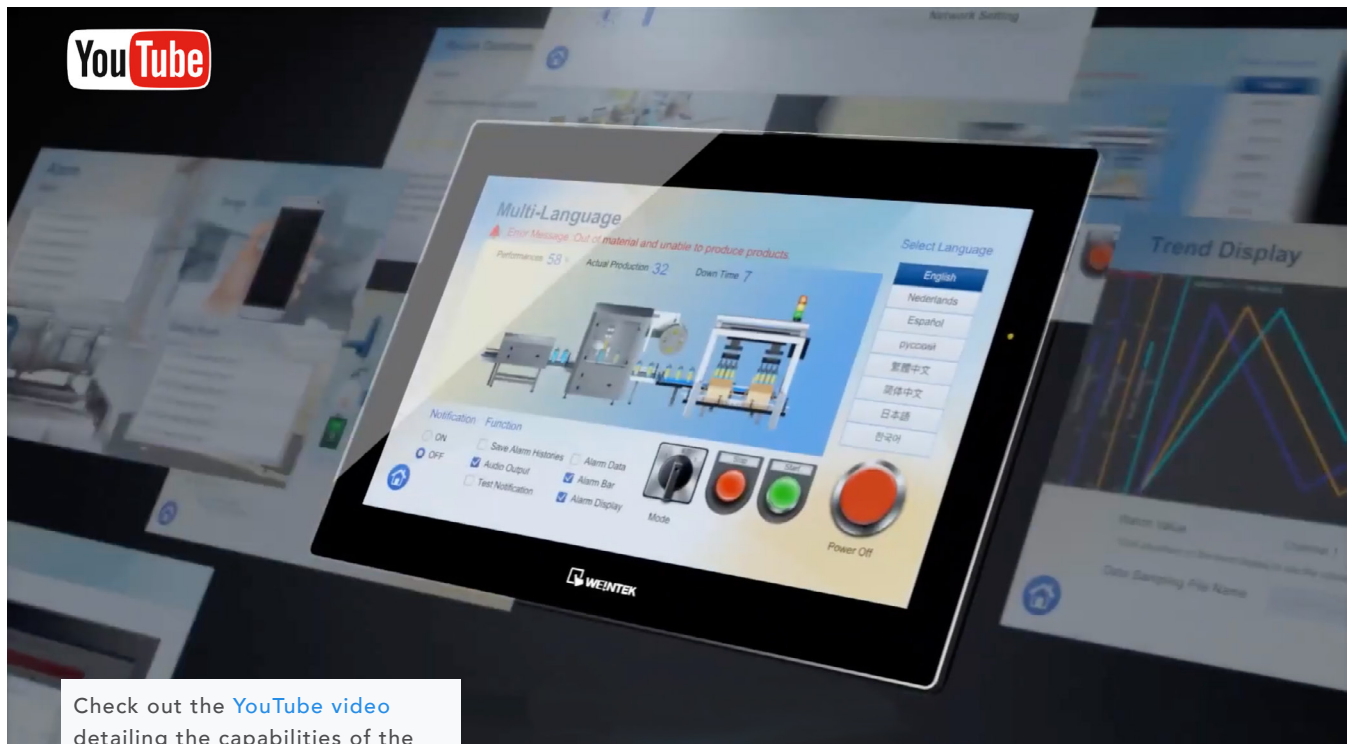


Selecting HMIs: **An explanation of the latest options for design engineers**

New HMI functions and formats mean there's a perfect-fit interface solution for every application. Here we outline several application classes as well as three advanced HMI categories – including controller HMIs, virtual (screenless) HMIs, and wifi-connected HMIs – and where their various features are most useful.

Today the functions and formats for human-machine interfaces (HMIs) in automated machinery know no bounds. Gone are the days when design engineers had to specify proprietary HMIs having narrowly defined applicability. But with more variation in what HMIs are and do comes more need for careful defining of design parameters — to ensure the most appropriate HMIs are specified.

In this white paper, we'll outline common considerations when designing HMIs into equipment as well as some application subtypes— and three major HMI classes that are relatively new to the automation industry. Then we'll compare the HMI features' suitability for various uses.



Check out the [YouTube video](#) detailing the capabilities of the revolutionary new cMT-3162X HMI from Weintek.

How the HMI design process starts

Human machine interfaces (HMIs) give personnel a way to monitor and manage machine tasks via some sort of graphical user interface (GUI). Communications with higher-level machine-level functions allows for more sophisticated interoperability. Now, the distinctions between these HMI elements have blurred ... with options abounding for rather specific design parameters. After all, today's automated installations rely on actuators, sensors, switches, controls, and I/O, and many of the latest HMIs can assume the tasks related to serving such production functions.

Where HMIs take the form of standalone hardware, they increasingly incorporate programmable logic controller (PLC) functionalities as well as connectivity to higher-level PAC, PC, or system controllers. Others take that multi-faceted functionality a step further with the ability to directly connect with remote I/O modules — for simplified integration at the edge of the automated installation.

If you're not considering new HMI and connectivity technologies, you're falling behind in your industry.

Just consider how the design process starts for most engineers, distributors, or salespeople involved in the specification of HMIs into a machine or operation. Due to COVID-19, the first step is typically to meet with the supplier representative on a Zoom or Webex meeting to discuss preliminary design details. Due to the flexibility of Weintek solutions, those first video calls primarily focus on application parameters.

Of course, engineers using traditional design approaches might settle on a control system and then say, "Well, we need an interface — and here's a basically suitable HMI."

In contrast, leveraging the benefits of more integrated (and powerful) HMI solutions necessitates a holistic consideration of all the components' interoperabilities.

Powerful processors are at the heart of HMIs capable of handling ever-more automation tasks. Learn more about the dual-core 1-GHz processors that Weintek uses in many of its HMIs by clicking on this weintekusa.com deep link ... as that dual-core processor is an industry leader in terms of speed. Now with its newer X series of HMIs, Weintek is taking processing to the next level with a quad-core 1.6-GHz processor — which is about four times faster than the dual core. Even so, the components in this technologically advanced X series are affordably priced.

So as mentioned, Weintek's breadth of HMI and connectivity products ensures the supplier has suitable solutions for various applications.

For example, an engineer who is making a simple banding machine may not need lots of powerful features. Here, Weintek may suggest an MT8053iE 4.3-in. HMI that's functionality (in the form of dual Ethernet and built-in remote access as well as a passthrough to the PLC) may be warranted — especially as such options can in some cases cost less than \$400 ... far less than the \$1,000 or more that it generally costs just to get the remote-connection function.



In contrast, an OEM looking to impart a slight upgrade on an existing line of packaging machines may need a traditional mid-range HMI that directly mounts to these machines' frames. Here, Weintek may suggest an XE-series HMI having an aluminum or plastic enclosure.

In other instances, a machine builder's end user may be requesting a super-powerful HMI to execute advanced controls. Here, Weintek may suggest an HMI from its cMT line of products. In some cases, these applications may also necessitate machine designs supporting CODESYS programmability. Here, Weintek may supply a cMT3092X HMI that allows programming with CODESYS.

Even less traditional installations may aim to implement facility operations without an operator manning the machine in question. Here, Weintek may suggest a screenless (also called a faceless or virtual) HMI.

In fact, the flexibility of these cutting-edge HMIs means that in many instances, the Weintek representative will have multiple options to suggest. That in turn gives engineers and distributors more flexibility in solving design problems.

Deeper dive on first choice: Screen versus screenless HMIs

We'll cover the innovations integrated into Weintek's newest screen HMIs in the next section of this white paper, but first consider some new screenless offerings ... and their benefits.

Weintek screenless (faceless) HMIs are DIN-rail-mount devices that have all the hardware and capabilities of an HMI, but without a screen. Complemented with a wifi-connection device, these screenless options let machine operators and plant managers use their smartphones, tablets, and PCs as extensions of their HMIs.



Weintek's newer cMT line of HMIs offer two suites of functions with diverging (and uniquely applicable) capabilities. Newer X-series HMIs have capacitive touchscreens for intuitive gesture control. In contrast, screenless HMIs such as the cMT-SVR-200 shown here uses wifi to connect with local and offsite display devices.

Among other things, that lets these end users:

- Move around the plant floor while accessing a machine's data
- Share concurrent access to a machine with multiple other users

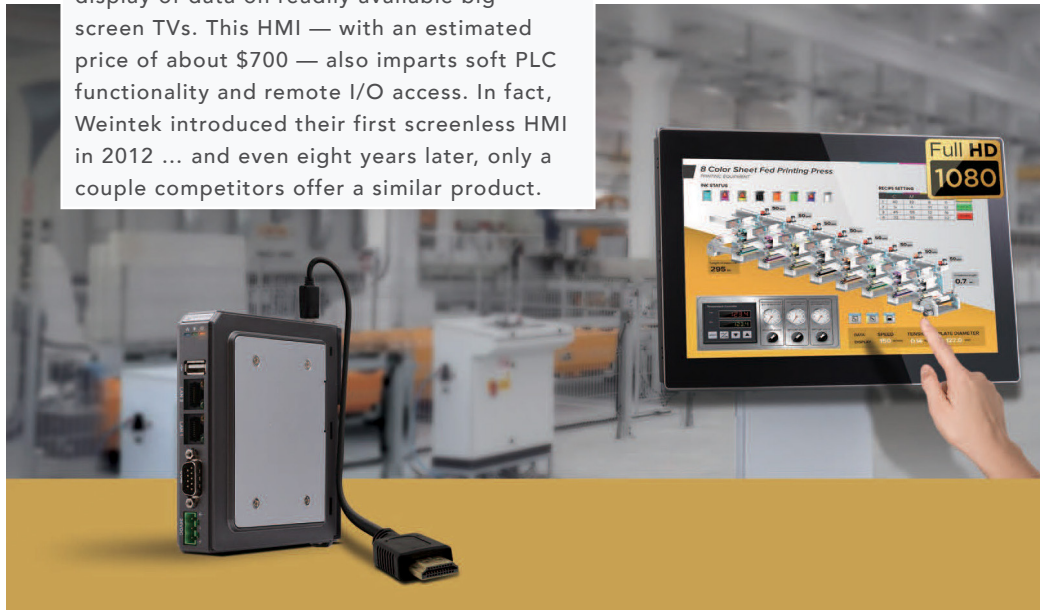
Such HMIs display data through device-compatible GUIs that present machine information in the form of live feedback, diagrams, and system schematics — as well as simple text where warranted. These tablet, phone, and laptop GUIs are typically customized to the application — something only associated with the highest-performance HMIs even a few years ago.

In some cases, a ubiquitous HDMI output: An even more sophisticated HMI in this Weintek screenless (faceless) series has a standard HDMI output. That connection option lets plant-management teams develop pertinent displays for a given piece of equipment and then (using a standard off-the-shelf consumer-grade flatscreen TV — such a 60-in. TV from Costco, for example) prominently display machine statistics, operation status, and other values (including warnings) for operators on the plant floor.

Screenless HMIs let engineers leverage the cost and availability benefits ubiquitous consumer-grade designs (in this case, flatscreen TVs) just as industrial Ethernet has done over the last three decades for connectivity

Taking the screenless-HMI technology still further is the most sophisticated HMI in this Weintek series — one that allows the addition of a CODESYS license.

Weintek offers a DIN-rail-mount screenless (virtual) HMI with an HDMI output for the display of data on readily available big-screen TVs. This HMI — with an estimated price of about \$700 — also imparts soft PLC functionality and remote I/O access. In fact, Weintek introduced their first screenless HMI in 2012 ... and even eight years later, only a couple competitors offer a similar product.



Wifi options for the use of screenless HMIs

Consider how certain screenless Weintek cMT HMIs compare to traditional HMIs. These screenless (sometimes called virtual) HMIs excel in outdoor environments: Weintek recently supplied screenless HMIs having wifi connectivity — something few other component makers offer — to an energy OEM looking to incorporate such HMI connectivity. The OEM's remote piece of equipment operates in an inaccessible outdoor environment, but (with the Weintek HMI) allows operations managers to continuously monitor the equipment. Other similar applications include remote pump stations and water lift stations. These stations are often located in remote open fields with no operator present. The typical industry solution for upgrading such stations is to swap out simple pushbutton-based controls with HMIs. The problem with that approach is that these water stations are out in the sun — and exposed to the elements. Therefore,

This is a [Weintek cMT-SVR-200 screenless HMI](#) with wifi. In fact, this screenless HMI also comes in a cMT-SVR-202 variation that includes an EasyAccess 2.0 license.



an HMI that's permanently installed at such a location requires a ruggedized body and an expensive sunlight-readable display ... or some sort of swingout panel that retracts into a housing or control panel. Still other HMI installations at such stations actually include a shade roof over the HMI.

A better approach is to employ a Weintek screenless HMI having wifi connectivity. This solution only necessitates that a wifi antenna mount outside the metal control panel — which in the vast majority of cases is quite easy to setup. Then the station operator (when he or she comes by once a day or week or as needed) can simply pull up in the work truck; connect to the HMI via wifi using a laptop, tablet, or phone; reset alarms or check or adjust other station settings; stay in the air conditioned or heated truck as the system updates (if applicable); and then log off and move onto the next location.

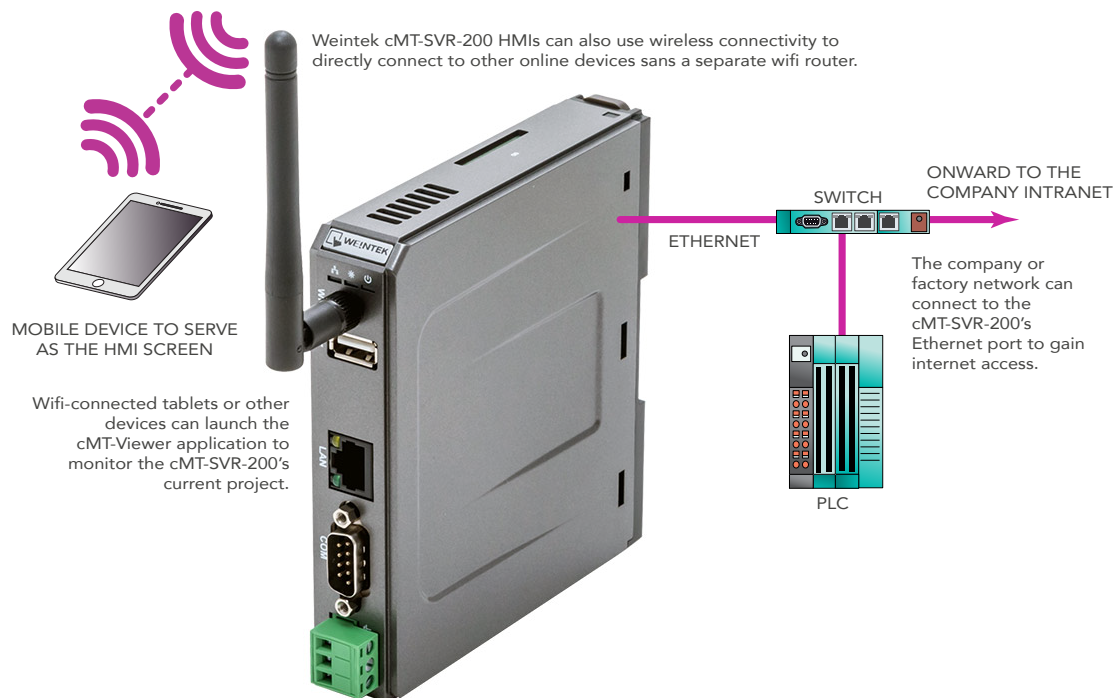
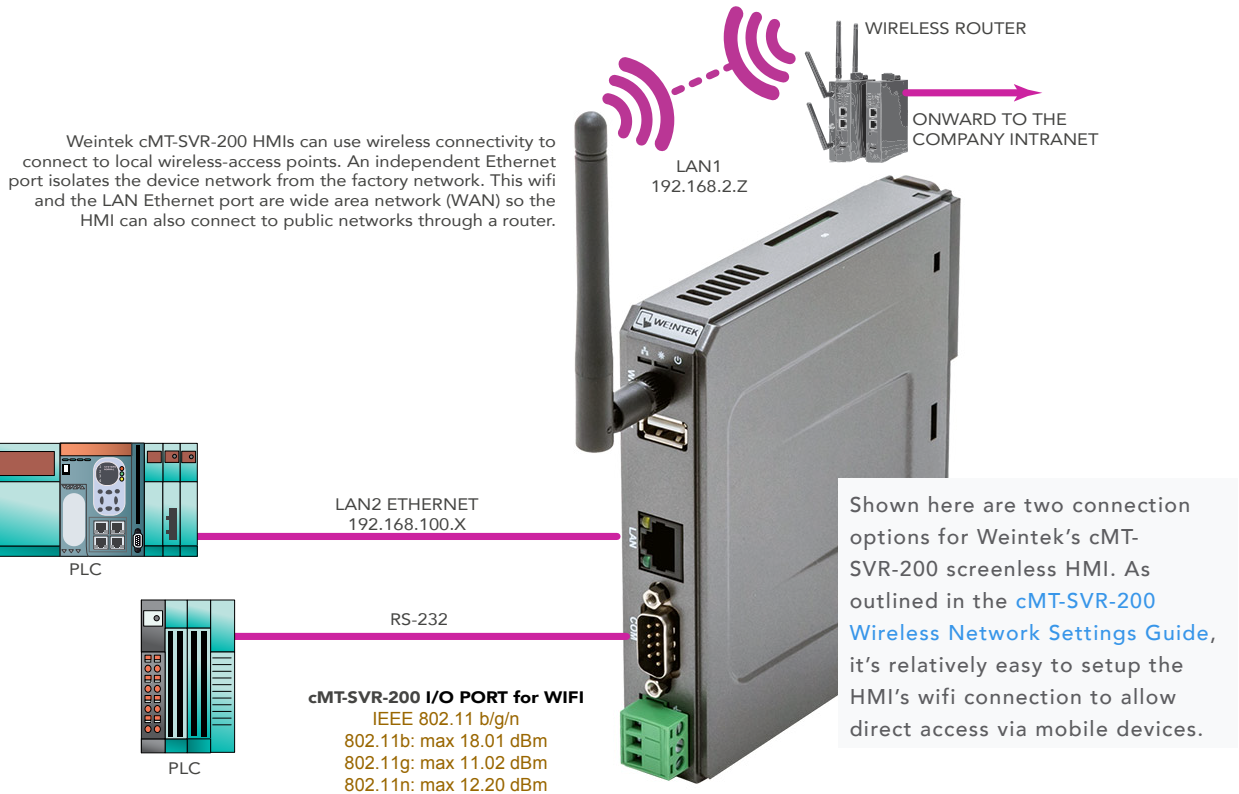
So it's clear how wifi connectivity allows the use of mobile devices in conjunction with screenless HMIs. Following is a short listing of wifi-enabled HMIs from Weintek as well as related connectivity products offering wifi connectivity for flexible architectures.

Besides allowing the use of mobile devices in conjunction with screenless HMIs, wifi connectivity also allows for full-feature remote connectivity.

Another option to leverage wifi with HMIs is to use a wifi-enabled gateway — such as this [Weintek cMT-G02 IIoT gateway](#). This component connects to company networks and includes Ethernet ports for simple wiring ... as well as three serial ports (RS232, RS485-2W, and RS485-4W) to concurrently accommodate other automation devices.



HOW SCREENLESS HMIs USE WIFI TO CONNECT TO DISPLAYS



Machine management during COVID-19 with HMI-based remote accessibility

Save for the oil and gas sector, automation is one market that's seen little slowdown during the COVID-19 pandemic. Distributors have continued to work on existing projects even while supplying to new projects aimed at previously non-automated applications.

Here's where it's clear — the remote connectivity described earlier in this white paper isn't applicable only to lonely and remote equipment untended by human personnel. Remote access can also serve machines tended by an operator 24/7. Of course, a screenless HMI is inappropriate here ... but a cMT X-series HMI:

- Allows the local operator to do his or her job
- Allows maintenance personnel fully functional access to the HMI if the machine isn't running properly

So assume our application is a packaging machine, and it's exhibiting some slight issue that doesn't necessitate a full line shutdown — but an issue that's significant enough to warrant a call to maintenance.



Once the maintenance technician arrives, he or she goes to the back of the machine to investigate the limit switch, photoeye, motor, or other potentially problematic component. What helps maintenance technicians in these situations is that they can (via the Weintek cMT Viewer mobile app downloadable on the Apple and Google Play stores) log into the troublesome machine's HMI and see all its screens — even while roaming about the machine or servicing its components inside a back panel, for example.

This wifi-enabled access is truly independent — not a mirror of what a local operator is seeing, as on systems from other HMI suppliers. That's because Weintek HMIs allow fully independent multi-user experiences to let an operator stay on screen A while the maintenance technician (digging around the machine's back panel) is on screen B and a supervisor (on or offsite) is logged into the machine's screen C which may list output data and statistics about the packaging machine's throughput.

This multi-user remote-access capability has been a feature on Weintek cMT HMIs for some time ... and the new cMT X-series HMIs are no exception.

Now assume we're facing a more dire situation: You're an OEM, it's the night shift, and you get a call that a machine you supplied to a customer is down. Well, before COVID-19 you may have gotten on a flight as soon as possible to troubleshoot the issue — purchasing a very expensive plane ticket and slogging through a full day or more of travel before reaching the machine's location to begin the fix.

In contrast, a downed machine with an HMI allowing remote access lets OEMs immediately log onto the machine from an online computer to troubleshoot the machine's issues and execute or initiate fixes. The remote access offers bank-commerce-level security via a 256-bit AES encrypted VPN tunnel right to the machine's HMI to let the OEM make changes or offer expert instructions on fixes.


Taking this capability still further is the passthrough (gateway) role certain Weintek HMIs can assume. This allows remote access to the PLC of the system to which the HMI is connected ... whether the PLC is a soft PLC built into the Weintek HMI or a standalone component from another manufacturer ... as HMIs from the cMT line of products directly connect with hundreds of PLCs from dozens of PLC manufacturers.

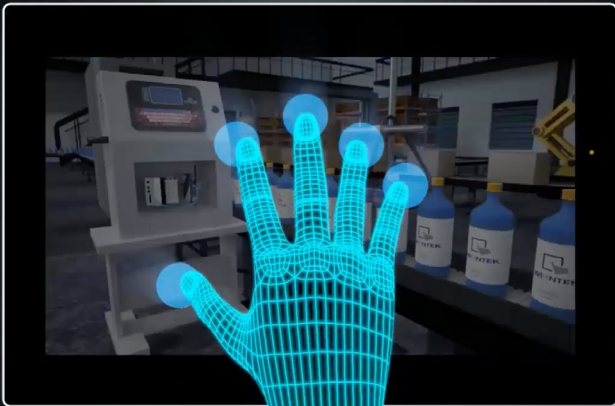
Another HMI feature inspired by consumer electronics: Capacitive functions

We've just detailed how consumer-grade smart devices allow the use of screenless HMIs in a variety of applications. Another way in which smart devices such as smartphones and tablets have inspired evolution in the design of HMIs is in the functionality of their cMT-X series HMI.

Consider how the most advanced HMIs in the Weintek cMT-X series incorporate touchscreen gesture controls. These are the capacitive-touch and haptics features (as well as related feedback) for highly intuitive input and output so common and familiar in commercial products ... including functions that let users swipe and zoom and pinch graphical elements on the HMI screen.

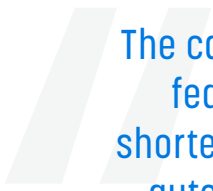
CUSTOMIZABLE GESTURES





Check out the [YouTube video](#) detailing how Weintek leads the industrial world in its implementation of sophisticated capacitance-based gesture controls on its HMIs. Case in point: The [cMT-3162X full-HD HMI](#) offers stunning resolution in a large format and haptic feedback — including slight vibrational feedback when virtual buttons are pressed. That very slight vibrational feedback is especially useful on a loud factory floor, when other confirmational feedback in the form of short beeps and other auditory confirmation may go unheard.

These capabilities are made possible with capacitive-touch subcomponents and complementary firmware in the HMI. [Click on this deep link to a YouTube.com video about the Weintek cMT3162X 15.6-in. FHD capacitive-touch HMI](#) for more about what such functionality allows in industrial settings on very large HMIs.



The capacitive-touch and haptics features of Weintek HMIs have shortened the time that industrial automation components tend to technologically lag consumer electronics.

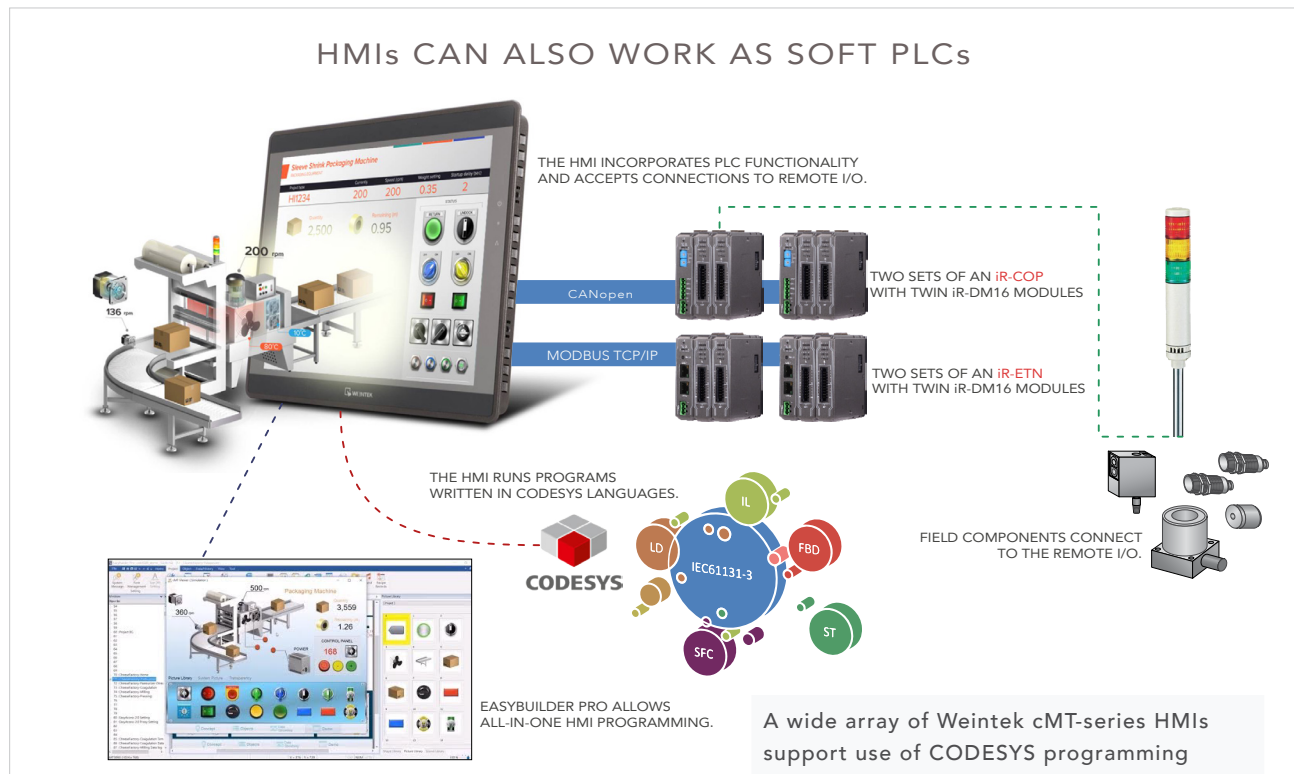
In fact, machine builders can now leverage the specifics of what an HMI's various capacitive-touch gestures do. For example, a three-finger swipe right might change what menu the HMI displays — eliminating the need for a button on the homescreen to flip through screens. In a similar way, a five-finger pinch down on the HMI surface might take the user back to a designated homescreen. Three fingers up from the bottom might give the user a half menu to allow adjustment of the HMI's brightness and more. All of this is programmable — and leverages the familiarity that so many people have with these gestures thanks to their use of personal devices.

Employing HMIs for control tasks

Reconsider HMIs (sometimes called controller HMIs) that (besides their interface tasks) also serve as soft PLCs. These HMIs must contain suitable hardware with:

- Sufficient processing and memory capacity
- Ethernet, I/O, COM, and other modes of connectivity
- Programming

For the latter, a leading approach is to use IEC 61131-3's Controller Development System (CODESYS) to create (and download to a controller HMI) all necessary programming — then monitor the soft PLCs



running projects can visualize on the HMI with configuration done through Weintek's programming environment, which is called EasyBuilder Pro (EBPro). Despite some changes in the automation industry over the last few years, CODESYS remains most common for its supports of five programming languages. In fact, CODESYS excels for PLC setup.

Visit [this deep link](#) on weintekusa.com for the white paper *Better use of remote I/O with CODESYS-programmable controller HMIs* detailing this type of HMI functionality.

Earlier in this white paper, we detailed the dual processors within cMT HMIs — so one serves only HMI functions (such as data collection, displaying information, and batch processing) and the other only soft-PLC functions. Also mentioned were the quad-core 1.6-GHz processors Weintek puts into its newer X-series HMIs for top-

performance real-time controls and connectivity. Here, segregated HMI logic and control logic mean heavy processing demand from either has no bearing on the HMI's other tasks. Plus, the asymmetric multi-processing architecture (unlike the symmetric multiprocessing or SMP of most computers running one OS across all their CPU cores) lets Weintek use various OS combinations on one HMI's CPU board.



The new **cMT-FHD-X-220** screenless HMI has an external touchscreen.

About Weintek

Weintek's industry-leading HMI technology gives design engineers:

- Unique feature combinations not available from other suppliers
- An easy-to-implement ecosystem of hardware and software
- Reasonable pricing on components with advanced functions
- Flexible systems for OEMs looking to break from traditional suppliers having rigid design mindsets

Weintek also makes the process of changing design approaches easier for engineers tasked with implementing “factory of the future” solutions — recognizing that change can initially represent extra work and challenges for design teams that are comfortable with established design approaches.

Weintek develops, designs, and manufacture of practical HMI solutions in the new IIoT era. WEINTEK LAB's mission is to provide quality, customizable HMI-solutions that fulfill industrial automation requirements while maintaining customer satisfaction by providing on-demand customer service. Since the North American branch opening of Weintek USA in 2016, Weintek's innovative technology has been available for direct purchase in the USA and Canada.