Examples of User Requirements Specifications for a Mechatronic System

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The following categories encompass the types of user requirements for mechatronic systems:

1. Size/Capacity/Force/Torque/Stroke:
   This is the most obvious user requirement. It is related to the size of the system, in relationship to what is can do. For example, a bottle filling system will be able to fill 1000 bottles per hour; or on elevator can carry eight persons; or a printer can print 12 pages per minute.

2. Safety/Reliability/Maintainability/Availability.

3. System dynamics (e.g. rise time; overshoot; settling time).

4. Resolution/Accuracy/Precision:
   These characteristics are related to both actuator(s) and transducer(s).
   Resolution is the smallest change in input that would cause a change in output.
   Accuracy is freedom from systematic errors.
   Precision is freedom from random errors.

5. User Friendliness:
   The system user interface should be user friendly. It should allow different levels if access. It should also be “fool proof”.

6. Energy Consumption:
   In some application, reducing the amount of energy consumed must be restricted/reduced.

7. Cost (Capital cost/Running cost):
   It is important to consider all costs associated with the system, throughout the lifetime of the system. This includes capital costs (initial cost of the system) as well as running costs (energy costs, maintenance cost).

8. Space/Size/Weight:
   In certain cases, there may be constraint on the size of the system and its weight.

9. Environment:
   It is important to consider the environment in which the system will be operated. For example, ambient temperature, humidity, dust, and foreign particle and fluid ingress. The IP rating selection of the enclosure is thus important (IP: ingress protection, see table at the end of this document).

10. Versatility:
    A versatile system is one that can be used in different ways.

First number (Projection against sloid objects)	Definition	Second number (Protection against liquids)	Definition
0	No Protection	0	No Protection
1	Protected against solids objects over 50mm (e.g. accidental touch by hands)	1	Protected against vertically falling drops of water
2	Protected against solids objects over 12mm (e.g. fingers)	2	Protected against direct sprays up to 15° from the vertical
3	Protected against solids objects over 2.5mm (e.g. tools and wires)	3	Protected against direct sprays up to 60° from the vertical
4	Protected against solids objects over 1mm (e.g. tools, wires and small wires)	4	Protected against direct sprays from all directions – limited ingress permitted
5	Protected against dust - limited ingress (no harmful deposit)	5	Protected against low pressure jets if water from all directions - limited ingress permitted
6	Totally protected against dust	6	Protected against strong jets of water e.g. for use on shipdecks - limited ingress permitted
***	***	7	Protected against the effects of temporary immersion between 15cm and 1m. Duration of test 30 minutes
***	***	8	Protected against long periods of immersion under pressure

