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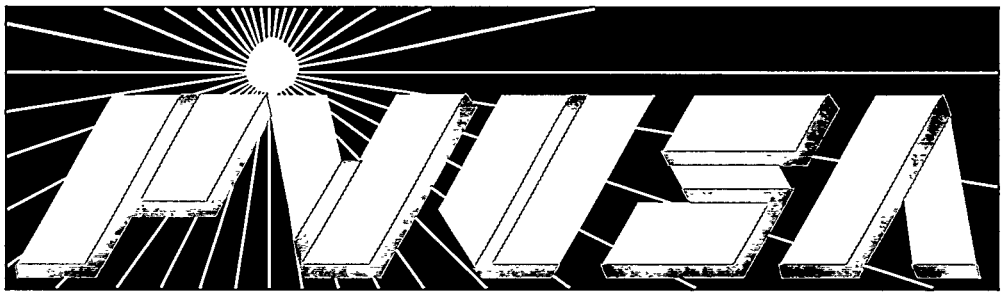

Kerman Photovoltaic Power Plant
R&D Data Collection Computer System
Operations and Maintenance

June 1994

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KERMAN PHOTOVOLTAIC POWER PLANT R&D DATA COLLECTION COMPUTER SYSTEM OPERATION AND MAINTENANCE

June 1994

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for

Pacific Gas and Electric Company
Research and Development
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R&D DATA COLLECTION COMPUTER SYSTEM
OPERATIONS AND MAINTENANCE

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Section 1

SYSTEM OVERVIEW

The Supervisory Control and Data Acquisition (SCADA) system at the Kerman PV Plant monitors 52 analog, 44 status, 13 control, and 4 accumulator data points in real-time. A Remote Terminal Unit (RTU) polls 7 peripheral data acquisition units that are distributed throughout the plant once every second, and stores all analog, status, and accumulator points that have changed since the last scan. The R & D Computer, which is connected to the SCADA RTU via a RS-232 serial link, polls the RTU once every 5-7 seconds and records any values that have changed since the last scan. A SCADA software package called RealFlex runs on the R&D computer and stores all updated data values taken from the RTU, along with a time-stamp for each, in a historical real-time database. From this database, averages of all analog data points and snapshots of all status points are generated every 10 minutes and appended to a daily file. These files are downloaded via modem by PVUSA/Davis staff every day, and the data is placed into the PVUSA database.

Section 2

SCADA

HARDWARE

The SCADA system is comprised of one RTU and seven peripheral units manufactured by Harris/Westronics Inc. This equipment is commonly used by PG&E for SCADA. The peripheral units include 1 D20A analog input, 1 D20S digital input, and 5 D20C combination boards, all of which are connected via a 250Kb transformer-coupled, RS-485 fiber-optic link to the RTU. The peripheral units are used to issue controls, to record analog and accumulator values, and to monitor status (digital) values. These units scan each of their associated channels approximately 1000 times a second, and the RTU scans each of the peripherals once a second (except accumulator inputs which get scanned once every 60 seconds by the RTU).

The RTU has eight RS-232 serial ports (7 data and 1 Westmaint) through which data can be passed to the outside world. At Kerman, two of the data ports are used. Port 1 is used by the PG&E region to transfer certain data points via radio link to a monitoring center in Fresno, CA using PG&E serial transfer protocol. Port 5 is used by PG&E R&D to transfer all data to the on-site R&D Computer using Harris protocol. A port on the front panel of the RTU can be used to monitor RTU activity using a built in facility called Westmaint, and 5 data ports on the rear panel are spares.

Figure 2-1 below shows a general overview of the SCADA hardware at Kerman.

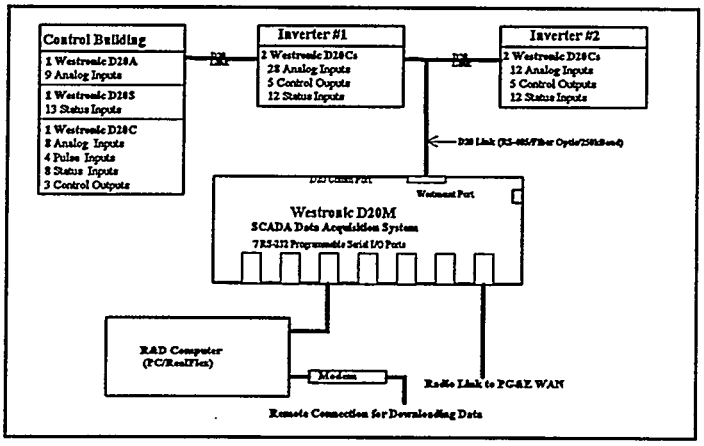

Figure 2-1. Kerman SCADA hardware layout.

SOFTWARE

Eight files reside in the RTUs EEPROMs and provide information regarding system configuration and serial protocol information. These files are listed in Table 2-1 along with brief descriptions of their operation.

Table 2-1

SCADA Configuration Files

A003.CFG	Harris port configuration file. This file tells the RTU which port to use to transfer data using Harris protocol, what the baud rate will be, serial communication parameters (data bits, stop bits, parity, etc.), what data points to transfer. It also contains the data types, ranges, and count translations for each point in the system.
A009.CFG	PG&E protocol configuration file. This file is similar to the A003 file in that it defines which port will be using PG&E protocol, what data points it will transfer, and other port specific information.
A026.CFG	DTA configuration file. Comms watchdog file. DTA monitors on-line/off-line status of points specified in this file. Associates specified points with pseudo points specified in this file.
B003.CFG	D.20 configuration file. This file specifies the different SCADA timing parameters such as analog scan rate, digital scan rate, network retry interval, etc.
B008.CFG	Harris/SCADA Configuration File
B012.CFG	IRIG configuration file. Contains DCA application index, local time offset, and update frequency.
B014.CFG	Westmaint facility configuration file. This file contains data descriptions of all the peripheral boards in the system, all data point names and point associations, login information for the Westmaint program, and configuration information pertaining to the Westmaint port (port 0 on the front panel of the D20), and the other 7 serial ports on the D20.

Software built into the D20 called Westmaint allows a user to interact with the D20 through a null-modem serial connection (a pin-connection diagram for this cable is shown in Appendix A) from a PC. The Westmaint facility will emulate a VT100 terminal, and provides screens for viewing real-time data of all channels (in count[1] form), as well as the ability to download new configuration files into the EEPROMs and configure the RTU using its monitor language. Although the user can communicate with the RTU using a standard communications package such as Procomm, a tailored script for CrossTalk IV is available that incorporates the ability to view, manipulate, compile, and download the configuration files, as well as logon to the Westmaint facility.

[1]Analog data within the SCADA system is represented in counts where the range for a particular channel can be between -32768 and 32767. For instance, the standard analog input range is from -10V to +10V (or +/-1 Amp with a current shunt installed). So for this example, -10V is represented by -32768, and +10V is +32767 in the RTU.

For more information regarding the SCADA hardware and Westmaint, please refer to the Harris/Westronic documentation supplied with the system - a copy is available at the site.

Section 3

THE R&D COMPUTER

HARDWARE

The R&D Computer at Kerman is a Dell 486/33 with 8 MB of RAM and a 528MB IDE hard drive. The hard drive has been divided into two partitions, a 105 MB DOS partition and a 423 MB QNX partition. The hard drive can store approximately 14 (all analog channels, 24 hours a day) days of real-time plant data. Beyond that, the integrity of the data and the stability of the system becomes uncertain. The QNX partition is the primary, so the system will always boot into QNX unless the '4' key is held down during the boot process. Other peripherals associated with the R&D Computer include a 14" Dell monitor, a USRobotics V.32bis Courier modem, and a Tandberg 525MB SCSI tape drive.

The computer is located in the trailer at the site, and communicates with the RTU over an RS-232 serial link. The pin description of the PC/RTU connection cable is described in Appendix A. The R&D Computer uses COM1 to communicate with the RTU, and COM2 to link to the modem. The computer is powered by an uninterruptable Power Supply (UPS) located in the Control Building.

SOFTWARE

Table 3-1 lists the primary software used on the R&D Computer:

Table 3-1

R&D Computer Software

Name	Serial Number	Version
QNX	QNX06950	3.20
QNX Windows	N/A	2.3
Harris Driver	N/A	Dec. 22, 1992
RealFlex Windows	1220509W	1.22
tdcback	tdc090	2.0
Kermit	public domain freeware	

Master copies of the software are kept at:

Endecon
S&W Plaza
3160 Crown Canyon Road, Suite 240
San Ramon, CA 94583
Phone: (510) 867-3360
Fax: (510) 867-3362

Manuals for the software can be found on site, or at the address shown above.

A tape backup of the hard drive is also kept at the above address, as well as two tape backup copies of all the real-time databases from approximately June 1st through September 30th.

QNX / QNX Windows

The primary operating system on the R&D Computer is QNX which is required for operating RealFlex. Like UNIX, QNX is a multi-tasking operating system. Many of the commands are identical to those in UNIX, although the command set as a whole is much smaller. In addition to being a multi-tasking platform, QNX is also a real-time operating system. This means that each process is guaranteed processor time within some maximum time period. That means that no single process can dominate the processor for longer than the maximum time-slice. The net result is that the system is able to handle data in real-time, and all the sub-processes required to process the incoming data can do their respective computations concurrently.

On bootup, the system is configured per commands in the sys.init.0 file. It then logs in as user 'auto', and starts QNX/Windows and RealFlex automatically. QNX/Windows is simply a graphical, windowing extension of QNX that runs on top of the QNX kernel.

The sys.init.0 file is similar to the config.sys file in DOS. It is basically a QNX script file that has commands to load the video drivers, mount the hard drive and floppy drives, configure the modem and the comm software, configure the comm ports, and to set up passwords and the auto login. A copy of the current sys.init.0 file can be found in Appendix D, along with descriptions of most of the commands.

As there are too many commands available in QNX to detail here, a few of the standard ones are listed below in Table 3-2.

Table 3-2

Useful QNX Commands

ls	list files in current directory
more [fname]	show contents of ASCII file on screen
vi [fname]	visual editor - same as vi for UNIX
pwd	print working directory
cd [directory]	change directory (cd .. goes up one level in the directory structure)
tsk	display current operational tasks on screen
slay [tsk_name]	remove a task from the system by terminating it
zap [file name]	kills a busy file
files	gives information about files
rm [fname]	remove file
mkdir [dirname]	create directory
rmdir [dirname]	remove directory

Help on any QNX command, although extremely minimal, can be found by typing the command name followed by a question mark. For instance, Figure 3-1 shows how to find more information about the 'files' command.

```
$ files ? [Enter]
use: files [directory] [options]*
options: +busy +current +directory +modified +totals_only
        -sort -used -verbose +verbose a=[&|^]attr_list p=pattern
         d=dd-mon-yy t=hh:mm:ss +Before
$
```

Figure 3-1. QNX help example.

Another important point to note concerning QNX is that drives are represented by numbers, not letters as in DOS. Therefore, the hard drive is device number 3, and the floppy drives are numbered 1 and 2.

To see a list of all QNX commands, simply change to the /cmds directory by typing

cd /cmds [Enter]

Note: A forward slash is used between directories, not a backwards slash as in DOS.

Then type

ls | more [Enter].

The '|' symbol means "pipe" the output of *ls* to the *more* utility. *More* simply allows the user to view files one page at a time.

For more information concerning QNX or QNX commands specifics please refer to the QNX Users Manual.

Harris Driver

The Harris driver is software that "speaks" Harris protocol with the Harris driver on the RTU over the RS-232 line. It asks the RTU for any updated information approximately once every 5-7 seconds. As the real-time data comes in, the Harris driver passes it over to RealFlex for archival in the historical database. The Harris driver is loaded from one of the RealFlex startup files called *coldstart* which is located in the 3:/realflex/data directory. The most important thing about the Harris driver is that it converts RTU counts to Harris counts. The full range for Harris counts is from -2048 to +2047 (integer values). This means that -32768 in RTU counts (max negative value on RTU) gets mapped to -2048 Harris counts and +32767 (max positive value on RTU) gets mapped to +2047. Note that the resolution from the Harris driver is limited to 12 bits versus the 16 bits available.

RealFlex

RealFlex is a canned SCADA package written by BJ Software in Friendswood, Texas that runs on QNX RealFlex offers facilities to view real-time data, configure, edit, and maintain multiple databases, develop graphical screens and user interfaces for the system, print, interface with QNX, and to accomplish many other SCADA related tasks. A description of the RealFlex configuration at Kerman follows, as well as descriptions of some relevant RealFlex components. For details concerning RealFlex functions please refer to the RealFlex User's Manual.

Startup

coldstart. The system boots into RealFlex automatically on startup. Configuration information is read from an initialization file called *coldstart* which resides in the '3:/realflex/data directory'. This file is listed in Appendix D.4. It tells RealFlex what drivers to load, what parameters to use for each of them, and each of their task priorities. *coldstart* also contains lines to configure printers and defines files to use for scheduled events. A detailed description of this file can be found on page 6-4 in the RealFlex Installation Guide section of the supplied RealFlex documentation.

rptcron. The QNX scheduler, *cron* (just as in UNIX), is used by RealFlex to schedule events such as periodic hard drive checks, regular report generation, scheduled batch file execution, tape backups, etc. After completing the driver installation and printer configuration from the *coldstart* file, RealFlex reads scheduler information from a file called rptcron. This file is listed in Appendix D.2. A detailed description of this file can be found on page 7-2 in the RealFlex Windows Implementation Guide section of the supplied RealFlex documentation. In addition to the default maintenance tasks that are described in the manual, *rptcron* is used at Kerman to create the daily average data file at midnight and to append the averaged data to this file every 10 minutes. A detailed description of this process can be found on page 3-12.

Manual Startup. Refer to Appendix B.2 for instruction on how to start RealFlex manually from the QNX prompt.

Viewing/Moving Around RealFlex

The Mouse and Screen. RealFlex has been designed using the Open Look standard. This means that all programs run within a window (or multiple windows). Each window can be closed using its "push-pin" in the upper left-hand corner. The mouse can be used to push buttons, depress push-pins, move windows, cause menus to appear, and make menu selections. The right mouse button is called the "menu button", and the left mouse button is called the "select button". Any selections other than making a menu appear on the screen or making a sub-menu appear from a menu should be made using the left mouse button. All menu selections should be made with the right mouse button. More information concerning the mouse can be found in the RealFlex Windows - Getting Around in RealFlex guide, page 3-1.

Additional explanations of the RealFlex user's interface and functionality of RealFlex can be found in the RealFlex Windows Operator's Guide.

Viewing System Performance and Weather Data. Realflex provides a facility to view the real-time values of all channels in the database. These screens are accessed by choosing 'System Summary Display' from the '**MASTER MENU**' on the main RealFlex title bar. This procedure is detailed in Appendix B.12 ("To get basic channel displays from within RealFlex:").

Getting to a QNX Shell. This procedure is done using the **WORKSPACE** menu from within RealFlex Windows. The user is referred Appendix B.9 ("Opening a QNX Window") for instructions on opening a QNX shell from RealFlex Windows.

The Database. Data is mapped from the RTU into the RealFlex database using virtual ports. Virtual ports were originally designed by Harris to mimic the operation of external ports on the older RTUs. Virtual ports have no correspondence to actual I/O ports in the system. They are used in the definition of the database to tell RealFlex where to find each data point in the mapping. The system at Kerman has been designed with 15 virtual ports. The current mapping is shown in Table 3-3. Although each virtual port can map 64 individual channels, the configuration chosen for Kerman allocates 1 virtual port per SCADA peripheral card. This was done to simplify the mapping, and to allow plenty of extra channels for future expansion of the system.

Table 3-3

Harris Port Mapping

Port #	Location	Port Type	Peripheral	Point Range	# Points	# CTRL Pts.
1	Control Building	Control & Indication (1)	D20S1	1-14	14	
2	spare	Control & Indication (1)	D20S1			
3	12kV Switch	Control & Indication (1)	D20C1	9-16	8	3
4	Inverter #1	Control & Indication (1)	D20C1-INV1	1-14	14	5
5	Inverter #1 (spare)	Control & Indication (1)	D20C2-INV1			
6	Inverter #2	Control & Indication (1)	D20C1-INV2	1-13	13	5
7	Inverter #2 (spare)	Control & Indication (1)	D20C2-INV2			
8	12kV Switch	Accumulator (7)	D20C1	1-4	4	
9	spare					
10	Weather Station	Analog (3)	D20A1	3-10	8	
10	Redundancy	Analog (3)	D20A1	15-16	2	
11	12kV Switch	Analog (3)	D20C1	1-8	8	
12	Inverter #1	Analog (3)	D20C1-INV1	1-15	15	
13	Inverter #1 (spare)	Analog (3)	D20C2-INV1	1-5, 9-13	10	
14	Inverter #2	Analog (3)	D20C1-INV2	1-12	12	
15	Inverter #2 (spare)	Analog (3)	D20C2-INV2			

The information in Table 3-3 is used to create the RTU's database mapping in the A003 file (Harris configuration, Appendix C.1. Consequently, both the Harris driver and the RealFlex database must be made aware of the data mapping as it exists in the RTU. The Harris driver is configured using a program called *make_harris.*

make_harris. Before a user can define an RTU within the RealFlex database, a template providing the basic port information for the RTU must be created. *make_harris* creates this template. Specifically, *make_harris* allows the RealFlex database designer to enter the maximum number of channels (data points) that will be used with each virtual port, and what type of data (digital, analog, meter, or accumulator) each port will be mapping, and reports the current status for each port (active = 1, inactive = 0).

make_harris* must be set up before the database can be created and edited, and must be run either from *dbedit (refer to Appendix B.3), **or in a QNX shell window from RealFlex** (refer to Appendix B.9 for the procedure on how to open a QNX window).

Figure 3-2 below shows the *make_harris* user-interface, as well as the current setup for Kerman.

TELEMETRY
Harris Protocol

Port Configuration: RTU supports 15 Ports (Y/N) Y (N = 7 Ports!)

	type	# points	o/l		type	# points	o/l
Port 1:	1	32	1	Port 2:	1	32	1
Port 3:	1	32	1	Port 4:	1	32	1
Port 5:	1	32	1	Port 6:	1	32	1
Port 7:	1	32	1	Port 8:	7	4	1
Port 9:				Port 10:	3	32	1
Port 11:	3	32	1	Port 12:	3	32	
Port 13:	3	32	1	Port 14:	3	32	
Port 15:	3	32					

Figure 3-2. *make_harris* user interface.

In order for RealFlex to collect and convert data from an RTU, it must be told where the data is coming from, how each data point is mapped from the Harris driver's virtual ports, conversion information from Harris counts to engineering units, alarm information, and any other point specific information. This data is entered by the user with a program called *dbedit*. *dbedit* must be run from RealFlex. Appendix B.3 gives the procedure for running *dbedit*.

dbedit

Because *dbedit* is a fairly elaborate database interfacing program, the user is referred to section 2 (Database Implementation) on page 2-1 in the RealFlex Windows Implementation Guide, V4. A few of the more confusing aspects of *dbedit* are detailed here.

The main *dbedit* screen is shown in Figure 3-3.

PCU MAINTENANCE

NAME	ADDRESS	ACTIVE	CHAN	STATUS	ANALOGS	METERS	TANKS
SYSTEM	0	ON	0	19	2	0	0
KERMAN_CALIB	1	OFF	1	0	49	4	0
KERMAN	1	ON	1	55	52	4	0

F1-ADD F2-DELETE F3-SORT F4-TELEMETRY F5/F6-EDIT DB F7-DISK UTIL
F8-DB OPTIONS F9-COPY PCU F10-EXIT SF1-WARMSTART SF10-HELP

Figure 3-3. *dbedit* user interface.

The 'PCU[2] MAINTENANCE' menu shown in Figure 3-3 is the opening menu of the database editor process (*dbedit*). Summary information concerning all RTU's in the RealFlex database is input and maintained by the user on this screen. The 'SYSTEM' PCU is internal to RealFlex and keeps information such as printer status, hard drive space available, etc. The 'KERMAN_CALIB' PCU is a special configuration used during calibration, and contains only the analog channels at Kerman. Each point in the 'KERMAN_CALIB' PCU is configured to convert Harris counts back to raw voltages or currents as originally seen by the SCADA peripherals. As can be seen under the 'ACTIVE' column,

[2]The acronym PCU stands for process control units, and is RealFlex's term for RTU.

the 'KERMAN_CALIB' PCU is not currently collecting data. The 'KERMAN' PCU represents the normal RTU configuration at Kerman, and contains all the defined data points and calibration coefficients used in the system.

Although the RealFlex database can handle data from multiple RTUs and multiple I/O drivers, the implementation at Kerman is 1 to 1. This means that there is 1 RTU called 'Kerman', and RealFlex is "fed" data from 1 I/O driver, called the Harris driver. The Harris driver passes data to the RealFlex database (RFDB) through a control queue as defined in both the Harris driver startup line (from within the *coldstart* file) and *dbedit*. The *harris* driver definition from the *coldstart* file is shown in Figure 3-4. The channel number definition is shown in bold (**c=1**).

```
0  8  *  1  0  harris c=1 O=2 o=2 d=100 r=2 t=100 f=0 p=$tty3 B=9600
```

Figure 3-4. Line from *coldstart* file to load harris driver.

In Figure 3-3, the *dbedit* 'PCU MAINTENANCE' screen, the column 'CHAN' represents the control queues used by each PCU in the system. The '1' shown for the 'KERMAN' PCU corresponds with the channel number defined for the *harris* driver as shown in Figure 3-4.

If a new PCU were to be added to the RealFlex database, it would be added on the 'PCU MAINTENANCE' screen shown in Figure 3-3. Before any data points can be added to the system or edited, the "Telemetry Data" for the PCU must be defined. This is done using the *make_harris* program. As explained on Page 3-7, *make_harris* can either be run from within a QNX shell manually, or from *dbedit* (easiest method). Running *make_harris* from *dbedit* simply means pressing the [F4] ('TELEMETRY) key from the 'PCU MAINTENANCE' screen. The phrase "Telemetry" is a term used by RealFlex to refer to any data transferred to and from a remote unit to the RealFlex database over a serial link. Refer to Page 3-7 for more information on using *make_harris*.

To access the individual point definitions simply use the up/down arrow keys from the 'PCU MAINTENANCE' screen to select the 'KERMAN' PCU, move over to the desired group (ANALOGS, STATUS, etc.) using the [Tab] key, and choose [F6] to edit the database. A screen with

all the labels for that particular data type will be displayed. Using the arrow key, position the highlighted area over the desired data point and press [Return]. An editing window similar to Figure 3-5 will appear.

ANALOG MAINTENANCE

TAG NAME:	D20A1_AN03	HLM:	0.000
POINT DESC:	WEATHER - GSA	COLOR:	NO ALARM
UNITS:	W/m^2	LLM:	0.00
POINT OFFSET:	10	COLOR:	NO ALARM
AUX ADDRESS:	3	HHLM:	0.00
SUBTYPE:	0	COLOR:	NO ALARM
EU TYPE:	0	LLLM:	0.00
MIN RAW:	-2048	COLOR:	NO ALARM
MAX RAW:	2047	ROC TYPE:	0
MIN EU:	-1800	ROC INHIBIT:	0
MAX EU:	1800	ROC LIMIT:	0.000
		ALARM ACTION:	0
		ALARM DEADBAND:	0
		EU VALUE:	677.342

Figure 3-5. Analog maintenance screenform.

Figure 3-5 shows the analog maintenance screenform for the global single axis irradiance data point. The only items that are not either intuitive or explained in the RealFlex users manual are the 'POINT OFFSET' and 'AUX ADDRESS'. These fields are used for the Harris virtual port mapping. **'POINT OFFSET' refers to the virtual port #, and 'AUX ADDRESS' refers to the actual point #** on the associated D20 peripheral unit. Appendix F lists all the points in the system along with their labels, virtual port numbers, actual point numbers, and associated peripherals.

The last important point to note about *dbedit* concerns notifying the Harris driver following changes to the RealFlex database. This is done by typing [Shift]-[F1] ('WARMSTART') from the 'PCU MAINTENANCE' screen. The Harris driver should be "warm-started" in this fashion whenever any changes are made using *dbedit*.

histdb

RealFlex communicates with the Harris driver to obtain any updated data from the RTU, and puts it into the historical database using a process called *histdb*. *histdb* is the database manager. All inquires from the database and inserts into the database must go through *histdb*. *histdb* converts from Harris

counts (-2048 to +2047) to engineering units before placing the data in the database. The conversion parameters are defined for each point when the database is configured using *dbedit* (with the 'MIN/MAX RAW' and 'MIN/MAX EU' fields). All calibration factors for the system are incorporated into the conversion parameters for each point. Calibration factors are discussed on Page 4-1, and are listed in Appendix E.

Some important points concerning histdb:

- *histdb* must be running for any program, driver, or user to interface with the database in any way.
- The RealFlex database files can not be manually accessed, moved, renamed, or deleted when *histdb* is running. Refer to Appendix B for procedures concerning the database files.
- *histdb* is responsible for all calculations pertaining to data in the database when accessed through RealFlex. This is pertinent to the generation of averaged data for the PVUSA database because it is important to know that *histdb* is generating the averages and not the Report Generator.
- *histdb* should always run at priority level 7. This is one higher than normal, and therefore requires a '+' sign following the '&' whenever starting *histdb* manually. For example, after deleting the real-time database the user would restart *histdb* by typing "ontty $tty0 histdb &+[Return]". As an aside, the 'ontty $tty0 histdb' command tells the system to start *histdb* on virtual console 0 (as opposed to the current console) where all the other system processes exist. We do this so that the process will not be killed when we logoff, or if some problem arises with the modem (the process for which exists on $tty4).

The Report Generator. The Report Generator is a RealFlex utility that can be used to assemble "reports" based on data in the historical database. The user can use The Report Generator to create custom reports that include averages, mins, maxs, raw data, etc. The procedure for running The Report Generator from RealFlex is shown in Appendix B.4. For particulars concerning The Report Generator the user is referred to page 5-1 of the RealFlex Windows Implementation Guide, V4.

The Report Generator is used at Kerman to produce the 10-minute averages in comma-separated-value (.CSV) format. The name of the report is 'Kerman'. The report contains field definitions for every analog, status, and accumulator point in the system. Because The Report Generator only accepts a certain number of characters per line, and because the field definitions for all the points at the plant take up much more space than is available on one line, the .CSV format was set up in multiple lines. Each field is separated by

a comma in the report so that when the 'Kerman' report is generated every 10 minutes, each data point is separated by a comma in the output file. Each of the analog fields in the 'Kerman' report has been defined to output the average for that particular point over the previous 10 minutes. The first field on the first line contains the date and time the report was generated. This date/time field is generated from the system clock.

In order to make the data available any time during the day, to keep the time it takes to generate a report to a minimum, and to get the daily files in a semi-manageable form, the 'Kerman' report is generated once every 10 minutes instead of once a day. *rg_exec* (the Report Generator executable file) is spawned every 10 minutes by *cron* (as specified in *rptcron*). The Report Generator executes the 'Kerman' report, generating averages for the previous 10 minutes (analog values only, status values are snapshot). The report is output to the file *3:/realflex/bin/Kerman*. 3 minutes following each generation of the 'Kerman' report (i.e. 10:13, 10:23, 10:33, etc.), *cron* spawns a batch file (refer to section on batch files) which appends the 'Kerman' report file to a file in the *3:/realflex/data/Kerman.data* directory of the format "DDMMYYkm.csv" that contains all of the 10-minute averages since midnight on that day.

Batch Files and Daily Average File Generation

As described previously, QNX batch files are used to create a new daily file at midnight every night, and to append the average data reports generated every 10 minutes to this file. These batch files are explained briefly in table 3-4, and are listed in Appendix G.

Table 3-4

Kerman DAS Batch Files

Name	Directory	Description
rundaily.bat	/realflex/data/Kerman.batch	Creates temporary file with current date in it, then uses *led* and *ledcmds* to parse date.
ledcmds	/realflex/data/Kerman.batch	Contains *led* commands to parse date and create the *run10.bat* file. This file is passed to *led* by *rundaily.bat*.
run10.bat	/realflex/data/Kerman.batch	This file is run after each 10-minute average report is generated. It appends *Kerman* report file to a daily file of the name DDMMYYkm.csv.

rundaily.bat. The process of appending 10-minute average data to a daily file begins at 12:04am every night. The file *rundaily.bat* is spawned by *cron* (according to *rptcron*) at this time. *rundaily.bat* uses the system *date* command to put the current date and time into a file called *datefile* in the 3:/realflex/data/Kerman.batch directory. Then, *rundaily.bat* uses the system *led* command to parse the date in *datefile* and create the *run10.bat* file according to the commands that are redirected (with the '<' symbol) to it from the file *ledcmds*.

ledcmds. *ledcmds* is a command file that is passed to the system *led* command by *rundaily.bat*. It first parses out the date from the date/time string in *datefile*. An example string is shown below.

24-Nov-93 12:05:00 am

ledcmds parses the string taking the dashes out of the string, replacing the character representation of the month with the numerical (ie. 11), and removing the time. So, the string looks like

241193

after the first stage of *ledcmds*. Next, *ledcmds* appends 'km.csv' to the string forming

241193km.csv

Now that the daily file string has been created, *ledcmds* instructs *led* to put the system concatenate command (*cat*) followed by the path that the file will reside in before the string as follows:

cat 3:/realflex/data/Kerman.data/241193km.csv

The form of the *cat* command is *cat [input_file1] [input_file2]* > [output_file].* Because the *cat* command will not create a new file if the *output_file* does not exist, the report file must be concatenated to the daily file and the result must be stored in a temporary file [*tmp*]. Then the temporary file must be copied over to the daily file (this will overwrite the previous daily file each time, or will create a new daily file with the first report in it at 12:10am). *ledcmds* does this by continuing the previously described process and assembling the following two lines:

- cat 3:/realflex/data/Kerman.data/241193km.csv 3:/realflex/bin/Kerman >
- 3:/realflex/data/Kerman.batch/tmp
- cp 3:/realflex/data/Kerman.batch/tmp 3:/realflex/data/Kerman.data/241193km.csv

These lines are then written to a file called *run10.bat* and that file is made executable with the command (last line in *rundaily.bat*)

chattr a=+e rundaily.bat

Now the file *run10.bat* exists with the commands to append the *Kerman* report to an existing daily file in the /realflex/data/Kerman.data directory, or if it is the first report of the day and no daily file exists yet, *run10.bat* will create the daily file with the first 10-minute average report in it.

Once *run10.bat* has been created at 12:04am each day, it can be run after each 10-minute report is generated and the new data will be appended to the daily file.

hbackup

hbackup is a RealFlex utility found in the realflex/bin directory, used to backup a realflex database to an ASCII file, or restore an ASCII file previously backed up using *hbackup*. *hbackup* allows the user to specify an end time, duration, what calculations (average, min, max, raw) *histdb* should perform on the data (compression), the compression interval, and what points to include. *hbackup* is particularly useful when "5-second" data is needed in a manageable form. It provides the only method for transferring "5-second" data to a readable ASCII format. Figure 3-6 is a screen dump of the on-line help for *hbackup* and shows the format used.

```
$ hbackup ?
use: hbackup SAve|REstore [options]
options:                                  Default
Directory    : Destination Directory          ^data/hist.back
e=End Time   : DDMMMYY@HH:MM:SS                  Current Time
d=Duration   : nnMonth|Week|Day|Hour          1Day
c=Compression : nnDay|Hour|Min + None|Min|Max|Avg|Raw  None
t=Db Type    : an,mt,st                    an,mt,st
P=PCU Mask   : Wildcard                      *
p=Point Mask : Wildcard                      *
l=Log file   : Error messages                /tmp/hbackup.log
$
```

Figure 3-6. *hbackup* on-line help.

For example, if the user wanted to write the raw analog "5-second" data to a file for the period between 12:00:00 and 15:00:00 on October 15, 1993, he would type

hbackup sa e=15oct93@15:00:00 d=3hour t=an [Return]

at the QNX prompt while RealFlex was running. **RealFlex must be running to use hbackup.** Unless a specific directory is specified as the first parameter on the command line, the data new data file will be placed in the /realflex/data/hist.back directory. The file is always named using the date of the last data point in the sample. Therefore, the name of the data file for this example would be

15Oct93.??

and will be found in the realflex/data/hist.back directory.

kermit

kermit is a standard serial communications file transfer protocol. It is installed on the Kerman R&D Computer. *kermit* was chosen because it is a standard protocol that has been implemented on most platforms, and because it is one of the few offered for QNX. Because *kermit* is the only serial transfer protocol on the system at Kerman, it is used for all transfer of files to and from the R&D Computer by both serial and direct links through the comm port. The *kermit* on-line help is shown in Figure 3-7.

```
$ kermit ?
KERMIT V2.03
use: kermit [device] SEnd [options]* src_file[,dst_file] [x=index_file] ...
 or kermit [device] REceive [options]* [p=prefix] [f=forced_filename]
options: -make_dir +Qterm +relaxed_timing +verbose -verbose
       D=debug_file -ers -q_8bit=ON|ENABLE|DISABLE -q_rpt=ON|OFF
       s=setup_file +binary +unique
$
```

Figure 3-7. *kermit* on-line help.

A typical use for *kermit* at Kerman would be to download a daily 10-minute average data file. This is done by logging on to the system via modem (refer to Appendix B for logging on procedures) and typing the following line at the QNX prompt:

kermit se [data_file_name]

where [data_file_name] is replaced by the actual name of the file to download. The user's remote communications program should automatically initiate the transfer procedure. If the remote comm program does not automatically start the download, the user should manually initiate the download specifying *kermit* as the protocol.

Section 4

CALIBRATION FACTORS

Calibration factors were determined in April of 1993 for all analog points at Kerman. During calibration, known values (voltages or currents) were input into the system at the various measurement points throughout the plant. These values were held constant for five minutes per input level, and were then increased to the next level. During this process the RealFlex system recorded "5-second" data for all analog channels. Following the completion of each channel, 1-minute averages were generated using the Report Generator. These averages were then imported into Excel and regressed against the actual values that were injected into the system. A multiplier for each channel was calculated based on the regressions performed. The multipliers for each channel were then applied to the Ymin and Ymax values in the database using *dbedit*. Appendix E lists all analog Ymin and Ymax values in the Kerman database.

For more information concerning calibration techniques, procedures, and actual regression values, please refer to Appendix H for contact names and telephone numbers.

CHANGING CALIBRATION FACTORS

Follow the procedure called '**Running the Database Editor (dbedit)**' (Appendix B.3). Move the cursor to the 'KERMAN' PCU using the down arrow keys. Next, using the [Tab] key, move the cursor to the 'ANALOGS' column and press [F6] ('EDIT DB') to edit the database. A window with all the analog scan points in the system should come up listed by tag name. By positioning the cursor on the particular point whose calibration constants you want to change and pressing [Return], a window with all the individual configuration information for that point should come up. To change the calibration constants, simply change the appropriate 'YMAX', 'YMIN', 'EUMAX', and 'EUMIN' fields as desired. **Before exiting make sure to do a 'WARMSTART' by pressing [Shift]-[F1] from the main *dbedit* screen.**

Section 5

THE MODEM AND COMMUNICATION SOFTWARE

The R&D Computer at Kerman is set up with a USRobotics V.32bis modem connected to COM2. The modem is a 14.4 kbaud modem capable of baud rates up to 19200 bits per second with compression. Upon startup of the system, the modem is initialized by a program called *comm* from within the *sys.init.0* file. *comm* runs in the background on the computer and emulates a virtual terminal through the modem. This enables other computers to connect to the Kerman R&D Computer via modem, and login as a new user as if directly connected on a LAN. PLANT CONTROL CAN NOT BE PERFORMED REMOTELY! To get a password, contact the PVUSA project manager at the number shown in Appendix H. The *comm* initialization line in *sys.init.0* is shown in Figure 5-1.

```
ontty $tty4 comm +l +h b=19200 i=at&f&a3&b1&h1&r2| a=ATA| l=$con1 q=15 "m=Welcome to the Kerman R&D
Computer"
```

Figure 5-1. *comm* initialization line in the *coldstart* file.

The initialization line shown in Figure 5-1 starts up *comm* on $tty4, which is QNX's name for COM2. We use COM2 because COM1 is being used by RealFlex to talk to the RTU. The baud rate is set at 19200 by setting "b=19200", and the modem is initialized with the string following the "i=". The "a=" parameter is the modem's manual answer string, and is sent to the modem by *comm* when a ring alert is sent to the computer from the modem. The other parameters can be referenced in the QNX Users Manual.

THE MODEM PHONE NUMBER

The phone number for the line that the modem is connected to is:

(209) 846-7958

Section 6

THE TAPE DRIVE AND SOFTWARE

A 525MB SCSI Tandberg tape drive is connected to the Kerman R&D Computer. The software required to use the tape drive is located in the 3:/tdcback directory. These files are listed and described in Table 6-1.

Table 6-1

Kerman Tape Backup Software

File	Directory	Page	Description
aha	/tdcback	7	SCSI driver for tape - must be loaded before tdcback, tdc, or tdcdir is used.
tdcback	/tdcback	13	Main backup software. Saves, restores, lists files of tape, etc.
tdc	/tdcback	12	Small utility program to gracefully unload aha, and to send SCSI commands to devices on the SCSI bus.
tdcdir	/tdcback	22	Utility for saving and restoring a directory tree. *tdcdir* is not a client of the *aha* administrator as are the other tdc programs.
TDCBACK_FULL	/cmds	N/A	Batch file that automatically loads *aha* and does a full backup to tape of the entire hard disk. Any errors go to /tdcback/errors, and a verify log is written to /tdcback/verify_log. Gracefully unloads *aha* when finished.
TDCBACK_INCR	/cmds	N/A	Batch file that automatically loads *aha* and does an incremental backup of the entire hard disk. Any errors go to /tdcback/errors, and a verify log is written to /tdcback/verify_log. Gracefully unloads *aha* when finished.
TDCBACK_CSV	/cmds	N/A	Batch file that automatically loads *aha* and does a backup of the /realflex/data/Kerman.data directory (not subdirectories). This batch file is intended to back up all the daily data files. Any errors go to /tdcback/errors, and a verify log is written to /tdcback/verify_log. Gracefully unloads *aha* when finished.
TDCBACK_HIST	/cmds	N/A	Batch file that automatically loads *aha* and does a backup of the /realflex/data/hist.save directory where the backed up historical databases reside. Any errors go to /tdcback/errors, and a verify log is written to /tdcback/verify_log. Gracefully unloads *aha* when finished.
TDCBACK_LIST	/cmds	N/A	Batch file that automatically load *aha* and lists all the files on the tape currently in the drive. Any errors go to /tdcback/errors, and the actual list is written to /tdcback/list.

The last five items in Table 6-1 list batch files that have been developed for some of the common backups done regularly on the system. These files may be run from any directory. Listings of these files can be found in Appendix G, and explanations of the various commands used are contained in the *tdcback* manual.

In general, these tape backup procedures take a long time. When executed remotely they should be run on virtual console $tty0, which is the system console, so the user doesn't have to be logged in for the entire duration of the backup. To run one of the batch files when logged on remotely, simply type:

ontty $tty0 [batch file name] [Return]

After starting the batch file with the command above, the user may log out of the system, and the backup will proceed until finished or interrupted by an error. The batch files listed in Table 6-1 put an error log called *errors* and a verify log called *verify_log* in the /tdcback directory. It is in the user's best interest to consult these logs after each backup is complete to confirm that all went as planned.

New tapes must be formatted before any data can be stored on them. The procedure **'Initializing a Tape'** in Appendix B will format and initialize a new tape. **Formatting a tape erases all data that was previously stored on it.**

Section 7

REGULAR MAINTENANCE

HISTORICAL DATABASE MAINTENANCE

Because the RealFlex historical database is set up to collect data every 5-7 seconds on all analog, status, and accumulator channels, it gets quite unwieldy in size very quickly. As the database approaches 65MB the system becomes unstable, averages get lost, and the directory and file structure on the hard disk become corrupt. Therefore, it is important to monitor the size of the historical database frequently.

The RealFlex historical database and its associated files are kept in the

/realflex/data/hist

directory. The file that contains all of the data, and that is of concern, is called

histdata

By changing to the /realflex/data/hist directory with the command

cd /realflex/data/hist [Return]

and using the *files* command, the sizes, dates and times last changed, and file names of all historical data files will be display as shown in Figure 7-1.

```
$ files

    Blks        Date        Time        Name
     15         1-Dec-93    9:15am      data.bit
   60552        1-Dec-93    9:04am      histdata
    1676        1-Dec-93    8:22am      histindex
       1        1-Dec-93    9:15am      index.bit
       5        1-Dec-93    8:00am      index.root

Total blocks: 62249   Total files: 5
$
```

Figure 7-1. Example listing of /realflex/data/hist directory.

Notice the line shown in bold in Figure 7-1. The number '60552' is the size of *histdata* in blocks. **One block equals 512 bytes.** Therefore, the size of *histdata* shown in Figure 7-1 is

60552 * 512 = 31,002,624 bytes (31 Mbytes).

When the size of this file exceeds 100,000 blocks (~50 MB), the procedure for 'Removing (or Moving) the Real-Time Historical Database' shown in Appendix B should be followed. Under no circumstances should the size of *histdata* exceed 127,000 (~65 MB) blocks! The size of *histdata* should be checked every time a user logs onto the system. Generally, it should be removed once every two weeks.

During the summer months when data are critical, all of the real-time data should be archived to two tapes. This procedure starts by **moving** each historical database as it gets too large every two weeks into its own temporary directory. Then, once a month, the temporary directories containing the old historical databases should be backed up using the command *TDCBACK_HIST*. **Before deleting the old databases, there should be a copy of each on TWO different tapes.** So, during the time period when all the data are being saved, and the *histdata* file gets to a size where it should be removed, follow the procedure for 'Moving the Real-Time Historical Database'.

It is important to note that these files can not be manipulated in any way while *histdb* is running. *histdb* is the database manager, and locks these files when it is active. Whenever the historical database is to be backed up, moved, or deleted, the *histdb* process must be *slay*ed first, and then restarted on $tty0 with the '&+' parameter when done.

HARD DRIVE MAINTENANCE

Occasionally, when the system gets bogged down because of a database that has gotten too large, or when an operation gets canceled before it has completed writing to disk, the integrity of the directory and file structure on the hard disk gets "confused". It is therefore good practice to perform regular hard drive maintenance operations that check for any abnormalities on the hard drive. Unfortunately, these procedures must be done at the site. The procedure "Hard Drive Maintenance" on Appendix B.6 should be carried out at least once every two months.

Additionally, it is important to monitor the free space on the hard drive frequently, and to delete un-needed files whenever possible. The command to quickly see how much hard drive space is available is

query [Return]

Appendix A

CABLES

CABLES

A.1. RealFlex PC-to-RTU Cable Pin Connections

X-END SIGNAL (D20)	PIN NO.	COLOR CODE	PIN NO.	Y-END SIGNAL (RF)
RTS	7	RED	1	DCD
CTS	8			
+V(5/12)	4			
RXD	2	WHT	3	TXD
TXD	3	GRN	2	RXD
COM	5	BLK	5	COM
DCD	1	ORN	6	RSR
			7	RTS
			8	CTS

Appendix B

PROCEDURES

PROCEDURES

B.1. Booting into DOS

To boot into the DOS partition on the R&D Computer simply press the '4' key down after the memory check and before the computer beeps.

B.2. Running RealFlex from the QNX Prompt

From the QNX prompt type:

windows [Enter]

Then, when the mouse pointer becomes visible, position the mouse pointer anywhere on the screen *other than the menu bar on top* and click the *right* mouse button.

A menu should appear at the mouse pointer. Position the mouse pointer over 'Programs' and click with the *right* mouse button.

Another menu should appear to the right of the first menu. Position the cursor over the word 'RealFlex' and click with the *left* mouse button.

RealFlex should now start. It will wait about 5 seconds for you to choose 'WARM START' or 'COLD START', but will then continue on to do a 'WARM START' by default.

B.3. Running the Database Editor (*dbedit*)

1. Position the mouse cursor over the **'MASTER MENU'** button on the RealFlex menu bar and click on the left mouse button.
2. Position the mouse cursor over the **'UTILITIES'** option on the menu that appears below **'MASTER MENU'** and click with the left mouse button.
3. Choose **'DATABASE EDITOR'** in the upper-left hand corner of the next menu that appears to the right of 'Utilities' and click on the right mouse button. *dbedit* should come up.

B.4. Starting the Report Generator

1. Position the mouse cursor over the **'MASTER MENU'** button on the RealFlex menu bar and click on the left mouse button.
2. Position the mouse cursor over the **'UTILITIES'** option on the menu that appears below **'MASTER MENU'** and click with the left mouse button.
3. Position the mouse cursor over the **'REPORT GENERATOR'** and click with the left mouse button.

B.5. Shutting RealFlex Down

1. Position the mouse cursor over the **'MASTER MENU'** button on the RealFlex menu bar and click on the left mouse button.
2. Position the mouse cursor over the **'UTILITIES'** option on the menu that appears below **'MASTER MENU'** and click with the left mouse button.
3. Position the mouse cursor over the **'EXIT REALFLEX'** and click with the left mouse button.

4. A message box will appear asking if you are sure you want to exit RealFlex. Click on 'YES' with the left mouse button.
5. Press [Return] after the message to type 'windows' appears in text.

B.6. Hard Drive Maintenance

You must be at a QNX prompt to execute this procedure. If Realflex is running, exit it using the 'Shutting Realflex Down' procedure. At the QNX prompt type:

slay comm t=4 u=8000 -v -q [Return]

slay olwm [Return]

slay dialog [Return]

slay screen_event [Return]

slay queue [Return]

Next, type **tsk** followed by [Return] and verify that 12 or less tasks are running on the system.

Then type **dcheck 3** [Return]

Press [Return] when it prompts you. When it is finished, type

files 3:/ +b [Return] and make sure no files are listed as busy. If files are busy, at the prompt type: **zap** *filename*. Then type

chkfsys 3 [Return] and **yes** [Return] after you have read the warning. If any errors come up follow the instructions to have the program fix them.

Reboot the computer using the reset button on the front panel when chkfsys is finished. All these were done to make sure HD is in good condition.

B.7. Initializing a Tape

From the QNX prompt type the following lines:

cd /tdcback [Return]
aha & [Return]
tdcback aha0 1 init "put_file_name_here" [Return] (example: Kerman_backup_tape#X, where X is a number greater than last one. Check directory.)
tdcback aha0 1 quit [Return]

B.8. Tape Backup Procedures

B.8.1. Backing Up the Hard Drive While at the Site

Before you start follow Hard Drive Maintenance Procedures above.

1. Make sure the desired tape is in the tape drive. (Initialize, if necessary or read the TapeX.list file for important information about the Tape.)
2. Although RealFlex can be running when a backup is done, it is suggested that it be shut down so that all files on the hard disk are accessible. RealFlex locks certain files and therefore will not allow them to be backed up while it is running. To shut RealFlex down follow the procedure for 'Shutting RealFlex Down'.

3. To initiate the backup, pick the appropriate batch file from Table 6-1, type its name in at the QNX prompt followed by a [Return]. Make sure to use capitols. For example, to initiate a full backup of the hard drive type

TDCBACK_FULL [Return]

at the QNX prompt. The backup should commence and it takes about 2 hours.

4. Make list of changed tapes. From the QNX prompt type the following lines:
cd/tdcback [Return]
aha & [Return]
tdcback aha0 1 list > tapeX.list [Return]
mv tapeX.list /realflex/data/kerman.data/tape_backup_logs [Return]

The files *errors*, *tapeX.list*, and *verify_log* will contain pertinent information concerning the backup after it is completed. The files can be found in the /tdcback directory.

5. **more Verify_Log** file to make sure backup was successful and move file to *tapes_logs* directory.

B.8.2. Backing Up the Hard Drive Remotely

For this procedure the user must be logged in to the Kerman system remotely. This procedure will not back up the /realflex/data/hist directory (namely the current historical database) because RealFlex is running (unless *histdb* is *slay*ed). So, follow the procedure for 'Shutting Down *histdb*' or 'Removing the Real-Time Database' prior to executing this procedure if the current RTDB should be backed up.

1. Shut down *histdb* if necessary.
2. Choose the appropriate backup procedure from Table 6-1.
3. Type the following line at the QNX prompt, replacing *TDCBACK_FULL* with the appropriate batch file name.

ontty $tty0 TDCBACK_FULL [Return]

4. The backup should commence. The files *errors* and *verify_log* will contain pertinent information concerning the backup after it is completed. The files can be found in the /tdcback directory.
5. Log off system as desired, the backup will continue in the background until it is finished, or it encounters an unrecoverable error.

B.9. Opening a QNX Window

1. Position the mouse cursor in a blank area of the screen (the RealFlex base window) where no windows are open, and no buttons or menu bars exist (in other words, on the background of the screen).
2. Click with the right mouse button. A menu should appear.
3. Position the mouse cursor over the 'UTILITIES' option and click with the right mouse button. A new menu should appear just to the right of the previous one.
4. Position the mouse cursor over the 'SHELL' option and click with the left mouse button.
4. A QNX window should open. To close this window type 'exit' from the QNX prompt within this window.

MAKE SURE TO CLOSE THE QNX SHELL WINDOW WHEN FINISHED!

B.10. Direct serial link between R&D Computer and another PC

1. Make sure you have a null modem connection from laptop (COM1) to R&D Computer (COM2)
2. Run any comm program you want on laptop (like term.exe in windows) with the following settings:
   a. baud=19200
   b. direct connection
   c. hardware flow control
3. On R&D Computer, get into a QNX shell by clicking the right mouse button on the windows background, choosing utilities from the menu, and choosing shell from the following menu.
4. type:

   slay comm t=4 u=8000 -v -q

   stty +fix >$tty4

   stty inton=3 baud=19200 +hangup >$tty4

   ontty $tty4 login

The laptop should be asking for login at this time. Download as desired.

B.11. Procedure for re-connecting modem to R&D Computer.

0. Connect modem to COM2 (direct serial connection)
1. Cycle power on modem
2. In QNX shell type:

   slay login t=4

   stty +fix >$tty4

   stty inton=3 baud=19200 bits=8 par=none stop=1 esc=0 +hangup up=a1 down=a9 right=a6 left=a4 ins=ab del=ac >$tty4

   ontty $tty4 comm +l +h b=19200 i=at&f|``at| a=ata l=$con1 q=15 "m=Welcome to the Kerman DAS"

Notice where the quotes are on the "m=" line, it's important!

B.12. To get basic channel displays from within RealFlex:

1. Click on MASTER MENU with the right mouse button
2. Click on SYSTEM SUMMARY with the right mouse button
3. Click on KERMAN with the right mouse button
4. Click on PAGE DOWN and PAGE UP with right button to scroll through analog, status, control, and accumulator data points.
5. To close: Click on "push-pin" in upper left corner of window with left mouse button.

B.14. Removing the Real-Time Historical Database:

1. From the QNX prompt type

cd /realflex/bin[Return]

2. Type

pwd[Return]

and verify that you are now in the /realflex/bin directory.

3. Type

start_up +t[Return]

slay Wrealflex [Return]

cd /realflex/data/hist[Return]

ls[return]

verify that the file '*histdata*' is in that direcotory

2. Type

The next line will DELETE the real-time database files - if they need to be archived first, follow the procedure for Moving the Real-Time Historical Database.

To delete the database type:

rm *[Return]

3. Type

cd /realflex/bin[Return]

ontty $tty0 realflex Return]

The previous line re-starts Realflex.

4. Wait about 1 minute for the system to start up and type

tsk | more[Return]

and verify that *histdb* and *Wrealflex* are listed.

B.15. Moving the Real-Time Historical Database:

During the summer (from 6/1 through 10/1), the following steps should be followed to backup the Kerman historical database whenever the ***histdata*** file exceeds 130,000 blocks (about 65MB).

1. **cd /realflex/bin** [Return]
2. **start_up +t** [Return]
3. **slay Wrealflex** [Return]
4. **cd /realflex/data/hist.save** [Return]
5. **mkdir** ddmmyy**kmhist** [Return] (ddmmyy is the current date)
6. **ls** [Return] (make sure the directory was created correctly)
7. **cd /realflex/data/hist** [Return]

Be very careful to type the next step carefully!

8. **mv * ../hist.save/**ddmmyy**kmhist** [Return]
9. **cd /realflex/bin** [Return]
10. **ontty $tty0 realflex** [Return] (after this command wait about 30 seconds for system to start up)

11. **tsk | more** [Return] (verify that *histdb* is listed in the task list)
12. Fill out an O&M sheet and fax it to PVUSA.

B.15. Restoring an Archived Real-Time Historical Database:

Use this procedure to restore a database that has been archived in the '/realflex/data/hist.save/mmddyykmhist' directory (where mmddyy is the date the database was archived).

1. **cd /realflex/bin** [Return]
2. **start_up +t** [Return]
3. **slay Wrealflex** [Return]
4. **cd /realflex/data/hist** [Return]
5. **mkdir temp** [Return]
6. **mv * temp** [Return]
7. **cd /realflex/data/hist.save** [Return]
8. **cd** mmddyy**kmhist** [Return] (where mmddyy is the date the desired database was archived)
9. **mv * /realflex/data/hist** [Return]
10. **cd /realflex/bin** [Return]
11. **ontty $tty0 realflex** [Return] (wait about 30 seconds for system to start up)

If real-time data needs to be extracted from this database, do your *hbackup* command now.

If the original database needs to be re-installed, use the following procedure:

1. **cd /realflex/bin** [Return]
2. **start_up +t** [Return]
3. **slay Wrealflex** [Return]
4. **cd /realflex/data/hist** [Return]
5. **mv * ../hist.save/mmddyykmhist** [Return] (where mmddyy is the same mmddyy used in step 8 above)
6. **cd temp** [Return]
7. **mv * ..** [Return]
8. **cd ..** [Return]
9. **rmdir temp** [Return]
10. **cd /realflex/bin** [Return]
11. **ontty $tty0 realflex** [Return]
12. **tsk** [Return] (to look for *histdb* on the list and make sure histdb is running)

B.16. Directions for Re-booting System:

1. In the top left corner of the screen is a graphic "button" with the words "MASTER MENU". Using the mouse, position the mouse cursor over this button. Click on the mouse's right button once.

2. A menu should appear. Position the mouse cursor over the "UTILITIES" menu item and click on the mouse's right button. Another menu should appear.

3. Choose the "EXIT REALFLEX" menu item by positioning the mouse cursor over this selection and pressing the left mouse button. There should be a single audible beep, and a message saying "Shutting Down RealFlex" should appear.

4. When this message disappears you should hear another audible beep and the screen should be blank except for a down arrow in the upper left corner of the screen. Position the cursor over this arrow and click on the left mouse button. The screen should go black, there should be some writing at the top, and there should be a command prompt (a '$') just below the writing.

5. At this point simply push the reset button on the front panel of the computer once. The reset button is a horizontal button next to the power switch. The computer should reboot and automatically go into RealFlex.

B.17. If the System is Not Responding Properly

There are several situations where the mouse or keyboard will be operating incorrectly or not at all. The first approach is to attempt to bring down the computer as outlined in Appendix B.16. If this is unsuccessful, the next safest approach is to have the system rebooted remotely. Contact Endecon Engineering at (510) 867-3360 to perform this operation. Finally, if you are unable to have the system rebooted remotely, then you must reboot the computer via the reset button. This approach can be damaging if it is performed when the computer is writing to the hard disk. Before pressing the reset button make sure that the drive light shows no activity. The system will then reboot and bring QNX and Realflex into operation.

B.18. Logging onto the R&D Computer Via Modem

1. Using a Hayes compatible 14.4 kbaud or slower modem (V.42bis, V.32bis, MNP 2-5 supported) configured for no parity, 8 data bits, and 1 stop bit, dial (209) 846-7958.

2. If the connection is made successfully, the following lines should be displayed:

```
Welcome to the Kerman R&D Computer
QNX Version 3.15H  Node 0  $tty4  Local Time:  8-Nov-93  6:24:09
pm
Copyright (c) Quantum Software Systems Ltd. 1983,1989
Login:
```

3. At the 'password:' prompt type the password.

B.19. Viewing the Historical Database

Note: You must be at the R&D Computer at Kerman to do this.

1. Select 'Master Menu' with the left mouse button.

2. Select 'Utilities' with the left mouse button.

3. Select 'Historical Maintenance' with the right mouse button.

4. Use the cursor and page-up/down buttons to move up and down through the points list. Place the highlight line on the desired point.

5. Press F3 to edit this point.

6. Using the up/down arrows to change the values, and the Tab button to change fields, select the desired date and time to view.

7. Press [Enter] when ready to view data. If data is entered correctly, the window should fill with the real-time data for the chosen point for the time and date specified.

8. Scroll through the data using the Page Up/Page Down buttons.

9. Press [ESC] to exit the real-time screen, and F10 to exit back to RealFlex.

B.20. Changing RealFlex Passwords

1. Click on 'Master Menu' with the left mouse button.
2. Click on 'Utilities' with the left mouse button.
3. Click on 'Change Passwords' with the right mouse button.
4. Type in the old password.
5. Follow instructions to change desired passwords.

B.21. Setting the Clock

1. From a QNX prompt type **date ?** [Return]
2. Following the format shown, use the **date** command to enter the new date and time followed by [Return].
3. That set the QNX clock, but not the internal clock. The internal clock must be set in order for the change to be permanent. To change the internal clock type **rtc at +set** [Return]. And example of changing the date is shown below.

```
$ date ?
DATE [1.2]
use: date [day [month [year [hour [min [sec]]]]] [am|pm]
$ date 21 01 94 12 32 00 pm
$ rtc at +set
$
```

Appendix C

SCADA CONFIGURATION FILES

SCADA CONFIGURATION FILES

C.1. A003 - Harris Protocol Configuration File

```
/******************************************************************************/
/*                                              */
/* File:  A003_CFG.TXT   - HR6000/XA-21 PROTOCOL CONFIGURATION FILE    */
/*                                              */
/*                                              */
/*                                              */
/* Author: Faizal H.                                  */
/* Date:   Oct 23, 1991                               */
/*                                              */
/* ((C)) Copyright Westronic Inc., 1991.  All rights reserved.          */
/* Licensed Material - Property of Westronic Inc.                 */
/*                                              */
/*                                              */
/*                                              */
/* Description:                                     */
/*                                              */
/*    This file is the HR6000/XA-21 protocol configuration - application */
/*    A003.  This file contains two sections which are:          */
/*                                              */
/*   1. DEFINE_TABLE                                  */
/*                                              */
/*     - the tables are defined in this section.  Note, only MAXRECS  */
/*       is configurable in this section.               */
/*     - For table A003_LRU, only size for the maximum number of     */
/*                                              */
/*   2. DATA_TABLE                                    */
/*                                              */
/*     - data is entered into this section.              */
/*                                              */
/*                                              */
/*                                              */
/* Revision History:                                 */
/* Num  Modified By          Date      Reason              */
/* ---  -------------        -------   ------------------- */
/* 1.0  Faizal H.            Oct 23/91  Created             */
/* 1.1  Faizal H.            Feb 27/92  XA-21 Upgrades.         */
/******************************************************************************/

/******************************************************************************/
/*                                              */
/*                DATA_TABLE Definitions                */
/*                                              */
/******************************************************************************/

/******************************************************************************/
/*    COMMUNICATION PORT CONFIGURATION TABLE                      */
/******************************************************************************/

DEFINE_TABLE = 1
     NAME = A003_COM
     MAXRECS = 1          /* MAXRECS = No. COMMs channels configured */
     CONTROL_WORD = 0x92
     DEFINE_RECORD:

     SIZE = * {21}

     DEFINE_DATA:
      s*4            /* 1. COM port            */
      li*4           /* 2. Baud rate           */
      i*2            /* 3. Data bits           */
      i*2            /* 4. Stop bits           */
      c              /* 5. Parity              */
```

```
      b          /*  filler                    */
      i*2        /* 6. RTS on delay            */
      i*2        /* 7. RTS off delay           */
      i*2        /* 8. Channel timeout/Auto answer timeout */
      c          /* 9. Modem used              */
      b          /*  filler                    */
      li*4       /*10. Control point (COM fail)  */
      s*4        /*11. Control point fail state  */
      i*2        /*12. Emulation mode            */
      s*30       /*13. Modem init string (Auto Dial Up)  */
      s*20       /*14. Phone number. (Auto Dial Up)      */
      li*4       /*15. Database check rate. (Auto Dial Up) */
      i*2        /*16. Auto Dial Up Retry        */
      i*2        /*17. LRU x-ref table offset    */
      i*2        /*18. Number of LRUs            */
      b*8        /*  future use                  */

/*************************************************************************/
/*    LRU CROSS REFERENCE CONFIGURATION TABLE                            */
/*************************************************************************/

DEFINE_TABLE = 2
    NAME = A003_LXR
    MAXRECS = 1        /* MAXRECS = No. Cross References      */
    CONTROL_WORD = 0x92
    DEFINE_RECORD:

    SIZE = * {2}

    DEFINE_DATA:
      i*2        /* 1. RTU address             */
      i*2        /* 2. LRU offset              */

/*************************************************************************/
/*    LRU CONFIGURATION TABLE                                            */
/*************************************************************************/

DEFINE_TABLE = 3
    NAME = A003_LRU
    MAXRECS = 1        /* MAXRECS = No. LRUs configured       */
    CONTROL_WORD = 0x92
    DEFINE_RECORD:

    SIZE = * {25}

    DEFINE_DATA:
      i*2        /* 1. Number of ports         */
      i*2        /* 2. R/L port size (4,6,18,12,16)     */
      i*2        /* 3. Control arm timeout     */
      i*2        /* 4. Setpoint arm timeout    */
      i*2        /* 5. Cos buffer size         */
      i*2        /* 6. MAX COS reported        */
      i*2        /* 7. SOE buffer size         */
      i*2        /* 8. SOE set size            */
      i*2        /* 9. SOE buffer reset DI     */
      s*4        /*10. SOE buffer reset DI state  */
      i*2        /*11. SOE buffer warning percentage   */
      i*2        /*11. COS buffer warning percentage   */
      c          /*13. SOE in NVRAM           */
      c          /*14. Keep newest SOEs.      */
      c          /*15. Local/Global Freeze.   */
      c          /*16. Report chatter indication.  */
      c          /*17. Time tag frozen ACC port    */
      c          /*18. All point offline for offline  */
      li*4       /*19. Time sync loss DI point     */
      i*2        /*20. SOE percentage (Auto Dial Up)   */
      i*2        /*21. COS percentage (Auto Dial Up)   */
      i*2        /*22. AD  percentage (Auto Dial Up)   */
      i*2        /*23. ACC percentage (Auto Dial Up)   */
      i*2,       /*24. Port configuration offset.  */
```

```
      b*16          /*  future use                  */


/*************************************************************************/
/*    LRU PORT CONFIGURATION TABLE                                       */
/*************************************************************************/

DEFINE_TABLE = 4
      NAME = A003_PRT
      MAXRECS = 15        /* MAXRECS = No. LRUS * (7 or 8 to 16)   */
      CONTROL_WORD = 0x92
      DEFINE_RECORD:

      SIZE = * {5}

      DEFINE_DATA:
       i*2          /* 1. Port type                */
       i*2          /* 2. Input mapping table offset      */
       i*2          /* 3. Number of input points          */
       i*2          /* 4. Output mapping table offset     */
       i*2          /* 5. Number of output points         */

/*************************************************************************/
/*    DIGITAL INPUT MAPPING TABLE                                        */
/*************************************************************************/

DEFINE_TABLE = 5
      NAME = A003MT01
      MAXRECS = 224       /* MAXRECS = No. of Indications       */
      CONTROL_WORD = 0x92
      DEFINE_RECORD:

      SIZE = * {5}

      DEFINE_DATA:
       li*4          /* 1. System point number           */
         c           /* 2. COS ownership                 */
         c           /* 3. SOE ownership                 */
         c           /* 4. Freeze ownership              */
         b           /* filler.                  */

/*************************************************************************/
/*    DIGITAL OUTPUT MAPPING TABLE                                       */
/*************************************************************************/

DEFINE_TABLE = 6
      NAME = A003MT02
      MAXRECS = 40        /* MAXRECS = No. Controls + (2 * No. R/L)  */
      CONTROL_WORD = 0x92
      DEFINE_RECORD:

      SIZE = * {3}

      DEFINE_DATA:
       li*4          /* 1. System point number           */
       li*4          /* 2. control duration or R/L base time   */
       li*4          /* 3. control type or R/L increment       */

/*************************************************************************/
/*    COUNTER MAPPING TABLE                                              */
/*************************************************************************/

DEFINE_TABLE = 7
      NAME = A003MT03
      MAXRECS = 4         /* MAXRECS = No. of Counters          */
      CONTROL_WORD = 0x92
      DEFINE_RECORD:

      SIZE = * {4}
```

```
    DEFINE_DATA:
     li*4          /* 1. System point number          */
       c           /* 2. Freeze ownership             */
       c           /* 3. Type of accumulator          */
      i*2          /* 4. Dead Band (Auto Dial Up)     */


/*************************************************************************/
/*    ANALOG INPUT MAPPING TABLE                                         */
/*************************************************************************/

DEFINE_TABLE = 8
    NAME = A003MT04
    MAXRECS = 192        /* MAXRECS = No. AtoD points                   */
    CONTROL_WORD = 0x92
    DEFINE_RECORD:

    SIZE = * {8}

    DEFINE_DATA:
     li*4          /* 1. System point number          */
     li*4          /* 2. D20M minimum.                */
     li*4          /* 3. HR6000/XA-21 minimum.        */
     li*4          /* 4. Low Limit (Auto Dial Up)     */
     li*4          /* 5. High Limit (Auto Dial Up)    */
     li*4          /* 6. DeadBand (Auto Dial Up)      */
       c           /* 7. freeze ownership             */
      i*1          /* 8. Scale factor.                */


/*************************************************************************/
/*    ANALOG OUTPUT MAPPING TABLE                                        */
/*************************************************************************/

DEFINE_TABLE = 9
    NAME = A003MT05
    MAXRECS = 1          /* MAXRECS = No. DtoA points                   */
    CONTROL_WORD = 0x92
    DEFINE_RECORD:

    SIZE = * {3}

    DEFINE_DATA:
     li*4          /* 1. System point number          */
     li*4          /* 2. zero scale                   */
     li*4          /* 3. full scale                   */

/*************************************************************************/
/*    DEVICE CONFIGURATION TABLE                                         */
/*************************************************************************/

DEFINE_TABLE = 10
    NAME = A003DEVT
    MAXRECS = 1          /* MAXRECS = No. of devices configured         */
    CONTROL_WORD = 0x92
    DEFINE_RECORD:

    SIZE = * {2}

    DEFINE_DATA:
     i*2           /* 1. DCA number                   */
     i*2           /* 2. Message length               */


/*************************************************************************/
/*                                                                       */
/*              DATA_TABLE DATA                                          */
/*                                                                       */
/*************************************************************************/
```

```
/*************************************************************************/
/*    COMMUNICATION PORT CONFIGURATION TABLE                             */
/*************************************************************************/


DATA_TABLE = 1

    COM5            /* 1. COM port                    */
    9600            /* 2. Buad rate                   */
    7               /* 3. Data bits                   */
    1               /* 4. Stop bits                   */
     O              /* 5. Parity                      */
     20             /* 6. RTS on delay                */
     10             /* 7. RTS off delay               */
     360            /* 8. Channel timeout             */
     y              /* 9. Modem used                  */
     -1             /*10. Control point (COM fail)    */
     ON             /*11. Control point fail state    */
     6000           /*12. Emulation                   */
     ""             /*13. Modem Init String           */
     ""             /*14. Phone number.               */
     00             /*15. DB Check rate.              */
     00             /*16. Auto dial retry             */
     00             /*17. LRU x-ref table offset      */
      1             /*18. Number of LRUs              */
/*************************************************************************/
/*    LRU CROSS REFERENCE CONFIGURATION TABLE                            */
/*************************************************************************/

DATA_TABLE = 2

    1, 00,  /* COM5 */      /* 1. RTU address 2. LRU offset      */

/*************************************************************************/
/*    LRU CONFIGURATION TABLE                                            */
/*************************************************************************/

DATA_TABLE = 3

     15             /* 1. Number of ports             */
     6              /* 2. R/L port size (4,6,18,12,16) */
     10000          /* 3. Control arm timeout         */
     5000           /* 4. Setpoint arm timeout        */
     125            /* 5. Cos buffer size             */
     31             /* 6. MAX COS reported            */
     100            /* 7. SOE buffer size             */
     1              /* 8. SOE set size                */
     -1             /* 9. SOE buffer reset DI         */
     ON             /*10. SOE buffer reset DI state   */
     100            /*11. SOE buffer warning percentage */
     100            /*12. COS buffer warning percentage */
     Y              /*13. SOE in NVRAM                */
     Y              /*14. Keep newest SOEs.           */
     N              /*15. Local/Global Freeze         */
     N              /*16. Report chatter indication.  */
     N              /*17. Time tag frozen ACC ports.  */
     N              /*18. All points offline for offline */
     -1             /*19. Time sync loss DI point     */
     00             /*20. SOE percentage (Auto Dial Up) */
     00             /*21. COS percentage (Auto Dial Up) */
     00             /*22. AD  percentage (Auto Dial Up) */
     00             /*23. ACC percentage (Auto Dial Up) */
     00             /*24. Port configuration offset   */


/*************************************************************************/
/*    PORT CONFIGURATION TABLE                                           */
/*************************************************************************/

DATA_TABLE = 4
```

```
/*   LRU 1                                  */

/*   PORT INPUT  No.   OUTPUT No.                    */
/*   TYPE OFFSET INPUTS OFFSET OUTPUTS                    */

     1  00    32   00   00    /* C&I                */
     1  32    32   00   00    /* C&I                */
     1  64    32   00    8    /* C&I                */
     1  96    32    8    8    /* C&I                */
     1 128    32   16    8    /* C&I                */
     1 160    32   24    8    /* C&I                */
     1 192    32   32    8    /* C&I                */
     9  00     4   00   00    /* 24 BIT ACCUMULATOR    */
    00  00    00   00   00    /* SPARE              */
     3  00    32   00   00    /* ANALOG             */
     3  32    32   00   00    /* ANALOG             */
     3  64    32   00   00    /* ANALOG             */
     3  96    32   00   00    /* ANALOG             */
     3 128    32   00   00    /* ANALOG             */
     3 160    32   00   00    /* ANALOG             */

/*************************************************************************/
/*   DIGITAL INPUT MAPPING TABLE                                         */
/*************************************************************************/

DATA_TABLE = 5

/*   SYSTEM COS SOE FREEZE                          */
/*   POINT  OWN OWN OWN                             */
/* PORT 1 */
      00   Y  N  Y
       1   Y  N  Y
      -1   Y  N  Y
       3   Y  N  Y
       4   Y  N  Y
       5   Y  N  Y
       6   Y  N  Y
       7   Y  N  Y
       8   Y  N  Y
       9   Y  N  Y
      10   Y  N  Y
      11   Y  N  Y
      12   Y  N  Y
      13   Y  N  Y
      -1   Y  N  Y
      -1   Y  N  Y
      -1   Y  N  Y
      -1   Y  N  Y
      -1   Y  N  Y
      -1   Y  N  Y
      -1   Y  N  Y
      -1   Y  N  Y
      -1   Y  N  Y
      -1   Y  N  Y
      -1   Y  N  Y
      -1   Y  N  Y
      -1   Y  N  Y
      -1   Y  N  Y
      -1   Y  N  Y
      -1   Y  N  Y
      -1   Y  N  Y

/* PORT2 */
      -1   Y  N  Y
      -1   Y  N  Y
      -1   Y  N  Y
      -1   Y  N  Y
      -1   Y  N  Y
```

```
    -1  Y N Y
    -1  Y N Y
    -1  Y N Y
    -1  Y N Y
    -1  Y N Y
    -1  Y N Y
    -1  Y N Y
    -1  Y N Y
    -1  Y N Y
    -1  Y N Y
    -1  Y N Y
    -1  Y N Y
    -1  Y N Y
    -1  Y N Y
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    -1  Y N Y
    -1  Y N Y
    -1  Y N Y
    -1  Y N Y
    -1  Y N Y
    -1  Y N Y
    -1  Y N Y
    -1  Y N Y
    -1  Y N Y
    -1  Y N Y
    -1  Y N Y
    -1  Y N Y

/* PORT 3 */
    72  Y N Y
    73  Y N Y
    74  Y N Y
    75  Y N Y
    76  Y N Y
    77  Y N Y
    78  Y N Y
    79  Y N Y
    -1  Y N Y
    -1  Y N Y
    -1  Y N Y
    -1  Y N Y
    -1  Y N Y
    -1  Y N Y
    -1  Y N Y
    -1  Y N Y
    -1  Y N Y
    -1  Y N Y
    -1  Y N Y
    -1  Y N Y
    -1  Y N Y
    -1  Y N Y
    -1  Y N Y
    -1  Y N Y
    -1  Y N Y
    -1  Y N Y
    -1  Y N Y
    -1  Y N Y
    -1  Y N Y
    -1  Y N Y
    -1  Y N Y
    -1  Y N Y
    -1  Y N Y
    -1  Y N Y

/* PORT 4 */
    80  Y N Y
    81  Y N Y
    82  Y N Y
    83  Y N Y
    84  Y N Y
```

```
        85  Y  N  Y
        86  Y  N  Y
        87  Y  N  Y
        88  Y  N  Y
        89  Y  N  Y
        90  Y  N  Y
        91  Y  N  Y
        92  Y  N  Y
        93  Y  N  Y
        -1  Y  N  Y
        -1  Y  N  Y
        -1  Y  N  Y
        -1  Y  N  Y
        -1  Y  N  Y
        -1  Y  N  Y
        -1  Y  N  Y
        -1  Y  N  Y
        -1  Y  N  Y
        -1  Y  N  Y
        -1  Y  N  Y
        -1  Y  N  Y
        -1  Y  N  Y
        -1  Y  N  Y
        -1  Y  N  Y
        -1  Y  N  Y
        -1  Y  N  Y
        -1  Y  N  Y

/* PORT 5 */
        -1  Y  N  Y
        -1  Y  N  Y
        -1  Y  N  Y
        -1  Y  N  Y
        -1  Y  N  Y
        -1  Y  N  Y
        -1  Y  N  Y
        -1  Y  N  Y
        -1  Y  N  Y
        -1  Y  N  Y
        -1  Y  N  Y
        -1  Y  N  Y
        -1  Y  N  Y
        -1  Y  N  Y
        -1  Y  N  Y
        -1  Y  N  Y
        -1  Y  N  Y
        -1  Y  N  Y
        -1  Y  N  Y
        -1  Y  N  Y
        -1  Y  N  Y
        -1  Y  N  Y
        -1  Y  N  Y
        -1  Y  N  Y
        -1  Y  N  Y
        -1  Y  N  Y
        -1  Y  N  Y
        -1  Y  N  Y
        -1  Y  N  Y
        -1  Y  N  Y
        -1  Y  N  Y
        -1  Y  N  Y


/* PORT 6 */
        112  Y  N  Y
        113  Y  N  Y
        114  Y  N  Y
        115  Y  N  Y
        116  Y  N  Y
        117  Y  N  Y
```

```
      118  Y  N  Y
      119  Y  N  Y
      120  Y  N  Y
      121  Y  N  Y
      122  Y  N  Y
      123  Y  N  Y
      124  Y  N  Y
      -1  Y  N  Y
      -1  Y  N  Y
      -1  Y  N  Y
      -1  Y  N  Y
      -1  Y  N  Y
      -1  Y  N  Y
      -1  Y  N  Y
      -1  Y  N  Y
      -1  Y  N  Y
      -1  Y  N  Y
      -1  Y  N  Y
      -1  Y  N  Y
      -1  Y  N  Y
      -1  Y  N  Y
      -1  Y  N  Y
      -1  Y  N  Y
      -1  Y  N  Y
      -1  Y  N  Y
      -1  Y  N  Y

/* PORT 7 */
      -1  Y  N  Y
      -1  Y  N  Y
      -1  Y  N  Y
      -1  Y  N  Y
      -1  Y  N  Y
      -1  Y  N  Y
      -1  Y  N  Y
      -1  Y  N  Y
      -1  Y  N  Y
      -1  Y  N  Y
      -1  Y  N  Y
      -1  Y  N  Y
      -1  Y  N  Y
      -1  Y  N  Y
      -1  Y  N  Y
      -1  Y  N  Y
      -1  Y  N  Y
      -1  Y  N  Y
      -1  Y  N  Y
      -1  Y  N  Y
      -1  Y  N  Y
      -1  Y  N  Y
      -1  Y  N  Y
      -1  Y  N  Y
      -1  Y  N  Y
      -1  Y  N  Y
      -1  Y  N  Y
      -1  Y  N  Y
      -1  Y  N  Y
      -1  Y  N  Y
      -1  Y  N  Y
      -1  Y  N  Y


/***************************************************************************/
/*    DIGITAL OUTPUT MAPPING TABLE                              */
/***************************************************************************/

DATA_TABLE = 6

/*    SYSTEM DURATION/ TYPE/                          */
/*    POINT  BASE     INCREMENT                       */
```

```
    00  200    00
     1  200    00
     2  200    00
    -1  200    00
    -1  200    00
    -1  200    00
    -1  200    00
    -1  200    00

     8  200    00
     9  200    00
    10  200    00
    11  200    00
    12  200    00
    -1  200    00
    -1  200    00
    -1  200    00

    -1  200    00
    -1  200    00
    -1  200    00
    -1  200    00
    -1  200    00
    -1  200    00
    -1  200    00
    -1  200    00

    24  200    00
    25  200    00
    26  200    00
    27  200    00
    28  200    00
    -1  200    00
    -1  200    00
    -1  200    00

    -1  200    00
    -1  200    00
    -1  200    00
    -1  200    00
    -1  200    00
    -1  200    00
    -1  200    00
    -1  200    00

/***************************************************************************/
/*   COUNTER MAPPING TABLE                                    */
/***************************************************************************/

DATA_TABLE = 7


/*   SYSTEM FREEZE  TYPE   DEAD                         */
/*   POINT  OWN           BAND                     */

    00   Y    P    00
     1   Y    P    00
     2   Y    P    00
     3   Y    P    00

/***************************************************************************/
/*   ANALOG INPUT MAPPING TABLE                                */
/***************************************************************************/

DATA_TABLE = 8

/*   SYSTEM D20M HARRIS   LOW   HIGH    DEAD  FREEZE  SCALE */
```

```
/*   POINT MIN  MIN      LIMIT  LIMIT     BAND  OWN   FACTOR */

     /* -5v to 5v scaled to -2048 to 2047   */

     -1  -32767 -2048    -32767 32767    64    Y      16
     -1  -32767 -2048    -32767 32767    64    Y      16
      2  -32767 -2048    -32767 32767    64    Y      16
      3  -32767 -2048    -32767 32767    64    Y      16
      4  -32767 -2048    -32767 32767    64    Y      16
      5  -32767 -2048    -32767 32767    64    Y      16
      6  -32767 -2048    -32767 32767    64    Y      16
      7  -32767 -2048    -32767 32767    64    Y      16
      8  -32767 -2048    -32767 32767    64    Y      16
      9  -32767 -2048    -32767 32767    64    Y      16
     -1  -32767 -2048    -32767 32767    64    Y      16
     -1  -32767 -2048    -32767 32767    64    Y      16
     -1  -32767 -2048    -32767 32767    64    Y      16
     -1  -32767 -2048    -32767 32767    64    Y      16
     14  -32767 -2048    -32767 32767    64    Y      16
     15  -32767 -2048    -32767 32767    64    Y      16
     -1  -32767 -2048    -32767 32767    64    Y      16
     -1  -32767 -2048    -32767 32767    64    Y      16
     -1  -32767 -2048    -32767 32767    64    Y      16
     -1  -32767 -2048    -32767 32767    64    Y      16
     -1  -32767 -2048    -32767 32767    64    Y      16
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     -1  -32767 -2048    -32767 32767    64    Y      16
     -1  -32767 -2048    -32767 32767    64    Y      16
     -1  -32767 -2048    -32767 32767    64    Y      16
     -1  -32767 -2048    -32767 32767    64    Y      16
     -1  -32767 -2048    -32767 32767    64    Y      16
     -1  -32767 -2048    -32767 32767    64    Y      16
     -1  -32767 -2048    -32767 32767    64    Y      16

     32  -32767 -2048    -32767 32767    64    Y      16
     33  -32767 -2048    -32767 32767    64    Y      16
     34  -32767 -2048    -32767 32767    64    Y      16
     35  -32767 -2048    -32767 32767    64    Y      16
     36  -32767 -2048    -32767 32767    64    Y      16
     37  -32767 -2048    -32767 32767    64    Y      16
     38  -32767 -2048    -32767 32767    64    Y      16
     39  -32767 -2048    -32767 32767    64    Y      16
     -1  -32767 -2048    -32767 32767    64    Y      16
     -1  -32767 -2048    -32767 32767    64    Y      16
     -1  -32767 -2048    -32767 32767    64    Y      16
     -1  -32767 -2048    -32767 32767    64    Y      16
     -1  -32767 -2048    -32767 32767    64    Y      16
     -1  -32767 -2048    -32767 32767    64    Y      16
     -1  -32767 -2048    -32767 32767    64    Y      16
     -1  -32767 -2048    -32767 32767    64    Y      16
     -1  -32767 -2048    -32767 32767    64    Y      16
     -1  -32767 -2048    -32767 32767    64    Y      16
     -1  -32767 -2048    -32767 32767    64    Y      16
     -1  -32767 -2048    -32767 32767    64    Y      16
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     -1  -32767 -2048    -32767 32767    64    Y      16
     -1  -32767 -2048    -32767 32767    64    Y      16
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     -1  -32767 -2048    -32767 32767    64    Y      16
     -1  -32767 -2048    -32767 32767    64    Y      16
     -1  -32767 -2048    -32767 32767    64    Y      16
     -1  -32767 -2048    -32767 32767    64    Y      16
     -1  -32767 -2048    -32767 32767    64    Y      16
     -1  -32767 -2048    -32767 32767    64    Y      16
     -1  -32767 -2048    -32767 32767    64    Y      16
```

48	-32767	-2048	-32767	32767	64	Y	16
49	-32767	-2048	-32767	32767	64	Y	16
50	-32767	-2048	-32767	32767	64	Y	16
51	-32767	-2048	-32767	32767	64	Y	16
52	-32767	-2048	-32767	32767	64	Y	16
53	-32767	-2048	-32767	32767	64	Y	16
54	-32767	-2048	-32767	32767	64	Y	16
55	-32767	-2048	-32767	32767	64	Y	16
56	-32767	-2048	-32767	32767	64	Y	16
57	-32767	-2048	-32767	32767	64	Y	16
58	-32767	-2048	-32767	32767	64	Y	16
59	-32767	-2048	-32767	32767	64	Y	16
60	-32767	-2048	-32767	32767	64	Y	16
61	-32767	-2048	-32767	32767	64	Y	16
62	-32767	-2048	-32767	32767	64	Y	16
-1	-32767	-2048	-32767	32767	64	Y	16
-1	-32767	-2048	-32767	32767	64	Y	16
-1	-32767	-2048	-32767	32767	64	Y	16
-1	-32767	-2048	-32767	32767	64	Y	16
-1	-32767	-2048	-32767	32767	64	Y	16
-1	-32767	-2048	-32767	32767	64	Y	16
-1	-32767	-2048	-32767	32767	64	Y	16
-1	-32767	-2048	-32767	32767	64	Y	16
-1	-32767	-2048	-32767	32767	64	Y	16
-1	-32767	-2048	-32767	32767	64	Y	16
-1	-32767	-2048	-32767	32767	64	Y	16
-1	-32767	-2048	-32767	32767	64	Y	16
-1	-32767	-2048	-32767	32767	64	Y	16
-1	-32767	-2048	-32767	32767	64	Y	16
-1	-32767	-2048	-32767	32767	64	Y	16
-1	-32767	-2048	-32767	32767	64	Y	16
-1	-32767	-2048	-32767	32767	64	Y	16

64	-32767	-2048	-32767	32767	64	Y	16
65	-32767	-2048	-32767	32767	64	Y	16
66	-32767	-2048	-32767	32767	64	Y	16
67	-32767	-2048	-32767	32767	64	Y	16
68	-32767	-2048	-32767	32767	64	Y	16
-1	-32767	-2048	-32767	32767	64	Y	16
-1	-32767	-2048	-32767	32767	64	Y	16
-1	-32767	-2048	-32767	32767	64	Y	16
72	-32767	-2048	-32767	32767	64	Y	16
73	-32767	-2048	-32767	32767	64	Y	16
74	-32767	-2048	-32767	32767	64	Y	16
75	-32767	-2048	-32767	32767	64	Y	16
76	-32767	-2048	-32767	32767	64	Y	16
-1	-32767	-2048	-32767	32767	64	Y	16
-1	-32767	-2048	-32767	32767	64	Y	16
-1	-32767	-2048	-32767	32767	64	Y	16
-1	-32767	-2048	-32767	32767	64	Y	16
-1	-32767	-2048	-32767	32767	64	Y	16
-1	-32767	-2048	-32767	32767	64	Y	16
-1	-32767	-2048	-32767	32767	64	Y	16
-1	-32767	-2048	-32767	32767	64	Y	16
-1	-32767	-2048	-32767	32767	64	Y	16
-1	-32767	-2048	-32767	32767	64	Y	16
-1	-32767	-2048	-32767	32767	64	Y	16
-1	-32767	-2048	-32767	32767	64	Y	16
-1	-32767	-2048	-32767	32767	64	Y	16
-1	-32767	-2048	-32767	32767	64	Y	16
-1	-32767	-2048	-32767	32767	64	Y	16
-1	-32767	-2048	-32767	32767	64	Y	16
-1	-32767	-2048	-32767	32767	64	Y	16
-1	-32767	-2048	-32767	32767	64	Y	16
-1	-32767	-2048	-32767	32767	64	Y	16

80	-32767	-2048	-32767	32767	64	Y	16
81	-32767	-2048	-32767	32767	64	Y	16
82	-32767	-2048	-32767	32767	64	Y	16
83	-32767	-2048	-32767	32767	64	Y	16

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84 -32767 -2048   -32767 32767   64   Y   16
85 -32767 -2048   -32767 32767   64   Y   16
86 -32767 -2048   -32767 32767   64   Y   16
87 -32767 -2048   -32767 32767   64   Y   16
88 -32767 -2048   -32767 32767   64   Y   16
89 -32767 -2048   -32767 32767   64   Y   16
90 -32767 -2048   -32767 32767   64   Y   16
91 -32767 -2048   -32767 32767   64   Y   16
-1 -32767 -2048   -32767 32767   64   Y   16
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-1 -32767 -2048   -32767 32767   64   Y   16
-1 -32767 -2048   -32767 32767   64   Y   16
-1 -32767 -2048   -32767 32767   64   Y   16
-1 -32767 -2048   -32767 32767   64   Y   16


/*****************************************************************************/
/*   ANALOG OUTPUT MAPPING TABLE                                 */
/*****************************************************************************/

DATA_TABLE = 9

/*   SYSTEM ZERO  FULL                          */
```

```
/*    POINT  SCALE SCALE                                    */

      -1    65535  32767     /* 4 to 20mA range (20mA adaptors)       */

/*************************************************************************/
/*    DEVICE CONFIGURATION TABLE                              */
/*************************************************************************/

DATA_TABLE = 10

/*    DCA   MESSAGE                                  */
/*    NUMBER LENGTH                                    */

      1,    256         /*                          */
```

C.2. A009 - PG&E Protocol Configuration File

```
/* ************************************************************************** */
/*                                  A009_CFG  */
/*  Name:       Pacific Gas and Electric Protocol Configuration      */
/*  Author:     Quint G. Nagramada - Substation Engineering          */
/*  Date:       January 12, 1993                                     */
/*                                                                   */
/*  Description:  The following are the record definitions for the   */
/*          Pacific Gas and Electric (PG&E) protocol.                */
/*                                                                   */
/*          PVUSA KERMAN PHOTOVOLTAIC PLANT                          */
/*                                                                   */
/* ************************************************************************** */

DEFINE_TABLE = 1          /* Port configuration table definition      */
  NAME = A009_CFG
  MAXRECS = 4          /* Number PG&E protocols running in system    */
  CONTROL_WORD = 0x12    /* Multi-Element, NVRAM, Read / Write       */
  DEFINE_RECORD:
    SIZE = * { 11 }
  DEFINE_DATA:
    u*2,     /* RTS_On_Delay (Minimum turnaround time)              */
    u*2,     /* RTS_Off_Delay (RTS hold on after finished Tx)       */
    u*2,     /* Character to character timeout (milliseconds)       */
    u*2,     /* Communication port timeout (milliseconds)           */
    u*2,     /* Baud rate ( 1200, 2400, 4800, 9600 )                */
    u*1,     /* Number of stop bits per character (1 or 2)          */
    u*1,     /* Parity Checking (None = 0, Odd = 1, Even = 2)       */
    u*1,     /* Number of logical RTU's defined for this port       */
    u*1,     /* Offset to first Logical Rtu in LRU cross reference  */
    s*5      /* Communication Port Name                             */
    b        /* Byte filler for word alignment                      */

  /* ************************************************************************** */
DEFINE_TABLE = 2          /* Logical RTU Cross Reference Tbl Definition  */
  NAME = A009_LXR      /* # of com port to LRU cross ref in this table  */
  MAXRECS = 4          /* Number of logical RTU's (all channels)      */
  CONTROL_WORD = 0x12  /* Multi-Element, NVRAM, read / write          */
  DEFINE_RECORD:
    SIZE = * {2}
  DEFINE_DATA:
    u*2,          /* PG&E RTU address for this logical RTU          */
    u*2           /* LRU number offset into LRU config table        */

  /* ************************************************************************** */
DEFINE_TABLE = 3          /* Logical RTU Configuration table definition  */
  NAME = A009_LRU      /* Logical Remote Unit                         */
  MAXRECS = 4          /* Number of  LRU ( all channels)              */
  CONTROL_WORD = 0x12  /* Multi-Element, NVRAM, read / write          */
  DEFINE_RECORD:
    SIZE = * { 8 }
  DEFINE_DATA:
    u*2,          /* Control ARM/EXECUTE Timeout (Milliseconds)   */
    u*2,          /* SOE Buffer Size (Number of Events)           */
    u*1,          /* pSOS LRU priority (50 (low) to 250 (high))   */
    u*1,          /* Normal (0) or virtual (1) mode of operation  */
    u*1,          /* Analog SOE enable (1) or disable (0) flag    */
    u*1,          /* MCD edge (0->1 = 0, 1->0 = 1, both = 2       */
    u*1,          /* Status ctr edge (0->1 = 0, 1->0 = 1, Both = 2)*/
    u*1           /* Number of LU's for LRU (virtual + 1 Normal)  */

  /* ************************************************************************** */
DEFINE_TABLE = 4          /* Logical Unit Config Table Definition        */
  NAME = A009_LU
  MAXRECS = 4          /* Number of Logical Units within LRUs         */
  CONTROL_WORD = 0x12    /* Multi-Element, NVRAM, Read / Write        */
  DEFINE_RECORD:
    SIZE = * { 11 }
  DEFINE_DATA:
```

```
      u[2]*2,          /* Offset, number in pulsed  ctl map table     */
      u[2]*2,          /* Offset, number in raise/lower map table     */
      u[2]*2,          /* Offset, number in status/SOE map table      */
      u[2]*2,          /* Offset, number in accumulator map table     */
      u[2]*2,          /* Offset, number in analog input map table    */
        u*2           /* IRIG-B local clock indication point number */
                     /* 65535 (-1) = disable                  */

  /* ************************************************************************ */
DEFINE_TABLE = 5          /* Status/SOE map table definition           */
   NAME = A009MT01
   MAXRECS = 560
                  /* (excluding points reserved for accumulators) */
   CONTROL_WORD = 0x12     /* Multi - Element, NVRAM, Read / Write       */
   DEFINE_RECORD:
     SIZE = * { 3 }
   DEFINE_DATA:
      u*2,           /* Mapped point                          */
      u*1,           /* Flags - SOE_EN (Bit 0), K_BIT (Bit 1)       */
      b             /* Even word alignment                    */

  /* ************************************************************************ */
DEFINE_TABLE = 6          /* Analog map table definition               */
   NAME = A009MT04
   MAXRECS = 448
   CONTROL_WORD = 0x12     /* Multi - Element, NVRAM, Read / Write       */
   DEFINE_RECORD:
     SIZE = * { 3 }
   DEFINE_DATA:
      u*2,           /* Mapped point                          */
      u*1,           /* Exception deadband value                 */
      u*1            /* SOE deadband value                     */

  /* ************************************************************************ */
DEFINE_TABLE = 7          /* Bistable control map table definition      */
   NAME = A009MC01
   MAXRECS = 160
   CONTROL_WORD = 0x12     /* Multi - Element, NVRAM, Read / Write       */
   DEFINE_RECORD:
     SIZE = * { 3 }
   DEFINE_DATA:
      u*2,           /* Mapped point                          */
      u*1,           /* Control duration * .1 sec for output      */
      u*1            /* Ctl type (On/Off = 0, MT = 128, MC = 64)    */


  /* ************************************************************************ */
DEFINE_TABLE = 8          /* Raise/Lower map table definition          */
   NAME = A009MC02
   MAXRECS = 0          /* Number of raise/lower pairs              */
   CONTROL_WORD = 0x12     /* Multi-Element, NVRAM, Read / Write         */
   DEFINE_RECORD:
     SIZE = * { 2 }
   DEFINE_DATA:
      u*2,           /* Mapped raise point for pair              */
      u*2            /* Mapped lower point for pair               */

  /* ************************************************************************ */
DEFINE_TABLE = 9          /* Accumulator definition table              */
   NAME = A009MT03
   MAXRECS = 16          /* Number of counters ( form C equals one )    */
   CONTROL_WORD = 0x12     /* Multi-Element, NVRAM, Read / Write         */
   DEFINE_RECORD:
      SIZE = * {3}
   DEFINE_DATA:
      u*2,           /* Hardware point number                 */
      u*1,           /* Counter type  1 - Transition             */
      b             /*          2 - Pulse                */
```

```
/* ************************************************************************ */

DATA_TABLE = 1          /* Port Configuration Table Definition      */

  50,       /* RTS On Delay = 50 ms                          */
  30,       /* RTS Off Delay = 30 ms                         */
  30,       /* Character to character timeout = 30 ms        */
  60000,      /* Communication port timeout = 60 seconds     */
  1200,       /* Baud rate = 1200 baud                       */
  2,        /* Stop bits = 2                                 */
  0,        /* Parity   = None                               */
  1,        /* 1 Logical RTU defined on this COM port        */
  0,        /* Offset of 0 into the LRU cross reference table */
  "COM1",     /* Using D20 M communication port #1 - s101    */

  50,       /* RTS On Delay = 50 ms                          */
  30,       /* RTS Off Delay = 30 ms                         */
  30,       /* Character to character timeout = 30 ms        */
  60000,      /* Communication port timeout = 60 seconds     */
  1200,       /* Baud rate = 1200 baud                       */
  2,        /* Stop bits = 2                                 */
  0,        /* Parity   = None                               */
  1,        /* 1 Logical RTU defined on this COM port        */
  1,        /* Offset of 0 into the LRU cross reference table */
  "COM2",     /* Using D20 M communication port #2           */

  50,       /* RTS On Delay = 50 ms                          */
  30,       /* RTS Off Delay = 30 ms                         */
  30,       /* Character to character timeout = 30 ms        */
  60000,      /* Communication port timeout = 60 seconds     */
  1200,       /* Baud rate = 1200 baud                       */
  2,        /* Stop bits = 2                                 */
  0,        /* Parity   = None                               */
  1,        /* 1 Logical RTU defined on this COM port        */
  2,        /* Offset of 0 into the LRU cross reference table */
  "COM3",     /* Using D20 M communication port #3           */

  50,       /* RTS On Delay = 50 ms                          */
  30,       /* RTS Off Delay = 30 ms                         */
  30,       /* Character to character timeout = 30 ms        */
  60000,      /* Communication port timeout = 60 seconds     */
  1200,       /* Baud rate = 1200 baud                       */
  2,        /* Stop bits = 2                                 */
  0,        /* Parity   = None                               */
  1,        /* 1 Logical RTU defined on this COM port        */
  3,        /* Offset of 0 into the LRU cross reference table */
  "COM4",     /* Using D20 M communication port #4           */

  /* ************************************************************************ */

DATA_TABLE = 2    /* Logical RTU Cross Reference Configuration Table    */

  704,      /* PG&E RTU address for this logical RTU         */
  0,        /* LRU number offset into LRU config table       */

  704,        /* Port 2 RTU address = 704                    */
  1,        /* LRU  number offset into LRU config table      */

  704,        /* Port 3 RTU address = 704                    */
  2,        /* LRU number offset into LRU config table       */

  704,      /* Port 4 RTU address = 704                      */
  3,        /* LRU number offset into LRU config table       */
/* ************************************************************************ */

DATA_TABLE = 3    /* LRU configuration Table                   */

  5000,     /* Control Arm Timeout = 5 second                */
  400,      /* SOE buffer maximum size = 400 events          */
  100,      /* pSOS LRU priority = 100 (normal)              */
```

```
 0,        /* Virtual (1) ; Normal (0)                    */
 0,        /* Analog SOE disabled                         */
 2,        /* MCD counts both 0->1 and 1->0 edges          */
 1,        /* Status counters count on 1->0 edges only     */
 1,        /* 1 Normal Unit                               */

 5000,      /* Control Arm Timeout = 5 second              */
 400,       /* SOE buffer maximum size = 400 events         */
 100,       /* pSOS LRU priority = 100 (normal)            */
 0,        /* Virtual (1) ; Normal (0)                    */
 0,        /* Analog SOE disabled                         */
 2,        /* MCD counts both 0->1 and 1->0 edges          */
 1,        /* Status counters count on 1->0 edges only     */
 1,        /* 1 Normal Unit                               */

 5000,      /* Control Arm Timeout = 5 second              */
 400,       /* SOE buffer maximum size = 400 events         */
 100,       /* pSOS LRU priority = 100 (normal)            */
 0,        /* Virtual (1) ; Normal (0)                    */
 0,        /* Analog SOE disabled                         */
 2,        /* MCD counts both 0->1 and 1->0 edges          */
 1,        /* Status counters count on 1->0 edges only     */
 1,        /* 1 Normal Unit                               */

 5000,      /* Control Arm Timeout = 5 second              */
 400,       /* SOE buffer maximum size = 400 events         */
 100,       /* pSOS LRU priority = 100 (normal)            */
 0,        /* Virtual (1) ; Normal (0)                    */
 0,        /* Analog SOE disabled                         */
 2,        /* MCD counts both 0->1 and 1->0 edges          */
 1,        /* Status counters count on 1->0 edges only     */
 1,        /* 1 Normal Unit                               */

/* ************************************************************************** */

DATA_TABLE = 4          /* L.U. Configuration Table Definition       */

 /* Port 1 LU's config                          */

      /* Offset, number in normal mode ctl. output map tbl        */
      /* Offset, number in normal mode raise/lower map tbl        */
      /* Offset, number in normal mode status/SOE  map tbl        */
      /* Offset, number in normal mode accumulator map tbl        */
      /* Offset, number in normal mode analog input map tbl       */

 00, 40,
 00, 00,
 00, 140,          /* Normal mode unit, */
 00,  4,
 00, 112,
  151,  /* IRIG-B local clock indication point number       */


 /* Port 2 LU's config                          */

      /* Offset, number in normal mode ctl. output map tbl        */
      /* Offset, number in normal mode raise/lower map tbl      . */
      /* Offset, number in normal mode status/SOE  map tbl        */
      /* Offset, number in normal mode accumulator map tbl        */
      /* Offset, number in normal mode analog input map tbl       */

 40, 40,
 00, 00,
140, 140,          /* Normal mode unit, */
  4,  4,
112, 112,
  151,  /* IRIG-B local clock indication point number       */
```

```
/* Port 3 LU's config                                    */

      /* Offset, number in normal mode ctl. output map tbl      */
      /* Offset, number in normal mode raise/lower map tbl      */
      /* Offset, number in normal mode status/SOE  map tbl      */
      /* Offset, number in normal mode accumulator map tbl      */
      /* Offset, number in normal mode analog input map tbl     */

 80, 40,
 00, 00,
280, 140,          /* Normal mode unit, */
  8,  4,
224, 112,
  151, /* IRIG-B local clock indication point number      */


/* Port 4 LU's config                                    */

      /* Offset, number in normal mode ctl. output map tbl      */
      /* Offset, number in normal mode raise/lower map tbl      */
      /* Offset, number in normal mode status/SOE  map tbl      */
      /* Offset, number in normal mode accumulator map tbl      */
      /* Offset, number in normal mode analog input map tbl     */

 120, 40,
 00, 00,
 420, 140,          /* Normal mode unit, */
  12,  4,
 336, 112,
  151, /* IRIG-B local clock indication point number      */


/* ************************************************************************ */

DATA_TABLE = 5          /* Status/SOE point mapping          */

/* ------------------ LRU #0 - Port 1 ------------------*/

  0,3,  1,3,  2,3,  3,3,  4,3,  5,3,  6,3,  7,3,  8,3,  9,3,
 10,3, 11,3, 12,3, 13,3, 14,3, 15,3, 16,3, 17,3, 18,3, 19,3,
 20,3, 21,3, 22,3, 23,3, 24,3, 25,3, 26,3, 27,3, 28,3, 29,3,
 30,3, 31,3, 22,3, 33,3, 34,3, 35,3, 36,3, 37,3, 38,3, 39,3,
 40,3, 41,3, 42,3, 43,3, 44,3, 45,3, 46,3, 47,3, 48,3, 49,3,
 50,3, 51,3, 52,3, 53,3, 54,3, 55,3, 56,3, 57,3, 58,3, 59,3,
 60,3, 61,3, 62,3, 63,3,                68,3, 69,3,
 70,3, 71,3, 72,3, 73,3, 74,3, 75,3, 76,3, 77,3, 78,3, 79,3,
 80,3, 81,3, 82,3, 83,3, 84,3, 85,3, 86,3, 87,3, 88,3, 89,3,
 90,3, 91,3, 92,3, 93,3, 94,3, 95,3, 96,3, 97,3, 98,3, 99,3,
100,3,101,3,102,3,103,3,104,3,105,3,106,3,107,3,108,3,109,3,
110,3,111,3,112,3,113,3,114,3,115,3,116,3,117,3,118,3,119,3,
120,3,121,3,122,3,123,3,124,3,125,3,126,3,127,3,128,3,129,3,
130,3,131,3,132,3,133,3,134,3,135,3,136,3,137,3,138,3,139,3,
140,3,141,3,142,3,143,3,


/* ------------------ LRU #1 - Port 2 ------------------ */

  0,3,  1,3,  2,3,  3,3,  4,3,  5,3,  6,3,  7,3,  8,3,  9,3,
 10,3, 11,3, 12,3, 13,3, 14,3, 15,3, 16,3, 17,3, 18,3, 19,3,
 20,3, 21,3, 22,3, 23,3, 24,3, 25,3, 26,3, 27,3, 28,3, 29,3,
 30,3, 31,3, 22,3, 33,3, 34,3, 35,3, 36,3, 37,3, 38,3, 39,3,
 40,3, 41,3, 42,3, 43,3, 44,3, 45,3, 46,3, 47,3, 48,3, 49,3,
 50,3, 51,3, 52,3, 53,3, 54,3, 55,3, 56,3, 57,3, 58,3, 59,3,
 60,3, 61,3, 62,3, 63,3,                68,3, 69,3,
 70,3, 71,3, 72,3, 73,3, 74,3, 75,3, 76,3, 77,3, 78,3, 79,3,
 80,3, 81,3, 82,3, 83,3, 84,3, 85,3, 86,3, 87,3, 88,3, 89,3,
 90,3, 91,3, 92,3, 93,3, 94,3, 95,3, 96,3, 97,3, 98,3, 99,3,
```

```
 100,3,101,3,102,3,103,3,104,3,105,3,106,3,107,3,108,3,109,3,
 110,3,111,3,112,3,113,3,114,3,115,3,116,3,117,3,118,3,119,3,
 120,3,121,3,122,3,123,3,124,3,125,3,126,3,127,3,128,3,129,3,
 130,3,131,3,132,3,133,3,134,3,135,3,136,3,137,3,138,3,139,3,
 140,3,141,3,142,3,143,3,


/* ---------- LRU #2 - Port 3 ---------- */

  0,3,  1,3,  2,3,  3,3,  4,3,  5,3,  6,3,  7,3,  8,3,  9,3,
 10,3, 11,3, 12,3, 13,3, 14,3, 15,3, 16,3, 17,3, 18,3, 19,3,
 20,3, 21,3, 22,3, 23,3, 24,3, 25,3, 26,3, 27,3, 28,3, 29,3,
 30,3, 31,3, 22,3, 33,3, 34,3, 35,3, 36,3, 37,3, 38,3, 39,3,
 40,3, 41,3, 42,3, 43,3, 44,3, 45,3, 46,3, 47,3, 48,3, 49,3,
 50,3, 51,3, 52,3, 53,3, 54,3, 55,3, 56,3, 57,3, 58,3, 59,3,
 60,3, 61,3, 62,3, 63,3,                68,3, 69,3,
 70,3, 71,3, 72,3, 73,3, 74,3, 75,3, 76,3, 77,3, 78,3, 79,3,
 80,3, 81,3, 82,3, 83,3, 84,3, 85,3, 86,3, 87,3, 88,3, 89,3,
 90,3, 91,3, 92,3, 93,3, 94,3, 95,3, 96,3, 97,3, 98,3, 99,3,
100,3,101,3,102,3,103,3,104,3,105,3,106,3,107,3,108,3,109,3,
110,3,111,3,112,3,113,3,114,3,115,3,116,3,117,3,118,3,119,3,
120,3,121,3,122,3,123,3,124,3,125,3,126,3,127,3,128,3,129,3,
130,3,131,3,132,3,133,3,134,3,135,3,136,3,137,3,138,3,139,3,
140,3,141,3,142,3,143,3,


/* ---------- LRU #3 - Port 4 ---------- */

  0,3,  1,3,  2,3,  3,3,  4,3,  5,3,  6,3,  7,3,  8,3,  9,3,
 10,3, 11,3, 12,3, 13,3, 14,3, 15,3, 16,3, 17,3, 18,3, 19,3,
 20,3, 21,3, 22,3, 23,3, 24,3, 25,3, 26,3, 27,3, 28,3, 29,3,
 30,3, 31,3, 22,3, 33,3, 34,3, 35,3, 36,3, 37,3, 38,3, 39,3,
 40,3, 41,3, 42,3, 43,3, 44,3, 45,3, 46,3, 47,3, 48,3, 49,3,
 50,3, 51,3, 52,3, 53,3, 54,3, 55,3, 56,3, 57,3, 58,3, 59,3,
 60,3, 61,3, 62,3, 63,3,                68,3, 69,3,
 70,3, 71,3, 72,3, 73,3, 74,3, 75,3, 76,3, 77,3, 78,3, 79,3,
 80,3, 81,3, 82,3, 83,3, 84,3, 85,3, 86,3, 87,3, 88,3, 89,3,
 90,3, 91,3, 92,3, 93,3, 94,3, 95,3, 96,3, 97,3, 98,3, 99,3,
100,3,101,3,102,3,103,3,104,3,105,3,106,3,107,3,108,3,109,3,
110,3,111,3,112,3,113,3,114,3,115,3,116,3,117,3,118,3,119,3,
120,3,121,3,122,3,123,3,124,3,125,3,126,3,127,3,128,3,129,3,
130,3,131,3,132,3,133,3,134,3,135,3,136,3,137,3,138,3,139,3,
140,3,141,3,142,3,143,3,


/* ********************************************************************** */


DATA_TABLE = 6          /* Analog point mapping                */

/* ---------- LRU #0 - Port 1  ( Analog ) ---------- */

   0,10,00,  1,10,00,  2,10,00,  3,10,00,  4,10,00,  5,10,00,
   6,10,00,  7,10,00,  8,10,00,  9,10,00, 10,10,00, 11,10,00,
  12,10,00, 13,10,00, 14,10,00, 15,10,00, 16,10,00, 17,10,00,
  18,10,00, 19,10,00, 20,10,00, 21,10,00, 22,10,00, 23,10,00,
  24,10,00, 25,10,00, 26,10,00, 27,10,00, 28,10,00, 29,10,00,
  30,10,00, 31,10,00, 32,10,00, 33,10,00, 34,10,00, 35,10,00,
  36,10,00, 37,10,00, 38,10,00, 39,10,00, 40,10,00, 41,10,00,
  42,10,00, 43,10,00, 44,10,00, 45,10,00, 46,10,00, 47,10,00,
  48,10,00, 49,10,00, 50,10,00, 51,10,00, 52,10,00, 53,10,00,
  54,10,00, 55,10,00, 56,10,00, 57,10,00, 58,10,00, 59,10,00,
  60,10,00, 61,10,00, 62,10,00, 63,10,00, 64,10,00, 65,10,00,
  66,10,00, 67,10,00, 68,10,00, 69,10,00, 70,10,00, 71,10,00,
  72,10,00, 73,10,00, 74,10,00, 75,10,00, 76,10,00, 77,10,00,
  78,10,00, 79,10,00, 80,10,00, 81,10,00, 82,10,00, 83,10,00,
  84,10,00, 85,10,00, 86,10,00, 87,10,00, 88,10,00, 89,10,00,
  90,10,00, 91,10,00, 92,10,00, 93,10,00, 94,10,00, 95,10,00,
  96,10,00, 97,10,00, 98,10,00, 99,10,00,100,10,00,101,10,00,
 102,10,00,103,10,00,104,10,00,105,10,00,106,10,00,107,10,00,
```

```
 108,10,00,109,10,00,110,10,00,111,10,00,

/* ---------- LRU #1 - Port 2  ( Analog ) ---------- */

  0,10,00,  1,10,00,  2,10,00,  3,10,00,  4,10,00,  5,10,00,
  6,10,00,  7,10,00,  8,10,00,  9,10,00, 10,10,00, 11,10,00,
 12,10,00, 13,10,00, 14,10,00, 15,10,00, 16,10,00, 17,10,00,
 18,10,00, 19,10,00, 20,10,00, 21,10,00, 22,10,00, 23,10,00,
 24,10,00, 25,10,00, 26,10,00, 27,10,00, 28,10,00, 29,10,00,
 30,10,00, 31,10,00, 32,10,00, 33,10,00, 34,10,00, 35,10,00,
 36,10,00, 37,10,00, 38,10,00, 39,10,00, 40,10,00, 41,10,00,
 42,10,00, 43,10,00, 44,10,00, 45,10,00, 46,10,00, 47,10,00,
 48,10,00, 49,10,00, 50,10,00, 51,10,00, 52,10,00, 53,10,00,
 54,10,00, 55,10,00, 56,10,00, 57,10,00, 58,10,00, 59,10,00,
 60,10,00, 61,10,00, 62,10,00, 63,10,00, 64,10,00, 65,10,00,
 66,10,00, 67,10,00, 68,10,00, 69,10,00, 70,10,00, 71,10,00,
 72,10,00, 73,10,00, 74,10,00, 75,10,00, 76,10,00, 77,10,00,
 78,10,00, 79,10,00, 80,10,00, 81,10,00, 82,10,00, 83,10,00,
 84,10,00, 85,10,00, 86,10,00, 87,10,00, 88,10,00, 89,10,00,
 90,10,00, 91,10,00, 92,10,00, 93,10,00, 94,10,00, 95,10,00,
 96,10,00, 97,10,00, 98,10,00, 99,10,00,100,10,00,101,10,00,
102,10,00,103,10,00,104,10,00,105,10,00,106,10,00,107,10,00,
108,10,00,109,10,00,110,10,00,111,10,00,

/* ---------- LRU #2 - Port 3  ( Analog ) ---------- */

  0,10,00,  1,10,00,  2,10,00,  3,10,00,  4,10,00,  5,10,00,
  6,10,00,  7,10,00,  8,10,00,  9,10,00, 10,10,00, 11,10,00,
 12,10,00, 13,10,00, 14,10,00, 15,10,00, 16,10,00, 17,10,00,
 18,10,00, 19,10,00, 20,10,00, 21,10,00, 22,10,00, 23,10,00,
 24,10,00, 25,10,00, 26,10,00, 27,10,00, 28,10,00, 29,10,00,
 30,10,00, 31,10,00, 32,10,00, 33,10,00, 34,10,00, 35,10,00,
 36,10,00, 37,10,00, 38,10,00, 39,10,00, 40,10,00, 41,10,00,
 42,10,00, 43,10,00, 44,10,00, 45,10,00, 46,10,00, 47,10,00,
 48,10,00, 49,10,00, 50,10,00, 51,10,00, 52,10,00, 53,10,00,
 54,10,00, 55,10,00, 56,10,00, 57,10,00, 58,10,00, 59,10,00,
 60,10,00, 61,10,00, 62,10,00, 63,10,00, 64,10,00, 65,10,00,
 66,10,00, 67,10,00, 68,10,00, 69,10,00, 70,10,00, 71,10,00,
 72,10,00, 73,10,00, 74,10,00, 75,10,00, 76,10,00, 77,10,00,
 78,10,00, 79,10,00, 80,10,00, 81,10,00, 82,10,00, 83,10,00,
 84,10,00, 85,10,00, 86,10,00, 87,10,00, 88,10,00, 89,10,00,
 90,10,00, 91,10,00, 92,10,00, 93,10,00, 94,10,00, 95,10,00,
 96,10,00, 97,10,00, 98,10,00, 99,10,00,100,10,00,101,10,00,
102,10,00,103,10,00,104,10,00,105,10,00,106,10,00,107,10,00,
108,10,00,109,10,00,110,10,00,111,10,00,

/* ---------- LRU #3 - Port 4  ( Analog ) ---------- */

  0,10,00,  1,10,00,  2,10,00,  3,10,00,  4,10,00,  5,10,00,
  6,10,00,  7,10,00,  8,10,00,  9,10,00, 10,10,00, 11,10,00,
 12,10,00, 13,10,00, 14,10,00, 15,10,00, 16,10,00, 17,10,00,
 18,10,00, 19,10,00, 20,10,00, 21,10,00, 22,10,00, 23,10,00,
 24,10,00, 25,10,00, 26,10,00, 27,10,00, 28,10,00, 29,10,00,
 30,10,00, 31,10,00, 32,10,00, 33,10,00, 34,10,00, 35,10,00,
 36,10,00, 37,10,00, 38,10,00, 39,10,00, 40,10,00, 41,10,00,
 42,10,00, 43,10,00, 44,10,00, 45,10,00, 46,10,00, 47,10,00,
 48,10,00, 49,10,00, 50,10,00, 51,10,00, 52,10,00, 53,10,00,
 54,10,00, 55,10,00, 56,10,00, 57,10,00, 58,10,00, 59,10,00,
 60,10,00, 61,10,00, 62,10,00, 63,10,00, 64,10,00, 65,10,00,
 66,10,00, 67,10,00, 68,10,00, 69,10,00, 70,10,00, 71,10,00,
 72,10,00, 73,10,00, 74,10,00, 75,10,00, 76,10,00, 77,10,00,
 78,10,00, 79,10,00, 80,10,00, 81,10,00, 82,10,00, 83,10,00,
 84,10,00, 85,10,00, 86,10,00, 87,10,00, 88,10,00, 89,10,00,
 90,10,00, 91,10,00, 92,10,00, 93,10,00, 94,10,00, 95,10,00,
 96,10,00, 97,10,00, 98,10,00, 99,10,00,100,10,00,101,10,00,
102,10,00,103,10,00,104,10,00,105,10,00,106,10,00,107,10,00,
108,10,00,109,10,00,110,10,00,111,10,00,
```

```
/* ************************************************************************** */


DATA_TABLE = 7          /* Control point mapping                */

/* ---------------- LRU #0 - Port 1  ( Control ) ---------------- */

    0,10,00,  1,10,00,  2,10,00,  3,10,00,  4,10,00,  5,10,00,
    6,10,00,  7,10,00,  8,10,00,  9,10,00, 10,10,00, 11,10,00,
   12,10,00, 13,10,00, 14,10,00, 15,10,00, 16,10,00, 17,10,00,
   18,10,00, 19,10,00, 20,10,00, 21,10,00, 22,10,00, 23,10,00,
   24,10,00, 25,10,00, 26,10,00, 27,10,00, 28,10,00, 29,10,00,
   30,10,00, 31,10,00, 32,10,00, 33,10,00, 34,10,00, 35,10,00,
   36,10,00, 37,10,00, 38,10,00, 39,10,00,

/* ---------------- LRU #1 - Port 2  ( Control ) ---------------- */

    0,10,00,  1,10,00,  2,10,00,  3,10,00,  4,10,00,  5,10,00,
    6,10,00,  7,10,00,  8,10,00,  9,10,00, 10,10,00, 11,10,00,
   12,10,00, 13,10,00, 14,10,00, 15,10,00, 16,10,00, 17,10,00,
   18,10,00, 19,10,00, 20,10,00, 21,10,00, 22,10,00, 23,10,00,
   24,10,00, 25,10,00, 26,10,00, 27,10,00, 28,10,00, 29,10,00,
   30,10,00, 31,10,00, 32,10,00, 33,10,00, 34,10,00, 35,10,00,
   36,10,00, 37,10,00, 38,10,00, 39,10,00,

/* ---------------- LRU #2 - Port 3  ( Control ) ---------------- */

    0,10,00,  1,10,00,  2,10,00,  3,10,00,  4,10,00,  5,10,00,
    6,10,00,  7,10,00,  8,10,00,  9,10,00, 10,10,00, 11,10,00,
   12,10,00, 13,10,00, 14,10,00, 15,10,00, 16,10,00, 17,10,00,
   18,10,00, 19,10,00, 20,10,00, 21,10,00, 22,10,00, 23,10,00,
   24,10,00, 25,10,00, 26,10,00, 27,10,00, 28,10,00, 29,10,00,
   30,10,00, 31,10,00, 32,10,00, 33,10,00, 34,10,00, 35,10,00,
   36,10,00, 37,10,00, 38,10,00, 39,10,00,

/* ---------------- LRU #3 - Port 4  ( Control ) ---------------- */

    0,10,00,  1,10,00,  2,10,00,  3,10,00,  4,10,00,  5,10,00,
    6,10,00,  7,10,00,  8,10,00,  9,10,00, 10,10,00, 11,10,00,
   12,10,00, 13,10,00, 14,10,00, 15,10,00, 16,10,00, 17,10,00,
   18,10,00, 19,10,00, 20,10,00, 21,10,00, 22,10,00, 23,10,00,
   24,10,00, 25,10,00, 26,10,00, 27,10,00, 28,10,00, 29,10,00,
   30,10,00, 31,10,00, 32,10,00, 33,10,00, 34,10,00, 35,10,00,
   36,10,00, 37,10,00, 38,10,00, 39,10,00,

/* ************************************************************************** */

DATA_TABLE = 9          /* Accumulator - Form "A" pulse  (0 TO 3) */

  0,2,  1,2,  2,2,  3,2,    /* port 1 Normal mode unit (4 pts mapped) */
  0,2,  1,2,  2,2,  3,2,    /* port 2 Normal mode unit (4 pts mapped) */
  0,2,  1,2,  2,2,  3,2,    /* port 3 Normal mode unit (4 pts mapped) */
  0,2,  1,2,  2,2,  3,2,    /* port 4 Normal mode unit (4 pts mapped) */

/* ************************** The End ********************************** */
```

C.3. A026 - Data Translation Application (DTA) Configuration File

```
/*****************************************************************************/
/*                                                        */
/* File:  A026_CFG.TXT                                    */
/*                                                        */
/*                                                        */
/* Client: NPC                                            */
/* Author: Paul Morton                                    */
/* Date:   May 14, 1990                                   */
/*                                                        */
/* ((C)) Copyright Westronic Inc., 1990.  All rights reserved.   */
/* Licensed Material - Property of Westronic Inc.         */
/*                                                        */
/*                                                        */
/*                                                        */
/* Description:                                           */
/*                                                        */
/* This module contains the configuration tables for this data   */
/* translation application. (DTA).  This DTA interfaces to WIN   */
/* and will monitor defined system points for communications     */
/* online and offline events.  When these events occur then a    */
/* digital input point will be set or cleared in the system data */
/* base.  .                                               */
/*                                                        */
/* For version 1.00, this DTA will only monitor the comms online/ */
/* offline flag for digital inputs to determine the online/offline */
/* status.  For VCS archived version 101, this application will also */
/* monitor online/offline status of analog inputs.  To determine the */
/* type of input being monitored, you must fill in the first element */
/* of each "pseudo status point definition" record with,  */
/*                                                        */
/*       1 - to monitor digital inputs  (1 == A026_DIGITAL)   */
/*       2 - to monitor analog  inputs  (2 == A026_ANALOG)    */
/*                                                        */
/*                                                        */
/*                                                        */
/*    1. DEFINE_TABLE                                     */
/*                                                        */
/*      - the tables are defined in this section.  Note, only MAXRECS */
/*        is configurable in this section.                */
/*                                                        */
/*    2. DATA_TABLE                                       */
/*                                                        */
/*      - data is entered into this section.              */
/*                                                        */
/*                                                        */
/*                                                        */
/* Revision History:                                      */
/* Num  Modified By        Date    Reason                 */
/* ---  ---------------  ------  ---------------------- */
/* 1.00  Paul Morton       14 May 90  Created             */
/* 1.01  Paul Morton       1 June 90  Added A026CFG table  */
/* 1.02  Paul Morton       7 June 90  rework              */
/* 1.03  Paul Morton       16 Oct 90  changed comments    */
/* 1.031  Mike Hoffinger   26 MAR 91  added CTRL tables   */
/* 1.032  Mike Hoffinger   03 JUN 91  aded config pseudo status  */
/*****************************************************************************/


DEFINE_TABLE = 1        /* DCA specific parameters        */
  NAME = A026DCA        /*                                */
  MAXRECS = 1        /*  MAXRECS = 1 alway                */
  CONTROL_WORD = 0x92  /*                                 */
  DEFINE_RECORD:     /*                                   */
    SIZE = 6      /*                            */
  DEFINE_DATA:
    i[3]*2
```

```
DEFINE_TABLE = 2          /*                                  */
   NAME = A026CFG         /*                                  */
   MAXRECS = 7          /*                                  */
   CONTROL_WORD = 0x92   /*                                  */
   DEFINE_RECORD:        /* MAXRECS = No. devices for which comms.   */
     SIZE = 8          /*        online/offline events will be   */
   DEFINE_DATA:          /*        processed                 */
     i[4]*2



DATA_TABLE = 1
     1,     /* This DCAs index into CFG_DCA in WIN configuration file */
    00,     /* SOE enable ?  1 = yes   0 = no                  */
     1      /* COS enable ?  1 = yes   0 = no                  */

DATA_TABLE = 2

/*************************************************************************
 *  Configuration for first device                                       *
 *************************************************************************/

   2,       /* Data type = 2 [analog input] for comms. status monitor  */
   0,       /*  system point of the analog input to monitor          */
 144,       /*  psuedo-status pt. to be used as comms. flag          */
   1,       /* initial state of pseudo status point 0 = OFF 1 = ON    */

   1,       /* Data type = 1 [digital input] for comms. status monitor */
   0,       /*  system point of the digital input to monitor         */
 145,       /*  psuedo-status pt. to be used as comms. flag          */
   1,       /* initial state of pseudo status point 0 = OFF 1 = ON    */

   1,       /* Data type = 1 [digital input] for comms. status monitor */
  64,       /*  system point of the digital input to monitor         */
 146,       /*  psuedo-status pt. to be used as comms. flag          */
   1,       /* initial state of pseudo status point 0 = OFF 1 = ON    */

   1,       /* Data type = 1 [digital input] for comms. status monitor */
  80,       /*  system point of the digital input to monitor         */
 147,       /*  psuedo-status pt. to be used as comms. flag          */
   1,       /* initial state of pseudo status point 0 = OFF 1 = ON    */

   1,       /* Data type = 1 [digital input] for comms. status monitor */
  96,       /*  system point of the digital input to monitor         */
 148,       /*  psuedo-status pt. to be used as comms. flag          */
   1,       /* initial state of pseudo status point 0 = OFF 1 = ON    */

   1,       /* Data type = 1 [digital input] for comms. status monitor */
 112,       /*  system point of the digital input to monitor         */
 149,       /*  psuedo-status pt. to be used as comms. flag          */
   1,       /* initial state of pseudo status point 0 = OFF 1 = ON    */

   1,       /* Data type = 1 [digital input] for comms. status monitor */
 128,       /*  system point of the digital input to monitor         */
 150,       /*  psuedo-status pt. to be used as comms. flag          */
   1        /* initial state of pseudo status point 0 = OFF 1 = ON    */
```

C.4. B003 - D.20 Configuration File

```
/*****************************************************************************/
/*                                                                           */
/* File:  B003_CFG.TXT                                                       */
/* Author: R. Winstanley                                                     */
/* Date:  December 6, 1991                                                   */
/*                                                                           */
/* This file includes the configuration table for the D.20 application.      */
/* Note the following recommendations:                                       */
/*                                                                           */
/* 1)   The NET WAIT TIME should be left at 5 ms.  This parameter            */
/*      states the delay placed between network retries.                     */
/*                                                                           */
/* 2)   The GLOBAL MESSAGE DELAY should be left at 10 ms.  It is the         */
/*      amount of time that the peripherals are allowed to process a         */
/*      global request.                                                      */
/*                                                                           */
/* 3)   The BINARY SCAN RATE should be approximately 10 times greater        */
/*      than the COS/SOE scan rate.                                          */
/*                                                                           */
/* 4)   The ANALOG SCAN RATE should be approximately 20 times greater        */
/*      than the COS/SOE scan rate.                                          */
/*                                                                           */
/* 5)   The ANALOG REFERENCE SCAN RATE should be left at 60000 ms.           */
/*      This is normally the rate at which the A and C peripherals           */
/*      check their voltage references.                                      */
/*                                                                           */
/*****************************************************************************/

DEFINE_TABLE = 1          /* D.20 Configuration table                        */
   NAME = D20_PARA
   MAXRECS = 1            /* Always 1                                        */
   CONTROL_WORD = 0x14
   DEFINE_RECORD:
      SIZE = * {10}

   DEFINE_DATA:
      i*2          /* Net wait time      (ms)                               */
      i*2          /* Net retries                                           */
      i*2          /* Global message delay  (ms)                            */
      i*2          /* Frequency of 00 scans (ms) (binary)                   */
      i*2          /* Frequency of 0A scans (ms) (analog)                   */
      i*2          /* Frequency of 11 scans (ms) (reference)                */
      i*2          /* Frequency of A0 scans (ms) (unused)                   */
      i*2          /* SOE sort buffer size                                  */
      i*2          /* D.20 DCA index number                                 */
      i*2          /* Debug level                                           */

DATA_TABLE = 1
      5            /* Net wait time      (ms)                               */
      20           /* Net retries                                           */
      10           /* Global message delay  (ms)                            */
      1000         /* Frequency of binary scans (ms)                        */
      1000         /* Frequency of analog scans (ms)                        */
      60000        /* Frequency of reference scans (ms)                     */
      60000        /* Frequency of A0 scans (ms) (unused)                   */
      10           /* SOE sort buffer size                                  */
      00           /* D.20 DCA index number                                 */
      00           /* Debug level                                           */
```

C.5. B008 - Harris/SCADA Configuration File

```
/*************************************************************************/
/*                                                                       */
/* File:  B008_CFG.TXT                                                   */
/*                                                                       */
/*                                                                       */
/* Client: WAPA                                                          */
/* Author: Jim McGhee                                                    */
/* Date:  May 24, 1990                                                   */
/*                                                                       */
/* ((C)) Copyright Westronic Inc., 1990.  All rights reserved.           */
/* Licensed Material - Property of Westronic Inc.                        */
/*                                                                       */
/*                                                                       */
/*                                                                       */
/* Description:                                                          */
/*                                                                       */
/*                                                                       */
/*   1. DEFINE_TABLE                                                     */
/*                                                                       */
/*     - the tables are defined in this section.  Note, only MAXRECS     */
/*       is configurable in this section.                                */
/*                                                                       */
/*   2. DATA_TABLE                                                       */
/*                                                                       */
/*     - data is entered into this section.                              */
/*                                                                       */
/*                                                                       */
/*                                                                       */
/* Revision History:                                                     */
/* Num  Modified By        Date      Reason                              */
/* ---  -----------------  --------  ------------------------------------*/
/* 0.04 Jim McGhee         23 May 90 Created                             */
/*************************************************************************/

DEFINE_TABLE = 1          /* WIN Configuration table                     */
   NAME = CFG_WIN
   MAXRECS = 1            /* Always 1                                    */
   CONTROL_WORD = 0x14
   DEFINE_RECORD:
      SIZE = * {5}

   DEFINE_DATA:
     i*2,                 /* Number of DPA                               */
     i*2,                 /* Event Size - future use                     */
     i*2,                 /* Application size - future use               */
     i*2,                 /* Flag - future use                           */
     i*2                  /* Debug level 0, 1, 2, 3                      */

DEFINE_TABLE = 2          /* WIN Configuration table                     */
   NAME = CFG_DCA
   MAXRECS = 3
   CONTROL_WORD = 0x14
   DEFINE_RECORD:
      SIZE = * {7}

   DEFINE_DATA:
     i*2                  /* Number of binary inputs                     */
     i*2                  /* Number of binary outputs                    */
     i*2                  /* Number of counters                          */
     i*2                  /* Number of analog inputs                     */
     i*2                  /* Number of analog outputs                    */
     i*2                  /* Number devices for the DCA                  */
     i*2                  /* Sort Time Tagged Events Flag                */
                          /*   - if 1, will sort with other DCAs         */
                          /*   - if 0, will not sort                     */

DATA_TABLE = 1
   2,                     /* Number of DPA                               */
```

```
  00,              /* Event Size                    */
  00,              /* Application size              */
   9,              /* Flag                      */
  00               /* Debug level 0, 1, 2, 3        */

DATA_TABLE = 2

/*****************************************************************************/
/*        First DCA = D.20                                                   */
/*****************************************************************************/
 144,              /* Number of binary inputs - status   */
  40,              /* Number of binary outputs - ctl     */
   4,              /* Number of counters - accum         */
 112,              /* Number of analog inputs            */
   0,              /* Number of analog outputs           */
   7,              /* Number devices for the DCA         */
  00,              /* Sort Time Tagged Events Flag       */

/*****************************************************************************/
/*        Third DCA - A026                                                   */
/*****************************************************************************/
   7,             /* Number of binary inputs            */
  00,             /* Number of binary outputs           */
  00,             /* Number of counters                 */
  00,             /* Number of analog inputs            */
  00,             /* Number of analog outputs           */
  00,             /* Number devices for the DCA         */
  00,             /* Sort Time Tagged Events Flag       */

/*****************************************************************************/
/*        Second DCA - Irig B DTA (NOTE: Minimum configuration listed)       */
/*****************************************************************************/
   2,              /* Number of binary inputs           */
   1,              /* Number of binary outputs          */
  00,              /* Number of counters                */
   6,              /* Number of analog inputs           */
   1,              /* Number of analog outputs          */
  00,              /* Number devices for the DTA        */
  00,              /* Sort Time Tagged Events Flag      */
```

C.6. B012 - IRIG Configuration File

```
DEFINE_TABLE = 1          /* IRIG configuration table definition.      */
  NAME = B012_CFG
  MAXRECS = 1
  CONTROL_WORD = 0x12
  DEFINE_RECORD:
    SIZE = * {3}
  DEFINE_DATA:
    i*2,          /* DCA application index number.          */
    i*2,          /* Local time offset in minutes      */
    i*2,          /* Update frequency                                  */

DATA_TABLE = 1            /* Configuration table.              */

  2, 00, 3
```

C.7. B014 - Westmaint II Configuration Definition File

```
/* ********************************************************************** */
/*                                                                        */
/*    WESMAINT II Configuration Definition File                           */
/*                                                                        */
/*    Author:   Quint G. Nagramada                                        */
/*    File:     B014_CFG.TXT                                              */
/*    Date:     January 12, 1993                                          */
/*                                                                        */
/*    Description:  PVUSA KERMAN PHOTOVOLTAIC PLANT                       */
/*                                                                        */
/**************************************************************************/

DEFINE_TABLE = 1            /* Port Configuration Records        */
   NAME = CFG_B014
   MAXRECS = 8              /* Only 8 ports in D20               */
   CONTROL_WORD = 0x12      /* Multi-element, NVRAM              */
   DEFINE_RECORD:
     SIZE = * {15}
   DEFINE_DATA:
     i*2,              /* Physical Channel No. ( COMx )      */
     i*2,              /* Channel Use Type 0 = none, 1 = Wesmaint*/

     i*2,              /* Channel Baud Rate                  */
     i*2,              /* Modem enable 0 = No, 1 = Yes       */
     lu*4,             /* DCD Wait Interval                  */
     lu*4,             /* RTS Wait Interval                  */
     lu*4,             /* RTS Clear Delay interval           */

     i*2,              /* login activity timeout in seconds  */
     i*2,              /* login lockout time in seconds      */
     i*2,              /* maximum wrong login attempts       */

     i*2,              /* wesmaint base priority             */
     i*2,              /* SOE buffer size                    */
     i*2,              /* COS buffer size                    */
     i*2,              /* Friendly data display              */

     s[1]*6,           /* Name for Task, and Mail Box        */


DEFINE_TABLE = 2            /* user's which may login record     */
  NAME = B014USER
  MAXRECS = 1               /* only 1 user                       */
  CONTROL_WORD = 0x12       /* NVRAM, multi element              */
  DEFINE_RECORD:
    SIZE = * {38}
  DEFINE_DATA:

    i*2,              /* time & date format style           */
    i*2,              /* activity log out time (milliseconds) */

    i*2,              /* call back delay time               */
    s[1]*26,          /* call back phone number             */

                      /* Application access definition      */
                      /* 1. application,                    */
                      /* 2. modify access enable            */
                      /* 3. read access enable              */

    lu*4, lx*4, lx*4,       /* 1st application control      */
    lu*4, lx*4, lx*4,       /* 2nd application control      */
    lu*4, lx*4, lx*4,       /* 3rd application control      */
    lu*4, lx*4, lx*4,       /* 4th application control      */
    lu*4, lx*4, lx*4,       /* 5th application control      */
    lu*4, lx*4, lx*4,       /* 6th application control      */
    lu*4, lx*4, lx*4,       /* 7th application control      */
```

```
    lu*4, lx*4, lx*4,       /* 8th application control          */
    lu*4, lx*4, lx*4,       /* 9th application control          */
    lu*4, lx*4, lx*4,       /* 10th application control         */

    s[1]*22,              /* name  (21+null)                */
    s[1]*22,              /* pasword (21+null)              */
    s[1]*22,              /* control password (21+null)     */
    s[1]*42               /* login welcome message (41+null)  */



DEFINE_TABLE = 3          /* Login System Credit Message      */
   NAME = WWELCOME
   MAXRECS = 3            /* Only 3 records allowed           */
   CONTROL_WORD = 0x12    /* NVRAM, multi-element             */
   DEFINE_RECORD:
     SIZE = * {4}
   DEFINE_DATA:

     u*2,                /* Row for text  ( 1 - 24 )         */
     u*2,                /* Colum for text ( 1 - 80 )        */
     u*2,                /* Attribute for text - 0 = Normal  */
                         /*                 1 = Inverse      */
     s[1]*80             /* text to display                  */


/*************************************************************************/

DEFINE_TABLE = 4          /* System Analog Input Comment Table    */
   NAME = DCTYPE0A        /* Type = Analog                        */
   MAXRECS = 118          /* 5 C Board Defined (16 pts / board)   */
   CONTROL_WORD = 0x10    /* 1 A Board Defined (32 pts/ board)    */
   DEFINE_RECORD:
     SIZE = *

   DEFINE_DATA:
    s[1]*10

DEFINE_TABLE = 5          /* Pulse Accumulator Input Comment Table  */
   NAME = DCTYPE06        /* Type = Pulse Accumulator               */
   MAXRECS = 4            /* Four Pulse Accumulators Defined        */
   CONTROL_WORD = 0x10
   DEFINE_RECORD:
     SIZE = *

   DEFINE_DATA:
    s[1]*10

DEFINE_TABLE = 6          /* System Status Input Comment Table    */
   NAME = DCTYPE00        /* Type = Status Input                  */
   MAXRECS = 153          /* 5 C Board Defined (16 pts / board)   */
   CONTROL_WORD = 0x12    /* 1 S Board Defined (64 pts / board)   */
   DEFINE_RECORD:
     SIZE = *

   DEFINE_DATA:
    s[1]*10

DEFINE_TABLE = 7          /* System Control Output Comment Table  */
   NAME = DCTYPE80        /* Type = Control                       */
   MAXRECS = 41           /* 5 C Board Defined (8 pts / board)    */
   CONTROL_WORD = 0x12
   DEFINE_RECORD:
   SIZE = *

   DEFINE_DATA:
    s[1]*10
```

```
DEFINE_TABLE = 8          /* Type = NADC                    */
   NAME = NADCA000        /* An NADC value may be defined for each   */
   MAXRECS = 00           /*  analog input. This value is used to  */
   CONTROL_WORD = 0x10    /*  "normalize" the ADC output and is the */
   DEFINE_RECORD:         /*  means by which the analog inputs are  */
      SIZE = *            /*  "calibrated" for the inaccuracies of  */
                          /*  the termination resistor.          */
   DEFINE_DATA:
      i[1]*2


DEFINE_TABLE = 9          /* System device status comment table     */
   NAME = DCTYPEDS        /* Type = Status Input            */
   MAXRECS = 7            /* Peripherals                    */
   CONTROL_WORD = 0x12
   DEFINE_RECORD:
      SIZE = *

   DEFINE_DATA:
      s[1]*41


/* ************************************************************************** */



DATA_TABLE = 1            /* Port Configuration Data        */

/*    COM0        */

   00,               /* channel 0                  */
   1,                /* used for wesmaint          */

   9600,             /* 9600 baud                  */
   00,               /* no modem                   */
   0L,               /* 0 millisecond DCD wait     */
   0L,               /* 0 millisecond RTS wait     */
   0L,               /* 0 millisecond RTS Clear delay  */

   120,              /* 120 seconds for auto logout,   */
   120,              /* 120 seconds for lock out       */
   4,                /* max of 4 retrys before lockout */
   00,               /* set to 0                   */
   80,               /* SOE buffer size            */
   80,               /* COS buffer size            */
   0,                /* Friendly data display      */

   "WES0",           /* process name               */


/*    COM1        */

   1,                /* channel 1                  */
   00,               /* not used for wesmaint      */

   9600,             /* 9600 baud                  */
   00,               /* no modem                   */
   0L,               /* 0 millisecond DCD wait     */
   0L,               /* 0 millisecond RTS wait     */
   0L,               /* 0 millisecond RTS Clear delay  */

   120,              /* 120 seconds for auto logout    */
   120,              /* 120 seconds for lock out       */
   4,                /* max of 4 retrys before lockout */
   00,               /* set to 0                   */
   80,               /* SOE buffer size            */
   80,               /* COS buffer size            */
   0,                /* Friendly data display      */

   "WES1",           /* process name               */
```

```
/*    COM2        */

    2,              /* channel 2                    */
    00,             /* not used for wesmaint        */

    9600,           /* 9600 baud                    */
    00,             /* no modem                     */
    00L,            /* 0 millisecond DCD wait       */
    00L,            /* 0 millisecond RTS wait       */
    00L,            /* 0 millisecond RTS Clear delay */

    120,            /* 120 seconds for auto logout  */
    120,            /* 120 seconds for lock out     */
    4,              /* max of 4 retrys before lockout */
    00,             /* set to 0                     */
    80,             /* SOE buffer size              */
    80,             /* COS buffer size              */
     0,             /* Friendly data display        */

    "WES2",         /* process name                 */


/*    COM3        */
                    3,          /* channel 3        */
    00,             /* not used for wesmaint        */

    9600,           /* 9600 baud                    */
    00,             /* no modem                     */
    00L,            /* 0 millisecond DCD wait       */
    00L,            /* 0 millisecond RTS wait       */
    00L,            /* 0 millisecond RTS Clear delay */

    120,            /* 120 seconds for auto logout  */
    120,            /* 120 seconds for lock out     */
    4,              /* max of 4 retrys before lockout */
    00,             /* set to 0                     */
    80,             /* SOE buffer size              */
    80,             /* COS buffer size              */
     0,             /* Friendly data display        */

    "WES3",         /* process name                 */


/*    COM4        */

    4,              /* channel 4                    */
    00,             /* not used for wesmaint        */

    9600,           /* 9600 baud                    */
    00,             /* no modem                     */
    00L,            /* 0 millisecond DCD wait       */
    00L,            /* 0 millisecond RTS wait       */
    00L,            /* 0 millisecond RTS Clear delay */

    120,            /* 120 seconds for auto logout  */
    120,            /* 120 seconds for lock out     */
    4,              /* max of 4 retrys before lockout */
    00,             /* set to 0                     */
    80,             /* SOE buffer size              */
    80,             /* COS buffer size              */
     0,             /* Friendly data display        */

    "WES4",         /* process name                 */


/*    COM5        */

    5,              /* channel 5                    */
```

```
   00,              /* not used for wesmaint          */

   9600,             /* 9600 baud                    */
   00,              /* no modem                      */
   00L,              /* 0 millisecond DCD wait       */
   00L,              /* 0 millisecond RTS wait       */
   00L,              /* 0 millisecond RTS Clear delay */

   120,              /* 120 seconds for auto logout  */
   120,              /* 120 seconds for lock out     */
   4,               /* max of 4 retrys before lockout */
   00,               /* set to 0                     */
   80,               /* SOE buffer size              */
   80,               /* COS buffer size              */
    0,               /* Friendly data display        */

   "WES5",            /* process name                */

/*    COM6        */

   6,               /* channel 6                     */
   00,               /* not used for wesmaint        */

   9600,             /* 9600 baud                    */
   00,              /* no modem                      */
   00L,              /* 0 millisecond DCD wait       */
   00L,              /* 0 millisecond RTS wait       */
   00L,              /* 0 millisecond RTS Clear delay */

   120,              /* 120 seconds for auto logout  */
   120,              /* 120 seconds for lock out     */
   4,               /* max of 4 retrys before lockout */
   00,               /* set to 0                     */
   80,               /* SOE buffer size              */
   80,               /* COS buffer size              */
    0,               /* Friendly data display        */

   "WES6",            /* process name                */

/*    COM7        */

   7,               /* channel 7                     */
   00,               /* not used for wesmaint        */

   9600,             /* 9600 baud                    */
   00,              /* no modem                      */
   00L,              /* 0 millisecond DCD wait       */
   00L,              /* 0 millisecond RTS wait       */
   00L,              /* 0 millisecond RTS Clear delay */

   120,              /* 120 seconds for auto logout  */
   120,              /* 120 seconds for lock out     */
   4,               /* max of 4 retrys before lockout */
   00,               /* set to 0                     */
   80,               /* SOE buffer size              */
   80,               /* COS buffer size              */
    0,               /* Friendly data display        */

   "WES7",            /* process name                */


DATA_TABLE = 2          /* User's Which may login definitions  */

    /* user 1 */

    0x15,             /* MMM DD/YY                   */
    00,              /* 0 second for auto logout     */
```

```
    00,              /* no call back delay              */
    "",              /* no call back number             */

    14, ffffffff, ffffffff, /* may use all wesmaint functions     */
     3, ffffffff, ffffffff, /* may not use all quantum functions  */
    00, ffffffff, ffffffff, /* may not use all SCS functions      */
    00, 00, 00,
    00, 00, 00,
    00, 00, 00,
    00, 00, 00,
    00, 00, 00,
    00, 00, 00,
    00, 00, 00,

    "westronic",        /* name                            */
    "rd",            /* pass word                       */
    "control",          /* control pass word               */
    "Welcome to Wesmaint II - PG&E SCADA", /* hello message       */



DATA_TABLE = 3          /* Login System Credit Messages       */

    10, 29, 00, "WESTRONIC INCORPORATED",
    12, 31, 00, "WESDAC D20 SYSTEM",
    14, 37, 00, "LOGIN"

DATA_TABLE = 4

  "SPARE  ",  /* System Analog Pt. #  1,  D20A1   Point 1       */
  "SPARE  ",  /* System Analog Pt. #  2,  "     Point 2       */
  "I-X IRRAD",  /* System Analog Pt. #  3,  "     Point 3       */
  "GLO IRRAD",  /* System Analog Pt. #  4,  "     Point 4       */
  "NOR IRRAD",  /* System Analog Pt. #  5,  "     Point 5       */
  "WIND SPED",  /* System Analog Pt. #  6,  "     Point 6       */
  "WIND DIR ",  /* System Analog Pt. #  7,  "     Point 7       */
  "AMBI TEMP",  /* System Analog Pt. #  8,  "     Point 8       */
  "PLN IRRAD",  /* System Analog Pt. #  9,  "     Point 9       */
  "REL HUMID",  /* System Analog Pt. # 10,  "     Point 10      */
  "SPARE  ",  /* System Analog Pt. # 11,  "     Point 11      */
  "SPARE  ",  /* System Analog Pt. # 12,  "     Point 12      */
  "SPARE  ",  /* System Analog Pt. # 13,  "     Point 13      */
  "SPARE  ",  /* System Analog Pt. # 14,  "     Point 14      */
  "REDD WATT",  /* System Analog Pt. # 15,  "     Point 15      */
  "REDD VARS",  /* System Analog Pt. # 16,  "     Point 16      */
  "SPARE  ",  /* System Analog Pt. # 17,  "     Point 17      */
  "SPARE  ",  /* System Analog Pt. # 18,  "     Point 18      */
  "SPARE  ",  /* System Analog Pt. # 19,  "     Point 19      */
  "SPARE  ",  /* System Analog Pt. # 20,  "     Point 20      */
  "SPARE  ",  /* System Analog Pt. # 21,  "     Point 21      */
  "SPARE  ",  /* System Analog Pt. # 22,  "     Point 22      */
  "SPARE  ",  /* System Analog Pt. # 23,  "     Point 23      */
  "SPARE  ",  /* System Analog Pt. # 24,  "     Point 24      */
  "SPARE  ",  /* System Analog Pt. # 25,  "     Point 25      */
  "SPARE  ",  /* System Analog Pt. # 26,  "     Point 26      */
  "SPARE  ",  /* System Analog Pt. # 27,  "     Point 27      */
  "SPARE  ",  /* System Analog Pt. # 28,  "     Point 28      */
  "SPARE  ",  /* System Analog Pt. # 29,  "     Point 29      */
  "SPARE  ",  /* System Analog Pt. # 30,  "     Point 30      */
  "SPARE  ",  /* System Analog Pt. # 31,  "     Point 31      */
  "SPARE  ",  /* System Analog Pt. # 32,  "     Point 32      */

  "AMP A  ",  /* System Analog Pt. # 33,  D20C1   Point 1       */
  "AMP B  ",  /* System Analog Pt. # 34,  "     Point 2       */
  "AMP C  ",  /* System Analog Pt. # 35,  "     Point 3       */
  "WATTS  ",  /* System Analog Pt. # 36,  "     Point 4       */
  "VARS   ",  /* System Analog Pt. # 37,  "     Point 5       */
  "VOLT A ",  /* System Analog Pt. # 38,  "     Point 6       */
  "VOLT B ",  /* System Analog Pt. # 39,  "     Point 7       */
```

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"VOLT C ",   /* System Analog Pt. # 40,  "    Point 8      */
"SPARE  ",   /* System Analog Pt. # 41,  "    Point 9      */
"SPARE  ",   /* System Analog Pt. # 42,  "    Point 10     */
"SPARE  ",   /* System Analog Pt. # 43,  "    Point 11     */
"SPARE  ",   /* System Analog Pt. # 44,  "    Point 12     */
"SPARE  ",   /* System Analog Pt. # 45,  "    Point 13     */
"SPARE  ",   /* System Analog Pt. # 46,  "    Point 14     */
"SPARE  ",   /* System Analog Pt. # 47,  "    Point 15     */
"SPARE  ",   /* System Analog Pt. # 48,  "    Point 16     */

"AMP A  ",   /* System Analog Pt. # 49, D20C1-INV1 Point 1      */
"AMP B  ",   /* System Analog Pt. # 50,  "    Point 2      */
"AMP C  ",   /* System Analog Pt. # 51,  "    Point 3      */
"WATTS  ",   /* System Analog Pt. # 52,  "    Point 4      */
"VARS   ",   /* System Analog Pt. # 53,  "    Point 5      */
"VOLT A ",   /* System Analog Pt. # 54,  "    Point 6      */
"VOLT B ",   /* System Analog Pt. # 55,  "    Point 7      */
"VOLT C ",   /* System Analog Pt. # 56,  "    Point 8      */
"DCVLTPOS ", /* System Analog Pt. # 57,  "    Point 9      */
"DCVLTPOS ", /* System Analog Pt. # 58,  "    Point 10     */
"DCAMPPOS ", /* System Analog Pt. # 59,  "    Point 11     */
"INV TEMP ", /* System Analog Pt. # 60,  "    Point 12     */
"MB TEMP1 ", /* System Analog Pt. # 61,  "    Point 13     */
"MB TEMP2 ", /* System Analog Pt. # 62,  "    Point 14     */
"MB TEMP3 ", /* System Analog Pt. # 63,  "    Point 15     */
"SPARE  ",   /* System Analog Pt. # 64,  "    Point 16     */

"TRKANGL 1", /* System Analog Pt. # 65, D20C2-INV1 Point 1      */
"TRKANGL 2", /* System Analog Pt. # 66,  "    Point 2      */
"TRKANGL 3", /* System Analog Pt. # 67,  "    Point 3      */
"TRKANGL 4", /* System Analog Pt. # 68,  "    Point 4      */
"PLN IRRAD", /* System Analog Pt. # 69,  "    Point 5      */
"SPARE  ",   /* System Analog Pt. # 70,  "    Point 6      */
"SPARE  ",   /* System Analog Pt. # 71,  "    Point 7      */
"SPARE  ",   /* System Analog Pt. # 72,  "    Point 8      */
"TRKANGL 5", /* System Analog Pt. # 73,  "    Point 9      */
"TRKANGL 6", /* System Analog Pt. # 74,  "    Point 10     */
"TRKANGL 7", /* System Analog Pt. # 75,  "    Point 11     */
"TRKANGL 8", /* System Analog Pt. # 76,  "    Point 12     */
"TRKANGL 9", /* System Analog Pt. # 77,  "    Point 13     */
"SPARE  ",   /* System Analog Pt. # 78,  "    Point 14     */
"SPARE  ",   /* System Analog Pt. # 79,  "    Point 15     */
"SPARE  ",   /* System Analog Pt. # 80,  "    Point 16     */

"AMP A  ",   /* System Analog Pt. # 81, D20C1-INV2 Point 1      */
"AMP B  ",   /* System Analog Pt. # 82,  "    Point 2      */
"AMP C  ",   /* System Analog Pt. # 83,  "    Point 3      */
"WATTS  ",   /* System Analog Pt. # 84,  "    Point 4      */
"VARS   ",   /* System Analog Pt. # 85,  "    Point 5      */
"VOLT A ",   /* System Analog Pt. # 86,  "    Point 6      */
"VOLT B ",   /* System Analog Pt. # 87,  "    Point 7      */
"VOLT C ",   /* System Analog Pt. # 88,  "    Point 8      */
"DCVLTPOS ", /* System Analog Pt. # 89,  "    Point 9      */
"DCVLTPOS ", /* System Analog Pt. # 90,  "    Point 10     */
"DCAMPPOS ", /* System Analog Pt. # 91,  "    Point 11     */
"INV TEMP ", /* System Analog Pt. # 92,  "    Point 12     */
"SPARE  ",   /* System Analog Pt. # 93,  "    Point 13     */
"SPARE  ",   /* System Analog Pt. # 94,  "    Point 14     */
"SPARE  ",   /* System Analog Pt. # 95,  "    Point 15     */
"SPARE  ",   /* System Analog Pt. # 96,  "    Point 16     */

"SPARE  ",   /* System Analog Pt. # 97, D20C2-INV2 Point 1      */
"SPARE  ",   /* System Analog Pt. # 98,  "    Point 2      */
"SPARE  ",   /* System Analog Pt. # 99,  "    Point 3      */
"SPARE  ",   /* System Analog Pt. #100,  "    Point 4      */
"SPARE  ",   /* System Analog Pt. #101,  "    Point 5      */
"SPARE  ",   /* System Analog Pt. #102,  "    Point 6      */
"SPARE  ",   /* System Analog Pt. #103,  "    Point 7      */
"SPARE  ",   /* System Analog Pt. #104,  "    Point 8      */
"SPARE  ",   /* System Analog Pt. #105,  "    Point 9      */
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  "SPARE   ",   /* System Analog Pt. #106,   "     Point 10      */
  "SPARE   ",   /* System Analog Pt. #107,   "     Point 11      */
  "SPARE   ",   /* System Analog Pt. #108,   "     Point 12      */
  "SPARE   ",   /* System Analog Pt. #109,   "     Point 13      */
  "SPARE   ",   /* System Analog Pt. #110,   "     Point 14      */
  "SPARE   ",   /* System Analog Pt. #111,   "     Point 15      */
  "SPARE   ",   /* System Analog Pt. #112,   "     Point 16      */

  "IRIG-B  ",   /* System Analog Pt. #113,   */
  "IRIG-B  ",   /* System Analog Pt. #114,   */
  "IRIG-B  ",   /* System Analog Pt. #115,   */
  "IRIG-B  ",   /* System Analog Pt. #116,   */
  "IRIG-B  ",   /* System Analog Pt. #117,   */
  "IRIG-B  ",   /* System Analog Pt. #118,   */


/* PULSE ACCUMULATOR INPUT COMMENT TABLE                    */
/*       Comment Table Entry is Limited to 9 Characters     */

DATA_TABLE = 5

  "PULSE OUT",    /* Sys Accumulator Pt. #1 D20C1   Point 1      */
  "PULSE IN ",    /* Sys Accumulator Pt. #2  "      Point 2      */
  "PULSE CAG",    /* Sys Accumulator Pt. #3  "      Point 3      */
  "PULS LEAD",    /* Sys Accumulator Pt. #4  "      Point 4      */


/* STATUS INPUT POINT COMMENT TABLE                         */
/*       Comment Table Entry is Limited to 9 Characters     */

DATA_TABLE = 6

  "BLDG SMOK",    /* Sys Status Pt. #  1,  D20S1   Point 1       */
  "BLDG INTR",    /* Sys Status Pt. #  2,   "      Point 2       */
  "SPARE   ",     /* Sys Status Pt. #  3,   "      Point 3       */
  "UPS FAIL ",    /* Sys Status Pt. #  4,   "      Point 4       */
  "UPS BYPAS",    /* Sys Status Pt. #  5,   "      Point 5       */
  "UPS TROBL",    /* Sys Status Pt. #  6,   "      Point 6       */
  "COM1 TRBL",    /* Sys Status Pt. #  7,   "      Point 7       */
  "COM2 TRBL",    /* Sys Status Pt. #  8,   "      Point 8       */
  "TRALHITMP",    /* Sys Status Pt. #  9,   "      Point 9       */
  "TRAL SMOK",    /* Sys Status Pt. # 10,   "      Point 10      */
  "AUXPWR UV",    /* Sys Status Pt. # 11,   "      Point 11      */
  "BATT UV  ",    /* Sys Status Pt. # 12,   "      Point 12      */
  "CHARG TRB",    /* Sys Status Pt. # 13,   "      Point 13      */
  "ANUN FAIL",    /* Sys Status Pt. # 14,   "      Point 14      */
  "SPARE   ",     /* Sys Status Pt. # 15,   "      Point 15      */
  "SPARE   ",     /* Sys Status Pt. # 16,   "      Point 16      */
  "SPARE   ",     /* Sys Status Pt. # 17,   "      Point 17      */
  "SPARE   ",     /* Sys Status Pt. # 18,   "      Point 18      */
  "SPARE   ",     /* Sys Status Pt. # 19,   "      Point 19      */
  "SPARE   ",     /* Sys Status Pt. # 20,   "      Point 20      */
  "SPARE   ",     /* Sys Status Pt. # 21,   "      Point 21      */
  "SPARE   ",     /* Sys Status Pt. # 22,   "      Point 22      */
  "SPARE   ",     /* Sys Status Pt. # 23,   "      Point 23      */
  "SPARE   ",     /* Sys Status Pt. # 24,   "      Point 24      */
  "SPARE   ",     /* Sys Status Pt. # 25,   "      Point 25      */
  "SPARE   ",     /* Sys Status Pt. # 26,   "      Point 26      */
  "SPARE   ",     /* Sys Status Pt. # 27,   "      Point 27      */
  "SPARE   ",     /* Sys Status Pt. # 28,   "      Point 28      */
  "SPARE   ",     /* Sys Status Pt. # 29,   "      Point 29      */
  "SPARE   ",     /* Sys Status Pt. # 30,   "      Point 30      */
  "SPARE   ",     /* Sys Status Pt. # 31,   "      Point 31      */
  "SPARE   ",     /* Sys Status Pt. # 32,   "      Point 32      */
  "SPARE   ",     /* Sys Status Pt. # 33,   "      Point 33      */
  "SPARE   ",     /* Sys Status Pt. # 34,   "      Point 34      */
  "SPARE   ",     /* Sys Status Pt. # 35,   "      Point 35      */
  "SPARE   ",     /* Sys Status Pt. # 36,   "      Point 36      */
  "SPARE   ",     /* Sys Status Pt. # 37,   "      Point 37      */
  "SPARE   ",     /* Sys Status Pt. # 38,   "      Point 38      */
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  "SPARE  ",   /* Sys Status Pt. # 39,  "   Point 39      */
  "SPARE  ",   /* Sys Status Pt. # 40,  "   Point 40      */
  "SPARE  ",   /* Sys Status Pt. # 41,  "   Point 41      */
  "SPARE  ",   /* Sys Status Pt. # 42,  "   Point 42      */
  "SPARE  ",   /* Sys Status Pt. # 43,  "   Point 43      */
  "SPARE  ",   /* Sys Status Pt. # 44,  "   Point 44      */
  "SPARE  ",   /* Sys Status Pt. # 45,  "   Point 45      */
  "SPARE  ",   /* Sys Status Pt. # 46,  "   Point 46      */
  "SPARE  ",   /* Sys Status Pt. # 47,  "   Point 47      */
  "SPARE  ",   /* Sys Status Pt. # 48,  "   Point 48      */
  "SPARE  ",   /* Sys Status Pt. # 49,  "   Point 49      */
  "SPARE  ",   /* Sys Status Pt. # 50,  "   Point 50      */
  "SPARE  ",   /* Sys Status Pt. # 51,  "   Point 51      */
  "SPARE  ",   /* Sys Status Pt. # 52,  "   Point 52      */
  "SPARE  ",   /* Sys Status Pt. # 53,  "   Point 53      */
  "SPARE  ",   /* Sys Status Pt. # 54,  "   Point 54      */
  "SPARE  ",   /* Sys Status Pt. # 55,  "   Point 55      */
  "SPARE  ",   /* Sys Status Pt. # 56,  "   Point 56      */
  "SPARE  ",   /* Sys Status Pt. # 57,  "   Point 57      */
  "SPARE  ",   /* Sys Status Pt. # 58,  "   Point 58      */
  "SPARE  ",   /* Sys Status Pt. # 59,  "   Point 59      */
  "SPARE  ",   /* Sys Status Pt. # 60,  "   Point 60      */
  "SPARE  ",   /* Sys Status Pt. # 61,  "   Point 61      */
  "SPARE  ",   /* Sys Status Pt. # 62,  "   Point 62      */
  "SPARE  ",   /* Sys Status Pt. # 63,  "   Point 63      */
  "SPARE  ",   /* Sys Status Pt. # 64,  "   Point 64      */

  "ACCUM 1 ",   /* Sys Accumulator Pt. #1 D20C1  Point 1       */
  "ACCUM 2 ",   /* Sys Accumulator Pt. #2  "   Point 2       */
  "ACCUM 3 ",   /* Sys Accumulator Pt. #3  "   Point 3       */
  "ACCUM 4 ",   /* Sys Accumulator Pt. #4  "   Point 4       */
  "SPARE  ",   /* Sys Status Pt. # 65,  D20C1  Point 5       */
  "SPARE  ",   /* Sys Status Pt. # 66,  "   Point 6       */
  "SPARE  ",   /* Sys Status Pt. # 67,  "   Point 7       */
  "SPARE  ",   /* Sys Status Pt. # 68,  "   Point 8       */
  "BKR OPEN ",   /* Sys Status Pt. # 69,  D20C1  Point 5       */
  "LOCAL REM",   /* Sys Status Pt. # 70,  "   Point 6       */
  "GND FAULT",   /* Sys Status Pt. # 71,  "   Point 7       */
  "T/T XMTFL",   /* Sys Status Pt. # 72,  "   Point 8       */
  "T/T RCVFL",   /* Sys Status Pt. # 73,  "   Point 9       */
  "T/T XMTFL",   /* Sys Status Pt. # 74,  "   Point 10      */
  "T/T RCVFL",   /* Sys Status Pt. # 75,  "   Point 11      */
  "IAXTRKTRB",   /* Sys Status Pt. # 76,  "   Point 12      */

  "BKR OPEN ",   /* Sys Status Pt. # 77, D20C1-INV1 Point 1       */
  "LOCAL REM",   /* Sys Status Pt. # 78,  "   Point 2       */
  "PCS ON  ",   /* Sys Status Pt. # 79,  "   Point 3       */
  "PCS SREDY",   /* Sys Status Pt. # 80,  "   Point 4       */
  "PCS SFLT ",   /* Sys Status Pt. # 81,  "   Point 5       */
  "PCS SHUTD",   /* Sys Status Pt. # 82,  "   Point 6       */
  "PCS OVTMP",   /* Sys Status Pt. # 83,  "   Point 7       */
  "DC GNDFLT",   /* Sys Status Pt. # 84,  "   Point 8       */
  "SMOKE DET",   /* Sys Status Pt. # 85,  "   Point 9       */
  "PCS FAULT",   /* Sys Status Pt. # 86,  "   Point 10      */
  "SYNC FAIL",   /* Sys Status Pt. # 87,  "   Point 11      */
  "SPARE  ",   /* Sys Status Pt. # 88,  "   Point 12      */
  "T1 HITEMP",   /* Sys Status Pt. # 89,  "   Point 13      */
  "FAN FAIL ",   /* Sys Status Pt. # 90,  "   Point 14      */
  "SPARE  ",   /* Sys Status Pt. # 91,  "   Point 15      */
  "SPARE  ",   /* Sys Status Pt. # 92,  "   Point 16      */

  "SPARE  ",   /* Sys Status Pt. # 93, D20C2-INV1 Point 1       */
  "SPARE  ",   /* Sys Status Pt. # 94,  "   Point 2       */
  "SPARE  ",   /* Sys Status Pt. # 95,  "   Point 3       */
  "SPARE  ",   /* Sys Status Pt. # 96,  "   Point 4       */
  "SPARE  ",   /* Sys Status Pt. # 97,  "   Point 5       */
  "SPARE  ",   /* Sys Status Pt. # 98,  "   Point 6       */
  "SPARE  ",   /* Sys Status Pt. # 99,  "   Point 7       */
  "SPARE  ",   /* Sys Status Pt. #100,  "   Point 8       */
  "SPARE  ",   /* Sys Status Pt. #101,  "   Point 9       */
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  "SPARE  ",   /* Sys Status Pt. #102,   "    Point 10       */
  "SPARE  ",   /* Sys Status Pt. #103,   "    Point 11       */
  "SPARE  ",   /* Sys Status Pt. #104,   "    Point 12       */
  "SPARE  ",   /* Sys Status Pt. #105,   "    Point 13       */
  "SPARE  ",   /* Sys Status Pt. #106,   "    Point 14       */
  "SPARE  ",   /* Sys Status Pt. #107,   "    Point 15       */
  "SPARE  ",   /* Sys Status Pt. #108,   "    Point 16       */

  "BKR OPEN ",   /* Sys Status Pt. #109, D20C1-INV2 Point 1       */
  "LOCAL REM",   /* Sys Status Pt. #110,   "    Point 2       */
  "PCS ON  ",   /* Sys Status Pt. #111,   "    Point 3       */
  "PCS SREDY",   /* Sys Status Pt. #112,   "    Point 4       */
  "PCS SFLT ",   /* Sys Status Pt. #113,   "    Point 5       */
  "PCS SHUTD",   /* Sys Status Pt. #114,   "    Point 6       */
  "PCS OVTMP",   /* Sys Status Pt. #115,   "    Point 7       */
  "DC GNDFLT",   /* Sys Status Pt. #116,   "    Point 8       */
  "SMOKE DET",   /* Sys Status Pt. #117,   "    Point 9       */
  "PCS FAULT",   /* Sys Status Pt. #118,   "    Point 10      */
  "SYNC FAIL",   /* Sys Status Pt. #119,   "    Point 11      */
  "SPARE  ",   /* Sys Status Pt. #120,   "    Point 12       */
  "FAN FAIL ",   /* Sys Status Pt. #121,   "    Point 13      */
  "SPARE  ",   /* Sys Status Pt. #122,   "    Point 14       */
  "SPARE  ",   /* Sys Status Pt. #123,   "    Point 15       */
  "SPARE  ",   /* Sys Status Pt. #124,   "    Point 16       */

  "SPARE  ",   /* Sys Status Pt. #125, D20C2-INV2 Point 1       */
  "SPARE  ",   /* Sys Status Pt. #126,   "    Point 2       */
  "SPARE  ",   /* Sys Status Pt. #127,   "    Point 3       */
  "SPARE  ",   /* Sys Status Pt. #128,   "    Point 4       */
  "SPARE  ",   /* Sys Status Pt. #129,   "    Point 5       */
  "SPARE  ",   /* Sys Status Pt. #130,   "    Point 6       */
  "SPARE  ",   /* Sys Status Pt. #131,   "    Point 7       */
  "SPARE  ",   /* Sys Status Pt. #132,   "    Point 8       */
  "SPARE  ",   /* Sys Status Pt. #133,   "    Point 9       */
  "SPARE  ",   /* Sys Status Pt. #134,   "    Point 10      */
  "SPARE  ",   /* Sys Status Pt. #135,   "    Point 11      */
  "SPARE  ",   /* Sys Status Pt. #136,   "    Point 12      */
  "SPARE  ",   /* Sys Status Pt. #137,   "    Point 13      */
  "SPARE  ",   /* Sys Status Pt. #138,   "    Point 14      */
  "SPARE  ",   /* Sys Status Pt. #139,   "    Point 15      */
  "SPARE  ",   /* Sys Status Pt. #140,   "    Point 16      */

  "IRIG-B  ",   /* Sys Status Pt. #141, */
  "IRIG-B  ",   /* Sys Status Pt. #142, */

  "COMM STAT",   /* Sys Status Pt. #143,   "    Watch dog pseudo #1 */
  "COMM STAT",   /* Sys Status Pt. #144,   "    Watch dog pseudo #2 */
  "COMM STAT",   /* Sys Status Pt. #145,   "    Watch dog pseudo #3 */
  "COMM STAT",   /* Sys Status Pt. #146,   "    Watch dog pseudo #4 */
  "COMM STAT",   /* Sys Status Pt. #147,   "    Watch dog pseudo #5 */
  "COMM STAT",   /* Sys Status Pt. #148,   "    Watch dog pseudo #6 */
  "COMM STAT",   /* Sys Status Pt. #149,   "    Watch dog pseudo #7 */



/* SYSTEM CONTROL OUTPUT COMMENT TABLE                    */
/*       Comment Table Entry is Limited to 9 Characters   */

DATA_TABLE = 7

  "BKR OPEN ",  /* Sys Control Pt. # 1,  D20C1   Point 1       */
  "BKR CLOSE",  /* Sys Control Pt. # 2,   "    Point 2       */
  "IX TRKRST",  /* Sys Control Pt. # 3,   "    Point 3       */
  "SPARE  ",  /* Sys Control Pt. # 4,   "    Point 4       */
  "SPARE  ",  /* Sys Control Pt. # 5,   "    Point 5       */
  "SPARE  ",  /* Sys Control Pt. # 6,   "    Point 6       */
  "SPARE  ",  /* Sys Control Pt. # 7,   "    Point 7       */
  "SPARE  ",  /* Sys Control Pt. # 8,   "    Point 8       */
  "BKR OPEN ",  /* Sys Control Pt. # 9, D20C1-INV1 Point 1       */
  "BKR CLOS ",  /* Sys Control Pt. # 10,   "    Point 2       */
```

```
  "INV DISAB",  /* Sys Control Pt. # 11,   "    Point 3       */
  "INV RESET",  /* Sys Control Pt. # 12,   "    Point 4       */
  "INVRESTRT",  /* Sys Control Pt. # 13,   "    Point 5       */
  "SPARE   ",  /* Sys Control Pt. # 14,   "    Point 6       */
  "SPARE   ",  /* Sys Control Pt. # 15,   "    Point 7       */
  "SPARE   ",  /* Sys Control Pt. # 16,   "    Point 8       */
  "SPARE   ",  /* Sys Control Pt. # 17, D20C2-INV1 Point 1       */
  "SPARE   ",  /* Sys Control Pt. # 18,   "    Point 2       */
  "SPARE   ",  /* Sys Control Pt. # 19,   "    Point 3       */
  "SPARE   ",  /* Sys Control Pt. # 20,   "    Point 4       */
  "SPARE   ",  /* Sys Control Pt. # 21,   "    Point 5       */
  "SPARE   ",  /* Sys Control Pt. # 22,   "    Point 6       */
  "SPARE   ",  /* Sys Control Pt. # 23,   "    Point 7       */
  "SPARE   ",  /* Sys Control Pt. # 24,   "    Point 8       */
  "BKR OPEN ",  /* Sys Control Pt. # 25, D20C1-INV2 Point 1       */
  "BKR CLOSE",  /* Sys Control Pt. # 26,   "    Point 2       */
  "INV DISAB",  /* Sys Control Pt. # 27,   "    Point 3       */
  "INV RESET",  /* Sys Control Pt. # 28,   "    Point 4       */
  "INVRESTRT",  /* Sys Control Pt. # 29,   "    Point 5       */
  "SPARE   ",  /* Sys Control Pt. # 30,   "    Point 6       */
  "SPARE   ",  /* Sys Control Pt. # 31,   "    Point 7       */
  "SPARE   ",  /* Sys Control Pt. # 32,   "    Point 8       */
  "SPARE   ",  /* Sys Control Pt. # 33, D20C2-INV2 Point 1       */
  "SPARE   ",  /* Sys Control Pt. # 34,   "    Point 2       */
  "SPARE   ",  /* Sys Control Pt. # 35,   "    Point 3       */
  "SPARE   ",  /* Sys Control Pt. # 36,   "    Point 4       */
  "SPARE   ",  /* Sys Control Pt. # 37,   "    Point 5       */
  "SPARE   ",  /* Sys Control Pt. # 38,   "    Point 6       */
  "SPARE   ",  /* Sys Control Pt. # 39,   "    Point 7       */
  "SPARE   ",  /* Sys Control Pt. # 40,   "    Point 8       */

  "IRIG-B  "   /* Sys Control Pt. # 41  */


DATA_TABLE = 9

  "A - Peripheral 1   ",
  "S - Peripheral 2   ",
  "C - Peripheral 3   ",
  "C - Peripheral 4   ",
  "C - Peripheral 5   ",
  "C - Peripheral 6   ",
  "C - Peripheral 7   ",

/* ******************************** The End ******************************** */
```

Appendix D

SOFTWARE CONFIGURATION FILES

SOFTWARE CONFIGURATION FILES

D.1. QNX

D.1.1. SYS.INIT.0

```
timer &

"The lines below is to enable communications on com2
slay comm u=8000 t=4 -v -q
slay ncomm u=8000 t=4 -v -q
stty +fix >$tty4
stty inton=3 baud=19200 bits=8 par=none stop=1 esc=0 +hangup up=al down=a9 right=a6
left=a4 ins=ab del=ac >$tty4
stty +hflow +iflow +oflow +split -igate >$tty4
ontty $tty4 comm +l +h b=19200 i=at&f&a3&b1&h1&r2| a=ATA| l=$con1 q=15 "m=Welcome
to the Kerman R&D Computer"

dots on

"       RealFlex supplied "sys.init" file for WINDOWS system
"
"
"       Check for PS/2 or AT and SET CLOCK
"
"
if eq #p 0006 then
        rtc ps2/30
else
        rtc at
endif
"
"
"       NON-Networked System Commands
"
"
search 3 5
"
"
"       RealFlex Required Commands
"
"
sleep 1
if lt #n 0004 then
        queue &
endif
if ge #n 0002 then
        alive +n >$null >*$null &
endif
"The following line is to make sure that a daily file (DDMMYYkm.csv) is
"created in the 3:/realflex/data/brad directory.
```

```
cd 3:/realflex/data/Kerman.batch/
rundaily.bat
cd 3:/
"
"
"           General Networked System Commands
"
"
if ge #n 0001 then
            search 3 5 +remote
            nacc 3 +read +write
            netboot &
if lt #n 0003 then
            clrhouse start p=10 &
endif
endif
"
"
"           Node 1 Networked System Commands
"
"
if eq #n 0001 then
            poll >$null &
endif
"
"
"   Mount hard disk drive speed enhancement caching routines
"
"
mount cache d=3 s=32k
mount xcache s=10k
mount bmcache d=3
mount FLOAT
"
if +d 3:/tmp then
else
            mkdir 3:/tmp
endif
"
"
"           Mount dynalib for tasks using the C86 Compiler
"
"
dyna &
sleep 1
"
"
"   Switch to primary console & output QNX logo to display screen
" Note:  ESC1 is switch to $con
"
"
"  Add sleep 1 if you have a corrupted QNX logo.
type
```

```
"
cp /expl/logo
"
"
"   Mount a second console and set terminal mode for QNX
"
"
mount console $con1
tcap set qnx >$con1
"
"
"   Mount a ramdisk to speed processing (requires 500k of memory)
"
"
"  Use the following commands if you have >8 MB memory for a ramdisk.
"mount ramdisk 5 s=500k
"dinit 5 -p
"mkdir 5:/realflex
"mkdir 5:/realflex/bin
"cp 3:/realflex/bin/Wdisp 5:/realflex/bin
"cp 3:/realflex/bin/Wpoke 5:/realflex/bin
"cp 3:/realflex/bin/Wcomm_summ 5:/realflex/bin
"cp 3:/realflex/bin/Wsys_summ 5:/realflex/bin
"search 5 3
"
"
"           Command for automatic startup of VGA screen driver
"           Assume standard VGA
"
"
/windows/drivers/qw.vga &+
"  The line below is for 800X600 operation using ATI card
"/windows/drivers/qw.vga_bios [paradise,1] &
"
"
"           Command for automatic startup of Mouse Driver (bus mouse)
" (Assume a Logitech C9 Serial Mouse)
"
"
/windows/drivers/mdrv microsoft ps/2 mouse &+~:
"
"
"           Commands for automatic startup of RealFlex Windows on reboot of system
"   This requires that the /windows/config/screen.cfg contains the
"           following line:
"                   ~~ start /realflex/bin/realflex
"
"  Enable the following commands if you wish to use QNX password protection
" features (Add passwords as indicated in file /config/pass.exp)
"  (See QNX manual for further details on QNX password protection)
"
"passon
"ontty $con login auto_pwds password
```

```
"
"  Enable the following commands if you DO NOT wish to use QNX password
" protection features (Add passwords as indicated in file /config/pass.exp)
"
passon
ontty $con login auto password
"
"
"  (The sysup command is required whether autostarting or not.)
"
"
sysup
```

D.2. RealFlex

D.2.1. COLDSTART

```
"
"              REALFLEX TASK START UP FILE
"
"
" NODE : node number on which to run task   (0 for current node)
" PRI : priority at which to run task   (4-highest <--> 15-lowest)
" TTY : device number of console on which to run task   (* current tty)
" FLAGS : create option for task (i.e., 1 -> concurrent, not a son)
"                          (     4 -> assume control of keyboard)
" WAIT : 1 -> wait until task completes before continuing; 0 -> do not wait
" TASK NAME : name (or path name) of task to create, plus arguments if any
"
"
" NODE   PRI  TTY   FLAGS  WAIT  TASK NAME
"
   0    5    *     1     0    memdb -c -g
   0    5    *     1     0    dbaccess -c -g
   0    8    *     4     1    Wdb_start
   0    7    *     1     0    histdb
   0    8    *     1     0    reports f=/realflex/data/printer.cfg
   0    7    *     1     0    alarmproc +e
   0    7    *     1     0    dataproc
   0    8    *     1     0    contdo
   0   10    *     1     0    /cmds/cron -l t=/realflex/data/rptcron
" The line below is a simulator driver.  Comment out this line for the real sy
" If I want to use the simulator, make c=[the same channel # as my RTU
" database (for example Endecon -> c=1).
" Also, I must comment out the harris driver line 3 instructions below.
"  0    8    *     1     0    Wscan_sim d=1000 s=2000 c=1
   0    8    *     1     0    rfhdcheck
" The line below gives the Harris configuration.  $tty3 = com1.  Refer to page
" c = realflex channel #(default 1), B=baud, d=scan time in ticks (1 tick =
" 50ms, 100=5 seconds), f=deadband value (0 reports everything)
   0    8    *     1     0    harris c=1 O=2 o=2 d=100 r=2 t=100 f=0 p=$tty3 B=9
   0    5    *     1     0    Wblink 1 2 16
```

```
  0   8   *   1   0   Walm_lines
  0   6   *   1   0   pass_adm
  0   6   *   1   0   Wcontrols
  0   6   *   1   0   update
  0   8   *   1   0   Wfonts
  0   6   *   1   0   heapmgr
  0   6   *   1   0   textmgr
" 0   9   *   1   0   action f=/realflex/data/alm_action
" 0   9   *   1   0   Wcalcdo /realflex/data/USER_CALC_FILE
```

D.2.2. RPTCRON

```
0 7 * * * reportdo m=0 m=2
0 * * * * reportdo m=1
0 7 1 * * reportdo m=3
0 7 1 1 * reportdo m=4
0 7 * * * reportdo c=0 c=1
0 4,8,12,16,20 * * * hist_clean_up +f
0 0 * * * hist_clean_up
5,15,35,45 * * * * rfhdcheck
0 0 * * * del_ev_file
4 0 * * * rtc at
4 0 * * * 3:/realflex/data/Kerman.batch/rundaily.bat > 3:/realflex/data/Kerman.batch/errs2
3,13,23,33,43,53 * * * * 3:/realflex/data/Kerman.batch/run10.bat
0,10,20,30,40,50 * * * * rg_exec f=^data/rg/Kerman t=p
```

Appendix E

REALFLEX DATABASE CALIBRATION PARAMETERS

REALFLEX DATABASE CALIBRATION PARAMETERS

Kerman PV Plant Calibration Factors as of 10/26/93

TAG NAME	POINT DESC	MIN RAW	MAX RAW	MIN EU	MAX EU
D20A1_AN03	WEATHER - GSA	-2048	2047	-1800	1800
D20A1_AN04	WEATHER - GHI	-2048	2047	-1800	1800
D20A1_AN05	WEATHER - DNI	-2048	2047	-1800	1800
D20A1_AN06	WEATHER - WIND SPED	-2048	2047	-50	50
D20A1_AN07	WEATHER - WIND DIR	0	2047	0	360
D20A1_AN08	WEATHER - AMBI TEMP	-2048	2047	-50	50
D20A1_AN10	WEATHER - REL HUMID	0	2047	0	120
D20A1_AN15	REDUND - WATTS	-2048	2047	-540	540
D20A1_AN16	REDUND - VARS	-2048	2047	-540	540
D20C1-1_AN01	INV#1 - AMP A	-2048	2047	-499.47	500.625
D20C1-1_AN02	INV#1 - AMP B	-2048	2047	-500.806	501.343
D20C1-1_AN03	INV#1 - AMP C	-2048	2047	-499.528	500.288
D20C1-1_AN04	INV#1 - KWATTS	-2048	2047	-300.680	300.270
D20C1-1_AN05	INV#1 - KVARS	-2048	2047	-300.706	300.564
D20C1-1_AN06	INV#1 - VOLT A	-2048	2047	-518.231	519.995
D20C1-1_AN07	INV#1 - VOLT B	-2048	2047	-516.426	519.950
D20C1-1_AN08	INV#1 - VOLT C	-2048	2047	-516.021	519.950
D20C1-1_AN09	INV#1 - DCVLTPOS	0	2047	0	598.347
D20C1-1_AN10	INV#1 - DCVLTNEG	-2048	0	-599.768	0
D20C1-1_AN11	INV#1 - DCAMPPOS	-2048	2047	-496.204	496.264
D20C1-1_AN13	INV#1 - MB TEMP1	0	2047	-100	400
D20C1-1_AN14	INV#1 - MB TEMP2	0	2047	-100	400
D20C1-1_AN15	INV#1 - MB TEMP3	0	2047	-100	400
D20C1-2_AN01	INV#2 - AMP A	-2048	2047	-502.626	502.515
D20C1-2_AN02	INV#2 - AMP B	-2048	2047	-502.686	502.515
D20C1-2_AN03	INV#2 - AMP C	-2048	2047	-501.796	503.206
D20C1-2_AN04	INV#2 - KWATTS	-2048	2047	-301.080	300.685
D20C1-2_AN05	INV#2 - KVARS	-2048	2047	-301.281	300.942
D20C1-2_AN06	INV#2 - VOLT A	-2048	2047	-519.59	519.980
D20C1-2_AN07	INV#2 - VOLT B	-2048	2047	-520.17	520.400
D20C1-2_AN08	INV#2 - VOLT C	-2048	2047	-520.55	520.550
D20C1-2_AN09	INV#2 - DCVLTPOS	0	2047	0	599.886
D20C1-2_AN10	INV#2 - DCVLTNEG	-2048	0	-600.155	0
D20C1-2_AN11	INV#2 - DCAMPPOS	-2048	2047	-498.385	497.785
D20C1_AN01	12KV - AMP A	-2048	2047	-25.003	24.995
D20C1_AN02	12KV - AMP B	-2048	2047	-24.948	25.037
D02C1_AN03	12KV - AMP C	-2048	2047	-24.943	24.983
D20C1_AN04	12KV - KWATTS	-2048	2047	-599.2	598.934
D20C1_AN05	12KV - KVARS	-2048	2047	-600.9	601.552
D20C1_AN06	12KV - VOLT A	-2048	2047	-15547	15596
D20C1_AN07	12KV - VOLT B	-2048	2047	-15579	15599
D20C1_AN08	12KV - VOLT C	-2048	2047	-15437	15576
D20C2-1_AN01	INV#1 - TRKANGL 1	0	2047	69.072	-50.643
D20C2-1_AN02	INV#1 - TRKANGL 2	0	2047	69.304	-52.828
D20C2-1_AN03	INV#1 - TRKANGL 3	0	2047	71.007	-52.387
D20C2-1_AN04	INV#1 - TRKANGL 4	0	2047	69.768	-50.912

D20C2-1_AN05	INV#1 - PLN IRRAD	0	2047	-1800	1800
D20C2-1_AN09	INV#1 - TRKANGL 5	0	2047	70.978	-52.514
D20C2-1_AN10	INV#1 - TRKANGL 6	0	2047	71.264	-53.400
D20C2-1_AN11	INV#1 - TRKANGL 7	0	2047	70.657	-55.189
D20C2-1_AN12	INV#1 - TRKANGL 8	0	2047	69.400	-51.312
D20C2-1_AN13	INV#1 - TRKANGL 9	0	2047	69.556	-51.602

Appendix F

KERMAN DATABASE MAPPING

KERMAN DATABASE MAPPING

Analog Mapping				
Pt Offst			Aux Address	
Port #	Name	D20 Sys. Point #	Card Point #	Card
10	I-X IRRAD	3	3	D20A1
10	GLO IRRAD	4	4	D20A1
10	NOR IRRAD	5	5	D20A1
10	WIND SPED	6	6	D20A1
10	WIND DIR	7	7	D20A1
10	AMBI TEMP	8	8	D20A1
10	PLN IRRAD	9	9	D20A1
10	REL HUMID	10	10	D20A1
10	REDD WATT	15	15	D20A1
10	REDD VARS	16	16	D20A1
11	AMP A	33	1	D20C1
11	AMP B	34	2	D20C1
11	AMP C	35	3	D20C1
11	WATTS	36	4	D20C1
11	VARS	37	5	D20C1
11	VOLT A	38	6	D20C1
11	VOLT B	39	7	D20C1
11	VOLT C	40	8	D20C1
12	AMP A	49	1	D20C1-INV1
12	AMP B	50	2	D20C1-INV1
12	AMP C	51	3	D20C1-INV1
12	WATTS	52	4	D20C1-INV1
12	VARS	53	5	D20C1-INV1
12	VOLT A	54	6	D20C1-INV1
12	VOLT B	55	7	D20C1-INV1
12	VOLT C	56	8	D20C1-INV1
12	DCVLTPOS	57	9	D20C1-INV1
12	DCVLTPOS	58	10	D20C1-INV1
12	DCAMPPOS	59	11	D20C1-INV1
12	INV TEMP	60	12	D20C1-INV1
12	MB TEMP1	61	13	D20C1-INV1
12	MB TEMP2	62	14	D20C1-INV1
12	MB TEMP3	63	15	D20C1-INV1
13	TRKANGL 1	65	1	D20C2-INV1
13	TRKANGL 2	66	2	D20C2-INV1
13	TRKANGL 3	67	3	D20C2-INV1
13	TRKANGL 4	68	4	D20C2-INV1
13	PLN IRRAD	69	5	D20C2-INV1
13	TRKANGL 5	73	9	D20C2-INV1
13	TRKANGL 6	74	10	D20C2-INV1
13	TRKANGL 7	75	11	D20C2-INV1

13	TRKANGL 8	76	12	D20C2-INV1
13	TRKANGL 9	77	13	D20C2-INV1
14	AMP A	81	1	D20C1-INV2
14	AMP B	82	2	D20C1-INV2
14	AMP C	83	3	D20C1-INV2
14	WATTS	84	4	D20C1-INV2
14	VARS	85	5	D20C1-INV2
14	VOLT A	86	6	D20C1-INV2
14	VOLT B	87	7	D20C1-INV2
14	VOLT C	88	8	D20C1-INV2
14	DCVLTPOS	89	9	D20C1-INV2
14	DCVLTPOS	90	10	D20C1-INV2
14	DCAMPPOS	91	11	D20C1-INV2
14	INV TEMP	92	12	D20C1-INV2

Status Mapping

Pt Offst			Aux. Address	
Port #	Name	D20 Sys. Point #	Card Point #	Card
1	BLDG SMOK	1	1	D20S1
1	BLDG INTR	2	2	D20S1
1	UPS FAIL	4	4	D20S1
1	UPS BYPAS	5	5	D20S1
1	UPS TROBL	6	6	D20S1
1	COM1 TRBL	7	7	D20S1
1	COM2 TRBL	8	8	D20S1
1	TRALHITMP	9	9	D20S1
1	TRAL SMOK	10	10	D20S1
1	AUXPWR UV	11	11	D20S1
1	BATT UV	12	12	D20S1
1	CHARG TRB	13	13	D20S1
1	ANUN FAIL	14	14	D20S1
3	BKR OPEN	69	9	D20C1
3	LOCAL REM	70	10	D20C1
3	GND FAULT	71	11	D20C1
3	T/T XMTFL	72	12	D20C1
3	T/T RCVFL	73	13	D20C1
3	T/T XMTFL	74	14	D20C1
3	T/T RCVFL	75	15	D20C1
3	IAX TRKTRB	76	16	D20C1
4	BKR OPEN	77	1	D20C1-INV1
4	LOCAL REM	78	2	D20C1-INV1
4	PCS ON	79	3	D20C1-INV1
4	PCS SREDY	80	4	D20C1-INV1
4	PCS SFLT	81	5	D20C1-INV1
4	PCS SHUTD	82	6	D20C1-INV1
4	PCS OVTMP	83	7	D20C1-INV1
4	DC GNDFLT	84	8	D20C1-INV1
4	SMOKE DET	85	9	D20C1-INV1

4	PCS FAULT	86	10	D20C1-INV1
4	SYNC FAIL	87	11	D20C1-INV1
4	SPARE	88	12	D20C1-INV1
4	T1 HITEMP	89	13	D20C1-INV1
4	FAN FAIL	90	14	D20C1-INV1
6	BKR OPEN	109	1	D20C1-INV2
6	LOCAL REM	110	2	D20C1-INV2
6	PCS ON	111	3	D20C1-INV2
6	PCS SREDY	112	4	D20C1-INV2
6	PCS SFLT	113	5	D20C1-INV2
6	PCS SHUTD	114	6	D20C1-INV2
6	PCS OVTMP	115	7	D20C1-INV2
6	DC GNDFLT	116	8	D20C1-INV2
6	SMOKE DET	117	9	D20C1-INV2
6	PCS FAULT	118	10	D20C1-INV2
6	SYNC FAIL	119	11	D20C1-INV2
6	SPARE	120	12	D20C1-INV2
6	FAN FAIL	121	13	D20C1-INV2

Control Mapping

Pt Offst. Port #	Name	D20 Sys. Point #	Control ID #	Card
3	BKR OPEN	1	1	D20C1
3	BKR CLOSE	2	1	D20C1
3	IX TRKRST	3	2	D20C1
4	BKR OPEN	9	1	D20C1-INV1
4	BKR CLOS	10	1	D20C1-INV1
4	INV DISAB	11	2	D20C1-INV1
4	INV RESET	12	3	D20C1-INV1
4	INVRESTRT	13	4	D20C1-INV1
6	BKR OPEN	25	1	D20C1-INV2
6	BKR CLOSE	26	1	D20C1-INV2
6	INV DISAB	27	2	D20C1-INV2
6	INV RESET	28	3	D20C1-INV2
6	INVRESTRT	29	4	D20C1-INV2

Accumulators Mapping

Pt Offst Port #	Name	D20 Sys. Point #	Aux. Address Card Point #	Card
8	PULSE OUT	1	1	D20C1
8	PULSE IN	2	2	D20C1
8	PULSE CAG	3	3	D20C1
8	PULS LEAD	4	4	D20C1

Appendix G

BATCH FILE LISTINGS

BATCH FILE LISTINGS

G.1. *rundaily.bat*

```
"Put date into datefile in the format DD-MMM-YY - HH:MM xm
date > 3:/realflex/data/Kerman.batch/datefile
"Use led to parse and convert time string in datefile to the format
"MMDDYYkm.csv and put that in the file run10.bat like this:
"     cat MMDDYYkm.csv 10minuteaveragefile > MMDDYYkm.csv
led 3:/realflex/data/Kerman.batch/datefile < 3:/realflex/data/Kerman.batch/ledcmds >
3:/realflex/data/Kerman.batch/errs
"Make run10.bat executable.
chattr a=+e 3:/realflex/data/Kerman.batch/run10.bat
```

G.2. Example *datefile*

```
24-Nov-93 12:05:00 am
```

G.3. *ledcmds*

```
1s/ /0/
1s/Jan/01/
1s/Feb/02/
1s/Mar/03/
1s/Apr/04/
1s/May/05/
1s/Jun/06/
1s/Jul/07/
1s/Aug/08/
1s/Sep/09/
1s/Oct/10/
1s/Nov/11/
1s/Dec/12/
1s/://
1s/-//
1s/am//
1s/pm//
1s/ [0-9]*//
1a
km.csv
.
1j
1k1
1i
cat 3:/realflex/data/Kerman.data/
.
1j
1a
 3:/realflex/bin/Kerman > 3:/realflex/data/Kerman.batch/tmp
.
1j
2i
cp 3:/realflex/data/Kerman.batch/tmp 3:/realflex/data/Kerman.data/
.
2j
w 3:/realflex/data/Kerman.batch/run10.bat
qq
```

G.4. Example *run10.bat*

```
cat 3:/realflex/data/Kerman.data/241193km.csv 3:/realflex/bin/Kerman > 3:/realflex/data/Kerman.batch/tmp
cp 3:/realflex/data/Kerman.batch/tmp 3:/realflex/data/Kerman.data/241193km.csv
```

G.5. *TDCBACK_INCR*

```
3:/tdcback/aha &
files 3:/ -v +m p=^bitmap | 3:/tdcback/tdcback aha0 1 continue "save incremental"
3:/tdcback/tdc aha0 1 quit
```

G.6. *TDCBACK_FULL*

```
/tdcback/aha &
echo "/tmp/dir.report" >/tmp/list
files 3:/ -v +d | /tdcback/tdcdir report >/tmp/dir.report
/tdcback/tdcback aha0 1 save </tmp/list
rm /tmp/dir/report /tmp/list
files 3:/ -v p=^bitmap | /tdcback/tdcback aha0 1 continue "errors /tdcback/errors" save verify
/tdcback/tdc aha0 1 quit
```

G.7. *TDCBACK_HIST*

```
/tdcback/aha &
echo "/tmp/dir.report" >/tmp/list
files 3:/realflex/data/hist.save -v +d | /tdcback/tdcdir report >/tmp/dir.report
/tdcback/tdcback aha0 1 save </tmp/list
rm /tmp/dir.report /tmp/list
files 3:/realflex/data/hist.save -v p=^bitmap | /tdcback/tdcback aha0 1 continue "errors /tdcback/errors" verbose save verify
>/tdcback/verify_log
/tdcback/tdc aha0 1 quit
```

G.8. *TDCBACK_CSV*

```
/tdcback/aha &
files 3:/realflex/data/Kerman.data -v +c p=^bitmap | /tdcback/tdcback aha0 1 continue "errors /tdcback/errors" verbose save verify
>/tdcback/verify_log
/tdcback/tdc aha0 1 quit
```

G.9. *TDCBACK_LIST*

```
/tdcback/aha &
/tdcback/tdcback aha0 1 verbose continue "errors /tdcback/errors" list >/tdcback/list
/tdcback/tdc aha0 1 quit
```

Appendix H

CONTACTS

CONTACTS

Item	Company Responsible	Contact	Telephone & FAX
Harris/Westonics Hardware	Harris Corporation	Adam Caballero	ph: (206) 828-2716 fx: (206) 828-2149
Weather Instrumentation	Augustine + Co.	Jim Augustine	hm: (510) 525-0464 fx: (510) 525-9410
Database Calibration	Endecon	Paul Hutchinson	ph: (916) 753-0796 fx: (916) 753-8469
Database Calibration Maintenance	PG&E	Dan Divine	ph: (209) 263-7115
R&D Computer	Endecon	Ben Valega	ph: (510) 867-3360 fx: (510) 867-3362
General Site Questions	PG&E	Brian Farmer	ph: (510) 866-5259 fx: (510) 866-5447