Manual: 8.5. Controlability

The controllability of a tag is one of three possibilities. A tag is either controllable, uncontrollable or semi-controllable. Choosing which of these categories any one tag falls into is probably the most important choice you will make regarding the mathematical modeling of your plant.

A tag is controllable if it can be modified manually by the operator of the plant. For that, it is usually a set point value. In a plant, there might be quite a few PID controllers in operation that automatically control various values based on others. While an operator might have the theoretical capability of turning a PID controller off and taking that controlled value into manual operation, chances are that this is not desired and rarely done. Thus, this value is only theoretically controllable but not actually controllable. We should mark as controllable only those values that are actually modified by the operators of the plant. It may be a good idea to have a conversation with an operator in the control room to come up with a list of tags that are actually available for direct modification.

Only those tags should be marked as controllable that could possibly have an impact upon the performance aspect of the plant that you wish to optimize. For example, there will be a few tags that have relevance for emergency procedures or start ups and shut downs that are actually manually controlled. But we are not interested in modifying these in order to optimize normal performance.

Every controllable tag is allowed to appear in a suggestion to the operator to change the plant's state. At any one time, it may not be necessary to change the value of every controllable tag but usually every controllable tag appears in some suggestions. You can see how often each tag appears in a suggestion in the report that you can read after the modeling step.

A tag is uncontrollable if it cannot be modified in any way by the operator of the plant. These are tags that measure the status of the outside world. Aspects of the weather such as temperature, humidity, and air pressure are examples. The quality of raw materials is usually an important aspect. Usually the amount of product that a plant produces is a major limiting amount that is prescribed by the customers of the plant.

Clearly there are many things that an operator cannot control. However, we should only include those aspects of the outside world that actually have an influence on the performance of the plant. If you believe the outside air temperature to influence the process (it usually does), then include it. There are some processes that are sensitive to humidity but most are not. While you probably measure humidity in your local weather station, only include it in the model as uncontrollable if you believe it to have an effect.

An uncontrollable tag is a boundary condition for the plant. The mathematical model that will be constructed will look for an operational point that is better than the current point but that has the same values for all uncontrollable tags. Every uncontrollable tag restricts the freedom of the optimizer and thereby reduces the possible improvement that the optimizer can achieve. Thus choosing which tags are uncontrollable has an important effect on the model.

Every tag that is neither controllable nor uncontrollable is therefore <u>semi-controllable</u>. These are all the tags that cannot be directly modified but are indirectly modified through the controllable tags. The large majority of available tags will be in this category and this is considered the default setting. When creating your list of tags, we strongly suggest that you start by regarding every tag as semi-controllable and then continue by marking those tags as controllable or uncontrollable that you identify as being so. In this way, you will end up with a list of relatively few and carefully chosen tags that can and should be modified and tags that represent restrictions to the plant.