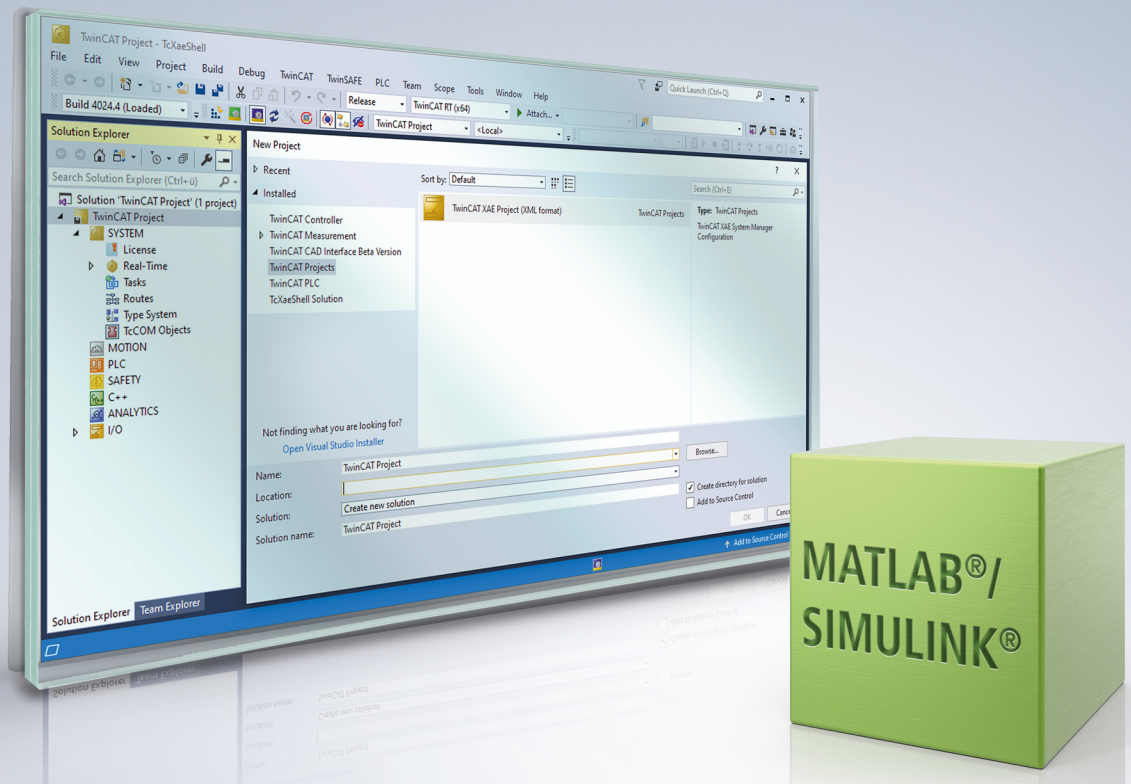
BECKHOFF New Automation Technology

Manual | EN

TE1402

TwinCAT 3 | Target for Embedded Coder®



2024-12-04 | Version: 1.0.0

Table of contents

1 Foreword

1.1 Notes on the documentation

This description is intended exclusively for trained specialists in control and automation technology who are familiar with the applicable national standards.
For installation and commissioning of the components, it is absolutely necessary to observe the documentation and the following notes and explanations.
The qualified personnel is obliged to always use the currently valid documentation.

The responsible staff must ensure that the application or use of the products described satisfies all requirements for safety, including all the relevant laws, regulations, guidelines, and standards.

Disclaimer

The documentation has been prepared with care. The products described are, however, constantly under development.
We reserve the right to revise and change the documentation at any time and without notice.
No claims to modify products that have already been supplied may be made on the basis of the data, diagrams, and descriptions in this documentation.

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Patents

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EP1590927, EP1789857, EP1456722, EP2137893, DE102015105702
and similar applications and registrations in several other countries.

EtherCAT® is registered trademark and patented technology, licensed by Beckhoff Automation GmbH, Germany

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1.2 For your safety

Safety regulations

Read the following explanations for your safety.
Always observe and follow product-specific safety instructions, which you may find at the appropriate places in this document.

Exclusion of liability

All the components are supplied in particular hardware and software configurations which are appropriate for the application. Modifications to hardware or software configurations other than those described in the documentation are not permitted, and nullify the liability of Beckhoff Automation GmbH & Co. KG.

Personnel qualification

This description is only intended for trained specialists in control, automation, and drive technology who are familiar with the applicable national standards.

Signal words

The signal words used in the documentation are classified below. In order to prevent injury and damage to persons and property, read and follow the safety and warning notices.

Personal injury warnings

⚠ DANGER
Hazard with high risk of death or serious injury.

⚠ WARNING
Hazard with medium risk of death or serious injury.

⚠ CAUTION
There is a low-risk hazard that could result in medium or minor injury.

Warning of damage to property or environment

NOTICE
The environment, equipment, or data may be damaged.

Information on handling the product

This information includes, for example:
recommendations for action, assistance or further information on the product.

1.3 Notes on information security

The products of Beckhoff Automation GmbH & Co. KG (Beckhoff), insofar as they can be accessed online, are equipped with security functions that support the secure operation of plants, systems, machines and networks. Despite the security functions, the creation, implementation and constant updating of a holistic security concept for the operation are necessary to protect the respective plant, system, machine and networks against cyber threats. The products sold by Beckhoff are only part of the overall security concept. The customer is responsible for preventing unauthorized access by third parties to its equipment, systems, machines and networks. The latter should be connected to the corporate network or the Internet only if appropriate protective measures have been set up.

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Beckhoff products and solutions undergo continuous further development. This also applies to security functions. In light of this continuous further development, Beckhoff expressly recommends that the products are kept up to date at all times and that updates are installed for the products once they have been made available. Using outdated or unsupported product versions can increase the risk of cyber threats.

To stay informed about information security for Beckhoff products, subscribe to the RSS feed at https://www.beckhoff.com/secinfo.

1.4 Documentation issue status

Version	Modifications
1.0.0	First release

2 Overview

TwinCAT 3 TE1402 Target for Embedded Coder® is an extension of the
TwinCAT 3 TE1400 Target for Simulink®. All features of the TwinCAT Target for Simulink® can be used.

In this documentation (TwinCAT 3 Target for Embedded Coder®) you will find restrictions and extensions of the TwinCAT Target for Simulink®.

More Information

Documentation TwinCAT 3 TE1400 Target for Simulink®

3 Installation

The same installation and setup requirements apply as described in TwinCAT 3 Target for Simulink® for version 2.x.xxx.

Deviating and other installation requirements

- MATLAB® R2022b or higher
- MathWorks® Embedded Coder™

Installation for TwinCAT 3.1 Build 4026

Name in the UI: TE1402 | TwinCAT 3 Target for Embedded Coder®

Command line: `tcpkg install TE1402.TargetForEmbeddedCoder.XAE`

Installation for TwinCAT 3.1 Build 4024

The installation for TwinCAT 3.1 Build 4024 is part of the setup TwinCAT 3 Tools for MATLAB® and Simulink® and is installed automatically.

4 Licenses

In addition to the TE1400 TwinCAT 3 Target for Simulink® license, you need the TE1402 TwinCAT 3 Target for Embedded Coder® license on your **engineering PC**.

With regard to **TwinCAT runtimes**, the same licenses are required as for the TwinCAT 3 Target for Simulink®. This means that you do not need any additional runtime licenses if you already use TwinCAT objects in your runtime that were compiled with the TwinCAT 3 Target for Simulink® or TwinCAT 3 Target for MATLAB®.

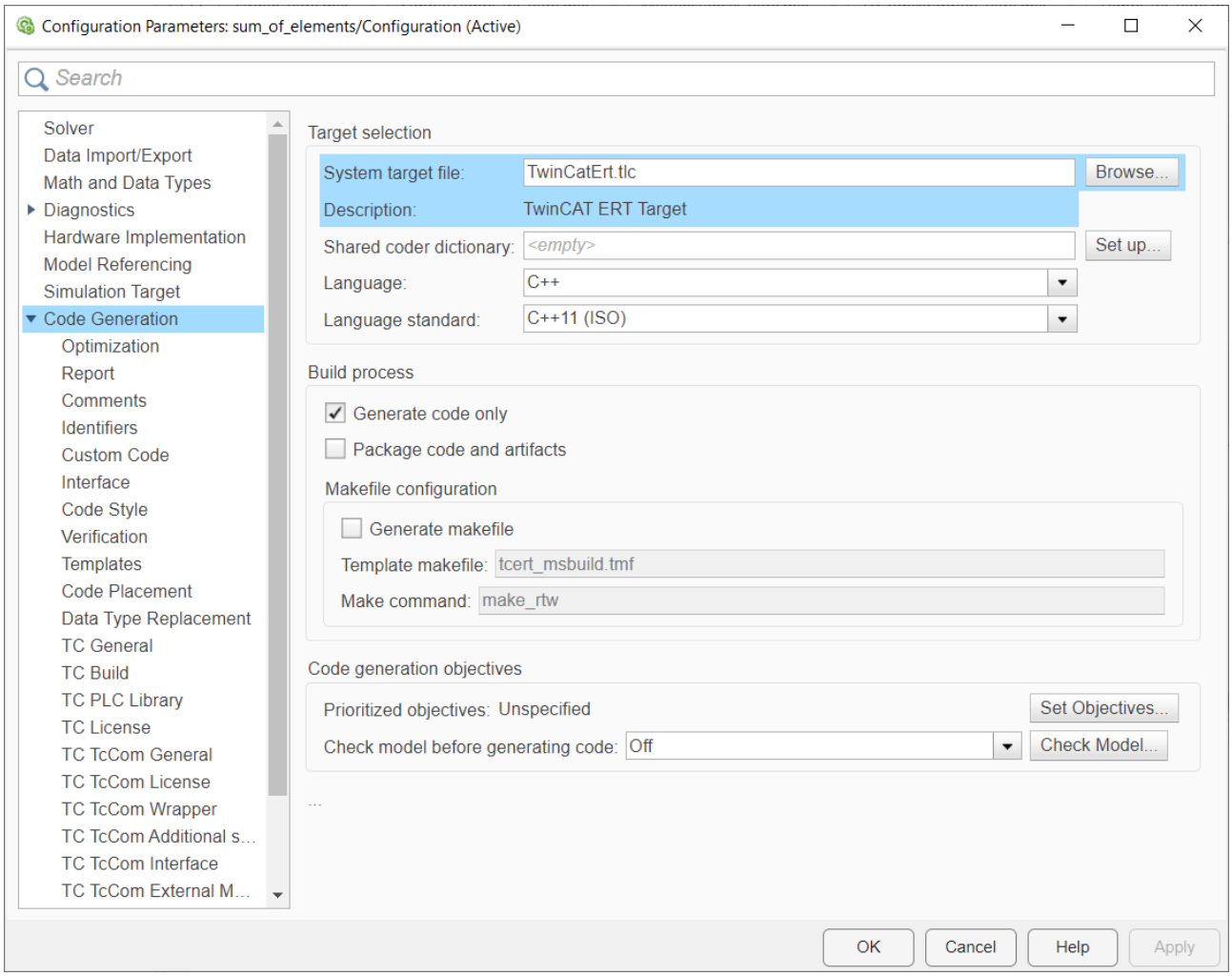
5 Parameterization in Simulink®

Using Embedded Coder® together with TwinCAT

Set the system target file to *TwinCatErt.tlc*.

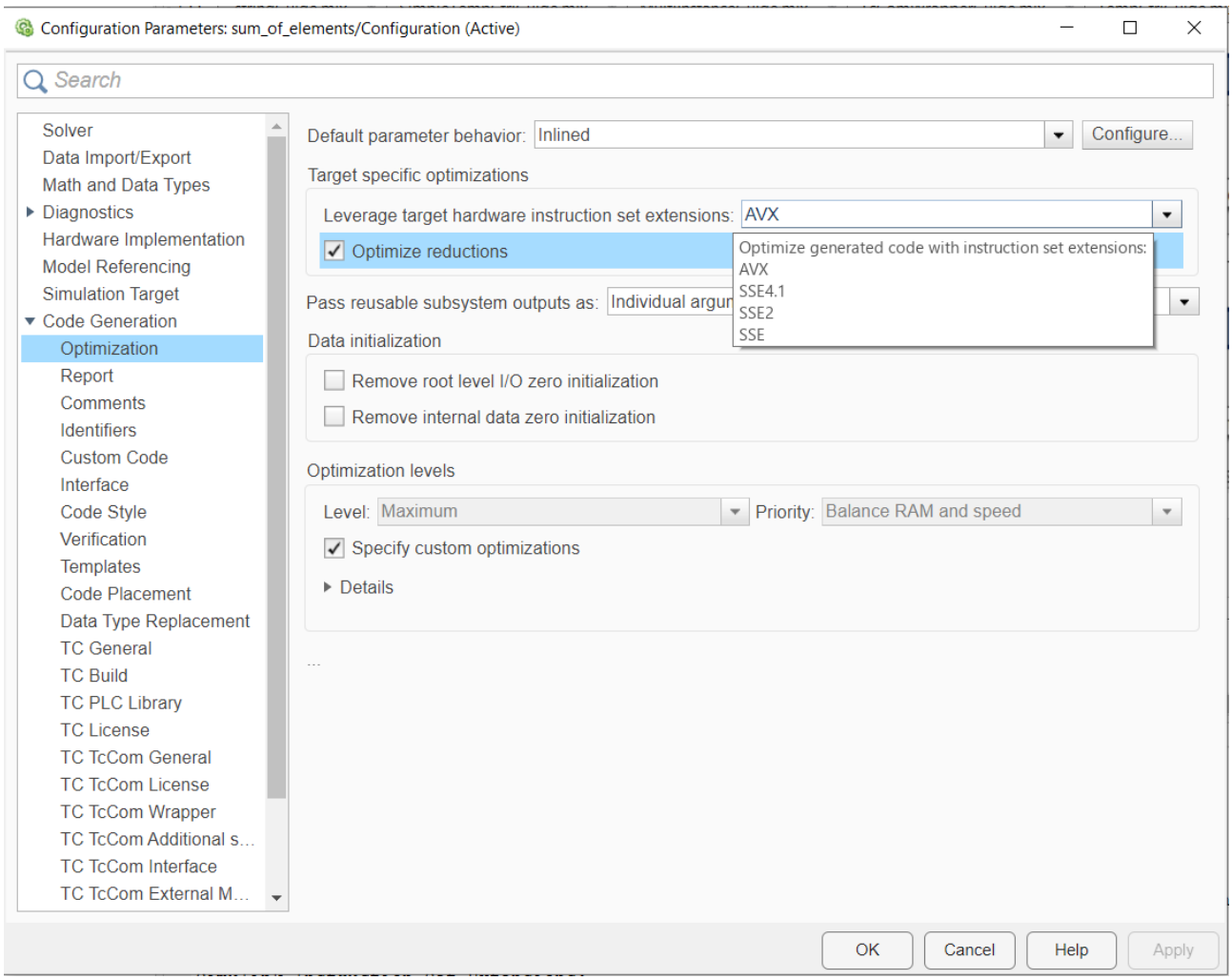
Command Line Interface (CLI):
`TwinCAT.ModuleGenerator.Simulink.ModelExportConfig.ShowModelParam(modelName,'SystemTargetFile','TwinCatErt.tlc');`

Or in the User Interface (UI) via the *Configuration Parameters* in the Simulink® model at **Code Generation > System target file**.



Sample in MATLAB®: SIMD instruction set extensions

In the „Simulink® Instruction Set Extensions“ sample, you will learn how to create a Simulink® model with the TwinCAT 3 Target for Embedded Coder, which uses SIMD instruction set extensions to accelerate model execution time.




```
TwinCAT.ModuleGenerator.Samples.Start('Simulink Instruction Set Extensions')
```

CPU of the target system must support instruction sets

Make sure that the target system on which you want to execute the generated object supports the set instruction set extension. When the object is loaded, the TwinCAT runtime checks the availability of the instruction sets and compares them with the instruction sets used in the object. If the CPU does not meet the requirements, the object is not loaded and a corresponding error message is issued in TwinCAT XAE.

The model can be built after parameterization via
Apps > Embedded Coder > Generate Code.

6 Restrictions

DSP System Toolbox™ AVX2 code replacement library

The DSP System Toolbox™ AVX2 code replacement library requires the TwinCAT.XAE.PublicSDK >4.9.0 and is therefore limited to TwinCAT 3.1. Build 4026.

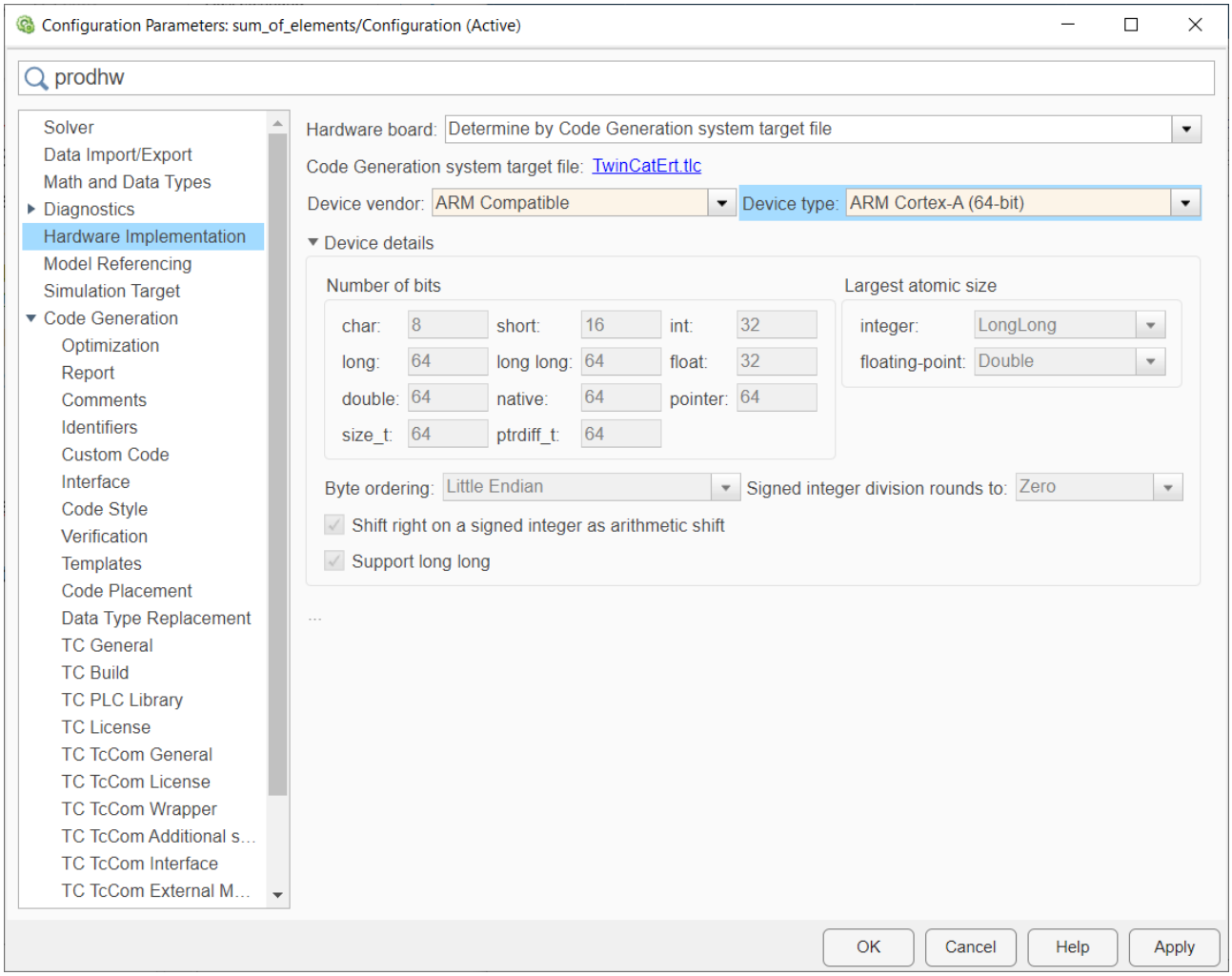
https://de.mathworks.com/help/dsp/ug/use-intel-avx2-code-replacement-library-to-generate-simd-code-from-simulink-blocks.html

SIMD for Arm®64 platforms

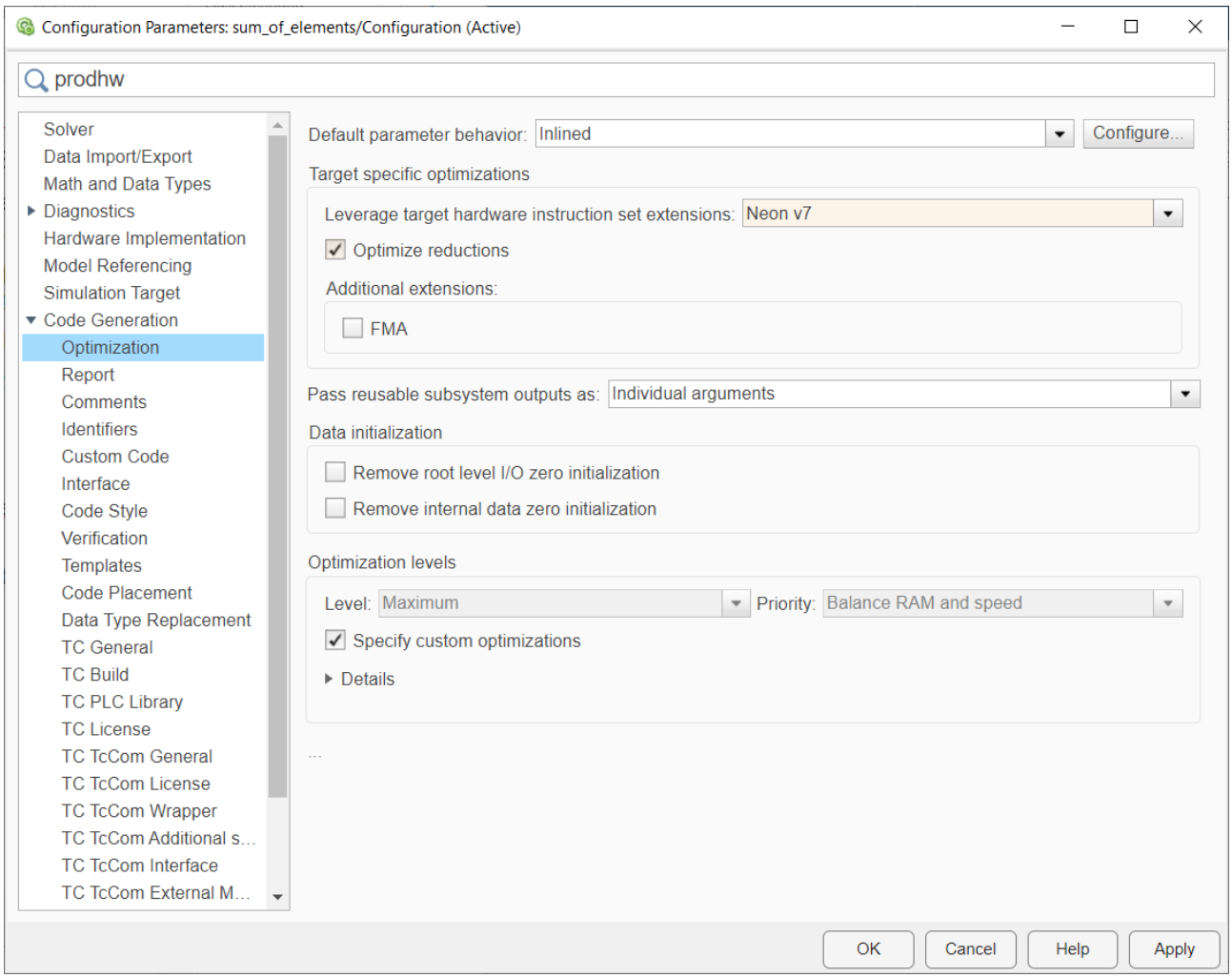
Neon instruction sets are only supported on MATLAB® R2024a. For R2014a, you must install the „Embedded Coder Support Package for Arm® Cortex®-A Processors“ package via the MATLAB® Add-on Explorer (for Beckhoff Embedded PCs CX82xx and CX9240). From MATLAB® R2024b, it is no longer necessary to install the package separately.

Quick reference guide

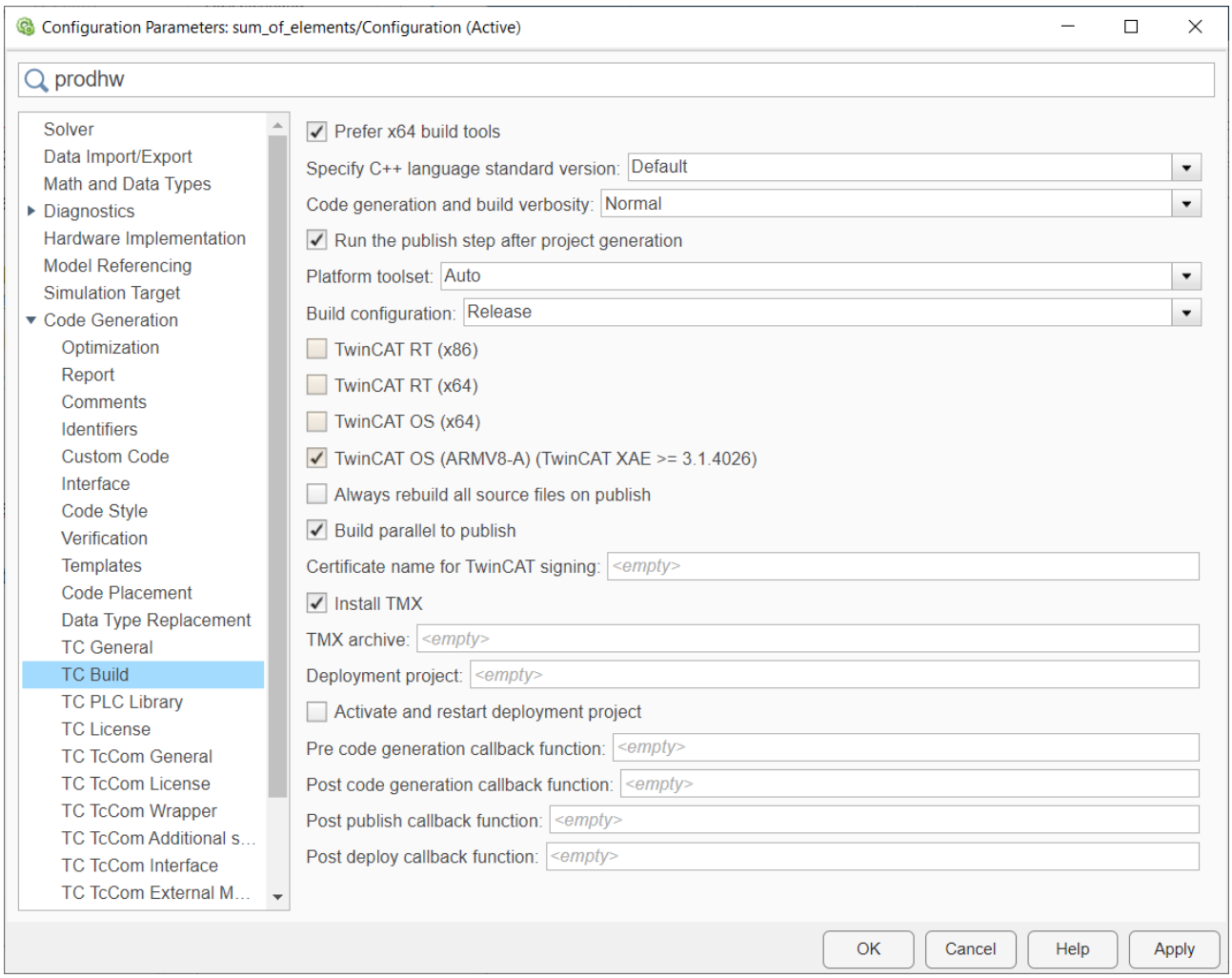
1. Set the Device vendor and Device type to Arm® Compatible and Arm® Cortex®-A (64-bit) to generate the code specific for Beckhoff Embedded PCs CX82xx and CX9240.



2. Select „Neon v7“ as hardware instruction set extensions and activate „Optimize reductions“.



3. Only select TwinCAT OS (Arm®V8-A) as the build platform.



⇨ You can use this configuration to compile the Simulink® model.

Ne10 Code Replacement Library

Currently not yet supported.

GenerateAllocFcn

If Reusable code and GenerateAllocFcn=off are recognized, the Single Instance Limitation is activated. GenerateAllocFcn is set to off by default.

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