MASTER

THE COMPUTER CONTROLLED MONITOR SYSTEM

AT

PANTEX PLANT

Heidrun D. Kuepper

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THE COMPUTER CONTROLLED
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ABSTRACT

The monitor system now in operation in the Gas Analysis Laboratory was designed to meet the Nuclear Safety specifications of a permanent and accurate record of hourly temperature and pressure readings on all weapons undergoing thermal exposure or accelerated aging. This report is designed to give the user an insight into the monitor system and its operation without requiring extensive knowledge of computer software. A flow chart of the actual monitor program as it currently exists is included as an appendix to this report.

EQUIPMENT

The system currently consists of a Decwriter Printer, a Digital Equipment Corporation PDP-8/f computer, and a Datametrics, Inc. designed monitor system.

The PDP-8/f computer (Figure 1) used in this system is equipped with a high speed paper tape reader, a high speed paper tape punch, an RK05 disc system with a 1.60 million words of storage, and 8K of twelve bit word memory.

The Datametrics Monitor System has a Type 1102 pressure multiplexer, a Model 1018B Readout, a Model 7200 Temperature multiplexer, and a master control panel. The master control panel has a clock showing the Julian calendar day, hour and minutes, a manual/automatic temperature channel selector, a temperature indicator, a temperature channel readout, and a teletype control for output. An alarm switch with a reset button is also located on this master panel.

Thermocouple leads which are specifically used for temperature sensing and leads for the CGS System used in pressure sensing are strategically located on the weapons where monitoring is required. The resultant readings are mechanically converted into ASCII Code before leaving the monitor system, then on to the computer through the teletype interface.

DISCUSSION

PAL8 assembly language is used in the data acquisition of the monitor program. An assembler produces a binary tape, which, with a DEC furnished floating point package (DEC-08-YQ4B-PB) are loaded into core by use of a binary loader. The program is started at location 200.

The monitor system program has two main objectives. One is to establish an upper and lower control limit for each of the monitor's 52 channels of which 20 channels monitor pressure and 32 channels monitor temperature. The pressure readings are measured in torr and temperature is measured in degrees Fahrenheit. The limits are set by the operator to give a desired range and if the temperature or pressure of any channel exceeds its specified preset tolerances, an alarm is activated. Simultaneously, the computer picks up the Julian Calendar date, hour and minute of the alarm, then the affected channel number and its reading; and proceeds to instruct the teletype to print this pertinent information and continues printing as long as out-of-tolerance conditions exist. In this manner, a permanent record of any activated alarm is maintained.

The second objective of the monitor program is to print out on an hourly basis a complete listing of all 52 channels and their respective readings. Another way to get a total printout of all channels is by pressing a Control Z key on the Decwriter and after the current scan is finished, a printout will be typed on the teletype. The format of the printout is the Julian calendar date, the hour and minutes followed by pressure readings and then the temperature readings. An example of the alarm and the

hourly printouts is shown in Illustration 1. It should also be noted that in the alarm printout, a 2 digit channel number signifies a pressure channel whereas a 3 digit number signifies a temperature channel. The first digit, 1, on the readout of the temperature channel should be ignored because its presence is solely to distinguish it from the pressure channels. A segment of the printout of control limits is in Illustration 2.

005:14 00

01:001.6 02:001.4 03:049.2 04:008.4 05:003.4
 06:774.8 07:920.8 08:001.2 09:000.8 10:001.1
 11:000.5 12:000.5 13:000.5 14:000.5 15:000.5
 16:000.6 17:000.5 18:000.5 19:000.5 20:000.6

01:150.4 02:077.2 03:150.2 04:073.6 05:073.4
 06:159.1 07:106.8 08:106.7 09:104.3 10:104.0
 11:080.7 12:106.8 13:157.2 14:157.9 15:158.8
 16:150.3 17:158.4 18:158.0 19:074.7 20:073.6
 21:136.0 22:137.4 23:137.4 24:136.6 25:076.8
 26:076.7 27:077.1 28:092.4 29:121.7 30:108.0
 31:075.5 32:135.6 005:14 15 +100 +148.4

005:14 20 +100 +151.0
 005:14 24 +100 +150.3

calendar date hour minute channel number temperature read out

ALARM PRINTOUT

005:15 00

01:001.5 02:001.4 03:048.0 04:000.4 05:003.3
 06:773.0 07:920.8 08:001.2 09:000.8 10:001.1
 11:000.5 12:000.5 13:000.5 14:000.5 15:000.5
 16:000.5 17:000.6 18:000.6 19:000.5 20:000.5

01:150.7 02:079.7 03:154.8 04:073.7 05:072.9
 06:159.3 07:106.9 08:106.5 09:104.3 10:104.3
 11:080.7 12:106.9 13:157.3 14:157.8 15:158.9
 16:158.3 17:158.1 18:157.8 19:074.9 20:074.7
 21:137.2 22:137.2 23:137.2 24:136.5 25:077.0
 26:077.0 27:077.2 28:092.6 29:120.3 30:107.5
 31:075.2 32:134.2

Hourly
PRINTOUT

005:16 00

01:001.6 02:001.4 03:049.0 04:008.4 05:003.3
 06:773.8 07:920.8 08:001.2 09:000.8 10:001.1
 11:000.6 12:000.5 13:000.6 14:000.6 15:000.5
 16:000.5 17:000.5 18:000.5 19:000.5 20:000.6

01:158.9 02:072.5 03:152.7 04:073.5 05:072.9
 06:159.3 07:106.6 08:106.6 09:104.3 10:104.9
 11:080.7 12:106.9 13:157.2 14:157.8 15:158.8
 16:150.2 17:158.1 18:157.9 19:074.7 20:074.5
 21:130.1 22:137.6 23:137.6 24:137.1 25:077.4
 26:077.3 27:077.9 28:092.4 29:120.0 30:107.2
 31:075.4 32:136.0 005:16 52 +100 +148.9

ALARM

005:17 00

01:001.6 02:001.4 03:049.2 04:008.4 05:003.4
 06:773.9 07:920.8 08:001.2 09:000.8 10:001.1
 11:000.5 12:000.5 13:000.6 14:000.5 15:000.6
 16:000.6 17:000.5 18:000.5 19:000.6 20:000.5

01:159.0 02:070.0 03:158.5 04:073.9 05:073.0
 06:150.1 07:107.1 08:106.7 09:104.0 10:104.1
 11:000.6 12:106.9 13:157.3 14:157.9 15:158.8
 16:150.1 17:150.1 18:157.8 19:074.5 20:074.8
 21:130.0 22:137.4 23:137.4 24:136.6 25:077.4
 26:077.2 27:077.5 28:092.6 29:120.6 30:109.6
 31:075.4 32:134.9 005:17 21 +100 +147.0
 005:17 25 +100 +150.4

ILLUSTRATION 1

UPPER LIMIT FOR PRESS. CHANNEL # 17 =	+999.0
LOWER LIMIT FOR PRESS. CHANNEL # 17 =	+0.0
UPPER LIMIT FOR PRESS. CHANNEL # 18 =	+999.0
LOWER LIMIT FOR PRESS. CHANNEL # 18 =	+0.0
UPPER LIMIT FOR PRESS. CHANNEL # 19 =	+999.0
LOWER LIMIT FOR PRESS. CHANNEL # 19 =	+0.0
UPPER LIMIT FOR PRESS. CHANNEL # 20 =	+999.0
LOWER LIMIT FOR PRESS. CHANNEL # 20 =	+0.0
UPPER LIMIT FOR TEMP. CHANNEL # 01 =	+999.0
LOWER LIMIT FOR TEMP. CHANNEL # 01 =	+0.0
UPPER LIMIT FOR TEMP. CHANNEL # 02 =	+999.0
LOWER LIMIT FOR TEMP. CHANNEL # 02 =	+0.0
UPPER LIMIT FOR TEMP. CHANNEL # 03 =	+999.0
LOWER LIMIT FOR TEMP. CHANNEL # 03 =	+0.0
UPPER LIMIT FOR TEMP. CHANNEL # 04 =	+999.0
LOWER LIMIT FOR TEMP. CHANNEL # 04 =	+0.0
UPPER LIMIT FOR TEMP. CHANNEL # 05 =	+999.0
LOWER LIMIT FOR TEMP. CHANNEL # 05 =	+0.0
UPPER LIMIT FOR TEMP. CHANNEL # 06 =	+163.0
LOWER LIMIT FOR TEMP. CHANNEL # 06 =	+153.0
UPPER LIMIT FOR TEMP. CHANNEL # 07 =	+999.0
LOWER LIMIT FOR TEMP. CHANNEL # 07 =	+0.0
UPPER LIMIT FOR TEMP. CHANNEL # 08 =	+999.0
LOWER LIMIT FOR TEMP. CHANNEL # 08 =	+0.0
UPPER LIMIT FOR TEMP. CHANNEL # 09 =	+999.0
LOWER LIMIT FOR TEMP. CHANNEL # 09 =	+0.0
UPPER LIMIT FOR TEMP. CHANNEL # 10 =	+999.0
LOWER LIMIT FOR TEMP. CHANNEL # 10 =	+0.0
UPPER LIMIT FOR TEMP. CHANNEL # 11 =	+999.0
LOWER LIMIT FOR TEMP. CHANNEL # 11 =	+0.0
UPPER LIMIT FOR TEMP. CHANNEL # 12 =	+999.0
LOWER LIMIT FOR TEMP. CHANNEL # 12 =	+0.0

ILLUSTRATION 2

Monitor System Program

Start of Program :

Put zero in
locations 1000-2000

initialize Keyboard
and teleprinter

FIXE = FIXIT

give calendar
day

CNTR has 52 Channels

Loop is done
52 times to
cover all channels -
20 Pressure
32 Temperature

Resets all
positions to their
original readings

Loop checks Readings
with limits. If out of
limits, sets alarm.
If in limits, increments
and checks until reaches
zero.

Printout of
Channel number
and its
upper limit.

GOT = GET + 11
(0742)

GETC = GET + 30
(4501)

Above changes
address of List
Text from pressure
to Temperature.

change of upper
limit value

Printout of
Channel # and
its lower limits

change of
lower limit
value

increment LIST
for next
channel

This Subroutine sets up input from teletype or monitor depending on value of Flag.

- This Subroutine asks if a printout has been requested by the operator or by time. If so, a printout is performed, otherwise goes back to start.

This Subroutine unpacks and prints
list created by text dialogue.

Has last
Character been
printed?

This Routine is an Overlay on the Floating Point Package. It accepts input from Monitor instead of Teletype and stores Ascii Characters in Aspo.

This Routine is an Optional Subroutine for the Floating Point Package. It checks for carriage return and line feed, does rubout for input errors and echos back what was typed on Keyboard.

This Subroutine prints out the Channel number and its data when the alarm activates.

If CHNO is greater than 4074, add 100 to make Channel number a temperature channel otherwise, it is a pressure channel.

Print Channel Number

Print data from alarming Channel number.

FIGURE 1

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