# Cryomodule Standby operation

1. **Step4 – stop LHe supply:** Close FV501 (HNOSS), close CV01 (PLC)
2. **Step6 – emptying 2K & 4K tanks:** PID CV02 and PID CV03 active until the LT03 and LT01 are empty
3. **Step8 – passive warm-up:**
   1. Close FV501, turn off the PID CV02 and CV03 regulators, turn of MKS2 regulator, open CV02, CV03 (50%), CV550 (will be set to CM-RHtr:CV550:sSetV, to change this PV use CM-RHtr:CV550:cSetV), wait until the temperature TT04 or TT05 reaches the temperature set in S7\_HighT (PLC memory variable) and at least one sensor data is valid then goto Step10
   2. if requested by the operator start the LHe cooling (state S5) or the warm-up (state S10)
4. **Step10 – cooling down:**
   1. close CV550 (HNOSS) and open FV501 (HNOSS) and wait until the temperature TT04 and TT05 goes below the temperature set in S7\_LowT (PLC memory variable) and at least one of the temperature probes gives valid data (later we may add a state parameter TT\_STBY\_MIN). The cooling is stopped (transition to step 8) when all valid temperature sensors achieve the minimum temperature or when all sensors don’t give reliable data.
   2. keep the FT552 < FT552\_MAX\_GB (parameter) and FT552 > FT552\_MIN\_GB (parameter). Algorithm: every 60 s adjust CV03 by 5% to fulfill the above conditions. When FT552\_MIN\_GB <= FT552 <= FT552\_MAX\_GB don’t change CV03. The parameters used here are the same parameters as used in the “LHe Cooling” state.
   3. if requested by the operator start the LHe cooling (state S5) or the warm-up (state S10)
   4. If the temp data will be invalid goto Step8

## Sequence parameters:

* Switching temperatures (low and high)
* Maximum pressure (what to do when it becomes too high?)
* Maximum/Minimum flow set by CM-Ctrl:S5\_P\_FT552\_MAX/MIN\_C/GB
* Opening of CV04 – does it need to be controlled?
* Opening of CV550
* Opening of CV551/CV552

## Data exchange needed between different systems:

The MKS2 regulation on/off is controlled by the bit m141.0 from the CM PLC.

CV550 is regulated via MKS2  
FV501 is controlled by HNOSS PLC based on State and step information from the CM PLC.

The limits for the LHe flow are taken from the State 5 (LHe Cooling) parameters.

The MKS2 PID SP (when the PID regulator is On) is controlled by CM-Ctrl:SP\_PT01-CV550:cSetV.