LEVERAGING CONNECTIVITY

A network analyzer that's boosting buildings' energy efficiency

Buildings account for 30 percent of global final energy use and 29 percent of the world's energy-related CO_2 emissions. But connected devices such as ABB's new M4M network analyzers are helping to reduce this impact by allowing accurate real-time energy data monitoring and enabling customers to improve building performance.

Today's buildings are running smarter thanks to accurate, real-time energy data monitoring provided by devices such as ABB's new M4M network analyzers.

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According to the UN's 2017 Environment Global Status Report, commercial and residential buildings account for 30 percent of global final energy use and 29 percent of the world's energy-related CO_2 emissions [1]. Daunting as these figures are, the report nevertheless notes that "building sector energy intensity (in terms of energy use per m^2) continues to improve at an annual average rate of around 1.5 percent."

Indeed, today's smarter buildings, which interconnect digital energy monitoring and control devices, have attained levels of efficiency that were impossible before the emergence of the Internet of Things (IoT) and scalable technology. For instance, connected devices, such as ABB's new M4M network analyzers, allow accurate real-time energy data monitoring and enable customers to improve building performance while reducing impact on the environment.

Connected devices, such as ABB's new M4M network analyzers, allow accurate real-time energy data monitoring.

Robust real-time monitoring

The first range of Bluetooth-equipped and ABB Ability™-native network analyzers from ABB, the M4M family, enables complete power-quality analysis and accurate energy-efficiency monitoring for commercial and industrial buildings, as well as data centers →01.

In commercial buildings, integration into ABB's scalable portfolio of energy and asset management digital solutions allows for efficient and rational use of real-time energy consumption and power monitoring, to avoid peak utility fees and penalties. In industrial buildings, M4M delivers easy monitoring and control of the power network to avoid outages, equipment damage and interruption of critical operations. User-defined alerts enhance reactivity to potential events in the electrical system, improving operations and allowing faster maintenance.

Also suitable for use in data centers, M4M network analyzers enable robust power chain and power quality monitoring, preventing damage

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M4M network analyzers cover everything from design and specifications to installation and commissioning.

to installed equipment and avoiding tripping or overloading, which can result in downtime. M4M network analyzers thus cover the complete customer experience, from design and specifications to installation and commissioning, as well as operations and maintenance →02.

Family feeling

M4M analyzers are available in two versions →03, the M4M 20, which is equipped with a graphic color display and 5-button keyboard, and the M4M 30, which is outfitted with a touchscreen color display, thus easily presenting power-monitoring information from basic to complete power quality analysis as well as energy efficiency evaluations. Thanks to the resulting family of characteristics, demands on customer learning are reduced.

These characteristics include a complete set of embedded communication protocol and I/O options for both versions in dedicated product codes, the same housing, the same installation and wiring process, and the same human machine interface (HMI), with product segmentation in terms of device access and measurement features. Both models' HMIs follow the ABB UX guidelines for intuitive interfaces, covering contents and the naming and order of menu items, thus making it easy to use any product type in the M4M range. The only difference is that the HMI is divided into 4 sections in the M4M 30, and 3 sections in the M4M 20.

Scrolling through a world of data

Naturally, data reading is an essential part of the HMI in any measurement device because it allows users to instantaneously read out minimum, maximum and average values of

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real-time parameters such as voltage, current, and power, as well as power quality KPIs such as total harmonic distortion (THD) and unbalances for voltage and current, all of which must comply with IEC standards.

The measurement data also includes energy values, which are either divided by tariffs for Time of Use (TOU) metering or are represented in 4 quadrants not only as energy consumption but also as local energy generation. Scrolling through and accessing needed information requires only a few steps through the menu, which provides clear lists and sub-menus, with titles and subtitles →04.

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Thanks to a family of characteristics, including the same I/O options and HMI, demands on customer learning are reduced.

The HMI's second section is called "Graphs." This enables visualization of bar graphs of the main real-time parameters and waveforms →05 by storing signal samples over 2-line cycles. Also, M4M network analyzers provide visualization of harmonics in order to identify eg if non-linear loads are affecting a power system. Voltage and current harmonics are displayed up to 15th on the HMI, while harmonics up to 40th are available via communication. Furthermore, the relationship between voltage and current is presented via phasor diagram and phasor data as numerical values →06.

The M4M 30 presents a historical view of key measurement data, which is supported by a 7 MB flash memory. This function makes it possible to

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store average values of the main real-time measured quantities over a specific time interval, as well as three max and three min demand values, which are referred to as specific time intervals, for up to 25 user-defined channels of memory →07.

Energy snapshots and energy trends provide visualization of energy consumption curves for 20 energy parameters over a given period, respectively. Each graph contains the last 12 stored energy values.

Configuration of network analyzers is made easy and quick by a list of default values, an intuitive data entry process and by pop-ups that provide feedback to the user. Security is ensured by

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Energy snapshots and trends provide visualization of consumption curves for 20 energy parameters over a given period.

user-defined passwords designed to avoid any modification by unauthorized personnel →08. An audit log inside the meter stores the meter's configuration data and creates a timestamp every time a major modification is carried out.

Furthermore, a commissioning wizard is available to guide the user during the first basic settings of the device such as when a network analyzer is first powered up or following a factory reset.

Notifications are available that can be divided into alarms, warnings and errors. Alarms represent threshold violations and can be stored in logs, as well as being linked to I/O. The M4M 30 can process complex alarms. This allows simple alarms to be combined into a single entity. Warnings are related to installation conditions, while errors are routed to device self-diagnostics.

Data that's easy to see

M4M HMI software uses advanced embedded graphic libraries outfitted with sophisticated graphical primitives that perfectly match the native 320 x 240 pixel (QVGA) 3.5-inch color display, thus supporting up to 65k colors. The result is excellent visibility of real time values, trends, icons and 2D graphs regardless of lighting conditions.

M4M display management is supported by an internal microcontroller unit (MCU) optimized for supporting Latin, European, Cyrillic and simplified UNICODE character sets. This gives the HMI's menus the flexibility to be displayed in local languages, including simplified Chinese characters.

Fully connected power monitoring

M4M analyzers are equipped with Modbus, BACnet/IP and Profibus DP-V0 state-of-the-art industrial protocols. These cover the main target applications for power quality analysis.

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03 The HMI on the M4M 20 is divided into 3 sections, whereas it is divided into 4 sections on the M4M 30.

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04 Accessing key data requires only a few steps.

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05 The HMI enables visualization of bar graphs of the main real-time parameters and waveforms.

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06 The relationship between voltage and current is presented via phasor diagram and phasor data as numerical values.

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07 The M4M 30 presents a historical view of key measurement data, which is supported by a 7MB flash memory.

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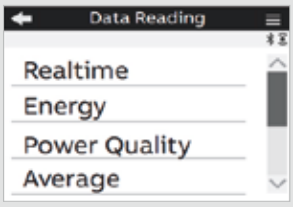
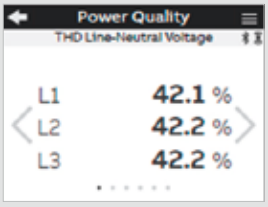
08 At first power-up or after a factory reset a "first commissioning wizard" is available, which guides the user through basic device settings. Security is ensured by user-defined passwords designed to avoid any modification by unauthorized personnel.





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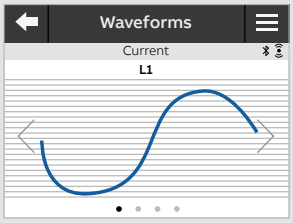

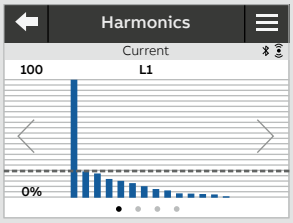

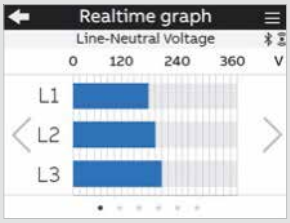

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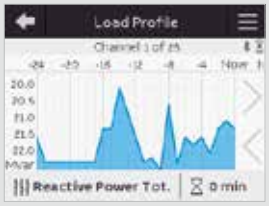

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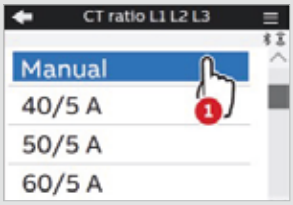

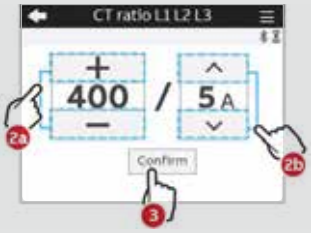

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The devices' communication interface makes it possible to remotely access their data and thus integrate them into DMS, BMS, SCADA systems or cloud services.

A protocol specifically designed for building automation, BACnet guarantees the full interoperability of M4M analyzers with BACnet-compliant devices using clear and unambiguous rules to communicate among devices. This arrangement,

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An internal microcontroller unit (MCU) supports Latin, European, Cyrillic and simplified UNICODE character sets.

M4M ANALYZERS IN A NUTSHELL

Full connectivity
ABB Ability™-native and Bluetooth-equipped M4M analyzers benefit from the scalability of the ABB energy and asset management solution: from local HMI, EPiC mobile APP and Ekip Connect desktop software for stand-alone visualization and commissioning, to a complete electrical systems view via ABB Ability™ EDCS.

Simple and intuitive
Compact dimensions, removable terminals and Rogowski coils make configuration simple and fast. Intuitive use and data access are ensured by a touchscreen color display, mobile APP and desktop software.

Energy efficiency
M4M network analyzers ensure complete power quality analysis and highly-accurate energy efficiency monitoring of electrical parameters and advanced power quality KPIs, enabling easy data aggregation and straightforward benchmark analyses through the ABB Ability™ EDCS.

Real-time supervision
M4M network analyzers make information accessible from any area of a system. They allow reactivity improvement in case of any event in an electrical system in order to avoid overloads, outages and uncoordinated maintenance, thanks to a comprehensive range of accurate data and interactive notifications.

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which is in full compliance with BACnet Testing Laboratories (BTL), is designed to futureproof the customer's investment.

And when it comes to mastering industrial automation processes, M4M analyzers' Profibus interface is ideal, as it allows integration with multi-master real-time communication networks.

All M4M analyzers are equipped with Bluetooth Low Energy module version 4.2. Wireless communication connects M4M to the EPiC mobile app (available for IOS and Android systems). The EPiC app allows efficient commissioning of M4M when a large number of units are being installed. This allows quick configuration by replicating meter settings on multiple devices. Communication between M4M and EPiC mobile uses encryption algorithms to protect data as it is being transferred and to authenticate connected devices, while fulfilling stringent cybersecurity requirements to avoid man-in-the-middle attacks.

> M4M analyzers' Profibus interface allows integration with multi-master real-time communication networks.

Scalable services
ABB is focusing on providing complete solutions, from individual M4M analyzers all the way up to full integration in the ABB Ability™ Electrical Distribution Control System (EDCS) cloud-computing platform.

When M4M is authorized to automatically access ABB Ability™ EDCS, it recognizes installed product versions and reads out the required registers, resulting in a seamless integration process. With M4M connected to ABB Ability™ EDCS, customers are not only able to have a full view of their energy demand but can optimize it →09.

Customers have the option of remotely configuring their M4M analyzers using Ekip Connect desktop software. This makes it possible for them to update an analyzer's firmware by accessing ABB Library servers using encrypted images, which ensures that only ABB original firmware is being installed on a device.

Hardware architecture
The M4M family of analyzers provides a range of peripherals. Different I/O options and

communication alternatives, together with two display choices, add up to a total of 13 potential configurations – a level of flexibility that is supported by the analyzer's modular approach to hardware and software design.

Printed circuit board assemblies (PCBAs) are stacked together →10. Peripherals can be configured by using dedicated PCBAs, which enable input/output and communication functions. This

> Customers are not only able to have a full view of their energy demand but can optimize it.

makes it possible to swap digital I/O, analog out, serial communication, Ethernet communication, or Ethernet with a daisy chain.

The bottom board is responsible for power supply and measurements. It makes it possible for users to choose between regular and Rogowski coil support. The top board hosts the main microcontroller, Bluetooth, HMI support, memory, RTC, LED, and part of the analog circuit. Two variants of this PCBA make it possible to choose between a touch display and a push-button HMI.

The analyzer's main application runs on a microcontroller with ARM M4 Cortex core, which provides ideal support for its real-time operating system as it manages analogue signal processing, mathematical algorithms for power quality analysis, display and communication control.

Wireless communication is supported by a dedicated coprocessor in charge of RF communication to the host.

M4M Production automation

M4M analyzers are assembled and tested in a high-capacity automated production line that ensures seamless traceability of all components as well as of test results from the first assembly station all the way to final boxing and storage. Handling robots controlled by a central computer gently move the analyzers from one test station to another until all verifications are successfully passed.

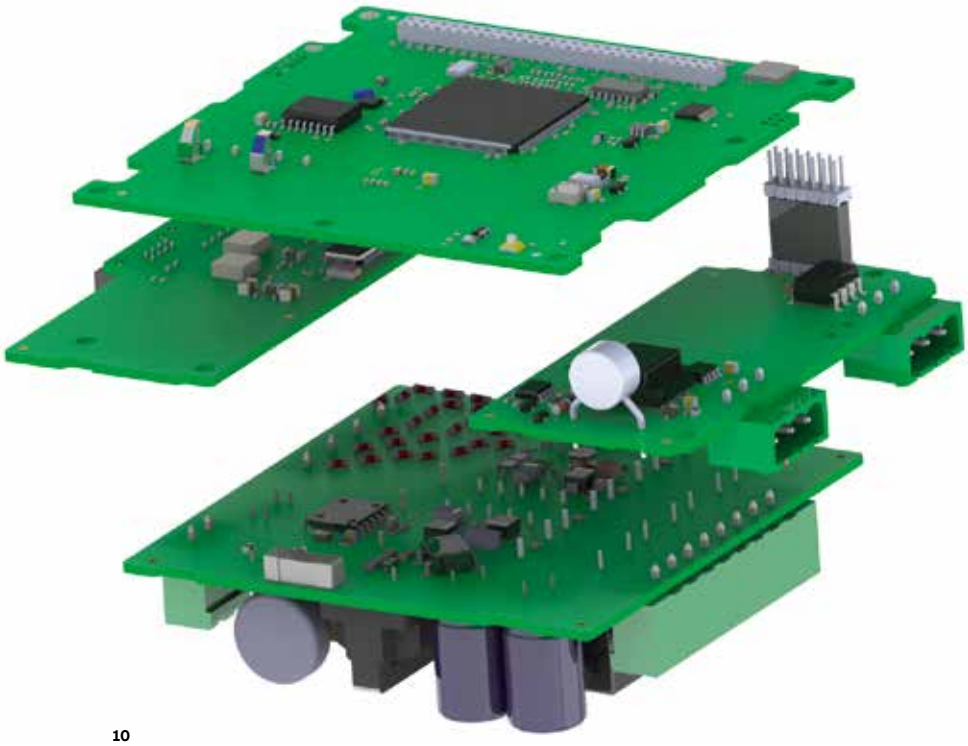
A remarkably accurate current and voltage generator feeds the most important test stations with precise current and voltage signals, ensuring the highest signal quality during the calibration process on 100 percent of the analyzers produced. The narrow acceptance criteria ensure that only perfectly calibrated products reach ABB's customers. •

09 Key advantages of M4M analyzers.

10 Peripherals can be configured by using dedicated PCBAs, which enable input/output and communication functions.

References

[1] See page 14 of: https://www.worldgbc.org/sites/default/files/UNEP%20188_GABC_en%20%28web%29.pdf



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