



Interoffice Communication

To Ron Bryan

From S. W. Sommer

Date April 3, 1984

Subject IBM PC-XT Replacement for the Perkin-Elmer Interdata Computer

Attached is the complete documentation for the hardware, software, maintenance, and operating procedures for the IBM Personal Computer XT which has replaced the Perkin-Elmer Interdata Computer. The IBM PC-XT will be used for the fixed point monitoring/leak detection program (as part of the VCM Plant's Leak Detection and Elimination Plan), for Oxychlorination reactor flammability monitoring, and for calculation of the Oxychlorination reactors' reduced pressure drops and steam/air ratios.

In mid-1983, Perkin-Elmer notified the VCM Plant that the printer/keyboard which interfaced with the Interdata computer would no longer be serviceable under the maintenance contract with Perkin-Elmer. In order for the printer/keyboard to be serviceable, approximately \$6000 would have had to have been invested in a new printer/keyboard of a different model. In December 1983, the plant decided to purchase an IBM PC-XT and a compatible multiplexer to perform the same functions as the Interdata computer.

The decision was based on the required cost to upgrade the Interdata system and on several other factors:

- 1) The Interdata computer had a high hardware failure rate and was unreliable.
- 2) Upgrading the software for Interdata took months or up to a year to complete because the software was maintained in Ponca City, not in the plant.
- 3) The FORTRAN computer language used by Interdata made input/output requests, debugging, and maintenance difficult.
- 4) The VCM Plant had an \$800/month maintenance contract with Perkin-Elmer. The savings from cancelling this contract will payout the total cost of the new system within 2 years.

The IBM PC-XT software is written in BASIC, is easy to understand, and will be maintained in the plant, allowing software changes to be made quickly. The IBM PC-XT hardware is reliable and can be maintained in the plant. No maintenance contract will be carried on the IBM PC-XT. Since the VCM Plant has two additional IBM PC-XT computers with interchangeable hardware, down-time of the system will be minimized. When hardware problems do arise, parts will be taken from the IBM PC-XT's in the main office building and placed in the IBM PC-XT which is replacing the Interdata computer. Replacement parts will then be ordered for the office computers. In this way, the stream factor of the fixed point monitoring system will be maximized.

The new system includes an IBM PC-XT and a Burr-Brown data multiplexer. The IBM PC-XT and the multiplexer communicate via a standard RS-232-C interface. All analog and discrete devices (transmitters, Provox outputs, annunciators, and gas chromatographs) are wired directly to the multiplexer. The IBM PC-XT requests data from the multiplexer via the RS-232-C interface, and the multiplexer responds to the request. The multiplexer data is then received and processed by the IBM PC-XT, and calculations are performed and logs or alarm messages are generated as directed by the BASIC program.

If you have any questions or comments, please call me at 5058.


Scott W. Sommer
Process Engineer

CC: RAC - JWW
MLA - MCM - JRH - CRH (3)
DLD - JGC - PDD - VMF - MWC - MJA - SJR - SCR

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IBM PC-XT/BURR-BROWN DOCUMENTATIONI. GENERAL SYSTEM DESCRIPTION

The system installed to perform the VCM Plant's VCM fixed point monitoring/leak detection, Oxychlorination flammability monitoring, and calculation of the Oxychlorination reactors' reduced pressure drops and steam/air ratios consists of an IBM Model 5160 Personal Computer XT and a Burr-Brown Model MCS 50A multiplexer. The computer and multiplexer are connected via an RS-232-C interface and cable. All field transmitters, Provox outputs, annunciators, and gas chromatographs are wired directly to termination strips inside the multiplexer unit housing. The IBM PC-XT requests data from the Burr-Brown multiplexer, and the multiplexer decodes the request and sends a response to the IBM-PC-XT. The IBM PC-XT then decodes the response, processes the data, and performs calculations using the data as directed by the BASIC program.

II. BURR-BROWN MULTIPLEXERSystem Configuration

A general layout of the Burr-Brown MCS50A multiplexer is shown in Figure 1. The three main components of the Burr-Brown multiplexer are the card cage, which houses the processor (CPU) card and all input/output cards, the field wiring termination strips, and the power supply. These three components are described below.

1. Termination strips: Field analog and discrete input and output signals are physically connected to screw-type terminations which are integral to the MCS50A. Each termination strip is connected to an input/output by means of a flat ribbon cable which snaps in at the termination strip and connects to the input/output card via a card edge connector. The plant's MCS50A has a termination strip for analog input channels 1-15, one for analog input channels 16-39, one for analog channels 40-63, one for discrete input channels 1-16, and one for discrete output channels 1-16.
2. Card cage assembly; The card cage assembly houses all of the logic, processing, and input/output cards. The card cage has a "back-plane" which has a standard Intel Multibus® configuration. All of the cards plug into the Multibus® back-plane. Card size, connections, voltage levels, signal distribution, and data levels are standardized by Multibus® specifications. The MCS50A card cage may house up to five cards, one of which must be the processor card (CPU). The flat ribbon cables from the termination strips are connected to the appropriate cards by means of a card-edge connector.

The processor card is connected by a flat ribbon cable to the auxiliary card which is mounted on the front of the card cage. The auxiliary card is the communications card, which sends the RS-232-C communications signal from the

processor card to the RS-232-C connector installed on the auxiliary card. A redundant RS-232-C port is included, but is not used in the plant's system.

3. Power supply: The power supply converts the 110VAC line supply voltage to +5VDC, -5VDC, +12VDC, and -12VDC signals for use by the processor and input/output cards.

Table I gives a description of the plant's MCS50A configuration system.

Loop Drawings

The field analog inputs, discrete inputs, and discrete outputs to/from the MCS50A are listed in Tables II, III, and IV, respectively. The loop drawing for each input and output are shown in Figures VCM-BB-1-SWS through VCM-BB-15-SWS. Terminations are shown in Figures VCM-BB-16-SWS through VCM-BB-20-SWS.

Diagnostics

There are two diagnostic functions of the MCS50A. One function performs a hardware integrity check, and the other provides a firmware integrity check. The MCS50A continually performs internal integrity routines and provides the results by means of seven LED indicators on the auxiliary card. These indicators are:

- PWR Power is on.
- RUN The processor card is operating properly.
- SCAN The MCS50A is properly configured.
- XMIT Data is being transmitted to the IBM PC-XT.
- REC The MCS50A is receiving data from the IBM PC-XT.
- L1 Communication port L1 is currently being used (normally used).
- L2 Communication port L2 is currently being used (not used in the plant's system).

The MCS50A also checks for firmware errors, including parity errors, checksum errors, and command errors. If any of these firmware errors is found, and error message is sent to the IBM PC-XT. A list of errors the MCS50A checks for are listed in Table V. Checksum calculations are optional and are not made in the plant's system. Error codes are sent only as a response to a command sent from the IBM PC-XT. If no command is received by the MCS50A, no error message (or other responses) will be sent. This prevents the communications line from becoming saturated whenever an error occurs. See the MCS50A User's Guide for additional information concerning parity and checksum errors.

Communications and Data Transmission

All analog and discrete inputs and outputs are multiplexed and converted to 12-bit resolution digital signals by their respective input/output cards. The digital data is then presented on the Multibus[®] for interface with the

processor card. The digital data passes to the processor card and is stored in the processor card's random access memory (RAM). The data is represented by four ASCII characters (analog data) or by two ASCII characters (discrete data). The processor firmware continuously scans each analog and discrete channel and updates the data in its memory. The processor contains 4K of RAM.

The data scan and digital data manipulation is controlled in the processor by a configuration command which is downloaded from the IBM PC-XT. The configuration command is sent only once to the MCS50A and is stored in RAM.

Communications with the IBM PC-XT are handled by the auxiliary card. The VCM Plant's system uses an RS-232-C interface with the MCS50A. All communications between the IBM PC-XT and the MCS50A travel along a standard RS-232-C cable with 25-pin connectors. The communications rate for both the IBM PC-XT and the MCS50A has been set at 300 BAUD (300 bits per seconds), with a data word length of 8 bits, all data with even parity, and one stop bit.

Communications are performed in the following sequence:

1. The IBM opens a communications file and writes a command to the file.
2. The command is sent along the RS-232-C cable and is controlled by the asynchronous communications adapter in the IBM PC-XT (explained later).
3. The MCS50A receives the commands, performs parity and checksum calculations, interprets the command, gathers the requested data, and sends a response via the auxiliary card to the IBM PC-XT.
4. The MCS50A response is stored in the IBM PC-XT communications buffer.
5. The IBM PC-XT loads the communications buffer data into RAM, decodes the response, and processes the data.

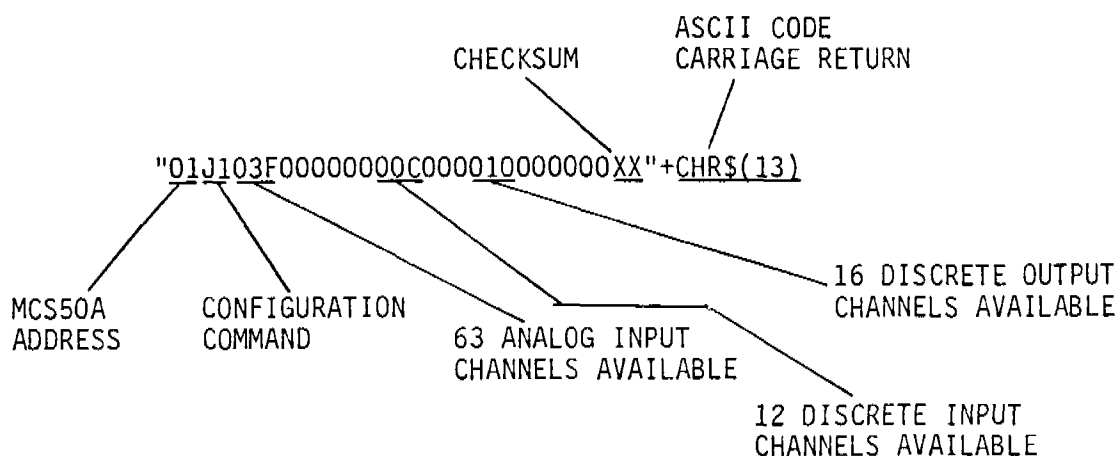
Commands and Responses

The first command sent by the IBM PC-XT is a configuration command. This command is stored in RAM of the MCS50A. If another command is sent before a configuration command is sent, the MCS50A will respond with an error code, indicating an unconfigured status. The configuration command consists of five parts:

1. MCS50A address. Since only one MCS50A is employed in the VCM Plant's system, the address used is: 01.
2. Configuration command code. This code is J1.
3. Card types and number of channels. Each card type (analog input, discrete output, etc.) and the number of channels to be scanned must be given.
4. Checksum. Since checksums are not used by the system, the checksum characters are: XX.
5. Carriage return. An ASCII carriage return symbol is placed at the end of each command to signify the end of the command.

The MCS50A will respond to the configuration command by restating the command. The IBM PC-XT checks to see that the response matches the command. If so, the configuration is complete and execution of the computer program continues. All commands are sent by the IBM PC-XT in ASCII code. See Table VI for a list of ASCII codes.

The configuration command sent to the MCS50A by the IBM PC-XT is:



Notice that all numerical values are in hexadecimal form (hex, or base 16). For example, 63 analog channels is represented by 03F, which is hex for 63. See Table VII for a list of hexadecimal to decimal conversions. The group of zeros unidentified in the configuration command above represent channel numbers for card types not used in the plant's system. For information on additional card types, see the MCS50A Users Manual.

The MCS50A responds to the above configuration command with the response:

`"01J103F00000000C0000100000002D"+CHR$(13)`

Note that the MCS50A calculated a checksum of 2D (decimal equivalent = 45) for the configuration string. The MCS50A always calculates a checksum, even if XX was specified in the command. The XX only tells the MCS50A to not compare checksums.

The carriage return code from Table VI is 13. This is represented in BASIC by the character code `CHR$(13)`. This code signals the end of a command.

The form of all other MCS50A commands are similar in structure to the configuration command. The other commands and data responses used and decoded, respectively, in the IBM PC-XT BASIC program are given in Table VIII. See the MCS50A User's Manual for additional information on the MCS50A commands.

III. IBM PC-XT COMPUTER

System Configuration

The IBM computer system employed is a Model 5160 Personal Computer-XT (IBM PC-XT) with 384K of installed RAM, a 340K floppy disk drive, a 10Mb Winchester (hard) disk drive, a color graphics monitor, an 80 character

per second (CPS) dot matrix graphics printer, and an asynchronous communications adapter. All parts of the PC-XT are interchangeable with parts from the other two PC-XT computers at the VCM Plant.

Diagnostics

Run-time diagnostics on the IBM PC-XT are limited to errors encountered during execution of the main BASIC program. The main program contains error trapping and identification routines to help the user to troubleshoot the system. The error trapping routines used in the program will be described with the program software and logic.

Communications and Data Transmission

Data transmission to the MCS50A is handled by the asynchronous communications adapter on the IBM PC-XT. The asynchronous communications adapter is an RS-232-C interface which can be linked directly with the MCS50A without the use of a modem or other interfacing device. The MCS50A requires an asynchronous data interface, as opposed to a synchronous data interface. Asynchronous communications refers to a communications link where data is transmitted only when available, whereas synchronous communications (as with TSO) requires a continuous transmission of data. Data transmission with the MCS50A is also half-duplex, which means data transmissions are sent by either the IBM PC-XT or the MCS50A but not both at any instant in time. Another way to think of half-duplex communications is to think of the communication cable as a one-lane data bridge over which data traffic can pass in either direction.

Software Configuration

The main BASIC computer program is contained in the file "FIXEDPT.EXE" on the hard disk. This file is an executable machine language file created from the compilation of the BASIC program "FIXEDPT.BAS", which also resides on the hard disk. This program includes the code which performs all the data input, calculations, and output for the VCM leak detection monitoring, oxychlorination flammability monitoring, and Oxychlorination reduced pressure drops and stem-to-air ratios table. The executable file "FAIL.EXE" illuminates an annunciator and gives an audible alarm upon an IBM PC-XT software or communications failure. "FAIL.EXE" also resides on the hard disk. Both "FIXEDPT.EXE" and "FAIL.EXE" are included in the batch file "MONITOR.BAT". The batch file is included to provide continuity in execution. If a software or communications failure should occur in "FIXEDPT.EXE" the file will stop execution, return to the computer's disk operating system (DOS) and execute the next command in the batch file "MONITOR.BAT", which illuminates the computer failure alarm. Without the batch file, execution of "FIXEDPT.EXE" would end with no way to automatically annunciate an alarm. More information on batch files can be obtained from the IBM DOS Manual.

Table IX shows the way in which the hard disk and floppy disk drives are configured. A brief description of the function of each of the files is also included in this table.

IV. DESCRIPTION OF "FIXEDPT.BAS"

The main BASIC program is contained in the file "FIXEDPT.BAS" and is listed in Appendix 1. The program is comprised of an executive timing routine and 21 subroutines. All of the calculational tasks are handled by the subroutines, and all "housekeeping" chores and timekeeping functions are initiated by the executive timing routine. Each portion of the program will be described in detail. A logic diagram for this program is shown in Figure 2, and an alphabetical listing of all variable names is given in Appendix 2.

The executive timing routine is the task scheduler for the program. This routine keeps the performance of each task on a rigid time schedule and directs the printing of all logs. Scheduling tasks in a real-time computer application is essential since all major tasks depend on time. The executive timing routine includes lines 260 through 370 of the main program.

A plot plan of the process area with the CAR-171 monitoring points indicated and a plot plan of the offsites area with the CAR-401 monitoring points indicated are shown in Figures 3 and 4, respectively. These diagrams will be used in the definition of a VCM leak as described below. The description below has been used to formulate the leak detection logic of the leak detection subroutine. A logic diagram of the leak detection routine is shown in Figure 5.

A VCM leak has been defined as a VCM concentration exceeding 10ppm in a monitoring area on both of two successive gas chromatograph scans. An area (or monitoring area) is comprised of one or more analyzer points. See Table X for the area definitions. Restated, a VCM leak occurs whenever the VCM concentration in any area exceeds 10ppm on two successive GC scans, regardless of which point in the area shows the high VCM concentration. For example, if analyzer CAR-171 point #1 showed 20 ppm VCM and point #3 showed 16ppm during one GC scan, no leak has occurred since the high VCM readings occurred on the same 10-point GC scan. If on the next scan, CAR-171 point #2 showed 12ppm VCM, a leak in Area #1 will have occurred, since points #1, #2, and #3 are all in the same area. Also, notice some GC points are located in more than one area. All of these are on CAR-171. Point #1 is in Area 1, Area 2, and Area 4. Point #4 is in Area 2 and Area 3. These overlaps have been added because these areas are so close together, if a leak occurred near CAR-171 Point #1 or #4, the wind could cause the VCM leaked to drift into adjacent areas. To eliminate recording multiple leaks when a single leak occurs (two successive high VCM readings for CAR-171 Point #1 would show a leak in Area 1, Area 2 and Area 4 simultaneously otherwise), the following logic has been installed in the computer program:

(7)

IF HIGH VCM OCCURS
FOR CAR-171 POINT:

AND ON THE NEXT
SCAN OCCURS FOR POINT:

A LEAK IS
IN AREA:

1, 2, or 3

1, 2, or 3

1

4

4

2

9

9

3

5

5

4

1 but not 4

4 but not 1

1

4 but not 1

1 but not 4

2

4 but not 9

9 but not 4

2

9 but not 4

4 but not 9

3

1 but not 5

5 but not 1

1

5 but not 1

1 but not 5

4

CCR 000018916

A detailed description of "FIXEDPT.BAS" follows.

<u>LINE NO.</u>	<u>DESCRIPTION</u>
	<u>Executive Timing Routine</u>
1-14	Program headings
19-30	Clear the monitor screen, define arrays base value, and declare all variables beginning with I, K, or L as integers
35-95	Dimension all arrays
100	Turn off monitor "softkeys" (function key indicators at bottom of BASIC screen).
102-104	Input of yesterday's date and calculation of current date.
105-155	Oxy flammability program enthalpy functions defined.
156-160	Monitor screen headings displayed.
240	Set error trapping routine as subroutine beginning at line 15000.
245-247	Start of executive timing routine.
250	Initial configuration of Burr-Brown set.
260	Set time at beginning of executive timing loop.
270	Reset discrete outputs for annunciator alarms which have cleared.
280	Check GC status.
290	Input GC analog inputs.
300	Calculate Oxy reactor flammabilities.
305	Update time.
310-320	Check for end of hour and print hourly log if end of hour.
330	If end of day, print daily log.
331	Reset daily log printing flag.
334-335	Display time and date on monitor screen.
337	Update time.
340-350	Test for 7:00 am; if 7:00 am, calculate and print oxy reactor d/p's and steam/air ratios.
355	Update time
360-370	Calculate time elapsed since beginning of current executive timing loop. If 16 seconds or greater, begin executive loop again.
280-390	Program end.

<u>LINE NO.</u>	<u>DESCRIPTION</u>
<u>Burr-Brown Initialization Routine</u>	
1000-1020	Start of Burr-Brown initialization routine.
1030-1110	Establish communications with Burr-Brown. If not able to establish communications after six attempts, stop execution.
1120-1130	Open permanent communication file with Burr-Brown.
1135-1170	Send configuration command to Burr-Brown and wait 150 milliseconds before inputting the Burr-Brown response.
1180	Test response for error codes.
1190-1200	If incorrect response is received, print error message.
1210-1270	Repeat command/response sequence for setting the analog input data gain to 1.
1280-1350	Repeat command/response sequence for setting the response turnaround time to 0 milliseconds.
1360-1370	Set GC flags and return to executive.
<u>GC Status Determination</u>	
2000-2070	Request discrete input data from Burr-Brown and receive the data. Check response for error codes.
2080-2100	Extract hexadecimal data from the response and convert to a decimal number.
2110	Convert the data from decimal to binary.
2120-2190	Check the binary data for the status of each GC, and display the status on the monitor screen.
2200-2280	If a GC has been turned off since the last GC check, print a message and set the GC status flag.
2290	Return to the executive timing routine.
<u>GC Analog Data Input</u>	
3000-3070	Request analog data for the leak detection routine from Burr-Brown and receive the data. Check the response for error codes.
3080-3130	Extract the hexadecimal data and gain for each channel of data requested.
3140	Convert the analog data to engineering units.
3150	Return to the executive timing routine.

<u>LINE NO.</u>	<u>DESCRIPTION</u>
	<u>Conversion of GC Analog Data to Engineering Units</u>
4000-4050	Convert the raw hexadecimal analog input data to decimal number form.
4060-3110	Convert each channel of data from decimal two's-complement into volts.
4115-4117	Program headings, begin CAR-171 calculations.
4120-4124	If CAR-171 is off, reset the previous pass hi VCM indicator array and skip to the CAR-401 calculations.
4130	Calculate CAR-171 stream ID.
4140-4160	Print message if stream ID is out of range.
4180	If stream ID has changed since the last GC pass, skip to the CAR-401 calculations since the CAR-171 data for the new channel is not available yet.
4190-4230	If data for the present stream ID has already been recorded on a previous scan, skip to the CAR-401 calculations.
4235	If stream ID=1, do leak detection routine.
4240	Convert GC data to PPM VCM.
4250-4270	If GC data is out of range, print message and set GC data = 0 if GC data is less than zero.
4280	Add current GC data to cumulative sum for daily average concentration calculation.
4290	Add 1 to the total number of GC scans for the current day.
4300	If the current data for the current point is the highest for the current day, store the data value.
4305-4330	Alarm the annunciator if the current VCM concentration is above 10ppm. Add 1 to the number of times the concentration has exceeded 10ppm.
4335-4550	Repeat the loop (lines 4115-4330) for CAR-401
4555-4760	Repeat the loop (lines 4115-4330) for CAR 904, except the leak detection routine is not done.
4770-4771	Set the old stream ID variable equal to the last stream ID and set the last stream ID equal to the current stream ID.
4775-4840	Display the current VCM concentrations for each GC point on the monitor screen.

<u>LINE NO.</u>	<u>DESCRIPTION</u>
4845-4390	Write the current VCM concentration data on the fixed disk.
4940	Return to the executive timing routine.
	<u>Oxy Flammability Analog Data Input</u>
5000-5260	Input all analog data for the oxy reactor flammability program and convert the raw data into volts.
5265-5390	Convert all analog data from volts into percent of full range.
5400-5500	Convert all analog data from percent of full range into engineering units.
5510	Return to Oxy reactor flammability calculation routine.
	<u>Process Area Leak Detection</u>
6000-6040	Set high VCM flag for GC data which exceeds 10ppm for CAR-171.
6042-6045	Set leak detection area flag variables.
6050-6220	Set arrays for leak detection based on high VCM concentrations for current GC scan.
6230-6280	Check leak detection array for last GC scan. If high VCM concentrations occurred in both the last scan and the current scan, record a leak, alarm the annunciator, and print a leak message.
6290-6310	Set the leak detection array for the last GC scan equal to the current leak detection array for the next GC scan.
6314-6317	Set the leak detection flag variables equal to the current flag variables for the next GC scan.
6320	Return to the GC analog input routine.
	<u>Off-sites Area Leak Detection</u>
7000-7250	Repeat the leak detection routine for CAR-401.
7260	Return to the GC analog input routine.
	<u>Hourly Report Generation and Printing</u>
8000-8020	Set the current hour equal to the last hour variable.
8021	If it is the end of the day, update the date.
8022	If it is the end of the day, set the flag to print the daily log once the program returns to the executive timing routine.

<u>LINE NO.</u>	<u>DESCRIPTION</u>
8025-8200	Print the hourly log.
8205-8380	Record the hourly data on the floppy disk.
8400-8430	Set the cumulative number of times above 10ppm VCM through last hour equal to the "old" number of 10ppm exceedences.
8440	Return to the executive timing routine.
<u>Daily Report Generation and Printing</u>	
9000-9017	Set the GC scan counters to 1 if the counters are 0 to avoid dividing by 0.
9020-9410	Print daily report.
9419-9750	Record daily report on the floppy disk.
9760-9860	Reset counting and data arrays, counters, and hard disk data files.
9870	Return to the executive timing routine.
<u>Oxy Flammability Calculation</u>	
10000-10080	Initialize variables and set number of conductivity cycles in the Oxy steam drums.
10090	Input analog values and convert to engineering units in subroutine beginning at line 5000.
10100	If the HCL flow to Oxy is less than 500 Lbs/Hr. or if the oxygen flow to Oxy is less than 100 Lbs./Hr., Oxy is down and skip the flammability calculations.
10110-10790	Calculate the Oxy reactor flammabilities and display the results on the monitor screen.
10795-10880	If the flammability at any point has exceeded 80%, alarm the annunciator and print out a message.
10890	Return to the executive timing routine.
<u>Error Identification and Message Printing</u>	
11000-11030	Ring the bell on the printer and print the time and date for the error message.
11040	Decode the value of FLAG and go to the appropriate error message.
11050-11610	Print the appropriate error message

<u>LINE NO.</u>	<u>DESCRIPTION</u>
<u>Hexadecimal to Decimal Conversion</u>	
12000-12020	Obtain the length of the hexadecimal string to convert to decimal form.
12030-12180	Calculate the decimal equivalent of the hexadecimal string.
12190	Return to the statement which called this subroutine.
<u>Oxy Reactor Pressure Drop Calculation</u>	
13000-13140	Input all analog data to be used in the Oxy reactor DP and steam/air ratio calculations. Divide the Burr-Brown response into data and data gain strings.
13150-13260	Convert the analog data into percent of full range.
13270-13300	Convert analog data into engineering units.
13310-13360	Calculate the denominator and numerator factors, respectively, for the Oxy reactor reduced pressure drop equations.
13370-13480	Calculate and print the Oxy reactor reduced pressure drops and steam/air ratios.
13490	Return to executive timing routine.
<u>Decimal To Binary Number Conversion</u>	
14000-14090	Convert a decimal number into a binary string.
14160	Return to the statement which called this subroutine.
<u>IBM Error Trapping Routine</u>	
15000-15050	Identify and print the IBM error message and error number.
15055	Clear the screen and redisplay the monitor screen headings.
15060	Resume at the statement immediately preceeding the statement which caused the error.

<u>LINE NO.</u>	<u>DESCRIPTION</u>
	<u>Burr-Brown Error Identification Routine</u>
16000-16041	Identify the Burr-Brown error number and print a message.
16050-16070	If the error number is 03, reconfigure the Burr-Brown and print a message.
16075	Clear the screen and redisplay the monitor screen headings.
16080	Return to the Burr-Brown error trapping routine.
	<u>Burr-Brown Error Trapping Routine</u>
17000-17030	Check the Burr-Brown responses for the "N" bit which indicates an error message.
17040	Return to the statement which called this subroutine.
	<u>Print Monitor Screen Headings</u>
18000-18110	Clear the monitor screen and redisplay the monitor screen headings.
18120	Return to the statement which called this subroutine.
	<u>Current Date Calculation</u>
19000-19165	Calculate new date.
19170	Assemble the new date string.
19180	Return to the hourly log printout routine.
	<u>Calculation of Number of Seconds Past Midnight</u>
20000-20060	Calculate the number of seconds past midnight by using the TIME\$ function.
20070	Return to the executive timing routine.
	<u>Annunicator Alarming Routine</u>
21000-21120	Check which annunciators should be in alarm and send the appropriate discrete output command to Burr-Brown.
21130	Check the discrete output command response for an error code.
21140	Return to the statement which called this subroutine.

V. AUXILIARY PROGRAMS

A program listing and description of "FAIL.BAS", "MONITOR.BAT" and "AUTOEXEC.BAT" are given in Appendices 3, 4, and 5, respectively.

VI. OPERATING THE SYSTEM

Operation of the IBM/Burr-Brown system is very simple. To bring the system online from a "cold start", follow the steps below.

1. Turn the power to the IBM Computer system unit, printer, and monitor on with the floppy disk drive empty.
2. Turn the power to the Burr-Brown multiplexer on.
3. Enter the current time and date at the DOS prompts on the IBM PC-XT.
4. Place a floppy disk containing the files given in Table IX in the floppy disk drive. A master floppy with these files is available, so the master may be copied directly to obtain a working disk. A copy of the master diskette should be kept in the fireproof cabinet in B. J. Rogers office.
5. At the DOS prompt C>, type in "MONITOR".
6. Enter the current time and date when prompted.
7. Enter yesterday's date as: Month, Yesterday, Year.
Example: 3,14,1984.
8. The program is now running. The screen titles and GC data, GC status indicators, and Oxy flammability data should all be present on the screen within 30 seconds. The GC data will begin updating in about 45 seconds. If this does not happen or if an error occurs during execution, refer to the troubleshooting section below for corrective actions.
9. To start the programs if DOS has already been loaded, make sure the properly configured floppy disk is in the floppy disk drive and begin at step 5 above.

VII. SYSTEM MAINTENANCE

Process Engineering Responsibilities

The responsibilities of Process Engineering regarding the maintenance of the IBM/Burr-Brown system are given below:

- 1) Program changes should be made only as required and should be documented fully by making revisions or additions to this manual. After program changes are made to a BASIC program, the program must be compiled again to obtain an updated executable file. Program changes should be made and the programs should be compiled on the IBM PC-XT's in the main office in order to minimize downtime of the fixed point monitor system. The updated program can then be loaded directed from a floppy onto the fixed point monitor computer.
- 2) All hardware changes must be documented by updating the loop drawings. Loop drawings should conform to the format in Figures VCM-BB-1-SWS through VCM-BB-20-SWS.

- 3) The floppy disk should be changed each Tuesday and Friday to avoid a "DISK FULL" error which will halt program execution. Full diskettes should be kept by the Environmental Coordinator. The diskettes should be kept four weeks and then should be reused. Any data on the diskettes which needs to be kept for environmental documentation, inspections, or audits should be printed from the diskette before reusing it.
- 4) The system documentation should periodically be reviewed and updated as necessary.
- 5) The environmental coordinator will have the primary responsibility for insuring the continued operation of the system.

Operations Department Responsibilities

- 1) All printer outputs should be collected by Operations and forwarded to M. L. Ashby. The daily report will be copied and distributed, and all other printer output should be sent to the Process Engineering environmental coordinator. No output should ever be discarded.
- 2) An hourly printout should be generated every hour on the hour. The printer should be checked periodically to see if the hourly reports are being generated. If the reports are not being generated, start taking manual GC readings at once.
- 3) If the execution of the program should stop for any reason, manual GC readings should be taken starting immediately, even if the "COMPUTER PROBLEM" annunciator is not lit.
- 4) If problems with the system develop, the call-out order will be:
 - 1) Process Engineering environmental coordinator (weekdays) or the Process Engineer with weekend duty (weekends).
 - 2) Scott Sommer, Office Phone: Ext. 5058
Home Phone: 477-4465
 - 3) Any Process Engineer during weekdays.
- 5) Operations will be responsible for responding to any alarms and making the necessary operating changes or initiating maintenance.
- 6) Operations will be responsible for filling out a leak report upon every leak occurrence and forwarding the leak report to M. L. Ashby and the Process Engineering environmental coordinator.

- 7) Operations will be responsible for calibrating the GC's during the weekend. The GC's must be turned off before calibrating so that the voltage signals outputted by the GC's are not recorded as data by the IBM PC-XT during the calibration.

Instrument Department Responsibilities

- 1) The Instrument Department should calibrate the GC's every day (Operations will calibrate the GC's on the weekends). The GC's must be turned off before calibrating so that the voltage signals outputted by the GC's are not recorded as data by the IBM PC-XT during calibration.
- 2) The Instrument Department will assist Process Engineering with all hardware changes made to the system.

VIII. SYSTEM TROUBLESHOOTING

The IBM PC-XT and the Burr-Brown multiplexer both are fairly simple to troubleshoot. Table XI is a troubleshooting chart which will aid in correcting most problems when they occur. The IBM reference books and the Burr-Brown User's Manual should be used as further reference sources.

IX. SUPPLIES

The following is a list of replacement parts and supplies for the IBM PC-XT. All parts should be charged to operating supplies (charge code #8611-801-355-3-17).

<u>ITEM DESCRIPTION</u>	<u>STOCK NO.</u>
5¼" Floppy Diskettes	57-445-16
Printer Paper for IBM 80 CPS Graphics Printer	32-500-01
Ribbon for IBM 80CPS Graphics Printer	57-446-01

TABLE I
MCS50A SYSTEM CONFIGURATION

<u>CARD CAGE</u>	<u>TERMINATION</u>
SLOT 1: SM51623 PROCESSOR CARD	NONE
SLOT 2: SM51401 DISCRETE OUTPUT CARD	SM50020 16 CHANNELS
SLOT 3: SM51200 DISCRETE INPUT CARD	SM50018 12 CHANNELS
SLOT 4: SM51102 ANALOG INPUT EXPANDER CARD	SM51525 CHANNELS 40 - 63 SM51523 CHANNELS 16 - 39
SLOT 5: SM51100 ANALOG INPUT CARD	SM51521 CHANNELS 1 - 5
<u>POWER SUPPLY</u>	<u>ENCLOSURE</u>
INPUT VOLTAGE: 110VAC	NEMA TYPE 4
OUTPUT VOLTAGES: ± 5 VDC, ± 12 VDC	EXPLOSION PROOF
<u>AUXILIARY CARD</u>	<u>RIBBON CABLES</u>
SM51820 RS-232-C AUXILIARY CARD DUAL PORTS	SM50037-000 RIBBON CABLES MALE SNAP-IN CONNECTOR FEMALE CARD EDGE CONNECTOR

TABLE II
ANALOG INPUTS

<u>CHANNEL NO.</u>	<u>INPUT</u>	<u>ORIGIN</u>
1	CAR-171 ID	CAR-171
2	CAR-171 DATA	CAR-171
3	CAR-401 ID	CAR-401
4	CAR-401 DATA	CAR-401
5	CAR-904 ID	CAR-904
6	CAR-904 DATA	CAR-904
7	SPARE	
8	R-301 TEMP IN (TI-302-1A)	FIELD
9	R-302 TEMP IN (TI-302-12A)	FIELD
10	R-303 TEMP IN (TI-304-12A)	FIELD
11	R-303 TEMP OUT (TI-305-12A)	FIELD
12	S-301 STEAM (FI-304)	PROVOX
13	S-302 STEAM (FI-307)	PROVOX
14	S-303 STEAM (FI-309)	PROVOX
15	O ₂ TO R-301	PROVOX
16	O ₂ TO R-302	PROVOX
17	O ₂ TO R-303	PROVOX
18	C ₂ H ₄ TO R-301	PROVOX
19	HCL TO OXY (TOTAL)	PROVOX
20	HCL TO R-302	PROVOX
21	SPARE	
22	SPARE	
23	SPARE	
24	R-301 PRESS. IN	PROVOX
25	R-301 D/P	PROVOX
26	R-302 D/P	PROVOX
27	R-303 D/P	PROVOX
28 - 63	SPARES	

TABLE III
DISCRETE INPUTS

<u>CHANNEL NO.</u>	<u>INPUT</u>	<u>ORIGIN</u>
1	SPARE	
2	SPARE	
3	SPARE	
4	SPARE	
5	SPARE	
6	SPARE	
7	SPARE	
8	SPARE	
9	CAR-171 IN SERVICE	CAR-171
10	CAR-401 IN SERVICE	CAR-401
11	CAR-904 IN SERVICE	CAR-904
12	SPARE	
13	SPARE	
14	SPARE	
15	SPARE	
16	SPARE	

TABLE IV
DISCRETE OUTPUTS

<u>CHANNEL NO.</u>	<u>OUTPUT</u>	<u>DESTINATION</u>
1	H1 VCM CONCENTRATION	ANNUNCIATOR
2	VCM LEAK	ANNUNCIATOR
3	HIGH OXY FLAMMABILITY	ANNUNCIATOR
4	COMPUTER FAILURE	ANNUNCIATOR
5	SPARE	
6	SPARE	
7	SPARE	
8	SPARE	
9	SPARE	
10	SPARE	
11	SPARE	
12	SPARE	
13	SPARE	
14	SPARE	
15	SPARE	
16	SPARE	

TABLE V

MCS50A ERROR CODES

<u>ERROR CODE</u>	<u>ERROR DESCRIPTION</u>
01	* Checksum error. Checksum in command does not agree with checksum calculated by the MCS50A.
02	Parity error.
03	No configuration. Scan LED will be extinguished if no configuration is present.
04	* No new class G data.
05	* Invalid subcommand.
06	Invalid command.
07	Channel number out of range.
08	Output date has the wrong number of characters.
09	Bad command format.
0A	Command not supported by software.
0B	Illegal command caused by sending a configuration command while configured.
0C	* Greater number of Type M cards specified than are in the system.
0D	* Bad M card subtype letter.
0E	* Bad M card subcommand number.
0F	* Bad X command subtype letter.
10	* Bad X command subcommand number.

* = These error codes should not be returned by the MCS50A because these errors apply to cards, commands or functions not utilized by the plant's system.

TABLE VI
ASCII CHARACTER CODES

ASCII value	Character	ASCII value	Character	ASCII value	Character	ASCII value	Character
128	Ç	160	á	192	Ł	224	α
129	u	161	í	193	±	225	β
130	é	162	ó	194	⌈	226	Γ
131	â	163	ú	195	†	227	π
132	à	164	ñ	196	—	228	Σ
133	ä	165	Ñ	197	+	229	σ
134	å	166	ä	198	⌋	230	μ
135	ç	167	ö	199	⌋	231	τ
136	ê	168	ç	200	ℓ	232	ϕ
137	è	169	┌	201	ℓ	233	⊖
138	ë	170	└	202	≡	234	Ω
139	ï	171	½	203	≡	235	δ
140	î	172	¼	204	≡	236	∞
141	ì	173	ı	205	≡	237	∅
142	À	174	«	206	≡	238	€
143	Á	175	»	207	≡	239	∩
144	Ê	176	⋯	208	≡	240	≡
145	æ	177	⌘	209	≡	241	±
146	Ⓐ	178	⌘	210	≡	242	≥
147	ô	179	└	211	≡	243	≤
148	ö	180	└	212	≡	244	└
149	ò	181	≡	213	≡	245	J
150	û	182	≡	214	≡	246	÷
151	ü	183	└	215	≡	247	≈
152	y	184	└	216	≡	248	°
153	Ö	185	≡	217	└	249	•
154	U	186	≡	218	└	250	•
155	ø	187	≡	219	■	251	√
156	£	188	≡	220	■	252	∞
157	¥	189	≡	221	■	253	²
158	Pt	190	└	222	■	254	■
159	/	191	└	223	■	255	(blank 'FF')

TABLE VI (CONT.)

ASCII value	Character	Control character	ASCII value	Character	ASCII value	Character	ASCII value	Character
000	{null}	NUL	032	{space}	064	@	096	`
001	☉	SOH	033	!	065	A	097	a
002		STX	034	"	066	B	098	b
003	♥	ETX	035	#	067	C	099	c
004	♦	EOT	036	\$	068	D	100	d
005	♣	ENQ	037	%	069	E	101	e
006	♠	ACK	038	&	070	F	102	f
007	{beep}	BEL	039	'	071	G	103	g
008	■	BS	040	(	072	H	104	h
009	{tab}	HT	041	)	073	I	105	i
010	{line feed}	LF	042	*	074	J	106	j
011	{home}	VT	043	+	075	K	107	k
012	{form feed}	FF	044	,	076	L	108	l
013	{carriage return}	CR	045	-	077	M	109	m
014	♪	SO	046	.	078	N	110	n
015	☼	SI	047	/	079	O	111	o
016	▶	DLE	048	0	080	P	112	p
017	▼	DC1	049	1	081	Q	113	q
018	↕	DC2	050	2	082	R	114	r
019	!!	DC3	051	3	083	S	115	s
020	π	DC4	052	4	084	T	116	t
021	5	NAK	053	5	085	U	117	u
022	—	SYN	054	6	086	V	118	v
023	⌞	ETB	055	7	087	W	119	w
024	⌞	CAN	056	8	088	X	120	x
025	⌞	EM	057	9	089	Y	121	y
026	→	SUB	058	:	090	Z	122	z
027	←	ESC	059	;	091	[	123	{
028	{cursor right}	FS	060	<	092	\	124	
029	{cursor left}	GS	061	=	093	]	125	}
030	{cursor up}	RS	062	>	094	^	126	~
031	{cursor down}	US	063	?	095	_	127	␣

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HEXADECIMAL CONVERSION TABLES

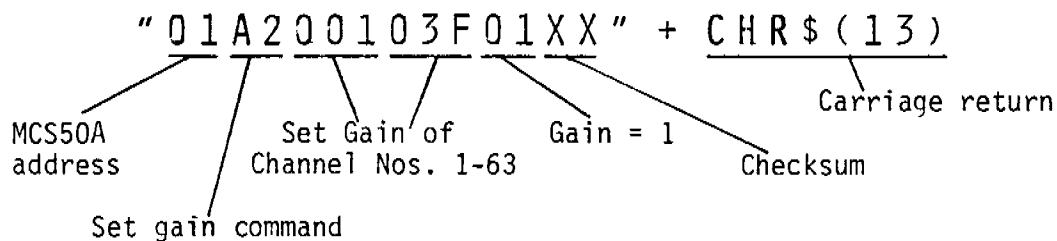
Binary to Hexadecimal Conversion Table

Hex	Decimal	Hex	Decimal
1	1	10	16
2	2	20	32
3	3	30	48
4	4	40	64
5	5	50	80
6	6	60	96
7	7	70	112
8	8	80	128
9	9	90	144
A	10	A0	160
B	11	B0	176
C	12	C0	192
D	13	D0	208
E	14	E0	224
F	15	F0	240
100	256	1000	4096
200	512	2000	8192
300	768	3000	12288
400	1024	4000	16384
500	1280	5000	20480
600	1536	6000	24576
700	1792	7000	28672
800	2048	8000	32768
900	2304	9000	36864
A00	2560	A000	40960
B00	2816	B000	45056
C00	3072	C000	49152
D00	3328	D000	53248
E00	3584	E000	57344
F00	3840	F000	61440

Binary bit pattern	Hex value	Decimal value
0001	1	1
0010	2	2
0011	3	3
0100	4	4
0101	5	5
0110	6	6
0111	7	7
1000	8	8
1001	9	9
1010	A	10
1011	B	11
1100	C	12
1101	D	13
1110	E	14
1111	F	15

TABLE VIIIMCS50A Commands/Responses1. Analog Input Gain

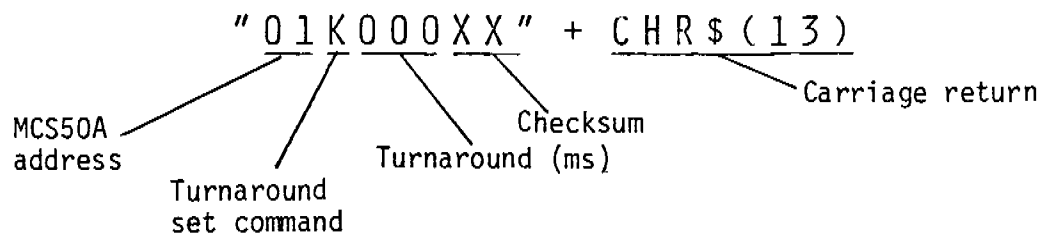
The analog input data gain is set to 1 by the following command:



The response is an echo of the command.

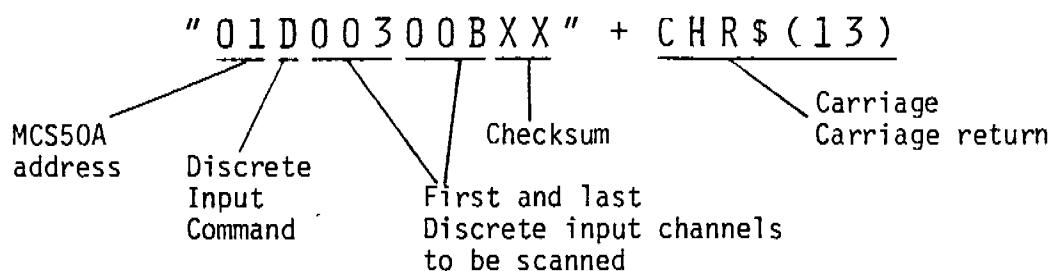
2. Command/Response Turnaround

The turnaround time for the delay between command and response has been set to zero milliseconds.

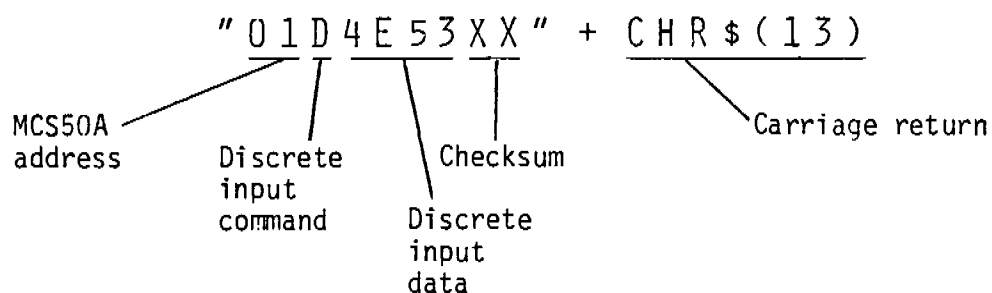


The response is an echo of the command.

TABLE VIII (cont.)

3. Discrete Input Data Request

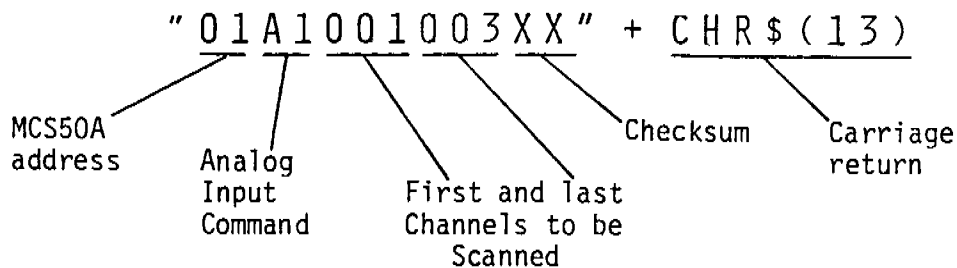
The response to the discrete input data request command is as follows:



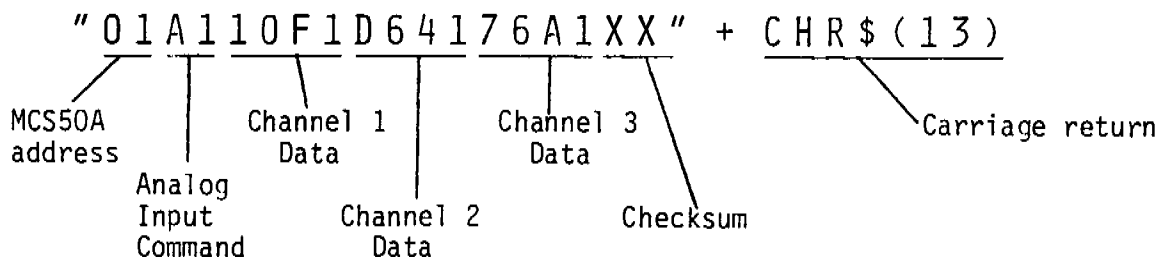
Converting the hex response to individual channel states:

4E53 hex = 0 1 0 0 1 1 1 0 0 1 0 1 0 0 1 1
 Corresponding channels = 8 7 6 5 4 3 2 1 16.....9

TABLE VIII (cont.)

4. Analog Input Data Request

The response to the analog input data request command is as follows:



The hexadecimal analog data is in two's complement form, which is decoded as follows:

For channel 1 data: hex 1 0 F 1

Data Gain

a. hex 10F = 271 decimal

b. Since $271 \leq 2048$,

$(271/2048) * 10 = 1.323$ Volts at Channel 1.

c. If Channel 1 is a 1V-5V signal representing 0-30 ppm VCM, then:

$(1.323-1)/4 * 30 = 2.42$ ppm VCM

d. $2.42 \text{ ppm} \times \text{GAIN} = 2.42 \times 1 = 2.42 \text{ ppm}$

TABLE VIII (cont.)

For channel 2 data: hex D 6 4 1
 Data Gain

a. hex D64 = 3428 decimal

b. Since $3428 \geq 2048$,

$$(3428 - 4096) / 2048 \times 10 = -3.26V \text{ at channel 2}$$

For a transmitter signal, a voltage of less than zero would indicate an input underrange.

5. Discrete Output Command

Eight channels of discrete output data must be sent at one time.
 To send a logic 1 to discrete output channel 2, send the command:

" 0 1 F 1 0 0 2 0 0 2 0 2 X X " + C H R \$ (1 3)

MCS50A address Discrete Output Command First and last channels to set discrete value Discrete output data Checksum Carriage return

The discrete output data corresponds to:

binary: 0 0 0 0 0 0 1 0 = 02 decimal

channel: 8 7 6 5 4 3 2 1

The response is an echo of the command.

TABLE IX
SOFTWARE CONFIGURATION

<u>FLOPPY DISK</u>		<u>HARD DISK</u>	
<u>FILE(S)</u>	<u>DESCRIPTION</u>	<u>FILE(S)</u>	<u>DESCRIPTION</u>
DOS FILES	Disk operating system. Allows IBM PC-XT to restart automatically after a power failure	DOS FILES	Allows the operating system to run off the hard disk during normal computer operations.
"AUTOEXEC.BAT"	Contains the commands necessary to restart the system and programs automatically after a power failure.	BASIC COMPILER	The files necessary to compile a basic program are located on the hard disk. If changes to "FAIL.BAS" or "FIXEDPT.BAS" are required, these programs must be re-compiled.
"EPADATA"	This file contains the hourly and daily printout information. This data is stored in "EPADATA" as a safeguard against losing the hard copy printouts.	"FIXEDPT.BAS"	The basic program which performs VCM leak detection, OXY flammability and OXY pressure drop and steam/air ratio calculations, input and output.
		"FIXEDPT.EXE"	The compiled "FIXEDPT.BAS." program.
		"FAIL.BAS"	The basic program used to annunciate a computer failure alarm.
		"FAIL.EXE"	The compiled "FAIL.BAS" program.
		"MONITOR.BAT"	The batch file containing the commands necessary to execute "FIXEDPT.EXE" and "FAIL.EXE", "MONITOR.BAT" controls the timing and execution of these files.

TABLE IX (cont.)

FLOPPY DISK		HARD DISK	
FILE(S)	DESCRIPTION	FILE(S)	DESCRIPTION
		"FIXEDPT1.BAS"	Same as "FIXEDPT.BAS", except line #102 has been deleted so that the manual input of the previous day's date is bypassed. Therefore, on a power failure, the system will re-start automatically. A message is displayed on the monitor screen to indicate a power failure has occurred. The time and date will have to be reset after a power failure has occurred. Execution of "FIXEDPT1.BAS" will need to be halted to do this. The system should be restarted using "MONITOR.BAT."
		"FIXEDPT1.EXE"	The compiled "FIXEDPT1.BAS" program.
		"HOURLDATA"	This file stores all leak detection data generated during the day. This file is cleared and re-initialized at the end of each day following the printing of the daily log.

TABLE X
VCM LEAK DETECTION AREAS

<u>AREA #</u>	<u>GC#</u>	<u>POINTS (1)</u>
1	CAR-171	1, 2, and 3
2	CAR-171	1 and 4
3	CAR-171	4 and 9
4	CAR-171	1 and 5
5	CAR-171	6
6	CAR-171	7
7	CAR-171	8
8	CAR-171	10
9	CAR-401	1
10	CAR-401	2
11	CAR-401	3, 4, 5 and 8
12	CAR-401	6
13	CAR-401	7
14	CAR-401	9 and 10

TABLE XI

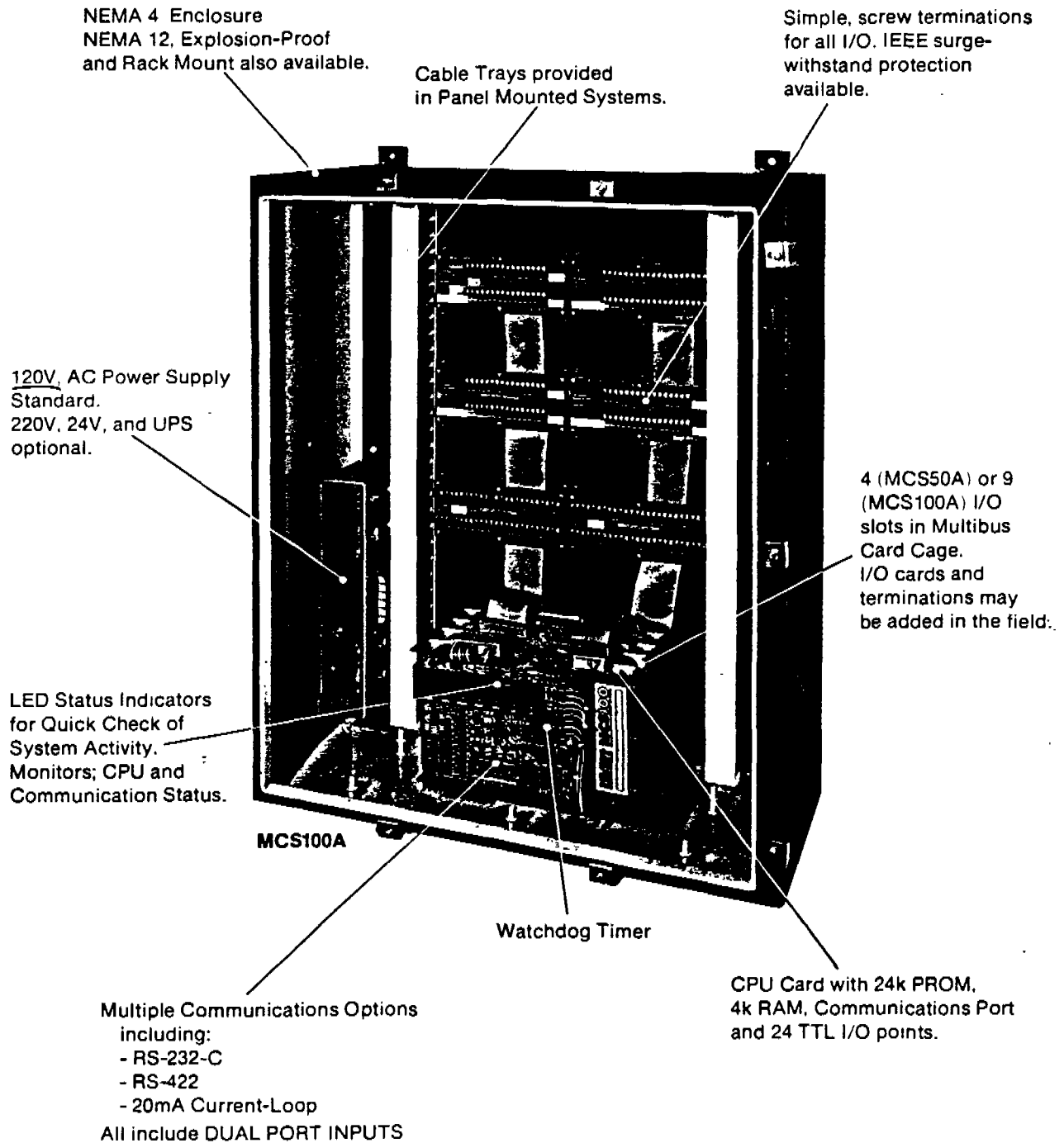
IBM PC-XT/BURR-BROWN TROUBLESHOOTING GUIDE

PROBLEM DESCRIPTION	PROBABLE CAUSES	REMEDY
1. No display on monitor.	No power to monitor.	Check power to monitor. If power is on, green LED on front of monitor will be on.
	Cable not connected to PC-XT.	Check connection of monitor to PC-XT and reconnect if necessary.
	Bad video tube.	If power is on and monitor is connected properly, video tube may be bad.
2. Continuous printout of logs.	Software problem - program is stuck in a printing loop.	Stop program execution by pressing "ctrl-break" - check screen for line number at break point. Check software and reload program.
3. Continuous printout of error messages	Hardware or software problem.	Note the error number and device (IBM, PC-XT or Burr-Brown), refer to the IBM Basic Manual, Appendix A for IBM, PC-XT errors or Table V for Burr-Brown errors.
4. Program stops execution and error message displayed on screen,	IBM PC-XT software error.	Refer to Appendix A of IBM Basic Manual for error descriptions.
5. Continuous input underrange messages for GC data	Memory card failure in GC.	Check voltage output from suspected memory card and replace card if necessary.

TABLE XI (cont.)

PROBLEM DESCRIPTION	PROBABLE CAUSES	REMEDY
6. Device I/O error on screen	Burr-Brown Communications failure	Check Burr-Brown status LED's. If L2 lamp is on, turn off the Burr-Brown and re-power. Restart the IBM PC programs.
	Burr-Brown failure.	Check the scan LED on the Burr-Brown. If not illuminated, the processor card has failed. Reseat the processor card. If scan light not on after restarting the IBM PC programs, replace the processor card.
7. Disk full error on screen.	Floppy disk is full.	Replace floppy disk with a new configured disk (See Table IX).
8. Device Timeout error on screen.	Printer not on line.	Make sure printer is powered up and on line.
	Burr-Brown failure.	Check Burr-Brown status LED's. (See #6, above.)
9. Program not executing and no error messages on screen or printer.	Burr-Brown failure.	Check Burr-Brown status LED's. (See #6, above.)
10. Power failure.		None required. The IBM PC-XT will automatically boot up. The time and date must be reentered by halting program execution at some convenient time if not correct.

MCS SERIES



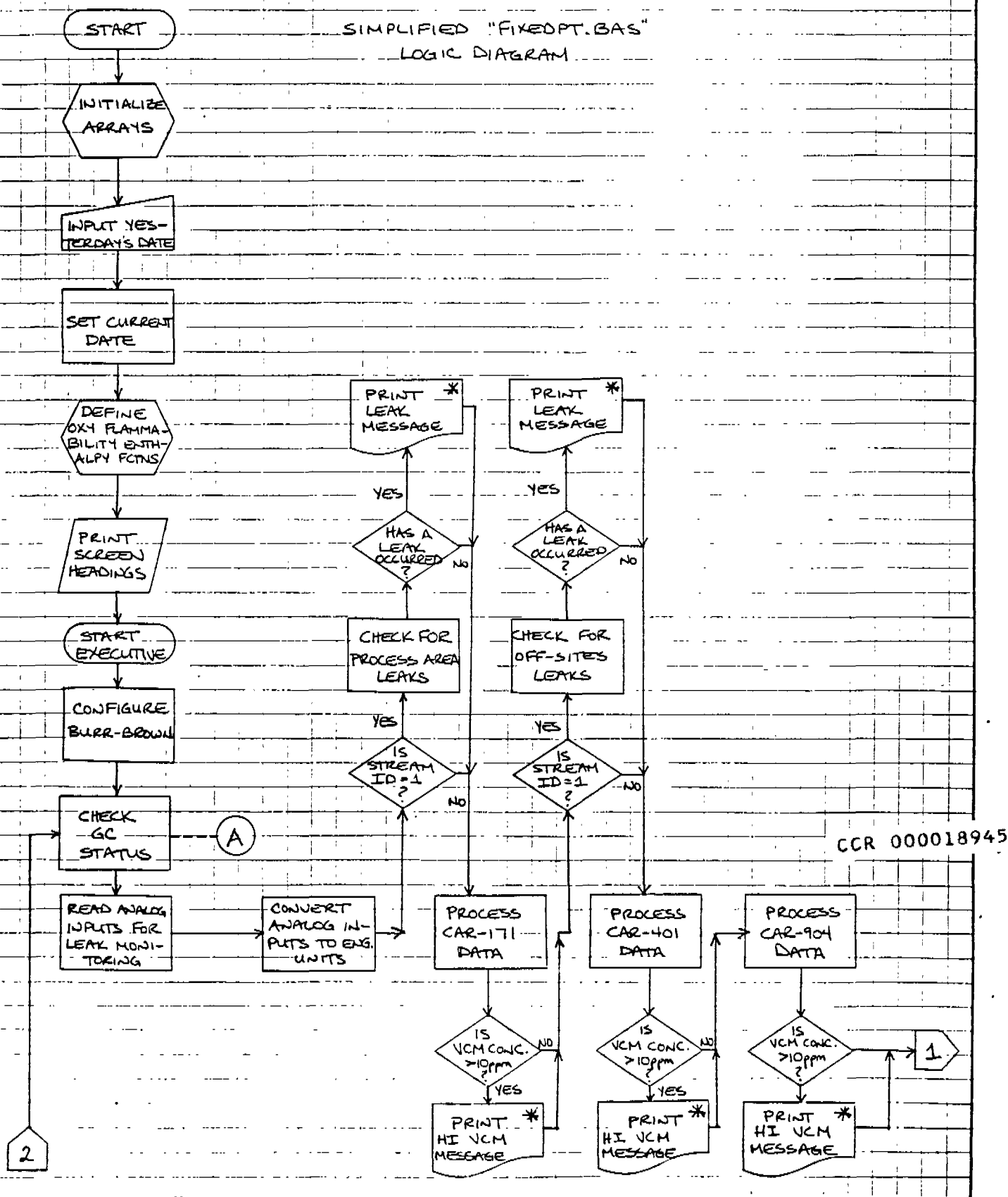
SMART I/O MULTIPLEXERS

CCR 000018944

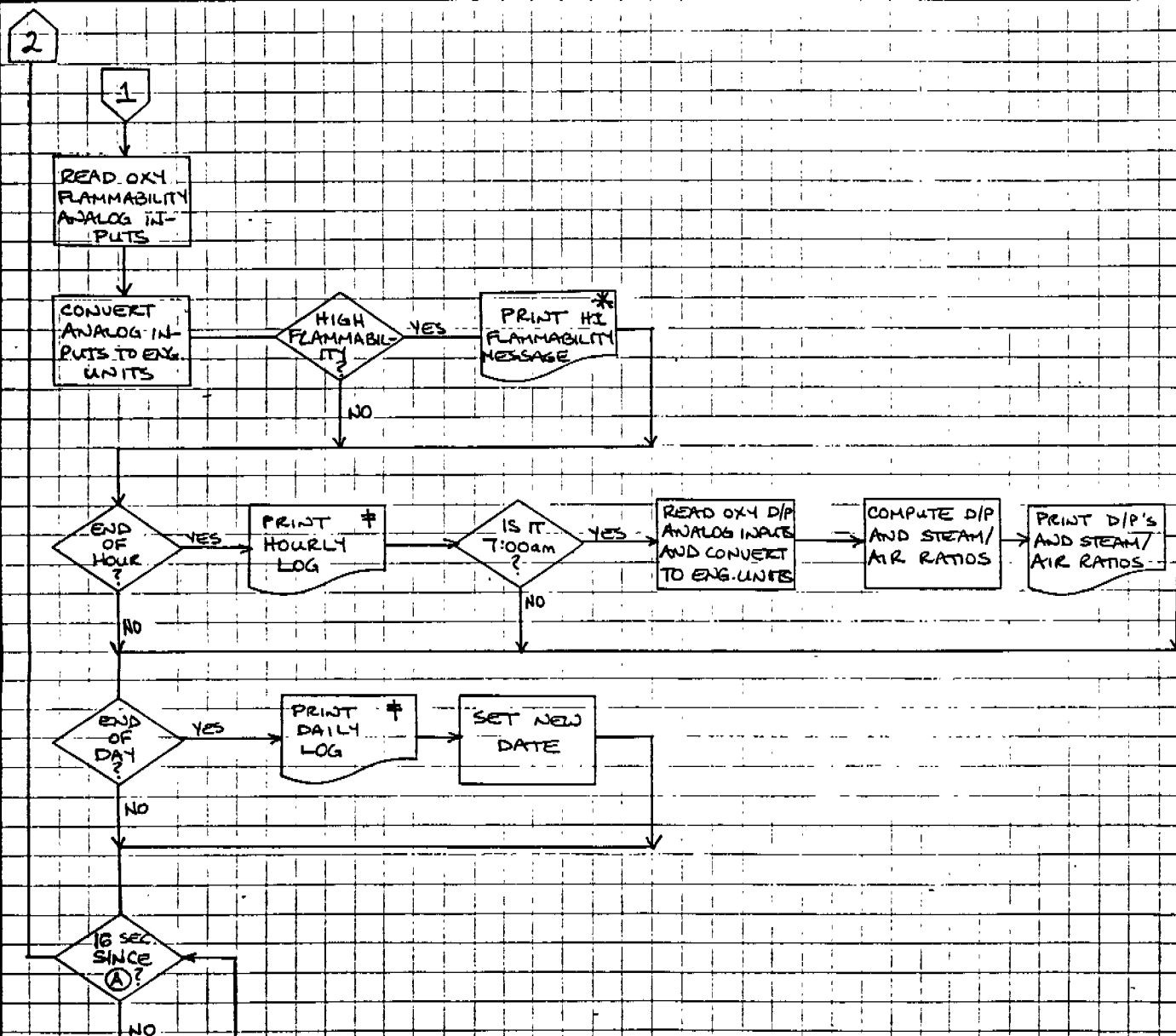
FIGURE 1. BURR-BROWN MULTIPLEXER.

Application _____ Date MARCH 19, 1984 Page 1 of 2
Procedure _____ Drawn By SWS

FIGURE 2.

SIMPLIFIED "FIXEDPT.BAS"
LOGIC DIAGRAM

Application _____ Date MARCH 19, 1984 Page 2 of 2
Procedure _____ Drawn By SWS

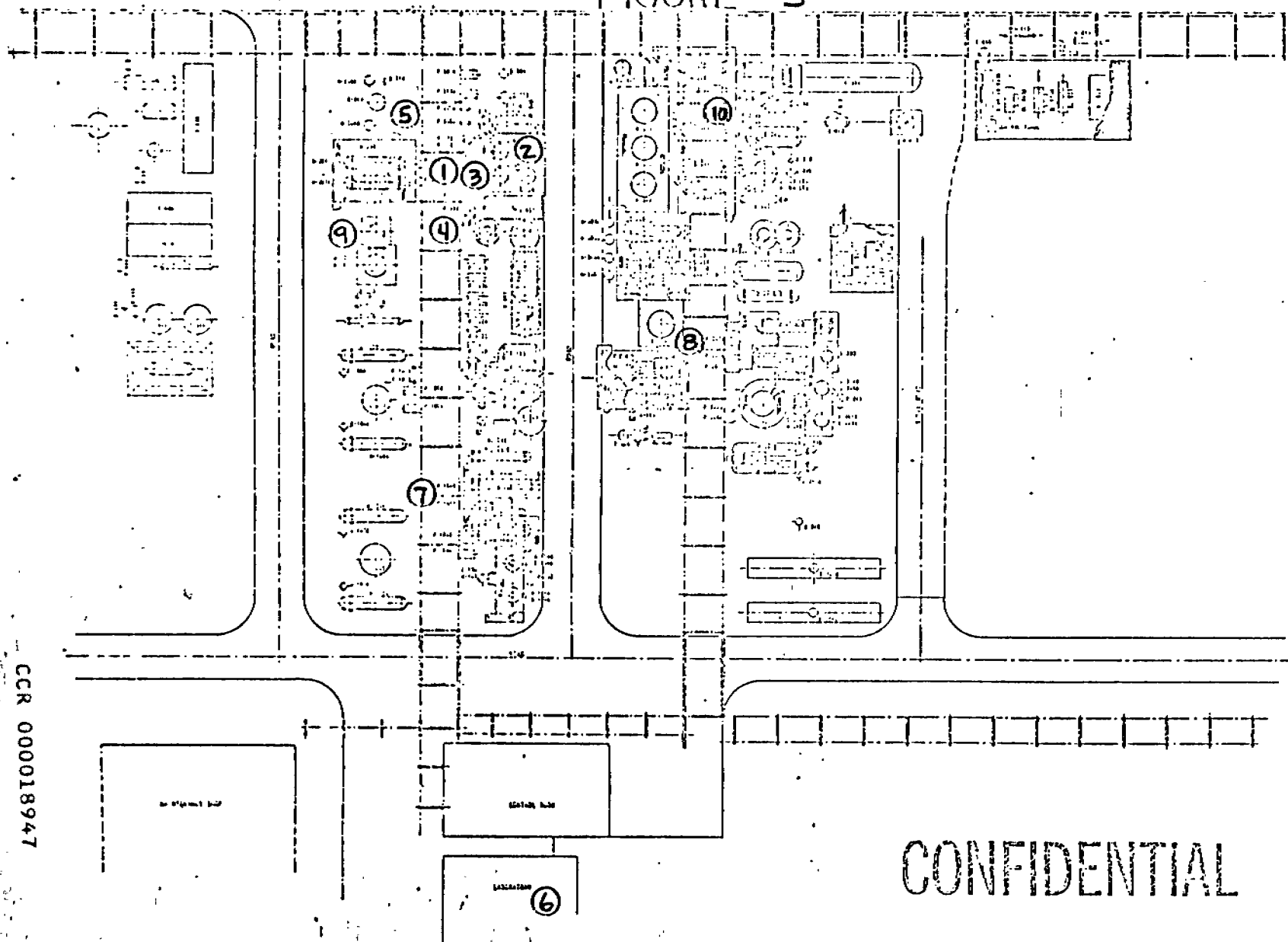


* - ANNUNCIATOR IS ALARMED DURING THESE STEPS.

† - DATA IS SAVED ON FLOPPY DISK DURING THESE STEPS.

CAR-17L MONITORING POINTS
PROCESS AREA

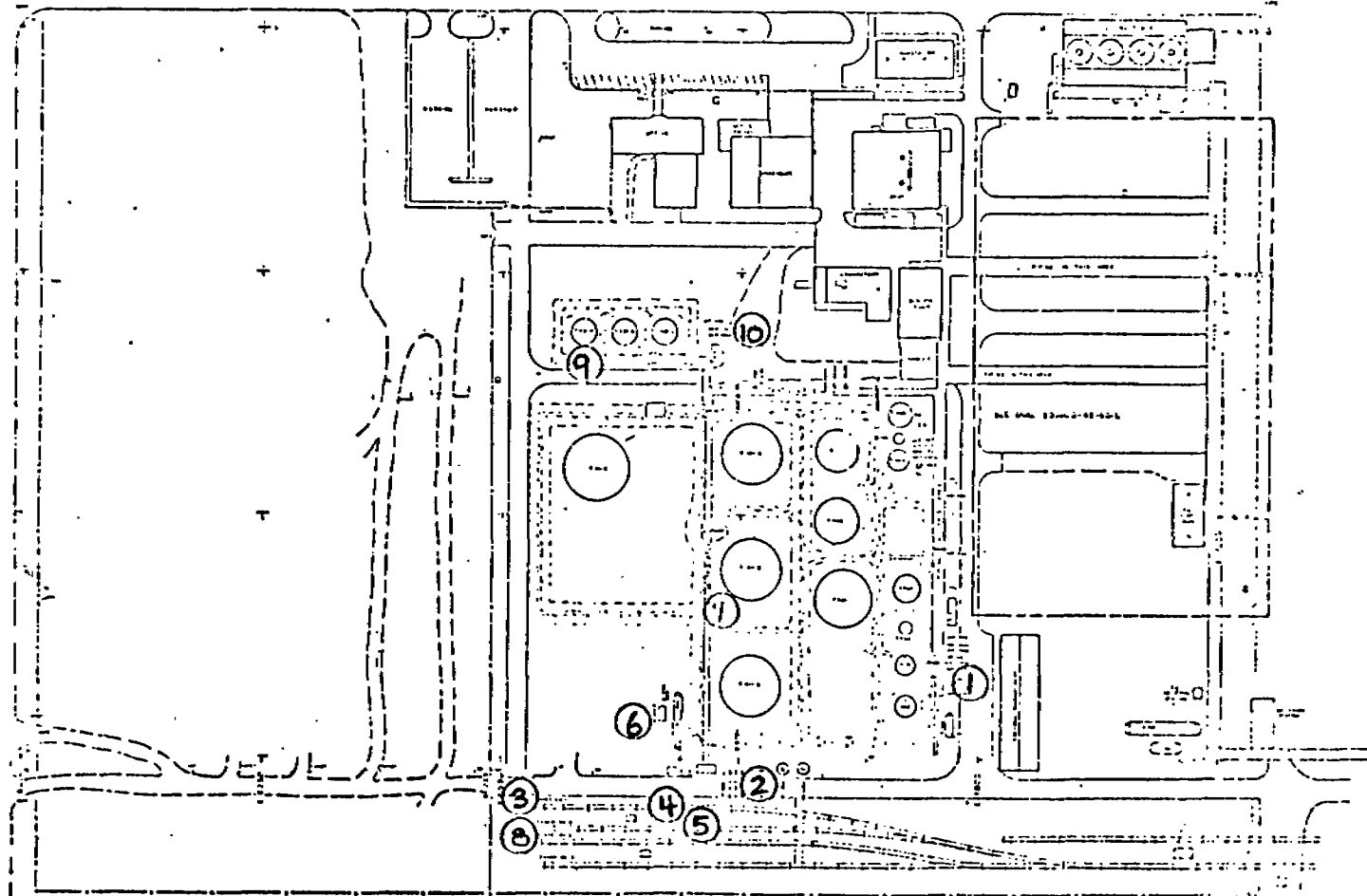
FIGURE-3



CONFIDENTIAL

92

CAR-401 MONITORING POINTS
OFF-SITE AREA
FIGURE 4



CONFIDENTIAL

CONFIDENTIAL

CCR 000018948

Application _____

Date MARCH 22, 1984 Page 1 of 4

Procedure _____

Drawn By SWS

FIGURE 5.

DETAILED LEAK DETECTION LOGIC
DIAGRAMCAR-171PROCESS AREACURRENT
STREAM ID=1SET HIGH VCM FLAG=1 IF
CURRENT G.C. CONC. FOR
POINT IS ≥ 10 PPM.HAVE ALL
10 GC. PTS.
BEEN CHECKED
?NEXT GC
POINT

YES

DID
PT. 1 SHOW
 ≥ 10 PPM VCM LAST
SCAN AND THIS
SCAN?

YES

AREA 1
ALARM
FLAG ON

No

DID
PT. 4 SHOW
 ≥ 10 PPM VCM LAST
SCAN AND THIS
SCAN?

YES

AREA 2
ALARM
FLAG ON

No

DID
PT. 5 SHOW
 ≥ 10 PPM VCM LAST
SCAN AND THIS
SCAN?

YES

AREA 3
ALARM
FLAG ON

No

DID
PT. 9 SHOW
 ≥ 10 PPM VCM LAST
SCAN AND THIS
SCAN?

YES

AREA 4
ALARM
FLAG ON

No

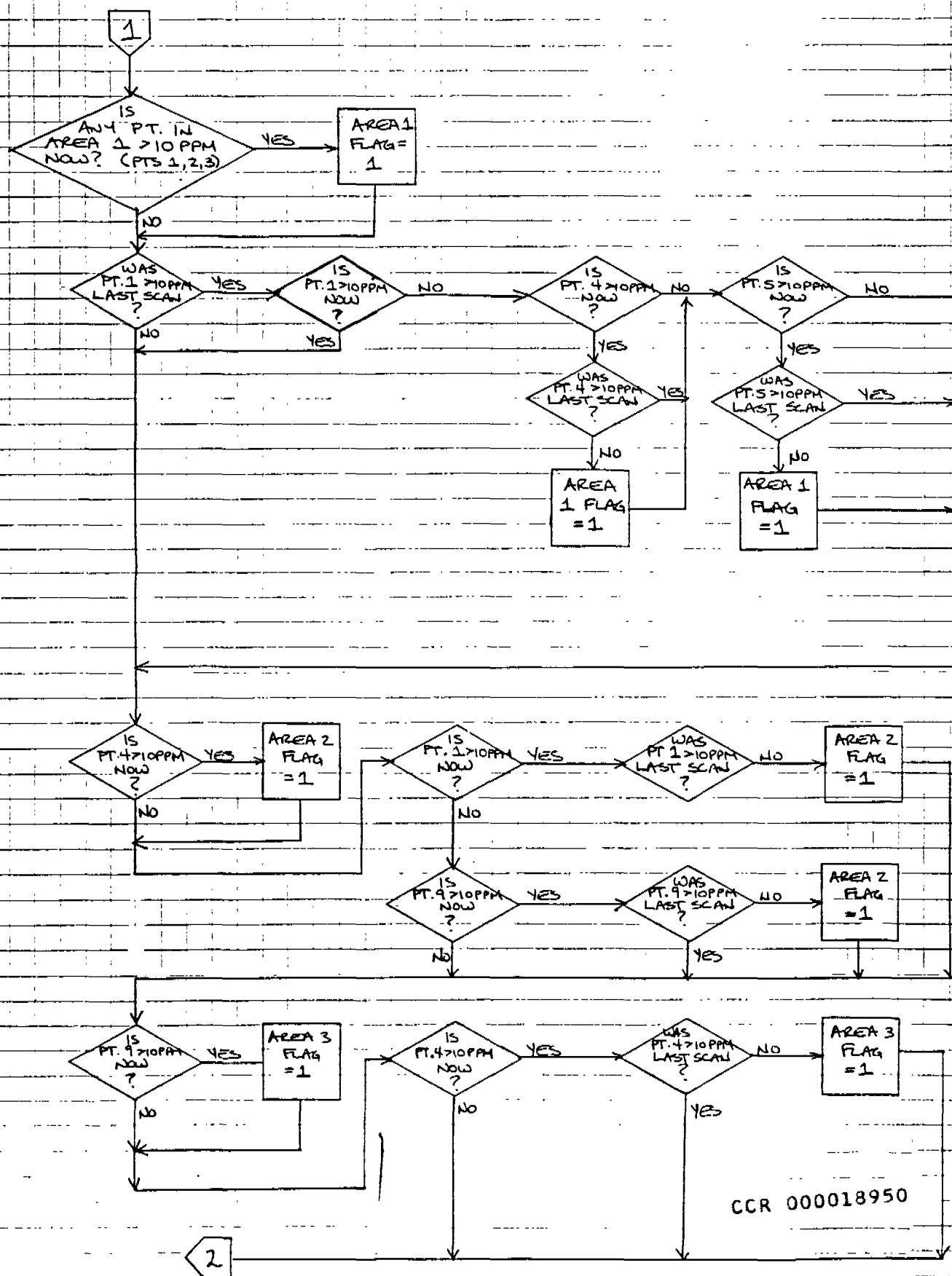
1

CCR 000018949

Application _____

Date MARCH 22, 1984 Page 2 of 4

Procedure _____

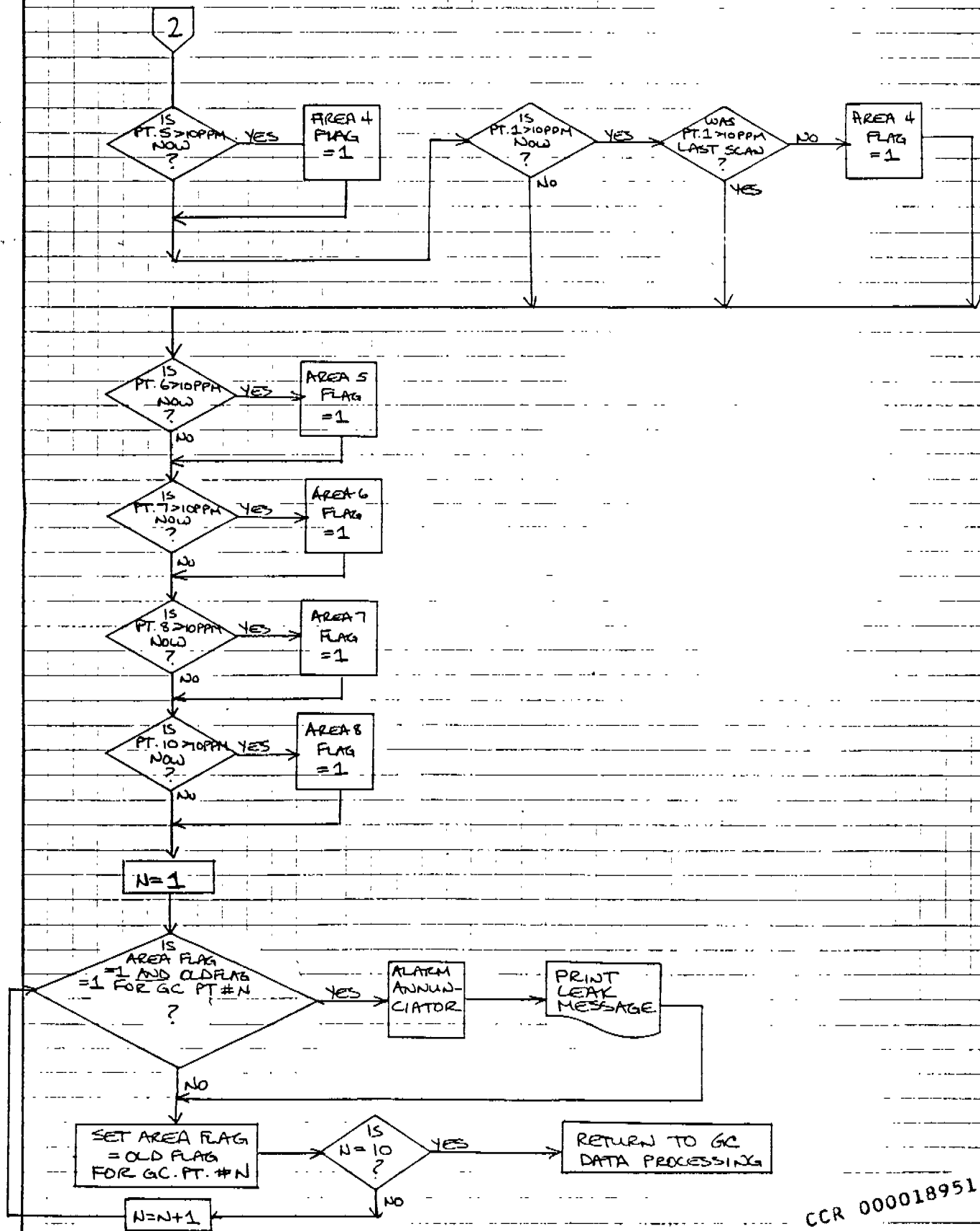
Drawn By SWS

CCR 000018950

Application _____

Date MARCH 22, 1984 Page 3 of 4

Procedure _____

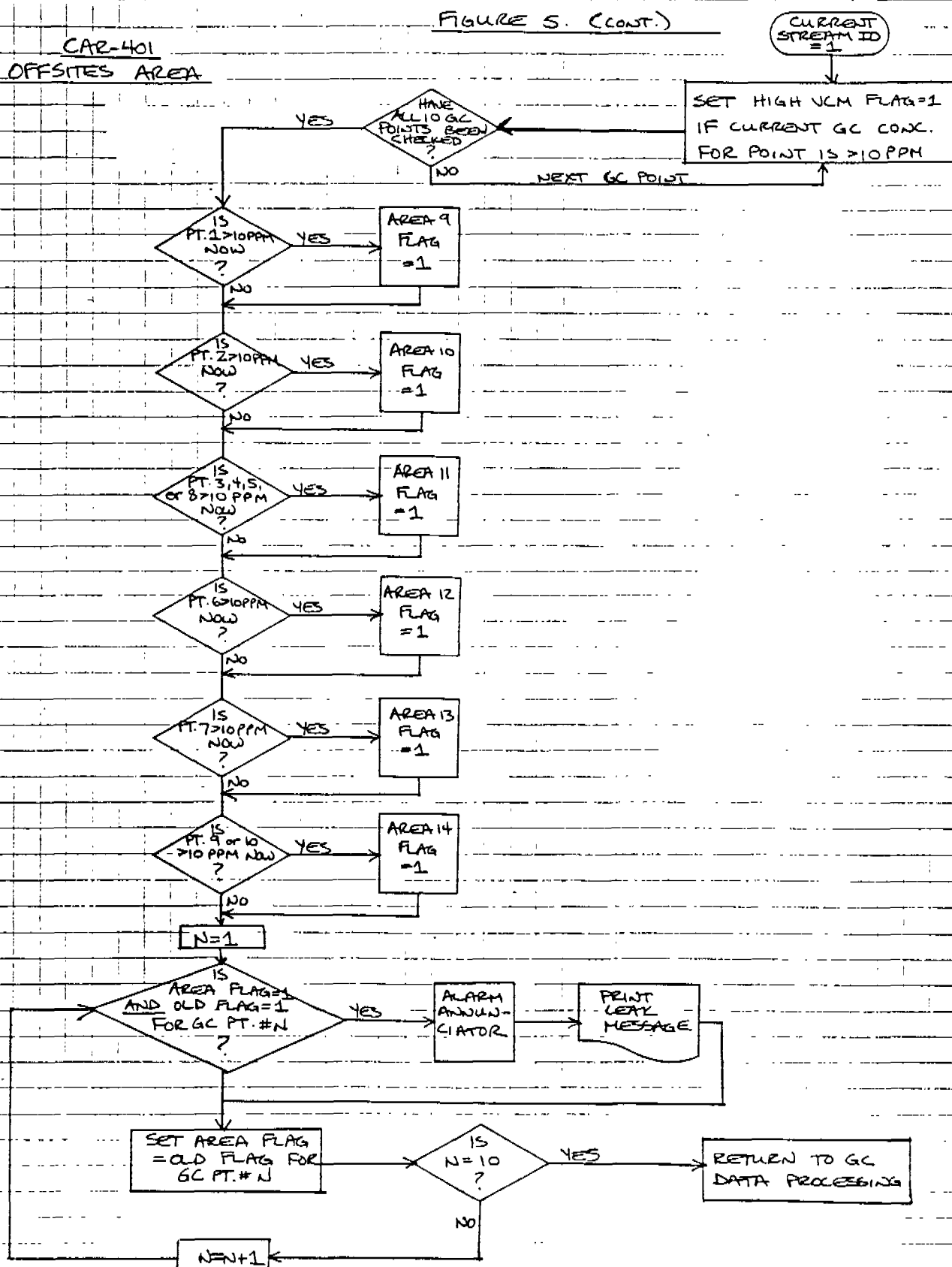
Drawn By SWS

CCR 000018951

FLOW CHART AND BLOCK DIAGRAM

Application _____ Date MARCH 22, 1984 Page 4 of 4Procedure _____ Drawn By SWS

FIGURE 5. (CONT.)

CAR-401
OFFSITES AREA

VCM-BB-1-SWS

PROVOK

1	13
2	14
3	15
4	16
5	17
6	18
7	19

TAG No. FIC-302
 FILE CASE I-6 #2
 SLOT A2
 DC# 5

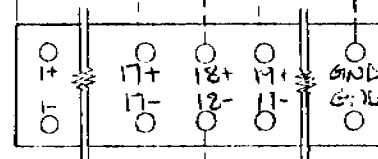
E/I

-01
 -02
 30
 40
 50+
 60-
 70
 80
 90
 100+
 110-
 120-6

24VDC

SHIELD

MULTIPLEXER



TAG No. F4-302
 MFG. BURR-BROWN
 TERMINATION TR #2
 MODEL SM51523

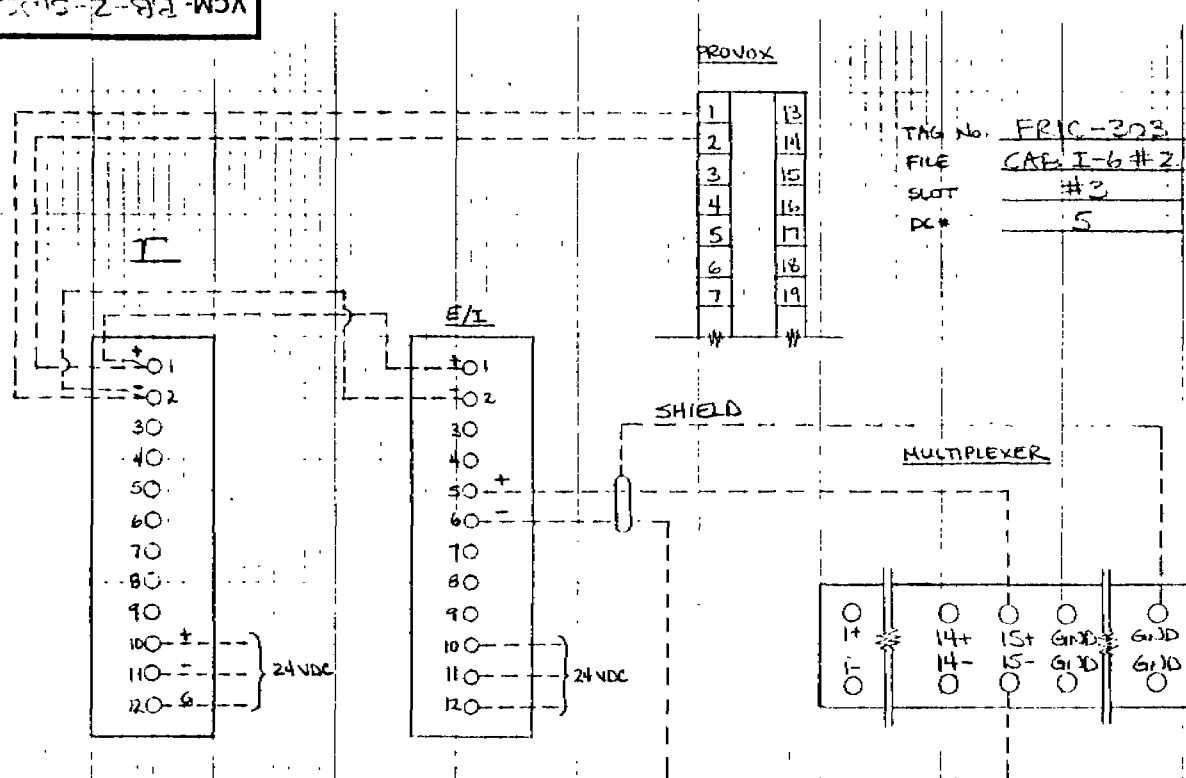
TAG No. F4-302-1
 MFG. TRANSMATION
 MODEL 3530T

REFERENCE DRAWING: B-T9701-A421EE-3

1	3/24/81	LOOP DRAWING	CWE	CWS
ISU	DATE	DESCRIPTION	BY	CKD
CONTINENTAL OIL COMPANY LAKE CHARLES VCM PLANT LAKE CHARLES, LA.				
F4-302 BURR-BROWN LOOP DRAWING				
SHEET 1 OF 20			SCALE: NONE	
APPROVED. DATE:		VCM-BB-1-SWS		REV 0

CCR 000018953

VCM-BB-2-SWS



TAG No. FRIC-303
 FILE CAB-I-6 #2
 SLOT #3
 DC* 5

TAG No. FY-303
 MFG. BURR-BROWN
 TERMINATION TR #1
 MODEL SMS1521

TAG No. FY-303-7
 MFG. TRANSMATION
 MODEL 3530T

TAG No. FY-303-5
 MFG. TRANSMATION
 MODEL 3530T

REFERENCE DRAWING: B-T4701-A184FF-3

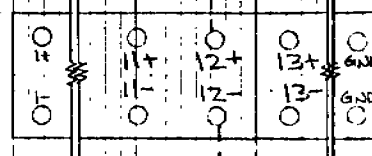
1	2/21/81	LOOP DRAWING	SWS	SWS	
ISU	DATE	DESCRIPTION	BY	CKD	APD
CONTINENTAL OIL COMPANY LAKE CHARLES VCM PLANT LAKE CHARLES, LA.					
FY-303 BURR-BROWN LOOP DRAWING					
SHEET <u>2</u> OF <u>20</u>			SCALE: NONE		
APPROVED: DATE:			VCM-BB-2-SWS		
					REV 0

VCM-BB-3-SWS

PROX

1	13
2	14
3	15
4	16
5	17
6	18
7	19
8	20
9	21
10	22
11	23
12	24

MULTIPLEXER



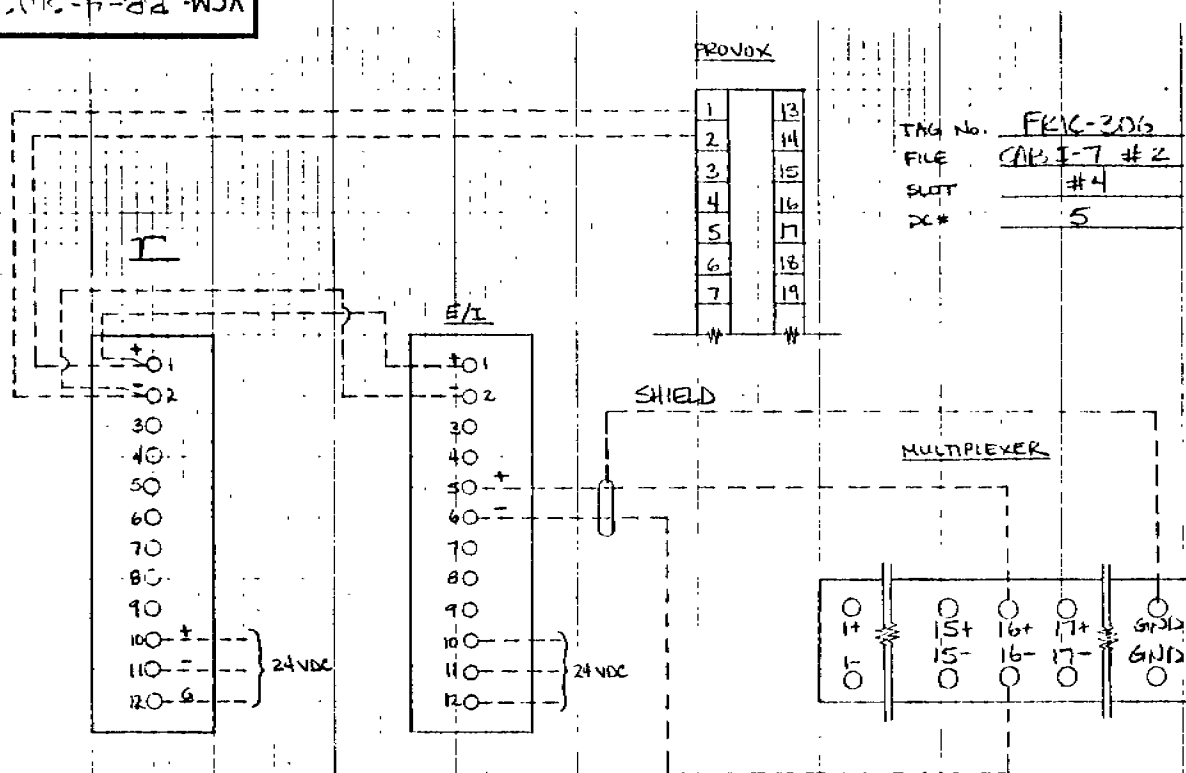
TAG NO. FY-304
 MFG. BURR-BROWN
 TERMINATION TP-111
 MODEL SM51521

TAG NO. LK-304/FY-304
 CAB. I-7
 FILE. #5
 SLOT #1
 DC# 6

1	2/24/81	LOOP DRAWING	SWS	SWS
ISU	DATE	DESCRIPTION	BY	CKD
CONTINENTAL OIL COMPANY LAKE CHARLES VCM PLANT LAKE CHARLES, LA.				
FY-304 BURR BROWN LOOP DRAWING				
SHEET <u>3</u> OF <u>20</u>			SCALE	
APPROVED:		VCM-BB-3-SWS		REV
DATE:				1

CCR 000018955

VCM-BB-4-SWS



TAG No. FY-306
 FILE CAB I-7 #2
 SLOT #4
 DC# 5

TAG No. FY-306
 MFG. BURR-BROWN
 TERMINATION TE#2
 MODEL SM51523

TAG No. FY-306-7
 MFG. TRANSMATION
 MODEL 3630T

TAG No. FY-306-5
 MFG. TRANSMATION
 MODEL 3530T

REFERENCE DRAWING B-T4701-

1	2/24/81	LOOP DRAWING	SWS	SWS	
ISU	DATE	DESCRIPTION	BY	CKD	APD
CONTINENTAL OIL COMPANY LAKE CHARLES VCM PLANT LAKE CHARLES, LA.					
FY-306 BURR-BROWN LOOP DRAWING					
SHEET <u>4</u> OF <u>20</u>			SCALE: NONE		
APPROVED: DATE:			VCM-BB-4-SWS		
					REV. 0

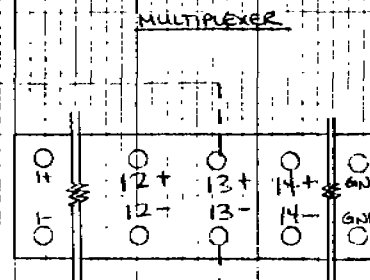
CCR 000018956

(4,

VCM-BB-5-SWS

PROX

1	13
2	14
3	15
4	16
5	17
6	18
7	19
8	20
9	21
10	22
11	23
12	24



TAG NO. FY-307
 MFG. BURR-BROWN
 TERMINATION TB11.1
 MODEL SMEIS21

TAG No. LIC-302/FY-307
 CAB. I-7
 FIVE #5
 SLOT #2
 DC# 6

1	2/24/81	LOOP DRAWING	SWS	SWS	
ISU	DATE	DESCRIPTION	BY	CHKD	APD

CONTINENTAL OIL COMPANY
 LAKE CHARLES VCM PLANT
 LAKE CHARLES, LA.

FY-307
 BURR-BROWN LOOP DRAWING

SHEET 5 OF 20

SCALE:

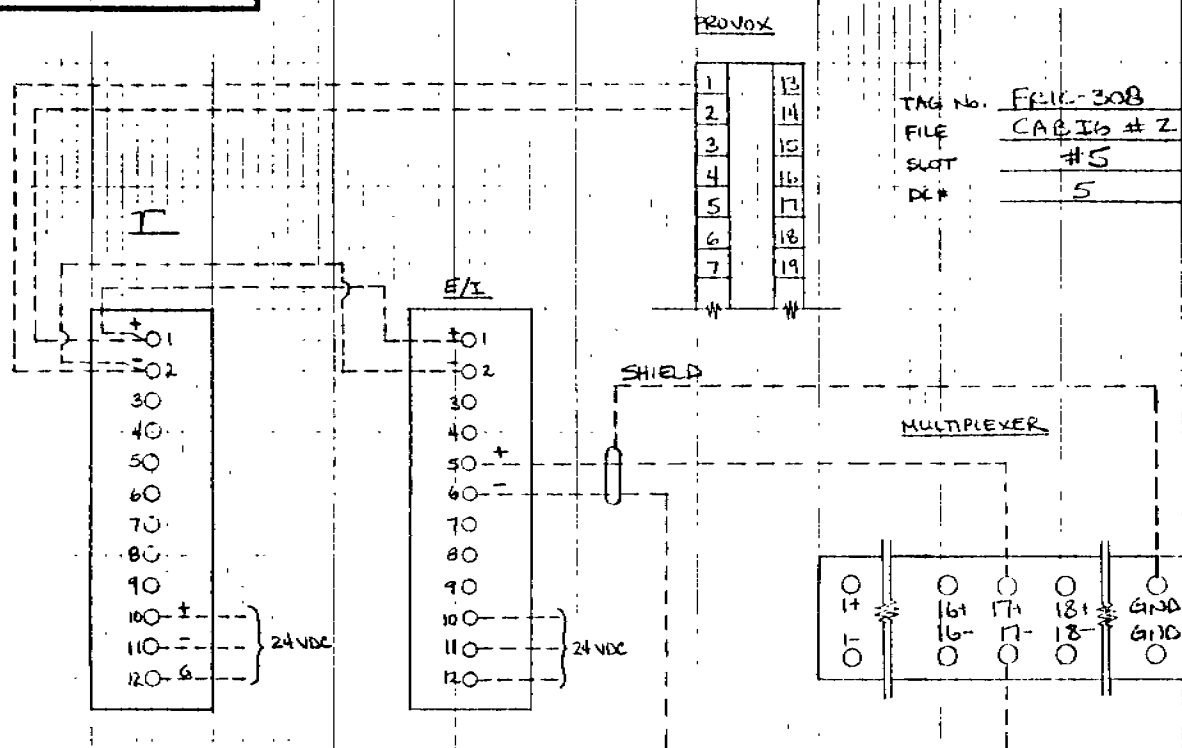
APPROVED:
DATE:

VCM-BB-5-SWS

REV
1

CCR 000018957

VCM-BB-6-SWS



TAG No. FY-308
 FILE CABIN #2
 SLOT #5
 DE # 5

TAG No. FY-308
 MFG. BURR-BROWN
 TERMINATION TB#2
 MODEL SMS1523

TAG No. FY-308-7
 MFG. TRANSMATION
 MODEL 3530T

TAG No. FY-308-5
 MFG. TRANSMATION
 MODEL 3530T

REFERENCE DRAWING: B-T4701-A429B3-3

1	2/24/81	LOOP DRAWING	SWS	SWS
ISU	DATE	DESCRIPTION	BY	CKD
CONTINENTAL OIL COMPANY LAKE CHARLES VCM PLANT LAKE CHARLES, LA.				
FY-308 BURR-BROWN LOOP DRAWING				
SHEET <u>6</u> OF <u>20</u>			SCALE: NONE	
APPROVED: DATE:		VCM-BB-6-SWS		REV 0

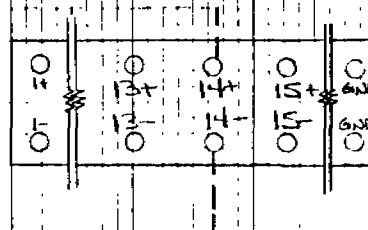
CCR 000018958

VCM-BB-7-SWS

PROX

1	13
2	14
3	15
4	16
5	17
6	18
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8	20
9	21
10	22
11	23
12	24

MULTIPLEXER



TAG NO. FY-309
 MFG. BURR-BROWN
 TERMINATION TB#1
 MODEL SMS1521

CCR 000018959

TAG NO. L14-303/FY-309
 LAB. I-7
 FILE #5
 SLOT #3
 DC# 6

1	2/21/81	LOOP DRAWING	CWS	SWS
ISU	DATE	DESCRIPTION	BY	CKD. APO
CONTINENTAL OIL COMPANY LAKE CHARLES VCM PLANT LAKE CHARLES, LA.				
FY-309 BURR BROWN LOOP DRAWING				
SHEET 1 of 20			SCALE:	
APPROVED:		VCM-BB-7-SWS		REV.
DATE:				1

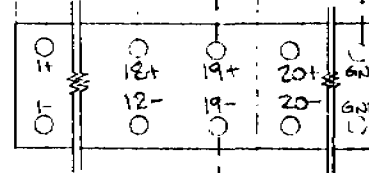
VCM-BB-8-SWS

PROVOK

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16

SHIELD

MULTIPLEXER



TAG NO. FY-312
 MFG BURR-BROWN
 TERMINATION IB #2
 MODEL SMSISZ3

TAG No. TREID 29
 CAB. I-4
 FILE. #3
 SLOT #12
 MUX# 1

CCR 000018960

1	2/24/81	LOOP DRAWING	CWS	SWS	
ISU	DATE	DESCRIPTION	BY	CKD	APD
CONTINENTAL OIL COMPANY LAKE CHARLES VCM PLANT LAKE CHARLES, LA.					
FY-312 BURR BROWN LOOP DRAWING SHEET <u>8</u> OF <u>20</u>					
SCALE NONE					
APPROVED. DATE.			VCM-BB-8-SWS		
			REV 0		

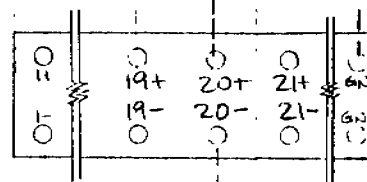
VCM-BB-9-SWS

PROVOK

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15
16

SHIELD

MULTIPLEXER



TAG NO. FY-370
 MFG. BURR-BROWN
 TERMINATION TR#2
 MODEL SM51523

TAG No. TRND 28
 CAG. I-4
 FILE #3
 SLOT #15
 MUX# 1

1	2/24/81	LOOP DRAWING	LWS	GWS
ISU	DATE	DESCRIPTION	BY	CKD
CONTINENTAL OIL COMPANY LAKE CHARLES VCM PLANT LAKE CHARLES, LA.				
FY-370 BURR BROWN LOOP DRAWING SHEET <u>9</u> OF <u>20</u>				
APPROVED:			SCALE: NONE	
DATE:			VCM-BB-9-SWS	
				REV
				0

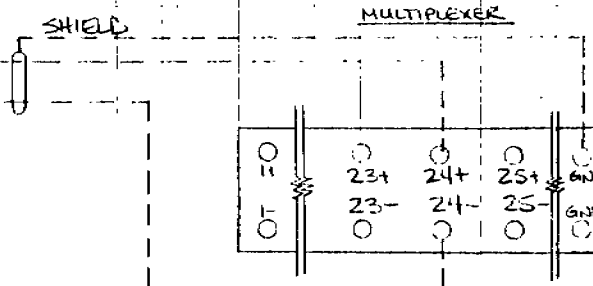
CCR 000018961

VCM-BB-10-SWS

PROVOK

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16

TAG No. PR-302
 CAB. I-5
 FILE #4
 SLOT #3
 MUX# 2

REFERENCE DRAWING: B-T7701-A488AM

TAG No. PR-302
 MFG. BURR-BROWN
 TERMINAL TB#2
 MODEL SMSIS23

1	2/24/81	LOOP DRAWING	SWS	SWS	
ISU	DATE	DESCRIPTION	BY	CKD.	APD
CONTINENTAL OIL COMPANY LAKE CHARLES VCM PLANT LAKE CHARLES, LA.					
PR-302.					
BURR BROWN LOOP DRAWING					
SHEET 10 of 20			SCALE NONE		
APPROVED:		VCM-BB-10-SWS		REV	
DATE:				0	

CCR 000018962

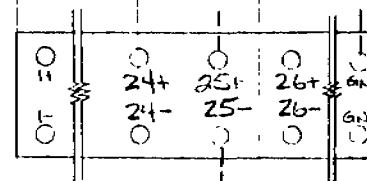
VCM-BB-11-SWS

PROVOK

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16

SHIELD

MULTIPLEXER



TAG NO. PDI-304
 MFG BURR-BROWN
 TERMINATION TB#2
 MODEL SM51523

TAG No. PDI-304
 CAB. I-5
 FILE. #4
 SLOT #3
 MUX# 2

REFERENCE DRAWINGS: E-74701-A482AP

1	2/24/81	LOOP DRAWING	CWS	SWS
ISU	DATE	DESCRIPTION	BY	CKD
CONTINENTAL OIL COMPANY LAKE CHARLES VCM PLANT LAKE CHARLES, LA.				
PDI-304 BURR BROWN LOOP DRAWING				
SHEET 11 OF 20			SCALE NONE	
APPROVED:		VCM-BB-11-SWS		REV
DATE:				0

CCR 000018963

VCM-BB-12-SWS

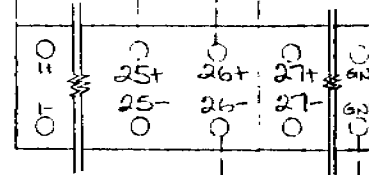
PROVOK

1
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15
16

TAG No PDI-308
 CAB. I-S
 FILE. #4
 SLOT #3
 MUX# 2

REFERENCE DRAWING: B-T9701-A482Au

MULTIPLEXER



TAG NO. PDI-308
 MFG BURR-BROWN
 TERMINATION TB#2
 MODEL SHS1523

1	2/24/81	LOOP DRAWING	SW	SW	
ISU	DATE	DESCRIPTION	BY	CKD	APD
CONTINENTAL OIL COMPANY LAKE CHARLES VCM PLANT LAKE CHARLES, LA.					
PDI-308 BURR BROWN LOOP DRAWING					
SHEET <u>12</u> OF <u>20</u>			SCALE NONE		
APPROVED: DATE			VCM-BB-12-SWS		
					REV

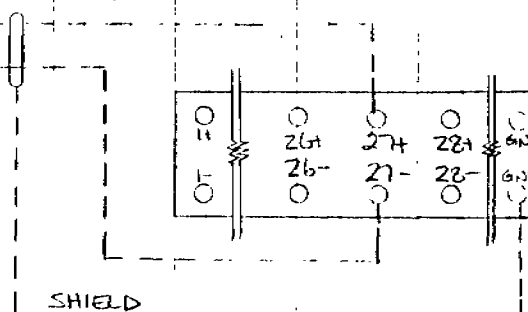
CCR 000018964

VCM-BB-13-SWS

PROVOK

1
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12
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14
15
16

MULTIPLEXER



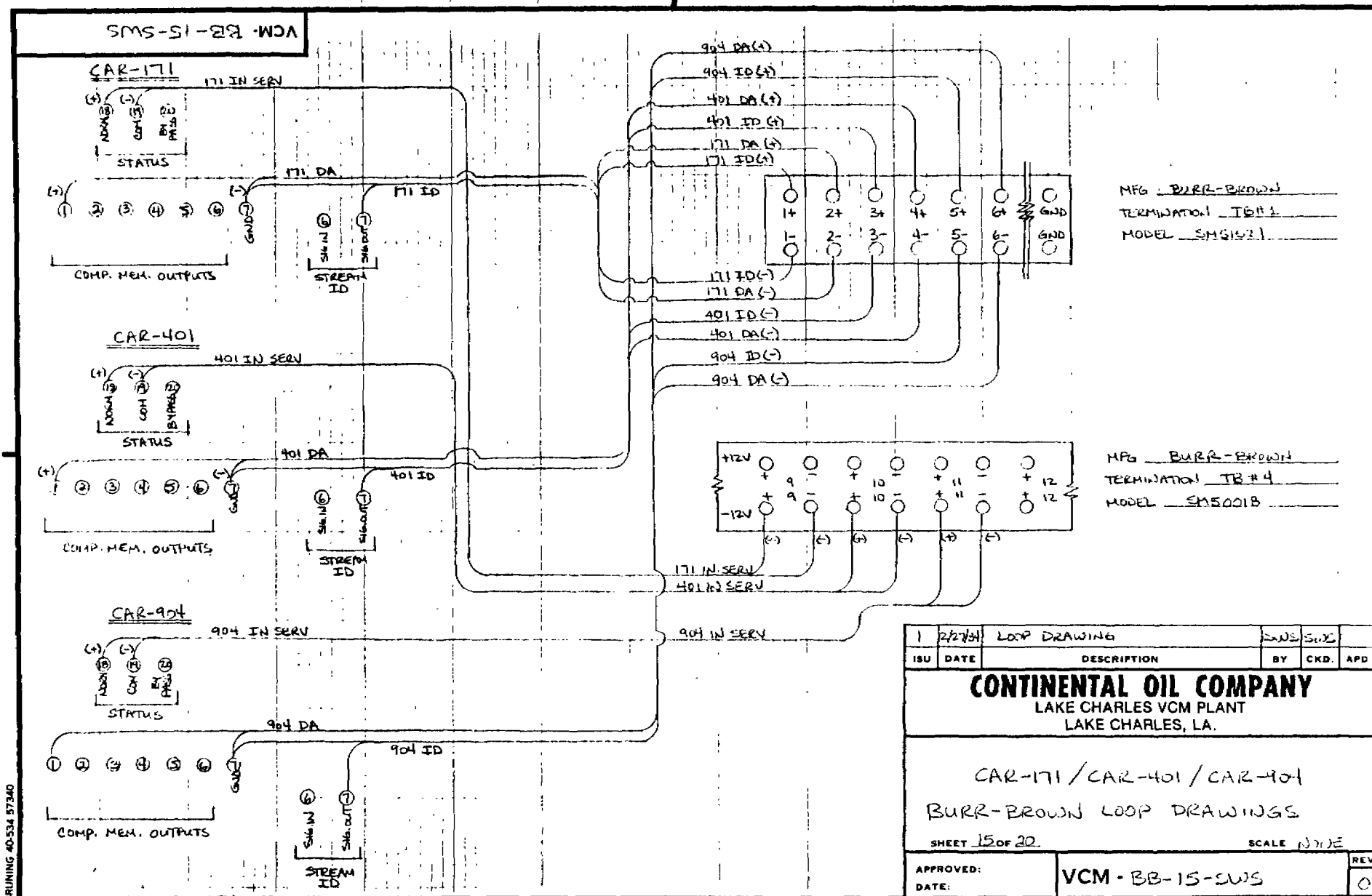
TAG NO. PDI-317
 MFG BURR-BROWN
 TERMINATION TB#2
 MODEL SMS1513

TAG No. PDI-317
 CAB. I-5
 FILE. #4
 SLOT #4
 MUX# 2

1	2/2/81	LOOP DRAWING	SWS	SWS	
ISU	DATE	DESCRIPTION	BY	CHKD.	APD
CONTINENTAL OIL COMPANY LAKE CHARLES VCM PLANT LAKE CHARLES, LA.					
PDI-317 BURR BROWN LOOP DRAWING					
SHEET 12 OF 20			SCALE: 100%		
APPROVED. DATE			VCM-BB-13-SWS		
					REV 0

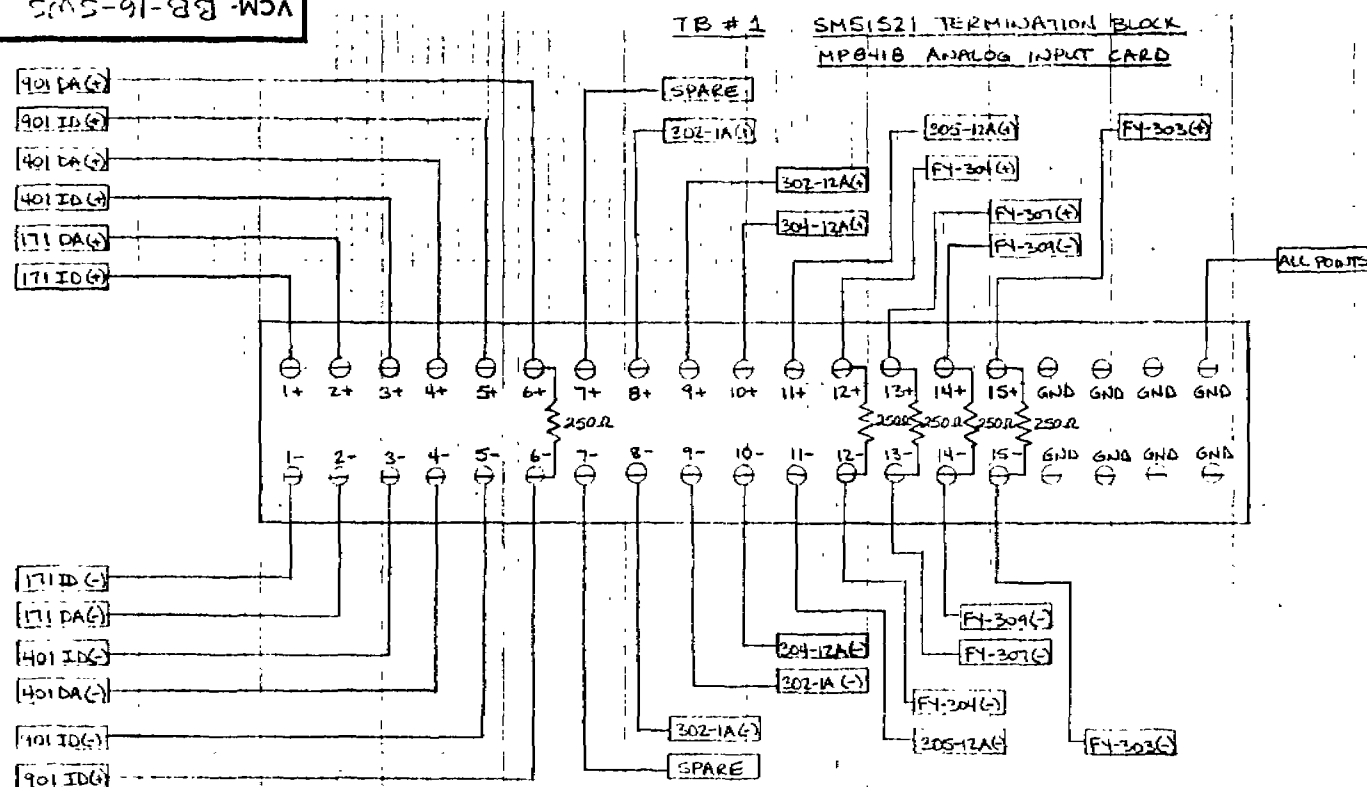
CCR 000018965



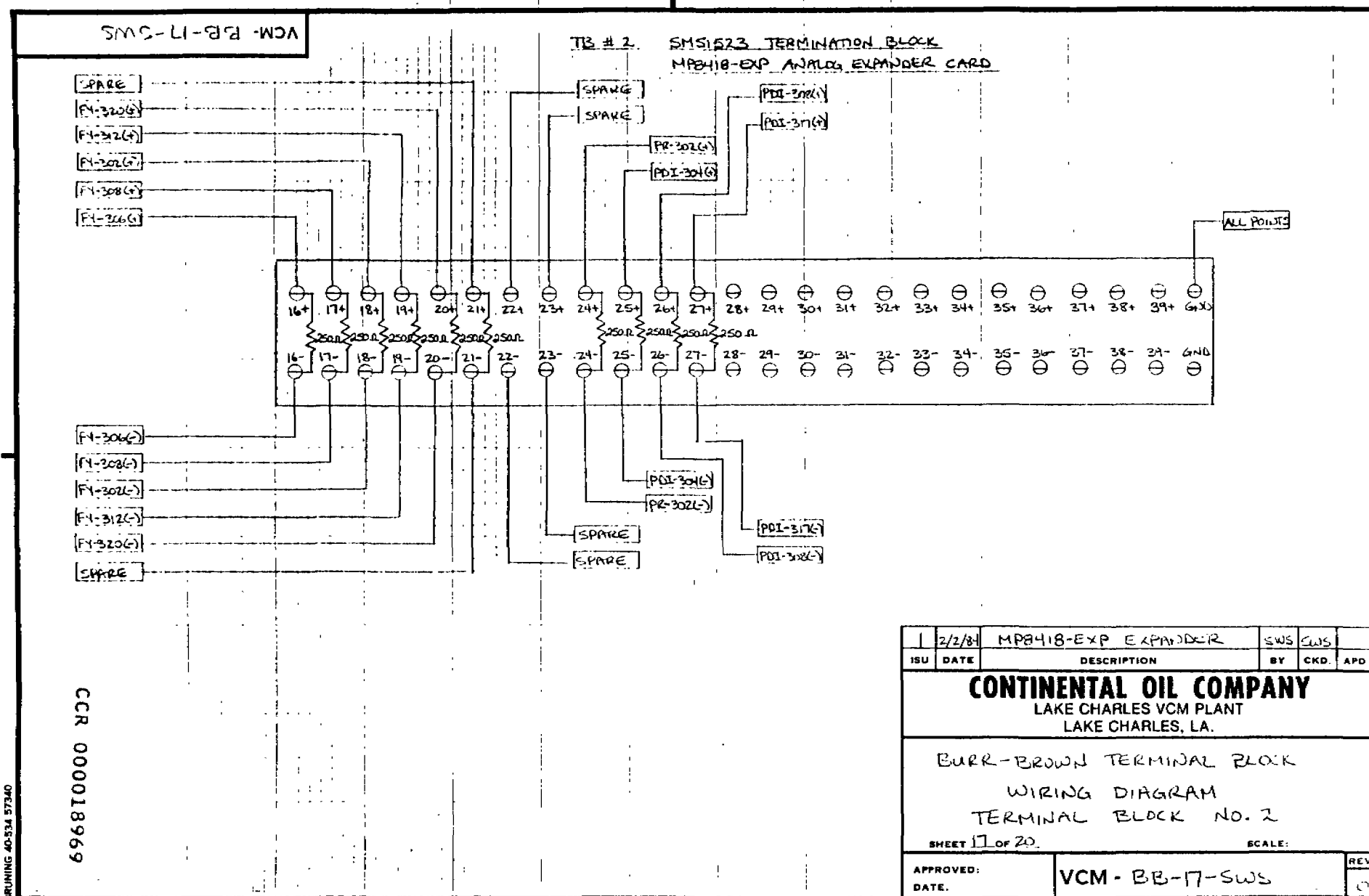


CCR 000018967

BRUNING 40-534 57340

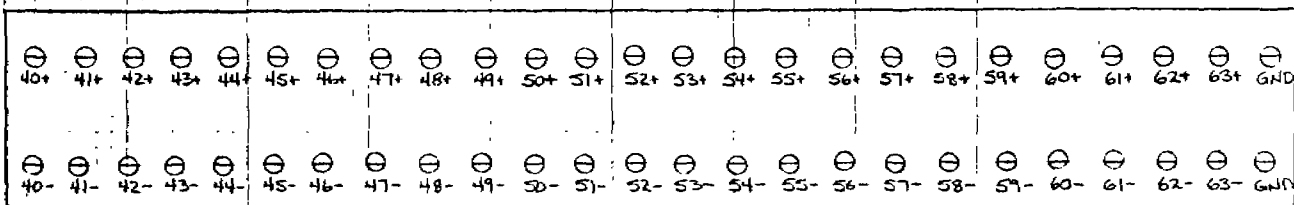


1	2/2/81	MP8418 AJALOS INPUT	SWS	SWS	
ISU	DATE	DESCRIPTION	BY	CHKD	APD
CONTINENTAL OIL COMPANY LAKE CHARLES VCM PLANT LAKE CHARLES, LA.					
BURR-BROWN TERMINAL BLOCK WIRING DIAGRAM TERMINAL BLOCK NO. 1					
SHEET 16 of 20.			SCALE		
APPROVED: DATE:		VCM-BB-16-SWS			



VCM-BB-18-SWS

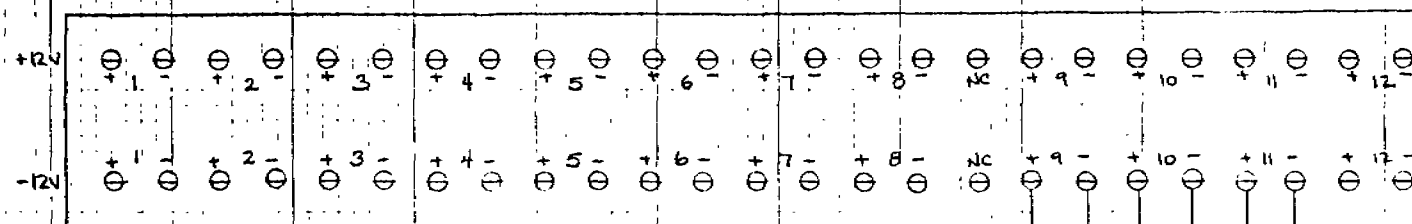
TB # 3

SMS 525 TERMINATION BLOCK
MPB418-EXP ANALOG EXPANDER CARD

1	2/2/81	MPB418-EXP EXPANDER	SJC	SJS	
ISU	DATE	DESCRIPTION	BY	CKD.	APD
CONTINENTAL OIL COMPANY LAKE CHARLES VCM PLANT LAKE CHARLES, LA.					
BURR-BROWN TERMINAL BLOCK WIRING DIAGRAM TERMINAL BLOCK NO. 3					
SHEET 18 of 20			SCALE:		
APPROVED:			VCM-BB-18-SWS		
DATE:			REV 0		

CCR 000018970

VCM-BB-19-SWS



TB#4

SM50018 TERMINATION BLOCK
MPB10 DISCRETE INPUT CARD

1	2/24/8	MPB10 DISCRETE INPUT	SWS	SWS	
ISU	DATE	DESCRIPTION	BY	CHK.	APD.
CONTINENTAL OIL COMPANY LAKE CHARLES VCM PLANT LAKE CHARLES, LA.					
BURR-BROWN TERMINAL BLOCK WIRING DIAGRAM TERMINAL BLOCK No. 4					
SHEET 19 OF 20				SCALE:	
APPROVED:			VCM-BB-19-SWS		
DATE:			REV		

CCR 000018971

VCM-BB-20-SWS

TB#5

SM50020 TERMINATION BLOCK

MP801 DISCRETE OUTPUT CARD

ANNUNCIATOR PANEL

HIGH VCM
CONC.VCM
LEAKHIGH OXY
FLAMCOMPUTER
TROUBLE

1+ 2+ 3+ 4+ 5+ 6+ 7+ 8+ 9+ 10+ 11+ 12+ 13+ 14+ 15+ 16+

1- 2- 3- 4- 5- 6- 7- 8- 9- 10- 11- 12- 13- 14- 15- 16-

1	3/2/81	MP801 DISCRETE OUTPUT	SWS	SWS
ISU	DATE	DESCRIPTION	BY	CHKD

CONTINENTAL OIL COMPANYLAKE CHARLES VCM PLANT
LAKE CHARLES, LA.BURR BROWN TERMINAL BLOCK
WIRING DIAGRAM
TERMINAL BLOCK NO. 5

SHEET 20 OF 20

SCALE:

APPROVED:
DATE:

VCM-BB-20-SWS

REV

0

(64)

CCR 000018973

```
334 LOCATE 1,1 : PRINT TIMER*
335 LOCATE 1,64 : PRINT D1:R1:
337 GOSUB 20000
340 IF (TIMER<25200 AND TIMER<25320) AND LPT=0 THEN GOSUB 10000
340 IF TIMER>25320 THEN GOTO 350
355 GOSUB 20000
360 DIFFTIME=TIMER-OLDTIME
370 IF DIFFTIME<13 OR DIFFTIME>0 THEN GOTO 370 ELSE GOTO 380
380 STOP
390 END
```

```

1000 ' INITIALIZATION PROGRAM FOR THE
1010 ' BURR-BROWN MULTIPLEXER UNIT
1020 '
1030 TRIES=6 : ' LOOP TO ESTABLISH CARRIER DETECT WITH BURR-BROWN
    40 ON ERROR GOTO 1020
1050 OPEN "COM1:300,N,2,1,DS,DS,LC10000" AS #1
1060 ON ERROR GOTO 1020
1070 CLOSE #1
1080 GOTO 1120
1090 TRIES=TRIES-1
1100 IF TRIES=0 THEN ON ERROR GOTO 0 : ' GIVE UP AFTER 6 ATTEMPTS
1110 RESUME
1120 OPEN "COM1:300,N,2,1,DS,DS,DS2000" AS #1
1130 GOTO 1130
1135 '
1136 ' SEND CONFIGURATION COMMAND TO THE BURR-BROWN
1137 '
1140 CONFIG#="01101010000000000000000000000000XX"+CHR$(12)
1150 PRINT #1,CONFIG#
1160 FOR I=1 TO 150 : NEXT : ' DELAY 150 MILLISECONDS
1170 LINE INPUT #1,RESP#
1180 GOSUB 17000
1190 IF (MID$(RESP#,1,26):MID$(CONFIG#,1,26)) THEN FLAG=6 ELSE GOTO 1140
1200 GOSUB 11000
1210 GAINSET#="011001010101XX"+CHR$(12) : ' SET ANALOG VALUE GAIN TO 1
1220 PRINT #1,GAINSET#
1230 FOR I=1 TO 150 : NEXT : ' DELAY 150 MILLISECONDS
1240 LINE INPUT #1,RESP#
1250 GOSUB 17000
1260 IF (MID$(RESP#,1,12):MID$(GAINSET#,1,12)) THEN FLAG=7 ELSE GOTO 1140
1270 GOSUB 11000
1280 TARSET#="011010101010XX"+CHR$(12) : ' SET TURNAROUND TIME TO 0 MILLISECONDS
1290 PRINT #1,TARSET#
1300 FOR I=1 TO 150 : NEXT : ' DELAY 150 MILLISECONDS
1310 LINE INPUT #1,RESP#
1320 GOSUB 17000
1330 IF (MID$(RESP#,1,6):MID$(TARSET#,1,6)) THEN FLAG=7 ELSE GOTO 1140
1340 GOSUB 11000
1350 ON ERROR GOTO 15000
1360 GCSET1=1 : GCSET2=1 : GCSET3=1
1370 RETURN

```

```
2000 ' GAS CHROMATOGRAPH STATUS PROGRAM
2010 '
2020 DINREQ$="01D00900BAX"+CHR$(13) : ' REQUEST DIN CHANNELS 1-11
2030 PRINT #1,DINREQ$;
2040 FOR I= 1 TO 20 : NEXT : ' DELAY 20 MILLISECONDS
2050 LINE INPUT #1,RESPDIN$ : ' INPUT FROM BURR-BROWN
2060 RESP$=RESPDIN$
2070 GOSUB 17000
2080 DINDATA$=MID$(RESPDIN$,4,2)
2090 HD$=DINDATA$
2100 GOSUB 12000 : ' HEX TO DECIMAL CONVERSION
2110 GOSUB 14000 : ' DECIMAL TO BINARY CONVERSION
2120 IF (BIN(1)=1) THEN CAR171$="OFF" ELSE CAR171$="ON"
2130 IF CAR171$="ON" THEN GCSET1=1
2140 IF (BIN(2)=1) THEN CAR401$="OFF" ELSE CAR401$="ON"
2150 IF CAR401$="ON" THEN GCSET2=1
2160 IF (BIN(3)=0) THEN CAR904$="OFF" ELSE CAR904$="ON"
2170 IF CAR904$="ON" THEN GCSET3=1
2180 LOCATE 21,1
2190 PRINT USING "CAR-171: % CAR-401: % CAR-904: %
";CAR171$,CAR401$,CAR904$
2200 IF CAR171$="OFF" AND GCSET1=1 THEN FLAG=14 ELSE GOTO 2230
2210 GCSET1=0
2220 GOSUB 11000
2230 IF CAR401$="OFF" AND GCSET2=1 THEN FLAG=15 ELSE GOTO 2260
2240 GCSET2=0
2250 GOSUB 11000
2260 IF CAR904$="OFF" AND GCSET3=1 THEN FLAG=16 ELSE GOTO 2290
2270 GCSET3=0
2280 GOSUB 11000
2290 RETURN
```

```
3000 ' ANALOG INPUT READ PROGRAM
3010 '
3020 AINREAD$="01A1001006XX"+CHR$(13) : ' REQUEST ANALOG CHANNELS 1-6
3030 PRINT #1,AINREAD$;
3040 FOR I=1 TO 20 : NEXT : ' DELAY 20 MILLISECONDS
3050 LINE INPUT #1,AINRESP$ : ' INPUT ANALOG DATA FROM BURR-BROWN
3060 RESP$=AINRESP$
3070 GOSUB 17000
3080 FOR I=1 TO 12 STEP 2 : ' DIVIDE ANALOG DATA INTO VALUE AND GAIN FIELDS
3090 L=I*2+3
3100 AINDATA$(I)=MID$(AINRESP$,L,3)
3110 L=L+3
3120 AINDATA$(I+1)=MID$(AINRESP$,L,1)
3130 NEXT
3140 GOSUB 4000 : ' CONVERT ANALOG DATA TO ENGINEERING UNITS
3150 RETURN
```

```

4000 ' CONVERSION OF CAR=171, CAR=171 AND CAR=101 PPM
4010 ' TO ENGINEERING UNITS
4020 '
4030 FOR I=1 TO 12 STEP 1
4040 HDI=AINDATA#(I)
4050 GOSUB 12000 : ' PPM TO DECIMAL CONVERSION
4060 DAT(I)=DEC
4070 IF (DAT(I)=2045) GOTO 4100 : ' DATA CONVERSION TO VOL%
4080 DAT(I)=(DAT(I)-1023)*10
4090 GOTO 4110
4100 DAT(I)=((DAT(I)-2045)/2045)*10
4110 NEXT I
4115 '
4116 ' PROCESS AREA FIXED POINT MONITOR CONCENTRATION CALCULATION
4117 '
4120 IF BIN(1)=0 GOTO 4130
4121 FOR I=1 TO 8
4122 AOLD(I)=0
4123 NEXT I
4124 GOTO 4340
4130 SID171%=(DAT(1)-1023)*10 : ' DATA CONVERSION FOR CAR=171
4140 IF SID171%<1 OR SID171%>10 THEN FLAG=1 ELSE GOTO 4190
4150 GOSUB 11000
4160 GOTO 4340
4180 IF (SID171%>OLD171%) GOTO 4340
4190 IF FLAG171%(SID171%)=1 GOTO 4340
4200 FLAG171%(SID171%)=1
4210 ID=SID171%-1
4220 IF ID=0 THEN ID=10
4230 FLAG171%(ID)=0
4240 IF SID171%=1 THEN GOSUB 5000
4240 GCDATA(1,SID171%)=((DAT(3)-1)/2)*100
4250 IF GCDATA(1,SID171%)<-1.5 THEN FLAG=1 ELSE GOTO 4270
4260 GOSUB 11000
4270 IF GCDATA(1,SID171%)<0! THEN GCDATA(1,SID171%)=0!
4280 DAYAVG(1,SID171%)=DAYAVG(1,SID171%)+GCDATA(1,SID171%)
4290 IF SID171%=1 THEN HCOUNT=HCOUNT+1
4300 IF GCDATA(1,SID171%)>HDATA(1,SID171%) THEN HDATA(1,SID171%)=GCDATA(1,SID171%)
4305 IF GCDATA(1,SID171%)<10! THEN DOUT1=0 ELSE DOUT1=1
4310 IF GCDATA(1,SID171%)<10! GOTO 4340
4320 HICOUNT%(1,SID171%)=HICOUNT%(1,SID171%)+1
4330 FLAG=1 : GOSUB 11000
4335 '
4336 ' OFF-SITES AREA FIXED POINT MONITOR CONCENTRATION CALCULATION
4337 '
4340 IF BIN(2)=0 GOTO 4350
4341 FOR I=9 TO 14
4342 AOLD(I)=0
4343 NEXT I
4344 GOTO 4560
4350 SID401%=(DAT(5)+.05)*10 : ' DATA CONVERSION FOR CAR=401
4360 IF SID401%<1 OR SID401%>10 THEN FLAG=1 ELSE GOTO 4400
4370 GOSUB 11000
4380 GOTO 4560
4390 IF (SID401%>OLD401%) GOTO 4560
4400 IF FLAG401%(SID401%)=1 GOTO 4560
4420 FLAG401%(SID401%)=1
4430 ID=SID401%-1

```

```

4440 IF ID=0 THEN ID=10
4450 FLAG401%(ID)=0
4455 IF SID401%=1 THEN GOSUB 1100
4460 GCDATA(2,SID401%)=(GCDATA(2,SID401%)+1)/4:ID=0
4470 IF GCDATA(2,SID401%)=1.5 THEN FLAG=1 ELSE GOTO 4490
4480 GOSUB 11000
4490 IF GCDATA(2,SID401%)=0! THEN GCDATA(2,SID401%)=0!
4500 DAYAVG(2,SID401%)=DAYAVG(2,SID401%)+GCDATA(2,SID401%)
4510 IF SID401%=1 THEN COUNT=COUNT+1
4520 IF GCDATA(2,SID401%)>HIDATA(2,SID401%) THEN HIDATA(2,SID401%)=GCDATA(2,SID401%)
4525 IF GCDATA(1,SID401%)=10! THEN DOUT1=0 ELSE DOUT1=1
4530 IF GCDATA(2,SID401%)=10! GOTO 4560
4540 HICOUNT%(2,SID401%)=HICOUNT%(2,SID401%)+1
4550 FLAG=2 : GOSUB 11000
4555 '
4556 ' INCINERATOR AREA STACK MONITOR CONCENTRATION CALCULATION
4557 '
4560 IF BIN(7)=0 GOTO 4770
4570 SID204%=(SID171%+SID401%)/2 : DATA CONVERSION FOR COX-904
4580 IF SID204%>1 THEN FLAG=1 ELSE GOTO 4610
4590 GOSUB 11000
4600 GOTO 4770
4610 IF (SID204%+SID171%)/2=10! THEN GOTO 4770
4620 IF FLAG=1 THEN FLAG=1 ELSE GOTO 4770
4630 FLAG904%(SID204%)=1
4640 ID=SID904%-1
4650 IF ID=0 THEN ID=2
4660 FLAG904%(ID)=0
4670 GCDATA(3,SID904%)=(GCDATA(3,SID904%)+1)/4:ID=0
4680 IF GCDATA(3,SID904%)=1.5 THEN FLAG=1 ELSE GOTO 4700
4690 GOSUB 11000
4700 IF GCDATA(3,SID904%)=0! THEN GCDATA(3,SID904%)=0!
4710 DAYAVG(3,SID904%)=DAYAVG(3,SID904%)+GCDATA(3,SID904%)
4720 IF SID904%=1 THEN COUNT=COUNT+1
4730 IF GCDATA(3,SID904%)>HIDATA(3,SID904%) THEN HIDATA(3,SID904%)=GCDATA(3,SID904%)
4735 IF GCDATA(1,SID904%)=10! THEN DOUT1=0 ELSE DOUT1=1
4740 IF GCDATA(3,SID904%)=10! GOTO 4770
4750 HICOUNT%(3,SID904%)=HICOUNT%(3,SID904%)+1
4760 FLAG=3 : GOSUB 11000
4770 OLD171%=NEW171% : OLD401%=NEW401% : OLD904%=NEW904%
4771 NEW171%=SID171% : NEW401%=SID401% : NEW904%=SID904%
4775 '
4776 ' UPDATE CURRENT CONCENTRATION DATA ON SCREEN
4778 '
4780 LOCATE 9,1
4790 FOR J=1 TO 2
4800 PRINT USING "      ##          ##.##          ##.##          ##.##"
      #.#;1,GCDATA(1,1),GCDATA(2,1),GCDATA(3,1)
4810 NEXT J
4820 FOR I=3 TO 10
4830 PRINT USING "      ##          ##.##          ##.##          ##.##"
      #.#;I,GCDATA(1,I),GCDATA(2,I),GCDATA(3,I)
4840 NEXT I
4845 '
4846 ' WRITE CURRENT CONCENTRATION DATA ON FIXED DISK
4847 '
4850 OPEN "C:HOURLDATA" FOR APPEND AS #1

```

(71)

```
4860 PRINT #3,"CCR-171"      CCR-401      CCR-201", LINE#
4870 FOR I=1 TO 2
4880 PRINT #3,USING "###.0"  "###.0"      "###.0";BCDATA(1,I),BCDATA(2,I)
      BCDATA(3,I)
4890 NEXT
4900 FOR I=3 TO 10
4910 PRINT #3,USING "###.0"  "###.0"      "###.0";BCDATA(1,I),BCDATA(2,I)
4920 NEXT
4930 CLOSE #3
4940 RETURN
```

CCR 000018980

```

5000 / INPUT OF ANALOG VALUES FOR FLAMMABILITY TEST THROUGH THE
5010 / CONVERSION OF RAW INPUT DATA TO ENGINEERING UNITS...
5020 /
5030 / READ ANALOG VALUES FOR FLAMMABILITY CALCULATION
5040 /
5030 AINREAD#="01A1000011XX" AIN#(1)
5040 PRINT #1, AINREAD#
5050 FOR I=1 TO 20 : NEXT I / DELAY 20 MILLISECOND
5060 LINE INPUT #1, AINRESP#
5070 RESP# = AINRESP#
5080 GOSUB 17000
5090 FOR I=1 TO 24 STEP 2
5100 L=I*2+3
5110 AINDATA#(I) = MID$(AINRESP#, L, 3)
5120 L=L+3
5130 AINDATA#(I+1) = MID$(AINRESP#, L, 1)
5140 NEXT I
5150 FOR I=1 TO 24 STEP 2
5160 HD# = AINDATA#(I)
5170 GOSUB 12000
5180 DAT(I) = HD#
5190 IF (DAT(I) > 2048) THEN DAT(I) = 2048
5200 DAT(I) = (DAT(I) / 2048) * 10
5210 GOTO 5230
5220 DAT(I) = ((DAT(I) - 1024) / 2048) * 10
5230 IF DAT(I) < 1 THEN DAT(I) = 1.001
5240 NEXT I
5250 /
5260 / CALCULATE ANALOG VALUES IN PERCENT OF RANGE
5270 /
5280 T(1) = ((DAT(1) - 1), 1) * 100 / 100
5290 T(2) = ((DAT(2) - 1), 4) * 100 / 150
5300 T(3) = ((DAT(3) - 1), 1) * 100 / 125
5310 /
5320 / CALCULATE ANALOG VALUES IN ENGINEERING UNITS
5330 /
5340 T(4) = ((DAT(4) - 1), 4) * 100 / 150
5350 STM(1) = ((DAT(9) - 1) / 4) * 100
5360 STM(2) = ((DAT(11) - 1) / 4) * 100
5370 STM(3) = ((DAT(13) - 1) / 4) * 100
5380 AIR(1) = ((DAT(15) - 1) / 4) * 100
5390 AIR(2) = ((DAT(17) - 1) / 4) * 100
5400 AIR(3) = ((DAT(19) - 1) / 4) * 100
5410 ETH = ((DAT(21) - 1) / 4) * 100
5420 HCL(1) = ((DAT(23) - 1) / 4) * 100
5430 HCL(2) = ((DAT(25) - 1) / 4) * 100
5440 STLB(1) = 2642 * STM(1)
5450 STLB(2) = 4879 * STM(2)
5460 STLB(3) = 2410 * STM(3)
5470 AIRB(1) = 16.65 * SQRT(AIR(1))
5480 AIRB(2) = 16.65 * SQRT(AIR(2))
5490 AIRB(3) = 16.65 * SQRT(AIR(3))
5500 ETHHR(1) = 723.4 * SQRT(ETH)
5510 HCMHR(1) = 16.17 * HCL(1)
5520 HCMHR(2) = 8.19 * HCL(2)
5530 HCMHR(1) = HCMHR(1) + HCMHR(2)
5540 ETMHR = ETHHR(1)
5550 RETURN

```

```

6000 ' EPA LEAK DETECTION PROGRAM --PROCESS ONE
6010
6020 FOR I=1 TO 10
  30 IF GCDATA(1,1)>=101 THEN HIGHZ(1,1)=1 ELSE HIGHZ(1,1)=0
  40 NEXT I
  42 IF HIGHZ(1,1)=1 AND IFLAG(1,1)=1 THEN LEAKFLAG(1)=1 ELSE LEAKFLAG(1)=0
6043 IF HIGHZ(1,4)=1 AND IFLAG(1,4)=1 THEN LEAKFLAG(2)=1 ELSE LEAKFLAG(2)=0
6044 IF HIGHZ(1,9)=1 AND IFLAG(1,9)=1 THEN LEAKFLAG(3)=1 ELSE LEAKFLAG(3)=0
6045 IF HIGHZ(1,5)=1 AND IFLAG(1,5)=1 THEN LEAKFLAG(4)=1 ELSE LEAKFLAG(4)=0
6050 FOR I=1 TO 8 : 'SET ARRAYS VALUES FOR CURRENT HI VCM CONCENTRATION
6060 ON I GOTO 6070,6090,6110,6130,6150,6170,6190,6210
6070 IF (HIGHZ(1,1)=1 OR HIGHZ(1,2)=1 OR HIGHZ(1,3)=1) THEN AREA(1)=1 ELSE AREA(
1)=0
6071 IF LEAKFLAG(2)=1 OR LEAKFLAG(4)=1 GOTO 6074
6072 IF ((AREA(1)=0 AND AOLD(1)=1) AND (HIGHZ(1,5)=1 OR HIGHZ(1,4)=1)) THEN AREA
(1)=1
6074 IF AREA(1)=1 AND AOLD(1)=1 THEN LEAKFLAG(1)=1 ELSE LEAKFLAG(1)=0
6080 GOTO 6220
6090 IF HIGHZ(1,4)=1 THEN AREA(2)=1 ELSE AREA(2)=0
6091 IF LEAKFLAG(1)=1 OR LEAKFLAG(3)=1 GOTO 6094
6092 IF ((AREA(2)=0 AND AOLD(2)=1) AND (HIGHZ(1,1)=1 OR HIGHZ(1,9)=1)) THEN AREA
(2)=1
6094 IF AREA(2)=1 AND AOLD(2)=1 THEN LEAKFLAG(2)=1 ELSE LEAKFLAG(2)=0
6100 GOTO 6220
6110 IF HIGHZ(1,9)=1 THEN AREA(3)=1 ELSE AREA(3)=0
6112 IF LEAKFLAG(2)=1 GOTO 6116
6114 IF ((AREA(3)=0 AND AOLD(3)=1) AND (HIGHZ(1,4)=1)) THEN AREA(3)=1
6116 IF AREA(3)=1 AND AOLD(3)=1 THEN LEAKFLAG(3)=1 ELSE LEAKFLAG(3)=0
6120 GOTO 6220
  30 IF HIGHZ(1,5)=1 THEN AREA(4)=1 ELSE AREA(4)=0
  42 IF LEAKFLAG(1)=1 GOTO 6136
6134 IF ((AREA(4)=0 AND AOLD(4)=1) AND (HIGHZ(1,1)=1)) THEN AREA(4)=1
6136 IF AREA(4)=1 AND AOLD(4)=1 THEN LEAKFLAG(4)=1 ELSE LEAKFLAG(4)=0
6140 GOTO 6220
6150 AREA(5)=HIGHZ(1,6)
6160 GOTO 6220
6170 AREA(6)=HIGHZ(1,7)
6180 GOTO 6220
6190 AREA(7)=HIGHZ(1,8)
6200 GOTO 6220
6210 AREA(8)=HIGHZ(1,10)
6220 NEXT I
6230 FOR I=1 TO 8 : ' COMPARE TO LAST SCAN HI VCM CONCENTRATIONS
6235 IF AREA(I)=1 AND AOLD(I)=1 THEN DOUT2=1 ELSE DOUT2=0
6240 IF AREA(I)=1 AND AOLD(I)=1 THEN FLAG=4 ELSE GOTO 6280
6250 LEAKS(I)=LEAKS(I)+1
6255 LEAKTOT=LEAKTOT+1
6256 LKTIME$(LEAKTOT)=TIME$
6257 LKAREA(LEAKTOT)=I
6260 LEAKAREA=I
6270 GOSUB 11000
6280 NEXT I
6290 FOR I=1 TO 8
6300 AOLD(I)=AREA(I)
6310 NEXT I
  14 IFLAG(1,1)=HIGHZ(1,1)
  5 IFLAG(1,4)=HIGHZ(1,4)
6316 IFLAG(1,9)=HIGHZ(1,9)
6317 IFLAG(1,5)=HIGHZ(1,5)

```

CCR 000018982

6320 RETURN

(74)

CCR 000018983

7000 LPA LEAK DETECTION PROGRAM---OFF-SITE AREA

(75)

```
7001  
7007 FOR I=1 TO 10  
7010 IF GCDATA(2,I)>=10 THEN HIGHZ(2,I)=1 ELSE HIGHZ(2,I)=0  
7020 NEXT I  
7030 FOR I=1 TO 6  
7040 ON I GOTO 7050,7070,7090,7110,7130,7150  
7050 AREA(9)=HIGHZ(2,1)  
7060 GOTO 7160  
7070 AREA(10)=HIGHZ(2,2)  
7080 GOTO 7160  
7090 IF (HIGHZ(2,3)=1 OR HIGHZ(2,4)=1) OR (HIGHZ(2,5)=1 OR HIGHZ(2,6)=1) THEN AREA(11)=1 ELSE AREA(11)=0  
7100 GOTO 7160  
7110 AREA(12)=HIGHZ(2,6)  
7120 GOTO 7160  
7130 AREA(13)=HIGHZ(2,7)  
7140 GOTO 7160  
7150 IF HIGHZ(2,9)=1 OR HIGHZ(2,10)=1 THEN AREA(14)=1 ELSE AREA(14)=0  
7160 NEXT I  
7170 FOR I=9 TO 14 : COMPARE TO LAST SCAN HI VCM CONCENTRATIONS  
7175 IF AREA(I)=1 AND AOLD(I)=1 THEN DOUT2=1 ELSE DOUT2=0  
7180 IF AREA(I)=1 AND AOLD(I)=1 THEN FLAG=5 ELSE GOTO 7220  
7190 LEAKS(I)=LEAKS(I)+1  
7195 LEAKTOT=LEAKTOT+1  
7196 LKTIME#(LEAKTOT)=TIME#  
7197 LKAREA(LEAKTOT)=1  
7200 LEAKAREA=I  
7210 GOSUB 11000  
7220 NEXT I  
7230 FOR I=9 TO 14  
7240 AOLD(I)=AREA(I)  
7250 NEXT I  
7260 RETURN
```

CCR 000018984

```

8000 ' LEAK LOG PRINTOUT PROGRAM FOR HOURLY REPORT
8010 '
8020 OLDHOUR=HOUR
8021 IF HOUR=0 THEN GOSUB 19000
8022 IF HOUR=0 THEN LOGSET=1 ELSE LOGSET=0
8025 '
8026 ' SEND OUTPUT TO PRINTER
8027 '
8030 FOR I=1 TO 10
8040 LPRINT CHR$(10);
8050 NEXT I
8060 LPRINT TIME$,DMYR$
8070 LPRINT "LEAKS DURING THE PAST HOUR:"
8082 LPRINT USING "AREA 1 (CAR-171,PTS 1,2,3) = ## LEAKS";LEAKS(1)-OLDLEAK(1)
8083 LPRINT USING "AREA 2 (CAR-171,PTS 1,4) = ## LEAKS";LEAKS(2)-OLDLEAK(2)
8084 LPRINT USING "AREA 3 (CAR-171,PTS 4,9) = ## LEAKS";LEAKS(3)-OLDLEAK(3)
8085 LPRINT USING "AREA 4 (CAR-171,PTS 1,5) = ## LEAKS";LEAKS(4)-OLDLEAK(4)
8086 LPRINT USING "AREA 5 (CAR-171,PT 6) = ## LEAKS";LEAKS(5)-OLDLEAK(5)
8087 LPRINT USING "AREA 6 (CAR-171,PT 7) = ## LEAKS";LEAKS(6)-OLDLEAK(6)
8088 LPRINT USING "AREA 7 (CAR-171,PT 8) = ## LEAKS";LEAKS(7)-OLDLEAK(7)
8089 LPRINT USING "AREA 8 (CAR-171,PT 10) = ## LEAKS";LEAKS(8)-OLDLEAK(8)
8090 LPRINT USING "AREA 9 (CAR-401,PT 1) = ## LEAKS";LEAKS(9)-OLDLEAK(9)
8091 LPRINT USING "AREA 10 (CAR-401,PT 2) = ## LEAKS";LEAKS(10)-OLDLEAK(10)
8092 LPRINT USING "AREA 11 (CAR-401,PTS 3,4,5,8) = ## LEAKS";LEAKS(11)-OLDLEAK(11)
8093 LPRINT USING "AREA 12 (CAR-401,PT 6) = ## LEAKS";LEAKS(12)-OLDLEAK(12)
8094 LPRINT USING "AREA 13 (CAR-401,PT 7) = ## LEAKS";LEAKS(13)-OLDLEAK(13)
8095 LPRINT USING "AREA 14 (CAR-401,PTS 9,10) = ## LEAKS";LEAKS(14)-OLDLEAK(14)
8110 FOR I=1 TO 3 : LPRINT CHR$(10);: NEXT
8120 LPRINT "NUMBER OF TIMES OVER 10 PPM FOR EACH POINT:"
8130 LPRINT
8140 LPRINT "POINT PROCESS AREA OFF-SITES INCINERATOR"
8150 FOR I=1 TO 2
8160 LPRINT USING " ## ## ## ";I,HICOUNT%(1,I)-OLDCOUNT%(1,I),HICOUNT%(2,I)-OLDCOUNT%(2,I),HICOUNT%(3,I)-OLDCOUNT%(3,I)
8170 NEXT I
8180 FOR I=3 TO 10
8190 LPRINT USING " ## ## ##";I,HICOUNT%(1,I)-OLDCOUNT%(1,I),HICOUNT%(2,I)-OLDCOUNT%(2,I)
8200 NEXT I
8205 '
8206 ' WRITE HOURLY OUTPUT ON FLOPPY DISK
8207 '
8210 OPEN "A:EPADATA" FOR APPEND AS #2
8220 PRINT #2,USING "%& %";TIME$,DMYR$

```

```

8230 PRINT #2,"LEAKS DURING THE PAST HOUR:"
8240 FOR I=1 TO 14
8250 PRINT #2,USING "AREA ## = ##.## LEAKS";I,LEAKS(I)-OLDLEAK(I)
8260 NEXT
8270 PRINT #2,"NUMBER OF TIMES OVER 10 PPM FOR EACH POINT:"
8280 PRINT #2,"POINT      PROCESS AREA      OFFSITES      INCINERATOR"
8290 FOR I=1 TO 2
8300 PRINT #2,USING " ##      ##      ##      ## ";I,H1
COUNT%(1,I)-OLDCOUNT%(1,I),HICOUNT%(2,I)-OLDCOUNT%(2,I),HICOUNT%(3,I)-OLDCOUNT%(
3,I)
8310 NEXT
8320 FOR I=3 TO 10
8330 PRINT #2,USING " ##      ##      ##";I,HICOUNT%(1,I)-OLDCOUN
T%(1,I),HICOUNT%(2,I)-OLDCOUNT%(2,I)
8340 NEXT
8350 CLOSE #2
8355 '
8356 ' SET LEAK COUNTERS
8357 '
8360 FOR I=1 TO 14
8370 OLDLEAK(I)=LEAKS(I)
8380 NEXT I
8390 FOR I=1 TO 10
8400 OLDCOUNT%(1,I)=HICOUNT%(1,I)
8410 OLDCOUNT%(2,I)=HICOUNT%(2,I)
8420 OLDCOUNT%(3,I)=HICOUNT%(3,I)
8430 NEXT I
8440 RETURN

```

```

9000 : LEAK LOG PRINTOUT PROGRAM FOR END OF DAY REPORT
9003 :
9004 : UPDATE DATE
9006 :
9010 :
9011 : SEND OUTPUT TO PRINTER
9012 :
9015 IF KOUNT1=0 THEN KOUNT1=1
9016 IF KOUNT2=0 THEN KOUNT2=1
9017 IF KOUNT3=0 THEN KOUNT3=1
9020 FOR I=1 TO 5 : LPRINT CHR$(10); : NEXT
9030 LPRINT TIME$,DMYF$
9040 LPRINT
9050 LPRINT "FIXED POINT MONITOR REPORT FOR ";
9060 LPRINT LOGDAT$
9070 LPRINT
9080 LPRINT "NUMBER OF LEAKS DURING THE PAST 24 HOURS:"
9092 LPRINT USING "AREA 1 (CAR-171,PTS 1,2,3) = ## LEAKS";LEAKS(1)
9093 LPRINT USING "AREA 2 (CAR-171,PTS 1,4) = ## LEAKS";LEAKS(2)
9094 LPRINT USING "AREA 3 (CAR-171,PTS 4,9) = ## LEAKS";LEAKS(3)
9095 LPRINT USING "AREA 4 (CAR-171,PTS 1,5) = ## LEAKS";LEAKS(4)
9096 LPRINT USING "AREA 5 (CAR-171,PT 6) = ## LEAKS";LEAKS(5)
9097 LPRINT USING "AREA 6 (CAR-171,PT 7) = ## LEAKS";LEAKS(6)
9098 LPRINT USING "AREA 7 (CAR-171,PT 8) = ## LEAKS";LEAKS(7)
9099 LPRINT USING "AREA 8 (CAR-171,PT 10) = ## LEAKS";LEAKS(8)
9100 LPRINT USING "AREA 10 (CAR-401,PT 2) = ## LEAKS";LEAKS(10)
9101 LPRINT USING "AREA 11 (CAR-401,PTS 3,4,5,8) = ## LEAKS";LEAKS(11)
9102 LPRINT USING "AREA 12 (CAR-401,PT 6) = ## LEAKS";LEAKS(12)
9103 LPRINT USING "AREA 13 (CAR-401,PT 7) = ## LEAKS";LEAKS(13)
9104 LPRINT USING "AREA 14 (CAR-401,PTS 9,10) = ## LEAKS";LEAKS(14)
9120 FOR I=1 TO 3 : LPRINT CHR$(10); : NEXT
9122 FOR I=1 TO LEAKDOT
9123 LPRINT USING "A LEAK OCCURED AT * ";LKTIME$(I);
9124 LPRINT USING " IN AREA ## ";LKGREA(I)
9125 LPRINT : LPRINT
9126 NEXT
9130 LPRINT "NUMBER OF TIMES OVER 10 PPM FOR EACH POINT:"
9140 LPRINT
9150 LPRINT "POINT PROCESS AREA OFF-SITES INCINERATOR"
9160 FOR I=1 TO 2
9170 LPRINT USING " ## ## ##";I,HICOUNT%(1,I),HICOUNT%(2,I),HICOUNT%(3,I)
9180 NEXT I
9190 FOR I=3 TO 10
9200 LPRINT USING " ## ## ##";I,HICOUNT%(1,I),HICOUNT%(2,I)
9210 NEXT I
9220 FOR I=1 TO 3 : LPRINT CHR$(10); : NEXT
9230 LPRINT "HIGHEST CONCENTRATION PER POINT LAST 24 HOURS:"
9240 LPRINT
9250 LPRINT "POINT PROCESS AREA OFF-SITES INCINERATOR"
9260 LPRINT
9270 FOR I=1 TO 2
9280 LPRINT USING " ## ## ## ##";I,HIDATA(1,I),HIDATA(2,I),HIDATA(3,I)
9290 NEXT I
9300 FOR I=3 TO 10
9310 LPRINT USING " ## ## ## ##";I,HIDATA(1,I),HIDATA(2,I)

```

```

9320 NEXT I
9330 FOR I=1 TO 3 : LPRINT CHR$(10); : NEXT
9340 LPRINT "AVERAGE CONCENTRATION PER POINT LAST 24 HOURS:" : LPRINT
9350 LPRINT "POINT          PROCESS AREA          OFF-SITES          INCINERATOR"
9360 FOR I=1 TO 2
9370 LPRINT USING "  ##                ##.##                ##.##                ##.##"; I, DAY/
VG(1,I)/KOUNT2, DAYAVG(2,I)/KOUNT2, DAYAVG(3,I)/KOUNT3
9380 NEXT I
9390 FOR I=3 TO 10
9400 LPRINT USING "  ##                ##.##                ##.##"; I, DAYAVG(1,I)/KOUNT2, I
AYAVG(2,I)/KOUNT2
9410 NEXT I
9419 '
9420 ' WRITE DAILY OUTPUT ON FLOPPY DISK
9430 '
9440 OPEN "A:EPADATA" FOR APPEND AS #2
9450 PRINT #2, USING "&                &"; TIME$, DMYR$
9460 PRINT #2, USING "FIXED POINT MONITOR REPORT FOR &"; LOGDATE$
9470 PRINT #2, "NUMBER OF LEAKS DURING THE PAST 24 HOURS:"
9480 FOR I1=1 TO 14
9490 PRINT #2, USING "AREA ## = ## LEAKS"; I1, LEAKS(I1)
9500 NEXT I1
9510 PRINT #2, "NUMBER OF TIMES OVER 10 PPM FOR EACH POINT:"
9520 PRINT #2, "POINT          PROCESS AREA          OFF-SITES          INCINERATOR"
9530 FOR I2=1 TO 2
9540 PRINT #2, USING "  ##                ##                ##                ##"; I2, I
ICOUNT%(1,I2), HICOUNT%(2,I2), HICOUNT%(3,I2)
9550 NEXT I2
9560 FOR I2=3 TO 10
9570 PRINT #2, USING "  ##                ##                ##"; I2, HICOUNT%(1,I2), HIC
OUNT%(2,I2)
9580 NEXT I2
9590 PRINT #2, "HIGHEST CONCENTRATION PER POINT LAST 24 HOURS:"
9600 PRINT #2, "POINT          PROCESS AREA          OFFSITES          INCINERATOR"
9610 FOR I3=1 TO 2
9620 PRINT #2, USING "  ##                ##.##                ##.##                ##.##"; I
3, HIDATA(1,I3), HIDATA(2,I3), HIDATA(3,I3)
9630 NEXT I3
9640 FOR I3=3 TO 10
9650 PRINT #2, USING "  ##                ##.##                ##.##"; I3, HIDATA(1,I3), HIDA
TA(2,I3)
9660 NEXT I3
9670 PRINT #2, "AVERAGE CONCENTRATION PER POINT LAST 24 HOURS:"
9680 PRINT #2, "POINT          PROCESS AREA          OFF-SITES          INCINERATOR"
9690 FOR I4=1 TO 2
9700 PRINT #2, USING "  ##                ##.##                ##.##                ##.##"; I4, DAY
AVG(1,I4)/KOUNT1, DAYAVG(2,I4)/KOUNT2, DAYAVG(3,I4)/KOUNT3
9710 NEXT I4
9720 FOR I4=3 TO 10
9730 PRINT #2, USING "  ##                ##.##                ##.##"; I4, DAYAVG(1,I4)/KOUNT1
, DAYAVG(2,I4)/KOUNT2
9740 NEXT I4
9750 CLOSE #2
9760 KOUNT1=0 : KOUNT2=0 : KOUNT3=0
9765 LEAKTOT=0
9767 '
9768 ' RESET AVERAGING AND COUNTING ARRAYS
9769 '
9770 FOR K=1 TO 10

```

(80)

```
9780 H1DATA(1,K)=0 : H1DATA(2,K)=0 : H1DATA(3,K)=0
9790 H1COUNT%(1,K)=0 : H1COUNT%(2,K)=0 : H1COUNT%(3,K)=0
9800 OLDCOUNT%(1,K)=0 : OLDCOUNT%(2,K)=0 : OLDCOUNT%(3,K)=0
9810 DAYAVG(1,K)=0 : DAYAVG(2,K)=0 : DAYAVG(3,K)=0
9820 NEXT K
9830 FOR Q=1 TO 14 : LEAKS(Q)=0 : OLDLEAK(Q)=0 : NEXT Q
9835 '
9836 ' CLEAR DATA FILE ON HARD DISK AND REINITIALIZE FOR NEXT DAY
9837 '
9838 LOGDAT$=DMYR$
9840 OPEN "C:HOURLDATA" FOR OUTPUT AS #3
9850 PRINT #3,USING "DATA FOR %";LOGDAT$
9860 CLOSE #3
9870 RETURN
```

CCR 000018989

```

10000 ' DAY FLAMMABILITY MONITOR PROGRAM
10010 '
10020 T1=T(1)
10030 T4=T(4)
10040 HCMHR(3)=0!
10050 '
10060 ' START PROCESSING...
10070 CYC(1)=6.3 : CYC(2)=6.3 : CYC(3)=6.1
10080 '
10090 GOSUB 5000 : ' READ ANALOG CHANNELS AND CONVERT TO ENG. UNITS
10100 IF (HCMHR(1)>250 OR AIRB(1)<100) GOTO 10890
10110 '
10120 ' OXYGEN TO R-301...
10130 O2(1)=AIRB(1)
10140 '
10150 ' HEAT OF REACTION (BTU/LBMOLE ETHYLENE REACTED)...
10160 HREAC=118000!
10170 '
10180 HTVAP=931! : ' STEAM HEAT OF VAPORIZATION
10190 TTMIN(1)=ETMHR(1)+HCMHR(1)+O2(1) : ' INLET FLOW TO P-301
10200 XM=0! : XOB(1)=0!
10210 XETBR=.02*ETMHR(1)
10220 ETMHR(1)=.98*ETMHR(1)
10230 '
10240 FOR I=1 TO 3 : ' LOOP FOR THREE REACTORS...
10250 ' HEAT CONTENT OF STEAM FROM REACTORS...
10260 QTR=STLB(I)*(HTVAP+123!/(CYC(I)-1!))
10270 ' HEAT CONTENT OF REACTANTS...
10280 QIN=O2(1)*FNENTH3(T1)+ETMHR(1)*FNENTH1(T1)+HCMHR(1)*FNENTH2(T1)+XETBR*FNENTH4(T1)
10290 IF (I=1) THEN 10420
10300 ' HEAT CONTENT OF REACTANTS...
10310 QIN=QTO+AIRB(I)*FNENTH3(T1)+HCMHR(I)*FNENTH2(T1)
10320 ' OXYGEN TO REACTOR...
10330 O2(I)=AIRB(I)+XOB(I-1)
10340 ' HCL TO REACTOR...
10350 HCMHR(I)=HCMHR(I)+HCB(I-1)
10360 ' TOTAL FLOW TO REACTOR...
10370 TTMIN(I)=ETMHR(I)+HCMHR(I)+O2(I)+XETB(I-1)+XHTB(I-1)
10380 ' SET EDC AND WATER OUTPUT TO ZERO ON FIRST PASS...
10390 XETZ=XETB(I-1)
10400 XHTZ=XHTB(I-1)
10410 GOTO 10450
10420 XETZ=XETBR
10430 XHTZ=0!
10440 ' REACTION FOR EACH REACTOR...
10450 TZ=T(I+1)
10460 X=(QTR-QIN+(ETMHR(I)*FNENTH1(TZ)+HCMHR(I)*FNENTH2(TZ)+O2(I)*FNENTH3(TZ)+XETZ*FNENTH4(TZ)+XHTZ*FNENTH5(TZ)))/(ETMHR(I)*(FNENTH1(TZ)+2!*FNENTH2(TZ)+.5*FNENTH3(TZ)-FNENTH4(TZ)-FNENTH5(TZ))+HREAC))
10470 ' ETHYLENE FROM REACTOR...
10480 ETMHR(I+1)=(1!-X)*ETMHR(I)
10490 ' HCL FROM REACTOR...
10500 HCB(I)=HCMHR(I)-2!*X*(ETMHR(I)*X)
10510 ' OXYGEN FROM REACTOR...
10520 XOB(I)=O2(I)-.5*(ETMHR(I)*X)
10530 ' CUMULATIVE ETHYLENE REACTED...
10540 XM=XM+X*ETMHR(I)
10550 ' EDC FROM REACTOR...

```

```

10560 XETB(I)=XM+XETBR
10570 '      WATER FROM REACTOR...
10580 XHTB(I)=XM
10590 '      HEAT CONTENT OF PRODUCTS...
10600 QTO=-QTR+QIN+HREAC*X*ETMHR(I)
10610 NEXT I
10620 XETA=0!
10630 XHTA=0!
10640 '
10650 'CALCULATE PERCENT EXPLOSIVE IN R-301 INLET, R-302 INLET, R-303 INLET,
10660 'AND BL-307 INLET, RESPECTIVELY
10670 PFLM(1)=Q2(1)/(TTMIN(1)*(.114+.000176*T1)+.243*XETBR+.00316*HDMHR(1)) : IF
PFLM(1)>.8 THEN COLOR 7,4
10680 PFLM(2)=Q2(2)/(TTMIN(2)*(.115+ (.243*XETB(2)+.00316*HDMHR(2)) (TTMIN(2)+.001
76*T(2))) : IF PFLM(2)>.8 THEN COLOR 7,4
10690 PFLM(3)=Q2(3)/(TTMIN(3)*(.117+ (.243*XETB(3)+.00316*HDMHR(3)) (TTMIN(3)+.000
176*T(3))) : IF PFLM(3)>.8 THEN COLOR 7,4
10700 PFLM(4)=XOB(3)/((XOB(3)+ETMHR(4))* .0841+.243*.03*ETMHR(4)) : IF PFLM(4)>.8
THEN COLOR 7,4
10710 FOR II=1 TO 4
10720 IF PFLM(II)>9.999999 THEN PFLM(II)=9.999999
10730 NEXT II
10740 LOCATE 23,1
10750 FOR I=1 TO 4
10760 IF PFLM(I)<0 THEN PFLM(I)=0
10770 NEXT I
10780 PRINT "FLAM:";
10790 PRINT USING " R-301 IN: #.### R-302 IN: #.### R-303 IN: #.### BL-307
IN: #.###";PFLM(1),PFLM(2),PFLM(3),PFLM(4)
10795 IF (PFLM(1)>.8 OR PFLM(2)>.8 OR PFLM(3)>.8 OR PFLM(4)>.8) THEN DOUT3=1 ELS
DOUT3=0
10800 IF PFLM(1)>.8 THEN FLAG=17 ELSE GOTO 10820
10810 GOSUB 11000
10820 IF PFLM(2)>.8 THEN FLAG=18 ELSE GOTO 10840
10830 GOSUB 11000
10840 IF PFLM(3)>.8 THEN FLAG=19 ELSE GOTO 10860
10850 GOSUB 11000
10860 IF PFLM(4)>.8 THEN FLAG=20 ELSE GOTO 10880
10870 GOSUB 11000
10880 COLOR 7,0
10890 RETURN

```

```

1000 / ERROR MESSAGES PROGRAM
1010 /
1020 GOSUB 21000
1030 FOR IS=1 TO 5 : LPRINT CHR$(7); : NEXT IS
1040 LPRINT TIME$,DMYR$
1050 ON FLAG GOTO 11050,11080,11110,11140,11160,11180,11220,11260,11290,11320,1
11350,11380,11410,11440,11460,11480,11500,11520,11540,11560
1060 LPRINT "***** HIGH VCM IN PROCESS AREA...POINT # ";SID171%
1070 LPRINT USING "          VCM CONCENTRATION = ##.## PPM";GCDA(1,SID171%)
1080 GOTO 11600
1090 LPRINT "***** HIGH VCM IN OFF-SITES AREA...POINT # ";SID401%
1100 LPRINT USING "          VCM CONCENTRATION = ##.## PPM";GCDA(2,SID401%)
1110 GOTO 11600
1120 LPRINT "***** HIGH VCM IN INCINERATOR AREA...POINT # ";SID904%
1130 LPRINT USING "          VCM CONCENTRATION = ##.## PPM";GCDA(3,SID904%)
1140 GOTO 11600
1150 LPRINT USING " LEAK IN PROCESS AREA ## *****";LEAKAREA
1160 GOTO 11600
1170 LPRINT USING " LEAK IN OFF-SITES AREA ## *****";LEAKAREA
1180 GOTO 11600
1190 LPRINT "***** BAD RESPONSE FROM BURR-BROWN *****"
1200 LPRINT "***** TO CONFIGURATION COMMAND... *****"
1210 LPRINT "***** CHECK COMMUNICATIONS INTEGRITY *****"
1220 GOTO 11600
1230 LPRINT "***** BAD RESPONSE FROM BURR-BROWN *****"
1240 LPRINT "***** TO TURNAROUND SET TIME COMMAND... *****"
1250 LPRINT "***** RE-EXECUTE CONFIGURATION LOOP *****"
1260 GOTO 11600
1270 LPRINT "***** INPUT UNDERRANGE...PROCESS AREA DATA"
1280 LPRINT "***** STREAM ID # ";SID171%
1290 GOTO 11600
1300 LPRINT "***** INPUT UNDERRANGE...OFF-SITES AREA DATA"
1310 LPRINT "***** STREAM ID # ";SID401%
1320 GOTO 11600
1330 LPRINT "***** INPUT UNDERRANGE...OFF-SITES AREA DATA"
1340 LPRINT "***** STREAM ID # ";SID904%
1350 GOTO 11600
1360 LPRINT "***** STREAM ID OUT OF RANGE...CAR-171"
1370 LPRINT "***** STREAM # ";OLD171%+1
1380 GOTO 11600
1390 LPRINT "***** STREAM ID OUT OF RANGE...CAR-401"
1400 LPRINT "***** STREAM # ";OLD401%+1
1410 GOTO 11600
1420 LPRINT "***** STREAM ID OUT OF RANGE...CAR-904"
1430 LPRINT "***** STREAM # ";OLD904%+1
1440 GOTO 11600
1450 LPRINT "***** CAR-171 OFF LINE *****"
1460 GOTO 11600
1470 LPRINT "***** CAR-401 OFF LINE *****"
1480 GOTO 11600
1490 LPRINT "***** CAR-904 OFF LINE *****"
1500 GOTO 11600
1510 LPRINT "***** HIGH FLAMMABILITY IN R-301 INLET *****"
1520 GOTO 11600
1530 LPRINT "***** HIGH FLAMMABILITY IN R-302 INLET *****"
1540 GOTO 11600
1550 LPRINT "***** HIGH FLAMMABILITY IN R-303 INLET *****"
1560 GOTO 11600
1570 LPRINT "***** HIGH FLAMMABILITY IN BL-307 INLET *****"

```

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11570 GOTO 11600

11600 FLAG=0

1610 FOR I=1 TO 10 : LPRINT CHR\$(10) : NEXT I

1620 RETURN

CCR 000018993

```
12000 / HEXADECIMAL TO DECIMAL CONVERSION ROUTINE
12010 /
12020 L=LEN(HD$)
12030 SUM=0 : K=0
12040 FOR I7=L TO 1 STEP -1
12050 CH$=MID$(HD$,I7,1)
12060 MULT=16^K
12070 IF CH$="1" THEN VALUE=1 ELSE IF CH$="2" THEN VALUE=2
12080 IF CH$="3" THEN VALUE=3 ELSE IF CH$="4" THEN VALUE=4
12090 IF CH$="5" THEN VALUE=5 ELSE IF CH$="6" THEN VALUE=6
12100 IF CH$="7" THEN VALUE=7 ELSE IF CH$="8" THEN VALUE=8
12110 IF CH$="9" THEN VALUE=9 ELSE IF CH$="A" THEN VALUE=10
12120 IF CH$="B" THEN VALUE=11 ELSE IF CH$="C" THEN VALUE=12
12130 IF CH$="D" THEN VALUE=13 ELSE IF CH$="E" THEN VALUE=14
12140 IF CH$="F" THEN VALUE=15 ELSE IF CH$="0" THEN VALUE=0
12150 SUM=SUM+MULT*VALUE
12160 K=K+1
12170 NEXT I7
12180 DEC=SUM
12190 RETURN
```

```

13000 ' OXY DP PROGRAM
13010 '
13020 SET=1
13025 IF (HCMHR(1)<250 OR AIRB(1)<100) GOTO 13490
13030 AINREAD$="01A1018018XX"+CHR$(13) : ' REQUEST FOR ANALOG CHANNELS 14-17
13040 PRINT #1,AINREAD$;
13050 FOR I8=1 TO 20 : NEXT I8 : ' DELAY 20 MILLISECONDS
13060 LINE INPUT #1,AINRESP$
13070 RESP$=AINRESP$
13080 GOSUB 17000
13090 FOR I9=1 TO 8 STEP 2 : ' DIVIDE ANALOG DATA INTO VALUE AND GAIN FIELDS
13100 L=I9*2+3
13110 AINDATA$(I9)=MID$(AINRESP$,L,3)
13120 L=L+3
13130 AINDATA$(I9+1)=MID$(AINRESP$,L,1)
13140 NEXT I9
13150 FOR I=1 TO 8 STEP 2
13160 HD$=AINDATA$(I)
13170 GOSUB 12000 : ' HEX TO DECIMAL CONVERSION
13180 DAT(I)=DEC
13190 IF (DAT(I)=-2048) GOTO 13220 : ' CONVERT TO ENGINEERING UNITS
13200 DAT(I)=(DAT(I)/2048)*10
13210 GOTO 13270
13220 DAT(I)=((DAT(I)-4096)/2048)*10
13230 IF DAT(I) .< 0 THEN FLAG=22 ELSE GOTO 13250
13240 GOSUB 11000
13250 IF DAT(I) .< 0! THEN DAT(I)=0!
13260 NEXT I
13270 R301PR=((DAT(1)-1)/4!)*200!
13280 DP(1)=((DAT(3)-1)/4!)*20!
13290 DP(2)=((DAT(5)-1)/4!)*30!
13300 DP(3)=((DAT(7)-1)/4!)*40!
13310 RX(1)=HCMHR(1)*.379+ETMHR(1)*.379+AIRB(1)*.379
13320 RX(2)=RX(1)-AIRB(1)*1.137+AIRB(2)*.379+HCMHR(2)*.379
13330 RX(3)=RX(2)-AIRB(2)*1.137+AIRB(3)*.379
13340 RY(1)=R301PR-DP(1)
13350 RY(2)=RY(1)-DP(2)
13360 RY(3)=RY(2)-DP(3)
13370 FOR I=1 TO 3
13380 DROP(I)=99.99 : ' CALCULATE RXR PRESSURE DROPS AND STEAM-TO-AIR RATIOS
13390 IF (RX(I)<>0!) THEN DROP(I)=(DP(I)*RY(I))/(RX(I)*RX(I))*10000!
13400 RAT(I)=99.99
13410 IF (AIR(I)<>0!) THEN RAT(I)=(STLB(I))/(AIRB(I)*18!)
13420 NEXT I
13430 LPRINT CHR$(12);
13440 LPRINT "OXYCHLORINATION REDUCED PRESSURE DROPS:"
13450 FOR J1=1 TO 3
13460 LPRINT USING "R-30# REDUCED DP = ###.##"          RATIO = ###.##";J1,DROP(J
1),RAT(J1)
13470 NEXT J1
13480 LPRINT CHR$(12);
13490 RETURN

```

(87)

```
14000 , DECIMAL TO BINARY NUMBER CONVERSION
14010 ,
  4020 FOR S=1 TO 16 : BIN(S)=0 : NEXT S
  4030 FOR I=1 TO 16
14040 BIN(I)=DEC MOD 2
    1050 REMAIN=DEC\2
14060 DEC=REMAIN
14070 L=I
14080 IF DEC=0 THEN 14160
14090 NEXT I
14160 RETURN
```

CCR 000018996

```
15000 'IBM PC-XT ERROR TRAPPING PROGRAM
15010 '
15030 FOR J3=1 TO 3 : LPRINT CHR$(10); : NEXT J3
15040 LPRINT USING"IBM PC-XT ERROR...ERROR ## in line ##### ":ERR,ERL
15050 FOR J4=1 TO 3 : LPRINT CHR$(10); : NEXT J4
15055 GOSUB 18000
15060 RESUME NEXT
```

```
16000 ' BURR-BROWN ERROR IDENTIFICATION PROGRAM
16010 '
16020 ERRNUM$=MID$(PESF$,4-2)
16030 FOR J5=1 TO 3 : LPRINT CHR$(10); : NEXT J5
16040 LPRINT "**** BURR-BROWN ERROR...ERROR # ";ERRNUM$;
16041 LPRINT " ****"
16050 IF ERRNUM$="03" THEN GOSUB 1140 ELSE GOTO 16070
16060 LPRINT : LPRINT "**** BURR-BROWN CONFIGURATION LOST---CHECK POWER SOURCE
***"
16070 FOR J6=1 TO 3 : LPRINT CHR$(10); : NEXT J6
16075 GOSUB 18000
16080 RETURN
```

(90)

```
17000 / TEST FOR ERROR MESSAGES FROM PURF-BROWN
17010 /
17020 TESTCON$=HID$(RESP$,3,1)
17030 IF TESTCON$="N" THEN GOSUB 16000
17040 RETURN
```

CCR 000018999

18000 / PRINT SCREEN HEADINGS AND VALUES

18001 /

18010 LOCATE 2,1

18011 CLS

18040 /

18050 PRINT "

FIXED POINT MULTIPLIER LOG

18060 PRINT "

CURRENT VALUE

18070 PRINT "

18080 PRINT

18090 PRINT "	POINT	PROCEED AREA	RESETTED	UNCLIP
OR"				

18100 PRINT "

--"

18110 PRINT

18120 RETURN

```
19000 ' ROUTINE TO KEEP CORRECT DATE
19010 '
19020 DAY%=DAY%+1
19030 IF DAY%<29 GOTO 19170
19035 LEAP%=YEAR% MOD 4
19039 IF MONTH%<>2 GOTO 19090
19040 IF MONTH%<>2 AND DAY%=29 THEN GOTO 19090
19060 IF LEAP%=0 GOTO 19090
19070 DAY%=1 : MONTH%=3
19090 IF ((LEAP%=0 AND DAY%=30) AND MONTH%=2) THEN MONTH%=3 ELSE GOTO 19100
19095 DAY%=1
19100 IF (DAY%=31 AND (MONTH%=4 OR MONTH%=6 OR MONTH%=9 OR MONTH%=11)) THEN MONTH%=MONTH%+1 ELSE GOTO 19140
19120 DAY%=1
19140 IF (DAY%=32) THEN MONTH%=MONTH%+1 ELSE GOTO 19170
19150 DAY%=1
19160 IF (DAY%=1) AND (MONTH%=13) THEN YEAR%=YEAR%+1 ELSE GOTO 19170
19165 MONTH%=1
19170 DMYR$=STR$(MONTH%)+ "-" +STR$(DAY%)+ "-" +STR$(YEAR%)
19180 RETURN
```

```
20000 / ROUTINE TO COUNT NUMBER OF SECONDS ELAPSED SINCE MIDNIGHT
20010 /
20020 T$=TIME$
20030 SEC=VAL(MID$(T$,7,2))
    0040 MIN=VAL(MID$(T$,4,2))
20050 HRS=VAL(MID$(T$,1,2))
20060 TIMER=SEC+60*MIN+3600*HRS
20070 RETURN
```

21000 ANNUNCIATOR ALGORITHM ROUTINE

21010 '

21020 IF DOUT1=0 AND DOUT2=1 AND DOUT3=0 THEN DOUT4="01F100100300XX"+CHR\$(13)

21030 IF DOUT1=1 AND DOUT2=0 AND DOUT3=0 THEN DOUT4="01F100100301XX"+CHR\$(13)

21040 IF DOUT1=1 AND DOUT2=1 AND DOUT3=0 THEN DOUT4="01F100100303XX"+CHR\$(13)

21050 IF DOUT1=1 AND DOUT2=0 AND DOUT3=1 THEN DOUT4="01F100100305XX"+CHR\$(13)

21060 IF DOUT1=0 AND DOUT2=1 AND DOUT3=1 THEN DOUT4="01F100100306XX"+CHR\$(13)

21070 IF DOUT1=0 AND DOUT2=1 AND DOUT3=0 THEN DOUT4="01F100100302XX"+CHR\$(13)

21080 IF DOUT1=0 AND DOUT2=1 AND DOUT3=1 THEN DOUT4="01F100100304XX"+CHR\$(13)

21090 IF DOUT1=1 AND DOUT2=1 AND DOUT3=1 THEN DOUT4="01F100100307XX"+CHR\$(13)

21100 PRINT #1,DOUT4

21110 FOR I=1 TO 20 : NEXT I : DELAY 20 MILLISECONDS

21120 LINE INPUT #1,PESP4

21130 GOSUB 17000

21140 RETURN

APPENDIX 2ALPHABETICAL LISTING OF VARIABLE
NAMES IN "FIXEDPT.BAS"A

A	Enthalpy function dummy variable
AINDATA\$(26)	Analog input data string.
AINREAD\$	GC Analog input request command
AINRESP\$	Analog input response from Burr-Brown
AIR(3)	O ₂ to each OXY reactor (raw data, volts)
AIRB(3)	O ₂ to each OXY reactor (Lb/Hr.)

B

BIN(16)	DISCRETE INPUT DATA ARRAY
---------	---------------------------

C

CAR171\$	CAR-171 status.
CAR401\$	CAR-401 status
CAR904\$	CAR-904 status.
CH\$	Hexadecimal data bit identifier
CONFIG\$	Burr-Brown configuration command.
CYC(3)	Cycles in steam drums in OXY.

D

DAT(26)	Analog input data array, volts
DAY%	current day of month
DAYAVG (3,10)	Average VCM concentration past 24 hrs., ppm.
DEC	Decimal value of hex data from Burr-Brown
DIFFTIME	Time elapsed since last GC scan, sec
DINREQ\$	Discrete input data request command
DMYR\$	Current date in Day/Month/Year format
DOUT\$	Discrete output set command
DOUT1	HI VCM concentration alarm flag.
DOUT2	VCM leak alarm flag
DOUT3	HI OXY Flammability alarm flag
DP(3)	OXY reactor pressure drops (input), psi
DROP(3)	Reduced OXY reactor pressure drops, psi.

E

ERRNUM\$	Burr-Brown error number identifier
ETMH	Total ethylene to OXY, LBMOLE/Hr.
ETMHR(4)	Ethylene to R-301, from OXY reactors, LBMOLE/HR.

F

FLAG	Error identification flag
FLAG171%(10)	CAR-171 data processing flag
FLAG401%(10)	CAR-401 data processing flag.
FLAG904%(10)	CAR-904 data processing flag

FNENTH1	Enthalpy function, ethylene
FNENTH2	Enthalpy function, HCL
FNENTH3	Enthalpy function, Oxygen
FNENTH4	Enthalpy function, EDC
FNENTH5	Enthalpy function, water

G

GAINSET\$	Analog data gain set command
GC DAT(3,10)	GC Data array, data in PPM VCM
GSET1	GC status change flag.
GSET2	GC status change flag.
GSET3	GC status change flag.

H

HCB(3)	HCL out of each OXY reactor, LBMOLE/Hr.
HCL(3)	HCL to each OXY reactor, Volts
HCMHR(3)	HCL to each OXY reactor, LBMOLE/Hr.
HD\$	Hexadecimal Data String Variable
HICOUNT%(3, 10)	Number of times 10 ppm VCM per GC point, last 24 hours
HIDATA(3, 10)	Highest VCM Conc. per GC point, last 24 hrs, ppm
HIGH%(3, 10)	Flag to indicate Hi VCM Conc. on GC scan
HOUR	Current Hour Change Indicator
HREAC	Oxy Reaction Heat of Reaction, BTU/LBMOLE
HRS	Current Hour of Day, Hr.
HTVAP	Heat of Vaporization of Water, BTU/Lb.

<u>I</u>	
I	Loop Index Variable
ID	Previous GC Stream ID
I FLAG (3,10)	Leak Detection GC Hi VCM Flag
II	Loop Index Variable
I1	Loop Index Variable
I2	Loop Index Variable
I3	Loop Index Variable
I4	Loop Index Variable
I6	Loop Index Variable
I7	Loop Index Variable
I9	Loop Index Variable

<u>J</u>	
J1	Loop Index Variable
J3	Loop Index Variable
J4	Loop Index Variable
J5	Loop Index Variable
J6	Loop Index Variable

<u>K</u>	
K	Loop Index Variable
KOUNT1	Number of CAR-171 GC Scans Per Day
KOUNT2	Number of CAR-401 GC Scans Per Day
KOUNT3	Number of CAR-904 GC Scans Per Day

L

L	Hexadecimal Data String Length
LEAKAREA	Area in which a Leak has Occurred
LEAKFLAG(10)	Process Area Leak Detection Flag
LEAKS (14)	Cumulative Leaks in Each Area, Current Hour
LEAKTOT	Total Number of Leaks, Current Day
LEAP%	Leap Year Indicator
LKAREA(50)	Array to Keep Track of Areas Which had Leaks
LKTIME\$ (50)	Time Leaks Occurred for Leaks in LKAREA(50)
LOGDAT\$	Date of Data for Daily Report
LOGSET	Daily Log Printout Flag.

M

MIN	Current Minute of Hour, Min.
MONTH%	Current Month of Year
MULT	Multiplier for Conversion of Hex to Decimal Data

O

OLDCOUNT%(3,10)	Cumulative 10 ppm per Point Through Last Hour
OLDHOUR	Last Hour
OLDLEAK(14)	Cumulative Leaks per Point Through Last Hour
OLDTIME	Time at Beginning of Each Executive Loop
OLD171%	Stream ID for CAR-171 Previous Pass.
OLD401%	Steam ID for CAR-401 Previous Pass.
OLD904%	Stream ID for CAR-904 Previous Pass.
O2(3)	Oxygen to Oxy Reactors, LBMOLES/Hr.

<u>P</u>	
PFLM(4)	Flammability into and out of Oxy Reactors, %
<u>Q</u>	
Q	Loop Index Variable
QIN	Heat Content of Oxy Reactants, BTU
QTO	Heat Content of Oxy Products, BTU
QTR	Heat Content of Steam From Oxy, BTU
<u>R</u>	
RAT(3)	Steam/Air Ratios From Oxy
REMAIN	Remainder Variable in Binary to Decimal Routine
RESP\$	Burr-Brown Responses
RESPDIN\$	Discrete input Response from Burr-Brown
RX(3)	Calculated Denominator Function, Oxy D/P's
RY(3)	Calculated Numerator Function, Oxy D/P's
<u>S</u>	
S	Loop Index Variable
SEC	Current Second of Minute, SEC
SET	Oxy D/P Calculation Flag
SID171%	CAR-171 Stream ID
SID401%	CAR-401 Stream ID
SID904%	CAR-904 Stream ID
STLB(3)	Steam Flow from Oxy Steam Drums, Lbs./Hr.
STM(3)	Steam Flow from Oxy Steam Drums (Raw Data, Volts)
SUM	Summing variable in hexadecimal data conversion routine.

<u>T</u>	
T(4)	Oxy Reactor Inlet/Outlet Temperatures, °C
T\$	Current Time
TARSET\$	Turnaround Time Set Command for Burr-Brown
TESTCON\$	String to Test for Burr-Brown Error Messages
TIME	Time Function, Sec
TIME\$	Current Time
TIMER	Number of Seconds Since Midnight, Sec
TRIES	Number of Tries to Establish Link w/Burr-Brown
TTMIN(3)	Inlet Flow to Each Oxy Reactor, LbMole/Hr.
TZ	Oxy Reactor Outlet Temperature, °C

<u>V</u>	
VALUE	Value Corresponding to Each Hexadecimal Bit.

<u>X</u>	
X	Fraction of Ethylene Reacted in Each Reactor
XETA	EDC Flow Out of Oxy, LbMole/Hr.
XETB(3)	EDC Flow From Each Reactor, LbMole/Hr.
XETBR	Fraction Impurities in Ethylene Feed
XETZ	EDC Out of Oxy, LbMole/Hr.
XHTA	Water Out of Oxy, LbMole/Hr.
XHTB(3)	Water Flow From Each Reactor, LbMole/Hr.
XHTZ	Water Flow From Previous Oxy Reactor, LbMole/Hr.
XM	Cumulative Ethylene Reacted, LbMole/Hr.
XOB(3)	Oxygen Out of Each Oxy Reactor, LbMole/Hr.

Y
YEAR%

Current Year

APPENDIX 3

(103)

1. The first part of the report is a summary of the work done during the year. It is a brief statement of the results of the work, and is intended to give a general impression of the progress made.

2. The second part of the report is a detailed account of the work done during the year. It is a full and complete statement of the results of the work, and is intended to give a detailed impression of the progress made.

3. The third part of the report is a summary of the work done during the year. It is a brief statement of the results of the work, and is intended to give a general impression of the progress made.

4. The fourth part of the report is a detailed account of the work done during the year. It is a full and complete statement of the results of the work, and is intended to give a detailed impression of the progress made.

5. The fifth part of the report is a summary of the work done during the year. It is a brief statement of the results of the work, and is intended to give a general impression of the progress made.

6. The sixth part of the report is a detailed account of the work done during the year. It is a full and complete statement of the results of the work, and is intended to give a detailed impression of the progress made.

7. The seventh part of the report is a summary of the work done during the year. It is a brief statement of the results of the work, and is intended to give a general impression of the progress made.

8. The eighth part of the report is a detailed account of the work done during the year. It is a full and complete statement of the results of the work, and is intended to give a detailed impression of the progress made.

9. The ninth part of the report is a summary of the work done during the year. It is a brief statement of the results of the work, and is intended to give a general impression of the progress made.

10. The tenth part of the report is a detailed account of the work done during the year. It is a full and complete statement of the results of the work, and is intended to give a detailed impression of the progress made.

APPENDIX 4"MONITOR.BAT"

<u>BATCH FILE COMMAND</u>	<u>DESCRIPTION</u>
1: BREAK ON	Allows CNTL-Break to stop execution of subsequent programs.
2: ECHO OFF	Turns off screen "ECHO" of commands in "MONITOR.BAT".
3: TIME	Allows current time to be set.
4: DATE	Allows current date to be set.
5: FIXEDPT	Runs "FIXEDPT" program.
6: FAIL	If "FIXEDPT" program stops execution, "FAIL" is run to alarm annunciator.

APPENDIX 5"AUTOEXEC.BAT."

<u>BATCH FILE COMMAND</u>	<u>DESCRIPTION</u>
1: BREAK ON	Allows CNTL-Break to stop execution of subsequent programs.
2: ECHO OFF	Turns off screen "ECHO" of command in "AUTOEXEC.BAT."
3: C:	Sets default disk drive to hard disk drive (Drive C:)
4: C: FIXEDPT1	Runs "FIXEDPT1" program on hard disk drive.
5: C: FAIL	If "FIXEDPT" program stops execution, "FAIL" is run to alarm annunciator.