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Naval Ocean Research and
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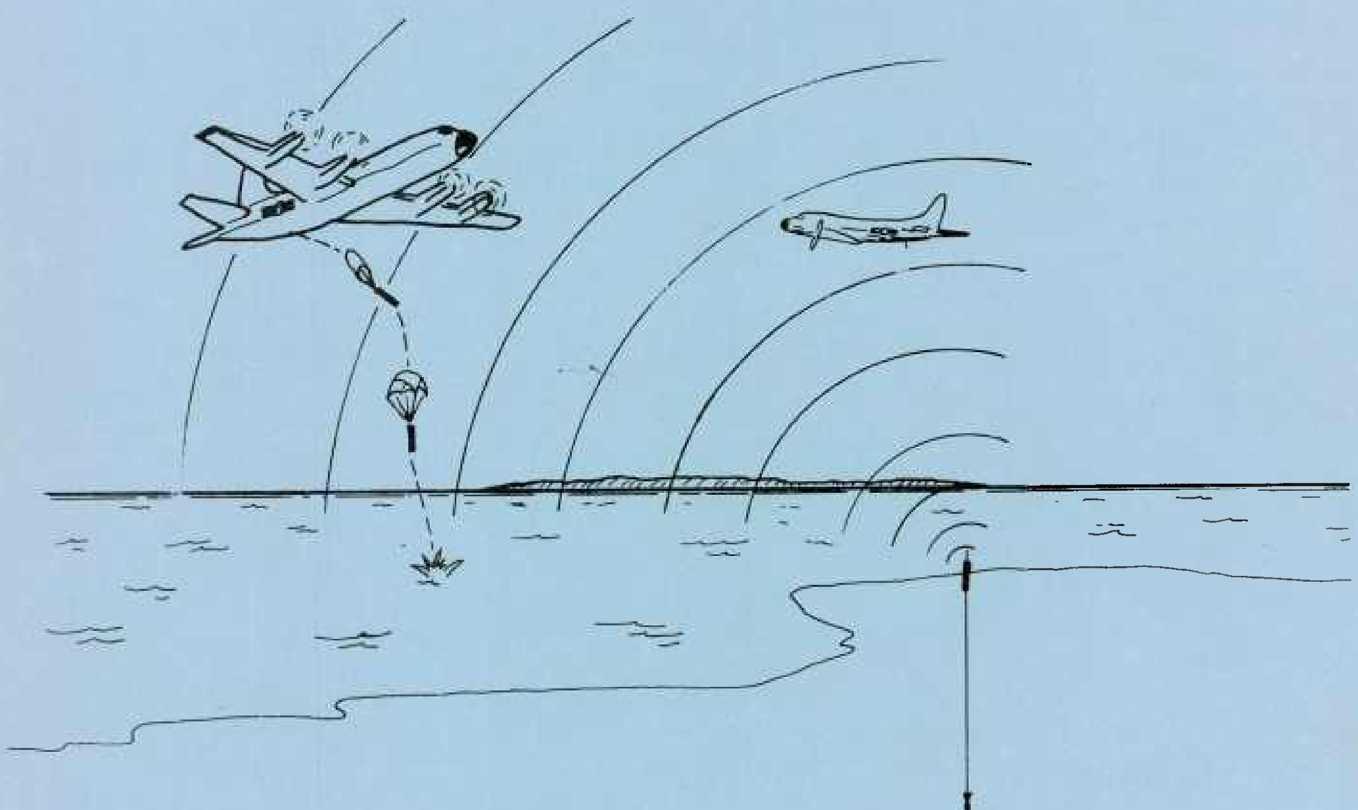
ADAPS Operation & Maintenance Manual



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EXECUTIVE SUMMARY

In the summer of 1982, the Ocean Technology Division (Code 252) of the Ocean Acoustics and Technology Directorate began development of an Airborne Data Acquisition and Processing System (ADAPS). System development was sponsored jointly by the Projects Support Branch (Code 7230) Ocean Projects Division of the Naval Oceanographic Office and the Ocean Projects Management Office (Code 540) of the Naval Ocean Research and Development Activity (NORDA).

The ADAPS is a user-programmable data acquisition system for use aboard RP-3A aircraft operated by the U. S. Naval Oceanographic Office. It is designed for rapid collection, editing and storage of data from aircraft launched expendable bathythermographs (AXBT's) and from various aircraft meteorological sensors.

This manual describes the installation, functional operation, interconnections for system set-up and operating software programs of the developed system. The system is very flexible in that the user can easily modify any of the software programs provided with the system or develop new programs which tailor system performance to specific needs. The system electronics are modularly designed so that failures can be corrected by rapid replacement of printed circuit cards.

Immediately after completion of the first of two systems, it was installed in the Naval Oceanographic Office project BIRDSEYE aircraft where it is now being utilized as part of the aircraft's suite of instruments. The second system was installed in project SEASCAN aircraft during January of 1984.

Installation and use of ADAPS has resulted in the automation of many airborne survey tasks which were previously accomplished in a more time consuming manner. Ocean thermal profile data can now be provided to fleet interests on a more timely basis, and post processing of survey data for research purposes is improved due to availability of both thermal profiles and meteorological data along with time and position information all on one storage media.

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1.0 INTRODUCTION

1.1 SYSTEM PURPOSE

The Airborne Data Acquisition and Processing System (ADAPS) was designed to provide rapid collection, editing and storage of data from aircraft launched expendable bathythermographs (AXBT) and from various aircraft meteorological sensors.

The system is intended for use aboard RP-3A aircraft operated by the Naval Oceanographic Office (NAVOCEANO) for conducting oceanographic and acoustic surveys. During these surveys many time consuming tasks must be performed by on-board personnel. These tasks include: 1) acquisition and editing of AXBT data, 2) preparation of standard JJXX bathymessages, 3) acquisition of sea surface temperature data along with sky-cloud background radiation, dew point, total temperature and true air speed data. These tasks were previously done in a very time consuming manner using various kinds of mass storage and recording devices including cassette tape, 1/2" analog tape, strip chart recorders and X-Y recorders. The ADAPS system allows acquisition and storage of all AXBT, meteorological, time and navigation data on one storage media - 1/2" 9-track computer-compatible magnetic tape. In addition, it provides the capability to perform on-board editing of AXBT data and subsequent automatic preparation of JJXX messages on paper tape, ready for use by Navy Message Centers. ADAPS automation of these tasks results in faster, less labor intensive survey operations and allows easier post processing of data on other computers without the necessity to transfer all data to industry compatible tape media.

1.2 SYSTEM DESCRIPTION

The Airborne Data Acquisition and Processing System (ADAPS) is a user programmable data acquisition system for use aboard RP-3A aircraft operated by the U. S. Naval Oceanographic Office (NAVOCEANO).

ADAPS is designed for rapid collection, editing and storage of data from aircraft-launched expendable bathythermographs (AXBT's) and from various aircraft meteorological sensors.

The system automatically provides time and aircraft position information for both the BT and meteorological samples, and provides aircraft true air speed information necessary to correct total temperature measurements.

All collected data is permanently stored on industry compatible 9-track magnetic tape. Capability is also provided for editing recorded AXBT data and automatically generating standard JJXX messages, which are recorded on paper tape for use by Navy message centers.

Although designed specifically for collection of AXBT data, the hardware and software flexibility of ADAPS allows relatively easy adaptation to other types of air launched expendable sensors such as air launched expendable sound velocity probes (AXSV) and air launched expendable conductivity temperature and depth probes (AXCTD).

As shown in Figure 1, the ADAPS is comprised of five main system elements. The following sections provide a brief description of each system element and explain its function in the overall system operation.

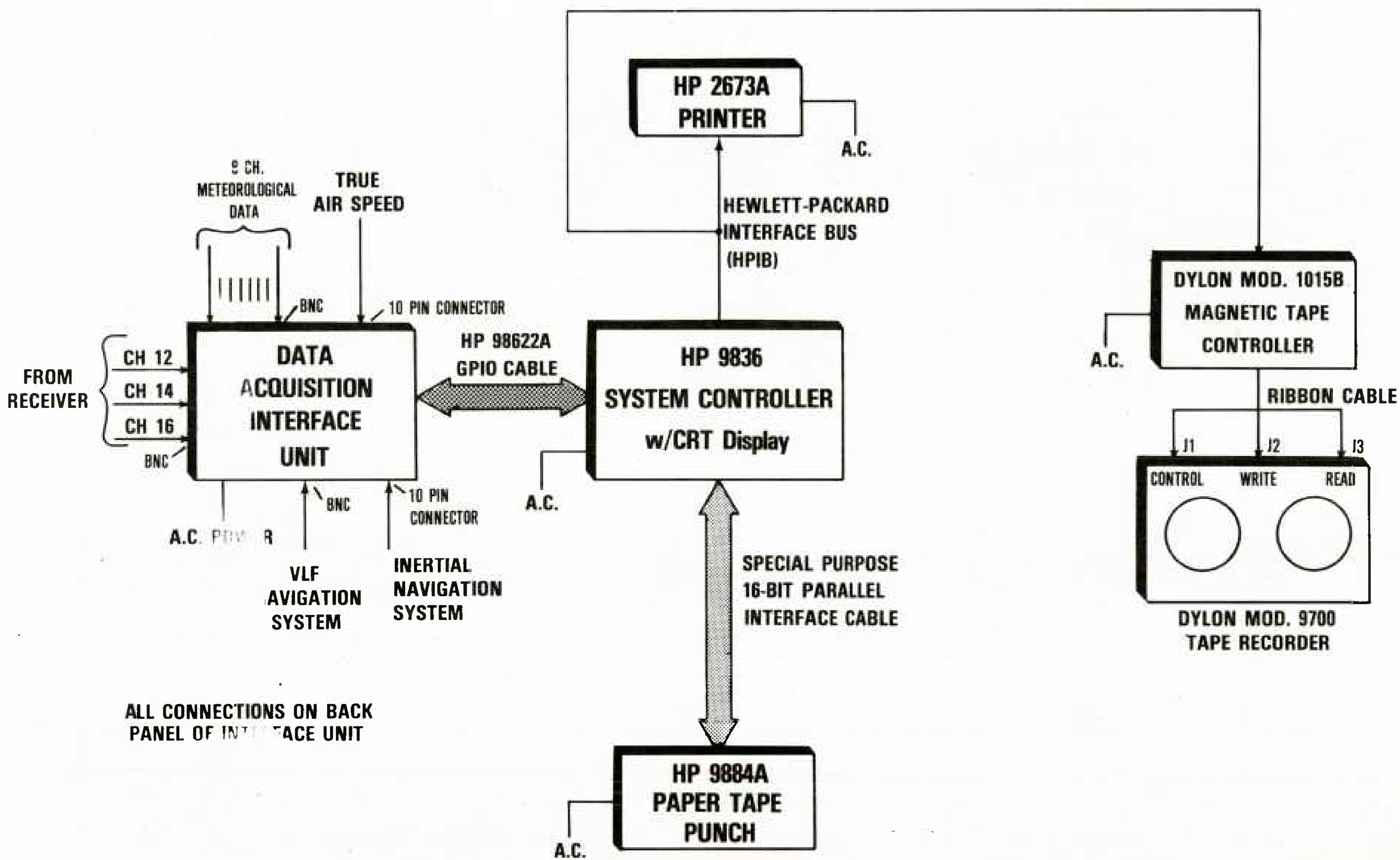


Figure 1. Airborne Data Acquisition and Processing System System Configuration and Interconnections

1.2.1 Data Acquisition Interface Unit

As shown in Figure 1, all data enters the system through the Data Acquisition Interface Unit (DAIU). The types and quantity of data accepted by the DAIU are as follows:

1. Data from up to three AXBT receiver channels. (Provisions for future expansion to four channels are included).

2. Data from either the GNS-500 VLF navigation system or the LTN-72 Inertial navigation system. (Selected by means of front panel switch.)

3. Data from the aircraft true air speed synchro transmitter.

4. Data from up to eight 0-5VDC analog inputs.

In the system data acquisition mode, the DAIU operates under control of the HP 9836 System Controller to provide signal conditioning, filtering and digitization of the incoming data, and transfers the digitized data to the System Controller for display, processing and storage. The DAIU is not used in the system data edit mode. For a more detailed description of DAIU operation, refer to the Theory of Operation section 5.0.

1.2.2 System Controller

An HP 9836A computer serves as the main System Controller in both the data acquisition and data edit modes of system operation. In data acquisition mode, the System Controller provides the necessary timing for determining when to sample data, checks status to verify data validity, provides real time CRT graphics display of data in engineering units, provides temporary data storage and controls all input/output operations between various system elements. In the data edit mode, the System Controller accesses data previously recorded on 9-track tape, displays data for editing and transfers edited products to the HP-2673A printer and to the HP 9884 paper tape punch.

1.2.3 Dylon Recording System

The Dylon Recording system actually consists of two units; the 9-track magnetic tape drive, and the 1015B controller/formatter, which allows the tape drive to be controlled by the System Controller. The Dylon Recording System is used to permanently store all data sampled by the ADAPS. During data acquisition mode, the data record for each AXBT launch is recorded. At end of flight, all meteorological data samples are recorded after the last AXBT data record. During the data edit mode, the Dylon Recording system provides all pre-recorded data for processing and editing under control of the HP 9836 System Controller. Refer to Figure 2 for further details on the Recording System data tape format.

1.2.4 System Paper Tape Punch

The HP 9884 Paper Tape Punch is used to record the edited data set for each AXBT in a form which can be used by Navy Message Centers for transmission to fleet users. The message is recorded on paper tape using 5-level BAUDOT code and

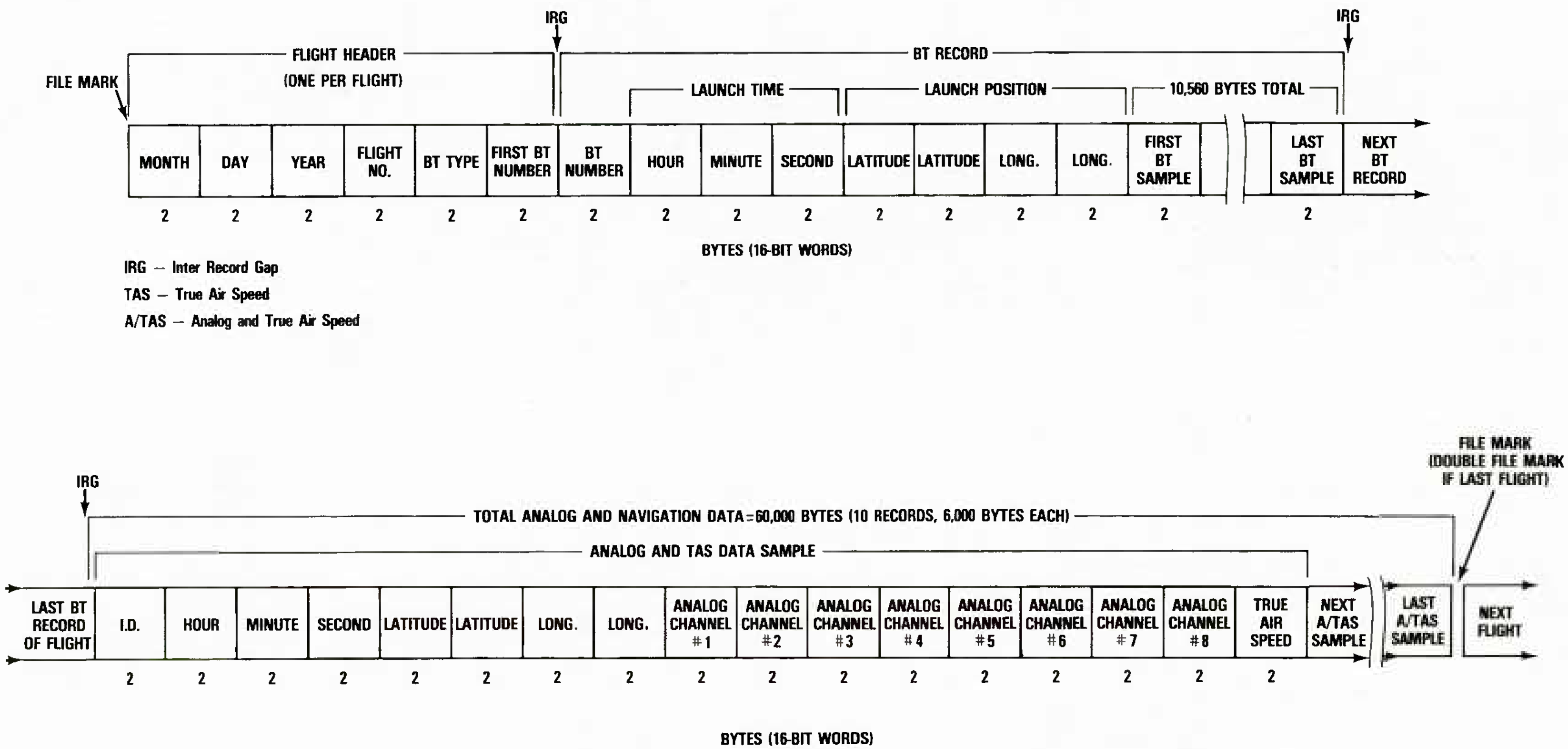


Figure 2. Dylon Tape Recording System File Format

arranged in a format known as a JJXX Bathymessage. Refer to Appendix A for the JJXX message format and digital character representations in 5-level BAUDOT code.

1.2.5 System Printer

The HP 2673A graphics printer is used to provide hard copy of CRT graphics as well as standard alphanumeric hard copy. The system printer automatically provides hard copy of edited BT profiles and JJXX messages during standard data editing operations, but hard copy CRT graphics or alphanumerics may be generated at any time by the operator through use of the System Controller's DUMP GRAPHICS and DUMP ALPHA function keys. The system printer is not normally in use during the data acquisition mode of operation.

1.3 SYSTEM PERFORMANCE CHARACTERISTICS

The performance characteristics of the ADAPS operating in its "as-delivered" hardware/software configuration are described below. It should be noted, however, that many of these characteristics are not fixed and may be widely varied to suit other data collection requirements.

1. The system is capable of collecting data from up to three AXBT channels simultaneously at a sample rate of 10 samples per second per channel. Provisions are made for expanding this capability to a maximum of four channels if required, with a resulting reduction in sample rates to approximately 7 samples/second.

2. Time and position at time of BT launch is provided for each AXBT data record.

3. While collecting AXBT data, a real time CRT display of the temperature-depth profile for each active BT is generated.

4. Concurrent with AXBT data collection, the system samples each of eight 0-5VDC analog input channels at a rate of one sample every 15 seconds. Each 15 second sample includes not only the eight analog channels but also time, position and aircraft true air speed.

5. All collected data is stored on 1/2 inch 9-track magnetic tape in raw binary form. Based on the typical time for a single environmental survey flight of 8 hours with a maximum of 90 AXBT's being launched, each magnetic tape provides sufficient storage capacity for eight flights. Refer to Figure 2 for a description of the magnetic tape data format.

6. Software is provided for accessing the recorded raw data, converting to engineering units and displaying BT profiles for editing. Editing is accomplished by cursor selection of data points representing significant profile inflection points. The selected data set is used to automatically generate a standard JJXX Bathymessage which is transmitted to paper tape for use by Navy message centers.

7. Software is provided to access data on a selected flight and generate BT profiles which are automatically edited to show temperature at each 50 meter increment of the profile.

8. Other programs are provided for performing system checkouts, setting the real time clock and for other types of data access and editing. See the Software Description Section 4.1 for complete details.

9. Data Collection Range and Resolution/Accuracy Characteristics are as follows:

BT Data		
Temperature Range	-	-2°C to + 35°C
Temperature Accuracy	-	±0.02°C
Depth Range	-	0 to 400 or 800 meters
Depth Resolution	-	±0.5 ft.
Analog Data		
Voltage Range	-	0 to 5 VDC
Voltage Accuracy	-	±.005V
Navigation Data		
Position Accuracy	-	±0.1 min Lat/Long
True Air Speed		
Range	-	70 - 450 knots
Resolution	-	±1.0 knot

2.0 SYSTEM INSTALLATION

2.1 EQUIPMENT MOUNTING

Special mounting brackets have been supplied to facilitate mounting of each system element in standard 19 inch equipment racks. Care should be taken to assure that all mounting brackets are securely installed and that they prevent movement of system equipment in any direction once the equipment is installed. The equipment with integral front rack mount flanges should not be installed using these flanges exclusively, but should be properly supported at sides and rear by using the angle brackets supplied with the system.

The CRT display of the System Controller is attached to the computer and locks into place by pushing in the sliding metal retaining bracket at the rear of the CRT unit. Since this is the only mounting restraint for the CRT unit, care should be taken to assure that the bracket is pushed all the way in and locked.

The cage atop the HP 2673A graphics printer is designed to re-fold the paper after printing (assuming perforated flat-pack paper is used). The printer should be mounted so as to provide sufficient space for loading new paper and for re-folding during printing operations.

The HP 9884A paper tape punch should be mounted so as to provide enough space above the unit to load tape and to operate the controls.

Cooling will not be a problem for the system when located in air conditioned spaces. However, consideration should be given to providing as much airflow as possible when mounting the system in racks or tight spaces.

2.2 SYSTEM INTERCONNECTION

Figure 1 shows the cable connections that are required between each of the ADAPS functional units. Refer to Figure 3 for the location of the various data and control connectors on the DAIU. The following considerations, along with the above mentioned illustrations, will assist in properly interconnecting the various elements of the ADAPS.

1. AXBT data from the aircraft receivers, all analog inputs and outputs and the VLF navigation system input are connected to the DAIU by means of coaxial BNC connectors. When installing ADAPS, new coaxial cables with properly installed BNC connectors should be used. Whenever possible each data input cable should be continuous with no intermediate connectors between the data source and the DAIU input, and should be of shortest possible length consistent with proper aircraft routing.

2. The true airspeed input data and the LTN-72 navigation data enter the DAIU by means of 10-pin circular connectors. These inputs should be connected to the true air speed computer synchro output and the LTN-72 6-wire output according to the pin assignments shown in Figure 4.

3. The HP 9836A System Controller interfaces to the DAIU and to the HP 9884 paper tape punch via HP 98622A 16-bit parallel interfaces. These interface units are plugged into the back of the System Controller and are clearly marked with their individual select codes (See System Configuration Section 2-3 for discussion of select codes.) The DAIU should be connected to the System Controller interface unit marked select code 12 using the cable marked with the same select code. The HP 9884 paper tape punch is connected to the System Controller Interface unit marked with select code 08 using the cable marked with the same select code.

4. The System Controller is connected to both the HP 2673A graphics printer and the Dylon Recording system via the Hewlett Packard Interface Bus (HPIB) which is integral to the System Controller. Standard HPIB cables are used for these connections.

5. Connection between the Dylon Model 1015B Magnetic Tape Controller and the Model 9700 Tape Transport is via ribbon cables and connectors supplied by Dylon Corp. Figure 5 illustrates the ribbon cable interconnections that must be made between the two units for proper operation.

6. All elements of the ADAPS require 120 VAC, 60 Hz single phase power. In making power connections to each of the electronic units, it is very important to connect each unit to the same phase of the 115 VAC, 60 Hz power system to prevent troublesome AC power ground loops. It is recommended that all units be plugged into a power strip which is in turn plugged into a single power source outlet.

7. <u>Grounding is very important to proper operation of the ADAPS system. Signal and power grounds and shields have been carefully carried</u> through the system to a single point located inside the DAIU. This point is also available on the back panel in the form of a ground post

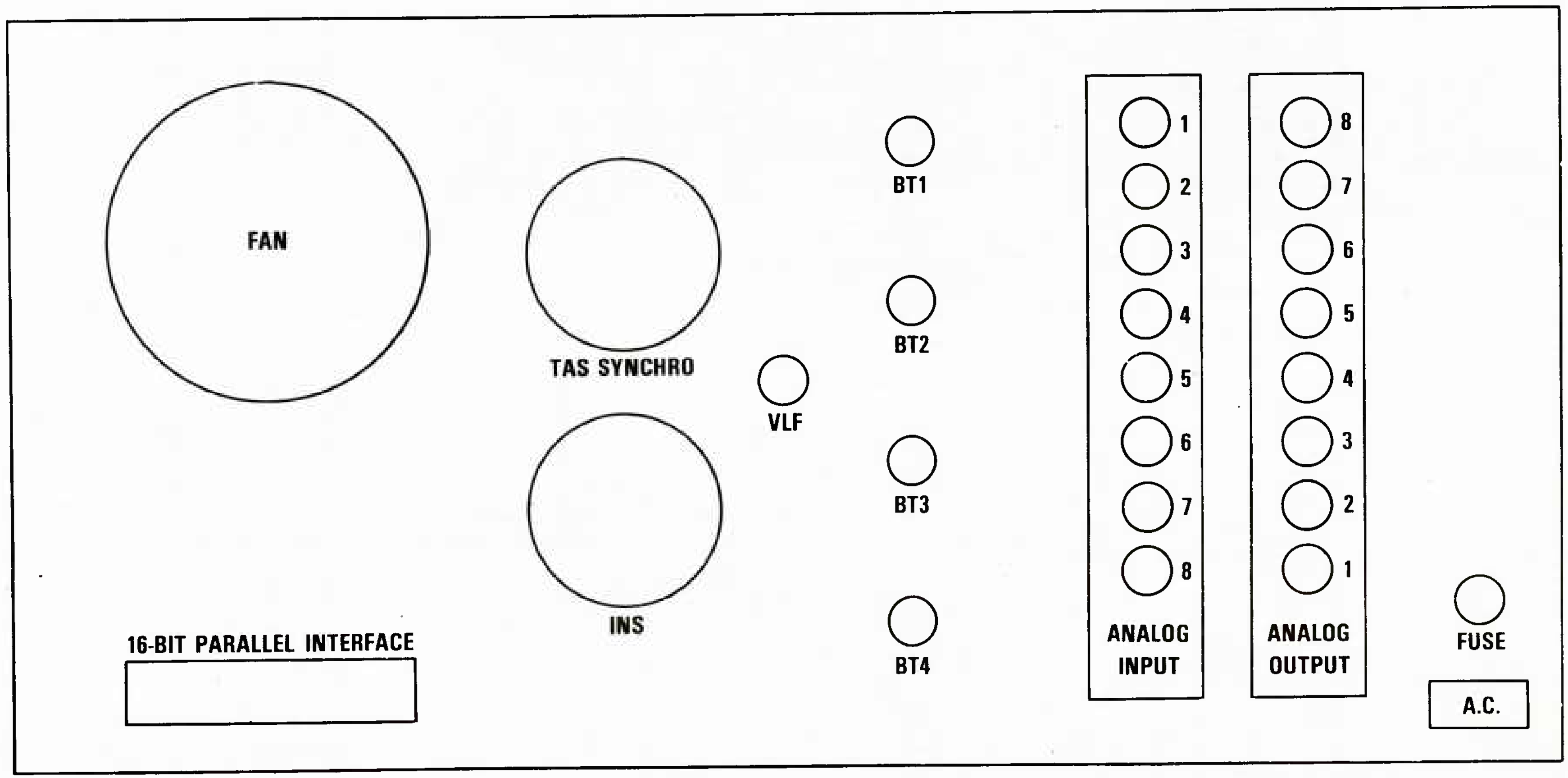


Figure 3. Data Acquisition Interface Unit Back Panel Input/Output Layout

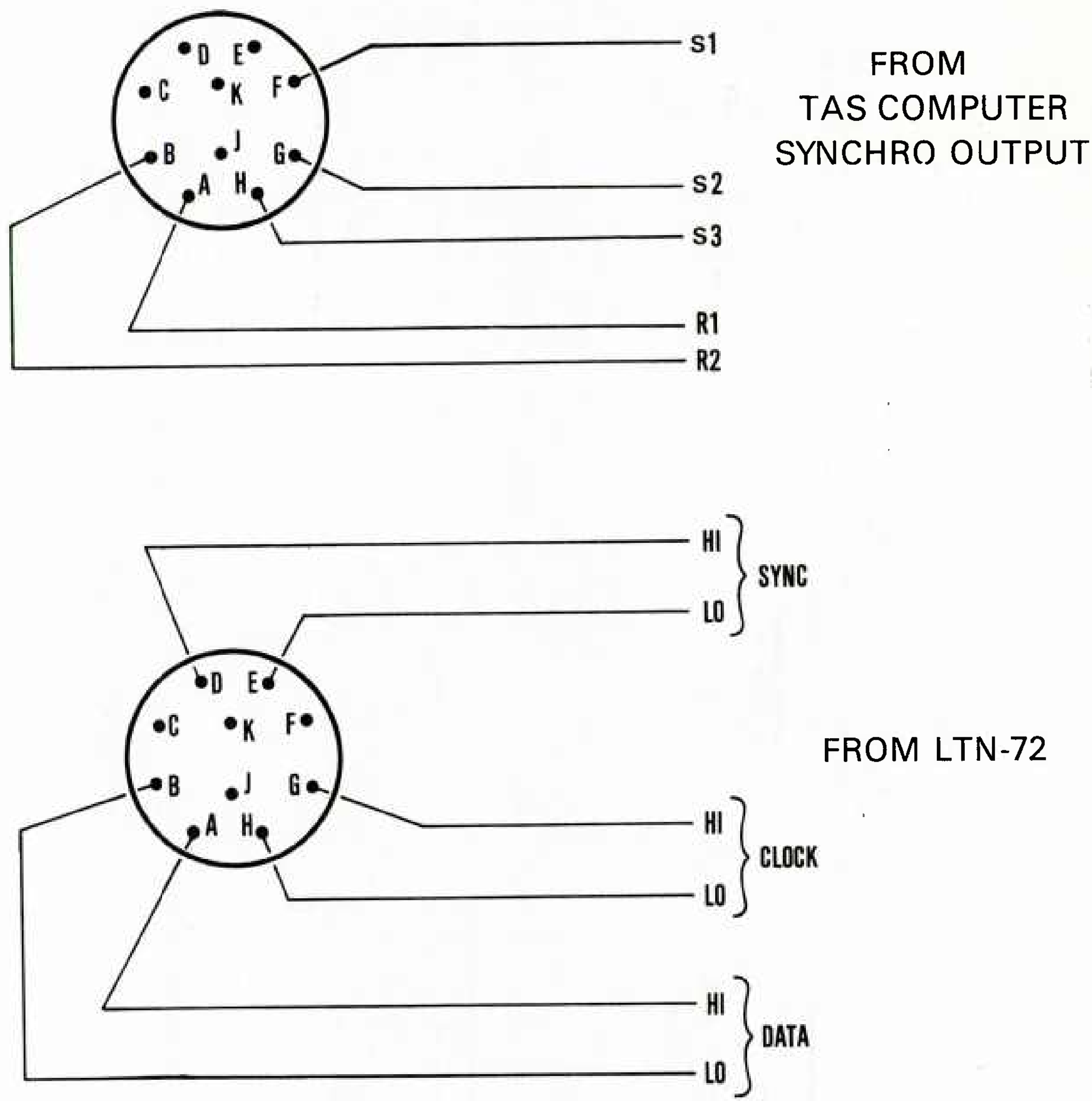


Figure 4. TAS/INS Data Cable Connections

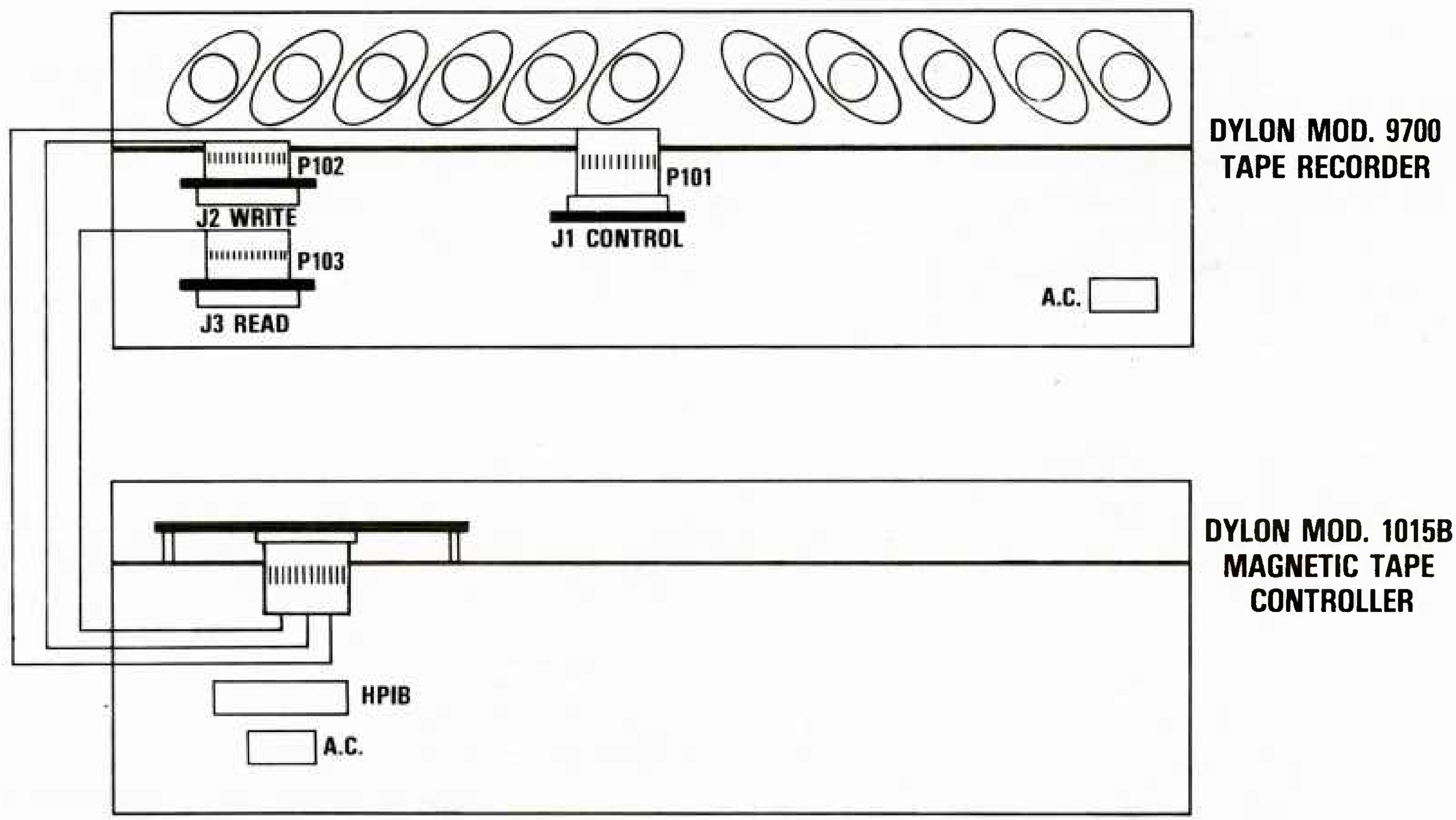


Figure 5. Dylon Tape Recording System Interconnection

located in the lower left corner of the back panel. This grounding post must be connected to airframe ground. The connection point must be a permanently installed metallic rack, console or structural member of the aircraft that is free of paint or any other insulating material. The connection should be firm, preferably bolted, to ensure proper contact with airframe ground.

8. In order to ensure positive vibration resistant cable connections it is imperative that hold-down screws or brackets supplied with the system be used at all interconnection points. This is particularly important in the aircraft environment where constant vibration is the largest contributing factor to intermittent connections and contacts. Caution should be exercised when routing cables to ensure against chafing or any undue strain placed upon the connectors.

3.0 SYSTEM CONFIGURATION

The following sections describe special requirements for configuring cards and interfaces in the ADAPS DAIU and System Controller. These requirements involve setting of configuration switches for proper operation of the system.

3.1 DATA ACQUISITION INTERFACE UNIT (DAIU) CONFIGURATION

The motherboard of the Interface Unit is designed so that cards may be inserted into any of the twelve available slots in any order. However, proper switch configurations are required on each card to assure proper interface operation.

Each card is clearly marked on the component side indicating its function. The unit is capable of accepting a total of twelve cards, i.e. four signal Conditioning Cards, four Period Counter Cards, Status/Termination card, Meteorological Data Card, Navigation Interface Card and the TAS Synchro Card.

NOTE: It is extremely important that no two like cards contain the same switch settings while being plugged into the Interface during operation. Damage to the Interface Unit and/or the system Controller may result if more than one card is configured in the same manner.

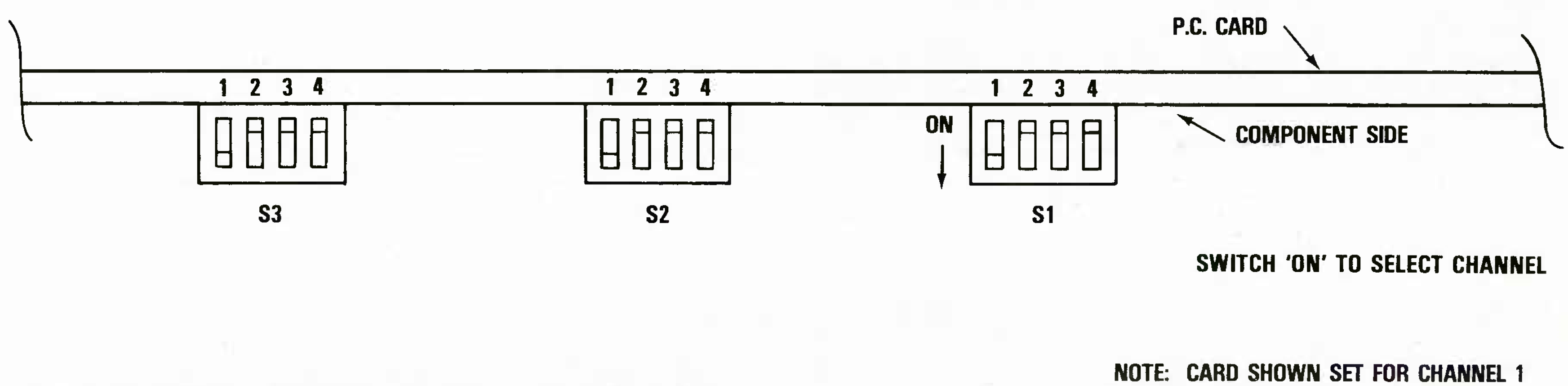
3.1.1 Analog Signal Conditioning Card Configuration

There are three signal conditioning cards which, when properly configured, will correspond to their respective input channels. See Figure 6 for proper switch settings to select the corresponding data channel. The cards may be installed in any of the 12 available slots.

3.1.2 Period Counter Card Configuration

There are three period counder cards which, when propoerly configured, will correspond to their respective input channels. See Figure 7 for proper switch settings to select the corresponding data channel. The cards may be installed in any of the 12 available card slots.

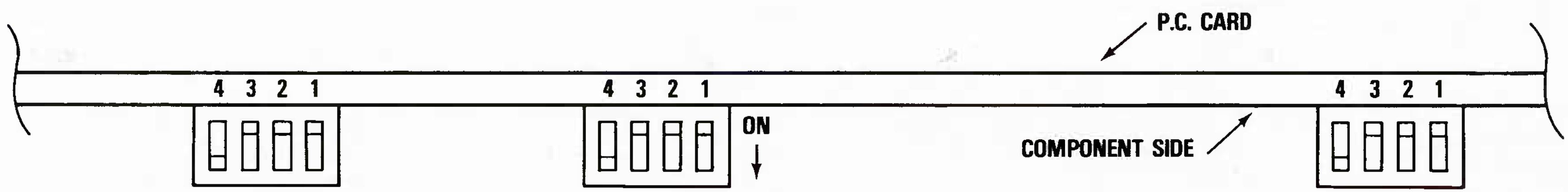
SWITCH NUMBERS CORRESPOND TO CHANNEL NUMBERS.
ALL THREE SWITCHES MUST BE CONFIGURED IDENTICALLY.



CAUTION: IT IS IMPORTANT THAT NO TWO CARDS CONTAIN THE SAME SWITCH SETTINGS. DAMAGE MAY OCCUR TO THE INTERFACE UNIT AND/OR THE SYSTEM CONTROLLER.

Figure 6. Signal Conditioning Card — Switch Configurations, Channel Select

SWITCH NUMBERS CORRESPOND TO CHANNEL NUMBERS.
ALL THREE SWITCHES MUST BE CONFIGURED IDENTICALLY.



SWITCH 'ON' TO SELECT CHANNEL

CAUTION: IT IS IMPORTANT THAT NO TWO CARDS CONTAIN THE SAME SWITCH SETTINGS. DAMAGE MAY OCCUR TO THE INTERFACE UNIT AND/OR THE SYSTEM CONTROLLER.

Figure 7. Period Counter Card — Switch Configurations, Channel Select

3.1.3 Navigation Interface Card Configuration

In order for the Navigation Interface Card to properly decode and interpret the aircrafts' navigation data, the switches must be configured to match the desired information code. Latitude and longitude information is accompanied by the code depicted in the table on Figure 8. Careful attention should be given to the arrangement of the switches on the card in order to select the proper code.

3.1.4 Status/Termination Card Configuration

Status of each AXBT data channel is monitored by the Status/Termination card to determine if a BT signal is present and if the signal is within the frequency range valid for AXBT's. The valid range is determined by resistor selection via switches on the card. At present, only one resistor (6.19 K) is installed for each switch and the switch position corresponding to this resistor should be "on".

Provision has been made for future addition of up to three more resistors to accommodate different frequency ranges when other types of expendable devices are used.

The Status/Termination Card is required at any time the Interface Unit is used with the HP 9836 System Controller. This card also provides proper termination of control lines and must be in place to avoid any "floating" condition which may occur in the otherwise open inputs.

3.2 SYSTEM CONTROLLER 16-BIT I/O CONFIGURATION (HP 98622A GPIO)

All data transfers to and from the DAIU and System Controller are routed through the HP 98622A 16-bit I/O (GPIO). This unit is plugged into the back of the System Controller and must be configured for proper operation with the DAIU by means of DIP switches located on the I/O plug-in card. Complete instructions for setting these switches are contained in the HP 98622A GPIO Interface Installation Manual. This manual is included as part of the HP 9836A Interfacing Techniques Manual provided with the System Controller. The appropriate switches should be set to provide the following I/O configuration.

1) Select Code - 12

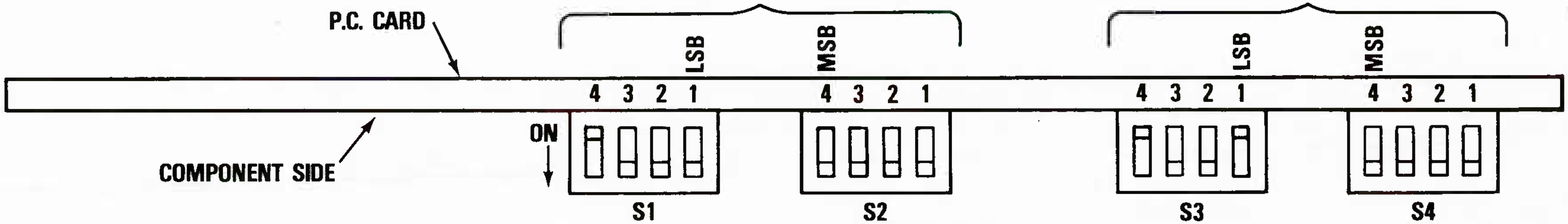
2) Interrupt level - Default

3) Data-In Clock Source

   Upper - RDY
   Lower - RDY

4) Option Select

   DOUT - Logic 1
   DIN - Logic 0
   HSHK - Logic 1
   PSTS - Logic 1
   PFLG - Logic 1
   PCTL - Logic 1



LATITUDE

	1	2	3	4
S1	1	1	1	0
S2	1	1	1	1

LONGITUDE

	1	2	3	4
S3	0	1	1	0
S4	1	1	1	1

1 ON
0 OFF

Figure 8. Navigation Card Switch Configuration

The 16-bit I/O provided with the ADAPS will already be configured for proper operation. The above information is provided in case of I/O replacement or in case the I/O configuration is inadvertently changed.

4.0 ADAPS SYSTEM OPERATION

The following contains information and instruction necessary for applying power and operating all elements of the ADAPS System. These procedures must be followed explicitly to ensure proper system operation.

4.1 ADAPS TURN-ON PROCEDURES

All elements of the ADAPS should first be connected as described in System Interconnection Section 2.2. Each unit, with the exception of the System Controller and the Dylon recording system may be powered up by simply activating the power on/off switches. The following instructions will assist in properly preparing the remaining elements for operation.

4.1.1 Recorder System

Switch the power of the Model 1015B to the ON position. The four left most indicators on the front panel will light and then extinguish after two seconds and remain extinguished. If they do not, the controller is probably defective and cannot be used.

In order to ensure correct tape loading, follow the steps listed below:

1. Turn on the drive power.
2. Check the tape reel for a write permit ring on the reverse side if the tape is to be written on.
3. Mount the tape on the supply hub, label side out. Pull out the reel locking lever, place the tape on the hub evenly and depress the locking lever. Spin the reel to make sure it is seated squarely on the hub. If it wobbles, repeat this step.
4. Thread the tape leader through the tape path, following the threading diagram on the tape drive. Wrap at least two turns of tape on the take up capstan. The tape should be taut against the various roller guides. If it is not, rotate the take-up capstan to remove any slack.
5. Close the front cover to protect the tape and drive from dust.
6. Momentarily depress the LOAD button.
7. The tape drive must be activated for computer control by momentarily depressing the ON-LINE button. The associated indicator should be illuminated.
8. The controller READY light should now be illuminated. If it is not, repeat this procedure. If it remains unlit the system is either defective or not properly installed.

4.1.2 HP 9836 System Controller

The power ON/OFF switch is located in the lower right front of the calculator unit. Prior to activating this switch the following steps will assist in properly initiating the basic operating system.

1. Insert the program disc entitled "BASIC System" and lock the disc drive door in the down position.

2. Turn on the computer system. The disc containing the BASIC operating system will automatically load as the power comes up. Proper loading is indicated by the CRT displaying "BASIC Ready 2.0".

3. Unlock the disc drive, remove the disc and return it to the disc file.

4. Insert the disc entitled "Extended BASIC 2.0" into the disc drive, type LOAD BIN "AP2_0" and press EXECUTE. Proper loading of Extended Basic 2.0 is indicated by the CRT displaying "BASIC Ext. AP 2.0".

5. After loading this program disc, remove it from the tape drive and return it to the disc file.

The system is now ready to accept the ADAPS data acquisition programs. Refer to section 4.2 for description of the ADAPS software and for instructions for loading and operating the software.

4.1.3 Tape Rewind and Unloading

In order to ensure correct unloading of tape, follow the steps listed below:

1. Momentarily depress the ON-LINE button. The associated indicator should extinguish.

2. Momentarily depress the REWIND button. If the tape is at the load point, it will be unloaded. If the tape is not at load point, it will be rewound only to load point. A second actuation of the REWIND button is required to unload the tape.

3. Remove the tape reel from the tape drive by pulling out the reel locking lever. The locking lever should be pushed back in when the tape drive is not in use.

4. The front cover should be kept closed any time the tape drive is not in use. Dust contamination of the tape drive can cause severe read/write problems.

4.2 SYSTEM SOFTWARE

4.2.1 Software Description

The ADAPS has been provided with a basic package of software which should be sufficient for normal airborne survey operations. The following is a brief description of each program provided in the ADAPS basic software package.

1. "SYS_CHECK" - Checks for proper operation of all peripherals and connecting interfaces.

2. "TIMEDATE" - Allows operator to check and set the computer real time clock.

3. "BT_DATA" - This is the system main data acquisition program. Data is collected from up to three AXBT channels simultaneously while providing real time CRT display of the temp-depth profiles. Stores each BT record on magnetic tape either automatically at end of descent or at operator command. Each AXBT record is stored along with time and position of launch.

   Concurrent with AXBT data acquisition, a sample is taken every 15 seconds which includes the following data:

   1. Time of sample
   2. Position at time of sample
   3. Voltage at each analog input (8 total)
   4. Aircraft true air speed

   Each of these samples is stored internally until end of survey flight at which time the entire data array is written to 9-track tape at the end of the last AXBT data record.

4. "BT_EDIT" - Allows the operator to display and edit the temperature-depth profile of any AXBT recorded on a survey flight. The operator selects a set of profile inflection points by means of a cursor and this data is used to automatically generate a standardized JJXX Bathymessage. A hard copy of the BT profile and associated JJXX message are automatically printed and the JJXX message data is automatically recorded on paper tape.

5. "FAST_EDIT" This program provides the same editing capabilities as "BT-EDIT" except that hard copy of profile and message are not generated, and the JJXX message is immediately recorded on paper tape.

6. "50M-DUMP" — Once a survey flight number is selected by the operator, this program proceeds automatically with no further operator intervention. For each AXBT data record on the selected flight, this program provides a hard copy of the BT profile along with temperature values at each 50 meter increment of the profile.

7. "TAPE_DUMP" — This program prints out a summary of the entire contents of an ADAPS data tape, by survey flight number. For each survey flight, the flight number and date are printed, followed by BT number, time of launch, and position at time of launch for each BT data record recorded on that survey flight. All survey flights recorded on the tape are automatically summarized in this manner.

8. "MET_LIST" — This program provides hard copy print-out of all meteorolgical data recorded on a selected data flight. Each data sample is printed as time, position, voltage at each of 8 analog inputs and true airspeed.

4.2.2 Software Operation

Prior to loading any software into the System Controller, the ADAPS turn-on procedures of section 4.1 must be performed. As indicated by the Software Description in section 4.2.1, the software which is provided with the ADAPS falls into three main categories; System Checkout, Data Acquisition and Data Processing. The System checkout programs should always be run prior to beginning data acquisition during a survey flight. This will assure that the system Real Time clock is properly set and that all peripherals and I/O devices are properly connected and operating.

The following general considerations will assist the operator in properly running the ADAPS software.

1. The ten keys labeled KØ through K9 and located in the upper left hand corner of the keyboard are called "softkeys" and are used extensively in the ADAPS programs to perform specific functions. A menu of labels which defines the current function of each softkey is displayed at the bottom of the CRT.

2. Whenever applications software is not being run, softkeys K5 through K9 are assigned functions which aid the operator in loading and storing programs on disc, displaying disc contents, listing programs and clearing memory. However, these keys may be redefined by a running applications program to serve other functions.

3. To load an applications program, press the softkey labeled LOAD and the CRT will display the command LOAD followed by quotation

marks within which the name of the program to be loaded is typed. For example:

LOAD "TIMEDATE"

4. To clear the computer memory, the softkey labeled SCRATCH is pressed followed by the EXECUTE key.

5. A catalog of programs and data resident on a disc may be displayed by pressing the softkey labeled CAT followed by the EXECUTE key. This will display a listing of all programs and data on the disc installed in the right hand disc drive.

6. Whenever a program asks for a yes or no decision, the operator may enter Y, N, YES, or NO, followed by pressing CONTINUE to enter the decision.

7. To reset the computer one of the shift keys must be pressed while pressing the RESET key.

4.2.2.1 System Checkout Software

1. Insert the ADAPS PROGRAM DISC into the right hand disc drive and close the drive door.

2. Press the "LOAD" softkey, type in TIMEDATE, and press the EXECUTE key. The "TIMEDATE" program will be loaded into the computer.

3. Press the RUN key. The current date setting will be displayed. If you wish to change the date, type in the new date in place of the old and press CONTINUE. The new date will be displayed at the upper right of the CRT, and the current time will be displayed at lower left.

4. If you wish to change the time, type in the new time in place of the old and press CONTINUE. The new date and time will be displayed at upper right and the time will be continuously updated until the program is stopped by pressing RESET.

5. Once date and time are properly set, clear the computer memory by pressing the SCRATCH softkey and EXECUTE.

6. Press the "LOAD" softkey, type in SYS_CHEK, and press the EXECUTE key. This loads the "SYS_CHEK" program.

7. Press the RUN key. The CRT will display "NAV INTERFACE NOW BEING CHECKED" and "PRESS ANY KEY TO CONTINUE SYSTEM CHECKOUT." The current latitude and

longitude being read by the DAIU will be displayed in the upper right of the CRT, if the navigation interface is properly operating.

8. If the interface does not respond after 2 seconds, an alarm is sounded and the CRT displays "NAV INTERFACE IS NOT RESPONDING!!" At this point, checks should be made to determine the cause of the problem.

9. If the Navigation Interface has responded properly, press any key on the keyboard and the computer will begin checkout of the analog interface.

10. Checkout of the analog and true airspeed interfaces proceeds essentially the same as for the navigation interface (steps 7 through 9).

11. Checkout of the printer, paper tape punch and tape recording system differs only in that no data is displayed,and the computer informs the operator if the interface is operating properly. For example, if the tape recorder is operating properly, the CRT will display "TAPE RECORDER IS OK" and "PRESS ANY KEY TO CONTINUE SYSTEM CHECKOUT."

12. After the tape recording system has been checked, press any key to begin checkout of the AXBT data acquisition functions. This requires simulated BT signals applied to all BT channels (1-3).

13. The signal frequency and computed temperature will be displayed at upper right of the CRT for each BT channel. If no signal is detected on a BT channel (i.e. channel 1) this is indicated by displaying "STATUS INDICATES NO CHAN 1 SIGNAL!!." Frequency and temperature of other channels will continue to be displayed.

14. If signal is present, but the Interface does not respond to a request for data this is indicated by displaying "CHAN 1 INTERFACE IS NOT RESPONDING."

15. If all BT channels check out properly, press any key to terminate the checkout and display "SYSTEM CHECK FINISHED."

4.2.2.2 Data Acquisition Software

The system checkout software of section 4.2.2.1 <u>must</u> be run prior to using the Data Acquisition Software.

ADAPS data acquisition is accomplished using the program named "BT_DATA." The following step-by-step procedures will assist in properly running this program.

1. Clear the computer memory by pressing the SCRATCH softkey, followed by EXECUTE.

2. Insert the ADAPS PROGRAM DISC into the right hand drive, and close the drive door.

3. Press the LOAD softkey, type BT_DATA, and press EXECUTE. This loads the program "BT_DATA."

4. Press RUN. The computer will request entry of the month, day, and year. After this information is entered, it will be displayed at upper right of the CRT.

5. The computer will ask for a flight number (must be integer number), first BT number for this flight and entry of shallow (1), deep (2), or mixed (3) for BT type. As each of these is entered, it is displayed at upper right of the CRT.

6. The computer now asks if all displayed information is correct. If "N" or "NO" is entered it will repeat request for entries starting at month, day and year.

7. If "Y" or "YES" is enterd, the computer next asks, "WILL THIS BE A NEW TAPE?" "Y" or "YES" should be entered only if the tape to be used is new and contains no data from previous survey flights. Otherwise, "N" or "NO" is entered after which the computer finds the end of the last survey flight data on the tape and proceeds to write the flight header data for the new survey flight.

After recording the flight header information, the computer loads the graphics display upon which BT temperature-depth profiles are plotted during data acquisition. Also displayed is a menu of softkey functions to be used by the operator during data acquisition. At this point, the system has begun to take meteorological data samples every 15 seconds, which it stores internally, and is waiting for launch of the first BT, as signaled by the operator pressing the appropriate softkey. Softkey functions are arranged by BT channel number from left to right. Normally, those functions designated by BT #1 correspond to BT channel 12, those designated by BT #2 correspond to BT channel 14 and those designated by BT #3 correspond to BT channel 16. Softkey function labels preceded by a "/" (i.e. "/ABORT") require that the SHIFT key be pressed to activate the softkey function.

BT signal outputs from channels 12, 14, and 16 are also monitored on oscilloscopes mounted in close proximity to the System Controller. This allows the operator to monitor the status of each BT channel in order to properly control data acquisition by means of softkey functions. To properly acquire and store BT and meteorological data, the below listed step-by-step procedure should be followed.

1. Press the "LAUNCH" softkey for the appropriate channel when the AXBT is launched from the aircraft.

This causes the computer to assign the next BT number to that launch, acquire and store time and position of launch. BT number and time of launch is displayed above the appropriate temperature-depth profile graphics field.

2. The displayed function label for the "LAUNCH" key just pressed now changes to "START".

3. Observe the oscilloscope display of the appropriate BT channel. When the display indicates that the BT has entered the water and begun RF transmission (single line-no noise), press the "START" softkey. The computer will now begin looking for a modulation signal on that channel, indicating that the probe has started its descent.

4. When the computer detects start of descent it will automatically begin sampling and storing data from that channel, while displaying a real-time temperature-depth profile in the appropriate display field.

5. When the "START" softkey is pressed, the displayed function label for this key changes to "LAUNCH/STOP."

6. If another BT is launched on the same channel as one which has not yet completed descent, press the "LAUNCH/STOP" softkey. This traps the next BT number, launch time and position of the second BT and holds it until the first BT has completed descent or is stopped by the operator.

7. When the "LAUNCH/STOP" softkey is pressed, the displayed function label for that key changes to "**/STOP", indicating that a second BT has been launched on that channel.

8. A descending BT may be allowed to descend to maximum depth (400 or 800 meters) at which time the computer automatically terminates sampling, or the operator may terminate prior to completion of descent by pressing the SHIFT key and, simultaneously, the "LAUNCH/STOP" softkey (or "**/STOP" softkey if a second BT has been launched on that channel). In either case the computer transfers the acquired data to magnetic tape and prepares for launch (or start) of a new BT on that channel.

9. If a second BT has <u>not</u> been launched on the same channel prior to termination, the displayed function label of the "LAUNCH/STOP" softkey changes to "LAUNCH" and operation for that channel begins again from step 1 above.

10. If a second BT has been launched on the same channel prior to termination the displayed function label of the "**/STOP" key changes to "START", the previously stored BT number and launch time are displayed above the appropriate graphics field, and operation for that channel begins again at step 3 above.

11. If, after launch, a BT malfunctions by not transmitting RF, or not releasing the probe, etc., that BT may be aborted by pressing the SHIFT key and the appropriate "/ABORT" softkey. Any data samples taken are not recorded on mag tape. The computer then prepares for another launch (start) on that channel. It should be remembered that when a BT is aborted, the BT number assigned to it is used although no data is recorded.

12. After termination of the last BT launched on the current survey flight, press the "SHIFT" key and, simultaneously, the "/END SURVEY" key. This causes the computer to transfer all meteorological data onto magnetic tape after the last BT data record. A double file mark is then written to tape to identify the end of the last valid data.

Although the above procedures were described using only one BT channel for examples, these procedures also apply to operations involving up to three active BT channels.

It should be noted that the operator is responsible for keeping track of which channel a BT is about to be launched on, and for monitoring the status of each BT signal on the oscilloscopes, so that data acquisition may be properly controlled by means of the special function keys assigned to each BT channel.

4.2.2.3 Data Processing Software

Several types of processing are available for ADAPS data through use of the "BT_EDIT", "FAST_EDIT", "MET_EDIT", "50M_DUMP" and "TAPEDUMP" programs. (See section 4.2.1 for a description of each program.)

Each of these programs operates on data which has been previously recorded on 9-track tape using the "BT_DATA" data acquisition program. Therefore, prior to running any processing program, the ADAPS must be powered up as described in section 4.0 and a magnetic tape containing the desired data must be mounted and loaded on the Dylon tape drive.

The following sections provide step-by-step procedures for properly utilizing the selected data edit program.

4.2.2.3.1 "BT_EDIT" Program

1. Insert the ADAPS PROGRAM DISC into the right hand drive and close the drive door.

2. Press the "SCRATCH" softkey followed by the EXECUTE key to clear memory.

3. Press the "LOAD" softkey, type in BT_EDIT, and press the EXECUTE key. This loads "BT_EDIT".

4. Press RUN. The computer asks for FLIGHT NUMBER, BT NUMBER AND BT TYPE. Enter each of these as instructed. The computer will now search the tape for the desired flight number and BT number.

5. When the desired flight and BT are found, the computer accesses the BT profile data, and displays the temperature-depth profile on the CRT along with BT number, time and position of launch.

6. Select a desired profile inflection point by moving the display cursor using the thumb wheel at upper left of the keyboard. When the cursor is aligned with the selected datapoint, press the "SELECT DATA" softkey. The depth and temperature at this point will be stored and displayed at the right of the profile display. You may select up to 23 different inflection points in this manner. The cursor may be moved up and down the profile to select datapoints in any order. They do <u>not</u> have to be successive in order of depth.

7. When the desired number of datapoints have been selected, press the "STOP" softkey. The computer will ask, "DO YOU WANT TO CHANGE ANYTHING?"

8. If "Y" or "YES" is entered, the BT profile is again displayed. Any selected data point may be deleted by pressing the "DELETE DATA" softkey, at which time the computer asks "DELETE DATA POINT NO.?". Type in the number of the data point to be deleted and press CONTINUE.

9. If "N" or "NO" is entered,the computer dumps the entire graphics display to the printer.

10. Press CONTINUE. The computer now sorts selected datapoints by depth and prepares a standard JJXX message which is displayed on the CRT.

11. Press CONTINUE again and the JJXX message is dumped to the printer and printed below the profile graphics.

12. Press CONTINUE again and the JJXX message is transferred to the paper tape punch.

13. The computer now asks for "NEXT BT NO.?" Enter the desired next BT number to be edited, press CONTINUE, and proceed as in steps 5 through 12.

NOTE: This program allows any BT number on the flight to be selected in any order.

4.2.2.3.2 "FAST_EDIT" Program

The "FAST_EDIT" program is identical to the "BT_EDIT" Program and operating procredures are the same, except for the following:

1. The computer initially asks only for the flight number and BT type. Editing automatically starts with the first BT on the flight and proceeds in sequence to the last BT.

2. Hard copy of edited profile and JJXX message is not generated on the system printer. The JJXX message is sent immediately to the paper tape punch.

3. When editing of a BT is completed, the computer does not ask for "NEXT BT NO?", but automatically proceeds to the next BT in sequence.

4. A "NEXT BT" softkey is provided to jump to the next BT in sequence if it is not desired to edit the BT currently being displayed.

4.2.2.3.3 "MET_LIST" Program

1. Insert the ADAPS PROGRAM DISK in the right hand drive and close the drive door.
2. Press the "LOAD" softkey, type in MET_EDIT, and press EXECUTE. This loads "MET_EDIT_.
3. Press RUN. The computer will ask for the desired flight number.
4. Enter the flight number and press CONTINUE.

The computer will search the tape for the selected flight number. When the flight number is found, the computer will input all meteorological data from that flight and begin printing out each successive data sample. Each sample is printed as time, position, voltage at each of 8 analog inputs,and true air speed. Printing will continue until data is expended or until the program is stopped.

4.2.2.3.4 "50M_DUMP"

1. Insert the ADAPS PROGRAM DISC into the right hand drive and close the drive door.
2. Press the "LOAD" softkey, type in 50M_DUMP and press EXECUTE. This loads "50M_DUMP".
3. The computer will ask for a flight number.
4. Enter the desired flight number and press CONTINUE.

The computer now proceeds with no further input from the operator. The selected flight number is found and data is entered from the first BT data record.

This data is used to display the BT profile and the temperature and depth at each 50 meter increment of the profile. The entire display is then dumped to the system printer for hard copy, and the next BT data record is accessed. This continues automatically until all BT records are processed for the flight number entered.

5.0 THEORY OF OPERATION

Except for the Data Acquisition Interface unit (DAIU), the theory of operation for each ADAPS system element is provided in the manufacturer's manuals supplied with the system. For this reason, only the DAIU will be discussed with any detail in this section.

5.1 DAIU THEORY OF OPERATION

All data accessed from or sent to (control) the DAIU by the System Controller is routed through the HP 98622A 16-bit I/O (GPIO). This I/O is installed in the System Controller, and is configured as described in section 3.2. Detailed information concerning the operation of the 98622A I/O is contained in the HP 98622A GPIO Interface installation Section of the Interfacing Techniques Manual for the HP 9836A System Controller. The reader should thoroughly review that section of the manual as well as the I/O configuration information contained in this document prior to reading the following theory of operation descriptions.

Figure 9 provides a simplified illustration of the DAIU internal interconnections. It should be noted that all DAIU circuit boards, with the exception of the status/termination card, are connected to a common output data bus and a common control and status bus. The DAIU is designed such that any circuit board may be installed in any of the twelve card slots in any order. Drawing no. SN-S07A identifies the bussed connections available to all twelve of the double card slots. The 16-bit output databus connections are labeled DIØ through DI 15. The control and status bus includes System Controller data output lines DOØ through DO7 which are used by the System Controller to select specific circuit boards from which to access digital data. Other control and status bus connections include handshake and control signals for the 16-bit interface and are labeled PCTL, PFLG, I/O, PSTS PRESET, EIR, CTLØ, CTL1, STIØ AND STI1. The remaining connections on each card slot are used for connections to back panel data inputs, connection to front panel indicators and control switches and for system power.

The following sections will describe the theory of operation of each type of circuit board installed in the DAIU.

5.1.1 Signal Conditioning Cards

Refer to drawing number SN-S03A for the signal conditioning card circuit schematic. The setting of switches S1 and S2 determine which BT data input channel will be used by the signal conditioning board. Setting of S3 determines which bus line the conditioned signal will be applied to. All three switches <u>must</u> be configured identically with only <u>one</u> of the 4 positions "on".

The high and low signal lines from the selected BT channel are applied to the inputs of A1, a unity gain, differential input instrumentation amplifier. A1 serves to isolate the incoming signal lines from circuit ground to prevent possible ground loops and common mode noise. The output of A1 is applied to A2 which clamps the incoming signal amplitude at 5.1 volts maximum. The output of A2 is

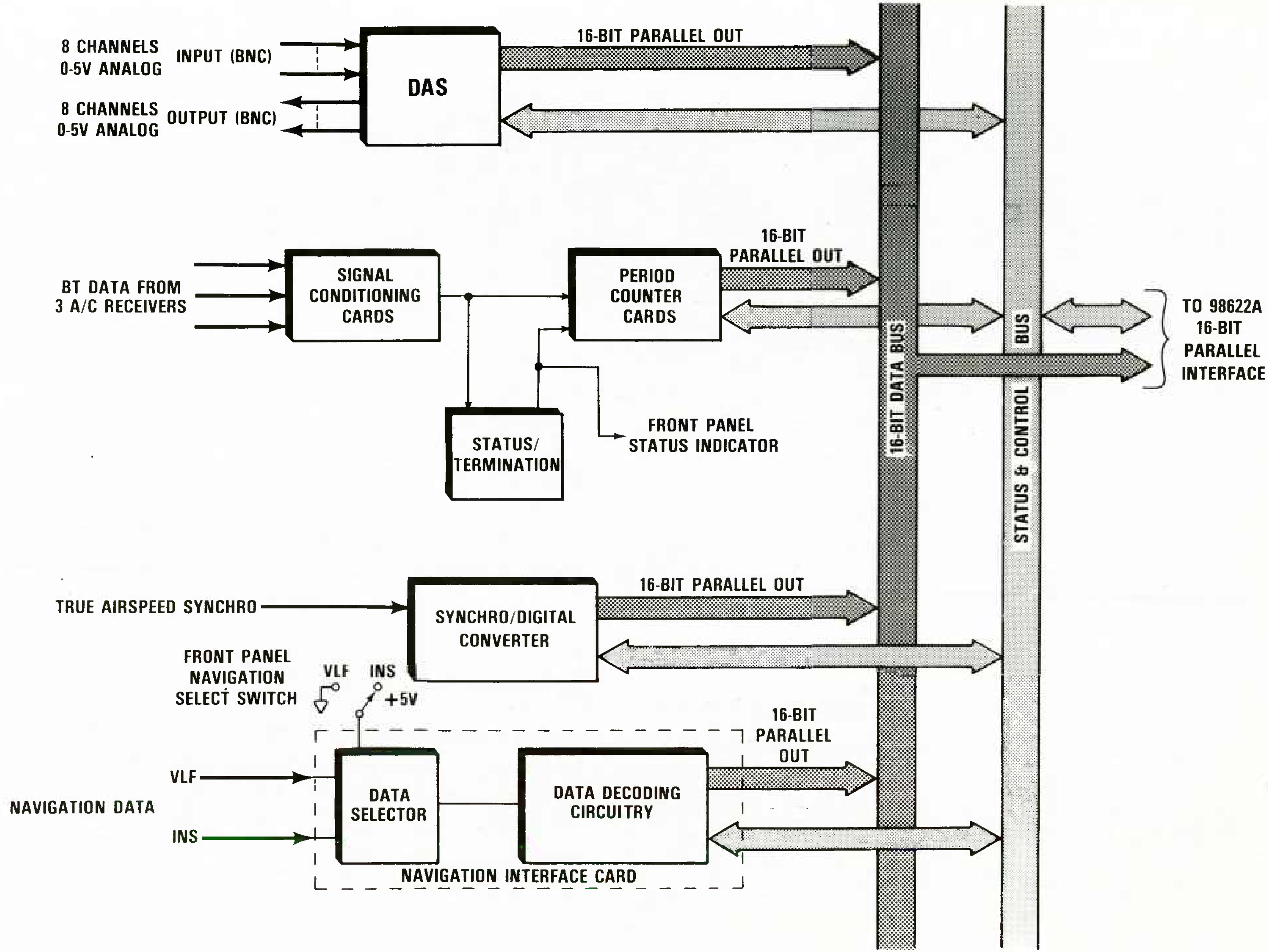


Figure 9. Data Acquisition Interface Unit Block Diagram

applied to a bandpass filter made up of high pass filter F1 and low pass filter F2. The 3db passband of this filter is approximately 1.1 KHz to 2.8 KHz. Comparator A3 triggers on the positive going slope of the signal at a threshold voltage set by R6, to produce a positive square wave output of 5 volts amplitude at the incoming signal frequency. The conditioned signal is then routed through switch S3 to the selected bus line and to the period counter circuits.

5.1.2 Period Counter Card

Refer to drawing number SN-S02A for the period counter card circuit schematic. Switches S1, S2 and S3 are preset to configure the card for operation with one of 4 possible BT data channels. All three switches must be set identically with only one of the four positions "on". Upon receipt of a peripheral control (PCTL) low level from the System Controller, the period counter card generates a peripheral flag (PFLG) high level output to acknowledge receipt of the data request. Upon receipt of a PFLG high level, the System Controller resets the PCTL line to the high state. The incoming BT signal, which has been pre-conditioned by the associated signal conditioning card, is then used to compute BT signal period in the form of a 16-bit binary count available at the data bus (DIØ-DI15). Once the period computation is complete, the period counter card brings the PFLG line low again, signaling the System Controller that there is a valid count on the data bus. At this time, the System Controller latches in the period count and stores it.

The above is a general description of the functional operation of the period counter card. What follows is a detailed description of the combinational logic used to implement the functions described above. Refer to reference signal points shown in drawing SN-S02A and in the Period Counter Timing Diagram shown in Figure 10.

The selected BT data signal is routed through buffer U4 to the clock input of flip-flop U1A. U1A, connected in the toggle mode, divides the incoming signal frequency by two, thus providing output pulses at reference points (3) and (4) which correspond to the incoming signal PERIOD. The incoming signal, (2), and the inverted signal period pulse (4) are routed to U3A whose output is used with various sections of U6 and associated RC networks to produce reset and trigger pulses at reference points (7) and (8). Upon receipt of a data request from the System Controller (PCTL goes low), reference point(5) is driven high and the next pulse at (7) is gated to the output of U3B. This resets the 16-bit counter made up of dual 4-bit counters U7 and U8, in preparation for a new period count, triggers U2B, setting (9) high. With (9) high, the next positive signal period pulse, (3), is gated through U3C to U3D. This in turn gates the 10 MHz clock from XO-1 into the U7-U8 counter, beginning the period count. The count continues as long as (3) is high, resulting in a final count proportional to the signal period. The next pulse at (8) resets both U2B and U2A which drives PFLG low again, signaling the System Controller that valid data is available on the bus at the outputs of bus drivers U9 and U10.

Just prior to requesting data, the system Controller sets control bus lines DOØ through DØ3 to a code which selects a specific period counter card. U5 decodes these lines to produce a low level on one of its 4 outputs. This low level is transferred by switch S1 (if properly set) to the enable inputs of tristate buffers U9, U10 and U11. This allows the System Controller to send and receive PCTL and PFLG control signals and access period count data from the selected card. The

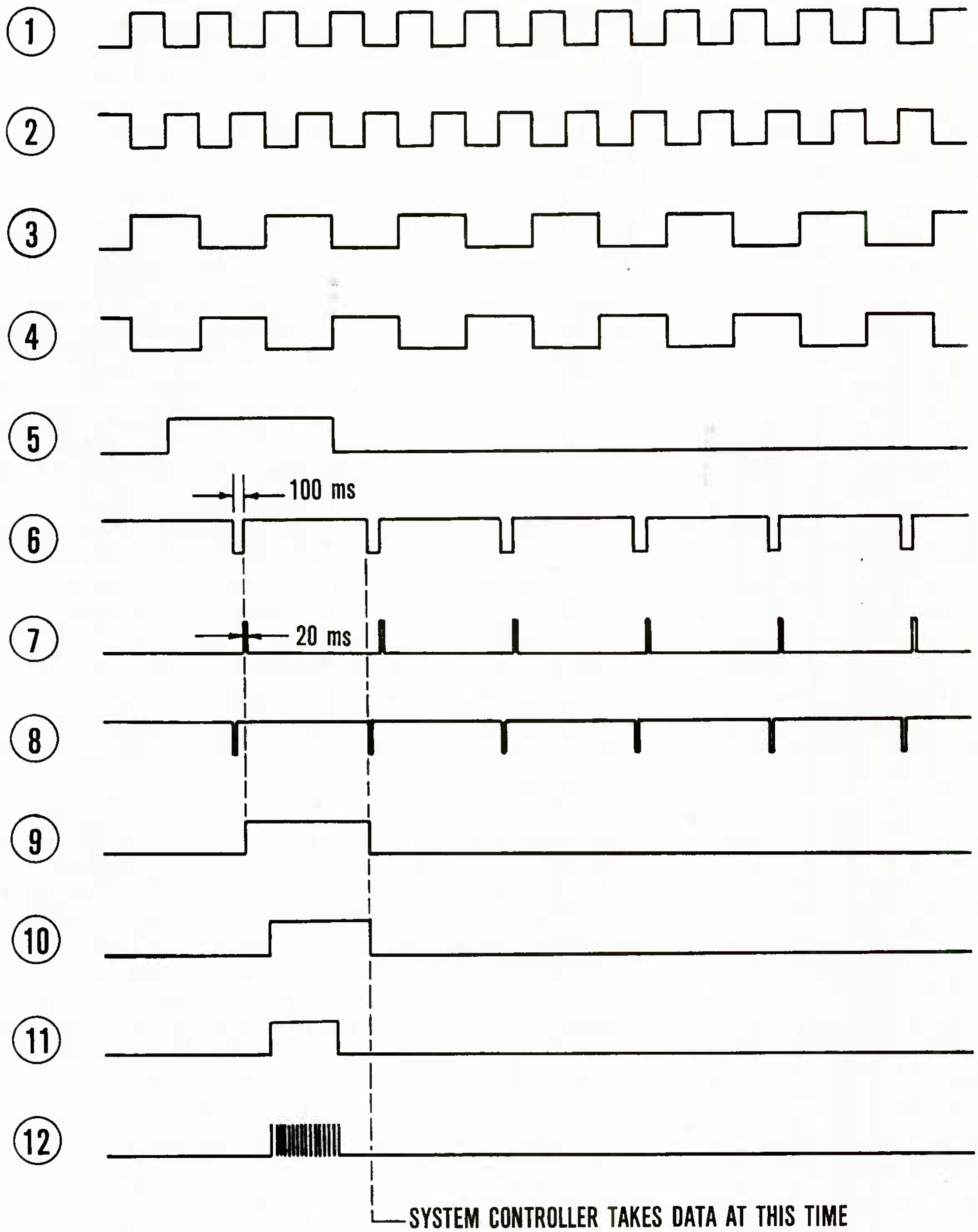


Figure 10. Period Counter Timing Diagram

System Controller also checks the BT signal status (STI-Ø) at this time to determine whether or not BT signal is being input from the associated receiver.

5.1.3 Navigation Interface Card

Refer to drawing number SN-S01A. The Navigation Interface card accepts input from either the LTN-72 inertial Navigation System or the GNS-500 VLF Navigation System, selects the latitude and longitute data words from the input and provides this information as a 24-bit word for access by the System Controller.

The VLF signal is applied to A4, a unity gain differential instrumentation amplifier used to isolate the signal and reduce common mode noise. As shown in the timing diagram of Figure 11, the output of A4, (1), is applied to a positive comparator A5, and negative compator A6. The output of A5, (2), is +5V pulses corresponding to each positive excursion of the input, (1). The output of A6, (3), is also +5V pulses, but corresponding to each negative excursion of input (1). (2) and (3) are applied to the set and reset inputs of flip flop U6, to produce an output, (4), which is an NRZ version of the incoming RZ data. (2) and (3) are also applied to U5 resulting in a signal at (5) which is the clock rate of the incoming serial data stream. (5) is applied to the input of U9A, half of a dual one shot. C9 and R21 have been selected so that the output pulse width of U9A is equal to 3 cycles of the input clock rate. The input clock continues to re-trigger U9A so that its output, (6), remains high until the input clock is absent for more than three clock cycles, a condition which occurs during the sync gap period of the input RZ data. At this time, U9A output (6) goes low signifying the end of a data word (synch pulse). The three signals which have been generated; NRZ data (4), clock, (5), and Synch, (6), are applied to Data Selector U10. If VLF is selected at the DAIU front panel these signals are selected and used for providing latitude and longitude data.

As shown in Figure 12, LTN-72 data is provided to the Navigation Interface card as three separate signals; NRZ Data, clock, and synch. These inputs are applied to A1, A2, A3 which are unity gain, differential amplifiers which serve to isolate the incoming signals and reduce common mode noise. The output of A1, A2 and A3 are applied to non-inverting buffers which act as level shifters to convert the high level input to +5V logic levels.

The data signal, (4), is applied directly to U10. Clock and Synch, (5) and (6) are applied to U5 which serves to disable the clock input to U10 whenever the synch line is low. The output of U5, (7), is input to U9B, half of a dual one shot, which functions exactly like U9A in the VLF circuits. That is, U9B senses when the clock is low for more than three clock cycles and produces a low-going synch pulse out, (8).

At this point, Data, Clock and Synch signals applied to the data selector U10 from either the LTN-72 or the VLF are identical. The position of the DAIU front panel NAV SELECT switch determines from which Navigation System Data, Clock and Synch signals will be obtained. The selected Data and Clock are applied to a 32-bit shift register made up of U11 through U14. The data is shifted into the shift register with the clock providing the necessary shift pulses. When the synch line goes low, indicating end of the 32-bit word, the clock pulses are disabled and data shifting terminates, leaving the full 32-bit word in the shift register with the 8-bits of word I.D. residing in U11 and the 24-bits of data residing in U12-U14. Occurence of the synch level also enables the latitude and longitude I.D. comparators U15-U16 and U17-U18. If the I.D. word in U11 matches the I.D. code set by

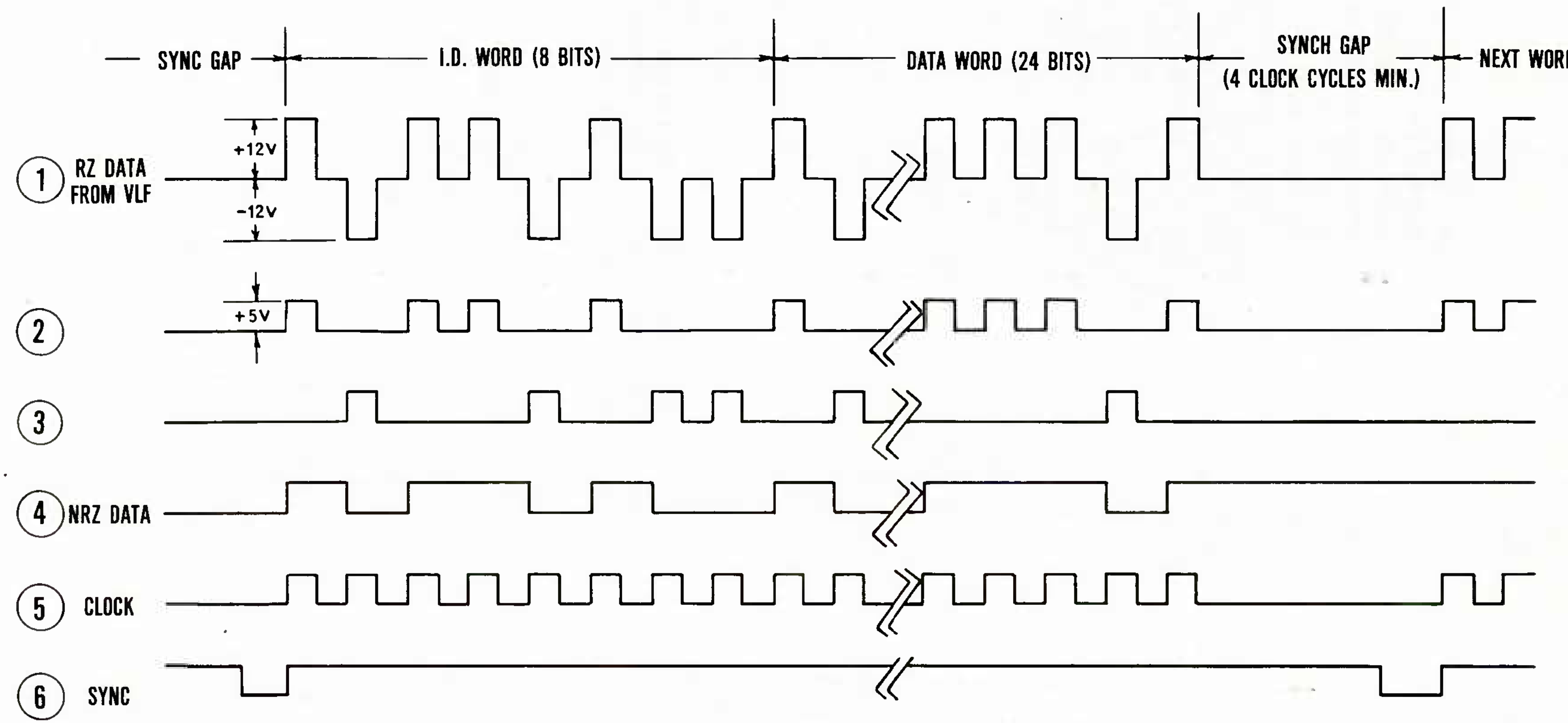


Figure 11. Navigation Interface Card - VLF Timing Diagram

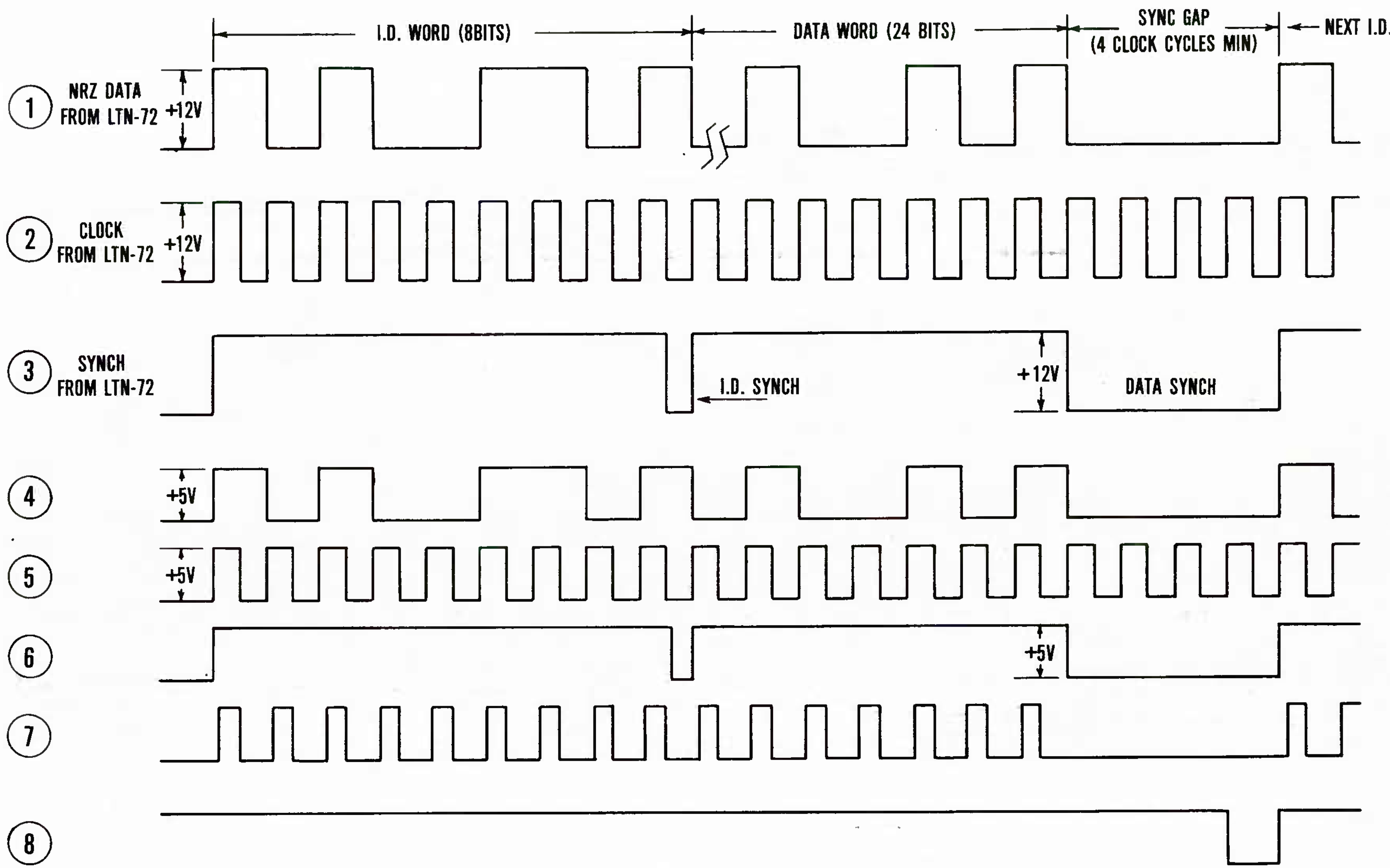


Figure 12. Navigation Interface Card - LTN-72 Timing Diagram

either S1-S2 or S3-S4, the associated comparator provides a latching pulse to the appropriate data latches (either U19-U21 or U11-U24). This latches the 24-bits of data residing in shift registers U12-U14 into the appropriate set of latches, thus updating the data available for access by the System Controller.

The System Controller receives the 24 bit latitude or longitude data as two sequential 16-bit words with the upper 8 bits always zero. To access data, the System Controller first sets control lines DOØ-DO3 to the select code for the lower 16-bits of latitude data. This provides an enable pulse to U20 and U21 which put this data onto the data bus DIØ-DI15. The System Controller then generates a PCTL data request which is inverted and sent back to the System Controller as a PFLG pulse allowing the System Controller to immediately latch and store the data on the data bus. The System Controller then changes the control code on DOØ-DO3 to enable U19 and U26 (all zero data). This puts the upper 16-bits of latitide data onto the data bus DIØ-DI15. Once again the System Controller generates PCTL, receives PFLG and stores the data. This process is repeated for accessing data using different control codes and accessing the lower 16 bits from U23, U24, and the upper 16 bits from U22, U26. It should be noted that U26 is enabled any time that either U19 or U22 are enabled and is used to provide all zeros in the upper 8 bits of the second 16-bit word accessed.

Since control line DO3 is always low any time that the System Controller is accessing navigation data, it is applied to U25 so that the latching signals from comparators U15-U16 and U17-U18 are disabled when data is being accessed, and prevents new data from being latched during this time.

5.1.4 Meteorological Data Card

Refer to drawing SN-S05A for the Meteorological Data Card Schematic diagram. The eight 0-5V analog inputs which enter through connectors on the DAIU backpanel are each routed to individual unity gain, differential amplifiers on the Meteorologial Data Card. These amplifiers, A1-A8, serve to buffer each incoming analog signal and route it back out to analog output connectors on the DAIU back panel for monitoring or recording. Each analog signal is also connected to one of the eight differential channel inputs of a DATEL HDAS-8 Data Acquisition System Module (See the manufacturer's data on this module contained in Appendix A, for further detail on module operation.)

Upon command of the System Controller, the DAS module sequentially selects each analog channel and converts its analog voltage to a 12-bit binary word available at DIØ-DI11 for System Controller access.

What follows is a description of the I/O control logic operation necessary to implement the above mentioned functions of the Meteorological Data Card. Refer to the logic timing diagram shown in Figure 13.

Prior to requesting data from the Meteorological Data Card, the System Controller sets control bus line DO 4 low which enables the internal tri-state buffers in the DAS module and tri-state buffer U1. This allows the System Controller to access the digital data from the DAS module and to send and receive I/O control signals through U1.

The System Controller next sends a peripheral reset pulse (PRESET), (1), to the trigger inputs of one shots U2A and U2B. This drives CLEAR

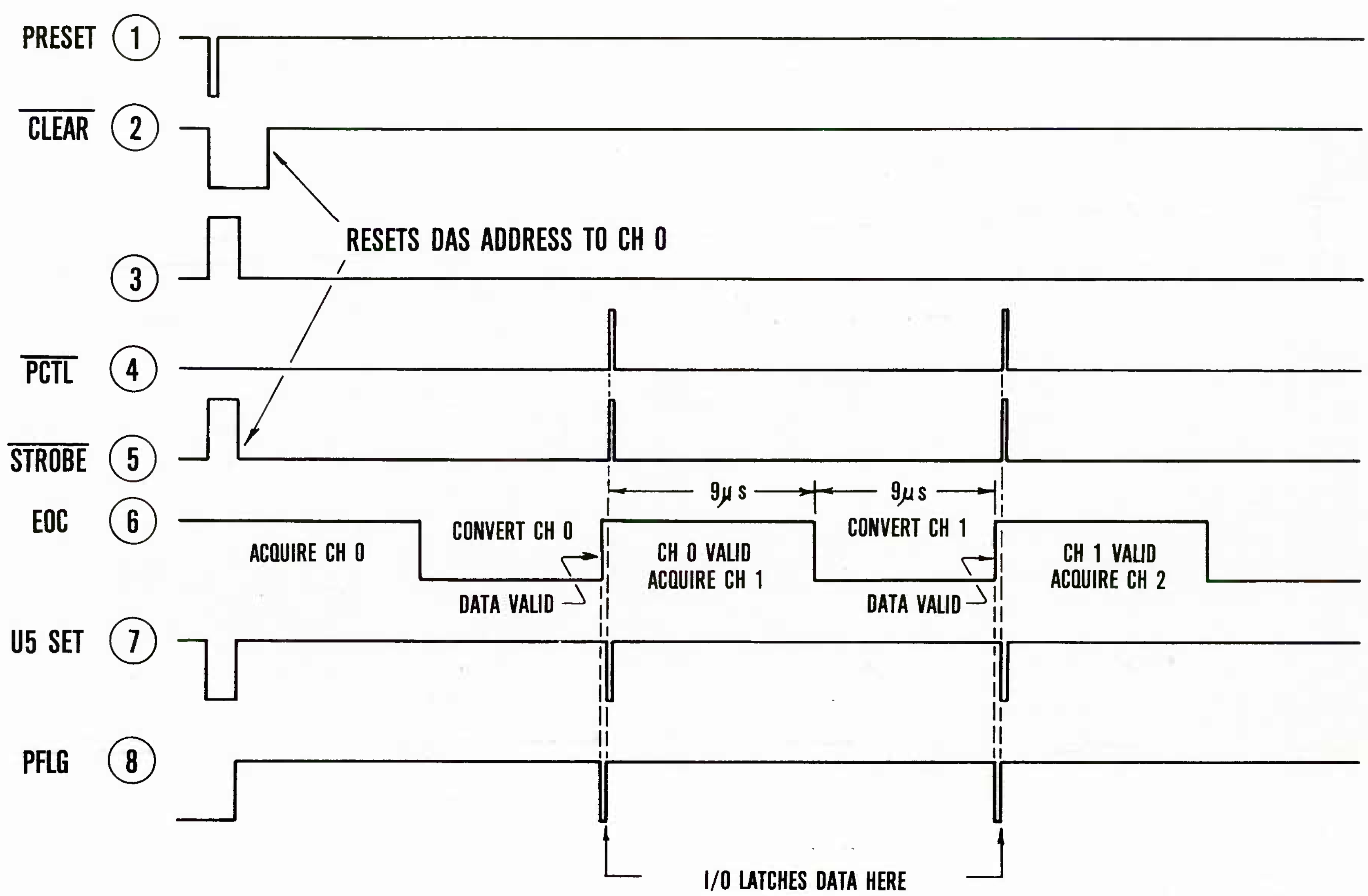


Figure 13. Timing Diagram - Meteorological Sensor Card I/O Control Logic

(2), at the DAS module low, while providing the necessary high to low transition at STROBE (5), to initiate acquisition and conversion of the first analog signal. Application of STROBE pulse while holding CLEAR in the low state resets the MUX address to channel Ø, so that the first analog signal which is acquired and converted is channel Ø. The output of U2B, (3), also serves to provide a low pulse at (7), setting the output of flip-flop U5 high and resulting in a high level at the peripheral flag (PFLG) output (8). Immediately after sending the PRESET pulse, the Systems Controller, under program control, checks the state of the PFLG line. A peripheral control (PCTL) data request is not sent until the PFLG line,(8), goes low. When conversion of the current channel is complete the DAS module generates a low to high transition at end of conversion (EOC) (6), which triggers U5, setting PFLG, (8), low. The System Controller then generates PCTL, (4), which initiates acquisition of the next channel, sets U5, and brings PFLG high again. When PFLG, (8), goes high again the System Controller drives PCTL, (4), low and takes the data on DIØ-D11. U1 assures that DI12-DI15 are always low.

The process is repeated until all eight analog channels have been acquired, converted and accessed by the System Controller.

5.1.5 True Air Speed Synchro to Digital Converter Card (TAS S/D Converter Card)

Refer to drawing number SN-S06A for the TAS S/D Converter Card schematic diagram.

The TAS S/D Converter Card provides continuous conversion of true air speed synchro data to a 12-bit digital word which, upon command of the System Controller, is placed upon the Data Bus for access by the System Controller. See the manufacturers data on the DDC SDC-19102-302 Synchro/Digital Converter contained in Appendix A for detailed information on the theory of operation of this module.

Prior to requesting data from the TAS S/D Converter Card, the System Controller drives control bus line DO-5 to the low state enabling tri-state buffers in the S/D module to place the converted data on databus lines DI-Ø through DI11. This level also enables U3 which allows the System Controller to send and receive peripheral control (PCTL) and peripheral flag (PFLG) signals to and from the S/D module for controlling the transfer of data. U3 also sets data bus lines DI12-DI15 to the low state.

The CB (count) output of the S/D module is high when updating the converted synchro signal. This provides a high level at PFLG which inhibits the System Controller from generating a PCTL data request while the S/D module is converting synchro data (This time period is 7 u sec maximum). When CB goes low, driving PFLG low, the System Controller drives PCTL low inhibiting the S/D module from converting while data is being taken. The PCTL level, inverted, also drives the PFLG line high again acknowledging the data request. When the System Controller sees PFLG go high, PCTL is reset to high level driving PFLG low and signaling the System Controller that valid data is on the data bus. The System Controller then accepts the data and stores it. This procedure repeats each time the System Controller accesses the TAS S/D Converter Card.

5.1.6 Status/Termination Card

Refer to drawing number SN-S04A for the Status/Termination Card schematic diagram.

The Status/Termination Card checks the output of each of the AXBT channel Signal Conditioning Cards to determine if a valid BT signal is present, and, if so, generates a status level for access by the System Controller. This card also provides proper termination of all control bus lines coming from the System Controller. This termination is required for proper operation, since the System Controller 16-bit I/O provides open collector outputs on all control lines.

U1 and U2 are dual one-shots whose output pulse period is set such that an incoming signal whose period is less than the one-shot output period will continuously retrigger the one-shot resulting in a continuous high level at its output. This indicates to the System Controller that a BT signal is available on that channel. If there is no signal being input to the BT channel, or if the incoming signal is outside the passband of the Signal Conditioning Card bandpass filter (Invalid) then no signal will appear to retrigger the associated one-shot and its output will be low, indicating to the System Controller that no valid BT signal is present. The System Controller checks this status line prior to each sample of a BT channel. (See section 5.1.2 Period Counter Card).

6.0 SYSTEM MAINTENANCE

6.1 PREVENTIVE MAINTENANCE

Although no formal schedule of preventive maintenance procedures is required, the system should be periodically inspected for loose connectors and printed circuit cards, cable chafing and/or deterioration, and for any foreign material which may be blocking cooling air intakes.

In addition, a periodic operational checkout should be performed to verify that the AXBT and analog data circuits of the DAIU are performing within specified accuracy limits.

Accuracy checks may be performed by applying known inputs to the AXBT, Analog, Navigation and True Airspeed circuits and using the "SYS_CHECK" program (see section 4.2.2.1) to observe the signal values obtained by the DAIU. Values displayed by the "SYS_CHEK" program should be within the accuracy specifications listed in section 1.3, item 9. The following sections provide instructions for accuracy checking and adjustment of each of the DAIU data circuits.

6.1.1 Navigation Data Accuracy Check

The navigation inputs should be set to a known position by manually setting both LTN-72 systems and the GNS-500 system to a known position. If possible, each system should be set to a different position.

The DAIU should be switched alternately to VLF and INS using the front panel NAV SELECT switch. In each switch position, the position displayed on the CRT should agree with that shown on the Navigator's station display to within ±0.1 minute on both latitude and longitude.

With the DAIU NAV SELECT switch in INS position, cycle the butler switch at the navigator's station to select the alternate LTN-72 system and check the displayed position as described above.

If the displayed position is not within accuracy limits, take corrective maintenance action (see section 6.2). No calibration adjustments are available in the Navigation Interface circuit.

6.1.2 Analog Circuits Accuracy Check

All eight analog inputs should be set to a known voltage by applying an accurate (accurate to ±.0005 volts) source of voltage to the analog input connectors on the back of the DAIU. Ideally, accuracy should be checked at 0.0 volts, 2.5 volts and 5.0 volts input. The voltage displayed on the CRT for each analog channel by the "SYS_CHEK" program should be within ±0.005V of the known input. Each of the analog outputs at the back of the DAIU should be checked with an accurate volt meter and should also be within ±0.005 volts of the known input.

If voltages displayed on the CRT are inaccurate, the input connector for analog channel 1 should be shorted and connected to the circuit ground terminal at the back of the DAIU. This will apply an input of zero volts. The offset voltage adjustment on the Meteorological Data Card should now be adjusted to obtain a displayed channel 1 voltage of 0.0 volts ±0.001 volt.

The channel 1 input connector should now be connected to an accurate 5.0 VDC source (the low side of the source should be grounded to circuit ground terminal). The gain adjustment on the Meteorological Data Card should now be adjusted to obtain a displayed channel 1 voltage of 5.0 volts ±0.002 volts. Recheck accuracy of all channels.

If the above adjustments cannot be made or do not result in accurate readings on all channels, the Meteorological Data Card may be defective and should be replaced.

The only adjustment for the analog outputs is the offset voltage adjustment at each buffer amplifier A1-A8 (see drawing SN-S05A). If any of the analog outputs are inaccurate, the offset voltage adjust for that channel should be set by grounding the input as described above and adjusting the offset pot for that channel to obtain a zero voltage reading at the associated analog output connector. It should be noted that the analog outputs are only for external monitoring of the input signals and the associated buffer amplifiers do not affect in any way the accuracy of the voltage seen by the System Controller.

6.1.3 True Airspeed Accuracy Check

Accuracy check of the true airspeed circuits should ideally be done while the aircraft is in flight, since application of simulated true airspeed synchro signals in extremely difficult. There are no calibration adjustments on the true airspeed circuits. Therefore, if displayed readings do not agree with those displayed at the navigator's station within ±1.0 knot, a defective TAS card should be suspected.

6.1.4 AXBT Circuits Accuracy Check

The AXBT checkout portion of the "SYS_CHEK" program displays temperature and frequency for each AXBT channel. An accurate frequency source should be used to supply simulated AXBT signals to each of the AXBT channels. This source should ideally modulate a RF generator set to the channel frequency of the associated receivers. The frequency signal displayed by the CRT should agree with the known modulation frequency source to within ±0.5 Hz. No calibration adjustment is available for the AXBT circuits. If displayed frequency is inaccurate, a defective signal conditioning card or period counter card for the inaccurate channel must be suspected.

6.2 CORRECTIVE MAINTENANCE

Most system malfunctions can be isolated to the subsystem level (DAIU, printer, etc.) by utilizing the system checkout software provided.

Once the malfunction has been isolated to the subsystem level, information provided in the following sections may be used to further identify and correct the problem.

6.2.1 DAIU Malfunctions

DAIU malfunctions can usually be isolated to the card level by utilizing the "SYS-CHEK" program. (See section 4.2.2) This program allows individual checking of the BT data interface, Navigation Interface, Analog data interface and true airspeed interface.

Once the problem is isolated to card level (i.e. BT interface, channel 1), the first step should be to check the external inputs to assure that the proper input is present. Reference should be made to the Theory of Operation, section 5.0 to determine what signal should be present. If the proper input signal is present, spare cards should be properly configured and substituted for the suspected defective cards (i.e. BT Analog Signal Conditioning Card and period Counter Card). This should correct the problem, and the defective cards can later be repaired.

If "SYS-CHEK" indicates that none of the DAIU interface cards are responding, the problem may be due to either a defective DAIU power supply or a defective HP 98622A 16-bit I/O. If a defective I/O is suspected refer to the HP manuals for maintenance procedures.

To check the DAIU Power Supplies use a voltmeter to test voltages at the output terminals of each supply (See drawing SN-S08A). If a defective power supply is found it should be removed and replaced with a spare unit. Figure 14 shows how to disassemble the bottom cover of the DAIU to remove and replace the power supplies.

CAUTION: When replacing power supplies pay very close attention to polarity and wire color codes.

Repair of defective DAIU cards can be accomplished using the Theory of Operation, Section 5.0 and associated timing diagrams and schematic diagrams.

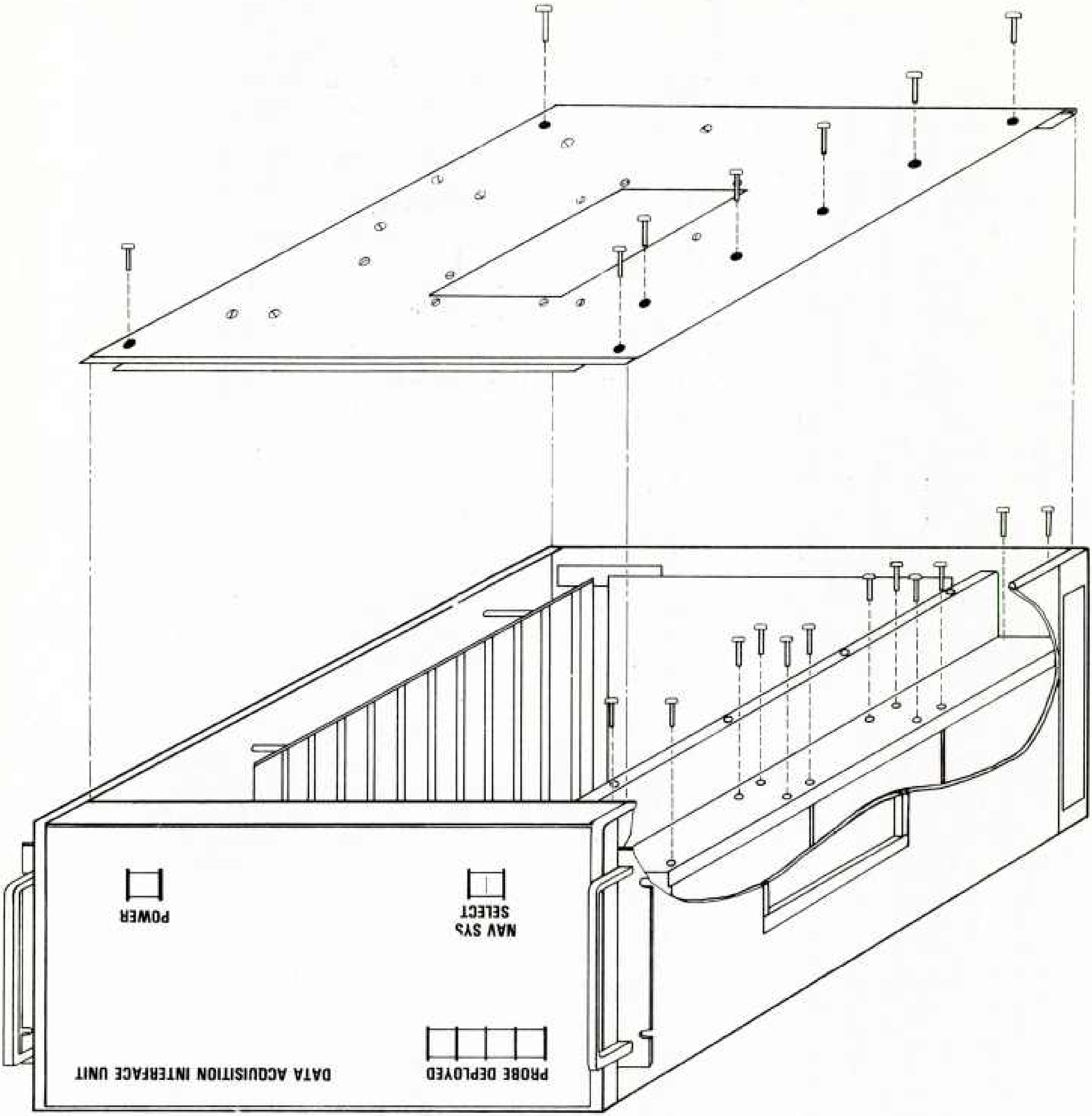


Figure 14. ADAPS Computer Interface Unit Disassembly Procedures

6.2.2 Hewlett-Packard Subsystem Malfunctions

In the event of a malfunction of the HP 9836A System Controller, its associated HP 98622A 16-bit interfaces or the HP 2673A printer or HP 9884 paper tape punch, refer to the corrective maintenance information contained in the appropriate Hewlett-Packard manuals provided with ADAPS.

If satisfactory correction of the problem is not obtained, contact an area Hewlett-Packard representative for repairs or consultation.

6.2.3 Dylon Recording System Malfunction

The Dylon Model 1015B controller and tape transport system are provided with a comprehensive operation and service manual. In the event of failure, refer to these manuals for user seviceable maintenance and troubleshooting procedures. If satisfactory results are not obtained, contact the Dylon Corporation.

7.0 SOFTWARE PROGRAMS

"BT_DATA"

```
10 OPTION BASE 1
20 INTEGER Bt,Type,Flight,G(1:12480),Bt1,Bt2,Bt3,Control,Month,D
ay,Year
30 FOR I=1 TO 40
40 PRINT TABXY(26,8);" DATA ACQUISITION PROGRAM "
50 PRINT TABXY(I+18,8);"*";
60 NEXT I
70 PRINT
80 FOR I=1 TO 10
90 PRINT TABXY(19,I+8);"*";
100 FOR J=1 TO 38
110 PRINT " ";
120 NEXT J
130 PRINT "*"
140 NEXT I
150 FOR I=1 TO 40
160 PRINT TABXY(I+18,19);"*";
170 NEXT I
180 PRINT
190 PRINT TABXY(28,12);" ENTER MONTH (MM) AND  "
200 PRINT TABXY(26,13);"     PRESS CONTINUE    "
210 INPUT Month
220 PRINT TABXY(28,12);"  ENTER DAY (DD) AND   "
230 PRINT TABXY(26,13);"     PRESS CONTINUE    "
240 INPUT Day
250 PRINT TABXY(28,12);" ENTER YEAR (YY) AND   "
260 PRINT TABXY(26,13);"     PRESS CONTINUE    "
270 INPUT Year
280 PRINT TABXY(0,1);
290 PRINT USING "AAAAA,2X,ZZ,1X,ZZ,1X,ZZ";"DATE:",Month,Day,Year
300 PRINT TABXY(28,12);"ENTER FLIGHT NUMBER AND"
310 PRINT TABXY(26,13);"     PRESS CONTINUE       "
320 INPUT Flight
330 PRINT TABXY(0,2);"FLIGHT NUMBER:";Flight;"    "
340 PRINT TABXY(27,12);"ENTER FIRST BT NUMBER AND"
350 PRINT TABXY(26,13);"     PRESS CONTINUE       "
360 INPUT Bt
370 PRINT TABXY(0,3);"FIRST BT NUMBER:";Bt;"    "
380 PRINT TABXY(26,12);"      ENTER BT TYPE          "
390 PRINT TABXY(26,13);"(1=SHALLOW,2=DEEP,3=MIXED)"
400 PRINT TABXY(28,14);" AND PRESS CONTINUE   "
410 INPUT Type
420 IF Type=1 THEN 470
430 IF Type=2 THEN 490
440 IF Type=3 THEN 510
450 BEEP 1000,.5
460 GOTO 380
470 PRINT TABXY(0,4);"BT TYPE: 'SHALLOW'"
```

```
480 GOTO 520
490 PRINT TABXY(0,4);"BT TYPE: 'DEEP'   "
500 GOTO 520
510 PRINT TABXY(0,4);"BT TYPE: 'MIXED'  "
520 PRINT TABXY(28,14);"                              "
530 BEEP 1000,.5
540 PRINT TABXY(27,12);" ALL DISPLAYED INFO OK?? "
550 PRINT TABXY(26,13);"                              "
560 INPUT Info$
570 IF Info$="Y" OR Info$="YES" THEN 610
580 IF Info$="N" OR Info$="NO" THEN 190
590 GOTO 530
610 PRINT TABXY(30,11);"                         "
620 PRINT TABXY(26,12);"WILL THIS BE A NEW TAPE? "
630 PRINT TABXY(26,13);"                             "
640 PRINT TABXY(24,15);"                                   "
650 INPUT Tape$
660 IF Tape$="Y" OR Tape$="YES" THEN 790
670 IF Tape$="N" OR Tape$="NO" THEN 700
680 BEEP 1000,.5
690 GOTO 620
700 OUTPUT 70401;"RW"
710 GOSUB Rewind_fin
720 OUTPUT 70401;"SF32000"
730 GOSUB Com_ready
740 ENTER 70403;P1,P2
750 IF BIT(P1,2)=0 THEN 740
760 GOSUB Com_ready
770 OUTPUT 70401;"SF1,1"
780 GOTO 930
790 PRINT TABXY(30,11);"NEW TAPE SELECTED"
800 PRINT TABXY(26,12);"ALL PREVIOUS DATA WILL BE"
810 PRINT TABXY(26,13);"      DESTROYED!!!       "
820 BEEP 1000,.5
830 PRINT TABXY(24,15);CHR$(131);"ARE YOU SURE ITS A NEW TAPE??"
;CHR$(128)
840 INPUT Tape$
850 IF Tape$="Y" OR Tape$="YES" THEN 890
860 IF Tape$="N" OR Tape$="NO" THEN 610
870 BEEP 1000,.5
880 GOTO 790
890 OUTPUT 70401;"RW"
900 GOSUB Rewind_fin
910 OUTPUT 70401;"WF"
920 GOSUB Com_ready
930 OUTPUT 70401;"ED,12,0;WR1"
940 OUTPUT 70402 USING "#,W";Month,Day,Year,Flight,Type,Bt
950 GOSUB Com_ready
```

```
960 OUTPUT 70401;"ED,10576,0"
970 OUTPUT 2 USING "#,B";255,75
980 GRAPHICS ON
990 GINIT
1000 VIEWPORT 0,131,8.100
1010 CSIZE 3.5,.6
1020 OFF KEY
1030 ASSIGN @Path6 TO "GRID800"
1040 ASSIGN @Path7 TO "GRID400"
1050 IF Type=1 THEN 1120
1060 ENTER @Path6;G(*)
1070 Max1=5288
1080 Max2=5289
1090 Bt_no=74
1100 WINDOW -7,105,-810,120
1110 GOTO 1180
1120 ENTER @Path7;G(*)
1130 Max1=2648
1140 Max2=2649
1150 Pointer=5294
1160 Bt_no=37
1170 WINDOW -7,105,-405,60
1180 GLOAD G(*)
1190 LINE TYPE 1
1200 INTEGER I,J,X
1210 J=8
1220 DIM Depth(5288)
1230 FOR U=0 TO 528 STEP .1
1240 Depth(J)=-1.5926*U
1250 J=J+1
1260 NEXT U
1270 Launch_flg1=0
1300 Plot1=9
1310 Plot2=9
1320 Plot3=9
1330 Sub1=0
1340 Sub2=0
1350 Sub3=0
1360 Start1=0
1370 Start2=0
1380 Start3=0
1390 Count1=0
1400 Count2=0
1410 Count3=0
1420 Met_id=7000
1430 MOVE 0,0
1440 INTEGER A(1:5288) BUFFER,B(1:5288) BUFFER,C(1:5288) BUFFER,
M(1:30000) BUFFER
```

```
1450 DIM D(5289),E(5289),F(5289)
1460 ASSIGN @Path1 TO BUFFER A(*);WORD
1470 ASSIGN @Path2 TO BUFFER B(*);WORD
1480 ASSIGN @Path3 TO BUFFER C(*);WORD
1490 ASSIGN @Path4 TO 12;WORD
1500 ASSIGN @Path5 TO 70402
1510 ASSIGN @Path6 TO BUFFER M(*);WORD
1520 MAT M= (0)
1530 OUTPUT @Path6 USING "#,W";Met_id
1540 MAT A= (0)
1550 MAT B= (0)
1560 MAT C= (0)
1570 Sample1=9
1580 Sample2=9
1590 Sample3=9
1600 BEEP 1000,.5
1610 ON KEY 0 LABEL "LAUNCH#1" GOSUB Launch1
1620 ON KEY 2 LABEL "LAUNCH#2" GOSUB Launch2
1630 ON KEY 4 LABEL "LAUNCH#3" GOSUB Launch3
1640 ON KEY 5 LABEL "/ABORT BT#1" GOSUB No_key
1650 ON KEY 15 GOSUB Abort1
1660 ON KEY 7 LABEL "/ABORT BT#2" GOSUB No_key
1670 ON KEY 17 GOSUB Abort2
1680 ON KEY 9 LABEL "/ABORT BT#3" GOSUB No_key
1690 ON KEY 19 GOSUB Abort3
1700 ON KEY 8 LABEL "/END SURVEY" GOSUB No_key
1710 ON KEY 18 GOTO Terminate
1720 ON KEY 1 GOSUB No_key
1721 ON KEY 3 GOSUB No_key
1722 ON KEY 6 GOSUB No_key
1730 CONTROL 12;32
1740 GOSUB Metdata
1750 ON CYCLE .1,15 GOSUB Btdata
1760 IF Sample1>Max1 THEN Transfer1
1770 IF Sample2>Max1 THEN Transfer2
1780 IF Sample3>Max1 THEN Transfer3
1781 IF Rstrt1=1 THEN GOSUB Restart1
1782 IF Rstrt2=1 THEN GOSUB Restart2
1783 IF Rstrt3=1 THEN GOSUB Restart3
1790 GOTO 1760
1800 !
1810 Btdata: LINE TYPE 1
1820 IF Start1=0 OR Sample1>Max1 THEN 2120
1830 CONTROL 12,3;15
1840 STATUS 12,5;Stio1
1850 IF BIT(Stio1,0) THEN 2090
1860 ON TIMEOUT 12,.005 GOTO 1900
1870 ENTER @Path4 USING "#,W";A(Sample1)
```

```
1880 IF A(Sample1)>6945 OR A(Sample1)<3700 THEN 1900
1890 GOTO 1920
1900 D(Sample1)=-5
1910 GOTO 1930
1920 D(Sample1)=((1/(A(Sample1)*1.E-7))-1440)/36
1930 IF Sample1=9 THEN 1950
1940 Sub1=10
1950 IF Sample1=Plot1 THEN 1970
1960 GOTO 2020
1970 IF D(Sample1)=-5 OR D(Sample1-Sub1)=-5 THEN 2010
1980 MOVE D(Sample1-Sub1),Depth(Sample1-Sub1)
1990 PEN 1
2000 DRAW D(Sample1),Depth(Sample1)
2010 Plot1=Plot1+10
2020 Sample1=Sample1+1
2030 GOTO 2120
2040 BEEP 1000,.5
2050 Start1=0
2060 STATUS 12,3;Status
2070 PRINT TABXY(1,12);"INTERFACE DOWN!",Status,Control
2080 GOTO 2120
2090 IF Sample1=9 THEN 2120
2100 IF Sample1>19 THEN 1900
2110 Rstrt1=1
2120 IF Start2=0 OR Sample2>Max1 THEN 2410
2130 CONTROL 12,3;14
2140 STATUS 12,5;Stio2
2150 IF BIT(Stio2,0) THEN 2380
2160 ON TIMEOUT 12,.005 GOTO 2200
2170 ENTER @Path4 USING "#,W";B(Sample2)
2180 IF B(Sample2)>6945 OR B(Sample2)<3700 THEN 2200
2190 GOTO 2220
2200 E(Sample2)=0
2210 GOTO 2230
2220 E(Sample2)=((1/(B(Sample2)*1.E-7))-1440)/36
2230 IF Sample2=9 THEN 2250
2240 Sub2=10
2250 IF Sample2=Plot2 THEN 2270
2260 GOTO 2320
2270 IF E(Sample2)=0 OR E(Sample2-Sub2)=0 THEN 2310
2280 MOVE (E(Sample2-Sub2)+35),Depth(Sample2-Sub2)
2290 PEN 1
2300 DRAW (E(Sample2)+35),Depth(Sample2)
2310 Plot2=Plot2+10
2320 Sample2=Sample2+1
2330 GOTO 2410
2340 BEEP 1000,.5
2350 Start2=0
```

```
2360 PRINT TABXY(30,12);"INTERFACE DOWN!"
2370 GOTO 2410
2380 IF Sample2=9 THEN 2410
2390 IF Sample2>19 THEN 2200
2400 Rstrt2=1
2410 IF Start3=0 OR Sample3>Max1 THEN 2700
2420 CONTROL 12,3;13
2430 STATUS 12,5;Stio3
2440 IF BIT(Stio3,0) THEN 2670
2450 ON TIMEOUT 12,.005 GOTO 2490
2460 ENTER @Path4 USING "#,W";C(Sample3)
2470 IF C(Sample3)>6945 OR C(Sample3)<3700 THEN 2490
2480 GOTO 2510
2490 F(Sample3)=0
2500 GOTO 2520
2510 F(Sample3)=((1/(C(Sample3)*1.E-7))-1440)/36
2520 IF Sample3=9 THEN 2540
2530 Sub3=10
2540 IF Sample3=Plot3 THEN 2560
2550 GOTO 2610
2560 IF F(Sample3)=0 OR F(Sample3-Sub3)=0 THEN 2600
2570 MOVE (F(Sample3-Sub3)+70),Depth(Sample3-Sub3)
2580 PEN 1
2590 DRAW (F(Sample3)+70),Depth(Sample3)
2600 Plot3=Plot3+10
2610 Sample3=Sample3+1
2620 GOTO 2700
2630 BEEP 1000,.5
2640 Start3=0
2650 PRINT TABXY(65,12);"INTERFACE DOWN!"
2660 GOTO 2700
2670 IF Sample3=9 THEN 2700
2680 IF Sample3>19 THEN 2490
2690 Rstrt3=1
2700 IF X1=0 THEN 2720
2701 PEN -1
2710 MOVE D(X1-10),Depth(X1-10)
2720 IF X2=0 THEN 2740
2721 PEN -1
2730 MOVE (E(X2-10)+35),Depth(X2-10)
2740 IF X3=0 THEN 2760
2741 PEN -1
2750 MOVE (F(X3-10)+70),Depth(X3-10)
2760 IF X4=0 THEN 2790
2770 MOVE 0,X4
2780 LINE TYPE 3
2790 CONTROL 12,3;Control
2800 RETURN
```

```
2810 !
2820 !
2830 Abort1: X1=11
2840         Start1=0
2850         FOR X1=19 TO Sample1 STEP 10
2860         IF D(X1)=0 OR D(X1-10)=0 THEN 2900
2870         MOVE D(X1-10),Depth(X1-10)
2880         PEN -1
2890         DRAW D(X1),Depth(X1)
2900         NEXT X1
2910         X1=0
2930         PEN 1
2940         MOVE 0,0
2950         DRAW 35,0
2960         FOR X4=-50 TO -800 STEP -50
2970         MOVE 0,X4
2980         LINE TYPE 3
2990         DRAW 105,X4
3000         NEXT X4
3010         X4=0
3020         Sample1=9
3030         Plot1=9
3040         Sub1=0
3041         IF Rstrt1=1 THEN 3051
3050         MAT A= (0)
3051         Rstrt1=0
3060         PEN -1
3070         MOVE 5,Bt_no
3080         LABEL Bt1
3081         MOVE 19,Bt_no
3082         LABEL T1$
3090         PEN 1
3091         IF Launch_flg1=0 THEN 3100
3092         GOSUB Launch1
3093         GOTO 3110
3100         ON KEY 0 LABEL "LAUNCH#1" GOSUB Launch1
3110         RETURN
3120 Abort2: X2=11
3130         Start2=0
3140         FOR X2=19 TO Sample2 STEP 10
3150         IF E(X2)=0 OR E(X2-10)=0 THEN 3190
3160         MOVE (E(X2-10)+35),Depth(X2-10)
3170         PEN -1
3180         DRAW (E(X2)+35),Depth(X2)
3190         NEXT X2
3200         X2=0
3220         PEN 1
3230         MOVE 35,0
```

```
3240          DRAW 70,0
3250          FOR X4=-50 TO -800 STEP -100
3260          MOVE 0,X4
3270          LINE TYPE 3
3280          DRAW 105,X4
3290          NEXT X4
3300          X4=0
3310          Sample2=9
3320          Plot2=9
3330          Sub2=0
3331          IF Rstrt2=1 THEN 3341
3340          MAT B= (0)
3341          Rstrt2=0
3350          PEN -1
3360          MOVE 40,Bt_no
3370          LABEL Bt2
3371          MOVE 55,Bt_no
3372          LABEL T2$
3380          PEN 1
3381          IF Launch_flg2=0 THEN 3390
3382          GOSUB Launch2
3383          GOTO 3400
3390          ON KEY 2 LABEL "LAUNCH#2" GOSUB Launch2
3400          RETURN
3410 Abort3:  X3=11
3420          Start3=0
3430          FOR X3=19 TO Sample3 STEP 10
3440          IF F(X3)=0 OR F(X3-10)=0 THEN 3480
3450          MOVE (F(X3-10)+70),Depth(X3-10)
3460          PEN -1
3470          DRAW (F(X3)+70),Depth(X3)
3480          NEXT X3
3490          X3=0
3510          PEN 1
3520          MOVE 70,0
3530          DRAW 105,0
3540          FOR X4=-50 TO -800 STEP -50
3550          MOVE 0,X4
3560          LINE TYPE 3
3570          DRAW 105,X4
3580          NEXT X4
3590          X4=0
3600          Sample3=9
3610          Plot3=9
3620          Sub3=0
3621          IF Rstrt3=1 THEN 3631
3630          MAT C= (0)
3631          Rstrt3=0
```

```
3640          PEN -1
3650          MOVE 75,Bt_no
3660          LABEL Bt3
3661          MOVE 90,Bt_no
3662          LABEL T3$
3670          PEN 1
3671          IF Launch_flg3=0 THEN 3680
3672          GOSUB Launch3
3673          GOTO 3690
3680          ON KEY 4 LABEL "LAUNCH#3" GOSUB Launch3
3690          RETURN
3700 !
3710 !
3720 Start1: Start1=1
3730          ON KEY 0 LABEL "LAUNCH/STOP #1" GOSUB Second1
3731          ON KEY 10 GOSUB Stop1
3740          RETURN
3750 Start2: Start2=1
3760          ON KEY 2 LABEL "LAUNCH/STOP #2" GOSUB Second2
3761          ON KEY 12 GOSUB Stop2
3770          RETURN
3780 Start3: Start3=1
3790          ON KEY 4 LABEL "LAUNCH/STOP #3" GOSUB Second3
3791          ON KEY 14 GOSUB Stop3
3800          RETURN
3810 !
3820 !
3830 Restart1: GOSUB Abort1
3840            LINE TYPE 1
3850            MOVE 5,Bt_no
3860            LABEL Bt1
3861            MOVE 19,Bt_no
3862            LABEL T1$
3870            Start1=1
3880            ON KEY 0 LABEL "LAUNCH/STOP #1" GOSUB Second1
3881            ON KEY 10 GOSUB Stop1
3890            RETURN
3900 Restart2: GOSUB Abort2
3910            LINE TYPE 1
3920            MOVE 40,Bt_no
3930            LABEL Bt2
3931            MOVE 55,Bt_no
3932            LABEL T2$
3940            Start2=1
3950            ON KEY 2 LABEL "LAUNCH/STOP #2" GOSUB Second2
3951            ON KEY 12 GOSUB Stop2
3960            RETURN
3970 Restart3: GOSUB Abort3
```

```
3980            LINE TYPE 1
3990            MOVE 75,Bt_no
4000            LABEL Bt3
4001            MOVE 90,Bt_no
4002            LABEL T3$
4010            Start3=1
4020            ON KEY 4 LABEL "LAUNCH/STOP #3" GOSUB Second3
4021            ON KEY 14 GOSUB Stop3
4030            RETURN
4040 !
4050 !
4060 Stop1: Sample1=Max2
4070        RETURN
4080 Stop2: Sample2=Max2
4090        RETURN
4100 Stop3: Sample3=Max2
4110        RETURN
4120 !
4130 !
4140 Transfer1:  CONTROL @Path1,4;10576
4150             OUTPUT 70401;"WR1"
4160             TRANSFER @Path1 TO @Path5
4170             GOSUB Abort1
4180             GOTO 1760
4190 Transfer2:  CONTROL @Path2,4;10576
4200             OUTPUT 70401;"WR1"
4210             TRANSFER @Path2 TO @Path5
4220             GOSUB Abort2
4230             GOTO 1760
4240 Transfer3:  CONTROL @Path3,4;10576
4250             OUTPUT 70401;"WR1"
4260             TRANSFER @Path3 TO @Path5
4270             GOSUB Abort3
4280             GOTO 1760
4290 Terminate:  GOSUB Com_ready
4300             OUTPUT 70401;"ED,6000,0;WR10"
4310             CONTROL @Path6,4;60000
4320             TRANSFER @Path6 TO @Path5;WAIT
4330             OUTPUT 70401;"WF"
4340             GOSUB Com_ready
4350             OUTPUT 70401;"WF"
4360             GOSUB Com_ready
4370             OUTPUT 2 USING "#,B";255,75
4380             GCLEAR
4390             PRINT TABXY(24,12);"ACQUISITION TERMINATED!"
4400             GOTO 5634
4410 Launch1:    IF Launch_flg1=0 THEN 4420
4413             Bt1=Bt1_sec
```

```
4414             T1$=T1_sec$
4416             GOTO 4430
4420             Bt1=Bt
4421             Bt=Bt+1
4422             T1$=TIME$(TIMEDATE)
4430             LORG 2
4431             LINE TYPE 1
4440             MOVE 5,Bt_no
4450             LABEL Bt1
4460             MOVE 19,Bt_no
4470             LABEL T1$
4472             A(1)=Bt1
4480             A(2)=VAL(T1$[1,2])
4490             A(3)=VAL(T1$[4,5])
4500             A(4)=VAL(T1$[7,8])
4501             IF Launch_flg1=1 THEN 4623
4510             Control=11
4520             CONTROL 12,3;11
4530             ENTER @Path4 USING "#,W";A(5)
4540             Control=10
4550             CONTROL 12,3;10
4560             ENTER @Path4 USING "#,W";A(6)
4570             Control=9
4580             CONTROL 12,3;9
4590             ENTER @Path4 USING "#,W";A(7)
4600             Control=8
4610             CONTROL 12,3;8
4620             ENTER @Path4 USING "#,W";A(8)
4621             GOTO 4630
4623             A(5)=Pos1_5
4624             A(6)=Pos1_6
4625             A(7)=Pos1_7
4626             A(8)=Pos1_8
4627             Launch_flg1=0
4630             ON KEY 0 LABEL "START BT#1" GOSUB Start1
4640             Control=0
4650             CONTROL 12,3;0
4660             RETURN
4670 Launch2:    IF Launch_flg2=0 THEN 4680
4671             Bt2=Bt2_sec
4672             T2$=T2_sec$
4674             GOTO 4690
4680             Bt2=Bt
4681             Bt=Bt+1
4682             T2$=TIME$(TIMEDATE)
4690             LORG 2
4691             LINE TYPE 1
4700             MOVE 40,Bt_no
```

```
4710           LABEL Bt2
4711           MOVE 55,Bt_no
4712           LABEL T2$
4720           B(1)=Bt2
4740           B(2)=VAL(T2$[1,2])
4750           B(3)=VAL(T2$[4,5])
4760           B(4)=VAL(T2$[7,8])
4761           IF Launch_flg2=1 THEN 4882
4770           Control=11
4780           CONTROL 12,3;11
4790           ENTER @Path4 USING "#,W";B(5)
4800           Control=10
4810           CONTROL 12,3;10
4820           ENTER @Path4 USING "#,W";B(6)
4830           Control=9
4840           CONTROL 12,3;9
4850           ENTER @Path4 USING "#,W";B(7)
4860           Control=8
4870           CONTROL 12,3;8
4880           ENTER @Path4 USING "#,W";B(8)
4881           GOTO 4890
4882           B(5)=Pos2_5
4883           B(6)=Pos2_6
4884           B(7)=Pos2_7
4885           B(8)=Pos2_8
4886           Launch_flg2=0
4890           ON KEY 2 LABEL "START BT#2" GOSUB Start2
4900           Control=0
4910           CONTROL 12,3;0
4920           RETURN
4930 Launch3:  IF Launch_flg3=0 THEN 4935
4931           Bt3=Bt3_sec
4932           T3$=T3_sec$
4934           GOTO 4950
4935           Bt3=Bt
4936           Bt=Bt+1
4937           T3$=TIME$(TIMEDATE)
4950           LORG 2
4951           LINE TYPE 1
4960           MOVE 75,Bt_no
4970           LABEL Bt3
4971           MOVE 90,Bt_no
4972           LABEL T3$
4980           C(1)=Bt3
5000           C(2)=VAL(T3$[1,2])
5010           C(3)=VAL(T3$[4,5])
5020           C(4)=VAL(T3$[7,8])
5021           IF Launch_flg3=1 THEN 5142
```

```
5030          Control=11
5040          CONTROL 12,3;11
5050          ENTER @Path4 USING "#,W";C(5)
5060          Control=10
5070          CONTROL 12,3;10
5080          ENTER @Path4 USING "#,W";C(6)
5090          Control=9
5100          CONTROL 12,3;9
5110          ENTER @Path4 USING "#,W";C(7)
5120          Control=8
5130          CONTROL 12,3;8
5140          ENTER @Path4 USING "#,W";C(8)
5141          GOTO 5150
5142          C(5)=Pos3_5
5143          C(6)=Pos3_6
5144          C(7)=Pos3_7
5145          C(8)=Pos3_8
5146          Launch_flg3=0
5150          ON KEY 4 LABEL "START BT#3" GOSUB Start3
5160          Control=0
5170          CONTROL 12,3;0
5180          RETURN
5190 Metdata: CONTROL 12,3;0
5200          Tmet$=TIME$(TIMEDATE)
5210          Hr=VAL(Tmet$[1,2])
5220          Min=VAL(Tmet$[4,5])
5230          Sec=VAL(Tmet$[7,8])
5240          OUTPUT @Path6 USING "#,W";Hr,Min,Sec
5250          Control=11
5260          CONTROL 12,3;11
5270          TRANSFER @Path4 TO @Path6;COUNT 2,WAIT
5280          Control=10
5290          CONTROL 12,3;10
5300          TRANSFER @Path4 TO @Path6;COUNT 2,WAIT
5310          Control=9
5320          CONTROL 12,3;9
5330          TRANSFER @Path4 TO @Path6;COUNT 2,WAIT
5340          Control=8
5350          CONTROL 12,3;8
5360          TRANSFER @Path4 TO @Path6;COUNT 2,WAIT
5370          Control=16
5380          CONTROL 12,3;16
5390          CONTROL 12;32
5400          FOR I=7 TO 14
5410          CONTROL 12,3;16
5420          TRANSFER @Path4 TO @Path6;COUNT 2,WAIT
5430          NEXT I
5440          Control=32
```

```
5450                 CONTROL 12,3;32
5460                 TRANSFER @Path4 TO @Path6;COUNT 2,WAIT
5470                 ON DELAY 15 GOSUB Metdata
5480                 Control=0
5490                 CONTROL 12,3;0
5500                 RETURN
5510 Rewind_fin:     ENTER 70401;P1,P2,P3,P4
5520                 IF BIT(P2,3)=0 OR BIT(P2,5)=1 THEN 5510
5530                 RETURN
5540 Com_ready:      ENTER 70401;P1,P2,P3,P4
5550                 IF BIT(P1,4)=0 THEN 5540
5560                 RETURN
5570 No_key:         RETURN
5571 Second1:        Bt1_sec=Bt
5572                 Bt=Bt+1
5573                 T1_sec$=TIME$(TIMEDATE)
5574                 Control=11
5575                 CONTROL 12,3;11
5576                 ENTER @Path4 USING "#,W";Pos1_5
5577                 Control=10
5578                 CONTROL 12,3;10
5579                 ENTER @Path4 USING "#,W";Pos1_6
5580                 Control=9
5581                 CONTROL 12,3;9
5582                 ENTER @Path4 USING "#,W";Pos1_7
5583                 Control=8
5584                 CONTROL 12,3;8
5585                 ENTER @Path4 USING "#,W";Pos1_8
5586                 Launch_flg1=1
5587                 ON KEY 0 LABEL "  **  /STOP #1" GOSUB No_key
5589                 Control=0
5590                 CONTROL 12,3;0
5591                 RETURN
5592 Second2:        Bt2_sec=Bt
5593                 Bt=Bt+1
5594                 T2_sec$=TIME$(TIMEDATE)
5595                 Control=11
5596                 CONTROL 12,3;11
5597                 ENTER @Path4 USING "#,W";Pos2_5
5598                 Control=10
5599                 CONTROL 12,3;10
5600                 ENTER @Path4 USING "#,W";Pos2_6
5601                 Control=9
5602                 CONTROL 12,3;9
5603                 ENTER @Path4 USING "#,W";Pos2_7
5604                 Control=8
5605                 CONTROL 12,3;8
5606                 ENTER @Path4 USING "#,W";Pos2_8
```

```
5607             Launch_flg2=1
5608             ON KEY 2 LABEL "   **   /STOP #2" GOSUB No_key
5610             Control=0
5611             CONTROL 12,3;0
5612             RETURN
5613 Second3:    Bt3_sec=Bt
5614             Bt=Bt+1
5615             T3_sec$=TIME$(TIMEDATE)
5616             Control=11
5617             CONTROL 12,3;11
5618             ENTER @Path4 USING "#,W";Pos3_5
5619             Control=10
5620             CONTROL 12,3;10
5621             ENTER @Path4 USING "#,W";Pos3_6
5622             Control=9
5623             CONTROL 12,3;9
5624             ENTER @Path4 USING "#,W";Pos3_7
5625             Control=8
5626             CONTROL 12,3;8
5627             ENTER @Path4 USING "#,W";Pos3_8
5628             Launch_flg3=1
5629             ON KEY 4 LABEL "   **   /STOP #3" GOSUB No_key
5631             Control=0
5632             CONTROL 12,3;0
5633             RETURN
5634 END
```

"TIMEDATE"

```
10     DIM Day$(0:6)[9]
20     DATA Monday,Tuesday,Wednesday,Thursday,Friday,Saturday,Sun
day
30     READ Day$(*)
40     !
41     Dmy$=FNDate$(TIMEDATE)
42     Hms$=FNTime$(TIMEDATE)
50     GOSUB Clear_screen
60     !
70     F$=CHR$(255)&CHR$(72)
80     !
90     PRINT TABXY(1,14);"ENTER THE DATE, AND PRESSCONTINUE"
100    OUTPUT 2 USING "#,11A,2A,";Dmy$,F$
110    !
120    INPUT Dmy$
130    !
140    ENTER Dmy$ USING "2D,4A,5D";D,M$,Y
150    GOSUB Clear_screen
160    !
170    PRINT TABXY(1,14);"ENTER THE TIME OF DAY AND PRESS CONTINU
E"
180    OUTPUT 2 USING "#,11A,2A";Hms$,F$
190    INPUT Hms$
200    ENTER Dmy$ USING "2D,4A,5D";D,M$,Y
210    !
220    SET TIMEDATE FNDate(Dmy$)+FNTime(Hms$)
230    !
240    GOSUB Clear_screen
250    W=(TIMEDATE DIV 86400) MOD 7
260    PRINT TABXY(1,1);"THE CLOCK HAS BEEN SET TO:"
270    PRINT TABXY(1,3);Day$(W);" ";Dmy$;"   ";FNTime$(TIMEDATE)
271    GOTO 270
275    GOTO Quit
280    !
290    !
300    !
310 Clear_screen: OUTPUT 2 USING "#,B";255,75
320               RETURN
330 Quit:   END
340    DEF FNTime$(Now)  !Given 'SECONDS' Return
         !'hh:mm:ss'
350    !
360    Now=INT(Now) MOD 86400
370    H=Now DIV 3600
380    M=Now MOD 3600 DIV 60
390    S=Now MOD 60
400    OUTPUT T$ USING "#,ZZ,K";H,":",M,":",S
410    RETURN T$
```

```
420    FNEND
430    !
440    DEF FNTime(T$) ! Given 'hh:mm:ss' Return '
         ! 'SECONDS'
450    ON ERROR GOTO Err
460    ENTER T$;H,M,S
470    RETURN (3600*H+60*M+S) MOD 86400
480 Err:  OFF ERROR
490    RETURN TIMEDATE MOD 86400
500    FNEND
510 DEF FNDate$(Seconds)! Given 'seconds' Return
          'dd mmm yyyy'
520    DATA JAN,FEB,MAR,APR,MAY,JUN,JUL,AUG,SEP,OCT,NOV,DEC
530    DIM Month$(1:12)[3]
540    READ Month$(*)
550    !
560    Julian=Seconds DIV 86400-1721119
570    Year=(4*Julian-1) DIV 146097
580    Julian=(4*Julian-1) MOD 146097
590    Day=Julian DIV 4
600    Julian=(4*Day+3) DIV 1461
610    Day=(4*Day+3) MOD 1461
620    Day=(Day+4) DIV 4
630    Month=(5*Day-3) DIV 153
640    Day=(5*Day-3) MOD 153
650    Day=(Day+5) DIV 5
660    Year=100*Year+Julian
670    IF Month<10 THEN
680      Month=Month+3
690    ELSE
700      Month=Month-9
710      Year=Year+1
720    END IF
730    OUTPUT D$ USING "#,ZZ,X,3A,X,4Z":Day,Month$(Month),Year
740    RETURN D$
750 FNEND
760    !
770 DEF FNDate(Dmy$)
780    !
790    DATA JAN,FEB,MAR,APR,MAY,JUN,JUL,AUG,SEP,OCT      ,NOV,DEC
800    DIM Month$(1:12)[3]
810    READ Month$(*)
820    !
830    ON ERROR GOTO Err
840    I$=Dmy$&"    "
850    ENTER I$ USING "DD,4A,5D":Day,M$,Year
860    IF Year<100 THEN Year=Year+1900
870    FOR I=1 TO 12
```

```
880   IF POS(M$,Month$(I)) THEN Month=I
890   NEXT I
900   IF Month=0 THEN Err
910   IF Month>2 THEN
920      Month=Month-3
930   ELSE
940      Month=Month+9
950      Year=Year-1
960   END IF
970   Century=Year DIV 100
980   Remainder=Year MOD 100
990   Julian=146097*Century DIV 4+1461*Remainder DIV 4+(153*Mont
h+2) DIV 5+Day+1721119
1000  Julian=Julian*86400
1010  IF Julian<2.08662912E+11 OR Julian>=2.143252224E+11 THEN E
rr
1020  RETURN Julian
1030 Err:OFF ERROR
1040    RETURN TIMEDATE
1050  FNEND
```

SHOW CURRENT | SHOW POWER-ON | SHOW DATACOMM | CONFIGURE POWER-ON | CONFIGURE DATACOMM | RESET CONFI

*************************** CONFIGURATION COMPLETED ***************************

SHOW CURRENT | SHOW POWER-ON | SHOW DATACOMM | CONFIGURE POWER-ON | CONFIGURE DATACOMM | RESET CONFIGURATION

PRINT SIZE: NORMAL COMPRESSED EXPANDED

LEFT MARGIN--SELECT 2 DIGITS (##)--RANGE: PRINT POSITIONS 01 THRU 80
FIRST DIGIT ## SECOND DIGIT ##
0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9

RIGHT MARGIN--MUST BE TO THE RIGHT OF THE LEFT MARGIN
FIRST DIGIT ## SECOND DIGIT ##
0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9

PERFORATED PAPER: ON OFF | AUTO PAGE MODE: ON OFF

TOP MARGIN LENGTH (LINES)--SELECT 3 DIGITS (###)--RANGE: 000 THRU 255
FIRST DIGIT ### SECOND DIGIT ### THIRD DIGIT ###
0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9

TEXT LENGTH (LINES)--SELECT 3 DIGITS (###)--RANGE: 001 THRU 255
FIRST DIGIT ### SECOND DIGIT ### THIRD DIGIT ###
0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9

MISCELLANEOUS SELECTIONS:
SAVE PAPER MODE | LINE WRAP AROUND | PERMANENT ENHANCEMENTS
TAB WITH ENHANCEMENTS | CR = CR,LF | LF = CR,LF AND FF = CR,FF

DISPLAY FUNCTIONS (TEMPORARY SETTING--WILL NOT EXIST AT POWER-ON): ON O

GRAPHICS X OFFSET (DOT COLUMNS)--SELECT 3 DIGITS (###)--RANGE: 000 THRU 720
FIRST DIGIT ### SECOND DIGIT ### THIRD DIGIT ###
0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9

GRAPHICS Y OFFSET (RASTER LINES)--SELECT 3 DIGITS (###)--RANGE: 000 THRU 999
FIRST DIGIT ### SECOND DIGIT ### THIRD DIGIT ###
0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9

CHARACTER SETS:
01 USASCII 02 ROMAN EXT 03 LINE DRAW 04 UNITED KINGDOM 05 DENMARK-NORWAY 06 FRANCE
07 GERMANY 08 JASCII 09 SPAIN 10 SWEDEN-FINLAND 11 ALL BLANK 12 HPL

PRIMARY CHARACTER SET--SELECT 2 DIGITS (##)--RANGE: 01 THRU 12
FIRST DIGIT ## SECOND DIGIT ##
0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9

SECONDARY CHARACTER SET:
FIRST DIGIT ## SECOND DIGIT ##
0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9

"EDIT"

```
10     OPTION BASE 1
20     GRAPHICS ON
30     GINIT
40     INTEGER A(1:12480),G(1:12480),I,J,K,Z,Data1(1:5287)
50     ASSIGN @Punch TO 8;CONVERT OUT BY PAIRS Convert$
60     DIM Convert$[200]
61     DATA 0,0,10,8,13,2,27,27,31,31
63     DATA 32,4,33,22,34,0,35,5,36,0,37,0,38,11,39,20,40,30,41,9
,42,0,43,17,44,6,45,24,46,7,47,23,48,13,49,29,50,25,51,16,52,10,
53,1,54,21,55,28,56,12,57,3
64     DATA 58,14,59,0,60,0,61,15,62,0,63,19,64,0,65,24,66,19,67,
14,68,18,69,16,70,22,71,11,72,5,73,12,74,26,75,30,76,9,77,7,78,6
,79,3,80,13,81,29,82,10,83,20
65     DATA 84,1,85,28,86,15,87,25,88,23,89,21,90,17,91,0,92,0,93
,0,94,0,95,0,96,0,97,24,98,19,99,14,100,18,101,16,102,22,103,11,
104,5,105,12,106,26,107,30,108,9
66     DATA 109,7,110,6,111,3,112,13,113,29,114,10,115,20,116,1,1
17,28,118,15,119,25,120,23,121,21,122,17,123,0,124,0,125,0,126,0
,127,0
67     FOR I=1 TO 200
68     READ Conv_data
69     Convert$[I]=CHR$(Conv_data)
70     NEXT I
72     W$="LAT:"
80     X$="DEG"
90     Y$="MIN"
100    Z$="LONG:"
110    OFF KEY
120    FOR I=1 TO 40
130    PRINT TABXY(30,8);" BT EDIT PROGRAM "
140    PRINT TABXY(I+18,8),"*";
150    NEXT I
160    PRINT
170    FOR I=1 TO 10
180    PRINT TABXY(19,I+8),"*";
190    FOR J=1 TO 38
200    PRINT " ";
210    NEXT J
220    PRINT "*"
230    NEXT I
240    FOR I=1 TO 40
250    PRINT TABXY(I+18,19),"*";
260    NEXT I
270    PRINT TABXY(29,12);"ENTER FLIGHT NO. AND"
280    PRINT TABXY(26,13);"      PRESS CONTINUE        "
290    INPUT Flight
300    PRINT TABXY(0,1);"FLIGHT NUMBER";Flight;"SELECTED"
310    PRINT TABXY(29,12);"ENTER BT NUMBER AND "
```

```
320    PRINT TABXY(26,13);"     PRESS CONTINUE         "
330    INPUT Bt
340    PRINT TABXY(0,2);"BT NUMBER";Bt;"SELECTED  "
350    PRINT TABXY(29,12);"   ENTER BT TYPE    "
360    PRINT TABXY(26,13);"(S=SHALLOW,D=DEEP,M=MIXED)"
370    PRINT TABXY(29,14);"AND PRESS CONTINUE"
380    INPUT Type$
390    IF Type$="S" THEN 430
400    IF Type$="D" THEN 450
410    IF Type$="M" THEN 470
420    GOTO 350
430    PRINT TABXY(0,3);"BT TYPE IS 'SHALLOW'"
440    GOTO 480
450    PRINT TABXY(0,3);"BT TYPE IS 'DEEP'    "
460    GOTO 480
470    PRINT TABXY(0,3);"BT TYPE IS 'MIXED'   "
480    BEEP 1000,.5
490    PRINT TABXY(26,13);CHR$(131);" IS ALL DISPLAYED INFO OK? "
;CHR$(128)
500    PRINT TABXY(29,12);"                             "
510    PRINT TABXY(29,14);"                             "
520    INPUT Ok$
530    IF Ok$="Y" OR Ok$="YES" THEN 560
540    IF Ok$="N" OR Ok$="NO" THEN 270
550    GOTO 490
560    IF Type$="S" THEN 700
570    Position=-222
580    Select_no1=-196
590    Select_no2=26
600    Bt_pos=50
610    T_pos=20
620    Lat_pos=-10
630    Long_pos=-40
640    Curs_labl=-70
650    Data_labl=-160
660    Data_header=-190
670    Sample_max=5280
680    Data_pos=26
690    GOTO 820
700    Position=-111
710    Select_no1=-98
720    Select_no2=13
730    Bt_pos=25
740    T_pos=10
750    Lat_pos=-5
760    Long_pos=-20
770    Curs_labl=-35
780    Data_labl=-80
```

```
790    Data_header=-95
800    Sample_max=2640
810    Data_pos=13
820    BEEP 1000,.5
830    PRINT TABXY(26,13);CHR$(130);" PRESS CONTINUE TO START    "
;CHR$(128)
840    PAUSE
850    OUTPUT 2 USING "#,B";255,75
860    OUTPUT 70401;"RW"
870    GOSUB Rewind_fin
880    OUTPUT 70401;"SF1"
890    GOSUB Com_ready
900    OUTPUT 70401;"RR1"
910    ENTER 70402 USING "#,W";Month,Day,Year,Flight2,Type,First
920    IF Flight2=Flight THEN 940
930    GOTO 880
940    OUTPUT 70401;"RR1"
950    ENTER 70402 USING "#,W";Bt_2
960    IF Bt_2=Bt THEN 990
970    ENTER 70405 USING "#"
971    GOSUB Com_ready
972    IF Bt_2=7000 THEN 981
980    GOTO 940
981    BEEP 1000,.5
982    PRINT TABXY(27,10);CHR$(131);"BT NUMBER NOT FOUND!!";CHR$(
128)
984    GOTO Next1
990    ENTER 70402 USING "#,W";Data1(*)
1000   Bt=Bt_2
1010   T1=Data1(1)
1020   T2=Data1(2)
1030   T3=Data1(3)
1040   T1$=VAL$(T1)
1050   T2$=VAL$(T2)
1060   T3$=VAL$(T3)
1070   Colon$=":"
1080   T4$=T1$&Colon$&T2$&Colon$&T3$
1090   Word1=Data1(4)
1100   Word2=Data1(5)
1110   GOSUB Posit
1120   IF Dir=3 THEN 1150
1130   Lat_dir$="N"
1140   GOTO 1160
1150   Lat_dir$="S"
1160   Lat_deg=Deg
1170   Lat_min=Min
1180   Word1=Data1(6)
1190   Word2=Data1(7)
```

```
1200  GOSUB Posit
1210  IF Dir=3 THEN 1240
1220  Long_dir$="E"
1230  GOTO 1250
1240  Long_dir$="W"
1250  Long_deg=Deg
1260  Long_min=Min
1261  OFF KNOB
1270  VIEWPORT 0,125,9,100
1280  IF Type$="S" THEN 1330
1290  WINDOW -7,53.7,-810,60
1300  ASSIGN @Path1 TO "EDIT_GRID2"
1310  ENTER @Path1;G(*)
1320  GOTO 1360
1330  WINDOW -7,53.7,-405,30
1340  ASSIGN @Path1 TO "EDIT_GRID"
1350  ENTER @Path1;G(*)
1360  GLOAD G(*)
1370  ON KEY 0 LABEL "SELECT DATA" GOSUB Select
1380  ON KEY 1 LABEL "STOP" GOSUB Stop
1390  ON KEY 5 LABEL "DELETE DATA" GOSUB Delete
1400  ON KEY 6 LABEL "DUMP GRAPHICS" GOSUB Dump2
1401  ON KEY 4 GOSUB No_key
1403  ON KEY 2 GOSUB No_key
1404  ON KEY 3 GOSUB No_key
1405  ON KEY 7 GOSUB No_key
1406  ON KEY 8 GOSUB No_key
1407  ON KEY 9 GOSUB No_key
1410  LINE TYPE 1
1420  PEN 1
1430  DIM Depth1(5280),Temp1(5280)
1440  DIM Temp2(23),Depth2(23),Message(31),Data(23)
1450  J=1
1460  FOR U=0 TO 528 STEP .1
1470  Depth1(J)=-1.5926*U
1480  J=J+1
1490  NEXT U
1500  FOR I=1 TO 5280
1510  IF Data1(I+7)>6945 OR Data1(I+7)<3700 THEN 1540
1520  Temp1(I)=((1/(Data1(I+7)*1.E-7))-1440)/36
1530  GOTO 1550
1540  Temp1(I)=-5
1550  NEXT I
1560  J=0
1570  K=0
1580  MOVE 0,0
1590  FOR I=2 TO Sample_max
1591  IF Temp1(I)=-5 OR Temp1(I-1)=-5 THEN 1620
```

```
1600  MOVE Temp1(I-1),Depth1(I-1)
1610  DRAW Temp1(I),Depth1(I)
1620  NEXT I
1630  CSIZE 3
1640  LORG 8
1650  FOR I=1 TO 23
1660  MOVE 39,(Select_no1+(-I*Select_no2))
1670  LABEL I
1680  NEXT I
1690  MOVE 36,Bt_pos
1700  LORG 2
1710  LABEL "BT NO.:":Bt
1720  MOVE 36,T_pos
1730  LABEL "TIME:";T4$
1740  MOVE 36,Lat_pos
1750  LABEL "LAT:";Lat_dir$;Lat_deg;"DEG";Lat_min;"MIN"
1760  MOVE 36,Long_pos
1770  LABEL "LONG:";Long_dir$;Long_deg;"DEG";Long_min;"MIN"
1780  MOVE 36,Curs_labl
1790  CSIZE 2.9
1800  LABEL "CURSOR:"
1810  MOVE 36,Data_labl
1820  CSIZE 3
1830  LABEL "SELECTED DATA:"
1840  MOVE 38,Data_header
1850  CSIZE 2.5
1860  LABEL "TEMP(DegC) DEPTH(M)"
1870  GSTORE A(*)
1871  ON KEY 4 LABEL "MANUAL POSIT." GOSUB Manual_posit
1880  MOVE 0,0
1890  I=1
1900  K=0
1910  Select=1
1920  GOSUB Select
1930  ON KNOB .080 GOTO 1950
1940  GOTO 1980
1950  PEN -1
1960  DRAW Temp1(I)-5,Depth1(I)
1970  PEN 1
1980  K=KNOBX
1990  I=I+K
2000  IF I<1 THEN I=1
2010  IF I>Sample_max THEN I=Sample_max
2020  PRINT TABXY(56,3)
2030  PRINT TABXY(56,4);PROUND(Temp1(I),-2);"DEG",PROUND(-Depth1
(I),-1);"M     "
2040  IF Terminate=1 THEN GOTO Next
2050  MOVE Temp1(I)-5,Depth1(I)
```

```
2060  DRAW Temp1(I)+5,Depth1(I)
2070  IF Depth1(I)>-50 THEN 2090
2080  GOTO 2100
2090  WAIT .020
2100  GLOAD A(*)
2110  GOTO 2040
2120  J=0
2130 Select:  OFF KEY 1
2140          CSIZE 3
2150          IF Select=1 THEN 2230
2160          MOVE Temp1(I)-5,Depth1(I)
2170          LORG 8
2180          LABEL Select
2190          MOVE Temp1(I)-5,Depth1(I)
2200          DRAW Temp1(I)+5,Depth1(I)
2210          LORG 2
2220          LABEL Select
2230          MOVE 38,Position
2240          LABEL USING "2X,DD.DD,X,2X,DDD.D";PROUND(Temp1(I),
-2),PROUND(-Depth1(I),-2)
2250          GSTORE A(*)
2260          Temp2(Select)=Temp1(I)
2270          Depth2(Select)=-Depth1(I)
2280          Select=Select+1
2290          IF Select>23 THEN GOSUB Stop
2300          Position=Position-Data_pos
2310          ON KEY 1 LABEL "STOP" GOSUB Stop
2320          RETURN
2330 Stop:    BEEP 1000,.5
2340          GRAPHICS OFF
2350          ALPHA OFF
2360          IF Select<23 THEN GOTO 2380
2370          PRINT TABXY(24,11);CHR$(131);"MAXIMUM NO. OF SAMPL
ES SELECTED";CHR$(128)
2380          PRINT TABXY(24,12);CHR$(131);"DO YOU WANT TO CHANG
E ANYTHING?";CHR$(128)
2390          INPUT Change$
2400          IF Change$="YES" OR Change$="Y" THEN 2520
2410          IF Change$="NO" OR Change$="N" THEN 2430
2420          GOTO 2400
2430          PRINT TABXY(24,11);"
   "
2440          PRINT TABXY(24,12);CHR$(131);"          DUMPING GRAPH
ICS        ";CHR$(128)
2450          GRAPHICS ON
2460          GOSUB Dump2
2470          GRAPHICS OFF
2480          PRINT TABXY(20,12);CHR$(131);"PRESS CONTINUE TO GE
```

```
NERATE JJXX MESSAGE";CHR$(128)
2490          BEEP 600,.5
2500          PAUSE
2510          GOSUB Jjxx
2520          PRINT TABXY(24.11);"
     "
2530          PRINT TABXY(24,12);"
     "
2540          GRAPHICS ON
2550          RETURN
2560 Jjxx:    FOR I=1 TO Select-1
2570          Data(I)=10*(((PROUND(Depth2(I),0))*100)+PROUND(Tem
p2(I),-1))
2580          NEXT I
2590          MAT SORT Data(*) DES
2600          Add=0
2610          Layer=0
2620          K=1
2630          FOR I=Select-1 TO 1 STEP -1
2640          Layer=INT(Data(I)*.00001)
2650          IF Layer>Add THEN GOTO 2670
2660          GOTO 2710
2670          Message(K)=99900+Layer
2680          !PRINT USING "ZZZZZ";Message(K)
2690          Add=Layer
2700          K=K+1
2710          Message(K)=Data(I)-(Layer*100000)
2720          !PRINT USING "ZZZZZ";Message(K)
2730          K=K+1
2740          NEXT I
2750          OUTPUT 2 USING "#,B";255.75
2760          PRINT TABXY(20,12);"ENTER QUADRANT NUMBER AND"
2770          PRINT TABXY(24,13);"PRESS CONTINUE"
2780          INPUT Quad
2790          OUTPUT 2 USING "#,B";255,75
2800          Jjxx$="JJXX"
2810          T4=T1*100+T2
2820          Ind=88888
2830          Slant$="/"
2840          PRINT USING "AAAA.8X,ZZ.ZZ,Z,7X,ZZZZ,A,7X,D,ZZ,ZZ,
7X,ZZZ,ZZ,7X,DDDDD";Jjxx$,Day,Month,4,T4,Slant$,Quad,Lat_deg,Lat
_min,Long_deg,Long_min,Ind
2850          !PRINT
2860          !PRINT
2870          Col=0
2880          Row=3
2890          W=1
2900          PRINT TABXY(Col,Row);
```

```
2910            IF W>K-1 THEN 3010
2920            PRINT USING "ZZZZZ";Message(W)
2930            W=W+1
2940            IF Col=0 THEN Col=1
2950            Col=Col+12
2960            IF Col>61 THEN 2980
2970            GOTO 2900
2980            Row=Row+2
2990            Col=0
3000            GOTO 2900
3010            PRINT "VXN-8"
3020            PRINT TABXY(1,18);CHR$(131);"PRESS CONTINUE TO DUM
P MESSAGE";CHR$(128)
3030            PAUSE
3031            PRINT TABXY(1,18);"
"
3040            OFF KEY
3050            DUMP ALPHA
3051            WAIT 5
3060            PRINT TABXY(1,18);CHR$(131);"PRESS CONTINUE TO PUN
CH TAPE   ";CHR$(128)
3070            PAUSE
3080            GOSUB Punch
3090            Terminate=1
3100            RETURN
3110 Delete:    LORG 2
3120            CSIZE 3
3130            MOVE 36,Bt_pos
3140            PEN -1
3150            LABEL "BT NO.:";Bt
3160            MOVE 36,T_pos
3170            LABEL "TIME:";T4$
3180            MOVE 36,Lat_pos
3190            LABEL "LAT:";Lat_dir$;Lat_deg;"DEG";Lat_min;"MIN"
3200            MOVE 36,Long_pos
3210            LABEL "LONG:";Long_dir$;Long_deg;"DEG";Long_min;"M
IN"
3220            PRINT TABXY(55,1);CHR$(131);"DELETE DATA POINT NO.
?";CHR$(128)
3230            INPUT Number
3240            MOVE Temp2(Number)-5,-Depth2(Number)
3250            LORG 8
3260            PEN -1
3270            LABEL Number
3280            MOVE Temp2(Number)-5,-Depth2(Number)
3290            DRAW Temp2(Number)+5,-Depth2(Number)
3300            LORG 2
3310            LABEL Number
```

```
3320            FOR I=Number+1 TO Select-1
3330            MOVE Temp2(I)-5,-Depth2(I)
3340            LORG 8
3350            PEN -1
3360            LABEL I
3370            MOVE Temp2(I)-5,-Depth2(I)
3380            PEN 1
3390            LABEL I-1
3400            MOVE Temp2(I)+5,-Depth2(I)
3410            LORG 2
3420            PEN -1
3430            LABEL I
3440            MOVE Temp2(I)+5,-Depth2(I)
3450            PEN 1
3460            LABEL I-1
3470            NEXT I
3480            FOR I=Number TO Select-1
3490            MOVE 38,(Select_no1+(-I*Select_no2))
3500            LORG 2
3510            PEN -1
3520            LABEL USING "2X,DD.DD,X,2X,DDD.D";PROUND(Temp2(I),
-2),PROUND(Depth2(I),-2)
3530            IF I=23 THEN 3560
3540            Temp2(I)=Temp2(I+1)
3550            Depth2(I)=Depth2(I+1)
3560            NEXT I
3570            PEN 1
3580            FOR I=Number TO Select-2
3590            MOVE 38,(Select_no1+(-I*Select_no2))
3600            LORG 2
3610            LABEL USING "2X.DD.DD,X,2X,DDD.D";PROUND(Temp2(I),
-2),PROUND(Depth2(I),-2)
3620            NEXT I
3630            Select=Select-1
3640            Position=Position+Data_pos
3650            PRINT TABXY(55,1);"                              "
3660            MOVE 36.Bt_pos
3670            PEN 1
3680            LABEL "BT NO.:";Bt
3690            MOVE 36,T_pos
3700            LABEL "TIME:";T4$
3710            MOVE 36,Lat_pos
3720            LABEL "LAT:";Lat_dir$;Lat_deg;"DEG";Lat_min;"MIN"
3730            MOVE 36,Long_pos
3740            LABEL "LONG:";Long_dir$;Long_deg;"DEG";Long_min;"M
IN"
3750            GSTORE A(*)
3760            RETURN
```

```
3770 Dump:          OUTPUT 701;"
3780                OUTPUT 701;"
3790                OUTPUT 701;"
3800                DUMP DEVICE IS 701,EXPANDED
3810                DUMP GRAPHICS
3820                RETURN
3830 Dump2:         OUTPUT 701;"
3840                OUTPUT 701;"
3850                OUTPUT 701;"
```

```
"
3860                DUMP GRAPHICS
3870                RETURN
3880 Next:     OUTPUT 2 USING "#,B";255,75
3890 Next1:    GCLEAR
3900           OUTPUT 70401;"SF1,1"
3910           GOSUB Com_ready
3920           OUTPUT 70401;"SR1"
3930           GOSUB Com_ready
3940           Terminate=0
3950           PRINT TABXY(27,12);"ENTER NEW BT NUMBER AND"
3960           PRINT TABXY(31,13);"PRESS CONTINUE"
3970           INPUT Bt
3980           OUTPUT 2 USING "#,B";255,75
3990           IF Type$="S" THEN 4020
4000           Position=-222
4010           GOTO 4030
4020           Position=-111
4021           OFF KNOB
4030           GOTO 940
4040 Posit:    Digit(4)=SHIFT(Word1,12)
4050           FOR I=3 TO 1 STEP -1
4060           Word1=ROTATE(Word1,-4)
4070           Digit(I)=SHIFT(Word1,12)
4080           NEXT I
4090           Min=(Digit(3)*10)+Digit(2)+(Digit(1)*.1)
4100           Dir=SHIFT(Word2,6)
4110           Digit(6)=ROTATE(Word2,6)
4120           Digit(6)=SHIFT(Digit(6),14)
4130           Digit(5)=ROTATE(Word2,4)
4140           Digit(5)=SHIFT(Digit(5),12)
4150           Deg=Digit(6)*100+Digit(5)*10+Digit(4)
```

```
4160            RETURN
4170 Rewind_fin:  ENTER 70401;P1,P2,P3,P4
4180              IF BIT(P2,3)=0 OR BIT(P2,5)=1 THEN 4170
4190              RETURN
4200 Com_ready:   ENTER 70401;P1,P2,P3,P4
4210              IF BIT(P1,4)=0 THEN 4200
4220              RETURN
4230 Punch:     IMAGE #,A,A,ZZ,ZZ.Z.A,ZZZZ,A,A,D.ZZ,ZZ,A,ZZZ.ZZ,A,
DDDDD
4231            OUTPUT @Punch USING "#,A,AAAA";CHR$(31),Jjxx$
4240            OUTPUT @Punch USING Punch;CHR$(32),CHR$(27),Day,Mo
nth,4,CHR$(32),T4,Slant$,CHR$(32),Quad,Lat_deg,Lat_min,CHR$(32),
Long_deg,Long_min,CHR$(32),88888
4250            OUTPUT @Punch USING "#,A,A,A";CHR$(13),CHR$(13),CH
R$(10)
4260            Line=1
4270            FOR Loop=1 TO K-1
4280            OUTPUT @Punch USING "#,ZZZZZ,A";Message(Loop),CHR$
(32)
4290            Line=Line+1
4300            IF Line=7 THEN 4320
4310            GOTO 4330
4320            OUTPUT @Punch USING "#,A,A,A";CHR$(13),CHR$(13),CH
R$(10)
4321            Line=1
4330            NEXT Loop
4340            OUTPUT @Punch USING "#,A,AAA.A,D.A,A,A,A";CHR$(31)
,"VXN",CHR$(27),8,CHR$(31),CHR$(13),CHR$(13),CHR$(10)
4350            RETURN
4351 Manual_posit: GCLEAR
4352               GLOAD A(*)
4353               MOVE 36,Lat_pos
4354               PEN -1
4355               LABEL "LAT:";Lat_dir$;Lat_deg;"DEG";Lat_min;"
MIN"
4356               MOVE 36,Long_pos
4357               PEN -1
4358               LABEL "LONG:";Long_dir$;Long_deg;"DEG";Long_m
in;"MIN"
4359               GSTORE A(*)
4360               GCLEAR
4362               PEN 1
4363               OUTPUT 2 USING "#,B";255,75
4364               PRINT TABXY(29,12);"ENTER LAT OCTANT(N OR S)"
4365               PRINT TABXY(32,13);"AND PRESS CONTINUE"
4366               INPUT Lat_dir$
4367               PRINT TABXY(29,12);"  ENTER LATITUDE DEG.(DD)
 "
```

```
4368                 INPUT Lat_deg
4369                 PRINT TABXY(29,12);"  ENTER LATITUDE MIN.(MM.
M)"
4370                 INPUT Lat_min
4371                 PRINT TABXY(1,1);"LAT=",Lat_dir$;Lat_deg;"DEG
",Lat_min;"MIN"
4372                 PRINT TABXY(29,12);"ENTER LONG OCTANT(E OR W)
  "
4373                 INPUT Long_dir$
4374                 PRINT TABXY(29,12);"  ENTER LONGITUDE DEG.(DD
D)"
4375                 INPUT Long_deg
4376                 PRINT TABXY(29,12);"  ENTER LONGITUDE MIN.(MM
.M)"
4377                 INPUT Long_min
4378                 PRINT TABXY(1,2);"LONG=",Long_dir$;Long_deg;"
DEG",Long_min;"MIN"
4379                 PRINT TABXY(30,13);"
          "
4380                 PRINT TABXY(29,12);"  ALL DISPLAYED INFO OK?
  "
4381                 INPUT Posit_ok$
4382                 IF Posit_ok$="Y" OR Posit_ok$="YES" THEN 4386
4383                 IF Posit_ok$="N" OR Posit_ok$="NO" THEN 4363
4384                 BEEP 1200,.5
4385                 GOTO 4380
4386                 OUTPUT 2 USING "#,B";255,75
4387                 GLOAD A(*)
4388                 MOVE 36,Lat_pos
4391                 LABEL "LAT:";Lat_dir$;Lat_deg;"DEG";Lat_min;"
MIN"
4392                 MOVE 36,Long_pos
4393                 LABEL "LONG:";Long_dir$;Long_deg;"DEG";Long_m
in;"MIN"
4394                 GSTORE A(*)
4395                 RETURN
4396 No_key:  RETURN
4397  END
```

"FAST_EDIT"

```
10      OPTION BASE 1
20      GRAPHICS ON
30      GINIT
40      INTEGER A(1:12480),G(1:12480),I,J,K,Z,Data1(1:5287)
50      ASSIGN @Punch TO 8;CONVERT OUT BY PAIRS Convert$
60      DIM Convert$[200]
61      DATA 0,0,10,8,13.2,27,27,31,31
63      DATA 32,4,33,22,34,0,35,5,36,0,37,0,38,11,39,20,40,30,41,9
,42,0,43,17,44,6,45,24,46.7.47,23,48.13,49,29,50,25,51,16,52.10,
53,1,54,21,55,28,56,12,57,3
64      DATA 58,14,59,0,60,0,61,15,62,0,63,19,64,0,65,24,66,19.67,
14,68,18,69,16,70,22.71.11,72,5,73.12,74,26,75,30,76,9,77,7,78,6
,79,3,80,13,81,29,82,10,83.20
65      DATA 84.1,85.28,86,15,87,25,88,23,89,21,90,17,91,0,92,0,93
,0,94,0,95,0,96,0,97,24,98,19,99,14,100,18.101,16,102,22,103,11,
104,5,105,12,106,26.107,30,108,9
66      DATA 109,7,110.6,111,3,112,13,113,29,114,10,115,20,116,1,1
17,28,118,15,119,25,120.23.121,21,122,17,123,0,124,0.125,0,126,0
,127,0
67      FOR I=1 TO 200
68      READ Conv_data
69      Convert$[I]=CHR$(Conv_data)
70      NEXT I
72      W$="LAT:"
80      X$="DEG"
90      Y$="MIN"
100     Z$="LONG:"
110     OFF KEY
120     FOR I=1 TO 40
130     PRINT TABXY(30,8);" FAST BT EDIT PROGRAM "
140     PRINT TABXY(I+18,8),"*";
150     NEXT I
160     PRINT
170     FOR I=1 TO 10
180     PRINT TABXY(19,I+8),"*";
190     FOR J=1 TO 38
200     PRINT " ";
210     NEXT J
220     PRINT "*"
230     NEXT I
240     FOR I=1 TO 40
250     PRINT TABXY(I+18,19),"*";
260     NEXT I
270     PRINT TABXY(29,12);"ENTER FLIGHT NO. AND"
280     PRINT TABXY(26,13);"      PRESS CONTINUE       "
290     INPUT Flight
300     PRINT TABXY(0,1);"FLIGHT NUMBER";Flight;"SELECTED"
350     PRINT TABXY(29,12);"   ENTER BT TYPE    "
```

```
360   PRINT TABXY(26,13);"(S=SHALLOW,D=DEEP,M=MIXED)"
370   PRINT TABXY(29,14);"AND PRESS CONTINUE"
380   INPUT Type$
390   IF Type$="S" THEN 430
400   IF Type$="D" THEN 450
410   IF Type$="M" THEN 470
420   GOTO 350
430   PRINT TABXY(0,3);"BT TYPE IS ´SHALLOW´"
440   GOTO 480
450   PRINT TABXY(0,3);"BT TYPE IS ´DEEP´    "
460   GOTO 480
470   PRINT TABXY(0.3):"BT TYPE IS ´MIXED´   "
480   BEEP 1000,.5
490   PRINT TABXY(26,13);CHR$(131);" IS ALL DISPLAYED INFO OK? "
;CHR$(128)
500   PRINT TABXY(29,12);"                          "
510   PRINT TABXY(29,14);"                          "
520   INPUT Ok$
530   IF Ok$="Y" OR Ok$="YES" THEN 560
540   IF Ok$="N" OR Ok$="NO" THEN 270
550   GOTO 490
560   IF Type$="S" THEN 700
570   Position=-222
580   Select_no1=-196
590   Select_no2=26
600   Bt_pos=50
610   T_pos=20
620   Lat_pos=-10
630   Long_pos=-40
640   Curs_labl=-70
650   Data_labl=-160
660   Data_header=-190
670   Sample_max=5280
680   Data_pos=26
690   GOTO 820
700   Position=-111
710   Select_no1=-98
720   Select_no2=13
730   Bt_pos=25
740   T_pos=10
750   Lat_pos=-5
760   Long_pos=-20
770   Curs_labl=-35
780   Data_labl=-80
790   Data_header=-95
800   Sample_max=2640
810   Data_pos=13
820   BEEP 1000,.5
```

```
830   PRINT TABXY(26,13);CHR$(130);" PRESS CONTINUE TO START    "
;CHR$(128)
840   PAUSE
850   OUTPUT 2 USING "#,B";255,75
860   OUTPUT 70401;"RW"
870   GOSUB Rewind_fin
880   OUTPUT 70401;"SF1"
890   GOSUB Com_ready
900   OUTPUT 70401;"RR1"
910   ENTER 70402 USING "#,W";Month,Day,Year,Flight2,Type,First
920   IF Flight2=Flight THEN 940
930   GOTO 880
940   OUTPUT 70401;"RR1"
950   ENTER 70402 USING "#,W";Bt_2
972   IF Bt_2=7000 THEN 981
980   GOTO 990
981   BEEP 1000,.5
982   PRINT TABXY(27,10);CHR$(131);"END OF FLIGHT------!!";CHR$(
128)
984   GOTO 4396
990   ENTER 70402 USING "#,W";Data1(*)
1000  Bt=Bt_2
1010  T1=Data1(1)
1020  T2=Data1(2)
1030  T3=Data1(3)
1040  T1$=VAL$(T1)
1050  T2$=VAL$(T2)
1060  T3$=VAL$(T3)
1070  Colon$=":"
1080  T4$=T1$&Colon$&T2$&Colon$&T3$
1090  Word1=Data1(4)
1100  Word2=Data1(5)
1110  GOSUB Posit
1120  IF Dir=3 THEN 1150
1130  Lat_dir$="N"
1140  GOTO 1160
1150  Lat_dir$="S"
1160  Lat_deg=Deg
1170  Lat_min=Min
1180  Word1=Data1(6)
1190  Word2=Data1(7)
1200  GOSUB Posit
1210  IF Dir=3 THEN 1240
1220  Long_dir$="E"
1230  GOTO 1250
1240  Long_dir$="W"
1250  Long_deg=Deg
1260  Long_min=Min
```

```
1261   OFF KNOB
1270   VIEWPORT 0,125,9,100
1280   IF Type$="S" THEN 1330
1290   WINDOW -7,53.7,-810,60
1300   ASSIGN @Path1 TO "EDIT_GRID2"
1310   ENTER @Path1;G(*)
1320   GOTO 1360
1330   WINDOW -7,53.7,-405,30
1340   ASSIGN @Path1 TO "EDIT_GRID"
1350   ENTER @Path1;G(*)
1360   GLOAD G(*)
1370   ON KEY 0 LABEL "SELECT DATA" GOSUB Select
1380   ON KEY 1 LABEL "STOP" GOSUB Stop
1381   ON KEY 2 LABEL "" GOSUB No_key
1382   ON KEY 3 LABEL "" GOSUB No_key
1383   ON KEY 6 LABEL "" GOSUB No_key
1384   ON KEY 7 LABEL "" GOSUB No_key
1385   ON KEY 8 LABEL "" GOSUB No_key
1386   ON KEY 4 GOSUB No_key
1390   ON KEY 5 LABEL "DELETE DATA" GOSUB Delete
1401   ON KEY 9 LABEL "NEXT BT" GOSUB Term
1410   LINE TYPE 1
1420   PEN 1
1430   DIM Depth1(5280),Temp1(5280)
1440   DIM Temp2(23),Depth2(23),Message(31),Data(23)
1450   J=1
1460   FOR U=0 TO 528 STEP .1
1470   Depth1(J)=-1.5926*U
1480   J=J+1
1490   NEXT U
1500   FOR I=1 TO 5280
1510   IF Data1(I+7)>6945 OR Data1(I+7)<3700 THEN 1540
1520   Temp1(I)=((1/(Data1(I+7)*1.E-7))-1440)/36
1530   GOTO 1550
1540   Temp1(I)=-5
1550   NEXT I
1560   J=0
1570   K=0
1580   MOVE 0,0
1590   FOR I=2 TO Sample_max
1591   IF Temp1(I)=-5 OR Temp1(I-1)=-5 THEN 1620
1600   MOVE Temp1(I-1),Depth1(I-1)
1610   DRAW Temp1(I),Depth1(I)
1620   NEXT I
1630   CSIZE 3
1640   LORG 8
1650   FOR I=1 TO 23
1660   MOVE 39,(Select_no1+(-I*Select_no2))
```

```
1670  LABEL I
1680  NEXT I
1690  MOVE 36,Bt_pos
1700  LORG 2
1710  LABEL "BT NO.:";Bt
1720  MOVE 36,T_pos
1730  LABEL "TIME:";T4$
1740  MOVE 36,Lat_pos
1750  LABEL "LAT:";Lat_dir$;Lat_deg;"DEG";Lat_min;"MIN"
1760  MOVE 36,Long_pos
1770  LABEL "LONG:";Long_dir$;Long_deg;"DEG";Long_min;"MIN"
1780  MOVE 36,Curs_labl
1790  CSIZE 2.9
1800  LABEL "CURSOR:"
1810  MOVE 36.Data_labl
1820  CSIZE 3
1830  LABEL "SELECTED DATA:"
1840  MOVE 38.Data_header
1850  CSIZE 2.5
1860  LABEL "TEMP(DegC) DEPTH(M)"
1870  GSTORE A(*)
1871  ON KEY 4 LABEL "MANUAL POSIT." GOSUB Manual_posit
1880  MOVE 0.0
1890  I=1
1900  K=0
1910  Select=1
1920  GOSUB Select
1930  ON KNOB .080 GOTO 1950
1940  GOTO 1980
1950  PEN -1
1960  DRAW Temp1(I)-5.Depth1(I)
1970  PEN 1
1980  K=KNOBX
1990  I=I+K
2000  IF I<1 THEN I=1
2010  IF I>Sample_max THEN I=Sample_max
2020  PRINT TABXY(56,3)
2030  PRINT TABXY(56.4);PROUND(Temp1(I),-2):"DEG",PROUND(-Depth1
(I),-1);"M    "
2040  IF Terminate=1 THEN GOTO Next
2050  MOVE Temp1(I)-5,Depth1(I)
2060  DRAW Temp1(I)+5,Depth1(I)
2070  IF Depth1(I)>-50 THEN 2090
2080  GOTO 2100
2090  WAIT .020
2100  GLOAD A(*)
2110  GOTO 2040
2120  J=0
```

```
2130 Select:  OFF KEY 1
2140          CSIZE 3
2150          IF Select=1 THEN 2230
2160          MOVE Temp1(I)-5,Depth1(I)
2170          LORG 8
2180          LABEL Select
2190          MOVE Temp1(I)-5,Depth1(I)
2200          DRAW Temp1(I)+5,Depth1(I)
2210          LORG 2
2220          LABEL Select
2230          MOVE 38,Position
2240          LABEL USING "2X,DD.DD,X,2X,DDD.D";PROUND(Temp1(I),
-2),PROUND(-Depth1(I),-2)
2250          GSTORE A(*)
2260          Temp2(Select)=Temp1(I)
2270          Depth2(Select)=-Depth1(I)
2280          Select=Select+1
2290          IF Select>23 THEN GOSUB Stop
2300          Position=Position-Data_pos
2310          ON KEY 1 LABEL "STOP" GOSUB Stop
2320          RETURN
2330 Stop:    BEEP 1000,.5
2340          GRAPHICS OFF
2350          ALPHA OFF
2360          IF Select<23 THEN GOTO 2380
2370          PRINT TABXY(24,11);CHR$(131);"MAXIMUM NO. OF SAMPL
ES SELECTED";CHR$(128)
2380          PRINT TABXY(24,12);CHR$(131);"DO YOU WANT TO CHANG
E ANYTHING?";CHR$(128)
2390          INPUT Change$
2400          IF Change$="YES" OR Change$="Y" THEN 2520
2410          IF Change$="NO" OR Change$="N" THEN 2510
2420          GOTO 2400
2510          GOSUB Jjxx
2520          PRINT TABXY(24,11);"
    "
2530          PRINT TABXY(24,12);"
    "
2540          GRAPHICS ON
2550          RETURN
2560 Jjxx:    FOR I=1 TO Select-1
2570          Data(I)=10*(((PROUND(Depth2(I),0))*100)+PROUND(Tem
p2(I),-1))
2580          NEXT I
2590          MAT SORT Data(*) DES
2600          Add=0
2610          Layer=0
2620          K=1
```

```
2630          FOR I=Select-1 TO 1 STEP -1
2640          Layer=INT(Data(I)*.00001)
2650          IF Layer>Add THEN GOTO 2670
2660          GOTO 2710
2670          Message(K)=99900+Layer
2680          !PRINT USING "ZZZZZ";Message(K)
2690          Add=Layer
2700          K=K+1
2710          Message(K)=Data(I)-(Layer*100000)
2720          !PRINT USING "ZZZZZ";Message(K)
2730          K=K+1
2740          NEXT I
2750          OUTPUT 2 USING "#,B";255,75
2760          PRINT TABXY(20,12);"ENTER QUADRANT NUMBER AND"
2770          PRINT TABXY(24,13);"PRESS CONTINUE"
2780          INPUT Quad
2790          OUTPUT 2 USING "#,B";255,75
2800          Jjxx$="JJXX"
2810          T4=T1*100+T2
2820          Ind=88888
2830          Slant$="/"
3080          GOSUB Punch
3090          Terminate=1
3100          RETURN
3110 Delete:  LORG 2
3120          CSIZE 3
3130          MOVE 36,Bt_pos
3140          PEN -1
3150          LABEL "BT NO.:";Bt
3160          MOVE 36,T_pos
3170          LABEL "TIME:";T4$
3180          MOVE 36,Lat_pos
3190          LABEL "LAT:";Lat_dir$;Lat_deg;"DEG";Lat_min;"MIN"
3200          MOVE 36,Long_pos
3210          LABEL "LONG:";Long_dir$;Long_deg;"DEG";Long_min;"M
IN"
3220          PRINT TABXY(55,1);CHR$(131);"DELETE DATA POINT NO.
?";CHR$(128)
3230          INPUT Number
3240          MOVE Temp2(Number)-5,-Depth2(Number)
3250          LORG 8
3260          PEN -1
3270          LABEL Number
3280          MOVE Temp2(Number)-5,-Depth2(Number)
3290          DRAW Temp2(Number)+5,-Depth2(Number)
3300          LORG 2
3310          LABEL Number
3320          FOR I=Number+1 TO Select-1
```

```
3330             MOVE Temp2(I)-5,-Depth2(I)
3340             LORG 8
3350             PEN -1
3360             LABEL I
3370             MOVE Temp2(I)-5,-Depth2(I)
3380             PEN 1
3390             LABEL I-1
3400             MOVE Temp2(I)+5,-Depth2(I)
3410             LORG 2
3420             PEN -1
3430             LABEL I
3440             MOVE Temp2(I)+5,-Depth2(I)
3450             PEN 1
3460             LABEL I-1
3470             NEXT I
3480             FOR I=Number TO Select-1
3490             MOVE 38,(Select_no1+(-I*Select_no2))
3500             LORG 2
3510             PEN -1
3520             LABEL USING "2X,DD.DD,X,2X,DDD.D";PROUND(Temp2(I),
-2),PROUND(Depth2(I),-2)
3530             IF I=23 THEN 3560
3540             Temp2(I)=Temp2(I+1)
3550             Depth2(I)=Depth2(I+1)
3560             NEXT I
3570             PEN 1
3580             FOR I=Number TO Select-2
3590             MOVE 38,(Select_no1+(-I*Select_no2))
3600             LORG 2
3610             LABEL USING "2X,DD.DD,X,2X,DDD.D";PROUND(Temp2(I),
-2),PROUND(Depth2(I),-2)
3620             NEXT I
3630             Select=Select-1
3640             Position=Position+Data_pos
3650             PRINT TABXY(55,1);"                              "
3660             MOVE 36,Bt_pos
3670             PEN 1
3680             LABEL "BT NO.:";Bt
3690             MOVE 36,T_pos
3700             LABEL "TIME:";T4$
3710             MOVE 36,Lat_pos
3720             LABEL "LAT:";Lat_dir$;Lat_deg;"DEG";Lat_min;"MIN"
3730             MOVE 36,Long_pos
3740             LABEL "LONG:";Long_dir$;Long_deg;"DEG";Long_min;"M
IN"
3750             GSTORE A(*)
3760             RETURN
3880 Next:       OUTPUT 2 USING "#,B";255,75
```

```
3890 Next1:     GCLEAR
3940            Terminate=0
3990            IF Type$="S" THEN 4020
4000            Position=-222
4010            GOTO 4030
4020            Position=-111
4021            OFF KNOB
4030            GOTO 940
4040 Posit:     Digit(4)=SHIFT(Word1,12)
4050            FOR I=3 TO 1 STEP -1
4060            Word1=ROTATE(Word1,-4)
4070            Digit(I)=SHIFT(Word1,12)
4080            NEXT I
4090            Min=(Digit(3)*10)+Digit(2)+(Digit(1)*.1)
4100            Dir=SHIFT(Word2,6)
4110            Digit(6)=ROTATE(Word2,6)
4120            Digit(6)=SHIFT(Digit(6),14)
4130            Digit(5)=ROTATE(Word2,4)
4140            Digit(5)=SHIFT(Digit(5),12)
4150            Deg=Digit(6)*100+Digit(5)*10+Digit(4)
4160            RETURN
4170 Rewind_fin:  ENTER 70401;P1,P2,P3,P4
4180              IF BIT(P2,3)=0 OR BIT(P2,5)=1 THEN 4170
4190              RETURN
4200 Com_ready:   ENTER 70401;P1,P2,P3,P4
4210              IF BIT(P1,4)=0 THEN 4200
4220              RETURN
4230 Punch:     IMAGE #,A,A,ZZ,ZZ,Z,A,ZZZZ,A,A,D,ZZ,ZZ,A,ZZZ,ZZ,A,
DDDDD
4231            OUTPUT @Punch USING "#,A,AAAA";CHR$(31),Jjxx$
4240            OUTPUT @Punch USING Punch;CHR$(32),CHR$(27),Day,Mo
nth,4,CHR$(32),T4,Slant$,CHR$(32),Quad,Lat_deg,Lat_min,CHR$(32),
Long_deg,Long_min,CHR$(32),88888
4250            OUTPUT @Punch USING "#,A,A,A";CHR$(13),CHR$(13),CH
R$(10)
4260            Line=1
4270            FOR Loop=1 TO K-1
4280            OUTPUT @Punch USING "#,ZZZZZ,A";Message(Loop),CHR$
(32)
4290            Line=Line+1
4300            IF Line=7 THEN 4320
4310            GOTO 4330
4320            OUTPUT @Punch USING "#,A,A,A";CHR$(13),CHR$(13),CH
R$(10)
4321            Line=1
4330            NEXT Loop
4340            OUTPUT @Punch USING "#,A,AAA,A,D,A,A,A,A";CHR$(31)
,"VXN",CHR$(27),8,CHR$(31),CHR$(13),CHR$(13),CHR$(10)
```

```
4350           RETURN
4351 Term:     Terminate=1
4352           RETURN
4353 No_key:   RETURN
4354 Manual_posit: GCLEAR
4355               GLOAD A(*)
4356               MOVE 36,Lat_pos
4357               PEN -1
4358               LABEL "LAT:";Lat_dir$;Lat_deg;"DEG";Lat_min;"
MIN"
4359               MOVE 36,Long_pos
4360               LABEL "LONG:";Long_dir$;Long_deg;"DEG";Long_m
in;"MIN"
4361               GSTORE A(*)
4362               GCLEAR
4363               PEN 1
4364               OUTPUT 2 USING "#,B";255,75
4365               PRINT TABXY(29,12);"ENTER LAT OCTANT(N OR S)"
4366               PRINT TABXY(32,13);"AND PRESS CONTINUE"
4367               INPUT Lat_dir$
4368               PRINT TABXY(29,12);"  ENTER LATITUDE DEG.(DD)
"
4369               INPUT Lat_deg
4370               PRINT TABXY(29,12);"  ENTER LATITUDE MIN.(MM.
M)"
4371               INPUT Lat_min
4372               PRINT TABXY(1,1);"LAT=",Lat_dir$;Lat_deg;"DEG
",Lat_min;"MIN"
4373               PRINT TABXY(29,12);"ENTER LONG OCTANT(E OR W)
  "
4374               INPUT Long_dir$
4375               PRINT TABXY(29,12);"  ENTER LONGITUDE DEG.(DD
D)"
4376               INPUT Long_deg
4377               PRINT TABXY(29,12);"  ENTER LONGITUDE MIN.(MM
.M)"
4378               INPUT Long_min
4379               PRINT TABXY(1,2);"LONG=",Long_dir$;Long_deg;"
DEG";Long_min;"MIN"
4380               PRINT TABXY(32,13);"
    "
4381               PRINT TABXY(29,12);"  ALL DISPLAYED INFO OK?
    "
4382               INPUT Posit_ok$
4383               IF Posit_ok$="Y" OR Posit_ok$="YES" THEN 4387
4384               IF Posit_ok$="N" OR Posit_ok$="NO" THEN 4364
4385               BEEP 1200,.5
4386               GOTO 4381
```

```
4387                    OUTPUT 2 USING "#,B";255,75
4388                    GLOAD A(*)
4389                    MOVE 36,Lat_pos
4390                    LABEL "LAT:";Lat_dir$;Lat_deg;"DEG";Lat_min;"
MIN"
4391                    MOVE 36,Long_pos
4392                    LABEL "LONG:";Long_dir$;Long_deg;"DEG";Long_m
in;"MIN"
4393                    GSTORE A(*)
4394                    RETURN
4396   END
```

"SYS_CHEK"

```
10     OPTION BASE 1
11     ON KBD GOSUB Key
12     Nextchek=0
13     PRINTER IS 1
20     INTEGER Word1,Word2,I,K,Chek(1:1024),Rechek(1:1024)
21     !
23     !*************NAVIGATION INTERFACE CHECKOUT***************
************
24     ON TIMEOUT 12.2 GOTO 68
25     PRINT TABXY(24.15);CHR$(131);"NOW CHECKING NAV INTERFACE";
CHR$(128)
26     PRINT TABXY(24,17);"PRESS ANY KEY TO CONTINUE"
27     IF Nextchek=1 THEN 94
30     CONTROL 12,3:0
32     CONTROL 12,3:8
33     ENTER 12 USING "#,W":Long2
36     CONTROL 12,3:9
37     ENTER 12 USING "#,W";Long1
41     CONTROL 12.3;10
42     ENTER 12 USING "#,W";Lat2
44     CONTROL 12,3:11
45     ENTER 12 USING "#.W";Lat1
46 Lat:     Word1=Lat1
47          Word2=Lat2
48          GOSUB Posit
49          IF Dir=3 THEN 52
50          Dir$="N"
51          GOTO 55
52          Dir$="S"
55          PRINT TABXY(1.1);"LAT",Dir$;Deg;"DEG",Min;"MIN";"
 "
56          PRINT Lat1.Lat2
58 Long:    Word1=Long1
59          Word2=Long2
60          GOSUB Posit
61          IF Dir=3 THEN 64
62          Dir$="E"
63          GOTO 65
64          Dir$="W"
65          PRINT "LONG",Dir$:Deg:"DEG",Min;"MIN";"        "
66          PRINT Long1.Long2
67          GOTO 25
68 Navprob: OUTPUT 2 USING "#,B":255,75
69    FOR I=1 TO 10
70    BEEP 1200,.1
71    BEEP 800,.1
72    NEXT I
74    PRINT TABXY(22.13):CHR$(131);"NAV INTERFACE NOT RESPONDING
```

```
!!";CHR$(128)
75     PRINT TABXY(22,17);"PRESS ANY KEY TO CONTINUE SYSTEM CHECK
";
76           IF Nextchek=1 THEN 94
77           GOTO 76
78 Posit:     Digit(4)=SHIFT(Word1,12)
79     FOR I=3 TO 1 STEP -1
80     Word1=ROTATE(Word1,-4)
81     Digit(I)=SHIFT(Word1,12)
82     NEXT I
83     Min=(Digit(3)*10)+Digit(2)+(Digit(1)*.1)
84     Dir=SHIFT(Word2,6)
85     Digit(6)=ROTATE(Word2,6)
86     Digit(6)=SHIFT(Digit(6),14)
87     Digit(5)=ROTATE(Word2,4)
88     Digit(5)=SHIFT(Digit(5),12)
89     Deg=Digit(6)*100+Digit(5)*10+Digit(4)
90     RETURN
91     !
93     !*******************ANALOG INTERFACE CHECKOUT*************
*************
94     OUTPUT 2 USING "#,B";255,75
95     ON TIMEOUT 12,2 GOTO Analog_problem
96     Nextchek=0
97     PRINT TABXY(24,15);CHR$(131);"NOW CHECKING ANALOG INTERFAC
E";CHR$(128)
98     PRINT TABXY(24,17);"PRESS ANY KEY TO CONTINUE"
99     IF Nextchek=1 THEN 179
100    PRINT
101    CONTROL 12,3;0
102    CONTROL 12,3;16
103    CONTROL 12;32
104 Form:     IMAGE AAAA,1X,Z,3X,Z.DD
111    FOR I=1 TO 8
121    ENTER 12 USING "#,W";A(I)
125    B(I)=A(I)*.001220712
126    PRINT TABXY(1,I)
128    PRINT USING Form;"CHAN";I,B(I)
131    NEXT I
166    GOTO 97
167 Analog_problem:   OUTPUT 2 USING "#,B";255,75
168    FOR I=1 TO 10
169    BEEP 1200,.1
170    BEEP 800,.1
171    NEXT I
172    PRINT TABXY(22,13);CHR$(131);"ANALOG INTERFACE NOT RESPOND
ING!!";CHR$(128)
173    PRINT TABXY(22,17);"PRESS ANY KEY TO CONTINUE SYSTEM CHECK
```

```
OUT"
174    IF Nextchek=1 THEN GOTO 179
175    GOTO 174
176    !
178    !******************TAS INTERFACE CHECKOUT*****************
************
179    OUTPUT 2 USING "#,B";255,75
180    ON TIMEOUT 12,2 GOTO Tas_problem
181    Nextchek=0
182    PRINT TABXY(24,15);CHR$(131);"NOW CHECKING TAS INTERFACE";
CHR$(128)
183    PRINT TABXY(24,17);"PRESS ANY KEY TO CONTINUE"
184    CONTROL 12,3;0
185    CONTROL 12,3;32
186    IF Nextchek=1 THEN 231
188    ENTER 12 USING "#,W";Tascount
189    Spd=(.2442*Tascount)+149.4618
190    Spd=PROUND(Spd,-1)
198    PRINT TABXY(1,1);"COUNT=";Tascount;"                "
199    PRINT "TRUE AIR SPEED=";Spd;"                "
208    WAIT .1
218    GOTO 186
219 Tas_problem:   OUTPUT 2 USING "#,B";255,75
220    FOR I=1 TO 10
221    BEEP 1200,.1
222    BEEP 800,.1
223    NEXT I
224    PRINT TABXY(22,13);CHR$(131);"TAS INTERFACE NOT RESPONDING
!!";CHR$(128)
225    PRINT TABXY(22,17);"PRESS ANY KEY TO CONTINUE SYSTEM CHECK
OUT"
226    IF Nextchek=1 THEN 231
227    GOTO 226
228    !
230    !*********************PRINTER CHECKOUT*******************
**************
231    OUTPUT 2 USING "#,B";255,75
232    ON TIMEOUT 7,2 GOTO Printer_problem
233    Nextchek=0
234    PRINT TABXY(24,15);CHR$(131);"NOW CHECKING PRINTER";CHR$(1
28)
235    PRINTER IS 701
236    PRINT "PRINTER IS OK--PRINTER IS OK--PRINTER IS OK--PRINTE
R IS OK--PRINTER IS OK"
237    PRINTER IS 1
238    PRINT TABXY(24,17);"PRINTER IS OK - PRESS ANY KEY TO CONTI
NUE SYSTEM CHECKOUT"
240    GOTO 250
```

```
241 Printer_problem:   OUTPUT 2 USING "#,B":255,75
242    PRINTER IS 1
244    FOR I=1 TO 10
245    BEEP 1200,.1
246    BEEP 800,.1
247    NEXT I
248    PRINT TABXY(22,13);CHR$(131);"PRINTER IS NOT RESPONDING!!"
;CHR$(128)
249    PRINT TABXY(22,17);"PRESS ANY KEY TO CONTINUE SYSTEM CHECK
OUT"
250    IF Nextchek=1 THEN 255
251    GOTO 250
252    !
254    !******************PAPER TAPE PUNCH CHECKOUT**************
***************
255    OUTPUT 2 USING "#,B":255,75
256    ON TIMEOUT 8,2 GOTO Punch_problem
257    Nextchek=0
258    PRINT TABXY(24,15);CHR$(131);"NOW CHECKING PAPER TAPE PUNC
H";CHR$(128)
259    FOR J=1 TO 2
260    FOR I=1 TO 100
261    OUTPUT 8 USING "#,A";CHR$(127)
262    NEXT I
263    FOR I=1 TO 100
264    OUTPUT 8 USING "#,A";CHR$(0)
265    NEXT I
266    NEXT J
267    PRINT TABXY(24,17);"PAPER TAPE PUNCH OK - PRESS ANY KEY TO
 CONTINUE"
268    GOTO 276
269 Punch_problem:   OUTPUT 2 USING "#,B";255,75
270    FOR I=1 TO 10
271    BEEP 1200,.1
272    BEEP 800,.1
273    NEXT I
274    PRINT TABXY(22,13);CHR$(131);"PUNCH IS NOT RESPONDING!!!";
CHR$(128)
275    PRINT TABXY(22,17);"PRESS ANY KEY TO CONTINUE SYSTEM CHECK
OUT"
276    IF Nextchek=1 THEN 282
277    GOTO 276
278    !
280    !*************TAPE RECORDING SYSTEM CHECKOUT**************
************
282    ON TIMEOUT 7,2 GOTO Tape_problem
285    Nextchek=0
286    OUTPUT 2 USING "#,B":255,75
```

```
287    PRINT TABXY(24,15);CHR$(131);"NOW CHECKING TAPE SYSTEM";CH
R$(128)
288    OUTPUT 70401;"RW"
289    GOSUB Rewind_fin
290    FOR I=1 TO 1024
291    Chek(I)=I
292    NEXT I
295    OUTPUT 70401;"WF"
296    GOSUB Com_ready
297    OUTPUT 70401;"ED,2048,0;WR1"
299    OUTPUT 70402 USING "#,W";Chek(*)
300    GOSUB Com_ready
301    OUTPUT 70401;"RW"
302    GOSUB Rewind_fin
303    OUTPUT 70401;"SF1"
304    GOSUB Com_ready
306    OUTPUT 70401;"RR1"
307    ENTER 70402 USING "#,W";Rechek(*)
308    GOSUB Com_ready
309    PRINT TABXY(24,17);"TAPE SYSTEM OK - PRESS ANY KEY TO CONT
INUE"
310    GOTO 318
311 Tape_problem:   OUTPUT 2 USING "#,B";255,75
312    FOR I=1 TO 10
313    BEEP 1200,.1
314    BEEP 800,.1
315    NEXT I
316    PRINT TABXY(22,13);CHR$(131);"TAPE IS NOT RESPONDING!!";CH
R$(128)
317    PRINT TABXY(22,17);"PRESS ANY KEY TO CONTINUE SYSTEM CHECK
OUT"
318    IF Nextchek=1 THEN 321
319    GOTO 318
320    !*************************************************************
************
321    OUTPUT 2 USING "#,B";255,75
322    Nextchek=0
323    PRINT TABXY(24,15);CHR$(131);"NOW CHECKING AXBT DATA ACQUI
SITION";CHR$(128)
324    PRINT TABXY(24,17);"PRESS ANY KEY TO CONTINUE"
325    IF Nextchek=1 THEN 392
326    PRINT TABXY(0,0)
327    ON TIMEOUT 12,2 GOTO Axbt_problem
328    Interface=1
329    Next_line=1
330    CONTROL 12,3;15
331    STATUS 12,5;Stio1
332    IF BIT(Stio1,0) THEN Status1_problem
```

```
333   ENTER 12 USING "#,W";Chan1
334   Freq1=1/(Chan1*1.E-7)
335   Freq1=PROUND(Freq1,-0)
336   Temp1=(Freq1-1440)/36
337   Temp1=PROUND(Temp1,-2)
340   PRINT TABXY(0,2);"CHAN 1: FREQ=";Freq1;"HZ  TEMP=";Temp1;"
DEG C      "
341   Interface=2
342   Next_line=2
343   CONTROL 12,3;14
344   STATUS 12,5;Stio2
345   IF BIT(Stio2,0) THEN Status2_problem
346   ENTER 12 USING "#,W";Chan2
347   Freq2=1/(Chan2*1.E-7)
348   Freq2=PROUND(Freq2,-0)
349   Temp2=(Freq2-1440)/36
350   Temp2=PROUND(Temp2,-2)
351   PRINT TABXY(0,4);"CHAN 2: FREQ=";Freq2;"HZ  TEMP=";Temp2;"
DEG C      "
352   Interface=3
353   Next_line=3
354   CONTROL 12,3;13
355   STATUS 12,5;Stio3
356   IF BIT(Stio3,0) THEN Status3_problem
357   ENTER 12 USING "#,W";Chan3
358   Freq3=1/(Chan3*1.E-7)
359   Freq3=PROUND(Freq3,-0)
360   Temp3=(Freq3-1440)/36
361   Temp3=PROUND(Temp3,-2)
362   PRINT TABXY(0,6);"CHAN 3: FREQ=";Freq3;"HZ  TEMP=";Temp3;"
DEG C      "
363   WAIT .5
364   GOTO 325
365 Status1_problem:    !
366   PRINT TABXY(0,2);CHR$(131);"STATUS INDICATES NO CHAN 1 SIG
NAL!!      ";CHR$(128)
367   GOTO 341
368 Status2_problem:    !
369   PRINT TABXY(0,4);CHR$(131);"STATUS INDICATES NO CHAN 2 SIG
NAL!!      ";CHR$(128)
370   GOTO 352
371 Status3_problem:    !
372   PRINT TABXY(0,6);CHR$(131);"STATUS INDICATES NO CHAN 3 SIG
NAL!!      ";CHR$(128)
373   GOTO 325
374 Axbt_problem:    !
375   OUTPUT 2 USING "#,B";255,75
376   FOR I=1 TO 10
```

```
377   BEEP 1200,.1
378   BEEP 800,.1
379   NEXT I
380   PRINT TABXY(22.13);CHR$(131);"INTERFACE FOR CHAN";Interfac
e;"IS NOT RESPONDING!!";CHR$(128)
381   PRINT TABXY(22.17);"PRESS ANY KEY TO CONTINUE"
382   ON Next_line GOTO 341.352.325
383 Key:    Empty$=KBD$
384         Nextchek=1
385         RETURN
386 Com_ready:  ENTER 70401:P1.P2.P3,P4
387             IF BIT(P1.4)=0 THEN 386
388             RETURN
389 Rewind_fin: ENTER 70401:P1.P2.P3.P4
390             IF BIT(P2.3)=0 OR BIT(P2.5)=1 THEN 389
391             RETURN
392   OUTPUT 2 USING "#,B";255,75
393   PRINT TABXY(24.15);"SYSTEM CHECK FINISHED!!"
394   END
```

"MET_LIST"

```
10    OPTION BASE 1
20    PRINTER IS 1
40    INTEGER M(1:30000) BUFFER,I,J,K,Z,Met_marker
41    ASSIGN @Path1 TO BUFFER M(*);WORD
42    ASSIGN @Path2 TO 70402
50    MAT M= (0)
70    W$="LAT:"
80    X$="DEG"
90    Y$="MIN"
100   Z$="LONG:"
110   OFF KEY
120   FOR I=1 TO 40
130   PRINT TABXY(26,8);" MET DATA EDIT PROGRAM "
140   PRINT TABXY(I+18,8),"*";
150   NEXT I
160   PRINT
170   FOR I=1 TO 10
180   PRINT TABXY(19,I+8),"*";
190   FOR J=1 TO 38
200   PRINT " ";
210   NEXT J
220   PRINT "*"
230   NEXT I
240   FOR I=1 TO 40
250   PRINT TABXY(I+18,19),"*";
260   NEXT I
270   PRINT TABXY(29,12);"ENTER FLIGHT NO. AND"
280   PRINT TABXY(26,13);"      PRESS CONTINUE         "
290   INPUT Flight
300   PRINT TABXY(0,1);"FLIGHT NUMBER";Flight;"SELECTED"
490   PRINT TABXY(26,13);CHR$(131);" IS ALL DISPLAYED INFO OK? "
;CHR$(128)
500   PRINT TABXY(29,12);"                          "
510   PRINT TABXY(29,14);"                          "
520   INPUT Ok$
530   IF Ok$="Y" OR Ok$="YES" THEN 820
540   IF Ok$="N" OR Ok$="NO" THEN 270
550   GOTO 490
820   BEEP 1000,.5
830   PRINT TABXY(26,13);CHR$(130);" PRESS CONTINUE TO START    "
;CHR$(128)
840   PAUSE
850   OUTPUT 2 USING "#,B";255,75
860   OUTPUT 70401;"RW"
870   GOSUB Rewind_fin
880   OUTPUT 70401;"SF1"
890   GOSUB Com_ready
900   OUTPUT 70401;"RR1"
```

```
910    ENTER 70402 USING "#,W":Month,Day,Year,Flight2,Type,First
920    IF Flight2=Flight THEN 931
930    GOTO 880
931    PRINTER IS 701
933    PRINT "*****************************************************
************************"
934    PRINT
935    PRINT "FLIGHT NO.":Flight2,Month;"-";Day;"-";Year,"
 MET. AND TAS DATA"
936    PRINT
937    PRINT "*****************************************************
************************"
938    PRINT
940    OUTPUT 70401:"RR1"
950    ENTER 70402 USING "#,W":Met_marker
960    IF Met_marker=7000 THEN 981
970    ENTER 70405 USING "#"
971    GOSUB Com_ready
980    GOTO 940
981    ENTER 70405 USING "#"
990    OUTPUT 70401:"SR1,1"
991    GOSUB Com_ready
994    OUTPUT 70401;"RR10"
995    TRANSFER @Path2 TO @Path1
998    Row=2
999    PRINTER IS 701
1000   GOTO 1016
1001   IMAGE AAAAA,1X,ZZ,A,ZZ,A,ZZ,2X,AAA,1X,ZZZ,AAA,1X,ZZ.D,A,A,
3X,AAAA,1X,ZZZ,AAA,1X,ZZ.D,A,A
1002   IMAGE AAAAA,3X,AAAAA,3X,AAAAA,3X,AAAAA,3X,AAAAA,3X,AAAAA,3
X,AAAAA,3X,AAAAA,3X,AAA
1003   IMAGE X,D.DD,4X,D.DD,4X,D.DD,4X,D.DD,4X,D.DD,4X,D.DD,4X,D.
DD,4X,D.DD,3X,DDD.D
1004   PRINT USING 1001:"TIME:",M(Row),":",M(Row+1),":",M(Row+2),
"LAT",Lat_deg,"deg",Lat_min,"´",Lat_dir$,"LONG",Long_deg,"deg",L
ong_min,"´",Long_dir$
1005   PRINT USING 1002:"CHAN1","CHAN2","CHAN3","CHAN4","CHAN5","
CHAN6","CHAN7","CHAN8","TAS"
1006   PRINT USING 1003;M(Row+7),M(Row+8),M(Row+9),M(Row+10),M(Ro
w+11),M(Row+12),M(Row+13),M(Row+14),M(Row+15)
1007   PRINT
1008   PRINT
1010   Row=Row+16
1011   IF (Row+15)>30000 THEN 1013
1012   GOTO 1016
1013   PRINTER IS 1
1014   GOTO 4360
1016   Word1=M(Row+3)
```

```
1026  Word2=M(Row+4)
1110  GOSUB Posit
1120  IF Dir=3 THEN 1150
1130  Lat_dir$="N"
1140  GOTO 1160
1150  Lat_dir$="S"
1160  Lat_deg=Deg
1170  Lat_min=Min
1180  Word1=M(Row+5)
1190  Word2=M(Row+6)
1200  GOSUB Posit
1210  IF Dir=3 THEN 1240
1220  Long_dir$="E"
1230  GOTO 1250
1240  Long_dir$="W"
1250  Long_deg=Deg
1260  Long_min=Min
1261  FOR I=7 TO 14
1262  M(Row+I)=(M(Row+I))*.0012207
1263  NEXT I
1264  M(Row+15)=(.0927734*M(Row+15))+70
1270  GOTO 1004
4040 Posit:   Digit(4)=SHIFT(Word1,12)
4050          FOR I=3 TO 1 STEP -1
4060          Word1=ROTATE(Word1,-4)
4070          Digit(I)=SHIFT(Word1,12)
4080          NEXT I
4090          Min=(Digit(3)*10)+Digit(2)+(Digit(1)*.1)
4100          Dir=SHIFT(Word2,6)
4110          Digit(6)=ROTATE(Word2,6)
4120          Digit(6)=SHIFT(Digit(6),14)
4130          Digit(5)=ROTATE(Word2,4)
4140          Digit(5)=SHIFT(Digit(5),12)
4150          Deg=Digit(6)*100+Digit(5)*10+Digit(4)
4160          RETURN
4170 Rewind_fin:  ENTER 70401;P1,P2,P3,P4
4180              IF BIT(P2,3)=0 OR BIT(P2,5)=1 THEN 4170
4190              RETURN
4200 Com_ready:   ENTER 70401;P1,P2,P3,P4
4210              IF BIT(P1,4)=0 THEN 4200
4220              RETURN
4360  END
```

"TAPEDUMP"

```
10     OPTION BASE 1
20     GRAPHICS ON
30     GINIT
31     PRINTER IS 1
33     Flag=0
40     INTEGER A(1:12480),G(1:12480),I,J,K,Z,Data1(1:5287)
72     W$="LAT:"
80     X$="DEG"
90     Y$="MIN"
100    Z$="LONG:"
110    OFF KEY
120    FOR I=1 TO 40
130    PRINT TABXY(28,8);"       TAPE DUMP          "
140    PRINT TABXY(I+18,8),"*";
150    NEXT I
160    PRINT
170    FOR I=1 TO 10
180    PRINT TABXY(19,I+8),"*";
190    FOR J=1 TO 38
200    PRINT " ";
210    NEXT J
220    PRINT "*"
230    NEXT I
240    FOR I=1 TO 40
250    PRINT TABXY(I+18,19),"*";
260    NEXT I
820    BEEP 1000,.5
821    PRINT TABXY(26,13);" WANT TO SELECT FLIGHT NO?"
822    INPUT Select$
823    IF Select$="Y" OR Select$="YES" THEN 826
824    IF Select$="N" OR Select$="NO" THEN 832
825    GOTO 820
826    PRINT TABXY(26,13);"     ENTER FLIGHT NUMBER    "
827    PRINT TABXY(26,14);"     AND PRESS CONTINUE     "
828    INPUT Flight
829    PRINT TABXY(26,14);"                            "
830    Flt_flg=1
832    PRINT TABXY(26,13);CHR$(130);" PRESS CONTINUE TO START    "
;CHR$(128)
840    PAUSE
841    PRINTER IS 701
850    OUTPUT 2 USING "#,B";255,75
860    OUTPUT 70401;"RW"
870    GOSUB Rewind_fin
880    OUTPUT 70401;"SF1"
890    GOSUB Com_ready
900    OUTPUT 70401;"RR1"
910    ENTER 70402 USING "#,W";Month,Day,Year,Flight2,Type,First
```

```
911   IF Flt_flg=0 THEN 931
920   IF Flight2=Flight THEN 931
930   GOTO 880
931   PRINT
932   PRINT
933   PRINT
934   PRINT
935   PRINT "*****************************************************
**************"
937   PRINT "FLIGHT NUMBER";Flight2,"    ",Month;"-";Day;"-";Year
938   PRINT
939   PRINT
941   OUTPUT 70401;"RR1"
950   ENTER 70402 USING "#,W";Bt_2
972   IF Bt_2=7000 THEN 981
980   GOTO 1001
981   ENTER 70405 USING "#"
984   GOSUB Com_ready
985   OUTPUT 70401;"SF2"
986   GOSUB Com_ready
987   ENTER 70403;P1
989   IF BIT(P1,2)=1 THEN 994
990   OUTPUT 70401;"SF2,1"
991   GOSUB Com_ready
993   GOTO 880
994   BEEP 1000,.5
995   PRINT "END OF DATA-----------!!"
996   PRINTER IS 1
998   PRINT TABXY(27,10);CHR$(131);"END OF DATA--------!!";CHR$(
128)
1000  GOTO 4360
1001  ENTER 70402 USING "#,W";Data1(1),Data1(2),Data1(3),Data1(4
),Data1(5),Data1(6),Data1(7)
1003  Bt=Bt_2
1010  T1=Data1(1)
1020  T2=Data1(2)
1030  T3=Data1(3)
1040  T1$=VAL$(T1)
1050  T2$=VAL$(T2)
1060  T3$=VAL$(T3)
1070  Colon$=":"
1080  T4$=T1$&Colon$&T2$&Colon$&T3$
1090  Word1=Data1(4)
1100  Word2=Data1(5)
1110  GOSUB Posit
1120  IF Dir=3 THEN 1150
1130  Lat_dir$="N"
1140  GOTO 1160
```

```
1150  Lat_dir$="S"
1160  Lat_deg=Deg
1170  Lat_min=Min
1180  Word1=Data1(6)
1190  Word2=Data1(7)
1200  GOSUB Posit
1210  IF Dir=3 THEN 1240
1220  Long_dir$="E"
1230  GOTO 1250
1240  Long_dir$="W"
1250  Long_deg=Deg
1260  Long_min=Min
1261 Output:   IMAGE #,AAAAAA,ZZZ,2X,AAAAAAAA,1X,AAA,1X,ZZZ,AAA,
1X,ZZ.D,A,A,2X,AAAA,1X,ZZZ,AAA,1X,ZZ.D,A,A
1262  PRINT USING Output;"BT NO.",Bt,T4$,"LAT",Lat_deg,"deg",Lat
_min,"´",Lat_dir$,"LONG",Long_deg,"deg",Long_min,"´",Long_dir$
1264  !PRINT "BT NO.";Bt
1265  !PRINT T4$
1266  !PRINT "LAT";Lat_deg;"DEG",Lat_min;"MIN",Lat_dir$
1267  !PRINT "LONG";Long_deg;"DEG",Long_min;"MIN",Long_dir$
1268  PRINT
1269  PRINT
1270  ENTER 70405 USING "#"
1272  GOTO 941
2340 Next:    OUTPUT 2 USING "#,B";255,75
3890          GCLEAR
3990          IF Type$="S" THEN 4020
4000          Position=-222
4010          GOTO 4030
4020          Position=-111
4030          GOTO 941
4040 Posit:   Digit(4)=SHIFT(Word1,12)
4050          FOR I=3 TO 1 STEP -1
4060          Word1=ROTATE(Word1,-4)
4070          Digit(I)=SHIFT(Word1,12)
4080          NEXT I
4090          Min=(Digit(3)*10)+Digit(2)+(Digit(1)*.1)
4100          Dir=SHIFT(Word2,6)
4110          Digit(6)=ROTATE(Word2,6)
4120          Digit(6)=SHIFT(Digit(6),14)
4130          Digit(5)=ROTATE(Word2,4)
4140          Digit(5)=SHIFT(Digit(5),12)
4150          Deg=Digit(6)*100+Digit(5)*10+Digit(4)
4160          RETURN
4170 Rewind_fin:  ENTER 70401;P1,P2,P3,P4
4180              IF BIT(P2,3)=0 OR BIT(P2,5)=1 THEN 4170
4190              RETURN
4200 Com_ready:   ENTER 70401;P1,P2,P3,P4
```

```
4210           IF BIT(P1,4)=0 THEN 4200
4220           RETURN
4230 Dump:     OUTPUT 701;"







"
4240           OUTPUT 701;"







"
4250           OUTPUT 701;"
"
4260           DUMP GRAPHICS
4270           RETURN
4360  END
```

"50M_DUMP"

```
10    OPTION BASE 1
20    GRAPHICS ON
30    GINIT
31    Flag=0
40    INTEGER A(1:12480),G(1:12480),I,J,K,Z,Data1(1:5287)
72    W$="LAT:"
80    X$="DEG"
90    Y$="MIN"
100   Z$="LONG:"
110   OFF KEY
120   FOR I=1 TO 40
130   PRINT TABXY(28,8);" 50 METER PROFILE DUMP "
140   PRINT TABXY(I+18,8),"*";
150   NEXT I
160   PRINT
170   FOR I=1 TO 10
180   PRINT TABXY(19,I+8),"*";
190   FOR J=1 TO 38
200   PRINT " ";
210   NEXT J
220   PRINT "*"
230   NEXT I
240   FOR I=1 TO 40
250   PRINT TABXY(I+18,19),"*";
260   NEXT I
270   PRINT TABXY(29,12);"ENTER FLIGHT NO. AND"
280   PRINT TABXY(26,13);"      PRESS CONTINUE        "
290   INPUT Flight
300   PRINT TABXY(0,1);"FLIGHT NUMBER";Flight;"SELECTED"
350   PRINT TABXY(29,12);"    ENTER BT TYPE    "
360   PRINT TABXY(26,13);"(S=SHALLOW,D=DEEP,M=MIXED)"
370   PRINT TABXY(29,14);"AND PRESS CONTINUE"
380   INPUT Type$
390   IF Type$="S" THEN 430
400   IF Type$="D" THEN 450
410   IF Type$="M" THEN 470
420   GOTO 350
430   PRINT TABXY(0,3);"BT TYPE IS 'SHALLOW'"
440   GOTO 480
450   PRINT TABXY(0,3);"BT TYPE IS 'DEEP'    "
460   GOTO 480
470   PRINT TABXY(0,3);"BT TYPE IS 'MIXED'   "
480   BEEP 1000,.5
490   PRINT TABXY(26,13);CHR$(131);" IS ALL DISPLAYED INFO OK? "
;CHR$(128)
500   PRINT TABXY(29,12);"                          "
510   PRINT TABXY(29,14);"                          "
520   INPUT Ok$
```

```
530    IF Ok$="Y" OR Ok$="YES" THEN 560
540    IF Ok$="N" OR Ok$="NO" THEN 270
550    GOTO 490
560    IF Type$="S" THEN 691
561    Depth_max=-800.00
570    Position=-222
580    Select_no1=-196
590    Select_no2=26
600    Bt_pos=50
610    T_pos=20
620    Lat_pos=-10
630    Long_pos=-40
640    Curs_labl=-70
650    Data_labl=-160
660    Data_header=-190
670    Sample_max=5280
680    Data_pos=26
690    GOTO 820
691    Depth_max=-400.00
700    Position=-111
710    Select_no1=-98
720    Select_no2=13
730    Bt_pos=25
740    T_pos=10
750    Lat_pos=-5
760    Long_pos=-20
770    Curs_labl=-35
780    Data_labl=-80
790    Data_header=-95
800    Sample_max=2640
810    Data_pos=13
820    BEEP 1000,.5
830    PRINT TABXY(26,13);CHR$(130);" PRESS CONTINUE TO START   "
;CHR$(128)
840    PAUSE
850    OUTPUT 2 USING "#,B":255,75
860    OUTPUT 70401;"RW"
870    GOSUB Rewind_fin
880    OUTPUT 70401;"SF1"
890    GOSUB Com_ready
900    OUTPUT 70401;"RR1"
910    ENTER 70402 USING "#,W";Month,Day,Year,Flight2,Type,First
920    IF Flight2=Flight THEN 940
930    GOTO 880
940    OUTPUT 70401;"RR1"
950    ENTER 70402 USING "#,W";Bt_2
972    IF Bt_2=7000 THEN 981
980    GOTO 990
```

```
981    BEEP 1000,.5
982    PRINT TABXY(27,10);CHR$(131);"END OF FLIGHT------!!";CHR$(
128)
984    GOTO 4360
990    ENTER 70402 USING "#,W";Data1(*)
1000   Bt=Bt_2
1010   T1=Data1(1)
1020   T2=Data1(2)
1030   T3=Data1(3)
1040   T1$=VAL$(T1)
1050   T2$=VAL$(T2)
1060   T3$=VAL$(T3)
1070   Colon$=":"
1080   T4$=T1$&Colon$&T2$&Colon$&T3$
1090   Word1=Data1(4)
1100   Word2=Data1(5)
1110   GOSUB Posit
1120   IF Dir=3 THEN 1150
1130   Lat_dir$="N"
1140   GOTO 1160
1150   Lat_dir$="S"
1160   Lat_deg=Deg
1170   Lat_min=Min
1180   Word1=Data1(6)
1190   Word2=Data1(7)
1200   GOSUB Posit
1210   IF Dir=3 THEN 1240
1220   Long_dir$="E"
1230   GOTO 1250
1240   Long_dir$="W"
1250   Long_deg=Deg
1260   Long_min=Min
1261   IF Flag=1 THEN 1443
1270   VIEWPORT 0,125.9,100
1280   IF Type$="S" THEN 1330
1290   WINDOW -7,53.7,-810,60
1300   ASSIGN @Path1 TO "EDIT_GRID2"
1310   ENTER @Path1;G(*)
1320   GOTO 1430
1330   WINDOW -7,53.7,-405,30
1340   ASSIGN @Path1 TO "EDIT_GRID"
1350   ENTER @Path1;G(*)
1430   DIM Depth1(5280),Temp1(5280)
1440   DIM Temp2(23),Depth2(23),Message(31),Data(23)
1441   Flag=1
1443   GLOAD G(*)
1444   LINE TYPE 1
1445   PEN 1
```

```
1450  J=1
1460  FOR U=0 TO 528 STEP .1
1470  Depth1(J)=-1.5926*U
1480  J=J+1
1490  NEXT U
1500  FOR I=1 TO Sample_max
1510  IF Data1(I+7)>6945 OR Data1(I+7)<3700 THEN 1540
1520  Temp1(I)=((1/(Data1(I+7)*1.E-7))-1440)/36
1530  GOTO 1550
1540  Temp1(I)=-5
1550  NEXT I
1560  J=0
1570  K=0
1580  MOVE 0,0
1590  FOR I=2 TO Sample_max
1591  IF Temp1(I)=-5 OR Temp1(I-1)=-5 THEN 1620
1600  MOVE Temp1(I-1),Depth1(I-1)
1610  DRAW Temp1(I),Depth1(I)
1620  NEXT I
1630  CSIZE 3
1690  MOVE 36,Bt_pos
1700  LORG 2
1710  LABEL "BT NO.:";Bt
1720  MOVE 36,T_pos
1730  LABEL "TIME:";T4$
1740  MOVE 36,Lat_pos
1750  LABEL "LAT:";Lat_dir$;Lat_deg;"DEG";Lat_min;"MIN"
1760  MOVE 36,Long_pos
1770  LABEL "LONG:";Long_dir$;Long_deg;"DEG";Long_min;"MIN"
1810  MOVE 36,Data_labl
1820  CSIZE 3
1830  LABEL "SELECTED DATA:"
1840  MOVE 38,Data_header
1850  CSIZE 2.5
1860  LABEL "TEMP(DegC) DEPTH(M)"
1870  GSTORE A(*)
1880  MOVE 0,0
1890  I=1
1900  K=0
2120  J=0
2130  MOVE 38,Position
2131  CSIZE 3
2133  LABEL USING "2X,DD.DD,X,2X,DDD.D";PROUND(Temp1(1),-2),PROU
ND(-Depth1(1),-2)
2134  Position=Position-Data_pos
2136  Test=2
2144  Depth=-50.00
2154  IF PROUND(Depth1(Test),-1)<Depth+.1 AND PROUND(Depth1(Test
```

```
),-1))Depth-.1 THEN 2184
2164  Test=Test+1
2174  GOTO 2154
2184  IF Temp1(Test)=-5 THEN 2300
2190  MOVE Temp1(Test)-5,Depth1(Test)
2200  DRAW Temp1(Test)+5,Depth1(Test)
2210  MOVE 38,Position
2280  LABEL USING "2X,DD.DD,X,2X,DDD.D";PROUND(Temp1(Test),-2),P
ROUND(-Depth1(Test),-2)
2300  Position=Position-Data_pos
2310  IF Depth=Depth_max THEN 2330
2320  Depth=Depth-50.00
2324  GOTO 2154
2330  GOSUB Dump
2340 Next:     OUTPUT 2 USING "#,B";255,75
3890           GCLEAR
3990           IF Type$="S" THEN 4020
4000           Position=-222
4010           GOTO 4030
4020           Position=-111
4030           GOTO 940
4040 Posit:    Digit(4)=SHIFT(Word1,12)
4050           FOR I=3 TO 1 STEP -1
4060           Word1=ROTATE(Word1,-4)
4070           Digit(I)=SHIFT(Word1,12)
4080           NEXT I
4090           Min=(Digit(3)*10)+Digit(2)+(Digit(1)*.1)
4100           Dir=SHIFT(Word2,6)
4110           Digit(6)=ROTATE(Word2,6)
4120           Digit(6)=SHIFT(Digit(6),14)
4130           Digit(5)=ROTATE(Word2,4)
4140           Digit(5)=SHIFT(Digit(5),12)
4150           Deg=Digit(6)*100+Digit(5)*10+Digit(4)
4160           RETURN
4170 Rewind_fin:  ENTER 70401;P1,P2,P3,P4
4180              IF BIT(P2,3)=0 OR BIT(P2,5)=1 THEN 4170
4190              RETURN
4200 Com_ready:   ENTER 70401;P1,P2,P3,P4
4210              IF BIT(P1,4)=0 THEN 4200
4220              RETURN
4230 Dump:        OUTPUT 701;"
```

```
"
4240                    OUTPUT 701;"
"
4250                    OUTPUT 701;"



"
4260                    DUMP GRAPHICS
4270                    RETURN
4360  END
```

APPENDIX A

BATHYTHERMOGRAPH LOG

1	2	3	4	5	6
MESSAGE PREFIX	DATE (GMT)	TIME (GMT)	QUAD / LATITUDE	LONGITUDE	INDICATOR GROUP
M_i M_i M_j M_j	DAY / MONTH / YR.	HOUR / MIN.	DEG. / MIN.	DEG. / MIN.	
	Y Y / M M / J	G G / g g	Q_c / L_a L_a / L_a L_a	L_o L_o L_o / L_o L_o	
J J X X		/			8 8 8 8 8
	16 17	18 – 21	23 – 27	28 – 32	

BATHYTHERMOGRAPH TRACE READINGS

DEPTH / TEMP.	DEPTH / TEMP.	DEPTH / TEMP.	DEPTH / TEMP.	DEPTH / TEMP.	DEPTH / TEMP.
Z_o Z_o / T_o T_o T_o	Z Z / T_z T_z T_z	Z Z / T_z T_z T_z	Z Z / T_z T_z T_z	Z Z / T_z T_z T_z	Z Z / T_z T_z T_z
0 0					
Z Z / T_z T_z T_z	Z Z / T_z T_z T_z	Z Z / T_z T_z T_z	Z Z / T_z T_z T_z	Z Z / T_z T_z T_z	Z Z / T_z T_z T_z
Z Z / T_z T_z T_z	Z Z / T_z T_z T_z	Z Z / T_z T_z T_z	Z Z / T_z T_z T_z	Z Z / T_z T_z T_z	RADIO CALL
38 – 42	43 – 47	48 – 52	53 – 57	58 – 62	63 – 67

1	2	3	4	5	6
MESSAGE PREFIX	DATE (GMT)	TIME (GMT)	QUAD / LATITUDE	LONGITUDE	INDICATOR GROUP
M_i M_i M_j M_j	DAY / MONTH / YR.	HOUR / MIN	DEG. / MIN.	DEG. / MIN.	
	Y Y / M M / J	G G / g g	Q_c / L_a L_a / L_a L_a	L_o L_o L_o / L_o L_o	
J J X X		/			8 8 8 8 8
	16 17	18 – 21	23 – 27	28 – 32	

BATHYTHERMOGRAPH TRACE READINGS

DEPTH / TEMP.	DEPTH / TEMP.	DEPTH / TEMP.	DEPTH / TEMP.	DEPTH / TEMP.	DEPTH / TEMP.
Z_o Z_o / T_o T_o T_o	Z Z / T_z T_z T_z	Z Z / T_z T_z T_z	Z Z / T_z T_z T_z	Z Z / T_z T_z T_z	Z Z / T_z T_z T_z
0 0					
Z Z / T_z T_z T_z	Z Z / T_z T_z T_z	Z Z / T_z T_z T_z	Z Z / T_z T_z T_z	Z Z / T_z T_z T_z	Z Z / T_z T_z T_z
Z Z / T_z T_z T_z	Z Z / T_z T_z T_z	Z Z / T_z T_z T_z	Z Z / T_z T_z T_z	Z Z / T_z T_z T_z	RADIO CALL
38 – 42	43 – 47	48 – 52	53 – 57	58 – 62	63 – 67

1	2	3	4	5	6
MESSAGE PREFIX	DATE (GMT)	TIME (GMT)	QUAD / LATITUDE	LONGITUDE	INDICATOR GROUP
M_i M_i M_j M_j	DAY / MONTH / YR	HOUR / MIN	DEG / MIN	DEG. / MIN.	
	Y Y / M M / J	G G / g g	Q_c / L_a L_a / L_a L_a	L_o L_o L_o / L_o L_o	
J J X X		/			8 8 8 8 8
	16 17	18 – 21	23 – 27	28 – 32	

BATHYTHERMOGRAPH TRACE READINGS

DEPTH / TEMP.	DEPTH / TEMP.	DEPTH / TEMP	DEPTH / TEMP.	DEPTH / TEMP.	DEPTH / TEMP.
Z_o Z_o / T_o T_o T_o	Z Z / T_z T_z T_z	Z Z / T_z T_z T_z	Z Z / T_z T_z T_z	Z Z / T_z T_z T_z	Z Z / T_z T_z T_z
0 0					
Z Z / T_z T_z T_z	Z Z / T_z T_z T_z	Z Z / T_z T_z T_z	Z Z / T_z T_z T_z	Z Z / T_z T_z T_z	Z Z / T_z T_z T_z
Z Z / T_z T_z T_z	Z Z / T_z T_z T_z	Z Z / T_z T_z T_z	Z Z / T_z T_z T_z	Z Z / T_z T_z T_z	RADIO CALL
38 – 42	43 –	48 – 52	53 – 57	58 – 62	63 – 67

FOR NAVY AIRCRAFT USE

		SQDN TYPE	SQDN NMBR	SORTIE NUMBER	YR	MON		
B	A				'		Ƶ	T
1	2	3 - 4	5 - 7	8 - 11	12	13 - 14	15	22

CODE	LETTERS	FIGURES	CODE	LETTERS	FIGURES
00000	Blank	Blank	10000	T	5
00001	E	3	10001	Z	+
00010	Linefeed	Linefeed	10010	L	)
00011	A		10011	W	2
00100	Space	Space	10100	H	#
00101	S	'	10101	Y	6
00110	I	8	10110	P	Ø
00111	U	7	10111	Q	1
01000	Car. Ret.	Car. Ret.	11000	O	9
01001	D	Acknowledge	11001	B	?
01010	R	4	11010	G	&
01011	J	Bell	11011	Figures	Figures
01100	N	,	11100	M	.
01101	F	!	11101	X	/
01110	C	:	11110	V	*
01111	K	(	11111	Letters	Letters

FIVE LEVEL BAUDOT CODE USED WITH ADAPS PAPER TAPE PUNCH

12 Bit Microelectronic Data Acquisition System Models HDAS-16, HDAS-8

FEATURES

- Miniature 62 Pin Package
- 12 Bit Resolution
- 10mV to 10V Full Scale Range
- Three-State Outputs
- 16 Channels Single Ended or 8 Channels Differential

GENERAL DESCRIPTION

Utilizing hybrid technology, Datel-Intersil offers a data acquisition system with superior performance and reliability, combined with low cost.

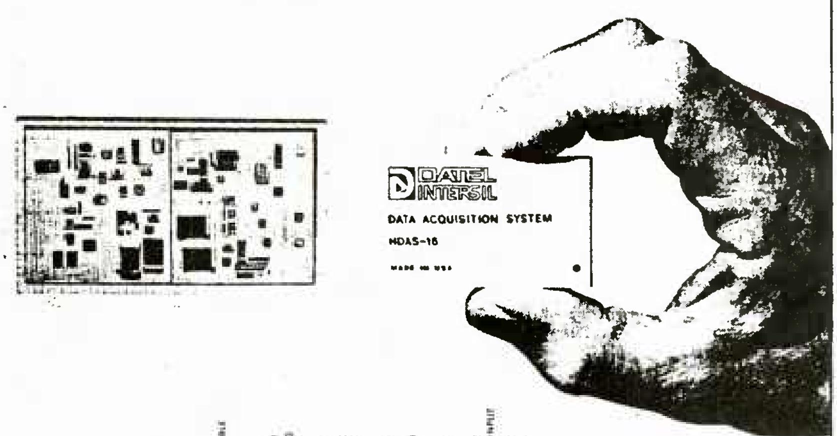
The HDAS-8 with 8 differential input channels and HDAS-16 with 16 single ended input channels are complete high performance 12 bit data acquisition systems in a 62 pin package. Acquisition and conversion time combined is 20μsec. max., giving a minimum throughput rate of 50 kHz. The twelve bit binary data can be transferred out in three four bit bytes, by means of the three-state data bus drivers. Output coding is straight binary in unipolar operation and offset binary in bipolar operation.

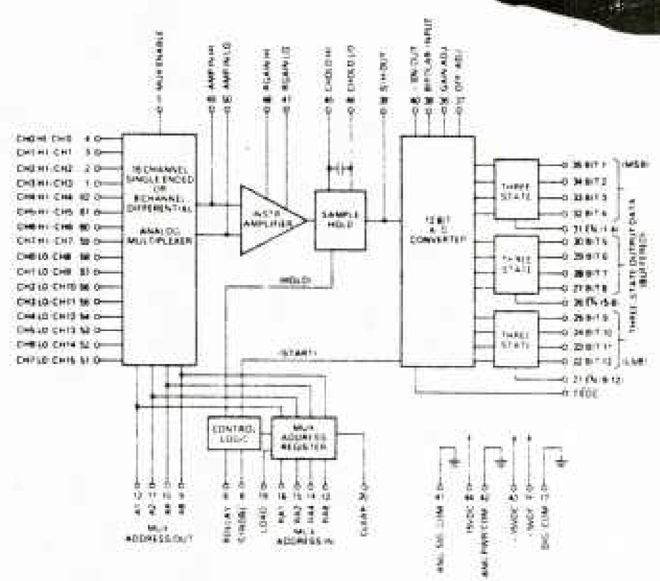
The HDAS circuit includes a multiplexer, programmable gain instrumentation amplifier, sample and hold circuit complete with MOS hold capacitor, 10 volt buffered reference, a twelve bit A/D converter with three-state outputs and digital logic.

The internal instrumentation amplifier is programmed with a single resistor for gains of 1 to 1000. This key feature is useful in low level signal applications involving bridge amplifiers, transducers, strain gauge and thermocouple interface.

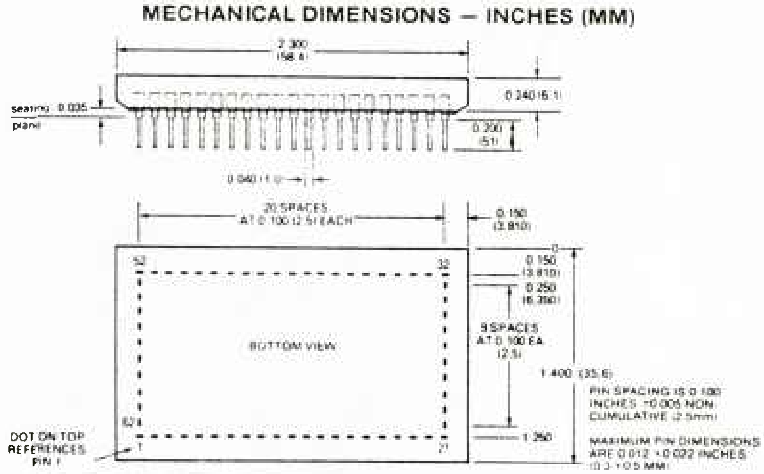
The HDAS is cased in a small hermetic 62 pin package. Models are available in three different temperature ranges: 0 to +70, −25 to +85, and −55 to +125 degrees centigrade.

High reliability versions of each model are also available. Power requirements are ±15VDC and +5VDC.





MECHANICAL DIMENSIONS — INCHES (MM)



SPECIFICATIONS, HDAS-16 & HDAS-8 (Typical at 25°C, ±15V and +5V supplies unless otherwise indicated).

MAXIMUM RATINGS

+5V Supply	−0.5V to +7.0V
+15V Supply	−0.5V to +18 0V
−15V Supply	+0.5 to −18.0V
Analog Input Channels[1]	±35V
Digital Input Pins	−0.5V to +7.0V

ANALOG INPUTS

Number of Channels	16 Single Ended (HDAS-16) 8 Differential (HDAS-8)
Voltage Ranges[2], unipolar	0 to +10mV to 0 to +10V
bipolar	±10mV to ±10V
Input Gain Equation	$G=1+\frac{20K}{RG}$
Common Mode Range	±11V min.
Input Resistance	100 megohms
Gain Equation Error	0.1% max.
Input Bias Current	200pA max.
Bias Current Tempco	Doubles every 10°C
Input Offset Current	50pA max.
Offset Current Tempco	Doubles every 10°C
Input Offset Voltage	8mV typ., 27 mV max.
Offset Voltage Tempco	20μV/°C + (10μV/°C×G)
Voltage Noise (RMS)	
G=1	150μV RTI[3]
G=1000	1.62μV RTI[3]
Input Capacitance, OFF channel	10pF
ON channel	100pF (HDAS-16) 50pF (HDAS-8)

ACCURACY

Resolution	12 Bits
System Error	±0.025% of FSR[4] max. (±1 LSB)
Nonlinearity	±½LSB max.
Differential Nonlinearity	±½LSB max.
Gain Error	Adj. to zero
Offset Error	Adj. to zero
Temp. Coeff. of Gain	±10ppm/°C typ., ±30ppm/°C max.
Temp. Coeff. of Offset	±7ppm/°C of FSR max.
Diff. Linearity Tempco	±3ppm/°C of FSR max.
CMRR(Gain=1)	82 db @ 10 KHz
CMRR(Gain=1000)	110 db @ 60 Hz
Monotonicity	Guaranteed over operating temp range
Power Supply Rejection	.01%/%

DYNAMIC CHARACTERISTICS

Throughput Rate	50 kHz min.
Acquisition Time	9μsec. typ. 10μsec max.
Conversion Time	9μsec. typ. 10μsec. max.
Aperture Delay Time	100nsec.
Sample-Hold Droop	1 μV/μsec.
Feedthrough (1 KHz)	.01% max.
Channel Crosstalk (MUX)	−80 dB at 1 kHz

DIGITAL OUTPUTS[5]

Parallel Data Out	12 parallel lines of buffered three-state output data. Drives 5 TTL loads.
Coding	Straight binary, Offset binary
Mux Address Out	Buffered output of address register. Drives 5 TTL loads.
$\overline{\text{EOC}}$ (Status)	Drives 5 TTL loads.

DIGITAL INPUTS[6]

$\overline{\text{Enable}}$	Three separate inputs which enable three-state outputs in 4 bit bytes. 1 LS TTL load.
Mux Address In	3 Bit (HDAS-8) or 4 bit (HDAS-16) binary address 1 LS TTL load.
$\overline{\text{Strobe}}$	1 LS TTL load Pulse Width: 40 nsec. ≤ t_W ≤ EOC
MuxEnable	1 LS TTL load
$\overline{\text{Load}}$	1 LS TTL load
$\overline{\text{Clear}}$	1 LS TTL load
POWER REQUIREMENT	+15VDC ±0.5V @ 67 mA max. −15VDC ±0.5V @ 71 mA max. +5VDC ±0.25V @ 155 mA max.

PHYSICAL ENVIRONMENTAL

Operating Temperature Range	0°C to +70°C (MC) −25°C to +85°C (MR) −55°C to +125°C (MM)
Storage Temperature Range	−65°C to +150°C
Package Size, max.	2.33 × 1 42 × .3 inches (36.07 × 59.18 × 8.89 mm)
Package Type	62 pin, hermetically sealed
Pins	Kovar
Weight	1.4 oz. (40 g)

NOTES:

1. ±20V in power off condition
2. Selectable with proper gain range.
3. RTI - Referred to Input
4. FSR - Full Scale Range 10V for 0 to +10V input, 5V for ±2.5V input.
5. All outputs are LSTTL (low power Schottky) Vout ("O") ≤ 0.4V Vout ("1") ≥ 2.7V
6. All inputs are LSTTL Vin ("O") < 0.8V Vin ("1") ≥ 2.0V

ORDERING INFORMATION

MODEL	OP. TEMP. RANGE
HDAS-16MC	0°C to 70°C
HDAS-16MR	−25°C to +85°C
HDAS-16MM	−55°C to +125°C
HDAS-8MC	0°C to 70°C
HDAS-8MR	−25°C to +85°C
HDAS-8MM	−55°C to +125°C

Receptacle for PC board mounting can be ordered through AMP Incorporated, #3-331272-4 (component lead spring socket) 62 required.

Evaluation socket, Datel P/N 58-6322-1 Includes PC board with offset and gain potentiometers, bifurcated terminals for electrical connections.

Trimming Potentiometer: TP20K (20 K ohms)

For high reliability versions of the HDAS, contact factory.

THESE MODELS ARE COVERED BY GSA CONTRACT

PIN CONNECTIONS

PIN NO.	HDAS-16	HDAS-8
1	CH3 IN	CH3 HI IN
2	CH2 IN	CH2 HI IN
3	CH1 IN	CH1 HI IN
4	CH0 IN	CH0 HI IN
5	MUX ENABLE	*
6	R DELAY	*
7	$\overline{\text{E O C}}$	*
8	$\overline{\text{STROBE}}$	*
9	A8 MUX ADDRESS OUT	*
10	A4 MUX ADDRESS OUT	*
11	A2 MUX ADDRESS OUT	*
12	A1 MUX ADDRESS OUT	*
13	RA8 MUX ADDRESS IN	*
14	RA4 MUX ADDRESS IN	*
15	RA2 MUX ADDRESS IN	*
16	RA1 MUX ADDRESS IN	*
17	DIGITAL COM	*
18	+5VDC	*
19	$\overline{\text{LOAD ENABLE}}$	*
20	$\overline{\text{CLEAR ENABLE}}$	*
21	$\overline{\text{ENABLE}}$ (Bits 9-12)	*
22	BIT 12 OUT (LSB)	*
23	BIT 11 OUT	*
24	BIT 10 OUT	*
25	BIT 9 OUT	*
26	$\overline{\text{ENABLE}}$ (Bits 5-8)	*
27	BIT 8 OUT	*
28	BIT 7 OUT	*
29	BIT 6 OUT	*
30	BIT 5 OUT	*
31	$\overline{\text{ENABLE}}$ (Bits 1-4)	*
32	BIT 4 OUT	*
33	BIT 3 OUT	*
34	BIT 2 OUT	*
35	BIT 1 OUT (MSB)	*
36	GAIN ADJ	*
37	OFFSET ADJ	*
38	BIPOLAR INPUT	*
39	SAMPLE/HOLD OUT	*
40	+10V OUT	*
41	ANALOG SIGNAL COM	*
42	ANALOG POWER COM	*
43	+15 VDC	*
44	−15 VDC	*
45	C HOLD HI	*
46	C HOLD LO	*
47	R GAIN LO	*
48	R GAIN HI	*
49	AMP IN HI	*
50	AMP IN LO	*
51	CH15 IN	CH7 LO IN
52	CH14 IN	CH6 LO IN
53	CH13 IN	CH5 LO IN
54	CH12 IN	CH4 LO IN
55	CH11 IN	CH3 LO IN
56	CH10 IN	CH2 LO IN
57	CH9 IN	CH1 LO IN
58	CH8 IN	CH0 LO IN
59	CH7 IN	CH7 HI IN
60	CH6 IN	CH6 HI IN
61	CH5 IN	CH5 HI IN
62	CH4 IN	CH4 HI IN

*Same as HDAS-16

TABLE 1 DESCRIPTION OF PIN FUNCTIONS

FUNCTION	LOGIC STATE	DESCRIPTION
DIGITAL INPUTS		
$\overline{\text{STROBE}}$	1 to 0	Initiates acquisition and conversion of analog signal
$\overline{\text{LOAD}}$	0	Random Address Mode. Initiated on falling edge of $\overline{\text{STROBE}}$
	1	Sequential Address Mode
$\overline{\text{CLEAR}}$	0	Allows next $\overline{\text{STROBE}}$ pulse to reset MUX ADDRESS to CH0 overriding $\overline{\text{LOAD}}$ command
MUX ENABLE	0	Disables internal MUX
	1	Enables internal MUX
MUX ADDRESS IN		Selects channel for Random Address Mode 8.4.2.1 natural binary coding
DIGITAL OUTPUTS		
$\overline{\text{E O C}}$		End of Conversion (STATUS)
	0	Conversion complete
	1	Conversion in process
$\overline{\text{ENABLE}}$ (1-4)	0	Enables three-state outputs Bits 1-4
	1	Disables three-state outputs Bits 1-4
$\overline{\text{ENABLE}}$ (5-8)	0	Enables three-state outputs Bits 5-8
	1	Disables three-state outputs Bits 5-8
$\overline{\text{ENABLE}}$ (9-12)	0	Enables three-state outputs Bits 9-12
	1	Disables three-state outputs Bits 9-12
MUX ADDRESS OUT		Output of MUX Address Register 8.4.2.1 natural binary coding
ANALOG INPUTS		
Channel Inputs		Limit voltage to ±20 V beyond power supplies. Ex.-if power supplies ON (±15V) maximum input voltage is ±35 V. If power supplies OFF (0 V), maximum input voltage is ±20 V
Bipolar Input		For unipolar operation, connect to PIN 39 (S/H OUT). For bipolar operation, connect to PIN 40 (+10 V OUT)
ANALOG OUTPUTS		
S/H OUT		Sample/Hold Output
+10 V OUT		Buffered +10 V reference output
ADJUSTMENT PINS		
ANG SIG COM		Low level analog signal return
GAIN ADJ		External gain adjustment, see calibration instructions
OFFSET ADJ		External offset adjustment, see calibration instructions
R GAIN		Optional gain selection point. Factory adjusted for G = 1 when left open
C HOLD		Optional hold capacitor connection
R DELAY		Optional acquisition time adjustment when connected to +5V factory adjusted for 9 μS

TECHNICAL NOTES

1. Input channels are protected to 20 V beyond power supplies. All digital output pins have one second short circuit protection and CHOLD has a ten second short circuit protection.
2. To increase acquisition time allotment, (time for the multiplexer, instrumentation amplifier and sample-hold to settle out) connect a resistor from RDELAY (Pin 6) to +5 V (Pin 18). Refer to Table 2 for delay times and resistor values.
3. An external hold capacitor can be connected between CHOLD HI and CHOLD LO. The addition of this capacitor will improve the sample-hold droop rate especially at high operating temperature ranges. It is recommended that polypropylene or teflon capacitors be used for best results.
4. The HDAS has a self starting circuit for free running sequential operation. If, however, in a power up condition the supply voltage slew rate is less than 3V/usec, the free running state may not be initialized. By applying a negative pulse to the $\overline{\text{STROBE}}$, this condition will be eliminated.
5. All digital inputs must be stable 50nsec before and 50nsec after high to low transition of $\overline{\text{STROBE}}$.
6. For UNIPOLAR operation connect BIPOLAR IN (Pin 38) to S/H out (Pin 39). For BIPOLAR operation connect BIPOLAR IN (Pin 38) to +10V OUT (Pin 40).
7. If HDAS reference (+10V OUT) is used for external circuitry, source current should be limited to 1mA.

TABLE 2 INPUT RANGE PARAMETERS (Typical)

INPUT RANGE	GAIN	RGAIN (Ω)	AMPLIFIER SETTLING TIME	RDELAY (Ω)	THROUGHPUT	SYSTEM ACCURACY
±10V	1	NONE	9μsec.	NONE	55.5 KHz	0.009%
±5V	2	20.0K	9μsec.	NONE	55.5 KHz	0.009%
±2.5V	4	6.667K	9μsec.	NONE	55.5 KHz	0.009%
±1V	10	2.222K	9μsec.	NONE	55.5 KHz	0.009%
±200mV	50	408.2	16μsec.	7K	40.0 KHz	0.010%
±100mV	100	202.0	30μsec.	21K	25.6 KHz	0.011%
±50mV	200	100.5	60μsec.	51K	14.5 KHz	0.016%
±20mV	500	40.08	144μsec.	135K	6.5 KHz	0.035%
±10mV	1000	20.02	288μsec.	279K*	3.3 KHz	0.069%

*This value exceeds the maximum recommended for use over military temperature ranges

NOTES:

$$RGAIN\ (\Omega) = \frac{20{,}000}{(GAIN-1)} \qquad RDELAY\ (\Omega) = \frac{\text{Amp Setting time}}{10^{-9}} - 9K$$

1. Throughput time = Amplifier Setting time and A/D Conversion Time
   A/D Conversion time = 9 μsec
2. Full Scale can be accommodated for analog signal ranges of ±10mV to ±10V
3. The analog input range to the A/D Converter is 0 to +10.0V for unipolar and −10.0V to +10.0V for bipolar operation

TABLE 3 CALIBRATION TABLE

UNIPOLAR RANGE	ADJUST	INPUT VOLTAGE
0 TO +5V	ZERO	+0.6 mV
	GAIN	+4.9982V
0 TO +10V	ZERO	+1.2 mV
	GAIN	+9.9963V
BIPOLAR RANGE		
±2.5V	OFFSET	−2.4994V
	GAIN	+2.4982V
±5V	OFFSET	−4.9988V
	GAIN	+4.9963V
±10V	OFFSET	−9.9976V
	GAIN	+9.9927V

CALIBRATION PROCEDURES

A) Offset and gain adjustments may be made by connecting two 20K trim potentiometers as shown in Figure 1.

B) Connect a precision voltage source to pin 4 (CHO). If the HDAS-8 is used, connect pin 58 (CH 0 LO) to analog ground. Ground pin 20 ($\overline{\text{CLEAR}}$) and momentarily short pin 8 ($\overline{\text{STROBE}}$). Trigger the A/D by connecting pin 7 ($\overline{\text{EOC}}$) to pin 8 ($\overline{\text{STROBE}}$). Select proper value for RGAIN and RDELAY by referring to Table 2.

C) Adjust the precision voltage source to the value shown in the Calibration Table for the unipolar zero adjustment (ZERO+½ LSB) or the bipolar offset adjustment (−FS + ½ LSB). Adjust the offset trim potentiometer so that the output code flickers equally between 0000 0000 0000 and 0000 0000 0001.

D) Change the output of the precision voltage source to the value shown in the Calibration Table for the unipolar or bipolar gain adjustment (+FS−1½LSB). Adjust the gain trim potentiometer so that the output flickers equally between 1111 1111 1110 and 1111 1111 1111.

FIG 1 EXTERNAL ADJ.

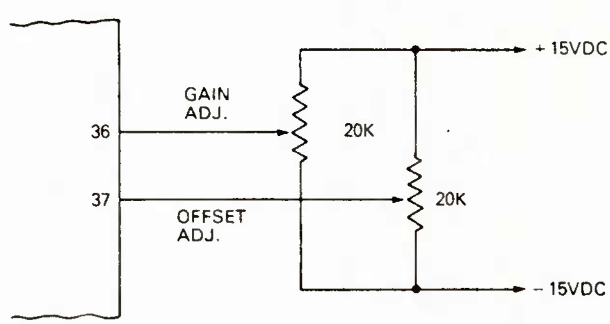


TABLE 4 OUTPUT CODING

	UNIPOLAR 0 to +10 V	0 to +5V	STRAIGHT BINARY
+FS-1 LSB	+9.9976	+4.9988	1111 1111 1111
+½FS	+5.0000	+2.5000	1000 0000 0000
+1 LSB	+0.0024	+0.0012	0000 0000 0001
ZERO	0.0000	0.0000	0000 0000 0000

	BIPOLAR ±10 V	±5V	OFFSET BINARY*
+FS-1 LSB	+9.9951	+4.9976	1111 1111 1111
+½FS	+5.0000	+2.5000	1100 0000 0000
+1 LSB	+0.0049	+0.0024	1000 0000 0001
ZERO	0.0000	0.0000	1000 0000 0000
−FS+1 LSB	−9.9951	−4.9976	0000 0000 0001
−FS	−10.000	−5.0000	0000 0000 0000

*For 2's complement - add inverter to MSB line.

TABLE 5 MUX CHANNEL ADDRESSING

MUX ADDRESS					ON CHANNEL	
PIN						
9	10	11	12	5		
RA8	RA4	RA2	RA1	MUX ENAB		
X	X	X	X	0	NONE	
0	0	0	0	1	0	
0	0	0	1	1	1	
0	0	1	0	1	2	
0	0	1	1	1	3	
0	1	0	0	1	4	
0	1	0	1	1	5	
0	1	1	0	1	6	HDAS-8
0	1	1	1	1	7	(3 BIT ADDRESS)
1	0	0	0	1	8	
1	0	0	1	1	9	
1	0	1	0	1	10	
1	0	1	1	1	11	
1	1	0	0	1	12	
1	1	0	1	1	13	
1	1	1	0	1	14	HDAS-16
1	1	1	1	1	15	(4 BIT ADDRESS)

MULTIPLEXER ADDRESSING

Channel Selection

The HDAS is capable of two modes of addressing the multiplexer.

RANDOM ADDRESS

Set Pin 19 ($\overline{\text{LOAD}}$) to logic "0". The next falling edge of $\overline{\text{STROBE}}$ will load the MUX CHANNEL ADDRESS present on Pin 13 to Pin 16. Address inputs must be stable 50 nsec before and after falling edge of $\overline{\text{STROBE}}$ pulse.

FREE RUNNING SEQUENTIAL ADDRESS

Set Pin 19 ($\overline{\text{LOAD}}$) and Pin 20 ($\overline{\text{CLEAR}}$) to logic "1" or leave open. Connect Pin 7 ($\overline{\text{EOC}}$) to Pin 8 ($\overline{\text{STROBE}}$). The falling edge of $\overline{\text{EOC}}$ will increment channel address. This means that when the $\overline{\text{EOC}}$ is low, the digital output data is valid for the previous channel (CHn - 1) than that channel indicated on MUX ADDRESS OUTPUT. The HDAS will continually scan all 16 channels.

example

CH 4 has been addressed and a conversion takes place. The $\overline{\text{EOC}}$ goes low and that Channels data becomes valid but MUX ADDRESS CODE is now CH5.

TRIGGERED SEQUENTIAL ADDRESS

Set Pin 19 ($\overline{\text{LOAD}}$) and Pin 20 ($\overline{\text{CLEAR}}$) to logic "1" or leave open. Apply a falling edge trigger pulse to Pin 8 ($\overline{\text{STROBE}}$). This negative transition causes the contents of the address counter to be incremented by one followed by an A/D conversion in 9 μsec.

FIG. 2 HDAS TIMING DIAGRAM

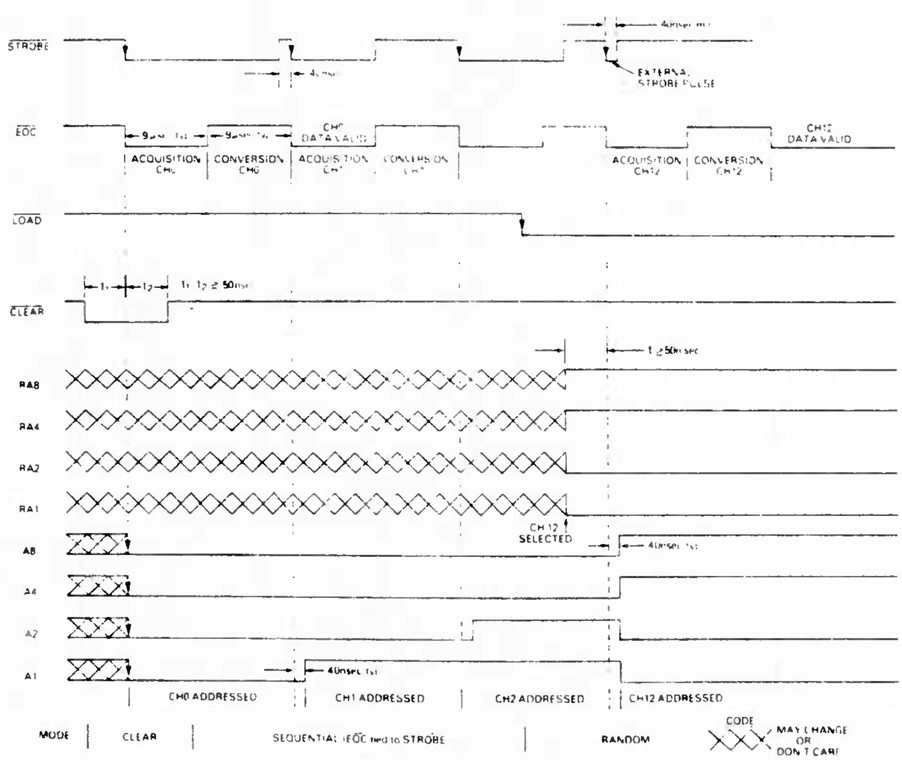
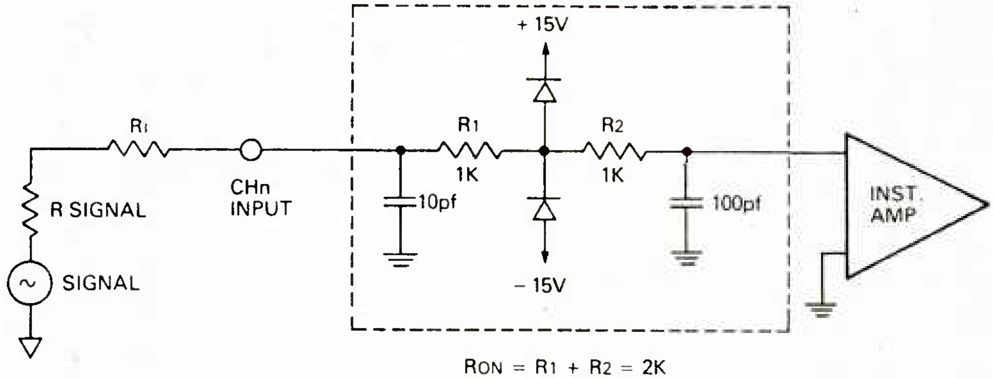


FIG. 3 MULTIPLEXER EQUIVALENT CIRCUIT



RON = R1 + R2 = 2K

INPUT VOLTAGE PROTECTION

As shown in Fig.3, the multiplexer has reversed biased diodes which protect the input channels from being damaged by overvoltage signals. The HDAS input channels are protected up to 20 V beyond the supplies and can be increased by adding series resistors (Ri) to each channel. This input resistor must limit the current flowing through the protection diodes to 10 mA.

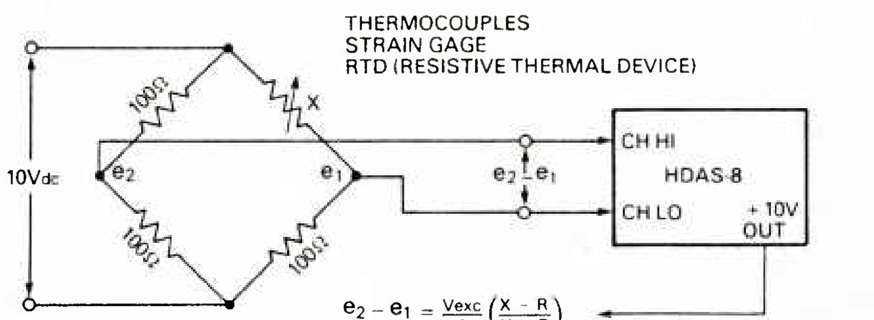
The value of Ri for a specific voltage protection range (Vp) can be calculated by the following formula:

Vp = (R signal + Ri + Ron) (10 mA)

where Ron = 2K

NOTE: Increased input series resistance will increase multiplexer settling time.

FIG. 4 LOW LEVEL INPUTS

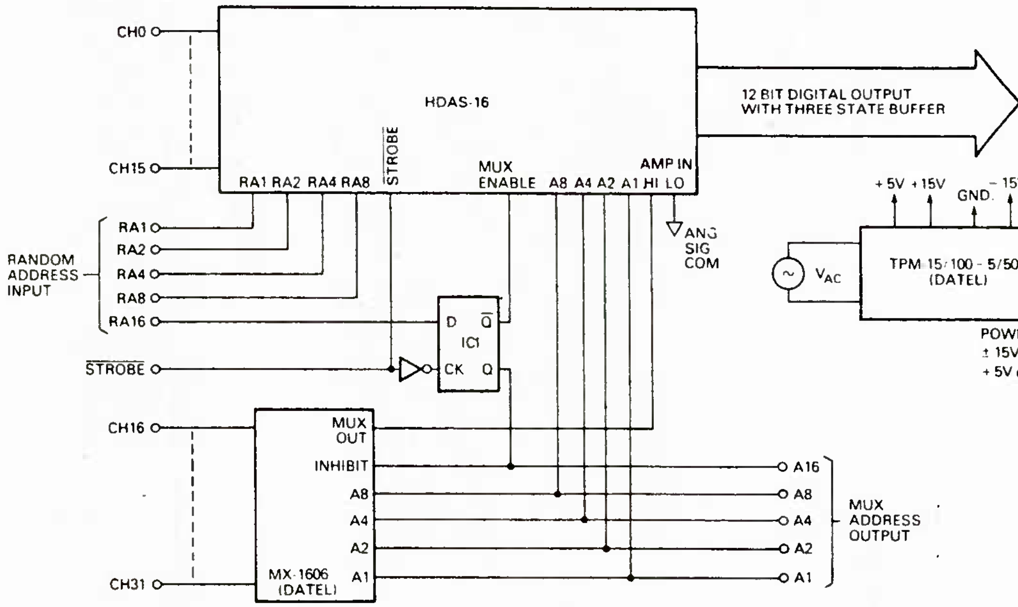


$$e_2 - e_1 = \frac{V_{exc}}{2}\left(\frac{X - R}{X + R}\right)$$

$V_{exc} = 10V$
$R = 100\,\Omega$

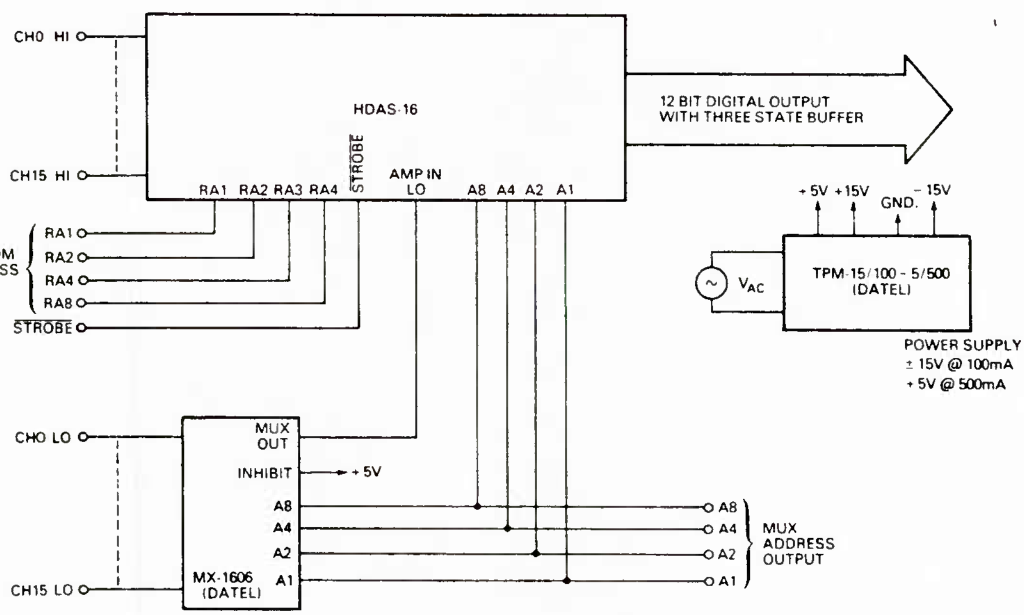
Remote monitoring of low level signals can be difficult, especially when analog signals pass through an environment with high levels of electrical noise. One solution is to use an instrumentation amplifier to extract the common mode voltage and amplify the voltage difference. The HDAS-8, an eight channel differential input system, can reject common-mode noise and allow amplification up to a gain of 1000. Direct connections to thermocouples, transducers, strain gages and RTD can be made through shielded twisted pairs. A differential RC filter may be used to attenuate normal mode noise.

FIG. 5 32 CHANNEL SINGLE ENDED DATA ACQUISITION SYSTEM



MX1606-16 CHANNEL CMOS MULTIPLEXER
IC1 — TYPE "D" FLIP FLOP

FIG. 6 16 CHANNEL DIFFERENTIAL DATA ACQUISITION SYSTEM

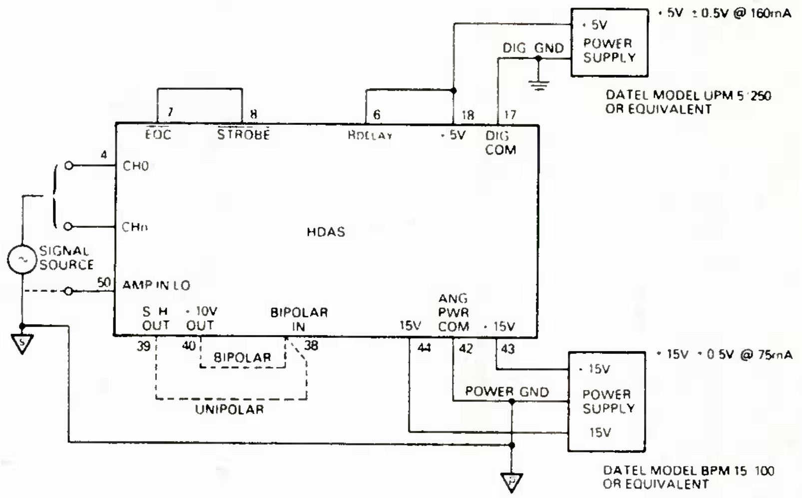


MX1606 – 16 CHANNEL CMOS MULTIPLEXER

MULTIPLEXER EXPANSION

Fig. 5 shows the interconnection scheme for expanding the multiplexer channel capacity of the HDAS-16 from 16 channels single ended to 32 channels. Fig. 6 shows a similar scheme to expand the HDAS-16 to 16 differential channels.

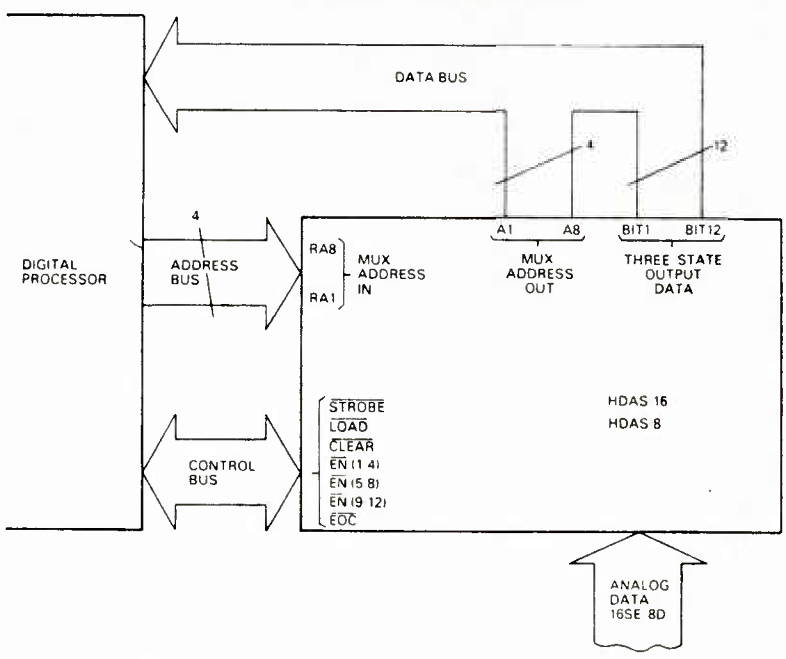
FIG. 7 SIMPLE CONNECTION DIAGRAM



NOTES:

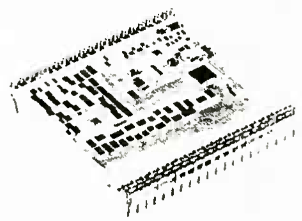
1. For HDAS-16, tie PIN 50 to "signal source common" if possible. Otherwise tie PIN 50 to PIN 41 (ANG SIG COM).
2. BIPOLAR connection yields ±10V range. UNIPOLAR connection yields 0 to ±10 V range. Other ranges are created by selecting appropriate value of Rg.
3. DIG COM, ANG PWR COM and ANG SIG COM are internally connected.

FIG. 8 PROCESSOR INTERFACE



SDC-19100 MONOBRID® SERIES*

ILC DATA DEVICE CORPORATION



10, 12 AND 14 BIT INDUSTRIAL S/D AND R/D CONVERTER

DESCRIPTION

The SDC-19100 Series hybrid industrial converters are available in 10, 12 or 14 bit resolution with accuracies of ±21 min, ±8.5 min and ±5.3 min respectively. Repeatability is 1 LSB for all versions. Velocity and direction outputs are standard features of these converters.

These units are available in low, mid and high frequency ranges, with input options for synchro, resolver or direct inputs.

The SDC-19100 Series converters are a low cost, low profile synchro or resolver to digital tracking devices. Because of a unique control transformer algorithm, these converters provide an inherently higher accuracy and jitter free output. Through the use of a type II tracking loop these converters do not exhibit velocity lag up to the specified tracking rates (Figure 1). In addition, the output data is always fresh and continuously available. Each unit is fully factory trimmed and requires no field adjustments or calibration.

APPLICATIONS

The SDC-19100 Series converters are designed to meet the requirements of the full range of industrial and commerical applications, including control systems, radar antenna position information, CNC machine tooling and robot axis control.

FEATURES

- *LOW COST*
- *FAST TRACKING*
- *3-STATE LATCHED OUTPUTS*
- *VELOCITY OUTPUT*
- *RESOLUTION/ACCURACY*
  10 BIT/±21 MINUTES
  12 BIT/±8.5 MINUTES
  *14 BIT/±5.3 MINUTES***
- *1 LSB REPEATABILITY*
- *DIRECTION AND COUNT OUTPUTS FOR INCREMENTAL APPLICATIONS*

Note: Monobrid® is a registered trademark of ILC Data Device Corporation.

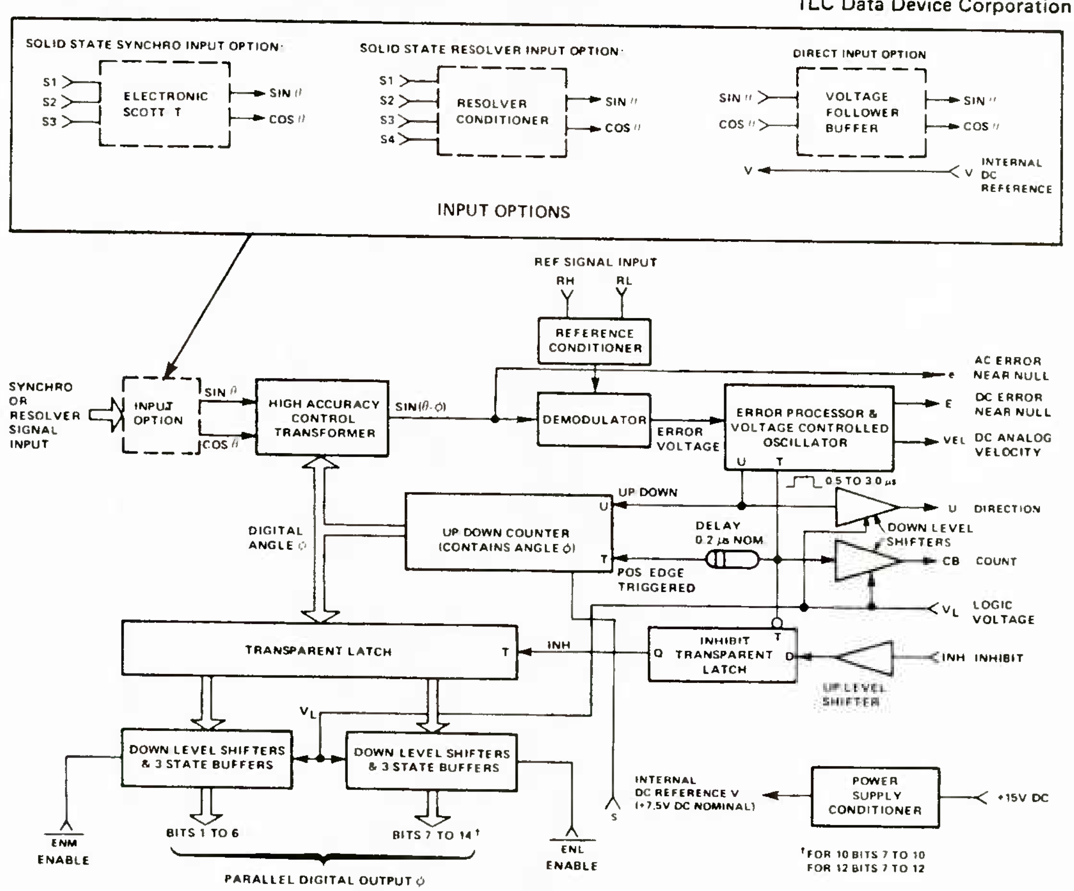


FIGURE 1. BLOCK DIAGRAM

* Patented

**Consult factory for higher accuracy.

SPECIFICATIONS

Apply over temperature range , power supply range, reference frequency and amplitude range, ± 10% signal amplitude variation, and up to 10% harmonic distortion in the reference.

PARAMETER	UNITS	VALUE		
SDC-19100 Series		1910X	1912X	1914X
RESOLUTION	bits	10	12	14
ACCURACY	min	±21	±8.5	±5.3
SIGNAL AND REFERENCE INPUT				
Carrier Frequency Range				
Low Range	kHz	.047 to1	.047 to 1	.047 to 1
Mid Range	kHz	.36 to 22	.36 to 22	.36 to 11
High Range	kHz	.36 to 22	.36 to 22	.6 to 11
REFERENCE INPUT CHARACTERISTICS				
Voltage Range	V rms	4 to 50 (26 nom)	20 to 150 (115 nom)	
Input Impedance				
Single Ended	Ω	50k min	300k min	
Differential	Ω	100k min	600k min	
Common Mode Range (DC common mode plus recurrent AC peak)	V	60 max	300 max	
SIGNAL INPUT CHARACTERISTICS (Voltage options and minimum input impedance balanced)				
Synchro		90V L-L	11.8V L-L	
Z_{in} (L-L)	kΩ	160	20	
Z_{in} Each (L-GND)	kΩ	100	13	
Resolver			11.8V L-L	
Z_{in} Singled Ended	kΩ		27	
Z_{in} Differential	kΩ		54	
Z_{in} Each (L-GND)	kΩ		27	
Direct (2.0V L-L)				
Input Signal Type		Sin and cos resolver signals referenced to converter internal DC reference V		
Sin/Cos Voltage Range		2V nominal, 2.3 max		
Maximum Voltage Without Damage		15V rms continuous; 100V peak transient		
Input Impedance		Z_{in} > 20 MΩ (transient protected voltage follower)		
DIGITAL INPUT/OUTPUT				
Logic type		TTL/CMOS compatible, depending on logic supply voltage		
Inputs		$Z_{in} \geqslant$ 25 kΩ pullup resistor to V_L		
Inhibit ($\overline{INH}$)		Logic "0" inhibits		
Enable Bits 1 to 6 $\overline{ENM}$; Enable Bits 7 to 14 $\overline{ENL}$; 7 to 12 $\overline{ENL}$; 7 to 10 $\overline{ENL}$		$\overline{ENM}$ and $\overline{ENL}$: Logic "0" enables; Logic "1" high impedance		
S		Logic "0" for use as CT		
Output				
Parallel Data	bits	10, 12 or 14 parallel lines; natural binary angle, positive logic		
Count (CB)		0.7 to 2.0 μsec positive pulse; leading edge initates counter update		
Direction (U)		Logic high when counting up and logic low when counting down		
Drive capability		1 std TTL load, 1.6 mA at 0.4V max		
ANALOG OUTPUTS				
Internal DC reference (V)	mV	+15 VDC/2 ≃ 7.5V nom		
AC Error (e)		10 mV rms per LSB of error (14 bits) 12.5 mV rms per LSB of error (10 and 12 bits)		
Filtered DC Error Voltage (E)		−1VDC per +1 LSB of error(±3 LSB range) 14 bit unit −1.25VDC per +1 LSB of error (±3 LSB range) 10 and 12 bit units.		
POWER SUPPLY CHARACTERISTICS				
Nominal Voltage		+15V Supply	Logic Supply	
Voltage Range	V	+11 to +16.5	+4.5 to +15	
Maximum Voltage Without Damage	V	+18	+18	
Current or Impedance		15 mA max	Z_{in} = 5 k Ω min	
TEMPERATURE RANGES				
Operating				
−30X	°C	0 to +70		
−10X	°C	−30 to +105		
Storage	°C	−30 to +105		
PHYSICAL CHARACTERISTICS				
Size	in	2.1 x 2.1 x 0.2 (53 x 53 x 5 mm) see mechanical outline		
Weight	oz	0.7 (20g)		

TECHNICAL INFORMATION

INTRODUCTION

The circuit shown in the SDC-19100 block diagram, Figure 1, consists of three main parts: the signal input option; a feedback loop whose elements are the control transformer, demodulator error processor, and up-down counter; and digital interface circuitry including various latches and buffers.

The input options accept a synchro or resolver input and produce a resolver type output for the control transformer. The first two options, called solid state synchro and resolver input, accept synchro and resolver signal inputs directly, and provide signal isolation internally. The third option is a direct input designed to operate with a 2V L-L input, which allows for the use of a lower reference voltage. Since it does not have an input scaling network it is inherently more accurate.

All input options are DC coupled with broadband characteristics up to the specified frequencies.

In a synchro or resolver, shaft angle data is transmitted as the ratio of carrier amplitudes across the terminals. The internal converter operates with signals in resolver format, $\sin\theta\cos\omega t$ and $\cos\theta\cos\omega t$. Synchro signals are of the form $\sin\theta\cos\omega t$, $\sin(\theta+120^\circ)\cos\omega t$, and $\sin(\theta+240^\circ)\cos\omega t$. The diagrams below show synchro and resolver signals as a function of the angle θ.

The feedback loop produces a digital angle Φ which tracks the analog input angle θ to within the specified accuracy of the converter. The control transformer performs the following trigonometric computation:

$$\sin(\theta-\Phi) = \sin\theta\cos\Phi - \cos\theta\sin\Phi$$

where θ is the angle representing the synchro or resolver shaft position, and Φ is the digital angle contained in the up-down counter in the converter. The tracking process consists of continually adjusting Φ to make $(\theta-\Phi)\rightarrow 0$, so that Φ will represent the shaft position θ.

The output of the demodulator is an analog DC level proportional to $\sin(\theta-\Phi)$. The error processor integrates this $\sin(\theta-\Phi)$ error signal, and the output of the integrator is used to control the frequency of a voltage controlled oscillator "clock" pulses which are accumulated by the up-down counter. The up-down counter is functionally an incremental integrator. Therefore there are two stages of integration, making the converter a Type II tracking servo. In a Type II servo, the voltage controlled oscillator always settles to a counting rate which makes $d\Phi/dt$ equal to $d\theta/dt$ without lag. The output data will always be fresh and available as long as the maximum tracking rate of the converter is not exceeded.

The digital interface circuitry has three main functions: to latch the output bits during an Inhibit command so that stable data can be read out, to furnish both parallel and 3-state data formats, and to act as a buffer between the internal CMOS logic and the external logic level.

Applying an Inhibit command will lock the data in the transparent latch without interfering with the continuous tracking of the feedback loop. This is a new feature, since S/D and R/D converters usually lock the up-down counter while an Inhibit is applied. In the SDC-19100 Series Monobrids, therefore, the digital angle Φ is always updated and the Inhibit can be applied for an abitrary amount of time. The Inhibit transparent latch and the 0.2 μs delay are also parts of the Inhibit circuitry, whose detailed operation is described in the Logic Output/Input Section.

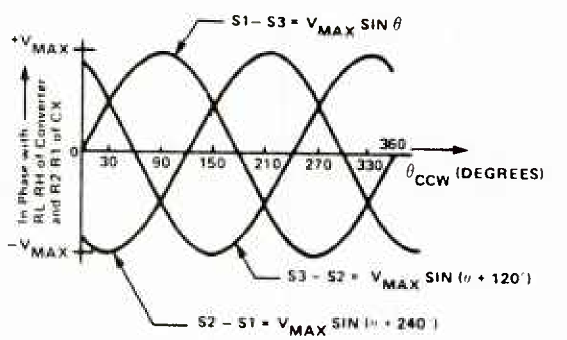
When testing or evaluating the converter, it is advisable to limit the power supply currents as follows:

+15V Supply Limit at 20 mA.
Logic Supply V_L at 2 mA + Digital Load at Logic 1.

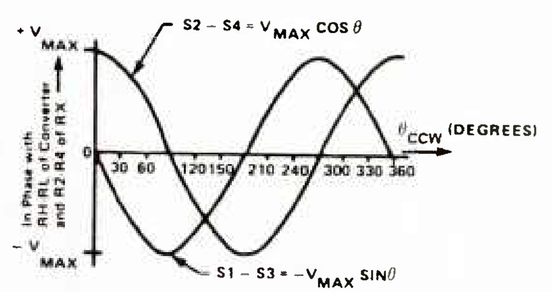
Analog circuits inside the SDC-19100 module are referenced to an internal DC reference level V which rides at +7.5 nominal with respect to the external ground (GND). V should not be connected to the external ground.

SOLID STATE BUFFER INPUTS

The solid state signal and reference inputs are true differential inputs with high AC and DC common mode rejection,



Standard Synchro Control Transmitter (CX) Outputs as a Function of CCW Rotation From Electrical Zero (EZ).



Standard Resolver Control Transmitter (RX) Outputs as a Function of CCW Rotation From Electrical Zero (EZ) With R2-R4 Excited.

SYNCHRO AND RESOLVER SIGNALS

so most applications will not require units with isolation transformers. Input impedance is maintained with power off. The recurrent AC peak + DC common mode voltage should not exceed the following values:

Input	Common Mode Maximum	Max Transient Peak Voltage
11.8V L-L	30V Peak	150V
26 V L-L	60V Peak	150V
90 V L-L	220V Peak	500V
115 V Ref	300V Peak	1000V
26 V Ref	60V Peak	200V

90V line-to-line systems may have voltage transients which exceed the 500V specification listed above.

Voltage transients are likely to occur whenever synchro voltages are switched on or off. For instance, a 1000V transient can be generated when the primary of a CX or TX driving a synchro or resolver input is opened.

DIRECT INPUT

Direct input units require a signal conditioner that provides a 2.0V rms nominal resolver type signal referenced to the internal DC reference V. This input option may be preferred in applications where the signal conditioner can be integrated with other components, as in many multiplexed systems.

LOGIC INPUT/OUTPUT

Logic outputs consist of parallel data bits and count (CB). All logic outputs are short-circuit proof to ground and to positive voltages as high as V_L. The CB output is a positive 0.7-2.0 µs pulse, and data changes about 0.2 µs after the leading edge of the pulse because of an internal delay (see Figure 1). Data is valid 0.5 µs after the leading edge of a CB. Angle is determined by adding bits in the 1 state.

The parallel digital outputs are gated to provide a 6 and a 4, 6 or 8 line byte, depending on the model for microprocessor bus interfacing. When the Enables for the gates are at logic 0, the gate outputs are at normal logic 1 or 0, depending on the bit state. When the Enables are at logic 1, the gate outputs are high impedance and the microprocessor sees an essentially open line. Outputs are valid 0.5 µs after an Enable is driven to logic 0. For 10, 12 or 14 bit parallel output operation when the 3-state feature is not used, the Enable lines should be tied to logic 0.

The Inhibit (INH) logic input locks the transparent latch so that the bits will remain stable while data is being transferred (see Figure 1). The output is stable 0.5 µs after the Inhibit is driven to logic 0. A logic 0 at the T input locks the latch, and a logic 1 allows the bits to change. The purpose of the INH transparent latch is to prevent the transmission of invalid data when there is an overlap between the CB and INH. While the counter is not being updated the CB is at logic 0 and the INH latch is transparent. When the CB goes to logic 1 the INH latch is locked. If a CB occurs after an INH has been applied, the latch will remain locked and its data cannot change until the CB returns to logic 0. If an INH is applied during a CB pulse, the latch will not lock until the CB pulse is over. The purpose of the 0.2 µs delay is to prevent a race condition between the CB and the INH in which the up-down counter begins to change just as an INH is applied.

The Direction Output (U) is valid as shown in Figure 2. It is logic 1 for counting up and logic 0 for counting down. Logic level at the (U) pin is valid up thru 0.5 µs before and 0.1 µs after the leading edge of the (CB) pulse.

Since the SDC-19100 converters contain a CMOS device, standard CMOS handling procedures should be followed.

TIMING

Figure 2 Shows the timing waveforms of the converter. Whenever an input angle change occurs, the converter changes the digital angle in 1 LSB steps and generates a CB pulse. The output data change is initiated by the leading edge of the CB pulse, delayed by the 0.2 µs (nominal) delay. The output becomes stable in less than 0.5 µs even though the CB pulse may last longer. Inhibit commands do not affect the updating of the converter no matter how long they are applied. A simple method of interfacing to a computer is to (a) apply the Inhibit, (b) wait 0.5 µs, (c) transfer the data, and (d) release the Inhibit.

DYNAMIC PERFORMANCE

A Type II servo loop ($K_V = \infty$) and very high acceleration constants give these converters superior dynamic performance, as listed in the specifications. If the power supply voltages are not the +15VDC nominal values, the specified input rates for full accuracy will increase or decrease in proportion to the fractional change in voltage.

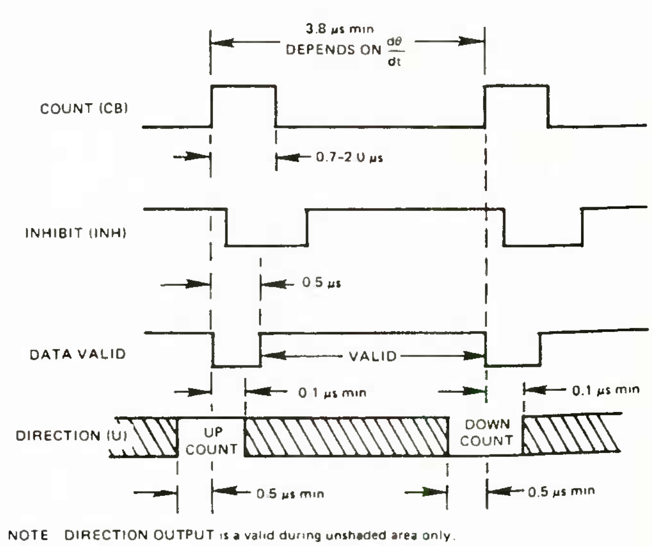


FIGURE 2. TIMING DIAGRAM

MODEL SELECTION/SPECIFICATION CHART

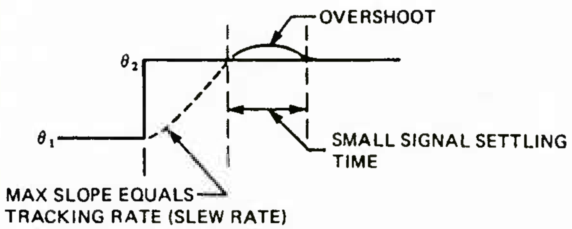
Type	Freq. (Hz)	Signal Voltage (L-L)	Ref Voltage (V)	Tracking Rate (RPS)	Acc. for 1 LSB lag error $^\circ/sec^2$	Settling Time for 179° Step to 1 LSB (ms)	Ka	Trans. Func. Breaks A	Trans. Func. Breaks B	Velocity ± RPS = ± Volts nom	Temp.* (°C)	Part No.
10 BIT RESOLUTION/±21 MINUTE ACCURACY SDC-1910X SERIES												
Synchro	47-1K	90	20-150	48	1400	350	4000	62	25	56=5	C	SDC 19103-301
Synchro	47-1K	90	20-150	48	1400	350	4000	62	25	56=5	M	SDC 19103-101
Synchro	360-22K	90	20-150	192	22000	90	62000	250	100	220=5	C	SDC 19101-301
Synchro	360-22K	90	20-150	192	22000	90	62000	250	100	220=5	M	SDC 19101-101
Synchro	360-22K	11.8	4-50	192	22000	90	62000	250	100	220=5	C	SDC 19100-301
Synchro	360-22K	11.8	4-50	192	22000	90	62000	250	100	220=5	M	SDC 19100-101
Resolver	360-22K	11.8	4-50	192	22000	90	62000	250	100	220=5	C	RDC 19105-301
Resolver	360-22K	11.8	4-50	192	22000	90	62000	250	100	220=5	M	RDC 19105-101
Resolver	360-22K	11.8	4-50	256	160000	30	460000	680	300	320=2.7	C	RDC 19106-301
Resolver	360-22K	11.8	4-50	256	160000	30	460000	680	300	320=2.7	M	RDC 19106-101
Direct	47-1K	2	4-50	48	1400	350	4000	62	25	56=5	C	XDC 19108-301
Direct	47-1K	2	4-50	48	1400	350	4000	62	25	56=5	M	XDC 19108-101
Direct	360-22K	2	4-50	192	22000	90	62000	250	100	220=5	C	XDC 19107-301
Direct	360-22K	2	4-50	192	22000	90	62000	250	100	220=5	M	XDC 19107-101
Direct	360-22K	2	4-50	256	160000	30	460000	680	300	320=2.7	C	XDC 19109-301
Direct	360-22K	2	4-50	256	160000	30	460000	680	300	320=2.7	M	XDC 19109-101
12 BIT RESOLUTION/±8.5 MINUTE ACCURACY SDC-1912X SERIES												
Synchro	47-1K	90	20-150	12	350	360	4000	62	25	14=5	C	SDC 19123-302
Synchro	47-1K	90	20-150	12	350	360	4000	62	25	14=5	M	SDC 19123-102
Synchro	360-22K	90	20-150	48	5500	90	62000	250	100	56=5	C	SDC 19121-302
Synchro	360-22K	90	20-150	48	5500	90	62000	250	100	56=5	M	SDC 19121-102
Synchro	360-22K	11.8	4-50	48	5500	90	62000	250	100	56=5	C	SDC 19120-302
Synchro	360-22K	11.8	4-50	48	5500	90	62000	250	100	56=5	M	SDC 19120-102
Resolver	360-22K	11.8	4-50	48	5500	90	62000	250	100	56=5	C	RDC 19125-302
Resolver	360-22K	11.8	4-50	48	5500	90	62000	250	100	56=5	M	RDC 19125-102
Resolver	360-22K	11.8	4-50	64	40000	60	460000	680	300	80=2.7	C	RDC 19126-302
Resolver	360-22K	11.8	4-50	64	40000	60	460000	680	300	80=2.7	M	RDC 19126-102
Direct	47-1K	2	4-50	12	350	360	4000	62	25	14=5	C	XDC 19128-302
Direct	47-1K	2	4-50	12	350	360	4000	62	25	14=5	M	XDC 19128-102
Direct	360-22K	2	4-50	48	5500	90	62000	250	100	56=5	C	XDC 19127-302
Direct	360-22K	2	4-50	48	5500	90	62000	250	100	56=5	M	XDC 19127-102
Direct	360-22K	2	4-50	64	40000	60	460000	680	300	80=2.7	C	XDC 19129-302
Direct	360-22K	2	4-50	64	40000	60	460000	680	300	80=2.7	M	XDC 19129-102
14 BIT RESOLUTION/±5.3 MINUTE ACCURACY SDC-1914X SERIES												
Synchro	47-1K	90	20-150	3	70	600	3000	56	25	3.2=5	C	SDC 19143-303
Synchro	47-1K	90	20-150	3	70	600	3000	56	25	3.2=5	M	SDC 19143-103
Synchro	360-22K	90	20-150	12	1100	150	50000	224	100	14=5	C	SDC 19141-303
Synchro	360-22K	90	20-150	12	1100	150	50000	224	100	14=5	M	SDC 19141-103
Synchro	360-22K	11.8	4-50	12	1100	150	50000	224	100	14=5	C	SDC 19140-303
Synchro	360-22K	11.8	4-50	12	1100	150	50000	224	100	14=5	M	SDC 19140-103
Resolver	360-22K	11.8	4-50	12	1100	150	50000	224	100	14=5	C	RDC 19145-303
Resolver	360-22K	11.8	4-50	12	1100	150	50000	224	100	14=5	M	RDC 19145-103
Resolver	600-22K	11.8	4-50	16	8100	90	370000	610	300	20=2.7	C	RDC 19146-303
Resolver	600-22K	11.8	4-50	16	8100	90	370000	610	300	20=2.7	M	RDC 19146-103
Direct	47-1K	2	4-50	3	70	600	3000	56	25	3.2=5	C	XDC 19148-303
Direct	47-1K	2	4-50	3	70	600	3000	56	25	3.2=5	M	XDC 19148-103
Direct	360-22K	2	4-50	12	1100	150	50000	224	100	14=5	C	XDC 19147-303
Direct	360-22K	2	4-50	12	1100	150	50000	224	100	14=5	M	XDC 19147-103
Direct	600-22K	2	4-50	16	8100	90	370000	610	300	20=2.7	C	XDC 19149-303
Direct	600-22K	2	4-50	16	8100	90	370000	610	300	20=2.7	M	XDC 19149-103

*C = 0°C to +70°C
M = −30°C to +105°C

As long as the maximum tracking rate is not exceeded, there will be no lag in the converter output. If a step input occurs, as is likely when the power is initially turned on, the response will be critically damped. The figure shows the response to a step input. After initial slewing at the maximum tracking rate of the converter, there is one overshoot which is inherent to a Type II servo. The overshoot settling to a final value is a function of the small signal settling time.

ANALOG OUTPUTS

The analog outputs are V, e, E, and VEL. V is an internal DC reference, +7.5 VDC nominal. The outputs e, E and VEL ride on the internal DC reference voltage V, and should be measured with respect to V. Outputs can swing ±5V when the voltage level of the +15V power supply is +15V. The output swing changes proportionally if the level is not a +15V.



RESPONSE TO A STEP INPUT

$$G = \frac{A^2\left(\frac{S}{B}+1\right)}{S^2\left(\frac{S}{10B}+1\right)}$$

NOTE: Values for A and B are found in the Model Selection/Specification Chart.

CONVERTER LOOP DYNAMICS

e is an AC error proportional to the error ($\theta - \phi$) with 10 mV/LSB nominal for the 14 bit unit and 12.5 mV/LSB nominal for the 12 and 10 bit units.

E is a filtered DC voltage proportional to the error ($\theta - \phi$) near the null point, with −1 VDC/+LSB of error for the 14 bit unit and −1.25 VDC/+LSB of error for the 12 and 10 bit units.

Velocity output (VEL) is a DC voltage proportional to angular velocity $d\theta/dt = d\phi/dt$. The output is positive for an increasing angle.

Maximum loading for each analog output is 1.0 mA. Outputs e, E, and VEL are not required for normal operation of the converter; V is used as internal DC reference with the direct input option.

ORDERING INFORMATION

SDC – 19100 –000

- Accy:
  - 1 = ±21 min (10 bit unit only)
  - 2 = ±8.5 min (12 bit unit only)
  - 3 = ±5.3 min (14 bit unit only)
- Reliability Grade: 0 = Standard
- Temp. Range:
  - 1 = −30°C to +105°C
  - 3 = 0°C to +70°C
- Input:
  - 0 = 11.8V, 400 Hz, Synchro, 26V Ref
  - 1 = 90V, 400 Hz, Synchro, 115V Ref
  - 3 = 90V, 60 Hz, Synchro, 115V Ref
  - 5 = 11.8V, 400 Hz, Resolver, 26V Ref
  - 6 = 11.8V, 2.4 KHz, Resolver, 26V Ref
  - 7 = 2.0V, 400 Hz, Direct, 26V Ref
  - 8 = 2.0V, 60 Hz, Direct, 26V Ref
  - 9 = 2.0V, 2.4 KHz, Direct, 2 6V Ref
- Resolution:
  - 0 = 10 bits
  - 2 = 12 bits
  - 4 = 14 bits
- Family Code
- Signal Input Type:
  - SDC = Synchro
  - RDC = Resolver
  - XDC = Direct

*See model selection chart for available models.

The outputs e, E and VEL are not closely controlled or characterized. Consult factory for further information.

IN GENERAL

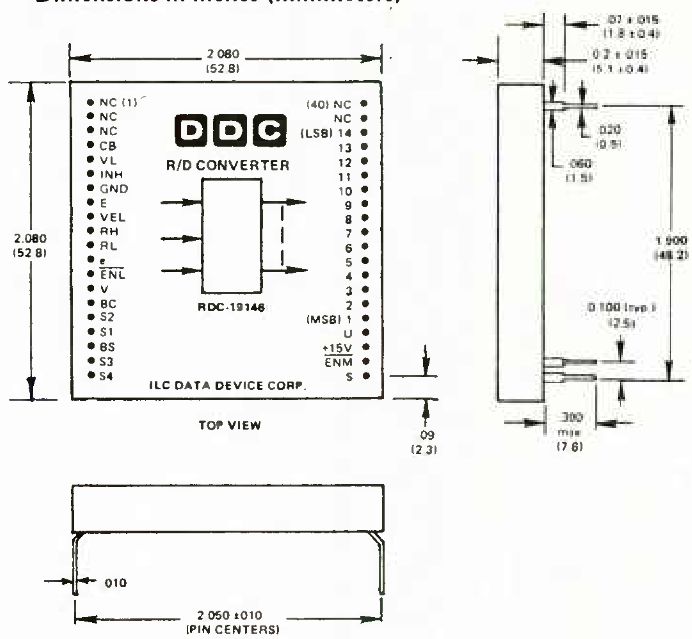
For applications where a square wave is more convenient than the conventional sine wave, the SDC-19100 Series converters are capable of operating with square waves.

When brushless resolvers are used as position transducers, it is recommended that the transmitter type be used because if a receiver resolver is used a decrease in accuracy will occur.

For users who desire a built-in-test (BIT) function to detect position error between the input and output, a simple detection circuit can be implemented with the AC error signal provided by the SDC-19100 converter. The schematic diagram for the BIT circuit is available from DDC.

MECHANICAL OUTLINE

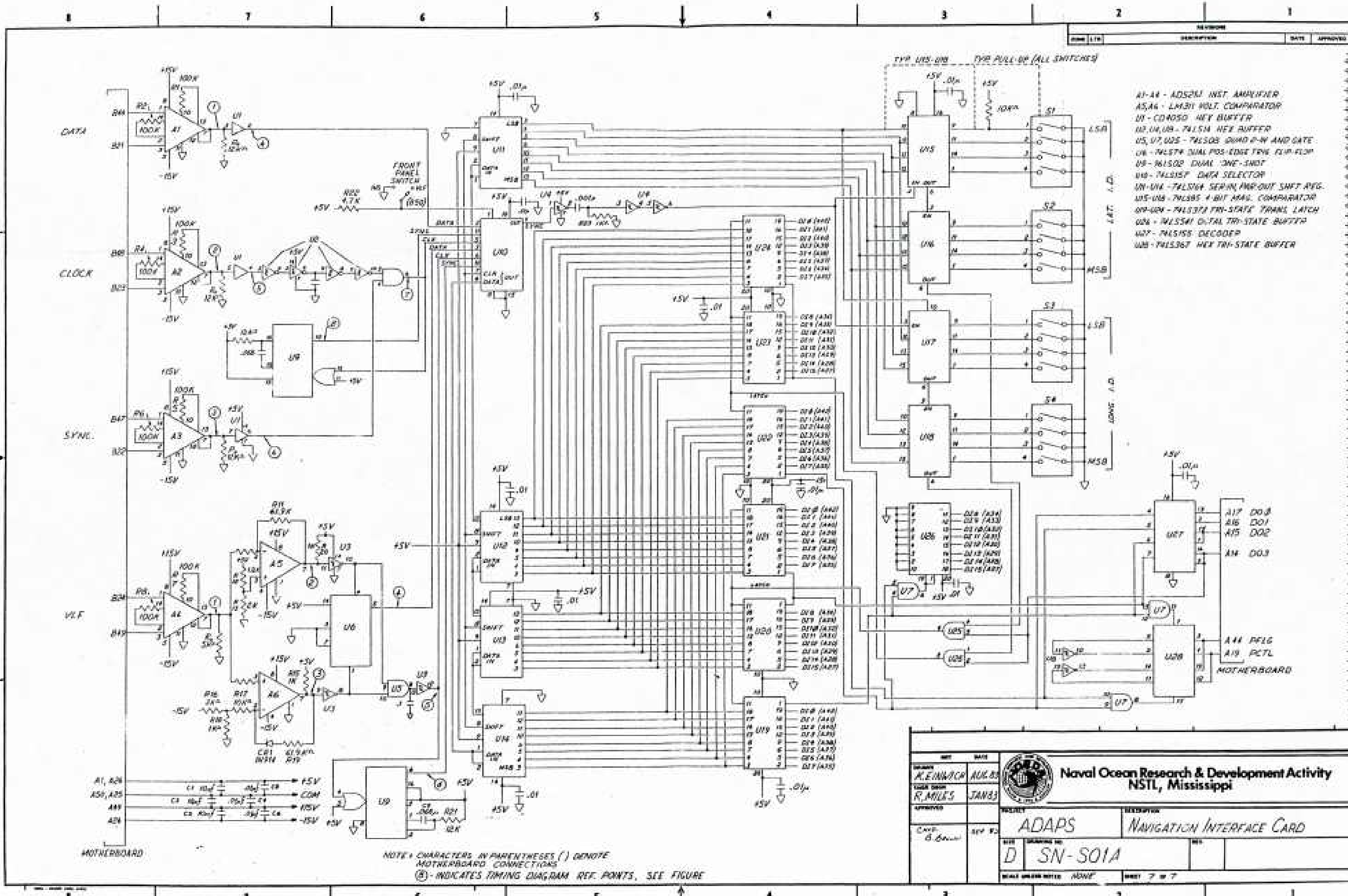
Dimensions in inches (millimeters)

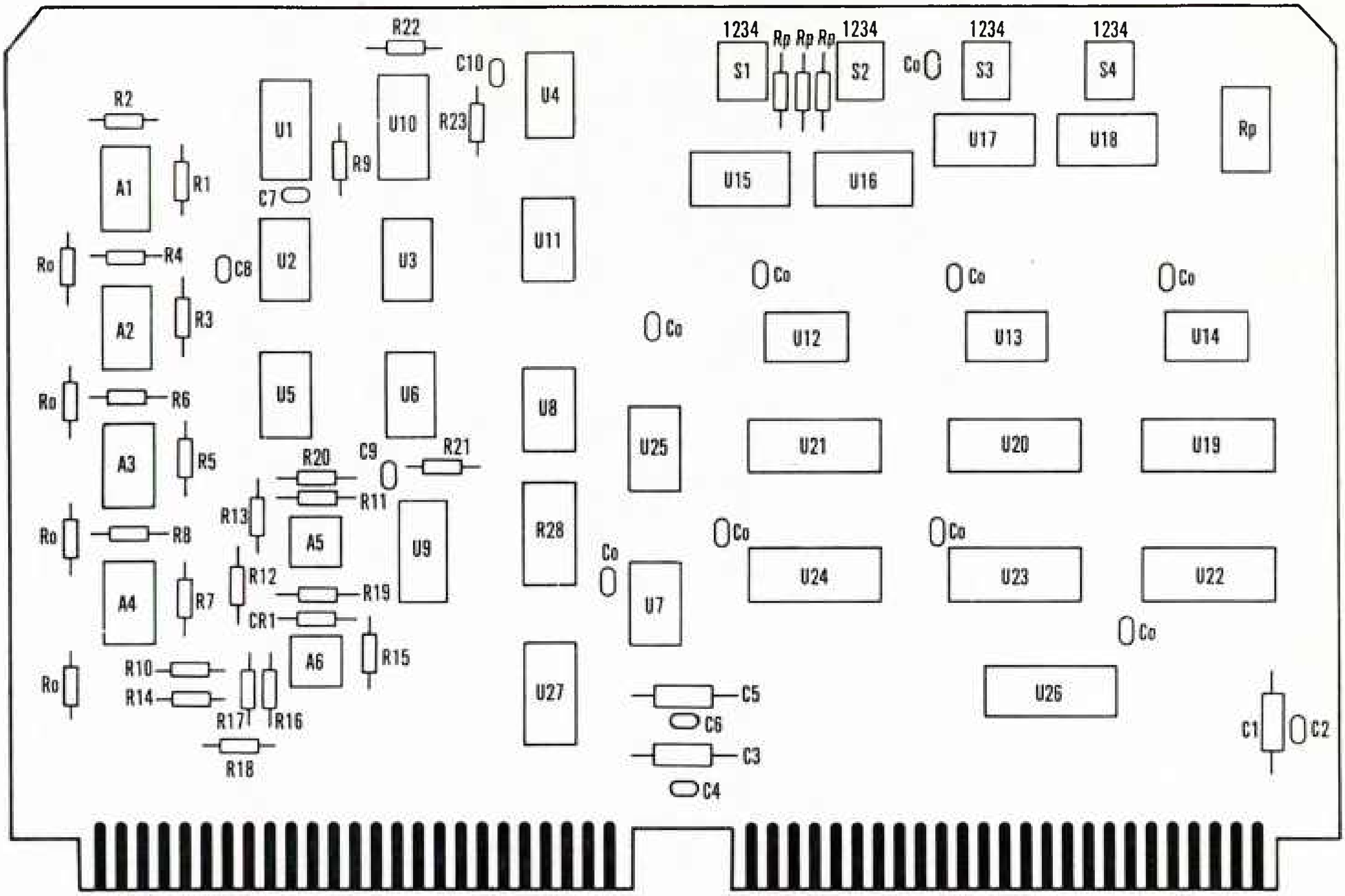


NOTES:

1. Pin material is bronze phosphor with solder plating.
2. Case material is glass filled Diallyl Phthalate per MIL-M-14, type SDC-F.
3. Pin S4 is present on resolver units, and omitted on synchro units.
4. Omit pins 11, 12, 13, 14 and 13, 14 for 10 bit units and 12 bit units respectively.
5. For the direct input option, pins S1 and S4 will be replaced by NC and S2 and S3 will be replaced by COS and SIN respectively.

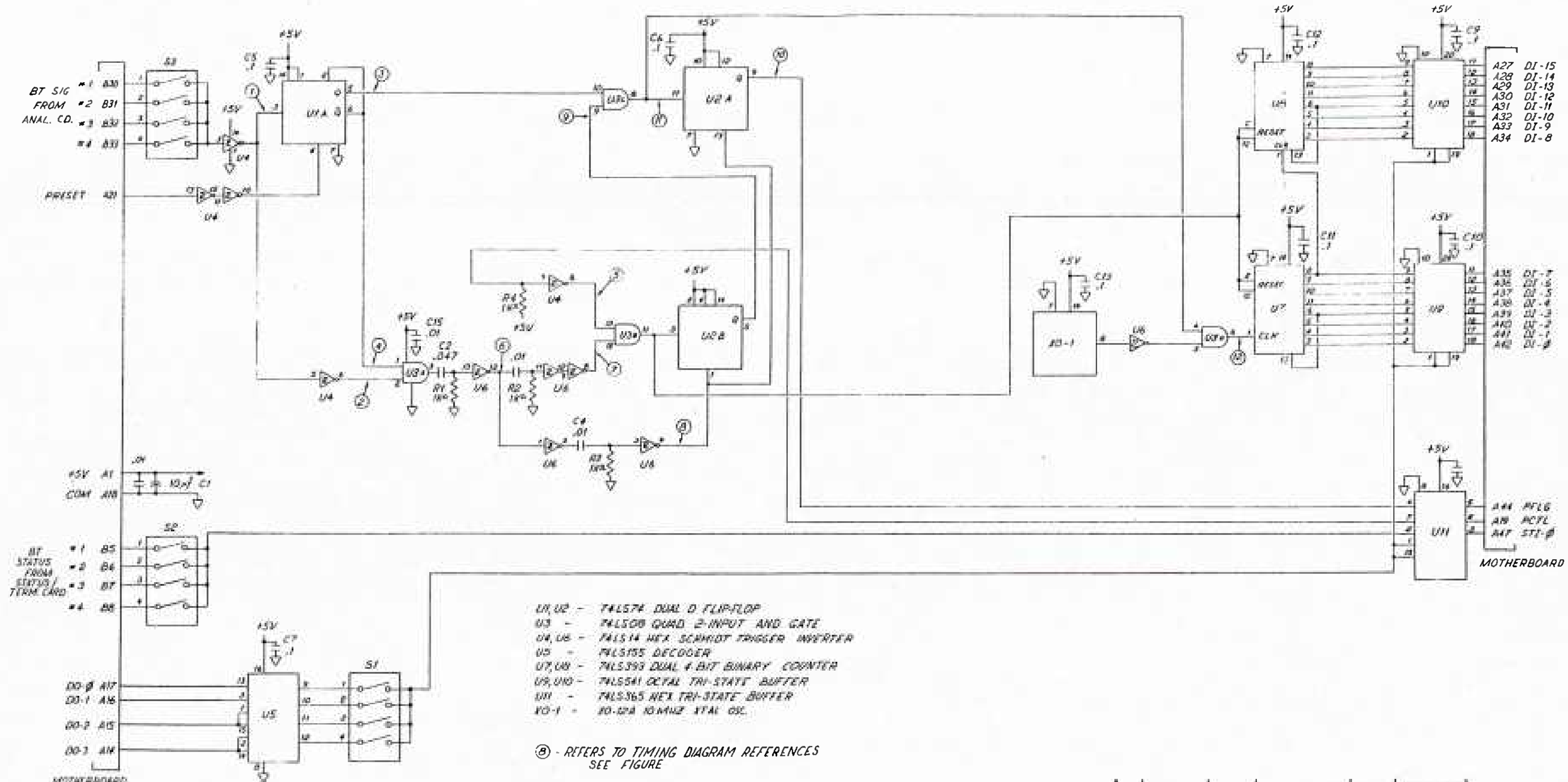
APPENDIX B


A1-A4 - AD521J INST. AMPLIFIER
A5,A6 - LM311 VOLT. COMPARATOR
U1 - CD4050 HEX BUFFER
U2,U4,U8 - 74LS14 HEX BUFFER
U5,U7,U25 - 74LS08 QUAD 2-IN AND GATE
U6 - 74LS74 DUAL POS-EDGE TRIG FLIP-FLOP
U9 - 96LS02 DUAL ONE-SHOT
U10 - 74LS157 DATA SELECTOR
U11-U14 - 74LS164 SER-IN, PAR-OUT SHFT REG.
U15-U18 - 74LS85 4-BIT MAG. COMPARATOR
U19-U24 - 74LS373 TRI-STATE TRANS. LATCH
U26 - 74LS541 OCTAL TRI-STATE BUFFER
U27 - 74LS155 DECODER
U28 - 74LS367 HEX TRI-STATE BUFFER
DATA
CLOCK
SYNC.
VLF
FRONT PANEL SWITCH
TYP. U15-U18
TYP. PULL-UP (ALL SWITCHES)
LSB
MSB
LAT. I.D.
LONG. I.D.
MOTHERBOARD
NOTE: CHARACTERS IN PARENTHESES ( ) DENOTE MOTHERBOARD CONNECTIONS
Ⓐ - INDICATES TIMING DIAGRAM REF. POINTS, SEE FIGURE
Naval Ocean Research & Development Activity
NSTL, Mississippi
K. EINWICH AUG 83
R. MILES JAN 83
ADAPS
NAVIGATION INTERFACE CARD
D
SN-S01A
NONE
7 of 7



A1-A4	AD521J INSTRUMENTATION AMPLIFIER
A5,A6	LM311 VOLTAGE COMPARATOR
U1	CD4050 HEX BUFFER
U2,U3,U4,U8	74LS14 HEX BUFFER
U5,U7,U25	74LS08 QUAD 2-INPUT AND GATE
U6	74LS74 DUAL POSITIVE-EDGE TRIG. FLIP-FLOP
U9	96LS02 DUAL ONE-SHOT
U10	74LS157 DATA SELECTOR
U11-U14	74LS164 SERIAL-IN,PARALLEL-OUT SHIFT REG.
U15-U18	75LS85 4-BIT MAGNITUDE COMPARATOR
U19-U24	74LS373 TRI-STATE TRANSPARENT LATCH
U26	74LS541 OCTAL TRI-STATE BUFFER
U27	74LS155 DECODER
U28	74LS367 BUFFER/INVERTER

NAVIGATION INTERFACE CARD SN: S01-A



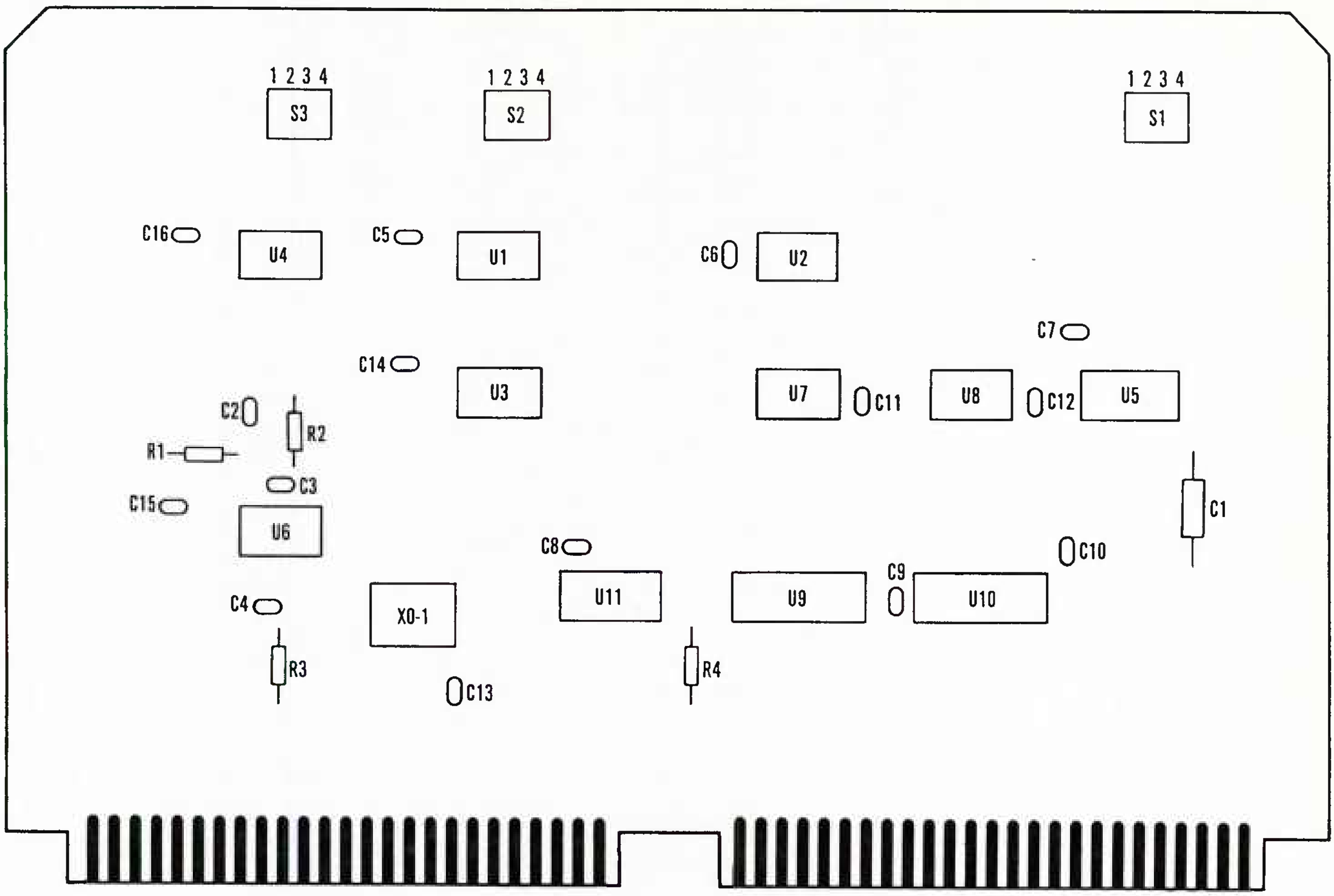
U1, U2 - 74LS74 DUAL D FLIP-FLOP
U3 - 74LS08 QUAD 2-INPUT AND GATE
U4, U6 - 74LS14 HEX SCHMIDT TRIGGER INVERTER
U5 - 74LS155 DECODER
U7, U8 - 74LS393 DUAL 4-BIT BINARY COUNTER
U9, U10 - 74LS541 OCTAL TRI-STATE BUFFER
U11 - 74LS365 HEX TRI-STATE BUFFER
XO-1 - XO-12A 10 MHZ XTAL OSC.

(8) - REFERS TO TIMING DIAGRAM REFERENCES
SEE FIGURE

INIT	DATE
DRAWN K. EINWICH	11 AUG
ENGR DSGN R. MILES	3-83
APPROVED	
CHKD B. BROWN	SEP 83

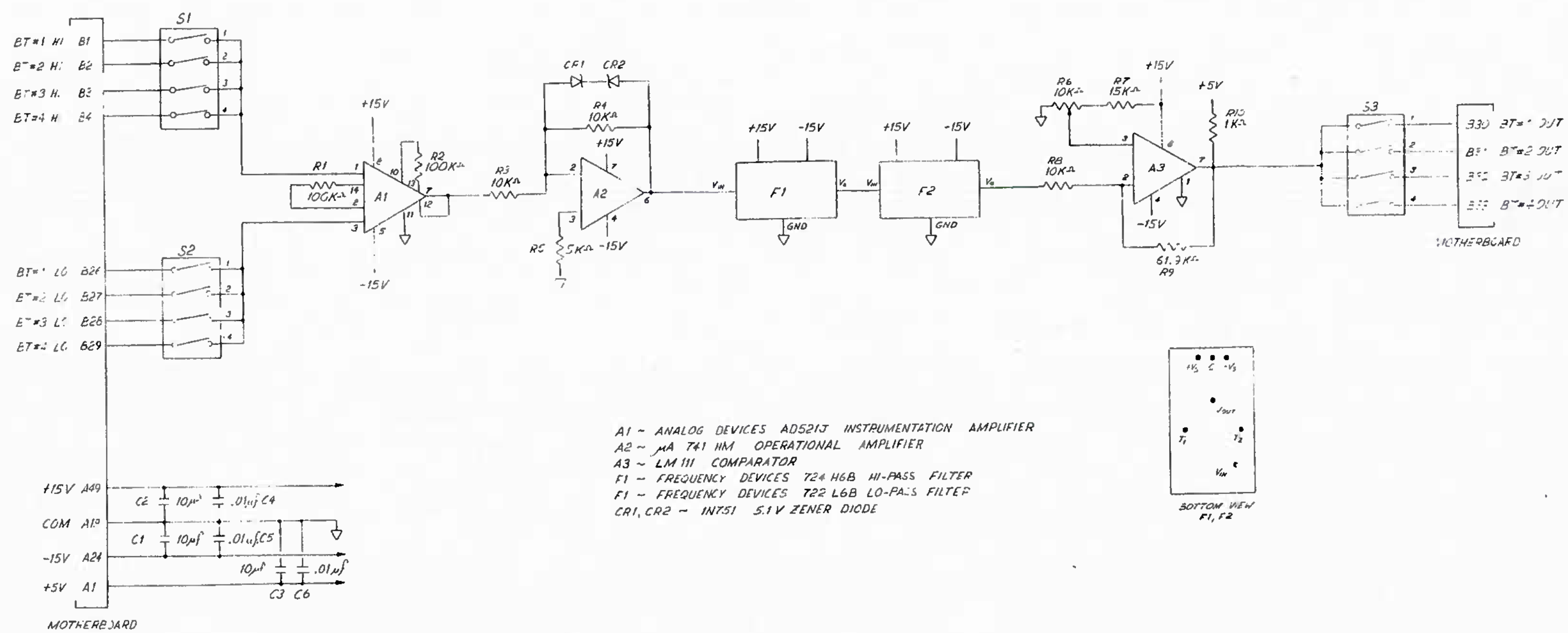
Naval Ocean Research & Development Activity
NSTL, Mississippi

PROJECT: ADAPS
DESCRIPTION: PERIOD COUNTER CARD
SIZE: D
DRAWING NO.: SN-S02 A
REV:
SCALE UNLESS NOTED: NONE
SHEET 4 OF 7



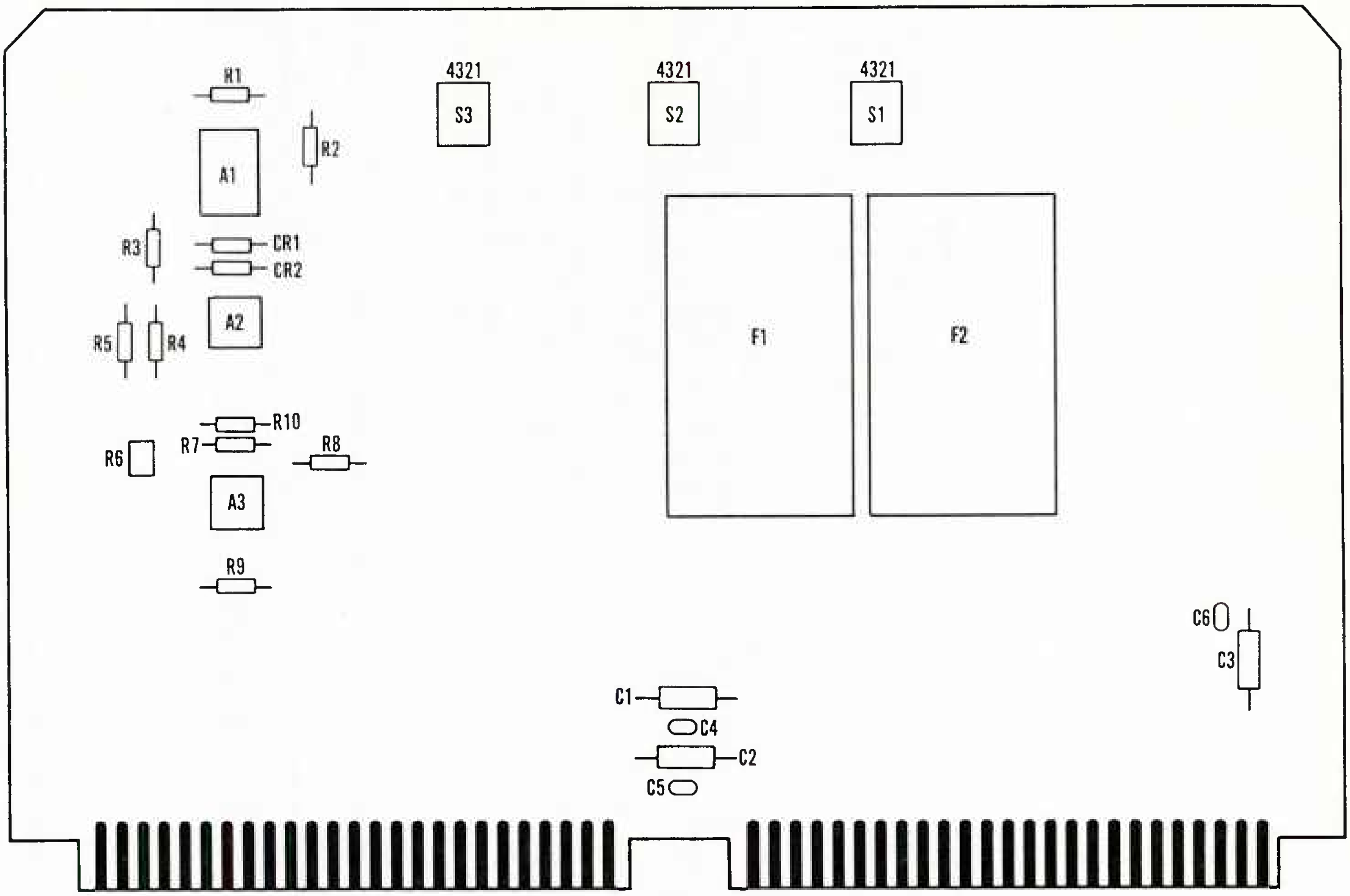
U1,U2	74LS74 DUAL FLIP-FLOP
U3	74LS08 QUAD 2-INPUT AND GATE
U4,U6	74LS14 HEX SCHMITT TRIGGER
U5	74LS155 DECODER
U7,U8	74LS393 DUAL 4-BIT BINARY COUNTER
U9,U10	74LS541 OCTAL TRI-STATE BUFFER
U11	74LS365 TRI-STATE HEX BUFFER
X0-1	X0-12A 10 MHz CRYSTAL OSCILLATOR

PERIOD COUNTER CARD SN: S02-A



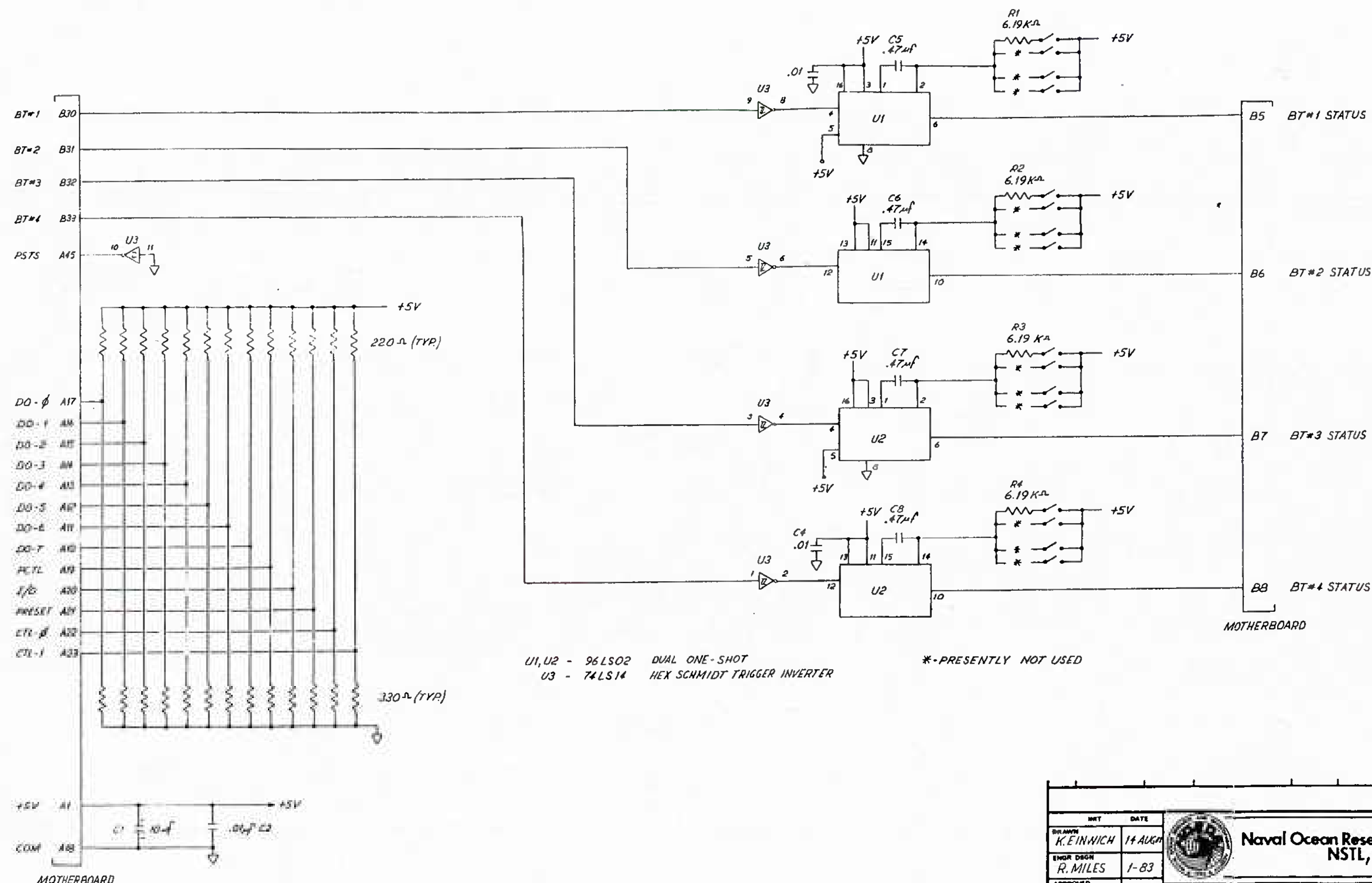
DRAWN	K. ELLINATOR
CHKD	E. BROWN
SIZE	D
DRAWING NO.	SN-..3A
SCALE UNLESS NOTED	NONE
SHEET	6 OF 7

Naval Ocean Research & Development Activity
NSTL, Mississippi



A1	ANALOG DEVICES AD521J INSTRUMENTATION AMPLIFIER
A2	uA 741HM OPERATIONAL AMPLIFIER
A3	LM111 COMPARATOR
F1	FREQUENCY DEVICES 724H6B HI-PASS FILTER
F2	FREQUENCY DEVICES 722L6B LO-PASS FILTER
CR1	1N751 5.1V ZENER DIODE
CR2	1N751 5.1V ZENER DIODE

SIGNAL CONDITIONING CARD SN: S03-A



REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPROVED

	INIT	DATE
DRAWN	K. EINWICH	14 AUG
ENGR DSGN	R. MILES	1-83
APPROVED	Chip Brown	Sep 83

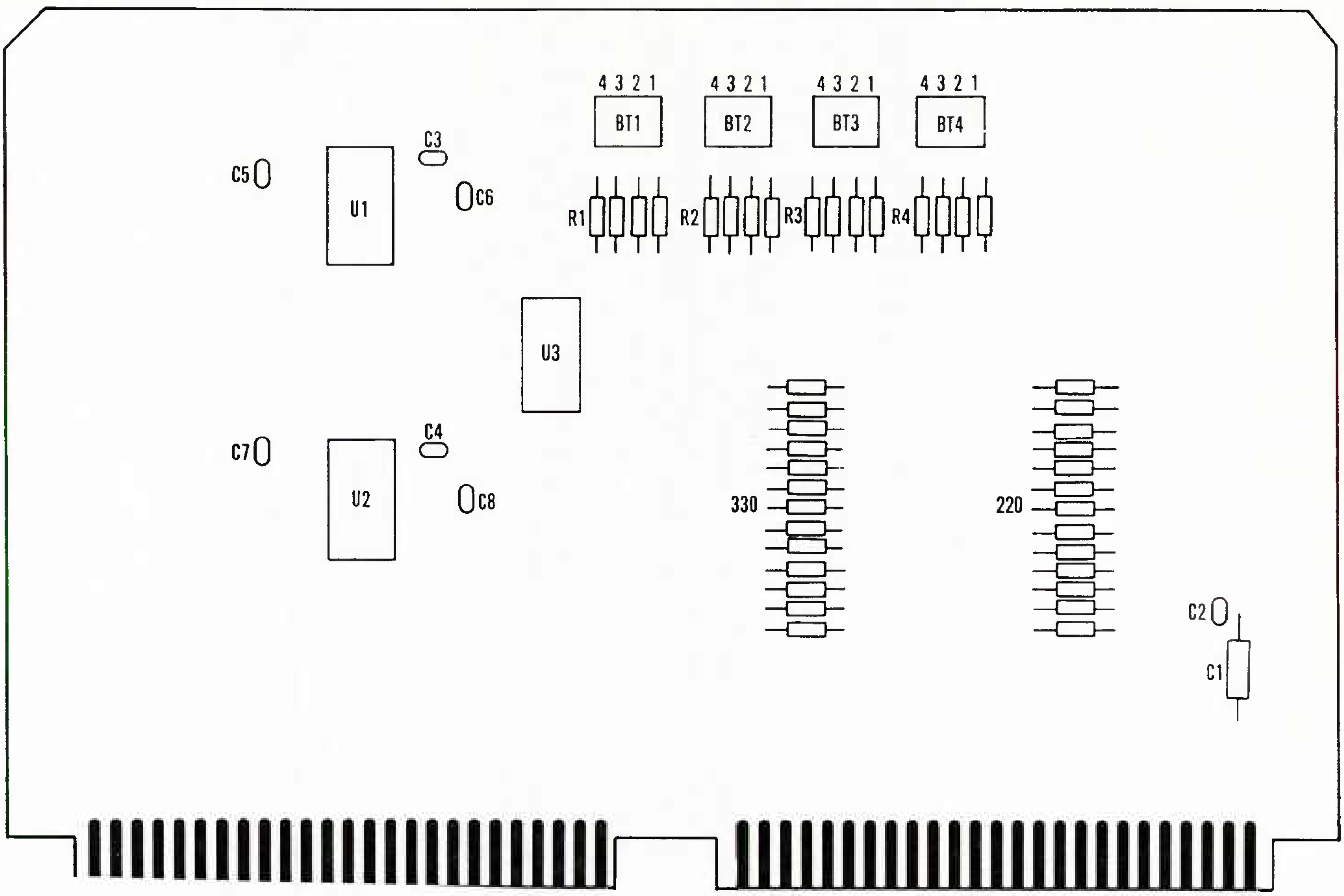
Naval Ocean Research & Development Activity
NSTL, Mississippi

PROJECT: ADAPS

DESCRIPTION: STATUS/TERMINATION CARD

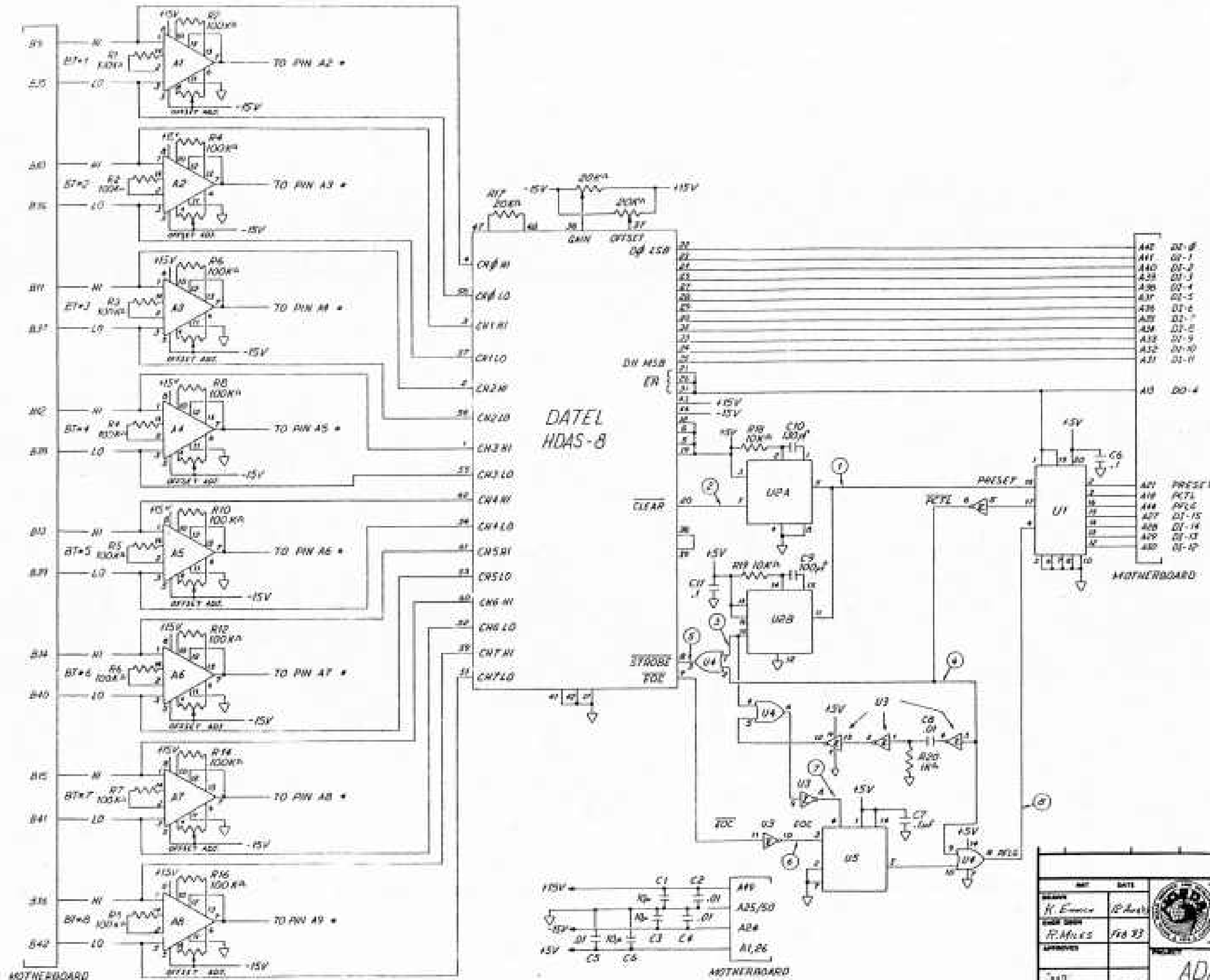
SIZE: D DRAWING NO. SN-S04A REV.

SCALE UNLESS NOTED: NONE SHEET 5 OF 7



U1,U2	96LS02 DUAL ONE-SHOT
U3	74LS14 HEX SCHMITT TRIGGER

STATUS TERMINATION CARD SN: S04-A



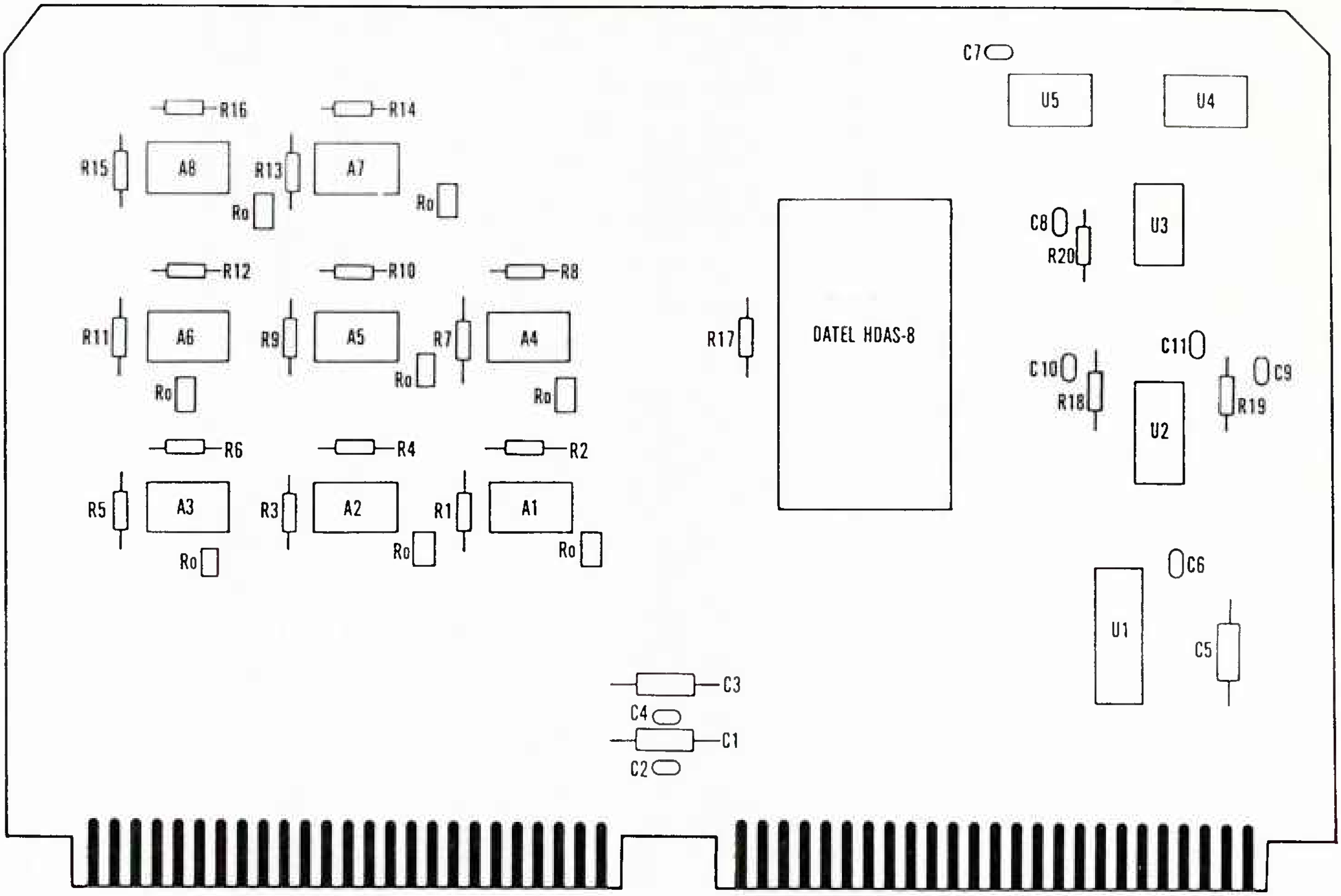
*-INDICATES MOTHERBOARD PIN NOS.

A1-A8 - AD521J INST. AMPLIFIER
HDAS-8 : DATA ACQ. MODULE-DATEL
U1 - 74LS541 OCT. TRI-STATE BUFFER
U2 - DM 74LS02 DUAL ONE SHOT
U3 - 74LS14 HEX SCHMIDT TRIG.
U4 - 74LS32 QUAD 2-INPUT OR GATE
U5 - 74LS74 DUAL D FLIP-FLOP

Naval Ocean Research & Development Activity
NSTL, Mississippi

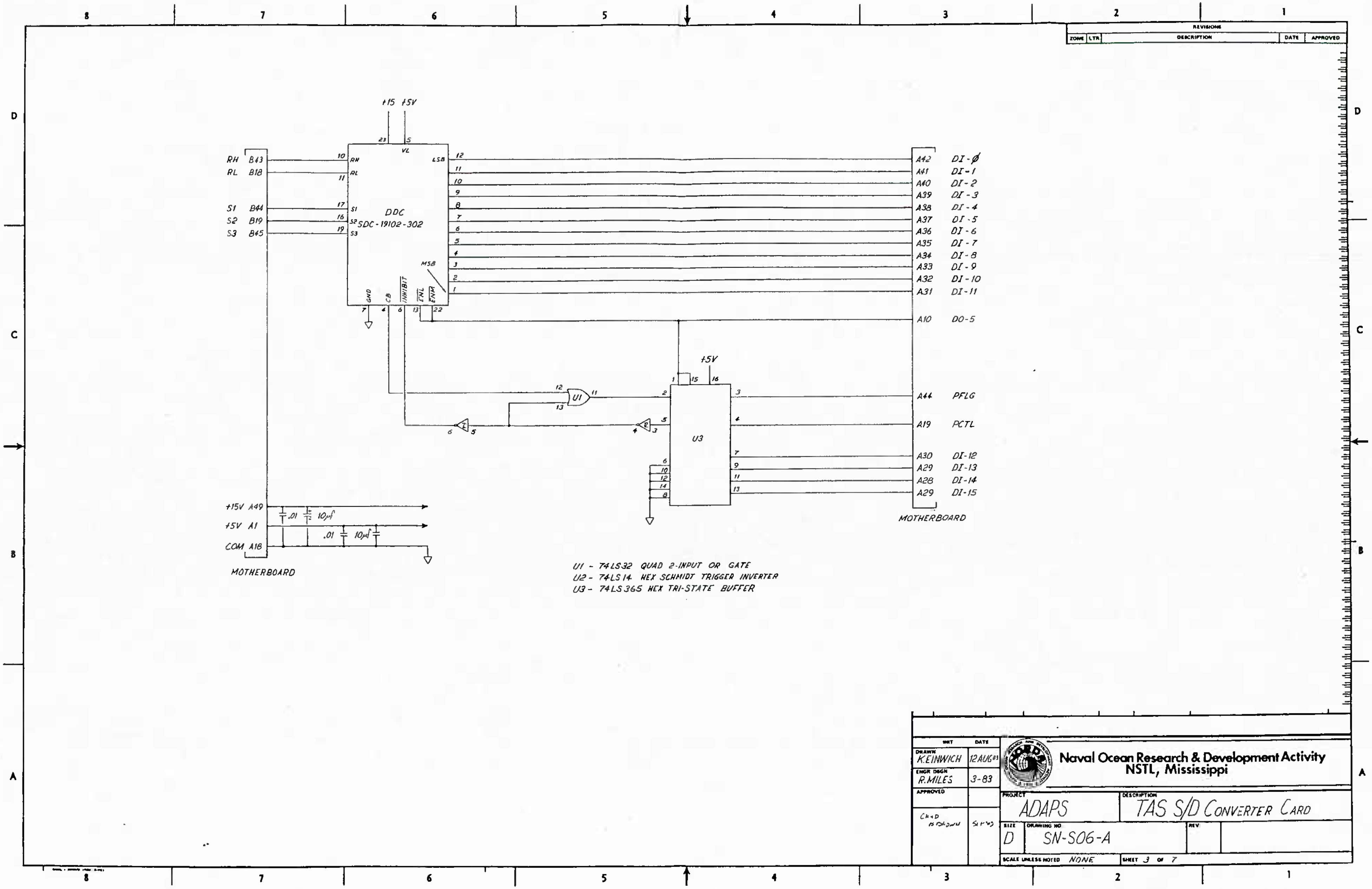
DRAWN	K. E[illegible]	[illegible]
CHECKED	R. Miles	Feb 83
APPROVED		

PROJECT: ADAPS
DESCRIPTION: METEOROLOGICAL DATA CARD
SIZE: D — DRAWING NO.: SN-505A
SCALE: NONE — SHEET 2 OF 7

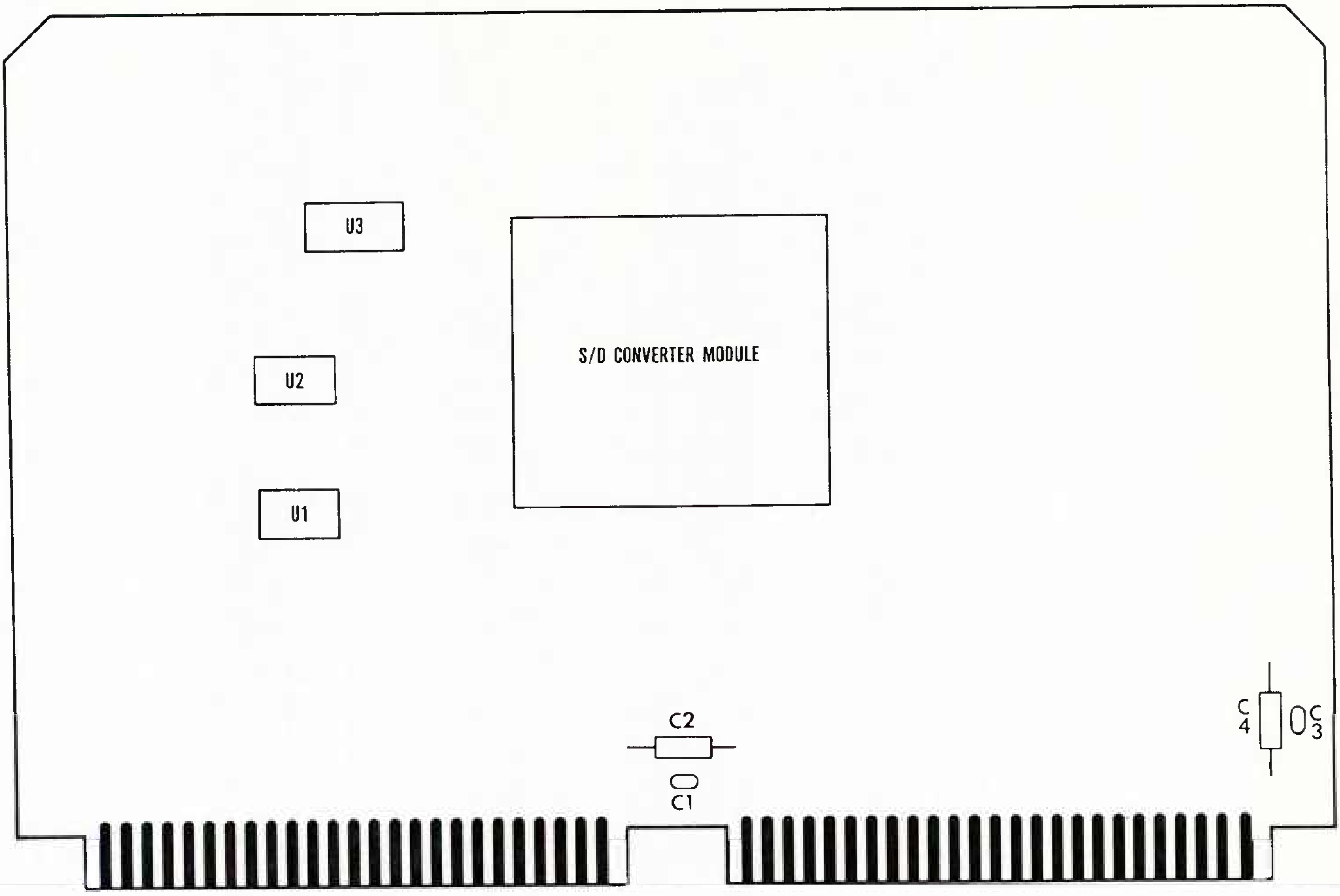


A1-A8	AD521J INSTRUMENTATION AMPLIFIER
HDAS-8	DATA ACQUISITION MODULE - DATEL
U1	74LS541 OCTAL TRI-STATE BUFFER
U2	DM96LS02 DUAL ONE-SHOT
U3	74LS14 HEX SCHMITT TRIGGER
U4	74LS32 QUAD 2-INPUT OR GATE
U5	74LS74 DUAL FLIP-FLOP

METEOROLOGICAL DATA CARD SN: S05-A

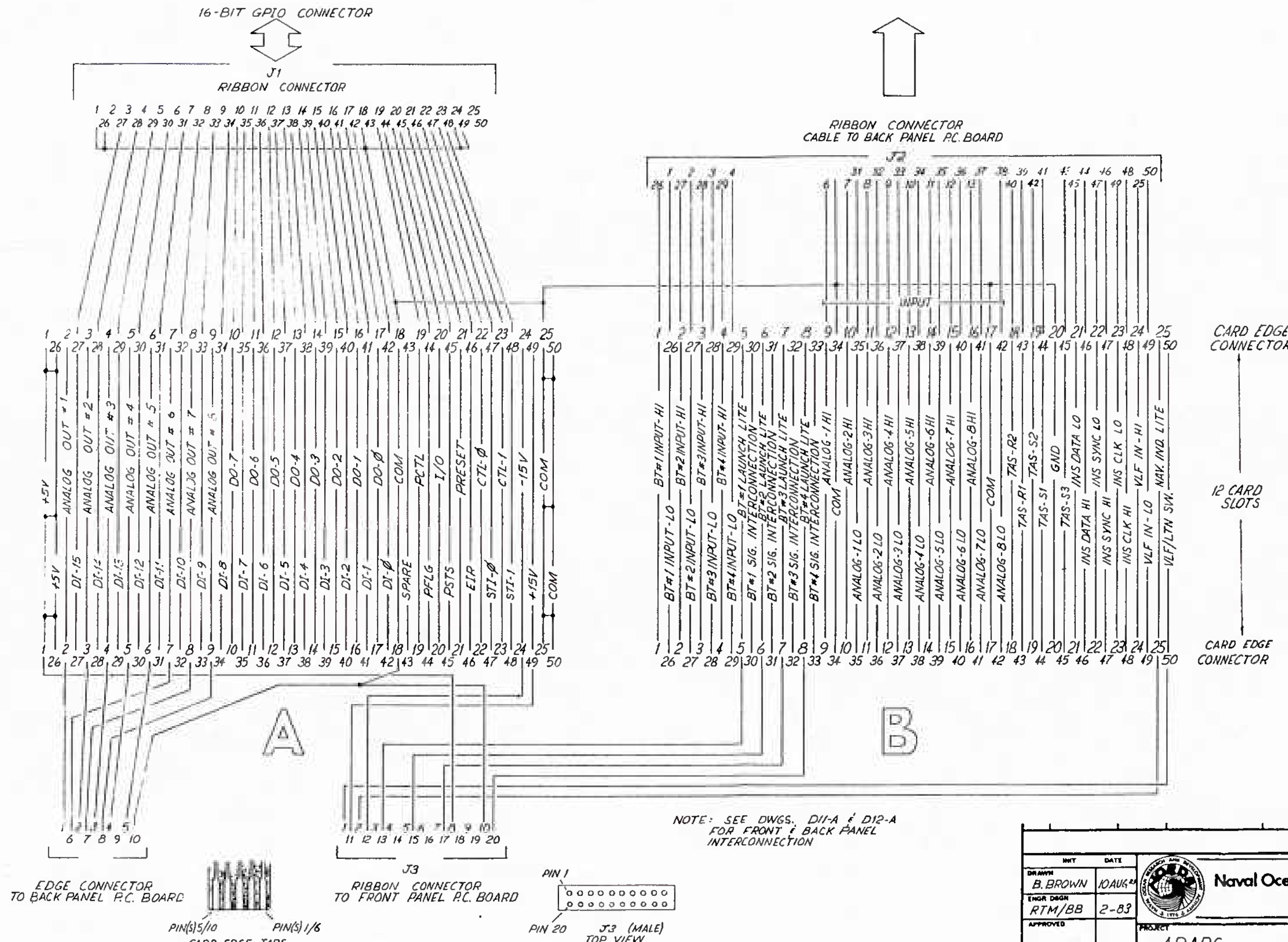


+15 +5V
DDC
SDC-19102-302
RH B43
RL B18
S1 B44
S2 B19
S3 B45
LSB
MSB
GND CB INHIBIT ENL ENM
A42 DI-Ø
A41 DI-1
A40 DI-2
A39 DI-3
A38 DI-4
A37 DI-5
A36 DI-6
A35 DI-7
A34 DI-8
A33 DI-9
A32 DI-10
A31 DI-11
A10 DO-5
+5V
U1
U3
A44 PFLG
A19 PCTL
A30 DI-12
A29 DI-13
A28 DI-14
A29 DI-15
MOTHERBOARD
+15V A49
+5V A1
COM A18
.01 10µf
.01 10µf
MOTHERBOARD
U1 - 74LS32 QUAD 2-INPUT OR GATE
U2 - 74LS14 HEX SCHMIDT TRIGGER INVERTER
U3 - 74LS365 HEX TRI-STATE BUFFER
REVISIONS
ZONE LTR DESCRIPTION DATE APPROVED
DRAWN K.EINWICH 12AUG83
ENGR DSGN R.MILES 3-83
APPROVED
Naval Ocean Research & Development Activity
NSTL, Mississippi
PROJECT ADAPS
DESCRIPTION TAS S/D CONVERTER CARD
SIZE D
DRAWING NO SN-S06-A
REV
SCALE UNLESS NOTED NONE
SHEET 3 OF 7



U1	74LS32 QUAD 2-INPUT OR GATE
U2	74LS14 HEX SCHMITT TRIGGER
U3	74LS365 TRI-STATE HEX BUFFER
SDC-19102-302	SYNCHRO/DIGITAL CONVERTER

TRUE AIR SPEED SYNCHRO/DIGITAL CONVERTER CARD SN: S06-A

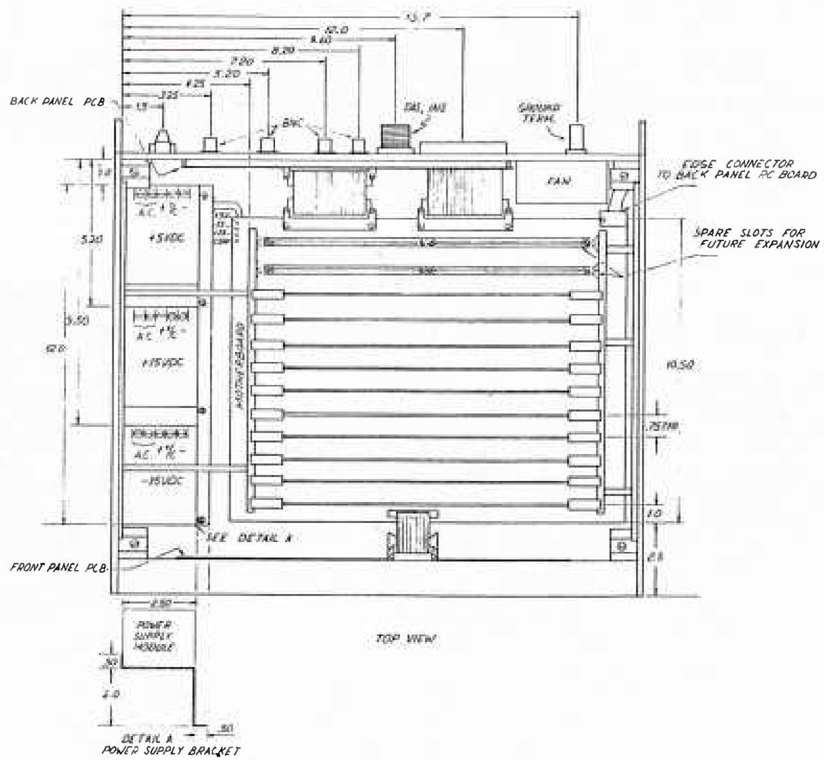


NOTE: SEE DWGS. D11-A & D12-A FOR FRONT & BACK PANEL INTERCONNECTION

	INIT	DATE
DRAWN	B. BROWN	10AUG 82
ENGR DSGN	RTM/BB	2-83
APPROVED		
CHKD.	B. BROWN	SEP 83

Naval Ocean Research & Development Activity
NSTL, Mississippi

PROJECT: ADAPS
DESCRIPTION: MOTHERBOARD
SIZE: D
DRAWING NO.: SN-S07A
REV.:
SCALE UNLESS NOTED: NONE
SHEET 1 OF 7



TOP VIEW

DETAIL A
POWER SUPPLY BRACKET

POWER SUPPLY : ACOPIAN MODEL 5EB250, 5VDC ; MODEL 15EB100, 15VDC (2EA) AC-DC REGULATED POWER MODULES
PRINTED CIRCUIT BOARDS: DATA ACQ. CARDS - 9.70 × 6.40 ; MOTHERBOARD SIZE 10.50 × 11.70 (MOUNTED TO ENCLOSURE BASE ; FRONT PNL PCB SIZE 12.0 × 6.0 ; BACK PANEL PCB 9.8 × 6.0
FAN: MODEL SU2A1, EG&G ROTRON SPRITE. 3.14 × 3.14 × 1.64 115 VAC, 21-35 CFM
CONNECTORS: AMPHENOL 50-PIN, MS 57-40500-9, 16-BIT I/O CONN. ; ALPHA 50-PIN RIBBON # FCC-210-20 ; AMPHENOL 10-PIN (TAS, INS), 2EA. MS3106A1815 ; AMPHENOL # 31-10 ISOLATED BNC, 21EA. ; SWITCHCRAFT EAC-302, 15A-250V A.C. POWER CONN., MOTHERBOARD CARD-EDGE TRW CARDCON 50-50SN-1

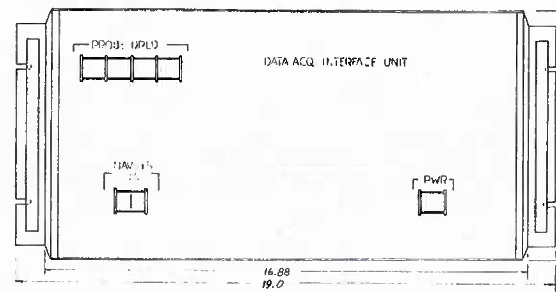
NOTE: SEE DWG # SN-S09A FOR EXTERIOR ENCLOSURE DIMENSIONS

REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPROVED

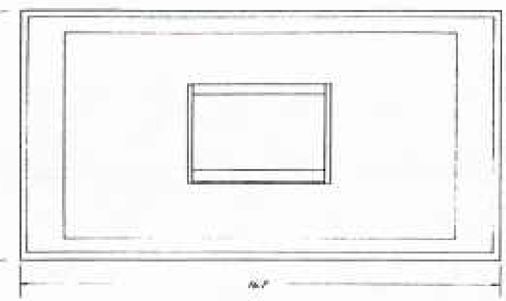
	INIT	DATE
DRAWN	B. BROWN	NOV. 83
ENGR DSGN	B. BROWN	OCT 82
APPROVED		

Naval Ocean Research & Development Activity
NSTL, Mississippi

PROJECT: ADAPS
DESCRIPTION: DATA ACQUISITION INTERFACE UNIT LAYOUT CONFIGURATION
SIZE: D
DRAWING NO.: SN-S08-A
REV.:
SCALE UNLESS NOTED: 1/2
SHEET 1 OF 2

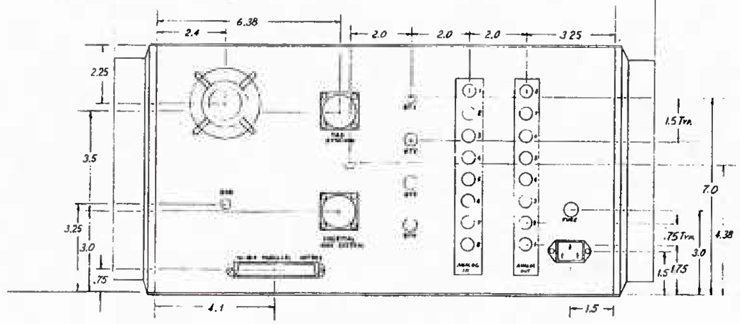


FRONT PANEL



SIDE VIEW

ENCLOSURE: ZERO CORP. ENCL. NO. VIP 170816-12-B, ALUM. ENCLOSURE
FRONT PANEL: SWITCHES & INDICATORS - OMRON, M2SA-7010 (INDICATOR); A3SJ-8040 (IND, SPLIT-SCR SW) A3SA-7010 (IND. SW.-PWR)
BACK PANEL: SEE DWG. # SN-S08A

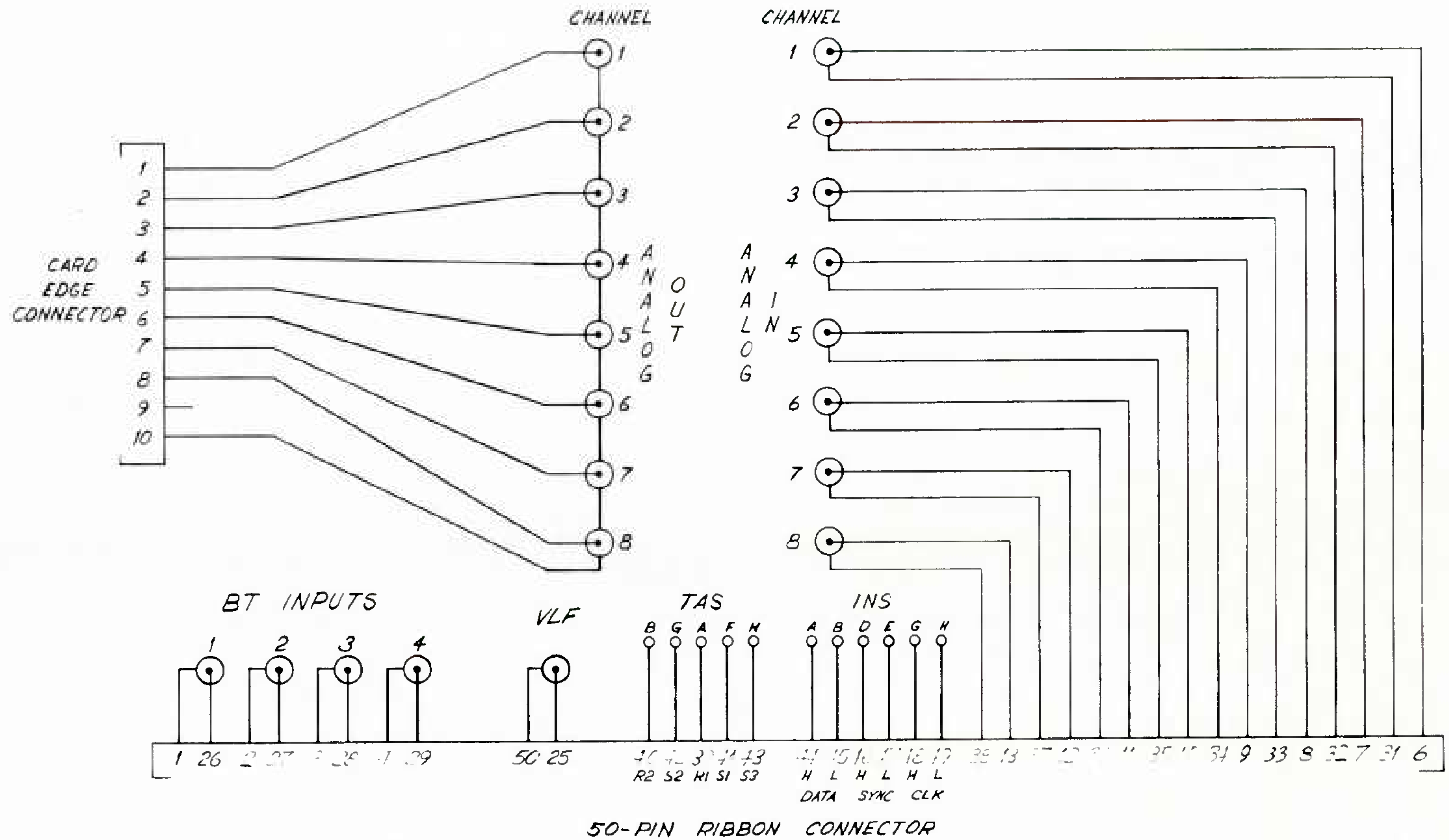


BACK PANEL

INIT	DATE
DRAWN B BROWN	Nov. 83
CHKD. DSGN B BROWN	Nov 82
APPROVED	

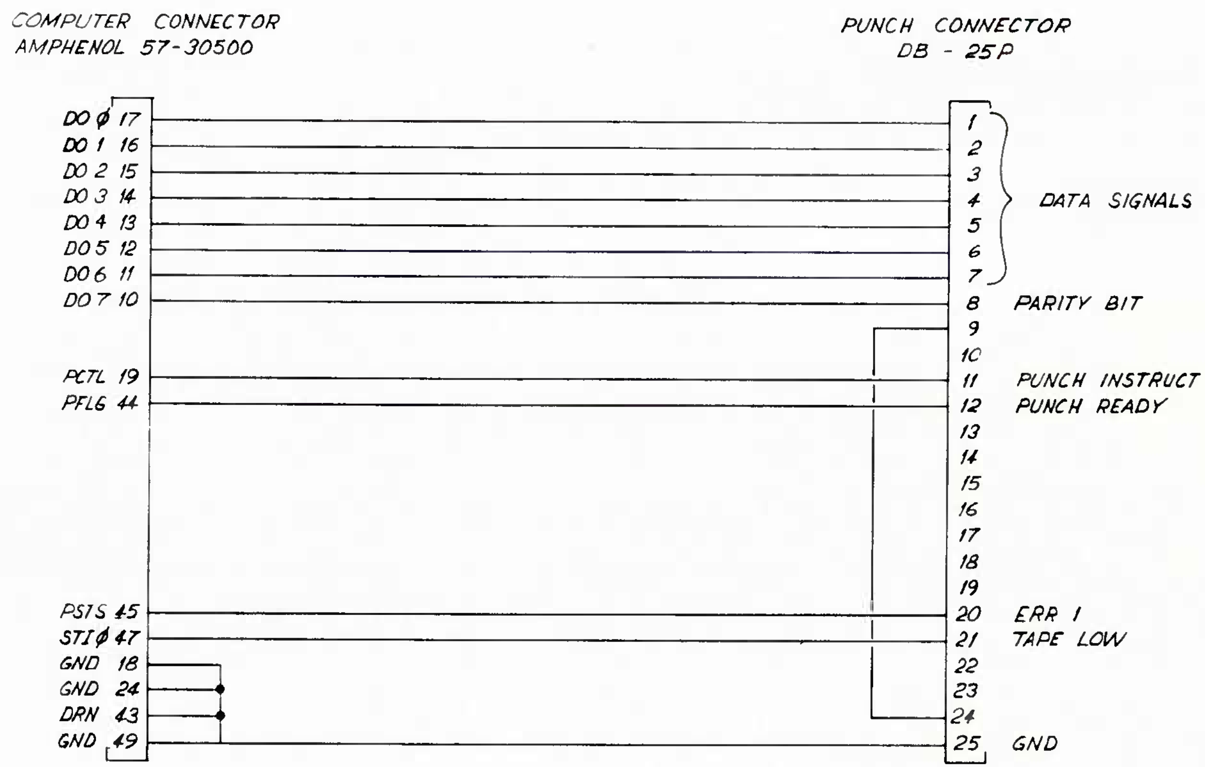
Naval Ocean Research & Development Activity
NSTL, Mississippi

PROJECT: ADAPS
DESCRIPTION: DATA ACQUISITION INTERFACE UNIT ENCLOSURE DESCRIPTION
SIZE: D
DRAWING NO.: SN-S09-A
REV.:
SCALE UNLESS NOTED: 1/2
SHEET 2 of 2

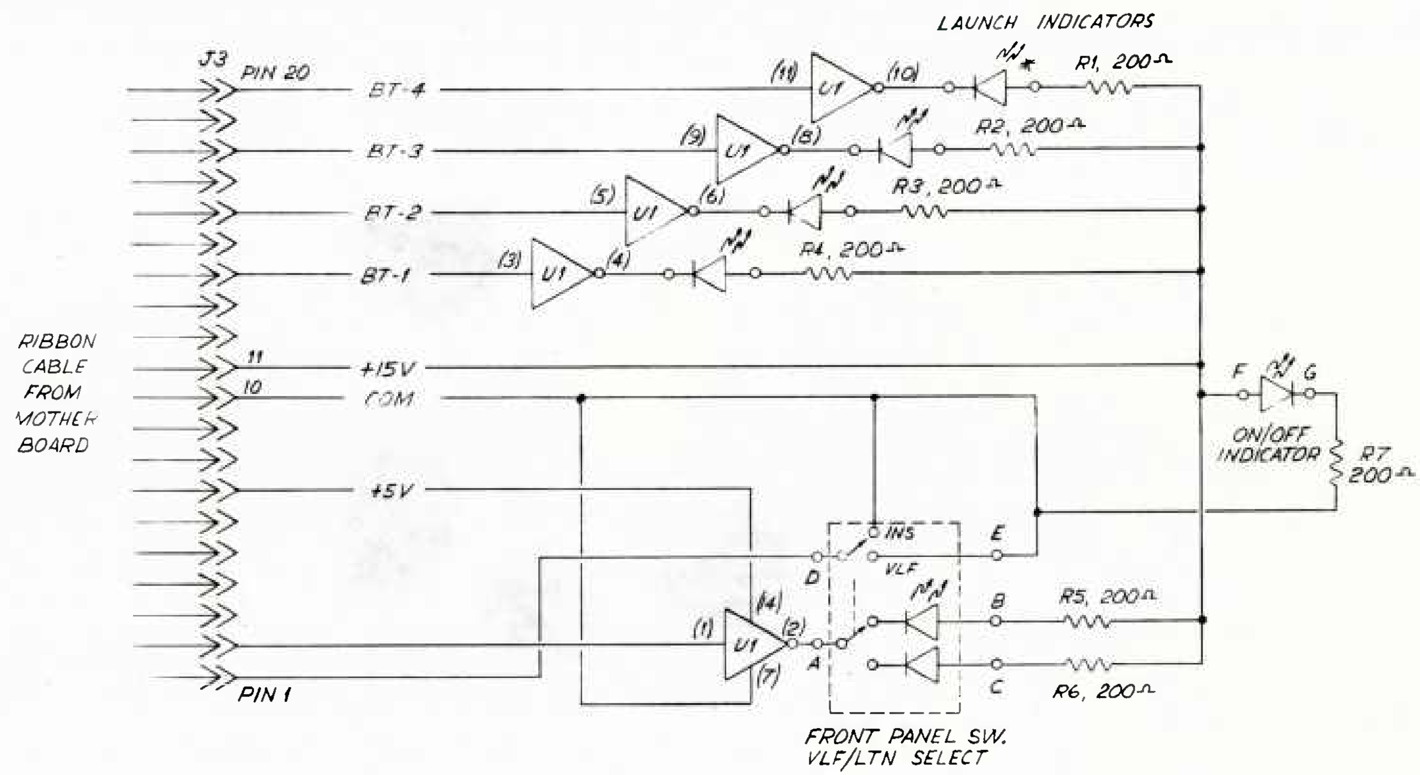


Naval Ocean Research & Development Activity

DATE			
8-83	DRAWN B. BROWN	DESCRIPTION BACK PANEL P.C. BOARD	
4-83	ENGR R. MILES	SIZE B	DWG. NO. SN-S08A	PROJECT ADAPS



DATE	Naval Ocean Research & Development Activity		
AUG 83	DRAWN B. BROWN	DESCRIPTION PAPER TAPE PUNCH INT-FCE CABLE	
JUL 83	ENGR R. MILES	SIZE B DWG. NO. SN-S09A	PROJECT ADAPS



* LED INICATORS LOCATED OFF-BOARD INSIDE OMRON COMPONENTS

U1 - 7405

DATE	Naval Ocean Research & Development Activity			
8-83	DRAWN B.BROWN	DESCRIPTION FRONT PANEL P.C. BOARD		
4-83	ENGR B.BROWN	SIZE B	DWG. NO. SN-S10A	PROJECT ADAPS