Implement Statistical Process Control In ThingWorx

ptc | تركيب THEASSEMBLY MAKE | SMART | THINGS

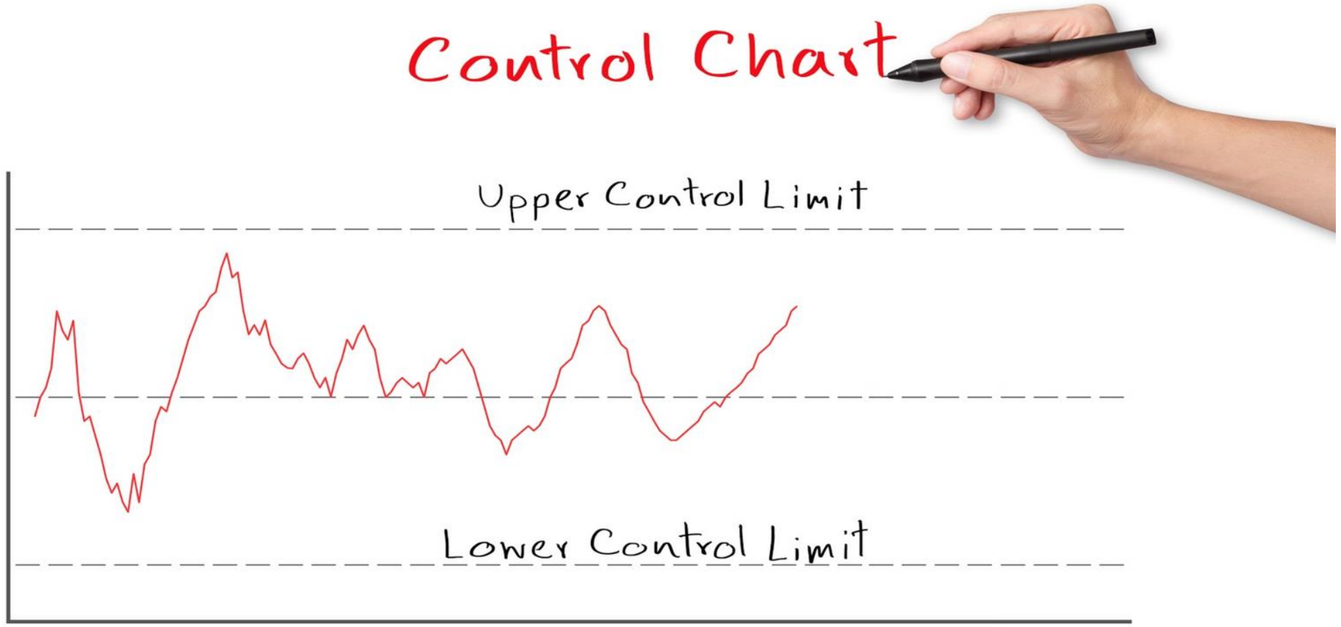
Implement Statistical Process Control In ThingWorx

ptc | تركيب THEASSEMBLY MAKE | SMART | THINGS

About The Assembly

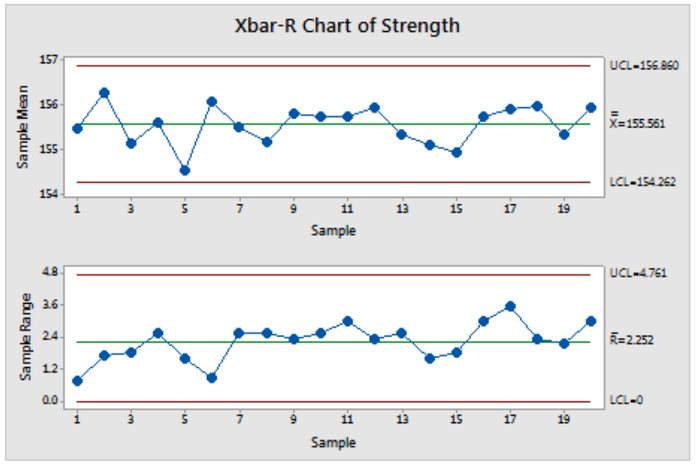
- A **smart lab** & **makerspace** based out of **in5** since 2014
- Over **300** free workshops done
- **Assembly : HACK** - Embedded systems, IoT, hardware
- **Assembly : CODE** - Software - APIs, frameworks, apps
- **Assembly: Data Science** - Advanced topics in AI/ML
- Audience – **Students** | **Professionals** | **Entrepreneurs**
- Focus on Smart Technology & Practical Applications
- Social Media: **@makesmartthings** | members.theassembly.ae
- www.theassembly.ae -> Online Workshops (for past videos)

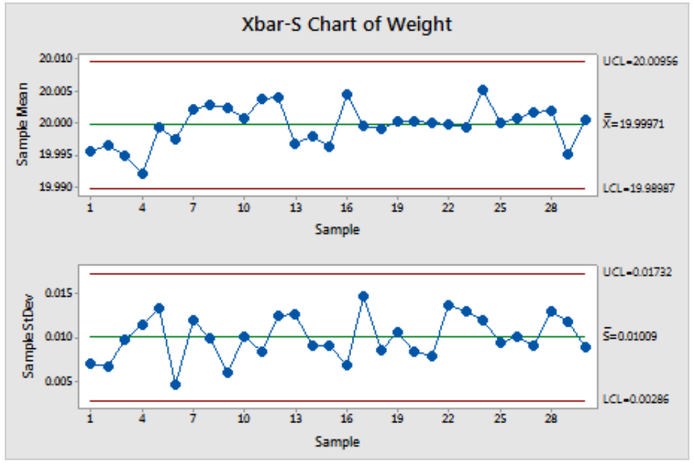
Statistical Process Control (SPC)

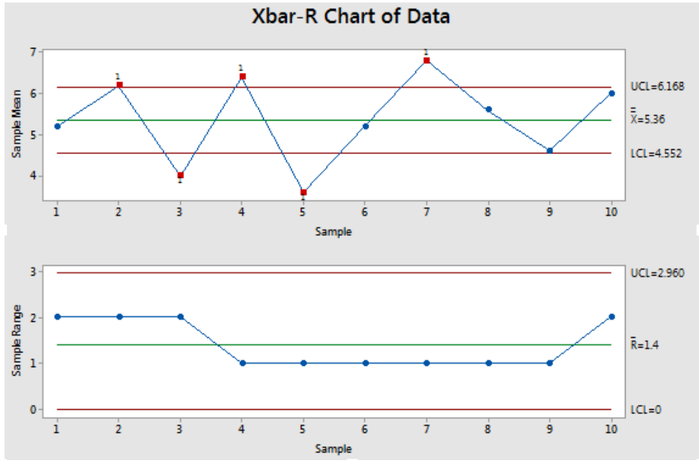


- A statistical method of **quality control** for processes
- Developed in 1920s – primarily for manufacturing
- **Driven by continuous data**
- IoT uses - **supply chain optimization**, **predictive maintenance**

Control Charts



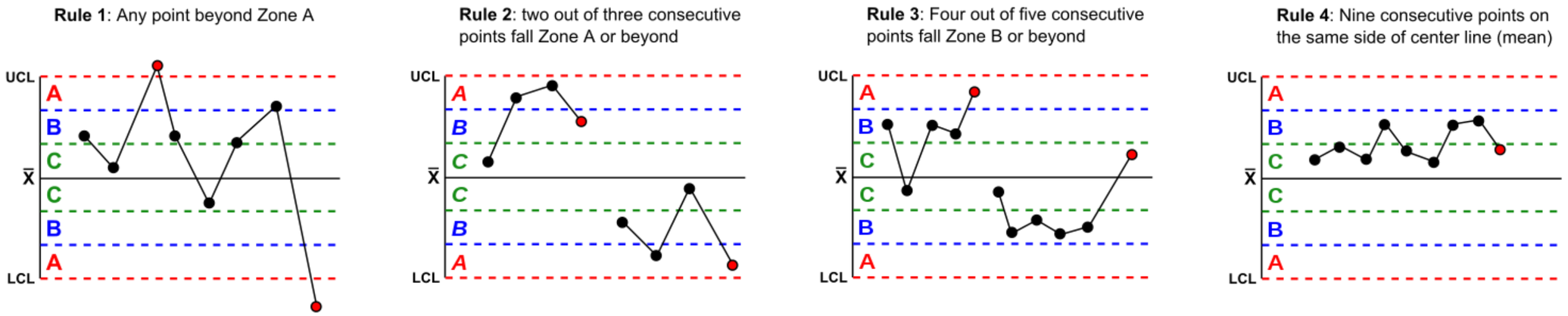




- **X-bar charts** – maps mean of values in samples over time
- **Range chart** – maps range of values in each sample over time
- **Sigma chart** – maps standard deviation of values in each sample by time
- More info: https://sixsigmastudyguide.com/x-bar-r-control-charts/ https://sixsigmastudyguide.com/x-bar-s-chart/

Control Rules

- **Western Electric Rules** https://en.wikipedia.org/wiki/Western_Electric_rules
- Zone Rules



Zone A = 3 sigma (std dev), Zone B = 2 sigma, Zone C = 1 sigma

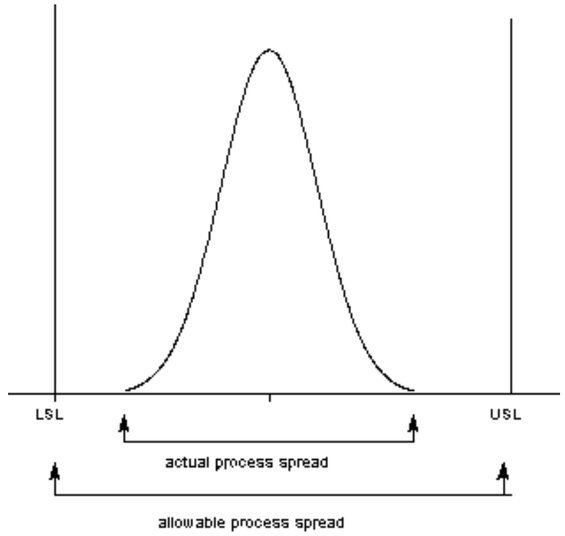
- R-chart/s-chart rules slightly different

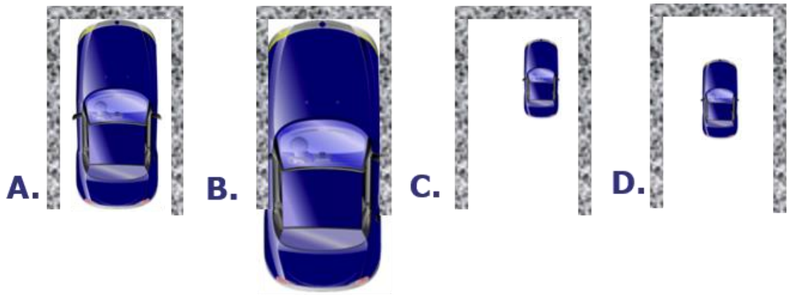
Process Capability

- **https://en.wikipedia.org/wiki/Process_capability**
- Compares output of ‘in-control process’ to specs
- **Process capability indices** (**CP** & **CPK**) - https://en.wikipedia.org/wiki/Process_capability_index
- **CPK** incorporates ‘centralization’
- **Capability histogram**

$$C_p = \frac{\mathrm{USL} - \mathrm{LSL}}{6\sigma}$$

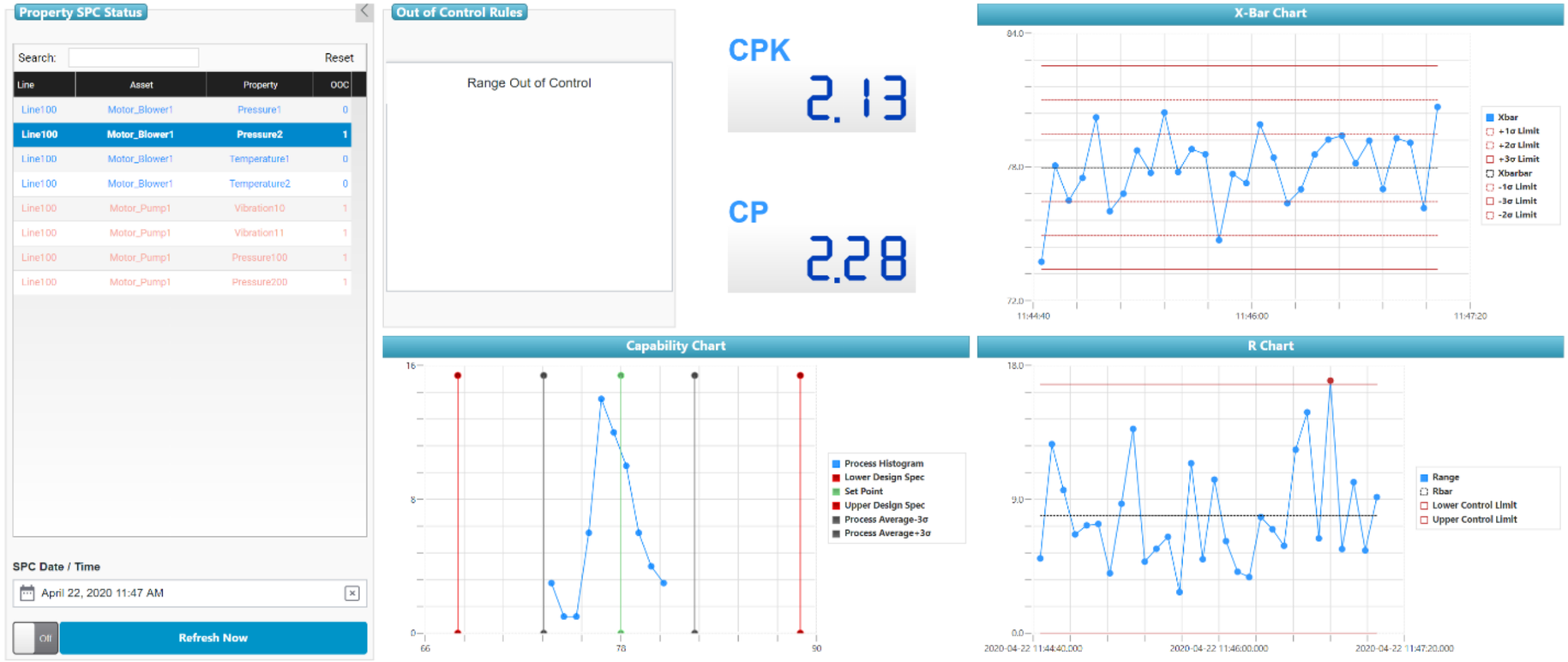
$$C_{pk} = \min\left[\frac{\mathrm{USL} - \mu}{3\sigma}, \frac{\mu - \mathrm{LSL}}{3\sigma}\right]$$





ThingWorx SPC Accelerator

- Pre-built full solution (with things, shapes, mashups and projects)
- Can add multiple production lines with multiple streaming assets (things)



Online Cloud Access Etiquette

- **LINK:** https://thingworx-srv.theassembly.ae
- RULE #1: **Prefix/suffix** all things and models you create with **a unique identifier** eg; with initials
- RULE #2: Be careful not to edit or modify objects created by others
- RULE #3: While logins will persist beyond the session, **don't count on data persisting** – Things will routinely be cleaned up on the server over days. If you would like to persist data, export items from Composer.

Data

- **LINK :** https://thingworx-srv.theassembly.ae/SPCWorkshopData.zip
- **CURATED & MODIFIED FROM**: developer.thingworx.com & community.ptc.com

THANK YOU!

ptc | تركيب THEASSEMBLY MAKE | SMART | THINGS