**BECKHOFF** New Automation Technology

# TwinCAT HMI:
# Responsive and platform-independent

# Simple to use. Your fastest way to the solution.
# Platform-independent: TwinCAT HMI.

What does the HMI solution of the future look like? How can the all-important user interface be given an industry-spanning design in the future so that maximum operator efficiency and optimum user comfort are ensured? Today, Beckhoff is pioneering the way to the next generation of HMI solutions with TwinCAT HMI:

TwinCAT now integrates the Human Machine Interface directly into the familiar environment of Microsoft Visual Studio®. Programming is unnecessary as configuration is handled with ease using the TwinCAT HMI graphical editor. As simple as the configuration is, the handling is equally adaptable: this web-based solution,

which is based on HTML5 and JavaScript, acts "responsively", irrespective of the operating system and device. The powerful basic architecture makes numerous application scenarios possible: from the local panel display solution to multi-client, multi-server and multi-runtime concepts. Individual extensions can be im-

plemented quickly via defined interfaces; the mix of standard controls and custom design elements facilitates individualisation and differentiation.

- Efficient engineering, integration in Visual Studio®
- Platform-independence
- Web-based (HTML5, JavaScript)
- Powerful architecture
- Modular expandability
- High-level programming language integration

We reserve the right to make technical changes.    We reserve the right to make technical changes.

# Beckhoff rethinks the HMI:
# engineering integrated in Visual Studio®.

**Visual Studio® integration**
TwinCAT HMI and its various pages are designed in Visual Studio®. A user-friendly graphical editor offers the possibility to place controls on the interface and to directly parameterise them.

**TwinCAT integration**
TwinCAT HMI and the TwinCAT project can be managed in one powerful solution. This allows the seamless interaction of both projects in one engineering tool.

**Teamwork**
It is also possible to connect to a source code database such as Team Foundation Server or Subversion, making engineering teamwork and collaboration simpler and easier to comprehend in the area of HMI as well.
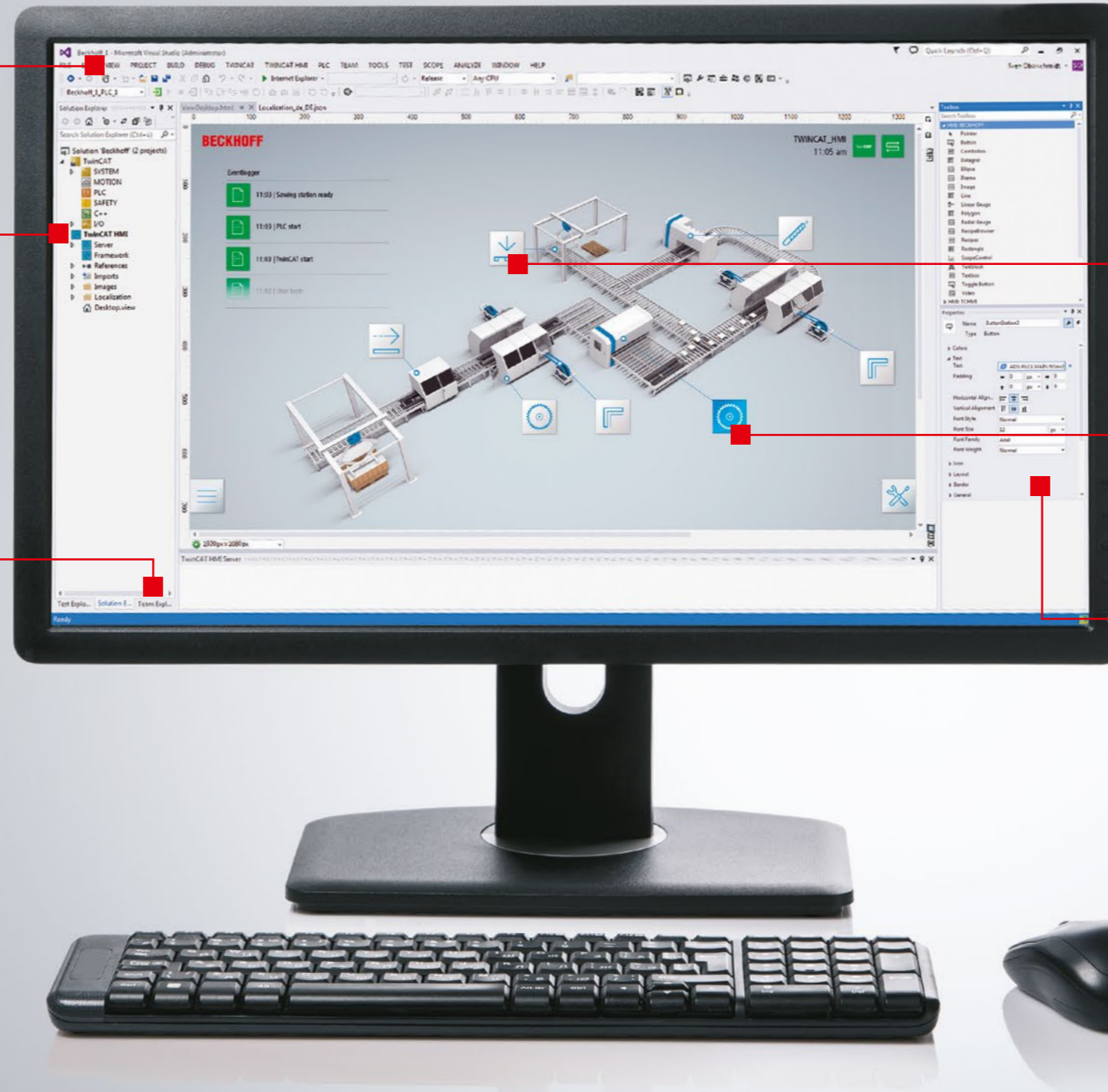
**HTML5 design**
TwinCAT HMI uses HTML5 as a basic technology. Many tools are available for the design of modern and ergonomic user interfaces. Different browser engines can be used to display these web pages.

**Live View**
Online values can be displayed and seen even during the design of an HMI, and the HMI pages can be directly operated at the same stage. Changes to the design are also possible in live mode.

**Easy configuration**
Apart from the parameters such as size and colour, it is also necessary to create links to the variables, e.g. from the PLC or from a C++ module. Wizards and drag & drop functions simplify engineering.

A good HMI must be simple, and achieving this simplicity begins with the engineering process. Through the integration of TwinCAT HMI in Visual Studio®, the graphical What-You-See-Is-What-You-Get (WYSIWYG) editor enables you to use simple controls from a toolbox, arrange them on the interface and link them to real-time variables. In addition, it is possible to assemble and parameterise user controls from the variety of simple controls, making the HMI design kit easy to expand. Ready-made HTML5 templates – like the kind that normally require design specialists – can be integrated with little effort in order to generate complex, yet ergonomic pages.

Depending on experience and the application type, the HMI logic can be implemented either on the client side in JavaScript or as a server extension that offers the possibility to create extensions in high-level languages, achieving maximum intellectual property (IP) protection. The HMI automatically adapts itself depending on the respective resolution and orientation of the display hardware; for example, a page can be used for various display sizes, aspect ratios and orientations. Since the browsers are available on different hardware platforms and operating systems, TwinCAT HMI can be executed on all processor platforms without recompiling or adaptation.

**More efficient engineering in Visual Studio®**
- Source code control
- WYSIWYG editor for HTML
- Target browsing
- Reusable project templates
- One tool for HMI and PLC development

# With TwinCAT HMI, you benefit from a new engineering philosophy.
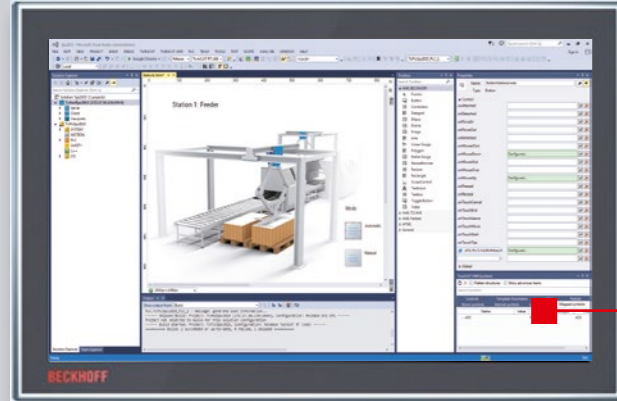
**WYSIWYG editor**
The "What-You-See-Is-What-You-Get" (WYSIWYG) editor in TwinCAT HMI enables you to graphically configure the interface without programming skills. Experts, however, can also develop and expand the HMI using HTML and JavaScript. As is usual in Visual Studio®, controls (e.g. buttons, labels) are available in a toolbox. In addition, users can create their own controls or develop them independently in HTML5.
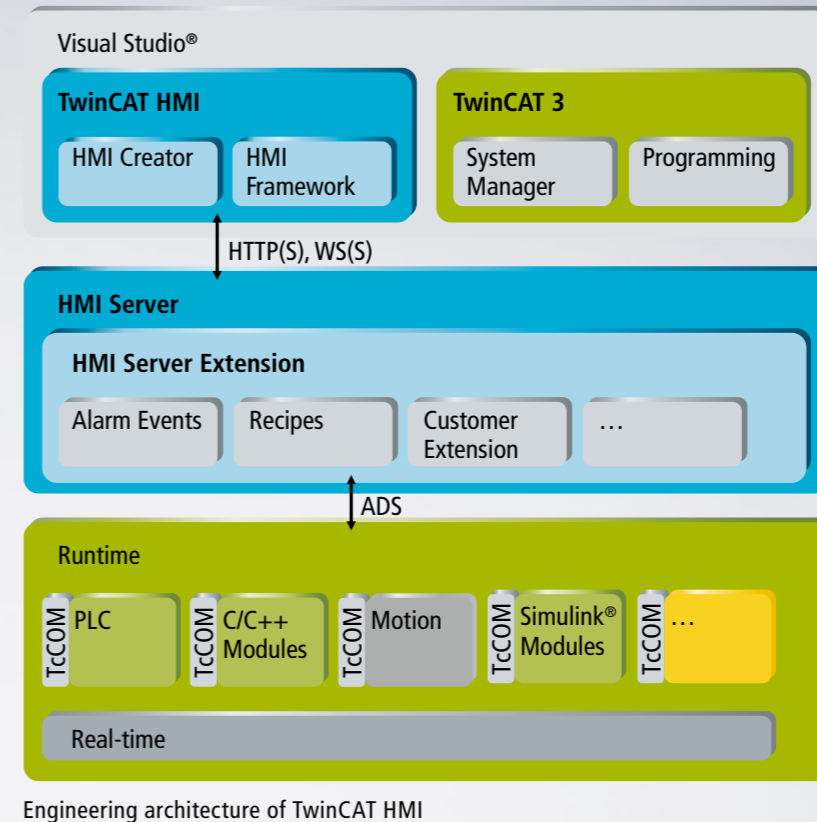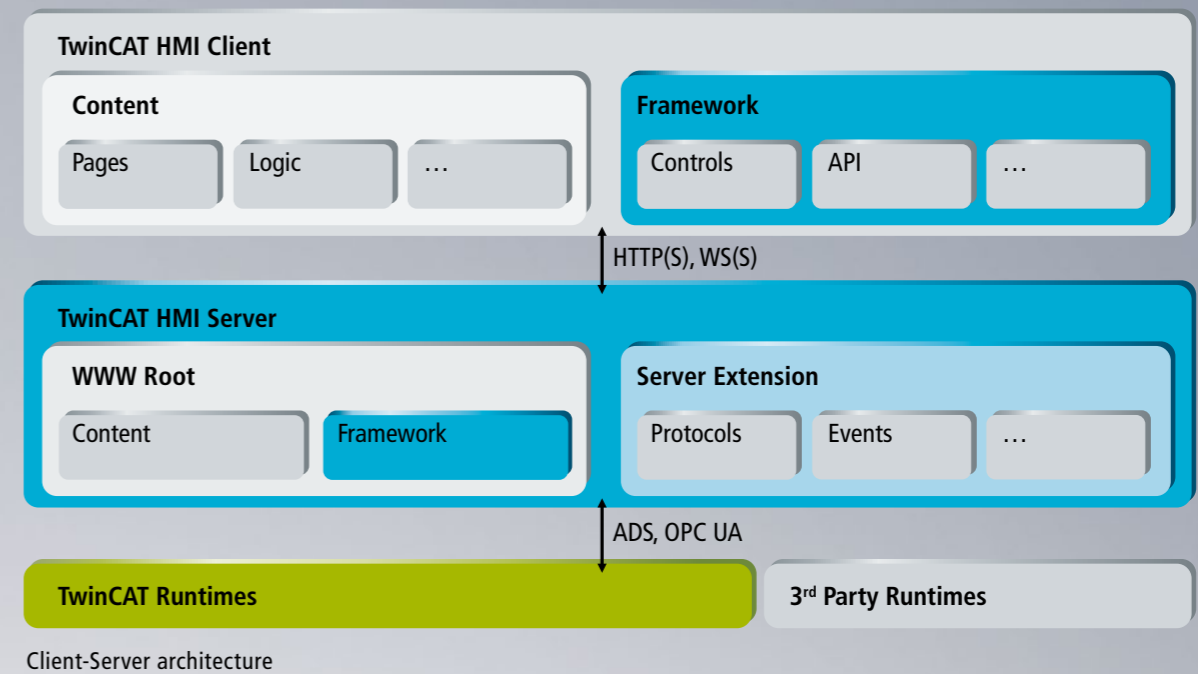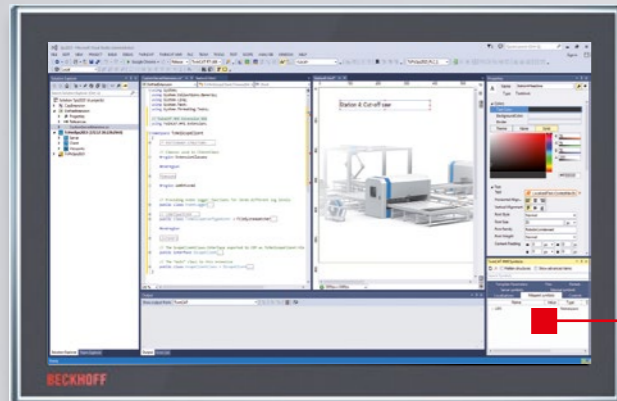
**Project templates**
Predefined project templates make start-up easy for the user. They provide standard machine operating functions (e.g. manual functions, machine parameters) and greatly reduce the HMI development time.
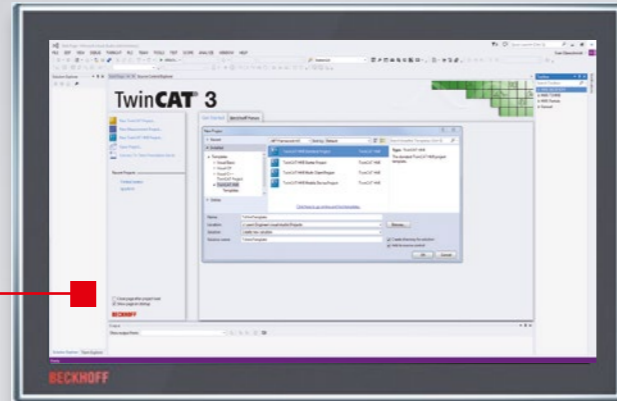
**High-level language integration**
It is very easy to expand the TwinCAT HMI server with "server extensions", which could be logically programmed with high-level languages or even an extension for a specific communication protocol.

**TwinCAT HMI Client**

| Content | | | Framework | | |
|---|---|---|---|---|---|
| Pages | Logic | … | Controls | API | … |

HTTP(S), WS(S)

**TwinCAT HMI Server**

| WWW Root | | Server Extension | | |
|---|---|---|---|---|
| Content | Framework | Protocols | Events | … |

ADS, OPC UA

| TwinCAT Runtimes | 3rd Party Runtimes |
|---|---|

Client-Server architecture

**Visual Studio®**

**TwinCAT HMI**

| HMI Creator | HMI Framework |
|---|---|

**TwinCAT 3**

| System Manager | Programming |
|---|---|

HTTP(S), WS(S)

**HMI Server**

**HMI Server Extension**

| Alarm Events | Recipes | Customer Extension | … |
|---|---|---|---|

ADS

**Runtime**

| TcCOM PLC | TcCOM C/C++ Modules | TcCOM Motion | TcCOM Simulink® Modules | TcCOM … |
|---|---|---|---|---|

| Real-time |
|---|

Engineering architecture of TwinCAT HMI

Users have access to a complete, universal engineering environment through the integration of TwinCAT HMI in TwinCAT automation software or Visual Studio®. The comprehensive TwinCAT HMI suite contains the HMI Creator, the HMI Framework and the HMI Server:

**TC HMI Creator:** the user-friendly graphics editor provides predefined project templates for fast start-up.

**TC HMI Framework:** provides a basis for client-side interaction (e.g. language switching), controls and an application programming interface (API).

**TC HMI Server:** the HMI clients securely communicate with the HMI server via HTTPS and web sockets. The server requests and provides data from the real-time systems.

**TC HMI Extensions:** the HMI is modularly expandable by functions through the use of extensions (e.g. Alarms & Events, TwinCAT Scope). Users can develop their own extensions in high-level languages. These extensions can be utilised to program complex logic.

**Simple engineering**
- HMI Creator and HMI Framework facilitate simple HMI configuration
- HMI Server extensions with programmable business logic
- High-level programming language integration

# Operating systems, resolutions, or devices: it's your choice. TwinCAT HMI automatically adapts to your needs.

No two machine controllers are alike: vastly different requirements and user-specific parameters must be accounted for. TwinCAT HMI thus meets the demand for maximum flexibility as a webbased and platform-independent user interface with maximum adaptability. Whatever device or operating system you use, TwinCAT HMI automatically adapts to the technology at hand. Scenarios for "Bring Your Own Device" (BYOD) in manufacturing are also supported. Whichever preferred format, whether it is a tablet, smartphone or industrial panel, it can be used today or later on. TwinCAT HMI always acts responsively and adapts itself according to the resolution, screen size and orientation of each device.
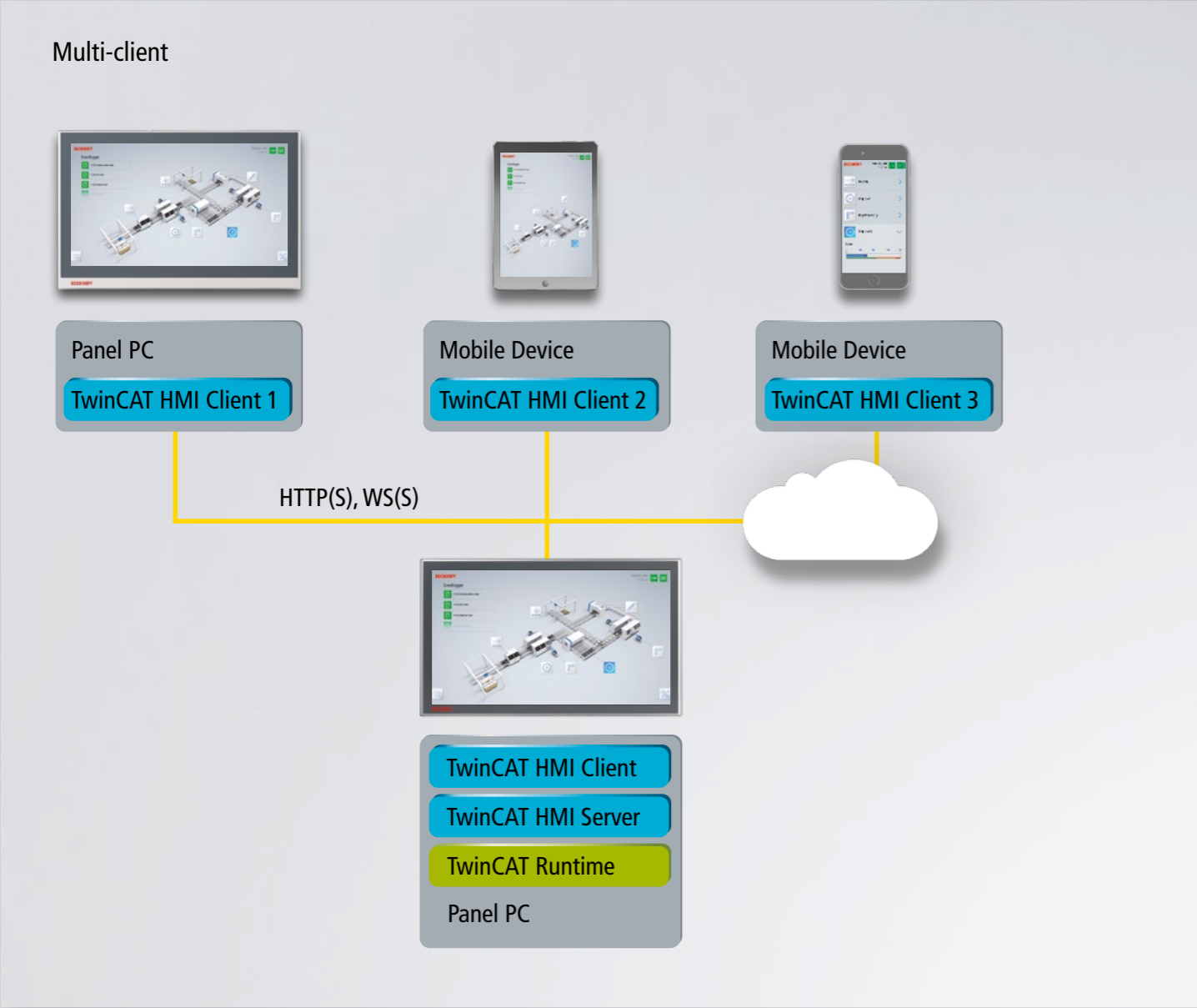
In addition to the free choice with regard to resolution, screen size and orientation, you can operate TwinCAT HMI Server on the most diverse de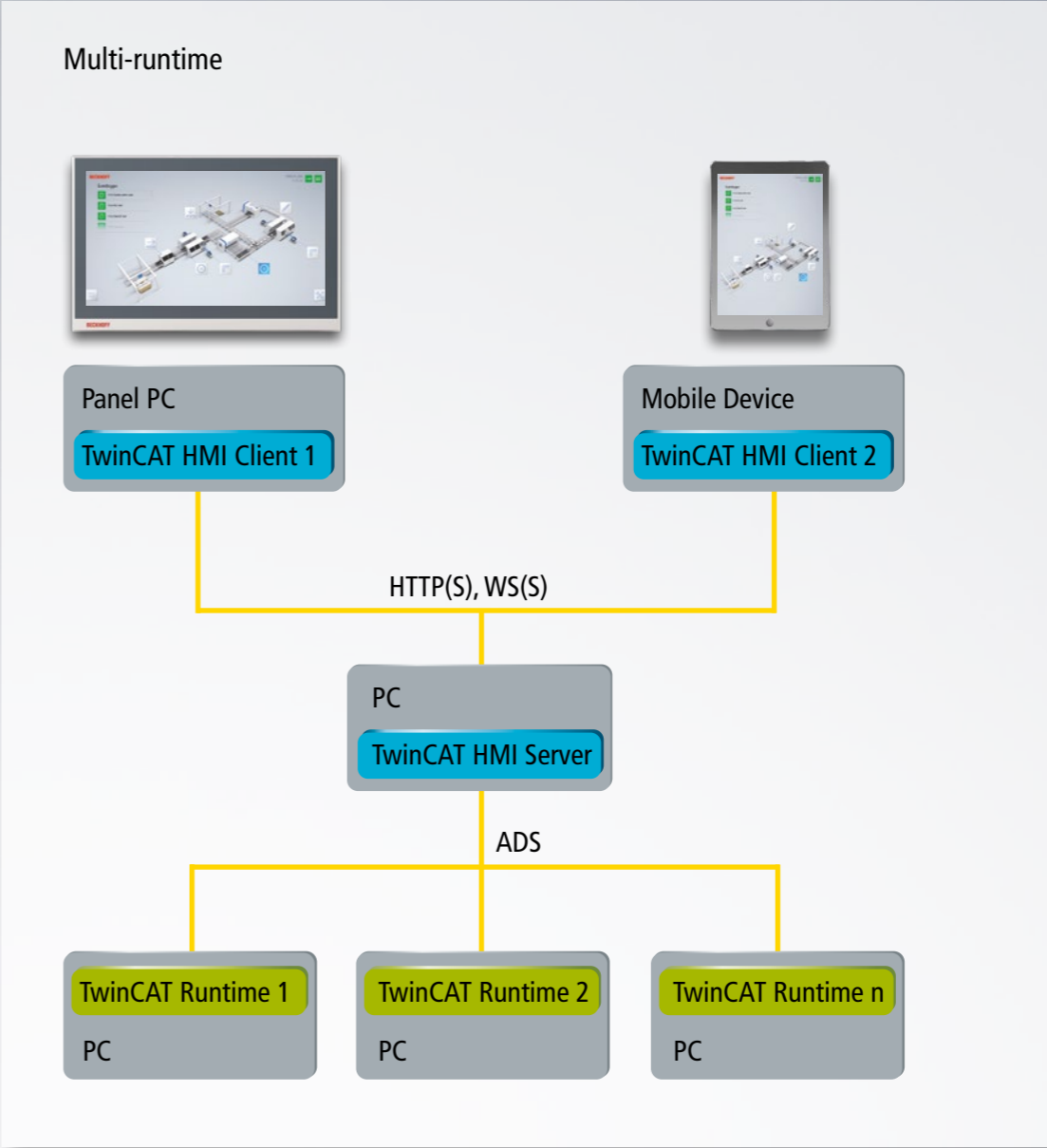vice platforms, since CPU performance classes ranging from ARM to multi-core are supported. Security has top priority with all platforms. Data are first encrypted and then exchanged between client and server via secured connections. The integrated user management features permit the adjustable issuing of rights.

**Flexible and secure**
- Free choice of resolution, screen size and orientation
- Support for all CPU performance classes
- Secure authentication and user management

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# Flexible use in the network,
# even with several clients at once.

## Multi-client

Panel PC

**TwinCAT HMI Client 1**

Mobile Device

**TwinCAT HMI Client 2**

Mobile Device

**TwinCAT HMI Client 3**

HTTP(S), WS(S)

**TwinCAT HMI Client**

**TwinCAT HMI Server**

**TwinCAT Runtime**

Panel PC

TwinCAT HMI can access the runtime from several clients in parallel and can be operated in parallel.

## Multi-runtime

Panel PC

**TwinCAT HMI Client 1**

Mobile Device

**TwinCAT HMI Client 2**

HTTP(S), WS(S)

PC

**TwinCAT HMI Server**

ADS

**TwinCAT Runtime 1**

PC

**TwinCAT Runtime 2**
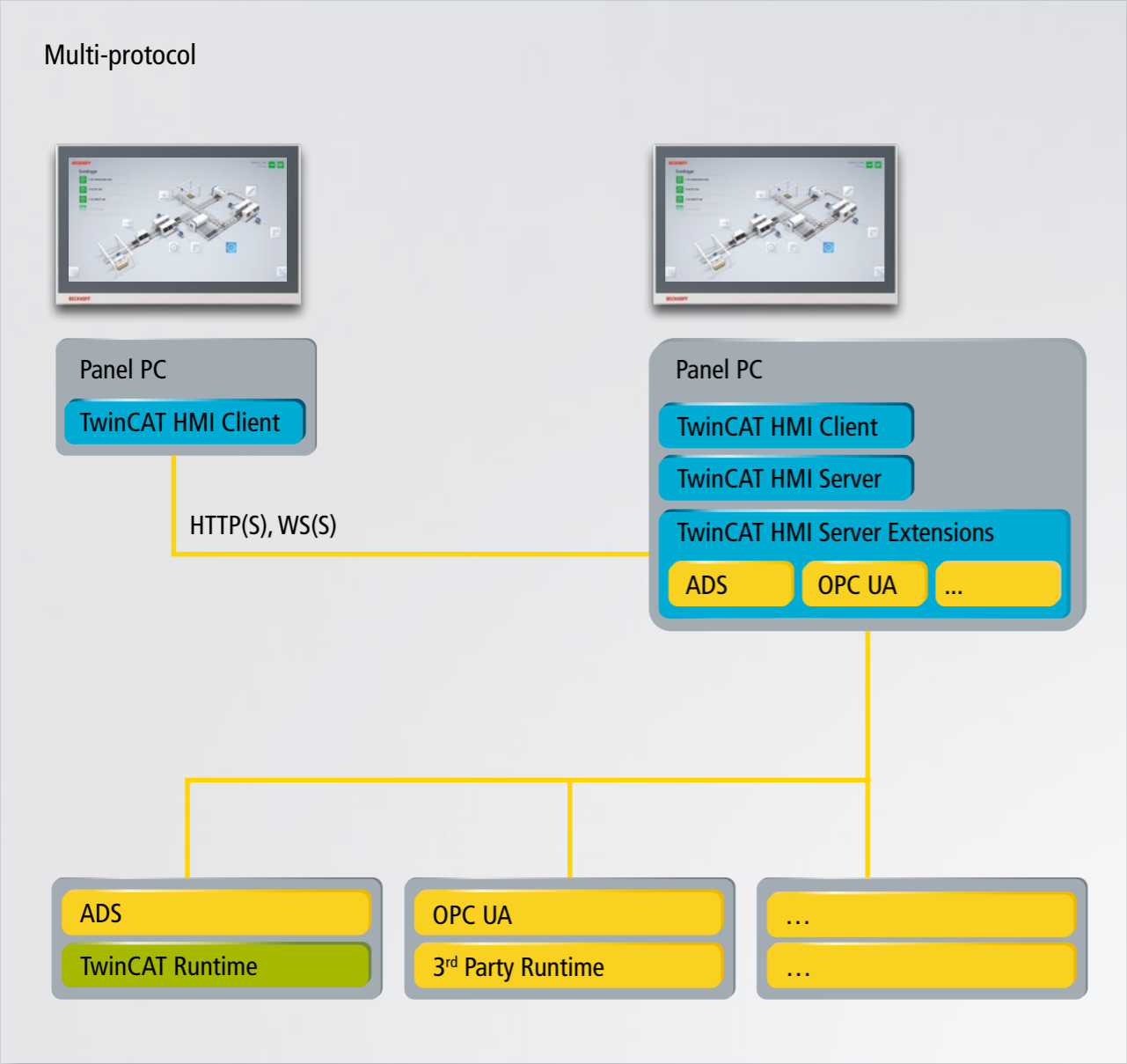
PC

**TwinCAT Runtime n**

PC

The TwinCAT HMI server supports access to several runtime systems.

TwinCAT HMI supports the most diverse application types and is thus suitable for all control architectures. The range of options begins with common "local client" solutions in which client, server and runtime are combined on one Panel PC. The communication between the browser and HMI S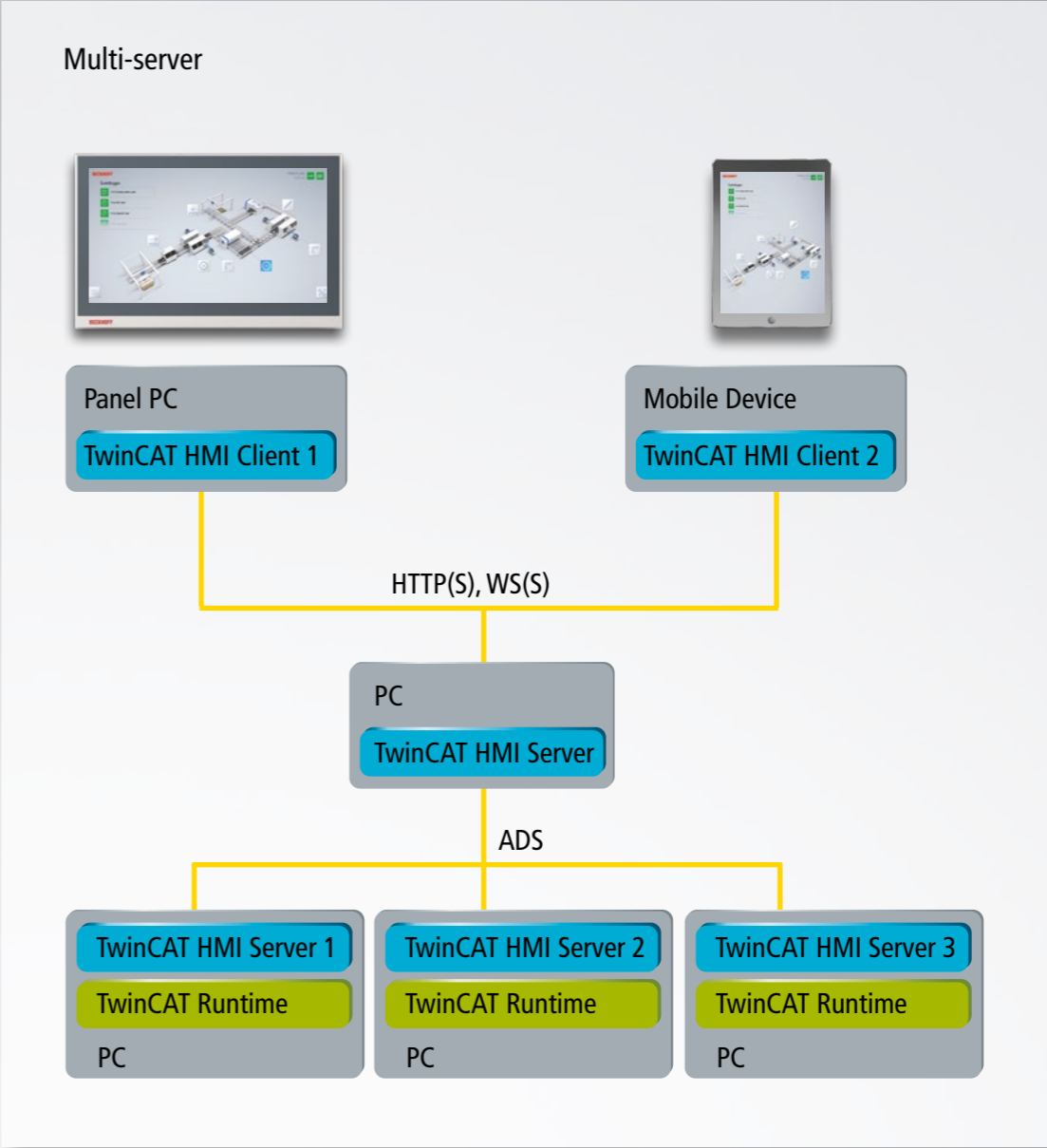erver is based on established IT standards. HTTPS and WebSocket-Secure guarantee the secure communication from the client to the server. The HMI server on the other hand, is connected to the respective controller(s) via standard automation protocols. OPC UA is also available for this along with the Automation Device Specification (ADS) in TwinCAT software.

**Support for all application types**
- Local client
- Multi-client
- Multi-runtime
- Multi-server
- Multi-protocol

# Flexible expansion through open communication protocols.

## Multi-protocol

**Panel PC**
- TwinCAT HMI Client

**Panel PC**
- TwinCAT HMI Client
- TwinCAT HMI Server
- TwinCAT HMI Server Extensions
  - ADS | OPC UA | ...

HTTP(S), WS(S)

- ADS
- TwinCAT Runtime

- OPC UA
- 3rd Party Runtime

- …
- …

The TwinCAT HMI server can use several protocols in parallel.

## Multi-server

**Panel PC**
- TwinCAT HMI Client 1

**Mobile Device**
- TwinCAT HMI Client 2

HTTP(S), WS(S)

**PC**
- TwinCAT HMI Server

ADS

**PC**
- TwinCAT HMI Server 1
- TwinCAT Runtime

**PC**
- TwinCAT HMI Server 2
- TwinCAT Runtime

**PC**
- TwinCAT HMI Server 3
- TwinCAT Runtime

A client can visualise data from different TwinCAT HMI Servers in parallel.

Additional protocols, for example, BACnet or IEC 60870, are easy to implement using the server extensions. Of course, various controllers can exchange their data with one or more clients in a local network. The clients can run on local PCs or Panel PCs, or on mobile devices such as tablets or smartphones. Secure connection to the cloud is also fully integrated. This permits the display of TwinCAT HMI pages on smartphones that are connected to the machine via a cloud, for example.

**Expansion via server extensions**
- Support for industry-specific protocols, e.g. BACnet
- Telecontrol protocols, e.g. IEC 60870
- IoT protocols, e.g. MQTT and AMQP

# TwinCAT HMI:
## features and extensions.

| Features | Description |
|---|---|
| **Microsoft Visual Studio® integration** | Visual Studio® is a well-known tool for PLC and HMI developers alike. It offers the ability to implement efficient machine programming processes (e.g. source code control interfacing). |
| **TwinCAT integration** | The engineering of TwinCAT (I/O, Motion, PLC, C++) and TwinCAT HMI takes place in the same tool. |
| **WYSISWYG editor** | The "What-You-See-Is-What-You-Get" (WYSIWYG) editor enables you to graphically configure the interface without programming skills. |
| **Themes** | Templates for the simple use of different styles; they can be expanded by your own themes. |
| **Live engineering** | During the development time, the functionality can be tested in the HMI Creator with live data from the real-time system. |
| **Multi-client** | An HMI can be configured for different screen resolutions and displayed by several devices at the same time. |
| **Multi-runtime** | TwinCAT HMI can connect via several real-time systems. TwinCAT runtimes can be programmed in PLC languages, C/C++ or MATLAB®/Simulink®. |
| **Multi-lingual** | Country-specific settings (language, measurement units, formatting) can be activated at runtime. Also, the language files can be exchanged easily with translation agencies. |
| **Security** | HMI client, server and engineering communicate via secure HTTPS and web socket connections. |
| **User controls** | Existing controls can simply be taken from the toolbox and placed on the interface by drag & drop, and then configured. This makes it easy to create your own controls. |
| **User Management** | User and group rights can be configured centrally. The user management of existing IT infrastructures (e.g. Windows domains) is supported. |
| **Charting/Trending** | Flexible representation of historical or live data from real-time applications or user-specific server extensions. |
| **Package Management** | Server extensions and custom framework controls can be bundled into a package for forwarding to other systems and installation in a repository. |

| Extensions | Description |
|---|---|
| **ADS** | Enables access to TwinCAT 2 and TwinCAT 3 target systems. The symbol files can be used for developing and testing the HMI offline. |
| **Alarms & Events** | The central reporting system can be easily integrated as an existing control. |
| **Scope** | TwinCAT Scope, the feature-filled software oscilloscope, can also be integrated in TwinCAT HMI. |
| **Recipe management** | Recipe data can be created in the engineering environment and activated in the PLC via existing controls. |
| **OPC UA** | Vendor-independent communications interface for integrating TwinCAT or other controls with OPC-UA interface |
| **SDK extension** | Software development kit for the programming of application-specific solutions (e.g. logic, protocols) |
| **Framework Control API** | For development of user-specific controls or integration of third-party controls. A project template for JavaScript is available. |

The simple, fully integrated HMI solution:
TwinCAT HMI. See all information at
▶ **www.beckhoff.com/TwinCAT-HMI**

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