



Caltrans

Department of Transportation, California

Signal Operations

CTTM #0001

Copyright © 2003 Caltrans

MODEL 2070 CONTROLLER

February 21, 2003

Table of Contents

<u>LIST OF FIGURES</u>	4
<u>LIST OF TABLES</u>	5
<u>1. OBJECTIVE:</u>	6
<u>2. GLOSSARY:</u>	6
<u>3. INTRODUCTION:</u>	7
<u>4. DESCRIPTION OF OPERATION:</u>	8
<u>5. THEORY OF OPERATION:</u>	8
<u>6. HANDLING AND INSTALLATION PRECAUTIONS:</u>	9
<u>7. TROUBLE SHOOTING:</u>	9
<u>8. BASIC TSCP GUIDELINES AND NAVIGATION RULES:</u>	10
<u>9. THE TSCP MENU STRUCTURE CHART:</u>	11
<u>TSCP MAIN MENU</u>	12
<u>DISPLAYS MENU</u>	13
<u>CONTROLLER MENU</u>	14
<u>PREEMPTION MENU</u>	15

<u>COMMANDS MENU</u>	16
<u>DETECTORS MENU</u>	17
<u>COMM/LOGIC MENU</u>	18
<u>COORDINATION MENU</u>	19
<u>UTILITIES MENU</u>	20
<u>TIME OF DAY MENU</u>	21
<u>10. 2070 CONTROLLER SIGNAL TIMING CHART:</u>	22
<u>APPENDIX A</u>	23
<u>A-1 NUMERICAL MENU LISTING:</u>	24
<u>A-2 FUNCTION LISTING:</u>	27
<u>A-3 2070 BLOCK DIAGRAM:</u>	31
<u>APPENDIX B</u>	32
<u>B-1 BASIC OS 9 COMMANDS:</u>	33
<u>B-2 PIN CONFIGURATION FOR C50S</u>	33
<u>REFERENCES</u>	34

List of Figures

[Figure 1: Displays](#) 13

[Figure 2: Controller](#)..... 14

[Figure 3: Preemption](#)..... 15

[Figure 4: Commands Menu](#) 16

[Figure 5: Detectors Menu](#) 17

[Figure 6: Comm/Logic Menu](#) 18

[Figure 7: Coordination Menu](#)..... 19

[Figure 8: Utilities Menu](#) 20

[Figure 9: Time Of Day Menu](#) 21

[Figure 10: 2070 Block Diagram](#)..... 31

List of Tables

<u>Table 1: Glossary of Terms</u>	7
<u>Table 2: ATC Support</u>	7
<u>Table 3: Main Menu</u>	24
<u>Table 4: Display Menu</u>	24
<u>Table 5 Controller Menu</u>	24
<u>Table 6 Preemption Menu</u>	25
<u>Table 7 Commands Menu</u>	25
<u>Table 8 Detector Menu</u>	25
<u>Table 9 Communications Menu</u>	25
<u>Table 10 Coordination Menu</u>	25
<u>Table 11 Time of Day Menu</u>	26
<u>Table 12 Utilities Menu</u>	26
<u>Table 13-1 Function Listing</u>	27
<u>Table 13-2 Function Listing</u>	28
<u>Table 13-3 Function Listing</u>	29
<u>Table 13-4 Function Listing</u>	30
<u>Table 14 Basic OS 9 Commands</u>	33

1. Objective:

At the completion of this module, the student will have a basic understanding of the functions of the various Model 2070 Modules. The student will be able to enter timing and configuration data into the Traffic Signal Control Program (TSCP) running on the Model 2070 Controller.

This training module covers TSCP in detail. TSCP is menu-driven and developed to use the advanced control features of the Model 2070 Controller. Also provided in this manual are the TSCP menu flow chart, numerical list of program menus, submenus, pages, and list of functions.

2. Glossary:

ATC	Advanced Transportation Controller
BG	Bus Grant. Permission to Send
CPU	Central Processing Unit
DRAM	Dynamic Random Access Memory (Volatile Memory)
EIA	Electronic Industries Association
EPROM	Ultraviolet Erasable, Programmable, Read Only Memory Device
EEPROM	Electrically Erasable, Programmable, Read Only Memory Device
Flash Memory	An integrated circuit memory device with a non volatile electrically bulk erasable and bit programmable memory with fast access times
FSK	Frequency Shift Keying a method that transmits data by using different frequencies to represent logic "1" and logic "0"
IEEE	Institute of Electrical and Electronic Engineers
IRQ	Interrupt Request, request for service
ITS	Intelligent Transportation System
MCU	Micro Controller Unit
MODEM	A device used for communication
MOS	Metal Oxide Semi-conductor
MULTITASKING	The management of programs and the system services they request as tasks that can be interleaved
NEMA	National Electrical Manufacturers Association
OS9	Real-Time Operating by Microware
P1	Plug #1 of the VME standard (16 Bit Bus)
P2	Plug #2 of the VME standard (32 Bit Bus)
POR	Power On Reset
RAM	Random Access Memory (Volatile memory)
ROM	Read Only Memory (Non-volatile memory)

RS-485	EIA balanced differential transmission standard. A twisted pair allowing several devices to be connected in parallel
SRAM	Static Random Access Memory (Volatile memory)
TSCP	Traffic Signal Control Program developed by LADOT
VME	Versa Modular Eurocard (IEEE standard P1014/D1.2)
ETC	Electronic Toll Collection
HOV	High Occupancy Vehicle
RWIS	Roadway Weather Information System
VMS	Variable Message Sign
WIM	Weigh in Motion
AVI	Auto Vehicle Identification
HAR	Highway Advisory Radio
CMS	Changeable Message Sign

Table 1: Glossary of Terms

3. Introduction:

The evolution of electronics has taken traffic control hardware from the electro-mechanical controllers to microcomputer, surface mount chip-based controllers. Modern electronics has allowed the development of precise control strategies and extended the service life of traffic control equipment. These advances have greatly improved traffic flow.

With the arrival of Intelligent Transportation Systems (ITS) and new applications of advanced transportation management, Caltrans, City of Los Angeles, and other agencies realized the need for an Advanced Transportation Controller (ATC). The 2070 ATC is designed to support the following:

-Traffic	-Communication	-Electronic Toll Collection
-Ramp	-Speed Monitor	-High Occupancy Vehicle
-Camera	-Incident Management	-Roadway Weather
-Irrigation	-Rail/Highway Presence	-Variable Message Sign
-Violations	-Freeway Lane Control	-Weigh in Motion
-Lane Use	-Highway Advisory Radio	-Auto Vehicle Identification
-Surveillance		-Changeable Message Signs

Table 2: ATC Support

Caltrans and LADOT took part in the development of an Advanced Transportation Controller Model 2070 and intended it to be used in a variety of Intelligent Transportation Systems (ITS). Caltrans will use the Model 2070 for field installation in Type 332 cabinets as a replacement for the Model 170

4. Description of Operation:

The Model 2070 Controller is a first generation ATC designed for traffic management applications and designed to be used in harsh environments. The OS9 real-time, multi-tasking operating system installed in the CPU Module enables the controller to run multiple application programs.

The Model 2070 Controller consists of a number of interchangeable modules and will operate in a TYPE 170 or NEMA environment. Accessible from the front of the controller is the front panel assembly, the power supply's on/off switch, fuse, front panel reset switch, and power indicator LED. All other modules CPU, Field IO, and communications are accessible at the back of the controller. The communication modules are optional; the type and number of modules utilized can vary for each 2070 controller.

5. Theory of Operation:

The CPU and Field I/O make up the primary modules on the back of the 2070. The motherboard accommodates CPU, Field I/O, and up to two dual channel modems.

The MCB includes a software settable Time-of Day clock, which tracks years 1995 through 2015. The service frequency (60Hz) automatically corrects the TOD clock. This eliminates long-term drift when power is present. Without service power, the clock will maintain an accuracy of +/- one minute for thirty days.

The CPU module communicates with all other modules through six-bi-directional serial channels. One channel drives the front panel that acts as a terminal. Another channel serves the Field I/O and the last four are for the modems. Each dual channel modem requires two channels each.

The Field I/O module connects the 2070 to the input and output files via the 104 pin C1S and 37 pin C37S connectors. The field module contains buffers and latches for 63 inputs and 63 outputs.

The CPU reads the Field I/O inputs at a rate of 1000 times/sec and writes to the I/O buffer outputs. The output drivers receive data from the buffers and send it out to the field. The outputs will only be allowed to be ON if the Field I/O continues to receive valid communication from the CPU. The loss of communication for two seconds or longer will cause all outputs to revert to the OFF condition and a watchdog error will be issued.

Portions of the 2070 controller must remain powered after service voltage has failed. A set of super capacitors powers the memory and real-time clock during power failures. The super capacitors have a minimum hold up time of seven days and can take up to several minutes to recharge after a power outage.

6. Handling and Installation Precautions:

Normal precautions for lifting and transporting electronic equipment must be observed when handling the 2070 controller. **Do Not** lift the controller by the Front Panel. This can cause the panel to flex and crack the liquid crystal display (LCD).

Heat is the primary reason most electronic devices fail. The controller is cooled by convection. Cooling relies on airflow through the ventilation slots on the top and bottom of the chassis. This is especially important for removing heat from the power supply. Never block these ventilation slots with paper work or other debris.

Mounting the 2070 inside the cabinet rack by its side plates will suspend it and allow for proper ventilation. Do Not set the controller on a solid shelf as this will block airflow resulting in over heating of the unit. Avoid installing the unit directly above heat generating devices.

Caution must be exercised when handling electronic components from electrostatic discharge. It may require 3500 volts before you can feel a static discharge, but as little as 20 volts can destroy or damage some electronic components. Unfortunately, electrostatic discharges can often weaken parts causing them to fail randomly months or years later.

Metal oxide semiconductors devices (MOS) and other components incorporated into the 2070 controller are easily damaged by static discharge. Damage can be done at any time when handling the modules by simply touching runners and edge connectors which lead to static sensitive components. The most common cause of damage is due to improper handling. To avoid damage, only personnel that are properly grounded, at static free workstations are to repair or handle the individual modules. **Do Not** swap or remove modules in the field. Always return the defective 2070 controllers to the repair lab. **All modules may not be inter-changeable.**

Always practice SAFETY when working out in the field; watch where you step, avoid stepping into oncoming traffic, and wear the proper safety clothing.

7. Trouble Shooting:

Although it is recommended not to change any modules in the field, the modems may be changed for diagnosing communication problems. When changing a modem, the new modem shall be placed in the same slot. Make sure all the toggle switches are set properly. Never replace the CPU or Field IO module in the field as this may lead to unexpected results.

8. Basic TSCP Guidelines and Navigation Rules:

The Traffic Signal Control Program is completely menu driven. Entering the menu screen address on the Data Entry Keyboard will provide access to the desired screens. The screen addresses are always left of the menu choices. Addresses can be from one to four keystrokes long and utilize the digits 1-9 and letters A-F.

The **Main Menu** is similar to the Base Display on the 170, controller. The **Main Menu** should be the starting point for entering screen addresses. Navigation through the program is a matter of entering the address of the desired location. Every address keystroke will travel deeper (advance) into the program. This process is shown and can be followed in the TSCP flowchart. Use the **ESCape** key to return (scroll back) to a previous menu or to the Main Menu (the start point for advancing to a new screen). Depress the **ESCape** key as many times as, or greater than, the number of address keystrokes used to advance into the program to scroll back to the **Main Menu** screen. The goal is to press the **ESCape** key enough times to return to the **Main Menu**. Repeated pressing is permitted. The program will stop at the **Main Menu**. Navigation between screens is restricted to routes shown by the lines connecting the various menu screen boxes as shown on the TSCP flow chart.

The **Front Panel Manager** lists all available programs and acts as a table of contents for the 2070 controller. Therefore, the Traffic Signal Control Program shall be returned to the Front Panel Manager screen (home position) when programming is complete. This will reduce confusion at the next visit. The preferred method for returning to the **Front Panel Manager** is by pressing the **STAR** key (*) once from the Main Menu. The non-preferred method of returning to the Front Panel Manager is by rapidly pressing STAR three times within one second from any place in the program. Using the second non-preferred method will cause the TSCP to jump to the last screen next time the program is accessed. **Do Not** use the second method to return to the Front Panel Manager.

Methods of entering timing sheet or configuration data vary between screens. Refer to the TSCP User Manual for a detailed description of entering timing and configuration data for the various screens.

Upon initial power-up, the 2070 controller will display the **Front Panel Manager**. This screen displays all programs available on that particular controller. To the right of each program is listed the program version number. To the left of the listing is the access number, which when entered will take you into the program.

Traffic Signal Control Program guidelines summary:

1. **Select TSCP from the Front Panel Manager**
2. **Enter the full address of the desired screen from the Main Menu on the Data Entry Keyboard**
3. **Check the name of the screen before entering data**

4. **Do not leave the current screen without ensuring data has been entered.**
5. **Return to the Front Panel Manager before leaving the intersection.**

9. The TSCP Menu Structure Chart:

Illustrated on the next pages is the Traffic Signal Control Program (TSCP) menu structure. The boxes represent; the main menu, data entry screens, and data observe screens. The flowcharts illustrate the program screens in detail. The title boxes are labeled with the screen name and its full address. The flowchart demonstrates how the **Main Menu** branches to the nine sub menus. Although the TSCP is very user friendly, the reader should familiarize himself or herself with the program layout presented on the program structure chart.

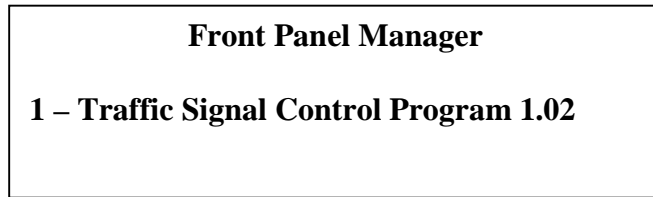
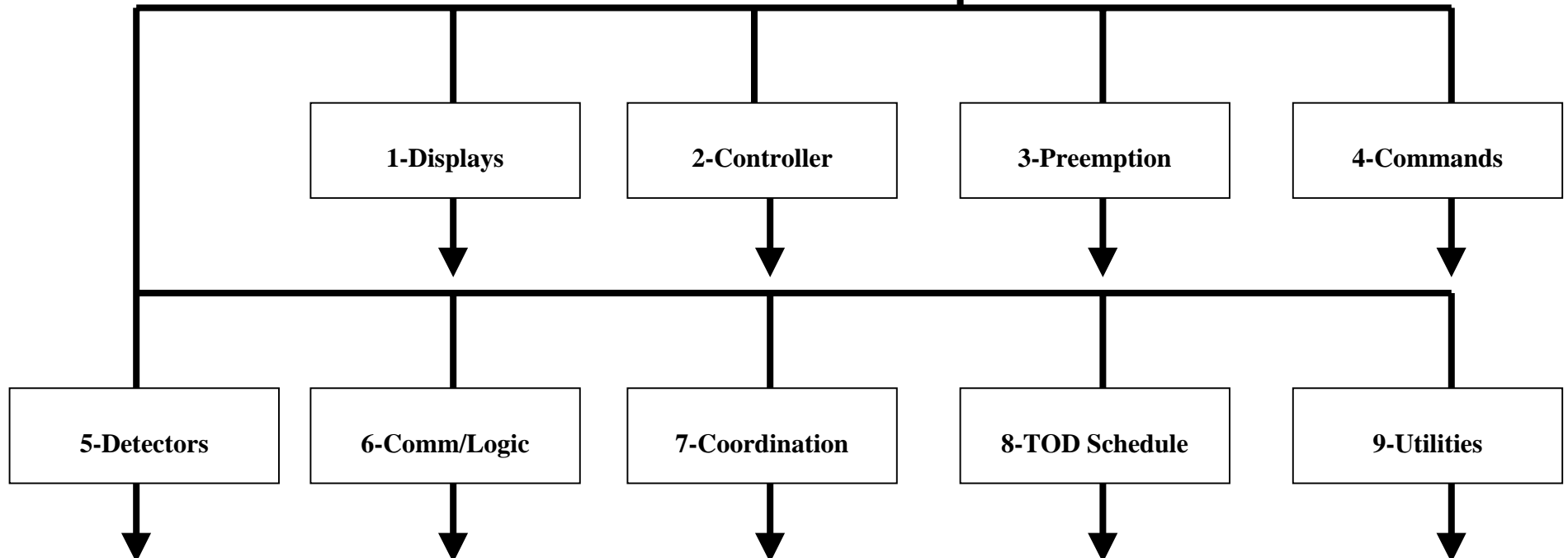
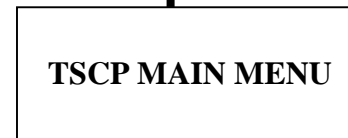
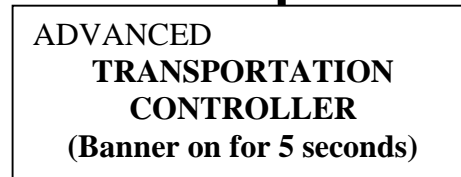


Figure 1: Front Panel Manger

TSCP MAIN MENU

The Caltrans Front Panel Manager screen is displayed when the 2070 is powered up. Select the Traffic Signal Control Program (TSCP) The TSCP Main Menu will come up after the banner screen. Arrows represent paths to other menus, submenus, pages or screens.



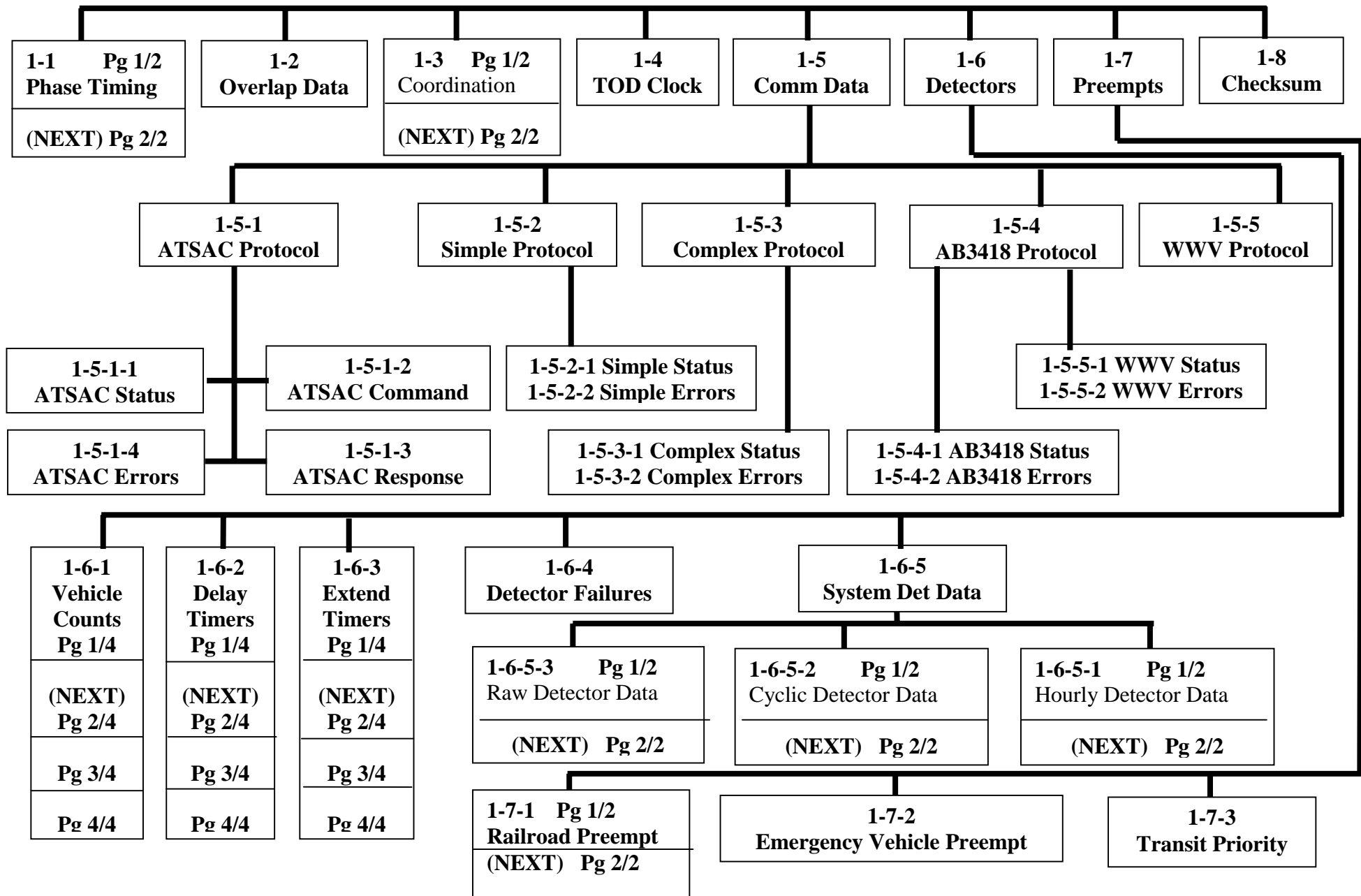
TSCP MAIL MENU

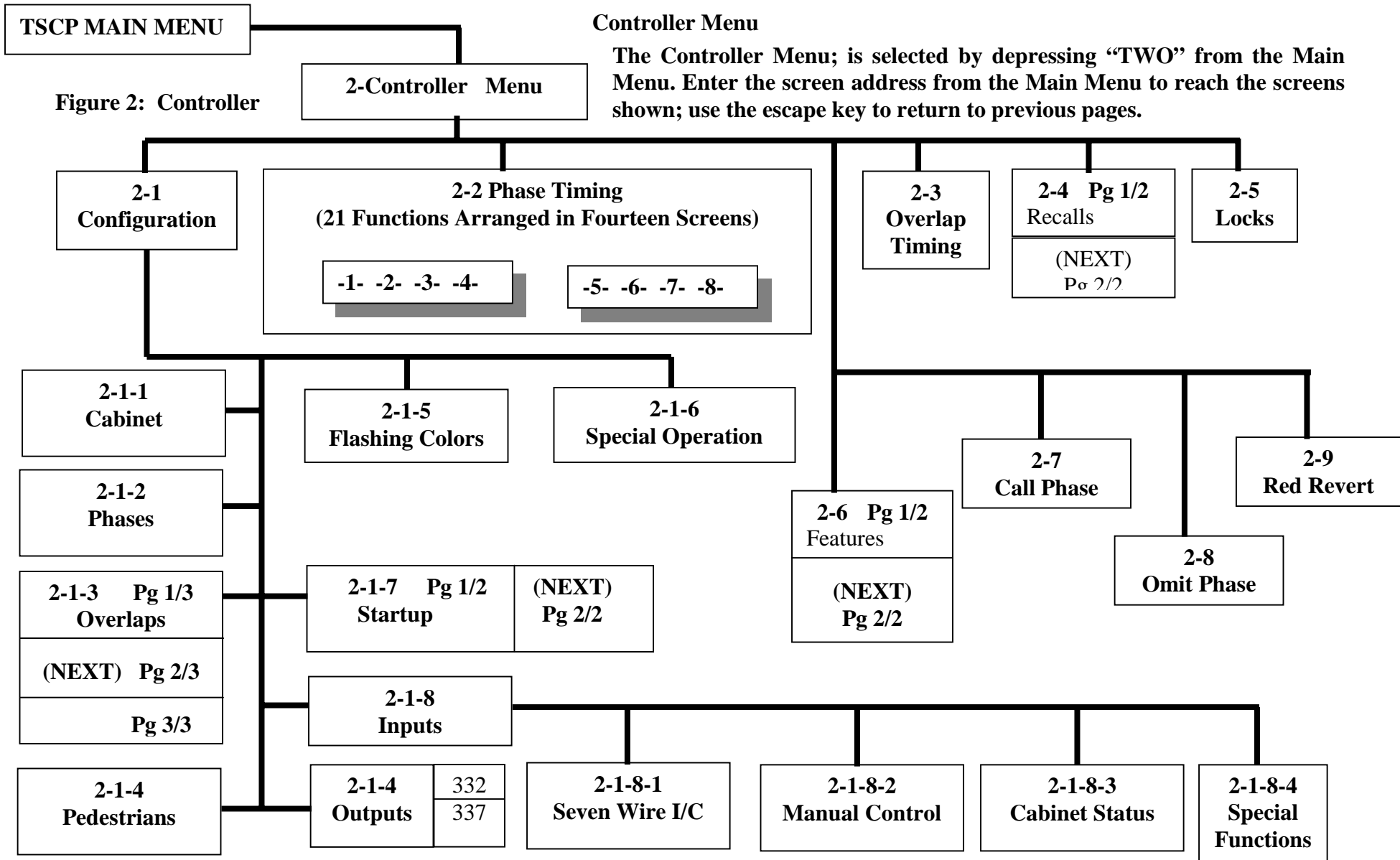
Displays Menu

The Display Menu; is selected by depressing "ONE" from the Main Menu. Enter the screen address from the Main Menu to reach the screens shown; use the escape key to return to previous pages or the Display Menu.

Figure 1: Displays

1-Displays Menu





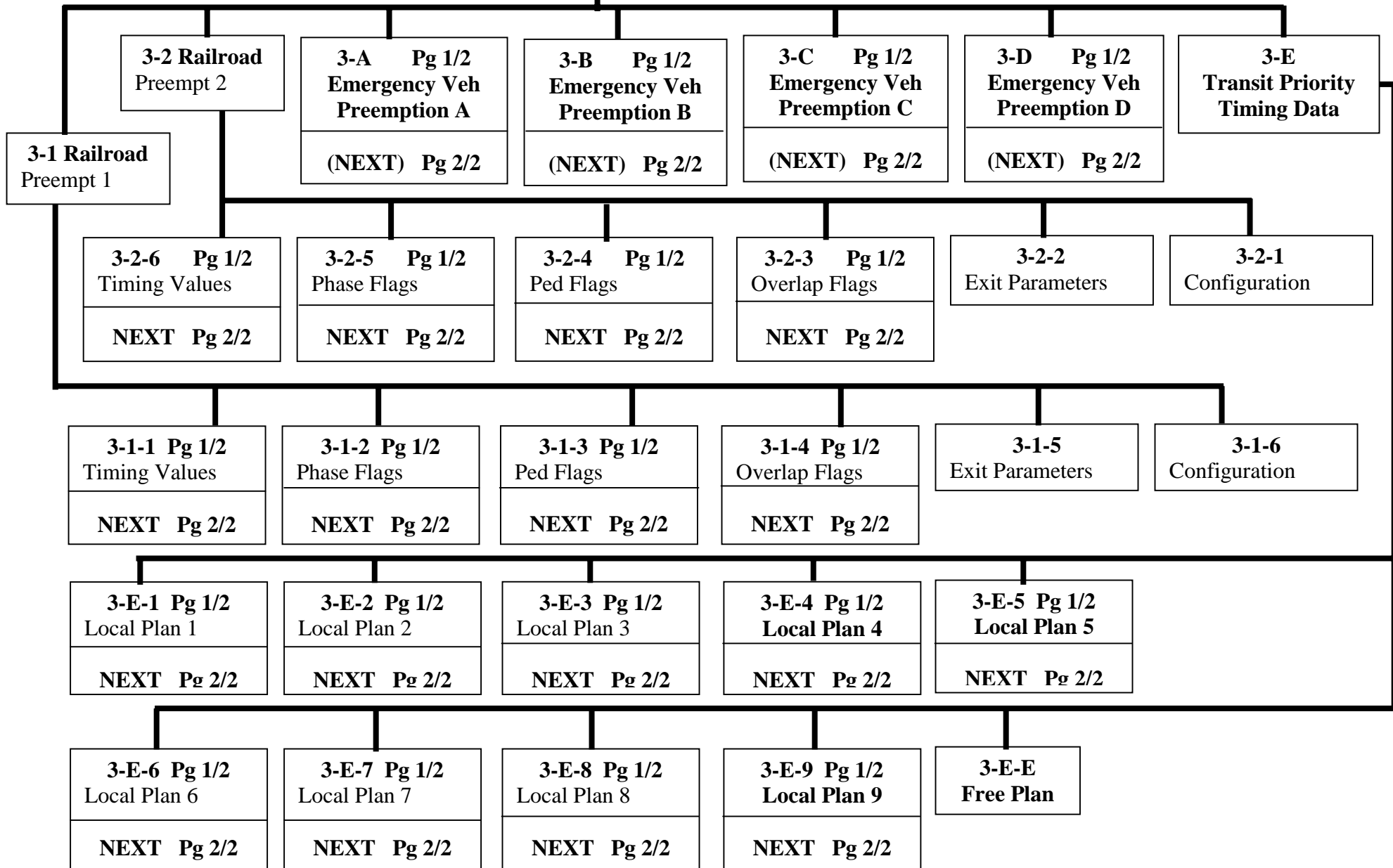
TSCP MAIN MENU

Preemption Menu

The Preemption Menu; is selected by depressing "THREE" from the Main Menu. Enter the screen address from the Main Menu to reach the screens shown; use the escape key to return to previous pages.

Figure 3: Preemption

3-Preemption Menu



Commands Menu

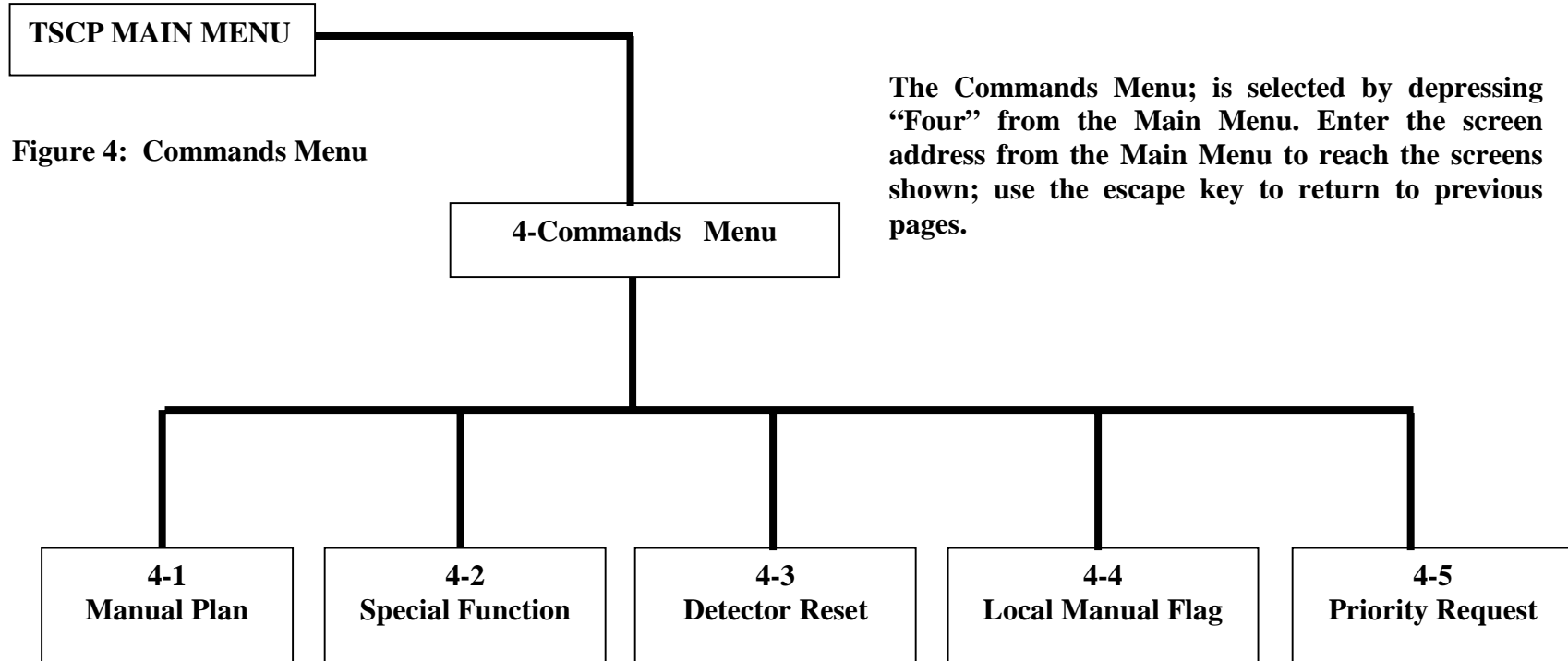
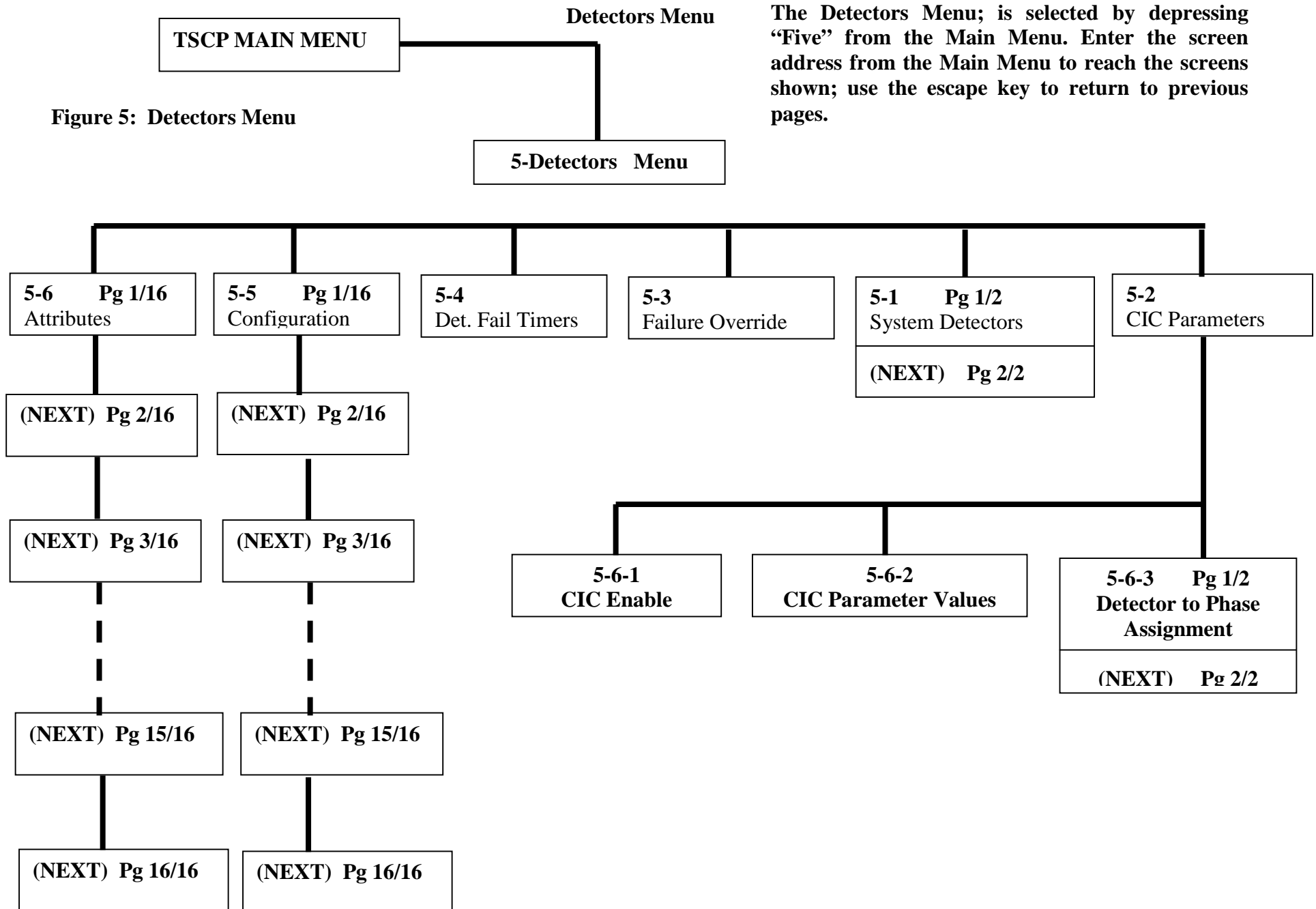


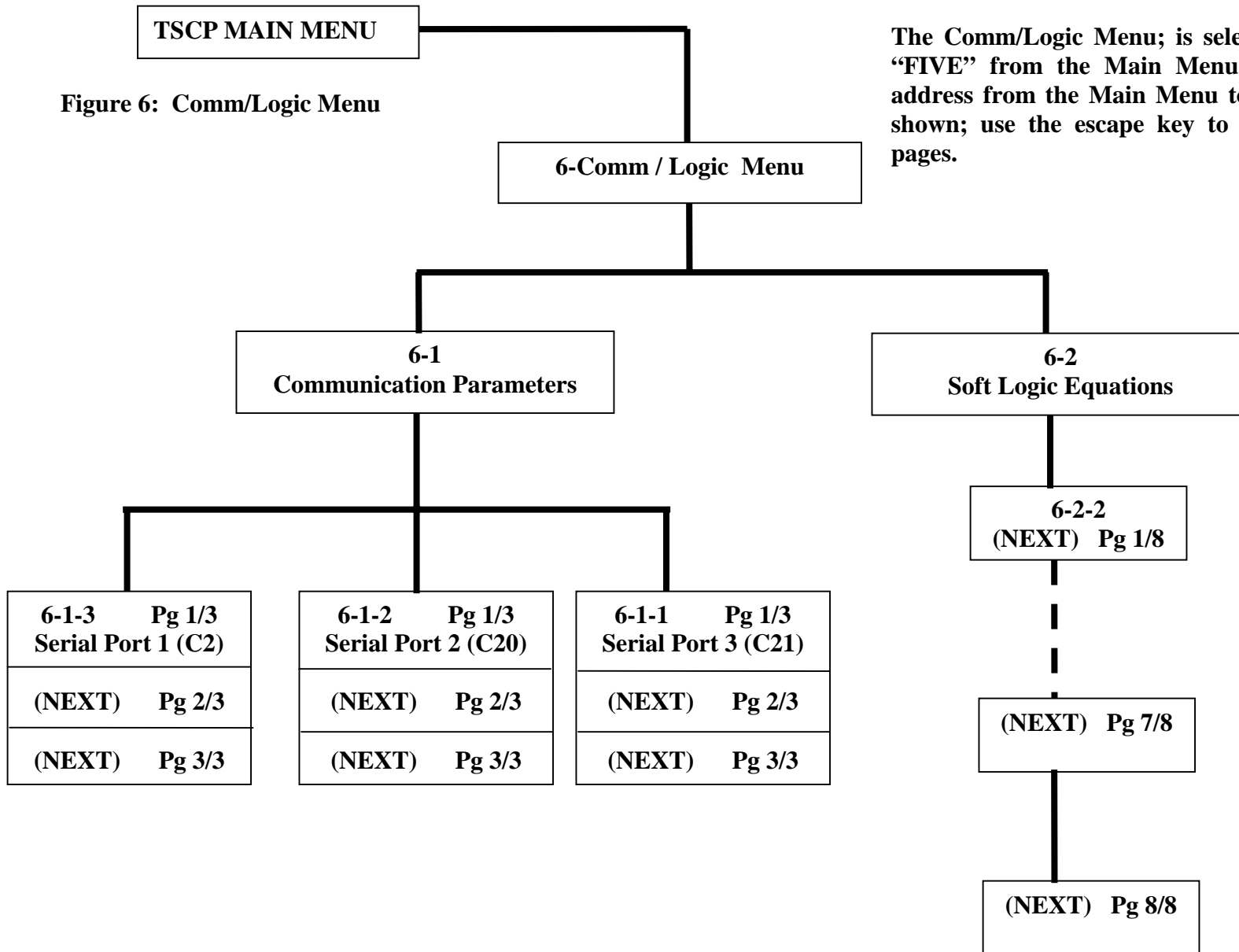
Figure 5: Detectors Menu

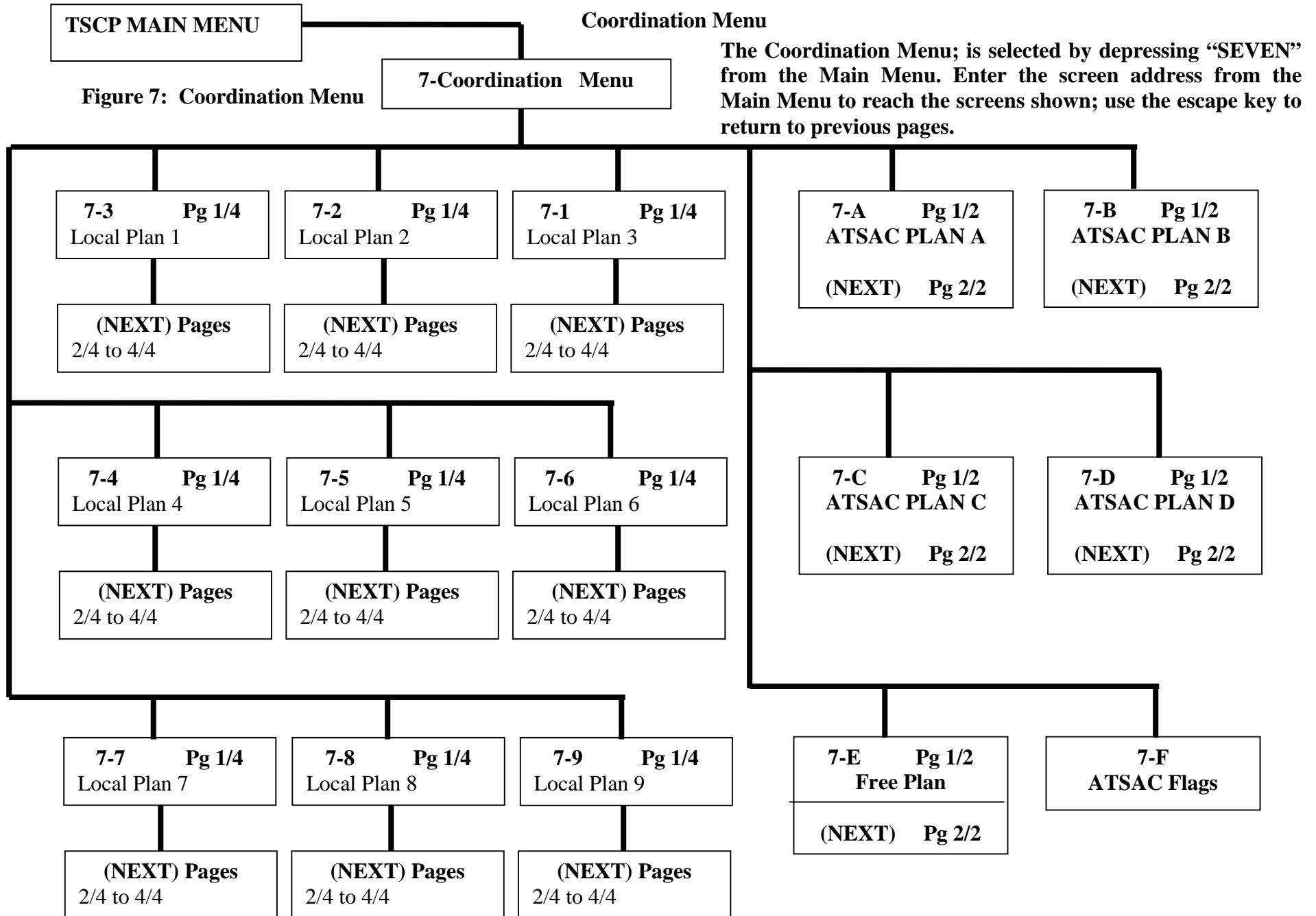


Comm/Logic Menu

The Comm/Logic Menu; is selected by depressing “FIVE” from the Main Menu. Enter the screen address from the Main Menu to reach the screens shown; use the escape key to return to previous pages.

Figure 6: Comm/Logic Menu



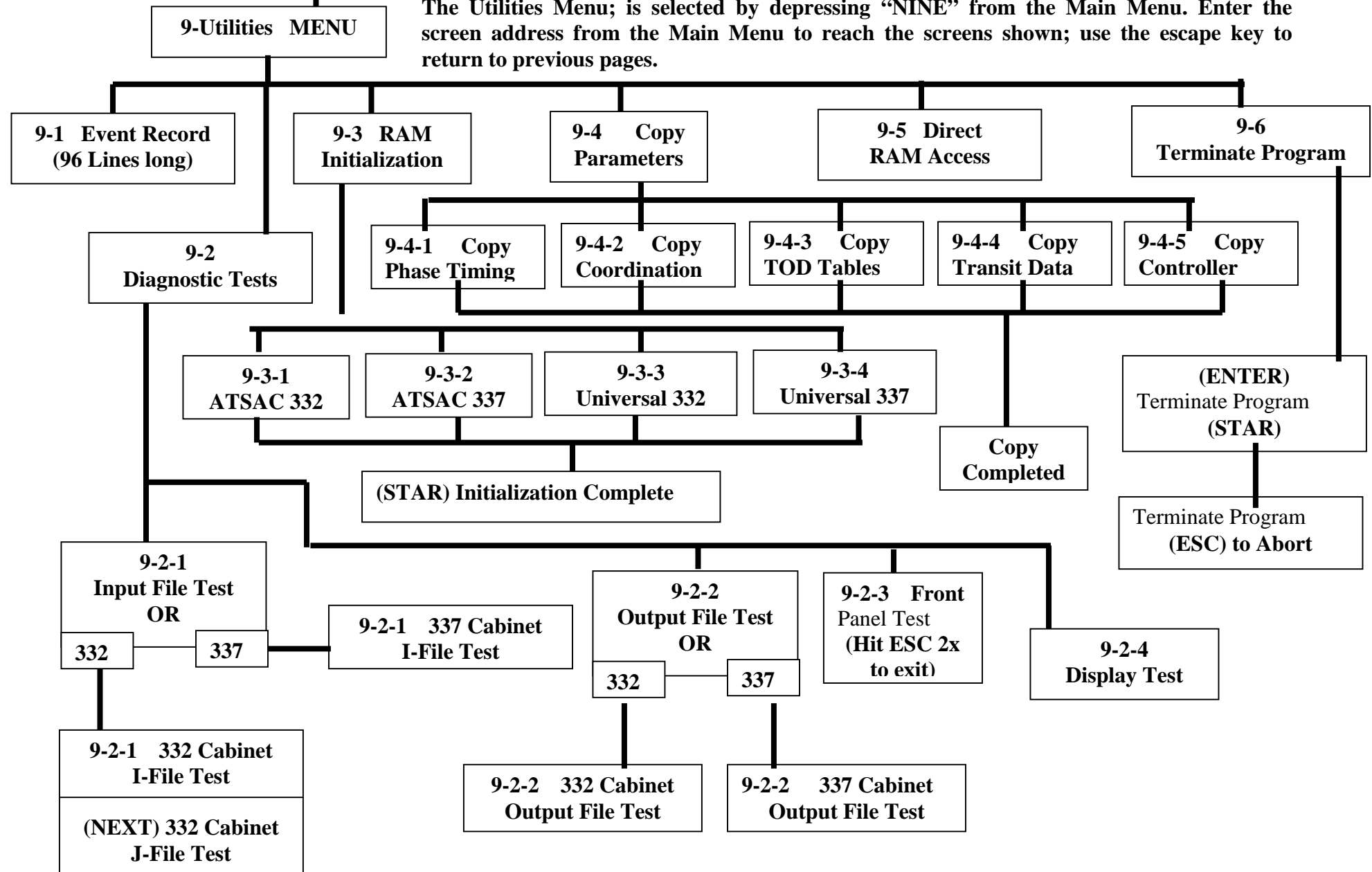


TSCP MAIN MENU

Figure 8: Utilities Menu

Utilities Menu

The Utilities Menu; is selected by depressing "NINE" from the Main Menu. Enter the screen address from the Main Menu to reach the screens shown; use the escape key to return to previous pages.

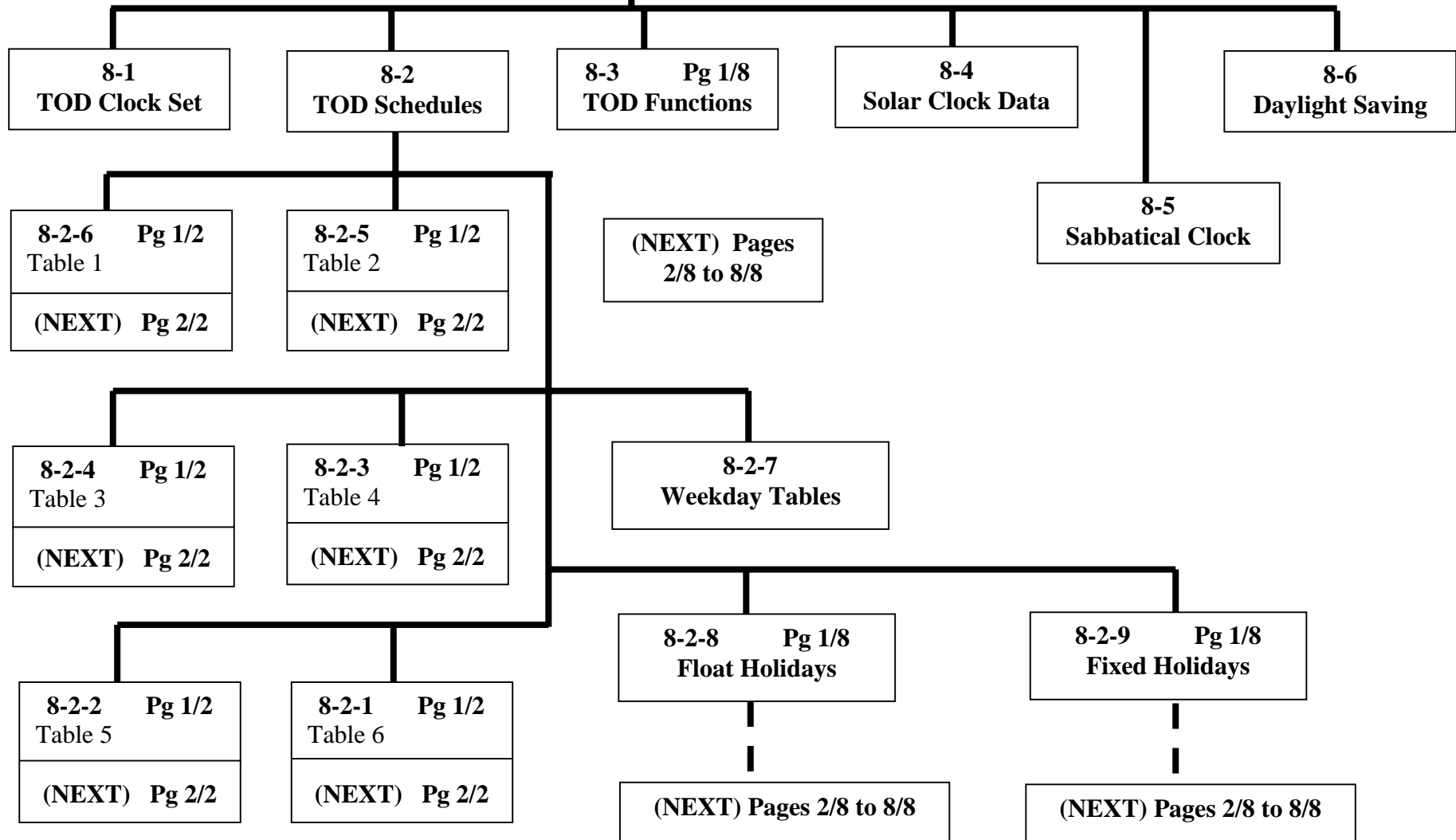


Time Of Day Menu

TSCP MAIN MENU

Figure 9: Time Of Day Menu

8-TIME-OF-DAY Schedule Menu



The TOD Schedule Menu; is selected by depressing “EIGHT” from the Main Menu. Enter the screen address from the Main Menu to reach the screens shown; use the escape key to return to previous pages.

10. 2070 Controller Signal Timing Chart:

The 2070 TSCP timing chart contains a title page (Page 1) and four additional pages (Pages 2-5), which are divided into various sections. The TSCP chart includes a Ram **Checksum** for each of the four additional pages(Pages 2-5). This is found in the intersection number box at the lower right corner of the title page

The **Checksum** is a hexadecimal number generated by summing the value assigned to position on the timing chart with the data in that position. The sum for each page is printed at the lower right of the title page and again at the top of pages 2-5. The **Checksum** will agree with the printed value on the title page only when the timing and configuration data entered matches the timing chart. This fact permits the timing to be verified by comparing the printed and displayed **Checksum** values. The displayed **Checksum** value can be found on TSCP at address 1-8.

Intersection timing and configuration data is divided into related sections and printed on the Timing Chart. These sections are further subdivided into boxes. At the upper left of every timing or configuration box is its name and address. Entering the full address from the Main Menu will bring up the associated TSCP screen. Timing Chart addresses can be two to four keystrokes long.

Section eight of the User's Manual states that it is important to enter addresses at the correct point and to verify the display. To keep things clear, note the Local Plan addresses under COORDINATION section. The nine Local Plan addresses 7-1 to 7-9 are represented by the shown addresses (7-1...9). All the plan addresses are only two keystrokes long. Entering three keystrokes here will cause the program to accept the last keystroke data. The Detector Reset address (4-3) on page two under MANUAL COMMANDS is a function and does not need to be entered.

Refer to the Traffic Signal Control Program for details on data entry methods. At the completion of programming, the controller shall be returned to the **Front Panel Manager** (home position). The preferred method of returning to the **Front Panel Manager** is by pressing STAR (*) from the Main Menu.

APPENDIX A

A-1 Numerical Menu Listing:

The following lists the menus, submenus, program pages, and screens. The menu heading is shown at the upper left; to the right is the main function of that heading. Under the menu heading are the page addresses, title pages, and a brief description of their function. Refer to the Traffic Signal Control Program (TSCP) user manual for the function and method of entering timing and configuration data.

MAIN MENU		BRANCHES TO ALL MENUS
1	Displays	Observe Data/Timing only
2	Controller	Enter Time Sheet Data, Parameters
3	Preemption	Enter RR and EV Data/Enable
4	Commands	Manual Select/Enable/Override
5	Detectors	Select Detector Attributes, Configuration /Timing
6	Comm/Logic	Select Comm, Parameters, Logic, Callback Numbers,
7	Coordination	Coordination Timing Data Entry
8	TOD Schedule	Enter Time Related Data/Functions
9	Utilities	Diagnostic Tests and Re-Initialization

Table 3: Main Menu

1 DISPLAY MENU		OBSERVE ONLY
1-1	Phase Timing	Displays Interval Timing in Real-Time
1-2	Overlap Data	Displays Overlap timing in Real Time
1-3	Coordination	Displays Coordination Timing in Real Time
1-4	TOD Clock	Displays Current Time and Date
1-5	Comm Data	Communications Display. (Submenu)
1-6	Detectors	Displays Detector Information
1-7	Preempts	Preempt Display (Submenu)
1-8	Checksum	Displays Checksums

Table 4: Display Menu

2-CONTROLLER MENU		ENTER DATA
2-1	Configuration	Controller Configuration (Submenu)
2-2	Phase Timing	Phase Timing , (12-Pages)
2-3	Overlap Timing	Overlap Timing, (6-Overlaps)
2-4	Recalls	Flag Recall Vehicle/Pedestrian, (2-Pages)
2-5	Locks	Flag Lock Phases
2-6	Features	Flag Special Phase Features, (2-Pages)
2-7	Call Phase	Flag Call to Phase on Green
2-8	Omit Phase	Flag Omit Phases on Green
2-9	Red Revert	Set Time to Display Red

Table 5 Controller Menu

3-PREEMPTION MENU		ENTER DATA
3-1	Railroad Preempt1	RR Preempt 1 (Submenus)
3-2	Railroad Preempt 2	RR Preempt 2 (Submenus)
3-A-D	Emergency Vehicle Preempt A,B,C,D	EV Timing Data (2-Pages)
3-E	Transit Priority Preempt	Transit Priority (Submenu)

Table 6 Preemption Menu

4-COMMANDS MENU		ENTER DATA
4-1	Manual Plan	Manual Coordination Plan Select
4-2	Special Function	Special Override Select
4-3	Detector Reset	Manual Detector Reset
4-4	Local Manual Flag	Local-Manual Enable
4-5	Priority Request	Manual Priority Request

Table 7 Commands Menu

5-DETECTOR MENU		ENTER DATA
5-1	Attributes	Detector Attributes/Flags (16 Pages)
5-2	Configuration	Detector Configuration /Timing (16 Pages)
5-3	Detector Fail Timers	Detector Failure Max/Min Times
5-4	Failure Override	Flag Override Phases
5-5	System Detectors	System Detector Port Assignment (2 Pages)
5-6	CIC Parameters	CIC Parameters (Submenu)

Table 8 Detector Menu

6-COMMUNICATIONS MENU		ENTER DATA
6-1	Comm Parameters	Serial Port Parameters: Address, Protocol
6-2	Soft Logic Eqns.	16 Equations (Eight Pages)
6-3	Callback Numbers	Callback Number (3Pages)

Table 9 Communications Menu

7-COORDINATION MENU		ENTER DATA
7-1 to 7-9	Local Manual Plans	Coordination Timing Plans 1-9
7-A to 7-D	ATSAC Plans A-D	ATSAC Flags Plans A-D
7-E	Free Plan	Free Plan Timing (2-Pages)
7-F	ATSAC Flags	ATSAC Flags Veh/Ped/Functions

Table 10 Coordination Menu

8-TIME OF DAY SCHEDULE MENU		ENTER DATA
8-1	TOD Clock Set	Set Time and Date
8-2	TOD Schedules	TOD Tables (Submenu)
8-3	TOD Functions	TOD: Time, Phases, Functions (8 Pages)
8-4	Solar Clock	Geographical Data
8-5	Sabbatical Clock	Flags Ped. Recall for Sabbatical
8-6	Daylight Saving	Enable/Disable Daylight Saving

Table 11 Time of Day Menu

9-UTILITIES MENU		SELECT FUNCTION/TEST
9-1	Event Record	Lists 96 Events
9-2	Diagnostic Tests	Test Controller (Submenu)
9-3	RAM Initializations	Re-Initialize Controller (Submenu)
9-4	Copy Parameters	Copy Data (Submenu)
9-5	Direct Ram Access	Password Protected
9-6	Terminate Program	Authorization Code Needed

Table 12 Utilities Menu

A-2 Function Listing:

Menu Options From Main Menu Display

AB3418 Errors	Observe Errors	1-5-4-2
AB3418 Protocol	Protocol Status	1-5-4
AB3418 Status	Observe Status	1-5-4-1
Attributes (DET)	Enter Attribute Flags	5-1
Cabinet (Select)	Cabinet Type	2-1-1
Cabinet Status	Status Input Config	2-1-8-3
Call to Phase	Enter Phase Flags	2-7
Checksum Ram	Observe Checksum	1-8
CIC Parameters	Enter CIC Parameters	5-6
Clock Local Set	Enter Date and Time	8-1
Comm Data	Observe Only	1-5
Comm Parameters	Enter Serial Port Parameters	6-1
Comm/Logic/Callback	Submenus Enter Logic Parameters	6
Commands	Menu Enter Parameters	4
Configuration	Menu-Enter Data	2-1
Configuration (DET)	Enter Detector Configuration	5-2
Configuration RR 1	Enter Configuration Data	3-1-6
Configuration RR 2	Enter Configuration Data	3-2-6
Configuration EV A-D	Enter Configuration Data	3-A to 3-D
Controller	Menu Enter Data	2
Controller Copy	Copy Data between Controllers	9-4-5
Controller Initialization	Select Cabinet Type	9-3
Coordination	Observe Only	1-3
Coordination	Menu Enter Data	7
Copy Coordination Data	Copy Data Between Plans	9-4-2
Copy Phase Timing	Copy Data Between Phases	9-4-1
Copy Time-of Day Table	Copy Data Between TOD Tables	9-4-3
Copy Transit Priority	Copy Transit Priority Data	9-4-4
Cyclic Detector Data	Observe Only	1-6-5-2
Date-Current	Enter Time and Date	8-1
Daylight Savings	Enable Daylight Savings	8-6
Delay Timers	Observe Only	1-6-2
Detector Attributes	Enter Detector Attributes/Phase	5-1
Detector Configuration	Configure Detectors/Phases	5-2
Det Fail Timers	Enter Time Data	5-3
Detector Reset	Press Star for Function	4-3
Det-Phase-Assignment	Enter Phase Assignment	5-6-3

Table 13-1 Function Listing

Detectors	Menu Enter Data	5
Detectors	Submenu-Observe	1-6
Diagnostic Tests	Submenu Diagnostic Tests	9-2
Direct Ram Access	Enter Password	9-5
Display Test	Display Segment Test	9-2-4
Displays	Menu Observe Only	1
Emergency Veh Preempt	Observe Only	1-7-2
Emergency Veh. A-D	Submenu EV A-D	3-A to 3-D
Event Log	Observe Only Error Log	9-1
Exit Parameters RR 1 & RR2	Enter Flags	3-1-5 to 3-2-5
Extended Timers Vehicle	Observe Only	1-6-3
Failed Detectors	Observe Only	1-6-4
Failure Override DET	Enter Phases for Detector #	5-4
Features	Enter Data Phase Flags	2-6
Flashing Colors	Enter Data Phase Flags	2-1-5
Floating Holiday Table	Enter DOW/Table	8-2-8
Fixed Holiday Table	Enter DOW/Table	8-2-9
Free Operation	Enter Plan # 255 Free	4-1
Free Plan	Enter Phase Flags	7-E
Front Panel Test	Keyboard Echo Test	9-2-3
Hourly Detector Data	Observe Only	1-6-5-3
Input File Test	I and J Input File Test	9-2-1
Inputs (Controller)	Submenu Enter Data	2-1-8
Loadswitch Assignment	Enter L/S Assignments	2-1-9
Local Plans 1-9	Enter Coordination Timing	7-1 to 7-9
Local Manual Flag	Star Toggle	4-4
Locks	Enter Phase Flags	2-5
Main Menu	Branches to All Menus	
Manual Plan	Enter Plan Number 0,9,254,255	4-1
Manual Control	Enter Data Input Config	2-1-8-2
Omit on Green	Enter Phase Flags	2-8
Output File Test	Observe Output File Test	9-2-2
Outputs	Enter L/S Assignments	2-1-9
Overlap Data	Observe Only	1-2
Overlap Flags (RR 1)	Enter Phase Flags/Function	3-1-4
Overlap Flags (RR 2)	Enter Phase Flags/Function	3-2-4
Overlap Timing	Enter Timing Data	2-3
Overlaps	Enter Phase Flags	2-1-3
Parameter CIC Values	Enter CIC Values/Parameters	5-6-2

Table 13-2 Function Listing

Ped Flags (RR 1)	Enter Phase Flags/Function	3-1-3
Ped Flags (RR 2)	Enter Phase Flags/Function	3-2-3
Pedestrians	Enter Phase Flags	2-1-4
Phase Call	Enter Phase Flags	2-7
Phase Features	Enter Phase Flags	2-6
Phase Flags (RR 1)	Enter Phase Flags/Function	3-1-2
Phase Flags (RR 2)	Enter Phase Flags/Function	3-2-2
Phase Locks	Enter Phase	2-5
Phase Omit	Enter Phase Flags	2-8
Phases Permitted, Restricted	Enter Phase Flags	2-1-2
Phase Recalls	Enter Phase Recall Flags	2-4
Phase Timing	Observe Only	1-1
Phase Timing	Enter Phase Timing	2-2
Phases	Enter Phase Flags	2-1-2
Port #1	Enter Port Parameters	6-1-1
Port # 2	Enter Port Parameters	6-1-2
Port #3	Enter Port Parameters	6-1-3
Preemption	Menu Submenu Enter Data	3
Preempts	Observe Only	1-7
Program Termination	Enter Code to Terminate Program	9-6
Railroad Preempt	Observe Only	1-7-1
Rail Preempt 1	Enter Config Data	3-1
Railroad Preempt 2	Enter Config Data	3-2
Ram Initialization	Select Cabinet Type	9-3
Ram Checksum	Observe Only Match Chart	1-8
Raw Detector Data	Observe Only	1-6-5-1
Recalls Vehicle/Peds	Enter Phase Flags	2-4
Red Revert	Enter Time	2-9
Sabbatical Clock	Enter Pedestrian Flags	8-5
Seven Wire I/C	Enter Enable Port Assignment	2-1-8-1
Soft Logic Equations	Enter Data/OP	6-2
Software Flash	Enter Plan #254	4-1
Solar Clock Data	Enter Geographical Data	8-4
Special Features	Enter Phase Flags	2-1-6
Special Function	Enter Enable Port Assignment	2-1-8-4
Special Function	Enter Enable/Function	4-2
Startup	Enter Parameters	2-1-7
System Detectors	Enter Detector Port Assignments	5-5
System Detector Data	Observe Only	1-6-5

Table 13-3 Function Listing

Test	Diagnostic Tests	9-2
Preempts EV A-D Timing	Enter Timing and Phases	3-A to 3-D
Timing Values (RR 1)	Enter Timing Values/Function	3-1-1
Timing Values (RR 2)	Enter Timing Values/Function	3-2-1
TOD Clock Set	Enter Time/Date	8-1
TOD Clock	Observe Only	1-4
TOD Functions	Enter Data/Phase Flags	8-3
TOD Schedule	Menu Enter Data TOD/Function	8
TOD Schedule	Enter Time/Plan Data	8-2
Transit Priority	Enter Bus Lane Timing	3-E
Universal 332	Initialize for 332 Cabinet	9-3-3
Universal 337	Initialize for 337 Cabinet	9-3-4
Utilities	Menu Test, Initialize	9
Vehicle Counts	Observe Only	1-6-1
Weekday Table Plan	Enter Weekday Number	8-2-7

Table 13-4 Function Listing

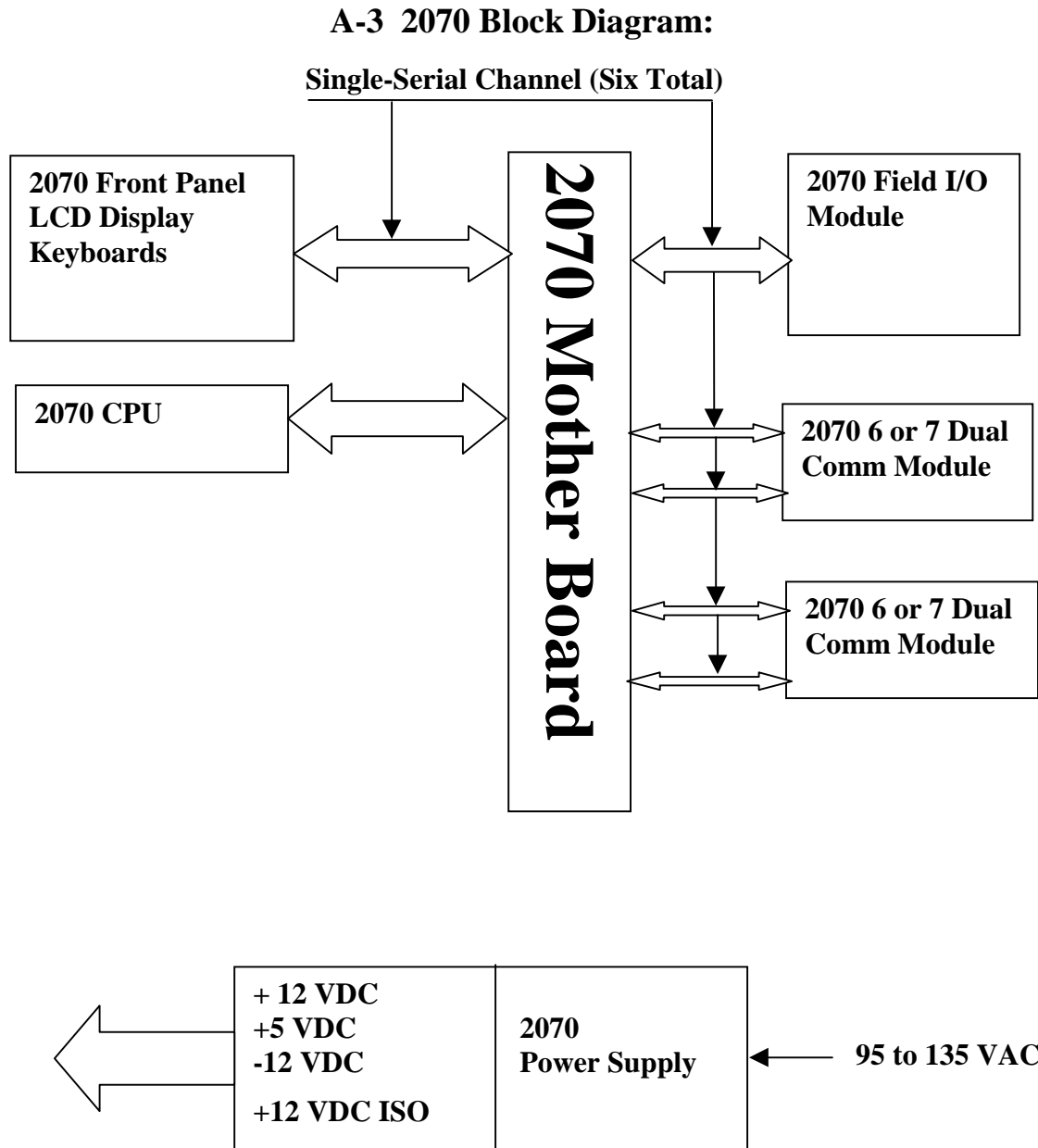


Figure 10: 2070 Block Diagram

The CPU communicates to the other 2070 modules by the use of the six serial channels connected to the motherboard, which supplies one channel each to the Field I/O module, the Front Panel Display., and two serial channels per communication slots. The Power Supply powers the entire 2070 unit.

APPENDIX B

B-1 Basic OS 9 Commands:

Basic OS9 Command	Description
Chd "dirname"	Changes the working directory into <i>dir_name</i>
Del "filename"	Deletes <i>file_name</i>
Procs	Displays current processes
Copy "filename" Destination "filename"	Copies the <i>filename</i> into another directory
ex: copy tscp /f0/TSCP/tscp	This is an example in implementing the copy command
Break	Reset the controller
Kermit ri	Controller receives file in binary format
Kermit ra	Controller receives file in ascii (text) format
Kermit si	PC receives file in binary format
Kermit sa	PC receives file in ascii (text) format
Pd	Displays the working directory path
Dir	Displays the files in working directory
Attr -pepre "filename"	Changes attributes to pepre
Current 2070 Directories:	
/f0	Root Read or Write
/f0wp	Root Read Only or Write Protected
/r2	Ram directory
/r0	Static memory
Memory Type	
	Flash
	Flash
	Volatile Ram
	Non-Volatile Ram

Table 14 Basic OS 9 Commands

B-2 Pin Configuration for C50S


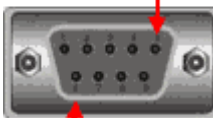
2070	PC	Male	Female
1 & 5	5		
3	2		
2	3		

Table 15 Basic OS 9 Commands

NOTE: Pins 5 and 1 should be jump together in the male end. Pins not shown are **NOT** used.

References

1. LADOT., Training Module DTTM 0016 Model 2070 Controller., Los Angeles: August 2002
2. Caltrans., TEES., Department of Transportation, California August 2002
3. LADOT., Traffic Signal Control Program, TSCP Ver 2.54., Los Angeles: June 2002