Copy New block data from Module to it's input image name. Block Sequence Number, Byte [0], is indexed evey scan of the port.
Byte [1] of the block contains the count of the number of bytes to process in the current block.
-3 and -4 indicate status blocks are being sent over.
-1 means more then 14 characters are being sent.

0

mvi94-ascii-1 module

COP
Copy File
Source ASCII:1:I.Data[0]
Dest MVI94ASCII.Input_Data[0]
Length 16

This rung will process the data for the MVI94ASCII module only when a new block of data has been received from the module. If there is not a new block pending, then this subroutine will not be called.

1

mvi94-ascii-1 module

NEQ
Not Equal
Source A MVI94ASCII.Input_Data[0]
112
Source B MVI94ASCII.Last_Read_Blk
112

First send status commands then read the status from the MPS. Controls in place for long strings.

JSR
Jump To Subroutine
Routine Name ASCII_SubRoutine_2

Write Output Image to MVI94-ASCII module.

2

COP
Copy File
Source MVI94ASCII.Output_Data[0]
Dest ASCII:1:O.Data[0]
Length 7

(End)

First send status commands
then read the status from the MPS.
Controls in place for long strings.

This rung will move the current block ID number to the Last_Read_Blk. This makes sure that only new blocks of data are processed.

0

mvi94-ascii-1 module

MOV
Move
Source MVI94ASCII.Input_Data[0]
123
Dest MVI94ASCII.Last_Read_Blk
123

Commands are stored in SString, which is triggered by the response from the command sent earlier.
Timer is for debugging, use it to slow down controls.

1

Char_Cnt_OverFlow
<Boolean_1[9]>
/
MPS_GetStatus
<Boolean_3[10]>
PSU_Control_Pwr
<Boolean_1[15]>

TON
Timer On Delay
Timer Timer
Preset 800
Accum 0
EN
DN

Timer.DN

ADD
Add
Source A 1
Source B count
2
Dest count
2

GRT
Greater Than (A>B)
Source A count
2
Source B 9

MOV
Move
Source 0
Dest count
2

next
<Boolean_3[24]>

First send status commands
then read the status from the MPS.
Controls in place for long strings.

Only 9 MPS status commands go out.
count = 0 is a manually sent command
count =1 is a PLC sent command
counts 2 thru 9 are status request commands
After sending out the command, wait for new data before sending out any new commands.
If the output string is a null, no new data will come in.

2

Char_Cnt_OverFlow
<Boolean_1[9]>
/
Timer.DN

mvi94-ascii-1 module
COP
Copy File
Source SString[count].DATA[0]
Dest MVI94ASCII.Write_String[0]
Length SString[count].LEN

mvi94-ascii-1 module
MOV
Move
Source SString[count].LEN
5
Dest MVI94ASCII.WriteLength
0

Rxlogic Commnads go
here - Manual

EQU
Equal
Source A count
2
Source B 1

COP
Copy File
Source NULL[0]
Dest SString[0]
Length 1

MPS_GetStatus
<Boolean_3[10]>
U

HMI commands go here

EQU
Equal
Source A count
2
Source B 2

COP
Copy File
Source NULL[0]
Dest SString[1]
Length 1

First send status commands
then read the status from the MPS.
Controls in place for long strings.
A command can be sent individually in this rung.

3

send_MPS_cmd
<Boolean_5[23]>

Rxlogic Commnads go here - Manual

COP
Copy File
Source Man_String
Dest SString[0]
Length 1

send_MPS_cmd
<Boolean_5[23]>
U

Checks if the string being sent to the MPS is greater than 1.
A zero length means no command is to be sent.
Also sends the first ten characters of he command and resets the timer.

4

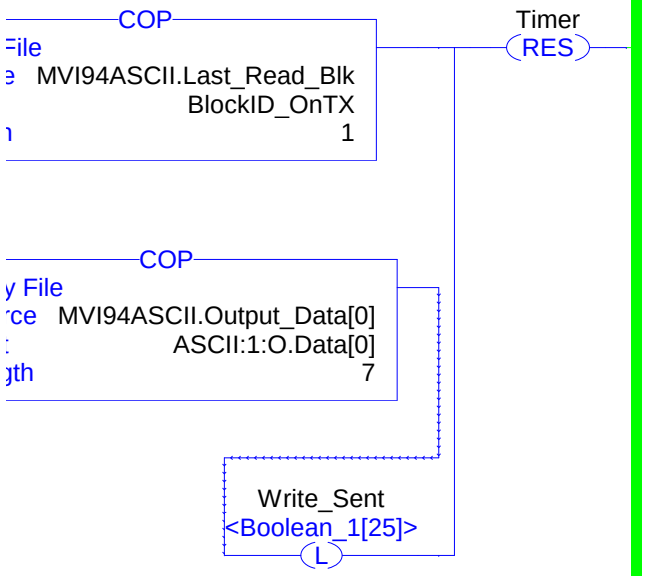
mvi94-ascii-1 module
GEQ
Grtr Than or Eql (A>=B)
Source A MVI94ASCII.WriteLength
0
Source B 1

Write_Sent
<Boolean_1[25]>
/

mvi94-ascii-1 module
COP
Copy File
Source MVI94ASCII.Write_String[0]
Dest MVI94ASCII.Output_Data[4]
Length 10

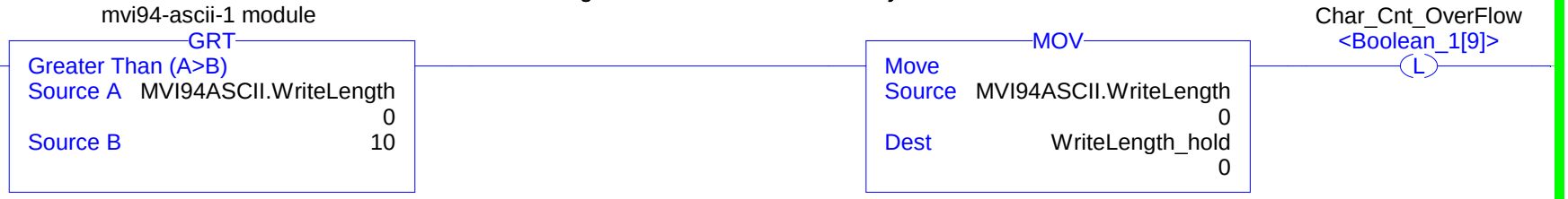
mvi94-ascii-1 module
MOV
Move
Source MVI94ASCII.WriteLength
0
Dest MVI94ASCII.Output_Data[2]
0

First send status commands
then read the status from the MPS.
Controls in place for long strings.



Checks if the outgoing string is greater than 10. Outgoing strings greater than 10 have to be processed in batches as the Flex can handle 10 (outgoing) bytes at a time. In this rung Char_Cnt_Overflow is latched which implies the above.This bit is checked(in rung 25) when the next character has to be sent out to the MPS, if it's still latched no new characters are sent.
Character length is limited to be 40 or less by this subroutine.

5



First send status commands
then read the status from the MPS.
Controls in place for long strings.

Calculates the number of characters that need to be processed in the next rung

6

Char_Cnt_OverFlow
<Boolean_1[9]>

MOV
Move
Source WriteLength_hold
0
Dest cycle_hold
31

CPT
Compute
Dest Char_Hold
3
Expression cycle_hold/10

CPT
Compute
Dest Xmit_Length
1
Expression cycle_hold-(Char_Hold*10)

NEQ
Not Equal
Source A Xmit_Length
1
Source B 0

CPT
Compute
Dest Xmit.PRE
0
Expression Char_Hold+1

EQU
Equal
Source A Xmit_Length
1
Source B 0

MOV
Move
Source Char_Hold
3
Dest Xmit.PRE
0

If the character length is longer then 40, then no commands are sent at all.

7

GRT
Greater Than (A>B)
Source A Xmit.PRE
0
Source B 4

Send_2_Long
<Boolean_5[22]>

First send status commands
then read the status from the MPS.
Controls in place for long strings.

8

Char_Cnt_OverFlow
<Boolean_1[9]>

Writes the characters 10 at a time that need to be processed and sent out to the MPS UP TO 40 c

mvi94-ascii-1 module

EQU
Equal
Source A Xmit.ACC
0
Source B 1

COP
Copy File
Source MVI94ASCII.Write_String[10]
Dest MVI94ASCII.Output_Data[4]
Length 10

GRT
Greater Than (A>B)
Source A Char_Hold
3
Source B 1

EQU
Equal
Source A Char_Hold
3
Source B 1

No
So

So

mvi94-ascii-1 module

EQU
Equal
Source A Xmit.ACC
0
Source B 2

COP
Copy File
Source MVI94ASCII.Write_String[20]
Dest MVI94ASCII.Output_Data[4]
Length 10

GRT
Greater Than (A>B)
Source A Char_Hold
3
Source B 2

EQU
Equal
Source A Char_Hold
3
Source B 2

No
So

So

mvi94-ascii-1 module

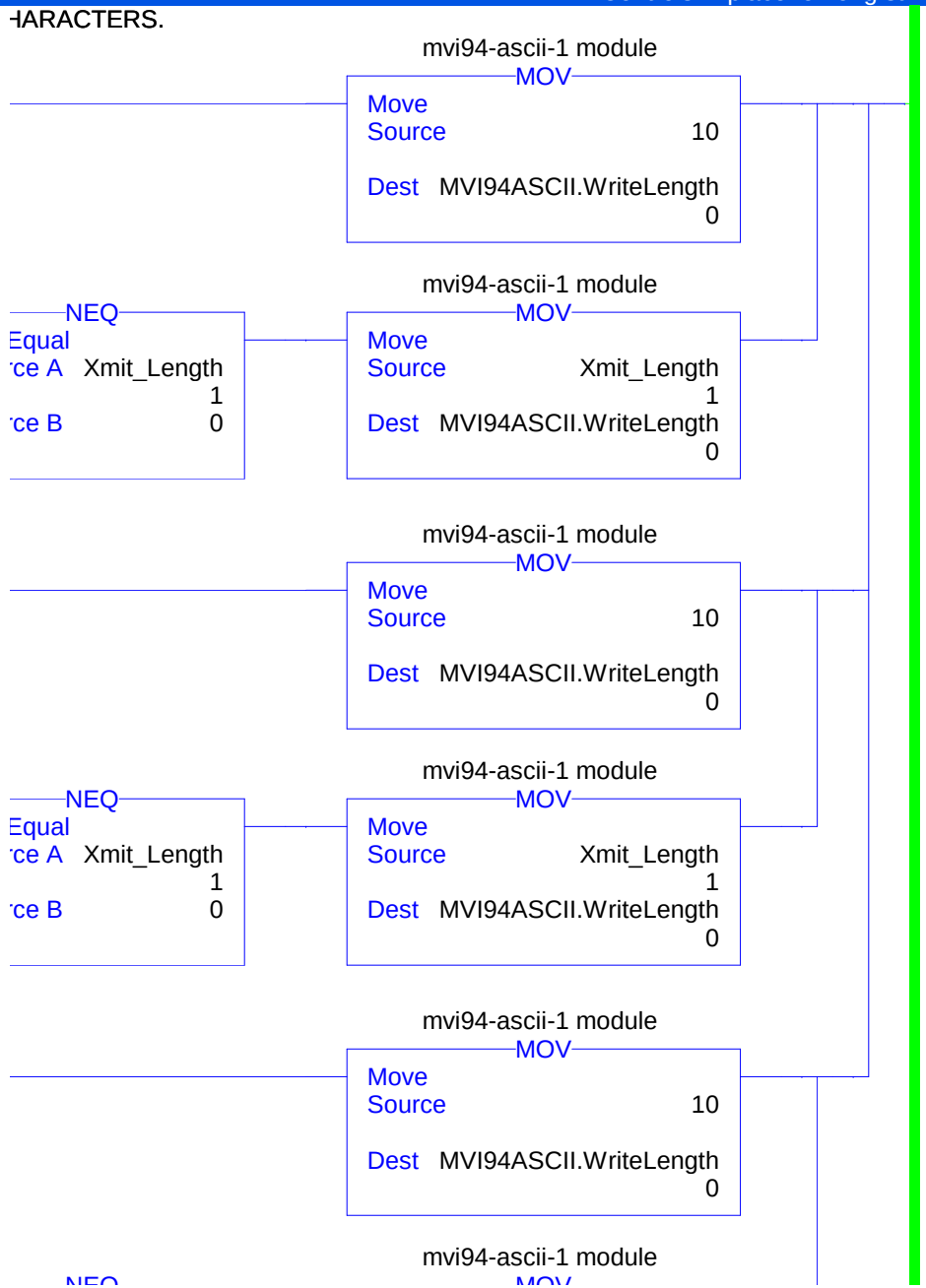
EQU
Equal
Source A Xmit.ACC
0
Source B 3

COP
Copy File
Source MVI94ASCII.Write_String[30]
Dest MVI94ASCII.Output_Data[4]
Length 10

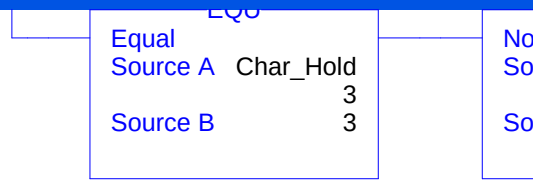
GRT
Greater Than (A>B)
Source A Char_Hold
3
Source B 3

EQU

First send status commands
then read the status from the MPS.
Controls in place for long strings.



First send status commands
then read the status from the MPS.
Controls in place for long strings.



First send status commands
then read the status from the MPS.
Controls in place for long strings.

NEQ
Equal
ce A Xmit_Length
1
ce B 0

MOV
Move
Source Xmit_Length
1
Dest MVI94ASCII.WriteLength
0

Upon seeing that the number of character transmitted on last block is equal to the WriteLength, the output image of the module will be cleared, and the WriteLength set to 0. This will clear the output image of the module (necessary, otherwise the module will constantly write data out the port), and set the length to zero (so that the same string is not written out the port again).

9

Write_Sent
<Boolean_1[25]>

mvi94-ascii-1 module
NEQ
Not Equal
Source A MVI94ASCII.Input_Data[0]
123
Source B BlockID_OnTX
89

Send_2_Long
<Boolean_5[22]>

mvi94-ascii-1 module
FLL
Fill File
Source 0
Dest MVI94ASCII.Output_Data[2]
Length 12

mvi94-ascii-1 module
MOV
Move
Source 0
Dest MVI94ASCII.WriteLength
0

Write_Sent
<Boolean_1[25]>
U

CTU
Count Up
Counter Xmit
Preset 0
Accum 0
CU
DN

First send status commands
then read the status from the MPS.
Controls in place for long strings.

The string with more then ten characters has been written out to the MPS, resets/clears the respective bits.

10

Xmit.DN

Send_2_Long
<Boolean_5[22]>

CLR
Clear
Dest Char_Cnt_OnTX
0

MOV
Move
Source 0
Dest WriteLength_hold
0

MOV
Move
Source 0
Dest Xmit.PRE
0

Char_Cnt_OverFlow
<Boolean_1[9]>
U

Xmit
RES

This rung will process incoming data that is less than 14 characters, the data is moved into MVI94ASCII_multiblock_rec_data, from where it is processed. Also the "carriage return" that is appended at the end of each imcoming string is deleted in this rung. The bit New_Data is set, which represents incoming of new data which needs to be processed.

11

mvi94-ascii-1 module
MVI94ASCII.multiple_blocks_rec_message
/

Value is -1 when
string is more then
14
LIM
Limit Test (CIRC)
Low Limit 1
Test MVI94ASCII.Input_Data[1]
-4
High Limit 14

Data starts at [2]
COP
Copy File
Source MVI94ASCII.Input_Data[2]
Dest MVI94ASCII.multiblock_rec_data[0]
Length MVI94ASCII.Input_Data[1]

[0] is flag for
status or long
strings
COP
Copy File
Source MVI94ASCII.multiblock_rec_data[0]
Dest Read_data_input.DATA[0]
Length MVI94ASCII.Input_Data[1]

Length of string is
in [1]
MOV
Move
Source MVI94ASCII.Input_Data[1]
-4
Dest Read_data_input.LEN
3

continue1
<Boolean_1[27]>

First send status commands
then read the status from the MPS.
Controls in place for long strings.

NMR and MPS have LF and CR reversed. Flex only looks at LF so must remove CR from string

12

continue1
<Boolean_1[27]>

FIND
Find String
Source Read_data_input '$r+$l'
Search CR '$r'
Start 1
Result CR_pos 1

If no CR is found, a value of zero will be returned

NEQ
Not Equal
Source A CR_pos 1
Source B 0

DELETE
String Delete
Source Read_data_input '$r+$l'
Qty 1
Start CR_pos 1
Dest Read_data_output '+$l'

If no CR is found, a value of zero will be returned

EQU
Equal
Source A CR_pos 1
Source B 0

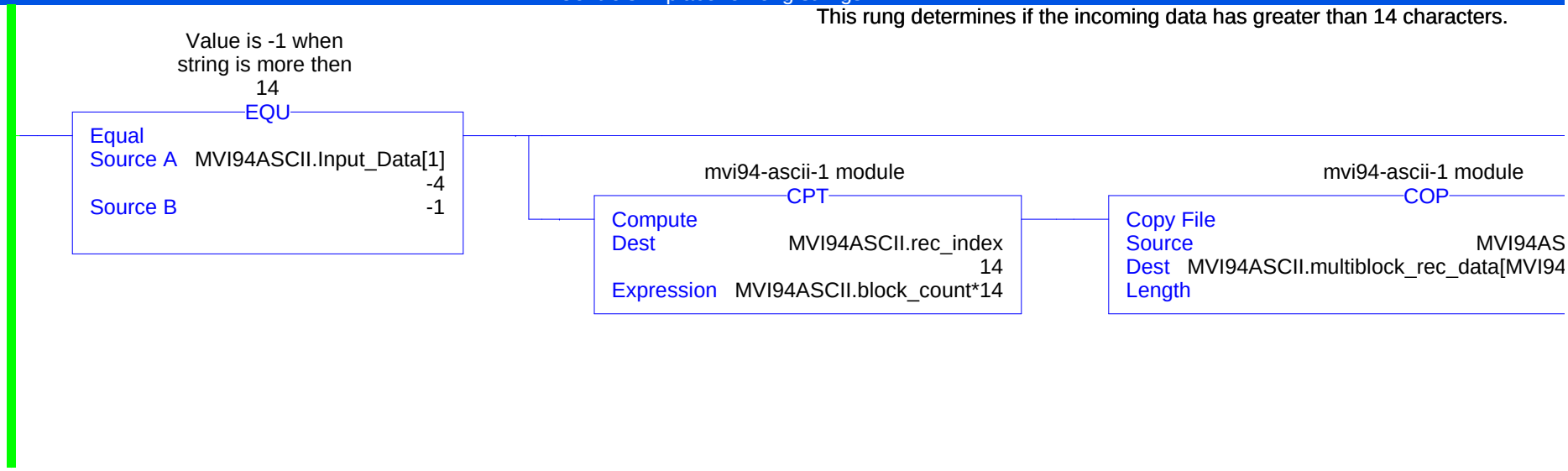
COP
Copy File
Source Read_data_input
Dest Read_data_output
Length Read_data_input.LEN

New_Data
<Boolean_3[23]>
L

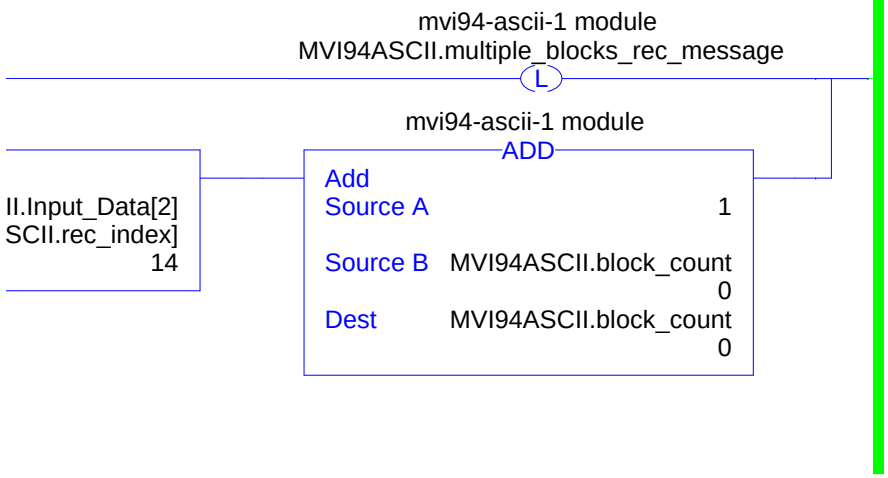
First send status commands
then read the status from the MPS.
Controls in place for long strings.

This rung determines if the incoming data has greater than 14 characters.

13



First send status commands
then read the status from the MPS.
Controls in place for long strings.



First send status commands
then read the status from the MPS.
Controls in place for long strings.

A string having greater than fourteen characters, is processed in the 4 and 5th rungs. In this rung the last fourteen characters are processed.

14

mvi94-ascii-1 module
MVI94ASCII.multiple_blocks_rec_message

Value is -1 when string is more then 14

LIM
Limit Test (CIRC)
Low Limit 1
Test MVI94ASCII.Input_Data[1]
-4
High Limit 14

mvi94-ascii-1 module
CPT
Compute
Dest MVI94ASCII.rec_index
14
Expression MVI94ASCII.block_count*14

mvi94-ascii-1 module
COP
Copy File
Source MVI94ASCII.Input_Data[2]
Dest MVI94ASCII.multiblock_rec_data[MVI94ASCII.rec_index]
Length MVI94ASCII.Input_Data[1]

mvi94-ascii-1 module
MOV
Move
Source 0
Dest MVI94ASCII.block_count
0

mvi94-ascii-1 module
MVI94ASCII.multiple_blocks_rec_message
U

CPT
Compute
Dest String_length
26
Expression MVI94ASCII.rec_index+MVI94ASCII.Input_Data[1]

[0] is flag for status or long strings

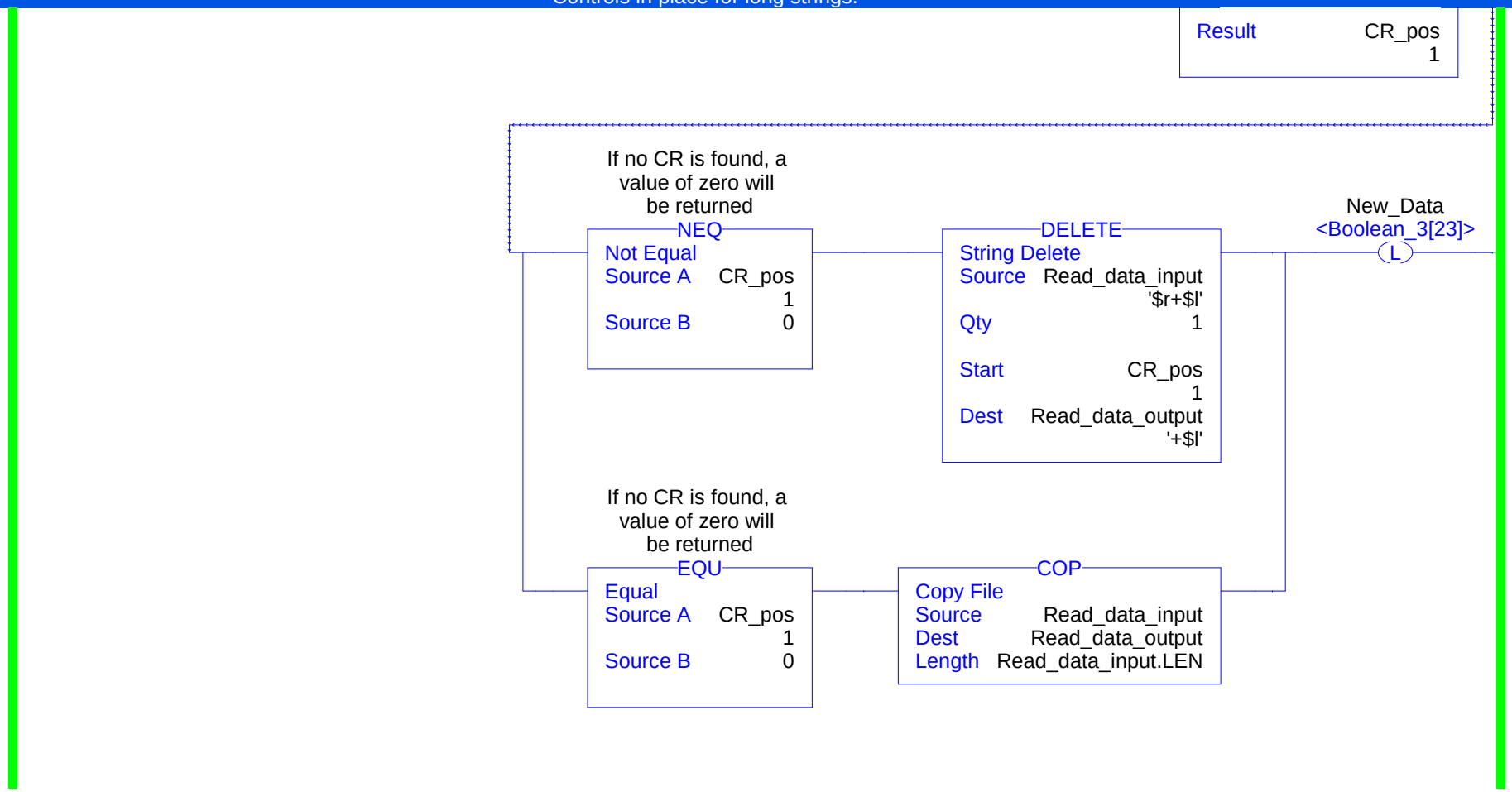
COP
Copy File
Source MVI94ASCII.multiblock_rec_data[0]
Dest Read_data_input.DATA[0]
Length String_length

Length of string is in [1]

MOV
Move
Source String_length
26
Dest Read_data_input.LEN
3

FIND
Find String
Source Read_data_input
'$r+$l'
Search CR
'$r'
Start 1

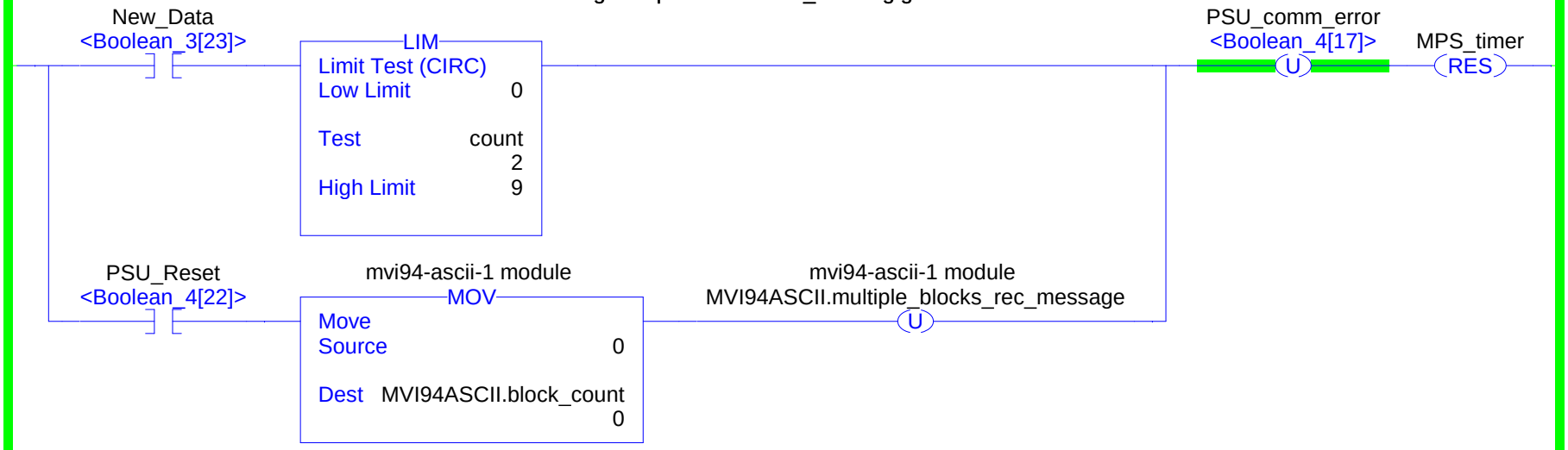
First send status commands
then read the status from the MPS.
Controls in place for long strings.



First send status commands
then read the status from the MPS.
Controls in place for long strings.

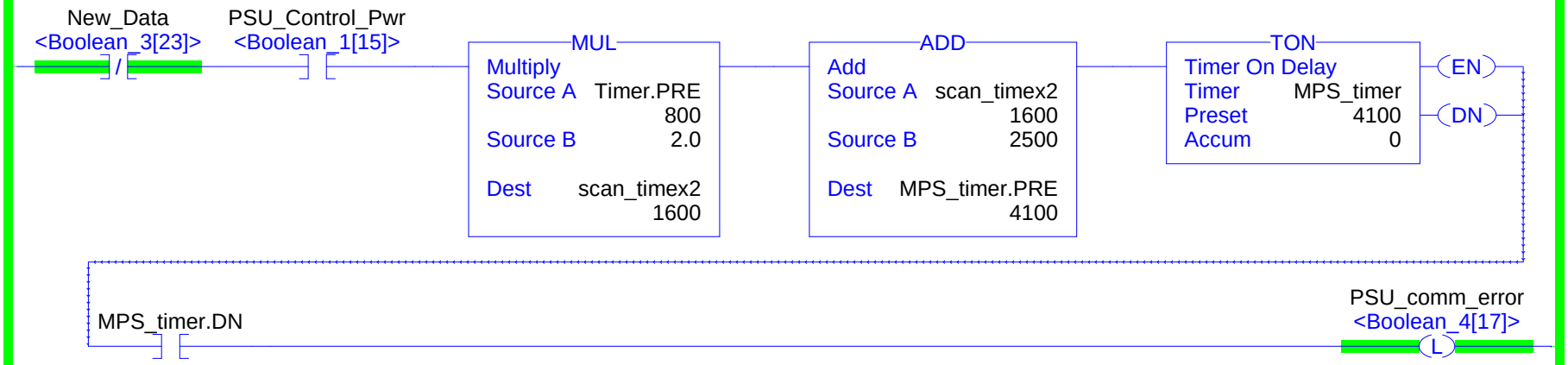
If new data exist and the count is between zero and 9 reset the MPS Timer.
Location of this rung is important as New_data tag gets reset within one scan.

15



In this rung a timer is used to check for communication errors with the Power supply.
The timer is set expire 1 sec after debug timer.
After timer has gone off, check for new message.

16



First send status commands
then read the status from the MPS.
Controls in place for long strings.

Count = 0 is for Manual input commands from RS5000 logix

17

EQU
Equal
Source A count
2
Source B 0

New_Data
<Boolean_3[23]>

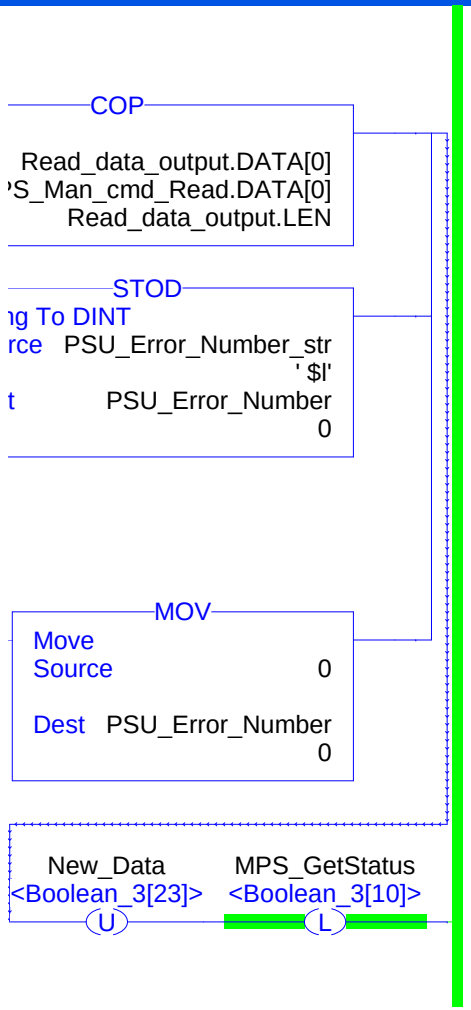
Copy Fi
Source
Dest M
Length

EQU
Equal
Source A Read_data_output.DATA[0]
'+'
Source B 63

MID
Middle String
Source Read_data_output
'+$l'
Qty 2
Start 3
Dest PSU_Error_Number_str
' $l'

NEQ
Not Equal
Source A Read_data_output.DATA[0]
'+'
Source B 63

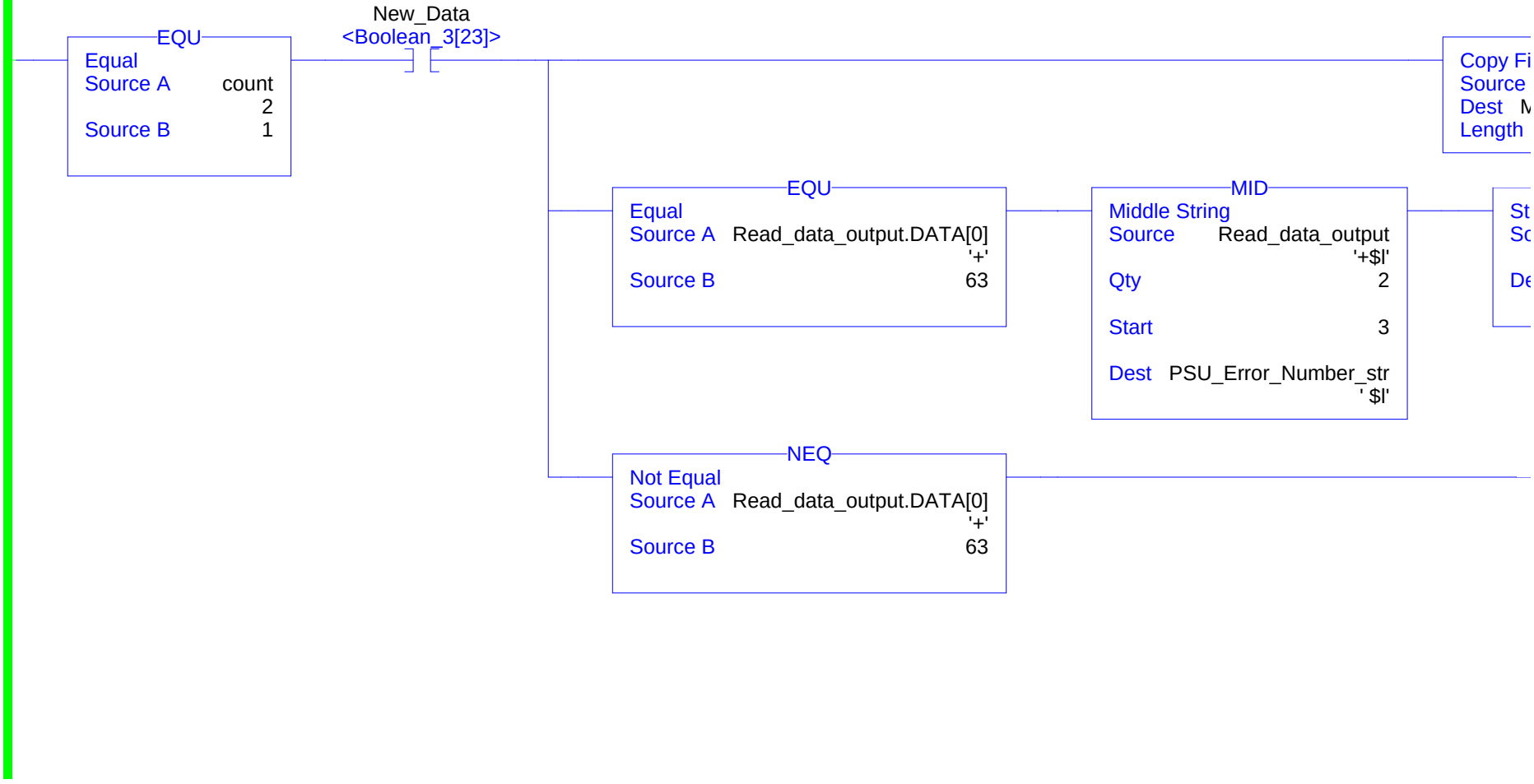
First send status commands
then read the status from the MPS.
Controls in place for long strings.



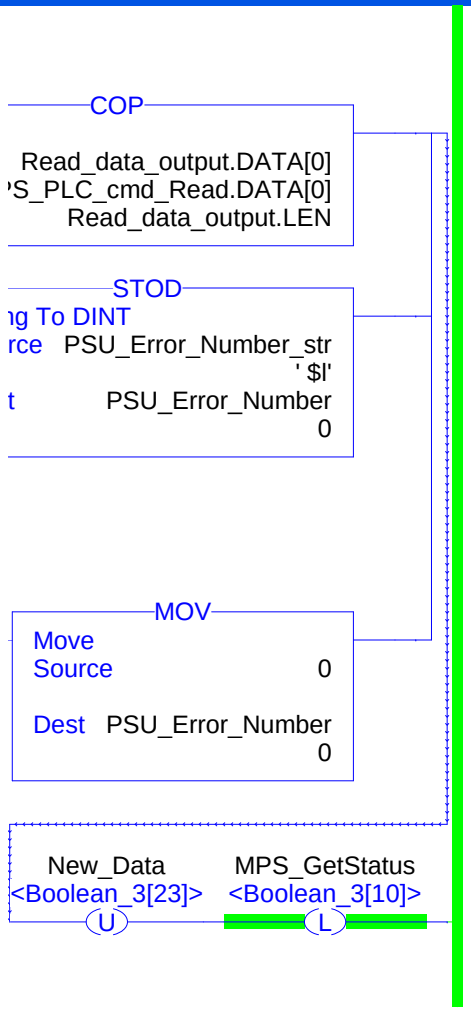
First send status commands
then read the status from the MPS.
Controls in place for long strings.

Count = 1 is for PLC / HMI commands

18



First send status commands
then read the status from the MPS.
Controls in place for long strings.



First send status commands
then read the status from the MPS.
Controls in place for long strings.

Reads the state of the MPS, whether in LOCAL REMOTE or LOCK.

19

New_Data
<Boolean_3[23]>

EQU
Equal
Source A count
2
Source B 8

COP
Copy File
Source Read_data_output.DATA[0]
Dest MPS_control_state_Read.DATA[0]
Length Read_data_output.LEN

New_Data
<Boolean_3[23]>
U

MPS_GetStatus
<Boolean_3[10]>
L

Reads the output current of the MPS

20

New_Data
<Boolean_3[23]>

EQU
Equal
Source A count
2
Source B 3

STOR
String to Real
Source Read_data_output
'+$I'
Dest MPS_Current_percent
0.0

New_Data
<Boolean_3[23]>
U

MPS_GetStatus
<Boolean_3[10]>
L

Reads the output voltage of the MPS

21

New_Data
<Boolean_3[23]>

EQU
Equal
Source A count
2
Source B 4

STOR
String to Real
Source Read_data_output
'+$I'
Dest MPS_Voltage_percent
1.0

MUL
Multiply
Source A MPS_Voltage_percent
1.0
Source B 0.06
Dest PSU_Output_voltage
0.06

New_Data
<Boolean_3[23]>
U

MPS_GetStatus
<Boolean_3[10]>
L

First send status commands
then read the status from the MPS.
Controls in place for long strings.

Reads the ADC readback value of the MPS

22

New_Data
<Boolean_3[23]>

EQU
Equal
Source A count
2
Source B 2

COP
Copy File
Source Read_data_output.DATA[0]
Dest MPS_ADC_Readback.DATA[0]
Length Read_data_output.LEN

COP
Copy File
Source MPS_ADC_Readback.DATA[0]
Dest MPS_ADC_value.DATA[0]
Length Read_data_output.LEN

MOV
Move
Source Read_data_output.LEN
2
Dest MPS_ADC_value.LEN
6

STOD
String To DINT
Source MPS_ADC_value
'00000$l'
Dest ADC_readback_MPS
0

New_Data
<Boolean_3[23]>
U

MPS_GetStatus
<Boolean_3[10]>
L

Reads the ADC set value of the MPS

23

New_Data
<Boolean_3[23]>

EQU
Equal
Source A count
2
Source B 6

COP
Copy File
Source Read_data_output.DATA[0]
Dest MPS_set_readback.DATA[0]
Length Read_data_output.LEN

COP
Copy File
Source MPS_set_readback.DATA[0]
Dest MPS_set_value.DATA[0]
Length Read_data_output.LEN

MOV
Move
Source Read_data_output.LEN
2
Dest MPS_set_value.LEN
7

STOD
String To DINT
Source MPS_set_value
'000000$l'
Dest Set_value_MPS
0

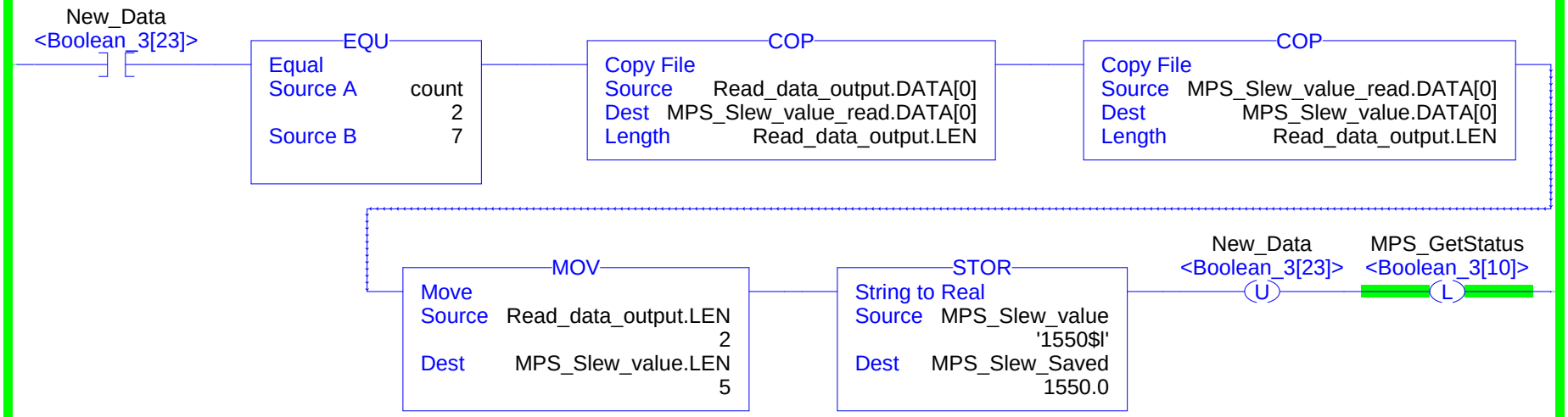
New_Data
<Boolean_3[23]>
U

MPS_GetStatus
<Boolean_3[10]>
L

First send status commands
then read the status from the MPS.
Controls in place for long strings.

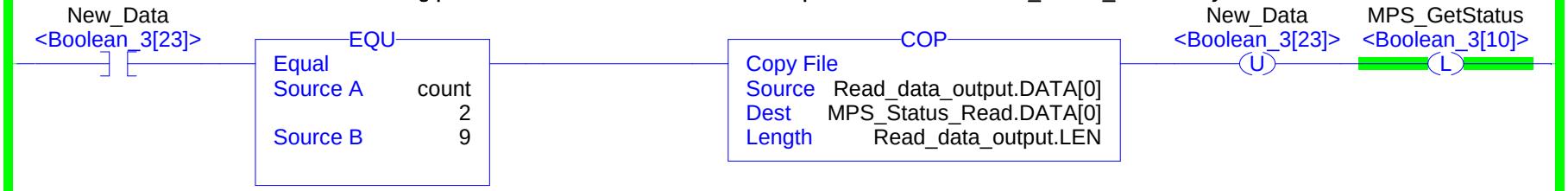
Reads the slew rate of the MPS

24



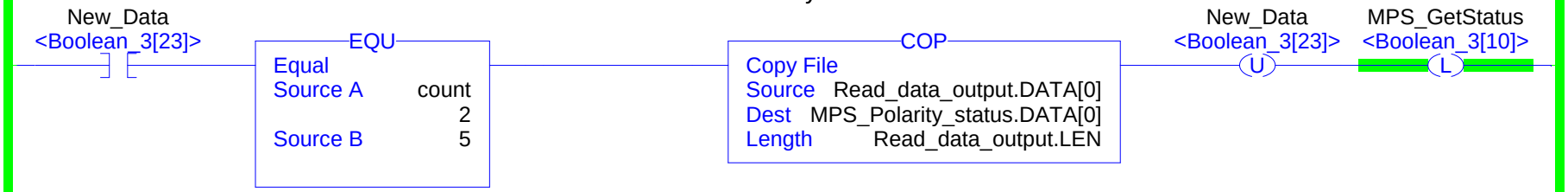
This rung processes the MPS status bits and copies them into the MPS_Status_Read array.

25



Reads the Polarity of the MPS

26



First send status commands
then read the status from the MPS.
Controls in place for long strings.

This block copies status information from the MVI94ASCII module. Status blocks are sent when no receive data is available.

27

Value is -1 when string is more then 14

EQU
Equal
Source A MVI94ASCII.Input_Data[1]
-3
Source B -4

mvi94-ascii-1 module
The following is the status information for the MVI94ASCII-1 module

COP
Copy File
Source MVI94ASCII.Input_Data[2]
Dest MVI94ASCII.InStat.Cycle_cntr
Length 1

mvi94-ascii-1 module
This block contains the status information that is returned by the module when the block ID is 252 (FC hex)

COP
Copy File
Source MVI94ASCII.Input_Data[4]
Dest MVI94ASCII.InStat.Block_info.Blks_read
Length 5

mvi94-ascii-1 module
The following is the status information for the MVI94ASCII-1 module

COP
Copy File
Source MVI94ASCII.Input_Data[14]
Dest MVI94ASCII.InStat.Port_Tx_State
Length 1

First send status commands
then read the status from the MPS.
Controls in place for long strings.

28

Value is -1 when
string is more then
14

EQU
Equal
Source A MVI94ASCII.Input_Data[1]
-3
Source B -3

mvi94-ascii-1 module
The following is
the status
information for the
MVI94ASCII-1 module

COP
Copy File
Source MVI94ASCII.Input_Data[2]
Dest MVI94ASCII.InStat.Cycle_cntr
Length 1

mvi94-ascii-1 module
This block contains
the status
information that is
returned by the
module when the
block ID is 253 (FD
hex)

COP
Copy File
Source MVI94ASCII.Input_Data[4]
Dest MVI94ASCII.InStat.Port_info.Receive_state
Length 5

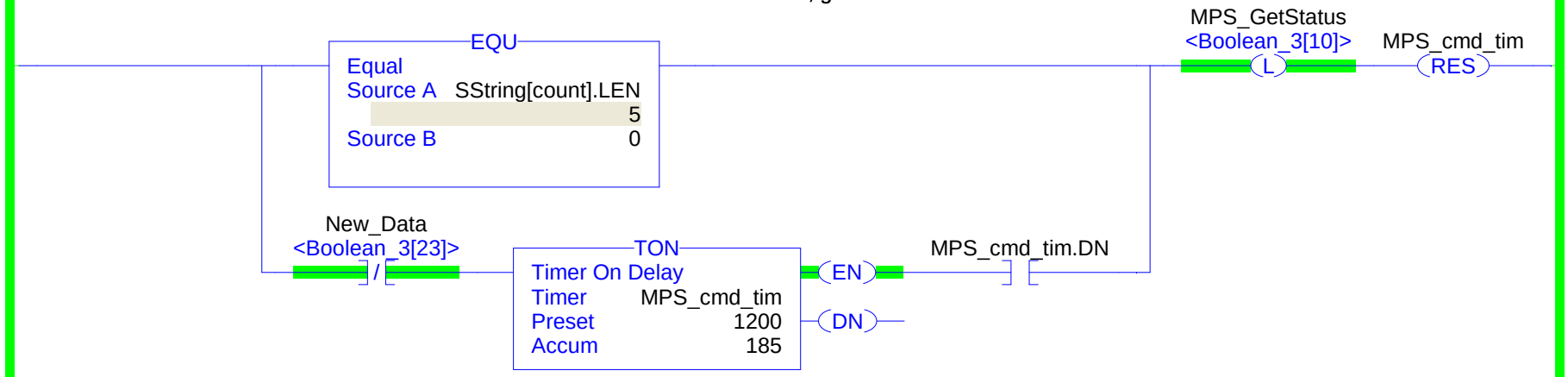
mvi94-ascii-1 module
The following is
the status
information for the
MVI94ASCII-1 module

COP
Copy File
Source MVI94ASCII.Input_Data[14]
Dest MVI94ASCII.InStat.Port_Tx_State
Length 1

First send status commands
then read the status from the MPS.
Controls in place for long strings.

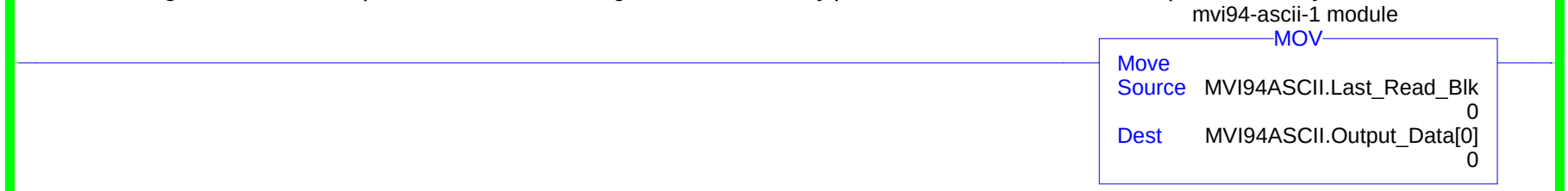
Once the MPS has replied to the command that was sent out, restart the MPS_GetStatus
Or if no command went out, go to next command.

29

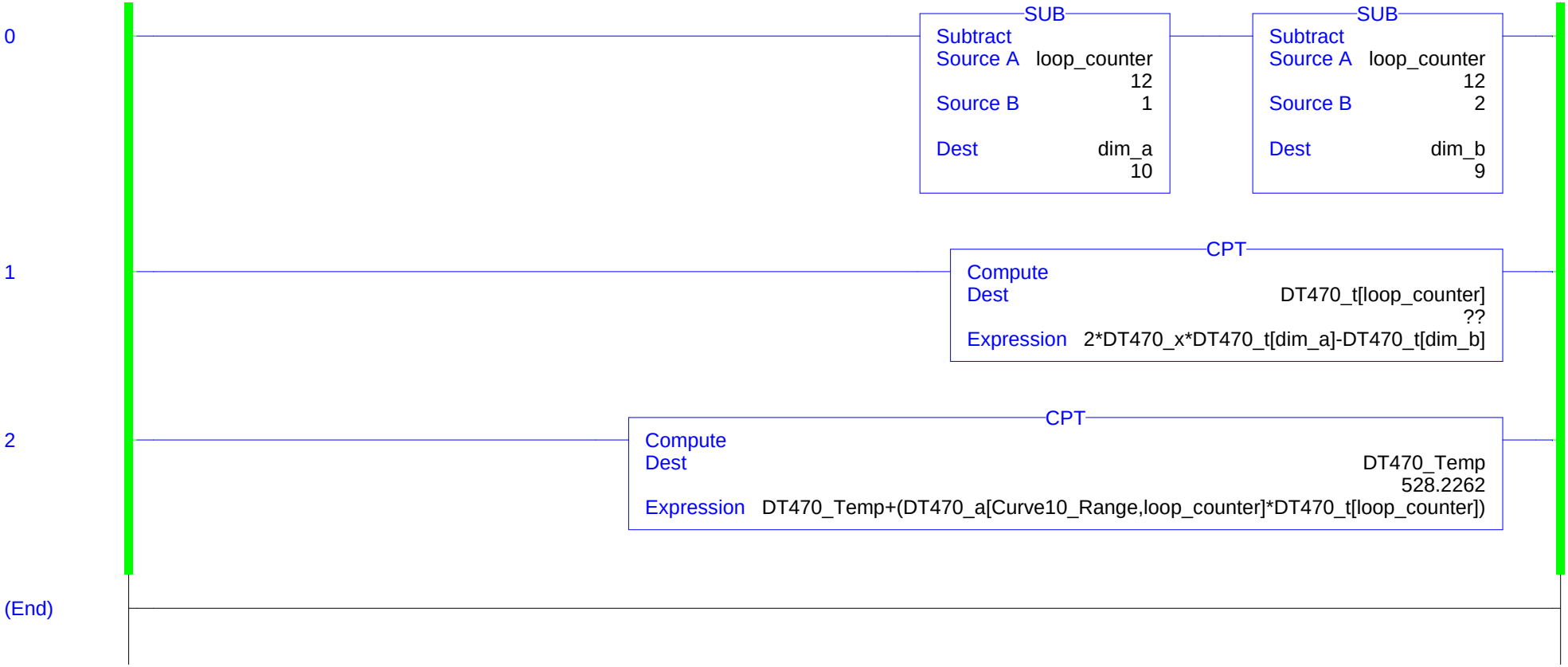


This last block moves the block ID number back to the module. When the module receives a new block of data on the Output image, this triggers the module to begin a new block of input data. Without this rung, the module will only present a new block of data to the processor every 1.5 seconds.

30



(End)


0
SUB
Subtract
Source A loop_counter
12
Source B 1
Dest dim_a
10
SUB
Subtract
Source A loop_counter
12
Source B 2
Dest dim_b
9
1
CPT
Compute
Dest DT470_t[loop_counter]
??
Expression 2*DT470_x*DT470_t[dim_a]-DT470_t[dim_b]
2
CPT
Compute
Dest DT470_Temp
528.2262
Expression DT470_Temp+(DT470_a[Curve10_Range,loop_counter]*DT470_t[loop_counter])
(End)

Determine the current needed for a given Momentum.
GOLDEN TUNE

0

CPT
Compute
Dest I_Q1
215.35939
Expression 0.6684*(P_SHMS**3)-7.709*(P_SHMS**2)+222.4*P_SHMS

This command is used to write a value between 0 to 999999 to the regulation module. Leading Zero format must be used.
Six numbers are to be used.

1

MPS_current_send
<Boolean_3[8]>

DTOS
DINT to String
Source MPS_Wa_Value
0
Dest Current_Output
'333503'

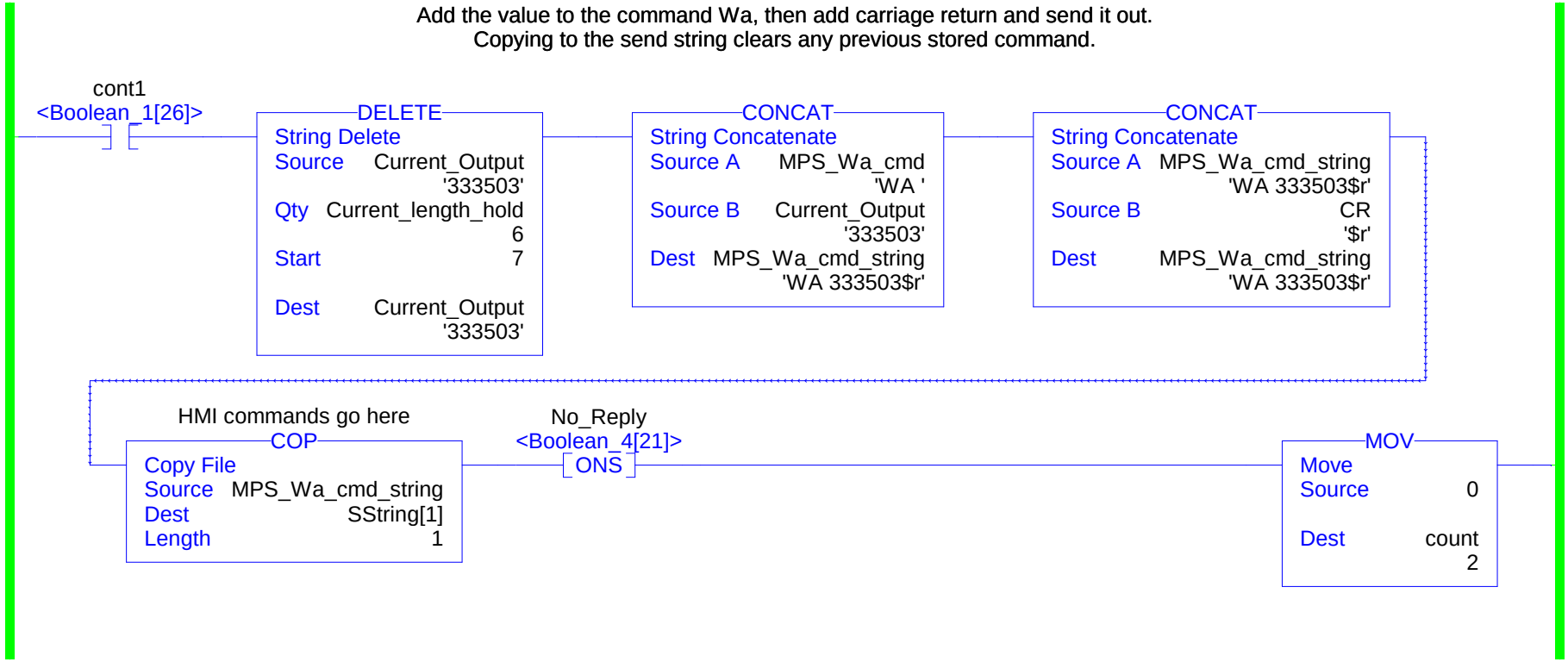
LEQ
Less Than or Eql (A<=B)
Source A Current_Output.LEN
6
Source B 6

MOV
Move
Source Current_Output.LEN
6
Dest Current_length_hold
6

SUB
Subtract
Source A 7
Source B Current_Output.LEN
6
Dest start_position
1

INSERT
Insert String
Source A zero_6x
'000000'
Source B Current_Output
'333503'
Start start_position
1
Dest Current_Output
'333503'

cont1
<Boolean_1[26]>


Add the value to the command Wa, then add carriage return and send it out.
Copying to the send string clears any previous stored command.
2
cont1
<Boolean_1[26]>
DELETE
String Delete
Source Current_Output '333503'
Qty Current_length_hold 6
Start 7
Dest Current_Output '333503'
CONCAT
String Concatenate
Source A MPS_Wa_cmd 'WA '
Source B Current_Output '333503'
Dest MPS_Wa_cmd_string 'WA 333503$r'
CONCAT
String Concatenate
Source A MPS_Wa_cmd_string 'WA 333503$r'
Source B CR '$r'
Dest MPS_Wa_cmd_string 'WA 333503$r'
HMI commands go here
COP
Copy File
Source MPS_Wa_cmd_string
Dest SString[1]
Length 1
No_Reply
<Boolean_4[21]>
ONS
MOV
Move
Source 0
Dest count 2

This command is used to set MPS current to zero, when the HMI resets interlocks.
If SString Length is greater then 30 characters, copy the commad to SString as this will ensure previous commands stored in SString will be erased and the MPS command will go out intact.

3

MPS_set_zero
<Boolean_3[19]>

HMI commands go here

LEQ
Less Than or Eql (A<=B)
Source A SString[1].LEN
0
Source B 30

HMI commands go here

CONCAT
String Concatenate
Source A SString[1]
''
Source B MPS_Wa_zero_cmd
'WA 000000$r'
Dest SString[1]
''

MOV
Move
Source 0
Dest count
2

HMI commands go here

GRT
Greater Than (A>B)
Source A SString[1].LEN
0
Source B 30

HMI commands go here

COP
Copy File
Source MPS_Wa_zero_cmd
Dest SString[1]
Length 1

Writes the slew rate to the MPS.

4

MPS_Slew_write
<Boolean_3[20]>

DTOS
DINT to String
Source MPS_Slew_write_value
100
Dest Slew_Value
'100'

COP
Copy File
Source MPS_Slew_write_cmd
Dest MPS_Slew_write_send
Length 3

CONCAT
String Concatenate
Source A MPS_Slew_write_send
'W1 100$r'
Source B Slew_Value
'100'
Dest MPS_Slew_write_send
'W1 100$r'

CONCAT
String Concatenate
Source A MPS_Slew_write_send
'W1 100$r'
Source B dec_zero
'$r'
Dest MPS_Slew_write_send
'W1 100$r'

HMI commands go here
LEQ
Less Than or Eql (A<=B)
Source A SString[1].LEN
0
Source B 30

HMI commands go here
CONCAT
String Concatenate
Source A SString[1]
''
Source B MPS_Slew_write_send
'W1 100$r'
Dest SString[1]
''

HMI commands go here
GRT
Greater Than (A>B)
Source A SString[1].LEN
0
Source B 30

HMI commands go here
COP
Copy File
Source MPS_Slew_write_send
Dest SString[1]
Length 1

MOV
Move
Source 0
Dest count
2

5

The N command is used to swtich-on the power supply (main contact).

MPS_PowerOn
<Boolean_3[16]>

HMI commands go here

LEQ
Less Than or Eql (A<=B)
Source A SString[1].LEN
0
Source B 38

HMI commands go here

CONCAT
String Concatenate
Source A SString[1]
''
Source B MPS_PowerN
'N$r'
Dest SString[1]
''

MOV
Move
Source 0
Dest count
2

HMI commands go here

GRT
Greater Than (A>B)
Source A SString[1].LEN
0
Source B 38

HMI commands go here

COP
Copy File
Source MPS_PowerN
Dest SString[1]
Length 1

6

This command is used to switch-off the power supply (main contactor).

MPS_PowerOff
<Boolean_3[15]>

HMI commands go here

LEQ
Less Than or Eql (A<=B)
Source A SString[1].LEN
0
Source B 38

HMI commands go here

CONCAT
String Concatenate
Source A SString[1]
''
Source B MPS_PowerF
'F$r'
Dest SString[1]
''

MOV
Move
Source 0
Dest count
2

HMI commands go here

GRT
Greater Than (A>B)
Source A SString[1].LEN
0
Source B 38

HMI commands go here

COP
Copy File
Source MPS_PowerF
Dest SString[1]
Length 1

This command is used to clear interlocks

7

MPS_Reset_interlocks
<Boolean_3[18]>

HMI commands go here

LEQ
Less Than or Eql (A<=B)
Source A SString[1].LEN
0
Source B 37

HMI commands go here

CONCAT
String Concatenate
Source A SString[1]
''
Source B MPS_RS
'RS$r'
Dest SString[1]
''

MOV
Move
Source 0
Dest count
2

HMI commands go here

GRT
Greater Than (A>B)
Source A SString[1].LEN
0
Source B 37

HMI commands go here

COP
Copy File
Source MPS_RS
Dest SString[1]
Length 1

This command is used to change the polarity of the power supply to negative.

8

MPS_PO_Neg
<Boolean_3[13]>

HMI commands go here

LEQ
Less Than or Eql (A<=B)
Source A SString[1].LEN
0
Source B 35

HMI commands go here

CONCAT
String Concatenate
Source A SString[1]
''
Source B MPS_PONeg
'PO -$r'
Dest SString[1]
''

MOV
Move
Source 0
Dest count
2

HMI commands go here

GRT
Greater Than (A>B)
Source A SString[1].LEN
0
Source B 35

HMI commands go here

COP
Copy File
Source MPS_PONeg
Dest SString[1]
Length 1

This command is used to change the polarity of the power supply to positive.

9

MPS_PO_Pos
<Boolean_3[14]>

HMI commands go here

LEQ
Less Than or Eql (A<=B)
Source A SString[1].LEN
0
Source B 35

HMI commands go here

CONCAT
String Concatenate
Source A SString[1]
''
Source B MPS_POPos
'PO +$r'
Dest SString[1]
''

MOV
Move
Source 0
Dest count
2

HMI commands go here

GRT
Greater Than (A>B)
Source A SString[1].LEN
0
Source B 35

HMI commands go here

COP
Copy File
Source MPS_POPos
Dest SString[1]
Length 1

This command is used to switch the power supply to remote.

10

MPS_Rem
<Boolean_3[17]>

HMI commands go here

LEQ
Less Than or Eql (A<=B)
Source A SString[1].LEN
0
Source B 36

HMI commands go here

CONCAT
String Concatenate
Source A SString[1]
''
Source B MPS_Remote
'REM$r'
Dest SString[1]
''

MOV
Move
Source 0
Dest count
2

HMI commands go here

GRT
Greater Than (A>B)
Source A SString[1].LEN
0
Source B 36

HMI commands go here

COP
Copy File
Source MPS_Remote
Dest SString[1]
Length 1

This command us used to switch-off the power supply(main contactor) and automatically set the set value to zero (WA 000000).

11

MPS_SOff
<Boolean_3[21]>

HMI commands go here

LEQ
Less Than or Eql (A<=B)
Source A SString[1].LEN
0
Source B 35

HMI commands go here

CONCAT
String Concatenate
Source A SString[1]
''
Source B MPS_SlowF
'SOFF$r'
Dest SString[1]
''

MOV
Move
Source 0
Dest count
2

HMI commands go here

GRT
Greater Than (A>B)
Source A SString[1].LEN
0
Source B 35

HMI commands go here

COP
Copy File
Source MPS_SlowF
Dest SString[1]
Length 1

Changes to local control.

12

MPS_Local
<Boolean_3[11]>

HMI commands go here

LEQ
Less Than or Eql (A<=B)
Source A SString[1].LEN
0
Source B 36

HMI commands go here

CONCAT
String Concatenate
Source A SString[1]
''
Source B MPS_Loc_cmd
'LOC$r'
Dest SString[1]
''

MOV
Move
Source 0
Dest count
2

HMI commands go here

GRT
Greater Than (A>B)
Source A SString[1].LEN
0
Source B 36

HMI commands go here

COP
Copy File
Source MPS_Loc_cmd
Dest SString[1]
Length 1

13

This command puts the controller into a mode, in which all errors will respond with a code number representing the error.

MPS_ERRC_write
<Boolean_3[9]>

HMI commands go here

LEQ
Less Than or Eql (A<=B)
Source A SString[1].LEN
0
Source B 35

HMI commands go here

CONCAT
String Concatenate
Source A SString[1]
''
Source B MPS_ERRC_cmd
'ERRC$r'
Dest SString[1]
''

MOV
Move
Source 0
Dest count
2

HMI commands go here

GRT
Greater Than (A>B)
Source A SString[1].LEN
0
Source B 35

HMI commands go here

COP
Copy File
Source MPS_ERRC_cmd
Dest SString[1]
Length 1

14

This command puts the controller into a mode, in which all errors will respond with a code number representing the error.

MPS_NASW_write
<Boolean_3[12]>

HMI commands go here

LEQ
Less Than or Eql (A<=B)
Source A SString[1].LEN
0
Source B 35

HMI commands go here

CONCAT
String Concatenate
Source A SString[1]
''
Source B MPS_NASW_cmd
'NASW$r'
Dest SString[1]
''

MOV
Move
Source 0
Dest count
2

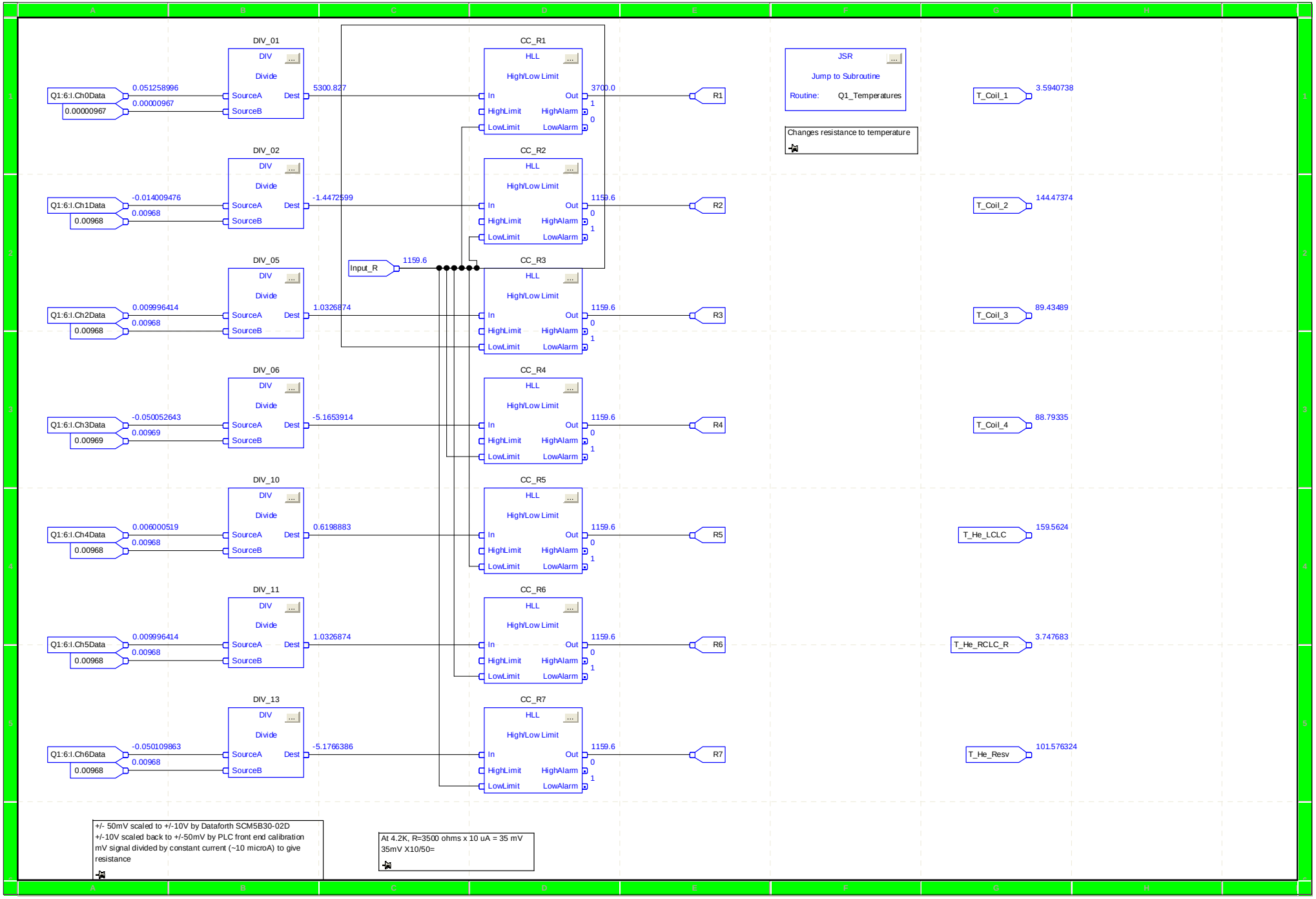
HMI commands go here

GRT
Greater Than (A>B)
Source A SString[1].LEN
0
Source B 35

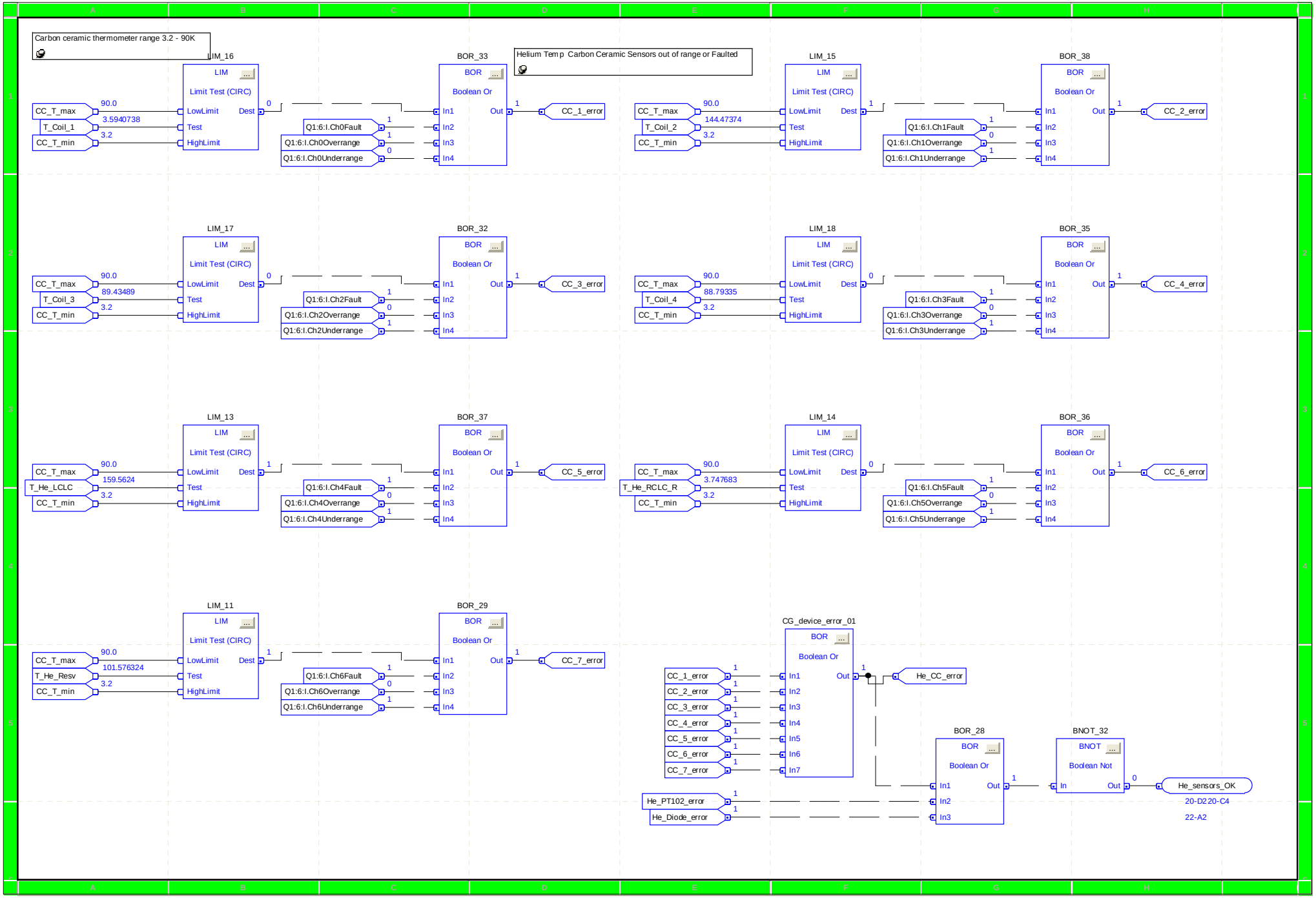
HMI commands go here

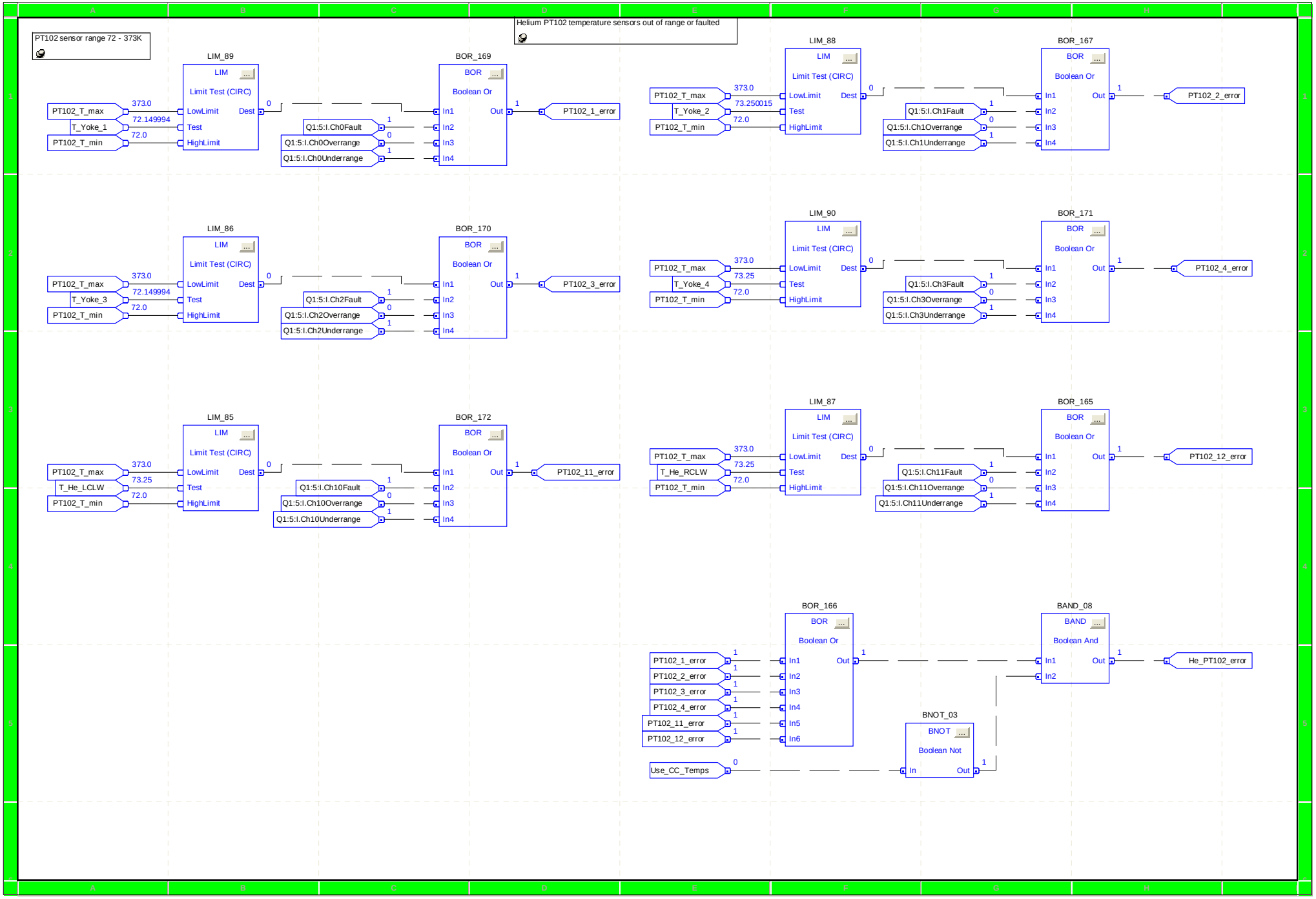
COP
Copy File
Source MPS_NASW_cmd
Dest SString[1]
Length 1

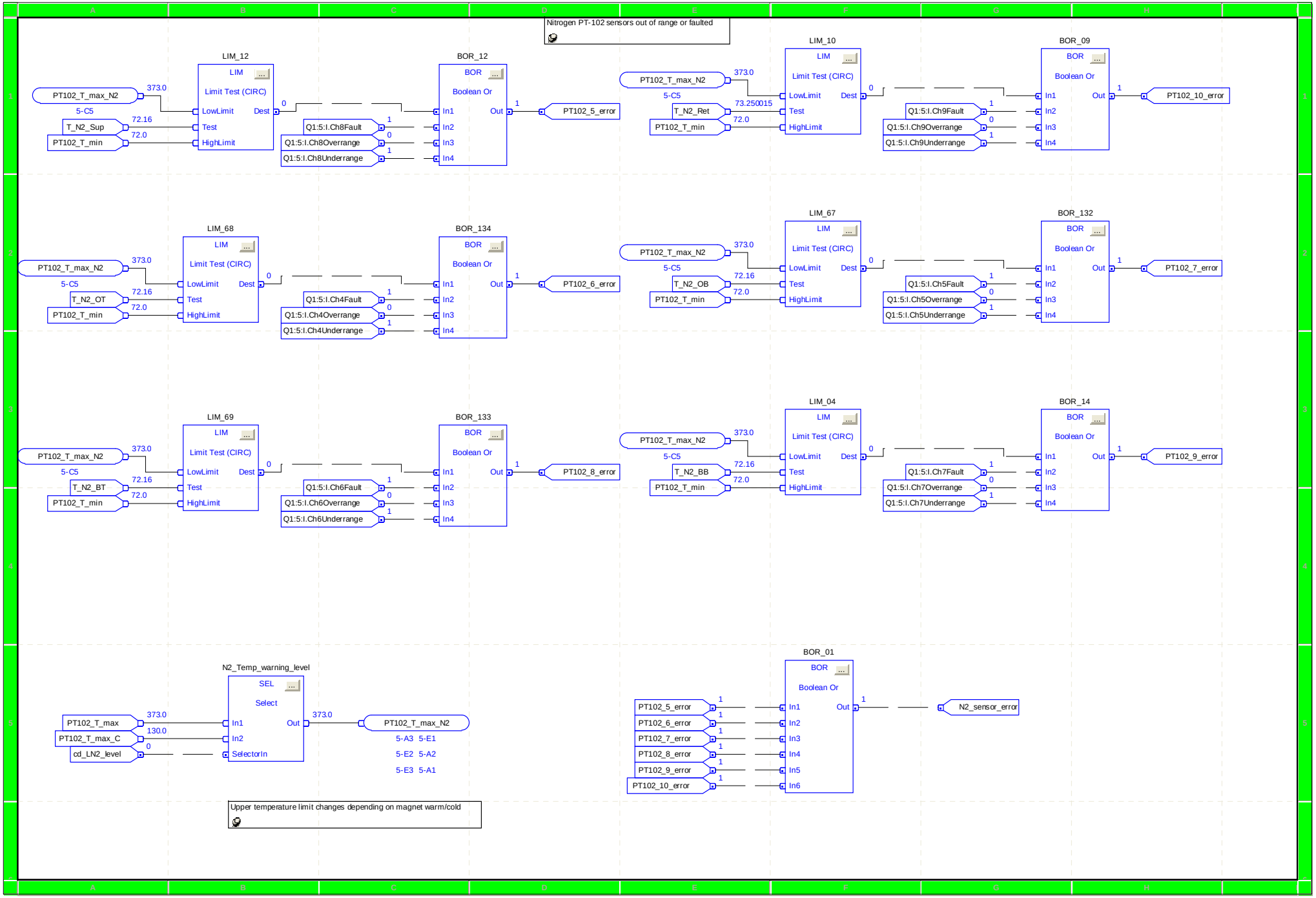
(End)

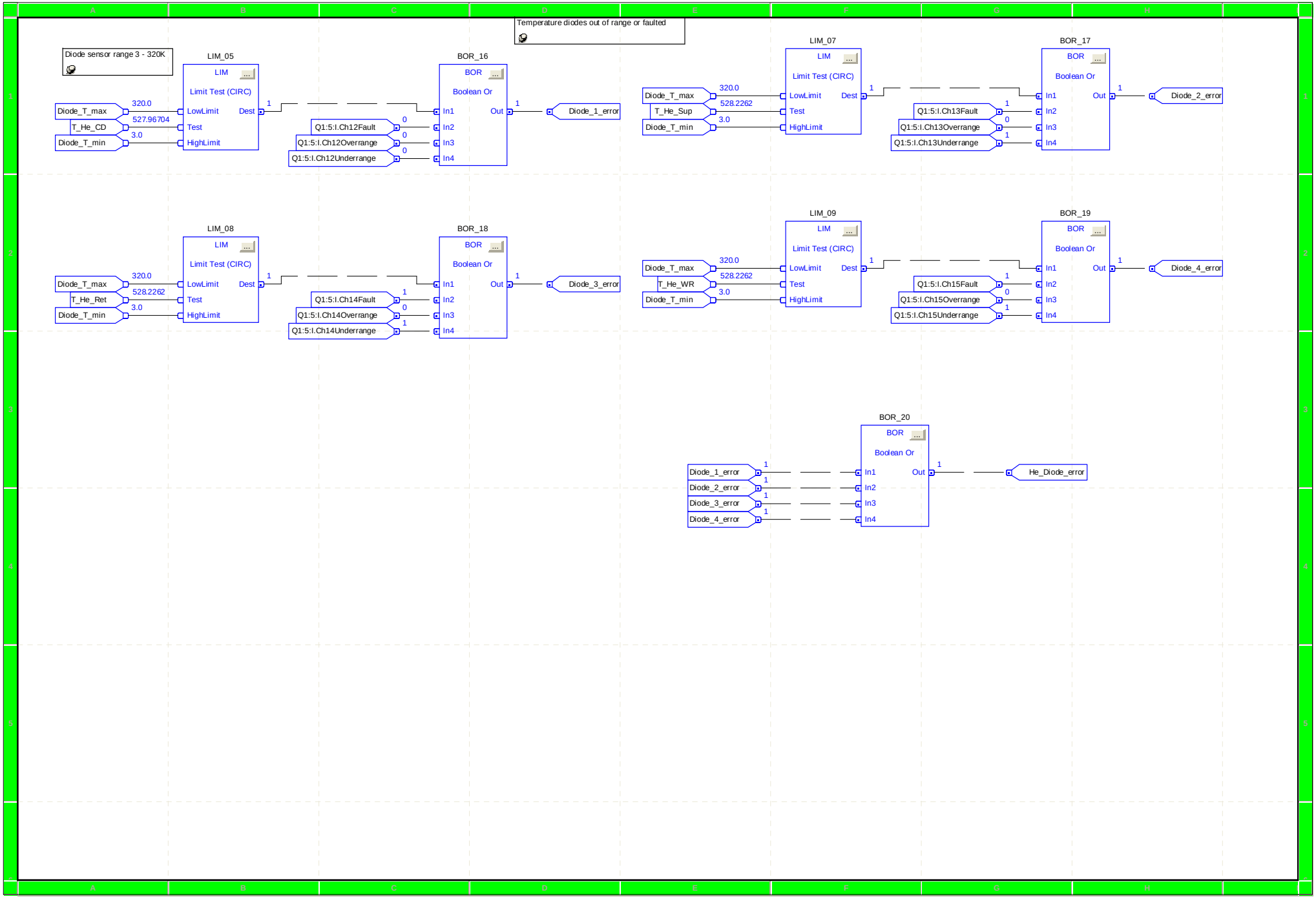

DIV_01
DIV
Divide
Q1:6:I.Ch0Data
0.051258996
0.00000967
0.00000967
SourceA
SourceB
Dest
5300.827
CC_R1
HLL
High/Low Limit
In
Out
3700.0
HighLimit
HighAlarm
LowLimit
LowAlarm
R1
JSR
Jump to Subroutine
Routine: Q1_Temperatures
Changes resistance to temperature
T_Coil_1
3.5940738
DIV_02
Q1:6:I.Ch1Data
-0.014009476
0.00968
0.00968
-1.4472599
CC_R2
1159.6
R2
T_Coil_2
144.47374
DIV_05
Input_R
1159.6
Q1:6:I.Ch2Data
0.009996414
0.00968
0.00968
1.0326874
CC_R3
R3
T_Coil_3
89.43489
DIV_06
Q1:6:I.Ch3Data
-0.050052643
0.00969
0.00969
-5.1653914
CC_R4
R4
T_Coil_4
88.79335
DIV_10
Q1:6:I.Ch4Data
0.006000519
0.00968
0.00968
0.6198883
CC_R5
R5
T_He_LCLC
159.5624
DIV_11
Q1:6:I.Ch5Data
0.009996414
0.00968
0.00968
1.0326874
CC_R6
R6
T_He_RCLC_R
3.747683
DIV_13
Q1:6:I.Ch6Data
-0.050109863
0.00968
0.00968
-5.1766386
CC_R7
R7
T_He_Resv
101.576324
+/- 50mV scaled to +/-10V by Dataforth SCM5B30-02D
+/-10V scaled back to +/-50mV by PLC front end calibration
mV signal divided by constant current (~10 microA) to give resistance
At 4.2K, R=3500 ohms x 10 uA = 35 mV
35mV X10/50=

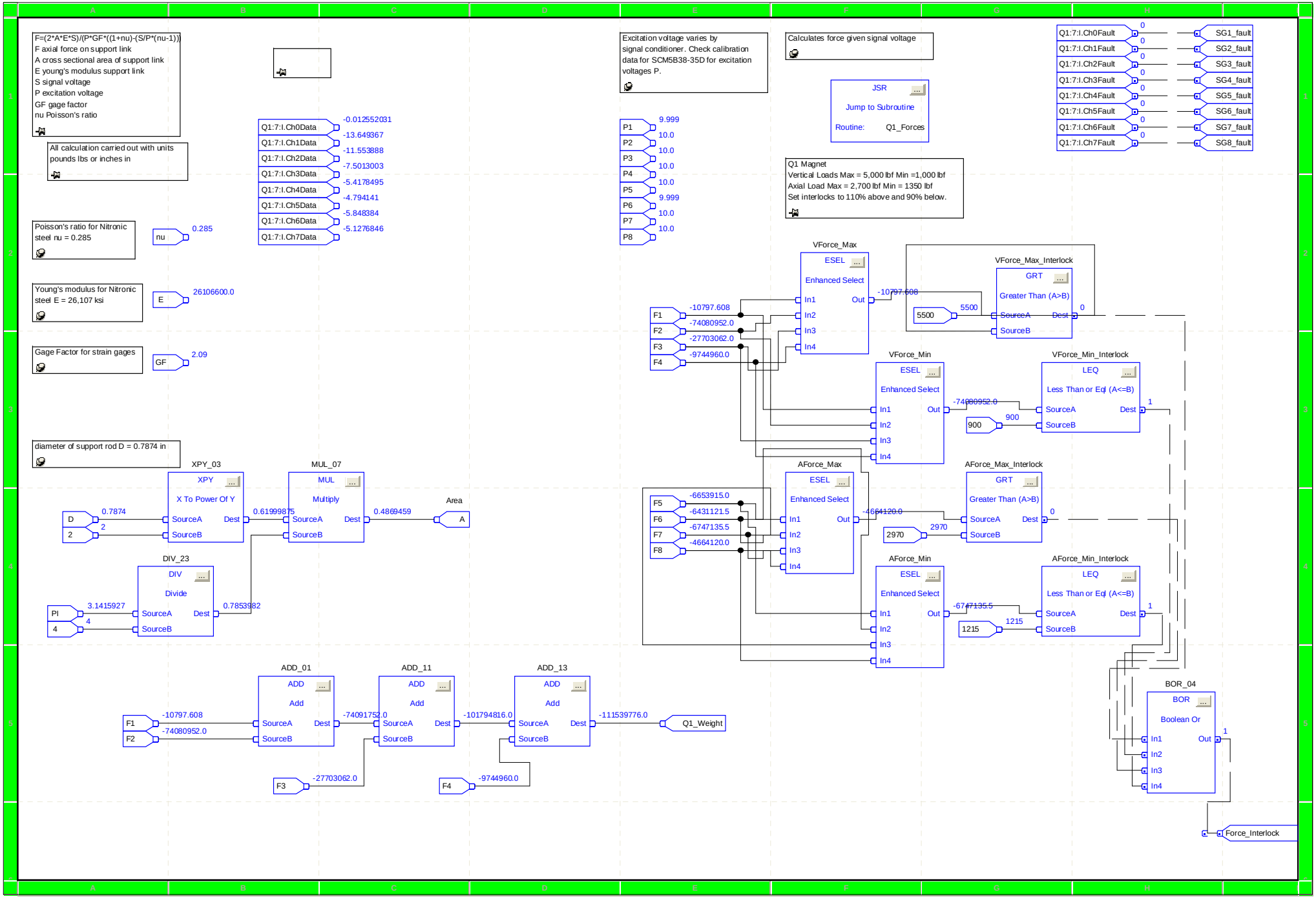

Nitrogen PT-102 Sensors
PT102-5
Q1:5:I.Ch8Data
72.16
T_N2_Sup
PT102-10
Q1:5:I.Ch9Data
73.250015
T_N2_Ret
PT102-6
Q1:5:I.Ch4Data
72.16
T_N2_OT
PT102-7
Q1:5:I.Ch5Data
72.16
T_N2_OB
PT102-8
Q1:5:I.Ch6Data
72.16
T_N2_BT
PT102-9
Q1:5:I.Ch7Data
72.16
T_N2_BB
PT100s are read thru dataforth module RTD 34 -1562
Helium PT-102 Sensors
PT102-1
Q1:5:I.Ch0Data
72.149994
T_Yoke_1
PT102-2
Q1:5:I.Ch1Data
73.250015
T_Yoke_2
PT102-3
Q1:5:I.Ch2Data
72.149994
T_Yoke_3
PT102-4
Q1:5:I.Ch3Data
73.25
T_Yoke_4
PT102-11
Q1:5:I.Ch10Data
73.25
T_He_LCLW
PT102-12
Q1:5:I.Ch11Data
73.25
T_He_RCLW
Helium Diodes
Q1:5:I.Ch12Data
3.12805176e-004
V1
Q1:5:I.Ch13Data
0.0
V2
Q1:5:I.Ch14Data
0.0
V3
Q1:5:I.Ch15Data
0.0
V4
Voltages converted to temperature
in
subroutine Q1_Temperatures.
Polynomial fits for Lakeshore
Standard
Curve 10.
Excitation current is 10uA.
T_He_CD
527.96704
T_He_Sup
528.2262
T_He_Ret
528.2262
T_He_WR
528.2262

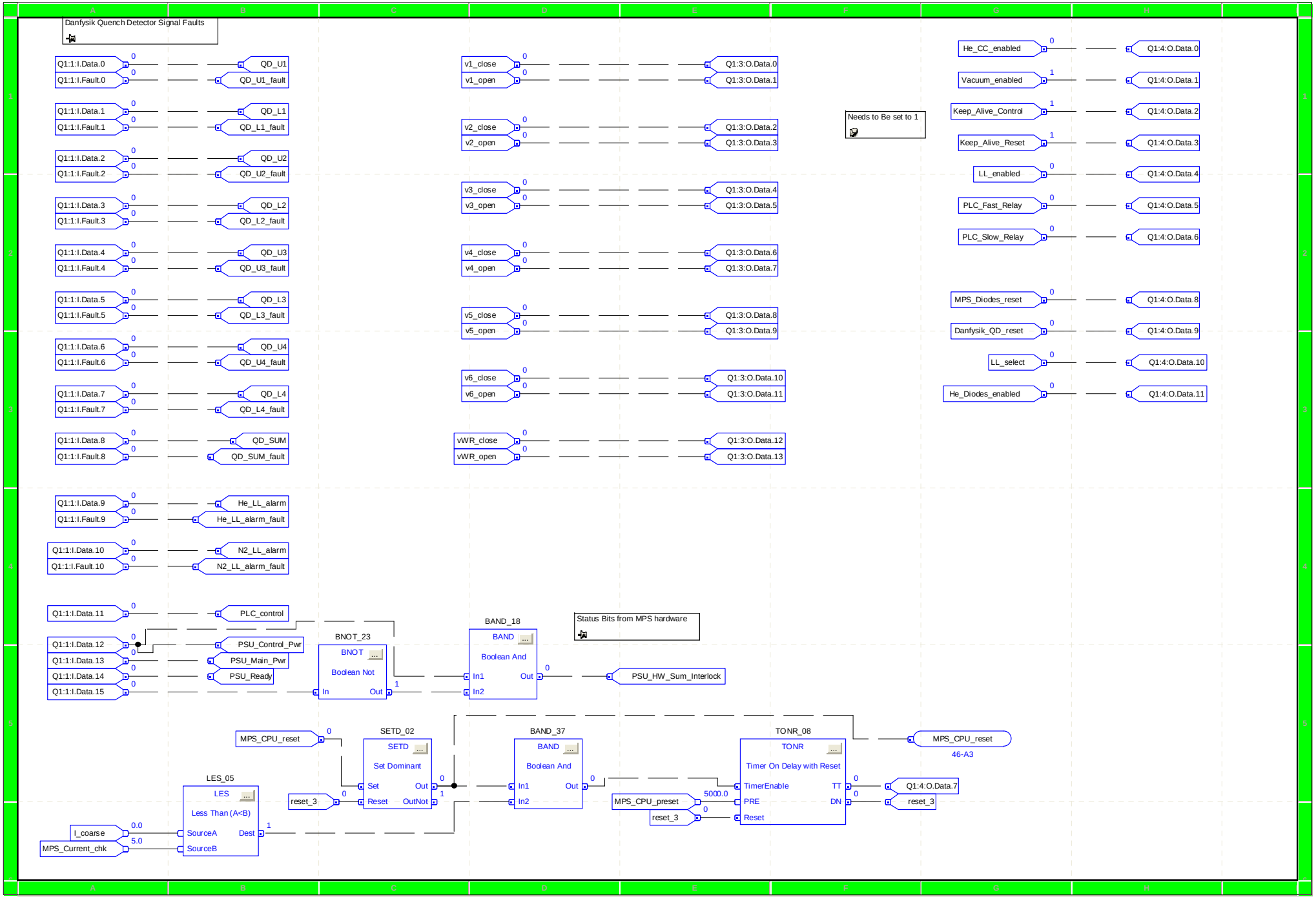

Carbon ceramic thermometer range 3.2 - 90K
LIM_16
LIM
Limit Test (CIRC)
CC_T_max
90.0
T_Coil_1
3.5940738
CC_T_min
3.2
LowLimit
Test
HighLimit
Dest
BOR_33
BOR
Boolean Or
Q1:6:I.Ch0Fault
Q1:6:I.Ch0Overrange
Q1:6:I.Ch0Underrange
In1
In2
In3
In4
Out
CC_1_error
Helium Temp Carbon Ceramic Sensors out of range or Faulted
LIM_15
T_Coil_2
144.47374
BOR_38
Q1:6:I.Ch1Fault
Q1:6:I.Ch1Overrange
Q1:6:I.Ch1Underrange
CC_2_error
LIM_17
T_Coil_3
89.43489
BOR_32
Q1:6:I.Ch2Fault
Q1:6:I.Ch2Overrange
Q1:6:I.Ch2Underrange
CC_3_error
LIM_18
T_Coil_4
88.79335
BOR_35
Q1:6:I.Ch3Fault
Q1:6:I.Ch3Overrange
Q1:6:I.Ch3Underrange
CC_4_error
LIM_13
T_He_LCLC
159.5624
BOR_37
Q1:6:I.Ch4Fault
Q1:6:I.Ch4Overrange
Q1:6:I.Ch4Underrange
CC_5_error
LIM_14
T_He_RCLC_R
3.747683
BOR_36
Q1:6:I.Ch5Fault
Q1:6:I.Ch5Overrange
Q1:6:I.Ch5Underrange
CC_6_error
LIM_11
T_He_Resv
101.576324
BOR_29
Q1:6:I.Ch6Fault
Q1:6:I.Ch6Overrange
Q1:6:I.Ch6Underrange
CC_7_error
CG_device_error_01
CC_1_error
CC_2_error
CC_3_error
CC_4_error
CC_5_error
CC_6_error
CC_7_error
In5
In6
In7
He_CC_error
BOR_28
He_PT102_error
He_Diode_error
BNOT_32
BNOT
Boolean Not
In
He_sensors_OK
20-D2 20-C4
22-A2

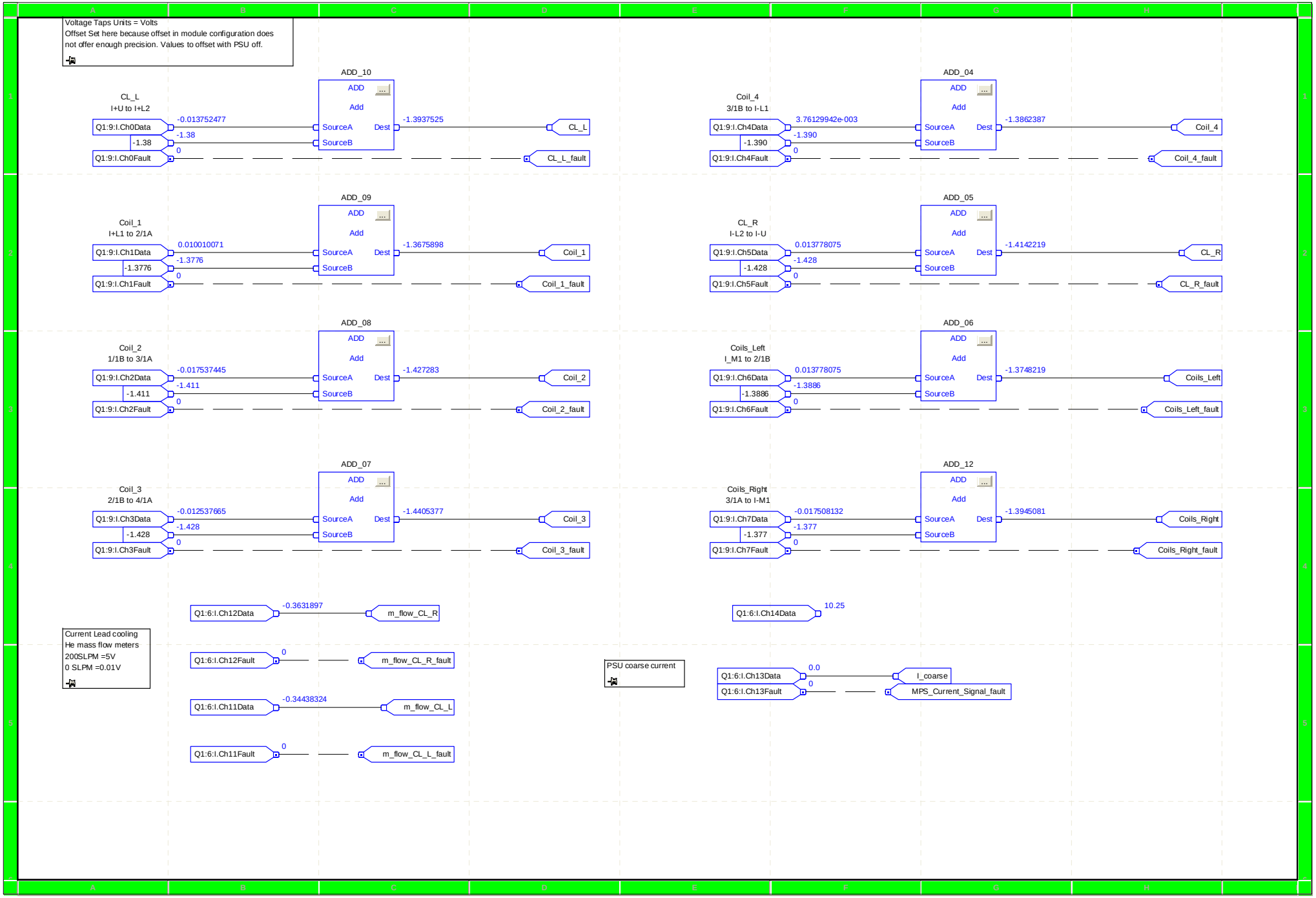

PT102 sensor range 72 - 373K
Helium PT102 temperature sensors out of range or faulted
LIM_89
LIM
Limit Test (CIRC)
PT102_T_max
T_Yoke_1
PT102_T_min
373.0
72.149994
72.0
LowLimit
Test
HighLimit
Dest
BOR_169
BOR
Boolean Or
Q1:5:I.Ch0Fault
Q1:5:I.Ch0Overrange
Q1:5:I.Ch0Underrange
In1
In2
In3
In4
Out
PT102_1_error
LIM_88
T_Yoke_2
73.250015
Q1:5:I.Ch1Fault
Q1:5:I.Ch1Overrange
Q1:5:I.Ch1Underrange
BOR_167
PT102_2_error
LIM_86
T_Yoke_3
Q1:5:I.Ch2Fault
Q1:5:I.Ch2Overrange
Q1:5:I.Ch2Underrange
BOR_170
PT102_3_error
LIM_90
T_Yoke_4
73.25
Q1:5:I.Ch3Fault
Q1:5:I.Ch3Overrange
Q1:5:I.Ch3Underrange
BOR_171
PT102_4_error
LIM_85
T_He_LCLW
Q1:5:I.Ch10Fault
Q1:5:I.Ch10Overrange
Q1:5:I.Ch10Underrange
BOR_172
PT102_11_error
LIM_87
T_He_RCLW
Q1:5:I.Ch11Fault
Q1:5:I.Ch11Overrange
Q1:5:I.Ch11Underrange
BOR_165
PT102_12_error
BOR_166
PT102_1_error
PT102_2_error
PT102_3_error
PT102_4_error
PT102_11_error
PT102_12_error
In5
In6
BAND_08
BAND
Boolean And
He_PT102_error
BNOT_03
BNOT
Boolean Not
Use_CC_Temps

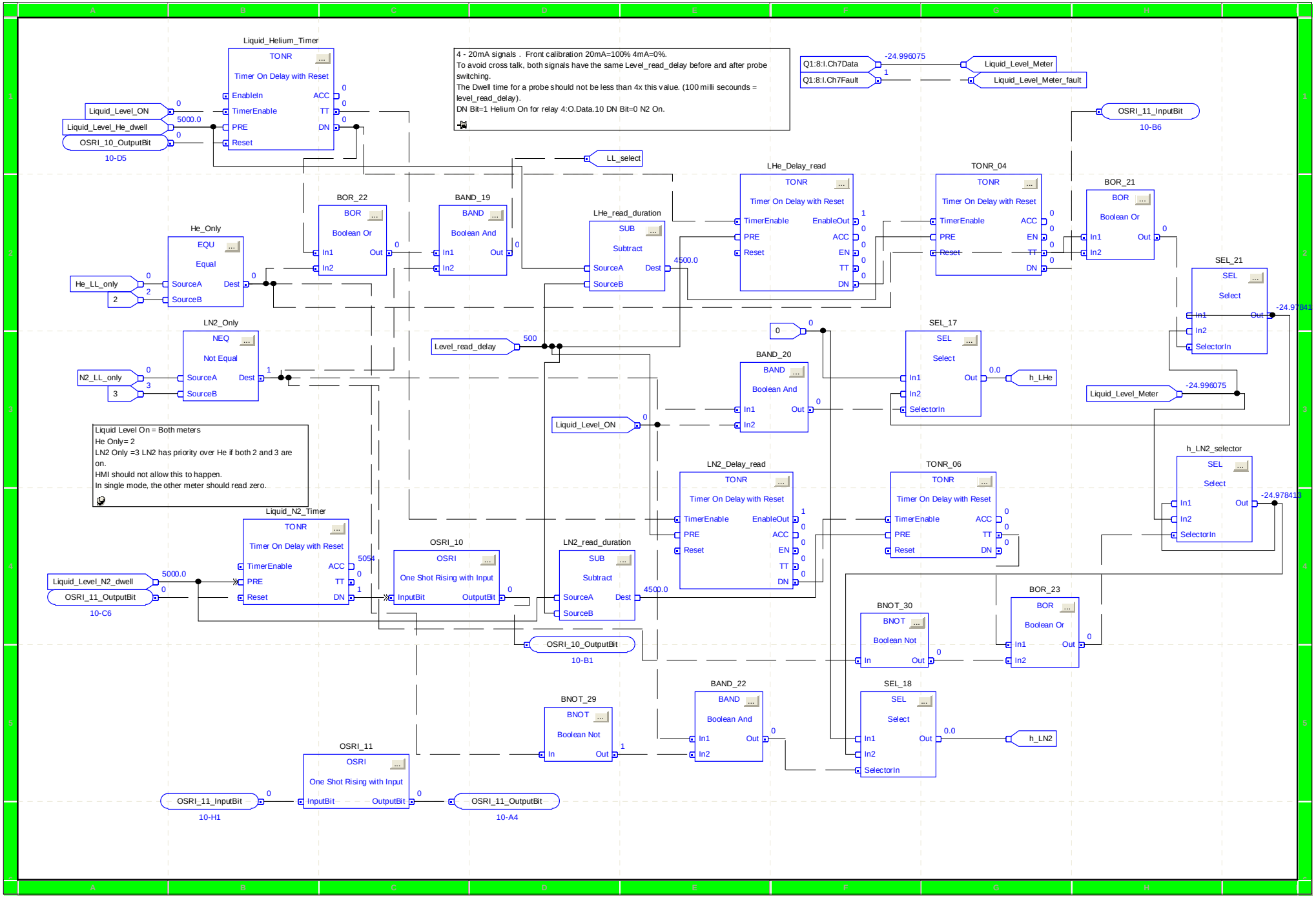

Nitrogen PT-102 sensors out of range or faulted
LIM_12
LIM
Limit Test (CIRC)
PT102_T_max_N2
373.0
5-C5
T_N2_Sup
72.16
PT102_T_min
72.0
LowLimit
Test
HighLimit
Dest
0
BOR_12
BOR
Boolean Or
Q1:5:I.Ch8Fault
Q1:5:I.Ch8Overrange
Q1:5:I.Ch8Underrange
In1
In2
In3
In4
Out
1
PT102_5_error
LIM_10
T_N2_Ret
73.250015
BOR_09
Q1:5:I.Ch9Fault
Q1:5:I.Ch9Overrange
Q1:5:I.Ch9Underrange
PT102_10_error
LIM_68
T_N2_OT
BOR_134
PT102_6_error
LIM_67
T_N2_OB
BOR_132
PT102_7_error
LIM_69
T_N2_BT
BOR_133
PT102_8_error
LIM_04
T_N2_BB
BOR_14
PT102_9_error
N2_Temp_warning_level
SEL
Select
PT102_T_max
PT102_T_max_C
130.0
cd_LN2_level
SelectorIn
5-A3 5-E1
5-E2 5-A2
5-E3 5-A1
Upper temperature limit changes depending on magnet warm/cold
BOR_01
PT102_5_error
PT102_6_error
PT102_7_error
PT102_8_error
PT102_9_error
PT102_10_error
In5
In6
N2_sensor_error

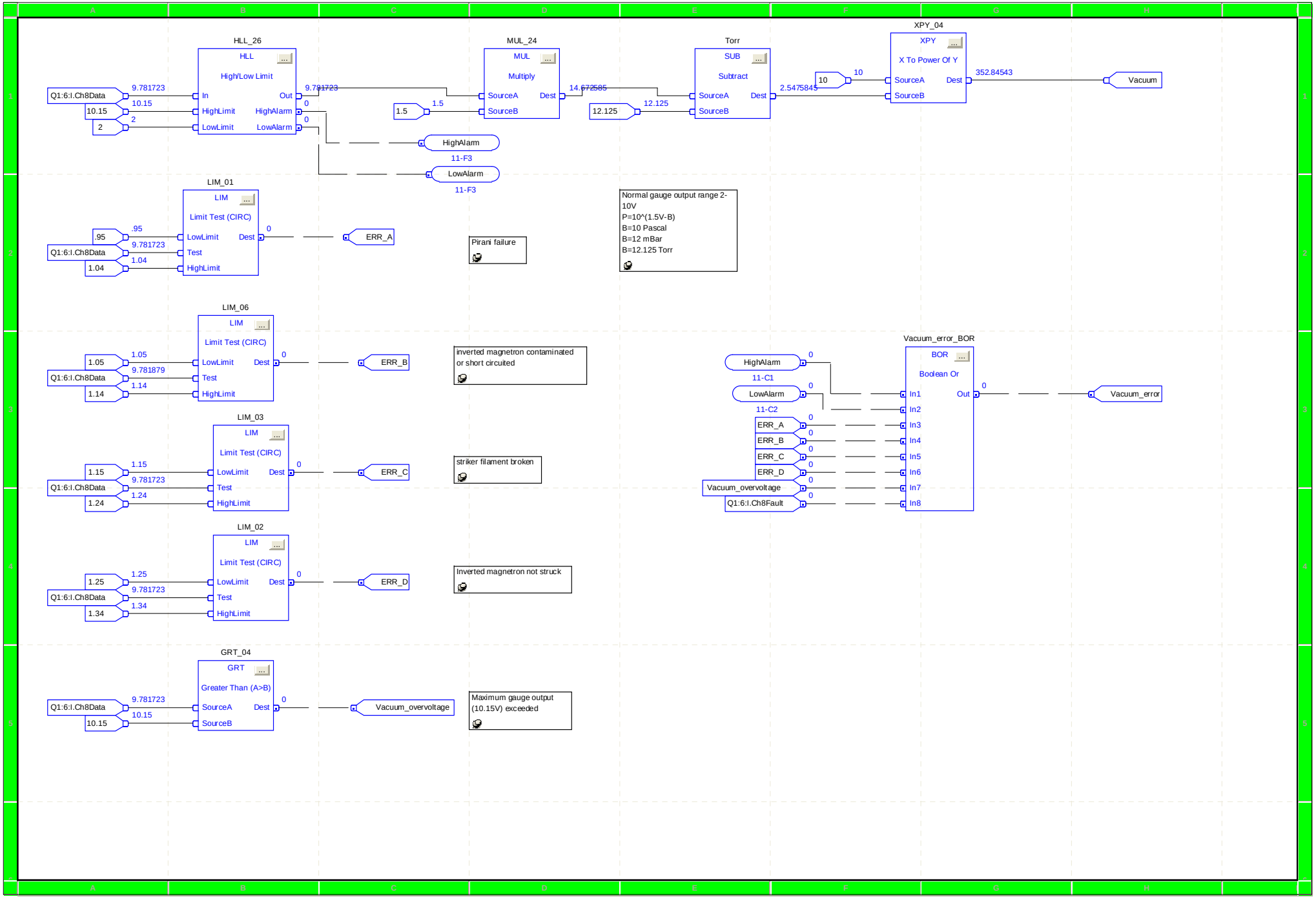

Temperature diodes out of range or faulted
Diode sensor range 3 - 320K
LIM_05
LIM
Limit Test (CIRC)
Diode_T_max
320.0
T_He_CD
527.96704
Diode_T_min
3.0
LowLimit
Test
HighLimit
Dest
1
BOR_16
BOR
Boolean Or
In1
In2
In3
In4
Out
Q1:5:I.Ch12Fault
Q1:5:I.Ch12Overrange
Q1:5:I.Ch12Underrange
0
Diode_1_error
LIM_07
T_He_Sup
528.2262
3.0
BOR_17
Q1:5:I.Ch13Fault
Q1:5:I.Ch13Overrange
Q1:5:I.Ch13Underrange
Diode_2_error
LIM_08
T_He_Ret
BOR_18
Q1:5:I.Ch14Fault
Q1:5:I.Ch14Overrange
Q1:5:I.Ch14Underrange
Diode_3_error
LIM_09
T_He_WR
BOR_19
Q1:5:I.Ch15Fault
Q1:5:I.Ch15Overrange
Q1:5:I.Ch15Underrange
Diode_4_error
BOR_20
Diode_1_error
Diode_2_error
Diode_3_error
Diode_4_error
He_Diode_error

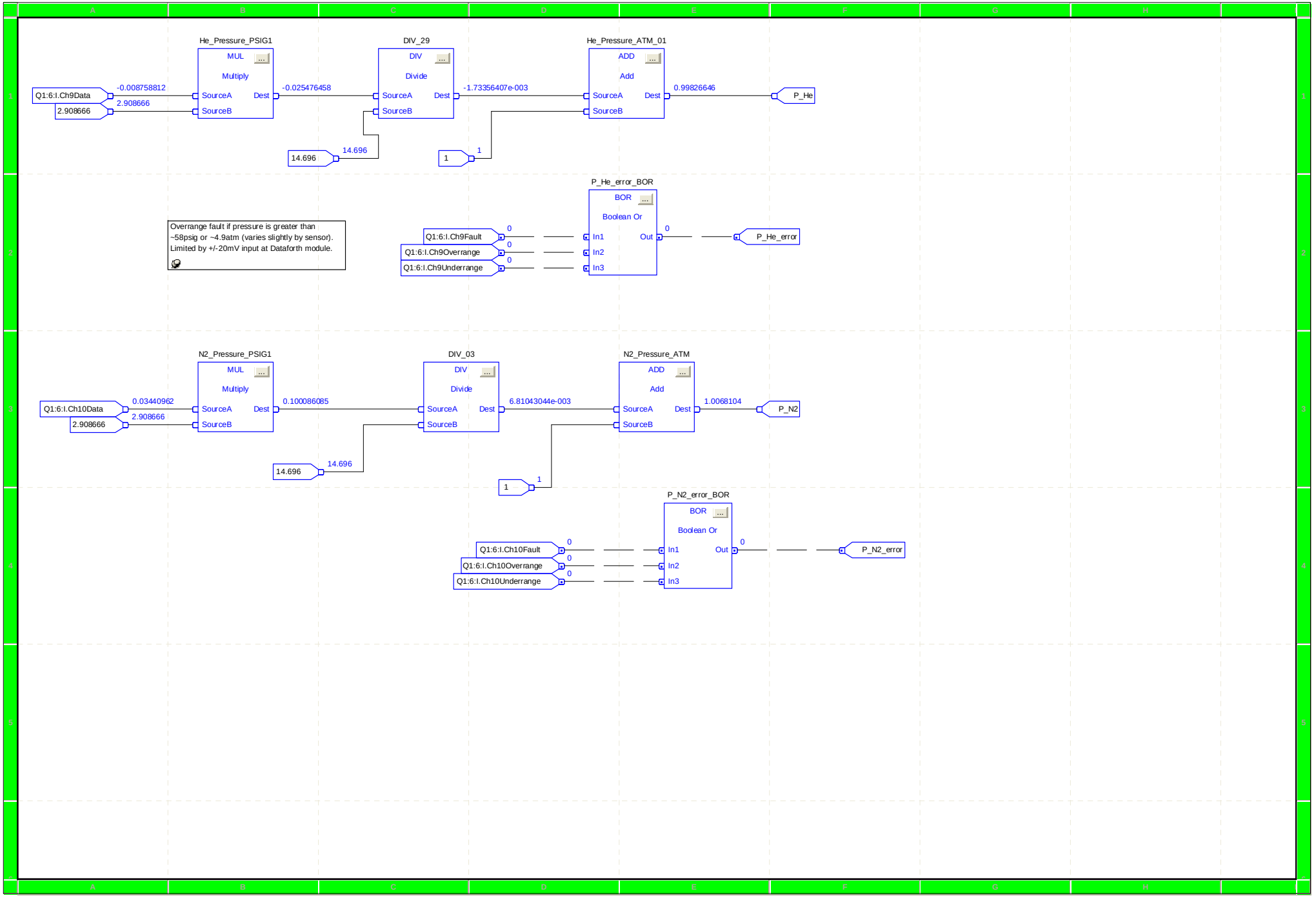

F=(2*A*E*S)/(P*GF*((1+nu)-(S/P*(nu-1))
F axial force on support link
A cross sectional area of support link
E young's modulus support link
S signal voltage
P excitation voltage
GF gage factor
nu Poisson's ratio
All calculation carried out with units pounds lbs or inches in
Poisson's ratio for Nitronic steel nu = 0.285
nu 0.285
Young's modulus for Nitronic steel E = 26,107 ksi
E 26106600.0
Gage Factor for strain gages
GF 2.09
diameter of support rod D = 0.7874 in
Q1:7:I.Ch0Data -0.012552031
Q1:7:I.Ch1Data -13.649367
Q1:7:I.Ch2Data -11.553888
Q1:7:I.Ch3Data -7.5013003
Q1:7:I.Ch4Data -5.4178495
Q1:7:I.Ch5Data -4.794141
Q1:7:I.Ch6Data -5.848384
Q1:7:I.Ch7Data -5.1276846
Excitation voltage varies by signal conditioner. Check calibration data for SCM5B38-35D for excitation voltages P.
P1 9.999
P2 10.0
P3 10.0
P4 10.0
P5 9.999
P6 10.0
P7 10.0
P8 10.0
Calculates force given signal voltage
JSR
Jump to Subroutine
Routine: Q1_Forces
Q1 Magnet
Vertical Loads Max = 5,000 lbf Min =1,000 lbf
Axial Load Max = 2,700 lbf Min = 1350 lbf
Set interlocks to 110% above and 90% below.
Q1:7:I.Ch0Fault 0 SG1_fault
Q1:7:I.Ch1Fault 0 SG2_fault
Q1:7:I.Ch2Fault 0 SG3_fault
Q1:7:I.Ch3Fault 0 SG4_fault
Q1:7:I.Ch4Fault 0 SG5_fault
Q1:7:I.Ch5Fault 0 SG6_fault
Q1:7:I.Ch6Fault 0 SG7_fault
Q1:7:I.Ch7Fault 0 SG8_fault
VForce_Max
ESEL
Enhanced Select
F1 -10797.608
F2 -74080952.0
F3 -27703062.0
F4 -9744960.0
In1 In2 In3 In4 Out -10797.608
VForce_Max_Interlock
GRT
Greater Than (A>B)
5500 SourceA
SourceB Dest 0
VForce_Min
ESEL
Enhanced Select
In1 In2 In3 In4 Out -74080952.0
VForce_Min_Interlock
LEQ
Less Than or Eql (A<=B)
900 SourceB
SourceA Dest 1
AForce_Max
ESEL
Enhanced Select
F5 -6653915.0
F6 -6431121.5
F7 -6747135.5
F8 -4664120.0
In1 In2 In3 In4 Out -4664120.0
AForce_Max_Interlock
GRT
Greater Than (A>B)
2970 SourceB
SourceA Dest 0
AForce_Min
ESEL
Enhanced Select
In1 In2 In3 In4 Out -6747135.5
AForce_Min_Interlock
LEQ
Less Than or Eql (A<=B)
1215 SourceB
SourceA Dest 1
XPY_03
XPY
X To Power Of Y
D 0.7874
2 2
SourceA SourceB Dest 0.61999875
MUL_07
MUL
Multiply
SourceA SourceB Dest 0.4869459
Area A
DIV_23
DIV
Divide
PI 3.1415927
4 4
SourceA SourceB Dest 0.7853982
ADD_01
ADD
Add
F1 -10797.608
F2 -74080952.0
SourceA SourceB Dest -74091752.0
ADD_11
ADD
Add
F3 -27703062.0
SourceA SourceB Dest -101794816.0
ADD_13
ADD
Add
F4 -9744960.0
SourceA SourceB Dest -111539776.0
Q1_Weight
BOR_04
BOR
Boolean Or
In1 In2 In3 In4 Out 1
Force_Interlock

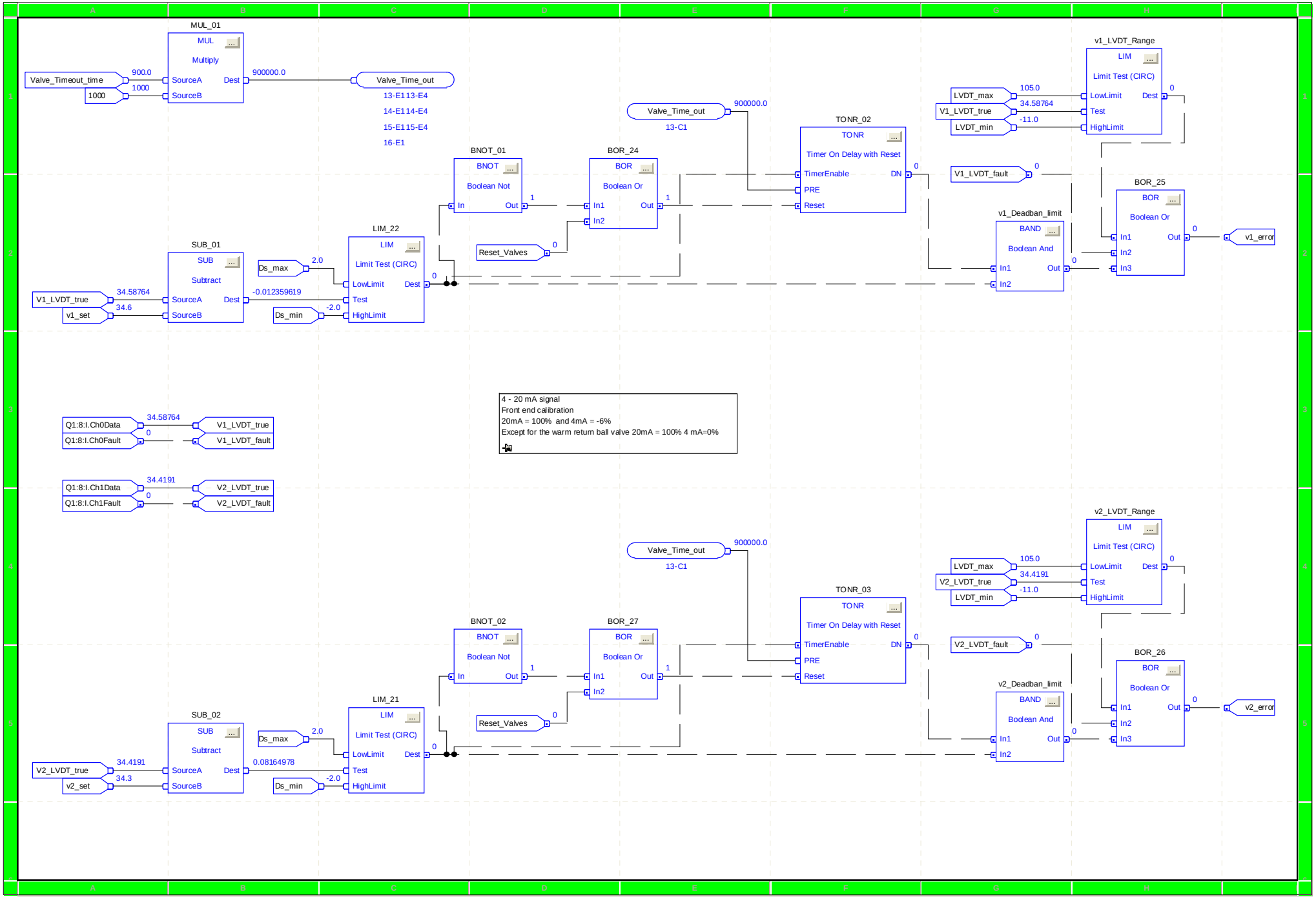

Danfysik Quench Detector Signal Faults
Q1:1:I.Data.0
Q1:1:I.Fault.0
QD_U1
QD_U1_fault
Q1:1:I.Data.1
Q1:1:I.Fault.1
QD_L1
QD_L1_fault
Q1:1:I.Data.2
Q1:1:I.Fault.2
QD_U2
QD_U2_fault
Q1:1:I.Data.3
Q1:1:I.Fault.3
QD_L2
QD_L2_fault
Q1:1:I.Data.4
Q1:1:I.Fault.4
QD_U3
QD_U3_fault
Q1:1:I.Data.5
Q1:1:I.Fault.5
QD_L3
QD_L3_fault
Q1:1:I.Data.6
Q1:1:I.Fault.6
QD_U4
QD_U4_fault
Q1:1:I.Data.7
Q1:1:I.Fault.7
QD_L4
QD_L4_fault
Q1:1:I.Data.8
Q1:1:I.Fault.8
QD_SUM
QD_SUM_fault
v1_close
v1_open
Q1:3:O.Data.0
Q1:3:O.Data.1
v2_close
v2_open
Q1:3:O.Data.2
Q1:3:O.Data.3
v3_close
v3_open
Q1:3:O.Data.4
Q1:3:O.Data.5
v4_close
v4_open
Q1:3:O.Data.6
Q1:3:O.Data.7
v5_close
v5_open
Q1:3:O.Data.8
Q1:3:O.Data.9
v6_close
v6_open
Q1:3:O.Data.10
Q1:3:O.Data.11
vWR_close
vWR_open
Q1:3:O.Data.12
Q1:3:O.Data.13
Needs to Be set to 1
He_CC_enabled
Vacuum_enabled
Keep_Alive_Control
Keep_Alive_Reset
LL_enabled
PLC_Fast_Relay
PLC_Slow_Relay
Q1:4:O.Data.0
Q1:4:O.Data.1
Q1:4:O.Data.2
Q1:4:O.Data.3
Q1:4:O.Data.4
Q1:4:O.Data.5
Q1:4:O.Data.6
MPS_Diodes_reset
Danfysik_QD_reset
LL_select
He_Diodes_enabled
Q1:4:O.Data.8
Q1:4:O.Data.9
Q1:4:O.Data.10
Q1:4:O.Data.11
Q1:1:I.Data.9
Q1:1:I.Fault.9
He_LL_alarm
He_LL_alarm_fault
Q1:1:I.Data.10
Q1:1:I.Fault.10
N2_LL_alarm
N2_LL_alarm_fault
Q1:1:I.Data.11
PLC_control
Q1:1:I.Data.12
Q1:1:I.Data.13
Q1:1:I.Data.14
Q1:1:I.Data.15
PSU_Control_Pwr
PSU_Main_Pwr
PSU_Ready
BNOT_23
BNOT
Boolean Not
In
Out
BAND_18
BAND
Boolean And
In1
In2
Out
Status Bits from MPS hardware
PSU_HW_Sum_Interlock
MPS_CPU_reset
SETD_02
SETD
Set Dominant
Set
Reset
OutNot
BAND_37
TONR_08
TONR
Timer On Delay with Reset
TimerEnable
PRE
Reset
TT
DN
5000.0
MPS_CPU_preset
reset_3
Q1:4:O.Data.7
46-A3
LES_05
LES
Less Than (A<B)
SourceA
SourceB
Dest
I_coarse
MPS_Current_chk
0.0
5.0

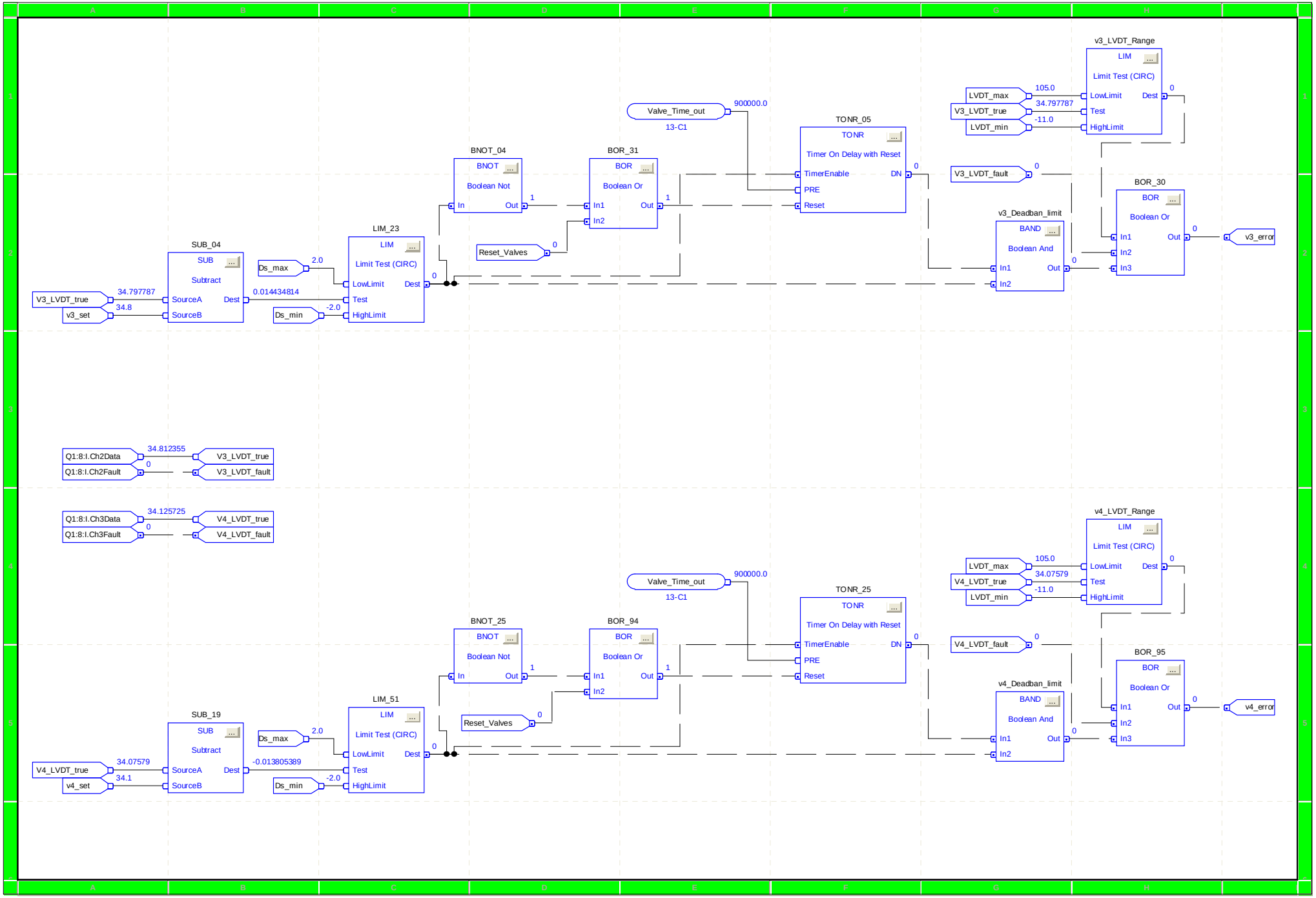

Voltage Taps Units = Volts
Offset Set here because offset in module configuration does not offer enough precision. Values to offset with PSU off.
ADD_10
CL_L
I+U to I+L2
Q1:9:I.Ch0Data
-0.013752477
-1.38
-1.38
Q1:9:I.Ch0Fault
0
SourceA
SourceB
Dest
-1.3937525
CL_L
CL_L_fault
ADD_04
Coil_4
3/1B to I-L1
Q1:9:I.Ch4Data
3.76129942e-003
-1.390
-1.390
Q1:9:I.Ch4Fault
0
-1.3862387
Coil_4
Coil_4_fault
ADD_09
Coil_1
I+L1 to 2/1A
Q1:9:I.Ch1Data
0.010010071
-1.3776
-1.3776
Q1:9:I.Ch1Fault
0
-1.3675898
Coil_1
Coil_1_fault
ADD_05
CL_R
I-L2 to I-U
Q1:9:I.Ch5Data
0.013778075
-1.428
-1.428
Q1:9:I.Ch5Fault
0
-1.4142219
CL_R
CL_R_fault
ADD_08
Coil_2
1/1B to 3/1A
Q1:9:I.Ch2Data
-0.017537445
-1.411
-1.411
Q1:9:I.Ch2Fault
0
-1.427283
Coil_2
Coil_2_fault
ADD_06
Coils_Left
I_M1 to 2/1B
Q1:9:I.Ch6Data
0.013778075
-1.3886
-1.3886
Q1:9:I.Ch6Fault
0
-1.3748219
Coils_Left
Coils_Left_fault
ADD_07
Coil_3
2/1B to 4/1A
Q1:9:I.Ch3Data
-0.012537665
-1.428
-1.428
Q1:9:I.Ch3Fault
0
-1.4405377
Coil_3
Coil_3_fault
ADD_12
Coils_Right
3/1A to I-M1
Q1:9:I.Ch7Data
-0.017508132
-1.377
-1.377
Q1:9:I.Ch7Fault
0
-1.3945081
Coils_Right
Coils_Right_fault
Q1:6:I.Ch12Data
-0.3631897
m_flow_CL_R
Q1:6:I.Ch12Fault
0
m_flow_CL_R_fault
Q1:6:I.Ch11Data
-0.34438324
m_flow_CL_L
Q1:6:I.Ch11Fault
0
m_flow_CL_L_fault
Current Lead cooling
He mass flow meters
200SLPM =5V
0 SLPM =0.01V
PSU coarse current
Q1:6:I.Ch14Data
10.25
Q1:6:I.Ch13Data
0.0
I_coarse
Q1:6:I.Ch13Fault
0
MPS_Current_Signal_fault

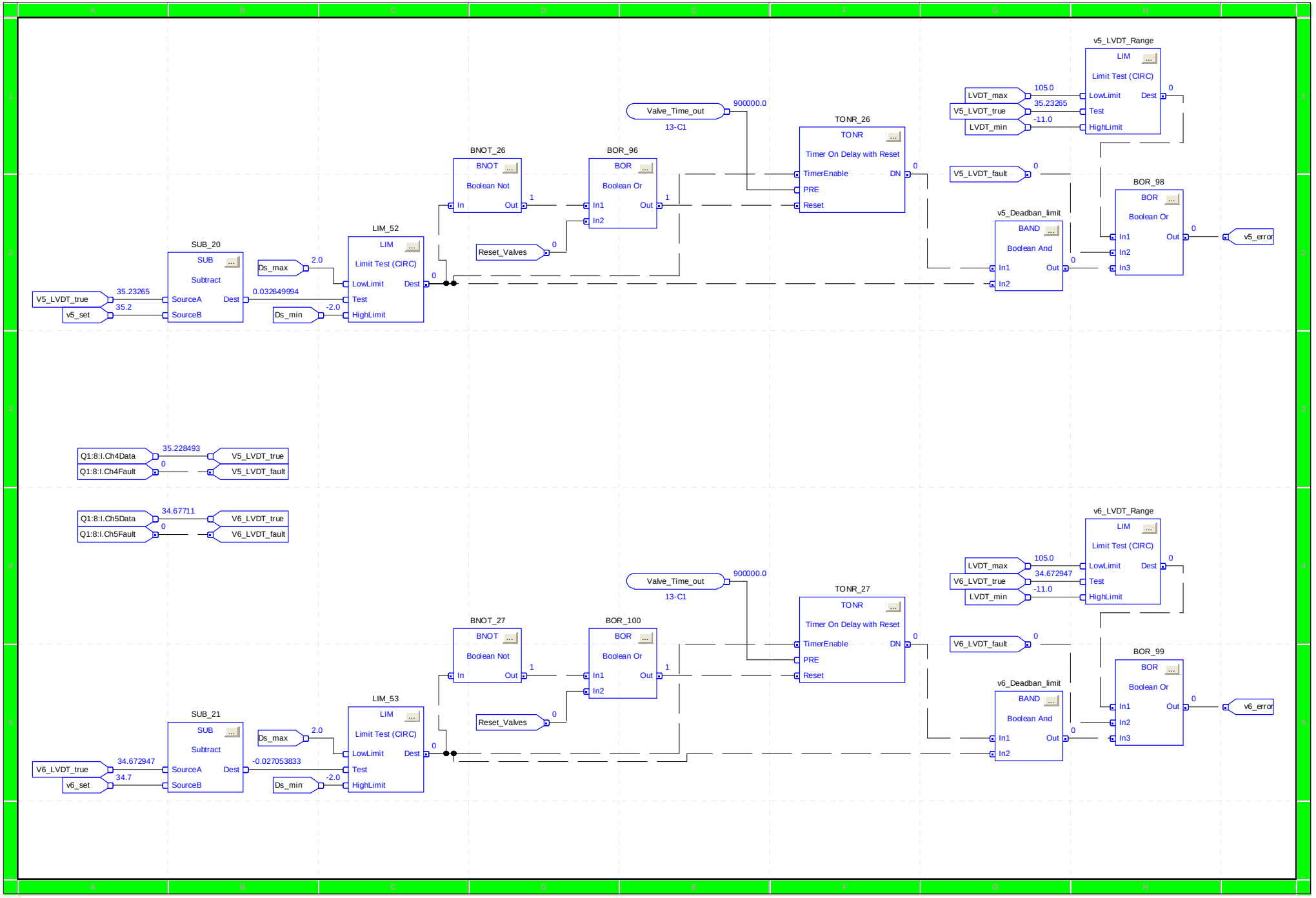

Liquid_Helium_Timer
TONR
Timer On Delay with Reset
Liquid_Level_ON
Liquid_Level_He_dwell
OSRI_10_OutputBit
10-D5
5000.0
4 - 20mA signals . Front calibration 20mA=100% 4mA=0%.
To avoid cross talk, both signals have the same Level_read_delay before and after probe switching.
The Dwell time for a probe should not be less than 4x this value. (100 milli secounds = level_read_delay).
DN Bit=1 Helium On for relay 4:O.Data.10 DN Bit=0 N2 On.
Q1:8:I.Ch7Data
Q1:8:I.Ch7Fault
-24.996075
Liquid_Level_Meter
Liquid_Level_Meter_fault
OSRI_11_InputBit
10-B6
LL_select
LHe_Delay_read
TONR_04
BOR_21
BOR_22
BAND_19
LHe_read_duration
He_Only
He_LL_only
SEL_21
LN2_Only
N2_LL_only
Level_read_delay
500
BAND_20
SEL_17
h_LHe
Liquid Level On = Both meters
He Only= 2
LN2 Only =3 LN2 has priority over He if both 2 and 3 are on.
HMI should not allow this to happen.
In single mode, the other meter should read zero.
h_LN2_selector
LN2_Delay_read
TONR_06
Liquid_N2_Timer
OSRI_10
LN2_read_duration
Liquid_Level_N2_dwell
OSRI_11_OutputBit
10-C6
BOR_23
BNOT_30
BNOT_29
BAND_22
SEL_18
h_LN2
OSRI_11
OSRI_11_InputBit
10-H1
OSRI_11_OutputBit
10-A4

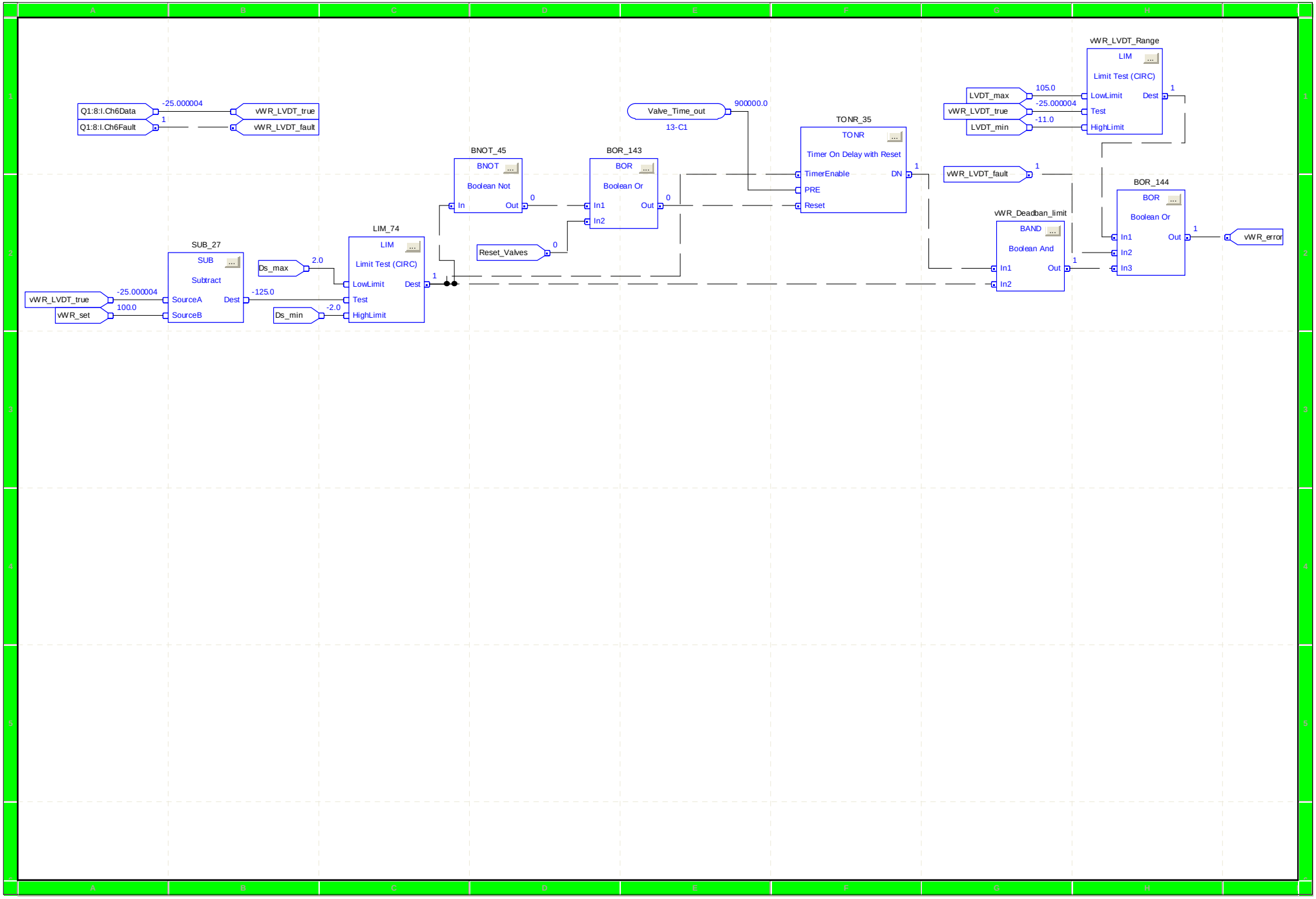

HLL_26
HLL
High/Low Limit
Q1:6:I.Ch8Data
9.781723
In
Out
9.781723
10.15
10.15
HighLimit
HighAlarm
0
2
2
LowLimit
LowAlarm
0
MUL_24
MUL
Multiply
1.5
1.5
SourceA
Dest
14.672585
SourceB
Torr
SUB
Subtract
12.125
12.125
SourceA
Dest
2.5475845
SourceB
XPY_04
XPY
X To Power Of Y
10
10
SourceA
Dest
352.84543
SourceB
Vacuum
HighAlarm
11-F3
LowAlarm
11-F3
LIM_01
LIM
Limit Test (CIRC)
.95
.95
LowLimit
Dest
0
ERR_A
Q1:6:I.Ch8Data
9.781723
Test
1.04
1.04
HighLimit
Pirani failure
Normal gauge output range 2-10V
P=10^(1.5V-B)
B=10 Pascal
B=12 mBar
B=12.125 Torr
LIM_06
LIM
Limit Test (CIRC)
1.05
1.05
LowLimit
Dest
0
ERR_B
Q1:6:I.Ch8Data
9.781879
Test
1.14
1.14
HighLimit
inverted magnetron contaminated or short circuited
LIM_03
LIM
Limit Test (CIRC)
1.15
1.15
LowLimit
Dest
0
ERR_C
Q1:6:I.Ch8Data
9.781723
Test
1.24
1.24
HighLimit
striker filament broken
LIM_02
LIM
Limit Test (CIRC)
1.25
1.25
LowLimit
Dest
0
ERR_D
Q1:6:I.Ch8Data
9.781723
Test
1.34
1.34
HighLimit
Inverted magnetron not struck
GRT_04
GRT
Greater Than (A>B)
Q1:6:I.Ch8Data
9.781723
SourceA
Dest
0
Vacuum_overvoltage
10.15
10.15
SourceB
Maximum gauge output (10.15V) exceeded
Vacuum_error_BOR
BOR
Boolean Or
HighAlarm
0
11-C1
LowAlarm
0
In1
Out
0
Vacuum_error
11-C2
ERR_A
0
In2
ERR_B
0
In3
ERR_C
0
In4
ERR_D
0
In5
Vacuum_overvoltage
0
In6
Q1:6:I.Ch8Fault
0
In7
In8

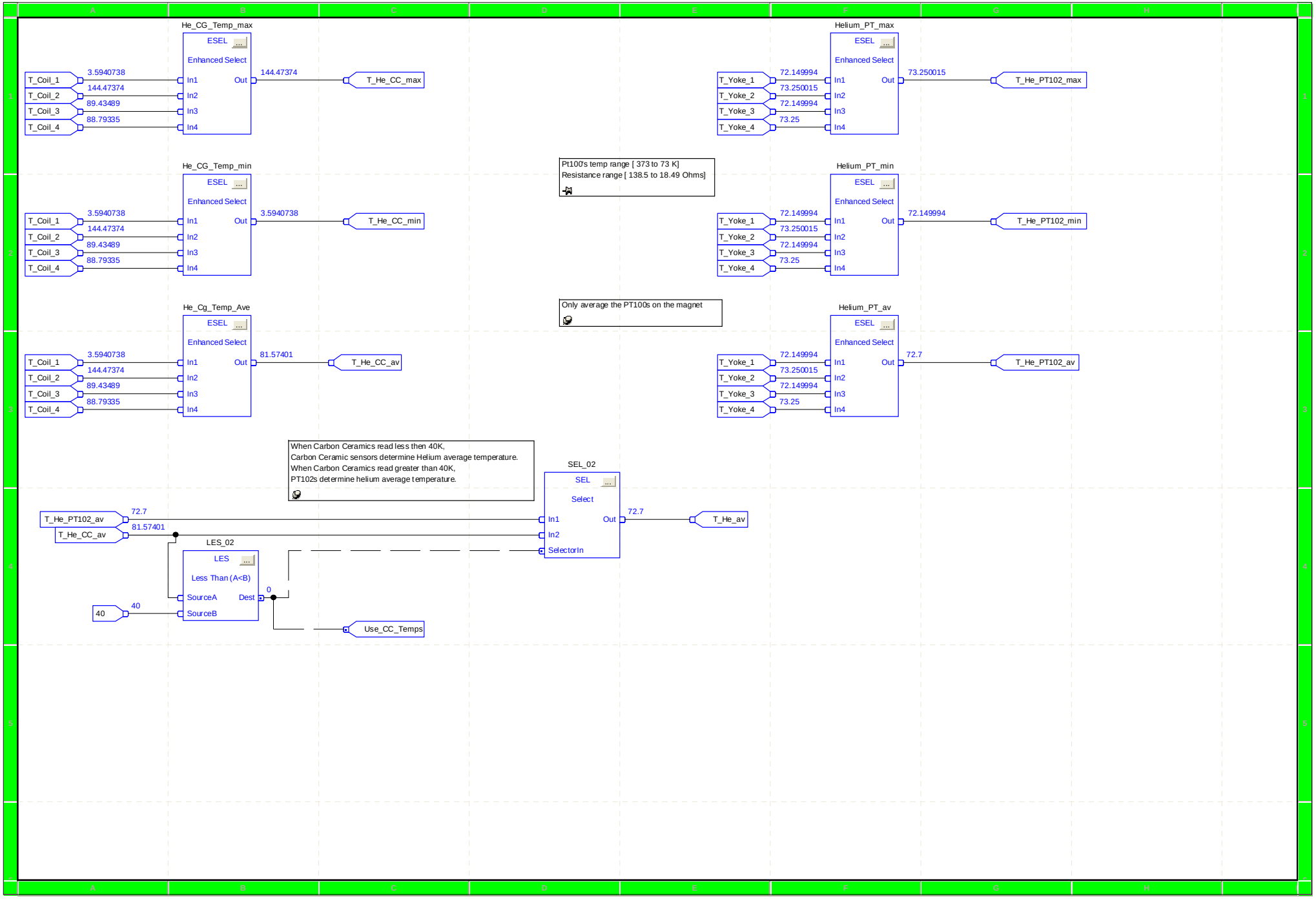

He_Pressure_PSIG1
MUL
Multiply
SourceA
SourceB
Dest
Q1:6:I.Ch9Data
-0.008758812
2.908666
2.908666
-0.025476458
DIV_29
DIV
Divide
SourceA
SourceB
Dest
14.696
14.696
-1.73356407e-003
He_Pressure_ATM_01
ADD
Add
SourceA
SourceB
Dest
1
1
0.99826646
P_He
P_He_error_BOR
BOR
Boolean Or
In1
In2
In3
Out
Q1:6:I.Ch9Fault
Q1:6:I.Ch9Overrange
Q1:6:I.Ch9Underrange
0
0
0
0
P_He_error
Overrange fault if pressure is greater than
~58psig or ~4.9atm (varies slightly by sensor).
Limited by +/-20mV input at Dataforth module.
N2_Pressure_PSIG1
MUL
Multiply
SourceA
SourceB
Dest
Q1:6:I.Ch10Data
0.03440962
2.908666
2.908666
0.100086085
DIV_03
DIV
Divide
SourceA
SourceB
Dest
14.696
14.696
6.81043044e-003
N2_Pressure_ATM
ADD
Add
SourceA
SourceB
Dest
1
1
1.0068104
P_N2
P_N2_error_BOR
BOR
Boolean Or
In1
In2
In3
Out
Q1:6:I.Ch10Fault
Q1:6:I.Ch10Overrange
Q1:6:I.Ch10Underrange
0
0
0
0
P_N2_error

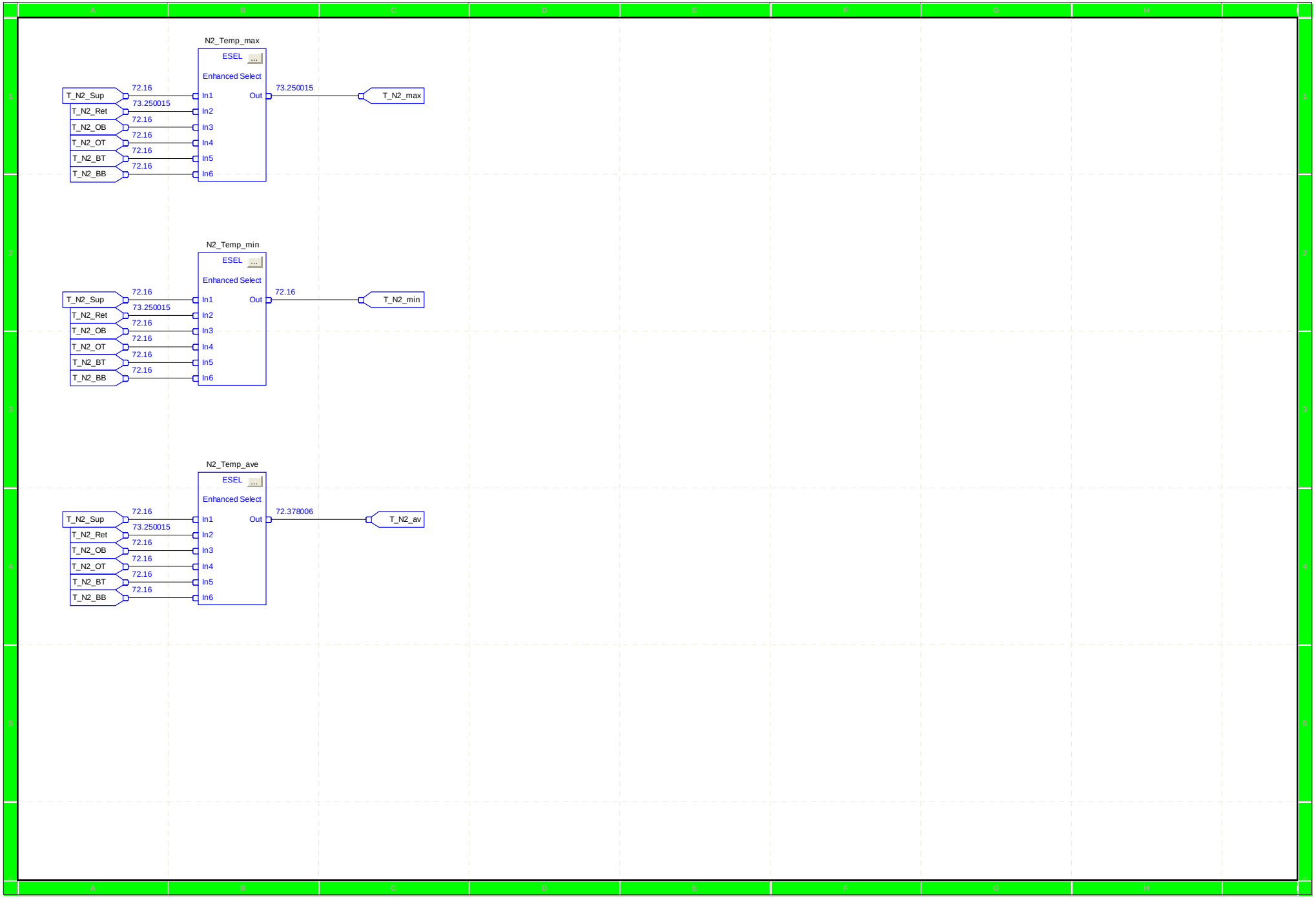

MUL_01
MUL
Multiply
Valve_Timeout_time
900.0
1000
SourceA
SourceB
Dest
900000.0
Valve_Time_out
13-E113-E4
14-E114-E4
15-E115-E4
16-E1
Valve_Time_out
900000.0
13-C1
TONR_02
TONR
Timer On Delay with Reset
TimerEnable
PRE
Reset
DN
0
LVDT_max
105.0
V1_LVDT_true
34.58764
LVDT_min
-11.0
LowLimit
Test
HighLimit
v1_LVDT_Range
LIM
Limit Test (CIRC)
V1_LVDT_fault
BNOT_01
BNOT
Boolean Not
In
Out
1
BOR_24
BOR
Boolean Or
In1
In2
BOR_25
v1_Deadban_limit
BAND
Boolean And
In3
v1_error
SUB_01
SUB
Subtract
V1_LVDT_true
34.58764
v1_set
34.6
SourceA
SourceB
Dest
-0.012359619
Ds_max
2.0
Ds_min
-2.0
LIM_22
Reset_Valves
4 - 20 mA signal
Front end calibration
20mA = 100% and 4mA = -6%
Except for the warm return ball valve 20mA = 100% 4 mA=0%
Q1:8:I.Ch0Data
34.58764
Q1:8:I.Ch0Fault
V1_LVDT_true
V1_LVDT_fault
Q1:8:I.Ch1Data
34.4191
Q1:8:I.Ch1Fault
V2_LVDT_true
V2_LVDT_fault
v2_LVDT_Range
TONR_03
BNOT_02
BOR_27
BOR_26
v2_Deadban_limit
SUB_02
LIM_21
V2_LVDT_true
v2_set
34.3
0.08164978

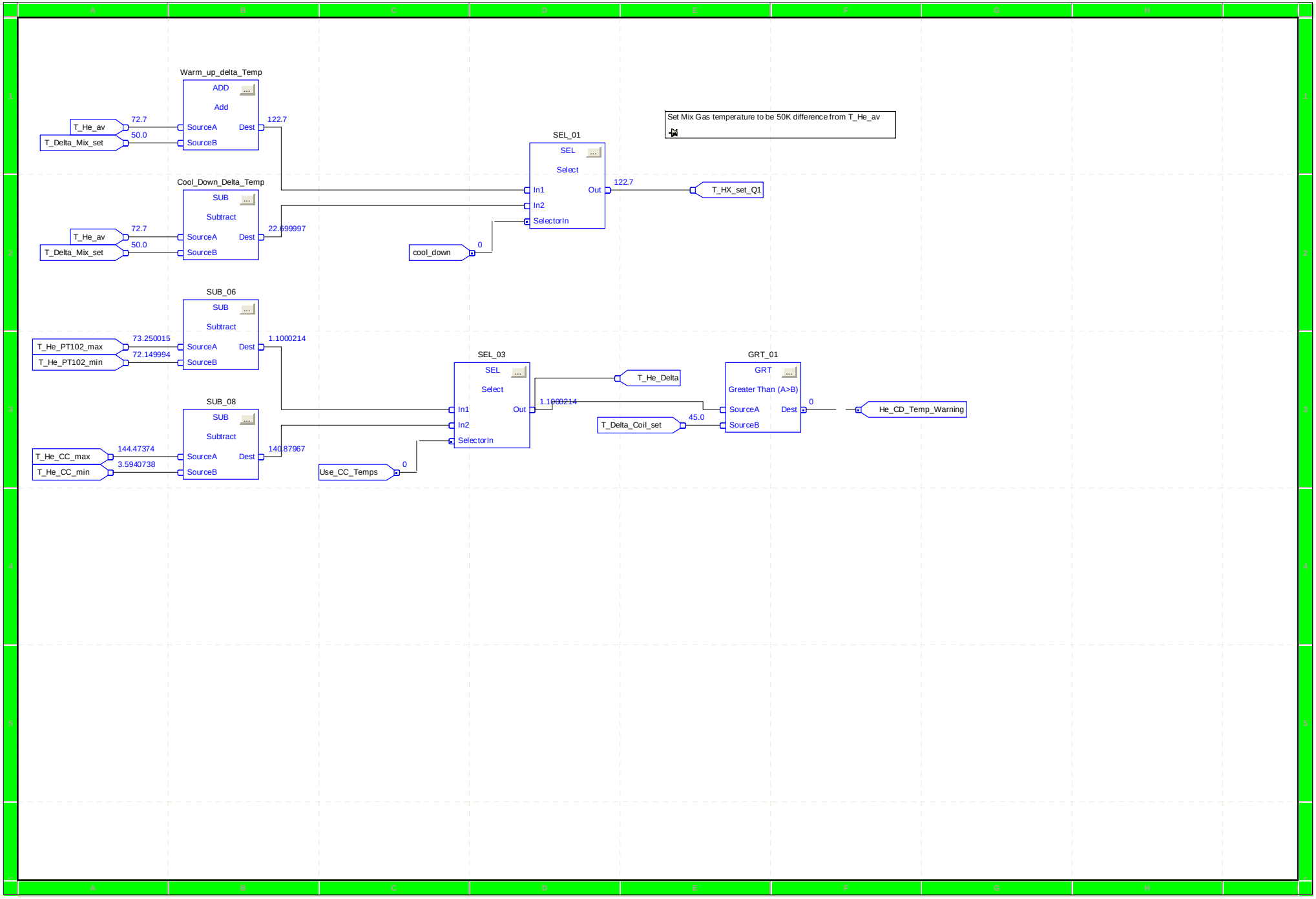

v3_LVDT_Range
LIM
Limit Test (CIRC)
LVDT_max
105.0
V3_LVDT_true
34.797787
LVDT_min
-11.0
LowLimit
Test
HighLimit
Dest
0
Valve_Time_out
900000.0
13-C1
TONR_05
TONR
Timer On Delay with Reset
TimerEnable
PRE
Reset
DN
V3_LVDT_fault
BNOT_04
BNOT
Boolean Not
In
Out
BOR_31
BOR
Boolean Or
In1
In2
BOR_30
In3
v3_Deadban_limit
BAND
Boolean And
v3_error
LIM_23
SUB_04
SUB
Subtract
SourceA
SourceB
V3_LVDT_true
34.797787
v3_set
34.8
Ds_max
2.0
Ds_min
-2.0
0.014434814
Reset_Valves
Q1:8:I.Ch2Data
34.812355
Q1:8:I.Ch2Fault
V3_LVDT_fault
Q1:8:I.Ch3Data
34.125725
Q1:8:I.Ch3Fault
V4_LVDT_true
V4_LVDT_fault
v4_LVDT_Range
105.0
34.07579
v4_error
TONR_25
BNOT_25
BOR_94
BOR_95
v4_Deadban_limit
LIM_51
SUB_19
-0.013805389
34.1
v4_set

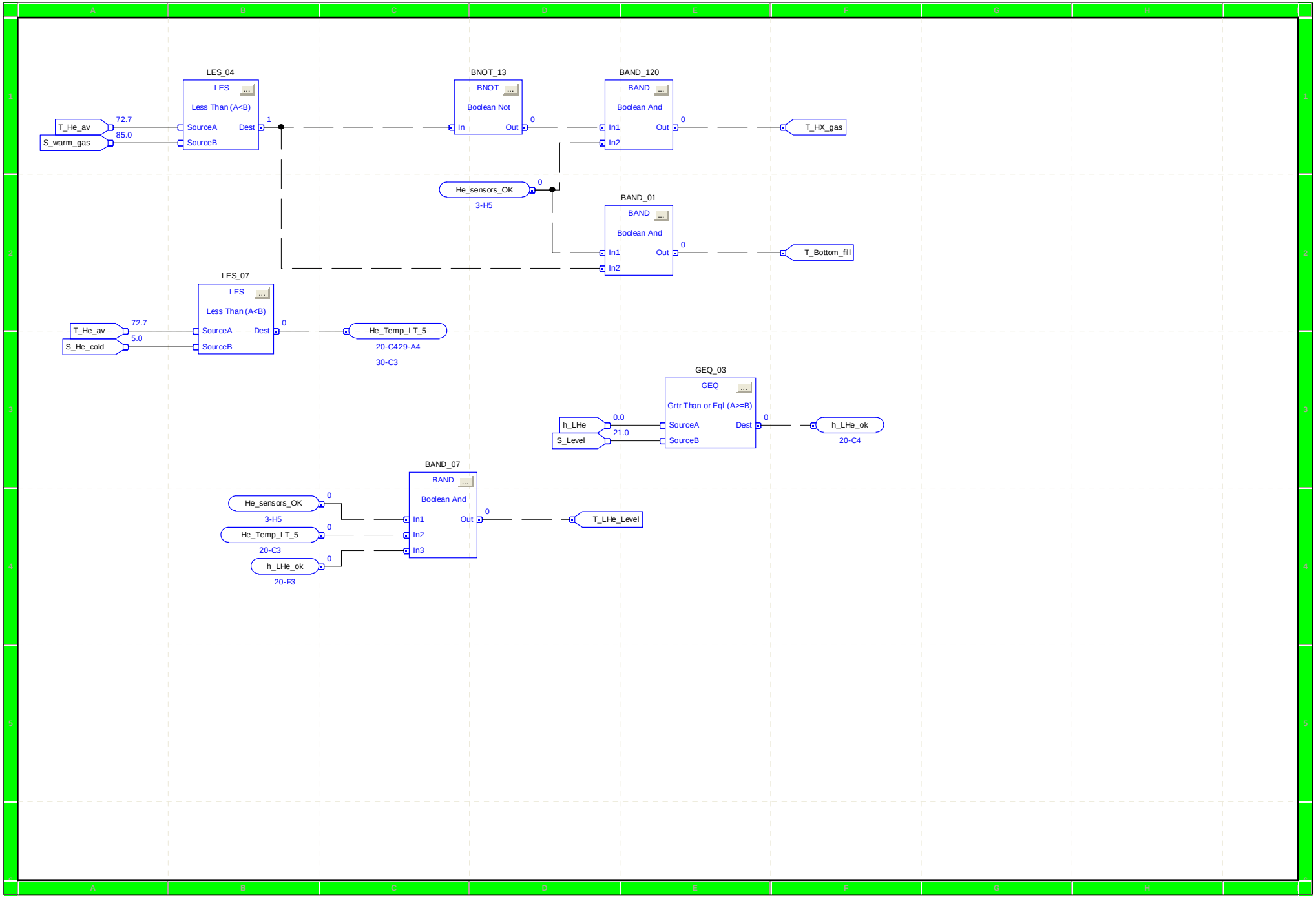

v5_LVDT_Range
LIM
Limit Test (CIRC)
LowLimit
Test
HighLimit
Dest
LVDT_max
105.0
V5_LVDT_true
35.23265
LVDT_min
-11.0
Valve_Time_out
900000.0
13-C1
TONR_26
TONR
Timer On Delay with Reset
TimerEnable
PRE
Reset
DN
V5_LVDT_fault
BNOT_26
BNOT
Boolean Not
In
Out
BOR_96
BOR
Boolean Or
In1
In2
BOR_98
In3
v5_Deadban_limit
BAND
Boolean And
v5_error
LIM_52
SUB_20
SUB
Subtract
SourceA
SourceB
v5_set
35.2
Ds_max
2.0
Ds_min
-2.0
0.032649994
Reset_Valves
Q1:8:I.Ch4Data
35.228493
Q1:8:I.Ch4Fault
V5_LVDT_true
V5_LVDT_fault
Q1:8:I.Ch5Data
34.67711
Q1:8:I.Ch5Fault
V6_LVDT_true
V6_LVDT_fault
v6_LVDT_Range
34.672947
v6_set
34.7
v6_Deadban_limit
v6_error
TONR_27
BNOT_27
BOR_100
BOR_99
LIM_53
SUB_21
-0.027053833

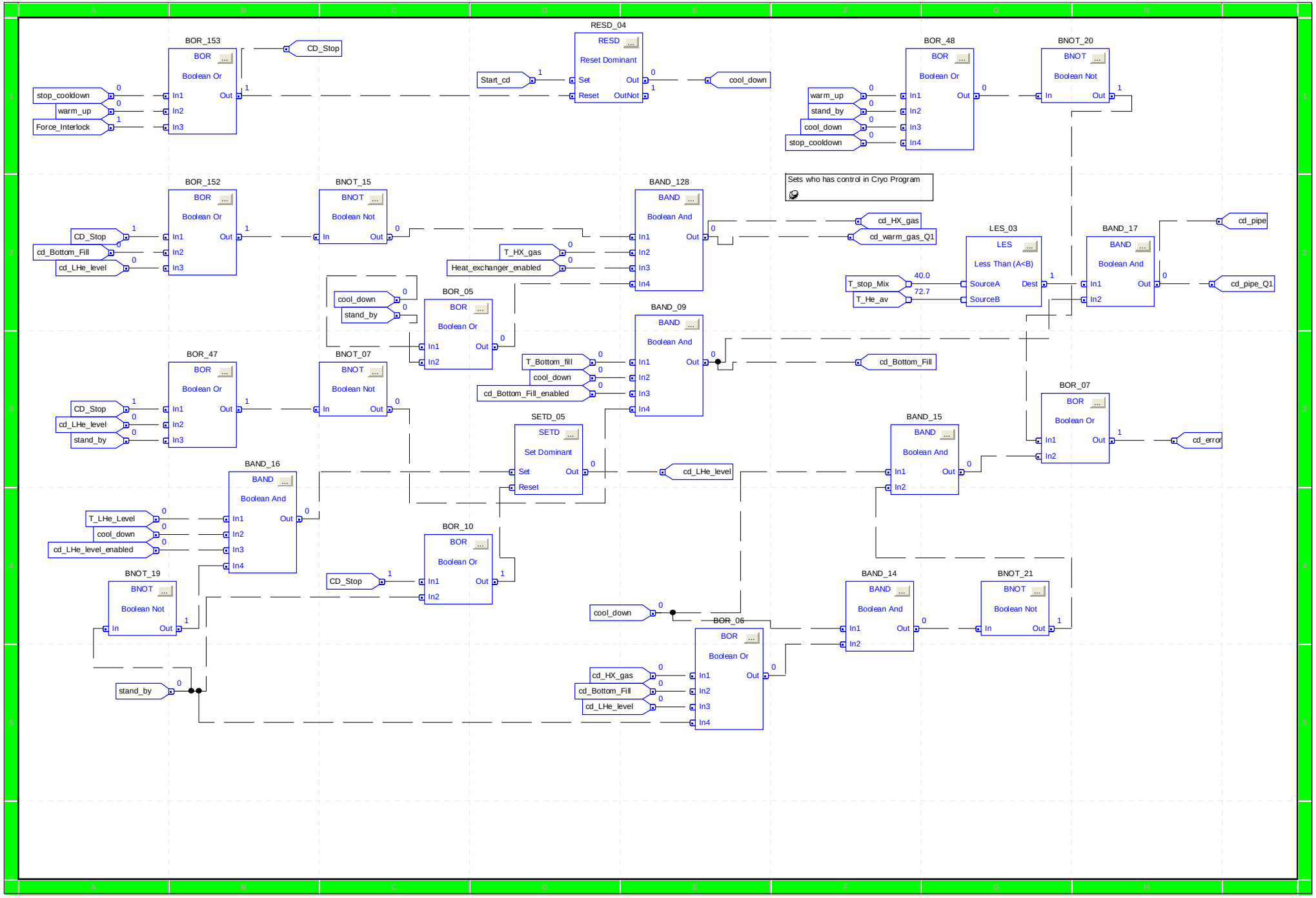

Q1:8:I.Ch6Data
Q1:8:I.Ch6Fault
-25.000004
1
vWR_LVDT_true
vWR_LVDT_fault
Valve_Time_out
13-C1
900000.0
TONR_35
TONR
Timer On Delay with Reset
TimerEnable
PRE
Reset
DN
BNOT_45
BNOT
Boolean Not
In
Out
BOR_143
BOR
Boolean Or
In1
In2
Out
LVDT_max
vWR_LVDT_true
LVDT_min
105.0
-25.000004
-11.0
vWR_LVDT_Range
LIM
Limit Test (CIRC)
LowLimit
Test
HighLimit
Dest
vWR_LVDT_fault
BOR_144
vWR_Deadban_limit
BAND
Boolean And
In3
vWR_error
LIM_74
Reset_Valves
SUB_27
SUB
Subtract
SourceA
SourceB
vWR_set
100.0
Ds_max
2.0
Ds_min
-2.0
-125.0

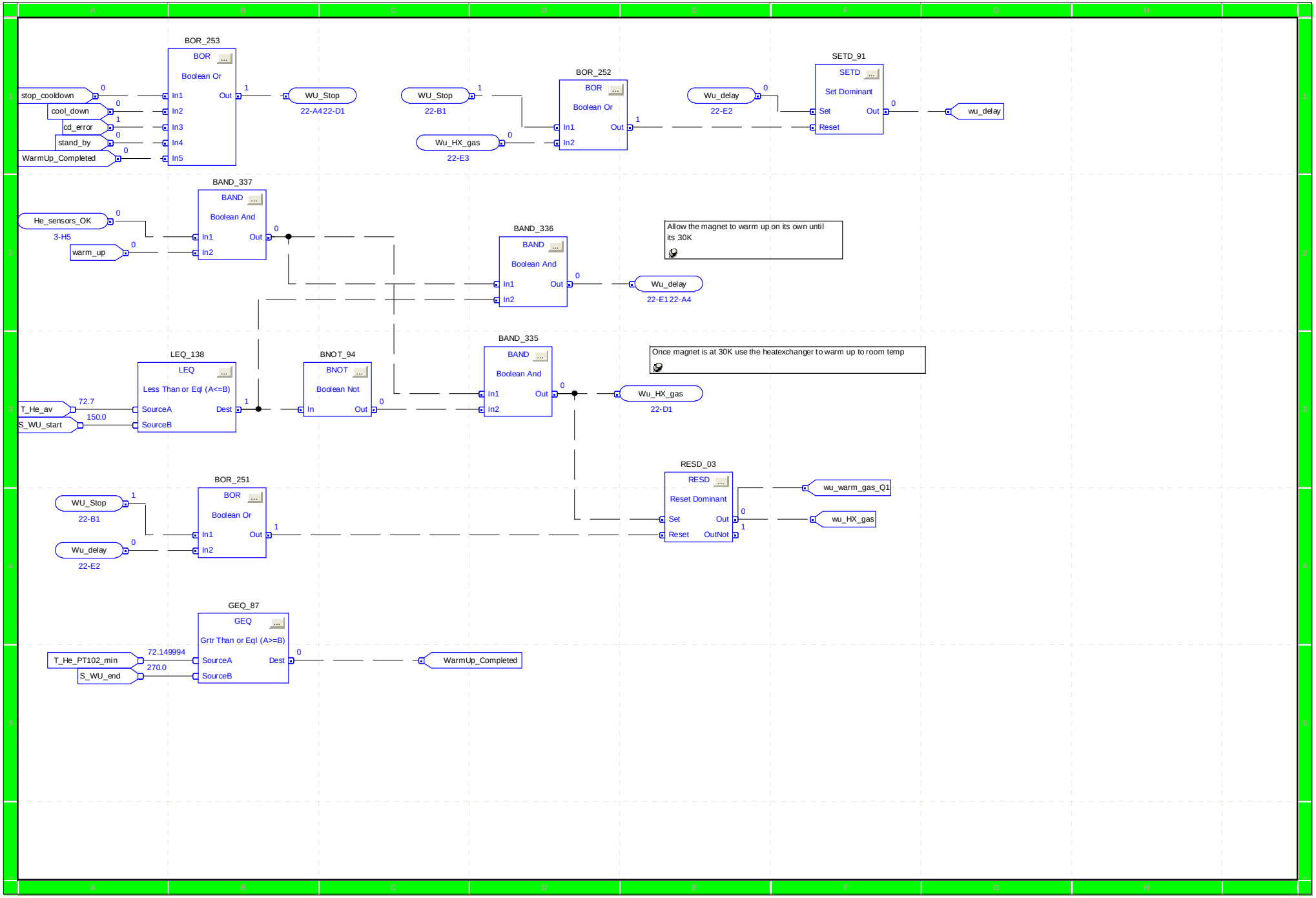

He_CG_Temp_max
ESEL
Enhanced Select
T_Coil_1
T_Coil_2
T_Coil_3
T_Coil_4
3.5940738
144.47374
89.43489
88.79335
In1
In2
In3
In4
Out
144.47374
T_He_CC_max
Helium_PT_max
T_Yoke_1
T_Yoke_2
T_Yoke_3
T_Yoke_4
72.149994
73.250015
72.149994
73.25
73.250015
T_He_PT102_max
He_CG_Temp_min
3.5940738
3.5940738
T_He_CC_min
Pt100's temp range [373 to 73 K]
Resistance range [138.5 to 18.49 Ohms]
Helium_PT_min
72.149994
72.149994
T_He_PT102_min
He_Cg_Temp_Ave
81.57401
T_He_CC_av
Only average the PT100s on the magnet
Helium_PT_av
72.7
T_He_PT102_av
When Carbon Ceramics read less then 40K,
Carbon Ceramic sensors determine Helium average temperature.
When Carbon Ceramics read greater than 40K,
PT102s determine helium average temperature.
SEL_02
SEL
Select
In1
In2
SelectorIn
Out
72.7
T_He_av
LES_02
LES
Less Than (A<B)
SourceA
SourceB
Dest
40
0
Use_CC_Temps

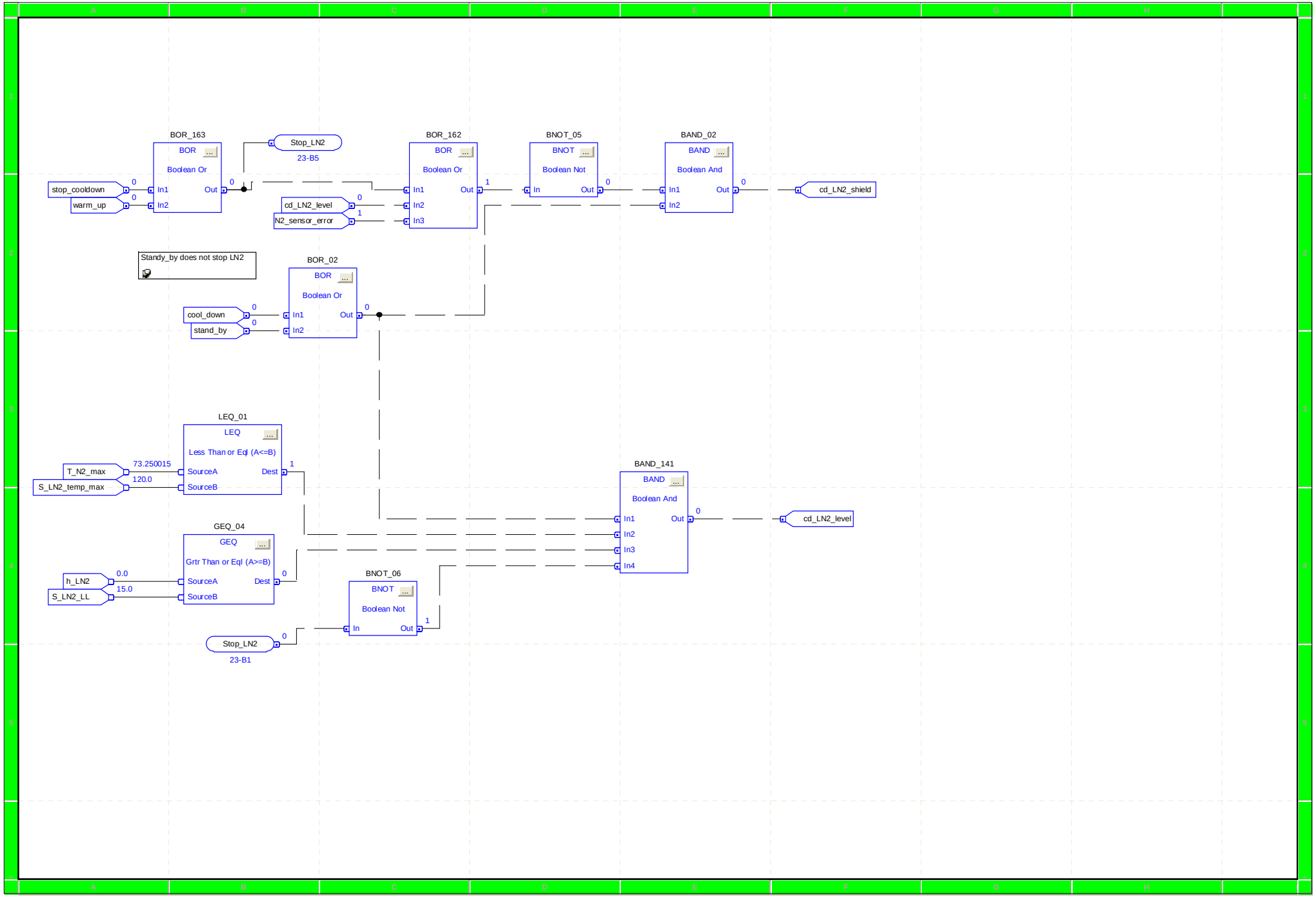

N2_Temp_max
ESEL
Enhanced Select
T_N2_Sup
72.16
In1
Out
73.250015
T_N2_max
T_N2_Ret
73.250015
In2
T_N2_OB
72.16
In3
T_N2_OT
72.16
In4
T_N2_BT
72.16
In5
T_N2_BB
72.16
In6
N2_Temp_min
ESEL
Enhanced Select
T_N2_Sup
72.16
In1
Out
72.16
T_N2_min
T_N2_Ret
73.250015
In2
T_N2_OB
72.16
In3
T_N2_OT
72.16
In4
T_N2_BT
72.16
In5
T_N2_BB
72.16
In6
N2_Temp_ave
ESEL
Enhanced Select
T_N2_Sup
72.16
In1
Out
72.378006
T_N2_av
T_N2_Ret
73.250015
In2
T_N2_OB
72.16
In3
T_N2_OT
72.16
In4
T_N2_BT
72.16
In5
T_N2_BB
72.16
In6

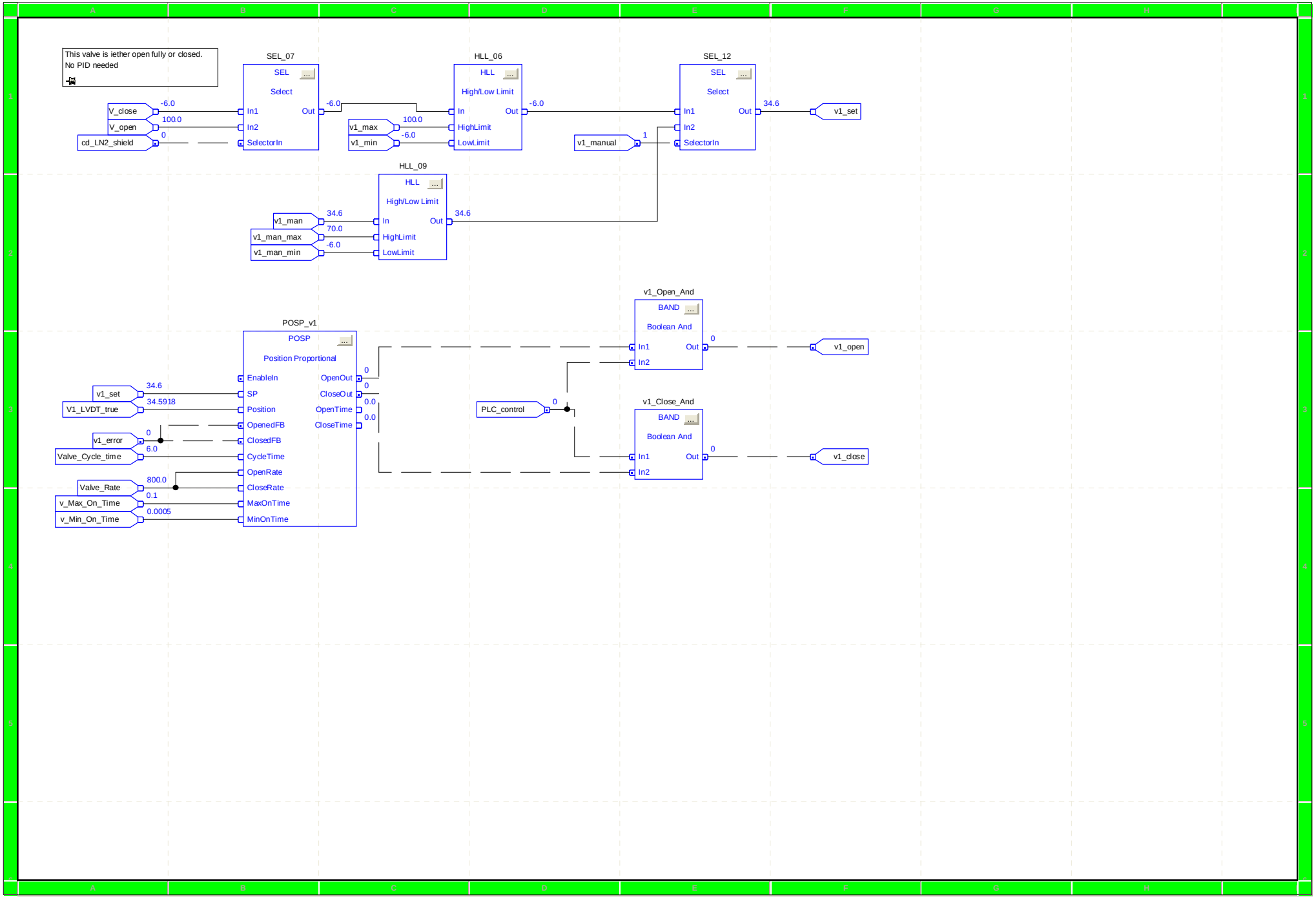

Warm_up_delta_Temp
ADD
Add
T_He_av
72.7
T_Delta_Mix_set
50.0
SourceA
SourceB
Dest
122.7
Cool_Down_Delta_Temp
SUB
Subtract
T_He_av
72.7
T_Delta_Mix_set
50.0
SourceA
SourceB
Dest
22.699997
SUB_06
SUB
Subtract
T_He_PT102_max
73.250015
T_He_PT102_min
72.149994
SourceA
SourceB
Dest
1.1000214
SUB_08
SUB
Subtract
T_He_CC_max
144.47374
T_He_CC_min
3.5940738
SourceA
SourceB
Dest
140.87967
Set Mix Gas temperature to be 50K difference from T_He_av
SEL_01
SEL
Select
In1
In2
SelectorIn
Out
122.7
T_HX_set_Q1
cool_down
0
SEL_03
SEL
Select
In1
In2
SelectorIn
Out
1.1000214
T_He_Delta
Use_CC_Temps
0
GRT_01
GRT
Greater Than (A>B)
SourceA
SourceB
Dest
1.1000214
T_Delta_Coil_set
45.0
0
He_CD_Temp_Warning

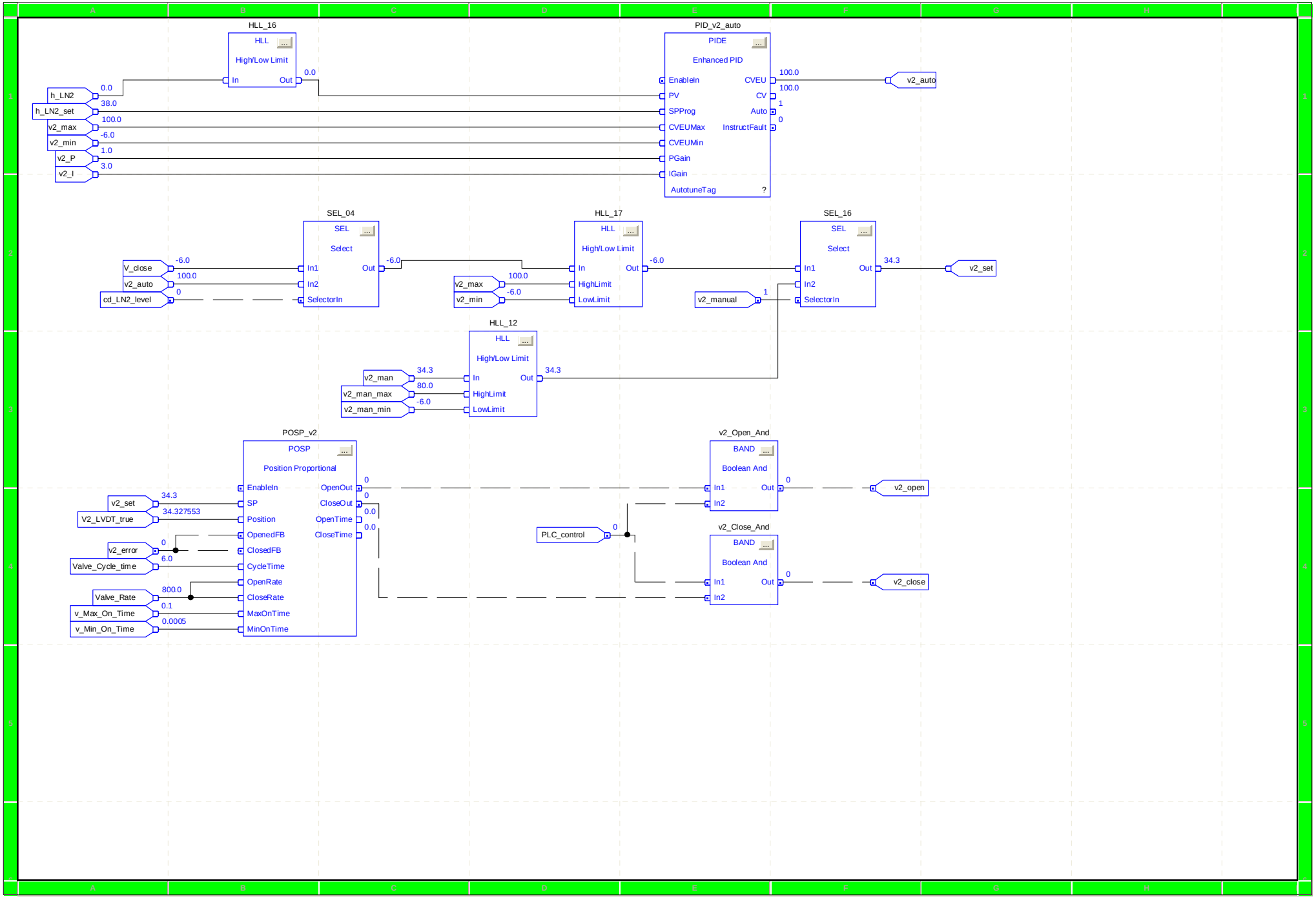

LES_04
LES
Less Than (A<B)
T_He_av
72.7
S_warm_gas
85.0
SourceA
SourceB
Dest
1
BNOT_13
BNOT
Boolean Not
In
Out
0
BAND_120
BAND
Boolean And
In1
In2
Out
0
T_HX_gas
He_sensors_OK
3-H5
BAND_01
BAND
Boolean And
In1
In2
Out
0
T_Bottom_fill
LES_07
LES
Less Than (A<B)
T_He_av
72.7
S_He_cold
5.0
SourceA
SourceB
Dest
0
He_Temp_LT_5
20-C429-A4
30-C3
GEQ_03
GEQ
Grtr Than or Eql (A>=B)
h_LHe
0.0
S_Level
21.0
SourceA
SourceB
Dest
0
h_LHe_ok
20-C4
BAND_07
BAND
Boolean And
He_sensors_OK
3-H5
He_Temp_LT_5
20-C3
h_LHe_ok
20-F3
In1
In2
In3
Out
0
T_LHe_Level

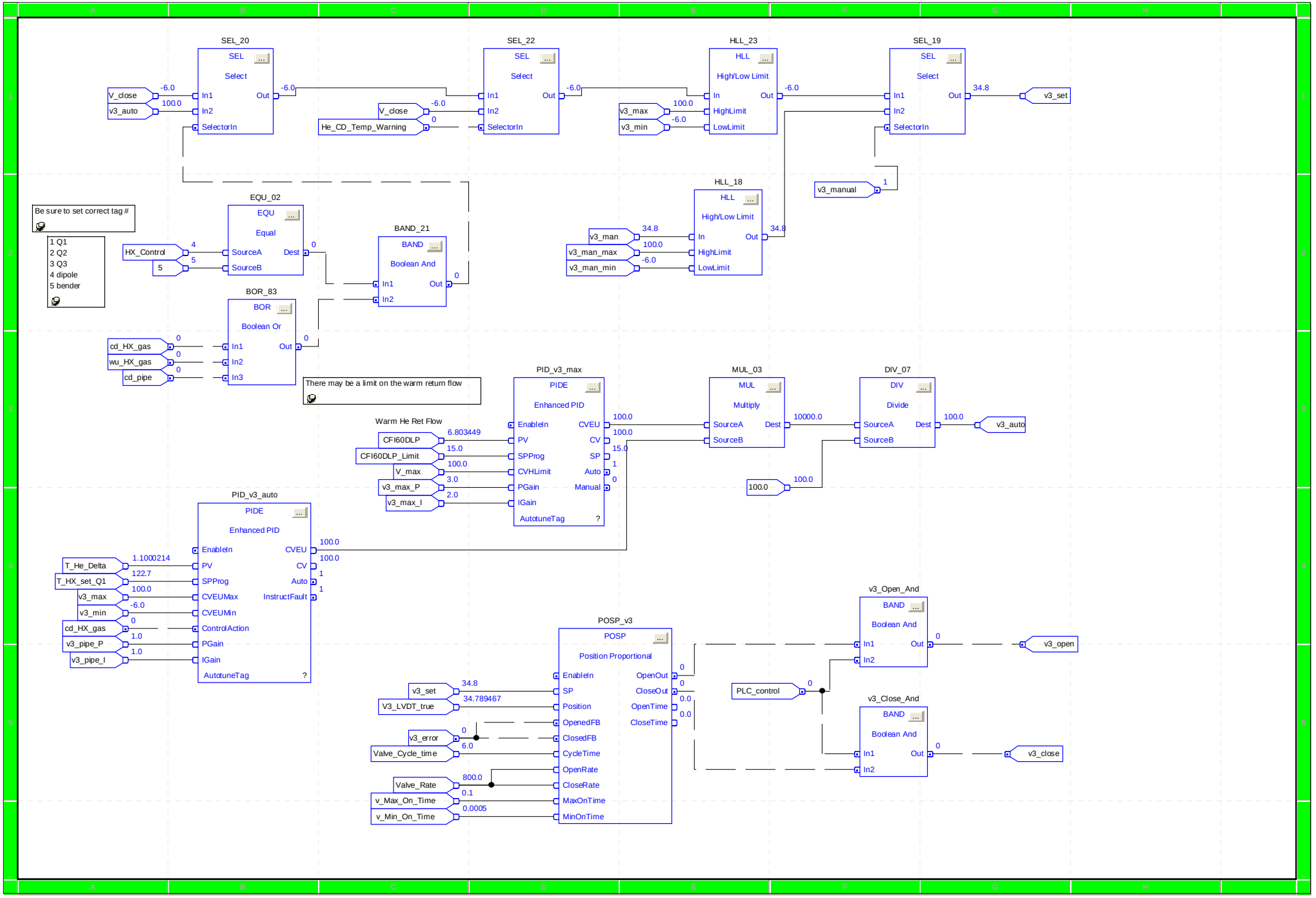

BOR_153
BOR
Boolean Or
stop_cooldown
warm_up
Force_Interlock
In1
In2
In3
Out
CD_Stop
RESD_04
RESD
Reset Dominant
Start_cd
Set
Reset
OutNot
cool_down
BOR_48
BOR
Boolean Or
warm_up
stand_by
cool_down
stop_cooldown
In4
BNOT_20
BNOT
Boolean Not
In
BOR_152
BOR
Boolean Or
CD_Stop
cd_Bottom_Fill
cd_LHe_level
BNOT_15
BNOT
Boolean Not
BAND_128
BAND
Boolean And
T_HX_gas
Heat_exchanger_enabled
cd_HX_gas
cd_warm_gas_Q1
Sets who has control in Cryo Program
LES_03
LES
Less Than (A<B)
T_stop_Mix
T_He_av
SourceA
SourceB
Dest
40.0
72.7
BAND_17
cd_pipe
cd_pipe_Q1
cool_down
stand_by
BOR_05
BAND_09
T_Bottom_fill
cd_Bottom_Fill_enabled
cd_Bottom_Fill
BOR_47
BNOT_07
BOR_07
cd_error
SETD_05
SETD
Set Dominant
Set
Reset
cd_LHe_level
BAND_15
BAND_16
T_LHe_Level
cd_LHe_level_enabled
BOR_10
BNOT_19
BAND_14
BNOT_21
BOR_06
cd_HX_gas
cd_Bottom_Fill
cd_LHe_level
stand_by

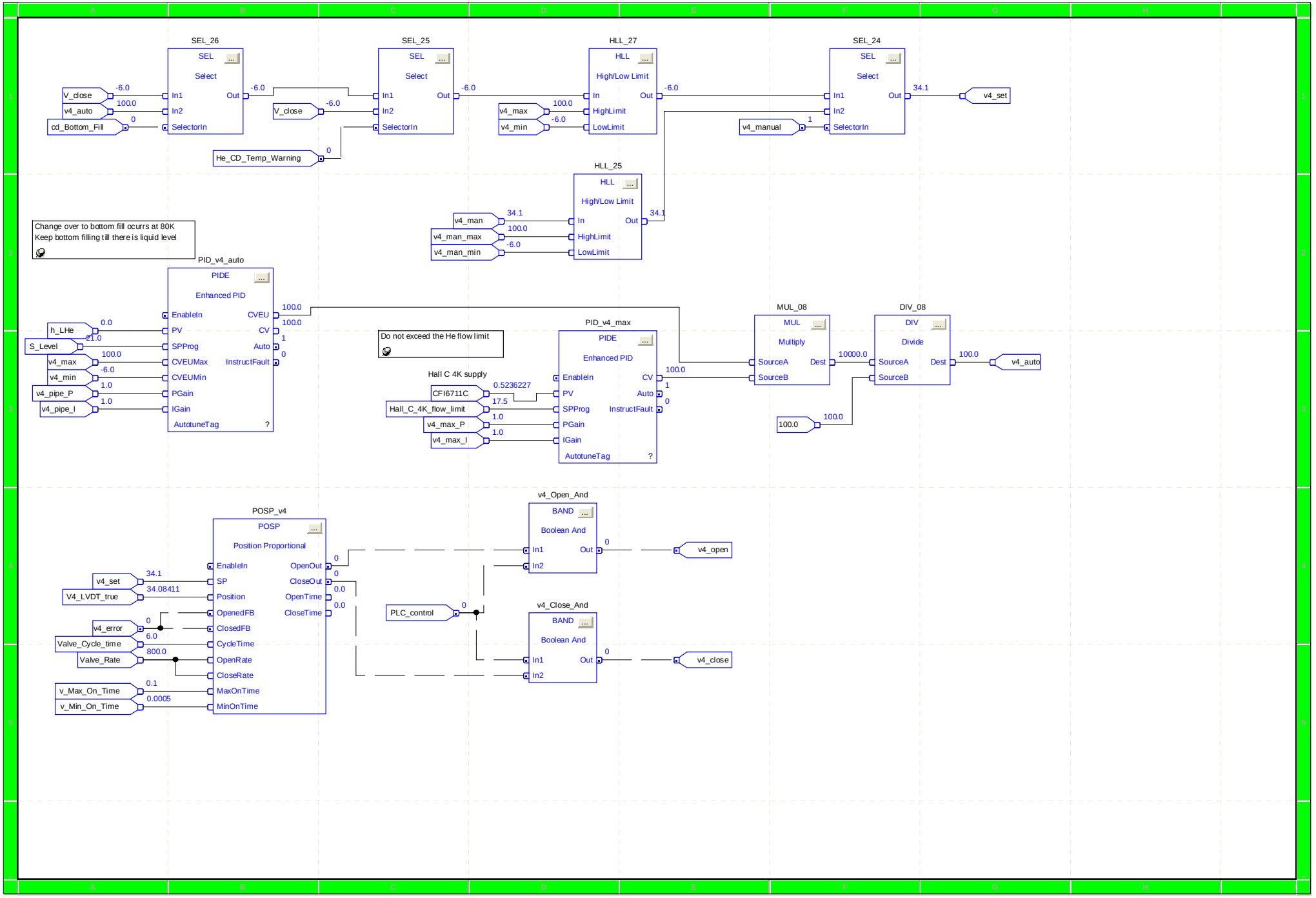

BOR_253
BOR
Boolean Or
stop_cooldown
cool_down
cd_error
stand_by
WarmUp_Completed
In1
In2
In3
In4
In5
Out
WU_Stop
22-A422-D1
WU_Stop
22-B1
Wu_HX_gas
22-E3
BOR_252
Wu_delay
22-E2
SETD_91
SETD
Set Dominant
Set
Reset
wu_delay
BAND_337
BAND
Boolean And
He_sensors_OK
3-H5
warm_up
BAND_336
Allow the magnet to warm up on its own until its 30K
Wu_delay
22-E122-A4
LEQ_138
LEQ
Less Than or Eql (A<=B)
T_He_av
S_WU_start
72.7
150.0
SourceA
SourceB
Dest
BNOT_94
BNOT
Boolean Not
In
BAND_335
Once magnet is at 30K use the heatexchanger to warm up to room temp
Wu_HX_gas
22-D1
RESD_03
RESD
Reset Dominant
OutNot
wu_warm_gas_Q1
wu_HX_gas
BOR_251
GEQ_87
GEQ
Grtr Than or Eql (A>=B)
T_He_PT102_min
S_WU_end
72.149994
270.0
WarmUp_Completed

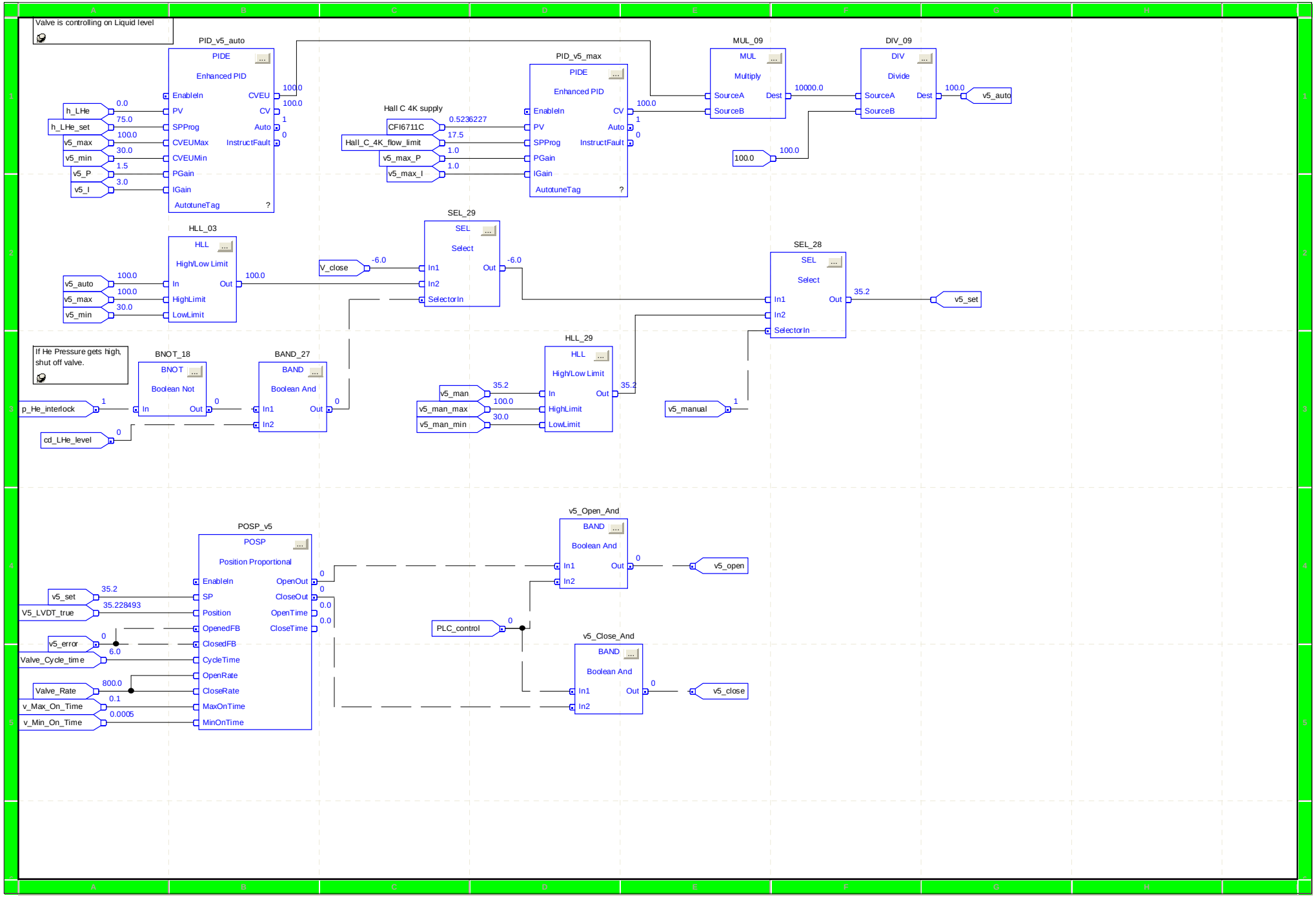

BOR_163
BOR
Boolean Or
stop_cooldown
warm_up
In1
In2
Out
Stop_LN2
23-B5
BOR_162
cd_LN2_level
N2_sensor_error
In3
BNOT_05
BNOT
Boolean Not
In
BAND_02
BAND
Boolean And
cd_LN2_shield
Standy_by does not stop LN2
BOR_02
cool_down
stand_by
LEQ_01
LEQ
Less Than or Eql (A<=B)
T_N2_max
S_LN2_temp_max
73.250015
120.0
SourceA
SourceB
Dest
BAND_141
In4
GEQ_04
GEQ
Grtr Than or Eql (A>=B)
h_LN2
S_LN2_LL
0.0
15.0
BNOT_06
Stop_LN2
23-B1

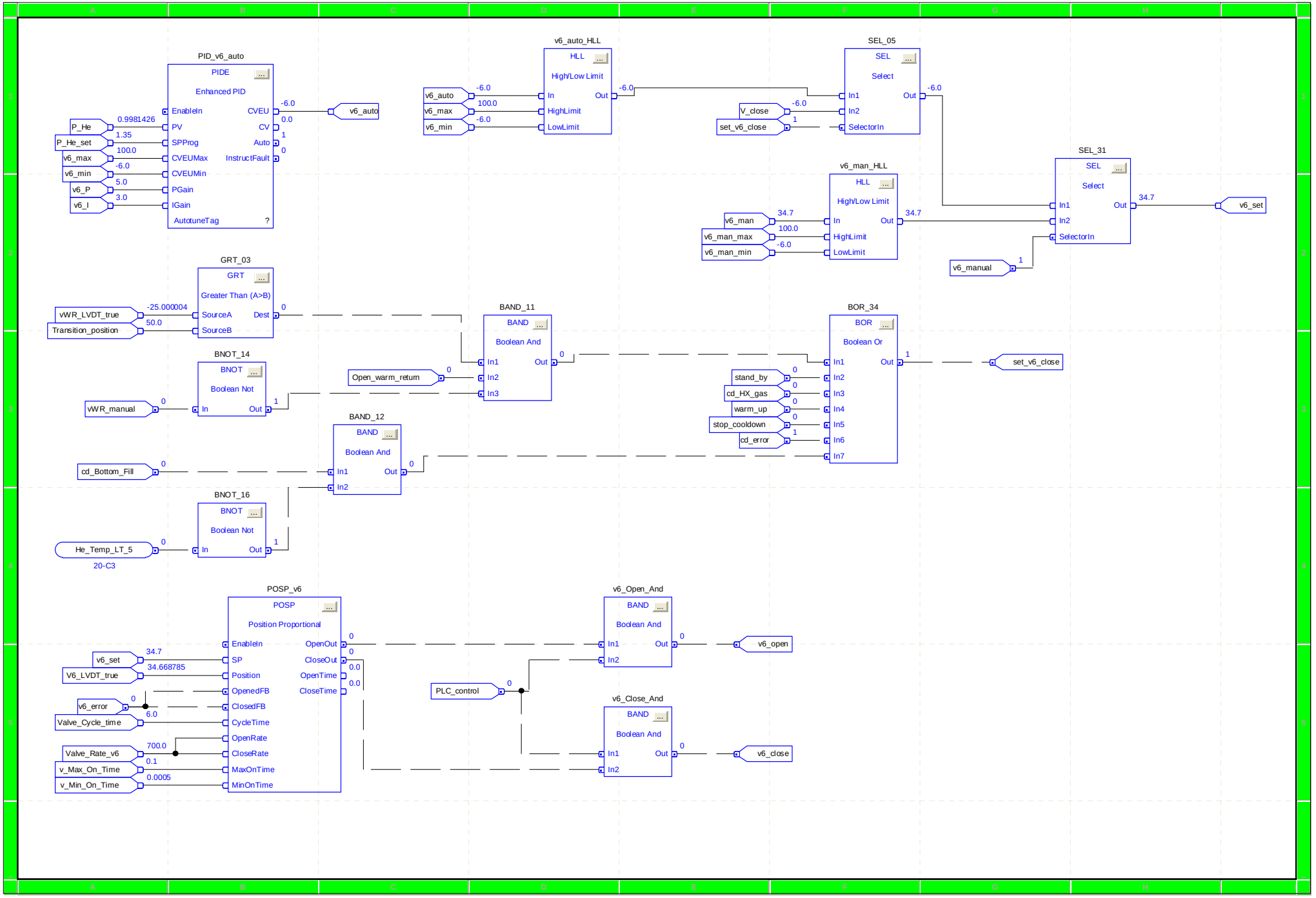

This valve is iether open fully or closed.
No PID needed
SEL_07
SEL
Select
V_close
-6.0
V_open
100.0
cd_LN2_shield
0
In1
In2
SelectorIn
Out
-6.0
HLL_06
HLL
High/Low Limit
v1_max
100.0
v1_min
-6.0
In
HighLimit
LowLimit
Out
-6.0
SEL_12
SEL
Select
v1_manual
1
In1
In2
SelectorIn
Out
34.6
v1_set
HLL_09
HLL
High/Low Limit
v1_man
34.6
v1_man_max
70.0
v1_man_min
-6.0
In
HighLimit
LowLimit
Out
34.6
v1_Open_And
BAND
Boolean And
In1
In2
Out
0
v1_open
POSP_v1
POSP
Position Proportional
v1_set
34.6
V1_LVDT_true
34.5918
v1_error
0
Valve_Cycle_time
6.0
Valve_Rate
800.0
v_Max_On_Time
0.1
v_Min_On_Time
0.0005
EnableIn
SP
Position
OpenedFB
ClosedFB
CycleTime
OpenRate
CloseRate
MaxOnTime
MinOnTime
OpenOut
CloseOut
OpenTime
CloseTime
0
0
0.0
0.0
PLC_control
0
v1_Close_And
BAND
Boolean And
In1
In2
Out
0
v1_close

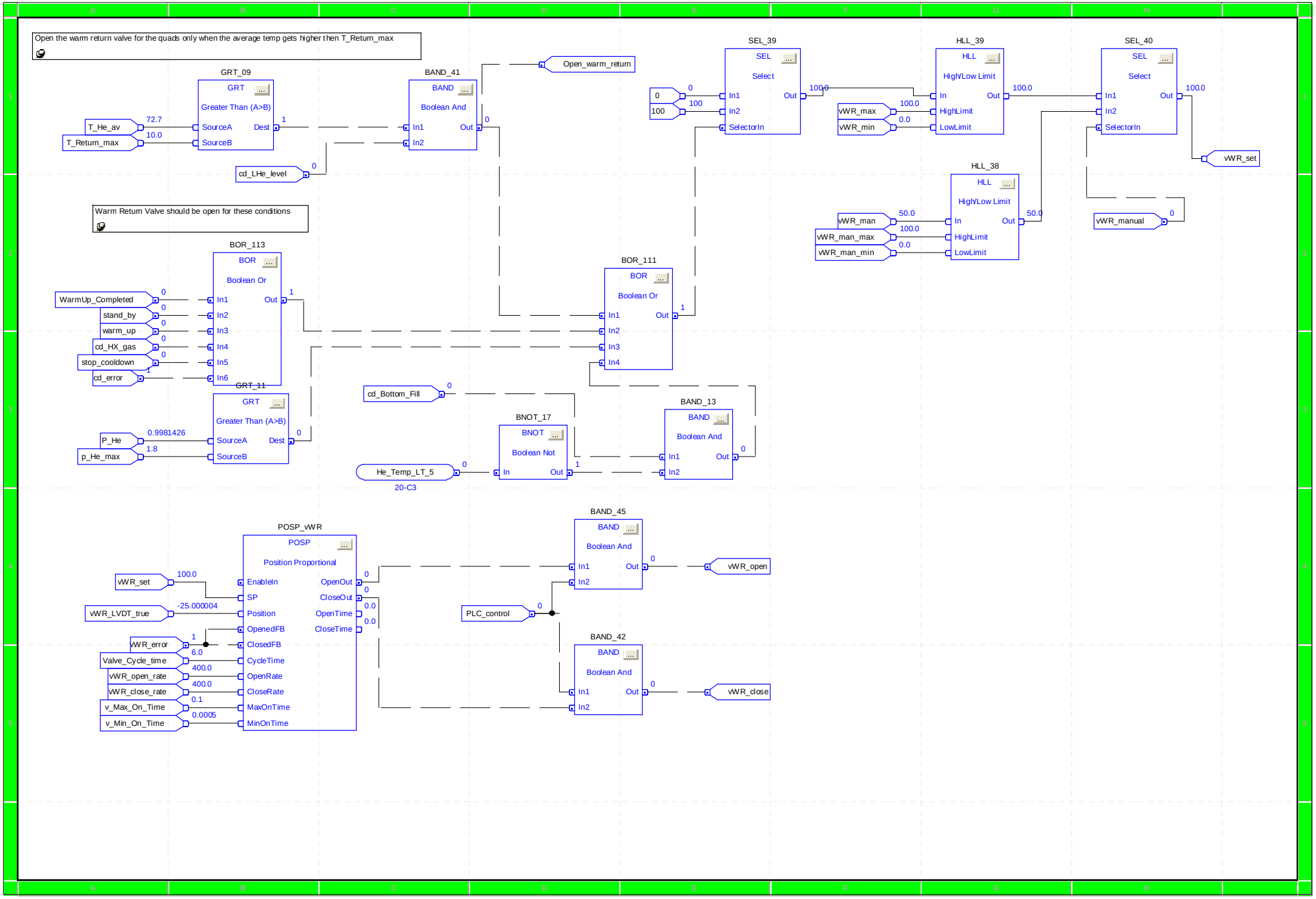

HLL_16
HLL
High/Low Limit
In
Out
0.0
h_LN2
0.0
h_LN2_set
38.0
v2_max
100.0
v2_min
-6.0
v2_P
1.0
v2_I
3.0
PID_v2_auto
PIDE
Enhanced PID
EnableIn
PV
SPProg
CVEUMax
CVEUMin
PGain
IGain
AutotuneTag
?
CVEU
CV
Auto
InstructFault
100.0
100.0
1
0
v2_auto
SEL_04
SEL
Select
In1
In2
SelectorIn
Out
V_close
-6.0
v2_auto
100.0
cd_LN2_level
0
-6.0
HLL_17
HLL
High/Low Limit
In
HighLimit
LowLimit
Out
v2_max
100.0
v2_min
-6.0
-6.0
SEL_16
SEL
Select
In1
In2
SelectorIn
Out
v2_manual
1
34.3
v2_set
HLL_12
HLL
High/Low Limit
In
HighLimit
LowLimit
Out
v2_man
34.3
v2_man_max
80.0
v2_man_min
-6.0
34.3
POSP_v2
POSP
Position Proportional
EnableIn
SP
Position
OpenedFB
ClosedFB
CycleTime
OpenRate
CloseRate
MaxOnTime
MinOnTime
OpenOut
CloseOut
OpenTime
CloseTime
v2_set
34.3
V2_LVDT_true
34.327553
v2_error
0
Valve_Cycle_time
6.0
Valve_Rate
800.0
v_Max_On_Time
0.1
v_Min_On_Time
0.0005
0
0
0.0
0.0
v2_Open_And
BAND
Boolean And
In1
In2
Out
PLC_control
0
0
v2_open
v2_Close_And
BAND
Boolean And
In1
In2
Out
0
v2_close

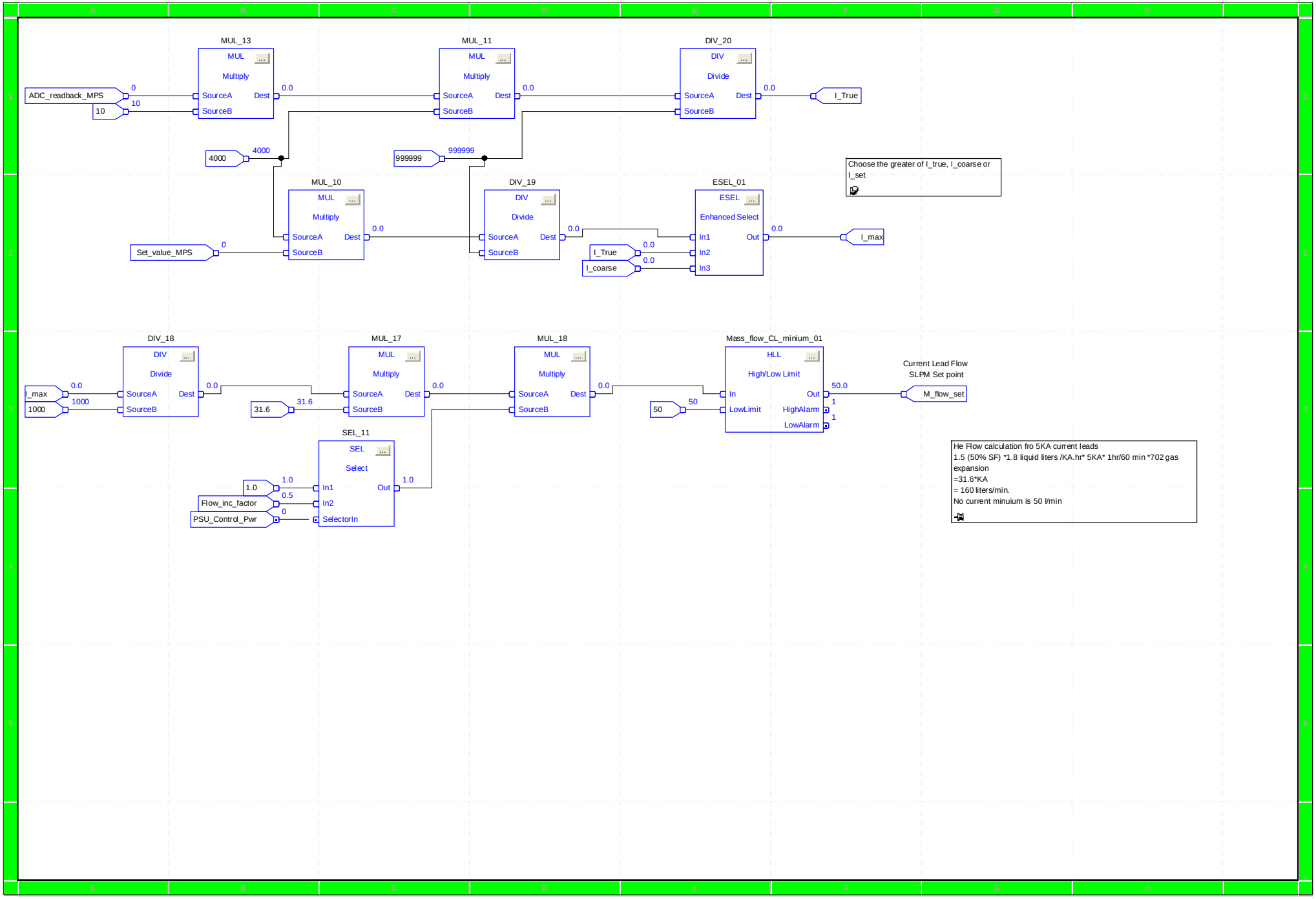

SEL_20
SEL
Select
V_close
-6.0
v3_auto
100.0
In1
In2
SelectorIn
Out
-6.0
SEL_22
SEL
Select
V_close
-6.0
He_CD_Temp_Warning
0
In1
In2
SelectorIn
Out
-6.0
HLL_23
HLL
High/Low Limit
v3_max
100.0
v3_min
-6.0
In
HighLimit
LowLimit
Out
-6.0
SEL_19
SEL
Select
In1
In2
SelectorIn
Out
34.8
v3_set
v3_manual
1
HLL_18
HLL
High/Low Limit
v3_man
34.8
v3_man_max
100.0
v3_man_min
-6.0
In
HighLimit
LowLimit
Out
34.8
Be sure to set correct tag #
1 Q1
2 Q2
3 Q3
4 dipole
5 bender
EQU_02
EQU
Equal
HX_Control
4
5
SourceA
SourceB
Dest
0
BAND_21
BAND
Boolean And
In1
In2
Out
0
BOR_83
BOR
Boolean Or
cd_HX_gas
0
wu_HX_gas
0
cd_pipe
0
In1
In2
In3
Out
0
There may be a limit on the warm return flow
PID_v3_max
PIDE
Enhanced PID
EnableIn
PV
SPProg
CVHLimit
PGain
IGain
AutotuneTag
CVEU
CV
SP
Auto
Manual
?
100.0
100.0
15.0
1
0
Warm He Ret Flow
CFI60DLP
6.803449
CFI60DLP_Limit
15.0
V_max
100.0
v3_max_P
3.0
v3_max_I
2.0
MUL_03
MUL
Multiply
SourceA
SourceB
Dest
10000.0
100.0
100.0
DIV_07
DIV
Divide
SourceA
SourceB
Dest
100.0
v3_auto
PID_v3_auto
PIDE
Enhanced PID
EnableIn
PV
SPProg
CVEUMax
CVEUMin
ControlAction
PGain
IGain
AutotuneTag
CVEU
CV
Auto
InstructFault
?
100.0
100.0
1
1
T_He_Delta
1.1000214
T_HX_set_Q1
122.7
v3_max
100.0
v3_min
-6.0
cd_HX_gas
0
v3_pipe_P
1.0
v3_pipe_I
1.0
POSP_v3
POSP
Position Proportional
EnableIn
SP
Position
OpenedFB
ClosedFB
CycleTime
OpenRate
CloseRate
MaxOnTime
MinOnTime
OpenOut
CloseOut
OpenTime
CloseTime
0
0
0.0
0.0
v3_set
34.8
V3_LVDT_true
34.789467
v3_error
0
Valve_Cycle_time
6.0
Valve_Rate
800.0
v_Max_On_Time
0.1
v_Min_On_Time
0.0005
PLC_control
0
v3_Open_And
BAND
Boolean And
In1
In2
Out
0
v3_open
v3_Close_And
BAND
Boolean And
In1
In2
Out
0
v3_close

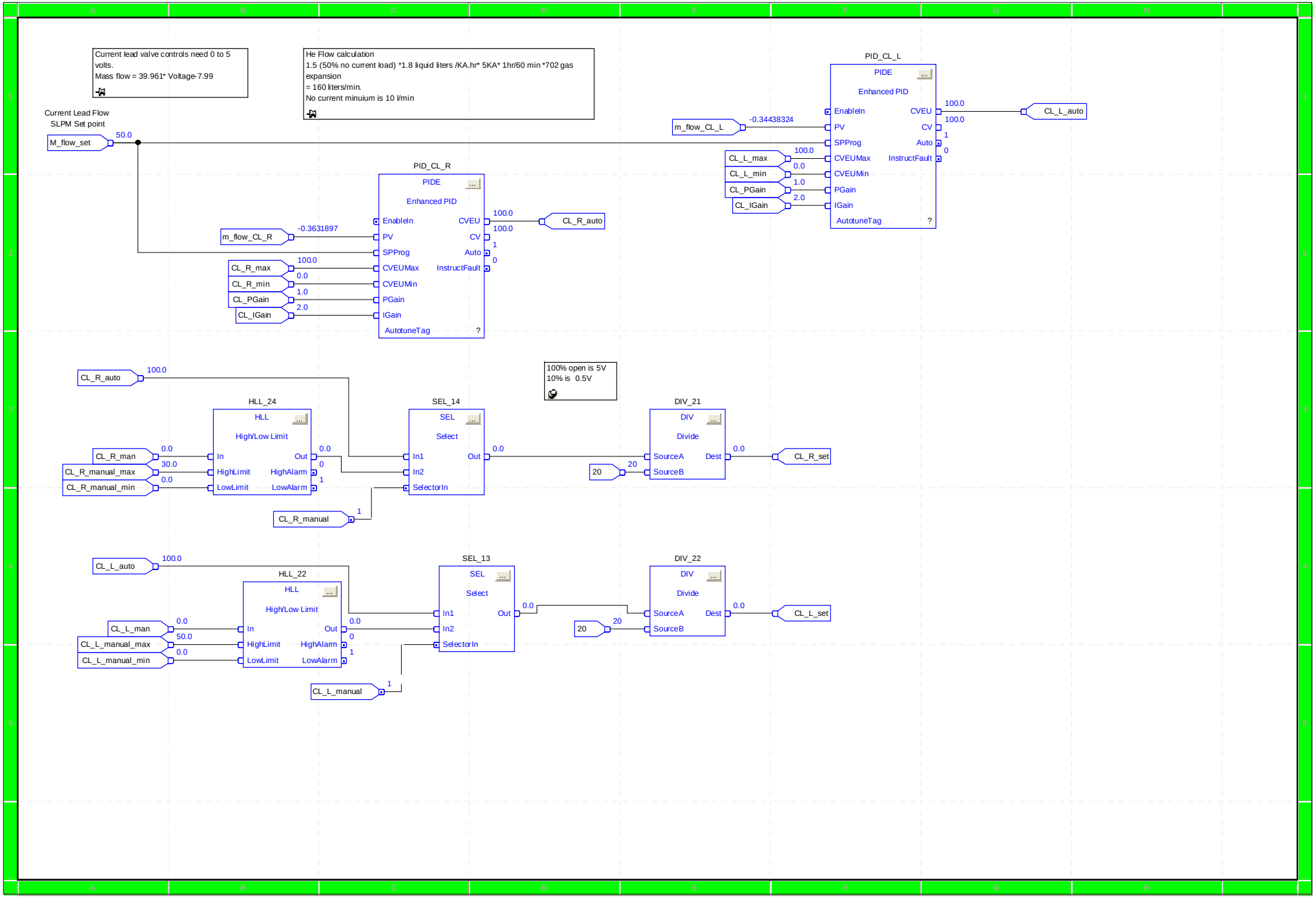

SEL_26
SEL
Select
V_close
-6.0
In1
Out
v4_auto
100.0
In2
cd_Bottom_Fill
0
SelectorIn
SEL_25
SEL
Select
-6.0
In1
Out
V_close
-6.0
In2
He_CD_Temp_Warning
0
SelectorIn
HLL_27
HLL
High/Low Limit
-6.0
In
Out
v4_max
100.0
HighLimit
v4_min
-6.0
LowLimit
SEL_24
SEL
Select
-6.0
In1
Out
34.1
v4_set
v4_manual
1
In2
SelectorIn
HLL_25
HLL
High/Low Limit
v4_man
34.1
In
Out
34.1
v4_man_max
100.0
HighLimit
v4_man_min
-6.0
LowLimit
Change over to bottom fill ocurrs at 80K
Keep bottom filling till there is liquid level
PID_v4_auto
PIDE
Enhanced PID
EnableIn
CVEU
100.0
h_LHe
0.0
PV
CV
100.0
1
S_Level
21.0
SPProg
Auto
0
v4_max
100.0
CVEUMax
InstructFault
v4_min
-6.0
CVEUMin
v4_pipe_P
1.0
PGain
v4_pipe_I
1.0
IGain
AutotuneTag
?
Do not exceed the He flow limit
PID_v4_max
PIDE
Enhanced PID
Hall C 4K supply
CFI6711C
0.5236227
EnableIn
CV
100.0
Hall_C_4K_flow_limit
17.5
PV
Auto
1
v4_max_P
1.0
SPProg
InstructFault
0
v4_max_I
1.0
PGain
IGain
AutotuneTag
?
MUL_08
MUL
Multiply
SourceA
Dest
10000.0
SourceB
100.0
100.0
DIV_08
DIV
Divide
SourceA
Dest
100.0
v4_auto
SourceB
POSP_v4
POSP
Position Proportional
EnableIn
OpenOut
0
34.1
v4_set
SP
CloseOut
0
34.08411
V4_LVDT_true
Position
OpenTime
0.0
v4_error
0
OpenedFB
CloseTime
0.0
6.0
Valve_Cycle_time
ClosedFB
800.0
Valve_Rate
CycleTime
OpenRate
CloseRate
0.1
v_Max_On_Time
MaxOnTime
0.0005
v_Min_On_Time
MinOnTime
v4_Open_And
BAND
Boolean And
In1
Out
0
v4_open
In2
PLC_control
0
v4_Close_And
BAND
Boolean And
In1
Out
0
v4_close
In2

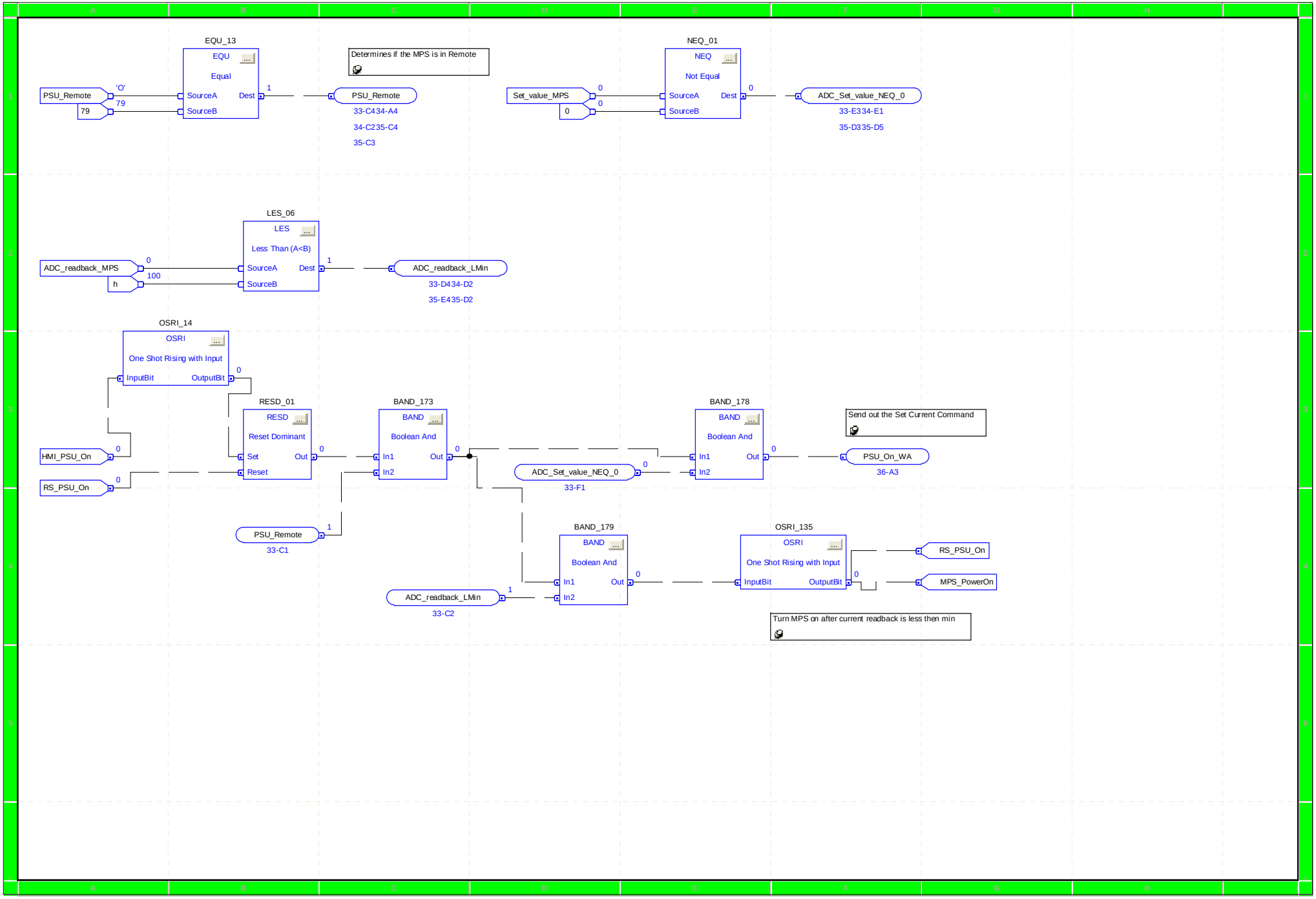

Valve is controlling on Liquid level
PID_v5_auto
PIDE
Enhanced PID
EnableIn
PV
SPProg
CVEUMax
CVEUMin
PGain
IGain
AutotuneTag
CVEU
CV
Auto
InstructFault
h_LHe
h_LHe_set
v5_max
v5_min
v5_P
v5_I
Hall C 4K supply
CFI6711C
Hall_C_4K_flow_limit
v5_max_P
v5_max_I
PID_v5_max
MUL_09
MUL
Multiply
SourceA
SourceB
Dest
DIV_09
DIV
Divide
v5_auto
HLL_03
HLL
High/Low Limit
In
HighLimit
LowLimit
Out
SEL_29
SEL
Select
In1
In2
SelectorIn
V_close
SEL_28
v5_set
If He Pressure gets high, shut off valve.
BNOT_18
BNOT
Boolean Not
p_He_interlock
cd_LHe_level
BAND_27
BAND
Boolean And
HLL_29
v5_man
v5_man_max
v5_man_min
v5_manual
POSP_v5
POSP
Position Proportional
SP
Position
OpenedFB
ClosedFB
CycleTime
OpenRate
CloseRate
MaxOnTime
MinOnTime
OpenOut
CloseOut
OpenTime
CloseTime
v5_set
V5_LVDT_true
v5_error
Valve_Cycle_time
Valve_Rate
v_Max_On_Time
v_Min_On_Time
v5_Open_And
v5_open
PLC_control
v5_Close_And
v5_close

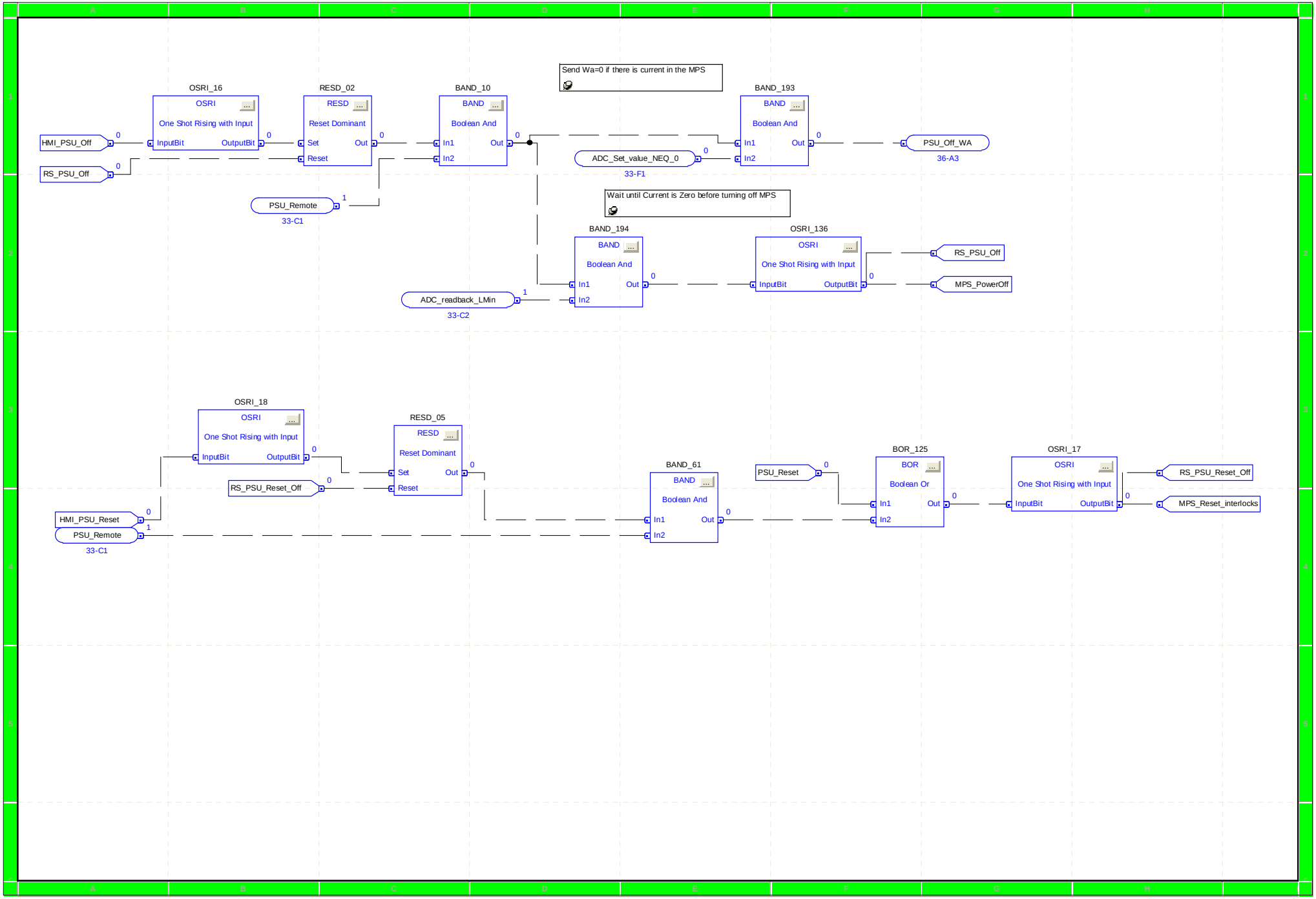

PID_v6_auto
PIDE
Enhanced PID
EnableIn
PV
SPProg
CVEUMax
CVEUMin
PGain
IGain
AutotuneTag
CVEU
CV
Auto
InstructFault
P_He
0.9981426
P_He_set
1.35
v6_max
100.0
v6_min
-6.0
v6_P
5.0
v6_I
3.0
v6_auto
v6_auto_HLL
HLL
High/Low Limit
In
HighLimit
LowLimit
Out
SEL_05
SEL
Select
In1
In2
SelectorIn
V_close
set_v6_close
SEL_31
v6_man_HLL
v6_man
v6_man_max
v6_man_min
v6_manual
v6_set
GRT_03
GRT
Greater Than (A>B)
SourceA
SourceB
Dest
vWR_LVDT_true
-25.000004
Transition_position
50.0
BAND_11
BAND
Boolean And
In3
Open_warm_return
BOR_34
BOR
Boolean Or
stand_by
cd_HX_gas
warm_up
stop_cooldown
cd_error
set_v6_close
BNOT_14
BNOT
Boolean Not
vWR_manual
BAND_12
cd_Bottom_Fill
BNOT_16
He_Temp_LT_5
20-C3
POSP_v6
POSP
Position Proportional
EnableIn
SP
Position
OpenedFB
ClosedFB
CycleTime
OpenRate
CloseRate
MaxOnTime
MinOnTime
OpenOut
CloseOut
OpenTime
CloseTime
v6_set
34.668785
V6_LVDT_true
v6_error
Valve_Cycle_time
6.0
Valve_Rate_v6
700.0
v_Max_On_Time
0.1
v_Min_On_Time
0.0005
v6_Open_And
v6_open
PLC_control
v6_Close_And
v6_close

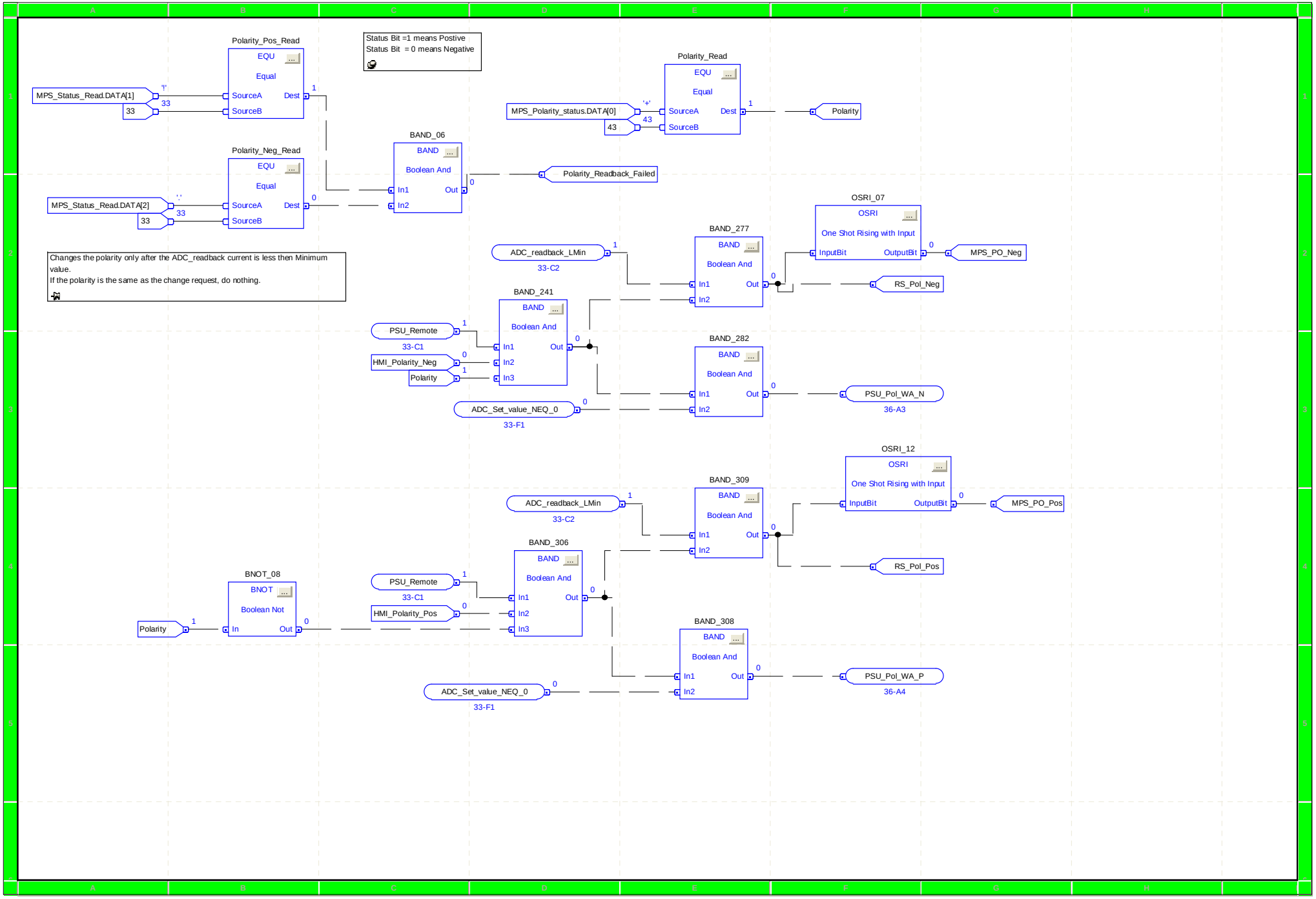

Open the warm return valve for the quads only when the average temp gets higher then T_Return_max
GRT_09
GRT
Greater Than (A>B)
T_He_av
72.7
T_Return_max
10.0
SourceA
SourceB
Dest
1
BAND_41
BAND
Boolean And
In1
In2
Out
0
Open_warm_return
cd_LHe_level
0
SEL_39
SEL
Select
0
100
In1
In2
SelectorIn
Out
100.0
HLL_39
HLL
High/Low Limit
vWR_max
100.0
vWR_min
0.0
In
HighLimit
LowLimit
Out
100.0
SEL_40
vWR_set
vWR_manual
0
HLL_38
vWR_man
50.0
vWR_man_max
100.0
vWR_man_min
0.0
50.0
Warm Return Valve should be open for these conditions
BOR_113
BOR
Boolean Or
WarmUp_Completed
stand_by
warm_up
cd_HX_gas
stop_cooldown
cd_error
In1
In2
In3
In4
In5
In6
Out
BOR_111
GRT_11
P_He
0.9981426
p_He_max
1.8
cd_Bottom_Fill
BNOT_17
BNOT
Boolean Not
He_Temp_LT_5
20-C3
BAND_13
POSP_vWR
POSP
Position Proportional
vWR_set
100.0
vWR_LVDT_true
-25.000004
vWR_error
Valve_Cycle_time
6.0
vWR_open_rate
400.0
vWR_close_rate
400.0
v_Max_On_Time
0.1
v_Min_On_Time
0.0005
EnableIn
SP
Position
OpenedFB
ClosedFB
CycleTime
OpenRate
CloseRate
MaxOnTime
MinOnTime
OpenOut
CloseOut
OpenTime
CloseTime
BAND_45
vWR_open
PLC_control
BAND_42
vWR_close

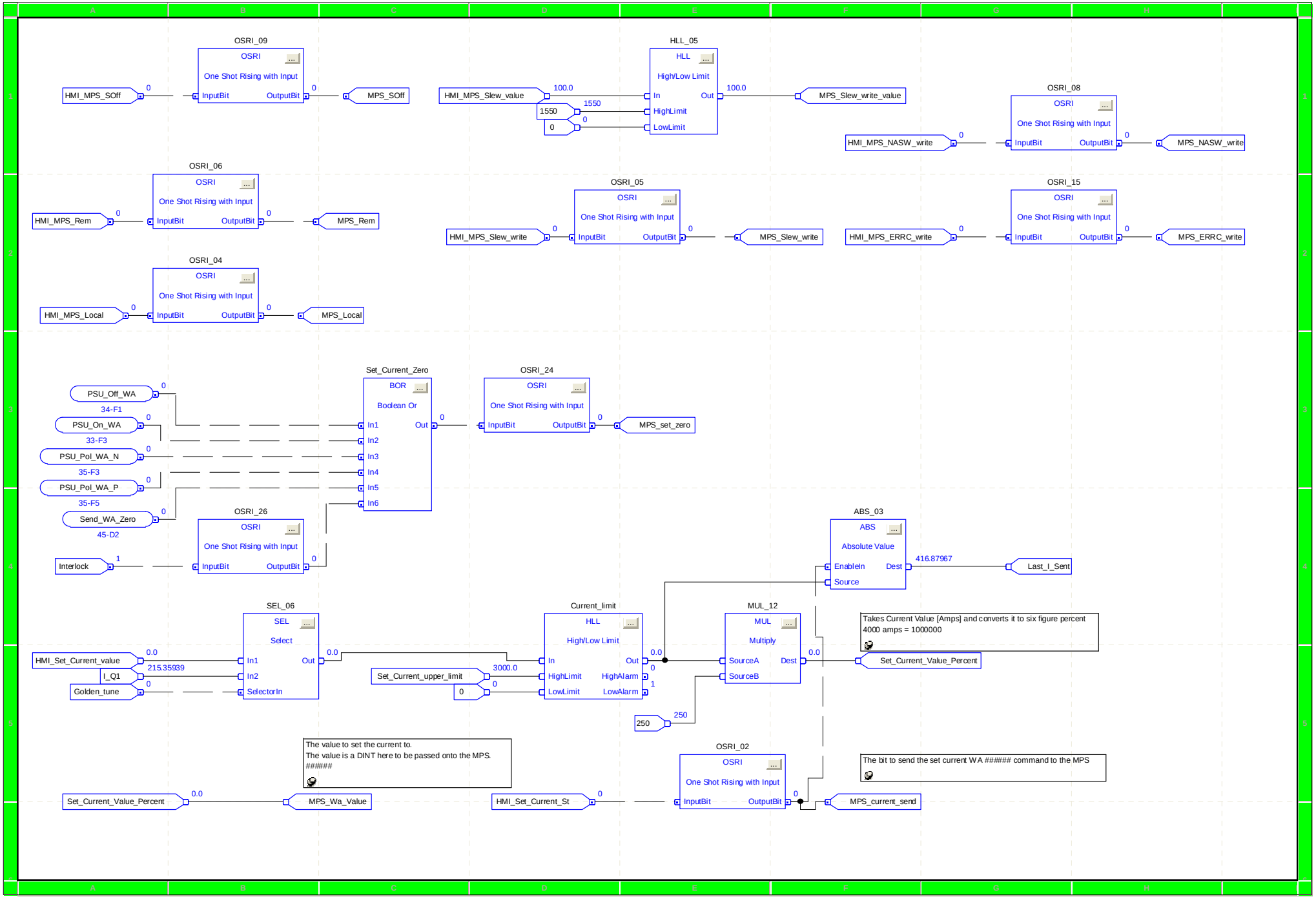

MUL_13
MUL
Multiply
ADC_readback_MPS
0
10
10
SourceA
SourceB
Dest
0.0
MUL_11
MUL
Multiply
SourceA
SourceB
Dest
0.0
DIV_20
DIV
Divide
SourceA
SourceB
Dest
0.0
I_True
4000
4000
999999
999999
Choose the greater of I_true, I_coarse or I_set
MUL_10
MUL
Multiply
SourceA
SourceB
Dest
0.0
Set_value_MPS
0
DIV_19
DIV
Divide
SourceA
SourceB
Dest
0.0
ESEL_01
ESEL
Enhanced Select
In1
In2
In3
Out
0.0
I_True
I_coarse
I_max
DIV_18
DIV
Divide
I_max
1000
SourceA
SourceB
Dest
0.0
MUL_17
MUL
Multiply
31.6
SourceA
SourceB
Dest
0.0
MUL_18
MUL
Multiply
SourceA
SourceB
Dest
0.0
Mass_flow_CL_minium_01
HLL
High/Low Limit
In
LowLimit
Out
HighAlarm
LowAlarm
50
50.0
1
1
Current Lead Flow SLPM Set point
M_flow_set
SEL_11
SEL
Select
1.0
Flow_inc_factor
PSU_Control_Pwr
0.5
0
In1
In2
SelectorIn
Out
1.0
He Flow calculation fro 5KA current leads
1.5 (50% SF) *1.8 liquid liters /KA.hr* 5KA* 1hr/60 min *702 gas expansion
=31.6*KA
= 160 liters/min.
No current minuium is 50 l/min


Current lead valve controls need 0 to 5 volts.
Mass flow = 39.961* Voltage-7.99
He Flow calculation
1.5 (50% no current load) *1.8 liquid liters /KA.hr* 5KA* 1hr/60 min *702 gas expansion
= 160 liters/min.
No current minuium is 10 l/min
Current Lead Flow SLPM Set point
M_flow_set
50.0
PID_CL_L
PIDE
Enhanced PID
m_flow_CL_L
-0.34438324
EnableIn
PV
SPProg
CVEUMax
CVEUMin
PGain
IGain
AutotuneTag
CVEU
CV
Auto
InstructFault
CL_L_max
CL_L_min
CL_PGain
CL_IGain
100.0
0.0
1.0
2.0
CL_L_auto
PID_CL_R
m_flow_CL_R
-0.3631897
CL_R_max
CL_R_min
CL_R_auto
100% open is 5V
10% is 0.5V
HLL_24
HLL
High/Low Limit
CL_R_man
CL_R_manual_max
CL_R_manual_min
In
HighLimit
LowLimit
Out
HighAlarm
LowAlarm
30.0
SEL_14
SEL
Select
In1
In2
SelectorIn
CL_R_manual
DIV_21
DIV
Divide
SourceA
SourceB
Dest
20
CL_R_set
HLL_22
CL_L_man
CL_L_manual_max
CL_L_manual_min
SEL_13
CL_L_manual
DIV_22
CL_L_set


EQU_13
EQU
Equal
PSU_Remote
'O'
79
79
SourceA
SourceB
Dest
1
Determines if the MPS is in Remote
PSU_Remote
33-C4 34-A4
34-C2 35-C4
35-C3
NEQ_01
NEQ
Not Equal
Set_value_MPS
0
0
SourceA
SourceB
Dest
0
ADC_Set_value_NEQ_0
33-E3 34-E1
35-D3 35-D5
LES_06
LES
Less Than (A<B)
ADC_readback_MPS
h
0
100
SourceA
SourceB
Dest
1
ADC_readback_LMin
33-D4 34-D2
35-E4 35-D2
OSRI_14
OSRI
One Shot Rising with Input
InputBit
OutputBit
0
RESD_01
RESD
Reset Dominant
HMI_PSU_On
RS_PSU_On
Set
Reset
Out
0
BAND_173
BAND
Boolean And
In1
In2
Out
0
PSU_Remote
33-C1
1
BAND_178
BAND
Boolean And
In1
In2
Out
0
ADC_Set_value_NEQ_0
33-F1
0
Send out the Set Current Command
PSU_On_WA
36-A3
BAND_179
BAND
Boolean And
In1
In2
Out
0
ADC_readback_LMin
33-C2
1
OSRI_135
OSRI
One Shot Rising with Input
InputBit
OutputBit
0
RS_PSU_On
MPS_PowerOn
Turn MPS on after current readback is less then min


Send Wa=0 if there is current in the MPS
OSRI_16
OSRI
One Shot Rising with Input
InputBit
OutputBit
RESD_02
RESD
Reset Dominant
Set
Reset
Out
BAND_10
BAND
Boolean And
In1
In2
BAND_193
HMI_PSU_Off
RS_PSU_Off
PSU_Remote
33-C1
ADC_Set_value_NEQ_0
33-F1
PSU_Off_WA
36-A3
Wait until Current is Zero before turning off MPS
BAND_194
OSRI_136
ADC_readback_LMin
33-C2
RS_PSU_Off
MPS_PowerOff
OSRI_18
RESD_05
RS_PSU_Reset_Off
BAND_61
PSU_Reset
BOR_125
BOR
Boolean Or
OSRI_17
HMI_PSU_Reset
PSU_Remote
33-C1
RS_PSU_Reset_Off
MPS_Reset_interlocks


Polarity_Pos_Read
EQU
Equal
MPS_Status_Read.DATA[1]
'!'
33
SourceA
SourceB
Dest
1
Status Bit =1 means Postive
Status Bit = 0 means Negative
Polarity_Read
MPS_Polarity_status.DATA[0]
'+'
43
Polarity
Polarity_Neg_Read
MPS_Status_Read.DATA[2]
'.'
BAND_06
BAND
Boolean And
In1
In2
Out
Polarity_Readback_Failed
Changes the polarity only after the ADC_readback current is less then Minimum value.
If the polarity is the same as the change request, do nothing.
OSRI_07
OSRI
One Shot Rising with Input
InputBit
OutputBit
MPS_PO_Neg
BAND_277
ADC_readback_LMin
33-C2
RS_Pol_Neg
BAND_241
PSU_Remote
33-C1
HMI_Polarity_Neg
BAND_282
PSU_Pol_WA_N
36-A3
ADC_Set_value_NEQ_0
33-F1
OSRI_12
MPS_PO_Pos
BAND_309
BAND_306
BNOT_08
BNOT
Boolean Not
In
HMI_Polarity_Pos
RS_Pol_Pos
BAND_308
PSU_Pol_WA_P
36-A4

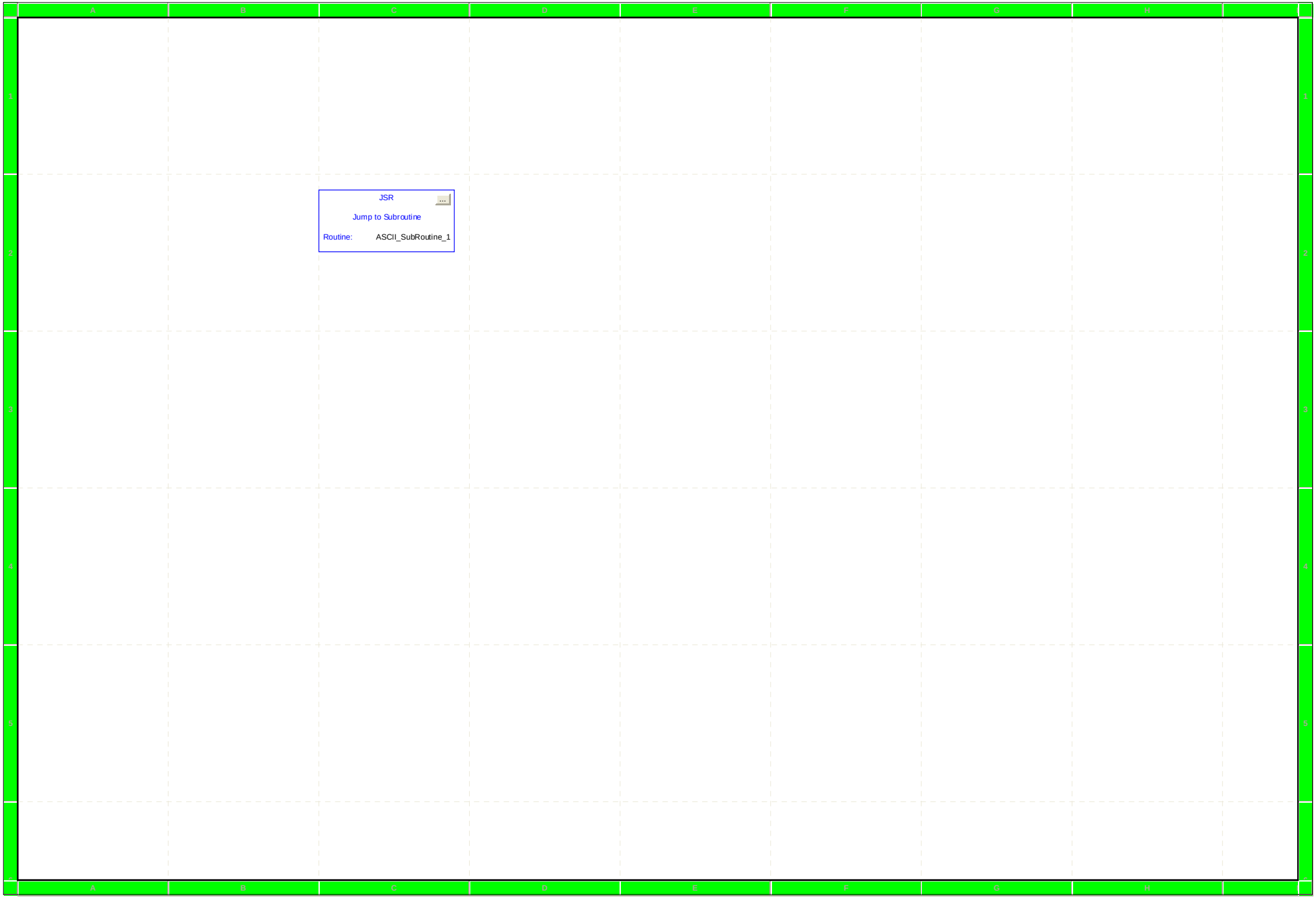

OSRI_09
OSRI
One Shot Rising with Input
HMI_MPS_SOff
InputBit
OutputBit
MPS_SOff
HLL_05
HLL
High/Low Limit
HMI_MPS_Slew_value
100.0
1550
0
In
HighLimit
LowLimit
Out
MPS_Slew_write_value
OSRI_08
HMI_MPS_NASW_write
MPS_NASW_write
OSRI_06
HMI_MPS_Rem
MPS_Rem
OSRI_05
HMI_MPS_Slew_write
MPS_Slew_write
OSRI_15
HMI_MPS_ERRC_write
MPS_ERRC_write
OSRI_04
HMI_MPS_Local
MPS_Local
Set_Current_Zero
BOR
Boolean Or
PSU_Off_WA
34-F1
PSU_On_WA
33-F3
PSU_Pol_WA_N
35-F3
PSU_Pol_WA_P
35-F5
Send_WA_Zero
45-D2
In1
In2
In3
In4
In5
In6
OSRI_24
MPS_set_zero
OSRI_26
Interlock
ABS_03
ABS
Absolute Value
EnableIn
Source
Dest
416.87967
Last_I_Sent
SEL_06
SEL
Select
HMI_Set_Current_value
215.35939
I_Q1
Golden_tune
In1
In2
SelectorIn
Current_limit
Set_Current_upper_limit
3000.0
HighAlarm
LowAlarm
MUL_12
MUL
Multiply
SourceA
SourceB
250
Takes Current Value [Amps] and converts it to six figure percent
4000 amps = 1000000
Set_Current_Value_Percent
The value to set the current to.
The value is a DINT here to be passed onto the MPS.
######
MPS_Wa_Value
OSRI_02
HMI_Set_Current_St
The bit to send the set current WA ###### command to the MPS
MPS_current_send

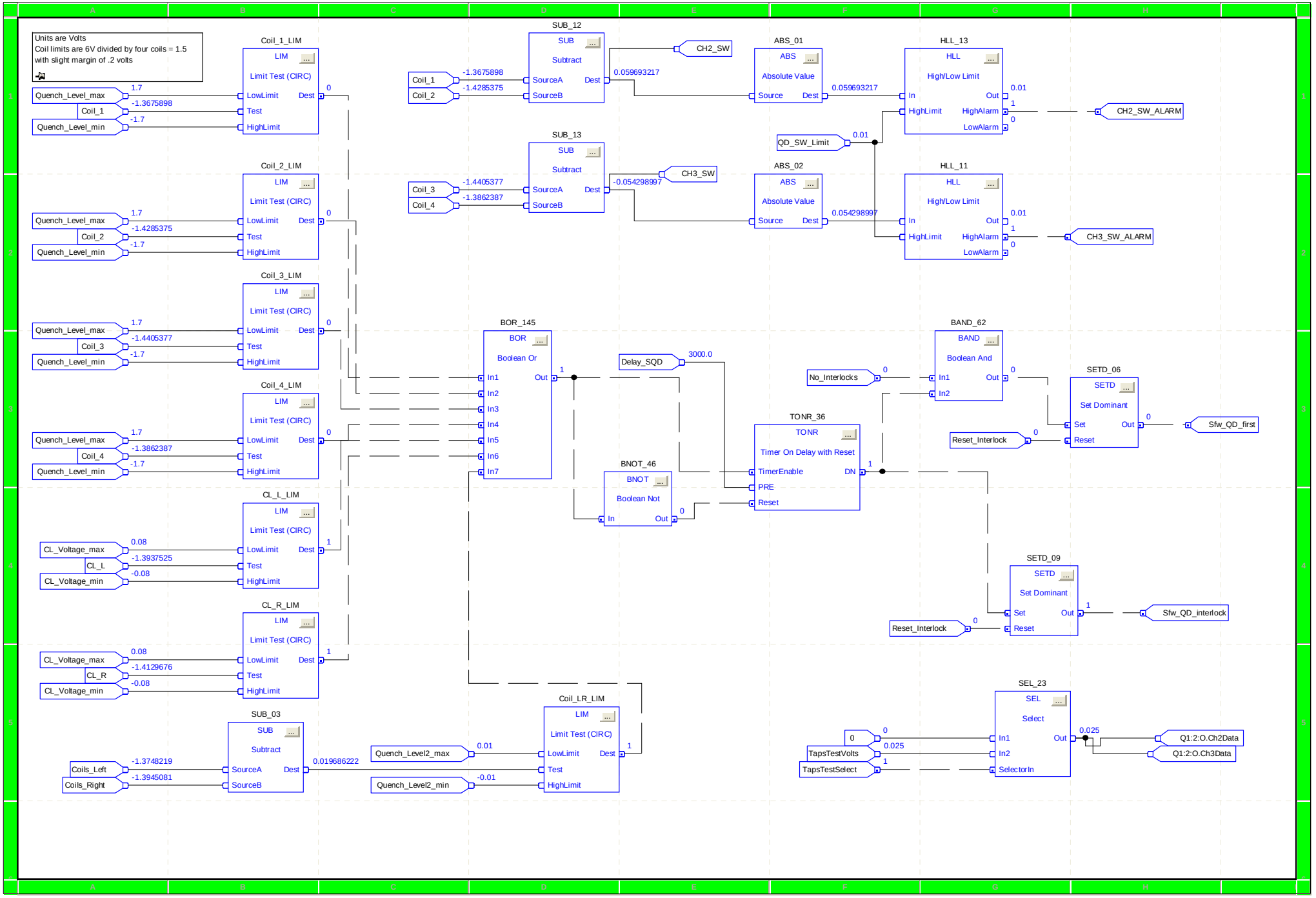
First jump to MPS command subroutine before jumping to ASCII Subroutine

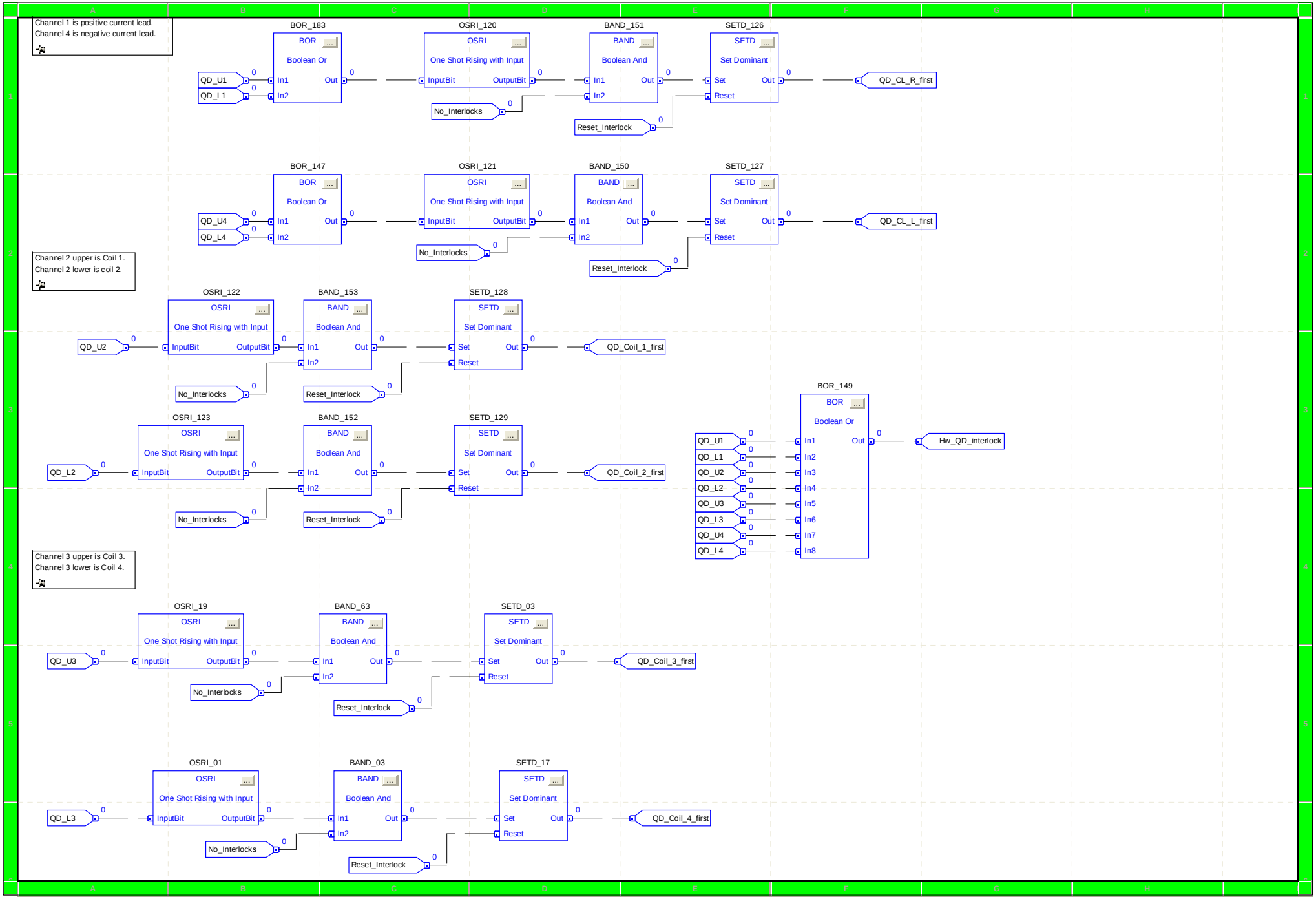
JSR

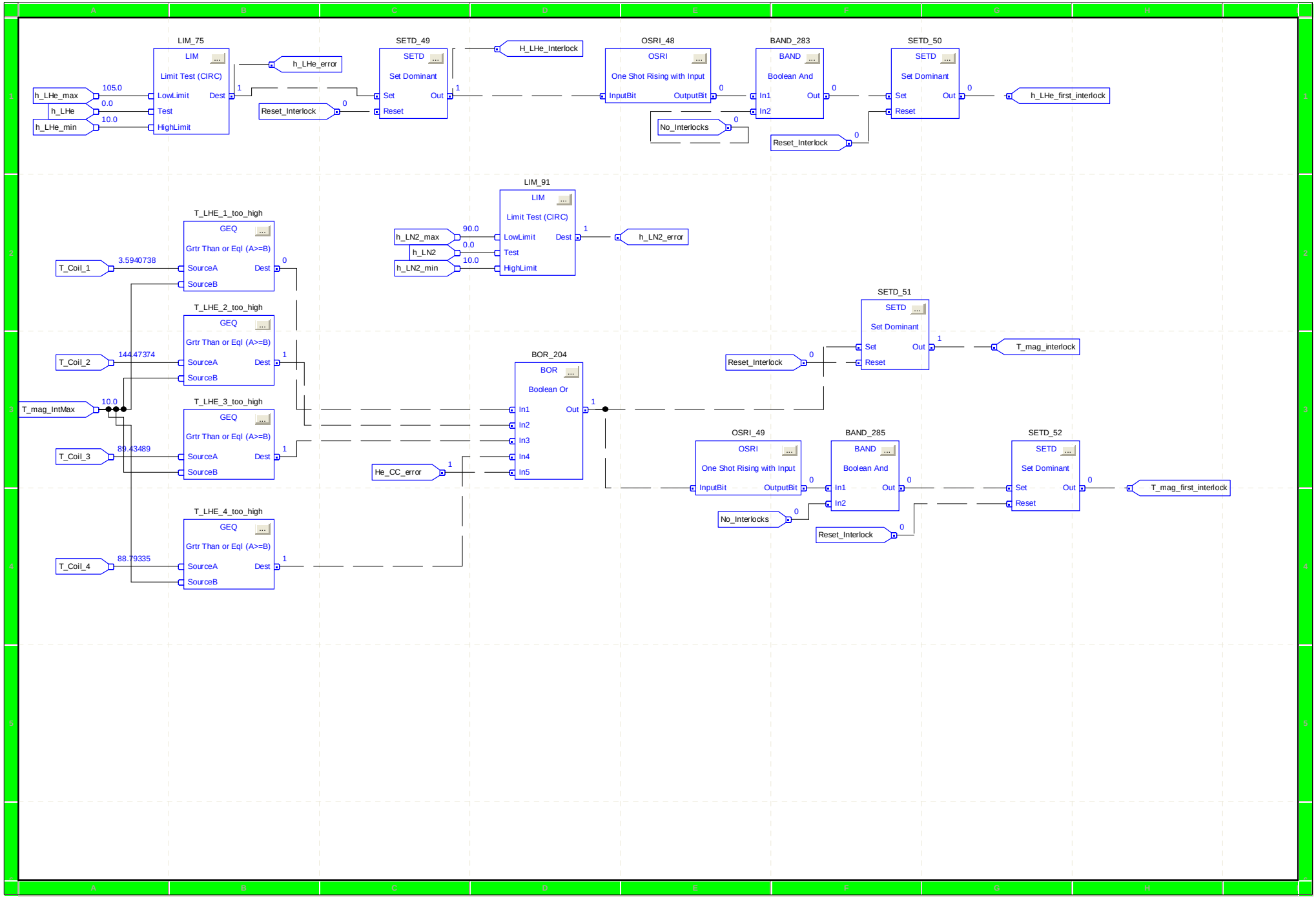
Jump to Subroutine

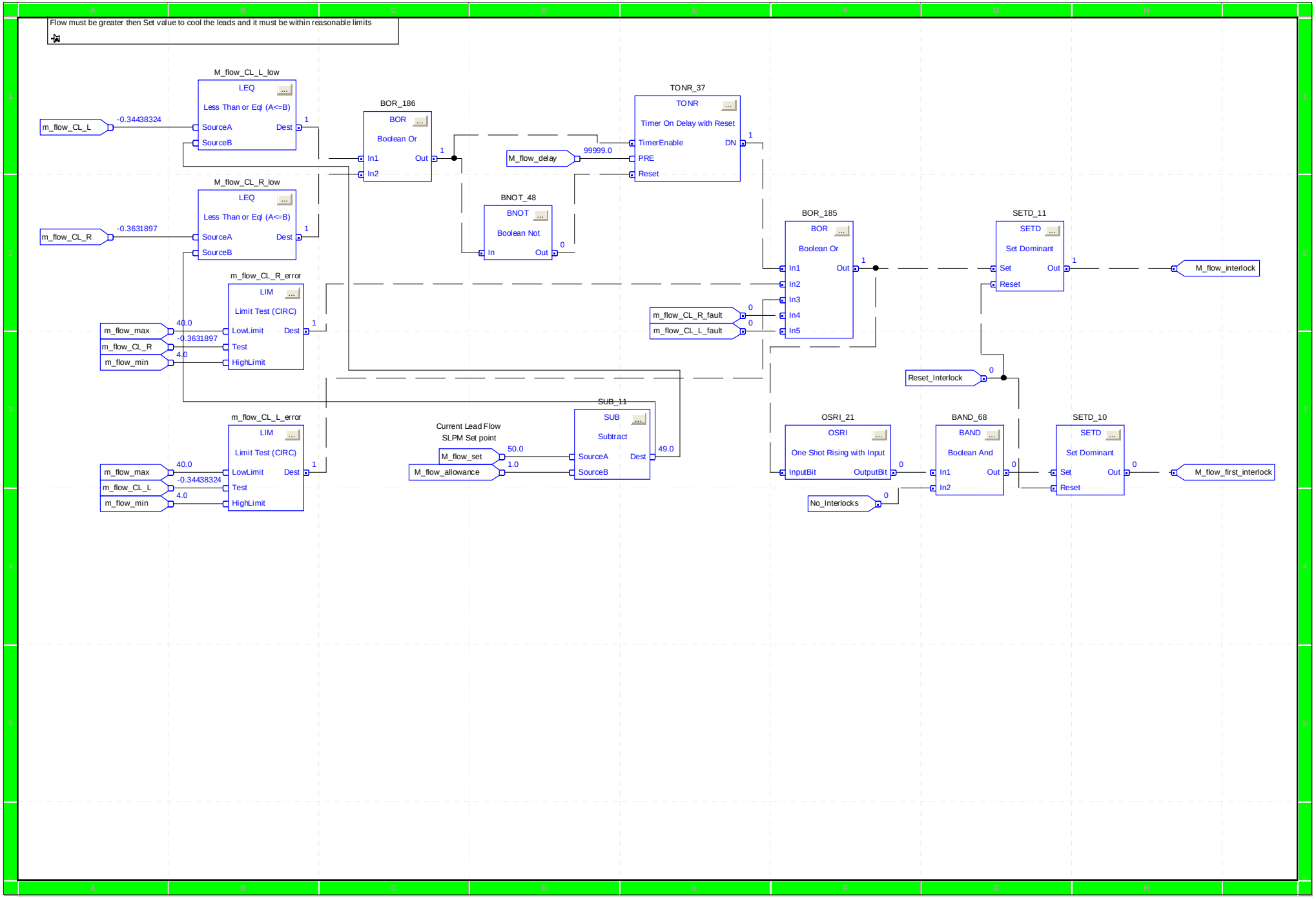
Routine: MPS_Commands

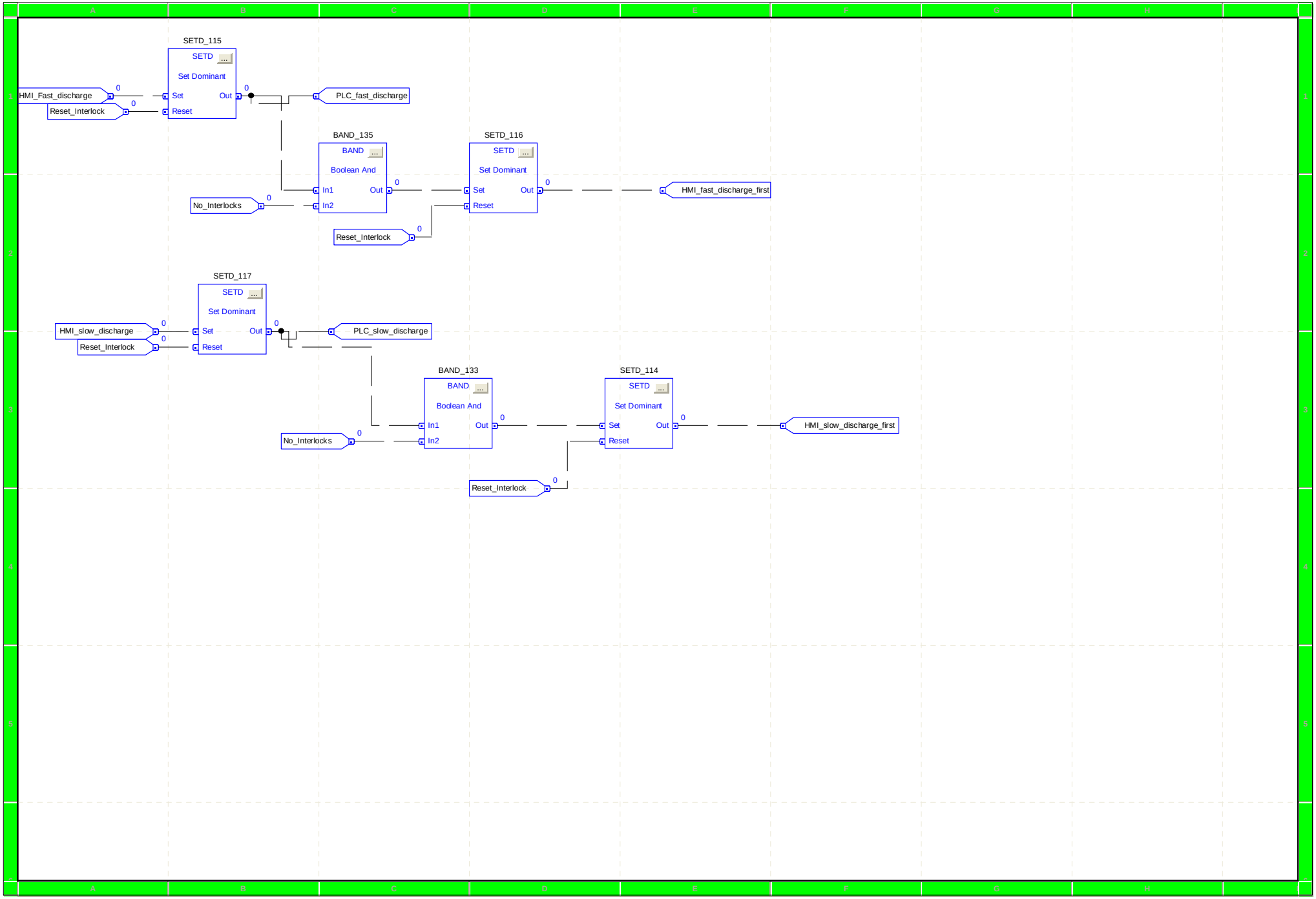

JSR
Jump to Subroutine
Routine:
ASCII_SubRoutine_1

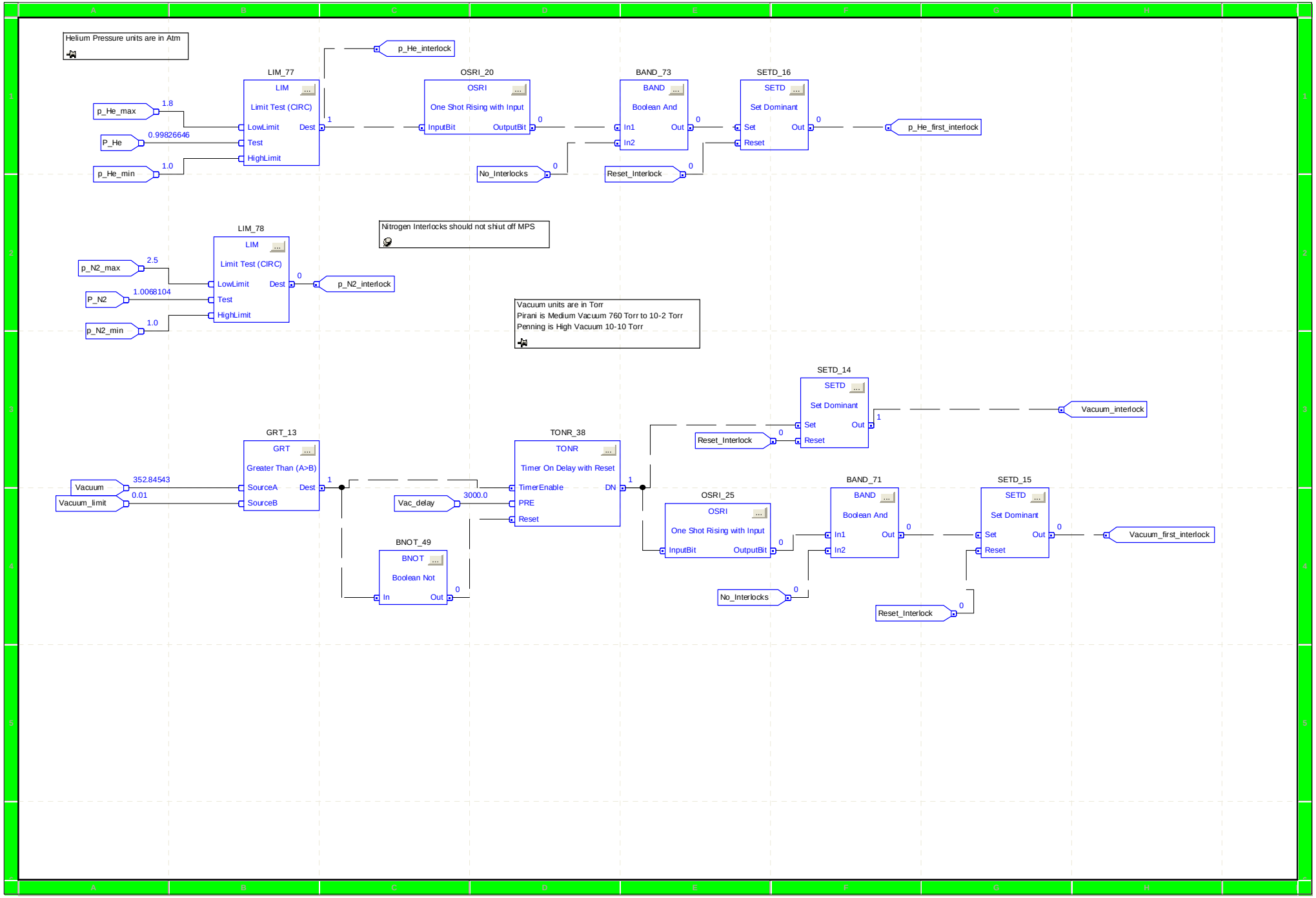

Units are Volts
Coil limits are 6V divided by four coils = 1.5 with slight margin of .2 volts
Coil_1_LIM
LIM
Limit Test (CIRC)
Quench_Level_max
Coil_1
Quench_Level_min
LowLimit
Test
HighLimit
Dest
SUB_12
SUB
Subtract
SourceA
SourceB
CH2_SW
ABS_01
ABS
Absolute Value
Source
HLL_13
HLL
High/Low Limit
In
HighLimit
Out
HighAlarm
LowAlarm
CH2_SW_ALARM
QD_SW_Limit
SUB_13
CH3_SW
ABS_02
HLL_11
CH3_SW_ALARM
Coil_2_LIM
Coil_3_LIM
Coil_4_LIM
BOR_145
BOR
Boolean Or
In1
In2
In3
In4
In5
In6
In7
Delay_SQD
3000.0
BNOT_46
BNOT
Boolean Not
TONR_36
TONR
Timer On Delay with Reset
TimerEnable
DN
PRE
Reset
BAND_62
BAND
Boolean And
No_Interlocks
SETD_06
SETD
Set Dominant
Set
Reset_Interlock
Sfw_QD_first
SETD_09
Sfw_QD_interlock
CL_L_LIM
CL_Voltage_max
CL_L
CL_Voltage_min
CL_R_LIM
CL_R
SUB_03
Coils_Left
Coils_Right
Coil_LR_LIM
Quench_Level2_max
Quench_Level2_min
SEL_23
SEL
Select
In1
In2
SelectorIn
TapsTestVolts
TapsTestSelect
Q1:2:O.Ch2Data
Q1:2:O.Ch3Data

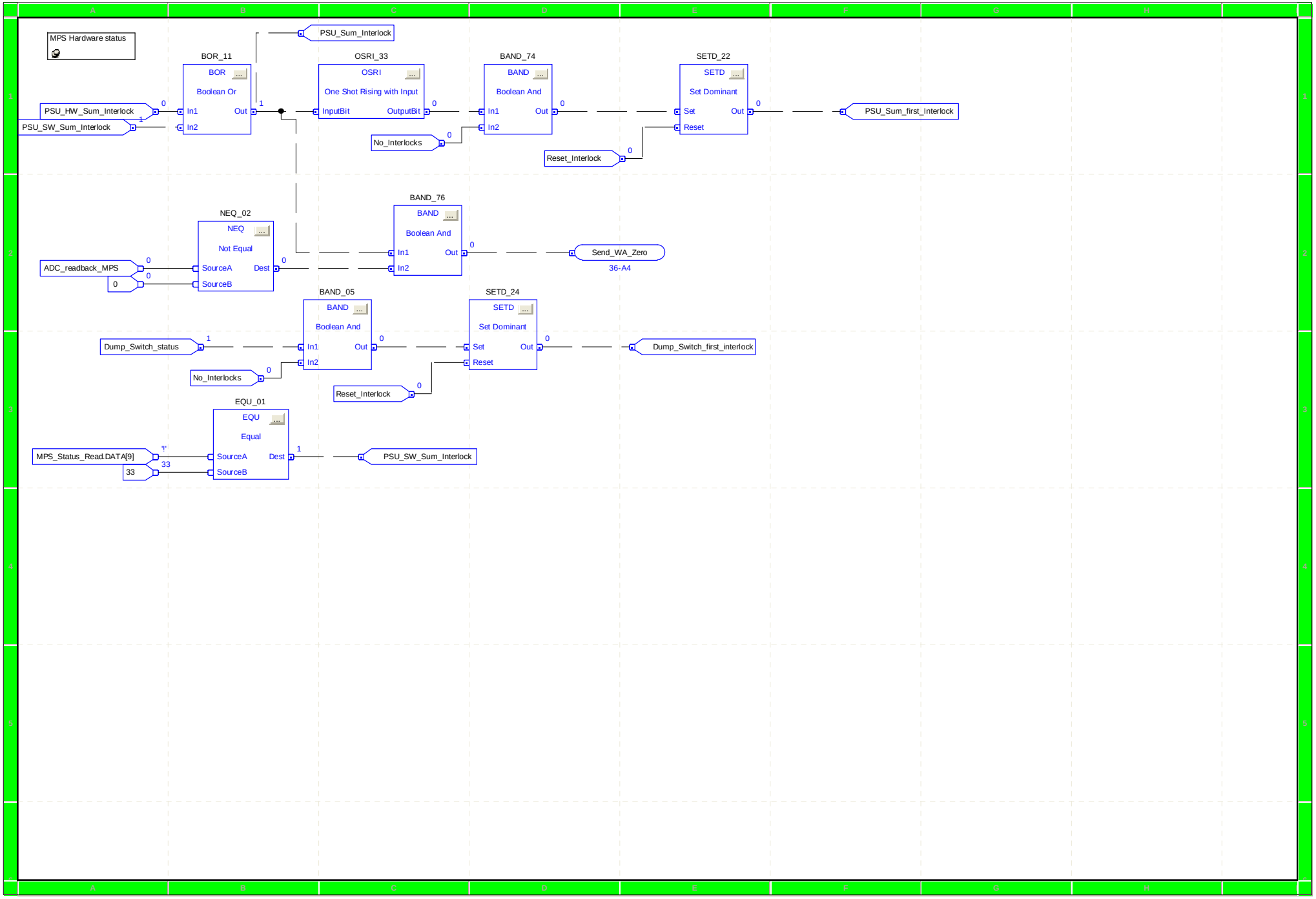

Channel 1 is positive current lead.
Channel 4 is negative current lead.
BOR_183
BOR
Boolean Or
QD_U1
QD_L1
In1
In2
Out
OSRI_120
OSRI
One Shot Rising with Input
InputBit
OutputBit
No_Interlocks
BAND_151
BAND
Boolean And
Reset_Interlock
SETD_126
SETD
Set Dominant
Set
Reset
QD_CL_R_first
BOR_147
QD_U4
QD_L4
OSRI_121
BAND_150
SETD_127
QD_CL_L_first
Channel 2 upper is Coil 1.
Channel 2 lower is coil 2.
OSRI_122
QD_U2
BAND_153
SETD_128
QD_Coil_1_first
OSRI_123
QD_L2
BAND_152
SETD_129
QD_Coil_2_first
BOR_149
QD_U1
QD_L1
QD_U2
QD_L2
QD_U3
QD_L3
QD_U4
QD_L4
In3
In4
In5
In6
In7
In8
Hw_QD_interlock
Channel 3 upper is Coil 3.
Channel 3 lower is Coil 4.
OSRI_19
QD_U3
BAND_63
SETD_03
QD_Coil_3_first
OSRI_01
QD_L3
BAND_03
SETD_17
QD_Coil_4_first

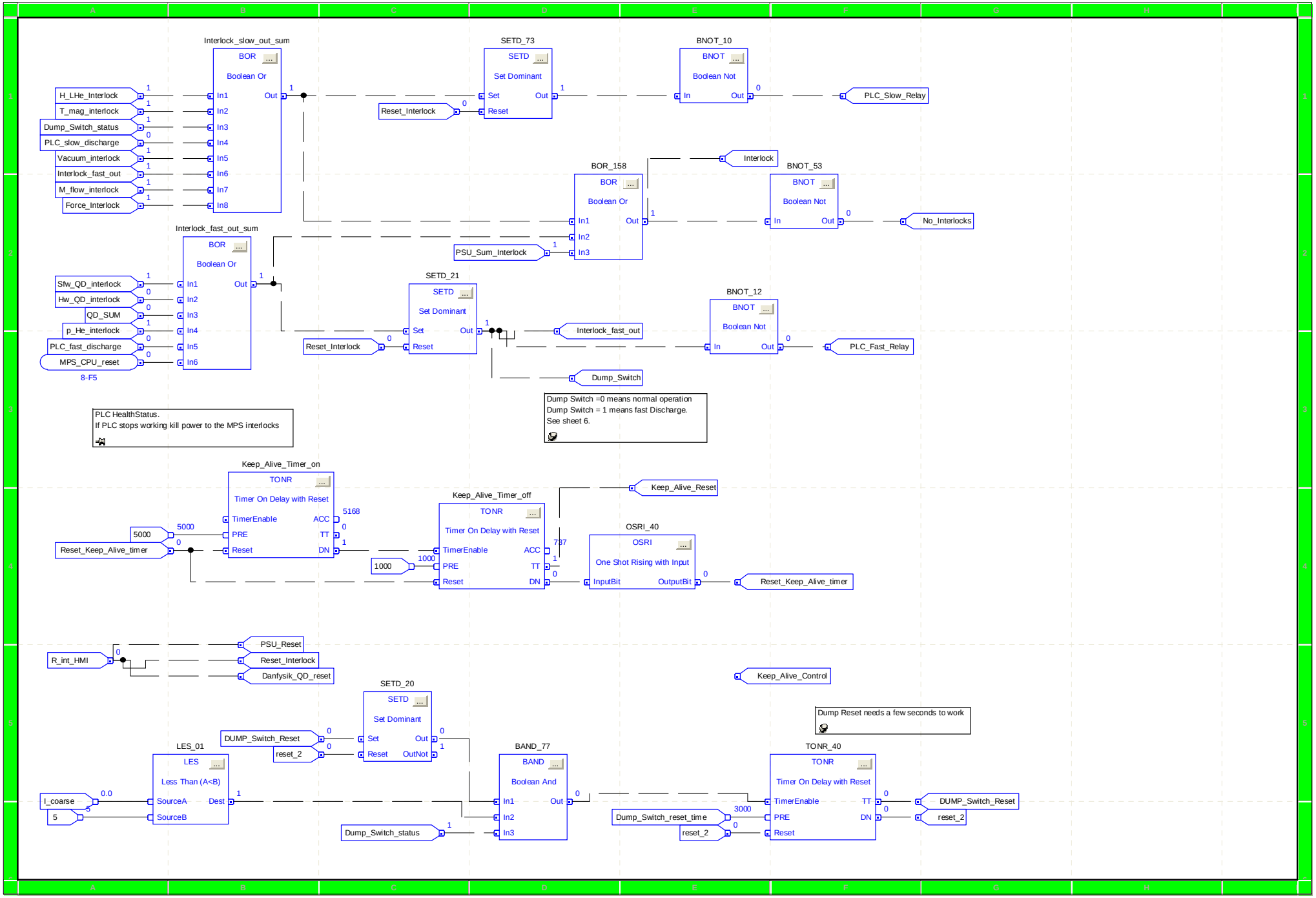

LIM_75
LIM
Limit Test (CIRC)
h_LHe_max
105.0
h_LHe
0.0
h_LHe_min
10.0
LowLimit
Test
HighLimit
Dest
1
h_LHe_error
Reset_Interlock
0
SETD_49
SETD
Set Dominant
Set
Reset
Out
1
H_LHe_Interlock
OSRI_48
OSRI
One Shot Rising with Input
InputBit
OutputBit
0
BAND_283
BAND
Boolean And
In1
In2
Out
0
No_Interlocks
0
Reset_Interlock
0
SETD_50
SETD
Set Dominant
Set
Reset
Out
0
h_LHe_first_interlock
LIM_91
LIM
Limit Test (CIRC)
h_LN2_max
90.0
h_LN2
0.0
h_LN2_min
10.0
LowLimit
Test
HighLimit
Dest
1
h_LN2_error
T_LHE_1_too_high
GEQ
Grtr Than or Eql (A>=B)
T_Coil_1
3.5940738
SourceA
SourceB
Dest
0
T_LHE_2_too_high
GEQ
Grtr Than or Eql (A>=B)
T_Coil_2
144.47374
SourceA
SourceB
Dest
1
T_mag_IntMax
10.0
T_LHE_3_too_high
GEQ
Grtr Than or Eql (A>=B)
T_Coil_3
89.43489
SourceA
SourceB
Dest
1
T_LHE_4_too_high
GEQ
Grtr Than or Eql (A>=B)
T_Coil_4
88.79335
SourceA
SourceB
Dest
1
He_CC_error
1
BOR_204
BOR
Boolean Or
In1
In2
In3
In4
In5
Out
1
SETD_51
SETD
Set Dominant
Set
Reset
Out
1
Reset_Interlock
0
T_mag_interlock
OSRI_49
OSRI
One Shot Rising with Input
InputBit
OutputBit
0
BAND_285
BAND
Boolean And
In1
In2
Out
0
No_Interlocks
0
Reset_Interlock
0
SETD_52
SETD
Set Dominant
Set
Reset
Out
0
T_mag_first_interlock


Flow must be greater then Set value to cool the leads and it must be within reasonable limits
M_flow_CL_L_low
LEQ
Less Than or Eql (A<=B)
m_flow_CL_L
-0.34438324
SourceA
SourceB
Dest
1
BOR_186
BOR
Boolean Or
In1
In2
Out
TONR_37
TONR
Timer On Delay with Reset
TimerEnable
PRE
Reset
DN
M_flow_delay
99999.0
M_flow_CL_R_low
m_flow_CL_R
-0.3631897
BNOT_48
BNOT
Boolean Not
In
BOR_185
In3
In4
In5
m_flow_CL_R_fault
m_flow_CL_L_fault
0
SETD_11
SETD
Set Dominant
Set
M_flow_interlock
m_flow_CL_R_error
LIM
Limit Test (CIRC)
LowLimit
Test
HighLimit
m_flow_max
40.0
m_flow_min
4.0
Reset_Interlock
SUB_11
SUB
Subtract
SourceA
SourceB
Current Lead Flow
SLPM Set point
M_flow_set
50.0
M_flow_allowance
1.0
49.0
m_flow_CL_L_error
OSRI_21
OSRI
One Shot Rising with Input
InputBit
OutputBit
No_Interlocks
BAND_68
BAND
Boolean And
SETD_10
M_flow_first_interlock

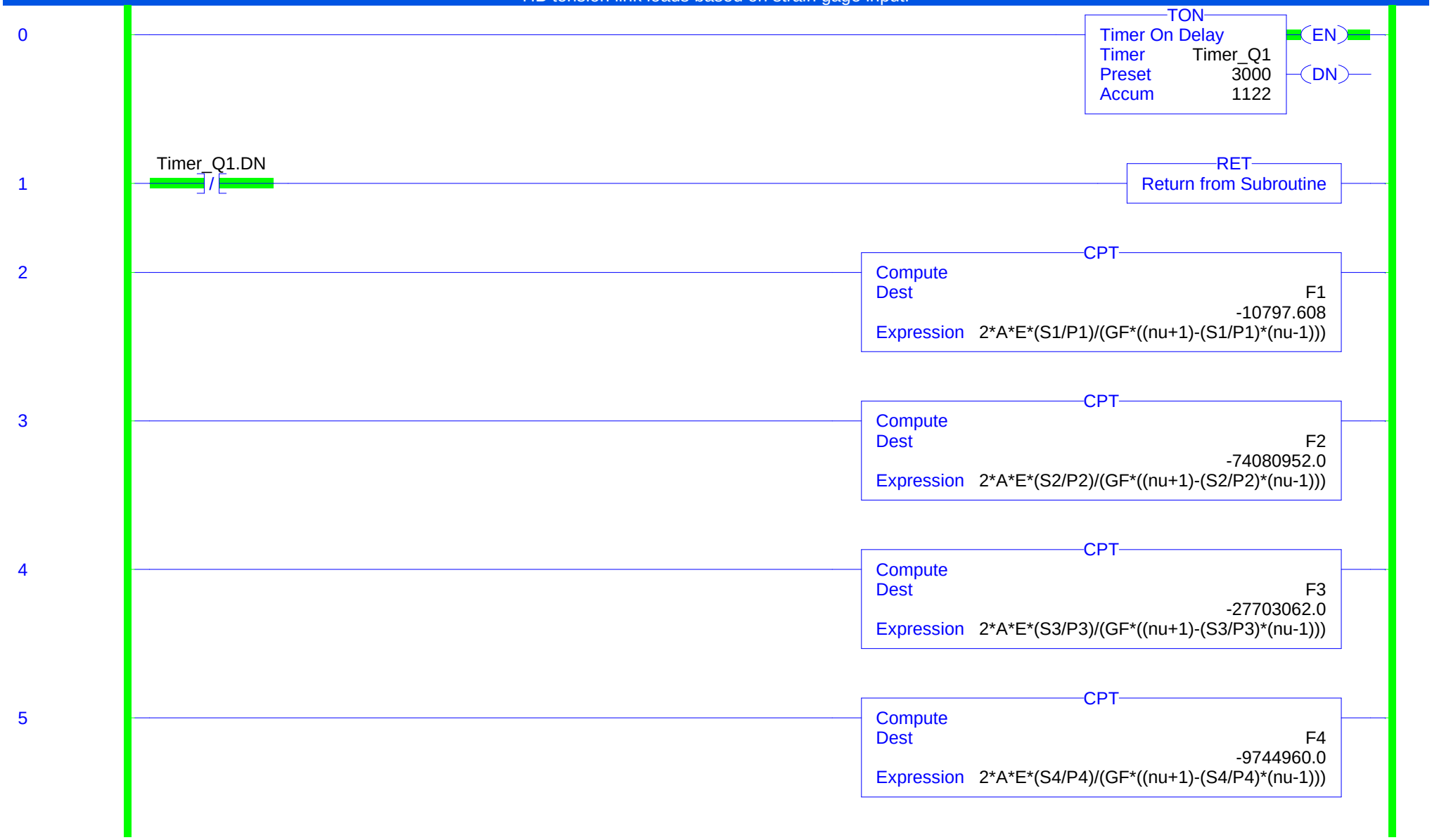

SETD_115
SETD
Set Dominant
HMI_Fast_discharge
Reset_Interlock
Set
Reset
Out
PLC_fast_discharge
BAND_135
BAND
Boolean And
In1
In2
No_Interlocks
SETD_116
HMI_fast_discharge_first
SETD_117
HMI_slow_discharge
PLC_slow_discharge
BAND_133
SETD_114
HMI_slow_discharge_first


Helium Pressure units are in Atm
p_He_interlock
LIM_77
LIM
Limit Test (CIRC)
p_He_max
1.8
P_He
0.99826646
p_He_min
1.0
LowLimit
Test
HighLimit
Dest
1
OSRI_20
OSRI
One Shot Rising with Input
InputBit
OutputBit
0
No_Interlocks
BAND_73
BAND
Boolean And
In1
In2
Out
Reset_Interlock
SETD_16
SETD
Set Dominant
Set
Reset
p_He_first_interlock
Nitrogen Interlocks should not shiut off MPS
LIM_78
p_N2_max
2.5
P_N2
1.0068104
p_N2_min
1.0
p_N2_interlock
Vacuum units are in Torr
Pirani is Medium Vacuum 760 Torr to 10-2 Torr
Penning is High Vacuum 10-10 Torr
SETD_14
Vacuum_interlock
GRT_13
GRT
Greater Than (A>B)
Vacuum
352.84543
Vacuum_limit
0.01
SourceA
SourceB
TONR_38
TONR
Timer On Delay with Reset
Vac_delay
3000.0
TimerEnable
PRE
Reset
DN
BNOT_49
BNOT
Boolean Not
OSRI_25
BAND_71
SETD_15
Vacuum_first_interlock


MPS Hardware status
PSU_Sum_Interlock
BOR_11
BOR
Boolean Or
PSU_HW_Sum_Interlock
PSU_SW_Sum_Interlock
In1
In2
Out
OSRI_33
OSRI
One Shot Rising with Input
InputBit
OutputBit
No_Interlocks
BAND_74
BAND
Boolean And
Reset_Interlock
SETD_22
SETD
Set Dominant
Set
Reset
PSU_Sum_first_Interlock
NEQ_02
NEQ
Not Equal
ADC_readback_MPS
SourceA
SourceB
Dest
BAND_76
Send_WA_Zero
36-A4
BAND_05
Dump_Switch_status
SETD_24
Dump_Switch_first_interlock
EQU_01
EQU
Equal
MPS_Status_Read.DATA[9]
33


Interlock_slow_out_sum
BOR
Boolean Or
H_LHe_Interlock
T_mag_interlock
Dump_Switch_status
PLC_slow_discharge
Vacuum_interlock
Interlock_fast_out
M_flow_interlock
Force_Interlock
In1
In2
In3
In4
In5
In6
In7
In8
Out
SETD_73
SETD
Set Dominant
Reset_Interlock
Set
Reset
BNOT_10
BNOT
Boolean Not
In
PLC_Slow_Relay
BOR_158
Interlock
BNOT_53
No_Interlocks
PSU_Sum_Interlock
Interlock_fast_out_sum
Sfw_QD_interlock
Hw_QD_interlock
QD_SUM
p_He_interlock
PLC_fast_discharge
MPS_CPU_reset
8-F5
SETD_21
BNOT_12
PLC_Fast_Relay
Dump_Switch
PLC HealthStatus.
If PLC stops working kill power to the MPS interlocks
Dump Switch =0 means normal operation
Dump Switch = 1 means fast Discharge.
See sheet 6.
Keep_Alive_Timer_on
TONR
Timer On Delay with Reset
TimerEnable
PRE
Reset
ACC
TT
DN
5000
5168
Reset_Keep_Alive_timer
Keep_Alive_Timer_off
1000
737
Keep_Alive_Reset
OSRI_40
OSRI
One Shot Rising with Input
InputBit
OutputBit
R_int_HMI
PSU_Reset
Danfysik_QD_reset
SETD_20
DUMP_Switch_Reset
reset_2
OutNot
Keep_Alive_Control
Dump Reset needs a few seconds to work
LES_01
LES
Less Than (A<B)
I_coarse
SourceA
SourceB
BAND_77
BAND
Boolean And
Dump_Switch_status
TONR_40
Dump_Switch_reset_time
3000

HB tension link loads based on strain gage input.



HB tension link loads based on strain gage input.

6

CPT
Compute
Dest F5
-6653915.0
Expression 2*A*E*(S5/P5)/(GF*((nu+1)-(S5/P5)*(nu-1)))

7

CPT
Compute
Dest F6
-6431121.5
Expression 2*A*E*(S6/P6)/(GF*((nu+1)-(S6/P6)*(nu-1)))

8

CPT
Compute
Dest F7
-6747135.5
Expression 2*A*E*(S7/P7)/(GF*((nu+1)-((S7/P7)*(nu-1))))

9

CPT
Compute
Dest F8
-4664120.0
Expression 2*A*E*(S8/P8)/(GF*((nu+1)-(S8/P8)*(nu-1)))

10

Timer_Q1
RES

(End)

Calculates the temperature of carbon ceramic resistors and temperature diodes.

0

TON
Timer On Delay
Timer Timer_Q1
Preset 3000
Accum 0
EN
DN

Use timer to give signals a chance to settle down before returning vlaued to main Program

1

Timer_Q1.DN
/

RET
Return from Subroutine

Equations to calculate temperature of a carbon ceramic resistor.
Curve fit is inverse polynomial with coefficients determined from manufacturer data.
Coefficients are different for each resistor.
T = K1(1000/R)^2+K2(1000/R)^4+K3(1000/R)^5

Q1 Coil_1 18283 / 18284 Redundant

2

T_Coil_1_Redundant
<Boolean_10[0]>
/

CPT
Compute
Dest T_Coil_1
3.5940738
Expression 57.025590*((1000/R1)**2)-184.857271*((1000/R1)**4)+287.727875*((1000/R1)**5)

T_Coil_1_Redundant
<Boolean_10[0]>

CPT
Compute
Dest T_Coil_1
3.5940738
Expression 48.161349*((1000/R1)**2)-161.443288*((1000/R1)**4)+446.754424*((1000/R1)**5)

Calculates the temperature of carbon ceramic resistors and temperature diodes.

Q1 Coil_2 18282 / 18282 Redundant

3

T_Coil_2_Redundant
<Boolean_10[1]>

CPT
Compute
Dest T_Coil_2
144.47374
Expression 55.619436*((1000/R2)**2)-132.784645*((1000/R2)**4)+370.172069*((1000/R2)**5)

T_Coil_2_Redundant
<Boolean_10[1]>

CPT
Compute
Dest T_Coil_2
144.47374
Expression 53.024216*((1000/R2)**2)-147.352761*((1000/R2)**4)+408.846588*((1000/R2)**5)

Q1 Coil_3 18285 / 18286 Redundant

4

T_Coil_3_Redundant
<Boolean_10[2]>

CPT
Compute
Dest T_Coil_3
89.43489
Expression 50.797087*((1000/R3)**2)-65.580504*((1000/R3)**4)+184.360367*((1000/R3)**5)

T_Coil_3_Redundant
<Boolean_10[2]>

CPT
Compute
Dest T_Coil_3
89.43489
Expression 47.990100*((1000/R3)**2)-94.660245*((1000/R3)**4)+279.464923*((1000/R3)**5)

Calculates the temperature of carbon ceramic resistors and temperature diodes.

Q1 Coil_4 18287 / 18288 Redundant

5

T_Coil_4_Redundant
<Boolean_10[3]>
/

CPT
Compute
Dest T_Coil_4
88.79335
Expression 53.047857*((1000/R4)**2)-85.374611*((1000/R4)**4)+202.458881*((1000/R4)**5)

T_Coil_4_Redundant
<Boolean_10[3]>

CPT
Compute
Dest T_Coil_4
88.79335
Expression 56.174255*((1000/R4)**2)-55.583156*((1000/R4)**4)+336.931870*((1000/R4)**5)

Q1 CL_POS_cold 16911 / 16912 Redundant

6

T_He_LCLC_Redundant
<Boolean_10[4]>
/

CPT
Compute
Dest T_He_LCLC
159.5624
Expression 58.334457*((1000/R5)**2)-144.532843*((1000/R5)**4)+411.198502*((1000/R5)**5)

T_He_LCLC_Redundant
<Boolean_10[4]>

CPT
Compute
Dest T_He_LCLC
159.5624
Expression 54.486520*((1000/R5)**2)-214.234124*((1000/R5)**4)+491.425447*((1000/R5)**5)

Calculates the temperature of carbon ceramic resistors and temperature diodes.

Q1 CL-Neg-cold 16913 / 16914 Redundant

7

T_He_RCLC_Redundant
<Boolean_10[5]>
/

CPT
Compute
Dest T_He_RCLC
121.71732
Expression 52.951413*((1000/R6)**2)-122.548711*((1000/R6)**4)+314.748788*((1000/R6)**5)

T_He_RCLC_Redundant
<Boolean_10[5]>

CPT
Compute
Dest T_He_RCLC
121.71732
Expression 55.371569*((1000/R6)**2)-181.257514*((1000/R6)**4)+464.708572*((1000/R6)**5)

Q1 CC-_He reservoir bottom 2164 / 2098 Redundant
Cryo_can

8

T_He_Resv_Redundant
<Boolean_10[6]>
/

CPT
Compute
Dest T_He_Resv
101.576324
Expression 54.451037*((1000/R7)**2)-187.848644*((1000/R7)**4)+345.902153*((1000/R7)**5)

T_He_Resv_Redundant
<Boolean_10[6]>

CPT
Compute
Dest T_He_Resv
101.576324
Expression 52.57577*((1000/R7)**2)-183.24250*((1000/R7)**4)+311.01978*((1000/R7)**5)

Calculates the temperature of carbon ceramic resistors and temperature diodes.

Equations to calculate the temperature of a Lakeshore DT-470 diode.
Standard Curve 10 is the combination of four Chebychev polynomials. Range 1 2-12K; range 2 12-25K; range 3 25-100K; range 4 100-475K.
Coefficients for each range are given as part of Lakeshore's Standard Curve 10.

T(x) = Sum[i=0 to i=n](a[i]*t[i](x))
x = ((Z-ZL)-(ZU-Z))/(ZU-ZL)
t[i+1](x) = 2*x*t[i](x)-t[i-1](x)

x is a normalized variable; Z is measured voltage, ZU is the upper limit for the fit range, ZL is the lower limit for the fit range. ZU and ZL given with Standard Curve 10.
t is the recursion relationship for the Chebychev polynomial fit. t[0](x) = 1 and t[1](x) = x. DT470_t is a one dimensional array containing the calculated values of t.
DT470_a is a two dimensional array containing the Chebychev coefficients a for each range.

The routine determines which range is appropriate for each sensor, then calculates DT470_x, DT470_t[0], and DT470_t[1], then call a 'FOR' loop sub-routine to determine the remaining values of DT570_t and carry out the summation. The resulting DT470_Temp is assigned to the temperature tag corresponding to the input voltage.

Q1 Diode-1

9

GEQ
Grtr Than or Eql (A>=B)
Source A V1
3.12805176e-004
Source B 1.36809

CPT
Compute
Dest Curve10_Range
3
Expression 0

CPT
Compute
Dest DT470_x
-1.1734353
Expression (V1-1.32412-(1.69812-V1))/(1.69812-1.32412)

CPT
Compute
Dest DT470_t[0]
1.0
Expression 1

CPT
Compute
Dest DT470_t[1]
-1.1734353
Expression DT470_x

CPT
Compute
Dest DT470_Temp
528.2262
Expression DT470_a[Curve10_Range,0]*DT470_t[0]+(DT470_a[Curve10_Range,1]*DT470_t[1])

FOR

CPT

Calculates the temperature of carbon ceramic resistors and temperature diodes.

FOR
For
Routine Name Diode_FOR_Loop
Index loop_counter
12
Initial Value 2
Terminal Value 11
Step Size 1

CPT
Compute
Dest T_He_CD
527.96704
Expression DT470_Temp

10

GEQ
Grtr Than or Eql (A>=B)
Source A V1
3.12805176e-004
Source B 1.12463

LES
Less Than (A<B)
Source A V1
3.12805176e-004
Source B 1.36809

CPT
Compute
Dest Curve10_Range
3
Expression 1

CPT
Compute
Dest DT470_x
-1.1734353
Expression (V1-1.11732-(1.42013-V1))/(1.42013-1.11732)

CPT
Compute
Dest DT470_t[0]
1.0
Expression 1

CPT
Compute
Dest DT470_t[1]
-1.1734353
Expression DT470_x

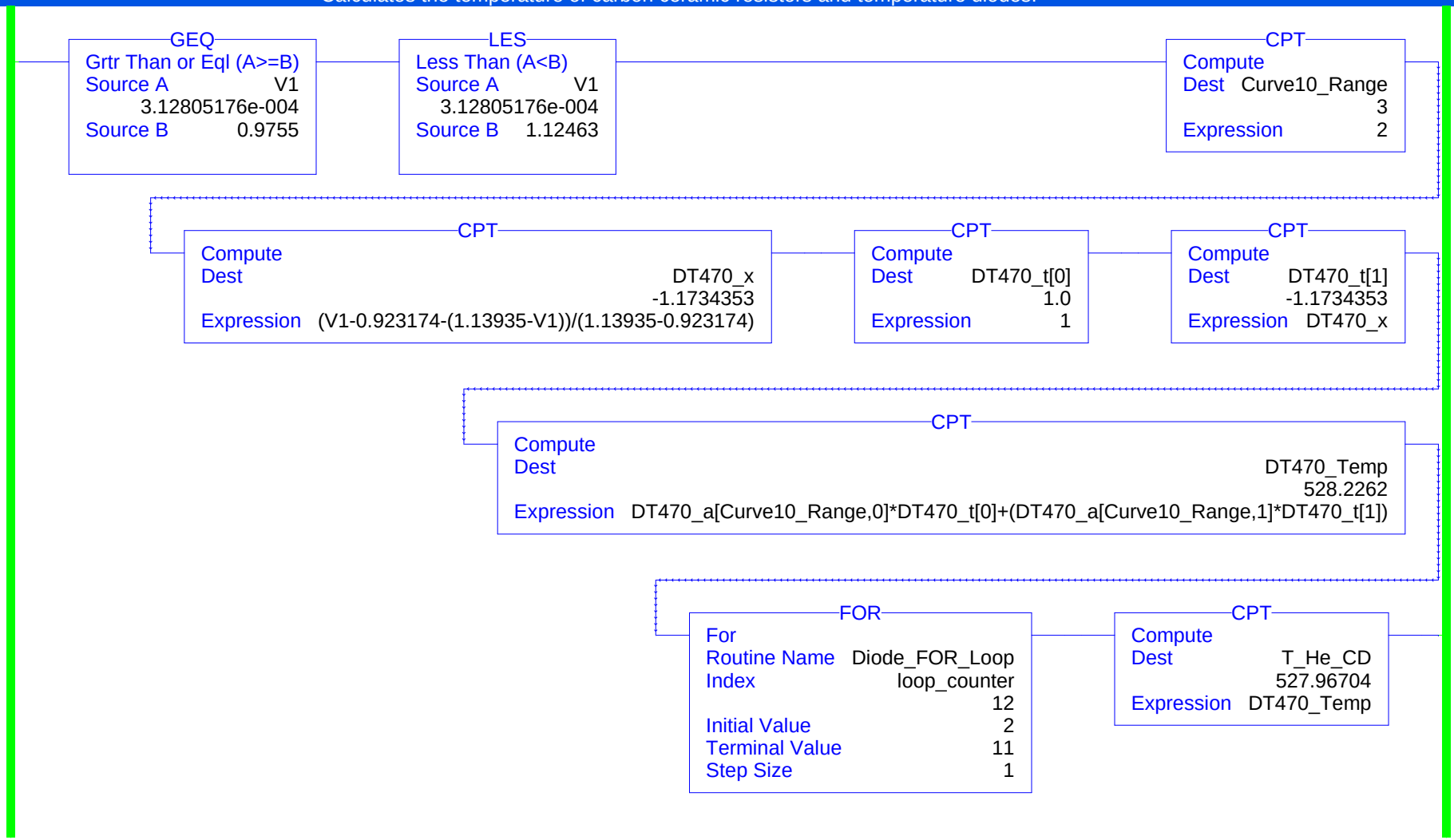
CPT
Compute
Dest DT470_Temp
528.2262
Expression DT470_a[Curve10_Range,0]*DT470_t[0]+(DT470_a[Curve10_Range,1]*DT470_t[1])

FOR
For
Routine Name Diode_FOR_Loop
Index loop_counter
12
Initial Value 2
Terminal Value 11
Step Size 1

CPT
Compute
Dest T_He_CD
527.96704
Expression DT470_Temp

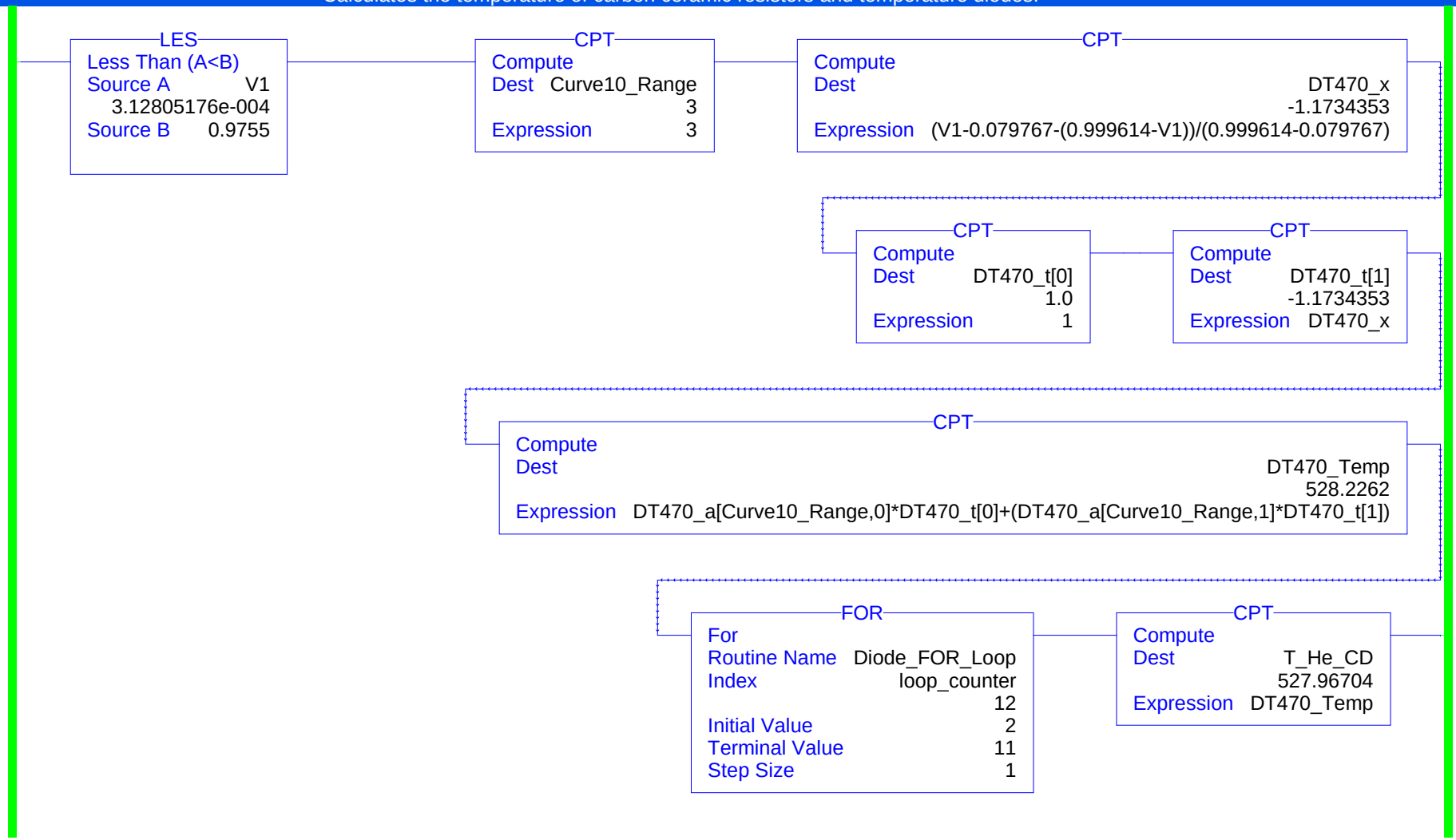
Calculates the temperature of carbon ceramic resistors and temperature diodes.

11



Calculates the temperature of carbon ceramic resistors and temperature diodes.

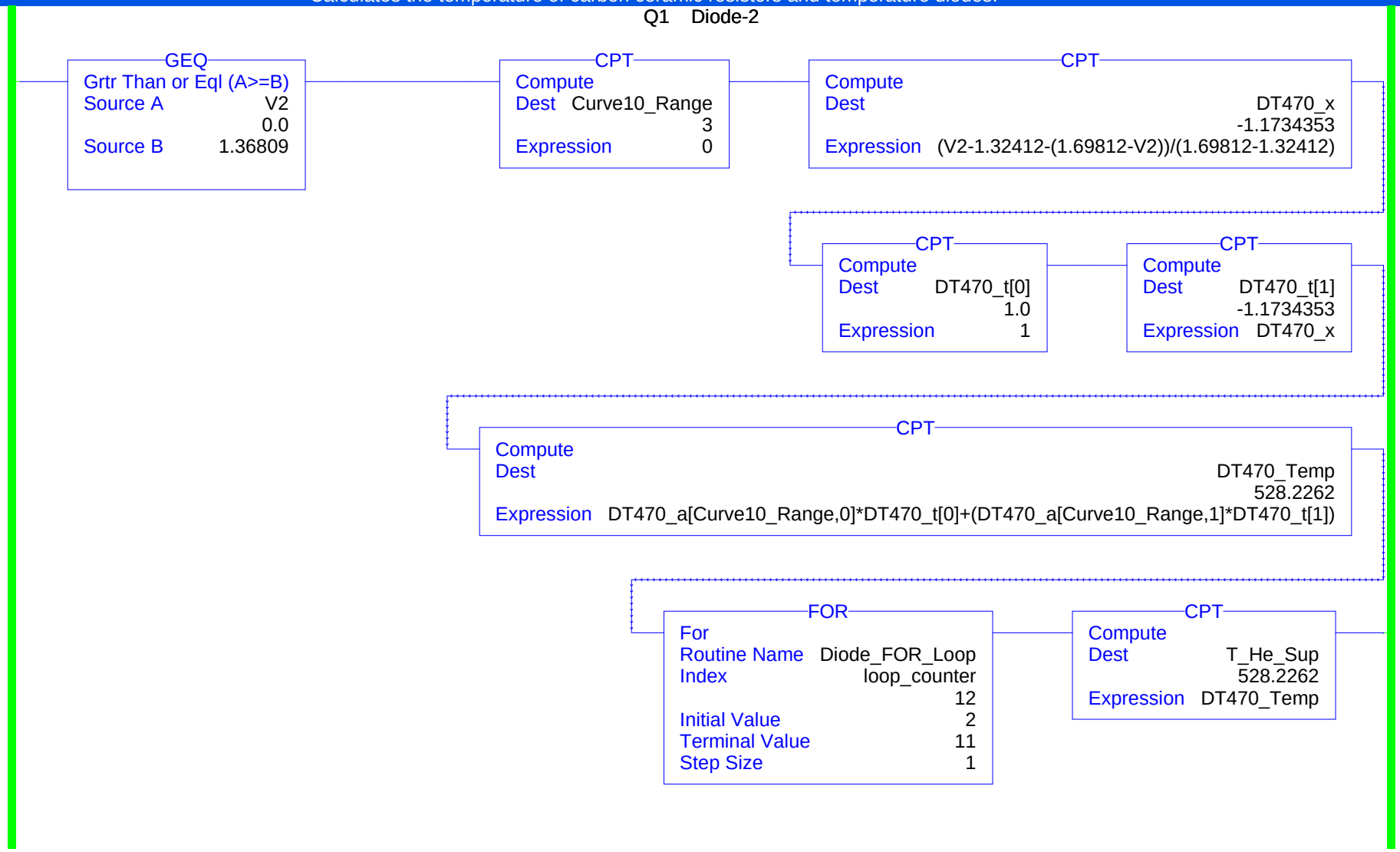
12



Calculates the temperature of carbon ceramic resistors and temperature diodes.

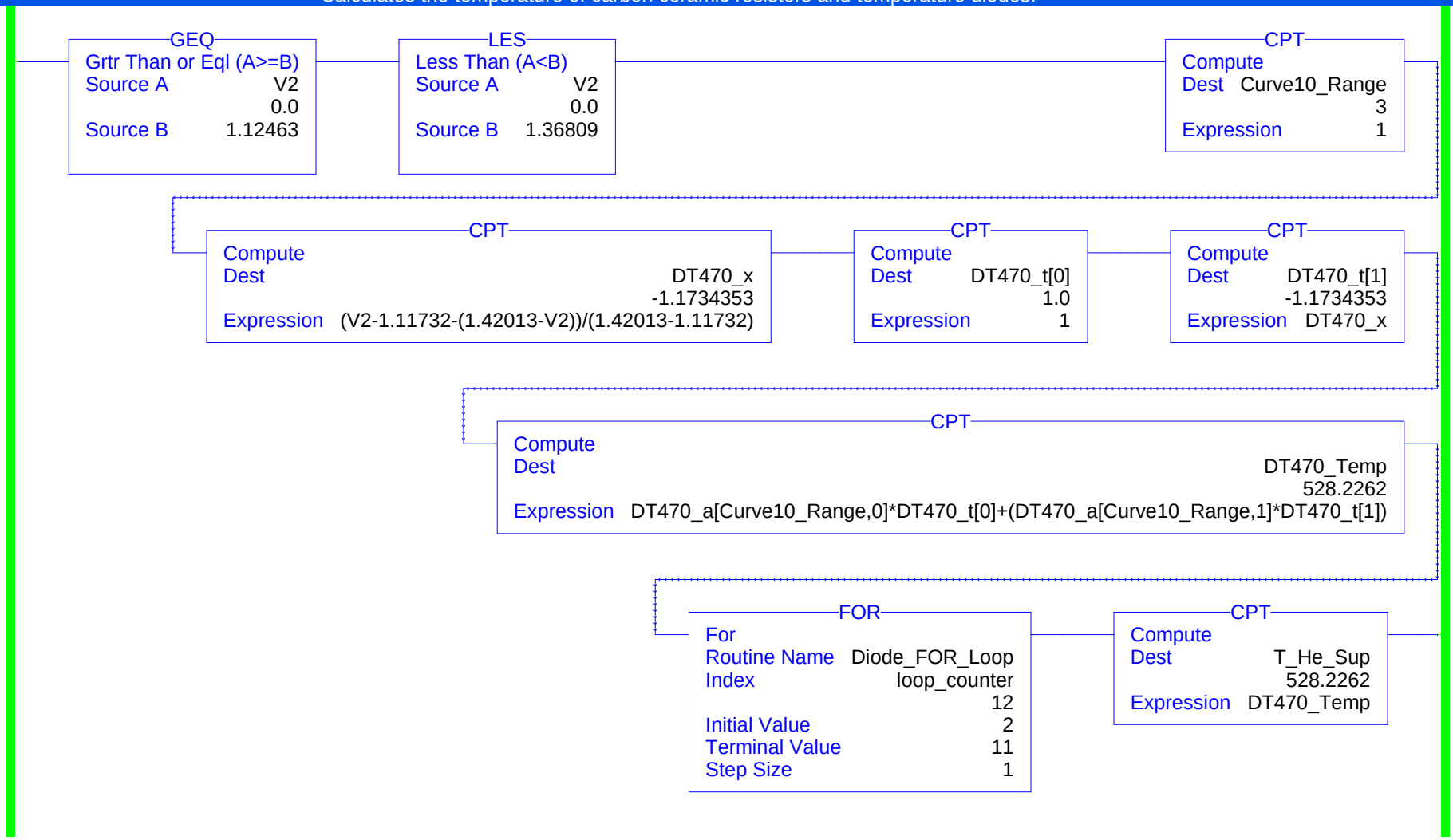
Q1 Diode-2

13



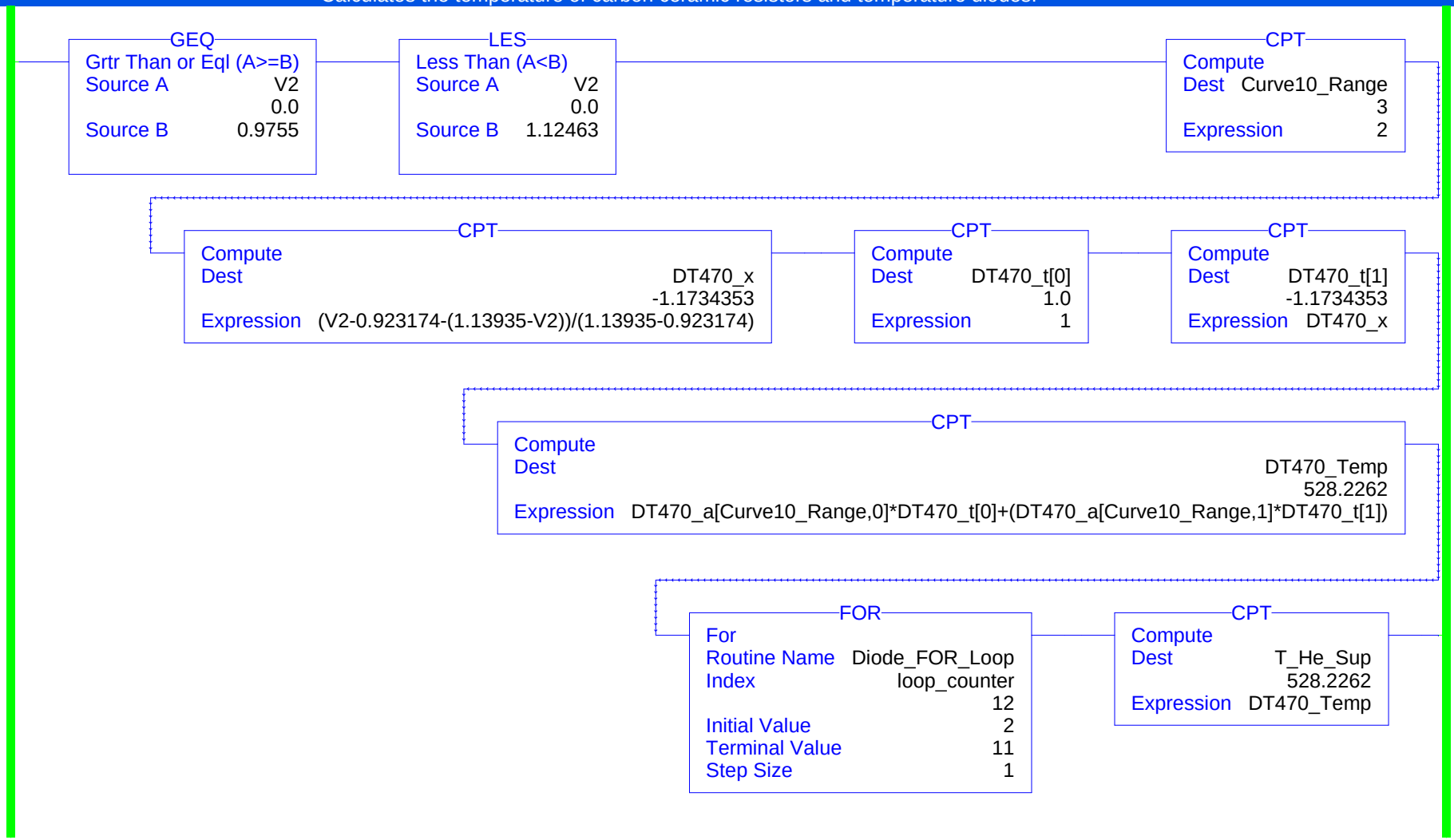
Calculates the temperature of carbon ceramic resistors and temperature diodes.

14



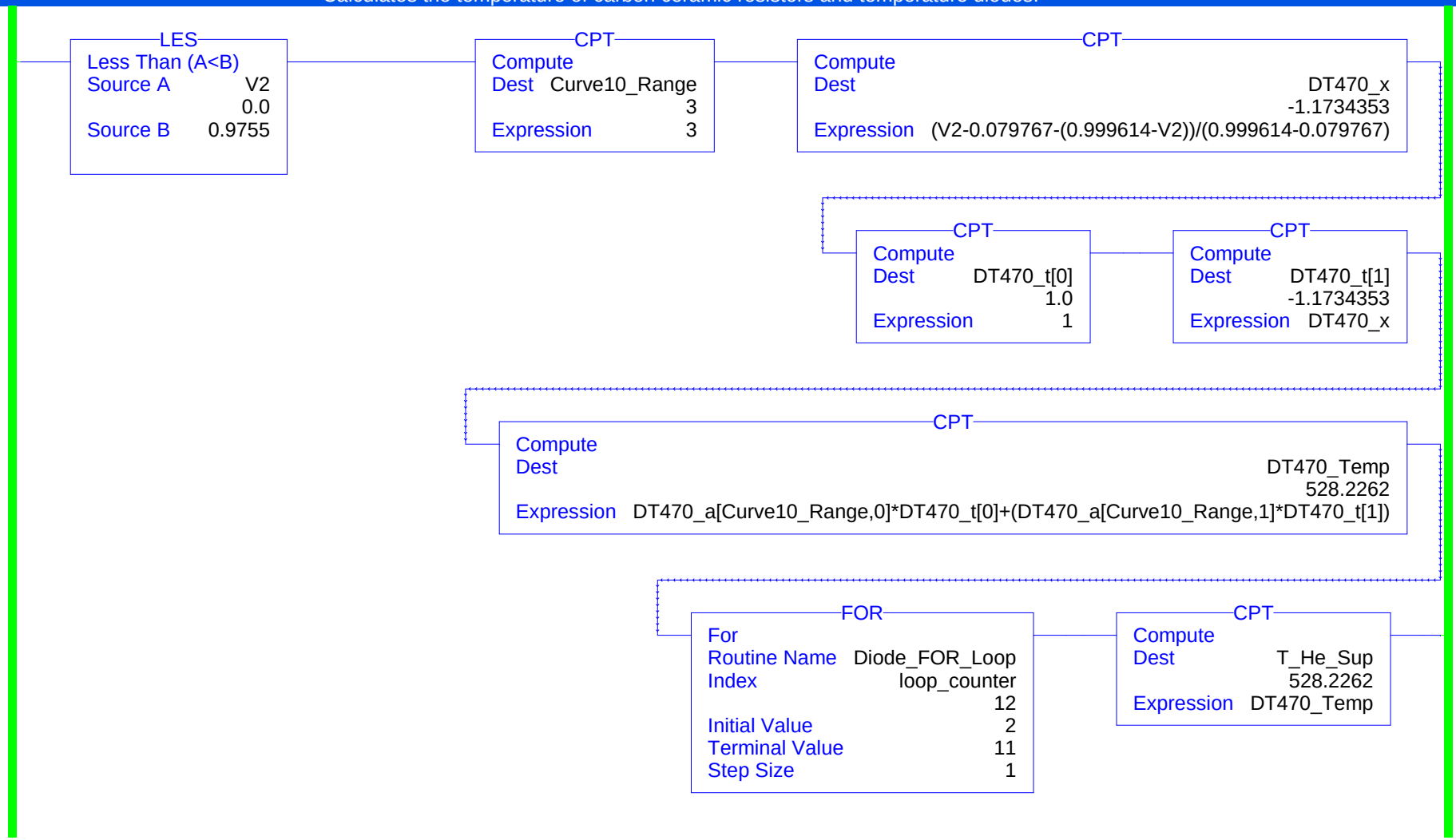
Calculates the temperature of carbon ceramic resistors and temperature diodes.

15



Calculates the temperature of carbon ceramic resistors and temperature diodes.

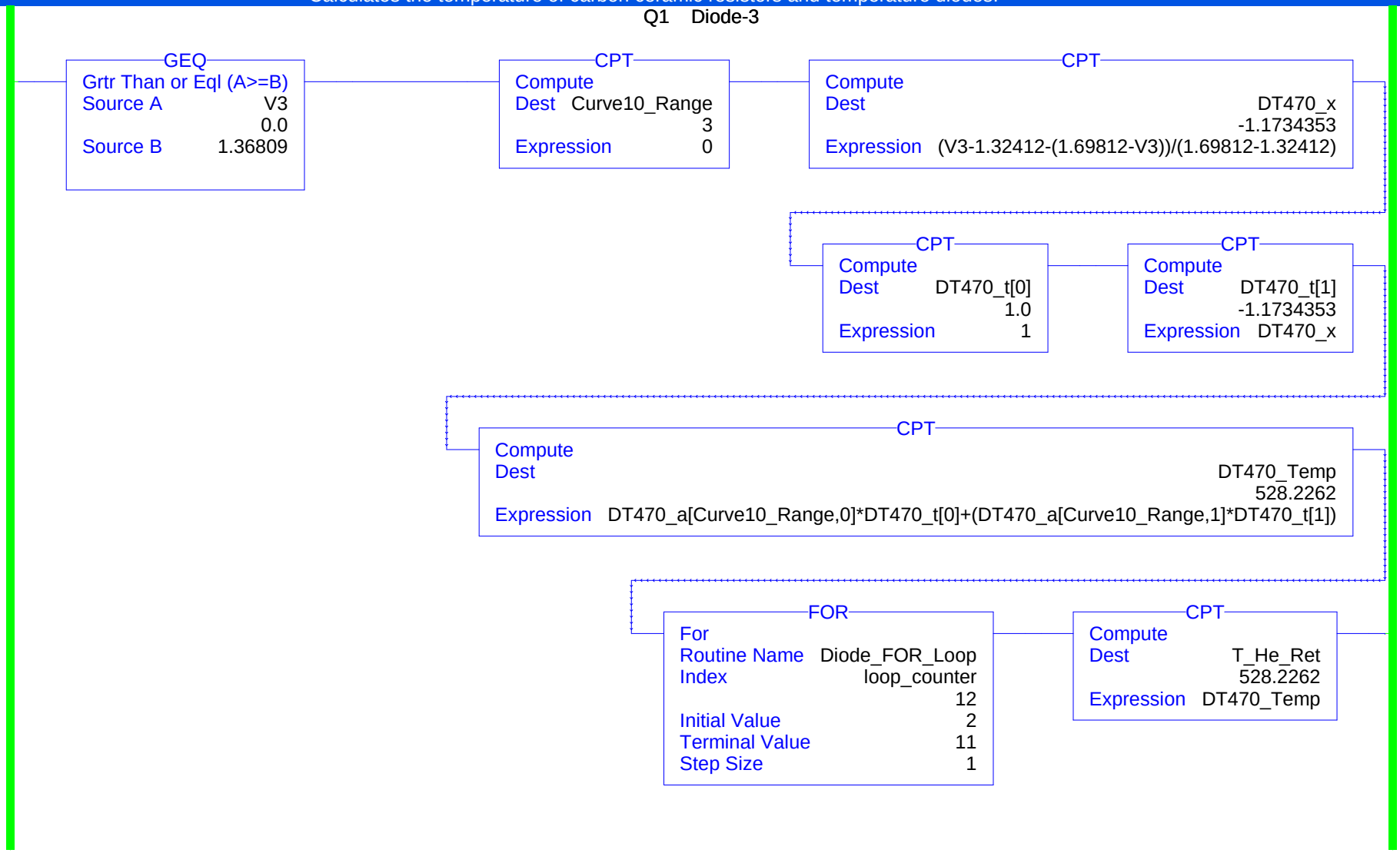
16



Calculates the temperature of carbon ceramic resistors and temperature diodes.

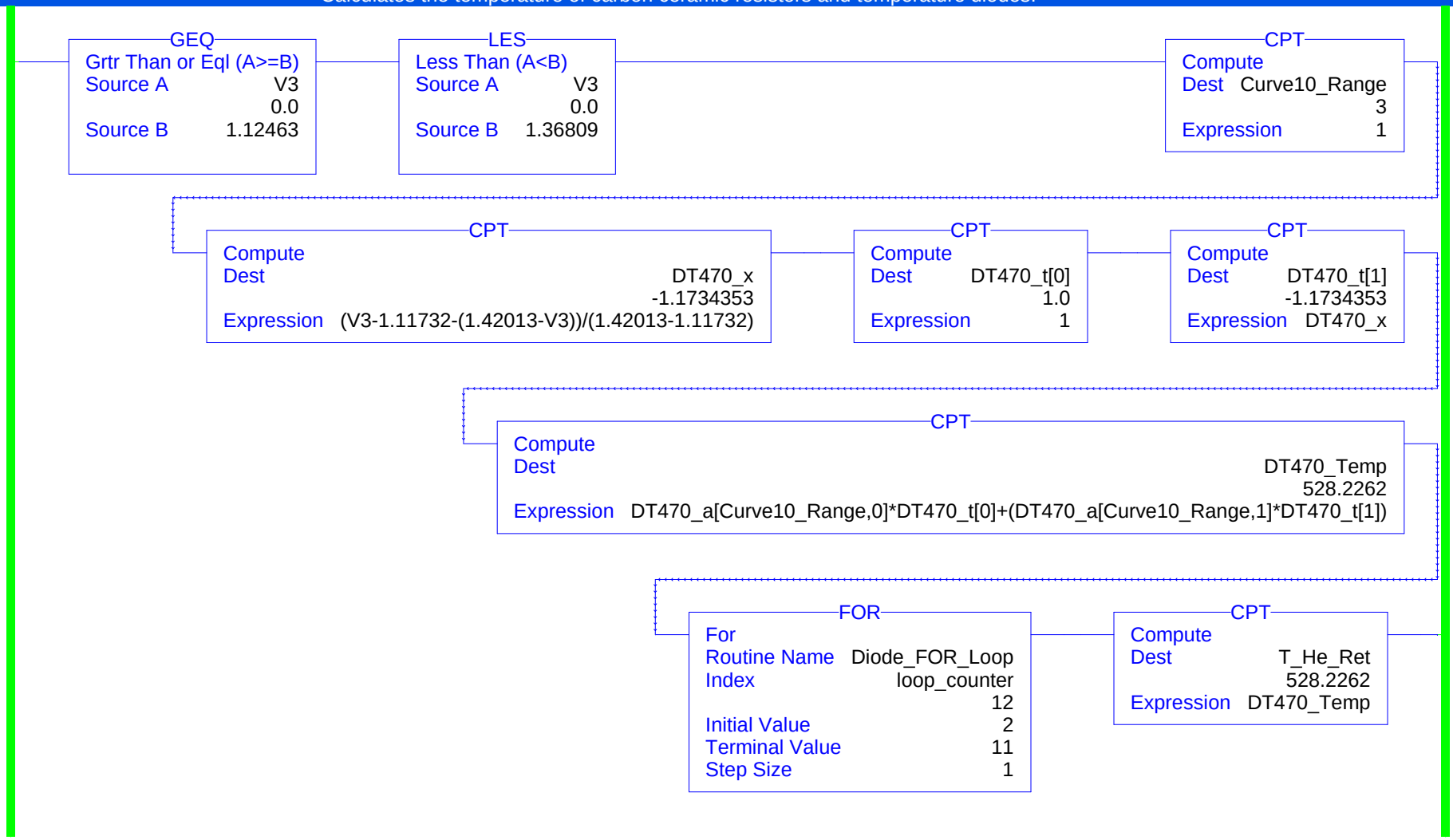
Q1 Diode-3

17



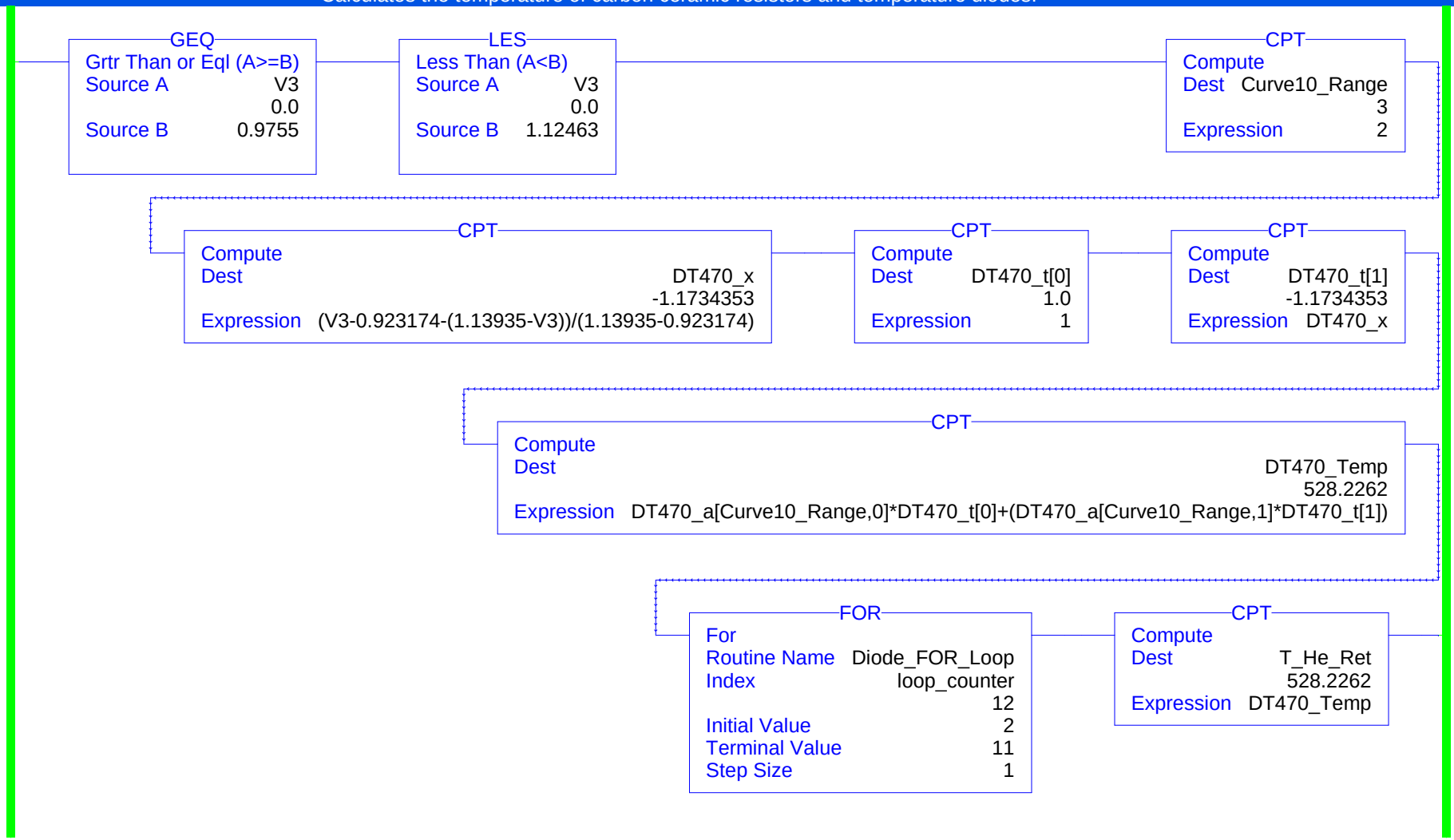
Calculates the temperature of carbon ceramic resistors and temperature diodes.

18



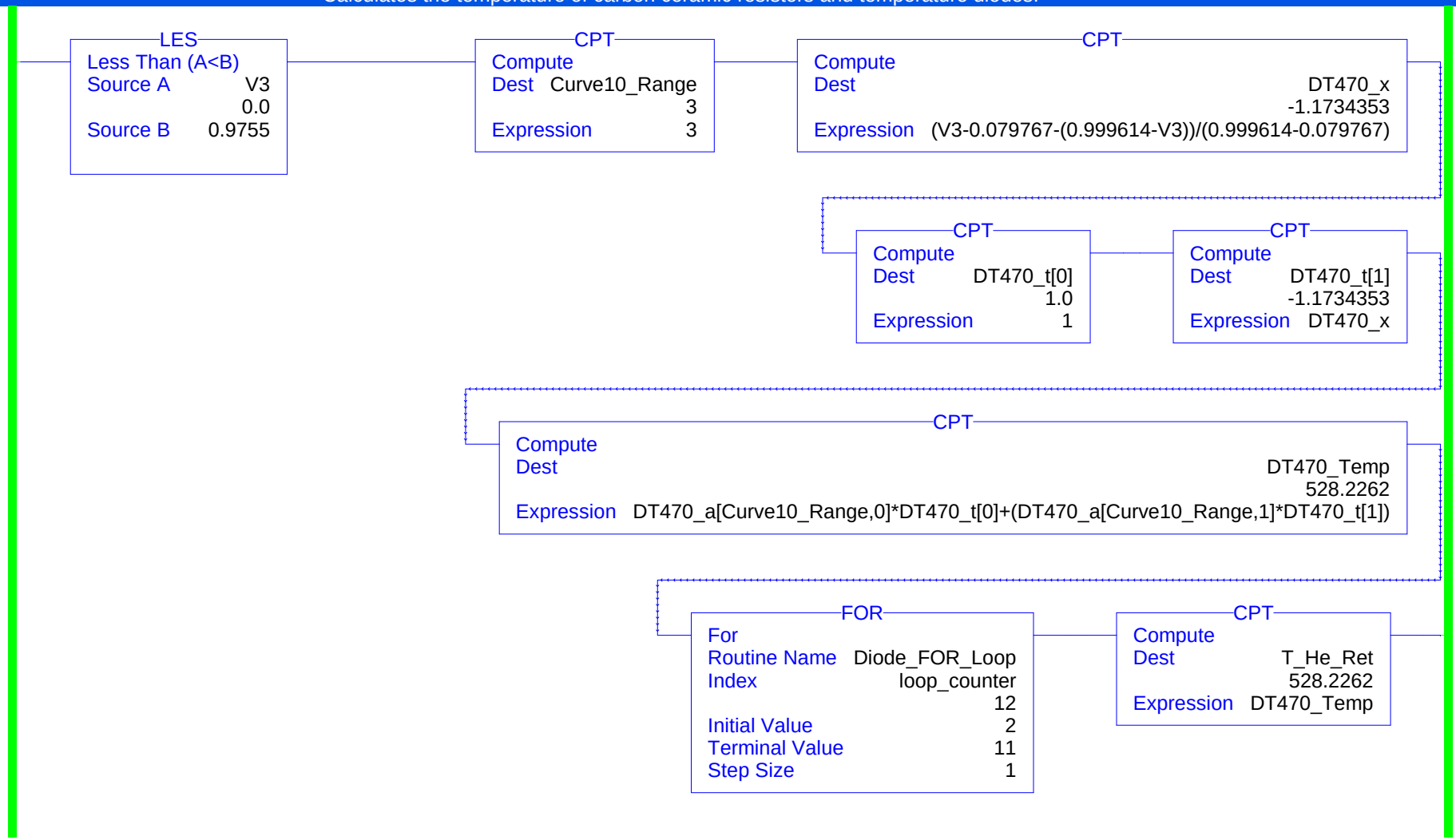
Calculates the temperature of carbon ceramic resistors and temperature diodes.

19



Calculates the temperature of carbon ceramic resistors and temperature diodes.

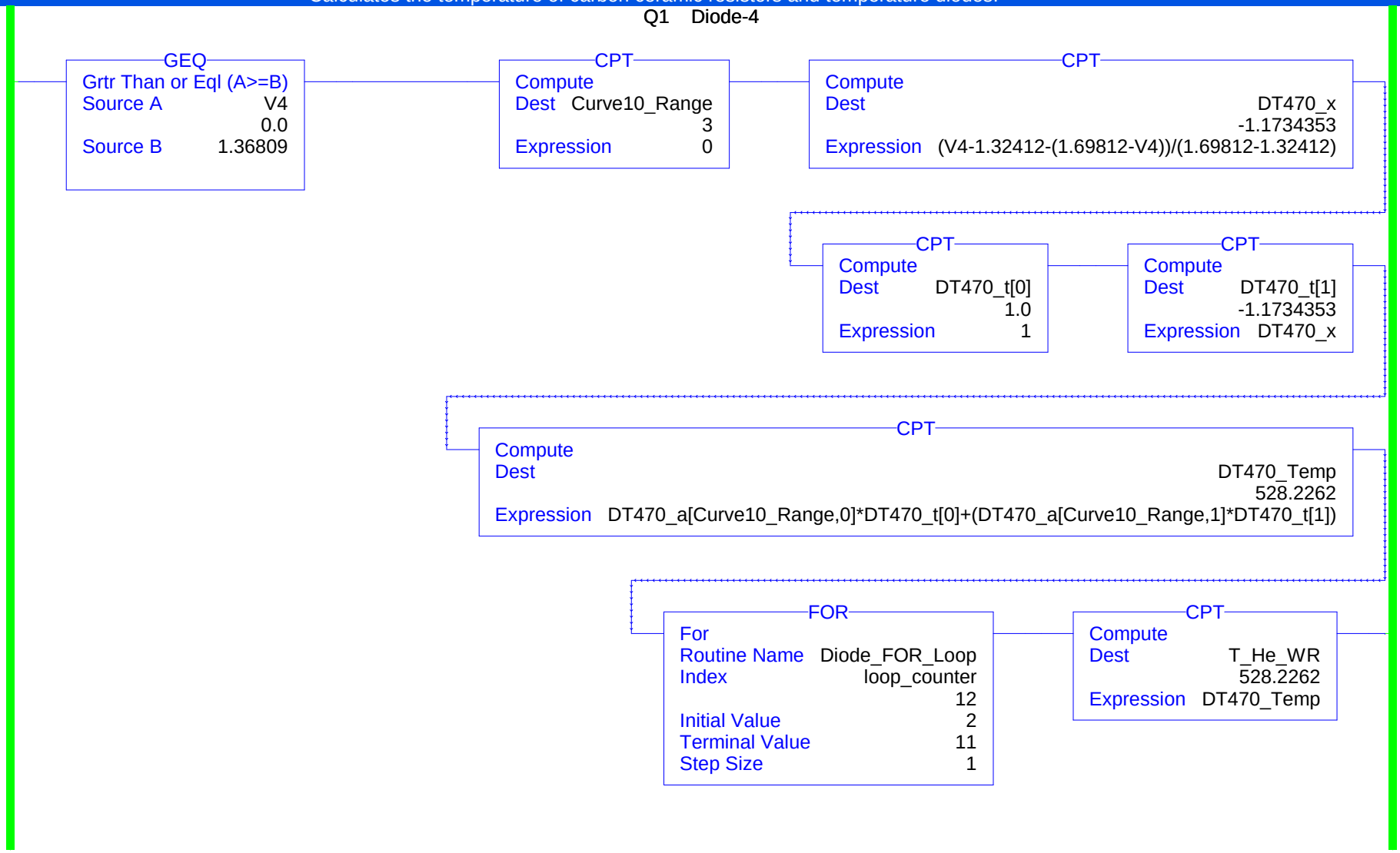
20



Calculates the temperature of carbon ceramic resistors and temperature diodes.

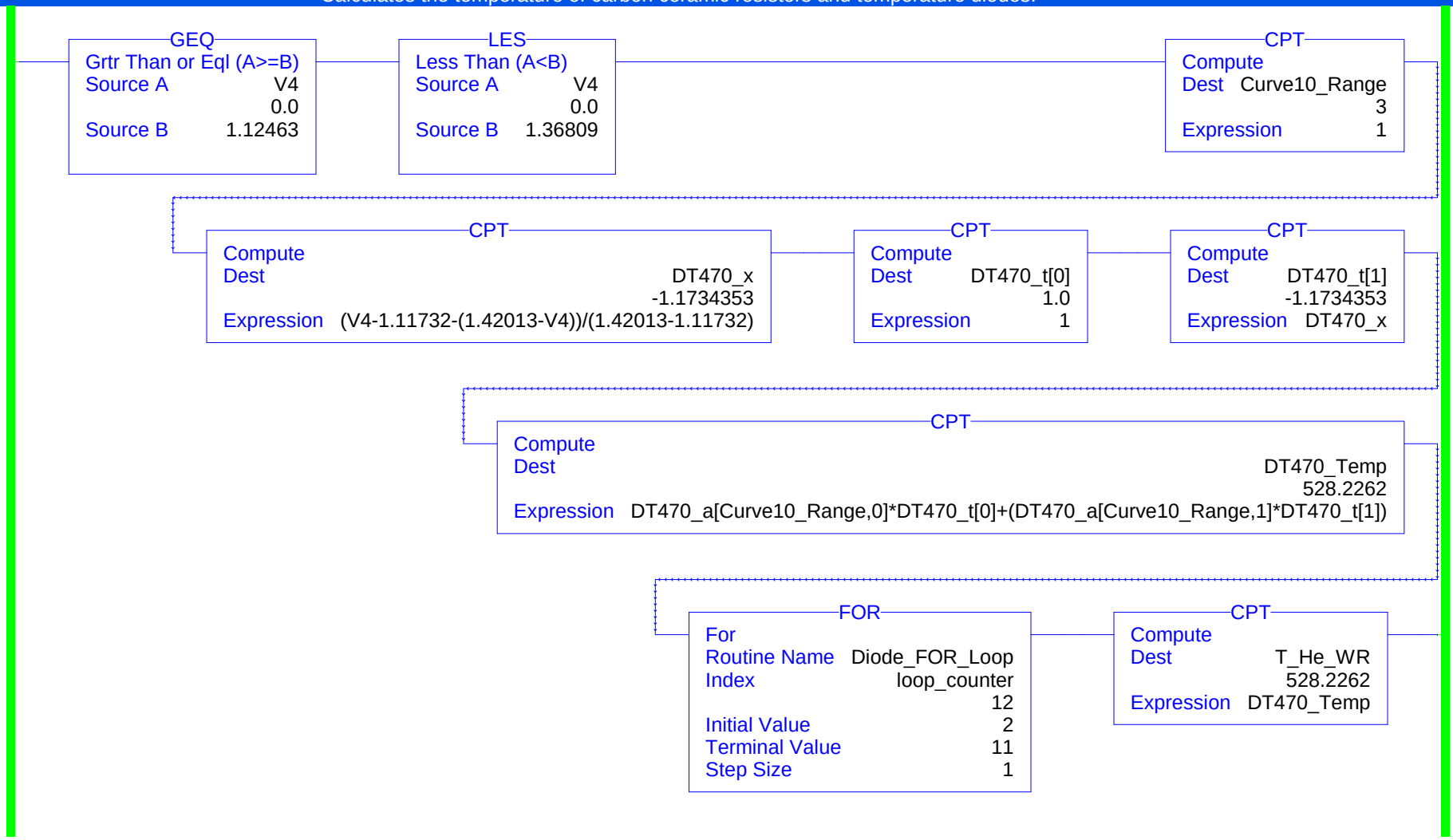
Q1 Diode-4

21



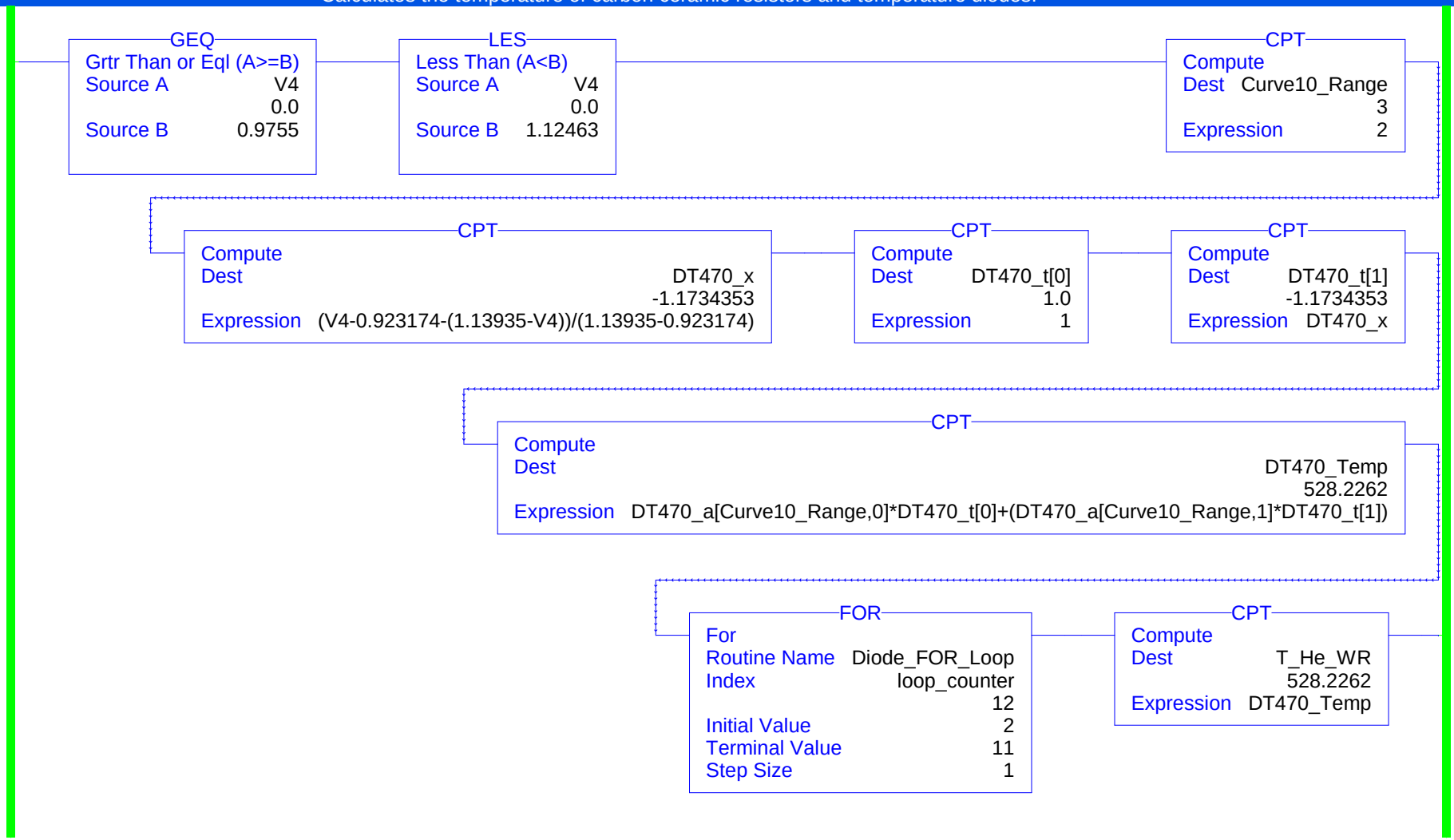
Calculates the temperature of carbon ceramic resistors and temperature diodes.

22



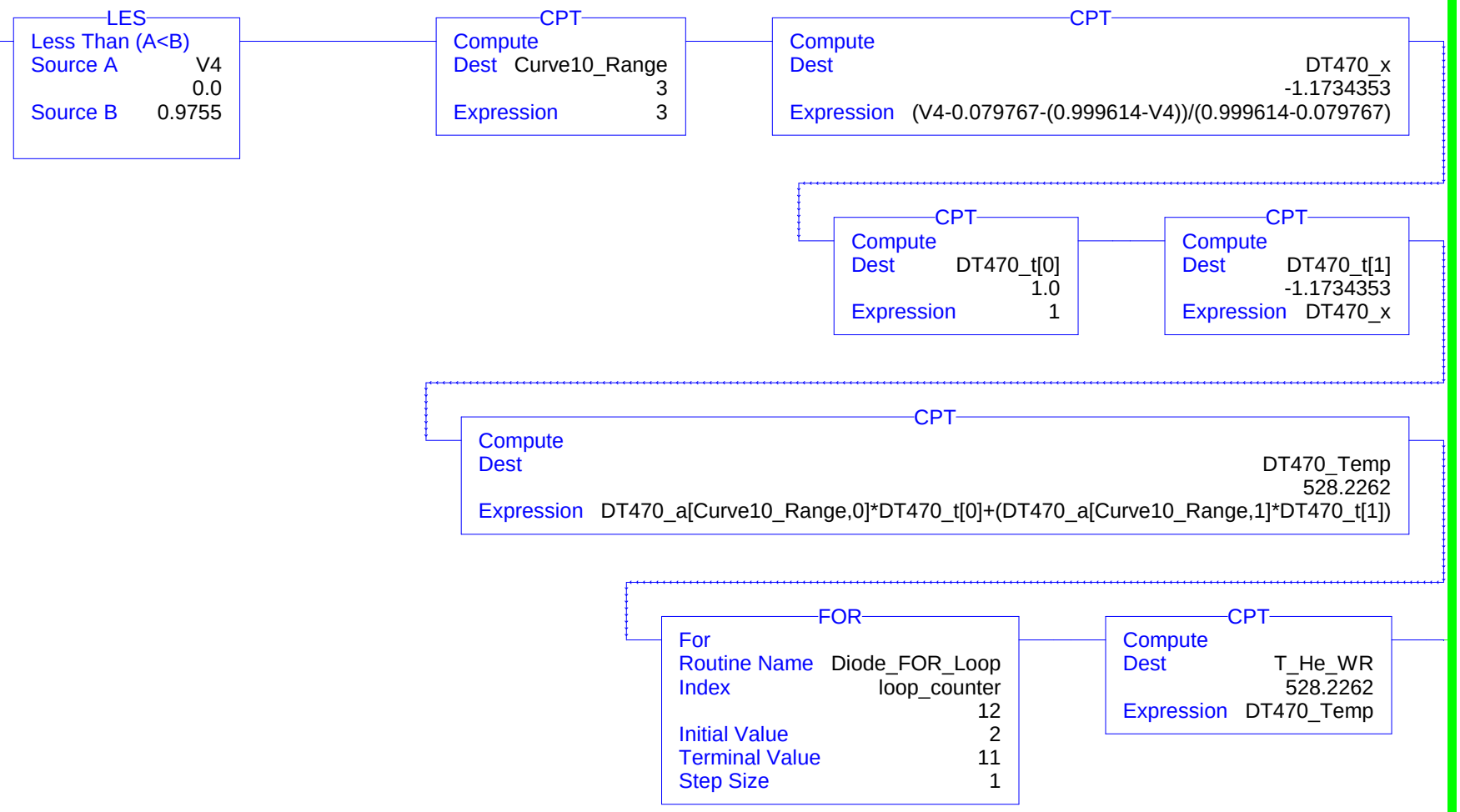
Calculates the temperature of carbon ceramic resistors and temperature diodes.

23

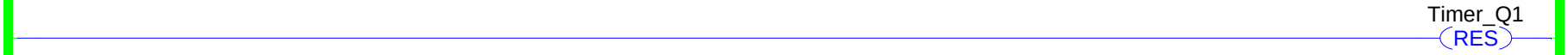


Calculates the temperature of carbon ceramic resistors and temperature diodes.

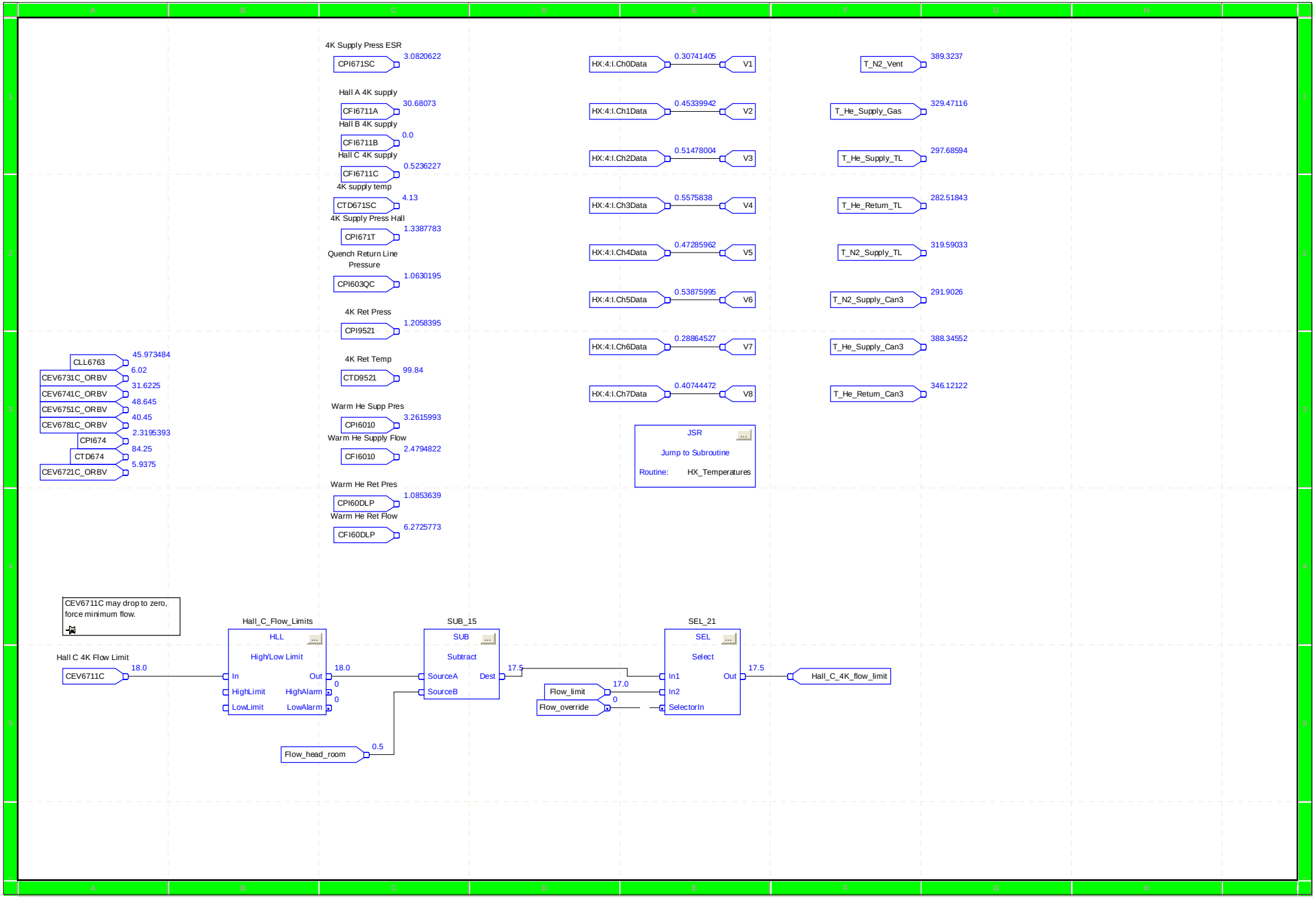
24

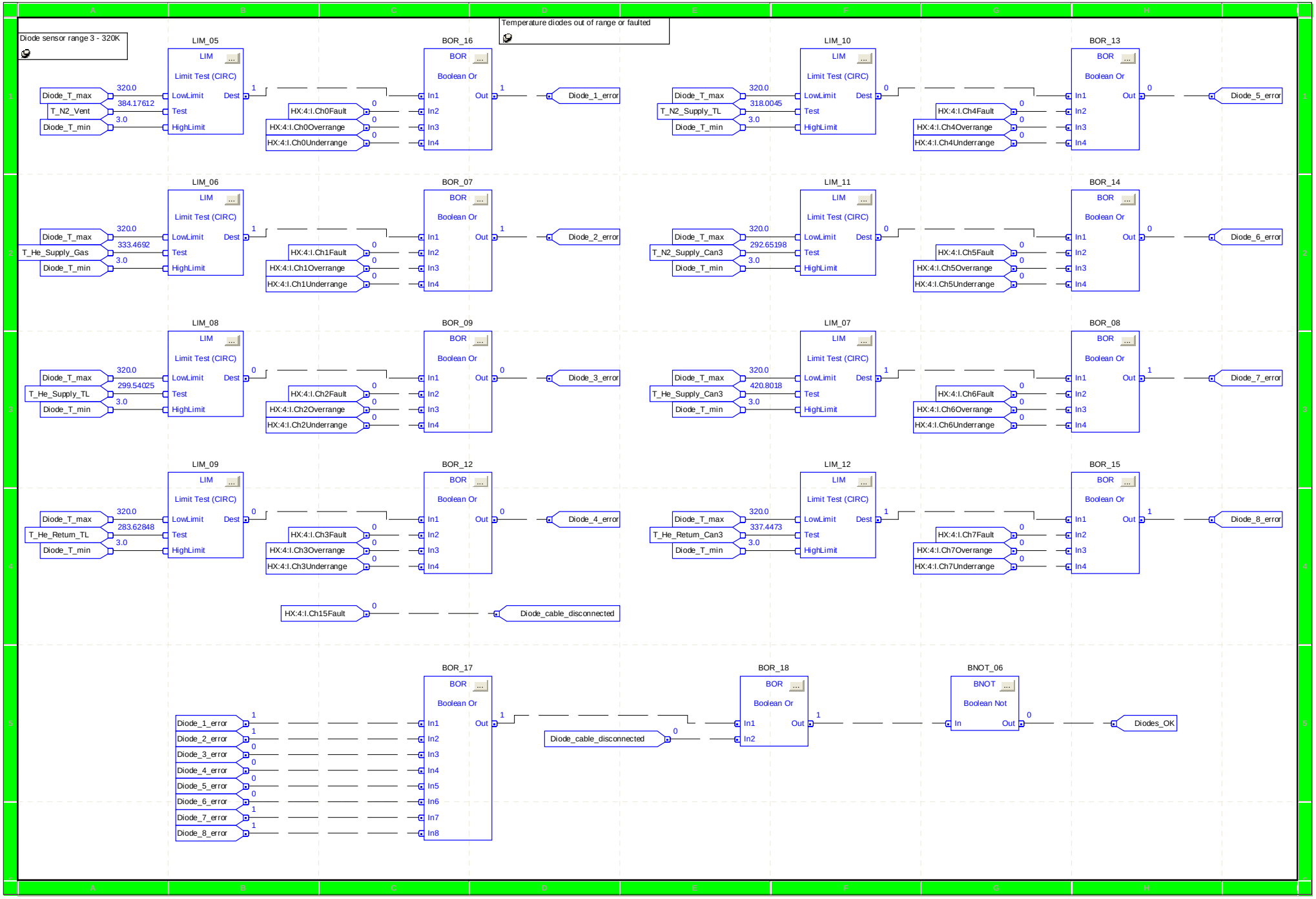


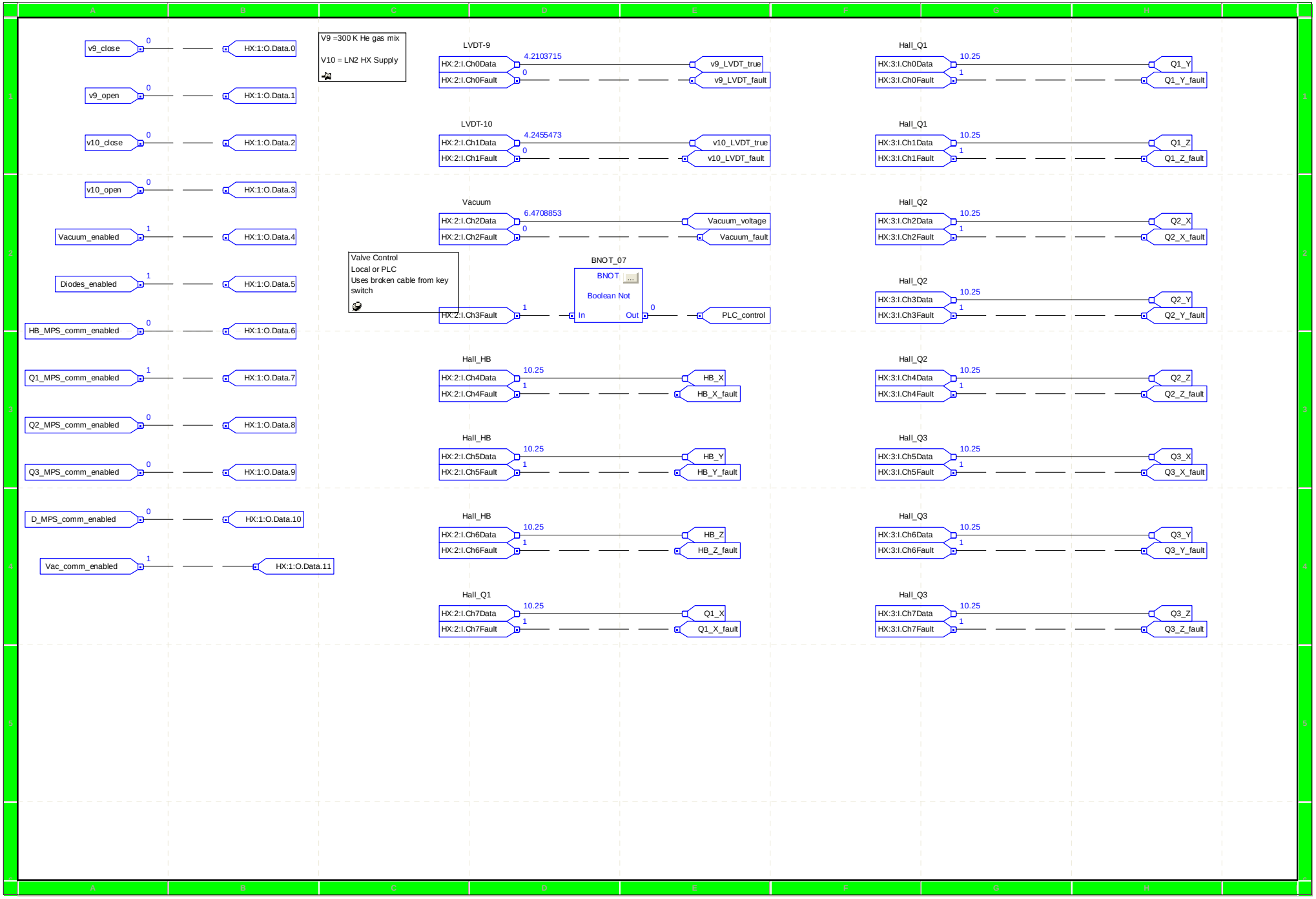
25

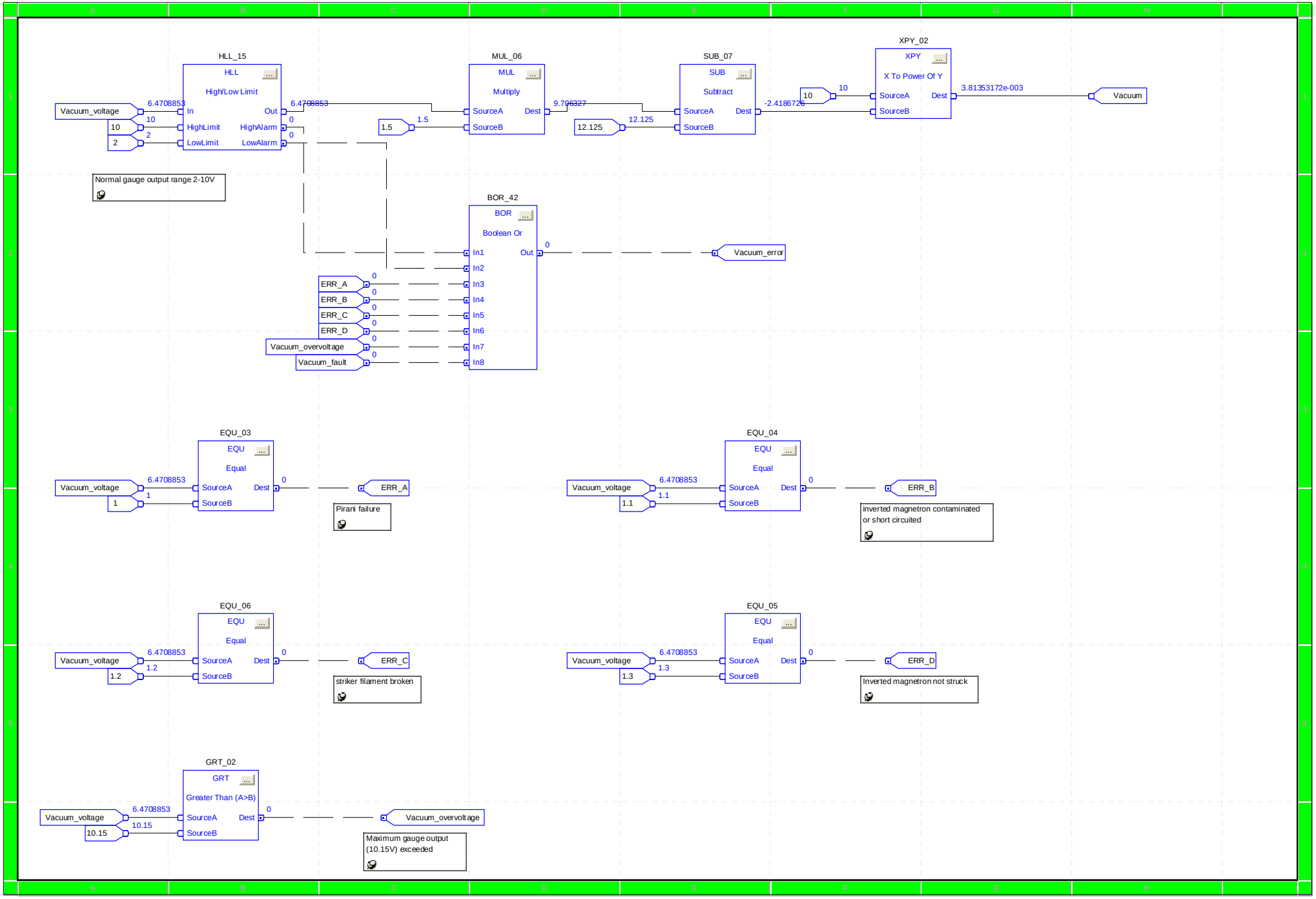


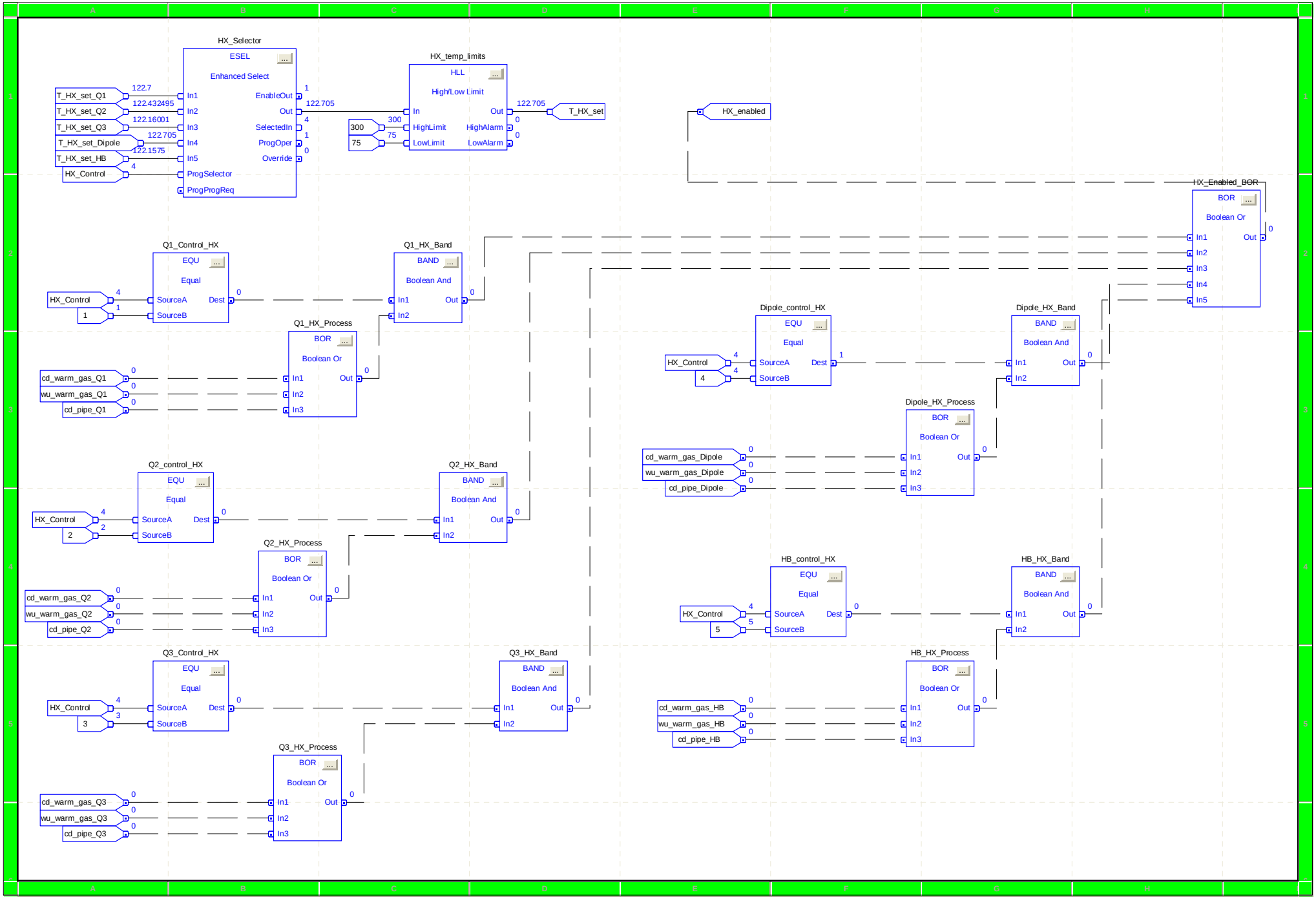
(End)

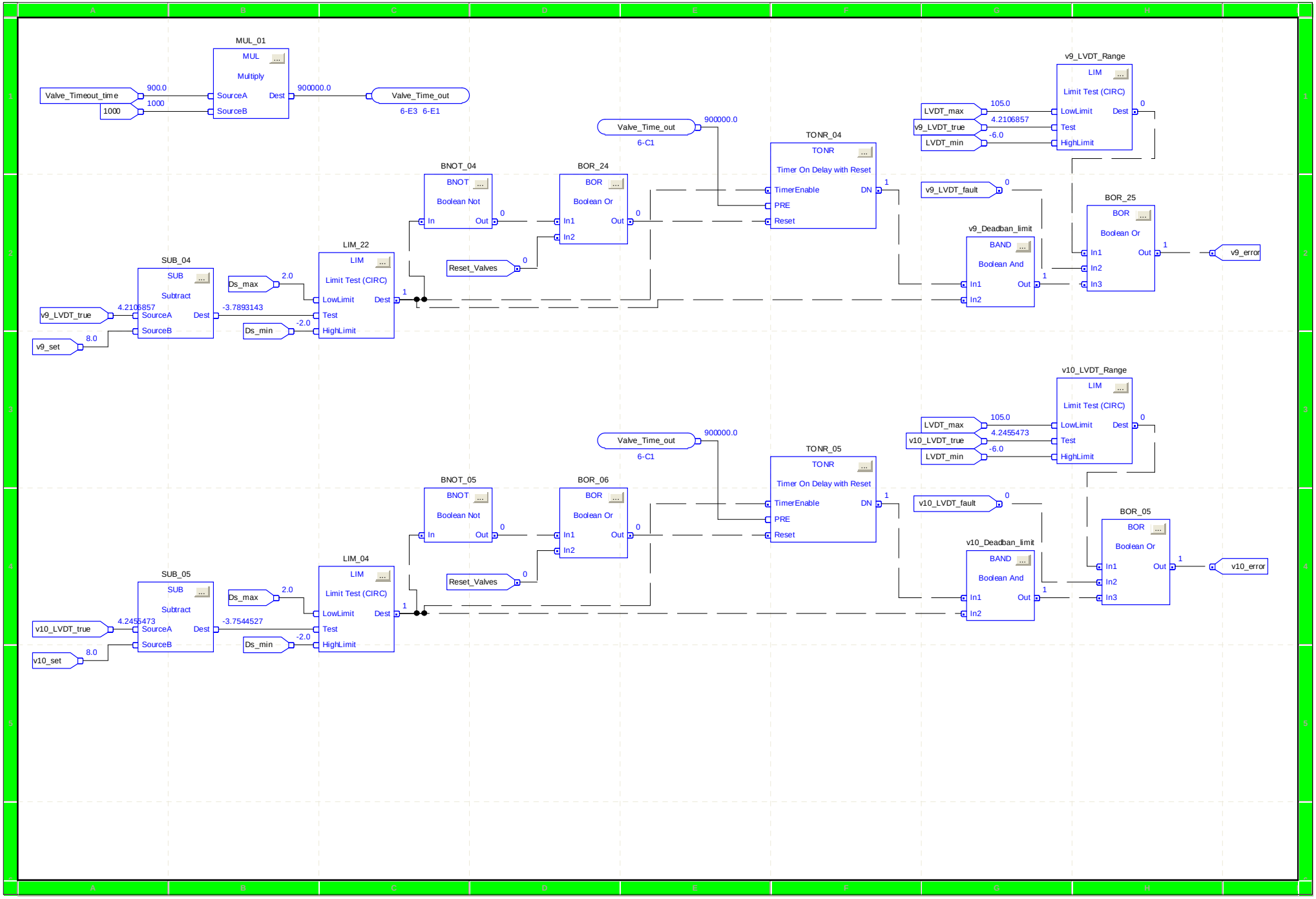

4K Supply Press ESR
CPI671SC
3.0820622
Hall A 4K supply
CFI6711A
30.68073
Hall B 4K supply
CFI6711B
0.0
Hall C 4K supply
CFI6711C
0.5236227
4K supply temp
CTD671SC
4.13
4K Supply Press Hall
CPI671T
1.3387783
Quench Return Line Pressure
CPI603QC
1.0630195
4K Ret Press
CPI9521
1.2058395
4K Ret Temp
CTD9521
99.84
Warm He Supp Pres
CPI6010
3.2615993
Warm He Supply Flow
CFI6010
2.4794822
Warm He Ret Pres
CPI60DLP
1.0853639
Warm He Ret Flow
CFI60DLP
6.2725773
CLL6763
45.973484
CEV6731C_ORBV
6.02
CEV6741C_ORBV
31.6225
CEV6751C_ORBV
48.645
CEV6781C_ORBV
40.45
CPI674
2.3195393
CTD674
84.25
CEV6721C_ORBV
5.9375
HX:4:I.Ch0Data
0.30741405
V1
HX:4:I.Ch1Data
0.45339942
V2
HX:4:I.Ch2Data
0.51478004
V3
HX:4:I.Ch3Data
0.5575838
V4
HX:4:I.Ch4Data
0.47285962
V5
HX:4:I.Ch5Data
0.53875995
V6
HX:4:I.Ch6Data
0.28864527
V7
HX:4:I.Ch7Data
0.40744472
V8
JSR
Jump to Subroutine
Routine: HX_Temperatures
T_N2_Vent
389.3237
T_He_Supply_Gas
329.47116
T_He_Supply_TL
297.68594
T_He_Return_TL
282.51843
T_N2_Supply_TL
319.59033
T_N2_Supply_Can3
291.9026
T_He_Supply_Can3
388.34552
T_He_Return_Can3
346.12122
CEV6711C may drop to zero, force minimum flow.
Hall C 4K Flow Limit
CEV6711C
18.0
Hall_C_Flow_Limits
HLL
High/Low Limit
In
HighLimit
LowLimit
Out
HighAlarm
LowAlarm
18.0
0
0
SUB_15
SUB
Subtract
SourceA
SourceB
Dest
17.5
Flow_head_room
0.5
SEL_21
SEL
Select
In1
In2
SelectorIn
Out
17.5
Flow_limit
17.0
Flow_override
0
Hall_C_4K_flow_limit

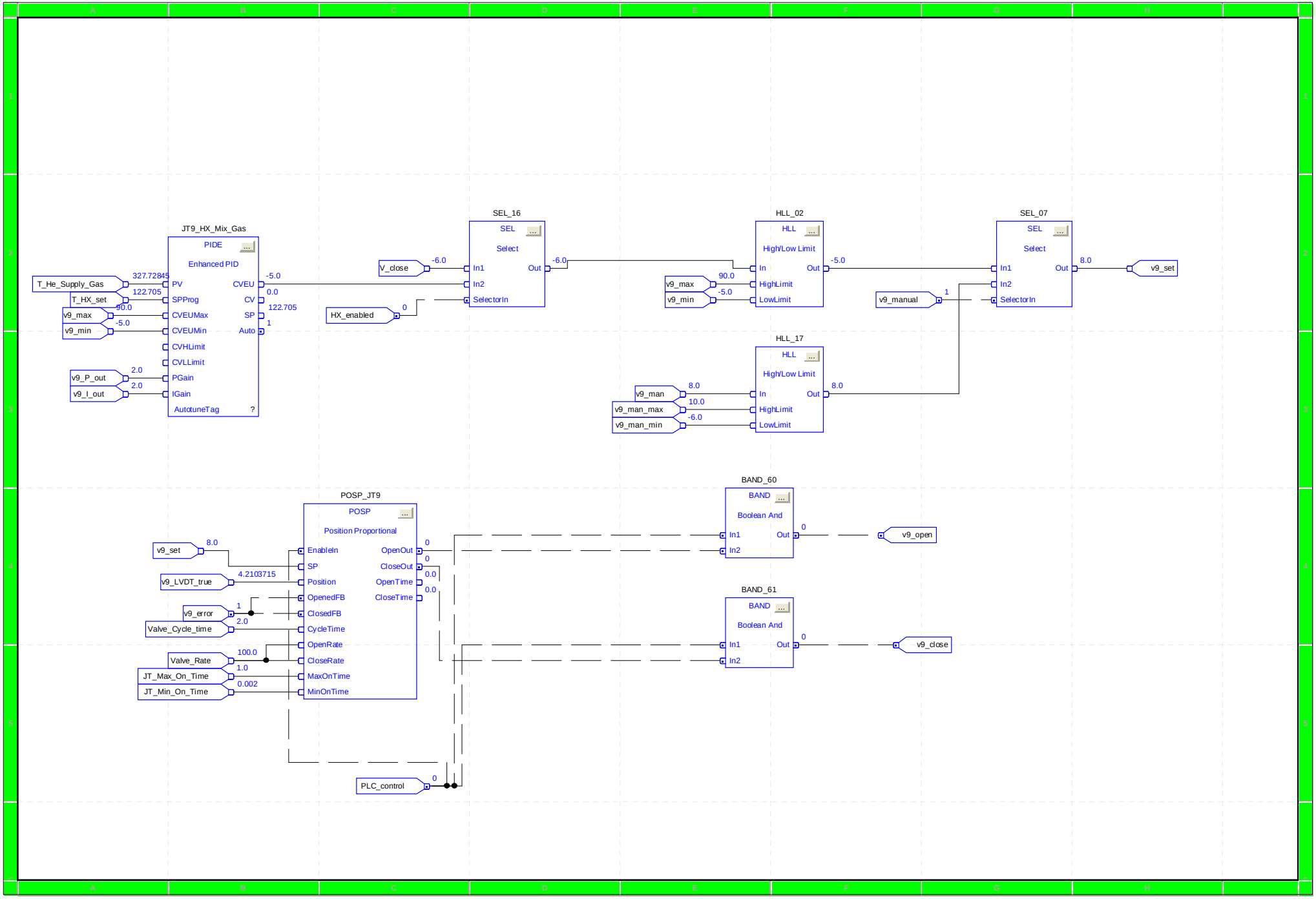

Diode sensor range 3 - 320K
Temperature diodes out of range or faulted
LIM_05
LIM
Limit Test (CIRC)
Diode_T_max
320.0
LowLimit
Dest
1
T_N2_Vent
384.17612
Test
Diode_T_min
3.0
HighLimit
BOR_16
BOR
Boolean Or
In1
Out
In2
In3
In4
HX:4:I.Ch0Fault
HX:4:I.Ch0Overrange
HX:4:I.Ch0Underrange
Diode_1_error
LIM_10
T_N2_Supply_TL
318.0045
BOR_13
HX:4:I.Ch4Fault
HX:4:I.Ch4Overrange
HX:4:I.Ch4Underrange
Diode_5_error
LIM_06
T_He_Supply_Gas
333.4692
BOR_07
HX:4:I.Ch1Fault
HX:4:I.Ch1Overrange
HX:4:I.Ch1Underrange
Diode_2_error
LIM_11
T_N2_Supply_Can3
292.65198
BOR_14
HX:4:I.Ch5Fault
HX:4:I.Ch5Overrange
HX:4:I.Ch5Underrange
Diode_6_error
LIM_08
T_He_Supply_TL
299.54025
BOR_09
HX:4:I.Ch2Fault
HX:4:I.Ch2Overrange
HX:4:I.Ch2Underrange
Diode_3_error
LIM_07
T_He_Supply_Can3
420.8018
BOR_08
HX:4:I.Ch6Fault
HX:4:I.Ch6Overrange
HX:4:I.Ch6Underrange
Diode_7_error
LIM_09
T_He_Return_TL
283.62848
BOR_12
HX:4:I.Ch3Fault
HX:4:I.Ch3Overrange
HX:4:I.Ch3Underrange
Diode_4_error
LIM_12
T_He_Return_Can3
337.4473
BOR_15
HX:4:I.Ch7Fault
HX:4:I.Ch7Overrange
HX:4:I.Ch7Underrange
Diode_8_error
HX:4:I.Ch15Fault
Diode_cable_disconnected
BOR_17
Diode_1_error
Diode_2_error
Diode_3_error
Diode_4_error
Diode_5_error
Diode_6_error
Diode_7_error
Diode_8_error
In5
In6
In7
In8
BOR_18
BNOT_06
BNOT
Boolean Not
In
Diodes_OK

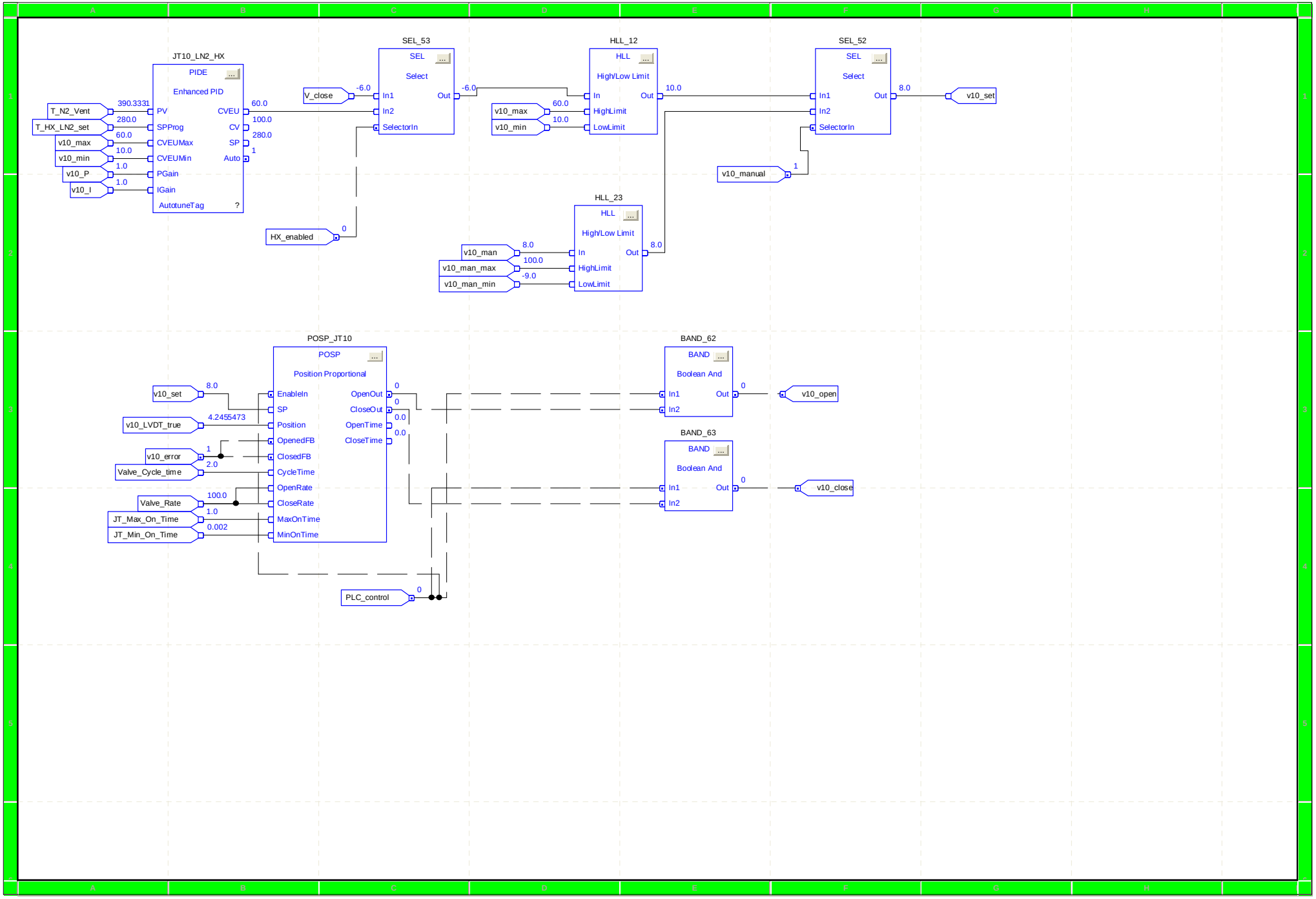

v9_close
v9_open
v10_close
v10_open
Vacuum_enabled
Diodes_enabled
HB_MPS_comm_enabled
Q1_MPS_comm_enabled
Q2_MPS_comm_enabled
Q3_MPS_comm_enabled
D_MPS_comm_enabled
Vac_comm_enabled
HX:1:O.Data.0
HX:1:O.Data.1
HX:1:O.Data.2
HX:1:O.Data.3
HX:1:O.Data.4
HX:1:O.Data.5
HX:1:O.Data.6
HX:1:O.Data.7
HX:1:O.Data.8
HX:1:O.Data.9
HX:1:O.Data.10
HX:1:O.Data.11
V9 =300 K He gas mix
V10 = LN2 HX Supply
Valve Control
Local or PLC
Uses broken cable from key switch
LVDT-9
HX:2:I.Ch0Data
HX:2:I.Ch0Fault
4.2103715
v9_LVDT_true
v9_LVDT_fault
LVDT-10
HX:2:I.Ch1Data
HX:2:I.Ch1Fault
4.2455473
v10_LVDT_true
v10_LVDT_fault
Vacuum
HX:2:I.Ch2Data
HX:2:I.Ch2Fault
6.4708853
Vacuum_voltage
Vacuum_fault
BNOT_07
BNOT
Boolean Not
In
Out
HX:2:I.Ch3Fault
PLC_control
Hall_HB
HX:2:I.Ch4Data
HX:2:I.Ch4Fault
10.25
HB_X
HB_X_fault
Hall_HB
HX:2:I.Ch5Data
HX:2:I.Ch5Fault
HB_Y
HB_Y_fault
Hall_HB
HX:2:I.Ch6Data
HX:2:I.Ch6Fault
HB_Z
HB_Z_fault
Hall_Q1
HX:2:I.Ch7Data
HX:2:I.Ch7Fault
Q1_X
Q1_X_fault
Hall_Q1
HX:3:I.Ch0Data
HX:3:I.Ch0Fault
Q1_Y
Q1_Y_fault
Hall_Q1
HX:3:I.Ch1Data
HX:3:I.Ch1Fault
Q1_Z
Q1_Z_fault
Hall_Q2
HX:3:I.Ch2Data
HX:3:I.Ch2Fault
Q2_X
Q2_X_fault
Hall_Q2
HX:3:I.Ch3Data
HX:3:I.Ch3Fault
Q2_Y
Q2_Y_fault
Hall_Q2
HX:3:I.Ch4Data
HX:3:I.Ch4Fault
Q2_Z
Q2_Z_fault
Hall_Q3
HX:3:I.Ch5Data
HX:3:I.Ch5Fault
Q3_X
Q3_X_fault
Hall_Q3
HX:3:I.Ch6Data
HX:3:I.Ch6Fault
Q3_Y
Q3_Y_fault
Hall_Q3
HX:3:I.Ch7Data
HX:3:I.Ch7Fault
Q3_Z
Q3_Z_fault

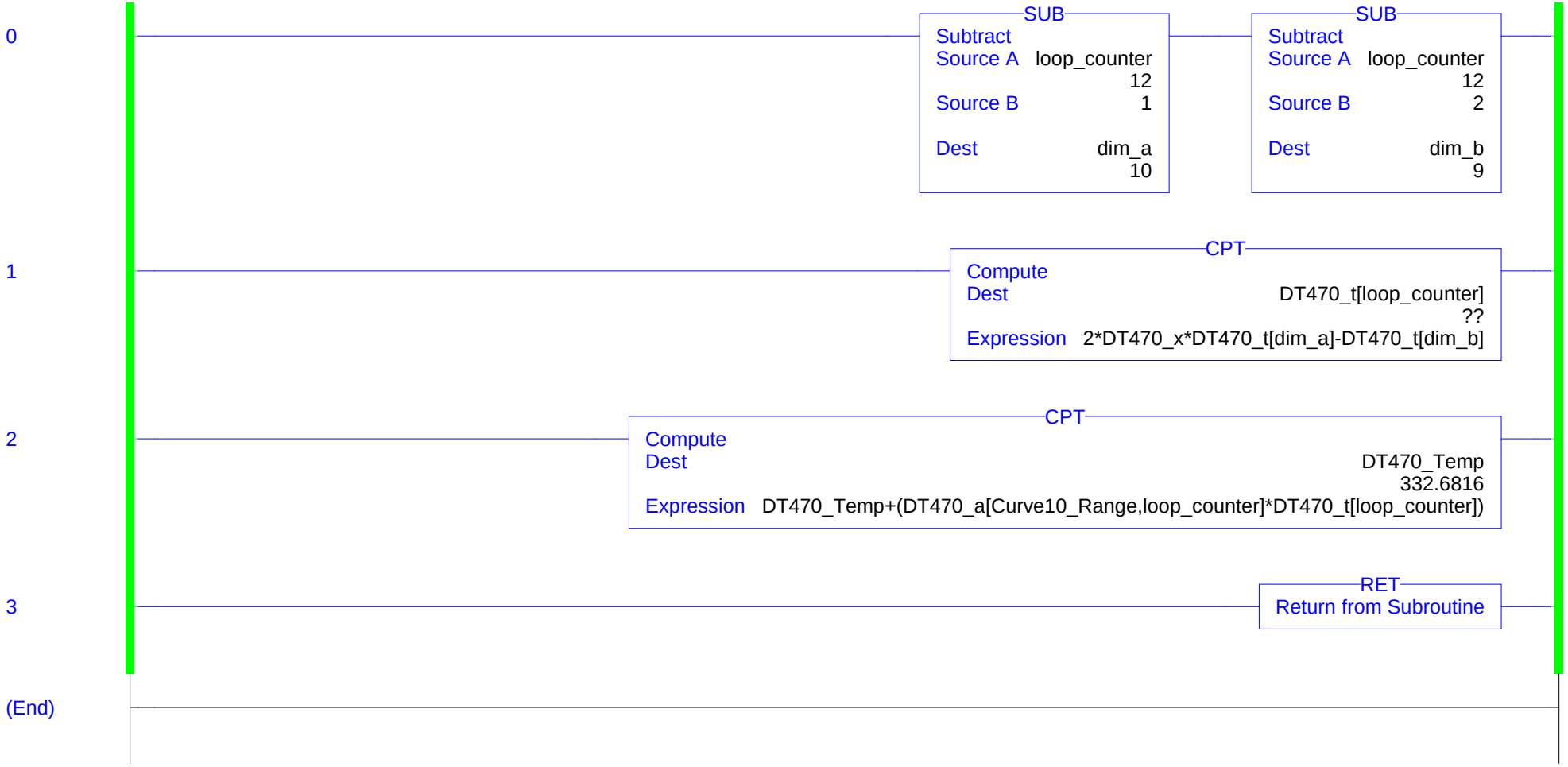

HLL_15
HLL
High/Low Limit
Vacuum_voltage
6.4708853
In
Out
6.4708853
10
HighLimit
HighAlarm
0
2
LowLimit
LowAlarm
0
Normal gauge output range 2-10V
MUL_06
MUL
Multiply
SourceA
Dest
9.706327
1.5
1.5
SourceB
SUB_07
SUB
Subtract
SourceA
Dest
-2.4186726
12.125
12.125
SourceB
XPY_02
XPY
X To Power Of Y
10
10
SourceA
Dest
3.81353172e-003
SourceB
Vacuum
BOR_42
BOR
Boolean Or
In1
Out
0
Vacuum_error
In2
ERR_A
0
In3
ERR_B
0
In4
ERR_C
0
In5
ERR_D
0
In6
Vacuum_overvoltage
0
In7
Vacuum_fault
0
In8
EQU_03
EQU
Equal
Vacuum_voltage
6.4708853
SourceA
Dest
0
ERR_A
1
1
SourceB
Pirani failure
EQU_04
EQU
Equal
Vacuum_voltage
6.4708853
SourceA
Dest
0
ERR_B
1.1
1.1
SourceB
inverted magnetron contaminated
or short circuited
EQU_06
EQU
Equal
Vacuum_voltage
6.4708853
SourceA
Dest
0
ERR_C
1.2
1.2
SourceB
striker filament broken
EQU_05
EQU
Equal
Vacuum_voltage
6.4708853
SourceA
Dest
0
ERR_D
1.3
1.3
SourceB
Inverted magnetron not struck
GRT_02
GRT
Greater Than (A>B)
Vacuum_voltage
6.4708853
SourceA
Dest
0
Vacuum_overvoltage
10.15
10.15
SourceB
Maximum gauge output
(10.15V) exceeded


HX_Selector
ESEL
Enhanced Select
T_HX_set_Q1
122.7
T_HX_set_Q2
122.432495
T_HX_set_Q3
122.16001
T_HX_set_Dipole
122.705
T_HX_set_HB
122.1575
HX_Control
In1
In2
In3
In4
In5
ProgSelector
ProgProgReq
EnableOut
Out
SelectedIn
ProgOper
Override
HX_temp_limits
HLL
High/Low Limit
In
HighLimit
LowLimit
HighAlarm
LowAlarm
300
75
T_HX_set
HX_enabled
HX_Enabled_BOR
BOR
Boolean Or
Q1_Control_HX
EQU
Equal
SourceA
SourceB
Dest
1
Q1_HX_Band
BAND
Boolean And
Q1_HX_Process
cd_warm_gas_Q1
wu_warm_gas_Q1
cd_pipe_Q1
Dipole_control_HX
Dipole_HX_Band
Dipole_HX_Process
cd_warm_gas_Dipole
wu_warm_gas_Dipole
cd_pipe_Dipole
Q2_control_HX
Q2_HX_Band
Q2_HX_Process
cd_warm_gas_Q2
wu_warm_gas_Q2
cd_pipe_Q2
HB_control_HX
HB_HX_Band
HB_HX_Process
cd_warm_gas_HB
wu_warm_gas_HB
cd_pipe_HB
Q3_Control_HX
Q3_HX_Band
Q3_HX_Process
cd_warm_gas_Q3
wu_warm_gas_Q3
cd_pipe_Q3

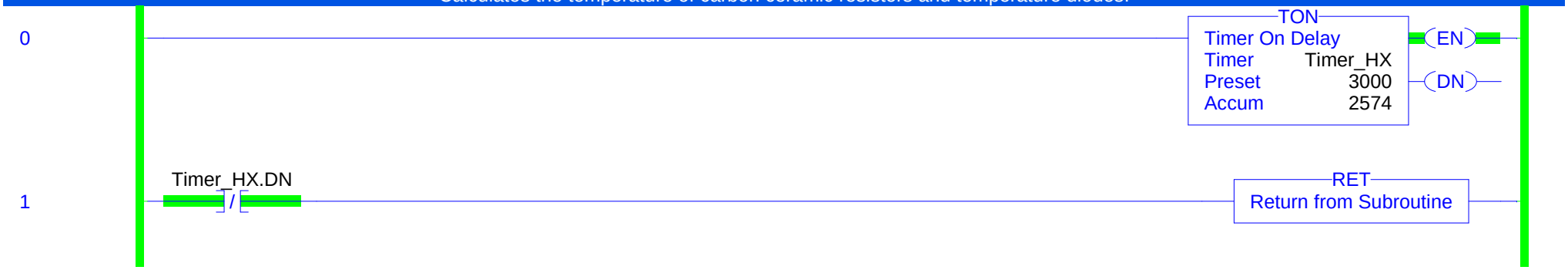

MUL_01
MUL
Multiply
Valve_Timeout_time
900.0
1000
SourceA
SourceB
Dest
900000.0
Valve_Time_out
6-E3 6-E1
Valve_Time_out
900000.0
6-C1
TONR_04
TONR
Timer On Delay with Reset
TimerEnable
PRE
Reset
DN
1
v9_LVDT_Range
LIM
Limit Test (CIRC)
LVDT_max
105.0
v9_LVDT_true
4.2106857
LVDT_min
-6.0
LowLimit
Test
HighLimit
Dest
0
BNOT_04
BNOT
Boolean Not
In
Out
BOR_24
BOR
Boolean Or
In1
In2
v9_LVDT_fault
BOR_25
v9_Deadban_limit
BAND
Boolean And
In3
v9_error
LIM_22
SUB_04
SUB
Subtract
Ds_max
2.0
Ds_min
-2.0
-3.7893143
v9_set
8.0
Reset_Valves
v10_LVDT_Range
105.0
4.2455473
v10_LVDT_true
v10_LVDT_fault
v10_Deadban_limit
BOR_05
v10_error
LIM_04
SUB_05
-3.7544527
v10_set
BNOT_05
BOR_06
TONR_05


JT9_HX_Mix_Gas
PIDE
Enhanced PID
T_He_Supply_Gas
327.72845
T_HX_set
122.705
v9_max
90.0
v9_min
-5.0
v9_P_out
2.0
v9_I_out
2.0
PV
SPProg
CVEUMax
CVEUMin
CVHLimit
CVLLimit
PGain
IGain
AutotuneTag
CVEU
CV
SP
Auto
-5.0
0.0
122.705
1
?
SEL_16
SEL
Select
V_close
-6.0
HX_enabled
0
In1
In2
SelectorIn
Out
-6.0
HLL_02
HLL
High/Low Limit
v9_max
90.0
v9_min
-5.0
In
HighLimit
LowLimit
Out
-5.0
SEL_07
SEL
Select
v9_manual
1
In1
In2
SelectorIn
Out
8.0
v9_set
HLL_17
HLL
High/Low Limit
v9_man
8.0
v9_man_max
10.0
v9_man_min
-6.0
In
HighLimit
LowLimit
Out
8.0
POSP_JT9
POSP
Position Proportional
v9_set
8.0
v9_LVDT_true
4.2103715
v9_error
1
Valve_Cycle_time
2.0
Valve_Rate
100.0
JT_Max_On_Time
1.0
JT_Min_On_Time
0.002
EnableIn
SP
Position
OpenedFB
ClosedFB
CycleTime
OpenRate
CloseRate
MaxOnTime
MinOnTime
OpenOut
CloseOut
OpenTime
CloseTime
0
0
0.0
0.0
PLC_control
0
BAND_60
BAND
Boolean And
In1
In2
Out
0
v9_open
BAND_61
BAND
Boolean And
In1
In2
Out
0
v9_close


JT10_LN2_HX
PIDE
Enhanced PID
T_N2_Vent
390.3331
PV
T_HX_LN2_set
280.0
SPProg
v10_max
60.0
CVEUMax
v10_min
10.0
CVEUMin
v10_P
1.0
PGain
v10_I
1.0
IGain
AutotuneTag
?
CVEU
60.0
CV
100.0
SP
280.0
Auto
1
SEL_53
SEL
Select
V_close
-6.0
In1
In2
SelectorIn
Out
-6.0
HX_enabled
0
HLL_12
HLL
High/Low Limit
v10_max
60.0
v10_min
10.0
In
HighLimit
LowLimit
Out
10.0
HLL_23
HLL
High/Low Limit
v10_man
8.0
v10_man_max
100.0
v10_man_min
-9.0
In
HighLimit
LowLimit
Out
8.0
SEL_52
SEL
Select
In1
In2
SelectorIn
Out
8.0
v10_set
v10_manual
1
POSP_JT10
POSP
Position Proportional
v10_set
8.0
v10_LVDT_true
4.2455473
v10_error
1
Valve_Cycle_time
2.0
Valve_Rate
100.0
JT_Max_On_Time
1.0
JT_Min_On_Time
0.002
EnableIn
SP
Position
OpenedFB
ClosedFB
CycleTime
OpenRate
CloseRate
MaxOnTime
MinOnTime
OpenOut
0
CloseOut
0
OpenTime
0.0
CloseTime
0.0
PLC_control
0
BAND_62
BAND
Boolean And
In1
In2
Out
0
v10_open
BAND_63
BAND
Boolean And
In1
In2
Out
0
v10_close


0
SUB
Subtract
Source A loop_counter
12
Source B 1
Dest dim_a
10
SUB
Subtract
Source A loop_counter
12
Source B 2
Dest dim_b
9
1
CPT
Compute
Dest DT470_t[loop_counter]
??
Expression 2*DT470_x*DT470_t[dim_a]-DT470_t[dim_b]
2
CPT
Compute
Dest DT470_Temp
332.6816
Expression DT470_Temp+(DT470_a[Curve10_Range,loop_counter]*DT470_t[loop_counter])
3
RET
Return from Subroutine
(End)

Calculates the temperature of carbon ceramic resistors and temperature diodes.



Calculates the temperature of carbon ceramic resistors and temperature diodes.

Equations to calculate the temperature of a Lakeshore DT-470 diode.
Standard Curve 10 is the combination of four Chebychev polynomials. Range 1 2-12K; range 2 12-25K; range 3 25-100K; range 4 100-475K.
Coefficients for each range are given as part of Lakeshore's Standard Curve 10.

T(x) = Sum[i=0 to i=n](a[i]*t[i](x))
x = ((Z-ZL)-(ZU-Z))/(ZU-ZL)
t[i+1](x) = 2*x*t[i](x)-t[i-1](x)

x is a normalized variable; Z is measured voltage, ZU is the upper limit for the fit range, ZL is the lower limit for the fit range. ZU and ZL given with Standard Curve 10.
t is the recursion relationship for the Chebychev polynomial fit. t[0](x) = 1 and t[1](x) = x. DT470_t is a one dimensional array containing the calculated values of t.
DT470_a is a two dimensional array containing the Chebychev coefficients a for each range.

The routine determines which range is appropriate for each sensor, then calculates DT470_x, DT470_t[0], and DT470_t[1], then call a 'FOR' loop sub-routine to determine the remaining values of DT570_t and carry out the summation. The resulting DT470_Temp is assigned to the temperature tag corresponding to the input voltage.

HX Diode-1

2

GEQ
Grtr Than or Eql (A>=B)
Source A V1
0.31108952
Source B 1.36809

CPT
Compute
Dest Curve10_Range
3
Expression 0

CPT
Compute
Dest DT470_x
-0.21679741
Expression (V1-1.32412-(1.69812-V1))/(1.69812-1.32412)

CPT
Compute
Dest DT470_t[0]
1.0
Expression 1

CPT
Compute
Dest DT470_t[1]
-0.21679741
Expression DT470_x

CPT
Compute
Dest DT470_Temp
332.6816
Expression DT470_a[Curve10_Range,0]*DT470_t[0]+(DT470_a[Curve10_Range,1]*DT470_t[1])

FOR

CPT

Calculates the temperature of carbon ceramic resistors and temperature diodes.

FOR
For
Routine Name Diode_FOR_Loop
Index loop_counter
12
Initial Value 2
Terminal Value 11
Step Size 1

CPT
Compute
Dest T_N2_Vent
389.1344
Expression DT470_Temp

3

GEQ
Grtr Than or Eql (A>=B)
Source A V1
0.31108952
Source B 1.12463

LES
Less Than (A<B)
Source A V1
0.31108952
Source B 1.36809

CPT
Compute
Dest Curve10_Range
3
Expression 1

CPT
Compute
Dest DT470_x
-0.21679741
Expression (V1-1.11732-(1.42013-V1))/(1.42013-1.11732)

CPT
Compute
Dest DT470_t[0]
1.0
Expression 1

CPT
Compute
Dest DT470_t[1]
-0.21679741
Expression DT470_x

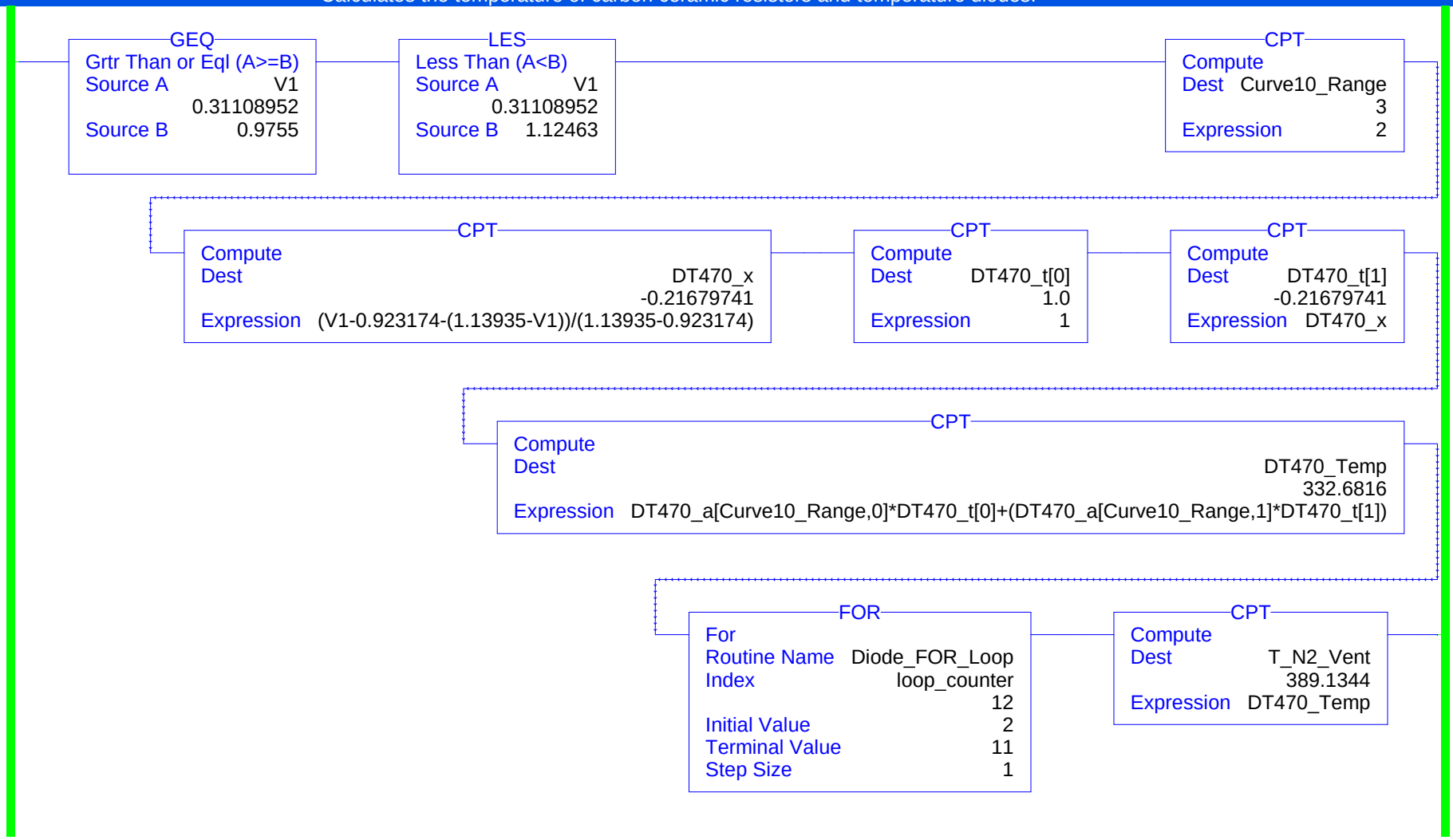
CPT
Compute
Dest DT470_Temp
332.6816
Expression DT470_a[Curve10_Range,0]*DT470_t[0]+(DT470_a[Curve10_Range,1]*DT470_t[1])

FOR
For
Routine Name Diode_FOR_Loop
Index loop_counter
12
Initial Value 2
Terminal Value 11
Step Size 1

CPT
Compute
Dest T_N2_Vent
389.1344
Expression DT470_Temp

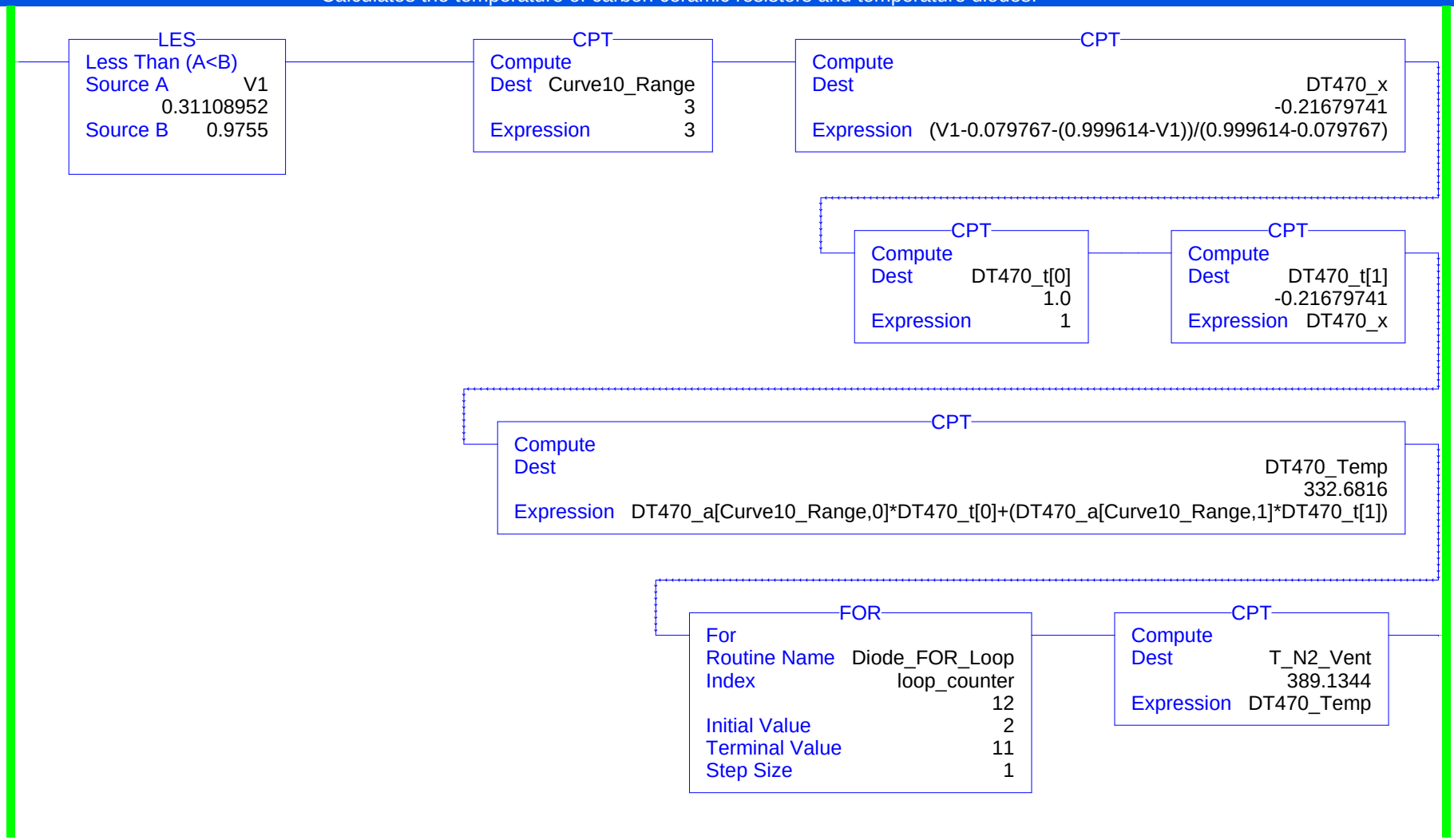
Calculates the temperature of carbon ceramic resistors and temperature diodes.

4



Calculates the temperature of carbon ceramic resistors and temperature diodes.

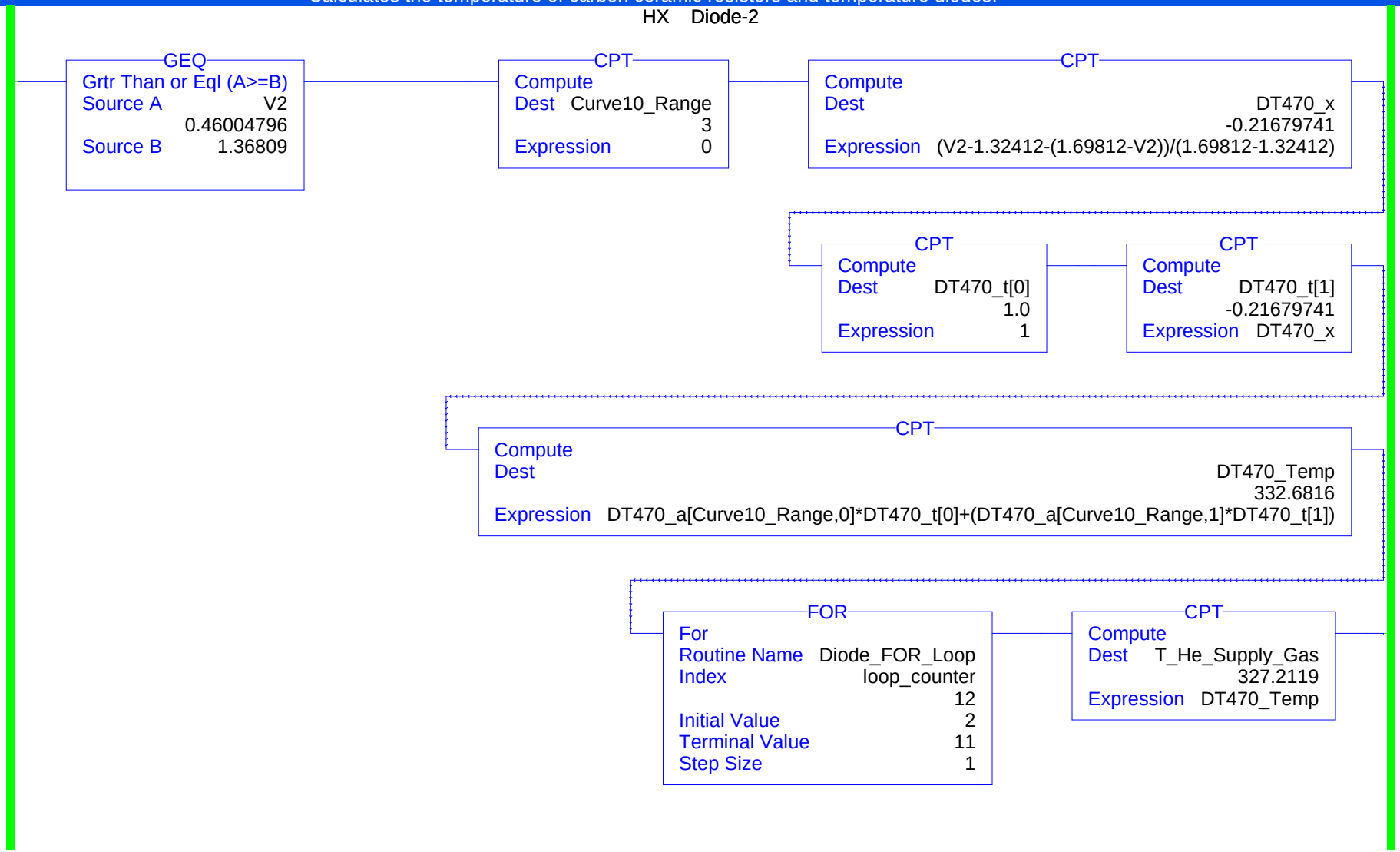
5



Calculates the temperature of carbon ceramic resistors and temperature diodes.

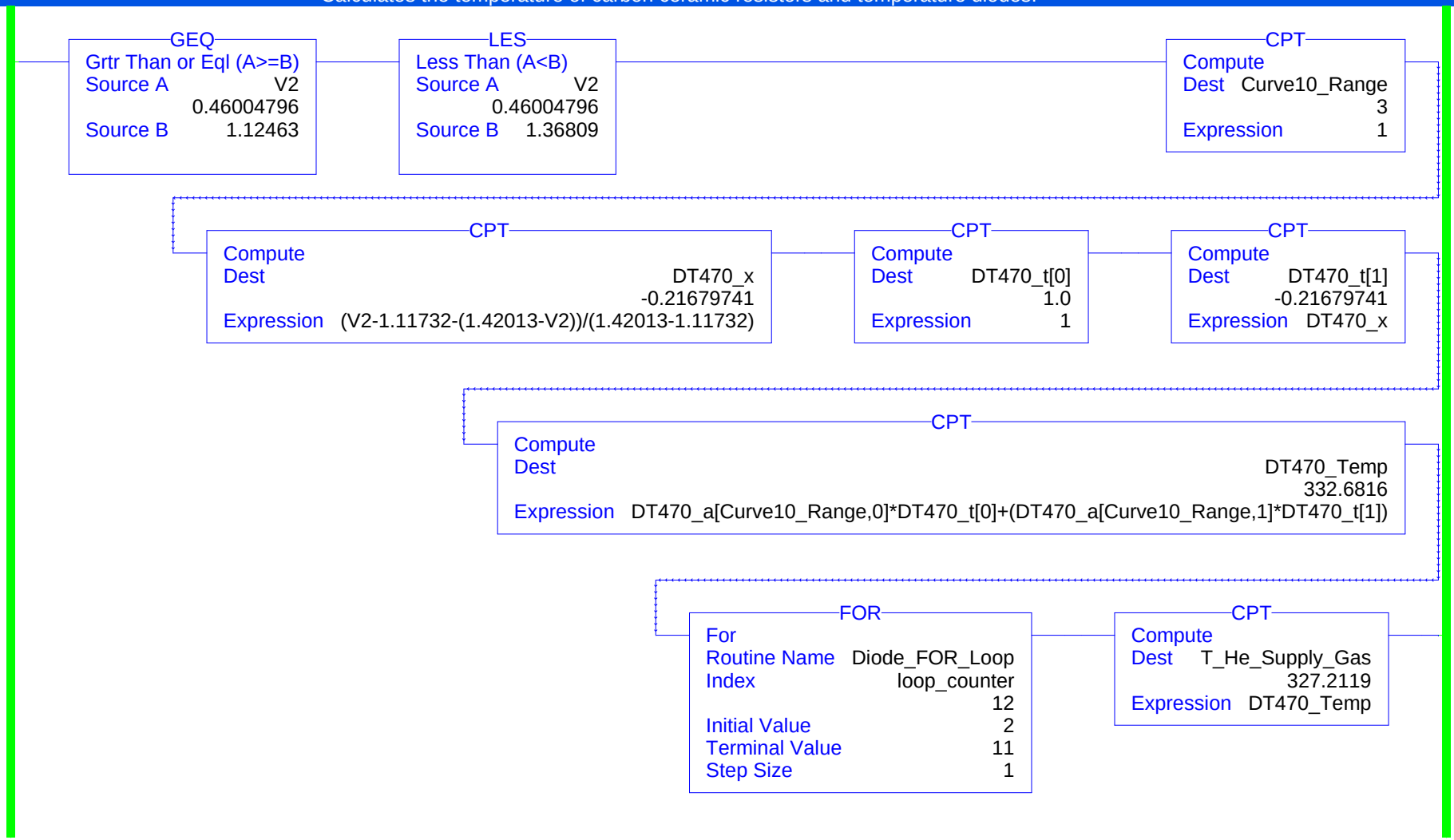
HX Diode-2

6



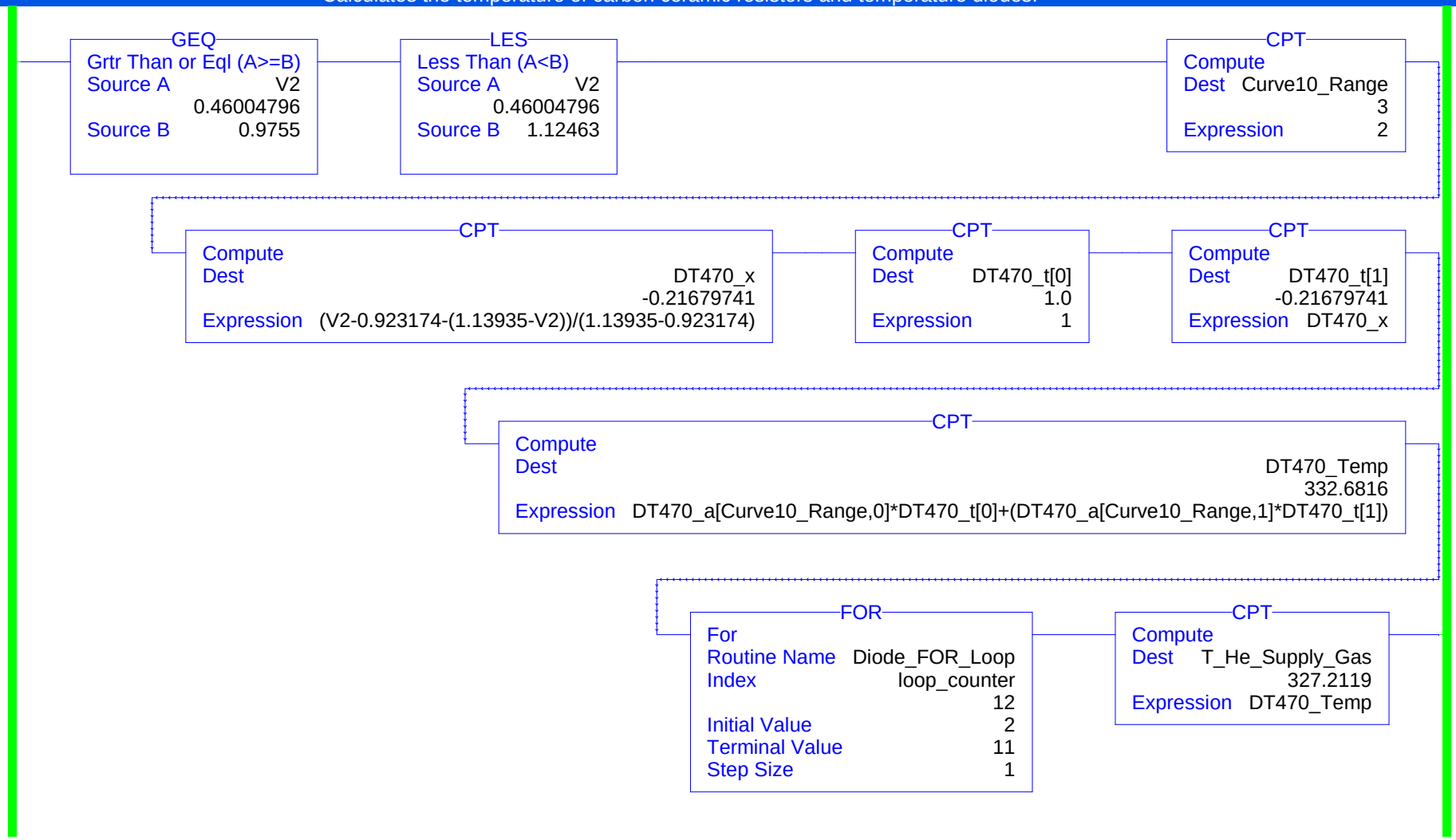
Calculates the temperature of carbon ceramic resistors and temperature diodes.

7



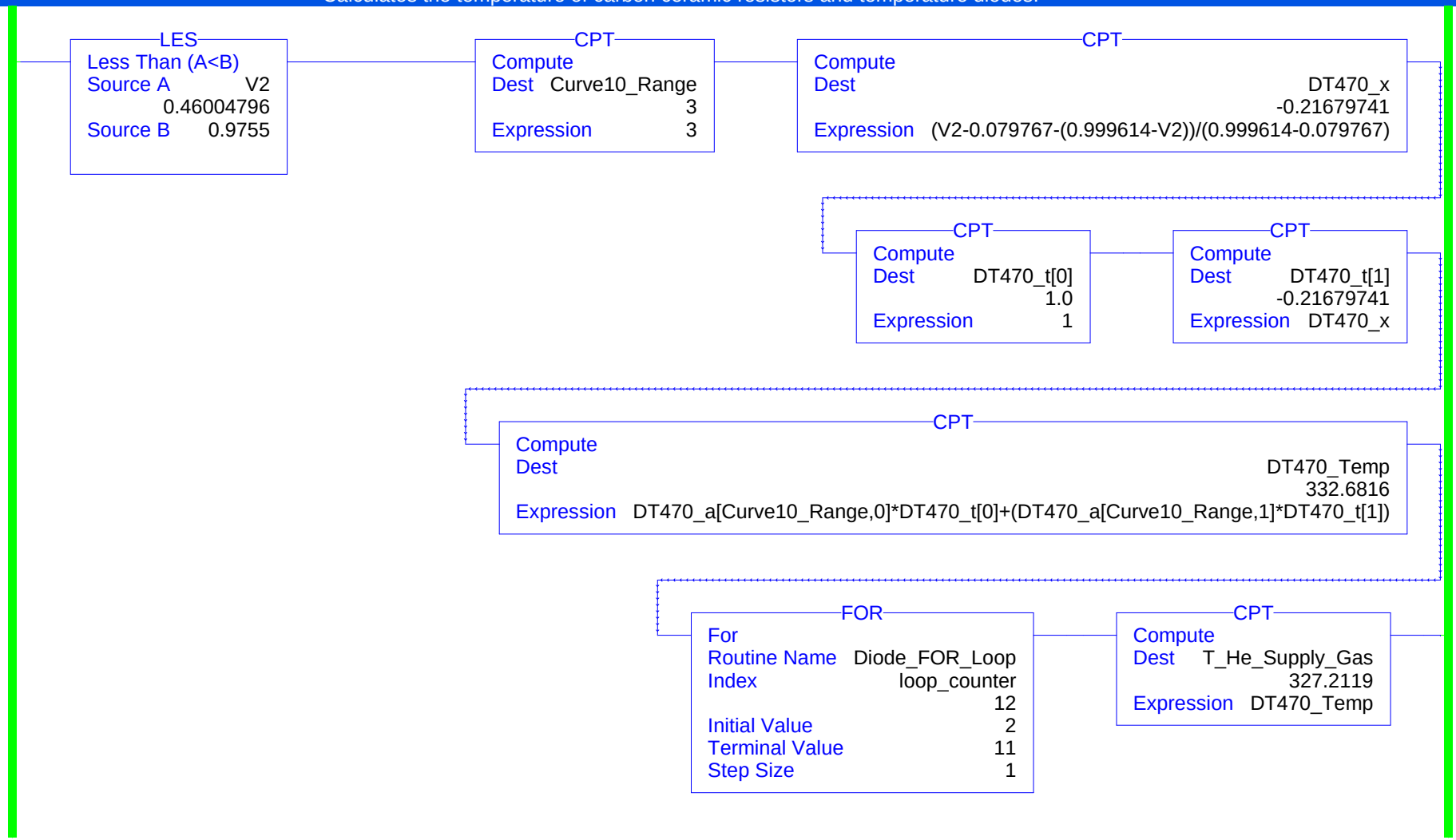
Calculates the temperature of carbon ceramic resistors and temperature diodes.

8



Calculates the temperature of carbon ceramic resistors and temperature diodes.

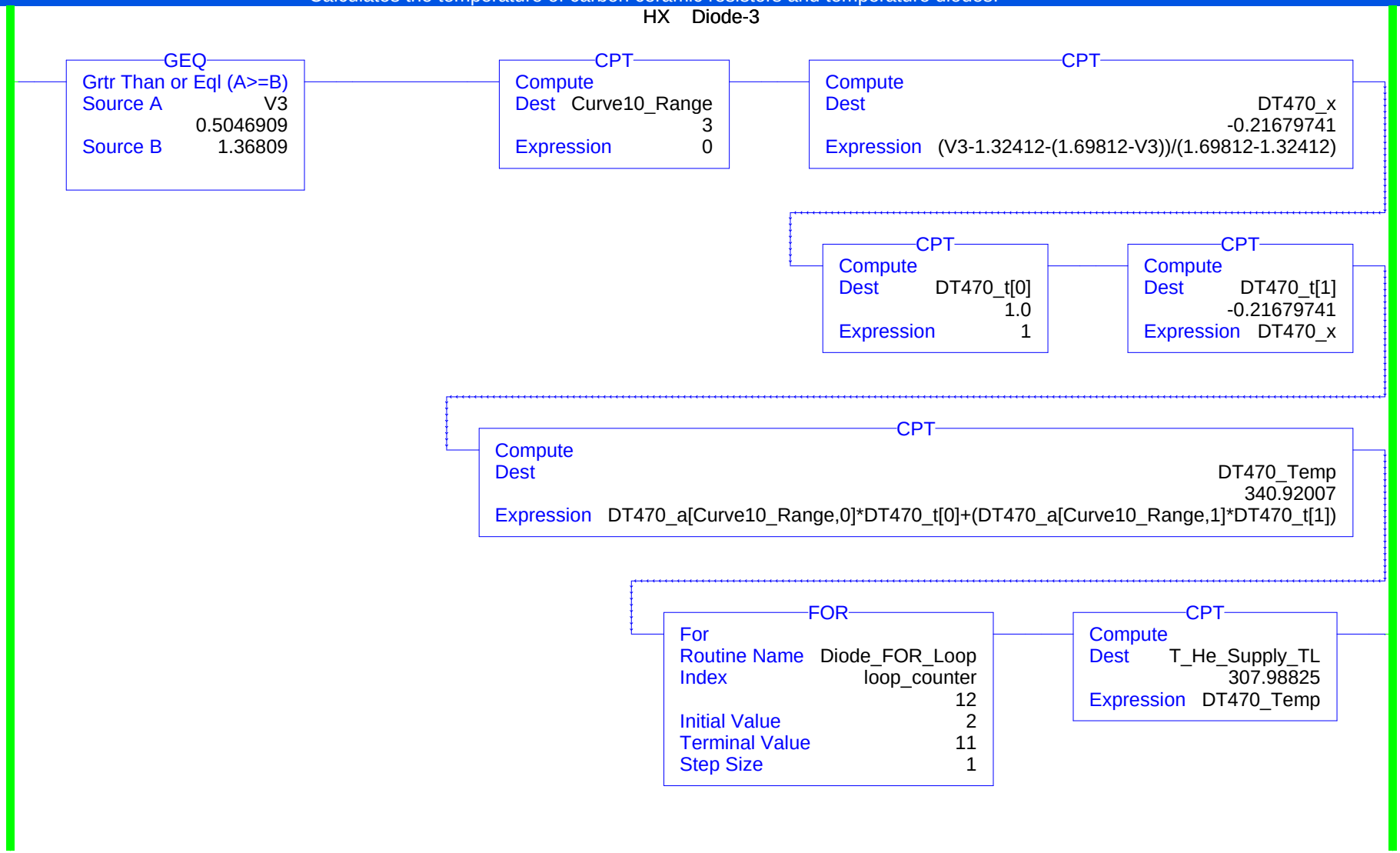
9



Calculates the temperature of carbon ceramic resistors and temperature diodes.

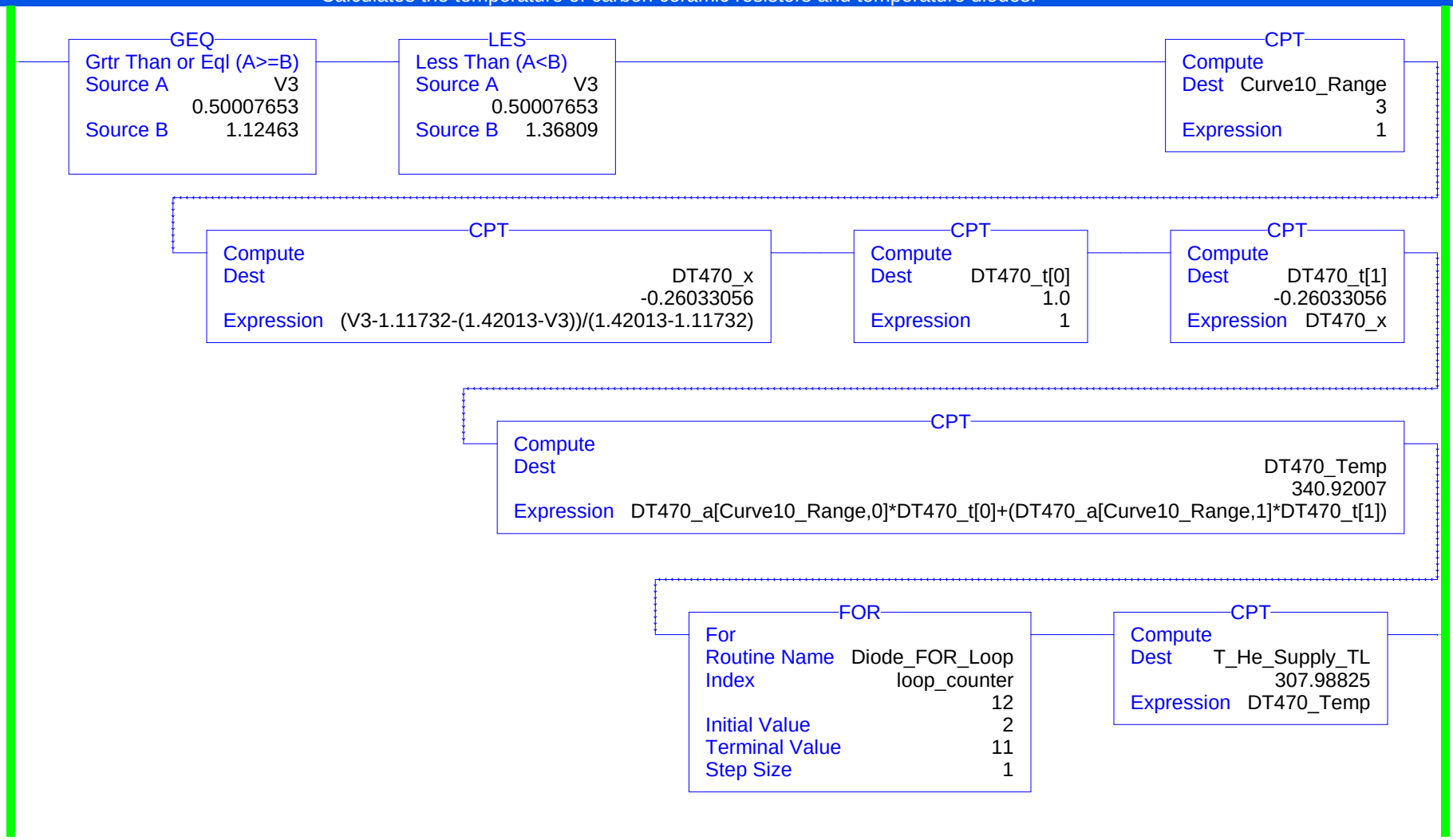
HX Diode-3

10



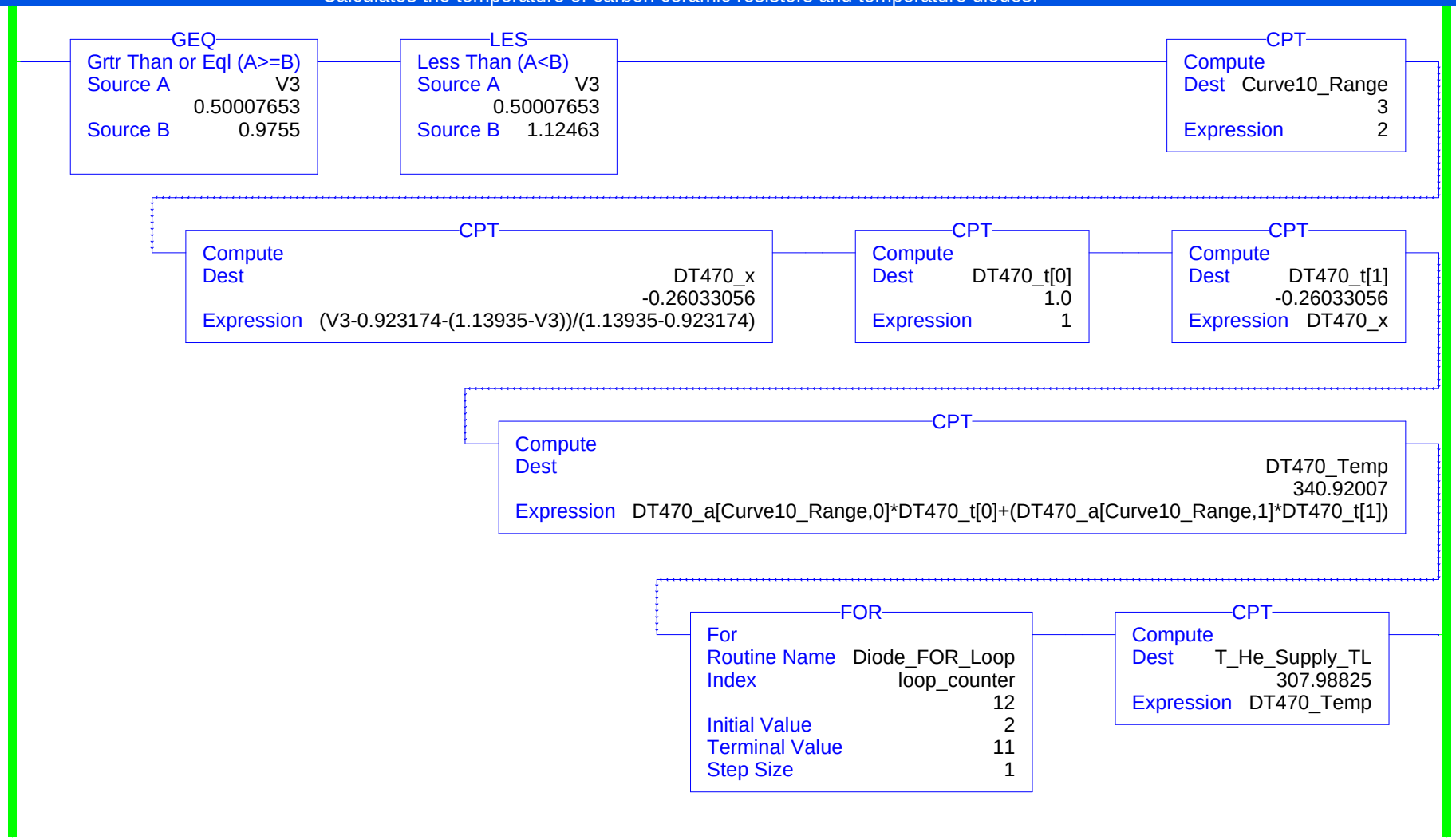
Calculates the temperature of carbon ceramic resistors and temperature diodes.

11



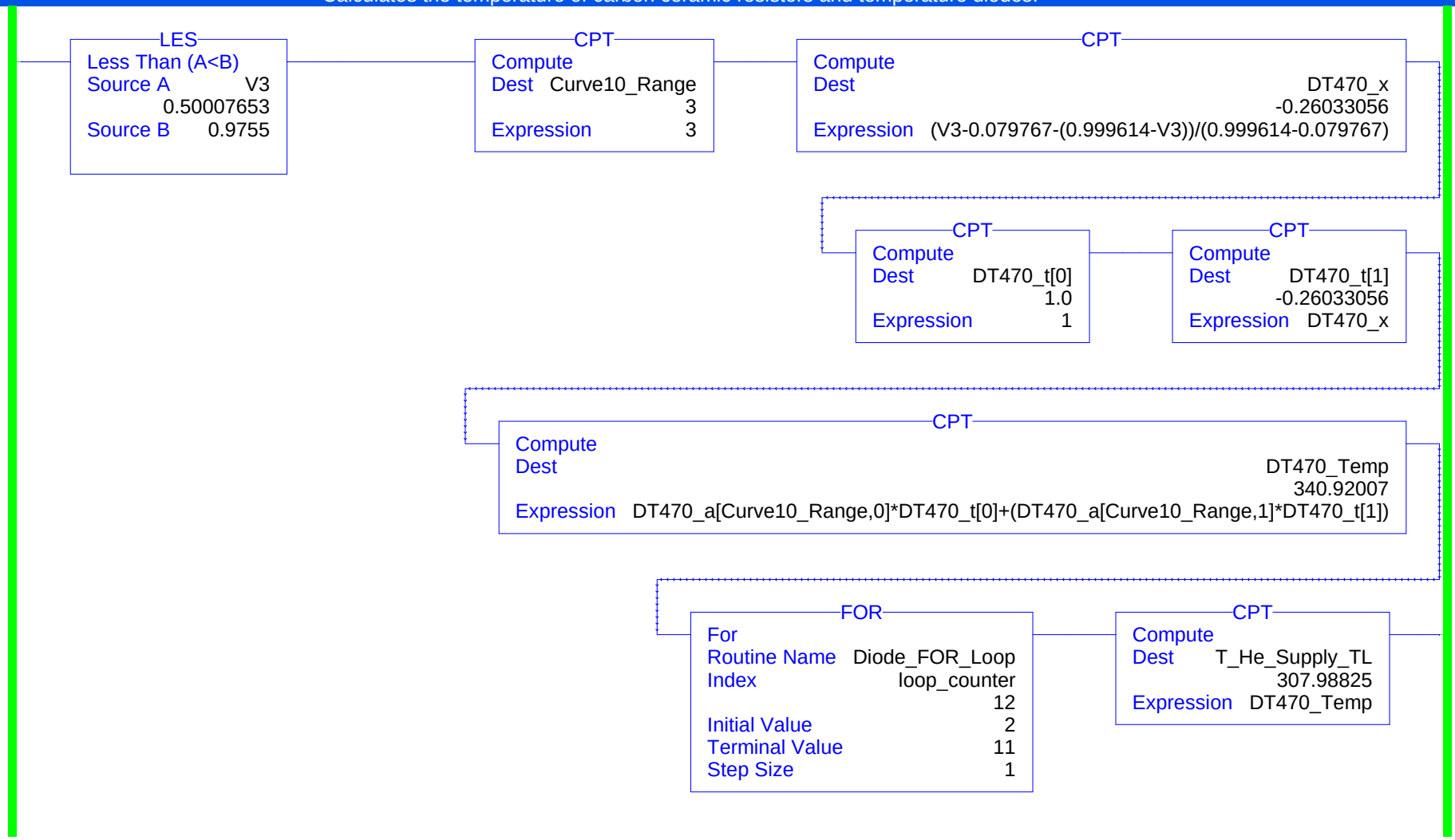
Calculates the temperature of carbon ceramic resistors and temperature diodes.

12



Calculates the temperature of carbon ceramic resistors and temperature diodes.

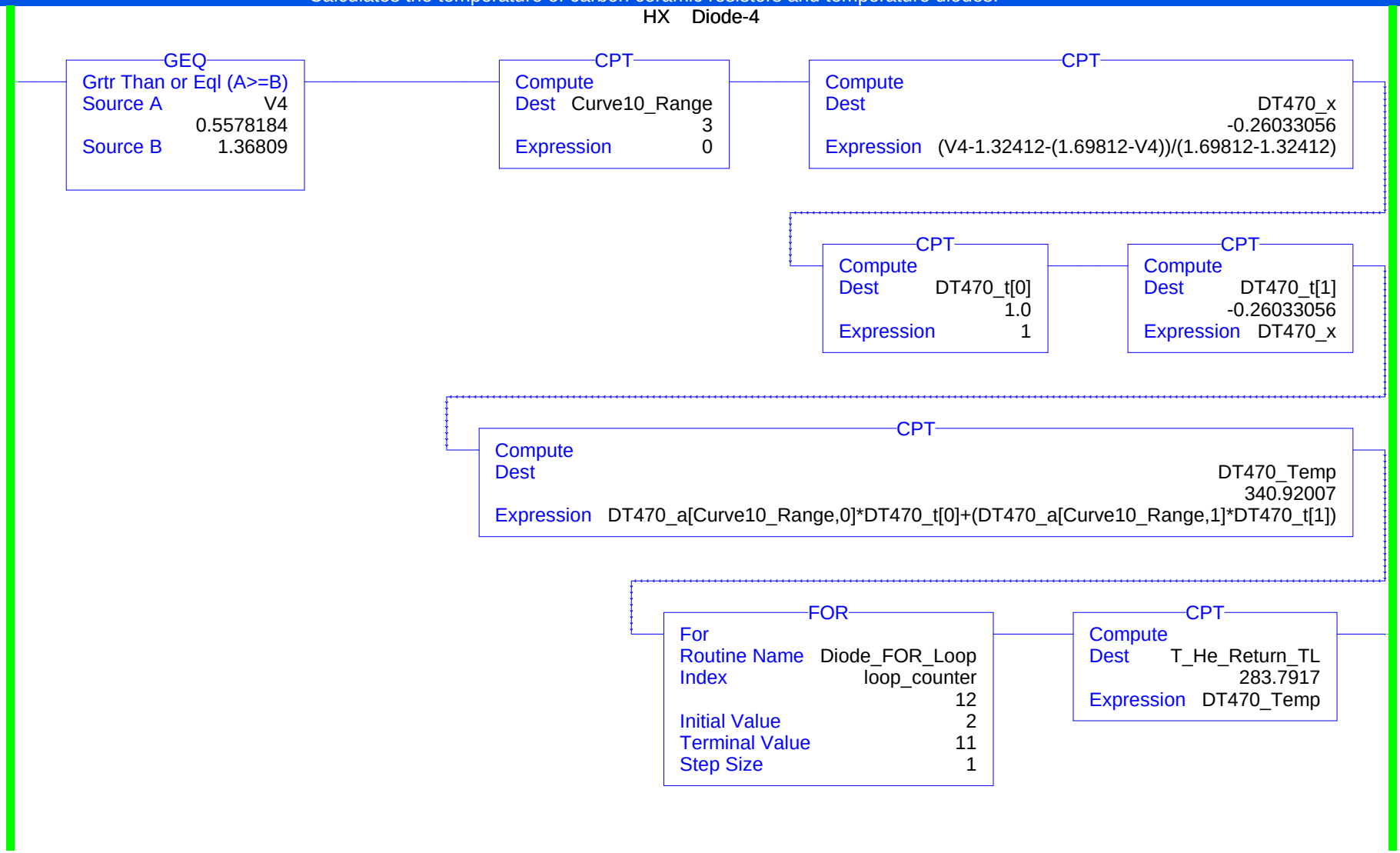
13



Calculates the temperature of carbon ceramic resistors and temperature diodes.

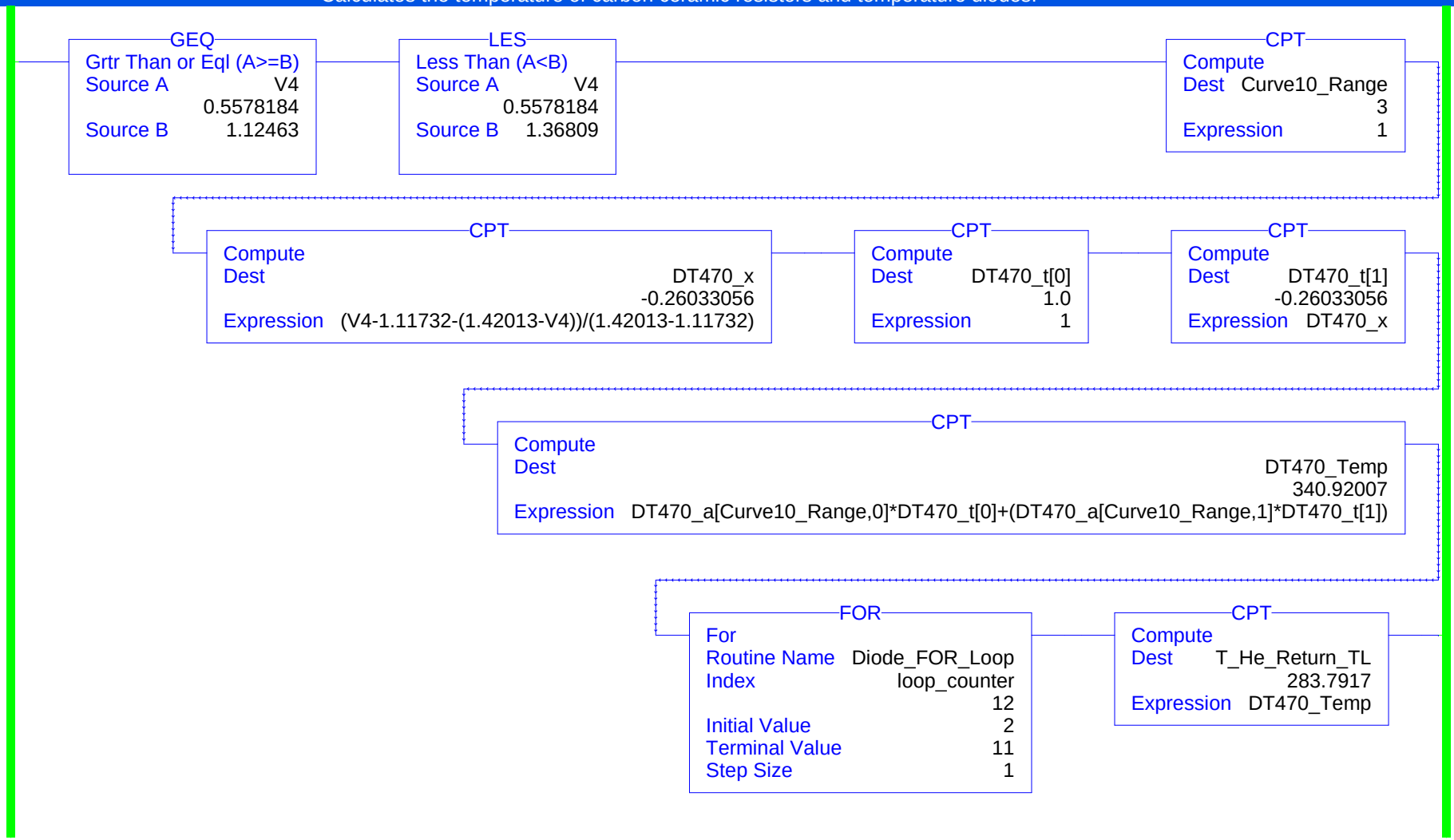
HX Diode-4

14



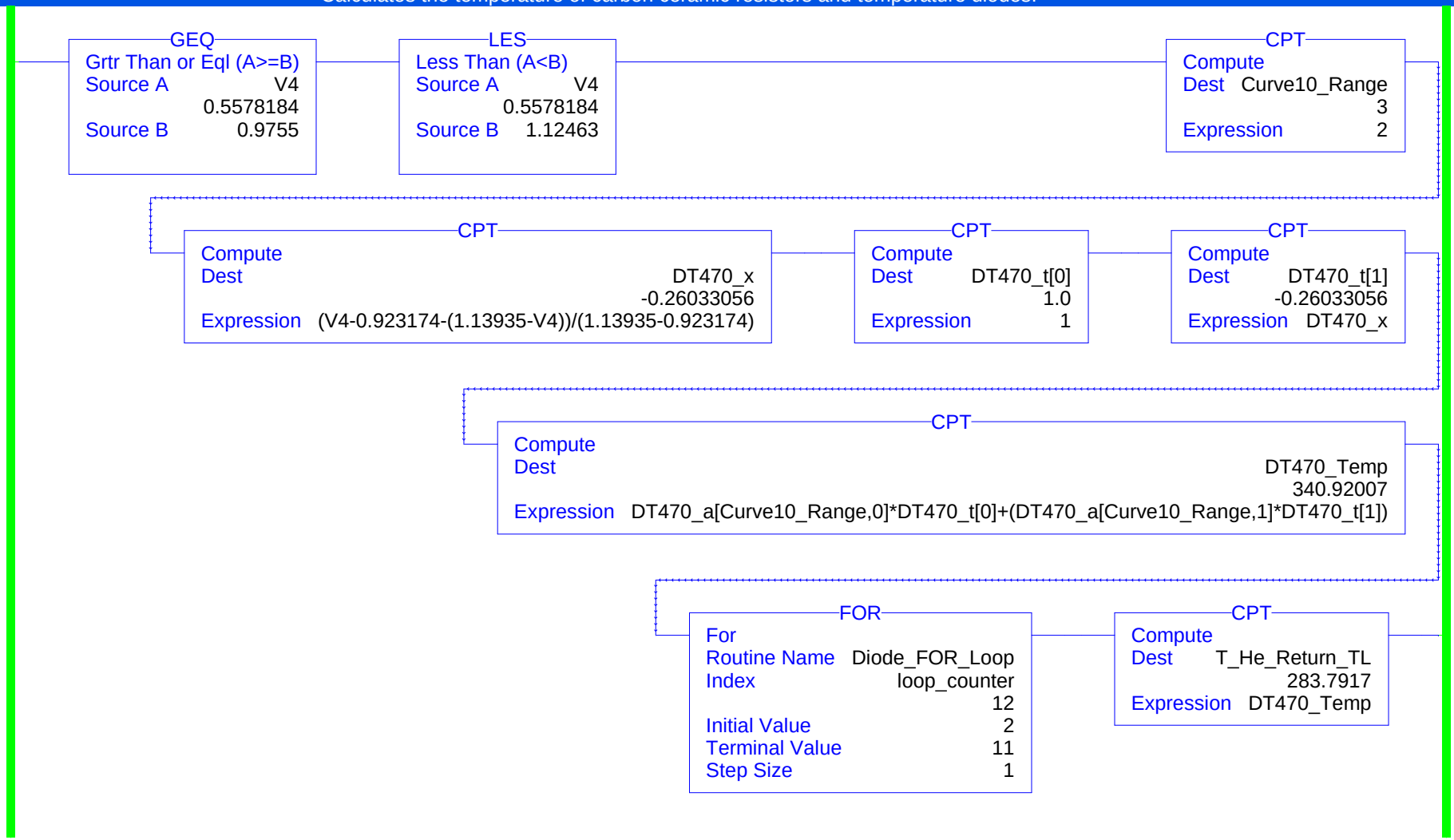
Calculates the temperature of carbon ceramic resistors and temperature diodes.

15



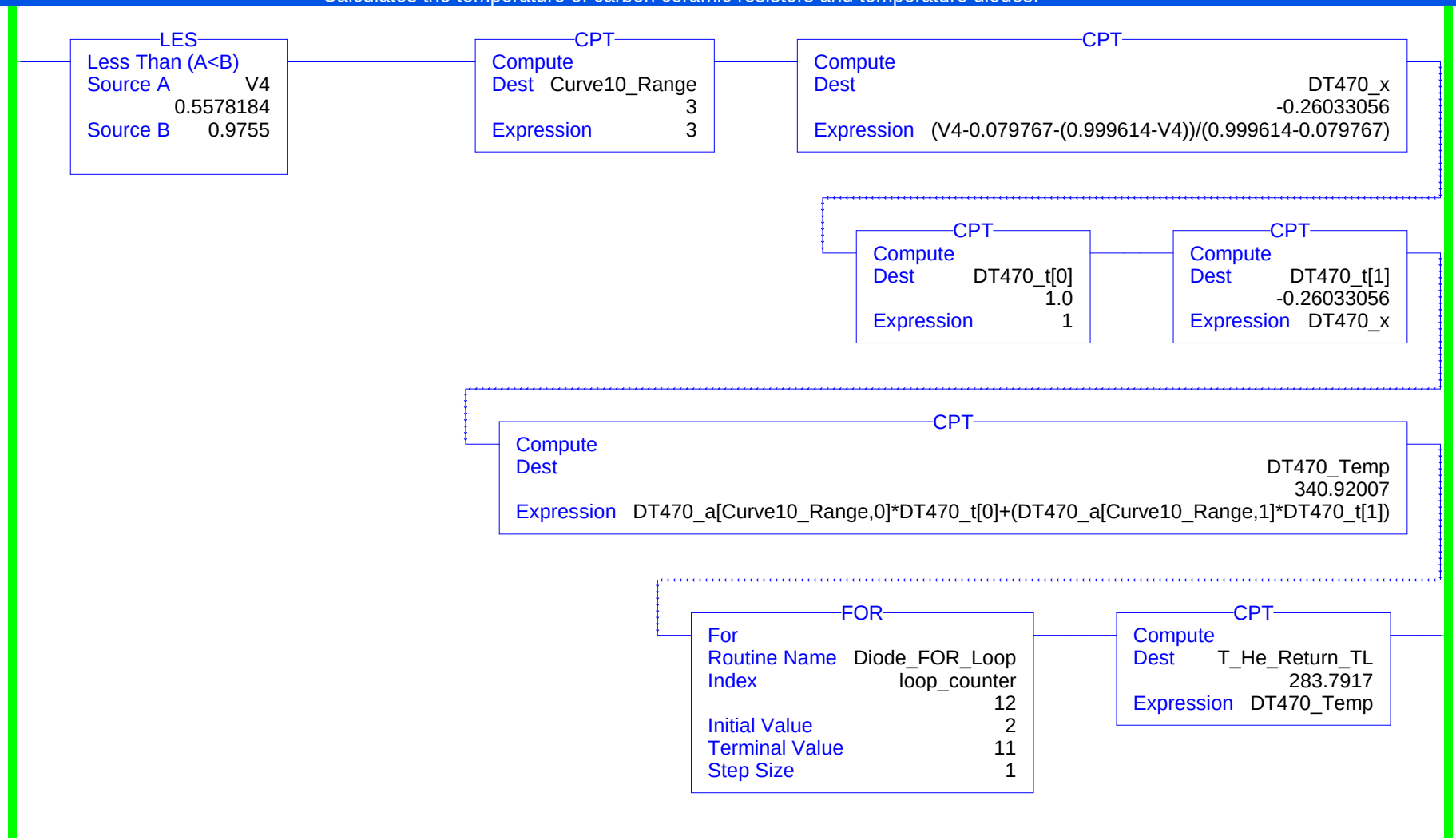
Calculates the temperature of carbon ceramic resistors and temperature diodes.

16



Calculates the temperature of carbon ceramic resistors and temperature diodes.

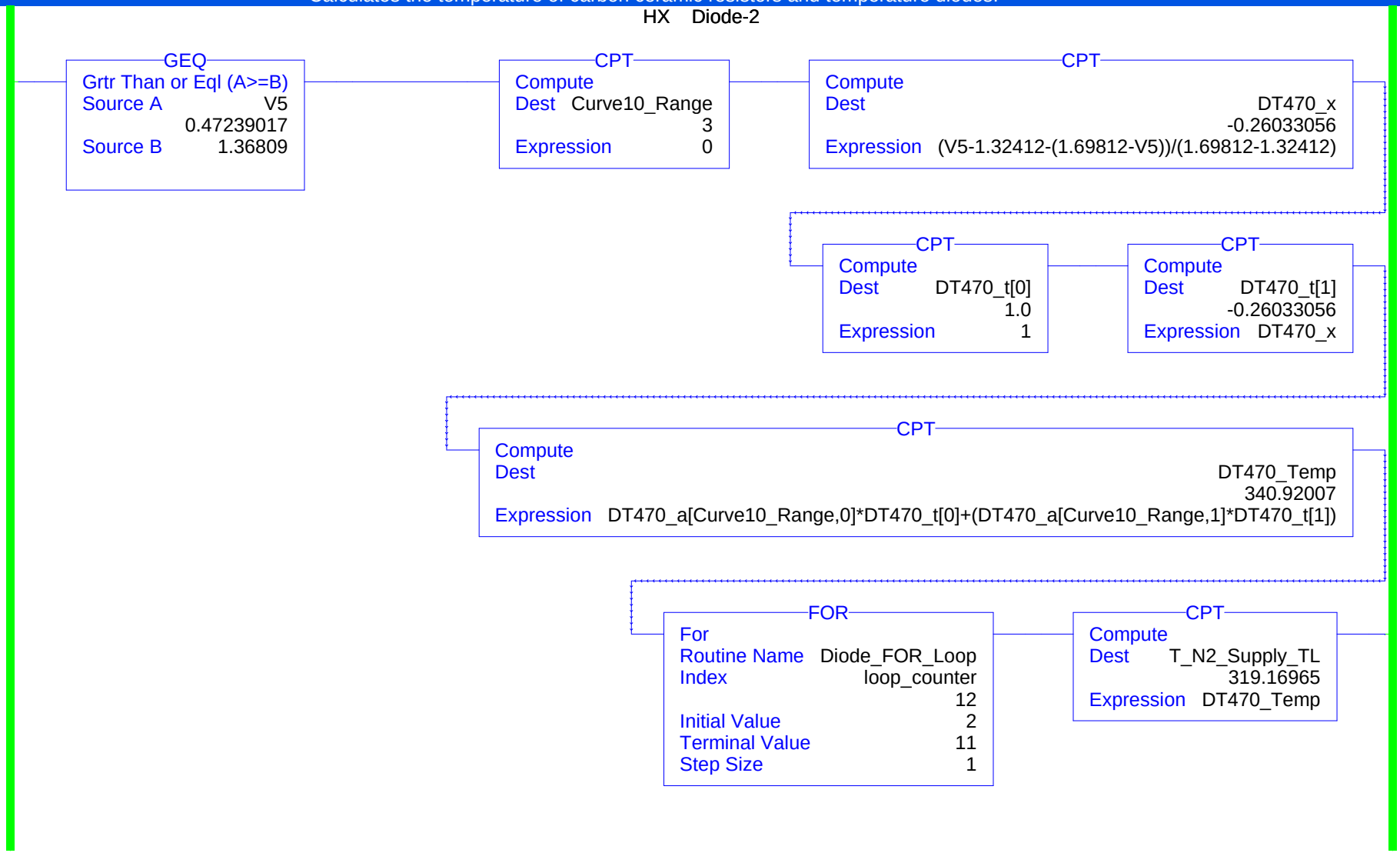
17



Calculates the temperature of carbon ceramic resistors and temperature diodes.

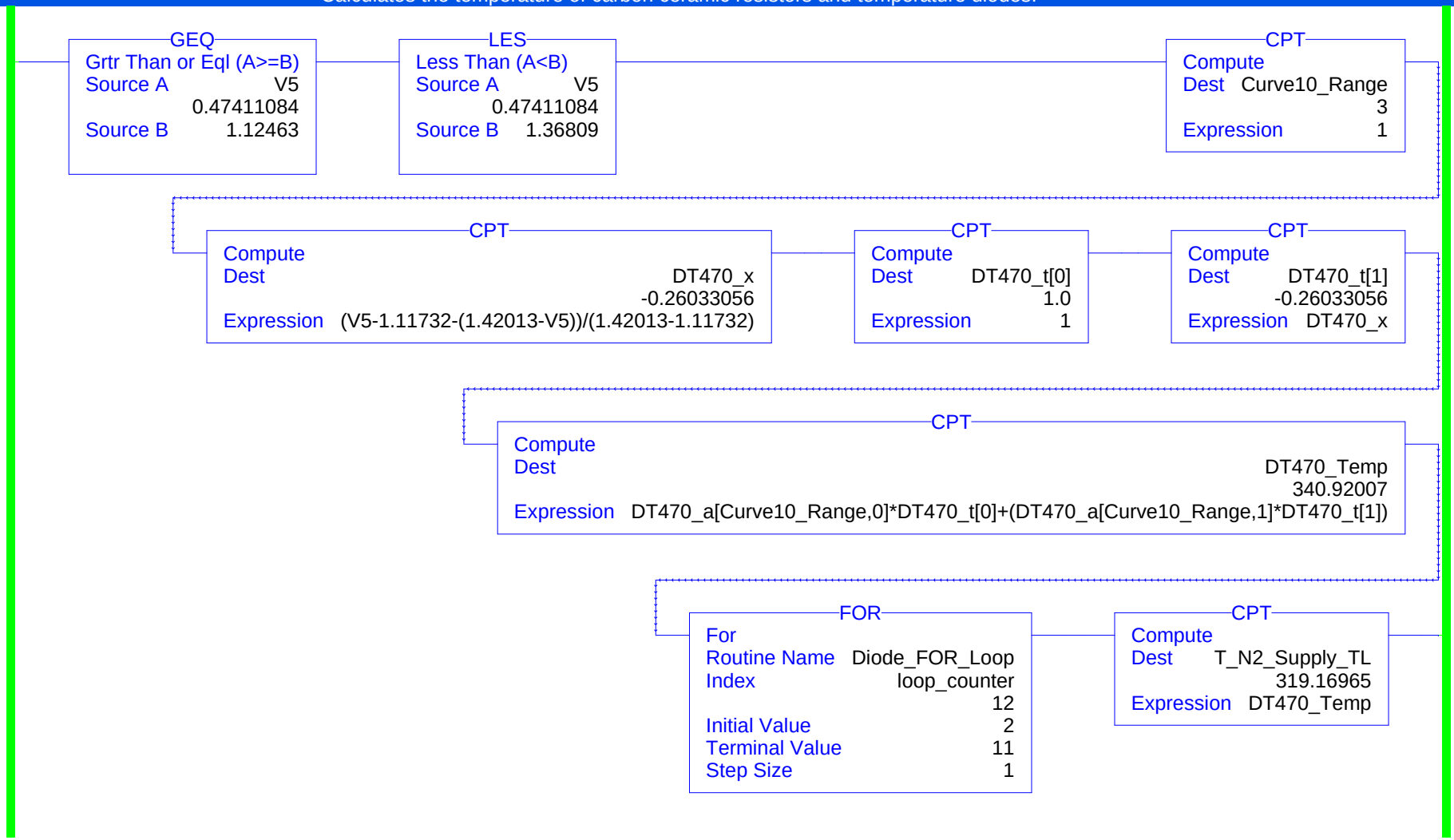
HX Diode-2

18



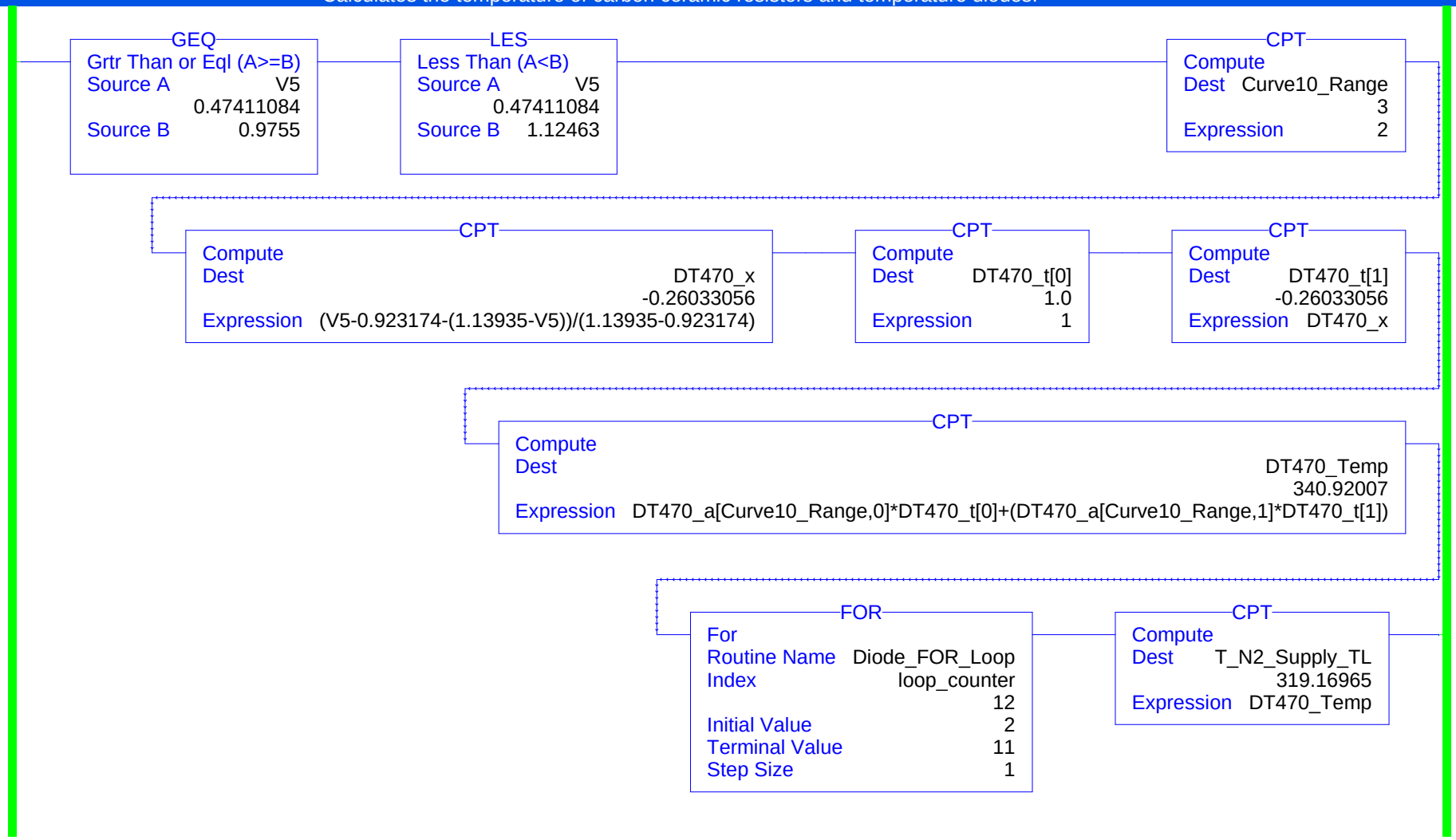
Calculates the temperature of carbon ceramic resistors and temperature diodes.

19



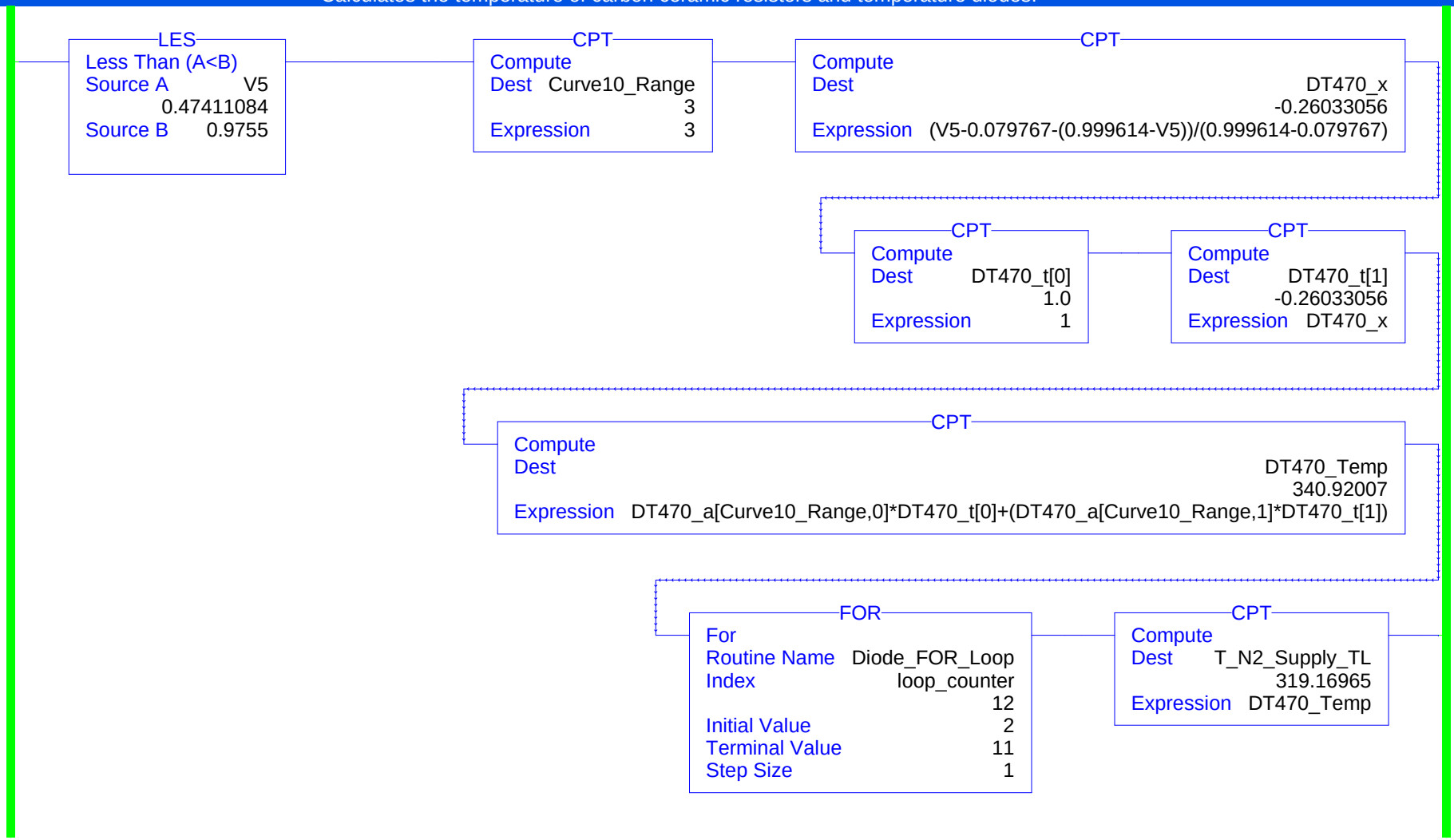
Calculates the temperature of carbon ceramic resistors and temperature diodes.

20



Calculates the temperature of carbon ceramic resistors and temperature diodes.

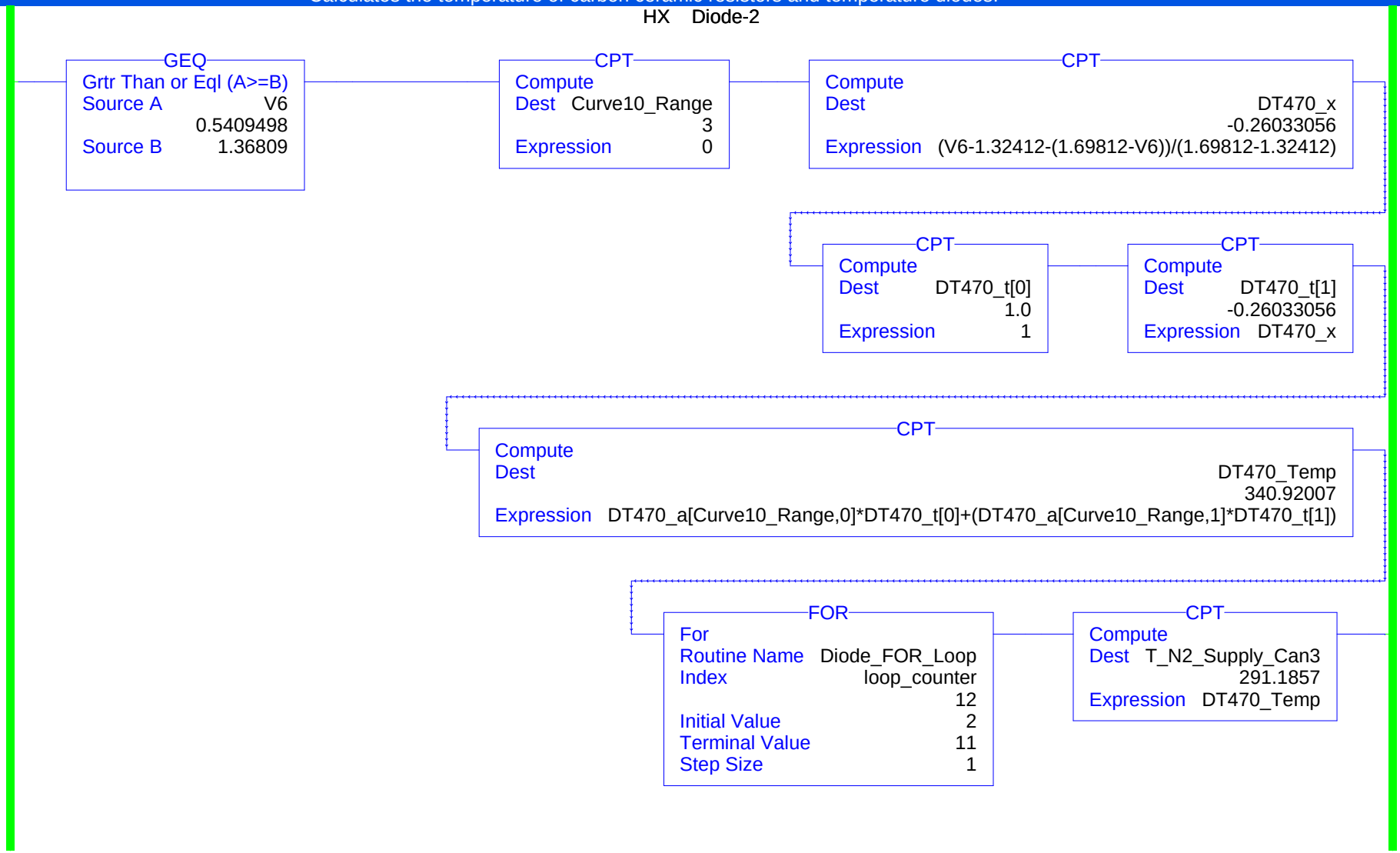
21



Calculates the temperature of carbon ceramic resistors and temperature diodes.

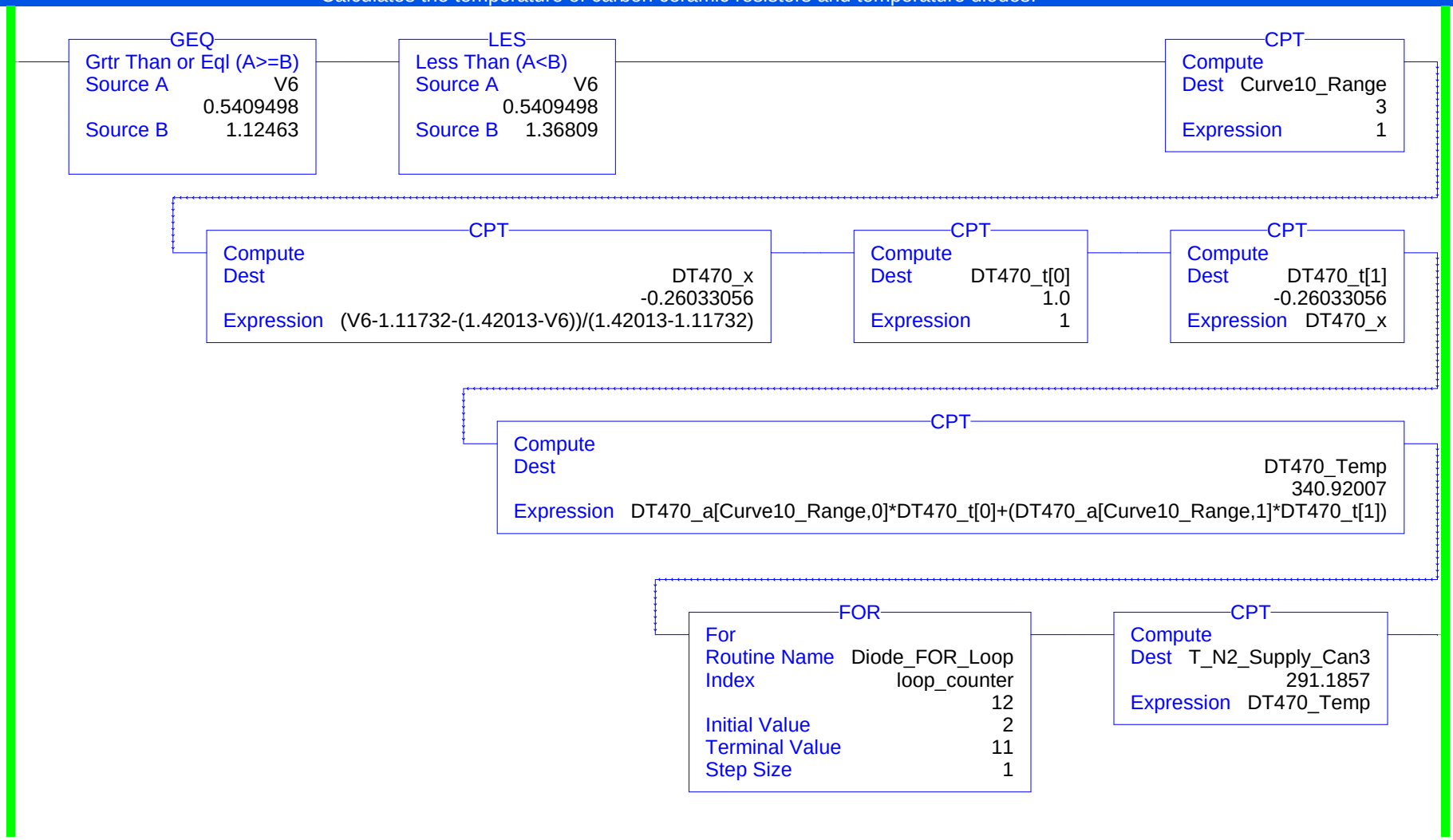
HX Diode-2

22



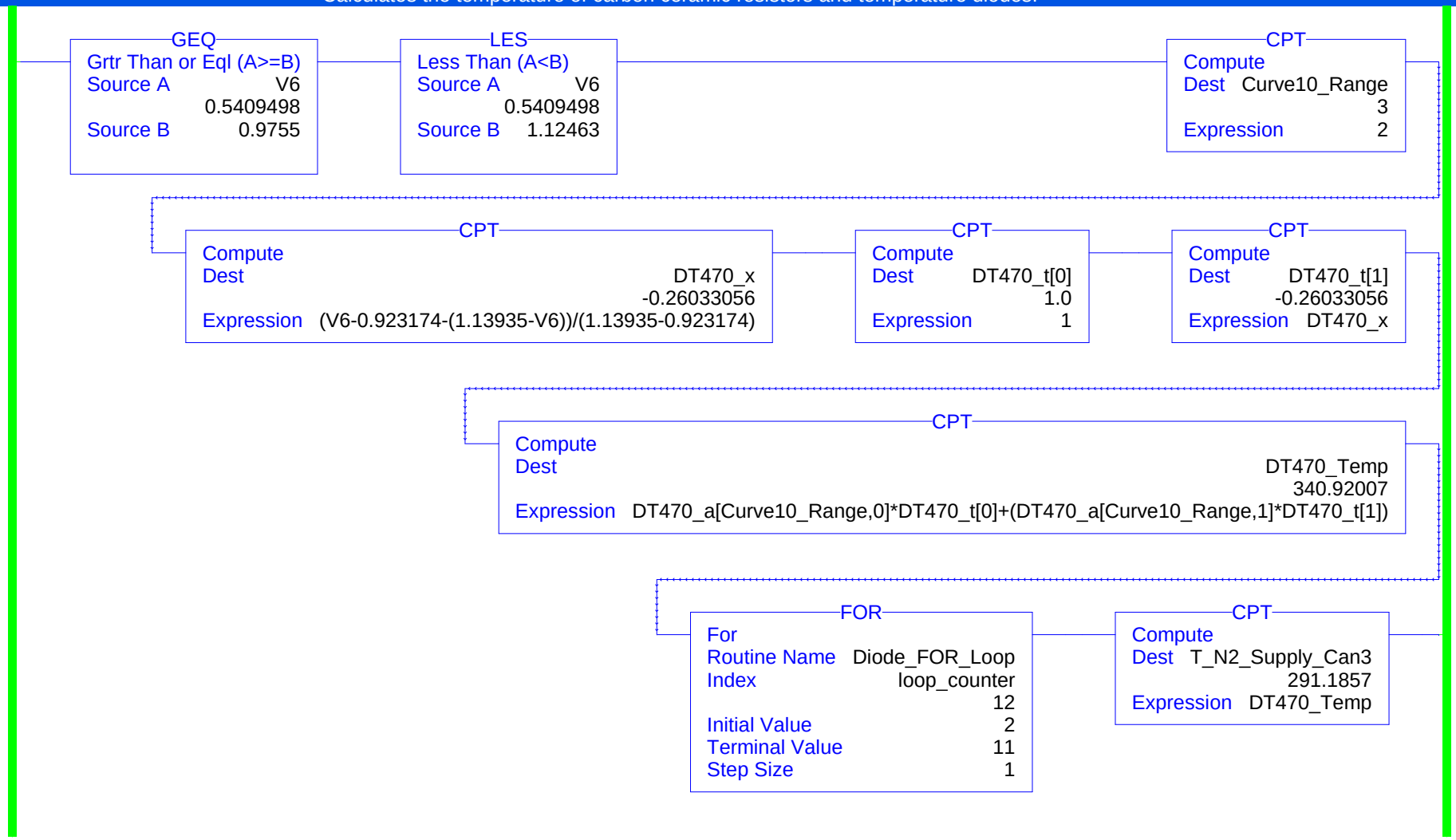
Calculates the temperature of carbon ceramic resistors and temperature diodes.

23



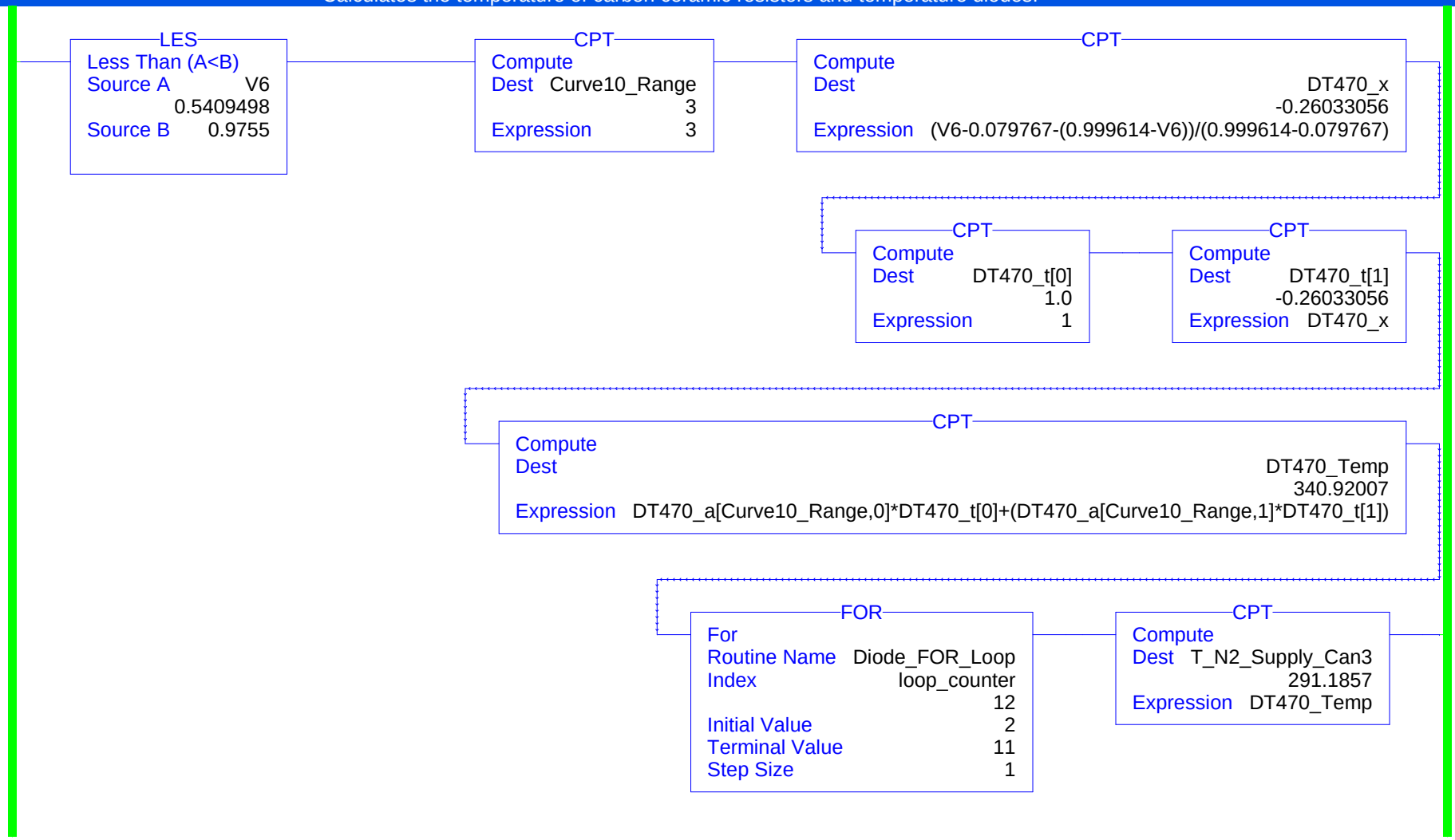
Calculates the temperature of carbon ceramic resistors and temperature diodes.

24



Calculates the temperature of carbon ceramic resistors and temperature diodes.

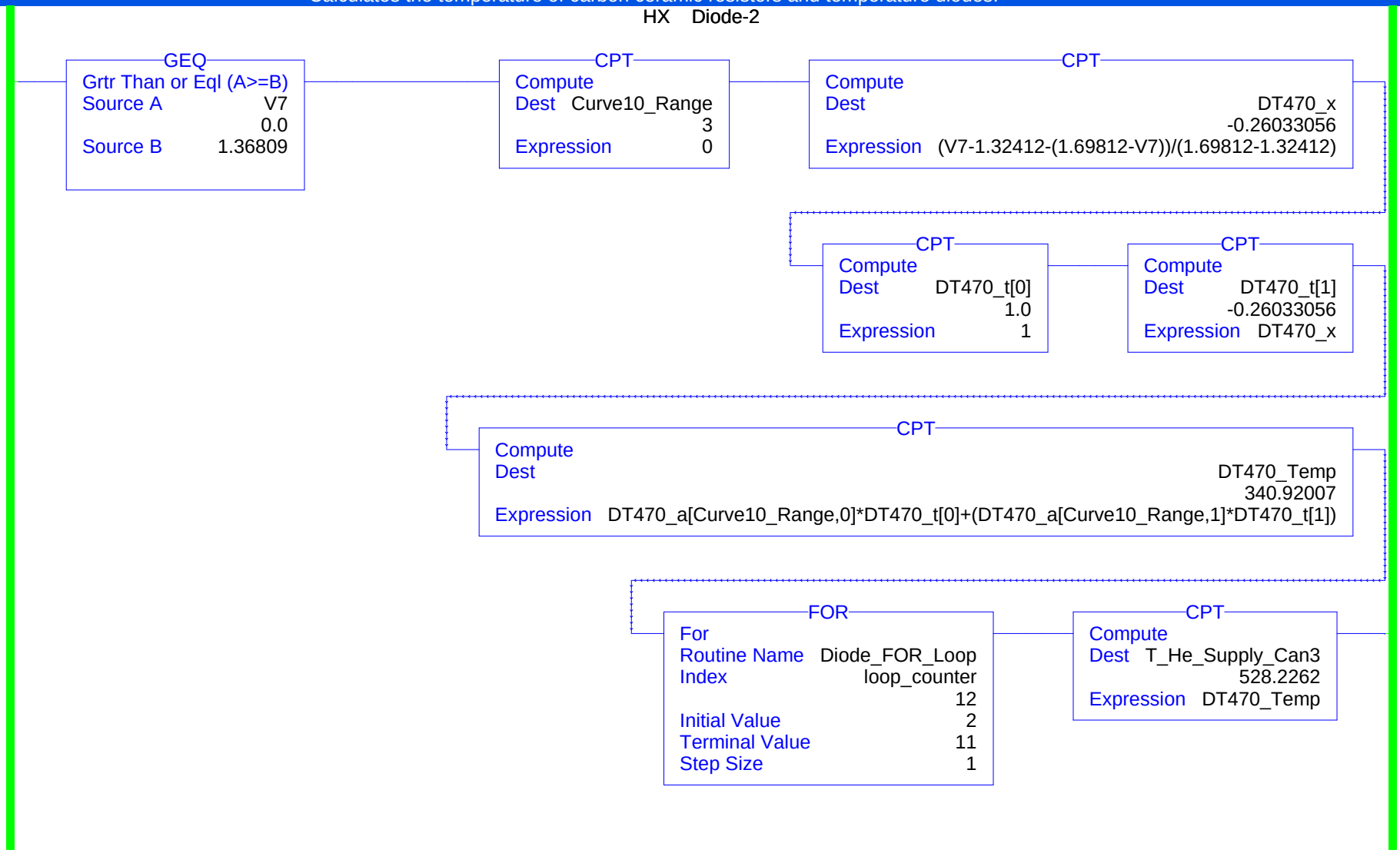
25



Calculates the temperature of carbon ceramic resistors and temperature diodes.

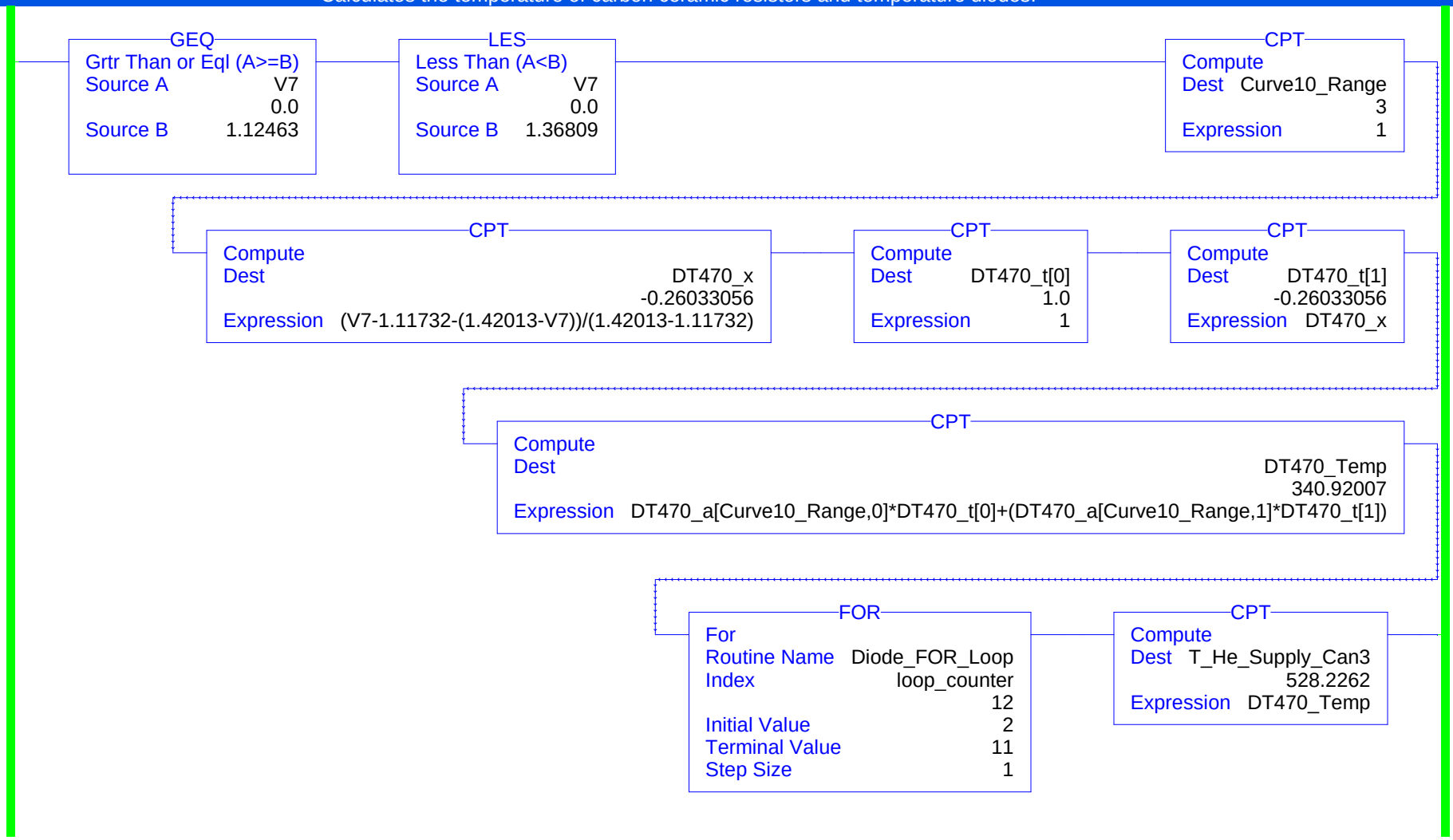
HX Diode-2

26



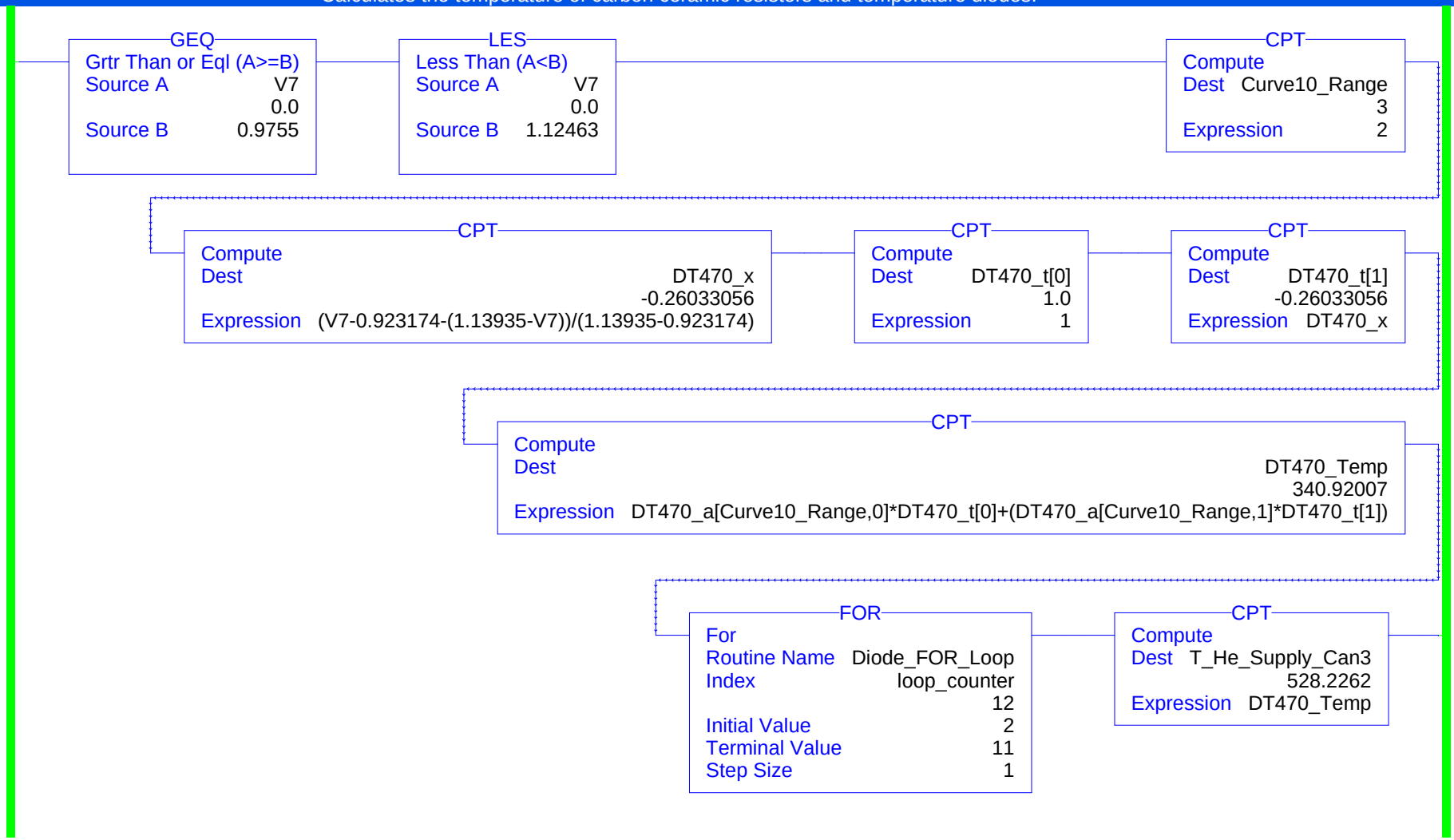
Calculates the temperature of carbon ceramic resistors and temperature diodes.

27



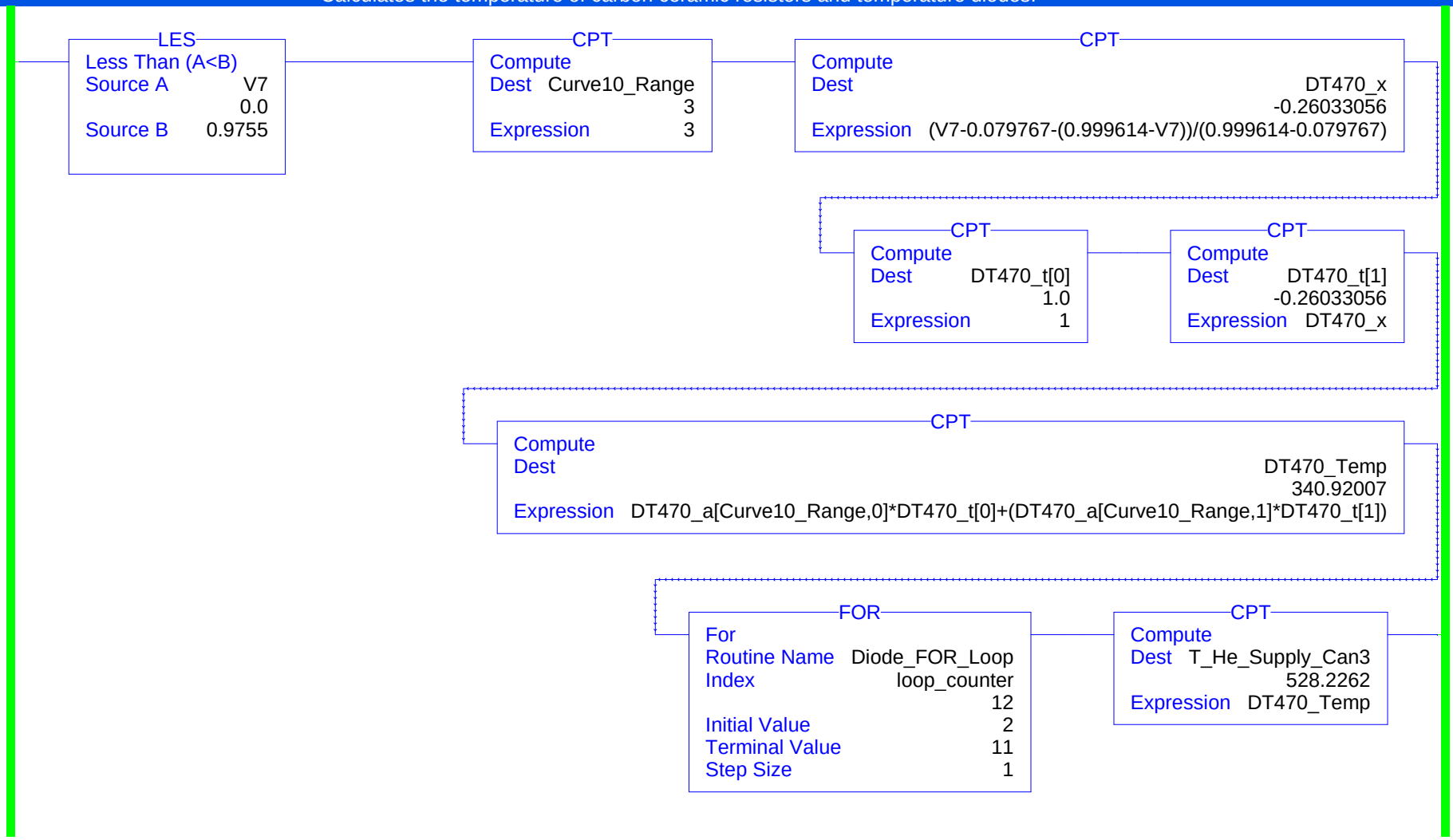
Calculates the temperature of carbon ceramic resistors and temperature diodes.

28



Calculates the temperature of carbon ceramic resistors and temperature diodes.

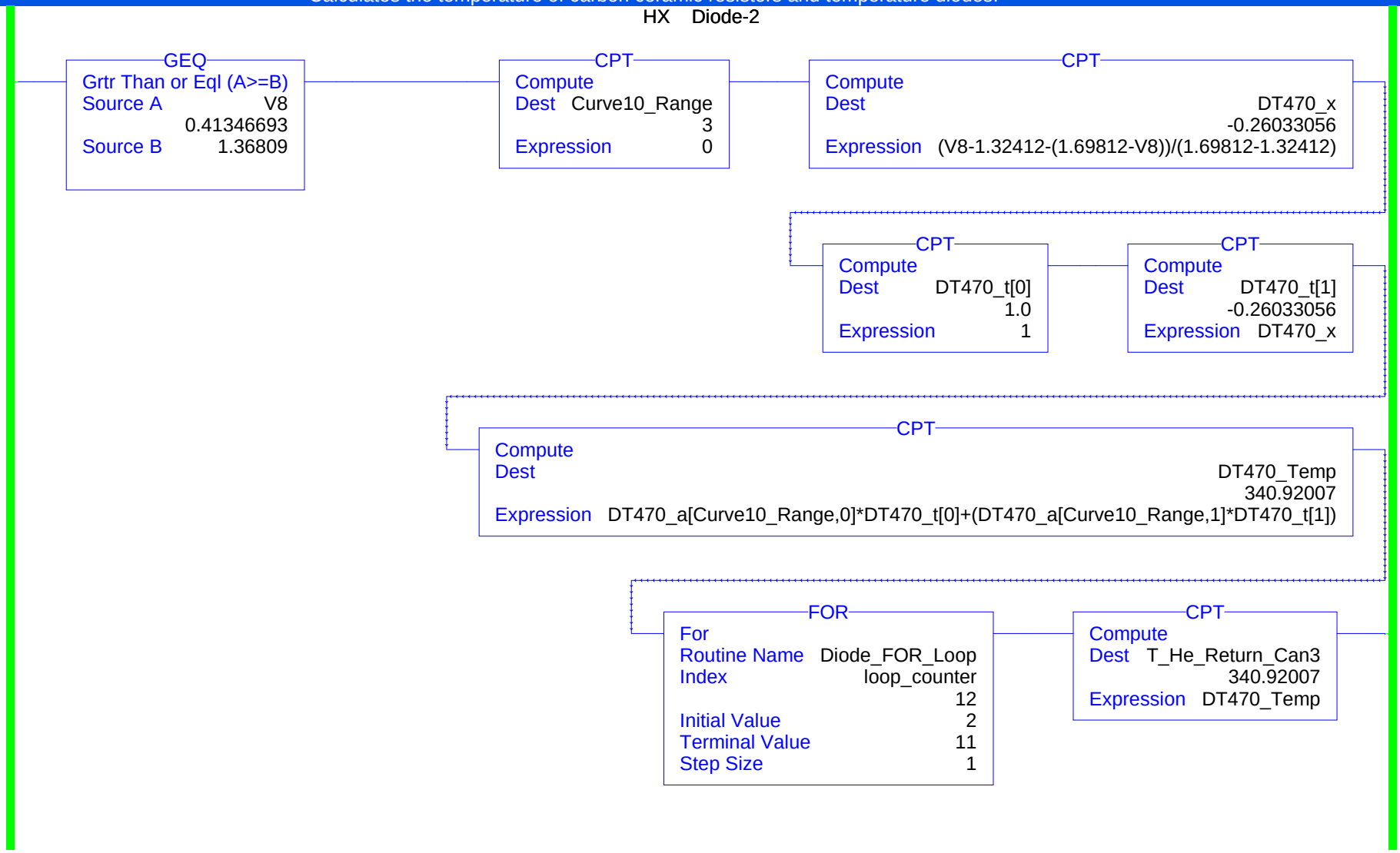
29



Calculates the temperature of carbon ceramic resistors and temperature diodes.

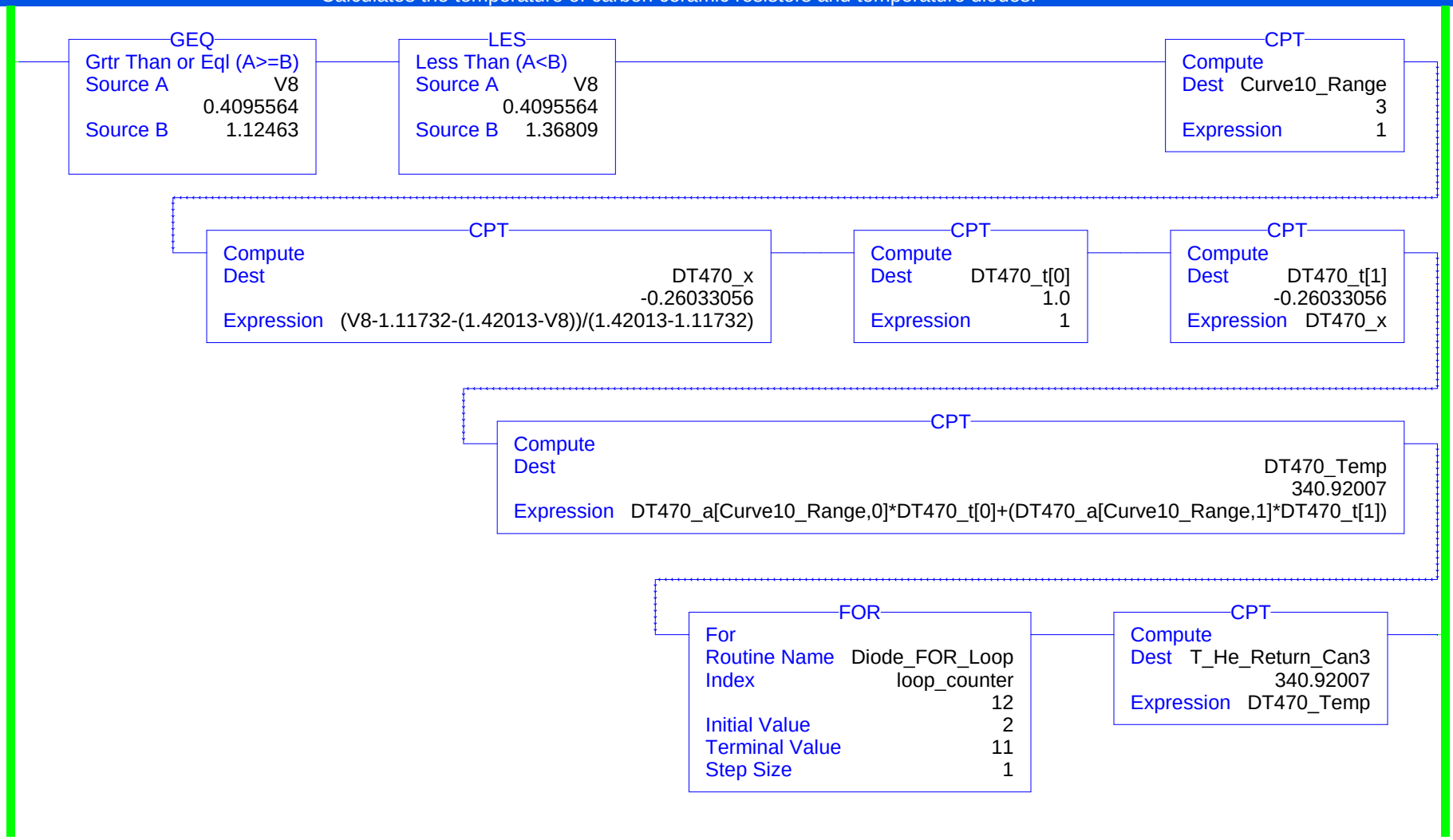
HX Diode-2

30



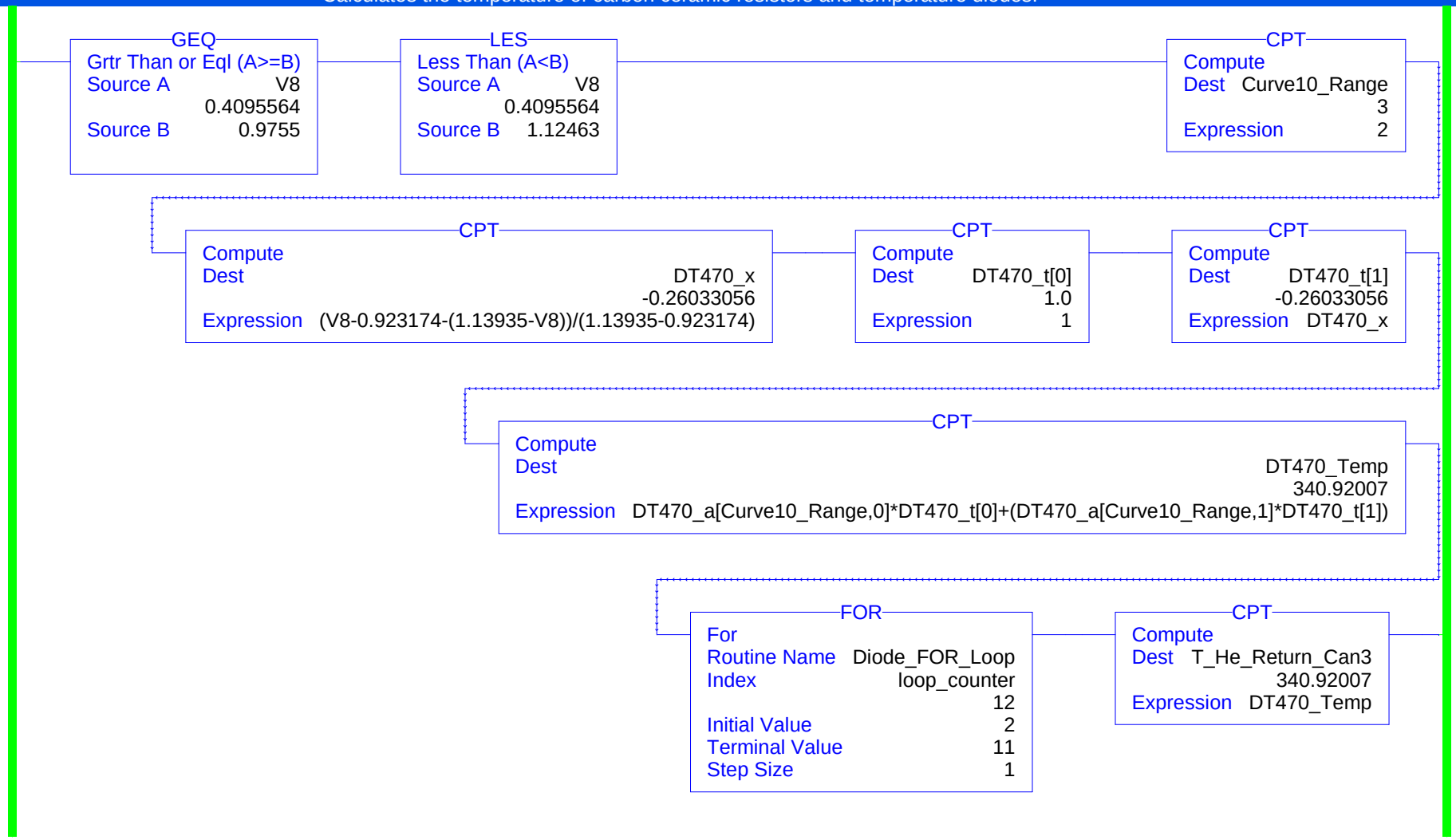
Calculates the temperature of carbon ceramic resistors and temperature diodes.

31



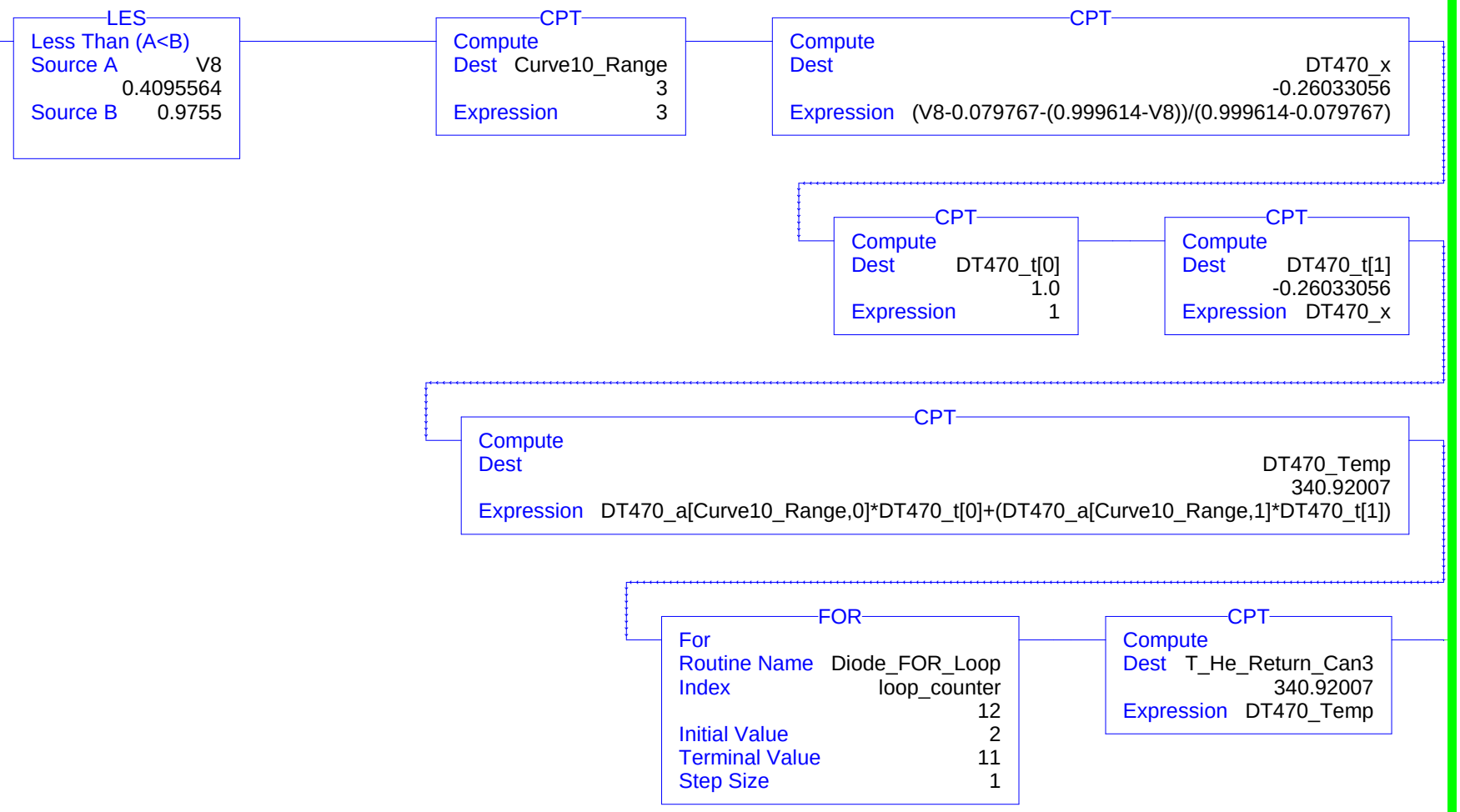
Calculates the temperature of carbon ceramic resistors and temperature diodes.

32



Calculates the temperature of carbon ceramic resistors and temperature diodes.

33



34

Timer_HX
RES

(End)