BECKHOFF New Automation Technology

Manual | EN

TwinCAT 3

Product overview

2023-12-11 | Version: 1.13.1

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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.

Trademarks

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Patents

The EtherCAT Technology is covered, including but not limited to the following patent applications and patents:
EP1590927, EP1789857, EP1456722, EP2137893, DE102015105702
and similar applications and registrations in several other countries.

EtherCAT®

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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.

In addition, the recommendations from Beckhoff regarding appropriate protective measures should be observed. Further information regarding information security and industrial security can be found here.

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.

2 Philosophy

In order to master the complexity of modern machines and at the same time to reduce the necessary engineering expenditure, the trend moves to modular control software. Individual functions, assemblies or machine units are thereby regarded as modules. These modules should be as independent as possible and structured hierarchically. The structural format should be that the lowest modules are the easiest and reusable basic elements. With standardized interfaces the software modules from higher-ranked modules can be combined to more complex machine units, up to a complete machine. Ideally the individual modules can be put into operation, extended, scaled and reused independent from each other.

The innovative software architecture of TwinCAT 3 exactly allows this kind of programming. Due to this possibilities for the software application TwinCAT 3 is also called **eXtended Automation (XA)**. eXtended Automation is the combination of the latest IT-technologies and scientific software-tools with the automation technology. This philosophy has been implemented not only in the section of engineering, but also up into the runtime.

TwinCAT 3 is classified into **eXtended Automation Engineering (XAE)** and in **eXtended Automation Runtime (XAR)**.

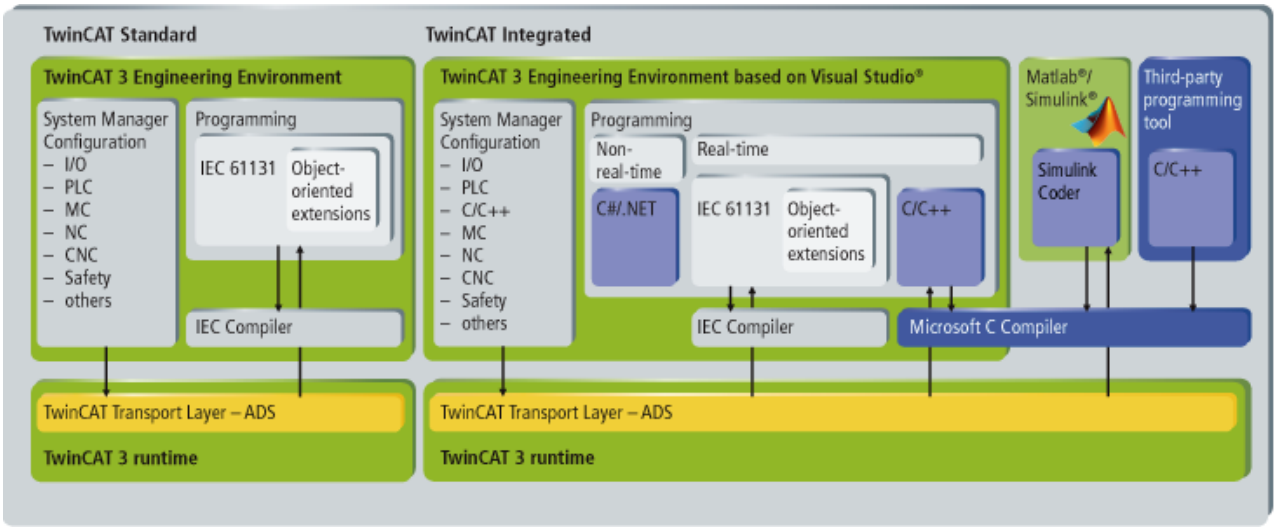
eXtended Automation Engineering XAE:

One of the main approaches of TwinCAT 3 is to simplify the software engineering. Instead of developing own standalone-tools it is obviously worthwhile to integrate into common and existing software development environments. For TwinCAT 3 this development environment is the Microsoft Visual Studio®.By integrating TwinCAT 3 as an extension into the Visual Studio®, we are providing the user an expandable and future-proof platform.

New definitions just as Solution or Solution Explorer find their way into the automation world. Even by inserting a TwinCAT Project into the Solution you will rapidly notice the known TwinCAT System Manager tree, whereby also TwinCAT 2 users can switch to TwinCAT 3 very easy. One of the main advantages is the integration of the TwinCAT 2 PLC Control into the TwinCAT System Manager. So the developer only needs one development tool for his application. This saves not only the switch between different development environments, but it also simplifies trainings, because now there is only one tool to be trained.

There are different possibilities how the integration into the Microsoft Visual Studio® can be done:

1. If the classic PLC programmer has not installed Microsoft Visual Studio® by now, the TwinCAT 3 Setup automatically will install the necessary Visual Studio® Shell. The TwinCAT 3 extensions are available after the installation. The known functionalities of TwinCAT 2 are covered and extended. The object-oriented extensions of the third edition are available for the PLC programming languages of the IEC 61131-3. Therewith it is also possible to inheritance PLC function blocks. In addition to PLC modules also modules for NC, CNC or Safety-applications can be created.
2. If there already is a version of Microsoft Visual Studio® on the Engineering-PC, but which is no full version, the TwinCAT 3 Extensions will be installed and integrate themselves into the existing Microsoft environment. The functional range is the same than under section 1.
3. If there is a full version of the Microsoft Visual Studios® on the Engineering PC, the TwinCAT 3 Extensions will be integrated into the existing Visual Studio®. Among the mentioned classic PLC functions, there are possibilities wherewith applications in C, C++ or MATLAB®/Simulink® can be programmed.
4. If there is TwinCAT 3 without a full version of Microsoft Visual Studios® on the Engineering PC, the classic PLC functionalities are available. If you later on install a full version of the Microsoft Visual Studio, the whole functional range including C, C++ and also MATLAB®/Simulink® is available.



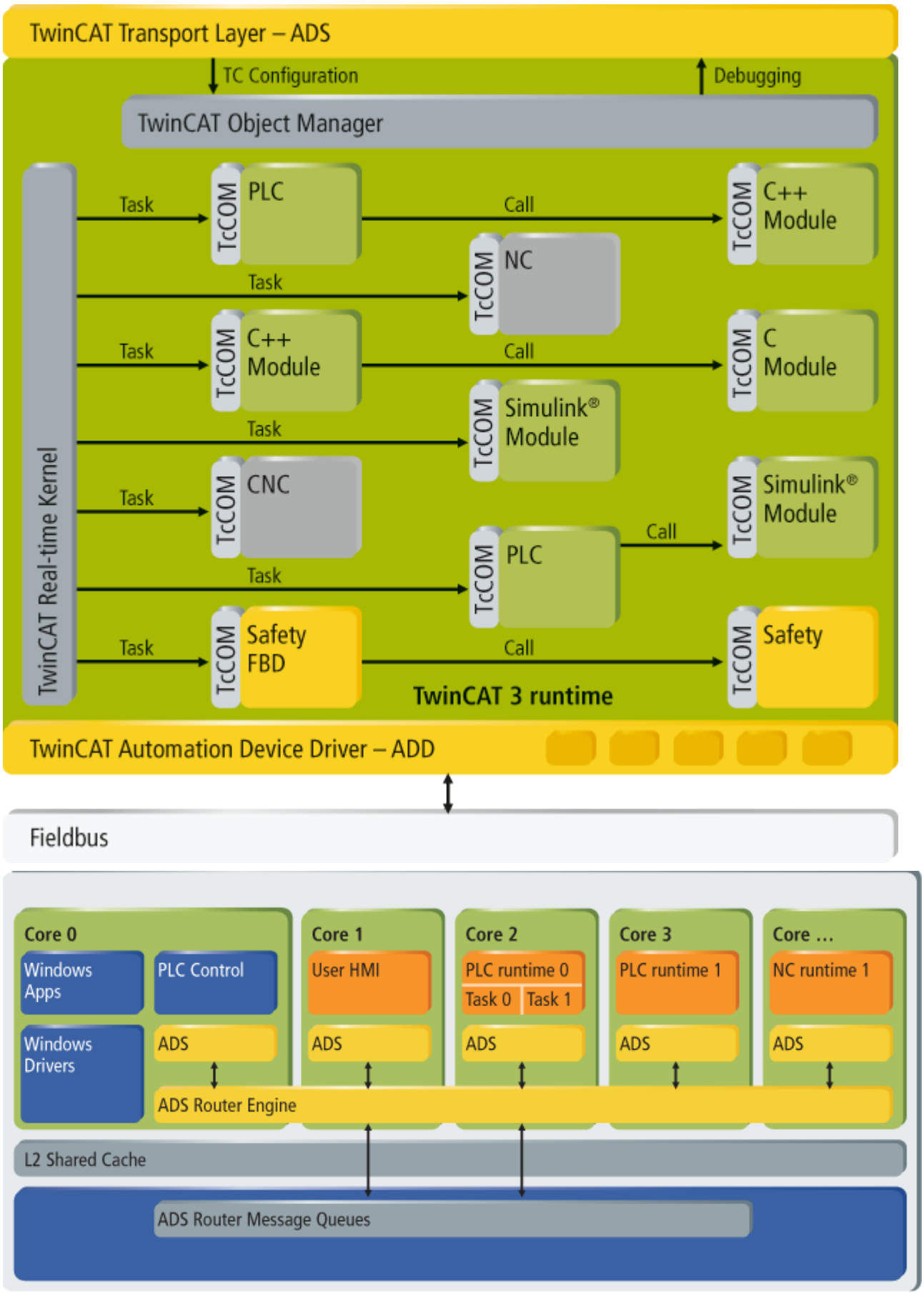
More details about the respective system requirements, the installation and the licensing can be found in the TwinCAT 3 product description.

eXtended Automation Runtime XAR:

The TwinCAT 3 Runtime offers a realtime environment where TwinCAT modules can be loaded, executed or administrated.The individual modules must not be created with the same Compiler and therewith can be programmed independent and by different manufacturers or developers. Furthermore it is not important if the modules are PLC, NC, CNC or from C-Code generated modules.

The generated modules are called cyclic from the Tasks. Several Tasks can run on one control PC. Because the different modules(SPS, C/C++, MATLAB®) can call themselves in the TwinCAT 3 Runtime, there are much more possibilities for the software architecture of the application. So it is possible to combine several modules, which have there own functionalities, to one complete machine application. The amount of modules, which are called from the task are unlimited. If the code-execution will take too long, the user will get cyclic exceedings. With TwinCAT 3 the amount of tasks is theoretically limited on 65000. But in the end it depends on the system resources of the runtime device.

A further highlight of TwinCAT 3 is the support of Multicore CPU's. Individual TwinCAT Tasks can be allocated on different cores of a CPU. So the performance of the newest multicore Industrial- and Embedded PCs can be used at its best.


TwinCAT Transport Layer – ADS
TC Configuration
Debugging
TwinCAT Object Manager
TwinCAT Real-time Kernel
Task
Call
TcCOM
PLC
C++ Module
NC
C Module
Simulink® Module
CNC
Safety FBD
Safety
TwinCAT 3 runtime
TwinCAT Automation Device Driver – ADD
Fieldbus
Core 0
Windows Apps
PLC Control
Windows Drivers
ADS
Core 1
User HMI
Core 2
PLC runtime 0
Task 0
Task 1
Core 3
PLC runtime 1
Core ...
NC runtime 1
ADS Router Engine
L2 Shared Cache
ADS Router Message Queues

3 Overview

This chapter explains the TwinCAT 3 naming concept and the classification of TwinCAT 3 products into different categories:

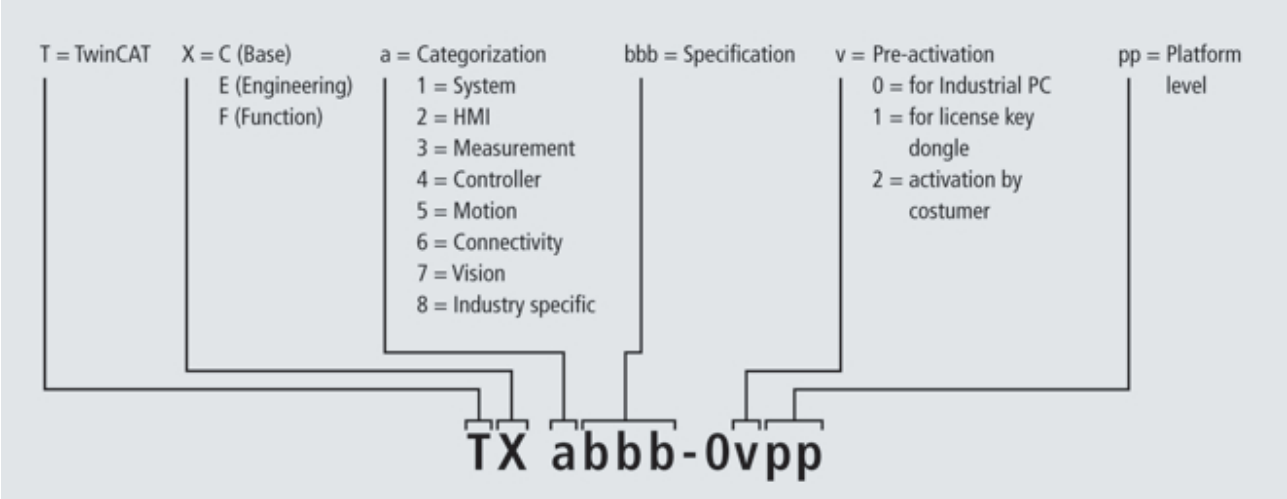
- Naming concept [▶ 11]: explains how to interpret the new TwinCAT 3 product names
- Product classes for TwinCAT 3 Functions [▶ 12]: information about the different categories for TwinCAT 3 Functions
- Platforms [▶ 12]: TwinCAT 3 products are purchased and licensed according to the underlying hardware, this chapter explains the different hardware categories

3.1 Naming concept

TwinCAT 3 products are divided into three different groups:

- **TE xxxx-xxxx:** TwinCAT 3 XAE (Engineering)
- **TC xxxx-xxxx:** TwinCAT 3 XAR (Runtime)
- **TF xxxx-xxxx:** TwinCAT 3 Functions (for TwinCAT 2 "Supplement" products)

The abbreviations represent the basic TwinCAT 3 naming concept and are thus also important as a reference if you later want to activate or order a TwinCAT 3 license. The general scheme of the TwinCAT 3 naming concept is as follows:



The abbreviations "TX abbb" are a description and identification of the actual product, whereas the abbreviations "00pp" describe the product according to your order. The following table explains the abbreviations in more detail:

Abbreviation	Description
T	TwinCAT
X	Describes the **TwinCAT 3 Basis System,** to which the product belongs. Possible entries are: E=Engineering, C=Runtime, F=Function
a	Describes the **product class**. If the product belongs to the "Runtime" or "Engineering" base system, it is always "1". If the product is a TwinCAT 3 Function, you can find more information here [▶ 12].
bbb	Number which **uniquely identifies a product** in the corresponding product class.
v	Describes the device ordered by a customer. There is already a license on this device, which was installed and activated during production.
00	**Reserved** for later use, at the moment filled out with "00".

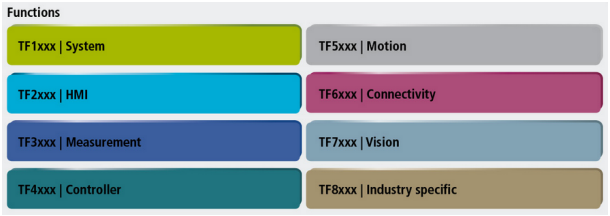
pp	Describes the **hardware platform**, on the basis of which the product was licensed. More information about the different hardware platforms can be found here [▶ 12].
bbbb	**Optional:** the **Build number** describes the version number of a product in detail.

For better understanding, the following table shows some examples:

Product Identifier	Description
TC1000-0010	TwinCAT 3 ADS, belonging to the basic system "Runtime" with product class "1". Has been licensed by the customer for hardware category 10.
TC1000-0020	TwinCAT 3 ADS, belonging to the basic system "Runtime" with product class "1". Has been licensed by the customer for hardware category 20.
TE1000-0030	TwinCAT 3 Engineering, belonging to the basic system "Engineering" with product class "1". Has been licensed by the customer for hardware category 30.
TF6100-0070	TwinCAT 3 OPC UA, belonging to the basic system "Function" with product class "6". Has been licensed by the customer for hardware category 70.
TF6310-0020	TwinCAT 3 TCP/IP, belonging to the basic system "Function" with product class "6". Has been licensed by the customer for hardware category 20.
...	...

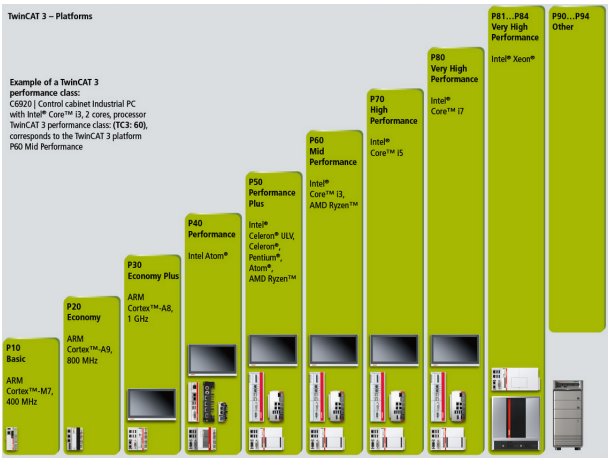
3.2 Product classes for TC3 Functions

TwinCAT 3 Functions have been grouped into several categories, which represent a so-called "Product Class" in the TC3 naming convention. The available categories are:



3.3 Hardware categories

Every TwinCAT 3 product is bought and licensed according to the underlying hardware. The hardware depends on the operating system and CPU and is identified by a category ID. The following images shows all hardware categories and their corresponding Beckhoff hardware products:



4 System requirements

TwinCAT 3 Engineering (XAE) and TwinCAT 3 Runtime (XAR) have different system requirements. If you install XAE and XAR on one computer, the requirements for both components must be met.

TwinCAT 3 eXtended Automation Engineering (XAE)

TwinCAT 3 XAE is an extension for Visual Studio, so that the requirements of Visual Studio must essentially be met.

System requirements for the Visual Studio 2017 Shell ("TcXaeShell") or Visual Studio 2022 Shell ("TcXaeShell64") supplied:

Operating systems	• Windows 10 • Windows 11
Hardware	• Processor speed 1.8 GHz or faster; dual-core or better is recommended • Main memory: at least 4 GB RAM (with TcXaeShell64: 16GB RAM recommended) • Hard disk space: 10 GB of available memory if Visual Studio is not yet installed. • Hard disk speed: the use of a solid-state drive (SSD) is recommended. • Graphics card: the minimum supported resolution should be 720p (1208 x 720). Recommended: support for FullHD resolution (1920 x 1080) or higher.

TwinCAT 3 eXtended Automation Runtime (XAR)

System requirements for TwinCAT 3 XAR depending on the program to be executed:

Operating systems	• Windows Embedded Standard 7 (WES7): supported up to TwinCAT 3.1 Build 4024 • Windows 10 • Windows 10 LTSB, LTSC
Beckhoff Embedded PC with TwinCAT 3 image	• Windows Embedded Compact 7 (WEC7): supported up to TwinCAT 3.1 Build 4024 • TwinCAT/BSD
Hardware	• Hard disk space: at least 2 GB • Main memory depends on the activated configuration

Hyper-V environment:

- The runtime environment cannot be started within a Hyper-V environment. This refers in particular to Hyper-V virtual machines running in a privileged Hyper-V machine. As soon as a component of the computer uses Hyper-V, only the engineering environment (XAE) can be used on this computer, but not the runtime environment (XAR). In addition to software solutions for virtual machines, Hyper-V can also be used by operating system tools (Device Guard, Credential Guard, Virtualization-based Security,...) or other Hyper-V programs.
- TwinCAT tries to detect these Hyper-V environments; however, due to the nature of virtualization approaches, they try and avoid detection, so that TwinCAT is unable to guarantee 100% detection.

VT-x CPU function:

- For 64-bit operating systems, the VT-x CPU function is mandatory (must be activated and available in the BIOS).

Real-time behavior:

- For optimal, reliable and high-performance real-time behavior, a complete system (hardware, BIOS, operating system, driver software, real-time control software) is absolutely essential. Each individual component of the control system must be checked and optimized for this application in order to achieve optimal, reliable and high-performance real-time behavior. Beckhoff Industrial PCs are optimized in detail for this purpose. When using the TwinCAT 3 Runtime (XAR) on PCs from third-party providers, flawless real-time behavior cannot be guaranteed.

Component-specific system requirements:

- Further system requirements can be found in the respective product descriptions of the TwinCAT components.

4.1 Supported network controllers

The TwinCAT RT driver is required for a network port if real-time protocols such as EtherCAT are used.

It enables the TwinCAT real-time to access the network chip.

The driver can be installed using the tool "TcRteInstall.exe", which is provided in *C:\TwinCAT\3.1\System*.

On the following page you will find a list of the supported Intel chips. The driver recognizes the chips by the vendor and device ID.

Support for a network card does not mean that the system is real-time capable. Beckhoff ensures this for its own IPCs and EPCs through a variety of measures. However, this cannot be guaranteed for other devices that use the same network controller.

NOTICE

Observe Beckhoff compatibility

The NICs installed in Beckhoff controllers are specially selected and qualified for RT use; no properties can be assured on third-party devices.
In case of doubt the original Intel driver must be used, which does not allow operation with the TwinCAT runtime with real-time protocols.

Last updated: TwinCAT 3.1 4024.35

Tcl2xx.INF

Vendor ID	Device ID	Description
0x8086 (Intel)	0x1521	Intel I350
	0x1533	Intel I210
	0x1534	Intel I210
	0x1535	Intel I210
	0x1536	Intel I210
	0x1537	Intel I210
	0x1538	Intel I210
	0x157B	Intel I210
	0x157C	Intel I210
	0x1539	Intel I211
	0x1F40	Intel I354
	0x1F41	Intel I354
	0x1F45	Intel I354
	0x156F	Intel I219 LM
	0x1570	Intel I219 V
	0x15B7	Intel I219 LM2
	0x15B8	Intel I219 V2
	0x15B9	Intel I219 LM3
	0x15D7	Intel I219 LM4
	0x15D8	Intel I219 V4
	0x15E3	Intel I219 LM5
	0x15D6	Intel I219 V5
	0x15BD	Intel I219 LM6
	0x15BE	Intel I219 V6
	0x15BB	Intel I219 LM7
	0x15BC	Intel I219 V7

Vendor ID	Device ID	Description
	0x15DF	Intel I219 LM8
	0x15E0	Intel I219 V8
	0x15E1	Intel I219 LM9
	0x15E2	Intel I219 V9
	0x0D4E	Intel I219 LM10
	0x0D4F	Intel I219 V10
	0x0D4C	Intel I219 LM11
	0x0D4D	Intel I219 V11
	0x0D53	Intel I219 LM12
	0x0D55	Intel I219 V12
	0x15F2	Intel I225 LM
	0x15F3	Intel I225 V
	0x3100	Intel I225 K
	0x15F7	Intel I220 V
	0x15F8	Intel I225 I
	0x15FD	Intel I225 blank/nvm

Tcl8254x.inf

Vendor ID	Device ID	Description
0x8086 (Intel)	0x1000	Intel 82542
	0x1001	Intel 82543GC
	0x1004	Intel 82543GC
	0x1008	Intel 82544EI
	0x1009	Intel 82544EI
	0x100C	Intel 82543EI
	0x100D	Intel 82544GC
	0x100E	Intel 82540EM
	0x100F	Intel 82545EM
	0x1010	Intel 82546EB
	0x1011	Intel 82545EM
	0x1012	Intel 82546EB
	0x1013	Intel 82541EI
	0x1014	Intel 82541ER
	0x1015	Intel 82540EM
	0x1016	Intel 82540EP
	0x1017	Intel 82540EP
	0x1018	Intel 82541EI
	0x1019	Intel 82547EI
	0x101A	Intel 82547EI
	0x101D	Intel 82546EB
	0x101E	Intel 82540EP
	0x1026	Intel 82545GM
	0x1027	Intel 82545GM
	0x1028	Intel 82545GM
	0x1049	Intel 82566MM - ICH8
	0x104A	Intel 82566DM - ICH8
	0x104B	Intel 82566DC - ICH8
	0x104C	Intel 82562V - ICH8

Vendor ID	Device ID	Description
	0x104D	Intel 82566MC - ICH8
	0x105E	Intel 82571EB
	0x105F	Intel 82571EB
	0x1060	Intel 82571EB
	0x1075	Intel 82547EI
	0x1076	Intel 82541GI
	0x1077	Intel 82547EI
	0x1078	Intel 82541ER
	0x1079	Intel 82546EB
	0x107A	Intel 82546EB
	0x107B	Intel 82546EB
	0x107C	Intel 82541PI
	0x107D	Intel 82572EI
	0x107E	Intel 82572EI
	0x107F	Intel 82572EI
	0x108A	Intel 82546GB
	0x108B	Intel 82573E
	0x108C	Intel 82573E
	0x1096	Intel 80003ES2LAN
	0x1098	Intel 80003ES2LAN
	0x1099	Intel 82546GB
	0x109A	Intel 82573L
	0x10A4	Intel 82571EB
	0x10A7	Intel 82575
	0x10A9	Intel 82575 (serdes)
	0x10B5	Intel 82546GB
	0x10B9	Intel 82572EI
	0x10BA	Intel 80003ES2LAN
	0x10BB	Intel 80003ES2LAN
	0x10BC	Intel 82571EB
	0x10BD	Intel 82566DM - ICH9
	0x10C4	Intel 82562GT - ICH8
	0x10C5	Intel 82562G - ICH8
	0x10C9	Intel 82576
	0x10D3	Intel 82574L
	0x10A9	Intel 82575 (quad copper)
	0x10CB	Intel 82567V - ICH9
	0x10E5	Intel 82567LM-4 - ICH9
	0x10EA	Intel 82577LM
	0x10EB	Intel 82577LC
	0x10EF	Intel 82578DM
	0x10F0	Intel 82578DC
	0x10F5	Intel 82567LM - ICH9(e.g. Dell E6400 Notebook)
	0x1502	Intel 82579LM
	0x1503	Intel 82579V
	0x150A	Intel 82576NS
	0x150E	Intel 82580
	0x1521	Intel I350

Vendor ID	Device ID	Description
	0x1533	Intel I210
	0x157B	Intel I210
	0x153A	Intel I217 LM
	0x153B	Intel I217 VA
	0x1559	Intel I218 V
	0x155A	Intel I218 LM
	0x15A0	Intel I218 LM2
	0x15A1	Intel I218 V
	0x15A2	Intel I218 LM3
	0x15A3	Intel I218 V3

Tcl8255x.inf

Vendor ID	Device ID	Description
0x8086 (Intel)	0x1029	Intel 82559
	0x1030	Intel 82559
	0x1031	82801CAM (PRO/100 VE Network Connection)
	0x1032	82801CAM (PRO/100 VE Network Connection)
	0x1033	82801CAM (PRO/100 VM Network Connection)
	0x1034	82801CAM (PRO/100 VM Network Connection)
	0x1038	Intel PRO/100 VM/KM Network Connection
	0x1039	Intel 82801CAM (PRO/100 VM Network Connection) ICH2
	0x103A	Intel 82801DB (LAN Controller with 82562ET/EZ (CNR) PHY) ICH4
	0x103B	Intel 82801DB (LAN Controller with 82562EM/EX PHY)
	0x103C	Intel 82801DB (LAN Controller with 82562EM/EX (CNR) PHY)
	0x103D	Intel 82801DB (PRO/100 VE Network Connection)
	0x103E	Intel 82801DB (PRO/100 VM Network Connection)
	0x1050	Intel 82801EB/ER (PRO/100 VE Network Connection) ICH5
	0x1051	Intel 82801EB/ER (PRO/100 VE Network Connection)
	0x1052	Intel 82801EB/ER (PRO/100 VM Network Connection)
	0x1053	Intel 82801EB/ER (PRO/100 VM Network Connection)
	0x1054	Intel 82801EB/ER (PRO/100 VE Network Connection (mobile))
	0x1055	Intel 82801EB/ER (PRO/100 VM Network Connection (mobile))
	0x1056	Intel 82801EB/ER (PRO/100 VM Network Connection (mobile))
	0x1057	Intel 82801EB/ER (PRO/100 VM Network Connection (mobile))
	0x1059	Intel 82551QM PRO/100 M
	0x1064	Intel 82801EB/ER (PRO/100 VE Network Connection) ICH6
	0x1065	Intel 82801FB/FR/FW/FRW
	0x1067	Intel(R) PRO/100 VE Network Connection

Vendor ID	Device ID	Description
	0x1068	Intel(R) PRO/100 VE Network Connection
	0x1069	Intel(R) PRO/100 VE Network Connection
	0x106A	Intel(R) PRO/100 VE Network Connection
	0x106B	Intel(R) PRO/100 VE Network Connection
	0x1092	
	0x1094	
	0x1209	Intel 82551ER/IT
	0x1229	Intel 82557/8/9/0/1 (EtherExpress PRO/100(B) Adapter)
	0x2449	82801CAM i815 Boser (ICH2)
	0x2459	Intel(R) PRO/100 VE Network Connection
	0x245D	Intel(R) PRO/100 VE Network Connection
	0x27DC	Intel(R) PRO/100 VE Network Connection

TcIXgbe.INF

Vendor ID	Device ID	Description
0x8086 (Intel)	0x1528	Intel X540-AT2 (X540-T1/X540-T2)
	0x1515	Intel X540_VF
	0x1530	Intel X540_VF_HV
	0x155C	Intel X540_VF_BYPASS
	0x1560	Intel X540T1
	0x1563	Intel X550T
	0x15D1	Intel X550T1
	0x15C2	Intel X550EM_A_KR
	0x15C3	Intel X550EM_A_KR_L
	0x15C4	Intel X550EM_A_SFP_N
	0x15C6	Intel X550EM_A_SGMII
	0x15C7	Intel X550EM_A_SGMII_L
	0x15C8	Intel X550EM_A_10G_T
	0x15CA	Intel X550EM_A_QSFP
	0x15CC	Intel X550EM_A_QSFP_N
	0x15CE	Intel X550EM_A_SFP
	0x15E4	Intel X550EM_A_10G_T
	0x15E5	Intel X550EM_A_1G_T
	0x15AA	Intel X550EM_X_KX4
	0x15AB	Intel X550EM_X_KR
	0x15AC	Intel X550EM_X_SFP
	0x15AD	Intel X550EM_X_10_G_T
	0x15AE	Intel X550EM_X_1_G_T
	0x15B0	Intel X550EM_X_XFI
	0x1564	Intel X550_VF_HV
	0x1565	Intel X550_VF
	0x15C5	Intel X550EM_A_VF
	0x15B4	Intel X550EM_A_VF_HF
	0x15A8	Intel X550EM_X_VF
	0x15A9	Intel X550EM_X_VF_HV

4.2 Compatibility of anti-virus programs (with the real-time execution of TwinCAT)

Beckhoff recommends that you give careful consideration to the use of anti-virus programs.

Anti-virus programs can be useful in helping the user to discover and remove malware that has infected the computer through the careless opening of mail attachments or via compromised downloads from the internet and is being run. However, such threat scenarios are unlikely with many purposes of use of controllers. If malware does infect a controller via a security hole, e.g. in the operating system, an anti-virus program no longer offers reliable protection. The malware can recognize the popular anti-virus programs and it potentially runs with the same rights as the anti-virus program, which it can then simply deactivate.

Anti-virus programs and operating systems must be updated regularly in order to be effective. These updates may be subject to validations for the release of the controller and the software components installed in it for productive use, making it impossible for Beckhoff to make a reliable statement about the compatibility with the TwinCAT automation software.

NOTICE

Incompatibility with Kaspersky Anti-Virus SDK

The anti-virus software Kaspersky Anti-Virus is incompatible with the TwinCAT Runtime XAR. Products developed on the basis of the Kaspersky Anti-Virus SDK are also incompatible with the TwinCAT Runtime XAR.

If you use Kaspersky Anti-Virus or products based on the Kaspersky Anti-Virus SDK, you can continue to use the TwinCAT Engineering XAE as normal, but the local RUN mode may react by crashing or freezing.

Windows Defender and other anti-virus programs

Windows Defender is an anti-virus component that comes with Windows 10 and is regarded as being as good as third-party products.

During regular tests of Windows Security Updates and Windows Defender within the scope of system and real-time examinations of TwinCAT and Beckhoff IPCs, Beckhoff has so far found no real-time violations of TwinCAT over a long period of time. This empirical value is taken as an indication of a compatible coexistence of Windows Defender and TwinCAT; however, no assurance for future updates can be derived from this. This experience has been gained in tests with active Windows Defender with the function extension "Real-time Protection" disabled at the same time. Due to its mode of operation, this function extension is a probable source of real-time violations of TwinCAT, because it monitors and examines process sequences and their data by accessing the Windows system.

Third-party anti-virus programs interact in different ways with the Windows system following installation and activation. Due to the complexity and the expenditure involved in examining this third-party software, Beckhoff does not regard itself as being able to make qualified statements about the influence of such software on the real-time execution of TwinCAT.

Beckhoff recommendation on the use of Windows Defender and other anti-virus programs

Beckhoff recommends preventing the exposure of controllers to direct points of entry of malware into the system as far as possible by selecting a holistic approach and not relying on the use of anti-virus software alone.

For use in Beckhoff products, Beckhoff offers its customers regular image updates for Beckhoff Industrial PCs containing validated security updates for use with TwinCAT.

Disclaimer

Beckhoff makes no warranties, expressed or implied, for real-time performance of it’s automation software TwinCAT for execution and real-time condition compliance in all cycles after installation or update of other software, including but not limited to anti-virus software, OS kernel mode drivers, security patches, and other software.

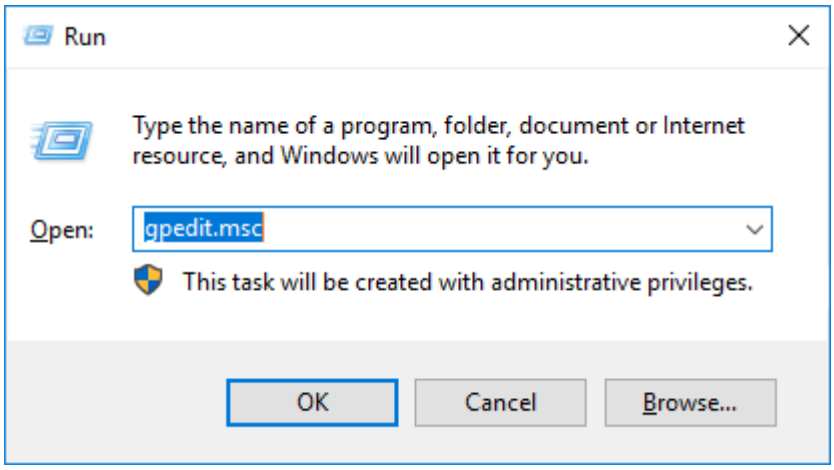
TwinCAT offers tools to validate real-time execution, and generally, the use of any software after installation on a control computer requires thorough review of system integrity as customary and state of the art in automation technology use cases.

4.2.1 Configuring and activating Windows Defender

Since Beckhoff cannot give any predictive assurances regarding the behavior of Windows Defender following future updates and since many controllers are unable to regularly procure the updates required for effective use, the component is deactivated by a group rule in the standard images from Beckhoff.

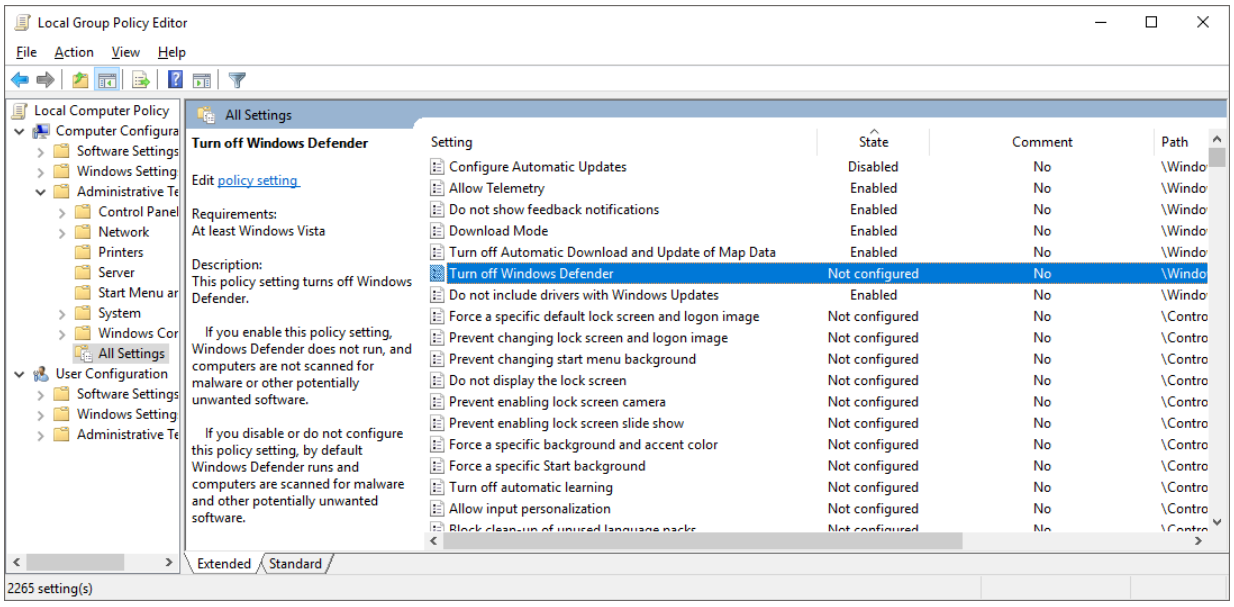
Activation of Windows Defender in Beckhoff standard systems with Windows 10

1. Open **Windows Run** with the shortcut **[Windows + R]** and enter "gpedit.msc". Confirm the dialog with **OK.**

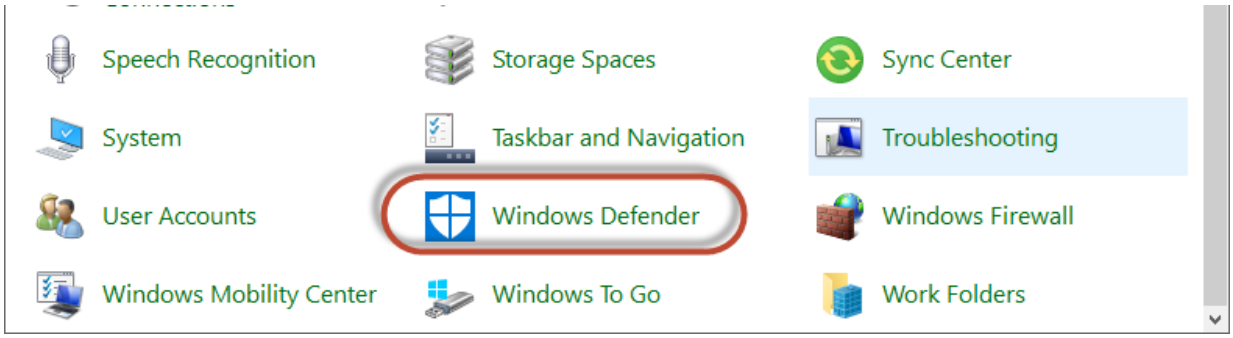


   ⇨ The group policy editor opens.

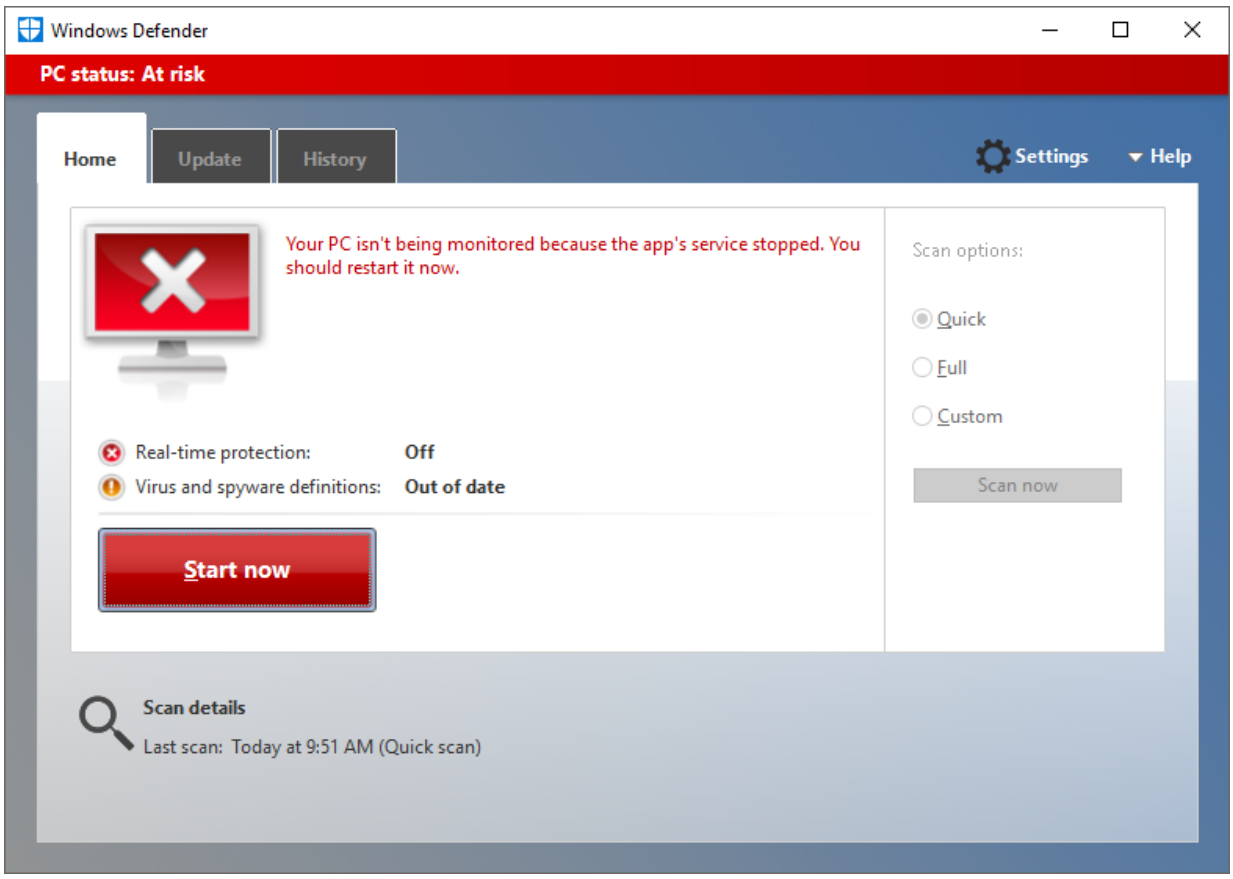
2. Adapt the entry "Turn off Windows Defender" accordingly.



3. Start Windows Defender in the Control Panels.



4. Activate Windows Defender with the **Start now** button.



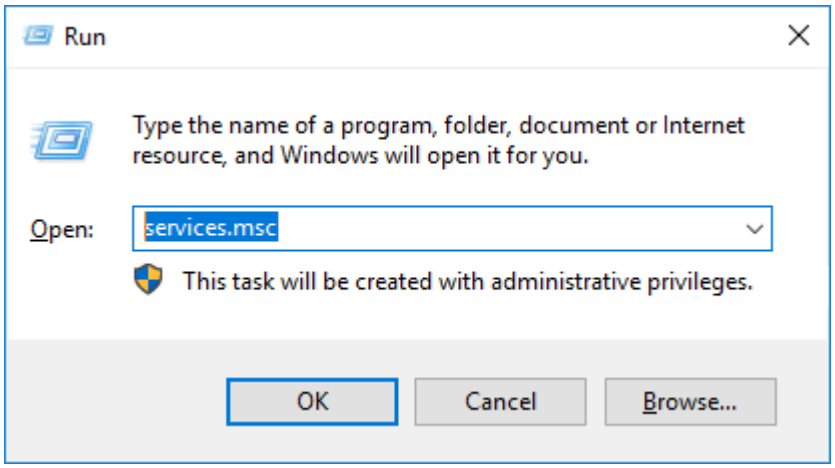
⇨ Windows Defender is activated.

4.2.2 Update Windows Defender and perform a scan

By default the Windows Update service is deactivated on Beckhoff standard systems with Windows 10. This is the only way to ensure that updates are not automatically installed and can thus negatively affect the controller.

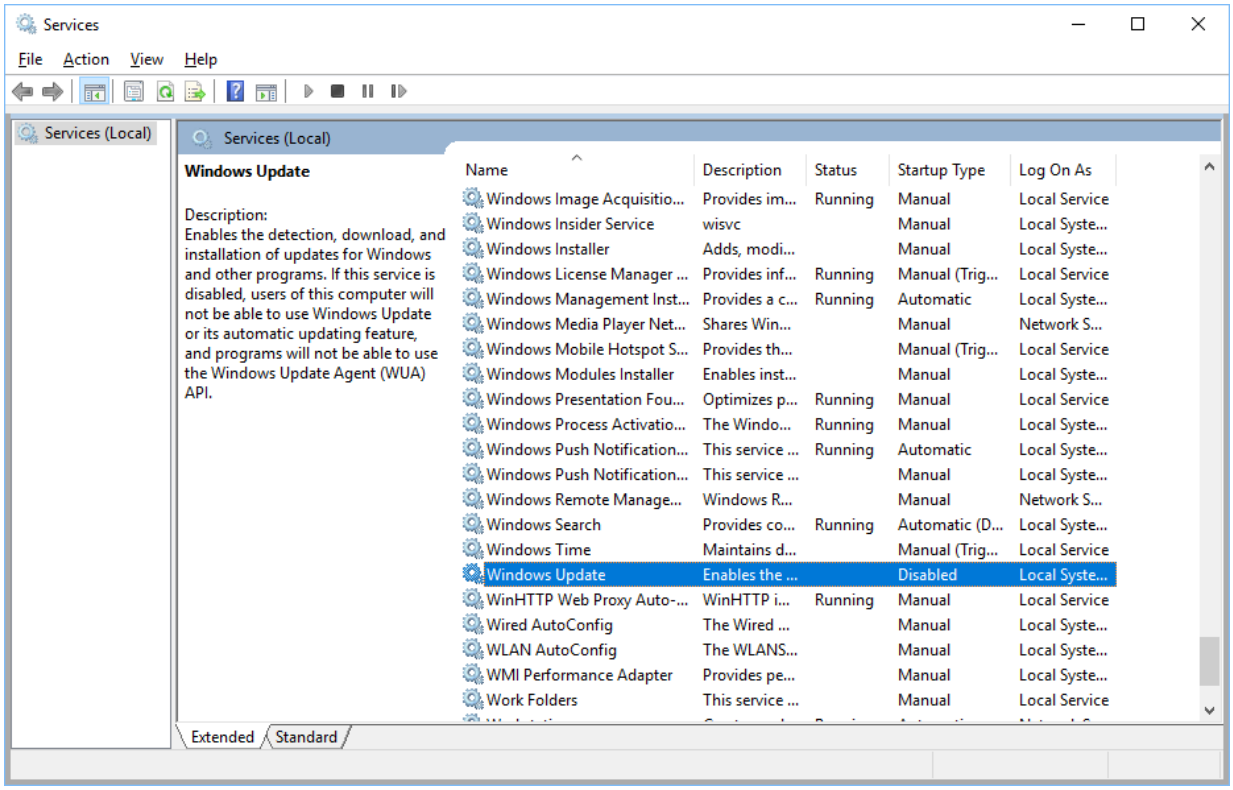
So that the Windows Defender definition files can be updated as shown here, the Windows Update service must be temporarily activated. As the update process itself runs differently depending on the update, it may be useful to set TwinCAT to CONFIG mode.

1. Open **Windows Run** with the shortcut **[Windows + R]** and enter "services.msc". Confirm the dialog with **OK**.

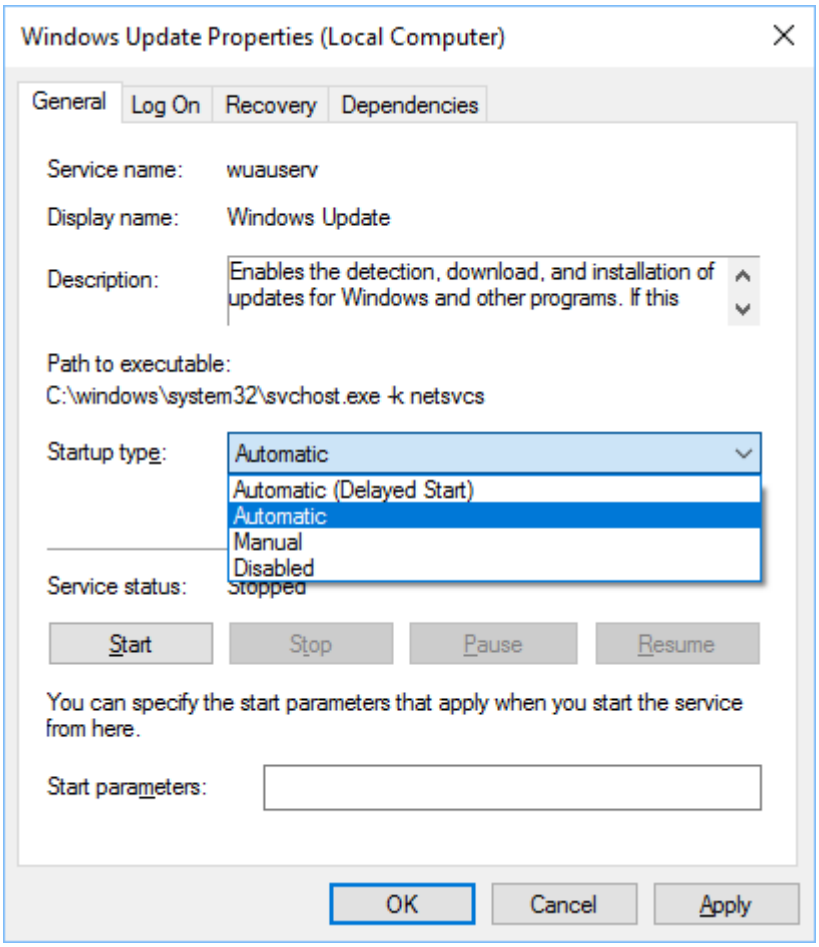


   ⇨ The **Services** dialog opens.

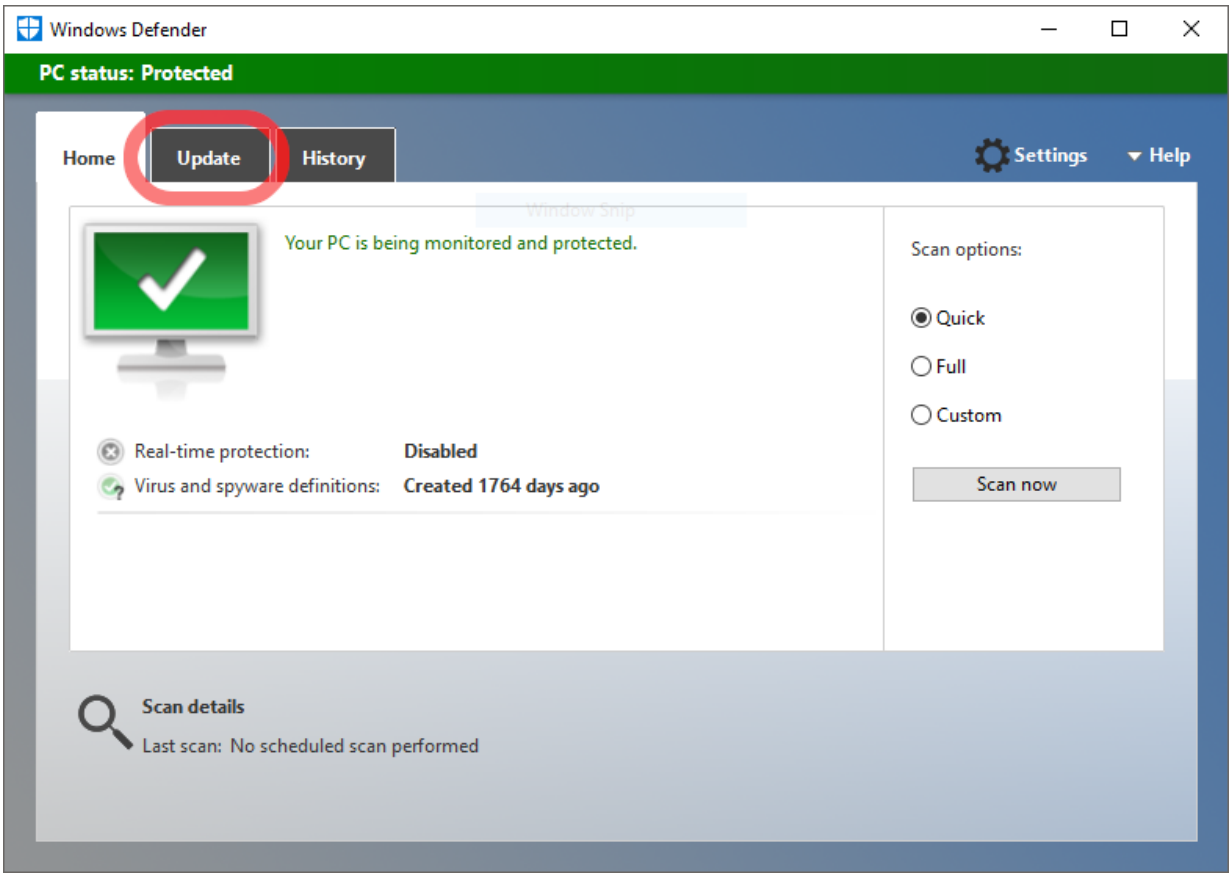
2. Double-click on the Windows Update service to open the associated settings.



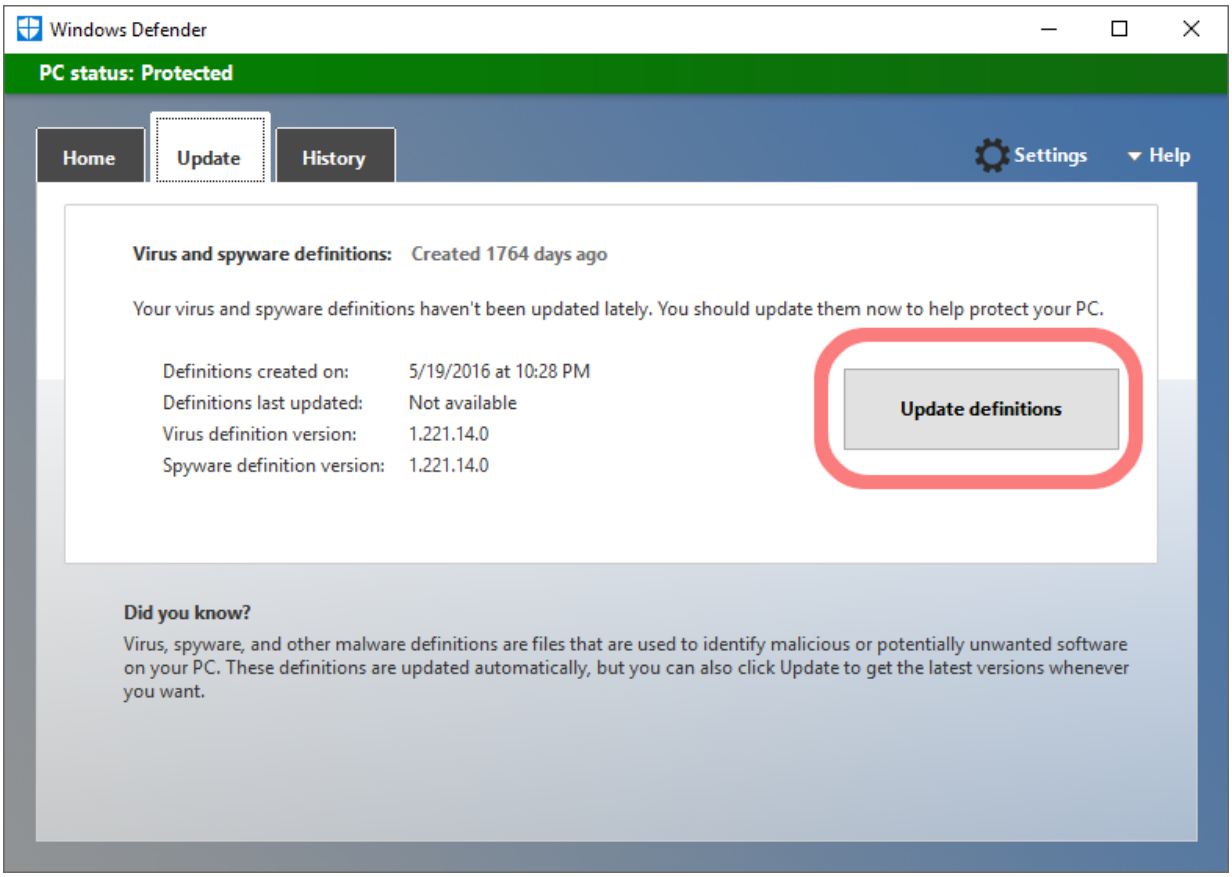
3. Set the Windows Update service to **Automatic** and confirm the dialog with **OK**.



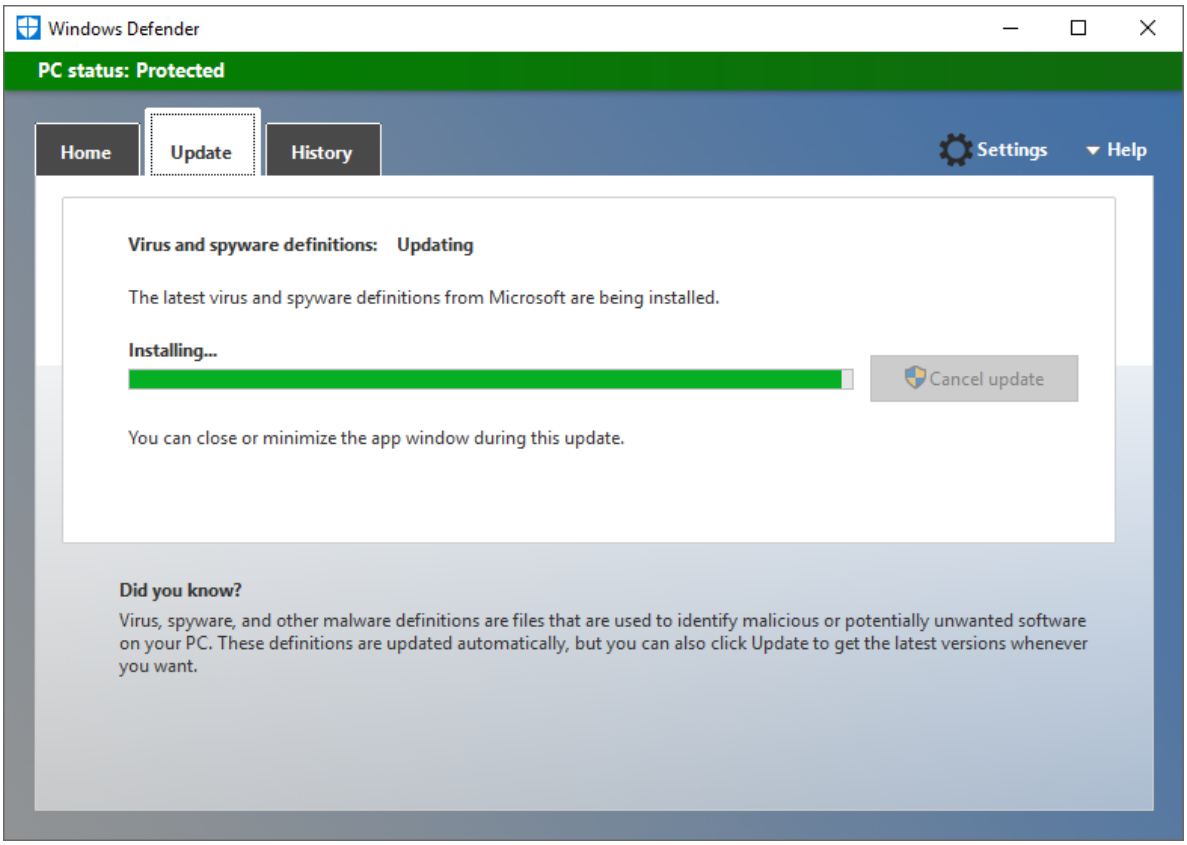
4. Open the **Update** tab in Windows Defender.



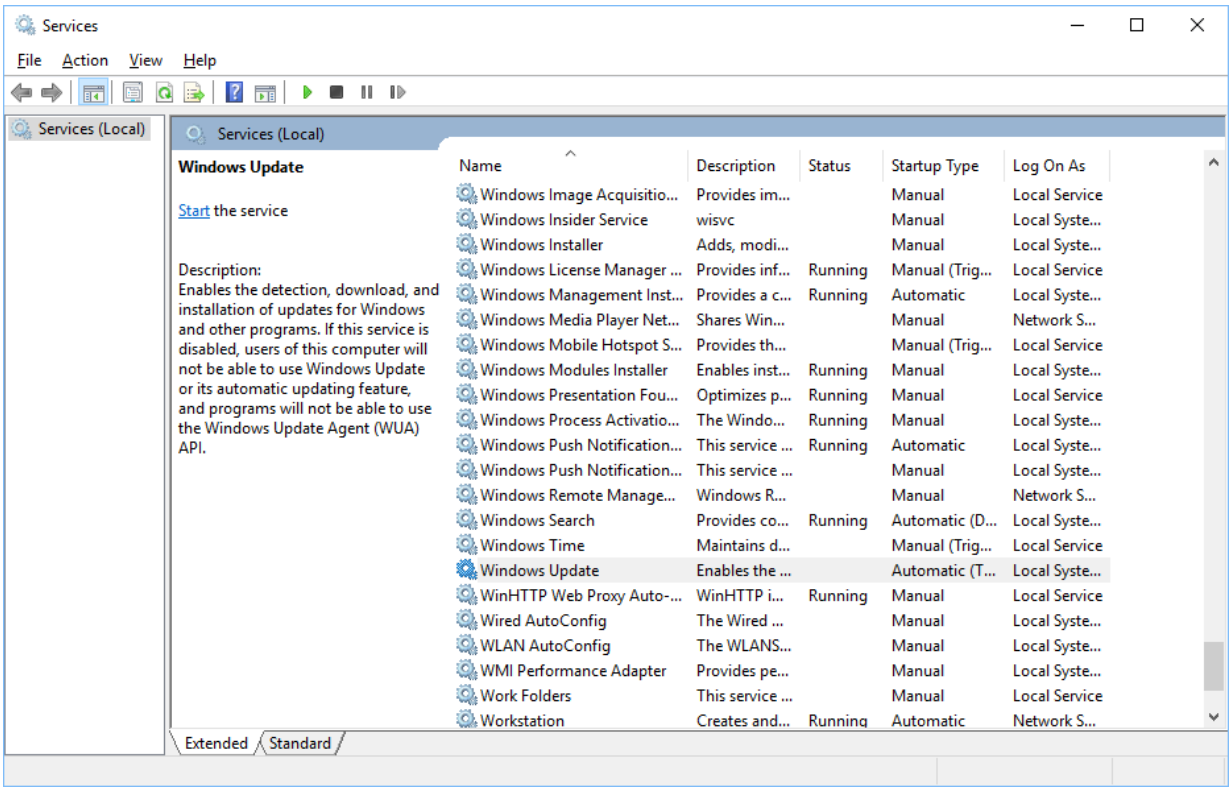
5. Update the Windows Defender definition files using the **Update definitions** button.



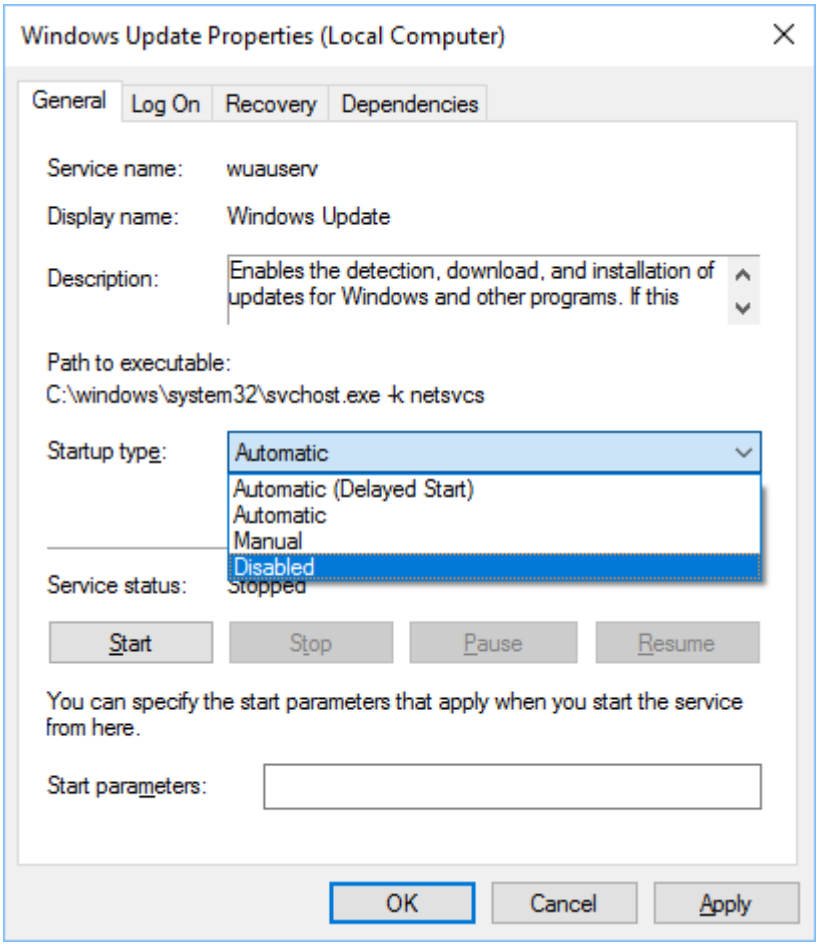
⇨ Windows Defender is updated.



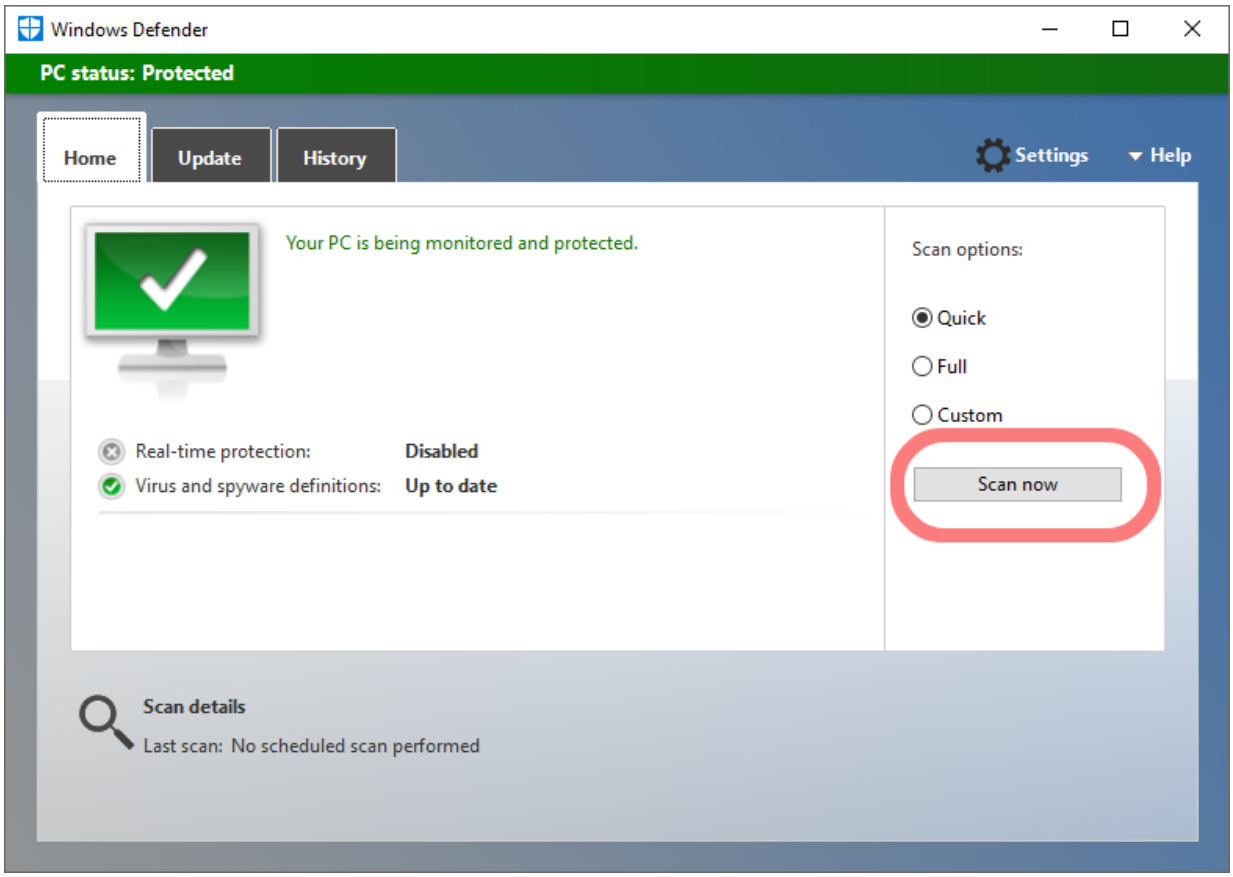
6. To deactivate the Windows Update service, double-click again on the Windows Update service to open the settings.



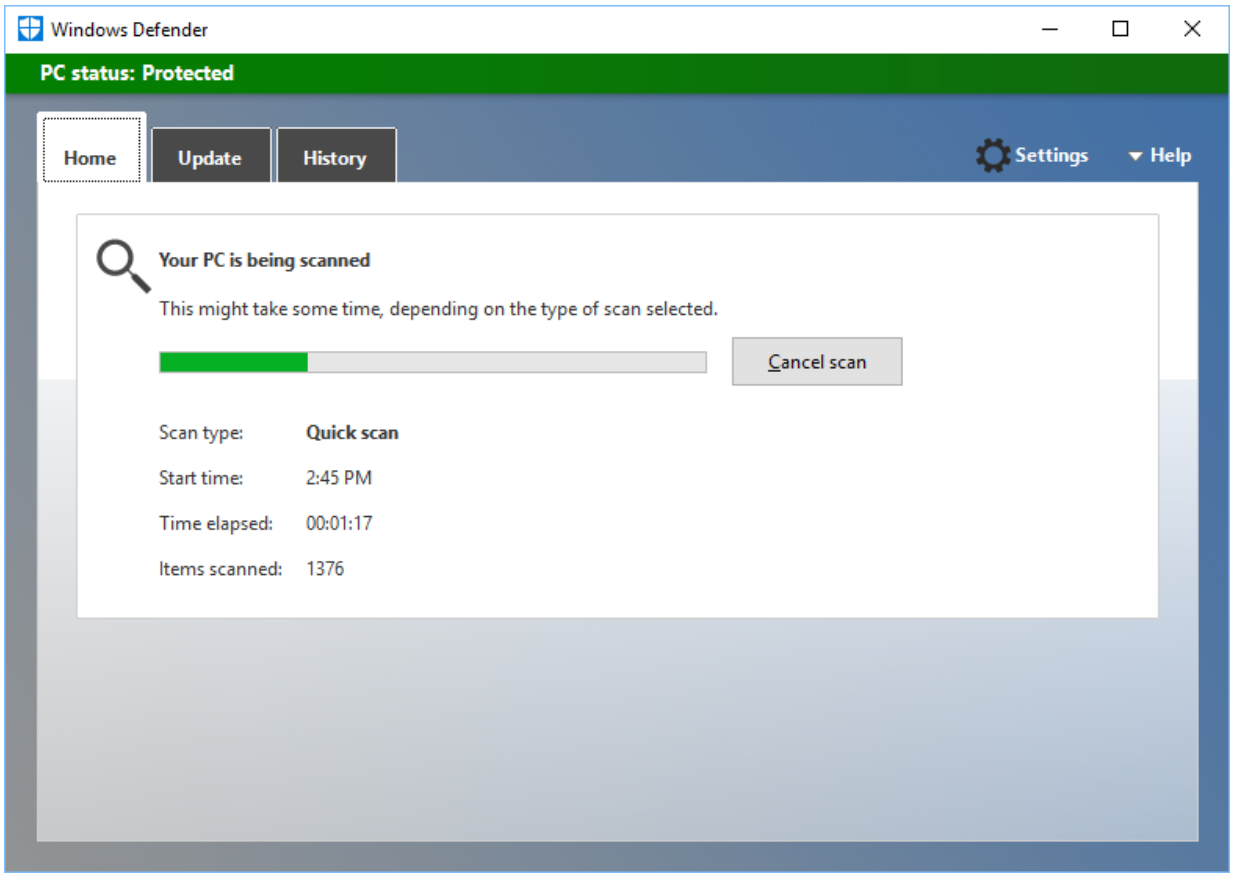
7. Set the Windows Update service to **Disabled** and confirm the dialog with **OK**.



8. Start the Windows Defender scan procedure with the **Scan now** button.



⇨ The computer is scanned.



Windows Defender with automated updates

If you decide, contrary to the recommendation given at the beginning, to use Windows Defender with automatic updates, familiarize yourself with the configuration in the MSDN.

This includes in particular the following properties:

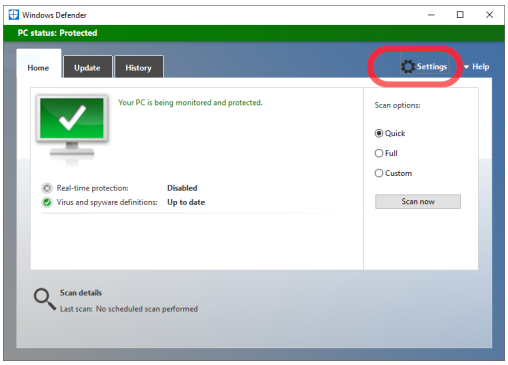
- Time / frequency of the procurement of updates
- Time / frequency of the system scan
- The version of the definition files that was acquired.

⇨ The last point in particular is relevant for the avoidance of negative effects on the operation of controllers. Because several new versions are sometimes published on the same day, there is no checking of where which version is in use in the case of direct acquisition. For controllers it is advantageous to check a certain version of the definition files first and then to install them in production. Microsoft describes different ways to do this: https://docs.microsoft.com/.... They allow the definition files to be downloaded first, tried out on a system and then distributed efficiently.

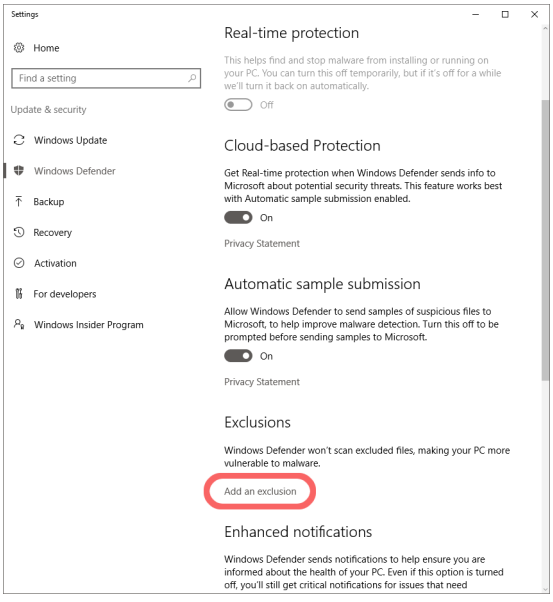
4.2.3 Determining monitoring exceptions

You can additionally stipulate whether file accesses made from the TwinCAT machine controller are excluded from monitoring by anti-virus programs in order to reduce corresponding false alarms of the anti-virus software:

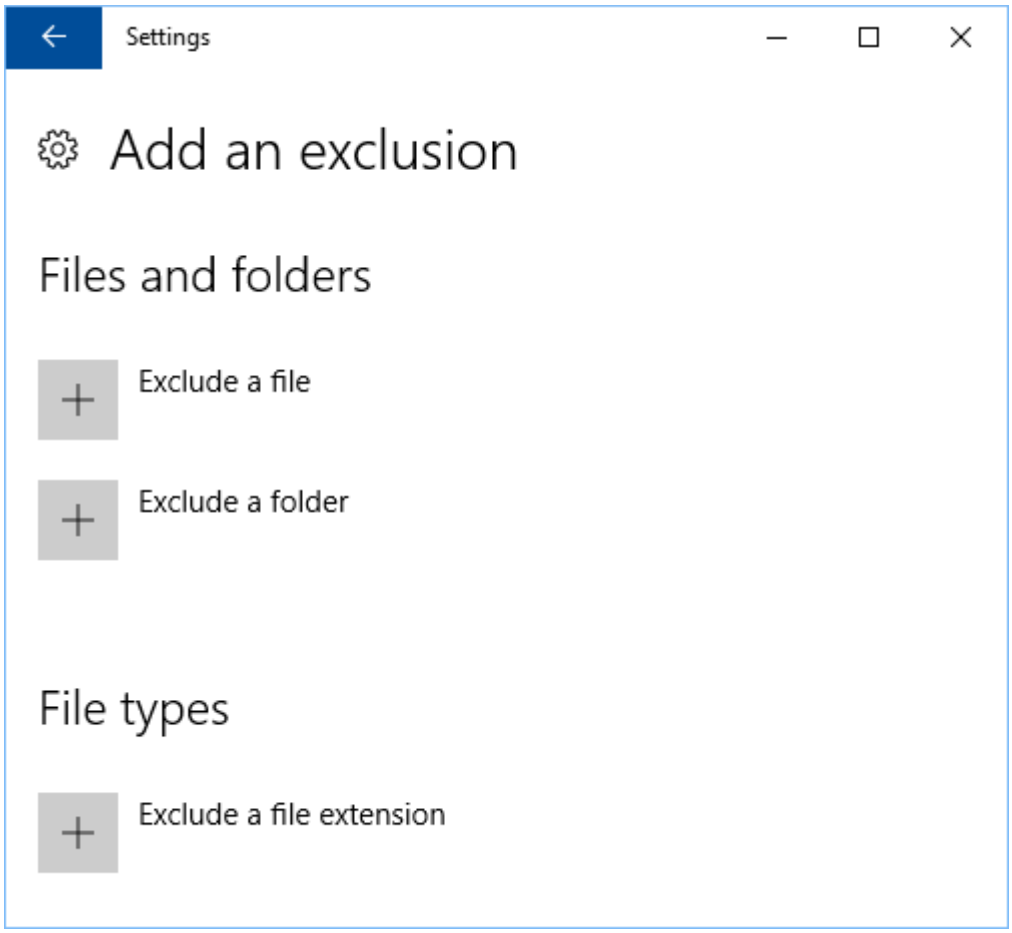
1. To adjust the Windows Defender settings, open them using the **Settings** button.



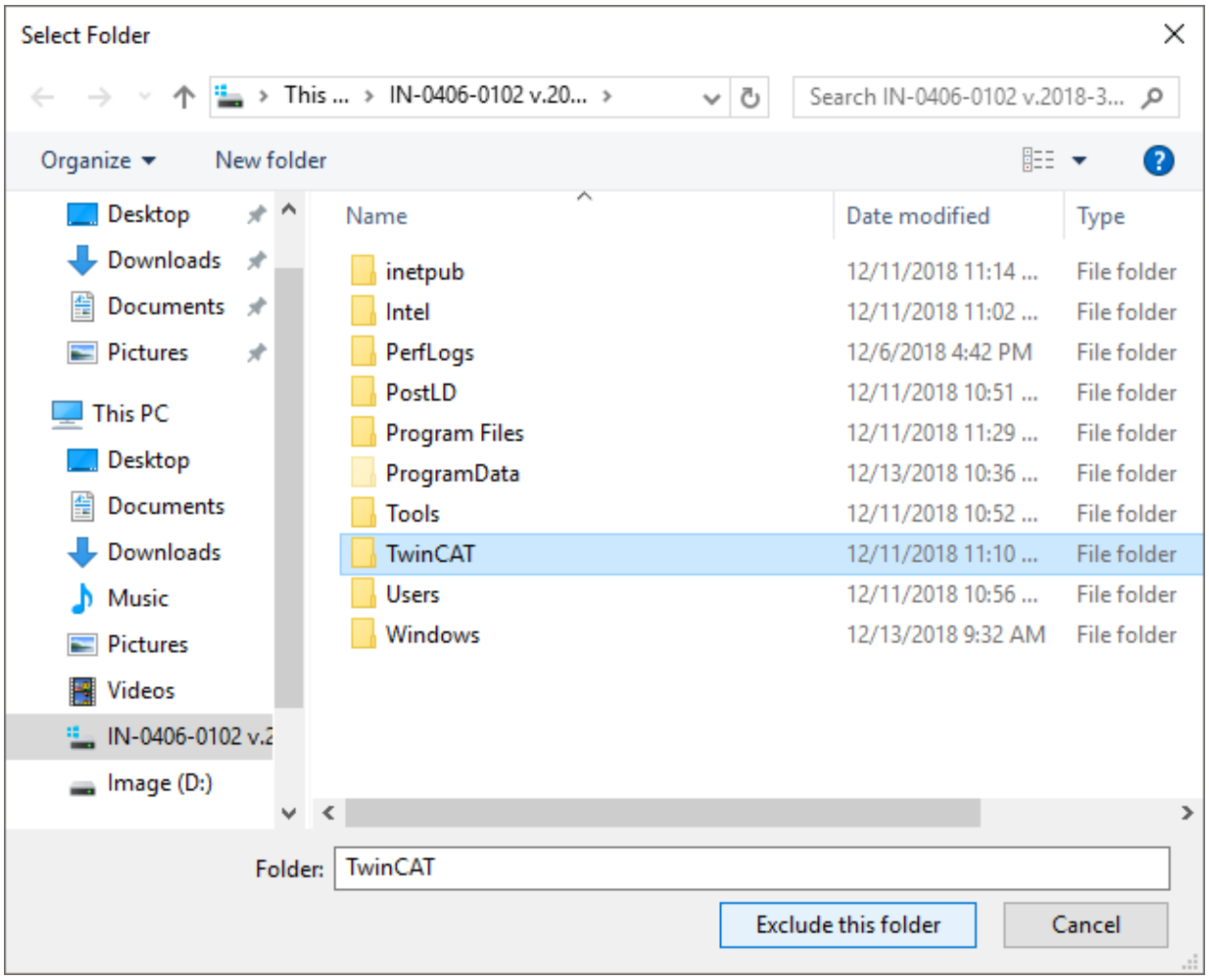
2. Use the **Add an exclusion** button to add exclusions that are not scanned by Windows Defender.



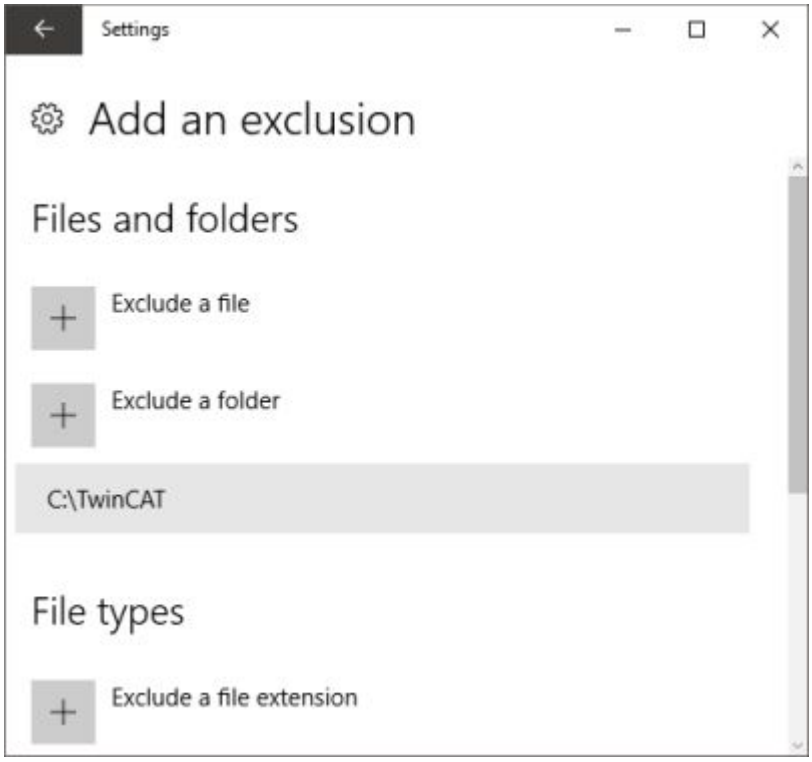
3. Add an excluded directory using the **Exclude a folder** button.



4. Select the directory *C:\TwinCAT* or the directory containing the TwinCAT installation.



⇨ The directory is added as an exclusion.



Further directories used by TwinCAT are documented in the IPC Security Guidelines.

More Information:
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