

What is a control sequence?

A control sequence is a comprehensive system control algorithm written in English. Example English language specifications from ASHRAE's primary system control sequence specification document (RP 1711):

Stepwise integrators with conditionals:

"Decrease "m" by 0.02 when the economizer is disabled if the economizer remained enabled for greater than 60 minutes."

Hysteresis formulation:

"If ΔT exceeds 2°F , send 2 requests until ΔT is less than 1.2°F ."

Conditionals such as `y=true if CHWT_set-u>1` (these are essentially also a hysteresis):

Enable output y if input u *"is $1^{\circ}\text{F} < \text{CHW supply temp setpoint}$."*

chiller
plant

ASHRAE RP-1711:

Advanced Sequences of Operation for HVAC Systems Phase II – Central Plants and Hydronic Systems

6.5 Chilled Water Plants: Series Chillers with WSE, Variable Primary CHW, Variable CW, Headered Pumps

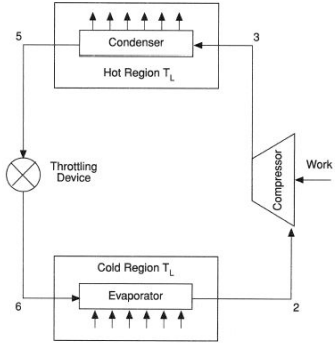


Figure 3. Basic vapor compression refrigerator.

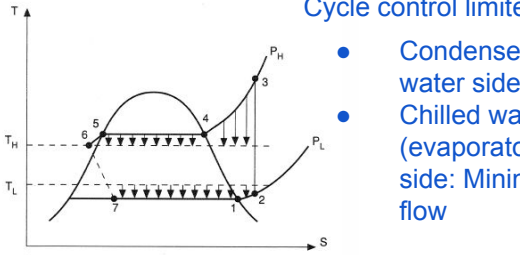
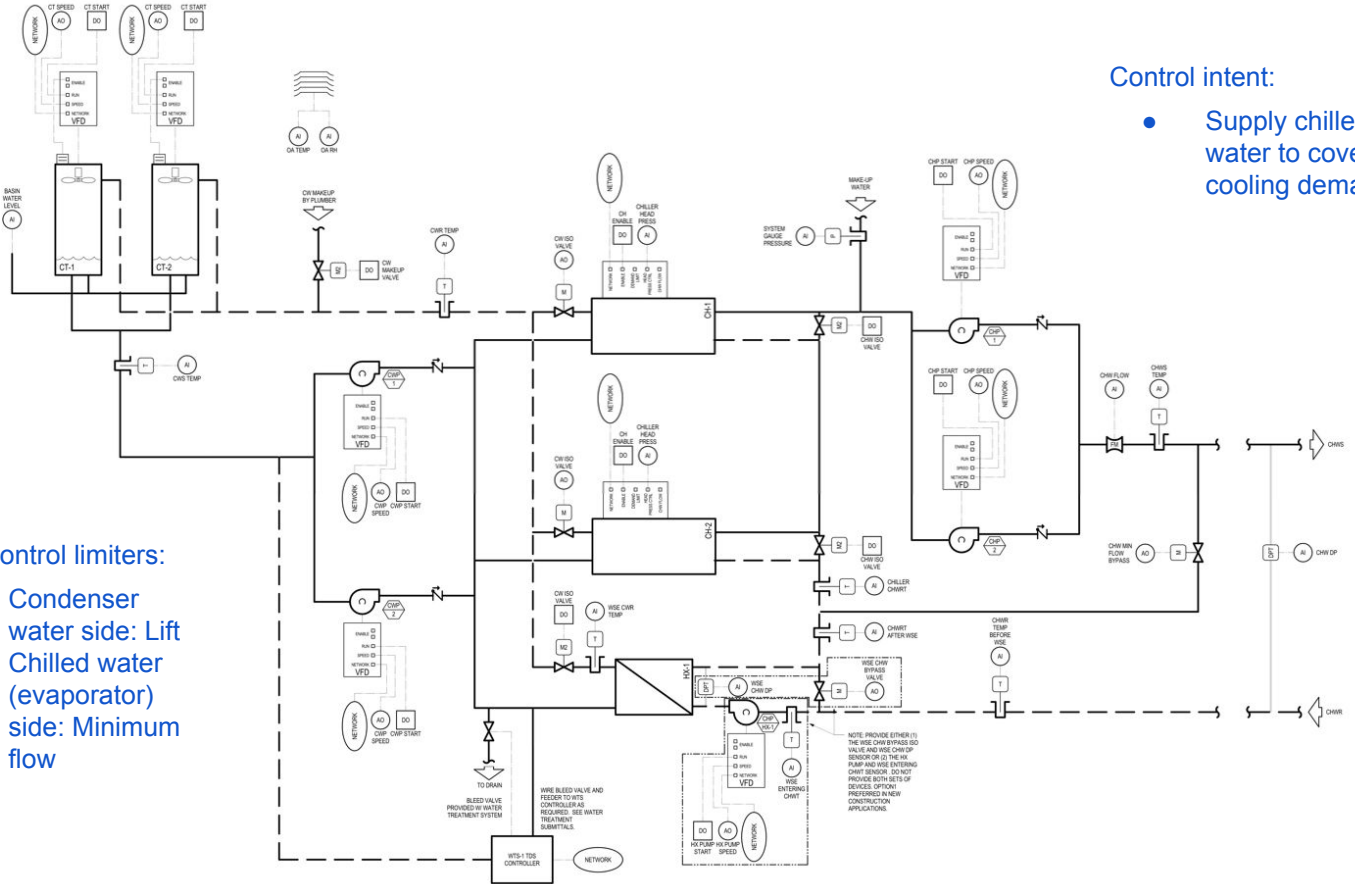


Figure 4. T-S diagram for basic vapor compression cycle.

Cycle control limiters:

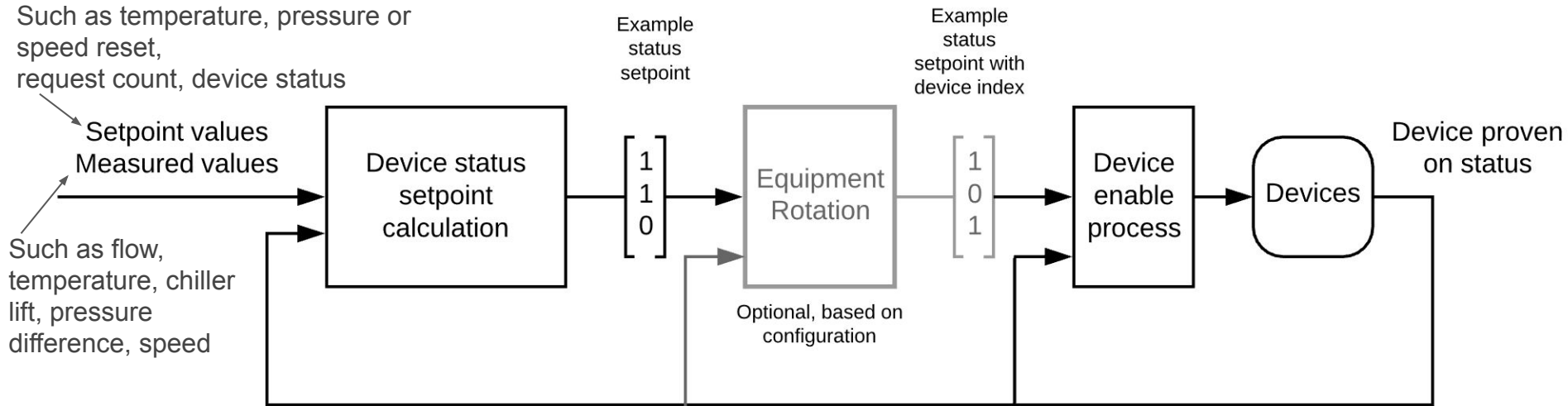
- Condenser water side: Lift
- Chilled water (evaporator) side: Minimum flow



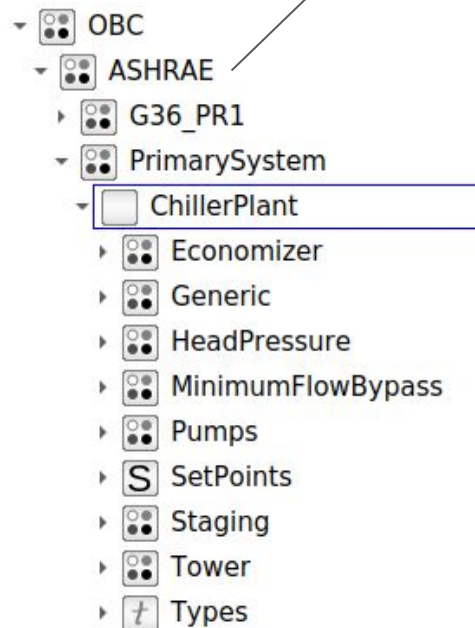
Control intent:

- Supply chilled water to cover cooling demand

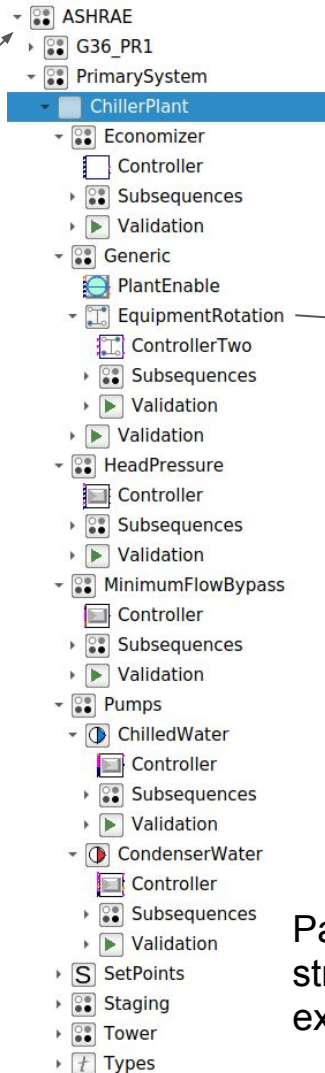
Overarching approach to device status control



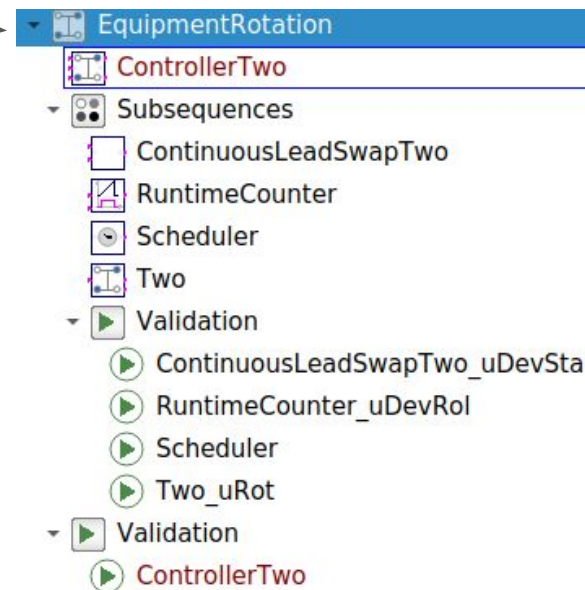
Library package



Package structure



Subpackage architecture



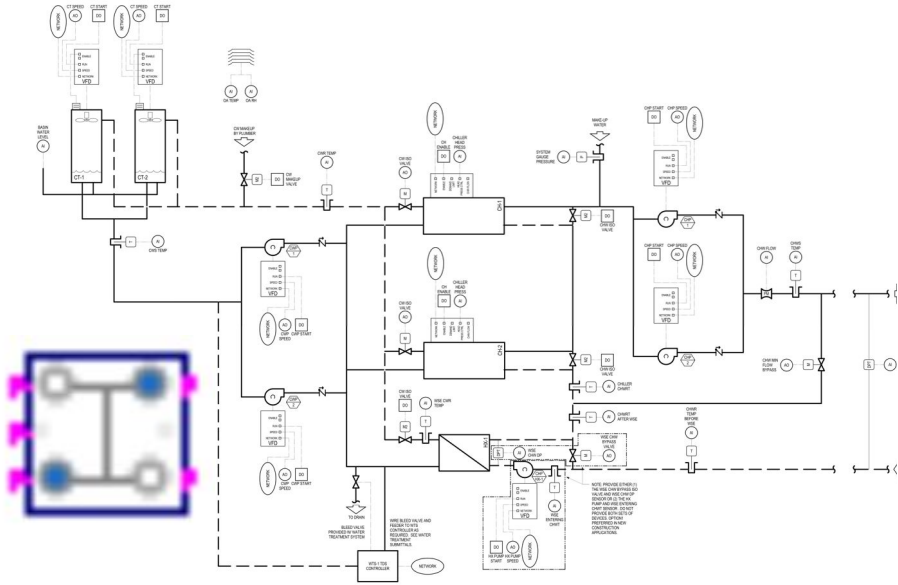
Package structure expanded

Controller architecture

Master
controller

ASHRAE RP-1711:
Advanced Sequences of Operation for HVAC Systems Phase II – Central Plants and Hydronic Systems

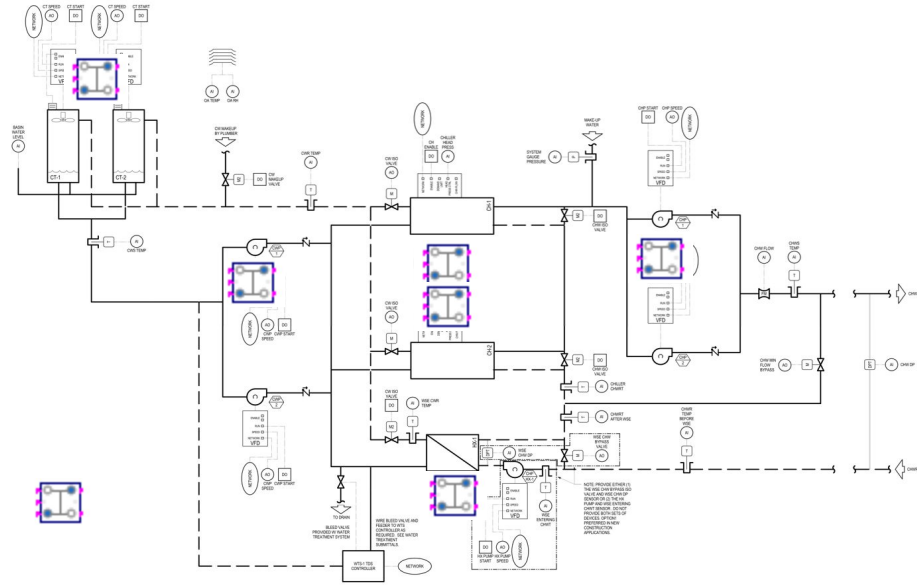
6.5 Chilled Water Plants: Series Chillers with WSE, Variable Primary CHW, Variable CW, Headered Pumps



Dedicated controllers

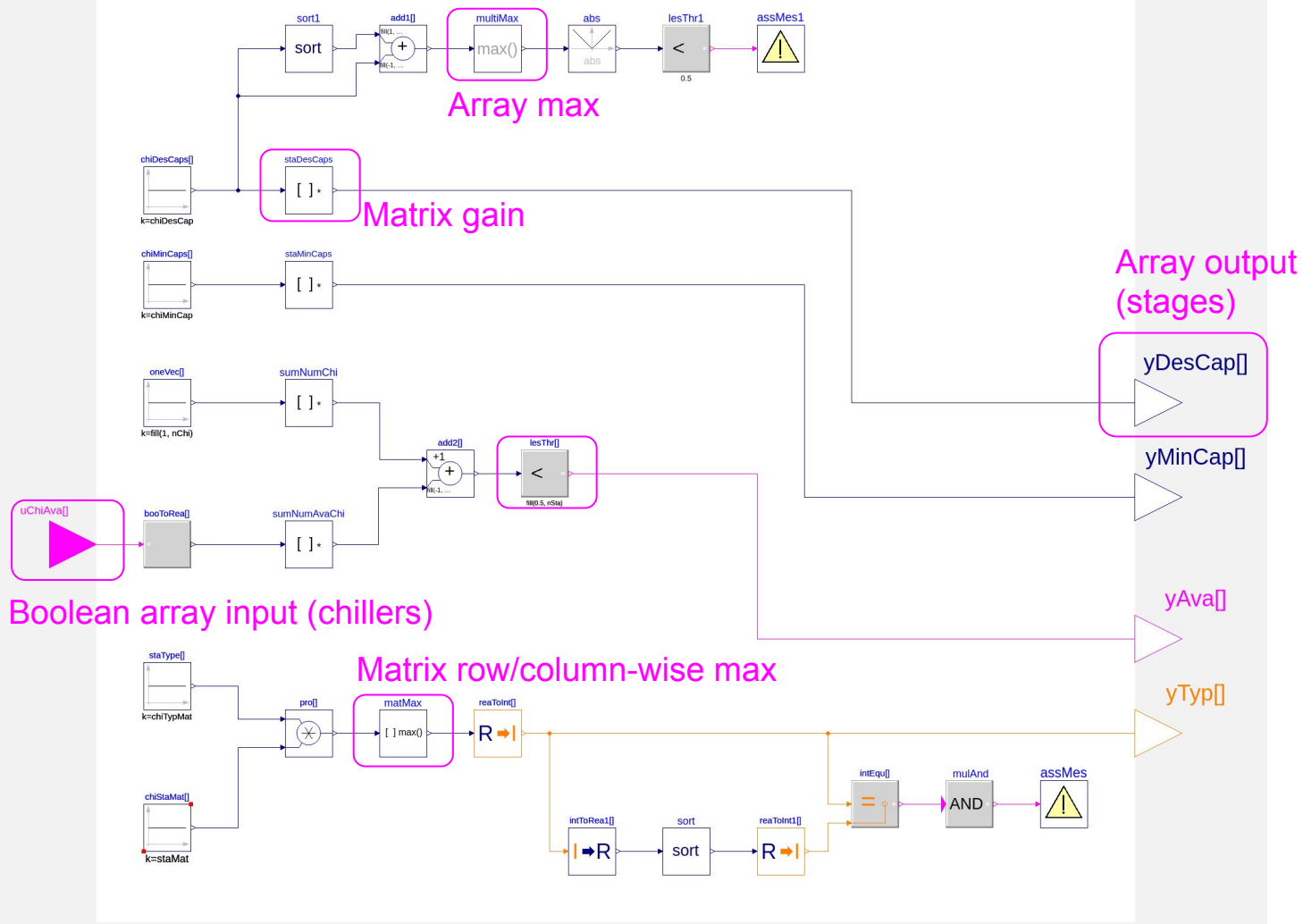
ASHRAE RP-1711:
Advanced Sequences of Operation for HVAC Systems Phase II – Central Plants and Hydronic Systems

6.5 Chilled Water Plants: Series Chillers with WSE, Variable Primary CHW, Variable CW, Headered Pumps



Staging configurator:

Involved usage of arrays



Stage change parameterization: usage of arrays

cha in Buildings.Controls.OBC.ASHRAE.PrimarySystem.ChillerPlant.Staging.Subsequences.Validation.Change

General Add modifiers Attributes

Component

Name cha

Comment Stage change

Model

Path Buildings.Controls.OBC.ASHRAE.PrimarySystem.ChillerPlant.Staging.Subsequences.Change

Comment Calculates the chiller stage signal

Parameters

Array parameters

nSta	3	Number of chiller stages
nChi	2	Number of chillers
staMat	{1,0},{0,1},{1,1}	Staging matrix with stage as row index and chiller as column index
chiDesCap	{500000,1000000}	Design chiller capacities vector
chiMinCap	{100000,200000}	Chiller minimum cycling loads vector
chiTyp	dStageTypes.positiveDisplacement,Buildings.Controls.OBC.ASHRAE.PrimarySystem.ChillerPlant.Types.ChillerAndStageTypes.constantSpeedCentrifugal	Chiller type. Recommended staging order: positive displacement, variable speed centrifugal, constant speed centrifugal
avePer	300	Time period for the rolling average
holPer	900	Time period for the value hold at stage change
upHolPer	900	Time period for the value hold at stage up change
dowHolPer	900	Time period for the value hold at stage down change
anyVsdCen	false	Plant contains at least one variable speed centrifugal chiller
posDisMult	0.8	Positive displacement chiller type staging multiplier
conSpeCenMult	0.9	Constant speed centrifugal chiller type staging multiplier
varSpeStaMin	0.45	Minimum stage up or down part load ratio for variable speed centrifugal stage types
varSpeStaMax	0.9	Maximum stage up or down part load ratio for variable speed centrifugal stage types
hasWSE	false	true = plant has a WSE, false = plant does not have WSE
delayStaCha	15*60	Delay stage change
shortDelay	10*60	Short stage 0 to 1 delay
longDelay	20*60	Long stage 0 to 1 delay
smallTDif	1	Offset between the chilled water supply temperature and its setpoint
largeTDif	2	Offset between the chilled water supply temperature and its setpoint
TDif	1	Offset between the chilled water supply temperature and its setpoint
dpDif	2*6895	Offset between the chilled water pump Differential static pressure and its setpoint
TDifHyst	1	Hysteresis deadband for temperature

Info

Cancel OK

How you can contribute

- Feedback on controller architecture
- Feedback on usage of arrays
- Sequence implementation review (chiller plant)
- Sequence development
 - Boiler plant
 - Basic blocks such as heat recovery, room thermostat
 - Additional sequences for: radiant heating and cooling, secondary