Easy migration with gateways

In order to integrate devices into a higher-level network, ESD Electronics provides a series of gateways and bridges linking CAN to Ethernet and to other fieldbuses.

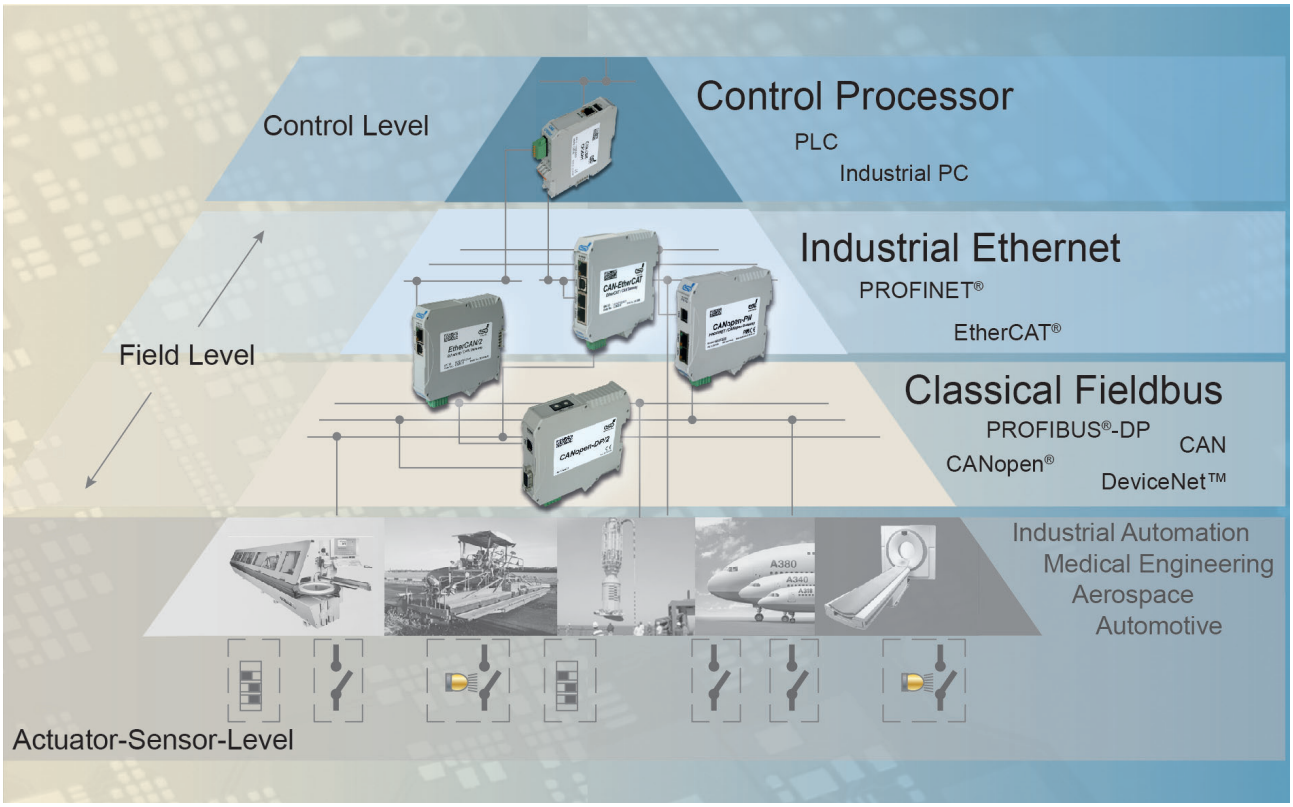

Figure 1: The classic fieldbus (CAN, Profibus, Devicenet etc.) is well-established within many industrial machines and equipment; Gateways set up a link to higher-level systems (Source: ESD Electronics)

New functionalities as well as Industry 4.0 concepts involve high data and information demands, which can only be met by fast communication protocols, partly with real-time characteristics. These concepts are often implemented by means of industrial Ethernet systems. However, a lot of industrial machinery and equipment is still controlled by classic fieldbus protocols such as CAN, CANopen, Devicenet, as well as Profibus. In order to integrate these devices into a higher-level network, ESD Electronics provides a series of gateways and bridges linking CAN to Ethernet and to other fieldbuses.

Although nowadays much is said and written about Industrial Ethernet, industrial communication is still distributed in almost equal shares between classic fieldbus systems and Ethernet. Thus, due to its high data security and its inexpensive components the CAN network is just as often used in industrial automation as in safety related areas. Many older industrial machines and devices use CAN to process input and output data in a decentralized way. In order to integrate CAN network communication with its various protocols into higher-level fieldbus or industrial Ethernet systems scalable and easy to configure gateways are needed.

ESD can call upon experience as a system vendor since the 1990s in the field of CAN-based automation solutions. This especially includes interface boards and gateways. With the help of gateways transitions between CAN/CANopen and industrial Ethernet, such as Profinet, Ethercat as well as Ethernet/IP and Profibus can easily be realized. CAN-to-Cloud solutions even go one step further by providing machine and process data by download over the internet. All this can be done without changing the machine programming. Bridges exchanging data with independent CAN networks or Ethercat networks complement the product range.

Gateways linking CAN to Profibus or Profinet do not have to be configured externally by the user. The entire configuration and parameter setting is completed by the PLC's (programmable logic computer) own user program, ▷

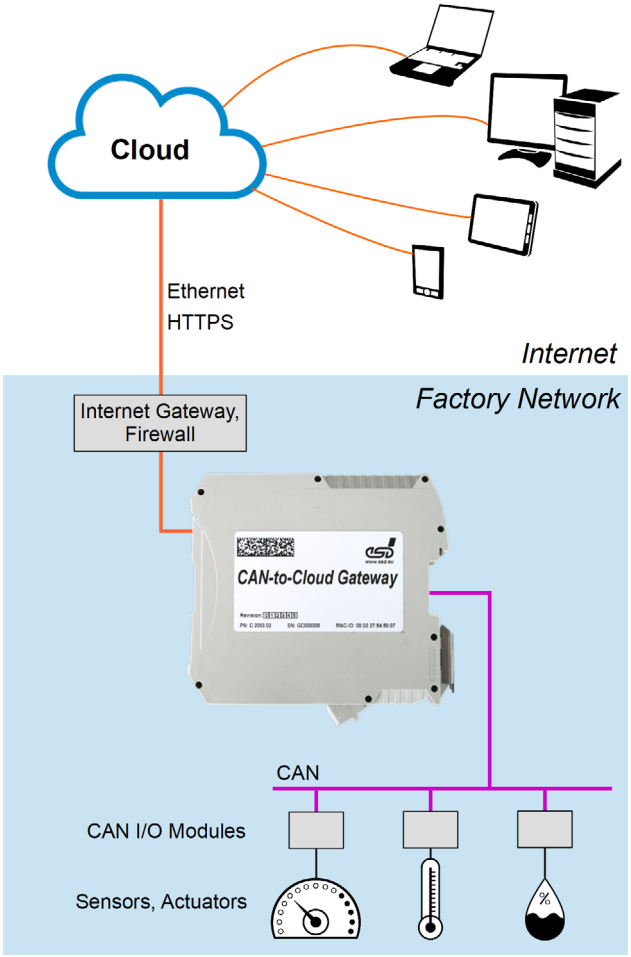

Figure 2: CAN-to-Cloud device connection (Source: ESD Electronics)

which makes the replacement of individual modules significantly easier. In the field there is no need for additional external tools or assistance to configure or to parameterize the gateways.

Linking CAN via Ethernet

When it comes to transferring CAN data to industrial Ethernet, ESD provides four different gateways. The devices CAN-PN and CANopen-PN connect CAN respectively CANopen to Profinet I/O.

The CAN-PN gateway with buffer storage is equipped with a CAN interface acc. to ISO 11898-2 and a Profinet interface (IEEE 802.3). It is particularly suitable for connecting the CAN network to PLCs such as Siemens S7-300, S7-400, S7-1200, or S7-1500. Configuration is performed for instance via the PLC Simatic manager or the TIA portal. This kind of configuration makes exchanging individual modules quite easy.

The CANopen-PN gateway serves as a link between CANopen devices and Profinet I/O. It operates with a maximum of 1440 input and 1440 output bytes on the Profinet bus. Like the CAN-PN this device has a CAN interface designed acc. to ISO 11898-2. By means of this gateway the integration of up to 127 CAN nodes is possible. Alternatively CAN is accessible via an Inrail bus plug connector. The Profinet interface is compatible with IEEE 802.3, and the gateway has been designed acc. to „Profibus international document TC2-09-0002“ as well as „CANopen specification CiA 309-4“. The configuration of the gateway is carried out via the Profinet configuration tool GSDML composer. The ESD CAN tools (CAN SDK, CANreal etc.) can be used for configuration and diagnosis of the CANopen-PN gateway.

With the help of the CAN-Ethercat gateway a connection to Ethercat can be realized, whereas the EtheCAN/2 establishes a link to Ethernet according to IEEE 802.3.

The CAN-Ethercat acts as Ethercat slave and is designed acc. to ETG.5000. Configuration and diagnosis is performed via the Ethercat master respectively the Ethercat configuration tool. In addition to its bridge-functionality the gateway can also be used as a switch port whenever Ethernet-based devices are to be integrated into an Ethercat network via EoE (Ethernet over Ethercat).

Based on the ESD NTCAN API the EtherCAN/2 can be operated like a local CAN interface (under Windows and Linux). It supports the free ESD CAN tools for bus diagnosis and commissioning as well as the CAN protocol stacks (CANopen, J1939 etc.). In order to establish a link to other operating systems the device supports the open UDP based protocol ELLSI (EtherCAN low level socket interface). Typically this protocol is used for the connection to a PLC. Especially for the connection to the Simatic types S7-300/400 an optional software package with functional components is available. They allow the transmission of CAN messages via UDP. Alternatively it is possible to use two EtherCAN2 gateways in a CAN-to-CAN bridge mode by combining two EtherCAN/2 gateways to create an independent system of two CAN networks via TCP/IP. The gateway has a wide range of configuration possibilities, which are managed via a web interface.

Linking CAN via the classic fieldbus

In order to link CAN modules to Profibus, ESD Electronics provides different gateways: The CAN-DP/2 gateway with layer-2 implementation supports the CAN protocol. It enables the connection to PLCs such as Simatic types S7-300/400. The gateway operates as a DP slave and is able to process up to 300 bytes process data (input and output side). The number of CAN nodes is not limited by the module. The device supports CAN IDs with 11 bits and 29 bits. The CAN-DP/2 is configured via the standard tools, the runtime configuration, however, is done by the PLC.

On the other hand, the CANopen-DP/2 gateway is able to transmit the CANopen protocol in addition to CAN. As a DP slave (acc. to IEC 61158) the gateway can process both 240 input bytes and 240 output bytes. The cycle time is only limited by the Profibus. A typical application would be the connection of Simatic S7 to CANopen. The configuration is carried out via the standard tools and runtime configuration via the PLC. Both gateways enable plug and play replacement in the field.

The DN-CBM-DP and DN-DP gateways are able to transmit the Devicenet protocol. Both gateways can be configured via the PLC and act as Profibus slaves.

Typically the DN-CBM-DP gateway connects a PLC to CAN-layer-2 or Devicenet. The DP slave provides up to 300 data bytes (240-byte input side and 60-byte output side or 60-byte input side and 240-byte output side). As a ▷

Figure 3: Gateways by ESD (Source: ESD Electronics)

CAN master, the DN-CBM-DP gateway also operates with CAN-layer-2.

CAN-to-Cloud – making data available via the internet

With the help of an Azure-IoT-Hub the CAN-to-Cloud Gateway allows a worldwide access to data of a certain CAN network. CAN data is sent to Microsoft Azure Cloud over a TLS/SSL encrypted secure connection. From there, data can be retrieved from anywhere in the world. The Microsoft Azure Cloud offers many different software services for the gateway's operation: it allows storage, display, and analysis of data. Based on these data it is possible to generate warnings that may be sent to computer systems or smartphones.

By means of a web browser interface the CAN-to-Cloud is very easy to handle. CAN data can be filtered via IDs or can be forwarded completely or partially. Moreover it is possible to process various data formats or to add application-specific information and time-stamps to messages. The cloud platform may be used for predictive maintenance so that on site monitoring can be omitted. Data hosting can take place in German computer centers if explicitly required (Microsoft Azure Deutschland, trustee: Telekom).

Bridges – integrating independent networks

Whenever independent networks are to be connected bridges come into play.

The ECX-EC Ethercat bridge merges two Ethercat slave segments. In this way process data between two independent Ethercat networks can be exchanged. For the synchronization of different cycles (DC) the bridge uses the exact difference between two slave time stamps as CoE (CAN over Ethercat) object. Thus, one master is synchronized with the other. Within a redundant network the ECX-EC bridge uses the first and the last slave simultaneously which allows the master to keep all slave segments synchronous in both segments. The Ethercat implementation relies onEthernet ports according to IEEE 802.3, configuration is effected via CoE objects and the firmware update as well as the EoE support (switch port) is performed via FoE. The Ethercat process image can be configured by means of typical network configuration tools (i.e. ESD workbench, Twincat).

The CAN bridge CAN-CBM-Bridge/2 with data buffering establishes a link between two CAN networks. It is able to connect CAN networks with different data rates. The bridge supports 11-bit and 29-bit identifiers and is equipped with CAN interfaces according to ISO 11898-2. They are electrically isolated by means of optocouplers and DC/DC converters. Configuration can be completed quite easily via the PC's serial interface (RS232). The device is designed for DIN EN rail mounting (T35). ◀

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