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105 K EAST ION EXCHANGE AND CARTRIDGE FILTER RESTART COMPUTER SOFTWARE USER DOCUMENTATION

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105 K East Ion Exchange and Cartridge Filter Restart
Instrumentation Computer Software User Documentation

Author DS Schermerhorn
Date 12-7-95

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1.0 Introduction

1.1 Purpose

The purpose of this document is to present operational information and instructions to the personnel involved in the operation of the 105 K Basin cartridge filter and IXM instrumentation computer display system.

1.2 Scope

This document describes the computer system from the termination of the instrument leads to the display of the instrumentation analog and discrete data on the computer screens.

The following components are described and discussed.

- A. Programmable Logic Controller (PLC)
- B. Communications Loop
- C. Computer Display System

1.3 Definitions

PLC .. Programmable Logic Controller. This is a microcomputer that controls the scanning of all instruments and conversion of the instrument raw data into engineering units.

RS232 .. The standard used for the serial communications loop that exists between the PLC and computer display system.

I/O Cards .. The input output cards are the interface between the field instruments and the PLC. There are four possible types of cards. The cards are simply electronic circuits that perform various specialized functions. Each card can be removed from the system and replaced by a new card in about 3 minutes. This rapid replacement capability limits system downtime to an extremely small fraction.

- A. Analog Input .. These cards transform a 4-20 ma signal to an integer between 6400-32000. The integer is then used by the PLC software in further scaling into engineering units. Special purpose temperature input cards are also used in the system to convert the basin thermocouple measurements into actual temperature data (rather than the 6400-32000 integer).
- B. Analog Output .. Not currently utilized in the present system. If installed in the future the cards would perform

the reverse function of the analog input cards. The cards are used in the industry for extremely fine control of positioning devices, for example flow control valves etc.

- C. Discrete Input .. This card accepts a discrete (on/off) signal in the form of a voltage and translates the voltage into a binary bit (0 or 1) that the PLC utilizes for internal logic control. This card is typically connected to on/off switches or device position switches commonly referred to as microswitches.
- D. Discrete Output .. This card performs the reverse function of the discrete input card and is currently used in the system to control the on/off status of the alarm horns.

1.4 Overview

The system consists of various instruments that measure basin system parameters. Some of the instruments measure parameters in the basin proper while others measure parameters in the basin water piping systems.

The instruments are terminated to I/O cards. Each card is directly connected to the PLC data bus, thus allowing extremely fast scanning and scaling of all instrument data.

1.5 Context Diagrams

Shown below is an overall block diagram of the basin instrumentation system.

Figure 1

1.6 System Environment

The system environment is a typical "office space" environment. The PLC area must be kept free of dirt and excessive accumulations of dust. Magnets must not be stored in or around the computer interface because the field may destroy data on removable media as it is removed from the disk drive and large fields would interfere with the color display.

1.7 Hardware

1.7.1 Computer Make and Model

The PLC is a SIMATIC TI545 built by Siemens Inc. The computer interface is an Action Instruments 486 industrial grade computer and touchscreen. The I/O cards are built by Siemens and Control Technology Inc.

1.7.2 Terminals and Work Stations

The initial design required one terminal, however the as built software will allow connection of other terminals. The software contains a feature to prevent accidentally acknowledging an alarm on auxiliary terminals (ACK DISABLE). This feature is discussed in other sections of this document. Installation of an auxiliary computer terminal will require the availability of an extra RS232 port or network connection.

1.7.3 Other Peripherals

There are no other peripherals, however a printer can be readily connected with only minor configuration adjustments to the software. The adjustments would not require an ECN.

1.7.4 Network or Data Link

A network was not required in the original design, however a network is easily built by using modular ethernet cards inserted into the PLC base. The initial data link is via a single serial port on the interface computer connected directly to the PLC via a specially configured communications cable.

1.7.5 Hardware Dependencies

The system is not dependent on any other computer hardware.

1.8 Software

The software consists of the following modules. In addition the interface platform requires the DOS Windows operating systems.

- A. Proprietary PLC system software.
- B. Custom built PLC site software.
- C. Proprietary interface software.
- D. Custom built interface software.

1.9 Typical and Maximum Use

1.9.1 Run Time

The system runs continuously 24 hours/day.

1.9.2 Memory Required

The system can run using 8 MB's, however 16 MB's will provide a more responsive system.

1.9.3 Disk Space

The system and interface software require 30 MB of disk space. The removable disk requires approximately 100 MB to store 1 year of data. It should be noted that data records can be archived by using public domain compression algorithms or commercial programs. The data files can usually be compressed to approximately 90 percent of their original size.

1.10 Security

The system does not require any special security measures, passwords are used for certain system functions and they should be maintained by as few people as possible. In the future if the system is connected to a network then a further layer of protection may be required unless dedicated leased communication lines are used.

It should be noted that the proprietary interface software is protected by a hardware "key" that MUST be present in the parallel port to "enable" the software. This security measure is designed to prevent unauthorized use of the software via

copyright infringements. If the key is not installed then the software WILL NOT be functional. The knowledge necessary to override this security system is proprietary.

2.0 Equipment Operation

2.1 Assumptions

No special assumptions are made regarding equipment operation.

2.2 Safety Inspection

No special inspections are required.

2.3 Operation Sequence

2.3.1 Power Up

The PLC is normally powered before the interface computer. To power the PLC, plug the power cord into any 120 VAC receptacle. With power applied verify the PLC GOOD, RUN and BATT GOOD LED lights are all on.

The interface computer is powered by plugging the power cord into any 120 VAC receptacle and by switching on power to the computer and monitor.

2.3.2 Operating System Startup

The PLC and interface system software starts automatically when power is applied. After the software starts all existing alarms should be acknowledged by the operator.

2.3.3 Operating System Shutdown

The system is shutdown by first performing a "Log Off" (if logged on) by pressing the Log Off button. The next step in the shutdown sequence is to contact the system programmer to perform a software shutdown (preferred). If the programmer is unavailable then the power down sequence may be performed as described below.

2.3.4 Power Down Sequence

The PLC is powered down by unplugging the electrical cord. If the Sonalert is still being supplied with power then it will actuate.

Sonalert is a trademark of Muller Capacitor Company.
(JED 12/1/95)

The interface computer is powered down by turning off its power switches for the computer and interface screen. To completely remove power the individual power cords should be unplugged.

3.0 System Operation

3.1 Log On

It is not necessary to log on to the system to enable data collection and display. Log on is necessary to access infrequently performed supervisory functions. The supervisory functions are fully explained in a later section.

3.2 Run

Data collection and display is started automatically when power is applied. No other operator commands are necessary.

3.3 Data Control

Data control is automatic.

3.4 Backup and Recovery

System software should ALWAYS be backed up in a location that is not easily compromised. It is highly recommended to store backups on a fileserver that is automatically backed up to tape.

Details of backup and recovery requirements are stated in WHC-SI-SNF-CSCM-001 105 K East Ion Exchange and Cartridge Filter Restart Computer Software Configuration Management Plan.

3.5 Archives

It is recommended that the data written to the removable media drive should be transferred to a computer connected to a network. This will allow storage of the data on a fileserver thus providing ready access by authorized personnel.

Details of archival requirements are stated in WHC-SD-SNF-CSCM-001 105 K East Ion Exchange and Cartridge Filter Restart Computer Software Configuration Management Plan.

The following are instructions for removing the removable disk from the disk drive. To reinstall the disk, reverse the instruction sequence.

NOTE: Magnets must not be in the vicinity when removing the drive. A strong magnetic field WILL destroy all information on the disk.

- A Verify the orange drive light is not on. If it is on then wait for the light to go out before continuing.
- B Press the knurled button on the front of the drive and wait for the drive to spin down.
- C Push the exposed slide lever to the right thus ejecting the disk. Insert the disk in its protective cover.

3.6 Password Maintenance

Passwords must be protected and associated records stored in a normally locked repository.

Details of password maintenance are stated in WHC-SD-SNF-CSCM-001 105 K East Ion Exchange and Cartridge Filter Restart Computer Software Configuration Management Plan.

3.7 Media Administration

Software and data master disks and backups must be labeled appropriately and stored in a controlled location.

Details of media administration are stated in WHC-SD-SNF-CSCM-001 105 K East Ion Exchange and Cartridge Filter Restart Computer Software Configuration Management Plan.

3.8 Log Off

It is not necessary to log off the computer system unless performing a supervisory function. If log off is not performed then the system will automatically log off if no activity is sensed by the system for 1 minute.

4.0 Input

4.1 Data Collection Forms

The system does not utilize data collection forms. Data collection is entirely automatic.

4.2 Menus

The "Special" menu is at the top of the interface screen. Each item in the menu is described below.

Start Uninitiated DDE Conversations ... This item is used to reestablish communications with the PLC. The command may be used to attempt to reestablish a faulted communications link.

Reinitialize DDE ... This item is used to restart communications with the PLC. It may be used to attempt to restart a faulted communications link.

Restart Alarm Log .. Restarts alarm logging to disk. Alarm logging will stop automatically upon detection of a disk fault.

Restart Historical Logging ... Restarts historical logging. Historical logging may be stopped by the operator or it may stop automatically upon detection of a disk error.

Stop Historical Logging ... Stops automatic logging of parameters to disk. Not normally required. A "Loss of Historical Logging" alarm will occur if this command is issued.

View Error/Information Log ... Provides viewing service for the interface system error and information log. The log should be closed or "Minimized" when viewing is completed.

Security Log On ... Provides an alternate method for logging on to the system.

Security Change Password ... Allows anyone the capability to change their password.

Configure Users ... Allows the system administrator the capability to change passwords and add/delete users from the users list.

Security Log Off ... Provides an alternate method for logging off the system.

4.3 Screens

Screen inputs and outputs are described below.

Menu Bar (Figures 2-17) ... The menu bar is visible at all times and runs along the bottom area of each screen. Each "button" on the menu activates an associated screen. The buttons marked "Basin, Shumps & Skimmer, PLC Comm and Annunciator" contain a small "dot" that will flash red if an alarm activates on one of its associated screens.

Flow Mimics (Figures 2-21) ... Flow mimics are piping symbols that are grey when no flow is present in the associated line and white when flow is present.

Pump Mimics (Figures 2-22) ... Pump mimics are pump symbols that are grey when the associated pump is off and white when the associated pump is on.

Parameter Blocks (Figures 2-7) ... Parameter blocks are areas of the screen that present information obtained directly from basin instrumentation. For example on figure 3 the area marked "PIT-206-1 (A)" is a parameter block that displays the

cartridge filter F-1A flowrate. Each block is active and can be touched or clicked to activate the "Alarm Control Screen".

Alarm Control Screen . . . The alarm control screen is used for controlling parameter alarms. The screen has "Active" checkboxes that are controlled by the system programmer to activate or deactivate each alarm, this function is controlled by appropriate engineering documentation. The screen has "Enabled" blocks that are used by the operations supervisor to temporarily disable faulted alarms, this function would be controlled by appropriate administrative procedures. The "Status" areas on the screen are red if the associated alarm is active and white if the associated alarm is inactive. The "Set, Dead Band, Scan Time and Range" areas are controlled by the system programmer. "Set" is the setting of the associated alarm. "Dead Band" is the offset required to reset the alarm. "Scan Time" is the time in seconds that the alarm is scanned by the PLC for example a scan time of 5 seconds indicates the PLC scans the instrument once every 5 seconds. "Range" is the range of the associated instrument.

Main Screen (Figure 2) . . . The main screen is the central focus of the operator interface. The three basin parameter screens (Filter, IXM & Basin) are accessed via the main screen. The dotted outlines on this screen are "active" areas. The active areas are touch sensitive and when touched or clicked on they will activate one of the three other screens. The active areas are also "alarm indicators". The alarm indicators will flash red if an alarm activates on the associated areas screen.

Filter Screen (Figure 3) . . . The filter Screen contains parameter blocks and flow mimics associated with the basin cartridge filters. This screen is accessed via the main screen.

IXM Screen (Figure 4) . . . The IXM Screen contains parameter blocks and flow mimics associated with the basin IXM's. This screen is accessed via the main screen.

Basin Screen (Figure 5) . . . The basin Screen contains parameter blocks and flow mimics associated with the center of basin area. This screen is accessed via the main screen.

Overview Screen (Figure 6) . . . The overview screen contains parameter blocks and mimics associated with the filters, IXM's and center of basin. The screen does not contain all the parameters contained on the filter, IXM and basin screens and exists to provide an overall view of the basin status.

Skimmer & Sumps Screen (Figure 7) ... This screen contains parameter blocks and mimics associated with the basin skimmer and sump systems.

Annunciator Screen (Figure 10) ... This screen contains the basin annunciators. The annunciators are connected to discrete (on/off) field devices that indicate the presence of an alarm condition. The RAD RESET button on this screen will reset any RAD alarms that have cleared. This provides a positive indication of spurious or rapid on/off RAD alarms.

Bypass Switches (Figure 11) ... The bypass switches are used for bypassing associated annunciator alarms that are faulted. The switches are controlled by the operations supervisor via a password. The pump bypass switches also located on this screen do not require a password for operation and are used for informing the system which recirc pump should be running or not running. If a running recirc pumps stops then a "Main Circ Pump Failure" alarm will annunciate.

Flow Totalizers (Figure 10) ... The totalizers are used for tracking accumulated water volume that has passed through the filters or IXM's. Each control provides the operations supervisor (via password) the capability to enter the associated serial number or to reset the totalizer.

Real Time Trends (Figure 23) ... The real time trends provide a trend line for various basin parameters. The update of each trend is automatic and continuous.

Historical Trends (Figure 25) ... The historical trend is similar to the real time trend except the operator can input up to 8 parameters and any time range. This allows display of any basin parameter for any length of time. The displayed trend can be saved to a computer file via the "Save Trend" button. The resulting file can be read by any word processor or spreadsheet program.

4.4 Commands

Commands are issued via the menus and screens as described in sections 4.2 and 4.3.

4.5 Input Preparation

The system does not require any manual preparation of inputs. Input collection is entirely automatic.

4.6 Command Files

The system does not utilize command files.

4.7 Data Files

The system does not require data file inputs.

5.0 Output

5.1 Reports

The system generates an online report of all basin alarms that are active (Summary List) and all historical alarms and events (Historical List). The historical list contains a detailed record of all actions performed by the interface software, including log on/off events.

5.2 Plots

The system plots are described in section 4.0.

5.3 Screens

Screen outputs are described in section 4.0.

5.4 Data Files

The format and contents of the data interface system files are described below.

System Historical File (C:\kbasin\histdata)... The format of the system historical file is proprietary. The file is used for supplying information to the real time and historical trends. A subset of the information in the file is sent to the plant historical file. The C: drive history files are archived for 35 days.

Plant Historical File (D:\kbasin\histdata)... The plant historical file is maintained on a removable media disk drive (drive D:). The file is a text version of a subset of the system historical file. The system historical file is sampled every 5 minutes to obtain a data set for the past 24 hours. The first line of the plant historical file contains the names of subsequent data fields. Each name is separated from its neighbor by a comma. Subsequent lines contain data entries for each of the names on the first line, again each entry is separated by its neighbor by a comma. Each line represents data from a 5 minute sample. The format of this file is termed CSV

for Comma Separated Variable. The CSV format is universally accepted by all word processors, data base and spreadsheet programs.

System Log (C:\kbasin\aehtdata & D:\kbasin\aehtdata)... The system log file can be read by any word processor program. The log maintains status of the system events related to the interface operating system. The log is maintained on the removable media disk drive. The C: drive "aeh" files are overwritten in a circular method every 35 days.

Serial Number Log (D:\kbasin\serlnum)... The serial number log maintains an hourly status of the IXM and cartridge filter serial numbers. The log is maintained on the removable media disk drive.

Alarm Log (C:\kbasin\alrmdata & D:\kbasin\alrmdata)... The alarm log maintains a detailed status of all system alarms and events as they occur. The list is the same as the "Historical" alarm list. The log is maintained on the removable media disk drive. The C: drive copy is kept for 35 days.

6.0 Error Messages

All common error messages are self explanatory, for example "Disk Full" etc. System errors however, usually require expert interpretation. When any error message appears the operator should log the message in the plant log and correct the problem if possible. The system programmer should be notified if unexplained system error message(s) have been received. For errors that interrupt or stop software operation a restart may be performed by turning the interface computer power off then back on.

7.0 System Recovery

7.1 Equipment Setup

There are no special equipment setups required to perform a system recovery.

7.2 Log On Sequence

Log on is not necessary to perform a system recovery.

7.3 Run Instructions

To perform an operator interface system recovery perform the following steps.

- A. If possible shutdown the "Viewer" program and "Windows" system by performing section 2.3.3. If not possible then continue to the next step.
- B. Turn off power to the computer.
- C. Wait about 15 seconds.
- D. Turn on power to the computer.
- E. Verify the system automatically restarts and acknowledge any existing alarms.
- F. If the system will not restart correctly or restarts but malfunctions again then the system programmer should be contacted to reload the system or application software or perform other troubleshooting methods.

To perform a PLC recovery proceed as follows.

- A. Contact the system programmer to determine the best course of action. The programmer may reload software or for serious errors may require replacement of the PLC.

7.4 Recovery of Programs and Database

Recovery of the software programs should NEVER be attempted, instead the file(s) should be erased and a backup copy used for restoration.

Recovery of system data can be readily performed by many commercial programs (i.e. DiskFix etc). There are also commercial corporations that specialize in data recovery and maintain a high success rate even with physically damaged drives. It should be noted that the system uses only one data disk so it is important to frequently transfer the data to a network fileserver or other suitable location.

7.5 Log Off Sequence

If a supervisor or programmer is logged on to the system then it will be necessary to perform a log off prior to performing a system recovery. A log off is performed by clicking the "Log Off" button.

8.0 References

WHC-SD-SNF-CSCM-001 105 K East Ion Exchange and Cartridge Filter Restart Computer Software Configuration Management Plan.

WHC-SD-SNF-CSDD-001 105 K East Ion Exchange and Cartridge Filter
Restart Computer Software Design Description.

WHC-SD-SNF-CSWD-001 105 K East Ion Exchange and Cartridge Filter
Restart Computer Software Documentation.

WHC-SD-SNF-CSRS-001 105 K East Ion Exchange and Cartridge Filter
Restart Computer Software Requirements Specification.

WHC-SD-SNF-ATP-012 105 K East Ion Exchange and Cartridge Filter
Restart Instrumentation Acceptance Test Procedure.

WHC-SD-SNF-TP-016 105 K East Ion Exchange and Cartridge Filter
Restart Instrumentation Test Plan.

WHC-SD-SNF-WP-016 105 K East Ion Exchange and Cartridge Filter
Restart Instrumentation Work Plan.

WHC-CM-6-1 Engineering Practices.

WHC-CM-3-10 Software Practices.

Appendix A
System Interface Screens

Figure 2
Main Screen

This screen displays the central point from which the filter, IXM and basin screens are accessed. The dotted lines are active areas that activate other screens when touched or clicked.

Figure 3
Filter Screen

This screen displays all information associated with the basin cartridge filters.

Figure 4
IXM Screen

This screen displays all the analog instrumentation associated with the IXM's.

Figure 5
Basin Screen

This screen displays all the analog instrumentation for the basin.

Figure 6
Overview Screen

This screen displays an overview of analog instrumentation for the basin.

Figure 8

PLC Communication Screen

This screen displays the status of the PLC communications.

Figure 11
Annunciator Bypass Screen

Figure 12
Alarm Summary Screen

MM/DD/YY	HH:MM:SS	EVT	Name
12/07/95	08:01:33	ALM	PLC_COMMUNICATION_ERROR_1
12/07/95	08:01:33	ALM	PLC_COMMUNICATION_ERROR_2

Previous Page Next Page History List

Figure 13
Totalizer Screen

Figure 15
Historical Trend Screen

Figure 16
Auxiliary Screen

File	Tools	Options	Special	Development
Programmer				Supervisor
Disable alarm horns.				Acknowledge all alarms.
Programming window.				Disable alarm ack on this terminal.
Set alarm horn timers.				Skimmer Lineup Option.
Test file write to D: drive.				
				Operator
				Test Skimmer
				Test Horns
				Alarm Signals

Figure 17
Log On Screen

DISTRIBUTION SHEET

To Distribution	From 100 K Area Process Engineering	Page 1 of 1
Project Title/Work Order 105 K East Ion Exchange and Cartridge Filter Restart Project		Date 12/7/95
		EDT No. 605790
		ECN No. NA

Name	MSIN	Text With All Attach.	Text Only	Attach./ Appendix Only	EDT/ECN Only
WIEMERS MJ	X3-84	X			
WHITEHURST R	R3-86	X			
SCHERMERHORN DS	L6-04	X			
EDWARDS PJ	A4-79	X			
MEDFORD DW	X3-74	X			
CENTRAL FILES	A3-88	X (ORIG + 2)			
<i>Project Files</i>	<i>X3-85</i>	<i>X</i>			