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# Adaptive Intrusion Data System (AIDS)

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# ADAPTIVE INTRUSION DATA SYSTEM (AIDS)

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ABSTRACT

The adaptive intrusion data system (AIDS) was developed to collect data from intrusion alarm sensors as part of an evaluation system to improve sensor performance. AIDS is a unique data system which uses computer controlled data systems, video cameras and recorders, analog-to-digital conversion, environmental sensors, and digital recorders to collect sensor data. The data can be viewed either manually or with a special computerized data-reduction system which adds new data to a data base stored on a magnetic disc recorder. This report provides a synoptic account of the AIDS as it presently exists. Modifications to the purchased subsystems are described, and references are made to publications which describe the Sandia-designed subsystems.

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ILLUSTRATIONS

# ADAPTIVE INTRUSION DATA SYSTEM (AIDS)

## Introduction

### AIDS System Description

The adaptive intrusion data system (AIDS) is a data collection system based on computer-controlled subsystems which were developed for use in evaluating and improving intrusion alarm sensors. The AIDS system consists of six main subsystems:

1. TV cameras and video recorders,
2. Weather sensors,
3. Analog and digital data system,
4. Minicomputer system controller,
5. Digital tape recorders, and
6. Teletype (TTY) keyboard and printer.

These subsystems work together to monitor the outputs of up to 48 intrusion alarm sensors and record video and digital data for each alarm that is activated. For each alarm activation, the current time and identification number of the alarm is printed, 7 seconds of video output from two TV cameras (which view the selected alarm sector) is recorded, and about 3.5 seconds of digital data is recorded. The digital data format consists of a repeating frame of data containing sync, time, weather bilevel, and analog words encoding all of the programmed variables. The format and word rate of the digital frame are programmed through an interactive software program in the Nova computer and entered on the TTY keyboard.[1]

Typically the AIDS is set up to monitor the sensor field for a prescribed period of time--generally during nighttime periods--in an effort to establish false-alarm rates and the causes for these alarms. Therefore, each morning the hard-copy record from the TTY keyboard is examined, and, in conjunction with a viewing of the video tapes, the probable cause of the alarm's activation is established. The digital tapes are then analyzed by a unique computer program that checks each digital data frame for sync, variable identification (ID) codes, and alarm data. When an error in any of the sync or ID codes occurs, a corresponding message is printed out on the TTY printer, and the entire frame of data is dropped. An error-free frame of data is unpacked, and the corresponding data (bilevel ID number and weather data) is stored in a data bank located on the disc pack attached to the Nova computer. Since each alarm record is headed by a current time tag and an alarm number, a specific alarm's data can be retrieved from the digital tape by using the alarm data search mode of the program. A specific alarm's analog data can then be located, stored on a disc file, decoded, and displayed on a cathode-ray tube (CRT) monitor for further analysis. Periodically, at the discretion of the analyst, the data bank can be interrogated, and the selected alarm can be plotted on a graph as a function of alarms per weather stimuli, i.e., temperature, wind speed, rain rate, potential gradient, or relative humidity.[2]

The intent of this document is to introduce the potential user to a simplified overview of AIDS and its primary subsystems. The block diagram shown in Figure 1 indicates the relationship of the major subsystems to each other. Each block will be discussed in greater detail in the sections which follow.

## TV Cameras and Video Tape Recorders

Four low-level TV cameras (Cohu 2855; see Figure 1) are located in pairs to cover the field of view of the alarm sensors in two separate sectors. A computer-controlled video switcher (Dynair FR8500) feeds two camera outputs to a pair of video tape recorders (IVC 700/800). Which pair of camera outputs is to be recorded is determined by the sector in which the active alarm is located. A character inserter (Laird 320104) adds the current time to the video frames to permit the video pictures to be cross-correlated to the printed alarm data. A detailed report on the video subsystem may be found in Reference 3.

## Weather Sensors

Most intrusion alarms are sensitive to activation by weather stimuli, so seven Teledyne Geo Tech weather sensors are mounted near the sensor fields. A National IMP-16 microprocessor is used to encode, filter, and display the temperature, wind speed and direction, relative humidity, precipitation rate, potential gradient, and precipitation accumulation on front panel readouts. The only command the Nova computer has on the IMP-16 is to control the calibration of the analog weather channels.

Other than during the calibration period, the weather subsystem is free running and the conditioned weather parameters are stored in the IMP-16's RAM and displayed on the front panel readouts. The data is transferred to the memory controlled data processor (MCDP) upon request from the MCDP. A detailed report on the weather subsystem may be found in Reference 4.

## Bilevel and Analog Data Subsystem

Each alarm sensor generally has two outputs, a fixed-level shift signal or bilevel output and the analog output of the actual sensor. All alarms are operating continuously, and the Nova computer periodically samples the bilevel output of each sensor. If a bilevel signal is detected, and not masked by a software command to suppress spurious alarms, the alarm ID number is printed on the TTY printer. If the analog mode of the data collection program is selected, the alarm sensor's analog output is digitally encoded and recorded on the digital magnetic tape

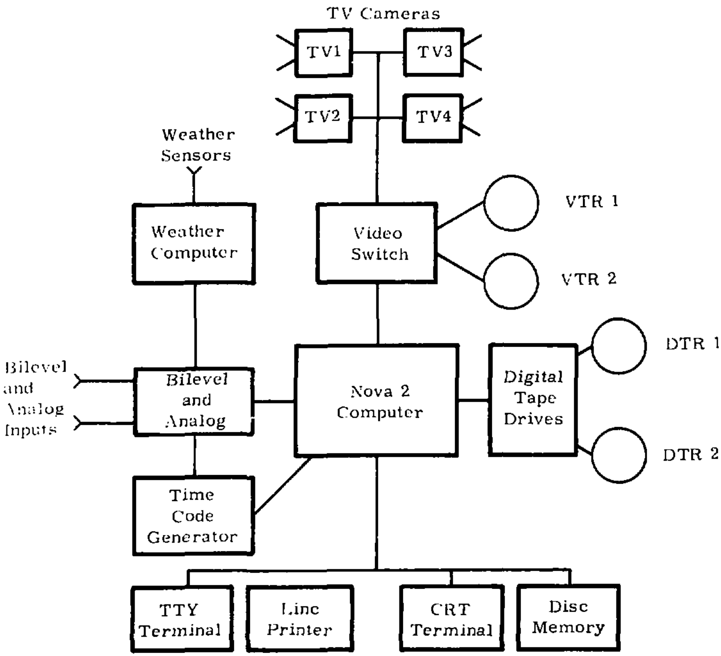


Figure 1. AIDS Block Diagram

recorders along with the bilevel, time, and weather data. Additional information on the bilevel and analog data subsystems may be found in References 5, 6, and 7.

## Minicomputer Controller

A minicomputer (see Figure 1) is used as the central controller of the AIDS system to implement the many control decisions which must be made. By using an interactive operating program, any changes in the number of alarms, operating modes, or control limits can be made quickly, easily, and under program control.[1]

The main control decisions are

- Monitor bilevel signals for alarms and mask for lockout limits
- Print record of alarm ID number and time of occurrence
- Format and control alarm analog data recording
- Control video camera switcher and video recorder control
- Control operating modes: bilevel, bilevel/TV/metro, calibrate, bilevel/TV/analog, diagnostic testing
- Format and control digital tape recording.

Data General Nova 2 minicomputer is used as the central control. The Nova 2 is a 16-bit machine with a 32K core memory. Even with core memory, it is necessary to power the Nova 2 from an uninterruptible power supply (UPS) to minimize the ac power dropout and restart problem. Additional information on Data General's Nova computers may be found in the manual, "How to Use the Nova Computers."[8] Reference 9 contains more information on the software routines for the minicomputer operating system.

## Digital Tape Controller and Recorders

A Datum digital tape controller and two Pertec digital tape recorders are used to store the large amount of digital data generated by the AIDS system. Two digital recorders are used to increase total data storage and to permit continuous operation. After one digital recorder has completely filled its digital tape, the Nova 2 will finish the file on the first tape and switch to the second tape recorder. The second tape will be properly started with a header and calibration records and will continue to record digital data. The first tape can be rewound and a fresh tape loaded on that digital tape recorder. System reliability is increased because operation is possible with only one operating digital tape recorder.

The Datum tape controller was selected to reduce the work load on the Nova 2. It handles the data formatting, control of the digital tape machines, and the direct memory access (DMA) data transfer between the buffer in the Nova's memory and the Datum data registers.

## TTY, CRT, Keyboard, and Printer

The interactive operating program running on the Nova 2 minicomputer requires communication between the operator and machine; therefore, a Texas Instruments TI733 TTY terminal is used as a hard-copy printer while the keyboard doubles as an operator input device. However, the 733 TTY has a maximum data baud rate of 300 Hz, which is too slow for outputting both the raw data dumps for diagnostic testing and the data from the graphics package for data reduction. A faster Data General line printer and a Tektronic CRT terminal with a 1200-Hz baud rate and hard-copy unit have been interfaced with the Nova 2 to greatly improve its data output capability.

## Datum Tape Controller Modifications

The Datum tape controller is the interface between the Nova computer and the magnetic tape recorders. The controller packs and unpacks data words between the computer's 16-bit bus and the 6-bit digital tape recorders. It also decodes commands from the computer and directly controls the digital tape drives. Several different data formats have evolved in packing 6-bit digital tape machine words into the 16-bit word of the Nova computer. The 6-6 format packs two 6-bit tape machine words into one 16-bit computer word, dropping bits 0, 1, 8, and 9. The 6-6-4 format packs three 6-bit tape machine words into one full 16-bit computer word, dropping two bits of the third 6-bit word. This special order Datum tape controller has several packing/unpacking registers to permit selection of either format. Additional modifications have been made in-house to enable remote computer control of the packing format and to change some of the status bits. The changes are indicated on the following notes.

Operation Changes with Sandia Modifications

1. Command bits
   a. Bit 5--EDIT
   b. Bit 6--Low density
   c. Bit 3--Tripack packing
2. REMOTE-MANUAL switch has been enabled.
   a. In manual mode, the above command bits are disabled.
   b. In manual mode, status bit 9 (9-track) is set.
   c. The packing switch is under the control of this switch.
3. In 7-track even parity, zero is converted to BCD 10 on write and the reverse on read.
4. Parity error is not set when reading EOF.
5. The parity switch or control bit is ignored when writing an EOF. Instead, even parity is written for 7-track EOF and odd parity for 9-track EOF.

The following is not a change but an explanation:

6. To use the EDIT mode, backspace over the record with the EDIT bit set. Then rewrite the record with the EDIT bit still set. The new record must contain the same number of tape characters as the old.

Nova Computer Adapter Board

| | | | |
|---|---|---|---|
| Remove | G27-2 → E30-1 | } | Disable THR1 |
| Add | E30-1 → E30-7 (GND) | | |
| Remove | G27-12 → E32-11 | } | EDIT on Command Bit 5 |
| Add | G27-2 → E32-11 | | |
| Remove | G28-5 → E29-5 | } | LOW DENSITY on Command Bit 6 |
| Add | G27-12 → E29-5 | | |

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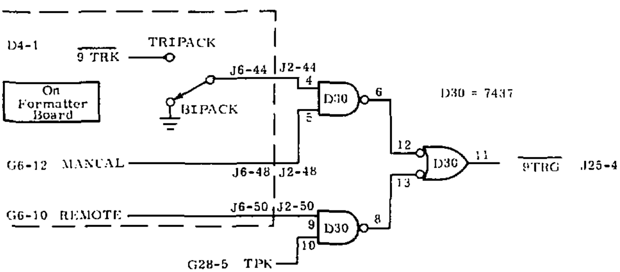
32-8 = Pin 8 at end of row 32

J2-44 = Pin 44 of connector J2 (Nova Adapter Board)

J6-44 = Pin 44 of connector J6 (Formatter Board)

29X8, 29X9, 29Y9 } = Old Tripack switch pins on Nova Adapter Board

Allow Tripack to be remotely and manually controlled.




| | | | | |
|---|---|---|---|---|
| Remove | 32-8 → switch | } | Switch connections | (32-8 = D32-9) |
| Remove | 29-9 → switch | | | (29-9 = J25-4) |
| Remove | GND → switch | | | |

Remove Switch and save for formatter board

Add J2-44 → D30-4

Add J2-48 → D30-5

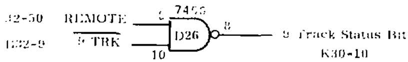
Add J2-50 · D30-9

Add G28-5 · D30-10

Add D30-6 · D30-12

Add D30-8 · D30-13

Add D30-11 · 29-9 (29-9 = J25-4)




Remove D32-8 · K30-10

Add J2-50 · D26-9

Add 32-8 · D26-10 (32-8 = D32-9)

Add D26-8 · K30-10

(9-track status bit = 1 in manual)

Formatter Board

Add Tripack switch

Add J6-44 · Center of switch

Add D4-1 · Tripack side of switch

Add GND · Bipack side of switch

Add J6-48 · G6-12

Add J6-50 · G6-10

(See drawing on page 12.)

Remove jumper E4 · E5 (near K12) BCD 10 · 0 on read in 7-track even parity

Add jumper E6 · E7 (near F10) No parity status on EOF

Add jumper E1 · E2 (near G7) No BUSY on rewind

Remove jumper E18 · E20 (near D3)

Remove jumper E18 · E19 (near D3)

Add jumper E19 · E20 (near D3)

Add jumper E21 · E22 (near front)

(Allows manual and remote by switch)

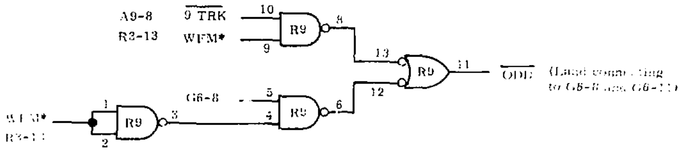
Remove jumper E23 · E24 (near H10)

Cut land E3-5 · F2-' (Delay counter board)

Add jumper E3-9 · F2-9

(0-BCD 10 on write in 7-track even parity)

Force correct parity when writing EOF, { 7-track--even / 9-track--odd }




Add on MC946 quad NAND in position R9.

Cut land ....ing from G6 pins 8 and 11 just before it feeds through board.

Add G6-8 → R9-5

Add "land feed through" previously disconnected from G6-8 → R9-11

Add R3-13 → R9-1

Add R9-1 → R9-2

Add R9-3 → R9-4

Add R3-13 → R9-9

Add A9-8 → R9-10

Add R9-8 → R9-13

Add R9-6 → R9-12

## Nova Interface Card Modification

Originally, the Nova interface (I/O) boards were built to operate with a 300-baud rate, 20-mA current loop circuit into a TI733 TTY. With the advent of several other terminals to be connected to the Nova, it was necessary to convert the current loop to a RS232 voltage (±5-V) circuit. The modifications are shown on the schematic, Figure 2. The current loop PC card in the TTY was removed, and a new cable was required to interface the TTY to the Nova I/O board.

The time for a full carriage return on the teletype is longer than the commands, RET and line feed, provided by the computer. This condition causes three to five characters to be missed at the beginning of each new line. Therefore, a gating circuit has been added to the I/O PC board to identify the RET command (...) and trigger a 0.2-second one-shot multivibrator which delays the start of printing characters on a new line until a full carriage return has occurred. The additional circuitry is shown in Figure 3.

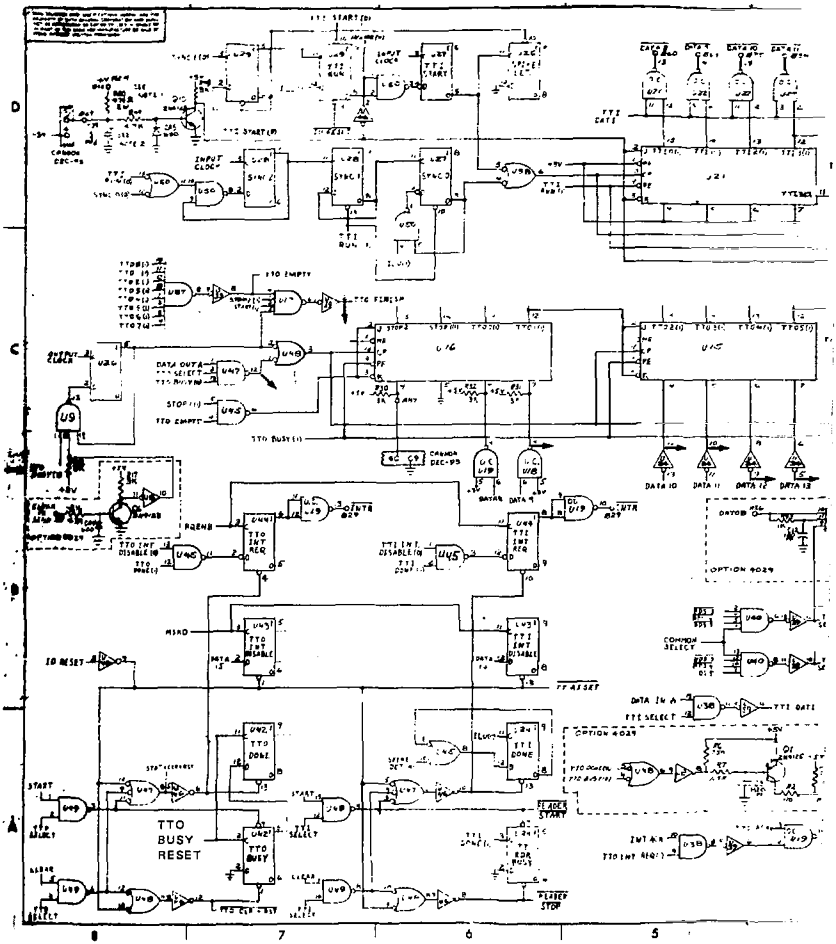
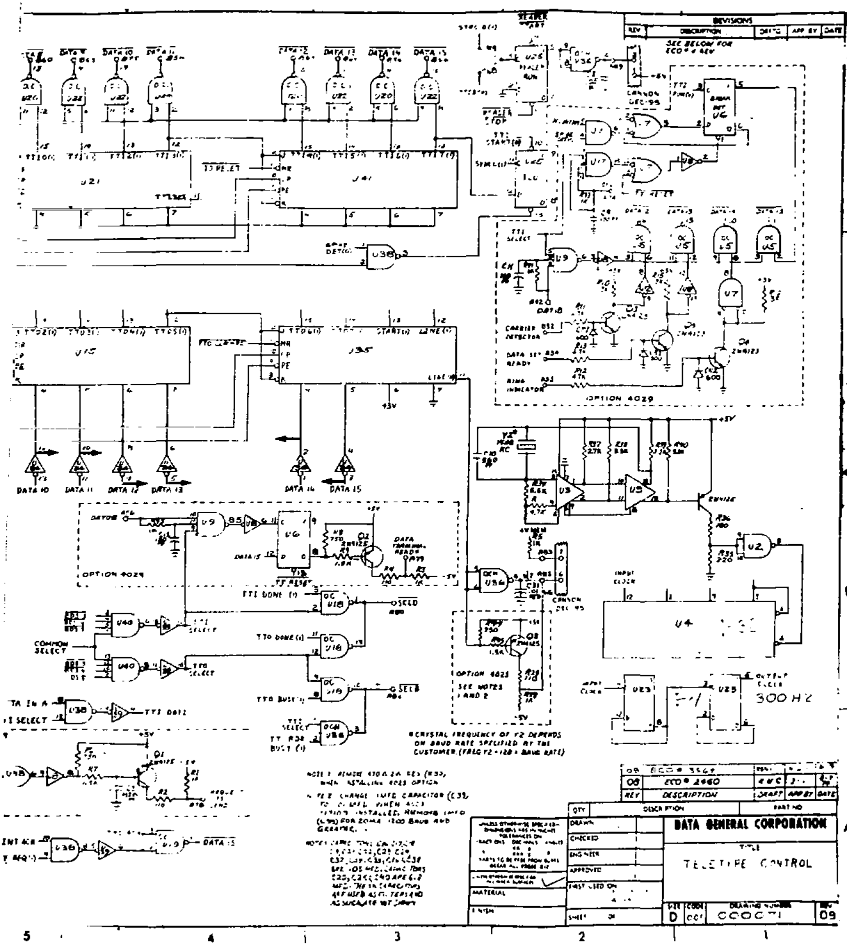



Figure 2. Nova Input/Ou




’. Nova Input/Output Schematic

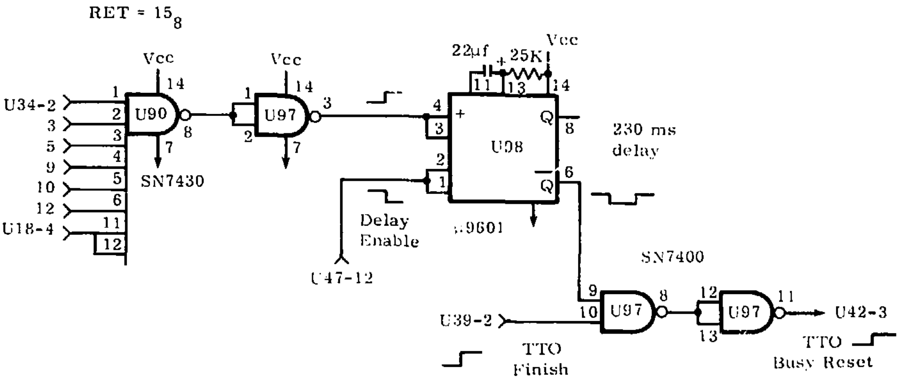



Figure 3. TTY Return Delay Circuit

## References

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[8]W. English, How to Use the Nova Computers, (Southboro, MA: Data General Corporation, October 1972).

[9]N. E. Corlis, Adaptive Intrusion Data System Software Routines, SAND79-1702 (Albuquerque: Sandia Laboratories, in printing).

## APPENDIX A

### TTY Interface Wiring

#### 20 mA Current Loop Interface

Current loop PC card must be inserted in TTY rack mount.

| Mother Board Pin | Nova Cable Wire Color | TTY Back Panel Pin | Function |
|---|---|---|---|
| 3 | Orange | E | Input to Nova |
| 4 | Yellow | 5 | -5 V |
| 6 | Green | D | Nova Output |
| 7 | Blue | 4 | +5 V |

#### RS 232 Voltage Loop Interface

Current loop PC card must be removed from TTY rack mount and Nova interface modified to the RS 232 voltage circuits.

| Mother Board Pin | Nova Cable Wire Color | TTY Back Panel Pin | Function |
|---|---|---|---|
| 3 | Orange | H | Input to Nova |
| 4 | Yellow | NC | -5 V |
| 6 | Green | 10 | Nova Output |
| 7 | Blue | 7 | GND |
| | | 6, 8, 9, K (jumpered together) | These jumpers must be made to enable the handshaking signals. |