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DYNAMIC [illegible] TEMPE[illegible]ATUR[illegible] MEASU[illegible]ENT SYSTEM FINAL REPORT

VOLUM[illegible] OPERATIO[illegible] AND PRO[illegible]AM MANUAL

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(NASA-CR-168267) DYNAMIC GAS TEMPERATURE MEASUREMENT SYSTEM. VOLUME 2: OPERATION AND PROGRAM MANUAL (Pratt and Whitney Aircraft) 151 p HC A08/MF A01 CSCL 14B

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SECTION 1
INTRODUCTION

The Hot Section Technology (HOST) Dynamic Gas Temperature Measurement System Computer Program acquires data from two Type B thermocouples of different diameters. The analysis method then determines the insitu value of an aerodynamic parameter Γ, containing the heat transfer coefficient from the transfer function of the two thermocouples. This aerodynamic parameter is then used to compute a frequency response spectrum and compensate the dynamic portion of the signal of the smaller thermocouple. Detailed discussions of the calculations for the aerodynamic parameter and the data compensation technique are presented in Section III.C. of Volume I. Compensated data is presented in either the time or frequency domain. Time domain data are presented as dynamic temperature vs time (compensated or uncompensated). Frequency domain data are presented per the table below (compensated or uncompensated):

Function	*Dimensions*	*Engineering Units*
• Power Spectral Density (PSD)	Mean Square/Hz	°F²/Hz (K²/Hz)
• Log Power Spectral Density = 10 $\log_{10}$ PSD	Mean Square/Hz	db ref 1°F²/Hz (0.309K²/Hz)
• Linear Power Spectral Density = Positive Square Root of PSD	rms/$\sqrt{Hz}$	°F/$\sqrt{Hz}$ (0.556K/$\sqrt{Hz}$)
• Narrowband Frequency Spectrum = Positive square root of autospectral density (autopower) function with narrowband signal correction for FFT windowing function applied and no normalization to per unit bandwidth	rms	°F (K)

The data analysis and compensation software was implemented on a digital computer based Hewlett Packard (HP) model 5451C Fourier Analyzer system. This manual contains the computer program listings, software operating instructions and computer hardware requirements. Extensive use was made of the HP system operating software package. For convenience, English units were used exclusively throughout the software.

CONTENTS

SECTION II
SYSTEM DESIGN

The HOST System is built around a HEWLETT-PACKARD 5451C FOURIER ANALYZER with 64K words of memory. The hardware required to run the system is listed in the table below:

DESCRIPTION	PART NO.	
21MX E-Series Computer	54451A	
System Control	5477A	
Display Unit	5460A	
Analog to Digital Converter	5466B	(1)
Control Unit	5475A	
Low Pass Filter (4 each)	54440A	
I/O Extender	12979B	
Digital Tape Unit	7970E	
Disc Drive	7900A	(2)
Disc Power Supply	13215A	
Graphics Terminal	2648A	
Video Hard Copy Unit	4632	(3)
Signature Analysis Control Panel	-	

(1) 4 Channel Option is required.
(2) This disc drive has been updated to 7906.
(3) Hard copy unit is manufactured by Tektronix.

The software for this system is based on the HEWLETT-PACKARD software supplied with the 5451C FOURIER SYSTEM. All functions in the standard Fourier System are maintained, boot-up and operation instructions are per the system manual. However additional software has been added to drive the HOST System.

This manual is divided into two sections:

- SYSTEM OPERATION - This section explains how to operate the HOST System Software.
- SYSTEM SOFTWARE - This section provides a complete listing of HOST System Software, and the Command Files used to generate the HOST System Overlays.

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SECTION 1 - SYSTEM OPERATION

System operation is divided into 3 parts, these are:

- o Theoretical TRANSFER FUNCTION of the large wire thermocouple to the small wire thermocouple.

- o Measured TRANSFER FUNCTION of the large wire thermocouple to the small wire thermocouple.

- o Data processing and plotting.

The abbreviation 'H(f)' will be used in place of the words 'TRANSFER FUNCTION' whenever that process is implied.

System input is accomplished by setting SYSTEM EDITS. During each part of system operation, a series of questions pertaining to that part of system operation is asked by the system to the user. Operation is then done per these edits.

1.0 THEORETICAL H(f) OF THE LARGE WIRE THERMOCOUPLE TO THE SMALL WIRE THERMOCOUPLE.

This part consisis of 4 phases, these are:

- o Inputting thermocouple wire and gas stream parameters.
- o Storing this data on the system disc.
- o Generating a family of curves, from .5 to 1.5 GAMMA, of the thermocouple wire vs. the gas stream, both large wire and small wire.
- o Dividing the two families (large wire/small wire) to obtain a third family of curves.

1.1 Thermocouple wire and gas stream parameter input is accomplished by setting SYSTEM EDITS. To access the edits for this part of the system, press RESTART, EDIT, AUTO-SEQ and YES on the SYSTEM CONTROL panel. A copy of these edits appears on the next page. Although the edits are self explanatory, edit no. 25 needs further clarification. This edit sets the frequency code for the family of curves about to be generated. It also sets the following system constraints:

- o Only 4 delta-f settings are allowed. These are .2, .5, 1, and 2.
- o Only -1, and 0 may be entered for powers of 10. That is, when the delta-f setting is .2 or .5, then a -1 must be entered for the power of 10. When the delta-f setting is 1 or 2, then a 0 must be entered.
- o Edit no. 28 must be an integar multiple that is greater then or equal edit no. 25

FAILURE TO OBSERVE THESE CONSTRAINTS WILL RESULT IN ERRONEOUS DATA!!!

1.2 The second phase consists of storing these edits on the system disc. Program edits are stored in a SET-UP and up to 100 set-ups can be stored on the system disc. After setting the edits for a particular T/C, the set-up is stored by pressing RESTART, MODE SHIFT and SAVE on the SYSTEM CONTROL panel. The system will ask what number to save the set-up into and the operator enters a number between 1 and 100. The program edits are now saved on the disc. Two set-ups are required for this part of system operation, one for the small wire T/C and another for the large wire T/C. One last note about set-ups, set-ups 1 thru 10 can be used for storage and processing. Set-ups 11 through 100 can only be used for storage.

DYNAMIC TEMPERATURE MEASUREMENT
THEORETICAL H(f) CRITERIA

PRINT PARAMETER VALUES?
'YES' FOR ALL, LINE # FOR SINGLE

11 T/C CODE (0=Pt/6%Rh, 1=Pt/30%Rh)?
CODE: 0

12 LENGTH OF SUPPORT WIRE (INCHES)?
<length> <pwr 10>
75 -3

13 LENGTH OF SMALLER WIRE (INCHES/2)?
<length> <pwr 10>
28 -3

14 DIAMETER OF SUPPORT WIRE (INCHES)?
< dmtr > <pwr 10>
15 -3

15 DIAMETER OF SMALLER WIRE (INCHES)?
< dmtr > <pwr 10>
795 -5

21 MEAN GAS TEMPERATURE (DEG-F)?
< temp > <pwr 10>
1700 0

22 MEAN GAS PRESSURE (PSIA)?
< pres > <pwr 10>
290 0

23 MACH NUMBER?
< numb > <pwr 10>
2251 -4

24 FUEL TO AIR RATIO (F/A)?
< rtio > <pwr 10 >
2 -2

PRINT THE REST OF THE PARAMETERS?

```
25  THEORETICAL DELTA-F SETTING?
--  < stts > <pwr 10>
        2       0

26  STARTING FREQUENCY?
    < freq > <pwr 10>
       10       0

27  ENDING FREQUENCY?
    < freq > <pwr 10>
       60       0

28  FREQUENCY INCREMENT?
    < incr > <pwr 10>
        2       0

29  LARGE OR SMALL WIRE T/C?
    (0=SMALL, 1=LARGE)        0

30  EVALUATE (LARGE WIRE/SMALL WIRE)
    T/C H(f)? (0=NO, 1=YES)         0

ENTER LINE # TO EDIT, NO TO STOP
```

1.3 The third phase consists of recalling a set-up for the large or small wire T/C and generate the transfer function of that T/C to the gas stream. This is accomplished by using the FINITE ELEMENT MODEL algorithm developed at P&WA. To recall a set-up, press RESTART, MODE SHIFT and RECALL on the SYSTEM CONTROL panel, and then enter the desired set-up number. The contents of the set-up on the disc remain unaltered. Press AUTO-SEQ to start generating the transfer function. Upon completion, the system will print ALL DONE! on the terminal.

1.4 The final phase consists of recalling the remaining set-up and generating its transfer function. At this point, edit no. 30 should have been set to 1 so that the transfer function of the large wire to small wire T/C can be evaluated.

2.0 MEASURED H(f) OF THE LARGE WIRE T/C TO THE SMALL WIRE T/C.

2.1 The first phase of this part consists of recalling the set-up for the small wire T/C. This must be done because if the set-up for the large wire T/C is in core, the system may generate a compensation spectrum for that T/C, RESULTING IN ERRONEOUS DATA!!

2.2 The second phase consists of setting the program edits for this part of the program. To access these edits, press RESTART, EDIT, MAP TIME and YES. The edits will be listed on the terminal. A copy of these edits appears on the next page. Although the edits are self explanatory, there are a few points worth mentioning:

- o The number entered for edit no. 8 must never be less than 70 because record no. 70 is the first record where raw time domain data is stored.
- o Amplifier gains are entered in VOLTS/VOLT.
- o Record levels and DC offsets are entered in VOLTS.

2.3 The last phase of this part consists of acquiring the data. Press MAP TIME on the SYSTEM CONTROL panel to enter this phase. The system will acquire data, scale it degrees farenheit, remove any DC offset if an offset was entered, and store it on the disc. A maximum of 122 records of data can be acquired. The system will evaluate a transfer function between the large and small wire T/C and determines if the measured H(f) curve crosses any of the theoretical H(f) curves. At this point one of two things happen, if the measured curve crosses any of the theoretical curves, the system will calculate an average vaule of GAMMA and display the result. Press CONTINUE on the CONTROL UNIT to generate the compensation spectrum based on the measured value of GAMMA. This process takes about 40 minutes and the system will print ALL DONE! upon completion. If the measured curve did not cross any of the theoreticals then a message to that effect is displayed on the terminal and processing stops.

```
DYNAMIC TEMPERATURE MEASUREMENT -
MEASURED [illegible] P) CRITERIA                PRINT THE REST OF THE PARAMETERS?

PRINT PARAMETER VALUES?
'YES' FOR ALL, LINE # FOR SINGLE

05  ADC DELTA-F SETTING?
    < stts > <pwr 10>
         2       0

06  ACQUIRE NEW DATA OR RE-PROCESS
    FROM THRU-PUT FILE? (0= NEW DATA,
    1=RE-PROCESS)         1
***************************************
*   IF ACQUIRING NEW DATA:
*
*   07  NUMBER OF THRU-PUT RECORDS
*        DESIRED?        64
****************************************
*   IF DATA IS RE-PROCESSED:
*
*   08  STARTING RECORD NUMBER? (70,
*        73, 76, ETC.)        70
*
*   09  NUMBER OF POWER SPECTRUM AVG'S
*         DESIRED?       120

13  NEW GAMMA AND NEW COMP. SPEC.?
    (0=NO, 1=YES)         1

14  OLD GAMMA BUT NEW COMP. SPEC.?
    (0=NO, 1=YES)         0

15  GAMMA VALUE:
    < valu > <pwr 10>
      6284      -8
```

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```
10   CHANNEL 'A' AMPLIFIER GAIN?        ENTER LINE # TO EDIT, NO TO STOP
     < gain > <pwr 10>
         50        0

11   CHANNEL 'A' RECORD LEVEL?
     < levl > <pwr 10>
          1        0

12   CHANNEL 'A' DC OFFSET?
     <offset> <pwr 10>
          0        0

20   CHANNEL 'B' AMPLIFIER GAIN?
     < gain > <pwr 10>
         50        0

21   CHANNEL 'B' RECORD LEVEL?
     < levl > <pwr 10>
          1        0

22   CHANNEL 'B' DC OFFSET
     <offset> <pwr 10>
          0        0

30   CHANNEL 'C' AMPLIFIER GAIN?
     < gain > <pwr 10>
         50        0

31   CHANNEL 'C' RECORD LEVEL?
     < levl > <pwr 10>
          1        0

32   CHANNEL 'C' DC OFFSET?
     <offset> <pwr 10>
          0        0
```

3.0 DATA PROCESSING AND PLOTTING

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3.1 Just as before the first phase is to set the edits for this part of system operation. Press RESTART, MODE SHIFT, EDIT, MAP TIME and YES on the SYSTEM CONTROL panel and the edits will be listed. Again a copy of these edits appears on the next page. Unlike the previous parts, this one is very deceiving. Great flexibility has been built into this part of the system. The following plot presentations are available:

o INSTANTANEOUS DATA
  - Small wire compensated or uncompensated, time or freq
  - Large wire compensated or uncompensated, time or freq

o AVERAGED DATA
  - Small wire compensated or uncompensated, freq only
  - Large wire uncompensated, freq only

o Radial TIME and FREQUENCY ranges are available.

3.2 After setting the system edits, press RESTART, MODE SHIFT, and MAP TIME to plot the data.

This concludes the OPERATION SECTION of this manual.

```
DYNAMIC TEMPERATURE MEASUREMENT -
PROCESSING AND PLOTTING CRITERIA

PRINT PARAMETER VALUES?
"YES" FOR ALL, LINE # FOR SINGLE

10  PLOT UNCOMPENSATED OR COMPENSATED
    DATA? (0=UNCOMP, 1=COMP)          0

20  PLOT AVERAGED OR INSTANTANEOUS
    DATA?  (0=AVG, 1=INST)          1
************************************
*   IF DATA IS INSTANTANEOUS:
*
*   21  STARTING RECORD NO.?      70
*
*   22  NO. OF RECORDS?      3
*
*   23  THRESHOLD TO CLEAR ON FREQ DA-
*       TA IN "dB"?      -60
*
*   24  NO. OF "SMOOTHS" TO PERFORM ON
*       TIME DATA?          0
*
*   25  PLOT TIME & FREQ DATA? (0=TIME
*       ONLY, 1=TIME & FREQ)        1
***************************************
*   IF DATA IS AVERAGED:
*
*   26  PLOT LARGE OR SMALL WIRE DATA?
*       (0=SMALL, 1=LARGE)          0

30  PLOT FULL OR PARTIAL TIME RANGE?
    (0=FULL, 1=PARTIAL)          1
****************************************
*   IF A PARTIAL RANGE IS DESIRED:
*
*   31 STARTING TIME?
*      < time > <pwr 10>
*        450      -3
*
*   32 ENDING TIME?
*      <time > <pwr 10>
*       475       -3

PRINT THE REST OF THE PARAMETERS?
```

```
35  PLOT FULL OR PARTIAL FREQ RANGE?
    (0=FULL, 1=PARTIAL)
**************************************
*   IF A PARTIAL RANGE IS DESIRED:
*
*   36  STARTING FREQ?
*       < freq > <pwr 10>
*          0       0
*
*   37  ENDING FREQ?
*       < freq > <pwr 10>
*        1000      0

40  ENTER PLOT CODE PER BELOW. (FREQ
    DATA ONLY)

    1=(RMS DEG-F)
    2=(RMS DEG-F)/SQRT-HZ
    3=(MEAN-SQR DEG-F)/HZ
    4=(MEAN-SQR DEG-F)/HZ - dB

51  TOP LINE HEADER?
              C/O OF 9 NODE RC CKT'S

52  BOTTOM LINE HEADER?
                  1-8-83  WWR

ENTER LINE # TO EDIT, NO TO STOP
```

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SECTION 2 - This section is divided into five parts listed below:

- o SYSTEM ROUTINES

  1) Keyboard Routines
  2) Furtran Routines
  3) Fortran Subroutines
  4) System Subroutines
  5) Keyboard Subroutines
  6) Text Buffers

- o SYSTEM ARRAYS

  1) Keyboard Program End Codes
  2) Data Block Qualifiers
  3) Thermocouple Wire and Gas Stream Parameter Equation Coefficients
  4) N.B.S. Temperature Equation Coefficients
  5) Input Array
  6) Thermocouple Wire Parameters
  7) Gas Stream Parameters
  8) Finite Element Coefficients - A,B,C,E,F&G
  9) Finite Element Coefficients - Z1 thru Z9
  10) Finite Element Solution - ZP(1) thru ZP(9)
  11) Scratch

- o DATA ASSIGNMENTS

  1) Variable Parameter Assignments
  2) File 1 Record Assignments

- o SYSTEM ALGORITHMS

  1) Thermocouple Wire Parameters
  2) Gas Stream Parameters
  3) Finite Element Solution Coefficients
  4) Finite Element Sollution

- o SYSTEM COMMAND FILES

1.0 SYSTEM ROUTINES - A diagram showing how these routines are broken down and linked together appears below.


```
                     ---------------
                     |   KEYBOARD    |
                     |   ROUTINES    |----------
                     |_______________|         |
                            |                  |
                            V                  V
                     ---------------      ---------
                     |   FORTRAN    |---->| TEXT    |
                     |   ROUTINES   |     | BUFFERS |
                     |______________|     |_________|
                            |
                            |
        --------------------|--------------------
        |                   |                   |
        |                   |                   |
        V                   V                   V
 --------------      --------------      --------------
 |  FORTRAN     |--->|  SYSTEM      |    |  KEYBOARD    |
 | SUBROUTINES  |    | SUBROUTINES  |    | SUBROUTINES  |
 |______________|    |______________|    |______________|
```

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1.1 Keyboard Routines

NO.	DEFINITION
11	Edit Routine - all edits
12	Finite Element solution H(f) Routine
13	Data Scaling Routine
17	Instantaneous Compensated Data Routine
18	Clear Routine
20	Edit Routine - all edits
21	Smoothing routines
22	Set-up Save Routine
23	Set-up Recall Routine
36	Graphics routines
39	Graphics routines
49	Clear Routine
50	Power Spectrum and Measured H(f) Routine
51	Data Acquisiton and Transcription Routine
59	Plot routines
100	Edit Routine - Theoretical H(f)
101	Edit Routine - Theoretical H(f)
102	Edit Routine - Measured H(f)
103	Edit Routine - Measured H(f)
104	Edit Routine - Measured H(f)
105	Edit Routine - Measured H(f)
106	Edit Routine - Processing & Plotting
107	Edit Routine - Processing & Plotting
108	Edit Routine - Processing & Plotting
109	Edit Routine - Processing & Plotting

```
 1 L     -11
 5 L    1000
 9 Y    1800   180    -2
15 L    1010
19 Y    5843   180D
24 Y    1802   180
29 #    1010    12     0
35 <
38 L    2000
42 Y    1800   180     2
48 L    2010
52 Y    5843   180D
57 Y    1801   180
62 #    2010    12     0
68 <
71 .
```

KYBD STACK 11

- o Enables/disables pushbutton switches on 5477A SYSTEM CONTROL UNIT by setting VP No. 180

  1) VP 180 = -2,(LABEL 1000), DISABLE
  2) VP 180 = 2,(LABEL 2000), ENABLE

1	L	-12						
5	L	1000						
9	Y	3020	1					
14	MS	38						
18	MS	18						
22	Y	5844	4					
27	Y	1805	20	1	1			
34	J	100	100					
39	Y	5838	10					
44	Y	5819	3	1				
50	Y	5819	1	1				
56	Y	5819	6	1				
62	MS	38	16					
67	MS	18						
71	Y	6020	199	2	201	56	0	-1
81	Y	6021						
85	Y	6022						
89	Y	6023						
93	MS	37						
97	MS	27						
101	MS	37	37D					
106	MS	27						
110	Y	6024	11	0	1			
117	Y	5838	10					

KYBD STACK 12

Finite element solution (F.E.S.) routine.

1) LABEL 1000 - F.E.S. for theoretical value of gamm

2) LABEL 2000 - F.E.S for measured value of gamma

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122	Y	5819	8	1				
128	Y	1805	198	1	4			
135	MS	38	19					
140	MS	18						
144	Y	6020	199	2	201	56	0	-1
154	Y	6026	11	10	30	50		
162	MS	38						
166	MS	18						
170	Y	5844	-4					
175	D							
178	L	2000						
182	MS	38	16					
187	MS	18						
191	Y	6020	199	2	201	56	0	-1
201	MS	31	7					
206	MS	11						
210	TP							
213	MS	11	1					
216	Y	6021						
222	Y	6022						
226	Y	6023						
230	Y	6027	262D	50	11	2	0	1
240	D							
243	Y	5838	10					

248	Y	5819	3	1				
254	Y	5819	1	1				
260	Y	5819	6	1				
266	MS	37						
270	MS	27						
274	MS	37	39D					
279	MS	27						
283	Y	6024	1	1	0			
290	MS	38	18					
295	MS	18						
299	Y	1823	1	1	0			
306	Y	6050	1	2048	1	2D	4D	
315	MS	31	9					
320	MS	21						
324	Y	3020						
328	D							
331	.							

1	L	-13			
5	L	100			
9	*	4			
13	F				
16	*-				
8		0	2		
24	L	200			
28	Y	1800	2	223D	
34	Y	1803	3	224D	-1
41	Y	1827	3	10	3D
48	Y	1805	281	5	6
55	L	999			
59	Y	5814			
63	Y	5838	50		
68	Y	5819	6	1	
74	D				
77	J	999	-1		
82	Y	1805	281	4	3
89	J	210			
93	TL				
96	J	300	-1		
101	Y	1805	281	3	2
108	J	210			
112	J	300	-1		

KYBD STACK 13

- o Scales Frequency Data based on the value of VP No. 281 (Plot Code)
- o Will print an error message if an illegal code is entered.

```
117 Y    1805     281      2        3
124 J     210
128 Y    3201
132 J     300      -1
137 Y    1805     281      1        2
144 Y    3201
148 J     300      -1
153 J     999      -1
158 L     210
--------------------------
162 :       0    3376   |
                        |
167 *       0    1000   |
                        |------> Wideband correction factor for P301
172 :       0      2D   |        Window (3.376*delta-f)
                        |
177 *       0      3D   |
------------------------|
182 <
185 L     300
189 D
192 J     200      36
197 <
200 .
```

```
  1 L     -17
  5 L     100
  9 Y    3020
 13 Y    1800      0    266D
 19 Y    1802      1    267D
 25 Y    6007      0
 30 X>      4
 34 :
 37 H1
 40 X>      5
 44 MS     31      9
 49 MS     11      6
 54 TR      6
 58 CL      0
 62 CL      1
 66 CL      2
 70 CL      3
 74 L     200
 78 MS     31      0D
 83 MS     11      2
 88 Y    1601      0      0D      3
 95 MS     31      0D
100 MS     11      3
105 X<      2
```

KYBD STACK 17

- o Routine to compensate instantaneous time domain data.
- o Routine compensates data for distortion caused by:
  1) Dividing by the compensation spectrum
  2) Performing and inverse Fourier X-Form

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```
109 J      210
113 Y     1805       1      1        11         1
121 CL       0       0    256
127 CL       0    1796   2047
133 Y     1805     269      1         3
140 L      205
144 J      100      21
149 #      205    269D      0
155 D
158 J      100      36
163 Y     1805     270      1         1
170 J      100      13
175 J      300      -1
180 _        0     512
185 CL       0    1024   2047
191 X>       1
195 X<       2
199 _        0    1024
204 CL       0    1024   2047
210 CL       3    1024   2047
216 _        3    1024
221 A+       3
225 J      210
229 _        0    1536
```

```
234 CL      0       0  1023
240 A+      1
244 Y    1805     269     1      3
251 L     220
255 J     100      21
260 $     220    269D     0
266 D
269 J     100      36
274 Y    1805     270     1      1
281 J     100      13
286 $     200      1D     0
292 J     300      -1
297 L     210
301 *       5
305 F
308 J     100      18
313 :       6
317 F
320 :       5
324 <
327 L     300
331 Y    5814
335 Y    5838      10
340 Y    5819       8     1
346 D
349 J     300      -1
354 .
```

KYBD STACK 16

o Routine to clear all channels below user input threshold.

```
  1 L     -18
  5 L     100
  9 X>      7
 13 TP      7
 17 Y    1800      4      0
 23 Y    1800   3000      0
 29 L     200
 33 Y    1821   3001      7     4D
 40 Y    1805   2902  2900D      2
 47 Y    1800   2900  2902D
 53 Y    1800   2901  2903D
 59 Y    1801      4     4D      5
 66 $     200    205      0
 72 Y    1800      4      0
 78 Y    1804   2000   268D     20
 85 Y    1827   2000     10  2000D
 92 Y    1803   2000  2000D  2900D
 99 L     300
103 Y    1821   3001      7     4D
110 Y    1805   2000  2902D      1
117 CL      0     4D     4D
123 Y    1801      4     4D
129 $     300   1024      0
135 <
138 .
```

KYBD STACK 20

o Edit routine.

o Controls listing and input to system edits.


```
  1 L     -20
  5 L    1500
  9 L    2500
 13 J    1000      11
 18 MS     38       3
 23 MS     16
 27 Y    3020
 31 Y    5838       8
 36 Y    5819      90       1
 42 L    1505
 46 Y    1800     180    1809
 52 Y    1806      53
 57 Y    1805      53       1        1
 64 J    1504      -1
 69 J    1520      -1
 74 L    1504
 78 Y    5838     54D
 83 Y    1805      53       2        4
 90 J     53D     55D
 95 Y    5838       8
100 Y    5819      93       1
106 J    1505      -1
111 J       0     55D
116 L    1520
```

120	Y	1800	19	0	
126	Y	5838	8		
131	Y	5819	92	1	
137	L	1525			
141	Y	1808	53		
146	Y	1805	53	0	1
153	J	1526	-1		
158	J	3000	-1		
163	L	1526			
167	Y	1805	53	1	1
174	J	1530	-1		
179	MS	37			
183	MS	27			
187	<				
190	L	1[illegible]30			
194	Y	1800	19	1	
200	Y	1800	180	1808	
206	Y	5838	54D		
211	J	53D	55D		
216	MS	37			
220	MS	27			
224	Y	5838	8		
229	Y	5819	93	1	
235	J	1525	-1		
240	L	3000			
244	Y	5819	97	1	
250	J	1525	-1		
255	.				

1	L	-21			
5	L	100			
9	CL	1			
13	Y	1800	5	0	
19	Y	1800	6	1	
25	Y	1800	7	2	
31	Y	1800	2000	5	-1
38	Y	1800	2001	25	-2
45	Y	1823	10	0	0
52	Y	1823	10	1	1
59	L	200			
63	Y	1821	2002	0	5D
70	Y	1821	2003	0	6D
77	Y	1821	2004	0	7D
84	Y	1803	2005	2002D	2001D
91	Y	1803	2006	2003D	2000D
98	Y	1803	2007	2004D	2001D
105	Y	1801	2008	2005D	2006D
112	Y	1801	2008	2008D	20007D
119	Y	1822	2008	1	6D
126	Y	1801	5	5D	
132	Y	1801	6	6D	
138	Y	1801	7	7D	
144	#	200	2046	0	

KYBD STACK 21

- o Smoothing routine
- o Two routines available:

  1) Label 100:

     f(x)=.25*f(x-1)+ .5*f(x)+.25*f(x+1)

  2) Label 300:

     $$f(x)= \frac{f(x)+f(x+1)}{2}$$

     where x= the channel number.

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150	X	1			
154	<				
157	L	300			
161	CL	1			
165	Y	1800	5	0	
171	Y	1800	6	1	
177	Y	1823	10	0	0
184	Y	1823	10	1	1
191	L	400			
195	Y	1821	2000	0	5D
202	Y	1821	2001	0	6D
209	Y	1801	2000	2000D	2001D
216	Y	1804	2000	2000D	2
223	Y	1822	2000	1	5D
230	Y	1801	5	5D	
236	Y	1801	6	6D	
242	#	400	2046	0	
248	X	1			
252	<				
255	.				

KYBD STACK 22

- Set-up save routine.
- Set-up is stored into COMMON area designated by VP # 480

1	L	-22				
5	L	2000				
9	MS	38	3			
14	MS	18				
18	Y	5844	20			
23	Y	5844	11			
28	Y	5842	2			
33	Y	5814				
37	Y	5838	9			
42	L	1003				
46	Y	5819	75	1		
52	Y	5819	64	1		
58	Y	1808	480			
63	Y	1805	480	1	1	1
71	J	1003	-1			
76	Y	1805	480	100	1	-1
84	J	1003	-1			
89	MS	37				
93	MS	27				
97	MS	37	480D			
102	MS	17				
106	Y	5506	1	74D	1	
113	Y	5506	1	187D	2	
120	MS	37				

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124	MS	17			
128	Y	5506	0	74	1
135	Y	5506	0	187	2
142	Y	1800	39	480D	
146	MS	37	480D		
153	MS	27			
157	MS	37			
161	MS	17			
165	Y	5844	-20		
170	Y	5844	-11		
175	L	9999			
179	D				
182	J	9999	-1		
187	.				

1	L	-23				
5	L	2000				
9	Y	5844	20			
14	Y	5844	12			
19	Y	5814				
23	Y	5838	9			
28	L	1003				
32	Y	5819	74	1		
38	Y	5819	64	1		
44	Y	1808	480			
49	Y	1805	480	1	1	1
57	J	1003	-1			
62	Y	1805	480	100	1	-1
70	J	1003	-1			
75	MS	37	480D			
80	MS	17				
84	Y	1800	83	32767		
90	Y	1800	84	0		
96	Y	1800	123	0		
102	MS	37				
106	MS	27				
110	Y	5844	-20			
115	Y	5844	-12			
120	L	9999				
124	D					
127	J	9999	-1			
132	.					

KYBD STACK 23

- o Set-up recall routine
- o Routine recalls COMMON area designated by VP # 480.

KYBD STACK 36

o Graphics routine.

```
  1 L     -36
  5 L     100
  9 MS     38      4
 14 MS     18
 18 Y    5838     50
 23 Y    5821      6
 28 Y    5804
 32 Y    5805
 36 Y    5809
 40 Y    5814
 44 Y    1805    271      1      2
 51 Y    5810    274D   275D   272D   273D
 59 J     110     -1
 64 Y    5810
 68 L     110
 72 Y    5864
 77 Y    5816      1
 82 Y    5615
 86 Y    5817      5
 91 J     100     39
 96 D
 99 <
102 L     200
106 MS     38      4
```

111	MS	18				
115	MS	5838	50			
120	Y	5821	6			
125	Y	5804				
129	Y	5803				
133	Y	5809				
137	Y	5814				
141	Y	1605	276	1	2	
148	Y	5810	279D	280D	277D	278D
156	J	210	-1			
161	Y	5810				
165	L	210				
169	Y	1805	281	4	3	
176	Y	5864	-1			
181	Y	5816	3			
186	J	220	-1			
191	Y	5864	1			
196	Y	5816	5			
201	L	220				
205	Y	5815				
209	Y	5817	281D			
214	J	100	39			
219	D					
222	[illegible]					
225	.					

```
 3 L    -39
 5 L    100
 9 Y    5838     35
14 Y    5808    975    350
20 Y    1800      1     39D
26 Y    5819     1D
31 Y    5808    950    350
37 Y    1801      1     39D     10
44 Y    5819     1D
49 Y    1801      1     39D     35
56 Y    5838     1D
61 <
64 .
```

KYBD STACK 39
----

o Graphics routine.

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KYBD STACK 49

1	L	-49			
5	L	100			
9	Y	1800	2000	223D	224D
16	Y	1800	2001	219D	220D
23	Y	1800	2002	245D	246D
30	Y	1804	2001	2001D	2000D
37	Y	1804	2002	2002D	2000D
44	Y	1800	1	2001D	
50	Y	1800	2	2002D	
56	Y	1802	1	1D	
62	Y	1801	2	2D	
68	<				
71	.				

o Routine calculates channel limits to clear on measured Transfer Function.

1	L	-50		
5	L	200		
9	Y	1800	0	0
15	L	1		
19	CL	0D		
23	Y	1801	0	0D
29	#	1	14	0
35	MS	38	4	
40	MS	18		
44	Y	6007	7	
49	MS	31	14D	
54	L	20		
58	MS	11		
62	*	7		
66	X>	1		
70	MS	11		
74	*	7		
78	X>	2		
82	MS	11		
86	F	1		
90	F	2		
94	SP	1	2	2
100	#	20	13D	0
106	MS	31	3	

KYBD STACK 50
----

o Routine performs a tri-spectrum ensemble averag[e] and evaluates transfer function.

o It then clears the data block according to the channel limits calculate[d] in stack 49.

o Finally it jumps to stac[k] 12 to determine the mea-sured value of gamma.

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111	Y	1806	0	3	
117	J	100	49		
122	L	30			
126	*	0D	2		
131	MS	21	0D		
136	CL	0D	0	2	
142	CL	0D	0	1D	
148	CL	0D	2D	2047	
154	Y	1801	0	0D	
160	*	30	4	0	
166	CH	1	?	2	
172	MS	21	1		
177	MS	21	2		
182	Y	1805	262	1	1
189	J	2000	12		
194	Y	1803	263	1	1
201	J	2000	12		
206	Y	5844	-6		
211	D				
214	.				

1	L	-51			
5	L	1000			
9	Y	5844 .	6		
14	Y	1805	20	1	1
21	J	100	102		
26	Y	1805	283	1	3
33	Y	1800	13	260D	
39	Y	1800	14	261D	
45	J	200 ,	50		
50	Y	1800	64	259D	
56	MS	38	3		
61	MS	16			
65	MS	32	1		
70	Y	100	0	1	
76	Y	100	0	2	
82	Y	100	0	3	
88	Y	5814			
92	Y	5838	10		
97	Y	5819	2	1	
103	D				
106	AS	22	3	[illegible]	
112	Y	5819	11	[illegible]	
118	Y	5819	1	1	
124	MS	22	1		

KYBD STACK 51

o This routine acquires data to the thru-put device (mag tape), transcribes it to the disc a linearizes the data.

129	MS	31	70					
134	MS	72						
138	MS	38	17					
143	MS	18						
147	Y	6020	199	2	201	56	0	-1
157	MS	31	70					
162	MS	11						
166	Y	1823	1	0	0			
173	Y	5838	10					
178	Y	5819	3	1				
184	Y	6029	1D	84D	70	3	2D	4D
194	Y	1800	13	159D				
200	Y	1800	14	70				
206	J	200	50					
211	D							
214	.							

KYBD STACK 59

- This routine determines program branching to plot compensated or uncompensated, time or frequency domain data.

1	L	-59			
5	L	2000			
9	Y	5844	6		
14	Y	5844	20		
19	Y	3020			
23	MS	38			
27	MS	18			
31	MS	37			
35	MS	17			
39	Y	1805	20	1	1
46	J	100	104		
51	J	9999			
55	L	2005			
59	Y	3010			
63	Y				
66	J	2005			
70	L	9999			
74	Y	5842	2		
79	Y	5844			
84	Y	5844	20		
89	Y	3010			
93	J	9998			
97	Y	3010			
101	MS	37			

105	MS	27			
109	Y	5844	-6		
114	Y	5844	-20		
119	Y	3020			
123	<				
126	L	9998			
130	Y	1805	265	1	1
137	J	200	-1		
142	Y	1805	282	1	3
149	MS	31	4		
154	MS	11			
158	J	150	-1		
163	MS	31	9		
168	MS	11			
172	TR				
175	*-				
178	X>	1			
182	MS	31	3		
187	MS	11			
191	Y	1805	264	1	1
196	:	1			
202	L	150			
206	J	200	13		
211	L	999			

215	D				
218	J	999	-1		
223	L	200			
227	Y	1805	264	1	2
234	J	100	17		
239	J	999	-1		
244	Y	1800	0	266D	
250	Y	6007	4		
255	L	300			
259	MS	31	0D		
264	MS	11			
268	D				
271	J	100	36		
276	Y	1805	270	1	1
283	J	100	13		
288	Y	1801	0	0D	3
295	#	300	267D	0	
301	Y	5814			
305	Y	5836	10		
310	Y	5819	6	1	
316	J	999	-1		
321	.				

```
  1 L    -100
  5 L     100
  9 Y    5844      3
 14 Y    1800     20        0
 20 MS     37
 24 MS     27
 28 Y    1800     54       51
 34 Y    1800     55      100
 40 L    1505
 44 Y    5838     51
 49 Y    5814
 53 Y    5819     99        1
 59 J    1500     20
 64 Y    1805     19        1        1
 71 J    1505     -1
 76 L    1510
 80 J    2000     11
 85 Y    5844     -3
 90 Y    5844     -4
 95 Y    5844    -20
100 L    1511
104 D
107 J    1511
111 L       1
```

KYBD STACK 100

- Edit routine theoretical H(f)

115	Y	1805	180	1809	2
122	Y	5819	1	1	
128	<				
131	J	1500	110		
136	Y	1800	54	51	
142	Y	1800	55	100	
148	Y	5838	51		
153	Y	5819	99	1	
159	<				
162	L	0			
166	J	11	1	1	
172	J	12	1	1	
178	J	13	1	1	
184	J	14	1	1	
190	J	15	1	1	
196	J	21	1	1	
202	J	22	1	1	
208	J	23	1	1	
214	J	24	1	1	
220	J	100	1	1	
226	Y	1805	480	1	2
233	Y	5814			
237	J	10	-1		
242	<				

245	L	10		
249	J	25	1	1
255	J	26	1	1
261	J	27	1	1
267	J	28	1	1
273	J	29	1	1
279	J	30	1	1
285	<			
288	L	11		
292	L	12		
296	L	13		
300	L	14		
304	L	15		
308	L	20		
312	L	21		
316	L	22		
320	L	23		
324	L	24		
328	L	25		
332	L	26		
336	L	27		
340	L	28		
344	L	29		
348	L	30		
352	J	530	1	1
358	<			
361	.			

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```
  1 L    -101
  5 L      11
  9 Y    5819     11      1
 15 Y     180D    199
 20 <
 23 L      12
 27 Y    5819     12      1
 33 Y     180D    203     204
 39 <
 42 L      13
 46 Y    5819     13      1
 52 Y     180D    205     206
 58 <
 61 L      14
 65 Y    5819     14      1
 71 Y     180D    207     208
 77 <
 80 L      15
 84 Y    5819     15      1
 90 Y     180D    209     210
 96 <
 99 L      21
103 Y    5819      21     1
109 Y     180D     211    212
```

KYBD STACK 101

o Edit routine - theoreti
  H(f)

115	<			
118	L	22		
122	Y	5819	22	1
128	Y	180D	213	214
134	<			
137	L	23		
141	Y	5819	23	1
147	Y	180D	215	216
153	<			
156	L	24		
160	Y	5819	24	1
166	Y	180D	201	202
172	<			
175	L	25		
179	Y	5819	25	1
185	Y	180D	217	216
191	<			
194	L	26		
198	Y	5819	26	1
204	Y	180D	219	220
210	<			
213	L	27		
217	Y	5819	27	1
223	Y	189D	245	246

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229	<			
232	L	28		
236	Y	5819	28	1
242	Y	180D	221	222
248	<			
251	L	29		
255	Y	5838	50	
260	Y	5819	29	1
266	Y	180D	200	
271	Y	5838	51	
276	<			
279	L	30		
283	Y	5838	50	
288	Y	5819	30	1
294	Y	180D	198	
299	Y	5838	1	
304	<			
307	L	100		
311	Y	5838	8	
316	Y	5819	94	1
322	Y	5838	51	
327	Y	1808	480	
332	<			
335	.			

KYBD STACK 102

- Edit routine - measured H(f)

1	L	-102			
5	L	100			
9	Y	5844	3		
14	Y	1800	20	0	
20	MS	37			
24	MS	27			
28	Y	1800	54	52	
34	Y	1800	55	103	
40	L	1505			
44	Y	5838	52		
49	Y	5814			
53	Y	5819	99	1	
59	J	1500	20		
64	Y	1805	19	1	1
71	J	1505	-1		
76	L	1510			
80	J	2000	11		
85	Y	5844	-3		
90	Y	5844	-6		
95	Y	5844	-20		
100	L	1511			
104	D				
107	J	1511			
111	L	1			

115	Y	1803	180	1809	2
122	Y	5819	1	1	
128	<				
131	Y	1800	54	52	
137	Y	1800	55	103	
143	Y	5819	99	1	
149	<				
152	L	0			
156	J	0	103		
161	<				
164	.				

KYBD STACK 103

o Edit routire - measured H(f)

1	L	-103			
5	L	0			
9	J	5	1	1	
15	J	6	1	1	
21	J	7	1	1	
27	J	8	1	1	
33	J	9	1	1	
39	J	13	1	1	
45	J	14	1	1	
51	J	15	1	1	
57	J	100	2	1	
63	Y	1805	480	1	2
70	Y	5814			
74	J	99	-1		
79	[illegible]				
82	L	99			
86	Y	5838	55		
91	J	10	2	1	
97	J	11	2	1	
103	J	12	2	1	
109	J	20	2	1	
115	J	21	2	1	
121	J	22	2	1	
127	J	30	2	1	

133	J	31	2	1
139	J	32	2	1
145	<			
148	L	5		
152	L	6		
156	L	7		
160	L	8		
164	L	9		
168	L	13		
172	L	14		
176	L	15		
180	Y	5838	52	
185	J	53D	104	
190	<			
193	L	10		
197	L	11		
201	L	12		
205	L	20		
209	L	21		
213	L	22		
217	L	30		
221	L	31		
225	L	32		
229	Y	5838	55	
234	J	53D	105	
239	<			
242	.			

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KYBD STACK 104

o Edit routine - measured H(f)

1	L	-104		
5	L	5		
9	Y	5819	5	1
15	Y	180D	223	224
21	<			
24	L	6		
28	Y	5819	6	1
34	Y	180D	283	
39	<			
42	L	7		
46	Y	5819	7	1
52	Y	180D	259	
57	<			
60	L	8		
64	Y	5819	8	1
70	Y	180D	261	
75	<			
78	L	9		
82	Y	5819	9	1
88	Y	180D	260	
93	<			
96	L	13		
100	Y	5819	13	1
106	Y	180D	262	

```
111 <

114 L      14

118 Y    5819       14        1

124 Y     180D      263

129 <

132 L      15

136 Y    5819       15        1

142 Y     180D      243      244

148 <

151 .
```

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```
  1 L   -105
  5 L     10
  9 Y   5819     10      1
 15 Y    180D   225    226
 21 <
 24 L     11
 28 Y   5819     11      1
 34 Y    180D   227    228
 40 <
 43 L     12
 47 Y   5819     12      1
 53 Y    180D   229    230
 59 <
 62 L     20
 66 Y   5819     20      1
 72 Y    180D   231    232
 78 <
 81 L     21
 85 Y   5819     21      1
 91 Y    180D   233    234
 97 <
100 L     22
104 Y   5819     22      1
110 Y    180D   235    236
```

KYBD STACK 105

- o Edit routine - measured H(f)

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```
116 <
119 L      30
123 Y    5819      30       1
129 Y     180D     237     238
135 <
138 L      31
142 Y    5819      31       1
146 Y     180D     239     240
154 <
157 L      32
161 Y    5819      32       1
167 Y     180D     241     242
173 <
176 L     100
180 Y    5838       8
185 Y    5819      94       1
191 Y    5838      52
196 Y    1808     460
201 <
204 .
```

KYBD STACK 106

o Edit routine - processing and plotting.

1	L	-106			
5	L	100			
9	Y	5844	6		
14	Y	1800	20	0	
20	MS	37			
24	MS	27			
28	Y	1800	54	53	
34	Y	1800	55	107	
40	L	1505			
44	Y	5838	53		
49	Y	5814			
53	Y	5819	99	1	
59	J	1500	20		
64	Y	1805	19	1	1
71	J	1505	-1		
76	L	1510			
80	J	2000	11		
85	Y	5844	-3		
90	Y	5844	-6		
95	Y	5844	-20		
100	L	1511			
104	D				
107	J	1511			
111	L	1			

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115	Y	1805	180	1809	2
122	Y	5819	1	1	
128	<				
131	Y	1800	54	52	
137	Y	1800	55	107	
143	Y	5819	99	1	
149	<				
152	L	0			
156	J	0	107		
161	<				
164	.				

KYBD STACK 107

o Edit routine - processing and plotting.

1	L	-107			
5	L	0			
9	J	10	1	1	
15	J	20	1	1	
21	J	21	1	1	
27	J	22	1	1	
33	J	23	1	1	
39	J	24	1	1	
45	J	25	1	1	
51	J	26	1	1	
57	J	30	1	1	
63	J	31	1	1	
69	J	32	1	1	
75	J	100	2	1	
81	Y	1805	480	1	2
88	Y	5814			
92	J	999	-1		
97	<				
100	L	999			
104	J	35	2	1	
110	J	36	2	1	
116	J	37	2	1	
122	J	40	2	1	
128	J	41	2	1	

134	J	51	2	1
140	J	52	2	1
146	<			
149	L	10		
153	L	20		
157	L	21		
161	L	22		
165	L	23		
169	L	24		
173	L	25		
177	L	26		
181	L	30		
185	L	31		
189	L	32		
193	J	53D	108	
198	<			
201	L	35		
205	L	36		
209	L	37		
213	L	40		
217	L	41		
221	L	51		
225	L	52		
229	J	53D	109	
234	<			
237	.			

```
  1 L   -108
  5 L     10
  9 Y   5819      10      1
 15 Y    180D     264
 20 <
 23 L     20
 27 Y   5819      20      1
 33 Y    180D     265
 38 <
 41 L     21
 45 Y   5819      21      1
 51 Y    180D     266
 56 <
 59 L     22
 63 Y   5819      22      1
 69 Y    180D     267
 74 <
 77 L     23
 81 Y   5819      23      1
 87 Y    180D     268
 92 <
 95 L     24
 99 Y   5819      24      1
105 Y    180D     269
```

KYBD STACK 108
----

o Edit routine - processing and plotting.

```
110 <
113 L     25
117 Y   5819      25      1
123 Y     180D    270
128 <
131 L     26
135 Y   5819      26      1
141 Y     180D    282
146 <
149 L     30
153 Y   5819      30      1
159 Y     180D    271
164 <
167 L     31
171 Y   5819      31      1
177 Y     180D    272     273
183 <
186 L     32
190 Y   5819      32      1
196 Y     180D    274     275
202 <
205 .
```

1	L	-109		
5	L	35		
9	Y	5838	54	
14	Y	5819	35	1
20	Y	180D	276	
25	<			
28	L	36		
32	Y	5838	54	
37	Y	5819	36	1
43	Y	180D	277	278
49	<			
52	L	37		
56	Y	5838	54	
61	Y	5819	37	1
67	Y	180D	279	280
73	<			
76	L	40		
80	Y	5838	54	
85	Y	5819	40	1
91	Y	180D	281	
96	<			
99	L	41		
103	Y	5838	54	
108	Y	5819	41	1

KYBD STACK 109

- Edit routine - processing and plotting.

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114	<				
117	L	51			
121	Y	1800	1	39D	
127	Y	5838	34		
132	Y	5819	13	1	
138	Y	5838	35		
143	Y	1805	180	1809	2
150	Y	5819	1D	1	
156	<				
159	Y	5803	35	1D	
165	<				
168	L	52			
172	Y	1801	1	39D	10
179	Y	5838	34		
184	Y	5819	14	1	
190	Y	5838	35		
195	Y	1803	180	1809	2
202	Y	5819	1D	1	
208	<				
211	Y	5803	35	1D	
217	<				
220	L	100			
224	Y	5838	8		
229	Y	5819	94	1	
235	Y	5838	53		
240	Y	1808	480		
245	<				
248	.				

PROGRAM	DEFINITION
Y 6020	Inputs user edits to array 'XIN'
Y 6021	Inputs T/C & gas stream Equation coef's to array 'C'
Y 6022	Evaluates T/C wire parameters
Y 6023	Evaluates gas stream parameters
Y 6024	Evaluates H(f) - (T/C wire/gas stream)
Y 6026	Evaluates H(f) - (large wire/small wire)
Y 6027	Evaluates measured value of GAMMA
Y 6028	Converts millivolts to degrees farenheit
Y 6029	Modified version of 'Y 6028' for 'HOST'
Y 6050	Connects points in the data block

```
FTN4,L
      SUBROUTINE Y6020(I,JBUF)
C
C Y 6020 N1 N2 N3 N4 N5 N6 PASSES VARIABLE PARAMETER VALUES
C TO THE FORTRAN USER BUFFER BY USING A DOUBLE PRECISION
C DATA BLOCK AS THE INTERMEDIATE BUFFER.  WHAT THIS PRO-
C GRAM DOES IS REMOVE THE 6 'END CODE' LIMITATION BY STORING
C THESE VARIABLE PARAMETER VALUES IN AN ARRAY CALLED 'XIN' AND
C PASSING THIS ARRAY THRU COMMON. A MAXIMUM OF 60 VARIABLE
C PARAMETERS CAN BE PASSED.
C
C REAL VARIABLES USE 2 INTEGAR VARIABLE PARAMETERS FOR EACH
C VARIABLE. THAT IS, THE REAL VARAIBLE MUST BE STORED IN TWO
C INTEGAR VARIABLE PARAMETERS, ONE FOR THE MANTISSA AND ONE
C FOR THE POWER OF 10.
C
C INTEGAR VARIABLES USE ONE INTEGAR VARIABLE PARAMETER PER
C VARIABLE.
C
C THE PROGRAM ACCEPTS ANY COMBINATION OF VARIABLES, THAT IS,
C REAL ONLY, INTEGAR ONLY OR BOTH BY SETTING A FLAG.
C
C Y 6020 IS FORMATTED PER BELOW:
C
C N1 = INTEGAR VARIABLE PARAMETER STARTING VP #
C N2 = NUMBER OF INTEGAR VARIABLES
C N3 = REAL VARIABLE STARTING VP#
C N4 = NUMBER OF REAL VARIABLES
C N5 = BLOCK # TO USE AS INTERMEDIATE BUFFER
C N6 = FLAG - -1 = BOTH, 0 = REAL ONLY, 1 = INTEGAR ONLY
C
C PROGRAM EXECUTION PRE-REQUISITES: NONE
C
C NOTE: THE 'COMMON' VARIABLES AND ARRAYS REFERENCED IN THIS
C PROGRAM WILL CHANGE WHEN USED IN DIFFERENT OVERLAYS. HOWEVER,
C THE REMAINING SOFTWARE WILL REMAIN UNCHANGED.
C
C PAUL T. PURPURA - 07/19/82
C
      DIMENSION JBUF(6),MQUAL(5)
      COMMON XIN(30),A(2),K(2),C(45),TC(4),GS(10),TP(10)
      COMMON FRQ
      N1=JBUF(1)
      N2=JBUF(2)
      N3=JBUF(3)
      N4=JBUF(4)
      N5=JBUF(5)
      N6=JBUF(6)
      MQUAL(1)=64
      MQUAL(2)=12
      MQUAL(3)=32767
      MQUAL(4)=42
      MQUAL(5)=0
      TEMP=0.
      ITEMP=0.
      [illegible]EMP=0
      DO 10 IZ=1,30
      XIN(IZ)=0.
10    CONTINUE
```

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```
      CALL KYBD(041514B,N5)
      CALL PUTQ(N5,MQUAL)
      IF(N6) 30,40,30
30    IVP=N1
      DO 35 ICTI=1,N2
      CALL KYBD(054440B,1822,IVP,N5,1)
      CALL GET(N5,1,TEMP,GUNK)
      XIN(ICTI)=TEMP
      IVP=IVP+1
35    CONTINUE
      IF(N6) 40,40,99
40    IVP=N3
      N4=N4/2
      DO 45 ICTR=ICTI,N4
      CALL KYBD(054440B,1822,IVP,N5,1)
      CALL GET(N5,1,TEMP,GUNK)
      CALL KYBD(054440B,1822,IVP+1,N5,1)
      CALL GET(N5,1,TTEMP,BUNK)
      XIN(ICTR)=TEMP*(10.**TTEMP)
      IVP=IVP+2
45    CONTINUE
99    CALL KYBD(041123B,2048)
      RETURN
      END
      END$
```

```
FTN4
      SUBROUTINE Y6021(I,JBUF)
C
C Y 6021 SETS UP AN ARRAY CALLED 'C' WHICH CONTAINS THE CO-
C EFFIEIENTS FOR THE THERMOCOUPLE WIRE (Pt/6%Rh & Pt/30%Rh)
C AND GAS STREAM EQUATIONS AND PASSES THEM THROUGH COMMON
C TO 'Y 6023' AND 'Y 6024'.
C
C PROGRAM EXECUTION PRE-REQUISITES: Y 6020
C
C PAUL T. PURPURA - 07/19/82
C
      COMMON XIN(30),A(2),K(2),C(45),TC(4),GS(10),TP(10)
      COMMON FRQ
      DO 10 IZ=1,45
      C(IZ)=0.
10    CONTINUE
      C(1)=3.8926*10.**(1)
      C(2)=1.8746*10.**(-3)
      C(3)=2.1226*10.**(-6)
      C(4)=-2.7926*10.**(-10)
      C(5)=3.2070*10.**(-2)
      C(6)=4.8648*10.**(-6)
      C(7)=-3.8201*10.**(-13)
      C(8)=-1.0204*10.**(-13)
      C(9)=2.6336*10.**(-4)
      C(10)=-2.4880*10.**(-8)
      C(11)=1.4592*10.**(-11)
      C(12)=-1.587*10.**(-15)
      C(13)=3.0239*10.**(1)
      C(14)=1.0526*10.**(-2)
      C(15)=-1.8102*10.**(-6)
      C(16)=1.1490*10.**(-10)
      C(17)=3.9228*10.**(-2)
      C(18)=4.8327*10.**(-6)
      C(19)=3.3457*10.**(-9)
      C(20)=-1.7809*10.**(-12)
      C(21)=2.2544*10.**(-16)
      C(22)=1.9764*10.**(-4)
      C(23)=3.2121*10.**(-8)
      C(24)=-1.5888*10.**(-11)
      C(25)=2.9097*10.**(-15)
      C(26)=1.8998*10.**(-5)
      C(27)=1.4023*10.**(-2)
      C(28)=2.7857*10.**(-5)
      C(29)=2.4733*10.**(-1)
      C(30)=-3.4000*10.**(-5)
      C(31)=1.3750
      C(32)=1.9429*10.**(-5)
      C(33)=1.4041*10.**(-2)
      C(34)=2.7400*10.**(-5)
      C(35)=2.4413*10.**(-1)
      C(36)=-3.4500*10.**(-5)
      C(37)=1.3690
      C(38)=1.9859*10.**(-5)
      C(39)=1.4062*10.**(-2)
      C(40)=2.7091*10.**(-5)
```

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```
C(41)=2.3937*10.**(-1)
C(42)=-7 5000*10.**(-5)
C(43)=1. 530
C(44)=9.0420*10.**(-9)
C(45)=1.6100*10.**(-5)
RETURN
END
END$
```

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```
FTN4,L
      SUBROUTINE Y6022(I,JBUF)
C
C Y 6022 CALCULATES THE FOLLOWING THERMOCOUPLE WIRE PARA-
C METERS AND OUTPUTS THEM INTO THE ARRAY 'TC' WHICH IS
C PASSED THROUGH COMMON.
C
C 1. DENSITY (RHO)
C 2. THERMAL CONDUCTIVITY (XK)
C 3. SPECIFIC HEAT (CP)
C 4. THERMAL DIFFUSITY (AL)
C
C THE VALUE OF 'XIN(8)' DETERMINES WHICH SET OF EQUATIONS
C WILL BE USED.
C
C 1. WHEN 'XIN(8)' IS '0' THEN EQUATIONS FOR Pt/6%Rh TC'S
C    WILL BE USED.
C
C 2. WHEN 'XIN(8)' IS '1' THEN EQUATIONS FOR Pt/30%Rh TC'S
C      WILL BE USED.
C
C PROGRAM EXECUTION PREQUISITES: Y 6020,Y 6021
C
C PAUL T. PURPURA - 07/19/82
C
      COMMON XIN(30),A(2),K(2),C(45),TC(4),GS(10),TP(10)
      COMMON FRQ
      DO 10 IZ=1,10
      TC(IZ)=0.
10    CONTINUE
      T=XIN(8)
      IF(XIN(1)) 99,20,30
20    RHO=1278.7
      XK=C(1)+C(2)*T+C(3)*T**2+C(4)*T**3
      CP=C(5)+C(6)*T+C(7)*T**2+C(8)*T**3
      AL=C(9)+C(10)*T+C(11)*T**2+C(12)*T**3
      GO TO 40
30    RHO=1092.1
      XK=C(13)+C(14)*T+C(15)*T**2+C(16)*T**3
      CP=C(17)+C(18)*T+C(19)*T**2+C(20)*T**3+C(21)*T**4
      AL=C(22)+C(23)*T+C(24)*T**2+C(25)*T**3
40    TC(1)=RHO
      TC(2)=XK/3600.
      TC(3)=CP
      TC(4)=AL
99    RETURN
      END
      END$
```

```
FTN4,L
      SUBROUTINE Y6023(I,JBUF)
C
C Y6023 CALCULATES THE FOLLOWING GAS STREAM PARAMETERS AND
C OUTPUTS THEM INTO THE ARRAY 'GS' WHICH IS PASSED THROUGH
C COMMON.
C
C  1. DENSITY (RHO)
C  2. THERMAL CONDUCTIVITY  XK)
C  3. SPECIFIC HEAT (CP)
C  4. SPECIFIC HEAT RATIO (GA)
C  5. VISCOSITY (XMU)
C  6. SONIC VELOCITY (C)
C  7. KINETIC VISCOSITY (G)
C  8. PRANDTL NUMBER (PR)
C  9. MEAN GAS VELOCITY (U)
C 10. AERODYNAMIC PARAMETER (GMA)
C
C EQUATIONS USED TO CALCULATE PARAMETERS 2, 3, AND 4 ARE DEFENDENT
C ON THE FUEL TO AIR RATIO (XIN(3)).
C
C PROGRAM EXECUTION PRE-REQUISITES: Y 6021
C
C PAUL T. PURPURA - 07/20/82
C
      COMMON XIN(30),A(2),K(2),C(45),TC(4),GS(10),TP(10)
      COMMON FRQ
      DO 10 IZ=1,10
      GS(IZ)=0.
10    CONTINUE
      T=XIN(8)
      P=XIN(9)
      XM=XIN(10)
      FA=XIN(3)
      XL1=.015
      XL2=.025
      IF(FA.LE.XL1) GO TO 20
      IF(FA.GT.XL1.AND.FA.LE.XL2) GO TO 30
      IF(FA.GT.XL2) GO TO 40
20    XK=C(26)*T+C(27)
      CP=C(28)*T+C(29)
      GA=C(30)*T+C(31)
      GO TO 50
30    XK=C(32)*T+C(33)
      CP=C(34)*T+C(35)
      GA=C(36)*T+C(37)
      GO TO 50
40    XK=C(38)*T+C(39)
      CP=C(40)*T+C(41)
      GA=C(42)*T+C(43)
50    XMU=C(44)*T+C(45)
      RHO=2.6983*(P/(T+460.))
      C=41.454*(SQRT(GA*(T+460.)))
      G=XMU/RHO
      PR=3600.*XMU*CP/XK
      U=XM*C
      GMA=.48*XK*(PR**(33333.E-5))*(SQRT(U))
      GMA=GMA/(SQRT(G)*TC(1)*TC(3))
```

```
GS(1)=RHO
GS(2)=XK
GS(3)=CP
GS(4)=GA
GS(5)=XMU
GS(6)=C
GS(7)=G
GS(8)=PR
GS(9)=U
GS(10)=GMA/3600.
A(1)=GS(10)
CALL XINTZ(X,IX,NP)
CALL KYBD(054440B,1800,243,K(1))
CALL KYBD(054440B,1800,244,K(2))
RETURN
END
END$
```

```
N4,L
      SUBROUTINE Y6024(I,JBUF)

Y 6024 N1 N2 N3 EVALUATES TRANSFER FUNCTIONS PER BELOW
FOR N1 VALUES OF GAMMA AND STORES THEM IN FILE 1 STARTING AT
RECORD 10, FOR SMALL WIRE DATA, AND RECORD 30, FOR LARGE
WIRE DATA. A MAXIMUM OF 13 VALUES OF GAMMA ARE ALLOWED.

1. SMALL WIRE (GAIN AND PHASE) VS THE GAS STREAM
2. LARGE WIRE (GAIN AND PHASE) VS THE GAS STREAM

Y 6024 IS FORMATTED PER BELOW:

N1 = THE NUMBER OF GAMMA VALUES
N2 = FLAG - 0 = .THEORETICAL GAMMA EVALUATED. GO FROM .5 TO 1.5
                 TIMES GAMMA IN .1 INC'S.
            1 = .MEASURED GAMMA EVALUATED, LEAVE ALONE
N3 = FLAG - 0 = .EVALUATE PIECEWISE TRANSFORM, CH 1 TO 50 CON-
                 SECUTIVE, THEN EVERY 10TH CHANNEL, THEN CH 1023
            1 = .EVALUATE SPECIFIED CHANNELS FROM EDITS

Y 6024 CALLS THE FOLLOWING SUBPROGRAMS:

1. TRFP - THIS SUBPROGRAM CALCULATES THE COEFFICIENTS FOR THE
          TRANSFER PROGRAM "TRFM" AND PASSES THEM THROUGH
          COMMON.

2. TRFM - THIS SUBPROGRAM EVALUATES THE TRANSFER FUNCTION.

3. XINIZ - THIS SUBPROGRAM CONVERTS ANY FLOATING POINT VAR-
           IABLE TO AN INTEGAR AND POWER OF 10.

PROGRAM EXECUTION PRE-REQUISITES: Y 6022,Y 6023

PAUL T. PURFURA - 09/04/82

      DIMENSION JBUF(3),MQUAL(5)
      COMMON XIN(30),A(2),K(2),C(45),TC(4),GS(10),TP(10)
      COMMON FRQ
      N1=JBUF(1)
      N4=JBUF(2)
      N5=JBUF(3)
      IF(N4)81,81,82
      T=XIN(11)+.00001
      GO TO 83
      T=XIN(14)+.00001
      IF(N5)4,4,5
      N2=1
      N7=1023
      N8=1
      GO TO 7
      CHN=XIN(12)/XIN(11)
      N2=CHN+.05
      CHN=XIN(13)/XIN(11)
      N8=CHN+.05
      CHN=XIN(25)/XIN(11)
      N7=CHN+.05
      MQUAL(1)=2048
      MQUAL(2)=5
      MQUAL(3)=32767
```

```
      IF(T-.5)63,61,61
61    IF(T-1.)64,62,62
62    IF(T-2.)65,66,66
63    MQUAL(4)=49
      GO TO 70
64    MQUAL(4)=53
      GO TO 70
65    MQUAL(4)=57
      GO TO 70
66    MQUAL(4)=61
70    MQUAL(5)=0
      DGMA=.5
      IC1=N2
      DO 9 IA=4,7
      XIN(IA)=XIN(IA)/12.
9     CONTINUE
      DO 10 IZ=1,11
      CALL KYBD(041514B,IZ)
      CALL PUTQ(IZ,MQUAL)
10    CONTINUE
      CALL KYBD(054440B,5838,1)
      DO 30 IG=1,N1
      OLDPHS=0.
      IF(N4)1,1,2
1     TGMA=GS(10)*DGMA
      GO TO 3
2     TGMA=GS(10)
3     DO 20 IC=N2,N7,N8
      IF(N5)6,6,15
6     IF(IC-1023)11,15,15
11    IF(IC-50)12,13,13
12    IC1=IC1+1
      GO TO 15
13    IF(IC-IC1)20,14,14
14    IC1=IC1+10
15    A(2)=TGMA
      XIC=IC
      FRQ=T*XIC
      CALL TRFF(X)
      CALL TRFM(X,Y)
      IF(OLDPHS-A(2))16,16,17
16    A(2)=OLDPHS
      GO TO 18
17    OLDPHS=A(2)
18    CALL PUT(IG,IC,A(1),A(2))
      CALL KYBD(054440B,5819,1,1)
      A(1)=FRQ
      CALL XINTZ(X,IX,NP)
      CALL KYBD(054440B,1800,1,K(1))
      CALL KYBD(054440B,1800,2,K(2))
      CALL KYBD(054440B,1809,1,2)
      IF(N4)19,19,20
19    A(1)=DGMA
      CALL XINTZ(X,IX,NP)
      CALL KYBD(054440B,1800,1,K(1))
      CALL KYBD(054440B,1800,2,K(2))
      CALL KYBD(054440B,1809,1,2)
20    CONTINUE
      DGMA=DGMA+.1
30    CONTINUE
```

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```
      IF(N4)31,31,50
31    IF(XIN(2))35,35,36
35    CALL KYBD(046523B,31,10)
      GO TO 37
36    CALL KYBD(046523B,31,30)
37    DO 40 IM=1,N1
      CALL KYBD(046523B,21,IM)
40    CONTINUE
50    RETURN
      END
      END$
```

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```
FTN4,L
      SUBROUTINE Y6026(I,JBUF)
C
C Y 6026 N1 N2 N3 N4 EVALUATES THE TRANSFER FUNCTION BETWEEN
C 2 DATA BLOCKS.
C
C Y 6026 IS FORMATTED PER BELOW:
C
C N1 = NUMBER OF RECORDS (GAMMA VALUES)
C N2 = START POINTER IN FILE 1 FOR SMALL WIRE VS GAS STREAM H(f)
C N3 = START POINTER IN FILE 1 FOR LARGE WIRE VS GAS STREAM H(f)
C N4 = START POINTER IN FILE 1 FOR 10 MIL VS 3 MIL
C
C THE PROGRAM USES BLOCKS 0 AND 1 FOR COMPUTATIONS
C
C PROGRAM EXECUTION PREQUISITES: Y 6024 (TWICE)
C
C PAUL T. PURPURA - 09/14/82
C
      DIMENSION JBUF(4),MQUAL(5)
      COMMON XIN(30)
      N1=JBUF(1)
      N4=JBUF(2)
      N5=JBUF(3)
      N6=JBUF(4)
      MQUAL(1)=2048
      MQUAL(2)=5
      MQUAL(3)=32767
      MQUAL(4)=61
      MQUAL(5)=0
      IS=N6
      CALL KYBD(041514B,2)
      CALL PUTR(2,MQUAL)
      DO 30 IR=1,N1
      CALL KYBD(046523B,31,N4)
      CALL KYBD(046523B,11)
      CALL KYBD(046523B,31,N5)
      CALL KYBD(046523B,11,1)
      XL=XIN(12)/XIN(11)
      XU=XIN(25)/XIN(11)
      XI=XIN(13)/XIN(11)
      IL=XL+.05
      IU=XU+.05
      IN=XI+.05
      DO 20 IC=IL,IU,IN
      CALL GET(0,IC,G3,P3)
      CALL GET(1,IC,G10,P10)
      TF10T3=G10/G3
      PH10T3=P10-P3
      T=ABS(PH10T3)
      IF(180.-T)10,13,13
10    IF(PH10T3)11,12,12
11    PH10T3=PH10T3-360.
      GO TO 13
12    PH10T3=PH10T3+360.
13    CALL PUT(2,IC,TF10T3,PH10T3)
20    CONTINUE
```

```
      N4=N4+1
      N5=N5+1
      CALL KYBD(046523B,31,IS)
      CALL KYBD(046523B,21,2)
      IS=IS+1
0     CONTINUE
      RETURN
      END
      END$
```

```
FTN4,L
      SUBROUTINE Y6027(I,JBUF)
C
C Y 6027 N1 N2 N3 N4 N5 N6 DETERMINES THE MEASURED VALUE OF GAMMA
C AND STORES IT IN 'GS(10)' FOR EVALUATION OF THE MEASURED TRANS-
C FER FUNCTION. IT IS FORMATTED PER BELOW:
C
C N1 = FLAG - 0 = READ GAMMA FROM COMMON, 1 = CALCULATE GAMMA.
C N2 = STARGING RECORD # IN FILE 1 FOR LARGE/SMALL WIRE H(f).
C N3 = NUMBER OF THEORETICAL X-FER FUNC. RECORDS
C N4 = SCRATCH BLOCK FOR THEORETICAL DATA.
C N5 = BLOCK WHERE MEASURED X-FER FUNC RESIDES
C N6 = BLOCK WHERE COHERENCE FUNC. RESIDES.
C
C IT PERFORMS THE FOLLOWING DATA CHECKS:
C
C 1. DETERMINES IF THE MEASURED GAIN CROSSES THE THEORETICAL X-FER
C    FUNCTION CURVE.
C
C 2. DETERMINES IF THE COHERENCE IS WITHIN SPECIFIED LIMITS OF
C    .8<Y**2<1.005.
C
C 3. DETERMINES IF A COMBINATION OF ABOVE ERRORS WOULD RESULT IN
C    NOT HAVING A MEASURED VALUE OF GAMMA.
C
C IN EACH OF THE ABOVE CASES, A MESSAGE IS DISPLAYED ON THE
C TERMINAL TO FLAG THE OPERATOR. IF A MEASURED VALUE OF GAMMA
C IS NOT DETERMINED, PROCESSING STOPS AND THE OPERATOR IS AD-
C VISED TO CORRECT THE PROBLEM AND REPEAT THE ACQUISITION.
C
C PROGRAM EXECUTION PRE-REQUISITES: Y 6020,Y 6021,Y 6022,Y 6023
C
C PAUL T. PURPURA - 09/27/82
C
      DIMENSION JBUF(6)
      COMMON XIN(30),A(2),K(2),C(45),TC(4),GS(10),TP(10)
      COMMON FRQ
      N1=JBUF(1)
      N2=JBUF(2)
      N3=JBUF(3)
      N4=JBUF(4)
      N5=JBUF(5)
      N6=JBUF(6)
      IF(N1)10,10,20
10    GS(10)=XIN(24)
      GO TO 99
20    AVC=0.
      Y2L=.8
      AVGMA=0.
      Y2U=1.005
      IRH=N2+N3-1
      FA=XIN(11)/XIN(14)
      NF=FA
      XL=(FA*XIN(12))/XIN(11)
      XU=FA*XIN(25)/XIN(11)
      IL=XL+.05
      IU=XU+.05
      TN=FA*XIN(13)/XIN(11)
      IN=TN+.05
      CALL KYBD(054440B,5838,1)
```

```
      DO 50 IC=IL,IU,IN
      IT=IC/NF
      CALL GET(N5,IC,GN,FH)
      DO 40 IR=N2,IRH
      IRT=IR+1
      CALL KYBD(046523B,31,IR)
      CALL KYBD(046523B,11,N4)
      CALL GET(N4,IT,V1,P1)
      CALL KYBD(046523B,31,IRT)
      CALL KYBD(046523B,11,N4)
      CALL GET(N4,IT,V2,P2)
      IF(GN-V1)40,31,31
31    IF(V2-GN)40,41,41
40    CONTINUE
      GO TO 44
41    CALL GET(N6,IC,Y2,PP)
      IF(Y2-Y2L)44,42,42
42    IF(Y2U-Y2)44,43,43
43    XIR=IR
      XN2=N2
      R1=.5+.1*(XIR-XN2)
      AVGMA=AVGMA+R1+(GN-V1)*(.1)/(V2-V1)
      AVC=AVC+1.
      GO TO 50
44    XIC=IC
      FR=XIC*XIN(14)
      A(1)=FR
      CALL XINTZ(X,IX,NP)
      CALL KYBD(054440B,5819,8,1)
      CALL KYBD(054440B,1800,1,K(1))
      CALL KYBD(054440B,1800,2,K(2))
      CALL KYBD(054440B,1809,1,2)
      CALL KYBD(054440B,5819,1,1)
50    CONTINUE
      IF(AVC)55,55,60
55    CALL KYBD(054440B,5819,10,1)
      CALL KYBD(042040B,0)
60    AVGMA=AVGMA/AVC
      A(1)=GS(10)
      CALL XINTZ(X,IX,NP)
      CALL KYBD(054440B,1800,1,K(1))
      CALL KYBD(054440B,1800,2,K(2))
      CALL KYBD(054440B,5819,4,1)
      CALL KYBD(054440B,1809,1,2)
      CALL KYBD(054440B,5819,1,1)
      GS(10)=GS(10)*AVGMA
      A(1)=GS(10)
      CALL XINTZ(X,IX,NP)
      CALL KYBD(054440B,1800,243,K(1))
      CALL KYBD(054440B,1800,244,K(2))
      CALL KYBD(054440B,5819,11,1)
      CALL KYBD(054440B,1809,243,244)
      CALL KYBD(054440B,5819,1,1)
99    RETURN
      END
      END$
```

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```
FTN4,L
      SUBROUTINE Y6028(I,JBUF)
C
C Y 6028 N1 N2 N3 N4 N5 N6 CONVERTS MILLIVOLTS TO DEG-FARENHEIT
C BY USE OF N.B.S. TEMPERATURE CURVES. DATA CAN BE FILTERED BUT
C NOT WINDOWED. IT READS DATA FROM FILE 1 ON THE DISC CONVERTS IT
C TO TEMPERATURE AND STORES IN THE SAME RECORD NUMBER THAT IT WAS
C REMOVED FROM.
C
C N1 = BLOCKSIZE
C N2 = # OF THRU-PUT RECORDS
C N3 = STARTING RECORD IN FILE 1
C N4 = TC CODE FLAG* 1 = CR/AL, 2 = PT/10%RH, 3 = PT6%/PT30%
C                    4 = CU/CON
C N5 = COORDINATE CODE
C N6 = FREQUENCY CODE
C
C THIS PROGRAM USES DATA BLOCKS 0 AND 1 FOR COMPUTATIONS. DATA
C MUST BE SCALED TO MILLIVOLTS PEAK.
C
C THIS PROGRAM CALLS 2 SUBPROGRAMS:
C
C 1. 'TCOEF' - WHICH INPUTS ALL TC CURVE EQUATION COEFFICIENTS.
C
C 2. 'TCALC' - WHICH CALCULATES TEMPERATURE FROM THE APPROPRIATE
C              TC CURVE.
C
C PAUL T. PURPURA - 09/14/82
C
      DIMENSION JBUF(6),MQUAL(5)
      COMMON XIN(30),A(2),K(2),TCF(11,9),IFL
      N1=JBUF(1)
      N2=JBUF(2)
      N3=JBUF(3)
      N4=JBUF(4)
      N5=JBUF(5)
      N6=JBUF(6)
      MQUAL(1)=N1
      MQUAL(2)=N5
      MQUAL(3)=32767
      MQUAL(4)=N6
      MQUAL(5)=0
      CALL KYBD(041514B,1)
      CALL PUTQ(1,MQUAL)
      IFL=N4
      CALL TCOEF(Z)
      CALL KYBD(054440B,5838,1)
      DO 20 IR=1,N2
      CALL KYBD(046523B,31,N3)
      CALL KYBD(046523B,11)
      CALL KYBD(054440B,1800,0,N3)
      CALL KYBD(054440B,5819,7,1)
      CALL KYBD(054440B,1809,0)
      CALL KYBD(054440B,5819,1,1)
      DO 10 IC=1,N1
      CALL GET(0,IC-1,A(1),CRAP)
      CALL TCALC(Z)
      CALL PUT(1,IC-1,A(1),CRAP)
10    CONTINUE
```

```
      CALL KYBD(046523B,31,N3)
      CALL KYBD(046523B,21,1)
      N3=N3+1
20    CONTINUE
      RETURN
      END
      END$
```

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FTR4,I


```
      SUBROUTINE Y6029(I,JBUF)
C
C Y 6029 N1 N2 N3 N4 N5 N6 IS A MODIFIED VERSION OF 'Y 6028',
C WRITTEN ESPECIALLY FOR 'HOST'. UNLIKE 'Y 6028, WHICH LINEARIZES
C ONLY ONE RECORD AT A TIME AND DOES NO SCALING, 'Y 6029' REMOVES
C AMPLIFIER DC OFFSET AND SCALES THE DATA PRIOR TO LINEARIZATION.
C 2 RECORDS ARE AC DATA (LARGE & SMALL WIRE T/C) AND THE THIRD
C IS THE DC CHANNEL. AFTER REMOVAL OF DC OFFSET AND SCALING, THE
C PROGRAM ADDS THE DC TO THE AC, CONVERTS IT TO TEMPERATURE AND
C THEN REMOVES THE DC, LEAVING PEAK TEMPERATURE. THIS IS DONE TO
C BOTH AC CHANNELS.
C
C PAUL T. PURPURA - 10/28/82
C
      DIMENSION JBUF(6),MQUAL(5)
      COMMON XIN(30),A(2),K(2),TCF(11,9),IFL
      N1=JBUF(1)
      N2=JBUF(2)
      N3=JBUF(3)
      N4=JBUF(4)
      N5=JBUF(5)
      N6=JBUF(6)
      MQUAL(1)=N1
      MQUAL(2)=N5
      MQUAL(3)=32767
      MQUAL(4)=N6
      MQUAL(5)=0
      IFL=N4
      CALL TCOEF(Z)
      CALL KYBD(054440B,5838,1)
      DO 10 ICL=1,14
      CALL KYBD(041514B,ICL-1)
10    CONTINUE
      CALL PUTQ(0,MQUAL)
      CALL PUTQ(1,MQUAL)
      CALL PUTQ(2,MQUAL)
      CALL KYBD(046523B,31,N3)
      DO 30 IR=1,N2
      CALL KYBD(046523B,11,3)
      CALL KYBD(046523B,11,4)
      CALL KYBD(046523B,11,5)
      CALL KYBD(046523B,31,-3,1)
      CALL KYBD(054440B,1800,0,N3)
      N3=N3+1
      CALL KYBD(054440B,1800,1,N3)
      N3=N3+1
      CALL KYBD(054440B,1800,2,N3)
      N3=N3+1
      CALL KYBD(054440B,5819,7,1)
      CALL KYBD(054440B,1809,0,2)
      CALL KYBD(054440B,5819,1,1)
```

```
      DO 20 IC=1,N1
      CALL GET(3,IC-1,D3M,CRAP)
      CALL GET(4,IC-1,D10M,CRAP)
      CALL GET(5,IC-1,DDC,CRAP)
      D3M=D3M-XIN(17)
      D10M=D10M-XIN(20)
      DDC=DDC-XIN(23)
      D3M=D3M*XIN(16)*(1000.)/XIN(15)
      D10M=D10M*XIN(19)*(1000.)/XIN(18)
      DDC=DDC*XIN(22)*(1000.)/XIN(21)
      A(1)=DDC
      CALL TCALC(Z)
      TDC=A(1)
      D3MDDC=D3M+DDC
      D10MDC=D10M+DDC
      A(1)=D3MDDC
      CALL TCALC(Z)
      T3MDDC=A(1)
      A(1)=D10MDC
      CALL TCALC(Z)
      T10MDC=A(1)
      T3M=T3MDDC-TDC
      T10M=T10MDC-TDC
      CALL PUT(0,IC-1,T3M,CRAP)
      CALL PUT(1,IC-1,T10M,CRAP)
      CALL PUT(2,IC-1,TDC,CRAP)
20    CONTINUE
      CALL KYBD(046523B,21,0)
      CALL KYBD(046523B,21,1)
      CALL KYBD(046523B,21,2)
30    CONTINUE
      RETURN
      END
      END$
```

1.3 Fortran Subroutines

SPCY	Evaluates sampling frequency for 'TRFM' and 'TRFP'
TCALC	Evaluates DEG-F for 'Y 6028' and 'Y 6029'
TCOEF	Inputs N.B.S. curves for 'Y 6028' and 'Y 6029'
TRFM	Evaluates H(f) algorithms for 'Y 6024'
TRFP	Evaluates H(f) coefficients for 'Y 6024'
XINTZ	Changes a floating point number to an integer & PWR 1

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```
FTN4,L
      SUBROUTINE SPCY(X)
C
C "SPCY" IS A SUBPROGRAM THAT DETERMINES THE SAMPLING FREQUENCY
C AS A FUNCTION OF THE INPUT FREQUENCY. IT OUTPUTS THROUGH THE
C ARRAY "A".
C
C CALLING PROGRAMS: TRFP, TRFM
C
C PAUL T. PURPURA 08/30/82
C
      COMMON XIN(30),A(2),K(2),C(45),TC(4),GS(10),TF(10)
      COMMON FRQ
      F=FRQ+.00001
      IF(F-62.5)1,2,2
1     P=1./F
      T=P/(5.*10.**(-4))
      T1=T/4.
      I1=T1
      T1=I1
      A(1)=(T1+1.)*4.
      GO TO 3
2     A(1)=32.
3     RETURN
      END
      END$
```

```
FTN4,L
      SUBROUTINE TCALC(Z)
C
C 'TCALC' IS A SUBPROGRAM THAT CALCULATES TEMPERATURE FROM THE
C COEFFICIENTS IN THE ARRAY 'TCF' AND SPECIFIED THE TC CODE FLAG
C ENTERED IN "Y 6028".
C
C CALLING PROGRAM: Y 6028
C
C PAUL T. PURPURA - 09/14/82
C
      COMMON XIN(30),A(2),K(2),TCF(11,9),IFL
      IF(IFL.EQ.1)GO TO 10
      IF(IFL.EQ.2)GO TO 20
      IF(IFL.EQ.3)GO TO 30
      IF(IFL.EQ.4)GO TO 40
      CALL WHAT
10    IRL=1
      GO TO 25
20    IRL=4
25    IRH=IRH+2
      GO TO 50
30    IRL=7
      IRH=IRL+3
      GO TO 50
40    IR=11
      GO TO 60
50    DO 55 IR=IRL,IRH
      IF(TCF(IR,1)-A(1))55,55,60
55    CONTINUE
60    XN=TCF(IR,2)*A(1)+TCF(IR,3)
      DF=TCF(IR,4)+TCF(IR,5)*XN+TCF(IR,6)*XN**2+TCF(IR,7)*XN**3
      DF=DF+TCF(IR,8)*XN**4+TCF(IR,9)*XN**5
      A(1)=DF
      RETURN
      END
      END$
```

```
FTN4,L
      SUBROUTINE TCOEF(Z)
C
C 'TCOEF' IS A SUBPROGRAM THAT CONTAINS ALL TC CURVE EQUATION CO-
C EFFICIENTS AND STORES THEM IN AN ARRAY CALLED 'TCF' WHICH IS
C IN COMMON.
C
C ALL EQUATIONS WERE DERIVED FROM N.B.S. CURVES, WHERE THE INDE-
C PENDENT VARIABLE (MILLIVOLTS) WAS NORMALIZED BETWEEN -1 AND +1.
C
C REFERENCE JUNCTION = 32 DEG-F.
C
C CALLING PROGRAM: Y6028
C
C PAUL T. PURFURA - 09/14/82
C
      COMMON XIN(30),A(2),K(2),TCF(11,9),IFL
      TCF(1,1)=6.0920*10.**(0)
      TCF(1,2)=29.4811*10.**(-2)
      TCF(1,3)=-7.9599*10.**(-1)
      TCF(1,4)=15.1469*10.**(1)
      TCF(1,5)=14.7235*10.**(1)
      TCF(1,6)=-14.4194*10.**(-1)
      TCF(1,7)=27.6855*10.**(-1)
      TCF(1,8)=0.
      TCF(1,9)=0.
      TCF(2,1)=16.3490*10.**(0)
      TCF(2,2)=19.4989*10.**(-2)
      TCF(2,3)=-21.8787*10.**(-1)
      TCF(2,4)=52.8841*10.**(1)
      TCF(2,5)=22.5012*10.**(1)
      TCF(2,6)=-40.4444*10.**(-1)
      TCF(2,7)=0.
      TCF(2,8)=0.
      TCF(2,9)=0.
      TCF(3,1)=32.9390*10.**(0)
      TCF(3,2)=54.6597*10.**(-3)
      TCF(3,3)=-18.9363*10.**(-1)
      TCF(3,4)=15.3262*10.**(2)
      TCF(3,5)=80.7975*10.**(1)
      TCF(3,6)=42.3674*10.**(0)
      TCF(3,7)=16.7773*10.**(0)
      TCF(3,8)=0.
      TCF(3,9)=0.
      TCF(4,1)=1.4780*10.**(0)
      TCF(4,2)=13.4771*10.**(-1)
      TCF(4,3)=-99.1914*10.**(-2)
      TCF(4,4)=23.4314*10.**(1)
      TCF(4,5)=17.7489*10.**(1)
      TCF(4,6)=-18.7673*10.**(0)
      TCF(4,7)=73.3276*10.**(-1)
      TCF(4,8)=0.
      TCF(4,9)=0.
```

```
TCF(5,1)=6.9130*10.**(0)
TCF(5,2)=36.7985*10.**(-2)
TCF(5,3)=-15.4338*10.**(-1)
TCF(5,4)=92.5658*10.**(1)
TCF(5,5)=49.4519*10.**(1)
TCF(5,6)=-24.9707*10.**(0)
TCF(5,7)=53.3789*10.**(-1)
TCF(5,8)=0.
TCF(5,9)=0.
TCF(6,1)=18.6120*10.**(0)
TCF(6,2)=17.0955*10.**(-2)
TCF(6,3)=-21.8181*10.**(-1)
TCF(6,4)=23.1347*10.**(2)
TCF(6,5)=86.9542*10.**(1)
TCF(6,6)=-14.0391*10.**(0)
TCF(6,7)=30.3267*10.**(0)
TCF(6,8)=0.
TCF(6,9)=0.
TCF(7,1)=27.4339*10.**(-3)
TCF(7,2)=683.6671*10.**(-1)
TCF(7,3)=-885.0557*10.**(-3)
TCF(7,4)=163.3668*10.**(0)
TCF(7,5)=404.1203*10.**(-1)
TCF(7,6)=-192.8691*10.**(-1)
TCF(7,7)=152.4649*10.**(-1)
TCF(7,8)=0.
TCF(7,9)=0.
TCF(8,1)=479.1847*10.**(-3)
TCF(8,2)=438.4414*10.**(-2)
TCF(8,3)=-110.0994*10.**(-2)
TCF(8,4)=455.2585*10.**(0)
TCF(8,5)=164.9036*10.**(0)
TCF(8,6)=-561.0958*10.**(-1)
TCF(8,7)=391.1915*10.**(-1)
TCF(8,8)=0.
TCF(8,9)=0.
TCF(9,1)=310.3278*10.**(-2)
TCF(9,2)=742.7122*10.**(-3)
TCF(9,3)=-130.4843*10.**(-2)
TCF(9,4)=110.4443*10.**(1)
TCF(9,5)=40.5648*10.**(1)
TCF(9,6)=-911.3308*10.**(-1)
TCF(9,7)=435.5711*10.**(-1)
TCF(9,8)=0.
TCF(9,9)=0.
TCF(10,1)=137.6271*10.**(-1)
TCF(10,2)=182.0053*10.**(-3)
TCF(10,3)=-150.4887*10.**(-2)
TCF(10,4)=244.3852*10.**(1)
TCF(10,5)=391.8105*10.**(0)
TCF(10,6)=-101.6005*10.**(0)
TCF(10,7)=677.5431*10.**(-1)
TCF(10,8)=0.
TCF(10,9)=0.
```

```
TCF(11,1)=17.4160*10.**(0)
TCF(11,2)=1105.5832*10.**(-4)
TCF(11,3)=-925.4837*10.**(-3)
TCF(11,4)=3606.8799*10.**(-1)
TCF(11,5)=31215.7227*10.**(-2)
TCF(11,6)=-299.8243*10.**(-1)
TCF(11,7)=1035.7422*10.**(-2)
TCF(11,8)=-569.6789*10.**(-2)
TCF(11,9)=2505.8594*10.**(-3)
RETURN
END
END$
```

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```
FTN4,L
C
C 'TRFM' IS A SUBPROGRAM THAT EVALUATES THE TRANSFER FUNCTION BE-
C TWEEN THE THERMOCOUPLE WIRE AND THE GAS STREAM. IT OUTPUTS
C GAIN AND PHASE INTO THE ARRAY 'A' WHICH IS IN COMMON.
C
C THIS SUBPROGRAM CALLS THE SUBPROGRAM 'SPCY' WHICH DETERMINES
C THE SAMPLING FREQUENCY AS A FUNCTION OF THE ANALYSIS FRE-
C QUENCY.
C
C CALLING PROGRAM: Y 6024
C
C PAUL T. PURPURA - 09/14/82
C
      SUBROUTINE TRFM(X,Y)
      DIMENSION Z(10),ZP(10)
      COMMON XIN(30),A(2),K(2),C(45),TC(4),GS(10),TP(10)
      COMMON FRQ
      CALL SPCY(X)
      XN2=A(1)
      N2=XN2
      LAP=0
      P1=0.
      P2=0.
      P3=0.
      ZC1=0.
      ZC2=0.
      PKPOS=0.
      PKNEG=0.
      DO 10 IZ=1,10
      Z(IZ)=0.
      ZP(IZ)=0.
10    CONTINUE
      T=0.
      DELTAT=TP(2)
      CN=TP(4)
      A1=TP(5)
      B=TP(6)
      C=TP(7)
      E=TP(8)
      F=TP(9)
      G=TP(10)
      DO 70 IC=1,32000
      T1=Z(1)
      T2=Z(2)
      T3=Z(3)
      T4=Z(4)
      T5=Z(5)
      T6=Z(6)
      T7=Z(7)
      T8=Z(8)
      T9=Z(9)
      T10=Z(10)
      TR=SIN(CN*T)
```

```
      ZP(1)=(.5)*(C*(T0+T2-2*T1))/(A1)+T1
      ZP(2)=(.5)*(C*(T1+T3-2*T2))/(A1)+T2
      ZP(3)=(.5)*(C*(T2+T4-2*T3)+F*(TR-T3))/(A1)+T3
      ZP(4)=(.5)*(C*(T3+T5-2*T4)+(2*F)*(TR-T4))/(A1)+T4
      ZP(5)=(.5)*(C*(T4+T6-2*T5)+(2*F)*(TR-T5))/(A1)+T5
      ZP(6)=(C*(T5-T6)+E*(T7-T6)+(F+G)*(TR-T6))/(A1+B)+T6
      ZP(7)=(.5)*(E*(T6+T8-2*T7)+(2*G)*(TR-T6))/(B)+T7
      ZP(8)=(.5)*(E*(T7+T9-2*T8)+(2*G)*(TR-T8))/(B)+T8
      ZP(9)=(E*(T8-T9)+G*(TR-T9))/(B)+T9
      P1=P2
      P2=Z(9)
      P3=ZP(9)
      T=T+DELTAT
      LAP=LAP+1
      IF(N2-LAP)21,21,22
21    T=0.
      LAP=0
22    DO 30 IP=1,9
      Z(IP)=ZP(IP)
30    CONTINUE
      IF(P2)31,31,33
31    IF(P3)33,32,32
32    ZC1=P2
      ZC2=P3
      XIC=IC
      XIC=XIC-2.
33    IF(ABS(P1)-ABS(P2))34,34,70
34    IF(ABS(P2)-ABS(P3))70,40,40
40    IF(P2)41,42,42
41    PKNEG=P2
      GO TO 43
42    PKPOS=P2
43    PKDIF=PKPOS-ABS(PKNEG)
      PKQT=PKDIF/ABS(PKNEG)
      IF(.001-PKQT)65,65,75
65    IF(XIC-200.*XN2)70,66,66
66    PKPOS=(PKPOS-PKNEG)/2.
      GO TO 75
70    CONTINUE
75    A(1)=PKPOS
      XNC=XIC/XN2
      NC=XNC
      YNC=NC
      CHR=YNC*XN2
      FRC=XIC-CHR
      FRC=FRC-ZC1/(ZC2-ZC1)
      PHSLAG=(FRC/XN2)*(-360.)
      A(2)=PHSLAG
999   RETURN
      END
      END$
```

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```
FTN4,L
      SUBROUTINE TRFP(X)
C
C 'TRFP'  CALCULATES THE FOLLOWING PARAMETERS REQUIRED BY THE
C TRANSFER FUNCTION PROGRAM 'TRFM' AND PLACES THEM INTO AN
C ARRAY CALLED 'TP' WHICH IS PASSED THROUGH COMMON.
C
C  1. DELTA
C  2. DELTAT
C  3. SIGMA
C  4. CN
C  5. A1
C  6. B
C  7. C
C  8. E
C  9. F
C 10. G
C
C REFERENCE 'DYNAMIC GAS TEMPERATURE MEASURING SYSTEM - SYSTEM
C DESIGN AND TEST PLAN (FR-16381)' FOR DEFINITION OF ABOVE TERMS.
C
C THIS SUBPROGRAM CALLS ANOTHER SUBPROGRAM (SPCY) WHICH DETERMINES
C THE SAMPLING FREQUENCY AS A FUNCTION OF THE ANALYSIS FREQUENCY.
C
C CALLING PROGRAM: 6024
C
C PAUL J. PURPURA - 07/20/82
C
      COMMON XIN(30),A(2),K(2),C(45),TC(4),GS(10),TP(10)
      COMMON FRQ
      DO 10 IZ=1,10
      TP(IZ)=0.
10    CONTINUE
      CALL SPCY(X)
      XN2=A(1)
      DELTA=XIN(4)/3.
      DELTAT=1./(XN2*FRQ)
      SIGMA=XIN(5)/3.
      CN=2.*3.1415*FRQ
      A1=(XIN(6)**2*DELTA)/(8.*TC(4)*DELTAT)
      B=(XIN(7)**2*SIGMA)/(8.*TC(4)*DELTAT)
      C=(XIN(6)**2)/(4.*DELTA)
      E=(XIN(7)**2)/(4.*SIGMA)
      F=(A(2)*SQRT(XIN(6))*DELTA)/(2.*TC(4))
      G=(A(2)*SQRT(XIN(7))*SIGMA)/(2.*TC(4))
      TP(1)=DELTA
      TP(2)=DELTAT
      TP(3)=SIGMA
      TP(4)=CN
      TP(5)=A1
      TP(6)=B
      TP(7)=C
      TP(8)=E
      TP(9)=F
      TP(10)=G
      RETURN
      END
      END$
```

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```
FTN4,L
      SUBROUTINE XINTZ(X,IX,NP)
C
C 'XINTZ' IS A SUBROUTINE THAT INTEGARIZES ANY FLOATING POINT
C NUMBER TO AN INTEGAR AND POWER OF 10. USE OF THIS SUBPRO-
C GRAM ALONG WITH SYSTEM KEYBOARD SUBPROGRAMS PERMITS OUTPUT
C TO THE TERMINAL WITHOUT USING THE FORTRAN FORMATTER, WHICH
C SAVES ABOUT 4000 WORDS OF PROGRAM MEMORY.
C
C IT MAY BE CALLED FROM ANY FORTRAN PROGRAM BY THE FOLLOWING
C SEQUENCE:
C
C CALL XINTZ(X,IX,NP)
C
C THIS PROGRAM COMMUNICATES TO THE MAIN PROGRAM VIA 2 ARRAYS.
C THESE ARE A(1) AND K(2).
C
C IT IS ALSO 'SMART' IN THAT IT WILL ROUND UP 1 DIGIT ON THE LAST
C ITERATION WHEN THE NUMBER BEING INTEGARIZED IS .5 OR GREATER.
C
C NOTE! THE COMMON AREA OF THIS SUBPROGRAM WILL VARY FROM ONE
C SOURCE LISTING TO ANOTHER, HOWEVER, THE GENERAL SOFTWARE
C WILL ALWAYS REMAIN UNCHANGED.
C
C CALLING PROGRAMS: Y 6024,Y 6028,IRFM
C
C PAUL T. FURZURA 4/6/82.
C HAPPY EASTER!
C
      COMMON XIN(30),C(45),TC(4),GS(10),TP(10),A(2),K(2)
      COMMON FRG
      N=0
      NP=0
      K(1)=0
      K(2)=0
      X=ABS(A(1))
501   IF(X-32000.) 510,502,502
502   X=X/10.
      NP=NP+1
      GO TO 501
510   IF(X-3200.) 520,520,550
520   IX=X
      TX=IX
      TTX=X
      IF(TX-TTX) 550,550,540
540   X=X*10.
      NP=NP-1
      K(2)=NP
      GO TO 510
550   IX=X
      TIX=IX
      DXTIX=X-TIX
      IF(.5-DXTIX) 570,600,600
570   IX=IX+1
600   IF(A(1)) 601,602,602
601   IX=-IX
602   K(1)=IX
      RETURN
      END
      END$
```

1.4 System Subroutines

NAME	DEFINITION
GET(N1,N2,X1,X2)	Accesses scaled data from block 'N1', channel 'N2' and stores it in 'X1' and 'X2' (real and imaginary)
PUT(N1,N2,X1,X2)	Places scaled data from 'X1' and 'X2' and stores it into block 'N2' channel 'N2' (real and imaginary)
PUTQ(N1,MQUAL)	Puts block qualifiers specified by the array 'MQUAL' into data block 'N1'
WHAT	Error flag

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SUBROUTINE	KYB'D EQUIVALENT	DEFINITION
KYBD(041123B,N1)	BS N1	SET THE SYSTEM BLOCKSIZE TO 'N1'
KYBD(041514B,N1)	CL N1	CLEAR BLOCK NO.'N1'
KYBD(042024B,N1)	D N1	DISPLAY BLOCK NO. 'N1'
KYBD(046523B,31,N1)	MS 31 N1	SET THE DISC FILE POINTER TO FILE 1, RECORD NO. 'N1'
KYBD(046523B,11,N1)	MS 11 N1	READ NEXT RECORD IN FILE 1 INTO BLOCK NO. 'N1'
KYBD(046523B,21,N1)	MS 21 N1	WRITE BLOCK NO.'N1' INTO NEXT RECORD IN FILE 1
KYBD(054440B,1800,N1,N2)	Y 1800 N1 N2	SET VARIABLE PARAMETER 'N1' TO 'N2'
KYBD(054440B,1809,N1,N2)	Y 1809 N1 N2	PRINT THE VALUE OF VARIABLE PARAMETER 'N1' THRU 'N2'
KYBD(054440B,1822,N1,N2,N3)	Y 1822 N1 N2 N3	KEYBOARD VERSION OF 'PUT'
KYBD(054440B,5838,N1)	Y 5838 N1	READ DISC TEXT BUFFER NO. 'N1' INTO CORE
KYBD(054440B,5819,N1)	Y 5819 N1 1	WRITE TEXT BUFFER MESSAGE NO. 'N1' ON THE TERMINAL

C-2

1.6 Text Buffers - A listing of all applicable text buffers follo
this page.

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```
Y 5803 1
WARNING -- CLEAR NEW DISC BUFFERS
/L␍
␊90␍
␊to program soft keys␍
␊f1=graphics ␍
␊f2=alpha␍
␊f3=set page full busy ␍
␊f4=clear page full busy ␍
␊f8=make copy␍
␊␛&f1a1k6L␛*dcfs ␍
␊␛&f1a2k6L␛*ddet ␍
␊␛&f1a3k5L␛*t1c␍
␊␛&f1a4k5L␛*t0c␍
␊␛&f1a8k2L␛␍ ␍
␊/*␍
␊01␍
␊           ␍
␊/*␍
␊11␍
␊MEASURED VALUE OF GAMMA [(FT**3/2)/SEC]:␍
␊  <mntssa> <pwr 10> ␍
␊/*␍
␊04␍
```

```
↳THEORETICAL VALUE OF GAMMA [(FT**3/2)/SEC]: %
↳  <mntssa> <pwr 10> %
↳/*%
↳07%
↳LINEARIZATION IS NOW OCCURRING%
↳ON THE FOLLOWING DATA RECORDS:%
↳/*%
↳08%
↳BAD DATA AT BELOW FREQ. %
↳DATA POINT DISCARDED. %
↳   <freq> <pwr 10>%
↳/*%
↳10%
↳THE MEASURED TRANSFER FUNCTION CURVE DID NOT CROSS ANY%
↳THEORETICAL TRANSFER FUNCTION CURVE BETWEEN .5 AND 1.5%
↳GAMMA, OR HAD BAD COHERENCE. A MEASURED VALUE OF GAMMA%
↳WAS NOT OBTAINED. CHECK YOUR DATA, CORRECT THE PROBLEM%
↳AND TRY AGAIN!Ω %
↳/*%
↳
```

```
Y 5803 8
WARNING -- CLEAR NEW DISC BUFFERS
/L␍
␊90␍
␊PRINT PARAMETER VALUES? ␍
␊"YES" FOR ALL, LINE # FOR SINGLE␍
␊/*␍
␊92␍
␊  ␍
␊ENTER LINE # TO EDIT, 0 TO STOP␍
␊/*␍
␊93␍
␊  ␍
␊LINE NUMBER?␍
␊/*␍
␊94␍
␊  ␍
␊PRINT THE REST OF THE PARAMETERS? ␍
␊/*␍
␊_
```

```
Y 5803 9
WARNING -- CLEAR NEW DISC BUFFERS
/L%
ㄣ97%
ㄣINVALID INPUT %
ㄣ/*%
ㄣ64%
ㄣSETUP NO.? (1-100)\ %
ㄣ/*%
ㄣ74%
ㄣRECALL%
ㄣ/*%
ㄣ75%
ㄣSAVE INTO %
ㄣ/*%
ㄣ_
```

```
Y 5803 10
WARNING -- CLEAR NEW DISC BUFFERS
/L%
↳01%
↳              %
↳/*%
↳08%
↳        %
↳ALL DONE!0%
↳/*%
↳03%
↳ℰ*ddet%
↳AALPHA-NUMERIC DISPLAY%
↳/*%
↳10%
↳ℰ*dcfs%
↳GGRAPHICS DISPLAY %
↳/*%
↳06%
↳SYSTEM IS EVALUATING TRANSFER FUNCTION. THE 2 VALUES SCROL- %
↳LING UP THE SCREEN ARE THE INSTANTANEOUS FREQUENCY AND GAM- %
↳MA INDEX. THE GAMMA INDEX IS NOT DISPLAYED WHEN THE SYSTEM%
↳IS EVALUATING THE TRANSFER FUNCTION FOR A MEASURED VALUE OF %
↳GAMMA.%
```

```
↳      <number> <pwr 10>%
↳/*%
↳02%
↳SYSTEM IS READY TO ACQUIRE DATA.%
↳      %
↳PRESS "CONTINUE" TO START DATA ACQUISITION.♤%
↳/*%
↳11%
↳END OF DATA ACQUISITION♤. %
↳/*%
↳
```

```
Y 5803 50
WARNING -- CLEAR NEW DISC BUFFERS
/L%
ㄣ01%
ㄣ(RMS DEG-F) %
ㄣ/*%
ㄣ02%
ㄣ(RMS DEG-F)/SQRT-HZ %
ㄣ/*%
ㄣ03%
ㄣ(MEAN-SQR DEG-F)/HZ %
ㄣ/*%
ㄣ04%
ㄣ(MEAN-SQR DEG-F)/HZ - dB%
ㄣ/*%
ㄣ05%
ㄣ(DEG-F) %
ㄣ/*%
ㄣ06%
ㄣTHE PLOT CODE PRESENTLY ENTERED IS ILLEGAL! %
ㄣ    %
ㄣPLEASE CORRECT THIS CONDITION BY ENTERING %
ㄣA LEGAL PLOT CODE FOR EDIT NO. 40.%
ㄣ      %
```

```
THANK YOU!@
/*
29

29 LARGE OR SMALL WIRE T/C?
   (0=SMALL, 1=LARGE)\
/*
30

30 EVALUATE (LARGE WIRE/SMALL WIRE)
   T/C H(f)? (0=NO, 1=YES)\
/*

```

```
Y 5803 51
WARNING -- CLEAR NEW DISC BUFFERS
/L%
↳11%
↳      %
↳11 T/C CODE (0=Pt/6%Rh, 1=Pt/30%Rh)?%
↳   CODE:\ %
↳/*%
↳14%
↳      %
↳14 DIAMETER OF SUPPORT WIRE (INCHES)? %
↳   < dmtr > <pwr 10>%
↳\ %
↳/*%
↳22%
↳      %
↳22 MEAN GAS PRESSURE (PSIA)?%
↳   < pres > <pwr 10>%
↳\ %
↳/*%
↳23%
↳      %
↳23 MACH NUMBER? %
↳_  < numb > <pwr 10>%
```

```
↳\ %
↳/*%
↳50%
↳/ %
↳/*%
↳13%
↳       %
↳13 LENGTH OF SMALLER WIRE (INCHES/2)? %
↳   <length> <pwr 10>%
↳\ %
↳/*%
↳15%
↳          %
↳15 DIAMETER OF SMALLER WIRE (INCHES)? %
↳   < dmtr > <pwr 10>%
↳\ %
↳/*%
↳12%
↳       %
↳12 LENGTH OF SUPPORT WIRE (INCHES)? %
↳   <length> <pwr 10>%
↳\ %
↳/*%
↳21%
```

```
ч      %
ч21 MEAN GAS TEMPERATURE (DEG-F)?%
ч   < temp > <pwr 10>%
ч\ %
ч/*%
ч28%
ч      %
ч28 FREQUENCY INCREMENT? %
ч   < incr > <pwr 10>%
ч\ %
ч/*%
ч24%
ч24 FUEL TO AIR RATIO (F/A)? %
ч   < rtio > <pwr 10>%
ч\ %
ч/*%
ч99%
чDYNAMIC TEMPERATURE MEASUREMENT - %
чTHEORETICAL H(f) CRITERIA %
ч    %
ч/*%
ч25%
ч25 THEORETICAL DELTA-F SETTING? %
ч   < sttg > <pwr 10>%
```

```
↳\ %
↳/*%
↳27%
↳      %
↳27 ENDING FREQUENCY?%
↳   < freq > <pwr 10>%
↳\ %
↳/*%
↳26%
↳      %
↳26 STARTING FREQUENCY?%
↳   < freq > <pwr 10>%
↳\ %
↳/*%
↳
```

```
Y 5803 52
WARNING -- CLEAR NEW DISC BUFFERS
/L%
410%
4    %
410 CHANNEL "A" AMPLIFIER GAIN?%
4   < gain > <pwr 10>%
4\ %
4/*%
411%
4      %
411 CHANNEL "A" RECORD LEVEL?%
4   < levl > <pwr 10>%
4\ %
4/*%
412%
4    %
412 CHANNEL "A" DC OFFSET? %
4   <offset> <pwr 10>%
4\ %
4/*%
420%
4    %
420 CHANNEL "B" AMPLIFIER GAIN?%
```

```
↳   < gain > <pwr 10>℅
↳\ ℅
↳/*℅
↳21℅
↳    ℅
↳21 CHANNEL "B" RECORD LEVEL?℅
↳   < levl > <pwr 10>℅
↳\ ℅
↳/*℅
↳22℅
↳    ℅
↳22 CHANNEL "B" DC OFFSET? ℅
↳   <offset> <pwr 10>℅
↳\ ℅
↳/*℅
↳30℅
↳    ℅
↳30 CHANNEL "C" AMPLIFIER GAIN?℅
↳   < gain > <pwr 10>℅
↳\ ℅
↳/*℅
↳31℅
↳       ℅
↳31 CHANNEL "C" RECORD LEVEL?  ℅
```

```
↳   < levl > <pwr 10>¶
↳\ ¶
↳/*¶
↳32¶
↳    ¶
↳32 CHANNEL "C" DC OFFSET? ¶
↳   <offset> <pwr 10>¶
↳\ ¶
↳/*¶
↳05¶
↳        ¶
↳05 ADC DELTA-F SETTING? ¶
↳   < sttg > <pwr 10>¶
↳\ ¶
↳/*¶
↳99¶
↳DYNAMIC TEMPERATURE MEASUREMENT - ¶
↳MEASURED H(f) CRITERIA¶
↳    ¶
↳/*¶
↳06¶
↳      ¶
↳06 NUMBER OF THRU-PUT RECORDS ¶
↳   DESIRED?\¶
```

```
↳/*↯
↳07↯
↳      ↯
↳07 NUMBER OF POWER SPECTRUM AV- ↯
↳   ERAGES DESIRED?\ ↯
↳/*↯
↳09↯
↳    ↯
↳09 NEW "GAMMA" AND COMP. SPECTRUM?↯
↳   (0=NO, 1=YES)\ ↯
↳/*↯
↳08↯
↳    ↯
↳08 STARTING RECORD NUMBER? (70,73,76↯
↳   ETC.)\ ↯
↳/*↯
↳
```

```
Y 5803 53
WARNING -- CLEAR NEW DISC BUFFERS
/L%
ㄣ10%
ㄣ      %
ㄣ10 PLOT UNCOMPENSATED OR COMPENSATED%
ㄣ   DATA? (0=UNCOMP, 1=COMP)\%
ㄣ/*%
ㄣ20%
ㄣ      %
ㄣ20 PLOT AVERAGED OR INSTANTANEOUS %
ㄣ   DATA? (0=AVG, 1=INST)\ %
ㄣ/*%
ㄣ21%
ㄣ**************************************%
ㄣ*  IF DATA IS INSTANTANEOUS:%
ㄣ* %
ㄣ*  21 STARTING RECORD NO.?\ %
ㄣ/*%
ㄣ22%
ㄣ* %
ㄣ*  22 NO. OF RECORDS?\%
ㄣ/*%
ㄣ30%
```

```
↳      %
↳30 PLOT FULL OR PARTIAL TIME RANGE? %
↳   (0=FULL, 1=PARTIAL)\ %
↳/*%
↳99%
↳DYNAMIC TEMPERATURE MEASUREMENT - %
↳PROCESSING AND PLOTTING CRITERIA%
↳      %
↳/*%
↳24%
↳* %
↳*  24 NO. OF "SMOOTHS" TO PERFORM ON%
↳*     TIME DATA?\ %
↳/*%
↳25%
↳* %
↳*  25 PLOT TIME & FREQ DATA? (0=TIME%
↳*     ONLY, 1=TIME & FREQ)\ %
↳/*%
↳31%
↳***********************************%
↳*  IF A PARTIAL RANGE IS DESIRED: %
↳* %
↳*  31 STARTING TIME?%
```

```
4*     < time > <pwr 10> %
4*  \%
4/*%
432%
4* %
4*  32 ENDING TIME?%
4*     < time > <pwr 10> %
4*  \%
4/*%
423%
4* %
4*  23 THRESHOLD TO CLEAR ON FREQ DA-%
4*     TA IN "dB"?\%
4/*%
426%
4**************************************%
4*  IF DATA IS AVERAGED: %
4* %
4*  26 PLOT LARGE OR SMALL WIRE DATA?%
4*     (0=SMALL, 1=LARGE)\ %
4/*%
4
```

```
Y 5803 54
WARNING -- CLEAR NEW DISC BUFFERS
/L%
ㄣ09%
ㄣ         %
ㄣ09 NEW GAMMA AND NEW COMP. SPEC.? %
ㄣ   (0=NO, 1=YES)\ %
ㄣ/*%
ㄣ13%
ㄣ   %
ㄣ13 OLD GAMMA BUT NEW COMP. SPEC.? %
ㄣ   (0=NO, 1=YES)\ %
ㄣ/*%
ㄣ14%
ㄣ      %
ㄣ14 GAMMA VALUE: %
ㄣ   < valu > <pwr 10>%
ㄣ\ %
ㄣ/*%
ㄣ29%
ㄣ      %
ㄣ29 EVALUATE 10mil/3mil H(f)? (0=NO%
ㄣ   1=YES)\%
ㄣ/*%
```

```
ḷ35%
ḷ    %
ḷ35 PLOT FULL OR PARTIAL FREQ RANGE? %
ḷ   (0=FULL, 1=PARTIAL)\ %
ḷ/*%
ḷ40%
ḷ         %
ḷ40 ENTER PLOT CODE PER BELOW. (FREQ %
ḷ   DATA ONLY)\%
ḷ/*%
ḷ41%
ḷ       %
ḷ   1=(RMS DEG-F)%
ḷ   2=(RMS DEG-F)/SQRT-HZ%
ḷ   3=(MEAN-SQR DEG-F)/HZ%
ḷ   4=(MEAN-SQR DEG-F)/HZ - dB %
ḷ/*%
ḷ36%
ḷ***********************************%
ḷ*  IF A PARTIAL RANGE IS DESIRED: %
ḷ* %
ḷ*  36 STARTING FREQ?%
ḷ*     < freq > <pwr 10> %
ḷ*  \%
```

```
↳/*¶
↳37¶
↳* ¶
↳*  37 ENDING FREQ?¶
↳*      < freq > <pwr 10> ¶
↳*  \¶
↳/*¶
↳
```

2.0 SYSTEM ARRAYS

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2.1 Keyboard Program End Codes

JBUF(1)	User end code 'N1'
JBUF(2)	User end code 'N2'
JBUF(3)	User end code 'N3'
JBUF(4)	User end code 'N4'
JBUF(5)	User end code 'N5'
JBUF(6)	User end code 'N6'

2.2 Data Block Qualifiers

MQUAL(1)	Data block blocksize
MQUAL(2)	Data block coordinate code
MQUAL(3)	Data block calibrator
MQUAL(4)	Data block frequency code
MQUAL(5)	Data block status

2.3 T/C Wire & Gas Stream Equation Coefficients

ARRAY	DEFINITION
C(1)	
|	
|	
|	
V	
C(45)	

2.4 N.B.S Temperature Equation Coefficients

TCF(1,1)	
|	
|	
|	
V	
TCF(11,9)	

XIN(1)	Edit No. 11 - Thermocouple code
XIN(2)	Edit No. 29 - Large or small wire TC flag
XIN(3)	Edit No. 24 - Fuel to air ratio
XIN(4)	Edit No. 12 - Length of support wire
XIN(5)	Edit NO. 13 - Length of smaller wire
XIN(6)	Edit No. 14 - Diameter of support wire
XIN(7)	Edit No. 15 - Diameter of smaller wire
XIN(8)	Edit No. 21 - Mean gas temperature
XIN(9)	Edit No. 22 - Mean gas pressure
XIN(10)	Edit No. 23 - Mach number
XIN(11)	Edit No. 25 - ADC delta-F setting (theoretical)
XIN(12)	Edit No. 26 - Starting frequency
XIN(13)	Edit No. 27 - Frequency increment
XIN(14)	Edit No. 05 - ADC Delta-F setting (measured)
XIN(15)	Edit No. 10 - CH: A amplifier gain
XIN(16)	Edit No. 11 - CH: A record level
XIN(17)	Edit No. 12 - CH: A DC offset
XIN(18)	Edit No. 20 - CH: B amplilfier gain
XIN(19)	Edit No. 21 - CH: B record level
XIN(20)	Edit No. 22 - CH: B DC offset
XIN(21)	Edit No. 30 - CH: C amplifier gain
XIN(22)	Edit No. 31 - CH: C record level
XIN(23)	Edit No. 32 - CH: C DC offset
XIN(24)	Edit No. 14 - Gamma value
XIN(25)	Edit No. 28 - Ending frequency
XIN(26)	Not used
XIN(27)	Not used
XIN(28)	Not used
XIN(29)	Not used
XIN(30)	Not used

NOTE: Edits referenced from XIN(14) to XIN(24) apply to measured H(f) criteria. All other edits referenced apply to theoretical H(f) criteria.

2.6 Thermocouple Wire Parameters

TC(1)	T/C wire density (Rho)
TC(2)	T/C Thermal conductivity (k)
TC(3)	Specific heat (Cp)
TC(4)	Thermal diffusity (delta)

2.7 Gas Stream Parameters

GS(1)	Gas stream density (Rho)
GS(2)	Gas stream thermal conductivity (K)
GS(3)	Gas stream specific heat (Cp)
GS(4)	Specific heat ratio (Y)
GS(5)	Viscosity (Mu)
GS(6)	Sonic Velocity (c)
GS(7)	Kinetic viscosity [SQRT.(G)]
GS(8)	Prandtl number (PR)
GS(9)	Mean gas velocity (U)
GS(10)	Aerodynamic parameter (Gamma)

2.8 Finite Element Coefficients

TP(1)	H(f) coefficient (DELTA)
TP(2)	H(f) coefficient (Delta T)
TP(3)	H(f) coefficient (delta)
TP(4)	H(f) coefficient (Cn)
TP(5)	H(f) coefficient (A)
TP(6)	H(f) coefficient (B)
TP(7)	H(f) coeffiicent (C)
TP(8)	H(f) coefficient (E)
TP(9)	H(f) coefficient (F)
TP(10)	H(f) coefficient (G)

2.9 Finite Element Coefficients

ARRAY	DEFINITION
Z(1)	H(f) coefficient (Z1)
Z(2)	H(f) coefficient (Z2)
Z(3)	H(f) coefficient (Z3)
Z(4)	H(f) coefficient (Z4)
Z(5)	H(f) coefficient (Z5)
Z(6)	H(f) coefficient (Z6)
Z(7)	H(f) coefficient (Z7)
Z(8)	H(f) coefficient (Z8)
Z(9)	H(f) coefficient (Z9)
Z(10)	H(f) coefficient (Z0)

2.10 Finite Element Solutions

ZP(1)	H(f) Node 1 Finite Element Solution (ZP1)
ZP(2)	H(f) Node 2 Finite Element Solution (ZP2)
ZP(3)	H(f) Node 3 Finite Element Solution (ZP3)
ZP(4)	H(f) Node 4 Finite Element Solution (ZP4)
ZP(5)	H(f) Node 5 Finite Element Solution (ZP5)
ZP(6)	H(f) Node 6 Finite Element Solution (ZP6)
ZP(7)	H(f) Node 7 Finite Element Solution (ZP7)
ZP(8)	H(f) Node 8 Finite Element Solution (ZP8)
ZP(9)	H(f) Node 9 Finite Element Solution (ZP9)
ZP(10)	H(F) Node 0 Finite Element Solution (ZP0)

2.11 Scratch Arrays

ARRAY	DEFINITION
A(1)	Pass intermediate data through COMMON
A(2)	
K(1)	
K(2)	

3.0 DATA ASSIGNMENTS

3.1 Variable Param Assignments

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VP #	MODE	DESCRIPTION
00 TO 14	-	SCRATCH
15 TO 18	-	NOT USED
19	-	EDIT FLAG
20	-	EDIT BUTTON FLAG
21 TO 38	-	NOT USED
39	-	SET-UP NO.
40 TO 52	-	NOT USED
53	-	EDIT PHASE - LABEL NO.
54	-	EDIT PHASE - TEXT BUFFER NO.
55	-	EDIT PHASE - KEYBOARD NO.
56 TO 73	-	NOT USED
74	-	SCRATCH
75 TO 179	-	NOT USED
180	-	SCRATCH
181 TO 186	-	NOT USED
187	-	SCRATCH
188 TO 197	-	NOT USED
198	1	AUTO SEQ - QUESTION NO. 30
199	1	AUTO SEQ - QUESTION NO. 11
200	1	AUTO SEQ - QUESTION NO. 29
201	1	AUTO SEQ - QUESTION NO. 24
202	1	AUTO SEQ - QUESTION NO. 24
203	1	AUTO SEQ - QUESTION NO. 12
204	1	AUTO SEQ - QUESTION NO. 12
205	1	AUTO SEQ - QUESTION NO. 13
206	1	AUTO SEQ - QUESTION NO. 13
207	1	AUTO SEQ - QUESTION NO. 14
208	1	AUTO SEQ - QUESTION NO. 14
209	1	AUTO SEQ - QUESTION NO. 15
210	1	AUTO SEQ - QUESTION NO. 15
211	1	AUTO SEQ - QUESTION NO. 21
212	1	AUTO SEQ - QUESTION NO. 21
213	1	AUTO SEQ - QUESTION NO. 22
214	1	AUTO SEQ - QUESTION NO. 22
215	1	AUTO SEQ - QUESTION NO. 23
216	1	AUTO SEQ - QUESTION NO. 23
217	1	AUTO SEQ - QUESTION NO. 25
218	1	AUTO SEQ - QUESTION NO. 25
219	1	AUTO SEQ - QUESTION NO. 26

VF #	MODE	DESCRIPTION
220	1	AUTO SEQ - QUESTION NO. 26
221	1	AUTO SEQ - QUESTION NO. 27
222	1	AUTO SEQ - QUESTION NO. 28
223	1	TIME MAP - QUESTION NO. 05
224	1	TIME MAP - QUESTION NO. 05
225	1	TIME MAP - QUESTION NO. 10
226	1	TIME MAP - QUESTION NO. 10
227	1	TIME MAP - QUESTION NO. 11
228	1	TIME MAP - QUESTION NO. 11
229	1	TIME MAP - QUESTION NO. 12
230	1	TIME MAP - QUESTION NO. 12
231	1	TIME MAP - QUESTION NO. 20
232	1	TIME MAP - QUESTION NO. 20
233	1	TIME MAP - QUESTION NO. 21
234	1	TIME MAP - QUESTION NO. 21
235	1	TIME MAP - QUESTION NO. 22
236	1	TIME MAP - QUESTION NO. 22
237	1	TIME MAP - QUESTION NO. 30
238	1	TIME MAP - QUESTION NO. 30
239	1	TIME MAP - QUESTION NO. 31
240	1	TIME MAP - QUESTION NO. 31
241	1	TIME MAP - QUESTION NO. 32
242	1	TIME MAP - QUESTION NO. 32
243	1	TIME MAP - QUESTION NO. 14
244	1	TIME MAP - QUESTION NO. 14
245	1	AUTO SEQ - QUESTION NO. 27
246	1	AUTO SEQ - QUESTION NO. 27
247 TO 258	-	NOT USED
259	1	TIME MAP - QUESTION NO. 07
260	1	TIME MAP - QUESTION NO. 08
261	1	TIME MAP - QUESTION NO. 09
262	1	TIME MAP - QUESTION NO. 13
263	1	TIME MAP - QUESTION NO. 14
264	2	TIME MAP - QUESTION NO. 10
265	2	TIME MAP - QUESTION NO. 20
266	2	TIME MAP - QUESTION NO. 21
267	2	TIME MAP - QUESTION NO. 22
268	2	TIME MAP - QUESTION NO. 23
269	2	TIME MAP - QUESTION NO. 24

VF #	MODE	DESCRIPTION
270	2	TIME MAP - QUESTION NO. 25
271	2	TIME MAP - QUESTION NO. 30
272	2	TIME MAP - QUESTION NO. 31
273	2	TIME MAP - QUESTION NO. 31
274	2	TIME MAP - QUESTION NO. 32
275	2	TIME MAP - QUESTION NO. 32
276	2	TIME MAP - QUESTION NO. 35
277	2	TIME MAP - QUESTION NO. 36
278	2	TIME MAP - QUESTION NO. 36
279	2	TIME MAP - QUESTION NO. 37
280	2	TIME MAP - QUESTION NO. 37
281	2	TIME MAP - QUESTION NO. 40
282	2	TIME MAP - QUESTION NO. 26
283	1	TIME MAP - QUESTION NO. 06
284 TO 479	-	NOT USED
480	-	SCRATCH
2000 TO 2008	-	SCRATCH
2009 TO 2029	-	NOT USED
3000	-	SCRATCH
3001	-	SCRATCH
3002 TO 3014	-	NOT USED

3.2 File 1 Record Assignments

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REC. NO.	ASSIGNMENT
0 TO 2	SCRATCH AREA
3	POWER SPECTRUM - SMALL WIRE T/C
4	POWER SPECTRUM - LARGE WIRE T/C
5	POWER SPECTRUM - REAL PART CROSS POWER (1)
6	POWER SPECTRUM - IMAG PART CROSS POWER (1)
7	MEASURED H(f) - (LARGE WIRE)/(SMALL WIRE)
8	COHERENCE FUNCTION - (Y**2)
9	THEORETICAL H(f) - (LARGE WIRE)/(SMALL WIRE)(2)
10 TO 29	THEORETICAL H(f) - (SMALL WIRE)/(GAS STREAM)(3)
30 TO 49	THEORETICAL H(f) - (LARGE WIRE)/(GAS STREAM)(3)
50 TO 69	THEORETICAL H(f) - (LARGE WIRE)/(SMALL WIRE)(3)
70 TO 438	DISC THROUGHPUT - RAW TIME DOMAIN DATA

(1) - STORED AS DOUBLE PRECISION
(2) - COMPENSATION SPECTRUM
(3) - H(f) CURVES GOING FROM .5 GAMMA TO 1.5 GAMMA IN INCREMENTS OF .1 GAMMA.

PROGRAM ALGORITHMS

4.1 T/C wire parameters - Pt/6%Rh and Pt/30%Rh respectively.

4.1.1 Density (LBS/IN**3)

```
RHO = 0.740
RHO = 0.632
```

4.1.2 Thermal conductivity (BTU/FT-SEC-DEG R)

```
K(T)=[1/3600][3.8926E+01 + (1.8746E-03)(T)
+ (2.1226E-06)(T**2) - (2.7962E-10)(T**3)]

K(T)=[1/3600][3.0239E+01 + (1.0526E-02)(T)
- (1.8102E-06)(T**2) + (1.1490E-10)(T**3)]
```

4.1.3 Specific Heat (BTU/LBm-DEG R)

```
CP(T)=3.2070E-02 + (4.8648E-06)(T) - (3.8201E-13)(T**2)
- (1.0204E-13)(T**3)

CP(T)=3.9228E-02 + (4.8327E-06)(T) + (3.3457E-09)(T**2)
- (1.7609E-12)(T**3) + (2.2544E-16)(T**4)
```

4.1.4 Thermal Diffusity (FT**2/SEC)

```
ALPHA(T)=2.6336E-04 - (2.4880E-08)(T) + (1.4592E-11)(T**2)
        - (1.5780E-15)(T**3)

ALPHA(T)=1.9764E-04 + (3.2121E-08)(T) - (1.5888E-11)(T**2)
        + (2.9097E+03)(T**3)
```

4.2 Gas stream parameters

4.2.1 Density (LBS/IN**3)

```
RHO = 2.6983(P/T)  where  P = PSIA,  T = DEG R
```

4.2.2 Thermal Conductivity (BTU/FT-HR-DEG R)

```
K(T)=1.40203E-02 + (1.89980E-05)(T)   for  F/A=.01
K(T)=1.40413E-02 + (1.94294E-05)(T)   for  F/A=.02
K(T)=1.40622E-02 + (1.98590E-05)(T)   for  F/A=.03
```

4.2.3 Specific Heat (BTU/LBm-DEG R)

```
CP(T)=2.4733E-01 + (2.7857E-05)(T)   for  F/A=.01
CP(T)=2.4413E-01 + (2.7400E-05)(T)   for  F/A=.02
CP(T)=2.3937E-01 + (2.7091E-05)(T)   for  F/A=.03
```

4.2.4 Specific Heat Ratio

```
Y(T)=1.3750E+00 - (-3.4000E-05)(T)   for  F/A=.01
Y(T)=1.3690E+00 - (-3.4500E-05)(T)   for  F/A=.02
Y(T)=1.3630E+00 - (-3.5000E-05)(T)   for  F/A=.03
```

4.2.5 Viscosity (LB/FT-SEC)

```
MU(T)=1.6100E-05 + (9.0260E-09)(T)
```

4.2.6 Sonic Velocity (FT/SEC)

```
C=41.454[SQRT[(Y)(T)] where T= DEG 12
```

4.2.7 Kinetic Viscosity (FT**2/SEC)

```
SQRT(y)=MU/RHO
```

4.2.8 Prandtl Number

```
PR=3600(MU)(CP)/K
```

4.2.9 Mean Gas Velocity (FT/SEC)

```
U=M(C)
```

4.2.10 Aerodynamic Parameter [FT**(3/2)/SEC]

```
GAMMA=[(.48)(K)[SQRT(U)][PR**(1.3)]

GAMMA=GAMMA/[(3600)(RHOw)(CPw)[SQRT(y)]
```

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4.3 Finite Element Solution Coefficient Algorithms

4.3.1	DELTA = L/3	o L=length of the T/C support wire
4.3.2	DELTA-Z= 1/(XN2)(Fn)	o XN2=the number of samples/cycle,determined by the subroutine 'SPCY' o Fn=the analysis frequency
4.3.3	delta = l/3	o l=1/2 the length of the smaller T/C wire
4.3.4	Cn = 2(Pi)(Fn)	
4.3.5	A=(D**2)(DELTA)/(8)(ALPHA)(DELAT-t)	o D=the diameter of the support wire ALPHA=the T/C wire thermal diffusity
4.3.6	B=(d**)(delta)/(8)(ALPHA)(DELTA-Z)	o d=the diameter of the smaller wire
4.3.7	C= D**2/4(DELTA)	
4.3.8	E= d**2/4(delta)	
4.3.9	F= GAMMA(DELTA)[SQRT(D)]/2(ALPHA)	
4.3.10	G= GAMMA(delta)[SQRT(d)]/2(ALPHA)	
4.3.11	TR=sin[(Cn)(T)]	o T=T+DELTA-t

4.4 Finite Element Solution Algorithms

4.4.1 ZP0=0

4.4.2 ZP1=(C/2A)(Z0+Z2-2Z1)+Z1

4.4.3 ZP2=(C/2A)(Z1+Z3-2Z2)+Z2

4.4.4 ZP3=(1/2A)[C(Z2+Z4-2Z3)+F(TR-Z3)]+Z3

4.4.5 ZP4=(1/2A)[C(Z3+Z5-2Z4)+2F(TR-Z4)]+Z4

4.4.6 ZP5=(1/2A)[C(Z4+Z6-2Z5)+2F(TR-Z5)]+Z5

4.4.7 ZP6=[1/(A+B)][C(Z5-Z6)+E(Z7-Z6)+

4.4.8 ZP7=(1/2B)[E(Z6+Z8-2Z7)+2G(TR-Z7)]+Z7

4.4.9 ZP8=(1/2B)[E(Z7+Z9-2Z8)+2G(TR-Z8)]+Z8

4.4.10 ZP9=(1/B)[E(Z8-Z7)+G(TR-Z9)]+Z9

```
********** COMMAND FILES FOR HOST PROGRAM OVERLAYS **********

                    ***** OVERLAY # 16 *****
@@
A,OVRLYN
T,SNAPC
@,6020
@,6021
@,6022
@,6023
@,6024
@,6027
@E
                        CSORT+
F,%Y6020
Y,Y6020
F,%Y6021
Y,Y6021
F,%Y6022
Y,Y6022
F,%Y6023
Y,Y6023
F,%Y6024
Y,Y6024
F,%Y6027
Y,Y6027
F,%TRFF
Y,TRFF
F,%TRFM
Y,TRFM
F,%SPCY
Y,SPCY
F,%XINTZ
Y,XINTZ
F,N3501A
Y,SICOS
                        CSORT-
F,N3500A
L,**
F,N3501A
L,**
F,A3060A
L,**
U,T*
  0J
::
**
```

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***** OVERLAY # 17 *****

```
@@
A,OVRLYN
T,SNAPC
@,6020
@,6028
@,6029
@E
                         CSORT+
F,%Y6020
Y,Y6020
F,%Y6028
Y,Y6028
F,%Y6029
Y,Y6029
F,%TCOEF
Y,TCOEF
F,%TCALC
Y,TCALC
                          CSORT-
F,N3500A
L,**
F,N3501A
L,**
F,A3060A
L,**
U,**
E,01
::
$$
```

```
                    ***** OVERLAY # 18 *****
OVRLYN
SNAPC
6050

                          CSORT+
%Y6050
Y6050
                           CSORT-
N3500A
**
N3501A
**
A3060A
**
**
01
```

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***** OVERLAY # 19 *****

```
@@
A,OVRLYN
T,SNAFC
@,6020
@,6026
@E
                    CSORT+
F,%Y6020
Y,Y6020
F,%Y6026
Y,Y6026
                     CSORT-
F,N3500A
L,**
F,N3501A
L,**
F,A3060A
L,**
U,**
E,01
::
$$
```


END OF FILE - P. T. FURFURA - 02/01/83

SECTION 3
FOURIER ANALYZER SYSTEM DESCRIPTION

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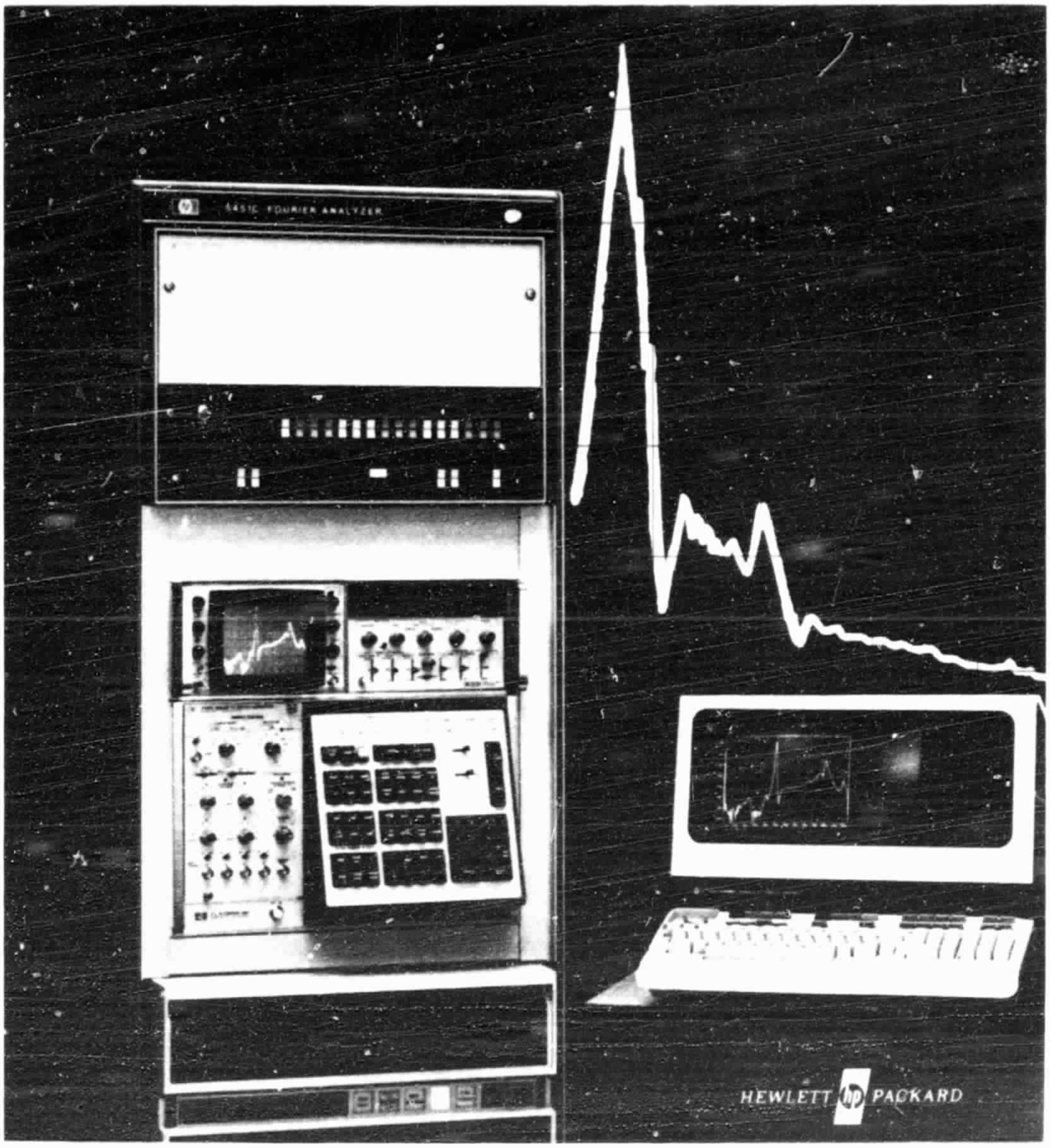
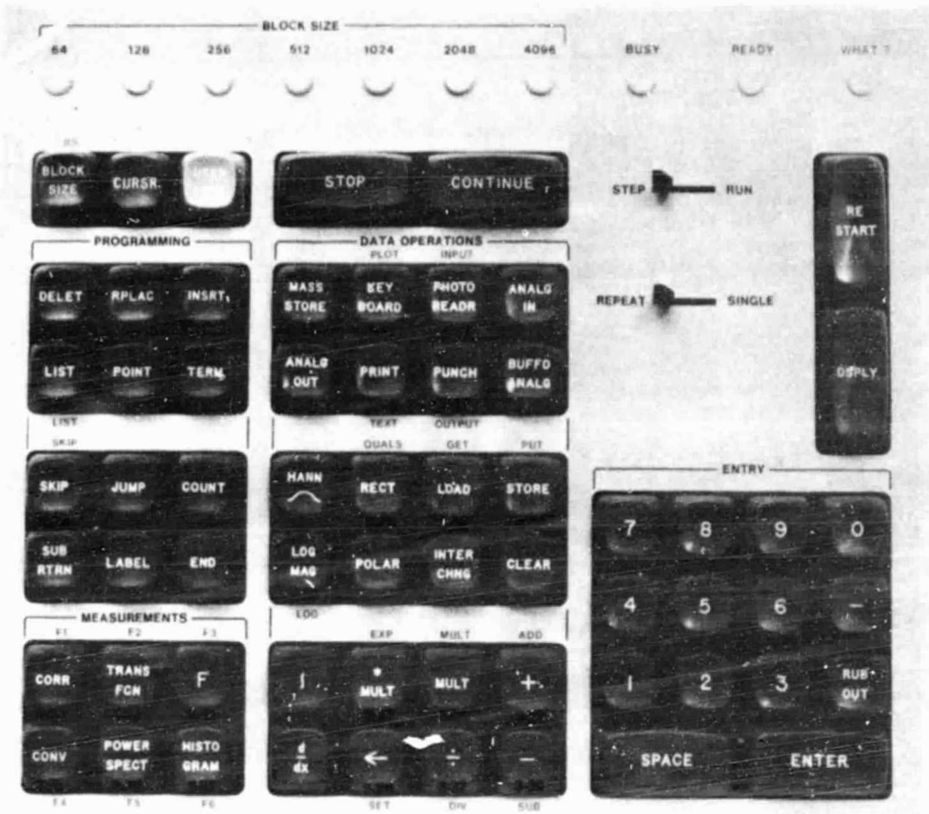
5451 FOURIER ANALYZER SYSTEM



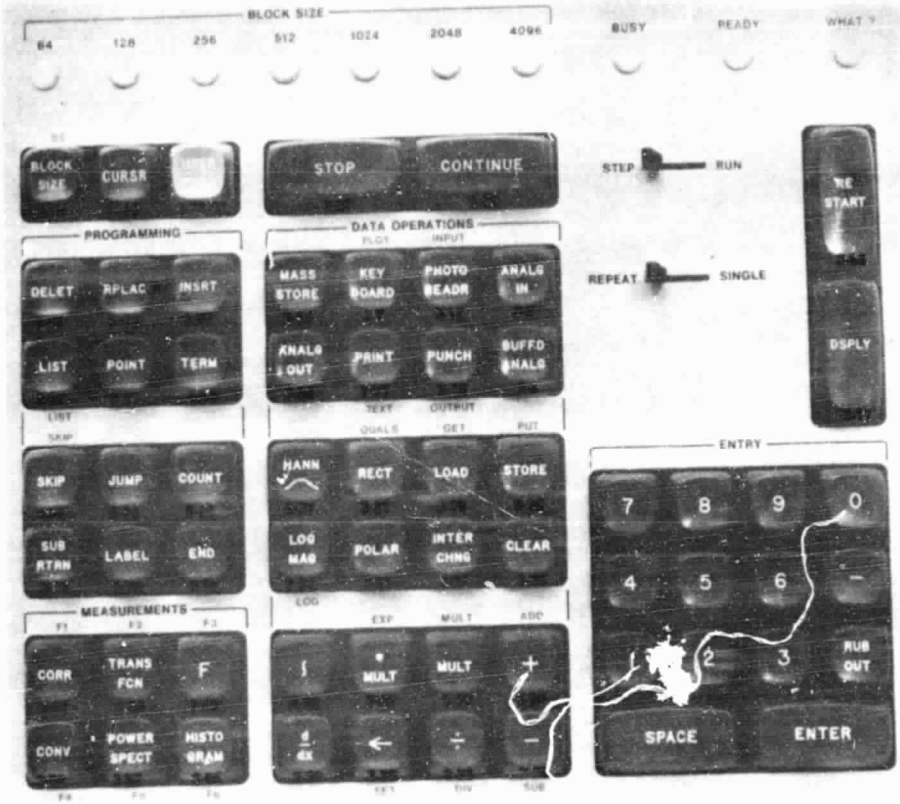
QUICK-KEY REFERENCE

GOLD KEYS



QUICK-KEY REFERENCE

STANDARD KEYS



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ALPHABETICAL INDEX OF KEY DESCRIPTIONS

This appendix contains an alphabetical index of the key descriptions followed by an illustration showing the key exactly as it appears on the front panel of the 5475A Control Unit. In addition, the symbol that is printed out for each key is shown. When a key has more than one function (e.g., KEYBOARD/PLOT), each is listed separately.

Table B-1. Alphabetical Index

Function	Key	Symbol	Function	Key	Symbol
Add*	ADD	Y A+	Block Size	BLOCK SIZE	BS
Analog In	ANALG IN	RA	Block Size*	BS BLOCK SIZE	Y BS
Analog Output	ANALG OUT	B	Block Subtraction	−	A-
Block Addition	+	A+	Buffered Analog	BUFFD ANALG	RB
Block Conjugate Multiply	* MULT	*_	Clear	CLEAR	CL
Block Division	÷	:	Complex Multiply	MULT	*
Block Multiply	MULT	*	Conjugate	* MULT	*_
Block Shift	←	—	Continue	CONTINUE	

Variable Parameter or User Program

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Table 8-1. Alphabetical Index (cont'd)

Function	Key	Symbol	Function	Key	Symbol
Convolution		CV	F1*	F1	Y CR
Correlation		CR	F2*	F2	Y CH
Count		#	F3*	F3	Y F
Cursor		/.	F4*	F4	Y CV
Delete		/D	F5*	F5	Y SP
Differentiation		%	F6*	F6	Y RH
Display		D	Get*	GET	Y X<
Division*	DIV	Y :	Histogram		RH
End			Input*	INPUT	Y R
Exponentiate*	EXP	Y *-	Insert		/I
Fourier Transform		F	Integer Divide		:

Variable Parameter or User Program

Table B-1. Alphabetical Index (cont'd)

Function	Key	Symbol	Function	Key	Symbol
Integer Multiply	■	*	Log*	■ LOG	Y TL
Integration	■	$	Loop Counter Divide	■	÷
Interchange	■	X	Loop Counter Multiply	■	*
Interval-centered Hanning	■	H1	Multiply*	MULT ■	Y *
Jump	■	J	Mass Store	■	MS
Keyboard	■	K	Output*	■ OUTPUT	Y P
Label	■	L	Photoreader	■	R
List	■	/L	Plot*	PLOT ■	Y K
List*	LIST ■	Y /L	Pointer	■	↑
Load	■	X<	Polar Coordinates	■	TP
Log Magnitude	■	TL	Power Spectrum	■	SP

**Variable Parameter or User Program*

Table 8-1. Alphabetical Index (cont'd)

Function	Key	Symbol	Function	Key	Symbol
Print		W	Store		X>
Punch		P	Subtract*	SUB	Y A-
Put*	PUT	Y X>	Subroutine Return		<
Qualifiers*	QUALS	Y TR	Terminate		/
Rectangular Coordinates		TR	Text*	TEXT	Y W
Replace		/R	Transfer Function		CH
Restart			User Program (Gold Key)		Y
Rotate		—			
Skip		IF			
Skip*	SKIP	Y IF			
Stop					

Variable Parameter or User Program