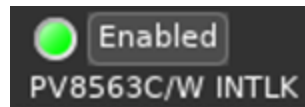Available from the Cryo Distribution Box (DBX) CSS screen in the top middle is an indicator for the interlocks for PV8563C and W

This PV is B_TORUS:LHe:PV8563_Permit

It is a Boolean (0 and 1) converted to a string in EPICS
0 = Disabled
1 = Enabled

Normal operations (no faults) this should be a 1 and enabled.

NOTE: The PLC screenshots were taken when online with the PLC on November 20, 2024 from around 10:00 – 11:00. As such some values may be different in the future, e.g. comparison levels are usually based on a tag which could change. Green indicates a true condition.

If there is a fault with any of these tags: DT_ValveClose, PV8563_LL_Interlock, or DT_ValveClose_Sol (which are described below) the following PID settings are used:

PV8563C goes to manual mode, manual output request of 0 and output value of 0
PV8563W goes to manual mode, manual output request of 0 and output value of 0

The PV is associated with the following tag on the DBX PLC: PV8563_Permit, which has the following logic on the PLC
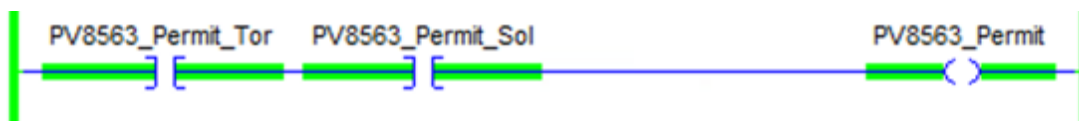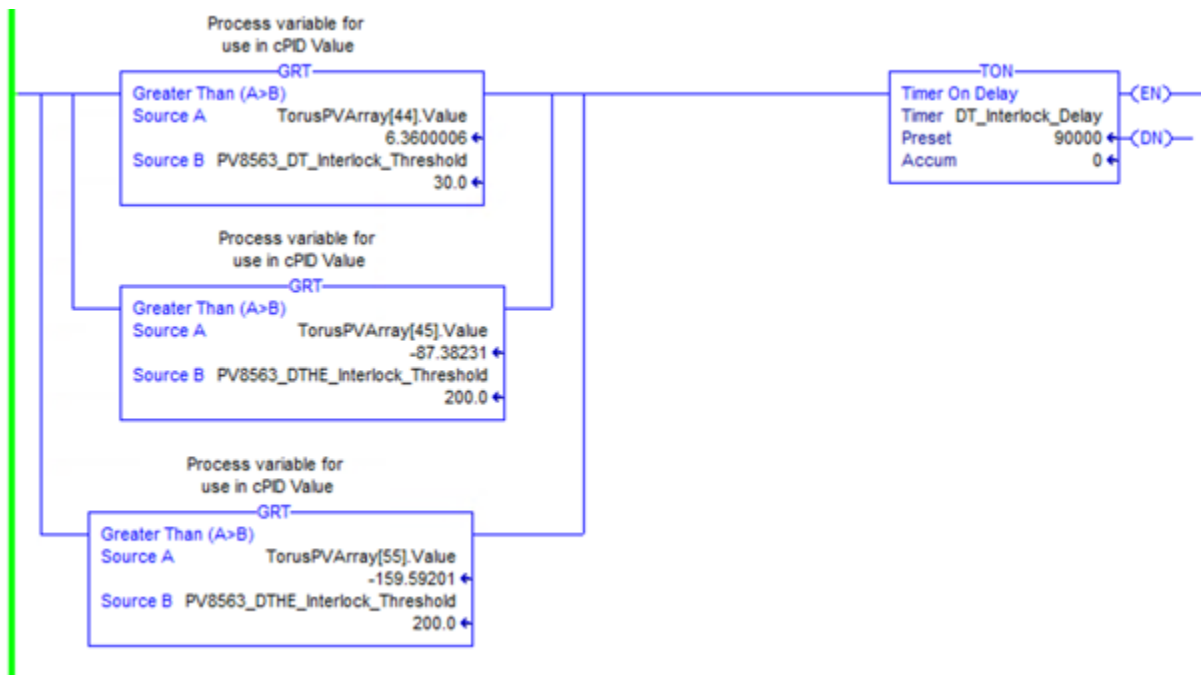

This is a Boolean AND of the two permit tags for the torus and solenoid when they 1 (ONE), each of which each have slightly more complex logic behind them.

The torus logic is as follows:
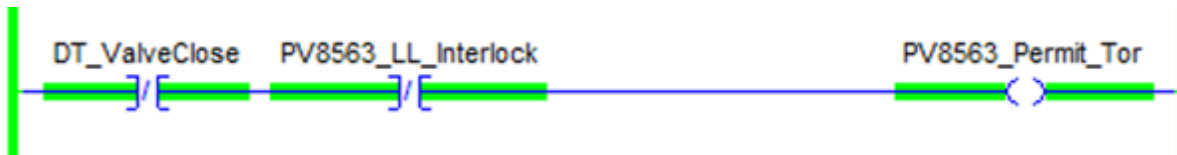
Which is the Boolean AND of the two tags when they are 0 (ZERO)
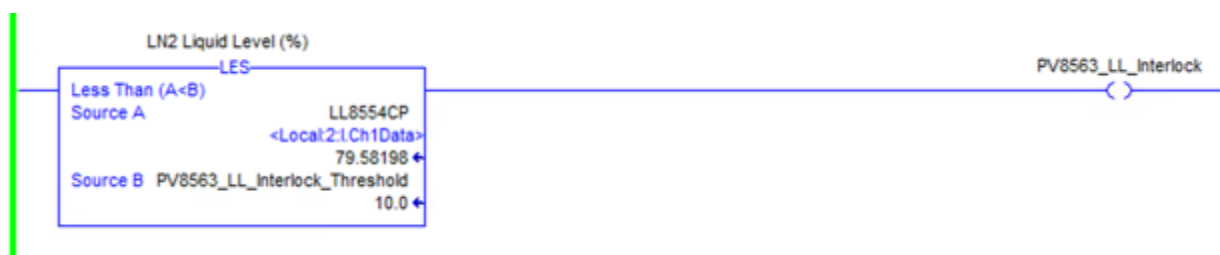DT_ValveClose is set after 90 seconds when the following is evaluated to true:

Which is the Boolean OR of the following conditions (if any are true the timer starts):
METAL4K_DT_MAX is greater than 30
He_Metal_DT is greater than 200
He_Metal_DT2 is greater than 200

PV8563_LL_Interlock is set when the following is evaluated to true:
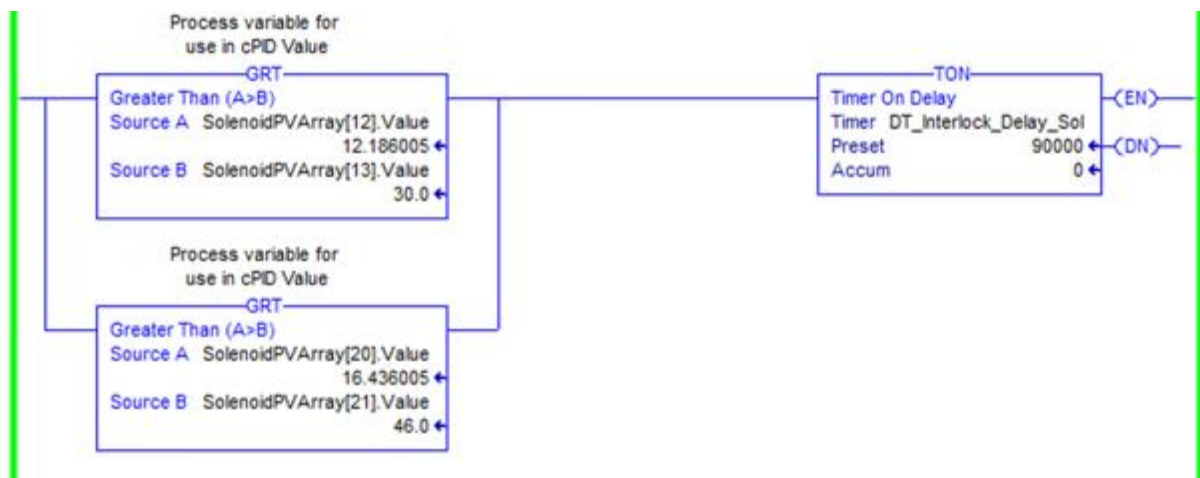

Which is when LL8554CP is less than 10

The solenoid logic is as follows:

Which is set when DT_ValveClose_Sol is set to 0 (ZERO)

DT_ValveClose_Sol is the Boolean OR of two timers both of which are set after 90 seconds
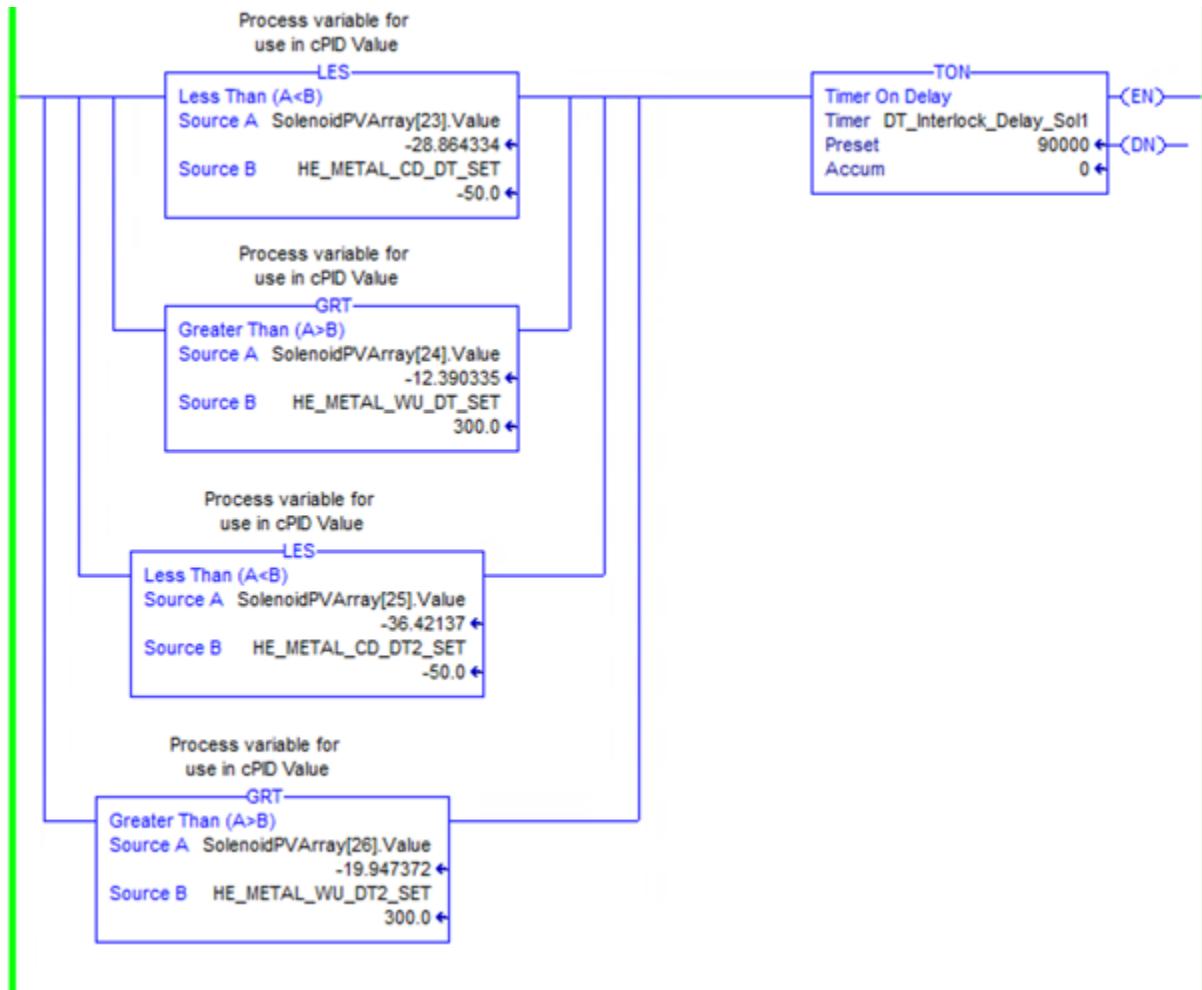
The first timer has the following logic:

Which is the Boolean OR of the following conditions (if any are true timer starts):
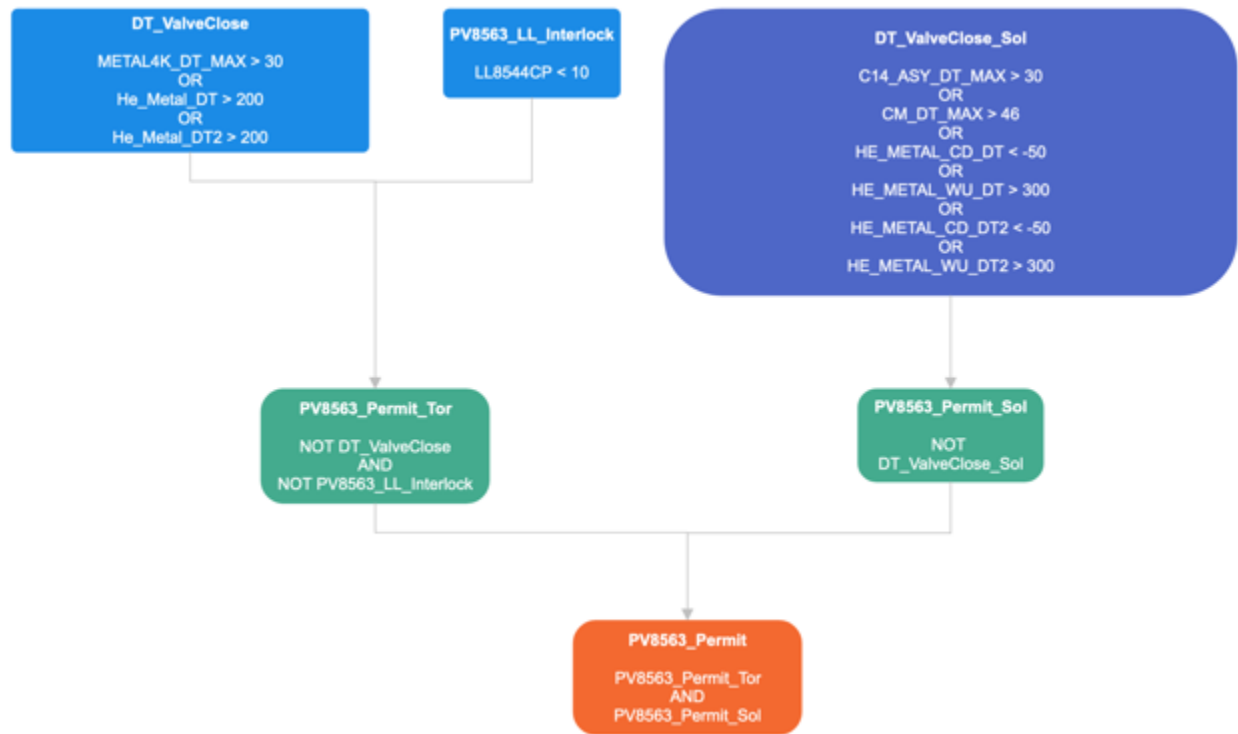C14ASY_DT_MAX is greater than 30
CM_DT_MAX is greater than 46

The second timer has the following logic:

Which is the Boolean OR of the following conditions (if any are true timer starts):
HE_METAL_CD_DT is less than -50
HE_METAL_WU_DT is greater than 300
HE_METAL_CD_DT2 is less than -50
HE_METAL_WU_DT2 is greater than 300

Flowchart of logic on DBX PLC

DT_ValveClose

METAL4K_DT_MAX > 30
OR
He_Metal_DT > 200
OR
He_Metal_DT2 > 200

PV8563_LL_Interlock

LL8544CP < 10

DT_ValveClose_Sol

C14_ASY_DT_MAX > 30
OR
CM_DT_MAX > 46
OR
HE_METAL_CD_DT < -50
OR
HE_METAL_WU_DT > 300
OR
HE_METAL_CD_DT2 < -50
OR
HE_METAL_WU_DT2 > 300

PV8563_Permit_Tor

NOT DT_ValveClose
AND
NOT PV8563_LL_Interlock

PV8563_Permit_Sol

NOT
DT_ValveClose_Sol

PV8563_Permit

PV8563_Permit_Tor
AND
PV8563_Permit_Sol

Additional Parameters from Torus and Solenoid PLCs

CCM_DSHR_DT = absolute value of (CCM_T_AVG - DSHR_T_AVG)
CCM_USHR_DT = absolute value of (CCM_T_AVG - USHR_T_AVG)
CCM_DT_MAX = absolute value of the highest coil delta value
METAL4K_T_MAX = DSHB_MaxT = HB_DS_S2.Temp

METAL4K_DT_MAX = highest value of: CCM_DSHR_DT, CCM_USHR_DT, CCM_DT_MAX
HE_METAL_DT = 60 second moving average of METAL4K_T_MAX - TD8111
HE_METAL_DT2 = 60 second moving average of METAL4K_T_MAX - TD8513T

C14ASY_DT_MAX = max of CCM 1-4, bobbins, cooling plates – min of same values

CM_T_MIN = minimum value of CCM 1-5, bobbins, cooling plates
CM_T_MAX = maximum value of CCM 1-5, bobbins, cooling plates

CM_DT_MAX = CM_T_MAX - CM_T_MIN
HE_METAL_CD_DT = TR8610 - CM_T_MAX
HE_METAL_WU_DT = TR8610 - CM_T_MIN
HE_METAL_CD_DT2 = TD8513S - CM_T_MAX
HE_METAL_WU_DT2 = TD8513S - CM_T_MIN