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Power Reactor Programs System Design Description

ATR In-Vessel Post Accident Monitoring System (IVPAMS)

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1. FUNCTION AND DESIGN REQUIREMENTS

The functions and design requirements for the ATR In-Vessel Post-Accident Monitoring System are detail`ed in EDF TRA-ATR-745 Rev. 1. "In-Vessel and Post Accident Monitoring System (IVPAMS)."

The In-Vessel Post-Accident Monitoring System was upgraded to be Y2K compliant during August 1999. This upgrade installed new Pentium Computers with the Windows NT operating system. The IVPAMS application was upgraded to using Wonderware's InTouch 7.0. The current release of InTouch corrects the known software bugs that were documented with InTouch version 5.0b. The method of synchronizing the time on the two IVPAMS computers was simplified during this upgrade. A small Internet "time" application runs in the background and the IVPAMS times are synced with a US Time Standard. The overall functionality of IVPAMS remains unchanged with the exception that it is now possible to display eight variables on the historical trend instead of four. No changes were required in the instrumentation or the Siemens' PLC and its program.

2. DESIGN DESCRIPTION

2.1 SYSTEM OVERVIEW

The ATR In-Vessel Post-Accident Monitoring System is designed to monitor and log data from selected plant parameters and display this information in the TRA Emergency Command Center (ECC) for use by the TRA Emergency Response Team. In addition to displaying this information in the ECC, this information is also displayed and logged in TRA 670 Room 130.

The IVPAMS' data acquisition system is located in TRA 670 Room 130 and is connected to the systems' main computer, IVPAMSA, via a serial link. An Ethernet Fiber Optic link is used to connect the main computer system to the remote computer, IVPAMSB, located in the ECC.

The plant parameters monitored include, vessel coolant level and temperature, Log N, reactor inlet and outlet pressure, emergency coolant flow, building water levels, canal level, and temperatures related to the safety relief valves. See Figures 2.1 and 2.2 for power and system block diagrams. See drawings Section 2.2.6 for system drawings.

2.2 HARDWARE

The In-Vessel Post Accident Monitoring System (IVPAMS) is composed of several measurement systems located throughout the plant, a data acquisition system located in TRA 670 Room 130, monitoring and display systems located in

TRA 670 Room 130 and TRA 680 Room 112. The IVPAMS is powered by an uninterruptible power system. The two monitoring and display systems located in TRA 670 Room 130 and TRA 680 Room 112 are connected to each other via a fiber optic Ethernet link.

2.2.1 MEASUREMENT SYSTEMS

2.2.1.1 Building Level

The IVPAMS measurement system includes two bubbler systems used to monitor a water level that may exist in the ATR building during and after a loss-of-coolant accident. These level measurements are made in the Primary Coolant Pipe Corridor, 83-LT-2, and in the Heat Exchanger Room, 83-LT-3. The measurement sensing location in the Primary Coolant Pipe Corridor is located at the 40 foot elevation, while the sensing location in the Heat Exchanger Room is located at the 48 foot elevation. The measured ranges for these building level measurements will be from the indicated sensing locations to the top of the reactor located at the 98 foot elevation.

Each of the bubbler systems include a Brooks flow indicator with an integral flow controller and a Rosemount Pressure Transmitter. The flow controller is used to maintain a uniform flow in the outlet tube regardless of the coolant head being sensed. The normal air supply for these systems is plant air, with a bottled Nitrogen source being used to provided a backup supply. If the plant air supply is lost, the Nitrogen backup source is automatically valved into the system to maintain bubbler flow. Both the plant air supply and the nitrogen backup supply are regulated at 40 psi. The pressure transmitters are powered by redundant 24 Volt power supplies and provide a 4-20 ma signal proportional to building level to the data acquisition system. These instruments are located on the west wall of the 1st basement Switch Gear Area. Details on these instruments are shown in Dwg. 444922.

2.2.1.2 Canal Level

The IVPAMS measurement system includes a bubbler systems used to monitor the water level ATR Canal, 83-LT-4. This bubbler system has a range of 0 to 21 feet with the outlet of the sensing tube located at the base of canal along the South wall of the canal.

The design of this bubbler system is similar to those used to monitor the building water levels. The instruments are located near those used to monitor the building water level. Details of 83-LT-4 are show in Dwg. 444922.

2.2.1.3 Pressure

The IVPAMS measurement system monitors the Primary Coolant Systems inlet and outlet pressure. An existing differential pressure Transmitter, DPT-1-4 is used to determine the pressure drop across the core. The inlet pressure Transmitter's (83-PT-5) impulse line is teed off of the DPT-1-4 high impulse line and outlet pressure Transmitter's (83-PT-6) impulse line is teed off of DPT-1-4 low impulse line. The two transmitters have a pressure range of 0 to 500 psi. These pressure transmitters are powered by redundant 24 Volt power supplies and provide a 4-20 ma signal to the data acquisition system. Details on these instruments are shown in Dwg. 444921.

2.2.1.4 Flow

The IVPAMS measurement system monitors the PCS Emergency Flow (83-FT-1) and the ATR Firewater Injection System Flow (83-FT-7) through the bottom head.

The PCS Emergency Flow is monitored by monitoring the differential pressure across an orifice plate in the 14" pipe downstream from the PCS emergency coolant pumps in the Heat Exchanger Room. The Transmitter, 83-FT-1 is calibrated to measure an input range of 0 - 180 inches of H_2O and provides a 4 to 20 mA signal to the data acquisition system. The transmitter is powered by redundant 24 volt power supplies. The data acquisition system conditions the 4 to 20 mA input to represent a 0 to 4700 gpm flow. The Emergency Flow algorithm is represented by the following equations:

Emergency Flow = 4700 * SQRT(Measured inches H_2O/ 180) GPM, where the range of measured inches H_2O = 0 to 180.

The ATR Firewater Injection Flow is measured using a Controlotron clamp-on transit-time ultrasonic flowmeter. The Flow Computer, 83-FT-7, is mounted in the IVPAMS rack located in TRA 670 Room 130. The two flow Transducers,

83-FT-7A (Upstream) and 83-FT-7B (Downstream) are mounted on the 8" firewater line in the 2nd basement just ahead of the control valves. The details of these measurement devices are shown in Dwg. 444924 and 443949.

2.2.1.5 Core Power

The IVPAMS measurement system monitors the Reactor Core Power by utilizing the same conditioned information signal feeding core power data to recorders and a period meter in the ATR control room. One of the Outputs, J104, from the ATR Keithley Model 25012 Log N period amplifier is short circuit protected with a 100 ohm resistor and is transient filtered with a 4 microfarad capacitor. J104 is shown on Dwg. 406525. This output provides a 0 to -8 volt signal to the data acquisition system representing an 8 decade monitoring range for reactor power.

2.2.1.6 Safety Relief Valve Leakage

The two Safety Relief Valves, SF-A-71 and SF-A-72 on the lower drain are instrumented with Type K thermocouples to monitor their inlet and outlet temperatures. An additional thermocouple was mounted on a small junction box located on the wall in the nozzle trench to monitor the ambient temperature in the nozzle trench. Thermocouple (TC) 83-TE-10 monitors the temperature on the lower drain (inlet to the relief valves). TCs 83-TE-11 and 83-TE-12 monitor the temperature on the piping near the outlet of SF-A-71 and SF-A-72 respectively. TC 83-TE-13 monitors the ambient temperature in the Nozzle Trench. Details of these thermocouples are shown on Dwg. 444927.

The intent in monitoring these various temperatures was to determine when the two valves were leaking based on the temperature gradients between the inlet and outlet and the ambient nozzle trench temperature.

2.2.1.7 In-Vessel Probe

The In-Vessel Probe provides two absolute thermocouples which will be available to monitor the reactor coolant temperature and 14 heated differential thermocouple junctions used to sense the

coolant level at discrete locations in the vessel between the elevations of 91' 11.8" and 74' 4.6". Type K thermocouple material was used to fabricate the absolute Tcs as well as the differential TC junctions. One of the TCs, 83-TE-15, will be monitored by the IVPAMS data acquisition system, while the other TC is a spare. Each of the 14 differential TCs is composed of two junctions. One of the junctions is heated by passing a current through a small heating element adjacent to the junction, while the other junction is not heated. A power supply capable of supplying a constant current is used to heat the 14 heated junctions. When coolant covers the heated junction, the heat is dissipated into the coolant and the emf generated by the two junction of the differential TC cancel each other. When the heated junction becomes uncovered, its temperature will begin to increase yielding an increase in the differential output from the two junctions. The probe was designed to provide a minimum of at least 5 mV output from each of the 14 differential elements from the covered to uncovered condition. The state of each of the 14 differential elements, i.e. covered or uncovered, is monitored by the data acquisition system and conditioned to provide an analog display of the coolant level in the vessel.

A Sorensen Power Supply Model DCR 150-3B2 is used in conjunction with this probe to provide the required constant current to the probes' heater elements.

The probe was fabricated and supplied by Delta-M Corporation of Oakridge, Tennessee. A "Technical and Operation Manual for the ATR In-vessel Post Accident Monitoring System Liquid Level and Temperature Measurement Probe", Document GT4204-05 provided by Delta-M discusses the design and operation of the probe.

2.2.2 DATA ACQUISITION SYSTEM

The IVPAMS data acquisition system consists of a Siemens' SIMATIC TI505 Programmable Controller and 4 input modules from Control Technology Inc. (CTI). One module is an Eight Channel Isolated Analog Input Module, CTI 2550. Six of these channels are configured for a 4 to 20 mA input, one channel is configured for a 0 to 10 volt input and one channel configured for a -10 to 10 volt input. Three of the input modules are Eight Channel Isolated Thermocouple Input Modules, CTI 2551. These modules can be configured for either thermocouple inputs or

millivolt inputs. Two of these module are configured for 0 to 50 Mv inputs, while five channels of the other input module were configured for Type K thermocouples with a temperature scale of °F. The remaining three channels on this module are unused. The millivolt inputs are used to acquire data from the liquid level probe's 14 discrete inputs and to monitor the voltage and current provided to the probe's heater elements.

The signals to the input modules are further processed using special function programs (SFPGM) on the SIMATIC TI505 Programmable Controller to provide input variables to the Monitoring & Display System. A DOS PLC Programming software package, TISOFT, running on the rack-mounted Comark computer was used to create the programs which runs on the PLC. Table 2.1 lists the various SFPGM, input words (WXnn) i.e. the acquired input signals, and variables created by the PLC for access by the software package running on the Monitoring and Display System.

A serial interface links the PLC to serial port, Com 2 of the IVPAMSA computer. With the Y2K Upgrade of the IVPAMS systems, a second computer was add to the IVPAMS system in TRA-670 Room 130 running Window NT and Y2K compliant software. The original DOS and Windows 3.1 computer system (Comark) remains located in the instrument rack and can be used to run the TISOFT application (DOS based) for reprogramming the Siemens 545 PLC. Should this be required, the serial cable connected to the PLC should be reconnected to Com 2 of the Comark Computer. The Windows NT Pentium Computer will normally be connected to the PLC via its Com 2 port running the Wonderware InTouch IVPAMS application.

2.2.3 UNINTERRUPTIBLE POWER SYSTEM

The IVPAMS data acquisition and display system is powered via an Uninterruptible Power System (UPS) designed to provide a continuous operating power should a failure occur in the normal power source in either TRA 670 Room 130 or TRA 680 Room 112.

For the main IVPAMS node located in TRA 670 Room 130, the UPS design included a 5.3 KVA UPS with a supplemental bank of batteries to provide minimum of four hours of continuous operating power. The design also includes a transfer switch to permit a portable generator to be used as a power source for the UPS should it be necessary to operate without commercial/diesel power for an extended period of time.

For the remote IVPAMS node located in the ECC, TRA 680 Room 112, an uninterruptible power system is achieved by using a 700 VA UPS to provide a short-term backup power source. The ECC power is backed up by an existing generator system that automatically restores power within less than 20 seconds of the failure of the commercial power in the building. The 700 VA UPS provides adequate backup power to cover the transition period between loss of commercial power and the time the diesel generator becomes operational.

Details of the two UPS are cover in the Best Power Technology's Installation Manual and User Manual. See Section 6.9.

2.2.4 MONITORING & DISPLAY SYSTEM

The Monitoring and Display portion of the IVPAMS includes two Pentium computers (mini tower chassis) operating in the Windows NT environment and two SVGA color-monitors. The computers have an integrated 10/100Mb 3Com network interface. The IVPAMS computers have 128MB of memory and 19Gb hard drive. An HP8200 CD-Writer installed in both of the IVPAMS computers to facilitate transferring of files from the development system.

The IVPAMSA communicates with the PLC via a serial port Com 2 and with IVPAMSB via an Ethernet network connection. IVPAMSB uses an Ethernet network connection to communicate with IVPAMSA. With appropriate software other computers can communicate with IVPAMSA and IVPAMSB over the network.

2.2.5 NETWORK SYSTEM

The two IVPAMS nodes are connected via a fiber optic Ethernet link routed through TRA 670, TRA 628, and TRA 614 to TRA 680. The network hub located in TRA 670 Room 130 is powered from the IVPAMS UPS.

The network node configuration for the IVPAMS system is document in a file contained on IVPAMS Software Configuration CD.

2.2.6 IVPAMS DRAWINGS

406525	LOG N AMPLIFIER SCHEMATIC	444920	ROSEMOUNT XMTR INSTALL.
440506	INSTRUMENT LOCATIONS	444921	83-FT-1 EMERGENCY FLOW INSTALL.
443945	REFLECTOR TANK LEVEL PROBE	444922	83-LT-2,3,4 LEVEL XMTR INSTALL.
443946	LEVEL PROBE ASSEMBLY	444923	83-PT-5,6 PCS XMTR INSTALL.
443947	FIBER CABLE ROUTING TO TRA-680	444924	83-FE-7 FIREWATER XMTR INSTALL.
443948	TRA-680 TERMINAL LOCATION	444927	83-TE-10, 11, 12, 13 TC INSTALL.
443949	COMPUTER RACK LOCATION & INSTALL.	444929	CONTROL/POWER INTERCONNECT DIAGM.
444917	DRAWING INDEX	444930	LLTM PROBE ISOMETRIC
444918	INSTRUMENT DESCRIPTIONS	444931	LLTME PROBE ASSEMBLY
444919	CONDUIT AND TUBING RUNS		

2.3 SOFTWARE

This section discusses the software used in configuring the IVPAMS system. Familiarity with Windows NT and Windows software packages used with the IVPAMS application is assumed.

2.3.1 SIEMENS' TISOFT2 RELEASE 4.3

The TISOFT2 Release 4.3 is a complete programming, documentation and troubleshooting package for use with SIMATIC TI505 programmable controllers. The package runs on an IBM PC and permits on-line programming of the PLC

The Controller is connected to the PC via Serial Port COM2. TISOFT is executed by entering "TI505 P2", where P2 designates serial port COM2.

Details on configuration and programming of the PLC are contained in "SIMATIC TI505/TI500 TISOFT2 Release 4.3 User Manual".

2.3.2 WONDERWARE INTOUCH

An InTouch software development package running on a Windows NT development system was used to create the IVPAMS application. A runtime version of InTouch is operating on each IVPAMS node, IVPAMSA and IVPAMSB. To run the IVPAMS application, each of the InTouch development and runtime systems require that a software licensing key to be load from a floppy to the hard drive. For convenience purposes in developing or troubleshoot the IVPAMS application, the development-licensing key can be temporarily accessed on each runtime node via a floppy disc.

All InTouch documentation is provided in online help files via the development system.

2.3.3 WONDERWARE TIDIR VERSION 4.04

The Wonderware TI Direct Server (TIDIR) is included on the Wonderware CD, I/O Servers. This server operates on node, IVPAMSA, and provided communication between the Siemens PLC and IVPAMS application running this node via serial port Com 2. Settings are documented in a file on the software configuration control CD.

2.4 IVPAMS CONFIGURATION

The InTouch IVPAMS application operates in a Windows NT environment. The various displays created with the IVPAMS application are composed of a series of windows. InTouch WindowViewer runtime executable is used to display the IVPAMS application on nodes, IVPAMSA and IVPAMSB. The IVPAMS application was designed to conceal WindowViewer's title bar and menu bar thus controlling easy access to other Windows applications. With proper User ID and password, the user may access the Title Bar and Menu Bar and exit the IVPAMS application.

The InTouch IVPAMS application files are located in the C:\ivpams99 directory. The IVPAMS application was designed such the identical IVPAMS files are located on each of the runtime nodes and the development node in order to simplify software configuration control. To ensure that the IVPAMS application starts automatically on startup the following executables have been located in the Windows' Startup folder for each node.

IVPAMSA: TIDIR, HISTDATA, and VIEW and an Internet-Time Utility.
IVPAMSB: HISTDATA and VIEW and an Internet-Time Utility.

Detailed configuration data for these applications are contained on the IVPAMS software configuration CD.

The IVPAMS application is setup to log historical data for 30 days. This data is stored in directory, C:\ivpams99\history. The individual tagnames of the parameters to be logged must be marked as "Log Data" in the Tagname Dictionary. Table 2.1 lists the tagnames being logged by the IVPAMS application. InTouch creates a separate log file for each day. These files are automatically named as YYMMDD00.log, where YY represents the year, MM represents the month (01-12), and DD represents the day (0-31) and 00 are always zeros. These historical files within the history directory can be rather larger. When backing up the IVPAMS99 directory, it would be desirable to deselect the history sub-directory to omit storing historical data on the configuration CD. Historical files can be backed up separately if desired. The Parameter associated with the Historical Logger can be modified as required from within Wonderware WindowMaker application via "Special/Configure/Historical Logging . . ." option.

TABLE 2.1 Logged Historical Data.

LOGGED IVPAMS PARAMETERS	TAGNAMES
Primary Coolant System Emergency Flow	FLOW_83FT1
Emergency Firewater Injection Flow	FLOW_83FT7
Building Water Level-Piping Space	LEVEL_83LT2
Building Water Level-Heat Exchanger Room	LEVEL_83LT3
Canal Water Level	LEVEL_83LT4
Reactor Coolant Level	LEVEL_Reactor
Reactor Power, Log N, 8 decades -5 to 3	POWER_Log_N
Primary Coolant System Inlet Pressure	PRESS_83PT5
Primary Coolant System Outlet Pressure	PRESS_83PT6
Level Probe Heater Current	PS_Current
Level Probe Heater Voltage	PS_Voltage
Safety Relief Valve Lower Drain Temp.	TEMP_83TE10
Safety Relief Valve SF_A_71 Outlet Temp.	TEMP_83TE11
Safety Relief Valve SF_A_72 Outlet Temp.	TEMP_83TE12
Safety Relief Valve Ambient Temp.	TEMP_83TE13
Reactor Upper Plenum Temperature	TEMP_83TE15

The Special/Security option within WindowMaker can be used to customize the list of users and setup their access level and privileges. Refer to Section 3.1 for more detail on the access levels and privileges. Once a user logs on with a access

level greater than zero, the IVPAMS application monitors the user's activity (mouse clicks or keystrokes). After 4 minutes of inactivity, a warning message is displayed indicating that if no further activity occurs within the next two minutes the user will be automatically logged off the system as a user with special privileges. This feature prevents the IVPAMS application from being left unattended with special access privileges. By accessing the "Special/Configure/WindowViewer" menu option, the inactivity times, warning and timeout, can modified.

The Siemens PLC input modules first conditions the input data for the IVPAMS application. The TISOFT application running on the PLC assigns input word identifications to each of the inputs, further conditioning the inputs as required using the PLC's "Special Function Programs" (SFPGM) and assigns variable identifications for use by the InTouch application. Table 2.2 provides a reference variable list. This table also provides a listing of status variables used by the IVPAMS application to monitor the PLC's condition.

TABLE 2.2 REFERENCE VARIABLE LIST

SFPGM	INPUT WORD	VARIABLES	COMMENT
1	WX1	V2. V4.	83-FT-1 PCS Emergency Flow. 4 to 20 mA (I) V2. = 0 to 180 Inches H_20 V4. = 4700 * SQRT(V2 / 180) GPM 0 to 4700 GPM
2	WX2	V6.	83-LT-2 Piping Space Bldg Level 40' - 98' 4 to 20 mA (I)
3	WX3	V8.	83-LT-3 Heat Exch. Bldg Level 48' - 98' 4 to 20 mA (I)
4	WX4	V 10.	83-LT-4 Canal Water Level 0 - 2 1' 4 to 20 mA (I)
5	WX5	V 12.	83-PT-5 PCS Inlet Pressure 0 - 500 PSI 4 to 20 mA (I)
6	WX6	V 14.	83-PT-6 PCS Outlet Pressure 0 - 500 PSI 4 to 20 mA (I)
7	WX7	V 16.	83-FT-7 Firewater Inj. Flow 0 -2000 GPM 0 to 10 V (I)
8	WX8	V 18. V20.	83-RT-17 Reactor Core Power -8 to 0 V -10 to 10 V (I) V20. = 10**(-5+ABS(V 18.)) See V94.
9	WX9	V22.	83-LE-18 Reactor Coolant Level 9 1' 11.8" 0 to 50 Mv (I)
10	WX 10	V24.	83-LE-19 Reactor Coolant Level 90' 7.8" 0 to 50 Mv (I)
11	WX 11	V26.	83-LE-20 Reactor Coolant Level 89' 3.8" 0 to 50 Mv (I)
12	WX 12	V28.	83-LE-2 1 Reactor Coolant Level 87' 11.8" 0 to 50 Mv (I)
13	WX 13	V30.	83-LE-22 Reactor Coolant Level 86' 7.8" 0 to 50 Mv (I)

TABLE 2.2 REFERENCE VARIABLE LIST

SFPGM	INPUT WORD	VARIABLES	COMMENT
14	WX 14	V32.	83-LE-23 Reactor Coolant Level 85' 4.9" 0 to 50 Mv (I)
15	WX 15	V34.	83-LE-24 Reactor Coolant Level 84' 1.5" 0 to 50 Mv (I)
16	WX 16	V36.	83-LE-25 Reactor Coolant Level 82' 2.6" 0 to 50 Mv (I)
17	WX 17	V38.	83-LE-26 Reactor Coolant Level 80' 10.6" 0 to 50 Mv (I)
18	WX 18	V40.	83-LE-27 Reactor Coolant Level 79' 6.6" 0 to 50 Mv (I)
19	WX 19	V42.	83-LE-28 Reactor Coolant Level 78' 2.6" 0 to 50 Mv (I)
20	WX20	V44.	83-LE-29 Reactor Coolant Level 76' 10.6" 0 to 50 Mv (I)
21	WX21	V46.	83-LE-30 Reactor Coolant Level 75' 6.6" 0 to 50 Mv (I)
22	WX22	V48.	83-LE-31 Reactor Coolant Level 74' 4.6" 0 to 50 Mv (I)
23	WX23	V50.	Power Supply Current 0 to 3 Amps 0 to 50 Mv (I)
24	WX24	V52.	Power Supply Voltage 0 to 150 Volts 0 to 50 Mv (I)
25	WX25	V54.	83-TE-10, Lower Drain Temperature Type K (I)
26	WX26	V56.	83-TE-11, SF-A-71 Outlet Temperature Type K (I)
27	WX27	V58.	83-TE-12, SF-A-72 Outlet Temperature Type K (I)
28	WX28	V60.	83-TE-13, Ambient Temperature Type K (I)
29	WX29	V62.	83-TE-15, Upper Plemum Temperature Type K (I)
30	WX30	V64.	Spare, V64. is not currently used.
31	WX31	V66.	Spare, V66. is not currently used.
32	WX32	V68.	Spare, V68. is not currently used.
8	-	V94.	V94.= -5+ABS(V18.) Log of Reactor Core Power
33	-	V96.	Analog Output of Level Probe-Used by InTouch
33	-	V98.	Analog Output of Level Probe-Used by SFPGM33
33	-	V100	Packed Level Probe Element Status (14 Points) V100.01 = C100 . . . V100.14 = C113
		V200	Module A1 & A4 Status WX1.16 = V200.01 ... WX8.16 = V200.08 WX25.16 = V200.09 ... WX32.16 = V200.16

TABLE 2.2 REFERENCE VARIABLE LIST

SFPGM	INPUT WORD	VARIABLES	COMMENT
		V201	Module A2 & A3 Status WX9.16 = V201.01 ... WX16.16 = V201.08 WX17.16 = V201.09 ... WX24.16 = V201.16
		V202	V202.1 = STW 1.15 - Battery Low (TI505) V202.2 = STW 1.14 - Scan Overrun (TI505) V202.3 = STW 184.1 - Module Mismatch Error
9,33	-	C100	83-LE-18, 0 = Dry, 1 = Covered
10,33	-	C101	83-LE-19, 0 = Dry, 1 = Covered
11,33	-	C102	83-LE-20, 0 = Dry, 1 = Covered
12,33	-	C103	83-LE-21, 0 = Dry, 1 = Covered
13,33	-	C104	83-LE-22, 0 = Dry, 1 = Covered
14,33	-	C105	83-LE-23, 0 = Dry, 1 = Covered
15,33	-	C106	83-LE-24, 0 = Dry, 1 = Covered
16,33	-	C107	83-LE-25, 0 = Dry, 1 = Covered
17,33	-	C108	83-LE-26, 0 = Dry, 1 = Covered
18,33	-	C109	83-LE-27, 0 = Dry, 1 = Covered
19,33	-	C110	83-LE-28, 0 = Dry, 1 = Covered
20,33	-	C111	83-LE-29, 0 = Dry, 1 = Covered
21,33	-	C112	83-LE-30, 0 = Dry, 1 = Covered
22,33	-	C113	83-LE-31, 0 = Dry, 1 = Covered
9 - 22	-	V92.	V92. sets the Mv value used for determining the level probe element condition, i.e Dry vs. Covered.
-	-	SW 10	Siemens TI 545 Controller - Dynamic Scan Time
-	-	SW 11	Siemens TI 545 Controller - I/O Module Status

(I) - INPUT RANGE, Variables Vn. or VnR = Real, Vn = Integer, Cn = Bit-of-Word Coil, Kn = Constant Memory

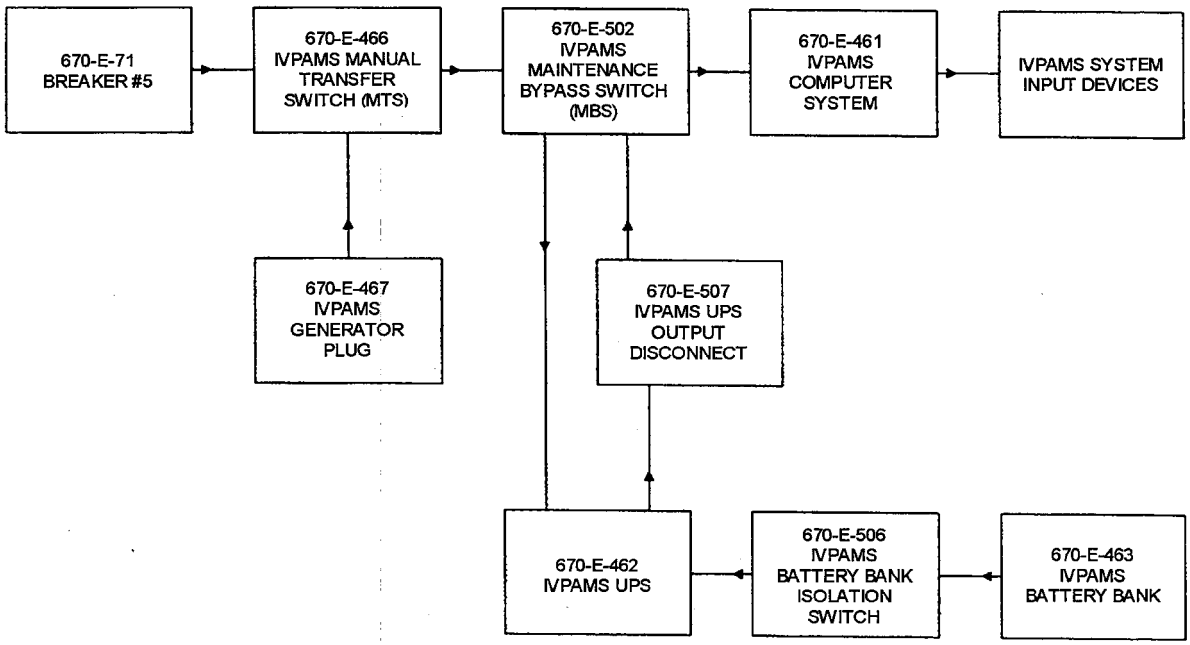

Figure 2.1 IVAMS POWER FLOW DIAGRAM (TRA-670)

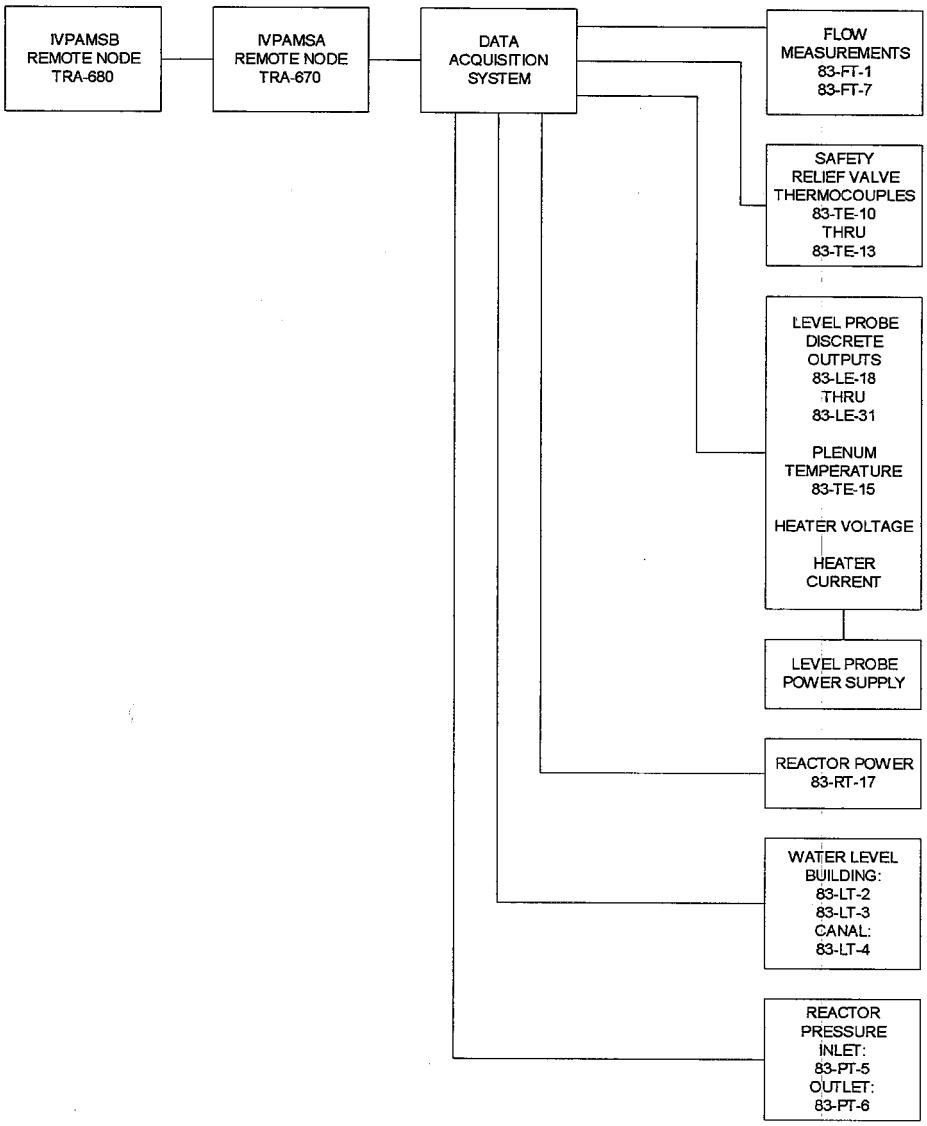

Figure 2.2 IVPAMS BLOCK DIAGRAM

3. OPERATION

The InTouch IVPAMS displays were developed using a series of Windows. All screen displays are identical on both nodes (IVPAMSA and IVPAMS B). Figure 3.1 shows the general IVPAMS screen layout. The upper area of the screen displays system status information and provides a key for the users to log on to the system with special access privileges. The lower portion of the screen displays various menu options that are available to the user. The upper and lower portions of the display are fixed and always visible to the user. The center portion of the display is used to display the IVPAMS data and additional status information that is available via the menu options. The lower right-hand area of the screen is used to display temporary system help screens and information on the various instruments. This portion of the screen is also used to display a digital readout for each instruments output when a realtime chart in being displayed in the center portion of the screen. Details of each portion of the IVPAMS screen will be discussed in the following subsections.

3.1 SYSTEM STATUS DISPLAY

Figure 3.2 shows a detail of the System Status indicators which are always displayed in the upper portion of the screen. The status of the following system parameters are continuously monitored:

IVPAMSA	The status of the InTouch IVPAMS application on node IVPAMSA.
HIST. LOG A	The status of the historical logger on node IVAPMSA.
IVPAMSB	The status of the InTouch IVPAMS application on node IVPAMSB.
HIST. LOG B	The status of the historical logger on node IVPAMSB.
PLC	The status of the physical serial connection between IVPAMS data acquisition system (PLC) and the main (IVPAMSA) computer's serial port Com2.
TIDIR	The status of the Wonderware Texas Instruments Direct Server (TIDIR) that allows the InTouch IVPAMS application to access data in TI545 PLC.

Each of the status indicators will display an "OK" in a green background to indicate that these parameters are functioning normally. A failure of a system's parameter is indicated by displaying "DOWN" in a red flashing background.

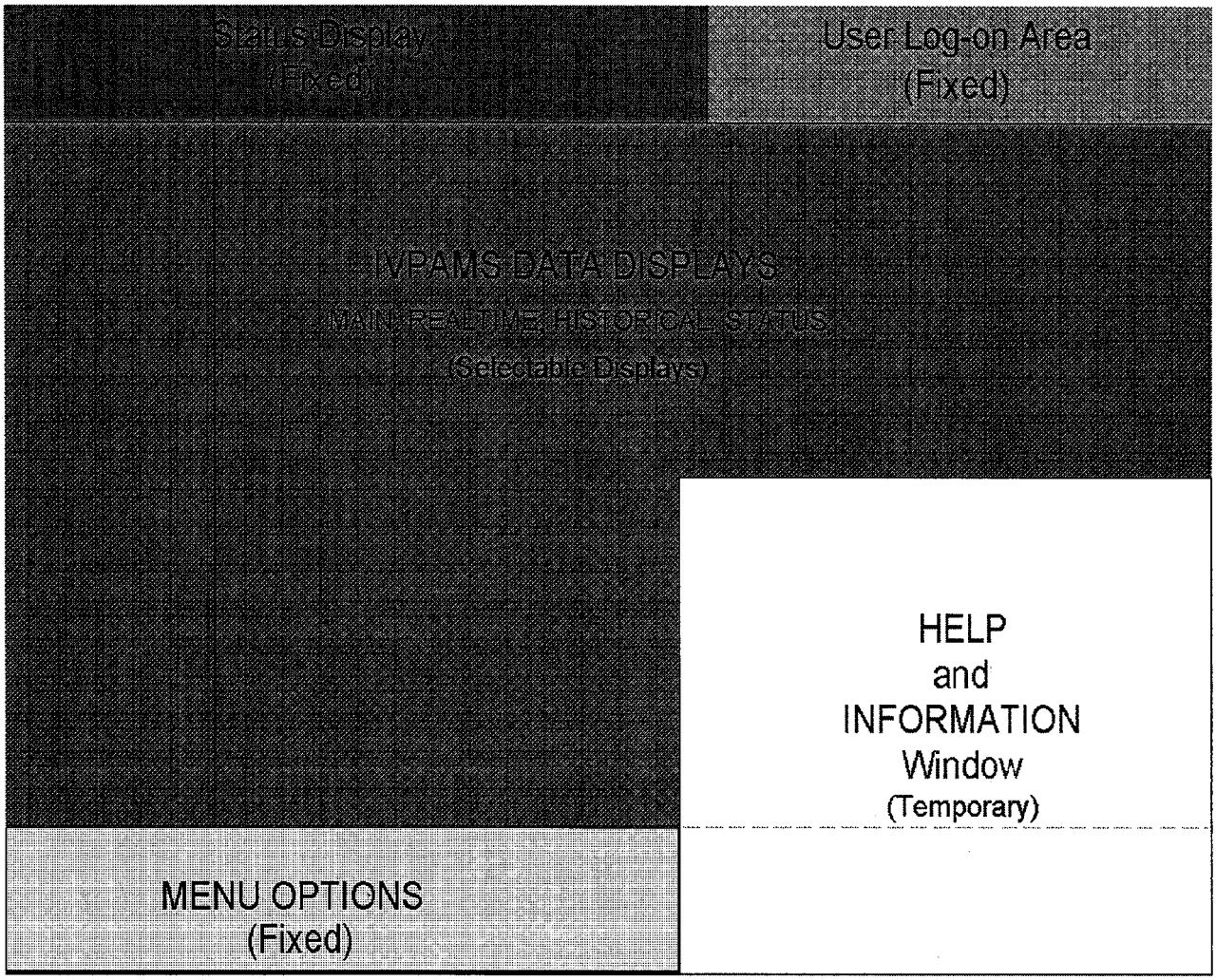

Figure 3.1 IVPAMS Display Screen Layout

3.2 USER DISPLAY

Figure 3.3 shows a detail of the user log-on area. This portion of the screen displays the user's ID and his access. The key in the key slot turned 90? indicates a user with access privileges has logged onto the IVPAMS display system. Various access levels and privileges designed into the IVPAMS application are listed in Table 3.1. When no special user is logged on to the system the key slot is empty and User "none" is displayed. No special user privileges are required to access all of the monitored and logged data that is displayed on the IVPAMS system. Clicking on the key slot opens windows for the user to input a User ID and a password to gain special access privileges.

TABLE 3.1 IVPAMS ACCESS PRIVILEGES

ACCESS LEVEL	ACCESS PRIVILEGES
0	All data and status displays, including Realtime and Historical
> 1499	Historical Trend Chart Options: Print and Save to File.
> 2499	Menu Options: Setpoints and System Adjustments + lesser privileges.
> 4000	Small Upper Band permits Windows access + all lesser privileges.
> 9000	Required to added or modify User List + all lesser privileges.

3.3 IVPAMS MENU

Figure 3.4 details the menu options that are available on the IVPAMS display. The "Setpoint" and "Sys Adj." options are available for users with access levels greater than 2499. The IVPAMS Menu is always available to the user. Clicking on the menu options in the first row of the menu changes the window being displayed in the center portion of the screen between Main, Realtime, Historical, or Status. The four screen are labeled so the user can identify the option that is currently being displayed. Selecting an option from the second row of the menu, Help, Sys Info, Setpoint, or Sys Adj., opens a smaller overlay window along the right-hand portion of the screen. Subsequent sections will discuss each of the menu options.

3.3.1 MAIN

Figure 3.5 shows the Main IVPAMS screen. This is the default screen that is displayed when the IVPAMS is started. The Main screen displays a pictorial representation of the In-Vessel Post-Accident Monitoring and Display System along with digital readouts for all of the plant parameters

being monitored. The reactor vessel area and each of the digital readouts shown on the Main screen are "Hot Spots". As the cursor is moved to a Hot Spot a rectangular box will highlight the Hot Spot. Clicking the left mouse button on a Hot Spot and holding it depressed will open up an information window describing the instrument channel and pertinent reference information. As the mouse button is released the information window will automatically close.

Figure 3.6 shows the additional information that is available by clicking on the vessel Hot Spot. The "Probe Elements" window displayed in Figure 3.6 shows the status of each individual element of the probe. Each indicator is blue when the element is covered and red for the uncovered condition. A flashing gray color indicates an out-of-range input signal or an open in the signal leads.

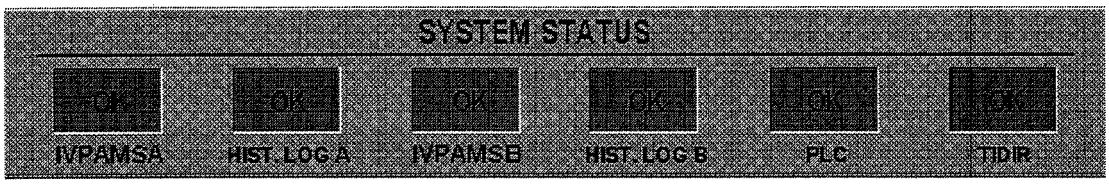

Figure 3.2 IVPAMS System Status Indicators

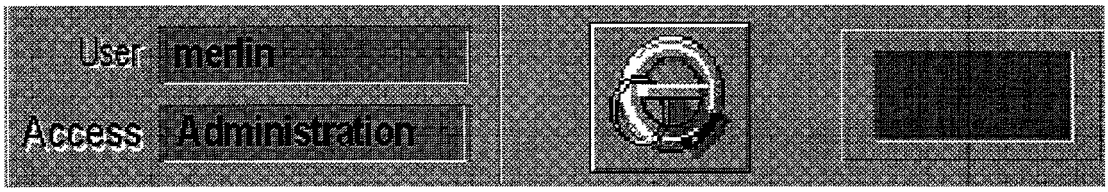

Figure 3.3 IVPAMS User Access Key

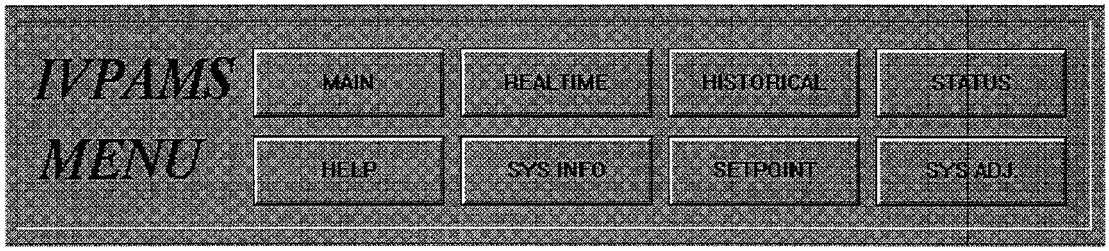

Figure 3.4 IVPAMS Menu Window

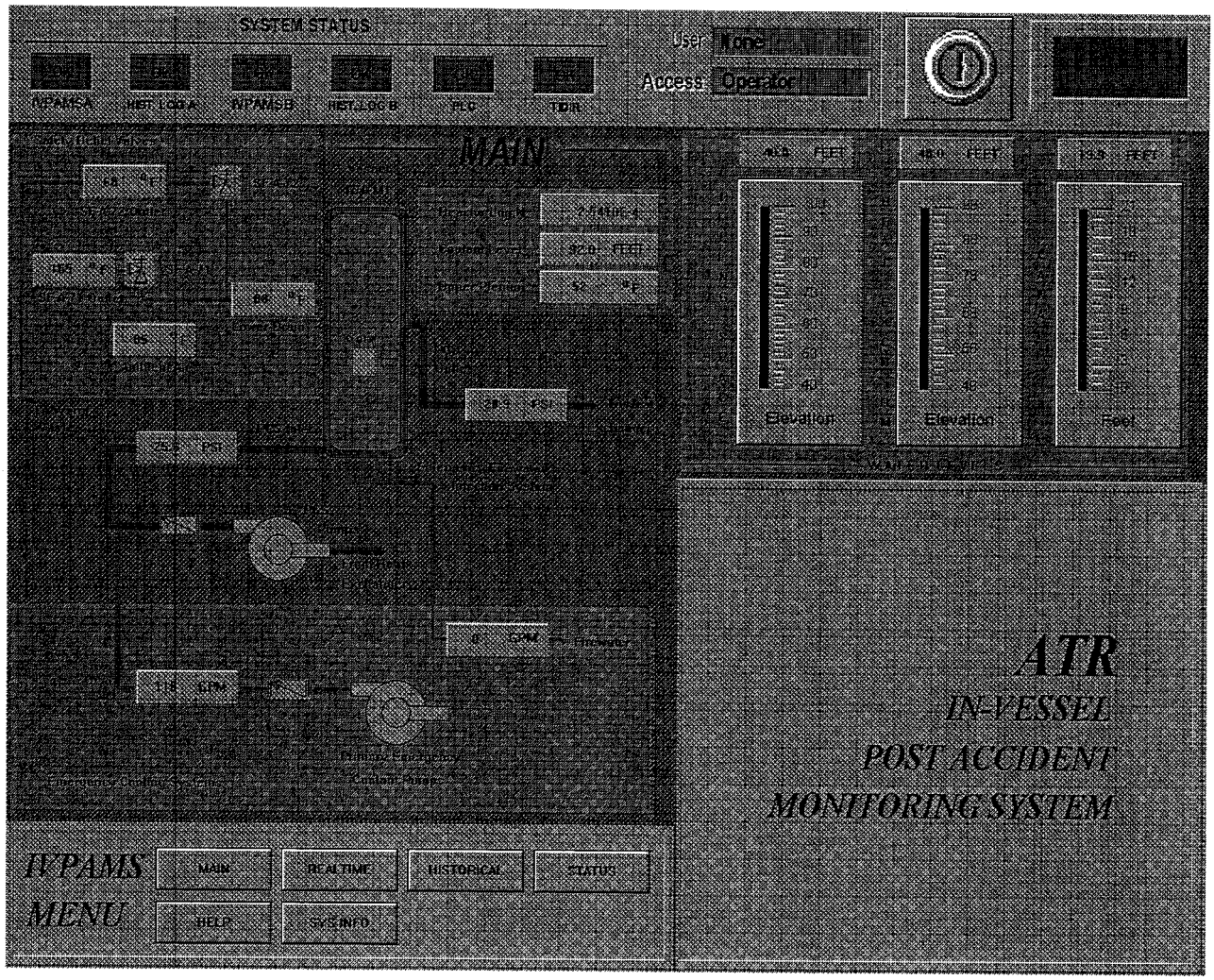

Figure 3.5 IVPAMS Main Screen.

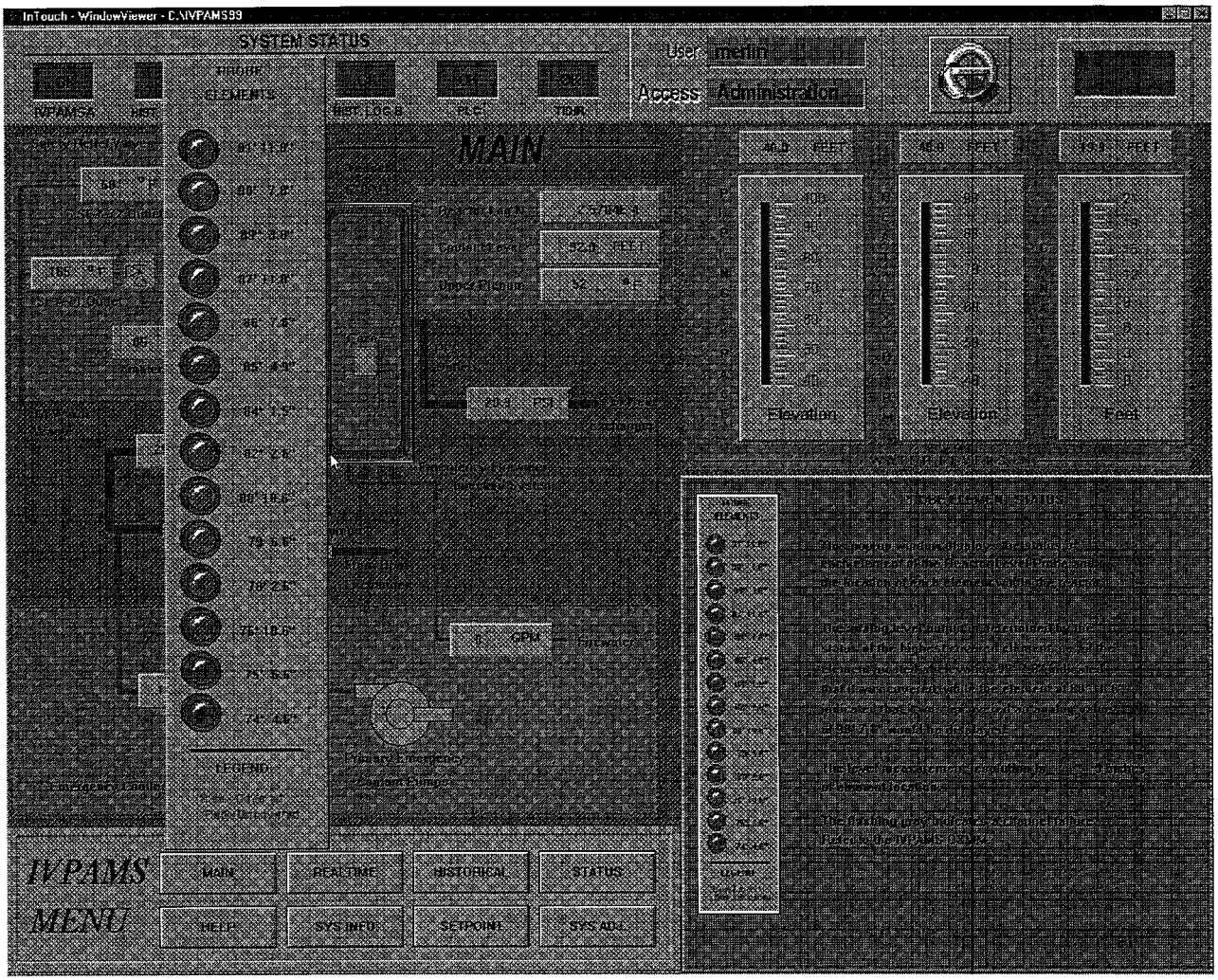

Figure 3.6 IVPAMS Main Screen with Probe Element Status Window Displayed.

3.3.2 REALTIME

Selecting the Realtime menu option displays the screen shown in Figure 3.7. The default realtime screens displays the reactor charts with a 10 minute time span. Each realtime screen provides three time span options: 1 minute, 10 minute, and 60 minutes. Clicking on the desired time span button will change time span on the displayed charts. The screens show data being continuously updated with current data on the far right hand of each display.

The realtime charts are organized into four groups: Reactor, Water Level, Emergency Cooling, and Safety Relief Valves. The lower right-hand corner of the screen is organized according to these groups and displays the current values for each of the plant parameters being monitored. The group heading located in the lower right-hand corner of the screen are designed to be Hot Spots. The user may select the realtime charts for a desired group by clicking on the group heading. The right-hand corner parameter display will remain visible while the various Realtime charts are displayed.

Selecting another option from the top row of the IVPAMS menu will close the realtime charts. Menu options on the bottom row will overlay a portion of the realtime screen with information.

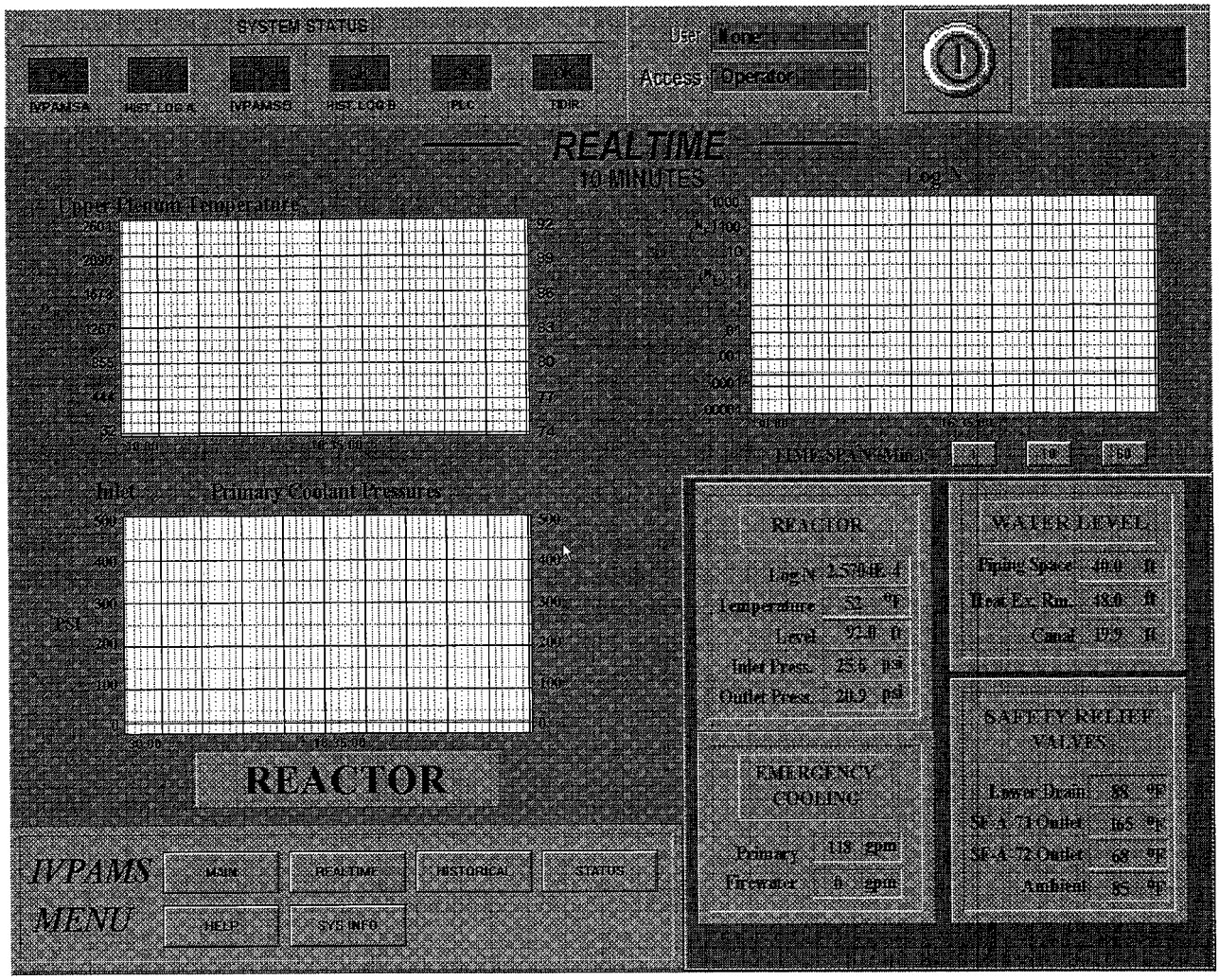

Figure 3.7 IVPAMS Realtime Display (Typical of 4).

3.3.3 HISTORICAL

Selecting the Historical option from the IVPAMS menu displays the Historical Trend Chart shown in Figure 3.8. When this option is initially selected the chart will display the last selected trends. Up to eight logged tagnames may be displayed on a historical trend. The trend chart has vertical and horizontal scooters that permit the user to change the range and time span to obtain better resolution while viewing a trend chart. The historical logger is currently configured to store historical data for up to 30 days. Historical log file older than 30 days will be automatically deleted.

The trend chart area is a Hot Spot. Clicking on the trend chart opens a Historical Trend Setup window which allows user to enter the desired start date, start time, chart length and tagnames to be displayed. When no historical data is available during the requested trend time the chart will appear black. Once the selected trends are displayed on the chart, their tagnames will be displayed in the eight rectangular boxes located near the lower portion of the historical display along with the trends color and the value of the trend at the locations of the right and left scooters. Clicking on one of these boxes will cause the scale of the selected tagname to be displayed to the left of the chart. Controls for zooming and scanning the trend charts are provided. The operation of these controls are explained in the systems on-line Help screens. Should a pen error occur for any of the tagnames associated with the various pens and error number will appear in the lower right-hand area of the screen. These errors are described in the InTouch Users Guide and in an on-line help file for the Historical display.

The "% of Full Power" display at the left of the historical chart will only be displayed when the "POWER_Log_N" tagname is selected. The "Print" and "Save to File" features on the Historical display are only visible on the display with proper log-on access.

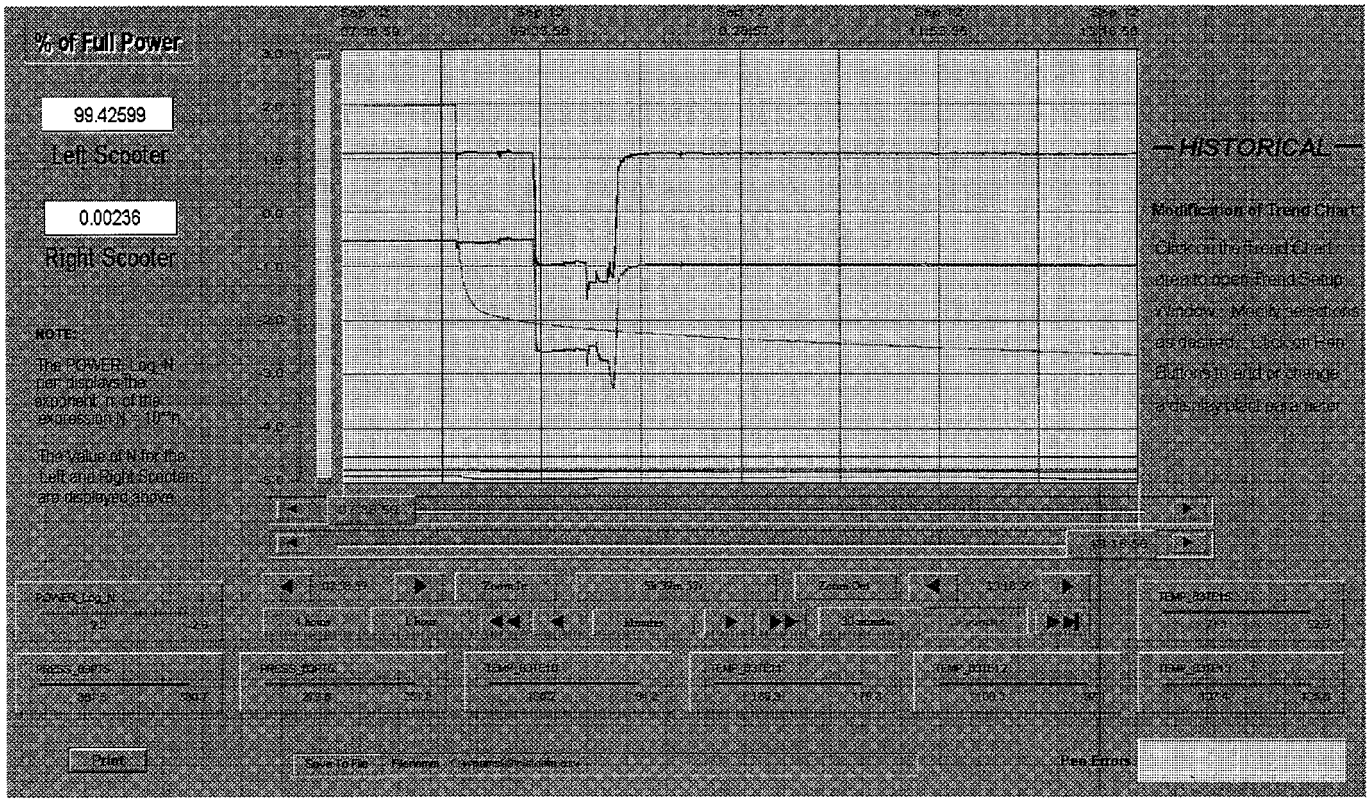

Figure 3.8 IVPAMS Historical Trend Chart Window.

3.3.4 STATUS

The Status display shown in Figure 3.9 provides information on the PLC system, the probes heater circuit node clocks, and the element status of the probe.

The PLC System displays the status of each Channel (1-8) of the four modules, the module's status (indicator above the A1, A2, A3 and A4), the system's dynamic scan time, battery condition, scan overrun, and module mismatch status. The Modules (A1 - A4) are hot spots. Placing the cursor on these modules and holding the left button depressed opens an information window that identifies each channel input.

The probe heater's voltage and current are monitored. From these values the resistance in the probe's heater circuit is calculated. Monitoring the real time resistance in the probes heater circuit is a means of monitoring the condition of the probes heater circuit. The resistance variation with time should be very low. Sudden changes in resistance can be an indications of problems.

The node times for IVPAMSA and IVPAMSB are displayed. This provides a convenient way for the users to verify that the time on both nodes is synced. The system times are synced with a National Time Standard. These times are also recorded in the historical log.

The condition of each of the probe's elements is shown next to the element's elevation. A blue indicator means the element is covered while a red indicator means the element is uncovered.

3.3.5 HELP

An additional help window is available for each of the screens, Main, Realtime, Historical, and Status, by clicking on the Help button in the IVPAMS Menu when the screen is being displayed. When multiple windows are available, buttons are provided for moving between screens. Some of these helps include multiple windows. Figure 3.10 shows a help window for the Main display which is typical of most help screens.

Figure 3.11 shows the help screen available for the Historical Trend screen. This help screen overlays the Historical screen and is more extensive than the other help screens because of the features available for selecting various tagnames, scanning, and zooming the displayed trends. The green "H"s shown on this help screen indicate hot spot locations.

Depressing the left mouse button on these hot spots will open an additional help window describing the operation of the feature clicked on.

A "Close" buttons is provided on each of the help screens to close the help screen after it has been reviewed.

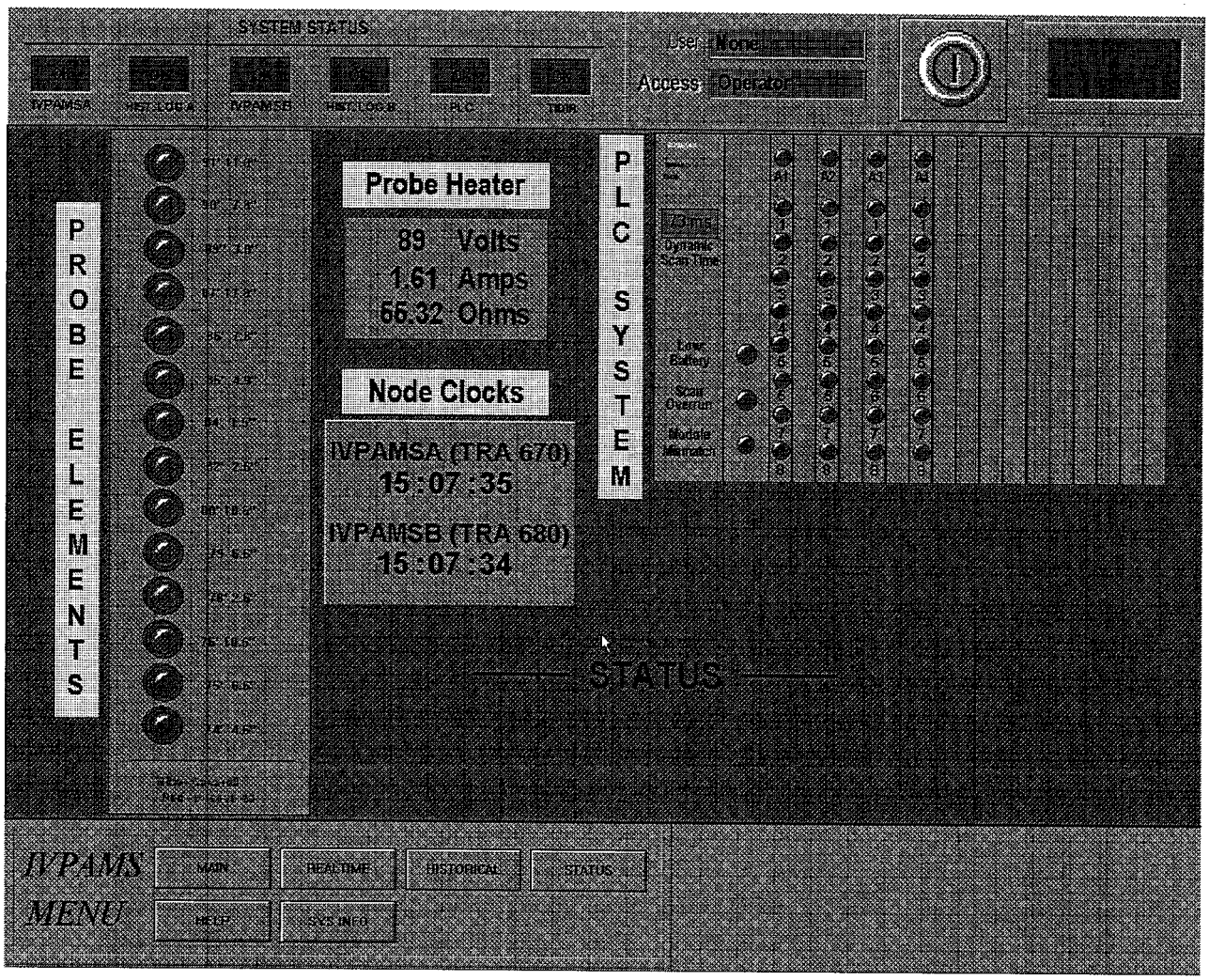

Figure 3.9 IVPAMS Status Display Window.

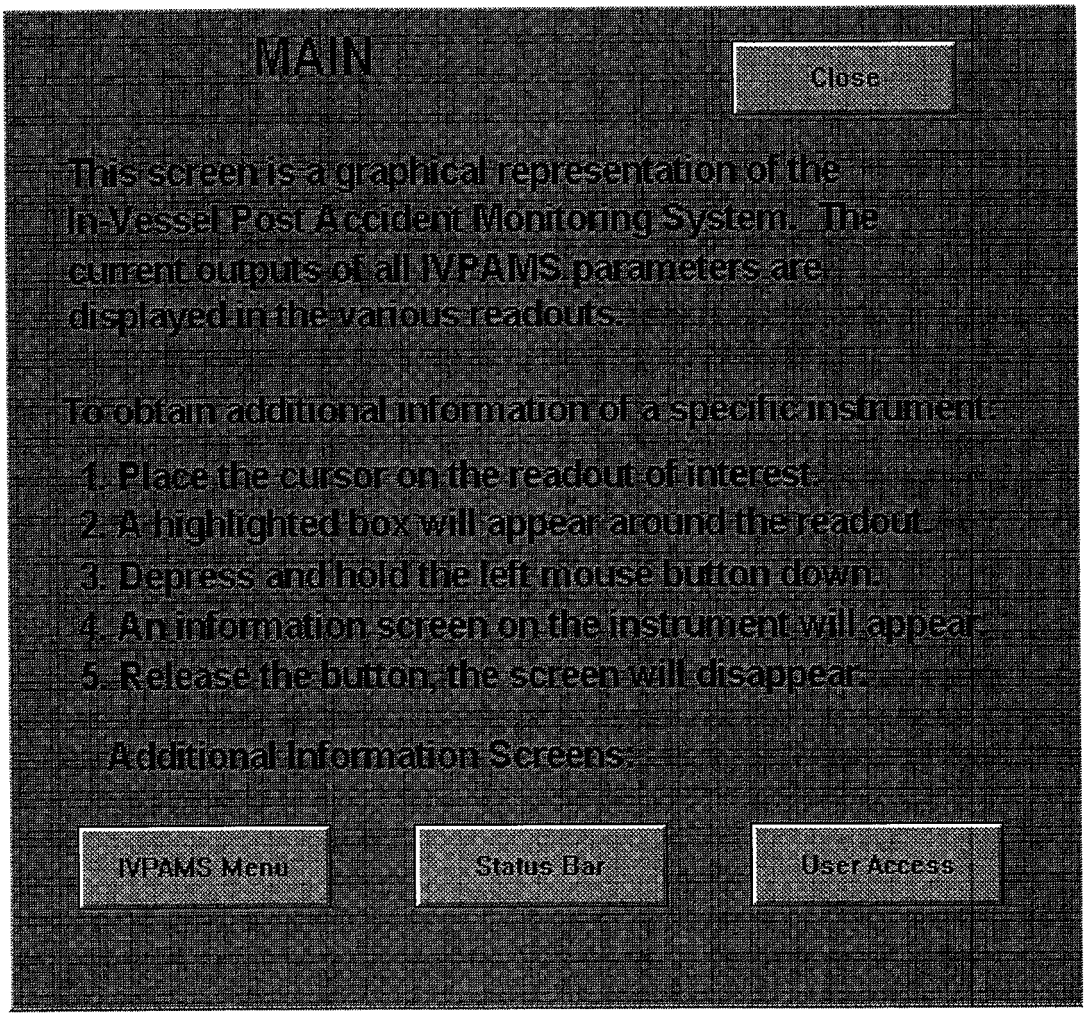

Figure 3.10 A Typical IVPAMS Help Window.

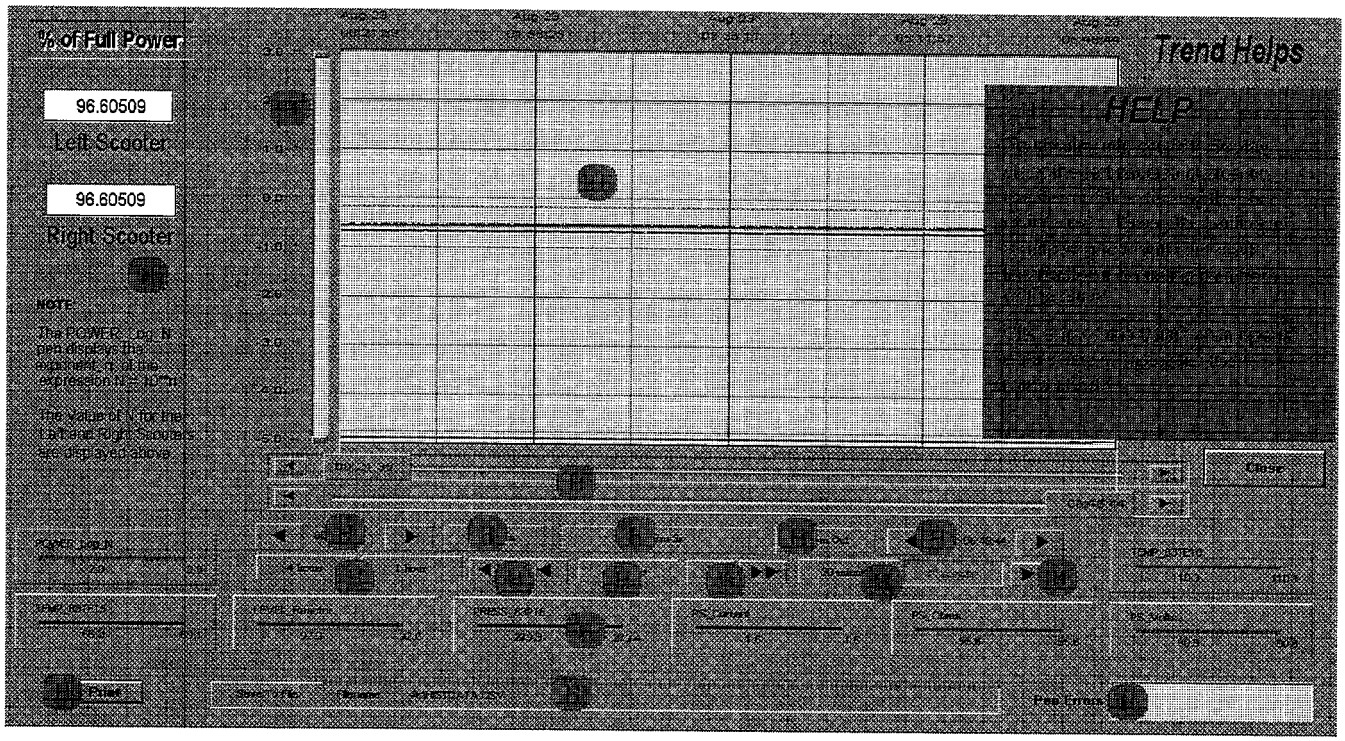

Figure 3.11 IVPAMS Historical Trend Help Screen

3.3.6 SYS INFO

Figure 3.12 shows the information screen that is opened up in the lower right corner of the screen. Not all of the information displayed will be of value to the typical user. The typical user would be interested in the Node names and the free disk space available on the drives to ensure that their is adequate data logging capacity is available on each drive.

Other information shown includes the application path, GDI Resources Free, USER Resources Free, Memory Free and the number of Tasks currently running on each system. GDI resources are used to manage the system graphics and printing. USER resources are associated with user input and output including keyboard and mouse inputs, window management, etc.

3.3.7 SETPOINTS

Figure 3.13 shows the setpoint adjustment controls available to the user via the Setpoint button in the IVPAMS Menu. This menu option requires special user access privileges. The first control available for setting the millivolt level at which the PLC discriminates between the covered and uncovered condition for each element of the coolant level probe. This setpoint will be determined by Engineering based upon factory acceptance test data. Pressing the update button enters the setpoint into the PLC memory.

The three additional controls permit the user to adjust a setpoint for three temperature parameters associated with the Safety Relief Valves. These setpoints are associated with the Safety Relief Valve display area of the Main display. When these setpoints are exceeded, the instrument readout titles associated with these Safety Relief Valve temperature measurements will flash. Engineering will determine acceptable setpoint values. These setpoint comparisons are performed within the IMPAMS InTouch application and not the PLC and are therefore node dependent. When adjusting these setpoints, they must be changed on both nodes and the update button pressed. Setting these temperature setpoints to their upper limit will disable these setpoints features. There is a digital readout provided with each setpoint.

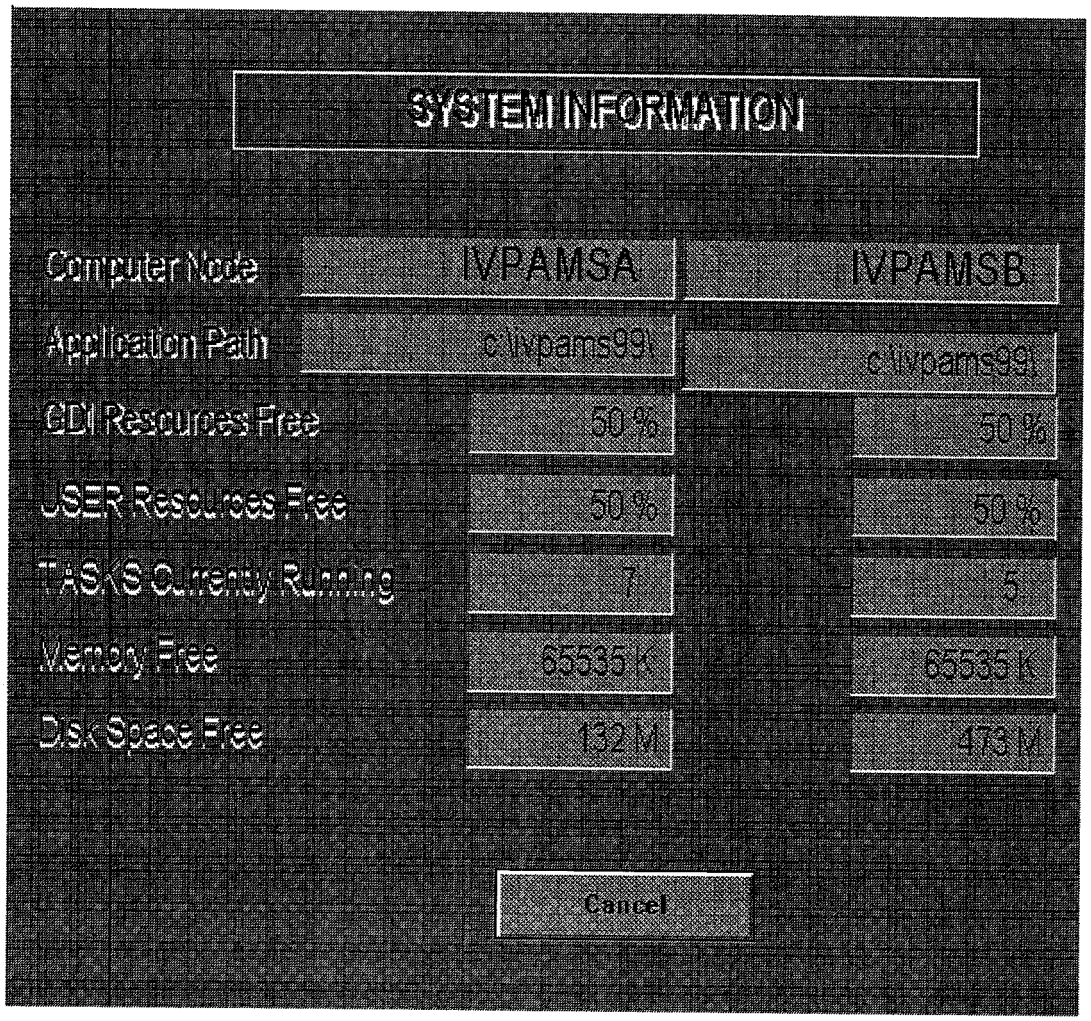

Figure 3.12 IVPAMS System Information Window.

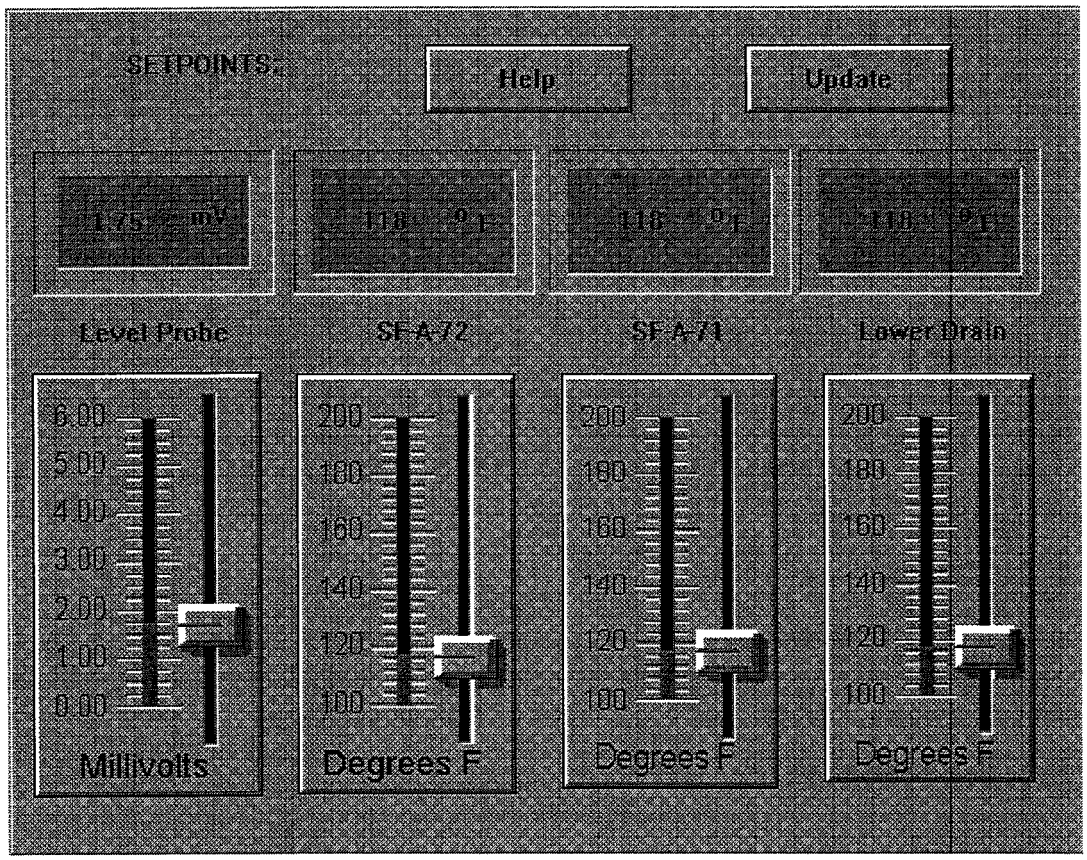

Figure 3.13 IVPAMS Setpoint Adjustment Controls.

3.3.8 SYSTEM ADJUSTMENTS (SYS ADJ.)

The "SYS ADJ." IVPAMS menu option displays the window shown in Figure 3.14. This menu option permits a user with special access privileges to start the historical logger on nodes, IVPAMSA or IVAPMSB, should the logger not startup normally during the startup of the IVPAMS application. There may be occasions when the system time is less than the current time in the historical log. The logger will not start until the system time is greater than the recorded log time. When the logger has not started due to time conflicts and the condition has been corrected, the historical logger buttons on this screen may be used to start the logger as necessary. It is expected that limited use of this option will be required.

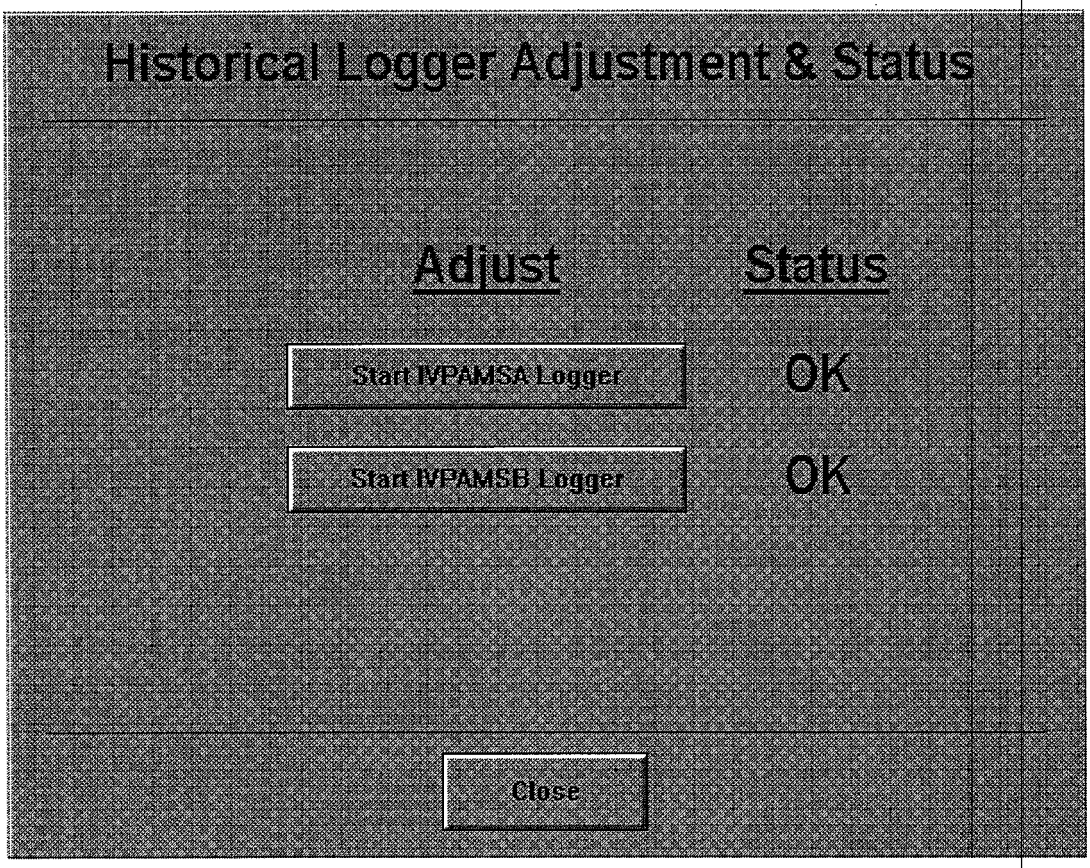

Figure 3.14 IVPAMS System Adjustment Window

4. SYSTEM LIMITATIONS, SETPOINTS, AND PRECAUTIONS

4.1 Level Probe Setpoints

There are no special limitations or system precautions associated with the operating IVPAMS system.

There is one critical setpoint associated with the operation of the In-Vessel Level Probe. This setpoint is adjusted from within the IVPAMS software (Refer to Section 3.2.7). This adjustment requires a password to obtain access to the Setup window.

Based on a review of the Factory Acceptance Test Results and the acceptance testing performed upon receiving the probe at the INEL the level probe setpoint should be set in the range of 1.75 to 2.0 mV. See Figure 3.13. Any changes to this setting should only be made after engineering review and evaluation of the above mentioned data.

4.2 SAFETY RELIEF TEMPERATURE SETPOINTS

The Safety Relief Valve temperature status monitoring system is designed to indicate flow through the relief valves. There is no flow through the system during normal plant operating conditions and temperature indications tend to be nearly equal in value and at or near Nozzle Trench ambient temperature.

The relief valve temperature indication on the Main screen starts flashing at default temperature of 118° F. The default setpoints can be adjusted under engineering direction if normal plant operating temperatures exceed the default settings. See Figure 3.13. Should these setpoints be changed, they must be changed on both nodes. These parameters are not networked between the nodes.

5. CASUALTY EVENTS AND RECOVERY PROCEDURES

Two unlikely events could present a problem to the operation of the IVPAMS system. Both of these involve failures in the computer systems associated with the IVPAMS.

The Siemens CPU modules controls the PLC and conditions the input signals for use by the InTouch IVPAMS application. The IVPAMS software in the CPU's memory is maintained in memory by battery power (backup) located on the CPU module. Should the battery or CPU module fail, this software can be reload into the CPU's memory from the rack mounted computer's hard drive (Node: IVPAMSA).

Recovery from a failure in either of the IVPAMS' computers (Nodes IVPAMSA or IVPAMSB) can be achieved by servicing the node as required and rebooting the computer. Should a hard drive fail, the drive should be replaced and the software reloaded from the vendors CDs and the IVPAMS application CD which is maintained under software configuration control. The IVPAMS application CD contains a file with installation instructions to guide the user through the recovery process.

5.1 GENERAL

The following events present problems to the IVPAMS system: Node failure, PLC failure, network and UPS failure. These failures are addressed in the following sections.

5.1.1 NODE FAILURE

Two unlikely events, memory failure and hard disk failure, could cause failure of the two nodes of the IVPAMS system. Recovery from these failures would require servicing of the computers by replacing defective memory or the hard disk. Should disk failure occur, the software should be reloaded from the Vendor's CD and the IVPAMS Software Configuration CD which is maintained under software configuration control. Rebooting the computer system would return the IVPAMS node to its operational state.

5.1.2 PLC FAILURE

The Siemens CPU module controls the PLC and conditions the signals for use by the InTouch IVPAMS application. The IVPAMS software in the CPU's memory is maintained in memory by battery power. The battery is located in the CPU module. Should battery failure result in the loss of the IVPAMS application software, the battery should be replaced and the software restored from the hard drive of the rack-mounted computer located in the IVPAMS instrument-rack.

5.1.3 NETWORK FAILURE

Should network failure occur, the Site Network Services personnel should be contacted. Once the network is operational, the IVPAMS nodes can be brought back in service by rebooting both nodes as required.

5.1.4 UPS FAILURE

The batteries associated with the IVPAMS UPS have a limited operational life. Refer to Vendor documentation for service and maintenance guidelines. Should the UPS fail, the UPS can be switched into a by-pass mode to plant power while UPS service is performed. Rebooting the node will return the system to operation. The generator backup cannot be used for source power if the UPS is off line.

6. MAINTENANCE

6.1 SOFTWARE

To make any changes to the IVPAMS software, the engineer should refer to the appropriate Vendor Software Manuals. Software Configuration Control procedures should be followed to maintain software control should any changes be required.

User ID & Password can be changed or modified by exiting the IVPAMS application running in InTouch's WindowViewer and clicking on the InTouch WindowMaker icon to open this application. From the WindowMaker's menu option "Special" and "Security". In order to modify and/or change the User ID or password the engineer must log on to the system with an appropriate ID and password.

6.2 MONITORING AND DISPLAY SYSTEM

The IVPAMS "Status" menu option provides status information of the general condition of the Siemens' PLC used for data acquisition. Should further detail be required refer to the applicable vendor's manual.

The equipment associated with the monitoring and display portion of the IVPAMS should not require any routine maintenance. Should maintenance be required on the computer systems or networking portion of the system refer to the appropriated vendor's manual listed in Section 6.9 and the configuration information of Section 6.8.

6.3 ROSEMOUNT TRANSMITTERS

"IVPAMS Rosemount Transmitter Calibration Procedure", DOP 2.1.22, and the calibration sheets, DOP 2.1.22.S should be follow to maintain these transmitters.

6.4 FLOW COMPUTER

The IVPAMS Firewater Injection Flow (83-FT-7) transducers are located on an segment of piping where it is not possible to produce a flow to verify the functional condition of the flow measuring system or perform an actual calibration. There are system conditions and parameters that can be checked to verify the operational status of the flow system. Recommended procedures to verify the operational status of the flow measuring system are outline in DOP 2.1.23 "IVPAMS Firewater Injection Flow (83-FT-7) Functional Test." For additional information refer to the Controlotron Field Manual listed in Section 6.9.

6.5 IN-VESSEL PROBE

Once the In-Vessel Probe is installed in the vessel, only limited testing can be performed to verify the status of the various elements and the general probe condition. The first check on the probe condition that should be considered would be to refer to the Probe Element Window in the IVPAMS application (Click on the left mouse button over the Vessel Area on the Main screen). Under normal vessel conditions all individual element indicators should appear "blue" indicating that each element is covered with coolant. A red condition for an indicator when the vessel is know to be full indicates a need for further testing.

The IVPAMS system monitors the voltage, current and resistance of the probes heater circuit. The resistance variation with time should be very low. Sudden changes in resistance can be an indication of problems in the probe heater circuit. Surveillance is required to maintain a running history of the status of the heater current.

The general condition of the individual elements may be obtained by performing an in situ test. This test consists of adjusting the heater current over a range from 0.8 Amp to 3.0 Amps and recording the mV output of each of the elements. This test should be performed when the condition of an element is in question or at least annually. Table 6.1 contains in situ test data obtained during the Factory Acceptance Test at Delta-M. A similar test will be conducted as part of the IVPAMS SO Test. The SO Test data should be used as reference data when comparing future test data. Table 6.2 can be used to log the test results during future testing. The condition of the vessel should be noted for each set of data recorded. Once the heater current is adjust to the value shown in Table 6.2, time should be allowed for the element's mV output to stabilize before recording data. The readings should then be recorded. By exiting the IVPAMS application and reconnecting the rack-mounted computer (DOS) to the PLC the test engineer can access all the data values to be recorded via the TI SOFT application, eliminating

the need for special test equipment. Access the "CHART" menu option and select the "L_PROBE" chart. The element's mV output data should remain consistent with the data taken following the initial probe installation for a given set of conditions. Changes in element's mV output versus time or the lack of output change as a function of change in heater current could indicate a problem with an element.

6.6 UNINTERRUPTIBLE POWER SYSTEMS

The following maintenance should be performed on the Best UPSs at least every 90 days. For additional details refer to the User Manuals (Section 6.9) or contact Best Technical Support.

A. Inspect and Clean the Unit.
Inspect wiring.
Vacuum dust from the unit.

B. Inspect and record the Alarm and Invertor Logs.

C. Perform an Outage Test and Check the Batteries.
With the UPS providing power to the IVPAMS system check the voltage of each individual battery. Individual battery voltage should be in the range of 11 1/2 volts to 12 1/2 volts. Voltage variation between the individual batteries should not exceed 0.4 volt. Contact Best Technical Support if Outage Test Fails.

D. Check the AC and DC meter functions and recalibrate if necessary.

Check values of the first 19 parameters on line and invertor for UPS on node IVPAMSA. According to Best Technical Support, the hand held Control Panel and Display of the FE5.3KVA could be disconnected and plugged into the Logic Board of the FE700, should it be desirable to further evaluate the status of the FE700. According to Best tech support, both systems have the identical logic card.

TABLE 6.1 Factory Acceptance In Situ Test Data For Level Probe Elements.

HEATER PARAMETERS	I: 0.802 A V: 40.6 V	I: 1.154 A V: 58.55 V	I: 1.617 A V: 81.98 V	I: 2.297 A V: 117.20 V	I: 3.015 A V: 150.17 V
ELEMENT ID.	mV OUTPUT	mV OUTPUT	mV OUTPUT	mV OUTPUT	mV OUTPUT
EL74-4.6 (DTC-1)	0.066	0.135	0.245	0.447	0.663
EL75-6.6 (DTC-2)	0.122	0.238	0.404	0.693	1.166
EL76-10.6 (DTC-3)	0.126	0.194	0.317	0.607	0.986
EL78-2.6 (DTC-4)	0.101	0.192	0.352	0.634	1.079
EL79-6.6 (DTC-5)	0.092	0.169	0.293	0.558	0.953
EL80-10.6 (DTC-6)	0.105	0.199	0.340	0.567	0.912
EL82-2.6 (DTC-7)	0.091	0.139	0.234	0.340	0.594
EL84-1.5 (DTC-8)	0.192	0.292	0.478	0.868	1.452
EL85-4.9 (DTC-9)	0.066	0.143	0.290	0.488	0.751
EL86-7.8 (DTC-10)	0.264	0.385	0.557	0.868	1.330
EL87-11.8 (DTC-11)	0.166	0.257	0.414	0.642	1.026
EL89-3.8 (DTC-12)	0.196	0.257	0.371	0.630	1.019
EL90-7.8 (DTC-13)	0.135	0.172	0.277	0.552	0.887
EL91-11.8 (DTC-14)	0.004	0.099	0.233	0.478	0.752

Test conducted 12/14/94 at Delta-M. Witnessed by Merlin Yancey and Rulon Hillam.

TABLE 6.2 In Situ Test of Level Probe Elements.

HEATER POWER SUPPLY SETTINGS	SPECIFIED	I: 0.792 - 0.808 A	I: 1.188 - 1.212 A	I: 1.604 - 1.636 A	I: 2.277 - 2.323 A	I: 2.97 - 3.03 A
	V50 V52	I:_____ V:_____	I:_____ V:_____	I:_____ V:_____	I:_____ V:_____	I:_____ V:_____
ELEMENT ID.	VARIABLES	MILLIVOLT OUTPUT	MILLIVOLT OUTPUT	MILLIVOLT OUTPUT	MILLIVOLT OUTPUT	MILLIVOLT OUTPUT
EL74-4.6 (DTC-1)	V22					
EL75-6.6 (DTC-2)	V24					
EL76-10.6 (DTC-3)	V26					
EL78-2.6 (DTC-4)	V28					
EL79-6.6 (DTC-5)	V30					
EL80-10.6 (DTC-6)	V32					
EL82-2.6 (DTC-7)	V34					
EL84-1.5 (DTC-8)	V36					
EL85-4.9 (DTC-9)	V38					
EL86-7.8 (DTC-10)	V40					
EL87-11.8 (DTC-11)	V42					
EL89-3.8 (DTC-12)	V44					
EL90-7.8 (DTC-13)	V46					
EL91-11.8 (DTC-14)	V48					

6.7 PARTS LIST

Tables 6.3 and 6.4 list the components associated with the IVPAMS Computer Systems and the IVPAMS data acquisition system.

Table 6.3 IVPAMS Computer System and Software

NODE	DESCRIPTION	QUANTITY
	Dell Optiplex GX1p Computer Pentium II 450 MHz, 128 MB SDRAM (100MHz) 40X CD ROM, 20 GB Hard Drive, Integrated 3Com 3C905B 10/100 MB Network Interface Integrated Audio & Graphic Controller, Keyboard	2
BOTH	HP 8200 CD-Writer	2
BOTH	Windows NT 4.0	2
BOTH	Wonderware InTouch Ver. 7.0 Runtime w/ I/O, 256 Tags	2
BOTH	20" Color Monitor	2
BOTH	Cabling as required	
IVPAMSA	Comark Computer Model 51-03940-102, 66 MHz CPU MS-DOS, video adapter, 2GB Hard Drive. (For Use in Programming Siemens PLC)	1
IVPAMSA	Siemens' TI-SOFT2 Release 4.3	1

TABLE 6.4 IVPAMS DATA SYSTEM PARTS LIST		
SYSTEM	DESCRIPTION	QUANTITY
Data Acquisition (PLC)	SIMATIC TI505 Mounting Rack P/N 505-6516	1
	SIMATIC TI505 Power Supply P/N 505-6660	1
	SIMATIC TI505 TI545 CPU P/N 545-1101	1
	SIMATIC TI505 Cable P/N PC545-CBL-9	1
	SIMATIC TI505 Blank Bezels P/N 2587705-8003	12
	Control Technology Inc. CTI 2550 - 8 Channel Analog Input	1
	Control Technology Inc. CTI 2551 - 8 Channel Thermocouple Input	3
Level Probe	Liquid Level Probe Delta M Corp. Spec. ES-51495 Rev. A	1
	Sorensen Power Supply Model DCR 150-3B2	1
	Current to Voltage Converter Ohio Semitronics P/N LRB-50 (50 Ohms)	2
	DC Current Transducer 0 to 3 Adc Ohio Semitroncis P/N CT7-008B-X395	1
	DC Voltage Transducer 0 to 150 Vdc Ohio Semitronics P/N VT7-005B	1
Transmitters and Power Supplies	Rosemount Pressure Transmitter Model 1153AD8RA	2
	Rosemount Pressure Transmitter Model 1153DB5RA	3
	Rosemount Pressure Transmitter Model 1153HD5RA	2
	Two-Wire Loop Power Supply (24Vdc) Acromag Model 25PS-20-1-DIN	12
	Brooks Instrument Low Flow Purgemeter Model 1350EK2BCJV5M with Brooks Instrument Integral Flow Controller Model 8900D3J1A1AC	3
UPS	Best Power Technology 700 VA UPS Model FE700VA-CS Input: 120 V, Output: 120 V	1
	Best Power Technology 5.3 KVA UPS Model FE5.3KVA-CS Input:208HW, Output 120HW, 240HW	1
	Best Power Technology External Batteries Model EBP-5F	1

6.8 REFERENCE MANUALS

ViewSonic User's. Guide (Monitor)

Rosemount 1153 Series D Alphaline Pressure Transmitters for Nuclear Service, MAN 4388, February 1992

Rosemount 1153 Series B Alphaline Pressure Transmitter for Nuclear Service, MAN 4302, May 1993

Controlotron, System 990, Uniflow Universal Clamp-on NEMA-Flowmeter Field Manual, August 1993.

Control Technology Inc., CTI 2550 Eight Channel Isolated Analog Input Module Installation and Operation Guide Ver. 2.0 CTI Part #062-00102

Control Technology Inc., CTI 2551 Eight Channel Isolated Thermocouple Input Module Installation and Operation Guide Ver. 2.0 CTI Part #062-00107

Acromag, User's Manual: Series 25PS, Model 25PS Two-Wire Loop Power Supply

Best Power Technology, Ferrups FE/QFE 500VA to 18 VA Installation Manual, February 7, 1994

Best Power Technology, Ferrups Uninterruptible Power Systems FE or QFE

500VA to 18KVA, User Manual.

Siemen's SIMATIC T1505/TI500 TISOFT2 Release 4.3 User Manual

Siemen's SIMATIC T1505 Programming Reference User-Manual

Siemen's 545 System and 1/0 Manual Set

Wonderware, InTouch (Refer to on-line documentation)