

APPENDIX C

HUMIDITY CONTROL COMPUTER CODE

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585 'User program can begin anywhere past this point
590 SETPT=0.15
591 SETPT2=0.250
592 TIME$="00.00.00"
593 CLS
594 NLOC=1
595 GOSUB 11000
600 '
602 ' CALCULATE INITIAL ERRORS, EK & EKO
603 '
604 GOSUB 4000
605 '
610 ON TIMER(20) GOSUB 645
620 TIMER ON
625 REM
630 GOTO 625
644 '
645 '-----
646 ' MAIN BODY OF PROGRAM
647 '-----
648 '
650 GOSUB 13000 'call subroutine temperature
660 GOSUB 1000 'call subroutine read voltage
680 GOSUB 5000 'call subroutine move motors
685 EK=EK1
686 EKO=EKO1
890 GOSUB 12000
950 IF N=0 THEN GOTO 960 ELSE GOTO 985
960 'OPEN "C:\DAA\TEST10.DAT" FOR APPEND AS #1
978 'PRINT #1,TBOT,100*RHBOT, TTOP,100*RHTOP
980 'CLOSE #1
985 N=N+1
987 IF N=20 THEN N=0
990 RETURN
998 '
999 '-----
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1000 'SUBROUTINE READ DEWPOINTER VOLTAGE => DPTOP & DPTOP
1001 '-----
1002 '
1030 VOLT1=0
1040 FOR J=1 TO 50
1050 S3$="CONFMEAS DCV, 205"
1060 LEN3=LEN(S3$)
1070 CALL IOOUTPUTS(DEV,S3$,LEN3)
1080 CALL IOENTER(DEV,V1)
1090 VOLT1=VOLT1+V1
1100 NEXT J
1120 RHBOT = (VO1*20)/100
1200 EK1 = ABS(RHBOT-SETPT) 'error calculation
1300 KP=18      'gain
1310 KI=15      'gain
1315 KD=15      'gain
1330 NSTEP=INT(KP*(EK1-EK+KI*EK+KD*(EK1-EK))+0.5)
1340 NSTEP=ABS(NSTEP)
1390 '
1400 VOLT2=0
1410 FOR I=1 TO 50
1420 S6$="CONFMEAS DCV,207"
1430 LEN6=LEN(S6$)
1440 CALL IOOUTPUTS(DEV,S6$,LEN6)
1450 CALL IOENTER(DEV,V2)
1460 VOLT2=VOLT2+V2
1470 NEXT I
1480 VO2=VOLT2/50
1490 RHTOP=(20*VO2)/100
1600 EKO1=ABS(RHTOP-SETT2)
1800 NSTEP2=INT(KP*(EKO1-EKO+KI*EKO+KD*(EKO1-EKO))+0.5)
1810 NSTEP2=ABS(NSTEP2)
1900 RETURN
1999 '
3999 '-----
4000 'SUBROUTINE CALCULATE INITIAL ERROR
4001 '-----
4010 VOLT1=0
4020 FOR J=1 TO 50
4030 S4$="CONFMEAS DCV,205"
4040 LEN4=LEN(S4$)
4050 CALL IOOUTPUTS(DEV,S4$,LEN4)
4060 CALL IOENTER(DEV,V1)
4070 VOLT1=VOLT1+V1
4080 NEXT J
4090 VO1=VOLT1/50
4095 RHBOT=(VO1*20)/100

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4100 EK=ABS(RHBOT-SETPT)
4190 '
4200 VOLT2=0
4210 FOR I=1 TO 50
4220 S5$="CONFMEAS DCV,207"
4230 LEN5=LEN(S5$)
4240 CALL IOOUTPUTS(DEV,S5$,LEN5)
4250 CALL IOENTER(DEV,V2)
4260 VOLT2=VOLT2+V2
4270 NEXT I
4280 VO2=VOLT2/50
4285 RHTOP=(VO2*20)/100
4290 EKO=ABS(RHTOP-SETPT2)
4300 RETURN
4999 '
5000 '-----
5001 'subroutine move motor
5002 '-----
5003 '
5010 IF RHBOT<SETPT THEN GOSUB 5030 ELSE GOTO 5180
5020 GOTO 5330
5030 IF SOLEN=1 THEN GOSUB 5050 ELSE GOSUB 5150
5040 RETURN
5050 IF DESI=1 THEN GOSUB 5070 ELSE GOSUB 5100
5060 RETURN
5070 L=0
5080 GOSUB 6500
5090 RETURN
5100 GOSUB 9000
5110 RETURN
5120 L=1
5130 GOSUB 7500
5140 RETURN
5150 L=1
5160 GOSUB 7500
5170 RETURN
5180 IF RHBOT=SETPT THEN GOTO 5330 ELSE GOSUB 5200
5190 GOTO 5330
5200 IF BUBL=1 THE GOSUB 5220 ELSE GOSUB 5250
5210 RETURN
5220 L=0
5230 GOSUB 7500
5240 RETURN
5250 IF SOLEN=1 THEN GOSUB 5270 ELSE GOSUB 5300
5260 RETURN
5270 L=1
5280 GOSUB 6500

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5290 RETURN
5300 GOSUB 8000
5301 L=1
5302 GOSUB 6500
5310 RETURN
5330 '
5341 IF RHTOP<SETPT THEN GOSUB 5360 ELSE GOTO 5510
5350 GOTO 5640
5360 IF SOLEN2=1 THE GOSUB 5380 ELSE GOSUB 5480
5370 RETURN
5380 IF DESI2=1 THEN GOSUB 5400 ELSE GOSUB 5430
5390 RETURN
5400 L=0
5410 GOSUB 6000
5420 RETURN
5430 GOSUB 9500
5440 RETURN
5450 L=1
5460 GOSUB 7000
5470 RETURN
5480 L=1
5490 GOSUB 7000
5500 RETURN
5510 IF RHTOT=SETPT2 THEN GOTO 5640 ELSE GOSUB 5530
5520 GOTO 5640
5530 IF BUBL2=1 THE GOSUB 5550 ELSE GOSUB 5580
5540 RETURN
5550 L=0
5560 GOSUB 7000
5570 RETURN
5580 IF SOLEN2=1 THEN GOSUB 5600 ELSE GOSUB 5630
5590 RETURN
5600 L=1
5610 GOSUB 6000
5620 RETURN
5630 GOSUB 8500
5631 L=1
5632 GOSUB 8500
5639 RETURN
5640 RETURN
6000 '
6001 '-----
6010 'subroutine move motor A
6011 '-----
6020 IF NA>1500 THEN GOTO 6040
6030 IF L=1 THEN NA=NA+NSTEP2
6040 IF L=0 THEN NA=NA-NSTEP2

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6050 DISABLE =2+4+8
6060 PORTB=MODEAB+DISABLE+MODECD
6070 OUT PB,PORTB
6080 IF NSTEP2=0 THEN GOTO 6180
6090 FOR I=1 TO NSTEP2
6100 IF L=0 THEN OUT PA,17
6110 IF L=0 THEN OUT PA,16
6115 IF NA>1000 THEN GOTO 6140
6120 IF L=1 THEN OUT PA,1
6130 IF L=1 THEN OUT PA,0
6140 NEXT I
6150 ENABLE=1+2+4+8
6160 PORTB=MODEAB+ENABLE
6170 OUT PB,PORTB
6180 IF NA<=0 THEN DESI2=0 ELSE DESI2=1
6190 IF NA<0 THEN NA=0
6200 RETURN
6498 '
6499 '-----
6500 'subroutine move motor B
6501 '-----
6502 '
6510 IF NB>1500 THEN GOTO 6530
6520 IF L=1 THEN NB=NB+NSTEP
6530 IF L=0 THEN NB=NB-NSTEP
6540 DISABLE =1+4+8
6550 PORTB=MODEAB+DISABLE+MODECD
6560 OUT PB,PORTB
6570 IF NSTEP=0 THEN GOTO 6670
6580 FOR I=1 TO NSTEP
6590 IF L=0 THEN OUT PA,34
6600 IF L=0 THEN OUT PA,32
6605 IF NB>1000 THEN GOTO 6630
6610 IF L=1 THEN OUT PA,2
6620 IF L=1 THEN OUT PA,0
6630 NEXT I
6640 ENABLE=1+2+4+8
6650 PORTB=MODEAB+ENABLE
6660 OUT PB,PORTB
6670 IF NB<=0 THEN DESI=0 ELSE DESI=1
6680 IF NB<0 THEN NB=0
6690 RETURN
6998 '
6999 '-----
7000 'subroutine move motor C
7001 '-----
7002 '

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7010 IF NC>1500 THEN GOTO 7030
7020 IF L=1 THEN NC=NC+NSTEP2
7030 IF L=0 THEN NC=NC-NSTEP2
7040 DISABLE =1+2+8
7050 PORTB=MODEAB+DISABLE+MODECD
7060 OUT PB,PORTB
7070 IF NSTEP2=0 THEN GOTO 7170
7080 FOR I=1 TO NSTEP2
7090 IF L=0 THEN OUT PA,68
7100 IF L=0 THEN OUT PA,64
7105 IF NC>1000 THEN GOTO 7130
7110 IF L=1 THEN OUT PA,4
7120 IF L=1 THEN OUT PA,0
7130 NEXT I
7140 ENABLE=1+2+4+8
7150 PORTB=MODEAB+ENABLE
7160 OUT PB,PORTB
7170 IF NC<=0 THEN BUBL2=0 ELSE BUBL2=1
7180 IF NC<0 THEN NC=0
7190 RETURN
7498 '
7499 '-----
7500 'subroutine move motor D
7501 '-----
7502 '
7510 IF ND>1500 THEN GOTO 7530
7520 IF L=1 THEN ND=ND+NSTEP
7530 IF L=0 THEN ND=ND-NSTEP
7540 DISABLE =1+2+4
7550 PORTB=MODEAB+DISABLE+MODECD
7560 OUT PB,PORTB
7570 IF NSTEP=0 THEN GOTO 7670
7580 FOR I=1 TO NSTEP
7590 IF L=0 THEN OUT PA,136
7600 IF L=0 THEN OUT PA,128
7605 IF NA>1000 THEN GOTO 7630
7610 IF L=1 THEN OUT PA,8
7620 IF L=1 THEN OUT PA,0
7630 NEXT I
7640 ENABLE=1+2+4+8
7650 PORTB=MODEAB+ENABLE
7660 OUT PB,PORTB
7670 IF ND<=0 THEN BUBL=0 ELSE BUBL=1
7680 IF ND<0 THEN ND=0
7690 RETURN
7998 '
7999 '-----

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8000 'subroutine to open solenoid valve
8001 '-----
8002 '
8010 DEV=709
8020 CALL IOCLEAR(DEV)
8030 S1$=SPACE$(25)
8040 S1$="OPEN 500"
8050 LH=LEN(S1$)
8060 CALL IOOUTPUTS(DEV,S1$,LH)
8070 SOLEN=1
8400 RETURN
8498 '
8499 '-----
8500 ' subroutine to open solenoid valve 2
8501 '-----
8502 '
8520 DEV=709
8530 CALL IOCLEAR(DEV)
8540 S8$=SPACE$(25)
8550 S8$="OPEN 501"
8560 LH=LEN(S8$)
8570 CALL IOOUTPUTS(DEV,S8$,LH)
8580 SOLEN2=1
8900 RETURN
8998 '
8999 '-----
9000 ' subroutine to close solenoid valve
9001 '-----
9002 '
9005 DEV=709
9010 CALL IOCLEAR(DEV)
9020 S2$=SPACE$(25)
9030 S2$="CLOSE 500"
9040 LH=LEN(S2$)
9050 CALL IOOUTPUTS(DEV,S2$,LH)
9060 SOLEN=0
9400 RETURN
9498 '
9499 '-----
9500 ' subroutine to close solenoid valve 2
9501 '-----
9502 '
9510 DEV=709
9520 CALL IOCLEAR(DEV)
9530 S9$=SPACE$(25)
9540 S9$="CLOSE 501"
9550 LH=LEN(S9$)

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9560 CALL IOOUTPUTS(DEV,S9$,LH)
9570 SOLEN2=0
9900 RETURN
10999 '-----
11000 'subroutine initialize
11001 '-----
11010 SOLEN=1
11015 SOLEN2=1
11020 PA=736: PB=744: CO=748
11030 OUT CO,192
11040 OUT PC,5
11050 'SET FULL OR HALF STEP
11060 MODEAB=0
11065 MODECD=2^6
11070 NA=0
11071 NA=0
11075 NC=0
11076 ND=0
11080 NSTEP=0
11081 NSTEP2=0
11090 BUBL=0: BUBL2=0
11100 DESI=0:DESI2=0
11110 GOSUB 9000
11150 GOSUB 9500
11170 GOSUB 13000
11200 DISABLE=2+4+8
11999 RETURN
12000 '
12001 '-----
12002 'subroutine print
12003 '-----
12004 '
12011 LOCATE 1,1
12012 PRINT" BUB    DES    BOT    BOT    BUB    DES    TOP    TOP"
12013 PRINT" POS    POS    T    R.H.    POS    POS    T    R.H"
12014 PRINT"                                           "
12015 LOCATE 3+NLOC
12050 PRINT USING"####";ND;
12080 PRINT USING"#####";NB;
12090 'IF SOLEN=1 THEN PRINT "OPEN";
12095 PRINT USING"####.##";TBOT;
12100 'IF SOLEN=0 THEN PRINT "CLOSED"
12101 PRINT USING"####.##";RHBOT*100
12102 PRINT"% ";
12140 PRINT USING"#####";NC;
12170 PRINT USING"#####";NA;
12180 IF SOLEN2=1 THEN PRINT"OPEN";

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12185 PRINT USING"####.##";TTOP;
12190 'IF SOLEN2=0 THEN PRINT"CLOSED";
12191 PRINT USING"###.#";RHTOP*100;
12192 PRINT "% ";
12200 LOCATE 1,1

12210 PRINT" BUB    DES    BOT    BOT    BUB    DES    TOP    TOP"
12220 PRINT" POS    POS    T    R.H.  POS    POS    T    R.H"
12230 PRINT"
12240 NLOC=NLOC+1
12250 IF NLOC=22 THEN NLOC=NLOC-1
12999 RETURN
13000 '
13001 '-----
13010 'subroutine temperature
13011 '-----
13020 TEMP1=0
13050 FOR J=1 TO 50
13060 S1$="CONFMEAS DCV, 206"
13070 LEN1=LEN(S1$)
13080 CALL IOOUTPUTS(DEV,S1$,LEN1)
13090 CALL IOENTER(DEV,TEM1)
13100 TEMP1=TEMP1+TEM1
13300 NEXT J
13310 TE1=TEMP1/50
13330 TBOT=TE1*20-20
13499 '
13500 TEMP2=0
13510 FOR I=1 TO 50
13520 S2$="CONFMEAS DCV, 208"
13530 LEN2=LEN(S2$)
13540 CALL IOOUTPUTS(DEV,S2$,LEN2)
13550 CALL IOENTER(DEV,TEM2)
13560 TEMP2=TEMP2+TEM2
13570 NEXT I
13580 TE2=TEMP2/50
13590 TTOT=TE2*20-20
13600 RETURN

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