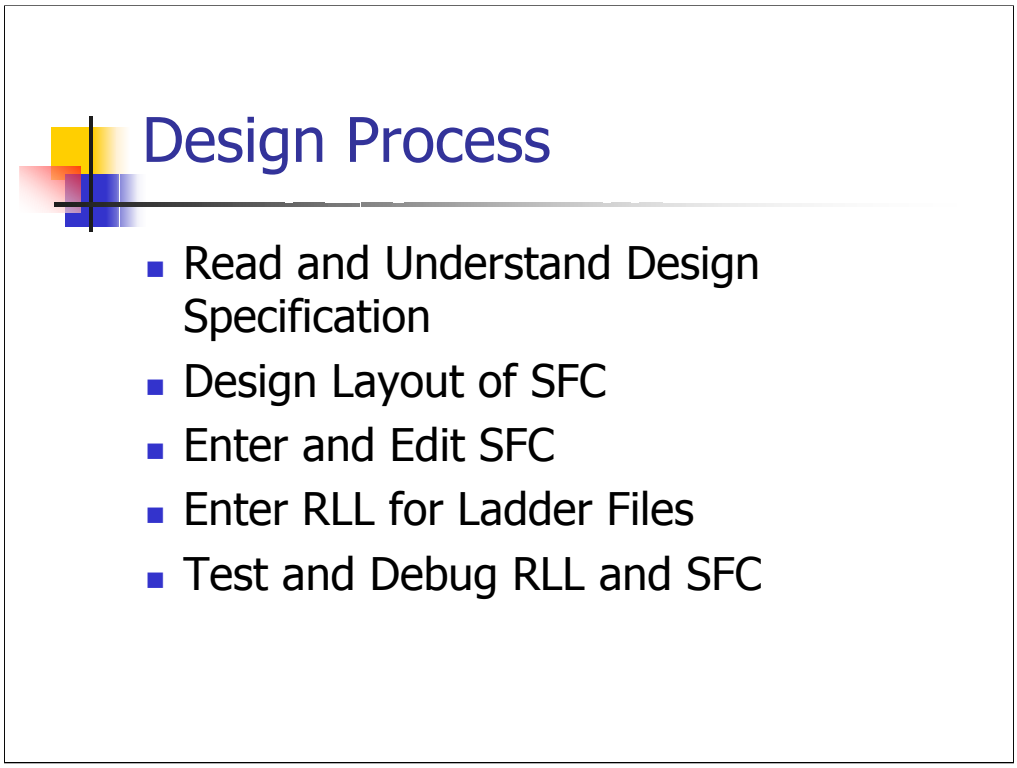
Sequential Function Chart (SFC) design leads to an architecture that is different from standard RLL.



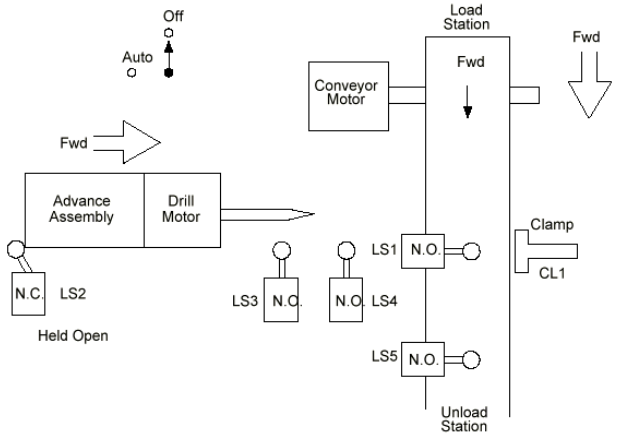
The design process for SFC is similar to that used for standard RLL designs. If the up most importance is having a complete and accurate requirements and design specification or document. How can you implement something when you don't know what it is that you want. The time and effort spent on writing the requirements and design will be return to you during the implementation phase.

The layout of the SFC contains the logic flow of the system. This would correspond to the structure statements of a language such as C. If you have a sequence of station in a work cell, each station would be a step and transition in the SFC. If the process is do this step and then the next step and so on, you would have a simple or sequential diagram.

If each station in the work cell is used concurrently, then a simultaneous branch structure is used. Or if different products are processed using the same station in the work cell, the selection branch is used.

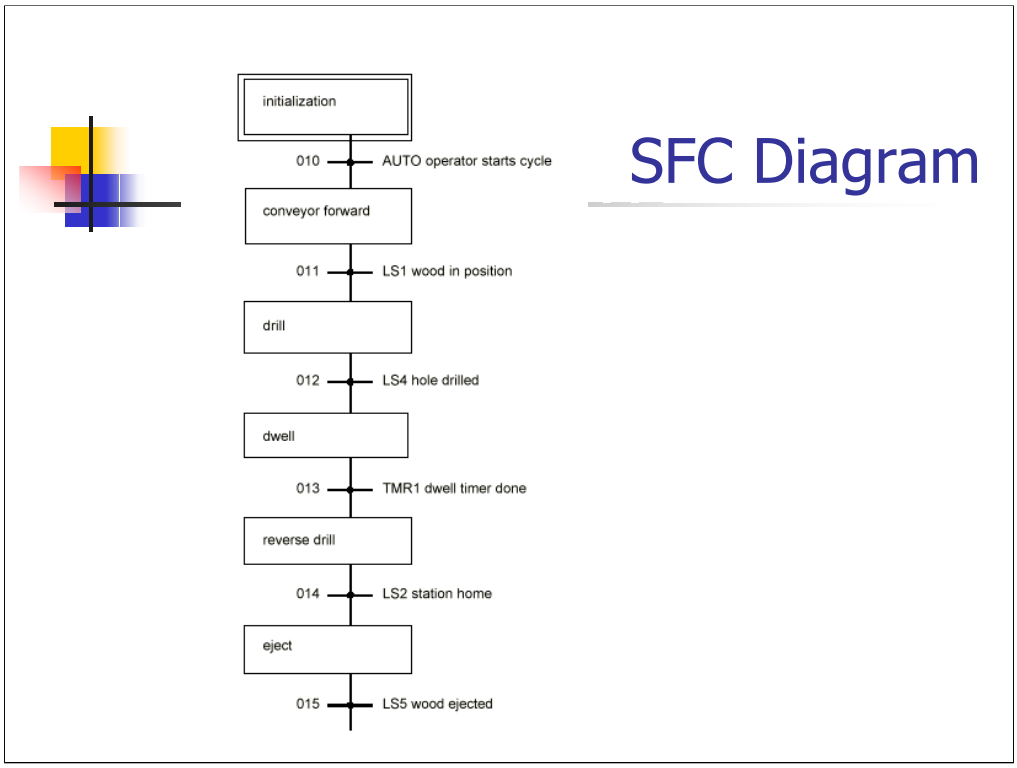
The final step is to design and enter the logic for the steps and transition in the SFC. This logic can be expressed as structured text, another SFC, or RLL. If SFC is used its steps and transition must lead to RLL or structured text.

One Station Drill machine



In this one station drill machine work cell there is a sequence of events that must occur in a specified sequence. Each step is ended by the change in state of a permissive or limit switch.

The requirements and design document would need to specify what must be done and in what sequence.

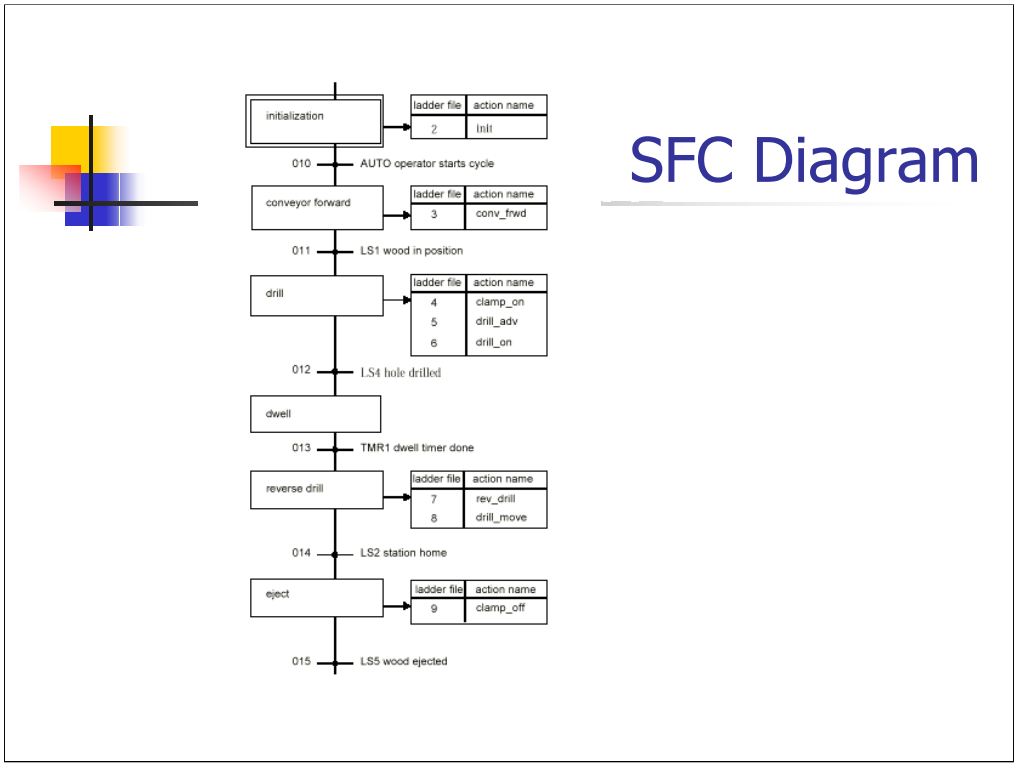


This requirement/design document in the case of a one station drill machine leads to the following SFC. Note that only the sequence at a high level of abstraction is shown in the SFC.

The steps are:

- •Conveyor Forward
- • Drill
- •Dwell (keep the drill in position but running)
- •Reverse drill
- •Eject
- •Etc

Note that most of the transitions are controlled by limit switches (LS1, LS2, LS4, and LS5). The dwell is controlled by time (TMR1). The logic for each step and transition is moderately simple with little interaction between each other, other than the SFC.

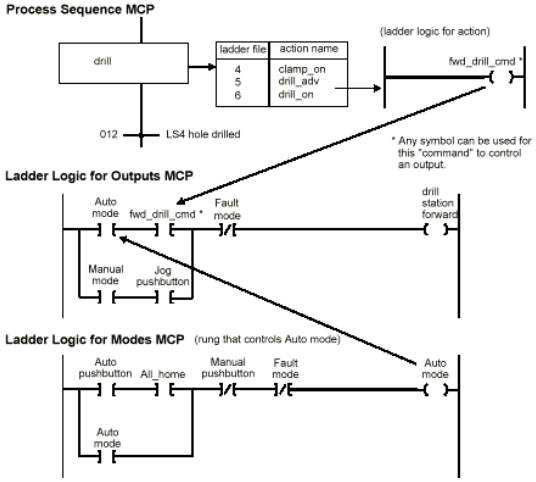


This diagram is similar to the previous one. The difference being is more detail is revealed about the steps. As an example the drill step will consist of three ladder files (4, 5, and 6). The use of multiple ladder files keeps the complexity of each step to a minimum by modularizing the logic.

This modularization leads to code that is:

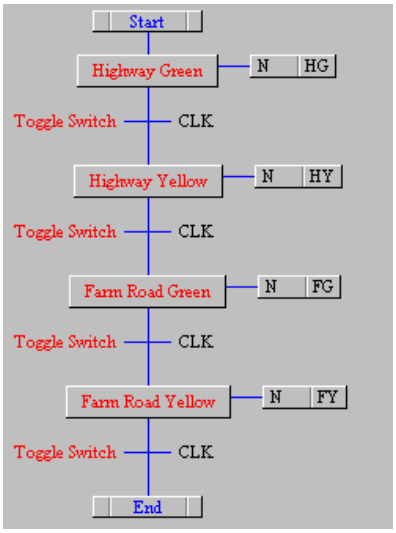
- Easier to implement.
- Easier to document
- And easier to maintain.

RLL for SFC



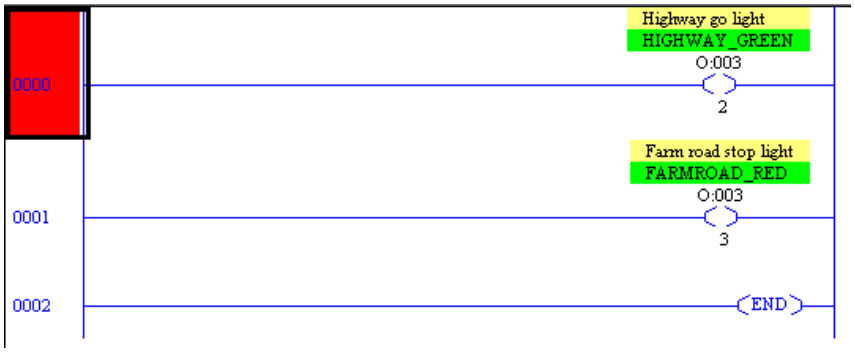
The above diagram shows the simplicity of each ladder file in the drill step. Remember, modularize, modularize, modularize.

Traffic Light SFC



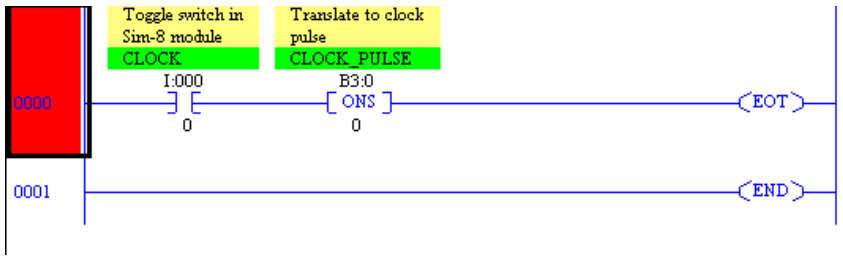
The initial state diagram for a traffic controller is a closed loop. This translates to a simple sequential SFC. Of course once the End is reach, the cycle in the SFC is continued. The SFC almost falls off the pages of the requirement specification for the traffic light controller.

Typical Step

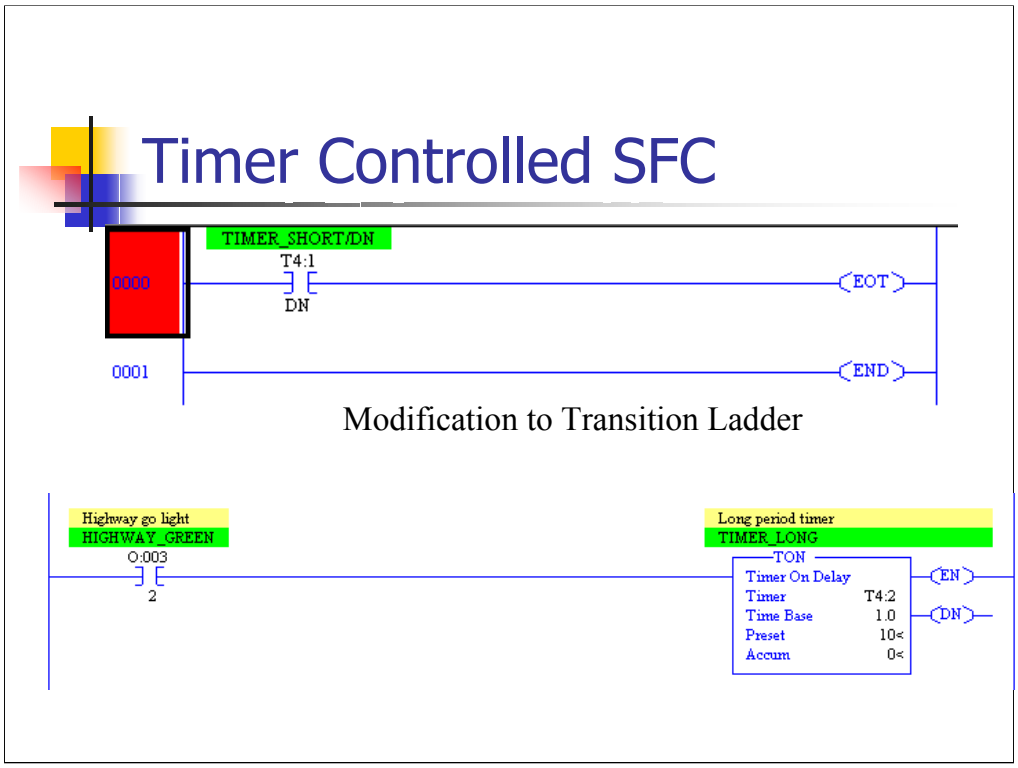


Notice that the logic in a given step is very simple. In this case the highway green light and the farm road red light is always on when we are in this step. When we exit this step because the associated transition is true the outputs will be deenergised, set to 0.

Typical Transition



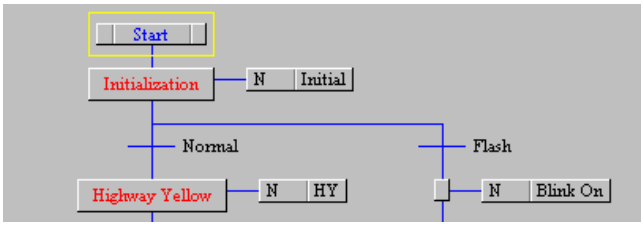
Also note that the transition logic is very simple. For one scan of the logic when the CLOCK input is energized, the EOT instruction is true. On the next scan the EOT instruction is false. EOT stands for End Of Transition. When EOT is true the transition condition is met, and the SFC moves on to the next step after one last scan of the step logic in which counter, timers and the like are reset.



When the controller moves from a toggled transition to a timed transition, all that needs to be changed is the transition ladder file. The one shot is replaced with the timer done contact.

The step associated with this would have the associated time added to the step RLL.

Change in SFC



If the control flow logic is changed the the SFC is changed. For example assume there is an timed mode in which the light cycles based on time and a flasher mode. A few changes to the SFC and the new design is completed.