

From Connectivity TO CONTEXT

Powering Data-Driven Industrial
Transformation in Your Factory



It is no secret that Industry 4.0 is upon us, and it is transforming traditional manufacturing into an adaptive and customer-centric environment capable of supporting new, innovative business models and revenue sources. As manufacturers increasingly embrace Industry 4.0 technologies in an effort to realize value, research indicates that leading organizations are set apart by their focus on the core of their industrial operations on the factory floor.

For many manufacturers, a key impediment to enabling factory-focused industrial transformation is securing the contextualized data needed to support truly transformative decisions.

Unlocking standardized and contextualized data requires factories to go beyond mere connectivity and leverage a native edge approach. In this whitepaper, we take a closer look at Industry 4.0, the importance of data contextualization, an actionable path to contextualize your factory's data, and the importance of a native edge approach.

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Defining Industry 4.0: Customer-Centered, Automation-Rich

There are many definitions of Industry 4.0, which refer to the **transformative introduction of technology into traditional manufacturing approaches**. But what does an Industry 4.0-enabled factory look like? In practice, Industry 4.0 is demonstrated in a factory that has auto-adapting processes capable of producing fully customized, unique products one after another at the same cost efficiencies as modern mass production. But its high level of adaptability and customer-centricity does not result in a heavy human burden or customized software solutions. Instead, the factory can achieve high volume production rates with minimal levels of human intervention or custom engineering.

But that's not all. This dynamic factory is automatically controlling material flow, eliminating downtime, and operating at the lowest level of inventory possible. The ultimate goal of Industry 4.0 is to transform manufacturing into an adaptive and customer-centric environment, capable of generating new business models and revenue sources—but through **intuitive, highly automated processes that eliminate the need for an army of engineers**.

Making this compelling vision a reality also requires robust, context-rich IIoT connectivity on the factory floor. Unfortunately, when it comes to IIoT, many factories aren't sure where to start.

An Industry 4.0-Enabled Factory



The Missing Link: IIoT & Data Contextualization

Data is the lifeblood of the modern factory. Factories have an abundance of data points coming from machines, devices, people, and more. But merely having the data is not enough. Many make the mistake of equating connectivity with Industry 4.0, but connectivity is merely a prerequisite to Industry 4.0. To enable true IIoT, factories must make the shift from connectivity to context.

While many IIoT platforms and manufacturing execution systems claim they can extract data from machines, the data gathered needs to have meaning. Without meaning, IIoT is relegated to colossal data lakes with no real value. While critical, contextualization does not happen immediately. It's not something that can be simply appended onto a system and turned on like a faucet. Instead, it takes years of connectivity and MES experience, as well as a platform that is architected to operate upon a contextualized data model for any of your data to have meaning and drive real benefits. As a core component of IIoT, **context is the missing link** and the reason many IIoT and Industry 4.0 projects fail to deliver the expected value.

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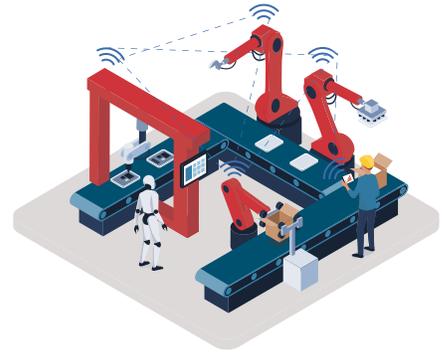
The Path to Contextualization: Three Key Phases of IIoT

There are three distinct phases of IIoT, which must be followed in order to achieve success. You first have to connect to a data source in an elegant manner. Secondly, you have to make sense of it in a standardized way, and then third, you have to make it useful to people as actionable information. Neglecting to complete any one of these phases will result in an inadequate and lackluster approach to IIoT. Without **true contextualization**, enabled by the following three-phased approach, companies will fail in their Industrial Transformation journeys.

Let's take a closer look at each of the three phases.

Phase 1: Connectivity

Establishing data connections can be difficult and complicated for a few reasons. First, there are many different standards in the market, including OPC UA, IPC CFX, and MTconnect, to name a few. Furthermore, many legacy machines have no adaptation capabilities at all. Last but not least, many factories are unsure how to connect with their machines in the first place. Machine connectivity and data standards are two distinct issues, both of which must be resolved in an elegant fashion in order to set your factory up for IIoT success.



Phase 2: Ontology

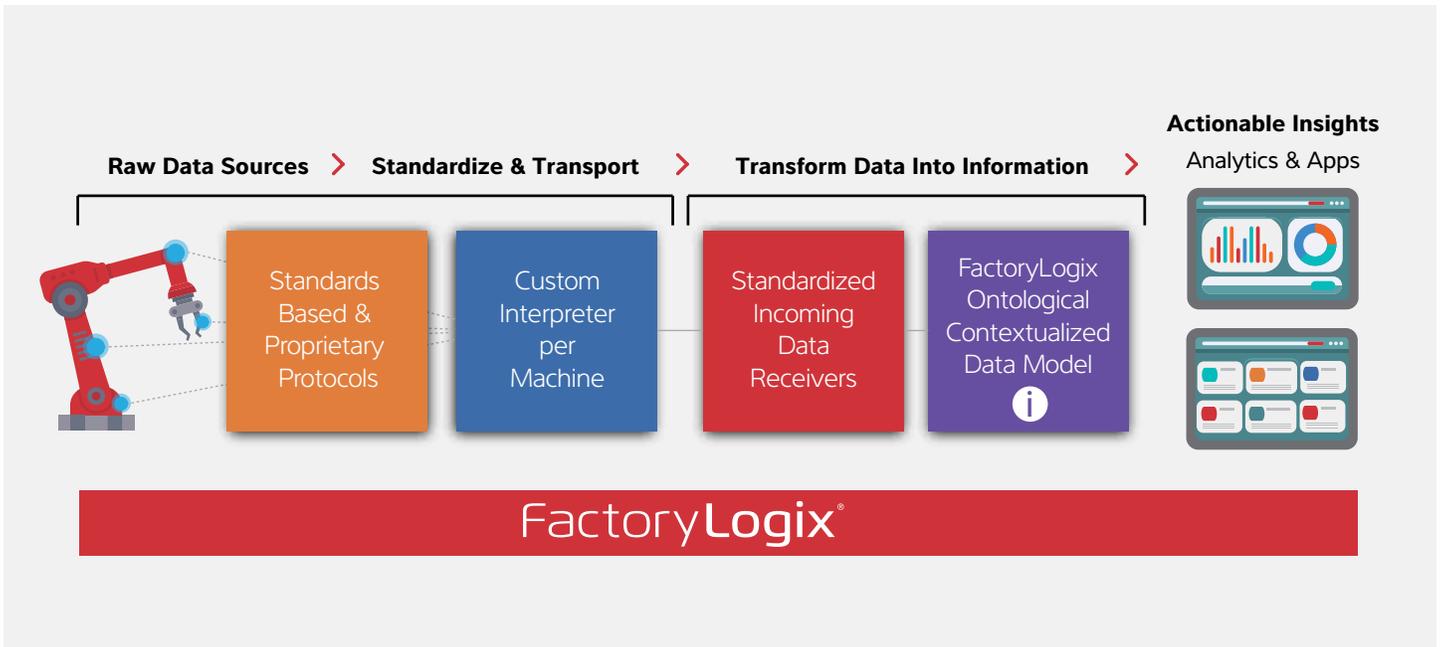
The second phase addresses where and how the data actually ends up. Too often, raw data is merely accumulated and placed in a file or data lake, which is insufficient to enable any kind of data-driven impact. Instead, data should be inserted into an ontological schema that means something within the larger context of the factory.



Phase 3: Action

Finally, data that is standardized and inserted into an ontological schema can finally make its way into intentional applications and analyses that can be utilized to optimize and improve processes, and achieve real value for the factory. This is the ultimate goal of IIoT—but without connectivity and ontology, factories can never achieve it.





Even if you had a magical connectivity solution, if the ontological piece is not there, then it doesn't matter. Some vendors may claim that they know how to get the data, and then you have vendors that may know how to consume the data, but what all of them are missing is the **complete end-to-end understanding of the data**. The concept of contextualization has finally started to spur many discussions lately because too many companies have gone down a path and have failed, and it is because the contextualization component was nowhere to be found. To embrace the future of IIoT, factories must identify a vendor and platform capable of moving beyond merely connecting and consuming information through an end-to-end understanding of the data.

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Enabling True Contextualization with a Complete Approach

The ideal solution must be inherently capable of interfacing with all protocols and legacy custom adaptors. More importantly, **it must be capable of solving the ontological issue**. In the context of ISA-95, Aegis' FactoryLogix solution has a unique position within the stack that enables contextualized data, MES, and business intelligence in a single platform.

The platform functions as a gateway between levels one and two. In levels two and three, FactoryLogix delivers application logic that uniquely contextualizes data so that it can be fed into level four, which is the ERP business system level. This is a **full-stack approach** that stands in stark contrast to other vendors. Let's take a closer look at each of the layers of FactoryLogix.



ADAPTATION LAYER

The first layer is the device adaptation layer and the FactoryLogix engine that is capable of handling high-speed data. This is the layer in which we connect the adapters to whatever protocol the machine is exposing.



CONTEXTUALIZATION LAYER

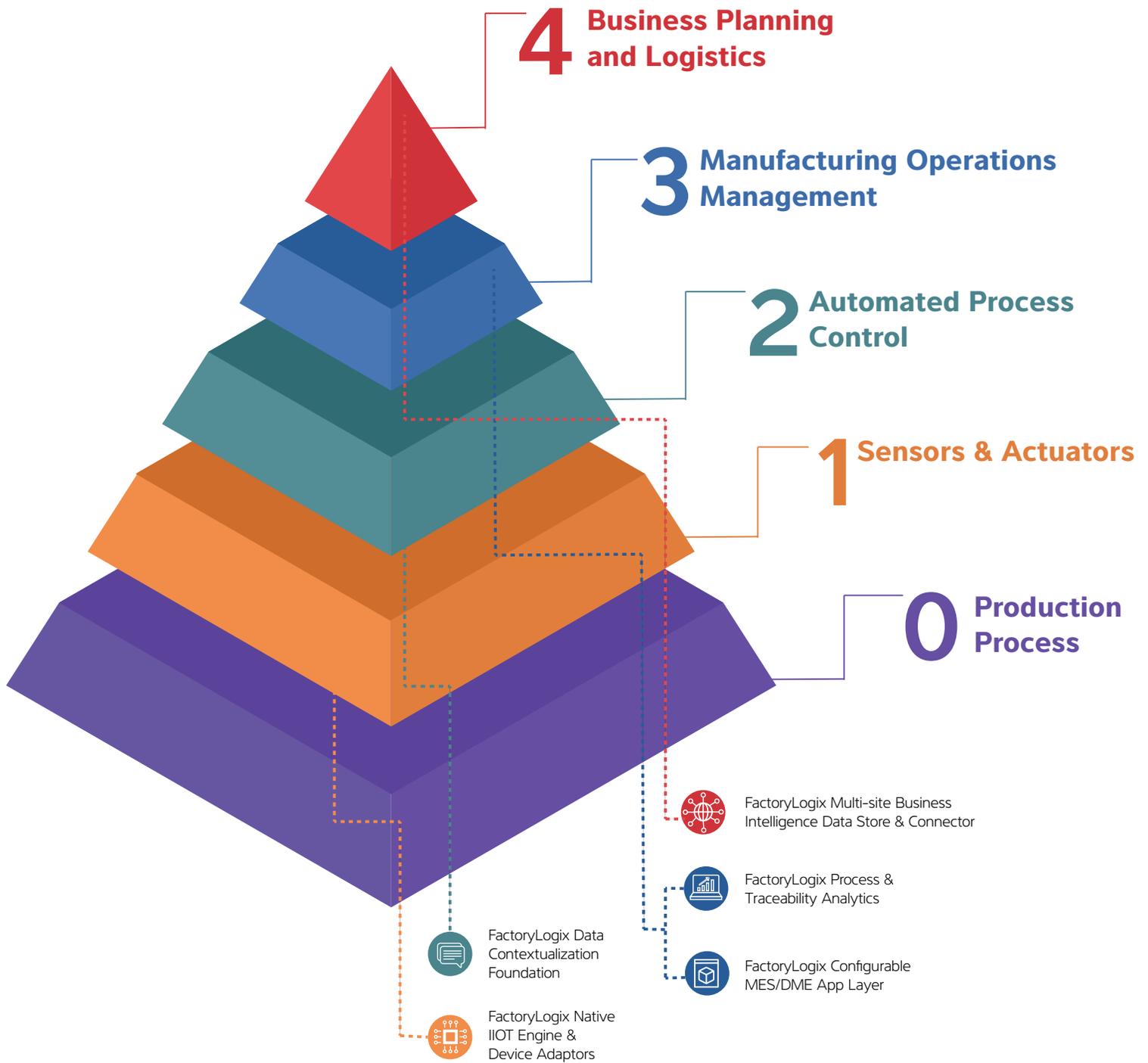
Next is the contextualization layer, which makes the data fully relational to the CAD Design, the Bill of Materials, the process context, the flow, the time dimension, all of the environment variables, the materials information, and even the human interaction. All incoming data is correlated against the PLM data. The processing and storing of this information are done in a meaningful manner, ensuring that the layers above do not ever have to change to leverage that information. This is a game-changer in IIoT.



MES, ANALYTICS, & BUSINESS INTELLIGENCE LAYERS

All of the upper layers just work automatically no matter how many new endpoints are added to the factory. Ultimately, this is key to enabling the kind of agility, product customization, and customer-centricity that define today's Industrial Transformation leaders.

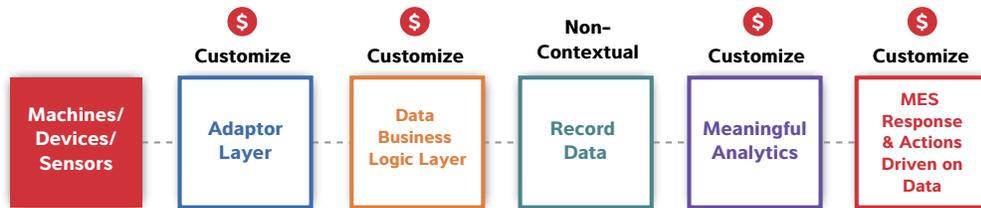
This is a future-forward vision for contextual connectivity inside the factory. But, in reality, many factories are filled with equipment that was made in the distant past. While FactoryLogix supports modern data standards, it is also inherently designed to deal with legacy machines. The innovative architecture enables the use of PLC connections, direct database, OPC UA, MT Connect, IPC CFX, and many others.



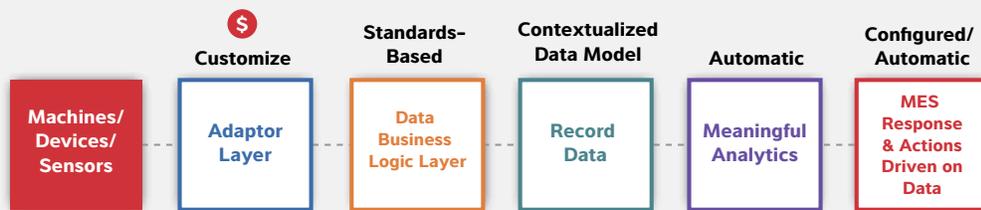
Minimizing Customization by Supporting Contextualization Out-of-the-Box

Today's factories are challenged to achieve unprecedented levels of adaptation and agility. But this adaptive factory environment must not lead to an increase in manufacturing cycles, expenses, or resources. Customization belongs on the line and not in your IIoT solution. Instead, your IIoT solution should be capable of supporting contextualization out of the box, with minimal customization to mitigate costs and accelerate time-to-value.

Typical IIoT Approach



FactoryLogix



A typical IIoT approach requires a custom adapter layer that is specific for each machine endpoint to get the appropriate data from machines and sensors throughout the factory floor. That information is then stored using a custom business logic layer but has zero contextual meaning. There is then another customization attempt to contextualize and apply meaning to the data. The MES is further customized to respond and take action on that data. This customization-intensive process is repeated for every unique device and must be updated each time new assets are added.

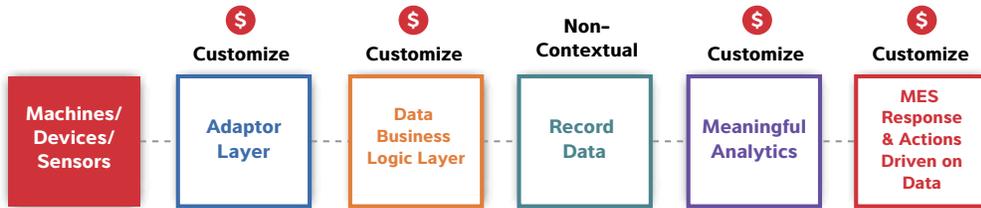
With FactoryLogix, data acquisition does not require custom connectors to each machine. Because of the existence of the ontological layer, the only ever-adapting aspect is the machine endpoint. Aegis uniquely builds all adapters to a normalized, documented data standard that servers understand, and the core FactoryLogix data model automatically makes that data meaningful. **As new machines are connected to FactoryLogix via standard-based adapters, the server infrastructure, the database, and the analytics, all work automatically. There is no need for endless customizations or modifications each time a new machine is added.**

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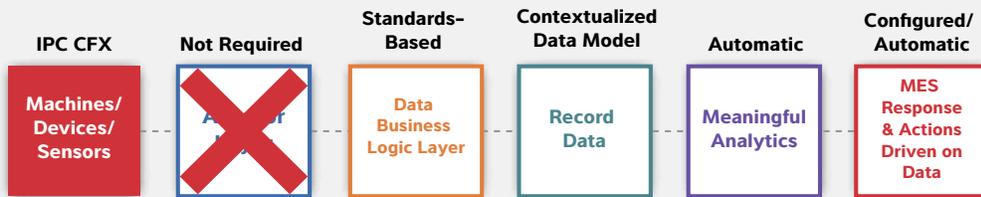
Creating Contextualization with the IPC CFX Data Standard

There is a pervasive need in the industry to make it easier for both vendors and manufacturers to acquire and exchange the data in a meaningful way. This will enable manufacturers to shift their focus from time and cost-intensive integrations to **driving business value and creating a competitive advantage**.

Typical IIoT Approach



FactoryLogix®



The IPC CFX (Connected Factory Exchange) data standard brings much-needed uniformity to the data exchange with factory assets. With the participation of more than 400 software, machine, and manufacturing organizations, this group set out to create a standard that would enable companies to connect any machine, system, or human source and to have the exact same standardized set of data as a result. IPC wanted to do this in a way that would not require third-party tool investments or licensing costs.

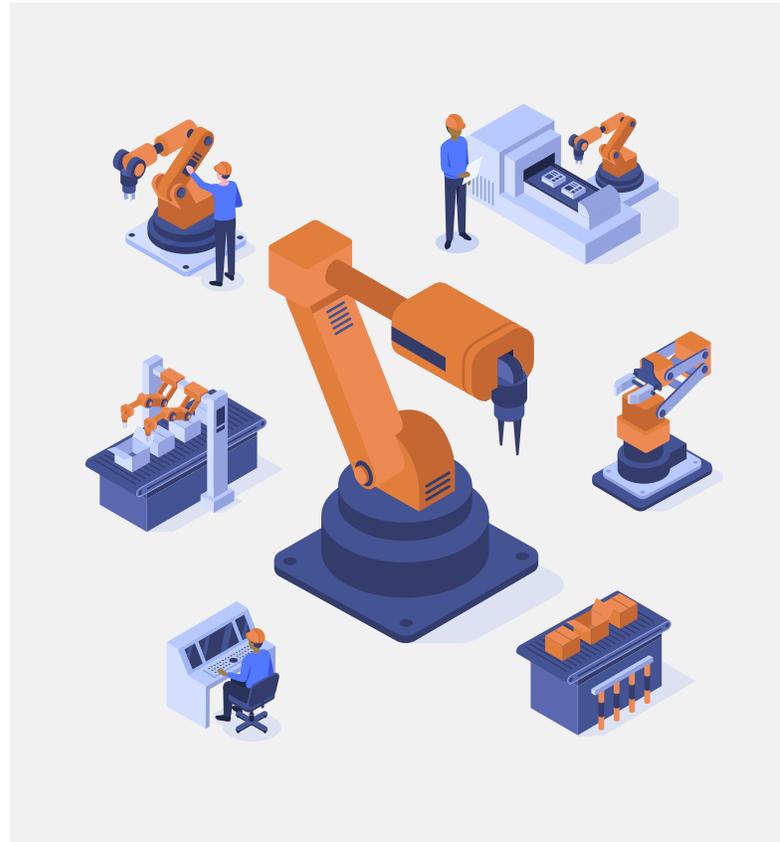
The IPC CFX standard addresses a critical gap in other IIoT standards. While other standards may be efficient at moving data from one place to another, they don't define the language. As a result, they are essentially moving the problem from the machine into the cloud or another data store. Unfortunately, no matter where it resides, that data is meaningless, lacks context, and is very challenging and time-consuming to interpret.

The IPC CFX data standard brings uniformity to the data exchange with factory assets.



The IPC CFX data standard defines the semantics at a level that has never been done before. Unlike other standards like MT Connect, CFX goes beyond the physical model of the machine and breaks the entity being monitoring down to capabilities level. Other standards have tried to define data based on machine type, but machines and devices are no longer monolithic. CFX took a novel and revolutionary approach by looking at machines not as monolithic entities but rather as collections of base capabilities—and these capabilities could be common to many machines. With CFX, **capabilities are defined in the content standard only once, and then reused with perfect consistency.**

IPC CFX does not eliminate the critical need for contextualization. Instead, it eliminates that final custom adapter layer component that is referenced in the diagram below. With FactoryLogix, if a CFX-compliant machine slides into the factory, our server will simply understand how to connect to it and interpret it. **Everything from that point forward, the recording of the data, the contextualization, the analytics, and the business logic of the application layer will simply work without an army of engineers.**



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Putting Industrial Transformation in Context

With the right digital platform, manufacturers can finally move beyond a passive approach to data and embrace contextual, cross-factory insights. **Making the critical shift from connectivity to context** is foundational to supporting the factory-focused IIoT initiatives that have been shown to deliver the greatest impact and value.

In order to achieve true Industry 4.0 benefits, the importance of data contextualization cannot be overstated. By embracing a native edge approach with an ontological architecture that mitigates costly customization and enables complete scalability, factories can ensure that they are capable of harnessing data to move the needle—no matter what information is being collected, where it is from, or how many new endpoints arise over time.

If you'd like to learn more about how FactoryLogix can enable transformative data contextualization inside your factory, visit www.aiscorp.com.



Email: info@aiscorp.com

Visit: www.aiscorp.com

Twitter: [@FactoryLogix](https://twitter.com/FactoryLogix)

LinkedIn: [linkedin.com/company/aegis-industrial-software](https://www.linkedin.com/company/aegis-industrial-software)

Corporate Headquarters

220 Gibraltar Road, Suite 300
Horsham, PA 19044

Phone: +1.215.773.3571

European Headquarters

Wetterkreuz 27
91058 Erlangen, Germany

Phone: +49.9131.7778.10

Asia Headquarters

Rm. 809, Dahua Hucheng Business Center
No 6, Lane 239, Dahua No. 1 Road
Putuo District, Shanghai, 200442, P.R. China

Phone: +86 21 5882 4882