

Optic Drive

Team:
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Cooperation:
Atlas Copco

Duration:
10 weeks

Institution:
Umeå Institute of Design



Project Goal Evolve the current Micro Torque series by focusing on operator feedback to address the remaining Quality Control issues.

Micro Torque High precision assembly with micro screws

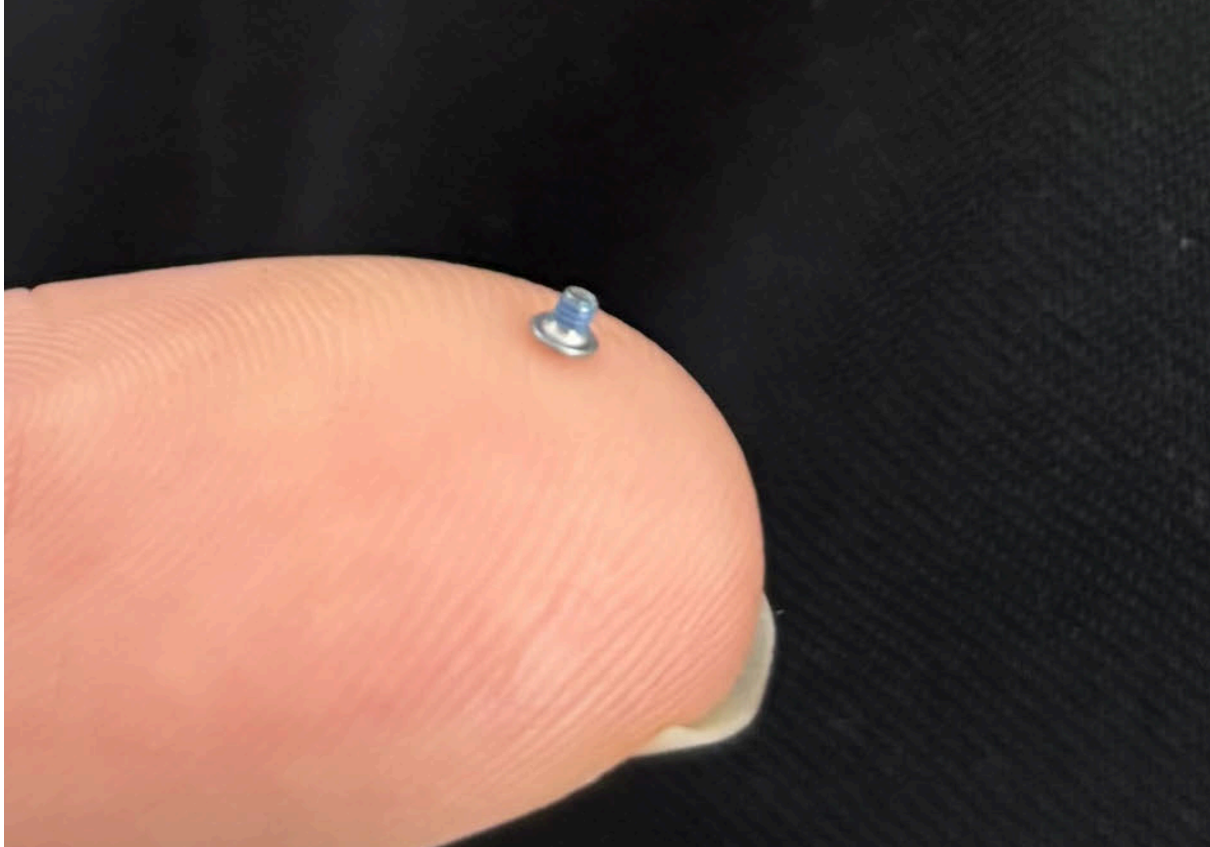
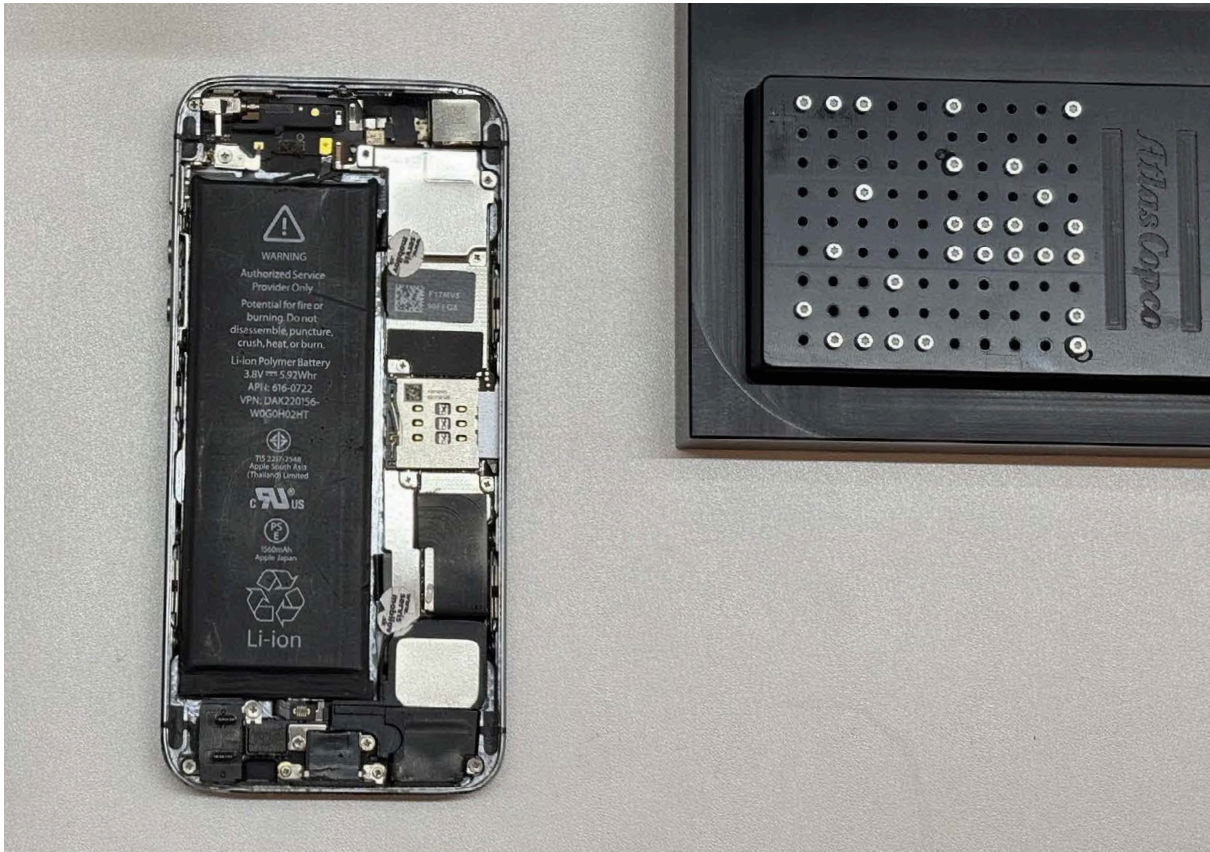
The project kicked off with a visit to Atlas Copco's Innovation Center in Bratislava and a factory visit to Enocconn in Hungary to gain insight into the tools and customer needs.

Assembly line at Enocconn, Hungary

Image Source: https://www.youtube.com/watch?v=QHaRh-BS_-I



Micro Torque covers assemblies below 500 cNm.



Project Goal Evolve current tools and resolve remaining Quality Control issues

The goal of these assembly lines is zero-defect production with minimal Quality Control issues.

Atlas Copco's advanced tightening strategies already prevent most tightening errors. Our field trip revealed misalignment and missing washers as the two key remaining challenges.

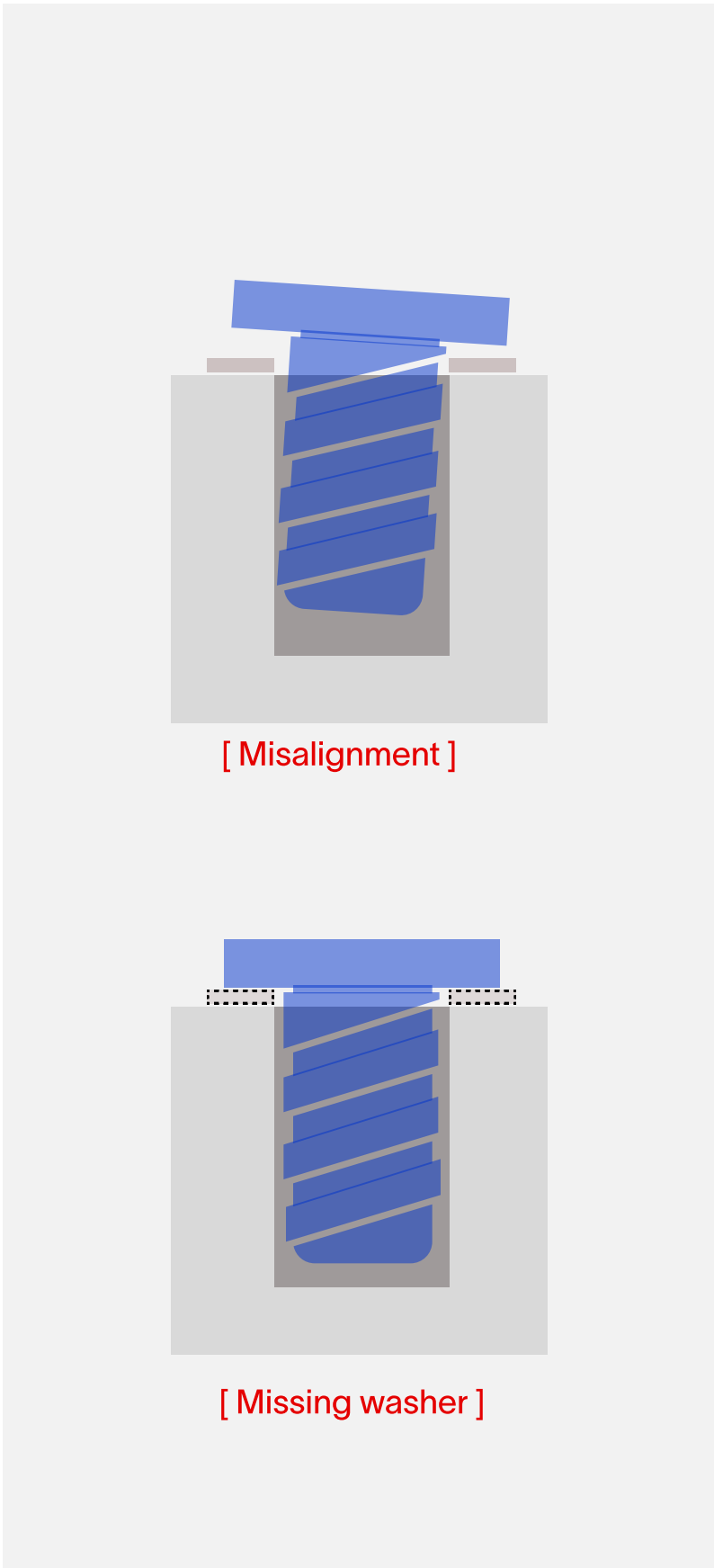
Current top-of-the-line series [ETF MT41/61, ETD MT21]



Quality Control issues solved



Remaining issues



Design Opportunity Improve tool feedback to resolve re-maining Quality Control issues

A display on the tool provides operators with real-time feedback right where they work. This empowers them to resolve Quality Control issues independently, guided by technology.





[1] Tilt Control Preventing missalign- ment



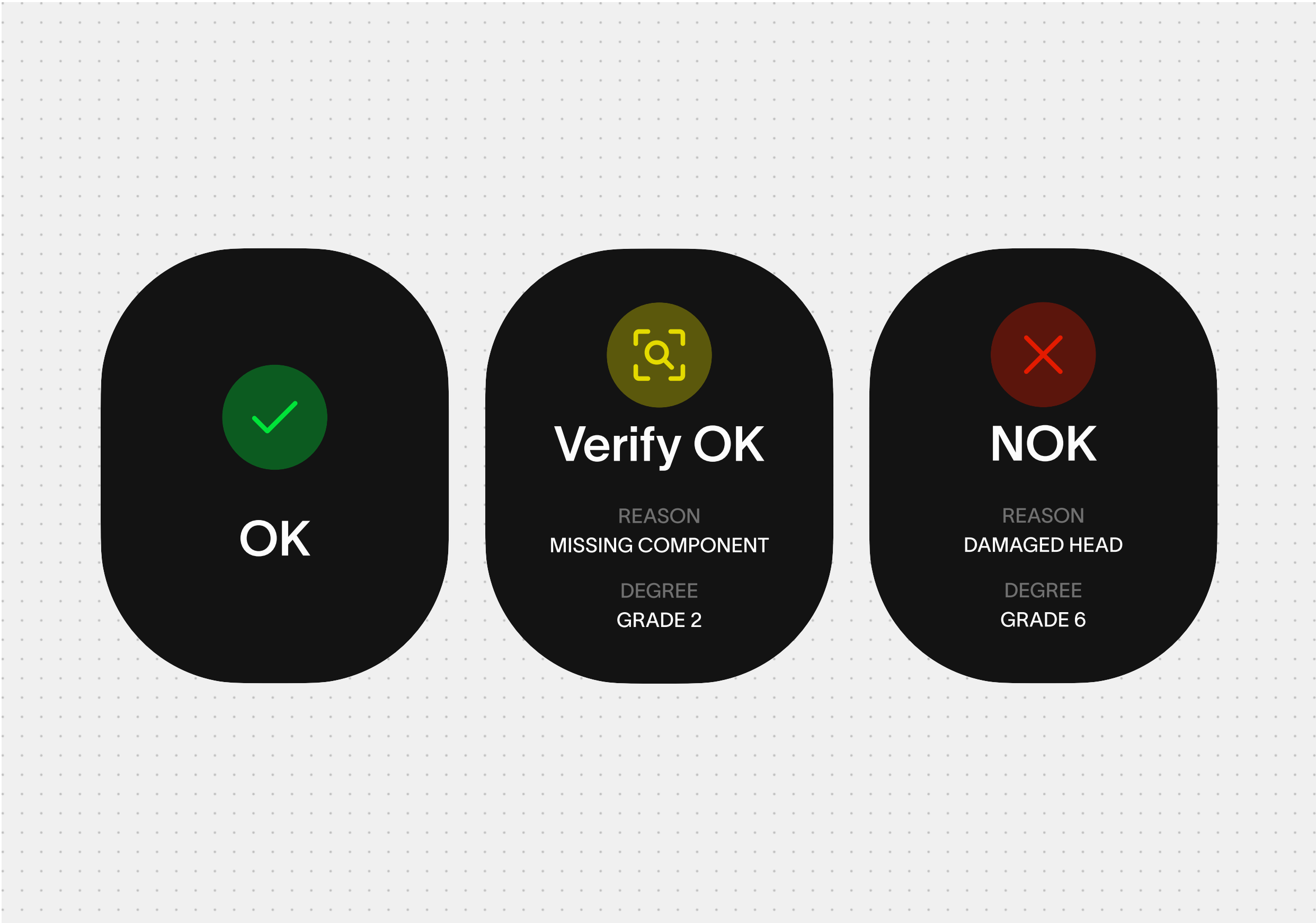
[Haptic Feedback] Alignment: Short

The tilt control feature indicates pitch and roll, similar to an aircraft spirit level. This helps prevent misalignment instead of detecting it afterward and requiring rework.

[2] Graph Conversion Detecting missing washers

The system currently classifies tightenings as OK or NOK. Missing washers may cause only minor deviations that are not severe enough to trigger an NOK. The new Verify OK status reports these non-critical deviations, prompting the operator to manually check for missing washers and verify the tightening.

UI Screens - Tightening classification



[Haptic Feedback] Verify OK: Short - Long



[Haptic Feedback] NOK: Long



[2] Graph Conversion

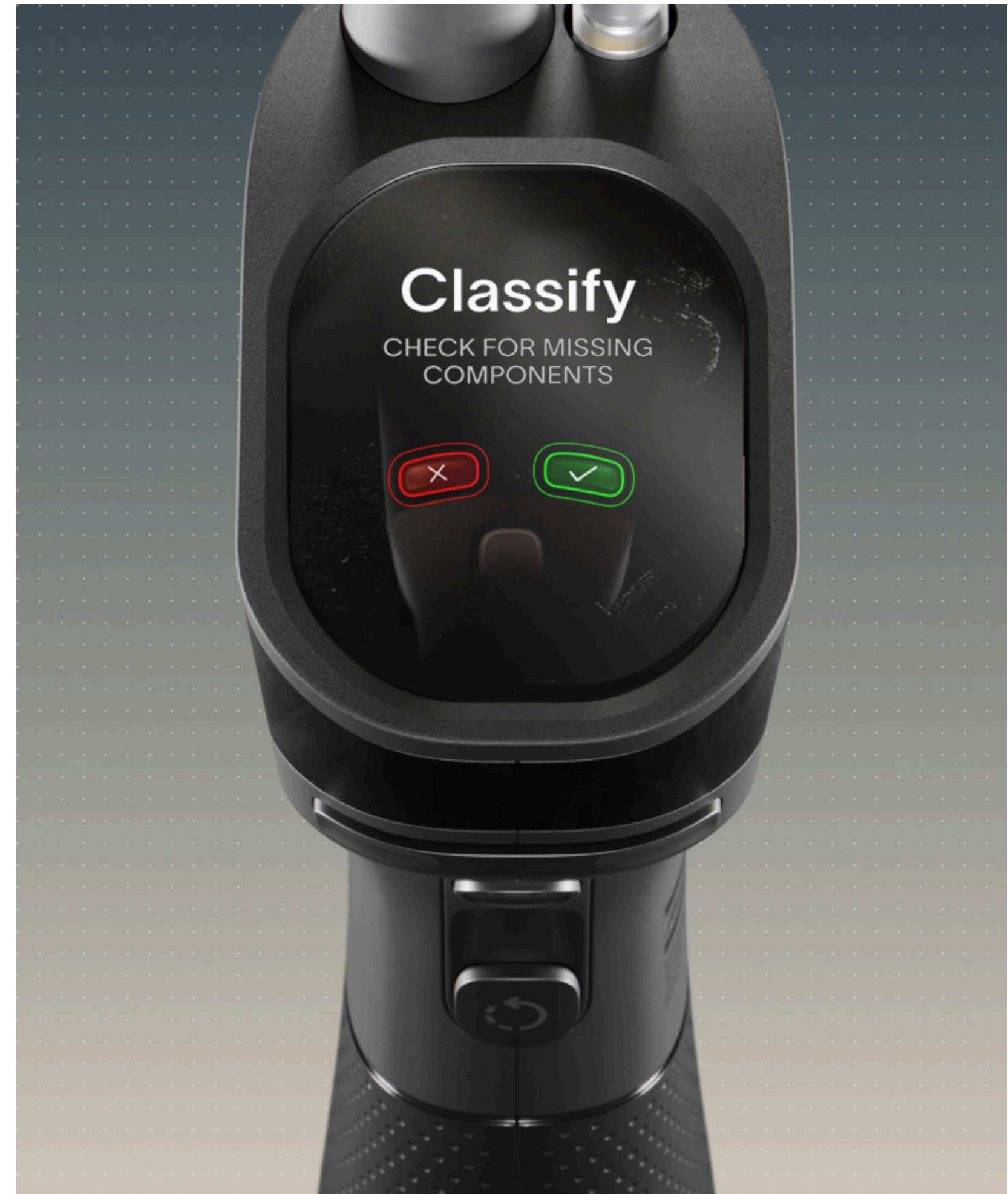
Classifying Verify Ok

Confirming a Verify OK tightening is done via the buttons beneath the display, as indicated in the UI.

[1] Verify OK



[2] Operator checks for missing washers



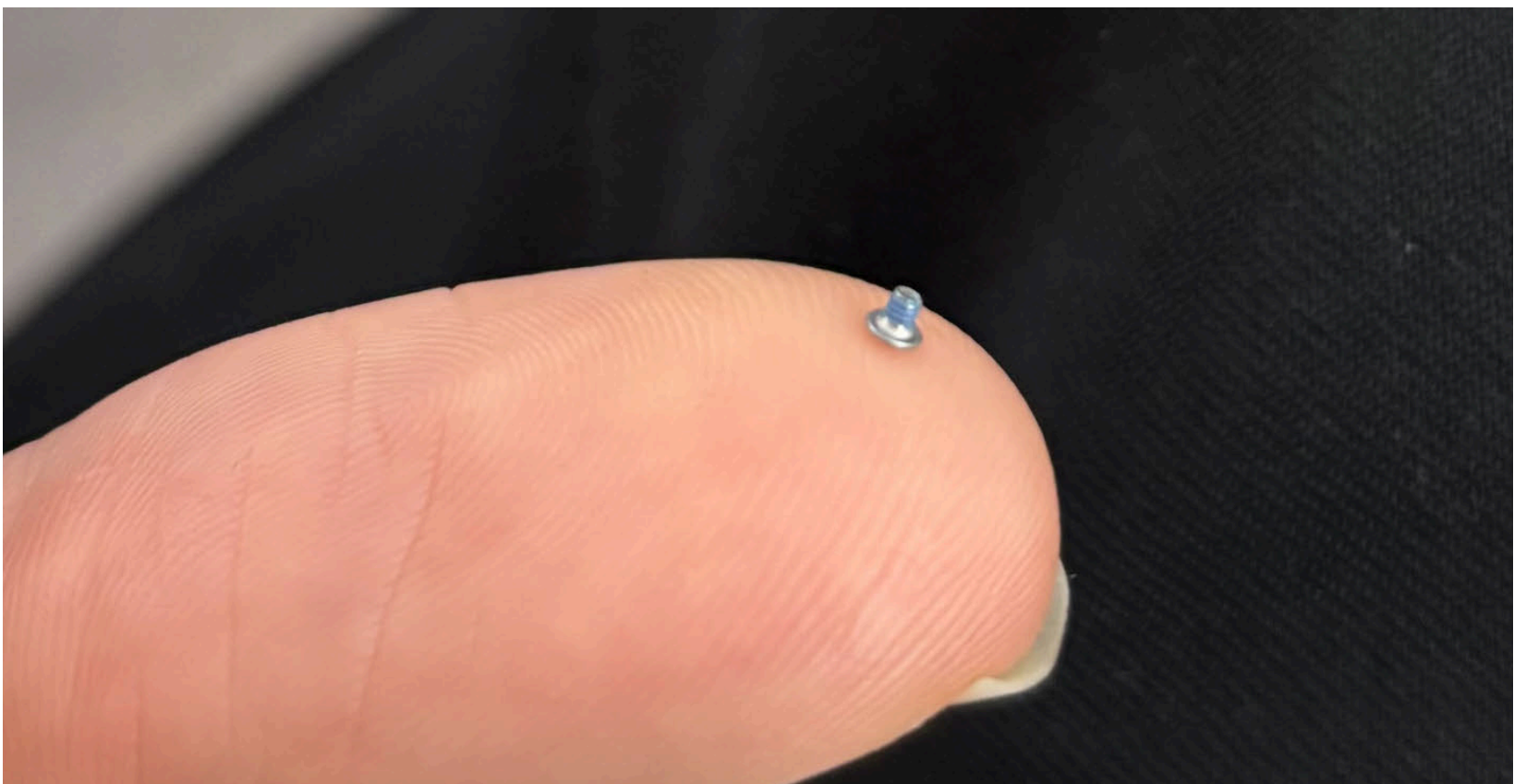
[3] Classifies Operation as OK or NOK



[3] Magnification Working with micro screws

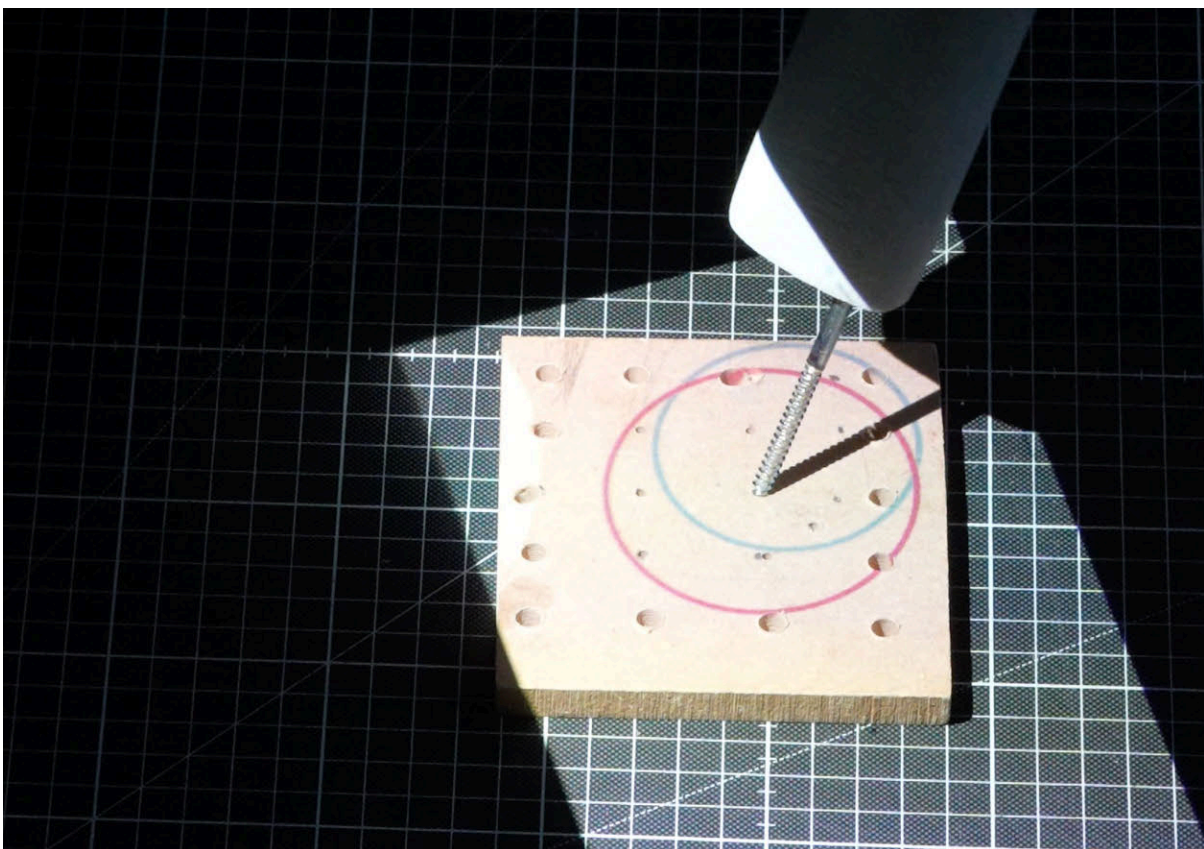
Working with micro screws is tedious and often leads to poor ergonomic positions as operators lean in for better eyesight. The magnification feature assists in aligning the tool, significantly reducing strain on the operator.

Magnification Button to activate or deactivate feature



Prototypes Feature exploration to functional prototypes

[1] Tilt Control - Laser



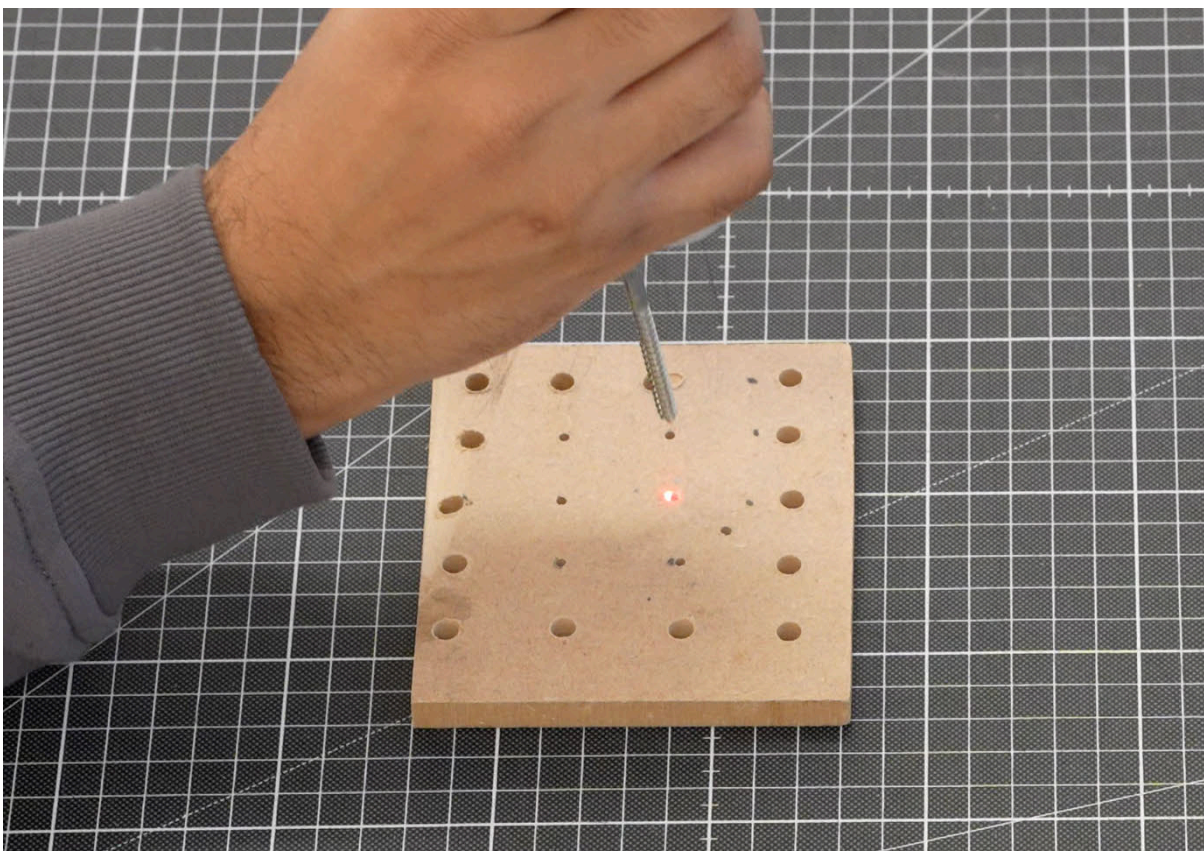
[2] Tilt Control - Display



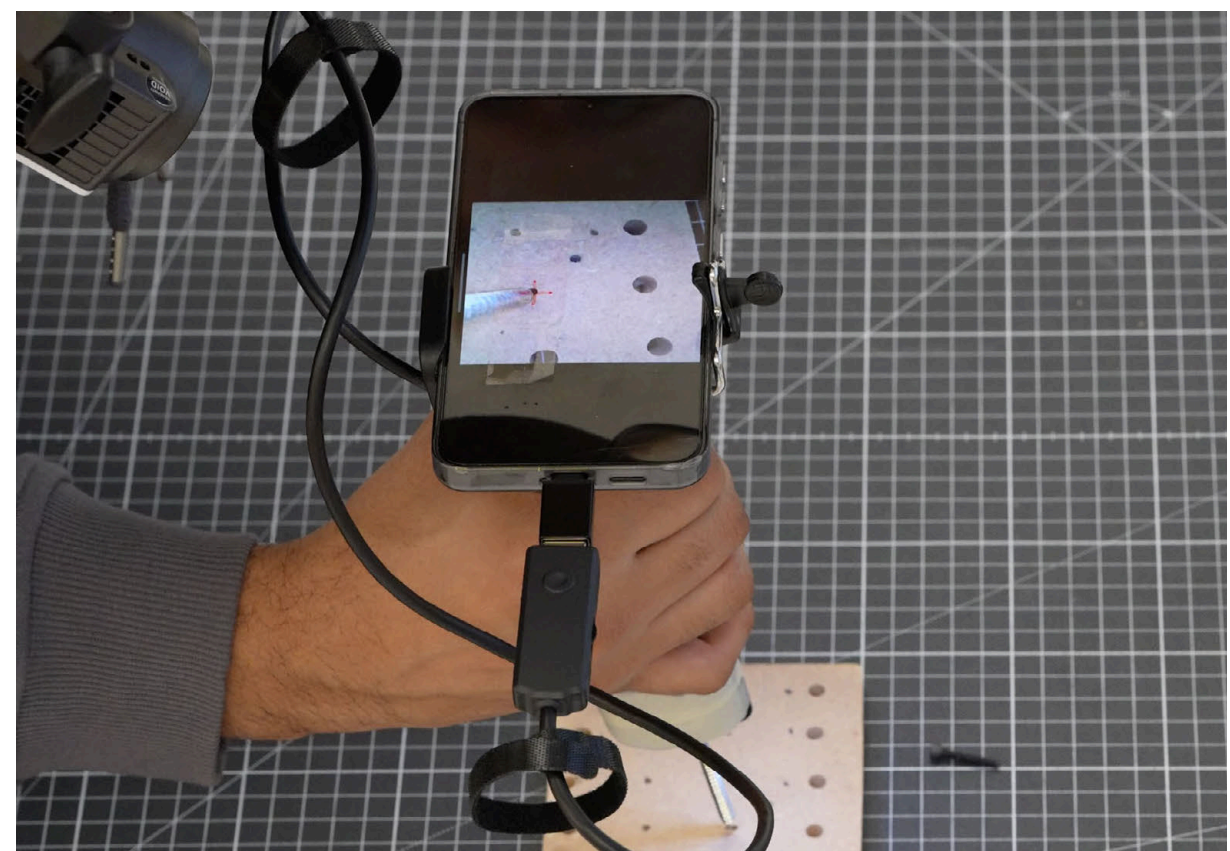
Tilt Control - Functional prototype



[1] Alignment - Laser



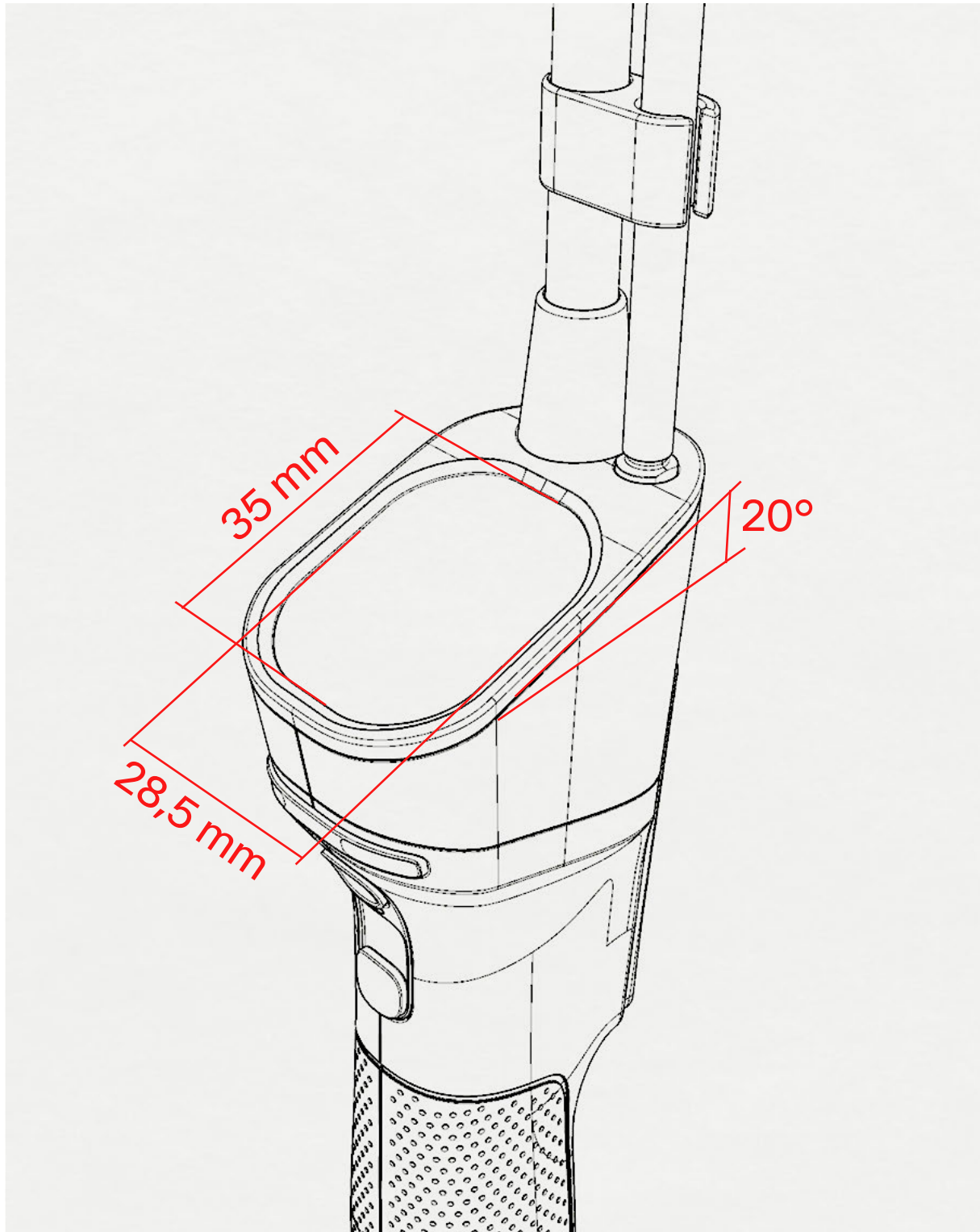
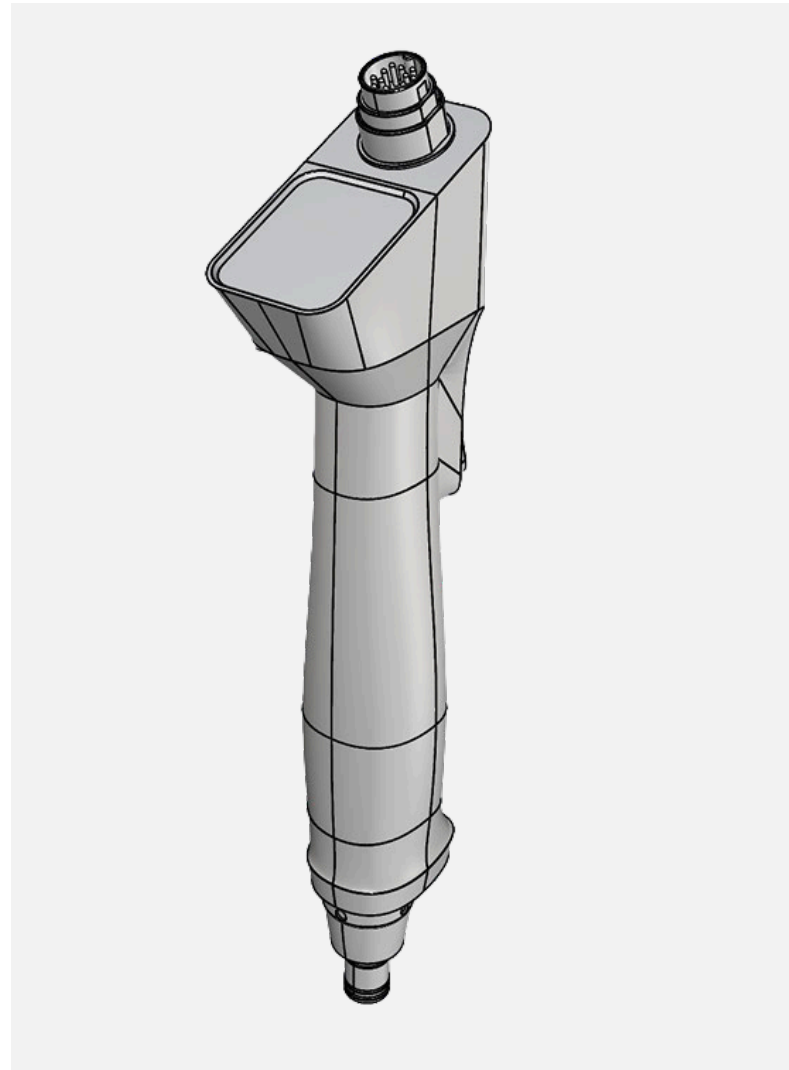
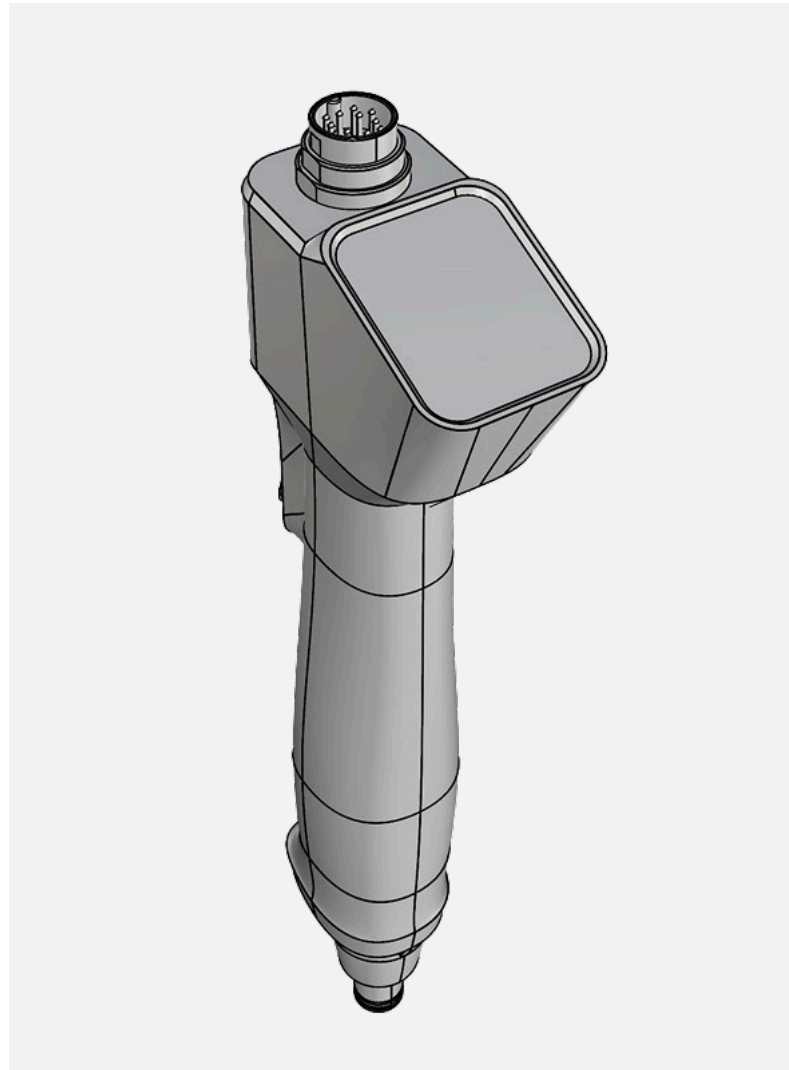
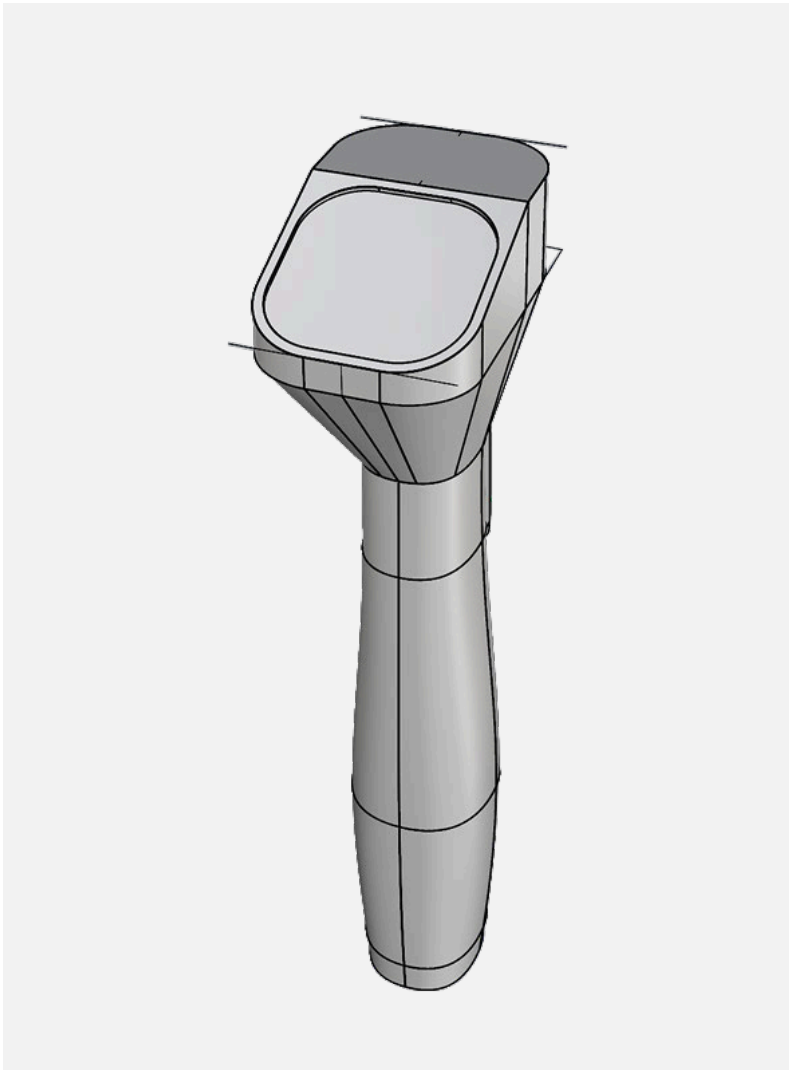
[2] Alignment - Display



Magnification - Functional prototype



Form and ergonomics Integrating a display

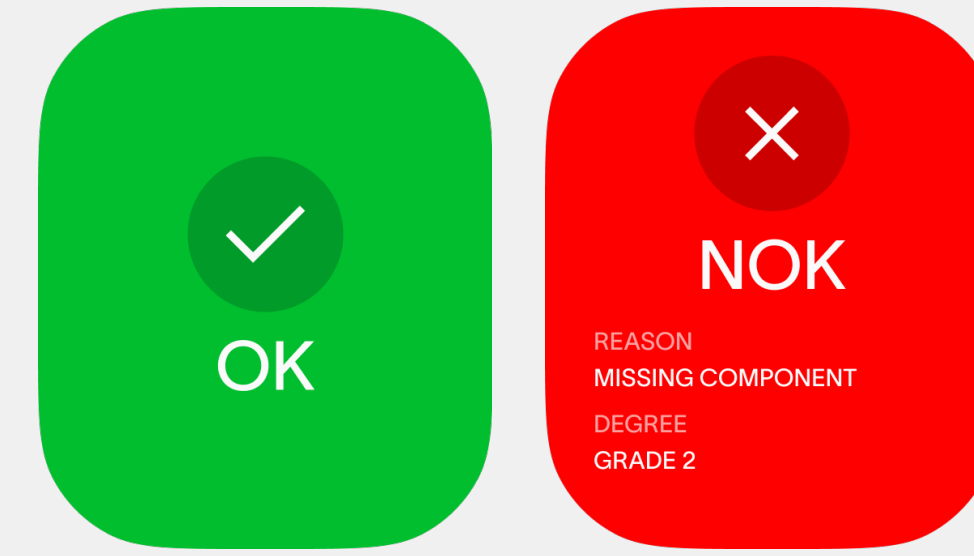


[Wireframe]

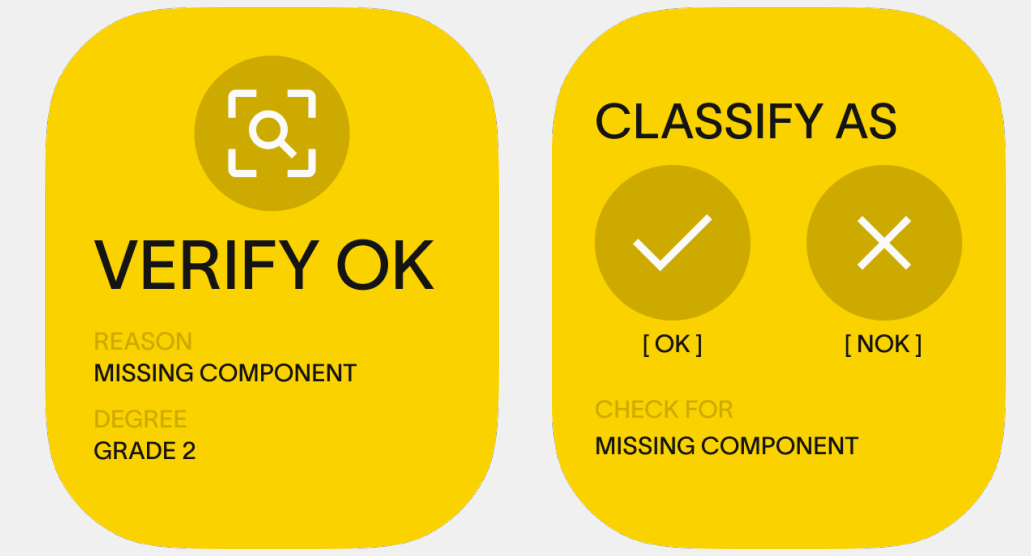


UI A screen large enough to display all relevant information

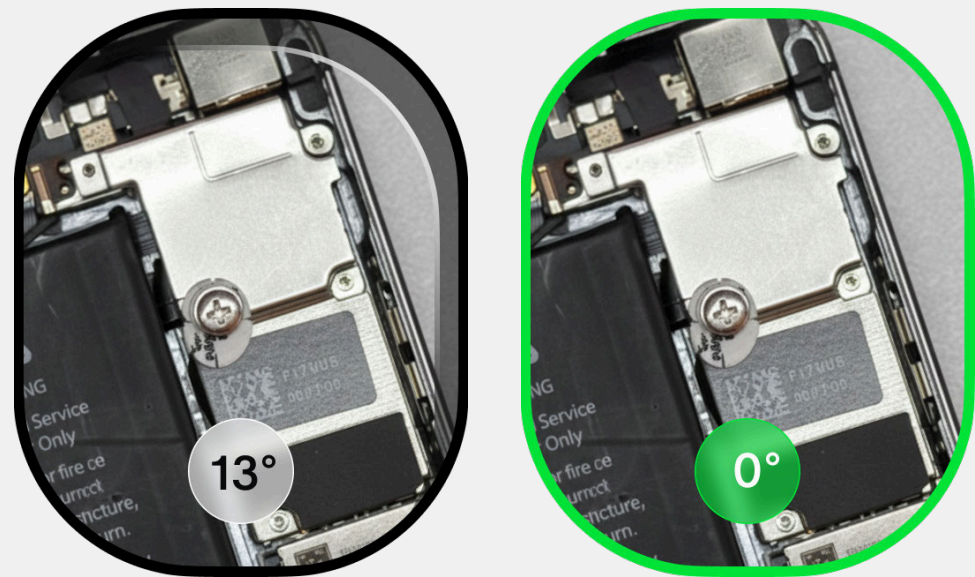
[Wireframes]



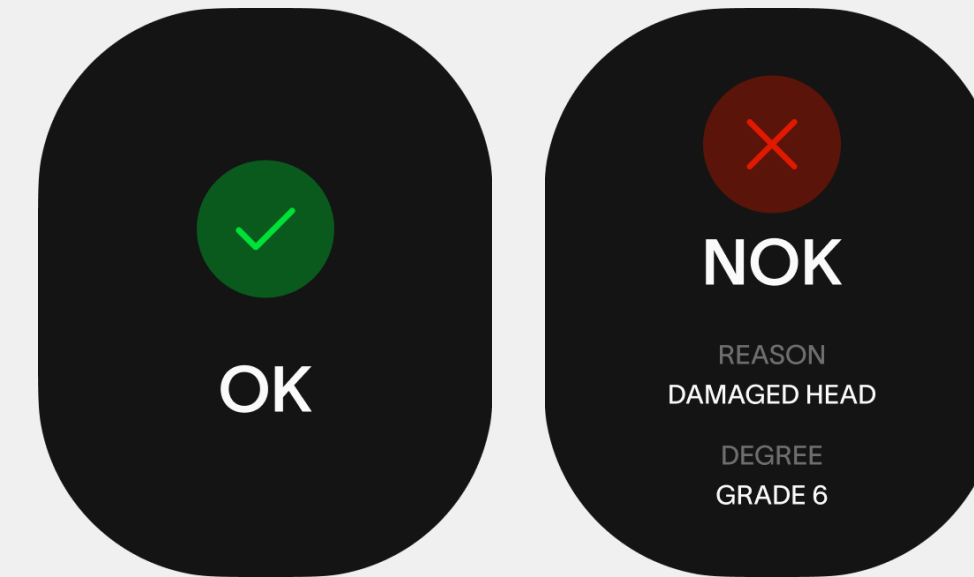
[Wireframes]



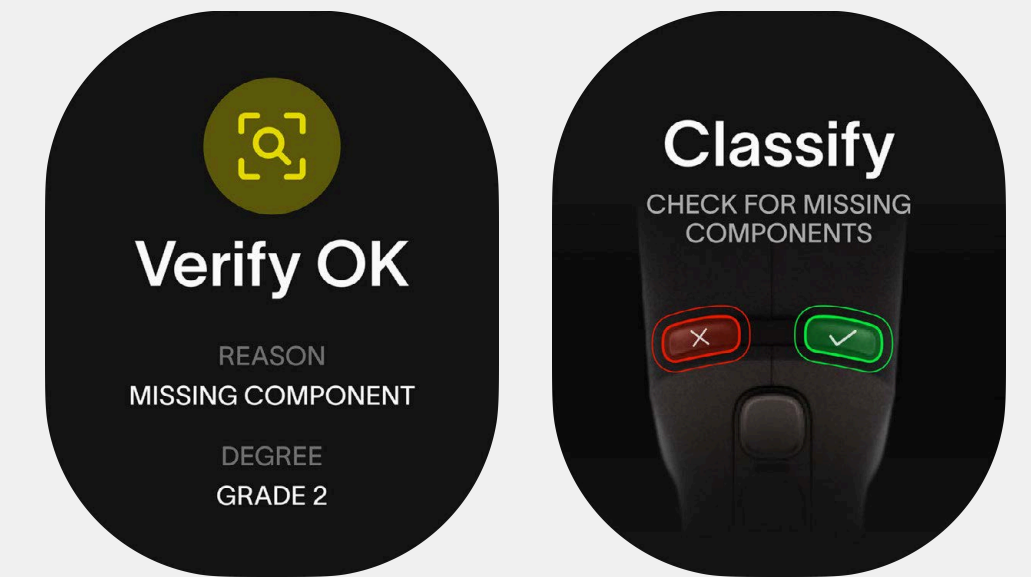
[UI]



[UI]



[UI]



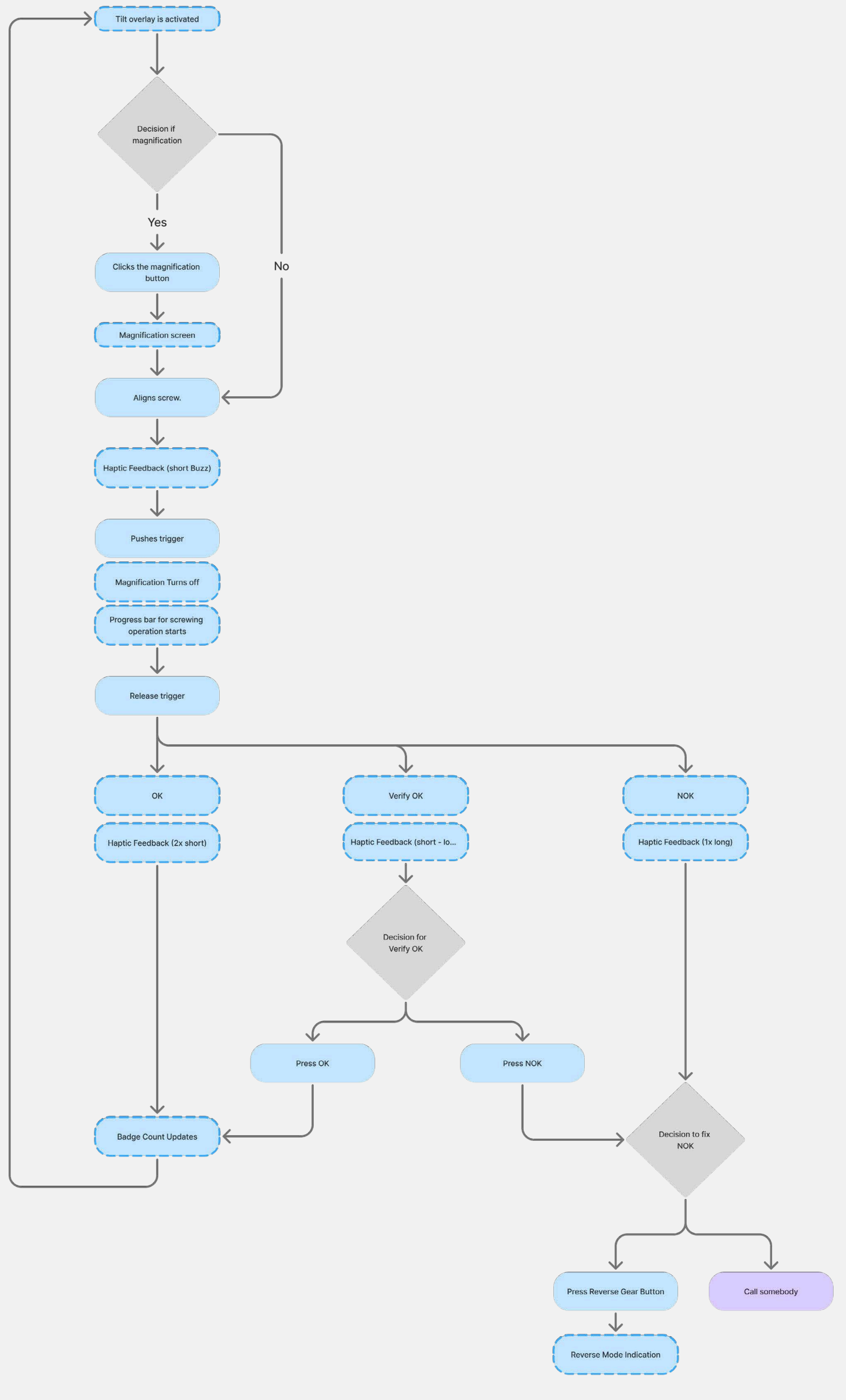
When using magnification, a transparent UI overlay indicates the tool's angle to maintain tilt control.

Following initial exploration, subtle colors were used to prevent operator fatigue after each tightening.

To guide operators through Verify OK, we clearly indicated where to act.

Buttons Three buttons for all features

Physical controls ensure glove-friendly usability. To prevent confusion with the magnification button, the reverse control was changed into a slider. A dedicated switch allows for quick OK/NOK classification.

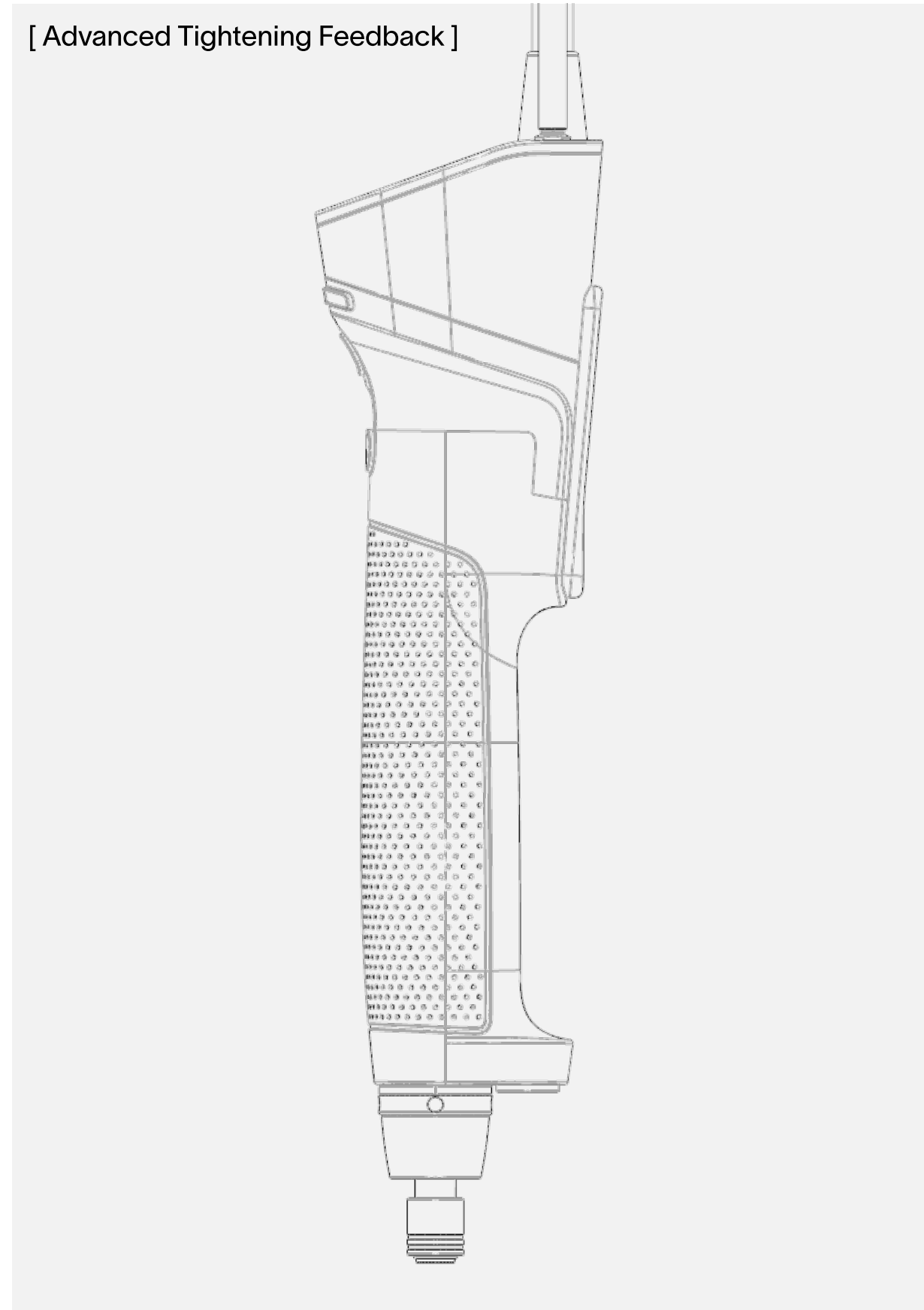
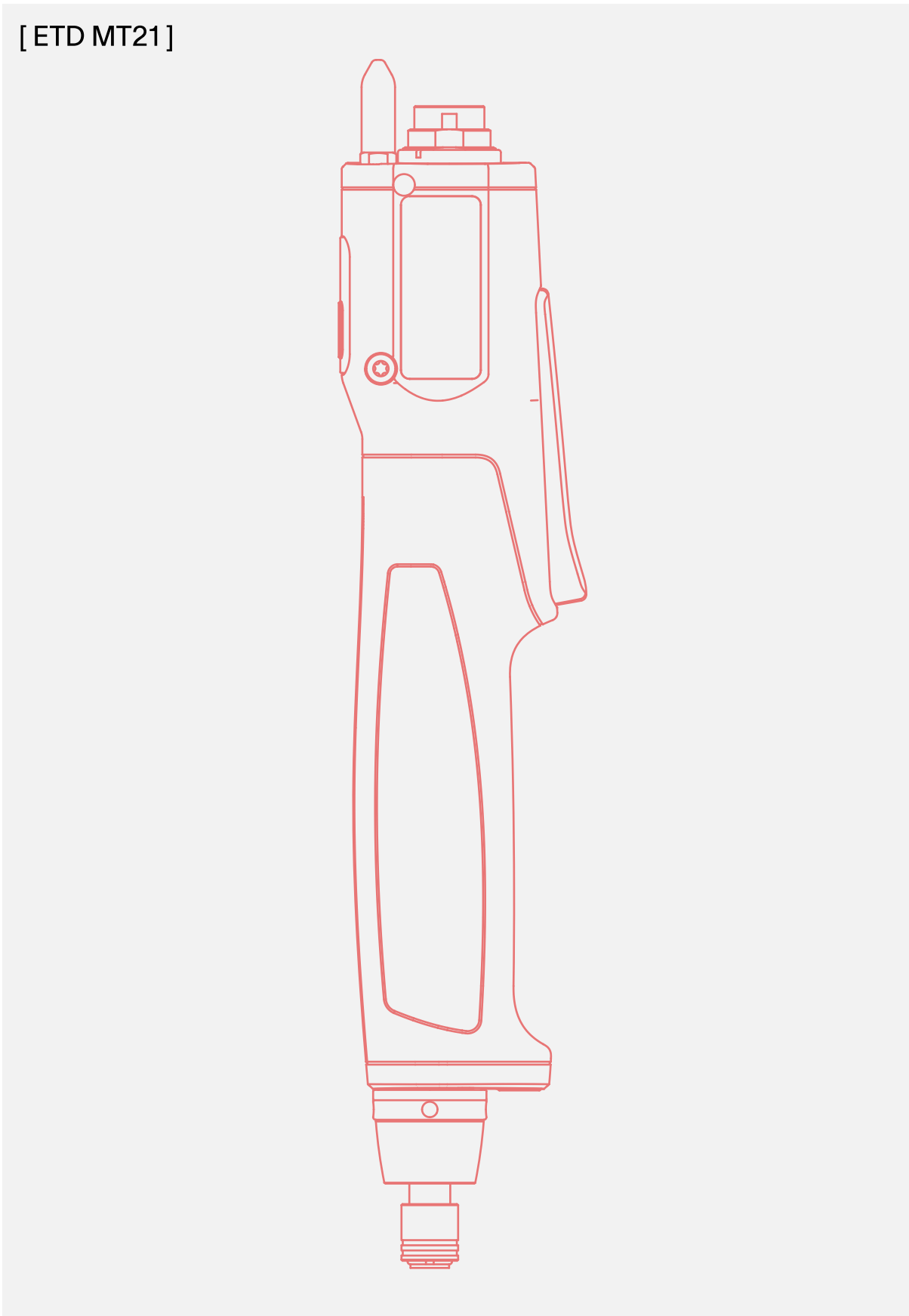


Exploring Button variants and layouts



Construction Integrating the new components into the existing ergonomic package

Built on decades of R&D, the current series ergonomics remain unchanged, including the proven handle shape.



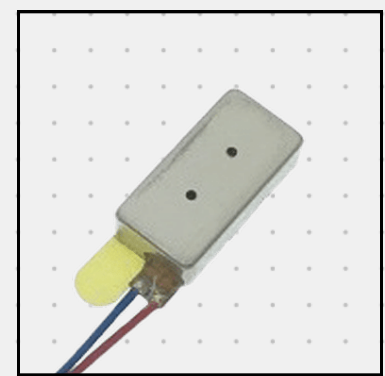
Display

[0.96 inch 128x64 TFT LCD Display
Panel SPI Interface
ST7735]



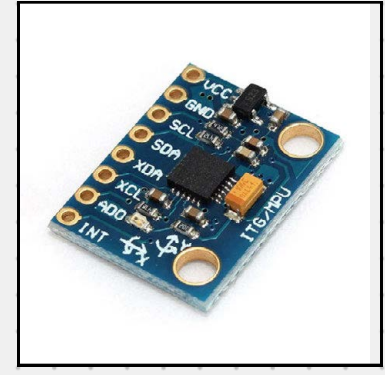
Vibration Motor

[C12-003 - 12mm Block LRA]



Gyroscope

[LSM6DSV16X 6-axis IMU]



Camera

[OV9281 1MP GS monokrom 160°]



Details An economical version and a few details of the regular tool

For customers not requiring visual feedback, an economical version is available. It comes without the display, camera, and extra sensors, communicating only the Verify OK status via an indicator light instead. The form factor remains unchanged but adopts the signature yellow branding of Atlas Copco's entry-level tools.



