RADIAN
CORPORATION

MASTER

**RADIAN REMOTE SAMPLING SYSTEM
DIGITAL PROCESSOR SYSTEM
Pittsburgh Energy Research Center**

10 March 1978

DISCLAIMER

This work was prepared as an account of work sponsored by an agency of the United States Government. Neither the United States Government nor any agency thereof, nor any of their employees, makes any warranty, express or implied, or assumes any legal liability or responsibility for the accuracy, completeness, or usefulness of any information, apparatus, product, or process disclosed, or represents that its use would not infringe on any existing patent. Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise, does not necessarily constitute or imply its endorsement, recommendation, or approval by the United States Government or any agency thereof. The views and opinions of authors expressed herein do not necessarily state or reflect those of the United States Government or any agency thereof.

DISTRIBUTION OF THIS DOCUMENT IS UNLIMITED

8500 Shoal Creek Blvd. / P.O. Box 9948 / Austin, Texas 78766 / (512)454-4797

DISCLAIMER

This report was prepared as an account of work sponsored by an agency of the United States Government. Neither the United States Government nor any agency Thereof, nor any of their employees, makes any warranty, express or implied, or assumes any legal liability or responsibility for the accuracy, completeness, or usefulness of any information, apparatus, product, or process disclosed, or represents that its use would not infringe privately owned rights. Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States Government or any agency thereof. The views and opinions of authors expressed herein do not necessarily state or reflect those of the United States Government or any agency thereof.

DISCLAIMER

Portions of this document may be illegible in electronic image products. Images are produced from the best available original document.

TABLE OF CONTENTS

- I. SYSTEM START-UP
- II. SOFTWARE DESCRIPTION
- III. INITIALIZATION MODULE
- IV. SAMPLING MODULE
- V. OPERATOR COMMANDS

I. COMPUTER STARTUP, SYSTEM INITIALIZATION
AND COMPUTER RELEASE PROCEDURES

A. Computer Startup Procedure

1. Turn the main power breaker to the ON position. (See Figure 2)
 - Located at the rear of the computer cabinet in the bottom left corner.
 - Controls the power to the cabinet circulation system, the computer, the disc and the tape unit.
 - The fans in the cabinet come on immediately after the breaker is turned on.
2. Turn the computer key to the ON position. (See Figure 1)
 - Located on the right side of the computer panel with positions of OFF-ON-LOCK.

FIGURE 1

TAPE UNIT

COMPUTER

DISC

FANS

MAIN POWER BREAKER
FOR CABINET

FIGURE 2

- Should always be turned on before any of the peripheral devices (disc, console, tape, CRT's and line printer).
 - The computer panel lights located above the computer switch light. However, the light above RUN still remains extinguished.
3. Turn the disc on.
- Important Note: It is essential to follow the exact sequence for turning the disc on and off that is described in this document, since the writing surface and the recording mechanism may be damaged otherwise.
 - Observe the operator controls are located on the front panel of the disc drive, and consist of two-position rocker switches (OFF-ON, READY-LOAD) and a thumbwheel switch (SELECT) and three indicator lights.
 - Position the thumbwheel SELECT switch such that zero appears in the window. This switch need never be repositioned.

FIGURE 3

- Depress the OFF-ON switch to the ON position. Note: The LOAD indicator and the ON indicator light indicating the disc writing mechanism is retracted and at the LOAD point and the disc drive stopped.

FIGURE 4

- Depress the LOAD-READY switch to the READY position. Note: The LOAD light is extinguished indicating the disc has started revolving to obtain a READY state on-line to the computer. When the disc is operationally ready (usually 15-20 seconds) the READY indicator lights. The disc has been correctly started and is ready for access by the computer.

FIGURE 5

FIGURE 6

4. Turn the computer console/DASHER on.
 - Depress the console power breaker to the ON position.
 - Located on the inside of the support standard under the keyboard. (See Figure 8)
 - Console fan is immediately operational.
 - Observe the three console keyboard switches.

FIGURE 7

- Depress the OFF-ON LINE switch to the ON LINE position and note the ON LINE and RDY indicators light.
 - Depress the VIEW OFF-ON switch to the VIEW-ON position (optional). This enables the print head to move to the right when not in use so the operator can observe the input.
 - Note: The computer console/DASHER must be turned on and in an ON-LINE/RDY state before computer-console communication can begin.
 - Depress the ALPHA
LOCK key on the console keyboard to insure that all alphabetic characters keyed will be upper case. The alpha lock indicator on the SHIFT key lights.
 - The PAPER
FAULT indicator lights and the RDY indicator is extinguished if more paper is needed.
5. Turn on the CRT's (cathode ray tubes) by pulling out the ON-BRIGHT knob.
- Located to the right of the CRT screen.
 - Adjust the brightness by turning the ON-BRIGHT button such that only the cursor (blinking dash mark) is observed on the screen.

FIGURE 8

- Depress the ALPHA
LOCK button on the keyboard to insure that all alphabetic characters are capitalized.

6. Turn on the line printer.

- Turn the line printer main power breaker to the ON position.
 - Located at the lower left side in the rear of the printer.
 - Ribbon motor will be activated.
- Raise the cover by pressing the two tabs on both sides of the printer cover.
- Align the paper by releasing it from the tractors and adjusting it.

7. Ready the DART system.

- Depress the POWER switch
 - The TTY and CAS power lights will turn on
 - The cassette will rewind, load a program into memory, rewind, and turn off the TTY and CAS power

- Set the battery clock.
 - Flip the clock switch to SET TIME.
 - Hold the red button under each clock section down and observe the display digits counting up.
 - Release the button when the desired number is displayed.

B. System Initialization

After the computer has been powered up properly (see Section I.A, Computer Startup Procedure), the system initialization procedure needs to be followed in the exact sequence to insure proper operation.

1. Observe the computer control panel consisting of an accumulator dial, indicator lights and twenty-two toggle switches. The toggle switches of operational importance are left to right of the program load switch (PR-LOAD), the reset/stop switch (RESET/STOP), the start/continue switch (START/CONT), and sixteen data switches (numbered 0 to 15).
2. Push in an upward direction data switches 0, 11, 12, 14 and 15.

Note: The switches can remain set in these positions under normal operations.

3. Depress the RESET/STOP to the STOP position, then to the RESET position.
4. Push in an upward direction the PR-LOAD switch.

Observe: The panel lights blink and the console prints out:

FILENAME?

Note: The following system initialization procedures are accomplished at the console/CRT. (See Figure 12)

5. Depress the RETURN button on the console keyboard.

Observe: The console may possibly type

PARTITION IN USE-TYPE C TO CONTINUE.

If this occurs, respond by entering a C on the keyboard. This sequence occurs only if the computer was not released properly before being last turned off.

Normally the console types:

MAPPED NOVA 3 RDOS REV 6.10
DATE (M/D/Y)?

6. Enter a two-digit numeric month, day and year separated by a slash (/) or a space (i.e., 11/12/77 or 5/2/77) and depress the RETURN key.

Observe the console types

TIME (H:M:S)?

FILENAME?

*
**

PARTITION IN USE-TYPE C TO CONTINUE

} Occurs only if
system has been
previously im-
properly released.

CONTINUE

MAPPED NOVA 3 RDOS REV 6.10

DATE (M/D/Y)? MM/DD/YR

TIME (H:M:S)? HR:MN

R

{ Indicates ready for another
operator command.

* Indicates depression of RETURN key.

** Underlined characters indicate operator input.

FIGURE 12

SYSTEM INITIALIZATION CONSOLE INTERACTION SUMMARY

7. Enter a two-digit, numeric hour and minute separated by a colon (:) or a space (i.e., 6:52 or 16:3) and depress the RETURN key.

Observe: The computer indicator lights blink, the READY indicator on the disc blinks, and the console types R indicating a ready state.

Note: At this point the computer system has been "booted-up". The previous steps 1-7 are sometimes referred to as "booting-up from disc". This simply means the computer system has been turned on and the operating system has been read from disc into memory enabling the operator to communicate through the console with the computer system.

8. The NOVA 3 is now under the control of Data General's Real-Time Disk Operating System (RDOS). Any of its commands or programs can now be executed.

C. System Release and Power Down

Procedure: The location of each switch noted here is described in the startup procedure (Section I.A.).

1. Enter on the console;

RELEASE DPØ and depress the

RETURN key.

2. The console types:

MASTER DEVICE RELEASED

3. Depress the switch on
o LOAD
o READY
the disc drive to the LOAD position.

Important; Wait until the LOAD indicator lights before any other disc manipulation begins.

4. Switch the main power breaker for the line-printer to the OFF position.
5. Depress the OFF/ON rocker switch on the tape unit to the OFF position.
6. Switch the console/DASHER main power breaker to the OFF position.
7. Depress the ON-BRIGHT buttons on the CRT.

8. Observe the disc control panel. If
the LOAD indicator is on, depress the

ON

OFF

switch on the control panel
to the OFF position.

9. Turn the computer key to the OFF position.
10. Depress the main computer power breaker
to the OFF position.

II. SOFTWARE DESCRIPTION

The Radian Remote Sampling System provides for the dual processing of data. The sampling software can be active in the foreground, taking data from the DART, while other processing such as program development or report generation can be going on in the background. The sampling software consists of two modules - an initialization module and a sampling module. The initialization software must be executed to set up disk files used by the sampling software. Once these disk files have been created, most of the parameters contained in them can be changed via operator commands to the sampling software.

The initialization module creates three disk files. The first of these files is a sampling system file, SAMPSYS, which contains general system parameters as described in Table III-1. The next file, consisting of channel initialization data, is stored in a file named IDMMDDHH where MM is the month, DD is the day, and HH is the hour when the file was created or last updated. The layout for this file is in Table III-2. The third file, calibration data, is stored in a file named CDMDDHH, where MMDDHH are the same as described above. The layout for this file is in Table III-3.

The NOVA 3 sampling software utilizes the three files for controlling the sampling and the limit checking. These files can be accessed and changed using operator commands. The DART sampling software waits until it receives a signal from the NOVA 3. This signal either requests battery clock data or status bits or requests analog channel data. The requested data is acquired by the DART and transmitted to the NOVA 3.

The initialization module is a separate executable program or save file that is called from Data General's Real

Time Disk Operating System (RDOS) by typing in INITS followed by pressing RETURN. To execute the sampling module, the NOVA 3 must be under control of RDOS. The operator types in RSAMP followed by pressing RETURN to execute the sampling module.

To terminate either module, the operator should hold down the control key (CTRL) and press the A key. The computer will print INT and return control to RDOS.

The NOVA 3 computer system contains a Memory Management and Protection Unit which provides for dual programming. While one program is operating in the foreground, typically the sampling module, another program can be executing in the background, e.g., program development utilities. Each of the grounds has its own console in the hardware configuration. The background console, which is the main system console, is the CRT. It is via keyboard commands to RDOS that all processing in the system takes place, including the execution of programs in the foreground. The DASHER serves as console to the foreground programs. When the sampling module is executed in the foreground, the data logging will take place on the DASHER.

Once RDOS has been booted-up, the following sequence should be typed in at the console:

- 1) CLEAR/A \
clear use count of all files
- 2) DIR DPOF \
get under fixed disk directory
- 3) CLEAR/A \
clear use count

- 4) @SSINIT@
 initiate CLI in foreground.

- 5) To execute the initialization module in the foreground, type on the DASHER:

INITS

- 6) To execute the sampling module in the foreground, type on the DASHER:

RSAMP

The operator interface to the sampling module is via two character commands. The command processor is alerted by an escape character (ESC) followed by pressing RETURN. The system time is printed out and the processor waits for a command. The two character command must be typed in followed by pressing RETURN. If an invalid command is typed in, the processor prints out a question mark. The command processor must be alerted again using the ESC, RETURN sequence. The available operator commands are listed in Table V-1.

III. INITIALIZATION MODULE

The initialization module must be executed before the sampling module. This module is a separate program with overlays which set up disk files needed by the sampling module.

The first of these files, SAMP SYS, contains general sampling system parameters. This file, described in Table III-1, contains the data necessary for the operation of the sampling module as well as the status of each of the analog channels. This file is 128 bytes in length and contains one record as described in the table.

The second disk file created by the initialization module is the channel parameter initialization data file. The file name is of the form IDMMDDHH where MMDDHH represents the month (MM), day (DD), and hour (HH) that the file was created. This file, described in Table III-2, contains such data as channel heading, data to convert from voltage to engineering units, and data for limit checking. Each record is 512 bytes long. The file for 32 channels contains four records. Each channel entry requires 60 bytes of storage.

The third disk file, described in Table III-3, contains calibration data for each channel. The file name is of the form CDMDDHH where MMDDHH represents the month (MM), day (DD), and hour (HH) when the file was created. The data in this file are used to correct input data for instrument drift and inaccuracies. Each record is 512 bytes long. The file for 32 channels contains two records. Each channel entry requires 32 bytes of storage.

The initialization module is called from Data General's Real Time Disk Operating System (RDOS) by typing in the module

TABLE III-1
SAMPSYS File Layout

<u>Word</u>	<u>Description</u>
1-5	Current initialization data file name
6-10	Current calibration data file name
11	Sampling time (seconds)
12	Averaging time (seconds)
13	Last channel number
14	Number of samples per average
15	Next available location for average data storage
16	Automatic print interval (number of average)
17	Number of channels in use
18-20	Extra
21-25	Current average data file name
26-32	Extra
33	Channel 0 status
34	Channel 1 status
35-64	Channel 2-31 ₁₀ status

TABLE III-2
Initialization Data File Layout

IDMMDDHH File Name
(512 Bytes Per Record)
(60 Bytes Per Channel)

<u>Word</u>	<u>Description</u>
1-32	Extra
33	Channel number
34-36	Channel 0 label
37-39	Channel 0 units
40	Extra
41-42	Zero voltage value
43-44	Full scale value
45-46	Lower warning limit
47-48	Upper warning limit
49-50	Lower invalidation limit
51-52	Upper invalidation limit
53-54	Maximum change between samples
55-62	Extra
63	Channel number
64-66	Channel 1 label

TABLE III-3
Calibration Data File Layout
CDMMDDHH File Name
(512 Bytes Per Record)
(32 Bytes Per Channel)

<u>Word</u>	<u>Description</u>
1	Channel number
2	Calibration month for channel 0
3	Calibration day
4	Calibration time
5-6	Zero value
6-7	Span value
8-9	Input span value
10-16	Extra
17	Channel number
18	Calibration month for channel 1
:	:
:	:
:	:
:	:

save file name INITS followed by pressing RETURN. The following sequence of events takes place in the module.

- 1) A program label is printed with the current date and time

RADIAN REMOTE SAMPLING SYSTEM

** INITIALIZATION MODULE **

** REVISION 0.0 **

3/5/78 14:28:26

- 2) The current initialization data file name and the current calibration data file name is printed.

If there is no SAMPSYS file on disk, no file names are printed.

CURRENT INITIALIZATION FILE - ID030310

CURRENT CALIBRATION FILE - CD030111

- 3) The computer prints the message:

*** SYSTEM PARAMETER DATA ***

- 4) The computer prints the message:

LAST OCTAL CHANNEL NUMBER

- 5) Type in the last channel number in octal (0-37) to be utilized followed by pressing RETURN.

-
- 6) The system sampling time is asked for. This procedure is described in Section V in the CS command.
 - 7) The system averaging time is asked for. This procedure is described in Section V in the CA command.
 - 8) The automatic print interval is asked for. This procedure is described in Section V in the CP command.
 - 9) The channel parameter initialization data is requested. This procedure is described in Section V in the CI command.
 - 10) The channel calibration data is requested. This procedure is described in Section V in the CC command.
 - 11) The computer prints the message

END OF INITIALIZATION
STOP
R
 - 12) Control is returned to RDOS for execution of RDOS commands or the sampling module, RSAMP.

IV. SAMPLING MODULE

A. Description

The sampling module performs the tasks of sampling the analog channels, averaging the data, and storing the averages on disk. The initialization module must have been executed prior to the sampling module so that the system file and the channel calibration and parameter files are resident on disk. Once activated, the sampling module accepts operator commands which allow the alteration of these parameters and disk files.

B. Sampling

The sampling module reads in the system disk files and the channel initialization and parameter files. After completing its initialization procedure, the module readies the operator command task which reads in and interprets the commands. The sampling module then waits until it receives a command to start sampling or until the time reaches a pre-set sampling time.

When the sampling begins, the NOVA 3 sends a signal to the DART requesting data for a particular channel. The DART receives and interprets the signal and digitizes the requested channel. When the digitization is complete, the DART transmits the left byte of the data and then the right byte. The NOVA 3 accepts this data and decodes it from BCD to voltage. The data from each active channel is requested from the DART in the same manner.

The NOVA 3 then converts the voltage to engineering units and applies the zero and span correction values. This result is then checked against the warning and invalidation limits as well as the maximum change between samples. A failure of the invalidation or the maximum change tests will cause the data to be rejected. The data that is not rejected is added into sums which are used to calculate the arithmetic averages. This procedure is performed every sampling time.

C. Averaging

The data for each channel is added into a sum. After the appropriate number of sample times, the averaging routine is called. This routine divides the sum for each channel by the number of samples for each channel to compute the arithmetic average for the channel.

The data averages are then checked against the upper (UW) and lower (LW) warning limits, the upper (UI) and lower (LI) invalidation limits, and the maximum change (MC) criterion. The averages also must be composed of at least half of the available samples or they are flagged as an invalid average (IA). These flags, along with the averages, are then stored in memory, to be later written to a disk file. A message, indicating violation of any of these criteria is logged on the console.

The 32 status bits are then requested from the DART. These bits are received and stored in memory as four bytes. This status data is stored along with the averages for later data processing.

TABLE IV-1
Average Data Disk File
File Name ADMDD
(512 bytes per record)

<u>Word</u>	<u>Description</u>
1	Record number
2	Initialization data file month and day (month * 100 + day)
3	Initialization data file time
4	Calibration data file month and day (month * 100 + day)
5	Calibration data file time
6	Extra
7	Number of channels
8	Next available storage location
9	Time of first average
10	Status in left byte/channel number in right byte
11-12	Floating point data average for this channel
13	Status/channel
13-14	Data average
⋮	⋮
n	First 16 status bits from DART
n+1	Second 16 status bits from DART
n+2	Time of second average
⋮	⋮

D. DART Software

The DART functions as the analog-to-digital conversion subsystem for the data acquisition system. The DART features are described in Appendix A. This Appendix describes the utilization of the DART in a stand-alone environment. This configuration requires a console keyboard/printer to be connected directly to the DART. In the Radian Remote Sampling System, the DART is used as a slave to the NOVA 3 computer.

The DART/SLAVE software is a very small monitor program which waits on an interrupt from the NOVA 3. Upon receiving this interrupt, the DART/SLAVE inputs the character sent from the NOVA 3. If the character is 375₆, the DART retrieves the battery clock information (month, day, hour, minute) and transmits them. If the character is in the range 0-37₆, the DART selects the channel specified by the character and digitizes it. When the digitization is complete, the DART reads in the two data bytes and transmits them. If the character received is none of the above, the DART turns on the TTY power switch to alert the operator. The software then returns to the wait mode until another NOVA 3 interrupt is sensed.

E. Remote Communications

The sampling module supports remote communications via a low speed, 30 characters per second modem. When in communications from a remote console, the operator has access to all of the operator commands available at the local console.

To establish this communications link, the Teletype console should be plugged in and turned on. The telephone number of the modem should then be dialed. The modem automatically answers and turns on its tone. The remote telephone should then be placed in the acoustic coupler of the Teletype console. The carrier detect light should come on. The TERM READY button should be depressed to illuminate the DATA light. The baud rate (CPS) button should be up for 30 characters per second. The DUPLEX button should be down for full duplex. The PARITY button should be down for no parity checking. The CAPS LOCK switch should be down for capital letters only. The Teletype console is now ready to accept operator commands.

All commands via the Teletype console are input exactly as on the local console. To alert the sampling system, press the escape (ESC) key followed by pressing RETURN. The time will be printed and the sampling module will wait for a command. For the remote input, the characters are printed only after the RETURN is pressed.

To terminate communications, simply lift the telephone from the acoustic coupler. The NOVA 3 modem will automatically sense the loss of carrier and will hang up. If at any time during the remote communications the carrier is lost, the NOVA 3 modem must be dialed again.

F. Power Failure/Automatic Restart

The NOVA 3 and the DART computers are equipped with circuitry to detect the loss of power. When this loss is detected, an orderly shutdown procedure takes place.

When power is restored, the DART system restarts itself, reads in its sampling program from cassette, and re-initializes its parameters. The NOVA 3 system restarts itself and performs a delay until the disk is up to speed and is in the ready state.

The message

POWER RESTORED

is printed on the console. The sampling software delays a short time longer and then requests the battery clock information from the DART. The NOVA 3 prints the message

BATTERY CLOCK: 3/6/78 23:18
SYSTEM CLOCK: 3/6/78 23:15
*** RESUME SAMPLING AT 23:20 ***

This indicates that the power failure occurred at the system clock time, 23:15 and power was restored at the battery clock time, 23:18. The system clock is then reset to the battery clock time. The time to resume sampling is the next even averaging time. This delay allows the instruments to stabilize after a power failure and helps to keep from sampling invalid data from instrumentation affected by power failures.

V. OPERATOR COMMANDS

All operator commands to the sampling system are in the form of two character commands. The sampling module must first be alerted. The operator must press the escape (ESC) key and then the RETURN key. The sampling module will respond by typing the current system time in hours, minutes, and seconds: 14:26:15. The operator must then type in one of the two character commands followed by pressing RETURN. If an illegal command is typed in, the sampling module will print a question mark. The module must be re-alerted by the ESC, RETURN sequence.

The available operator commands are described in this section. The descriptions include the system response and operator interaction with each command.

In the following section, the notation , means pressing the RETURN key.

TABLE V-1
Operator Commands

BC - Request battery clock time and data from DART and print it
CA - Change system averaging time
CC - Change channel calibration data
CI - Change channel initialization data
CP - Change automatic print interval
CS - Change system sampling time
DC - Mark channel as being down
ES - End sampling and write data to disk
FA - Print latest averages
PB - Print both voltage and engineering units for all channels
PC - Print channel calibration data
PD - Print data averages stored on disk
PF - Print data averages on disk formatted with headings
PH - Print channel headings
PI - Print channel initialization data
PR - Print raw data in engineering units
PS - Print status of channels
PV - Print raw data in voltage
SS - Start sampling
ST - Request status bits from the DART and print them
UC - Mark channel as being up
?? - Print command summary

COMMAND: BC

FUNCTION: Request the battery clock time and date from the DART and print it. Reset the system clock if necessary.

OPERATOR INTERACTION: When requested, type in Y or N followed by pressing RETURN to indicate whether the system clock time should be reset to the battery clock time.

EXAMPLE: BATTERY CLOCK: 3/5 12:01
SYSTEM CLOCK: 3/5 12:00
RESET CLOCK (Y/N)? N,

COMMAND: CA

FUNCTION: Change the system averaging time

OPERATOR INTERACTION:

(1) To change the averaging time, type in the new averaging time followed by pressing RETURN.

(2) To retain the current averaging time, press RETURN

EXAMPLE: SYSTEM AVERAGING TIME (SEC) = 10 5,

COMMAND: CC

FUNCTION: Change the channel calibration data

OPERATOR INTERACTION:

- (1) The computer prints the message:
OCTAL CHANNEL NUMBER =
- (2) Type in the channel number in octal (0-37) followed
by pressing RETURN.
- (3) The computer prints the current calibration month
CALIBRATION MONTH = 2
- (4) Type in the month (1-12) when the calibration was per-
formed followed by pressing RETURN.
- (5) The computer prints the current calibration day
CALIBRATION DAY = 25
- (6) Type in the day (1-31) when the calibration was performed
followed by pressing RETURN
- (7) The computer prints the current calibration time:
CALIBRATION TIME (HHMM) = 1425
- (8) Type in the time of day (0-2359) when the calibration was
performed followed by pressing RETURN
- (9) The computer prints the current zero value:
ZERO VALUE = -1.0

**RADIAN
CORPORATION**

- (10) Type in the value obtained during the zero mode of calibration followed by pressing RETURN
- (11) The computer prints the current span value
SPAN VALUE = 1004.1
- (12) Type in the value obtained during the span mode of calibration followed by RETURN
- (13) The computer prints the current input span value
INPUT SPAN VALUE = 1000.0
- (14) Type in the value that the channel should span to followed by pressing RETURN
- (15) The computer will continue to request calibration data as in Steps 1-14 until an up arrow (^) followed by pressing RETURN is typed in as a response to the channel number.

EXAMPLE:

OCTAL CHANNEL NUMBER = 0 ,
CALIBRATION MONTH = 2 3 ,
CALIBRATION DAY = 25 4 ,
CALIBRATION TIME (HHMM) = 1425 1100 ,
ZERO VALUE = -1.0 2.0 ,
SPAN VALUE = 1004.1 1002. ,
INPUT SPAN VALUE = 1000.0 ,
OCTAL CHANNEL NUMBER = ^ ,

COMMAND: CI

FUNCTION: Change channel initialization parameters

OPERATOR INTERACTION:

- 1) The computer prints the message:
OCTAL CHANNEL NUMBER =
- 2) Type in the channel number in octal (0-37) followed by
pressing RETURN
- 3) The computer prints the current channel label:
CHANNEL LABEL = TEMP
- 4) Type in the channel label, up to 6 characters, followed by
pressing RETURN
- 5) The computer prints the units for the channel:
CHANNEL UNITS = DEGF
- 6) Type in the channel units, up to 6 characters, followed by
pressing RETURN
- 7) The channel zero voltage value in engineering units is
printed:
ZERO VOLTAGE = 0.0
- 8) Type in the value in engineering units which corresponds to
zero volts.
- 9) The channel full-scale value in engineering units is printed:
FULL SCALE VALUE = 1000.0

- 10) Type in the value in engineering units which corresponds to full-scale voltage followed by pressing RETURN
- 11) The computer prints the lower warning limit for the channel:
LOWER WARNING LIMIT = 10.0
- 12) Type in the lower warning limit for the channel in engineering units followed by pressing RETURN
- 13) The computer prints the upper warning limit for the channel:
UPPER WARNING LIMIT = 900.0
- 14) Type in the upper warning limit for the channel in engineering units followed by pressing RETURN
- 15) The computer prints the lower limit for data invalidation for the channel:
LOWER INVALID LIMIT = 5.0
- 16) Type in the lower invalidation limit for the channel in engineering units followed by pressing RETURN
- 17) The computer prints the upper limit for data invalidation for the channel:
UPPER INVALID LIMIT = 950.0
- 18) Type in the upper invalidation limit for the channel in engineering units followed by pressing RETURN
- 19) The computer prints the maximum allowable change between samples:
MAXIMUM CHANGE BETWEEN SAMPLES FOR SAMPLING TIME OF 10 SECONDS = 10.0

**RADIAN
CORPORATION**

- 20) Type in the maximum change for the channel in engineering units followed by pressing RETURN.
- 21) The computer will continue to request channel parameter data as in steps 1-20 until an up arrow (^) followed by pressing RETURN is typed in as a response to the channel number.

EXAMPLE: OCTAL CHANNEL NUMBER = 0 ↓
CHANNEL LABEL = TMP TEMP ↓
CHANNEL UNITS = DEGF ↓
ZERO VOLTAGE = 0.0 ↓
FULL SCALE VALUE = 1000.0 500.0 ↓
LOWER WARNING LIMIT = 10.0 20.0 ↓
UPPER WARNING LIMIT = 900.0 ↓
LOWER INVALID LIMIT = 0.0 ↓
UPPER INVALID LIMIT = 1000.0 500.0 ↓
MAXIMUM CHANGE BETWEEN SAMPLES FOR SAMPLING TIME OF
10 SECONDS = 10.0 ↓
OCTAL CHANNEL NUMBER = ^ ↓

COMMAND: CP

FUNCTION: Change automatic print interval for logging averages
on the console

OPERATOR INTERACTION:

- 1) The computer prints the message:
AUTOMATIC PRINT INTERVAL (NO. OF AVGS/0 = NONE) =
- 2) To inhibit the automatic printing of the averages, type a
zero followed by pressing RETURN
- 3) To print each average, type a one followed by pressing
RETURN
- 4) To print every fifth average, type a five followed by
pressing RETURN, etc.

EXAMPLE: AUTOMATIC PRINT INTERVAL (NO. OF AVGS/0 = NONE) = 1 ↓

**RADIAN
CORPORATION**

COMMAND: CS

FUNCTION: Change system sampling time

OPERATOR INTERACTION:

- 1) The computer prints the current system sampling time:
SYSTEM SAMPLING TIME (SEC) = 10
- 2) Type in the sampling time in seconds followed by pressing
RETURN

EXAMPLE: SYSTEM SAMPLING TIME (SEC) = 10.5 }

**RADIAN
CORPORATION**

COMMAND: DC

FUNCTION: Mark a channel as being down

OPERATOR INTERACTION:

- 1) The computer prints the message:
OCTAL CHANNEL NUMBER =
- 2) Type in the number of the channel in octal (0-37) that is
to be marked as down followed by pressing RETURN

EXAMPLE: OCTAL CHANNEL NUMBER = 1 }

**RADIAN
CORPORATION**

COMMAND: ES

FUNCTION: Specify the time to end sampling

OPERATOR INTERACTION:

- 1) The computer prints the message:
END SAMPLING TIME(HHMM)(RETURN FOR NOW) -
- 2) To end sampling immediately, press RETURN
- 3) To specify the time to end sampling, type in the time
(0-2359) followed by pressing RETURN
- 4) The NOVA3 will stop interrogating the DART at the specified
time

EXAMPLE: END SAMPLING TIME(HHMM)(RETURN FOR NOW) - 1100 ↓

COMMAND: PA

FUNCTION: Print latest set of averages stored in memory

OPERATOR INTERACTION:

- (1) If no averages have been calculated, the computer prints the message:
 NO AVERAGES
- (2) If averages have been computed, the computer prints the channel headings and the average for each channel in engineering units

EXAMPLE: TIME CHANO CHAN1
 UNIT0 UNIT1
 1135 10.5 98.8

**RADIAN
CORPORATION**

COMMAND: PB

FUNCTION: Print both voltage and engineering units for last sample

OPERATOR INTERACTION: None

EXAMPLE: TIME CHAN0 CHAN1
 UNIT0 UNIT1
 1125 14.6 293.2
 1125 0.146 0.293

COMMAND: PC

FUNCTION: Print the channel calibration data

OPERATOR INTERACTION:

- 1) The computer prints the message:
OUTPUT TO CONSOLE(0) OR PRINTER(1) -
- 2) To print the calibration data on the console, type in a zero followed by pressing RETURN
- 4) The input calibration data will be printed on the requested output device

EXAMPLE: OUTPUT TO CONSOLE(0) OR PRINTER(1) = 1 ↓

COMMAND: PD

FUNCTION: Print data averages stored on disk. This data is printed with the channel number, status of the data, and the average.

OPERATOR INTERACTION:

- (1) The computer prints the message:
OUTPUT TO CONSOLE(0) OR PRINTER(1) =
- (2) To print the data averages on the console, type in a zero followed by pressing RETURN.
- (3) To print the data averages on the printer, type in a one followed by pressing RETURN

EXAMPLE: OUTPUT TO CONSOLE(0) OR PRINTER(1) = 1,
1140 0 10.5 1 UW 595.2
1150 0 MC 29.6 2 UW 590.4

Where the first column is the time, followed by the channel number, the channel status, and the average. The channel status is one of the following:

- IA - invalid average (not enough samples)
- MC - maximum change between averages
- LW - less than lower warning limit
- UW - greater than upper warning limit
- LI - less than lower invalidation limit
- UI - greater than upper invalidation limit

COMMAND: PF

FUNCTION: Print data averages stored on disk formatted with headings

OPERATOR INTERACTION:

- 1) The computer prints the message:
OUTPUT TO CONSOLE(0) OR PRINTER(1) -
- 2) To print the data averages on the console, type in a zero followed by pressing RETURN.
- 3) To print the data averages on the printer, type in a one followed by pressing RETURN.

EXAMPLE: OUTPUT TO CONSOLE(0) OR PRINTER(1) - 0

TIME	CHANO UNIT0	CHAN1 UNIT1
1130	25.6	314.1
1140	26.1	320.0
1150	26.2	319.8

**RADIAN
CORPORATION**

COMMAND: PH

FUNCTION: Print headings for all active channels on the console

OPERATOR INTERACTION: None

EXAMPLE:	TIME	CHANO	CHAN1
		UNITO	UNIT1

COMMAND: PI

FUNCTION: Print the channel initialization parameters

OPERATOR INTERACTION:

- 1) The computer prints the message:
OUTPUT TO CONSOLE(0) OR PRINTER(1) =
- 2) To print the initialization data on the console, type in a zero followed by pressing RETURN
- 3) To print the initialization data on the printer, type in a one followed by pressing RETURN
- 4) The channel initialization parameters are printed on the requested output device

EXAMPLE: OUTPUT TO CONSOLE(0) OR PRINTER(1) = 0

COMMAND: PR

FUNCTION: Print raw sample data in engineering units on the
console

OPERATOR INTERACTION: None

EXAMPLE:	TIME	CHANO UNITO	CHAN1 UNIT1
	1123	42.9	164.3

RADIA
CORPORATION

COMMAND: PS

FUNCTION: Print the status of all active channels on the console

OPERATOR INTERACTION: None

EXAMPLE:	TIME	CHAN0	CHAN1
		UNIT0	UNIT1
		UP	DOWN

RADIAN
CORPORATION

COMMAND: PV

FUNCTION: Print the raw data samples in voltage on the console

OPERATOR INTERACTION: None

EXAMPLE: 1139 0.932 0.146

**RADIAN
CORPORATION**

COMMAND: SS

FUNCTION: Set the time to start sampling

OPERATOR INTERACTION:

- 1) The computer prints the message:
START SAMPLING TIME (HHMM) (RETURN FOR NOW) =
- 2) To start sampling immediately, press RETURN
- 3) To specify the time to start sampling, type in the time
(0-2359) followed by pressing RETURN
- 4) The NOVA3 will begin interrogating the DART at the specified
time

EXAMPLE: START SAMPLING TIME (HHMM) (RETURN FOR NOW) = 1000

RADIAN
CORPORATION

COMMAND: ST

FUNCTION: Request the status bits from the DART and print them

OPERATOR INTERACTION: None

EXAMPLE: STATUS = 00000000 10100100 11001010 11100011

**RADIAN
CORPORATION**

COMMAND: UC

FUNCTION: Mark a channel as being up

OPERATOR INTERACTION:

- 1) The computer types the message
OCTAL CHANNEL NUMBER =
- 2) Type in the number of the channel in octal (0-37) that is
to be marked up followed by pressing RETURN

EXAMPLE: OCTAL CHANNEL NUMBER = 2 ↓

**RADIAN
CORPORATION**

COMMAND: ??

FUNCTION: Print summary of operator commands

OPERATOR INTERACTION: None

EXAMPLE: BC - READ AND PRINT BATTERY CLOCK

CA - CHANGE AVERAGING TIME

CC - CHANGE CALIBRATION DATA

:
:

APPENDIX A
DART Documentation
(under separate cover)

APPENDIX B

NOTES

1. The calibration, initialization, and average data files (file names preceded by CD, ID, and AD) remain on disk until deleted by an operator using the RDOS DELETE command.
2. The programs are set up to execute from directory DPOF, the fixed disk, with data being stored on DPOF. A copy of the programs is also on directory DPO, the removable disk. Disk files can be moved from one disk or directory to another using the RDOS MOVE command.