station I.D. will be determined by a pencil switch on the card rack detector, where the bit is considered active when the pencil switch is closed. If this entry is turned "off" the station I.D. must be set in comm port #1 parameters. If the controller contains a master, it will be programmed to the local station I.D.s number plus one.

(12) Console Time Out Time

This entry allows the operator to set the amount of time after the last keystroke has been made on the keyboard before the controller will disable the security code and blank the display. The entry is from 0 to 99 seconds.

3.3.3.3. CONTROLLER, Selection 3 - INIT. RINGS

Entries are made on this screen to define controller initialization sequencing for each ring. It includes fields to set initial phase and interval, and the phase next decision if the initialization phase is brought up in the yellow interval.

The initial phase fields are numeric. An acceptable value for ring 1 is 1 to 4, for ring 2 is 5 to 8.

Possible initial field settings are green, yellow, and red (abbrev. GRN, YEL and RED) which is defined by an encoded field. This entry per ring selects the initial interval for the define phase.

A yellow phase-next decision field is provided per ring. The entry parameters are identical to the initial phase

fields. This entry only applies if the initial phase is programmed for a YEL interval initialization.

There is also a provision under "USE OPP. RING'S INPUTS" for programming individual phases to use the other ring's inputs for Max termination inhibit, Red Rest, Stop Time, Force Off, Ped Recycle, Omit Red Clearance and Max II.

If the Run Timer is activated after initialization has been incorrectly programmed, an initialization error will

be displayed.

3.3.3.4 CONTROLLER, Selection 4 - FLASH

The Flash sub-menu contains selections for programming various flash control parameters including phase and overlap flash states, beginning and ending flash phases, return from flash clearances and common flash phases and overlaps. Also accessed from the flash menu is the flash enable "switch".

3.3.3.4.1 FLASH, Selection 1 - FLASH PARAMETERS

The Allow Flash screen contains an encoded field for enabling the flash logic. Possible values are No and Yes. A value of No disables the function; a Yes enables it.

The Allow Flash feature causes the controller to preempt to Flash if the coordination mode of the system configuration word is

FLASH.

Voltage Monitor Flash

Voltage Monitor Flash allows the voltage monitor output for the controller to go high to allow the conflict monitor to begin flash. Entry procedure is the same as Allow Flash.

3.3.3.4.2 FLASH, Selection 2 - FLASH STATES

This screen permits programming of independent vehicle, pedestrian and overlap flash states for each phase during the external flash mode or time of day flash. The encoded fields are organized in a matrix of three rows by eight columns; outputs are assigned to rows and phases to columns. The possible flashing states for the vehicle and overlap outputs are red, yellow and dark (abbreviated RED, YEL, DRK). The pedestrian outputs are either 1 or 0 (on and off respectively).

3.3.3.4.3 FLASH, Selection 3 - BEG/END FLASH PHASES

The operator uses this screen to define where in the phase sequence flashing begins or ends when it is invoked by flash input or by the time of day flash command. Four numeric fields are provided to define the beginning and ending flash phases for each ring. Valid entries are the

phases that comprise their respective rings; ie. 1 - 4 for ring one and 5 - 8 for ring two. 0 is also an acceptable entry for either field.

3.3.3.4.4 FLASH, Selection 4 - RETURN CLEARANCES

This screen allows the operator to select two clearance times for the controller to time after ending the flash sequence. Two decimal numeric fields are provided, one for yellow clearance time and the second for red clearance. Acceptable values range from 0.0 to 9.9.

3.3.3.4.5 FLASH, Selection 5 - COMMON PHASES AND OVERLAPS

Two encoded field groups are provided to allow the operator to program, through the keyboard, the flash sequence for the signal head indications for all eight phases and all eight overlaps. The flash sequence applies only to flashing applications in which the controller is defining the flashing operation.

One encoded group is used to define common flash phases and the other common flash overlaps. Eight columns allow each phase to be assigned independently. Encoded selections are 0 and 1. All 0 selections are flashed together while the 1 selections are dark and vice-versa.

3.3.3.5 CONTROLLER, Selection 5, OVERLAPS

The Overlap menu is a second level sub-menu that provides all the program information for Overlap setup and operation. Entry procedures for selections 1 - 8 are as follows:

3.3.3.5.1 OVERLAPS, Selection 1, PARAMETERS

This entry allows the operator to define the method of Overlap programming for the Controller. The Overlap programming is accomplished through the keyboard or through a standard NEMA overlap program card. The display header will read Overlap Parameters. This menu contains three basic entries:

1. INTERNAL PROGRAMMING ON/OFF - Internal Overlaps
2. LOCK MODE ON/OFF - Lock Overlaps in Red
3. NEXT CONFLICT MODE ON/OFF - Conflict Phase Lock
4. CALC. FROM PARENT ON/OFF - Parent Phase Active

1. The SERIES 900-V21 controller contains the option of utilizing a standard NEMA overlap card or Internal Overlaps programmed through the keyboard for overlaps 1-4. With the internal overlap programming mode OFF, the controller reads the NEMA overlap program card. With the internal overlap programming mode ON, the controller reads the internally defined program for the overlaps.
2. The second parameter is the option of having the overlaps lock in red until their separate clearance times have timed out. With the Lock in the OFF mode the overlaps could possibly time into another phase

movement. With the Lock in the ON mode the overlap added green and clearance must be timed out for a phase next to occur.

3. The conflict phase lock entry mode allows the operator to define the operation of the Overlaps to function relative to the Overlap Conflicting Phases.

   The Conflict mode functions in a similar manner as the LOCK mode except the CONFLICT mode only applies when a phase next conflicts with an overlap. This relates to Overlap Conflicting Phases, which define phases conflicting with overlaps.

   The CONFLICT mode when set to ON will lock the controller in the RED interval until the conflicting overlap clearance times have terminated. To disable the feature, the CONFLICT mode is placed in the OFF position.

4. The parent phase entry when ON will cause an overlap to time the clearance times of the phase causing the overlap to terminate. The delay green time can still be used and must be entered in the overlap clearance times. When using the parent phase times we do not recommend that overlaps be programmed for conflicting phases or overlaps.

3.3.3.5.2 OVERLAPS, Selection 2, PROGRAM

This entry allows the operator to program the Internal Overlaps through the keyboard. Note: For the Internal Overlap Outputs to function, the Internal Overlap mode which is found in the previous menu must ON.
The SERIES 900-V21 controller contains eight (8) internal overlaps. The four extra overlaps can be defined to utilize the unused ped movement outputs for phases 1, 3, 5, and 7 and must be programmed from the keyboard.

The overlap program screen allows the operator to view any three of the overlap program configurations at one time. Enter an ON or OFF under each phase which you desire to be included in the one of the eight overlaps being programmed.

3.3.3.5.3. OVERLAPS, Selection 3, TYPES

The operator is able to define the overlap types for each of the eight (8) overlaps available in the SERIES 900-V11.0 controller. Internal to the controller, three (3) overlap type selections are available. These are defined as follows:

NORMAL
ILLINOIS
FLORIDA

The eight (8) overlaps in the SERIES 900-V21 series controller are independent of each other. Each of the eight (8) overlaps can be defined as any one of the three types.

The entry procedure allows the operator to toggle each phase entry through the three possible overlap types. Once the desired overlap type is selected, press the ENTR key.
DEFINITIONS:

NORMAL

In the normal mode the overlap will operate as a direct function of the parent phase(s).

ILLINOIS

Condition 1 - If the suppression phase is green the overlap is red.

Condition 2 - If in a suppression phase and the phase next is a suppression phase then the overlap will remain red.

Condition 3 - In all other conditions the suppression phase does not alter the overlap.

FLORIDA

Condition 1 - In a suppression phase the overlap operates in a dark mode - all three outputs.

Condition 2 - In all other cases the Florida style overlap operates the same as the Normal style overlap.

3.3.3.5.4. OVERLAP, Selection 4, CONFLICTING PHASES

This entry allows the operator to define any of the eight phases as conflicting with any overlap.

Enter the conflicting phases with the defined overlaps needed for the application. The phase numbers are listed on the top line header in order from one to eight. The eight overlaps are listed in rows. Cursor up or down to view all eight overlap inputs, and then toggle the phase number to enter an ON or OFF value.

An example of a phase conflicting with an overlap would be on a right turn movement (overlap 1) displaying a green turn arrow. For example -overlap 1 = phases 2 + 5 + 6. Phase 1 conflicts with overlap 1, so when phases 1 and 5 are timing, overlap 1 would remain red. This allows an efficient and safer intersection control device.

3.3.3.5.5 OVERLAP, Selection 5, CONFLICTING OVERLAPS

This entry screen allows the operator to define an overlap to conflict with another overlap. The eight overlaps are listed on the top line header with the eight overlaps also listed on the screen in rows to form a matrix. Toggle the overlap number to enter the correct ON or OFF value for each matrix entry.

3.3.3.5.6 OVERLAP, Selection 6, SUPPRESSION PHASES

This entry allows the operator to define a phase as a suppression phase. This entry should be used only in conjunction with the Illinois and Florida style overlaps.

3.3.3.5.7 OVERLAP, Selection 7, CLEARANCES

The SERIES 900-V21 controller allows the operator to program separate green yellow and red clearance times for each overlap. Each entry has a range of valid entries from 0.0 to 9.9 seconds. The entries for all eight overlaps can be viewed on one screen selection.

Green	0.0 - 255
Yellow	0.0 - 9.9
Red	0.0 - 9.9

3.3.3.5.8 OVERLAP MENU, Selection 8, OUTPUT MAP

This entry allows the operator to define the outputs for overlaps 5 - 8. The outputs available include all eight (8) pedestrian outputs on phase 1 - 8. The output programming is accomplished through an output map. Enter the appropriate output location for the additional 4 overlaps.

3.3.3.5.9 OVERLAP MENU, Selection 9, Pedestrian Overlap

The pedestrian overlap is a feature that will allow any of the eight phase pedestrian movements to be mapped onto any of the eight possible pedestrian phase outputs. With the feature active and pedestrians assigned from the other ring (phase 1 ped assigned to phase 5), caution must be taken when the assigning these overlaps. A pedestrian output mapping must always be in place for the pedestrians to work in a normal manner. After erasing the EEPROM, initializing the phase data will cause these entries to be mapped for standard NEMA.

3.3.3.6 CONTROLLER, Selection 6, ALARMS

There are several screens which allow for alarms to be defined.

3.3.3.6.1 ALARMS, Selection 1, ALARM PARAMETERS

TXMIT ALARMS - This screen is used to activate the active alarm buffer to be transmitted to the master

RECORD PATTRN EVTS - This screen is use to activate the recording of the timer changes in the system configuration. This entry can also be activated in several other places

3.3.3.6.2 ALARM MASK

Used to enable or disable alarms being placed into the event buffer. There are a total of sixty-four (64) alarm enable fields presented.

The alarm enable fields are grouped in rows of eight. The alarm numbers on a particular row are identified to the left of the first enable field on that row. The column headings identify the number of the alarm in the group. For example, the alarms in the second row are from alarm #9 to #16 with #9 being located in the first column and #16 in the last.

An alarm is enabled by selecting a "1" in the appropriate field; selecting "0" disables it.

3.3.3.6.3 FWD ALARM MASK

The forward alarm mask is used to generate alarms desired to be forwarded to the central timer

3.3.3.7 CONTROLLER, Selection 7, ACTIVATE RUN

This entry is similar to a modified ON/OFF switch. When the ACTIVATE RUN TIMER? is set to YES the controller functions normally. The OFF mode applies stop timing to the controller and disables all outputs including Voltage Monitor. If the controller is in a cabinet, turning the Run Timer OFF will cause the conflict monitor to activate cabinet flash. This entry must be in the OFF position for some of the crucial entries in the SERIES 900-V21 controller to be enabled. The barrier programming and the internal diagnostics are two examples. When the Run Timer is reactivated, the controller will begin in its start-up sequence, however; if the barriers are incorrectly programmed an error will occur. Upon error detection, the Activate Run will still remain in the OFF position, until the error is corrected.

3.3.3.8 CONTROLLER, Selection 8, DIMMING

This entry allows the operator to allow the controller to dim each individual output as a function of Time of Day or an external input. Each Phase/Pedestrian/Overlap allows dimming to be assigned on an individual output basis.

The entry type is an Encoded Field Group with 8 columns and 9 rows. The entry selections are two types: 0 = Off, 1 = On.

The time of day dimming would be called up under a command entry. Each of the 17 command entries is capable of calling for dimming operation. The number 3 output is assigned as the dimming output. This output operates in conjunction with a TBC parameter called TOD dimming. When TOD dimming is active or in the ON position, output number 3 calls for dimming to become active. The output pin assignment on the "D" connector is still high; thereby, still allowing the use of the special function output number 3. NOTE: The TOD dimming will not be active unless the TOD dimming switch is set in the ON position; this entry is located under TBC parameters: selection 6 under Weekday entries (4) from Main Menu. The external input may be assigned on the "D" connector or through Test Inputs A or B. The input is referenced to logic ground.

3.3.4 MAIN MENU, Selection 2, COORDINATION

3.3.4.1 COORDINATION, Selection 1, TEST CONFIGURATION

The Controller Test Configuration is a entry that allows the operator to define a coordination test set up for the controller. The Test Configuration operates on the highest priority level in the controller. The Test Configuration defines the mode of command selection, mode of coordination selection, offset selection, a plan number selection (0-16) and a command mode selection.

1. Command Mode Selection - The command selection defines how one of the seventeen (17) commands will be selected. The screen entries are the encoded field type with the following definitions.

OFF Command mode is inactive, commands will never be used

AUT Auto - Uses external inputs and reverts to TBC if inputs are lost.

TBC TBC Command number selects commands

RTC Use the Command Mode as defined in the TBC Configuration as generated by the RT Clock from the Holiday and Weekday entries.

2. Coordinator Mode Entries - The screen entries are the encoded field type and define from which configuration the offset and plan number will be selected to develop the internal coordination.

OFF Coordinator Off, will never run

AUT Auto - Uses external inputs and reverts to TBC if inputs are lost.

EXT External Coordination only
XCY External Cycle Counter - Time Base selects Offset, Plan

ICY Internal Cycle Counter - External selects Offset, Plan

FL Flash

RTC Use the Mode as defined in the TBC configuration generated by the RT Clock

3. Offset - This entry selects the test offset or allows the selection of the offset based on the coordination mode.

   Offset 1 to 4 1 - 4 Offsets

   Offset 9 Use the Offset defined by coordination mode.

4. Plan - This entry selects the test plan or allows the selection of the plan based on the coordination mode.

   Plan 0 to 16 17 independent plans

   Plan 99 Use the Plan defined by the coordination mode

3.3.4.2 COORDINATION, Selection 2, CYCLE OFFSET TRANSITION

This screen allows the cycle length, four (4) offset values, the transition percentage, and the dwell time to be entered for the 16 different coordination plans. All of the 16 plans may be divided into a combination of cycles and splits to conform to the operators ideas of traffic flow. The field type used for these entries is the numeric type with all data pertaining to a plan displayed on one line.

1. CYCLE LENGTH - The interval of time for the coordinator to guarantee either the beginning or end of green for a single sequence through all the used phases. The selection range is from 000 to 255 seconds.

2. OFFSET TIME - Offset time is defined as the amount of time from the Sync pulse to the beginning time (Time 00) of the local cycle counter. The local counter is used to determine the Yield and Force Off point during coordination. There are 4 Offset times allowed for each Plan (Cycle) or a total of 64 offset entries. The

offset times are entered in real time in seconds.

3. TRANSITION PERCENTAGE - This entry allows the operator to define the percentage change allowed during synchronization of the local cycle counter to the master cycle counter or external sync pulse. One entry is allowed per plan for short way (cycle length decreased) and one entry is allowed for long way (cycle length increased). The percentage range is from 10% to 24%. An entry of 00 will disable the short or long-way change.

   When short way is disabled, the synchronization is similar to dwell and the percentage is defined by the long way entry. When both the short and long entry are set to 00 then the controller will automatically use the dwell time.

3.3.4.3 COORDINATION MENU, Selection 3, PLAN SPLITS

For plan splits, one of four screens will be displayed depending upon the coordination type selection.

3.3.4.3.1 Standard Coordination Split Menu

1. Primary Force Off - This entry allows the operator to define the last Force Off point for each phase. During coordination, this Force Off point is used to calculate the end of the vehicle and pedestrian permissive periods. The primary force off must be entered before the secondary force off.

   The secondary force off is set to the same value as the primary force off until the secondary force off point is manually changed.

2. Secondary Force Off - This entry allows the operator to define a Secondary Force Off point for each phase. The Secondary Force Off point is normally the same value as the Primary Force Off point; however, the Secondary Force Off point allows the operator to define a point for conditional re-service of a phase during coordination or to force the controller out of a phase if an early minor permissive period was used.

3. Vehicle Yield Point - This entry allows the operator to define the beginning of the permissive period for each of the eight (8) phases. During a coordinated operation, omits are applied as a method of control. The Vehicle Yield Point is the point in the cycle that the omits applied during coordination are lifted. This allows the phase to be serviced.

4. Pedestrian Yield Point - This entry allows the operator to define the beginning of the Pedestrian Permissive period for each of the eight (8) phases.

The Pedestrian Yield Point is the time at which the coordination pedestrian omits are lifted.

Using a combination of the above programming entries it is possible for the operator to program Eight independent permissive periods for each plan.

3.3.4.3.2 New Jersey Coordination Split Menu

If the operator selects the New Jersey Mode of Coordination then a plan menu of the following entries will be displayed.

Floating Force Off Values - One floating force off value is entered for each phase which will define the end of green time for a phase. When calculating the Floating Force Off Values for a given plan, be sure to take into consideration the yellow and red clearance times.

Start Of Permissive Period - A programmable entry which will allow the permissive period to start. The permissive period is that time at which the controller can leave the coordinated phase and service any phases with an active call.

End Of Permissive Period - A programmable entry which will define the end of the permissive period.

Ring 1 Coordinated Phase - An entry defining the ring 1 coordinated phase to be phases 1,2,3,4 or none.

Ring 2 Coordinated Phase - An entry defining the ring 2 coordinated phase to be phases 5,6,7,8 or none.

3.3.4.3.3 Dual Permissive split Menu

As expressed earlier, dual permissive coordination is designed to operate in percent or in time. If the operator selects one of the four permissive modes of coordination, a screen designed for entry of data in the dual format will appear as the split screen.

Start of Perm. Period - A programmable entry which will allow the permissive period to start.
End of Perm. Period - A programmable entry which will define the end of the permissive period.

Yield Phases - Eight programmable entries which allow selection of the yield phases during the permissive period.

Permissive Period 2 - A second permissive which has the same three entries as above.

Ring 1 and 2 Coordinated Phase - An entry which allows selection of phases 1,2,3,4 or none and 5,6,7,8 or none as

the coordinated phases.

Force Off All Phases - An entry which allows selection of a point along the coordinated cycle cause a force-off on any phase which is green.

Recycle Walk Point - An entry activated when timing the permissive mode in seconds as the point along the coordinated cycle when the coordinated phase(s) recycle to walk.

3.3.4.3.4 Easy Coordination Split Menu

If the operator needs a simple coordination operation, one that provides automatic calculation of Permissives and Force Offs and the flexibility of semi-actuated operation on the side street and turn phases, the easy programming mode of coordination should be set ON. If easy is set ON, a screen displaying the Easy Split entries for each phase and the Coordination Phase(s) entry for each phase will be displayed on a per plan basis. The selection of the easy coordination split option also gives the operator two options for allowing the start of pedestrian service on the coordinated phases as described in

1. Easy Split - This entry allows the operator to define the time allocated to each phase. The total time allocated for each ring should equal the cycle length and the time in each ring on the same side of the barrier should be equal. From these entries the internal coordinator will calculate and implement the proper permissives and force offs.

3.3.4.6 COORDINATION, Selection 6, COORDINATION PARAMETERS

These parameters are useful when setting up coordination to match a hard-wire system, a computer controlled system, or setting up a Naztec closed loop secondary. The coordination parameters screen consists of the following entries:

1. SYNC LENGTH - This entry allows the operator to define the length of the sync pulse output. Range is adjustable from 0.0 to 9.9 seconds. This sync output length also applies when the sync is placed on the offset lines.

2. PSEUDO SYNC - This entry allows the operator to activate the pseudo sync timer. The Pseudo timer inhibits false sync inputs from triggering a premature sync. Used when interfacing to a hard-wire system containing an offset interrupter.

3. COORDINATION RUN - This entry allows the operator to override any coordination errors. CRUN stands for

Coordination Run. In this mode, only the first coordination error is recorded. When CRUN is on and an error occurs which causes the controller to run free, the next change in plan will cause the coordination to become active again.

4. APPLY HOLD - This entry will allow the coordinator to hold in a non-coordinated phase until the force-off point value for that phase has completed timing. Once a call is placed on the phase and the controller is operating in a coordinated sequence, a hold is applied to that phase. This entry is done on a per phase basis. This feature works in conjunction with the Select Max 2 option of each phase. For this option to operate, the Select Max 2 option must be ON for each non-coordinated phase that is desired to operate.

5. COORDINATION TYPE - The Naztec Controller has 7 selections for different types of coordination operation. Each are briefly discussed in the following paragraphs.

   Normal Coordination - This selection will cause the standard Naztec coordination operation to be implemented in the 920 controller. The display screen will allow two yield points and two force off points for each phase in a given plan.

   EASY - This entry will activate the easy programming coordination mode as specified by the State of Texas. This mode changes the Plan Split Screen from displaying Yield and Force Off points to displaying the Easy Split entries and Coordinated Phases. It also causes the internal coordination firm-ware to begin an automatic calculation of permissive periods and force-offs. There are two options for Pedestrian Service for the coordinated phases under the coordination programming if the "Easy Programming" option is selected. One option is to allow the pedestrian service to begin as soon as the coordinated phase enters green. The other option is to force the pedestrian service to wait until the zero point of the local cycle counter. This prevents the pedestrian service from starting early in the event the coordinated phases return to green early in the cycle due to a lack of demand on the other phases. This option is selected from the mode of recycle below (Par 8.3) if the easy programming option is programed "on".

   NEW JERSEY - This entry will allow activation of the permissive mode of coordination. When active the permissive mode plan screen is also activated. NOTE: CNA not to be utilized in this mode.

   DUAL PERMISSIVE TIMED

DUAL PERMISSIVE TIMED WITH FLOATING FORCE OFFS
DUAL PERMISSIVE PERCENT
DUAL PERMISSIVE PERCENT WITH FLOATING FORCE OFFS -

The four dual permissive selections select a single screen. The screen contains the following.

Two Start and ending entries for the dual permissive periods. Two entries which allow the setection of the yield phases during the permissive periods. One coordinated phase entry for each ring. Two force off points for each phase. One force off all phases point and one recycle the walk entry point.

The force off entries are related to the local cycle counter when timeing in seconds or percent. When a floating selection is made, the force off begins timing when the phase enters green. Caution must be taken by the timing engineer when permissive type of operation is selected that all phases can be service with the amount of cycle time programed.

6. ELECTRO MECHANICAL - This entry determines how the external coordination will receive its sync and offset. If the electro mechanical is active, the four (4) offset inputs are used and the Sync is imposed on the active offset line. When the entry is inactive, then the offset is binary encoded on lines 1 and 2 and the sync is assumed to be on the offset 3 line.

7. CLOSED LOOP OPTION - When this option is active, it is necessary that the on street master be set up to run the entire arterial in traffic responsive operation. To make sure that the controller will responsd to the master, it is necessary to set the system timer (paragraph 3.3.8.1) to a value. If the local does not receive a request from the master within this timed value, then it will revert to the TBC configuration to run both coordination and commands.

8. WALK RECYCLE - During coordination the SERIES 900-V11.0 controller contains several options on how to program the Pedestrian movement if the Rest in Walk entry is active for a phase. There are three (3) entries to describe how the controller will recycle if the rest in walk entry is selected during coordination. The three conditions programed are:

LV WLK BEF: = Leave Walk before Recycle
LV WLK AFT: = Leave Walk after Recycle
RECYC MODE: = Mode of Recycle

8.1 Leave Walk Before Recycle - When a phase has a rest in walk activated during coordination, the controller will enter the phase, time the Walk interval, then Rest. A decision on when to leave the Walk interval

relates to the LWB entry.

LWB = TIMED Leave the Walk Interval when the Primary Phase Force Off point minus the Pedestrian Clearance time is equal to the Local Coordinator Cycle time. Note that

this is an automatic calculation of the rest in walk time.

LWB = ON DEMND Leave the Walk Interval when an opposing demand is placed on the phase.

8.2 Leave Walk After Recycle - When a phase has recycled back to the Walk Interval during coordination, the phase Force Off memory will be active. When the phase is resting in Walk, the LWA entry allows the same two Walk termination selections as the LWB entry.

8.3 Mode of Recycle - This entry applies to the Coordinated Phase, programmed for Rest in Walk. The recycle options are only active after the phase has been forced off and no opposing demand has been preset.

RCY = OFF Do not recycle. If Easy Programming is selected, allow pedestrian service as soon as the phase enters green. With the Easy option, it is necessary to program the rest in walk option active for the coordinated phases (Par. 3.3.3.1.6(5)) if these phases are programmed for pedestrian recall.

RCY = IMMED Recycle immediately. If Easy Programming is selected, pedestrian service not allowed to begin until the local cycle counter zero point.

RCY = PH OMIT 2 Recycle when phases 1,2 and 5,6 have phase omits applied.

RCY = PH OMIT 1 Recycle when phases 3,4 and 7,8 have phase omits applied.

RCY = NoPedOmt Recycle when the Pedestrian Omits are lifted on the coordinated phase. (Earliest moment the coordination will allow the Walk Interval to be serviced).

9. INTERCONNECT - This entry when set to SYS will set the system input to cause the coordinator to change from External to TBC if the Free input is active high, or disable the coordinator and cause Free operation if the Free input is active low. When set to FREE, this

input will disable the coordinator and cause the controller to run free. The System input is active high and inactive when grounded.

10. EXTERNAL COORDINATION LINE - This entry will activate the external coordination input.

11. STOP IN WALK - As explained in section 3, this entry will stop the local coordinator as long as a Walk or Ped clearance is being output.

12. WALK=VEH PERM - When operating in coordination, this entry will force the end of the Walk Permissive period to equal that of the Vehicle Permissive period. This allows Pedestrian Intervals to occur later than they normally do.

3.3.4.7 COORDINATION, Selection 7, COORDINATION ERRORS

This entry allows the operator to display the first active coordination error to be defined by the controller. The defined errors occur when after 2 consecutive cycles, the SERIES 900-V21 controller attempts to service a phase but is unable to do so due to incorrect programming of the coordination parameters. After the programming errors have been corrected, Coordination Errors need to be cleared before the coordinator will operate. The screen layout for the Configuration that caused a failure is similar to the Test configuration. The phases that were skipped will be displayed using the encoded field group.

3.3.5 MAIN MENU, Selection 3, PREEMPTS

The Preempt Menu contains 5 screen selections for programming preemption operation. It also contains a field used to identify which of the preempts is currently being programmed. To select a preempt screen for a particular preempt, first enter the number of the preempt to be programmed in the field at the bottom of the Preemption Menu. It is labelled "Which Preempt?". Then select the screen that contains the desired parameters. HINT: An easy way to access the "Which Preempt?" field is to press the PAGE DOWN key. After the preempt number is entered, press the PAGE UP key, then select the screen.

3.3.5.1 PREEMPTS, Selection 1, ALLOW PREEMPTS

Entering a "1" into any of the five (5) "ALLOW PREEMPT" fields causes the associated preempt to be enabled. A "0" disables the preempt and causes the controller to ignore activity on that preempt's input.

Note that, for convenience, this preempt screen differs

from the other preempt screens in that all preempts may be enabled / disabled from a single screen. The rest of the preempt screens access fields only associated with the currently selected preempt.

3.3.5.2 PREEMPT, Selection 2, PARAMETERS

The Preempt Parameters screen contains seven entries that define or modify a preempts' function. They are:

DELAY - Delay before preemption - This parameter allows a time delay from 0 to 999 seconds to elapse before an active preemption input is recognized.

MINIMUM - Minimum preemption state time - This parameter defines a minimum amount of time the controller will stay in the preemption state regardless of whether the preempt input remains active. Once the minimum time has elapsed, the controller will continue in the preempt state for as long as the preempt input is active.

MAXIMUM - Maximum Preemption State Time - defines the maximum time, in minutes, that the preemption state will be maintained during a continuously active preempt input. If the maximum time expires before the preempt input becomes inactive, the input will no longer be recognized and the preempt will terminate as though the input had become inactive. The preempt input will continue to NOT be recognized as long as it continues to be asserted. Once the input becomes inactive, this feature is "reset", and the next assertion of the input will be recognized as a preempt call.

TYPE - Type of Preempt - Any preempt may be identified as a Rail or Fire (emergency vehicle) preempt. This entry is used to make this selection. The difference between the two types involves priority. A rail preempt is given higher priority than a fire preempt and will therefore interrupt (or preempt) a fire preempt that may be in progress. Generally, no more than one preempt will be identified as rail, in which case it will be given highest priority by the controller.

If multiple preempts of a type are enabled, they will be given priority based on the preempt number. For example, if preempts 1, 2, and 4 are defined as FIRE, they will be prioritized in the same order, with preempt 1 being highest (among the fire preempts only). If, in this example, preempt 3 is programmed to be a RAIL type, then it will receive the highest priority among all preempts.

One final note regarding preempt priority; if more

than one preempt is defined as RAIL, the rail preempts will be prioritized among themselves based on preempt number exactly the same as for multiple fire preempts. All rail preempts will still receive priority over any fire preempts.

TRACK LOCK - Enabling this parameter causes momentary preemption inputs to be captured, or "locked", so that the controller proceeds to the preemption state and remains there until the minimum preemption time is satisfied. If the input is reasserted and is active when the minimum time expires, the controller remains in the preemption state as if the input had been present continuously from the time that it was first recognized.

FLASH - Preemption Flash - This parameter allows the preemption routine to call up a flash sequence in accordance with the defined preemption flash parameters. The controller will flash when the appropriate preempt call is recognized if the parameter is set to ON. If this parameter is OFF, the controller will cycle among the user-programmed allowable phases.

PED OMIT - Pedestrian Omit - Pedestrian movements are inhibited during preemption sequences (track clearance and preemption states) if this parameter is enabled.

SKIP CLR - Skip Track Clearance - If enabled, this parameter causes the track clearance state to be skipped when the applicable preempt interrupts another preempt. If this feature is not enabled (OFF), then the preempt progresses normally, timing track clearance intervals if they are defined, regardless of whether a lower-priority preempt was interrupted.

3.3.5.3 PREEMPTS, Selection 3, Phases/Overlaps

Use this screen to select the phases and overlaps that are to be active if the preempt is programmed to cycle (ie. not flash) during preemption. It is also used to select track clearance phases/overlaps and return phases for both cycling and flashing preempt sequences.

1. Track Clearance Phases - Only one (1) track clearance phase per ring is allowed. If a track clearance phase is not defined for a ring, the ring will enter into a RED REST state while the other ring times the track clearance phase. If neither ring has a track clearance phase defined, the controller will skip the track clearance interval and enter directly into the preemption state.

2. Track Clearance Overlaps - Each overlap may be

enabled or disabled during the track clearance interval. Enabled overlaps will time green intervals according to the standard overlap program. Overlaps disabled in this field will remain red during track clearance.

3. Preemption Phases - This entry is used to define the phases that will cycle during the preemption state. Phases not enabled will be skipped. More that one phase per ring may be enabled. If no phases are enabled, the controller will go to an all red condition for the duration of preempt.

4. Preemption Overlaps - Use this entry to enable /disable individual overlaps during the preemption state. If enabled, an overlap will operate according to its standard program; if disabled, it will remain red during the preemption state.
5. Return from Preemption Phases - Use this entry to specify the starting phases following a preemption sequence. Only one phase per ring is allowed.

The entry fields on this screen are all of the encoded-group type. Selections are limited to 0 and 1 which indicate DISABLED and ENABLED (or OFF and ON) respectively.

3.3.5.4 PREEMPTS, Selection 4, Preemption Times

Values for various preemption intervals are entered on this screen. Five columns of intervals accept entries as follows:

MINimum -	0 - 99		
WaLK -	0 - 99		
Ped CLr -	0 - 99		
YELlow -	0.0 -9.9	(3.0 - 9.9 if min yellow is on)	
RED -	0.0 - 9.9		

Three rows are provided, as described below, each of which contains some or all of the above intervals.

1. Begin Preemption Clearance Times - These are the clearance times used to terminate the phases that are active when a call to preemption is recognized, in place of the times for these intervals which are programmed for the active phase.

2. Track Clearance Times - This row sets the track clearance times for the phases programmed as the track clearance phases.

3. Return Clearances - Red and Yellow clearance times to be used when returning from preemption

are entered in the two applicable fields on this row.

3.3.5.5 PREEMPTS, Selection 5, FLASH

Use this screen to define the flashing states for phases, overlaps and pedestrian movements if flash preemption is enabled. One entry is provided for each phase, overlap and pedestrian movement.

1. VEHicle phase flash - The settings in this row define the states of the signal heads during flash preemption. Each head may be programmed to flash YELlow, flash RED, or to remain DaRK.

2. PEDestrian - Each phase may be programmed to have the pedestrian head be dark (OFF) or to display solid don't walk (ON) during preemption state.
3. OverLaP flash - Use the fields in this row to define the overlap flash states during preemption. The selective settings are YELlow flash, RED flash, and DaRK.

3.3.5.6 PREEMPTS, Selection 6, Recall

Each preemption has a recall that can be activated for each phase that determines how each phase will operate during preemption cycling. The standard Nema preemption modes can be programed. If there is no desire to change the recall mode during preemption, no effect can be selected.

3.3.6 MAIN MENU, Selection 4, TIME BASED COORDINATION

Selection 4, the TIME BASED COORDINATION menu provides the operator with all the necessary entries to enable the TBC control in the SERIES 900-V21. Under this menu there are 7 screens which apply to the TBC entries. A brief description of each screen is listed below.

3.3.6.1 TIME BASED COORDINATION, Selection 1, CLOCK/CALENDAR

This entry allows the operator to set the time of day clock.

3.3.6.2 TIME BASED COORDINATION, Selection 2, TBC PARAMETERS

This entry allows the operator to manually turn the Real Time Clock On of Off through the keyboard. The method of referencing for the TBC function and the point of reference for the Real Time Clock are both selectable under this feature.

The second entry under this screen defines the application of where the sync coordinates on any pattern change. This entry is called the Change Mode. With the Change mode OFF, the sync coordinates in reference to the real time clock. With the Change mode ON, the sync

coordinates in reference to the next pattern change.

The third entry allows the operator to set the pulse length for the sync pulse. This will be the length of the sync pulse output by the controller if used as a master. The range is 0-9.9 seconds.

The fourth entry enables Time Of Day Dimming of the signals if this feature is programmed

The fifth entry allows the operator to program the Month and the week of that month when Daylight Savings Time begins and ends.

The sixth entry allows the operator to define Resynchronization Reference Point for the real time

clock. An entry of all zeroes (default) will select midnight. Any hour and minute entry is acceptable.

3.3.6.3 TIME BASED COORDINATION, Selection 3, COMMANDS

The use of the Command menu provides the user with a vast array of T.O.D. selectable options and signal sequence patterns. The first screen under this selection will ask Which Command? The options are plans 0-16 with 0 being the default plan.

3.3.6.3.1. COMMANDS, Selection 1,OUTPUTS/DETECTOR-MAP/DIMMING

This entry permits the state of 8 special outputs and the detector map and detector fail map to be programmed for each command, thus placing the items under T.O.D. control. Special Output number 7 is assigned to dimming when the T.O.D. dimming switch is ON. Special Output number 8 is assigned to Pulse Output. This output can be used to reset the conflict monitor.

3.3.6.3.2 COMMANDS, Selection 2, CONFLICTING PHASES

A conflicting phases definition may be specified for each command. Refer to section 3.3.3.1.3.

3.3.6.3.3 COMMANDS, Selection 3, RECALL DEFINITIONS

Each phase recall definition is selectable on a T.O.D. control basis. In addition to the standard 6 recall definitions an additional 3 entries are allowed.

3.3.6.3.4 COMMANDS, Selection 4, PHASE OPTIONS

Using the encoded field group entries on this screen, the following optional features may be enabled or disabled on a per phase basis for each T.O.D. activated command:

Rest in Walk	Red Rest
No Skip Phase	Dual Entry
Soft Recall	Pedestrian Omit
Max 2 Selection	Inhibit Max
Ped 2 Selection	Dallas Mode

3.3.6.3.5 COMMANDS, Selection 5, PH ROTATE & CONDITIONAL

The operator is able to reverse the phase pair sequence and select the conditional service option as a function of T.O.D. The following modes are permitted for each entry as follows:

With all REVERSE PH's entries set to NO, the controller will operate in a normal sequence. Any phase pair programmed as YES will reverse the sequence of the pair. An entry of YES for conditional service/reservice for any phase pair will enable conditional service/reservice for that pair. A NO entry will not allow conditional service/reservice.

3.3.6.4 TIME BASED COORDINATION, Selection 4, WEEKDAYS

This entry allows the operator to define the command mode, coordination mode, offset number, plan number, and command number on a weekly basis. Weekday Entries provides a means for the operator to select and change coordination configurations on the basis of the day of the week and the time of day. The SERIES 900-V21 controller contains one hundred and fifty (150) Weekday Entries. An entry allows the operator to define a specific start and stop date during the year for each entry. The operator also has the flexibility to program one entry to control all seven days of the week, or five days of the week (Monday - Friday), or a specific day of the week.

3.3.6.5 TIME BASED COORDINATION, Selection 5, HOLIDAYS

The SERIES 900-V21 controller contains fifty (50) Holiday entries. This entry allows the operator to define a special event for up to 50 independent occurrences during the year. The Holiday entries also contain provisions for the selection of Annual and Floating Holidays.

The Annual Holiday is a specific date on the calendar that occurs the same date every year. Example: New Years or Christmas. This feature is selected by programming the Month, Day of month, and programming 87 as the year. This will automatically set the year to AN and cause the entry to repeat annually.

The Floating Holiday is a holiday which occurs on a specific day of a specific week during a certain month each year. Example: Thanksgiving Day. This feature is selected by programming the Month, then the Week of that

month (instead of the day), and then programming 86 as the year. This will automatically set the year to FL (floating) and the day of the week must be selected under the DAY heading of the column.

3.3.6.6 TIME BASED COORDINATION,Selection 6,TBC CONFIGURATION

This entry screen allows the operator to manually override or enable any particular coordination sequence through the keyboard. The TBC Configuration entry only overrides temporarily; meaning that at the next scheduled Weekday or Holiday entry the manual entry is no longer active.

3.3.6.7 TIME BASED COORDINATION, Selection 7, ERRORS

This entry allows the operator to display the first active coordination error to be defined by the controller. The defined errors occur when after two consecutive cycles the SERIES 900-V21 controller attempts to service a phase but is unable to do so due to due to incorrect programming of the coordination parameters. After the programming errors have been corrected, the skipped phases error should be cleared to re-enable the coordinator.

3.3.7 MAIN MENU, Selection 5, DETECTORS

3.3.7.1. DETECTORS, Selection 1, PHASES CALLED

This Screen allows the operator to map the location of sixteen detectors to any of the eight (8) phases in the controller. The first eight (8) detectors are the standard NEMA vehicle detectors. The remaining eight or special detectors are vehicle detector inputs 1 to 8 on the "D" connector. A detector will both call and extend the phase it is mapped to.

When the DETECTOR screen is first entered it will ask Which Map? There are three (3) detector maps available. Map one (1) is the default map. The detector maps are a function of the time of day commands. When the time of day commands are not active, Map Number One (1) is read by the controller.

The screen uses encoded field group format for data entry. The screen layout allows each of the sixteen (16) possible detector inputs to be assigned to any of the eight (8) phases. A default program exists under the diagnostic initialization menu to assign the standard NEMA setup to the map 1 assignments.

3.3.7.2 DETECTORS, Selection 2, PHASES EXTENDED

This screen allows the operator to define a detector map for 16 detectors that only extends the phase which they

are mapped.

This screen enters data in the same format as selection 1, Detector Phase Called.

3.3.7.3 DETECTORS, Selection 3, DELAY DEFEAT

This entry allows the operator to define a detector map for 16 detectors in the controller to defeat the detector delay timer for certain detector arrangements. This screen enters data in the same format as selection 1, Detector Phases Called.

3.3.7.4 DETECTORS, Selection 4, DELAY AND STRETCH

This Screen allows the operator to define a delay timer and stretch timer for each of the 16 independent detectors in the controller. The delay timer has a range from 0 - 99 seconds while the stretch time is programmable from 0 to 9.9 seconds.

The delay timer functions with the vehicle call input to the controller. When the controller has a vehicle call, the delay timer will start counting down. After the delay time has expired, the controller then receives a vehicle call from that particular detector. The call for each detector is delayed by the time the operator programs into that detector timer.

The Stretch Timer allows the operator to define a stretch time for each of the 12 detectors. The stretch timer becomes active after the delay time has timed out. The stretch timer will continue to place a vehicle call after the vehicle has left the detector for the time programmed for each detector. The stretch timer range is from 0.0 to 9.9 seconds. This screen is arranged so that the operator can program both the delay and stretch time entry for each detector. The screen uses the numeric field type.

3.3.7.5 DETECTORS, Selection 5, FAILURE TABLE

To keep track of detector failures, the SERIES 900-V21 has 3 different detector maps which determine if a detector failure has occurred Each of the maps can be selected by a time of day command. Failure parameters are entered as follows:

1. The detector failure time is an entry which allows the controller to count the detector actuations during this sampling period and compare them to a programmed low and high allowable detector count.

2. A Low detector count number per detector sets the number of counts which the detector must see not to fail. If the detector does not equal this count within

the detector failure time, then it is declared failed.

3. A HIGH detector count number per detector sets the maximum number of counts allowed during the failure time. If this count is exceeded during the time period, then the detector is declared failed.

3.3.8 MAIN MENU, Selection 6, COMMUNICATIONS MENU

This menu selection provides the operator with all the necessary entries to establish the setup parameters for each communication port.

3.3.8.1 COMMUNICATIONS, Selection 1, COMM PORT 1 PARAMETERS

This entry allows the operator to define the parameters for communication port number 1.

Modem	EV24 or HS12
Baud	Supported baud rates are: 300 Baud 600 Baud 1200 Baud 2400 Baud 4800 Baud 9600 Baud
Station ID No.	000 to 999
Communication Timer	0.0 to 9.9 seconds
Modem Timer	00 to 2550 (in tens of seconds)
Duplex	FULL or HALF
Dial command	OFF, DIAL or WWV
System Timer	00 to 99 minutes. Amount of time the controller had its last comm.

When Dial is selected, these additional functions need to be programmed.

Dial Time	00 to 99 seconds	
Area Code 1	Exchange Number 1	Telephone Number 1
Area Code 2	Exchange Number 2	Telephone Number 2

When WWV is selected, the time zone must be entered. Four time zones are allowed in the United States; Eastern, Central, Mountain and Pacific.

3.3.8.2 COMMUNICATIONS, Selection 2, COMM PORT 2 PARAMETERS

This entry allows the operator to define the parameters for communication port number 2.

BAUD	Supported baud rates are: 300 Baud 600 Baud 1200 Baud 2400 Baud 4800 Baud 9600 Baud
COMM	0.0 to 9.9 seconds
DUPLEX	FULL or HALF
MODEM	00 to 2550 (in tens of seconds)
DIAL-TIMER	0 - 99 seconds

3.3.8.3 COMMUNICATIONS MENU, Selection 3, TRANSFER DATA

Entries for Transfer Data and Receive Data allow the operator to upload/download controller parameters from one unit to another via a data transfer cable. Four categories of data may be selected for transfer. They are:

NONE
PHASE = All Phase data
FEATURE = All Feature data
RT CLK = Real Time Clock data
COOR. = Coordination parameter data
BARRIER = Barrier data
ALL LOC = All data

If an error occurs while transmitting or if the receiver unit creates an error, the display will present a transmission error for the transmitting unit and a receiver error for the receiving unit.

3.3.8.4. COMMUNICATIONS, Selection 4, RECEIVE DATA

This entry is the second component to Feature 63, Transmit Data. Place the controller in the receive mode in order to monitor a transfer.

3.3.8.5 COMMUNICATIONS, Selection 7, DOWN LOAD

This selection allows the operator in the field to request a download of the permanent data base from the central computer. To set up this request, alarm 37 must be activated and allowed to be forwarded to the central computer. If not connected to a master, transmit alarms must be activated. The entry is then selected and the operator has two options, local or master down load. If the local contains a master, the master alarm #9 must be active and forwared for a master download to work.

3.3.9 MAIN MENU, Selection 7, STATUS DISPLAYS

The status displays, selection 7 from the main menu provide the operator with the controller real time data. There are 6 status displays screens under selection 7. Descriptions of each selection is listed below.

3.3.9.1 STATUS DISPLAYS, Selection 1, TIMING STATUS

The timing status display is probably one the most useful screens on the controller. The operator is able to view the actual timing for each phase and interval for all phases on one view screen. Additional status information is also available on this screen such as Phase ON, Phase Next, Max II timing, Reason for Termination, etc.

3.3.9.2 STATUS DISPLAYS, Select 2, COORDINATION CONFIGURATION

This display provides the operator with all the information regarding coordination functions. Such functions include:

Local Cycle Counter
Master Cycle Counter
Current Plan in Progress
Current Offset in Progress
Current Command Number in Progress
Transition Percentage Indicator
System Configuration
TBC Configuration
External Configuration
Closed Loop Status

3.3.9.3 STATUS DISPLAYS, Selection 3, INPUTS

This display will allow the operator to view the real-time intersection inputs such as vehicle calls, pedestrian calls, holds, phase and pedestrian omits. The display will also show coordination and preemption operation by displaying the vehicle and pedestrian inhibits. The inhibits are functions of the coordination programming and apply omits to the phases at various times.

3.3.9.4 STATUS DISPLAYS, Selection 4, DETECTOR DEL/STR

This display will provide the user with a means of viewing the delay and stretch times and their countdown when active for each detector input. Multiple detectors (nine) are displayed at one time.

3.3.9.5 STATUS DISPLAYS, Selection 5, ALARMS

The SERIES 900-V21 NEMA Traffic Controller contains a total of 64 internal and external alarm input/outputs. This screen will allow the operator to view the alarm status for each individual alarm. The screen will indicate active alarms, alarms which have changed from 0 (inactive) to 1 (active) and alarms which have changed from 1 to 0.

3.3.9.6 STATUS DISPLAYS, Selection 6, COMM TIMER

This display shows the status of the Communications Timer.

3.3.9.7 STATUS DISPLAYS, Selection 7, REPORTS AND BUFFERS

This display can show either the actual real time Volume/Occupancy of each detector loop or an individual sample. The display of each real time sample is stored into a buffer called the Sample Data. Also the Event and Alarm Buffer can be displayed

3.3.9.7.1 REPORTS AND BUFFERS, Selection 1, Real Time Sample

Under the real time sample the volume/ occupancy count for each of the 8 vehicle detectors and 8 system detectors can be displayed. When the sample time is complete the data is stored into the Sample Data Buffer. A maximum of 99 samples at a maximum sample time of 24 seconds can be stored.

3.3.9.7.2 REPORTS AND BUFFERS, Selection 2, Sample Data

This Buffer keeps a collection of all of the real time samples up to the amount defined by the sample time.

3.3.9.7.3 REPORTS AND BUFFERS, Selection 3, EVENTS

Displays the major information about a event such as Date, TIme, Station I.D., Type of Event, and 6 bits of information about the event. The types of events are as follows:

1. Alarms - A copy of the Alarm is store into the event buffer.

2. Preemption - A copy of the preemption activity is stored into this buffer.

3. Access - A copy of the user number and use I.D. is stored into the event buffer each time.

4. Pattern - A status of the controllers closed loop operation is stored into the event buffer for each type of change including the accumulated offset.

5. % Phase Green - A copy of the percentage that a phase is green can be calculated and stored into memory. This is done by using the Controller Parameter Entry according to paragraph 3.3.3.2.

3.3.9.8 STATUS DISPLAYS, Selection 8, LAMP MONITOR

This selection allows the display of all of the current monitor parameters and allows the operator to calibrate the intersectio for lamp monitoring.

3.3.9.8.1 LAMP MONITOR, Selection 1, REAL TIME DISPLAY

The Lamp monitor display allows the operator to read all of the operations related to the current monitor p.c. board.

1. Cabinet Current

a. Offset - This is the calibration constant related to the p.c. board and the intersection. After the

system runs for a time, it will automatically try to calibrate the channel. A value between 0 and 9999 will be displayed when calibration occurs.

b. Current - This reading is the real time current relative to a calibration point on the p.c. board. This point should be set to about 3000 counts for a worst case reading using the pot. adjustment during set up. Current range to 0 to 4000 counts.

2. Luminaire Current

The offset and current reading for the luminare current are the same as the cabinet readings.

3. Voltage

The real time voltage reading displays an exact reading for the 120 cabinet voltage. The reading should be calibrated for around 3000 counts for 120 volts during cabinet set up in the field. Range is 0 to 4000 counts.

4. Binary pattern

When the current monitor is operating in normal current operation, a binary pattern is displayed on the real time current display that allows the active phase pattern to be displayed.

```
0  1  2  3  4  5  6  7
-A--  -B--  -C--  -D--
```

A = 00 Phase 1, 10 Phase 2, 01 Phase 3, 11 Phase 4

B = 00 Ring 1 Red, 10 Green, 01 Walk, 11 Yellow

C = 00 Phase 5, 10 Phase 6, 01 Phase 7, 11 Phase 8

D = 00 Ring 2 Red, 10 Green, 01 Walk, 11 Yellow

A,B,C,D ALL = 0, ALL RED

3.3.9.2 CURRENT MONITOR, Selection 2, PHASE VALUES

This menu selection provides access to all of the 128 possible combinations of current monitor normalized resistance storage. Along with normalized cabinet resistance storage, the hour in which the calculation is made. This time (in hours) allows for comparison of the total number of hours the data is valid. Once this time is exceeded, the normalized value is set to zero. The values are stored according to the binary code described in selection 1.

3.3.9.3 CURRENT MONITOR, Selection 3, OVERLAP VALUES

This menu allows access to a possible 8 values of overlap resistance storage when all red is selected on the binary display. This stores the overlap's resistance when features such as delayed green are programmed as part of the overlaps.

3.3.9.4 CURRENT MONITOR, Selection 4, FLASH VALUES

Not implemented.

3.3.10 MAIN MENU, Selection 8, SPECIAL FUNCTIONS

This menu selection provides the operator with access to the security code and security code programming and other special functions.

3.3.10.1 SPECIAL FUNCTIONS, Selection 1, ENTER SECURITY CODE

This entry screen allows the operator to enter a security code into the controller. The security code is entered by first setting the user number, 01 to 64, followed by the users own personal access code.

3.3.10.2 SPECIAL FUNCTIONS, Selection 2, SET SECURITY CODE

This entry allows the operator to set up to 64 different access codes, one for each of the 1 to 64 user numbers, and to determine the level of security for each of the users. The level of security are define as:

None	Display Only
Entry	Allow display and entry
Diagnostics	Allow all of the above and diagnostics
Download	Allow all of the above and a reload or programming of the controller software
Security	Allow all of the above and the ability to set security codes. The highest priority.

If the operator access code is forgotten for the system administrator, it is impossible for any one to access this table and modify the security codes and levels.

Setting of security codes begin after the EEPROM has been cleared. Since a new EEPROM may have existing data, access to clear EEPROM can be accomplished by setting pencil switch number 3. Once memory is cleared, the controller will allow access to the Set Security as long as no security code is set and no level of access is defined. Once any entry is made and the operator leaves the screen then the security code is set. Therefore, it becomes necessary that one of users be allowed to have the highest priority , Security, in order to change any of the passwords and levels of access.

A second feature of the security allows for a no security

setting. If this option is desired, then after clearing the EEPROM no entries aree made the in Set Security menu.

As long as all positions are zero and levels are none, then a security code entry is not required for any controller operation.

3.3.10.3 SPECIAL FUNCTIONS, Selection 3, PRINT

This entry allows the operator to select print parameters from an encoded field selection. The printer operates from Communication Port number 1 only. The correct compatible baud rate must be selected to match the printer functions.

A baud rate of 1200 is suggested.

The printer parameters are selectable from the list below:

NONE	No data printed
ALL	All data below
CONTROLLER	Controller data
COORDINATION	Coordination data
PREEMPTS	Preemption data
TB COORD	Time Base data
DETECTORS	Detector data
COMMS	Communications data
VOL/OCC	Volume/Occupancy data

The ESC key aborts any printer functions and performs the normal escape function to the previous menu or screen.

3.3.10.4 SPECIAL FUNCTIONS, Selection 4, DIAGNOSTICS

This menu is unique to the Naztec SERIES 900-V21 NEMA Traffic Controller product line. A complete set of diagnostic tests and initialization programs are accessible through this menu.

When selecting this screen, a warning is displayed if the run timer is on advising that the run timer must be turned off to execute this function. This is a safety feature to prevent an unsafe condition being caused if the controller is operating an intersection. After the

run timer is turned off it is possible to continue this menu. The screen selection sub-menus are split into three functions:

CLEAR EEPROM
INITIALIZATION
SELF TESTS

3.3.10.4.1 DIAGNOSTICS, Selection 1, CLEAR EEPROM

This screen entry allows the operator to erase the EEPROM completely of all data values stored. A special security code and a special password are needed in order to complete this function if the security code option is enabled by pencil switch SW 3. If the security code option is not enabled, a caution screen is displayed. This two step security process provides a means for making sure that the operator wants to erase the stored data.

3.3.10.4.2 DIAGNOSTICS, Selection 2, INITIALIZATION

This menu is split into five sub-menu structures for each module of the controller software. The five sub-menu structures are listed below:

3.3.10.4.2.1 INITIALIZATION, Selection 1, PHASES/OVERLAPS

This entry allows the operator to initial the Phase and overlap times to a standard value. It also turns all of the Phase entry ON/OFF parameters OFF and sets each Phase Recall to the minimum recall status. Sets up the detector mapping and pedestrian overlap mapping to standard NEMA. The initialization times are as follows:

Min Green	10 sec	TTR	0 sec
Gap	2.0 sec	TBR	0 sec
Max 1	30 sec	Min Gap	0 sec
Max 2	40 sec	MIG	10 sec
Yellow	4.0 sec	Walk 2	4 sec
Red	1.0 sec	Ped Clr2	14 sec
Walk	4 sec	Max 3	0 sec
Ped Clr	14 sec	Max Ext	0 sec
Add Init	0.0 sec		

3.3.10.4.2.2 INITIALIZATION, Selection 2, COORDINATION

This screen entry allows the operator to set up all coordination entries to an initialized state. The following values will be entered:

Cycle Length	60 sec
Offset Time	000 sec
Veh Yield Point	000 sec
Ped Yield Point	000 sec
Primary F.O.	000 sec
Secondary F.O.	000 sec
Output Sync Width	1.0 sec
Transition %	17 %
Test Configuration	Command Mode = RTC Coordination Mode = RTC Offset = 9, Plan and Command = 99
Coordination Fail	Reset to all zeros

3.3.10.4.2.3 INITIALIZATION, Selection 3, WEEKDAYS/HOLIDAYS

This entry allows the operator to zero out all Weekday entries and initialize the Holiday entry programs.

3.3.10.4.2.4 INITIALIZATION, Selection 4, COMMANDS

This entry allows the operator to zero out all 17 command entries and pre-program commands 1 - 16 to correspond to plan numbers 1 - 16.

3.3.10.4.2.5 INITIALIZATION PROGRAMS, Selection 5, PREEMPTS

This entry causes all 5 of the Preemptions parameters to be set to a default value as follows:

TYPE			RAIL		
DELAY			5 sec		
MINIMUM			5 sec		
TRACK LOCK			OFF		
FLASH			ON		
PED OMIT			ON		
TRACK CLRNC PHASES			NONE		
OLPS			NONE		
PREEMPTION PHASES			NONE		
OLPS			NONE		
RETURN PHASES			2 & 6		
TIMES:	MIN	WLK	PCL	YEL	RED
BEGIN CLRNC's	5	4	10	3.0	1.0
TRACK CLRNC's	5	4	10	3.0	1.0
RETRN CLRNC's				3.0	1.0
FLASH:					
ALL VEH			RED		
ALL PED			OFF		
ALL OVERLAP			RED		

3.3.10.4.3 DIAGNOSTICS, Selection 3, SELF TESTS

This menu selection allows the operator to run a complete set of diagnostic routines on every section, including inputs/outputs in the controller system.

3.3.10.4.3.1 SELF TESTS, Selection 1, RAM

This screen selection allows the operator to check out the RAM devices in the controller. The RAM test will confirm that the RAM is in working condition. This test allows options of:

NONE	No ram test
ONCE	Tests ram once
CONT.	Tests ram continuously

3.3.10.4.3.2 SELF TESTS, selection 2, ROM

This screen selection allows the operator to test the EPROM devices in the controller. The ROM test will search a specific checksum number for comparison value. If the checksum is not found or is incorrect, a fail message will be given. Otherwise a STATUS: PASSED and the checksum value will be shown.

3.3.10.4.3.3 SELF TESTS, Selection 3, COMM PORTS (1,2)

The Communication tests allow for the Communication and Printer Port diagnostics, and the E.I.A. - RS-232 inputs and outputs to be run. The Communication Port allows the controller to be connected into a system network whereas the Printer Port will connect to a local printer or computer. Running this test requires that a special test connector be connected to each port. The same test connector can be used for either Port, but must be in place during the test. The test allows the choice of either or both communications ports and the option of testing once or continuously.

3.3.10.4.3.4 SELF TESTS, Selection 4, CONNECTORS (A - D)

A diagnostic check of each input/output is accomplished through the use of a wrap-around connector which completes the circuit from each input to the appropriate output. Each connector A through D has this capability built in. A message of COMPLETE or a Failure Message of the failed input/output will be displayed after the diagnostic is complete for each connector.

3.3.10.5 SPECIAL FUNCTIONS, Selection 5, DOWNLOAD SW

This entry provides for the downloading of the controllers computer software from the central if the controller contains Flash Proms. When this entry is made the controller will go into a 3 minute wait state and display a message " Waiting for a Download". If the computer has not established communication with the controller, it will again test the check sum of the prom memory and begin running. Check sum failure may occur with the prom memory. Each time power is applied to the timer a modulo 128 check sum is calculated on a CRC polynomial of X**16 + X**12 + X**5 + 1. If the check sum fails, the timer will power up in a mode that states, " Waiting for a Download". This will also occur when a new set of unprogrammed proms are installed.

For cases where it is impossible to access the DOWNLOAD entry, it will be necessary to remove AC POWER and the top cover of the timer. Once the cover is removed, turn on pencil switch 5. When this is done and power is restored to the controller, a message will be displayed of " waiting for a download ", " pencil switch 5 is set".

As downloading the program to the controller proceeds, the next message displayed is " erasing ". After about 2 minutes of erasing the display will read " programming". This will take about 4 minutes. At the end of the programming interval, the controller will begin generating the check sums. The display will read " check sum calculation". When all of programming is complete, the central computer will send the controller a signal to

4.1 INSTALLATION PROCEDURE

This procedure should be followed for every new controller:

A. Open the box and remove the SERIES 900 controller unit along with all of its packing material. Remove all tape and materials from the outside of the unit.

B. Open the controller and check the seating of all of the power and ribbon cables which interconnect the power supply with the main controller assembly, and the input/output board with the CPU/Display board.

C. Set the option switches for the desired operation and program the Overlap Card for the desired overlap phases.(if program card overlaps are to be used) The option switches are set as follows:

1. Barrier Programming - Switches 1 & 2

SW1	SW2	
ON	ON	User Programmable Barriers
OFF	ON	Standard 8 Phase Quad Left
ON	OFF	12 | 3478 PHASING (Quad-Sequential) 56 |
OFF	OFF	Standard 4 Phase

2. Security Code - Switch 3

SW3	
OFF	Security Code function of clear EEPROM disabled
ON	Allow for clearing of EEPROM so that the Security Codes can be programmed

3. Skip Yellow Clearance Times - Switch 4

SW4	
OFF	Dont enable the feature
ON	Enable the Illinois Skip Yellow Feature

4. Yellow Clearance Times - Switch 7

SW7

OFF All Yellow Clearance Times programmable from 0.0 to 9.9 seconds.

ON All Yellow Clearance Times programmable from 3.0 to 9.9 seconds.

4. Spare Switches Switches 4, 6 and 8

D. Mating plugs for the controller are:

Nema Connector A	MS3116E-2255S
Nema Connector B	MS3116E-2255P
Nema Connector C	MS3116E-2461P
Connector D	AMP 206437-1 57-POS,STND

4.2 Statement of Warranty

Naztec, Inc. warrants the SERIES 900-V11.0 controller to be free from material and workmanship defects for a period of one (1) year from the time the unit ships from the factory. Transportation charges to and from the factory are not a part of this warranty.

The warranty does not apply if the unit has been subjected to misuse, abuse, or any act of God. Naztec, Inc. does not accept liability for nor warrant to anyone any subsequential damages that may occur with the SERIES 900-V11.0 controller whether the unit is used properly or not.

All requests for repairs should be directed first to the distributor and then to the factory. If the equipment is to be returned for service and/or repairs, a Return Authorization must be obtained. When the equipment is returned, the Model Number, Serial Number, Return Authorization, and a statement indicating the problem must be attached.

All controllers will be shipped F.O.B. Sugar Land, Texas. In the event of shipping damage, the customer will be responsible for filing a claim with the freight carrier.

4.3 COPYRIGHT

4.4 NEMA Pin Assignments

CONNECTOR A Pin	Function	CONNECTOR B Pin	Function	CONNECTOR C Pin	Function
A	SPARE	A	Phase 1 Next	A	Coded St Bit A(2)
B	+24V DC Output	B	Spare	B	Coded St Bit B(2)
C	Voltage Monitor	C	Phase 2 Next	C	Phase 8 Dont Walk
D	Phase 1 Red	D	Phase 3 Green	D	Phase 8 Red
E	Phase 1 Don't Walk	E	Phase 3 Yellow	E	Phase 7 Yellow
F	Phase 2 Red	F	Phase 3 Red	F	Phase 7 Red
G	Phase 2 Don't Walk	G	Phase 4 Red	G	Phase 6 Red
H	Phase 2 Ped Clr	H	Phase 4 Ped Clr	H	Phase 5 Red
J	Phase 2 Walk	J	Phase 4 Don't Walk	J	Phase 5 Yellow
K	Phase 2 Veh Call	K	Phase 4 Check	K	Phase 5 Ped Clr
L	Phase 2 Ped Call	L	Phase 4 Veh Call	L	Phase 5 Dont Walk
M	Phase 2 Hold	M	Phase 4 Ped Call	M	Phase 5 Next
N	Stop Time (1)	N	Phase 3 Veh Call	N	Phase 5 ON
P	Inhibit Max Term(1)	P	Phase 3 Ped Call	P	Phase 5 Veh Call
R	External Start	R	Phase 3 Omit	R	Phase 5 Ped Call
S	Interval Advance	S	Phase 2 Omit	S	Phase 6 Veh Call
T	Indicator Lamp Ctrl	T	Phase 5 Ped Omit	T	Phase 6 Ped Call
U	AC - (NEUTRAL)	U	Phase 1 Omit	U	Phase 7 Ped Call
V	Chassis Ground	V	Ped Recycle (2)	V	Phase 7 Veh Call
W	Logic Ground	W	Spare	W	Phase 8 Ped Call
X	Flashing Logic	X	Spare	X	Phase 8 Hold
Y	Coded St Bit C (1)	Y	Phase 3 Walk	Y	Force Off (2)
Z	Phase 1 Yellow	Z	Phase 3 Ped Clr	Z	Stop Timing (2)
a	Phase 1 Ped Clr	a	Phase 3 Don't Walk	a	Inhib Max Term(2)
b	Phase 2 Yellow	b	Phase 4 Green	b	Spare
c	Phase 2 Green	c	Phase 4 Yellow	c	Coded St Bit C(2)
d	Phase 2 Check	d	Phase 4 Walk	d	Phase 8 Walk
e	Phase 2 ON	e	Phase 4 ON	e	Phase 8 Yellow
f	Phase 1 Veh Call	f	Phase 4 Next	f	Phase 7 Green
g	Phase 1 Ped Call	g	Phase 4 Omit	g	Phase 6 Green
h	Phase 1 Hold	h	Phase 4 Hold	h	Phase 6 Yellow
i	Force Off (1)	i	Phase 3 Hold	i	Phase 5 Green
j	Ext Min Recall	j	Phase 3 Ped Omit	j	Phase 5 Walk
k	Man Ctrl Enable	k	Phase 6 Ped Omit	k	Phase 5 Check
m	Non Act I	m	Phase 7 Ped Omit	m	Phase 5 Hold
n	Test Input A	n	Phase 8 Ped Omit	n	Phase 5 Omit
p	AC + (HOT)	p	Overlap A Yellow	p	Phase 6 Hold
q	Spare	q	Overlap A Red	q	Phase 6 Omit
r	Coded St Bit B (1)	r	Phase 3 Check	r	Phase 7 Omit
s	Phase 1 Green	s	Phase 3 On	s	Phase 8 Omit
t	Phase 1 Walk	t	Phase 3 Next	t	Phase 8 Veh Call
u	Phase 1 Check	u	Overlap D Red	u	Red Rest (2)
v	Phase 2 Ped Omit	v	Spare	v	Omit Red Clear(2)
w	Omit Red Clear (1)	w	Overlap D Green	w	Phase 8 Ped Clr
x	Red Rest (1)	x	Phase 4 Ped Omit	x	Phase 8 Green
y	Spare	y	Spare	y	Phase 7 Dont Walk
z	Non Act II	z	Max II Select (2)	z	Phase 6 Dont Walk
AA	Test Input B	AA	Overlap A Green	AA	Phase 6 Ped Clr
BB	Walk Rest Modifier	BB	Overlap B Yellow	BB	Phase 6 Check

CONTINUED ON NEXT PAGE
CONTINUED FROM PRECEEDING PAGE

CC	Coded St Bit A(1)	CC	Overlap B Red	CC	Phase 6 On
DD	Phase 1 ON	DD	Overlap C Red	DD	Phase 6 Next
EE	Phase 1 Ped Omit	EE	Overlap D Yellow	EE	Phase 7 Hold
FF	Ped Recycle (1)	FF	Overlap C Green	FF	Phase 8 Check
GG	MAX II SELECT (1)	GG	Overlap B Green	GG	Phase 8 On
HH	Spare	HH	Overlap C Yellow	HH	Phase 8 Next
				JJ	Phase 7 Walk
				KK	Phase 7 Ped Clr
				LL	Phase 6 Walk
				MM	Phase 7 Check
				NN	Phase 7 On
				PP	Phase 7 Next

4.5 Connector D Pin Assignments

CONNECTOR D

Pin	Function		Pin	Function
1	IN	OFFSET 2	30	IN DETECTOR 13
2	IN	FREE/	31	IN DETECTOR 10
3	IN	SYSTEM/TOD RESYNC	32	IN DETECTOR 11
4	IN	PREEMPTION 4	33	IN DETECTOR 12
5	IN	CYCLE 2	34	IN EXT. COORD. ACT/PRE6
6	IN	OFFSET 3	35	OUT OFFSET 1
7	IN	FLASH IN	36	IN ALARM 6
8	IN	PREEMPTION 5	37	IN ENABLE PREEMPTION
9	IN	PREEMPTION 3	38	I/O SPARE
10	OUT	PREEMPT ACTIVE	39	I/O SPARE
11	IN	SPLIT 2	40	OUT LMP SELD/FUNCT. 8/LEVEL
12	IN	CYCLE 3	41	OUT LMP SELC/FUNCT. 7
13	IN	OFFSET 1	42	OUT OFFSET 2
14	OUT	LMP SELB/FUNCT. 6	43	OUT OFFSET 3
15	IN	PREEMPTION 2	44	OUT SPLIT 3
16	IN	PREEMPTION 1	45	OUT SPECIAL FUNCT. 1
17	IN	DETECTOR 16	46	OUT SPECIAL FUNCT. 3
18	IN	ALARM 1	47	OUT SPECIAL FUNCT. 8/PULSE
19	IN	SPLIT 3	48	NOT USED
20	IN	OFFSET 4	49	OUT OFFSET 4
21	IN	DETECTOR 15	50	OUT SPLIT 2
22	OUT	LMP SELA/FUNCT. 5	51	OUT CYCLE 3
23	OUT	EXT. COORD. ACT	52	OUT SPECIAL FUNCT. 2
24	OUT	FLASH ACT	53	OUT +24V DC
25	IN	DETECTOR 14	54	OUT LOGIC GROUND
26	IN	ALARM 3	55	OUT CHASSIS GROUND
27	IN	ALARM 4	56	OUT CYCLE 2
28	IN	DIMMING OR ALARM 5	57	IN DETECTOR 9
29	IN	ALARM 2		

4.6 Data Transfer Connectors' Pin Assignment

Comm Port 1		Comm Port 2, 3, and 4
Pin	Function	Pin Function
2	Transmit Data	
3	Receive Data	
5	Clear to Send	
4	Request to Send	
7	Logic Ground	

4.7 Wire list for Test Connectors A, B & C

Connector "A"			Connector "B"			Connector "C"		
From	To	To	From	To	To	From	To	To
D	v	EE	BB	G	V	C	j	m
Z	f	L	GG	c	n	y	D	P
a	K	g	HH	b	U	d	n	
e	M	AA	w	d	m	x	R	
X	h		r	f	T	K	p	
s	N		CC	J	k	G	L	v
DD	P		p	H	S	g	AA	a
E	w		s	K	R	F	i	u
t	FF		y	t	z	f	J	Z
C	x		FF	F	j,L	BB	k	s
r	GG		C	a	P,i	H	M	X
Y	k		e	Z	h	h	KK	Y
CC	BB		u	AA	N	z	N	t
H	i		D	A	g	B	MM	S
u	R		EE	DD	M	c	DD	EE
J	j		E	q	x	A	CC	T
d	T					HH	LL	U
b	z					e	GG	q
G	S					JJ	FF	V
c	m					w	NN	r
F	n					E	pp	W

4.7.1 Wire list for Test Connector D & Comm Ports

Connector "D"

From	To	To
45	18	13
52	29	1
46	26	6
47	27	20
23	34	5
24	28	12
35	16	57
42	15	31
43	9	32
49	4	33
56	8	30
51	3	25
50	7	21
44	2	17
10	11	
48	19	
22	39	
14	38	
41	37	
40	36	

Comm Ports 1 and 2

From	To
2	3
4	5

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* see lane control signal supplement

4.9 GLOSSARY OF TERMS

This section defines the mnemonic terms used for the SERIES 900-V21 controller and its associated programming charts.

Phase — Term used in traffic for an individual traffic movement with its own timing intervals. The symbol ϕ is used in place of the word phase on the programming screens.

MVMT. — (MOVEMENT) This space is provided for each phase on the programming sheets for each phase to record that individual movement, ie northbound left turn, etc.

MIN GRN — (MINIMUM GREEN) The minimum green interval.

GAP, EXT — (GAP or EXTENSION) The amount of time added by a detector actuation.

MAX 1 — (MAXIMUM NO. 1) The maximum green time allowed from the occurrence of a serviceable conflicting call.

MAX 2 — (MAXIMUM NO. 2) A different maximum time selectable by external input or by internal time base.

YELLOW — (YELLOW CLEARANCE) The yellow clearance interval following a green.

RED — (RED CLEARANCE) The red clearance interval following the yellow clearance.

WALK — (WALK) The walk time given in response to a pedestrian actuation (pedestrian pushing pedestrian button) or pedestrian recall.

PED CLR — (PEDESTRIAN CLEARANCE) The flashing don't walk interval following the walk interval.

ADD INIT — (ADDED INITIAL) An amount of time that is added to the minimum green by each vehicle on that approach crossing the detector with the red signal displayed.

TT REDUC — (TIME TO REDUCE) The amount of time required for the controller to reduce the GAP, EXT, described

above, from the time programmed to the MIN GAP time described below.

TB REDUC (TIME BEFORE REDUCTION) The time that a conflicting call must exist before the TT REDUC interval above starts timing.

MIN GAP (MINIMUM GAP) The lowest value to which the GAP, EXT described above can be reduced by the TT REDUC feature.

MX IN GR (MAXIMUM INITIAL GREEN) The maximum initial green that can be achieved by the ADD INIT feature described above.

WALK 2 (WALK NO. 2) An alternate walk time that can be selected by the controllers time base feature.

PED CLR2 (PEDESTRIAN CLEARANCE NO. 2) An alternate pedestrian clearance which will follow WALK 2 if this feature is selected.

MAX 3 (MAXIMUM NO. 3) A special dynamic maximum 3 time which can be utilized if the phase terminates by the maximum timing out for two consecutive cycles.

MAX EXT (MAXIMUM EXTENSION) The amount of time added to the existing maximum time each time the maximum timer times out after the two consecutive cycles mentioned above until the value reaches the MAX 3 time programmed.

CONFLICTING PHASES - A means to program phases which would normally time concurrently which inhibits them from timing concurrently. EXAMPLE - If phases 1 and 5 which normally time concurrently are programmed as CONFLICTING PHASES, they cannot time together, so they will each be serviced only during alternate cycles.

RECALL - A means of placing a recurring call on that phase. A minimum recall will always place a vehicle demand on that phase as if each time the phase terminates a vehicle actuates the detector. A maximum recall will duplicate recurring vehicles actuating the detector to extend the phase to the maximum time each cycle. A pedestrian recall will duplicate a pedestrian actuating the pedestrian push button for that phase every cycle during the red. These recalls can be programmed in combinations, ie pedestrian and maximum.

PH ROTATION - (PHASE ROTATION) A means of reversing the timing sequence of phase pairs 1 & 2, 3 & 4, 5 & 6 and 7 & 8. When 1 & 2 are reversed, 2 will time before 1, etc.

PLAN - A coordination plan. A total of 16 plans are available with each one capable of its own cycle length and cycle

split.

SPLIT - The split is defined as the proportion of the cycle length assigned to each phase within the cycle.

COMMANDS - A command consists of various selectable options. A total of 17 commands are available and can be selected by various means including time base.

OFFSETS - An offset is defined as a time relationship to a central or reference clock. A total of 4 offsets are available.

OVERLAP - An overlap is defined as a red, yellow and green output which can be made up of a combination of phases. A total of 8 overlaps are available.

TIME BASE OPERATION - Operation on a time-of-day, day-of-week schedule. In the Naztec SERIES 900-V21 controller, a total of 80 weekday entries and 50 holiday entries are available to change the status of operation on a time basis.

PREEMPT - A means of altering the operation of the controller in response to an external input such as a railroad track circuit. The change might consist of flashing operation or a limited operation. There are a total of 5 preempts available in the Naztec Controller, allowing, as an example, four for emergency vehicle preempts (one per approach), and one for railroad preempt.

POWER SUPPLY

The power supply in the SERIES 900-V21 controller is of the linear type. Two separate transformers are used, one supplies +24 volts and the other +5 volts. Circuitry in the power supply generates a 120 Hz clock from the input line voltage for use by the controller's CPU. Also integral to the power supply is Brown-Out detection. The power supply signals the CPU of low line voltage conditions before the +5 volt supply is affected. The CPU then initiates an orderly shutdown sequence.

CPU/DISPLAY BOARD

The CPU/Display board contains the controller's processing components, keyboard, display, and communications ports. In fact, most of the functional blocks of the controller with the exception of inputs and outputs are contained on this board.

The Z80180 microcontroller is the heart of the Naztec SERIES 900-V21 controller. This single device includes a microprocessor, a two channel communications controller, programmable timers, and interrupt control. Devices U1, U2, U7 and U8 are RS232 drivers and receivers that complete the communications circuitry.

Three types of memory are found on the CPU board. Up to three EPROM devices are used to store the controlling software. Up to three static RAMs are used for working storage while AC power is applied. An EEPROM provides non-volatile storage of operator-programmed controller parameters. The SERIES 900-V21 provides an extra measure of EEPROM data protection by including special "lock" circuitry that requires a specific sequence to be followed by the processor when changing EEPROM data. This combination hardware/software lock virtually eliminates the possibility of the processor erroneously writing to EEPROM during momentary disruptions, such as those due to excessive voltage transients or AC power "glitches".

The display is a 4-line x 40-character LCD module that is interfaced to the microcontroller via the processor bus. The display module requires +5 volts for on-board logic and from approximately -2 to -5 volts bias for the display itself. The display bias voltage is fully temperature compensated by circuitry that includes Q3, Q4, Q6, R28-R30, R32, R33 and R35-R37. Display backlighting is provided by an electro-luminescent (EL) panel which is also integral to the display module. The EL panel is powered by inverter T1 which automatically adjusts the AC supply voltage to compensate for brightness variations due to temperature and age.

Time-of-day and date are maintained by device U21. This real-time clock (RTC) obtains backup power during AC power outages from a large-value "super" capacitor, C40, for a minimum of 48 hours. The RTC is factory tuned to be accurate to within 1 second during a 24-hour period. Should recalibration become necessary, it is strongly recommended that controllers be returned to the factory.

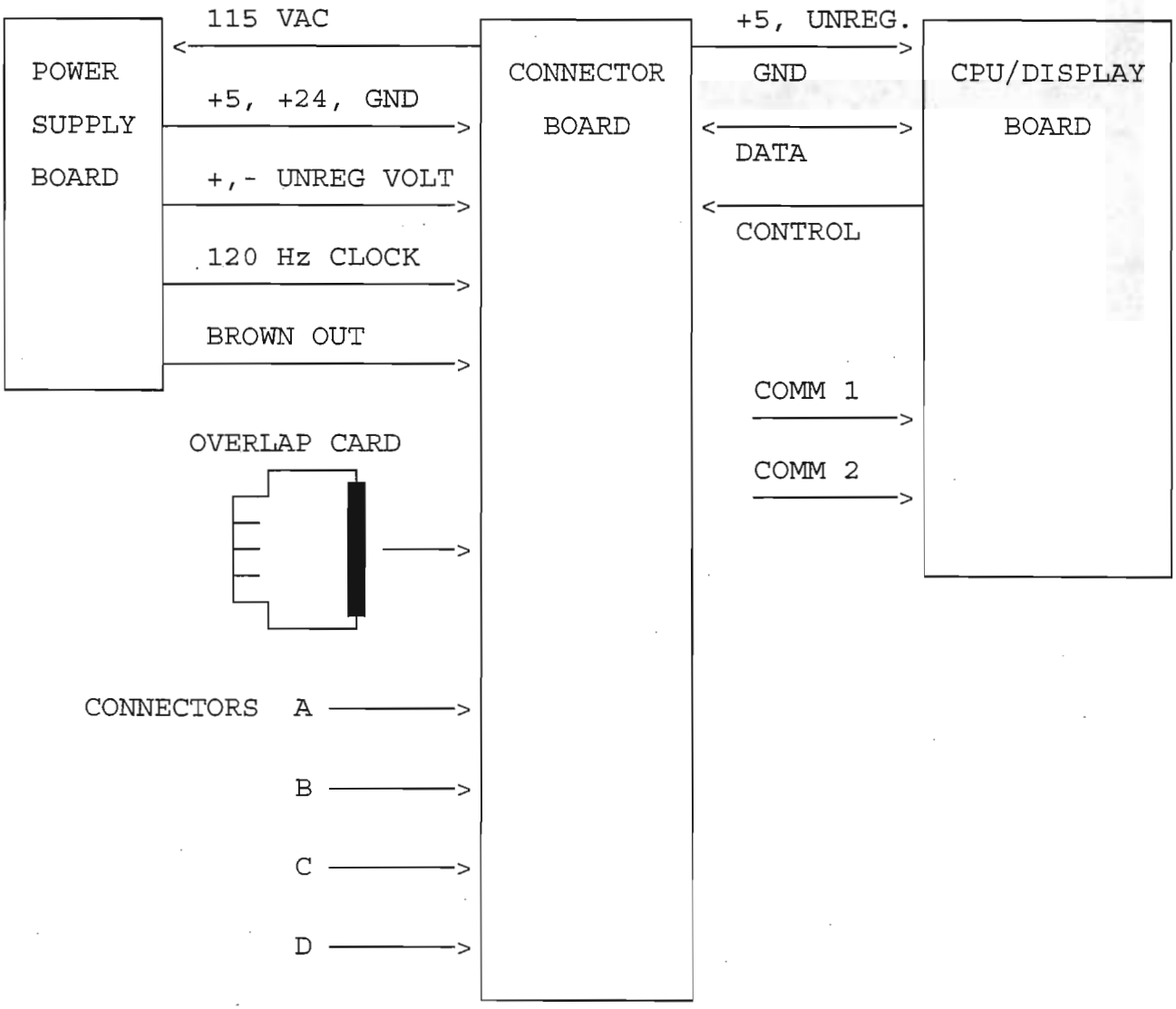
Also on the CPU board, a 20-key keypad is interfaced to the processor bus via devices U20, U27, and RP5. Audible feedback is provided by a piezo-electric tone generator, A1. +5V is monitored by U33. The processor is "watched" by watchdog timer U32 and its associated circuitry. U9 is the central device of the circuitry used to generate control signals for the various I/O devices.

CONNECTOR BOARD

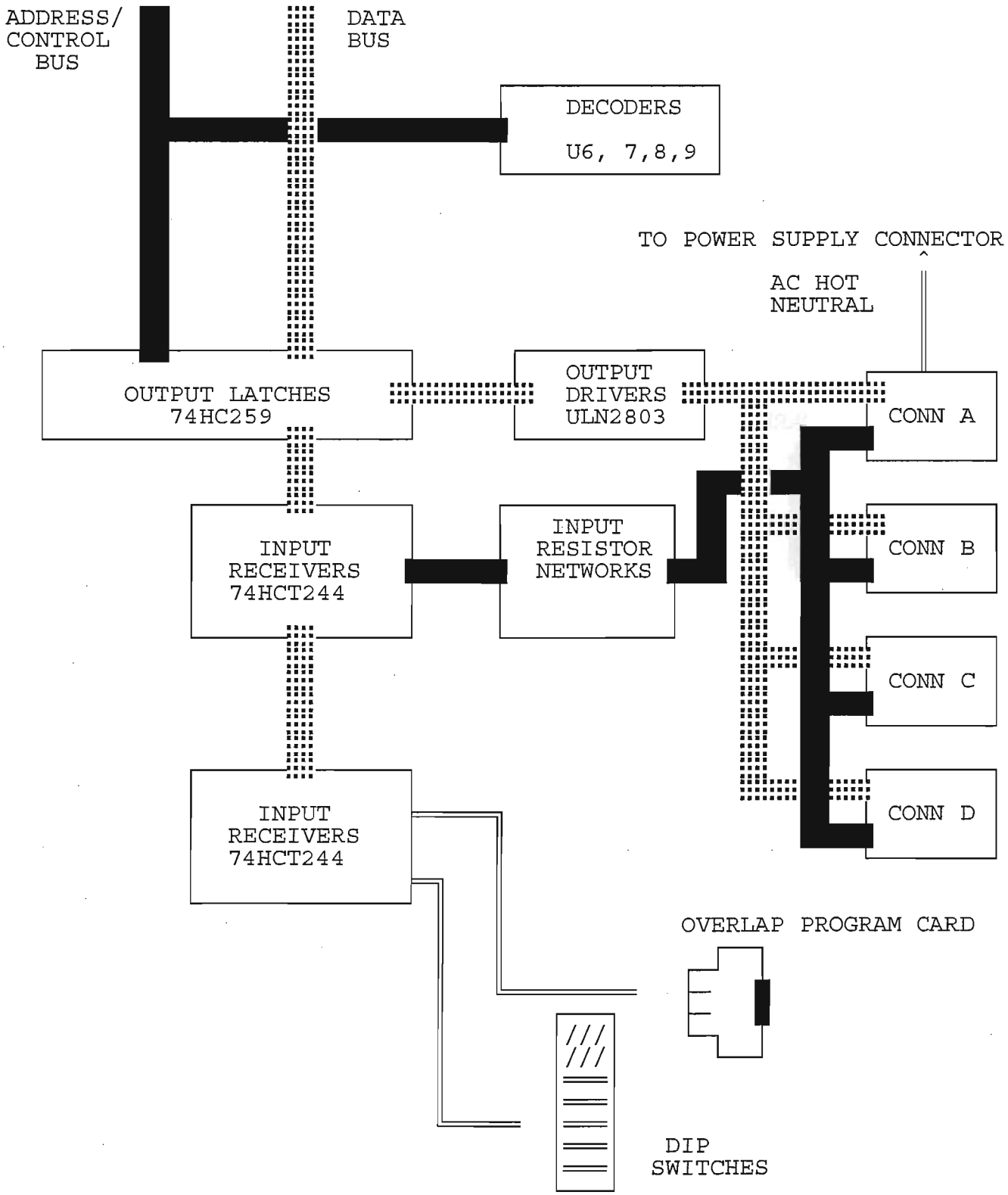
The connector board contains NEMA input/output connectors A, B, and C, and non-NEMA connector D. All inputs on these connectors are level-shifted from NEMA levels (+24V) to logic levels (+5V) through resistor-divider networks. The level-shifted input signals are gated onto the data bus by 74HCT244 devices. Output signal states are latched by 74HCT259 devices and buffered by ULN2803 drivers.

Also on the connector board is the overlap card connector and an 8-position dip-switch. 74HCT244 devices are used to input overlap card and switch position programming data. Overlap Programming Card jumper positions are read during initial power-up. Therefore, changing the overlap programming card with the controller still running is prohibited. Such action may cause damage to the unit. Partial address bus decoding is performed by devices U6-U9 to generate device select signals for all output latches and input receivers.

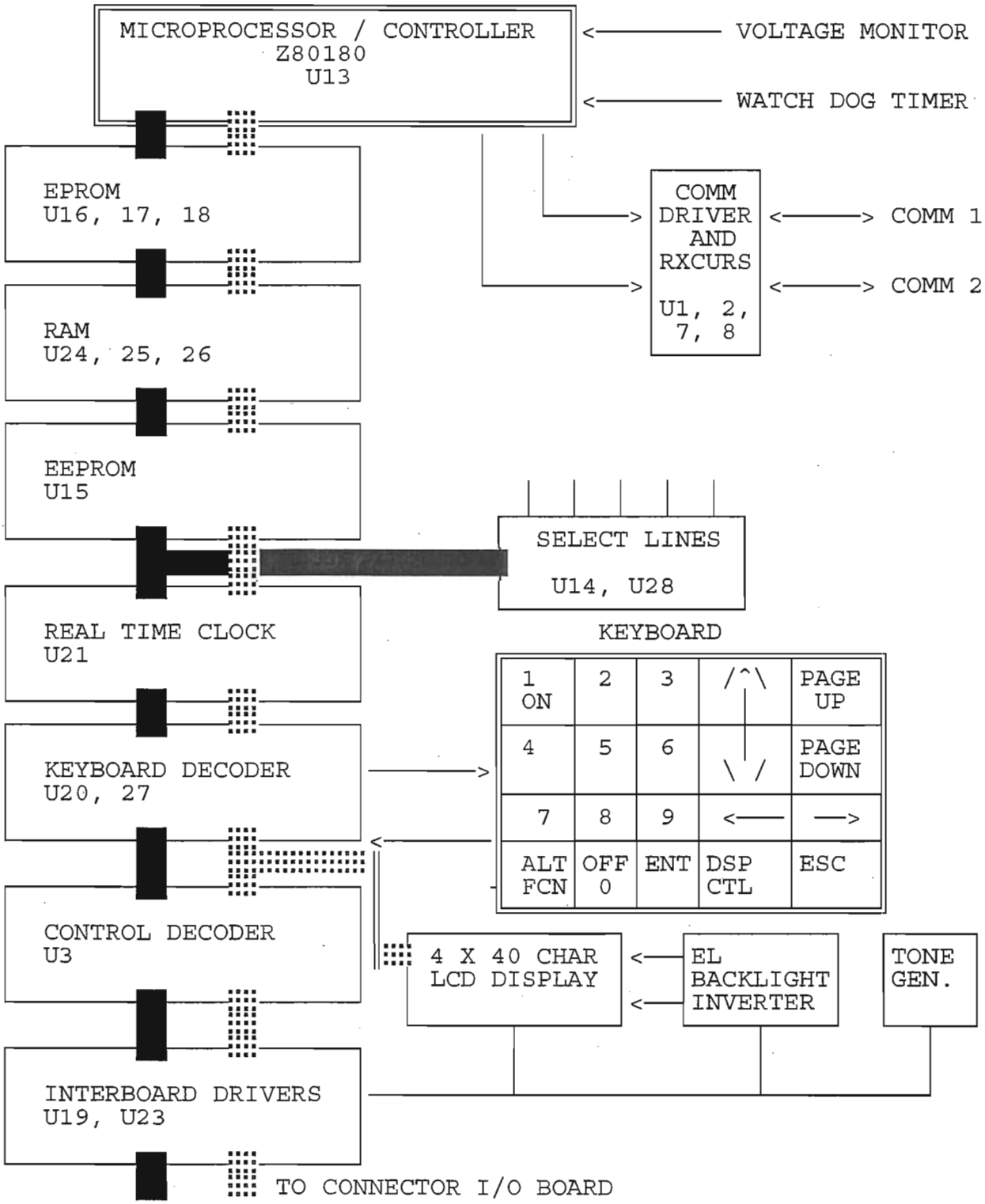
SERIES 900-V21 BLOCK DIAGRAM



SERIES 900-V21 CONNECTOR INPUT/OUTPUT BOARD



SERIES 900-V21 CPU BOARD



TROUBLE SHOOTING:

Most problems associated with the controller can be traced to improper setup or programming of parameters. The table below will assist the operator in identifying and correcting some of the most common problems.

SYMPTOM	POSSIBLE CAUSE	PROBABLE SOLUTION
Dead Controller	Blown 110 VAC fuse	Check fuse or replace
Display Running but NO Outputs	Blown 24 Volt fuse Run Timer is OFF	Replace fuse Turn On Run Timer
Won't Xmit/Receive	Baud Rate not Set	Set Baud Rate
Won't accept data	Security code not Entered	Enter Security Code
Keyboard will not respond	Decoder Chips	Replace
Does not store new Phase data	Bad EEPROM	Check/Replace
Bad data in memory	Unitialized EEPROM	Clear EEPROM
Real Time Clock will not Run/Update	RTC not set up	Set up at least Weekday Entry and Turn the Real Time Clock ON
RTC always runs too fast or slow	Calibration OFF	Adjust RTC to 32.7683 KHz
Controller comes and goes	Loose Connections	Check for loose ICs or cable connections

Note: A 6 (six) digit frequency counter is a must to adust the RTC within 1 (one) second per day.

6.0 Examples

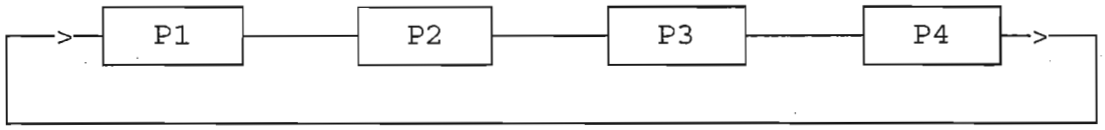
6.1 Barrier Configurations

The Naztec SERIES 900-V21 NEMA Controller contains four (4) programmable barriers. Each programmable barrier is capable of containing 1 - 8 phases with unlimited patterns.

Listed below are several commonly used phase plans. Examples shown for 4 Phase Sequential, 8 Phase Quad, Quad Sequential are accessible by only changing a pencil switch configuration.

Example 1:

4 Phase Sequential

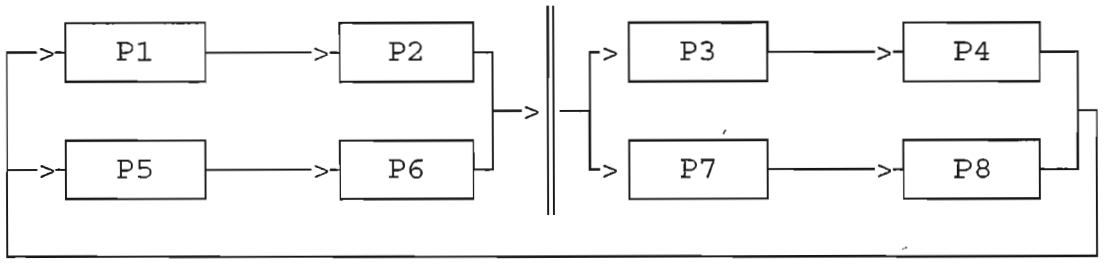


Pencil Switch Settings:

SW1	SW2
OFF	OFF

Example 2:

8 Phase Quad



Pencil Switch Settings:

SW1	SW2
OFF	ON

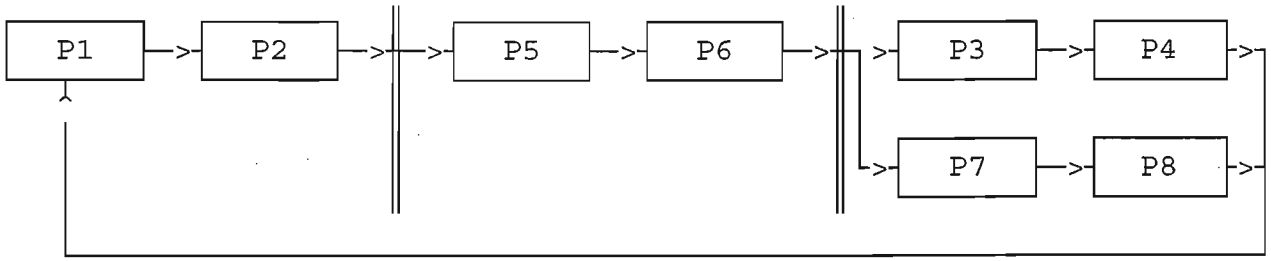
Special Sequential Quad

User Programmable Barriers:

Pencil Switch Settings:

SW1	SW2
ON	ON

Note: In this mode, the operator can define any phasing techniques.



Barrier Programming

	Barrier 1	Barrier 2	Barrier 3	Barrier 4
Phase 1	ON	OFF	OFF	OFF
2	ON	OFF	OFF	OFF
3	OFF	OFF	ON	OFF
4	OFF	OFF	ON	OFF
5	OFF	ON	OFF	OFF
6	OFF	ON	OFF	OFF
7	OFF	OFF	ON	OFF
8	OFF	OFF	ON	OFF

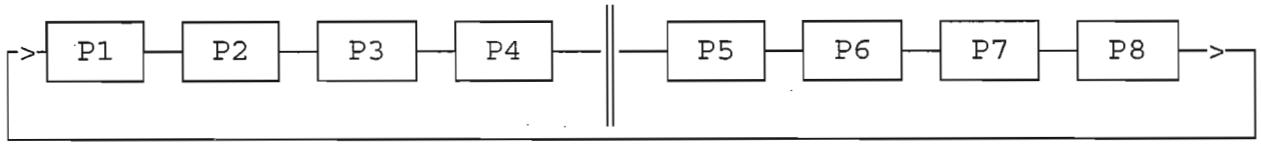
8 Phase Sequential

User Programmable Barriers:

Pencil Switch Settings:

SW1	SW2
ON	ON

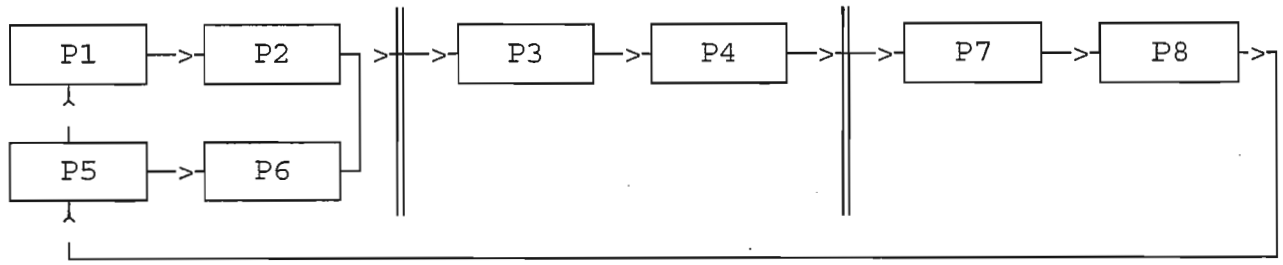
Note: In this mode, the operator can define any phasing techniques.



Barrier Programming

	Barrier 1	Barrier 2	Barrier 3	Barrier 4
Phase 1	ON	OFF	OFF	OFF
2	ON	OFF	OFF	OFF
3	ON	OFF	OFF	OFF
4	ON	OFF	OFF	OFF
5	OFF	ON	OFF	OFF
6	OFF	ON	OFF	OFF
7	OFF	ON	OFF	OFF
8	OFF	ON	OFF	OFF

Quad Sequential



Pencil Switch Settings:

SW1	SW2
ON	OFF

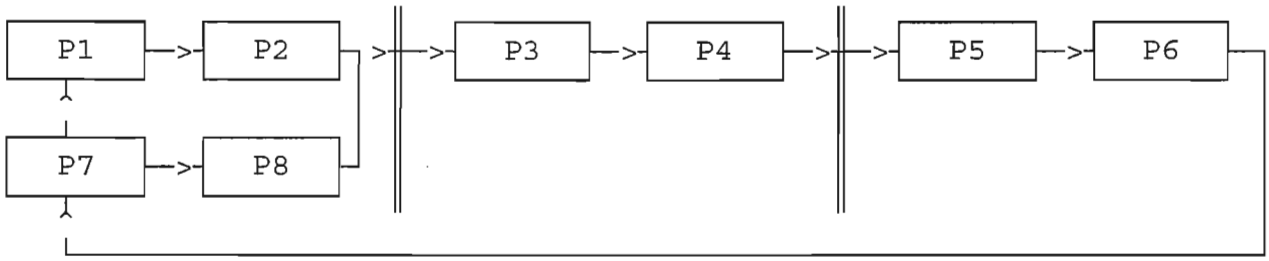
Special Quad Sequential

User Programmable Barriers:

Pencil Switch Settings:

SW1	SW2
ON	ON

Note: In this mode, the operator can define any phasing techniques.

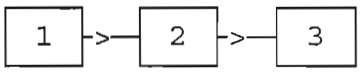


Barrier Programming

	Barrier 1	Barrier 2	Barrier 3	Barrier 4
Phase 1	ON	OFF	OFF	OFF
2	ON	OFF	OFF	OFF
3	OFF	ON	OFF	OFF
4	OFF	ON	OFF	OFF
5	OFF	OFF	ON	OFF
6	OFF	OFF	ON	OFF
7	ON	OFF	OFF	OFF
8	ON	OFF	OFF	OFF

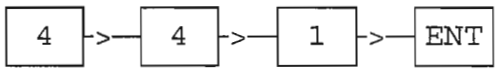
6.2 Off Duty Flash Example

Listed below are the necessary steps to enable an Off Duty Flash program in the SERIES 900-V21 Controller. This example begins from the MAIN MENU screen selection. The correct keystroking will be listed in boxes as follows:



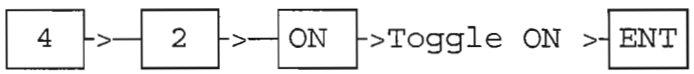
1. Step number 1 will be to enable the Real Time Clock. There are three basic steps that must be followed in this order.

    1. Set at least one Weekday Entry. The clock must have at least one entry under the Weekdays in order for the clock to operate. Under the RUN DAY entry enter a Sunday thru Saturday option. This is listed as S-S.



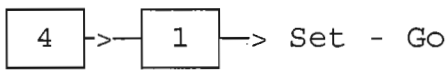
    2. Under the RUN DAY entry enter a Sunday thru Saturday option. This is shown as S-S. Go back to the Main Menu.

    3. Set the RTC active as follows:



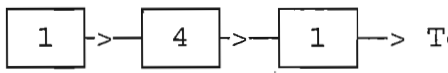
Go back to the Main Menu.

    4. Set the current Day, Date and Time

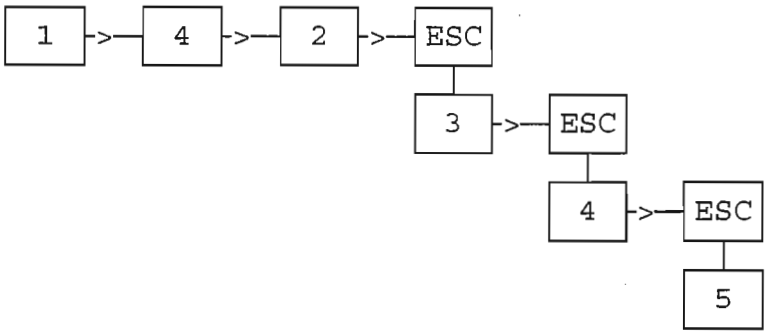


2. Step number 2 will be to set up the necessary Flash Parameters.

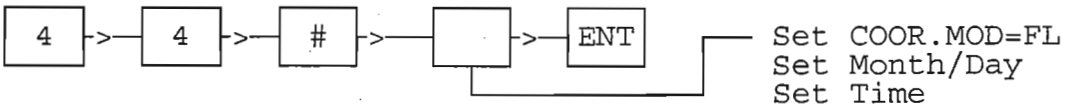
    1. Flash Parameters - Set the desired Flash option.



2. Set the desired options under the Flash menu. Set desired options on each screen before pressing ESC

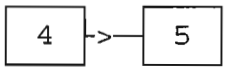


3. Step 3 is to set the desired flash program start and stop times. Once inside the Weekday Entry leave the following entries set to these parameters. Note: These should already be set if the correct diagnostic initialization program was completed. OFFSET = 1, PLAN = 1, COMMD = 0, CMD MODE = OFF. Set the other parameters for the desired operation. Note: The coordinator must be programmed for the entire week and year even if it is told to go free. Example: If only a Monday thru Friday program is needed, a program must be entered for Saturday and Sunday.



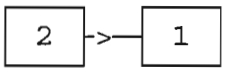
4. After the Weekday entries are completed, the Holiday entries should be programmed or cleared if not needed. A clear entry in the Holiday Program would read as follows:

```
1 00-00-00 HOL 00:00 OFF OFF  1   1  0
```



5. The next step is to activate the Coordinator. This is accomplished in the Test Configuration mode. The following program should be entered.

```
NEW - OFF  RTC    9    99   0
```



6.3 Time Based Coordination Example

The following example is an addition to the Off Duty Flash example which will utilize some of the same procedures and steps.

Repeat Step 1 items 1, 2, 3.

Repeat Step 4 and 5.

1. In addition to Step 5, the Coordination Test Configuration entry should read as follows:

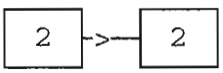
If special commands are to be used the entries are:

NEW - RTC RTC 9 99 99

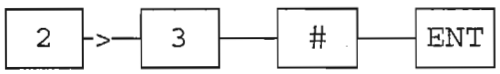
If no special commands are to be used the entries are:

NEW - OFF RTC 9 99 0

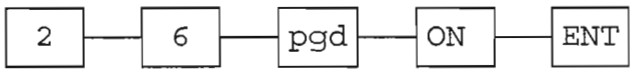
2. The next step is to select the desired cycle time, offset, and transition percentage.



3. Step number three is to set the desired Splits for each Plan. A Plan is a combination of a Cycle and Split.

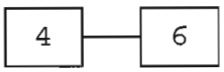


Note: If Easy Split entry is desired, the Easy Program mode must be in the ON position.



Note: Check the Holiday entries for clearance of all unwanted date entries. Step number 4.

4. Activate Coordination Plan.



Enter the desired Plan to start coordination.

6.4 Flow Chart SERIES 900-V21 Controller Menus