NBS TECHNICAL NOTE 956

U.S. DEPARTMENT OF COMMERCE / National Bureau of Standards

FORTRAN Program To Determine Length of Gage Blocks Using Single Wavelength Interferometry

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FORTRAN PROGRAM TO DETERMINE LENGTH OF GAGE BLOCKS USING SINGLE WAVELENGTH INTERFEROMETRY

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Abstract

A description of a computer program which computes the length of a gage block from a process using single wavelength interferometry is given. The computer program has been written in American National Standards Institute FORTRAN, with emphasis on making it as machine-independent as possible. A sample of input and output is given.

Key Words: FORTRAN computer program; gage blocks; interferometry

1. INTRODUCTION

The computer program described in this paper computes and reports the length of a gage block from a measurement process using single wavelength interferometry. The computer subprograms are written in American National Standards Institute Fortran thereby making them transportable. Descriptions of the input, computations, and output are given. Listings of the computer subprograms are included along with a sample run. For a detailed report on the measurement process, see NBS Monograph 152, "A Gage Block Measurement Process Using Single Wavelength Interferometry."

2. DESCRIPTION OF INPUT

A part of the input data to the computer program is in fixed field format and the remainder in free field format. A fixed field format specifies that the data must be punched in specific columns on the input card or recorded in specific fields of an input record. In addition, the data must be right justified in the allotted fields. Free field format allows the data in the allotted fields to appear anywhere in the input record. Data recorded in the free field format is accepted only if it is numeric. Non-numeric characters are ignored except in the cases where a "D" is used to denote double precision data or an "E" is used to denote floating point data. Numerical values are separated from each other by one or more blanks or a comma. Alphanumeric data consists of numbers, alphabetic letters and special characters like : or /. The description of the data which follows implies the use of cards as input. Other media, such as a magnetic tape or a mass storage data file, using the same specifications may be used. See Section 5.1 for an example. Sections 4 and 5 of NBS Monograph 152 describe in detail the procedures used in acquiring the data.

Card No.	Data Description	Data Type	Column Position
1	Test number	Alphanumeric	2 - 7
	Time (hr:min)	Alphanumeric	9 - 13
	Observer	Alphanumeric	15 - 17
	Platen Number	Alphanumeric	19 - 21
	Month	Numeric	These values separated by one or more blanks or a comma appear anywhere between 23 - 80 in the order specified.
	Day	Numeric	
	Year	Numeric	
	Interferometer number*	Numeric	
	1 for Zeiss-LB (long blocks)		
	2 for Hilger 1955 (short blocks)		
	3 for Zeiss-SB (short blocks)		
	Bridge reading (before normal observation)	Numeric	
	Bridge reading (before reverse)	Numeric	
	Bridge reading (after normal observation)	Numeric	
	Bridge reading (after reverse)	Numeric	

*The interferometer number may refer to different interferometers than those mentioned above. See Section A1.B.

2	Thermocouple reading for the block (μV)	Numeric	These values separated by one or more blanks or a comma appear anywhere between 1 - 80 in the order specified.
	Thermocouple reading for the air (μV)	Numeric	
	First barometric pressure reading in mm of Hg	Numeric	
	Second barometric pressure reading in mm of Hg	Numeric	
	Hygrometer dial reading	Numeric	
	Hygrometer element number**	Numeric	
	1 for #6388 (long blocks)		
	2 for #6499 (long blocks)		
	3 for #6331 (short blocks)		
	4 for #6415 (short blocks)		
	5 for #7536 (short blocks)		
	6 for #7530 (short blocks)		

**The hygrometer element number may refer to different elements than the ones specified above. See Section A1.B.

3	Number of blocks using the above conditions***	Numeric	Anywhere in 1 - 80.

***This number is 1 for long blocks. For short blocks it is the number of blocks wrung to the platen.

4	Block serial number	Alphanumeric	1 - 6
	Nominal block length (inches)	Numeric	9 - 20
	Assumed block length (inches)	Double precision numeric	28 - 40
	Coefficient of expansion (in micro inches per degrees Celsius of block)	Double precision numeric	41 - 60
	Maker of block MAT for Matrix DOA for DoAll P+W for Pratt & Whitney HOM for Hommel WEB for Weber CEJ for CEJ FON for Fonda F-J for Ford Johnsen	Alphanumeric	71 - 73
	Material of block ST for steel alloy CC for chrome carbide TC for tungsten carbide CV for cervit (glass ceramic) CS for cervit plus steel	Alphanumeric	75 - 76
	Type of block REC for rectangular SQR for square RND for round R+S for cervit and steel	Alphanumeric	78 - 80

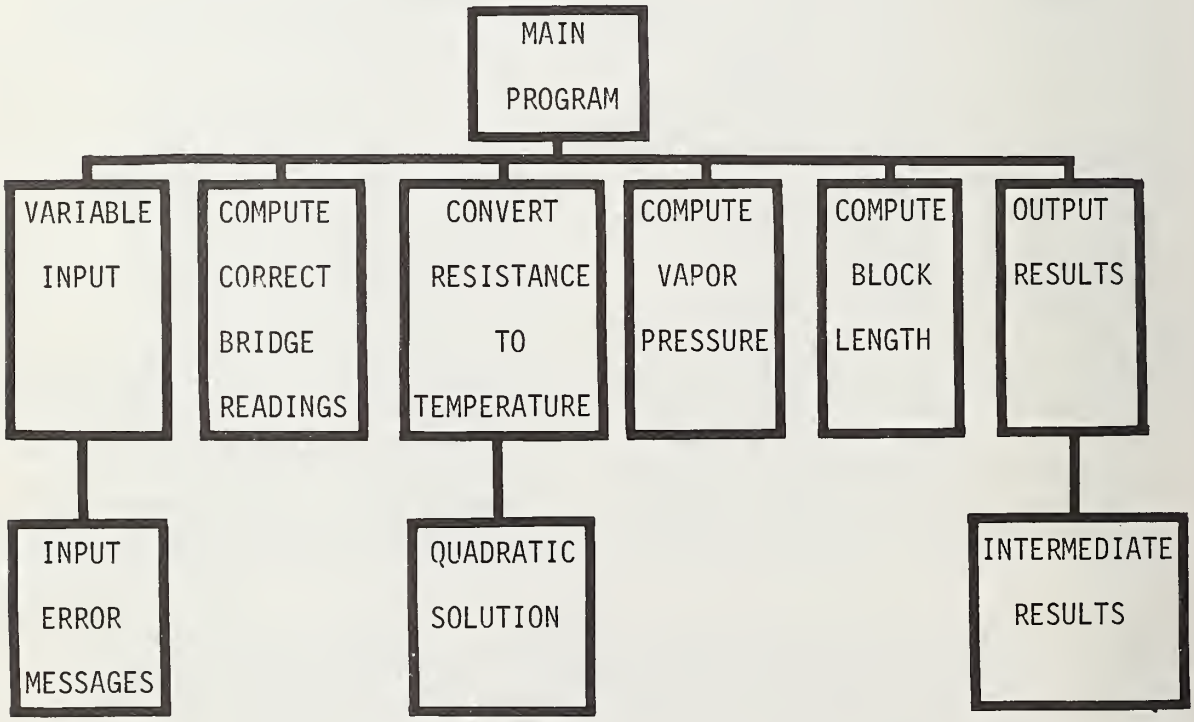
5	First fringe fraction reading	Numeric	These values separated by one or more blanks or a comma appear anywhere between 1 - 80 in the order specified.
	Second fringe fraction reading	Numeric	
	Third fringe fraction reading	Numeric	
	Fourth fringe fraction reading	Numeric	
	Fifth fringe fraction reading	Numeric	
	Sixth fringe fraction reading	Numeric	

Cards 4 and 5 are repeated for the number of times indicated on card 3. If more data is available, repeat cards 1 through 5. The end of data is denoted by the flag STOP punched in columns 2 - 5 of the final card.

3. COMPUTER PROGRAM

This section contains a listing of the computer program with all its subprograms needed to carry out the necessary input, calculations, and output. The subprograms are written in American National Standards Institute Fortran thereby making them transportable. Alphanumeric data is restricted to three characters per computer word. Hard copy output is restricted to 120 characters per line. Card output is restricted to 80 columns. The program was written for the Univac 1108 and is operational under the EXEC-8 operating system. There are 1580 lines of Fortran code consisting of one main program, ten subprograms, and one BLOCK DATA subprogram. The BLOCK DATA subprogram contains all the variables which may need to be changed due to the replacement of any of the equipment used in the interferometric measurements. In addition to the Fortran COMMENT statements dispersed throughout the subprograms, there is a description of the function of each subprogram on the right hand side of the listing.

3.1 Flow Diagram of Computer Program



```
C     ****************************************************************MAN00010
C                                                                      MAN00020
C     THIS IS THE MAIN PROGRAM FOR COMPUTING LENGTH OF GAGE BLOCKS     MAN00030
C     USING SINGLE WAVELENGTH INTERFEROMETRY                           MAN00040
C     THIS PROGRAM READS THE INPUT DATA                                MAN00050
C     AND CONTROLS THE FLOW OF THE CALCULATIONS                        MAN00060
C     WHEN DATA IS READ BY READIT (VARIABLE FORMAT INPUT)              MAN00070
C     A CHECK IS MADE FOR THE EXPECTED NUMBER OF INPUT VALUES          MAN00080
C     IF THERE ARE LESS VALUES A MESSAGE IS PRINTED AND                MAN00090
C     EXECUTION TERMINATES                                             MAN00100
C     WRITTEN BY RUTH N. VARNER                                        MAN00110
C                                                                      MAN00120
C     ****************************************************************MAN00130
C                                                                      MAN00140
      DIMENSION M(80),VALUE(8),VALUEP(6),VALUE3(6)                     MAN00150
      DOUBLE PRECISION F                                               MAN00160
      DOUBLE PRECISION P,LAMO,TA,PHI                                   MAN00170
      DOUBLE PRECISION LSUBP,COEXP,TB,L20                              MAN00180
      DOUBLE PRECISION NOOFFR,LAMTPF,FPRIM                             MAN00190
      DOUBLE PRECISION SLTCOR,OBLCOR,PHSCOR,VACWLN                     MAN00200
      INTEGER TERM(2)                                                  MAN00210
      REAL NOM                                                         MAN00220
      INTEGER DAY,YEAR,TESTNO                                          MAN00230
      COMMON /IO/ IN,IOUT,IPCH                                         MAN00240
      INTEGER ELEMNT                                                   MAN00250
      COMMON /BRGOUT/ BRGM,THERRS,REFTEM                               MAN00260
      COMMON /IFER/ TB,TA,ELEMNT                                       MAN00270
      COMMON /BRGIN/ XYZ(4),BROGR(4),INTFER,BROCOR                     MAN00280
      COMMON /OUTR/ TESTNO(2),TIME(2),OBS,PLATEN                       MAN00290
      COMMON /BARPRS/ P,BARAVG                                         MAN00300
      COMMON /HUMIOV/ F,HUMID                                          MAN00310
      COMMON /OUT/ PHI,LSUBP,LAMO,L20,NOOFFR,LAMTPF,FPRIM,SERNO(2),    MAN00320
     2 INTERI(4),NOM,MNTH,DAY,YEAR,LS(2),COEXPP,BRDGIO(2),MAK,THIO(2), MAN00330
     3 MAT,BARIO(2),TYPE,HYIO(2),CORR                                  MAN00340
      COMMON /COMP/ COEXP                                              MAN00350
      COMMON /INPUT/ THBL,THAIR,BARREO(2),HYGROM,OUM                   MAN00360
      COMMON /INPUT3/ FFM(6)                                           MAN00370
      COMMON /TABVAL/ VACWLN(3),SLTCOR(3),OBLCOR(3),PHSCOR(3),         MAN00380
     2 INTSNO(4,3),LSSNO(2,3),HYGSNO(2,6),BROSNO(2,3),THRSNO(2,3),     MAN00390
     3 BARSNO(2,3),CONFAC(3)                                           MAN00400
      EQUIVALENCE (BRDGR(1),VALUE(5))                                  MAN00410
      EQUIVALENCE (THBL,VALUEP(1))                                     MAN00420
      EQUIVALENCE (FFM(1),VALUE3(1))                                   MAN00430
      DATA TERM(1),TERM(2) /3HSTO,3HP  /                               MAN00440
C                                                                      MAN00450
C     ****************************************************************MAN00460
C                                                                      MAN00470
C     READ DATA WHICH REMAINS CONSTANT FOR ALL BLOCKS                  MAN00480
C       COLUMNS 2-7      TEST NUMBER        2A3                      MAN00490
C       COLUMNS 9-13     TIME               A3,A2                    MAN00500
C       COLUMNS 15-17    OBSERVER           A3                       MAN00510
C       COLUMNS 19-21    PLATEN             A3                       MAN00520
C        THE FOLLOWING DATA SEPARATED BY SPACES BEGINS AFTER COLUMN 23 MAN00530
```

```
C   THE VALUES MAY BE PUNCHED ANYWHERE ON THE REMAINOER OF THE CARD      MAN00540
C                        MONTH                                          MAN00550
C                        OAY                                            MAN00560
C                        YEAR                                           MAN00570
C                        INTERFEROMETER NUMBER                          MAN00580
C                         BRIDGE READING 1                              MAN00590
C                         BRIDGE READOING 2                             MAN00600
C                         BRIOGE READOING 3                             MAN00610
C                         BRIDGE READING 4                              MAN00620
C                                                                       MAN00630
C     ****************************************************************MAN00640
C                                                                       MAN00650
20    READ (IN,140) TESTNO(1),TESTNO(2),TIME(1),TIME(2),OBS,PLATEN,(M(I)MAN00660  Read data card 1.
     2,I=23,80)                                                         MAN00670
C                                                                       MAN00680
C     ****************************************************************MAN00690
C                                                                       MAN00700
C     STOP PUNCHED IN COLUMNS 2-5 TERMINATES OATA INPUT                 MAN00710
C                                                                       MAN00720
C     ****************************************************************MAN00730
C                                                                       MAN00740
      IF (TESTNO(1).EQ.TERM(1).ANO.TESTNO(2).EQ.TERM(2)) GO TO 120      MAN00750  Check for end of data.
      CALL READIT (VALUE,23,80,K,M)                                     MAN00760
      IF (K.EQ.8) GO TO 60                                              MAN00770
40    WRITE (IOUT,160) (M(I),I=1,80)                                    MAN00780
      STOP                                                              MAN00790
60    MNTH=VALUE(1)                                                     MAN00800
      OAY=VALUE(2)                                                      MAN00810
      YEAR=VALUE(3)                                                     MAN00820
      INTFER=VALUE(4)                                                   MAN00830
C                                                                       MAN00840
C     ****************************************************************MAN00850
C                                                                       MAN00860
C     READ THE FOLLOWING DATA WHICH IS PUNCHEO ANYWHERE ON THE CARO     MAN00870
C     THERMOCOUPLE READING FOR THE BLOCK                                MAN00880
C     THERMOCOUPLE READOING FOR THE AIR                                 MAN00890
C     BAROMETER READING 1                                               MAN00900
C     BAROMETER READOING 2                                              MAN00910
C     HYGROMETER READING                                                MAN00920
C     HYGROMETER ELEMENT NUMBER                                         MAN00930
C                                                                       MAN00940
C     ****************************************************************MAN00950
C                                                                       MAN00960
      READ (IN,180) (M(I),I=1,80)                                       MAN00970  Read data card 2.
      CALL READIT (VALUEP,1,80,K,M)                                     MAN00980
      IF (K.NE.6) GO TO 40                                              MAN00990
      ELEMNT=VALUEP(6)                                                  MAN01000
C                                                                       MAN01010
C     ****************************************************************MAN01020
C                                                                       MAN01030
C     SET UP NEEDED SERIAL NUMBERS FROM DATA STATEMENTS                 MAN01040  Pick up identification of
C                                                                       MAN01050    interferometer
C     ****************************************************************MAN01060    laser
C                                                                       MAN01070    hygrometer
      INTERI(1)=INTSNO(1,INTFER)                                        MAN01080    bridge
      INTERI(2)=INTSNO(2,INTFER)                                        MAN01090    barometer
      INTERI(3)=INTSNO(3,INTFER)                                        MAN01100    thermometer
      INTERI(4)=INTSNO(4,INTFER)                                        MAN01110
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      LS(1)=LSSNO(1,INTFER)                                              MAN01120
      LS(2)=LSSNO(2,INTFER)                                              MAN01130
      HYID(1)=HYGSNO(1,ELEMNT)                                           MAN01140
      HYID(2)=HYGSNO(2,ELEMNT)                                           MAN01150
      BRDGID(1)=BRDSNO(1,INTFER)                                         MAN01160
      BRDGID(2)=BRDSNO(2,INTFER)                                         MAN01170
      THID(1)=THRSNO(1,INTFER)                                           MAN01180
      THID(2)=THRSNO(2,INTFER)                                           MAN01190
      BARID(1)=BARSNO(1,INTFER)                                          MAN01200
      BARID(2)=BARSNO(2,INTFER)                                          MAN01210
C                                                                        MAN01220
C     ***************************************************************  MAN01230
C                                                                        MAN01240
C     COMPUTE AVERAGE OF BRIDGE READINGS                                 MAN01250
C     APPLY BRIDGE CORRECTIONS                                           MAN01260
C                                                                        MAN01270
C     ***************************************************************  MAN01280
C                                                                        MAN01290
      CALL BAVGCO                                                        MAN01300  Apply bridge correction.
C     ***************************************************************  MAN01310
C                                                                        MAN01320
C     CONVERT CORRECTED RESISTANCE TO REFERENCE TEMPERATURE IN C         MAN01330
C     USE A QUADRATIC EQUATION                                           MAN01340
C                                                                        MAN01350
C     ***************************************************************  MAN01360
C                                                                        MAN01370
      CALL RESTEM                                                        MAN01380  Convert resistance to
C     ***************************************************************  MAN01390  temperature.
C                                                                        MAN01400
C     CONVERT MICROVOLT READINGS TO DEGREES C                            MAN01410
C           FOR THERMOCOUPLES (BLOCK AND AIR)                            MAN01420
C     COMPUTE BLOCK TEMPERATURE AND AIR TEMPERATURE                      MAN01430
C                                                                        MAN01440
C     ***************************************************************  MAN01450
C                                                                        MAN01460
      THBL=THBL*CONFAC(INTFER)                                           MAN01470
      THAIR=THAIR*CONFAC(INTFER)                                         MAN01480
      TB=REFTEM+THBL                                                     MAN01490
      TA=REFTEM+THAIR                                                    MAN01500
C                                                                        MAN01510
C     ***************************************************************  MAN01520
C                                                                        MAN01530
C     COMPUTE AVERAGE OF BAROMETRIC PRESSURE READINGS                    MAN01540
C                                                                        MAN01550
C     ***************************************************************  MAN01560
C                                                                        MAN01570
      BARAVG=(BARRED(1)+BARRED(2))/2.0                                   MAN01580
      P=BARAVG                                                           MAN01590
C                                                                        MAN01600
C     ***************************************************************  MAN01610
C                                                                        MAN01620
C     COMPUTE HUMIDITY AND VAPOR PRESSURE                                MAN01630
C                                                                        MAN01640
C     ***************************************************************  MAN01650
C                                                                        MAN01660
      CALL HUMVP                                                         MAN01670  Compute vapor pressure.
C     ***************************************************************  MAN01680
C                                                                        MAN01690
```

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C     READ CARD TELLING NUMBER OF BLOCKS RUNG TO PLATEN                    MAN01700
C                                                                          MAN01710
C     ***********************************************************************MAN01720
C                                                                          MAN01730
      READ (IN,180) (M(I),I=1,80)                                          MAN01740     Read data card 3.
      CALL READIT (VALUE2,1,80,K,M)                                        MAN01750
      IF (K.NE.1) GO TO 40                                                 MAN01760
      N=VALUE2                                                             MAN01770
      DO 100 I=1,N                                                         MAN01780     Set up repeat loop.
C                                                                          MAN01790
C     ***********************************************************************MAN01800
C                                                                          MAN01810
C     READ VALUES WHICH CHANGE FOR EACH BLOCK  (FIXED FIELD)               MAN01820
C      COLUMNS 1-6      SERIAL NUMBER      2A3                           MAN01830
C      COLUMNS 9-20     NOMINAL SIZE       F12.0                         MAN01840
C      COLUMNS 28-40    ASSUMED LENGTH     D13.0                         MAN01850
C      COLUMNS 41-60    COEF. OF EXP.      D20.0                         MAN01860
C      COLUMNS 71-73    MAKER              A3                            MAN01870
C      COLUMNS 75-76    MATERIAL           A2                            MAN01880
C      COLUMNS 78-80    TYPE               A3                            MAN01890
C                                                                          MAN01900
C     ***********************************************************************MAN01910
C                                                                          MAN01920
      READ (IN,200) SERNO(1),SERNO(2),NOM,LSUBP,COEXP,MAK,MAT,TYPE         MAN01930     Read data card 4.
      READ (IN,180) (M(J),J=1,80)                                          MAN01940     Read data card 5.
C                                                                          MAN01950
C     ***********************************************************************MAN01960
C                                                                          MAN01970
C     READ FRINGE FRACTION MEASUREMENTS                                    MAN01980
C     CHECK FOR VALIDITY OF INPUT DATA                                     MAN01990
C                                                                          MAN02000
C     ***********************************************************************MAN02010
C                                                                          MAN02020
      CALL READIT (VALUE3,1,80,K,M)                                        MAN02030
      IF (K.NE.6) GO TO 40                                                 MAN02040
      IF (ABS(FFM(1)-FFM(6)).LE.3.0) GO TO 80                              MAN02050
      IF (ABS(FFM(2)-FFM(5)).LE.3.0) GO TO 80                              MAN02060
      IF (ABS(FFM(3)-FFM(4)).LE.3.0) GO TO 80                              MAN02070
      WRITE (IOUT,220) (FFM(II),II=1,6)                                    MAN02080
80    CONTINUE                                                             MAN02090
C                                                                          MAN02100
C     ***********************************************************************MAN02110
C                                                                          MAN02120
C     CALCULATE WAVELENGTH AT OBSERVED CONDITIONS                          MAN02130
C     CALCULATE LENGTH OF BLOCK                                            MAN02140
C                                                                          MAN02150
C     ***********************************************************************MAN02160
C                                                                          MAN02170
      CALL COMPUT                                                          MAN02180
C     ***********************************************************************MAN02190
C                                                                          MAN02200
C     PRINT RESULTS FOR EACH LENGTH                                        MAN02210
C                                                                          MAN02220
C     ***********************************************************************MAN02230
C                                                                          MAN02240
      CALL OUTPUT                                                          MAN02250
100   CONTINUE                                                             MAN02260     End repeat loop.
      GO TO 20                                                             MAN02270
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120   WRITE (IOUT,240)                                                    MAN02280
      STOP                                                                MAN02290
C                                                                         MAN02300
C                              FORMATS                                    MAN02310
140   FORMAT (1X,2A3,1X,A3,A2,1X,A3,1X,A3,1X,58A1)                        MAN02320
160   FORMAT (1X,10HCHECK DATA/1X,80A1)                                   MAN02330
180   FORMAT (80A1)                                                       MAN02340
200   FORMAT (2A3,2X,F12.0,7X,D13.0,D20.0,10X,A3,1X,A2,1X,A3)             MAN02350
220   FORMAT (//1X,38H******CHECK FRINGE FRACTION DATA******/1X,6F6.0)    MAN02360
240   FORMAT (1H1)                                                        MAN02370
C                                                                         MAN02380
      END                                                                 MAN02390


      SUBROUTINE READIT (Z,KOL,KOLP,K,N)                                  REA00010
C                                                                         REA00020
C     ****************************************************************REA00030
C                                                                         REA00040
C**   ANSI FORTRAN SUBROUTINE TO READ NUMBERS IN ANY FORMAT ANYWHERE   **REA00050
C**   ON A CARD (BETWEEN CARD COLUMNS 'KOL' AND 80, INCLUSIVE).        **REA00060
C**   WRITTEN BY ROY H. WAMPLER, STATISTICAL ENGINEERING LABORATORY,   **REA00070
C**   NATIONAL BUREAU OF STANDARDS, WASHINGTON, D. C. 20234            **REA00080
C**   VERSION OF FEBRUARY 8, 1971                                      **REA00090
C     MODIFIED BY RUTH N. VARNER                                          REA00100
C     MODIFICATION CAUSES DATA TO BE PICKED UP FROM N                     REA00110
C     AND STORED IN Z                                                     REA00120
C                                                                         REA00130
C     ****************************************************************REA00140
C                                                                         REA00150
C**   NUMBERS TO BE READ BY THIS ROUTINE SHOULD OBEY THE FOLLOWING     **REA00160
C**   RULES.                                                           **REA00170
C**                                                                    **REA00180
C**   (1)  BETWEEN ANY TWO NUMBERS THERE MUST BE A SEPARATOR.  THIS    **REA00190
C**   CAN BE ONE OR MORE BLANK SPACES, A COMMA, ANY LETTER EXCEPT D    **REA00200
C**   OR E, OR ANY CHARACTER EXCEPT A PLUS SIGN, A MINUS SIGN, OR A    **REA00210
C**   DECIMAL.                                                         **REA00220
C**                                                                    **REA00230
C**   (2)  NUMBERS CAN APPEAR IN INTEGER FORM.  EXAMPLES ARE           **REA00240
C**   0  63  -271  +81063  01  2,71,-534,28                            **REA00250
C**                                                                    **REA00260
C**   (3)  NUMBERS CAN BE WRITTEN WITH A DECIMAL POINT.  EXAMPLES ARE  **REA00270
C**   0. -1.0  38.1  -63.  .00015  +371,286                            **REA00280
C**                                                                    **REA00290
C**   (4)  NUMBERS CAN BE WRITTEN WITH AN EXPONENT WHICH MUST BE       **REA00300
C**   PRECEDED BY A D OR E.  (IN THIS ROUTINE D IS CONSIDERED EQUIVA-  **REA00310
C**   LENT TO E, AND NUMBERS WITH D ARE NOT INTERPRETED TO BE          **REA00320
C**   DOUBLE PRECISION NUMBERS.)  EXAMPLES ARE                         **REA00330
C**    2.1E12  2.1E 12  2.1E+12  2.1E-12                               **REA00340
C**   -2.1D12 -2.1D 12 -2.1D+12 -2.1D-12                               **REA00350
C**   0021.E02 .00021E5 2.1E0 2.1E-0                                   **REA00360
C**   21E12  21E+12  210-12                                            **REA00370
C**   THE LAST THREE EXAMPLES ILLUSTRATE THAT A DECIMAL NEED NOT BE    **REA00380
C**   USED IN CONNECTION WITH THE D OR E.                              **REA00390
C                                                                         REA00400
C     ****************************************************************REA00410
C                                                                         REA00420
      DIMENSION Z(40),A(3),N(80),IDIGIT(10)                               REA00430
C     ****************************************************************REA00440
```

Free Field
Input Subprogram

```
C                                                                       REA00450
C**   THE FOLLOWING DIMENSION STATEMENT AND THE THREE DATA STATEMENTS **REA00460
C**   WHICH FOLLOW THAT ARE MACHINE-DEPENDENT.                        **REA00470
      DIMENSION T(77)                                                   REA00480
      DATA T(1),T(2),T(3),T(4),T(5),T(6),T(7),T(8),T(9),T(10),T(11),    REA00490
     2 T(12),T(13),T(14),T(15),T(16),T(17),T(18),T(19),T(20),T(21),T(22)REA00500
     3,T(23),T(24),T(25),T(26),T(27),T(28),T(29),T(30),T(31),T(32),T(33)REA00510
     4,T(34),T(35),T(36),T(37),T(38),T(39),T(40),T(41),T(42),T(43),T(44)REA00520
     5,T(45),T(46),T(47),T(48),T(49),T(50),T(51),T(52),T(53),T(54),T(55)REA00530
     6,T(56),T(57),T(58),T(59),T(60),T(61),T(62),T(63),T(64),T(65),T(66)REA00540
     7,T(67),T(68),T(69),T(70),T(71),T(72),T(73),T(74),T(75),T(76),     REA00550
     8 T(77) /1.E-38,1.E-37,1.E-36,1.E-35,1.E-34,1.E-33,1.E-32,1.E-31,  REA00560
     9 1.E-30,1.E-29,1.E-28,1.E-27,1.E-26,1.E-25,1.E-24,1.E-23,1.E-22,  REA00570
     * 1.E-21,1.E-20,1.E-19,1.E-18,1.E-17,1.E-16,1.E-15,1.E-14,1.E-13,  REA00580
     1 1.E-12,1.E-11,1.E-10,1.E-9,1.E-8,1.E-7,1.E-6,1.E-5,1.E-4,1.E-3,  REA00590
     2 1.E-2,1.E-1,1.,1.E1,1.E2,1.E3,1.E4,1.E5,1.E6,1.E7,1.E8,1.E9,1.E10REA00600
     3,1.E11,1.E12,1.E13,1.E14,1.E15,1.E16,1.E17,1.E18,1.E19,1.E20,1.E21REA00610
     4,1.E22,1.E23,1.E24,1.E25,1.E26,1.E27,1.E28,1.E29,1.E30,1.E31,1.E32REA00620
     5,1.E33,1.E34,1.E35,1.E36,1.E37,1.E38/                             REA00630
      DATA IZERO,IMAX /39,77/                                           REA00640
      COMMON /IO/ NR,NW,IPCH                                            REA00650
C**   THE DIMENSIONED VARIABLE T IS USED FOR ENTERING POWERS OF TEN   **REA00660
C**   INTO THE PROGRAM.                                               **REA00670
C**   IZERO IS THE SUBSCRIPT OF T SUCH THAT T(IZERO) = 1. (= 1.E0).   **REA00680
C**   (ON THE UNIVAC 1108, T(IZERO) = T(39).)                         **REA00690
C**   IMAX IS THE LARGEST SUBSCRIPT OF T.                             **REA00700
C**   IN THE PROGRAM IT IS ASSUMED THAT (1 + IMAX)/2 = IZERO.  THAT   **REA00710
C**   IS, WE ASSUME THAT VALID SINGLE PRECISION NUMBERS RANGE IN      **REA00720
C**   ABSOLUTE VALUE FROM 10.**(1 - IZERO) TO 10.**(IZERO - 1), OR ARE**REA00730
C**   EQUAL TO ZERO.                                                  **REA00740
C**   NR IS THE COMPUTER'S READING UNIT, AND NW ITS WRITING UNIT.     **REA00750
C                                                                       REA00760
C     ******************************************************************REA00770
C                                                                       REA00780
C**   CHARACTERS OF INTEREST ARE ENTERED. THEY WILL BE COMPARED       **REA00790
C**   WITH N.                                                         **REA00800
C                                                                       REA00810
C     ******************************************************************REA00820
C                                                                       REA00830
      DATA IDIGIT(1),IDIGIT(2),IDIGIT(3),IDIGIT(4),IDIGIT(5),IDIGIT(6), REA00840
     2 IDIGIT(7),IDIGIT(8),IDIGIT(9),IDIGIT(10) /1H0,1H1,1H2,1H3,1H4,1H5REA00850
     3,1H6,1H7,1H8,1H9/                                                 REA00860
      DATA IPLUS,IMINUS,IDECML,ID,IE,IBLANK /1H+,1H-,1H.,1HD,1HE,1H /   REA00870
C                                                                       REA00880
C     ******************************************************************REA00890
C                                                                       REA00900
C     THE CHARACTERS ON ONE CARD ARE READ IN AN A-FORMAT AND STORED   **REA00910
C**   IN N.                                                           **REA00920
C                                                                       REA00930
C     ******************************************************************REA00940
C                                                                       REA00950
      IF (KOL.GE.1.AND.KOL.LE.80) GO TO 20                              REA00960
      IF (KOLP.GT.1.AND.KOLP.LE.80) GO TO 20                            REA00970
      CALL ERROR (KOL,A,N,LL,NW,7)                                      REA00980
      RETURN                                                            REA00990
C                                                                       REA01000
C     ******************************************************************REA01010
C                                                                       REA01020
```

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C**   APPROPRIATE VARIABLES ARE INITIALIZED.                          **REA01030
C                                                                       REA01040
C     ******************************************************************REA01050
C                                                                       REA01060
20    IDORE=0                                                           REA01070
      IEXP=0                                                            REA01080
      ISIGX=0                                                           REA01090
      K=0                                                               REA01100
      NDE=0                                                             REA01110
      NDEC=0                                                            REA01120
      NODEC=0                                                           REA01130
      NUMB=0                                                            REA01140
      NXDIG=0                                                           REA01150
      SIG=0.                                                            REA01160
      SIGN=0.                                                           REA01170
C                                                                       REA01180
C     ******************************************************************REA01190
C                                                                       REA01200
C**   THE CHARACTERS ON THE CARD ARE EXAMINED.                        **REA01210
C**   WHEN NUMBERS ARE FOUND THEY ARE STORED IN Z(K).                 **REA01220
C                                                                       REA01230
C     ******************************************************************REA01240
C                                                                       REA01250
      DO 1900 I=KOL,KOLP                                                REA01260
C     ******************************************************************REA01270
C                                                                       REA01280
C**   DETERMINE IF N(I) IS A DIGIT.                                   **REA01290
C                                                                       REA01300
C     ******************************************************************REA01310
C                                                                       REA01320
      IF (N(I).GE.IDIGIT(1).AND.N(I).LE.IDIGIT(10)) GO TO 980           REA01330
C     ******************************************************************REA01340
C                                                                       REA01350
C**   N(I) IS NOT A DIGIT.                                            **REA01360
C**   DETERMINE IF N(I) IS A PLUS, MINUS, DECIMAL, D, E, OR BLANK.    **REA01370
C                                                                       REA01380
C     ******************************************************************REA01390
C                                                                       REA01400
      IF (NUMB) 220,40,220                                              REA01410
40    IF (N(I)-IPLUS) 60,200,60                                         REA01420
60    IF (N(I)-IMINUS) 80,140,80                                        REA01430
80    IF (N(I)-IDECML) 100,120,100                                      REA01440
100   NDE=0                                                             REA01450
      SIG=0.                                                            REA01460
      GO TO 1500                                                        REA01470
120   NDE=1                                                             REA01480
      GO TO 1500                                                        REA01490
140   SIG=-1.                                                           REA01500
160   IF (NDE) 180,1500,180                                             REA01510
180   NDE=0                                                             REA01520
      GO TO 1500                                                        REA01530
200   SIG=1.                                                            REA01540
      GO TO 160                                                         REA01550
220   IF (IDORE) 620,240,620                                            REA01560
240   IF (NDEC) 440,260,440                                             REA01570
260   IF (N(I)-ID) 300,280,300                                          REA01580
280   IDORE=1                                                           REA01590
      NODEC=1                                                           REA01600
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      GO TO 1500                                                        REA01610
300   IF (N(I)-IE) 320,280,320                                          REA01620
320   IF (N(I)-IDECML) 360,340,360                                      REA01630
340   NDEC=1                                                            REA01640
      GO TO 1500                                                        REA01650
360   IF (N(I)-IPLUS) 400,380,400                                       REA01660
380   SIG=1.                                                            REA01670
      GO TO 1640                                                        REA01680
400   IF (N(I)-IMINUS) 1640,420,1640                                    REA01690
420   SIG=-1.                                                           REA01700
      GO TO 1640                                                        REA01710
440   IF (N(I)-ID) 480,460,480                                          REA01720
460   IDORE=1                                                           REA01730
      GO TO 1500                                                        REA01740
480   IF (N(I)-IE) 500,460,500                                          REA01750
500   IF (N(I)-IDECML) 540,520,540                                      REA01760
520   NDE=1                                                             REA01770
      GO TO 1680                                                        REA01780
540   IF (N(I)-IPLUS) 580,560,580                                       REA01790
560   SIG=1.                                                            REA01800
      GO TO 1680                                                        REA01810
580   IF (N(I)-IMINUS) 1680,600,1680                                    REA01820
600   SIG=-1.                                                           REA01830
620   IF (N(I)-IDECML) 680,640,680                                      REA01840
640   NDE=1                                                             REA01850
      IF (NXDIG) 1680,660,1680                                          REA01860
660   IF (NDEC) 1680,1640,1680                                          REA01870
680   IF (IDORE-1) 700,820,700                                          REA01880
700   IF (N(I)-IPLUS) 740,720,740                                       REA01890
720   SIG=1.                                                            REA01900
      GO TO 780                                                         REA01910
740   IF (N(I)-IMINUS) 780,760,780                                      REA01920
760   SIG=-1.                                                           REA01930
780   IF (NXDIG) 1680,800,1680                                          REA01940
800   IF (NDEC) 1680,1640,1680                                          REA01950
820   IF (NXDIG) 1680,840,1680                                          REA01960
840   IF (N(I)-IMINUS) 860,960,860                                      REA01970
860   IF (N(I)-IPLUS) 880,920,880                                       REA01980
880   IF (N(I)-IBLANK) 900,920,900                                      REA01990
900   IF (NDEC) 1680,1640,1680                                          REA02000
920   ISIGX=1                                                           REA02010
940   IDORE=IDORE+1                                                     REA02020
      GO TO 1500                                                        REA02030
960   ISIGX=-1                                                          REA02040
      GO TO 940                                                         REA02050
C                                                                       REA02060
C     ******************************************************************REA02070
C                                                                       REA02080
C**   N(I) IS A DIGIT.                                                **REA02090
C                                                                       REA02100
C     ******************************************************************REA02110
C                                                                       REA02120
980   IF (NUMB) 1000,1020,1000                                          REA02130
1000  IF (IDORE) 1400,1240,1400                                         REA02140
C                                                                       REA02150
C     ******************************************************************REA02160
C                                                                       REA02170
C**   N(I) IS THE FIRST DIGIT OF A NUMBER.                            **REA02180
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C                                                                       REA02190
C     ***************************************************************REA02200
C                                                                       REA02210
1020  IF (SIG) 1040,1060,1040                                           REA02220
1040  SIGN=SIG                                                          REA02230
      SIG=0.                                                            REA02240
      GO TO 1080                                                        REA02250
1060  SIGN=1.                                                           REA02260
1080  IF (NDE) 1100,1120,1100                                           REA02270
1100  NDEC=NDE+1                                                        REA02280
      NDE=0                                                             REA02290
1120  DO 1140 L=1,10                                                    REA02300
      IF (N(I).NE.IDIGIT(L)) GO TO 1140                                 REA02310
      IN=L-1                                                            REA02320
      GO TO 1160                                                        REA02330
1140  CONTINUE                                                          REA02340
1160  ZED=IN                                                            REA02350
      IF (ZED) 1180,1200,1180                                           REA02360
1180  LL=1                                                              REA02370
      GO TO 1220                                                        REA02380
1200  LL=0                                                              REA02390
1220  NUMB=1                                                            REA02400
      GO TO 1500                                                        REA02410
C                                                                       REA02420
C     ***************************************************************REA02430
C                                                                       REA02440
C**   N(I) IS THE J-TH DIGIT OF A NUMBER WHERE J IS GREATER THAN      **REA02450
C**   ONE.                                                            **REA02460
C                                                                       REA02470
C     ***************************************************************REA02480
C                                                                       REA02490
1240  IF (NDEC) 1260,1280,1260                                          REA02500
1260  NDEC=NDEC+1                                                       REA02510
1280  DO 1300 L=1,10                                                    REA02520
      IF (N(I).NE.IDIGIT(L)) GO TO 1300                                 REA02530
      IN=L-1                                                            REA02540
      GO TO 1320                                                        REA02550
1300  CONTINUE                                                          REA02560
1320  FIN=IN                                                            REA02570
      ZED=10.*ZED+FIN                                                   REA02580
      IF (ZED) 1340,1500,1340                                           REA02590
1340  LL=LL+1                                                           REA02600
      IF (LL.LT.IZERO) GO TO 1500                                       REA02610
      IF (LL.EQ.IZERO) GO TO 1360                                       REA02620
      GO TO 1380                                                        REA02630
1360  CALL ERROR (KOL,A,N,LL,NW,1)                                      REA02640
      GO TO 1500                                                        REA02650
1380  CALL ERROR (KOL,A,N,LL,NW,2)                                      REA02660
      GO TO 1920                                                        REA02670
C                                                                       REA02680
C     ***************************************************************REA02690
C                                                                       REA02700
C**   N(I) IS AN EXPONENTIAL DIGIT.                                   **REA02710
C                                                                       REA02720
C     ***************************************************************REA02730
C                                                                       REA02740
1400  IF (IDORE-1) 1440,1420,1440                                       REA02750
1420  ISIGX=)                                                           REA02760
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1440  DO 1460 L=1,10                                                    REA02770
      IF (N(I).NE.IDIGIT(L)) GO TO 1460                                 REA02780
      IN=L-1                                                            REA02790
      GO TO 1480                                                        REA02800
1460  CONTINUE                                                          REA02810
1480  IEXP=10*IEXP+IN                                                   REA02820
      NXDIG=NXDIG+1                                                     REA02830
      GO TO 1500                                                        REA02840
C                                                                       REA02850
C     ****************************************************************REA02860
C                                                                       REA02870
C**   DETERMINE IF THE LAST COLUMN OF THE CARD HAS BEEN REACHED.      **REA02880
C                                                                       REA02890
C     ****************************************************************REA02900
C                                                                       REA02910
1500  IF (I-80) 1900,1520,1520                                          REA02920
C     ****************************************************************REA02930
C                                                                       REA02940
C**   LAST COLUMN HAS BEEN REACHED.                                   **REA02950
C**   END-OF-CARD ROUTINE IS NOW EXECUTED.                            **REA02960
C                                                                       REA02970
C     ****************************************************************REA02980
C                                                                       REA02990
1520  IF (IDORE) 1600,1540,1600                                         REA03000
1540  IF (NUMB) 1580,1560,1580                                          REA03010
1560  SIG=0.                                                            REA03020
      NDE=0                                                             REA03030
      GO TO 1900                                                        REA03040
1580  IF (NDEC) 1680,1640,1680                                          REA03050
1600  IF (NXDIG) 1680,1620,1680                                         REA03060
1620  IF (NDEC) 1680,1640,1680                                          REA03070
C                                                                       REA03080
C     ****************************************************************REA03090
C                                                                       REA03100
C**   K-TH NUMBER (WHICH APPEARED IN INTEGER FORM) IS STORED AS       **REA03110
C**   Z(K).                                                           **REA03120
C                                                                       REA03130
C     ****************************************************************REA03140
C                                                                       REA03150
1640  K=K+1                                                             REA03160
      IF (ZED) 1660,1860,1660                                           REA03170
1660  Z(K)=SIGN*ZED                                                     REA03180
      GO TO 1880                                                        REA03190
C                                                                       REA03200
C     ****************************************************************REA03210
C                                                                       REA03220
C**   K-TH NUMBER (WHICH APPEARED IN NON-INTEGER FORM) IS STORED AS   **REA03230
C**   Z(K).                                                           **REA03240
C                                                                       REA03250
C     ****************************************************************REA03260
C                                                                       REA03270
1680  K=K+1                                                             REA03280
      NDEC=NDEC+NODEC                                                   REA03290
      IF (ZED) 1700,1860,1700                                           REA03300
1700  KK=LL+ISIGX*IEXP-NDEC+1                                           REA03310
      IF (KK.GT.(1-IZERO).AND.KK.LT.IZERO) GO TO 1800                   REA03320
      IF (KK.LT.(1-IZERO)) GO TO 1720                                   REA03330
      IF (KK.EQ.(1-IZERO)) GO TO 1740                                   REA03340
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      IF (KK.EQ.IZERO) GO TO 1760                                       REA03350
      IF (KK.GT.IZERO) GO TO 1780                                       REA03360
1720  CALL ERROR (KOL,A,N,LL,NW,3)                                      REA03370
      GO TO 1800                                                        REA03380
1740  CALL ERROR (KOL,A,N,LL,NW,4)                                      REA03390
      GO TO 1800                                                        REA03400
1760  CALL ERROR (KOL,A,N,LL,NW,5)                                      REA03410
      GO TO 1800                                                        REA03420
1780  CALL ERROR (KOL,A,N,LL,NW,6)                                      REA03430
      GO TO 1800                                                        REA03440
1800  M=KK-LL+IZERO                                                     REA03450
      IF (M.LE.0.OR.M.GT.IMAX) GO TO 1820                               REA03460
      Z(K)=SIGN*ZED*T(M)                                                REA03470
      GO TO 1880                                                        REA03480
1820  M=IZERO-LL                                                        REA03490
      IF (M.NE.0) GO TO 1840                                            REA03500
C     M IS EQUAL TO ZERO (SPECIAL CASE)                                 REA03510
      M=M+1                                                             REA03520
      ZED=ZED*T(M)                                                      REA03530
      M=KK+IZERO-1                                                      REA03540
      Z(K)=SIGN*ZED*T(M)                                                REA03550
      GO TO 1880                                                        REA03560
C     M IS NOT EQUAL TO ZERO                                            REA03570
1840  ZED=ZED*T(M)                                                      REA03580
      M=KK+IZERO                                                        REA03590
      Z(K)=SIGN*ZED*T(M)                                                REA03600
      GO TO 1880                                                        REA03610
1860  Z(K)=0.                                                           REA03620
C                                                                       REA03630
C     ****************************************************************REA03640
C                                                                       REA03650
C**   APPROPRIATE VARIABLES ARE RE-INITIALIZED.                        **REA03660
C                                                                       REA03670
C     ****************************************************************REA03680
C                                                                       REA03690
1880  IDORE=0                                                           REA03700
      IEXP=0                                                            REA03710
      ISIGX=0                                                           REA03720
      KK=0                                                              REA03730
      LL=0                                                              REA03740
      M=0                                                               REA03750
      NDEC=0                                                            REA03760
      NODEC=0                                                           REA03770
      NUMB=0                                                            REA03780
      NXDIG=0                                                           REA03790
      SIGN=0.                                                           REA03800
1900  CONTINUE                                                          REA03810
      RETURN                                                            REA03820
1920  KK=0                                                              REA03830
      LL=0                                                              REA03840
      M=0                                                               REA03850
      RETURN                                                            REA03860
      END                                                               REA03870


C     ****************************************************************ERR00010
C                                                                       ERR00020
C     THIS SUBPROGRAM CONTAINS ERROR MESSAGES USED BY READIT SUBPROGRAM ERR00030
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C     THIS SUBPROGRAM WAS WRITTEN BY ROY WAMPLER                          ERR00040
C     AND MODIFIED BY RUTH N. VARNER                                      ERR00050
C                                                                         ERR00060
      SUBROUTINE ERROR (KOL,A,N,LL,NW,KEY)                                ERR00070
C                                                                         ERR00080
C     ******************************************************************ERR00090
C                                                                         ERR00100
      DIMENSION A(3),N(80)                                                ERR00110
      GO TO (20,40,60,80,100,  120,140), KEY                              ERR00120
20    WRITE (NW,180) LL                                                   ERR00130
      GO TO 160                                                           ERR00140
40    WRITE (NW,200) LL                                                   ERR00150
      GO TO 160                                                           ERR00160
60    WRITE (NW,220)                                                      ERR00170
      GO TO 160                                                           ERR00180
80    WRITE (NW,240)                                                      ERR00190
      GO TO 160                                                           ERR00200
100   WRITE (NW,260)                                                      ERR00210
      GO TO 160                                                           ERR00220
120   WRITE (NW,280)                                                      ERR00230
      GO TO 160                                                           ERR00240
140   WRITE (NW,300) KOL                                                  ERR00250
      RETURN                                                              ERR00260
160   WRITE (NW,320)                                                      ERR00270
      WRITE (NW,340) (N(I),I=1,80)                                        ERR00280
      RETURN                                                              ERR00290
C                       FORMATS                                           ERR00300
C                                                                         ERR00310
180   FORMAT (25H0*****  DIAGNOSTIC  *****/1X,                           ERR00320
     2 64H*****  THE NUMBER OF SIGNIFICANT DIGITS IN A NUMBER HAS REACHEERR00330
     3D ,I3,42H.  THIS MAY PRODUCE OVERFLOW OR UNDERFLOW.)                ERR00340
200   FORMAT (20H0*****  ERROR  *****/1X,                                ERR00350
     2 64H*****  THE NUMBER OF SIGNIFICANT DIGITS IN A NUMBER HAS REACHEERR00360
     3D ,I3,43H.  THIS WILL PRODUCE OVERFLOW OR UNDERFLOW.)               ERR00370
220   FORMAT (87H0*****  ERROR  *****  NUMBER IS TOO SMALL IN ABSOLUTE VERR00380
     2ALUE AND WILL PRODUCE UNDERFLOW.)                                   ERR00390
240   FORMAT (87H0*****  DIAGNOSTIC  *****  NUMBER IS SMALL IN ABSOLUTE ERR00400
     2VALUE AND MAY PRODUCE UNDERFLOW.)                                   ERR00410
260   FORMAT (86H0*****  DIAGNOSTIC  *****  NUMBER IS LARGE IN ABSOLUTE ERR00420
     2VALUE AND MAY PRCDUCE OVERFLOW.)                                    ERR00430
280   FORMAT (86H0*****  ERROR  *****  NUMBER IS TOO LARGE IN ABSOLUTE VERR00440
     2ALUE AND WILL PRODUCE OVERFLOW.)                                    ERR00450
300   FORMAT (44H0*****  ERROR  *****  THE VALUE OF 'KOL' IS ,I6,         ERR00460
     2 27H AND THIS VALUE IS INVALID./1X,                                 ERR00470
     3 50HKOL MUST BE GREATER THAN 0 AND MUST NOT EXCEED 80.)             ERR00480
320   FORMAT (72H THIS OCCURRED IN CONNECTION WITH READING THE DATA ON TERR00490
     2HE FOLLOWING CARD)                                                  ERR00500
340   FORMAT (1H ,80A1)                                                   ERR00510
      END                                                                 ERR00520


C     ******************************************************************BAV00010
C                                                                         BAV00020
C     THIS SUBPROGRAM COMPUTES THE CORRECTED AVERAGE BRIDGE READING       BAV00030
C     WRITTEN BY RUTH N. VARNER                                           BAV00040
C                                                                         BAV00050
      SUBROUTINE BAVGCO                                                   BAV00060
C                                                                         BAV00070
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C     ***************************************************************BAV000B0
C                                                                     BAV00090
      COMMON /BRGIN/ XYZ(4),BRDGR(4),INTFER,BRDCOR                    BAV00100
      COMMON /IO/ IN,IOUT,IPCH                                        BAV00110
      COMMON /BRGTAB/ IUNIT(9,3),ITEN(9,3),ITENTH(9,3),IHUNO(9,3)     BAV00120
      COMMON /BRGOUT/ BRGMN,THERRS,REFTEM                             BAV00130
      BRGMN=0.0                                                       BAV00140
      BRDCOR=0.0                                                      BAV00150
      DO 20 I=1,4                                                     BAV00160
      BRGMN=BRGMN+BRDGR(I)                                            BAV00170
      IRRAV=BRDGR(I)*100.0                                            BAV001B0
      I4=MOD(IRRAV,10)                                                BAV00190
      I3=MOD((IRRAV/10),10)                                           BAV00200
      I2=MOD((IRRAV/100),10)                                          BAV00210
      I1=MOD((IRRAV/1000),10)                                         BAV00220
      IFP=INTFER                                                      BAV00230
      IF (I1.LT.1.OR.I1.GT.9) GO TO 40                                BAV00240
      IF (I2.LT.1.OR.I2.GT.9) GO TO 40                                BAV00250
      IF (I3.LT.1.OR.I3.GT.9) GO TO 40                                BAV00260
      IF (I4.LT.1.OR.I4.GT.9) GO TO 40                                BAV00270
      BRDCOR=FLOAT(ITEN(I1,IFP)+IUNIT(I2,IFP)+ITENTH(I3,IFP)+IHUNO(I4,IFBAV002B0
     2P))*1.E-5+BRDCOR                                                BAV00290
20    CONTINUE                                                        BAV00300
C                                                                     BAV00310
C     ***************************************************************BAV00320
C                                                                     BAV00330
C     COMPUTE AVERAGE OF BRIDGE READINGS                              BAV00340
C     COMPUTE AVERAGE OF BRIDGE CORRECTIONS                           BAV00350
C                                                                     BAV00360
C     ***************************************************************BAV00370
C                                                                     BAV00380
      BRGMN=BRGMN/4.0                                                 BAV00390
      BRDCOR=BRDCOR/4.0                                               BAV00400
C                                                                     BAV00410
C     ***************************************************************BAV00420
C                                                                     BAV00430
C     SUBTRACT BRIDGE ZERO                                            BAV00440
C                                                                     BAV00450
C     ***************************************************************BAV00460
C                                                                     BAV00470
      BRDCOR=BRDCOR-.00005                                            BAV004B0
      THERRS=BRGMN+BRDCOR                                             BAV00490
      RETURN                                                          BAV00500
C                                                                     BAV00510
C     ***************************************************************BAV00520
C                                                                     BAV00530
C     TERMINATE RUN IF THERE IS AN INCORRECT DIAL READING             BAV00540
C                                                                     BAV00550
C     ***************************************************************BAV00560
C                                                                     BAV00570
40    WRITE (IOUT,60) I1,I2,I3,I4                                     BAV00580
60    FORMAT (1X,24HCHECK RESISTANCE AVERAGE/1X,4I1)                  BAV00590
      STOP                                                            BAV00600
      END                                                             BAV00610


C     ***************************************************************RES00010
C                                                                     RES00020
```

This subprogram averages the four given bridge readings and their corresponding corrections. The averaged correction is added to the averaged reading. Bridge zero is .00005 ohms and is subtracted from the corrected reading. The bridge zero value is specific to NBS equipment. The user must modify this for his own equipment. See line of code numbered BAV00480.

```
C     THIS SUBPRDGRAM CDNVERTS RESISTANCE TD REFERENCE TEMPERATURE      RES00030
C     USING THE EQUATIDNS DESCRIBED IN NBS MDNDGRAPH 126               RES00040
C     A QUADRATIC SDLUTIDN IS DERIVED                                  RES00050
C     WRITTEN BY RUTH N. VARNER                                        RES00060
C                                                                      RES00070
      SUBRDUTINE RESTEM                                                RES00080
C                                                                      RES00090
C     ****************************************************************RES00100
C                                                                      RES00110
      CDMMDN /BRGDUT/ BRGMN,THERRS,REFTEM                              RES00120
      CDMMDN /BRGIN/ XYZ(4),BRDGR(4),INTFER,BRDCDR                     RES00130
      CDMMDN /RESTAB/ TALPHA(3),DELTA(3),RICEPT(3)                     RES00140
      DOUBLE PRECISIDN TALPHA,DELTA,AMT,A,B,C,RICEPT,RZERD,RT1,RT2     RES00150
      AMT(T)=.045D0*(T/100.D0)*(T/100.D0-1.D0)*(T/419.58D0-1.D0)*(T/630.RES00160
     274D0-1.D0)                                                       RES00170
      IFP=INTFER                                                       RES00180
      A=DELTA(IFP)/10000.D0                                            RES00190
      B=-(1.D0+DELTA(IFP)/100.D0)                                      RES00200
      RZERD=RICEPT(IFP)                                                RES00210
      C=(THERRS/RZERD-1.D0)/TALPHA(IFP)                                RES00220
      CALL QUAD (A,B,C,IND,RT1,RT2)                                    RES00230
      REFTEM=RT2+AMT(RT2)                                              RES00240
      RETURN                                                           RES00250
      END                                                              RES00260
```

This subprogram sets up the coefficients to convert resistance to temperature using the quadratic equation where

$$t = t' + M(t')$$

$$t' = \frac{1}{\alpha}\left(\frac{R_T}{R_o} - 1\right) + \delta\left(\frac{t'}{100} - 1\right)\frac{t'}{100}$$

α and δ and R_o are constants for the calibrated thermometer being used in the measurements. R_T is the measured resistance.

$$M(t') = .045\left(\frac{t'}{100}\right)\left(\frac{t'}{100} - 1\right)\left(\frac{t'}{419.58} - 1\right)\left(\frac{t'}{630.74} - 1\right)$$

```
C     ****************************************************************QUA00010
C                                                                      QUA00020
C     THIS SUBPRDGRAM GIVES A GENERAL QUADRATIC SDLUTIDN               QUA00030
C     CHECKS ARE MADE FDR ND SDLUTION, IMAGINARY SDLUTIDN              QUA00040
C     ALGDRITHM USED IS DETERMINED BY CDEFFICIENTS                     QUA00050
C     AN INDICATDR IS RETURNED DENDTING TYPE DF RESULT                 QUA00060
C     WRITTEN BY RUTH N. VARNER                                        QUA00070
C                                                                      QUA00080
      SUBRDUTINE QUAD (A,B,C,IND,RT1,RT2)                              QUA00090
C                                                                      QUA00100
C     ****************************************************************QUA00110
C                                                                      QUA00120
      DDUBLE PRECISIDN RT1,RT2,A,B,C,CDNST,D,A2,C2,BMINUS,BPLUS,CP     QUA00130
      DDUBLE PRECISIDN D1,D2,D3                                        QUA00140
      DATA CDNST /1.D-8/                                               QUA00150
C     IND=0   ALL IS CDRRECT                                           QUA00160
C     IND=1   NO SDLUTIDN PDSSIBLE RT1=0  RT2=0                        QUA00170
C     IND=2   IMAGINARY RDDTS RT1=0 RT2=0                              QUA00180
C     IND=3 EQUATIDN IS LINEAR DNLY RT1 IS CDMPUTED.                   QUA00190
      IND=0                                                            QUA00200
      RT1=0.D0                                                         QUA00210
      RT2=0.D0                                                         QUA00220
      IF (DABS(A)-CDNST) 20,20,120                                     QUA00230
20    IF (DABS(B)-CONST) 40,40,80                                      QUA00240
C   ND PDSSIBLE SDLUTIDN A=0  B=0                                      QUA00250
40    IND=1                                                            QUA00260
60    RETURN                                                           QUA00270
80    IF (DABS(C)-CONST) 40,40,100                                     QUA00280
C    LINEAR EQUATIDN A=0                                               QUA00290
100   RT1=-C/B                                                         QUA00300
      IND=3                                                            QUA00310
      RETURN                                                           QUA00320
```

```
120   IF (DABS(B)-CONST) 140,140,200                                    QUA00330
140   IF (DABS(C)-CONST) 60,60,160                                      QUA00340
160   CP=C/A                                                            QUA00350
      IF (CP) 180,60,40                                                 QUA00360
180   RT1=DSQRT(-CP)                                                    QUA00370
      RT2=-RT1                                                          QUA00380
      RETURN                                                            QUA00390
200   IF (DABS(C)-CONST) 220,220,280                                    QUA00400
220   IF (B) 240,60,260                                                 QUA00410
240   RT1=-B/A                                                          QUA00420
      RETURN                                                            QUA00430
260   RT2=B/A                                                           QUA00440
      RETURN                                                            QUA00450
C     DO THIS IN DOUBLE PRECISION                                       QUA00460
280   D1=B                                                              QUA00470
      D1=D1*D1                                                          QUA00480
      D2=A                                                              QUA00490
      D2=D2*C                                                           QUA00500
      D2=4.D0*D2                                                        QUA00510
      D3=D1-D2                                                          QUA00520
      IF (D3) 300,320,340                                               QUA00530
C     IMAGINARY ROOTS                                                   QUA00540
300   IND=2                                                             QUA00550
      RETURN                                                            QUA00560
320   D=0.D0                                                            QUA00570
      GO TO 360                                                         QUA00580
340   D=DSQRT(D3)                                                       QUA00590
360   A2=2.D0*A                                                         QUA00600
      C2=2.D0*C                                                         QUA00610
      BMINUS=-B-D                                                       QUA00620
      BPLUS=-B+D                                                        QUA00630
      IF (B.LT.0.D0) GO TO 380                                          QUA00640
      RT1=C2/BMINUS                                                     QUA00650
      RT2=BMINUS/A2                                                     QUA00660
      GO TO 400                                                         QUA00670
380   RT1=BPLUS/A2                                                      QUA00680
      RT2=C2/BPLUS                                                      QUA00690
400   RETURN                                                            QUA00700
      END                                                               QUA00710


C     ****************************************************************HUM00010
C                                                                       HUM00020
C     THIS SUBPROGRAM CONVERTS HYGROMETER DIAL READINGS                 HUM00030
C     TO RELATIVE HUMIDITY USING THE EQUATION                           HUM00040
C     AND COEFFICIENTS APPROPRIATE FOR EACH HYGROMETER                  HUM00050
C     WRITTEN BY RUTH N. VARNER                                         HUM00060
C                                                                       HUM00070
      SUBROUTINE HUMVP                                                  HUM00080
C                                                                       HUM00090
C     ****************************************************************HUM00100
C                                                                       HUM00110
      DOUBLE PRECISION TA,TB,F                                          HUM00120
      COMMON /HUMIDV/ F,HUMID                                           HUM00130
      COMMON /HUMCOR/ CORRF(6)                                          HUM00140
      COMMON /HUMDAT/ COEF(6,6,3)                                       HUM00150
      COMMON /IO/ IN,IOUT,IPCH                                          HUM00160
      COMMON /IFER/ TB,TA,ELEMNT                                        HUM00170
```

This subprogram converts the hygrometer dial readings to humidity using the appropriate coefficient in the equation

$$\text{humidity} = Ax^5 + Bx^4 + Cx^3 + Dx^2 + Ex + F$$

To this value is added a humidity correction factor.

```
      COMMON /INPUT/ THBL,THAIR,BARRED(2),HYGROM,DUM                    HUM00180
      INTEGER ELEMNT                                                    HUM00190
      J=ELEMNT                                                          HUM00200
      L=1                                                               HUM00210
      GO TO (20,40,60,80,100,  120), J                                  HUM00220
20    IF (HYGROM.LT.20.0.OR.HYGROM.GT.94.0) GO TO 260                   HUM00230
      GO TO 140                                                         HUM00240
40    IF (HYGROM.LT.6.0.OR.HYGROM.GT.90.0) GO TO 260                    HUM00250
      GO TO 140                                                         HUM00260
60    IF (HYGROM.LT.6.0.OR.HYGROM.GT.90.0) GO TO 260                    HUM00270
      GO TO 140                                                         HUM00280
80    IF (HYGROM.LT.12.0.OR.HYGROM.GT.94.0) GO TO 260                   HUM00290
      IF (HYGROM.GT.31.0) L=2                                           HUM00300
      IF (HYGROM.GT.53.0) L=3                                           HUM00310
      GO TO 140                                                         HUM00320
100   IF (HYGROM.LT.20.0.OR.HYGROM.GT.94.0) GO TO 260                   HUM00330
      GO TO 140                                                         HUM00340
120   IF (HYGROM.LT.6.0.OR.HYGROM.GT.94.0) GO TO 260                    HUM00350
      IF (HYGROM.GT.29.0) L=2                                           HUM00360
      IF (HYGROM.GT.61.0) L=3                                           HUM00370
140   HUMID=((((COEF(1,J,L)*HYGROM+COEF(2,J,L))*HYGROM+COEF(3,J,L))*HYGRHUM00380
     2OM+COEF(4,J,L))*HYGROM+COEF(5,J,L))*HYGROM+COEF(6,J,L)            HUM00390
C                                                                       HUM00400
C     ****************************************************************HUM00410
C                                                                       HUM00420
C     APPLY HUMIDITY CORRECTION FACTOR                                  HUM00430
C     CONVERT AIR TEMPERATURE TO DEGREES F                              HUM00440
C                                                                       HUM00450
C     ****************************************************************HUM00460
C                                                                       HUM00470
      TAF=1.8*TA+32.                                                    HUM00480
      TAFDIF=(80.0-TAF)/20.0                                            HUM00490
C                                                                       HUM00500
C     ****************************************************************HUM00510
C                                                                       HUM00520
C     DETERMINE HUMIDITY CORRECTION                                     HUM00530
C     COEFFICIENTS WERE DETERMINED BY USING DATA                        HUM00540
C             READ FROM GRAPH AND FITTING IT TO A                       HUM00550
C             CURVE WHICH PRODUCED A SMALL RESIDUAL                     HUM00560
C             STANDARD DEVIATION (OMNITAB WAS USED)                     HUM00570
C                                                                       HUM00580
C     ****************************************************************HUM00590
C                                                                       HUM00600
      IF (TAF.GT.80.0.OR.TAF.LT.60.0) GO TO 220                         HUM00610
      IF (HUMID.LT.16.0) GO TO 160                                      HUM00620
      IF (HUMID.GT.75.0) GO TO 180                                      HUM00630
      CORRF(J)=3.0*TAFDIF                                               HUM00640
      GO TO 200                                                         HUM00650
160   CORRF(J)=(((-.01250001*HUMID)+.43500001)*HUMID+(-.94000003))*TAFDIHUM00660
     2F                                                                 HUM00670
      GO TO 200                                                         HUM00680
180   CORRF(J)=(((-.14880970E-3*HUMID)+(-.046130921))*HUMID+7.2446414)*THUM00690
     2AFDIF                                                             HUM00700
C     CONVERT REALTIVE HUMIDITY TO VAPOR PRESSURE IN MM                 HUM00710
C     Y(VAPOR PRESSURE) = 0.174 X (RELATIVE HUMIDTY)                    HUM00720
200   HUMID=HUMID+CORRF(J)                                              HUM00730
      F=HUMID*0.174                                                     HUM00740
      RETURN                                                            HUM00750
```

These coefficients were determined from the graph for humidity correction factors found in Appendix B.

Vapor Pressure = .174 (corrected humidity)

```
220   WRITE (IOUT,240) TAF                                              HUM00760
240   FORMAT (//1X,83HHUMIDITY CORRECTION CANNOT BE APPLIED BECAUS TEMPEHUM00770
     2RATURE IS BEYOND ALLOWABLE RANGE/1X,12HTEMPERATURE=F12.4)         HUM00780
      STOP                                                              HUM00790
260   WRITE (IOUT,280) HYGROM                                           HUM00800
280   FORMAT (//1X,24HHYGROMETER DIAL READING F12.4,1X,                 HUM00810
     2 15HIS CUT OF RANGE)                                             HUM00820
      STOP                                                              HUM00830
      END                                                               HUM00840


C     ******************************************************************COM00010
C                                                                       COM00020
C     THIS SUBPROGRAM COMPUTES THE EFFECTIVE WAVELENGTH                 COM00030
C     AND LENGTH OF BLOCK                                               COM00040
C     USING EQUATIONS DEFINED IN NBS MONOGRAPH 152                      COM00050
C     WRITTEN BY RUTH N. VARNER                                         COM00060
C                                                                       COM00070
      SUBROUTINE COMPUT                                                 COM00080
C                                                                       COM00090
C     ******************************************************************COM00100
C                                                                       COM00110
      DOUBLE PRECISION BETA,FPRIM1,FPRIM2,TDIF1,TDIF2,TDIF3             COM00120
      DOUBLE PRECISION F                                                COM00130
      DOUBLE PRECISION A,P,LAM0,SIG,SIG2,TA,B,C,LAMTPF,LTPRIM,PHI       COM00140
      DOUBLE PRECISION LSUBP,COEXP,TB,NOOFFR,FPRIM,L20,L21              COM00150
      DOUBLE PRECISION NOMP,CORRP                                       COM00160
      DOUBLE PRECISION SLTCOR,OBLCOR,PHSCOR,VACWLN                      COM00170
      REAL NOM                                                          COM00180
      INTEGER DAY,YEAR                                                  COM00190
      COMMON /INTOUT/ A,B,C,BETA,LTPRIM,L21                             COM00200
      COMMON /IO/ IN,IOUT,IPCH                                          COM00210
      INTEGER ELEMNT                                                    COM00220
      COMMON /IFER/ TB,TA,ELEMNT                                        COM00230
      COMMON /BRGIN/ XYZ(4),BRDGR(4),INTFER,BRDCOR                      COM00240
      COMMON /BARPRS/ P,BARAVG                                          COM00250
      COMMCN /HUMIDV/ F,HUMID                                           COM00260
      COMMON /OUT/ PHI,LSUBP,LAM0,L20,NOOFFR,LAMTPF,FPRIM,SERNO(2),     COM00270
     2 INTERI(4),NOM,MNTH,DAY,YEAR,LS(2),COEXPP,BRDGID(2),MAK,THID(2),  COM00280
     3 MAT,BARID(2),TYPE,HYID(2),CORR                                   COM00290
      COMMON /COMP/ COEXP                                               COM00300
      COMMON /INPUT3/ FFM(6)                                            COM00310
      COMMON /TABVAL/ VACWLN(3),SLTCOR(3),OBLCOR(3),PHSCOR(3),          COM00320
     2 INTSNO(4,3),LSSNO(2,3),HYGSNO(2,6),BRDSNO(2,3),THRSNO(2,3),      COM00330
     3 BARSNO(2,3),CONFAC(3)                                            COM00340
C                                                                       COM00350
C     ******************************************************************COM00360
C                                                                       COM00370
C     COMPUTE WAVELENGTH AT OBSERVED CONDITIONS                         COM00380
C     USE WAVELENGTH CORRECTION FORMULA                                 COM00390
C     LAM0 IS EXPRESSED IN MICRO METERS                                 COM00400
C     AND IS SELECTED FROM THE BLOCK DATA SUBPROGRAM                    COM00410
C                                                                       COM00420
C     ******************************************************************COM00430
C                                                                       COM00440
      LAM0=VACWLN(INTFER)                                               COM00450
      SIG=1.D0/LAM0                                                     COM00460
      SIG2=SIG*SIG                                                      COM00470
```

This subprogram computes the length of the gage block. See John S. Beers, "A Gage Block Measurement Process Using Single Wavelength Interferometry," Nat. Bur. of Stds. Mono. 152, Dec. 1975, sections 6, 6.1, 6.2, and 6.3 for a detailed description of the calculations.

Compute wavelength at observed conditions.

```
      A=(P*(8342.13D0+2406030.D0/(130.0D0-SIG2)+15997.D0/(38.9D0-SIG2))*COM00480
     21.D-8)/720.775D0                                                  COM00490
      B=(1.D0+P*(.817D0-.0133D0*TA)*1.D-6)/(1.D0+.003661D0*TA)          COM00500
      C=F*(5.7224D0-.0457D0*SIG2)*1.D-8                                 COM00510
C                                                                       COM00520
C     ****************************************************************COM00530
C                                                                       COM00540
C     DIVIDE BY 254.D-4 TO GET TO MICRO INCHES                          COM00550
C     .0254 METERS = 1 INCH                                             COM00560
C     LAMTPF COMPUTED IN MICRO INCHES                                   COM00570
C                                                                       COM00580
C     ****************************************************************COM00590
C                                                                       COM00600
      LAMTPF=(LAM0/(1.D0+A*B-C))/254.D-4                                COM00610
C     ****************************************************************COM00620
C                                                                       COM00630
C     COMPUTE FRINGE FRACTION FROM FRINGE FRACTION MEASUREMENT DATA     COM00640
C     CHECK VALIDITY OF FRINGE FRACTION MEASUREMENTS                    COM00650
C                                                                       COM00660
C     ****************************************************************COM00670
C                                                                       COM00680
      PHI=((FFM(2)-FFM(1))/(FFM(3)-FFM(1))+(FFM(5)-FFM(6))/(FFM(4)-FFM(6COM00690
     2)))/2.0                                                           COM00700
      IF (PHI) 40,80,20                                                 COM00710
20    IF (PHI-1.0) 80,80,40                                             COM00720
40    WRITE (IOUT,60)                                                   COM00730
60    FORMAT (1X,45HFRINGE FRACTION IS NEGATIVE OR GREATER THAN 1)      COM00740
      STOP                                                              COM00750
80    BETA=1.C0+COEXP*(TB-20.D0)                                        COM00760
      LTPRIM=LSUBP*BETA                                                 COM00770
      CCEXPP=COEXP                                                      COM00780
C                                                                       COM00790
C     ****************************************************************COM00800
C                                                                       COM00810
C     MULTIPLY BY 1.D6 TO GET INCHES                                    COM00820
C     PICK INTEGER PART OF FRINGES                                      COM00830
C     DETERMINE VALUE CLOSEST TO ASSUMED LENGTH                         COM00840
C                                                                       COM00850
C     ****************************************************************COM00860
C                                                                       COM00870
      NOOFFR=((2.0D0*LTPRIM)/LAMTPF)*1.D6                               COM00880
      INTF=NOOFFR                                                       COM00890
      FPRIM=INTF                                                        COM00900
      FPRIM=FPRIM+PHI                                                   COM00910
      FPRIM1=FPRIM+1.D0                                                 COM00920
      FPRIM2=FPRIM-1.D0                                                 COM00930
      TDIF1=DABS(NOOFFR-FPRIM)                                          COM00940
      TDIF2=DABS(NCOFFR-FPRIM1)                                         COM00950
      TDIF3=DABS(NCOFFR-FPRIM2)                                         COM00960
      IF (TDIF1-TDIF2) 100,100,120                                      COM00970
100   IF (TDIF1-TDIF3) 200,200,180                                      COM00980
120   IF (TDIF1-TDIF3) 140,140,160                                      COM00990
140   FPRIM=FPRIM1                                                      COM01000
      GO TO 200                                                         COM01010
160   IF (TDIF2-TDIF3) 140,140,180                                      COM01020
180   FPRIM=FPRIM2                                                      COM01030
C                                                                       COM01040
C     ****************************************************************COM01050
```

Compute fringe fraction.

Calculate the whole number of fringes in the gage block.

```
C                                                                       COM01060
C     COMPUTE LENGTH OF BLOCK                                           COM01070
C     SAVE ONLY 8 DECIMALS                                              COM01080
C     COMPUTE CORRECTION IN MICRO INCHES                                COM01090
C                                                                       COM01100
C     ****************************************************************COM01110
C                                                                       COM01120
200   L21=(LAMTPF/2.D0)*FPRIM*1.D-6*(1.D0+COEXP*(20.D0-TB))+LSUBP*(SLTCOCOM01130
     2R(INTFER)+OBLCOR(INTFER)+PHSCOR(INTFER))                          COM01140
      IL20=L21*1.D8                                                     COM01150
      L20=IL20                                                          COM01160
      L20=L20/1.D8                                                      COM01170
      NOMP=NOM                                                          COM01180
      CORRP=L20-NOMP                                                    COM01190
      CORR=CORRP*1.D6                                                   COM01200
      RETURN                                                            COM01210
      END                                                               COM01220


C     ****************************************************************INF00010
C                                                                       INF00020
C     THIS SUBPROGRAM PRINTS ONE PAGE AND                               INF00030
C     PUNCHES TWO CARDS FOR EACH MEASUREMENT                            INF00040
C     WRITTEN BY RUTH N. VARNER                                         INF00050
C                                                                       INF00060
      SUBROUTINE OUTPUT                                                 INF00070
C                                                                       INF00080
C     ****************************************************************INF00090
C                                                                       INF00100
      DIMENSION L20P(12)                                                INF00110
      REAL NOM                                                          INF00120
      INTEGER DAY,YEAR                                                  INF00130
      INTEGER ELEMNT                                                    INF00140
      DOUBLE PRECISION LSUBP,LAM0,P,F,PHI,L20                           INF00150
      DOUBLE PRECISION NOOFFR,LAMTPF,FPRIM                              INF00160
      DOUBLE PRECISION TB,TA                                            INF00170
      DOUBLE PRECISION VACWLN,SLTCOR,OBLCOR,PHSCOR                      INF00180
      COMMON /INTOUT/ A,B,C,BETA,LTPRIM,L21                             INF00190
      DOUBLE PRECISION A,B,C,BETA,LTPRIM,L21                            INF00200
      COMMON /IO/ IN,IOUT,IPCH                                          INF00210
      COMMON /OUT/ PHI,LSUBP,LAM0,L20,NOOFFR,LAMTPF,FPRIM,SERNO(2),     INF00220
     2 INTERI(4),NOM,MNTH,DAY,YEAR,LS(2),COEXPP,BRDGID(2),MAK,THID(2),  INF00230
     3 MAT,BARID(2),TYPE,HYID(2),CORR                                   INF00240
      COMMON /OUTR/ TESTNO(2),TIME(2),OBS,PLATEN                        INF00250
      COMMON /BRGIN/ XYZ(4),BRDGR(4),INTFER,BRDCOR                      INF00260
      COMMON /INPUT/ THBL,THAIR,BARRED(2),HYGROM,DUM                    INF00270
      COMMON /BARPRS/ P,BARAVG                                          INF00280
      COMMON /HUMIDV/ F,HUMID                                           INF00290
      COMMON /IFER/ TB,TA,ELEMNT                                        INF00300
      COMMON /BRGOUT/ BRGMN,THERRS,REFTEM                               INF00310
      COMMON /HUMCOR/ CORRF(6)                                          INF00320
      COMMON /TABVAL/ VACWLN(3),SLTCOR(3),OBLCOR(3),PHSCOR(3),          INF00330
     2 INTSNO(4,3),LSSNO(2,3),HYGSNO(2,6),BRDSNO(2,3),THRSNO(2,3),      INF00340
     3 BARSNO(2,3),CONFAC(3)                                            INF00350
      WRITE (IOUT,20)                                                   INF00360
20    FORMAT (1H1,17X,38HINTERFEROMETRIC GAGE BLOCK MEASUREMENT//)      INF00370
      WRITE (IOUT,40) SERNO(1),SERNO(2),TESTNO(1),TESTNO(2),INTERI(1),ININF00380
     2TERI(2),INTERI(3),INTERI(4),NOM,MNTH,DAY,YEAR,PHI,TIME(1),TIME(2),INF00390
```

Calculate the length of the gage block.

This subprogram produces the final output consisting of a printed page and two punched cards for each block. See the included example in Section 5.

```
     3LS(1),LS(2)                                                          INF00400
40    FORMAT (1X,10HSERIAL NO.,7X,2A3,1X,8HTEST NO.,1X,2A3,1X,             INF00410
     2 14HINTERFEROMETER,5X,4A3/1X,12HNOMINAL SIZE,2X,F9.6,1X,4HDATE,3X,  INF00420
     3 I2,1H/,I2,1H/,I2,1X,18HMEAS. FRINGE FRAC.,7X,F4.2/1X,              INF00430
     4 14HASSUMED LENGTH,10X,4HTIME,5X,A3,A2,1X,12HLIGHT SOURCE,3X,       INF00440
     5 9HLASER NO.,1X,2A3)                                                INF00450
      SCORR=SLTCOR(INTFER)                                                INF00460
      OCORR=OBLCOR(INTFER)                                                INF00470
      PCORR=PHSCOR(INTFER)                                                INF00480
      WRITE (IOUT,60) LSUBP,OBS,LAM0,COEXPP,PLATEN,SCORR,MAK,OCORR,MAT,PINF00490
     2CORR,TYPE                                                           INF00500
60    FORMAT (1X,D23.9,1X,8HOBSERVER,4X,A3,1X,15HVAC. WAVELENGTH,D15.9/    INF00510
     2 1X,11HCOEF OF EXP,E12.6,1X,6HPLATEN,6X,A3,1X,9HSLIT CORR,8X,E13.7INF00520
     3/1X,5HMAKER,15X,A3,17X,10HCBLIQ CORR,7X,E13.7/1X,8HMATERIAL,13X,A2INF00530
     4,17X,10HPHASE CORR,7X,E13.7/1X,4HTYPE,16X,A3/)                      INF00540
      WRITE (IOUT,80) BRDGID(1),BRDGID(2),THID(1),THID(2),BARID(1),BARIDINF00550
     2(2),HYID(1),HYID(2)                                                 INF00560
80    FORMAT (1X,9HBRIDGE ID,1X,2A3,20X,14HTHERMOMETER ID,1X,2A3/1X,       INF00570
     2 12HBAROMETER ID,1X,2A3,17X,13HHYGROMETER ID,1X,2A3/)               INF00580
      WRITE (IOUT,100) BRDGR(1),BARRED(1),BRDGR(2),BARRED(2),HYGROM,BRDGINF00590
     2R(3)                                                                INF00600
100   FORMAT (29X,11HENVIRONMENT///8X,11HTEMPERATURE,19X,8HPRESSURE,14X,INF00610
     2 8HHUMIDITY//1X,6HBRIDGE,13X,F8.5,6X,9HBAROMETER,3X,F6.2,6X,        INF00620
     3 10HHYGROMETER/1X,8HREADINGS,11X,F8.5,6X,8HREADINGS,4X,F6.2,6X,     INF00630
     4 8HREADING ,5X,F4.1/20X,F8.5)                                       INF00640
      WRITE (IOUT,120) BRDGR(4),BRGMN,BARAVG,BRDCOR,CORRF(ELEMNT),THERRSINF00650
     2,P,HUMID,REFTEM,F                                                   INF00660
120   FORMAT (20X,F8.5/1X,4HMEAN,15X,F8.5,18X,F6.2/1X,4HCORR,15X,F8.5,     INF00670
     2 44X,F3.1/1X,17HTHERM. RESISTANCE,2X,F8.5,6X,8HPRESSURE,4X,F6.2,6XINF00680
     3,8HHUMIDITY,5X,F4.1/1X,10HREF. TEMP.,10X,F7.3,30X,11HVAPOR PRESS.,  INF00690
     4 2X,F4.1)                                                           INF00700
      WRITE (IOUT,140) THBL,THAIR,TB,TA                                   INF00710
140   FORMAT (1X,19HTHERMOCOUPLE(BLOCK),1X,F7.3/1X,17HTHERMOCOUPLE(AIR),INF00720
     2 3X,F7.3/1X,11HBLOCK TEMP.,D16.5/1X,9HAIR TEMP.,D18.5//)            INF00730
C                                                                         INF00740
C     ******************************************************************INF00750
C                                                                         INF00760
C     CONVERT DOUBLE PRECISION NUMBER TO FIXED POINT NUMBER               INF00770
C                                                                         INF00780
C     ******************************************************************INF00790
C                                                                         INF00800
      CALL DPFD (L20,L20P,12,8)                                           INF00810
      WRITE (IOUT,160) L20P                                               INF00820
160   FORMAT (1X,21HFINAL LENGTH OF BLOCK,3X,12A1)                        INF00830
      WRITE (IOUT,180) CORR                                               INF00840
180   FORMAT (11X,11HCORRECTION ,F6.2)                                    INF00850
      LAMTPF=LAMTPF*.0254D0                                               INF00860
      WRITE (IOUT,200) NOOFFR,LAMTPF,FPRIM                                INF00870
200   FORMAT (//1X,18HNUMBER OF FRINGES=,3X,D16.8/1X,                     INF00880
     2 21HEFFECTIVE WAVELENGTH=D16.8/1X,7HFPRIME=,14X,D16.8)              INF00890
C                                                                         INF00900
C     ******************************************************************INF00910
C                                                                         INF00920
C     PRINT INTERMEDIATE CALCULATIONS                                     INF00930
C                                                                         INF00940
C     ******************************************************************INF00950
C                                                                         INF00960
      CALL INTPRT                                                         INF00970
```

```
C     ***************************************************************INF00980
C                                                                     INF00990
C     PUNCH TWO CARDS FOR EACH MEASUREMENT                            INF01000
C     THE FOLLOWING FORMAT IS USED                                    INF01010
C     CARD 1                                                          INF01020
C     SERIAL NUMBER,NOMINAL SIZE,MONTH,OAY,YEAR,COEFFICIENT OF EXP.,  INF01030
C     PRESSURE, BLOCK TEMP., AIR TEMP., MAKER, MATERIAL, TYPE         INF01040
C     CARO 2                                                          INF01050
C     SERIAL NUMBER,NOMINAL SIZE,MONTH,OAY,YEAR,VAPOR PRESSURE,       INF01060
C     MEASUREO FRINGE FRACTION, PLATEN IO., MAKER, MATERIAL, TYPE     INF01070
C                                                                     INF01080
C     ***************************************************************INF01090
C                                                                     INF01100
      PP=P                                                            INF01110
      TAP=TA                                                          INF01120
      TBP=TB                                                          INF01130
      FP=F                                                            INF01140
      PHIP=PHI                                                        INF01150
      WRITE (IPCH,220) SERNO(1),SERNO(2),NOM,MNTH,DAY,YEAR,CORR,COEXPP,PINF01160
     2P,TAP,TBP,MAK,MAT,TYPE                                          INF01170
220   FORMAT (2A3,1X,F11.6,3(1X,I2),1X,F6.2,1X,F10.8,1X,F7.2,1X,F7.3,1X,INF01180
     2 F7.3,1X,A3,1X,A2,1X,A3)                                        INF01190
      WRITE (IPCH,240) SERNO(1),SERNO(2),NOM,MNTH,DAY,YEAR,CORR,FP,PHIP,INF01200
     2PLATEN,LSUBP,MAK,MAT,TYPE                                       INF01210
240   FORMAT (2A3,1X,F11.6,3(1X,I2),1X,F6.2,1X,F4.1,1X,F4.2,1X,A3,1X,  INF01220
     2 F11.7,10X,A3,1X,A2,1X,A3)                                      INF01230
      RETURN                                                          INF01240
      END                                                             INF01250


      SUBROUTINE OPFO (A,B,N,O)                                       DPF00010
C                                                                     DPF00020
C     ***************************************************************DPF00030
C                                                                     OPF00040
C**      A ROUTINE TO CONVERT A DOUBLE PRECISION NO. TO A BLOCK OF    **DPF00050
C**     FIELO-OATA CHARACTERS WHICH WHEN OUTPUT WITH SUITABLE FORMAT  **OPF00060
C**     (EG. 30A1) WILL YIELD THE NO. IN F-TYPE FORMAT--NO EXPONENT.  **OPF00070
C**     THE OUTPUT NO. WILL BE RIGHT ADJUSTEO IN THE FIELD.           **DPF00080
C**                                                                   **DPF00090
C**     A=THE O.P. NO. TO BE CONVERTED                                **DPF00100
C**     B=A BLOCK OF N WORDS TO CONTAIN THE RESULTS. THE CHARACTERS    **OPF00110
C**    ARE STORED ONE TO A WORD IN B, LEFT ADJUSTED IN THE WORD       **OPF00120
C**     N=FIELD WIDTH OESIRED                                         **OPF00130
C**     O=NO. OF PLACES DESIREO TO RIGHT OF DECIMAL PT.               **OPF00140
C**                                                                   **OPF00150
C**     IF NO. OVERFLOWS FIELO WIDTH, FIELD IS FILLED WITH *'S        **OPF00160
C**     IF UNDERFLOW OCCURS RESULT WILL BE ZERO                       **DPF00170
C**                                                                   **DPF00180
C**    *RESTRICTION- AT LEAST ONE CHARACTER POSITION MUST BE ALLOWED  **OPF00190
C**                  FOR SIGN REGARDLESS OF + OR -. IF USER OBJECTS     DPF00200
C**                  TO THIS RESTRICTION, HE NEED ONLY USE THE          OPF00210
C**                  RESULTING OUTPUT CHARACTERS BEGINNING AT B(2)    **OPF00220
C**                  INSTEAO OF B(1).                                   DPF00230
C     WRITTEN  BY CLAYTON ALBRIGHT--CSO                               OPF00240
C**                                                                  **DPF00250
C                                                                     OPF00260
C     ***************************************************************OPF00270
C                                                                     OPF00280
```

Convert a double precision number to a fixed point number.

```
C**   TYPE STATEMENTS                                                    **DPF00290
C                                                                          DPF00300
C     ***************************************************************DPF00310
C                                                                          DPF00320
      INTEGER B,D                                                          DPF00330
      DOUBLE PRECISION A,X                                                 DPF00340
C                                                                          DPF00350
C     ***************************************************************DPF00360
C                                                                          DPF00370
C**   DIMENSION STATEMENT                                                **DPF00380
C                                                                          DPF00390
C     ***************************************************************DPF00400
C                                                                          DPF00410
      DIMENSION B(1),KFD(10)                                               DPF00420
C     ***************************************************************DPF00430
C                                                                          DPF00440
C**   DATA STATEMENT                                                     **DPF00450
C                                                                          DPF00460
C     ***************************************************************DPF00470
C                                                                          DPF00480
      DATA KFD(1),KFD(2),KFD(3),KFD(4),KFD(5),KFD(6),KFD(7),KFD(8),        DPF00490
     2 KFD(9),KFD(10) /1H0,1H1,1H2,1H3,1H4,1H5,1H6,1H7,1H8,1H9/            DPF00500
      DATA IBLK /1H /                                                      DPF00510
      DATA MINUS /1H-/                                                     DPF00520
      DATA IDDT /1H./                                                      DPF00530
      DATA ISTAR /1H*/                                                     DPF00540
      IF (D+1.GE.N) GO TO 120                                              DPF00550
C                                                                          DPF00560
C     ***************************************************************DPF00570
C                                                                          DPF00580
C**    ROUND NO. AT DESIRED DECIMAL PLACE                                **DPF00590
C                                                                          DPF00600
C     ***************************************************************DPF00610
C                                                                          DPF00620
      X=DABS(A)+.5*10.**(-D)                                               DPF00630
      MM=N-D-2                                                             DPF00640
      X=X*10.**(-MM)                                                       DPF00650
      IF (X.GE.1.D0) GO TO 120                                             DPF00660
      IF (X.GE.0.1D0.AND.A.LT.0.) GO TO 120                                DPF00670
      MM=MM+1                                                              DPF00680
      DO 20 I=1,MM                                                         DPF00690
      B(I)=IBLK                                                            DPF00700
      K=X*10.                                                              DPF00710
      X=X*10.-FLOAT(K)                                                     DPF00720
      IF (K.NE.0) GO TO 40                                                 DPF00730
20    CONTINUE                                                             DPF00740
      I=MM                                                                 DPF00750
C                                                                          DPF00760
C     ***************************************************************DPF00770
C                                                                          DPF00780
C**    PREFIX MINUS SIGN IF A NEGATIVE                                   **DPF00790
C                                                                          DPF00800
C     ***************************************************************DPF00810
C                                                                          DPF00820
40    IF (A.LT.0.D0) B(I)=MINUS                                            DPF00830
      IF (I.EQ.MM) GO TO 80                                                DPF00840
C                                                                          DPF00850
C     ***************************************************************DPF00860
```

```
C                                                                       DPF00870
C**    CONVERT INTEGER PART                                            **DPF00880
C                                                                       DPF00890
C     ************************************************************************DPF00900
C                                                                       DPF00910
      I=I+1                                                             DPF00920
      DO 60 J=I,MM                                                      DPF00930
      B(J)=KFD(K+1)                                                     DPF00940
      K=X*10.                                                           DPF00950
60    X=X*10.-FLOAT(K)                                                  DPF00960
C                                                                       DPF00970
C     ************************************************************************DPF00980
C                                                                       DPF00990
C**    STORE DEC. PT.                                                  **DPF01000
C                                                                       DPF01010
C     ************************************************************************DPF01020
C                                                                       DPF01030
80    MM=MM+2                                                           DPF01040
      B(MM-1)=IDOT                                                      DPF01050
C                                                                       DPF01060
C     ************************************************************************DPF01070
C                                                                       DPF01080
C**    CONVERT FRACTIONAL PART                                         **DPF01090
C                                                                       DPF01100
C     ************************************************************************DPF01110
C                                                                       DPF01120
      DO 100 I=1,D                                                      DPF01130
      B(MM)=KFD(K+1)                                                    DPF01140
      MM=MM+1                                                           DPF01150
      K=X*10.                                                           DPF01160
100   X=X*10.-FLOAT(K)                                                  DPF01170
      RETURN                                                            DPF01180
C                                                                       DPF01190
C     ************************************************************************DPF01200
C                                                                       DPF01210
C**    STORE *'S IF OVERFLOW                                           **DPF01220
C                                                                       DPF01230
C     ************************************************************************DPF01240
C                                                                       DPF01250
120   DO 140 I=1,N                                                      DPF01260
140   B(I)=ISTAR                                                        DPF01270
      RETURN                                                            DPF01280
      END                                                               DPF01290


C     ************************************************************************INT00010
C                                                                       INT00020
C     THIS SUBPROGRAM PRINTS OUT INTERMEDIATE RESULTS                   INT00030
C     WRITTEN BY RUTH N. VARNER                                         INT00040
C                                                                       INT00050
      SUBROUTINE INTPRT                                                 INT00060
C                                                                       INT00070
C     ************************************************************************INT00080
C                                                                       INT00090
      DOUBLE PRECISION A,B,C,BETA,LTPRIM,L21,TA,TB,P,F                  INT00100
      COMMON /ID/ IN,IOUT,IPCH                                          INT00110
      COMMON /INTOUT/ A,B,C,BETA,LTPRIM,L21                             INT00120
      COMMON /IFER/ TB,TA,ELEMNT                                        INT00130
```

This subprogram prints intermediate calculated values used in computing the length of the block. These values are listed at the end of the printed output for each block. See Section 6 of Monograph 152 for a description of the calculations.

```
      COMMON /HUMIDV/ F,HUMID                                          INT00140
      COMMON /BARPRS/ P,BARAVG                                         INT00150
      WRITE (IOUT,20) A,B,C,BETA,LTPRIM,L21,TA,TB,P,F                  INT00160
20    FORMAT (/18X,2HA=D20.8,14X,2HB=D20.8/18X,2HC=D20.8,6X,           INT00170
     2 10HTEMP CORR=D20.8/1X,19HLENGTH AT NEW TEMP=D20.8,5X,           INT00180
     3 11HNEW LENGTH=D20.8/11X,9HAIR TEMP=D20.8,5X,11HBLOCK TEMP=D20.8/ INT00190
     4 11X,9HPRESSURE=D20.8,1X,15HVAPOR PRESSURE=D20.8)                INT00200
      RETURN                                                           INT00210
      END                                                              INT00220


      BLOCK DATA                                                       TAB00010
C                                                                      TAB00020
C     ***************************************************************TAB00030
C                                                                      TAB00040
C     THIS IS A BLOCK DATA SUBPROGRAM                                  TAB00050
C     WHICH CONTAINS ALL THE VARIABLES                                 TAB00060
C     THAT MAY HAVE TO BE CHANGED                                      TAB00070
C     WITH A CHANGE IN EQUIPMENT                                       TAB00080
C     USED IN SINGLE WAVELENGTH INTERFERDMETRY                         TAB00090
C     INPUT-OUTPUT UNITS ARE DEFINED                                   TAB00100
C     WRITTEN BY RUTH N. VARNER                                        TAB00110
C                                                                      TAB00120
C     ***************************************************************TAB00130
C                                                                      TAB00140
      DDUBLE PRECISION SLTCOR,DBLCOR,PHSCOR                            TAB00150
      DDUBLE PRECISION VACWLN                                          TAB00160
      DOUBLE PRECISION TALPHA,DELTA,RICEPT                             TAB00170
      INTEGER HYGSND,BRDSND,THRSND,BARSND                              TAB00180
      COMMON /TABVAL/ VACWLN(3),SLTCOR(3),DBLCOR(3),PHSCOR(3),         TAB00190
     2 INTSND(4,3),LSSND(2,3),HYGSND(2,6),BRDSNO(2,3),THRSNO(2,3),    TAB00200
     3 BARSNO(2,3),CONFAC(3)                                          TAB00210
      COMMON /BRGTAB/ IUNIT(9,3),ITEN(9,3),ITENTH(9,3),IHUND(9,3)      TAB00220
      COMMON /RESTAB/ TALPHA(3),DELTA(3),RICEPT(3)                     TAB00230
      COMMON /HUMDAT/ COEF(6,6,3)                                      TAB00240
      COMMON /HUMCOR/ CORRF(6)                                         TAB00250
      COMMON /IO/ IN,IDUT,IPCH                                         TAB00260
C                                                                      TAB00270
C     ***************************************************************TAB00280
C                                                                      TAB00290
C     DEFINE INPUT AND OUTPUT UNITS                                    TAB00300
C                                                                      TAB00310
C     ***************************************************************TAB00320
C                                                                      TAB00330
      DATA IN,IDUT,IPCH /5,6,1/                                        TAB00340
C     ***************************************************************TAB00350
C                                                                      TAB00360
C     DEFINE:  INTERFEROMETER SERIAL NUMBERS                           TAB00370
C              LIGHT SOURCE SERIAL NUMBERS                             TAB00380
C              HYGROMETER SERIAL NUMBERS                               TAB00390
C              BRIDGE SERIAL NUMBERS                                   TAB00400
C              THERMOMETER SERIAL NUMBERS                              TAB00410
C              BAROMETER SERIAL NUMBERS                                TAB00420
C              VACUUM WAVELENGTH                                       TAB00430
C              THERMOCOUPLE CONVERSION FACTORS                         TAB00440
C              SLIT CORRECTIONS                                        TAB00450
C              OBLIQUITY CORRECTIONS                                   TAB00460
C              PHASE CORRECTIONS                                       TAB00470
```

This is a BLOCK DATA subprogram which contains all the parameters needed to perform the required calculations. See the comment statements. In the event that any given parameter is changed, only this subprogram needs to be recompiled. The data contained in this subprogram is specific to NBS equipment. The user must modify them for his own equipment.

```
C                                                                       TAB00480
C     ***************************************************************TAB00490
C                                                                       TAB00500
C      INTERFEROMETER SERIAL NUMBERS       AS OF MAY 1976             TAB00510
      DATA INTSNO(1,1),INTSNO(2,1),INTSNO(3,1),INTSNO(4,1) /3HZEI,3HSS-,TAB00520
     2 3HLB ,3H   /                                                     TAB00530
      DATA INTSNO(1,2),INTSNO(2,2),INTSNO(3,2),INTSNO(4,2) /3HHIL,3HGER,TAB00540
     2 3H 19,3H55 /                                                     TAB00550
      DATA INTSNO(1,3),INTSNO(2,3),INTSNO(3,3),INTSNO(4,3) /3HZEI,3HSS-,TAB00560
     2 3HS8 ,3H   /                                                     TAB00570
C      LIGHT SOURCE SERIAL NUMBERS          AS OF MAY 1976             TAB00580
      DATA LSSNO(1,1),LSSNO(2,1) /3HIOD,3HINE/                          TAB00590
      DATA LSSNO(1,2),LSSNO(2,2) /3HSP-,3H163/                          TAB00600
      DATA LSSNO(1,3),LSSNO(2,3) /3HPE-,3H184/                          TAB00610
C      HYGROMETER SERIAL NUMBERS            AS OF MAY 1976             TAB00620
      DATA HYGSNO(1,1),HYGSNO(2,1) /3H 63,3H88 /                        TAB00630
      DATA HYGSNO(1,2),HYGSNO(2,2) /3H 64,3H99 /                        TAB00640
      DATA HYGSNO(1,3),HYGSNO(2,3) /3H 63,3H31 /                        TAB00650
      DATA HYGSNO(1,4),HYGSNO(2,4) /3H 64,3H15 /                        TAB00660
      DATA HYGSNO(1,5),HYGSNO(2,5) /3H 75,3H36 /                        TAB00670
      DATA HYGSNO(1,6),HYGSNO(2,6) /3H 75,3H30 /                        TAB00680
C      BRIDGE SERIAL NUMBERS                AS OF MAY 1976             TAB00690
      DATA BRDSNO(1,1),BRDSNO(2,1) /3H107,3H634/                        TAB00700
      DATA BRDSNO(1,2),BRDSNO(2,2) /3H118,3H684/                        TAB00710
      DATA BRDSNO(1,3),BRDSNO(2,3) /3H045,3H848/                        TAB00720
C      THERMOMETER SERIAL NUMBERS           AS OF MAY 1976             TAB00730
      DATA THRSNO(1,1),THRSNO(2,1) /3H  2,3H06 /                        TAB00740
      DATA THRSNO(1,2),THRSNO(2,2) /3H  1,3H84 /                        TAB00750
      DATA THRSNO(1,3),THRSNO(2,3) /3H183,3H335/                        TAB00760
C      BAROMETER SERIAL NUMBERS        AS OF MAY 1976                   TAB00770
      DATA BARSNO(1,1),BARSNO(2,1) /3HS11,3H264/                        TAB00780
      DATA BARSNO(1,2),BARSNO(2,2) /3HS12,3H566/                        TAB00790
      DATA BARSNO(1,3),BARSNO(2,3) /3HU11,3H485/                        TAB00800
C      VACUUM WAVELENGTHS IN MICRO METERS     AS OF MAY 1976             TAB00810
      DATA VACWLN(1) /.632990074D0/                                     TAB00820
      DATA VACWLN(2) /.632991420D0/                                     TAB00830
      DATA VACWLN(3) /.632991419D0/                                     TAB00840
C      THERMOCOUPLE CORRECTION FACTORS IN MICRO VOLTS   AS OF MAY 1976   TAB00850
      DATA CONFAC(1) /.0248/                                            TAB00860
      DATA CONFAC(2) /.0248/                                            TAB00870
      DATA CONFAC(3) /.0248/                                            TAB00880
C      SLIT CORRECTIONS     AS OF MAY 1976                              TAB00890
      DATA SLTCOR(1) /.0062D-6/                                         TAB00900
      DATA SLTCOR(2) /.016D-6/                                          TAB00910
      DATA SLTCOR(3) /.0062D-6/                                         TAB00920
C      OBLIQUITY CORRECTIONS    AS OF MAY 1976                         TAB00930
      DATA OBLCOR(1) /0.0D0/                                            TAB00940
      DATA OBLCOR(2) /.166D-6/                                          TAB00950
      DATA OBLCOR(3) /0.0D0/                                            TAB00960
C      PHASE CORRECTIONS                                                TAB00970
      DATA PHSCOR(1) /0.0D0/                                            TAB00980
      DATA PHSCOR(2) /0.0D0/                                            TAB00990
      DATA PHSCOR(3) /0.0D0/                                            TAB01000
C                                                                       TAB01010
C     ***************************************************************TAB01020
C                                                                       TAB01030
C       DATA STATEMENTS CONTAINING BRIDGE CORRECTIONS FOR               TAB01040
C       BRIDGE 1076343    (LONG BLOCKS)                                 TAB01050
```

```
C      MARCH 9, 1973                                                    TAB01060
C                                                                       TAB01070
C     ******************************************************************TAB01080
C                                                                       TAB01090
      DATA ITEN(1,1),ITEN(2,1),ITEN(3,1),ITEN(4,1),ITEN(5,1),ITEN(6,1), TAB01100
     2 ITEN(7,1),ITEN(8,1),ITEN(9,1) /-46,-66,-100,6*0/                 TAB01110
      DATA IUNIT(1,1),IUNIT(2,1),IUNIT(3,1),IUNIT(4,1),IUNIT(5,1),      TAB01120
     2 IUNIT(6,1),IUNIT(7,1),IUNIT(8,1),IUNIT(9,1) /0,-1,-1,-3,-4,-4,-6,TAB01130
     3 -6,-8/                                                           TAB01140
      DATA ITENTH(1,1),ITENTH(2,1),ITENTH(3,1),ITENTH(4,1),ITENTH(5,1), TAB01150
     2 ITENTH(6,1),ITENTH(7,1),ITENTH(8,1),ITENTH(9,1) /-2,-1,-1,-1,0,1,TAB01160
     3 2,1,2/                                                           TAB01170
      DATA IHUND(1,1),IHUND(2,1),IHUND(3,1),IHUND(4,1),IHUND(5,1),      TAB01180
     2 IHUND(6,1),IHUND(7,1),IHUND(8,1),IHUND(9,1) /9*0/                TAB01190
C                                                                       TAB01200
C     ******************************************************************TAB01210
C                                                                       TAB01220
C      DATA STATEMENTS CONTAINING BRIDGE CORRECTIONS FOR                TAB01230
C      BRIDGE 118684       (SHORT BLOCKS)                               TAB01240
C      MAY 14, 1973                                                     TAB01250
C                                                                       TAB01260
C     ******************************************************************TAB01270
C                                                                       TAB01280
      DATA ITEN(1,2),ITEN(2,2),ITEN(3,2),ITEN(4,2),ITEN(5,2),ITEN(6,2), TAB01290
     2 ITEN(7,2),ITEN(8,2),ITEN(9,2) /535,1031,7*0/                     TAB01300
      DATA IUNIT(1,2),IUNIT(2,2),IUNIT(3,2),IUNIT(4,2),IUNIT(5,2),      TAB01310
     2 IUNIT(6,2),IUNIT(7,2),IUNIT(8,2),IUNIT(9,2) /39,83,137,176,205,  TAB01320
     3 254,298,352,411/                                                 TAB01330
      DATA ITENTH(1,2),ITENTH(2,2),ITENTH(3,2),ITENTH(4,2),ITENTH(5,2), TAB01340
     2 ITENTH(6,2),ITENTH(7,2),ITENTH(8,2),ITENTH(9,2) /-12,-14,-6,7,10,TAB01350
     3 8,11,19,27/                                                      TAB01360
      DATA IHUND(1,2),IHUND(2,2),IHUND(3,2),IHUND(4,2),IHUND(5,2),      TAB01370
     2 IHUND(6,2),IHUND(7,2),IHUND(8,2),IHUND(9,2) /-3,-6,-4,-7,-5,-3,-1TAB01380
     3,-4,-7/                                                           TAB01390
C                                                                       TAB01400
C     ******************************************************************TAB01410
C                                                                       TAB01420
C     DATA STATEMENTS CONTAINING BRIDGE CORRECTIONS FOR                 TAB01430
C     BRIDGE 1045848   (SHORT BLOCKS)                                   TAB01440
C     BRIDGE CALIBRATED JUNE 1974      ADDED TO FILE  MAY  1976         TAB01450
C                                                                       TAB01460
C     ******************************************************************TAB01470
C                                                                       TAB01480
      DATA ITEN(1,3),ITEN(2,3),ITEN(3,3),ITEN(4,3),ITEN(5,3),ITEN(6,3), TAB01490
     2 ITEN(7,3),ITEN(8,3),ITEN(9,3) /-22,-50,-70,-100,-110,-160,-170,  TAB01500
     3 -200,-220/                                                       TAB01510
      DATA IUNIT(1,3),IUNIT(2,3),IUNIT(3,3),IUNIT(4,3),IUNIT(5,3),      TAB01520
     2 IUNIT(6,3),IUNIT(7,3),IUNIT(8,3),IUNIT(9,3) /-1,-1,1,5,6,7,9,11, TAB01530
     3 11/                                                              TAB01540
      DATA ITENTH(1,3),ITENTH(2,3),ITENTH(3,3),ITENTH(4,3),ITENTH(5,3), TAB01550
     2 ITENTH(6,3),ITENTH(7,3),ITENTH(8,3),ITENTH(9,3) /-2,-1,-2,-2,-3, TAB01560
     3 -3,-3,-3,-4/                                                     TAB01570
      DATA IHUND(1,3),IHUND(2,3),IHUND(3,3),IHUND(4,3),IHUND(5,3),      TAB01580
     2 IHUND(6,3),IHUND(7,3),IHUND(8,3),IHUND(9,3) /0,0,0,0,1,1,1,1,1/  TAB01590
C                                                                       TAB01600
C     ******************************************************************TAB01610
C                                                                       TAB01620
C     THESE VALUES ARE FOR PLATINUM RESISTANCE THERMOMETER 206          TAB01630
```

```
C     CALIBRATED MARCH 1973                                              TAB01640
C     ICE POINT READING VALUE OF MAR 73 IS 25.49967 FOR LONG BLOCKS      TAB01650
C     CORRECTIONS TO ICE POINT READING IS BASED ON                       TAB01660
C           TABLE OF CORRECTIONS DATED MARCH 9 1973 FOR LONG BLOCKS      TAB01670
C                                                                        TAB01680
C     ***************************************************************** TAB01690
C                                                                        TAB01700
      DATA TALPHA(1),DELTA(1),RICEPT(1) /3.924916D-3,1.497060D0,         TAB01710
     2 25.49967D0/                                                       TAB01720
C     ***************************************************************** TAB01730
C                                                                        TAB01740
C     THESE VALUES ARE FOR PLATINUM RESISTANCE THERMOMETER 184           TAB01750
C     CALIBRATED APRIL 1970                                              TAB01760
C     ICE POINT READING VALUE OF OCT 1970 IS 25.49024 FOR SHORT BLOCKS   TAB01770
C     CORRECTIONS TO ICE POINT READING IS BASED ON                       TAB01780
C           TABLE OF CORRECTIONS DATED MAY 14 1973 FOR SHORT BLOCKS      TAB01790
C                                                                        TAB01800
C     ***************************************************************** TAB01810
C                                                                        TAB01820
      DATA TALPHA(2),DELTA(2),RICEPT(2) /3.92SS40D-3,1.496746D0,         TAB01830
     2 25.49024D0/                                                       TAB01840
C     ***************************************************************** TAB01850
C                                                                        TAB01860
C     THESE VALUES ARE FOR PLATINUM RESISTANCE THERMOMETER 18333S6       TAB01870
C     CALIBRATED 12 MAY 1975 AND ADDED TO PROGRAM  MAY  1976             TAB01880
C     ICE POINT READING VALUE OF AUGUST 197S IS 25.4911                  TAB01890
C                                                                        TAB01900
C     ***************************************************************** TAB01910
C                                                                        TAB01920
      DATA TALPHA(3),DELTA(3),RICEPT(3) /3.926490D-3,1.496418D0,         TAB01930
     2 25.S272D0/                                                        TAB01940
C     ***************************************************************** TAB01950
C                                                                        TAB01960
C     COEFFICIENTS TO CONVERT HYGROMETER DIAL READINGS TO                TAB01970
C                          RELATIVE HUMIDITY                             TAB01980
C     COEFFICIENTS WERE DETERMINED BY USING DATA READ                    TAB01990
C                    FROM GRAPHS AND FITTING IT TO A                     TAB02000
C                    CURVE WHICH PRODUCED A SMALL RESIDUAL               TAB02010
C                    STANDARD DEVIATION (OMNITAB WAS USED)               TAB02020
C                                                                        TAB02030
C     ***************************************************************** TAB02040
C                                                                        TAB02050
C     FOR HYGROMETER NO. 6388          DIAL READINGS 20-94  S.D. = .0BS5 TAB02060
C                                                                        TAB02070
      DATA COEF(1,1,1),COEF(2,1,1),COEF(3,1,1),COEF(4,1,1),COEF(S,1,1),  TAB02080
     2 COEF(6,1,1) /0.0,.B0219603E-6,-.13484731E-3,.94506S29E-2,         TAB02090
     3 .057676889,3.2519574/                                            TAB02100
C                                                                        TAB02110
C     FOR HYGROMETER NO. 6499          DIAL READINGS 6-90   S.D. = .0740 TAB02120
C                                                                        TAB02130
      DATA COEF(1,2,1),COEF(2,2,1),COEF(3,2,1),COEF(4,2,1),COEF(S,2,1),  TAB02140
     2 COEF(6,2,1) /0.0,.65136230E-6,-.92S77329E-4,.57717107E-2,         TAB02150
     3 .47062332,19.933SS3/                                             TAB02160
C                                                                        TAB02170
C     FOR HYGROMETER NO. 6331          DIAL READINGS 6-90   S.D. = .0560 TAB02180
C                                                                        TAB02190
      DATA COEF(1,3,1),COEF(2,3,1),COEF(3,3,1),COEF(4,3,1),COEF(5,3,1),  TAB02200
     2 COEF(6,3,1) /.174676S7E-7,-.3984S771E-5,.3397111SE-3,             TAB02210
```

The graphs used to determine the coefficients of the polynominal used to convert hygrometer readings to humidity are included in Appendix B.

```
     3 -.10504197E-1,.32362140,5.3862669/                                    TAB02220
C                                                                            TAB02230
C     FOR HYGROMETER NO. 6415          OIAL REAOINGS 12-30  S.O. = .0503     TAB02240
C                                                                            TAB02250
      OATA COEF(1,4,1),COEF(2,4,1),COEF(3,4,1),COEF(4,4,1),COEF(5,4,1),      TAB02260
     2 COEF(6,4,1) /.0,.0,.65559490E-4,.014809146,-.19089446,30.320804/      TAB02270
C                                                                            TAB02280
C     FOR HYGROMETER NO. 6415          OIAL READINGS 32-52  S.O. = .0676     TAB02290
C                                                                            TAB02300
      OATA COEF(1,4,2),COEF(2,4,2),COEF(3,4,2),COEF(4,4,2),COEF(5,4,2),      TAB02310
     2 COEF(6,4,2) /0.,0.,-.14204590E-3,.016586594,.090819407,26.575904/     TAB02320
C                                                                            TAB02330
C     FOR HYGROMETER NO. 6415          DIAL REAOINGS 54-94  S.D. = .0453     TAB02340
C                                                                            TAB02350
      OATA COEF(1,4,3),COEF(2,4,3),COEF(3,4,3),COEF(4,4,3),COEF(5,4,3),      TAB02360
     2 COEF(6,4,3) /.0,.66647333E-5,-.18321483E-2,.19128393,-8.2743911,      TAB02370
     3 178.31654/                                                            TAB02380
C                                                                            TAB02390
C     FOR HYGROMETER NO. 7536 OIAL REAOINGS 20-94 S.O.=.0713                 TAB02400
C                          UPDATED  MAY  1976                                TAB02410
      DATA COEF(1,5,1),COEF(2,5,1),COEF(3,5,1),COEF(4,5,1),COEF(5,5,1),      TAB02420
     2 COEF(6,5,1) /0.0,.58413931E-6,-.95920989E-4,.68906373E-2,             TAB02430
     3 .10049310,2.9815834/                                                  TAB02440
C                                                                            TAB02450
C     FOR HYGROMETER NO. 7530 DIAL READINGS 6-28 S.D.=.0764                  TAB02460
C                         UPOATED  MAY  1976                                 TAB02470
      OATA COEF(1,6,1),COEF(2,6,1),COEF(3,6,1),COEF(4,6,1),COEF(5,6,1),      TAB02480
     2 COEF(6,6,1) /0.0,0.0,.88707597E-3,-.02749612,.66239972,22.164879/     TAB02490
C                                                                            TAB02500
C     FOR HYGROMETER NO. 7530 DIAL REAOINGS 30-60 S.D.=.0842                 TAB02510
C                           UPDATEO  MAY  1976                               TAB02520
      DATA COEF(1,6,2),COEF(2,6,2),COEF(3,6,2),COEF(4,6,2),COEF(5,6,2),      TAB02530
     2 COEF(6,6,2) /0.0,-.21884830E-4,.39983941E-2,-.26986193,8.6278505,     TAB02540
     3 -65.528703/                                                           TAB02550
C                                                                            TAB02560
C     FOR HYGROMETER NO. 7530 OIAL REAOINGS 62-94 S.O.=.0810                 TAB02570
C                          UPOATEO  MAY  1976                                TAB02580
      DATA COEF(1,6,3),COEF(2,6,3),COEF(3,6,3),COEF(4,6,3),COEF(5,6,3),      TAB02590
     2 COEF(6,6,3) /0.0,.27055579E-4,-.78616507E-2,.85760725,-40.874399,     TAB02600
     3 773.55925/                                                            TAB02610
      END                                                                    TAB02620
```

4. DESCRIPTION OF OUTPUT

The output from the computer program consists of two parts.

A printed page is generated for each block. This contains the environmental conditions, the instruments used in the measurement, the calculated values: temperature, pressure, humidity, vapor pressure and final length of block. The end of the page contains the printout of some of the intermediate calculated values. See Section 5. Sample Run.

Two punched cards are produced for each calculation of length. These cards have the following format.

Card No.	Input or Computed	Variable	Type	Column Position
1	Input	Block serial number	Alphanumeric	1 - 6
	Input	Nominal block length	Numeric	8 - 18
	Input	Month	Numeric	20 - 21
	Input	Day	Numeric	23 - 24
	Input	Year	Numeric	26 - 27
	Computed	Length correction (micro-inches)	Numeric	29 - 34
	Input	Coefficient of expansion (micro-inches per degrees Celsius of block)	Numeric	36 - 45
	Computed	Pressure (mm of Hg)	Numeric	47 - 53
	Computed	Air temperature (Celsius)	Numeric	55 - 61
	Computed	Block temperature (Celsius)	Numeric	63 - 69
	Input	Maker of block	Alphanumeric	71 - 73
	Input	Material of block	Alphanumeric	75 - 76
	Input	Type of block	Alphanumeric	78 - 80
2	Input	Block serial number	Alphanumeric	1 - 6
	Input	Nominal block length	Numeric	8 - 18
	Input	Month	Numeric	20 - 21
	Input	Day	Numeric	23 - 24
	Input	Year	Numeric	26 - 27
	Computed	Length correction (micro-inches)	Numeric	29 - 34
	Computed	Vapor pressure (mm of Hg)	Numeric	36 - 39
	Computed	Fringe fraction	Numeric	41 - 44
	Input	Platen	Alphanumeric	46 - 48
	Input	Assumed block length (inches)	Numeric	50 - 60
	Input	Maker of block	Alphanumeric	70 - 73
	Input	Material of block	Alphanumeric	75 - 76
	Input	Type of block	Alphanumeric	78 - 80

5. SAMPLE RUN

Included in this section is a sample run consisting of listings of the input, printed output, and punched card output.

5.1 Listing of Input Data For Sample Run

```
  LONG1 12:46 RNV H-4 4 16 73 1 27.52715 27.52590 27.52590 27.52715                    Card 1
 -.56  .05 758.28 758.28 66.0  1                                                       Card 2
  1                                                                                    Card 3
  2306          10.0          10.00000200             11.5D-6          DOA ST REC     Card 4
  969 1045 1221 1221 1045 967                                                          Card 5
  LONG2  1:47 RNV H-7 4 16 73 1 27.52715 27.52590 27.52590 27.52715                    Card 1
 -.56  .05 758.28 758.28 40.0  2                                                       Card 2
  1                                                                                    Card 3
  2306          10.0          10.00000200             11.5D-6          DOA ST REC     Card 4
 969  1045 1221 1221 1045 967                                                         Card 5
  L9697  1151 CDT VK2 02 23 76 3 27.54140 27.54140 27.54140 27.54140                   Card 1
3.0 3.17 757.27 757.32    62 5                                                       Card 2
 2                                                                                    Card 3
   194          .127             .127002             11.50D-6          HOM ST REC     Card 4
594 648 834 833 646 594                                                              Card 5
   9L5          .133             .132999             11.50D-6          FON ST R       Card 4
655 797 890 890 795 652                                                              Card 5
 STOP                                                                                Flag to terminate run.
```

5.2 Listing of Card Output From Sample Run

```
2306   10.000000  4 16 73  -2.39  .00001150  758.28  19.999  19.984 DOA ST REC
2306   10.000000  4 16 73  -2.39  4.6  .30 H-4  10.0000020          DOA ST REC
2306   10.000000  4 16 73   -.53  .00001150  758.28  19.999  19.984 DOA ST REC
2306   10.000000  4 16 73   -.53  7.9  .30 H-7  10.0000020          DOA ST REC
 194     .127000  2 23 76   2.89  .00001150  757.29  19.924  19.920 HOM ST REC
 194     .127000  2 23 76   2.89  4.1  .22 VK2    .1270020          HOM ST REC
 9L5     .133000  2 23 76   -.49  .00001150  757.29  19.924  19.920 FON ST R
 9L5     .133000  2 23 76   -.49  4.1  .60 VK2    .1329990          FON ST R
```

5.3 Listing of Printed Output From Sample Run

INTERFEROMETRIC GAGE BLOCK MEASUREMENT

SERIAL NO.	2306	TEST NO.	LONG1	INTERFEROMETER	ZEISS-L8
NOMINAL SIZE	10.000000	DATE	4/16/73	MEAS. FRINGE FRAC.	.30
ASSUMED LENGTH		TIME	12:46	LIGHT SOURCE	LASER NO.IODINE
	.10C000020+002	OBSERVER	RNV	VAC.WAVELENGTH	.632990074+000
COEF OF EXP	.115000-04	PLATEN	H-4	SLIT CORR	.6200000-08
MAKER	DOA			OBLIQ CORR	.C000000
MATERIAL	ST			PHASE CORR	.0000000
TYPE	REC				

BRIDGE ID 107634	THERMOMETER ID 206
BAROMETER ID S11264	HYGROMETER ID 6388

ENVIRONMENT

TEMPERATURE		PRESSURE		HUMIDITY	
BRIDGE	27.52715	BAROMETER	758.28	HYGROMETER	
READINGS	27.52590	READINGS	758.28	READING	66.0
	27.52590				
	27.52715				
MEAN	27.52652		758.28		
CORR	-.00077				1.8
THERM. RESISTANCE	27.52575	PRESSURE	758.28	HUMIDITY	26.5
REF. TEMP.	19.998			VAPOR PRESS	4.6
THERMOCOUPLE(BLOCK)	-.014				
THERMOCOUPLE(AIR)	.001				
BLOCK TEMP.	.19984+002				
AIR TEMP.	.19999+002				

FINAL LENGTH OF BLOCK 9.99999761
CORRECTION -2.39

NUMBER OF FRINGES= .80275766+006
EFFECTIVE WAVELENGTH= .63281863+002
FPRIME= .80275730+006

A=	.29090595-003	B=	.93216834+000
C=	.25839945-006	BETA=	.99999981+000
LTPRIM=	.10000000+002	L21=	.99999976+001
TA=	.19998861+002	TB=	.19983733+002
P=	.75828C00+003	F=	.46074117+001

INTERFEROMETRIC GAGE BLOCK MEASUREMENT

SERIAL NO.	2306	TEST NO.	LONG2	INTERFEROMETER	ZEISS-LB
NOMINAL SIZE	10.000000	DATE	4/16/73	MEAS. FRINGE FRAC.	.30
ASSUMED LENGTH		TIME	1:47	LIGHT SOURCE	LASER NO.IODINE
	.10000020+002	OBSERVER	RNV	VAC.WAVELENGTH	.63299074+000
COEF OF EXP	.115000-04	PLATEN	H-7	SLIT CORR	.6200000-08
MAKER	DOA			OBLIQ CORR	.0000000
MATERIAL	ST			PHASE CORR	.0000000
TYPE	REC				

BRIDGE ID 107634 THERMOMETER ID 206
BAROMETER ID S11264 HYGROMETER ID 6499

ENVIRONMENT

TEMPERATURE		PRESSURE		HUMIDITY	
BRIDGE	27.52715	BAROMETER	758.28	HYGROMETER	
READINGS	27.52590	READINGS	758.28	READING	40.0
	27.52590				
	27.52715				
MEAN	27.52652		758.28		
CORR	-.00077				1.8
THERM. RESISTANCE	27.52575	PRESSURE	758.28	HUMIDITY	45.5
REF. TEMP.	19.998			VAPOR PRESS	7.9
THERMOCOUPLE(BLOCK)	-.014				
THERMOCOUPLE(AIR)	.001				
BLOCK TEMP.	.19984+002				
AIR TEMP.	.19999+002				

FINAL LENGTH OF BLOCK 9.99999947
CORRECTION -.53

NUMBER OF FRINGES= .80275751+006
EFFECTIVE WAVELENGTH= .63281875+002
FPRIME= .80275730+006

A=	.29090595-003	B=	.93216834+000
C=	.44436448-006	BETA=	.99999981+000
LTPRIM=	.10000000+002	L21=	.99999995+001
TA=	.19998861+002	TB=	.19983733+002
P=	.75828000+003	F=	.79232759+001

INTERFEROMETRIC GAGE BLOCK MEASUREMENT

SERIAL NO.	194	TEST NO.	L9697	INTERFEROMETER	ZEISS-SB
NOMINAL SIZE	.127000	DATE	2/23/76	MEAS. FRINGE FRAC.	.22
ASSUMED LENGTH	.127002000+000	TIME	1151	LIGHT SOURCE	LASER NO.PE-184
		OBSERVER	CDT	VAC.WAVELENGTH	.632991419+000
COEF OF EXP	.115000-04	PLATEN	VK2	SLIT CORR	.6200000-08
MAKER	HOM			OBLIQ CORR	.0000000
MATERIAL	ST			PHASE CORR	.0000000
TYPE	REC				

BRIDGE ID 045848 THERMOMETER ID 183335
BAROMETER ID U11485 HYGROMETER ID 7536

ENVIRONMENT

TEMPERATURE		PRESSURE		HUMIDITY	
BRIDGE	27.54140	BAROMETER	757.27	HYGROMETER	
READINGS	27.54140	READINGS	757.32	READING	62.0
	27.54140				
	27.54140				
MEAN	27.54140		757.29		
CORR	-.00049				1.8
THERM. RESISTANCE	27.54091	PRESSURE	757.29	HUMIDITY	23.3
REF. TEMP.	19.846			VAPOR PRESS	4.1
THERMOCOUPLE(BLOCK)	.074				
THERMOCOUPLE(AIR)	.079				
BLOCK TEMP.	.19920+002				
AIR TEMP.	.19924+002				

FINAL LENGTH OF BLOCK .12700289
CORRECTION 2.89

NUMBER OF FRINGES= .10195149+005
EFFECTIVE WAVELENGTH= .63282014+002
FPRIME= .10195221+005

A=	.29052805-003	B=	.93240557+000
C=	.22728539-006	BETA=	.99999908+000
LTPRIM=	.12700188+000	L21=	.12700290+000
TA=	.19924338+002	TB=	.19920122+002
P=	.75729500+003	F=	.40526296+001

INTERFEROMETRIC GAGE BLOCK MEASUREMENT

SERIAL NO.	9L5	TEST NO.	L9697	INTERFEROMETER	ZEISS-SB
NOMINAL SIZE	.133000	DATE	2/23/76	MEAS. FRINGE FRAC.	.60
ASSUMED LENGTH	.132999000+000	TIME	1151	LIGHT SOURCE	LASER NO.PE-184
		OBSERVER	CDT	VAC.WAVELENGTH	.632991419+000
COEF OF EXP	.115000-04	PLATEN	VK2	SLIT CORR	.6200000-08
MAKER	FON			OBLIQ CORR	.0000000
MATERIAL	ST			PHASE CORR	.0000000
TYPE	R				

BRIDGE ID 045848 THERMOMETER ID 183335
BAROMETER ID U11485 HYGROMETER ID 7536

ENVIRONMENT

TEMPERATURE		PRESSURE		HUMIDITY	
BRIDGE	27.54140	BAROMETER	757.27	HYGROMETER	
READINGS	27.54140	READINGS	757.32	READING	62.0
	27.54140				
	27.54140				
MEAN	27.54140		757.29		
CORR	-.00049				1.8
THERM. RESISTANCE	27.54091	PRESSURE	757.29	HUMIDITY	23.3
REF. TEMP.	19.846			VAPOR PRESS	4.1
THERMOCOUPLE(BLOCK)	.074				
THERMOCOUPLE(AIR)	.079				
BLOCK TEMP.	.19920+002				
AIR TEMP.	.19924+002				

FINAL LENGTH OF BLOCK .13299951
CORRECTION -.49

NUMBER OF FRINGES= .10676561+005
EFFECTIVE WAVELENGTH= .63282014+002
FPRIME= .10676603+005

A=	.29052805-003	B=	.93240557+000
C=	.22728539-006	BETA=	.99999908+000
LTPRIM=	.13299888+000	L21=	.13299951+000
TA=	.19924338+002	TB=	.19920122+002
P=	.75729500+003	F=	.40526296+001

6. ERROR MESSAGES

1. CHECK DATA followed by last data card read.

   This message is printed by the main program and execution is terminated under the following conditions:

   a. Number of numeric values on data card 1 $\neq$ 8
   b. Number of numeric values on data card 2 $\neq$ 6
   c. Number of numeric values on data card 3 $\neq$ 1
   d. Number of numeric values on data card 5 $\neq$ 6

2. CHECK FRINGE FRACTION DATA

   This message is printed by the main program if the absolute difference of corresponding fringe fraction is greater than 3. The calculations are continued.

3. CHECK RESISTANCE AVERAGE followed by listing of dial readings.

   This message is printed by the subprogram BAVGCO and execution is terminated if the resistance dial readings do not fall in the range 0 to 9.

4. FRINGE FRACTION IS NEGATIVE OR GREATER THAN 1

   This message is printed by the subprogram COMPUT if the computed value of the observed fringe fraction is negative or greater than 1. Execution is terminated when this occurs.

5. The remainder of the possible error messages are produced by the subprogram ERROR. They may occur when the input data is not in a correct format.

ACKNOWLEDGEMENTS

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REFERENCES

1. Riddle, J. L., et al, "Platinum Resistance Thermometry," National Bureau of Standards Monograph 126 (1973).

2. Beers, John S., "A Gage Block Measurement Process Using Single Wavelength Interferometry," National Bureau of Standards Monograph 152 (December 1975).

3. American Standard Fortran (1966), American National Standards Institute, Inc., New York.

APPENDIX A

A1. Parameters in BLOCK DATA Subprogram

A1.A Input-Output Units

```
IN = 5      input unit (card reader)
IOUT = 6    output unit (printer)
IPCH = 1    output unit (punch)
```

A1.B The following table defines each parameter, its computer program variable name, and its current value at the time this paper was published. Numbers enclosed in brackets beside the parameter value is the number used for input. (See Section 2. Description of Input, card 1 and card 2.) As indicated in the table the apparatus used for measuring long and short blocks are different. Two different sets of apparatus may be used in measuring short blocks.

Computer Variable	Description	Long Blocks	Short Blocks	
INTSNO	Interferometric serial number	[1]Zeiss-LB	[2]Hilger 1955	[3]Zeiss-SB
LSSNO	Laser serial number	IODINE	SP-163	PE-184
VACWLN	Vacuum wavelength	.632990074	.632991420	.632991419
HYGSNO	Hygrometer serial number (range 8% - 40%)	[1]6388	[3]6331	[5]7536
	Hygrometer serial number (range 30% - 80%--long blocks) (range 35% - 80%--short blocks)	[2]6499	[4]6415	[6]7530
BRDSNO	Bridge serial number	107634	118684	045848
THRSNO	Thermometer serial number	206	184	183335
BARSNO	Barometer serial number	S11264	S12566	U11485

CONFAC	Thermocouple conversion factor	.0248°/μV	.0248°/μV	.0248°/μV
SLTCOR	Slit correction	$.0062 \times 10^{-6}$	$.016 \times 10^{-6}$	$.0062 \times 10^{-6}$
OBLCOR	Obliquity correction	0.0	$.166 \times 10^{-6}$	0.0
PHSCOR	Phase correction	0.0	0.0	0.0

When a newly calibrated resistance bridge is introduced, the bridge serial number (BRDSNO) must be changed. Associated with each bridge there is a table of corrections. The appropriate variables ITEN, IUNIT, ITENTH, IHUND need to be changed.

When a newly calibrated platinum resistance thermometer is introduced, the thermometer serial number (THRSNO) must be changed. The constants α (Alpha), δ (Delta), and R_0 (RICEPT) in the international practical temperature scale formulas must be changed.

When a newly calibrated hygrometer is introduced, the hygrometer serial number (HYGSNO) must be changed.

The coefficients (COEFF) of the polynominal used to convert the hygrometer readings to relative humidity must be recomputed.

A2. Cross Reference of Labeled Common

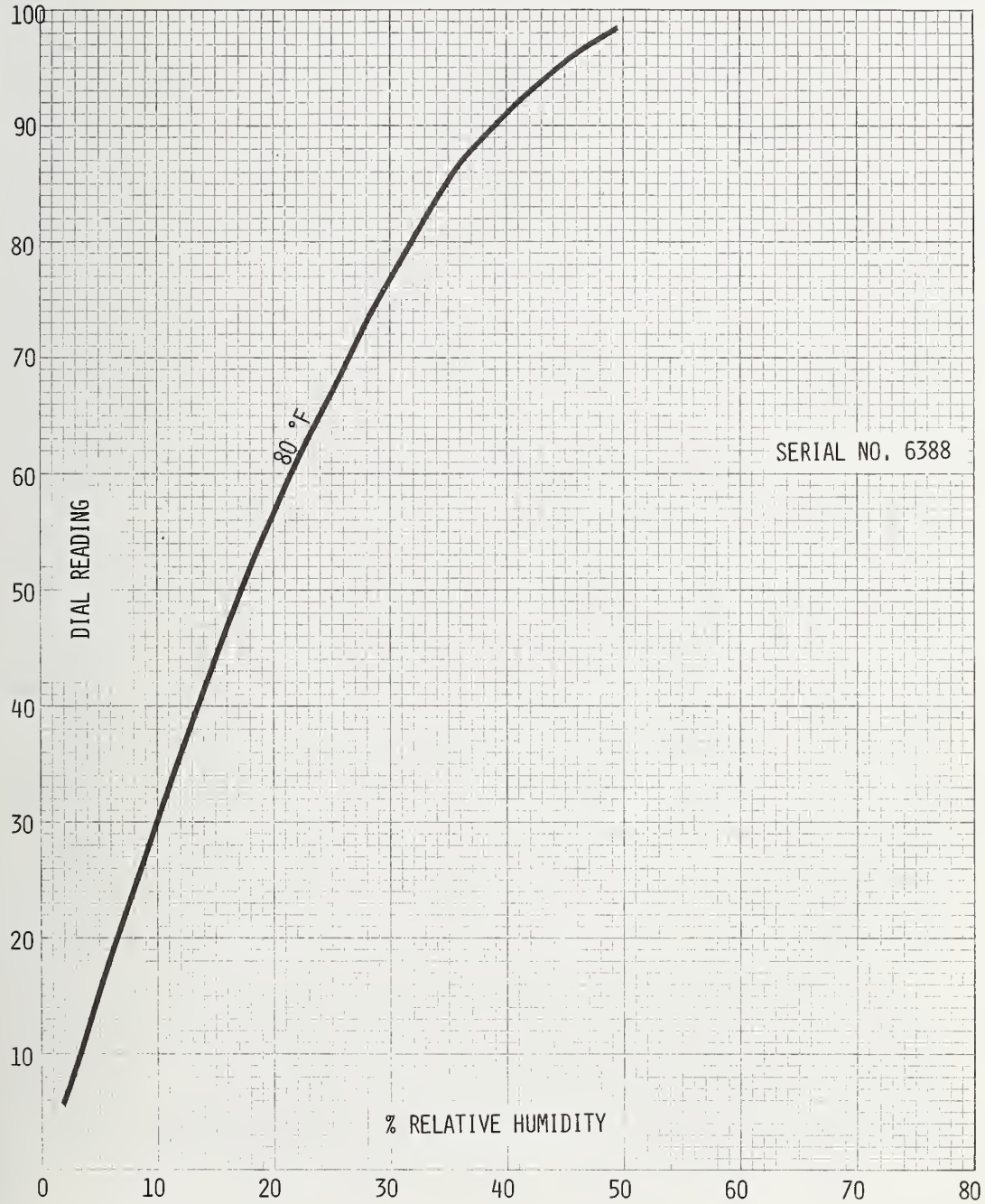
Common Block Name	Size (Computer Words)	Subprograms Using Labeled Common					
OUT	39	MAIN	COMPUT	OUTPUT			
COMP	2	MAIN	COMPUT				
INPUT	6	MAIN	HUMVP	OUTPUT			
INPUT3	6	MAIN	COMPUT				
BRGTAB	108	BAVGCO	TABLES				
RESTAB	18	RESTEM	TABLES				
HUMCOR	6	HUMVP	OUTPUT	TABLES			
HUMDAT	108	HUMVP	TABLES				
IO	3	MAIN	BAVCOR	COMPUT	OUTPUT	HUMVP	TABLES
BRGOUT	3	MAIN	BAVCOR	RESTEM	OUTPUT		
INFER	5	MAIN	HUMVP	COMPUT	OUTPUT	INTPRT	
BRGIN	10	MAIN	BAVCOR	RESTEM	COMPUT	OUTPUT	
OUTR	6	MAIN	OUTPUT				
BARPRS	3	MAIN	COMPUT	OUTPUT	INTPRT		
HUMIDV	3	MAIN	HUMVP	COMPUT	OUTPUT	INTPRT	
INTOUT	12	COMPUT	OUTPUT	INTPRT			
TABVAL	75	COMPUT	OUTPUT	TABLES	MAIN		

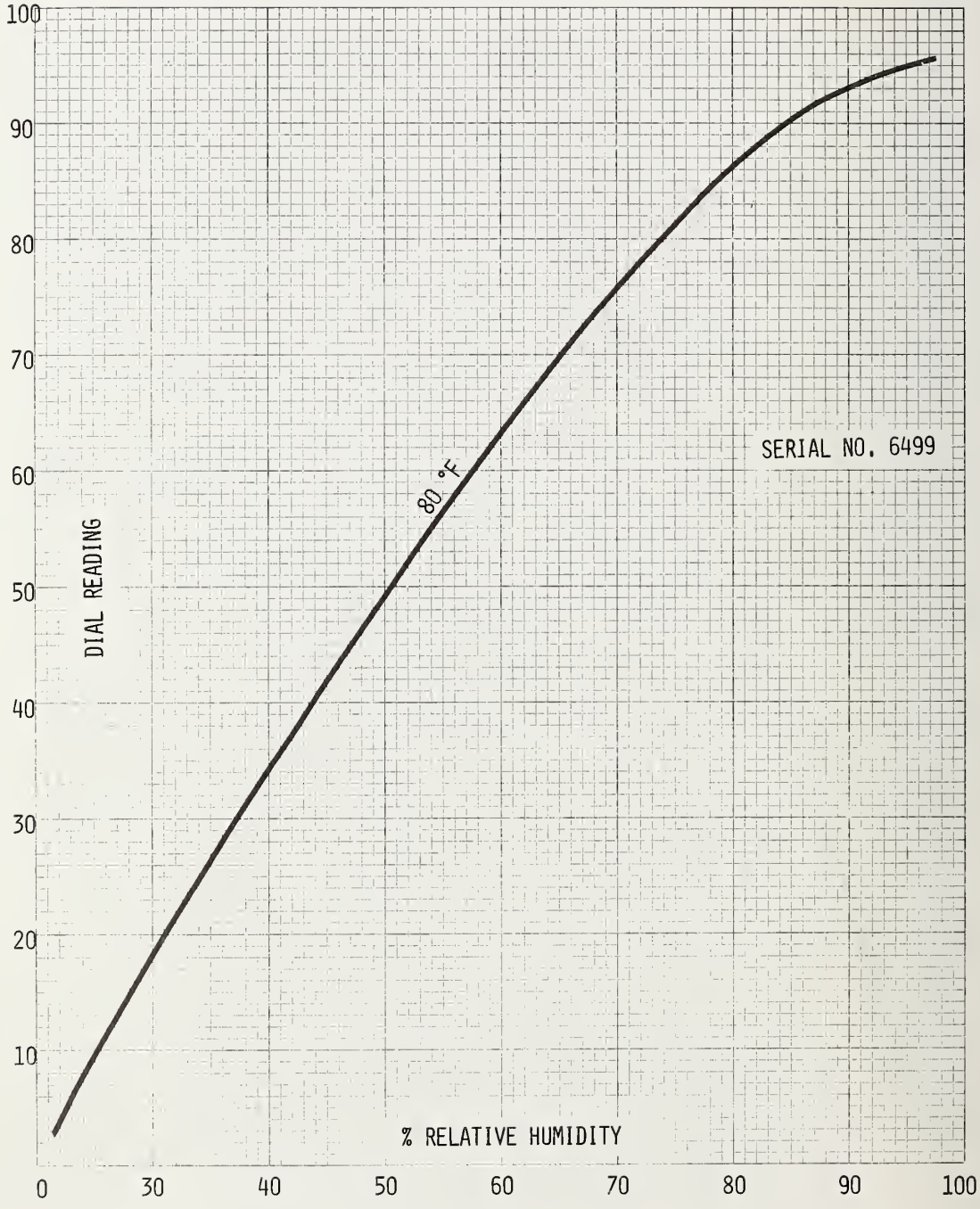
A3. Computer Storage Needed By Subprograms

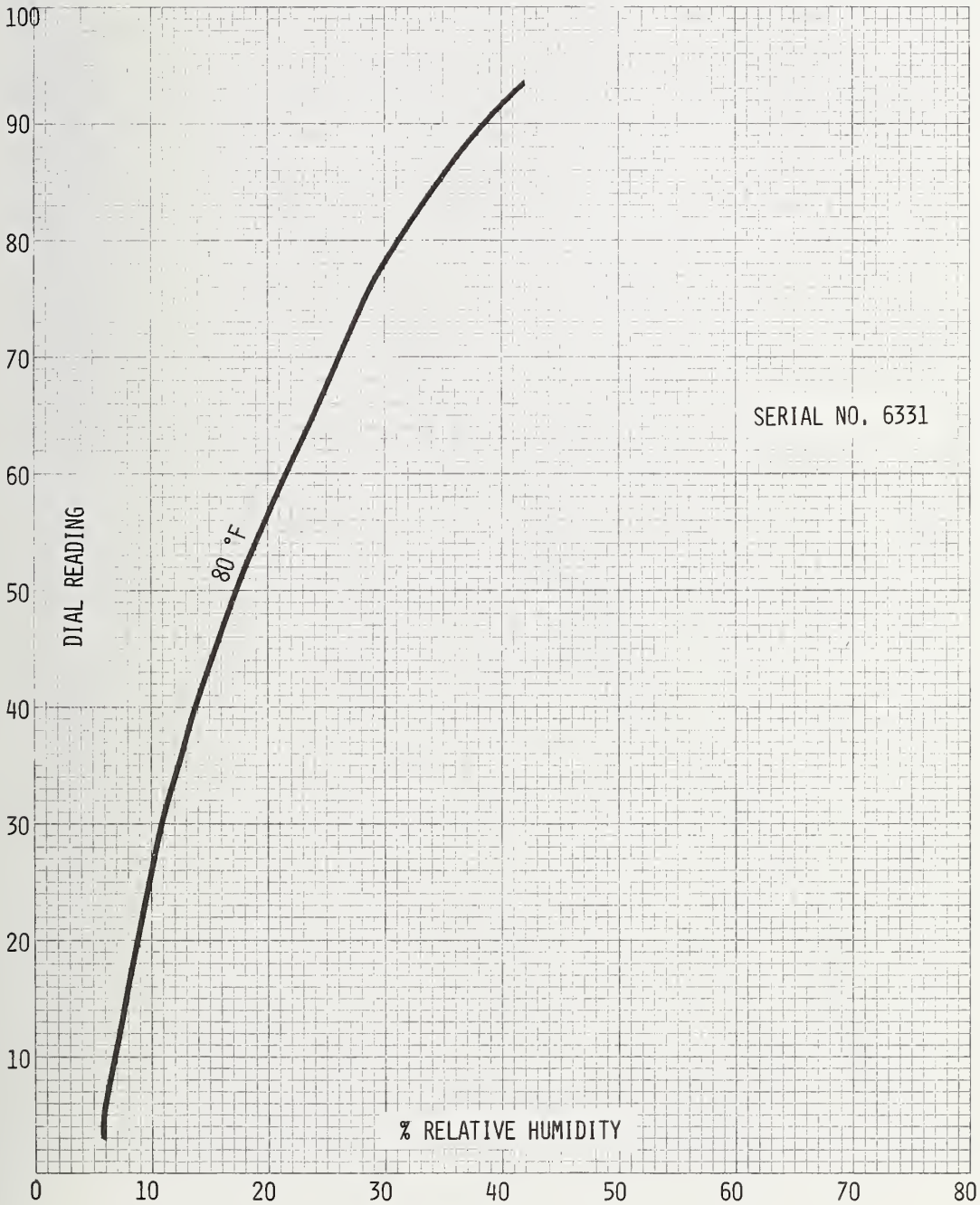
Subprogram	Lines of Code	Storage	
		Code	Data
MAIN	239	383	128
READIT	387	586	144
ERROR	52	104	164
BAVCOR	61	167	41
RESTEM	26	57	36
QUAD	71	193	36
HUMVP	84	236	73
COMPUT	122	192	83
OUTPUT	125	196	404
DFFD	129	194	54
INTPRT	22	24	40
TABLES	262	0	0
Total	1580	2138	1203

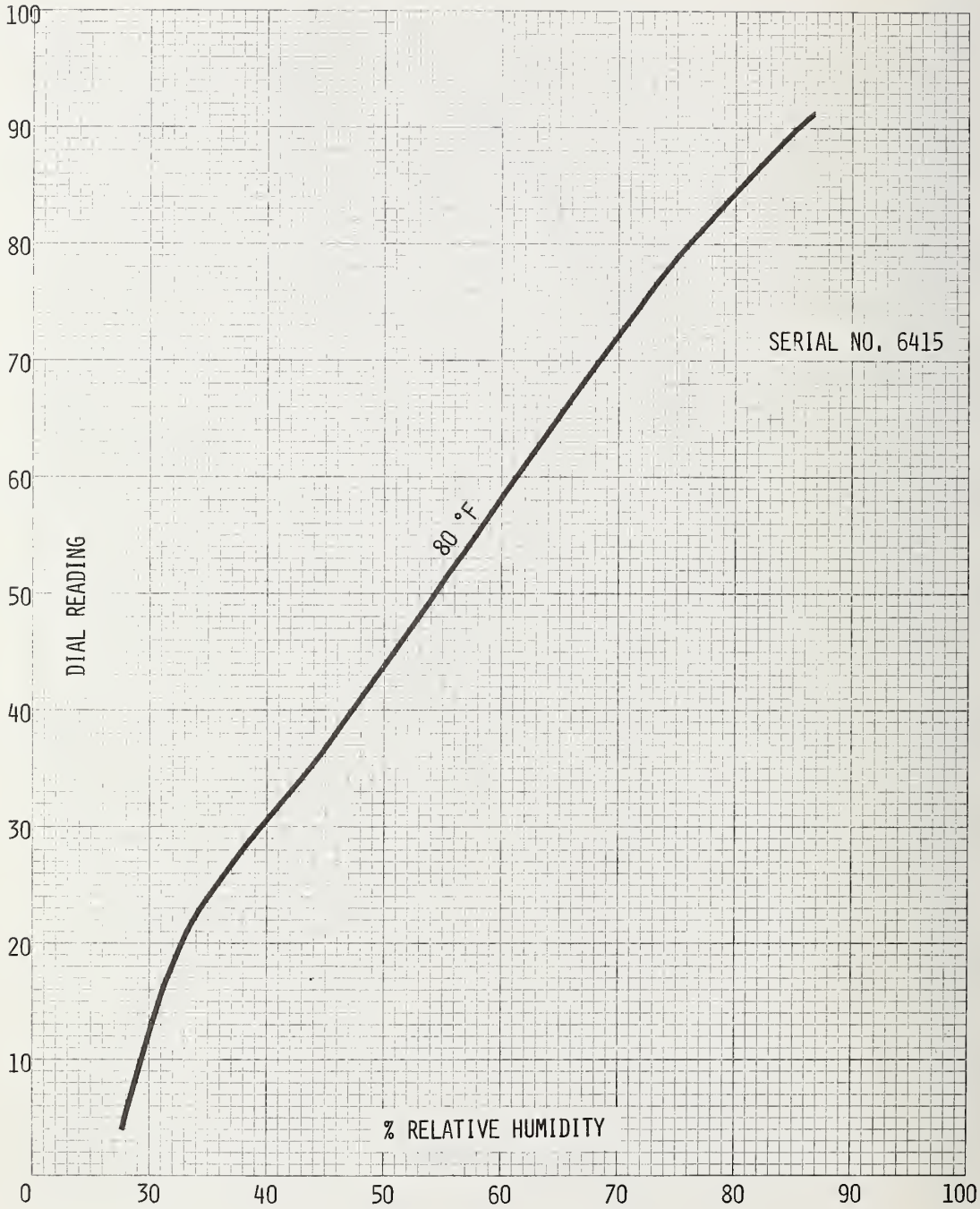
APPENDIX B

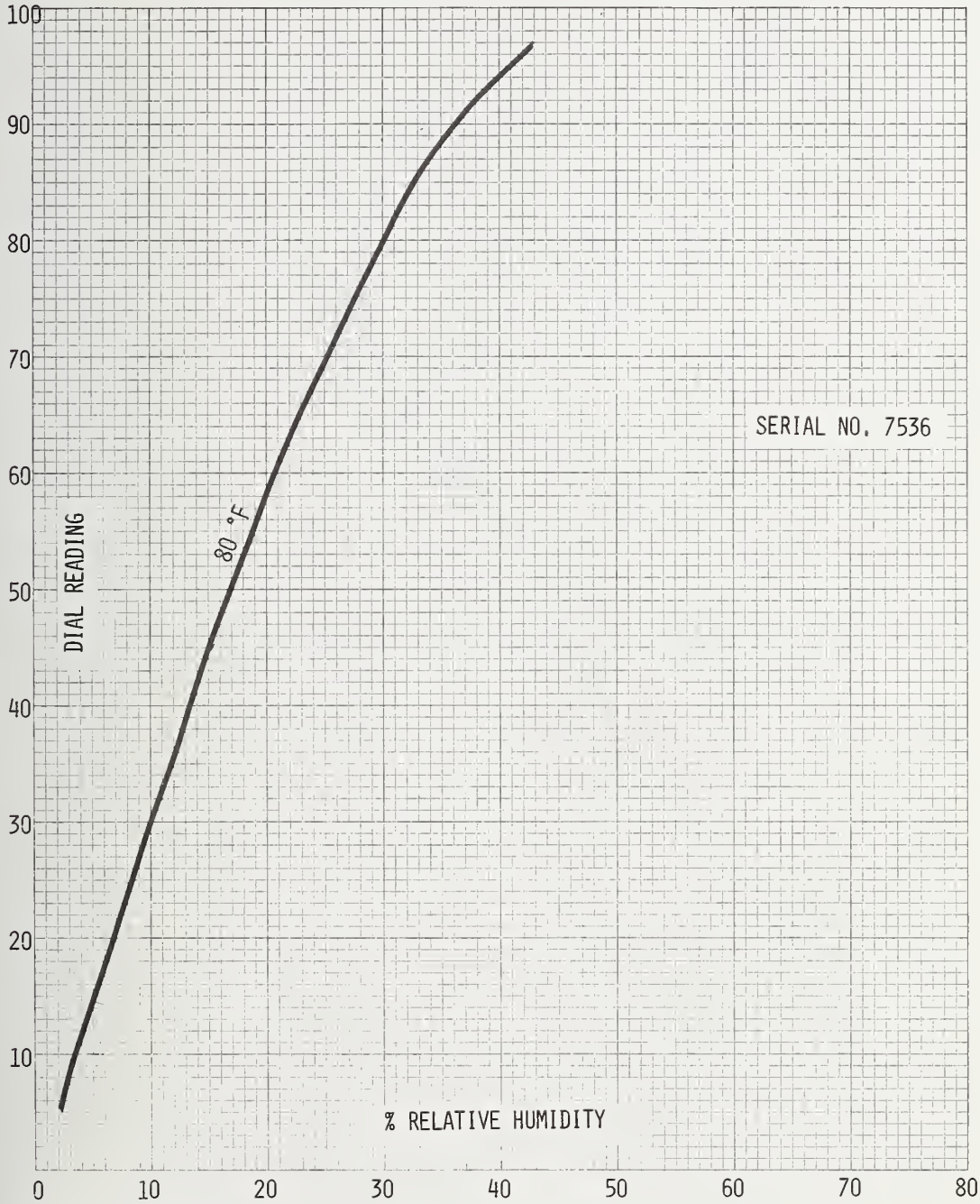
GRAPHS FOR CONVERTING
HYGROMETER READINGS TO HUMIDITY

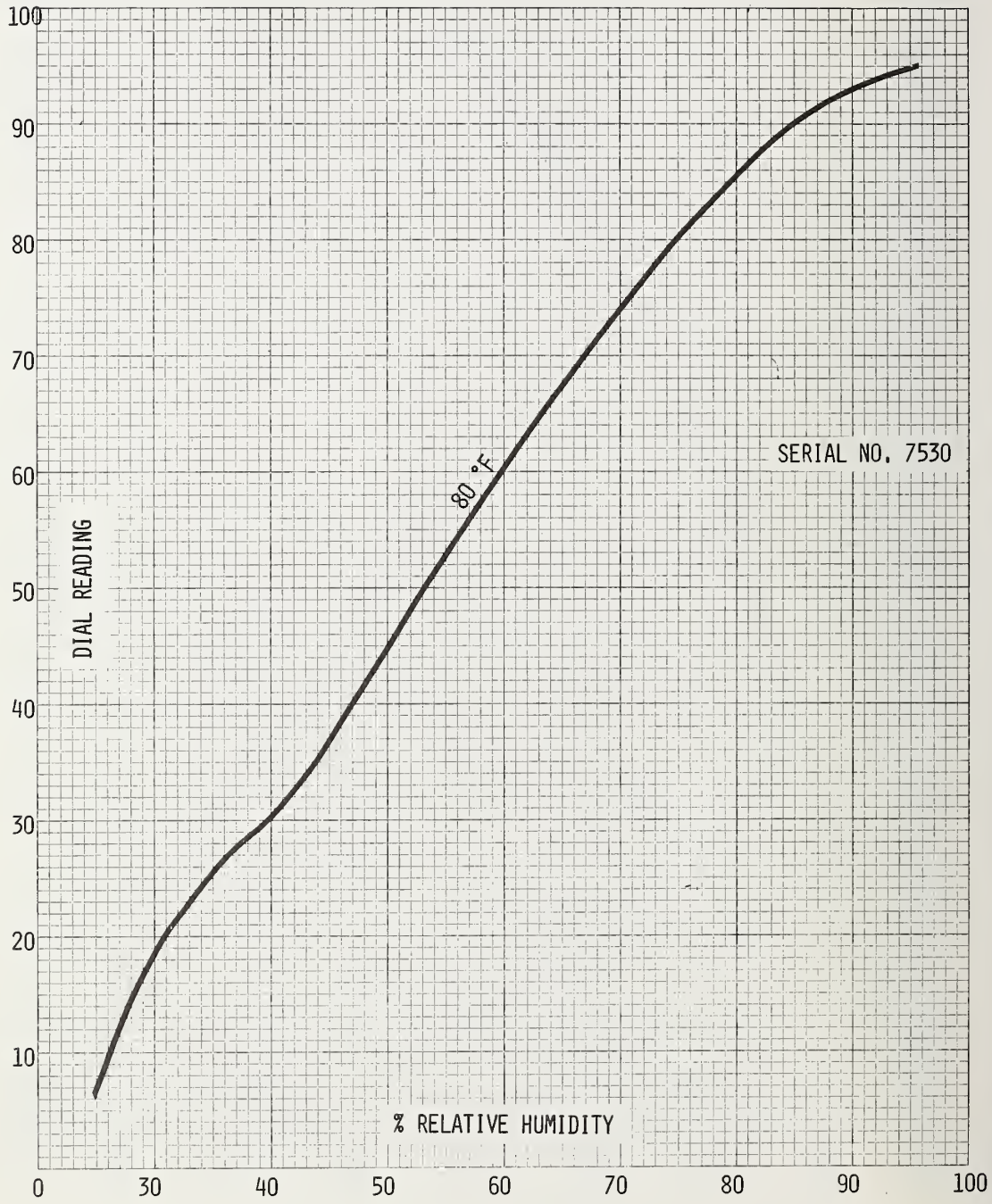


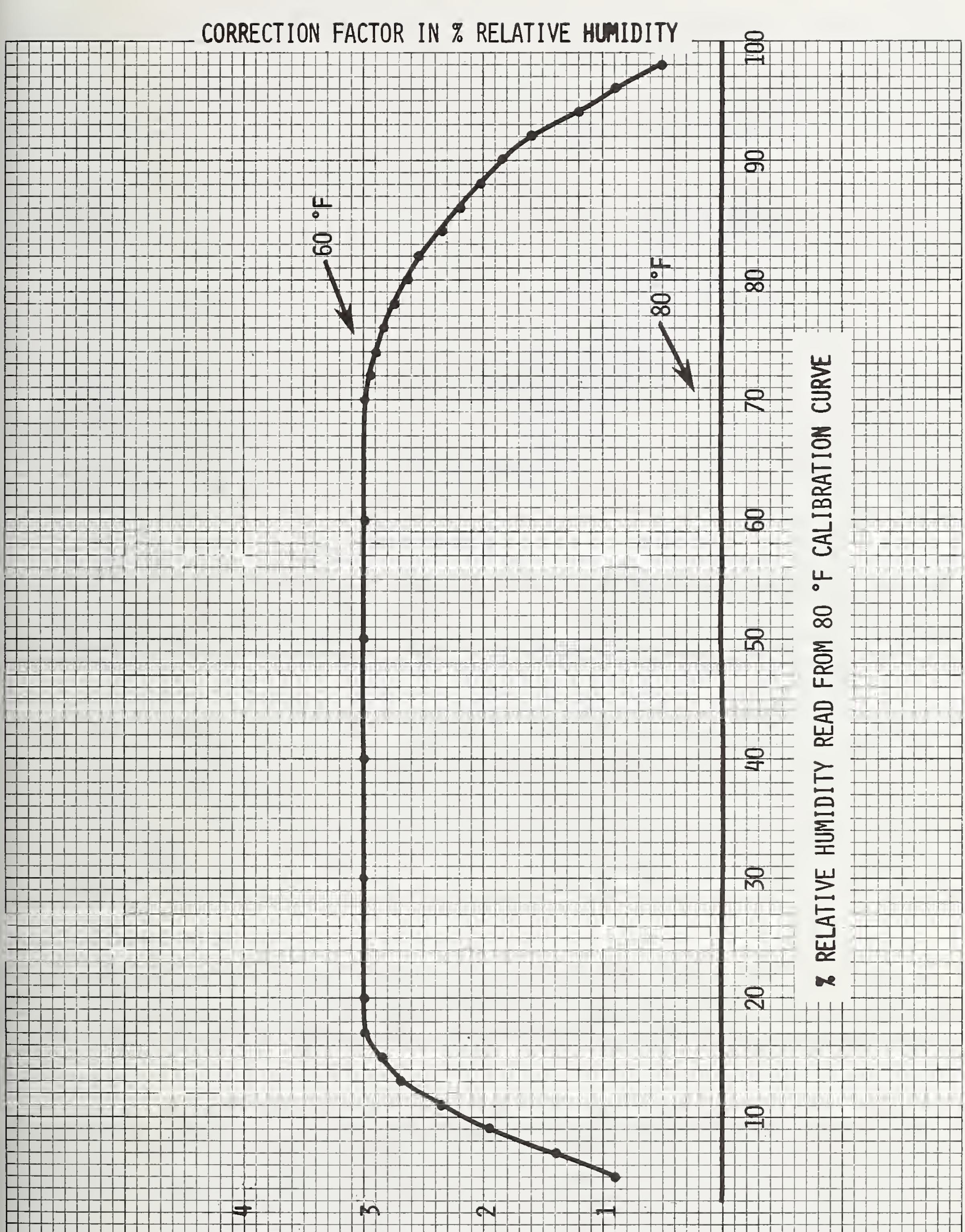

100
90
80
70
60
50
40
30
20
10
DIAL READING
80 °F
SERIAL NO. 6499
% RELATIVE HUMIDITY
0
30
40
50
60
70
80
90
100


100
90
80
70
60
50
40
30
20
10
0
10
20
30
40
50
60
70
80
DIAL READING
80 °F
SERIAL NO. 6331
% RELATIVE HUMIDITY


100
90
80
70
60
50
40
30
20
10
0
30
40
50
60
70
80
90
100
DIAL READING
% RELATIVE HUMIDITY
80 °F
SERIAL NO. 6415


100
90
80
70
60
50
40
30
20
10
DIAL READING
80 °F
SERIAL NO. 7536
% RELATIVE HUMIDITY
0
10
20
30
40
50
60
70
80


100
90
80
70
60
50
40
30
20
10
DIAL READING
80 °F
SERIAL NO. 7530
% RELATIVE HUMIDITY
0
30
40
50
60
70
80
90
100


CORRECTION FACTOR IN % RELATIVE HUMIDITY
% RELATIVE HUMIDITY READ FROM 80 °F CALIBRATION CURVE
60 °F
80 °F
1
2
3
4
10
20
30
40
50
60
70
80
90
100

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16. ABSTRACT *(A 200-word or less factual summary of most significant information. If document includes a significant bibliography or literature survey, mention it here.)*

A description of a computer program which computes the length of a gage block from a process using single wavelength interferometry is given. The computer program has been written in American National Standards Institute FORTRAN, with emphasis on making it as machine-independent as possible. A sample of input and output is given.

17. KEY WORDS *(six to twelve entries; alphabetical order; capitalize only the first letter of the first key word unless a proper name; separated by semicolons)*

FORTRAN computer program; gage blocks; interferometry

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