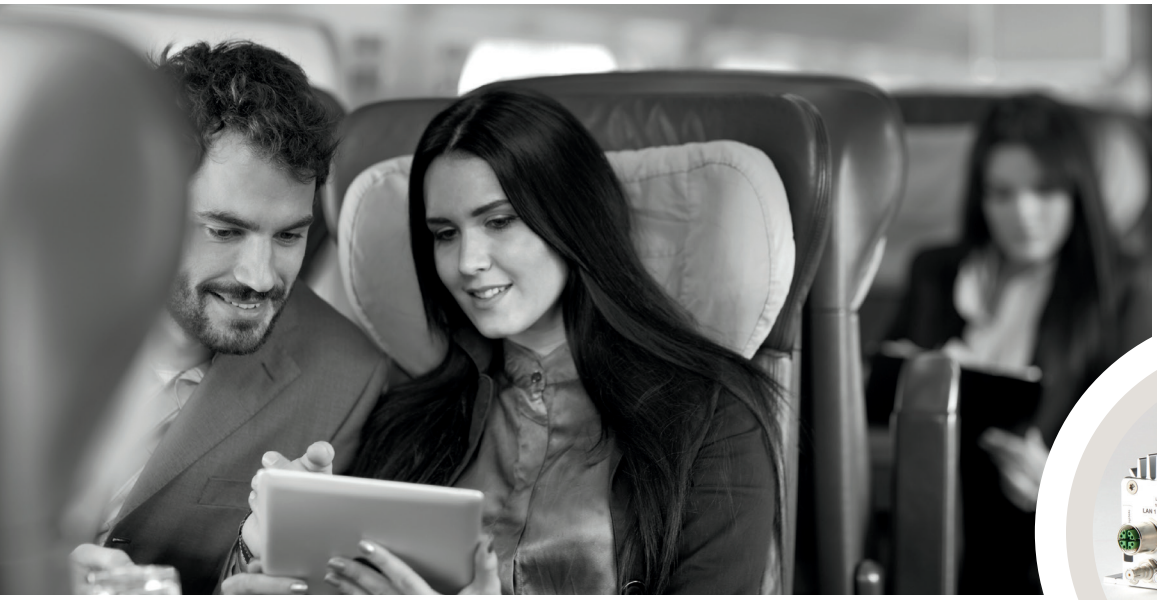
ELTEC systems

WIRELESS

COMMUNICATION SYSTEMS



WIRELESS COMMUNICATION SYSTEMS FOR DEMANDING APPLICATIONS

For private persons gaining stable and secure access to the internet is regarded a fundamental right. For companies it is inevitable for their success. Gaining and sharing information has become a key factor of companies' competitive strategy. With the CyBox line ELTEC provides key elements of the required infrastructure for information exchange in industrial and mobile environments, such as public transportation, agriculture and heavy duty machinery, or general industry.

THE FAMILY OF WIRELESS COMMUNICATION SYSTEMS COMPRISES OF TWO MAIN PRODUCT LINES

CYBOX AP	CYBOX LTE
Wireless Access Points	Wireless Routers

Information generated inside vehicles, i.e. maintenance or other operational data, needs to be transferred to central servers, a back office, or a service team. Vice versa, data needs to be received in vehicles, such as updated schedules, seat reservations, or positioning information. In addition, internet access for passengers requires land-generated data to be distributed to passengers' mobile, wireless devices.

In large installations, such as complete trains, the vehicle-land connection is the task of a central server which sends data over a wire-based backbone within the train. Attached CyBox APs distribute this content over the air to passengers as well as collect data from sensors. In smaller installations, for example in a bus, a CyBox LTE is used to hold the vehicle-land connection via LTE and simultaneously route the information to either wire-attached or wireless client devices.

Both product lines are particularly designed for demanding markets with requirements in terms of maximum throughput, physical and electrical robustness, as well as long term availability. The products are available in different case designs to account for different mounting situations and environments. They have no serviceable parts and operate in ambient temperatures between -40 and +70 °C without forced air cooling. The use of industry proven M12 connectors supports the overall robustness of the devices.

The CyBox AP and CyBox LTE provide very flexible powering options. They can be powered by a local DC power source (24 … 110V DC) or via power-over-Ethernet.

The CyBox AP and CyBox LTE products provide elaborate management software, offering extensive means to configure the devices using their web interface, or, on command line level, by dedicated commands and scripts.

The integrated and programmable firewall ensures maximum security, also by isolating clients from each other. All configurations can be stored inside the devices or uploaded to a server. Some variants also offer the possibility to load the device configuration via USB.

PASSENGER INFOTAINMENT AND INFRASTRUCTURE SOLUTIONS

THE FAMILY OF WIRELESS COMMUNICATION SYSTEMS OFFERS FIVE SUPPLEMENTARY PRODUCT LINES

CYBOX MP
Mobile Computing Platform

CYBOX CS
Communication Server

CYBOX GW
Mobile Wireless Gateway

CYBOX ED
Ethernet Data Concentrator

CYBOX DC
Mobile Display Computer

The CyBox MP is a powerful computing platform for mobile applications such as video streaming, video or data recording and others. With its Intel Atom 38xx CPU the CyBox MP is especially well equipped for video encoding and decoding. It offers interfaces for wired Gigabit Ethernet as well as for wireless WiFi/LTE. The CyBox MP is designed for passenger infotainment and video surveillance as well as video storage for forensic purposes. As an option, the two hard disks are mounted on user exchangeable trays for creating rotating archives.

The CyBox CS is a communication server with a powerful CPU supporting 4 to 6 LTE interfaces for increased data throughput. It serves as the head station in large systems.

The CyBox GW is a mobile wireless gateway system, serving as media source in smaller systems. It combines multiple LTE and WiFi interfaces with hard disk interfaces and downstream Ethernet circuitry.

The CyBox ED comprises a comprehensive selection of interfaces to collect maintenance data from vehicle-internal devices. Its CPU provides for Gigabit Ethernet as well as WAN connectivity. Application fields include the collection of device data and its transmission to land-based data centers. It is housed in a small but very robust case, supported by a full set of M12 interface connectors.

The CyBox DC is the centerpiece of displays for on-train passenger infotainment systems. It can drive up to two standard LCD panels with independent contents, its local CPU is used to receive information over Ethernet and to display it on the LCD screens.

CERTIFIED PRODUCTS FOR HARSH ENVIRONMENTS

Unlike indoor and stationary electronics, components used in mobile applications must meet the most severe environmental requirements. Typical ambient temperatures require electronic components to be designed for extended temperature range of -40 to +70 °C. In addition, they must be resilient with respect to shocks, bumps, vibration and humidity.

The individual target markets have established industrial standards and products for these markets.

EN 50155 REQUIRED ENVIRONMENTAL TESTS

TEST CATEGORY	SPECIFICATIONS
Climatic Tests (cold storage, cooling dry heat, damp heat)	-40 to +70 °C rise to +85 °C for 10 min
Shock and Vibration	acceleration levels depend on mounting conditions
Power Supply	must tolerate an input voltage of 0.7 UN to 1.25 UN and without service interruption, and overvoltages up to 1.4 UN without damage
Power Supply	Class S2 must bridge external power interruptions up to 10 ms
Electromagnetic Compatibility	immunity tests: - electrostatic discharge (ESD) - radiated and conducted disturbances - fast transient (burst) and surge immunity emission tests: - radiated and conducted emissions

ROLLING STOCK APPROVAL

The international standard EN 50155 applies to general electronic equipment on rolling stock and covers the conditions of operation, design, construction, and testing of electronic equipment, as well as basic hardware and software requirements. Specifically, the standard mandates a number of tests that electronic equipment needs to pass before it can be deployed in rolling stock applications.

EN 50155 COMPLIANT

The demands on the power supply in rolling stock are far more demanding than those in industrial applications. The nominal supply voltages range from 24 VDC up to 110 VDC, depending on the country standards and train characteristics. Rail applications usually require the internal DC power supply to be isolated from the external supply lines to avoid the risk of fault currents passing through the train body or possibly the track back to the battery.

Train manufacturers and operators are also concerned about fire and smoke behaviour of equipment that is on board a train. Generally the European standard EN 45545-2 is applicable for electronic equipment.

AUTOMOTIVE APPROVAL

In Europe electronic equipment must satisfy stringent requirements for the installation in motor vehicles. Type approvals of electronic equipment require defined values for electromagnetic compatibility.

The EMC tests include radiated and conducted emissions as well as immunity to radiated and conducted disturbances.

If the electronic equipment is directly connected to the on-board supplies, which is true in most cases, special protection has to be added to the internal power input as the tests include high-voltage positive and negative transients.

The EMC performance tests must be performed by a designated technical lab and submitted to the authorities for type approval. The criteria for approval also include the companies' ability to produce the electronic equipment conforming to the EMC regulations. This implies that the company has a QM system in place, and is able to freeze the parts list for the product during its life. Any change to the parts list has to be assessed for its effects on EMC. This assessment has to occur in consensus with the designated technical service and its result submitted to the approval authority.

INDUSTRY CERTIFICATION

ELTEC has a long history of serving industrial applications and thus to fulfill diverse regulatory requirements. Besides being ISO 9001 certified, connections to several notified bodies guarantee certified compliance with regulations for different applications, such as RED devices or industrial control systems (EN 61131).

WIRELESS TECHNOLOGY FOR THE TRANSPORTATION MARKET

Products for the transportation market require robustness with respect to the mechanical and electrical environment in which they are deployed. The CyBox AP and CyBox LTE –W and –R models have been particularly designed to meet these requirements.

The products are equipped with two 10/100/1000 Mbps Ethernet ports with auto-negotiation of data rate and cable crossover. The ports are internally connected to a switch and can be used to connect a second access point for improved WiFi service. The switch works independently from the access point CPU, so that internal failures do not influence traffic between the two Ethernet ports.

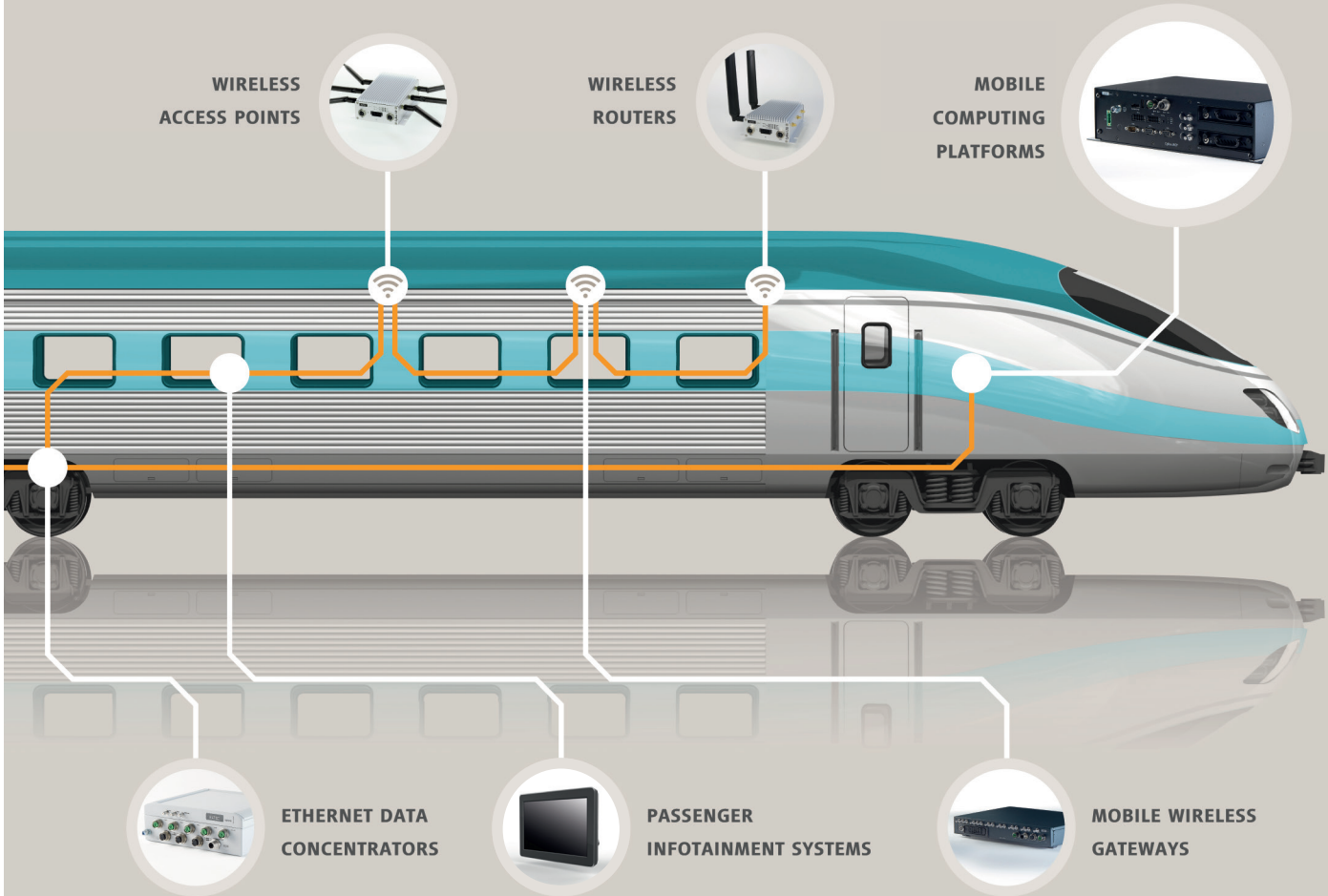
WALLMOUNT

The –W models are designed for wall mounting, i.e. behind wall or ceiling panels, or under a seat. The case provides IP40 ingress protection and is robust for maximum mechanical protection.

RACKMOUNT

The –R models are designated for rack mount. The dimensions of the robust IP40 housing allow two devices to be mounted side by side in a standard 19" rack.

Besides the PoE powering option both models feature an ultra-wide DC power supply input for nominal inputs between 24 V and 110 V, providing an effective input voltage range between 12 V and 154 V.



CYBOX AP

The CyBox AP can host two independent WiFi radios, allowing operation of flexible wireless network configurations, including different frequency bands. The WiFi interfaces are fully compliant to IEEE 802.11a/b/g/n/ac with wireless transmission rates of 920 Mbps on each interface and 2x2 and 3x3 MIMO-support.

CYBOX AP 2-W
wallmount

CYBOX AP-D
din-rail

CYBOX AP-O
outdoor

CYBOX AP-R
rackmount

CYBOX LTE 2-W
wallmount

COMMON FEATURES CYBOX AP AND CYBOX LTE

- EN 50155 compliant
- IEEE 802.11a/b/g/n/ac resp. LTE compliant
- simultaneous operation on 2.4 GHz and 5 GHz frequencies
- integrated 3-port Gigabit Ethernet switch, 2 external ports
- 24 – 110 VDC / POE optional
- -40 to +70 °C operating temperature
- integrated firmware for management and configuration

CYBOX LTE

The CyBox LTE has two independent radio modules, allowing operation of flexible wireless network configurations, including LTE / HSDPA+ / GSM / GPRS / EDGE / EV-DO, GSMR or IEEE 802.11a/b/g/n/ac compliant WiFi interfaces. LTE provides up to 100 Mbps download and 50 Mbps upload rate on each interface. For each LTE / GSM radio the CyBox LTE has up to four software selectable SIM cards for least cost routing in international traffic.

The CyBox LTE can optionally be equipped with a GNSS interface supporting GPS, GLONASS and Galileo positioning systems.

CYBOX GW

The CyBox GW is an all-in-one wireless gateway. It offers five slots for wireless modules allowing the installation of up to five LTE interfaces or combinations of e.g. three LTE modules for enhanced uplink and two WiFi modules for simultaneous connectivity. With this functionality the CyBox GW works as a mid-range LTE-to-WiFi gateway. The integrated hard drive is able to store or host local content and allows to use the device e.g. as a media server.

FEATURES CYBOX GW

- 5 miniPCI Express module slots, 4 SIM card slots for each module
- enhanced CPU to handle modules
- SATA interface for hard drives

CYBOX MP

The CyBox MP was designed to meet the requirements of mobile applications: passive cooling, an enclosure according to IP40, no moving parts, all of which make the CyBox MP resistant to shocks and vibrations and minimizes the need for preventive maintenance.

FEATURES CYBOX MP

- scalable Intel Atom 38xx-CPU (up to quad core, 1.9GHz)
- IEEE 802.11a/b/g/n/ac compliant
- UMTS/LTE
- dual SATA-interface with trays for 2 x 2.5"-storage devices
- opto-coupled I/Os
- wide range power supply (24 – 110 VDC)
- -40 to +70 °C operating temperature
- Linux OS
- EN 50155 compliant

FEATURES CYBOX ED

- scalable i.MX6 (up to quad core)
- IEEE 802.11a/b/g/n/ac or LTE compliant
- GigaBit Ethernet port
- opto-coupled I/Os
- four opto-coupled RS422/485 ports
- wide range power supply (24 – 110 VDC) / POE optional
- -40 to +70 °C operating temperature
- local Linux OS
- EN 50155 compliant

CYBOX ED

The CyBox ED comes in a robust die-cast aluminum housing. It is completely conduction-cooled. A selection of parallel I/O bits, as well as the four serial ports (RS232/485), software selectable and opto-coupled, are used for interfacing to external devices on vehicles. The local CPU with dual ARM cores running under Linux is used to communicate data to land-based servers via WiFi or via wirebased Ethernet.

CYBOX DC

The CyBox DC is designed to drive displays for on-train passenger information systems. It can directly connect to standard LCDs, its local CPU is used to receive information over Ethernet, for example in the form of HTTP-formated strings and to present it on the LCD screen. An internal web server supports these applications.

FEATURES CYBOX DC

- scalable Intel Atom 38xx CPU (up to quad core, 1.9GH)
- Ethernet port
- two independent display interfaces for 2x LVDS panels
- 24 – 110 VDC supply
- -40 to +70°C operating temperature
- Linux OS
- EN 50155 compliant

TRANSPORTATION MARKET APPLICATIONS

The transportation market has undertaken significant development towards information exchange between mobile vehicles and associated base stations. Mobile vehicles may be passenger trains, streetcars, busses, agricultural and construction machines.

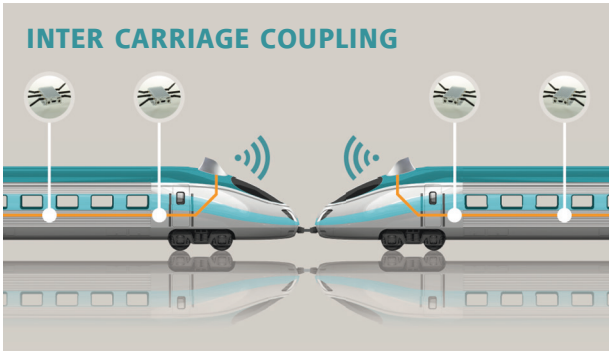
Information is generated inside those vehicles, i.e. maintenance or other operational data that need to be transferred to central servers, a back office, or a service team. Vice versa, data needs to be received by those vehicles, such as updated schedules, seat reservations, or positioning information.

PUBLIC TRANSPORTATION

The CyBox AP builds the key infrastructure element for providing internet access to passengers on board trains and buses. Its two radios operating in 2.4 GHz and 5 GHz bands simultaneously result in flexibility and large bandwidth share to each user. The integrated firewall ensures privacy of the sessions by isolating clients from each other. A large number of virtual LANs (VLAN) actively supports the network topology of the provider.

The CyBox AP also contains software for a wireless connection between train carriages. Such wireless backbones are used in retrofit applications, where there is no possibility to add Ethernet cables through the carriage coupling. The challenge is to establish and maintain such connections in an unstable environment, such as train reconfiguration, connection losses, or other trains on neighbor tracks. The firmware of the CyBox AP contains the Inter Carriage Connection Protocol ICCP, a bridging algorithm developed by ELTEC to automatically establish and maintain a wireless LAN backbone for trains.

The CyBox LTE is used to provide the vehicle-land connection. Such connections transfer internet session data for passengers as well as infrastructure information. Since the CyBox LTE can be equipped with LTE and GSMR modules at the same time it makes a very compact and universal communication unit. For international traffic the unit can be equipped with multiple SIM cards which reduce roaming costs by using local connections in each country. The position of the vehicle can be precisely detected by the integrated GPS/GNSS receiver.



AGRICULTURAL AND CONSTRUCTION MACHINES

Precision farming is based on the analyzation of large data volumes. To optimize the output todays agricultural farming solutions depend on centralized data bases with the need of a mobile data exchange. Large construction machines bind a large amount of capital making uninterrupted availability essential for their operators. Preventive maintenance concepts have been developed in order to maximize the time in service. They are based on telematics data collected from the ECUs in the machine and transmitted to the ERP system of the manufacturer.

WIRELESS TECHNOLOGY FOR THE INDUSTRIAL MARKET

The environmental and power requirements for products for general industrial markets typically deployed in stationary environments such as control cabinets are usually less demanding as in mobile applications, however more cost sensitive. The CyBox AP and CyBox LTE –D models are robust, cost optimized designs with a small footprint.

The devices are powered by 24 V DC nominal voltage, generally available in industrial environments. The supply input tolerates voltages between 12 V and 34 V continuously.

To attach to the industrial network, the products are equipped with a 10/100/1000 Mbps Ethernet port with auto-negotiation and TX-crossover, so they need no crossed cables. The network interface uses a standard RJ45 connector.

DIN RAIL

The –D models are designed for DIN-rail mounting inside control cabinets. The case provides IP20 ingress protection and all connectors and indicators are available at the front for easy installation and maintenance.

CYBOX AP

The CyBox AP-D is equipped with a standardized PCI Express minicard WiFi radio, allowing the operation of flexible wireless network configurations. The WiFi interface is fully compliant to IEEE 802.11a/b/g/n/ac, allowing a wireless transmission rate of 450 Mbps with three antennas.

CYBOX LTE

The CyBox LTE has one radio module, allowing operation of flexible wireless network configurations, including LTE/HSDPA+/GSM/GPRS/EDGE/EV-DO, or GSMR. LTE provides 100 Mbps download and 50 Mbps upload rate on each interface.

HIPERCAM A

The HiPerCam A is an intelligent camera in a very robust housing designed to observe the surroundings of large machines which are hard to overlook without special measures. In agricultural machines it is used to supervise crop being harvested and transported into in-machine intermediate storage.

The HiPerCam A can choose from several Megapixel CMOS video sensor options, has an internal CPU with dual ARM cores, running at 1000 MHz each, and operates under a local Linux. An external Gigabit Ethernet interface can transfer uncompressed video. Internal video hardware codecs support JPEG and h.264 compression. The ingress protection is IP6K9K, allowing high-pressure water cleaning.

HIPERCAM I

The HiPerCam I is used for a similar purpose in industrial applications. Many machines are housed in security enclosures, and provide no direct insight into the production process. This is where the HiPerCam I supervises the internal operation of the machine and transports a video stream to a computer, attached externally.

INDUSTRY APPLICATIONS

INDUSTRY 4.0

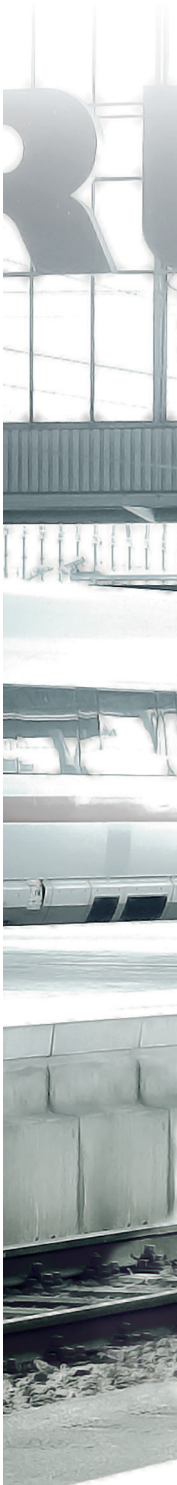
The term "Industry 4.0" refers to the fourth industrial revolution. The first industrial revolution was the mechanization of production using water and steam power; it was followed by the second industrial revolution which introduced mass production with the help of electric power, followed by the digital revolution, the use of electronics and IT to further automate production.

Characteristic for industrial production in an Industry 4.0 environment are the customized products under the conditions of mass production. The automation technology uses self-optimization, self-configuration, self-diagnosis, cognition and intelligent support of workers in their increasingly complex work.

KEY ELEMENTS OF SO CALLED "SMART FACTORIES" ARE

- Smart products – They know their history, actual status and path to completion. They communicate wirelessly with their near environment.
- Global facility – An organization-wide infrastructure to plan globally, produce locally, increase capacities on-the-spot and exploit synergies.
- Augmented operators – A technology to foster abilities of machine operators by enabling telepresence and omnipresence of knowledge in order to reduce errors.
- Social machines – Communication based shared knowledge in order to compensate down times, regulate loads, and adapt flexibly.
- Virtual production – A strategy to drive the production at its optimum and provide transparency on operating conditions and product status.

The CyBox AP plays a central role in key elements of Industry 4.0 by providing wireless access at the perimeter of large production machines e.g. in metal or wood processing. It provides connections to the individual machine, to replicate parts of the machine HMI onto a mobile device. The machine operator works more effectively and saves time. Service technicians can communicate complex cases directly with the back office and share live pictures or technical information directly at the machine – a significant increase in efficiency. The session security plays a significant role, as the machines' internal network is closed and unauthorized access can present high risks. The fact that the integrated firewall of the CyBox AP is completely accessible for configuration is a major strength in this application.



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