

## iExo – Part of EVO-MTI

### Qualification and live monitoring of an exoskeleton

#### BACKGROUND

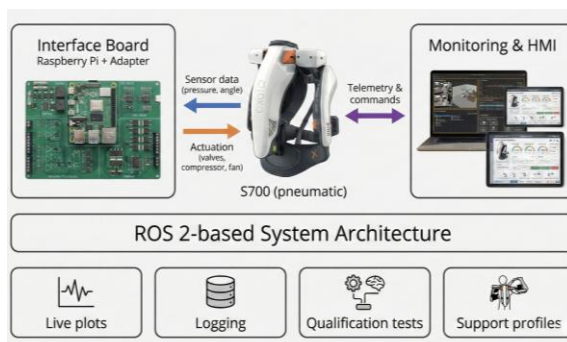
Work above head level is common in many industries and can cause high physical strain in the shoulder and neck region. Shoulder exoskeletons can reduce this load, but many commercial systems behave like “black boxes”: internal sensor signals, system states and assistance parameters are not accessible, and support is often limited to a few predefined modes. This makes it difficult to document what the system actually does during a task, to reproduce measurements across sessions, or to adapt assistance to context factors such as tool weight or work phase. Within the EVO-MTI project, iExo addresses this gap by making an active exoskeleton transparent, measurable and adaptable to work scenarios.

#### FOCUS OF WORK

iExo retrofits a commercial pneumatic shoulder exoskeleton (exoIQ S700) with an interface layer based on a Raspberry Pi and an adapter board. Internal signals—pneumatic pressures and arm elevation angles—are acquired, time-stamped and streamed to a Linux host via a ROS 2-based system architecture. This shared architecture (SysArch, developed in parallel within EVO-MTI) provides the integration backbone so that monitoring, logging and later data services can be connected consistently across subprojects. A lightweight HMI (laptop or tablet) is used to monitor live states and to configure, adjust and scale assistance behaviour (profiles and modes) in a controlled manner. In iExo, the focus is on qualification: we establish stable signal paths, calibration and plausibility checks, and repeatable test procedures under defined safety constraints, while enabling controlled actuation of valves, compressor and fan. In addition, the S700 is prepared as a “universal” demonstrator in which parameterisable support profiles can be tuned and, as a next step, adapted to task context to approximate different torque-angle behaviours..

#### KEY MESSAGES

iExo turns a closed commercial active exoskeleton into a transparent, experiment-ready system with live monitoring and traceable, time-synchronised data.



The qualification workflow supports safe operation and makes measurements reproducible and comparable across sessions. By aligning with the ROS 2-based SysArch within EVO-MTI, iExo provides a clean and consistent data stream that can be reused by other project parts (e.g., structured datasets and later decision support), while the “universal profile” concept enables not only selecting support profiles but also modifying and parameterising the assistance and, in the next step, adapting it to different tasks—allowing systematic comparisons of assistance strategies on the same hardware.

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#### Project partner

Helmut-Schmidt-Universität |  
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