TECHNICAL DATASHEET · SOFTWARE

MPC Speed Control

PYTHON EDITION · NO MATLAB · CARIMO DCMK KIT

A pure-Python software package for **Model Predictive Control** of the CARIMO DC Motor Kit, speed loop. A real constrained quadratic program (OSQP) plans every move and a **Kalman observer** rejects load disturbances. The motor self-identifies its own FOPDT model in about 15 seconds, then MPC controls it. Five Qt dashboards drive the experiments and a one-click launcher installs and runs everything. No MATLAB, no Simulink, no toolbox licence.

Five experiment dashboards

1. **Smoothness & prediction horizon.** How far MPC looks ahead.
2. **Constraint handling.** Hard PWM limits, enforced by the QP.
3. **Kalman disturbance observer.** Holding speed under load.
4. **Model mismatch.** Robustness when the model is off.
5. **Rate limits & trajectory tracking.** Smooth, bounded moves.

Demo flow: plant-ID → tuning → constraints → disturbance observer → trajectory tracking.

System requirements	
Language	Python 3.11
Dependencies	NumPy, SciPy, OSQP, pyserial, Matplotlib, PyQt6, simple-pid
MATLAB / toolbox	**Not required**
OS	Windows 10 / 11
Port	One free USB 2.0 port
Hardware	CARIMO DC Motor Kit, V2 (16-bit) or V1 (8-bit)
Control	Speed loop · real OSQP QP + Kalman observer · 15 ms tick
Setup	One-click START_HERE.bat launcher

What's included

- ✓ **Five Qt experiment dashboards** plus the one-click launcher
- ✓ **Plant identification** (FOPDT) with a per-kit model store
- ✓ **Demo protocol** + method / validation report
- ✓ **Perpetual software licence** with a year of updates
- ✓ **MPC engine**: OSQP QP + Kalman observer
- ✓ **Runs on both kits**, V1 and V2, from one setting
- ✓ **Fully tested**, and validated on real kits
- ✓ **Readable, editable Python** source

Licensing & scope

Perpetual lab licence. The software is **pure Python** and needs **no MATLAB, Simulink or toolbox**. It runs on the user's own PC and is licensed separately from the hardware. The **CARIMO DC Motor Kit** is sold separately. MPC Speed Control is also available as **Simulink editions** (Python-QP bridge, or pure-MATLAB quadprog), and a Fuzzy Logic and PI/PID edition run on the same kit.