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SAFETY SUMMARY

The following are general safety precautions that are not related to any specific procedure and therefore do not appear elsewhere in this publication. These are recommended precautions that personnel must understand and apply during many phases of operation and maintenance.

KEEP AWAY FROM LIVE CIRCUITS

Operating personnel must at all times observe all safety regulations. Do not replace components or make adjustments inside the equipment with the high voltage supply turned on. Under certain conditions, dangerous potentials may exist when the power control is in the off position, due to charges retained by capacitors. To avoid casualties, always remove power and discharge and ground a circuit before touching it.

DO NOT SERVICE OR ADJUST ALONE

Under no circumstances should any person reach into or enter the enclosure for the purpose of servicing or adjusting the equipment except in the presence of someone who is capable of rendering aid.

RESUSCITATION

Personnel working with or near high voltages should be familiar with modern methods of resuscitation.

WARNING

High voltages capable of causing death are used in this equipment. Use extreme caution when servicing either the power supplies or their load components.

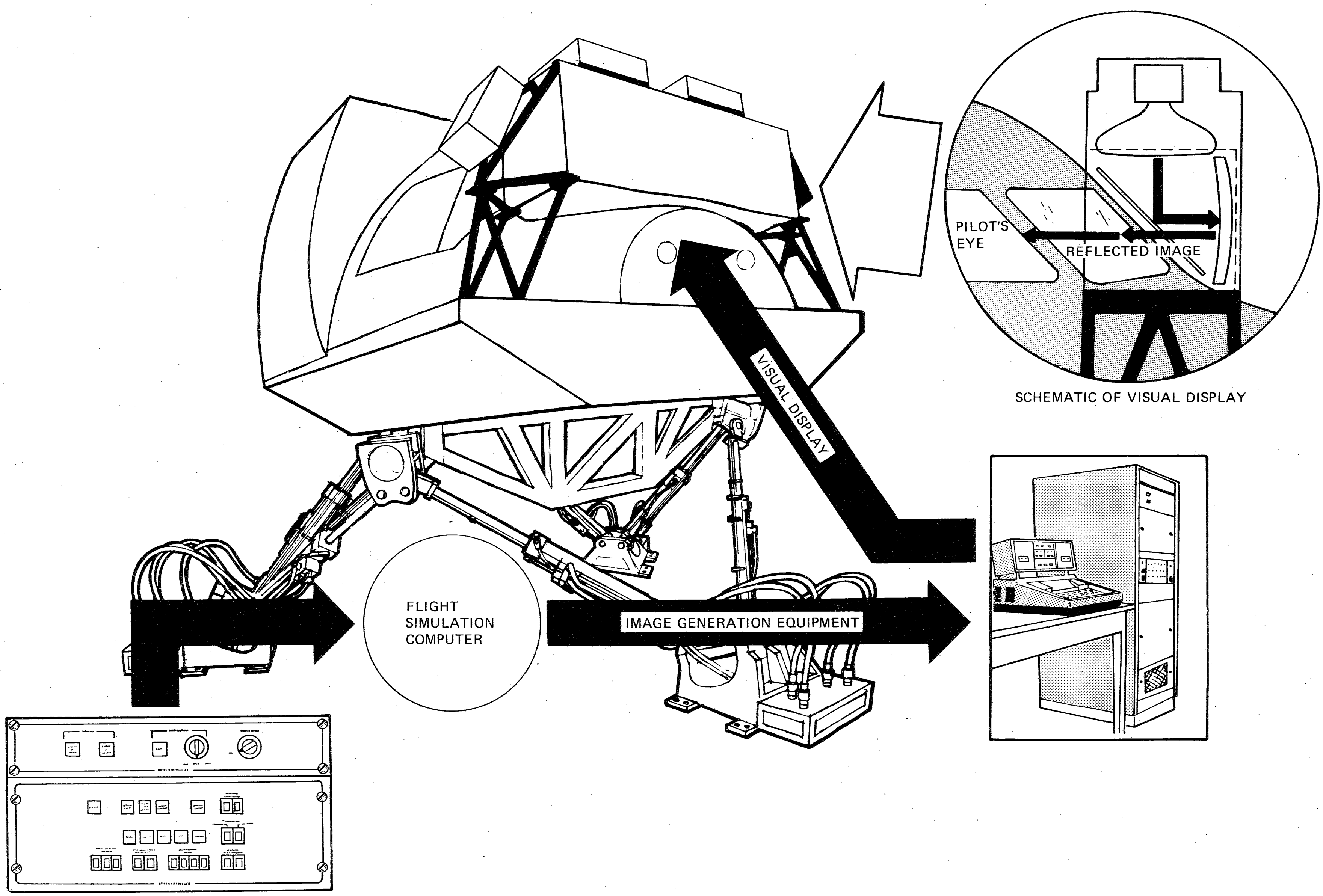


Figure 1-1. Novoview Visual System

SECTION I

GENERAL INFORMATION

1.1 INTRODUCTION

This manual includes information relevant to the installation, operation, theory of operation, and maintenance for the Redifon Electronics Novoview Visual System (Figure 1-1).

1.2 SCOPE

The contents of this manual include: an equipment description, references for installation, theory of operation, and maintenance instructions. As noted in the table of contents, a separate section of this manual is devoted to each of the above topics.

1.3 BASIC NOVOVIEW SYSTEM

The Novoview System is a night only visual attachment that generates a realistic true to scale representation of any airport and the immediate surroundings as it would appear to the pilot of an aircraft maneuvering about the airport area.

The Novoview System generates a realistic night scene from a mathematical model stored in a computer memory. In this model, there is information about the position of the lights, plus data defining their parameters i.e. color, direction, flashing, etc. — and details of the runway surface with markings.

Figure 1-2 is a simplified block diagram of the Novoview Visual System. The Novoview Computer is a general purpose mini-computer that is supplied with data from the Host (simulator) computer concerning aircraft position, attitude, and instructor control inputs from the Visual Control Panel through the Buffered Interface Unit (BIU). The Host computer transfers blocks of words to the BIU which then generates an interrupt to the Novoview Computer and the word block is transferred to the Novoview Computer under Novofly program control. The word block is used together with model data in the Novoview Computer to produce an output to the Display Processor. The Display Processor then uses the information to generate the analog signals to the Deflection Driver which produces the final display to the optical system.

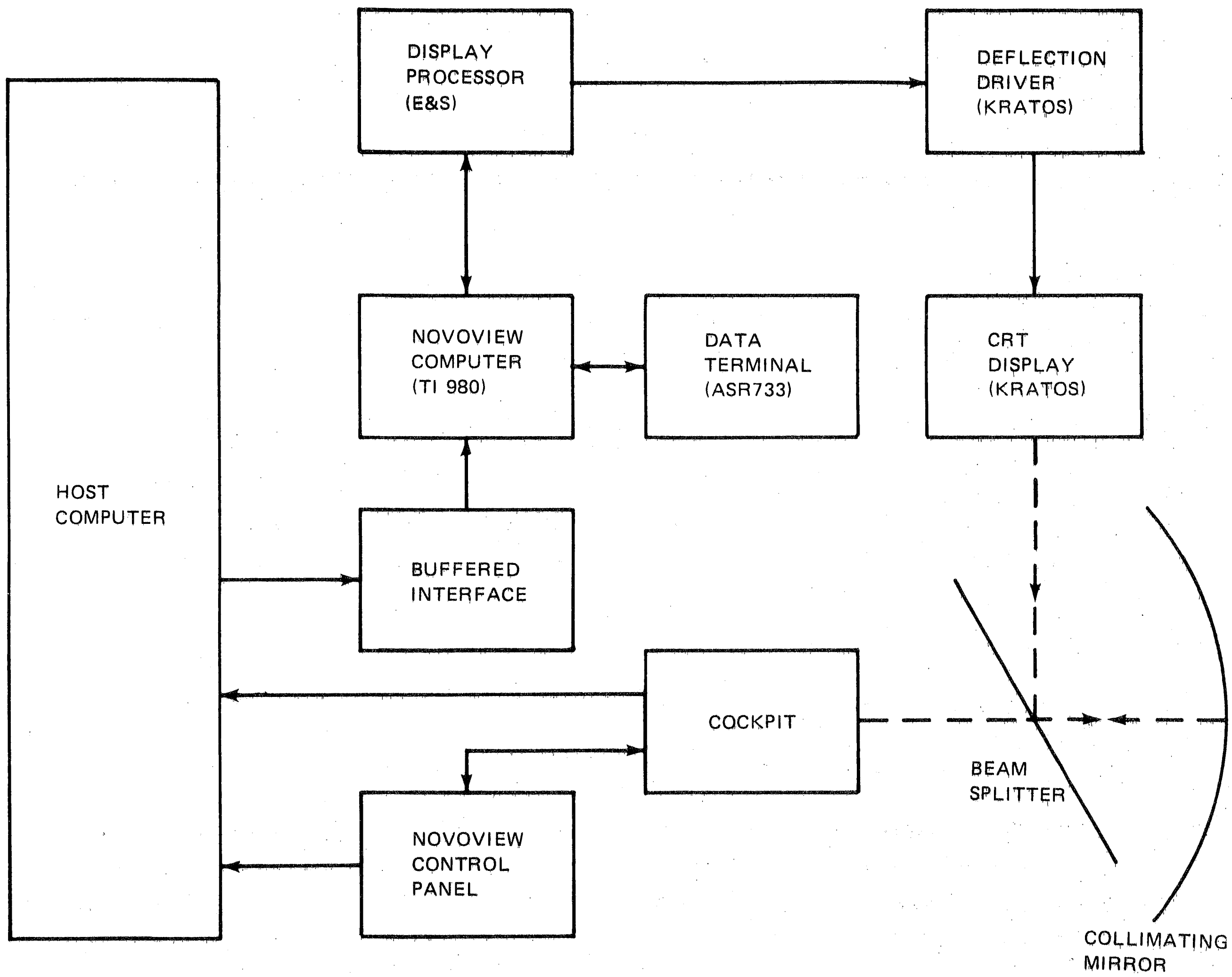


Figure 1-2. Novoview 6000 Visual System Simplified Block Diagram

1.4 SYSTEM COMPONENTS

The Novoview 6000 Visual System is comprised of nine major units.

a. Visual Control Panel
b. Buffered Interface Unit
c. Novoview Computer
d. Data Terminal
e. Display Processor
f. CRT Display
g. Optics
h. Mechanical Assembly
i. AC Power Control Panel

The Novoview Computer, Display Processor, and AC Power Control Panel are mounted in a standard 24 in. cabinet.

1.4.1 Visual Control Panel

The Visual Control Panel (Figure 1-3), located in the cockpit of the simulator, provides the instructor pilot control over the scene displayed. Volumes 2 and 6 contain detailed information on the Visual Control Panel. The actual switch configuration and dimensions are defined for individual systems according to customer requirements.

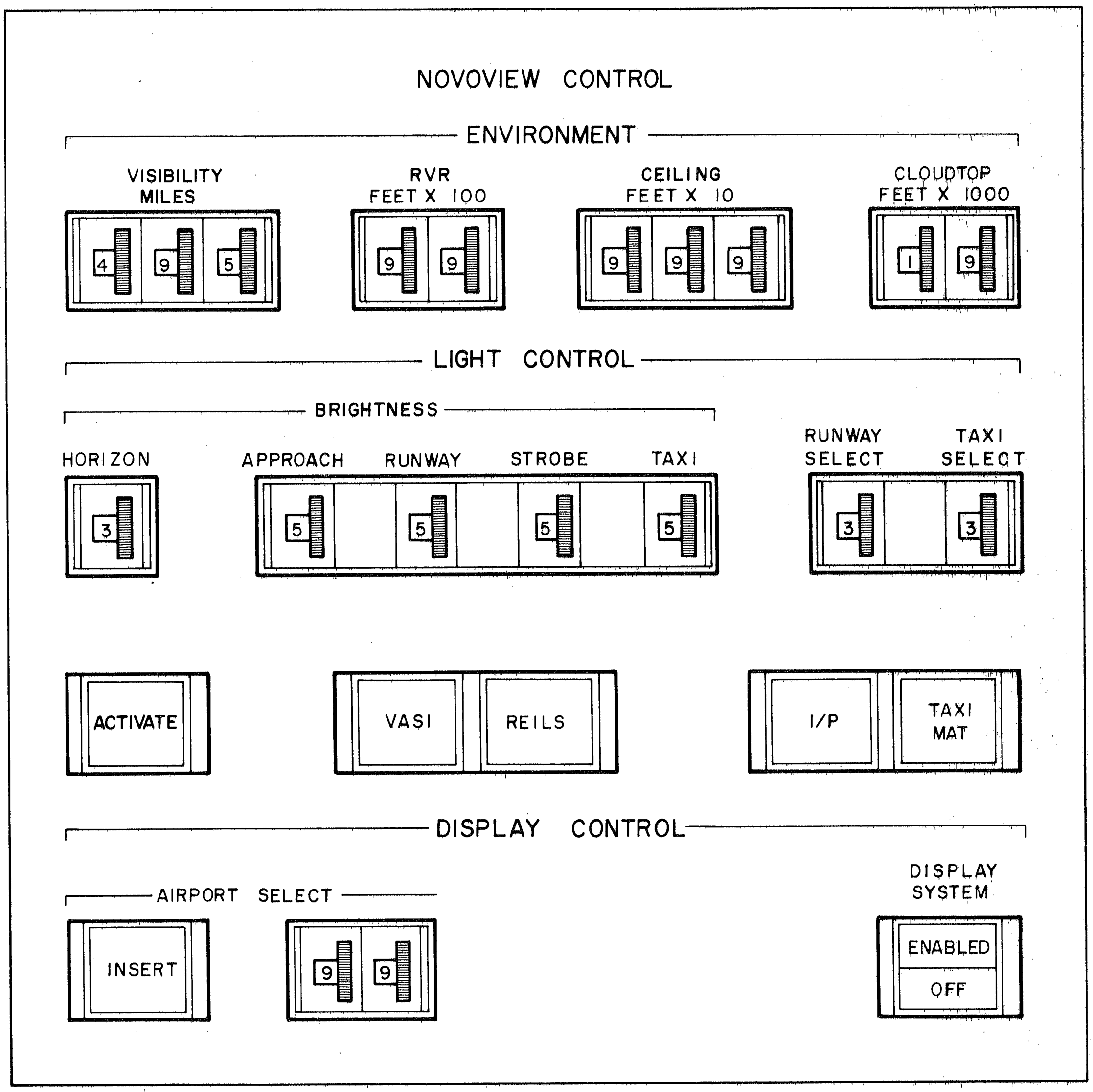


Figure 1-3. Visual Control Panel

1.4.2 Buffered Interface Unit

The Buffered Interface Unit comprises the electronics to implement the data transfer from the Host Computer to the Novoview Computer. The number of printed circuit boards and their configuration vary according to the type of Host Computer.

1.4.3 Novoview Computer

The Novoview Computer is a TI 980 general purpose mini-computer (Figure 1-4). The computer control panel is physically contained on a plug-in printed circuit board with operator access to switches and controls through a front panel cutout. Switch functions are performed by two or three position toggle switches. The control panel indicators are light emitting diodes (LED). A key operated switch, located on the left of the control panel, disables certain console controls. An indicator lamp above the key switch indicates the application of primary ac power to the CPU. The power switch for the computer, fuses, and the battery in the computer, used to maintain memory during power off periods, and controlled by BATTERY ON/OFF switch are located at the rear of the chassis. The chassis is 24 in. long x 17 in. wide. The front panel is 12.25 in. high x 19 in. wide.

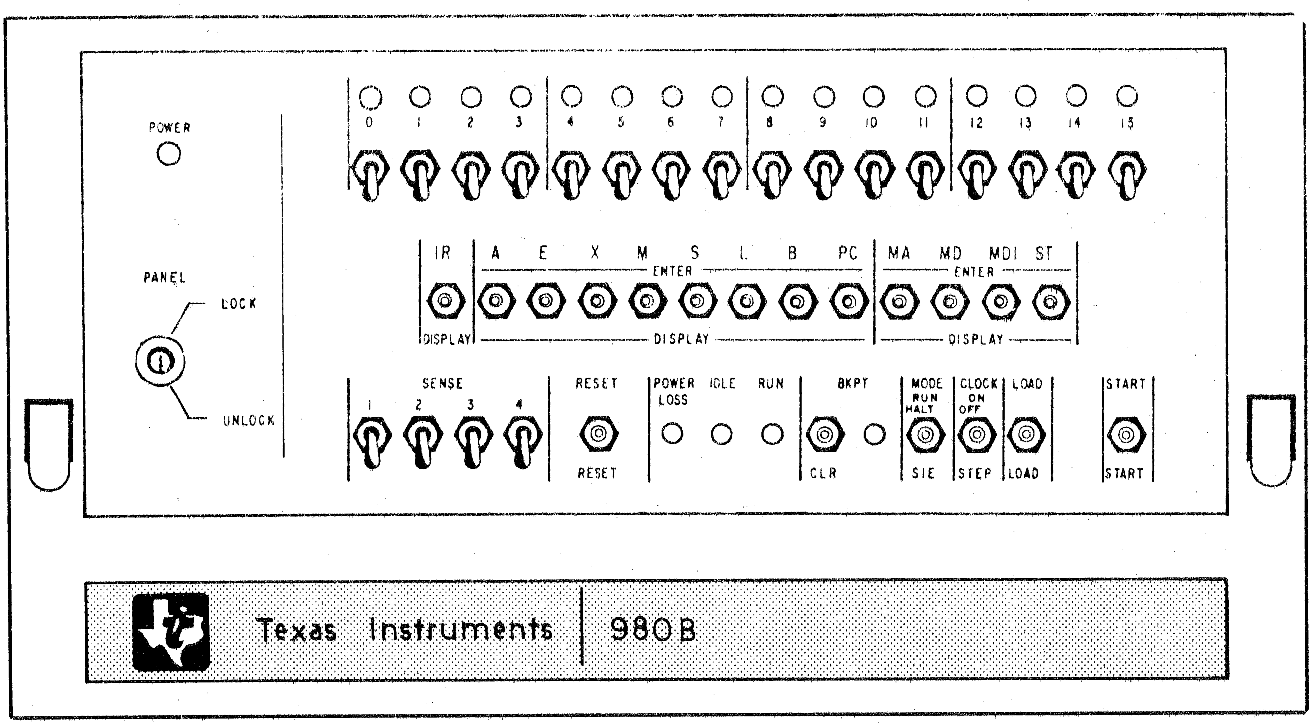


Figure 1-4. Novoview Computer

1.4.4 Data Terminal

The Data Terminal (Figure 1-5) is a TI ASR733 ASCII-coded automatic send/receive data terminal. The Data Terminal is capable of transmitting and receiving; printing, playing back (from tape) and recording on tape the ASCII code and character set at switch selectable speeds of 10, 15 or 30 characters per second (CPS) via a standard Electronic Industries Association (EIA) line interface.

The Data Terminal contains a keyboard printer and two cassette tape drives. Control function switches are located in three primary control areas:

a. Module assembly display and upper switch panel
b. The ON LINE / OFF and master power switches
c. Keyboard

The Data Terminal contains fuses for the power supplies and the ac line. The chassis of the Data Terminal is 19.50 in. long x 21.18 in. wide x 14.62 in. high.

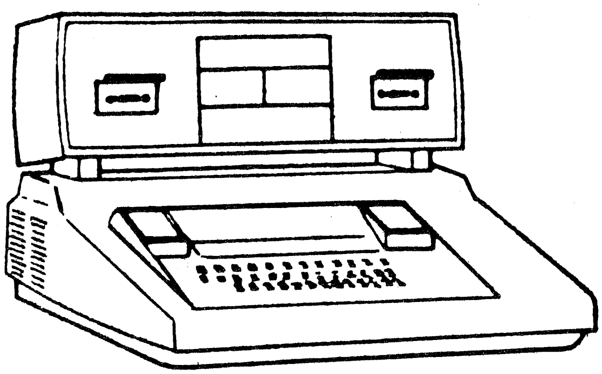


Figure 1-5. Data Terminal

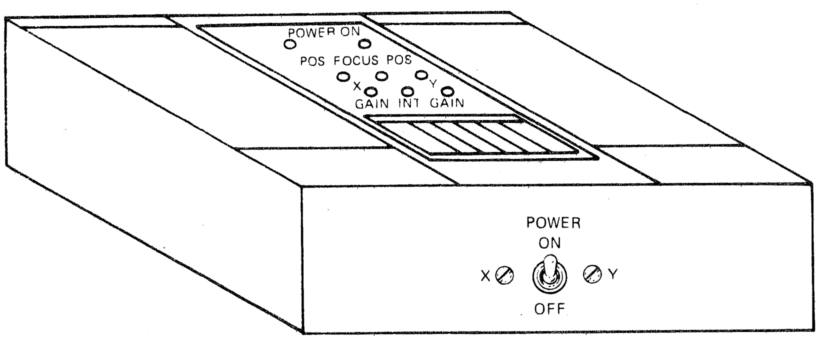
1.4.5 Display Processor

The Display Processor contains plug in printed circuit boards and is located at the top of the Novoview cabinet. The hardware associated with the Display Processor is used to perform several functions necessary to provide the output for the display. The chassis of the Display Processor is 15.75 in. high x 24 in. wide.

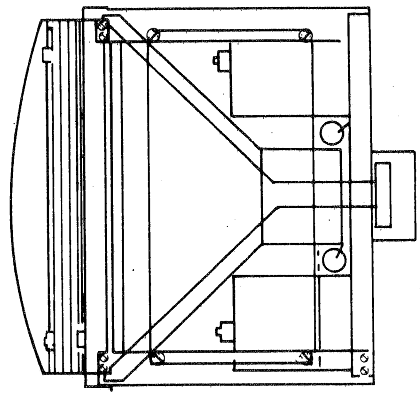
1.4.6 CRT Display

The CRT Display (Figure 1-6) is a two-chassis unit. The Deflection Driven circuitry is located in one chassis, and a 25-inch color cathode ray tube and high voltage circuitry in another. Interconnecting cables connect the CRT chassis to the Deflection Driver and the Deflection Driver to the Novoview cabinet.

The Deflection Driver contains a number of adjustments for the final scene observed by the pilot. The CRT Display and Deflection Driver provide the final deflection, color selection, and intensity. The power ON/OFF switch located on the Deflection Driver effects both the CRT Display and Deflection Driver. Two fuses are located in the primary wiring of the Deflection Driver. The chassis of the Deflection Driver is 19 in. wide x 10.5 in. high x 21 in. deep. The interconnecting cable connector is not included in the aforementioned depth measurement. The CRT chassis is 24 in. wide x 19 in. high x 24.35 in. deep.



DEFLECTION DRIVER



CRT

Figure 1-6. CRT Display

1.4.7 AC Power Control Panel

The ac power required to operate the Novoview System is supplied from the AC Power Control Panel (Figure 1-7). The Power Control Panel, located below the Novoview Computer, contains the circuit breakers, fuses, a power relay, an elapsed time meter, the master power switch, and the necessary circuitry to control the ac power to the Novoview System.

The chassis is 19 in. long x 5 in. wide x 12.22 in. high.

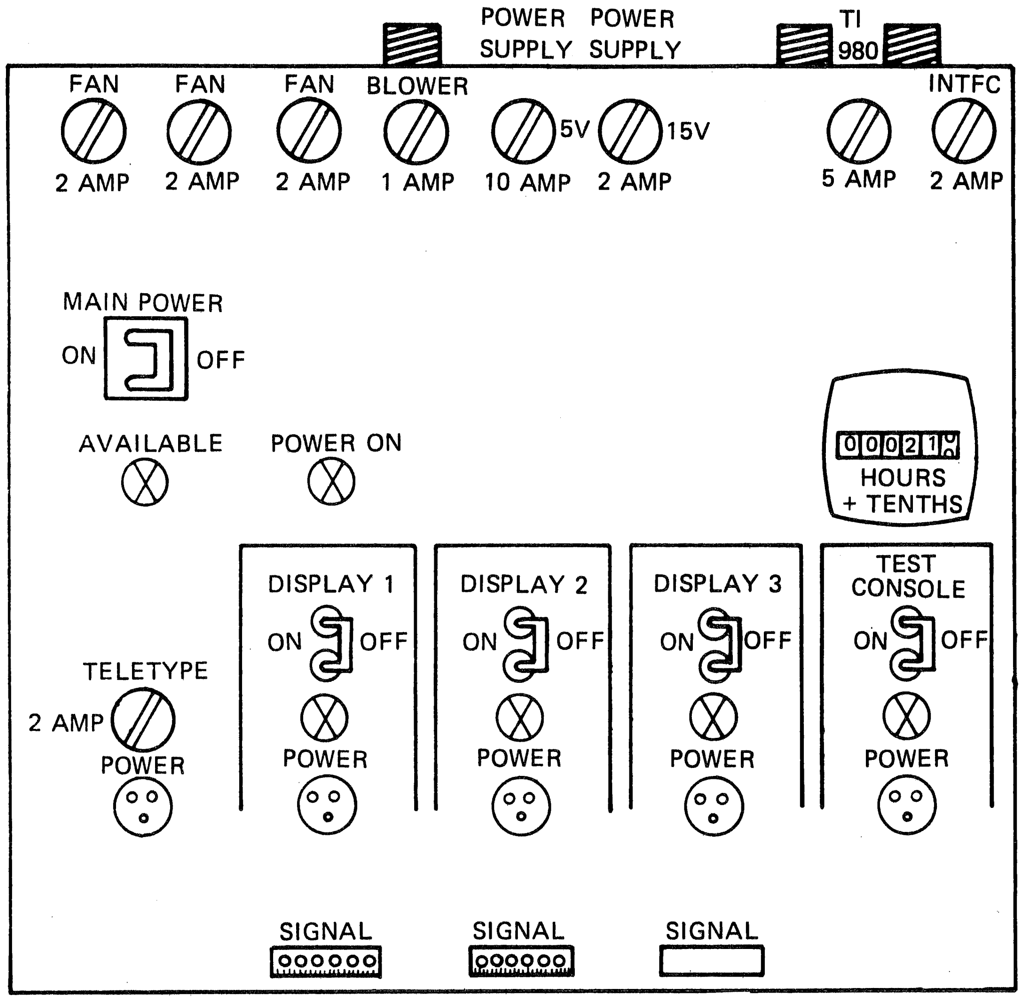


Figure 1-7. AC Power Control Panel

1.4.8 Mechanical Assembly

The mechanical assembly is a structure fitted to the simulator cockpit to provide a mounting for the display and driver chassis, the beam splitter and collimating mirror. It is manufactured so that when the display and optics are in place, the pilot sees the visual scene with images at infinity. The structure is enclosed in a light tight covering and is 96 in. long x 33 in. wide x 33 in. high.

1.4.9 Optics

The optics (Figure 1-8) for the Novoview Visual System consists of a collimating mirror and a beam splitter. The optics in the Novoview System are used to produce the final infinity display for the pilot. The main collimating mirror is 21.5 in. long x 41 in. wide. The side window collimating mirror is 22.5 in. long x 31.5 in. wide. The beam splitter is 36.5 in. long x 40.75 in. wide.

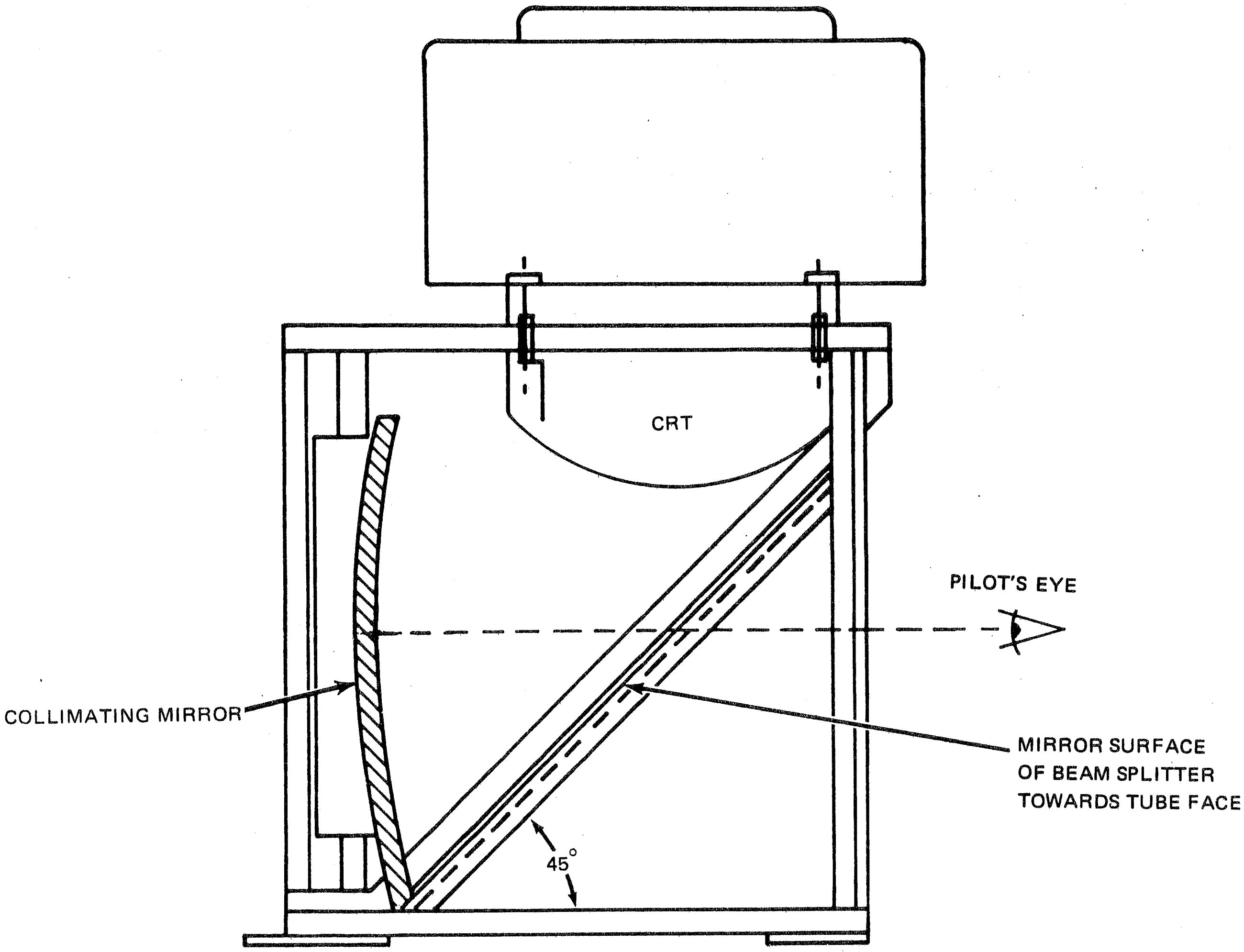


Figure 1-8. Optics

1.5 LEADING PARTICULARS

1.5.1 Power Requirements

Power requirements of the Novoview Visual System are listed in Table 1-1. The system is capable of operating with a supply of 230 vac ± 10% over a frequency range of 47 to 63 Hz.

Table 1-1. Power Requirements

EQUIPMENT	POWER REQUIREMENTS
Image Generator	1500 Watts
CRT Display	2400 Watts
Novoview Control	100 Watts

1.5.2 Physical Characteristics

1.5.2.1 Simulator Loading. The weights of the simulator mounted equipment are listed in table 1-2.

1.5.2.2 Vibration. The mechanical mounting of the optical components of the display is such that vibration and "G" forces, due to motion under all normal flight maneuvers, will not allow noticeable picture degradation to the observers in the cockpit.

Table 1-2. Equipment Weight

EQUIPMENT	WEIGHT
CRT Displays (2) & Driver Chassis (2)	300 lbs
Optics	200 lbs
Support Frame (See Note)	400 lbs (average)
Light Proofing	100 lbs

NOTE:
The support frame weight will vary with individual simulators.

1.5.3 Space Requirements

The space requirements for the system are listed in Table 1-3.

1.5.4 Environmental Requirements

The operating and non-operating environmental requirements are listed in Table 1-4.

Table 1-3. Space Requirements

UNIT	REQUIREMENT
Mechanical Assembly and Optics	Allow adequate clearance between simulators, mechanical assembly and the walls and ceiling where system is to be installed.
Novoview Cabinet	80 in. x 54 in. x 80 in. high including access space
Visual Control Panel	Dimensions vary according to mounting constraints

Table 1-4. Environmental Requirements

ENVIRONMENT	REQUIREMENT
Temperature	
Operating	$+59^\circ$F to $+86^\circ$F
Storage	-104°F to $+122^\circ$F
Humidity	
Operating	0% to 95% Relative Humidity
Non-Operating	0% to 95% (Non-Condensing)

1.6 VENDOR DOCUMENTATION

Table 1-5 contains the applicable documentation required to maintain the Novoview Visual System.

1.7 SOFTWARE PROGRAMS

The software programs are contained on cassette tapes and are listed in table 1-6.

1.8 EQUIPMENT SUPPLIED

Table 1-7 lists the equipment supplied.

Table 1-5 Vendor Maintenance Manuals Supplied

TITLE	PART NUMBER	MANUFACTURER
Novoview 6000 Image Generator & Display Manual	901023-002	Evans & Sutherland Computer Corp.
Novoview RSM Software	908000-001	Evans & Sutherland Computer Corp.
Novoview 6000/RSM System Drawings	901023-001	Evans & Sutherland Computer Corp.
Manual, CM325, Color Graphics CRT Monitor	901019-100	Kratos Display Division
Maintenance Manual System Description	TI 943012-9701	Texas Instruments Incorporated
Maintenance Manual Arithmetic Unit & Control Console	TI 960699-9702	Texas Instruments Incorporated
Maintenance Manual Memory, Memory Controller & Direct Memory Access Channel (DMAC)	TI 943012-9702	Texas Instruments Incorporated
Maintenance Manual Power Supply	TI 942773-9703	Texas Instruments Incorporated
Maintenance Manual Parts List & Assy. Dwg.	TI 943012-9703	Texas Instruments Incorporated
Maintenance Manual Electrical Drawings	TI 943012-9704	Texas Instruments Incorporated
Maintenance Manual Load, Pin & Wire List	TI 943012-9705	Texas Instruments Incorporated
Maintenance Manual Logic Documentation List	TI 943012-9706	Texas Instruments Incorporated
Assembly Language Programmer's Ref. Manual	TI 943013-9701	Texas Instruments Incorporated
CPU Performance Assurance Test	TI 961961-9770	Texas Instruments Incorporated
Assembly Language Input/Output	TI 961961-9734	Texas Instruments Incorporated
Communications Module User's Manual	TI 966643-9701	Texas Instruments Incorporated
Terminal User's Guide Engineering Data	TI 943010-9701	Texas Instruments Incorporated
Input/Output Data Module User's Manual	TI 965956-9701	Texas Instruments Incorporated

Table 1-5. Vendor Maintenance Manuals Supplied (continued)

TITLE	PART NUMBER	MANUFACTURER
Direct Memory Access Channel Manual	TI 966312-9701	Texas Instruments Incorporated
733 ASR/KSR Operating Instructions	TI 959227-9701	Texas Instruments Incorporated
733 ASR/KSR Maintenance Manual	TI 960129-9701	Texas Instruments Incorporated

Table 1-6. Software Programs Supplied

PROGRAM	PART NUMBER	MANUFACTURER
NOVOFLY	901021-001	Evans & Sutherland Computer Corp.
STREDT	901021-002	Evans & Sutherland Computer Corp.
NOVOTEST	901021-003	Evans & Sutherland Computer Corp.
TESTPAT	901021-004	Evans & Sutherland Computer Corp.
CPU PAT	901021-005	Evans & Sutherland Computer Corp.
733 PDT	901021-006	Evans & Sutherland Computer Corp.

Table 1-7. Equipment Supplied

EQUIPMENT	PART NUMBER	MANUFACTURER
Novoview Cabinet	101000-045	Evans & Sutherland Computer Corp.
Back Panel	153101-100	Evans & Sutherland Computer Corp.
Novoview Computer	943852-0003	Texas Instruments Incorporated
Power Supply	153131-100	Evans & Sutherland Computer Corp.
Power Control	153132-100	Evans & Sutherland Computer Corp.
Data Terminal ASR 733	973955-001	Texas Instruments Incorporated
Display Monitor	CM325	Kratos
Mechanical Assembly	1100-0014	Redifon Simulation Incorporated
Beam Splitters	800215	Redifon Simulation Incorporated
Collimating Mirror	800214	Redifon Simulation Incorporated

SECTION II

INSTALLATION

2.1 INTRODUCTION

The initial installation of the Novoview Visual System will be accomplished by an installation team from Redifon Electronics. This section of the manual contains installation procedures for components of the Novoview Visual System.

2.2 PACKAGING

The Novoview System is shipped in several containers as follows:

1 Box for each Display CRT Unit
1 Box for each Display Drive Unit
1 Box TI 980A Computer
1 Box 733 ASR Terminal
1 Box Novoview Cabinet
1 Box Cables and miscellaneous hardware
1 Box for each Collimating Mirror
1 Box for each Beam Splitter

CAUTION

Handle each unit carefully when removing it from the shipping containers. Use special caution not to damage the neck or face of the CRT's and the surfaces of the collimating mirrors and beam splitters.

2.3 VISUAL INSPECTION

Inspect equipment after unpacking for damage that may have occured during transit. Check that there are no loose or broken knobs, bent or broken panel connectors, and no dents or scratches on the panel surfaces. Specifically, the equipment should be visually inspected for the following items before placing it in operation:

a. Inspect the cathode ray tube for any evidence of damage and that it is firmly mounted.
b. Check to see that all tubes and interconnecting cables in the displays are firmly seated.
c. Check for loose or damaged components.
d. Check all printed circuit boards for proper seating in connectors.
e. Inspect mirrors and beam splitters for defects.

2.4 INSTALLATION

For installation of Display Processor, Data Terminal, and Novoview Computer refer to Novoview 6000/RSM Image Generator & Display Manual No. 901023-002, Appendix A.

2.4.1 Required Tools and Test Equipment

Table 2-1 contains a list of tools and test equipment necessary for installing the Novoview Visual System.

2.4.2 Novoview Computer Installation

Follow installation instructions in T.I. Manual 961961-9770.

2.4.3 CRT Installation

Observe the following instructions when removing and installing the CRT.

WARNING

> Extreme care must be taken when removing and replacing CRT. Glass envelope under pressure and personal injury may result if dropped. When installing CRT, ensure scope mounting bracket adjustable nuts on simulator fuselage are extended preventing the face of the CRT damaging the beam splitter.

a. Disconnect cooling fan cable.
b. Unscrew bolts and remove aluminum CRT cover.
c. Remove four nuts holding CRT support bracket.
d. Remove steel flat washer and insulating nylon washer off four bolts.
e. Disconnect cables to CRT.
f. Lift CRT straight up and place on work bench.
g. Remove six socket head cap screws from each CRT support bracket making note of which hole pattern has been used.

Install new CRT as follows:
a. Place CRT brackets on new CRT using same hole pattern.
b. Extend bolts fully on frame where CRT support bracket is mounted. This ensures enough clearance between the new CRT and the beam splitter.
c. Lower CRT on four bolts and reset bolts to where there is a 1/8 inch clearance between CRT and beam splitter.
d. Replace insulating nylon washer and steel flat washer.
e. Replace four nuts holding CRT support bracket.
f. Replace aluminum cover over CRT and replace bolts.
g. Connect cooling fan cable.

CAUTION

> Check fan operation. Operation of CRT without fan may overheat CRT and damage to equipment may occur.

Table 2-1. Special Tools and Test Equipment

TEST EQUIPMENT	PART NUMBER	MANUFACTURER
Extender Board (Memory)	226759-1 (Rev. B)	Texas Instruments Incorporated
Extender Board (I/O, DMA)	226851-001	Texas Instruments Incorporated
Extender Board (Power Supply)	226853-001	Texas Instruments Incorporated
Extender Cable (AU_1, AU_2)	966381-1	Texas Instruments Incorporated
Oscilloscope	475 or equivalent	Tektronix
Probe		Tektronix
H. V. Probe for Oscilloscope		
Multimeter	Mdl. 245 or equiv.	Data Precision
Voltage Multiplier to 30 KV	V-30 or equiv.	Data Precision
Wire Wrap Gun	14R-2F or equiv.	Gardner & Denver
Bit for Wire Wrap Gun	26263	Gardner & Denver
Bit for Wire Wrap Gun	519936	Gardner & Denver
Sleeve for Wire Wrap Gun	18840	Gardner & Denver
Sleeve for Wire Wrap Gun	507100	Gardner & Denver
Hand Unwrap Tool	A31478	Gardner & Denver
Hand Unwrap Tool (Mini)	505084	Gardner & Denver
Photometer	51 or equiv.	Hagner

2.4.4 Optics Installation

Observe the following procedures when removing and installing the collimating mirror and beam splitters. Soft cotton type gloves must be worn while handling any part of the optics. This task requires the use of three men.

a. Remove front face of light tight hood.
b. Remove retaining latches of collimating mirror and swing mirror open on hinges.

CAUTION

> Extreme care must be taken in handling mirror and beam splitter to avoid bringing anything in contact with the surfaces, i.e. fingers touching the surface or sharp objects falling from pockets. This will damage the mirror and beam splitters.

c. While two men firmly support collimating mirror, the third man removes hinge pins.
d. Handling from the back side only, lower collimating mirror. Store face up in safe area. Cover mirror with tissue paper or equivalent.

The beam splitter is now accessible and is removed as follows:

a. Remove outside beam splitter stops.
b. Remove outside.
c. Loosen nuts on center post of beam splitter retainer. This allows beam splitter to be slid outward.
d. Slightly lift outward side of beam splitter and with two men supporting beam splitter at inboard and outboard, move beam splitter outward enough to clear center post.
e. Move beam splitter carefully forward and downward avoiding contact with CRT. If necessary to avoid contact, loosen and move CRT forward to increase clearance between the beam splitter and the CRT. Scribe marks on box structure before moving CRT allowing CRT to be adjusted back to its original position.

Install beam splitter as follows:

a. Hold beam splitter with treated (reflective) surface facing up. Slide beam splitter on guide of structure.
b. Move beam splitter carefully upward avoiding contact with CRT.
c. Tighten the nuts on center post of beam splitter retainer.
d. Replace outside adjustable retaining bar.
e. Replace outside beam splitter stops.
f. Move CRT to its original position observing the scribed marks and tighten.

The beam splitter is now installed. Install collimating mirror as follows:

a. Remove cover from mirror and, handling from the back side only, place mirror on hinges and replace hinge pins.
b. Swing mirror to closed position and tighten retaining latches.
c. Replace front face of light tight hood.

SECTION III

OPERATION

3.1 INTRODUCTION

This section of the manual contains instructions necessary for the operation of the Novoview Visual System. Included in this section are turn-on procedures, instructions for the use of controls and indicators, preoperational checks, operational procedure, and turnoff procedures.

3.2 CONTROLS AND INDICATORS

3.2.1 Visual Control Panel

Table 3-1 contains the function of the controls and indicators for the Novoview Control Panel (Figure 3-1).

3.2.2 Novoview Computer

Refer to Model 980 Computer Maintenance Manual number 960699-9702, paragraph 2-3 for the function of the controls and indicators for the Novoview Computer.

3.2.3 Data Terminal

Refer to Model 980 Computer Terminal User's Guide Model 733 ASR/KSR Data Terminal, Section III for the function of the controls and indicators for the Data Terminal.

3.2.4 Novoview Image Generator

Refer to Novoview Image Generator & Display Manual 901023-002 for the function of the controls and indicators for the Novoview Image Generator.

Table 3-1. Visual Control Panel Controls and Indicators

REF DES	CONTROL OR INDICATOR	FUNCTION
1	ACTIVATE Switch/Indicator	Switch operation illuminates runway or taxi lights. Indicator is white when off and red when on.
2	BRIGHTNESS HORIZON Digit Switch	Controls brightness of horizon between low and full brilliance in three discrete steps, plus an off position. The intermediate brightness levels are adjusted between low and full brilliance range.
3	BRIGHTNESS APPROACH Digit Switch	Controls brightness of approach lights between low and full brilliance in five discrete steps, plus an off position. The intermediate brightness levels are adjusted between low and full brilliance range.
4	BRIGHTNESS RUNWAY Digit Switch	Controls brightness of runway lights between low and full brilliance in five discrete steps, plus an off position. The intermediate brightness levels are adjusted between low and full brilliance range.
5	BRIGHTNESS STROBE Digit Switch	Controls brightness of strobe lights between low and full brilliance in five discrete steps, plus an off position. The intermediate brightness levels are adjusted between low and full brilliance range.
6	BRIGHTNESS TAXI Digit Switch	Controls brightness of taxi lights between low and full brilliance in five discrete steps, plus an off position. The intermediate brightness levels are adjusted between low and full brilliance range.
7	TAXI SELECT Digit Switch	Selects taxi lights for the purpose of setting intensities as predetermined by the Host Computer. This is a special feature.
8	RUNWAY SELECT Digit Switch	Selects runway lights for the purpose of setting intensities.

Table 3-1. Visual Control Panel Controls and Indicators

REF DES	CONTROL OR INDICATOR	FUNCTION
9	TAXI MAT Switch/Indicator	Selects taxiway surface for the purpose of taxiing to predetermined areas as selected by the Host Computer. This is a special feature. Indicator white when off and amber when on.
10	I/P Switch/Indicator	I/P selects the initial position of aircraft predetermined by the Host Computer. Indicator white when off and amber when on.
11	LIGHT CONTROL REILS OFF Switch/Indicator	Switch operation illuminates Runway End Identification Lighting System (REILS) on display. Indicator white when off and amber when on.
12	LIGHT CONTROL VASI Switch/Indicator	Switch operation illuminates Visual Approach Slope Indicator (VASI) on display. Indicator white when off and amber when on.
13	ENVIRONMENT VISIBILITY MILES Digit Switch	Visibility in miles is set in increments of one mile to a maximum of 495 miles.
14	ENVIRONMENT RVR FEET X 100 Digit Siwtch	Runway Visibility Range (RVR) is set in increments of 100 feet to a maximum of 9,900 feet.
15	ENVIRONMENT CEILING FEET X 10 Digit Switch	This control sets the cloud base between ground level and 9,990 feet in increments of 10 feet.
16	ENVIRONMENT CLOUDTOP FEET X 1000 Digit Switch	This control sets the cloudtop between sea level and 19,000 feet in increments of 1,000 feet. Selection of cloudtop equal to or less than cloud base implements clear sky. A horizon glow is visible when aircraft breaks out of cloudtop.
17	DISPLAY SYSTEM ENABLED/OFF Switch/ Indicator	Switch controls display on/off status. Indicator white when off and green when on.

Table 3-1. Visual Control Panel Controls and Indicators

REF DES	CONTROL OR INDICATOR	FUNCTION
18	AIRPORT SELECT Digit Switch	Controls manual pre-select of an airport model to be made.
19	AIRPORT SELECT INSERT Switch/Indicator	Controls loading of preselected airport. Indicator green until depressed, then turns red and display goes blank for approx. 90 seconds. Then airport model is displayed and switch/indicator changes from green to red.

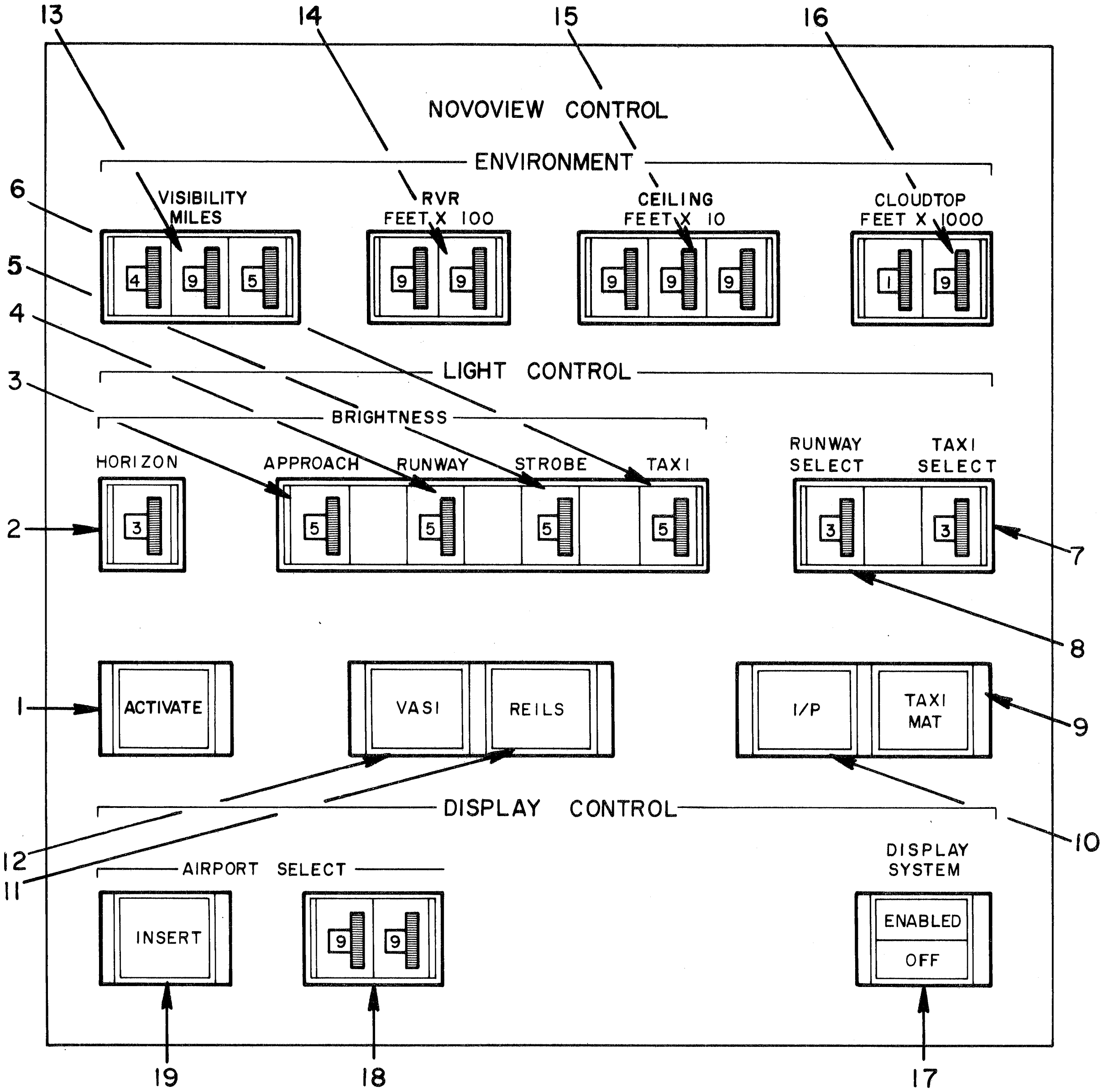


Figure 3-1. Visual Control Panel Controls and Indicators

3.3 SYSTEM POWER

The system power is controlled by two illuminated push-button switches on the top panel of the Novoview rack, designated ON and OFF. The OFF switch is illuminated if the system is connected to primary power and the main circuit breaker on the AC Power Control Panel in the rear of the Novoview rack is ON.

Note

> If the main power should be interrupted for any reason, the equipment will go to and remain in the OFF state.

The AC Power Control Panel has individual circuit breakers for each display and indicating fuses in the lines to other units. If power is to be removed from the equipment for servicing, the main power circuit breaker should be turned off.

CAUTION

Remove power to the Novoview Computer by setting S3 AC POWER 50/60Hz ON/OFF switch on the rear of the Novoview Computer Chassis to OFF. This removes power to the Novoview Computer only. The Data Terminal contains its own power switch. The BATTERY ON/OFF switch S1 enables power to the memory boards in the computer. Ensure BATTERY ON/OFF switch set to ON while in normal operation because if ac power is interrupted for any reason, battery power maintains the memory in the Novoview Computer. Set switch S1 to OFF if removing memory board. Failure to do this will damage circiut board.

3.4 PREPARATION FOR USE

The following procedures enable the system to be initialized and placed in a ready mode of operation.

3.4.1 Data Terminal Switches

Set switches on the Data Terminal as follows:

a. POWER - ON
b. ON LINE/OFF - ONLINE
c. TAPE FORMAT - CONT
d. KEYBOARD - LINE
e. PLAYBACK - LINE
f. RECORD - LINE

Note

Should Data Terminal not operate after setting switches in the above procedures, refer to operating procedures in the Novoview Image Generator & Display Manual 901023-002.

3.5 PROGRAM LOADING

All system programs are on cassette tapes which are loaded by means of the Data Terminal. Detailed descriptions of the operation of the Novoview computer panel and the Data Terminal are given in the TI Maintenance Manual (Volume 1) 943012-9701, and in the Data Terminal Manual 959227-9701. A brief operating procedure is given.

To place a cassette tape in a drive, open the door and insert the tape (label outward and tape uppermost) carefully, exerting a slight downward pressure against the springs. The door may be closed easily if the cassette is properly positioned.

a. Set cassette drive #1 (left hand cassette drive) to PLAYBACK (center rocker switch down). Observe PLAYBACK indicator illuminates.

b. Place cassette cartridge containing required program (e.g. NOVOFLY) in cassette drive #1.
c. Press REWIND. Wait for tape to stop (may already be rewound). END light illuminates.
d. Press LOAD switch. Wait for END light to extinguish and READY light to illuminate.

3.5.1 Novoview Computer Operation

Set the Novoview Computer as follows:

a. Set MODE RUN switch to HALT.
b. Press RESET.
c. Set register display entry switches to 0006.
d. Press PC switch to ENTER.
e. Set MODE switch to RUN.
f. Press LOAD switch. Wait for IDLE light to illuminate (about seven seconds). This enters the program loader from beginning of tape. The Novoview Computer will idle with Hex 8A in the display lights.
g. Press START switch. Wait for IDLE light to illuminate indicating that program has been loaded. The Novoview Computer will idle with Hex 8D in the display lights for a correct load.

The system is now ready to execute the program which has just been loaded. In order to execute press START.

CAUTION

Rewind tapes as soon as they are loaded. Never remove a tape which has not been rewound. Never turn off power to the Data Terminal unless any tapes that are in it are rewound. Contamination of the tape surface or power transients can destroy a tape. All system tapes are write-protected by having the red tab on the cartridge toward the middle of the cartridge. If the cassette drive is in the RECORD mode, it will be impossible to complete step d, paragraph 3.4.1.

SECTION IV

THEORY OF OPERATION

4.1 INTRODUCTION

This section of the manual provides theory of operation of the Novoview Visual System.

4.2 NOVOVIEW SYSTEM

The Novoview System provides the pilot with a realistic presentation of an airport and surrounding area lighting that responds to aircraft maneuvers in real time. This is accomplished using mathematical data stored on magnetic tape defining the locations of the lights that make up the airport model and mathematical data from the Host Computer that defines the aircraft attitude position with respect to the airport. The Novoview System is normally in an on-line, real-time mode by execution of the Novofly program. Its operation is controlled by operator intervention, by SENSE switch operation, Data Terminal inputs, or inputs from the Visual Control Panel. When the system is not being used for simulation, it can be used to run a number of stand-alone programs. In this mode, it is used to create new models, edit existing models, examine models for correctness, and to run various maintenance programs for verification system performance, display calibration, and performing detailed diagnostic procedures on the Image Generator.

4.3 NOVOVIEW SYSTEM COMPONENTS

The Novoview system is comprised of seven functional units. A discussion of these units are given in the subsequent paragraphs.

4.3.1 Visual Control Panel

The Visual Control Panel allows the instructor pilot to control the selection of a model, cloud and visibility parameter, brightness levels of certain lights, and on/off control of other lights by means of switch operation. The actual switch configuration is defined in Section III.

4.3.2 Buffered Interface Unit

The Buffered Interface Unit (BIU) interfaces the Host Computer and the Novoview Computer. The aircraft position and control information is transferred from the Host Computer to the BIU as a block of words and stored in the BIU memory. Data that is used to define aircraft position and attitude and instructor inputs from the Visual Control Panel is transferred from the Host Computer to the BIU in data blocks by the visual interface program. When a transfer of a data block is complete, the BIU logic generates an interrupt to the Novoview Computer and the Novofly software controls the transfer of the data, one word at a time, into the Novoview Computer memory. Refer to Volume 6 for a detailed description of the BIU.

Note

The above mentioned programs are "stand alone" programs and do not run under the control of an "executive" or "supervisor" program.

4.3.3 The Novofly Program

The Novofly program is used to load the model data from tape into memory, accepts the host computer input blocks, carries out computations using the data from both and edits the results of the computations to the output format required by the display processor.

The data output to the display processor defines:

a. Aircraft position (relative to model origin)
b. The position of the first light of each string (relative to model origin) and the string characteristics (color, brightness, etc.). A light string is a linear array of lights having the same spacing and characteristics.
c. The spacing between lights for each string.
d. A constant used to modify the assigned brightness of each light according to instructor defined visibility and cloud conditions.
e. A set of values used in the display processor hardware to determine in which view a light will be displayed — front, left or right window.
f. A set of values used in the display processor hardware to achieve rotation of the final display according the aircraft attitude and the view (front, left, or right) where the lights will be seen.
g. The special parameters used to produce the raster strings — runway surface, runway markings and horizon.

4.3.4 Data Terminal

The data terminal (ASR 733) is a teletypewriter/tape cassette device that is used for program and model loading. It is also used for operator control or data inputs to the Novoview computer during the execution of all stand alone programs with the exception of TESTPAT.

4.3.5 Display Processor

The Display Processor hardware functionally performs a number of operations:

a. Calculates the vector from pilots eye to each light.
b. Normalizes the light position values in order to generate the appropriate deflection at the display plane.
c. Updates the position from light to light within a string.
d. Determines in which view the light would appear.
e. Selects the appropriate rotation matrice according to the field of view and modifies deflection according to the values in the selected matrix.
f. Modifies the brightness of each light according to input visibility, cloud, range and type of light. The latter modification is special to runway lighting to prevent a brightness

build up at the distant end of the runway due to perspective.

g. Carries out a perspective division to present a realistic display.

h. Generates a color select output to the display system.

i. Carries out the conversion from digital values of deflection and intensity to the analog form required by the display.

j. Delays the bright-up of the display according to the amount of deflection necessary for each light. The analog part of the display processor contains a number of adjustments which effects the final output to the display.

4.3.6 CRT Display

The CRT Display has identical but separate X and Y axis deflection amplifiers. The low voltage power supplies are also identical, but electronically and mechanically separate for isolation between the two deflection systems. Because the CRT Display is a beam penetration type color monitor, the CRT anode voltage is changed to different values to select correspondingly different colors. As a consequence, the deflection circuit gains, the video grid control, and the focus voltage are also changed automatically by the inputs of the Display Processor to different values to maintain the deflection sensitivity, relative video intensity, and focus constant for different colors.

4.3.7 Optics

Light rays emitted from the CRT strike the semireflective beam splitter and are directed into the collimating mirror. The rays are reflected by the collimating mirror to pass through the beam splitter. The CRT is arranged so that the effective distance (taking into account the beam splitter) between the face of the CRT and the surface of the collimating mirror is approximately equal to the focal length of the collimating mirror (R_2 Figure 4-2).

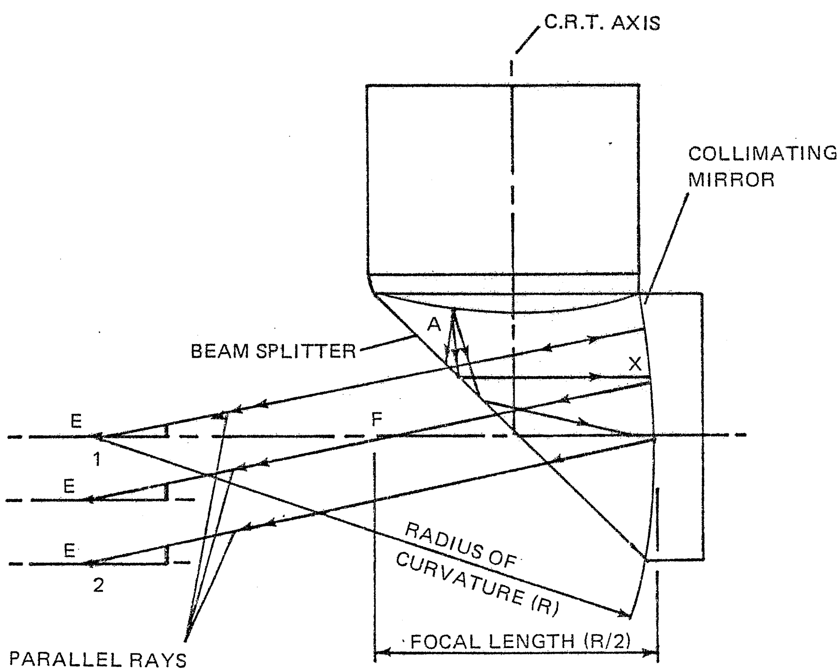


Figure 4-1. Side View of Optics

If the point source of light (A) is considered, the ray of light that leaves (A) parallel to the CRT axis passes through the focal point (F) of the collimating mirror after reflection at point X and arriving at the pilot's eye (E). It can be seen that the other rays of light leaving point A are not parallel to the CRT but are parallel to X-E after reflection by the collimating mirror.

Wherever the pilot's eye is positioned (E, E_1, E_2) within the limits defined by the recommended viewing volume, his eye registers exactly the same view of the image of point A in the collimating mirror because the light rays arriving at the eye from point A are parallel and form the same angle with a horizontal axis. Since the pilot's range-finding ability with binocular vision uses the strain energy expended by his eye muscles in converging the line of sight of each eye to evaluate distance, and as the rays arriving at each eye from point A are parallel, his eye muscles are relaxed and the pilot assumes that point A is distant from him. This assumption, although incorrect, is further reinforced by the fact that the CRT displays scene that are generated in perspective by the Display Processor.

4.4 COORDINATE SYSTEMS

Refer to Section 5.1 Novoview Image Generator & Display Manual 901023-002 for a detailed description of coordinate systems.

SECTION V

MAINTENANCE

5.1 INTRODUCTION

This section of the manual contains or references instructions necessary for the maintenance for the Novoview Visual System. Included in this section are preventive maintenance procedures, corrective maintenance, alignment, and troubleshooting procedures.

5.2 MAINTENANCE CONCEPT

The following paragraphs contain information and instructions to enable the technician to determine fault isolation to the circuit board level.

5.3 PREVENTIVE MAINTENANCE

The Novoview Visual System is composed mostly of solid state integrated circuits. Periodic maintenance, however, is needed to check the analog adjustments. When cleaning mirrors used in the Novoview System by methods usually employed on similar mirrors, the glass may become damaged. A safe method for general cleaning of the optics in the Novoview System is contained in paragraph 5.3.1.1.

Refer to table 5-1 for the list of publications when performing preventive maintenance procedures.

Table 5-1. Publications For Preventive Maintenance Procedures

EQUIPMENT	PUBLICATION
CRT Display & Deflection Driver	Novoview Image Generator & Display Manual Number 901023-002
Novoview Computer	Model 960B/980B Computer Maintenance Manual No. 942773-9703
Data Terminal	Silent 700 Electonic Data Terminals, Models 732/733 ASR/KSR Maintenance Manual No. 960129-9701
Image Generator	Novoview Image Generator & Display Manual Number 901023-002

5.3.1. Preventive Maintenance Schedule

The Novoview Visual System is composed mostly of solid state digital and analog circuitry requiring no periodic maintenance. However, there are a few maintenance tasks which must be accomplished on a regular basis. Periodic inspections have been divided into four time intervals; daily, weekly, monthly, and quarterly as described below. At each inspection, all necessary adjustments to either the IP or the displays must be recorded in the system maintenance log.

a. Daily.

1. Clean cassette read/write heads on the Data Terminal.

b. Weekly Inspection.

1. Ensure cooling fans are operating properly on display driver, Novoview Computer, Data Terminal, and in the Novoview Cabinet.
2. Cycle through all test patterns and make adjustments to color coincidence, fadeout brightness, focus or raster alignment as necessary.

c. Monthly Inspection. In addition to the procedures followed in the weekly inspection, perform the following:

1. Clean the filter on the main blower at the bottom of the Novoview Cabinet.
2. Clean the filter screen at the rear of the Novoview Computer.
3. Run NOVOTST diagnostic programs.

d. Quarterly Inspection. The quarterly inspection is the major inspection and involves thorough checks on all system adjustments.

1. Clean filters and tape heads as discussed in monthly inspection.
2. Check operation of cooling fans.
3. Ensure +5 and ±15 volt power supplies are within their proper limits (Refer to Appendix A of Novoview Image Generator & Display Manual No. 901023-002).
4. Check timing of SYNC signal (Section 9.3.1 Novoview Image Generator & Display Manual No. 901023-002).
5. Run NOVOTST diagnostics.
6. Check remaining processor adjustments (Section 9.3 Novoview Image Generator & Display Manual No. 901023-002).
7. Check all display adjustments including high voltage settings, video signal input levels, clipping, etc (Section 9.4 Novoview Image Generator & Display Manual No. 901023-002).

5.3.1.1 Optics Cleaning.

The following preventive maintenance procedure for cleaning the optics applies only to identifiable foreign matter resulting from normal handling and environmental conditions, i.e. finger prints, atmospheric haze and dust. All other conditions should be handled on an individual basis and under advisement by Redifon Simulation Inc. The following materials are required for this procedure.

a. Soft clean cloth
b. Distilled water (70 - 85 F)

Perform the following for cleaning the optics:

a. Fold cloth for washing, rinsing, and drying to form a pad of sufficient thickness to minimize point contact pressures.
b. Immerse washing cloth in water.
c. Wring cloth so that water will not drip or run on mirror surface when light pressure is applied.
d. Use straight, smooth strokes over entire area followed by light strokes in opposite direction by 90 degrees. Immerse washing cloth in distilled water as required.
e. Use a clean cloth and repeat steps a through d.

CAUTION

Do not allow water to dry on mirror surface because of water stains that may remain on surface of mirror.

f. After rinsing, dry surface with a clean dry cloth using multi-directional strokes to remove drops of water.

5.4 CORRECTIVE MAINTENANCE

Refer to the applicable schematics and theory of operation for troubleshooting the Visual Control Panel and interface units.

SECTION VI

DRAWING LIST

6.1 INTRODUCTION

This section contains a list of schematics, wiring and general assembly drawings for use with the Novoview Visual System. The Visual Control Panel and Buffered Interface Unit schematics are located in Volume 6. The general assembly drawings are located in Volume 7.

Table 6-1 contains the drawing list for the Novoview System.

Table 6-1. Drawing List

TITLE	NUMBER
Novoview Electronics Assembly	1500-0003
Control Panel Assembly	1510-0001
Panel - Control	500006
Box - Control Panel	500007
Plate - Connector Mounting	500008
Wiring Diagram - Control Panel	500011
Circuit Board Assembly - PDP11/45 Interface	1530-0001
Wire List, PDP11 Interface	500012
Logic Diagram - PDP11 Interface	500013
Cable Assembly PDP11/45	1540-0001
Wire List, PDP11/45 Cable Assembly	500009
Cable Assembly - 6 Conductor	1540-0009
Cable Assembly - Special Purpose	1540-0003
Wire List, Special Purpose Cable	500024
Cable Assembly - Special Purpose	1540-0004
Wire List, Special Purpose Cable	500023
Installation - Boost Transformer	500001
Installation - Dual Fast Forward Feature	500002
Installation - Output Protect Feature	500003
Wire List, Cockpit Interface, Unit 5	500072
Bracket, Mounting	500052
Assembly - Mechanical Visual Installation	1100-0014
Assembly - Forward Box	1110-0009
Frame - Novoview	800147
Collimating Mirror - Aluminum and Glass	800214
Beamsplitter	800215
Assembly - Driver	1130-0005 through -0008
Assembly - Monitor	1140-0001/2

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OPERATIONS MANUAL

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SECTION I

GENERAL

1.1 INTRODUCTION

This manual includes information relevant to the operation of the Redifon Electronics Novoview System.

1.2 SCOPE

The scope of this manual is to provide maintenance personnel, instructor pilots, and modellers with information covering system operation. This manual is divided into four sections: Section I, General; Section II, Maintenance Personnel Operation; Section III, Instructor Pilot Operation; and Section IV, Novoview Modelling.

SECTION II

MAINTENANCE PERSONNEL OPERATION

2.1 INTRODUCTION

This section contains information to enable personnel to ready the Novoview System for the instructor pilot. Included are instructions for bringing up power, loading programs and models, tape duplication, type operation, and sense switch options.

2.2 POWER UP

Normally, system power is controlled by two illuminated push-button switches (POWER ON/OFF) located on the front panel above the Novoview Computer in the Novoview cabinet. The following procedures are performed after a complete power shut down:

a. Set MAIN POWER circuit breaker on AC Power Control Panel to ON. Observe POWER ON indicator illuminates.
b. Observe AVAILABLE indicator on AC Power Control Panel is illuminated.
c. Set applicable DISPLAY circuit breaker to ON and observe POWER indicator illuminates.
d. Press POWER ON indicator switch on the front top panel of the Novoview cabinet. Observe ON indicator illuminates.

2.2.1 Data Terminal Switches

Set switches on the Data Terminal as follows:

a. POWER-ON
b. ON LINE/OFF - ONLINE
c. TAPE FORMAT - CONT
d. KEYBOARD - LINE
e. PLAYBACK - LINE
f. RECORD - LINE

Note

Should Data Terminal not operate after setting switches in the above procedures, refer to operating procedures in Novoview Image Generator and Display Manual 901023-002.

2.3 PROGRAM LOADING

All system programs are on cassette tapes which are loaded by means of the Data Terminal. To place a cassette tape in a drive, open the door and insert the tape (label outward and tape uppermost) carefully, exerting a slight downward pressure against the springs. The door may be closed easily if the cassette is properly positioned. The left-hand cassette drive is referred to as Drive #1 and the right-hand drive as Drive #2.

a. Set cassette Drive #1 to playback (center rocker switch down). Observe PLAYBACK indicator illuminates.
b. Place cassette cartridge containing required program (e.g. NOVOFLY) in cassette Drive #1.
c. Press Rewind. Wait for tape to stop (may already be rewound). END light illuminates.
d. Press LOAD switch. Wait for END light to extinguish and READY light to illuminate.

2.3.1 Novoview Computer Operation

Unless otherwise specified, set the Novoview Computer as follows:

a. Set MODE RUN switch to HALT.
b. Press RESET
c. Set register display entry switches to 0006
d. Press PC switch to ENTER
e. Set MODE switch to RUN
f. Press LOAD switch. Wait for IDLE light to illuminate (about seven seconds). This enters the program loader from beginning of tape. The Novoview Computer will idle with Hex 8A in the display lights.
g. Press START switch. Wait for IDLE light to illuminate indicating that program has been loaded. The Novoview Computer will idle with Hex 8D in the display lights for a correct load.
h. Set MODE RUN switch to HALT
i. Set register display entry switches to 2FFF.
j. Press E switch to ENTER
k. Set register display entry switches to 008C
l. Press PC switch to ENTER
m. Set MODE switch to RUN
n. Press START switch. Wait for IDLE light to illuminate indicating that program has been loaded. The Novoview Comuter will idle with Hex 8D in the display lights.
o. Rewind and remove cassette
p. Place the correct model cassette in Drive #2
q. Press START switch

CAUTION

Rewind tapes as soon as they are loaded. Never remove a tape which has not been rewound. ~~Never~~ turn off power to the Data Terminal unless tapes that are in it are rewound. Contamination of the tape surface or power transients can destroy a tape. All system tapes are write-protected by having the red tab on the cartridge toward the middle of the cartridge. If the cassette drive is in the RECORD mode, it will be impossible to complete step d, paragraph 2.2.1.

2.4 NOVOFLY OPERATION

NOVOFLY is the real-time operating program. It is a stand-alone program that provides, in addition to its normal simulation functions, aids for model debugging; capability for locally-controlled maneuvering and model selection; and a keyboard routine to examine and enter data.

The program is loaded by the procedure outlined in paragraph 2.3. Set Novoview Computer SENSE switch 2 in the up position and the remaining SENSE switches in the down position. When the program has finished loading, depress START switch and the program will begin operation in the utility Type toutine. Place a model tape in Cassette Drive #2.

2.5 MODEL LOADING

When a search is initiated for a model, either by local entry from the Type program or by command from the Visual Control Panel via the Host Computer, the program begins a search. The cassette tape goes into a fast forward mode to minimize search time until the selected model is located. When the model is located, it is loaded and the tape rewinds.

2.6 TYPE ROUTINE

The type routine accepts inputs from the keyboard and provides a variety of utility functions. All keyboard entries 0 through 9 and A through F are interpreted as hexadecimal data. Certain other characters are interpreted as commands. All data inputs are placed in a register called DAT which can hold four characters. DAT is initially zero and new entries are added to form a right-justified word. The most recent four characters are retained so if a mistake is made, continue typing until the last four entries are correct.

The following is an explanation of the command codes accepted by the program.

- G - find and load the model whose two-decimal-digit name is in DAT. For example, typing 02G will initiate search for model 2.
- L - transfer DAT to a starting address register AD1. Clear DAT.
- O - type out contents of memory locations from AD1 to DAT. If DAT is less than AD1, only one location is read. For example, 1ØØØL1ØØD0 will result in a 14-word dump from hex 1ØØØ. 1ØØØLO will output location 1ØØØ only (DAT was set to zero by L and no further data was entered).
- M - place contents of DAT into MODE register. MODE is used for local maneuvering and determines the variable to be changed by means of a SENSE switch.
- P - initiates a dump of aircraft variables relative to the model origin. The output is X, Y, and Z (decimal, feet), and H, P, and R (degrees), in that order.
- T - transfer to the address given by DAT. 18ØØT will transfer the program to the start of the Type program. T alone will begin execution at location zero (the start point for NOVOFLY).
- CR - a carriage return will cause the contents of DAT to be loaded into the location specified by AD1, and AD1 is incremented. For example, 1ØØØF(CR) loads ØØØF into 1ØØØ. If this were followed by 12349(CR), 1234 would be deposited into 1ØØ1.

Note

The type routine can be restarted at location 18ØØ, in which case all registers will be initialized to zero. CR enters data into memory. If CR is depressed inadvertently, try to find which location was destroyed (most likely location zero).

2.7 SENSE SWITCH OPTIONS

The four program SENSE Switches (SSW), control certain NOVOFLY options. SSW1 up will stop execution of the main picture-generation program of NOVOFLY and transfer control to Type. Momentary operation is sufficient to effect the transfer.

SSW2 up causes the Novofly program to ignore transfer of data from the Host computer and stops movement of the scene being displayed in the configuration represented by the last data transfer. This enables local control through the use of SENSE switches 3 and 4 described below.

SSW3 and SSW4 are used to locally control visibility and aircraft parameters without the Host computer inputs.

SSW3 determines the sign of the intended change (down is +, up is -). SSW4 causes the increment to be added each frame, down stops the increment. The number entered into the MODE register determines which quantity is to be changed:

MODE	QUANTITY
0	Visibility
1	Heading
2	Pitch
3	Roll
4	X
5	Y
6	Z
7	Aircraft Axis

The following sequence would be used to increase heading angle and decrease altitude:

a. Transfer to Type.
b. Enter 1MT to set mode 1 and return to main program.

c. Set SSW3 down and SSW4 up long enough to get the desired heading change. Use SSW1 to transfer to Type.
d. Enter 6MT to get into Mode 6.
e. Set SSW3 up and activate SSW4 until desired altitude is established.

The aircraft position/attitude can be determined by entering 'P' while in the type routine to obtain a printout of aircraft variables.

2.8 TAPE DUPLICATION

Cassette tapes may be copied at high speed for making back-up tapes. It is recommended that copies of program and model tapes be made against the possibility that an original tape is damaged. Duplication requires the following steps.

a. Set PLAYBACK and RECORD switches on lower row of ASR panel to LOCAL.
b. Set KEYBOARD and PRINTER switches on lower row of ASR panel to OFF.
c. Lift keyboard cover of Data Terminal and set ADC switch (upper left area) to OFF.
d. Insert the source (original) tape into CASSETTE 1 transport.
e. Set RECORD CONTROL switch to OFF.
f. Press CASSETTE 1 REWIND
g. When END light illuminates, press LOAD/FF. Observe READY lamp illuminates after a few seconds.
h. Insert the copy tape into CASSETTE 2 transport.
i. Press CASSETTE 2 REWIND.
j. When END lamp illuminates, press LOAD/FF.
k. Set CASSETTE 1 to PLAYBACK; CASSETTE 2 will be in record.
l. Press RECORD CONTROL/ON switch and observe ON lamp illuminates.
m. Set TAPE FORMAT switch to CONT.
n. Press CONT START switch to begin high speed tape duplication. Data is transmitted from CASSETTE 1 to CASSETTE 2 until END lamp illuminates.
o. When END lamp illuminates, press CONT STOP switch.
p. Press CASSETTE 1 REWIND switch and CASSETTE 2 REWIND switch. Remove cassette tapes when rewinding has completed.

Note

To stop duplication process at any time, press CONT STOP switch. Check newly duplicated tapes by loading and operating them.

q. Lift keyboard cover of Data Terminal and set ADC switch to ON.

SECTION III

VISUAL CONTROL PANEL OPERATION

3.1 INTRODUCTION

The following paragraphs describe the operation of the Visual Control Panel by the instructor pilot. The Visual Control Panel becomes operational after the appropriate model has been loaded per instructions in paragraph 2.3. Figure 3-1 is a pictorial representation of the Visual Control Panel.

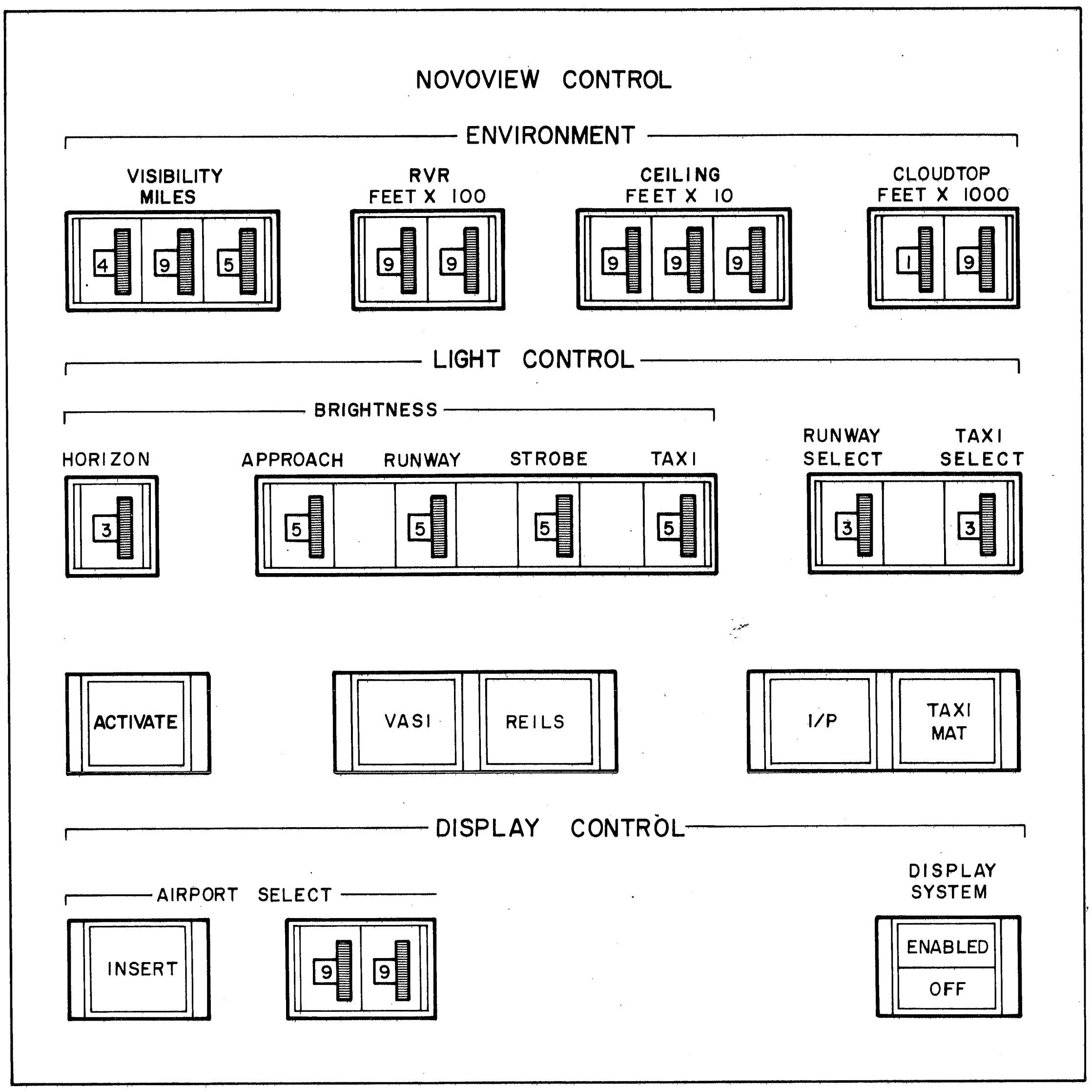


Figure 3-1. Visual Control Panel

a. Press DISPLAY SYSTEM ENABLE/OFF switch/indicator and observe indicator changes from white to green.
b. Select the desired airport by turning the thumbwheel AIRPORT SELECT digit switch. Refer to table 3-1 for locations.
c. Press AIRPORT SELECT INSERT switch/indicator and observe AIRPORT SELECT INSERT switch/indicator changes from green to red and display is blanked. Wait approximately 90 seconds for the computer to search for the correct airport model then observe airport model is displayed. If there is no apparent display, call radio aids for a position reset because the aircraft may be positioned somewhere other than the start of the runway.

   To call up another mode, set AIRPORT SELECT digit switch to the desired model number (Table 3-1), and observe display has not changed. Press AIRPORT SELECT INSERT switch/indicator and observe the same indications as in step c.
d. The following procedures contain operating instructions of the LIGHT CONTROL area:
   1. Set LIGHT CONTROL HORIZON digit switch to control the brightness of the horizon on the display. The Horizon can be controlled between low and full brilliance in five discrete steps plus an off position. The intermediate brightness levels are adjusted between low and full brilliance range.
   2. Set BRIGHTNESS APPROACH digit switch to control the brightness of approach lights. Lights can be controlled between low and full brilliance in five discrete steps plus an off position. The intermediate brightness levels are adjusted between low and full brilliance range.
   3. Set BRIGHTNESS RUNWAY digit switch to control the brightness of the runway lights between low and full brilliance in five discrete steps, plus an off position. The intermediate brightness levels are adjusted between low and full brilliance range.
   4. Set BRIGHTNESS STROBE digit switch to control the brightness of the strobe lights between low and full brilliance in five discrete steps, plus an off position. The intermediate brightness levels are adjusted between low and full brilliance range.
   5. Set TAXI SELECT digit switch for selecting taxi lights for the purpose of setting intensities as predetermined by the Host Computer. This is a special feature.
   6. Set BRIGHTNESS TAXI digit switch to control the brightness of the taxi lights between low and full brilliance in five discrete steps plus an off position. The intermediate brightness levels are adjusted between low and full brilliance range.
   7. Set RUNWAY SELECT digit switch for selecting a specific runway on the display.
   8. Press ACTIVATE switch/indicator and observe ACTIVATE switch/indicator changes from white to red. Switch operation illuminates runway or taxi lights.
   9. Press VASI switch/indicator and observe VASI switch/indicator changes from white to amber. Switch operation illuminates Visual Approach Slope Indicator (VASI) on display.
   10. Press REILS switch/indicator and observe REILS switch/indicator changes from white to amber. Switch operation illuminates Runway End Identification Lighting System (REILS) on display.
   11. Press I/P switch/indicator and observe I/P switch/indicator changes from white to amber. The I/P switch/indicator selects the initial position of aircraft predetermined by the Host Computer.

12. Press TAXI MAT switch/indicator and observe TAXI MAT switch/indicator changes from white to amber. Switch operation selects taxiway surface for the purpose of taxiing to predetermined areas as selected by the Host Computer. This is a special feature.

e. The following procedures contain operating instructions of the ENVIRONMENT area:

1. The visibility is varied by setting the ENVIRONMENT VISIBILITY MILES digit switch. Visibility is set in increments of one mile to a maximum of 495 miles.
2. Runway visibility range (RVR) is varied by setting RVR FEET X 100 digit switch. RVR is set in increments of 100 feet to a maximum of 9,900 feet.
3. The ceiling or cloud base is varied by setting CEILING FEET X 10 digit switch. This control sets the ceiling between ground level and 9,990 feet in increments of 10 feet.
4. The cloudtop is varied by setting CLOUDTOP FEET X 1000 digit switch. This control sets the cloudtop between sea level and 19,000 feet in increments of 1000 feet. Selection of cloudtop equal to or less than cloud base implements a clear sky. A horizon glow is visible when the aircraft breaks out above the clouds.

Table 3-1. Airport Location

AIRPORT DIGIT SWITCH SETTING	AIRPORT	RUNWAY
01	Teterboro	6,24,1,9
02	Stewart	9,27,16,34
03	La Guardia	4,22,13,31
04	Allentown	6,24,13,31
05	Dulles	1R/19L, 1L/19R
06	Kennedy	4R/22L, 31L, 13R
07	White Plains	16, 34, 11, 29
08	Newark	4R/22L, 11, 29
09	Richmond	15, 33, 6, 24
10	Denver	35R/17L, 26L/8R
11	Boston	4R, 22L, 15R, 33L
12	Le Bourget	3, 21, 7, 25
13	Wichita	1R/19L, 1L/19R
14	Hutchinson	13, 31, 3, 21
15	Salina	35, 17
16	O'Hare	14R/32L, 9R/27L
17	Atlanta	8, 26, 9R, 27L
18	Los Angeles	25L/7R, 6L/24R
19	St. Louis (Lambert)	30L-12R 6&24
20	Seattle (Seatac)	16R-34L, 16L, 34R
21	Dallas (Love Field)	31L/13R, 13L/31R
22	Oklahoma City (Will Rogers World)	17R/35L, 17L/35R
23	Mexico City	23L/5R, 5L/23R
24	Juneau	8, 26

SECTION IV

NOVOVIEW MODELLING

4.1 INTRODUCTION

This section of the manual contains instructions for model planning and the use of Novoview modelling forms.

4.2 MODELLING

Modelling is the process of defining the features of a particular airport that would be visible at night with respect to their particular characteristics (brightness, color, etc.) and their position with respect to a common (model) origin. The final definition is expressed in a mathematical format and written on cassette tape ready for use by the Novofly program.

4.3 DATA GATHERING

This is perhaps the least interesting, but most necessary aspect of the modelling process. In order to have an accurate reproduction of an airfield and its environment, you will need to start with good maps and diagrams of the area. A good source of U. S. airport data is the Airport Obstruction Charts put out by the National Ocean Survey. These depict the airport and immediate surroundings on a scale of 1" = 1,000 ft., and are accurate enough to give runway/taxiway spacing, general size of terminal buildings and hangers, and general arrangement of surrounding streets. Also depicted, are the location and height of lighted obstructions in the area.

Most airports will have blueprint type engineering drawings scaled around 1000' to the inch, which are good for measuring distances on the airport itself. These may be obtainable through the airport engineering office.

For the environment around the airport, where accuracy is not so important, any kind of map you can find will work. Of course, the better and larger your map, the easier your task and the better the finished product. A Geological Survey Map is nice, but may not be up-to-date as to freeways and such. A good quality city map may be good enough, but if the airport is very far out-of-town, it may not be on the map. You will probably end up using a combination of several maps and doing some extrapolating, as well.

When considering the area outside of the airport, it is important to consider what training exercises will be utilized. The kind of approach to be flown to your model will make a good deal of difference, particularly if circling approaches are to be used. For example, in order to be FAA certified for circling approaches, the pilot must be able to see lights on the ground at all times when the approach is flown, at minimum visibility and ceiling. There may be other similar restrictions you will need to consider, and these should be explored as part of the data gathering process.

The majority of your model environment will most likely be made up of major roads and highways. These provide the most efficient use of your lights and strings and also enable you to spread your model out. Relatively small individual features, such as buildings, should be avoided unless they are necessary to the training mission.

Another important bit of data you will need is the location and composition of any special features which your pilots may consider aids or cues - or even distractions during an actual approach to that airfield. This information you will have to get from the pilots themselves. Items such as these can make the difference between a "pretty picture" and a valuable training aid and should not be overlooked.

4.4 AIRPORT CHARACTERISTICS

On most airports used by commercial carriers, there are arrangements of lights which are required to be standard, so that the perspective view that the flight crews see will be as constant as possible from one field to another. This fact will make your task somewhat easier in that the brightness, color and spacing are well documented. The following is a discussion of the typical lights on an airport.

4.4.1 Approach Lights

The majority of major airfields will have some type of approach light system. These are standard arrangements of bright directional lights placed so that they lead up to the threshold of the runway, thereby providing heading and attitude information during low visibility landings.

Figures 4-5, 4-6, and 4-7 depict the general arrangement of three widely used systems. Figures 4-8, 4-9, and 4-10 are completed modelling forms for the threshold bar. These forms will be explained more fully in paragraph 4.6.

4.4.2 Strobe or Sequenced Flashing Light

These are very bright, condenser discharge lights which flash in sequence toward the runway. They are usually positioned very close to the center row of the approach system and run from the end of the approach lights to a point near the threshold. The strobe is handled as a special light type in the Novofly software and will be explained more throughly in paragraph 4.6.2.

4.4.3 Runway Edge Lighting

These are directional lights spaced every 200 feet down the runway and about 10 feet out from each edge. When U.S. runways are viewed from the approach end, the last 2000 feet (or 10 lights) will be orange, and the remainder white. Your training requirements will determine if you need to put directional orange lights at both ends.

4.4.4 Centerline Lighting

These directional lights begin about 75 feet down the runway and are spaced every 50 feet. On U.S. runways, viewed from the approach end, the lights 3000 feet to 1000 feet from the far end alternate red and white, and the last 1000 feet are red; the remainder are white. Here again, you will need to determine if the back course lights need be modelled.

4.4.5 Taxiway Lights

Since we cannot reproduce the blue taxiway edge light, you may want to only display the green centerline of the taxiway. These lights are 50 feet apart; although, for long parallel taxiways, you may want to use a wider spacing (up to 200 feet) as the lights can be better used elsewhere. The only taxi lights on the runway are the centerline of high speed turnoffs.

4.4.6 Beacon

Although there are many different types of beacons throughout the world, they are usually similar and modelled in much the same way. The beacon on a U.S. airport, for example, is a rotating spotlight with a white light on one side and a green light on the other. It rotates six times per minute. From a distance, it appears as an alternating green and white light flashing every five seconds.

The beacon is modelled with two flashing single light strings, one green and one white. Both strings will be located at the same point and have the same period and on-time (50 and 8 work well). The phase of the strings will be zero for one, and half of the period (25) for the other. The flash process will be explained.

4.4.7 Obstruction Lights

These are used to delineate buildings, antennas and other vertical obstructions around the airport. The lights are usually red and seldom flashing. As these are generally single lights requiring one string for two of them, a lot of strings can be used if all the obstruction lights are reproduced. You may wish to model only the more significant ones.

4.4.8 Terminal, Hangers, etc.

Buildings are hard to reproduce and take a lot of strings. It is a good idea, however, to place large clusters of lights on your model where the pilot will expect to see large clusters on the airport. This will help him to orient himself as to the location of the runway and other airport features, when the model is seen from the distance.

4.4.9 VASI (Visual Approach Slope Indicator)

This is a system of lights which give the pilot glideslope information during the final part of his landing. Although there are many configurations, basically, there are two boxes beside the runway with red and white lights in each. They are about 50 feet to the side of the runway and 700 feet apart. The lights are arranged such that when the pilot is on the proper glide-slope, he will see red lights in the upper (far) box, and white in the lower. If he is low, both boxes are red, and if high, both are white. Like the strobe, VASI is handled as a special type in the software and will be discussed in paragraph 4.6.2.

This is by no means an exclusive listing, and you will undoubtedly come across other light sources which you will need to consider.

4.5 MODEL PLANNING

A good deal of time can be saved by formulating which features you will want in your final model environment. There should be little question as to the airport features and these should be modelled first in order to determine how many strings and lights are left-over for the environment. At this point, a sketch of some sort should be made to enable you to distribute your remaining strings over the areas which you require.

Another factor to be considered is whether to use submodels or not. Submodels can save a lot of time in the modelling process, but it should be kept in mind that the length of the model (on the tape cassette) is the same as a finished model. If a large number of submodels are used, more time may be spent reading and writing them on the cassette than is saved by using the more convenient numbers.

4.5.1 Model Origin

There are three separate origins for the X, Y, Z coordinate system which must be considered when preparing model data. They are:

a. Submodel Origin: This is a point in the data base chosen for convenience or, in the case of RSM submodels, to minimize the use of diagonal edges. During the load-and-pack process (see paragraph 4.17) offsets and rotations are entered to orientate all of the submodels to the final model origin.
b. Final Model Origin: This is the point around which the finished model is assembled. This also is a point chosen at the convenience of the modeller. The typical point is the intersection of the centerline and threshold of the main runway considered with the X axis oriented along the runway centerline. This point is displaced, but <u>not</u> rotated to coincide with the simulator origin for the airport concerned.
c. Simulator Origin: This is the point, usually in latitude and longitude, which the simulator associates with the airport. It may be the location of one of the Navaids or the touchdown point on the runway or some other point on the airport. This location will have to be derived from the host computer data. (The T vector is computed from the eyepoint to this point.) In most cases, the runway heading may be modelled at zero degrees, which the host computer will consider as a heading relative to its Navaid heading, and therefore, display it at the correct heading for the Navaid selected. This information will also depend on the makeup of the host computer program.

4.6 NOVOVIEW MODELLING FORMS

The forms used by Redifon (Figures 4-1, 4-2, and 4-3) are designed to correlate with the computer format, which will be discussed later.

The following is a brief description of the form used to record string data. (Figure 4-1.)

Description: This column is for the modeller's use only. The information here does not go into the computer.

4.6.1 String Number

This is a direct count of the strings in the submodel. Two spaces are provided so that the string's number in the final model may be entered as needed.

4.6.2 Type

This code tells the computer that certain strings are to be processed through subroutines in the software. It also allows the control panel in the cockpit to communicate with the model when the Novofly is in operation. The type codes are as follows:

Type 0 = General: Used for general environment and airport lights which are not controlled from the control panel.

Type 1, 2 and 4: Strings assigned these types will have adjustable brightness. The lights are "connected" via the software to the five-step digi switches on the control panel. Type 1 is normally used for approach systems and Type 2 assigned to runway edge lights.

Type 3 = Strobe: This type is associated with the sequenced flashing lights in your model. The Type 3 strings are processed through a subroutine which gives it the sequenced effect as well as the extra brightness. An entry must also be made in the Period, Wait-time and Phase columns. There are a maximum of eight strobe strings available.

Type 5 = VASI: Type 5 strings are processed through the VASI subroutine which makes use of the elevation angle (covered later) to give the pilot accurate glideslope information. Each Type 5 string must be considered as two strings, (one white and one red) when considering the total of 400. Also, each light must be considered as two lights. There are a maximum of eight Type 5 VASI strings available.

Type 6 = VASI Repeat: This type is used to save computing time when two or more VASI strings describe the same glideslope. They are listed and entered in the model immediately after the Type 5 string which is being duplicated. Each Type 6 string must also be considered as two strings and two lights for each one programmed.

Note

Type 3, 5 and 6 strings may also be connected to five Step switches and/or On-Off switches.

Type 7 = REILS: Type 7 strings are processed through a subroutine which causes them to flash twice per second. They may be made directional, but the flash rate may not be altered. Type Sevens are controlled by an On-Off switch on the Instructor's panel.

Type 8 and 9: Lights of these type are "connected" to On-Off switches which may be installed.

Note

The configuration of the Instructor's panel should be consulted to determine if Types 4, 8 and 9 may be used. These are options and not installed on all systems.

Type 10 = Stars: These lights are modelled in the normal manner, but their X, Y, Z position remains relative to the Pilot's eyepoint, rather than the model origin. The standard 30 string star submodel is located on a plane 1000 feet above the Pilot's eyepoint, i.e., Z=1000'.

Flags: The purpose of this code is to further describe the characteristics of the string to the computer.

D = Directional - When this flag is used, a heading must also be entered in the heading column. This will be the direction from which the light "shines" and when seen from along this axis, will appear at its maximum assigned brightness. As one moves around the light, in either direction, the brightness is reduced until 90 degrees or more from the axis, it cannot be seen.

B = Bidirectional - Similar to Directional, except that the light "shines" along the reciprocal of the heading as well. Once again, the brightness reduces to zero at 90 degrees off the axis.

F = Flashing - Used for flashing lights. Entries must be made in the period, on-time and phase columns in order to describe the rate of the flash desired. These entries will be explained when those columns are discussed.

Note

A string may not be made flashing and Directional/Bidirectional.

P = Point Directional - This code gives a Directional light with the heading automatically assigned at 180 degrees. Also, the brightness will remain constant as we move around to 90 degrees off of that heading. This gives the lights an "on" or "off" characteristic, depending on where they are viewed from.

R = Reverse Point
Directional - Same as above, except the heading is automatically assigned 0 degrees.

Note

Point and Reverse Point Directional are compatible with Flashing.

I = Range
Intensity When a long string of closely spaced lights is viewed along its length, there can appear an unnatural "bunching" of lights at the far end due to the fact that, though brightness can be reduced realistically over a distance, point size cannot. To overcome this problem, an additional range attenuation function is added to strings which will normally be seen from an end-on aspect such as runway edge lights and approach lights. This is accomplished by using the "I" flag.

This flag will cause the entire string to appear somewhat dimmer so you will need to apply it to all the strings in the runway area (for example) so that they will appear as the same or similar brightness.

4.6.3 # Points

Numbers from 1 to 511 may be entered in this column to indicate the number of lights in the string. When the model is complete, this column should total 6000 points or less.

4.6.4 Color

Used to define color of string, as per following code:

0 = Red
2 = Orange
3 = White/Yellow
4 = Green

Note

For Type 5 (VASI) strings, no color input is needed, as red and white are assumed.

4.6.5 Intensity

Brightness may be specified by a number from 0 to 7.99. A brightness level of 1, however, is the maximum which the scope will display at any given time. Settings greater that 1 will not become effective until range or visibility attenuation begin to effect them. For example, two lights side-by-side; one assigned intensity 1.5, and the other 2.0, will appear the same brightness (Intensity = 1) until the range is increased and/or the visibility decreased. As the display values of both lights decreases, the lesser one will drop below 1 and will appear to dim, while the other remains at 1.

The brightness is scaled such that a setting of .875 is half as bright as a setting of 1, etc.

For virtually all lights in a normal model, settings from .4 to 1.5 will suffice. You should keep in mind, however, that some of your lights will be controlled by 5 step-switches on the control panel and you should familiarize yourself with the effects of these switches on the visual presentation before assigning intensities to Type 1 and 2 lights.

4.6.6 Group #

The group number (0-5) of a string is used in conjunction with the runway select switch on the panel to allow the instructor to adjust the intensity of the lights associated with one runway, independently of the others. To achieve this, all strings associated with a given runway will be given the same group number. General purpose strings, i.e., Type 0, are not assigned a group number.

4.6.7 Flashing, Directional, VASI and Strobe Strings

The next three columns are shared by flashing, directional, VASI and strobe strings, as the features entered in these columns are mutually exclusive.

4.6.7.1 Directionality

For directional or bidirectional strings, the HDG column is used to enter the heading of the directionality axis. This heading is measured in whole degrees, clockwise from the X axis.

4.6.7.2 VASI

Type 5 VASI strings require an entry in the ELEV column to describe the aim angle of the VASI unit being simulated. Entries from 0 - 7.9 are accepted.

4.6.7.3 Flashing

Flashing lights require entries in all three columns. The characteristics of a flashing string are defined in units of 200 m.sec. (1/5 sec.). Entries from 0 to 255 are accepted as follows:

a. Period - This should be considered as the total of the on-time and off-time of the light.
b. On-Time - Length of time the light is on in any one cycle.
c. Phase - This will determine at what point in the previously defined period the light will come on. Phase is not critical, except when compared to other flashing lights with which you wish an alternating effect.

   For example, consider an airport beacon (see paragraph 4.4.6) with alternating white and green light.

The rotation of the beacon is 6 RPM, or once every 10 seconds. Therefore, a Period of 10 seconds is required which is equivalent to 50 frames. From a given point, the beacon appears to be "on" for approximately 2 seconds or 10 frames.

First, model the white light with a Phase of 0. Next, the green light with the same Period and On-time, but a Phase of 25 (or half the Period).

The end result is an alternating white and green light, flashing at equal intervals.

4.6.7.4 Strobe

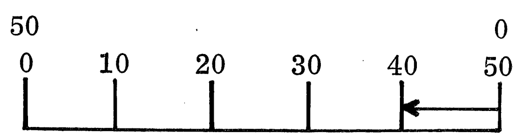
An entry is required in all three columns for each of the eight strobe lights available. This allows the strobe strings to be used to depict more than conventional sequenced flashing lights. The units used to define the characteristics of a strobe are the 33 m. sec. update frames. This means that the fastest that the strobe will step from one light to the next is limited by the fact that the picture itself is redrawn every 33 m. sec. (1/30 sec.). In order to program the performance of a strobe string, the following entries must be made:

a. Period - As in flashing lights, this term will represent the total cycle time of the strobe or strobe system.

b. Wait Time - This term defines the time interval between one light and the next. For normal sequenced flashing lights, this number should be zero.

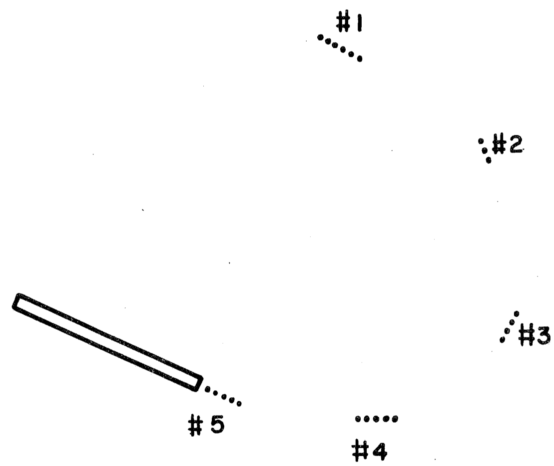
   If the string in question has been made directional in the flags entry an entry of heading is required rather than Wait Time. In this case, the Wait Time is automatically zero. Therefore, a strobe with an extended interval between flashes cannot be made directional.

c. Phase - This term will determine when in the previously defined Period the strobe starts. The Phase is counted backward from the end of the Period. For example, a strobe with a Period of 50 frames and a Phase of 10 will start on the 40th frame of the Period.



Consider the following example:

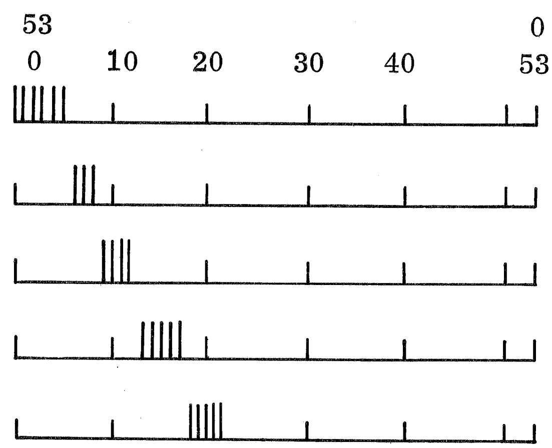
A set of lead-in strobes to a runway, as shown on the following page.



The real world system takes .5 sec. to run to the runway, waits one second, then starts over. The first consideration is the Period. The system has a total of 23 lights, and therefore will take 23/30 sec. for the strobe to run the full length. Add to that 30/30ths or 1 second for the pause, and the total period for the system is 53/30 sec., versus the 23/30 sec. required in the Novoview. If the strobe rate is important to training, the only way to approach the .5 sec. (15/30) is to reduce the number of lights in the system.

Assume in this case that 23/30 is adequate for training. The period of the system is then 53 frames. Each of the five strings will then have a Period of 53. As it is necessary that the time between flashes be as short as possible, "zero" is entered for the wait time. Note that this enables us to make these strings directional if necessary. All that remains is the Phase calculation.

	PER	WT	PHA	# Pts
#1	53	0	53 or 0	6
#2	53	0	47	3
#3	53	0	44	4
#4	53	0	40	5
#5	53	0	35	5



Strobe #1 may be said to start at the beginning of the Period. Either 53 or "zero" may be entered for the Phase, since in counting backward 53 frames from the end of the Period, the result is the same as zero frames from the end. As there are six lights in #1, it will require six frames (0-5). The next string should start in the next (or 6th) frame:
53 - 6 = 47; which is the Phase for strobe #2.

Strobe #2 should finish in the 8th frame, and #3 should start in the 9th: 53 - 9 = 44.

Strobe #4 should start in the 13th frame: 53 - 13 = 40.

The last strobe, #5, will start in the 18th frame: 53 - 18 = 35.

There will then be a 30 frame pause (23-53) to the end of the Period, after which the cycle will start over.

Note

In the example, if a .5 sec. interval is required from one light to the next, an entry of 15 should be made in the Wait time column. This has the effect of multiplying the 1/30 sec. frame time by 15, which in this case results in a .5 sec. unit of measurement. For string #3, above, if the entries were PER = 53, W.T. = 15, PHA = 44, the result would be a Period of 795/30 sec. or 26.5 sec. The strobe would actually start 135/30 sec. or 4.5 sec. into that Period, i.e.,

$$\frac{795 - (44x15)}{30} = 135/30 = 4.5 \text{ sec.}$$

4.6.8 X, Y, Z

These three columns are used to enter the location, with relation to the X, Y and Z axes of the first and last point of the string. With this information and the number of points in the string, the computer will establish the proper angle or string direction as well as the proper spacing. The values of X, Y and Z may be in feet or meters.

4.6.9 Angle/Spacing

An alternate method of defining the string position is to enter the first point, as above, and then to enter the angle (in the X, Y plane) and the spacing between points (feet or meters). The computer will then calculate the last point. As before, the angle is measured clockwise from the X axis.

4.7 EDGE DATA FORM (Fig. 4-2)

The surface texture in the Novoview 6000 system is constructed of three and four-sided polygons which must be assembled into the desired features. These polygons, or surfaces, are defined by first designating the various edges which make them up. At any one time, the system can display an RSM submodel, consisting of 64 surfaces made up from 64 edges. There are available up to six separate RSM submodels in any given data base. These submodels are accessed via the runway select switch on the instructor's panel. This switch, as mentioned in paragraph 4.6.6 reads the Group # of the light strings associated with a particular runway. Simultaneously, the RSM submodel which has been built for that runway and assigned the same number, will be accessed.

A form similar to Figure 4-2 should be employed to list the edge data. There are five kinds of edges which may be used in various combinations to construct the surfaces. They are as follows:

4.7.1 Normal X Edges

These edges are perpendicular to the X axis of the RSM submodel and their value is defined as the point where the edge intersects the X axis. Negative values are not allowed for X edges, therefore, the submodel origin should be selected accordingly.

4.7.2 Symmetrical X Edges

These are also perpendicular to the X axis, but have the additional property that they may be "reflected" to the opposite end of the runway when it is in view. It is intended that these be used to depict the touchdown zone stripes, which are usually identical at each end. This allows us to simulate the markings at both ends of the runway while utilizing the data space for only one. Entries under SETS will be discussed in paragraph 4.7.6.

4.7.3 Centerline X Edges

These are X edges which are "rolled" ahead of the airplane, allowing the system to depict a dashed centerline on the runway. Use is made of the short visual range (≤ 2000'), so that a stripe may be placed just out of view and consequently will not suddenly appear as the airplane moves forward.

A typical submodel would include the first four or five dashes of the centerline on the end near the origin. SETS are also required (see paragraph 4.7.6).

4.7.4 Normal Y Edges

These edges are perpendicular to the Y axis and their value is defined as the point where they intersect the Y axis. They may be positive or negative.

4.7.5 Diagonal Edges

These edges are not perpendicular to either axis. They are defined with a first point/last point format, similar to the strings. The computer utilizes the last point information to compute the slope of the edge from the first point, but in fact goes from one edge of the submodel to the other, through the first point along the slope computed from the last point.

Due to the increased computing time required for diagonal edges, a maximum of eight may be used and still maintain a total of 64 edges. If more than eight are required, a two-to-one trade-off may be necessary, i.e., 10 diagonal limits the total count to 60. The absolute maximum is twenty-two diagonal edges, due to storage space.

The information down the "righthand" column should also be filled in. These are:

a. Data Base - The name of the data base that this submodel will eventually be a part of.
b. GRP # - This is the submodel number (0-5) which relates the RSM to a given runway.
c. OFF SETS - The X, Y, Z and heading off sets necessary to place the submodel in the proper place relative to the model origin.
d. SETS - These are counters which must be set so that the computer will know how many of each type edge is required.

S (symmetrical) - The symmetrical edges are entered into the computer as X edges and must be the first edges in the list. The S counter is then set to the correct number, so that the program knows how far down the list to look for symmetrical edges.

C (centerline) - The centerline edges are also entered as X edges and must follow directly behind the symmetrical edges. The C counter must then be set to the proper number.

X - This will be the total of all X edges, symmetrical, centerline and normal. The remainder of the X edges, i.e., the normal X edges, must be listed directly after the centerline edges. (see note below)

Y - Next in the list, after all of the X edges, comes the Y edges. This counter may be set to the number of Y edges. (see note below)

D - After the Y edges are listed, the diagonal edges are entered. The D counter may be set to the number of diagonal edges.

Note

The X, Y and D counters will be incremented as the edges are entered into the computer (discussed in paragraph 4-9). When the data entry is finished, the computer's count should be compared to the count on the modelling form, as this is one indication of typing errors.

T - This counter determines how many times the centerline edges are "rolled" ahead of the aircraft, which prevents the centerline stripes from going past the end of the runway, or stopping half way. As a general rule,

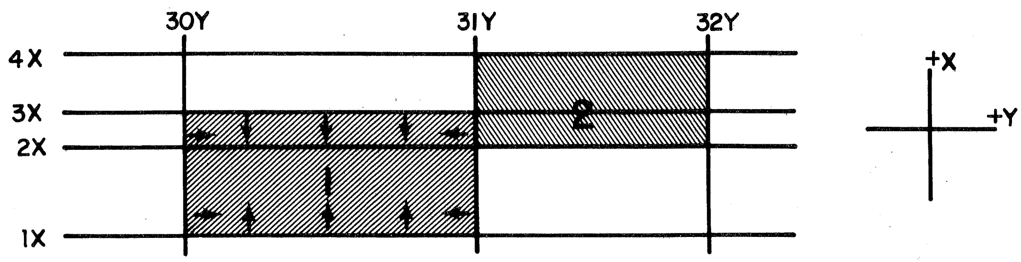
$$T = \frac{\text{Runway Length} - 800'}{(\text{CL edge \#3} - \text{CL edge \#1})}$$, rounded off to the nearest stripe.

M - This is the value of X, around which the symmetrical edges are reflected. This number may be derived by adding the value of the least symmetrical edge to the value which that same edge should have after reflection and dividing by two. This method will take into account displaced thresholds and overruns.

4.8 FACE DATA FORM

Once the edges have been defined, the surfaces are then constructed utilizing the edge number (not the value). A given surface may be made either grey or white by assigning the appropriate type number (Figure 4-3).

In defining the surfaces, it is important that the correct "sense" of the edge is assigned. Basically, this means telling the program which side of an edge is to be used. For the non-diagonal edges, this is straight forward. Consider the following surfaces:



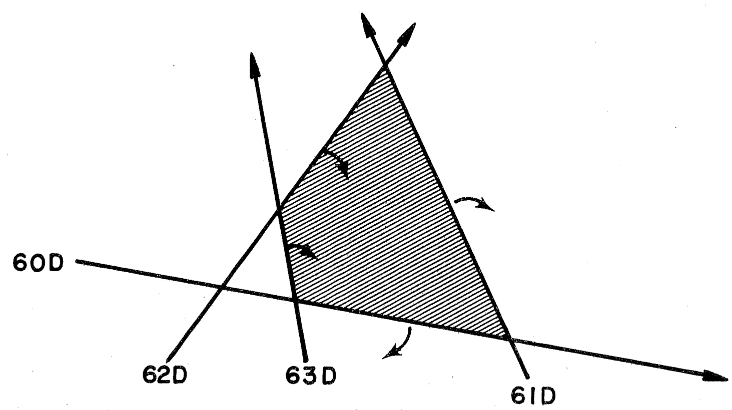
In order to "fill in" surface #1, the positive side of 1X and the negative side of 3X must be shaded. Also, the positive side of 30Y and the negative of 31Y are required. The entries on the data sheet for this surface should then be,

1	2	3	4
1	-3	30	-31

Similarly, the entries for #2 should be,

1	2	3	4
2	-4	31	-32

The Sense of a diagonal edge is related to its slope and may best be determined in the following manner:



If the edge were to be rotated clockwise around its first point; does it move into the surface or away from it? If it moves into the surface, it is considered to be a positive edge of that surface. If it moves away, it is a negative edge. In the above example, 62D and 63D are positive and 60D and 61D are negative for the surface represented by the shaded area. Therefore, for that surface the entry on the data form would be,

1	2	3	4
62	63	-60	-61

Consider the following example of a 30,000' runway with precision instrument markings, a parallel taxiway, three perpendicular turnoffs and two high speed turnoffs. The edge and surface data forms (Figure 4-2 and 4-3) have been filled out to agree with figure 4-4.

Some areas of interest are:

a. The edges are listed with the symmetrical edges first followed by the centerline, normal X, normal Y and diagonal, in that order.
b. The edges need not be listed in ascending value, although they may be somewhat easier for the modeller to work with if they are.
c. Two or more surfaces of the same color may not cross each other. The taxiway formed by faces 40 and 42 must be split where it crosses face 36.
d. A triangular face (38, 39, or 44) is considered as a four-sided face with one side listed twice.
e. Within the four edges entered for a face, there is no particular order required.
f. On the face data form the type 0 and 1 faces may be intermixed.
g. An edge is considered to have the same direction throughout its length, despite the fact that the surface being defined is "behind" the start point of the edge. Edges 62 and 63, in surface 42, have the same signs as in face 40.

4.9 STRING EDIT

What follows is a step-by-step description of the different aspects of the string edit program. This is conversational (question & answer) type program, which will ask the operator for the pertinent data required for the type strings or surfaces being entered. To enter the program into the TI980:

a. Place cassette containing STREDT in either drive.
b. Set that drive to playback.
c. Press rewind, wait for end light.
d. Press load, wait for ready light.
e. ON TI980:
   1. Set Run Switch to HALT.
   2. Press Reset Switch.
   3. Set up 0006 on Data Indicator Switches (i.e., #13 & 14 up, all others down).
   4. PC switch to ENTER.
   5. RUN switch to RUN.
   6. Press LOAD switch up. Wait for IDLE light to come on, (about 7 seconds).
   7. Press START switch. Wait for IDLE light again, indicating that the program is loaded.
   8. Press START switch.
f. Program will respond by typing "ZERO MEMORY?".
g. Type Y (for Yes). Computer then zeros the memory locations used for model storage, does several line feeds, types "PAGE 1", does several more line feeds and type " > ", indicating it is ready to receive data.

You are now ready to enter your model data. Tell the computer what kind of data (Strings, Edges, etc.) you wish to enter. For this, Modes must be established.

a. Operator types "M", program responds: (M) "ODES-RSM OR STRINGS?". If RSM data is to be entered, operator responds with "R" after which the program asks "ENGLISH OR METRIC?". Operator responds "E" or "M" depending on whether the measurements are in feet or meters. The program next asks "EDGES OR FACES?", and operator responds "E" or "F" to indicate which part of the RSM data is to be considered. Next, the program says "RSM # =" and operator enters the number of the RSM submodel that he is entering the data for.

If string data is to be entered, operator responds to the initial question with "S", after which the program asks "LAST POINT OR ANGULAR?". If the data to be entered is in the first point/last point form, the operator responds "L". If the data is in the angle/spacing format, he types "A". The program next asks "ENGLISH OR METRIC?", to which the operator responds "E" or "M", as above.

Note

After initial loading, the program comes up in strings, last point and English mode. If at any time another data format is required, some combination of the above process must be used.

4.10 ADD STRING (Last Point Mode)

a. Operator types "A"; program responds with (A)"DD STRING", a line feed, "#1". (On subsequent adds, computer will automatically give the next number in the string count, up to 400.)
b. After giving string number, program says "TYPE=". Operator responds with the (0-10) type code he has assigned for that string.

Note

After the operator types the pertinent data, the space bar should be pressed to enter the data and to move the program to the next step.

c. The program next says "FLAGS=", and operator enters the flag codes assigned to that string. If none, enter "0".
d. The program next says "#PTS=", and operator enters the number of lights in the string.
e. "COLOR="; enter color code required for the string.
f. "INT="; enter brightness value assigned.
g. If any type other than "0" has been specified, the program will now say "GROUP#="; enter the group number assigned to the runway with which the string is associated.
h. At this point, if directional lights have been indicated, program will say "HEADING="; operator enters heading of directional axis.

If a Type 5 VASI is indicated, program will now ask for elevation angle.

If a flashing flag has been entered on the next line, the program will say "PER="; the Period of the flash should be entered. "OT=", On-time of the light is entered. "PHA=" Phase is entered.

If a Type 3 has been specified, the program will line feed and say "PER", "WAIT" or "HDG", and "PHA".

i. After a line feed, the program will say "FIRST POINT (X, Y, Z)=". Operator will enter the values for X, Y & Z, which have been calculated and recorded on the modelling form.

j. After another line feed, the program will now say "LAST POINT X,Y,Z)="; the last point coordinates are now entered. This is the last entry for the string; program will now do a line feed and type " > ", indicating it is ready for another add string or modes, etc.

4.11 <u>ADD STRING (Angular)</u>

The entry process for angle/spacing defined strings is the same as above, down to step j. Rather than last point, the program will say "STRING DIRECTION"; the angle which the string extends from at the first point is entered. Program then says "SPACING="; the distance between lights is entered.

Using this spacing and the number of points indicated in step d, the program will then compute, and type on the next line the coordinates of the last point.

Note

> If a string only has one light, no last point or angle/spacing information is requested.

4.12 <u>ADD EDGE</u>

After the edge mode has been selected and the RSM group number specified, the appropriate edge data may be entered.

a. Operator types "A"; program responds with (A)"DD".

b. Operator now enters the type of edge which is required, i.e., X, Y or D. Symmetrical and centerline edges are entered as "X" at this point.

c. Program prints out "EDGE #0" (or sequential number up to 63), followed by "VALUE=" if an "X" or "Y" has been specified, or after a line feed, "START POINT=" if a diagonal edge is specified.

d. Operator now enters the value assigned to the "X" or "Y" edge, or the X, Y, Z coordinates of the first point, if diagonal. After first point, the program will line feed and ask for the "LAST POINT=".

e. After the value or last point data has been entered, program will line feed and type "   ", indicating it is ready for the next command.

4.13 <u>SETS</u>

In order to set the counters, the operator types "S", and program responds (S)"ET". The operator then types one of the following characters:

   a. "S" - Program responds (S)"YMMETRICAL X EDGE COUNT=". Operator enters number of symmetrical edges.

b. "C" - Program responds (C)"ENTERLINE X EDGE COUNT=". Operator enters the number of centerline edges.

c. "X" - Program responds "TOTAL X (TYPE 0) EDGE COUNT=". Operator may either examine this counter by pressing the space bar, or he may set it by entering the total number of X edges assigned to the submodel.

d. "Y" - Program responds (Y)"(TYPE 1) EDGE COUNT="; handled the same as step c. - applies for Y edges.

e. "D" - Program responds (D)"IAGONAL EDGE COUNT="; handled the same as step c. - applies for diagonal edges.

f. "T" - Program responds (T)"OTAL CENTERLINE COUNT=". Operator enters the number of centerline stripes required in the submodel.

g. "M" - Program responds (M)"IRROR X SYMMETRY POINT=". Operator enters the point about which the symmetrical edges will be reflected.

An additional feature for the convenience of the operator is the replicate capability. This allows the operator to duplicate an entire RSM submodel into another submodel number. If two or more submodels are very similar, it may be easier to type one and then replicate it into the other, and then make the required changes, than it would be to type both. After Set, the operator enters the number of the submodel to be copied. Program then says "IN RSM#", and operator enters the number of the submodel he is creating.

Note

The change routine (see paragraph 4.19.2) has no facility for changing the type of an edge if an error is made. The following procedure may be used.

If, for example, an edge has been entered as an X and it should be Y, then the X edge counter will have been incremented and will show one more than the expected total. Via the SET entries above the operator may change the X count to one less than it was, and the Y count to one more than it was. The counters will then have the correct numbers and the program will consider the incorrectly entered edge as a Y edge rather than an X edge.

4.14 ADD FACE

a. Operator types "A"; program responds with (A)"DD FACE #0". (Program automatically gives next number of face counting, up to #63.)

b. Program next says "TYPE="; operator enters "0" or "1" for a light-grey or dark-grey face, respectively.

c. Program then says "±E1, ±E2, ±E3, ±E4"; operator enters the edge numbers, as entered above, of the four edges which make up the face. Attention must be given to ensure that the edges are assigned the correct sense, i.e., a negative sign must be entered when required.

4.15 WRITE

When all of the strings, edges and faces in the model (or submodel) have been entered, the data may be written onto a magnetic tape cassette for storage.

a. Ensure that the tape is "Write" enabled, i.e., the holes on the bottom edge of the cassette are covered.

b. Cassette initialization: When the computer is instructed to write a model, it reads through the tape until it finds an end of file mark. When the mark is found, the tape is reversed back to the beginning of the end of file mark and the model data in the computer memory is written over the end of file mark. At the conclusion of the writing process, another end of file mark is automatically placed on the tape to indicate the new end of the model data. If the tape does not have any models already on it, or if an old model tape is to be overwritten, the operator will need to place an end of file mark at the beginning of the tape.

   This is accomplished by typing "I"; the program responds (I)"NIT UNIT#"; operator answers "1" or "2", depending on which drive the tape is in. An end of file mark will then be written on the tape and the program will return, ready for the next step.

Note

This procedure must be carried out before the start of the load and pack process (see below), as the program will not accept the "I" as a command during that time.

c. Type "W"; program will respond (W)"RITE UNIT#". Operator enters "1" or "2", depending on which drive unit (left or right) that the tape to be written on is in.

d. Program next asks for "FILE NAME-". The operator now enters the name he wishes to assign to the model or submodel. The name must have eight characters; the last two of which are numbers. (These two digits become the model number on the final model tape.) After the last character of the file name is entered, the program rewinds the cassette drive indicated and starts reading the tape, looking for the end of file mark. When it is found, the model data is recorded (as indicated by the blinking red lights on the record panel).

Note

The program writes a 400 string model with six RSM submodels each time. If there are not that many in the model, then they are written as empty data locations, i.e., a two string submodel takes the same amount of tape as a full final model.

e. After the write process is complete, the tape rewinds and the program asks "ZERO MEMORY?". If a new model is to be worked on, the operator should respond with "Y". If, however, an additional copy of the model is required or additional work is to be done to it, the operator should respond with "N", and carry on as required.

4.16 LOAD AND PACK

This is the process used to assemble the submodels into the final model and/or offset the final model to the simulator origin.

a. Operator types "L"; program responds (L)"OAD FILE="; operator enters the eight character name of the first submodel, or if the model is already in the computer memory, types a carriage return.

b. Program next says "READ UNIT#"; operator enters "1" or "2", depending on which cassette drive the submodel tape is in. Computer will then read the model data from the tape. (This step is deleted if the model is already in memory.)

c. When the read is complete, the program will say "ROTATION ANGLE="; operator enters the degrees of rotation necessary to align the submodel coordinate system with the final model coordinate system.

   If the situation arises where the final model must be rotated to correspond with some heading in the host computer, this rotation will have to be done on each submodel individually. For example, if a submodel needs 40 degrees of rotation to align it with the final model, but the final model must be rotated 30 degrees to align with the simulator, then the submodel should be rotated 70 degrees.

d. Program next says "DISPLACEMENT X, Y, Z (FEET)="; operator enters the X, Y, Z measurements from the final model origin to the submodel origin. (This can be thought of as the X, Y, Z point on the final model coordinate system at which the submodel origin is located.)

e. The program now provides the following information about the submodel which may be useful as a reference.
   1. Number of red, orange, yellow and green lights.
   2. Number of strings and total number of lights.
   3. String point list cross reference; this is a list of the data locations at which the first four words of the string data are stored in the final model format. If this list is not required, the operator may skip it by placing Sense Switch #1, on the computer face, in the "UP" position.

f. Program now again says "LOAD FILE=", indicating it is ready for another submodel. The above process is repeated until all submodels have been read into the computer memory. When no more submodels remain, the operator responds to "LOAD FILE=" by typing "$".

g. Program now provides:
   1. Total number of red, orange, yellow and green lights.
   2. Total number of strings and lights.

Note

If the total red and orange lights is greater than 400, or if the total lights is greater than 6000, an advisory caution statement will be printed.

h. Program next says "MODEL OFFSET X, Y, Z (FEET)="; operator enters the X, Y, & Z measurements from the simulator origin to the final model origin.

i. Program now says "RSM OFFSET="; operator enters any offset required to make the Group 0 RSM coordinate system coincide with the final model coordinate system.

j. Program now says "RSM HEADING ANGLE="; operator enters degrees of rotation required to align the Group 0 RSM data with the Group 0 runway lights, etc.
k. Program now provides the number of X edges, Y edges, Diagonal edges and faces in Group 0.
l. Steps i., j., and k., are repeated for RSM Groups 1-5.
m. Program next says "WRITE UNIT #"; operator enters number of cassette driver in which the tape to be written on is placed.

Note

At this point the load and pack routine has been exited.

n. Program says "FILE NAME-"; operator enters eight character name of the model.
o. Final model data is now written on the magnetic cassette.

4.17 READ

In order to change or add to an existing model or submodel, the operator places the model tape in either cassette drive.

a. Operator types "R"; program responds (R)"EAD UNIT #"; operator enters number of cassette drive.
b. Program says "FILE NAME-"; operator enters eight character name of model he wishes to alter.

Note

When alterations are complete, the revised model may be written in a new place on the tape (under a different name/number) or in the same place it was before under the same title.

c. The model tape is now read until the desired model is found. When found, the data is read into the computer memory.
d. When the read is complete, the program will type " > ", indicating it is ready for data.

4.18 CONVENIENCE FEATURES

The following are some of the features incorporated to make the data entry process easier.

4.18.1 Space Bar Use

When the ADD functions are being performed, the program "remembers" the data entered in the previous string (edge or face). If a data entry in the current string is the same as in the previous one (type or # of points, for example) pressing the space bar will enter that data into the current string (edge or face).

4.18.2 Escape (ESC)

Similarly, if at some point, all of the remaining data in a string is the same as in the previous one, the escape (ESC) key may be pressed and the remainder of the data will be entered.

Note

> When considering string location, the program "remembers" the first point and the vector to the next light in the string. Therefore, the data for last point may have to be typed each time, even though the numbers are the same as in the previous strings.

4.18.3 Rubout

If a typing mistake is noticed before it is entered into memory, pressing RUBOUT will cause the machine to backspace to the beginning of the entry and line feed, at which time the correct entry may be made. If the erroneous data has already been entered, then a change string must be performed. (See paragraph 4.19.2)

4.18.4 Title Listing

When the program is reading a model tape, during the read or write process, it will print out the eight character title of each model it reads through. This may be helpful if the contents of the tape are unknown.

4.19 VOCABULARY PROGRAM

The following is an explanation of the program "vocabulary".

4.19.1 Add

See paragraph 4.10.

4.19.2 Change

Used in order to alter an existing string, edge or face (depending on what mode the program is in). Operator types "C"; program responds (C)"HANGE STRING #". Operator enters number of string to be changed. Program now asks the same questions it does in ADD STRING. If the data item is not to be changed, operator presses the space bar to retain present data. If item is to be changed, operator types in new data when the item is asked for.

Note

> The program remembers the angle/spacing of the string. If the number of points in the string is changed, the program will compute a new last point reflecting the same angle/spacing, but more lights. In this situation, the last point will have to be retyped if it is to remain the same.

4.19.3 Delete

A string or group of strings may be completely deleted by typing "D"; program responds (D)"ELETE STRING #"; operator enters number of the first string to be deleted. Program then says "THROUGH"; operator enters the number of the last string to be deleted. All of the strings following this block in the model are moved up the list the appropriate amount.

4.19.4 Initialize See paragraph 4.15.

4.19.5 Print

To print out the data contained in a block of strings, the operator types "P"; program responds (P)"RINT STRING #". Operator enters number of the first string to be printed. Program next types "THROUGH", and operator enters the number of the last string to be printed.

By responding "A", rather than a number, the operator may list all of the strings, edges or faces in the model.

4.19.6 Read See paragraph 4.18.

4.19.7 Write See paragraph 4.15.

4.19.8 Zero Memory?

The computer memory may be zeroed out at anytime by typing "Z" and then responding "Y" to the (Z)"ERO MEMORY?" question. This should always be done when work on a model is initiated.

Note

If an attempt is made to read a model into memory and another model is already there, a read error will occur.

4.19.9 (CNTL) L

This will reinitiate the page count.

FILE NAME: ______________

	STR	TYP	FLG	PTS	COL	INT	GRP	PER	HDG WT OT	ELV PHA	X	Y	Z	ANGLE/SPACING
														/
														/
														/
														/
														/
														/
														/
														/
														/
														/
														/
														/
														/
														/
														/
														/
														/
														/
														/
														/

Group	Rnway
0	______
1	______
2	______
3	______
4	______
5	______

Offsets for: ______________

X ________

Y ________

Z ________

HDG ________ Page ___ of ___

Figure 4-1.

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#	Typ			
0		10		
1		150		
2		500		
3		575		
4		1000		
5		1150		
6		1500		
7		1575		
8		2000		
9		2075		
10		2500		
11		2575		
12		3000		
13		3075		
14		400		
15		550		
16		650		
17		800		
18		900		
19		1050		
20		1150		
21		1300		
22		0		
23		100		
24		8500		
25		8600		
26		9900		
27		10,000		
28	Y	-540		
29		-460		
30		-75		
31		-72		

#	Typ			
32		-67		
33		-61		
34		-55		
35		-52		
36		-49		
37		-43		
38		-40		
39		-37		
40		-25		
41		-22		
42		-10		
43		-1.5		
44		-1.5		
45		10		
46		22		
47		25		
48		37		
49		40		
50		43		
51		49		
52		52		
53		55		
54		61		
55		67		
56		72		
57		75		
58		-2600		
59	D	2000 / 3000	-460 / -75	0 / 0
60	D	2200 / 3200	-460 / -75	0 / 0
61	D	2400 / 2800	-460 / -75	0 / 0
62	D	4500 / 3500	-460 / -75	0 / 0
63	D	4700 / 3700	-460 / -75	0 / 0

DATA BASE

GRP # 0

OFF SETS

X = 0

Y = 0

Z = 0

HDG = 0

SETS

S = 14

C = 8

X = 28

Y = 31

D = 5

T = 37

M = 5000

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Figure 4-2.

FACE #	TYPE	1	2	3	4
0	0	0	-1	32	-34
1	0	0	-1	35	-38
2	0	0	-1	39	-40
3	0	0	-1	41	-42
4	0	0	-1	45	-46
5	0	0	-1	47	-48
6	0	0	-1	49	-52
7	0	0	-1	53	-55
8	0	2	-3	32	-33
9	0	2	-3	34	-36
10	0	2	-3	37	-39
11	0	2	-3	48	-50
12	0	2	-3	51	-53
13	0	2	-3	54	-55
14	0	4	-5	32	-39
15	0	4	-5	48	-55
16	0	6	-7	34	-36
17	0	6	-7	37	-39
18	0	6	-7	48	-50
19	0	6	-7	51	-53
20	0	8	-9	34	-36
21	0	8	-9	37	-39
22	0	8	-9	48	-50
23	0	8	-9	51	-53
24	0	10	-11	37	-39
25	0	10	-11	48	-50
26	0	12	-13	37	-39
27	0	12	-13	48	-50
28	0	14	-15	43	-44
29	0	16	-17	43	-44
30	0	18	-19	43	-44
31	0	20	-21	43	-44

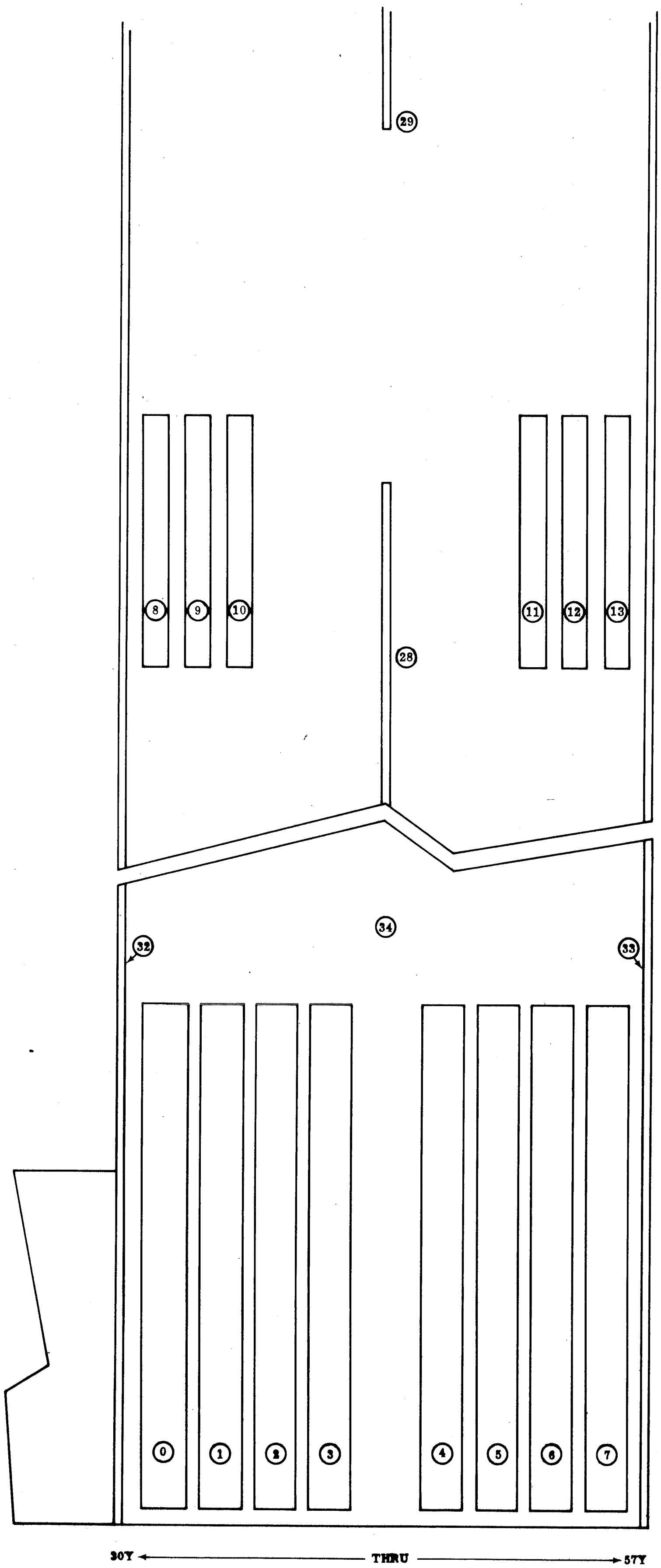
FACE #	TYPE	1	2	3	4
32	0	22	-27	30	-31
33	0	22	-27	56	-57
34	1	22	-27	30	-57
35	1	22	-23	28	-30
36	1	23	-26	28	-29
37	1	-59	29	60	-30
38	1	-61	59	59	-30
39	1	-60	29	61	61
40	1	-62	29	63	-30
41	1	24	-25	29	-30
42	1	-62	-26	63	-28
43	1	26	-27	-62	-30
44	1	-63	-63	-26	-58

FILE NAME: ____________________

MODEL NAME: ____________________

Page ___ of ___

Figure 4-3. Face Data Form



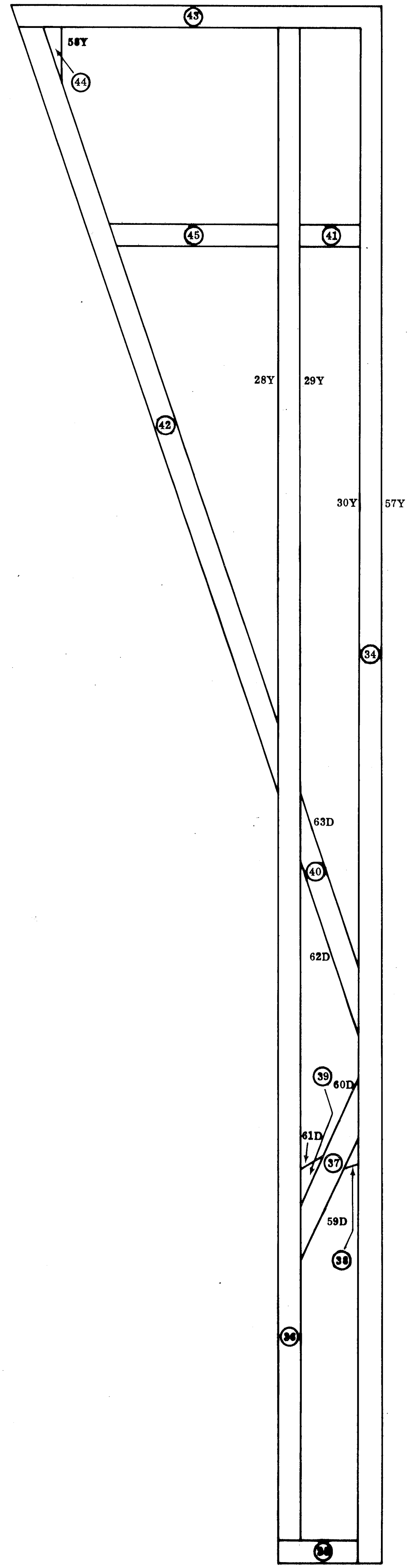


Figure 4-4. Faces and Edges

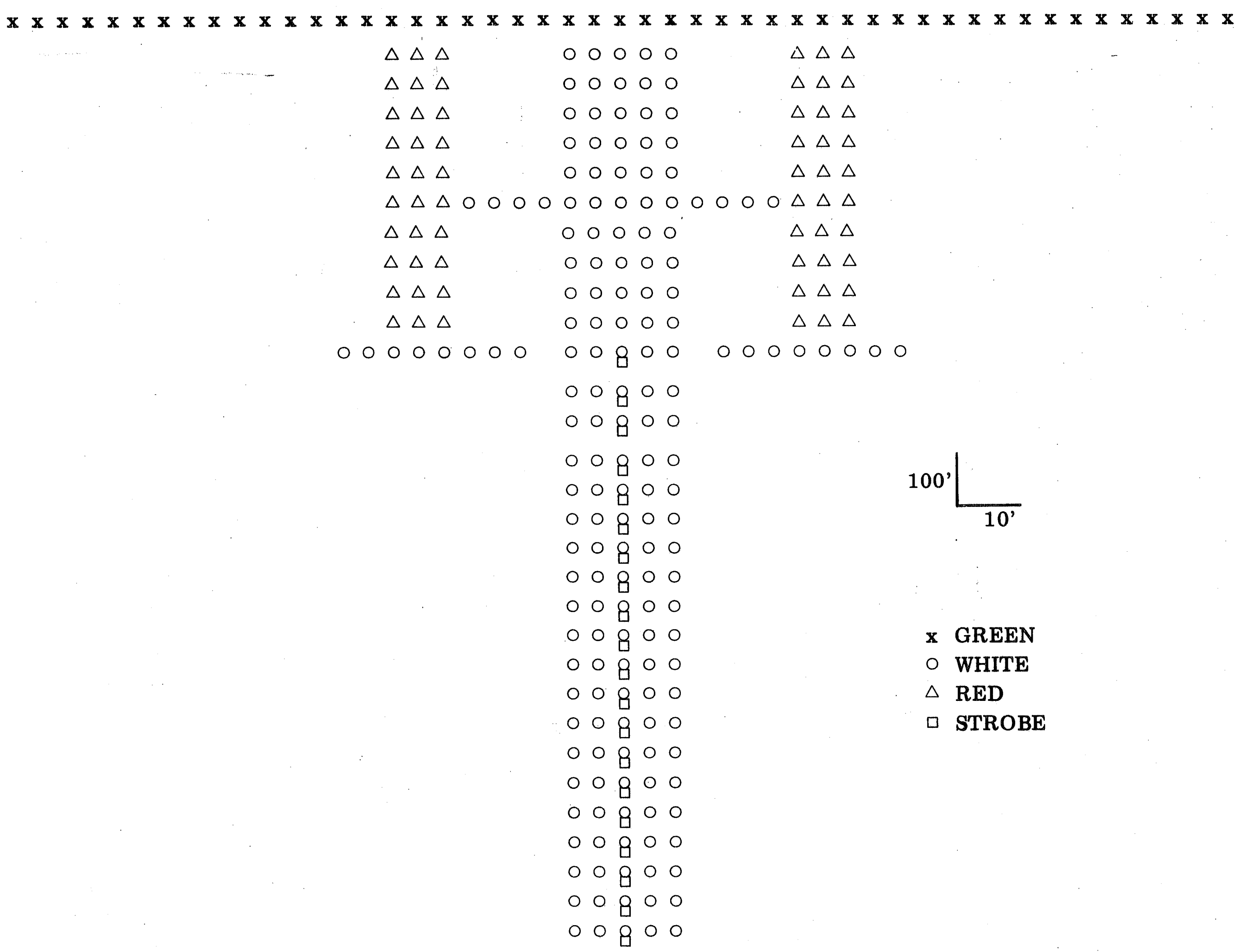


Figure 4-5. CAT II Lighting

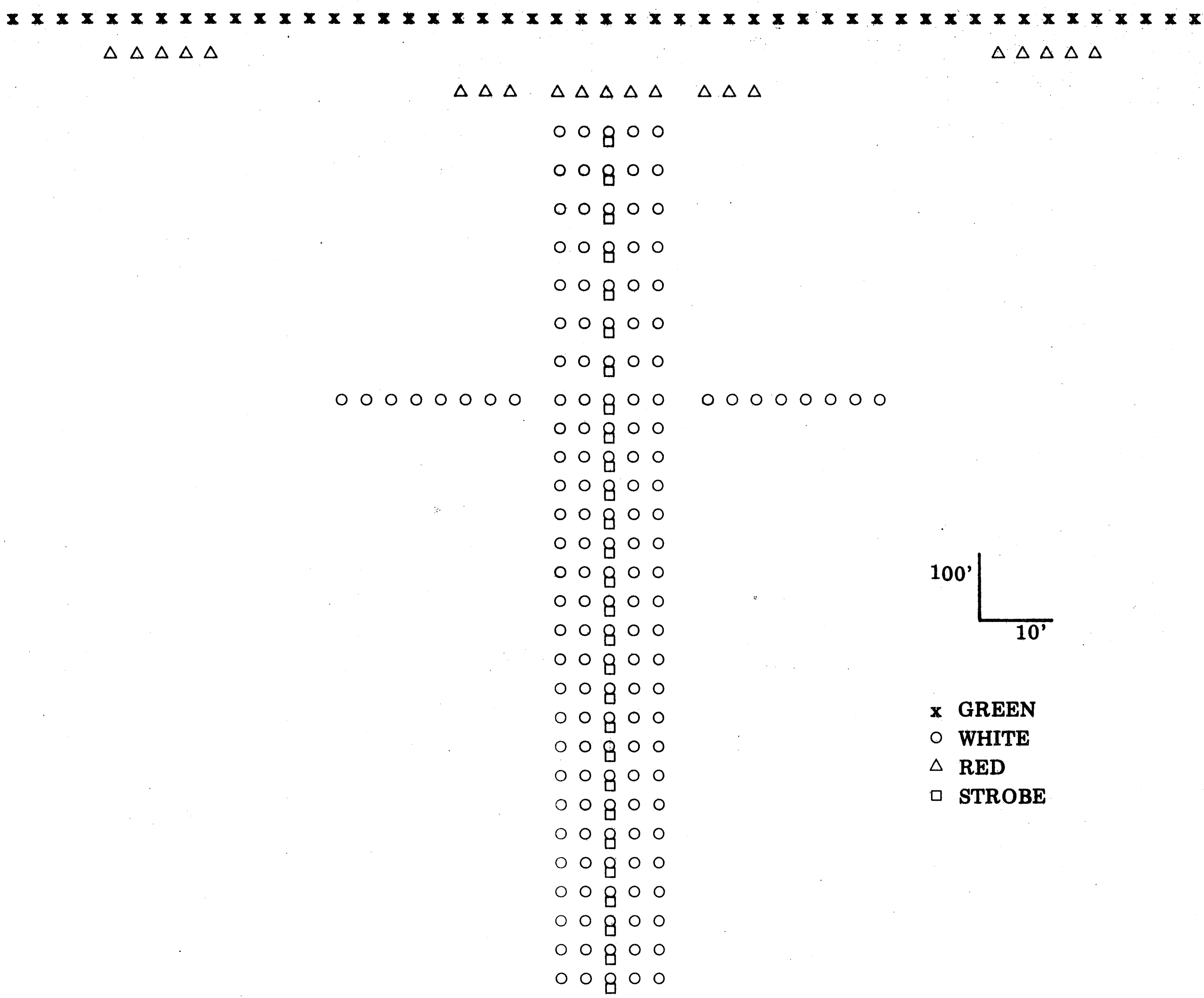


Figure 4-6. CAT I Lighting

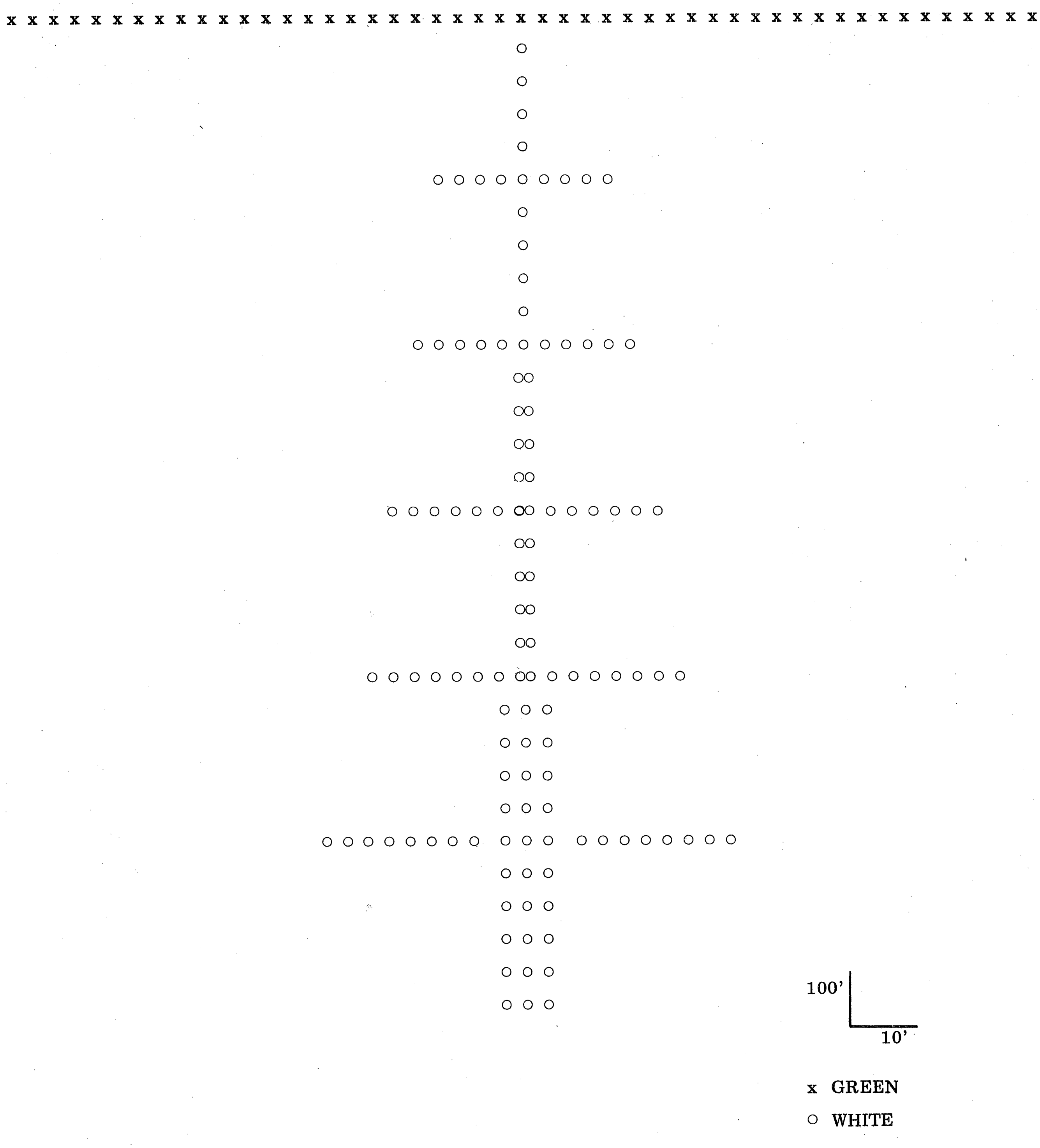


Figure 4-7. Calvert Lighting

FILE NAME: ______________________

CAT I	STR	TYP	FLG	PTS	COL	INT	GRP	PER	HDG WT OT	ELV PHA	X	Y	Z	ANGLE / SPACING
Str[illegible]		3	D	14	3	1.5			180		-2900 / -300	0 / 0	0 / 0	
C_L Left #2		1	ID	28	"	"			"		-3000 / -300	-7 / -7	" / "	
C_L Left #1		"	"	"	"	"			"		" / "	-3.5 / -3.5	" / "	
C_L		"	"	"	"	"			"		" / "	0 / 0	" / "	
C_L Right #1		"	"	"	"	"			"		" / "	3.5 / 3.5	" / "	
C_L Right #2		"	"	"	"	"			"		" / "	7 / 7	" / "	
Left X Bar		"	"	8	"	"			"		-1000 / -1000	-15 / -50	" / "	
Right X Bar		"	"	"	"	"			"		" / "	50 / 15	" / "	
Terminal L		"	"	3	0	"			"		-200 / -200	-15 / -25	" / "	
Terminal R		"	"	"	"	"			"		" / "	25 / 15	" / "	
Terminal C_L		"	"	5	"	"			"		" / "	7 / -7	" / "	
Pre-[illegible]eshold		"	"	"	"	"			"		-100 / -100	-85 / -100	" / "	
Pre-Threshold		"	"	"	"	"			"		" / "	100 / 85	" / "	
Threshold		2	"	49	4	1.25			"		0 / 0	120 / -120	" / "	

Group	Runway
0	
1	
2	
3	
4	
5	

Offsets for: ______________________

X ____________

Y ____________

Z ____________

HDG ____________ Page ____ of ____

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Figure 4-8.

FILE NAME: ____________________

CAT II	STR	TYP	FLG	PTS	COL	INT	GRP	PER	HDG WT OT	ELV PHA	X	Y	Z	ANGLE / SPACING
Strobe		3	D	11	3	1.5		0	180	0	-3000 / -1000	0 / 0	0 / 0	CAT II
C_L 2R		1	ID	30	"	1.35	"		"		" / -100	7 / 7	" / "	
C_L 1R		"	"	"	"	"	"		"		" / "	3.5 / --	" / "	
C_L		"	"	"	"	"	"		"		" / "	0 / --	" / "	
C_L 1L		"	"	"	"	"	"		"		" / "	-3.5 / --	" / "	
C_L 2L		"	"	"	"	"	"		"		" / "	-7 / --	" / "	
X Bars 1000'		"	"	8	"	"	"		"		-1000 / -1000	50 / 15	" / "	
X Bars 1000'		"	"	"	"	"	"		"		" / "	-15 / --	" / "	
X Bars 500'		"	"	4	"	"	"		"		-500 / -500	25.8 / 10.8	" / "	
X Bars 500'		"	"	"	"	"	"		"		" / "	-10.8 / --	" / "	
Red Wing		"	"	9	0	"	"		"		-900 / -100	40 / 40	" / "	
"		"	"	"	"	"	"		"		" / --	35 / --	" / --	
"		"	"	"	"	"	"		"		" / --	30 / --	" / --	
"		"	"	"	"	"	"		"		" / --	-30 / --	" / --	
"		"	"	"	"	"	"		"		" / --	-35 / --	" / --	
"		"	"	"	"	"	"		"		" / --	-40 / --	" / --	
Threshold		2	"	49	4	"	"		"		0 / 0	120 / -120	" / "	

Group	Runway
0	______
1	______
2	______
3	______
4	______
5	______

Offsets for: ____________________

X ____________

Y ____________

Z ____________

HDG ____________ Page ____ of ____

Figure 4-9.

FN 1039 (9/76)

REDIFON

FILE NAME: ______________

CALVERT	STR	TYP	FLG	PTS	COL	INT	GRP	PER	HDG WT OT	ELV PHA	X	Y	Z	ANGLE / SPACING
Threshold	1	2	ID	49	4	1.25	0		180		0 0	-120 120	0 0	
Approach ℄	2	1	"	10	3	"	"		"		-100 -1000	0 0	0 0	
"	3	"	"	"	"	"	"		"		-1100 -2000	-2.5 -2.5	" "	
"	4	"	"	"	"	"	"		"		" "	2.5 2.5	" "	
"	5	"	"	"	"	"	"		"		-2100 -3000	-5 -5	" "	
"	6	"	"	"	"	"	"		"		" "	0 0	" "	
"	7	"	"	"	"	"	"		"		" "	5 5	" "	
Cross Bar	8	"	"	9	"	"	"		"		-500 -500	-36 36	" "	
"	9	"	"	5	"	"	"		"		-1000 -1000	50 14	" "	
"	10	"	"	"	"	"	"		"		" "	-14 -50	" "	
"	11	"	"	6	"	"	"		"		-1500 -1500	62.5 17.5	" "	
"	12	"	"	"	"	"	"		"		" "	-17.5 -62.5	" "	
"	13	"	"	7	"	"	"		"		-2000 -2000	75 21	" "	
"	14	"	"	"	"	"	"		"		" "	-21 -75	" "	
"	15	"	"	8	"	"	"		"		-2500 -2500	87.5 24.5	" "	
"	16	"	"	"	"	"	"		"		" "	-24.5 -87.5	" "	
	17													
	18													
	19													
	20													

Group	R'nway
0	____
1	____
2	____
3	____
4	____
5	____

Offsets for: ______________

X ________

Y ________

Z ________

HDG ________ Page ___ of ___

Figure 4-10.

FN 1037 (9/76)

VOLUME 3
NOVOVIEW VISUAL SYSTEM
VENDOR DOCUMENTATION

MANUAL NO. 75115
ORIGINAL ISSUE
LEAR 35/36

REDIFON

SECTION I

GENERAL

1.1 INTRODUCTION

This volume contains a list of the vendor manuals necessary to maintain and operate the NOVOVIEW Visual System. These manuals have been shipped under separate cover.

Novoview 6000 Image Generator & Display Manual

Novoview RSM Software

Novoview 6000/RSM System Drawings

Manual, CM325, Color Graphics CRT Monitor

Maintenance Manual System Description

Maintenance Manual Arithmetic Unit & Control Console

Maintenance Manual Memory, Memory Controller & Direct Memory Access Channel (DMAC)

Maintenance Manual Power Supply

Maintenance Manual Parts List & Assy. Drwg.

Maintenance Manual Electrical Drawings

Maintenance Manual Load, Pin & Wire List

Maintenance Manual Logic Documentation List

Assembly Language Programmer's Ref. Manual

CPU Performance Assurance Test

Assembly Language Input/Output

Communications Module User's Manual

Terminal User's Guide Engineering Data

Input/Output Data Module User's Manual

Direct Memory Access Channel Manual

733 ASR/KSR Cperating Instructions

733 ASR/KSR Maintenance Manual

Vendor Maintenance Manuals Supplied

TITLE	PART NUMBER	MANUFACTURER
Novoview 6000 Image Generator & Display Manual	901023-002	Evans & Sutherland Computer Corp.
Novoview RSM Software	908000-001	Evans & Sutherland Computer Corp.
Novoview 6000/RSM System Drawings	901023-001	Evans & Sutherland Computer Corp.
Manual, CM325, Color Graphics CRT Monitor	901019-100	Kratos Display Division
Maintenance Manual System Description	TI 943012-9701	Texas Instruments Incorporated
Maintenance Manual Arithmetic Unit & Control Console	TI 960699-9702	Texas Instruments Incorporated
Maintenance Manual Memory, Memory Controller & Direct Memory Access Channel (DMAC)	TI 943012-9702	Texas Instruments Incorporated
Maintenance Manual Power Supply	TI 942773-9703	Texas Instruments Incorporated
Maintenance Manual Parts List & Assy. Dwg.	TI 943012-9703	Texas Instruments Incorporated
Maintenance Manual Electrical Drawings	TI 943012-9704	Texas Instruments Incorporated
Maintenance Manual Load, Pin & Wire List	TI 943012-9705	Texas Instruments Incorporated
Maintenance Manual Logic Documentation List	TI 943012-9706	Texas Instruments Incorporated
Assembly Language Programmer's Ref. Manual	TI 943013-9701	Texas Instruments Incorporated
CPU Performance Assurance Test	TI 961961-9770	Texas Instruments Incorporated
Assembly Language Input/Output	TI 961961-9734	Texas Instruments Incorporated
Communications Module User's Manual	TI 966643-9701	Texas Instruments Incorporated
Terminal User's Guide Engineering Data	TI 943010-9701	Texas Instruments Incorporated
Input Output Data Module User's Manual	TI 965956-9701	Texas Instruments Incorporated

Vendor Maintenance Manuals Supplied (continued)

TITLE	PART NUMBER	MANUFACTURER
Direct Memory Access Channel Manual	TI 966312-9701	Texas Instruments Incorporated
733 ASR/KSR Operating Instructions	TI 959227-9701	Texas Instruments Incorporated
733 ASR/KSR Maintenance Manual	TI 960129-9701	Texas Instruments Incorporated

VOLUME 4
NOVOVIEW VISUAL SYSTEM
SOFTWARE MANUAL

MANUAL NO. 75115
ORIGINAL ISSUE
LEAR 35/36

REDIFON

VOLUME 5
NOVOVIEW VISUAL SYSTEM
ACCEPTANCE PROCEDURES

MANUAL NO. 75115
ORIGINAL ISSUE
LEAR 35/36

REDIFON

SECTION I

GENERAL

1.1 INTRODUCTION

This manual should contain the Acceptance Procedures for the Novoview Visual System. These procedures have been shipped prior to this date under separate cover. Upon receipt of this manual, place Acceptance Procedures in this section.

VOLUME 6
NOVOVIEW VISUAL SYSTEM
BUFFERED INTERFACE UNIT
& VISUAL CONTROL PANEL

MANUAL NO. 75115

ORIGINAL ISSUE

LEAR 35/36

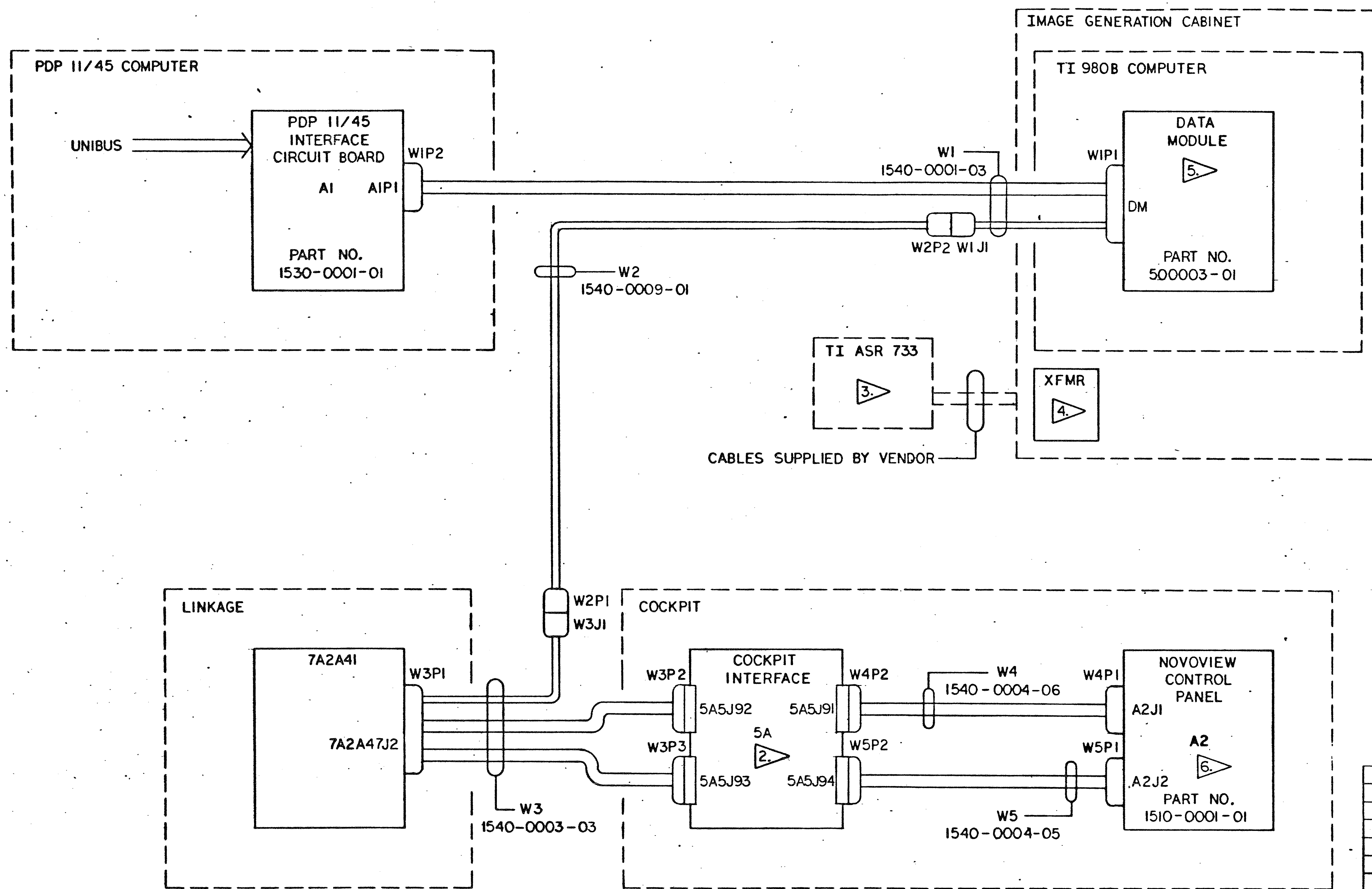
REDIFON

SECTION I

GENERAL

This volume will be provided at a later date. In the interim, drawings and schematics on the buffered interface unit and on the visual control panel can be found in Volume 7.

ZONE	LTR	REVISIONS DESCRIPTION	DATE	APPROVED



NOTES:

1. CABLE SYSTEM AS SHOWN.
2. WIRE COCKPIT INTERFACE PER DWG NO. 500072.
3. INSTALL DUAL FAST FORWARD FEATURE TO ASR 733 PER DWG NO. 500002.
4. INSTALL TRANSFORMER PER DWG NO. 500001.
5. INSTALL OUTPUT PROTECT FEATURE TO DATA MODULE CIRCUIT BOARD PER DRAWING NO. 500003.
6. INSTALL MOUNTING BRACKET PER DWG NO. 500052.

QTY	CODE IDENT	PART NUMBER	DESCRIPTION
1	53988	500052-01	BRACKET, MOUNTING
1	53988	500072	WIRE LIST, CKPT INTFC
1	53988	500003-01	I/O DATA MODULE
1	53988	500002-01	DUAL FAST FORWARD FEATURE
1	53988	500001	INSTL, BOOST TRANSFORMER
1	53988	1540-0004-06	CABLE ASSY, SPECIAL PURPOSE
1	53988	1540-0004-05	CABLE ASSY, SPECIAL PURPOSE
1	53988	1540-0003-03	CABLE ASSY, SPECIAL PURPOSE
1	53988	1540-0009-01	CABLE ASSY, 6 WIRE
1	53988	1540-0001-03	CABLE ASSY, PDP 11/45
1	53988	1530-0001-01	CIRCUIT BD ASSY, PDP 11/45 INTFC
1	53988	1510-0001-01	CONTROL PANEL ASSY

NEXT ASSY	USED ON
	LEAR

APPLICATION

UNLESS OTHERWISE SPECIFIED ALL DIMENSIONS ARE IN INCHES
3 PLACE DECIMALS ±0.010
2 PLACE DECIMALS ±0.030
1 PLACE DECIMALS ±0.060

MATERIAL —/—

FINISH —/—

CONTRACT NO. 75115

©REDIFON ELECTRONICS, INC ARLINGTON, TEXAS

DRAFTSMAN	J. Nix	3-7-77
DESIGNER		
CHECKER	Dww	
ENGINEER	D. Wilson	3-14-77
OTHER	[illegible]	3-15-77
FINAL	[illegible]	3-15-77

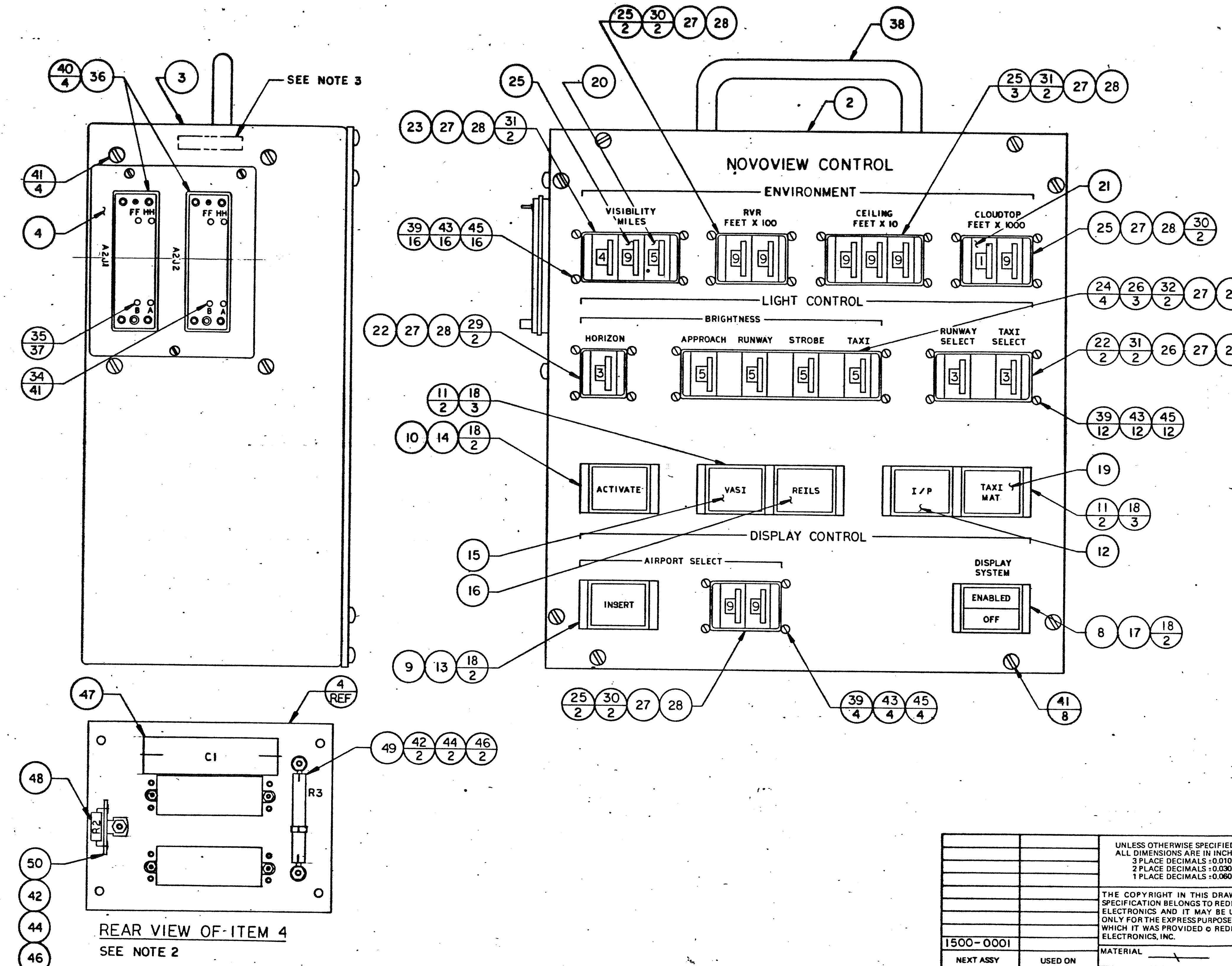
REDIFON

TITLE NOVOVIEW ELECTRONICS ASSEMBLY

SIZE	CODE IDENT NO.	DRAWING NO.
D	53988	1500-0003

SCALE: NONE | DO NOT SCALE THIS DWG | SHEET 1 OF 1

ZONE	LTR	REVISIONS DESCRIPTION	DATE	APPROVED



NOTES:

1. (X over X) DENOTES ITEM NO. / DENOTES QTY USED.
2. WIRE PANEL PER DWG NO. 500011.
3. ASSEMBLY NUMBER TO BE RUBBER STAMPED IN .12 CHARACTERS, WHITE INK, IN THE APPROXIMATE POSITION SHOWN.

ITEM	QTY	PART NUMBER	DESCRIPTION	VENDOR
50	1	863	TERMINAL STRIP	H.H.SMITH
49	1	880-1018	RESISTOR, ADJ., 50Ω, 12W	ALLIED
48	1	823-1051	RESISTOR, 5.1Ω, 3W	ALLIED
47	1	39D1086040GP4	CAPACITOR, 1000MF, 40V	SPRAGUE
46	3		NUT, HEX NO.4	
45	32		NUT, HEX NO.2	
44	3		WASHER, LOCK NO. 4	
43	32		WASHER, LOCK NO.2	
42	3		SCREW, PAN HD 4-40 X 1/4	
41	12		SCREW, PAN HD 6-32 X 1/4	
40	8		SCREW, SKT HD 4-40 X 1/4	
39	32		SCREW, PAN HD 2-56 X 3/8	
38	1	H-9111-B	HANDLE ASSY	BUD
37				
36	2	MS50RM-58	CONNECTOR	BURNDY
35	37	RC24M-9	CONTACT PINS, FEMALE	BURNDY
34	41	RM24M-9	CONTACT PINS, MALE	BURNDY
33	19	6839	LAMP	GE
32	2	2-45002-7	STUD ASSY	DIGITRAN
31	6	-3		
30	6	-2		
29	2	2-45002-1	STUD ASSY	
28	8	8-06042-2	MTG BRACKET, LEFT	
27	8	8-06041-2	MTG BRACKET, RIGHT	
26	4	8-10056-2	SPACER	
25	9	8078/230	SWITCHING MODULE, 0-9	
24	4	8-R-260	, 0-5	
23	1	8-R-295	, 0-4	
22	3	8-R-264	, 0-3	
21	1	8037/230	, 0-1	
20	1	8-R-259	SWITCHING MODULE, 0, .5	DIGITRAN
19	1	10EARIVI3	LENS, TAXI MAT	MASTER SPECIALTIES
18	12	10E505	BARRIER	MASTER SPECIALTIES
17	1	10EARIVI6	LENS, ENABLED / OFF	
16	1	10EARIVI2	, REILS	
15	1		, VASI	
14	1		, ACTIVATE	
13	1		, INSERT	
12	1	10EARIVI2	LENS, I/P	
11	4	10EAICIF3J3L(AW)NI	SWITCH, LIGHTED PUSHBUTTON	
10	1	10EAICIF1J3L(RW)NI		
9	1	10EAICIF1J3L(RG)NI		
8	1	10EAICIF3J3L(GW)NI	SWITCH, LIGHTED PUSHBUTTON	MASTER SPECIALTIES
7	200FT	252419	WIRE, 24 AWG	DEARBORN
6	AR	805036W	TAPE, NYLON LACING	DEARBORN
5		500011	WIRING DIAGRAM - CONT PNL	REDIFON
4	1	500008-01	CONNECTOR MTG PLATE	REDIFON
3	1	500007-01	BOX - CONTROL PANEL	
2	1	500006-01	PANEL - CONTROL	
1		1510-0001	CONTROL PANEL ASSY	REDIFON

NEXT ASSY	USED ON
1500-0001	

APPLICATION

UNLESS OTHERWISE SPECIFIED ALL DIMENSIONS ARE IN INCHES
3 PLACE DECIMALS ±0.010
2 PLACE DECIMALS ±0.030
1 PLACE DECIMALS ±0.060

MATERIAL —

FINISH —

CONTRACT NO. 75113

DRAFTSMAN	[illegible]	2/10/75
DESIGNER		
CHECKER	DWW	
ENGINEER	D Wilson	11/10/76
OTHER	M. Carmichael	11-16-76
FINAL	[illegible]	11-17-76

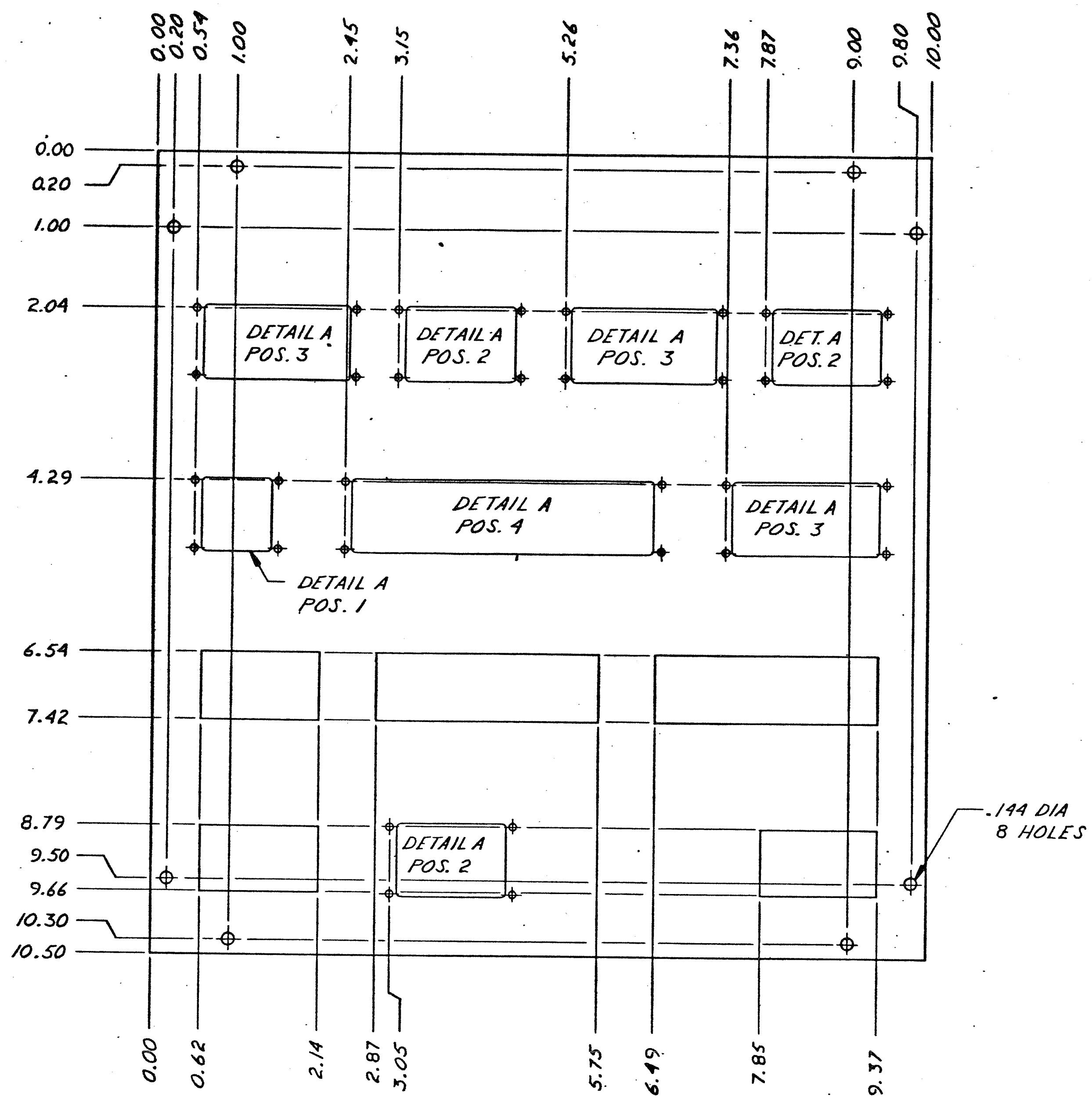
REDIFON

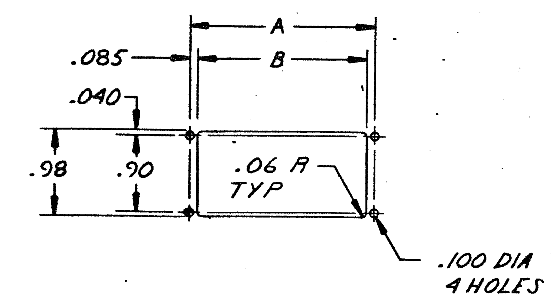
TITLE: CONTROL PANEL ASSEMBLY

SIZE	CODE IDENT NO.	DRAWING NO.
D	53988	1510 - 0001

SCALE: FULL | DO NOT SCALE THIS DWG | SHEET 1 OF 1

REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPROVED





DETAIL A				
POSITION	1	2	3	4
DIM A	1.09	1.59	2.09	4.09
DIM B	.92	1.42	1.92	3.92

DETAIL A

NOTES:

1. MATERIAL: 6061-T6 ALUM. ALLOY, .125 THK.
2. FINISH: GRAY PER FED STD 595, NO. 36440.
3. LOCATE AND ENGRAVE LEGENDS ON FRONT OF PANEL IN THE APPROXIMATE POSITIONS AS SHOWN ON SHEET 2 THIS DRAWING. LEGENDS TO BE IN GOTHIC AND FILLED WITH BLACK PAINT.
4. REFERENCE DESIGNATORS TO BE RUBBER STAMPED IN .12 CHARACTERS, WHITE INK, IN THE APPROXIMATE POSITIONS SHOWN ON SHEET 3 THIS DRAWING.
5. PART NUMBER TO BE RUBBER STAMPED IN .12 CHARACTERS, WHITE INK, IN THE APPROXIMATE POSITION SHOWN ON SHEET 3 THIS DRAWING.

-01 SHOWN

NEXT ASSY	USED ON
1510-0001	
APPLICATION	

UNLESS OTHERWISE SPECIFIED ALL DIMENSIONS ARE IN INCHES
3 PLACE DECIMALS ±0.0005
2 PLACE DECIMALS ±0.010
1 PLACE DECIMALS ±0.030

MATERIAL: SEE NOTE 1

FINISH: SEE NOTE 2

CONTRACT NO. 75113

REDIFON ELECTRONICS, INC ARLINGTON, TEXAS

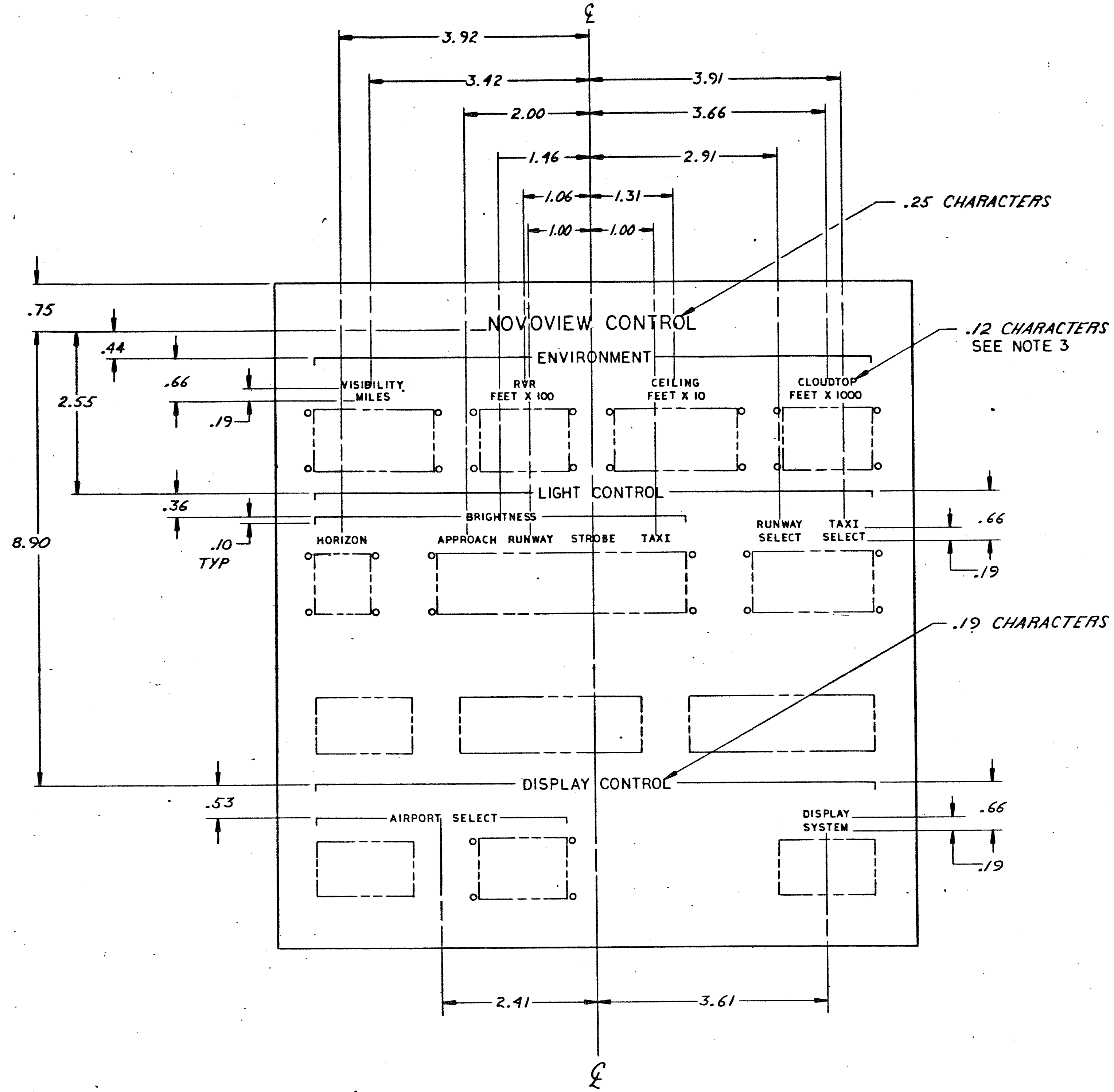
DRAFTSMAN	[illegible]	11/14/75
DESIGNER		
CHECKER	Dow	
ENGINEER	[illegible]	11/10/76
OTHER	M. [illegible]	11-17-76
FINAL	[illegible]	11-18-76

REDIFON

TITLE: PANEL — CONTROL

SIZE	CODE IDENT NO.	DRAWING NO.
D	53988	500006

SCALE: FULL | DO NOT SCALE THIS DWG | SHEET 1 OF 3



FRONT VIEW OF PANEL

REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPROVED

UNLESS OTHERWISE SPECIFIED ALL DIMENSIONS ARE IN INCHES
3 PLACE DECIMALS ±0.010
2 PLACE DECIMALS ±0.030
1 PLACE DECIMALS ±0.060

CONTRACT NO.

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DRAFTSMAN	[signature]	11/24/75
DESIGNER		
CHECKER		
ENGINEER		
OTHER		
FINAL	[signature]	11-18-76

NEXT ASSY	USED ON
1510-0001	
APPLICATION	

MATERIAL

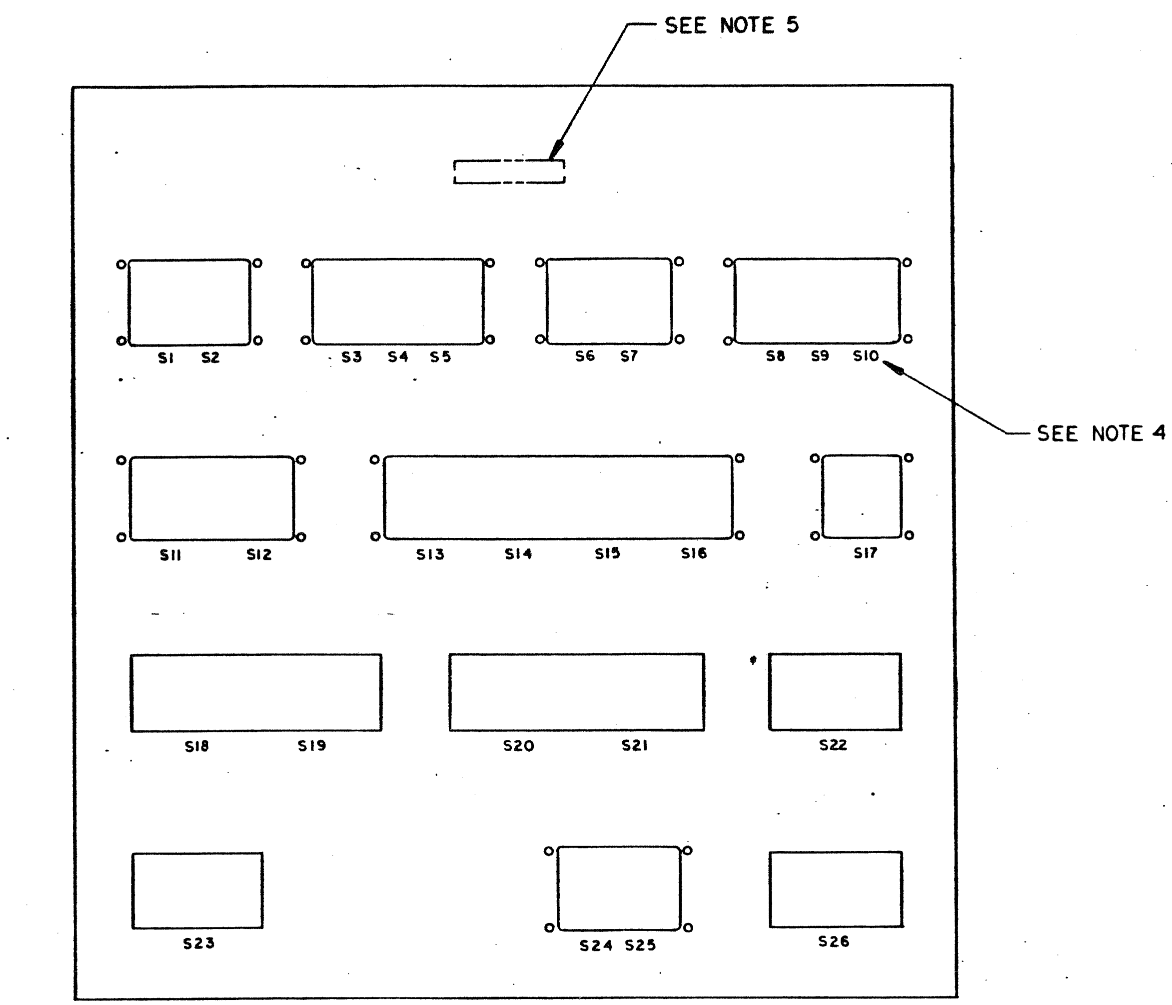
FINISH

REDIFON

TITLE PANEL — CONTROL

SIZE	CODE IDENT NO.	DRAWING NO.
D	53988	500006

SCALE: FULL | DO NOT SCALE THIS DWG | SHEET 2 OF 3



BACK VIEW OF PANEL

REVISIONS

ZONE	LTR	DESCRIPTION	DATE	APPROVED

UNLESS OTHERWISE SPECIFIED
ALL DIMENSIONS ARE IN INCHES
3 PLACE DECIMALS ±0.010
2 PLACE DECIMALS ±0.030
1 PLACE DECIMALS ±0.060

NEXT ASSY	USED ON
1510-0001	

APPLICATION

MATERIAL —/—

FINISH —/—

CONTRACT NO.

DRAFTSMAN	[signature]	11/26/75
DESIGNER		
CHECKER		
ENGINEER		
OTHER		
FINAL	[signature]	11-18-76

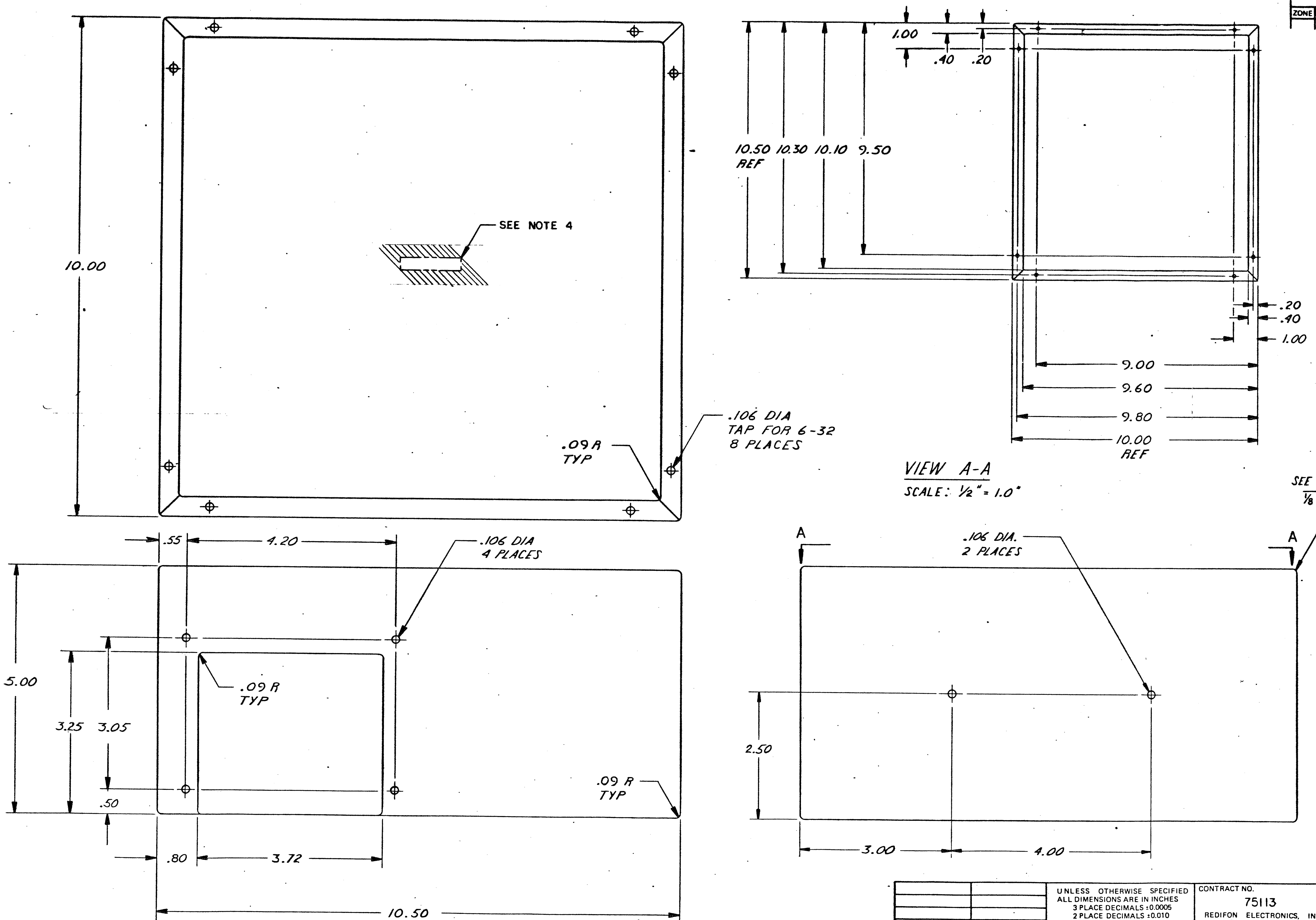
REDIFON

TITLE

PANEL — CONTROL

SIZE	CODE IDENT NO.	DRAWING NO.
D	53988	500006

SCALE: FULL | DO NOT SCALE THIS DWG | SHEET 3 OF 3



NOTES:

1. REMOVE ALL BURRS AND SHARP EDGES
2. WELD AND RADIUS ALL CORNERS AS SHOWN.
3. FINISH: TEXTURED MATTE BLACK PER FED-STD-595, NO. 37038.
4. PART NUMBER TO BE RUBBER STAMPED IN .12 CHARACTERS, WHITE INK, IN THE APPROXIMATE POSITION SHOWN.

REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPROVED

1510-0001	
NEXT ASSY	USED ON
APPLICATION	

UNLESS OTHERWISE SPECIFIED ALL DIMENSIONS ARE IN INCHES
3 PLACE DECIMALS ±0.0005
2 PLACE DECIMALS ±0.010
1 PLACE DECIMALS ±0.030

MATERIAL 16 GA. (0.60) LOW CARBON STEEL SHT

FINISH SEE NOTE 3

CONTRACT NO. 75113

REDIFON ELECTRONICS, INC ARLINGTON, TEXAS

DRAFTSMAN	[signature]	10/28/75
DESIGNER		
CHECKER	DWW	
ENGINEER	D Wilson	11/10/76
OTHER	M. Carmichael	11-16-76
FINAL	[signature]	11-17-76

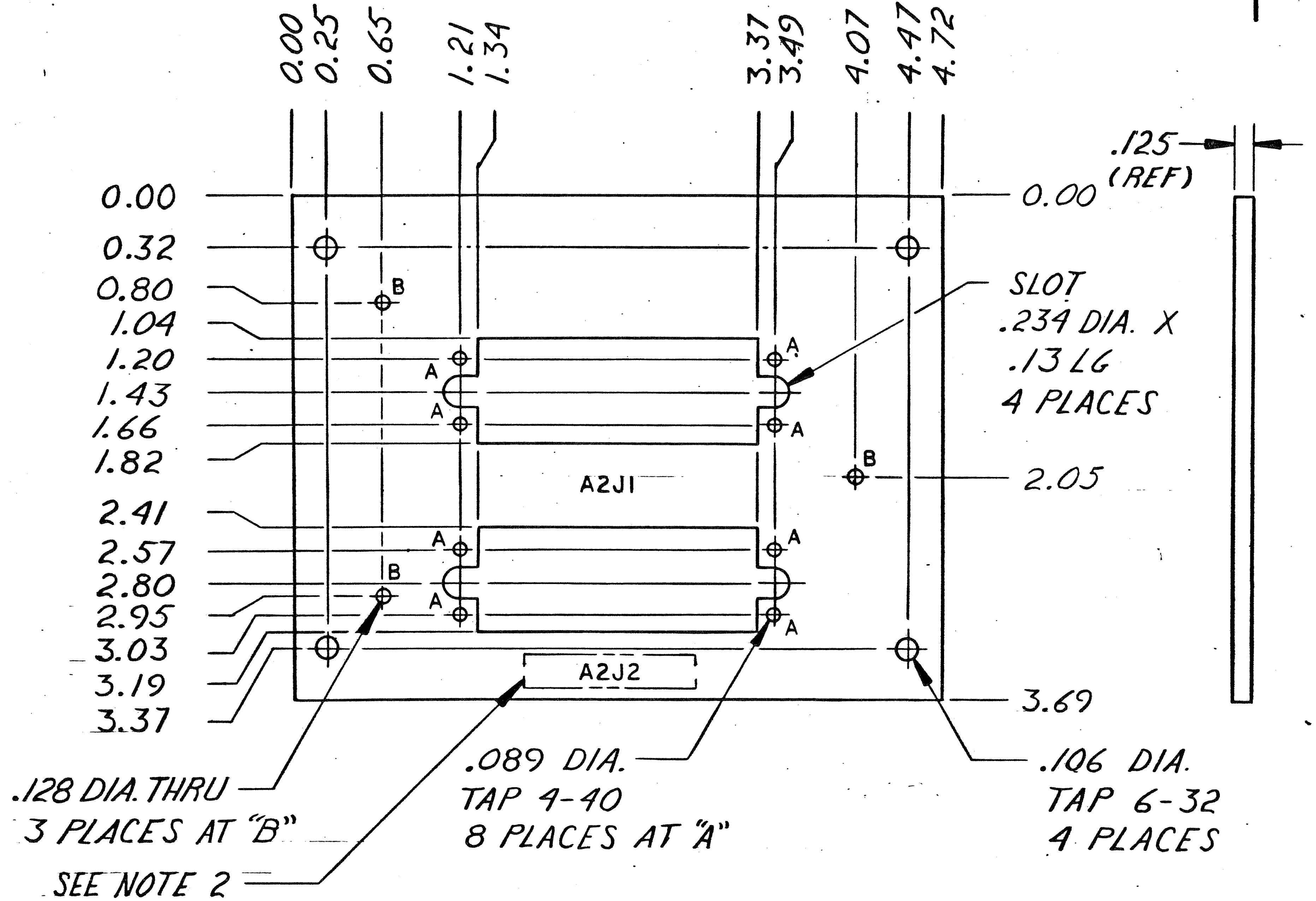
REDIFON

TITLE BOX – CONTROL PANEL

SIZE	CODE IDENT NO.	DRAWING NO.
D	53988	500007

SCALE: FULL | DO NOT SCALE THIS DWG | SHEET 1 OF 1

REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPROVED



NOTES

1. REFERENCE DESIGNATORS TO BE RUBBER STAMPED IN .12 CHARACTERS, WHITE INK, IN THE APPROXIMATE POSITIONS SHOWN.
2. PART NUMBER TO BE RUBBER STAMPED IN .12 CHARACTERS, WHITE INK, IN THE APPROXIMATE POSITION, OPPOSITE SIDE, SHOWN.

-01 SHOWN

1510-0001	
NEXT ASSY	USED ON
APPLICATION	

UNLESS OTHERWISE SPECIFIED
ALL DIMENSIONS ARE IN INCHES
3 PLACE DECIMALS ±0.010
2 PLACE DECIMALS ±0.030
1 PLACE DECIMALS ±0.060

MATERIAL 6061-T6 ALUM ALLOY PLATE, .125 THK

FINISH BLACK ANODIZE

CONTRACT NO. 75113

REDIFON ELECTRONICS, INC
ARLINGTON, TEXAS

DRAFTSMAN	Callahan, Bl	11/20/75
DESIGNER		
CHECKER	DWW	
ENGINEER	DWilson	11/10/76
OTHER	M. CARMICHAEL	11-17-76
FINAL	[illegible]	11-17-76

REDIFON

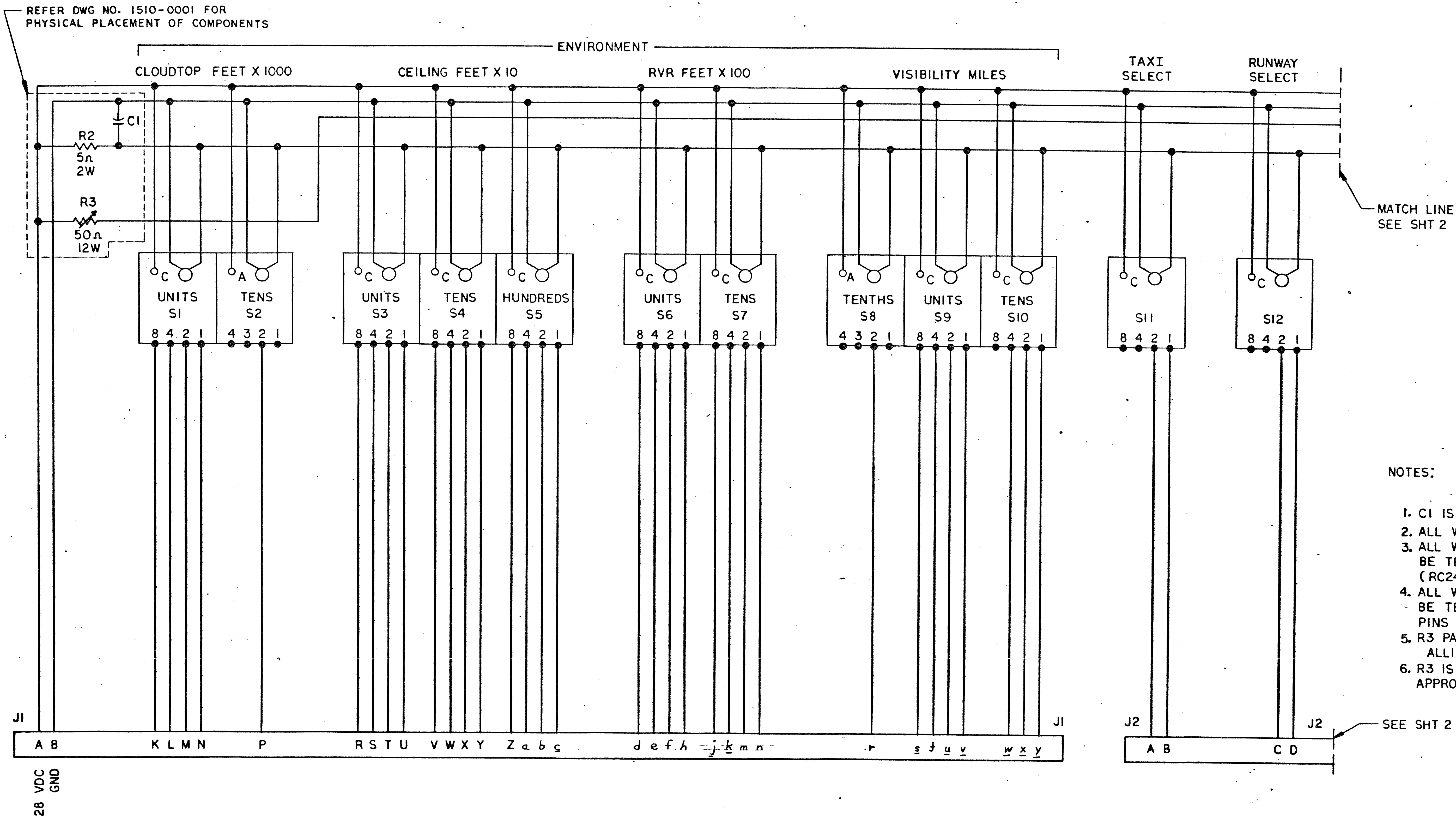
TITLE

PLATE - CONNECTOR MOUNTING

SIZE	CODE IDENT NO.	DRAWING NO.
B	53988	500008

SCALE: FULL | DO NOT SCALE THIS DWG | SHEET 1 OF 1

ZONE	LTR	DESCRIPTION	DATE	APPROVED
		REVISIONS		

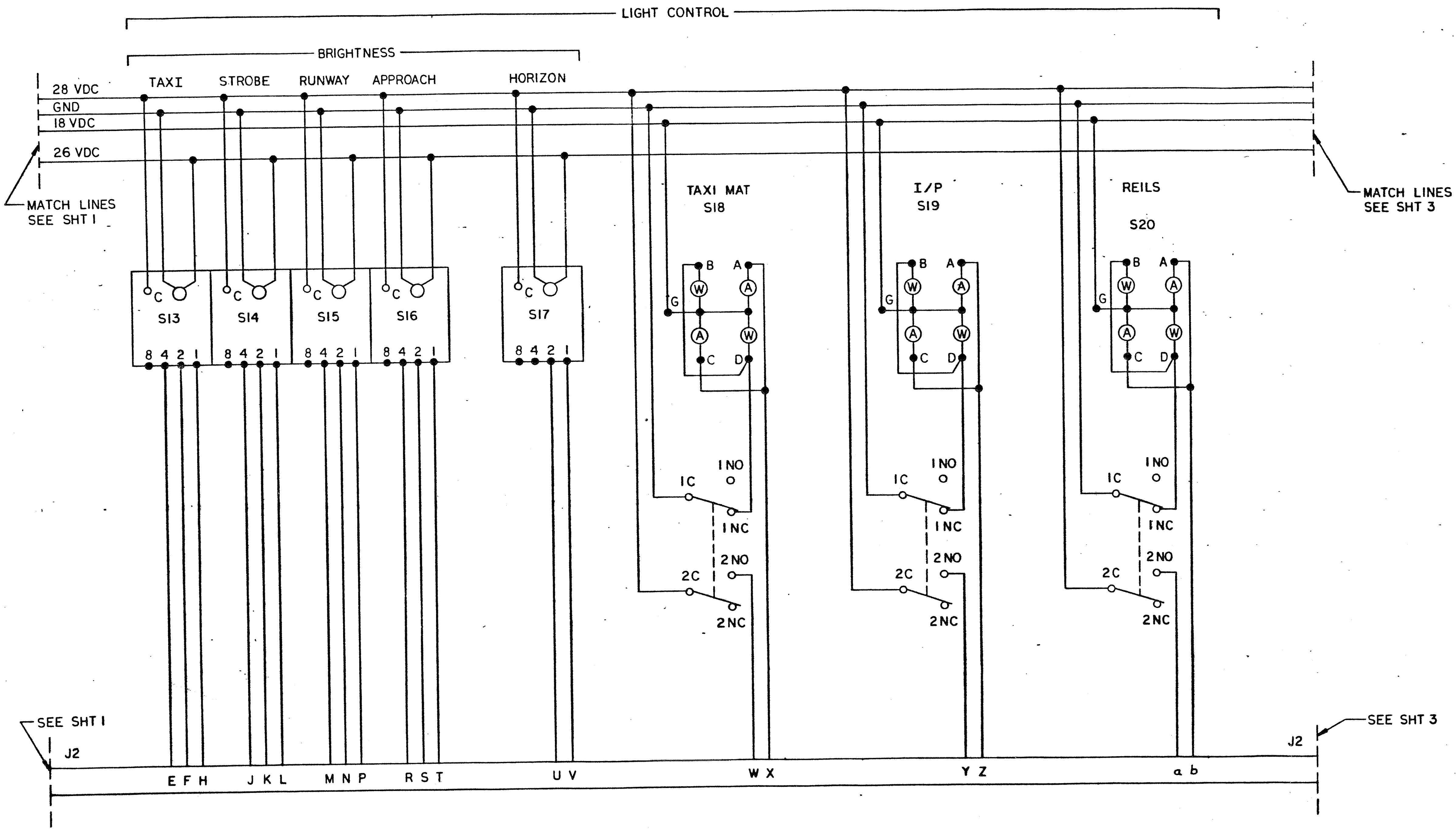


NOTES:

1. C1 IS 1000 MFD, 40 VDC.
2. ALL WIRE SHALL BE 24 AWG.
3. ALL WIRES TO J1 SHALL BE TERMINATED IN SOCKETS (RC24M-9).
4. ALL WIRES TO J2 SHALL BE TERMINATED IN MALE PINS (RM24M-9).
5. R3 PART NO.: ALLIED 880-1018.
6. R3 IS TO BE SET AT APPROX 30Ω.

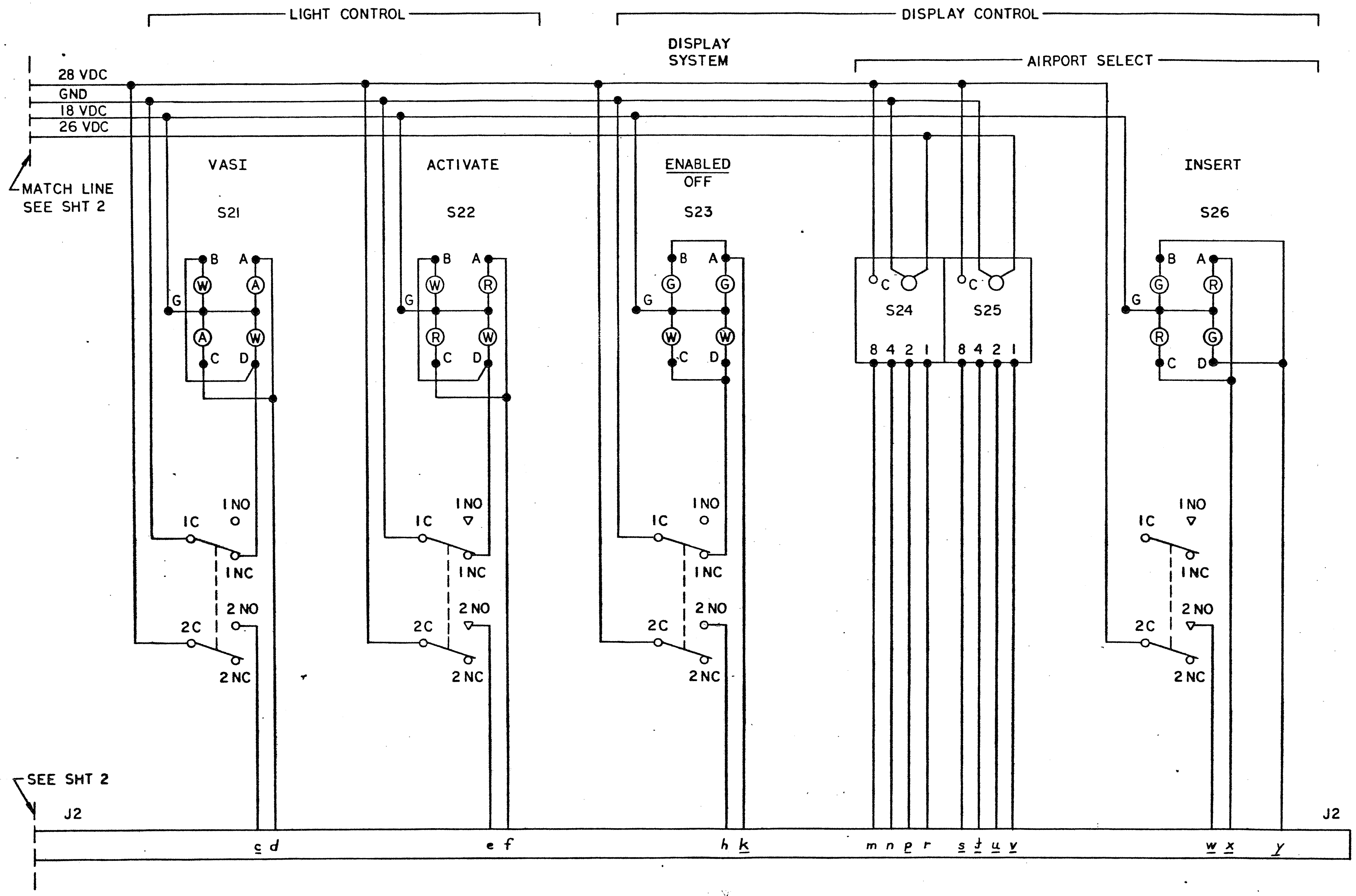
1510-0001		UNLESS OTHERWISE SPECIFIED ALL DIMENSIONS ARE IN INCHES 3 PLACE DECIMALS ±0.010 2 PLACE DECIMALS ±0.030 1 PLACE DECIMALS ±0.060	CONTRACT NO. 75113	REDIFON
NEXT ASSY	USED ON		DRAFTSMAN 12/1/75	TITLE WIRING DIAGRAM — CONTROL PANEL
APPLICATION		MATERIAL —	DESIGNER	
		FINISH —	CHECKER	
			ENGINEER 11/10/76	SIZE D CODE IDENT NO. 53988 DRAWING NO. 500011
			OTHER 11-16-76	SCALE NONE DO NOT SCALE THIS DWG SHEET 1 OF 3
			FINAL 11-17-76	

ZONE	LTR	REVISIONS DESCRIPTION	DATE	APPROVED



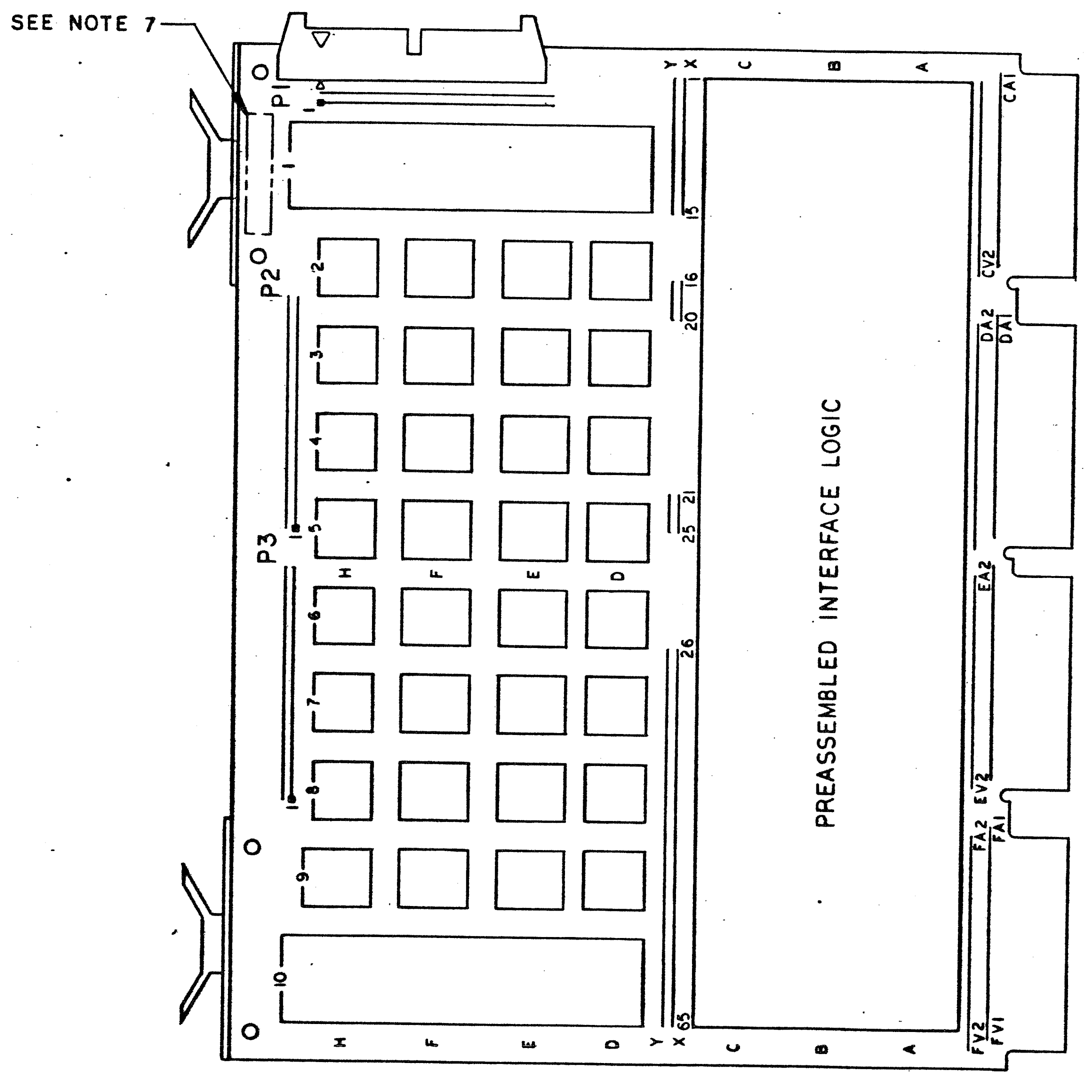
		UNLESS OTHERWISE SPECIFIED ALL DIMENSIONS ARE IN INCHES 3 PLACE DECIMALS ±0.010 2 PLACE DECIMALS ±0.030 1 PLACE DECIMALS ±0.060	CONTRACT NO.		REDIFON
			©REDIFON ELECTRONICS, INC ARLINGTON, TEXAS		TITLE WIRING DIAGRAM — CONTROL PANEL
		THE COPYRIGHT IN THIS DRAWING SPECIFICATION BELONGS TO REDIFON ELECTRONICS AND IT MAY BE USED ONLY FOR THE EXPRESS PURPOSE FOR WHICH IT WAS PROVIDED © REDIFON ELECTRONICS, INC.	DRAFTSMAN	12/1/75	
			DESIGNER		
			CHECKER		
			ENGINEER		
1510-0001			OTHER		SIZE D — CODE IDENT NO. 53988 — DRAWING NO. 500011
NEXT ASSY	USED ON	MATERIAL —	FINAL	11-12-76	
APPLICATION		FINISH —			SCALE: NONE — DO NOT SCALE THIS DWG — SHEET 2 OF 3

REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPROVED



		UNLESS OTHERWISE SPECIFIED ALL DIMENSIONS ARE IN INCHES 3 PLACE DECIMALS ±0.010 2 PLACE DECIMALS ±0.030 1 PLACE DECIMALS ±0.060	CONTRACT NO. ©REDIFON ELECTRONICS, INC ARLINGTON, TEXAS	REDIFON
		THE COPYRIGHT IN THIS DRAWING SPECIFICATION BELONGS TO REDIFON ELECTRONICS AND IT MAY BE USED ONLY FOR THE EXPRESS PURPOSE FOR WHICH IT WAS PROVIDED © REDIFON ELECTRONICS, INC.	DRAFTSMAN 12/1/75 DESIGNER CHECKER ENGINEER OTHER FINAL 11-17-76	TITLE WIRING DIAGRAM – CONTROL PANEL
1510-0001		MATERIAL —		SIZE D · CODE IDENT NO. 53988 · DRAWING NO. 500011
NEXT ASSY	USED ON	FINISH —		SCALE: NONE · DO NOT SCALE THIS DWG · SHEET 3 OF 3
APPLICATION				

REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPROVED



MDB 1710 BOARD

NOTES:

1. LOCATE 16-PIN DIP SOCKETS AT POSITIONS E2, E3, F2, F3, & F4, CUT JUMPERS BETWEEN PINS 7 & 8, AND SOLDER.
2. LOCATE 14-PIN DIP SOCKETS AT POSITIONS D4, D5, D6, D8, H3, & E5, AND SOLDER.
3. LOCATE BERG CONNECTOR AT POSITION P1, PIN 1, AND SOLDER.
4. LOCATE CAPACITORS AT POSITIONS D7 & E4, PINS 3 & 6, AND SOLDER.
5. WIRE PER WIRE LIST DWG NO. 500012
6. FOR REFERENCE ONLY: LOGIC SCHEMATIC DWG NO. 500013
7. ASSEMBLY NUMBER TO BE RUBBER STAMPED IN .12 CHARACTERS, WHITE INK, IN THE APPROXIMATE POSITION SHOWN.

QTY	LOCATION	PART NUMBER	DESCRIPTION	VENDOR
REF		500013	LOGIC SCHEMATIC	REDIFON
REF		500012	WIRE LIST	REDIFON
1	P1	65483-400	CONNECTOR	BERG
2	D7, E4	CD15FD201J	CAPACITOR, 200PF	CDE
1	H3	899-1-R1K	RESISTOR NETWORK, 1K	BECKMAN
1	F4	74161N	4-BIT COUNTER	
2	D8, E5	74121N	MONOSTABLE MULTIVIBRATOR	
1	D6	74107N	DUAL J-K M/S FLIP-FLOPS	
4	E2, E3, F2, F3	7489N	64-BIT R/W MEMORY	
1	D5	7400N	2 INPUT POSITIVE NAND GATE	
1	D4	7414N	HEX SCHMITT-TRIGGER INV	
5	NOTE 1	C931602	16-PIN DIP SOCKET	TI
6	NOTE 2	C931402	14-PIN DIP SOCKET	TI
1		MDB-1710	UNIBUS INTERFACE MODULE	MDB SYSTEMS

1500-0001	
NEXT ASSY	USED ON
APPLICATION	

UNLESS OTHERWISE SPECIFIED
ALL DIMENSIONS ARE IN INCHES
3 PLACE DECIMALS ±0.010
2 PLACE DECIMALS ±0.030
1 PLACE DECIMALS ±0.060

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MATERIAL —
FINISH —

CONTRACT NO. 75113

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ARLINGTON, TEXAS

DRAFTSMAN	[signature]	3/31/76
DESIGNER		
CHECKER	DWC	
ENGINEER	D. Wilson	8/10/76
OTHER	M. Carmichael	11-16-76
FINAL	[signature]	11-17-76

REDIFON

TITLE
CIRCUIT BOARD ASSEMBLY — PDP 11/45 INTERFACE

SIZE	CODE IDENT NO.	DRAWING NO.
D	53988	1530 - 0001

SCALE: NONE | DO NOT SCALE THIS DWG | SHEET 1 OF 1

MDB-1710
GENERAL-PURPOSE INTERFACE MODULE

INTRODUCTION

The MDB-1710 General-Purpose Interface Module acts as an interface to transfer information between a Digital Equipment Corp. PDP-11 Unibus™ and the user's peripheral device.

The MDB-1710 consists of a single quad module containing the following:

- fixed logic to interface with the PDP-11 and with user's interface logic built on the module. Fixed logic includes receivers and drivers, device address selection and decoder logic, and dual interrupt vector logic (see figure 1).
- circuit board facilities and wire-wrap posts to accommodate up to 40 integrated-circuit devices. These facilities are used to build logic interfacing the fixed logic on the module with the user's peripheral device.

The MDB-1710 fits into either the DEC BB-11, DD-11A, or DD-11B Peripheral Mounting Panel.

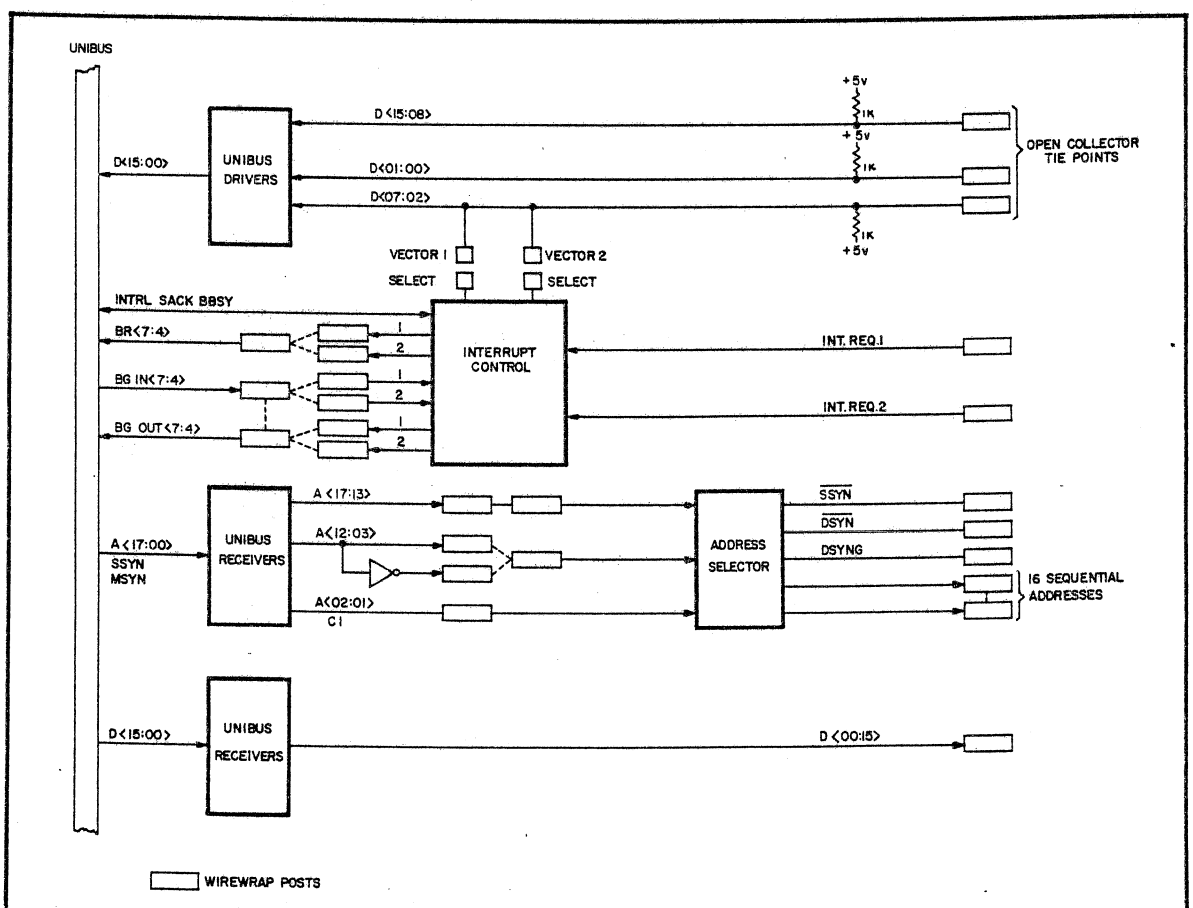


Figure 1 MDB-1710, Block Diagram

PHYSICAL DESCRIPTION

FIXED LOGIC

Logic provided on the module consists of integrated-circuit devices in dual-in-line (DIP) packages; and wire-wrap posts used to select interrupt levels and vector addresses, to program the device address, and to make Unibus driver inputs and receiver outputs, and interface address and control lines, available for connection to user interface logic.

Fixed logic is connected to the Unibus through etched fingers that engage the printed-circuit board connector. The module may include three (optional) ribbon cable connectors for interconnection between the MDB-1710 and the user's peripheral device or other MDB modules.

USER INTERFACE LOGIC

The module accommodates up to 40 integrated circuit devices in wire-wrap terminations. Sixteen positions (in locations 2H through 8H, and 2D through 8D) are dedicated for 14-pin DIP devices and have prewired power and ground connections (pins 14 and 7, respectively).

The remaining positions will also accommodate 14-pin devices, or 16-pin devices if jumpers connecting pins 7 and 8 are removed.

Columns 1 and 10 will accept devices with 22, 24, or 40 pins, as well as 14- or 16-pin devices. Use of three 24-pin devices, or two 40-pin devices, will reduce the number of possible 16-pin positions by four.

Columns 1 and 10 will also accept discrete components when space is not used for I-C devices. Wire-wrap posts are provided to accommodate discrete components in plated-through holes at 0.3-, 0.4-, and 0.6-inch centers.

All Unibus driver inputs and receiver outputs appear at wire-wrap posts for use in multiple-controller interfaces. Unibus driver inputs have pull-up resistors that permit using open-collector gates (7403 or equivalent) to OR-tie additional inputs to the drivers. Receiver outputs will handle up to 30 unit loads.

UNIBUS INTERFACE

Table 1 lists signals at the Unibus/MDB-1710 interface, and other signals that pass between the master device and the module.

Table 1 Master Device/MDB-1710 Interface Signals

Signal	Description
D00L-D15L	Unibus bidirectional data lines. Low (ground) is true, +3V is false.
INITL	Low-level true or negative-going transition received from master device. Use to produce internal master reset.

Table 1 Master Device/MDB-1710 Interface Signals (cont'd)

Signal	Description
A00L-A17L	Address lines from master device. Low level is true. Bits A01L, A02L, and A03L, and control line C1L encode one of sixteen addresses. Bits A04L through A17L are used to enable the decoder. Bit A001 is available for use by user interface logic, and may be strapped to carry byte-transfer signal generated by user interface logic.
C1L	Control line, low-level true, from master device. Controls address decoder and is available to control I/O status at user interface logic.
C0L	Control line, low-level true, from master device. Available to control I/O status at user interface logic, and may be used to transfer data from Unibus receivers into user interface logic.
MSYNL	Timing pulse from master device. Negative transition initiates internal timing sequence enabled by address decoding.
SSYNL	Negative-going pulse (approx 200 nsec) sent by MDB-1710 to master device. Follows (by approx 100 nsec) the negative-going transition of MYSNL when device address has been decoded.
BR4L-BR7L	One of four possible bus request levels sent by MDB-1710 to master device in response to request from user interface logic. Level is selected by means of wire-wrap jumper. Negative level is true.
BG4INH-BG7INH	One of four possible bus grant input levels sent by master device to MDB-1710 in response to bus request. Level is selected by means of wire-wrap jumper. High level is true.
BG4OUTH-BG7OUTH	One of four possible bus grant output levels selected by wire-wrap jumper and sent to another controller to extend a serial interrupt priority link. High level is true.
SACKL	Control level (low-level true) sent to master device by either interrupt circuit to acknowledge receipt of bus grant input. Reset when vector address has been transferred onto Unibus.
INTRL	Control level (low-level true) sent to master device by either interrupt circuit as vector address is transferred onto Unibus.
BBSYL	Busy signal (low-level true) sent to master device by either interrupt circuit. Level falls on receipt of bus grant input and rises as vector address is transferred onto Unibus.

USER LOGIC INTERFACE

Table 2 lists signals at the interface between fixed logic on the module and user interface logic. Connections are made at wire-wrap terminals on the module.

Table 2 Fixed Logic/User Logic Interface Signals

Signal	Description
<u>Signals to User Logic</u>	
DATA00-DATA15	Unibus data receiver outputs. High level true.
Device Address	Sixteen decoded discrete address lines. Eight may be used for input, and eight for output. Input address bits A00L, A01L, and A02L also available.
$\overline{\text{MSYNL}}$	Control signal from master device (inverted) used to initiate address timing.
DSYNG	Positive-going pulse (approx 300 nsec in duration) following MSYNL by approx 50 nsec, if device address is recognized. Useful for gating input data onto Unibus.
$\overline{\text{SSYN}}$	Negative-going pulse (approx 200 nsec) following MSYNL by approx 100 nsec, if device address is recognized.
$\overline{\text{DSYN}}$	Negative-going pulse (approx 200 nsec in duration) following rise of SSYN. Useful for loading registers in a DATO operation.
C1L	Control line from Unibus used to control I/O mode. Low-level true.
C0L	Control line from Unibus used to control I/O mode. Low-level true.
$\overline{\text{MR}}$	Negative-going pulse (inverted INITL pulse from Unibus) used as master reset.
INTADR1, INTADR2	Control level high when related vector address is transferred onto Unibus data lines.
DSEL1, DSEL2	Device-select control level rising when related interrupt circuit receives bus grant input, and falling when vector address is transferred onto Unibus lines.
Other Interrupt Signals	Status of "select" and "busy" flip-flops in both interrupt circuits.

Table 2 Fixed Logic/User Logic Interface Signals (cont'd)

Signal	Description
<u>Signals from User Logic</u>	
$\overline{\text{IDATA00}}$-$\overline{\text{IDATA15}}$	Unibus data driver inputs. Low-level true.
DEVINT1, DEVINT2	Bus request from user interface logic. High level true. User logic must drop DEVINT when DSEL becomes true.
BYTE XFER	Positive-going control pulse may be strapped to A00L input line and used for byte control.
DATA TO BUS	Positive-going control pulse generated by user interface when MDB-1710 is acting as the master device. May be strapped to C1L line to control data transfer.
DATA FROM BUS	Positive-going control pulse generated by user interface when MDB-1710 is acting as the master device. May be strapped to C0L line to control data transfer.
MSYNC	Positive-going control pulse generated by user interface when MDB-1710 is acting as the master device. May be strapped to MSYNL line to control initiation of address timing.

THEORY OF OPERATION

The logic diagram (Dwg. 40314) shows details of fixed logic furnished on the MDB-1710 module, and identifies wire-wrap posts at which data, address, and control signals are terminated.

In general, logic on the module includes:

- data bus receivers and drivers,
- address selection logic,
- interrupt logic, and
- user interface logic designed and built on the module for the particular device application.

The following paragraphs describe the theory of operation of this logic.

DATA BUS

The 16-bit data word DnL at the Unibus data interface is received and made available (as DATAn) at wire-wrap posts for connection to user interface logic (see figure 2).

The 16-bit data word $\overline{\text{IDATAn}}$ from the user interface, connected at wire-wrap posts, is applied through drivers to the Unibus lines. In an interrupt sequence, either of two vector addresses (strapped at wire-wrap posts) is enabled onto lines $\overline{\text{IDATA02}}$ through $\overline{\text{IDATA07}}$ by a respective INTADR1 or INTADR2 pulse.

ADDRESS SELECTION LOGIC

The address for the MDB-1710 is selected by jumper connections at wire-wrap posts. Any address from 760000 through 777777 may be selected. The logic provides eight DATI addresses, and eight DATO addresses.

Sixteen sequential addresses are decoded, with the decoders enabled by address lines A04L through A17L which control an open-collector wired-AND circuit (see figure 3).

Bus address lines A13L through A17L are hard-wired and all must be true at the input terminals to enable the wired-AND bus. Bus address lines A04L through A12L each provide two complementary outputs, either of which may be strapped to the wired-AND bus. If the user-selected address bit is to be true, the bus receiver output is strapped to the wired-AND bus. If that bit is to be false, the inverter output is strapped to the bus.

Bus address line A03L is hardwired to select either of the two decoder chips (in location 5C when A03L = "1", and location 6C when A03L = "0"). Address bits A01L and A02L, and control line C1L, are the least-significant bits of the address and are hard-wired to the decoders. Bit A00L is not used at the decoders.

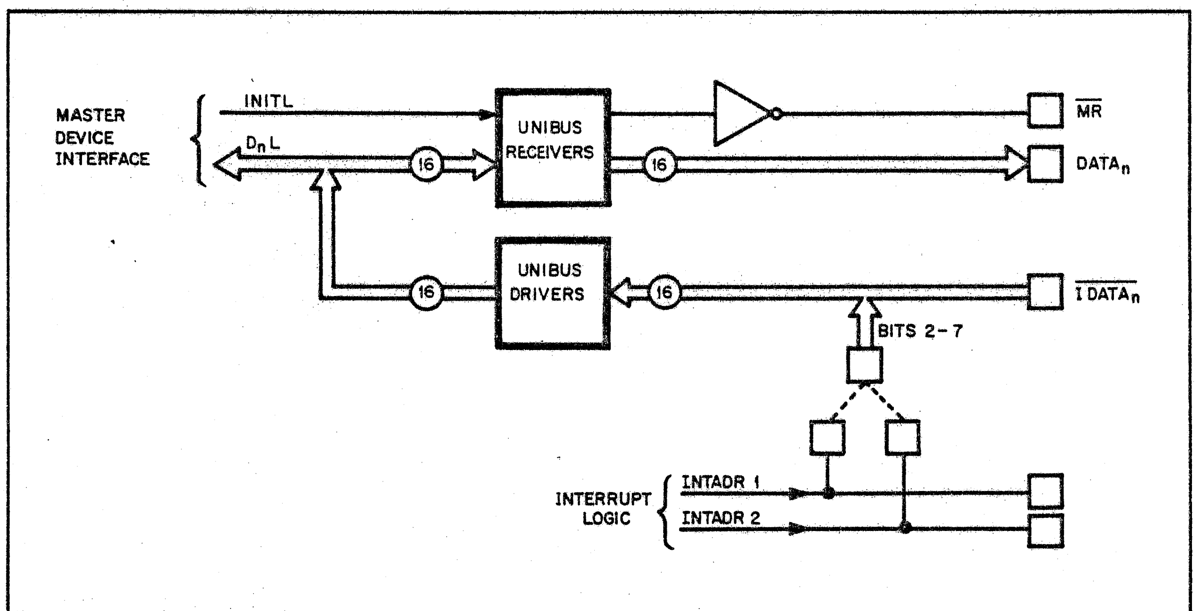
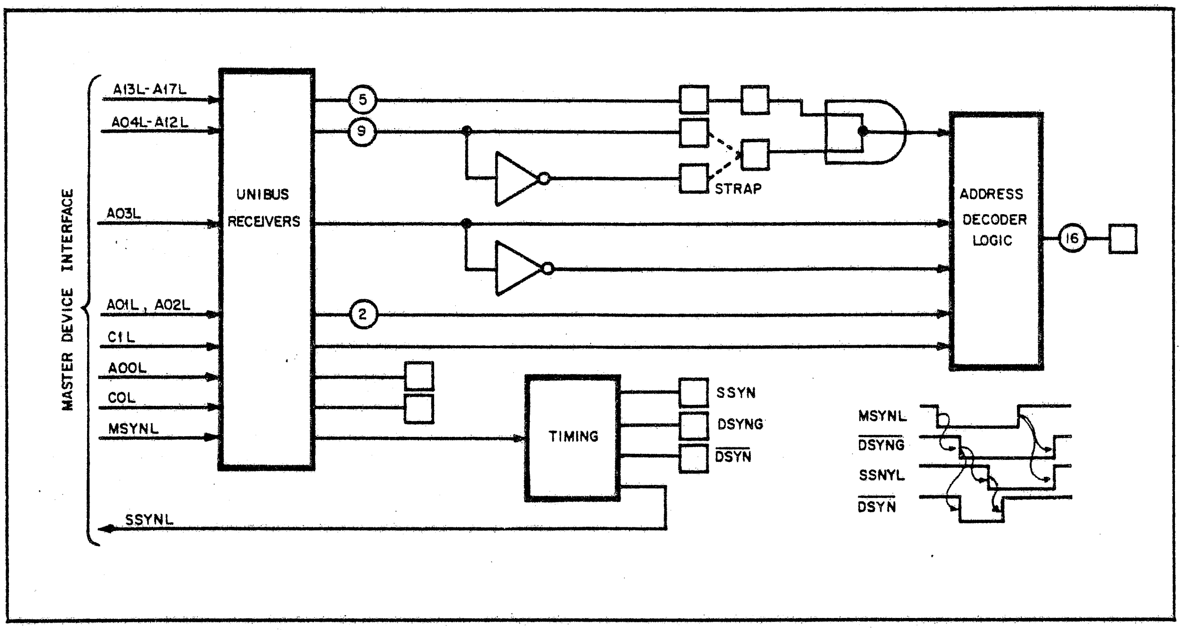


Figure 2 Data Bus, Block Diagram



A03		A02	A01	C1	Y35 X30	X36 Y30	Y36 X31	X37 Y31	Y37 Y32	Y39 Y33	X40 X34	X41 Y34
1	0	0	0	0	0	1	1	1	1	1	1	1
1	0	0	0	1	1	0	1	1	1	1	1	1
1	0	0	1	0	1	1	0	1	1	1	1	1
1	0	0	1	1	1	1	1	0	1	1	1	1
1	0	1	0	0	1	1	1	1	0	1	1	1
1	0	1	0	1	1	1	1	1	1	0	1	1
1	0	1	1	0	1	1	1	1	1	1	0	1
1	0	1	1	1	1	1	1	1	1	1	1	0

□ Decoder 6C ▩ Decoder 5C

Figure 3 Address Selection Logic, Block Diagram and Truth Table

Address selection logic also provides sync and loading signals. When the user address is decoded and the master device asserts MSYNL, the logic produces a series of timing signals DSYNG, SSYN, and DSYN. Term DSYN is a negative-going pulse approximately 200 nanoseconds in duration, and is useful for loading data registers when the master device is performing a DATO operation. The signal SSYN is sent to the user interface and terminates DSYN. Simultaneous with SSYN, SSYNL is sent to the Unibus interface to indicate that the address has been acknowledged.

INTERRUPT LOGIC

The MDB-1710 includes two separate sets of interrupt control logic, permitting the user to interrupt the PDP-11 processor through two unique vector addresses. Wire-wrap facilities on the module are used to select any two vector addresses from 4 through 374. A logic "1" in the address is made by connecting a wire-wrap jumper. Logic "0's" need not be jumpered. Either address is put onto the output data lines by a respective signal INTADR1 or INTADR2.

As shown in figure 4, bus request levels (BRnL) 4 through 7 are selected by wire-wrap jumpers.

An interrupt request is initiated when user interface logic puts a "1" (+3V) on a DEVINTn line, dropping the level on a selected bus request line at the master device interface.

When the master device sends the bus grant signal (BGnINH), interrupt logic sends DSELn to the user interface which may then remove the DEVINTn signal. The interrupt acknowledge signal SACKL is sent to the master device when the bus grant signal is received.

The vector address is then sent to the master device when the bus becomes available; that is, BBSYL becomes false, raising INTADR1 or INTADR2.

Other control signals BBSYL and INTRL sent to the master device reflect the state of either INTADRn line.

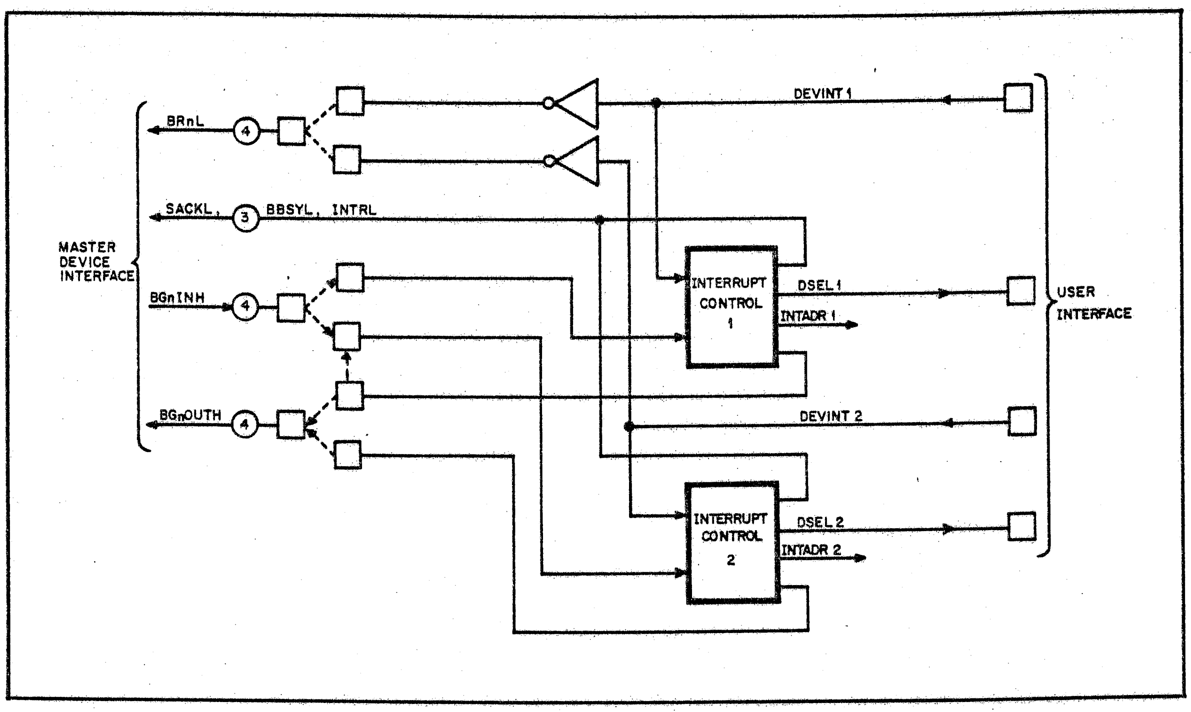


Figure 4 Interrupt Logic, Block Diagram

USER INTERFACE LOGIC

User interface logic is designed for a specific application, and is built in the 40 integrated-circuit device locations provided on the module.

All Unibus driver inputs and receiver outputs are available at wire-wrap posts and may be used for multiple controller interfaces. Inputs to Unibus drivers have pull-up resistors to accommodate open-collector gates (7403 or equivalent) which may be used to OR additional inputs to the drivers. Unibus receivers will handle up to 30 unit loads.

JUMPER CONNECTIONS

Certain jumper connections must be prepared on the module (other than the fixed logic/user logic connections) in order to configure the module for its application. Wire-wrap jumpers are to be prepared for both device address selection, and interrupt management and addresses.

ADDRESS LOGIC

Unibus address bits A04L through A12L must be connected to encode the device address. As shown on the logic diagram, for each bit an output may be taken from either the receiver output, or the output of an open-collector driver.

If a bit is to be true in the user-selected address, strap the receiver output to the wired-AND circuit. If the bit is to be false, strap the driver output to the wired-AND circuit.

Bits A13L through A17L are hardwired and must be true (low) at the Unibus lines to enable the address decoder.

INTERRUPT LOGIC

Interrupt logic must be connected for each of the two vector interrupt circuits. Perform connections as follows:

Vector Addresses. The 6-bit vector address for each circuit is formed by jumpers at three rows of three wire-wrap posts on both sides of the I-C device in location B5.

To encode the vector address for either interrupt circuit, connect a jumper between the output of a INTADR1 or INTADR2 inverter and the related $\overline{\text{IDATAn}}$ line (see logic diagram 40314). If both interrupts are to be used, wire addresses for both to $\overline{\text{IDATAn}}$ lines.

A jumper creates a logic "1". A logic "0" is implied by lack of a jumper.

Interrupt Management. Select the interrupt level for each interrupt circuit by connecting a jumper from terminal J or X to one of the four bus request (BRnL) terminals.

Unless both interrupts are to be at the same level, strap the selected bus grant input terminals to each interrupt circuit at terminal K or W.

If the interrupts are to be at the same level, strap the first-in-order interrupt circuit to a bus grant input, and then strap the bus grant input of the second circuit to the bus grant output of the first. For example:

a. jumper terminal K to BG4INH, then

b. jumper terminal W to terminal M.

If the interrupt is to be extended through another controller, connect the bus grant output from the appropriate interrupt circuit (terminal M or L) to the related bus grant output level (BGnOUTH).

USER LOGIC EXPANSION MODULE

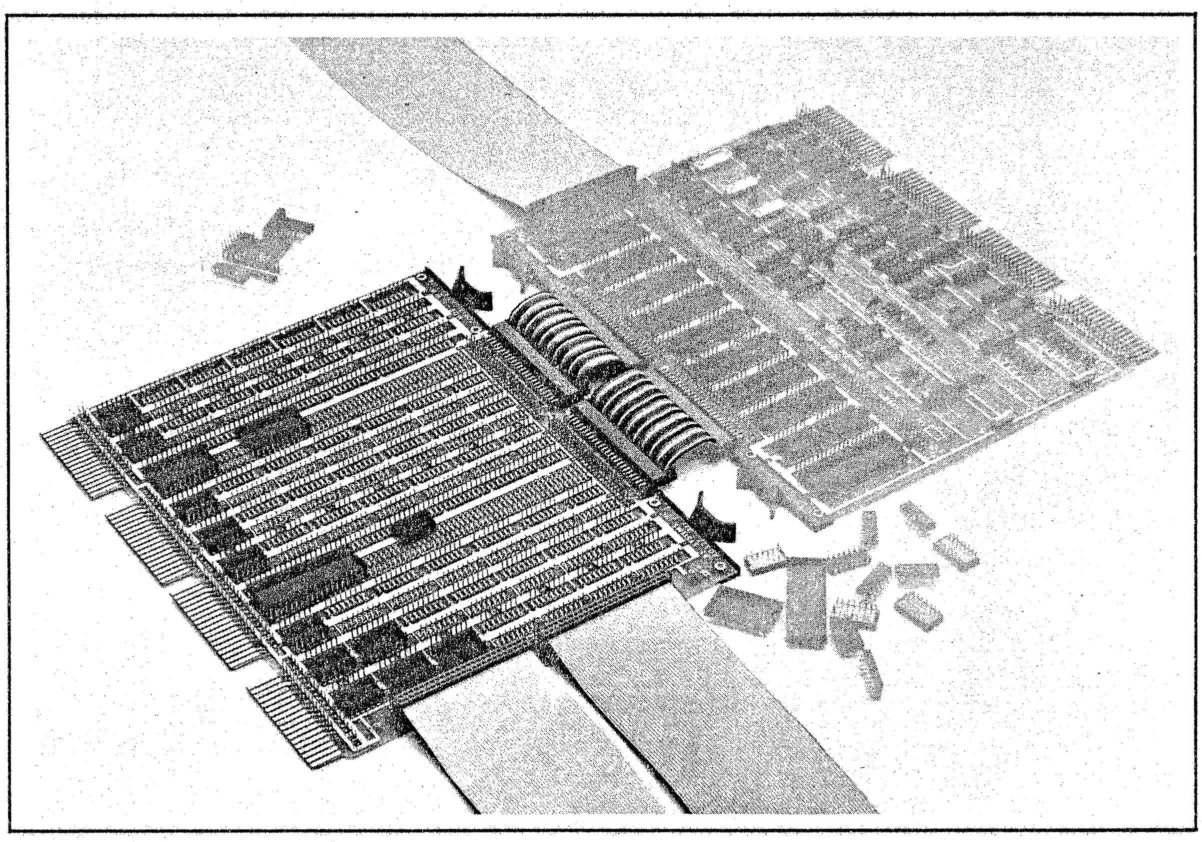
The MDB-11WW wire-wrap expansion module is available to expand user interface logic beyond the space allowed on the interface module. The MDB-11WW is designed for custom interface applications with Digital Equipment Corporation PDP-11 and PDP-8 computers, and occupies a single quad slot. Two-level wire-wrap posts, installed on the component side of the board, permit ½-inch board spacing within the computer mainframe.

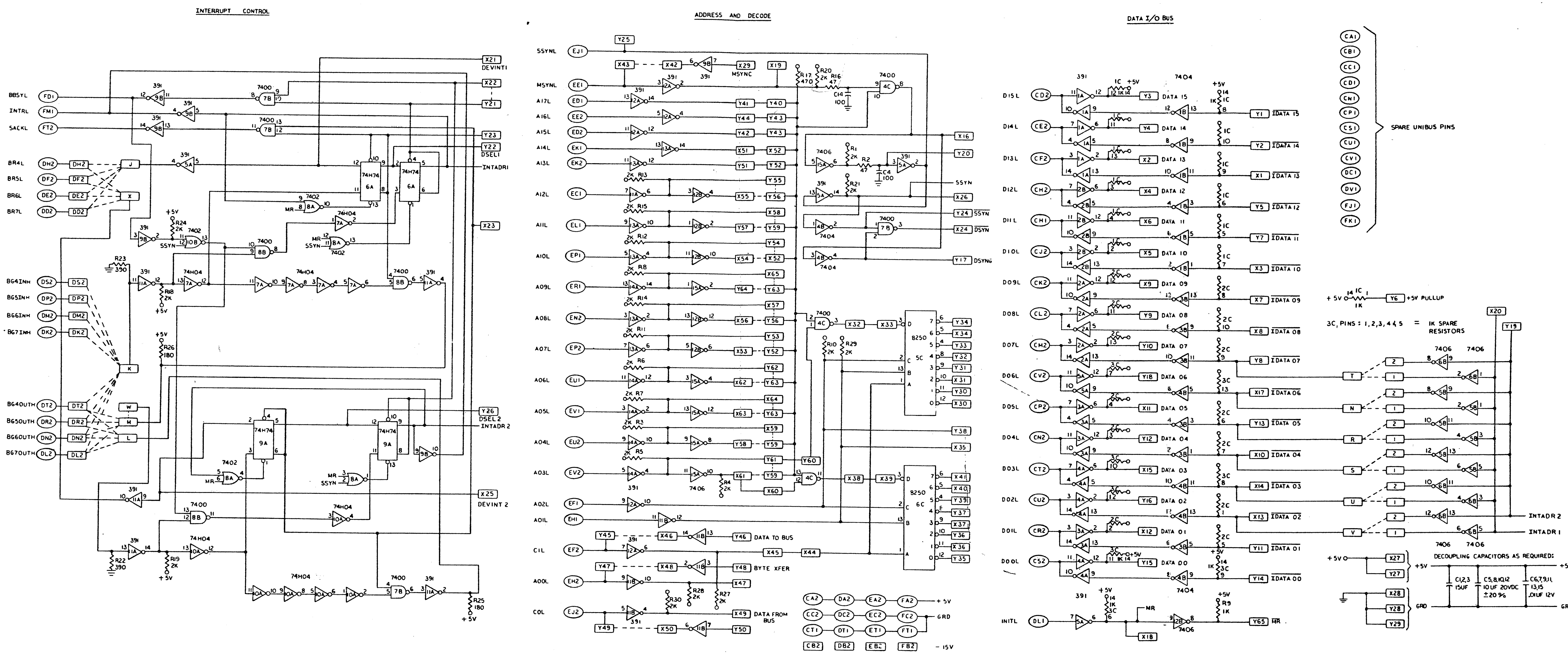
The module accommodates combinations of as many as 70 dual-in-line ICs or sockets having 14, 16, 18, 22, 24, or 40 pins. IC positions are identified with a column and row identification. Two of the 10 columns (4 and 8) will handle ICs with from 14 to 40 pins, with up to three 40-pin ICs, or five 24-pin ICs, per column. Discrete components may be installed in these columns with components on 0.3-, 0.4- or 0.6-inch centers wherever no IC is installed.

Sixteen of the 70 IC positions are dedicated for 14-pin sockets (positions A1 through A10, and H3 through H8), and have prewired power and ground connections (pins 14 and 7, respectively). All the remaining positions will accommodate 16-pin devices, but the connection between pins 7 and 8 must be removed for any position to hold a 16-pin device.

Each position has power and ground decoupling pads to accommodate high-frequency disc capacitors. Decoupling pads next to column 10 will hold six low-frequency tantalum capacitors on 0.4-inch centers.

Up to four ribbon cable connectors (optional) may be furnished on the module. Two connectors (opposite the card connector fingers) may be used for I/O cables to external devices, or for interconnection of other MDB modules. The remaining connectors may be used for cabling to peripheral devices. Connectors may be ordered with 20, 26, 34, 40, or 50 pins.





LOGIC DIAGRAM, MDB-1710

REVISIONS			
LTR	DESCRIPTION	DATE	APPROVED

NOTES:

1. An "X" in ref column designates the second entry of a wire end.
2. Total number of wires is 135
3. Ref: Schematic Dwg. No. 500013
   Assy Dwg No. 1530-0001

21		22		23		24													
11		12		13		14		15		16		17		18		19		20	
SHT	REV	2		3		4		5		6		7		8		9		10	

SHEET REVISION TABULATION

CONTRACT NO. 75113		
PREPARER	D. WILSON	
CHECKER	DW	
ENGINEER	D. Wilson	10-25-76
OTHER	M. CARMICHAEL	11-16-76
FINAL	[illegible]	11-17-76

REDIFON
REDIFON ELECTRONICS, INC
ARLINGTON, TEXAS

TITLE
WIRE LIST, PDP 11 INTERFACE

SIZE	CODE IDENT NO.	DRAWING NO.
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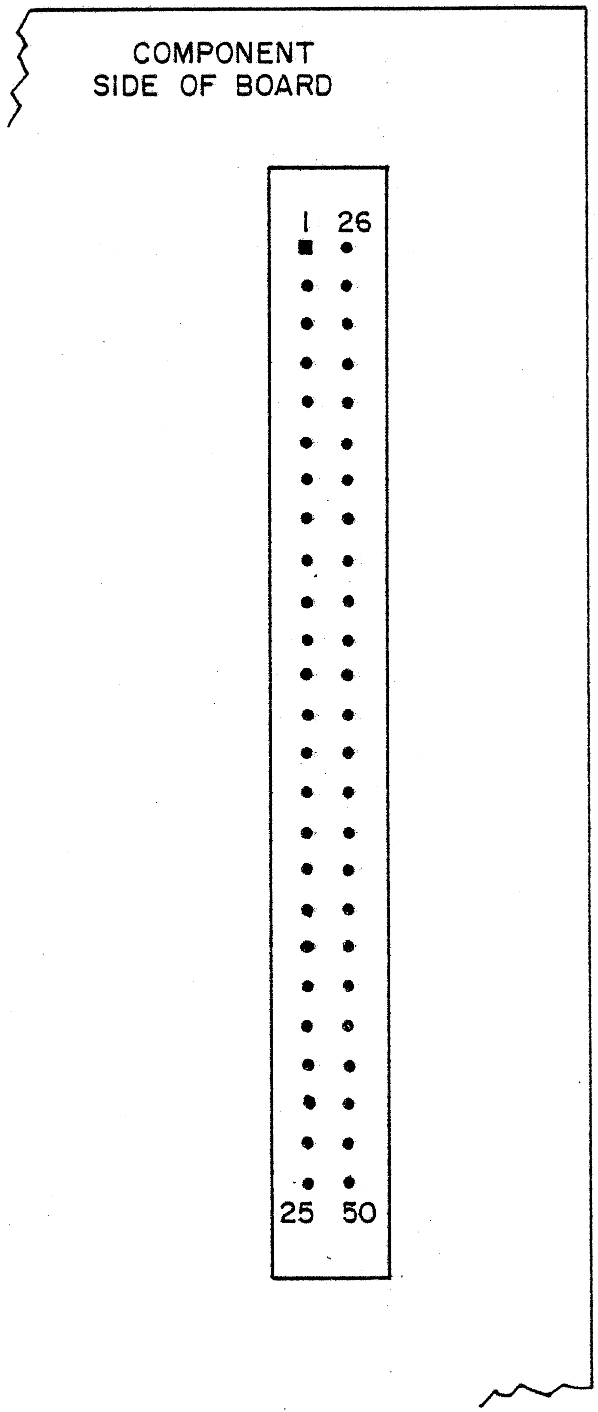
	REV:	SHEET 1 OF 24

FN 1053 (9/76)



HEADER SKETCH

REDIFON	SIZE	CODE IDENT NO.	DRAWING NO.
	A	53988	500012
	SCALE: NONE	REV:	SHEET 2 OF

REFERENCE DESIGNATION	PIN NO.	REFERENCE DESIGNATION	PIN NO.	LEVEL	REF	FUNCTION
D	A2					
	B2					
	C2					
	D2					
	E2					
	F2					
	H2					
	J2					
	K2	D	L2	1		BG7
	L2	D	K2	1	X	BG7
	M2	D	N2	1		BG6
	N2	D	M2	1	X	BG6
	P2	D	R2	1		BG5
	R2	D	P2	1	X	BG5
	S2	D	T2	1		BG4
	T2	D	S2	1	X	BG4
	U2					
	V2					

REFERENCE DESIGNATION	PIN NO.	REFERENCE DESIGNATION	PIN NO.	LEVEL	REF	FUNCTION
D4	1	H3	4	2		NIACK
	2	E5	5	1		IACK
		D8	3	2		
	3					
	4					
	5	X	36	1		WRITE EN
		E3	3	2		
	6	D4	9	1		G4
	7	P1	43	2		GND
	8	D5	9	1		G3
	9	D4	6	1	X	G4
	10	F4	2	1		COUNT
	11	D5	8	1		NCOUNT
	12					
	13					
	14					VCC

REDIFON

SIZE	CODE IDENT NO.	DRAWING NO.	REV:	SHEET
A	53988	500012		4

REFERENCE DESIGNATION	PIN NO.	REFERENCE DESIGNATION	PIN NO.	LEVEL	REF	FUNCTION
D5	1	D8	3	1		IACK
	2	D5	5	1	REF	READ
		D6	3	2		
	3	D5	10	1		G1
	4	D6	6	1		READY
	5	D5	2	1		READ
	6	P1	17	1		NIREADY
	7					GND
	8	D4	11	1	REF	NCOUNT
		D6	12	2		
	9	D4	8	1	REF	G3
	10	D5	3	1	REF	G1
	11	D6	9	1		G2
	12	E5	1	1		
	13	D8	1	1		NDLY
	14					VCC

REDIFON

SIZE	CODE IDENT NO.	DRAWING NO.
A	53988	500012
	REV:	SHEET 5

FN 1052 (9/76)

REFERENCE DESIGNATION	PIN NO.	REFERENCE DESIGNATION	PIN NO.	LEVEL	REF	FUNCTION
D6	1	D6	4	1		CARRY
		F4	15	2		
	2					WRITE
	3	D5	2	2	Ref	READ
	4	D6	1	1	REF	CARRY
	5					
	6	D5	4	1	Ref	READY
	7					GND
	8	H3	3	1		"1"
		D6	11	2		
	9	D5	11	1	Ref	G2
	10	D6	13	1		RESET
		X	37	2		
	11	D6	8	2	Ref	"1"
	12	D5	8	2	Ref	NCOUNT
	13	D6	10	1	Ref	RESET
		F4	1	2		
	14					VCC

REDIFON

SIZE	CODE IDENT NO.	DRAWING NO.
A	53988	500012
	REV:	SHEET 6

FN 1052 (9/76)

REFERENCE DESIGNATION	PIN NO.	REFERENCE DESIGNATION	PIN NO.	LEVEL	REF	FUNCTION
D7	1					
	2					
	3	D8	10	I		CA
	4					
	5					
	6	D8	11	I		CB
	7					GND
	8					
	9					
	10					
	11					
	12					
	13					
	14					VCC

REDIFON

SIZE	CODE IDENT NO.	DRAWING NO.
A	53988	500012
	REV:	SHEET 7

REFERENCE DESIGNATION	PIN NO.	REFERENCE DESIGNATION	PIN NO.	LEVEL	REF	FUNCTION
D8	1	D5	13	1	Ref	NDLY
	2					
	3	D5	1	1	Ref	IACK
		D4	2	2	Ref	
	4	H3	1	1		"1"
	5	H3	1	2		"1"
	6					DLY
	7					GND
	8					
	9	D8	14	1		VCC
	10	D7	3	1	Ref	CA
	11	D7	6	1	Ref	CB
	12					
	13					
	14	D8	9	1	Ref	VCC

REFERENCE DESIGNATION	PIN NO.	REFERENCE DESIGNATION	PIN NO.	LEVEL	REF	FUNCTION
E2	1	F2	1	1		
		E3	1	2		A
		E2	8	1		
	2					GND
		F2	3	1		
	3					WRITE EN
		X	15	1		
	4					DATA 03
		P1	13	1		
	5					IN12
		Y	16	1		
	6					DATA 02
		P1	14	1		
	7					IN13
		E2	2	1	Ref	
	8					GND
		P1	15	1		
	9					IN14
		X	12	1		
	10					DATA 01
		P1	16	1		
	11					IN 15
		Y	15	1		
	12					DATA 00
		F2	13	1		
	13	E3	13	2		D
		F2	14	1		
	14	E3	14	2		C
		F2	15	1		
	15	E3	15	2		B
		F2	16	1		
	16					VCC

REDIFON

SIZE	CODE IDENT NO.	DRAWING NO.
A	53988	500012
	REV:	SHEET 9

REFERENCE DESIGNATION	PIN NO.	REFERENCE DESIGNATION	PIN NO.	LEVEL	REF	FUNCTION
E3	1	F3	1	1		
		E2	1	2	Ref	A
	2	E3	8	1		
						GND
	3	F3	3	1		
		D4	5	2	Ref	WRITE EN
	4	Y	10	1		
						DATA 07
	5	P1	9	1		
						IN08
	6	Y	18	1		
						DATA 06
	7	P1	10	1		
						IN 09
	8	E3	2	1	Ref	
						GND
	9	P1	11	1		
						IN10
	10	X	11	1		
						DATA 05
	11	P1	12	1		
						IN 11
	12	Y	12	1		DATA 04
	13	F3	13	1		
		E2	13	2	Ref	D
	14	F3	14	1		
		E2	14	2	Ref	C
	15	F3	15	1		
		E2	15	2	Ref	B
	16	F3	16	1		
						VCC

REDIFON

SIZE	CODE IDENT NO.	DRAWING NO.
A	53988	500012
	REV:	SHEET 10

REFERENCE DESIGNATION	PIN NO.	REFERENCE DESIGNATION	PIN NO.	LEVEL	REF	FUNCTION
E4	1					
	2					
	3	E5	10	1		CC
	4					
	5					
	6	E5	11	1		CD
	7					GND
	8					
	9					
	10					
	11					
	12					
	13					
	14					VCC

REDIFON

SIZE	CODE IDENT NO.	DRAWING NO.
A	53988	500012
	REV:	SHEET / /

REFERENCE DESIGNATION	PIN NO.	REFERENCE DESIGNATION	PIN NO.	LEVEL	REF	FUNCTION
E5	1	D5	12	1	Ref	
	2					
	3	E5	7	1		GND
	4	E5	7	2		GND
	5	D4	2	1	Ref	IACK
	6					
	7	E5	3	1	Ref	GND
		E5	4	2	Ref	
	8					
	9	E5	14	1		VCC
	10	E4	3	1	Ref	CC
	11	E4	6	1	Ref	CD
	12					
	13					
	14	E5	9	1	Ref	VCC
		F4	14	2		

REDIFON

SIZE	CODE IDENT NO.	DRAWING NO.
A	53988	500012
	REV:	SHEET 12

REFERENCE DESIGNATION	PIN NO.	REFERENCE DESIGNATION	PIN NO.	LEVEL	REF	FUNCTION
F2	1	E2	1	1	Ref	A
	2	F2	8	1		GND
	3	E2	3	1	Ref	WRITE EN
		F3	3	2		
	4	Y	3	1		DATA 15
	5	P1	1	1		IN 00
	6	Y	4	1		DATA 14
	7	P1	2	1		IN 01
	8	F2	2	1	Ref	GND
	9	P1	3	1		IN 02
	10	X	2	1		DATA 13
	11	P1	4	1		IN 03
	12	X	4	1		DATA 12
	13	E2	13	1	Ref	D
	14	E2	14	1	Ref	C
	15	E2	15	1	Ref	B
	16	E2	16	1	Ref	VCC

REDIFON

SIZE	CODE IDENT NO.	DRAWING NO.
A	53988	500012
	REV:	SHEET 13

REFERENCE DESIGNATION	PIN NO.	REFERENCE DESIGNATION	PIN NO.	LEVEL	REF	FUNCTION
F3	1	E3	1	1	Ref	A
		F4	14	2		
	2	F3	8	1		GND
	3	E3	3	1	Ref	WRITE EN
		F2	3	2	Ref	
	4	X	6	1		DATA 11
	5	P1	5	1		IN 04
	6	X	5	1		DATA 10
	7	P1	6	1		IN 05
	8	F3	2	1	Ref	GND
	9	P1	7	1		IN 06
	10	X	9	1		DATA 09
	11	P1	8	1		IN 07
	12	Y	9	1		DATA 08
	13	E3	13	1	Ref	D
		F4	11	2		
	14	E3	14	1	Ref	C
		F4	12	2		
	15	E3	15	1	Ref	B
		F4	13	2		
	16	E3	16	1	Ref	VCC

REDIFON

SIZE	CODE IDENT NO.	DRAWING NO.
A	53988	500012
	REV:	SHEET 14

REFERENCE DESIGNATION	PIN NO.	REFERENCE DESIGNATION	PIN NO.	LEVEL	REF	FUNCTION
F4	1	D6	13	2	Ref	RESET
	2	D4	10	1	Ref	COUNT
	3	F4	5	1		GND
	4	F4	6	2		GND
	5	F4	3	1	Ref	GND
		F4	8	2		
	6	F4	8	1		GND
		F4	4	2	Ref	
	7	F4	9	1		"1"
		F4	10	2		
	8	F4	6	1	Ref	GND
		F4	5	2	Ref	
	9	F4	7	1	Ref	"1"
	10	H3	2	1		"1"
		F4	7	2	Ref	
	11	F3	13	2	Ref	D
	12	F3	14	2	Ref	C
	13	F3	15	2	Ref	B
	14	F3	1	2	Ref	A
	15	D6	1	2	Ref	CARRY
	16	E5	14	2	Ref	VCC

REFERENCE DESIGNATION	PIN NO.	REFERENCE DESIGNATION	PIN NO.	LEVEL	REF	FUNCTION
H3	1	D8	4	1	Ref	"1"
		D8	5	2	Ref	
	2	F4	10	1	Ref	"1"
	3	D6	8	1	Ref	"1"
	4	P1	18	1		NIACK
		D4	1	2	Ref	
	5					
	6					
	7	P1	26	2		GND
	8					
	9					
	10					
	11					
	12					
	13					
	14					VCC

REDIFON

SIZE	CODE IDENT NO.	DRAWING NO.
A	53988	500012
	REV:	SHEET 16

REFERENCE DESIGNATION	PIN NO.	REFERENCE DESIGNATION	PIN NO.	LEVEL	REF	FUNCTION
P1	1	F2	5	1	Ref	IN00
	2	F2	7	1	Ref	IN01
	3	F2	9	1	Ref	IN02
	4	F2	11	1	Ref	IN03
	5	F3	5	1	Ref	IN04
	6	F3	7	1	Ref	IN05
	7	F3	9	1	Ref	IN06
	8	F3	11	1	Ref	IN07
	9	E3	5	1	Ref	IN08
	10	E3	7	1	Ref	IN09
	11	E3	9	1	Ref	IN10
	12	E3	11	1	Ref	IN11
	13	E2	5	1	Ref	IN12
	14	E2	7	1	Ref	IN13
	15	E2	9	1	Ref	IN14
	16	E2	11	1	Ref	IN15
	17	D5	6	1	Ref	NIREADY
	18	H3	4	1	Ref	NIACK
	19					
	20					
	21					
	22					
	23					
	24					
	25					
	26	P1	28	1		
		H3	7	2	Ref	GND
	27	P1	29	2		GND

REDIFON

SIZE A | CODE IDENT NO. 53988 | DRAWING NO. 500012

REV: | SHEET 17

REFERENCE DESIGNATION	PIN NO.	REFERENCE DESIGNATION	PIN NO.	LEVEL	REF	FUNCTION
P1	28	P1	26	1	Ref	
		P1	30	2		GND
		P1	31	1		
	29	P1	27	2	Ref	GND
		P1	32	1		
	30	P1	28	2	Ref	GND
		P1	29	1	Ref	
	31	P1	33	2		GND
		P1	30	1	Ref	
	32	P1	34	2		GND
		P1	35	1		
	33	P1	31	2	Ref	GND
		P1	36	1		
	34	P1	32	2	Ref	GND
		P1	33	1	Ref	
	35	P1	37	2		GND
		P1	34	1	Ref	
	36	P1	38	2		GND
		P1	39	1		
	37	P1	35	2	Ref	GND
		P1	40	1		
	38	P1	36	2	Ref	GND
		P1	37	1	Ref	
	39	P1	41	2		GND
		P1	38	1	Ref	
	40	P1	42	2		GND
		P1	43	1		
	41	P1	39	2	Ref	GND
		P1	40	2	Ref	
	42					GND
		P1	41	1	Ref	
	43	D4	7	2		GND
	44					
	45					
	46					
	47					
	48					
	49					
	50					

REDIFON

SIZE	CODE IDENT NO.	DRAWING NO.
A	53988	500012
	REV:	SHEET 18

FN 1052 (9/76)

REFERENCE DESIGNATION	PIN NO.	REFERENCE DESIGNATION	PIN NO.	LEVEL	REF	FUNCTION
X	1					
	2	F2	10	1	X	DATA 13
	3					
	4	F2	12	1	X	DATA 12
	5	F3	6	1	X	DATA 10
	6	F3	4	1	X	DATA 11
	7					
	8					
	9	F3	10	1	X	DATA 09
	10					
	11	E3	10	1	X	DATA 05
	12	E2	10	1	X	DATA 01
	13					
	14					
	15	E2	4	1	X	DATA 03
	16					
	17					
	18					
	19	X	51	1		ADDR
	20					
	21					
	22					
	23					
	24					
	25					
	26					
	27					

REDIFON

SIZE	CODE IDENT NO.	DRAWING NO.
A	53988	500012
	REV:	SHEET 19

REFERENCE DESIGNATION	PIN NO.	REFERENCE DESIGNATION	PIN NO.	LEVEL	REF	FUNCTION
X	28					
	29					
	30					
	31					
	32					
	33					
	34					
	35					
	36	D4	5	1	X	WRITE EN
	37	D6	10	2	X	RESET
	38					
	39					
	40					
	41					
	42					
	43					
	44					
	45					
	46					
	47					
	48					
	49					
	50					
	51	X	19	1	X	ADDR
	52	X	57	1		ADDR
	53	Y	42	1		ADDR
	54					

REFERENCE DESIGNATION	PIN NO.	REFERENCE DESIGNATION	PIN NO.	LEVEL	REF	FUNCTION
X	55					
	56					
	57	X	52	1	X	ADDR
	58	Y	51	1		ADDR
	59	Y	52	1		ADDR
	60					
	61	Y	63	1		ADDR
	62					
	63	Y	41	1		ADDR
	64					
	65					

REFERENCE DESIGNATION	PIN NO.	REFERENCE DESIGNATION	PIN NO.	LEVEL	REF	FUNCTION
Y	1					
	2					
	3	F2	4	1	X	DATA 15
	4	F2	6	1	X	DATA 14
	5					
	6					
	7					
	8					
	9	F3	12	1	X	DATA 08
	10	E3	4	1	X	DATA 07
	11					
	12	E3	12	1	X	DATA 04
	13					
	14					
	15	E2	12	1	X	DATA 00
	16	E2	6	1	X	DATA 02
	17					
	18	E3	6	1	X	DATA 06
	19					
	20					
	21					
	22					
	23					
	24					
	25					
	26					
	27					

REFERENCE DESIGNATION	PIN NO.	REFERENCE DESIGNATION	PIN NO.	LEVEL	REF	FUNCTION
Y	28					
	29					
	30					
	31					
	32					
	33					
	34					
	35					
	36					
	37					
	38					
	39					
	40					
	41	X	63	1	X	ADDR
	42	X	53	1	X	ADDR
	43	Y	55	1		ADDR
	44	Y	54	1		ADDR
	45					
	46					
	47					
	48					
	49					
	50					
	51	X	58	1	X	ADDR
	52	X	59	1	X	ADDR
	53					
	54	Y	44	1	X	ADDR

REFERENCE DESIGNATION	PIN NO.	REFERENCE DESIGNATION	PIN NO.	LEVEL	REF	FUNCTION
Y	55	Y	43	1	X	ADDR
	56	Y	62	1		ADDR
	57					
	58					
	59	Y	64	1		ADDR
	60					
	61					
	62	Y	56	1	X	ADDR
	63	X	61	1	X	ADDR
	64	Y	59	1	X	ADDR
	65					

REDIFON

ENGINEERING ORDER

ORDER NO: 000043

DRAWING TITLE:	DRAWING NO:	REVISION LTR:	CHANGE CLASS	SHEET / OF
WIRE LIST, PDP 11/45 INTFC	500012	WAS N/C CHG. TO A	I [ ] II [✓]	1 / 4

APPROVAL ROUTING:	BY	DATE
PREP:	Callahan	5/24/77
CHECKER	[illegible]	[illegible]
ENGINEER	P. Lucas	
SYS. ENGR.	P. Lucas	
PROJ. MGR.	J.R. Peck	5/31/77
PROD.	J. Milan	
ILS:		
Q.A.	M. Cirvarthal	5-31-77

APPROVAL REQUIRED CUST. [ ] NONE [✓]

CUSTOMER APPROVAL

CHANGES	BY	DATE
MADE		
CHECKS		
RECORDED		

EFFECTIVITY
IN PROCESS/ON ORDER PARTS..... [ ] N/A
NEXT LOT/ORDER .... [ ]

PART DISP.	USE	REWORK	SCRAP
IN PROCESS	N/A		
ON ORDER			
IN STORES			

~~CONFIGURATION CHG. NO.:~~
~~CONF. LIST NOT AFFECTED........~~ [ ]
~~NEW CONTROL LIST...............~~ [ ]
~~UPDATE CONTROL LIST...........~~ [ ]

ECO [✓] ACN [ ] CHANGE DRAWING MASTER

RC [ ] PRC [ ] DO NOT CHG. DWG.MASTER

ECO, ACN BECOMES PART OF REFERENCE DRAWING UNTIL CHANGE IS INCORPORATED ON MASTER.

PRC BECOMES PART OF REFERENCE DRAWING AS USED ON CONTRACT NO.(S).

REASON FOR CHANGE:
CHANGE SETTING OF RD/WR FF

~~ZONE~~ SHEET	DESCRIPTION OF CHANGE:
1	NOTE 2.
	WAS: TOTAL NUMBER OF WIRES IS 135. IS: TOTAL NUMBER OF WIRES IS 139.
5	D5 - 8
6	D6

Sheet 5, D5 - 8

WAS:

8	D4	11	1	REF	N COUNT
	D6	12	2		

IS:

8	D4	11	1	REF	N COUNT

Sheet 6, D6

WAS:

1	D6	4	1		CARRY
	F4	15	2		

12	D5	8	2	REF	N COUNT

IS:

1	D6	4	1		"1"
	H3	5	2		

12	A4	15	1		CARRY

FN 1014 (3/77)

REDIFON

ENGINEERING ORDER

ORDER NO: 000043

DRAWING TITLE: Wire List, PDP 11/45 Interface

DRAWING NO: 500012

REVISION LTR: WAS N/C CHG. TO A

CHANGE CLASS I [ ] II [✓]

SHEET 2 OF 4

APPROVAL ROUTING:	BY	DATE
PREP:	[illegible signature]	5/24/77
CHECKER		
ENGINEER		
SYS. ENGR.		
PROJ. MGR.		
PROD.		
ILS:		
Q.A.		

APPROVAL REQUIRED CUST. [ ] NONE [✓]

CUSTOMER APPROVAL

CHANGES	BY	DATE
MADE		
CHECKS		
RECORDED		

EFFECTIVITY
IN PROCESS/ON ORDER PARTS..... [ ]
NEXT LOT/ORDER.................. [ ]

PART DISP.	USE	REWORK	SCRAP
IN PROCESS			
ON ORDER			
IN STORES			

CONFIGURATION CHG. NO.: [ ]
CONF. LIST NOT AFFECTED......... [ ]
NEW CONTROL LIST................ [ ]
UPDATE CONTROL LIST............ [ ]

ECO [✓] ACN [ ] CHANGE DRAWING MASTER

RC [ ] PRC [ ] DO NOT CHG. DWG. MASTER

ECO, ACN BECOMES PART OF REFERENCE DRAWING UNTIL CHANGE IS INCORPORATED ON MASTER.

PRC BECOMES PART OF REFERENCE DRAWING AS USED ON CONTRACT NO.(S).

REASON FOR CHANGE:
Change Setting of RO/WR FF

~~ZONE~~ SHEET | DESCRIPTION OF CHANGE:

15 F4

WAS:

15	D6	1	2	Ref	Carry

IS:

15	D6	12	1	Ref	Carry

16 H3

WAS:

5					

IS:

5	D6	1	2	Ref	"1"

REDIFON

ENGINEERING ORDER

ORDER NO: 000043

DRAWING TITLE: Wire List, PDP 11/45 Interface

DRAWING NO: 500012

REVISION LTR: WAS N/C CHG. TO A

CHANGE CLASS I [ ] II [✓]

SHEET 3 OF 4

APPROVAL ROUTING: BY DATE
PREP: Colleban 5/24/77
CHECKER
ENGINEER
SYS. ENGR.
PROJ. MGR.
PROD.
ILS:
Q.A.

APPROVAL REQUIRED CUST. [ ] NONE [✓]

CUSTOMER APPROVAL

CHANGES BY DATE
MADE
CHECKS
RECORDED

EFFECTIVITY
IN PROCESS/ON ORDER PARTS..... [ ]
NEXT LOT/ORDER.................. [ ]

PART DISP.	USE	REWORK	SCRAP
IN PROCESS			
ON ORDER			
IN STORES			

CONFIGURATION CHG. NO.: [ ]
CONF. LIST NOT AFFECTED......... [ ]
NEW CONTROL LIST............... [ ]
UPDATE CONTROL LIST........... [ ]

ECO [✓] ACN [ ] CHANGE DRAWING MASTER

RC [ ] PRC [ ] DO NOT CHG. DWG. MASTER

ECO, ACN BECOMES PART OF REFERENCE DRAWING UNTIL CHANGE IS INCORPORATED ON MASTER.

PRC BECOMES PART OF REFERENCE DRAWING AS USED ON CONTRACT NO.(S).

REASON FOR CHANGE:
Change Setting of RO/WR FF

~~ZONE~~ SHEET | DESCRIPTION OF CHANGE:

17 P1

WAS:

19					
20					

IS:

19	P1	20	2		GND
20	P1	45	1		
	P1	19	2	Ref	GND

FN 1014 (3/77)

REDIFON

ENGINEERING ORDER

ORDER NO: 000043

DRAWING TITLE: Wire List, PDP 11/45 Interface

DRAWING NO: 500012

REVISION LTR: WAS N/C CHG. TO A

CHANGE CLASS I [ ] II [✓]

SHEET 4 OF 4

APPROVAL ROUTING: BY DATE
PREP: [signature] 5/24/77
CHECKER
ENGINEER
SYS. ENGR.
PROJ. MGR.
PROD.
ILS:
Q.A.

APPROVAL REQUIRED CUST. [ ] NONE [✓]

CUSTOMER APPROVAL

CHANGES BY DATE
MADE
CHECKS
RECORDED

EFFECTIVITY
IN PROCESS/ON ORDER PARTS..... [ ]
NEXT LOT/ORDER.................. [ ]

PART DISP.	USE	REWORK	SCRAP
IN PROCESS			
ON ORDER			
IN STORES			

CONFIGURATION CHG. NO.: [ ]
CONF. LIST NOT AFFECTED......... [ ]
NEW CONTROL LIST................ [ ]
UPDATE CONTROL LIST............ [ ]

ECO [✓] ACN [ ]
CHANGE DRAWING MASTER

RC [ ] PRC [ ]
DO NOT CHG. DWG. MASTER

ECO, ACN BECOMES PART OF REFERENCE DRAWING UNTIL CHANGE IS INCORPORATED ON MASTER.

PRC BECOMES PART OF REFERENCE DRAWING AS USED ON CONTRACT NO.(S).

REASON FOR CHANGE:
Change Setting of RO/WR FF

~~ZONE~~ SHEET: 18

DESCRIPTION OF CHANGE:

P1

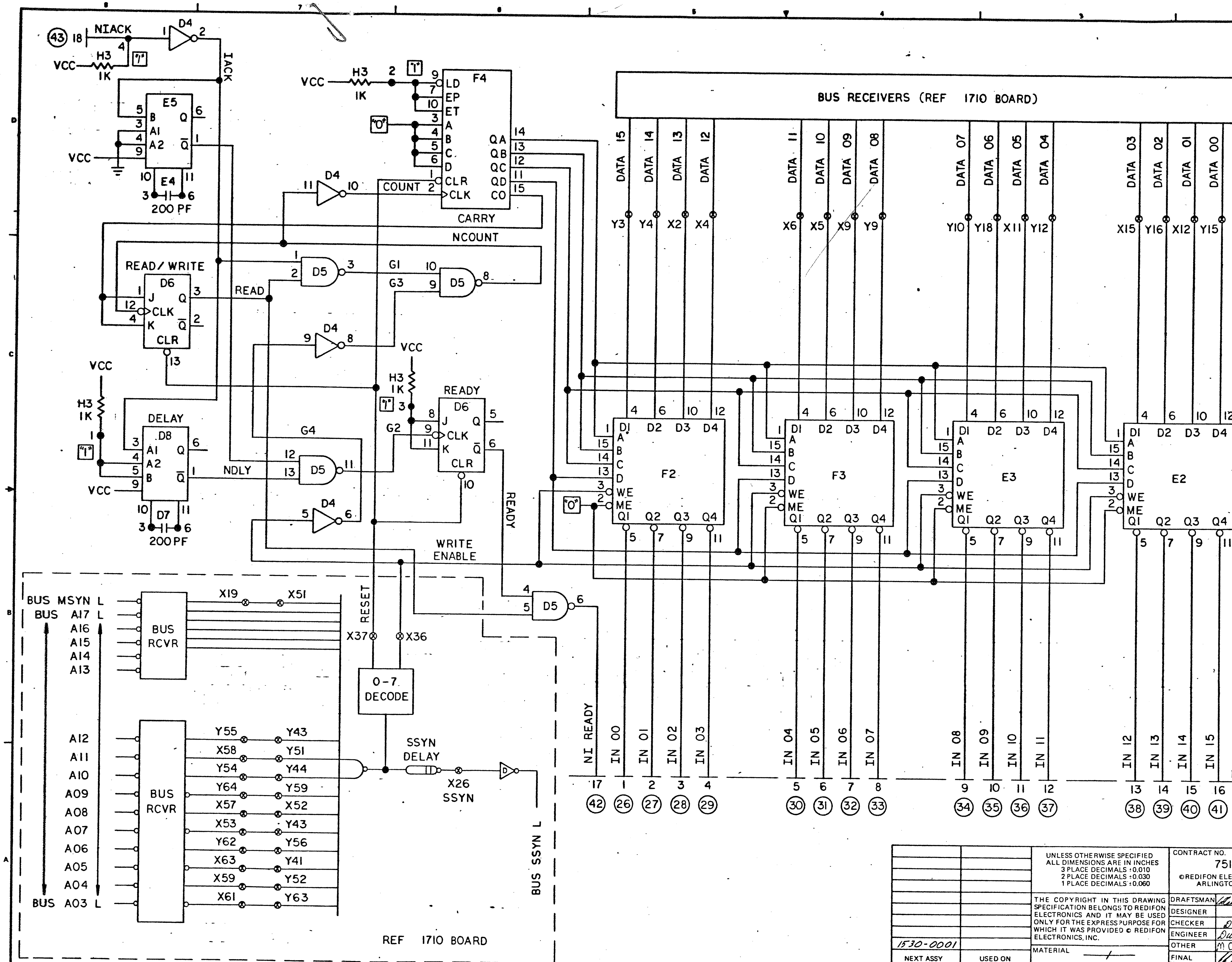
WAS:

42	P1	40	2	REF	GND
44					
45					

IS:

42	P1	44	1		GND
	P1	40	2	REF	
44	P1	42	1	REF	GND
	P1	45	2		
45	P1	20	1	REF	GND
	P1	44	2	REF	

FN 1014 (3/77)



NOTES:

1. JUMPERS ADDED FOR INTERRUPT BYPASS:
   DS2 TO DT2.
   DP2 TO DR2
   DM2 TO DN2
   DK2 TO DL2.
2. DEVICE DATA ADDRESS IS 776520.
3. ⊗ DENOTES WIRE WRAP PINS.
4. ALL SIGNALS THRU PI ARE VIA TWISTED PAIRS. LETTERS IN CIRCLE DENOTE PINS FOR THE RETURN OF THE NEARBY SIGNAL. THESE RETURNS ARE ALL JUMPERED TOGETHER AND GROUNDED.
5. DEVICE RESET ADDRESS IS 776522.

PART NO.	LOCATION
7400	D5
7414	D4
7489	E2, E3, F2, F3
74107	D6
74121	D8, E5
74161	F4
899-1-RIK	H3
CD15FD201J	D7, E4

REVISIONS

ZONE	LTR	DESCRIPTION	DATE	APPROVED

UNLESS OTHERWISE SPECIFIED ALL DIMENSIONS ARE IN INCHES
3 PLACE DECIMALS ±0.010
2 PLACE DECIMALS ±0.030
1 PLACE DECIMALS ±0.060

CONTRACT NO. 75113

REDIFON

TITLE LOGIC DIAGRAM — PDP 11/45 INTERFACE.

DRAFTSMAN	[signature]	12/4/75
DESIGNER		
CHECKER	DWW	
ENGINEER	[signature]	11/10/76
OTHER	M. [signature]	11-4-76
FINAL	[signature]	11-17-76

1530-0001

NEXT ASSY | USED ON

APPLICATION

MATERIAL —/—

FINISH —/—

SIZE D | CODE IDENT NO. 53988 | DRAWING NO. 500013

SCALE NONE | DO NOT SCALE THIS DWG | SHEET 1 OF 1

REDIFON — ENGINEERING ORDER

ORDER NO: 000042

DRAWING TITLE:	DRAWING NO:	REVISION LTR:	CHANGE CLASS	SHEET
Logic Diagram - PDP 11/45 Interface	500013	WAS N/C CHG. TO A	I [ ] II [✓]	1 OF 1

APPROVAL ROUTING:	BY	DATE
PREP:	Callahan	5/24/77
CHECKER	[illegible]	5/31/77
ENGINEER	P. Gross	
SYS. ENGR.	P. Gross.	
PROJ. MGR.	J. K. Peck	5/31/77
PROD.	J. Main	5/31/77
ILS:		
Q.A.	M. Carmichael	5-31-77

APPROVAL REQUIRED: CUST. [ ] NONE [✓]

CUSTOMER APPROVAL

CHANGES	BY	DATE
MADE		
CHECKS		
RECORDED		

EFFECTIVITY
IN PROCESS/ON ORDER PARTS..... [ ]
NEXT LOT/ORDER..... N/A [ ]

PART DISP.	USE	REWORK	SCRAP
IN PROCESS	N/A		
ON ORDER			
IN STORES			

~~CONFIGURATION CHG. NO.: [ ]~~
~~CONF. LIST NOT AFFECTED........ [ ]~~
~~NEW CONTROL LIST.............. [ ]~~
~~UPDATE CONTROL LIST.......... [ ]~~

ECO [✓] ACN [ ] CHANGE DRAWING MASTER
RC [ ] PRC [ ] DO NOT CHG. DWG. MASTER

ECO, ACN BECOMES PART OF REFERENCE DRAWING UNTIL CHANGE IS INCORPORATED ON MASTER.

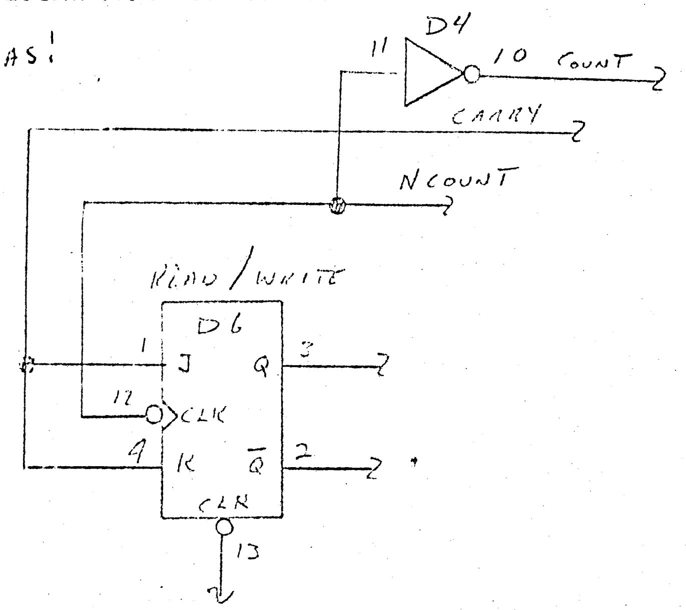
PRC BECOMES PART OF REFERENCE DRAWING AS USED ON CONTRACT NO.(S).

REASON FOR CHANGE:
Change setting of RD/WR FF

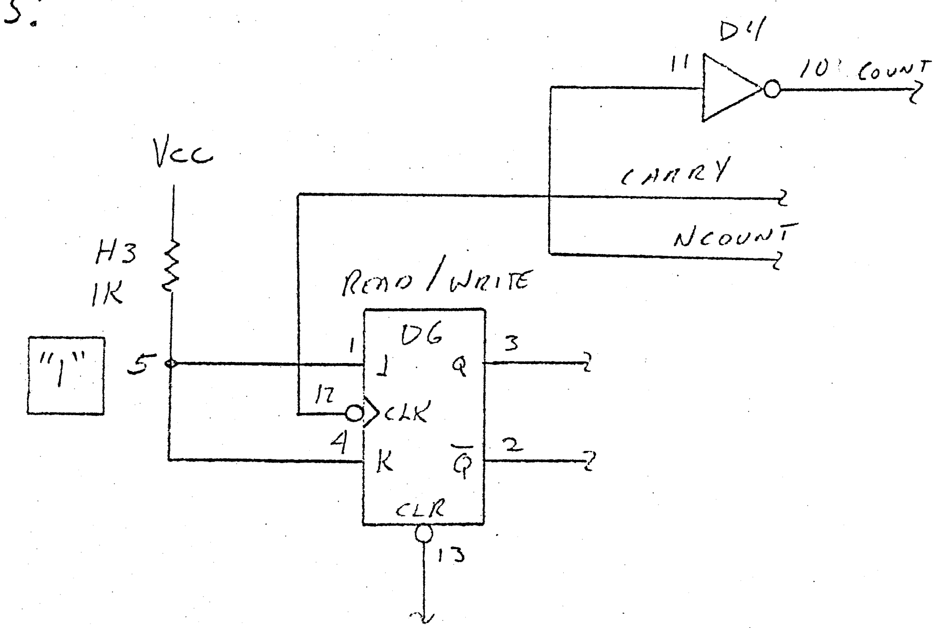
ZONE: C-8

DESCRIPTION OF CHANGE:

WAS!

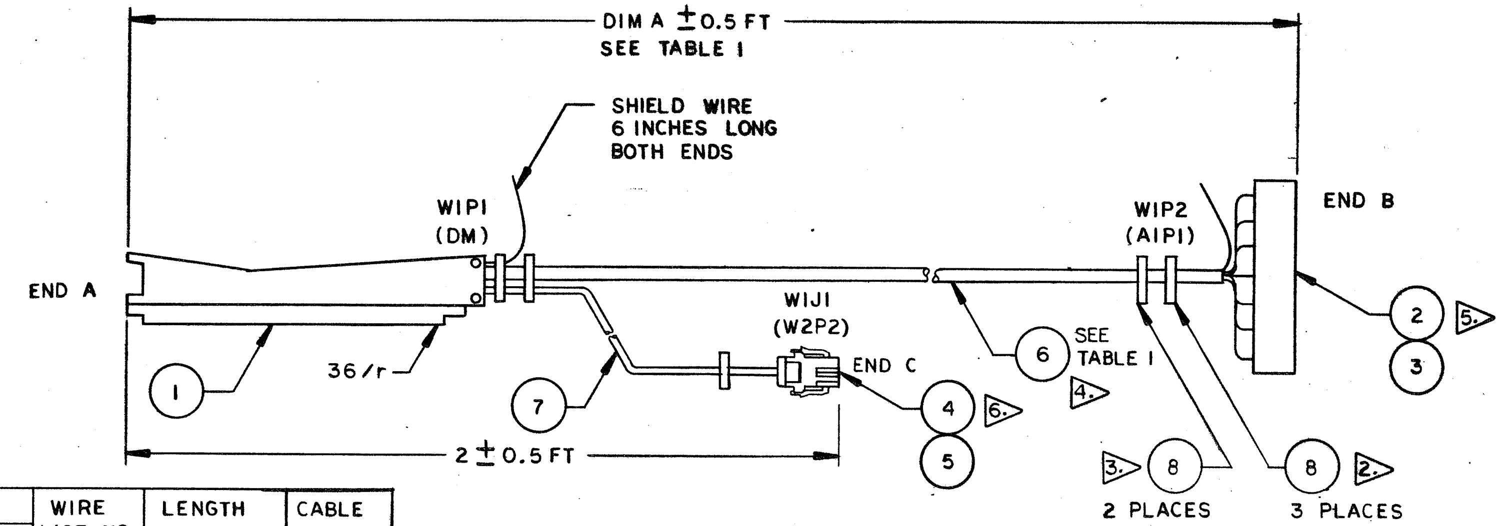


IS!



1014 (3/7

REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPROVED
	A	ADD -03 & 04 CONFIGURATIONS	3/17/77	DWW
B-3	B	IN P/L ITEM 3, WAS QTY 36, NOW QTY 40 FOR -01, -02, -03 ASSY PER EO 000041.	6/2/77	DWW



-01 ASSY SHOWN

TABLE I

CABLE DASH NO.	END A CONNECTOR REF. DES. (MATING REF. DES.) 2	END A AND B CABLE REF DES AND PART NO. 3	END B CONNECTOR REF. DES. (MATING REF. DES.) 2	END C CONNECTOR REF. DES. (MATING REF. DES.) 2	WIRE LIST NO.	LENGTH DIMENSION A IN FEET	CABLE PART NO.
-01	WIP1 (DM)	W1 1540-0001-01	WIP2 (A1P1)	WIJ1 (W2P1)	500009	20	RCN2209
-02	WIP1 (DM)	W1 1540-0001-02	WIP2 (A1P1)	WIJ1 (W2P2)	500025	30	RCN2209
-03	WIP1 (DM)	W1 1540-0001-03	WIP2 (A1P1)	WIJ1 (W2P2)	500009	20	RCN2209
-04	WIP1 (DM)	W1 1540-0001-04	WIP2 (A1P1)	WIJ1 (W2P2)	500071	30	RCN2621

1. FOR WIRE LIST, SEE TABLE 1.

2. MARK CONNECTOR REF. DES. AND (MATING CONNECTOR REF. DES.) ON IDENTIFICATION TAG, ITEM NO. 8, USING INDELIBLE INK OR HOT STAMP. SEE TABLE I. LOCATE IDENTIFICATION TAGS APPROXIMATELY 3.0 INCHES FROM CONNECTOR END.

3. MARK CABLE REF. DES. AND PART NUMBER ON IDENTIFICATION TAG, ITEM NO. 8, USING INDELIBLE OR HOT STAMP. SEE TABLE I. LOCATE IDENTIFICATION TAGS APPROXIMATELY 5.0 INCHES FROM CONNECTOR END.

4. WIRE PAIRS SHALL BE KEPT TWISTED TO WITHIN 1/2 INCH OF THE CONNECTOR.

5. CRIMP TOOL FOR WIP2 IS HT-95.

6. CRIMP TOOL FOR WIJ1 IS BURNDY MIOS-1 WITH S-9 DIE SET AND SL-40 STOP BUSHING.

7. BOTH WIRES SHALL BE TWISTED TOGETHER AT THE RATE OF 12-14 TURNS PER FOOT MINIMUM.

QTY -04	QTY -03	QTY -02	QTY -01	ITEM NO.	PART NUMBER	DESCRIPTION	VENDOR
30.5 FEET				9	RCN2621	CABLE, 21 TWISTED PAIRS	GORE
5	5	5	5	8	PLMIM-CP	TIES, IDENTIFICATION	PANDUIT
5 FEET	5 FEET	5 FEET	5 FEET	7	7054	WIRE, 24 AWG	ALPHA
	20.5 FEET	30.5 FEET	20.5 FEET	6	RCN2209	CABLE, 24 AWG 24 TWISTED PAIRS	GORE
3	2	2	2	5	RCM24M-9	CONTACTS, FEMALE	BURNDY
1	1	1	1	4	SMS6R-1	CONNECTOR, 6 POSITION	BURNDY
40	40	40	40	3	47745	CONTACTS, MINI-PV CTW	BERG
1	1	1	1	2	65043-015	CONNECTOR, MINI-LATCH, 2X44	BERG
1	1	1	1	1	217081-2	CONNECTOR, EDGE, WITH HARDWARE	TI

FOR PART NO. SEE TABLE I

NEXT ASSY	USED ON
	COMMON

APPLICATION

UNLESS OTHERWISE SPECIFIED
ALL DIMENSIONS ARE IN INCHES
3 PLACE DECIMALS ±0.010
2 PLACE DECIMALS ±0.030
1 PLACE DECIMALS ±0.060

MATERIAL —/—
FINISH —/—

CONTRACT NO. 75113

DRAFTSMAN	[signature]	8/6/76
DESIGNER		
CHECKER	DWW	
ENGINEER	D. Wilson	11/16/76
OTHER	M. [signature]	11-16-76
FINAL	[signature]	11-17-76

REDIFON

TITLE
CABLE ASSEMBLY,
PDP 11/45

SIZE	CODE IDENT NO.	DRAWING NO.	REV
D	53988	1540-0001	B

SCALE: NONE | DO NOT SCALE THIS DWG | SHEET 1 OF 1

REVISIONS

LTR	DESCRIPTION	DATE	APPROVED

SHT	REV	2		3		4		5											

SHEET REVISION TABULATION

CONTRACT NO. 75113		
PREPARER	D. WILSON	
CHECKER	DW	
ENGINEER	D. Wilson	10/26/76
OTHER	M. Carmichael	10-27-76
FINAL	[illegible]	11-17-76

REDIFON

REDIFON ELECTRONICS, INC
ARLINGTON, TEXAS

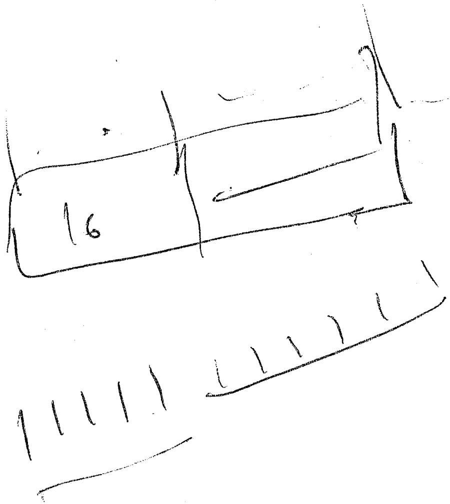
TITLE WIRE LIST, PDP 11/45

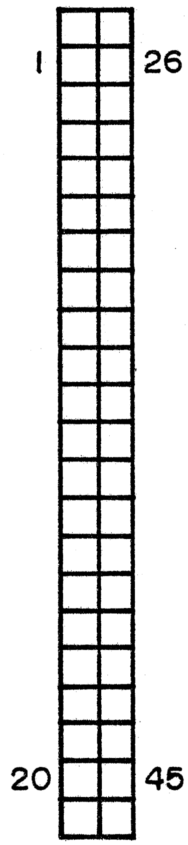
CABLE ASSY

SIZE	CODE IDENT NO.	DRAWING NO.
A	53988	500009

REV: SHEET 1 OF 5

FN 1053 (9/76)





WIRE SIDE OF P2

PIN ASSIGNMENTS

HEADER SKETCH

REDIFON	SIZE A	CODE IDENT NO. 53988	DRAWING NO. 500009
	SCALE: NONE	REV:	SHEET 2 OF

CONNECTOR REF DES	PIN NO.	CONNECTOR REF DES	PIN NO.	TWISTED PAIR NO.	COLOR	COMMENT
P1	A	P2	29	TP1	Blk (Brn)	RCN 2209 cable
	B	P2	28	TP2	Blk (Red)	
	C	P2	26	TP3	Blk (Orn)	
	D	P2	27	TP4	Blk (Yel)	
	E	P2	33	TP5	Blk (Grn)	
	F	P2	32	TP6	Blk (Blu)	
	H	P2	30	TP7	Blk (Vio)	
	J	P2	39	TP8	Blk (Gry)	
	K	P2	40	TP9	Blk (Wht)	
	L	P2	31	TP10	Brn (Red)	
	M	P2	37	TP11	Brn (Orn)	
	N	P2	38	TP12	Brn (Yel)	
	P	P2	42	TP13	Brn (Grn)	
	R	P2	36	TP14	Brn (Blu)	
	S	P2	34	TP15	Brn (Vio)	
	T					
	U	P2	35	TP16	Brn (Gry)	
	V	P2	41	TP17	Brn (Wht)	
	W					
	X					
	Y					
	Z					
	a					
	b					
	c					
	d					
	e					

REDIFON

SIZE	CODE IDENT NO.	DRAWING NO.
A	53988	500009
	REV:	SHEET 3

FN 1051 (9/76)

CONNECTOR REF DES	PIN NO.	CONNECTOR REF DES	PIN NO.	TWISTED PAIR NO.	COLOR	COMMENT
P1	f					
	h					
	j	P2	43	TP18	Wht (Red)	
	k					
	l					
	m					
	n					
	p					
	r	J1	2			VCC EXT
	1	P2	4	TP1	Brn (Blk)	IN03
	2	P2	3	TP2	Red (Blk)	IN02
	3	P2	1	TP3	Orn (Blk)	IN00
	4	P2	2	TP4	Yel (Blk)	IN01
	5	P2	8	TP5	Grn (Blk)	IN07
	6	P2	7	TP6	Blu (Blk)	IN06
	7	P2	5	TP7	Vio (Blk)	IN04
	8	P2	14	TP8	Gry (Blk)	IN13
	9	P2	15	TP9	Wht (Blk)	IN14
	10	P2	6	TP10	Red (Brn)	IN05 344
	11	P2	12	TP11	Orn (Brn)	IN11
	12	P2	13	TP12	Yel (Brn)	IN12
	13	P2	17	TP13	Grn (Brn)	IRDY
	14	P2	11	TP14	Blu (Brn)	IN10
	15	P2	9	TP15	Vio (Brn)	IN08
	16					
	17	P2	10	TP16	Gry (Brn)	IN09
	18	P2	16	TP17	Wht (Brn)	IN15

REDIFON

SIZE	CODE IDENT NO.	DRAWING NO.
A	53988	500009
	REV:	SHEET 4

CONNECTOR REF DES	PIN NO.	CONNECTOR REF DES	PIN NO.	TWISTED PAIR NO.	COLOR	COMMENT
P1	19					
	20					
	21					
	22					
	23					
	24					
	25					
	26					
	27					
	28					
	29					
	30					
	31					
	32	J1	1			Out 13
	33					
	34	P2	18	TP18 X	Red (Wht)	IACK
	35					
	36					

REDIFON	SIZE	CODE IDENT NO.	DRAWING NO.
	A	53988	500009
		REV:	SHEET 5

CPU ERROR.
mod 0 [illegible]

REDIFON

ENGINEERING ORDER

ORDER NO: 000044

DRAWING TITLE: WIRE LIST, PDP 11/45 - CABLE ASSY

DRAWING NO: 500009

REVISION LTR: WAS N/C CHG. TO A

CHANGE CLASS I [ ] II [✓]

SHEET 1 OF 1

APPROVAL ROUTING: BY / DATE
PREP: Callahan 5/24/77
CHECKER: D. Holmes 5/31/77
ENGINEER: P. Curtis
SYS. ENGR.: P. Curtis
PROJ. MGR.: J. R. Peck 5/31/77
PROD.: [illegible]
ILS:
Q.A.: M. Carmichael 5-31-77

APPROVAL REQUIRED: CUST. [ ] NONE [✓]

CUSTOMER APPROVAL

CHANGES BY DATE
MADE
CHECKS
RECORDED

EFFECTIVITY
IN PROCESS/ON ORDER PARTS..... [ ]
NEXT LOT/ORDER.................. [ ]
NA

PART DISP.	USE	REWORK	SCRAP
IN PROCESS			
ON ORDER			
IN STORES			

NA

~~CONFIGURATION CHG. NO.:~~
~~CONF. LIST NOT AFFECTED.........~~
~~NEW CONTROL LIST..............~~
~~UPDATE CONTROL LIST...........~~

ECO [✓] ACN [ ] CHANGE DRAWING MASTER

RC [ ] PRC [ ] DO NOT CHG. DWG. MASTER

ECO, ACN BECOMES PART OF REFERENCE DRAWING UNTIL CHANGE IS INCORPORATED ON MASTER.

PRC BECOMES PART OF REFERENCE DRAWING AS USED ON CONTRACT NO.(S).

REASON FOR CHANGE:
TIE UNUSED WIRES TO GROUND

~~ZONE~~ ~~PAGE~~ SHT: 3

DESCRIPTION OF CHANGE:

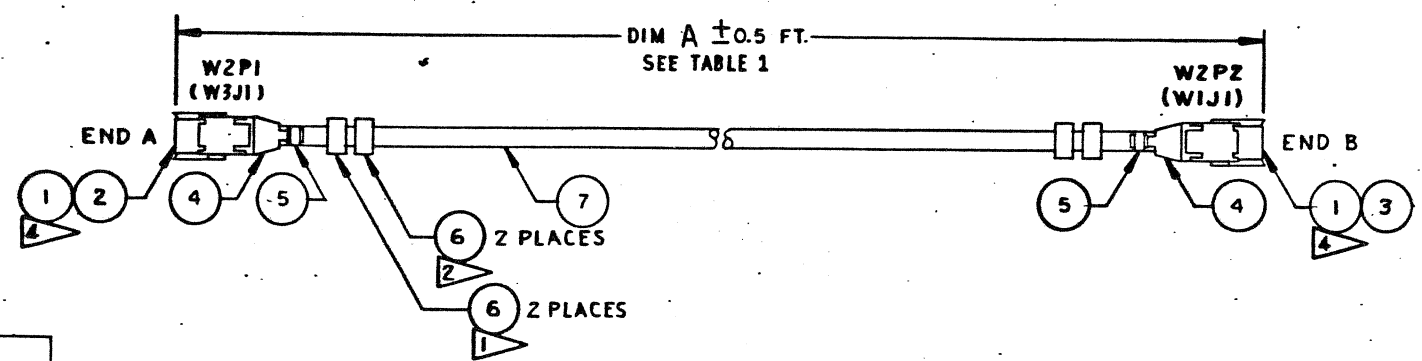
ADD:

	CONNECTOR REF DES	PIN No.	CONNECTOR REF DES	PIN No.	TWISTED PAIR No.	COLOR	COMMENT
	P1	A	P2	29	TP1	BLK (BRN)	RCN 2209 CABLE
		W					
ADD:		X	P2	19			TIE ALL UNUSED WIRES TO THESE PINS
		Y	P2	20			
		Z	P2	44			
		a	P2	45			

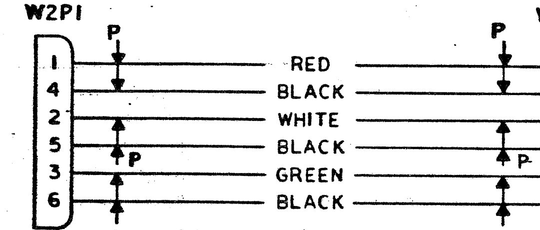
FN 1014 (3/77)

ZONE	LTR	DESCRIPTION	DATE	APPROVED
3B, 7B	A	ADDED -04 AND -05 FJP	20 JAN 77	
6C 8B	B	ADDED - 06 AR	15 MAR 77	
3B 8B	C	ADDED 07 AR	28 MAR 77	

REVISIONS



-01 ASSY SHOWN



SCHEMATIC DIAGRAM
FIGURE 1

NOTES:

1. MARK CONNECTOR REF. DES. AND (MATING CONNECTOR REF. DES.) ON IDENTIFICATION TAG, ITEM NO. 6, USING INDELIBLE INK OR HOT STAMP. SEE TABLE I. LOCATE IDENTIFICATION TAGS APPROXIMATELY 3.0 INCHES FROM CONNECTOR END.
2. MARK CABLE REF. DES. AND PART NO. ON IDENTIFICATION TAG, ITEM NO. 6, USING INDELIBLE INK OR HOT STAMP. SEE TABLE 1. LOCATE IDENTIFICATION TAGS APPROXIMATELY 5.0 INCHES FROM CONNECTOR END.
3. USE BURNDY CRIMP TOOL MIOS-1 WITH S-10 DIE SET AND SL-40 STOP BUSHING.
4. KEEP WIRES TWISTED TO WITHIN 1/2 INCH OF CONNECTORS.

TABLE 1

CABLE DASH NO.	END A CONNECTOR REF DES (MATING REF DES) 1	END A AND B CABLE REF DES AND PART NO. 2	END B CONNECTOR REF DES (MATING REF DES) 1	SCHEM DIAG FIG NO.	LENGTH DIMENSION A IN FEET
-01	W2P1 (W3J1)	W2 1540-0009-01	W2P2 (W1J1)	1	20
-02	W2P1 (W1P4)	W2 1540-0009-02	W2P2 (2A3J1)	1	30
-03	W2P1 (W3P4)	W2 1540-0009-03	W2P2 (W1J1)	1	25
-04	W3P1 (W2P3)	W3 1540-0009-04	W3P2 (W8P1)	1	25
-05	W3P1 (W2P3)	W3 1540-0009-05	W3P2 (W8P1)	1	35
-06	W3P1 (W1P4)	W3 1540-0009-06	W3P2 (A2J4)	1	60
-07	W3P1 (W2P3)	W3 1540-0009-07	W3P2 (W8P1)	1	40

QTY -07	QTY -06	QTY -05	QTY -04	QTY -03	QTY -02	QTY -01	ITEM NO.	PART NUMBER	DESCRIPTION	VENDOR
40.5 FEET	60.5 FEET	35.5 FEET	25.5 FEET	25.5 FEET	30.5 FEET	20.5 FEET	7	1318	CABLE- 22 AWG 3 TWISTED PAIRS	ALPHA
4	4	4	4	4	4	4	6	PLMIM-CP	TIE, IDENTIFICATION	PANDUIT
2	2	2	2	2	2	2	5	PLT1.5I-CP	TIE, CABLE	PANDUIT
2	2	2	2	2	2	2	4	SMS6H-1	HOOD, STRAIN RELIEF	BURNDY
6	6	6	6	6	6	6	3	RM20M-13	CONTACT, MALE	BURNDY
6	6	6	6	6	6	6	2	RC20M-13	CONTACT, FEMALE	BURNDY
2	2	2	2	2	2	2	1	SMS6P-1	CONNECTOR, 6 POSITION	BURNDY

FOR PART NO. SEE TABLE 1.

NEXT ASSY	USED ON
	COMMON

APPLICATION

UNLESS OTHERWISE SPECIFIED ALL DIMENSIONS ARE IN INCHES
3 PLACE DECIMALS ±0.010
2 PLACE DECIMALS ±0.030
1 PLACE DECIMALS ±0.060

MATERIAL —
FINISH —

CONTRACT NO. 76116
©REDIFON ELECTRONICS, INC ARLINGTON, TEXAS

DRAFTSMAN		11/11/76
DESIGNER		
CHECKER		
ENGINEER		11/22/76
OTHER		11-22-76
FINAL		11-22-76

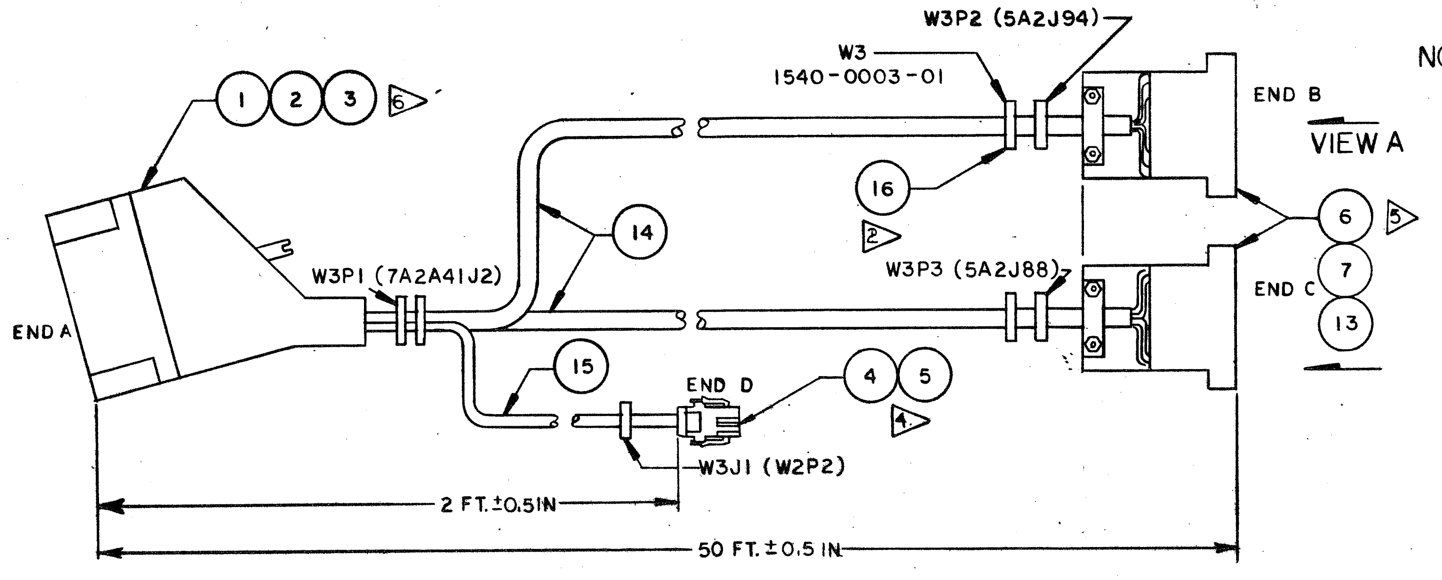
REDIFON

TITLE: CABLE ASSEMBLY- 6 CONDUCTOR

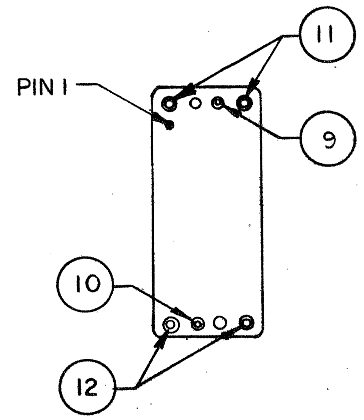
SIZE	CODE IDENT NO.	DRAWING NO.
D	53988	1540-0009

SCALE: NONE DO NOT SCALE THIS DWG SHEET 1 OF 1

REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPROVED
B-3	A	VIEW A ADDED	1/17/77	DWW
	B	ADD 03 & 04 CONFIGURATIONS	3/9/77	DWW



-01 ASSY SHOWN



VIEW A

NOTES

1. FOR WIRE LIST SEE TABLE I.
2. MARK CONNECTOR REF. DES. AND (MATING CONNECTOR REF. DES.) ON IDENTIFICATION TAG ITEM NO.16 USING INDELIBLE INK OR HOT STAMP. SEE TABLE I. LOCATE IDENTIFICATION TAGS APPROXIMATELY 3.0 INCHES FROM CONNECTOR END.
3. MARK CABLE REF. DES. AND PART NUMBER ON IDENTIFICATION TAG ITEM NO.16 USING INDELIBLE OR HOT STAMP. SEE TABLE I. LOCATE IDENTIFICATION TAGS APPROXIMATELY 5.0 INCHES FROM CONNECTOR END.
4. CRIMP TOOL FOR W3J1 IS BURNDY MIOS-1 WITH S-9 DIE SET AND SL-40 STOP BUSHING.
5. FOR W3P2 & W3P3
   CRIMP TOOL AMP 90277-1
   EXTRACTION TOOL AMP 30518-3
6. FOR W3P1
   CRIMP TOOL AMP 90223-5
   EXTRACTION TOOL AMP 91038-3

TABLE I

CABLE DASH NO.	END A CONNECTOR REF. DES. (MATING REF DES)	END B CONNECTOR REF. DES. (MATING REF DES)	END A, B & C CABLE REF. DES. AND PART NO.	END C CONNECTOR REF. DES. (MATING REF DES)	END D CONNECTOR REF. DES.	WIRE LIST NO.
01	W3P1 (7A2A41J2)	W3P2 (5A2J94)	W3 1500-0003-01	W3P3 (5A2J88)	W3J1 (W2P2)	500010
02	W3P1 (7A2A41J2)	W3P2 (5A4J2)	W3 1500-0003-02	W3P3 (5A4J3)	W3J1 (W2P2)	500024
03	W3P1 (7A2A47J2)	W3P2 (5A5J92)	W3 1500-0003-03	W3P3 (5A5J93)	W3J1 (W2P1)	500024
04	W3P1 (7A2A41J2)	W3P2 (5A6J12)	W3 1500-0003-04	W3P3 (5A6J13)	W3J1 (W2P2)	500024

QTY -04	QTY -03	QTY -02	QTY -01	ITEM NO.	PART NUMBER	DESCRIPTION	VENDOR
7	7	7	7	16	PLM1M-CP	TIES, IDENTIFICATION	PANDUIT
15 FEET	15 FEET	15 FEET	15 FEET	15	7054	WIRE, 24 AWG	ALPHA
101 FEET	101 FEET	101 FEET	101 FEET	14	RCN2235	CABLE, 24 AWG, 7/32, 50 CONDUCTOR	AMP
2	2	2	2	13	201848-1	CLAMP, STRAIN RELIEF	AMP
4	4	4	4	12	201046-4	GUIDE PIN, CORNER, MALE	AMP
4	4	4	4	11	201047-4	GUIDE PIN, CORNER, FEMALE	AMP
2	2	2	2	10	200871-1	JACKSCREW - LONG, MALE	AMP
2	2	2	2	9	200867-1	JACKSCREW - LONG, FEMALE	AMP
				8			
100	100	100	100	7	66105-4	CONTACTS, FEMALE	AMP
2	2	2	2	6	203622-2	CONNECTOR, 50 POSITION	AMP
6	6	6	6	5	RM24M-9	CONTACTS, MALE	BURNDY
1	1	1	1	4	SMS6R-1	CONNECTOR, 6 POSITION	BURNDY
104	104	104	104	3	203874-4	CONTACTS, MALE	AMP
1	1	1	1	2	204337-1	45° SHIELD & CABLE CLAMP	AMP
1	1	1	1	1	204750-1	CONNECTOR, 104 POSITION	AMP

UNLESS OTHERWISE SPECIFIED
ALL DIMENSIONS ARE IN INCHES
3 PLACE DECIMALS ±0.010
2 PLACE DECIMALS ±0.030
1 PLACE DECIMALS ±0.060

CONTRACT NO. 75113

REDIFON

NEXT ASSY	USED ON
APPLICATION	COMMON
MATERIAL	—
FINISH	—
DRAFTSMAN	8/13/76
DESIGNER	
CHECKER	
ENGINEER	
OTHER	
FINAL	11-17-76

TITLE
CABLE ASSEMBLY — SPECIAL PURPOSE

SIZE	CODE IDENT NO.	DRAWING NO.
D	53988	1540 - 0003

SCALE: NONE | DO NOT SCALE THIS DWG | SHEET 1 OF 1

REVISIONS			
LTR	DESCRIPTION	DATE	APPROVED

SHT	REV	2		3		4		5	

SHEET REVISION TABULATION

CONTRACT NO. 75114		
PREPARER	D WILSON	
CHECKER	DW	
ENGINEER	D. Wilson	Oct 25, 76
OTHER	M Carmichael	10-27-76
FINAL		

REDIFON

REDIFON ELECTRONICS, INC
ARLINGTON, TEXAS

TITLE WIRE LIST,
SPECIAL PURPOSE CABLE

SIZE	CODE IDENT NO.	DRAWING NO.
A	53988	500024
	REV:	SHEET 1 OF 5

FN 1053 (9/76)

CONNECTOR REF DES	PIN NO.	CONNECTOR REF DES	PIN NO.	TWISTED PAIR NO.	COLOR	COMMENT
P2	1	P1	C12			044-0
	2	P1	A12			1
	3	P1	C11			2
	4	P1	A11			3
	5	P1	C10			4
	6	P1	A10			5
	7	P1	C9			6
	8	P1	A9			7
	9	P1	C8			8
	10	P1	A8			9
	11	P1	C7			10
	12	P1	A7			11
	13	P1	C6			12
	14	P1	A6			13
	15	P1	C5			14
	16	P1	A5			15
	17	P1	B5			[illegible]
	18	P1	D6			045-1[illegible]
	19	P1	F5			2
	20	P1	D5			3
	21	P1	F4			4
	22	P1	D4			5
	23	P1	F3			6
	24	P1	D3			7
	25	P1	F2			8
	26	P1	D2			9
	27	P1	F1			10

REDIFON

SIZE	CODE IDENT NO.	DRAWING NO.
A	53988	500024
	REV:	SHEET 2

FN 1051 (9/76)

	CONNECTOR REF DES	PIN NO.	CONNECTOR REF DES	PIN NO.	TWISTED PAIR NO.	COLOR	COMMENT
	P2	28	P1	D1			045-11
		29	P1	C14			12
		30	P1	A14			13
		31	P1	C13			14
		32	P1	A13			15
		33	P1	F18			046-0
		34	P1	D18			1
		35	P1	F17			2
		36	P1	D17			3
		37	P1	F16			4
		38	P1	D16			5
		39	P1	F15			6
		40	P1	D15			7
		41	P1	F14			8
		42	P1	D14			9
		43	P1	F13			10
		44	P1	D13			11
		45	P1	F12			12
		46	P1	D12			13
		47	P1	F7			14
		48	P1	D7			15
		49	P1	B6			
	P2	50	P1	B7			
	P3	1	P1	J12			047-0
		2	P1	G12			1
		3	P1	J11			2
		4	P1	G11			3

REDIFON	SIZE	CODE IDENT NO.	DRAWING NO.	REV:	SHEET
	A	53988	500024		3

FN 1051 (9/76)

CONNECTOR REF DES	PIN NO.	CONNECTOR REF DES	PIN NO.	TWISTED PAIR NO.	COLOR	COMMENT
P3	5	P1	J10			047-4
	6	P1	G10			5
	7	P1	J9			6
	8	P1	G9			7
	9	P1	J8			8
	10	P1	G8			9
	11	P1	J7			10
	12	P1	G7			11
	13	P1	J6			12
	14	P1	G6			13
	15	P1	J5			14
	16	P1	G5			15
	17	P1	B8			
	18	P1	B9			
	19	P1	B10			
	20	P1	B11			
	21	P1	B12			
	22	P1	B13			
	23	P1	B14			
	24	P1	D8			
	25	P1	D11			
	26	P1	E1			
	27	P1	E2			
	28	P1	E3			
	29	P1	E4			
	30	P1	E5			
	31	P1	E6			

REDIFON

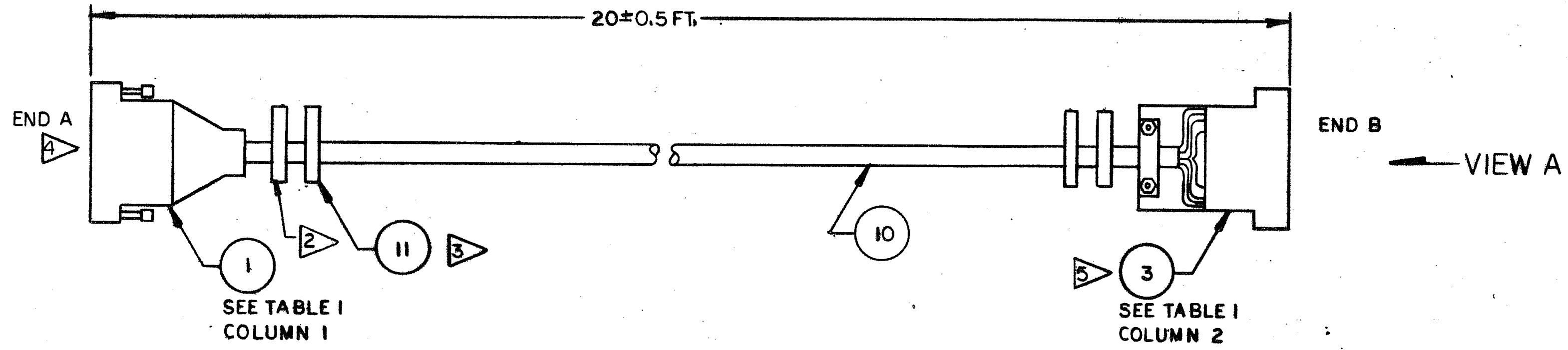
SIZE	CODE IDENT NO.	DRAWING NO.
A	53988	500024
	REV:	SHEET 4

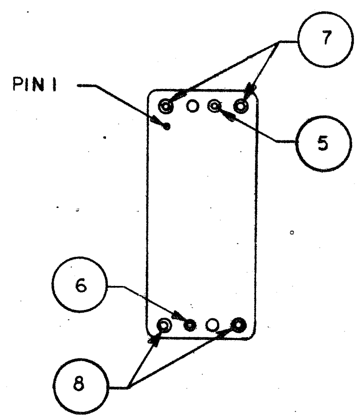
CONNECTOR REF DES	PIN NO.	CONNECTOR REF DES	PIN NO.	TWISTED PAIR NO.	COLOR	COMMENT
P3	32	P1	E7			
	33	P1	E12			
	34	P1	E13			
	35	P1	E14			
	36	P1	E15			
	37	P1	E16			
	38	P1	E17			
	39	P1	E18			
	40	P1	F8			
	41	P1	F11			
	42	P1	G13			
	43	P1	G14			
	44	P1	H5			
	45	P1	H6			
	46	J1	2			
	47	P1	H7			
	48	P1	H8			
	49	P1	H9			
P3	50	P1	H10			
J1	1	P1	F6			
	2	P3	46			Ref
	3	P1	H11			
	4	P1	H12			
	5	P1	H13			
J1	6	P1	H14			

REDIFON

SIZE	CODE IDENT NO.	DRAWING NO.
A	53988	500024
	REV:	SHEET 5

REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPROVED
C-4	A	VIEW A ADDED	1/19/77	DWW
	B	ADD 05,06,07 & 08 CONFIGURATIONS	3/17/77	DWW





VIEW A

NOTES

1. FOR WIRE LIST SEE DWG 500023
2. MARK CONNECTOR REF. DES. AND (MATING CONNECTOR REF. DES.) ON IDENTIFCATION TAG ITEM NO.11 USING INDELIBLE INK OR HOT STAMP. SEE TABLE I. LOCATE IDENTIFICATION TAGS APPROXIMATELY 3.0 INCHES FROM CONNECTOR END.
3. MARK CABLE REF. DES. AND PART NUMBER ON IDENTIFICATION TAG ITEM NO.11 USING INDELIBLE OR HOT STAMP. SEE TABLE I. LOCATE IDENTIFICATION TAGS APPROXIMATELY 5.0 INCHES FROM CONNECTOR END.
4. CRIMP TOOL FOR W4PI & W5PI IS BURNDY MIOS-I WITH S-9 DIE SET AND SL-40 STOP BUSHING.
5. FOR W4P2 & W5P2
   CRIMP TOOL AMP 90277-I
   EXTRACTION TOOL AMP 30518-3

TABLE I

CABLE DASH NO.	END A CONNECTOR REF DES (MATING REF DES) [2]	COLUMN I CONTACT ITEM NO.	END A & B CABLE REF DES AND PART NO. [3]	END B CONNECTOR REF DES (MATING REF DES) [2]	COLUMN 2 CONTACT ITEM NO.
01	W5PI (A2J2)	2	W5 1540-0004-01	W5P2 (5A2J89)	4
02	W4PI (A2JI)	12	W4 1540-0004-02	W4P2 (5A2J94)	13
03	W5PI (A2J2)	2	W5 1540-0004-03	W5P2 (5A4J8)	4
04	W4PI (A2JI)	12	W4 1540-0004-04	W4P2 (5A4JI)	4
05	W5PI (A2J2)	2	W5 1540-0004-05	W5P2 (5A5J94)	4
06	W4PI (A2JI)	12	W4 1540-0004-06	W4P2 (5A5J91)	4
07	W5PI (A2J2)	2	W5 1540-0004-07	W5P2 (5A6JI4)	4
08	W4PI (A2JI)	12	W4 1540-0004-08	W4P2 (5A6JII)	4

QTY 08	QTY 07	QTY 06	QTY 05	QTY -04	QTY -03	QTY -02	QTY -01	ITEM NO.	PART NUMBER	DESCRIPTION	VENDOR
						50		13	66103-4	CONTACT, MALE	AMP
50		50		50		50		12	RM24M-9	CONTACT MALE	BURNDY
4	4	4	4	4	4	4	4	11	PLMIM-CP	TIES, IDENTIFICATION	PANDUIT
20.5 FEET	20.5 FEET	20.5 FEET	20.5 FEET	20.5 FEET	20.5 FEET	20.5 FEET	20.5 FEET	10	RCN2235	CABLE, 24 AWG, 7/32, 50 CONDUCTOR	GORE
1	1	1	1	1	1	1	1	9	201848-1	CLAMP, STRAIN RELIEF	AMP
2	2	2	2	2	2	2	2	8	201046-4	GUIDE PIN, CORNER, MALE	AMP
2	2	2	2	2	2	2	2	7	201047-4	GUIDE PIN, CORNER, FEMALE	AMP
1	1	1	1	1	1	1	1	6	200871-1	JACKSCREW - LONG, MALE	AMP
1	1	1	1	1	1	1	1	5	200867-1	JACKSCREW - LONG, FEMALE	AMP
50	50	50	50	50	50		50	4	66105-4	CONTACT, FEMALE	AMP
1	1	1	1	1	1	1	1	3	203622-2	CONNECTOR, 50 POSITION	AMP
	50		50		50		50	2	RC24M-9	CONTACT, FEMALE	BURNDY
1	1	1	1	1	1	1	1	1	MS50PMI24	CONNECTOR, 50 POSITION	BURNDY

NEXT ASSY	USED ON
	COMMON
APPLICATION	

UNLESS OTHERWISE SPECIFIED ALL DIMENSIONS ARE IN INCHES
3 PLACE DECIMALS ±0.010
2 PLACE DECIMALS ±0.030
1 PLACE DECIMALS ±0.060

MATERIAL —/—
FINISH —/—

CONTRACT NO. 75113

DRAFTSMAN	[signature]	9/2/76
DESIGNER		
CHECKER	DWW	
ENGINEER	[signature]	11/10/76
OTHER	[signature]	11-16-76
FINAL	[signature]	11-17-76

REDIFON

TITLE CABLE ASSEMBLY - SPECIAL PURPOSE

SIZE	CODE IDENT NO.	DRAWING NO.
D	53988	1540-0004

SCALE: NONE | DO NOT SCALE THIS DWG | SHEET 1 OF 1

REVISIONS			
LTR	DESCRIPTION	DATE	APPROVED

SHT	REV	2		3															

SHEET REVISION TABULATION

CONTRACT NO. 75113		
PREPARER	D. WILSON	
CHECKER	DW	
ENGINEER	D Wilson	10-27-76
OTHER	M. Carmichael	10-28-76
FINAL	J DeFeo	11-17-76

REDIFON
REDIFON ELECTRONICS, INC
ARLINGTON, TEXAS

TITLE
WIRE LIST,
SPECIAL PURPOSE CABLE

SIZE	CODE IDENT NO.	DRAWING NO.
A	53988	500023

REV: SHEET 1 OF 3

FN 1053 (9/76)

CONNECTOR REF DES	PIN NO.	CONNECTOR REF DES	PIN NO.	TWISTED PAIR NO.	COLOR	COMMENT
P1	A	P2	1			RCN2235 cable
	B	P2	2			
	C	P2	3			
	D	P2	4			
	E	P2	5			
	F	P2	6			
	H	P2	7			
	J	P2	8			
	K	P2	9			
	L	P2	10			
	M	P2	11			
	N	P2	12			
	P	P2	13			
	R	P2	14			
	S	P2	15			
	T	P2	16			
	U	P2	17			
	V	P2	18			
	W	P2	19			
	X	P2	20			
	Y	P2	21			
	Z	P2	22			
	a	P2	23			
	b	P2	24			
	c	P2	25			
	d	P2	26			
	e	P2	27			

REDIFON

SIZE	CODE IDENT NO.	DRAWING NO.
A	53988	500023
	REV:	SHEET 2

FN 1051 (9/76)

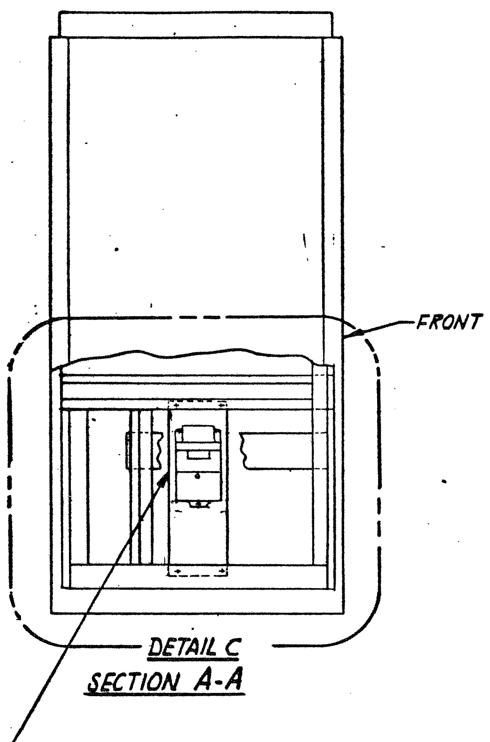
CONNECTOR REF DES	PIN NO.	CONNECTOR REF DES	PIN NO.	TWISTED PAIR NO.	COLOR	COMMENT
P1	f	P2	28			
	h	P2	29			
	j	P2	30			
	k	P2	31			
	m	P2	32			
	n	P2	33			
	p	P2	34			
	r	P2	35			
	s	P2	36			
	t	P2	37			
	u	P2	38			
	v	P2	39			
	w	P2	40			
	x	P2	41			
	y	P2	42			
	z	P2	43			
	AA	P2	44			
	BB	P2	45			
	CC	P2	46			
	DD	P2	47			
	EE	P2	48			
	FF	P2	49			
	HH	P2	50			

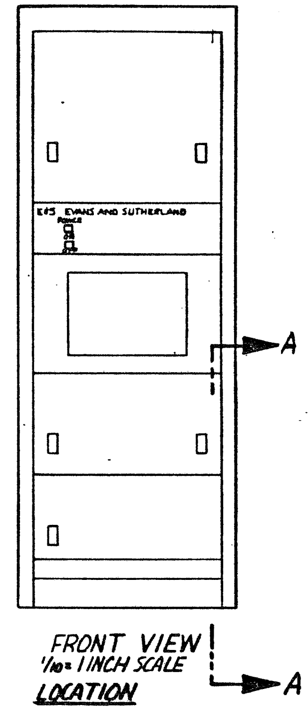
REDIFON

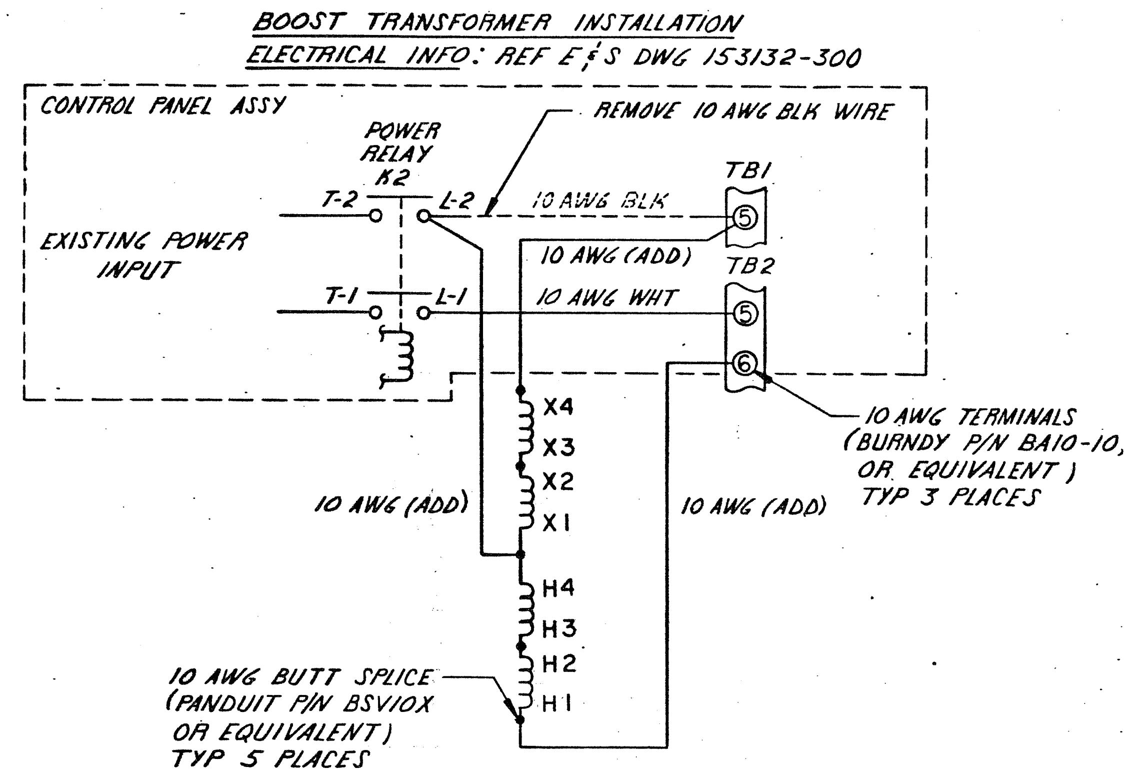
SIZE A | CODE IDENT NO. 53988 | DRAWING NO. 500023

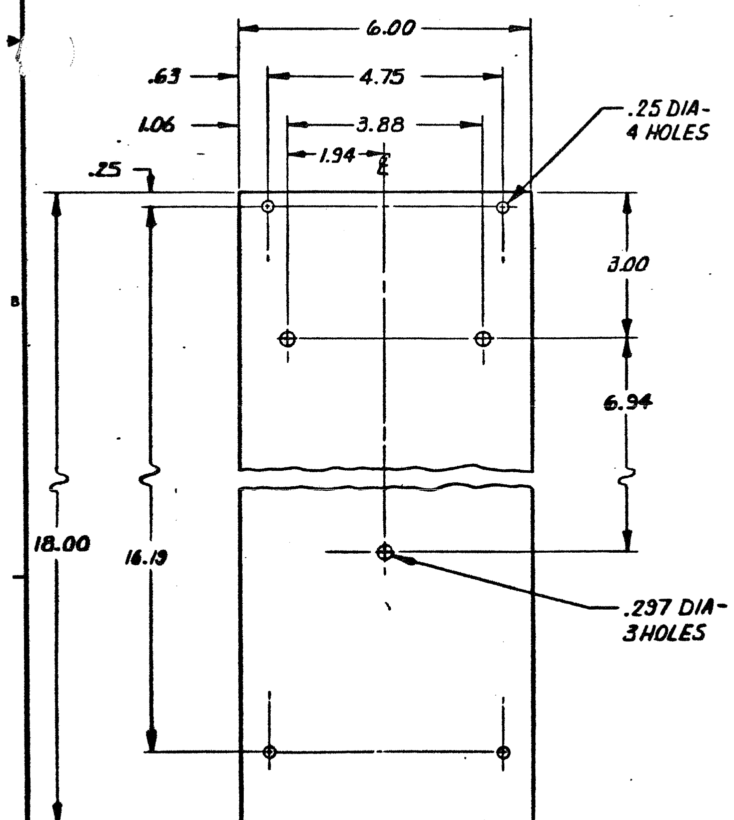
REV: | SHEET 3

ZONE	LTR	REVISIONS DESCRIPTION	DATE	APPROVED

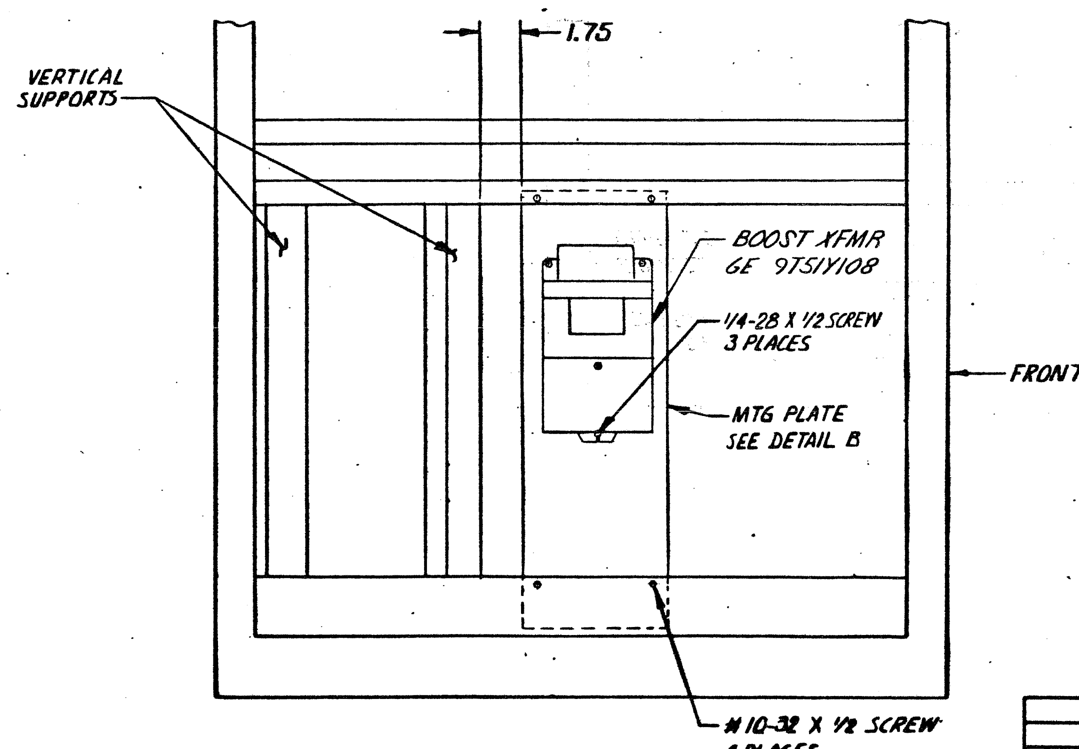








TRANSFORMER MTG PLATE
6061-T6 ALUM ALLOY -.125 THK
DETAIL B 1/2 SCALE



DETAIL C 1/4 SCALE

BOOST TRANSFORMER INSTALLATION INSTRUCTIONS

1. MOUNT TRANSFORMER ON PLATE.
2. REMOVE ACCESS PLATE FROM TRANSFORMER.
3. SPLICE X2 TO X3 AND H2 TO H3.
4. SPLICE X1 AND H4 TO A PIECE OF 10 AWG WIRE.
5. SPLICE H1 TO A PIECE OF 10 AWG WIRE.
6. SPLICE X4 TO A PIECE OF 10 AWG WIRE.
7. REMOVE "KNOCK-OUT" IN TRANSFORMER.
8. REMOVE COVER FROM CONTROL PANEL ASSY.
9. MOUNT TRANSFORMER AS SHOWN.
10. IN CONTROL PANEL ASSY, REMOVE WIRE BETWEEN L2 AND TB1.
11. CONNECT TRANSFORMER TO CONTROL PANEL ASSY AS SHOWN.
12. REPLACE COVER ON CONTROL PANEL ASSY.

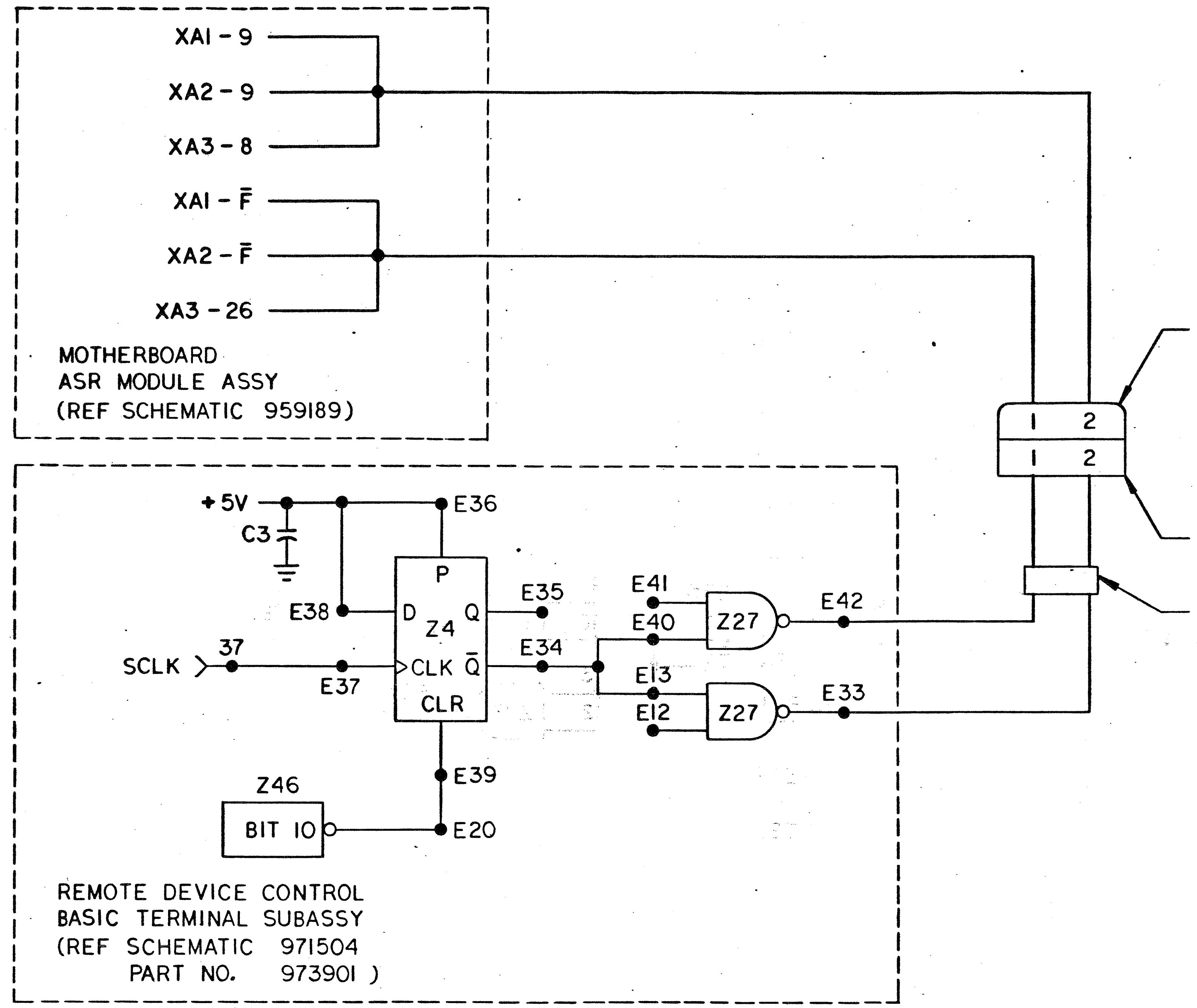
NOTE:
1. A SECTION OF THE EXISTING E&S POWER CABLE MAY BE USED IN PLACE OF THE 10 AWG WIRE.

ALTERED ITEM DRAWING

REDIFON

	COMMON	UNLESS OTHERWISE SPECIFIED ALL DIMENSIONS ARE IN INCHES 3 PLACE DECIMALS ±0.0005 2 PLACE DECIMALS ±0.010 1 PLACE DECIMALS ±0.030	CONTRACT NO. 75113 REDIFON ELECTRONICS, INC ARLINGTON, TEXAS	TITLE INSTALLATION - BOOST TRANSFORMER
NEXT ASSY	USED ON	THE COPYRIGHT IN THIS DRAWING SPECIFICATION BELONGS TO REDIFON LTD AND IT MAY BE USED ONLY FOR THE EXPRESS PURPOSE FOR WHICH IT WAS PROVIDED © REDIFON LTD	DRAFTSMAN / DESIGNER / CHECKER / ENGINEER / OTHER 11-16-76 / FINAL 11-17-76	SIZE D, CODE IDENT NO. 53988, DRAWING NO. 500001
APPLICATION		MATERIAL NOTED IN F/D; FINISH —		SCALE None; DO NOT SCALE THIS DWG; SHEET 1 OF 1

ZONE	LTR	REVISIONS DESCRIPTION	DATE	APPROVED



CONNECTOR: BURNDY SMS6P-1
CONTACTS: RC24M-9 (2 REQ'D)

CONNECTOR: BURNDY SMS6R-1
CONTACTS: RM24M-9 (2 REQ'D)

CABLE TIE: PANDUIT PLM1M-CP
MARK PART NUMBER 500002-01
UTILIZING INDELIBLE INK

NOTES:

1. ALL LOGIC DEVICES ARE EXISTING SPARES ON THE REMOTE DEVICE CONTROL CARD.
2. ALL CONNECTIONS TO BE 24 GA STRANDED WIRE AND SOLDERED AT DESIGNATED TIE-POINTS.
3. ADD JUMPER WIRES AS FOLLOWS:
   E20 TO E39
   E37 TO PIN 37
   E38 TO E36 & +5V SIDE OF C3
   E34 TO E13 & E40.
4. ADD WIRES TO BURNDY CONN AS SHOWN.

ALTERED ITEM DRAWING

ITEM	QTY	PART NUMBER	DESCRIPTION	VENDOR
9	AR	7054	WIRE 24 AWG	ALPHA
8	REF	959189	SCHEMATIC	TI
7	REF	971504	SCHEMATIC	TI
6	2	RC24M-9	CONTACTS, FEMALE	BURNDY
5	2	RM24M-9	CONTACTS, MALE	BURNDY
4	1	SMS6R-1	CONNECTOR	BURNDY
3	1	SMS6P-1	CONNECTOR	BURNDY
2	1	PLM1M-CP	CABLE TIE	PANDUIT
1				

NEXT ASSY	USED ON
	COMMON
APPLICATION	

UNLESS OTHERWISE SPECIFIED
ALL DIMENSIONS ARE IN INCHES
3 PLACE DECIMALS ±0.010
2 PLACE DECIMALS ±0.030
1 PLACE DECIMALS ±0.060

MATERIAL —/—
FINISH —/—

CONTRACT NO. 75113

DRAFTSMAN	Callahan, S.L.	11/8/76
DESIGNER		
CHECKER	DWW	
ENGINEER	D. Wilson	10/08/76
OTHER	M. Carmichael	11-16-76
FINAL		11-17-76

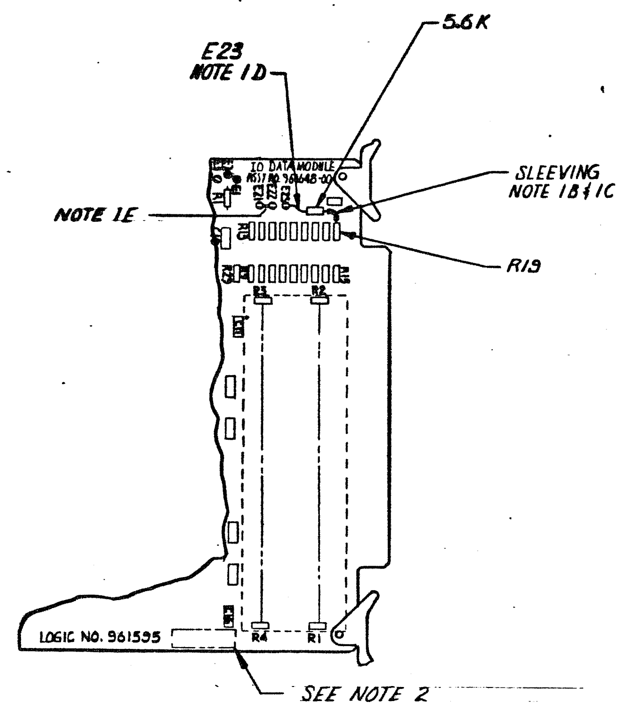
REDIFON

TITLE: INSTALLATION — DUAL FAST FORWARD FEATURE

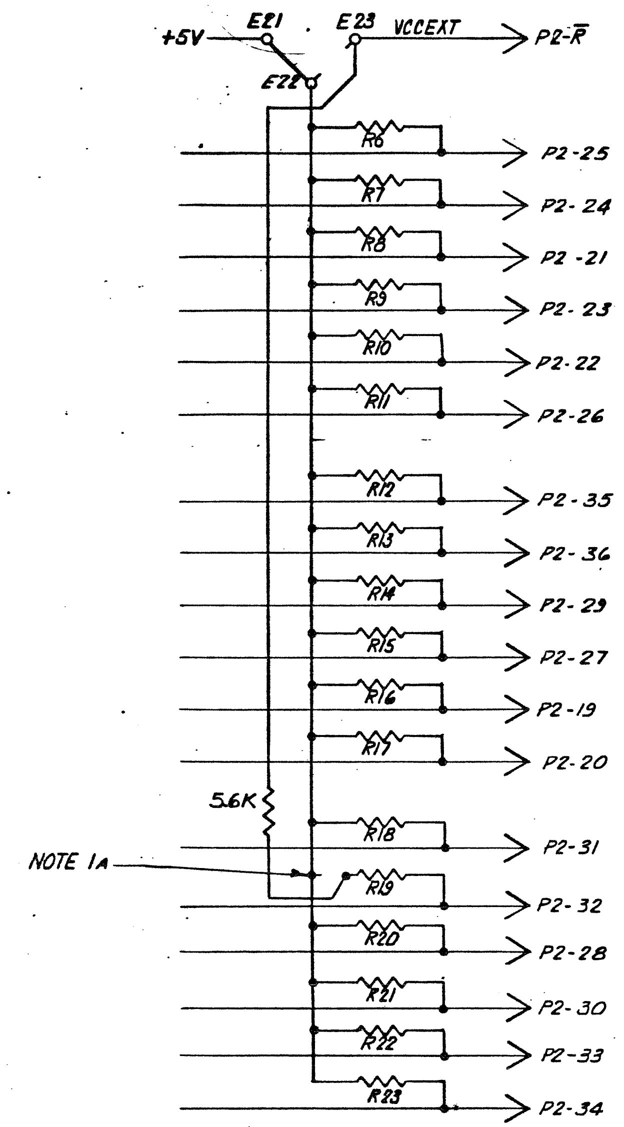
SIZE	CODE IDENT NO.	DRAWING NO.
C	53988	500002

SCALE: NONE | DO NOT SCALE THIS DWG | SHEET 1 OF 1

ZONE	LTR	REVISIONS DESCRIPTION	DATE	APPROVED



TI DWG NO 961648 SHEET 3
FROM TI MANUAL NO 965956-9701
I/O DATA MODULE USER'S MANUAL



TI DWG NO. 961595 SHEET 3
FROM TI MANUAL NO. 965956-9701
I/O DATA MODULE USER'S MANUAL

NOTES:

1. TI I/O DATA MODULE MODIFICATION PROCEDURE:
   - A) DISCONNECT R19 FROM BUS
   - B) SOLDER END OF R19 TO 5.6K, 1/4W RESISTOR
   - C) SLIP A PIECE OF SLEEVING OVER SOLDER CONNECTION
   - D) SOLDER OTHER END OF 5.6K RESISTOR TO E23.
   - (E) ADD JUMPER FROM E21 TO E22.
2. PART NUMBER TO BE RUBBER STAMPED IN .12 CHARACTERS, BLACK INK, IN THE APPROXIMATE POSITION SHOWN.

ALTERED ITEM DRAWING

ITEM	QTY	PART NUMBER	DESCRIPTION	VENDOR
4	REF	961595	SCHEMATIC	TI
3	AR		SLEEVING	
2	1	RC07GF562J	RESISTOR, 5.6K, 1/4W	
1	1	961648	I/O DATA MODULE BD	TI

	COMMON
NEXT ASSY	USED ON
APPLICATION	

UNLESS OTHERWISE SPECIFIED ALL DIMENSIONS ARE IN INCHES
3 PLACE DECIMALS ±0.0005
2 PLACE DECIMALS ±0.010
1 PLACE DECIMALS ±0.030

MATERIAL —/—
FINISH —/—

CONTRACT NO. 75113
REDIFON ELECTRONICS, INC ARLINGTON, TEXAS

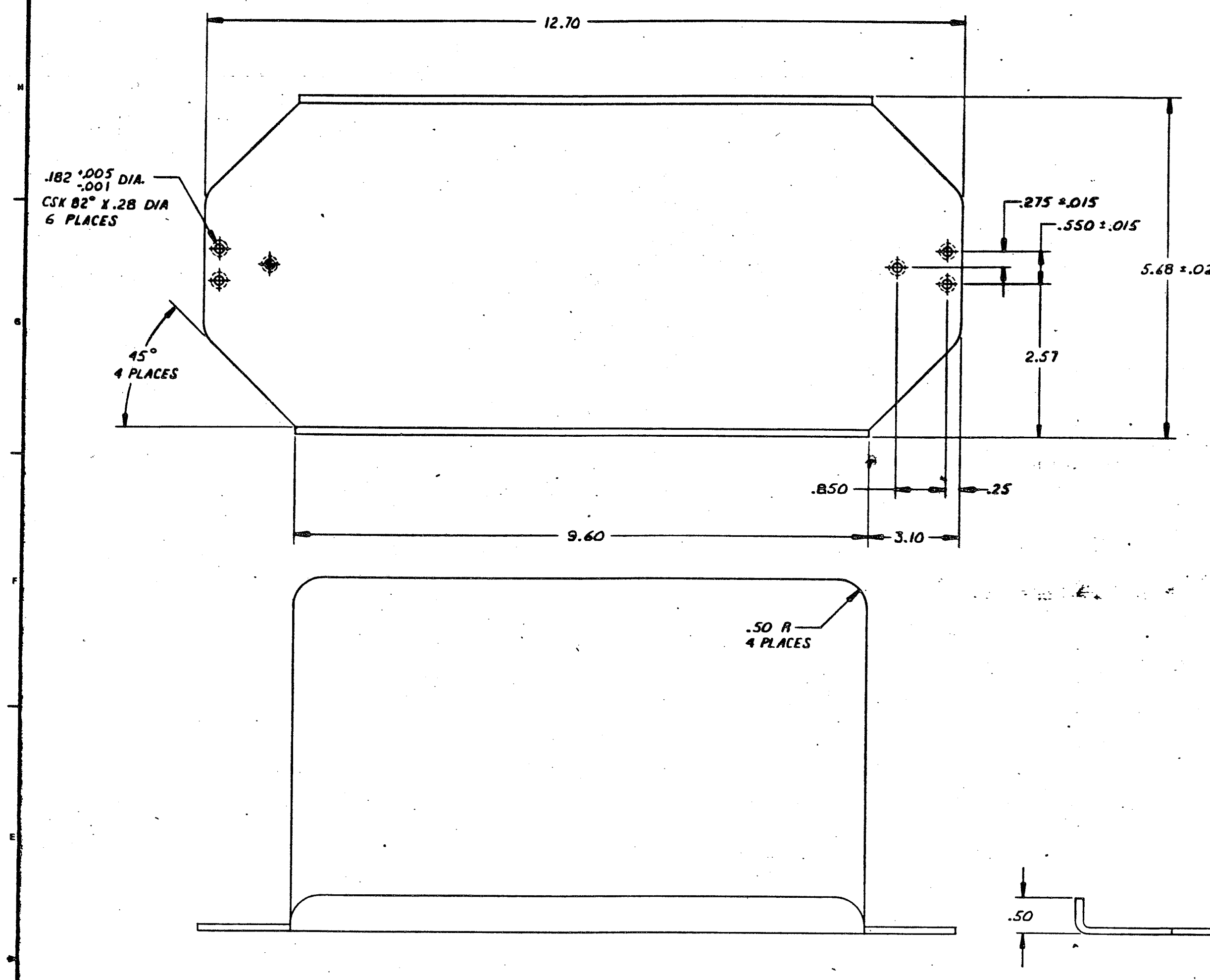
DRAFTSMAN	T WORKMAN	1-MAY-75
DESIGNER		
CHECKER	DWW	
ENGINEER	D Wilson	11/10/76
OTHER	M Grinsted	11-16-76
FINAL	[signature]	11-17-76

REDIFON

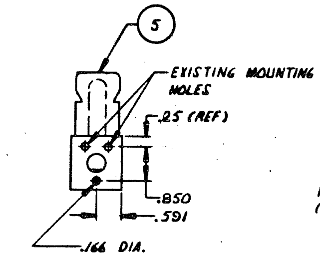
TITLE: INSTALLATION — OUTPUT PROTECT FEATURE

SIZE	CODE IDENT NO.	DRAWING NO.
D	53988	500003

SCALE: NONE | DO NOT SCALE THIS DWG | SHEET 1 OF 1

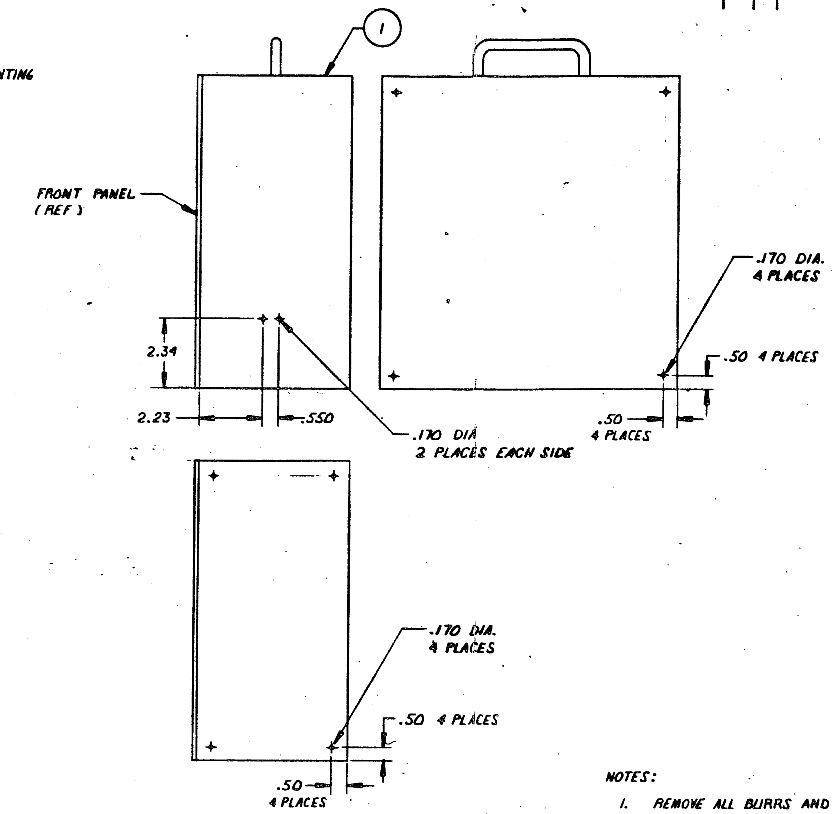


-01 BRACKET, ANGLE



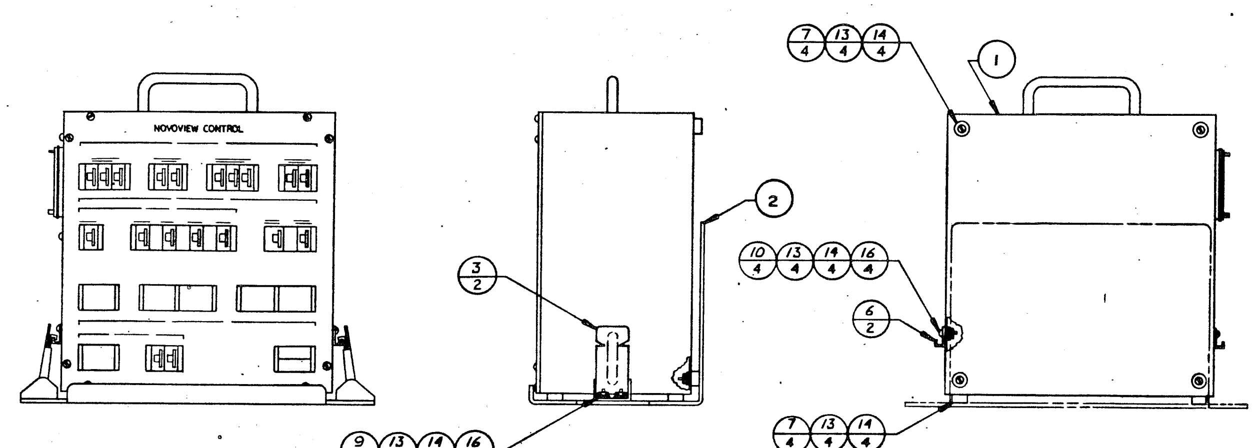
-02 LATCH, TOGGLE

SCALE: NONE



NOTES:

1. REMOVE ALL BURRS AND SHARP EDGES.
2. MATERIAL: 12 GA. 1018 SHEET STEEL.
3. FINISH: TEXTURED MATTE BLACK PER FED-STD-595, NO. 37038



-03 ANGLE BRACKET MODIFICATION

SCALE: NONE

MODIFICATION DRAWING

QTY -03	ITEM NO.	PART NUMBER	DESCRIPTION	VENDOR
10	16		NUT, HEX, NO.6	-
	15			
18	14		WASHER, FLAT, NO.6	
18	13		WASHER, LOCK, NO.6	-
	12			
	11			
4	10		SCREW, PAN HEAD, .138-32 X 3/8	-
6	9		SCREW, FLAT HEAD, .138-32 X 7/16	-
	8			
8	7	2196	BUMPER, RUBBER, W/SCREW & NUT	H.H. SMITH
2	6	TL100-5	PLATE, STRIKER	DZUS
2	5	TL100A	LATCH, TOGGLE	DZUS
	4			
2	3	500052-02	LATCH, TOGGLE	MAKE FROM ITEM 5
1	2	500052-01	BRACKET, ANGLE	
1	1	1510-0001	CONTROL PANEL ASSY	

REVISIONS

ZONE	LTR	DESCRIPTION	DATE	APPROVED

NEXT ASSY	USED ON
APPLICATION	

UNLESS OTHERWISE SPECIFIED ALL DIMENSIONS ARE IN INCHES
3 PLACE DECIMALS ±0.010
2 PLACE DECIMALS ±0.030
1 PLACE DECIMALS ±0.060

MATERIAL 2

FINISH 3

CONTRACT NO 75115

DRAFTSMAN	[illegible]	1/11/77
DESIGNER		
CHECKER	[illegible]	
ENGINEER	[illegible]	3/16/77
OTHER	[illegible]	3/16/77
FINAL	[illegible]	3-16-77

REDIFON

TITLE BRACKET, MOUNTING

SIZE	CODE IDENT NO.	DRAWING NO.
E	53988	500052

SCALE: FULL | DO NOT SCALE THIS DWG | SHEET 1 OF 1

REVISIONS

LTR	DESCRIPTION	DATE	APPROVED

SHT	REV	2		3		4		5											

SHEET REVISION TABULATION

CONTRACT NO.	75115	
PREPARER	D WILSON	Feb 23, 77
CHECKER	DWW	
ENGINEER	D Wilson	2/23/77
OTHER	M. G. CARMICHAEL	3-3-77
INAL	[illegible]	3-4-77

REDIFON

REDIFON ELECTRONICS, INC
ARLINGTON, TEXAS

TITLE

Wire List
Cockpit Interface, Unit 5

SIZE	CODE IDENT NO.	DRAWING NO.
A	53988	500072

REV: SHEET 1 OF 5

FN 1053 (9/76)

REFERENCE DESIGNATION	PIN NO.	REFERENCE DESIGNATION	PIN NO.	LEVEL	REF	FUNCTION
J91	1	A5TB2	1			28VDC
	2	A5TB2	2			GND
	3					
	4					
	5					
	6					
	7					
	8					
	9	J92	15			Cloudtop-Units-MSB
	10	J92	14			Cloudtop-Units
	11	J92	13			Cloudtop-Units
	12	J92	12			Cloudtop-Units-LSB
	13	J92	16			Cloudtop-Tens
	14	J92	24			Ceiling-Units-MSB
	15	J92	23			Ceiling-Units
	16	J92	22			Ceiling-Units
	17	J92	21			Ceiling-Units-LSB
	18	J92	28			Ceiling-Tens-MSB
	19	J92	27			Ceiling-Tens
	20	J92	26			Ceiling-Tens
	21	J92	25			Ceiling-Tens-LSB
	22	J92	32			Ceiling-100s-MSB
	23	J92	31			Ceiling-100s
	24	J92	30			Ceiling-100s
	25	J92	29			Ceiling-100s-LSB
	26	J92	7			RVR-Units-MSB
	27	J92	6			RVR-Units

REFERENCE DESIGNATION	PIN NO.	REFERENCE DESIGNATION	PIN NO.	LEVEL	REF	FUNCTION
J91	28	J92	5			RVR-Units
	29	J92	4			RVR-Units-LSB
	30	J92	11			RVR-Tens-MSB
	31	J92	10			RVR-Tens
	32	J92	9			RVR-Tens
	33	J92	8			RVR-Tens-LSB
	34					
	35	J92	39			Visibility-Tenths
	36	J92	43			Visibility-Units-MSB
	37	J92	42			Visibility-Units
	38	J92	41			Visibility-Units
	39	J92	40			Visibility-Units-LSB
	40	J92	48			Visibility-Tens-MSB
	41	J92	47			Visibility-Tens
	42	J92	46			Visibility-Tens-LSB
	43					
	44					
	45					
	46					
	47					
	48					
	49					
	50					
J94	1	J92	20			Taxi-Select-MSB
	2	J92	19			Taxi-Select

REDIFON	SIZE	CODE IDENT NO.	DRAWING NO.
	A	53988	500072
		REV:	SHEET 3

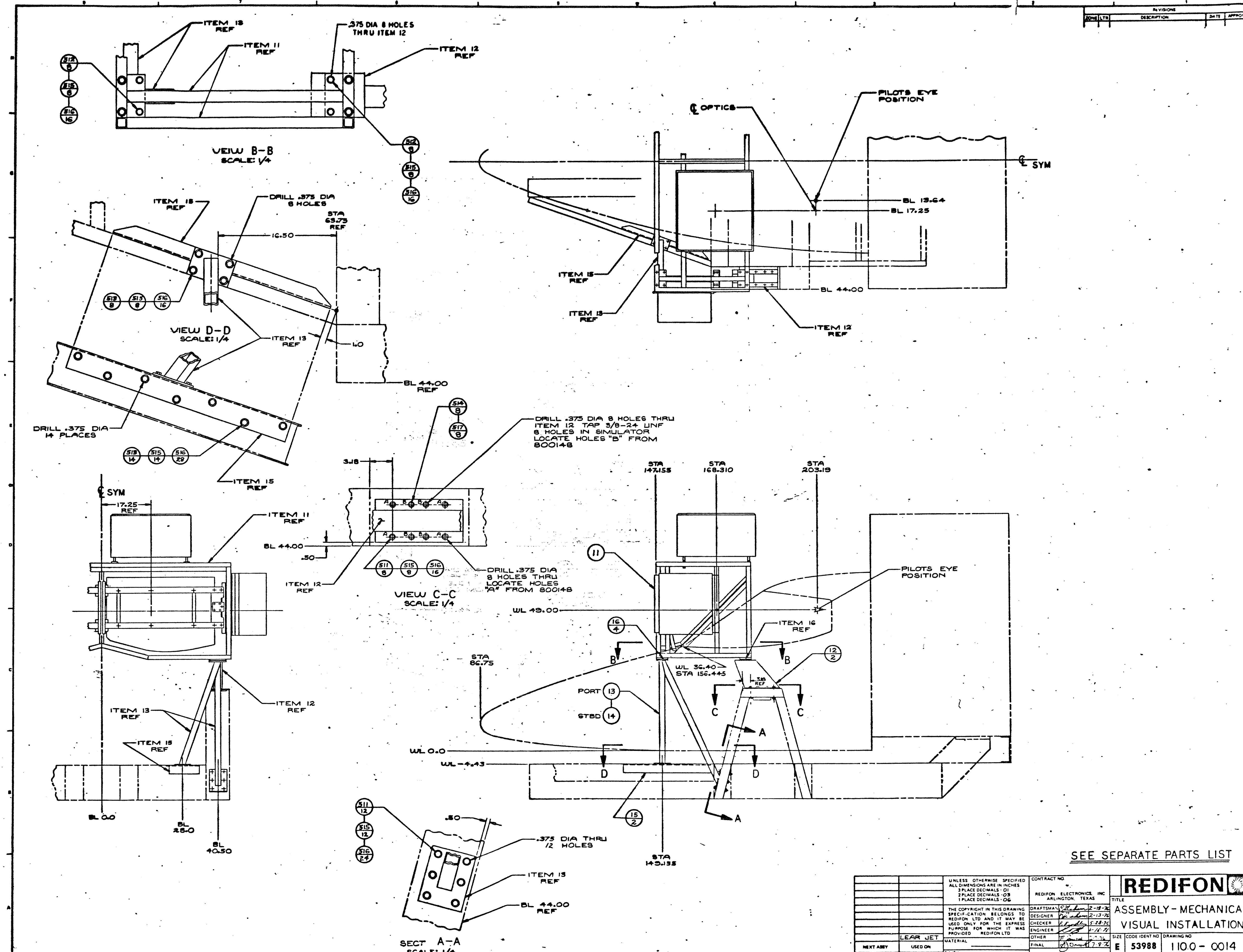
REFERENCE DESIGNATION	PIN NO.	REFERENCE DESIGNATION	PIN NO.	LEVEL	REF	FUNCTION
J94	3	J93	10			Runway-Select-MSB
	4	J93	9			Runway-Select
	5	J85	65			Brightness-Taxi-MSB
	6	J85	64			Brightness-Taxi
	7	J85	63			Brightness-Taxi-LSB
	8	J85	70			Brightness-Strobe-MSB
	9	J85	67			Brightness-Strobe
	10	J85	66			Brightness-Strobe-LSB
	11	J92	38			Brightness-Runway-MSB
	12	J92	37			Brightness-Runway
	13	J92	36			Brightness-Runway-LSB
	14	J92	35			Brightness-Approach-MSB
	15	J92	34			Brightness-Approach
	16	J92	33			Brightness-Approach-LSB
	17	J93	13			Brightness-Horizon-MSB
	18	J93	12			Brightness-Horizon
	19	J92	44			Taxi Mat-CMD
	20	J87	67			Taxi Mat-IND
	21	J92	45			I/P-CMD
	22	J87	70			I/P-IND
	23	J92	2			REIL-CMD
	24	J87	60			REIL-IND
	25	J92	1			VASI-CMD
	26	J87	62			VASI-IND
	27	J92	18			ACTIVATE-CMD
	28	J87	63			ACTIVATE-IND
	29	J93	16			ENABLE-CMD

REFERENCE DESIGNATION	PIN NO.	REFERENCE DESIGNATION	PIN NO.	LEVEL	REF	FUNCTION
J94	30					
	31	J87	64			ENABLE-IND
	32	J93	4			Airport Select-Units-MSB
	33	J93	3			Airport Select-Units
	34	J93	2			Airport Select-Units
	35	J93	1			Airport Select-Units-LSB
	36	J93	8			Airport Select-Tens-MSB
	37	J93	7			Airport Select-Tens
	38	J93	6			Airport Select-Tens
	39	J93	5			Airport Select-Tens-LSB
	40	J93	15			Insert-CMD
	41	J87	65			Insert-Red-IND
	42	J87	66			Insert-Green-IND
	43					
	44					
	45					
	46					
	47					
	48					
	49					
	50					
J93	46	A5TB2	1			28 VDC

VOLUME 7
NOVOVIEW VISUAL SYSTEM
GENERAL ASSEMBLY & PARTS LIST

MANUAL NO. 75115
ORIGINAL ISSUE
LEAR 35/36

REDIFON



SEE SEPARATE PARTS LIST

	LEAR JET	UNLESS OTHERWISE SPECIFIED ALL DIMENSIONS ARE IN INCHES 3 PLACE DECIMALS ·01 2 PLACE DECIMALS ·03 1 PLACE DECIMALS ·06	CONTRACT NO. REDIFON ELECTRONICS, INC ARLINGTON, TEXAS	REDIFON
NEXT ASSY	USED ON	THE COPYRIGHT IN THIS DRAWING SPECIFICATION BELONGS TO REDIFON LTD AND IT MAY BE USED ONLY FOR THE EXPRESS PURPOSE FOR WHICH IT WAS PROVIDED REDIFON LTD	DRAFTSMAN 2-18-76; DESIGNER 2-13-76; CHECKER 5-28-76; ENGINEER 5-16-76; OTHER; FINAL 7-8-76	TITLE ASSEMBLY - MECHANICAL VISUAL INSTALLATION
APPLICATION		MATERIAL; FINISH		SIZE E; CODE IDENT NO 53988; DRAWING NO 110.0 - 0014
				SCALE AS NOTED; DO NOT SCALE THIS DWG; SHEET 1 OF 1

LEAR JET INSTALLATION NO. 14

REVISIONS LTR	DATE / APPROVED	ITEM	DWG SIZE	PART NO. (CODE IDENT)	DESCRIPTION	UNIT QUANTITY PER ASSEMBLY				
		1		1100-0014	GEN ASSY	1				
		2			CIRCUIT DIAG					
		3			WIRING SEE PROJECT SWDL					
		4								
		5			TEST SPEC					
		6								
		7								
		8								
		9								
		10			LIGHT TIGHT REQD					
		11	E	1110-0009	NOVOVIEW BOX ASSEMBLY (FWD)	1				
		12	C	800148-01	PILLAR-SUPPORT	2				
		13	D	800149-01	PYLON (PORT SIDE)	1				
		14	D	800149-02	PYLON (STBD SIDE)	1				
		15	C	800138-01	SUPPORT ANGLE-PYLON	2				
		16	B	800139-03	PACKERS	4				

APPLICATION

CONTRACT NO.

REDIFON ELECTRONICS, INC
ARLINGTON, TEXAS

REDIFON

ASSEMBLY	
DATE	2-19-76
PREPARED	R Graham
CHECKED	E Fende
APPROVED	[illegible]

ASSEMBLY TITLE: ASSEMBLY-MECH VISUAL INSTL

SHEET 1 OF 3

SIZE: A | CODE IDENT NO.: 53988 | PARTS LIST NO.: 1100-0014

LEAR JET INSTALLATION NO. 14

ITEM	DWG SIZE	PART NO. (CODE IDENT)	DESCRIPTION	UNIT QUANTITY PER ASSEMBLY				
501	A	1100-0014	PURCHASED PARTS					
502								
503								
504								
505								
506								
507								
508								
509								
510								
511			BOLT 3/8-24 UNF X 4 HEX HEAD STL	20				
512			BOLT 3/8-24 UNF X 2 HEX HEAD STL	16				
513			BOLT 3/8-24 UNF X 1 1/4 HEX HEAD STL	22				
514			BOLT 3/8-24 UNF X 3/4 HEX HEAD STL	8				
515			NUT 3/8-24 UNF SELF LOCKING STL	58				
516			WASHER 3/8 FLAT STEEL	104				

REVISIONS: LTR | DATE | APPROVED

APPLICATION

CONTRACT NO.

REDIFON ELECTRONICS, INC
ARLINGTON, TEXAS

REDIFON

ASSEMBLY	14
DATE	2-17-76
PREPARED	R. Graham
CHECKED	E. Findley
APPROVED	[illegible]

ASSEMBLY TITLE: ASSEMBLY—MECH VISUAL INSTL

SHEET 2 OF 3

SIZE: A | CODE IDENT NO.: 53988 | PARTS LIST NO.: 1100-0014

LEAR JET INSTALLATION NO 14

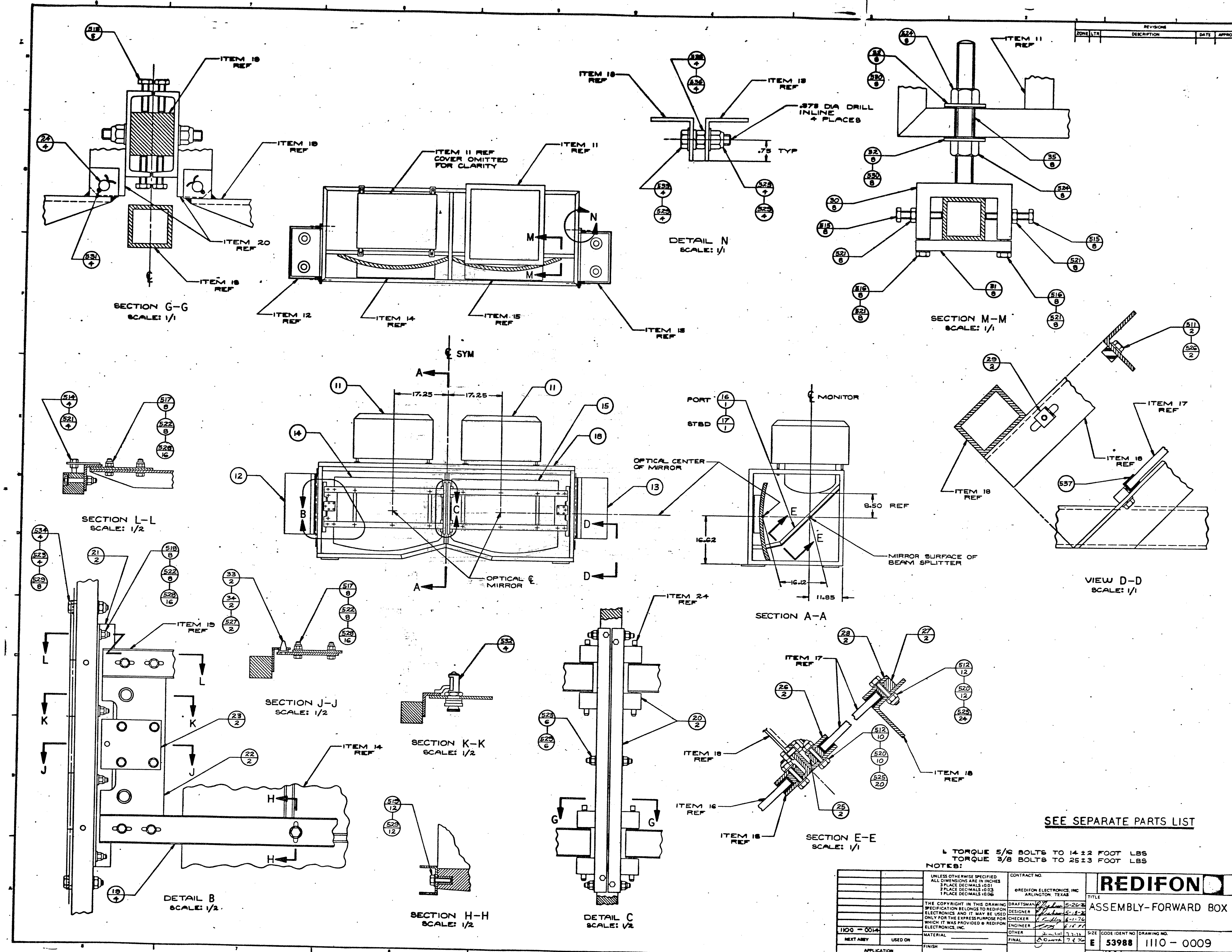
REVISIONS	ITEM	DWG SIZE	PART NO. (CODE IDENT)	DESCRIPTION	UNIT QUANTITY PER ASSEMBLY				
LTR / DATE / APPROVED	517			WASHER 3/8 LOCK STEEL	8				
	518								
	519								
	520								
	521								
	522								
	523								
	524								
	525								
	526								
	527								
	528								
	529								
	530								
	531								
APPLICATION	532								

CONTRACT NO.

REDIFON ELECTRONICS, INC
ARLINGTON, TEXAS

REDIFON

		ASSEMBLY TITLE	SHEET
ASSEMBLY	14	ASSEMBLY—MECH VISUAL INSTL	3 OF 3
DATE	2-17-76		
PREPARED	R Graham		
CHECKED	E Findley	SIZE: A / CODE IDENT NO.: 53988	PARTS LIST NO.: 1100-0014
APPROVED	J Peter		



SECTION G-G
SCALE: 1/1
ITEM 18 REF
ITEM 20 REF
ITEM 11 REF COVER OMITTED FOR CLARITY
ITEM 11 REF
ITEM 12 REF
ITEM 14 REF
ITEM 15 REF
ITEM 13 REF
DETAIL N
SCALE: 1/1
ITEM 19 REF
.375 DIA DRILL INLINE 4 PLACES
.75 TYP
SECTION M-M
SCALE: 1/1
ITEM 11 REF
℄ SYM
17.25
OPTICAL ℄ MIRROR
SECTION L-L
SCALE: 1/2
PORT
STBD
℄ MONITOR
OPTICAL CENTER OF MIRROR
8.50 REF
16.62
16.12
11.85
MIRROR SURFACE OF BEAM SPLITTER
SECTION A-A
VIEW D-D
SCALE: 1/1
ITEM 17 REF
ITEM 16 REF
ITEM 18 REF
SECTION J-J
SCALE: 1/2
SECTION K-K
SCALE: 1/2
ITEM 24 REF
SECTION E-E
SCALE: 1/1
DETAIL B
SCALE: 1/2
SECTION H-H
SCALE: 1/2
DETAIL C
SCALE: 1/2
SEE SEPARATE PARTS LIST
NOTES:
1. TORQUE 5/16 BOLTS TO 14±2 FOOT LBS
TORQUE 3/8 BOLTS TO 25±3 FOOT LBS
UNLESS OTHERWISE SPECIFIED ALL DIMENSIONS ARE IN INCHES
REDIFON ELECTRONICS, INC ARLINGTON, TEXAS
THE COPYRIGHT IN THIS DRAWING SPECIFICATION BELONGS TO REDIFON ELECTRONICS AND IT MAY BE USED ONLY FOR THE EXPRESS PURPOSE FOR WHICH IT WAS PROVIDED © REDIFON ELECTRONICS, INC.
1100 - 0014
NEXT ASSY
USED ON
APPLICATION
REDIFON
ASSEMBLY-FORWARD BOX
SIZE E
CODE IDENT NO 53988
DRAWING NO. 1110 - 0009
DO NOT SCALE THIS DWG
SHEET 1 OF 1

ITEM	DWG SIZE	PART NO. (CODE IDENT)	DESCRIPTION	UNIT QUANTITY PER ASSEMBLY
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				
11	E	1140-0002	MONITOR DISPLAY	2
12	E	1130-0007	DRIVER UNIT PORT	1
13	E	1130-0008	DRIVER UNIT STBD	1
14	E	800214-01	COLLIMATING MIRROR PORT	1
15	E	800214-02	COLLIMATING MIRROR STBD	1
16	B	800215-01	BEAM SPLITTER PORT	1

REVISIONS: LTR | DATE | APPROVED

APPLICATION

CONTRACT NO.

REDIFON ELECTRONICS, INC
ARLINGTON, TEXAS

REDIFON

ASSEMBLY	09
DATE	5-27-76
PREPARED	Graham
CHECKED	E Findley
APPROVED	[illegible]

ASSEMBLY TITLE: ASSEMBLY—FORWARD BOX

SHEET 1 OF 6

SIZE: A | CODE IDENT NO.: 53988 | PARTS LIST NO.: 1110-0009

LEAR JET ASSEMBLY 09

REVISIONS	ITEM	DWG SIZE	PART NO. (CODE IDENT)	DESCRIPTION	UNIT QUANTITY PER ASSEMBLY				
LTR / DATE / APPROVED	17	B	800215-02	BEAM SPLITTER STBD	1				
	18	E	800147-0	FRAME NOVOVIEW BOX (FRONT)	1				
	19	D	800156-01	CHANNEL-MIRROR (HINGE HALF)	4				
	20	C	800037-02	HINGE HALF-BRACKET MIRROR	2				
	21	D	800155-0	ANGLE-MOUNTING BRACKET MIRROR	2				
	22	D	800154-0	LATCH-PLATE MIRROR	2				
	23	B	800157-0	PLATE MIRROR	2				
	24	B	800064-0	HINGE PIN MIRROR	4				
	25	C	800176-0	SPACER-CLAMP, BEAM SPLITTER SUPPORT CENTER	2				
	26	C	800177-0	CLAMP-BEAM SPLITTER SUPPORT CENTER	2				
	27	C	800135-02	SPACER-CLAMP, BEAM SPLITTER SUPPORT OUTBD	2				
	28	C	800129-02	CLAMP-BEAM SPLITTER SUPPORT OUTBD	2				
	29	B	800047-02	BLOCK-BEAM SPLITTER	2				
	30	B	800042-02	CLAMP-MONITOR SUPPORT	8				
	31	B	800041-0	PLATE-CLAMP, MONITOR SUPPORT	8				
	32	B	800060-01	WASHER-INSULATING	8				
APPLICATION									

CONTRACT NO.

REDIFON ELECTRONICS, INC
ARLINGTON, TEXAS

REDIFON

ASSEMBLY	09				
DATE	5-27-76				
PREPARED	Graham				
CHECKED	E. Finley				
APPROVED	[illegible]				

ASSEMBLY TITLE
ASSEMBLY—FORWARD BOX

SHEET 2 OF 6

SIZE	CODE IDENT NO.	PARTS LIST NO.
A	53988	1110-0009

ITEM	DWG SIZE	PART NO. (CODE IDENT)	DESCRIPTION	UNIT QUANTITY PER ASSEMBLY
33	B	800062-01	GUIDE-PIN, MIRROR	2
34	B	800063-01	BUSHING-GUIDE PIN	2
35	B	800059-01	BUSHING-INSULATING	8
36				
37				
38				
39				
40				
41				
42				
43				
44				
45				
46				
47				
48				

REVISIONS: LTR / DATE / APPROVED

APPLICATION

CONTRACT NO.

REDIFON ELECTRONICS, INC
ARLINGTON, TEXAS

REDIFON

ASSEMBLY	09
DATE	5-27-76
PREPARED	Graham
CHECKED	E Findley
APPROVED	[illegible]

ASSEMBLY TITLE: ASSEMBLY— FORWARD BOX

SHEET 3 OF 6

SIZE: A

CODE IDENT NO.: 53988

PARTS LIST NO.: 1110-0009

LEAR JET ASSEMBLY 09

ITEM	DWG SIZE	PART NO. (CODE IDENT)	DESCRIPTION	UNIT QUANTITY PER ASSEMBLY				
501								
502								
503								
504								
505								
506								
507								
508								
509								
510								
511			BOLT 10-32 UNF X 5/8 HEX HEAD STL	2				
512			BOLT 10-32 UNF X 1.0 HEX HEAD STL	22				
513			BOLT 1/4-28 UNF X 1.5 HEX HEAD STL	8				
514			BOLT 1/4-28 UNF X 2.0 HEX HEAD STL	4				
515			BOLT 1/4-28 UNF X 1 3/4 HEX HEAD STL	16				
516			BOLT 1/4-28 UNF X 1.0 HEX HEAD STL	16				

REVISIONS: LTR / DATE / APPROVED

APPLICATION

CONTRACT NO.

REDIFON ELECTRONICS, INC
ARLINGTON, TEXAS

REDIFON

ASSEMBLY	09
DATE	5-27-76
PREPARED	Graham
CHECKED	E. Ford
APPROVED	[illegible]

ASSEMBLY TITLE
ASSMEBLY — FORWARD BOX

SHEET 4 OF 6

SIZE A | CODE IDENT NO. 53988 | PARTS LIST NO. 1110-0009

LEAR JET ASSEMBLY 09

ITEM	DWG SIZE	PART NO. (CODE IDENT)	DESCRIPTION	UNIT QUANTITY PER ASSEMBLY				
517			BOLT 5/16-24 UNF X 1.0 HEX HEAD STL	16				
518			BOLT 5/16-24 UNF X 2.0 HEX HEAD STL	8				
519			BOLT, LOCK 3/8-24 UNF X 1.0	12				
520			NUT, LOCK 10-32 UNF HEX STL	22				
521			NUT 1/4-28 UNF HEX STL	36				
522			NUT 5/16-24 UNF LOCK HEX STL	24				
523			NUT 3/8-24 UNF LOCK HEX STL	14				
524			NUT 5/8-18 UNF HEX STL	16				
525			WASHER NO. 10 FLAT STL	44				
526			WASHER NO. 10 LOCK STL	2				
527			WASHER 1/4 LOCK STL	2				
528			WASHER 5/16 FLAT STL	48				
529			WASHER 3/8 FLAT STL	34				
530			WASHER 5/8 FLAT	16				
531			COTTER PIN 1/16 DIA X 1.0 LG	4				
532			LATCH - ADJUSTABLE PAWL	4				

REVISIONS: LTR | DATE | APPROVED

APPLICATION

CONTRACT NO.

REDIFON ELECTRONICS, INC
ARLINGTON, TEXAS

REDIFON

ASSEMBLY	09
DATE	5-27-76
PREPARED	Graham
CHECKED	E Findley
APPROVED	J Dites

ASSEMBLY TITLE: ASSEMBLY — FORWARD BOX

SHEET 5 OF 6

SIZE: A | CODE IDENT NO.: 53988 | PARTS LIST NO.: 1110-0009

LEAR JET ASSEMBLY 09

ITEM	DWG SIZE	PART NO. (CODE IDENT)	DESCRIPTION	UNIT QUANTITY PER ASSEMBLY
533			BOLT 3/8-24 UNF X 1.5 HEX HEAD STL	4
534			BOLT 3/8-24 UNF X 2.5 HEX HEAD STL	4
535			NUT 3/8-24 UNF HEX STL	4
536			WASHER 3/8 LOCK STL	8
537			CHANNEL-GLASS SETTING 9/16 X 7/16 X 1/4	25' APPROX

REVISIONS: LTR / DATE / APPROVED

APPLICATION

CONTRACT NO.

REDIFON ELECTRONICS, INC
ARLINGTON, TEXAS

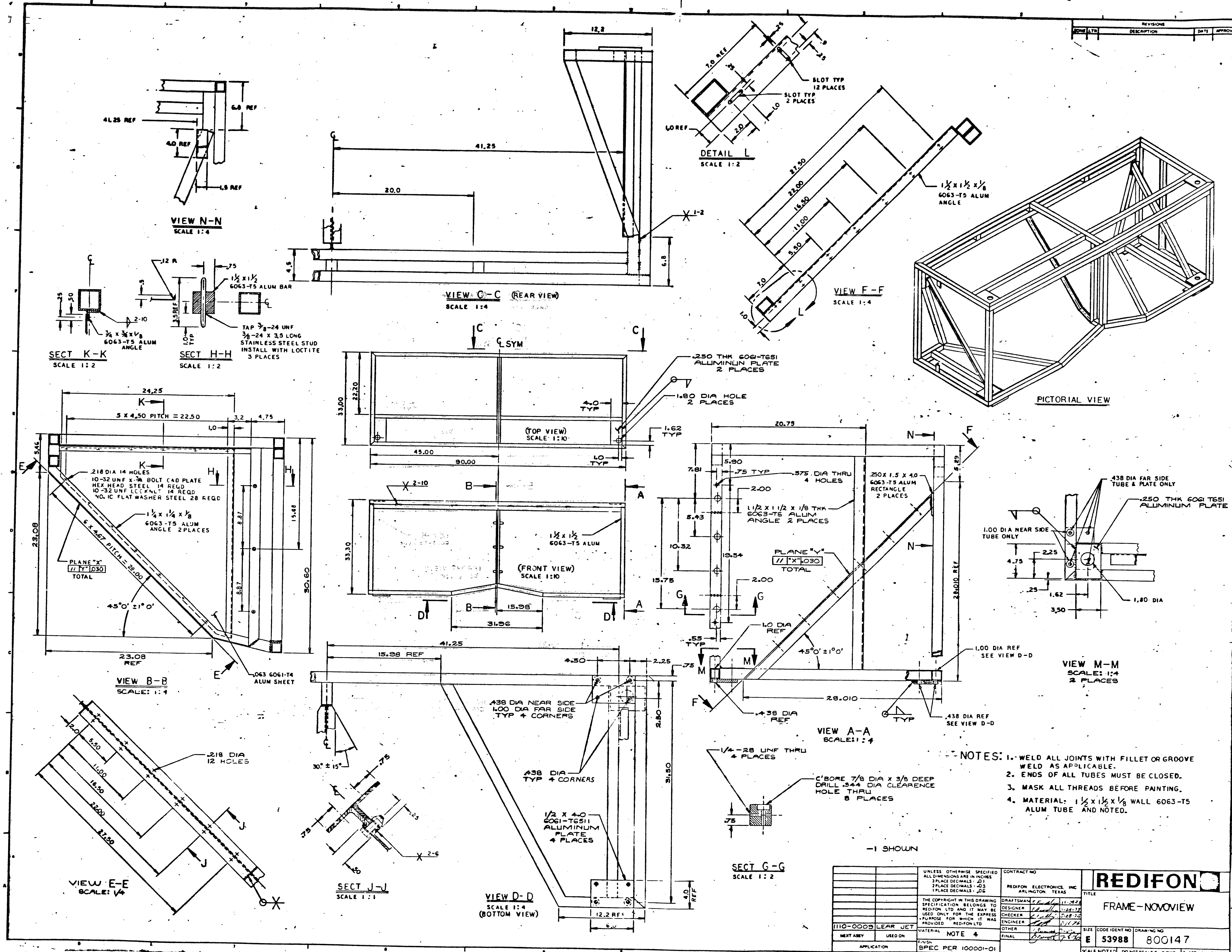
REDIFON

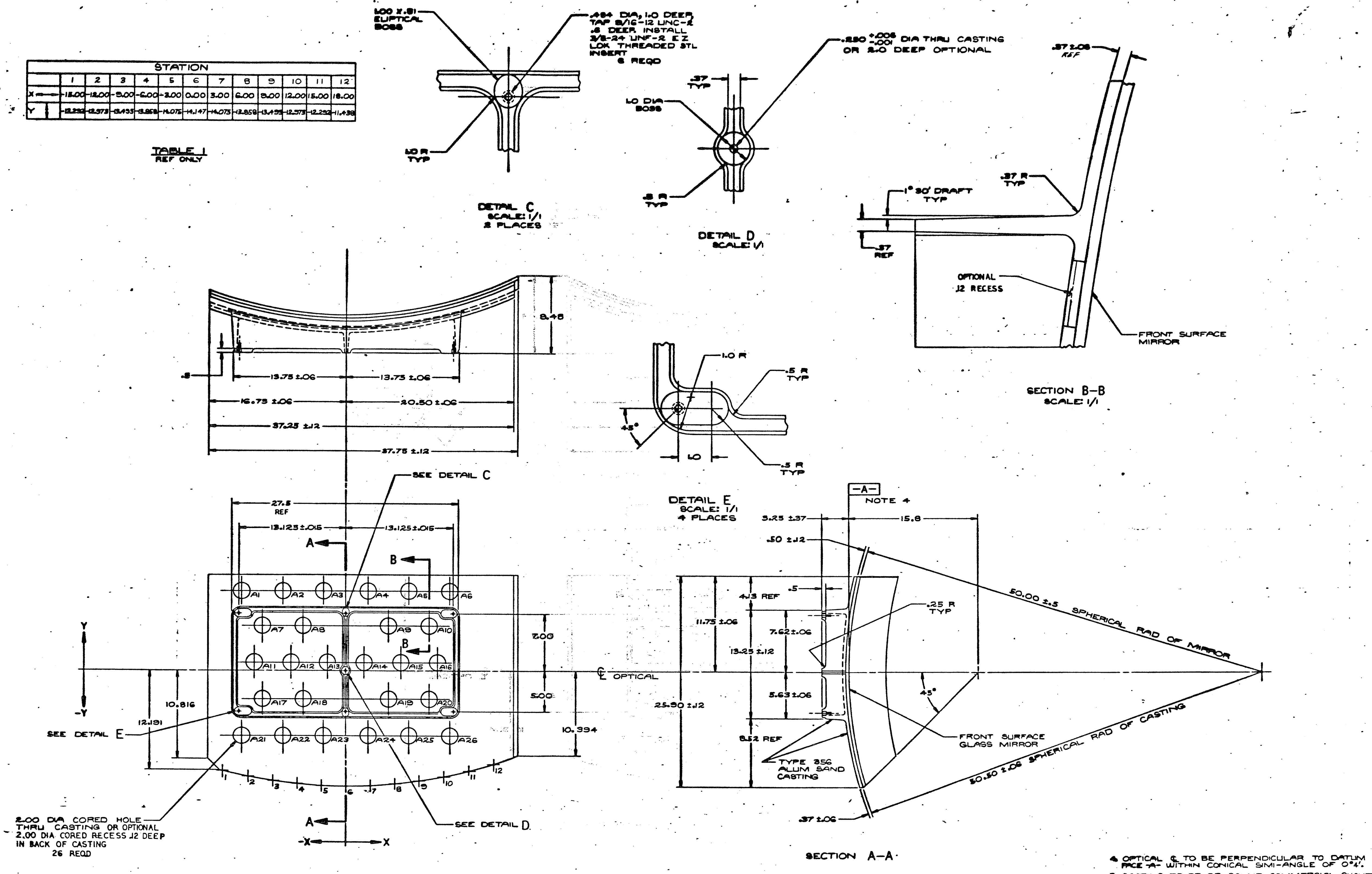
ASSEMBLY	09
DATE	5-27-76
PREPARED	Graham
CHECKED	E. Fiddler
APPROVED	J. Peter

ASSEMBLY TITLE: ASSEMBLY — FORWARD BOX

SHEET 6 OF 6

SIZE: A | CODE IDENT NO.: 53988 | PARTS LIST NO.: 1110-0009


VIEW N-N
SCALE 1:4
VIEW C-C (REAR VIEW)
SCALE 1:4
DETAIL L
SCALE 1:2
SLOT TYP 12 PLACES
SLOT TYP 2 PLACES
VIEW F-F
SCALE 1:4
1 1/2 x 1 1/2 x 1/8 6063-T5 ALUM ANGLE
PICTORIAL VIEW
SECT K-K
SCALE 1:2
3/4 x 3/4 x 1/8 6063-T5 ALUM ANGLE
SECT H-H
SCALE 1:2
1 1/2 x 1 1/2 6063-T5 ALUM BAR
TAP 3/8-24 UNF
3/8-24 x 3.5 LONG STAINLESS STEEL STUD INSTALL WITH LOCTITE 3 PLACES
(TOP VIEW)
SCALE 1:10
.250 THK 6061-T651 ALUMINUM PLATE 2 PLACES
1.80 DIA HOLE 2 PLACES
(FRONT VIEW)
SCALE 1:10
1 1/2 x 1 1/2 6063-T5 ALUM
.218 DIA 14 HOLES
10-32 UNF x 3/4 BOLT CAD PLATE HEX HEAD STEEL 14 REQD
10-32 UNF LOCKNUT 14 REQD
NO. 10 FLAT WASHER STEEL 28 REQD
1 1/4 x 1 1/4 x 1/8 6063-T5 ALUM ANGLE 2 PLACES
PLANE "X"
TOTAL
.063 6061-T4 ALUM SHEET
VIEW B-B
SCALE: 1:4
.375 DIA THRU 4 HOLES
.250 x 1.5 x 4.0 6063-T5 ALUM RECTANGLE 2 PLACES
1 1/2 x 1 1/2 x 1/8 THK 6063-T5 ALUM ANGLE 2 PLACES
PLANE "Y"
TOTAL
VIEW A-A
SCALE: 1:4
1.00 DIA REF SEE VIEW D-D
.438 DIA REF SEE VIEW D-D
.438 DIA FAR SIDE TUBE & PLATE ONLY
.250 THK 6061 T651 ALUMINUM PLATE
1.00 DIA NEAR SIDE TUBE ONLY
VIEW M-M
SCALE: 1:4
2 PLACES
.218 DIA 12 HOLES
VIEW E-E
SCALE: 1/4
SECT J-J
SCALE 1:1
.438 DIA NEAR SIDE
1.00 DIA FAR SIDE
TYP 4 CORNERS
.438 DIA TYP 4 CORNERS
1/2 x 4.0 6061-T6511 ALUMINUM PLATE 4 PLACES
VIEW D-D
SCALE 1:4
(BOTTOM VIEW)
1/4-28 UNF THRU 4 PLACES
C'BORE 7/8 DIA x 3/8 DEEP DRILL .344 DIA CLEARENCE HOLE THRU 8 PLACES
SECT G-G
SCALE 1:2
-1 SHOWN
NOTES:
1. WELD ALL JOINTS WITH FILLET OR GROOVE WELD AS APPLICABLE.
2. ENDS OF ALL TUBES MUST BE CLOSED.
3. MASK ALL THREADS BEFORE PAINTING.
4. MATERIAL: 1 1/2 x 1 1/2 x 1/8 WALL 6063-T5 ALUM TUBE AND NOTED.
UNLESS OTHERWISE SPECIFIED ALL DIMENSIONS ARE IN INCHES
3 PLACE DECIMALS ± .01
2 PLACE DECIMALS ± .03
1 PLACE DECIMALS ± .06
THE COPYRIGHT IN THIS DRAWING SPECIFICATION BELONGS TO REDIFON LTD AND IT MAY BE USED ONLY FOR THE EXPRESS PURPOSE FOR WHICH IT WAS PROVIDED REDIFON LTD
REDIFON ELECTRONICS, INC ARLINGTON TEXAS
REDIFON
FRAME-NOVOVIEW
1110-0009 LEAR JET
NEXT ASSY
USED ON
APPLICATION
MATERIAL NOTE 4
FINISH SPEC PER 100001-01
SIZE E
CODE IDENT NO 53988
DRAWING NO 800147
SCALE NOTED
DO NOT SCALE THIS DWG
SHEET 1 OF 1



STATION												
	1	2	3	4	5	6	7	8	9	10	11	12
X	-15.00	-12.00	-9.00	-6.00	-3.00	0.00	3.00	6.00	9.00	12.00	15.00	18.00
Y	-12.292	-12.973	-13.435	-13.858	-14.075	-14.147	-14.075	-13.859	-13.495	-12.573	-12.292	-11.438

TABLE 1
REF ONLY

-01 PORT SIDE SHOWN
-02 STBD SIDE OPPOSITE

4. OPTICAL ℄ TO BE PERPENDICULAR TO DATUM FACE -A- WITHIN CONICAL SIMI-ANGLE OF 0°4'.

3. CASTING TO BE OF SOUND COMMERCIAL QUALITY, FREE FROM POROSITY AND BLOWHOLES.

2. GLASS MIRROR WHEN SURFACE COATED, IS TO BE BONDED TO ALUM CASTING. CONTACT SURFACES ARE TO BE PRIMED PRIOR TO APPLIPICATION OF GENERAL ELECTRIC RTV-60 SILICONE RUBBER ADHESIVE ACCORDING TO MANUFACTURERS RECOMMENDATIONS RTV-60 TO BE BLACK, RED OPTIONAL.

1. ENTIRE ALUM CASTING BACK TO BE PRIME COATED AND FINISH COATED WITH OPTICAL FLAT BLACK.

CORE HOLE SYMBOL														
HOLE SYM	A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	A11	A12	A13	A14
X	-12.75	-7.75	-2.75	2.75	7.75	12.75	-10.25	-5.25	5.25	10.25	-11.25	-6.75	-2.25	2.25
Y	8.75	8.75	8.75	9.75	9.75	9.75	5.50	5.50	5.50	5.50	1.0	1.0	1.0	1.0

HOLE SYM	A15	A16	A17	A18	A19	A20	A21	A22	A23	A24	A25	A26
X	6.75	11.25	-10.25	-5.25	5.25	10.25	-12.75	-7.95	-2.75	2.75	7.75	12.75
Y	1.0	1.0	-3.5	-3.5	-3.5	-3.5	-8.0	-8.0	-8.0	-8.0	-8.0	-8.0

ALL DIMENSIONS ± .10 FOR THIS TABLE ONLY

TABLE 2

0110 - 0005		UNLESS OTHERWISE SPECIFIED ALL DIMENSIONS ARE IN INCHES 3 PLACE DECIMALS .01 2 PLACE DECIMALS .03 1 PLACE DECIMALS .06	CONTRACT NO REDIFON ELECTRONICS INC ARLINGTON, TEXAS
NEXT ASSY	USED ON	THE COPYRIGHT IN THIS DRAWING SPECIFICATION BELONGS TO REDIFON LTD AND IT MAY BE USED ONLY FOR THE EXPRESS PURPOSE FOR WHICH IT WAS PROVIDED REDIFON LTD	DRAFTSMAN 11-22-75; DESIGNER RFSL; CHECKER; ENGINEER; OTHER; FINAL
APPLICATION		MATERIAL NOTED; FINISH PER SPEC 100002 - 01	

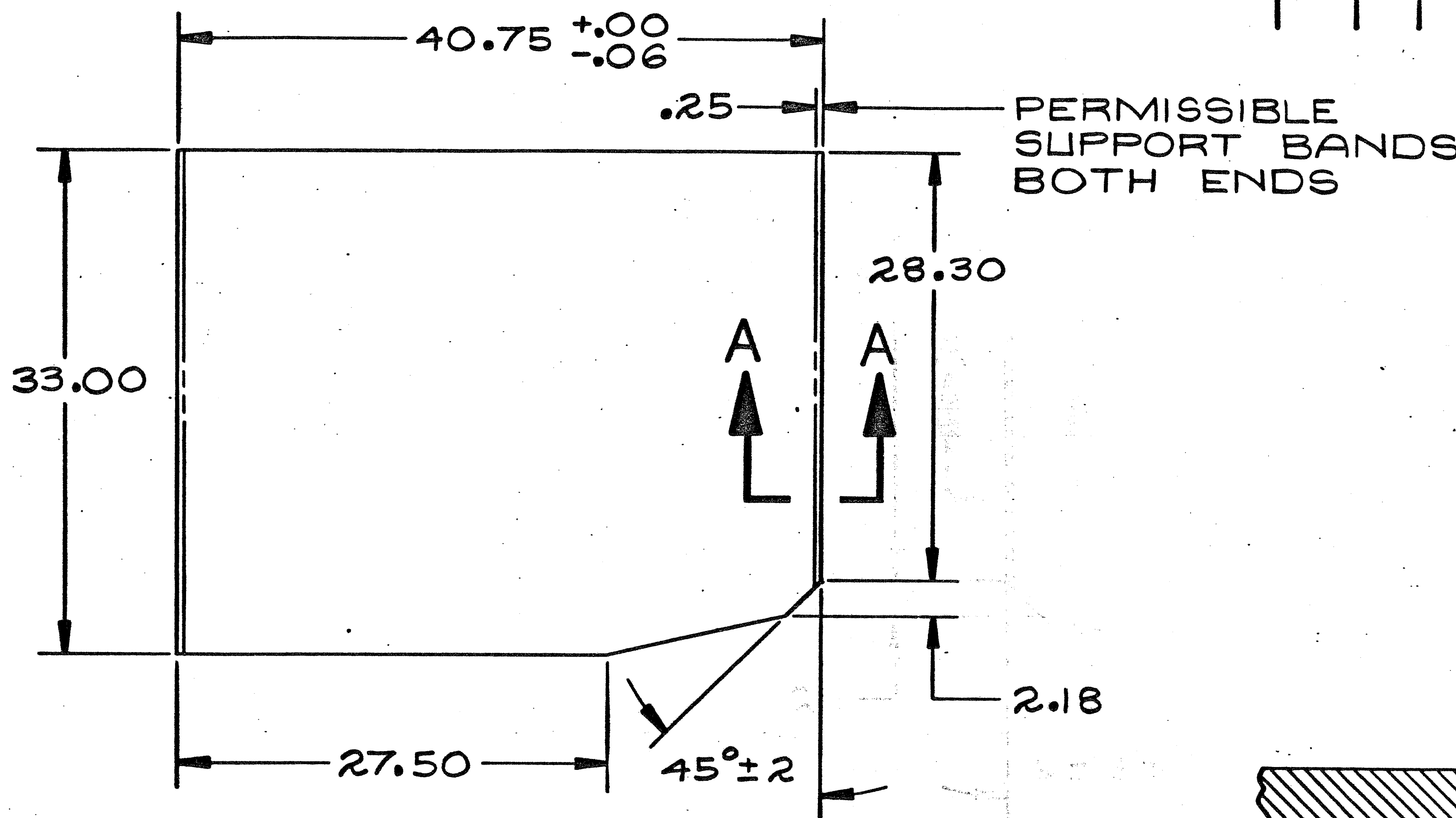
REDIFON

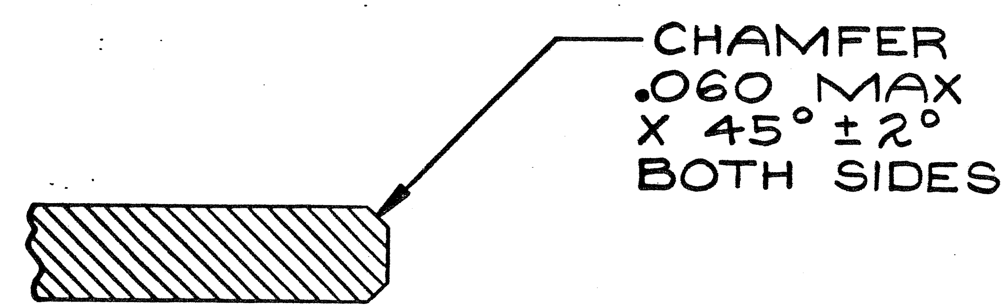
TITLE COLLIMATING MIRROR – ALUMINUM AND GLASS (MODIFIED)

SIZE	CODE IDENT NO	DRAWING NO
E	53988	800214

SCALE NOTED | DO NOT SCALE THIS DWG | SHEET 1 OF 1

REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPROVED





SECT A–A
SCALE: 2/1
BOTH ENDS

-01 SHOWN COATED FAR SIDE
-02 SHOWN COATED NEAR SIDE

1110-0009	
NEXT ASSY	USED ON
APPLICATION	

UNLESS OTHERWISE SPECIFIED
ALL DIMENSIONS ARE IN INCHES
3 PLACE DECIMALS ±0.01
2 PLACE DECIMALS ±0.03
1 PLACE DECIMALS ±0.06

MATERIAL
1/4 FLOAT GLASS

FINISH
PER SPEC 100003-01

CONTRACT NO.

REDIFON ELECTRONICS, INC
ARLINGTON, TEXAS

DRAFTSMAN	R Graham	3-29-76
DESIGNER	R Graham	3-29-76
CHECKER	E Finlley	5-27-76
ENGINEER	[illegible]	6-10-76
OTHER	MGC	10-6-76
FINAL	W DeFur	10-6-76

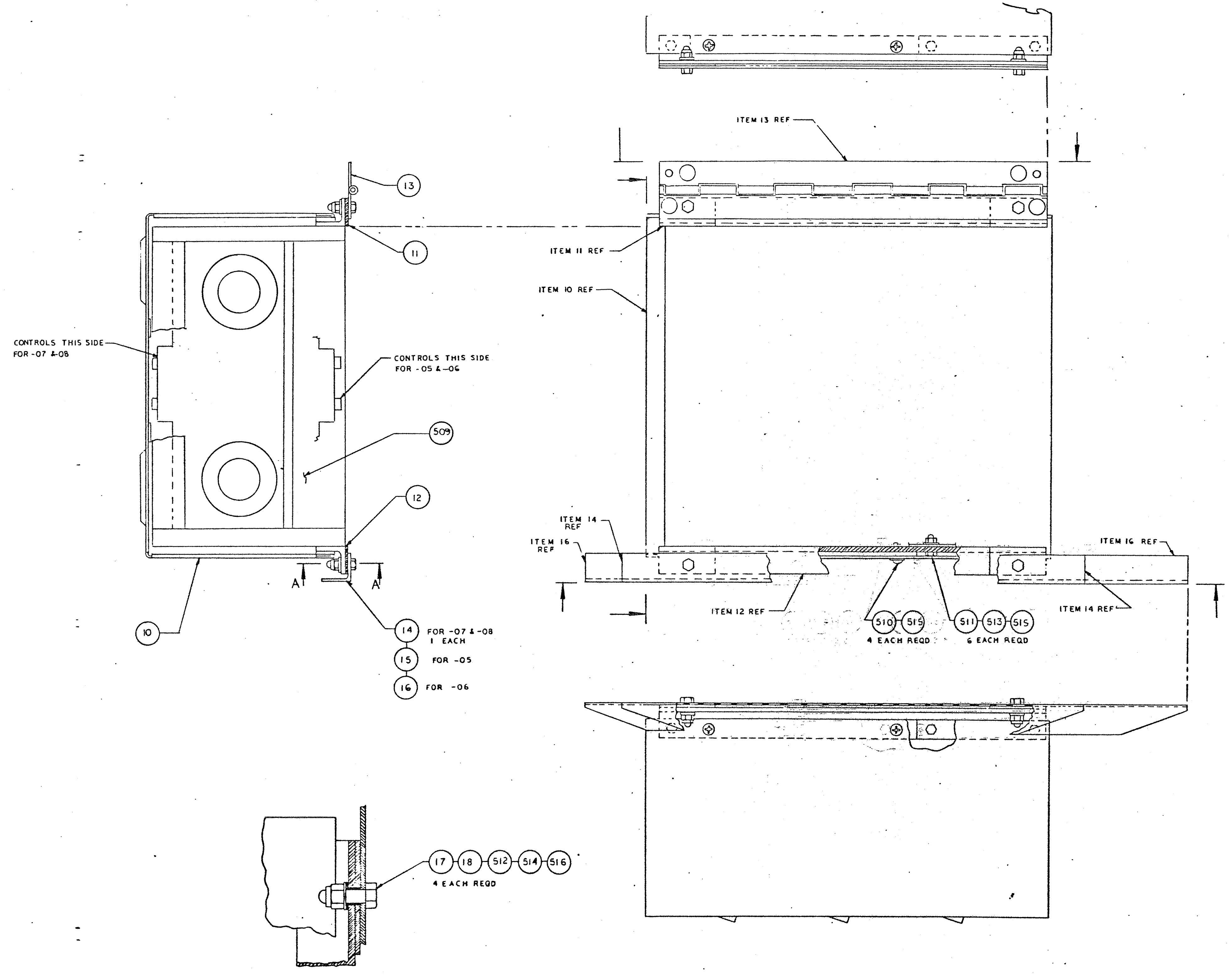
REDIFON

TITLE
BEAMSPLITTER

SIZE	CODE IDENT NO.	DRAWING NO.
B	53988	800215

SCALE: 1/10 | DO NOT SCALE THIS DWG | SHEET 1 OF 1

ZONE	LTR	DESCRIPTION	DATE	APPROVED
	A	ADDED DETAIL B & ITEMS 19, 20, 21, 22, 23, 506, 507 & 508 FOR -0007 & -0008	10-12-76	3-23-77
	B	CANCELLED REV. A	3-22-77	3-23-77



SECT A-A
SCALE 1:1

-0006 SHOWN-0005 OPPOSITE
-0007 SHOWN-0008 OPPOSITE

SEE SEPARATE PARTS LIST

	NEXT ASSY	USED ON
-08	1110-0018	
-07	1110-00[illegible]	
-05-06	1110-00[illegible]	

APPLICATION

UNLESS OTHERWISE SPECIFIED
ALL DIMENSIONS ARE IN INCHES
3 PLACE DECIMALS ±0.01
2 PLACE DECIMALS ±0.03
1 PLACE DECIMALS ±0.06

MATERIAL

CONTRACT NO

©REDIFON ELECTRONICS, INC
ARLINGTON, TEXAS

DRAFTSMAN 5-28-76
DESIGNER 5-28-76
CHECKER 7-15-76
ENGINEER 7-5-76
FINAL

REDIFON

TITLE
ASSEMBLY—DRIVER

SIZE	CODE IDENT NO	DRAWING NO
E	53988	1130 -0005 THRU -000[illegible]

ASSEMBLY NO. 05 06 07 08

REVISIONS LTR	DATE	APPROVED
A	10-13-76	Elf
B	3-22-77	Elf

ITEM	DWG SIZE	PART NO. (CODE IDENT)	DESCRIPTION	UNIT QUANTITY PER ASSEMBLY 05	06	07	08	
1								
2								
3								
4								
5								
6								
7								
8								
9								
10	E	800029-01	COVER — DRIVER	1	1	1	1	
11	C	800028-03	ANGLE — DRIVER MOUNT	1	1	1	1	
12	C	800028-04	ANGLE — DRIVER MOUNT	1	1	1	1	
13	C	800133-01	HINGE — DRIVER	1	1	1	1	
14	C	800175-03	ANGLE — DRIVER ATTACH			1	1	
15	C	800175-01	ANGLE — DRIVER ATTACH	1				
16	C	800175-02	ANGLE — DRIVER ATTACH		1			

APPLICATION

CONTRACT NO.

REDIFON ELECTRONICS, INC
ARLINGTON, TEXAS

REDIFON

ASSEMBLY	-0005	-0006	-0007	-0008	
DATE	5-28-76	5-28-76	5-28-76	5-28-76	
PREPARED	E Findley	E Findley	E Findley	E Findley	
CHECKED	[illegible]				
APPROVED	[illegible]				

ASSEMBLY TITLE
ASSEMBLY — DRIVER

SHEET 1 OF 3

SIZE	CODE IDENT NO.	PARTS LIST NO.
A	53988	1130-0005 THRU -0008

ASSEMBLY NO 05 06 07 08

REVISIONS LTR	DATE / APPROVED
A	10-13-76 Elf
B	3-22-77 Elf

ITEM	DWG SIZE	PART NO. (CODE IDENT)	DESCRIPTION	UNIT QUANTITY PER ASSEMBLY 05	06	07	08	
17	B	800059-02	BUSHING – INSULATING	4	4	4	4	
18	B	800060-02	WASHER – INSULATING	4	4	4	4	
19	B	~~800184-01~~	~~ANGLE–STOP~~				1	
20	~~B~~	~~800184-02~~	~~ANGLE – STOP~~			1		
21	B	~~800185-01~~	~~SPACER~~			1	1	
22	B	~~800187-01~~	~~PLATE – INSULATING~~			1	1	
23	B	~~800059-04~~	~~BUSHING–INSULATING~~			1	1	
24								
25								
26								
27								
28								
29								
30								
31								
32								

APPLICATION

CONTRACT NO.

REDIFON ELECTRONICS, INC
ARLINGTON, TEXAS

REDIFON

ASSEMBLY	-0005	-0006	-0007	-0008
TE	5-28-76	5-28-76	5-28-76	5-28-76
PREPARED	E Findley	E Findley	E Findley	E Findley
CHECKED	[signature]			
APPROVED	[signature]			

ASSEMBLY TITLE: ASSEMBLY— DRIVER

SHEET 2 OF 3

SIZE: A | CODE IDENT NO.: 53988 | PARTS LIST NO.: 1130-0005 THRU-0008

ASSEMBLY NO. 05 06 07 08

REVISIONS LTR	DATE / APPROVED
A	10-13-76 / Elf
B	3-22-77 / Elf

ITEM	DWG SIZE	PART NO. (CODE IDENT)	DESCRIPTION	UNIT QUANTITY PER ASSEMBLY				
501								
502								
503								
504								
505								
506			~~BOLT – 1/4 – 28 UNF X 1 1/4 HEX HEAD STEEL~~			1	1	
507			~~LOCKNUT 1/4 28 UNF HEX STEEL~~			1	1	
508			~~WASHER – 1/4 STEEL FLAT~~			1	1	
509			ELECTRONIC DRIVER UNIT (EVANS & SUTHERLAND)	1	1	1	1	
510			SCREW – 10-32 UNF X 5/8 PAN HEAD STEEL	4	4	4	4	
511			BOLT – 10-32 UNF X 5/8 HEX HEAD STEEL	6	6	6	6	
512			BOLT – 3/8 – 24 UNF X 1 1/4 HEX HEAD STEEL	4	4	4	4	
513			NUT – 10-32 UNF HEX STEEL (PLAIN)	6	6	6	6	
514			LOCK NUT – 3/8 -24 UNF HEX STEEL	4	4	4	4	
515			LOCK WASHER NO. 10 STEEL	6	6	6	6	
516			WASHER – 3/8 STEEL (FLAT)	4	4	4	4	

APPLICATION

CONTRACT NO.

REDIFON ELECTRONICS, INC
ARLINGTON, TEXAS

REDIFON

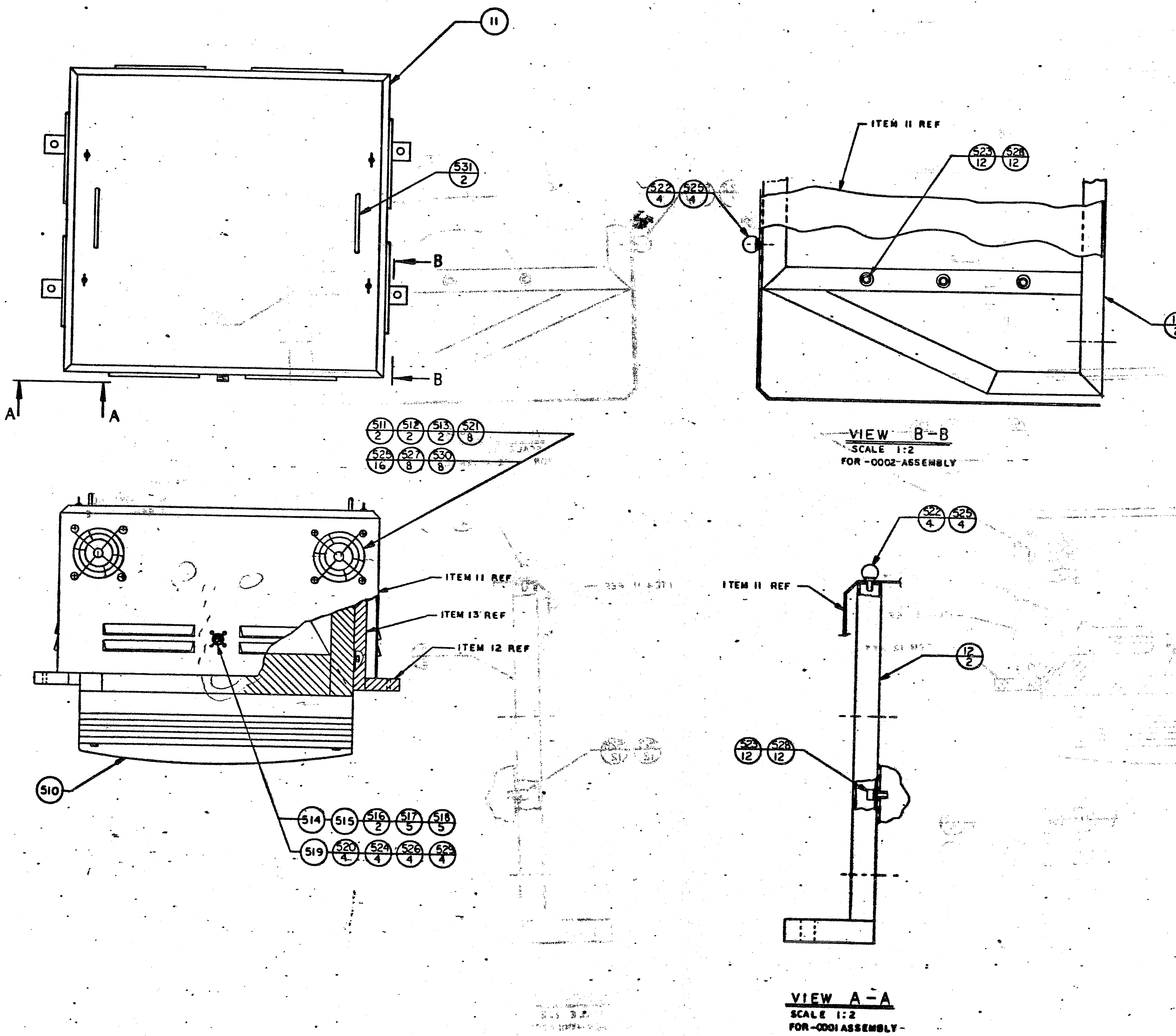
ASSEMBLY	-0005	-0006	-0007	-0008
DATE	6-1-76	6-1-76	6-1-76	6-1-76
PREPARED	E Findley	E Findley	E Findley	E Findley
CHECKED	[signature]			
APPROVED	[signature]			

ASSEMBLY TITLE
ASSEMBLY – DRIVER

SHEET 3 OF 3

SIZE A | CODE IDENT NO. 53988 | PARTS LIST NO. 1130 -0005 THRU -0008

REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPROVED
	A	ADDED CALLOUT AND LOCATION FOR ITEM 531 AND ITEM 14	8-29-75	
	B	REVISED LOCATION OF FANS REMOVED YOKE COVER AND SPACERS	12-18-75	
	C	ADDED ITEM 531	4 30 76	



NOTES:

1. REMOVE ALL DISPLAY MONITOR PANELS.
2. REMOVE THE CRT YOKE PROTECTION COVER.

SEE SEPARATE PARTS LIST

	NEXT ASSY	USED ON
-0002	1120-0001	6-0002
-0002	1110-0007-0008	6-0009
-0001	1110-0013	
-0001	1110-0003	THRU-0006
	APPLICATION	

UNLESS OTHERWISE SPECIFIED ALL DIMENSIONS ARE IN INCHES
3 PLACE DECIMALS ·0.0005
2 PLACE DECIMALS ·0.010
1 PLACE DECIMALS ·0.030

MATERIAL

FINISH

CONTRACT NO

REDIFON ELECTRONICS INC
ARLINGTON TEXAS

DRAFTSMAN		7/23/75
DESIGNER		9-23-75
CHECKER		9-23-75
ENGINEER		7-29-75
OTHER	MG	
FINAL		7-5-76

REDIFON

TITLE
ASSEMBLY — MONITOR

SIZE	CODE IDENT NO	DRAWING NO
E	53988	1140 -0001 -0002

SCALE 1:4 DO NOT SCALE THIS DWG SHEET 1 OF 1

REVISIONS		ITEM	DWG SIZE	PART NO. (CODE IDENT)	DESCRIPTION	UNIT QUANTITY PER ASSEMBLY				
LTR	DATE / APPROVED					01	02			
	12-18-75	1	E							
	4/30/76	2								
C		3								
		4								
		5								
		6								
		7								
		8								
		9								
		10								
		11	E	800058-01	COVER, DISPLAY MONITOR	1	1			
		12	D	800043-01	SUPPORT FRAME MONITOR	2				
		13	D	800082-01	SUPPORT FRAME MONITOR		2			
		14								
		15								
APPLICATION		16								

CONTRACT NO.

REDIFON ELECTRONICS, INC
ARLINGTON, TEXAS

REDIFON

ASSEMBLY	-01	-02			
TE	7/24/75	7/24/75			
PREPARED	Browne	Browne			
CHECKED	[illegible]	[illegible]			
APPROVED	[illegible]	[illegible]			

ASSEMBLY TITLE: ASSEMBLY— DISPLAY MONITOR

SHEET 1 OF 3

SIZE	CODE IDENT NO.	PARTS LIST NO.
A	53988	1140-0001/0002

REVISIONS		
LTR	DATE	APPROVED
~	12-18-75	[illegible]
C	4/30/76	[illegible]

ITEM	DWG SIZE	PART NO. (CODE IDENT)	DESCRIPTION	UNIT QUANTITY PER ASSEMBLY 01	02			
501								
502								
503								
504								
505								
506								
507								
508								
509								
510			DISPLAY MONITOR MODEL CM 325	1	1			
511		3-15-4451	FAN (HOWARD CYCLOHM)	2	2			
512		6-182-026	FINGER GUARD (HOWARD CYCLOHM)	2	2			
513	C	1540-0006-01	CABLE ASSEMBLY (W101)	1	1			
514	C	1540-0006-02	CABLE ASSEMBLY (W102)	1	1			
515	C	1540-0006-03	CABLE ASSEMBLY (W103)	1	1			
516								

APPLICATION

CONTRACT NO.

REDIFON ELECTRONICS, INC
ARLINGTON, TEXAS

REDIFON

ASSEMBLY	-01	-02
DATE	7/24/75	7/24/75
PREPARED	Brown	Brown
CHECKED	[illegible]	[illegible]
APPROVED	[illegible]	[illegible]

ASSEMBLY TITLE: ASSEMBLY— DISPLAY MONITOR

SHEET 2 OF 3

SIZE: A

CODE IDENT NO.: 53988

PARTS LIST NO.: 1140-0001-0002

[illegible]

REVISIONS LTR	DATE	APPROVED
C	12-18-75 4/30/76	[illegible]

ITEM	DWG SIZE	PART NO. (CODE IDENT)	DESCRIPTION	UNIT QUANTITY PER ASSEMBLY 01	02			
517		ABMS-AC	MOUNT, CABLE TIES (PANDUIT)	5	5			
518		PLTIM-CP	CABLE TIES (PANDUIT)	5	5			
519								
520			4-40 X 1/2 SCREW, PAN HD	4	4			
521			10-32 X 3/4 SCREW, PAN HD	8	8			
522			10-32 X 1/2 THUMBSCREW	4	4			
523			1/4-28 X 5/8 SCREW, SOCKET HD	12	12			
524			#4 WASHER, FLAT	4	4			
525			#10 WASHER, FLAT	20	20			
526			#4 WASHER, INT. LOCK	12	12			
527			#10 WASHER, SPLIT LOCK	8	8			
528			#1/4 WASHER, SPLIT LOCK	12	12			
529			4-40 NUT, HEX	4	4			
530			10-32 NUT, HEX	8	8			
531		US 26D	CABINET PULLS (STANLEY)	2	2			
532								

APPLICATION

CONTRACT NO.

REDIFON ELECTRONICS, INC
ARLINGTON, TEXAS

REDIFON

ASSEMBLY	-01	-02			
TE	7/24/75	7/24/75			
PREPARED	Browne	Browne			
CHECKED	[illegible]	[illegible]			
APPROVED	[illegible]	[illegible]			

ASSEMBLY TITLE
ASSEMBLY — DISPLAY MONITOR

SHEET 3 OF 3

SIZE	CODE IDENT NO.	PARTS LIST NO.
A	53988	1140-0001-0002

VOLUME 8
NOVOVIEW VISUAL SYSTEM
RECOMMENDED SPARES

MANUAL NO. 75115
ORIGINAL ISSUE
LEAR 35/36

REDIFON

SECTION I

GENERAL

1.1 GENERAL

This manual should contain the Novoview Visual System Recommended Spares that were shipped at an earlier date. Upon receipt of this manual, place Recommended Spares List in this section.

NSPBLD/NSPMER

SOFTWARE IMPLEMENTATION DOCUMENT

NSPBLD/NSPMER Software Implementation Document
Part Number: 901181-109

NSPBLS Software Part Number: 908042-501
NSPMER Software Part Number: 908042-503

Prepared by

EVANS & SUTHERLAND COMPUTER CORPORATION
580 Arapeen Drive
Salt Lake City, Utah 84108

NSPBLD/NSPMER SOFTWARE IMPLEMENTATION DOCUMENT

CONTENTS

ILLUSTRATIONS

TABLES

Table | Page

LIST OF EFFECTIVE PAGES

On a changed text page the portion affected by the latest change is indicated by a vertical line in the outer margin of the page. Changes to illustrations are indicated by miniature pointing hands. Change number 0 indicates an original page. Flowchart names are listed here because flowchart pages are not consecutively numbered with the text. The number in parentheses following the flowchart name indicates the number of sheets for that particular flowchart.

PAGE NUMBER	CHANGE NUMBER
i-1 - i-7	0
1-1 - 1-5	0
2-1 - 2-124	0
NBCLPROC (14)	0
NBDIV222 (1)	0
NBEMCNVR (6)	0
NBEMDLET (6)	0
NBEMEXND (6)	0
NBEMFIND (8)	0
NBEMINST (9)	0
NBEMPRNT (6)	0
NBGMPROC (11)	0
NBLMCNEX (4)	0
NBLMCNMA (4)	0
NBLMCNMB (4)	0
NBLMCNVR (7)	0
NBLMDLET (8)	0
NBLMEXMA (3)	0
NBLMEXMB (3)	0
NBLMFDMB (8)	0
NBLMFIND (8)	0
NBLMINMA (8)	0
NBLMINST (8)	0
NBLMPRNT (6)	0
NBLMUPDT (7)	0
NBLMUPMA (7)	0
NBLMVECT (8)	0
NBMMERGE (5)	0
NBMMEROR (1)	0
NBMMTRAN (10)	0
NBMMTVTX (2)	0
NBMUL224 (1)	0
NBNBLIST (2)	0
NBNBMAIN (1)	0
NBNBCTYP (1)	0
NBSMBRIT (1)	0
NBSMCMDL (6)	0

NBSMCNTR	(2)	0
NBSMEXSN	(1)	0
NBSMFDEP	(1)	0
NBSMFIND	(3)	0
NBSMINEP	(1)	0
NBSMINST	(3)	0
NBSMLIST	(3)	0
NBSMPREP	(1)	0
NBSMRMOV	(4)	0
NBSMSSUR	(2)	0
NBSMTREB	(12)	0
NBSQROOT	(1)	0
NBVBNRM	(1)	0
NBVDIFF	(3)	0
NBVPLANE	(1)	0
NBVUBNRM	(1)	0
NBVXPRD	(1)	0
3-1 - 3-4		0
4-1 - 4-5		0
5-1 - 5-11		0
6-1 - 6-2		0
GL-1 - GL-4		0

SECTION 1

INTRODUCTION

1.1 DOCUMENT SCOPE AND STRUCTURE

This document provides an overview of the NOVOVIEW SP model building system in sufficient detail to permit an experienced programmer to understand the system methodology, structure, and internal operation. The document consists of six sections, as follows:

Section 1	States the function of the program, contains an overall block diagram that relates the program to the remainder of the NSP system, and discusses the overall program structure and operation.
Section 2	Describes the internal operation of the program modules. The structure of this section corresponds to that of the program's overall block diagram. Block diagrams in this section correspond to blocks within the overall diagram.
Section 3	Describes how to regenerate a working program from individual modules.
Section 4	Contains the disk directories that list the contents of the disks which carry the program and its related material.
Section 5	Lists the name and corresponding part number for each of the modules that make up the program.
Section 6	Describes the link map, concordance, and module listings for the program.

This entire document is structured around the concept of the module, where a module is a subroutine or a collection of subroutines that has been assigned a part number. Section 2 is divided into subsections, the lowest order of which describes a module. Flowcharts are provided to the module level; therefore, subroutines in a module are flowcharted as part of that module's flowchart. Section 5 gives the name and corresponding part number for all modules. The listings in section 6 are separated into modules. The name and part number for each module appear at the top of its listing.

1.2 PROGRAM FUNCTION

The NSP model building system consists of two programs: NSPBLD and NSPMER. The first, NSPBLD, generates the various data module types required for a complete model. Once the data modules are completed, they can be read back into NSPBLD where they can be edited to correct errors or make desired modifications. NSPBLD also provides facilities for listing various portions of the data module currently contained within the program's buffer.

The second program, NSPMER, is used to merge two light or surface data modules into a single module. This program reads two modules specified by the user and merges their contents into a single module if there is sufficient room. The composite module then has any ambiguous data structures reinitialized. This leaves the new module in a "safe" state which can then be edited by using NSPBLD to reestablish the various data structures with respect to the composite data.

1.3 PROGRAM STRUCTURE

The two programs, NSPBLD and NSPMER, have the same basic structure as shown by block diagrams in figures 1-1 and 1-2. In each case, the main program control is handled by the text scanner. This scanner traverses the stored scan tree and performs the indicated functions. These functions include such things as requesting data from the user, comparing data against known limits, jumping to another portion of the scan tree, and executing procedures.

As the scanner traverses the tree, it builds up the data in the parameter block. When sufficient data have been received from the user, as determined by the scan tree, the scanner passes control to one of the data processing procedures that use the data in the parameter block to insert, delete, change, or list data in the module block. All data communication between the scanner and the various processing procedures is accomplished through the parameter block. The various procedure groups, such as light module procedures, etc., may use some internal temporary storage, but they communicate with other groups only through the parameter block or the module block.

The scanner also controls the major input and output of data. The scanner I/O procedures are used to pass data modules between mass storage devices and the module block buffer. The I/O procedures also handle I/O to the system console. The only I/O not handled directly by the scanner are data transfers to the Tektronix 4010 display from the display procedures (see section 1.4).

1.4 PROGRAM CONFIGURATION

The program NSPBLD exists in two configurations: (1) standard (no Tektronix 4010 support) and (2) display (with Tektronix 4010 support). The standard version is called NSPBLS and is generated by using the files NBSWHO and DSTEMP (see sections 2.6.2 and 2.7.1). The display version is called NSPBLD and is generated by using the file NBDWHO (see section 2.7.1) and the Tektronix 4010 display package (see separate document). References in this document to NSPBLD are the generic program and such references apply to both NSPBLS and NSPBLD.

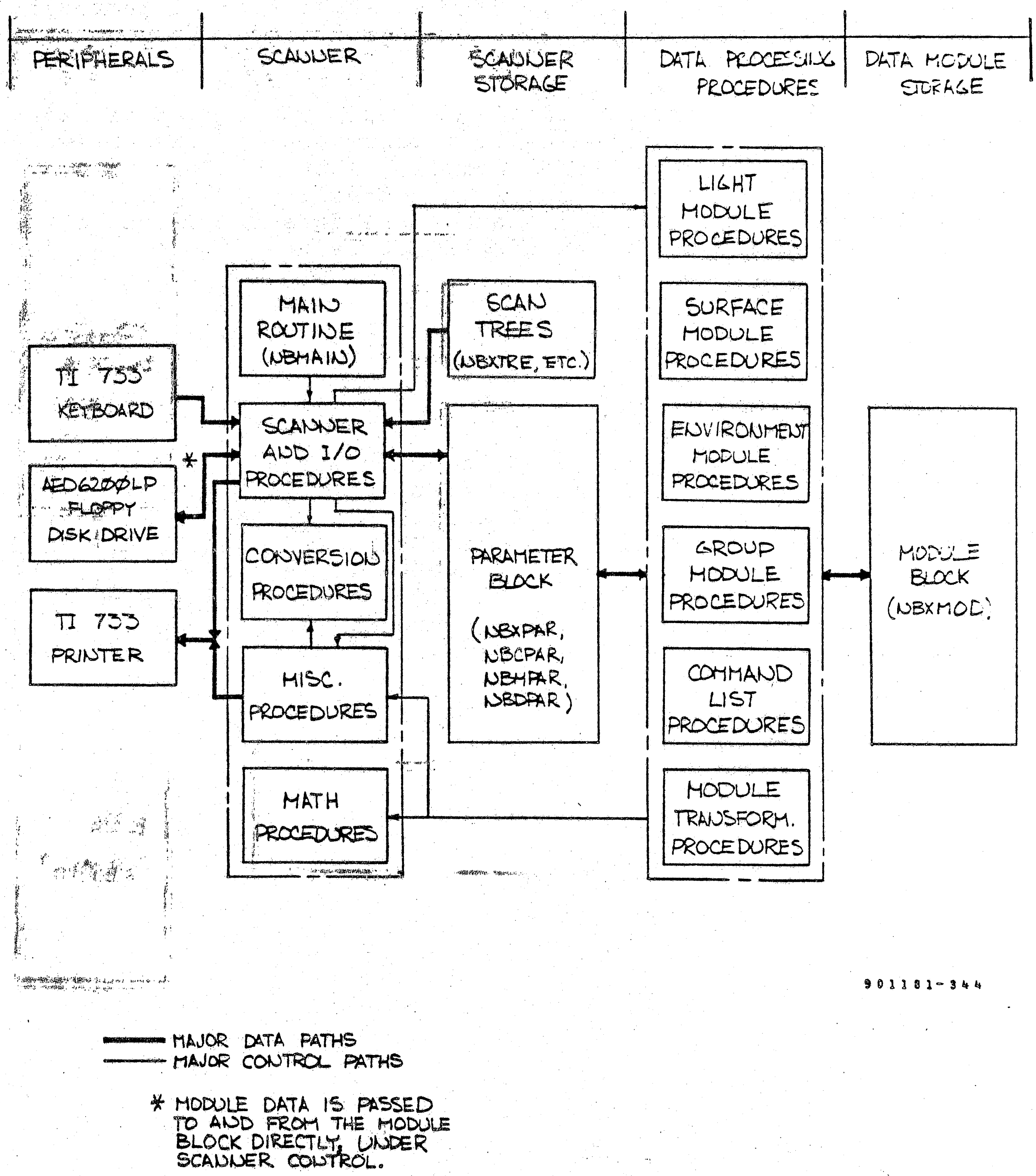


FIGURE 1-1
NSPBLD BLOCK DIAGRAM

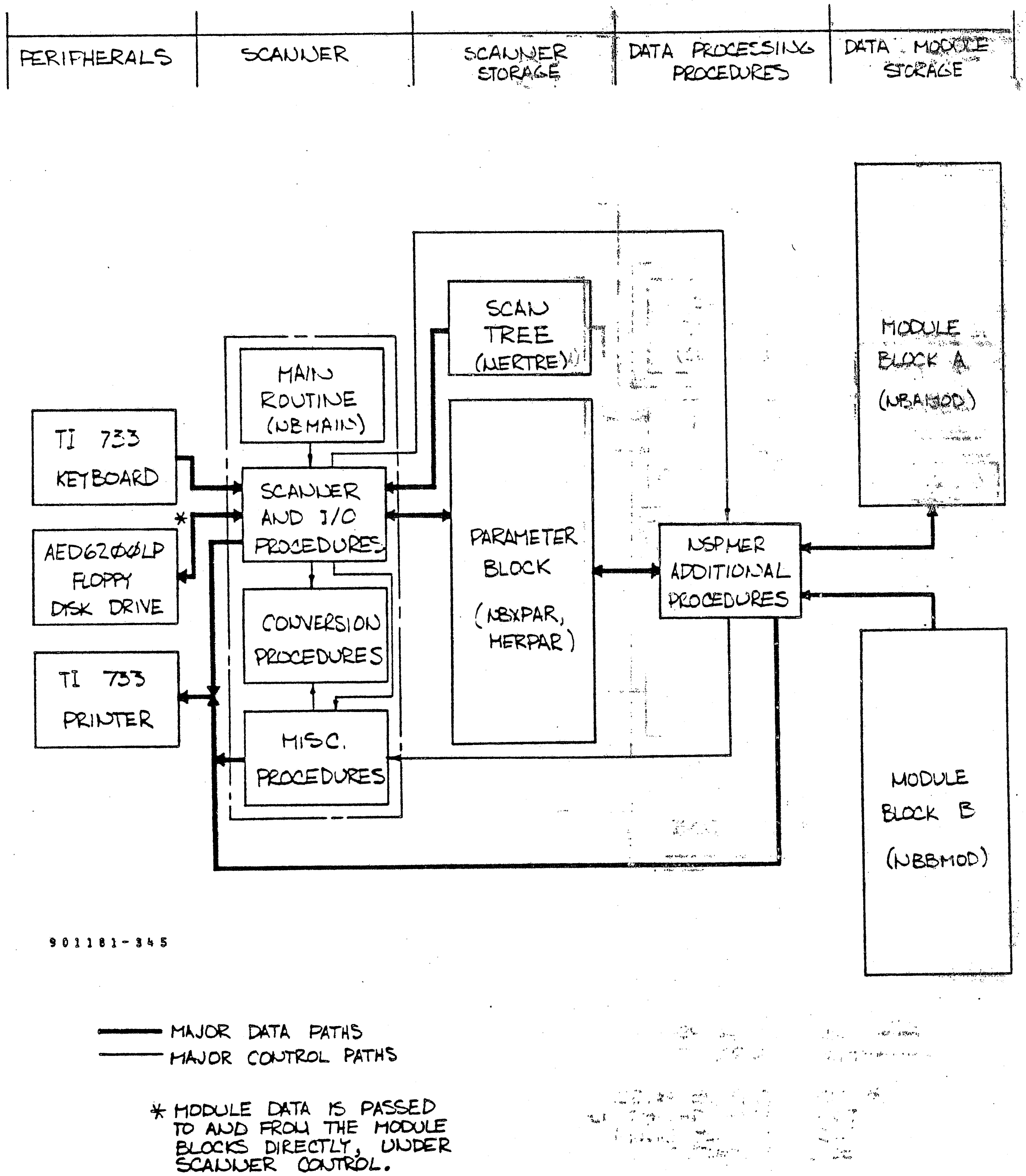


FIGURE 1-2
NSPMER BLOCK DIAGRAM

SECTION 2

MODULE DESCRIPTIONS

2.1 INTRODUCTION

This section describes in detail the internal operation of the NSPBLD and NSPMER programs. The arrangement of this section corresponds to the block diagrams for these programs in section 1 (figures 1-1 and 1-2). Each separate block of procedures on those diagrams corresponds to a module group section here. For example, the block labeled "light module procedures" in figure 1-1 is discussed here in section 2.10, titled "Module Group: NSPBLD Light Module Procedures." The block diagrams found in this section are expansions of the individual blocks of figures 1-1 and 1-2. For example, the block labeled "light module procedures" in figure 1-1 is expanded here in figure 2-25 to show the individual modules of the light module groups.

Each module group section is further divided into subsections that discuss individual modules; the general arrangement of the subsections corresponds to the block diagram for the module group. For example, the light module group block diagram (figure 2-25 in section 2.10) shows eight module blocks, one of which is labeled LMDLET. This module is discussed in section 2.10.2, titled "Module: LMDLET."

Flowcharts are provided for modules that require them. The flowcharts are in alphabetical sequence following this section. For quick reference to find a flowchart, see the alphabetical listing of them on the List of Effective Pages (following the Contents pages). Flowchart syntax and naming conventions are discussed in the following section (2.1.1).

Contents pages). Flowchart syntax and naming conventions are discussed in the following section (2.1.1).

2.1.1 FLOWCHART SYNTAX

The symbols used in the flowcharts for this document are shown and described in figure 2-1. The flowcharts have been drawn at a module (file) level, with individual procedures detailed more fully for the data processing procedures and other complex modules.

The flowchart name corresponds to the module (and source file) name as follows:

NBname

where:

NB = the program prefix for the modeling system.

name = the module name (same as the source file name).

For example, the flowchart name for the module SMINST contained in the file SMINST would be NBSMINST.

The connector identifiers for on-page connectors are unique for the page on which they occur, but may not be unique for the entire flowchart if the flowchart is longer than one page. The off-page connector identifier is unique within a flowchart for a module, but may not be unique for all flowcharts of the program or system.

2.2 MAIN ROUTINE: NBMAIN

The module NBMAIN contains the NSP model building system main procedure, NSPBLD. This procedure initializes the required number of logical units, sets up the scan parameter list (NB$PAR), and passes control to the scanner (T3SCAN), which then proceeds to traverse the scan tree pointed to by the scan parameter list.

The procedure NSPBLD is used for both NSPBLD and NSPMER. The list of logical units to be initialized and the appropriate scan parameter list for each program are located in modules NBDWHO and MERMSG, respectively. This enables the main routine and scanner to be general in nature and independent of program function.

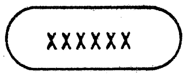
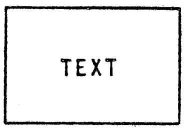
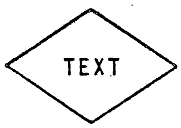
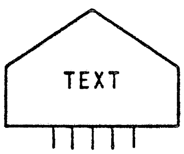
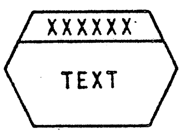
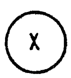
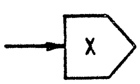
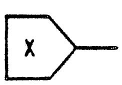
SYMBOL	TITLE	EXPLANATION
	ENTRY/EXIT	XXXXXX = ENTRY POINT LABEL OR 'ENTRY' OR 'RETURN' OR 'EXIT'
	PROCESS	TEXT = DESCRIPTION OF PROCESS BEING PERFORMED
	DECISION	TEXT = DESCRIPTION OF DECISION BEING MADE
	DISPATCH	TEXT = DESCRIPTION OF DISPATCH BEING PERFORMED
	PROCEDURE CALL	XXXXXX = PROCEDURE ENTRY POINT NAME TEXT = DESCRIPTION OF PROCEDURE BEING PERFORMED
	ONPAGE CONNECTOR	X = CONNECTOR IDENTIFIER
	'TO' OFFPAGE CONNECTOR	X = CONNECTOR IDENTIFIER
	'FROM' OFFPAGE CONNECTOR	X = CONNECTOR IDENTIFIER

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FIGURE 2-1
FLOWCHART SYNTAX

2.3 MODULE GROUP: SCANNER AND I/O PROCEDURES

The scanner and I/O procedures (see figure 2-2) are contained in the following modules:

MODULE	FUNCTION	SECTION
T$SCAN	Command scanner	2.3.1
KEYIOS	Keyboard I/O procedures	2.3.2
NBFIOS	Floppy disk I/O procedures	2.3.3

The scanner (T$SCAN) reads and interprets items in the scan tree. These items may direct the scanner to issue a prompt to the keyboard and retrieve a user response via procedures in KEYIOS. The data sent and received are converted to or from binary form by the various procedures discussed in section 2.4.

Other scan items may direct the scanner to read or write a data module via the file I/O procedures contained in NBFIOS. Various other modules and procedures may also use the I/O procedures to perform special I/O operations.

2.3.1 MODULE: T$SCAN

The module T$SCAN is the command scanner. It consists of a number of procedural groups as indicated in the block diagram in figure 2-3. When T$SCAN is called, the initialization procedure clears the internal scan control and execution stack. The scan pointer (register B) is initially set to the top of the scan tree specified in the scan parameter block (pointed to by register X). Control is then passed to the dispatcher.

The tree scan item dispatcher retrieves the data word pointed to by the scan pointer. The most significant byte of this word contains the scan item opcode. The dispatcher isolates the opcode and uses it as an index into the handler dispatch table. Control is dispatched to the appropriate item processing procedure.

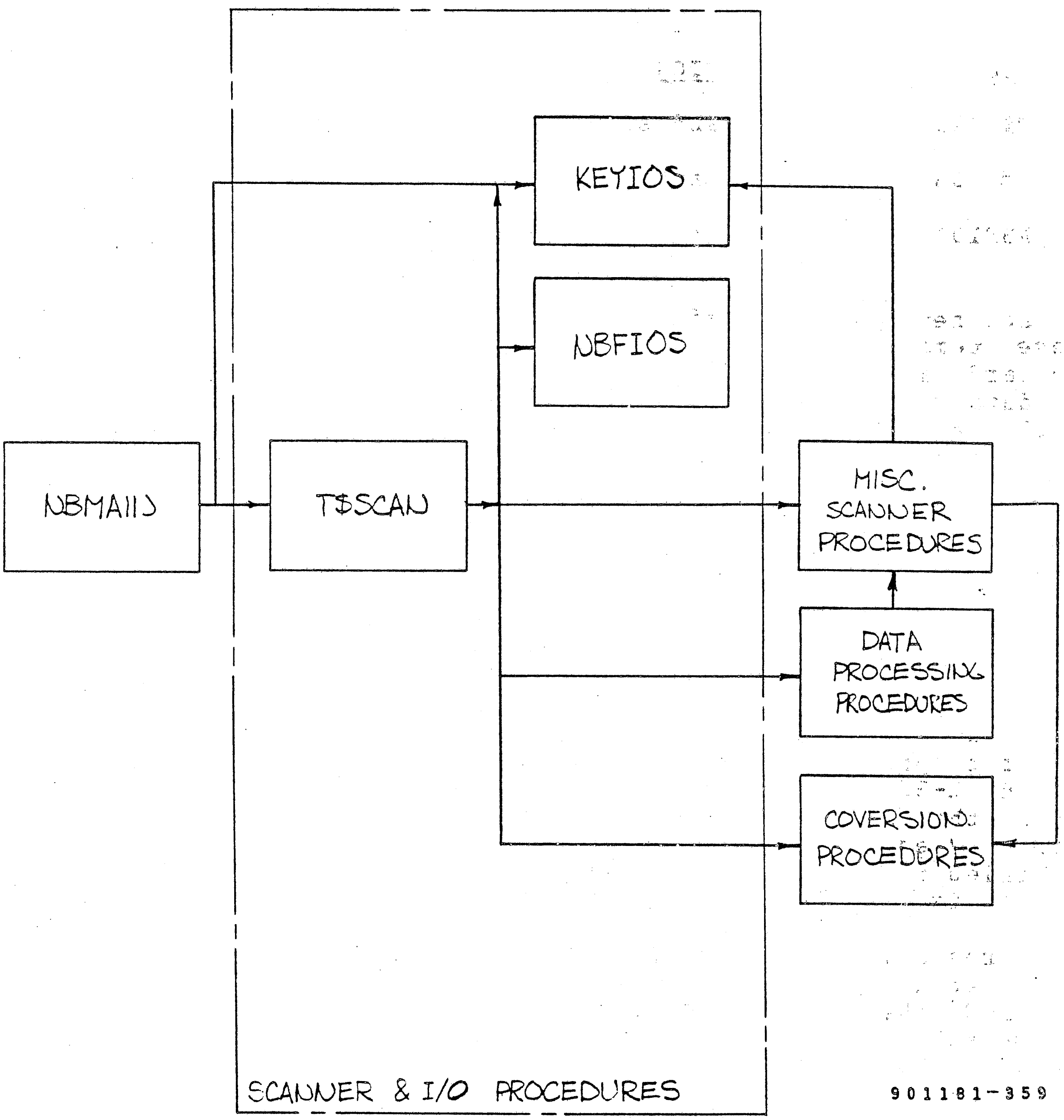

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FIGURE 2-2
SCANNER AND I/O PROCEDURES BLOCK DIAGRAM

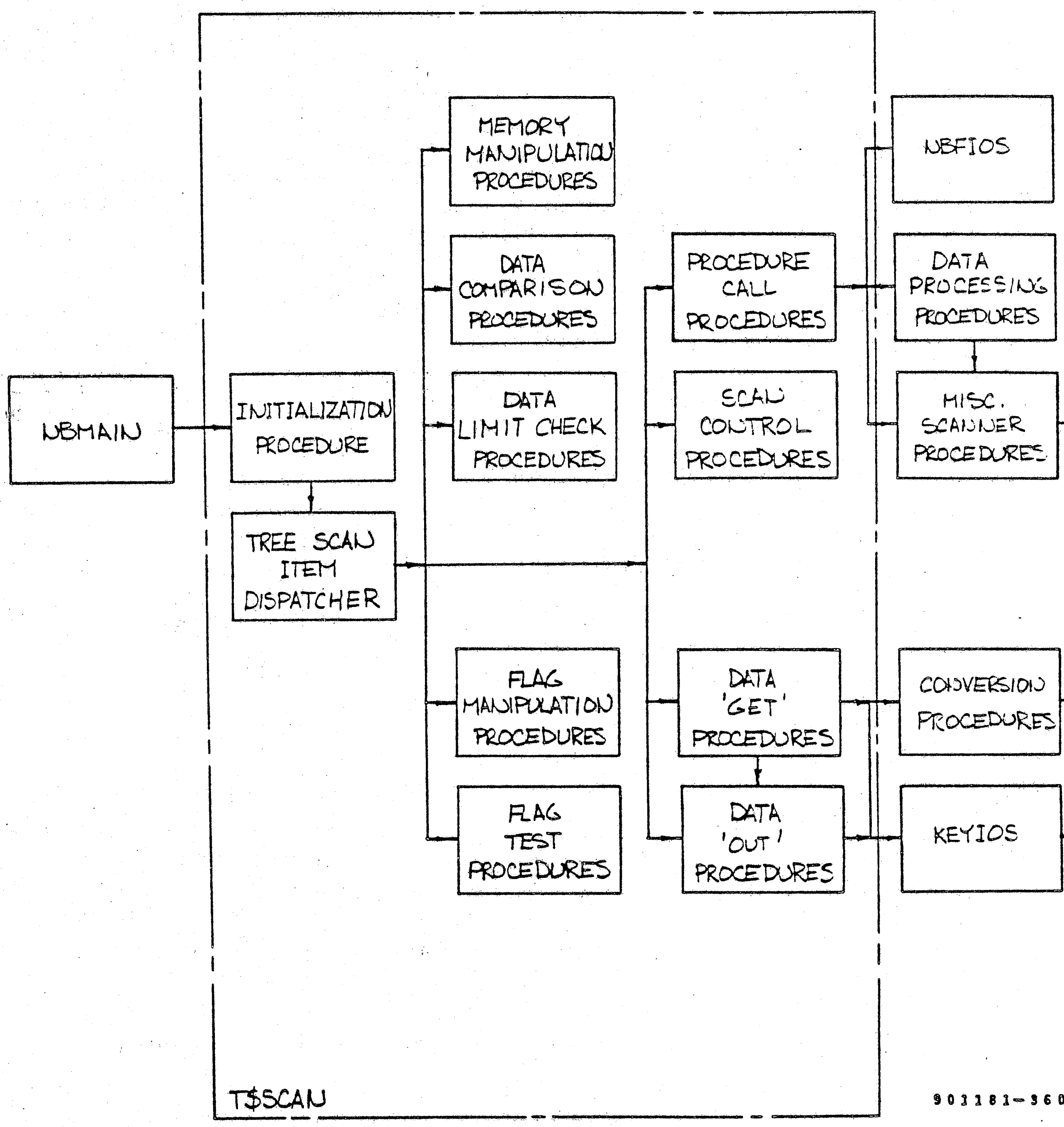

FIGURE 2-3
T$SCAN: COMMAND SCANNER MODULE BLOCK DIAGRAM

The scan item processing procedures can be classified into nine procedural groups as follows:

TITLE	SECTION
Scan control procedures	2.3.1.1
Procedure call procedures	2.3.1.2
Data "get" procedures	2.3.1.3
Data comparison procedures	2.3.1.4
Data limit check procedures	2.3.1.5
Memory manipulation procedures	2.3.1.6
Data "out" procedures	2.3.1.7
Flag manipulation procedures	2.3.1.8
Flag test procedures	2.3.1.9

Each of these groups is discussed in detail in the following paragraphs. Refer to figures 2-4 through 2-13 for descriptions of the scan item data formats.

2.3.1.1 T$SCAN Scan Control Procedures

The scanner contains a scan pointer stack which is used in conjunction with the scan control procedures to manipulate the scan pointer. The following procedures are included in this group:

PROCEDURE	FUNCTION
T$LINK	Set the scan pointer to the new specified value
T$PSHS	Push the specified value onto the scan pointer stack
T$POPS	Pop a value off the scan pointer stack into the scan pointer
T$PSJS	Push the address of the next scan item onto the scan pointer stack and set the scan pointer to the specified value

Refer to figure 2-4 for the corresponding scan item data formats.

OPCODE Ø	
SCAN POINTER	

PROCEDURE: T$LINK

CONTINUE SCAN AT 'SCAN POINTER'.

OPCODE 1	
SCAN POINTER	

PROCEDURE: T$PSHS

PUSH 'SCAN POINTER' ON SCAN STACK.

OPCODE 2	n

PROCEDURE: T$POPS

POP 'n' ITEMS FROM THE SCAN STACK AND CONTINUE SCAN AT LOCATION POINTED TO BY n^{th} ITEM.

IF n = Ø, A SINGLE ITEM IS POPPED.

OPCODE 3	
SCAN POINTER	

PROCEDURE: T$PSJS

PUSH LOCATION OF NEXT SCAN ITEM ONTO SCAN STACK AND CONTINUE SCAN AT 'SCAN POINTER'.

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FIGURE 2-4
DATA FORMATS OF THE SCAN CONTROL PROCEDURES

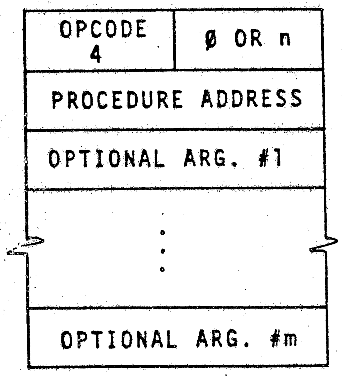
2.3.1.2 T$SCAN Procedure Call Procedures

The scanner contains an execution stack that is used in conjunction with the procedure call procedures to execute external routines to perform specialized scanning functions or data processing operations. The following procedures are in this group:

PROCEDURE	FUNCTION
T$PSHX	Push the specified procedure call's address onto the execution stack
T$POJX	Pop a procedure call's address off the execution stack and execute that call
T$PSJX	Execute the specified procedure call

Note that the items on the execution stack are actually the addresses of the scan items that caused the corresponding execution of T$PSHX. When T$POJX is executed, the scan pointer is loaded with the popped address and the procedure T$PSJX is executed, resulting in the call of the appropriate procedure.

Upon return, the scan pointer is restored and updated to point to the next scan item following the corresponding T$POJX scan item. Refer to figure 2-5 for the corresponding scan item data formats.



PROCEDURE: T$PSHX

PUSH THE LOCATION OF THIS SCAN ITEM ONTO THE EXECUTION STACK AND CONTINUE SCAN AT NEXT ITEM.

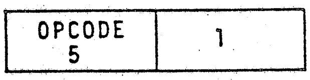
n = LENGTH OF THIS SCAN ITEM (IN WORDS).
IF n = Ø, LENGTH IS ASSUMED = 2.

PROCEDURE ADDRESS = ADDRESS OF PROCEDURE TO BE EXECUTED (SEE OPCODE 5, BELOW).

WHEN PROCEDURE IS CALLED, REGISTER B POINTS TO OPTIONAL ARGUMENT LIST (OPTIONAL ARG. #1).

m = NUMBER OF ARGUMENTS

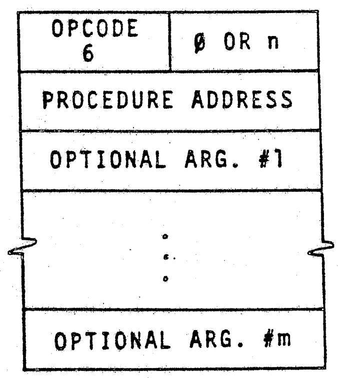
NOTE: n = m + 2



PROCEDURE: T$POJX

POP SCAN ITEM ADDRESS FROM EXECUTION STACK AND TREAT THE DESIGNATED ITEM AS THOUGH IT WERE OPCODE 6.

AFTER PROCEDURE HAS BEEN EXECUTED, CONTINUE SCAN AT NEXT ITEM.



PROCEDURE: T$PSJX

EXECUTE THE DESIGNATED PROCEDURE AND CONTINUE SCAN AT NEXT ITEM.

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FIGURE 2-5
DATA FORMATS OF THE PROCEDURE CALL PROCEDURES

2.3.1.3 T$SCAN Data "Get" Procedures

The data "get" procedures output a prompt message to the keyboard and then read the modeler's response. Each procedure expects a different type of input data. If the modeler enters data of the wrong type, an error message is printed and the modeler is once again asked for the data (i.e., the prompt is output again).

Once correct data are received, the data are converted to their internal program format, such as binary, packed ASCII, etc., as shown in figure 2-6. The value is then placed in the memory location specified by the scan item and also into the global buffer called T$TOKN. This buffer is two words long to accommodate all numeric data types (real, name, integer, etc.); however, some data types are longer than two words. In these cases, T$TOKN may be loaded with some other useful value such as data length (as in the case of ASCII strings), or T$TOKN may be left unchanged.

The following procedures are included in this group:

PROCEDURE	EXPECTED DATA TYPE	VALUE LEFT IN T$TOKN
T$GETC	Single ASCII character	Received character
T$GETS	ASCII string	String length (in words)
T$GETI	Single precision integer	Received value
T$GETR	Real value (double word)	Received value
T$GETN	Name	Received name
T$GETA	Ø/1, or N/Y	Received character
T$GETU	Unit (device and file name)	No change
T$GETM	Real value (with metric/English conversion)	Received value (in English units)

The procedure T$GETA is used to get a binary response, either N/Y (no or yes) or Ø/1. Not only is the ASCII character return in the specified memory location and T$TOKN, but a flag is cleared or set in the scanner flag word T$FLAG. The flag is called ALV..F (refer to listings for its equated value). The flag is set if a Y or a 1 is received; otherwise, it is cleared.

The procedure T$GETM is identical to T$GETR except that the data are converted by a call to M2BIN rather than R2BIN. As a result, the returned binary value may be scaled to English units if the conversion procedures metric/English conversion flag is set.

These "get" procedures act as co-routines with the procedure T$GET, which performs the majority of the work. This procedure determines the type of action that should be taken as a result of the terminator encountered in the input data. The following table indicates the action to be taken for the three legal terminators.

INPUT	ACTION
VALUE,<CR>	Process value
VALUE,<HT>	Process value
VALUE,<ESC>	Illegal terminator, ask again
<CR>	Ignore, ask again
<HT>	Convert and echo the current value in memory, and continue
<ESC>	Convert and echo the current value in memory, and continue; also set KGO..F in T$FLAG

As indicated in the table a response of <HT> causes the value in the memory location, specified by the scan item, to be converted to ASCII and written to the keyboard. This process is accomplished by calling the corresponding output procedure (to be discussed later).

When only an <ESC> (escape) is entered, the response is the same as if <HT> is entered, except that the "keep going" flag (KGO..F) in the scanner flag word is set. This results in skipping the input request on subsequent executions of T$GET. This makes each "get" request look as though the user had typed <HT>. This action continues until KGO..F is cleared either by T$GET when an error is detected or by a scan item in the scan tree.

Figure 2-7 describes the scan item format for the "get" procedures.

(IGNORED)	CHARACTER (ASCII)

SINGLE CHARACTER

n	
CHARACTER 1	CHARACTER 2
⋮	
CHARACTER 2n-1	CHARACTER 2n

CHARACTER STRING

n = # OF WORDS IN STRING
(PAD WITH >00 OR >FF)

S	2^{14}	2^{0}

SIGNED INTEGER

(TWO'S COMPLEMENT FOR NEGATIVE)

S	2^{21}		2^{7}
S	2^{6}	$2^{0}.2^{-1}$	2^{-8}

REAL

(TWO'S COMPLEMENT FOR NEGATIVE)

ASCII '-' OR IGNORED	CHARACTER
NUMBER	

NAME

CHARACTER	(IGNORED)
NUMBER	

ALTERNATE NAME

(USED ONLY IN SCAN ITEMS)

DEV. CHAR. 1	DEV. CHAR. 2
DEV. CHAR. 3	DEV. CHAR. 4
FILE CHAR. 1	FILE CHAR. 2
. . .	. . .
FILE CHAR. 5	FILE CHAR. 6
(SPARE)	

UNIT (DEVICE AND FILE NAME)

DEVICE IS PADDED WITH >A0 (ASCII SPACE).

FILE NAME PADDED WITH >FF.

SPARE IS RESERVED FOR FUTURE USE.

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FIGURE 2-6
INTERNAL PROGRAM FORMATS OF MODELING DATA

OPCODE	n
MESSAGE ADDRESS	
VALUE ADDRESS	

<u>PROCEDURES</u>:

T$GETC	OPCODE = 1Ø
T$GETS	OPCODE = 11
T$GETI	OPCODE = 12
T$GETR	OPCODE = 14
T$GETN	OPCODE = 15
T$GETA	OPCODE = 17
T$GETU	OPCODE = 18
T$GETM	OPCODE = 19

GET A RESPONSE FROM THE KEYBOARD AND CONVERT TO INTERNAL FORMAT.

n = Ø IN ALL CASES EXCEPT FOR T$GETA. FOR T$GETA:

n = Ø TO GET 'N' OR 'Y'
n = 1 TO GET 'Ø' OR '1'

MESSAGE ADDRESS = LOCATION OF PROMPT MESSAGE BUFFER.

VALUE ADDRESS = LOCATION TO PLACE RETRIEVED VALUE AND LOCATION TO FIND DEFAULT VALUE. IF VALUE ADDRESS = Ø, MODELER IS FORCED TO RESPOND (I.E., CANNOT USE <HT> OR <ESC>). ALSO, THE RECEIVED VALUE IS ONLY PLACED IN T$TOKN. THIS OPTION IS NOT VALID FOR T$GETS OR T$GETU.

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FIGURE 2-7
DATA FORMATS OF THE DATA GET PROCEDURES

2.3.1.4 T$SCAN Data Comparison Procedures

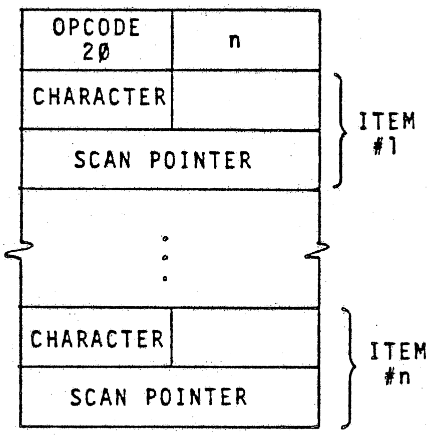
The data comparison procedures are used to dispatch scan control based on an input value. The following procedures are in this group:

PROCEDURE	FUNCTION
T$CMPC	Dispatch on character
T$CMPN	Dispatch on name

Both of these procedures compare the contents of T$TOKN with a list of possible items (characters or names). If a match is found, the current scan pointer is pushed onto the scan pointer stack, and the scan pointer is set to the value associated with the matched item. If no match is found, the scan continues immediately after the comparison scan item.

A special item has been allowed for use in the dispatch item list. This item is "ANY" which is equated to >FF. This item can be used in place of a character or the character portion of a name to cause a match with any value in T$TOKN. This provides a means of error detection during the comparison.

Refer to figure 2-8 for the corresponding scan item format and to the listings of the scan trees as examples.

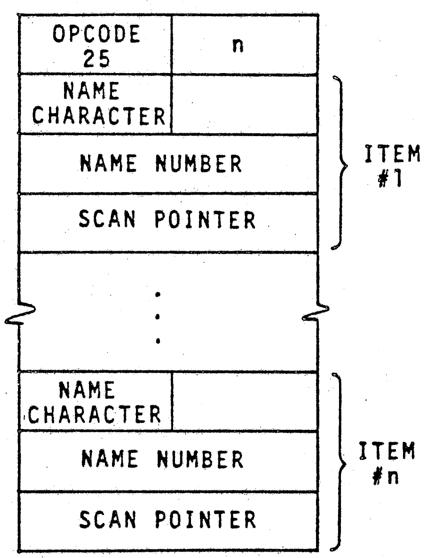


PROCEDURE: T$CMPC

COMPARE THE CHARACTER IN T$TOKN WITH 'CHARACTER' OF EACH 'ITEM' IN SEQUENCE. IF A MATCH IS FOUND, PUSH THE LOCATION OF THE NEXT SCAN ITEM ONTO THE SCAN STACK AND CONTINUE THE SCAN AT THE LOCATION INDICATED BY 'SCAN POINTER' FOR THE MATCHED ITEM. IF NO MATCH, CONTINUE SCAN AT NEXT SCAN ITEM.

n = NUMBER OF ITEMS TO CHECK.

NOTE: IF 'CHARACTER' = >FF, THE ITEM WILL MATCH ANY CHARACTER IN T$TOKN.



PROCEDURE: T$CMPN

SIMILAR TO OPCODE 20 EXCEPT THE COMPARISON IS DONE ON NAMES DESIGNATED BY 'NAME CHARACTER' AND 'NAME NUMBER'.

NOTE: IF 'NAME CHARACTER' = >FF, THE ITEM WILL MATCH ANY NAME IN T$TOKN.

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FIGURE 2-8
DATA FORMATS OF THE DATA COMPARISON PROCEDURES

2.3.1.5 T$SCAN Data Limit Check Procedures*

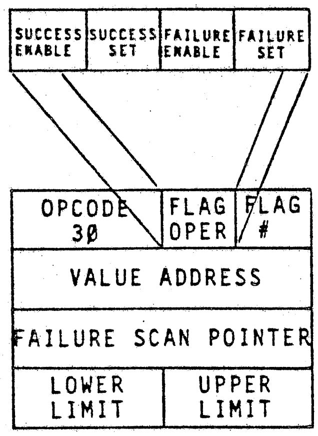
The data limit check procedures are used to compare a data item in memory against an upper or lower limit. If the data item is not within the specified limits (inclusively), the scan pointer is replaced with the designated scan value. The following procedures in this group act as conditional branches (see figure 2-9 for the data format for each entry):

PROCEDURE	FUNCTION
T$LIMB	Limit an integer value (limit values from 0 to 225)
T$LIMI	Same as T$LIMB, except limit values from -32768 to 32767
T$LIMR	Limit double-word real value
T$LIMN	Limit name value (limit check considers the character portions as well as the numeric portion)

All of the limit check procedures are capable of modifying a single specified bit flag in T$FLAG, depending on the result of the limit check. The flag designated in the scan item can be set, cleared, or unchanged on either success or failure of the limit check, depending on the encoded data in the scan item. Refer to figure 2-9 for the corresponding scan item data formats.

---

*These procedures use self-modifying code.



PROCEDURE: T$LIMB

CHECK THE INTEGER VALUE POINTED TO BY 'VALUE ADDRESS' AGAINST THE 'LOWER LIMIT' AND 'UPPER LIMIT' (Ø ≤ LIMITS ≤ 255). IF THE VALUE IS OUTSIDE THE LIMITS, CONTINUE SCAN AT 'FAILURE SCAN POINTER'. IF VALUE IS WITHIN THE LIMITS (INCLUSIVE), CONTINUE SCAN AT NEXT SCAN ITEM.

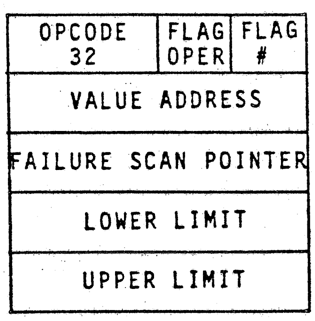
FLAG # = BIT NUMBER OF A FLAG IN T$FLAG.

SUCCESS ENABLE = ENABLE FLAG MODIFICATION IF LIMIT CHECK IS SUCCESSFUL.

SUCCESS SET = NEW STATE OF DESIGNATED FLAG IF LIMIT CHECK IS SUCCESSFUL AND SUCCESS ENABLE EQUALS 1.

FAILURE ENABLE = ENABLE FLAG MODIFICATION IF LIMIT CHECK IS A FAILURE.

FAILURE SET = NEW STATE OF DESIGNATED FLAG IF LIMIT CHECK FAILS AND FAILURE ENABLE = 1.



PROCEDURE: T$LIMI

SAME AS OPCODE 3Ø EXCEPT THE 'LOWER LIMIT' AND 'UPPER LIMIT' ARE INTEGERS BETWEEN -32768 AND 32767.

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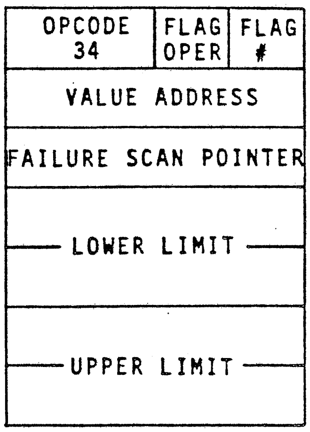
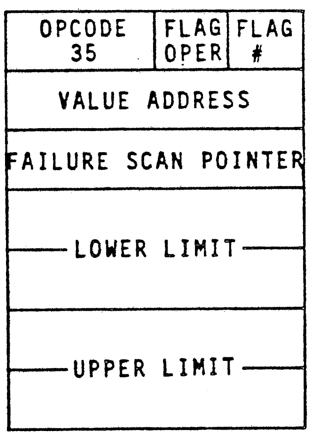
FIGURE 2-9 (PART A)
DATA FORMATS OF THE DATA LIMIT CHECK PROCEDURES



PROCEDURE: T$LIMR

SIMILAR TO OPCODE 3Ø EXCEPT THE VALUE BEING CHECKED, THE 'LOWER LIMIT', AND THE 'UPPER LIMIT' ARE DOUBLE WORDS IN 'REAL' FORMAT.



PROCEDURE: T$LIMN

SIMILAR TO OPCODE 3Ø EXCEPT THE VALUE BEING CHECKED IS A DOUBLE WORD IN 'NAME' FORMAT, AND 'LOWER LIMIT' AND 'UPPER LIMIT' ARE DOUBLE WORDS IN 'ALTERNATE NAME' FORMAT.

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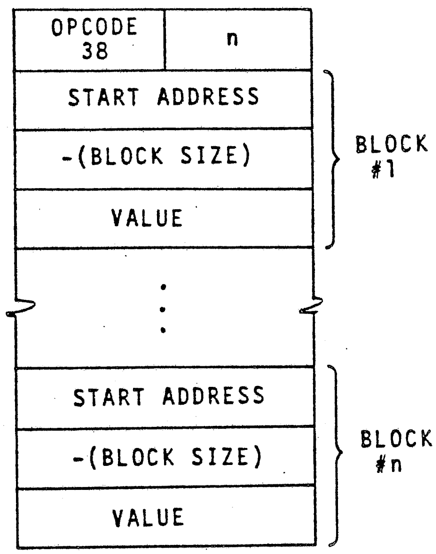
FIGURE 2-9 (PART B)
DATA FORMATS OF THE LIMIT CHECK PROCEDURES

2.3.1.6 T$SCAN Memory Manipulation Procedures

The memory manipulation procedures allow arbitrary blocks of memory to be initialized to some value or moved from one location to another. The procedures in this group are as follows:

PROCEDURE	FUNCTION
T$ZAPM	Initialize memory blocks
T$MOVM	Move memory blocks

The procedure T$ZAPM allows several different memory blocks to be initialized with a single scan item. Refer to figure 2-10 for the corresponding scan item formats.



PROCEDURE: T$ZAPM

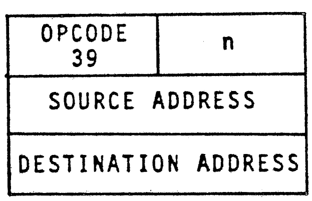
INITIALIZE MEMORY BLOCKS.

n = NUMBER OF MEMORY BLOCKS TO INITIALIZE.

START ADDRESS = ADDRESS OF MEMORY BLOCK.

BLOCK SIZE = NUMBER OF WORDS IN THE MEMORY BLOCK.

NOTE THAT THE NEGATIVE BLOCK SIZE IS PLACED IN THE SCAN ITEM BLOCK LIST ENTRIES.



PROCEDURE: T$MOVM

MOVE 'n' WORDS OF MEMORY DATA FROM 'SOURCE ADDRESS' TO 'DESTINATION ADDRESS'.

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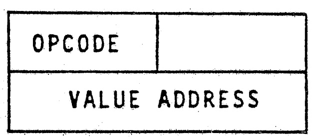
FIGURE 2-10
DATA FORMATS OF THE MEMORY MANIPULATION PROCEDURES

2.3.1.7 T$SCAN Data "Out" Procedures

The data "out" procedures correspond to the data "get" procedures. They are used to convert data from the internal format to an ASCII string which is output to the keyboard. The following procedures are in this group:

PROCEDURE	OUTPUT DATA TYPE
T$OUTC	Single ASCII character
T$OUTS	ASCII string
T$OUTI	Single precision integer
T$OUTR	Real value (double word)
T$OUTN	Name
T$OUTA	(Same as T$OUTC)
T$OUTU	Unit (device and file name)
T$OUTM	Real value (with English/metric conversion)

Refer to figure 2-11 for the scan item format and to figure 2-6 for the data type format.



PROCEDURES: T$OUTC OPCODE = 40
T$OUTS OPCODE = 41
T$OUTI OPCODE = 42
T$OUTR OPCODE = 44
T$OUTN OPCODE = 45
T$OUTA OPCODE = 47
T$OUTU OPCODE = 48
T$OUTM OPCODE = 49

CONVERT THE VALUE POINTED TO BY 'VALUE ADDRESS' TO AN ASCII STRING AND OUTPUT IT TO THE KEYBOARD.

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FIGURE 2-11
DATA FORMATS OF THE DATA OUT PROCEDURES

2.3.1.8 T$SCAN Flag Manipulation Procedures*

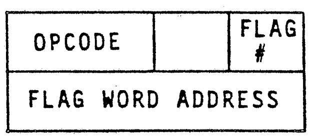
The flag manipulation procedures allow the setting or clearing of bit flags in arbitrarily specified flag words. The following procedures are included in this group:

PROCEDURE	FUNCTION
T$FLGS	Set a bit flag
T$FLGC	Clear a bit flag

Refer to figure 2-12 for scan item formats.

---

*These procedures use self-modifying code.



PROCEDURES: T$FLGS OPCODE = 36
T$FLGC OPCODE = 37

SET OR CLEAR THE DESIGNATED BIT (FLAG #) IN THE SPECIFIED FLAG WORD, RESPECTIVELY.

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FIGURE 2-12
DATA FORMATS OF THE FLAG
MANIPULATION PROCEDURES

2.3.1.9 T$SCAN Flag Test Procedures*

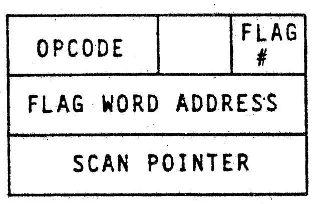
The flag test procedures allow scan control branches on bit flag conditions in arbitrarily specified flag words. The following procedures are included in this group:

PROCEDURE	FUNCTION
T$JOFS	Jump on flag set
T$JOFC	Jump on flag clear

Refer to figure 2-13 for scan item formats.

---

*These procedures use self-modifying code.



PROCEDURES: T$JOFS OPCODE = 8
T$JOFC OPCODE = 9

CONTINUE SCAN AT 'SCAN POINTER' IF THE DESIGNATED BIT (FLAG #) IN THE SPECIFIED FLAG WORD IS SET OR CLEARED, RESPECTIVELY. OTHERWISE, CONTINUE SCAN AT NEXT SCAN ITEM.

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FIGURE 2-13
DATA FORMATS OF THE FLAG
TEST PROCEDURES

2.3.2 MODULE: KEYIOS

The module KEYIOS contains three procedures which facilitate doing ASCII I/O to keyboard and printing devices. The first procedure, DATAS, is used to initialize a device and optionally assign it to a logical unit. This procedure is called with register X pointing to a standard program request block (PRB). The M register contains an encoded logical unit number, programmatic assign flag, and a maximum character count in the following form:

```
 0                   7 8                15
┌─┬──────────────────┬──────────────────┐
│ │ LOGICAL UNIT #   │ MAX. CHAR. CCUNT │
└─┴──────────────────┴──────────────────┘
 |
 PROGRAMMATIC ASSIGN FLAG
```

The logical unit number and maximum character count are moved to the PRB. If the programmatic assign flag is set, a monitor call is executed to perform the assign. The device is then initialized by doing another monitor call.

The second procedure, DATAI, reads a line of text from a device specified by an initialized PRB. DATAI is called with register X pointing to the PRB and register M pointing to the input buffer. The input buffer is of the form of the string constant shown in figure 2-6. This procedure checks the terminating character and if it is not a <HT>, <ESC>, or <CR>, a <CR> is substituted for the terminator.

The third procedure, DATAO, outputs a buffer of text to the device specified in the designated PRB. Again, the X register points to the PRB and the M register points to the text buffer. The text buffer is of the same form used by DATAI. It is not necessary for the buffer to contain a terminator; if there is no terminator, the text will be output, and the carriage will be left positioned after the last character.

2.3.3 MODULE: NBFIOS

The module NBFIOS contains procedures to perform disk file I/O. The procedures NB$DBI and NB$DBO perform a complete input and output operation, respectively. These two procedures are called with register B pointing to a parameter list. The parameter list is as follows:

1) File name block address

2) Buffer length

3) Buffer start address

The file name block format is the same as the internal unit data format shown in figure 2-6.

The procedures NB$DBI and NB$DBO perform the entire input or output operation by loading register X with the address of a table and calling NB$DBX. The procedure NB$DBX reads the table and executes a series of small routines to perform the various phases of the I/O process. These small routines are as follows:

ROUTINE	FUNCTION
NB$ASG	Assign device to logical unit
NB$DEF	Define a disk file
NB$OPN	Open a disk file
NB$RED	Read data
NB$WRT	Write data
NB$CLS	Close a disk file
NB$CKI	Generate and compare checksum on input
NB$CKO	Generate checksum for output

2.4 MODULE GROUP: CONVERSION PROCEDURES

The conversion procedures are a group of modules that contain procedures for converting various data types from one form to another. There are two basic sets of modules: the first performs ASCII to binary and binary to ASCII conversions; the second performs internal format conversions.

The ASCII/binary conversion routines are as follows:

MODULE	PROCEDURE	FUNCTION
D2BIN	D2BIN	Convert ASCII string to integer
BIN2D	BIN2D	Convert integer to ASCII string
M2BIN	M2BIN	Convert ASCII string to real (English/metric)
BIN2M	BIN2M	Convert real (English/metric) to ASCII string
R2BIN	R2BIN	Convert ASCII string to real
BIN2R	BIN2R	Convert real to ASCII string
A2UNIT	A2UNIT	Convert ASCII string to unit
UNIT2A	UNIT2A	Convert unit to ASCII string
CHR2A	CHR2A	Convert character to ASCII string
BIN2N	BIN2N	Convert name to ASCII string

In addition to these modules, the following modules provide support procedures:

MODULE	PROCEDURE	FUNCTION
CVTBIN	CVTBIN	Convert ASCII digit to binary
BINCVT	BINOVF	Check conversion buffer size
	BINPAD	Pad buffer with appropriate pad character
UPKCHR	UPKSET	Set up character unpack procedure
	UPKCHP	Unpack character from string
PAKCHR	DAKSET	Set up character pack procedure
	PAKCHR	Pack a character into string

The ASCII to binary conversion procedures use the following calling sequence:

(M)	Ø if UPKCHR initialized with input buffer address, or input buffer address for use by UPKCHR for character unpacking
@BRL ROUTINE	Where ROUTINE is the appropriate procedure name

On return:

Control returns to the location following the call if a conversion error occurred; otherwise, control returns to the second location following the call.

(X)	Terminating character
(A,E)	Binary result if double word format
(A)	Binary result if single word format

The binary formats are shown in figure 2-6. For procedure A2UNIT, register A must contain the address of the unit buffer prior to calling the procedure, and, upon return, register A is unchanged.

The binary to ASCII conversion procedures use the following calling sequence:

(A,E)	Binary value; only A is required for single-word values; A contains the unit buffer address for UNIT2A
(X)	Format control word
(M)	Zero if PAKCHR initialized with output buffer address, or output buffer address for use by PAKCHR for character packing
@BRL ROUTINE	Where ROUTINE is a procedure name

On return:

Control is returned to the location following the call if a conversion error occurred; otherwise, control is returned to the second location following the call.

The format control word has the following format:

```
 0              7 8          15
┌─┬─────────────┬─┬────────────┐
│ │             │ │            │
└─┴─────────────┴─┴────────────┘
 ↑ Total field   ↑ Number of fractional
 | length        | digits (only for
 | (chars.)      | BIN2R and BIN2M)
 |               |
 Ø=unformatted   Ø=left-justified
 1=formatted     1=right-justified
```

In formatted conversions, a space is used as the pad character; in unformatted conversions, a null is used as the pad character.

If the ASCII buffer is not large enough to hold the converted value, the entire buffer is filled with asterisks and the error return is taken.

The ASCII/binary support procedures use various calling sequences. Refer to the conversion procedures for details of these calling sequences and their use.

Of the support procedures, the character packing and unpacking procedures are of particular interest since they may be used as general routines aside from the conversion procedures. The calling sequences for the two packing procedures are as follows:

(M)	Output buffer address
@BRL PAKSET	Routine call to initialize PAKCHR so that the next call to PAKCHR will start packing at the beginning of the specified buffer
(A)	Character
@BRL PAKCHR	Routine call to pack the specified character into the next slot in the previously defined buffer

The calling sequences for the unpacking procedures are as follows:

(M)	Input buffer address
@BRL UPKSET	Routine call to initialize UPKCHR so that the next call to UPKCHR will start unpacking at the beginning of the specified buffer
@BRL UPKCHR	Routine call to unpack the next character in the previously defined buffer

On return:

(A)	Unpacked character

The internal format conversion procedures are as follows:

MODULE	PROCEDURE	FUNCTION
METENG	METENG	Convert metric (m.) to English (ft.)
ENGMET	ENGMET	Convert English (ft.) to metric (m.)
DEGPTC	DEGPTC	Convert degrees to parts of circle
PTCDEG	PTCDEG	Convert parts of circle to degrees

These four procedures are called with the value to be converted in registers A and E (A only for PTCDEG). The converted value is returned in A and E (A only for DEGPTC). The values are all in the real format except those in parts of a circle which have the following format:

180	90	45	. . .

2.5 MODULE GROUP: MATH PROCEDURES

The math procedures are a group of modules which perform a number of general mathematical operations, as indicated in the list below. Following the list are text descriptions and flowcharts for selected routines. Refer to the listings for more information about calling sequences, algorithm implementation, and algorithm restrictions. The procedures are listed below in library order.

MODULE	PROCEDURE	FUNCTION
MUL224	MUL224	Multiply two double-word values yielding a four-word result
DIV212	DIV212	Divide a double-word value by a single-word value yielding a double-word result (integer + fractional remainder)
DIV222	DIV222	Divide a double-word dividend by a double-word divisor yielding a double-word result (all quantities scaled)

MODULE	PROCEDURE	FUNCTION
SINCOS	COS	Compute cosine of angle
	SIN	Compute sine of angle
VBNRM	VBNRM	Block-normalize a three-component vector
VUBNRM	VUBNRM	Block-unnormalize a three-component vector
VDIFF	VDIFF	Vector difference
	VSUM	Vector sum
VXPRD	VXPRD	Vector cross-product
VPLANE	VPLANE	Generate plane equation (A,B,C,D) from three-position vectors
SQROOT	SQROOT	Compute square root of double-word value
ADD333	ADD333	Add two triple-word numbers yielding a triple-word result
ROT2DM	ROT2DM	Generate a two-dimensional rotation matrix
ROT2DT	ROT2DT	Rotate a two-dimensional vector using the specified rotation matrix

Module DIV222 contains the NSPBLD double-precision divide routine. It accepts a 32-bit dividend and a 32-bit divisor and produces a 32-bit quotient and a scaling factor in register X. If the divisor has fewer than 16 bits of precision, the routine uses the divide instruction to produce the high-order 16 bits, and divides the remainder again by the divisor to produce the low-order 16 bits of the quotient. If more than 16 bits of precision exist in the divisor, a single iteration of Newton's reciprocal approximation is executed to produce the reciprocal of the divisor as follows:

Let first guess $= B_0 = \dfrac{1}{\mathrm{DVSR(B0 - B15)}}$

then: $B = 2B_0 - \mathrm{DVSR} * B_0^2$

$B = B_0\,(2 - \mathrm{DVSR} * B_0)$

The quotient is, then:

$Q = A * B$

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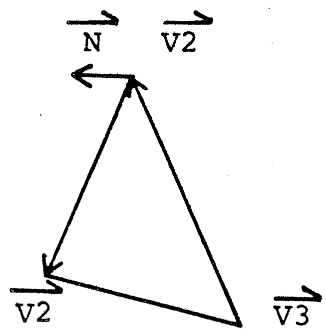
Module VPLANE contains the plane normal and distance generator. Using three input vectors, it generates the unit plane normal and the orthogonal distance from the plane to the origin of the model space.

To compute the unit plane normal, the cross-product is taken between vectors V1 - V2 and V2 - V3, both of which lie on the plane. The resultant vector is then normalized to produce the unit plane normal. The normal distance of the plane from the origin is computed by dotting the unit plane normal with V2.



$\vec{N} = (\overrightarrow{V1 - V2}) \times (\overrightarrow{V2 - V3})$ normalized

$\vec{D} = \vec{N} \cdot \vec{V2}$ scaled B22

Module SQROOT is the NSPBLD square root procedure. At entry, registers A and E contain R^2, and register M contains the first guess of R. Register X contains the iteration count for the following algorithm:

$$X_n = \frac{R^2}{R_n} + R_n$$

$$R_{(n+1)} = \frac{X_n}{2}$$

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The square root is returned in register A.

The procedure ROT2DM generates a rotation matrix consisting of single precision BØ sines and cosines. The designated angle is specified in parts of a circle.

The procedure ROT2DT rotates a two-component vector, using a rotation matrix generated by ROT2DM. The vector components are double-precision values. The resulting vector is scaled the same as the input vector.

2.6 MODULE GROUP: MISCELLANEOUS NSPBLD PROCEDURES.

The miscellaneous NSPBLD procedures are used by the scanner to perform special operations which are difficult or even impossible to perform with some combination of scan items. There are also procedures that are required by more than one data processing module group.

The scanner-related procedures are contained in a single module, NBMISC. This module contains the following procedures:

NBMISC PROCEDURE	FUNCTION
NBCSAW	Separate the shape and width fields from the composite form specified during light string operations
NBCDEG	Interface scanner to the procedure DEGPTC (section 2.4)
NBSAME	Compare two arbitrary memory locations
NBCDEV	Compare unit specification (see figure 2-6 for legal device name)
NBPDOP	Pad a string buffer with spaces and remove terminator
NBBLNK	Output two blank lines to the listing device
LMVLIM	Check current light module to see if there is sufficient space for the newly specified VASI group's strings
LMSTAT	Output the light module statistics to the keyboard
SMSTAT	Output the surface module statistics to the keyboard
SMEFLM	Check an edge or face name against the current surface module and report whether the edge or face is not defined

Since all of these procedures discussed above are called by the scanner, they all have the calling sequence described in section 2.3.1 for scan items T$PSHX and T$PSJX.

The modules that contain procedures shared by several processing module groups are as follows:

MODULE	PROCEDURE	FUNCTION
NBENTP	NBINEP	Insert an entry pointer
	NBPREP	Print entry points according to entry-point bit mask
	NBFDEP	Generate an entry point mask
	NBUPEP	Update entry pointer (after insert or delete of data)
NBCHNL	NBCH2N	Encode a channel number
	NBN2CH	Decode a channel number
NBSMEX	SMEXTN	Expand a surface module priority tree node specification based on node name (number)
	SMEXTA	Expand a surface module priority tree node specification based on node offset (data module relative)
NBLIST	NBLIST	Construct and list a message to the listing device
NBMOVE	NBMVUP	Contract a data structure (i.e., remove a data block from a data structure by moving the trailing portion up in memory)
	NBMVDN	Expand a data structure (i.e., open a block within the data structure by moving the trailing portion down in memory)
NBLNPT	NBLIPC	Initialize and compute the second light in a curved light string
	NBLNPC	Compute the next light location for a curved light string
	NBLNPS	Compute the next light location for a straight light string

2.6.1 MODULE: NBLIST

The procedure NBLIST is used to generate listings by combining text strings and converted values into a complete message. The message is described by a table of the form shown in figure 2-14. Each table entry describes a single data item in the message and an associated leading text string. The entry consists of four words:

1) Data type code

2) Data conversion format control word

3) Text string address

4) Data value address

NBLIST processes the table an entry at a time. The entries are processed by first outputting the leading text message with a call to DATAO (see section 2.3.2). The data item is then converted to an ASCII string by calling the appropriate conversion procedure (see section 2.4). The resultant ASCII string is then listed by another call to DATAO. This process continues until all table entries have been processed.

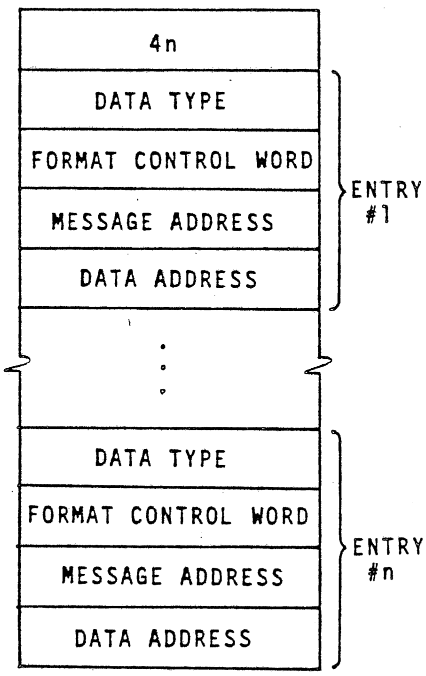
2.6.2 MODULE: DSTEMP

The module DSTEMP is used to define the display package entry points when the Tektronix 4010 display package is not linked with the program. The following scan tree entry points are defined in DSTEMP simply as a scan return:

NB$BKS
NB$DSL
NB$DSS
NB$VEW
NB$FND

The following procedure entry points are defined in DSTEMP as a subroutine return:

DSINIT
DSCMPR
DSCINS
DSCHCL



n = NUMBER OF ENTRIES IN THE TABLE

DATA TYPE = Ø INTEGER
1 REAL
2 NAME
3 SINGLE CHARACTER
4 (NO DATA, ONLY LEADING TEXT)
5 UNIT (DEVICE AND FILE NAME)
6 REAL (WITH ENGLISH/METRIC CONVERSION)

MESSAGE ADDRESS = LEADING TEXT BUFFER ADDRESS; IF = Ø, NO LEADING TEXT.

DATA ADDRESS = ADDRESS OF DATA BUFFER (SEE FIGURE 2-6 FOR FORMATS).

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FIGURE 2-14
NBLIST MESSAGE CONSTRUCTION TABLE

2.7 MODULE GROUP: NSPBLD MESSAGES

The NSPBLD messages are contained in a group of modules. The messages consist of text strings of the format shown in figure 2-6. These strings are used as prompts by the scanner and as fragments for composing listings with NBLIST. The following modules define the messages:

MODULE	MESSAGE TYPE
NBDWHO	Program identification message
NBXMSG	General system and common messages
NBLMSG	Messages peculiar to light module processing
NBSMSG	Messages peculiar to surface module processing
NBEMSG	Messages peculiar to environment module processing
NBGMSG	Messages peculiar to group module processing

2.7.1 MODULE: NBSWHO AND NBDWHO

The module NBSWHO contains the program start-up message for NSPBLS, which includes the program release and version numbers. NBSWHO also contains the three program request blocks (PRBs) associated with the three logical units used.

The module NBDWHO contains the program start-up message for NSPBLD, which includes the program release and version numbers. NBDWHO also contains the four program request blocks (PRBs) associated with the four logical units used.

In addition, these modules also contain several tables which control the program's configuration. One of these tables, NBLUTT, contains the logical unit assignment data used by NBMAIN to initialize the various logical units used by the modeling system. The following assignments are made:

LOGICAL UNIT (HEXIDECIMAL)	DEVICE	FUNCTION
4	(User assigned)	Command input/output
5	(User assigned)	4010 display (only used for NSPBLD)
6	(User assigned)	Listing output
F	KEY	Scan trace (used for debugging only)

The second table is the scan parameter list, NB$PAR, which is passed to T$SCAN by NBMAIN.

2.8 MODULE GROUP: NSPBLD DATA STORAGE

The major global data storage allocation for NSPBLD is defined by the following modules:

MODULE	DESCRIPTION	SECTION
NBWORK	Temporary work area	2.8.1
NBXPAR	System parameter block	2.8.2
NBCPAR	Command list parameter block	2.8.3
NBMPAR	Transformation parameter block	2.8.4
NBXMOD	Data module buffer	2.8.5

2.8.1 MODULE: NBWORK

The module NBWORK contains several temporary buffers used by the scanner as a scratchpad during the scanning operation. This module also contains the data module headers which are placed in the first four words of each module (see table 2-1).

	NAME	SIZE	SCALE	DESCRIPTION
1) Temporary Data				
	NB.TMP	6	-	Scratchpad
2) Temporary Vector				
	NB.VEC	-	-	(Vector label)
	NB.VEX	2	B22	Vector, Y
	NB.VEZ	2	B22	Vector, Y
	NB.VEZ	2	B22	Vector, Z
3) Module headers				
	LM.HED	4	-	Light module header
	SM.HED	4	-	Surface module header
	EM.HED	4	-	Environment header
	GM.HED	4	-	Group module header

TABLE 2-1
NBWORK PARAMETER BLOCK

2.8.2 MODULE: NBXPAR

The module NBXPAR contains the system parameter block. This parameter block consists of five overlaid data storage areas. The first 12 words of each area are used to store similar items of data; the remainder of each area has no correlation between the various overlays. The overlays, their description, and the corresponding table (2-2 through 2-6) are as follows:

OVERLAY	DESCRIPTION	TABLE
NB.PAR	Basic parameter block	2-2
LM.PAR	Light parameter block	2-3
SM.PAR	Surface parameter block	2-4
EM.PAR	Environment parameter block	2-5
GM.PAR	Group parameter block	2-6

NAME	SIZE	SCALE	DESCRIPTION
1) General Scan Control Data			
NB.UTS	1	ASCII	Type of units
NB.ENT	1	ASCII	Entity type
NB.PRB	6	-	File name block
NB.OPR	1	ASCII	Operation
NB.TYP	1	ASCII	Type flag
NB.FLG	1	-	Control flag word
NB.ABF	1	-	Buffer available flag
2) Entry Point Name			
NB.EPT	1	ASCII	Entry point name
NB.EPN	1	B15	Entry point number

TABLE 2-2
BASIC PARAMETER BLOCK (NB.PAR)

NAME	SIZE	SCALE	DESCRIPTION
1) General Scan Control Data			
LM.UTS	1	ASCII	Type of units
LM.ENT	1	ASCII	Entity type
LM.PRB	6	-	File name block
LM.OPR	1	ASCII	Operation
LM.TYP	1	ASCII	Light type
LM.FLG	1	-	Control flag word
LM.ABF	1	-	Buffer available flag
2) Entry-point name			
LM.EPT	1	ASCII	Entry point name
LM.EPN	1	B15	Entry point number
3) First String Specification			
LM.FCL	1	ASCII	First color name
LM.FSN	1	B15	First string number (REL)
LM.FCN	1	B15	First color number (ABS)
LM.FFL	1	-	First string control flags
LM.FAN	1	B15	First string number (ABS)
LM.FSA	1	B16	First string address (ABS)
4) Last String Specification			
LM.LCL	1	ASCII	Last color name
LM.LSN	1	B15	Last string number (REL)
LM.LCN	1	B15	Last color number (ABS)
LM.LFL	1	-	Last string control flags
LM.LAN	1	B15	Last string number (ABS)
LM.LSA	1	B16	Last string address (ABS)
5) Flashing and Strobe Data			
LM.ONT	1	B15	Light on-time
LM.OFT	1	B15	Light off-time
LM.PER	1	B15	Light period
LM.PHS	1	B15	Light phase

TABLE 2-3 (PART A)
LIGHT PARAMETER BLOCK (LM.PAR)

NAME	SIZE	SCALE	DESCRIPTION
6) Rotating Data			
LM.UAA	2	B22	Update angle (actual angle)
LM.UDA	1	BØ	Update angle (parts of circle)
7) VASI data			
LM.MST	1	B15	Number of VASI masters
LM.REP	1	B15	Number of VASI repeats
LM.MSW	1	B15	VASI master work area
LM.REW	1	B15	VASI repeat work area
LM.VAN	2	B22	VASI angle
8) General String Data			
LM.NUM	1	B15	Number of lights per string
LM.SPC	1	ASCII	Vector specification mode
LM.BRT	2	B22	Brightness
LM.SAW	1	B15	Encoded shape and width
LM.SHP	1	B15	Lobe shape
LM.WID	1	B15	Lobe width
LM.DAA	2	B22	Direction (actual angle)
LM.DIR	1	BØ	Direction (parts of circle)
LM.SWN	1	B15	Switch number
9) String Flags			
LM.FSL	1	ASCII	Control flag selection
LM.CHN	1	ASCII	CB + Channel number
LM.ALV	1	ASCII	ALTV flag
LM.NOB	1	ASCII	*B flag
LM.NOT	1	ASCII	*T flag
LM.NOS	1	ASCII	*SP flag
LM.PRI	1	ASCII	Priority
LM.IOF	1	ASCII	I/C flag
10) First Point Vector			
LM.FXX	2	B22	First point, X
LM.FYY	2	B22	First point, Y
LM.FZZ	2	B22	First point, Z

TABLE 2-3 (PART B)
LIGHT PARAMETER BLOCK (LM.PAB)

NAME	SIZE	SCALE	DESCRIPTION
11) Delta Vector			
LM.DXX	2	B15	Delta X
LM.DYY	2	B15	Delta Y
LM.DZZ	2	B15	Delta Z
12) Last Point Vector			
LM.LXX	2	B22	Last point, X
LM.LYY	2	B22	Last point, Y
LM.LZZ	2	B22	Last point, Z
13) Incremental Specification Parameters			
LM.DDS	2	B22	Delta distance
LM.HDA	2	B22	Heading (actual angle)
LM.HDG	1	BØ	Heading (parts of circle)
LM.ELA	2	B22	Elevation (actual angle)
LM.ELV	1	BØ	Elevation (parts of circle)
14) Internal Communication Parameters			
LM.EPM	1	-	Entry pointer mask
LM.EOP	1	ASCII	End of entry point list
LM.PTF	1	B16	Pointer to flashing entry
LM.PTR	1	B16	Pointer to rotating entry
LM.PTV	1	B16	Pointer to VASI entry
LM.PTS	1	B16	Pointer to strobe entry
LM.PSW	1	B16	Pointer to switch entry
15) Additional VASI data (NSPMER)			
LM.FVC	1	B15	First VASI color offset
LM.SVC	1	B15	Second VASI color offset

TABLE 2-3 (PART C)
LIGHT PARAMETER BLOCK (LM.PAR)

NAME	SIZE	SCALE	DESCRIPTION
1) General Scan Control Data			
SM.UTS	1	ASCII	Type of units
SM.ENT	1	ASCII	Entity type
SM.PRB	6	-	File name block
SM.OPR	1	ASCII	Operation
SM.	1	-	Dummy spacing word
SM.FLG	1	-	Control flags
SM.ABF	1	-	Buffer available flag
2) Entry Point Name			
SM.EPT	1	ASCII	Entry point name
SM.EPN	1	B15	Entry point number
3) First Item Specification			
SM.FSS	1	ASCII	First item name
SM.FSN	1	B15	First item number (REL)
SM.FAN	1	B15	First item number (ABS)
SM.FSA	1	B16	First item address (ABS)
4) Last Item Specification			
SM.LSS	1	ASCII	Last item name
SM.LSN	1	B15	Last item number (REL)
SM.LAN	1	B15	Last item number (ABS)
SM.LSA	1	B16	Last item address (ABS)

TABLE 2-4 (PART A)
SURFACE PARAMETER BLOCK (SM.PAR)

NAME	SIZE	SCALE	DESCRIPTION
5) Priority Tree Node Specification			
SM.FTS	1	ASCII	Father name
SM.FTN	1	B15	Father number (REL)
SM.FTA	1	B15	Father number (ABS)
SM.FTR	1	B15	Father offset (REL)
SM.TFS	1	ASCII	First true son name
SM.TFN	1	B15	First true son number (REL)
SM.TFA	1	B15	First true son number (ABS)
SM.TFR	1	B15	First true son offset (REL)
SM.TLS	1	ASCII	Last true son name
SM.TLN	1	B15	Last true son number (REL)
SM.TLA	1	B15	Last true son number (ABS)
SM.TLR	1	B15	Last true son offset (REL)
SM.FFS	1	ASCII	First false son name
SM.FFN	1	B15	First false son number (REL)
SM.FFA	1	B15	First false son number (ABS)
SM.FFR	1	B15	First false son offset (REL)
SM.FLS	1	ASCII	Last false son name
SM.FLN	1	B15	Last false son number (REL)
SM.FLA	1	B15	Last false son number (ABS)
SM.FLR	1	B15	Last false son offset (REL)
6) Symmetrical Surface Specification			
SM.SSF	1	ASCII	Symmetrical surface vector flag
SM.SSV	4	2*B22	Symmetrical surface vector
7) Centerline Specification			
SM.CMO	1	B15	Center stripes modelled
SM.CRE	1	B15	Center striped remaining
8) Surface Brightness			
SM.BRT	1	B15	Brightness
9) Surface Edge References			
SM.EG1	2	ASCII+B15	Surface edge 1
SM.EG2	2	ASCII+B15	Surface edge 2
SM.EG3	2	ASCII+B15	Surface edge 3
SM.EG4	2	ASCII+B15	Surface edge 4
SM.PTF	1	ASCII	Plane test control

TABLE 2-4 (PART B)
SURFACE PARAMETER BLOCK (SM.PAR)

	NAME	SIZE	SCALE	DESCRIPTION
10) Command List Designation				
	SM.ACS	1	ASCII	Active command list select
11) Edge/Face Flags				
	SM.FSL	1	ASCII	Control flag selection
	SM.CHN	1	ASCII	CB + channel number
	SM.NOB	1	ASCII	*B flag
	SM.NOT	1	ASCII	*T flag
	SM.LLL	1	ASCII	Landing light illumination
	SM.GND	1	ASCII	Ground illumination
	SM.A3D	1	ASCII	3D illumination
	SM.OCC	1	ASCII	Light occulting
12) General Vector #1				
	SM.V1X	2	B22	Vector 1, X
	SM.V1Y	2	B22	Vector 1, Y
	SM.V1Z	2	B22	Vector 2, Z
13) General Vector #2				
	SM.V2X	2	B22	Vector 2, X
	SM.V2Y	2	B22	Vector 2, Y
	SM.V2Z	2	B22	Vector 2, Z
14) General Vector #3				
	SM.V3X	2	B22	Vector 3, X
	SM.V3Y	2	B22	Vector 3, Y
	SM.V3Z	2	B22	Vector 3, Z
15) Plane Equation				
	SM.NRX	1	BØ	Normal, X
	SM.NRY	1	BØ	Normal, Y
	SM.NRZ	1	BØ	Normal, Z
	SM.DUV	2	B22	Plane offset
16) Internal Communication Parameters				
	SM.EPM	1	-	Entry-point mask
	SM.EOP	1	ASCII	End of entry point list
	SM.EOC	1	ASCII	End of cluster

TABLE 2-4 (PART C)
SURFACE PARAMETER BLOCK (SM.PAR)

NAME	SIZE	SCALE	DESCRIPTION
1) General Scan Control Data			
EM.UTS	1	ASCII	Type of units
EM.ENT	1	ASCII	Entity type
EM.PRB	6	-	File name block
EM.OPR	1	ASCII	Operation
EM.	1	-	Dummy spacing word
EM.FLG	1	-	Control flag word
EM.ABF	1	-	Buffer available flag
2) First Item Specification			
EM.FIT	1	ASCII	First item name
EM.FIN	1	B15	First item number (REL)
EM.FIA	1	B16	First item address (ABS)
EM.FTP	1	B15	First item type number
3) Last Item Specification			
EM.LIT	1	ASCII	Last item name
EM.LIN	1	B15	Last item number (REL)
EM.LIA	1	B16	Last item address (ABS)
EM.LTP	1	B15	Last item type number

TABLE 2-5 (PART A)
ENVIRONMENT PARAMETER BLOCK (EM.PAR)

NAME	SIZE	SCALE	DESCRIPTION
4) Priority Tree Node Specification			
EM.FTS	1	ASCII	Father name
EM.FTN	1	B15	Father number (REL)
EM.FTA	1	B15	Father number (ABS)
EM.FTR	1	B15	Father offset (REL)
EM.TSS	1	ASCII	True son name
EM.TSN	1	B15	True son number (REL)
EM.TSA	1	B15	True son number (ABS)
EM.TSR	1	B15	True son offset (REL)
EM.FSS	1	ASCII	False son name
EM.FSN	1	B15	False son number (REL)
EM.FSA	1	B15	False son number (ABS)
EM.FSR	1	B15	False son offset (REL)
EM.TMD	1	ASCII	True son surface module name
EM.TMN	1	B15	True son surface module number
EM.FMD	1	ASCII	False son surface module name
EM.FMN	1	B15	False son surface module number
EM.TST	1	ASCII	True son type
EM.FST	1	ASCII	False son type
EM.PTF	1	ASCII	Plane test control
EM.GCS	1	ASCII	Grandfather coordinate system name
EM.GCN	1	B15	Grandfather coordinate system number (REL)
EM.TCS	1	ASCII	True son coordinate system name
EM.TCN	1	B15	True son coordinate system number (REL)
EM.FCS	1	ASCII	False son coordinate system name
EM.FCN	1	B15	False son coordinate
5) Module Definition Specification			
EM.MTY	1	ASCII	Module type
EM.MDV	2	ASCII	Module device name
EM.MFN	3	ASCII	Module file name
EM.MSP	1	-	Module spare

TABLE 2-5 (PART B)
ENVIRONMENT PARAMETER BLOCK (EM.PAR)

NAME	SIZE	SCALE	DESCRIPTION
6) Dynamic Coordinate System Map Specification			
EM.MTX	1	ASCII	Matrix name
EM.MTN	1	B15	Matrix number
EM.COR	1	ASCII	Coordinate system name
EM.CON	1	B15	Coordinate system number
EM.DCS	1	ASCII	Map entry name
EM.DCN	1	B15	Map entry number (REL)
EM.DCI	1	B15	Map entry number (ABS) system number (REL)
EM.DYN	7	-	Dynamic coordinate system map
7) Runway Offset Specification			
EM.ROX	2	B22	Runway offset, X
EM.ROY	2	B22	Runway offset, Y
EM.ARH	2	B22	Runway offset, heading (degrees)
EM.ROH	1	BØ	Runway offset, heading (parts of circle)
8) Sun Vector Specification			
EM.ASH	2	B22	Sun heading (degrees)
EM.SHD	1	BØ	Sun heading (parts of circle)
EM.ASE	2	B22	Sun elevation (degrees)
EM.SEL	1	BØ	Sun elevation (parts of circle)
9) General Vector #1			
EM.V1X	2	B22	Vector 1, X
EM.V1Y	2	B22	Vector 1, Y
EM.V1Z	2	B22	Vector 1, Z
10) General Vector #2			
EM.V2X	2	B22	Vector 2, X
EM.V2Y	2	B22	Vector 2, Y
EM.V2Z	2	B22	Vector 2, Z

TABLE 2-5 (PART C)
ENVIRONMENT PARAMETER BLOCK (EM.PAR)

	NAME	SIZE	SCALE	DESCRIPTION
11) General Vector #3				
	EM.V3X	2	B22	Vector 3, X
	EM.V3Y	2	B22	Vector 3, Y
	EM.V3Z	2	B22	Vector 3, Z
12) Plane Equation				
	EM.NRX	1	BØ	Normal, X
	EM.NRY	1	BØ	Normal, Y
	EM.NRZ	1	BØ	Normal, Z
	EM.DUV	2	B22	Plane offset

TABLE 2-5 (PART D)
ENVIRONMENT PARAMETER BLOCK (EM.PAR)

NAME	SIZE	SCALE	DESCRIPTION
1) General Scan Control Data			
GM.UTS	1	ASCII	Type of units
GM.ENT	1	ASCII	Entity type
GM.PRE	6	-	File name block
GM.OPR	1	ASCII	Operation
GM.	1	-	Dummy spacing word
GM.FLG	1	-	Control flag word
GM.ABF	1	-	Buffer available flag
2) First Group Specification			
GM.FGP	1	ASCII	First group name
GM.FGN	1	B15	First group number
GM.FGA	1	B16	First group address
3) Last Group Specification			
GM.LGP	1	ASCII	Last group name
GM.FGN	1	B15	First group number
GM.FGA	1	B16	First group address
4) First Module Specification			
GM.FMD	1	ASCII	First module name
GM.FMN	1	B15	First module number
GM.FMA	1	B16	First module address
5) Last Module Specification			
GM.LMD	1	ASCII	Last module name
GM.LMN	1	B15	Last module number
GM.LMA	1	B16	Last module address
6) Module Definition			
GM.MDV	2	ASCII	Module device name
GM.MFN	3	ASCII	Module file name
GM.MSP	1	-	Module spare
GM.XXX	2	B22	Origin; X
GM.YYY	2	B22	Origin; Y
GM.DXX	2	B22	Delta; X
GM.DYY	2	B22	Delta; Y
7) Group Header Data			
GM.GMC	1	B15	Group rel. module count

TABLE 2-6
GROUP PARAMETER BLOCK (GM.PAR)

2.8.3 MODULE: NBCPAR

The module NBCPAR defines the command list parameter block. This parameter block is used to insert the command list instruction into the environment, edge, and face command list. This parameter block is not overlaid (see table 2-7).

2.8.4 MODULE: NBMPAR

The module NBMPAR defines the module transformation parameter block. This parameter block is used to transform light and surface modules. This parameter block is not overlaid (see table 2-8).

NAME	SIZE	SCALE	DESCRIPTION
1) Scan Control			
CL.FLG	1	-	Control flag word
2) Command List Specification			
CL.CMD	1	B16	Command list address
CL.ACL	1	B16	Command list entry count address
CL.ODT	1	B16	Opcode description table address
3) First Instruction Specification			
CL.FIT	1	ASCII	First instruction name
CL.FIN	1	B15	First instruction number
CL.FIA	1	B16	First instruction address (ABS)
4) Last Instruction Specification			
CL.LIT	1	ASCII	Last instruction name
CL.LIN	1	B15	Last instruction number
CL.LIA	1	B16	Last instruction address (ABS)

TABLE 2-7 (PART A)
COMMAND LIST PARAMETER BLOCK

NAME	SIZE	SCALE	DESCRIPTION
5) Instruction Definition Data			
CL.OPL	1	B15	Opcode mnemonic length
CL.OPN	2	ASCII	Opcode mnemonic
CL.OPC	1	B15	Opcode
CL.OPF	1	-	Opcode flag
CL.MDL	1	ASCII	Module name
CL.MDN	1	B15	Module number
CL.LTY	1	ASCII	Command list type
CL.EPT	1	ASCII	Entry point name
CL.EPN	1	B15	Entry point number
CL.OPT	1	ASCII	Option name
CL.ONM	1	B15	Option number
CL.MTX	1	ASCII	Matrix name
CL.MTN	1	B15	Matrix number

TABLE 2-7 (PART B)
COMMAND LIST PARAMETER BLOCK

NAME	SIZE	SCALE	DESCRIPTION
1) Rotation Angle			
MM.ANG	2	B22	Rotation angle (degrees)
MM.CIR	1	BØ	Rotation angle (parts of circle)
2) Translation Vector			
MM.TRX	2	B22	Translation Vector, X
MM.TRY	2	B22	Translation Vector, Y
MM.TRZ	2	B22	Translation Vector, Z

TABLE 2-8
MODULE TRANSFORMATION PARAMETER BLOCK

2.8.5 MODULE: NBXMOD

The module NBXMOD defines the data module buffer used by NSPBLD. This buffer contains four overlaid data module definitions as follows:

MODULE	DESCRIPTION	TABLE
SM.MOD	Surface data module	2-9
LM.MOD	Light data module	2-10
EM.MOD	Environment data module	2-11
GM.MOD	Group data module	2-12

The following tables (2-9 through 2-12) give pertinent information concerning these four modules. See figures 2-15 through 2-18 for corresponding diagrams.

NAME	SIZE	SCALE	DESCRIPTION
SM.IDT	4	-	Surface module identifier
SM.FEP	8	8*B15	Face entry pointers
SM.EEP	8	8*B15	Edge entry pointers
SM.TRE	5*9	-	Priority tree
SM.SUR	4	-	Symmetrical surface vector
SM.CEN	1	-	Centerline stripes
SM.AFC	1	B15	Actual face count
SM.AEC	1	B15	Actual edge count
SM.ANC	1	B15	Actual node count
SM.AFL	1	B15	Actual face command list length
SM.AEL	1	B15	Actual edge command list length
SM.FCM	16	-	Face command list
SM.ECM	16	-	Edge command list
SM.FAC	64*15	-	Face blocks
SM.EDG	64*15	-	Edge blocks
SM.SUM	1	B16	Checksum

TABLE 2-9
SURFACE DATA MODULE (SM.MOD)

NAME	SIZE	SCALE	DESCRIPTION
LM.IDT	4	-	Light module identifier
LM.SEP	8	8*B15	Light entry pointers
LM.FLS	6*4+1	-	Flashing strings
LM.ROT	4*3+1	-	Rotating strings
LM.VAS	2*4+1	-	VASI strings
LM.STB	6*18+1	-	Strobe strings
LM.SWT	32	32*B15	Switch pointers
LM.SSP	110	-	Switch string pointers
LM.AFC	1	B15	Actual flashing count
LM.ARC	1	B15	Actual rotating count
LM.AVC	1	B15	Actual VASI count
LM.ASC	1	B15	Actual strobe count
LM.TLR	1	B15	Total lights, red
LM.TLO	1	B15	Total lights, orange
LM.TLA	1	B15	Total lights, amber
LM.TLW	1	B15	Total lights, white
LM.TLG	1	B15	Total lights, green
LM.TLL	1	B15	Total lights, all colors
LM.TSR	1	B15	Total strings, red
LM.TSO	1	B15	Total strings, orange
LM.TSA	1	B15	Total strings, amber
LM.TSW	1	B15	Total strings, white
LM.TSG	1	B15	Total string count
LM.RED	1	B15	First red string
LM.ORG	1	B15	First orange string
LM.AMB	1	B15	First amber string
LM.WHT	1	B15	First white string
LM.GRN	1	B15	First green string
LM.NAS	1	B15	Next available string
LM.ALL	1	B15	Actual command list length
LM.CMD	8	8*B15	Light command list
LM.LIT	110*15	-	String blocks
LM.SUM	1	B16	Checksum

TABLE 2-10
LIGHT DATA MODULE (LM.MCD)

NAME	SIZE	SCALE	DESCRIPTION
EM.IDT	4	-	Environment module identifier
EM.OFF	4*5	-	Runway offsets
EM.FIL	11*6	-	Module list
EM.MAP	7	-	Dynamic coordinate system map
EM.SUN	2	-	Sun vector
EM.TRE	1+6*11	-	Priority tree
EM.CMD	64	-	Command list
EM.ANC	1	B15	Actual node count
EM.ACL	1	B15	Actual command list length
EM.SUM	1	B16	Checksum

TABLE 2-11
ENVIRONMENT DATA MODULE (EM.MOD)

NAME	SIZE	SCALE	DESCRIPTION
GM.IDT	4	-	Group module identifier
GM.GRP	256-6	-	Group storage buffer
GM.ASZ	1	-	Actual group buffer size
GM.SUM	1	B16	Checksum

TABLE 2-12
GROUP DATA MODULE (GM.MOD)

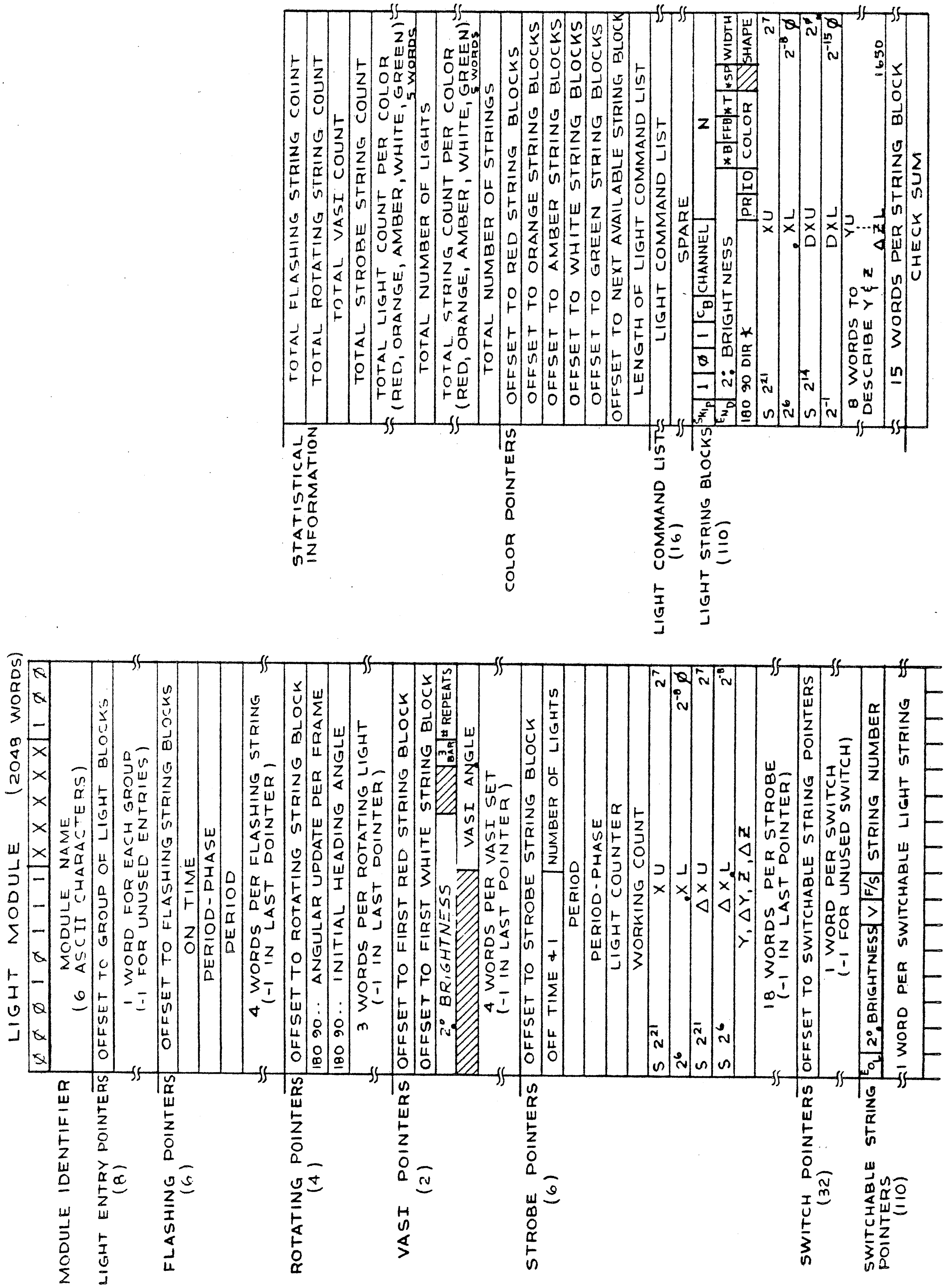

FIGURE 2-15
LIGHT DATA MODULE DIAGRAM

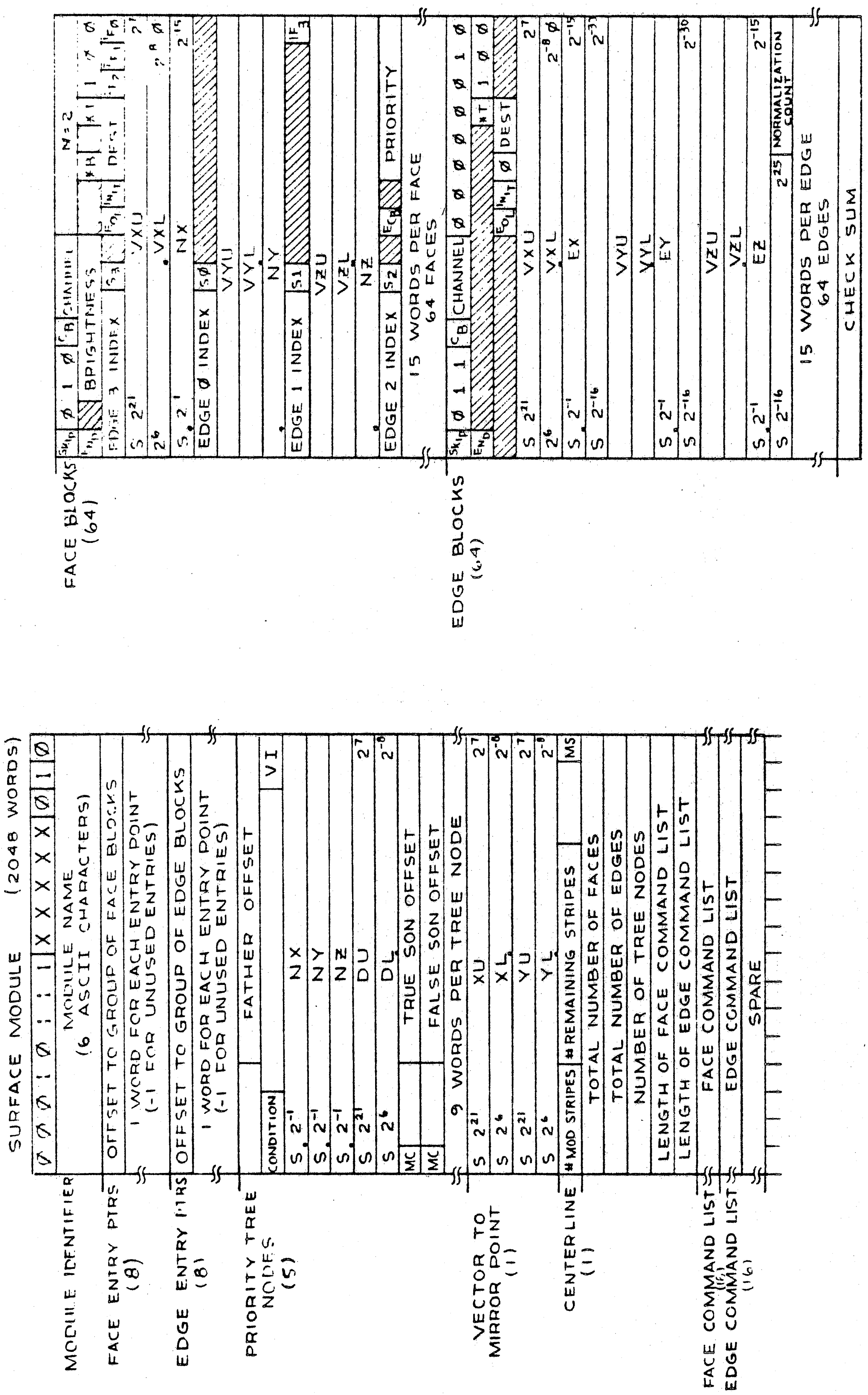

FIGURE 2-16
SURFACE DATA MODULE DIAGRAM

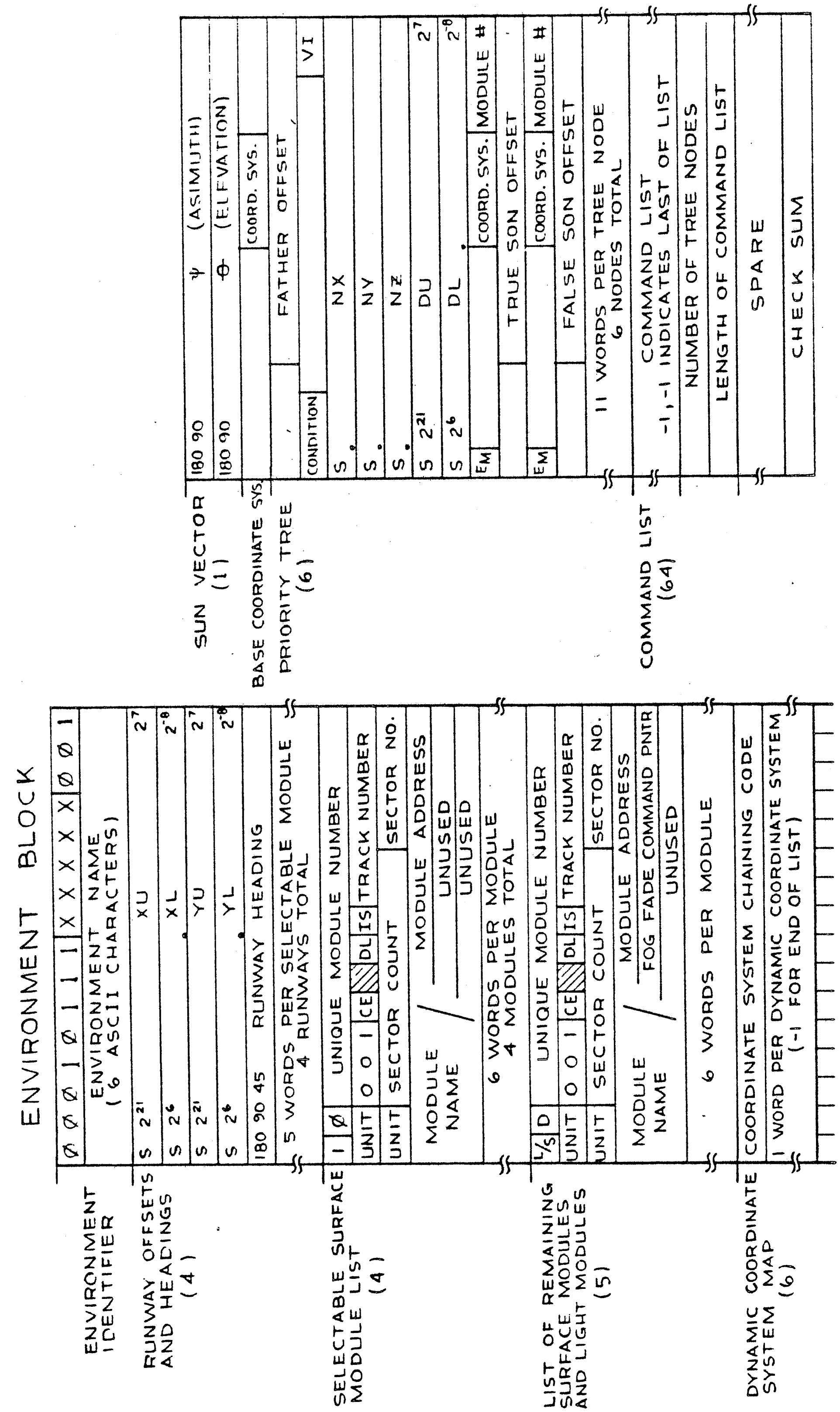

FIGURE 2-17
ENVIRONMENT DATA MODULE DIAGRAM

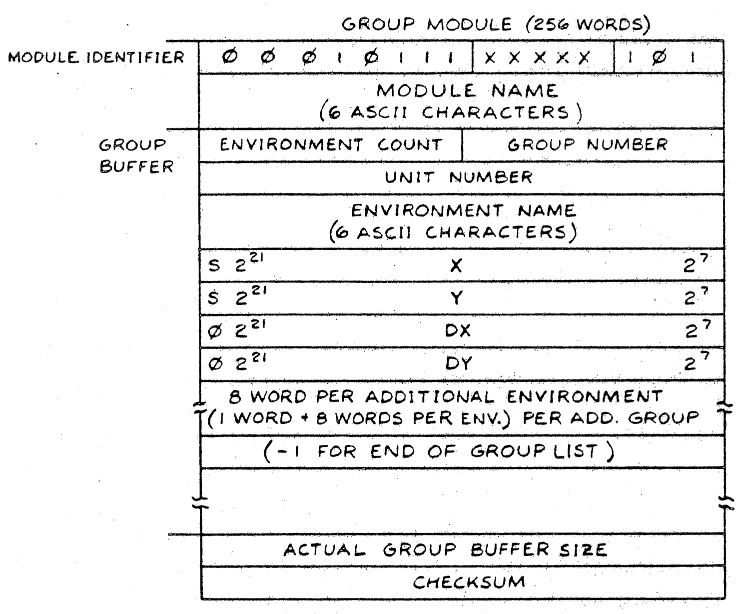

FIGURE 2-18
GROUP DATA MODULE DIAGRAM

2.9 MODULE GROUP: NSPBLD SCAN TREES

The scan trees for the model building system are tables of data which act as a program for the scanner. The scan items in the scan trees instruct the scanner (T$SCAN) on which type of data to request from the user and how to process the data. The scan tree for NSPBLD is divided into the following subscan trees:

MODULE	FUNCTION	SECTION
NBXTRE	Main tree, common branches	2.9.1
NBLTRE	Light tree	2.9.2
NBSTRE	Surface tree	2.9.3
NBETRE	Environment tree	2.9.4
NBGTRE	Group tree	2.9.5
NBMTRE	Transformation tree	2.9.6
NBDTRE	Display tree	2.17.3

The basic structure of the entire scan tree is shown in figure 2-19.

Each of the above-listed modules contains a list of equates for scan item opcodes, standard flag definitions, and other miscellaneous data. These standard equates are the same for each module. Along with these standard equates are equates for data peculiar to a given tree. Using these definitions and figures 2-2 through 2-7, the reader should be able to read and understand the operations of the scan trees.

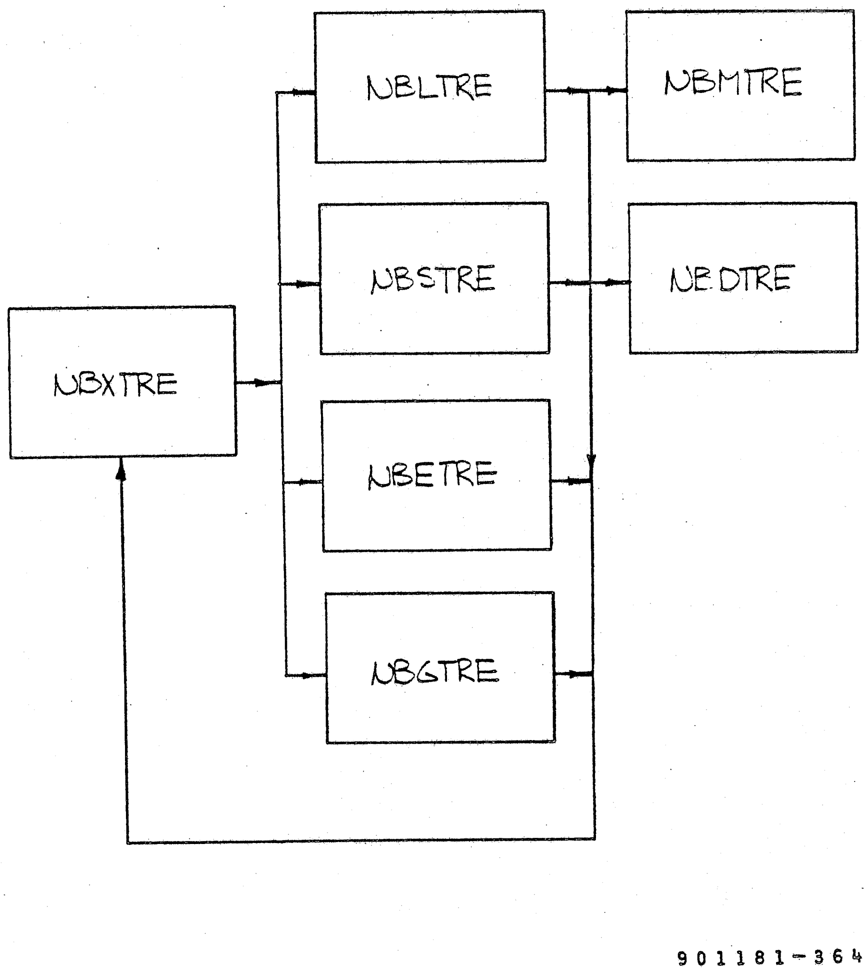

FIGURE 2-19
NSPBLD SCAN TREE BLOCK DIAGRAM

2.9.1 MODULE: NBXTRE

The module NBXTRE contains the main scan tree for NSPBLD. This module also contains a number of independent branches which perform common tasks. These branches are called from the other subscan trees. The following scan tree segments are defined in NBXTRE:

NAME	FUNCTION
T$TREE	Main scan tree segment
T$SELC	Dispatch to major subscan trees
T$ENGL	Set English units
T$METR	Set metric units
NB$ENT	Request entry-point data
NB$VER	Verify user-requested operation
NB$VEC	Request a three-component vector
NB$NAM/ NB$NIM	Request a device and file name
NB$XIT	Verify and "exit" a scan level
NB$ACT	Verify operation if data module is active
NB$NSP	Report error: insufficient space
NB$NER	Report error: bad name
NB$NEI	Report error: nonexistent item
NB$IIN	Request command list instruction data

Figure 2-20 shows the general flow of scan control within NBXTRE.

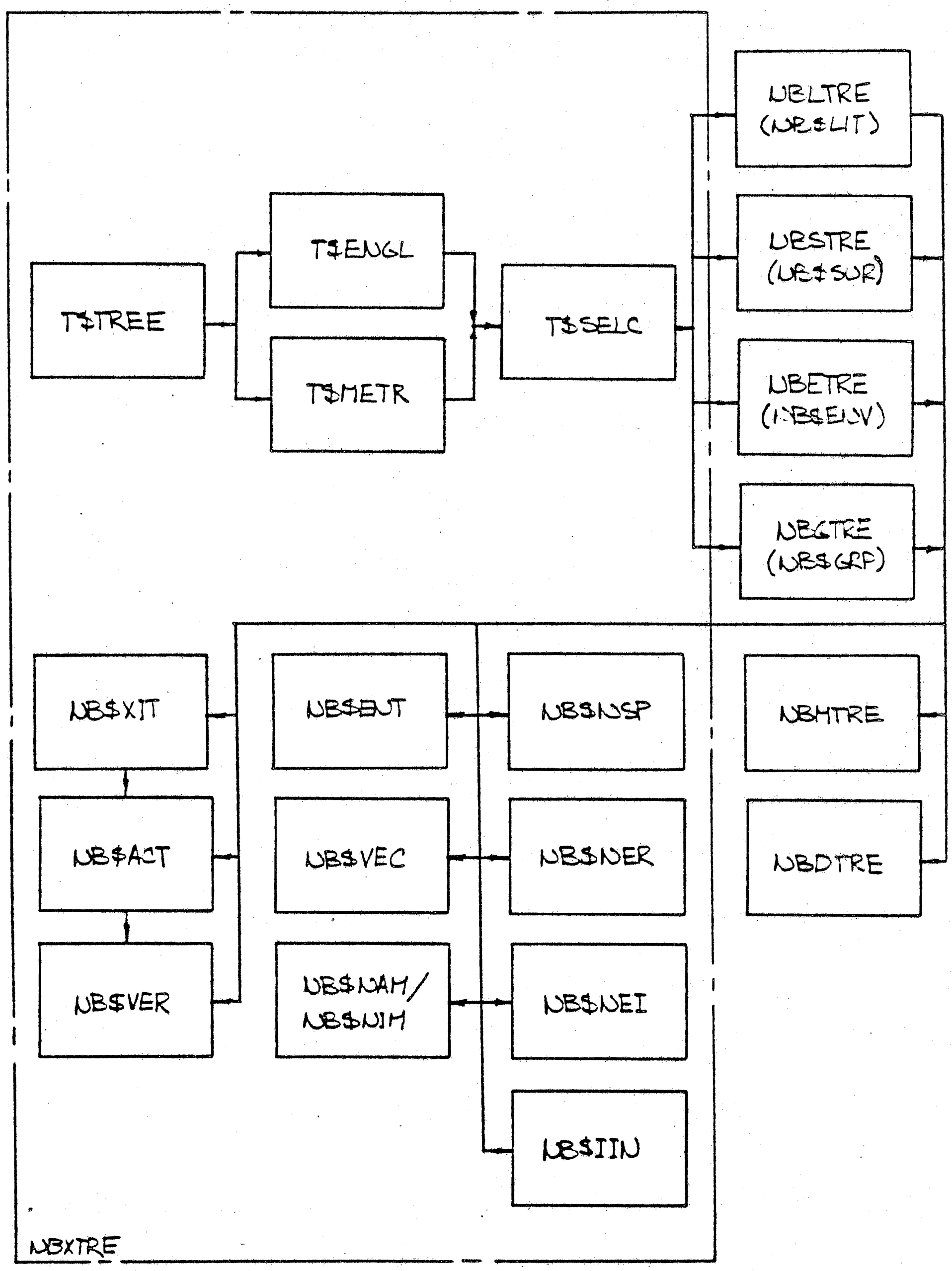

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FIGURE 2-20
NBXTRE BLOCK DIAGRAM

2.9.2 MODULE: NBLTRE

The module NBLTRE contains the light module subscan tree. This scan tree references the transformation and display subscan trees as well as several of the independent branches in NBXTRE. The following scan tree segments are defined in NELTRE:

NAME	FUNCTION
NB$LIT	Main light scan tree segment
L$READ	Read a light data module
L$EDIT	Use current module buffer data (edit module)
L$ZERO	Zero module buffer
L$PENT	Insert an entry point
L$INST	Insert a string definition
L$INSF	Insert a flashing string
L$INSR	Insert a rotating string
L$INVS	Insert a VASI group
L$INVR	Insert a VASI repeat string
L$INVM	Insert a VASI master string
L$INSS	Insert a strobe string
L$FPOF	Get off-time
L$FPON	Get on-time
L$FPPP	Get period and phase
L$INSN	Insert a normal string
L$IFLG	Get new flag values
L$CHNG	Change a light string
L$KILL	Kill a light string or strings
L$LIST	List a light string or strings
L$SELT	Select vector specification mode
L$WRIT	Write out a light data module
L$STAT	List module statistics
L$SNAM	Get a string name
L$FLSF	Get first and last string names
L$SLIM	Check name limits

Figure 2-21 shows the general flow of scan control within NBLTRE.

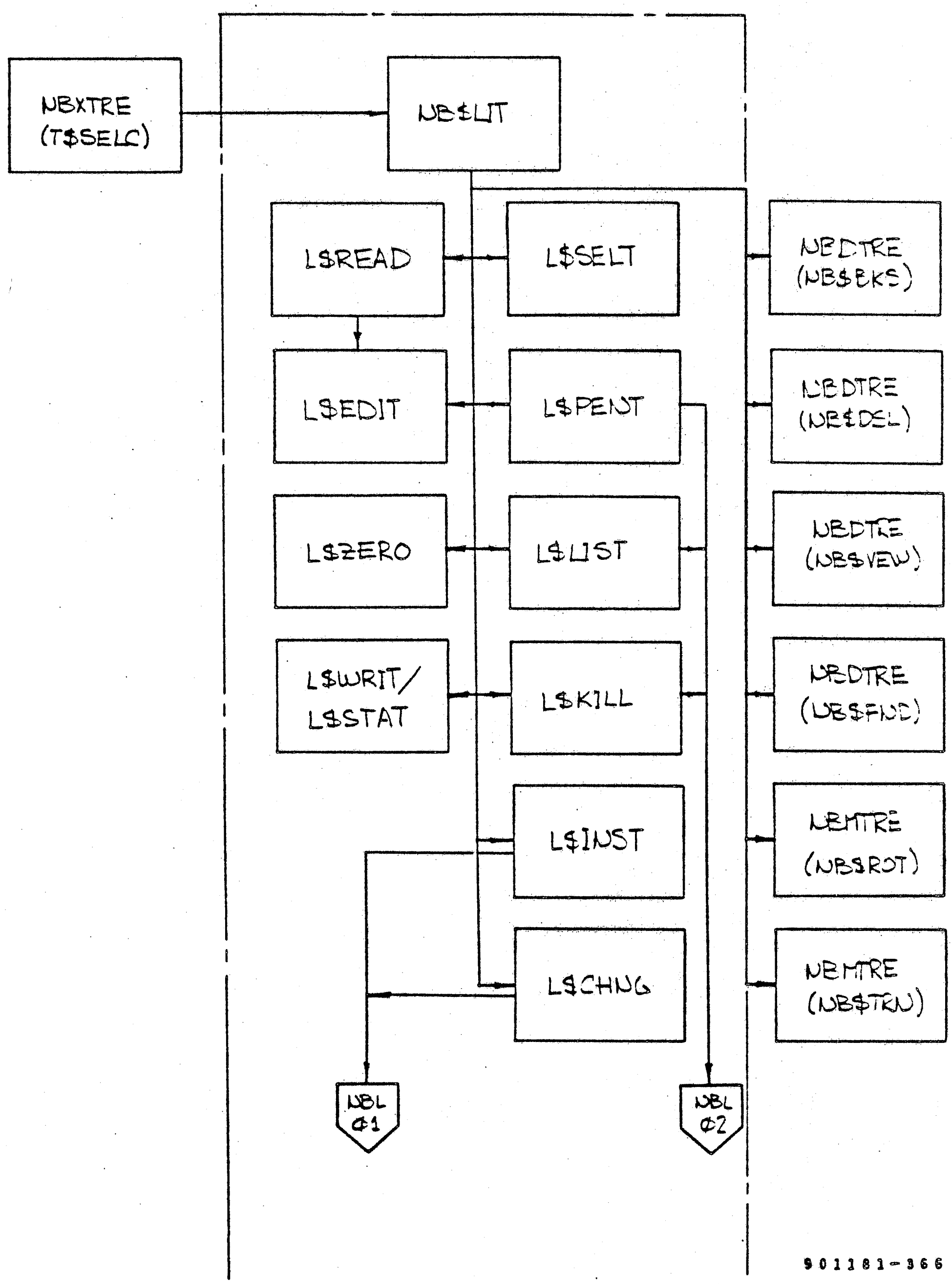

FIGURE 2-21 (PART A)
NBLTRE BLOCK DIAGRAM

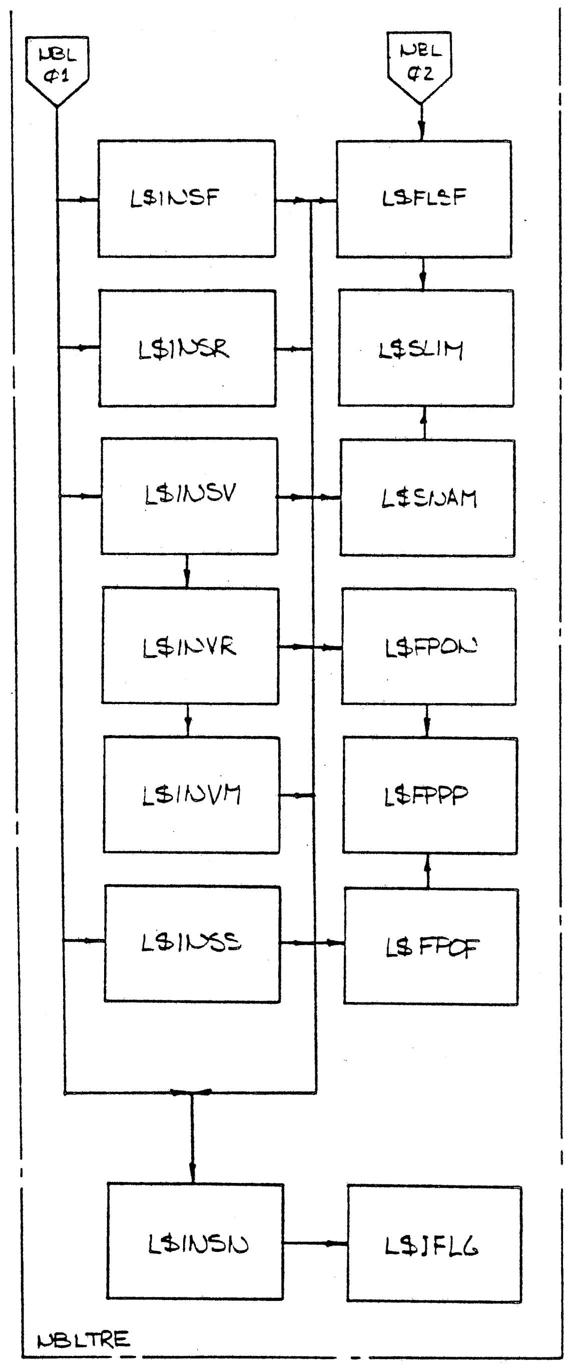

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FIGURE 2-21 (PART B)
NBLTRE BLOCK DIAGRAM

2.9.3 MODULE: NBSTRE

The module NBSTRE contains the surface module subscan tree. This scan tree references the transformation and display subscan trees as well as several of the independent branches in NBXTRE. The following scan tree segments are defined in NBSTRE:

NAME	FUNCTION
NB$SUR	Main surface scan tree segment
S$READ	Read a surface data module
S$EDIT	Use current module buffer data (edit module)
S$ZERO	Zero module buffer
S$PENT	Insert entry point
S$MVEC	Insert symmetrical surface vector
S$CENT	Insert center line
S$INST	Insert item
S$INED	Insert edge
S$INFA	Insert face
S$INTN	Insert priority tree node
S$ININ	Insert command list instruction
S$FLAG	Get flags
S$CHNG	Change an item
S$KILL	Kill an item or items
S$LIST	List an item or items
S$WRIT	Wirte out a surface data module
S$STAT	List module statistics
S$ENAM	Get edge names for faces
S$SNAM	Get an item name
S$FLSF	Get first and last item names
S$SLIM	Check name limits
S$SETL	Set up active command list

Figure 2-22 shows the general flow of scan control within NBSTRE.

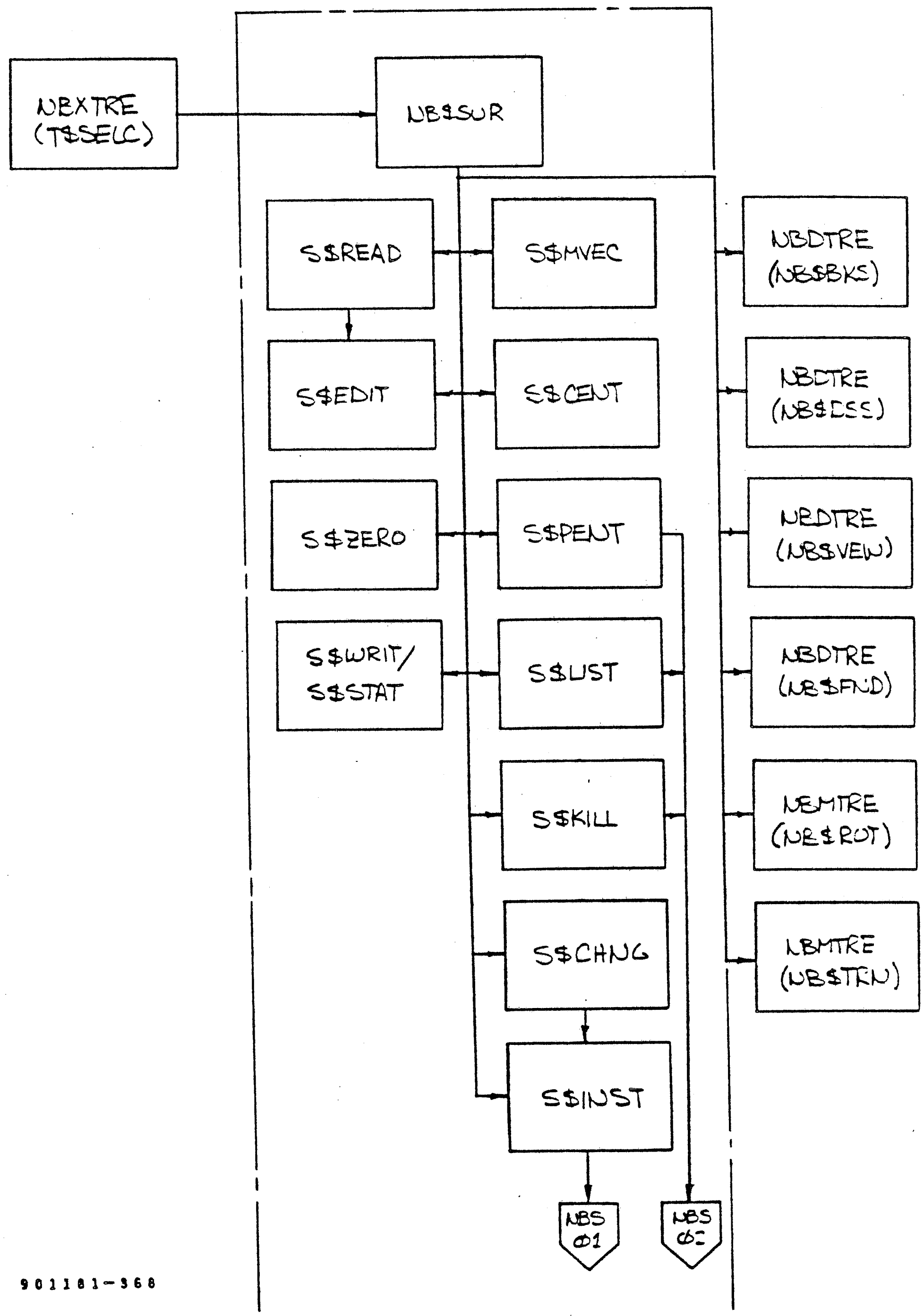

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FIGURE 2-22 (PART A)
NBSTRE BLOCK DIAGRAM

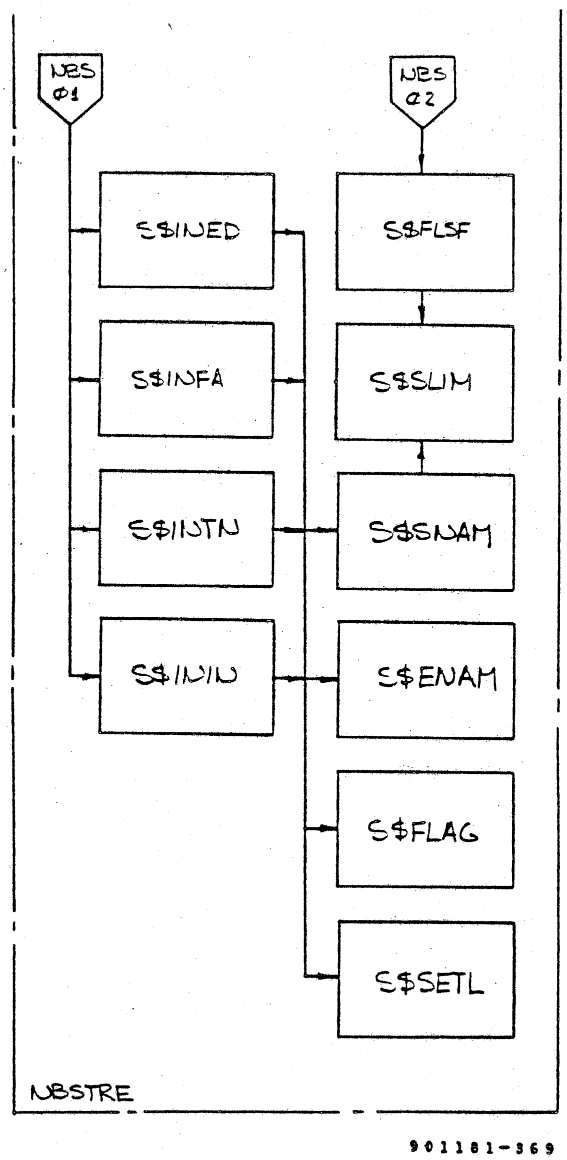

FIGURE 2-22 (PART B)
NBSTRE BLOCK DIAGRAM

2.9.4 MODULE: NBETRE

The module NBETRE contains the environment module subscan tree. This scan tree references several of the independent branches in NBXTRE. The following scan tree segments are defined in NBETRE:

NAME	FUNCTION
NB$ENV	Main environment scan tree segment
E$READ	Read an environment data module
E$EDIT	Use current module buffer (edit module)
E$ZERO	Zero current module buffer
E$SUN	Insert sun vector
E$DMAP	Insert dynamic coordinate system map
E$INST	Insert an item
E$INMD	Insert a model module definition
E$INRW	Insert runway offset
E$ININ	Insert command list instruction
E$INTN	Insert priority tree node
E$CHNG	Change an item
E$KILL	Kill an item or items
E$LIST	List an item or items
E$WRIT	Write out an environment module
E$NAME	Get an item name
E$FLIF	Get first and last item names
E$ILIM	Check name limits

Figure 2-23 shows the general flow or scan control within NBETRE.

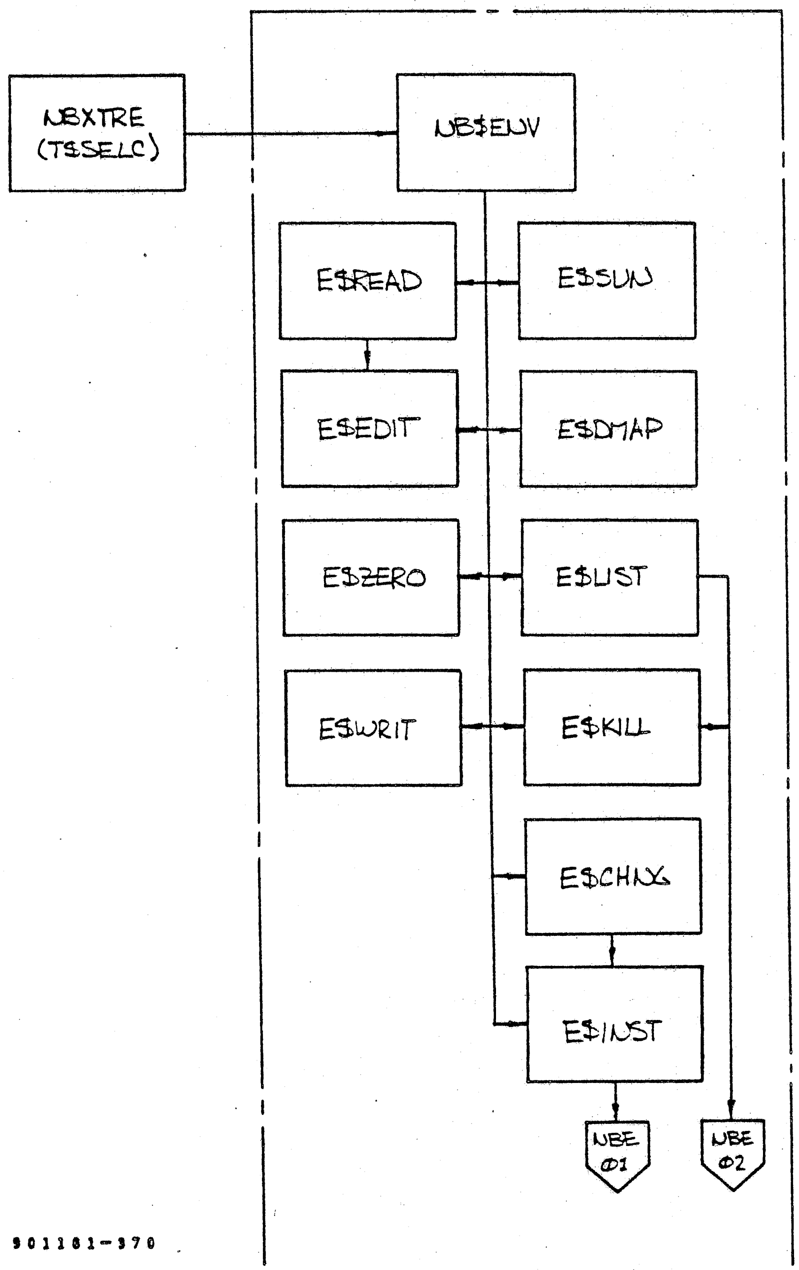

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FIGURE 2-23 (PART A)
NBETRE BLOCK DIAGRAM

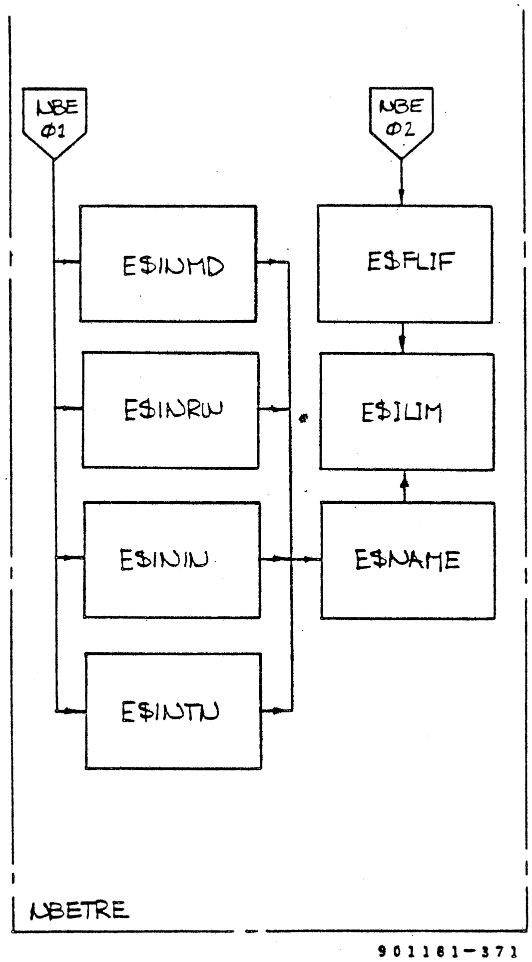


FIGURE 2-23 (PART B)
NBETRE BLOCK DIAGRAM

2.9.5 MODULE: NBGTRE

The module NBGTRE contains the group module subscan tree. This scan tree references several of the independent branches in NBXTRE. The following scan tree segments are defined in NBGTRE:

NAME	FUNCTION
NB$GRP	Main group scan tree segment
G$READ	Read a group data module
G$EDIT	Use current module buffer (edit module)
G$ZERO	Zero current module buffer
G$INST	Insert a group-relative module
G$CHNG	Change a group-relative module
G$KILL	Kill a group-relative module or modules
G$LIST	List a group or groups
G$MODN	Get a group-relative module name
G$WRIT	Write out a group module

Figure 2-24 shows the general flow or scan control within NBGTRE.

2.9.6 MODULE: NBMTRE

The module NBMTRE contains the module transformation subscan trees. The tree segments in this module are "called" from the light and surface subscan trees (NBLTRE and NBSTRE, respectively). There are two independent scan segments in NBMTRE: NB$TRN and NB$ROT. The segment NB$TRN requests a translation vector from the modeler and then calls the translation routine. The segment NB$ROT requests a Z rotation angle and calls the rotation procedure.

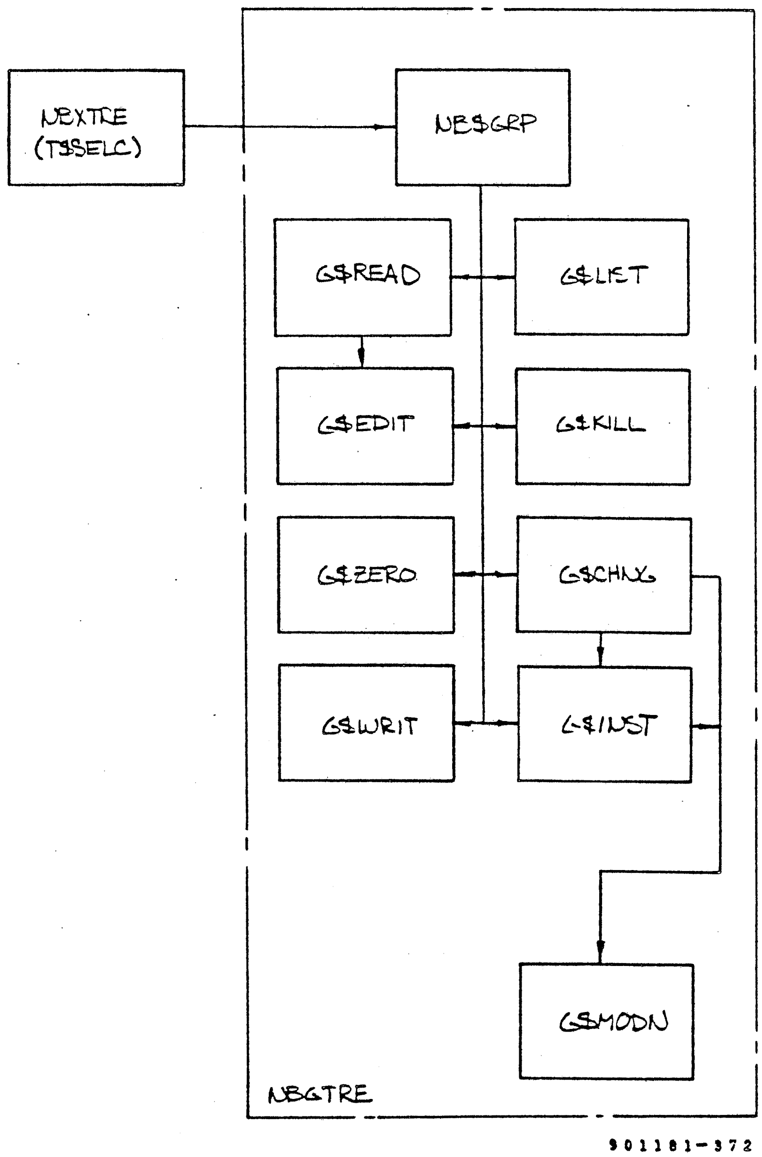


FIGURE 2-24
NBGTRE BLOCK DIAGRAM

2.10 MODULE GROUP: NSPBLD LIGHT MODULE PROCEDURES

The light module procedures used by NSPBLD to create and modify light data base modules are separated into two module sets. The first module set contains the actual procedures which are called by the system scanner (T$SCAN) to move and manipulate data between the light module buffer (NBXMOD) and the system parameter block (NBXPAR). The first set is comprised of the following modules:

MODULE	FUNCTION	SECTION
LMINST	Insert	2.10.1
LMDLET	Delete	2.10.2
LMPRNT	List	2.10.3
LMFIND	Load parameter block	2.10.4

The second set of modules contains support procedures for the major modules listed above. This set is comprised of the following:

MODULE	FUNCTION	SECTION
LMUPDT	Data structure update	2.10.5
LMCNEX	String specification expansion	2.10.6
LMCNVR	Data type conversion	2.10.7
LMVECT	Vector computation	2.10.8

See figure 2-25 for the NSPBLD block diagram.

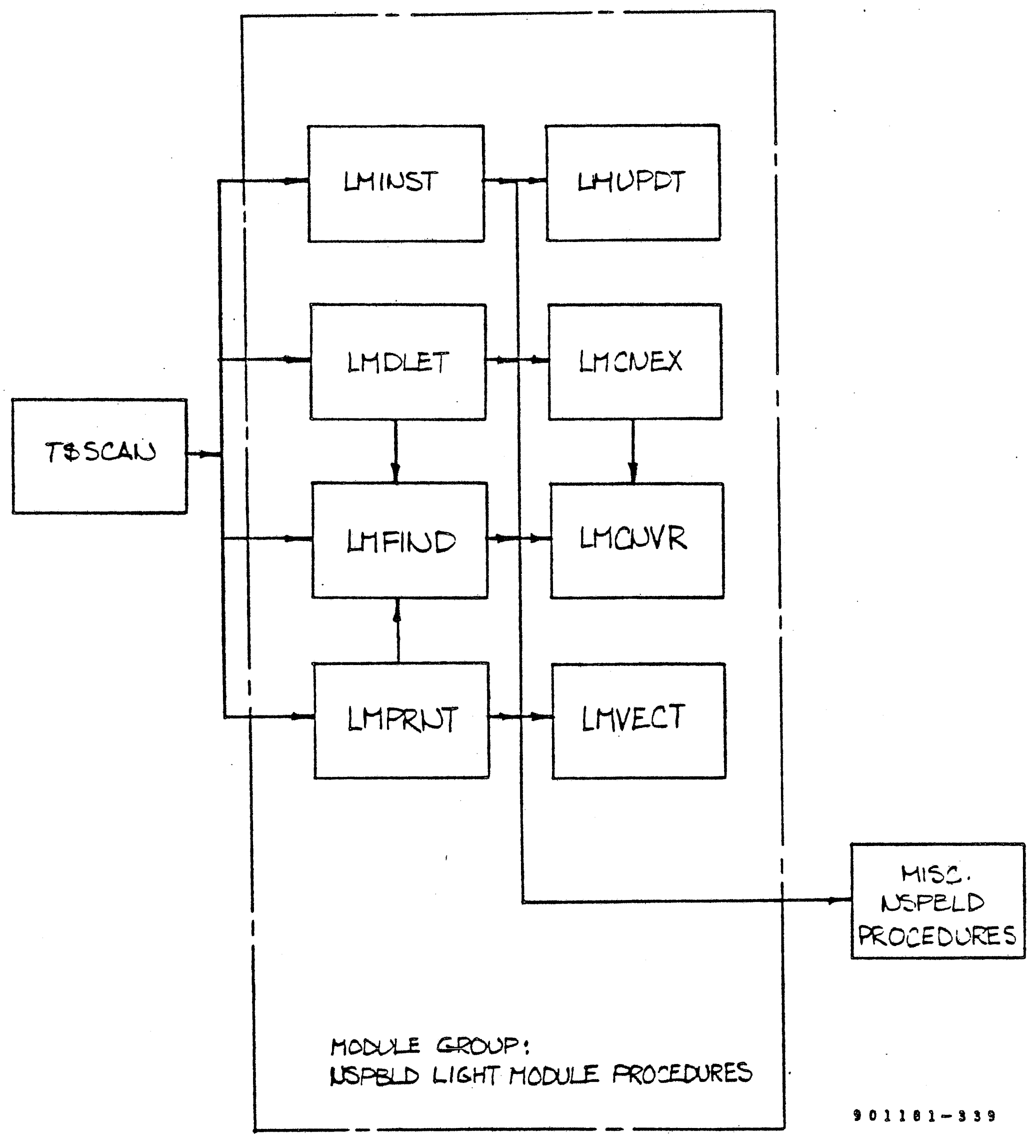


FIGURE 2-25
NSPBLD LIGHT MODULE PROCEDURES BLOCK DIAGRAM

2.10.1 MODULE: LMINST

The module LMINST contains procedures for inserting items into the various light module data structures. These procedures refer to data in the parameter block to determine which item or items are to be inserted. The data to be used within an item are also located in the parameter block.

The procedure LMINEP inserts an entry point in the light entry point list. This procedure uses the FIRST STRING and LAST STRING specifications in the parameter block to determine the range of the entry point. The FIRST STRING is used to generate the entry pointer, while the LAST STRING is used to determine in which string to set the END bit.

The following procedures are used to insert the various types of light strings:

PROCEDURE	LIGHT TYPE
LMINFS	Flashing light
LMINRT	Rotating light
LMINVS	VASI group
LMINST	Strobe
LMINLT	Normal light

The first four procedures move and pack the appropriate light characteristics data from the parameter block to the next available data block of the appropriate type within the light module. These four procedures then call LMINLT to insert the standard string block description into the light module according to the FIRST STRING specification in the parameter block.

VASIs are a special case; a VASI is composed of a number of different strings. To ease the construction of a VASI, the procedures LMINVS, LMINMS, and LMINRP are used in a co-routine fashion with the scanner to define the VASI data block, followed by the required number of master and repeat VASI strings. Two copies of each master and repeat VASI string are automatically generated (one in each VASI color) for every master or repeat string specified by the modeler.

The procedure LMINSW is called by LMINLT to generate an appropriate switch entry for those strings which have a switch number ≠ 0. This procedure manages both switch list pointers and the switch string pointer entries of the switch lists.

2.10.2 MODULE: LMDLET

The module LMDLET contains procedures for removing light string definitions from the light module. The procedures refer to data in the parameter block to determine which string or strings should be deleted.

The procedure LMRMOV deletes all the light strings between the strings specified by FIRST STRING and LAST STRING in the parameter block, inclusively. Each string is found by a call to LMFIND which loads the parameter block with the string data, including absolute pointers to the various data blocks which define the string. The string is then deleted by a call to LMDLET.

The procedure LMDLET deletes a single string from the light module by checking the light type and dispatching to the appropriate delete procedure as follows:

PROCEDURE	LIGHT TYPE
LMDEFS	Flashing light
LMDERT	Rotating light
LMDEVS	VASI group
LMDEST	Strobe
LMDENR	Normal light

In general, the first four procedures remove the special light characteristic data block (flashing, rotating, etc.), then call LMDLNR to remove the actual standard light string block. However, LMDEVS performs a more complex task. Since VASI groups contain several strings, LMDEVS must remove all string blocks associated with the VASI group. This is done by performing a process similar to LMRMOV, except that LMDEVS uses the VASI data block in the module to determine which strings belong to the VASI and must therefore be removed.

The procedure LMDEVS also has a second mode of operation when the CHANGE MODE flag of LM.FLG in the parameter block is set. In change mode, only the single VASI string pointed to by FIRST STRING is deleted.

The procedure LMDENR deletes the string block specified by FIRST STRING of the parameter block. This routine also has a second entry point, LMDELT, which allows the string block that will be deleted to be specified by color number and absolute string offset (relative to the top of the light module). This entry point is used by LMDEVS during the VASI delete procedure so as not to destroy the FIRST STRING specification.

The procedure LMDESW is called by LMDENR to remove any switch data associated with the string being deleted.

2.10.3 MODULE: LMPRNT

The module LMPRNT contains procedures for printing light module data. The data to be printed are loaded into the parameter block prior to being printed. The light strings to be printed are specified by FIRST STRING and LAST STRING in the parameter block.

The procedure LMLIST lists all light strings between the strings specified by FIRST STRING and LAST STRING in the parameter block, inclusively. Each string is found by a call to LMFIND which loads the parameter block. The actual listing is generated by a call to LMPRNT.

The procedure LMPRNT generates a single light string listing by making calls to LMPREP, LMPRHD, and LMPRLT. The procedure LMPREP lists any entry pointers which point to the string being listed according to the bit mask in LM.EOM in the parameter block.

The procedure LMPRHD lists the string header which consists of the string name (number), string type (normal, flashing, etc.), and any special characteristics (on-time, phase, etc.).

The procedure LMPRLT lists the standard light string data. This procedure also lists the END OF LIST message if the string being listed has the END bit set.

An additional procedure, LMPRLS, is used to list only the LAST POINT data for a string during an insert or change operation on a string when defined in FIRST POINT/DELTA SPACING format (see the NSP system operation and maintenance manual).

All portions of the string listings are performed by the procedure NBLIST. Refer to section 2.6.1 for details of the message description table format.

2.10.4 MODULE: LMFIND

The module LMFIND contains procedures for loading the parameter block with the data contained in the string block specified by FIRST STRING in the parameter block. These procedures also load data from any of the other various types of data blocks which point to the desired string block.

The procedure LMFIND searches the light module data structures and moves all data pertaining to the specified light (FIRST

STRING) to the parameter block. This is accomplished by calls to the remaining procedures in this module.

The procedure LMFDLT unpacks and moves the string block data to the parameter block. The procedure LMFDSW searches the switch data structure for switch string pointers which point to the desired string block. If a pointer is found, the switch number is moved to the parameter block along with the memory address of the switch string pointer. This procedure has a second entry point, LMFDSV, which is used to search for switch string pointers which point to the VASI data block. The entry point is used by LMFDVS, discussed later.

The procedure LMFDEP searches the light module entry-point list for entry pointers which point directly to the desired string block. A bit mask is produced with each bit corresponding to one of the entry pointers. This mask is placed in the parameter block.

The following procedures are used to search the special light characteristics lists for any data blocks that point to the desired string block:

PROCEDURE	LIGHT TYPE
LMFDFS	Flashing
LMFDRT	Rotating
LMFDST	Strobe
LMFDVS	VASI

These four routines are called in the order listed above. If any of these routines is successful in its respective search, the remaining routines are not called. In addition to loading the parameter block with the data from the data block, if one is found, these four procedures all load the appropriate pointer in the parameter with the memory address of the data block itself. This is later used to delete the data block if a delete operation is being performed.

The procedure LMFDVS has a slightly different search strategy from LMFDFS, etc. Since VASI strings appear in groups, this procedure searches for a VASI data block that defines a VASI group which contains the desired string.

2.10.5 MODULE: LMUPDT

The module LMUPDT contains procedures for maintaining the light module data structures. These procedures are used whenever a data block is inserted or deleted.

The procedure LMUPDT is the main procedure used in maintaining all pointers which point into the string block list. These pointers must be updated each time a string block is deleted or a new string block is added in accordance with:

PROCEDURE TO PERFORM UPDATE	POINTER TO BE UPDATED
LMUPLP	Flashing string block pointers
LMUPLP	Rotating string block pointers
LMUPVP	VASI string block color pointers
LMUPLP	Strobe string block pointers
LMUPSW	Switch string block pointers
LMUPEP	Entry pointers
LMUPCP	Color pointers

Each set of pointers is updated by a call to the appropriate procedure listed above. Note that the entry pointers are not updated during a change operation.

In addition to the procedures listed above, several additional procedures are included in this module for use during insertion and deletion of data blocks other than string blocks. The procedure LMUPSV is used to update the switch string pointers which point to VASI blocks when a VASI block is inserted or deleted.

The procedure LMUPSP is used to update the switch list pointers whenever a switch string pointer is inserted or deleted.

2.10.6 MODULE: LMCNEX

The module LMCNEX contains procedures for manipulating and expanding the FIRST STRING and LAST STRING specification in the parameter block.

The procedure LMEXCL expands a string specification by using the color name and color-relative string number found in the string specification. This is a general routine called by the scanner, with register B pointing to the address of the string specification buffer. Therefore, this routine can be used to expand a string specification anywhere in memory. Two additional entry points have been provided, LMEXFC and LMEXLC. These two entry points facilitate the calling of this routine when the FIRST STRING or LAST STRING specification, respectively, is to be expanded.

The procedure LMEXSA expands the FIRST STRING specification by using the absolute memory address of the string block found in LM.FSA of the parameter block. The procedure LMEXAN performs a similar function, except that it uses the absolute string number found in LM.FAN as the basis for the expansion.

The procedure LMSWFL swaps the FIRST STRING and LAST STRING specifications.

2.10.7 MODULE: LMCNVR

The module LMCNVR contains procedures for converting various data items from one form to another. The following list of procedures is used to convert a light string reference from one form to another, with respect to the current light module in memory.

PROCEDURE	INPUT FORM	OUTPUT FORM
LMA2CR	Absolute memory address	Color and color-relative number
LMA2SN	Absolute memory address	Absolute string number
LMCR2A	Color and color-relative number	Absolute memory address
LMSN2A	Absolute string number	Absolute memory address

The absolute memory address form is a single value which is used internal to the program to access string blocks. The absolute string number is a number from 0 to 109 that is used to generate switch string pointers which use string numbers rather than module-relative offsets, as do the other pointers in the light module. The color-relative string number form consists of a color number (0 through 4) and a string number relative to the start of that color in the string block list. The color-relative string numbering begins at 1 instead of at 0, as in the case of the absolute string numbers.

The procedures LMC2CN and LMCN2C are used to convert color names (ASCII R, O, A, W, and G) to color numbers (0 through 4) and vice versa, respectively.

The procedure LML2LN converts a light type (ASCII F, R, V, S, and N) to a light type number (0 through 4).

2.10.8 MODULE: LMVECT

The module LMVECT contains procedures for moving the various light module vectors. There are also procedures for computing the various vectors from data in the parameter block.

The procedures LMGTVC and LMPTVC are used to retrieve or store the first point and delta vector in a string block in the light module, respectively. These routines adjust the data format to compensate for differences in the NSP hardware data formats and the Texas Instrument format during the transfer of data between the string block in the module and the parameter block.

The procedure LMD2FL computes the last point vector from the first point and delta vectors as follows:

$$\vec{L} = \vec{F} + \vec{D} * (n-1)$$

where:

$\vec{L}$ = the last point vector.

$\vec{F}$ = the first point vector.

$\vec{D}$ = the delta vector.

n = the number of lights in the string.

All required data are retrieved from the parameter block, and the resulting vector is also stored in the parameter block.

The procedure LMFL2D computes the string delta vector from the first and last point vectors as follows:

$$\vec{D} = (\vec{L}-\vec{F})/(n-1)$$

where:

$\vec{L}$, $\vec{F}$, $\vec{D}$, and n are as above.

The procedures LMGTSV and LMPTSV perform the same basic function as LMGTVC and LMPTVC respectively, except that they are used to move the vector data between the parameter block and a strobe data block in the light module. The format conversion is also slightly different from that performed by LMGTVC and LMPTVC, since the strobe data block is interpreted by software (NSPFLY) rather than the NSP hardware itself.

The procedure LMSP2D computes the string delta vector from the spacing, heading angle, and elevation angle found in the parameter block as follows:

$$\vec{D} = \vec{S}\,[RY(-\Phi)]\,[RZ(\theta)]$$

where:

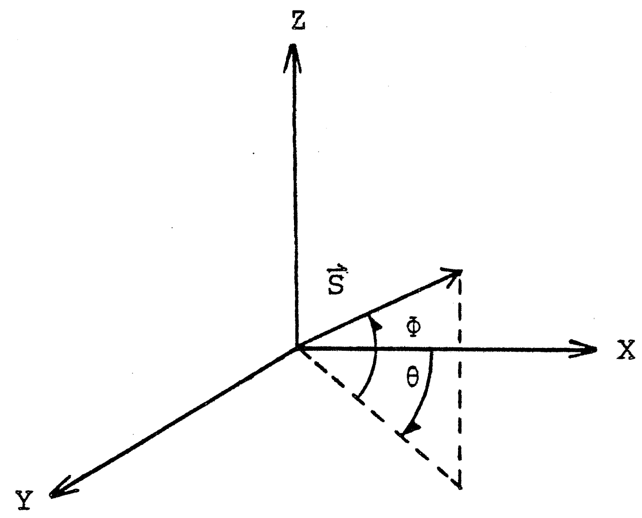
$$\vec{S} = (SP,0,0)$$

$$[RY(-\Phi)] = \begin{bmatrix} \cos(-\Phi) & 0 & -\sin(-\Phi) \\ 0 & 1 & 0 \\ \sin(-\Phi) & 0 & \cos(-\Phi) \end{bmatrix} = \begin{bmatrix} \cos(\Phi) & 0 & \sin(\Phi) \\ 0 & 1 & 0 \\ -\sin(\Phi) & 0 & \cos(\Phi) \end{bmatrix}$$

$$[RZ(\theta)] = \begin{bmatrix} \cos(\theta) & \sin(\theta) & 0 \\ -\sin(\theta) & \cos(\theta) & 0 \\ 0 & 0 & 1 \end{bmatrix}$$

SP = the light spacing.
θ = the heading angle measured clockwise from the X axis as viewed from the positive Z axis.
Φ = the elevation angle measured from the X-Y plane.

The following illustration shows the coordinate system that is used and the sign conventions. In this example, Φ and θ are positive.



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The procedure LMG2FL computes the last point vector for any string (curved as well as straight), using the first point vector, delta vector, and delta rotation angle found in the parameter block. The procedure first calls LMD2FL, which computes the last point vector, assuming a straight string. The string type is then checked; if it is straight, the procedure exits. If the string is curved, the Z component computed for a straight string is retained and new X and Y components are computed, using a simulation of the hardware curved string algorithm as follows:

$$\vec{L}' = \begin{cases} \vec{F} & \text{If: } n = 1 \\ \vec{F} + \vec{D}_o' & n = 2 \\ \vec{F} + \vec{D}_o' + \sum_{i=1}^{n-2} \vec{D}_i' & n > 2 \end{cases}$$

where:

$$\vec{D}_i' = \vec{D}_{i-1}\left[RZ(\alpha)\right]$$

$$\left[RZ(\alpha)\right] = \begin{bmatrix} \cos(\alpha) & \sin(\alpha) \\ -\sin(\alpha) & \cos(\alpha) \end{bmatrix}$$

NOTE: Sines and cosines are rounded to eight bits.

$\vec{F}$ and $\vec{D}_o'$ = two-component vectors composed of the X and Y components of the first point and delta vectors found in the parameter block, respectively.

$\vec{L}'$ = a two-component vector that is combined with the Z component from the straight string computation to produce the curved string last point vector.

α = the delta rotation angle specified as clockwise from the X axis when viewed from the positive Z axis.

n = the number of lights in the string.

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2.11 MODULE GROUP: NSPBLD SURFACE MODULE PROCEDURES

The surface module procedures are used by NSPBLD to create and modify surface data base modules. These procedures can be grouped functionally into two module sets. The first module set contains the actual procedures which are called by the system scanner (T$SCAN) to move and manipulate data between the surface module buffer (NBXMOD) and the system parameter block (NBXPAR). The first set is comprised of the following modules:

MODULE	FUNCTION	SECTION
SMINST	Insert	2.11.2
SMSSUR	Symmetrical surface processor	2.11.4
SMCNTR	Centerline processor	2.11.5
SMRMOV	Delete	2.11.8
SMLIST	List	2.11.9
SMFIND	Load parameter	2.11.11

The second set of modules contains support procedures and tables for the modules listed above. This set is comprised of the following:

MODULE	FUNCTION	SECTION
MSAVE	Preserve registers	2.11.1
SMINEP	Entry pointer module	2.11.3
SMIFTB	Illumination flag table	2.11.6
SMBRIT	Brightness table	2.11.7
SMPREP	Entry pointer printer	2.11.10
SMPDEP	Entry pointer mask generator	2.11.12
SMEXSN	Address expansion	2.11.13
SMTREB	Priority tree builder	2.11.14
SMCMDL	Command list procedure	2.11.15

See figure 2-26 for a block diagram of the surface module procedures.

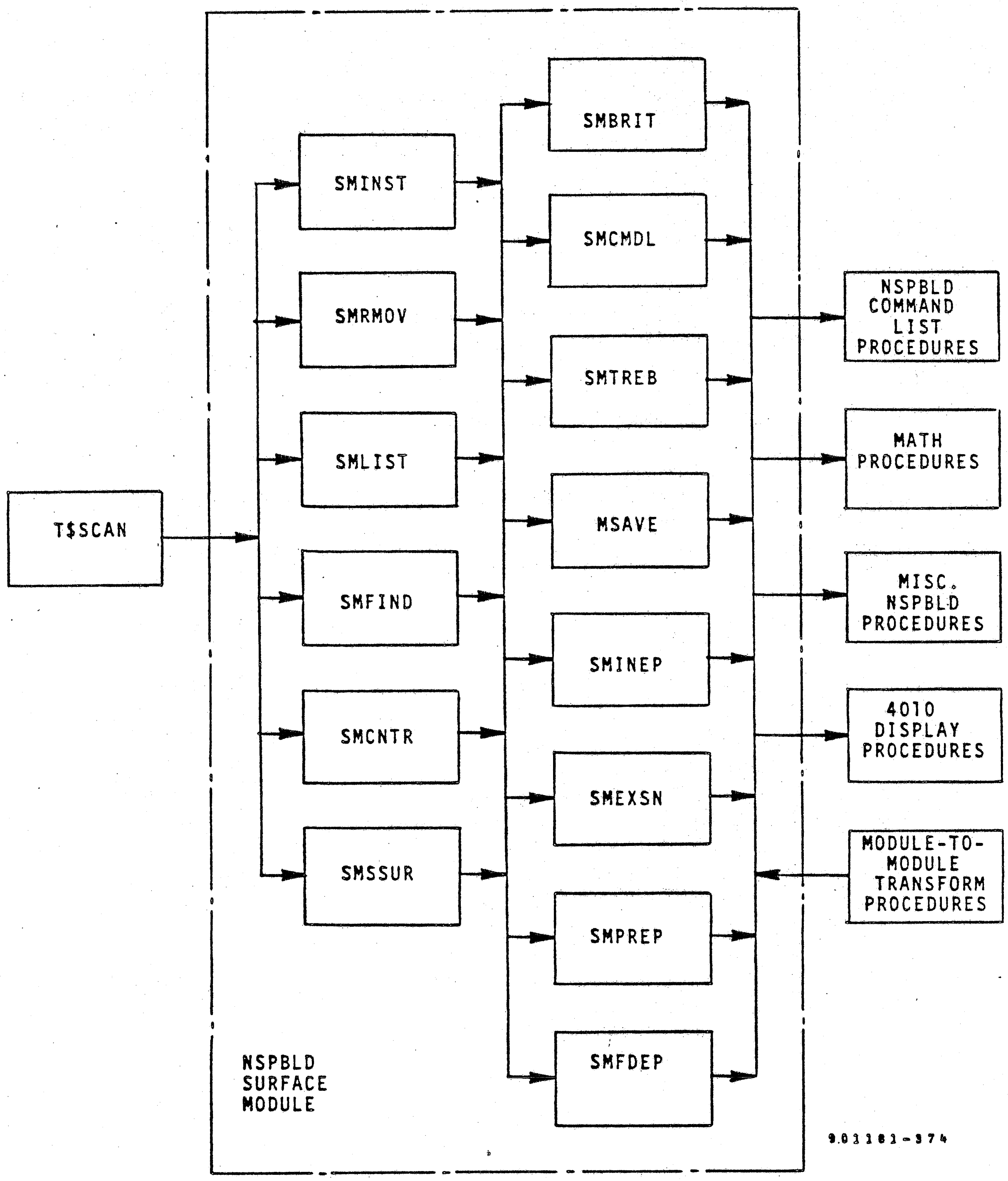


FIGURE 2-26
SURFACE MODULE PROCEDURES BLOCK DIAGRAM

2.11.1 MODULE: MSAVE

This module is a set of two 7-word tables which are used to preserve register contents during transition to and from subroutines.

2.11.2 MODULE: SMINST

Module SMINST contains procedures for inserting items into the various surface module data structures along with associated conversions and computations. These procedures refer to data in the parameter block to determine which item or items are to be inserted. The data to be used within an item are also derived from data located in the parameter block.

SMINST processes all requests for insertions of edges or faces. Procedures SMNONI and SMININ are evoked to process priority tree node insertions and command list entries, respectively. Subroutine NBUPEP is called to update entry pointers which change as a result of the insertion, and subroutine SMUPPT is used to update priority tree links. For faces, subroutine SMBRIT is used to access the brightness field for the face. Subroutine SMEDGS is used to access data for each edge reference. Subroutines SETE and SMSQ are used to compute the face normal. DSCINS is called to update the 4010 display bit map to reflect the inserted face (see section 1.4).

For edge inserts, subroutines VDIFF and VBNRM are used to compute the edge direction vector, which is inserted into the next available edge block in the surface module. Subroutine SMUPDT is called to update edge references within face blocks.

2.11.3 MODULE: SMINEP

Module SMINEP processes the insertion of entry pointers into the surface module entry pointer lists. The routine loads register A with the address of the first edge/face block (the block to be pointed to by the new entry pointer), and register E is loaded with the last face/edge block (the block for which the END bit will be set). The entry point number is moved from the parameter block to register X, and the entry point list address is loaded into register B. After these parameters are set up, subroutine NBINEP is called to insert the entry point into the module.

2.11.4 MODULE: SMSSUR

Module SMSSUR transfers a symmetrical surface vector between the parameter block and the surface module buffer. Entry pointer SMSSUR transfers the vector from the parameter block to the module buffer and sets or clears the mirror surface (MS) take bit. Entry point SMSSGT transfers the symmetrical surface vector from the surface module to the parameter block.

2.11.5 MODULE: SMCNTR

Module SMCNTR moves the centerline stripe values between the parameter block and the surface module buffer. Subroutine SMCNTR moves the information from the parameter block to the surface module, and subroutine SMCLGT moves the data from the module to the parameter block.

2.11.6 MODULE: SMIFTB

This module contains a table of status bits to be inserted into a new face block or changed face block. Bits 12 through 15 contain status bit settings, and bit 0 is a validity bit. If bit 0 = 1, the status bit configuration contained in bits 12 through 15 of the entry is not valid. If bit 0 = 0, the configuration is valid.

The table is indexed by the right-justified concatenation of items SM.LLL, SM.GND, SM.ABD, and SM.OCC as shown in the parameter table (table 2-13).

```
                                                   ┌-------IF3 (BIT 12)
                                                   |
                                                   | ┌-----IF2 (BIT 13)
          ┌-VALIDITY BIT (1 = NOT VALID)           | |
          |                                        | | ┌--IF1 (BIT 14)
          |                                        | | |
          ↓                                        | | | ┌IF0 (BIT 15)
INDEX     0 ┌-----------BITS 1 - 11---------┐      ↓ ↓ ↓ ↓

0 0 0 0   0 x  x  x  x  x  x  x  x  x  x  x      0 1 1 1
0 0 0 1   1 x                             x      0 0 0 0
0 0 1 0   0 x                             x      0 0 1 0
0 0 1 1   0 x                             x      0 0 1 1
0 1 0 0   0 x                             x      0 1 1 0
0 1 0 1   1 x                             x      0 0 0 0
                        NOT
0 1 1 0   1 x                             x      0 0 0 0
0 1 1 1   1 x                             x      0 0 0 0
                        USED
1 0 0 0   0 x                             x      0 1 0 1
1 0 0 1   1 x                             x      0 0 0 0
1 0 1 0   0 x                             x      0 0 0 0
1 0 1 1   0 x                             x      0 0 0 1
1 1 0 0   0 x                             x      0 1 0 0
1 1 0 1   1 x                             x      0 0 0 0
1 1 1 0   1 x                             x      0 0 0 0
1 1 1 1   1 x  x  x  x  x  x  x  x  x  x  x      0 0 0 0
↑ ↑ ↑ ↑
| | | └-SM.OCC
| | |
| | └---SM.ABD
| |
| └-----SM.GND
|
└-------SM.ILL
```

TABLE 2-13
SMIFTB PARAMETER TABLE

2.11.7 MODULE: SMBRIT

Module SMBRIT fetches the face brightness parameter from the brightness table (SMBRTB) and positions the value in bits 1 through 9 of register A. Each entry of SMBRTB contains two brightness values in the high and low bytes. At entry to SMBRIT, register A contains a byte offset into table SMBRTB. The value returned is a B1 number between 0.0 and 1.9961.

2.11.8 MODULE: SMRMOV

Module SMRMOV contains procedures for removing face or edge definitions, priority tree nodes, or command list entries from the resident surface module. The procedures refer to data in the parameter block to determine which entity or entities should be deleted.

The procedure SMDLET is a special entry used to delete a single entry. Procedure SMRMOV deletes all entities defined by the FIRST ITEM specification and LAST ITEM specification in the parameter block. Subroutine NBUPEP is called to update the module entry pointers which are affected by the deletions, and, for faces, DSCMPR compresses the display bit map. The subroutine SMPTRD is called to adjust module pointers and subroutine SMUPDT is called to update face block edge reference numbers. When all deletions are completely processed, control is returned to T$SCAN.

2.11.9 MODULE: SMLIST

The module SMLIST contains procedures for printing surface module data. The data to be printed are loaded into the parameter block prior to being printed. The entities which may be printed are face block data, edge block data, priority tree nodes, or command lists. The entities to be printed are identified in the parameter block at entry and are delimited by FIRST ITEM and LAST ITEM specifications which are set up in the parameter block by T$SCAN prior to dispatch to SMLIST. Subroutine SMNODL processes all priority tree requests and subroutine SMPRIN processes all command list entries.

For faces and edges, subroutine SMRNGE sets up the loop variables and checks the range of requested entities. For legal requests, subroutines SMEXS2 and SMFIND generate appropriate information in the parameter block, and then subroutine SMPRNT is called to produce the listing for the current entity. SMPRNT in turn dispatches to SMPREP to print entry pointer information and then to NBLIST to output the face or edge data. When all requested entities have been processed, control is returned to T$SCAN.

2.11.10 MODULE: SMPREP

Module SMPREP uses the entry pointer mask, SM.EPM, to print all entry points which point to a given face/edge block. Register A is loaded with mask SM.EPM and subroutine NBPREP is called to actually print out the entry pointers.

2.11.11 MODULE: SMFIND

Module SMFIND loads the parameter block with valid information for the edge block, face block, priority tree node, or command list entry as identified by the parameter block item SM.FSS.

Subroutine SMNODF is called to build the parameter block for a requested priority tree node. Subroutines SMSSGT and SMCLGT load information relative to module centerline and symmetrical surfaces into the parameter block. Then, for a face or edge block, all pertinent data are extracted from the module, converted and placed into the parameter block.

2.11.12 MODULE: SMFDEP

Module SMFDEP is called by SMLIST to generate an entry pointer mask which identifies all entry pointers pointing to the edge/face block, whose address is passed to SMFDEP in register A. Subroutine NBFDEP is called to actually compute the mask which is placed at location SM.EPM of the parameter block.

2.11.13 MODULE: SMEXSN

The module SMEXSN contains procedures for expanding the identification and address parameter block items for a given face, edge, priority tree node, or command list entry. From parameter block items SM.FSS and SM.FSN, items SM.FAN and SM.FSA are determined and set into the parameter block.

There are two entry points to the module. SMEXSN is used if register B contains a pointer to the address of SM.FSS, or SMEXS2 is used if register B contains a pointer to SM.FSS.

2.11.14 MODULE: SMTREB

The module SMTREB contains procedures to perform all manipulations of the priority tree information in the resident surface module. These procedures, together with the function performed by each, are listed as follows:

PROCEDURE	FUNCTION
SMNODI	Insert priority tree node
SMNODF	Set up parameter block for node
SMNODR	Delete priority tree node
SMNODL	List priority tree node
SMUPPT	Update node pointers

The procedure SMNODI creates a new node in the priority tree and changes all pointers affected by the insertion. If the node contains a new separating plane, subroutine VPLANE is called to compute the plane normal which is set into the new mode. The routine also sets the "end of cluster" bits for terminal nodes.

The procedure SMNODF uses subroutine SMBKWN to set information relative to the node's father, true son, false son, and plane normal into the parameter block, and, for terminal nodes, sets cluster delimiting face information into the parameter block.

The procedure SMNODR calls subroutine CKSONS to update all node pointers to the deleted node. Then subroutine NODKIL is called to set the deleted node to null.

The procedure SMNODL calls subroutine NBLIST to output the plane equations, father node, true son, and false son information.

The procedure SMUPPT updates pointers to terminal node faces when a face is inserted or deleted.

2.11.15 MODULE: SMCMDL

The module SMCMDL contains all procedures which manipulate the command lists of the resident surface module. A list of procedures and the functions performed by each follows:

PROCEDURE	FUNCTION
SMININ	Insert a command
SMDLIN	Delete command(s)
SMPRIN	Print command(s)
SMFDIN	Build parameter block
SMEXIN	Build command list parameter block
SMSETE	Set edge command list as active
SMSETF	Set face command list as active

To insert a new command, the procedure SMININ calls SMEXIN to expand the command list parameter block, and then calls subroutine CLININ which actually performs the insertion. Finally, the item number SM.FSN is incremented and subroutine SMEXSN is called to expand the FIRST ITEM information in the parameter block.

The deletion process performed by the procedure SMDLIN consists of calling subroutine SMEXIN to expand the command list parameter block, and then calling CLDLIN to delete the requested commands.

The procedure SMPRIN first calls SMEXIN to expand the parameter block, then a loop is entered to print each command. Subroutines CLFDIN and CLPRIN are evoked to actually output each command.

SMFDIN is evoked to build the command list parameter block for the currently active command. SMEXIN expands the FIRST and LAST item information and moves the command(s) to the parameter block by calling CLEXFI, CLEXLI, and CLFDIN.

The procedures SMSETE and SMSETF set either the edge command list or the face command list as the currently active command list, respectively.

2.12 MODULE GROUP: NSPBLD ENVIRONMENT MODULE PROCEUDRES

The environment module procedures (see figure 2-27) generate and manipulate the data structures in the environment data module. These procedures are organized into two sets of program modules. The first set of modules contains those procedures called by the scanner to perform a required data manipulation. This module set is composed of the following modules:

MODULE	FUNCTION	SECTION
EMINST	Insert item	2.12.1
EMDLET	Delete item	2.12.2
EMPRNT	Print item	2.12.3
EMFIND	Find item	2.12.4

The second module set consists of support procedures called by those modules listed above. This second set is composed of the following modules:

MODULE	FUNCTION	SECTION
EMEXND	Expand specifications	2.12.5
EMCNVR	Data conversion	2.12.6

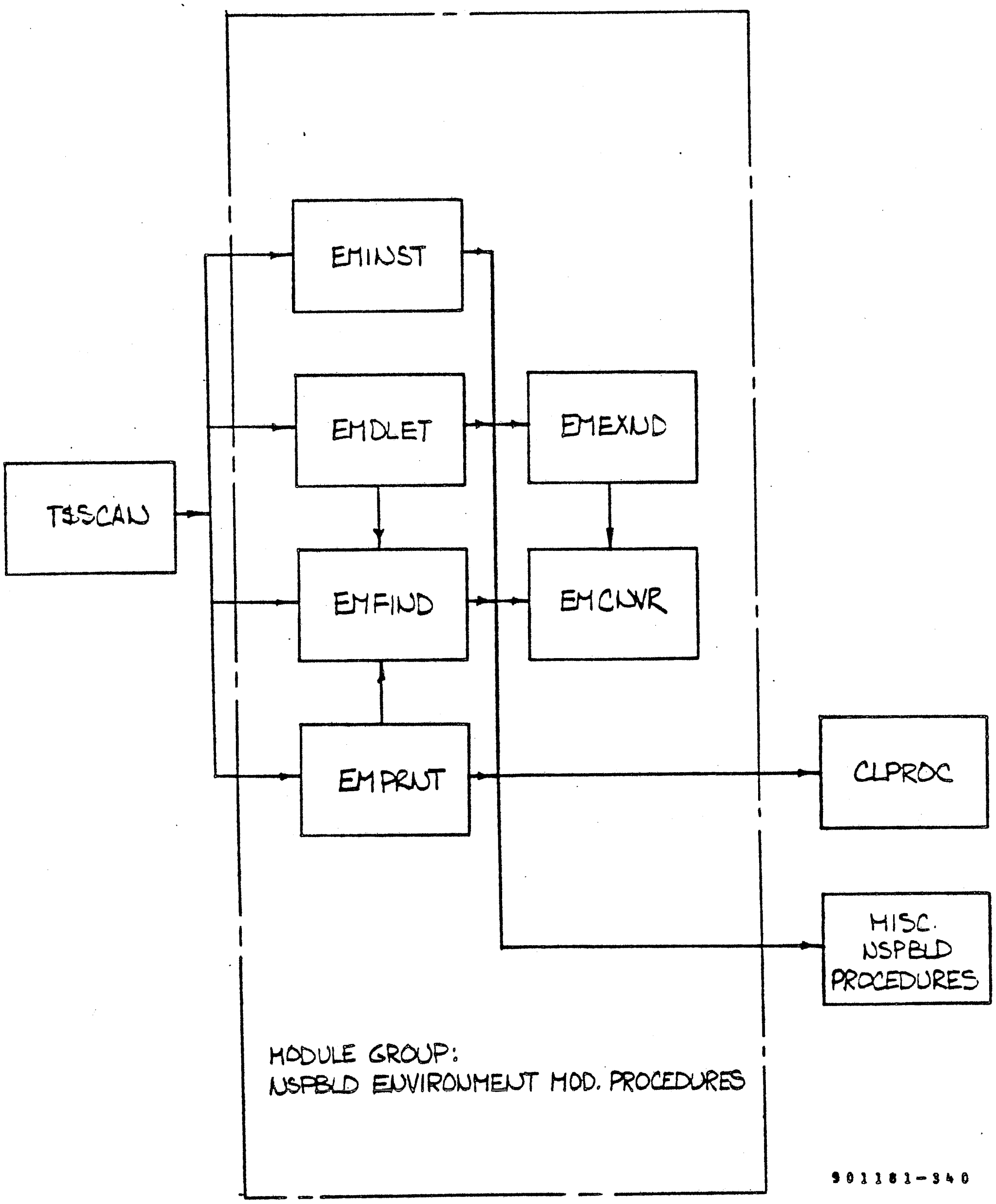


FIGURE 2-27
NSPBLD ENVIRONMENT MODULE PROCEDURES BLOCK DIAGRAM

2.12.1 MODULE: EMINST

The module EMINST contains procedures for inserting items into the various environment module data structures. These procedures refer to data in the parameter block to determine which item is to be inserted. The data to be used to construct the item are also found in the parameter block.

The procedure EMINST inserts several different types of items by dispatching to an appropriate routine, depending on the item type. The item is specified by FIPST ITEM in the parameter block. The following item types are inserted by this procedure:

PROCEDURE	ITEM TYPE
EMINMD	Model module definition
EMINRW	Runway offset
EMININ	Command list instruction
EMINTN	Priority tree node

Each of the above-listed procedures retrieves the data pertinent to the item to be inserted from the parameter block, then formats, packs, and moves them to the appropriate data block in the environment module.

The procedure EMININ differs from the other three procedures in that it accomplishes the insert task by moving the FIRST ITEM specification from the environment parameter block to the command list parameter block. The actual insertion is performed by the common command list procedure found in CLPROC (section 2.14).

This module, EMINST, also contains procedures for inserting the sun vector (EMINSU) and for inserting the dynamic coordinate system map. The entire dynamic coordinate system map exists in the parameter block; a call to EMINDM causes the map to be moved to the environment module. The map is constructed by successive calls to the procedure EMINCO, which defines the next consecutive entry in the copy of the map in the parameter block.

2.12.2 MODULE: EMDLET

The module EMDLET contains procedures for deleting items from the environment module data structures. The item or items are designated in the parameter block.

The procedure EMRMOV removes all items of a specific type which occur between the items designated in the FIRST ITEM and LAST ITEM specifications of the parameter block, inclusively. This is done by dispatching to one of the following procedures according to item type:

PROCEDURE	ITEM TYPE
EMDEMD	Model module definition
EMDERW	Runway offset
EMDEIN	Command list instruction
EMDETN	Priority tree node

Each of these procedures deletes one item at a time until all of the specified items are deleted. The procedure EMDEIN deletes command list instructions by transferring FIRST ITEM and LAST ITEM to the command list parameter block and then calling the appropriate procedure in the module CLPROC (section 2.14).

The procedure EMRMOV has a second entry point, EMDLET, which copies the FIRST ITEM specification to the LAST ITEM specification prior to proceeding with EMRMOV. This results in only a single item being deleted.

2.12.3 MODULE: EMPRNT

The module EMPRNT consists of procedures which list various items in the environment module data structures. The items to be listed are those which are between the items specified by FIRST ITEM and LAST ITEM in the parameter block.

The procedure EMLIST loads the parameter block with each item to be listed, one at a time, by calling EMFIND (see section 2.12.4). Once loaded, the item is printed by calling EMPRNT, which dispatches to one of the following procedures according to item type:

PROCEDURE	ITEM TYPE
EMPRMD	Model module definition
EMPRRW	Runway offset
CLPRIN	Command list instruction
EMPRTN	Priority tree node

Each of these procedures prints the appropriate item information as it is contained in the parameter block. Note that the procedure CLPRIN is contained in the module CLPROC (section 2.14.1).

All printed data are output by calls to NBLIST, which was discussed in section 2.6.1.

2.12.4 MODULE: EMFIND

The module EMFIND contains procedures which load the parameter block with data from the environment module. The procedure EMFIND retrieves a pointer from FIRST ITEM in the parameter block which points to the item to be loaded. This procedure then dispatches to one of the following procedures which perform the actual data transfer:

PROCEDURE	ITEM TYPE
EMFDMD	Model module definition
EMFDRW	Runway offset
EMFDIN	Command list instruction
EMFDTN	Priority tree node

Two additional procedures are also contained in this module: EMFDSU, which loads the parameter block with the sun vector data, and EMFDDM, which loads the parameter block with a copy of the entire dynamic coordinate system map.

2.12.5 MODULE: EMEXND

The module EMEXND consists of a number of procedures which expand and manipulate various specifications in the parameter block. This module also contains some miscellaneous support procedures.

The procedure EMEXIT is used to expand an item specification. This procedure requires register B to be pointing to the address of the desired specification buffer. The buffer is expanded, using the item name and number found in the designated buffer. This procedure has two additional entry points, EMEXFT and EMEXLT, which assume that the desired specification buffer is FIRST ITEM or LAST ITEM in the parameter block, respectively.

The procedure EMEXIN moves the FIRST ITEM and LAST ITEM specification from the environment parameter block (NBXPAR) to the command list parameter block (NBCPAR) and expands the specifications in the command parameter block.

The procedure EMEXTN expands a priority tree node specification from a node name and number. This procedure is called in a similar manner to EMEXIT above. Its main function is to produce the information required to link one tree node to another tree node in the environment module.

The procedure EMEXTA is similar to EMEXTN, except that the node specification is expanded from the node's module relative offset, rather than from its name and number.

The procedures EMLINK, EMULNK, and EMUNLK are used during priority tree node manipulation to keep track of the tree linkage. The procedure EMLINK generates the linkage between the node being created or modified and its two son nodes. The procedures EMULNK and EMUNLK desolve linkages between a node and its old father. The only difference between EMULNK and EMUNLK is their calling sequences.

2.12.6 MODULE: EMCNVR

The module EMCNVR contains procedures for converting data from one format to another. The following procedures are included:

PROCEDURE	DATA INPUT FORMAT	DATA OUTPUT FORMAT
EMIT2T	Item type (ASCII)	Item type index
EMMD2A	Module definition name	Absolute memory address
EMRW2A	Runway offset name	Absolute memory address
EMIN2A	Command list instruction name	Absolute memory address
EMTN2A	Priority tree node name	Absolute memory address

This module also contains the procedure EMSETU, which sets up the command list parameter block with the information required to enable the command list procedures (CLPROC, section 2.14.1) to access the environment module command list. One of the required pieces of information is the opcode description table address (EM.ODT). It is the opcode description table which controls the scanning and processing of command list instructions. This module contains the opcode description table for the environment command list.

2.13 MODULE GROUP: NSPBLD GROUP MODULE PROCEDURES

The group module procedures generate and manipulate the group data module data structure. These procedures are contained in a single program module, GMPROC (section 2.13.1).

2.13.1 MODULE: GMPROC

The module GMPROC contains all of the procedures required to insert, delete, find, and print a group or group-relative module.

The procedure GMINGM inserts the module definition defined in the parameter block into the group module at the module location specified by FIRST MODULE, relative to the group specified by FIRST GROUP. If the designated group does not yet exist, the group header is created and inserted into the module at the appropriate location (numeric order). The procedure GMINMD is called to insert the actual module definition into the group at the appropriate position relative to the other modules in the group.

The procedure GMRMOV removes a block of module definitions from a designated group. The group is specified by FIRST GROUP in the parameter block. The block of modules to be removed is specified by FIRST MODULE and LAST MODULE in the parameter block. Each module definition is removed one at a time until all of the modules between FIRST MODULE and LAST MODULE, inclusive, have been removed. If this results in an empty group, the group header is also removed.

The procedure GMDLGM is the procedure used by GMRMOV to remove a single group-relative module definition. The module deleted is specified by FIRST GROUP and FIRST MODULE in the parameter block.

The procedure GMPRNT prints a block of group definitions. The groups to be listed are all of those between the groups specified by FIRST GROUP and LAST GROUP, inclusively. Each defined group is listed one at a time, with the group header being listed first, followed by each of the module definitions contained in that group. The listings are generated by successive calls to NBLIST, which constructs the listing from data found in the parameter block by using a listing description table. Refer to section 2.6.1 for a detailed discussion of NBLIST.

GMPRNT uses the procedures GMFDGP and GMFDGM to move the group header and module definitions, respectively, from the group module to the parameter block so that they can be listed.

The procedure GMEXGP is used by the scanner to expand a group specification. The expansion is done by using the group name (number) as the key in searching the current group module for the absolute address of the designated group. The actual search is performed by the procedure GMGP2A, which returns the absolute address. If the group is not defined, GMGP2A sets the NEW GROUP flag in GM.FLG of the parameter block; otherwise, the flag is cleared.

Two additional entry points have been provided for the procedure GMEXGP: GMEXFG and GMEXLG. These two entry points are used by the group module procedures to expand the FIRST GROUP and LAST GROUP specifications without having to resort to the more complicated calling procedure used by the scanner to call GMEXGP.

The procedure GMEXGM (with additional entry points GMEXFM and GMEXLM) is analogous to GMEXGP for the expansion of group-relative module specifications. The expansion is performed by searching a group for the specified module name (number) using GMGM2A which sets the APPEND MODULE flag in GM.FLG of the parameter block if the designated module does not exist; otherwise, the flag is cleared.

In the case of entry points GMEXFM and GMEXLM, the FIRST MODULE and LAST MODULE specifications, respectively, are expanded relative to the group specified by FIRST GROUP.

2.14 MODULE GROUP: NSPBLD COMMAND LIST PROCEDURES

The command list procedures are used to generate and manipulate command lists in the environment and surface data modules. These procedures are contained in a single module CLPROC (section 2.14.1).

2.14.1 MODULE: CLPROC

The module CLPROC contains the procedures required to insert, delete, print, and find instructions within any of the various types of command lists found in the data modules. These procedures use a special parameter block (NBCPAR) to control their operations. This parameter block is similar in function and purpose to the main parameter block (NBXPAR), but it is not overlaid. This enables the various module groups which call procedures within CLPROC to do so without concern for data retention in the main parameter block. See section 2.8.3 for a detailed description of this parameter block.

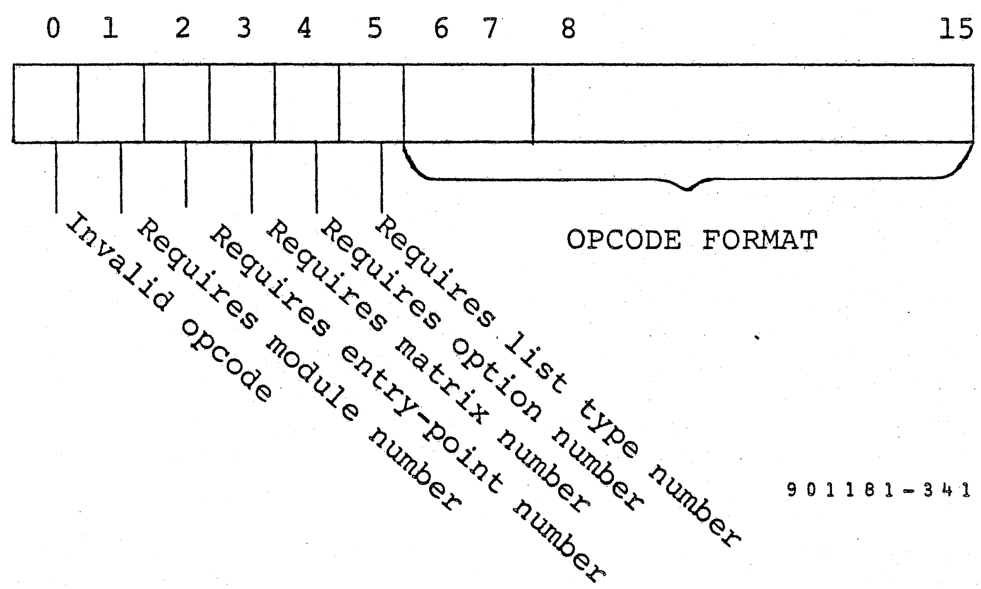
The procedures within CLPROC require three pieces of information before any procedure can be executed properly. These must be loaded into the parameter block as follows:

PARAMETER BLOCK LOCATION	FUNCTION/DESCRIPTION
CL.CMD	Command list address
CL.ACL	Command list length count address
CL.ODT	Opcode description table address

The command list address (CL.CMD) is the address in memory where the command list starts. The command list length count address (CL.ACL) points to the memory location which contains the actual current command list length. The opcode description table address (CL.ODT) points to the opcode description table which defines valid opcodes and instruction formats.

The opcode description table consists of one word of data for each defined opcode. At present, only 21 opcodes (0 through 20) are defined; therefore, the opcode description tables are 21 words long. The opcode is used as an index into this table to retrieve information about the validity and format for a given instruction.

Each opcode description table entry is of the following format:



The bit flags (bits 0 through 5) are used by the scanner to determine which data items to request from the modeler when a specific instruction is selected. The opcode format field is used internally to control the packing or unpacking processes performed when the instruction is moved between the parameter block and the command list. The various instruction formats are as follows:

FORMAT 0

10	11 15
0	OPCODE

FORMAT 1

	7 10	11 15
0	MTX #	OPCODE

FORMAT 2

	7 10	11 15
0	OPT #	OPCODE

FORMAT 3

	3 6	7 10	11 15
0	ENTRY POINT	MOD #	OPCODE

FORMAT 4

	5 6	7 10	11 15
0	LIST TYPE	MOD #	OPCODE

FORMAT 5

	3 6	7 10	11 15
0	ENTRY POINT	0	OPCODE

FORMAT 6

	5 6	7 10	11 15
0	3	0	OPCODE

Key:

OPCODE = instruction opcode (0 through 20)
MTX # = matrix number
OPT # = option number
ENTRY POINT = entry-point number
MOD # = module number
LIST TYPE = command list type number
0 = face
1 = edge
2 = light
3 = environment

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For examples of opcode description tables, see the listings of modules EMCNVR and SMCMDL.

The procedure CLININ inserts the instruction defined in the parameter block and specified by the FIRST INSTRUCTION specification in the parameter block into the current command list. This procedure uses data from the opcode description table to pack the instruction data and allocate space in the command list.

The procedure CLDLIN deletes a block of instructions from the current command list. The instructions are removed one at a time and the command list is then compressed. The block of instructions to be retrieved is specified by FIRST INSTRUCTION and LAST INSTRUCTION, inclusively.

The procedure CLPRIN lists the instruction currently contained in the parameter block.

The procedure CLFDIN moves the instruction specified by FIRST INSTRUCTION in the parameter block from the command list to the parameter block. This procedure uses information from the opcode description table to unpack the instruction data.

The procedure CLEXIN expands an instruction specification by using the instruction name (number) found in the specification buffer and the current command list and opcode description table. This procedure has two additional entry points, CLEXFI and CLEXLI, which assume that the specification buffer is FIRST INSTRUCTION or LAST INSTRUCTION in the parameter block, respectively.

The procedure CLEXMN expands the mnemonic definition in the parameter block by using the ASCII mnemonic and the current opcode description table. A second entry point, CLNBMN, is supplied to allow the scanner to call this procedure.

The procedure CLEXOP expands the mnemonic definition in the parameter block by using the opcode and the opcode description table. A second entry point, CLNBOP, is provided for calling this procedure from the scanner.

A group of procedures is included in this module (CLPROC) to facilitate the conversion of data from one form to another. These procedures are as follows:

PROCEDURE	INPUT FORM	OUTPUT FORM
CLIN2A	Instruction number	Absolute memory address
CLOP2M	Opcode	ASCII mnemonic
CLM2OP	ASCII mnemonic	Opcode
CLOP2F	Opcode	Opcode description table entry data
CLF2LN	Opcode description table entry data	Instruction length (in words)

2.15 MODULE GROUP: MODULE-TO-MODULE TRANSFORM PROCEDURES

These modules contain the handlers for the module-to-module rotate and translate functions. These functions provide the user the capability of imparting Z rotations about the model space origin or 3-D translations to resident models.

The rotate function is entered from the command scanner as shown in figure 2-28. The scanner converts the rotation angle and stores it in degrees, at location MM.ANG in the module-to-module parameter block (MBMPAR) prior to dispatch. The angle is also stored in parts of a circle at location MM.CIR of MBMPAR. For all light strings, the first point vector, at location LM.FXX in parameter block NBXPAR, is transformed as follows:

XN (B22) = XO*COSTH - YO*SINTH

YN (B22) = XO*SINTH + YO*COSTH

where XO, YO is the old (untransformed) vector, scaled B22; SINTH is the sine of the rotate angle and COSTH is the cosine, both scaled B0. The same algorithm is used to transform the delta vector at location LM.DXX.

For linear strings, the following algorithm is used to transform the direction angle:

LM.DAA = LM.DAA + MM.ANG.

For surface modules, the rotation transformation is imparted to first point (SM.V1X, SM.V1Y) and second point (SM.V2X, SM.V2Y) for all edges in the module. The symmetrical surface vector and all priority tree nodes, which reside in the module header, are also transformed.

The translate function is entered from the command scanner as shown in figure 2-28. The scanner converts the translate vector and stores its three components into the module-to-module parameter block (NBMPAR) at locations MM.TRX, MM.TRY, and MM.TRZ, scaled B22. For strings, the first point vector is translated as follows:

```
LM.FXX = LM.FXX + MM.TRX    (B22)
LM.FYY = LM.FYY + MM.TRY    (B22)
LM.FZZ = LM.FZZ + MM.TRZ    (B22)
```

For surfaces, the first point vector and second point vector for all edges are translated as follows:

```
SM.V1X = SM.V1X + MM.TRX    (B22)
SM.V1Y = SM.V1Y + MM.TRY    (B22)
SM.V1Z = SM.V1Z + MM.TRZ    (B22)
```

Similarly, the second point is translated:

```
SM.V2X = SM.V2X + MM.TRX    (B22)
SM.V2Y = SM.V2Y + MM.TRY    (B22)
SM.V2Z = SM.V2Z + MM.TRZ    (B22)
```

Finally, the symmetrical surface vector and all priority tree nodes are translated. To translate the priority tree nodes, the distance component of the normal is translated as follows:

$$D(T) = D(I) + (T \bullet N(I)) \quad (B22)$$

The translate vector is dotted with the separating plane normal and the resulting scalar is added to the original distance component to produce the new distance component.

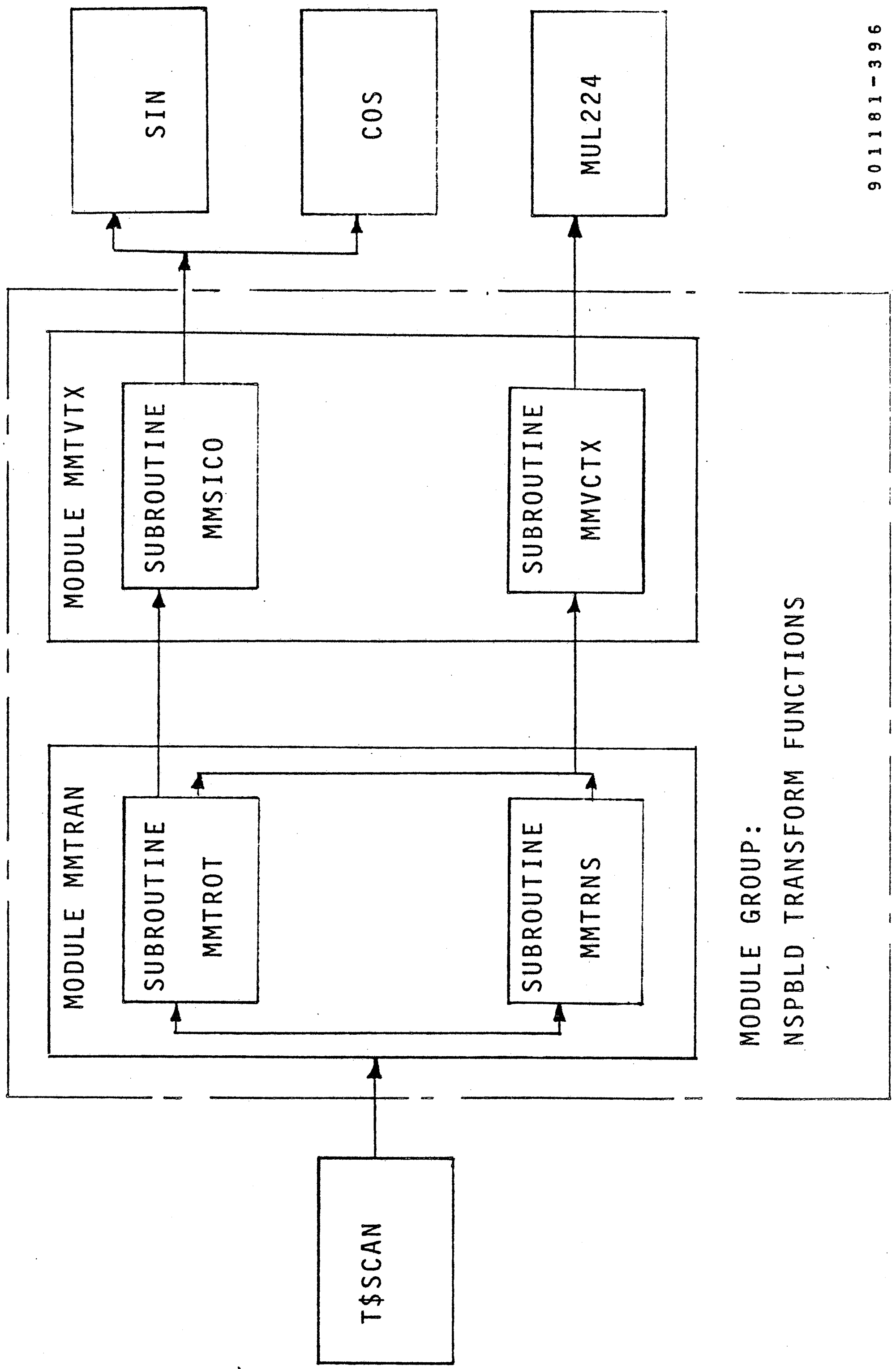


FIGURE 2-28
MODULE-TO-MODULE TRANSFORM FUNCTION BLOCK DIAGRAM

2.15.1 MODULE MMTRAN

This module contains the main control procedures for the transform functions. All module rotates enter through location MMTROT. Procedure MMSICO is called to set up the matrix of the rotation, and then separate loops are established for lights and surfaces. All module translates enter through location MMTRNS, before the common loops are entered for lights or surfaces which perform the transformations as described above.

2.15.2 MODULE MMTVTX

This module contains two subroutines which support the module-to-module transform functions. Subroutine MMVCTX is called to perform some transformation, either a rotation or translation, depending on the setting of bit TRNFLG in flag word FLAGS. At entry, register A contains a pointer to a vector to be transformed.

Subroutine MMSICO loads the rotation angle (MM.CIR) into register A and calls procedure ROT2DM to set up the matrix for the rotation. The routine also clears the translate flag, TRNFLG, in flag word FLAGS.

2.16 MODULE GROUP: NSPMER MERGE PROCEDURES

These modules contain the handler for the NSPBLD module-to-module merge function and associated subroutines. The main handler routines are contained in module MMERGE, described in section 2.16.8. A general functional block diagram of the merge function is shown in figure 2-29 below.

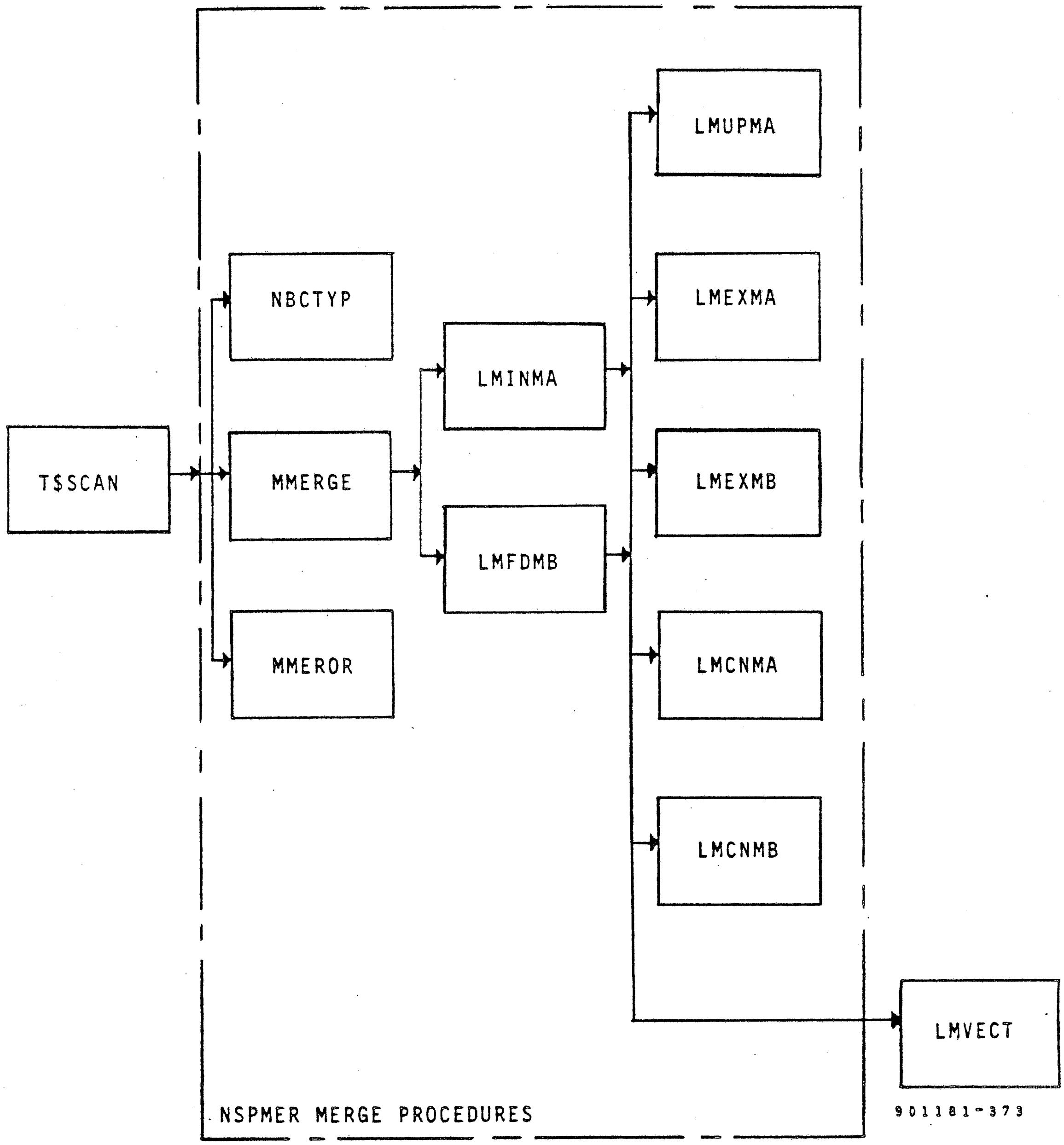


FIGURE 2-29
MERGE FUNCTION BLOCK DIAGRAM

2.16.1 MODULE: NBMMSC

The module NBMMSC performs the same functions for NSPMER as the module NBMISC performs for NSPBLD (see section 2.6). However, since the function of NSPMER is not as complicated as NSPBLD, not as many miscellaneous scan procedures are required. The following procedures are included in this module:

PROCEDURE	FUNCTION
NBCDEV	Check device name
NBSAME	Compare two values in memory
LBSTAT	Output light module statistics
SMSTAT	Output surface module statistics

The procedures NBCDEV and NBSAME are identical to the procedures of the same names in NBMISC. The procedures LMSTAT and SMSTAT are identical to the procedures of the same name in NBMISC, except that all data module references (NBXMOD) have been changed to reference data module A' (NBAMOD).

2.16.2 MODULE: NBCTYP

This module checks module types for the module-to-module merge function.

Calling sequence

@BRL NBCTYP

No parameters are passed to NBCTYP in registers and none are returned. Registers A and E are destroyed.

Subroutine description

This subroutine is called to verify that the two resident modules to be merged are of the same type. They both must be either light string modules or surface modules. If the modules are different types or if they are neither light string nor surface modules, bit 9 (ERR..F) of error flag word T$FLAG is set. If both module types are determined to be valid, error flag ERR..F is cleared.

2.16.3 MODULE: MERTRE

The module MERTRE contains the entire NSPMER scan tree. The tree consists of two segments: the first, T$TREE, is the main program control loop; the second, MM$MER, performs the merge operation by requesting two input modules and then performing the merge operation. If the merge is successful, an output file is requested and the composite module is written out to that file.

Refer to section 2.3.1 for details about the operation of the scanner and the function of each scan item in the scan tree.

2.16.4 MODULE: MERMSG

The module MERMSG contains the text fragments used by the scanner for the merge function. This module also contains the NSPMER program message which includes the program release and version numbers.

The module MERMSG performs the same function for NSPMER as NBDWHO performs for NSPBLD, so far as program configuration is concerned. Refer to section 2.7.1 for a description of the form and function of the various configuration tables.

2.16.5 MODULE: MERPAR

The module MERPAR contains the merge function parameter block definition used by NSPMER. This parameter block is non-overlaid and is used with NBXPAR to form the complete NSPMER parameter block. Table 2-14 below describes the merge function parameter block:

NAME	SIZE	SCALE	DESCRIPTION
MM.ERR	1	B15	Error code word
MM.IN1	6	-	First input file
MM.IN2	6	-	Second input file
MM.OUT	6	-	Output file

TABLE 2-14
MERPAR DESCRIPTION TABLE

2.16.6 MODULE: NBAMOD

The module NBAMOD defines the first data module buffer used by NSPMER. This buffer contains two overlaid module definitions as follows:

MODULE	DESCRIPTION
SA.MOD	Surface data module
LA.MOD	Light data module

This buffer is used to hold the data module read-in from the first input file during the merge operation. This is also the buffer used to hold the composite data module. See tables 2-15 and 2-16 for a description of these two modules.

NAME	SIZE	SCALE	DESCRIPTION
SA.IDT	4	-	Surface module identifier
SA.FEP	8	8*B15	Face entry pointers
SA.EEP	8	8*B15	Edge entry pointers
SA.TRE	5*9	-	Priority tree
SA.SUR	4	-	Symmetrical surface vector
SA.CEN	1	-	Centerline stripes
SA.AFC	1	B15	Actual face count
SA.AEC	1	B15	Actual edge count
SA.ANC	1	B15	Actual node count
SA.AFL	1	B15	Actual face command list length
SA.AEL	1	B15	Actual edge command list length
SA.FCM	16	-	Face command list
SA.ECM	16	-	Edge command list
SA.FAC	64*15	-	Face blocks
SA.EDG	64*15	-	Edge blocks
SA.SUM	1	B16	Checksum

TABLE 2-15
SA.MOD DESCRIPTION TABLE

NAME	SIZE	SCALE	DESCRIPTION
LA.IDT	4	-	Light module identifier
LA.SEP	8	8*B15	Light entry pointers
LA.FLS	6*4+1	-	Flashing strings
LA.ROT	4*3+1	-	Rotating strings
LA.VAS	2*4+1	-	VASI strings
LA.STB	6*18+1	-	Strobe strings
LA.SWT	32	32*B15	Switch pointers
LA.SSP	110	-	Switch string pointers
LA.AFC	1	B15	Actual flashing count
LA.ARC	1	B15	Actual rotating count
LA.AVC	1	B15	Actual VASI count
LA.ASC	1	B15	Actual strobe count
LA.TLR	1	B15	Total lights, red
LA.TLO	1	B15	Total lights, orange
LA.TLA	1	B15	Total lights, amber
LA.TLW	1	B15	Total lights, white
LA.TLG	1	B15	Total lights, green
LA.TLL	1	B15	Total lights, all colors
LA.TSR	1	B15	Total strings, red
LA.TSO	1	B15	Total strings, orange
LA.TSA	1	B15	Total strings, amber
LA.TSW	1	B15	Total strings, white
LA.TSG	1	B15	Total strings, green
LA.ALC	1	B15	Total string count
LA.RED	1	B15	First red string
LA.ORG	1	B15	First orange string
LA.AMB	1	B15	First amber string
LA.WHT	1	B15	First white string
LA.GRN	1	B15	First green string
LA.NAS	1	B15	Next available string
LA.ALL	1	B15	Actual command list length
LA.CMD	8	8*B15	Light command list
LA.LIT	110*15	-	String blocks
LA.SUM	1	B16	Checksum

TABLE 2-16
LA.MOD DESCRIPTION TABLE

2.16.7 MODULE: NBBMOD

The module NBBMOD defines the second data module buffer used by NSPMER. This buffer contains two overlaid module definitions as follows:

MODULE	DESCRIPTION
SB.MOD	Surface data module
LB.MOD	Light data module

This buffer is used to hold the data module read-in from the second input file during the merge operation. Tables 2-17 and 2-18 describe these two modules.

NAME	SIZE	SCALE	DESCRIPTION
SB.IDT	4	-	Surface module identifier
SB.FEP	8	8*B15	Face entry pointers
SB.EEP	8	8*B15	Edge entry pointers
SB.TRE	5*9	-	Priority tree
SB.SUR	4	-	Symmetrical surface vector
SB.CEN	1	-	Centerline stripes
SB.AFC	1	B15	Actual face count
SB.AEC	1	B15	Actual edge count
SB.ANC	1	B15	Actual node count
SB.AFL	1	B15	Actual face command list length
SB.AEL	1	B15	Actual edge command list length
SB.FCM	16	-	Face command list
SB.ECM	16	-	Edge command list
SB.FAC	64*15	-	Face blocks
SB.EDG	64*15	-	Edge blocks
SB.SUM	1	B16	Checksum

TABLE 2-17
SB.MOD DESCRIPTION TABLE

NAME	SIZE	SCALE	DESCRIPTION
LB.IDT	4	-	Light module identifier
LB.SEP	8	8*B15	Light entry pointers
LB.FLS	6*4+1	-	Flashing strings
LB.ROT	4*3+1	-	Rotating strings
LB.VAS	2*4+1	-	VASI strings
LB.STB	6*18+1	-	Strobe strings
LB.SWT	32	32*B15	Switch pointers
LB.SSP	110	-	Switch string pointers
LB.AFC	1	B15	Actual flashing count
LB.ARC	1	B15	Actual rotating count
LB.AVC	1	B15	Actual VASI count
LB.ASC	1	B15	Actual strobe count
LB.TLR	1	B15	Total lights, red
LB.TLO	1	B15	Total lights, orange
LB.TLA	1	B15	Total lights, amber
LB.TLW	1	B15	Total lights, white
LB.TLG	1	B15	Total lights, green
LB.TLL	1	B15	Total lights, all colors
LB.TSR	1	B15	Total strings, red
LB.TSO	1	B15	Total strings, orange
LB.TSA	1	B15	Total strings, amber
LB.TSW	1	B15	Total strings, white
LB.TSG	1	B15	Total strings, green
LB.ALC	1	B15	Total string count
LB.RED	1	B15	First red string
LB.ORG	1	B15	First orange string
LB.AMB	1	B15	First amber string
LB.WHT	1	B15	First white string
LB.GRN	1	B15	First green string
LB.NAS	1	B15	Next available string
LB.ALL	1	B15	Actual command list length
LB.CMD	8	8*B15	Light command list
LB.LIT	110*15	-	String blocks
LB.SUM	1	B16	Checksum

TABLE 2-18
LB.MOD DESCRIPTION TABLE

2.16.8 MODULE: MMERGE

This module contains the handler for the module-to-module merge function. It is called by the scanner (T$SCAN) to merge two resident light string modules or two resident surface modules.

Calling sequence

@BRL MMERGE

No parameters are passed to MMERGE in registers and none are returned. Registers are not preserved by MMERGE.

Subroutine description

The routine first determines whether it must merge surface modules or light string modules. In both cases, module limits are next checked. For light strings, the merged module must fall within the following limits:

Total number of flashing lights ≤ 6
Total number of strobes ≤ 6
Total number of rotating lights ≤ 4
Total number of VASIs ≤ 2
Total number of strings ≤ 110

For surfaces, the merged module must fall within the following limits:

Total number of edges ≤ 64
Total number of faces ≤ 64

For light string modules, a loop is set up to merge all strings from module B, in module buffer LB.MOD, into module A, in module buffer LA.MOD. For each "B" string, subroutines LBEXAN, LBFIND, and LAEXFC are called to set up the parameter block for the string, and subroutine LAINSR is called to insert the "B" string into module A. When all "B" strings have been merged, all entry pointers and end bits are cleared in module A.

For surfaces, after the limit checks are accomplished, the symmetrical surface specifications, entry pointers, priority tree, and command list entries are all cleared in module A. Then all edges from module B are appended to module A, and all "B" faces are appended to module A after the "B" edge references are adjusted. Finally, the END bits and ECP bits are cleared in module A.

2.16.9 MODULE: MMEROR

This module contains all error message definitions for the module-to-module merge function, and a subroutine which decodes the error type and prints the appropriate message.

Calling sequence

@BRL MMEROR

No parameters are passed to MMEROR in registers and none are returned. Registers X, M, and S are destroyed.

Subroutine description

The error code word, MM.ERR, is used as an index to access the message address from the message address table, MSGADR. This address is loaded into register M for subroutine DATAO which is called to output the appropriate message. After the message is printed, control is returned to the caller.

2.16.10 MODULE: LMINMA

The module LMINMA contains procedures for inserting items into the various light module data structures. These procedures refer to data in the parameter block to determine which item or items are to be inserted. The data to be used within an item are also located in the parameter block.

The procedure LAINSR inserts the light string defined in the parameter block into light module A, as indicated by the FIRST STRING specification in the parameter block. The procedure dispatches to the appropriate insert procedure according to light type.

The various types of light strings are inserted by the following procedures:

PROCEDURE	LIGHT TYPE
LAINFS	Flashing light
LAINRT	Rotating light
LAINVS	VASI
LAINST	Strobe
LAINLT	Normal light

The first four procedures move and pack the appropriate light characteristic data from the parameter block to the next available data block of the appropriate type within the light module. These four procedures then call LAINLT to insert the standard string block description into the light module according to the FIRST STRING specification in the parameter block.

VASI strings require special processing since a single VASI data block points to several strings. For this reason, several flags within LM.FLG in the parameter block are used to keep track of the VASI blocks which have been inserted and the completeness of the VASI group definition.

The procedure LAINSW is called by LAINLT to generate an appropriate switch entry for those strings which have a switch number ≠ Ø. This procedure manages both switch list pointers and the switch string pointer entries of the switch lists.

2.16.11 MODULE: LMFDMB

The module LMFDMB contains procedures for loading the parameter block with the data contained in the string block specified by FIRST STRING in the parameter block. These procedures also load data from any of the other various types of data blocks which point to the desired string block.

The procedure LBFIND searches the light module B data structures and moves all data pertaining to the specified light string (FIRST STRING) to the parameter block. This is accomplished by calls to the remaining procedures in this module.

The procedure LBFDLT unpacks and moves the string block data to the parameter block. The procedure LBFDSW searches the switch data structure for switch string pointers which point to the desired string block. If a pointer is found, the switch number is moved to the parameter block along with the memory address of the switch string pointer. This procedure has a second entry point, LBFDSV, which is used to search for switch string pointers that point to VASI data blocks. The entry point is used by LBFDVS which is discussed later.

The following procedures are used to search the special light characteristic lists for any data blocks which point to the desired string block:

PROCEDURE	LIGHT TYPE
LBFDFS	Flashing
LBFDRT	Rotating
LBFDST	Strobe
LBFDVS	VASI

These four routines are called in the order listed above. If any of these routines are successful in their respective search, the remaining routines are not called. In addition to loading the parameter block with the data from the data block, if one is found, these four procedures load the appropriate pointer in the parameter block with the memory address of the data block itself.

The procedure LBFDVS has a slightly different search strategy from LMFDFS, etc. Since VASI strings appear in groups, this procedure searches for a VASI data block that defines a VASI group which contains the desired string. This procedure also sets three bit flags found in LM.FLG of the parameter block. These flags indicate the following:

FLAG NAME	INTERPRETATION
LMBVAS	First string of new VASI group
LMBVNC	First string of either VASI color
LMBVSC	This string is of the second VASI color

2.16.12 MODULE: LMUPMA

The module LMUPMA contains procedures for maintaining the light module A data structures. These procedures are used whenever a data block is inserted.

The procedure LAUPDT is the main procedure used in maintaining all pointers which point into the string block list. These pointers must be updated each time a new string block is added:

PROCEDURE TO PERFORM UPDATE	POINTER TO BE UPDATED
LMUPLP	Flashing string block pointers
LMUPLP	Rotating string block pointers
LMUPVP	VASI string block color pointers
LMUPLP	Strobe string block pointers
LMUPSW	Switch string block pointers
LMUPCP	Color pointers

Each set of pointers is updated by a call to the appropriate procedure listed above.

In addition to the above procedures, several additional procedures are included in this module for use during insertion of data blocks other than string blocks. The procedure LMUPSV is used to update the switch string pointers which point to VASI blocks when a VASI block is inserted.

The procedure LMUPSP is used to update the switch list pointers whenever a new switch string pointer is inserted.

2.16.13 MODULE: LMEXMA

The module LMEXMA contains procedures for manipulating and expanding the FIRST STRING and LAST STRING specification in the parameter block with respect to light module A.

The procedure LAEXCL expands a string specification by using the color name and color-relative string number found in the string specification. This is a general routine called by the scanner with register B pointing to the address of the string specification buffer. Therefore, this routine can be used to expand a string specification anywhere in memory. Two additional entry points have been provided: LAEXFC and LAEXLC. These two entry points facilitate the calling of this routine when the FIRST STRING or LAST STRING specification, respectively, is to be expanded.

The procedure LAEXSA expands the FIRST STRING specification by using the absolute memory address of the string block found in LM.FSA of the parameter block. The procedure LAEXAN performs a similar function, except that it uses the absolute string number found in LM.FAN as the basis for the expansion.

The procedure LMSWFL is identical to the procedure of the same name found in module LMCNEX (section 2.10.6). It is included here for convenience.

2.16.14 MODULE: LMEXMB

The module LMEXMB contains procedures for manipulating and expanding the FIRST STRING and LAST STRING specification in the parameter block with respect to light module B.

The procedure LBEXCL expands a string specification by using the color name and color-relative string number found in the string specification. This is a general routine called by the scanner with register B pointing to the address of the string specification buffer. Therefore, this routine can be used to expand a string specification anywhere in memory. Two additional entry points have been provided: LBEXFC and LBEXLC. These two entry points facilitate the calling of this routine when the FIRST STRING or LAST STRING specification, respectively, is to be expanded.

The procedure LBEXSA expands the FIRST STRING specification by using the absolute memory address of the string block found in LM.FSA of the parameter block. The procedure LBEXAN performs a similar function, except that it uses the absolute string number found in LM.FAN as the basis for the expansion.

2.16.15 MODULE: LMCNMA

The module LMCNMA contains procedures for converting various data items from one form to another.

The following list of procedures is used to convert a light string reference from one form to another with respect to the current light module A in memory (NBAMOD).

PROCEDURE	INPUT FORM	OUTPUT FORM
LAA2CR	Absolute memory address	Color and color-relative number
LAA2SN	Absolute memory address	Absolute string number
LACR2A	Color and color-relative number	Absolute memory address
LASN2A	Absolute string number	Absolute memory address

The absolute memory address form is a single value that is used within the program to access string blocks. The absolute string number is a number from 0 to 109 which is used to generate switch string pointers that use string numbers rather than module-relative offsets, as do the other pointers in the light module. The color-relative string number form consists of a color number (0 through 4) and a string number relative to the start of that color in the string block list. The color-relative string numbering begins at 1 instead of a 0, as in the case of absolute string numbers.

The procedures LMC2CN, LMCN2C, and LML2LN are not module dependent. These procedures are identical to the procedures of the same name found in module LMCNVR (section 2.10.7). They are included in this module for convenience.

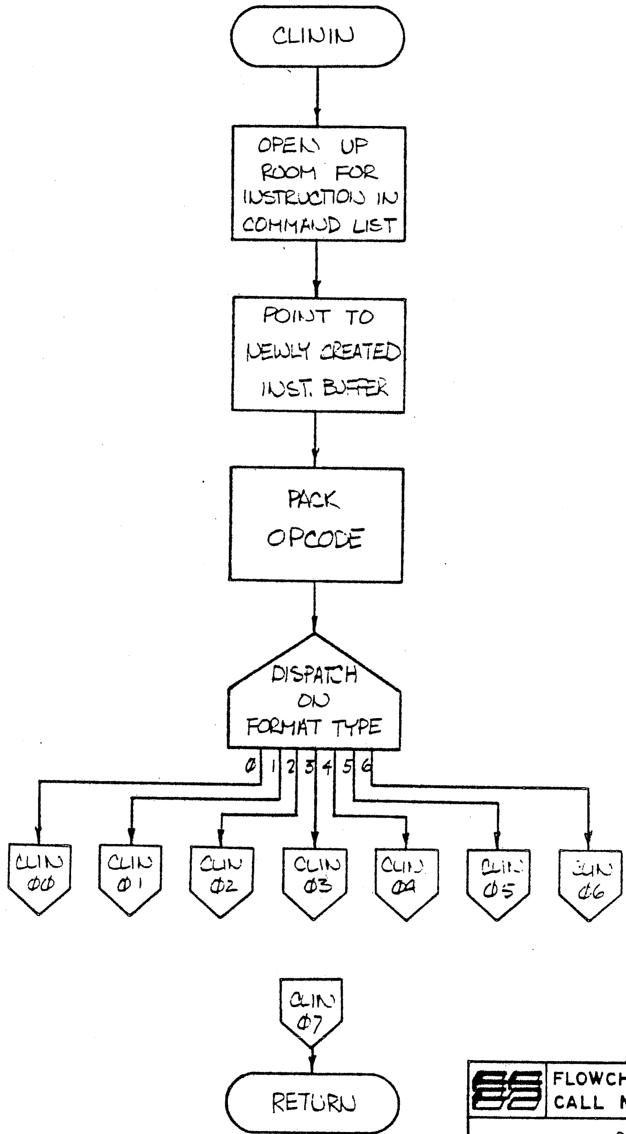
2.16.16 MODULE: LMCNMB

The module LMCNMB contains procedures for converting various data items from one form to another.

The following list of procedures is used to convert a light string reference from one form to another with respect to the current light module B in memory (NBBMOD).

PROCEDURE	INPUT FORM	OUTPUT FORM
LBA2CR	Absolute memory address	Color and color-relative number
LBA2SN	Absolute memory address	Absolute string number
LBCR2A	Color and color-relative number	Absolute memory address
LBSN2A	Absolute string number	Absolute memory address

The absolute memory address form is a single value which is used within the program to access string blocks. The absolute string number is a number from 0 to 109 which is used to generate switch string pointers that use string numbers rather than module-relative offsets, as do the other pointers in the light module. The color-relative string number form consists of a color number (0 through 4) and a string number relative to the start of that color in the string block list. The color-relative string numbering begins at 1 instead of at 0, as in the case of absolute string numbers.



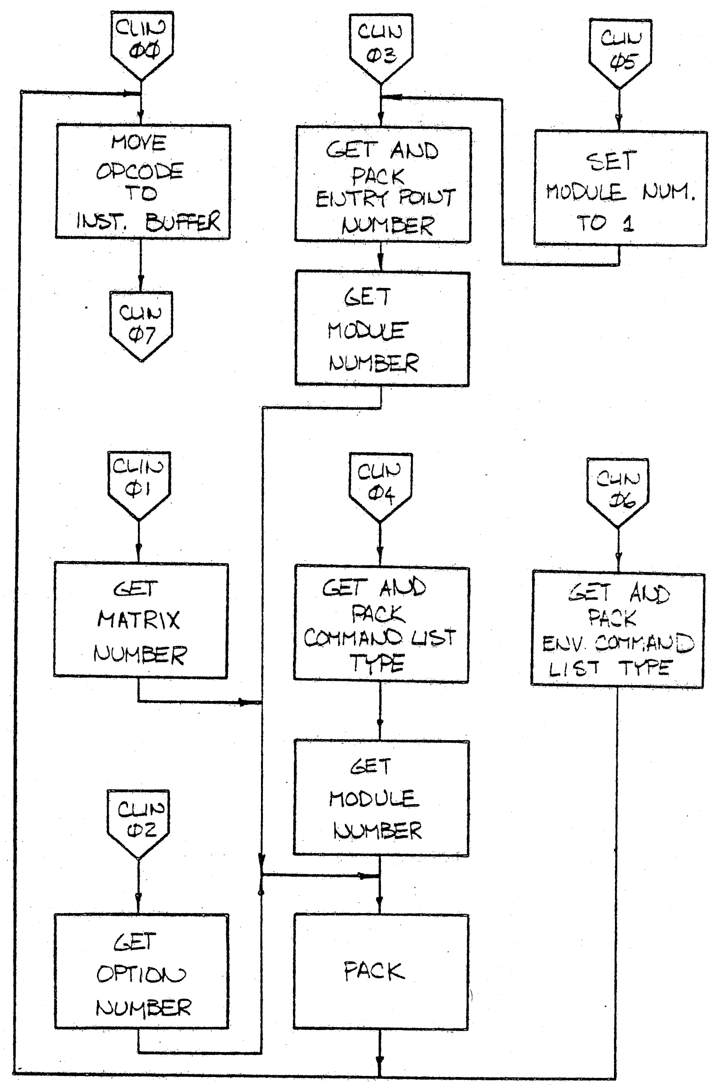
FLOWCHART
CALL NAME: NBCLPROC

ANALYST: W.R. | MODULE: CLPROC
DRAWN BY: W.R. | PN: [illegible]
SHEET 1 OF 14 | RELEASE: Ø2
VERSION: Ø1
REVISION: [illegible]

NOTES:
SUBROUTINE:
CLININ

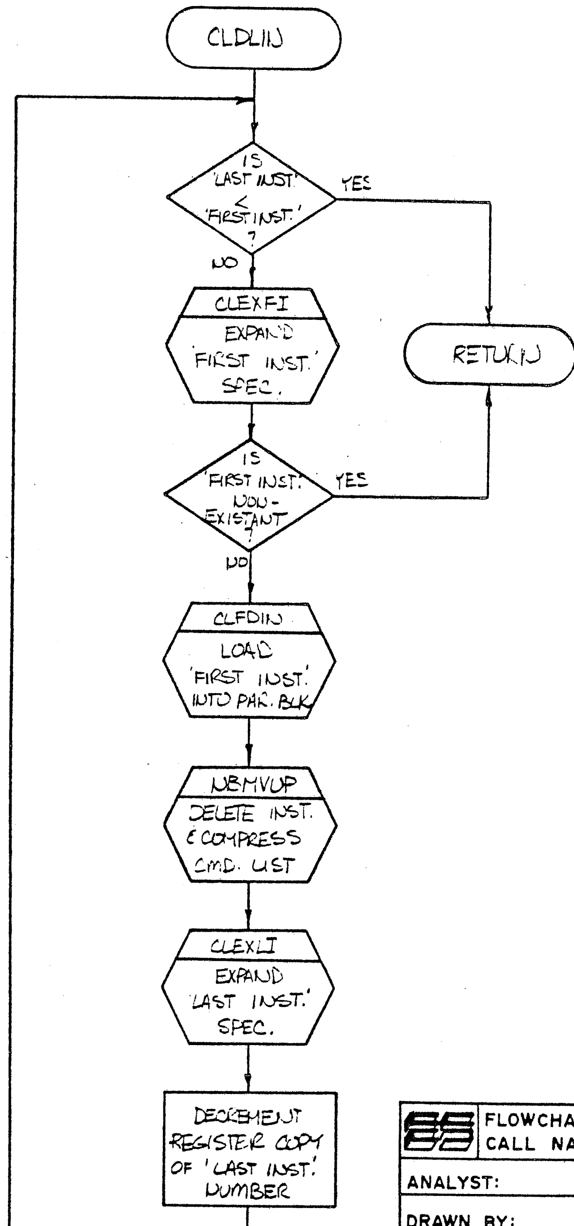
SYSTEM: NSP

FORM 5-018-0



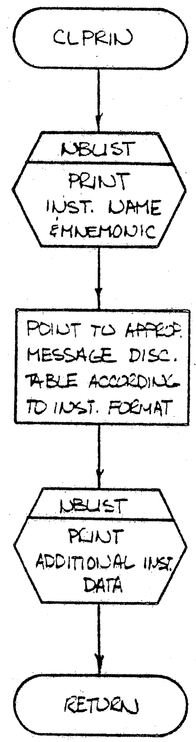
FLOWCHART CALL NAME: NBCLPROC	
ANALYST:	MODULE:
DRAWN BY:	PN:
SHEET 2 OF 14	RELEASE:
NOTES: SUBROUTINE: CLIN (CONTINUED)	VERSION: / REVISION:
SYSTEM: NSP	

FORM 5-018-0



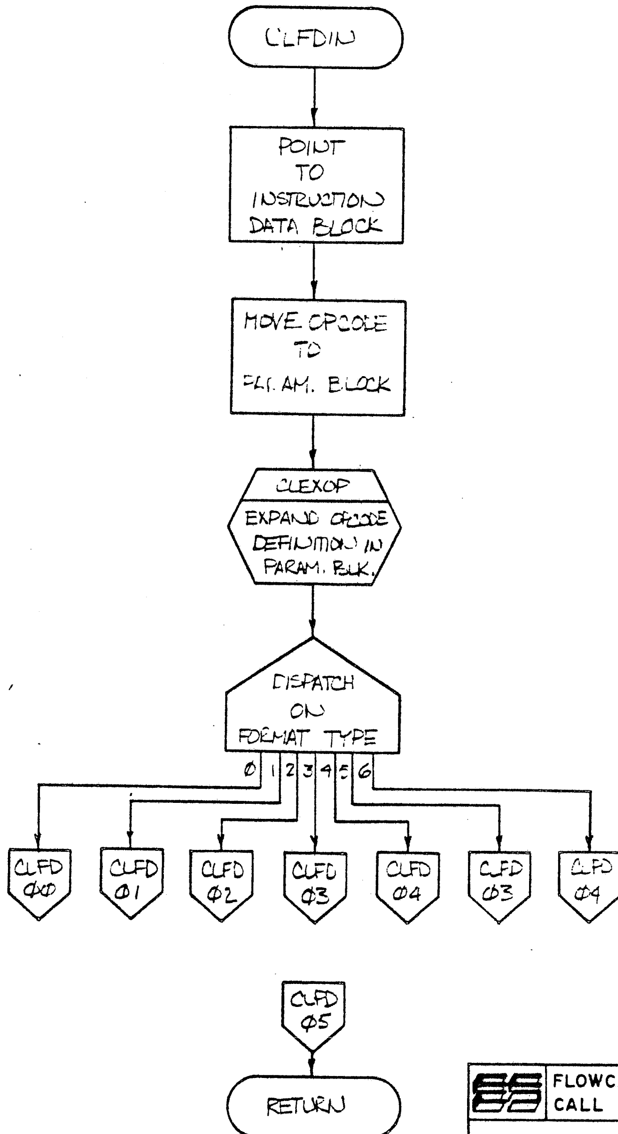
FLOWCHART CALL NAME: NBCLPROC	
ANALYST:	MODULE:
DRAWN BY:	PN:
SHEET 3 OF 14	RELEASE:
NOTES: SUBROUTINE: CLDLIN	VERSION: REVISION:
SYSTEM: NSP	

FORM 5-018-0



FLOWCHART CALL NAME: NBCLPLOC	
ANALYST:	MODULE:
DRAWN BY:	PN:
SHEET 4 OF 14	RELEASE:
NOTES: SUBROUTINE CLPRIN	VERSION:
	REVISION:
SYSTEM: NSP	

FORM 8-018-0

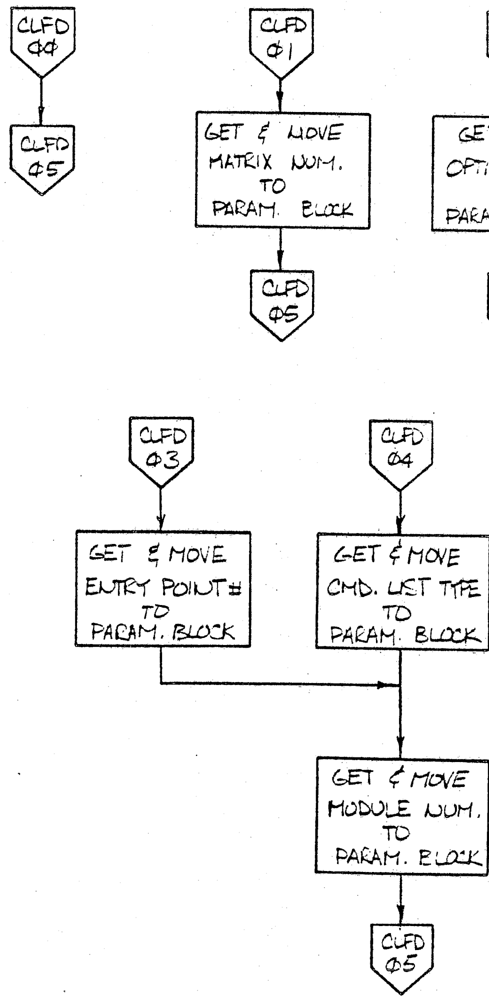


FLOWCHART
CALL NAME: NBCLFCUC

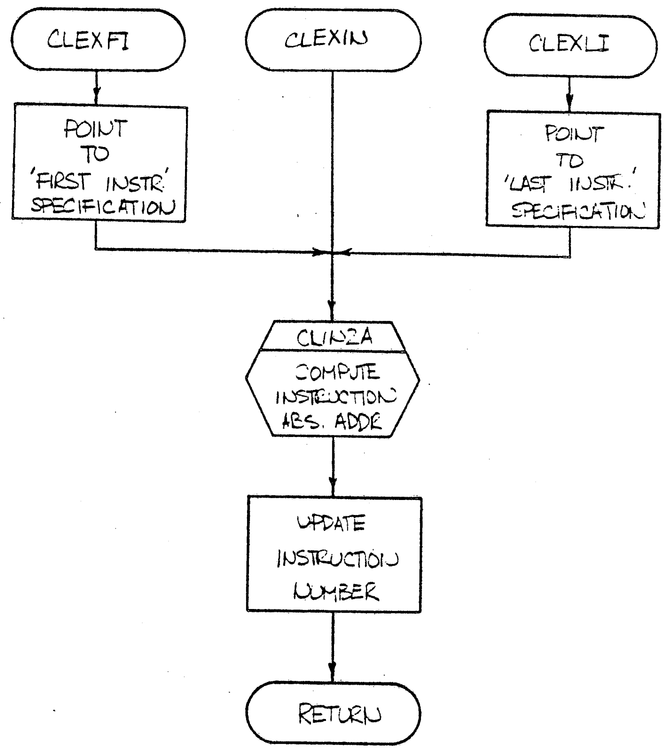
ANALYST:	MODULE:
DRAWN BY:	PN:
SHEET 5 OF 14	RELEASE:
NOTES: SUBROUTINE: CLFDIN	VERSION:
	REVISION:

SYSTEM: NSP

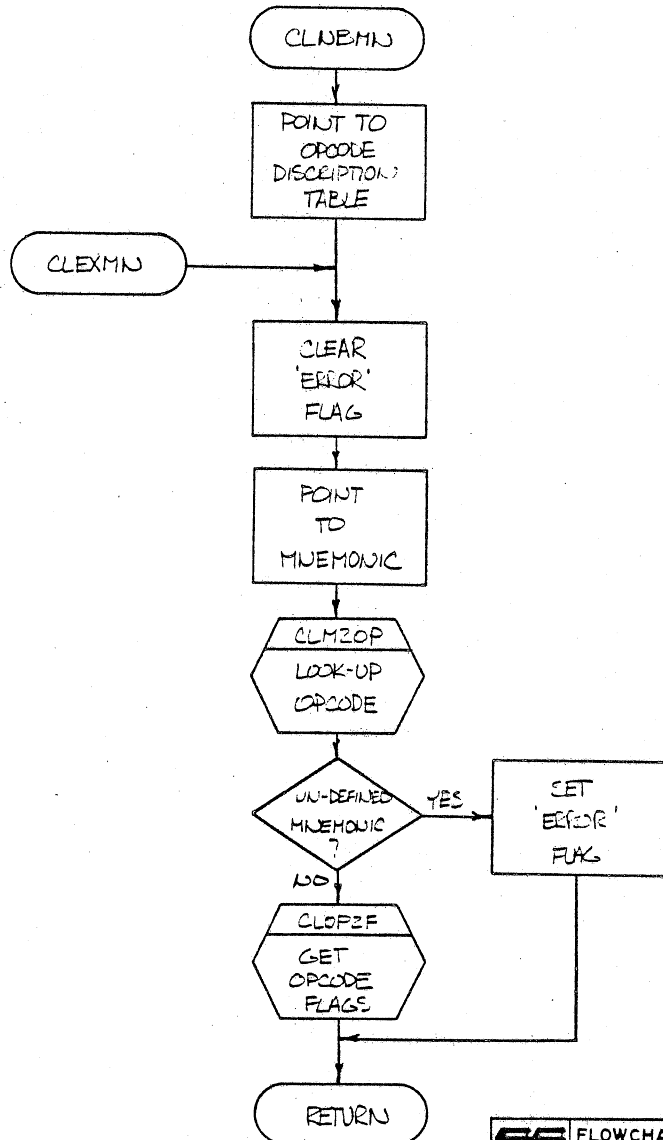
FORM 5-018-0



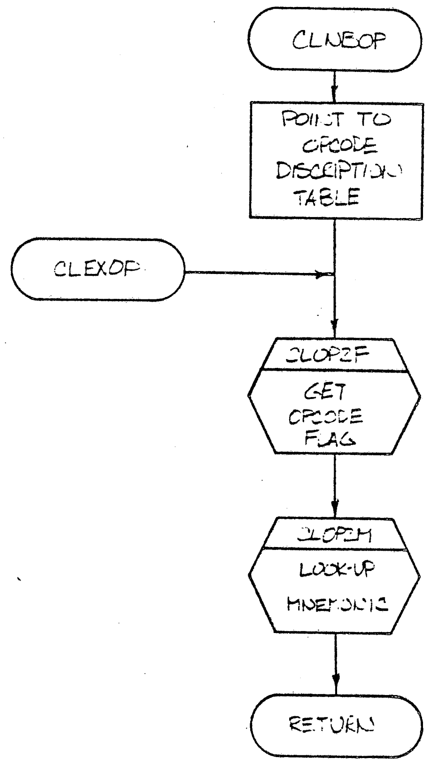
FLOWCHART CALL NAME: NBCLPLOC	
ANALYST:	MODULE:
DRAWN BY:	PN:
SHEET 6 OF 14	RELEASE:
NOTES: SUBROUTINE;	VERSION:
	REVISION:
CLFDIN (CONTINUED)	
SYSTEM: NSP	
FORM 5-018-0	



FLOWCHART CALL NAME: NBCLPEUC	
ANALYST:	MODULE:
DRAWN BY:	PN:
SHEET 7 OF 14	RELEASE:
NOTES: SUBROUTINES:	VERSION:
	REVISION:
CLEXIN, CLEXFI, CLEXLI	
SYSTEM: NSP	
FORM 5-018-0	

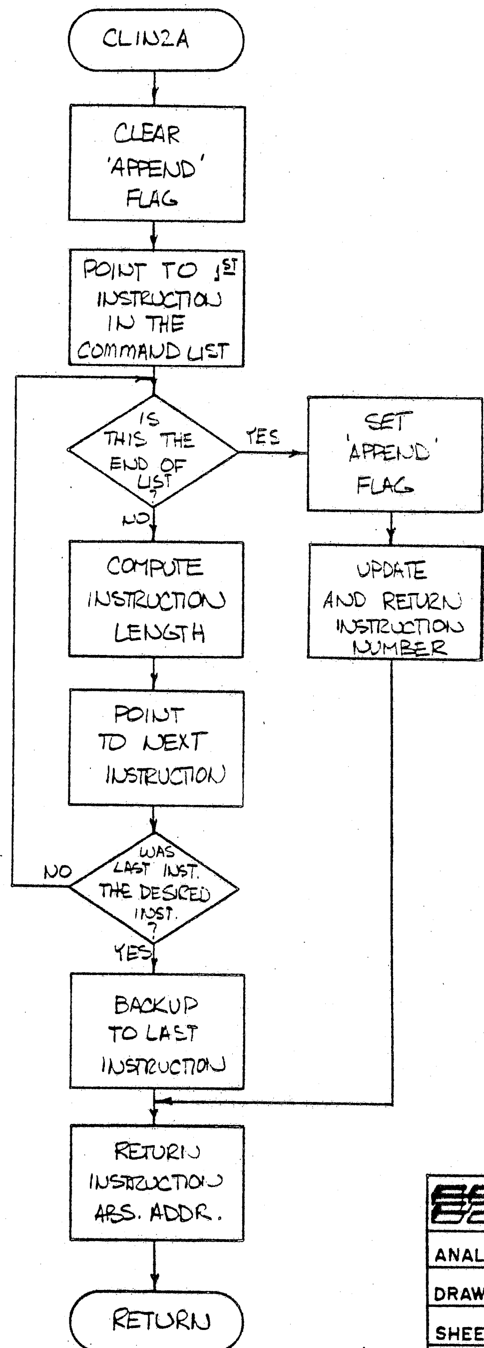


FLOWCHART CALL NAME: NB CLPROC	
ANALYST:	MODULE:
DRAWN BY:	PN:
SHEET 8 OF 14	RELEASE:
NOTES: SUBROUTINES:	VERSION:
	REVISION:
CLEXMN, CLNBMN	
SYSTEM: NSP	
FORM 5-018-0	

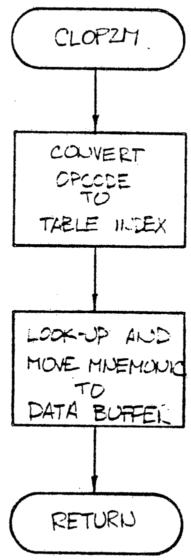


FLOWCHART CALL NAME: NBCLPROC	
ANALYST:	MODULE:
DRAWN BY:	PN:
SHEET 9 OF 14	RELEASE:
NOTES: SUBROUTINES: CLEXOP, CLNBOP	VERSION:
	REVISION:
SYSTEM: NSP	

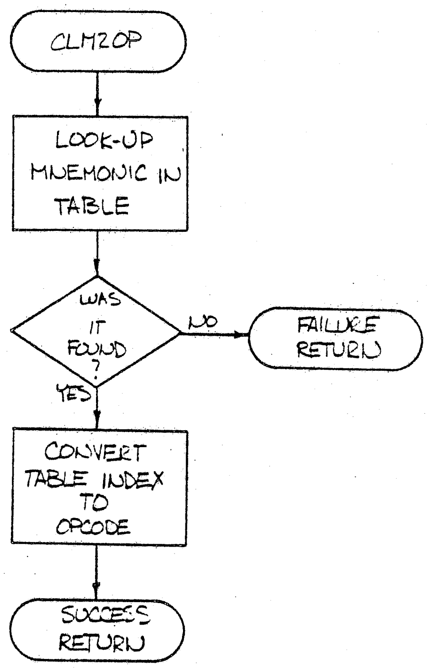
FORM 5-018-0



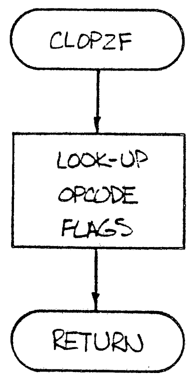
FLOWCHART CALL NAME: NBCLPROC	
ANALYST:	MODULE:
DRAWN BY:	PN:
SHEET 1Ø OF 14	RELEASE:
NOTES: SUBROUTINE: CLIN2A	VERSION: REVISION:
SYSTEM: NSP	
FORM 5-018-0	



FLOWCHART CALL NAME: NBCLPROC	
ANALYST:	MODULE:
DRAWN BY:	PN:
SHEET 11 OF 14	RELEASE:
NOTES: SUBROUTINE: CLOP2M	VERSION: REVISION:
SYSTEM: NSP	
FORM 5-018-0	

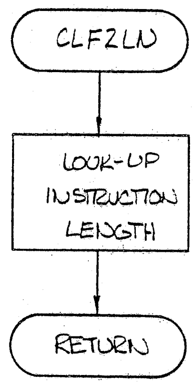


FLOWCHART CALL NAME: NBCLPROC	
ANALYST:	MODULE:
DRAWN BY:	PN:
SHEET 12 OF 14	RELEASE:
NOTES: SUBROUTINE: CLM2OP	VERSION: REVISION:
SYSTEM: NSP	
FORM 5-018-0	

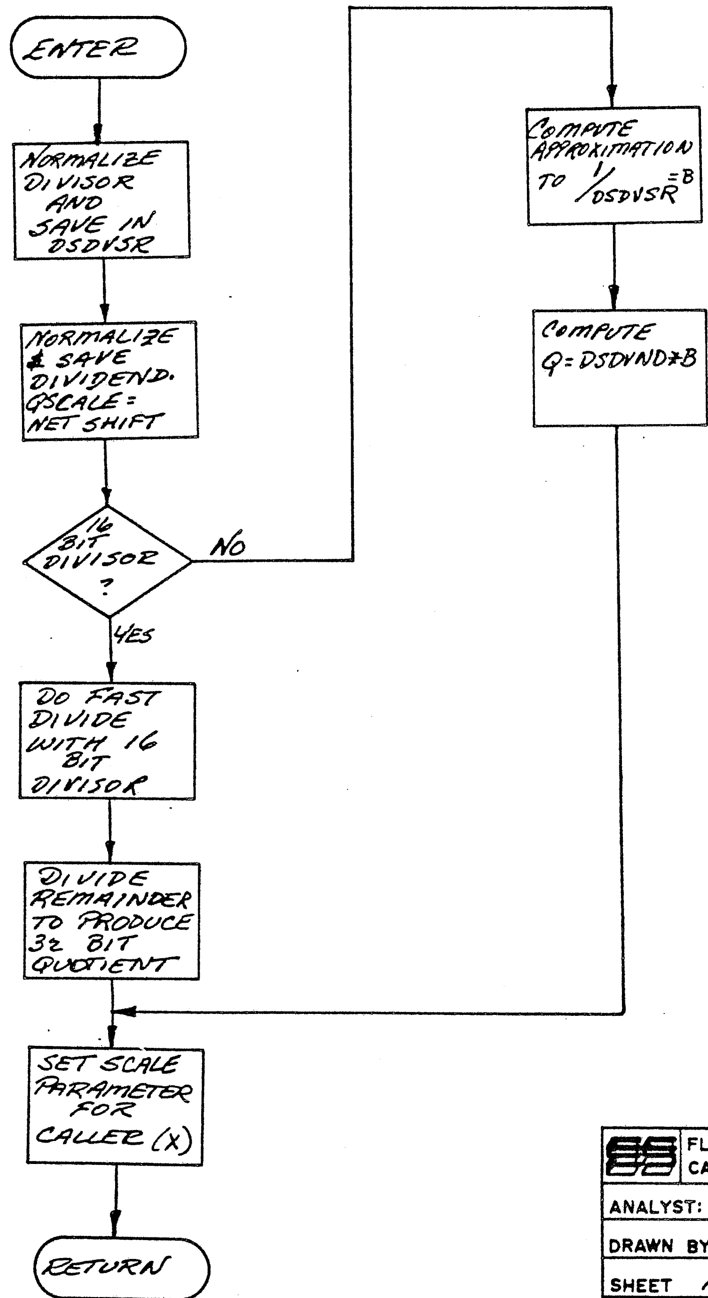


FLOWCHART CALL NAME: NBCLPR[illegible]	
ANALYST:	MODULE:
DRAWN BY:	PN:
SHEET 13 OF 14	RELEASE:
NOTES: SUBROUTINE: CLOPZF	VERSION: REVISION:
SYSTEM: NSP	

FORM 5-018-0

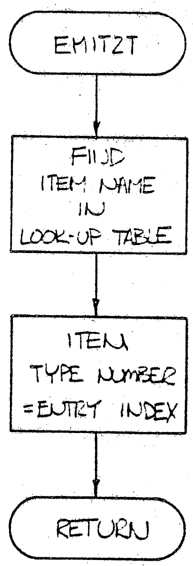


FLOWCHART CALL NAME: NBCLPROC	
ANALYST:	MODULE:
DRAWN BY:	PN:
SHEET 14 OF 14	RELEASE:
NOTES: SUBROUTINE: CLF2LN	VERSION:
	REVISION:
SYSTEM: NSP	
FORM 5-018-0	

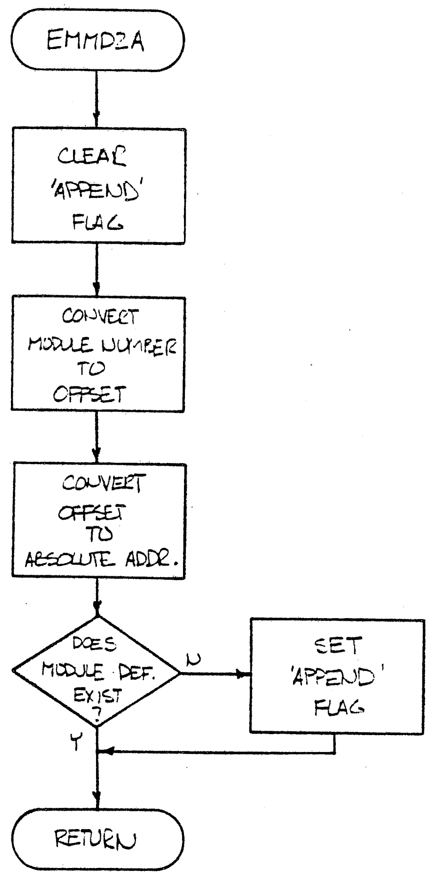


FLOWCHART CALL NAME: NBDIV222	
ANALYST: C.W.	MODULE: DIV222
DRAWN BY: C.W.	PN: 908028-003
SHEET 1 OF 1	RELEASE: 02
NOTES:	VERSION: 01
	REVISION: NC
SYSTEM: NSP	

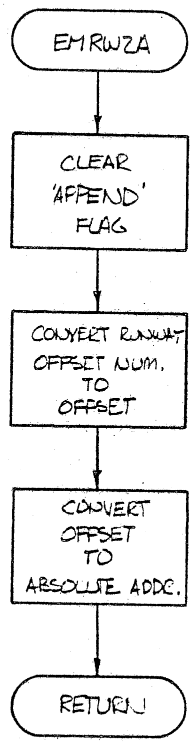
FORM 5-018-0



FLOWCHART CALL NAME: NBEMCNVR	
ANALYST: W.R.	MODULE: EMCNVR
DRAWN BY: W.R.	PN: 9Ø8Ø29-Ø7E
SHEET 1 OF 6	RELEASE: Ø2
NOTES: SUBROUTINE: EMITZT	VERSION: Ø1
	REVISION: NC
SYSTEM: NSP	
FORM 5-018-0	



FLOWCHART CALL NAME: NSEEMDMVE	
ANALYST:	MODULE:
DRAWN BY:	PN:
SHEET 2 OF 6	RELEASE:
NOTES: SUBROUTINE: EMMD2A	VERSION: REVISION:
SYSTEM: NSP	
FORM 5-018-0	

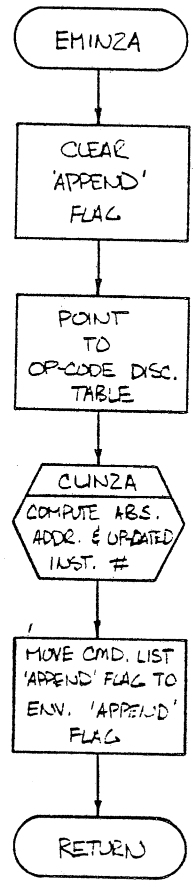


FLOWCHART
CALL NAME: NBEMCNVR

ANALYST:	MODULE:
DRAWN BY:	PN:
SHEET 3 OF 6	RELEASE:
NOTES: SUBROUTINE' EMRWZA	VERSION:
	REVISION:

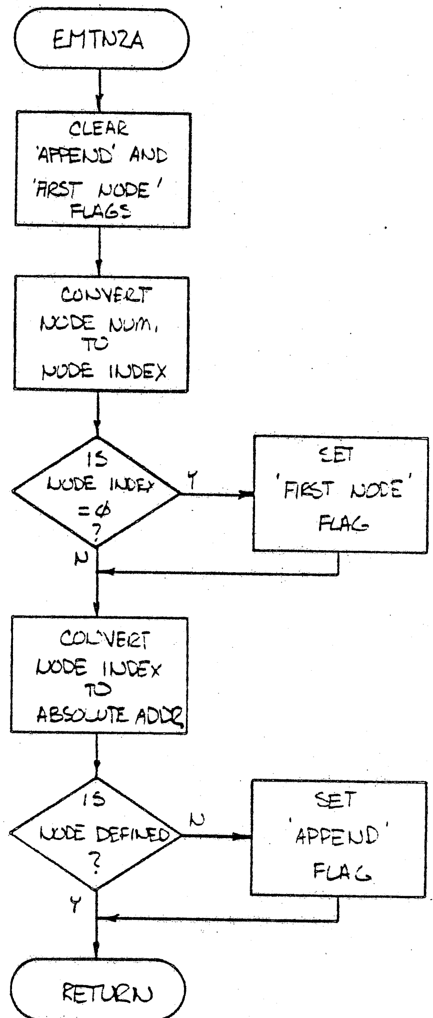
SYSTEM: NSP

FORM 5-018-0



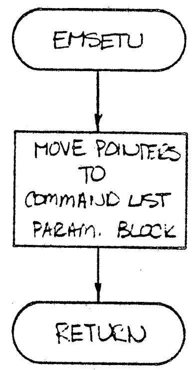
FLOWCHART CALL NAME: NBEMONVR	
ANALYST:	MODULE:
DRAWN BY:	PN:
SHEET 4 OF 6	RELEASE:
NOTES: SUBROUTINE: EMINZA	VERSION: REVISION:
SYSTEM: NSP	

FORM 5-018-0

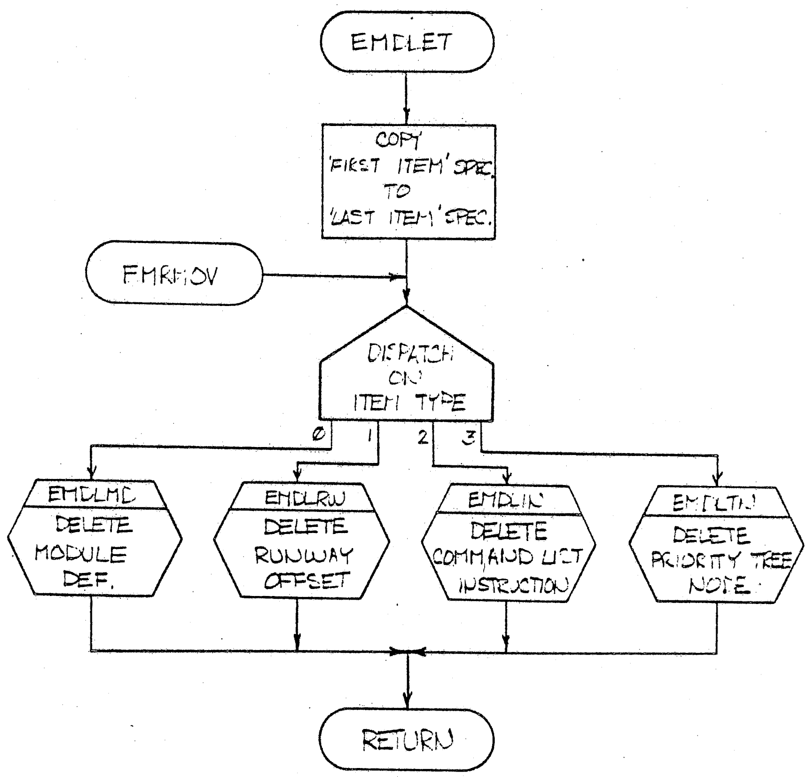


FLOWCHART CALL NAME: NBEMCNVR	
ANALYST:	MODULE:
DRAWN BY:	PN:
SHEET 5 OF 6	RELEASE:
NOTES: SUBROUTINE: EMTNZA	VERSION: REVISION:
SYSTEM: NSP	

FORM 6-018-0

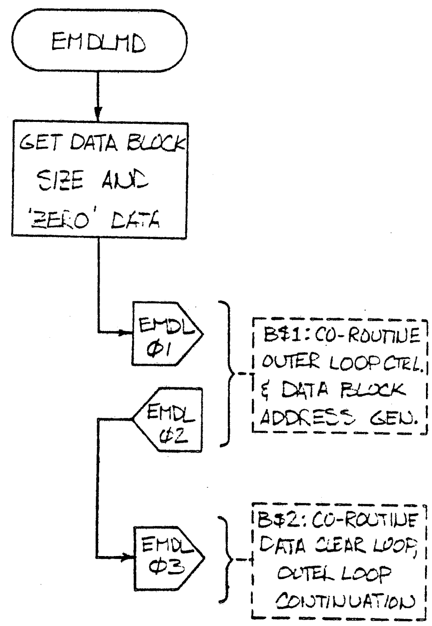


FLOWCHART CALL NAME: NBEMCDVR	
ANALYST:	MODULE:
DRAWN BY:	PN:
SHEET 6 OF 6	RELEASE:
NOTES: SUBROUTINE: EMSETU	VERSION: REVISION:
SYSTEM: NSP	
FORM 5-018-0	



FLOWCHART CALL NAME: NBEMDLET	
ANALYST: W.R.	MODULE: EMDLET
DRAWN BY: W.R	PN: 9Ø8ØØØ-Ø71
SHEET 1 OF 6	RELEASE: Ø2
NOTES: SUBROUTINE: EMDLET	VERSION: Ø1
	REVISION: N/C
SYSTEM: NSP	

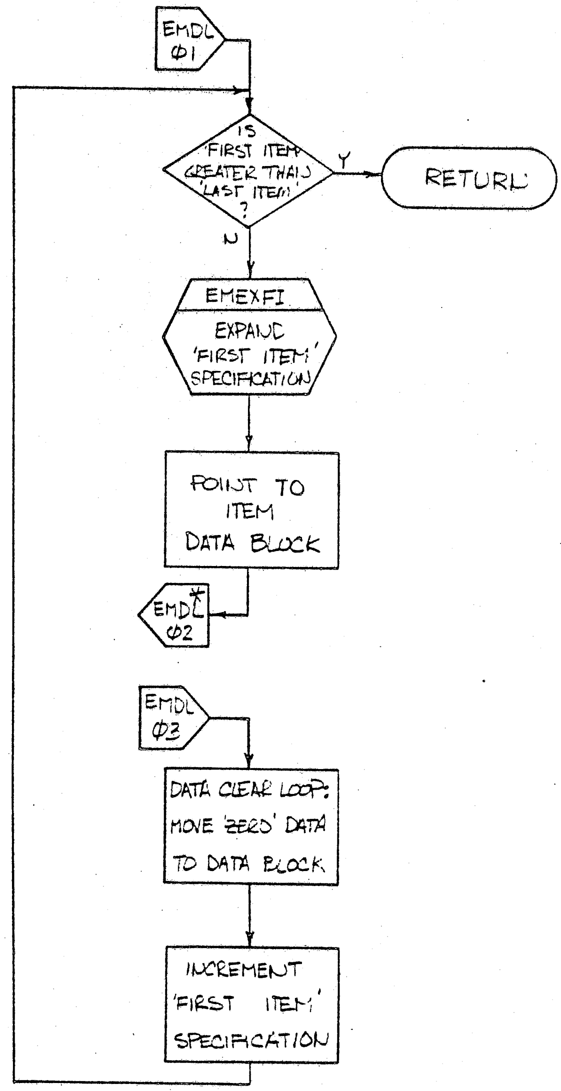
FORM 5-018-0



FLOWCHART CALL NAME: NBEMDLET	
ANALYST:	MODULE:
DRAWN BY:	PN:
SHEET 2 OF 6	RELEASE:
NOTES: SUBROUTINE: EMDLMD	VERSION: REVISION:
SYSTEM: NSP	

FORM 5-018-0

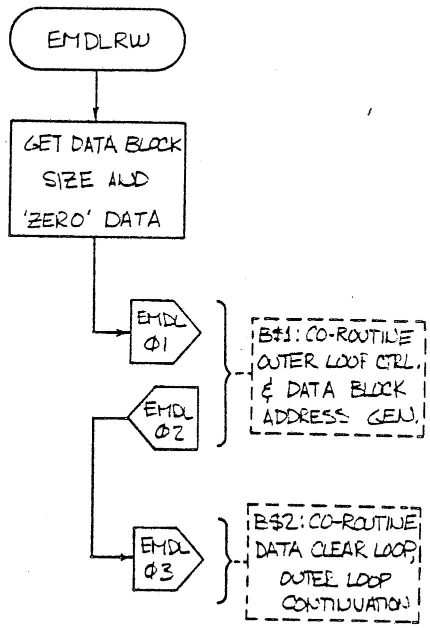
B$1:
CO-ROUTINE



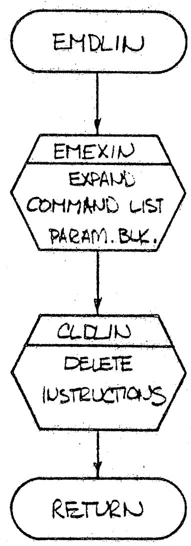
B$2:
CO-ROUTINE

*: RETURN TO POINT OF CALL

FLOWCHART CALL NAME: MBEMDLET	
ANALYST:	MODULE:
DRAWN BY:	PN:
SHEET 3 OF 6	RELEASE:
NOTES: CO-ROUTINES FOR:	VERSION:
	REVISION:
EMDLMD, EMDLRW, EMDLTN	
SYSTEM: NSP	
FORM 5-018-0	

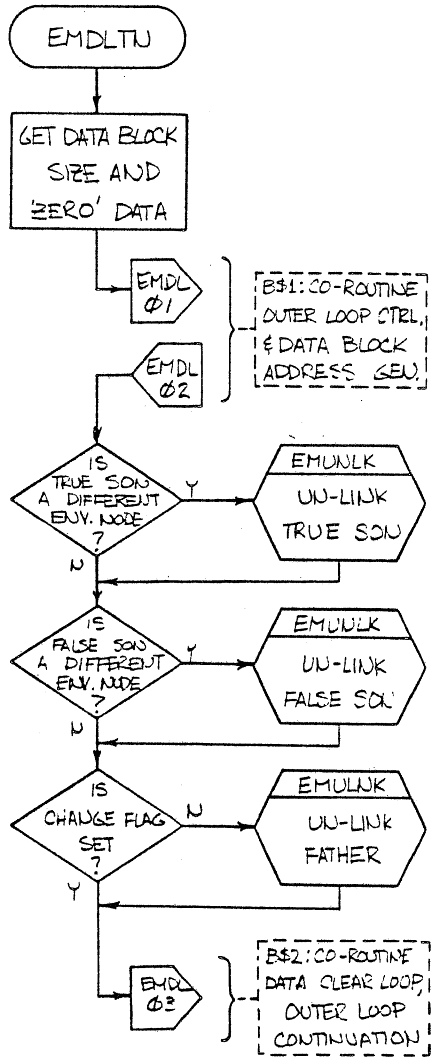


FLOWCHART CALL NAME: NBEMDLET	
ANALYST:	MODULE:
DRAWN BY:	PN:
SHEET 4 OF 6	RELEASE:
NOTES: SUBROUTINE: EMDLRW	VERSION: REVISION:
SYSTEM: NSP	
FORM 5-018-0	

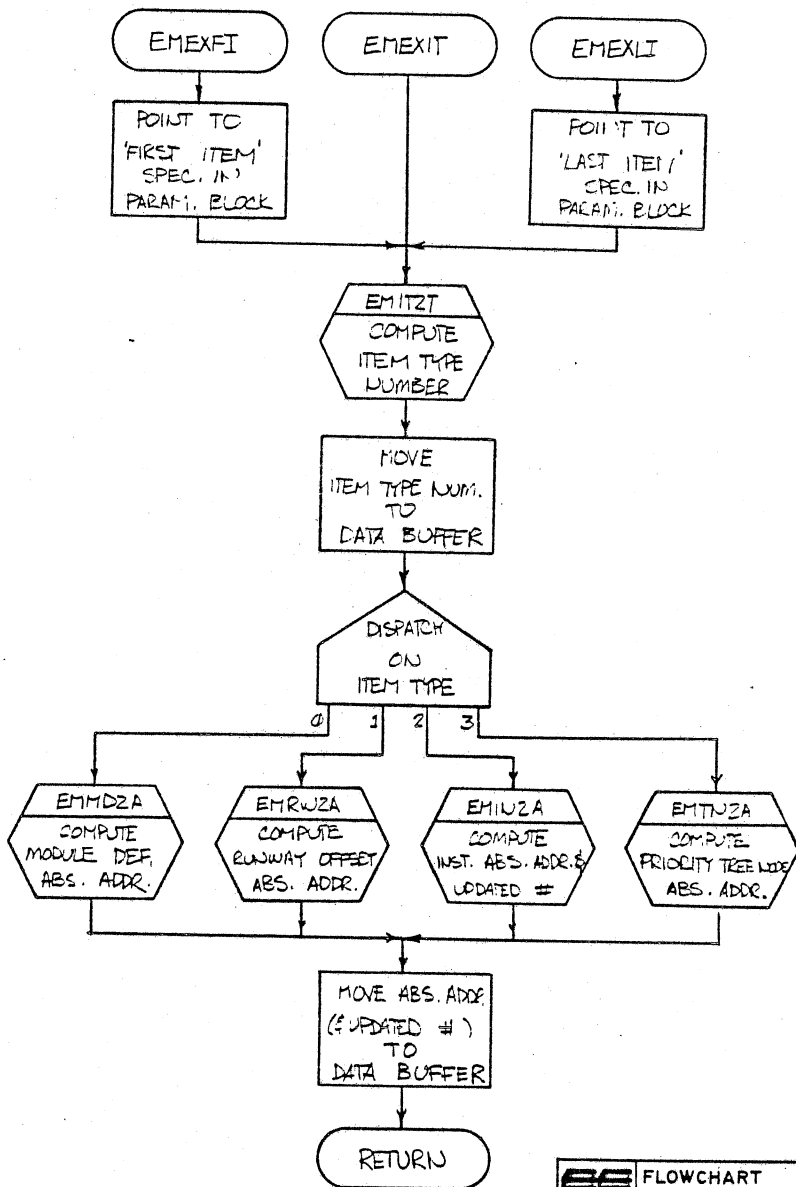


FLOWCHART CALL NAME: NEEMDLET	
ANALYST:	MODULE:
DRAWN BY:	PN:
SHEET 5 OF 6	RELEASE:
NOTES: SUBROUTINE: EMDLIN	VERSION: REVISION:
SYSTEM: NSP	

FORM 5-018-0

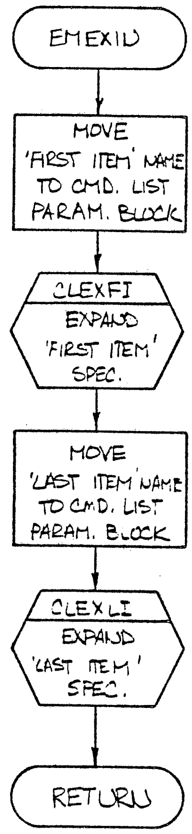


FLOWCHART CALL NAME: NBEMDLET	
ANALYST:	MODULE:
DRAWN BY:	PN:
SHEET 6 OF 6	RELEASE:
NOTES: SUBROUTINE: EMDLTN	VERSION:
	REVISION:
SYSTEM: NSP	
FORM 5-018-0	

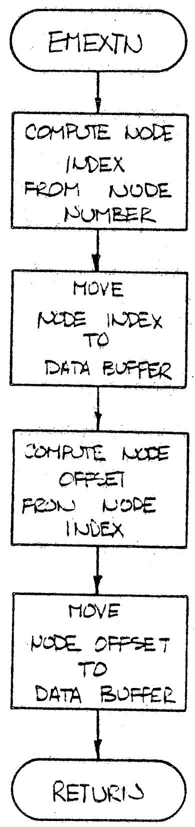


FLOWCHART CALL NAME: NBEMEXND	
ANALYST: W.R.	MODULE: EMEXND
DRAWN BY: W.R.	PN: 908039-074
SHEET 1 OF 6	RELEASE: 01
NOTES: SUBROUTINES:	VERSION: 01
	REVISION: NC
EMEXIT, EMEXFI, EMEXLI	
SYSTEM: NSP	

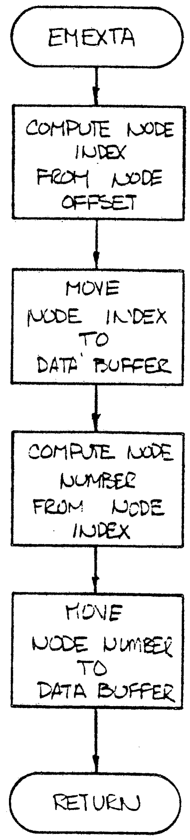
FORM 5-018-0



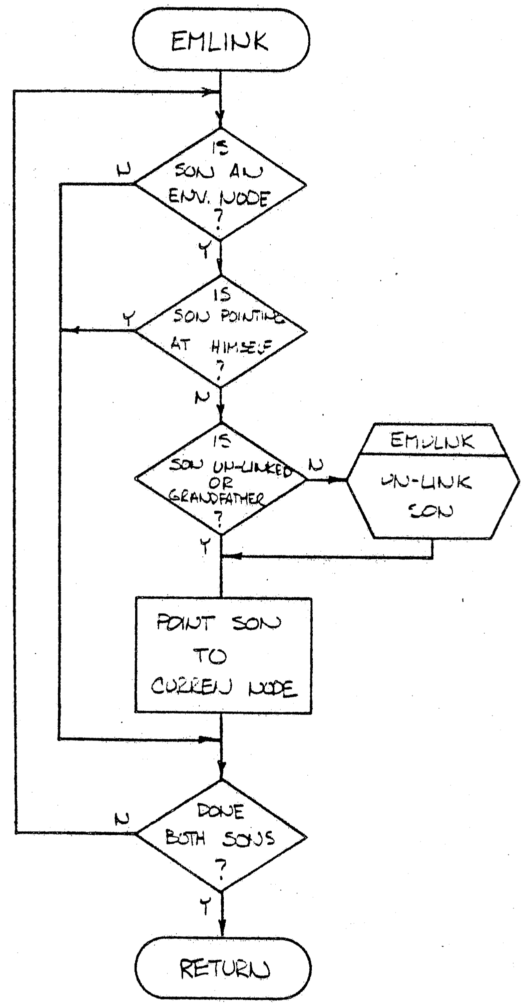
FLOWCHART CALL NAME: NREMEXND	
ANALYST:	MODULE:
DRAWN BY:	PN:
SHEET 2 OF 6	RELEASE:
NOTES: SUBROUTINE: EMEXND	VERSION: REVISION:
SYSTEM: NSP	
FORM 5-018-0	



FLOWCHART CALL NAME: NBEMEXND	
ANALYST:	MODULE:
DRAWN BY:	PN:
SHEET 3 OF 6	RELEASE:
NOTES: SUBROUTINE: EMEXTN	VERSION: REVISION:
SYSTEM: NSP	
FORM 5-018-0	

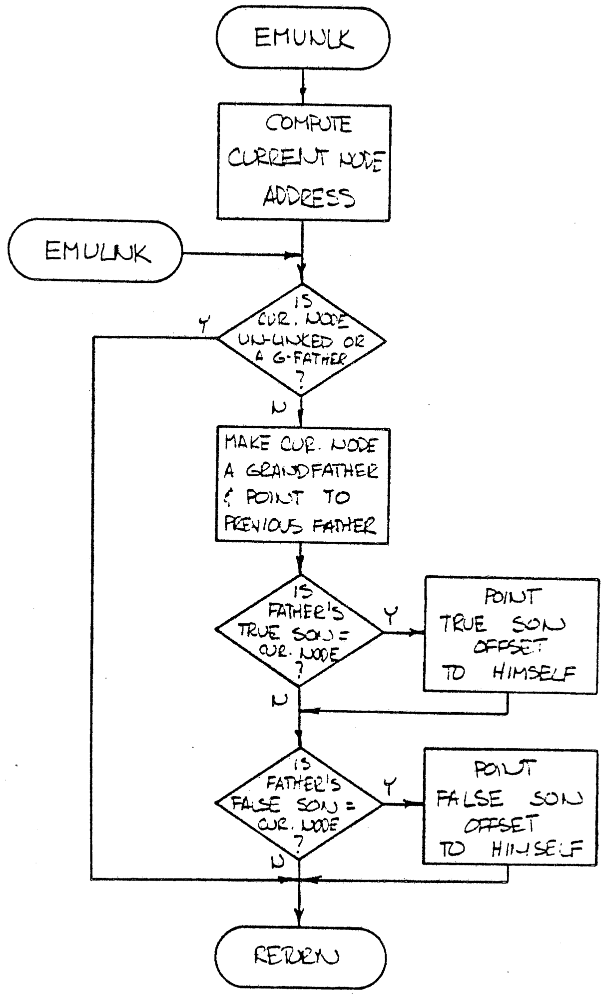


FLOWCHART CALL NAME: NBEMEND	
ANALYST:	MODULE:
DRAWN BY:	PN:
SHEET 4 OF 6	RELEASE:
NOTES: SUBROUTINE: EMEXTA	VERSION: REVISION:
SYSTEM: NSP	
FORM 5-018-0	



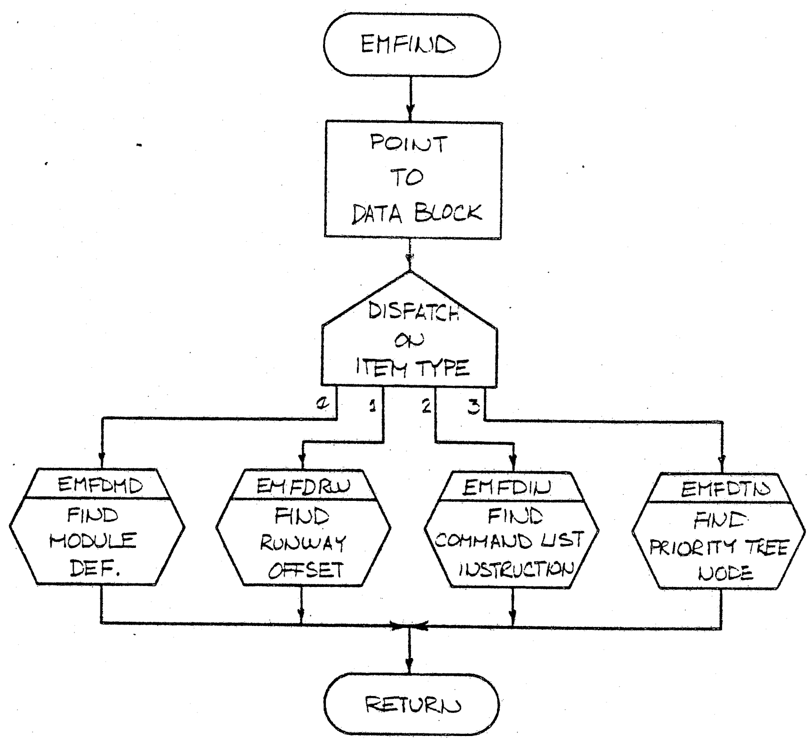
FLOWCHART CALL NAME: NEEMEXND	
ANALYST:	MODULE:
DRAWN BY:	PN:
SHEET 5 OF 6	RELEASE:
NOTES: SUBROUTINE: EMLINK	VERSION: REVISION:
SYSTEM: NSP	

FORM 5-018-0

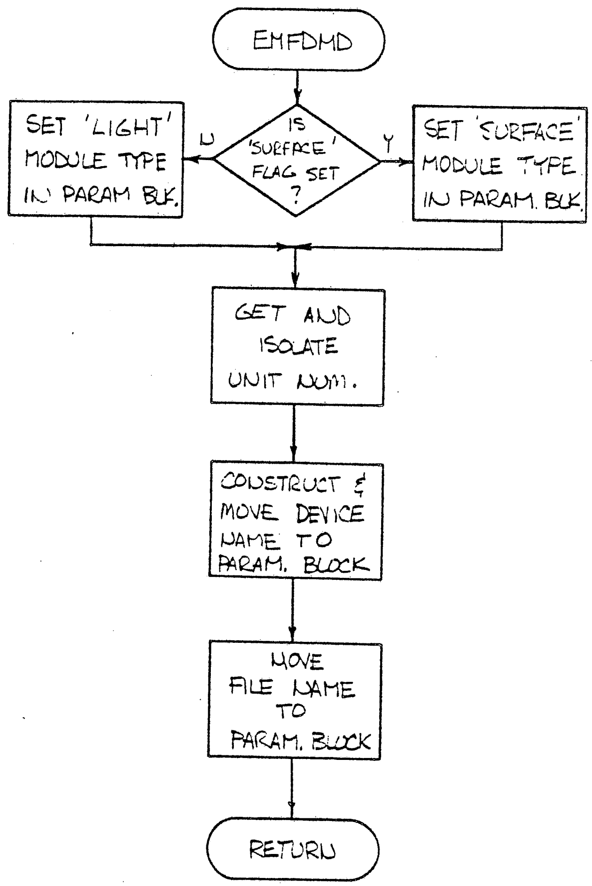


FLOWCHART CALL NAME: NBEMEXND	
ANALYST:	MODULE:
DRAWN BY:	PN:
SHEET 6 OF 6	RELEASE:
NOTES: SUBROUTINES:	VERSION:
	REVISION:
EMUNLK, EMULNK	
SYSTEM: NSP	

FORM 5-018-0

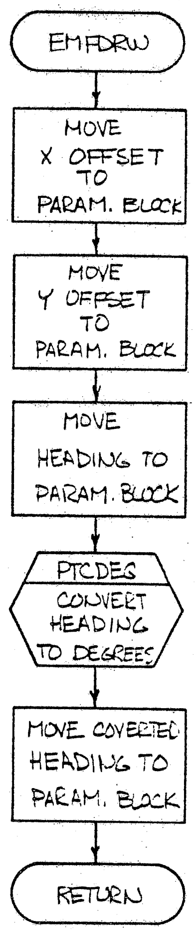


FLOWCHART CALL NAME: NBEMFIND	
ANALYST: W.R.	MODULE: EMFIND
DRAWN BY: W.R.	PN: 908029-073
SHEET 1 OF 8	RELEASE: 01
NOTES: SUBROUTINE: EMFIND	VERSION: 01 REVISION: NC
SYSTEM: NSP	
FORM 5-018-0	

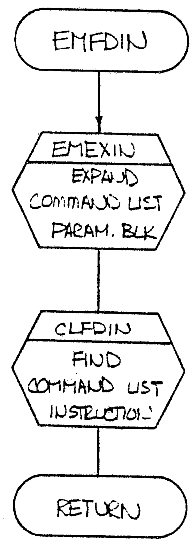


FLOWCHART CALL NAME: NBEMFIND	
ANALYST:	MODULE:
DRAWN BY:	PN:
SHEET 2 OF 8	RELEASE:
NOTES: SUBROUTINE. EMFDMD	VERSION: REVISION:
SYSTEM: NSP	

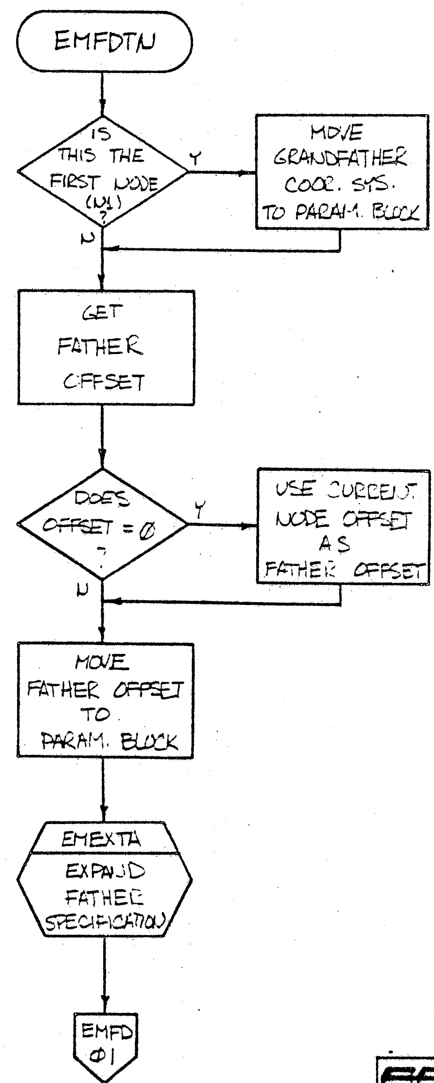
FORM 5-018-0



FLOWCHART CALL NAME: UBEMFIUD	
ANALYST:	MODULE:
DRAWN BY:	PN:
SHEET 3 OF 8	RELEASE:
NOTES: SUBROUTINE: EMFDRW	VERSION: REVISION:
SYSTEM: NSP	
FORM 5-018-0	



FLOWCHART CALL NAME: NBEMFIND	
ANALYST:	MODULE:
DRAWN BY:	PN:
SHEET 4 OF 8	RELEASE:
NOTES: SUBROUTINE: EMFDIN	VERSION: REVISION:
SYSTEM: NSP	
FORM 5-018-0	



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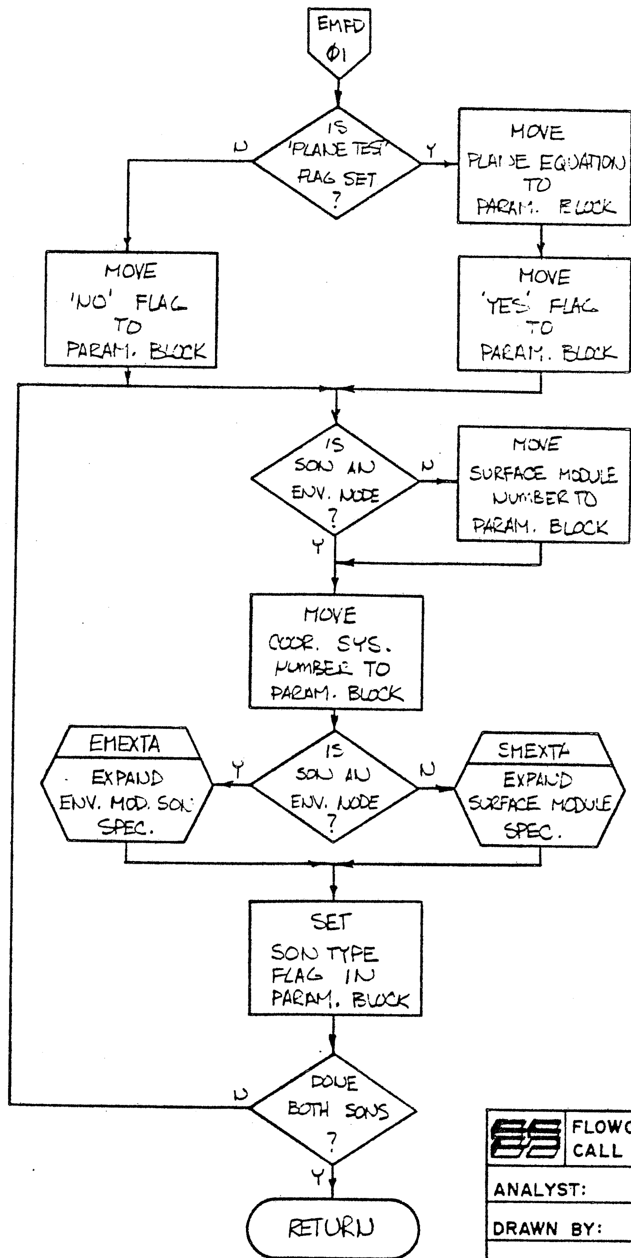
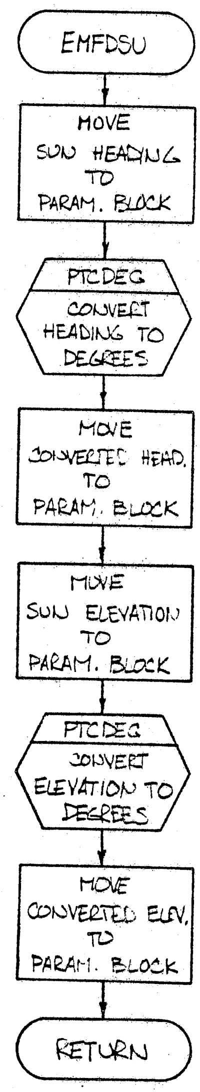
ANALYST:	MODULE:
DRAWN BY:	PN:
SHEET 5 OF 8	RELEASE:
NOTES: SUBROUTINE: EMFDTN	VERSION:
	REVISION:
SYSTEM: NSP	

FORM 5-018-0



FLOWCHART CALL NAME: NBEMFIND	
ANALYST:	MODULE:
DRAWN BY:	PN:
SHEET 6 OF 8	RELEASE:
NOTES:	VERSION:
SUBROUTINE	REVISION:
EMFDTN (CONTINUED)	
SYSTEM: NSP	
FORM 5-018-0	

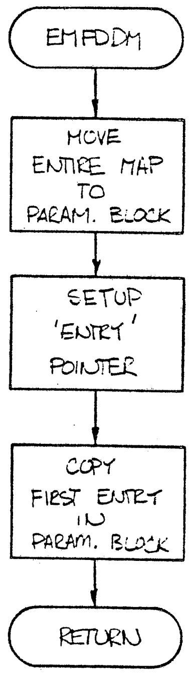


FLOWCHART
CALL NAME: NBEMFIND

ANALYST:
MODULE:
DRAWN BY:
PN:
SHEET 7 OF 8
RELEASE:
NOTES:
VERSION:
SUBROUTINE
REVISION:
EMFDSU

SYSTEM: NSP

FORM 5-018-0



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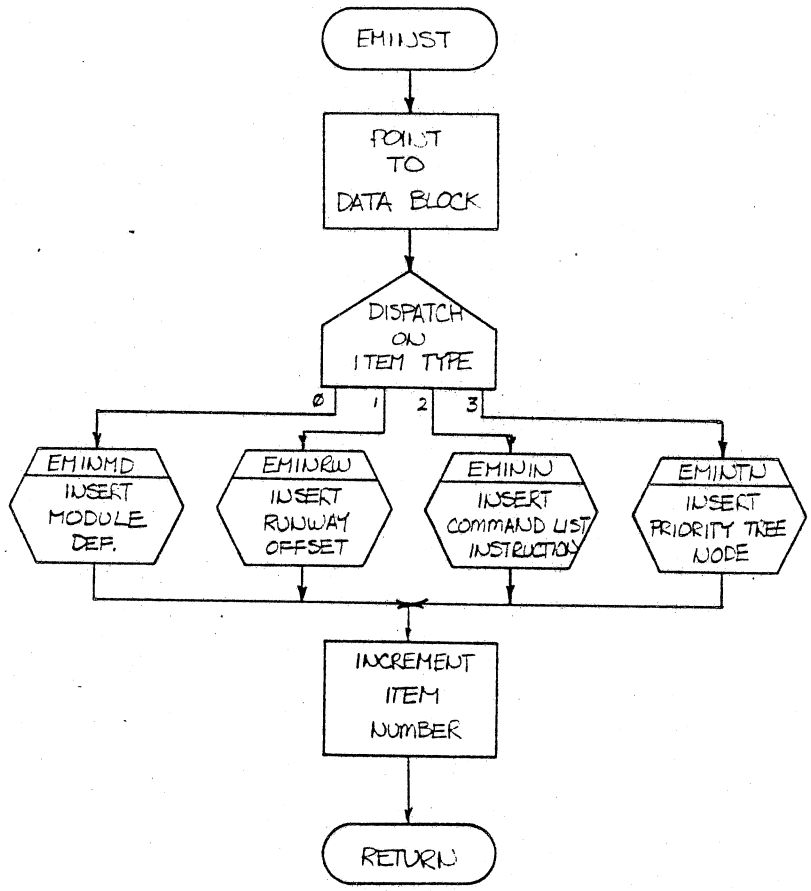
ANALYST:	MODULE:
DRAWN BY:	PN:
SHEET 8 OF 8	RELEASE:
NOTES: SUBROUTINE EMFDDM	VERSION: REVISION:
SYSTEM: NSP	
FORM 5-018-0	

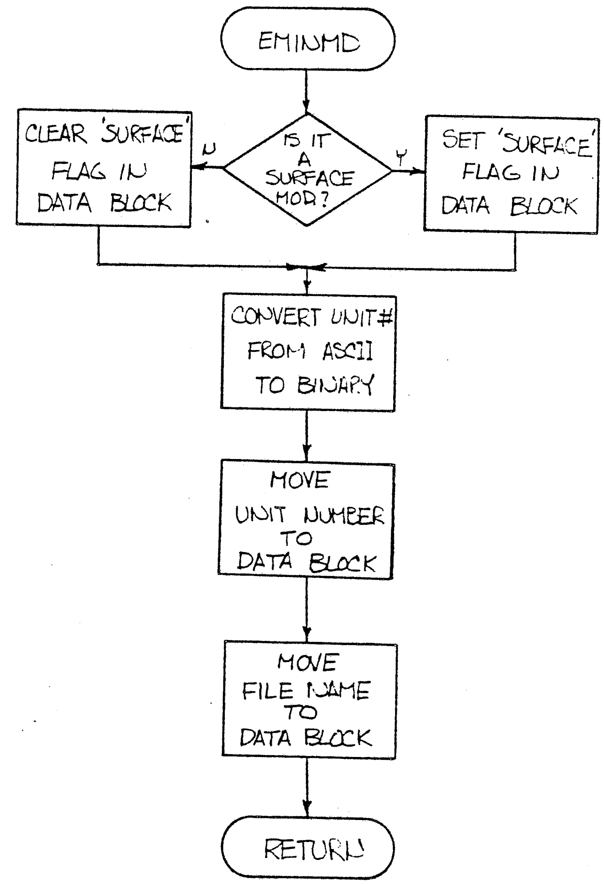


FLOWCHART
CALL NAME: NBEMINST

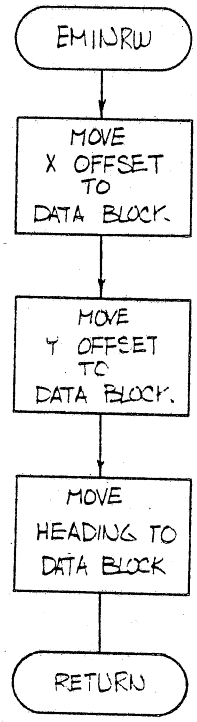
ANALYST: W.R.
MODULE: EMINST
DRAWN BY: W.R.
PN: 908029-070
SHEET 1 OF 9
RELEASE: 02
NOTES:
VERSION: Ø1
SUBROUTINE: EMINST
REVISION: NC

SYSTEM: NSP

FORM 5-018-0



FLOWCHART CALL NAME: NBEMINST	
ANALYST:	MODULE:
DRAWN BY:	PN:
SHEET 2 OF 9	RELEASE:
NOTES: SUBROUTINE: EMINMD	VERSION: REVISION:
SYSTEM: NSP	
FORM 5-018-0	

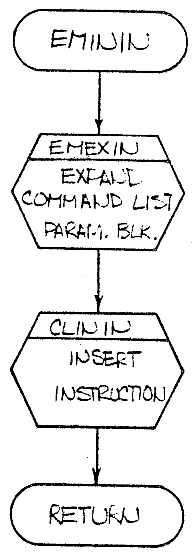


FLOWCHART
CALL NAME: NREMINST

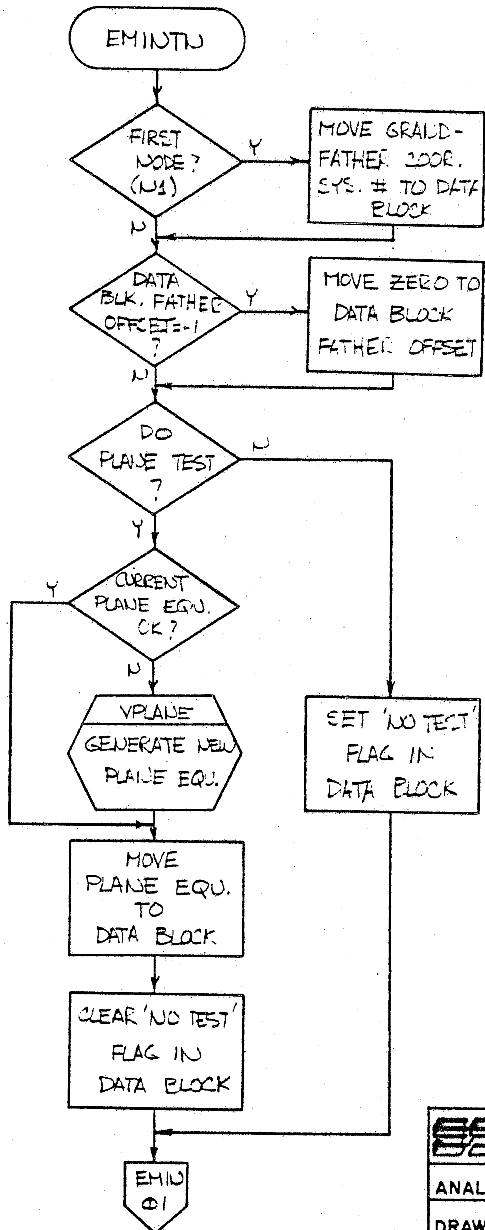
ANALYST:	MODULE:
DRAWN BY:	PN:
SHEET 3 OF 9	RELEASE:
NOTES: SUBROUTINE: EMINRW	VERSION:
	REVISION:

SYSTEM: NSP

FORM 5-018-0



FLOWCHART CALL NAME: NBEMINST	
ANALYST:	MODULE:
DRAWN BY:	PN:
SHEET 4 OF 9	RELEASE:
NOTES: SUBROUTINE: EMININ	VERSION:
	REVISION:
SYSTEM: NSP	
FORM 5-018-0	

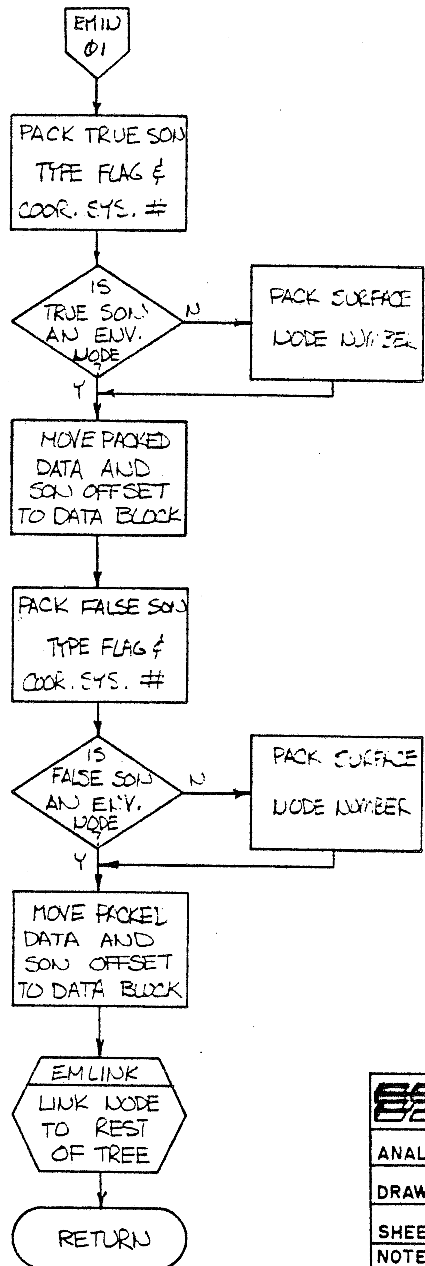


FLOWCHART
CALL NAME: NBEMINST

ANALYST: MODULE:
DRAWN BY: PN:
SHEET 5 OF 9 RELEASE:
NOTES: VERSION:
SUBROUTINE: REVISION:
EMINTN

SYSTEM: NSP

FORM 5-018-0



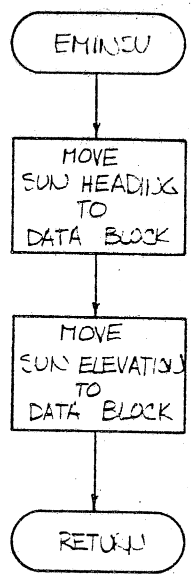
FLOWCHART
CALL NAME: NBEHINIT

ANALYST:	MODULE:
DRAWN BY:	PN:
SHEET 6 OF 9	RELEASE:
NOTES:	VERSION:
SUBROUTINE:	REVISION:

EMINTN (CONTINUED)

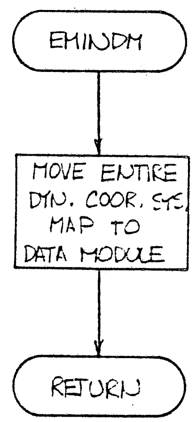
SYSTEM: NSP

FORM 5-018-0

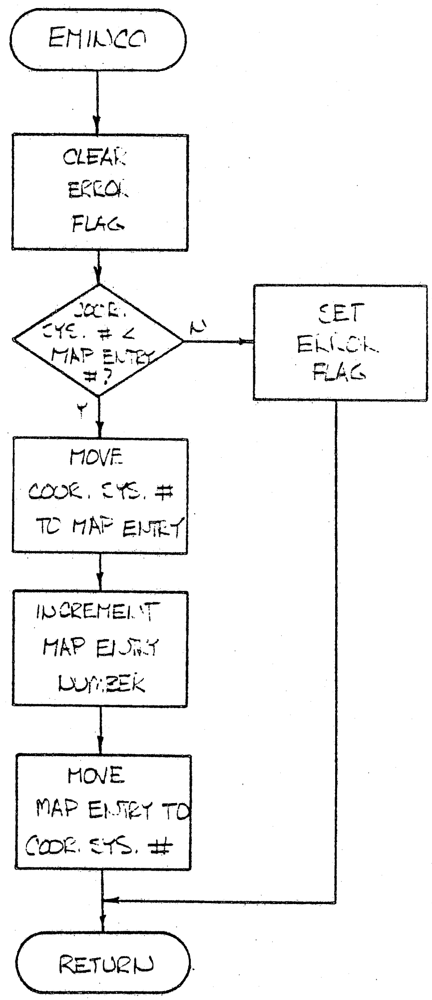


FLOWCHART CALL NAME: NBEMINST	
ANALYST:	MODULE:
DRAWN BY:	PN:
SHEET 7 OF 9	RELEASE:
NOTES: SUBROUTINE: EMINSU	VERSION: REVISION:
SYSTEM: NSP	

FORM 5-018-0

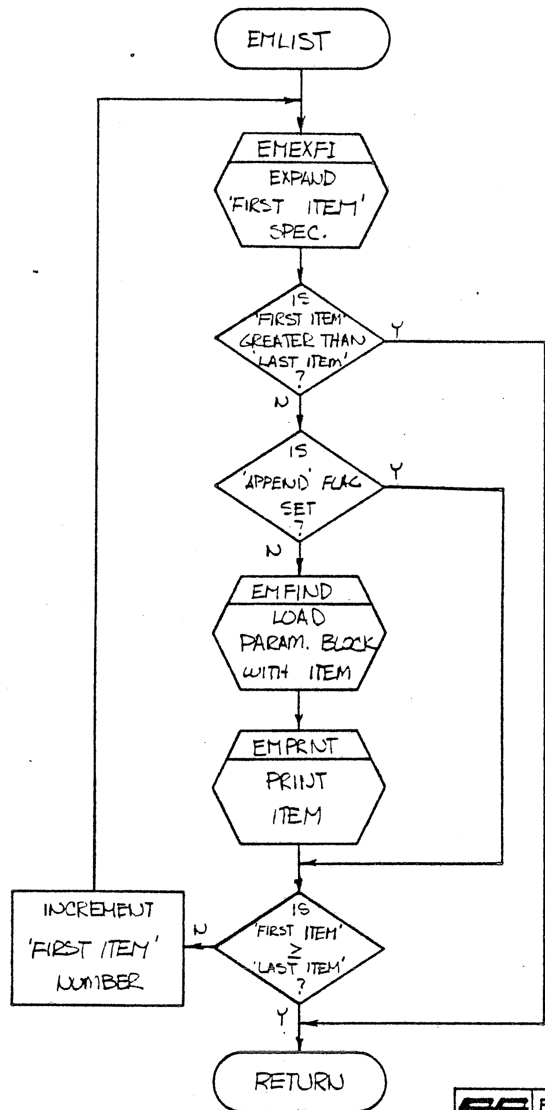


FLOWCHART CALL NAME: NBEMINST	
ANALYST:	MODULE:
DRAWN BY:	PN:
SHEET 8 OF 9	RELEASE:
NOTES: SUBROUTINE: EMINDM	VERSION: REVISION:
SYSTEM: NSP	
FORM 5-018-0	



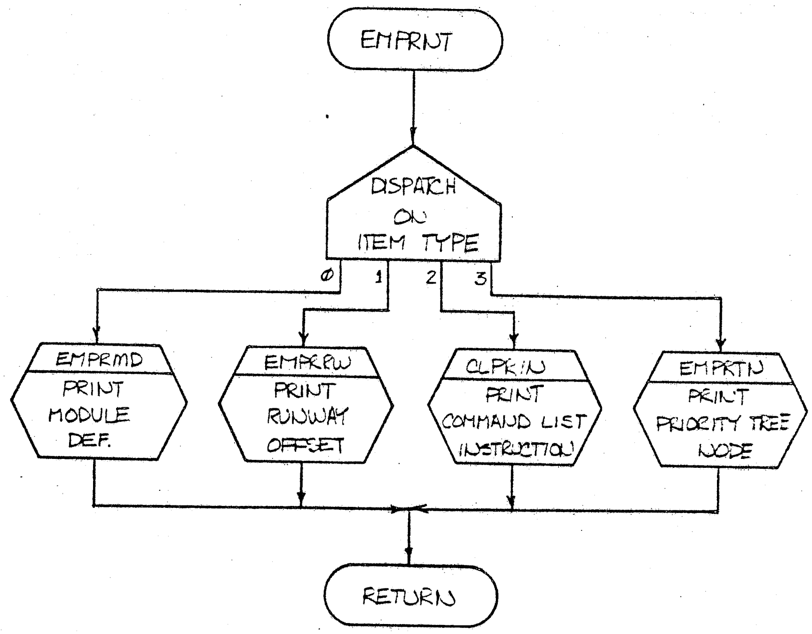
FLOWCHART CALL NAME: NBEMINST	
ANALYST:	MODULE:
DRAWN BY:	PN:
SHEET 9 OF 9	RELEASE:
NOTES: SUBROUTINE: EMINCO	VERSION:
	REVISION:
SYSTEM: NSP	

FORM 5-018-0



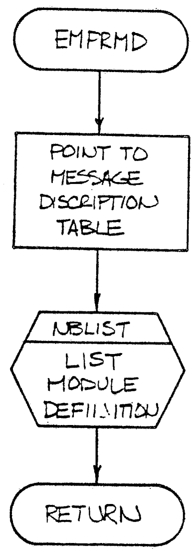
FLOWCHART CALL NAME: NBEMPRNT	
ANALYST: W.R.	MODULE: EMPRNT
DRAWN BY: W.R.	PN: 7??-0?9-072
SHEET 1 OF 6	RELEASE: 01
NOTES: SUBROUTINE: EMLIST	VERSION: 01 REVISION: NC
SYSTEM: NSP	

FORM 5-018-0



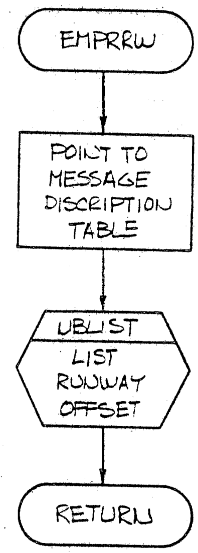
FLOWCHART CALL NAME: NBEMPRNT	
ANALYST:	MODULE:
DRAWN BY:	PN:
SHEET 2 OF 6	RELEASE:
NOTES:	VERSION:
SUBROUTINE:	REVISION:
EMPRNT	
SYSTEM: NSP	

FORM 5-018-0



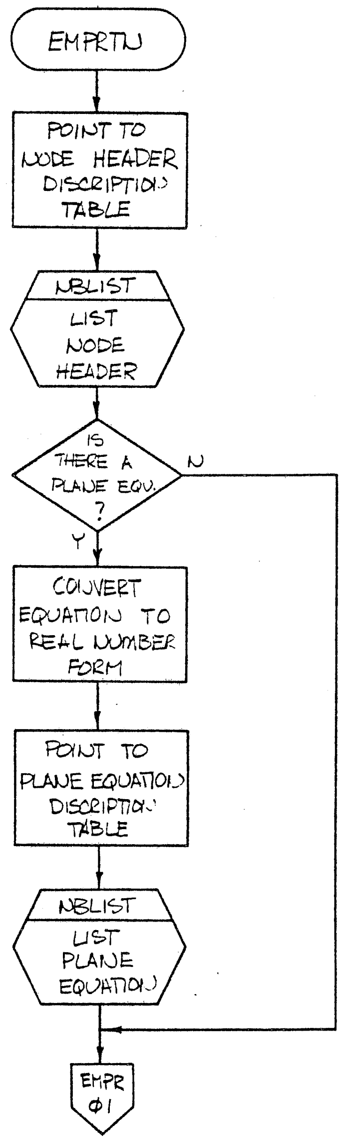
FLOWCHART CALL NAME: UBEMPRNT	
ANALYST:	MODULE:
DRAWN BY:	PN:
SHEET 3 OF 6	RELEASE:
NOTES: SUBROUTINE: EMPRMD	VERSION:
	REVISION:
SYSTEM: NSP	

FORM 6-018-0

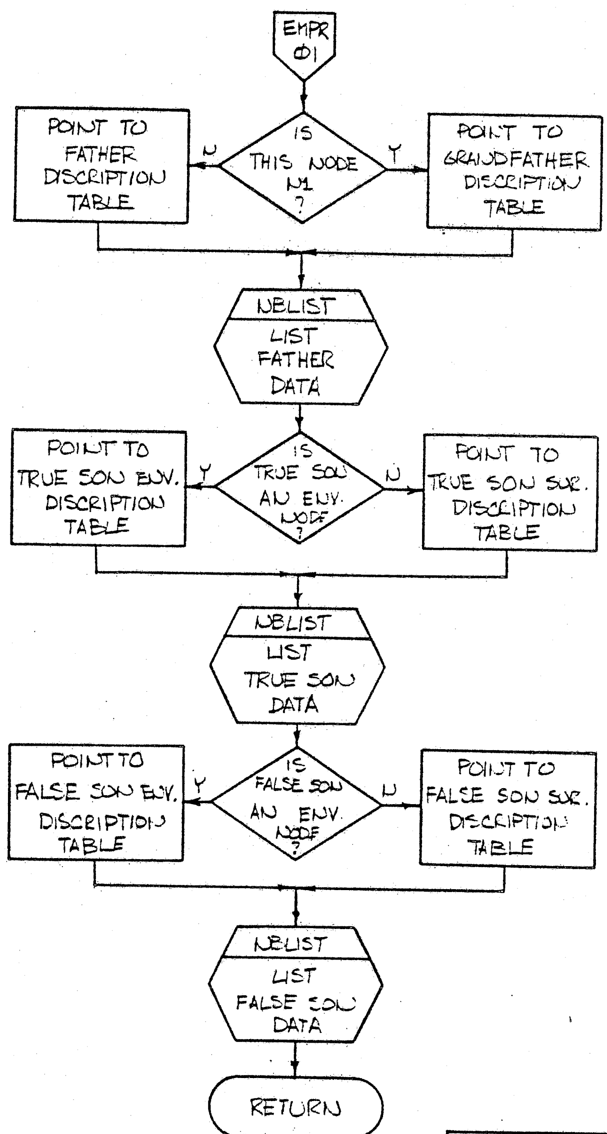


FLOWCHART CALL NAME: UBEMPRNT	
ANALYST:	MODULE:
DRAWN BY:	PN:
SHEET 4 OF 6	RELEASE:
NOTES: SUBROUTINE: EMPRRW	VERSION:
	REVISION:
SYSTEM: NSP	

FORM 5-018-0

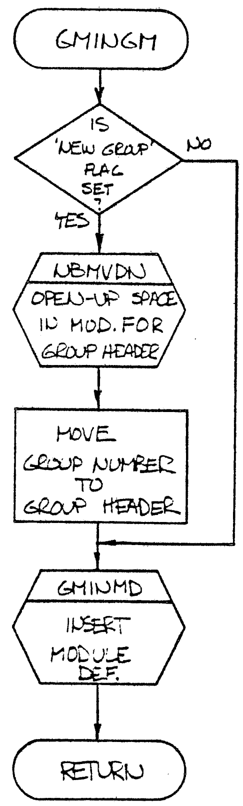


FLOWCHART CALL NAME: NBEMPLOT	
ANALYST:	MODULE:
DRAWN BY:	PN:
SHEET 5 OF 6	RELEASE:
NOTES:	VERSION:
SUBROUTINE: EMPRTN	REVISION:
SYSTEM: NSP	
FORM 5-018-0	

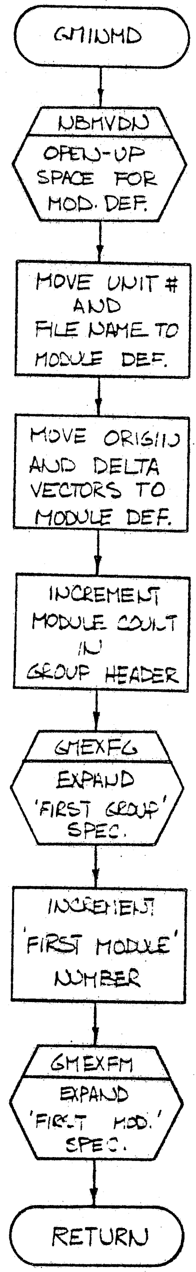


FLOWCHART CALL NAME: NBEMPRINT	
ANALYST:	MODULE:
DRAWN BY:	PN:
SHEET 6 OF 6	RELEASE:
NOTES:	VERSION:
SUBROUTINE:	REVISION:
EMPRTN (CONTINUED)	
SYSTEM: NSP	

FORM 5-018-0

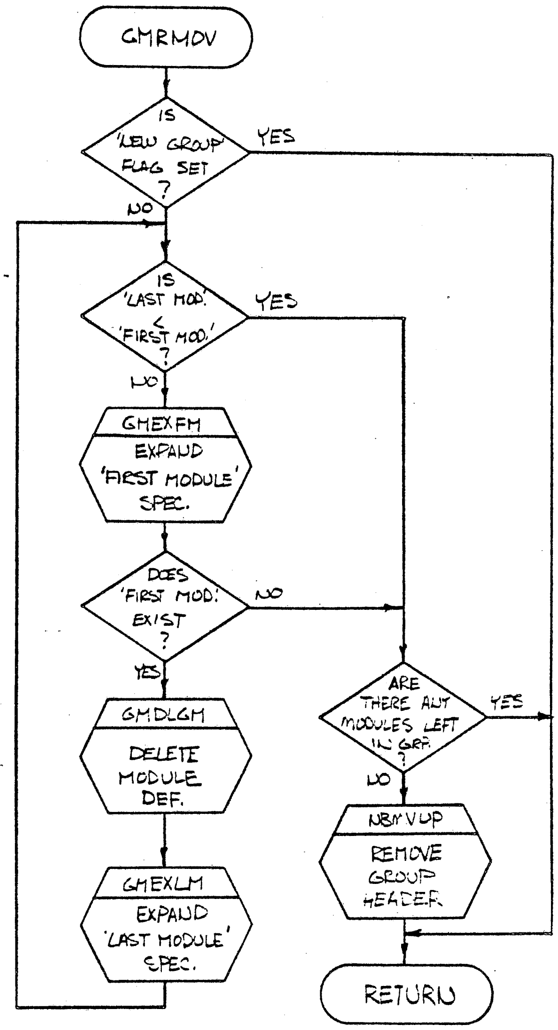


FLOWCHART CALL NAME: NBGMPLOC	
ANALYST: W.R.	MODULE: GMPLOC
DRAWN BY: W.R.	PN: 908031-00A
SHEET 1 OF 11	RELEASE: 02
NOTES: SUBROUTINE: GMINGM	VERSION: 01
	REVISION: NC
SYSTEM: NSP	
FORM 5-018-0	

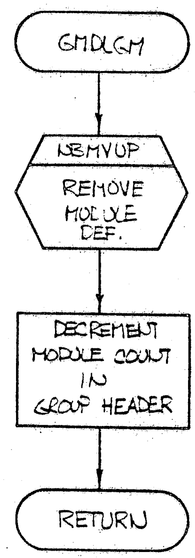


FLOWCHART CALL NAME: NB GMPLOC	
ANALYST:	MODULE:
DRAWN BY:	PN:
SHEET 2 OF 11	RELEASE:
NOTES: SUBROUTINE: GMINMD	VERSION:
	REVISION:
SYSTEM: NSP	

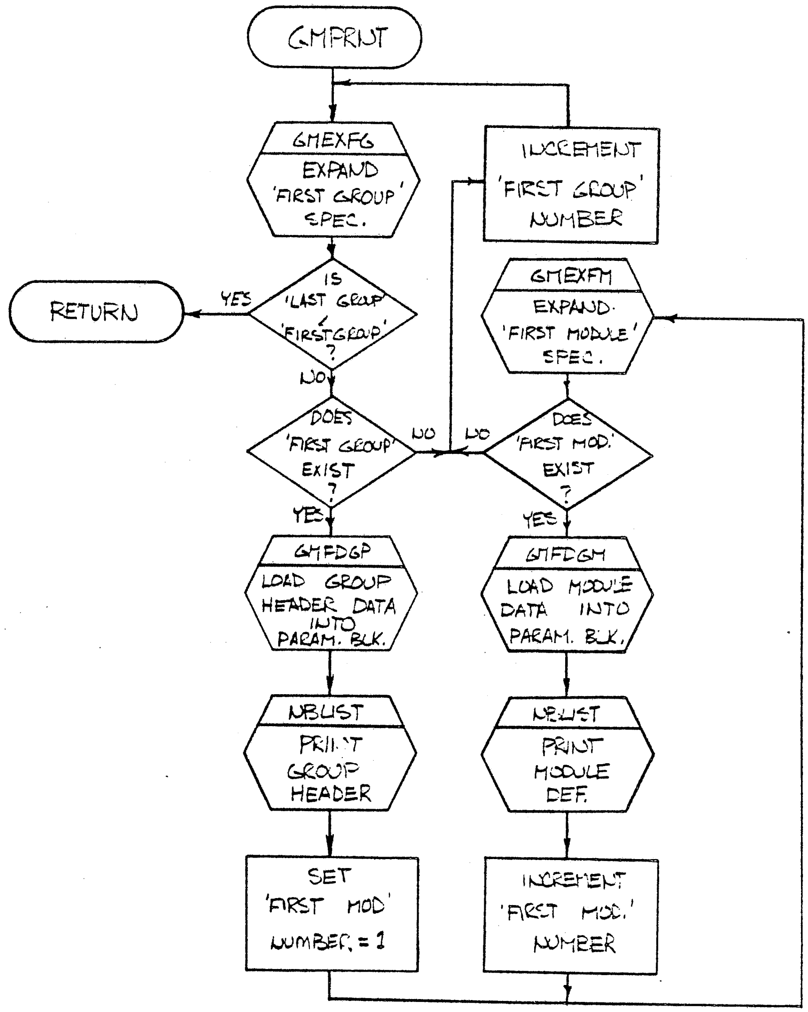
FORM 5-018-0



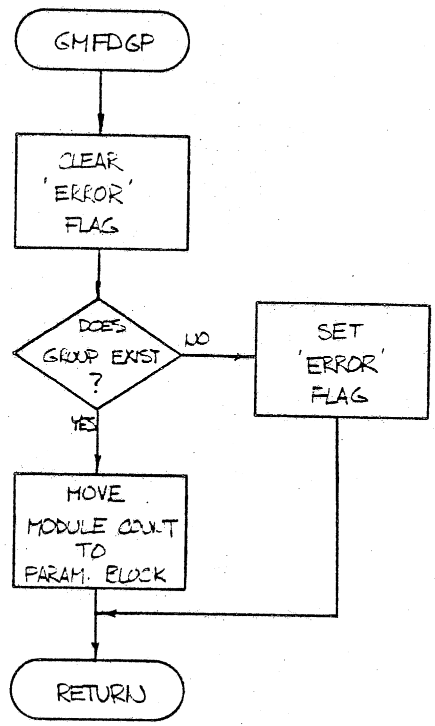
FLOWCHART CALL NAME: NBGMPROC	
ANALYST:	MODULE:
DRAWN BY:	PN:
SHEET 3 OF 11	RELEASE:
NOTES: SUBROUTINE GMRMOV	VERSION: REVISION:
SYSTEM: NSP	
FORM 5-018-0	



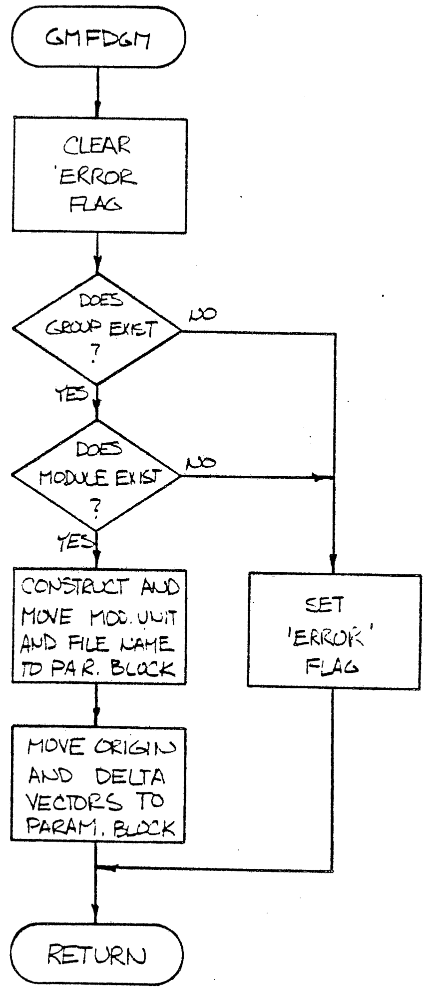
FLOWCHART CALL NAME: NBGMPROC	
ANALYST:	MODULE:
DRAWN BY:	PN:
SHEET 4 OF 11	RELEASE:
NOTES: SUBROUTINE: GMDLGM	VERSION: REVISION:
SYSTEM: NSP	
FORM 5-018-0	



FLOWCHART CALL NAME: NBGMPROC	
ANALYST:	MODULE:
DRAWN BY:	PN:
SHEET E OF 11	RELEASE:
NOTES: SUBROUTINE: GMPRINT	VERSION: REVISION:
SYSTEM: NSP	
FORM 5-018-0	



FLOWCHART CALL NAME: NBGMPROC	
ANALYST:	MODULE:
DRAWN BY:	PN:
SHEET 6 OF 11	RELEASE:
NOTES: SUBROUTINE' GMFDGP	VERSION: REVISION:
SYSTEM: NSP	
FORM 5-018-0	

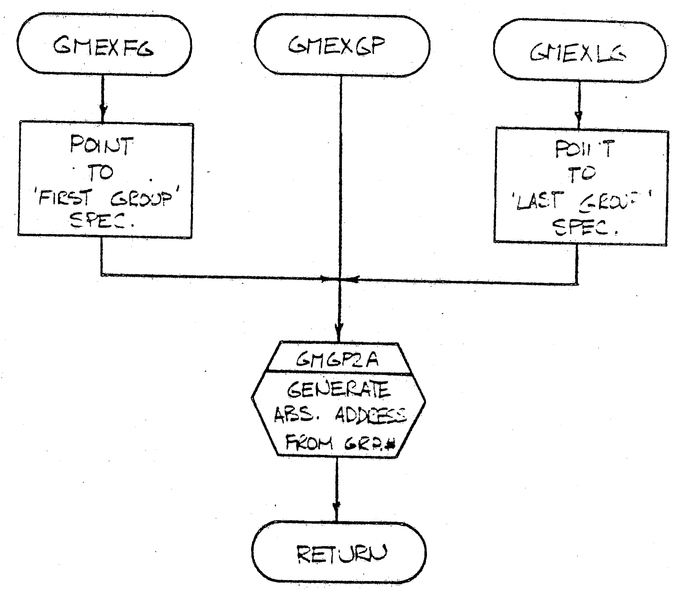


FLOWCHART
CALL NAME: NBGMPLOT

ANALYST:	MODULE:
DRAWN BY:	PN:
SHEET 7 OF 11	RELEASE:
NOTES: SUBROUTINE: GMFDGM	VERSION:
	REVISION:

SYSTEM: NSP

FORM 5-018-0



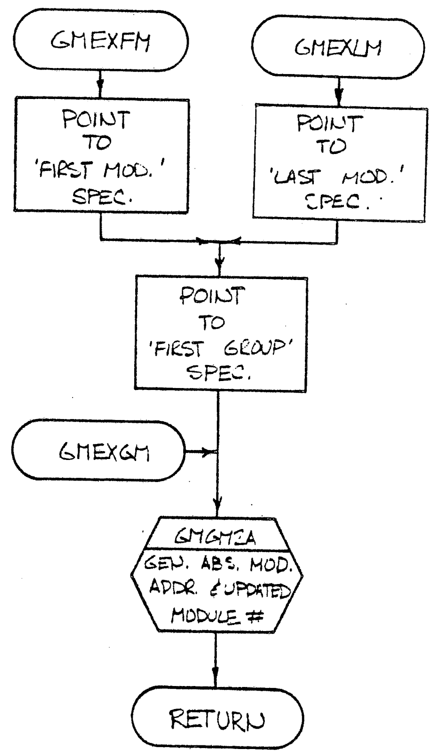
FLOWCHART
CALL NAME: NBGMPROC

ANALYST:	MODULE:
DRAWN BY:	PN:
SHEET 8 OF 11	RELEASE:
NOTES:	VERSION:
SUBROUTINES:	REVISION:

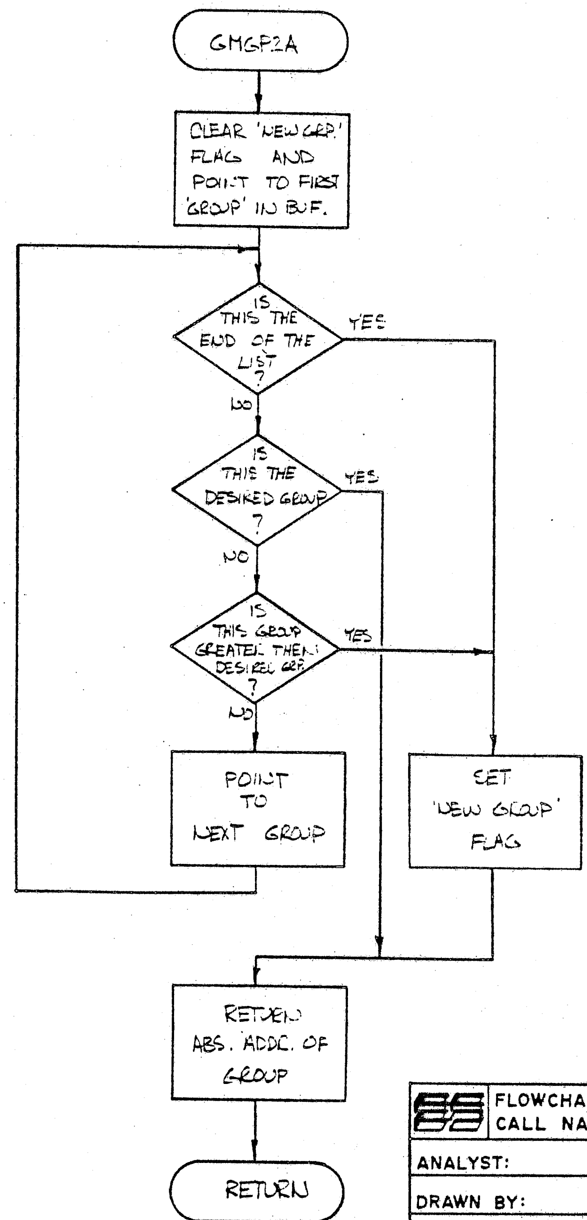
GMEXGP, GMEXFG, GMEXLG

SYSTEM: NSP

FORM 5-018-0

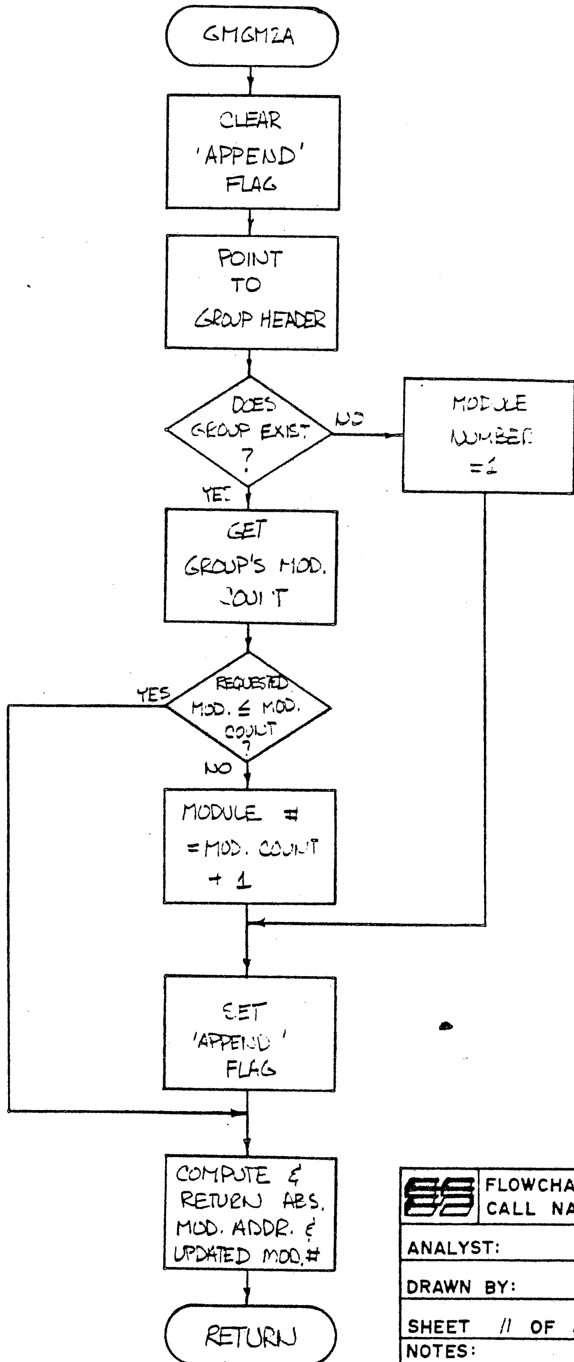


FLOWCHART CALL NAME: NBGMFRDC	
ANALYST:	MODULE:
DRAWN BY:	PN:
SHEET 9 OF 11	RELEASE:
NOTES: SUBROUTINES:	VERSION:
	REVISION:
GMEXGM, GMEXFM, GMEXLM	
SYSTEM: NSP	
FORM 5-018-0	



FLOWCHART	
CALL NAME: NBGMPLO1	
ANALYST:	MODULE:
DRAWN BY:	PN:
SHEET 10 OF 11	RELEASE:
NOTES: SUBROUTINE: GMGP2A	VERSION:
	REVISION:
SYSTEM: NSP	

FORM 5-018-0

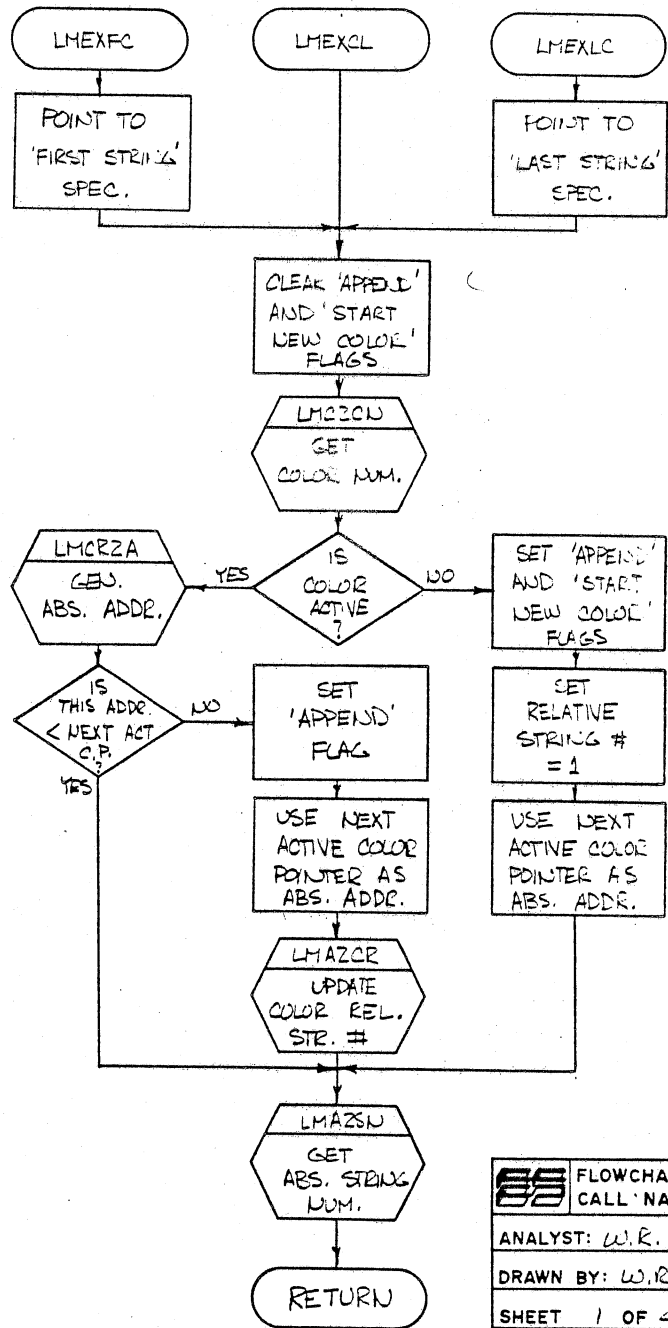


FLOWCHART
CALL NAME: NBGMFLOC

ANALYST:	MODULE:
DRAWN BY:	PN:
SHEET 11 OF 11	RELEASE:
NOTES: SUBROUTINE GMGM2A	VERSION:
	REVISION:

SYSTEM: NSP

FORM 5-018-0



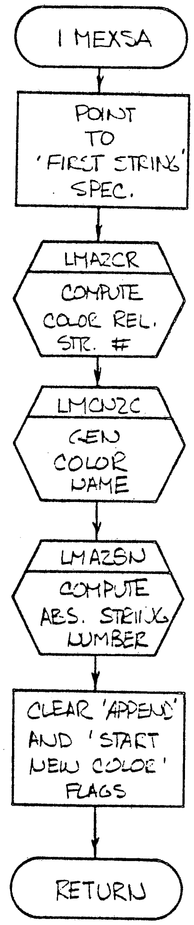
FLOWCHART
CALL NAME: NBLMCNEX

ANALYST: W.R. | MODULE: LMCNEX
DRAWN BY: W.R. | PN: 903039-045
SHEET 1 OF 4 | RELEASE: 02
NOTES: | VERSION: 01
SUBROUTINES: | REVISION: NC

LMEXCL, LMEXFC, LMEXLC

SYSTEM: NSP

FORM 5-018-0

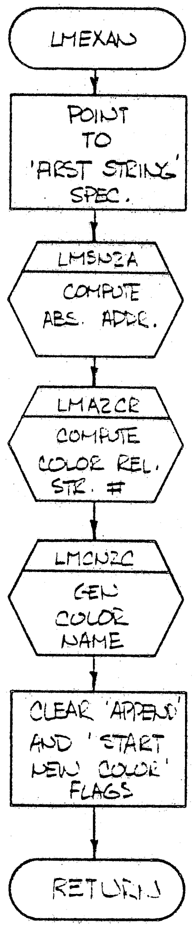


FLOWCHART
CALL NAME: NRLMCNEX

ANALYST:	MODULE:
DRAWN BY:	PN:
SHEET 2 OF 4	RELEASE:
NOTES: SUBROUTINE: LMEXSA	VERSION:
	REVISION:

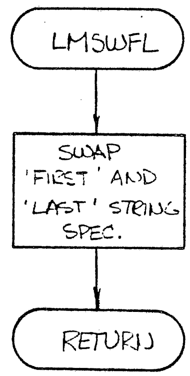
SYSTEM: NSP

FORM 5-018-0

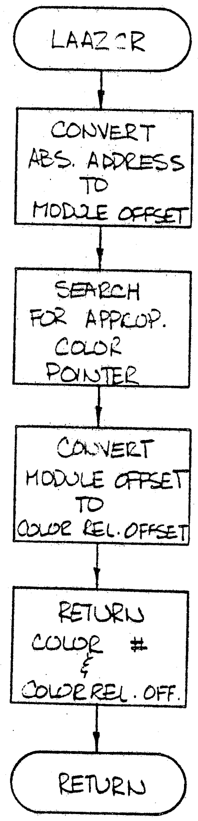


FLOWCHART CALL NAME: NBLMCNEX	
ANALYST:	MODULE:
DRAWN BY:	PN:
SHEET 3 OF 4	RELEASE:
NOTES: SUBROUTINE: LMEXAN	VERSION:
	REVISION:
SYSTEM: NSP	

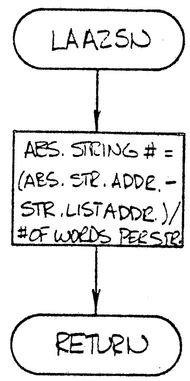
FORM 5-018-0



FLOWCHART CALL NAME: NBLMINDEX	
ANALYST:	MODULE:
DRAWN BY:	PN:
SHEET 4 OF 4	RELEASE:
NOTES: SUBROUTINE: LMSWFL	VERSION:
	REVISION:
SYSTEM: NSP	
FORM 5-018-0	



FLOWCHART CALL NAME: NBLMCNMA	
ANALYST: W.R.	MODULE: LMCNMA
DRAWN BY: W.R.	PN: 9080II-01E
SHEET 1 OF 4	RELEASE: 01
NOTES: SUBROUTINE: LAAZCR	VERSION: Ø1
	REVISION: N/C
SYSTEM: NSP	
FORM 5-018-0	

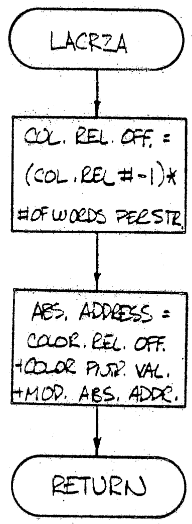


FLOWCHART
CALL NAME: NBLMONMA

ANALYST:	MODULE:
DRAWN BY:	PN:
SHEET 2 OF 4	RELEASE:
NOTES: SUBROUTINE: LAAZSN	VERSION:
	REVISION:

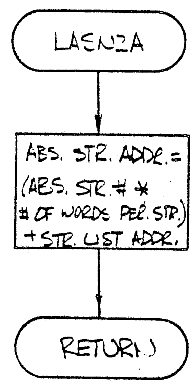
SYSTEM: NSP

FORM 5-018-0

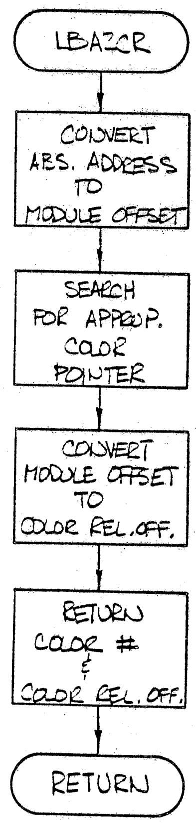


FLOWCHART CALL NAME: NBLM[illegible]MA	
ANALYST:	MODULE:
DRAWN BY:	PN:
SHEET 3 OF 4	RELEASE:
NOTES: SUBROUTINE: LACRZA	VERSION: REVISION:
SYSTEM: NSP	

FORM 5-018-0



FLOWCHART CALL NAME: NBLMCNMA	
ANALYST:	MODULE:
DRAWN BY:	PN:
SHEET 4 OF 4	RELEASE:
NOTES: SUBROUTINE: LASN2A	VERSION: REVISION:
SYSTEM: NSP	
FORM 8-018-0	

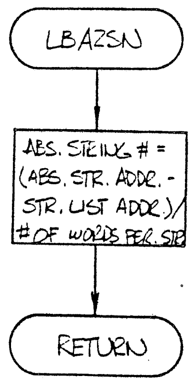


FLOWCHART
CALL NAME: NBLMCNMB

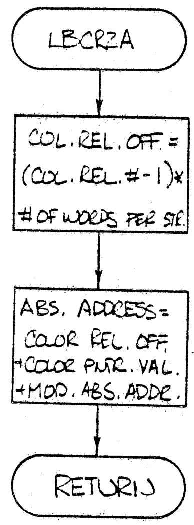
ANALYST: W.R.	MODULE: LMCNMB
DRAWN BY: W.R.	PN: 9D8030-016
SHEET 1 OF 4	RELEASE: 01
NOTES: SUBROUTINE: LBA2CR	VERSION: 01
	REVISION: NC

SYSTEM: NSP

FORM 5-018-0

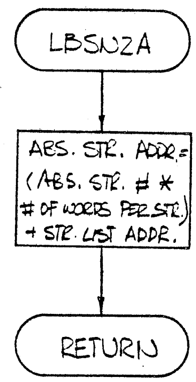


FLOWCHART CALL NAME: NBLMCNMB	
ANALYST:	MODULE:
DRAWN BY:	PN:
SHEET 2 OF 4	RELEASE:
NOTES: SUBROUTINE: LBAZSN	VERSION: REVISION:
SYSTEM: NSP	
FORM 5-018-0	

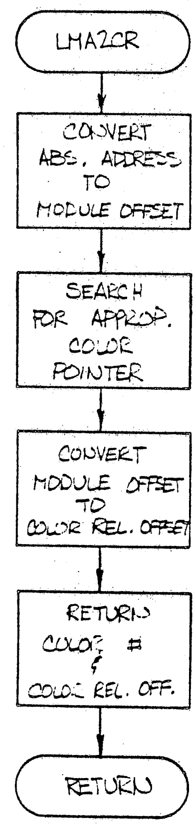


FLOWCHART CALL NAME: NBLMCNMB	
ANALYST:	MODULE:
DRAWN BY:	PN:
SHEET 3 OF 4	RELEASE:
NOTES: SUBROUTINE: LBCR2A	VERSION: REVISION:
SYSTEM: NSP	

FORM 5-018-0

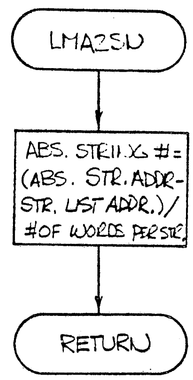


FLOWCHART CALL NAME: NBLF.SNMB	
ANALYST:	MODULE:
DRAWN BY:	PN:
SHEET 4 OF 4	RELEASE:
NOTES: SUBROUTINE: LBSNZA	VERSION: REVISION:
SYSTEM: NSP	
FORM 8-018-0	

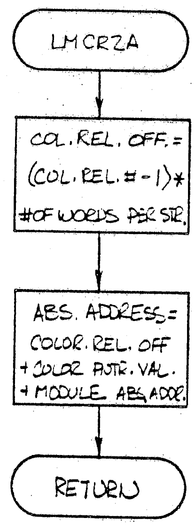


FLOWCHART CALL NAME: NBLMCNVR	
ANALYST: W.R.	MODULE: LMCNVR
DRAWN BY: W.R.	PN: 90B020-046
SHEET 1 OF 7	RELEASE: 02
NOTES: SUBROUTINE: LMA2CR	VERSION: 01
	REVISION: NC
SYSTEM: NSP	

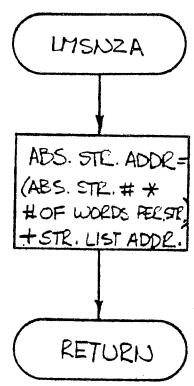
FORM 5-018-0



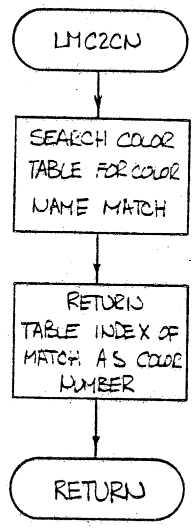
FLOWCHART CALL NAME: NBLMCNVR	
ANALYST:	MODULE:
DRAWN BY:	PN:
SHEET 2 OF 7	RELEASE:
NOTES: SUBROUTINE: LMA2SN	VERSION: REVISION:
SYSTEM: NSP	
FORM 8-018-0	



FLOWCHART CALL NAME: NBLMCINVR	
ANALYST:	MODULE:
DRAWN BY:	PN:
SHEET 3 OF 7	RELEASE:
NOTES: SUBROUTINE: LMCRZA	VERSION: REVISION:
SYSTEM: NSP	
FORM 5-018-0	



FLOWCHART CALL NAME: NBLMCNVR	
ANALYST:	MODULE:
DRAWN BY:	PN:
SHEET 4 OF 7	RELEASE:
NOTES: SUBROUTINE: LMSN2A	VERSION: REVISION:
SYSTEM: NSP	
FORM 5-018-0	

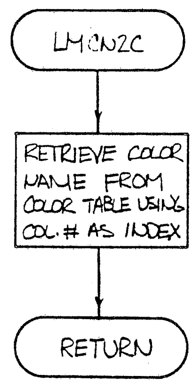


FLOWCHART
CALL NAME: NBLMGMVR

ANALYST:	MODULE:
DRAWN BY:	PN:
SHEET 5 OF 7	RELEASE:
NOTES: SUBROUTINE: LMC2CN	VERSION:
	REVISION:

SYSTEM: NSP

FORM 5-018-0

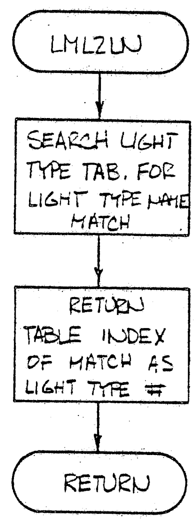


FLOWCHART
CALL NAME: NBLMCNVR

ANALYST: | MODULE:
DRAWN BY: | PN:
SHEET 6 OF 7 | RELEASE:
NOTES: | VERSION:
SUBROUTINE: | REVISION:
LMCN2C

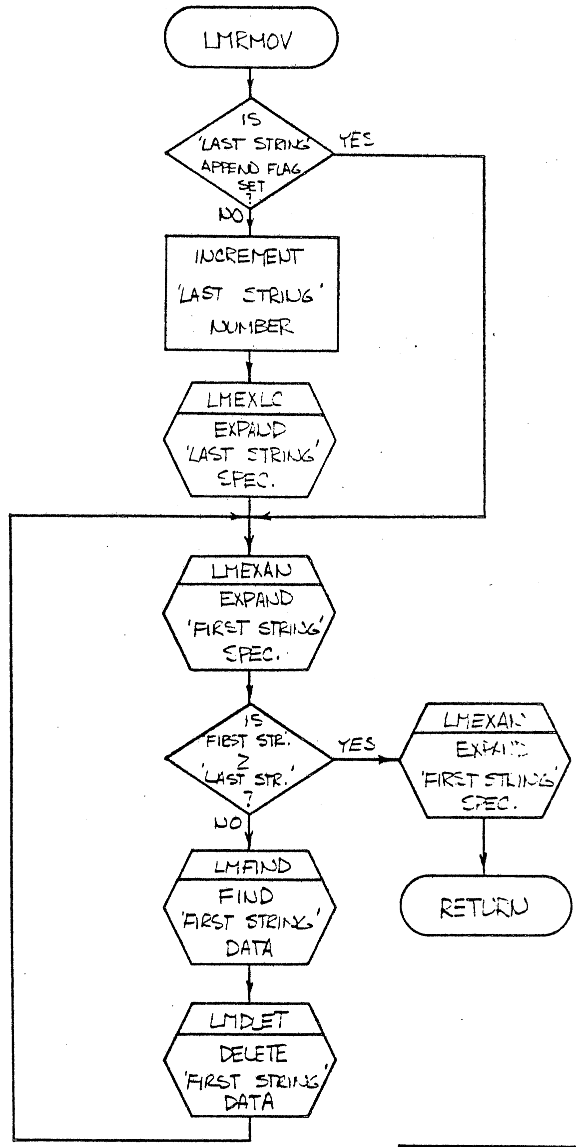
SYSTEM: NSP

FORM 5-018-0



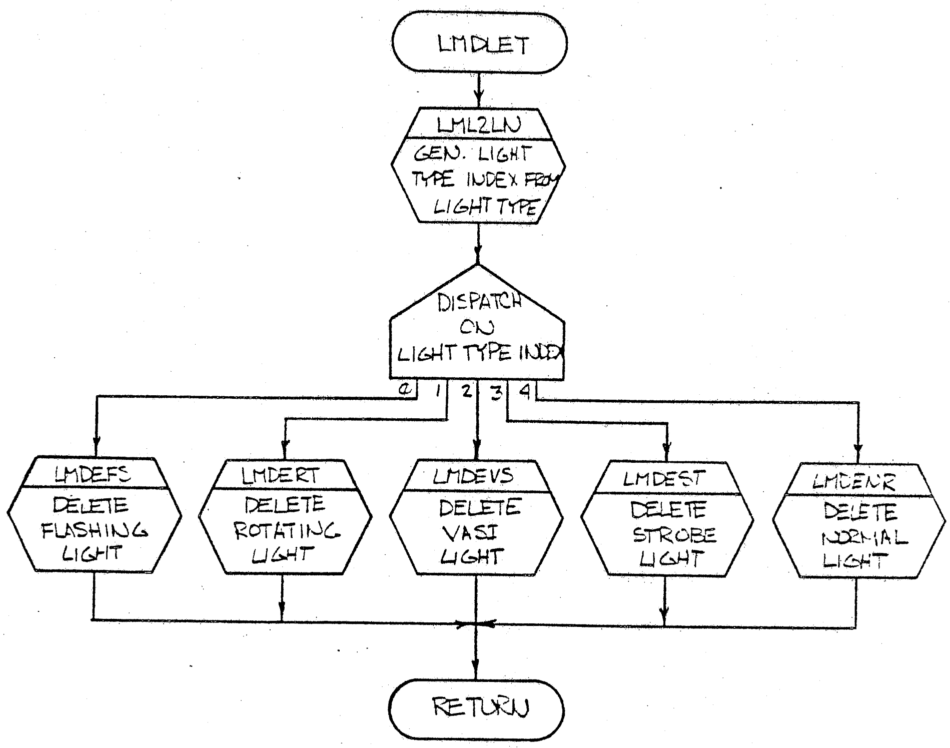
FLOWCHART CALL NAME: NBLMCNVR	
ANALYST:	MODULE:
DRAWN BY:	PN:
SHEET 7 OF 7	RELEASE:
NOTES: SUBROUTINE LMLZLN	VERSION: REVISION:
SYSTEM: NSP	

FORM 5-018-0



FLOWCHART CALL NAME: NBLMDLET	
ANALYST: W.R.	MODULE: LMDLET
DRAWN BY: W.R.	PN: 9Ø8Ø29-Ø41
SHEET 1 OF 8	RELEASE: Ø2
NOTES: SUBROUTINE: LMRMOV	VERSION: Ø1 REVISION: NC
SYSTEM: NSP	

FORM 5-018-0

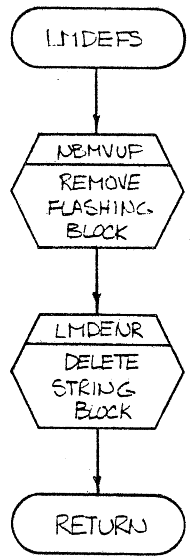


FLOWCHART
CALL NAME: NBLMDLET

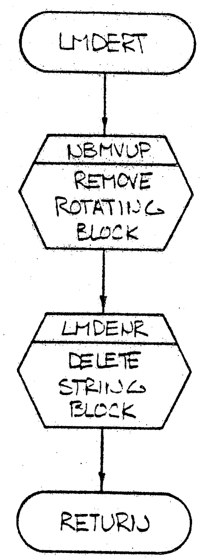
ANALYST:
MODULE:
DRAWN BY:
PN:
SHEET 2 OF 8
RELEASE:
NOTES:
SUBROUTINE LMDLET
VERSION:
REVISION:

SYSTEM: NSP

FORM 5-018-0

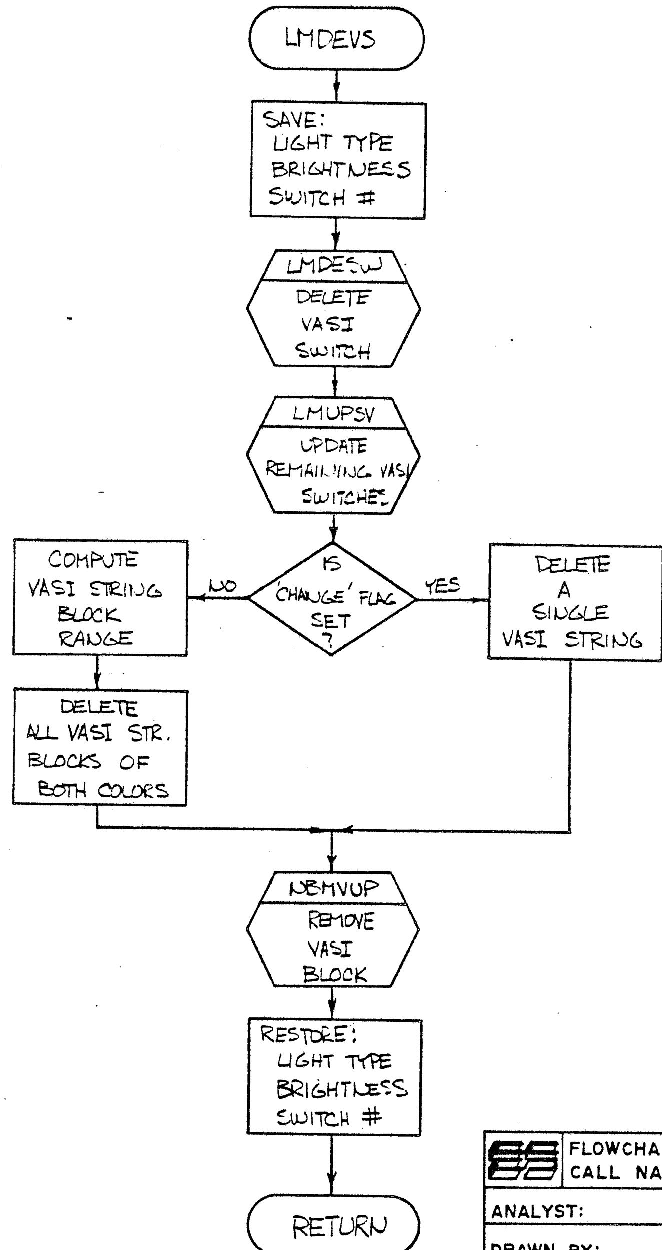


FLOWCHART CALL NAME: NELMDLET	
ANALYST:	MODULE:
DRAWN BY:	PN:
SHEET 3 OF 8	RELEASE:
NOTES: SUBROUTINE: LMDEFS	VERSION:
	REVISION:
SYSTEM: NSP	
FORM 5-018-0	



FLOWCHART CALL NAME: NBLMDLET	
ANALYST:	MODULE:
DRAWN BY:	PN:
SHEET 4 OF 8	RELEASE:
NOTES: SUBROUTINE: LMDERT	VERSION: REVISION:
SYSTEM: NSP	

FORM 5-018-0

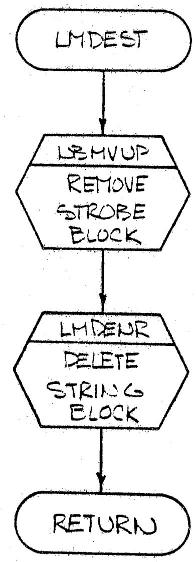


FLOWCHART
CALL NAME: NBLMDLET

ANALYST:	MODULE:
DRAWN BY:	PN:
SHEET 5 OF 8	RELEASE:
NOTES: SUBROUTINE: LMDEVS	VERSION:
	REVISION:

SYSTEM: NSP

FORM 5-018-0

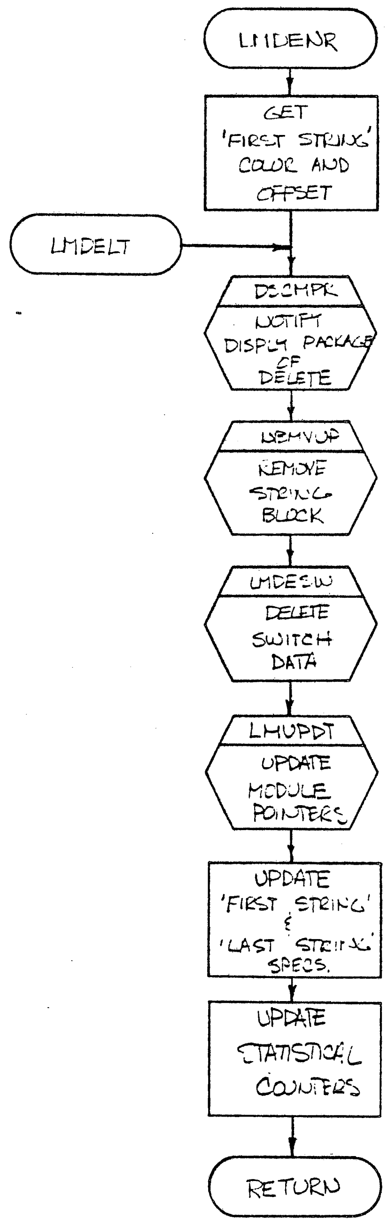


FLOWCHART
CALL NAME: NBLMDLET

ANALYST:	MODULE:
DRAWN BY:	PN:
SHEET 6 OF 8	RELEASE:
NOTES: SUBROUTINE: LMDEST	VERSION:
	REVISION:

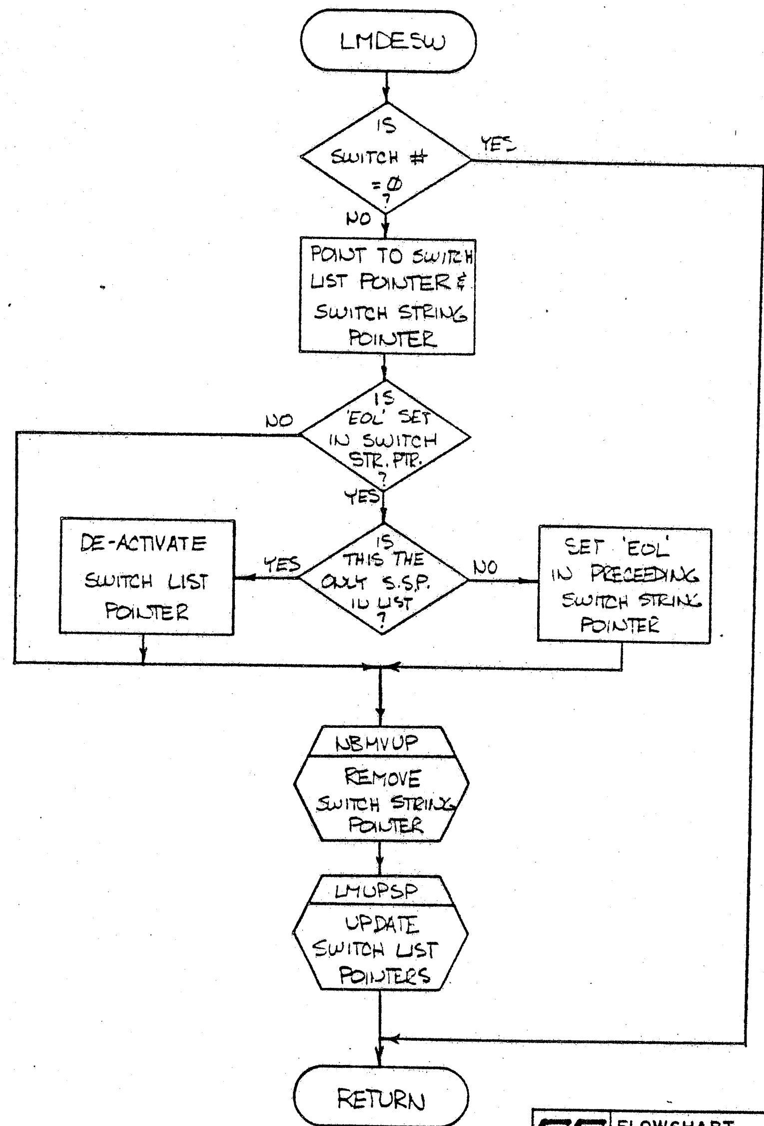
SYSTEM: NSP

FORM 5-018-0

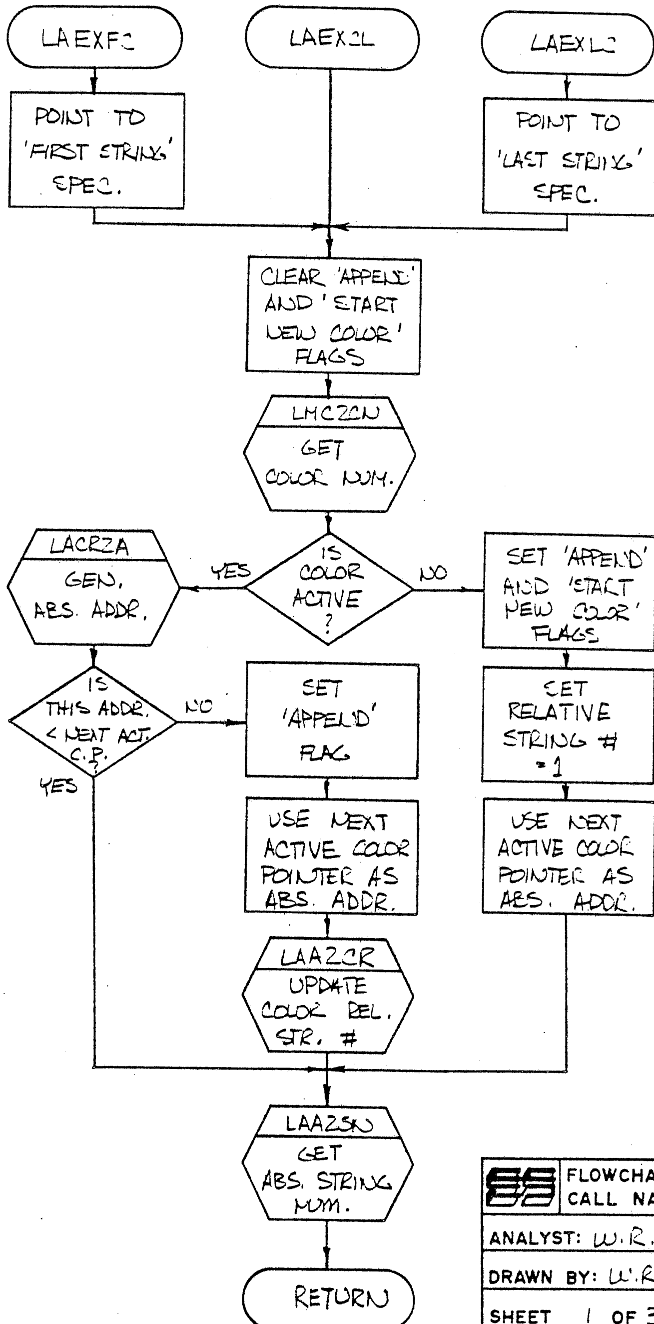


FLOWCHART CALL NAME: NBLMDLET	
ANALYST:	MODULE:
DRAWN BY:	PN:
SHEET 7 OF 8	RELEASE:
NOTES: SUBROUTINES: LMDENR, LMDELT	VERSION:
	REVISION:
SYSTEM: NSP	

FORM 5-018-0



FLOWCHART CALL NAME: NBLMDLET	
ANALYST:	MODULE:
DRAWN BY:	PN:
SHEET 8 OF 8	RELEASE:
NOTES: SUBROUTINE: LMDESW	VERSION:
	REVISION:
SYSTEM: NSP	
FORM 5-018-0	



FLOWCHART
CALL NAME: NBLMEXMA

ANALYST: W.R. | MODULE: LMEXMA

DRAWN BY: W.R. | PN: 908020-003

SHEET 1 OF 3 | RELEASE: 02

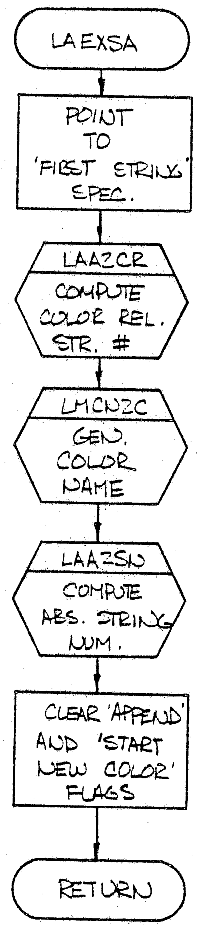
NOTES: | VERSION: 01

SUBROUTINES: | REVISION: 00

LAEXCL, LAEXFC, LAEXLC

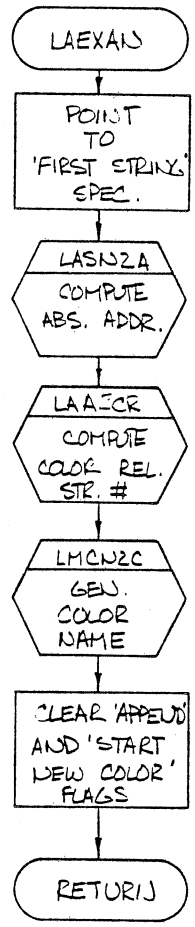
SYSTEM: NSP

FORM 5-018-0



FLOWCHART CALL NAME: UBLMEXMA	
ANALYST:	MODULE:
DRAWN BY:	PN:
SHEET 2 OF 3	RELEASE:
NOTES: SUBROUTINE: LAEXSA	VERSION:
	REVISION:
SYSTEM: NSP	

FORM 5-018-0

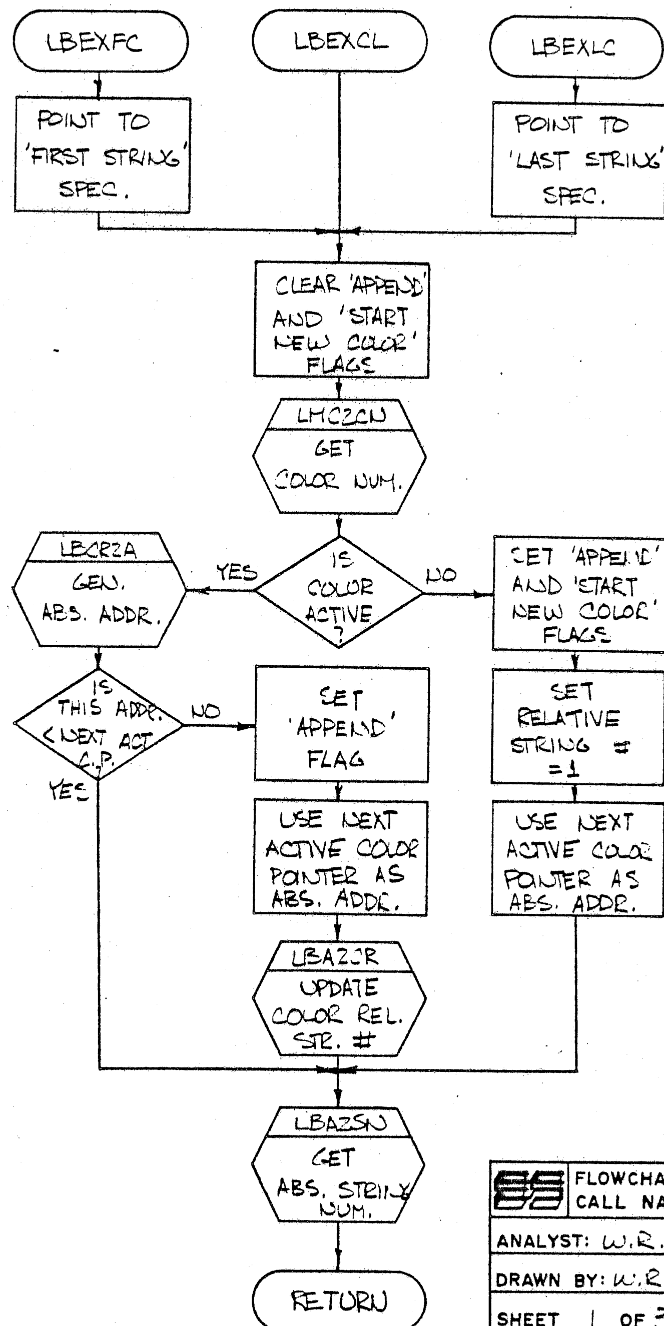


FLOWCHART
CALL NAME: NBLHEXMA

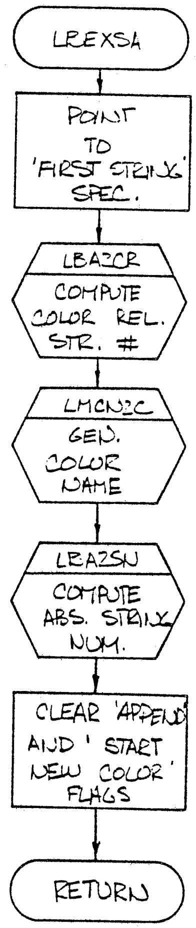
ANALYST:	MODULE:
DRAWN BY:	PN:
SHEET 3 OF 3	RELEASE:
NOTES: SUBROUTINE: LAEXAN	VERSION:
	REVISION:

SYSTEM: NSP

FORM 5-018-0

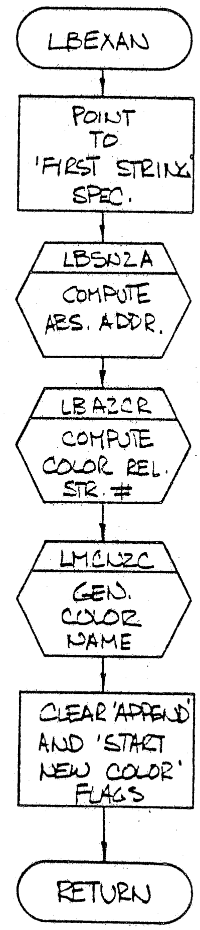


FLOWCHART CALL NAME: NBLMEXMB	
ANALYST: W.R.	MODULE: LMEXMB
DRAWN BY: W.R.	PN: 908030-014
SHEET 1 OF 2	RELEASE: 02
NOTES: SUBROUTINES:	VERSION: 01 REVISION: NC
LBEXCL, LBEXFC, LBEXLC	
SYSTEM: NSP	
FORM 6-018-0	



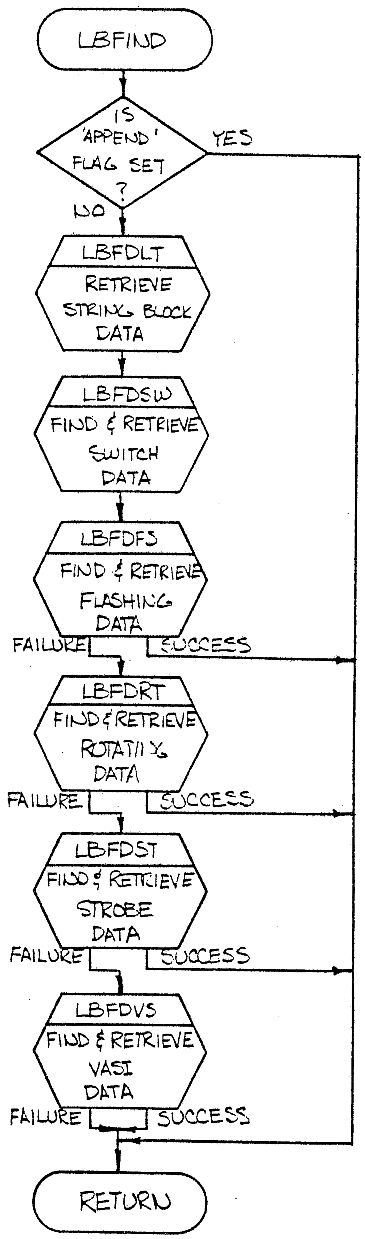
FLOWCHART CALL NAME: NBLMEXMB	
ANALYST:	MODULE:
DRAWN BY:	PN:
SHEET 2 OF 3	RELEASE:
NOTES: SUBROUTINE: LREXSA	VERSION: REVISION:
SYSTEM: NSP	

FORM 5-018-0

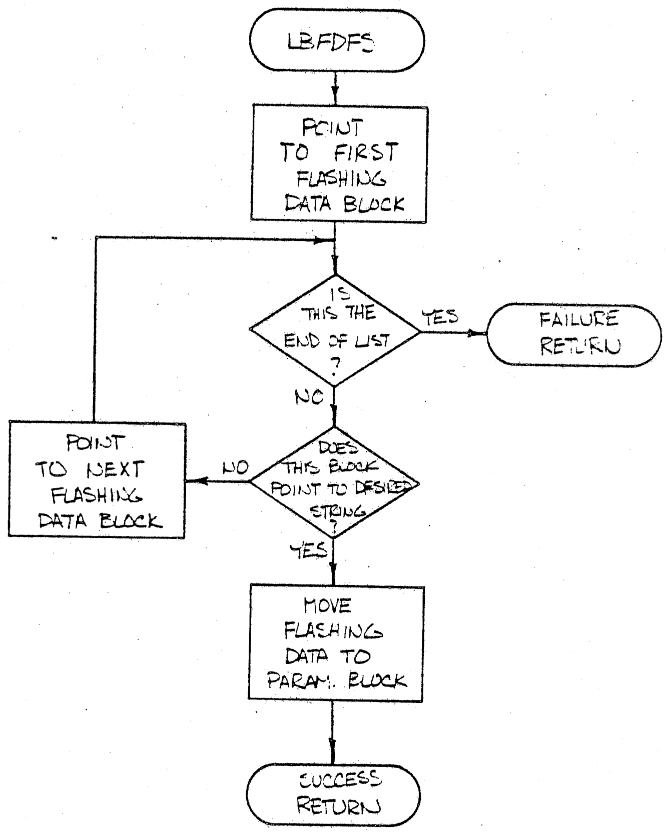


FLOWCHART CALL NAME: NB_MEXMB	
ANALYST:	MODULE:
DRAWN BY:	PN:
SHEET 3 OF 3	RELEASE:
NOTES: SUBROUTINE: LBEXAN	VERSION: REVISION:
SYSTEM: NSP	

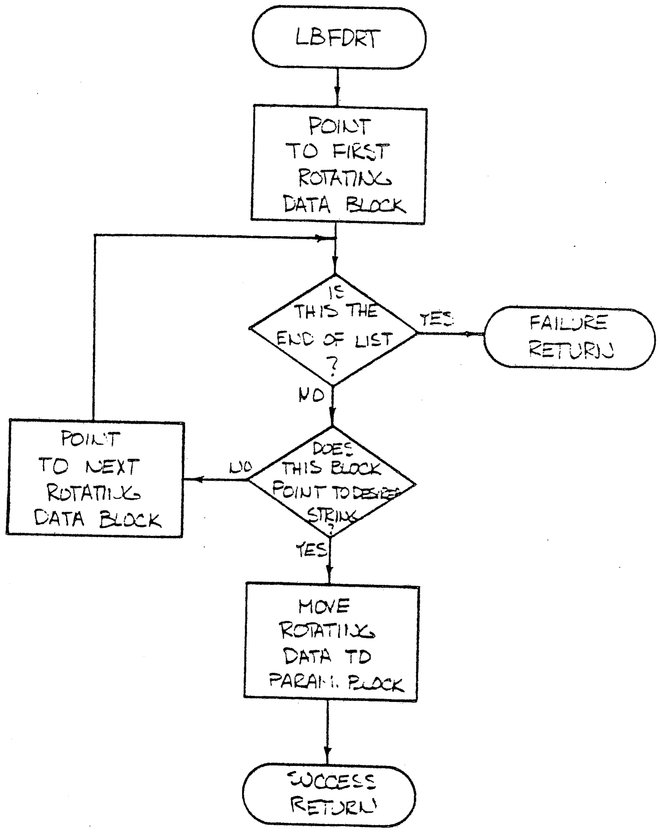
FORM 5-018-0



FLOWCHART CALL NAME: NBLMFDMB	
ANALYST: W.R.	MODULE: LMFDMB
DRAWN BY: W.R.	PN: 908033-011
SHEET 1 OF 8	RELEASE: 72
NOTES: SUBROUTINE: LBFIND	VERSION: 01 REVISION: NC
SYSTEM: NSP	
FORM 5-018-0	

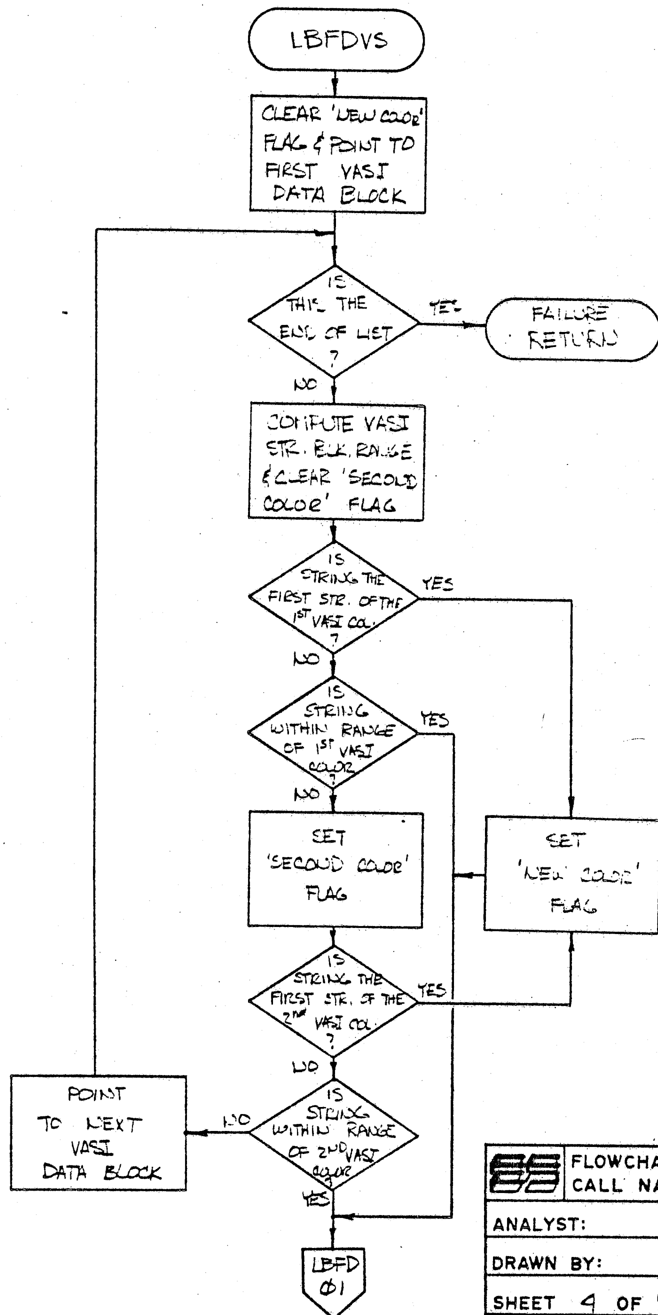


FLOWCHART CALL NAME: NBLMFDMB	
ANALYST:	MODULE:
DRAWN BY:	PN:
SHEET 2 OF 8	RELEASE:
NOTES: SUBROUTINE: LBFDFS	VERSION: REVISION:
SYSTEM: NSP	
FORM 5-018-0	



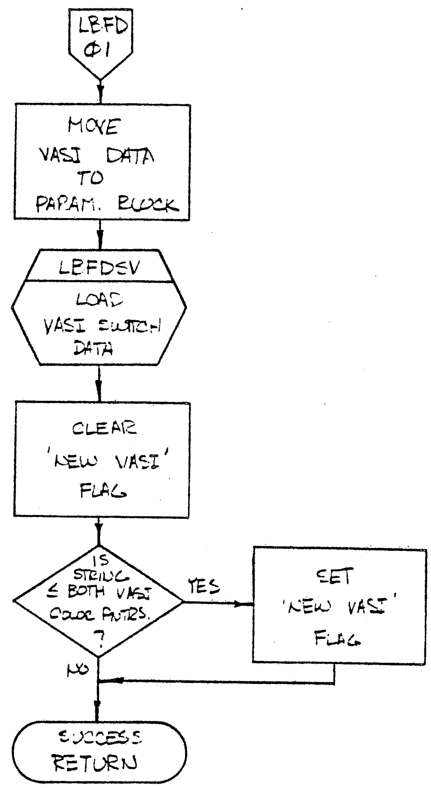
FLOWCHART CALL NAME: NBLMFDMB	
ANALYST:	MODULE:
DRAWN BY:	PN:
SHEET 3 OF 8	RELEASE:
NOTES: SUBROUTINE: LBFDRT	VERSION: REVISION:
SYSTEM: NSP	

FORM 5-018-0

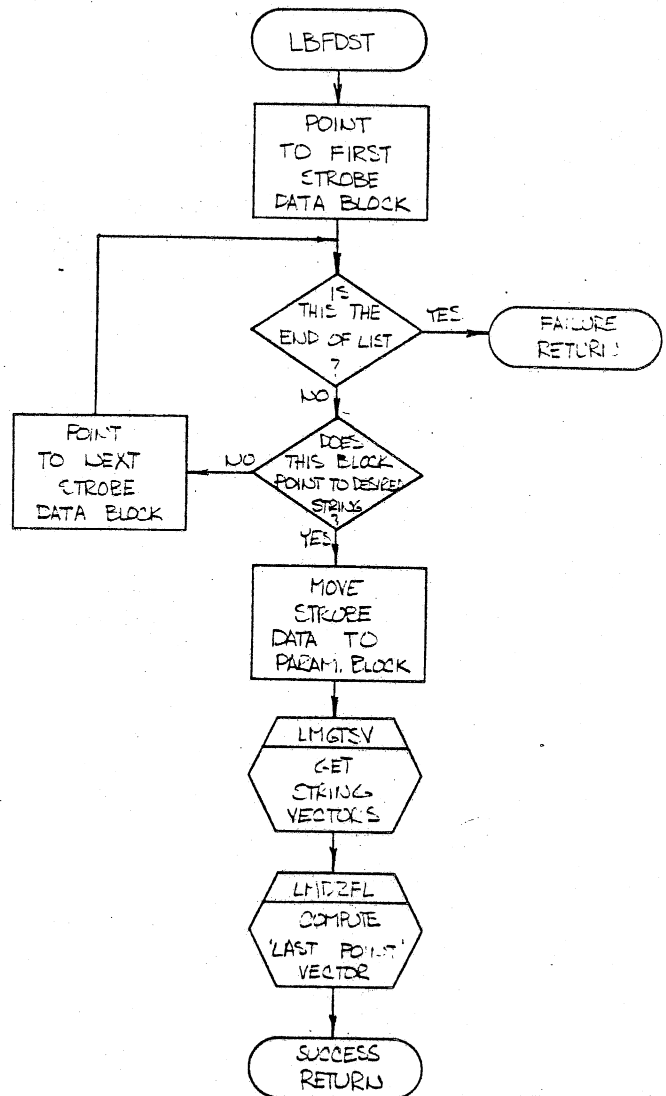


FLOWCHART CALL NAME: NBLMFDMB	
ANALYST:	MODULE:
DRAWN BY:	PN:
SHEET 4 OF 8	RELEASE:
NOTES: SUBROUTINE: LBFDVS	VERSION:
	REVISION:
SYSTEM: NSP	

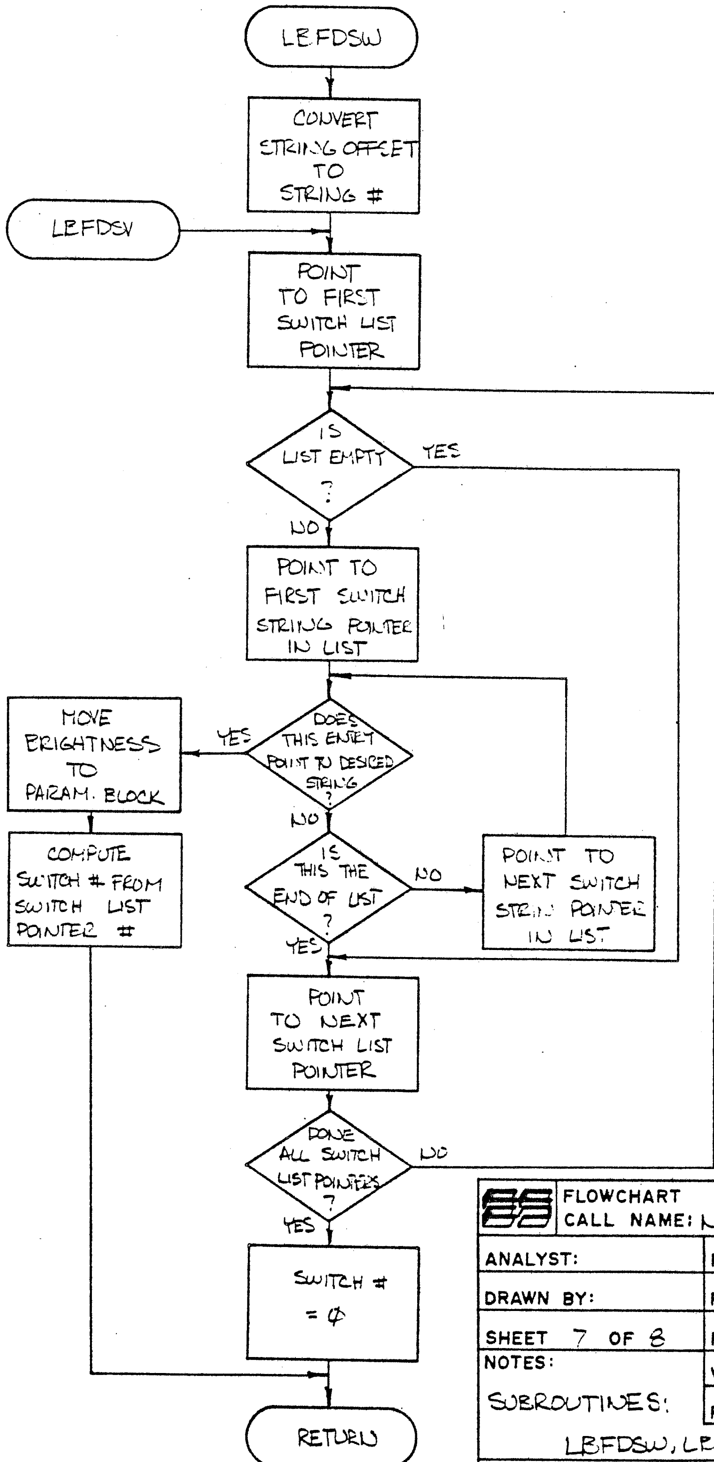
FORM 5-018-0



FLOWCHART CALL NAME: NBLMFDME	
ANALYST:	MODULE:
DRAWN BY:	PN:
SHEET 5 OF 8	RELEASE:
NOTES: SUBROUTINE:	VERSION:
	REVISION:
LBFDVS (CONTINUED)	
SYSTEM: NSP	
FORM 5-018-0	



FLOWCHART CALL NAME: NBLMFDMP	
ANALYST:	MODULE:
DRAWN BY:	PN:
SHEET 6 OF 8	RELEASE:
NOTES: SUBROUTINE: LBFDST	VERSION: REVISION:
SYSTEM: NSP	
FORM 5-018-0	

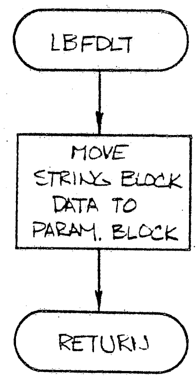


FLOWCHART
CALL NAME: NBLMFDM2

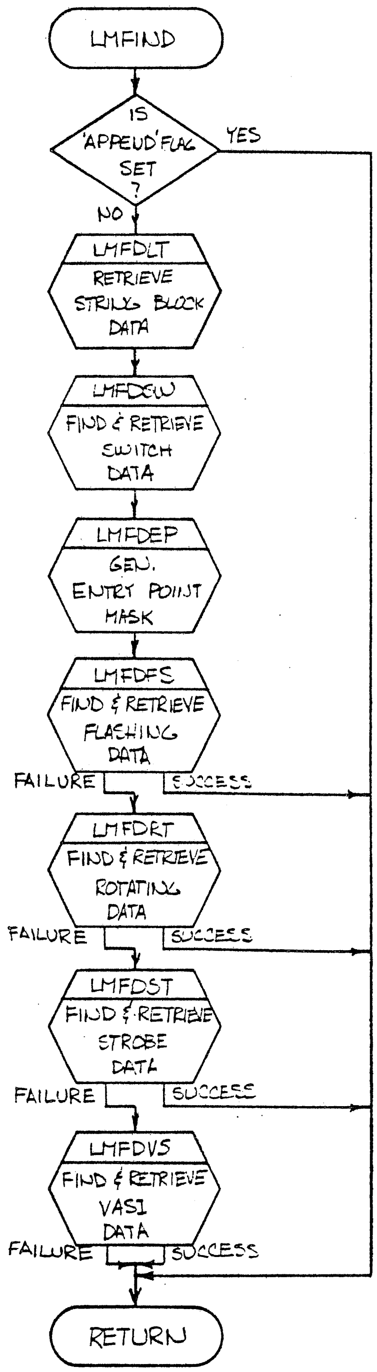
ANALYST: | MODULE:
DRAWN BY: | PN:
SHEET 7 OF 8 | RELEASE:
NOTES: | VERSION:
SUBROUTINES: | REVISION:
LBFDSW, LBFDSV

SYSTEM: NSP

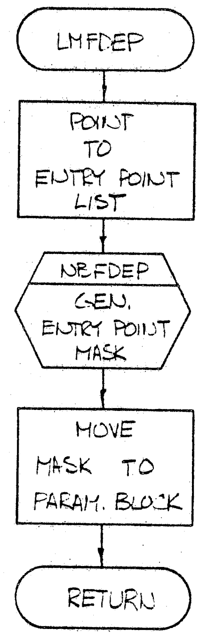
FORM 5-018-0



FLOWCHART CALL NAME: NEW FDMB	
ANALYST:	MODULE:
DRAWN BY:	PN:
SHEET 8 OF 8	RELEASE:
NOTES: SUBROUTINE: LBFDLT	VERSION: REVISION:
SYSTEM: NSP	
FORM 5-018-0	

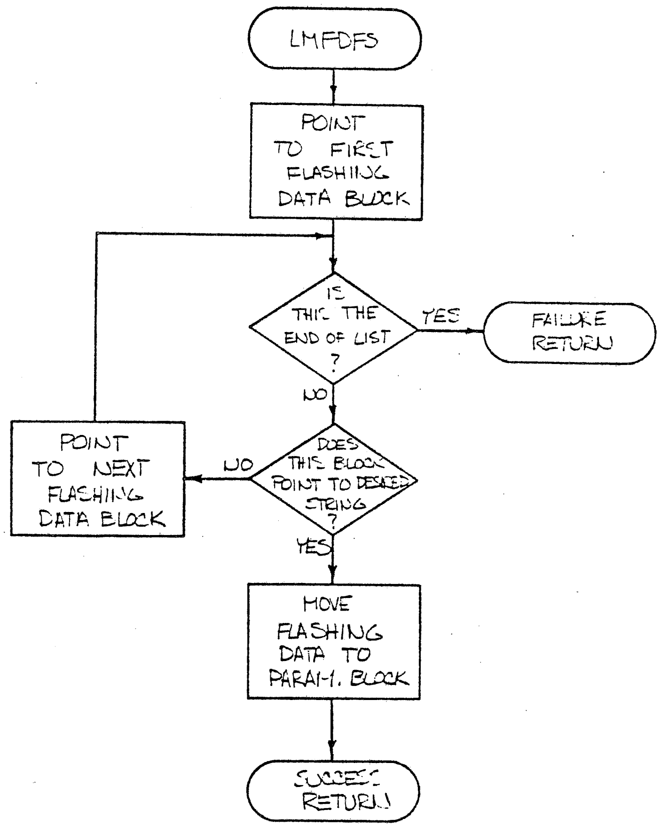


FLOWCHART CALL NAME: NBLMFIND	
ANALYST: W.R.	MODULE: LMFIND
DRAWN BY: W.R.	PN: 905320-043
SHEET 1 OF 8	RELEASE: 02
NOTES: SUBROUTINE: LMFIND	VERSION: 01 REVISION: NC
SYSTEM: NSP	
FORM 5-018-0	

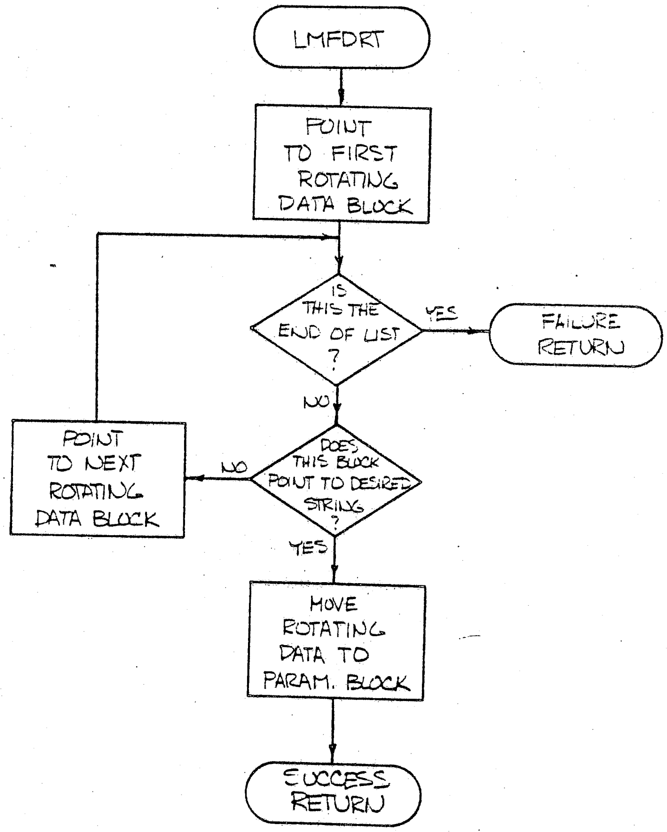


FLOWCHART CALL NAME: NBLMFIND	
ANALYST:	MODULE:
DRAWN BY:	PN:
SHEET 2 OF 8	RELEASE:
NOTES: SUBROUTINE: LMFDEP	VERSION:
	REVISION:
SYSTEM: NSP	

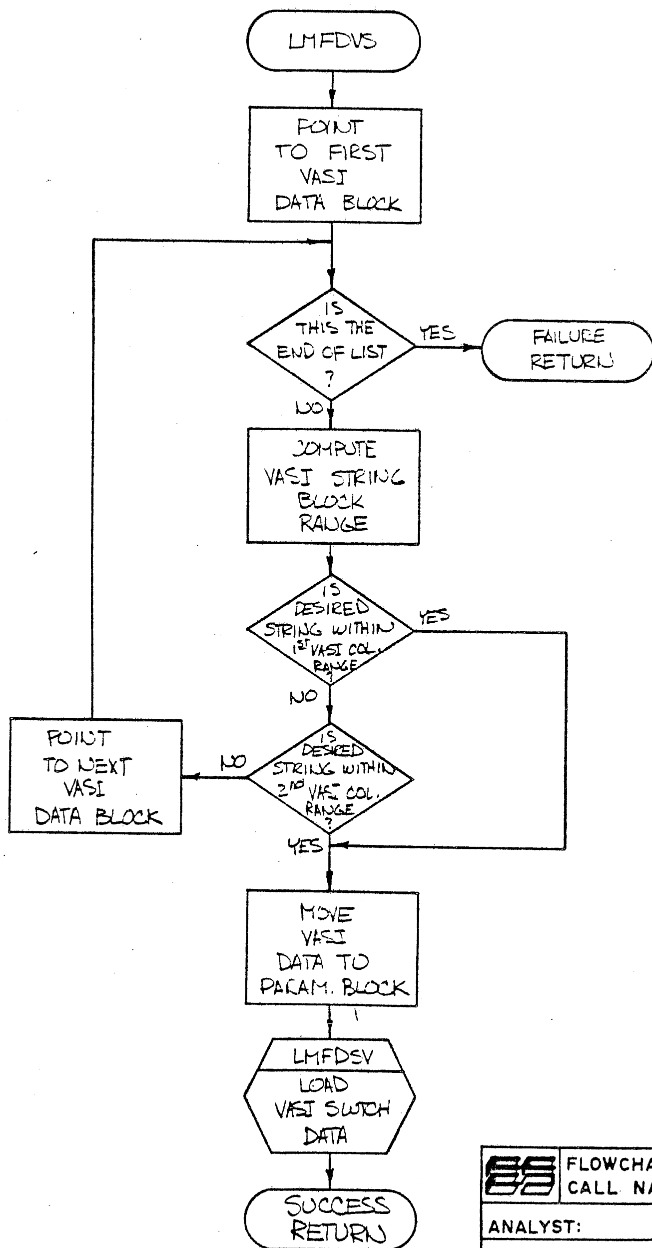
FORM 5-018-0



FLOWCHART CALL NAME: NBLMFIND	
ANALYST:	MODULE:
DRAWN BY:	PN:
SHEET 3 OF 8	RELEASE:
NOTES: SUBROUTINE: LMFDFS	VERSION: REVISION:
SYSTEM: NSP	
FORM 5-018-0	



FLOWCHART CALL NAME: NBLMFIND	
ANALYST:	MODULE:
DRAWN BY:	PN:
SHEET 4 OF 8	RELEASE:
NOTES: SUBROUTINE: LMFDRT	VERSION: REVISION:
SYSTEM: NSP	
FORM 5-018-0	

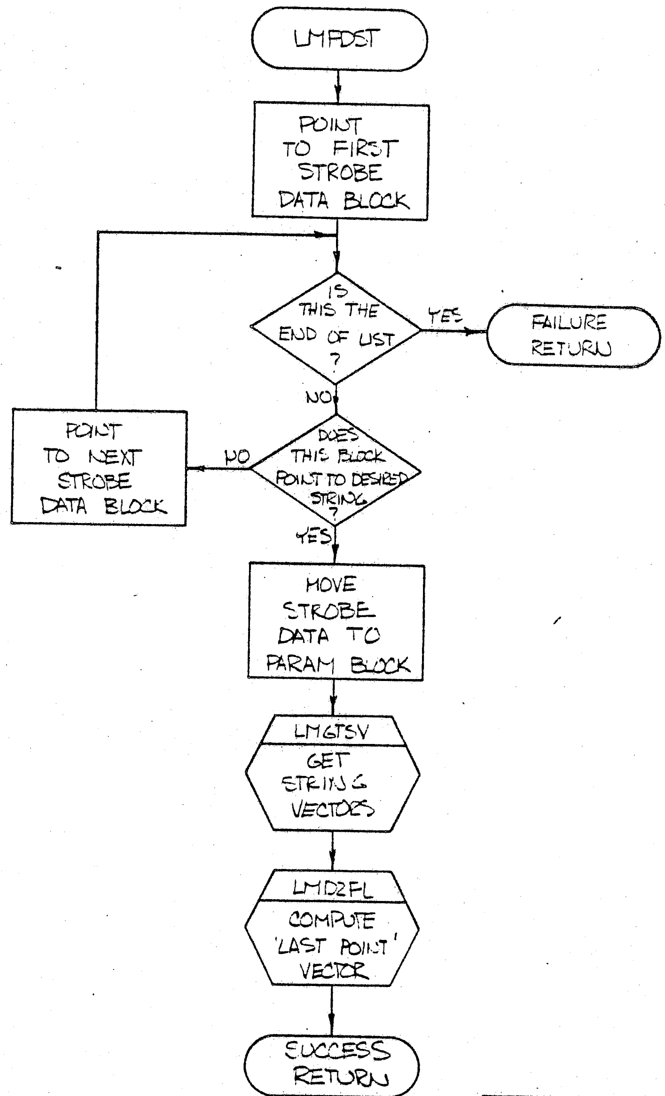


FLOWCHART
CALL NAME: NBLMFIND

ANALYST:	MODULE:
DRAWN BY:	PN:
SHEET 5 OF 8	RELEASE:
NOTES: SUBROUTINE: LMFDVS	VERSION:
	REVISION:

SYSTEM: NSP

FORM 5-018-0

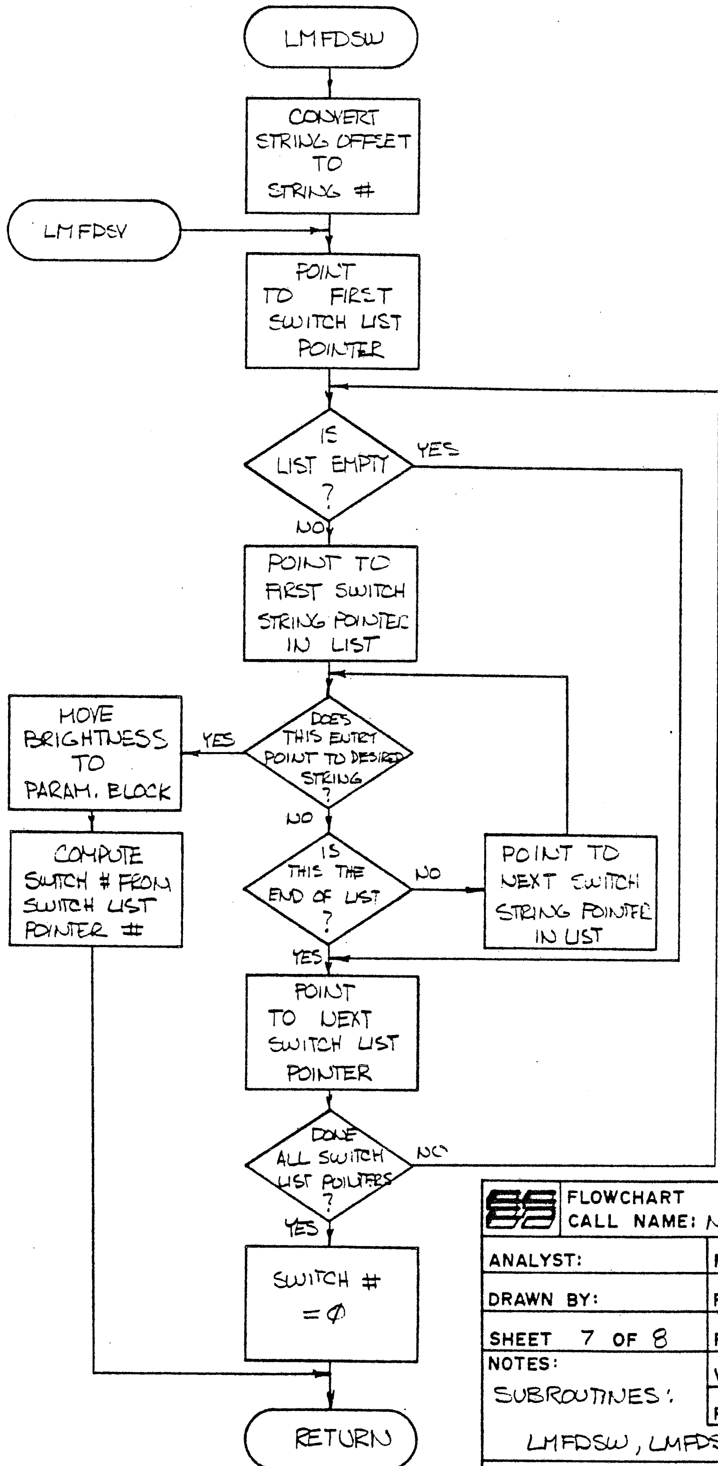


FLOWCHART
CALL NAME: NBLMFIND

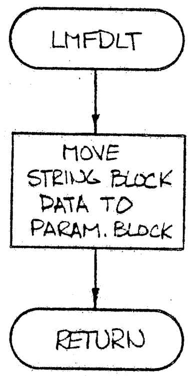
ANALYST:	MODULE:
DRAWN BY:	PN:
SHEET 6 OF 8	RELEASE:
NOTES: SUBROUTINE: LMFDST	VERSION:
	REVISION:

SYSTEM: NSP

FORM 5-018-0



FLOWCHART CALL NAME: NBLMFIND	
ANALYST:	MODULE:
DRAWN BY:	PN:
SHEET 7 OF 8	RELEASE:
NOTES: SUBROUTINES: LMFDSW, LMFDSV	VERSION: REVISION:
SYSTEM: NSP	
FORM 5-018-0	

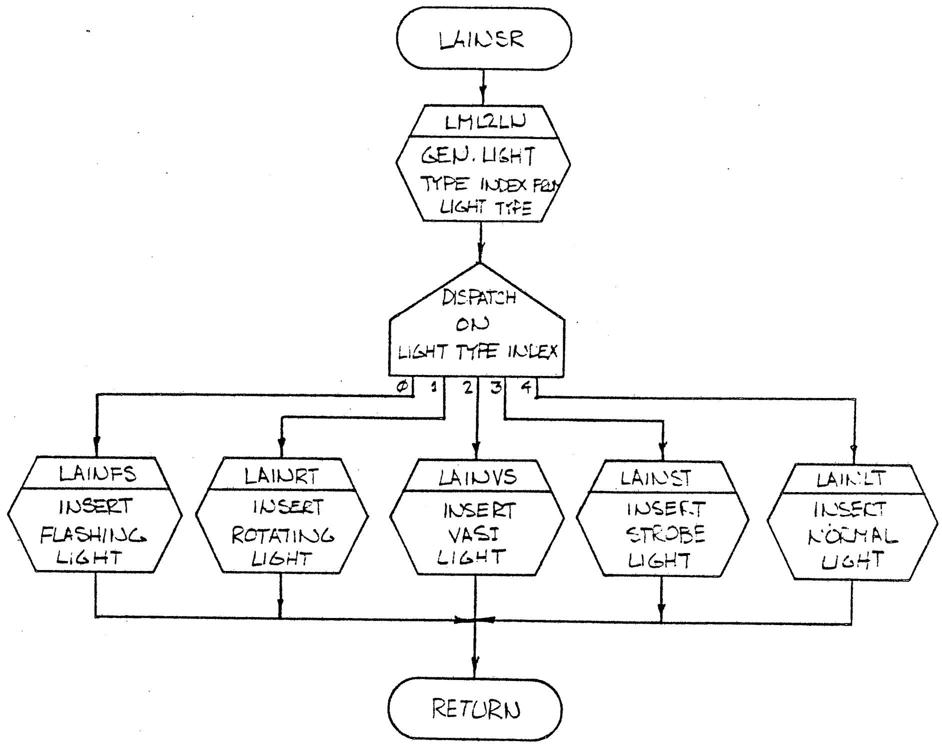


FLOWCHART
CALL NAME: NBLMFIND

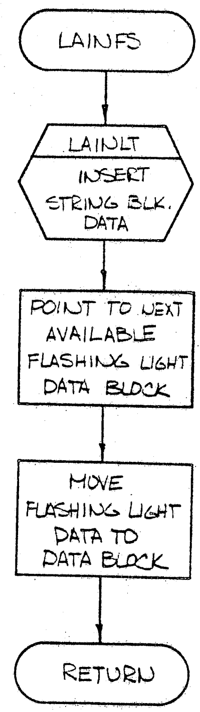
ANALYST:	MODULE:
DRAWN BY:	PN:
SHEET 8 OF 8	RELEASE:
NOTES: SUBROUTINE: LMFDLT	VERSION:
	REVISION:

SYSTEM: NSP

FORM 5-018-0



FLOWCHART CALL NAME: NELMINMA	
ANALYST: W.R.	MODULE: LMINMA
DRAWN BY: W.R.	PN: 90832D-Ø10
SHEET 1 OF 8	RELEASE: 00
NOTES: SUBROUTINE: LAINSR	VERSION: Ø1 REVISION: NC
SYSTEM: NSP	
FORM 5-018-0	

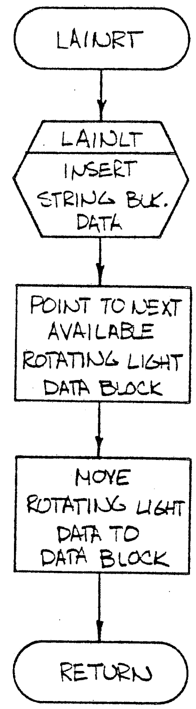


FLOWCHART
CALL NAME: NBLHINMA

ANALYST:	MODULE:
DRAWN BY:	PN:
SHEET 2 OF 8	RELEASE:
NOTES: SUBROUTINE: LAINFS	VERSION:
	REVISION:

SYSTEM: NSP

FORM 5-018-0

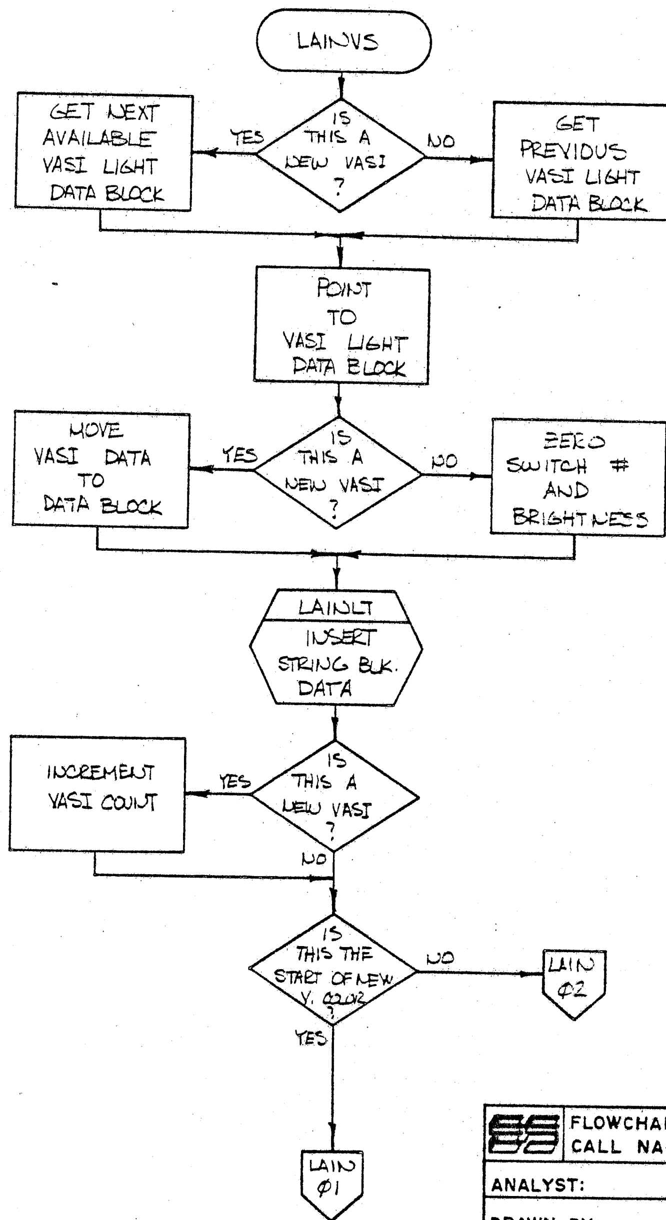


FLOWCHART
CALL NAME: NBLMIINMA

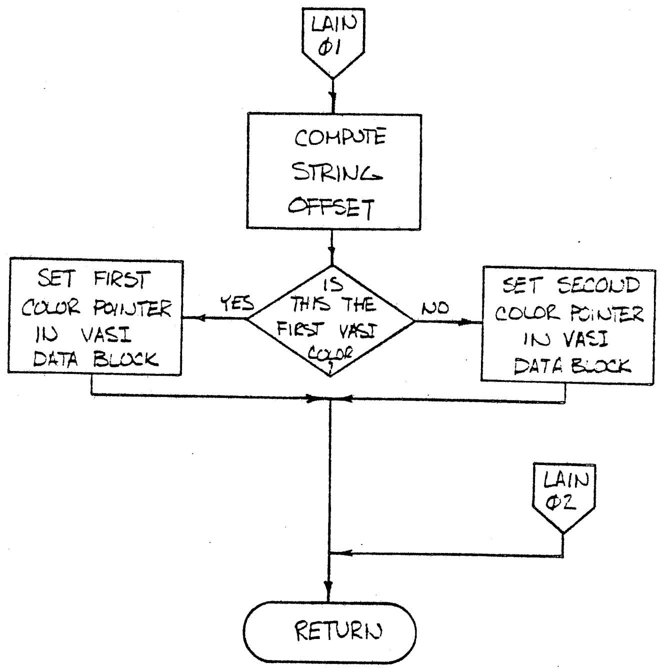
ANALYST:	MODULE:
DRAWN BY:	PN:
SHEET 3 OF 8	RELEASE:
NOTES: SUBROUTINE: LAINRT	VERSION:
	REVISION:

SYSTEM: NSP

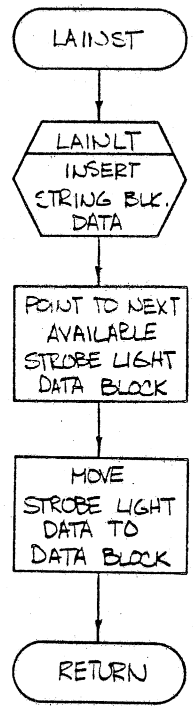
FORM 5-018-0



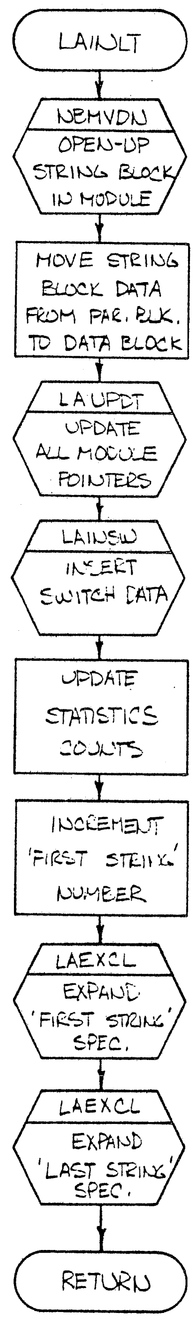
FLOWCHART CALL NAME: NEUMIDMA	
ANALYST:	MODULE:
DRAWN BY:	PN:
SHEET 4 OF 8	RELEASE:
NOTES: SUBROUTINE: LAINVS	VERSION: REVISION:
SYSTEM: NSP	
FORM 5-018-0	



FLOWCHART CALL NAME: NBLMINMA	
ANALYST:	MODULE:
DRAWN BY:	PN:
SHEET 5 OF 8	RELEASE:
NOTES: SUBROUTINE: LAINVS (CONTINUED)	VERSION: REVISION:
SYSTEM: NSP	
FORM 5-018-0	



FLOWCHART CALL NAME: NBLMIINMA	
ANALYST:	MODULE:
DRAWN BY:	PN:
SHEET 6 OF 8	RELEASE:
NOTES: SUBROUTINE: LAINST	VERSION: REVISION:
SYSTEM: NSP	
FORM 5-018-0	

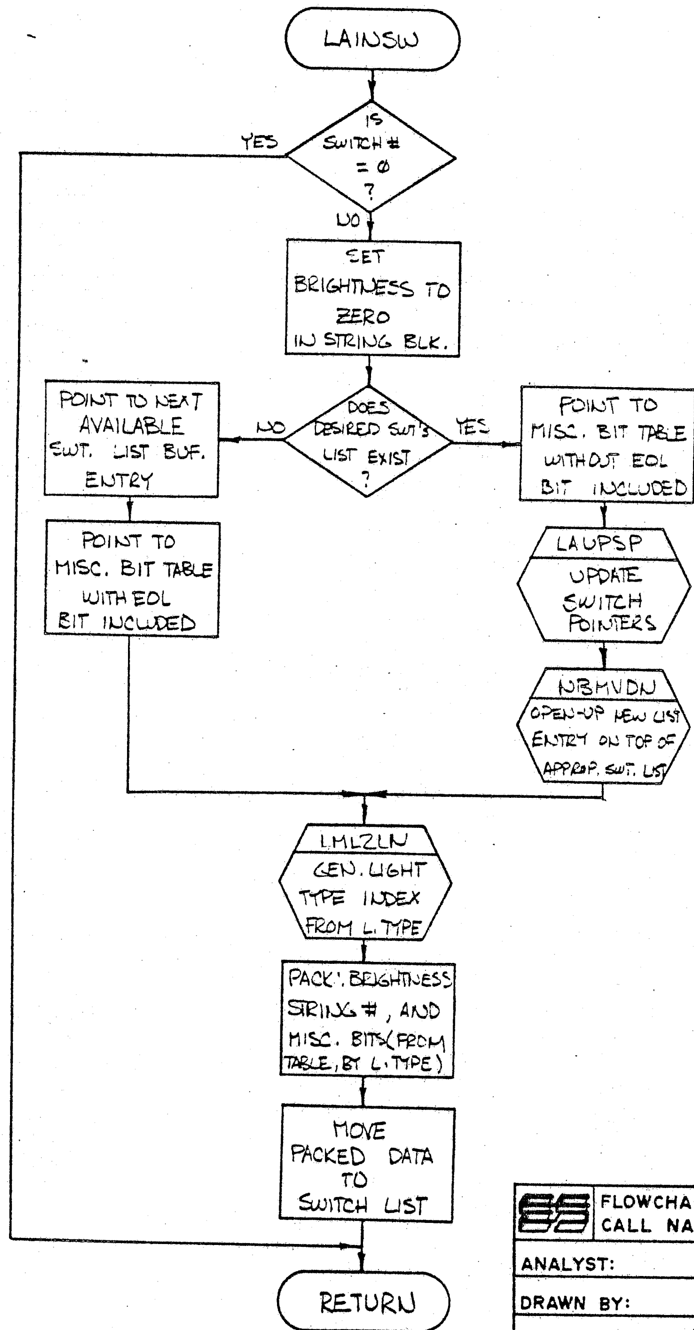


FLOWCHART
CALL NAME: NELMINMA

ANALYST:	MODULE:
DRAWN BY:	PN:
SHEET 7 OF 8	RELEASE:
NOTES: SUBROUTINE: LAINLT	VERSION:
	REVISION:

SYSTEM: NSP

FORM 5-018-0

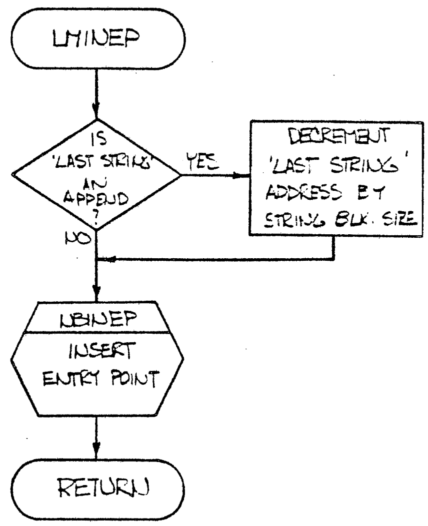


FLOWCHART
CALL NAME: NBLMINMA

ANALYST:	MODULE:
DRAWN BY:	PN:
SHEET 8 OF 8	RELEASE:
NOTES: SUBROUTINE: LAINSW	VERSION:
	REVISION:

SYSTEM: NSP

FORM 5-018-0

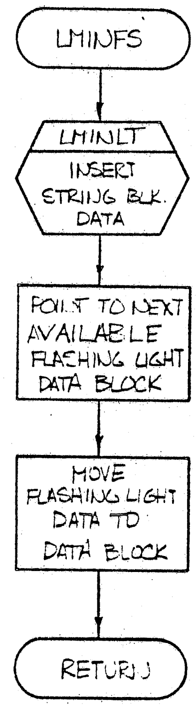


FLOWCHART
CALL NAME: NBLMINST

ANALYST: W.R.
MODULE: LMINST
DRAWN BY: W.R.
PN: 95879-044
SHEET 1 OF 3
RELEASE: Ø2
NOTES:
SUBROUTINE:
LMINEP
VERSION: Ø1
REVISION: 102

SYSTEM: NSP

FORM 5-018-0

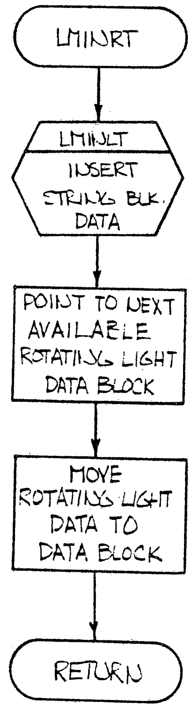


FLOWCHART
CALL NAME: NBLMINST

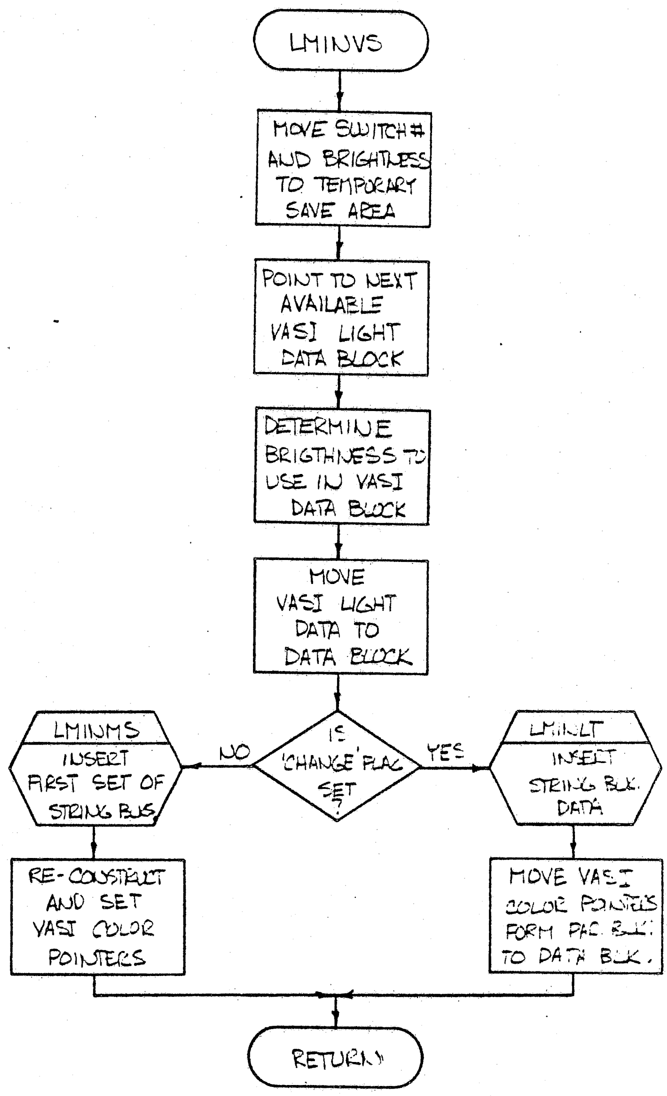
ANALYST:	MODULE:
DRAWN BY:	PN:
SHEET 2 OF 8	RELEASE:
NOTES: SUBROUTINE: LMINFS	VERSION:
	REVISION:

SYSTEM: NSP

FORM 5-018-0



FLOWCHART CALL NAME: NBLMINST	
ANALYST:	MODULE:
DRAWN BY:	PN:
SHEET 3 OF 8	RELEASE:
NOTES: SUBROUTINE: LMINRT	VERSION: REVISION:
SYSTEM: NSP	
FORM 5-018-0	

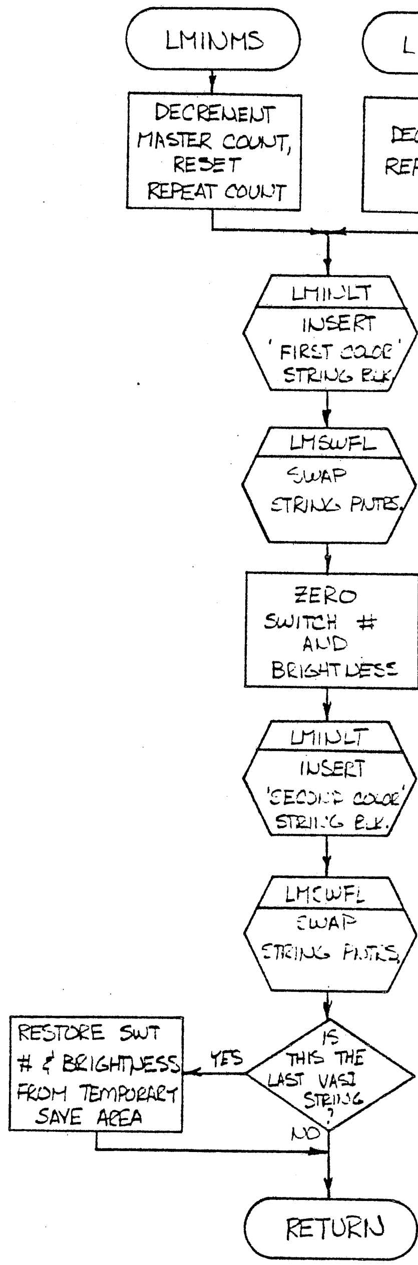


FLOWCHART
CALL NAME: NBLMINST

ANALYST:	MODULE:
DRAWN BY:	PN:
SHEET 4 OF 8	RELEASE:
NOTES: SUBROUTINE: LMINVS	VERSION:
	REVISION:

SYSTEM: NSP

FORM 5-018-0

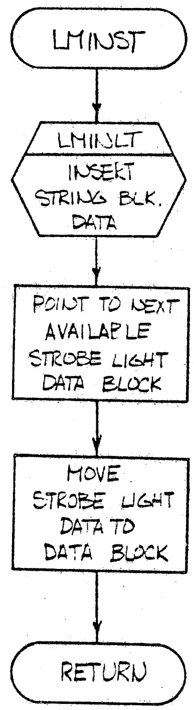


FLOWCHART
CALL NAME: NBLMINST

ANALYST:
MODULE:
DRAWN BY:
PN:
SHEET 5 OF 8
RELEASE:
NOTES:
VERSION:
SUBROUTINES:
REVISION:
LMINMS, LMINRP

SYSTEM: NSP

FORM 5-018-0

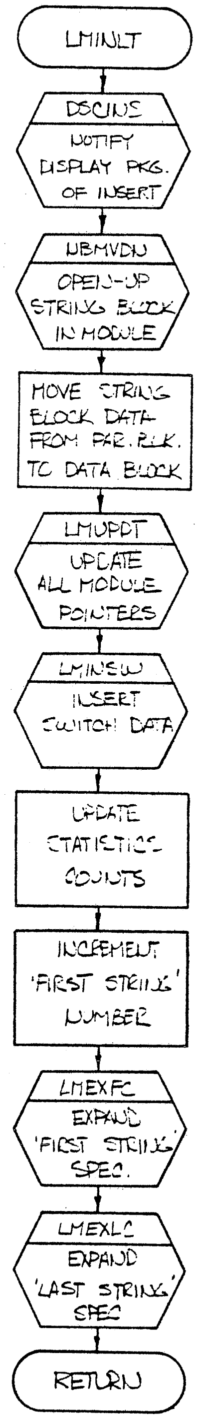


FLOWCHART
CALL NAME: NBLMINST

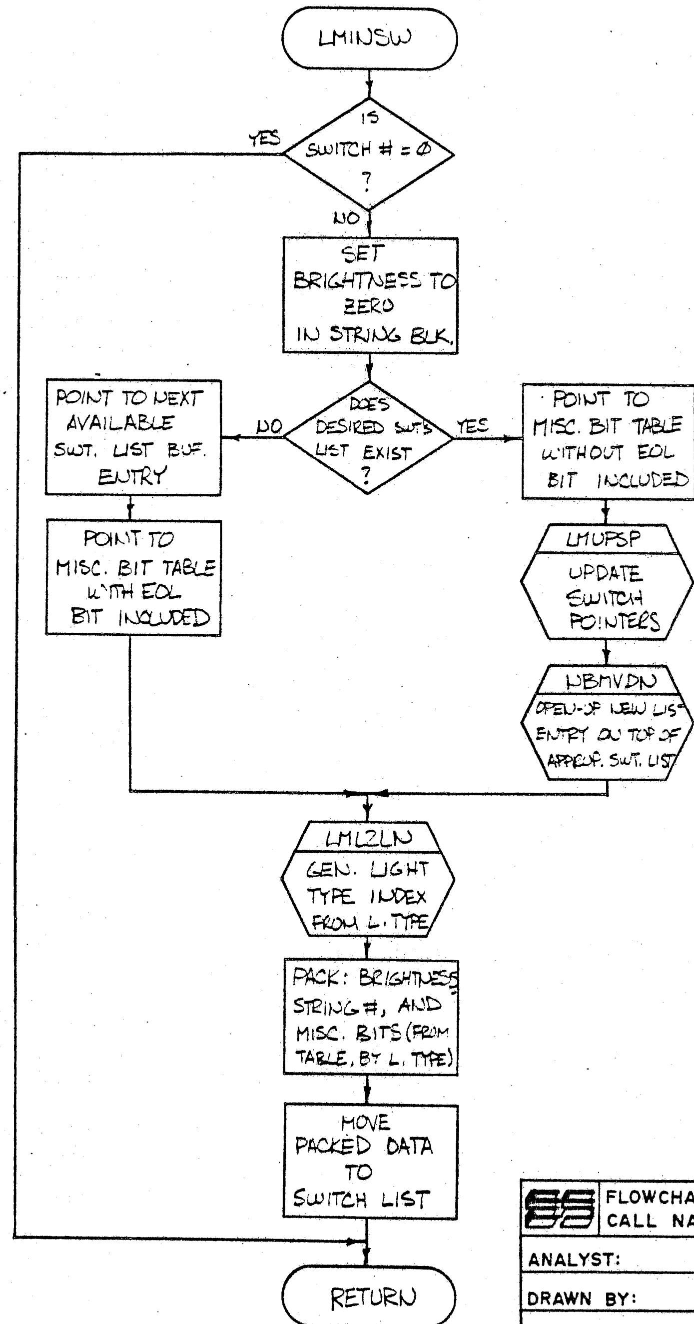
ANALYST:	MODULE:
DRAWN BY:	PN:
SHEET 6 OF 8	RELEASE:
NOTES: SUBROUTINE: LMINST	VERSION:
	REVISION:

SYSTEM: NSP

FORM 5-018-0



FLOWCHART CALL NAME: NBLMINST	
ANALYST:	MODULE:
DRAWN BY:	PN:
SHEET 7 OF 8	RELEASE:
NOTES: SUBROUTINE: LMINLT	VERSION:
	REVISION:
SYSTEM: NSP	
FORM 5-018-0	

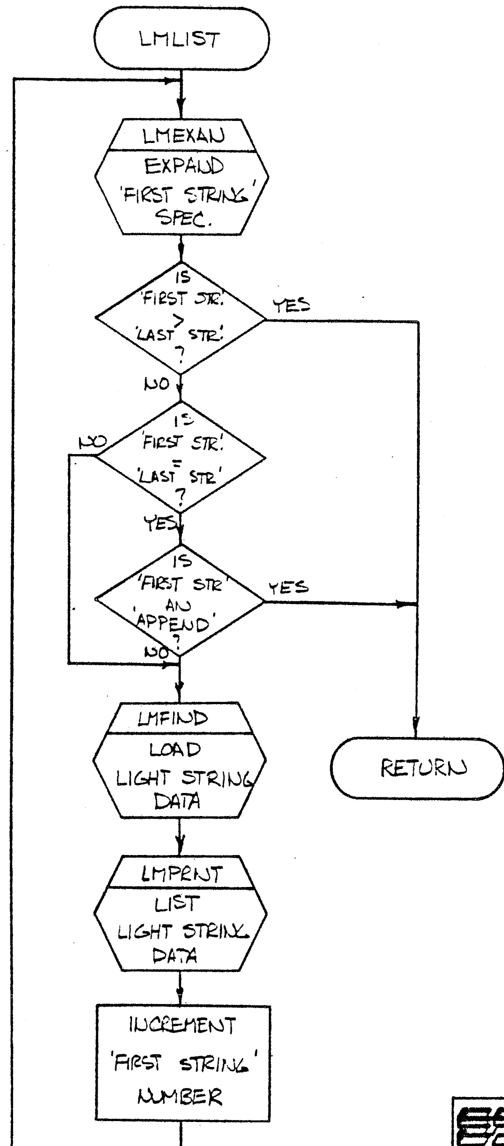


FLOWCHART
CALL NAME: NBLMINST

ANALYST:	MODULE:
DRAWN BY:	PN:
SHEET 8 OF 8	RELEASE:
NOTES: SUBROUTINE: LMINSW	VERSION:
	REVISION:

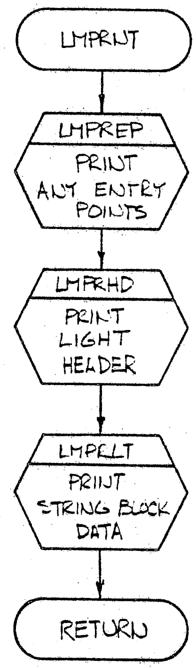
SYSTEM: NSP

FORM 5-018-0



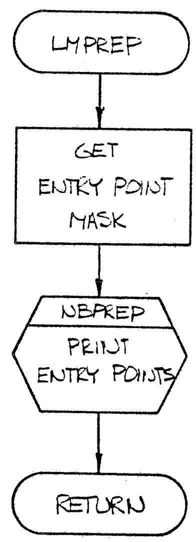
FLOWCHART CALL NAME: NELMPRNT	
ANALYST: W. R.	MODULE: LMPRNT
DRAWN BY: W. R.	PN: 908029-042
SHEET 1 OF 6	RELEASE: 02
NOTES: SUBROUTINE: LMLIST	VERSION: 01 REVISION: NC
SYSTEM: NSP	

FORM 5-018-0



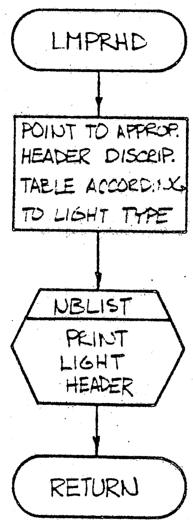
FLOWCHART CALL NAME: NBLMPRNT	
ANALYST:	MODULE:
DRAWN BY:	PN:
SHEET 2 OF 6	RELEASE:
NOTES: SUBROUTINE: LMPRNT	VERSION:
	REVISION:
SYSTEM: NSP	

FORM 5-018-0



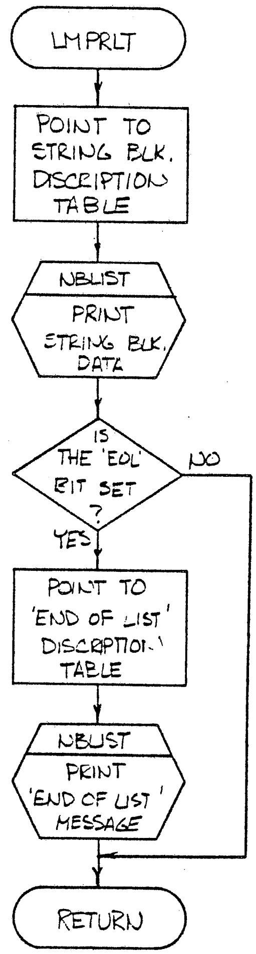
FLOWCHART CALL NAME: NBLMPRINT	
ANALYST:	MODULE:
DRAWN BY:	PN:
SHEET 3 OF 6	RELEASE:
NOTES: SUBROUTINE: LMPREP	VERSION:
	REVISION:
SYSTEM: NSP	

FORM 5-018-0



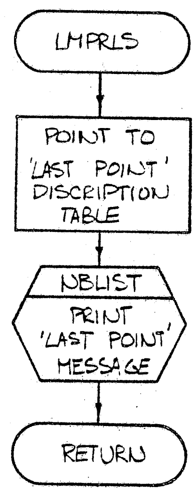
FLOWCHART CALL NAME: NBLMPRNT	
ANALYST:	MODULE:
DRAWN BY:	PN:
SHEET 4 OF 6	RELEASE:
NOTES: SUBROUTINE: LMPRHD	VERSION: REVISION:
SYSTEM: NSP	

FORM 5-018-0



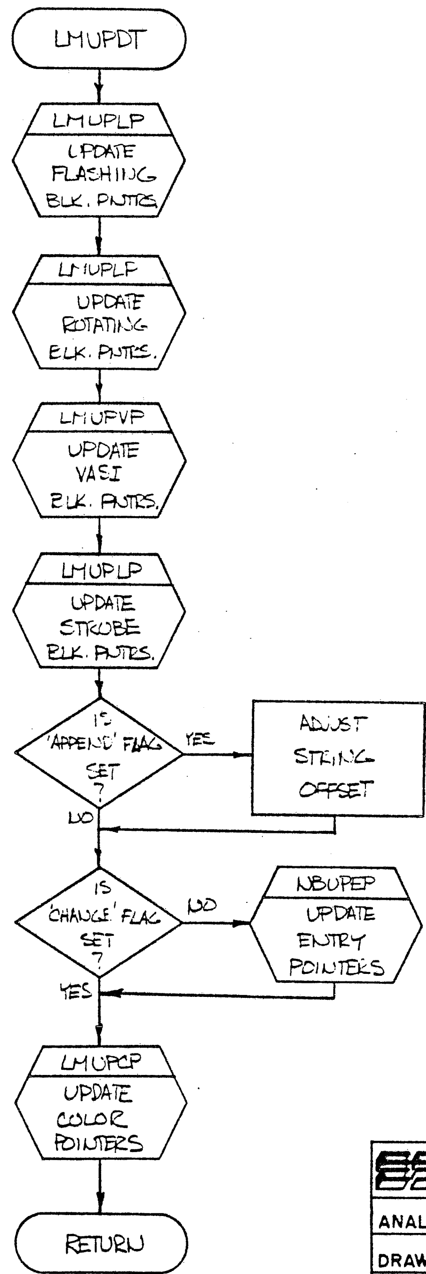
FLOWCHART CALL NAME: NBLMPRNT	
ANALYST:	MODULE:
DRAWN BY:	PN:
SHEET 5 OF 6	RELEASE:
NOTES: SUBROUTINE: LMPRLT	VERSION:
	REVISION:
SYSTEM: NSP	

FORM 5-018-0



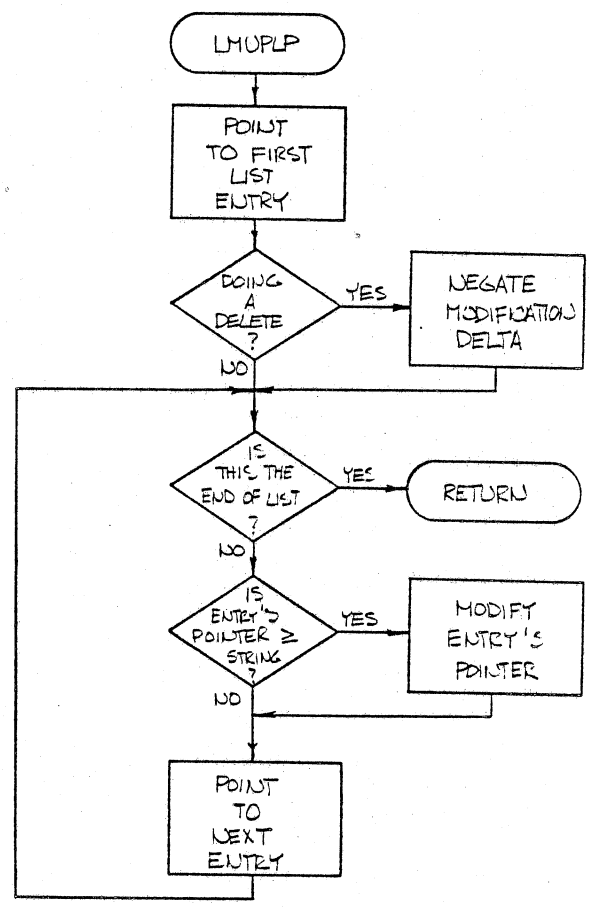
FLOWCHART CALL NAME: NBLMPRNT	
ANALYST:	MODULE:
DRAWN BY:	PN:
SHEET 6 OF 6	RELEASE:
NOTES: SUBROUTINE: LMPRLS	VERSION:
	REVISION:
SYSTEM: NSP	

FORM 5-018-0



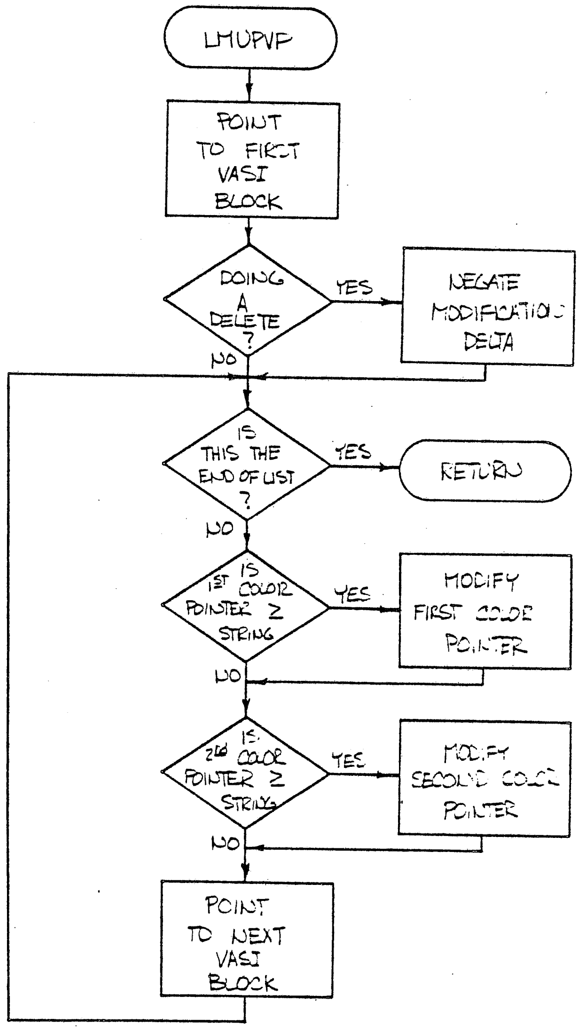
FLOWCHART CALL NAME: NBLMUPDT	
ANALYST: W.R.	MODULE: LMUPDT
DRAWN BY: W.R.	PN: 908009-044
SHEET 1 OF 7	RELEASE: 02
NOTES: SUBROUTINE: LMUPDT	VERSION: 01 REVISION: NC
SYSTEM: NSP	

FORM 5-018-0

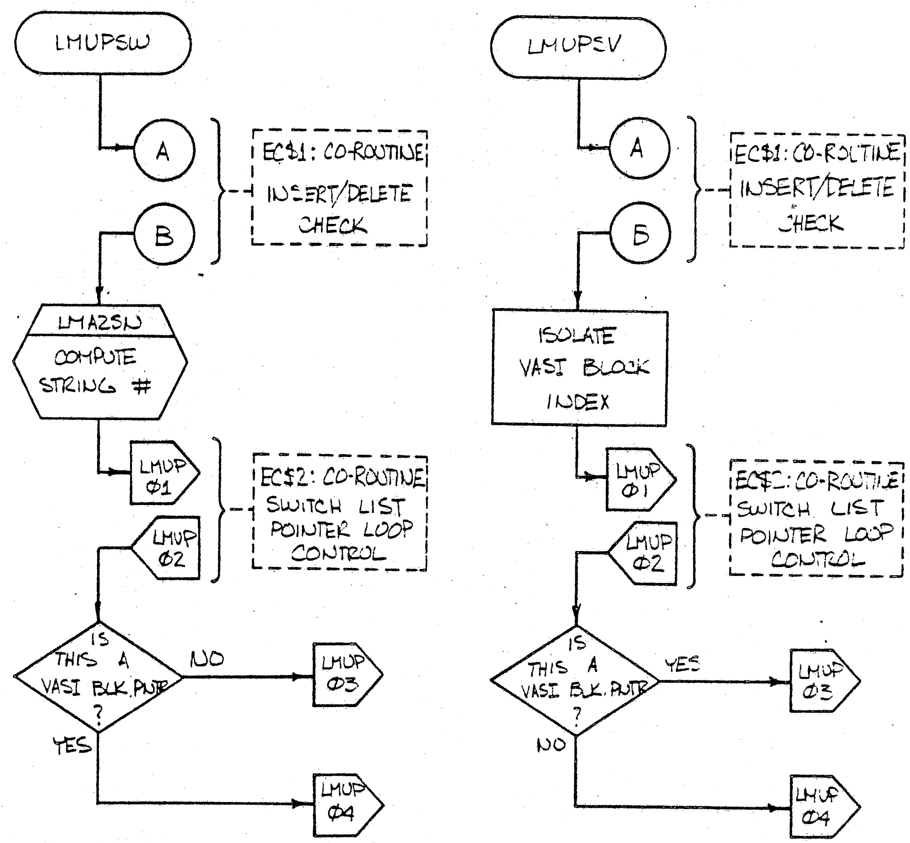


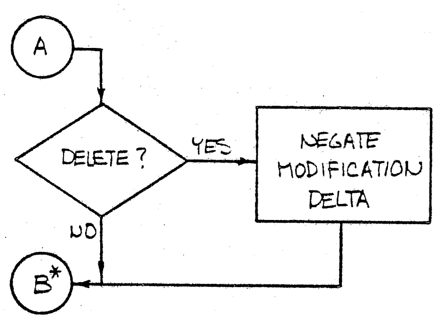
FLOWCHART CALL NAME: NBLMUPDT	
ANALYST:	MODULE:
DRAWN BY:	PN:
SHEET 2 OF 7	RELEASE:
NOTES: SUBROUTINE: LMUPLP	VERSION: REVISION:
SYSTEM: NSP	

FORM 5-018-0



FLOWCHART CALL NAME: NBLMUPDT	
ANALYST:	MODULE:
DRAWN BY:	PN:
SHEET 3 OF 7	RELEASE:
NOTES: SUBROUTINE: LMUPVP	VERSION: REVISION:
SYSTEM: NSP	
FORM 5-018-0	





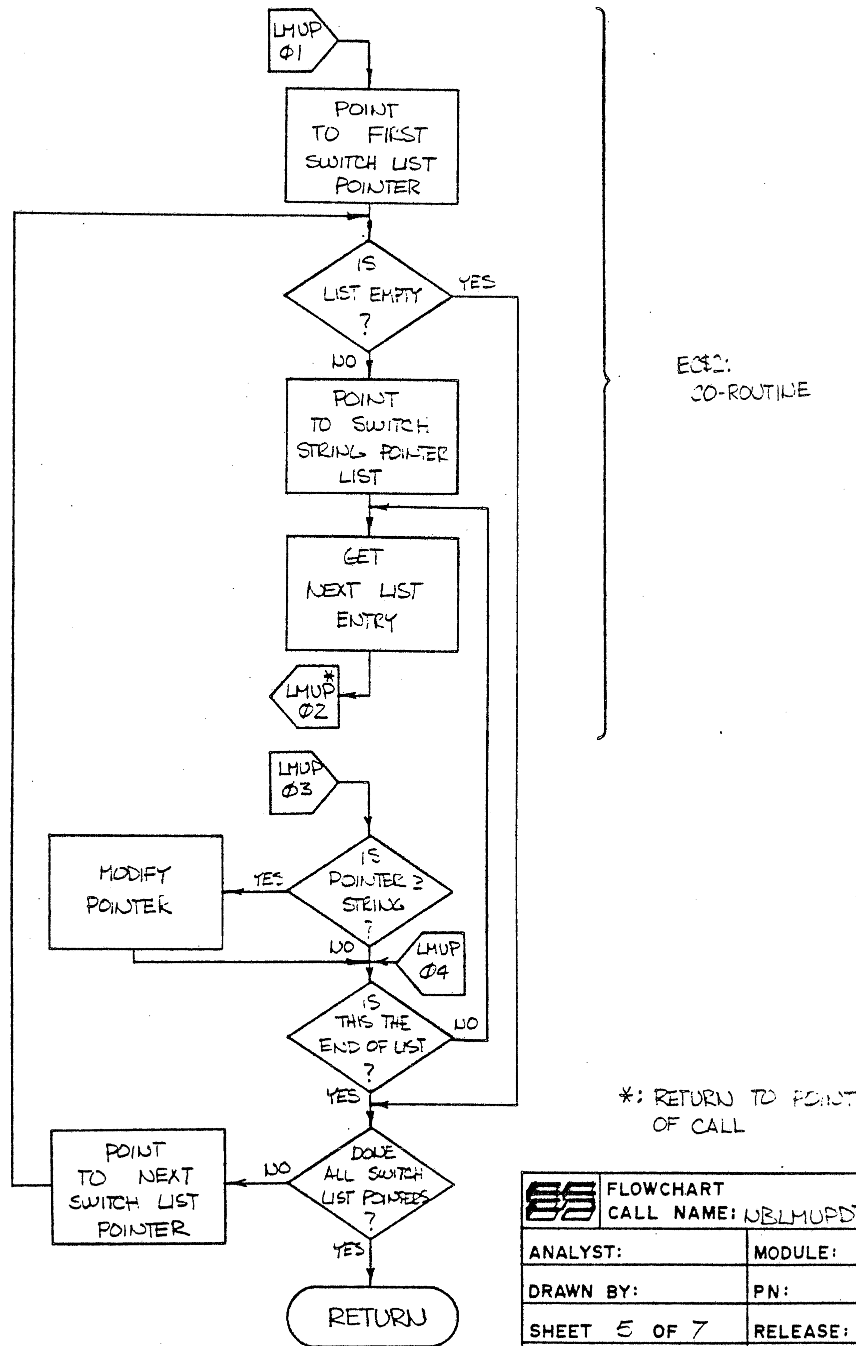
EC$1: CO-ROUTINE
INSERT/DELETE CHECK
*: RETURN TO POINT OF CALL

FLOWCHART
CALL NAME: NBLMUPDT

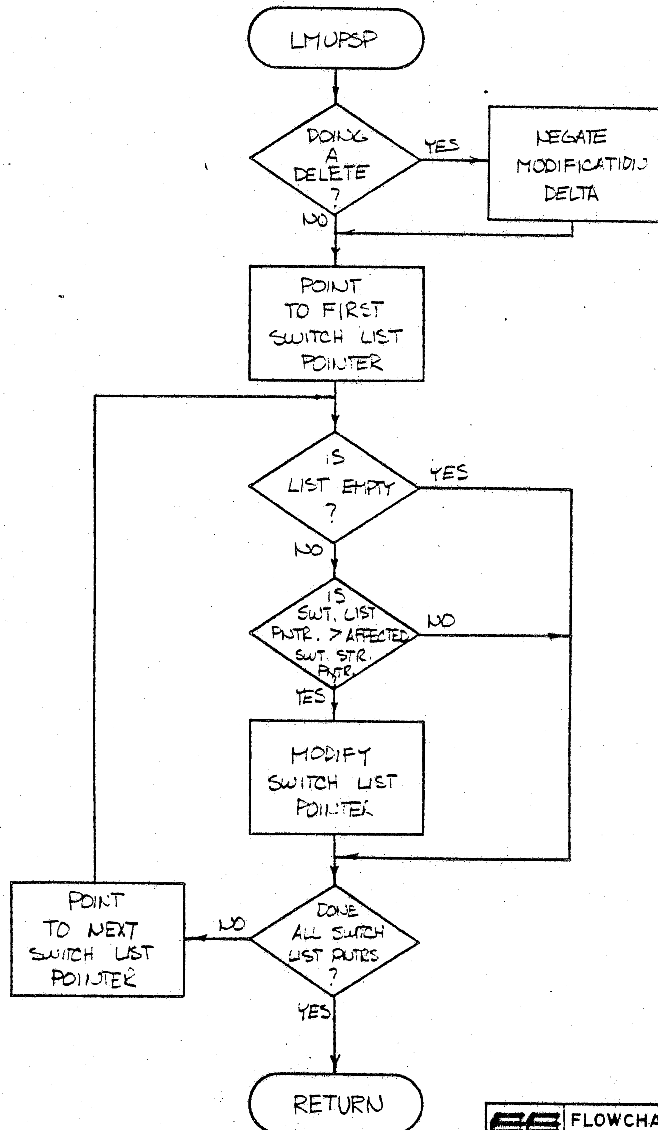
ANALYST:	MODULE:
DRAWN BY:	PN:
SHEET 4 OF 7	RELEASE:
NOTES: SUBROUTINES: LMUPSW, LMUPSV	VERSION:
	REVISION:

SYSTEM: NSP

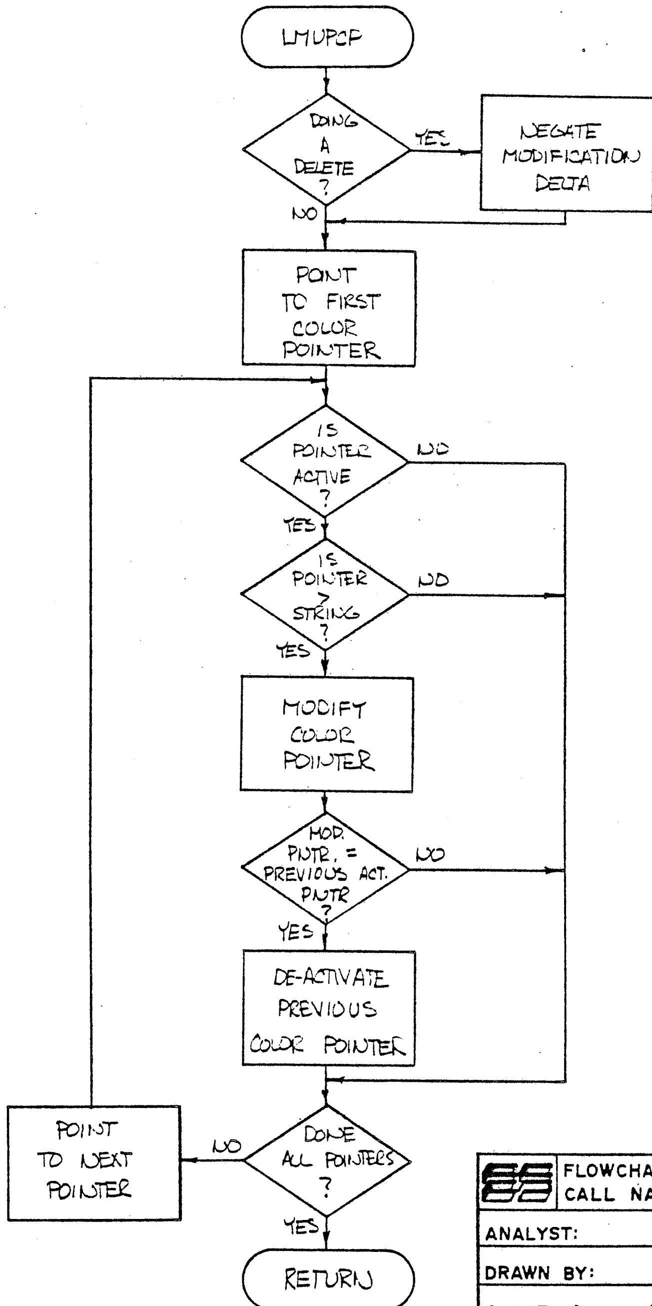
FORM 5-018-0



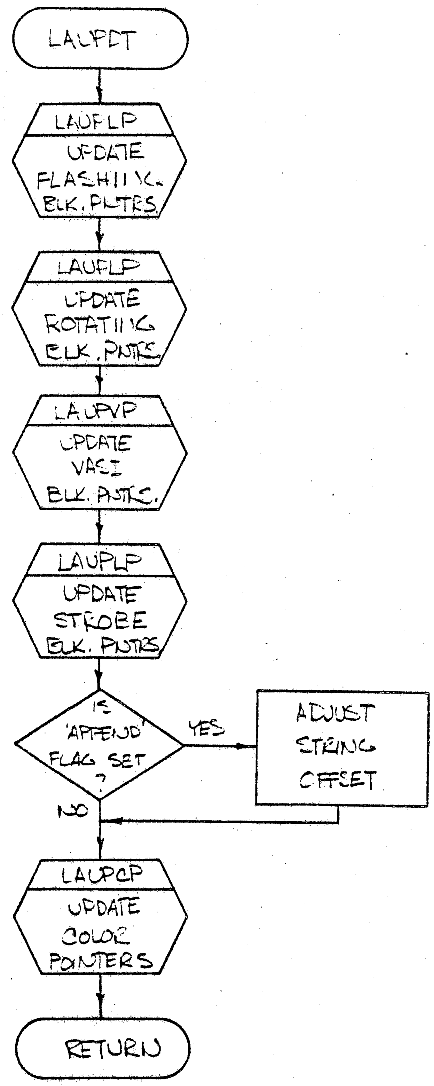
FLOWCHART CALL NAME: NBLMUPDT	
ANALYST:	MODULE:
DRAWN BY:	PN:
SHEET 5 OF 7	RELEASE:
NOTES: SUBROUTINES:	VERSION:
	REVISION:
LMUPSW, LMUPSV (CONTINUED)	
SYSTEM: NSP	
FORM 5-018-0	



FLOWCHART CALL NAME: NBLMUPDT	
ANALYST:	MODULE:
DRAWN BY:	PN:
SHEET 6 OF 7	RELEASE:
NOTES: SUBROUTINE: LMUPSP	VERSION:
	REVISION:
SYSTEM: NSP	
FORM 5-018-0	

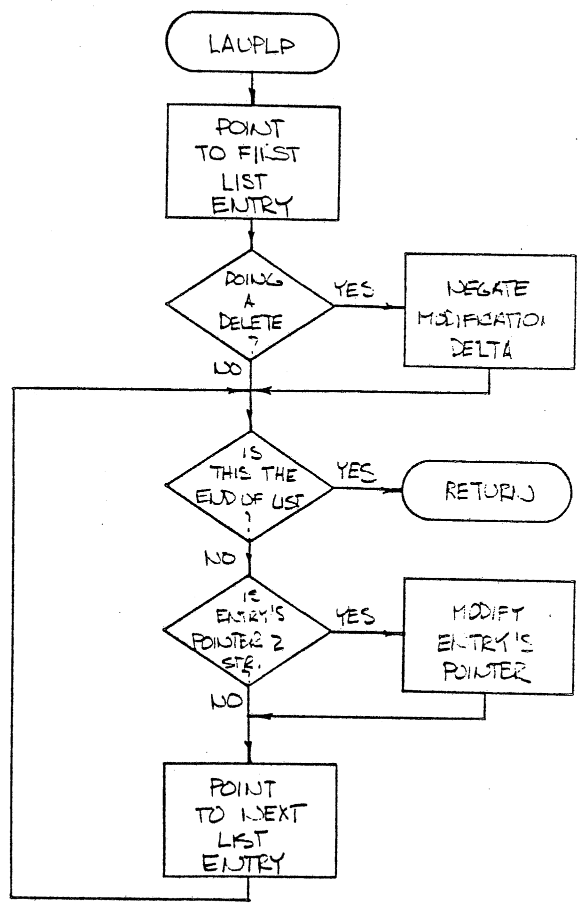


FLOWCHART CALL NAME: NELMUPDT	
ANALYST:	MODULE:
DRAWN BY:	PN:
SHEET 7 OF 7	RELEASE:
NOTES: SUBROUTINE: LMUPCP	VERSION:
	REVISION:
SYSTEM: NSP	
FORM 5-018-0	



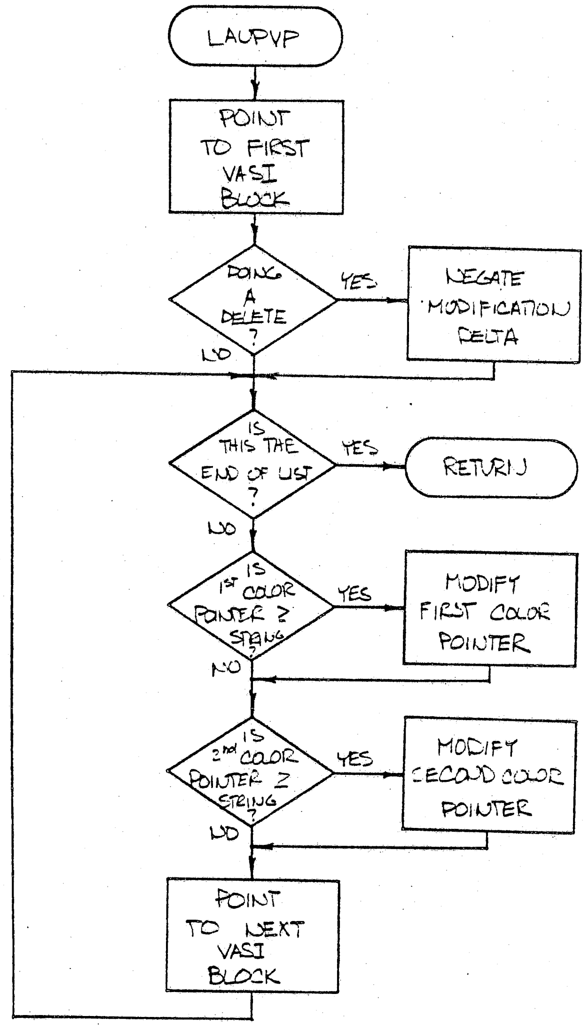
FLOWCHART CALL NAME: NELMUPMA	
ANALYST: W.R.	MODULE: LMUPMA
DRAWN BY: W.R.	PN: 908030-012
SHEET 1 OF 7	RELEASE: 02
NOTES: SUBROUTINE: LAUPDT	VERSION: 01
	REVISION: NC
SYSTEM: NSP	

FORM 5-018-0



FLOWCHART CALL NAME: NBLMOFMA	
ANALYST:	MODULE:
DRAWN BY:	PN:
SHEET 2 OF 7	RELEASE:
NOTES: SUBROUTINE: LAUPLP	VERSION:
	REVISION:
SYSTEM: NSP	

FORM 5-018-0

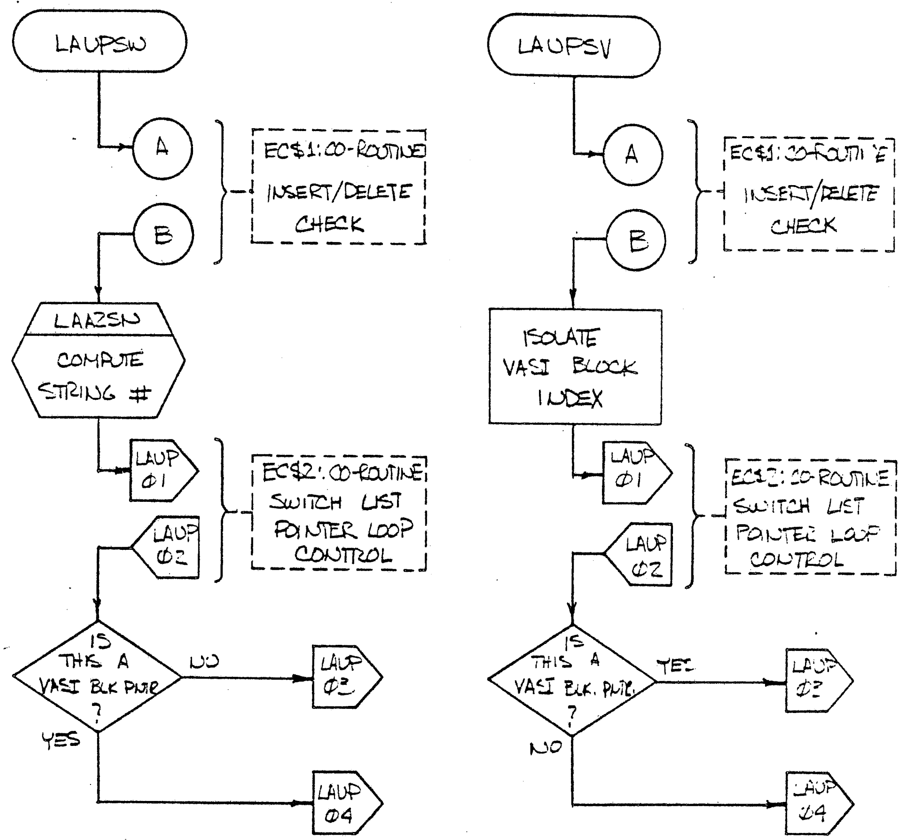


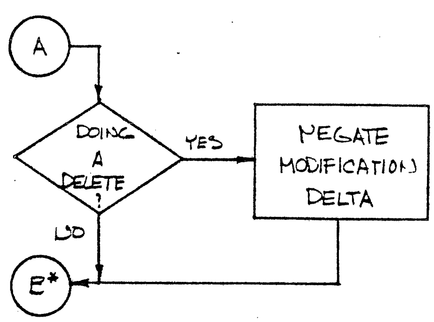
FLOWCHART
CALL NAME: NBLMOPHA

ANALYST:	MODULE:
DRAWN BY:	PN:
SHEET 3 OF 7	RELEASE:
NOTES: SUBROUTINE: LAUPVP	VERSION:
	REVISION:

SYSTEM: NSP

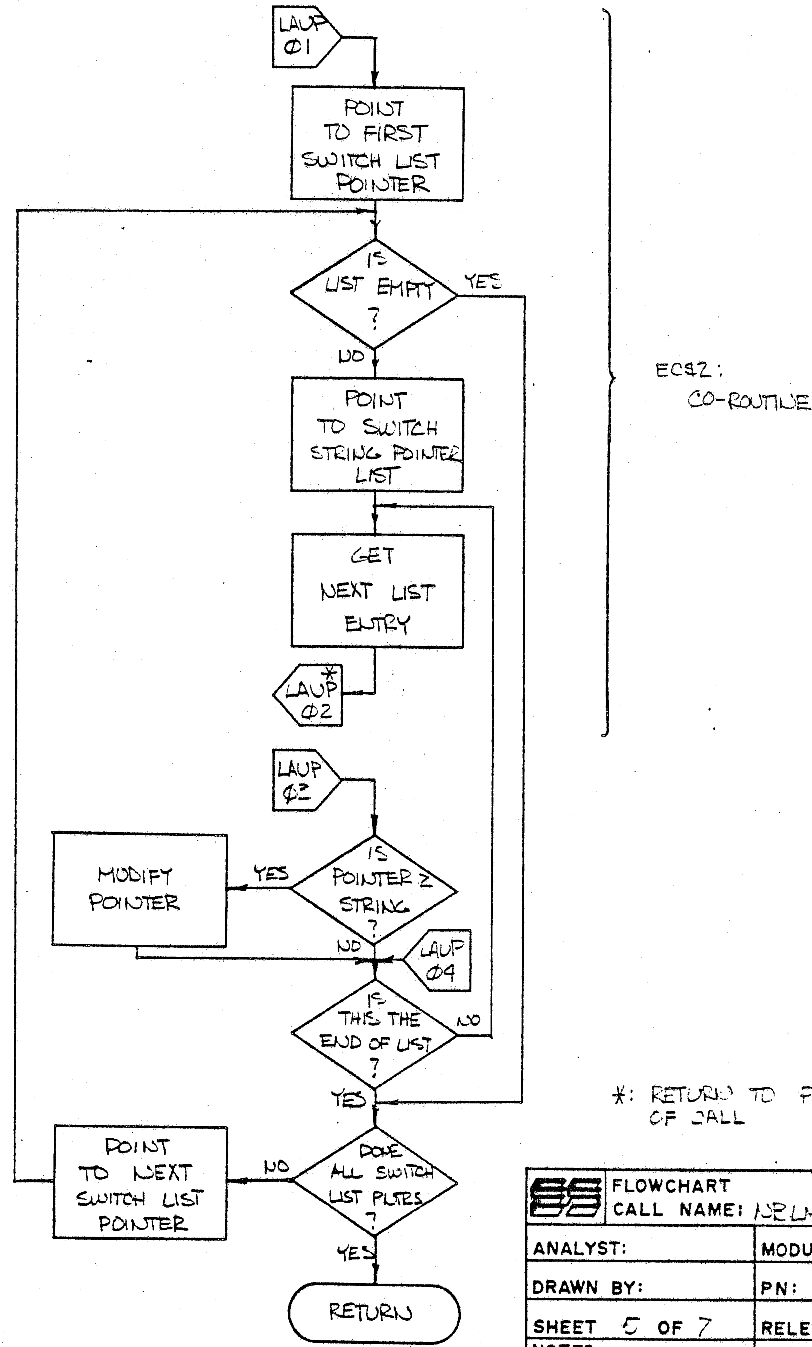
FORM 5-018-0





EC$1: CO-ROUTINE
INSERT/DELETE CHECK
*: RETURN TO POINT OF CALL

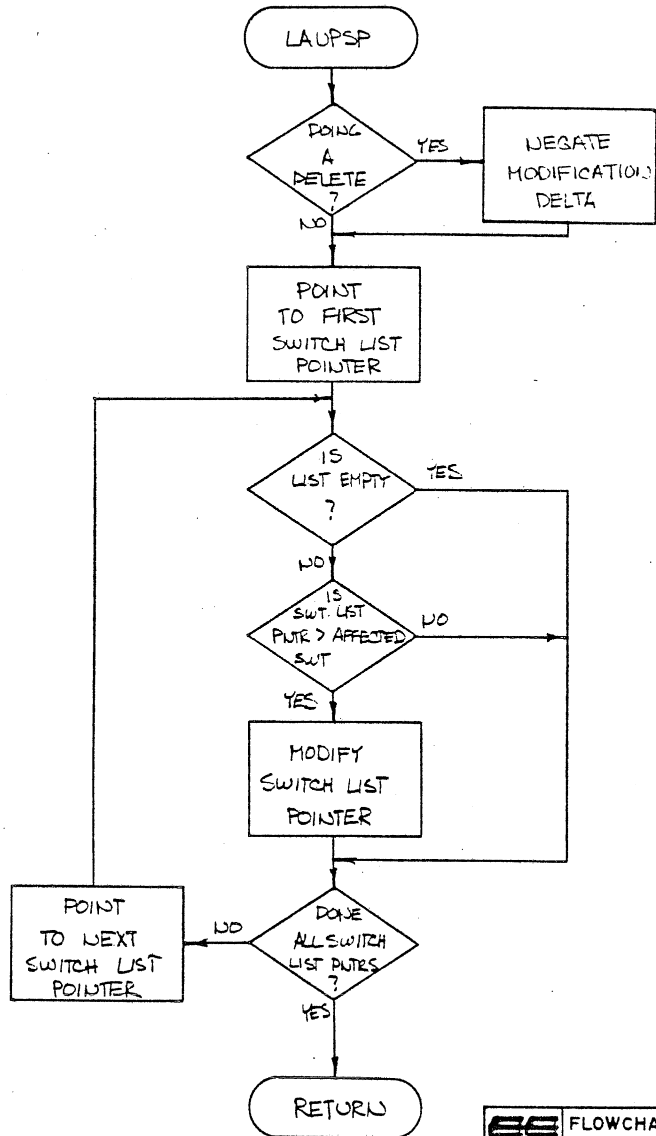
FLOWCHART CALL NAME: NBLMUPMA	
ANALYST:	MODULE:
DRAWN BY:	PN:
SHEET 4 OF 7	RELEASE:
NOTES: SUBROUTINES: LAUPSW, LAUPSV	VERSION: REVISION:
SYSTEM: NSP	
FORM 5-018-0	



*: RETURN TO POINT OF CALL

FLOWCHART CALL NAME: NBLMUPHA	
ANALYST:	MODULE:
DRAWN BY:	PN:
SHEET 5 OF 7	RELEASE:
NOTES: SUBROUTINES:	VERSION: REVISION:
LAUPSW, LAUPSV (CONTINUED)	
SYSTEM: NSP	

FORM 5-018-0

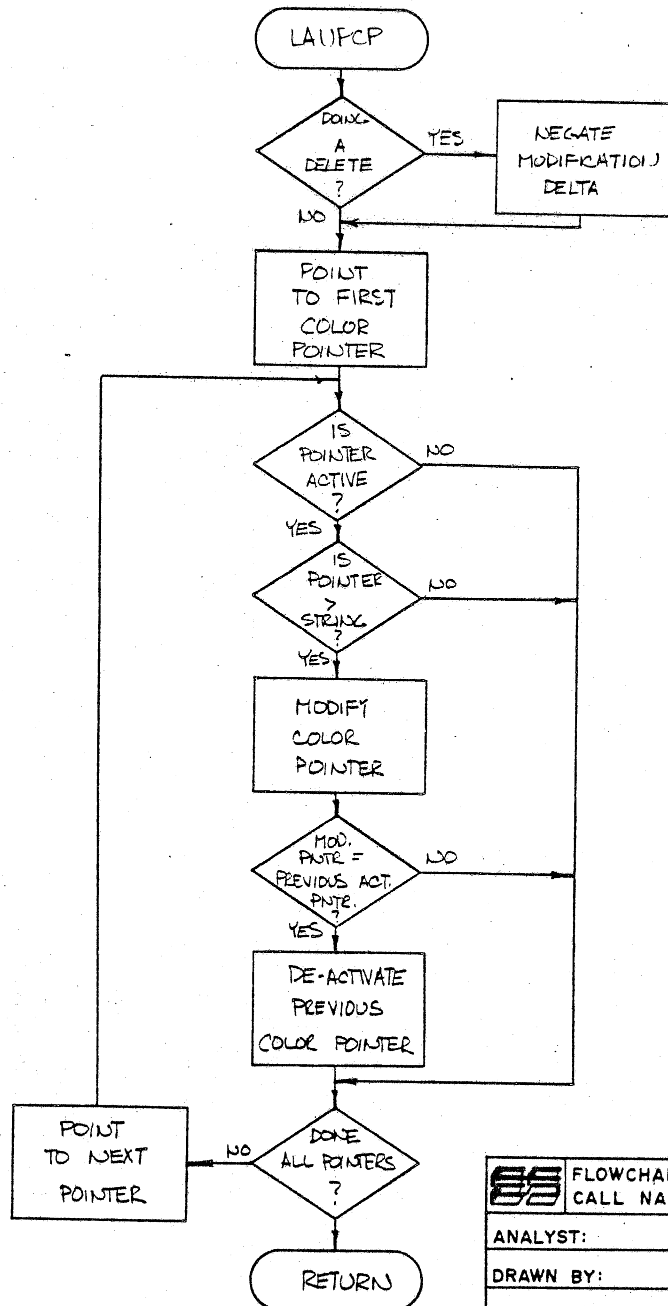


FLOWCHART
CALL NAME: NBLMUPMA

ANALYST: | MODULE:
DRAWN BY: | PN:
SHEET 6 OF 7 | RELEASE:
NOTES: SUBROUTINE: LAUPSP | VERSION:
REVISION:

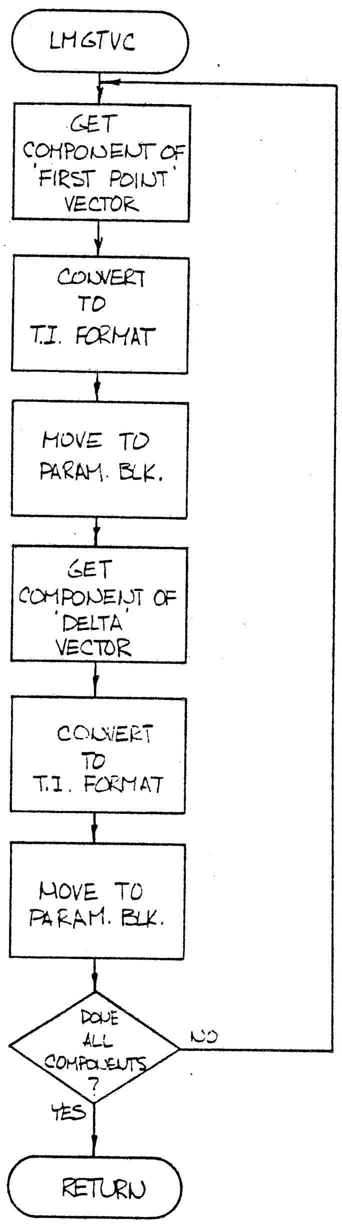
SYSTEM: NSP

FORM 8-018-0



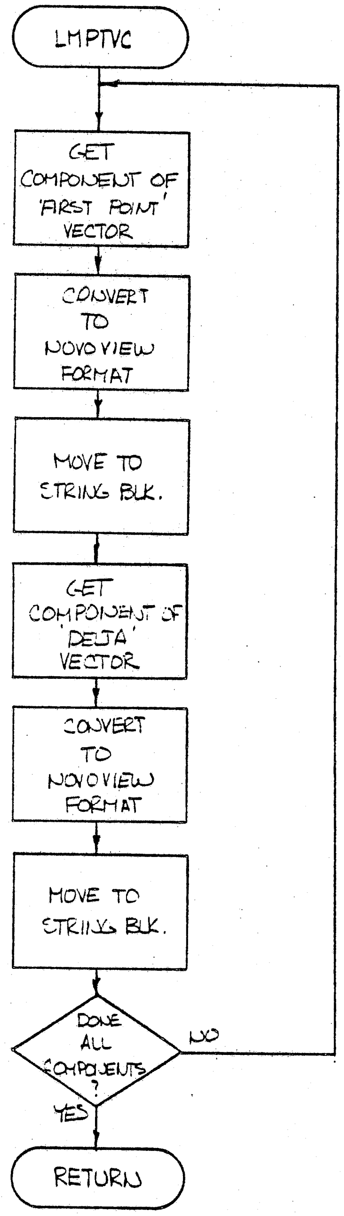
FLOWCHART CALL NAME: NEWMOPMA	
ANALYST:	MODULE:
DRAWN BY:	PN:
SHEET 7 OF 7	RELEASE:
NOTES: SUBROUTINE: LAUPCP	VERSION:
	REVISION:
SYSTEM: NSP	

FORM 5-018-0

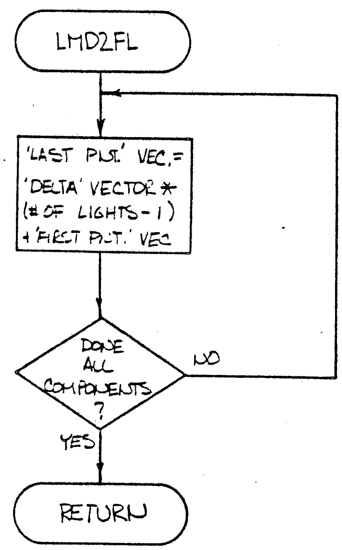


FLOWCHART CALL NAME: NBLMVECT	
ANALYST: W.R.	MODULE: LMVECT
DRAWN BY: W.R.	PN: 908[illegible]-Ø47
SHEET 1 OF 8	RELEASE: Ø2
NOTES: SUBROUTINE: LMGTVC	VERSION: Ø1 REVISION: NC
SYSTEM: NSP	

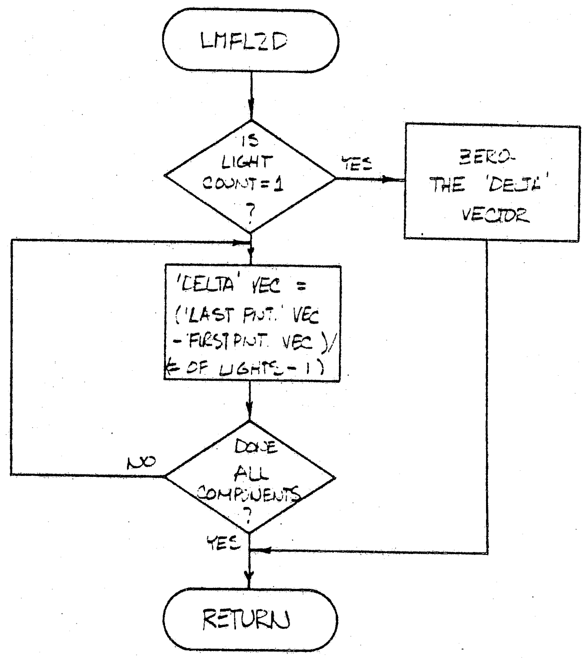
FORM 5-018-0



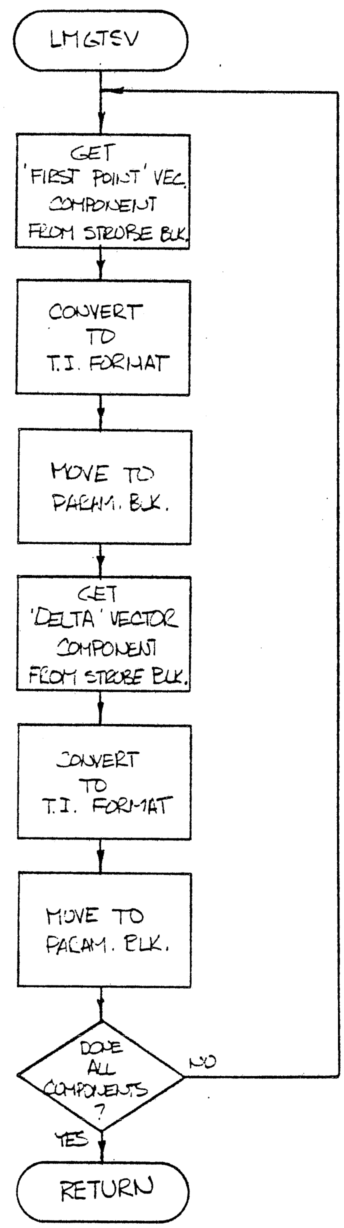
FLOWCHART CALL NAME: NPLMVECT	
ANALYST:	MODULE:
DRAWN BY:	PN:
SHEET 2 OF 8	RELEASE:
NOTES: SUBROUTINE: LMPTVC	VERSION: REVISION:
SYSTEM: NSP	
FORM 5-018-0	



FLOWCHART CALL NAME: NELMVECT	
ANALYST:	MODULE:
DRAWN BY:	PN:
SHEET 3 OF 8	RELEASE:
NOTES: SUBROUTINE: LMD2FL	VERSION: REVISION:
SYSTEM: NSP	
FORM 5-018-0	



FLOWCHART CALL NAME: NRLM VECT	
ANALYST:	MODULE:
DRAWN BY:	PN:
SHEET 4 OF 6	RELEASE:
NOTES: SUBROUTINE: LMFL2D	VERSION: REVISION:
SYSTEM: NSP	
FORM 6-018-0	

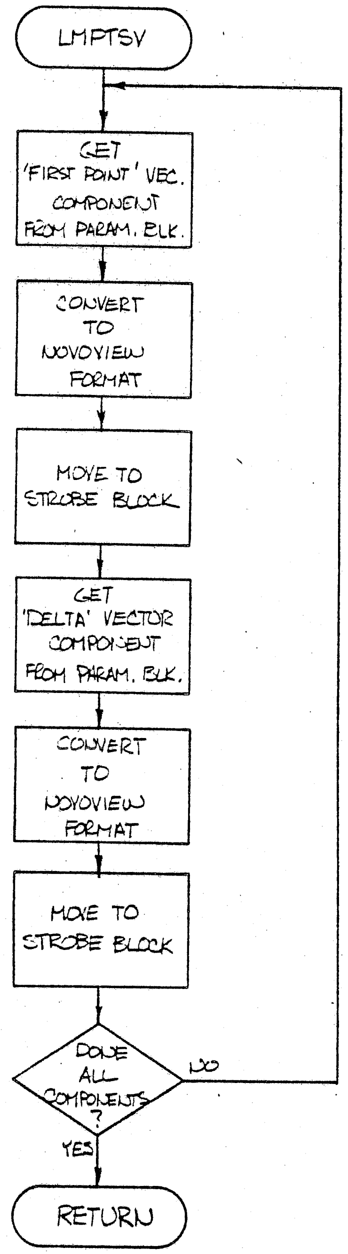


FLOWCHART
CALL NAME: NBLMVECT

ANALYST:	MODULE:
DRAWN BY:	PN:
SHEET 5 OF 8	RELEASE:
NOTES: SUBROUTINE: LMGTSV	VERSION:
	REVISION:

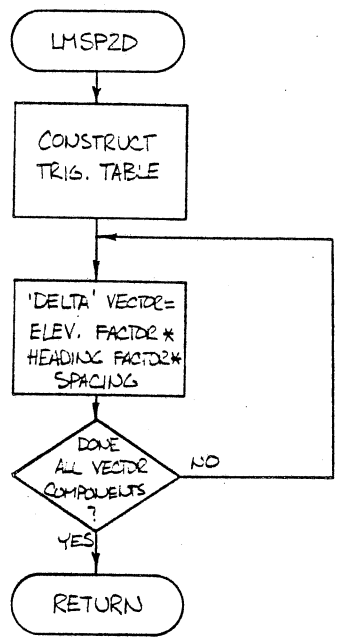
SYSTEM: NSP

FORM 5-018-0



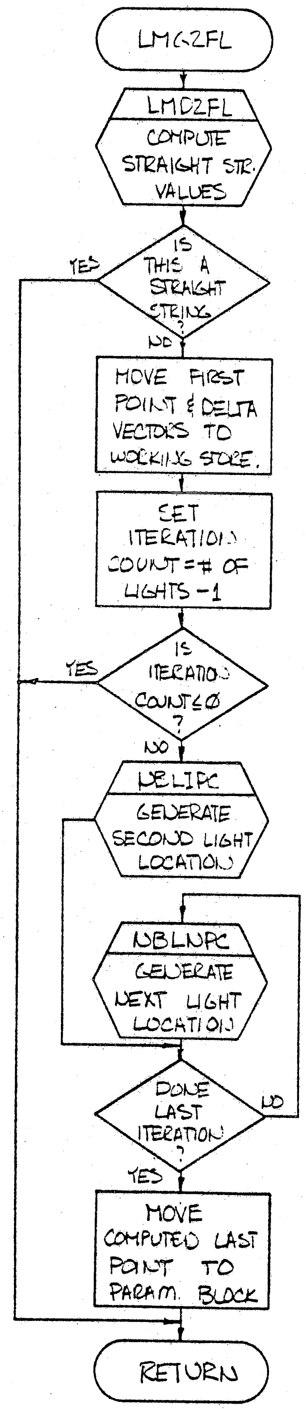
FLOWCHART CALL NAME: NBLMVECT	
ANALYST:	MODULE:
DRAWN BY:	PN:
SHEET 6 OF 8	RELEASE:
NOTES: SUBROUTINE: LMPTSV	VERSION: REVISION:
SYSTEM: NSP	

FORM 5-018-0



FLOWCHART CALL NAME: NBLMVECT	
ANALYST:	MODULE:
DRAWN BY:	PN:
SHEET 7 OF 8	RELEASE:
NOTES: SUBROUTINE: LMSP2D	VERSION: REVISION:
SYSTEM: NSP	

FORM 5-018-0

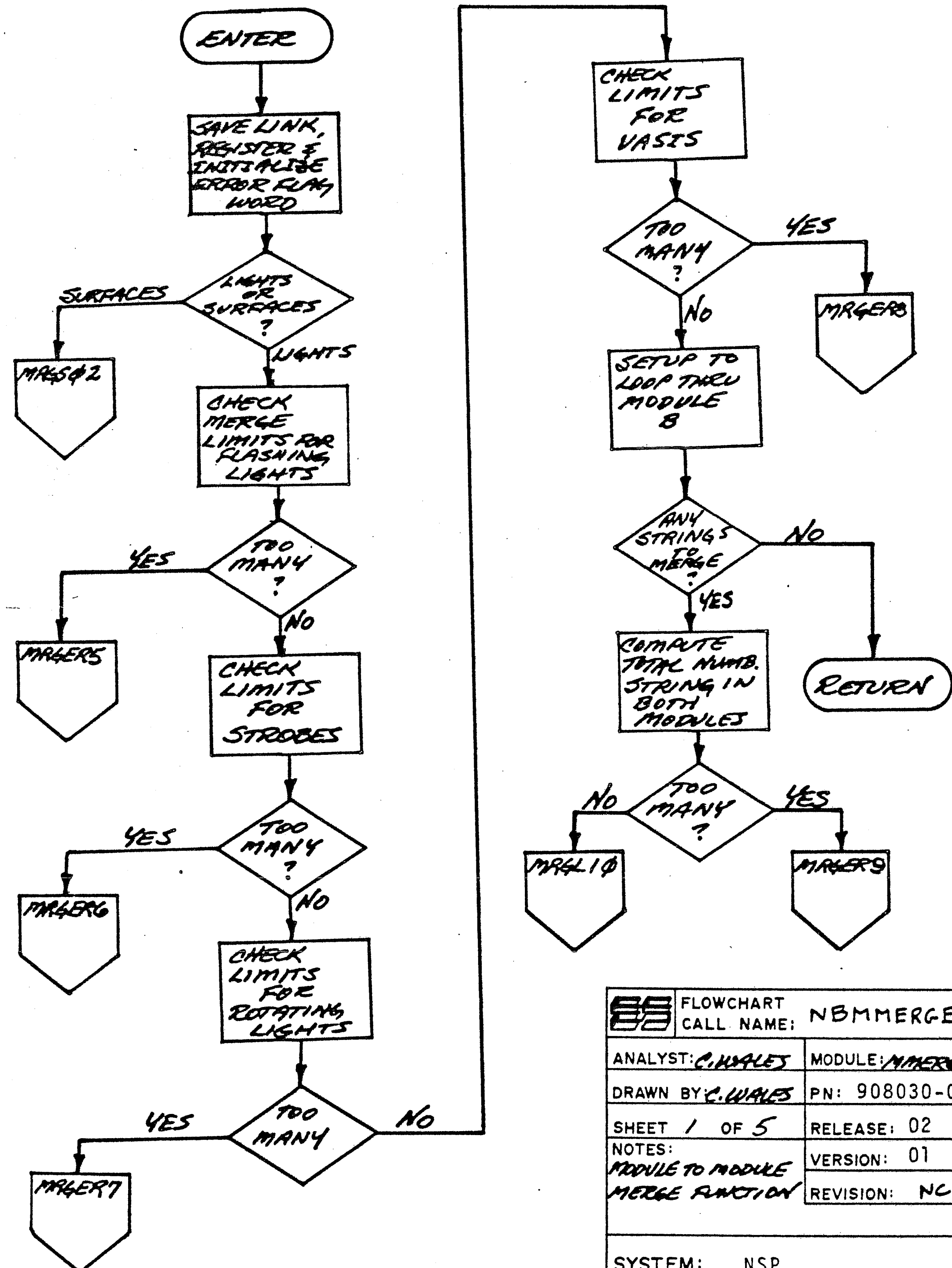


FLOWCHART
CALL NAME: NELMVECT

ANALYST:	MODULE:
DRAWN BY:	PN:
SHEET 8 OF 8	RELEASE:
NOTES: SUBROUTINE: LMG2FL	VERSION:
	REVISION:

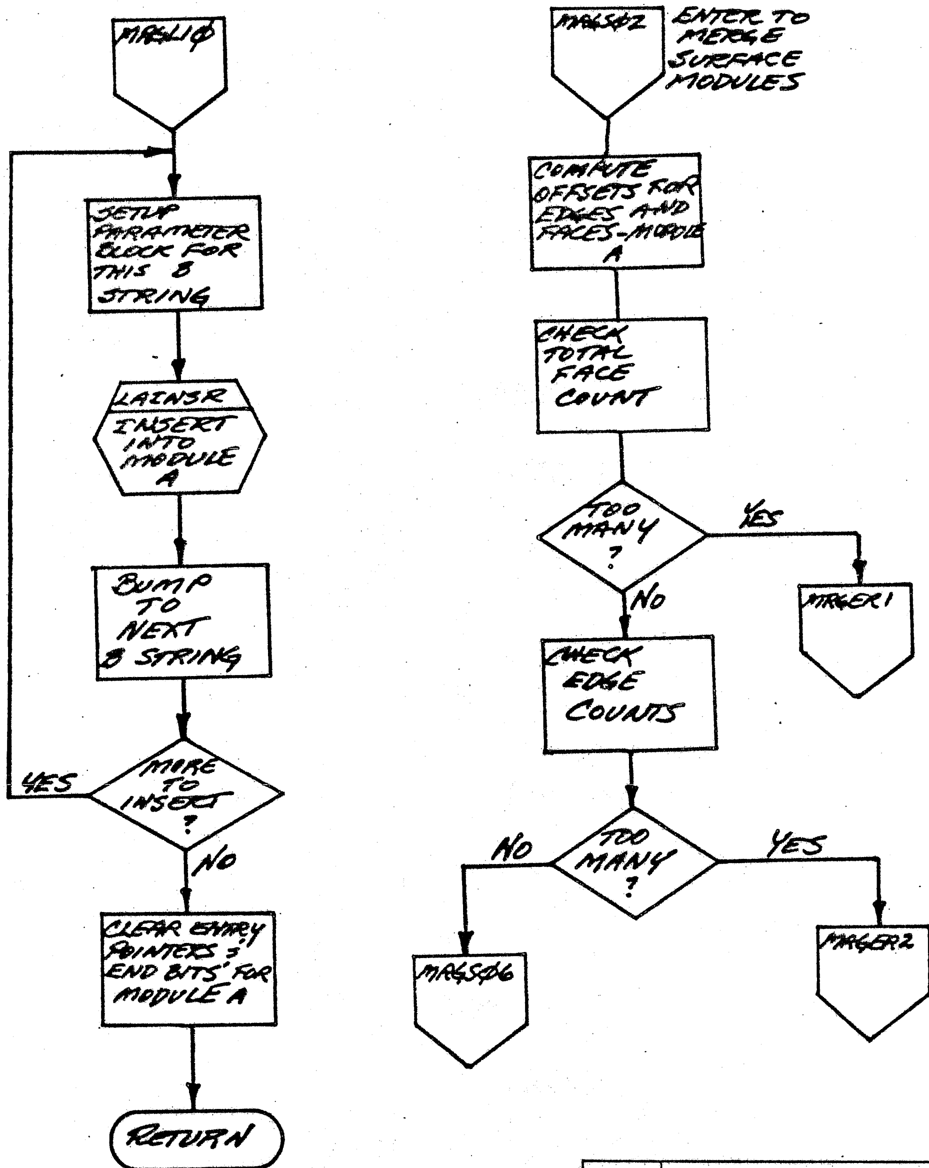
SYSTEM: NSP

FORM 5-018-0



FLOWCHART CALL NAME: NBMMERGE	
ANALYST: C. WALES	MODULE: MMERGE
DRAWN BY: C. WALES	PN: 908030-008
SHEET 1 OF 5	RELEASE: 02
NOTES: MODULE TO MODULE MERGE FUNCTION	VERSION: 01
	REVISION: NC
SYSTEM: NSP	

FORM 5-018-0



FLOWCHART CALL NAME: NBMMERGE

ANALYST: C. WALES

MODULE: MMERGE

DRAWN BY: C. WALES

PN:

SHEET 2 OF 5

RELEASE:

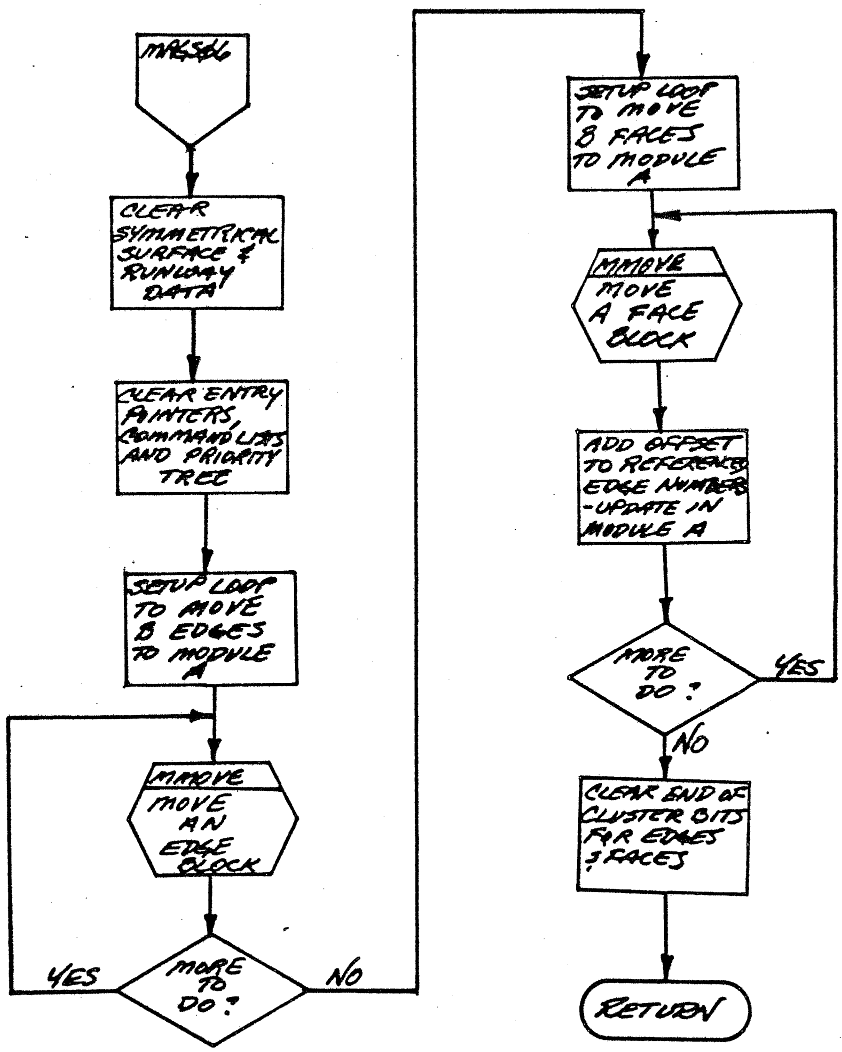
NOTES:

VERSION:

REVISION: NC

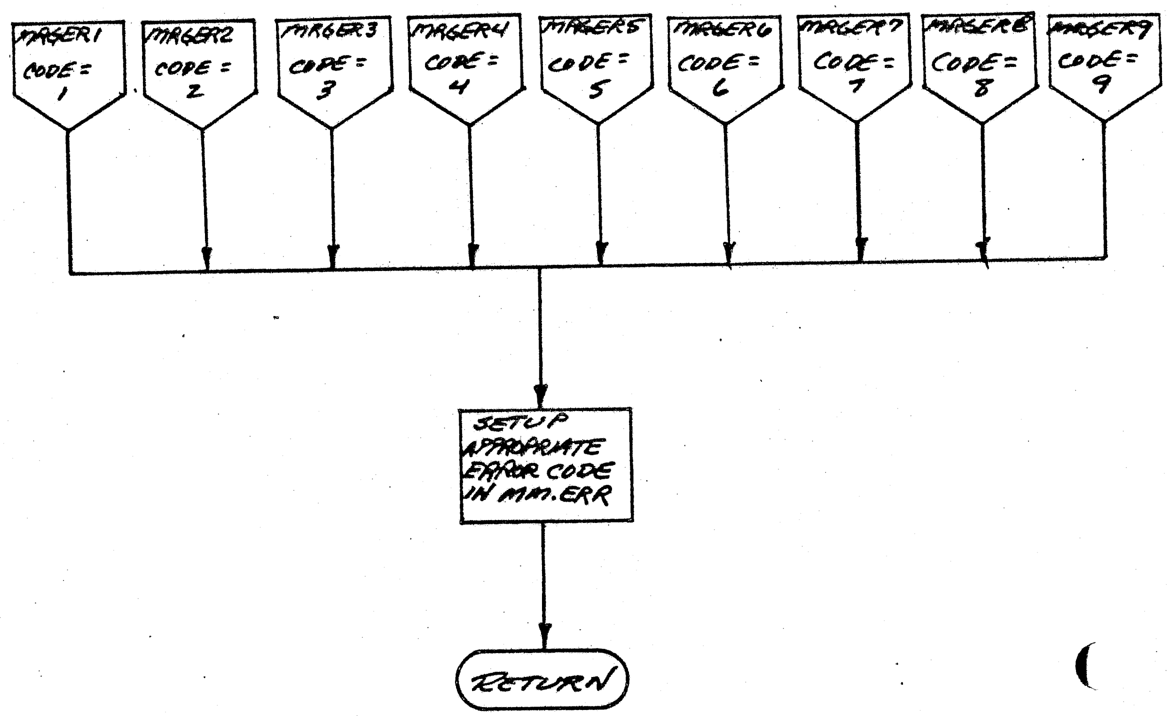
SYSTEM: NSP

FORM 5-018-0



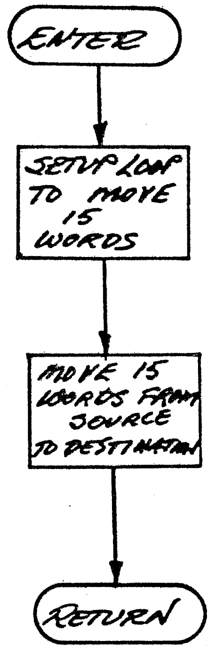
FLOWCHART CALL NAME:	NBMMERGE
ANALYST: C. WALES	MODULE: MMERGE
DRAWN BY: C. WALES	PN:
SHEET 3 OF 5	RELEASE:
NOTES:	VERSION:
	REVISION: NC
SYSTEM: NSP	

FORM 5-018-0



FLOWCHART CALL NAME:	NBMMERGE
ANALYST: C. WALES	MODULE: MMERGE
DRAWN BY: C. WALES	PN:
SHEET 4 OF 5	RELEASE:
NOTES: ERROR EXITS	VERSION:
	REVISION:
SYSTEM: NSP	

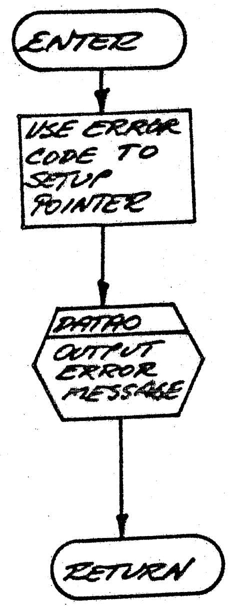
FORM 5-018-0



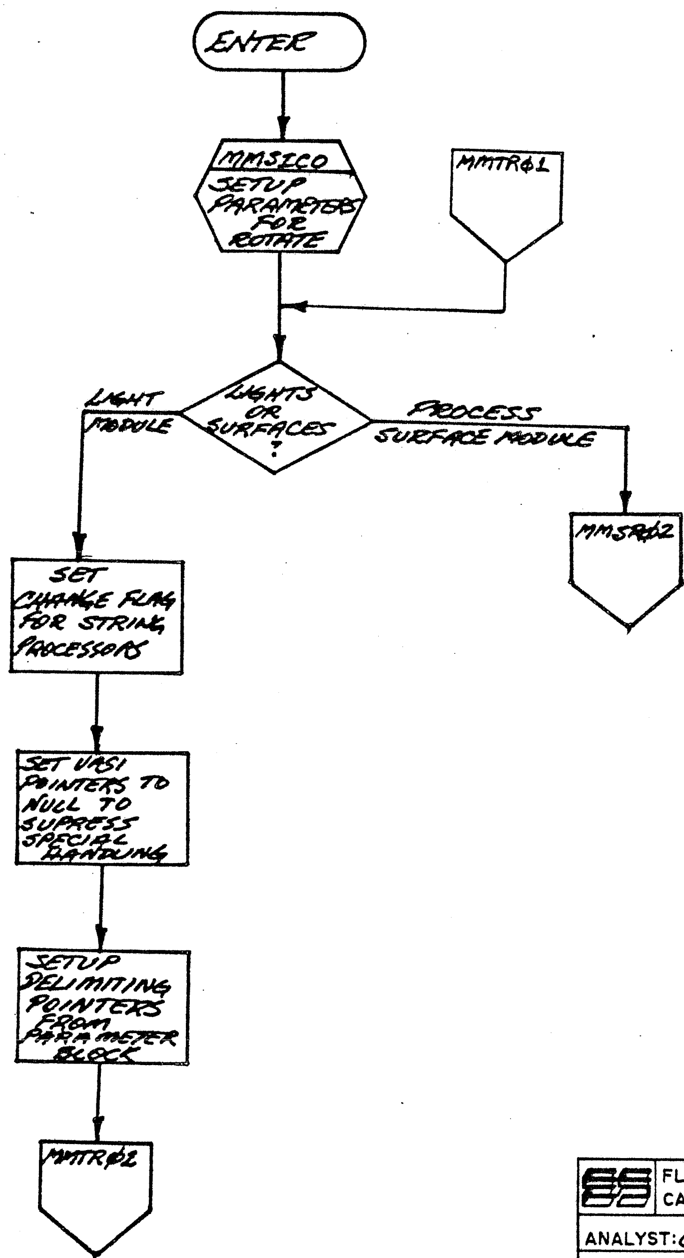
AT ENTRY,
REGISTER A POINTS TO DESTINATION AND REGISTER E POINTS TO SOURCE

FLOWCHART CALL NAME: NBMMERGE	
ANALYST: C. WALES	MODULE: MMERGE
DRAWN BY: C. WALES	PN:
SHEET 5 OF 5	RELEASE:
NOTES: SUBROUTINE MMOVE	VERSION:
	REVISION: NC
SYSTEM: NSP	

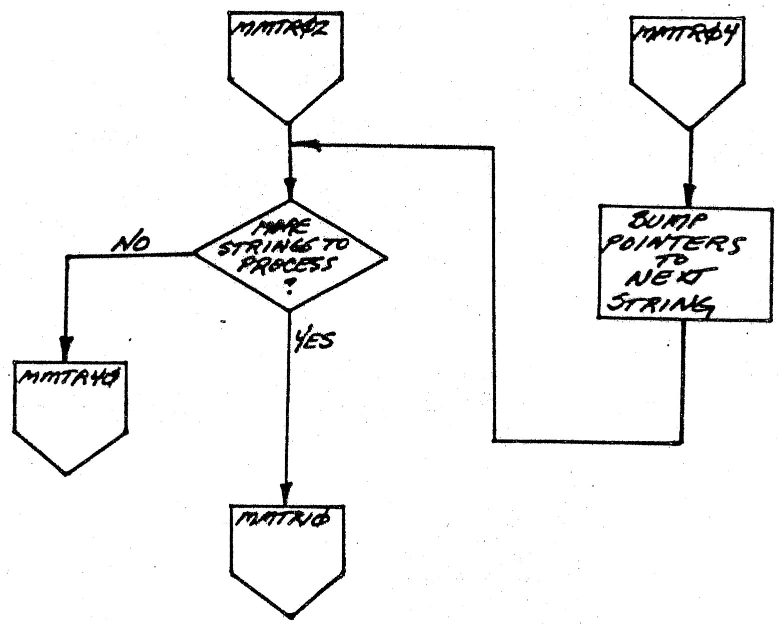
FORM 5-018-0



FLOWCHART CALL NAME:	NBMMEROR
ANALYST: C. WALES	MODULE: MMEROR
DRAWN BY: C. WALES	PN: 908030-009
SHEET 1 OF 1	RELEASE: 02
NOTES: ERROR MESSAGE OUTPUT ROUTINE FOR MODULE MERGE FUNCTION	VERSION: 01
	REVISION: NC
SYSTEM: NSP	
FORM 5-018-0	

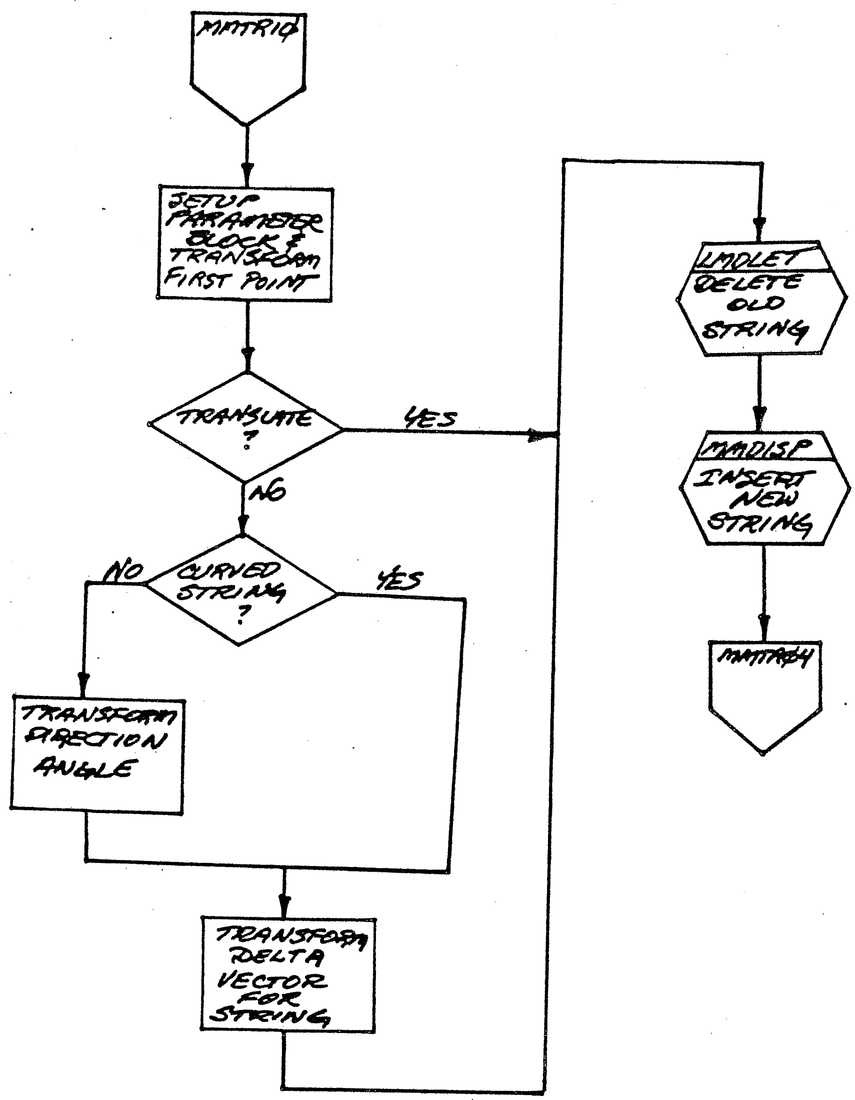


FLOWCHART CALL NAME: NBMMTRAN	
ANALYST: C. WALES	MODULE: MMTRAN
DRAWN BY: C. WALES	PN: 900029-082
SHEET 1 OF 10	RELEASE: 02
NOTES: SUBROUTINE MMTROT	VERSION: 01
	REVISION: NC
SYSTEM: NSP	
FORM 5-018-0	



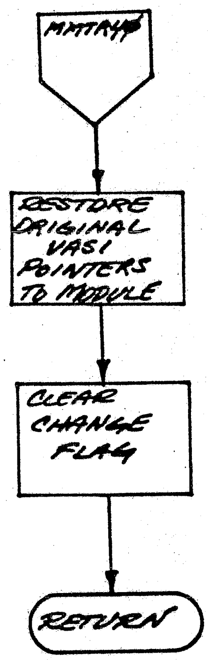
FLOWCHART CALL NAME: NBMMTRAN	
ANALYST: C. WALES	MODULE: MMTRAN
DRAWN BY: C. WALES	PN:
SHEET 2 OF 10	RELEASE:
NOTES:	VERSION:
	REVISION:
SYSTEM: NSP	

FORM 5-018-0



FLOWCHART CALL NAME: NBM.MATRN	
ANALYST: C. WALES	MODULE: MATRAN
DRAWN BY: C. WALES	PN:
SHEET 3 OF 10	RELEASE:
NOTES:	VERSION:
	REVISION:
SYSTEM: NSP	

FORM 5-018-0

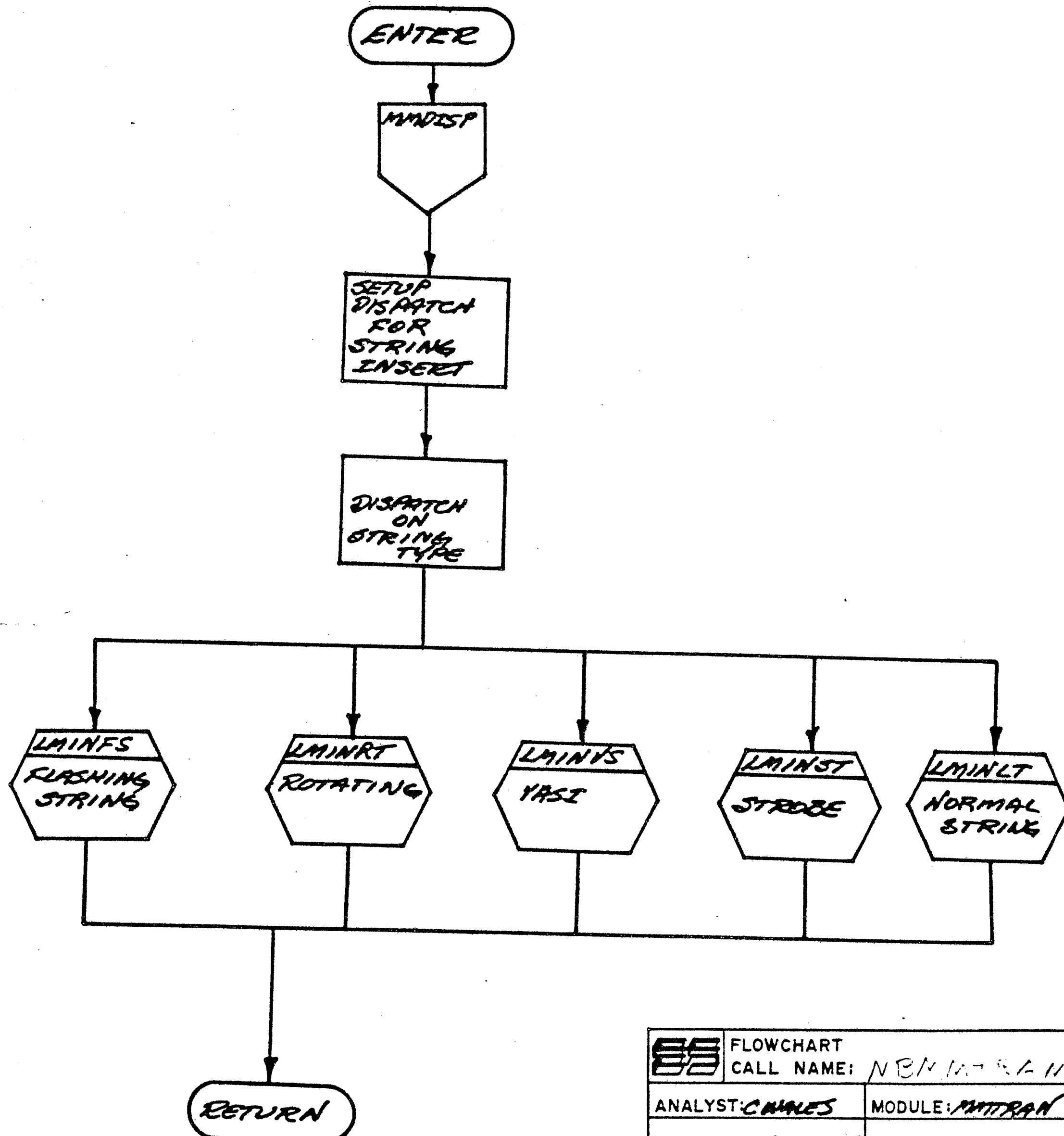


FLOWCHART
CALL NAME: NEMMTRAN

ANALYST: C. WALES	MODULE: MMTRAN
DRAWN BY: C WALES	PN:
SHEET 4 OF 10	RELEASE:
NOTES:	VERSION:
	REVISION:

SYSTEM: NSP

FORM 5-018-0

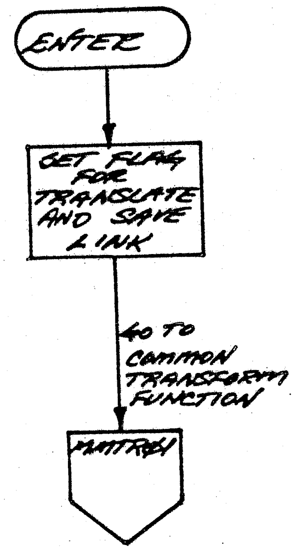


FLOWCHART
CALL NAME: NBNMTRAN

ANALYST: C WALES	MODULE: MMTRAN
DRAWN BY: C. WALES	PN:
SHEET 5 OF 10	RELEASE:
NOTES: SUBROUTINE MMDISP	VERSION:
	REVISION:

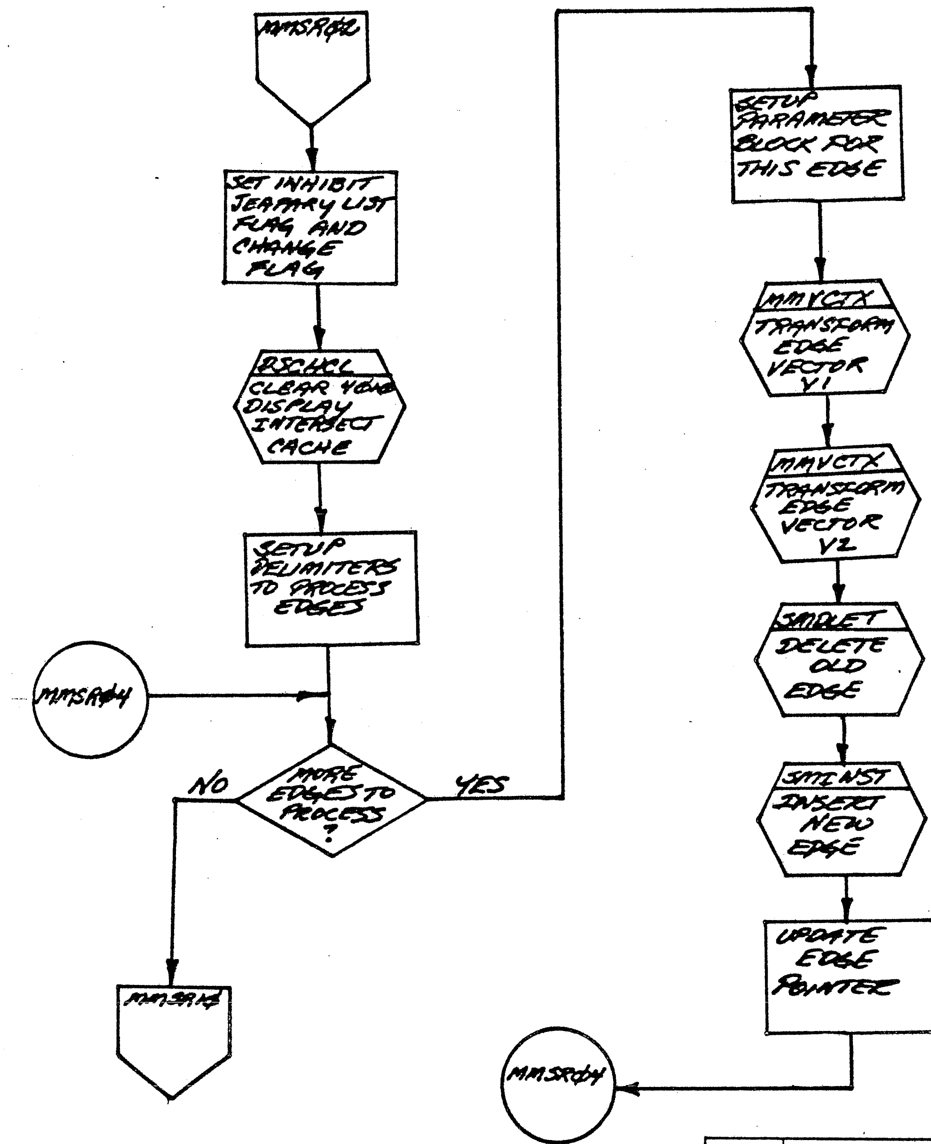
SYSTEM: NSP

FORM 5-018-0



FLOWCHART CALL NAME: NFMMTRAN	
ANALYST: C. WALES	MODULE: MMTRAN
DRAWN BY: C. WALES	PN:
SHEET 6 OF 10	RELEASE:
NOTES: SUBROUTINE MMTRNS	VERSION:
	REVISION:
SYSTEM: NSP	

FORM 5-018-0

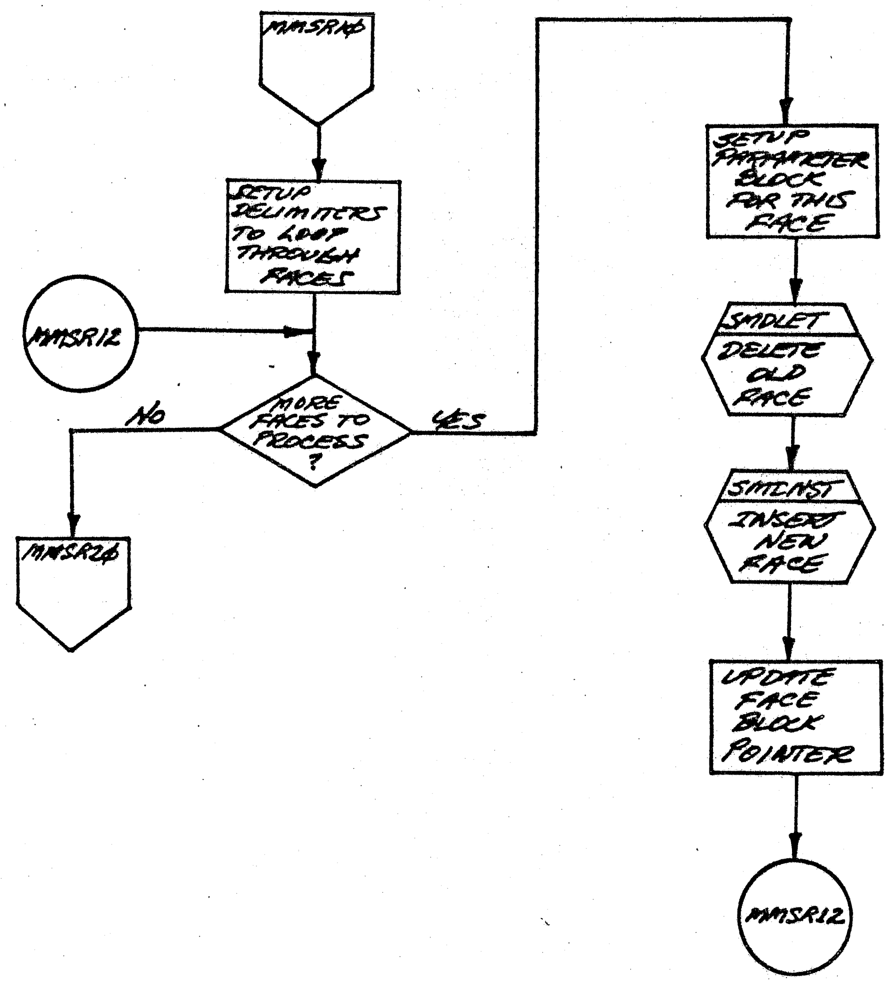


FLOWCHART
CALL NAME: NBMMTRAN

ANALYST: C. WALES | MODULE: MMTRAN
DRAWN BY: C. WALES | PN:
SHEET 7 OF 10 | RELEASE:
NOTES: | VERSION:
REVISION:

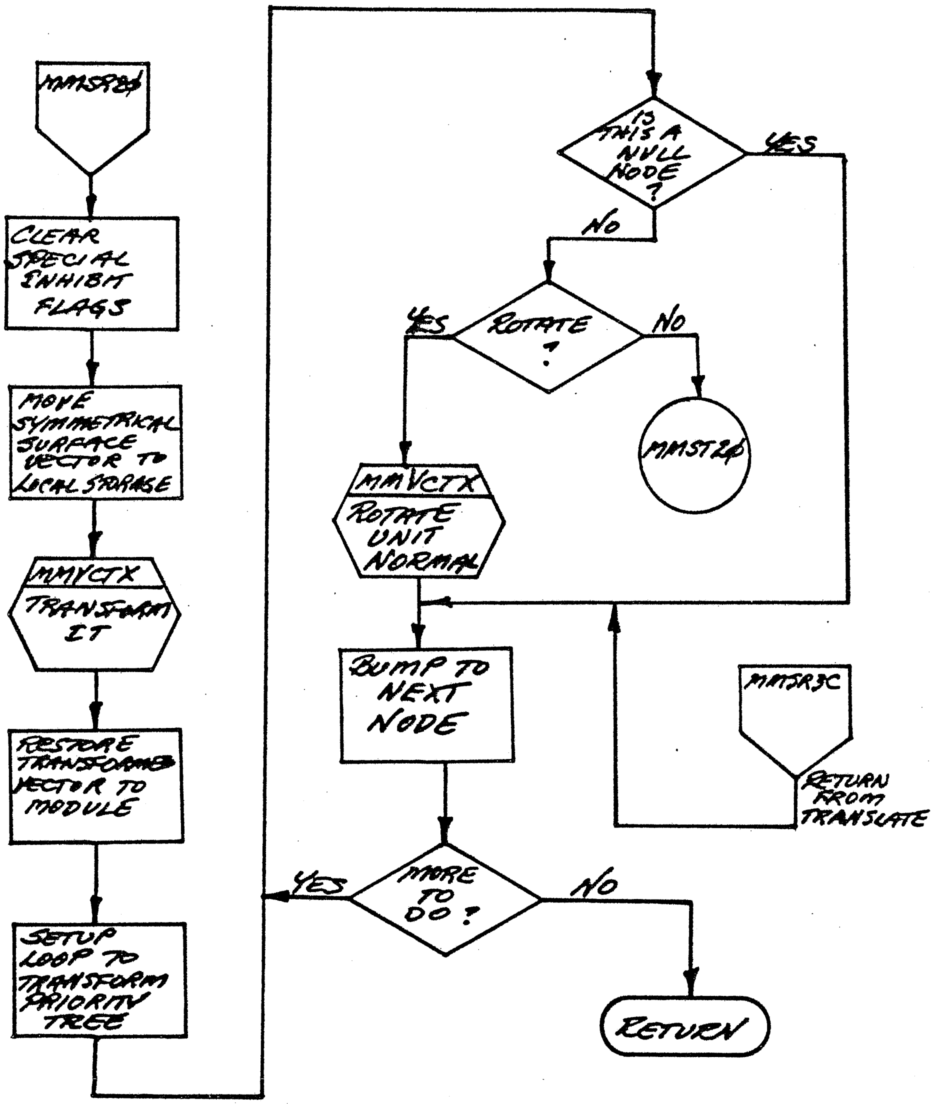
SYSTEM: NSP

FORM 5-018-0

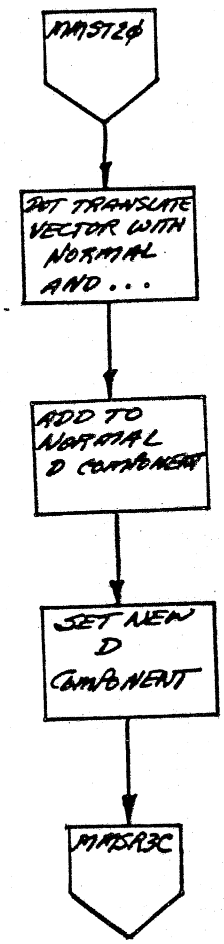


FLOWCHART CALL NAME: NEMATRAN	
ANALYST: C. WALES	MODULE: MATRAN
DRAWN BY: C. WALES	P.N:
SHEET 8 OF 10	RELEASE:
NOTES:	VERSION:
	REVISION:
SYSTEM: NSP	

FORM 5-018-0



FLOWCHART CALL NAME: NBMMTRAN	
ANALYST: C. WALES	MODULE: MATTRAN
DRAWN BY C. WALES	PN:
SHEET 9 OF 10	RELEASE:
NOTES:	VERSION:
	REVISION:
SYSTEM: NSP	
FORM 5-018-0	

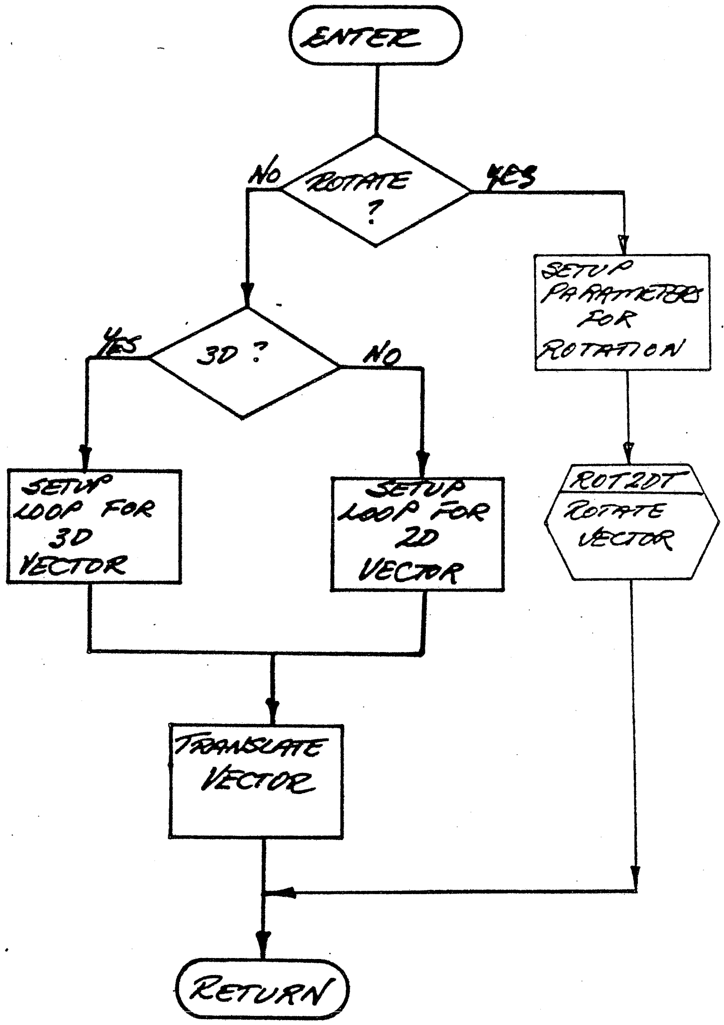


FLOWCHART
CALL NAME: NBMMTRAN

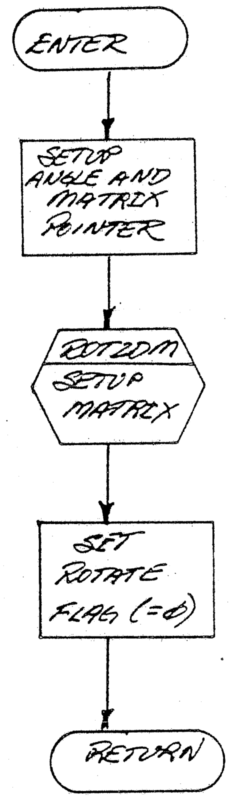
ANALYST: C. WALES	MODULE: MMTRAN
DRAWN BY: C. WALES	PN:
SHEET 10 OF 10	RELEASE:
NOTES:	VERSION:
	REVISION:

SYSTEM: NSP

FORM 5-018-0

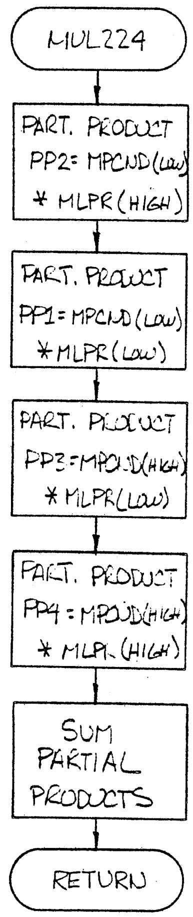


FLOWCHART CALL NAME: NBMMTVTX		
ANALYST: C. WALES		MODULE: MMTVTX
DRAWN BY: C. WALES		PN: S05 [illegible]
SHEET 1 OF 2		RELEASE: 0[illegible]
NOTES: SUBROUTINE MMVCTX		VERSION: 0[illegible] REVISION: N[illegible]
SYSTEM: NSP		
FORM 5-018-0		

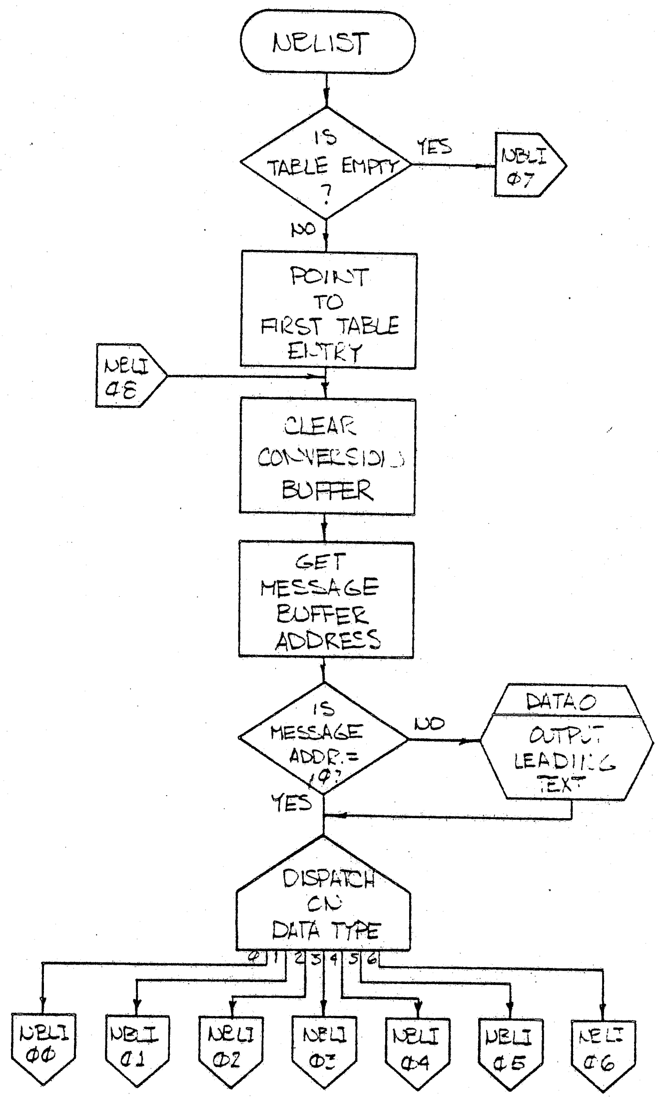


FLOWCHART CALL NAME: NEMMTVTX	
ANALYST: C. WALES	MODULE: MMTVTX
DRAWN BY: C. WALES	PN:
SHEET 2 OF 2	RELEASE:
NOTES: SUBROUTINE MMSICO	VERSION:
	REVISION:
SYSTEM: NSP	

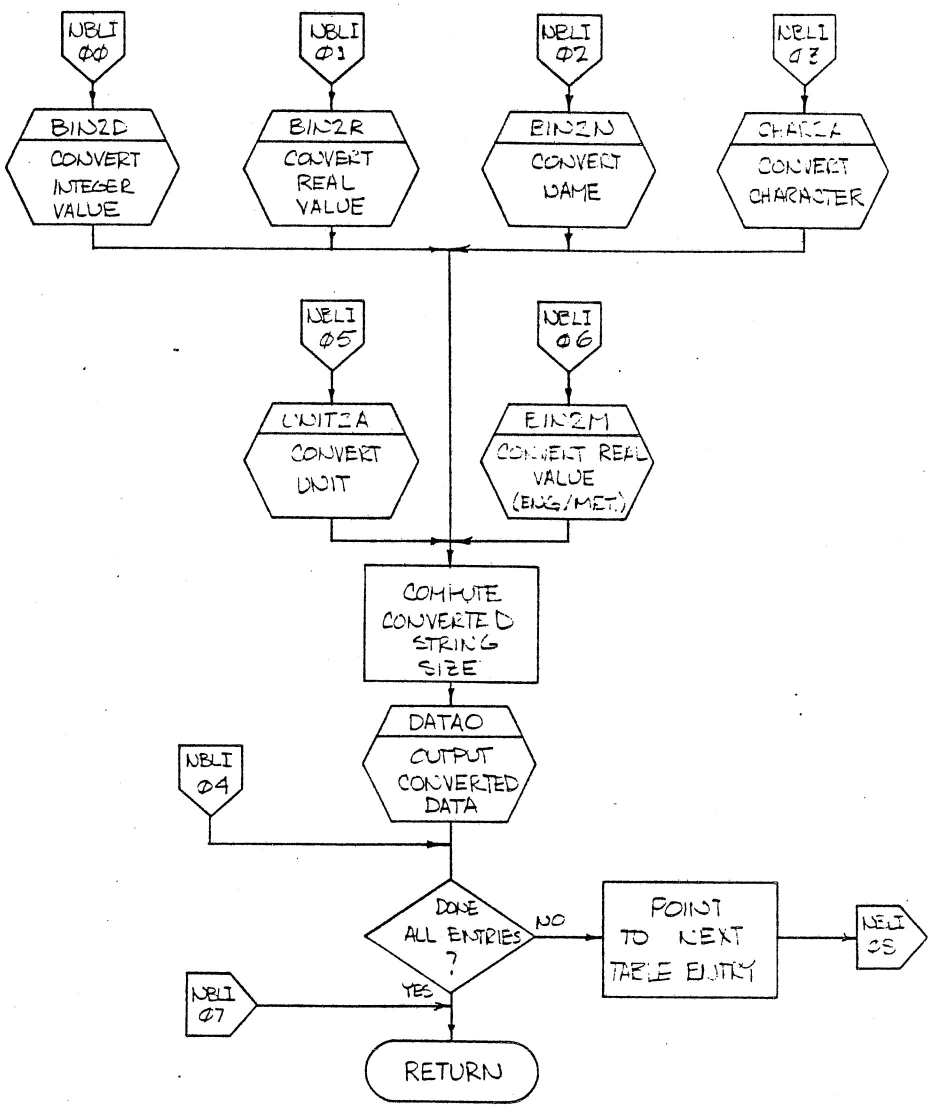
FORM 5-018-0



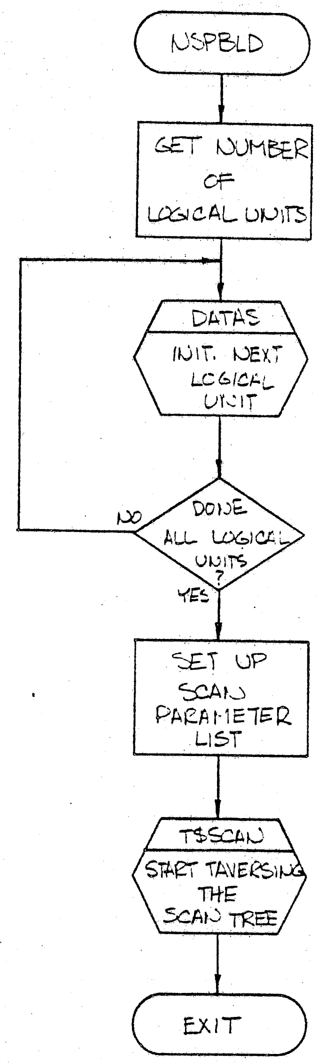
FLOWCHART CALL NAME: NBMUL224	
ANALYST: C.W.	MODULE: MUL224
DRAWN BY: W.C.	PN: 905 028-001
SHEET 1 OF 1	RELEASE: 02
NOTES:	VERSION: 01
	REVISION: NC
SYSTEM: NSP	
FORM 5-018-0	



FLOWCHART CALL NAME: NBNBLIST	
ANALYST: W.R.	MODULE: NBLIST
DRAWN BY: W.R.	PN: 905[illegible]-006
SHEET 1 OF 2	RELEASE: Ø2
NOTES:	VERSION: Ø1
	REVISION: NC
SYSTEM: NSP	
FORM 5-018-0	



FLOWCHART CALL NAME: DBNBLIST	
ANALYST:	MODULE:
DRAWN BY:	PN:
SHEET 2 OF 2	RELEASE:
NOTES:	VERSION:
	REVISION:
SYSTEM: NSP	
FORM 5-018-0	

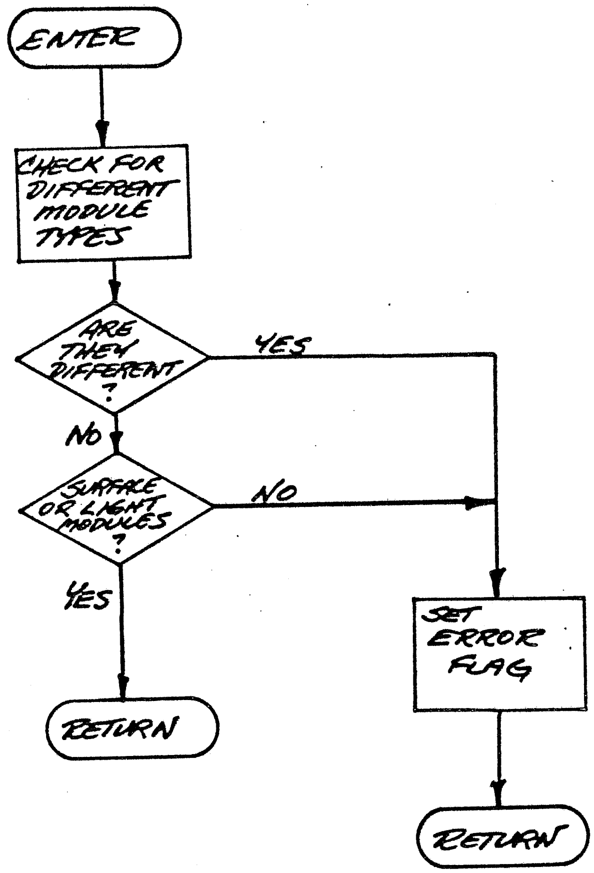


FLOWCHART
CALL NAME: NBNBMAIN

ANALYST: L.O.	MODULE: NBMAIN
DRAWN BY: W.R	PN: 9087[illegible]9-[illegible]
SHEET 1 OF 1	RELEASE: [illegible]
NOTES:	VERSION: [illegible]
MAIN ROUTINE: NSPBLD	REVISION: [illegible]

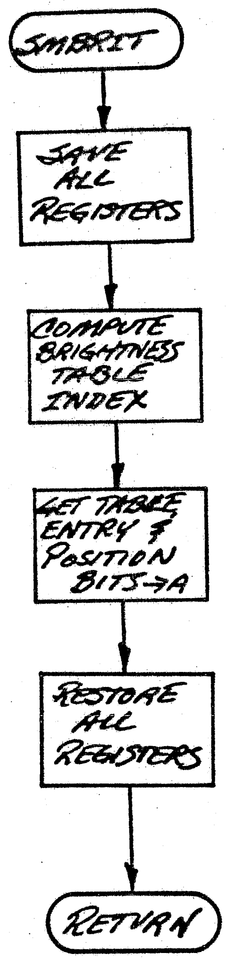
SYSTEM: NSP

FORM 5-018-0



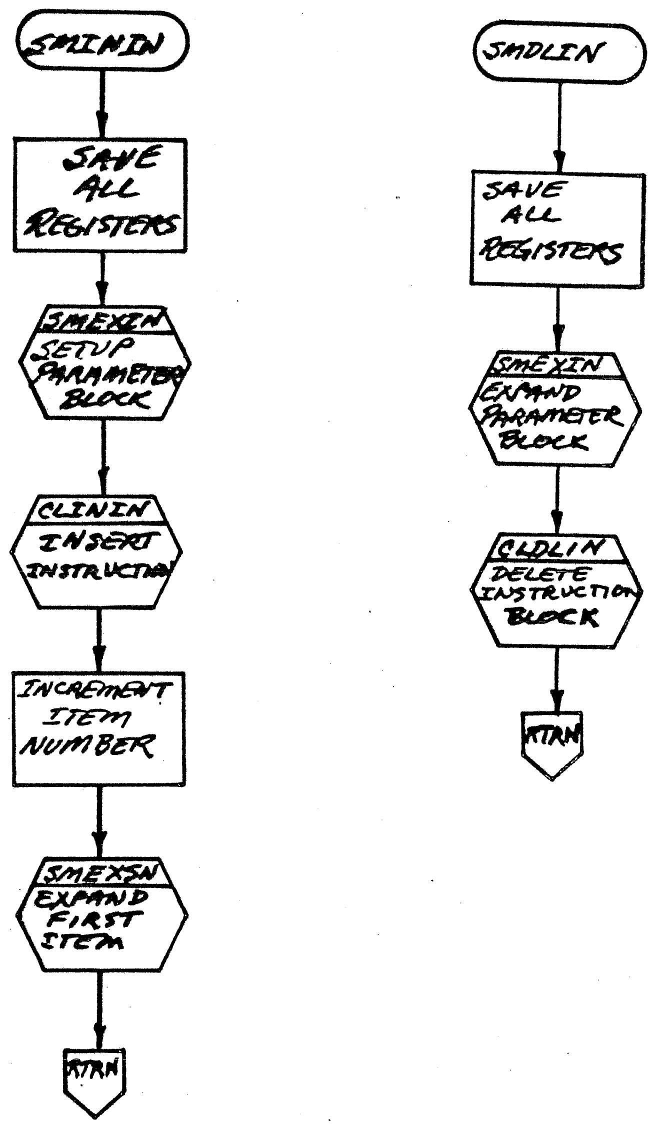
FLOWCHART CALL NAME:	NBNBCTYP
ANALYST: C. WALES	MODULE: NBCTYP
DRAWN BY: C. WALES	PN: 90803D-00[illegible]
SHEET 1 OF 1	RELEASE: [illegible]
NOTES: CHECK MODULE TYPES FOR MODULE MERGE FUNCTION	VERSION: Ø1
	REVISION: NC
SYSTEM: NSP	

FORM 5-018-0



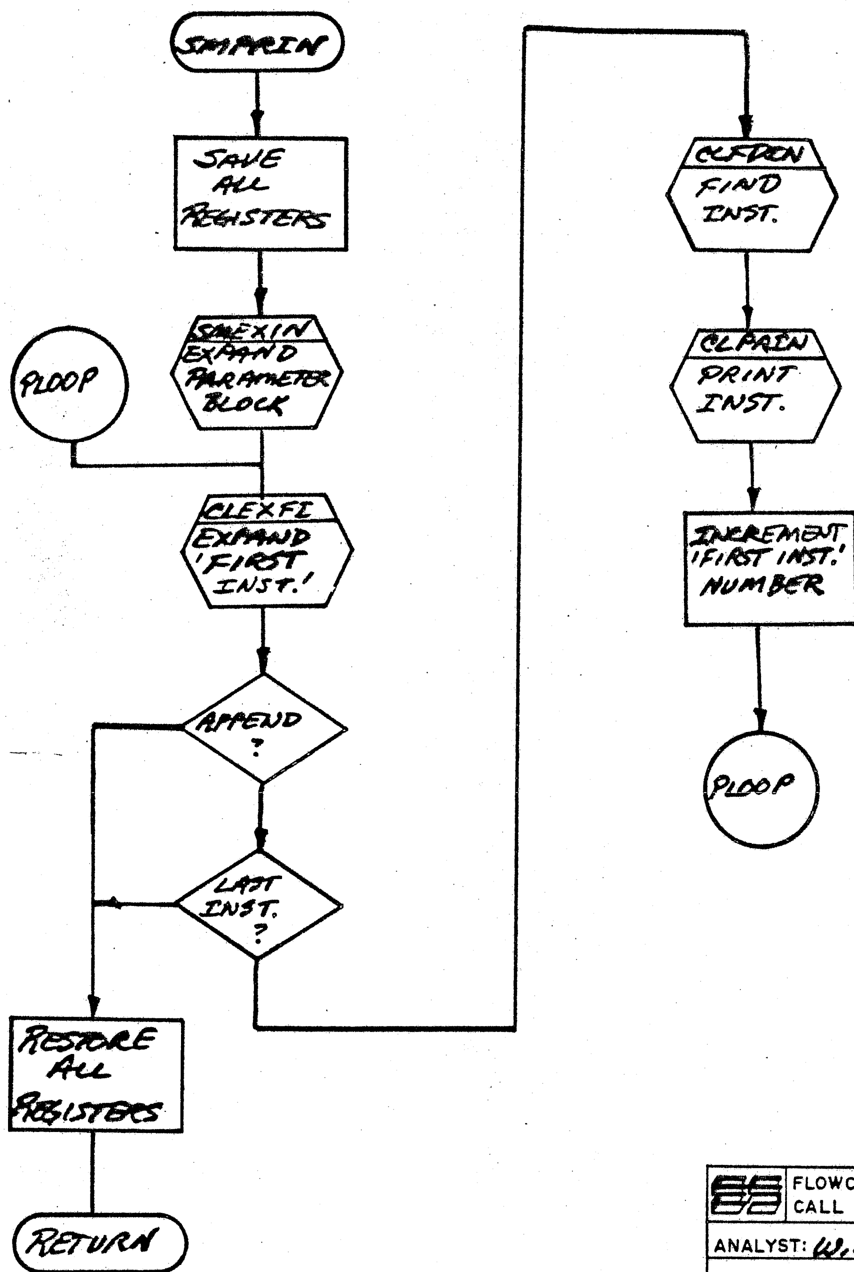
FLOWCHART CALL NAME:	NBSMBRIT
ANALYST: K.K.	MODULE: SMBRIT
DRAWN BY: C. WALES	PN: 908022-056
SHEET 1 OF 1	RELEASE: 02
NOTES:	VERSION: 01
	REVISION: N3
SYSTEM: NSP	

FORM 5-018-0



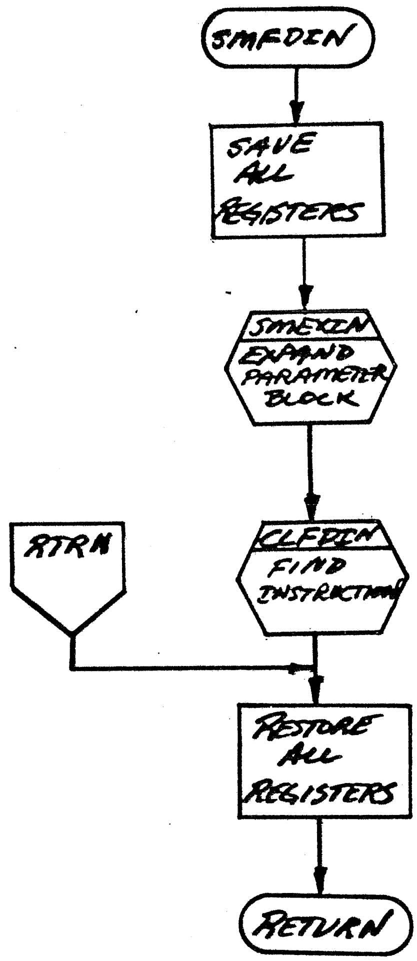
FLOWCHART CALL NAME: NBSMCMDL	
ANALYST: W.R.	MODULE: SMCMDL
DRAWN BY: C.W.	PN: 909029-264
SHEET 1 OF 6	RELEASE: 02
NOTES:	VERSION: Ø1
	REVISION: NC
SYSTEM: NSP	

FORM 5-018-0



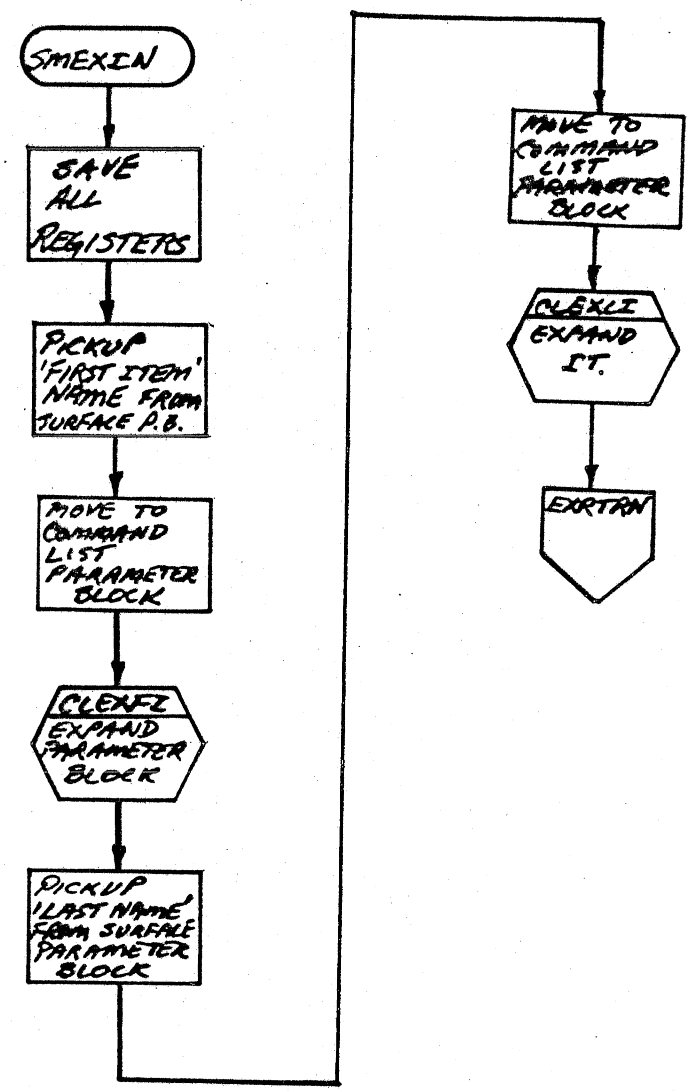
FLOWCHART CALL NAME:	NBSMCMDL
ANALYST: W.R.	MODULE: SMCMDL
DRAWN BY: C.WALES	PN:
SHEET 2 OF 6	RELEASE:
NOTES:	VERSION:
	REVISION:
SYSTEM: NSP	

FORM 5-018-0



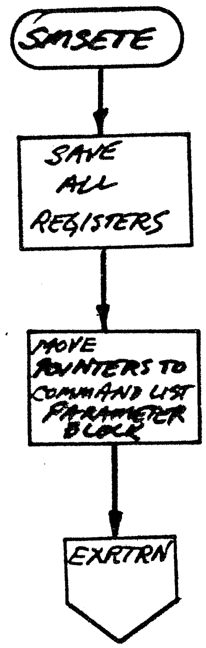
FLOWCHART CALL NAME: NBSMCMDL	
ANALYST: N.R.	MODULE SMCMDL
DRAWN BY: C.W	PN:
SHEET 3 OF 6	RELEASE:
NOTES:	VERSION:
	REVISION:
SYSTEM: NSP	

FORM 5-018-0

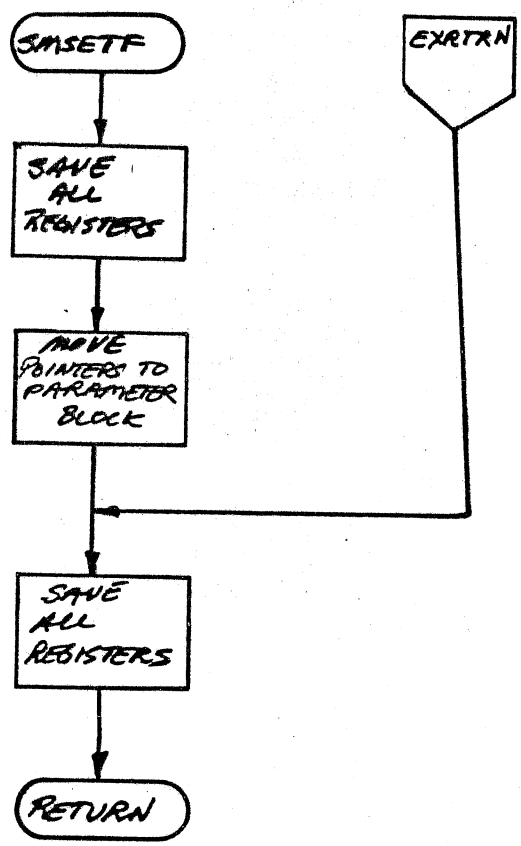


FLOWCHART CALL NAME: NBSMCMDL	
ANALYST: W.R.	MODULE: SMCMDL
DRAWN BY: C.W.	PN:
SHEET 4 OF 6	RELEASE:
NOTES:	VERSION:
	REVISION:
SYSTEM: NSP	

FORM 5-018-0

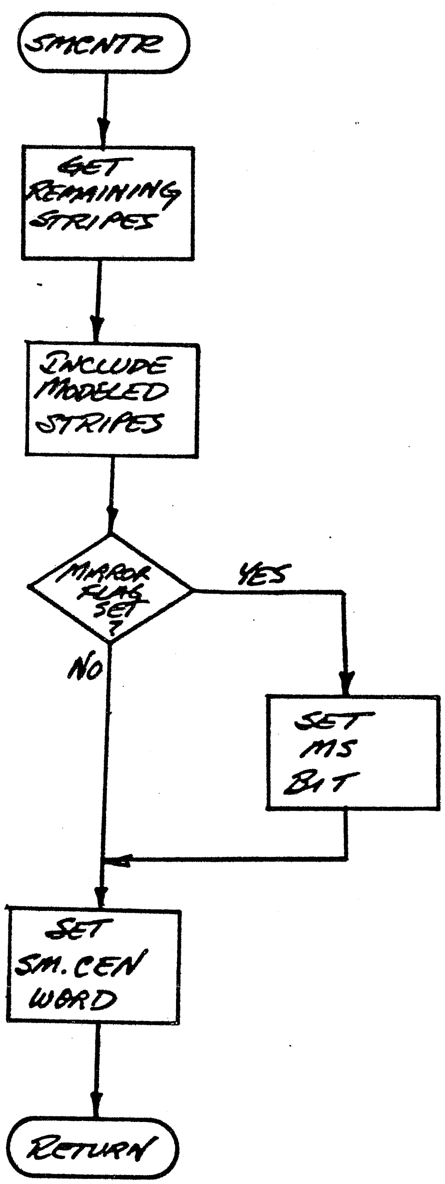


FLOWCHART CALL NAME: NBSMCMDL	
ANALYST: W.R.	MODULE: SMCMDL
DRAWN BY: C.W.	PN:
SHEET 5 OF 6	RELEASE:
NOTES:	VERSION:
	REVISION:
SYSTEM: NSP	
FORM 5-018-0	

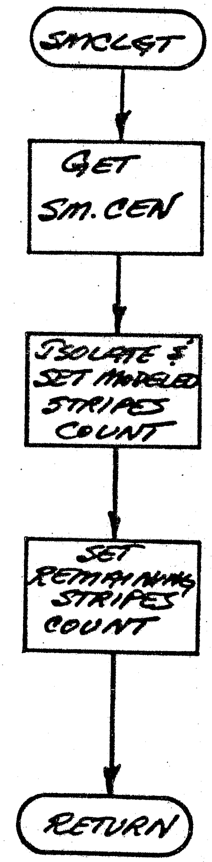


FLOWCHART CALL NAME: NBSMCMDL	
ANALYST: W.R.	MODULE: SMCMDL
DRAWN BY: C.W.	PN:
SHEET 6 OF 6	RELEASE:
NOTES:	VERSION:
	REVISION:
SYSTEM: NSP	

FORM 5-018-0

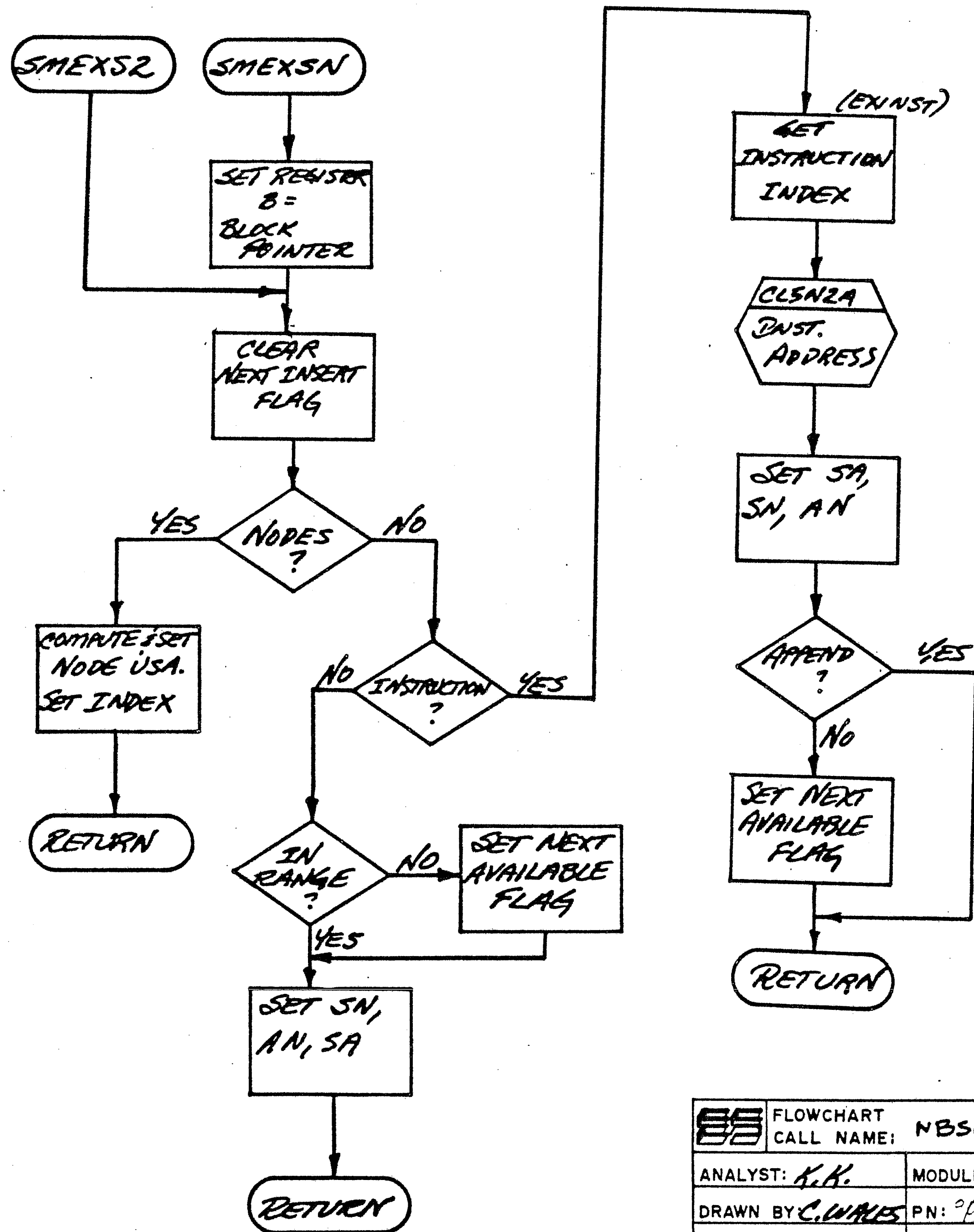


FLOWCHART CALL NAME: NBSMCNTR	
ANALYST: K.K.	MODULE: SMCNTR
DRAWN BY C. WALES	PN: 9D8D[illegible]-Ø54
SHEET 1 OF 2	RELEASE: Ø2
NOTES:	VERSION: Ø1
	REVISION: NC
SYSTEM: NSP	
FORM 5-018-0	

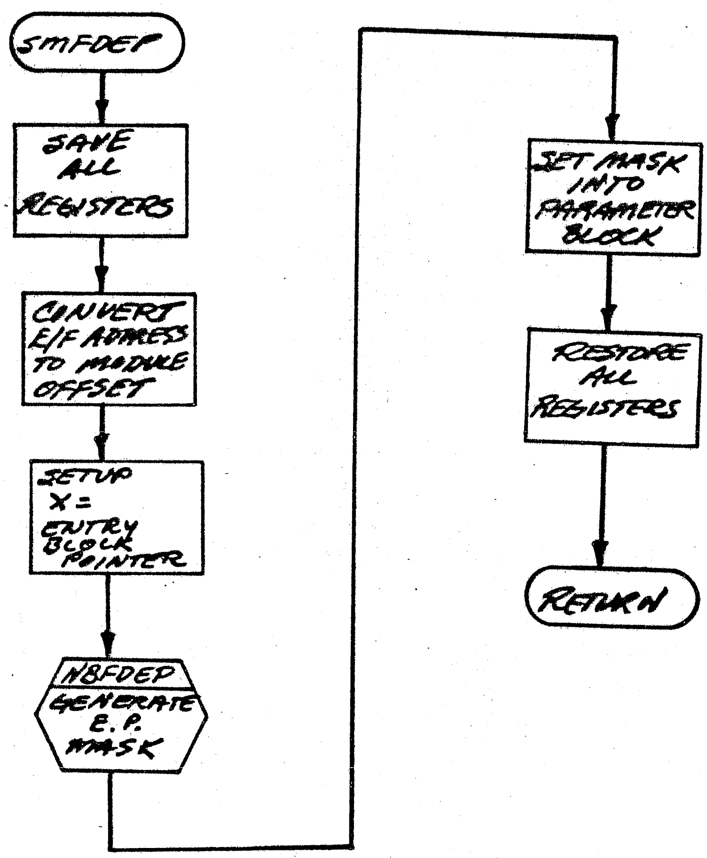


FLOWCHART CALL NAME:	NBSMCNTR
ANALYST: K.K.	MODULE: SMCNTR
DRAWN BY C. WALES	PN:
SHEET 2 OF 2	RELEASE:
NOTES:	VERSION:
	REVISION:
SYSTEM: NSP	

FORM 5-018-0



FLOWCHART CALL NAME:	NBSMEXSN
ANALYST: K.K.	MODULE: SMEXSN
DRAWN BY: C. WALES	PN: ØØ8Ø29-Ø62
SHEET 1 OF 1	RELEASE: Ø2
NOTES:	VERSION: Ø1
	REVISION: N2
SYSTEM: NSP	
FORM 5-018-0	



FLOWCHART CALL NAME: NBSMFDEP

ANALYST: K.K. | MODULE: SMFDEP

DRAWN BY C. WALES | PN: 908329-Ø61

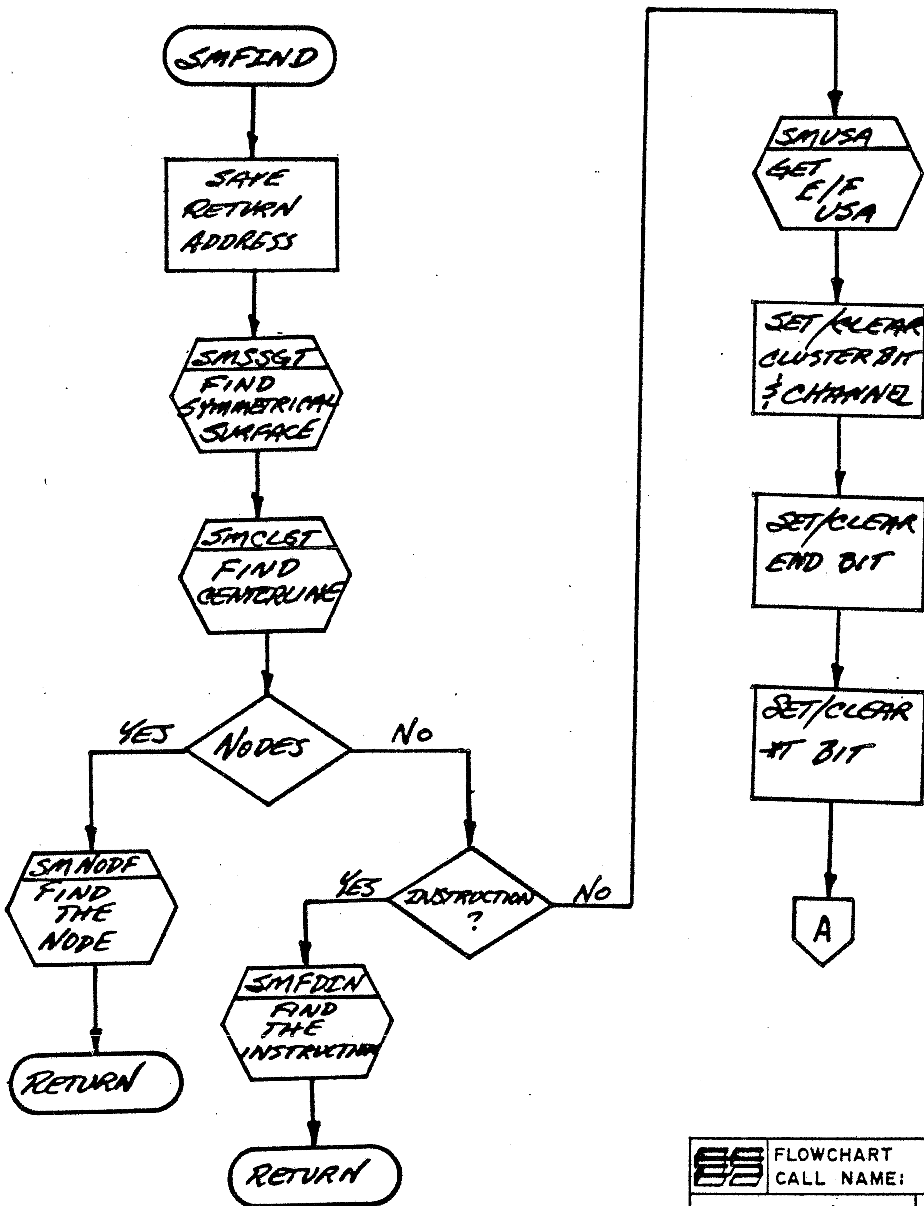
SHEET / OF / | RELEASE: Ø2

NOTES: | VERSION: Ø1

REVISION: NC

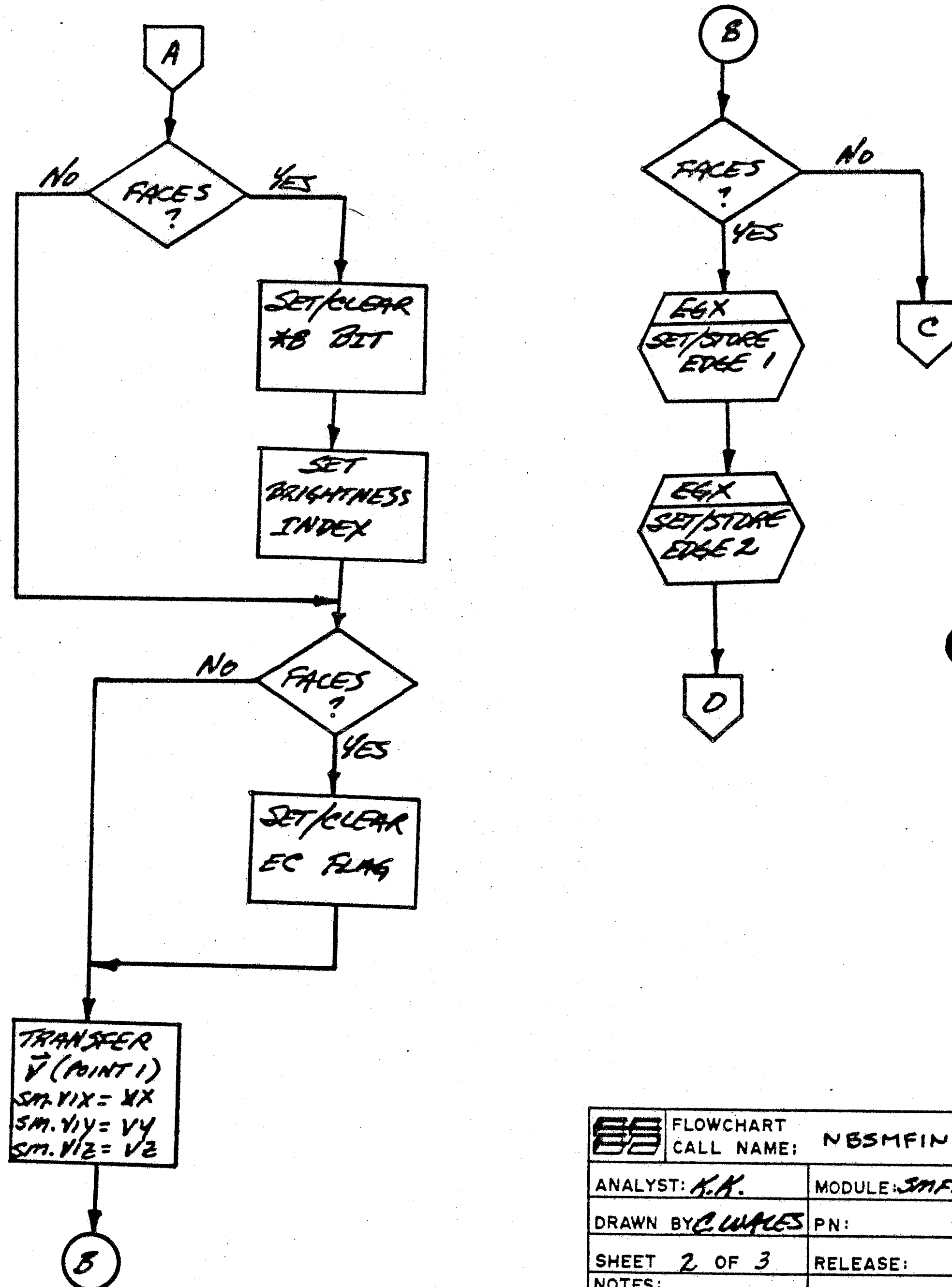
SYSTEM: NSP

FORM 5-018-0



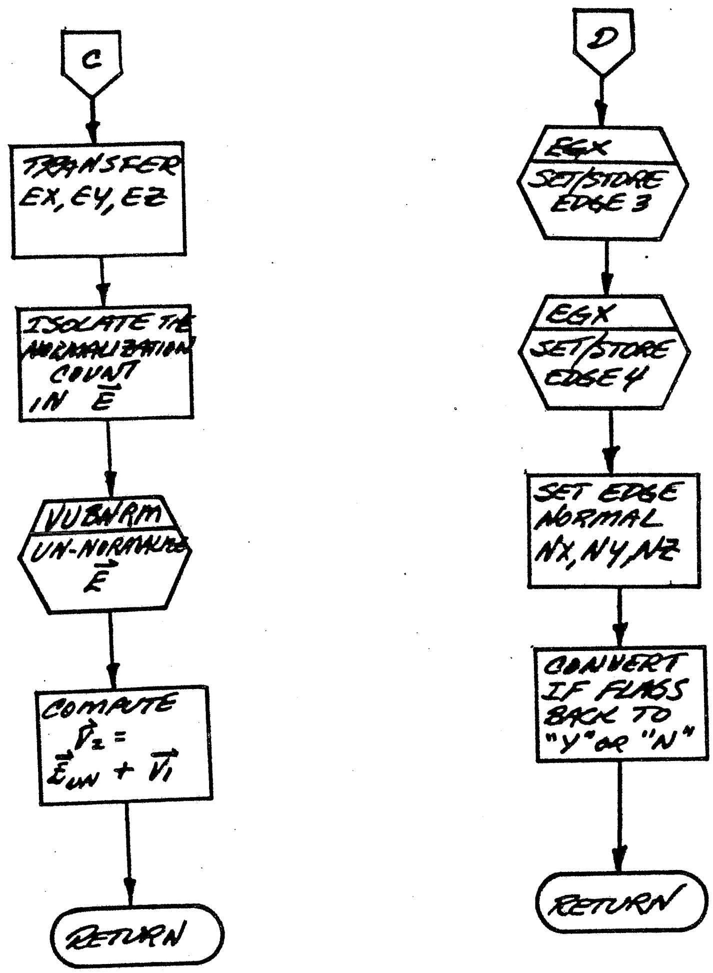
FLOWCHART CALL NAME: NBSMFIND	
ANALYST: K.K.	MODULE: SMFIND
DRAWN BY C. WALES	PN: 908039-060
SHEET 1 OF 3	RELEASE: 02
NOTES:	VERSION: 31
	REVISION: 112
SYSTEM: NSP	

FORM 5-018-0



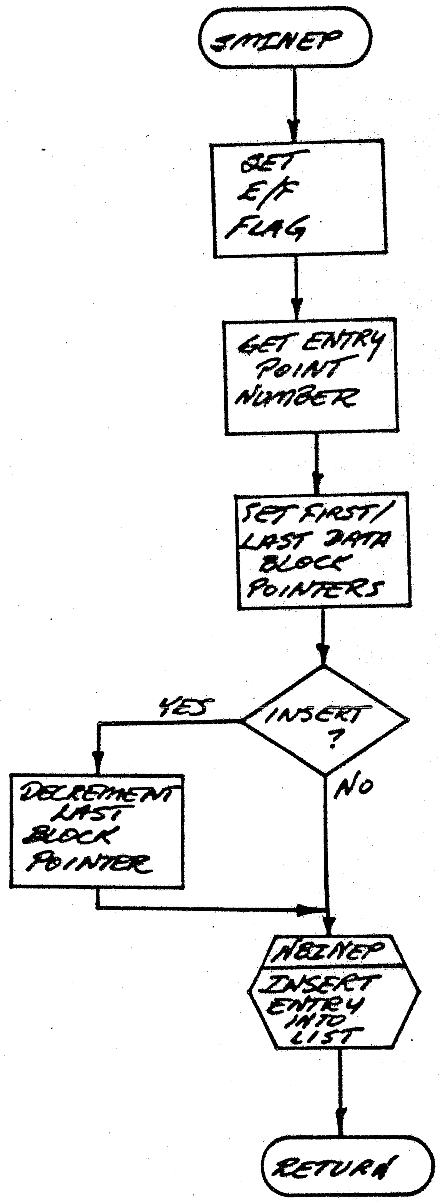
FLOWCHART CALL NAME:	NBSMFIND
ANALYST: K.K.	MODULE: SMFIND
DRAWN BY C. WALES	PN:
SHEET 2 OF 3	RELEASE:
NOTES:	VERSION:
	REVISION:
SYSTEM: NSP	

FORM 5-018-0



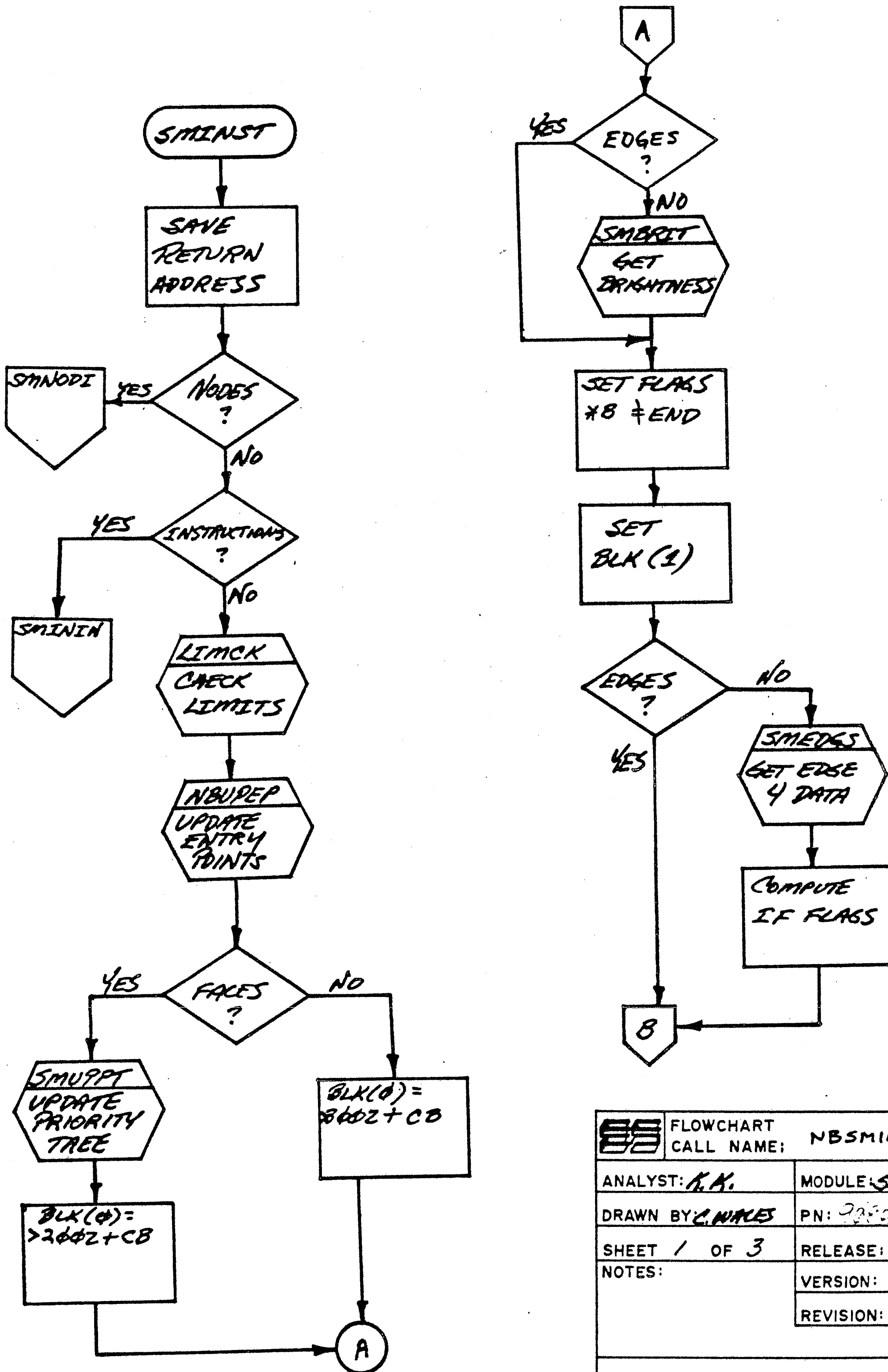
FLOWCHART CALL NAME:	NBSMFIND
ANALYST: K. K.	MODULE: SMFIND
DRAWN BY: C. WALES	PN:
SHEET 3 OF 3	RELEASE:
NOTES:	VERSION:
	REVISION:
SYSTEM: NSP	

FORM 5-018-0



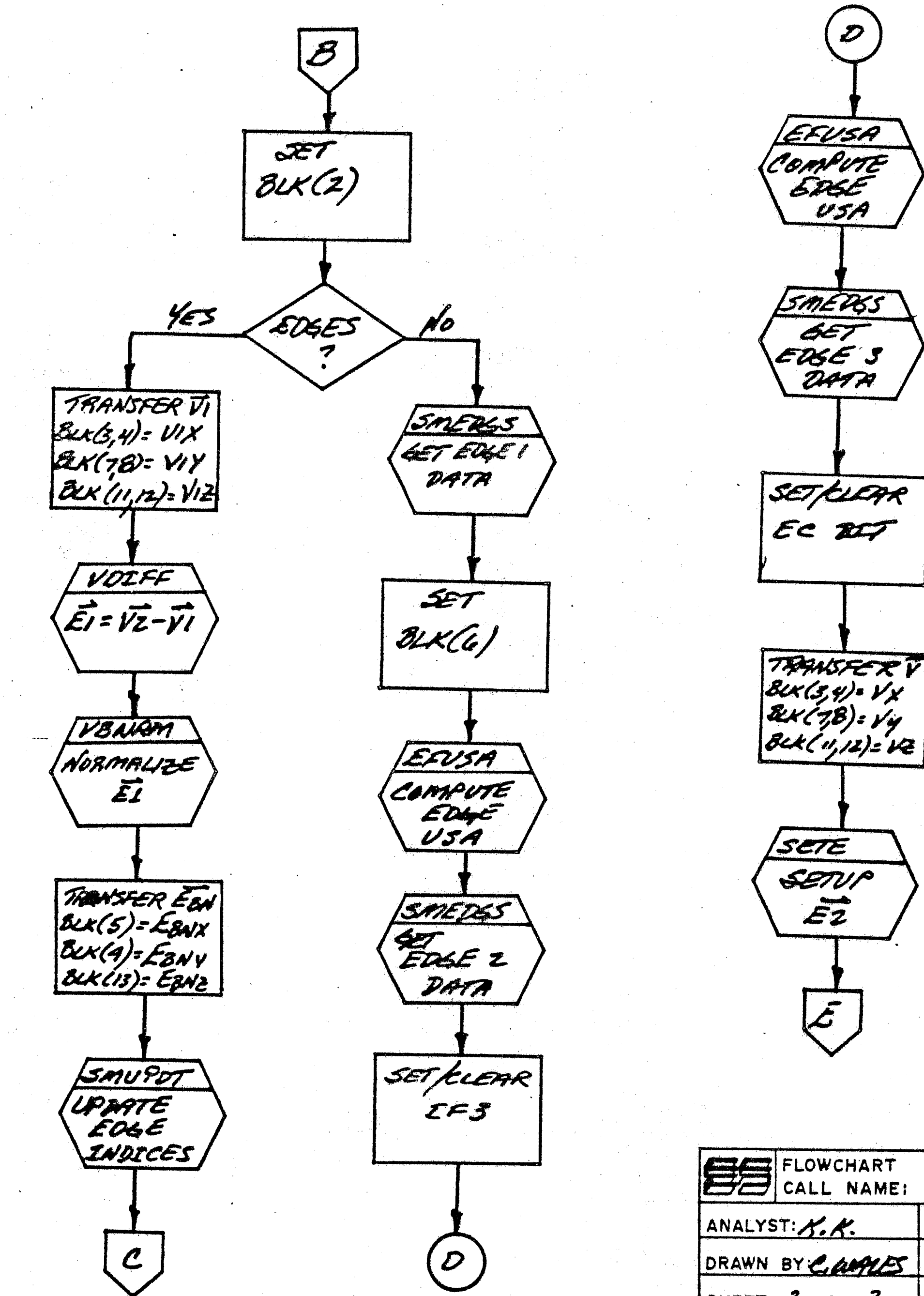
FLOWCHART CALL NAME:	NBSMINEP
ANALYST: K.K	MODULE: SMINEP
DRAWN BY: G.W	PN: 908032-35[illegible]
SHEET 1 OF 1	RELEASE: 0[illegible]
NOTES:	VERSION: [illegible]
	REVISION: N[illegible]
SYSTEM: NSP	

FORM 5-018-0



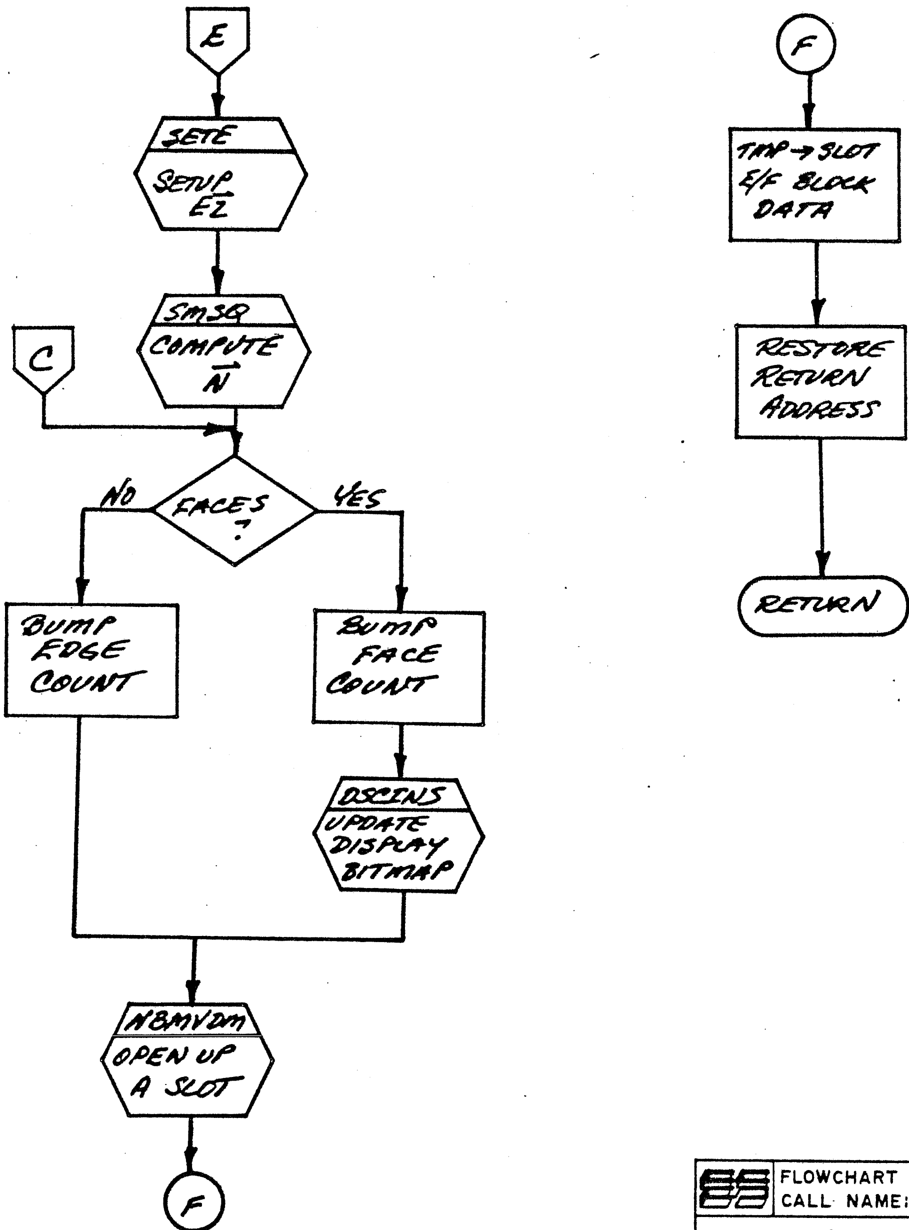
FLOWCHART CALL NAME:	NBSMINST
ANALYST: K.K.	MODULE: SMINST
DRAWN BY: C. WALES	PN: [illegible]
SHEET 1 OF 3	RELEASE: 02
NOTES:	VERSION: 01
	REVISION: 113
SYSTEM: NSP	

FORM 8-018-0

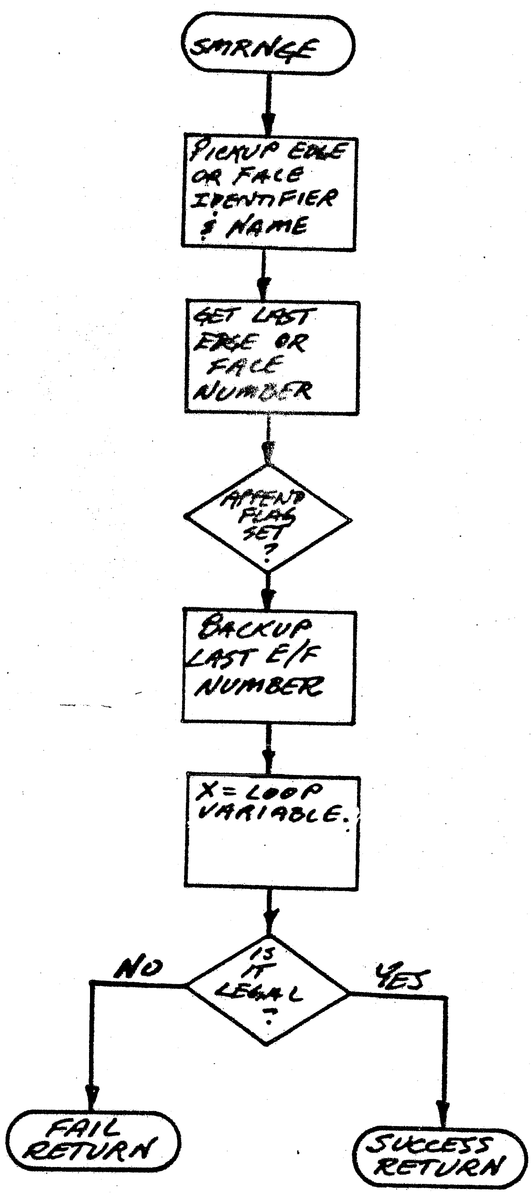


FLOWCHART CALL NAME: NBSMINST	
ANALYST: K.K.	MODULE: SMINST
DRAWN BY: C.WALES	PN:
SHEET 2 OF 3	RELEASE:
NOTES:	VERSION:
	REVISION:
SYSTEM: NSP	

FORM 5-018-0

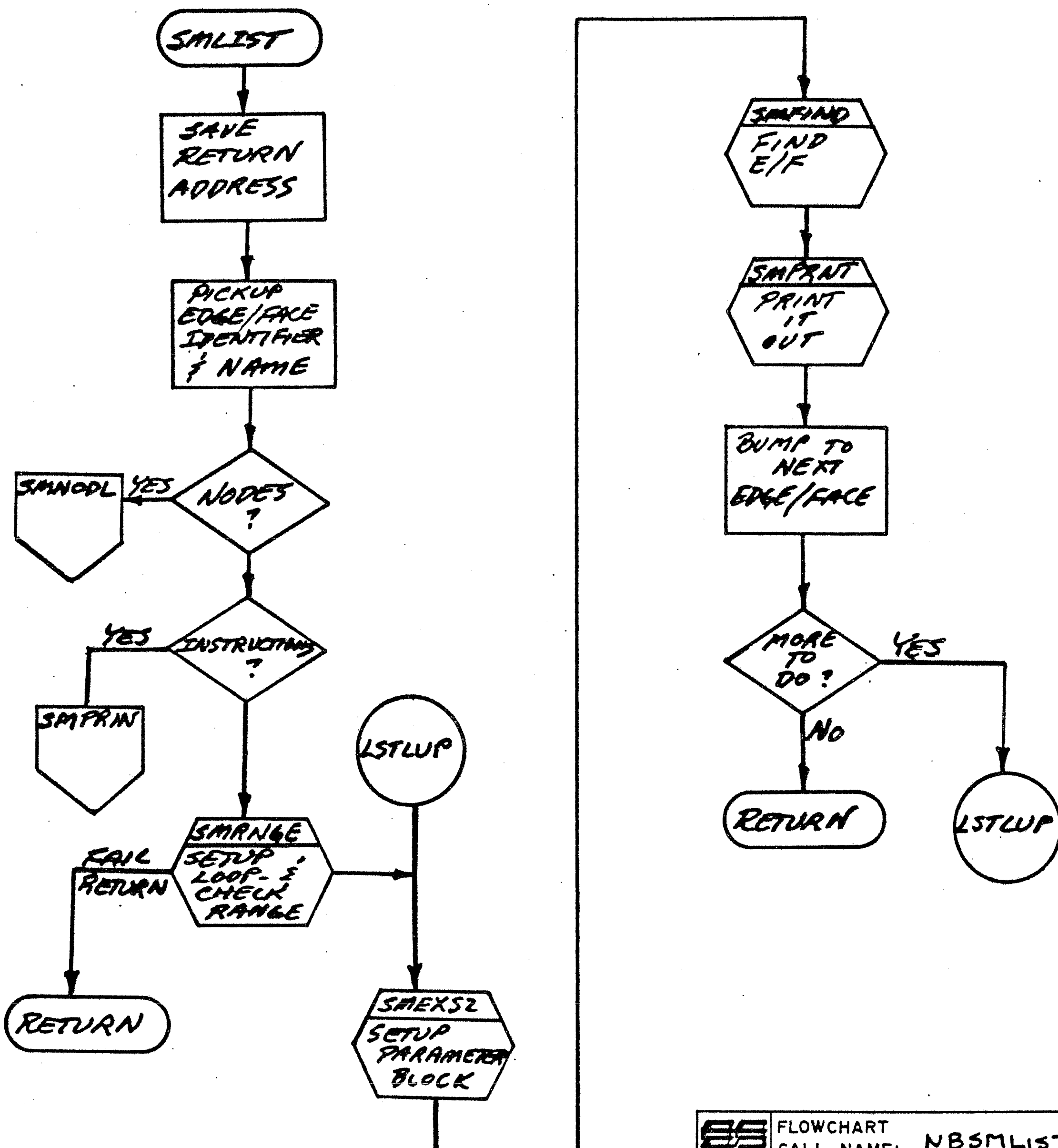


FLOWCHART CALL NAME: NBSMINST	
ANALYST: K.K.	MODULE: SMINST
DRAWN BY C. WALES	PN:
SHEET 3 OF 3	RELEASE:
NOTES:	VERSION:
	REVISION:
SYSTEM: NSP	
FORM 5-018-0	



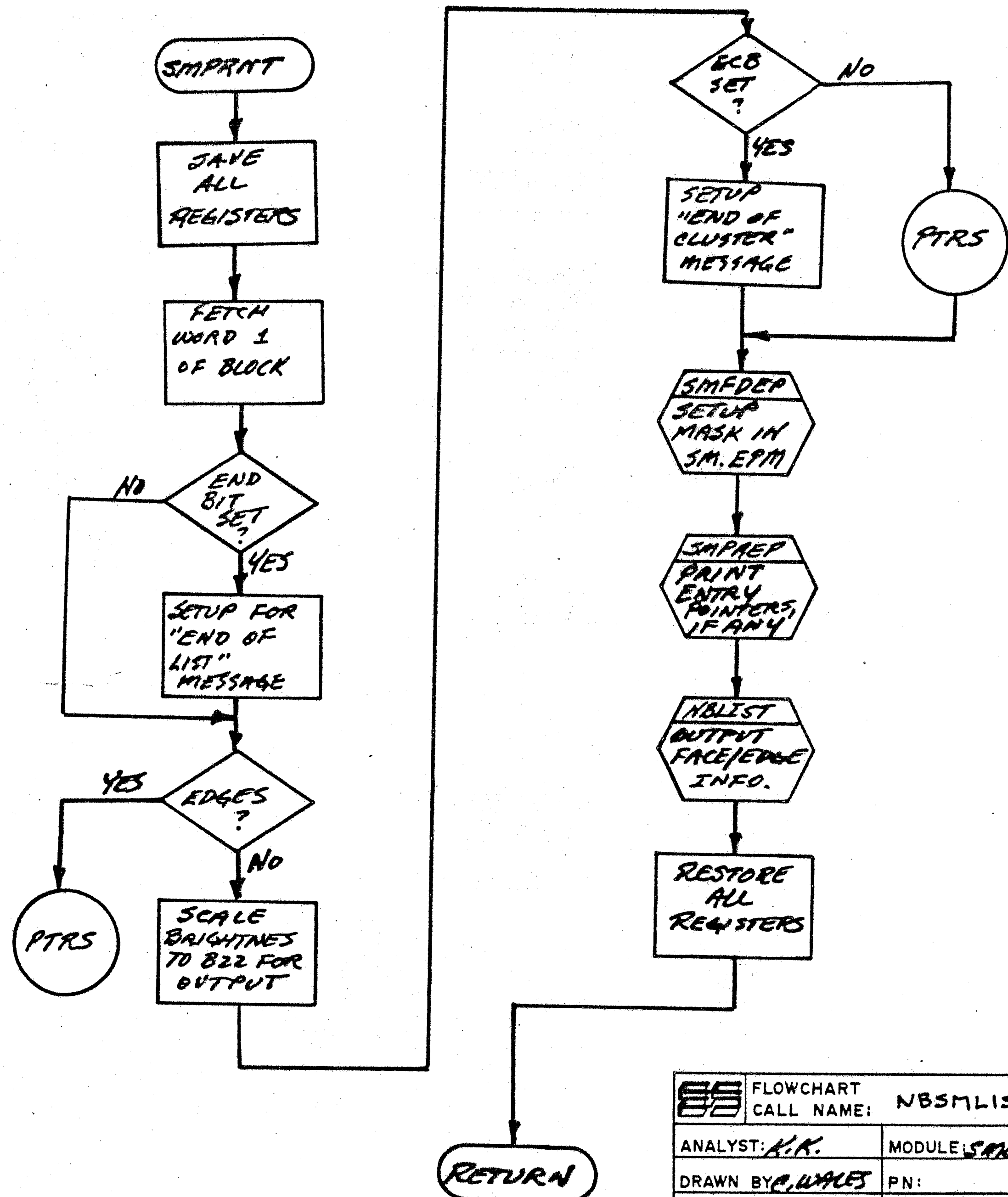
FLOWCHART CALL NAME:	NBSMLIST
ANALYST: K.K.	MODULE: SMLIST
DRAWN BY: C.WALES	PN:
SHEET 1 OF 3	RELEASE:
NOTES:	VERSION:
	REVISION:
SYSTEM: NSP	

FORM 5-018-0



FLOWCHART CALL NAME: NBSMLIST	
ANALYST: K.K.	MODULE: SMLIST
DRAWN BY: C. MAYES	PN:
SHEET 2 OF 3	RELEASE:
NOTES:	VERSION:
	REVISION:
SYSTEM: NSP	

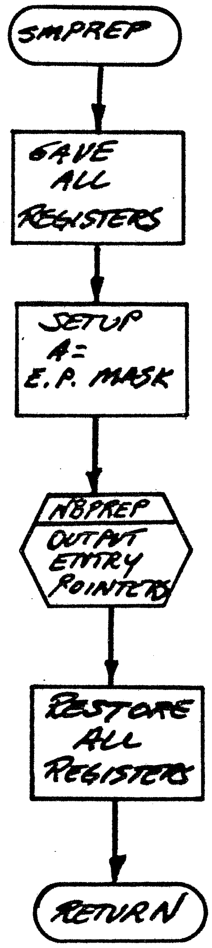
FORM 5-018-0



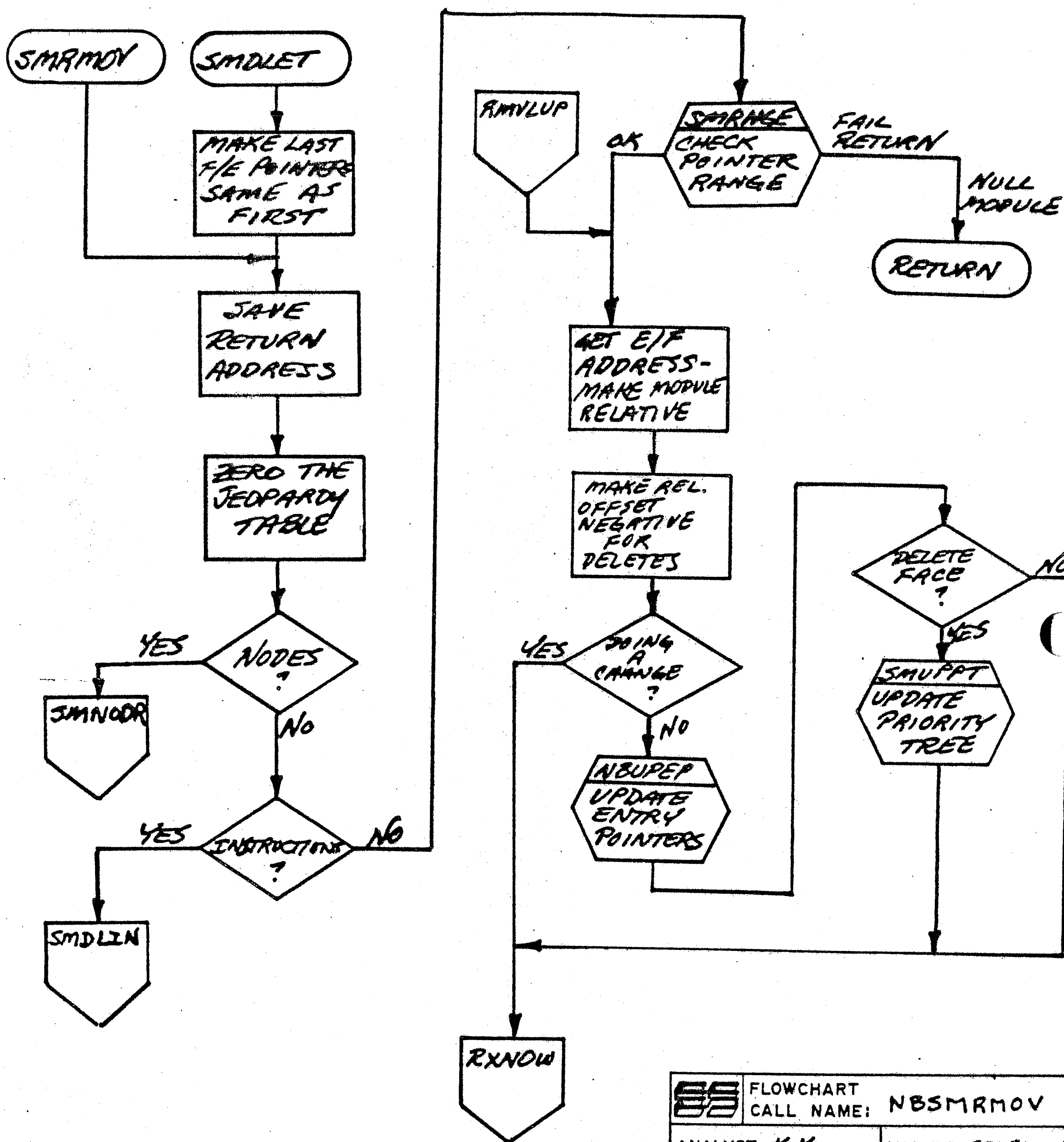
FLOWCHART CALL NAME:	NBSMLIST
ANALYST: K.K.	MODULE: SMLIST
DRAWN BY: C. WALES	PN:
SHEET 3 OF 3	RELEASE:
NOTES:	VERSION:
	REVISION:

SYSTEM: NSP

FORM 5-018-0

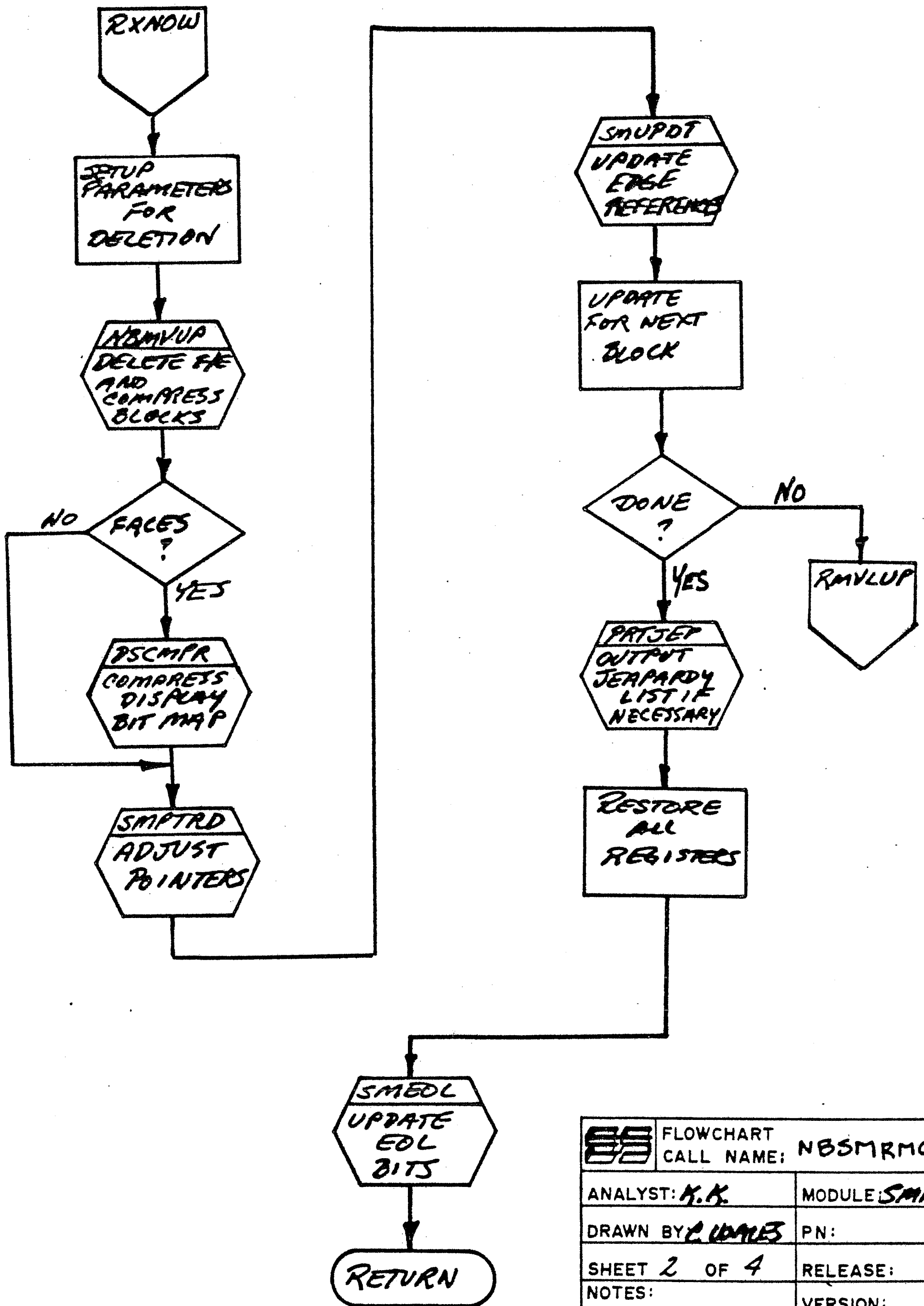


FLOWCHART CALL NAME: NBSMPREP	
ANALYST: K.K.	MODULE: SMPREP
DRAWN BY C. WALES	PN: [illegible]
SHEET 1 OF 1	RELEASE: [illegible]
NOTES:	VERSION: [illegible]
	REVISION: [illegible]
SYSTEM: NSP	
FORM 5-018-0	



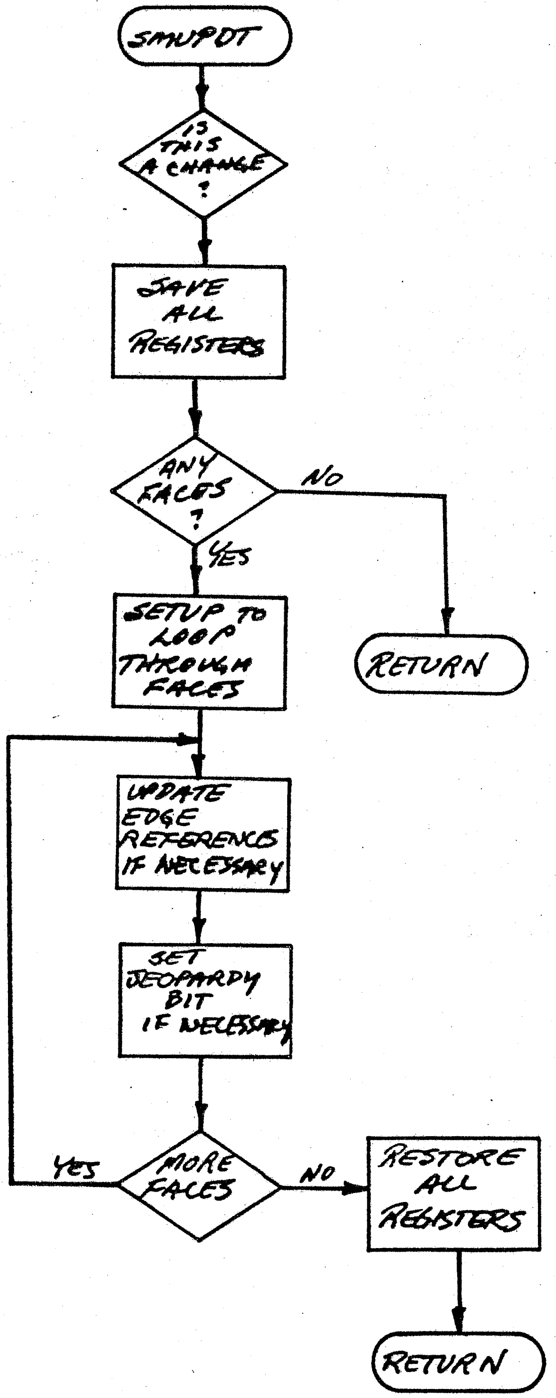
FLOWCHART CALL NAME: NBSMRMOV	
ANALYST: K.K.	MODULE: SMRMOV
DRAWN BY C.WALES	PN: [illegible]
SHEET 1 OF 4	RELEASE: [illegible]
NOTES:	VERSION: [illegible]
	REVISION: NC
SYSTEM: NSP	

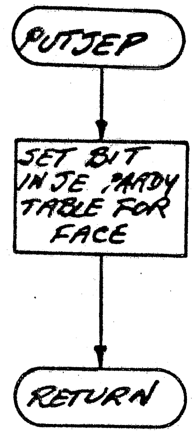
FORM 5-018-0



FLOWCHART CALL NAME: NBSMRMOV	
ANALYST: K.K.	MODULE: SMRMOV
DRAWN BY: C. WALES	PN:
SHEET 2 OF 4	RELEASE:
NOTES:	VERSION:
	REVISION:
SYSTEM: NSP	

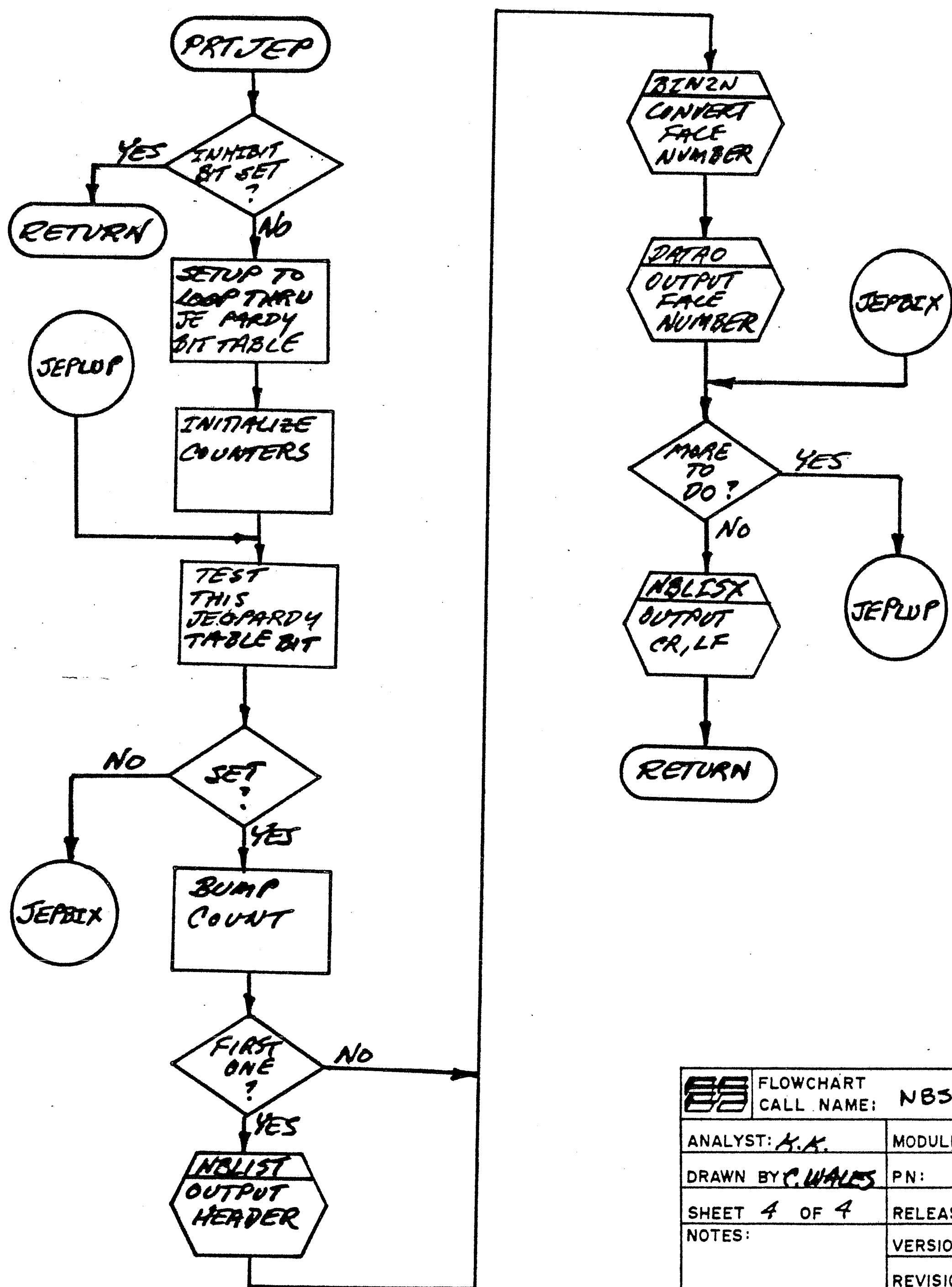
FORM 5-018-0



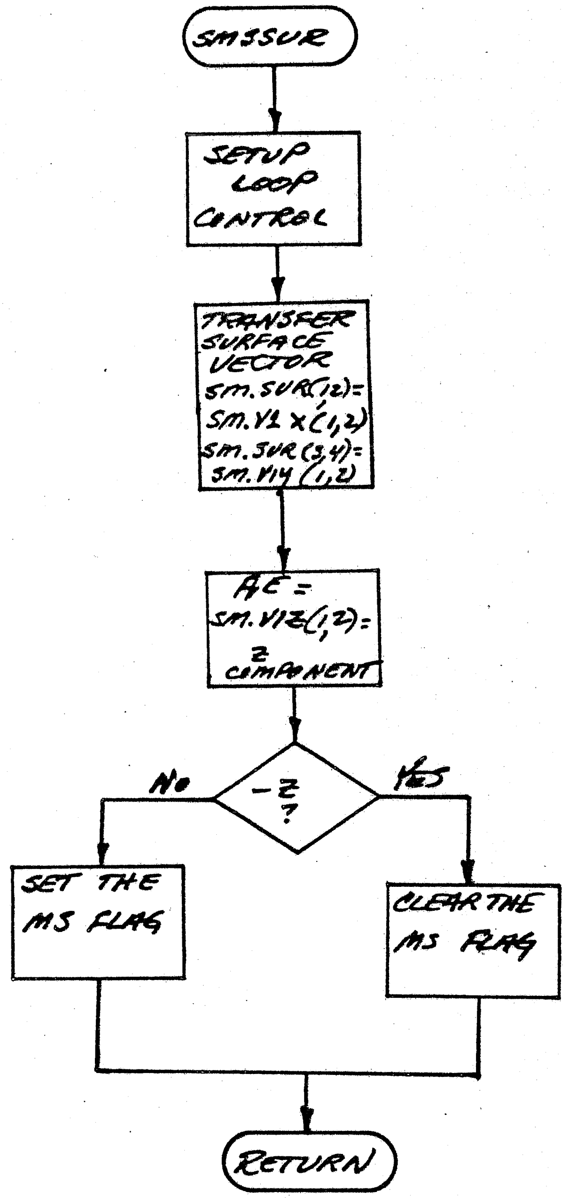


FLOWCHART CALL NAME:	NBSMRMOV
ANALYST: K.K.	MODULE: SMRMOV
DRAWN BY: C. NALES	PN:
SHEET 3 OF 4	RELEASE:
NOTES:	VERSION:
	REVISION:
SYSTEM: NSP	

FORM 5-018-0

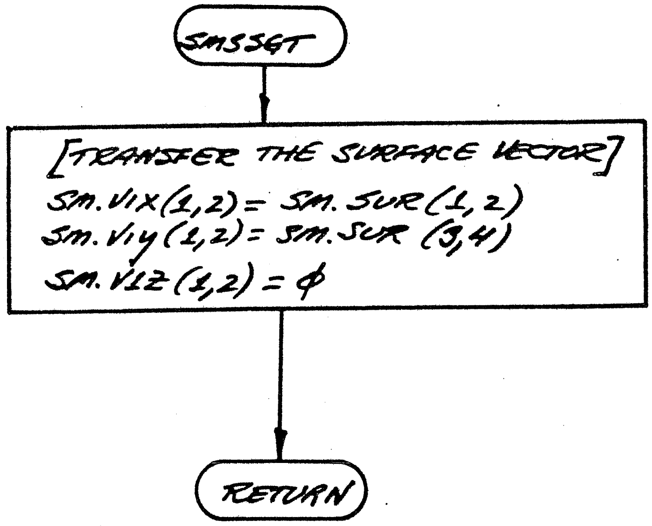


FLOWCHART CALL NAME: NBSMRMOV	
ANALYST: K.K.	MODULE: SMRMOV
DRAWN BY: C. WALES	PN:
SHEET 4 OF 4	RELEASE:
NOTES:	VERSION:
	REVISION:
SYSTEM: NSP	
FORM 5-018-0	



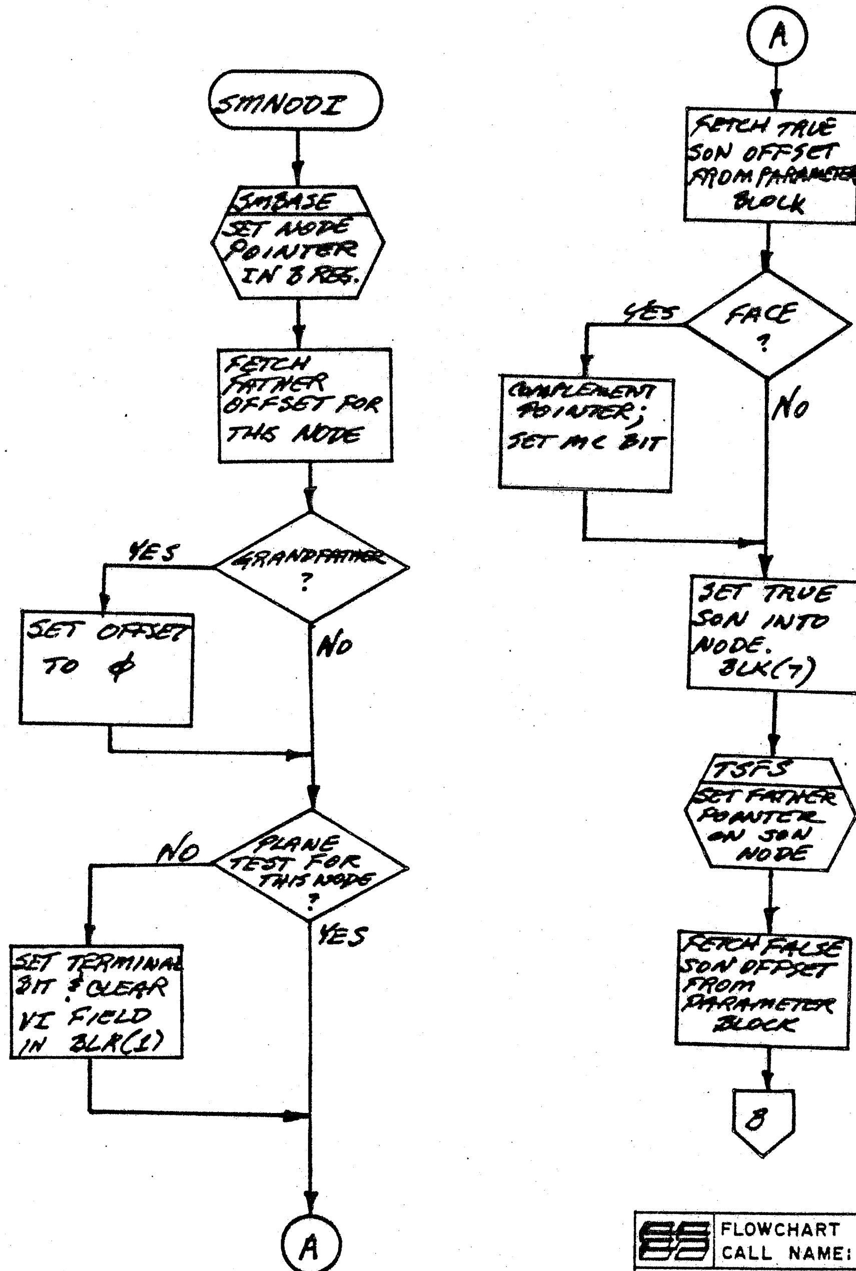
FLOWCHART CALL NAME:	NBSMSSUR
ANALYST: K.K.	MODULE SMSSUR
DRAWN BY: C. WALES	PN: 908023-05E
SHEET 1 OF 2	RELEASE: Ø2
NOTES:	VERSION: Ø1
	REVISION: NC
SYSTEM: NSP	

FORM 5-018-0

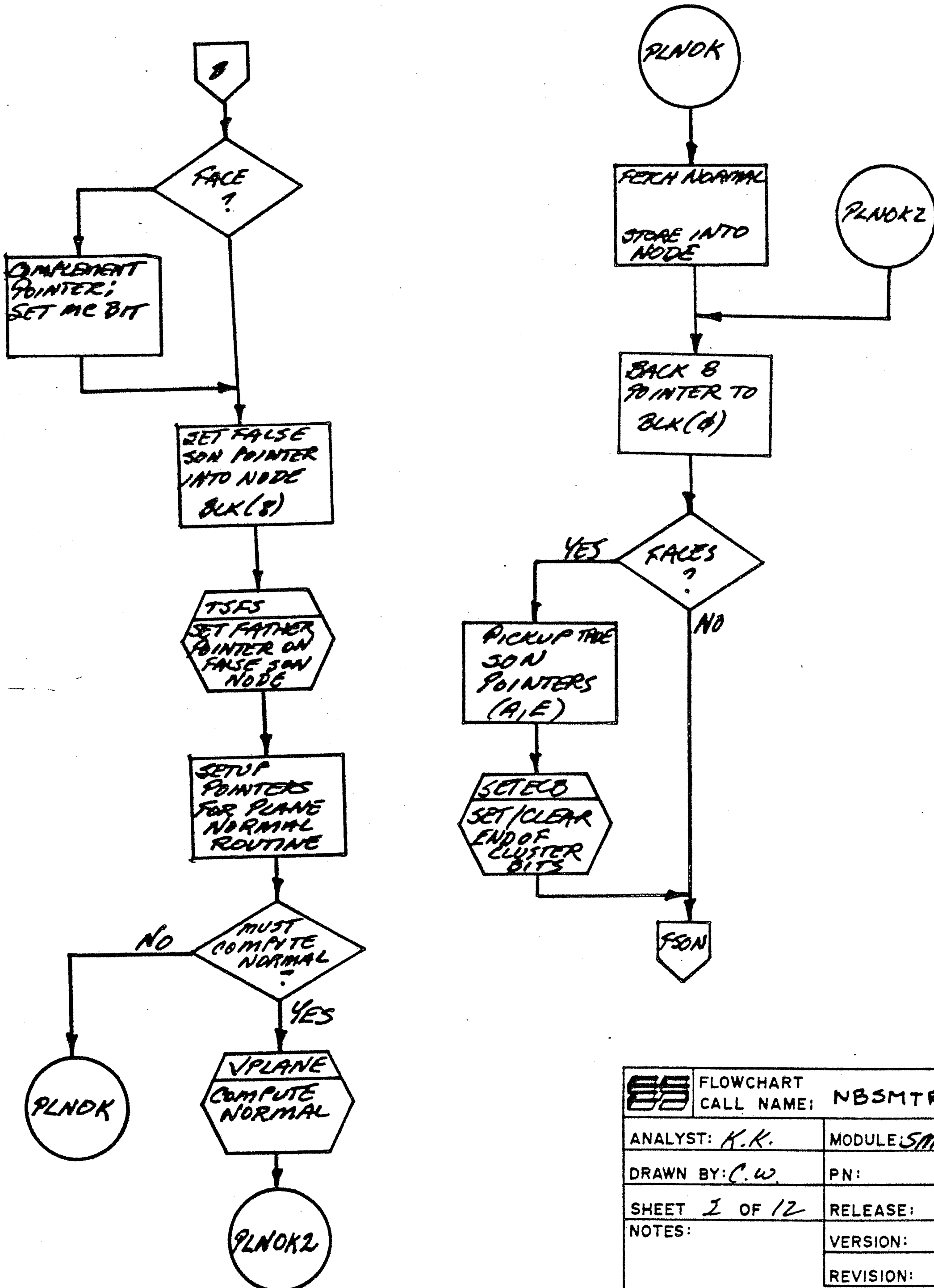


FLOWCHART CALL NAME:	NBSMSSUR
ANALYST: K.K.	MODULE: SMSSUR
DRAWN BY: C. [illegible]	PN:
SHEET 2 OF 2	RELEASE:
NOTES:	VERSION:
	REVISION:
SYSTEM: NSP	

FORM 5-018-0

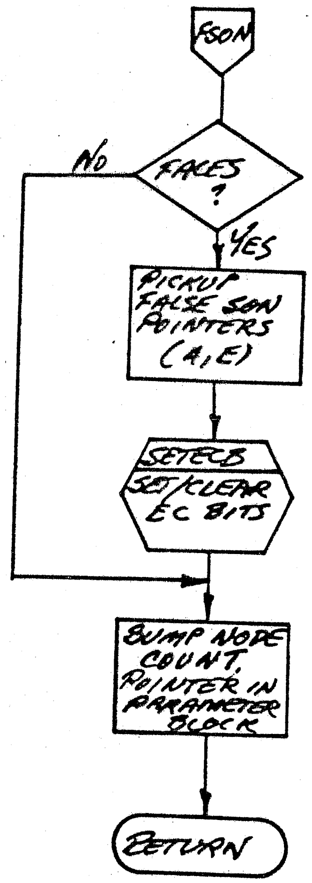


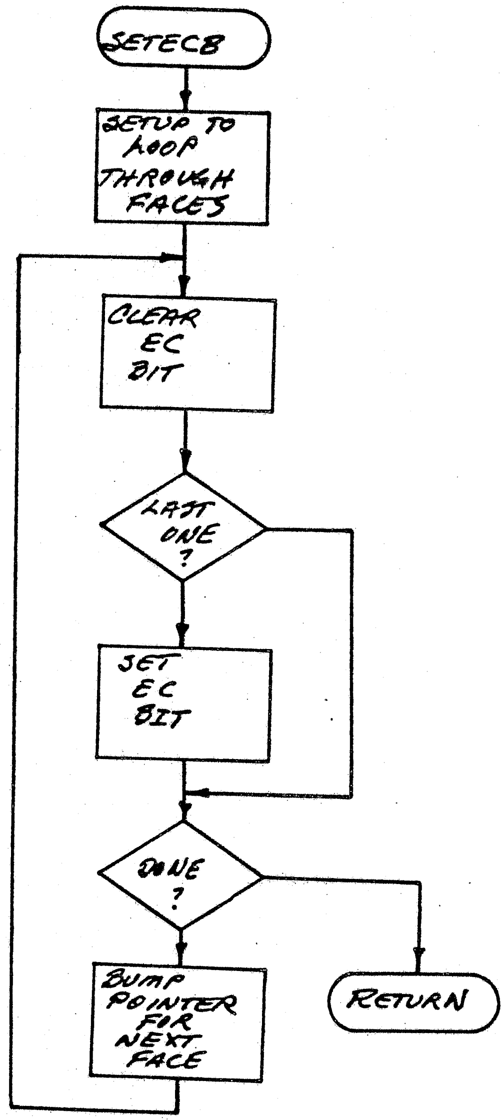
FLOWCHART CALL NAME: NBSMTREB	
ANALYST: K. K	MODULE: SMTREB
DRAWN BY: C. W.	PN: [illegible]
SHEET 1 OF 12	RELEASE: Ø[illegible]
NOTES:	VERSION: Ø1
	REVISION: [illegible]
SYSTEM: NSP	
FORM 5-018-0	



FLOWCHART CALL NAME: NBSMTREB	
ANALYST: K.K.	MODULE: SMTREB
DRAWN BY: C.W.	PN:
SHEET 2 OF 12	RELEASE:
NOTES:	VERSION:
	REVISION:
SYSTEM: NSP	

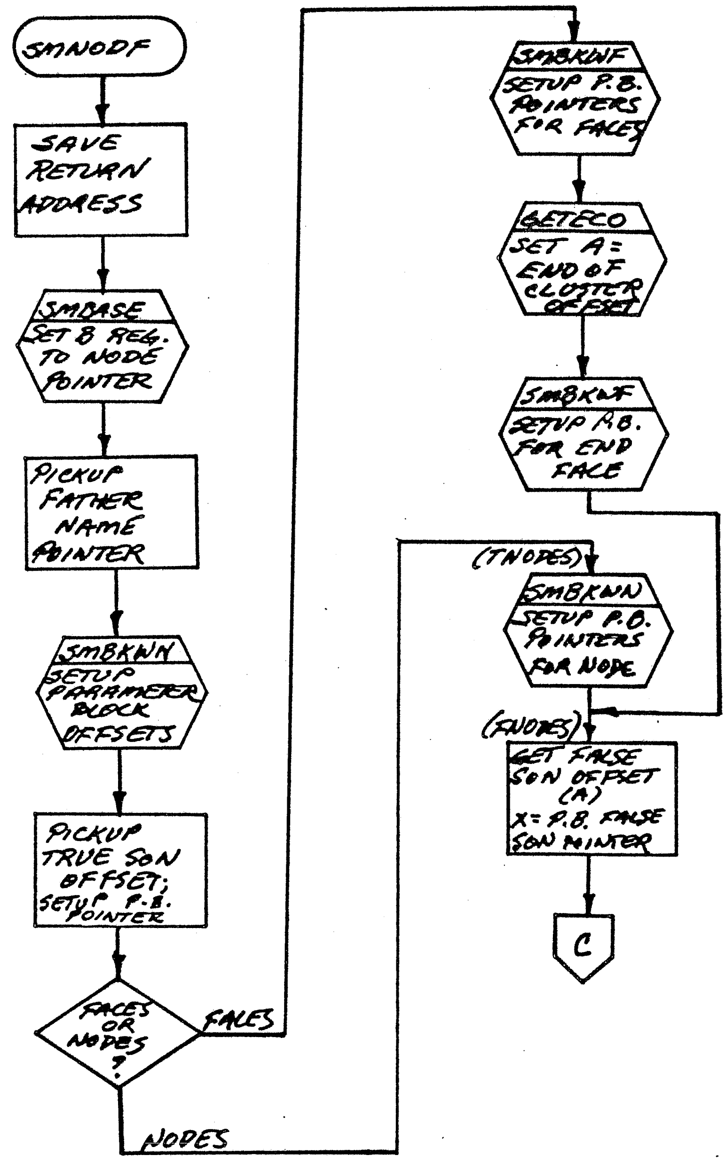
FORM 5-018-0





FLOWCHART CALL NAME:	NBSMTREB
ANALYST: K.K.	MODULE: SMTREB
DRAWN BY C. WALLS	PN:
SHEET 3 OF 12	RELEASE:
NOTES:	VERSION:
	REVISION:
SYSTEM: NSP	

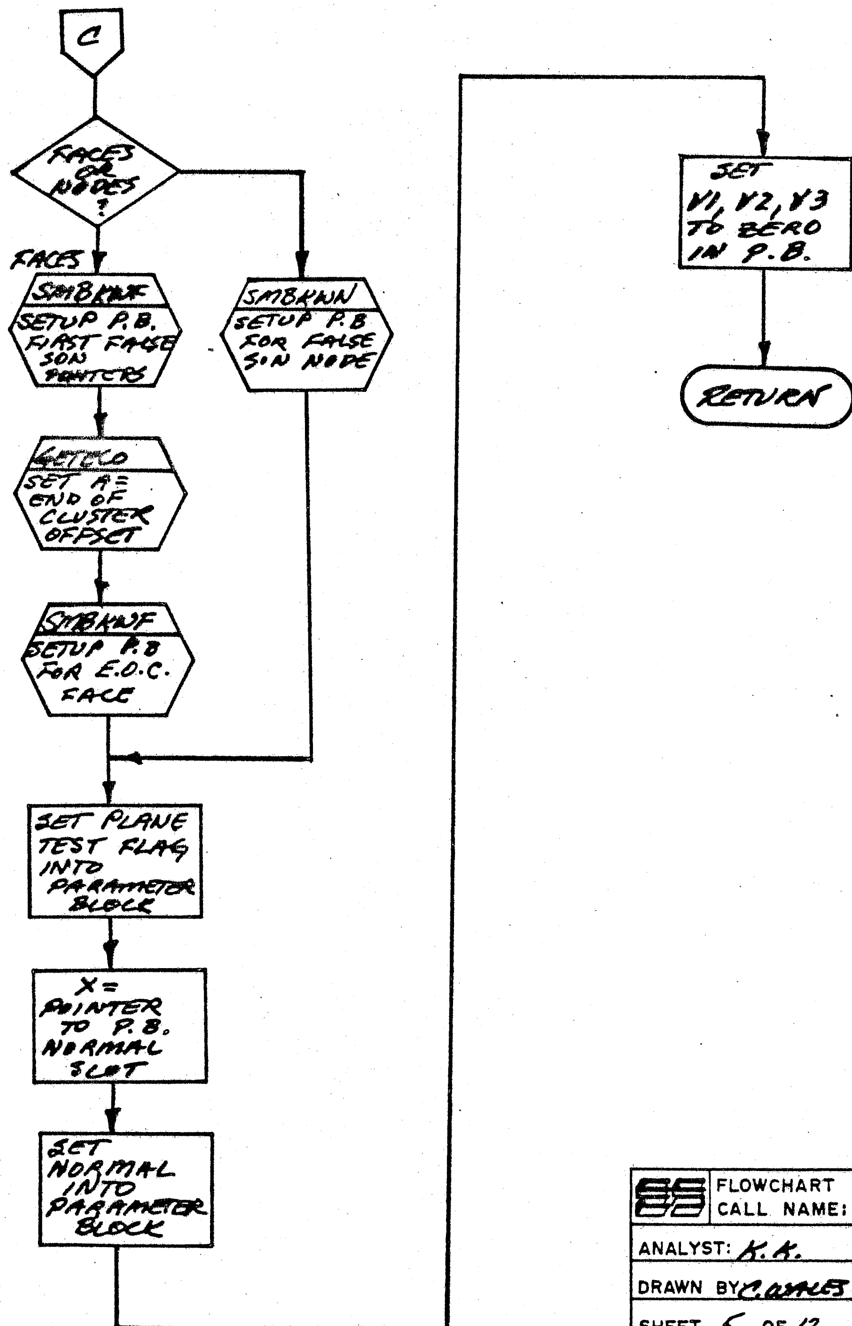
FORM 5-018-0



FLOWCHART CALL NAME:	NBSMTREB
ANALYST: K.K.	MODULE: SMTREB
DRAWN BY: C.WALES	PN:
SHEET 4 OF 12	RELEASE:
NOTES:	VERSION:
	REVISION:

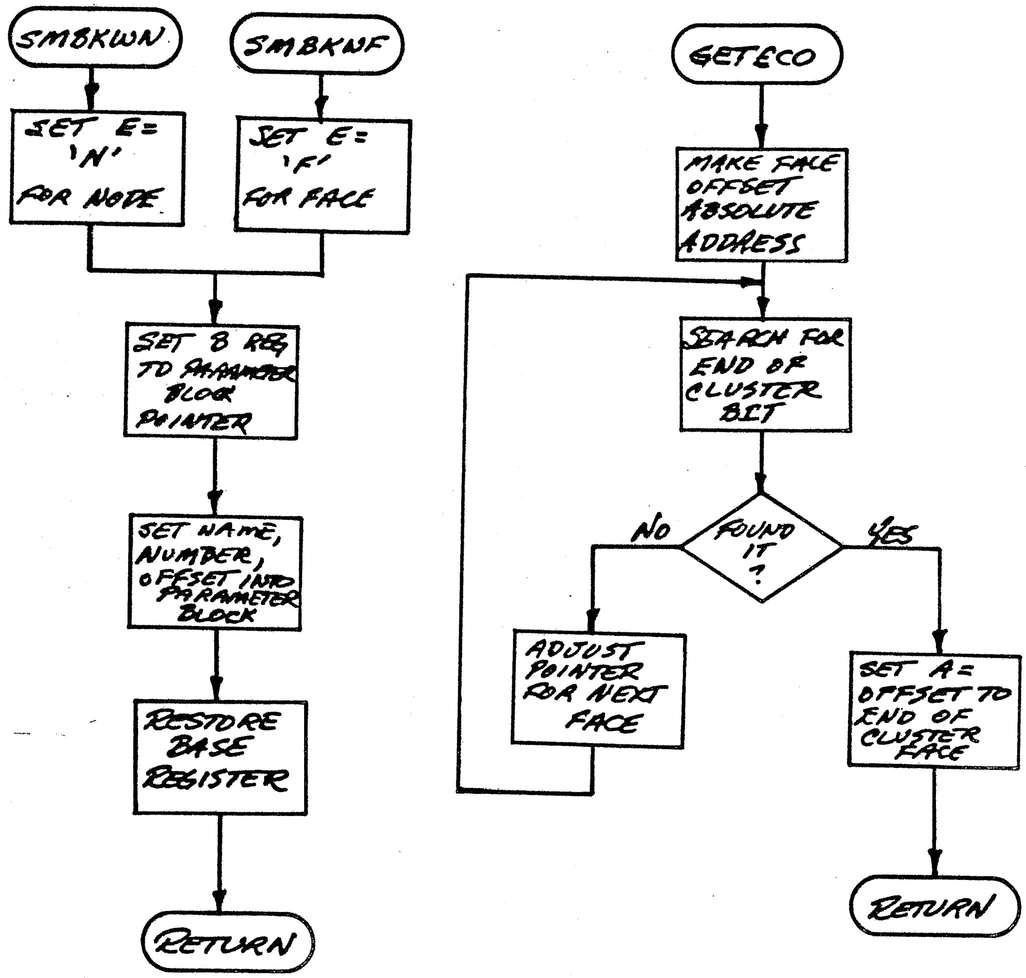
SYSTEM: NSP

FORM 5-018-0

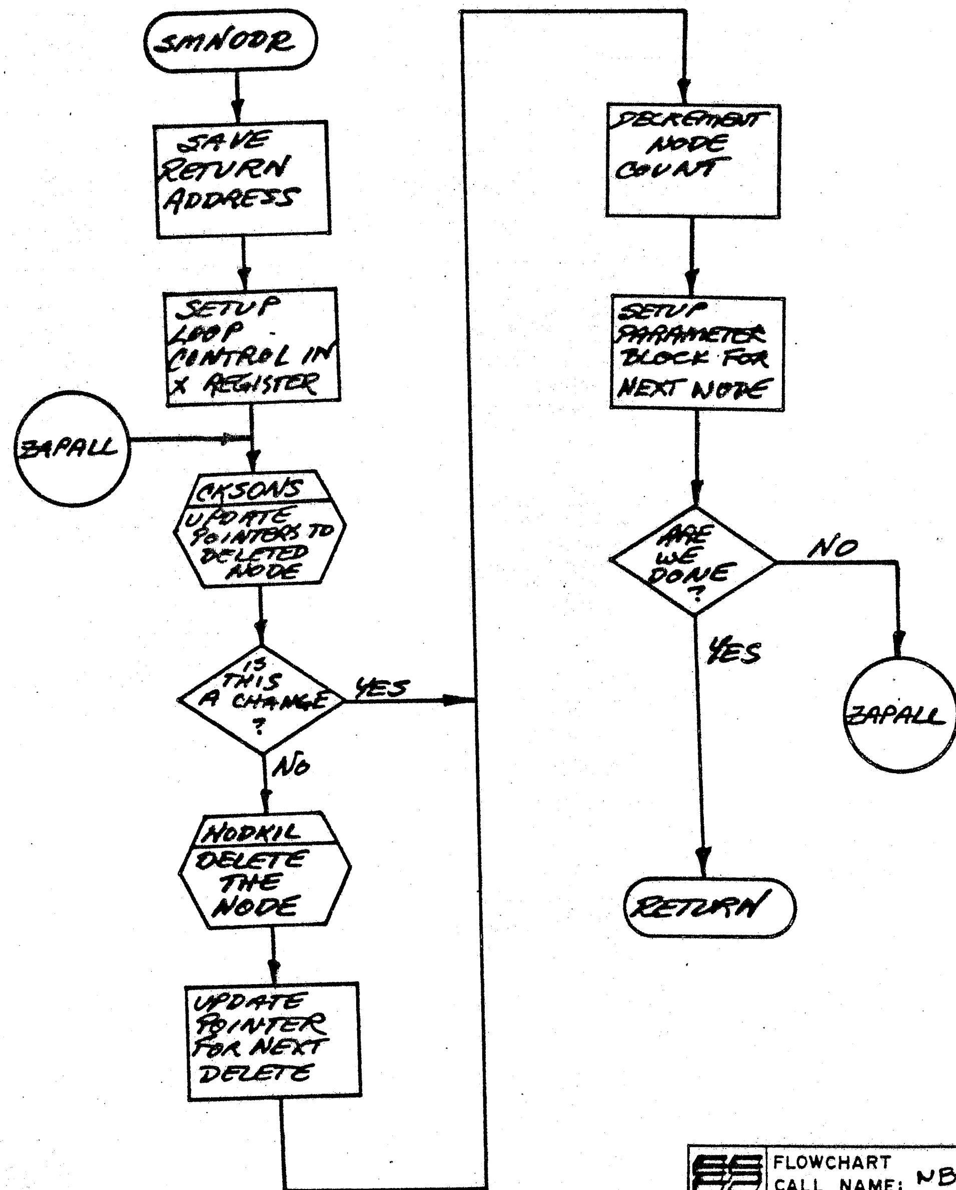


FLOWCHART CALL NAME: NBSMTREB	
ANALYST: K.K.	MODULE: SMTREB
DRAWN BY C. OSALES	PN:
SHEET 5 OF 12	RELEASE:
NOTES:	VERSION:
	REVISION:
SYSTEM: NSP	

FORM 5-018-0

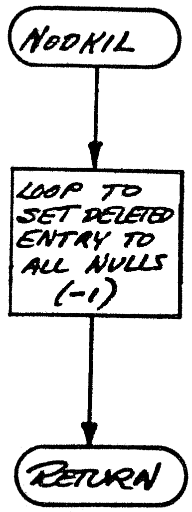


FLOWCHART CALL NAME: NBSMTREB	
ANALYST: K.K.	MODULE: SMTREB
DRAWN BY: C. WALES	PN:
SHEET 6 OF 12	RELEASE:
NOTES:	VERSION:
	REVISION:
SYSTEM: NSP	
FORM 5-018-0	



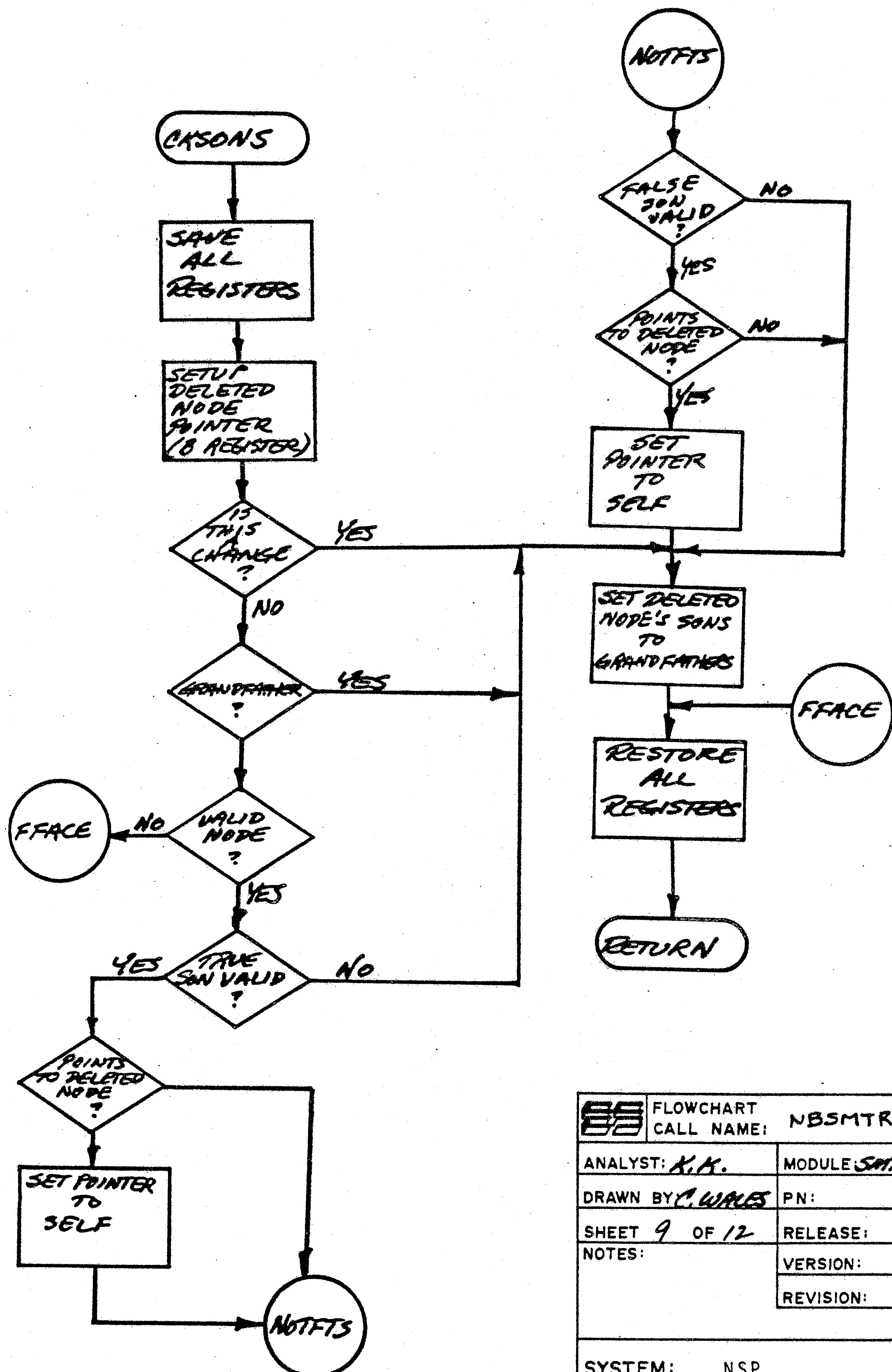
FLOWCHART CALL NAME: NBSMTREB	
ANALYST: K.K.	MODULE: SMTREB
DRAWN BY C.WALES	PN:
SHEET 7 OF 12	RELEASE:
NOTES:	VERSION:
	REVISION:
SYSTEM: NSP	

FORM 5-018-0



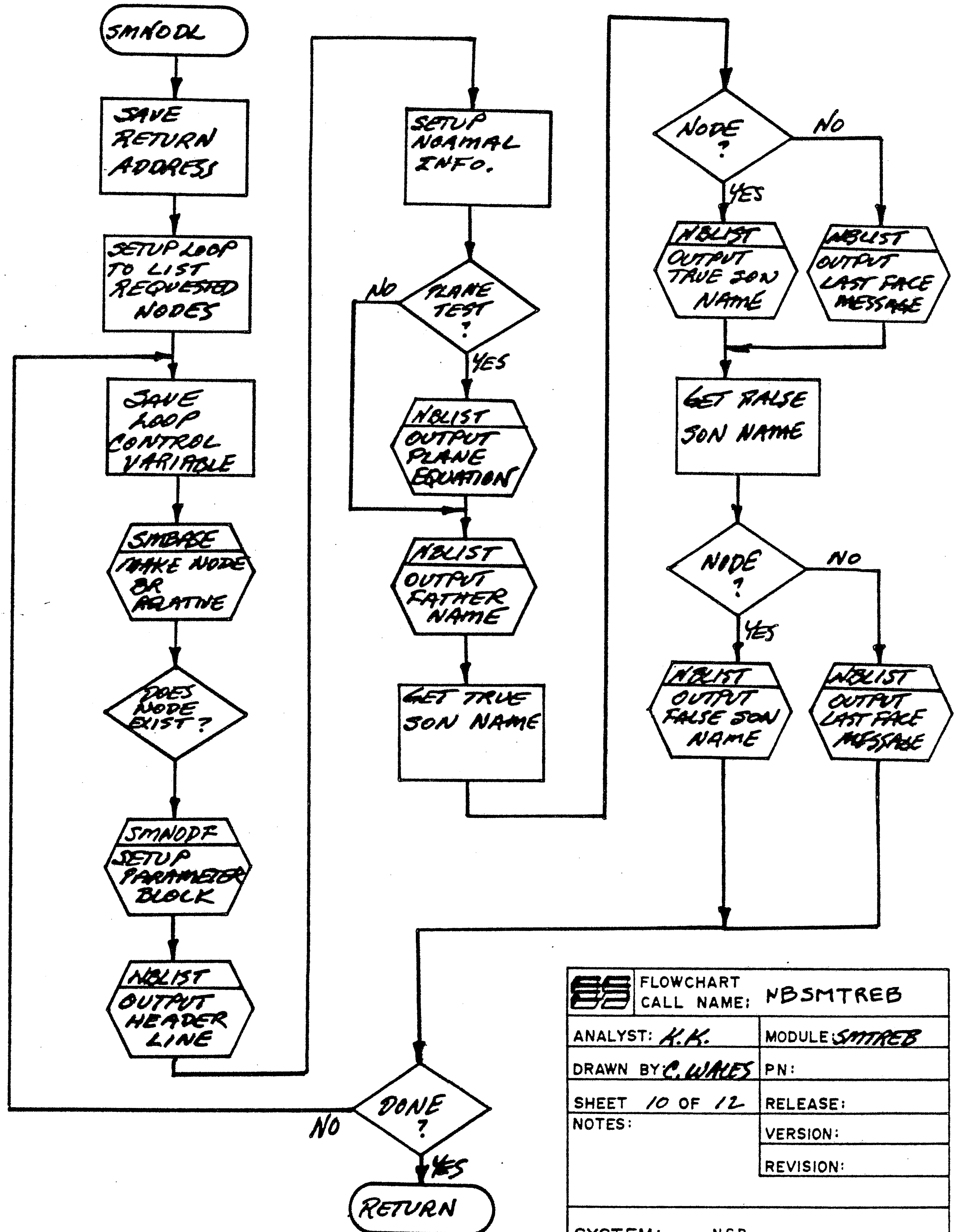
FLOWCHART CALL NAME: NBSMTREB	
ANALYST: K.K.	MODULE: SMTREB
DRAWN BY C.WAKES	PN:
SHEET 8 OF 12	RELEASE:
NOTES:	VERSION:
	REVISION:
SYSTEM: NSP	

FORM 5-018-0



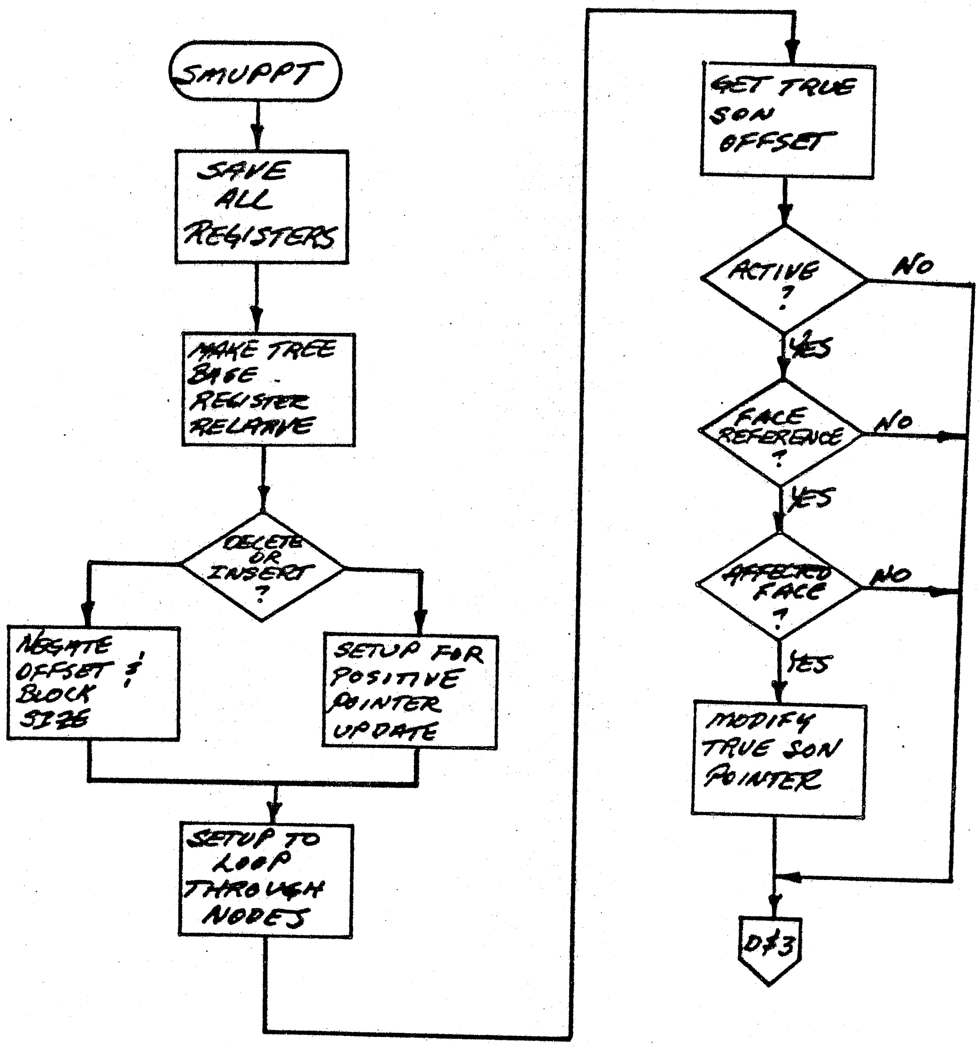
FLOWCHART CALL NAME: NBSMTREB	
ANALYST: K.K.	MODULE: SMTREB
DRAWN BY: C. WALES	PN:
SHEET 9 OF 12	RELEASE:
NOTES:	VERSION:
	REVISION:
SYSTEM: NSP	

FORM 5-018-0



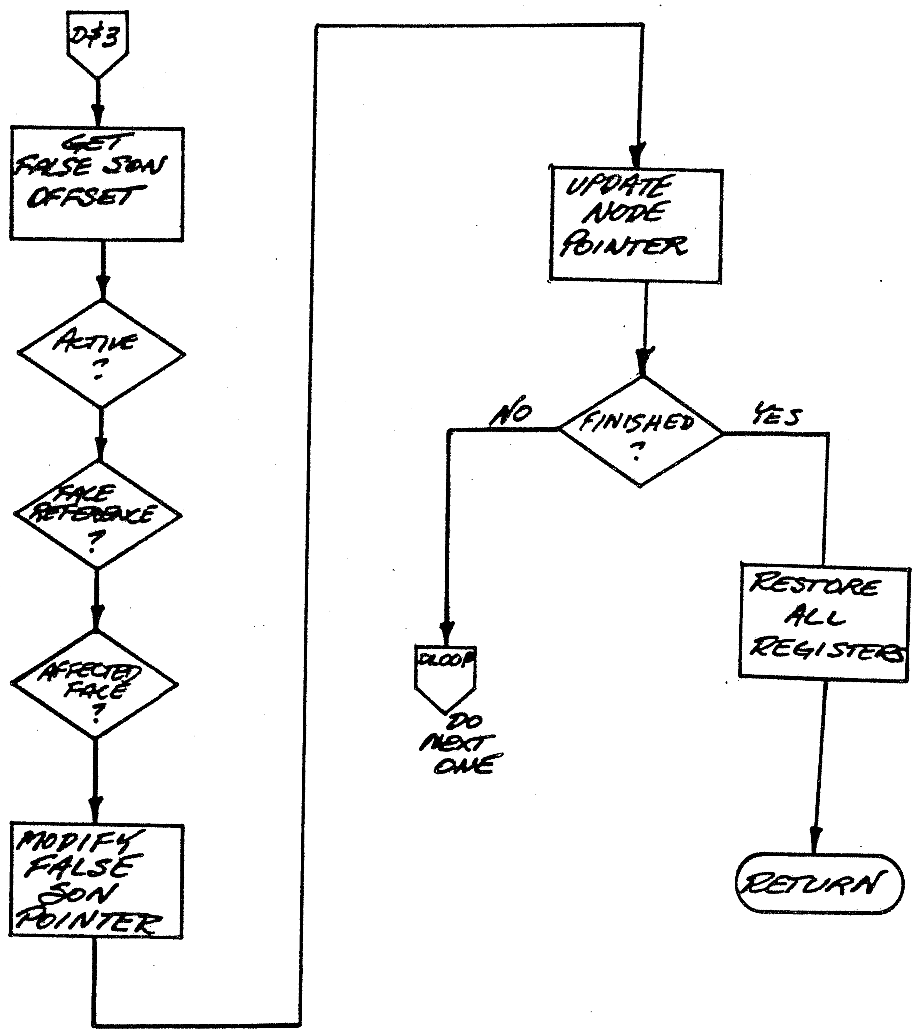
FLOWCHART CALL NAME: NBSMTREB	
ANALYST: K.K.	MODULE: SMTREB
DRAWN BY: C. WALES	PN:
SHEET 10 OF 12	RELEASE:
NOTES:	VERSION:
	REVISION:
SYSTEM: NSP	

FORM 5-018-0



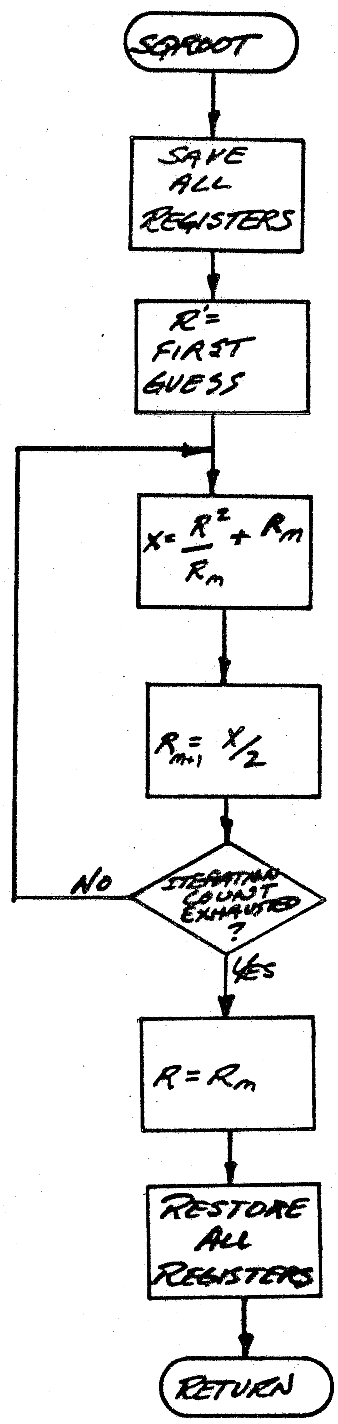
FLOWCHART CALL NAME:	NBSMTREB
ANALYST: K.K.	MODULE: SMTREB
DRAWN BY: C. WALES	PN:
SHEET 11 OF 12	RELEASE:
NOTES:	VERSION:
	REVISION:
SYSTEM: NSP	

FORM 6-018-0



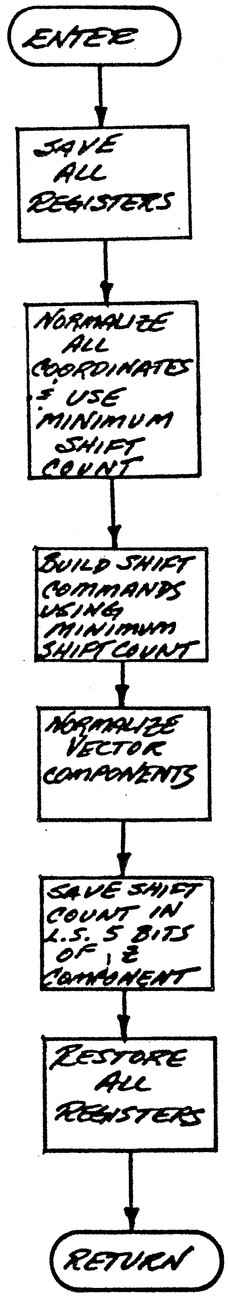
FLOWCHART CALL NAME:	NBSMTREB
ANALYST: K.K.	MODULE: SMTREB
DRAWN BY C.WALES	PN:
SHEET 12 OF 12	RELEASE:
NOTES:	VERSION:
	REVISION:
SYSTEM: NSP	

FORM 5-018-0



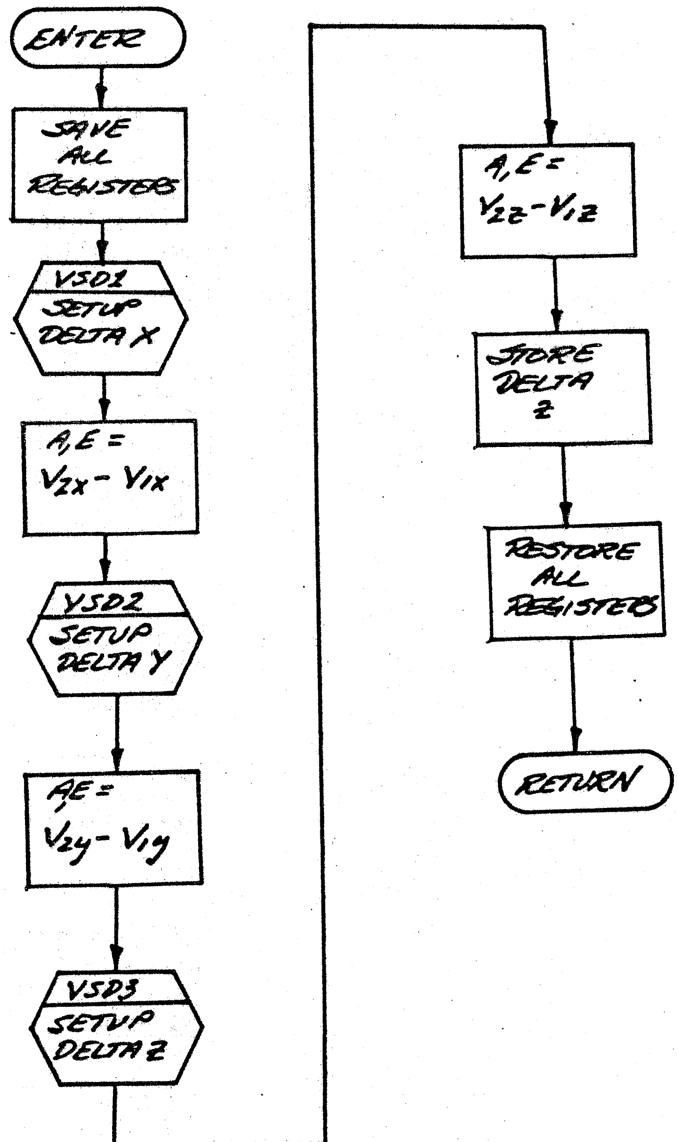
FLOWCHART CALL NAME: NBSQROOT	
ANALYST: K.K.	MODULE: SQROOT
DRAWN BY C. MALES	PN: 9Ø8Ø28-Ø1Ø
SHEET / OF /	RELEASE: Ø2
NOTES:	VERSION: Ø1
	REVISION: NC
SYSTEM: NSP	

FORM 5-018-0



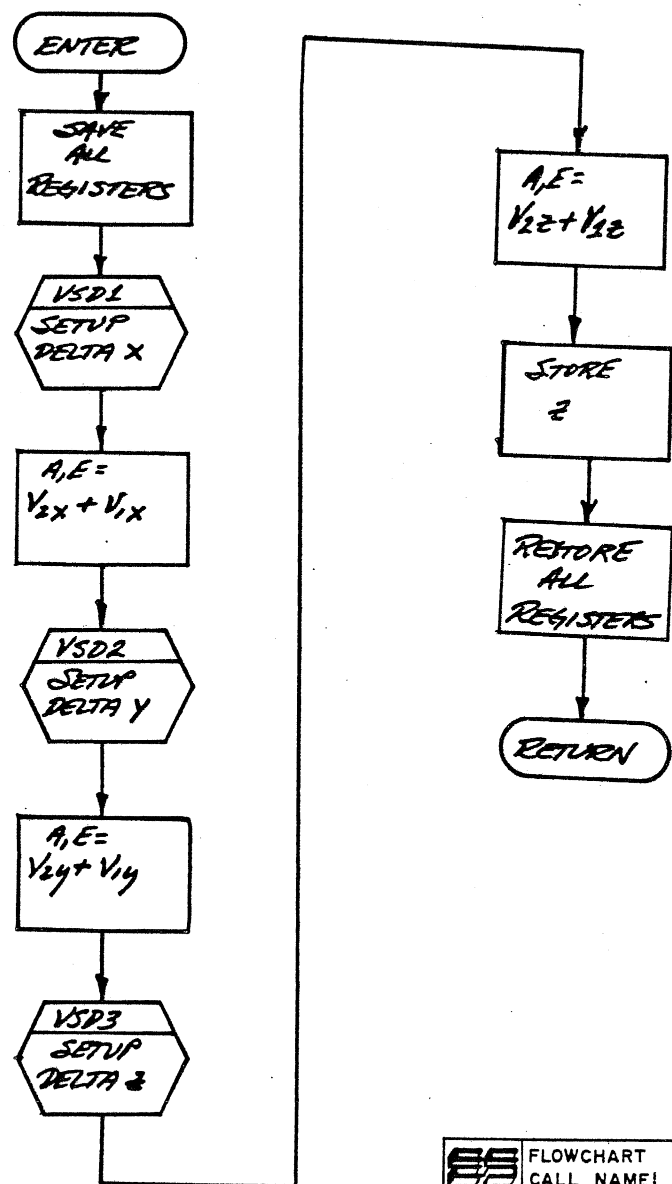
FLOWCHART CALL NAME: NBVBNRM	
ANALYST: K.K.	MODULE: VBNRM
DRAWN BY: C.WALB	PN: 9Ø8Ø28-ØØ5
SHEET 1 OF 1	RELEASE: Ø2
NOTES:	VERSION: Ø1
	REVISION: NC
SYSTEM: NSP	

FORM 5-018-0



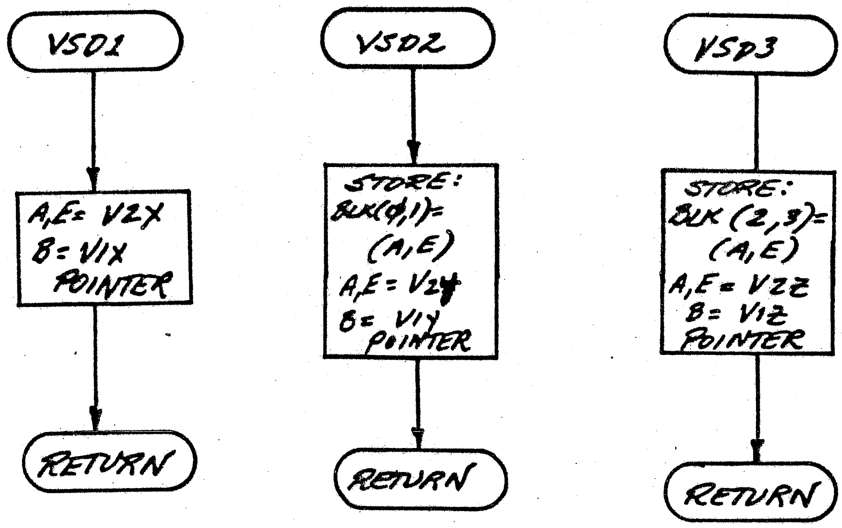
FLOWCHART CALL NAME:	NBVDIFF
ANALYST: K.K.	MODULE: VDIFF
DRAWN BY: C. WALES	PN: 9Ø8Ø28-ØØ7
SHEET 1 OF 3	RELEASE: Ø2
NOTES: SUBROUTINE VDIFF	VERSION: Ø1
	REVISION: NC
SYSTEM: NSP	

FORM 5-018-0



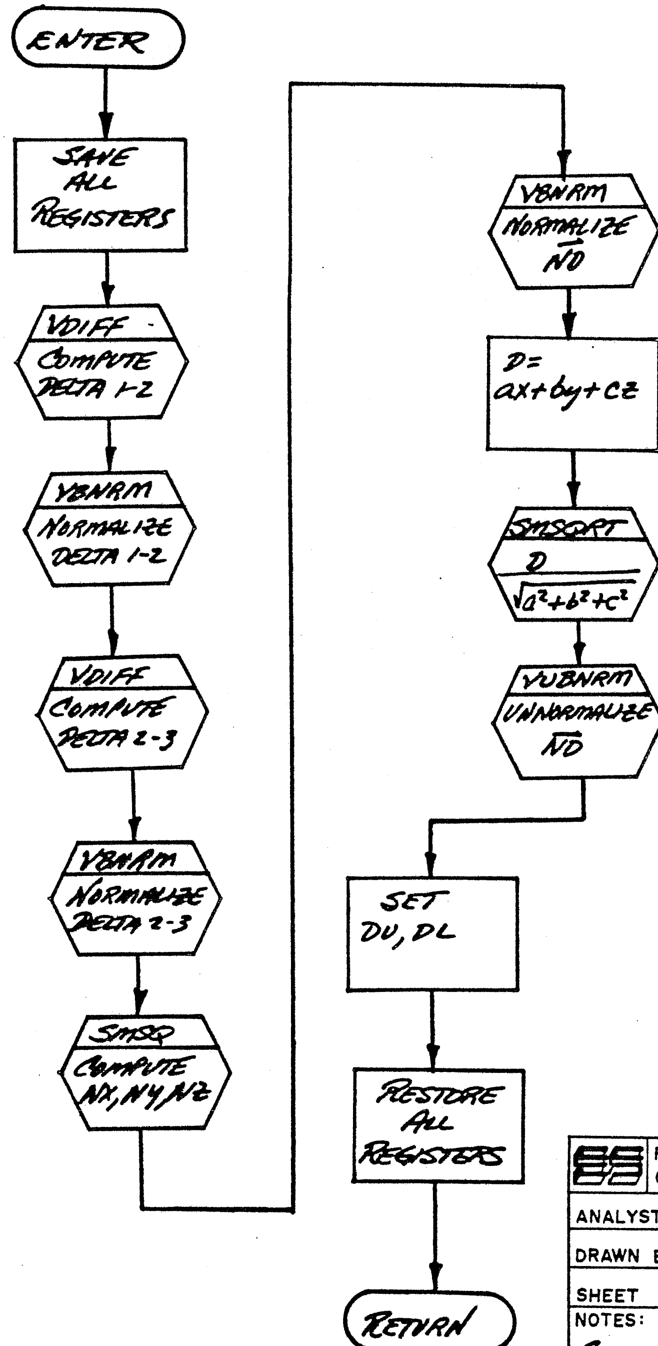
FLOWCHART CALL NAME:	NBVDIFF
ANALYST: K.K.	MODULE: VDIFF
DRAWN BY: C. WALES	PN: 9Ø8Ø28-ØØ7
SHEET 2 OF 3	RELEASE: Ø2
NOTES: SUBROUTINE VSUM	VERSION: Ø1
	REVISION: NC
SYSTEM: NSP	

FORM 5-018-0



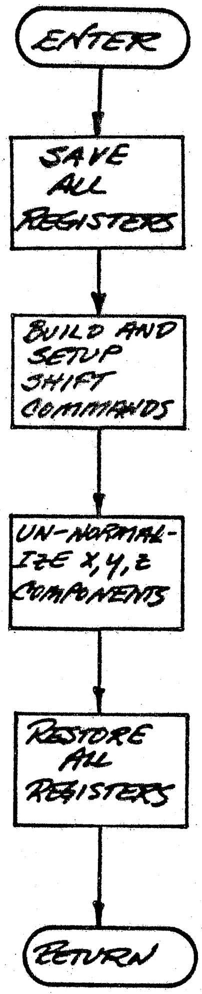
FLOWCHART CALL NAME:	NBVDIFF
ANALYST: K.K.	MODULE: VDIFF
DRAWN BY: C. WALES	PN: 9Ø8Ø28-ØØ7
SHEET 3 OF 3	RELEASE: Ø2
NOTES: SUBROUTINES VSD1, VSD2, VSD3	VERSION: Ø1
	REVISION: NC
SYSTEM: NSP	

FORM 5-018-0



FLOWCHART CALL NAME:	NBVPLANE
ANALYST: K.K.	MODULE: VPLANE
DRAWN BY C. IVALES	PN: 9Ø8Ø28-ØØ9
SHEET 1 OF 1	RELEASE: Ø2
NOTES: SUBROUTINE VPLANE	VERSION: Ø1
	REVISION: NC
SYSTEM: NSP	

FORM 5-018-0

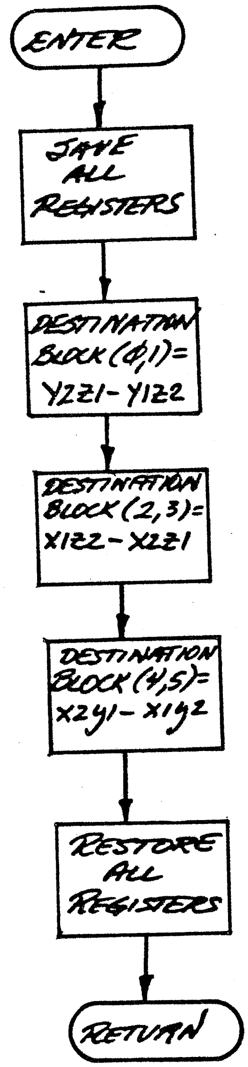


FLOWCHART CALL NAME: NBVUBNRM

ANALYST: K.K.
MODULE: VUBNRM
DRAWN BY: C. WALES
PN: 9Ø8Ø28-ØØ6
SHEET 1 OF 1
RELEASE: Ø2
NOTES: SUBROUTINE VUBNRM
VERSION: Ø1
REVISION: NC

SYSTEM: NSP

FORM 5-018-0



FLOWCHART CALL NAME: NBVXPRD	
ANALYST: K.K.	MODULE: VXPRD
DRAWN BY C WALES	PN: 9Ø8Ø28-ØØ8
SHEET 1 OF 1	RELEASE: Ø2
NOTES: SUBROUTINE VXPRD	VERSION: Ø1
	REVISION: NC
SYSTEM: NSP	

FORM 5-018-0

SECTION 3

GENERATION PROCEDURES

3.1 INTRODUCTION

This section describes the process required to regenerate the model building system (NSPBLD and NSPMER) from source modules delivered on disks 908042-803 and 908042-804. Section 3.2 describes the assembly procedure. Section 3.3 describes the library generation procedures. Section 3.4 describes the final program link procedure.

3.2 ASSEMBLY PROCEDURE

The program sources may be assembled one at a time using the standard assembler, SAPGFL. Refer to the basic TI system use and operation documents for details on the use of the assembler.

Tables 3-1 and 3-2 contain a list of source files and associated object files which must be assembled for the NSPBLD and NSPMER programs, respectively.

All of the object files for NSPBLD and NSPMER will fit on a single side of a disk along with a full system.

SOURCE	OBJECT	SOURCE	OBJECT	SOURCE	OBJECT
NBMAIN	NOMAIN	LMFIND	LOFIND	UNIT2A	UNIT2O
T$SCAN	TOSCAN	LMUPDT	LOUPDT	CHR2A	CHR2O
KEYIOS	KOYIOS	LMCNEX	LOCNEX	BIN2N	OBJ2N
NBFIOS	NOFIOS	LMCNVR	LOCNVR	CVTBIN	CVTOBJ
NBMISC	NOMISC	LMVECT	LOVECT	BINCVT	OBJCVT
NBENTP	NOENTP	MSAVE	OSAVE	UPKCHR	UPKOBJ
NBCHNL	NOCHNL	SMINST	SOINST	PAKCHR	PAKOBJ
NBSMEX	NOSMEX	SMINEP	SOINEP	METENG	METOBJ
NBLNPT	NOLNPT	SMSSUR	SOSSUR	ENGMET	OBJMET
NBLIST	NOLIST	SMCNTR	SOCNTR	DEGPTC	DEGOBJ
NBMOVE	NOMOVE	SMIFTB	SOIFTB	PTCDEG	OBJDEG
NBSWHO	NOSWHO	SMBRIT	SOBRIT	MUL224	MOL224
NBXMSG	NOXMSG	SMRMOV	SORMOV	DIV212	DOV212
NBLMSG	NOLMSG	SMLIST	SOLIST	DIV222	DOV222
NBSMSG	NOSMSG	SMPREP	SOPREP	SINCOS	SONCOS
NBEMSG	NOEMSG	SMFIND	SOFIND	VBNRM	OBNRM
NBGMSG	NOGMSG	SMFDEP	SOFDEP	VUBNRM	OUBNRM
NBWORK	NOWORK	SMEXSN	SOEXSN	VDIFF	ODIFF
NBXPAR	NOXPAR	SMTREE	SOTREE	VXPRD	OXPRD
NBCPAR	NOCPAR	SMCMDL	SOCMDL	VPLANE	OPLANE
NBMPAR	NOMPAR	EMINST	EOINST	ADD333	AOD333
NBXMOD	NOXMOD	EMDLET	EODLET	ROT2DM	ROO2DM
NBXTRE	NOXTRE	EMPRNT	EOPRNT	ROT2DT	ROO2DT
NBLTRE	NOLTRE	EMFIND	EOFIND	DSTEMP	DOTEMP
NBSTRE	NOSTRE	EMEXND	EOEXND		
NBETRE	NOETRE	EMCNVR	EOCNVR		
NBGTRE	NOGTRE	GMPROC	GOPROC		
NBMTRE	NOMTRE	D2BIN	D2OBJ		
CMPROC	COPROC	BIN2D	OBJ2D		
MMTRAN	MOTRAN	M2BIN	M2OBJ		
MMTVTX	MOTVTX	BIN2M	OBJ2M		
LMINST	LOINST	R2BIN	R2OBJ		
LMDLET	LODLET	BIN2R	OBJ2R		
LMPRNT	LOPRNT	A2UNIT	O2UNIT		

TABLE 3-1
NSPBLD LIBRARY CONTENTS

SOURCE	OBJECT	SOURCE	OBJECT	SOURCE	OBJECT
NBMAIN	NOMAIN	BIN2N	OBJ2N	MERMSG	MORMSG
T$SCAN	TOSCAN	CVTBIN	CVTOBJ	MERPAR	MORPAR
KEYIOS	KOYIOS	BINCVT	OBJCVT	NBAMCD	NOAMOD
NBFIOS	NOFIOS	UPKCHR	UPKOBJ	NBBMCD	NOBMOD
NBMOVE	NOMOVE	PAKCHR	PAKOBJ	MMERGE	MOERGE
NBXPAR	NCXPAR	METENG	METOBJ	MMERCR	MOEROR
D2BIN	D2OBJ	ENGMET	OBJMET	LMINMA	LOINMA
BIN2D	OBJ2D	DEGPTC	DEGOBJ	LMFDMB	LOFDMB
M2BIN	M2OBJ	PTCDEG	OBJDEG	LMUPMA	LOUPMA
BIN2M	OJB2M	DIV212	DOV212	LMEXMA	LOEXMA
R2BIN	R2OBJ	SINCOS	SONCOS	LMEXMB	LOEXMB
BIN2R	OBJ2R	NBMMSC	NOMMSC	LMCNMA	LOCNMA
A2UNIT	O2UNIT	NBCTYP	NOCTYP	LMCNMB	LOCNMB
UNIT2A	UNIT2O	MERTRE	MORTRE	LMVECT	LOVECT
CHR2A	CHR2O				

TABLE 3-2
NSPMER LIBRARY CONTENTS

3.3 LIBRARY GENERATION PROCEDURES

Before the final program is linked, all of the assembled object files must be concatenated into a single library file. This file is constructed with the object copy program (CPYOBJ). Refer to the basic TI system use and operation documents.

The object files listed in tables 3-1 and 3-2 must be concatenated (in the order shown) to generate the library files for NSPBLD and NSPMER. The library files are called NBSLIB and MERLIB, respectively.

The files must be concatenated with no EOFs between object modules. The last object module in the library must be followed by 2 EOFs.

3.4 LINKING PROCEDURES

The two programs, NSPBLD and NSPMER, are linked with the link editor, LINKG. Refer to the basic TI system use and operation documents for details of the program execution. The program

NSPBLD is linked by executing LINKG with the file NBSLIB as the object input file and NSPBLS as the object output file. The following commands are given to LINKG:

```
00,NBMAIN,NSPBLS,1,0,
/*
```

The program NSPMER is linked by executing LINKG with the file MERLIB as the object input file and NSPMER as the object output file. The following commands are given to LINKG:

```
00,NBMAIN,NSPMER,1,0,
/*
```

SECTION 4

DISK DIRECTORIES

4.1 INTRODUCTION

This section contains the disk directories for the four disk sides that carry the NSPBLD/NSPMER program. Disk directories are produced by the TI program CATLOG. Refer to Texas Instruments' software documentation for an explanation of the disk directory format.

The disk part number, ECO level, and side are encoded in the first line of the directory. An example of a typical first line would read as follows:

CATLOG FOR VOLUME 908042 SERIAL NUMBER 803NCA

meaning: "This directory is for disk 908042-803, ECO level NC, side A."

CATALOG FOR VOLUME 908042 SERIAL NUMBER 803NCA

NAME	SECTOR ADDR	EXTENT	RECORD SIZE	POINTER	TYPE	
T$SCAN	0020	0377	0004	0373	PERMANENT	BLOCKED
KEYIOS	0199	0040	0004	0036	PERMANENT	BLOCKED
NBFIOS	01C1	0093	0004	0089	PERMANENT	BLOCKED
NBMAIN	021E	0018	0004	0014	PERMANENT	BLOCKED
NBMISC	0230	0080	0004	0076	PERMANENT	BLOCKED
NBENTP	0280	0061	0004	0057	PERMANENT	BLOCKED
NBCHNL	02BD	0023	0004	0019	PERMANENT	BLOCKED
NBSMEX	02D4	0036	0004	0032	PERMANENT	BLOCKED
NBLIST	02F8	0049	0004	0045	PERMANENT	BLOCKED
NBMOVE	0329	0028	0004	0024	PERMANENT	BLOCKED
NBDWHO	0345	0022	0004	0018	PERMANENT	BLOCKED
NBXMSG	035B	0064	0004	0060	PERMANENT	BLOCKED
NBLMSG	039B	0051	0004	0047	PERMANENT	BLOCKED
NBSMSG	03CE	0029	0004	0025	PERMANENT	BLOCKED
NBEMSG	03EB	0014	0004	0010	PERMANENT	BLOCKED
NBGMSG	03F9	0023	0004	0019	PERMANENT	BLOCKED
NBWORK	0410	0013	0004	0009	PERMANENT	BLOCKED
NBXPAR	041D	0123	0004	0119	PERMANENT	BLOCKED
NBCPAR	0498	0020	0004	0016	PERMANENT	BLOCKED
NBMPAR	04AC	0011	0004	0007	PERMANENT	BLOCKED
NBXMOD	04B7	0062	0004	0058	PERMANENT	BLOCKED
NBXTRE	04F5	0083	0004	0079	PERMANENT	BLOCKED
NBLTRE	0548	0157	0004	0153	PERMANENT	BLOCKED
NBETRE	05E5	0139	0004	0135	PERMANENT	BLOCKED
NBGTRE	0670	0081	0004	0077	PERMANENT	BLOCKED
NBMTRE	06C1	0042	0004	0038	PERMANENT	BLOCKED
DSTEMP	06EB	0017	0004	0013	PERMANENT	BLOCKED
NBSWHO	06FC	0022	0004	0017	PERMANENT	BLOCKED
CLPROC	0712	0210	0004	0206	PERMANENT	BLOCKED
MMTRAN	07E4	0088	0004	0079	PERMANENT	BLOCKED
MMTVTX	083C	0039	0004	0027	PERMANENT	BLOCKED
NBSTRE	0863	0171	0004	0167	PERMANENT	BLOCKED
NBLNPT	090E	0047	0004	0043	PERMANENT	BLOCKED

TOTALS
0033 FILES
02333 SECTORS

TABLE 4-1
BLD/MER DIRECTORY FOR DISK SIDE 908042-803NCA

CATALOG FOR VOLUME 908042 SERIAL NUMBER 803NCB

NAME	SECTOR ADDR	EXTENT	RECORD SIZE	POINTER	TYPE	
LMINST	0020	0158	0004	0154	PERMANENT	BLOCKED
LMDLET	00BE	0116	0004	0112	PERMANENT	BLOCKED
LMPRNT	0132	0104	0004	0100	PERMANENT	BLOCKED
LMFIND	019A	0165	0004	0161	PERMANENT	BLOCKED
LMUPDT	023F	0098	0004	0094	PERMANENT	BLOCKED
LMCNEX	02A1	0069	0004	0065	PERMANENT	BLOCKED
LMCNVR	02E6	0066	0004	0062	PERMANENT	BLOCKED
LMVECT	0328	0125	0004	0109	PERMANENT	BLOCKED
MSAVE	03A5	0010	0004	0006	PERMANENT	BLOCKED
SMINEP	03AF	0023	0004	0019	PERMANENT	BLOCKED
SMSSUR	03C6	0021	0004	0017	PERMANENT	BLOCKED
SMCNTR	03DB	0017	0004	0013	PERMANENT	BLOCKED
SMIFTB	03EC	0014	0004	0010	PERMANENT	BLOCKED
SMBRIT	03FA	0026	0004	0022	PERMANENT	BLOCKED
SMRMOV	0414	0068	0004	0064	PERMANENT	BLOCKED
SMLIST	0458	0058	0004	0054	PERMANENT	BLOCKED
SMPREP	0492	0016	0004	0012	PERMANENT	BLOCKED
SMFIND	04A2	0055	0004	0051	PERMANENT	BLOCKED
SMFDEP	04D9	0018	0004	0014	PERMANENT	BLOCKED
SMEXSN	04EB	0033	0004	0029	PERMANENT	BLOCKED
SMTREB	050C	0140	0004	0136	PERMANENT	BLOCKED
SMCMDL	0598	0074	0004	0070	PERMANENT	BLOCKED
EMINST	05E2	0095	0004	0091	PERMANENT	BLOCKED
EMDLET	0641	0065	0004	0061	PERMANENT	BLOCKED
EMPRNT	0682	0095	0004	0091	PERMANENT	BLOCKED
EMFIND	06E1	0098	0004	0094	PERMANENT	BLOCKED
EMEXND	0743	0081	0004	0077	PERMANENT	BLOCKED
EMCNVR	0794	0077	0004	0073	PERMANENT	BLOCKED
GMPROC	07E1	0150	0004	0146	PERMANENT	BLOCKED
SMINST	0877	0129	0004	0125	PERMANENT	BLOCKED

TOTALS
0030 FILES
02264 SECTORS

TABLE 4-2
BLD/MER DIRECTORY FOR DISK SIDE 908042-803NCB

CATALOG FOR VOLUME 908042 SERIAL NUMBER 804NCA

NAME	SECTOR ADDR	EXTENT	RECORD SIZE	POINTER	TYPE	
NBMMSC	0020	0069	0004	0065	PERMANENT	BLOCKED
NBCTYP	0065	0016	0004	0012	PERMANENT	BLOCKED
MERMSG	0075	0029	0004	0023	PERMANENT	BLOCKED
MERPAR	0092	0011	0004	0007	PERMANENT	BLOCKED
NBAMOD	009D	0046	0004	0042	PERMANENT	BLOCKED
NBBMOD	00CB	0046	0004	0042	PERMANENT	BLOCKED
MMERGE	00F9	0087	0004	0083	PERMANENT	BLOCKED
MMEROR	0150	0032	0004	0028	PERMANENT	BLOCKED
LMINMA	0170	0152	0004	0148	PERMANENT	BLOCKED
LMFDMB	0208	0162	0004	0158	PERMANENT	BLOCKED
LMUPMA	02AA	0097	0004	0093	PERMANENT	BLOCKED
LMEXMA	030B	0070	0004	0066	PERMANENT	BLOCKED
LMEXMB	0351	0062	0004	0058	PERMANENT	BLOCKED
LMCNMA	038F	0066	0004	0062	PERMANENT	BLOCKED
LMCNMB	03D1	0042	0004	0038	PERMANENT	BLOCKED
MERTRE	03FB	0057	0004	0053	PERMANENT	BLOCKED

TOTALS
0016 FILES
01044 SECTORS

TABLE 4-3
BLD/MER DIRECTORY FOR DISK SIDE 908042-804NCA

CATALOG FOR VOLUME 908042 SERIAL NUMBER 804NCB

NAME	SECTOR ADDR	EXTENT	RECORD SIZE	POINTER	TYPE	
MUL224	0020	0038	0004	0025	PERMANENT	BLOCKED
DIV212	0046	0021	0004	0017	PERMANENT	BLOCKED
DIV222	005B	0041	0004	0035	PERMANENT	BLOCKED
VBNRM	0084	0023	0004	0019	PERMANENT	BLOCKED
VUBNRM	009B	0018	0004	0014	PERMANENT	BLOCKED
VDIFF	00AD	0024	0004	0020	PERMANENT	BLOCKED
VXPRD	00C5	0025	0004	0021	PERMANENT	BLOCKED
VPLANE	00DE	0050	0004	0046	PERMANENT	BLOCKED
SQROOT	0110	0019	0004	0015	PERMANENT	BLOCKED
ADD333	0123	0024	0004	0019	PERMANENT	BLOCKED
ROT2DM	013B	0021	0004	0017	PERMANENT	BLOCKED
ROT2DT	0150	0026	0004	0022	PERMANENT	BLOCKED
SINCOS	016A	0024	0004	0020	PERMANENT	BLOCKED
D2BIN	0182	0026	0004	0022	PERMANENT	BLOCKED
BIN2D	019C	0030	0004	0026	PERMANENT	BLOCKED
M2BIN	01BA	0020	0004	0016	PERMANENT	BLOCKED
BIN2M	01CE	0020	0004	0016	PERMANENT	BLOCKED
R2BIN	01E2	0033	0004	0029	PERMANENT	BLOCKED
BIN2R	0203	0042	0004	0038	PERMANENT	BLOCKED
A2UNIT	022D	0037	0004	0033	PERMANENT	BLOCKED
UNIT2A	0252	0033	0004	0029	PERMANENT	BLOCKED
CHR2A	0273	0022	0004	0018	PERMANENT	BLOCKED
BIN2N	0289	0031	0004	0027	PERMANENT	BLOCKED
CVTBIN	02A8	0017	0004	0013	PERMANENT	BLOCKED
BINCVT	02B9	0025	0004	0021	PERMANENT	BLOCKED
UPKCHR	02D2	0021	0004	0017	PERMANENT	BLOCKED
PAKCHR	02E7	0023	0004	0019	PERMANENT	BLOCKED
METENG	02FE	0017	0004	0013	PERMANENT	BLOCKED
ENGMET	030F	0018	0004	0014	PERMANENT	BLOCKED
DEGPTC	0321	0020	0004	0016	PERMANENT	BLOCKED
PTCDEG	0335	0018	0004	0014	PERMANENT	BLOCKED

TOTALS
0031 FILES
00807 SECTORS

TABLE 4-4
BLD/MER DIRECTORY FOR DISK SIDE 908042-804NCB

SECTION 5

PARTS LIST

5.1 INTRODUCTION

This section contains the list of modules required to make up the NSPBLD/NSPMER software assembly. An explanation of how to use the parts list is provided below. The information in this section of the document is provided for informational purposes only and does not in any way imply deliverable items.

5.1.1 PARTS LIST USE

Each module is described with a two-line entry. The first line has three parts (separated by commas). The first part is the overall assembly mnemonic name, the second is the module mnemonic name, and the third is the spelled-out module name.

The second line of the module entry is keyed to the column headings at the top of the page. Columns that have an in-house or parts list bookkeeping function are omitted from the following explanation of column functions.

HEADING	USE
PART NO	See below for P/N suffix designations.
REQD ECO	ECO level required for this assembly's use of the module.
COMP ECO	Current ECO level of the module.
TYP	Part type code.
ADD ECO	ECO level of entire assembly when a new module is added. Changes to an existing module do not affect this column.

The suffixes of part numbers carry the following meaning:

SUFFIX	MEANING
-0XX	Source files
-2XX	Listings
-4XX	Software assembly structures
-5XX	Executable programs
-6XX	Load maps
-8XX	Software assembly structures

Only one six-digit part number prefix is used for each module. The suffix attached to the part number distinguishes between that module's source files (-0XX) and listings (-2XX). The other suffixes are non-module related.

```
                  RUN DATE=09/21/78            EVANS + SUTHERLAND     RPT ID=008  PAGE    1

                                   PRODUCT STRUCTURE (GUZZINTA) REPORT FOR SP,908042-803,,,,01,N,Y,N
MAKE     ASSEMBLY 908042-803        NSPBLD/NSPMER SOURCE FILE PACKAGE, PART 1 OF 2             AT ECO NC  ENGR=JCB

                            REQD COMP ENGR.                                    LOCATION DESIGNATIONS      ADD  QTY PER
  SEC  LINENO       PART NO  ECO   ECO DSH  SER NO TYP CD MEAS             1    2        3          4     ECO ASSEMBLY
-----------------  ---------- --    -- ---  ------ -- -- --               ---- ---- -------- ----------- --  ------
A 010 ----------   NSPBLD SOURCE FILES PART 1/3                             E + S
A 010 ----------   908042-401  NC   NC  401          SA M   EA                        SIDE A                P0       1*

A 020 ----------   NSPBLD SOURCE FILES PART 2/3                             E + S
A 020 ----------   908042-404  NC   NC  404          SA M   EA                        SIDE B                P0       1*

M 010 ----------   FLOPPY DISKETTE                                          E + S
M 010 ----------   801755-001  NC   NC  001          MM M   EA                                              P0       1*

                                                                  3 LINE ITEMS LISTED
```

TABLE 5-1
NSPBLD/NSPMER SOURCE FILE PACKAGE, PART 1 OF 2

```
                    RUN DATE=09/21/78        EVANS & SUTHERLAND        RPT ID=008   PAGE   1
                                        PRODUCT STRUCTURE (GUZZINTA) REPORT FOR SP,908042-804,,,,01,N,Y,N
MAKE     ASSEMBLY 908042-804            NSPBLD/NSPMER SOURCE FILE PACKAGE, PART 2 OF 2              AT ECO NC   ENGR=JCB

                              REQD COMP ENGR.                                  LOCATION DESIGNATIONS        ADD  QTY PER
  SEC  LINENO         PART NO  ECO  ECO DSH  SER NO TYP CD MEAS               1    2       3          4     ECO ASSEMBLY
----------------   ----------  --   --  ---  ------ -- -- --                ---- ---- --------- ---------- --  ------
A 010 ----------   NSPBLD SOURCE FILES PART 3/3                              E + S
A 010 ----------   908042-407  NC   NC  407            SA M  EA                        SIDE B               P0      1*

A 020 ----------   NSPMER SOURCE FILES                                       E + S
A 020 ----------   908042-410  NC   NC  410            SA M  EA                        SIDE A               P0      1*

M 010 ----------   FLOPPY DISKETTE                                           E + S
M 010 ----------   801755-001  NC   NC  001            MM M  EA                                             P0      1*

                                                                      3 LINE ITEMS LISTED
```

TABLE 5-2
NSPBLD/NSPMER SOURCE FILE PACKAGE, PART 2 OF 2

RUN DATE=09/21/78 EVANS + SUTHERLAND RPT ID=008 PAGE 1

PRODUCT STRUCTURE (GUZZINTA) REPORT FOR SP,908042-401,,,,01,N,Y,N

MAKE ASSEMBLY 908042-401 NSPBLD SOURCE FILES PART 1/3 AT ECO NC ENGR=L. O.

SEC	LINENO	PART NO	REQD ECO	COMP ECO	ENGR DSH	SER NO	TYP	CD	MEAS	LOCATION DESIGNATIONS 1 2 3 4	ADD ECO	QTY PER ASSEMBLY
S 010	----------	NSPBLD, T$SCAN,		SCAN CONTROL ROUTINE						E + S		
S 010	----------	908026-001	NC	NC	001		SW	M	EA		PO	1*
S 020	----------	NSPBLD, KEYIOS,		KEYBOARD I/O ROUTINES						E + S		
S 020	----------	908026-002	NC	NC	002		SW	M	EA		PO	1*
S 030	----------	NSPBLD, NBFIOS,		DISK I/O ROUTINES						E + S		
S 030	----------	908026-003	NC	NC	003		SW	M	EA		PO	1*
S 040	----------	NSPBLD, NBMAIN,		NSPBLD & NSPMER MAIN PROCEDURE						E + S		
S 040	----------	908029-001	NC	NC	001		SW	M	EA		PO	1*
S 050	----------	NSPBLD, NBMISC,		MISC NSPBLD SCAN PROCEDURES						E + S		
S 050	----------	908029-002	NC	NC	002		SW	M	EA		PO	1*
S 060	----------	NSPBLD, NBENTP,		ENTRY POINT PROCEDURES						E + S		
S 060	----------	908029-003	NC	NC	003		SW	M	EA		PO	1*
S 070	----------	NSPBLD, NBCHNL,		CHANNEL NUMBER ENCODE/DECODE PROCEDURES						E + S		
S 070	----------	908029-004	NC	NC	004		SW	M	EA		PO	1*
S 080	----------	NSPBLD, NBSMEX,		SURFACE MODULE PRIORITY TREE MODE EXPANSION						E + S		
S 080	----------	908029-005	NC	NC	005		SW	M	EA		PO	1*
S 090	----------	NSPBLD, NBLIST,		LISTING PROCEDURE						E + S		
S 090	----------	908029-006	NC	NC	006		SW	M	EA		PO	1*
S 100	----------	NSPBLD, NBMOVE,		DATA STRUCTURE EXPANSION AND CONTRACTION						E + S		
S 100	----------	908029-007	NC	NC	007		SW	M	EA		PO	1*
S 110	----------	NSPBLD, NBSWHO,		CONFIGURATION TABLES (STANDARD NSPBLD)						E + S		
S 110	----------	908029-010	NC	NC	010		SW	M	EA		PO	1*
S 120	----------	NSPBLD, NBDWHO,		CONFIGURATION TABLES (NSPBLD WITH 4010)						E + S		
S 120	----------	908029-011	NC	NC	011		SW	M	EA		PO	1*
S 130	----------	NSPBLD, NBXMSG,		COMMON MESSAGE DEFINITIONS						E + S		
S 130	----------	908029-012	NC	NC	012		SW	M	EA		PO	1*
S 140	----------	NSPBLD, NBLMSG,		LIGHT MODULE MESSAGE DEFINITIONS						E + S		
S 140	----------	908029-013	NC	NC	013		SW	M	EA		PO	1*
S 150	----------	NSPBLD, NBSMSG,		SURFACE MODULE MESSAGE DEFINITIONS						E + S		
S 150	----------	908029-014	NC	NC	014		SW	M	EA		PO	1*
S 160	----------	NSPBLD, NBEMSG,		ENVIRONMENT MODULE MESSAGE DEFINITIONS						E + S		
S 160	----------	908029-015	NC	NC	015		SW	M	EA		PO	1*
S 170	----------	NSPBLD, NBGMSG,		GROUP MODULE MESSAGE DEFINITIONS						E + S		
S 170	----------	908029-016	NC	NC	016		SW	M	EA		PO	1*

TABLE 5-3
NSPBLD SOURCE FILES, PART 1/3, PAGE 1

```
RUN DATE=09/21/78        EVANS + SUTHERLAND          RPT ID=008  PAGE   2
                         PRODUCT STRUCTURE (GUZZINTA) REPORT FOR SP,908042-401,,,,01,N,Y,N
MAKE     ASSEMBLY 908042-401   NSPBLD SOURCE FILES PART 1/3          AT ECO NC   ENGR=L. O.
                              REQD COMP ENGR.                          LOCATION DESIGNATIONS        ADD  QTY PER
 SEC  LINENO         PART NO   ECO  ECO DSH  SER NO TYP CD MEAS       1    2      3          4    ECO ASSEMBLY
----------------   ----------- --   -- ---  ------ --  -- --        ---- ---- -------- ---------- --  ------
S 180 ----------   NSPBLD, NBLNPT, LIGHT STRING LIGHT LOCATION PROCEDURES   E + S
S 180 ----------   908029-017  NC   NC  017         SW M   EA                                     PO     1*

S 190 ----------   NSPBLD, NBWORK, TEMPORARY WORKING BUFFER ALLOCATION      E + S
S 190 ----------   908029-020  NC   NC  020         SW M   EA                                     PO     1*

S 200 ----------   NSPBLD, NBXPAR, MAIN PARAMETER BLOCK DEFINITIONS         E + S
S 200 ----------   908029-021  NC   NC  021         SW M   EA                                     PO     1*

S 210 ----------   NSPBLD, NBCPAR, COMMAND LIST PARAMETER BLOCK DEFINITIONS E + S
S 210 ----------   908029-022  NC   NC  022         SW M   EA                                     PO     1*

S 220 ----------   NSPBLD, NBMPAR, MODULE TRANSFORMATION PARAMETER BLOCK DEF E + S
S 220 ----------   908029-023  NC   NC  023         SW M   EA                                     PO     1*

S 230 ----------   NSPBLD, NBXMOD, DATA MODULE DEFINITIONS                  E + S
S 230 ----------   908029-024  NC   NC  024         SW M   EA                                     PO     1*

S 240 ----------   NSPBLD, NBXTRE, MAIN NSPBLB SCAN TREE                    E + S
S 240 ----------   908029-030  NC   NC  030         SW M   EA                                     PO     1*

S 250 ----------   NSPBLD, NBLTRE, LIGHT MODULE SCAN TREE                   E + S
S 250 ----------   908029-031  NC   NC  031         SW M   EA                                     PO     1*

S 260 ----------   NSPBLD, NBSTRE, SURFACE MODULE SCAN TREE                 E + S
S 260 ----------   908029-032  NC   NC  032         SW M   EA                                     PO     1*

S 270 ----------   NSPBLD, NBETRE, ENVIRONMENT MODULE SCAN TREE             E + S
S 270 ----------   908029-033  NC   NC  033         SW M   EA                                     PO     1*

S 280 ----------   NSPBLD, NBGTRE, GROUP MODULE SCAN TREE                   E + S
S 280 ----------   908029-034  NC   NC  034         SW M   EA                                     PO     1*

S 290 ----------   NSPBLD, NBMTRE, MODULE TRANSFORMATION SCAN TREE          E + S
S 290 ----------   908029-035  NC   NC  035         SW M   EA                                     PO     1*

S 300 ----------   NSPBLD, CLPROC, COMMAND LIST PROCEDURES                  E + S
S 300 ----------   908029-081  NC   NC  081         SW M   EA                                     PO     1*

S 310 ----------   NSPBLD, MMTRAN, MODULE TRANSFORMATION FUNCTION           E + S
S 310 ----------   908029-082  NC   NC  082         SW M   EA                                     PO     1*

S 320 ----------   NSPBLD, MMTVTX, MODULE TRANSFORMATION SUBROUTINES        E + S
S 320 ----------   908029-083  NC   NC  083         SW M   EA                                     PO     1*

S 330 ----------   NSPBLD, DSTEMP, DISPLAY PROCEDURE STUBS                  E + S
S 330 ----------   908029-084  NC   NC  084         SW M   EA                                     PO     1*

                                                          33 LINE ITEMS LISTED
```

TABLE 5-4
NSPBLD SOURCE FILES, PART 1/3, PAGE 2

RUN DATE=09/21/78 EVANS + SUTHERLAND RPT ID=008 PAGE 1

PRODUCT STRUCTURE (GUZZINTA) REPORT FOR SP,908042-404,,,,01,N,Y,N

MAKE ASSEMBLY 908042-404 NSPBLD SOURCE FILES PART 2/3 AT ECO NC ENGR=L. O.

SEC	LINENO	PART NO	REQD ECO	COMP ECO	ENGR. DSH	SER NO	TYP	CD	MEAS	LOCATION DESIGNATIONS 1 2 3 4	ADD ECO	QTY PER ASSEMBLY
S 010	----------	NSPBLD, LMINST, LIGHT MODULE INSERT PROCEDURES								E + S		
S 010	----------	908029-040	NC	NC	040		SW	M	EA		P0	1*
S 020	----------	NSPBLD, LMDLET, LIGHT MODULE DELETE PROCEDURES								E + S		
S 020	----------	908029-041	NC	NC	041		SW	M	EA		P0	1*
S 030	----------	NSPBLD, LMPRNT, LIGHT MODULE PRINT PROCEDURES								E + S		
S 030	----------	908029-042	NC	NC	042		SW	M	EA		P0	1*
S 040	----------	NSPBLD, LMFIND, LIGHT MODULE FIND PROCEDURES								E + S		
S 040	----------	908029-043	NC	NC	043		SW	M	EA		P0	1*
S 050	----------	NSPBLD, LMUPDT, LIGHT MODULE UPDATE PROCEDURES								E + S		
S 050	----------	908029-044	NC	NC	044		SW	M	EA		P0	1*
S 060	----------	NSPBLD, LMCNEX, LIGHT MODULE EXPANSION PROCEDURES								E + S		
S 060	----------	908029-045	NC	NC	045		SW	M	EA		P0	1*
S 070	----------	NSPBLD, LMCNVR, LIGHT MODULE CONVERSION PROCEDURES								E + S		
S 070	----------	908029-046	NC	NC	046		SW	M	EA		P0	1*
S 080	----------	NSPBLD, LMVECT, LIGHT MODULE VECTOR PROCEDURES								E + S		
S 080	----------	908029-047	NC	NC	047		SW	M	EA		P0	1*
S 090	----------	NSPBLD, MSAVE , SURFACE MODULE REGISTER SAVE AREA								E + S		
S 090	----------	908029-050	NC	NC	050		SW	M	EA		P0	1*
S 100	----------	NSPBLD, SMINST, SURFACE MODULE INSERT PROCEDURES								E + S		
S 100	----------	908029-051	NC	NC	051		SW	M	EA		P0	1*
S 110	----------	NSPBLD, SMINEP, SURFACE MODULE ENTRY POINT INSERTION								E + S		
S 110	----------	908029-052	NC	NC	052		SW	M	EA		P0	1*
S 120	----------	NSPBLD, SMSSUR, SURFACE MODULE SYMETRICAL SURFACE PROCEDURE								E + S		
S 120	----------	908029-053	NC	NC	053		SW	M	EA		P0	1*
S 130	----------	NSPBLD, SMCNTR, SURFACE MODULE MODULE CENTERLINE PROCEDURE								E + S		
S 130	----------	908029-054	NC	NC	054		SW	M	EA		P0	1*
S 140	----------	NSPBLD, SMIFTB, SURFACE MODULE ILLUMINATION FLAG TABLE								E + S		
S 140	----------	908029-055	NC	NC	055		SW	M	EA		P0	1*
S 150	----------	NSPBLD, SMBRIT, SURFACE MODULE BRIGHTNESS TABLE								E + S		
S 150	----------	908029-056	NC	NC	056		SW	M	EA		P0	1*
S 160	----------	NSPBLD, SMRMOV, SURFACE MODULE DELETE PROCEDURES								E + S		
S 160	----------	908029-057	NC	NC	057		SW	M	EA		P0	1*
S 170	----------	NSPBLD, SMLIST, SURFACE MODULE PRINT PROCEDURES								E + S		
S 170	----------	908029-058	NC	NC	058		SW	M	EA		P0	1*

TABLE 5-5
NSPBLD SOURCE FILES, PART 2/3, PAGE 1

```
                       RUN DATE=09/21/78            EVANS + SUTHERLAND     RPT ID=008  PAGE    2
                                              PRODUCT STRUCTURE (GUZZINTA) REPORT FOR SP,908042-404,,,,01,N,Y,N
MAKE      ASSEMBLY 908042-404                 NSPBLD SOURCE FILES PART 2/3                                 AT ECO NC  ENGR=L. O.

                                        REQD COMP ENGR.                                          LOCATION DESIGNATIONS      ADD  QTY PER
  SEC  LINENO                  PART NO  ECO  ECO DSH  SER NO TYP CD MEAS                     1    2       3          4     ECO. ASSEMBLY
-----------------              ----------- --  -- ---  ------ -- -- --                      ---- ---- -------- ---------- --  ------
S 180 ----------   NSPBLD, SMPREP, SURFACE MODULE ENTRY POINT PRINT PROCEDURE              E + S
S 180 ----------   908029-059  NC  NC  059            SW M   EA                                                            PO       1*

S 190 ----------   NSPBLD, SMFIND, SURFACE MODULE FIND PROCEDURES                          E + S
S 190 ----------   908029-060  NC  NC  060            SW M   EA                                                            PO       1*

S 200 ----------   NSPBLD, SMFDEP, SURFACE MODULE ENTRY POINT FIND PROCEDURE               E + S
S 200 ----------   908029-061  NC  NC  061            SW M   EA                                                            PO       1*

S 210 ----------   NSPBLD, SMEXSN, SURFACE MODULE EXPANSION PROCEDURES                     E + S
S 210 ----------   908029-062  NC  NC  062            SW M   EA                                                            PO       1*

S 220 ----------   NSPBLD, SMTREB, SURFACE MODULE PRIORITY TREE PROCEDURES                 E + S
S 220 ----------   908029-063  NC  NC  063            SW M   EA                                                            PO       1*

S 230 ----------   NSPBLD, SMCMDL, SURFACE MODULE COMMAND LIST PROCEDURES                  E + S
S 230 ----------   908029-064  NC  NC  064            SW M   EA                                                            PO       1*

S 240 ----------   NSPBLD, EMINST, ENVIRONMENT MODULE INSERT PROCEDURES                    E + S
S 240 ----------   908029-070  NC  NC  070            SW M   EA                                                            PO       1*

S 250 ----------   NSPBLD, EMDLET, ENVIRONMENT MODULE DELETE PROCEDURES                    E + S
S 250 ----------   908029-071  NC  NC  071            SW M   EA                                                            PO       1*

S 260 ----------   NSPBLD, EMPRNT, ENVIRONMENT MODULE PRINT PROCEDURES                     E + S
S 260 ----------   908029-072  NC  NC  072            SW M   EA                                                            PO       1*

S 270 ----------   NSPBLD, EMFIND, ENVIRONMENT MODULE FIND PROCEDURES                      E + S
S 270 ----------   908029-073  NC  NC  073            SW M   EA                                                            PO       1*

S 280 ----------   NSPBLD, EMEXND, ENVIRONMENT MODULE EXPANSION PROCEDURES                 E + S
S 280 ----------   908029-074  NC  NC  074            SW M   EA                                                            PO       1*

S 290 ----------   NSPBLD, EMCNVR, ENVIRONMENT MODULE CONVERSION PROCEDURES                E + S
S 290 ----------   908029-075  NC  NC  075            SW M   EA                                                            PO       1*

S 300 ----------   NSPBLD, GMPROC, GROUP MODULE PROCEDURES                                 E + S
S 300 ----------   908029-080  NC  NC  080            SW M   EA                                                            PO       1*

                                                                30 LINE ITEMS LISTED
```

TABLE 5-6
NSPBLD SOURCE FILES, PART 2/3, PAGE 2

RUN DATE=09/21/78 EVANS + SUTHERLAND RPT ID=008 PAGE 1

MAKE ASSEMBLY 908042-407 PRODUCT STRUCTURE (GUZZINTA) REPORT FOR SP,908042-407,,,,01,N,Y,N
NSPBLD SOURCE FILES PART 3/3
AT ECO NC ENGR=L. O.

SEC	LINENO	PART NO	REQD ECO	COMP ECO	ENGR. DSH	SER NO	TYP	CD	MEAS	LOCATION DESIGNATIONS 1	2	3	4	ADD ECO	QTY PER ASSEMBLY
S 010	----------	CVTLIB, D2BIN , DECIMAL ASCII TO BINARY CONVERSION								E + S					
S 010	----------	908027-001	NC	NC	001		SW	M	EA					PO	1*
S 020	----------	CVTLIB, BIN2D , BINARY TO DECIMAL ASCII CONVERSION								E + S					
S 020	----------	908027-002	NC	NC	002		SW	M	EA					PO	1*
S 030	----------	CVTLIB, M2BIN , MET/ENG REAL ASCII TO BINARY CONVERSION								E + S					
S 030	----------	908027-005	NC	NC	005		SW	M	EA					PO	1*
S 040	----------	CVTLIB, BIN2M , BINARY TO MET/ENG REAL ASCII CONVERSION								E + S					
S 040	----------	908027-006	NC	NC	006		SW	M	EA					PO	1*
S 050	----------	CVTLIB, R2BIN , REAL ASCII TO BINARY CONVERSION								E + S					
S 050	----------	908027-007	NC	NC	007		SW	M	EA					PO	1*
S 060	----------	CVTLIB, BIN2R , BINARY TO REAL ASCII CONVERSION								E + S					
S 060	----------	908027-008	NC	NC	008		SW	M	EA					PO	1*
S 070	----------	CVTLIB, A2UNIT, ASCII DEV/FILE TO UNIT BLOCK CONVERSION								E + S					
S 070	----------	908027-011	NC	NC	011		SW	M	EA					PO	1*
S 080	----------	CVTLIB, UNIT2A, UNIT BLOCK TO ASCII DEV/FILE CONVERSION								E + S					
S 080	----------	908027-012	NC	NC	012		SW	M	EA					PO	1*
S 090	----------	CVTLIB, CHR2A , SINGLE CHARACTER TO ASCII BUFFER CONVERSION								E + S					
S 090	----------	908027-013	NC	NC	013		SW	M	EA					PO	1*
S 100	----------	CVTLIB, BIN2N , BINARY TO ASCII NAME CONVERSION								E + S					
S 100	----------	908027-014	NC	NC	014		SW	M	EA					PO	1*
S 110	----------	CVTLIB, CVTBIN, ASCII TO BINARY CONVERSION SUPPORT								E + S					
S 110	----------	908027-015	NC	NC	015		SW	M	EA					PO	1*
S 120	----------	CVTLIB, BINCVT, BINARY TO ASCII CONVERSION SUPPORT								E + S					
S 120	----------	908027-016	NC	NC	016		SW	M	EA					PO	1*
S 130	----------	CVTLIB, UPKCHR, CHARACTER UNPACKING PROCEDURES								E + S					
S 130	----------	908027-017	NC	NC	017		SW	M	EA					PO	1*
S 140	----------	CVTLIB, PAKCHR, CHARACTER PACKING PROCEDURES								E + S					
S 140	----------	908027-018	NC	NC	018		SW	M	EA					PO	1*
S 150	----------	CVTLIB, METENG, METRIC TO ENGLISH CONVERSION								E + S					
S 150	----------	908027-019	NC	NC	019		SW	M	EA					PO	1*
S 160	----------	CVTLIB, ENGMET, ENGLISH TO METRIC CONVERSION								E + S					
S 160	----------	908027-020	NC	NC	020		SW	M	EA					PO	1*
S 170	----------	CVTLIB, DEGPTC, DEGREES TO PARTS OF CIRCLE CONVERSION								E + S					
S 170	----------	908027-021	NC	NC	021		SW	M	EA					PO	1*

TABLE 5-7
NSPBLD SOURCE FILES, PART 3/3, PAGE 1

RUN DATE=09/21/78 EVANS + SUTHERLAND RPT ID=008 PAGE 2

PRODUCT STRUCTURE (GUZZINTA) REPORT FOR SP,908042-407,...,01,N,Y,N
AT ECO NC ENGR=L. O.

MAKE ASSEMBLY 908042-407 NSPBLD SOURCE FILES PART 3/3

SEC	LINENO	PART NO	REQD ECO	COMP ECO	ENGR. DSH	SER NO	TYP	CD	MEAS	LOCATION DESIGNATIONS 1 2 3 4	ADD ECO	QTY PER ASSEMBLY
S 180	----------	CVTLIB, PTCDEG,		PARTS OF CIRCLE TO DEGREES CONVERSION						E + S	PO	1*
S 180	----------	908027-022	NC	NC	022		SW	M	EA			
S 190	----------	MTHLIB, MUL224,		DOUBLE PRECISION MULTIPLY						E + S	PO	1*
S 190	----------	908028-001	NC	NC	001		SW	M	EA			
S 200	----------	MTHLIB, DIV212,		DOUBLE BY SINGLE PRECISION DIVIDE						E + S	PO	1*
S 200	----------	908028-002	NC	NC	002		SW	M	EA			
S 210	----------	MTHLIB, DIV222,		DOUBLE BY SINGLE PRECISION DIVIDE						E + S	PO	1*
S 210	----------	908028-003	NC	NC	003		SW	M	EA			
S 220	----------	MTHLIB, SINCOS,		SINE/COSINE PROCEDURES						E + S	PO	1*
S 220	----------	908028-004	NC	NC	004		SW	M	EA			
S 230	----------	MTHLIB, VBNRM,		VECTOR BLOCK NORMALIZATION						E + S	PO	1*
S 230	----------	908028-005	NC	NC	005		SW	M	EA			
S 240	----------	MTHLIB, VUBNRM,		VECTOR BLOCK UN-NORMALIZATION						E + S	PO	1*
S 240	----------	908028-006	NC	NC	006		SW	M	EA			
S 250	----------	MTHLIB, VDIFF ,		VECTOR SUM AND DIFFRENCE						E + S	PO	1*
S 250	----------	908028-007	NC	NC	007		SW	M	EA			
S 260	----------	MTHLIB, VXPRD ,		VECTOR CROSS PRODUCT						E + S	PO	1*
S 260	----------	908028-008	NC	NC	008		SW	M	EA			
S 270	----------	MTHLIB, VPLANE,		PLANE EQUATION GENERATION PROCEDURE						E + S	PO	1*
S 270	----------	908028-009	NC	NC	009		SW	M	EA			
S 280	----------	MTHLIB, SQROOT,		SQUARE ROOT						E + S	PO	1*
S 280	----------	908028-010	NC	NC	010		SW	M	EA			
S 290	----------	MTHLIB, ADD333,		TRIPLE PRECISION ADD						E + S	PO	1*
S 290	----------	908028-011	NC	NC	011		SW	M	EA			
S 300	----------	MTHLIB, ROT2DM,		2-D ROTATION MATRIX GENERATION						E + S	PO	1*
S 300	----------	908028-012	NC	NC	012		SW	M	EA			
S 310	----------	MTHLIB, ROT2DT,		2-D ROTATION TRANSFORMATION PROCEDURE						E + S	PO	1*
S 310	----------	908028-013	NC	NC	013		SW	M	EA			

31 LINE ITEMS LISTED

TABLE 5-8
NSPBLD SOURCE FILES, PART 3/3, PAGE 2

RUN DATE=09/21/78 EVANS + SUTHERLAND RPT ID=008 PAGE 1

PRODUCT STRUCTURE (GUZZINTA) REPORT FOR SP,908042-410,,,,01,N,Y,N

MAKE ASSEMBLY 908042-410 NSPMER SOURCE FILES AT ECO NC ENGR=L. O.

SEC	LINENO	PART NO	REQD ECO	COMP ECO	ENGR. DSH	SER NO	TYP	CD	MEAS	LOCATION DESIGNATIONS 1	2	3	4	ADD ECO	QTY PER ASSEMBLY
S 010	----------	NSPMER, NBMMSC,	MISC. NSPMER SCAN PROCEDURES							E + S					
S 010	----------	908030-001	NC	NC	001		SW	M	EA					P0	1*
S 020	----------	NSPMER, NBCTYP,	MODULE TYPE CHECK PROCEDURE							E + S					
S 020	----------	908030-002	NC	NC	002		SW	M	EA					P0	1*
S 030	----------	NSPMER, MERTRE,	NSPMER SCAN TREE							E + S					
S 030	----------	908030-003	NC	NC	003		SW	M	EA					P0	1*
S 040	----------	NSPMER, MERMSG,	NSPMER CONFIGURATION TABLES AND MESSAGES							E + S					
S 040	----------	908030-004	NC	NC	004		SW	M	EA					P0	1*
S 050	----------	NSPMER, MERPAR,	MERGE PARAMETER BLOCK DEFINITIONS							E + S					
S 050	----------	908030-005	NC	NC	005		SW	M	EA					P0	1*
S 060	----------	NSPMER, NBAMOD,	DATA MODULE A DEFINITIONS							E + S					
S 060	----------	908030-006	NC	NC	006		SW	M	EA					P0	1*
S 070	----------	NSPMER, NBBMOD,	DATA MODULE B DEFINITIONS							E + S					
S 070	----------	908030-007	NC	NC	007		SW	M	EA					P0	1*
S 080	----------	NSPMER, MMERGE,	MODULE MERGE PROCEDURES							E + S					
S 080	----------	908030-008	NC	NC	008		SW	M	EA					P0	1*
S 090	----------	NSPMER, MMEROR,	ERROR REPORT PROCEDURES							E + S					
S 090	----------	908030-009	NC	NC	009		SW	M	EA					P0	1*
S 100	----------	NSPMER, LMINMA,	LIGHT MODULE MERGE INSERT PROCEDURES (MOD A)							E + S					
S 100	----------	908030-010	NC	NC	010		SW	M	EA					P0	1*
S 110	----------	NSPMER, LMFDMB,	LIGHT MODULE MERGE FIND PROCEDURES (MOD B)							E + S					
S 110	----------	908030-011	NC	NC	011		SW	M	EA					P0	1*
S 120	----------	NSPMER, LMUPMA,	LIGHT MODULE MERGE UPDATE PROCEDURES (MOD A)							E + S					
S 120	----------	908030-012	NC	NC	012		SW	M	EA					P0	1*
S 130	----------	NSPMER, LMEXMA,	LIGHT MODULE MERGE EXPAN. PROCEDURES (MOD A)							E + S					
S 130	----------	908030-013	NC	NC	013		SW	M	EA					P0	1*
S 140	----------	NSPMER, LMEXMB,	LIGHT MODULE MERGE EXPAN. PROCEDURES (MOD B)							E + S					
S 140	----------	908030-014	NC	NC	014		SW	M	EA					P0	1*
S 150	----------	NSPMER, LMCNMA,	LIGHT MODULE MERGE CONV. PROCEDURES (MOD A)							E + S					
S 150	----------	908030-015	NC	NC	015		SW	M	EA					P0	1*
S 160	----------	NSPMER, LMCNMB,	LIGHT MODULE MERGE CONV. PROCEDURES (MOD B)							E + S					
S 160	----------	908030-016	NC	NC	016		SW	M	EA					P0	1*

16 LINE ITEMS LISTED

TABLE 5-9
NSPMER SOURCE FILES

SECTION 6

LISTINGS

6.1 INTRODUCTION

The listing set for the NSPBLD/NSPMEP program is bound separately in three volumes; the volumes are titled "Listing Set for the NSPBLD/NSPMEP Program," with a P/N of 908042-806. Each file in the set consists of the listing for that file, followed by a file concordance. Load maps will be found at the end of the listing set. Refer to Texas Instruments' software documentation for explanations of listing formats.

The front matter of each listing volume contains a table of the files in the volume, listed in the order in which they occur. Headings in this table are as follows:

FILE NAME	Module disk file name
IDT NAME	Module name as found in the listing and load maps
PART NUMBER	Module part number and revision level
CHANGE NUMBER	Listing set change-tracking device

6.1.1 LISTING SET CHANGES

If a file is changed and given a new revision level, the entire file will be replaced in the listing set. Revised files will be supplied to the holder of the listing set via change packages. Each change package will contain the replacement copies for one or more files and a new front matter table that will show the new revision level for each of the affected files.

The change packages will be numbered sequentially; i.e., the first change sent out for this listing set will be labeled "change 1"; the second, "change 2," and so on. All files replaced by change 1 (or 2, etc.) will be identified as such by placing a 1 (or 2, etc.) in the change number column for each file affected.

GLOSSARY OF TERMS AND ACRONYMS

A

ASCII -- American Standard Code for Information Interchange

B

BYTE -- eight bits

C

CENTERLINE DATA BLOCK -- a data block found in a surface data module used to replicate the modeled centerline segment along the entire length of the runway

COMMAND LIST -- a list of data items found in the light, surface, and environment data modules which controls the execution of the data module by the NSP hardware

CONCORDANCE -- an alphabetized cross-reference of all symbols contained within a program module

D

DYNAMIC COORDINATE SYSTEM -- a coordinate system which may be modified in real time

DYNAMIC COORDINATE SYSTEM MAP -- a data block found in an environment data module which describes the linkage between the various dynamic coordinate systems used in the data base and supported by the NSP hardware and NSPFLY

E

EDGE BLOCK -- a data block found in a surface data module which describes the location and orientation of an infinite edge which may be used to define faces

ENTRY POINTER -- a pointer found in a light or surface data module which points to a list of light string, face, or edge blocks in that same module

ENVIRONMENT DATA MODULE -- a data base module which defines the overall characteristics of a single data base area

F

FACE BLOCK -- a data block found in a surface data module which contains a description of a single face (surface) defined by references to four edge blocks and also containing a number of special surface attributes

FLASHING DATA BLOCK -- a data block in a light data module which contains flash pattern characteristics and a pointer to the string block within the same data module for which those characteristics apply

G

GAMING AREA -- the area in which a model is concentrating and is seen on the display at a given time

GROUP DATA MODULE -- a data base module which defines groupings of environment modules which are to be data base managed as a complete data base model

GROUP HEADER -- a data block found in a group data module which defines the group number and the size of the group (i.e., the number of environments in the group)

GROUP MODULE DEFINITION BLOCK -- a data block found in a group data module which defines an environment data module which is included in a specific group and the data base management parameters associated with that environment

L

LIGHT DATA MODULE -- a data base module which defines a group of light strings which are used in a data base

LIGHT STRING BLOCK -- a data block in a light data module which defines a single light string's location, size, length, color, etc.

MODULE -- that portion of a program or data base which is contained in a single file

MODULE CHECKSUM -- a checksum for the data module which is used to verify the integrity of a data module each time it is read into a program

MODULE DEFINITION BLOCK -- a data block in an environment data module which defines a light or surface data module which is to be used as part of the data base environment

MODULE LIST -- a list of module definition blocks found in an environment data module which defines the various light and surface data modules of which the data base environment is comprised

MODULE STATISTICS -- a series of pointers and counters found in the light and surface data modules used only by NSPBLD/NSPMER to control the construction and modification of the data module

OVERLAID -- occupying the same physical memory but used at different times

PRIORITY TREE -- a binary tree data structure which has its initial node in the environment module for a data base and which may have some, or all, of its terminal nodes in the various surface modules in the data base; used to compute the priority of the various faces in the data base for hidden surface processing

PRIORITY TREE NODE -- a data block in a surface or environment module segment of the data base priority tree which may contain a separating plane and which points to other nodes in the tree or to clusters of faces (surface module only)

ROTATING DATA BLOCK -- a data block in a light data module which contains rotation characteristics and a pointer to the string block within the same data module for which these characteristics apply

RUNWAY OFFSET -- a data block found in an environment data module which defines a runway's location and orientation

SCAN TREE -- a data structure used to control the text scanning process

STROBE DATA BLOCK -- a data block in a light data module which contains strobe characteristics and a pointer to the string block within the same data module for which these characteristics apply

SUN VECTOR -- a vector found in an environment data module which defines the direction of the illumination source used to illuminate the surfaces in the data base environment

SURFACE DATA MODULE -- a data base module which defines a group of surfaces which are used in a data base

SWITCH LIST POINTER -- a pointer found in a light data module which corresponds to a light switch number and points to the beginning of a switch string pointer list which defines all light strings controlled by the corresponding switch

SWITCH STRING POINTER -- a pointer contained in a switch string pointer list, found in a light module, which points to a string block for which the appropriate switch applies

SYMMETRICAL SURFACE VECTOR -- a vector found in a surface data module used to mirror selected faces

VASI -- visual approach slope indicator

VASI DATA BLOCK -- a data block in a light data module which contains VASI characteristics and two pointers (one for each of the two VASI colors) to the string block lists within the same data module for which those characteristics apply