

HOW TO USE IOT GATEWAYS WITH SERIAL OR ETHERNET BRIDGES FOR UPDATING LEGACY MACHINERY

IoT functionality is vital to modern automation. Here we explain networking devices called IoT gateways and how these connect machines and systems to the Cloud.



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Today, 20 billion connected devices have Internet of Things (IoT) capabilities. With the rise of these devices have come staggering amounts of data along with technologies to make the most of system bandwidth. Such technologies include new IoT gateways which connect systems and their HMIs, sensors, and controls to other machines and the Cloud for top machine functionality.

IoT gateways join dissimilar networks to ...

1. Integrate a wide range of machinery
2. Synchronize processes across multiple locations
3. Impart control over dataflows and subscriber access

In addition, IoT gateways enable new modes of industrial automation and control to ...

1. Allow sharing of legacy control-platform data to modern databases and SCADA systems
2. Add data logging and log-backup capabilities to legacy control platforms
3. Add event (alarm) logging and messaging as well as event-log backup capabilities to legacy control platforms

What's more, IoT gateways:

- Execute *edge computing* functions — by processing and condensing feedback signals for only relevant or anomalous data
- Communicate information to higher networks and the Cloud
- Improve supply-chain efficiency by enabling the sharing of real-time production demand with vendors

**What are gateways and other connectivity components?
Basic definitions**

Switches, routers, and bridges in industrial applications: Recall that switches in the context of industrial automation are pieces of hardware with arrays of ports to accommodate and connect *network nodes* — points on the machine that transmit, accept, or otherwise handle data.

In contrast, routers simply direct (route) data between nodes on single-protocol networks — usually employing tables to make decisions and connecting local and wireless area networks (LANs and WANs). Data packets are sent to destinations based on internet protocol (IP) addresses. One caveat here is that automation devices often have their own communication protocols and data formats. So just connecting them to a router won't make the data and controls widely usable.

A third type of hardware for industrial networking called bridges join similar networks (or LANs on one protocol) to serve as data links with an input and an output ... and essentially function as repeaters capable of filtering data.



Weintek cMT-G03 and Weintek cMT-G04 gateways are part of the manufacturer's cMT Series that helps users solve industrial control and connectivity challenges. The latter are a cost-effective gateway option for Ethernet-based HMI and PLC functions. A small form factor simplifies integration into existing IT infrastructure and onto various machines.

As we'll explore, Weintek USA doesn't offer standalone switches or routers. Instead, the manufacturer supplies powerful multipurpose hardware and data-handling devices for automated applications (including robust I/O devices, HMIs, and gateways) that often incorporate these more basic building blocks of networking to satisfy the needs of Big Data and Industry 4.0.

Gateways: How they work and what they do

Gateways (in some contexts called protocol converters) operate on multiple network layers. They join dissimilar networks by making the necessary physical connections and required protocol conversions where applicable. In this way, gateways function as messaging agents to collect one system's data and then interpret and send it onward to some other network or system.

Some gateways even process application data with onboard microcontrollers to reduce how much machine nodes must perform such tasks. That way, nodes can be simpler and less costly, which is especially helpful in facilities running operations that necessitate huge node arrays.

Case in point: Weintek's cMT-G03 and cMT-G04 gateways include super-fast 32-bit RISC cortex-A8 600 MHz processors (protected by fanless cooling) and built-in 256-MB flash memory for processing; they also support MPI communications with a 187.5K baud rate. These gateways execute many of the data-related tasks typically associated with HMIs, which is useful where a screen for users isn't required. These tasks include the running of macros for control tasks and data-transfer functions; concurrent

cMT-G04 IIoT GATEWAY with Ethernet bridge



Memory	Flash	256 MB
	RAM	256 MB
Processor		ARM RISC 528MHz
I/O Port	SD Card Slot	N/A
	USB Host	N/A
	USB Client	N/A
	Ethernet	LAN:10/100 Base-T x1 SW1, SW2:10/100 Base-T x1 (2 port Ethernet switch)
RTC		Built-in
Power	Input Power	10.5~28VDC
	Power Isolation	Built-in
	Power Consumption	270mA@12VDC • 150mA@24VDC
	Voltage Resistance	500VAC (1 min.)
	Isolation Resistance	Exceed 50MΩ at 500VDC
	Vibration Endurance	10 to 25Hz (X, Y, Z direction 2G 30 minutes)
Specification	PCB Coating	Yes
	Enclosure	Plastic
	Dimensions	109 x 81 x 27 mm
	Weight	Approx. 0.14 kg
	Mount	35 mm DIN rail mounting
Environment	Protection Structure	IP20
	Storage Temperature	-20° ~ 60°C (-4° ~ 140°F)
	Operating Temperature	0° ~ 50°C (32° ~ 122°F)
	Relative Humidity	10% ~ 90% (non-condensing)
Certificate	CE	CE marked
	UL	
Software		EasyBuilder Pro V6.01.02 or later versions

On the cMT-G04, SW1 and SW2 connect to machine network and a LAN port connects to company or wider factory network.

cMT-G03 IIoT GATEWAY with serial bridge



Memory	Flash	256 MB
	RAM	256 MB
Processor		ARM RISC 528MHz
I/O Port	SD Card Slot	N/A
	USB Host	N/A
	USB Client	N/A
	Ethernet	10/100 Base-T x 1
COM Port		COM1: RS-232 2W, RS-485 2W/4W COM2: RS-232 2W, RS-485 2W/4W
RTC		Built-in
Power	Input Power	10.5~28VDC
	Power Isolation	Built-in
	Power Consumption	300mA@12VDC • 150mA@24VDC
	Voltage Resistance	500VAC (1 min.)
	Isolation Resistance	Exceed 50MΩ at 500VDC
	Vibration Endurance	10 to 25Hz (X, Y, Z direction 2G 30 minutes)
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Certificate	CE	CE marked
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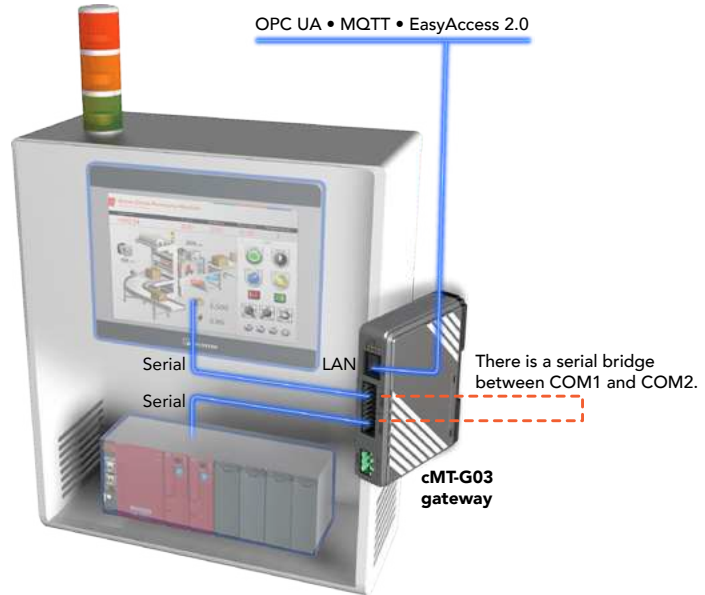
The Weintek cMT-G03 gateway lets engineers upgrade existing serial-based controllers and touch panels without modifying any code. There is a transparent passthrough between COM1 and COM2. Hardware connectivity includes an Ethernet port (to connects to a machine network) and transparent serial port (RS232, RS485-2W or RS485-4W) One for existing HMI and one for existing PLC.

cMT-G03 for IIoT CONNECTIVITY

Upgraded IIoT setups employing a Weintek cMT-G03 require no additional serial interface, as the gateway integrates this and other networking subcomponents.



Legacy (isolated) setup

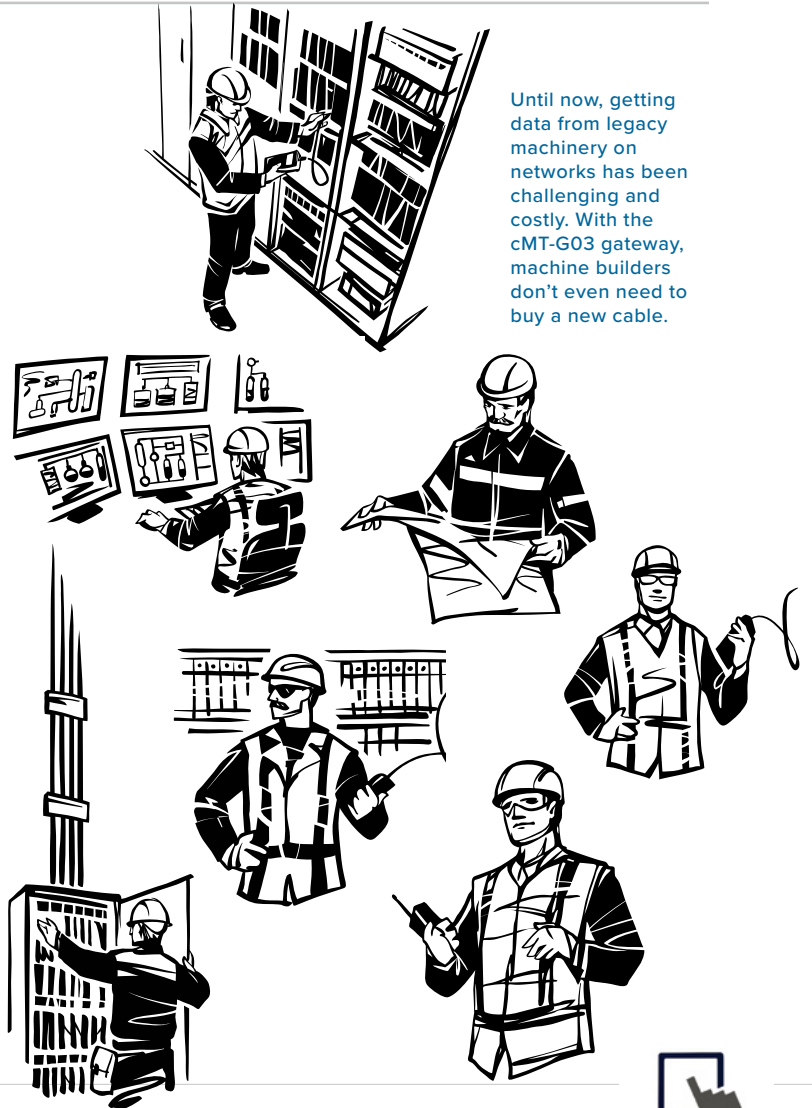


A transparent serial bridge on the Weintek cMT-G03 gateway enables updating legacy machines without modifying any code on the existing panel or controller. This makes it easy to get machine data on the former without the trouble of reconfiguring machine communications. Plus it enhances data security.

networking with many devices; sending alarm email messages or push notifications to mobile phones (via EasyAccess 2.0); logging useful alarm data; triggering general data storage; and interfacing with myriad Cloud services.

What makes a gateway an IIoT gateway: IIoT gateways take connectivity a step further and join equipment to wider networks and the Cloud (via wired or wireless means) for full enterprise-level use of automation capabilities. With complementary software, IIoT gateways also eliminate the complicated challenges of bridging for connectivity. This simplifies commissioning and even allows remote machine management, firmware updates, and configuration. Many IIoT gateways can organize and process data from machine nodes to make it transmissible over the Internet; these also accept data from the Cloud and distribute it to machine nodes.

Internet connections require that IIoT gateways prevent problems associated with service interruptions — for example, by keeping machine networks and the LAN functioning by buffering data to the Internet upon resumption of service. Internet connections of any type also necessitate security measures. Manufacturing operations in particular need features that isolate company and machine networks. This is why some IIoT gateways protect the machines and systems they connect with a multi-faceted approach to security — employing high-level encryption, local user control of



Until now, getting data from legacy machinery on networks has been challenging and costly. With the cMT-G03 gateway, machine builders don't even need to buy a new cable.

remote access, and isolated hardware design. Security on Weintek cMT-G04 gateways is ensured in these ways. An isolated Ethernet port communicates with the company network, and twin network adapter cards on cMT G-series gateways (mentioned earlier) can only pass predefined data to each other ... with the builder having full control over what data points can be accessed.

Of course, many plant engineers also want to store their data directly to a database without an intermediate PC to execute this job. Taking the PC out of the equation boosts security, overall system reliability, and ease of integration. Many functions traditionally performed by a PC can be handled by Weintek cMT G-series gateways — including OPC UA tasks. That's why the cMT-G04 gateway includes MySQL and Microsoft SQL Server database communications.

Overcoming the challenges of retrofitting designs

Traditional means of retrofitting for IoT functionality by modifying system architecture: Consider how on non-networked and distributed systems, even the common task of changing machine parameters is difficult — requiring that an engineer or technician walk to each machine and manually enter parameters. Lack of data accessibility also means potential problems in the factory can go unnoticed and eventually lead to defective end products.

No wonder so many facilities are retrofitting their systems for connectivity ... and the IoT use of machine data for automating processes or improving facility operations.

The first step in imparting IoT functionality is to get data from existing communication interfaces, most commonly through serial and Ethernet ports. But integrating miscellaneous factory-automation equipment can be challenging, especially where disparate



Shown here from left to right are the Weintek cMT-G01 with three serial ports (RS232, RS485-2W and RS485-4W); the cMT-G04 IIoT gateway with Ethernet bridge and built-in Ethernet switch — and SW1 and SW2 to connect to the machine network and a LAN port to connects to the company network; the cMT-G03 gateway; and cMT-G02 IIoT gateway with Wi-Fi connectivity to connects to company network, on Ethernet port (eliminating the need to rewire Ethernet cables); and three serial ports (RS232, RS485-2W and RS485-4W) to connects to three different serial buses at the same time.

machines in a facility use different controllers. It can be particularly difficult to integrate machine operations into IT/OT monitoring and SCADA and enterprise resource planning (ERP) systems, partly due to how there are multitudes of different protocols.

What's worse, traditional upgrade approaches usually force engineers to buy several pieces of hardware. Sometimes it's hard to choose the hardware (such as switches, for example) and all that hardware can be especially costly if the design needs industrial-grade components.

Simpler approach (and enabling software) to retrofit machines with IoT connectivity: Weintek cMT-G03 and cMT-G04 or smart communication gateways give plant managers and end users

a simple solution for updating legacy equipment. The cMT-G03 gateway model has two COM serial ports and one LAN/WAN Ethernet port and can work as a serial bridge. The cMT-G04 gateway includes two built-in SW switches and one LAN/WAN Ethernet port and works as an Ethernet switch for connecting existing machine devices and IIoT systems without needing modifications to existing networking architecture. A technician simply plugs in communication cables already on the legacy system, and the machinery immediately connects to IIoT — even while operating no differently than before.

In addition, both the cMT-G03 and the cMT-G04 independently communicate with machine devices and convert common protocols to MQTT, OPC UA, and SQL.

Software to facilitate setup: The cMT-G03 and cMT-G04 gateways accept setup via Weintek’s EasyBuilder Pro. This integrated development environment includes multi-language support and communication drivers with guaranteed compatibility — which minimizes design effort and cost. Weintek cMT-G03 and cMT-G04 gateways also run Weintek EasyAccess 2.0 software. This allows remote access to machines and push notifications to mobile devices about machine health and other parameters.

Summary of protocols that IIoT gateways connect and serve

Cloud services on industrial systems include I/O and software that handles raw machine data and feedback by manipulating and analyzing that data. Then the distilled data is put to use.

MQTT (Message Queuing Telemetry Transport) is a protocol that supports communications from sensors and mobile devices with scalability. Weintek cMT G-series gateways support this popular and growing protocol.

BRAND	DRIVER COVERAGE
CD Automation	All
ELSIST S.r.l.	All
FATEK AUTOMATION Corp.	All
KEYENCE Corp.	All
KOYO ELECTRONICS CO., LTD.	All
LS industrial Systems	LS MASTER-K MODBUS RTU
LS Mecapion	LS Mecapion Metronix AnyPack
Mitsubishi Electric Corp.	All
MODBUS IDA	All
OMRON	All
Panasonic Electric Works	PLCs (no servomotors)
Rockwell Automation	Allen-Bradley CompactLogix/FlexLogix Allen-Bradley DF1 Allen-Bradley PLC5
Schneider Electric	All but Uni-Telway
Shenzhen Inovance Technology	All
Siemens AG ... and for token-based buses such as MPI, no pass-through is needed	TI505 TI565
Trio Motion Technology	All

Weintek cMT G-series gateways also include built-in support for OPC UA. The OPC Foundation has officially certified the OPC UA server on these gateways for compliance, which ensures seamless device integration. The built-in server can change communication settings, add or modify or delete OPC UA nodes (and their corresponding PLC data) and change PLC communication parameters.

IT/OT management with SCADA and ERP systems: The Weintek cMT-G04 gateway with Ethernet bridge can serve as a bridge to multiple IIoT services. Web configuration is through a standard web browser, which simplifies system maintenance. Available functions that are configurable and accessible through the Internet include system and OPC UA settings, PLC communication parameters, and data and event logs.

SQL: Weintek cMT G-series gateways support Structured Query Language (SQL) database synchronization of data logs and event logs to MySQL and MS SQL database servers. That simplifies access for IT personnel — especially when compared to setups that employ a Raspberry Pi for computing or a more complex PC-based





With more than 20 years of experience in industrial automation, Weintek has an array of laboratory equipment (including environment, drop, vibration, and endurance test machines) to ensure its components are rugged and will work perfectly in industrial environments.

IoT database interface ... as most such systems require the integration of multiple hardware and software solutions to complete the loop.

What to know about the Amazon Web Services (AWS) Cloud service: Amazon Web Services Inc. offers Cloud-based services to give users database storage, applications, and on-demand computational power and IT resources. In some setups, gateways can interface with AWS's application programming interface (API) gateway; the latter lets engineers create and host APIs for gateway-to-Cloud connectivity. This enables aggregation of data in:

- An Amazon S3 bucket — public Cloud-based data storage in the AWS product called Simple Storage Service (S3)
- An Amazon DynamoDB database — a managed service that gives users summaries and analytics of their data

Otherwise, with the AWS Lambda service (supporting Python, Node.js, Java, and C#) engineers can make the design run Cloud-based code without provisioning servers for that beforehand.

As mentioned, Weintek cMT G-series gateways include built-in support for MQTT. Because MQTT in turn supports Amazon AWS IoT, the cMT G-series gateways are suitable solutions for enterprises that employ the Amazon AWS.

Note that Weintek cMT G-series gateways can also be configured as **MODBUS TCP/IP gateways**.

The rest of the cMT product line — and other Weintek USA offerings

The Weintek cMT family of products includes four different cMT-G gateway models; cMT-SVR server devices; a cMT-FHD headless operator interface; and an array of sophisticated cMT touch panels, industrial PCs, and smart HMIs.

WEINTEK develops, designs, and manufactures practical HMI and connectivity solutions for the new IIoT era. WEINTEK LAB aims to provide quality, customizable 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. For more information, call Weintek USA at 425.488.1100 or visit weintekusa.com.