Abstract: Recent trends in modern manufacturing, such as the growing need for flexibility and the increasing degree of automation in industrial facilities, require distributed control solutions. Implementations of such control schemas and underlying architectures come along with an exponential increase of the automation system’s complexity. Therefore, methods for supporting automation engineers during the development processes are highly required. This paper presents an approach to supporting model-based engineering (MBE) of distributed manufacturing automation systems. The approach is based on the combination of notation, characteristics, and design patterns across multiple levels of an adapted development process. Accordingly, a prototypical support tool has been implemented. The modeling approach has been evaluated by case studies and additional usability experiments to determine the benefit of its application within the design of manufacturing automation systems.