Here are answers to some of the most commonly asked questions about the comprehensive integration of FOUNDATION™ Fieldbus into Experion™ PKS:

- How does Foundation Fieldbus prioritize communications to ensure that control related traffic always comes first?

- What did Honeywell do to provide high-performance, high-reliability Fieldbus communications?

- What is Link Schedule Optimization and why is it important?

- What does it mean when Honeywell says it has a controller-independent design for fastest data access? Why is this important to me?

- How thoroughly are FF alarms integrated into Experion PKS?

- What should I check if I don't see alarms from a device?

- What kind of testing has the Honeywell Fieldbus system been through?

- Do I have to test a Fieldbus device before I can use it with the Honeywell Experion Fieldbus Interface Module?

- What do I have to do add a new device to a control scheme?

- What testing does Honeywell do of third party Fieldbus devices? Why is this so important?

- Does Experion PKS support manufacturer-specific extensions of parameters and connections?

- Do I have to pay to have a Fieldbus device tested?

- What is the capacity of a Honeywell Fieldbus control system? How many devices can you handle?

- How does redundancy of the Fieldbus Interface Module work in Experion? If my primary Fieldbus Interface Module fails, will there be a bump in control?

- Does Honeywell support and recommend using Fieldbus "control on the wire"? What exactly is "control on the wire?"

- Can I upgrade my devices using the Honeywell Experion system? Do I need to remove them from service?

- Do I have to have a separate maintenance package to see Fieldbus maintenance and diagnostics information?

- What is the PKS Advantage program?

- What is the Link Active Schedule? Why is a Backup Link Active Schedule (BLAS) important?

- Are Fieldbus devices from different manufacturers interchangeable?

- How can I tell where a Fieldbus device block is being used in a control scheme?

- Can I use both Fieldbus and non-Fieldbus functions in my control scheme?

- How can the operator see what a loop with control on the wire is doing?

- How can I use one of the new segment diagnostic modules to assess the operation of the segment?

- Does Experion PKS support Fieldbus Methods?

- What is Block Instantiation? Does Experion PKS support Block Instantiation?

- I changed a parameter in a Fieldbus device connected to Experion by using an external tool, but the parameter did not update in an Experion display. What might be wrong?

- Why does it take a long time to commission (load) a device? Why do some devices take longer than others?

- Why don't I see all of the available function blocks in the Monitor view after I commission a device?

- How are fieldbus addresses allocated? What should I do if I connect a device and it cannot be seen?

Answers:

How does Foundation Fieldbus prioritize communications to ensure that control related traffic always comes first?

Basically, the Foundation Fieldbus specification provides three distinct communication priorities:
- **First, control**. All publications (that is, connections or "wires" between Fieldbus function blocks) are given first priority. They are guaranteed to occur every macrocycle at a given time regardless of the amount of traffic on the link (sometimes referred to as a "channel"). Note these connections between function block outputs and inputs are referred to as VCR's (Virtual Communications Relationships).
- **Second, alerts and alarms**. These are the next highest priority after control. Any alarm is guaranteed to be sent to the host (or in the case of Experion, the Fieldbus Interface Module, or FIM) for handling, no matter how many parameter accesses or other activities are taking place. A time-stamp is also generated within the device based on synchronized time. This assures the alarm notification will indicate the correct time.
- **Third, unsolicited reads/writes**. This covers all other forms of link traffic, including parameter access (for displays), link schedule loading (for on-line changes), and device firmware downloading. Writes are given priority over reads. A set point or other parameter change, for example, would be handled the fastest.

What did Honeywell do to provide high-performance, high-reliability Fieldbus communications?

Many systems burden the link by utilizing client-server access to all parameters all the time. This leaves very little bandwidth for anything else. As a result, these systems may have timing issues because of unwise use of these services. In contrast, the Honeywell FIM only uses such services on demand per a very intelligent algorithm which minimizes H1 client-server load while providing fast response to applications. The Honeywell Experion Fieldbus performance exceeds that of other systems! Our FF-related displays come up much faster, and we have faster downloads because of more bandwidth availability. And that's *before* link schedule optimization is invoked to improve the bandwidth even further.

What is Link Schedule Optimization and why is it important?

The Foundation Fieldbus H1 link communicates at a modest 31.25 kbaud. Accepted engineering guidelines indicate that a maximum of up to 25 publications ("wires" between function blocks) per second are possible per link (Fieldbus channel). Honeywell provides a graphical link schedule display to help guide the engineer during application configuration. For simple control scenarios, optimizing the link schedule is not difficult. But more complex and demanding control applications warrant a tool which makes the engineer's job easier and more reliable. Honeywell's unique Link Schedule Optimization automatically arranges control events on the link in way that minimizes the total duration of link scheduled activities and control latency while maximizing available free bandwidth. The result is more devices per link, better display performance, and better control. Users reduce installation costs and get more "system" for the money while minimizing wear-and-tear on expensive plant equipment such as actuators because of the reduced control latency.
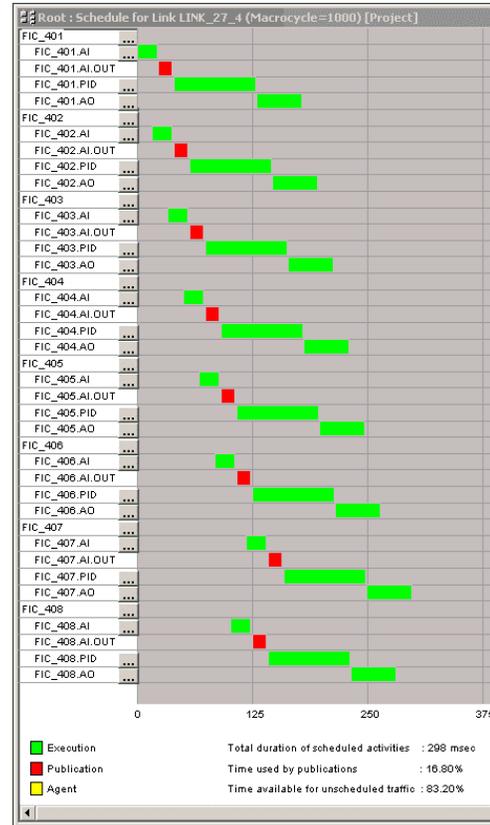
Optimized Link Schedule

What does it mean when Honeywell says it has a controller-independent design for fastest data access? Why is this important to me?

Most control system designs apply the Fieldbus interface as merely another I/O (input/output) module on their system. This forces all parameter access to go through the host's controller communication infrastructure. That is fine for control function data access using Function Blocks, but Transducer and Resource blocks can contain hundreds of important parameters as well. The controller essentially becomes the bottleneck. Honeywell designed the Fieldbus Interface Module to be independent of the controller, passing only control related data to it. That is one of the keys to the FIM's amazing performance. When the operator needs to see critical tuning or alarm data, it is there in an instant. Furthermore, Fieldbus function blocks are available to the user even if the controller is removed or interrupted. In fact, for monitoring only or "control on the wire" applications, the controller isn't even needed.

How thoroughly are FF alarms integrated into Experion PKS?

Honeywell Experion PKS utilizes the alarm announcements generated by the FF devices. Some systems burden the limited communications bandwidth by polling for alarms or may even generate alarms in the control system instead in the FF devices. In Experion, since both the diagnostic and process alarm notifications are time-stamped based on shared knowledge of time on the links, the time reported for the event is not compromised by transport time through the system. Additionally, Honeywell employs a unique alarm recovery technique that overcomes the lack of an alarm recovery mechanism in FF. After disruptive events, such as failovers, restarts or other temporary breaks in communications, the alarming systems is certain to be synchronized with the devices' alarms.

What should I check if I don't see alarms from a device?

The Fieldbus specifications provide several device parameters which must be set correctly in order for alarming to work properly.

- In every device's RESOURCE block, the parameter LIM_NOTIFY (Current Limit of Unconfirmed Alerts) describes the number of alerts that the device can send out at the same time. A setting of zero results in never transmitting any alarm notifications. It must be set greater than zero for alarming to work.
- Also in every device's RESOURCE block, the parameter FEATURES_SEL must have the "Reports" bit set (FEATURE_SEL[1]). Without it, the device never issues any alarm notifications.
- All function blocks that support alarming (e.g., AI, PID, DI, etc.) provide an option to support operator acknowledgement status stored in the device or stored in the control system's alarm server. Experion™ PKS supports operator acknowledgement stored in the server to provide alarm acknowledgement operation consistent with the rest of Experion™ PKS, particularly with respect to multiple console independence of alarm acknowledgement. Therefore the FF parameter ACK_OPTION is always automatically set by Experion™ PKS to ones for supported alarms, and the parameter is generally hidden to avoid user confusion.
- Function blocks that support alarming also allow each different alarm condition to be disabled. It is always good to check that the disables are set appropriately.
- Function blocks that support alarming also allow each different alarm condition to be reported at independently specified priority, as set by parameters whose name ends in "_PRI". Priority 0 clears any alarm status, clearing reports and preventing new ones from being issued. Priority 1 clears any alarm reports and preventing new ones from being issued, but allows the alarm status to continue to be observed in the ALARM_SUM and alarm object status. Priorities 2 through 7 are considered "advisory" and priorities 8 through 15 are considered "critical" in FF. They are mapped into similar Experion™ PKS priorities.

What kind of testing has the Honeywell Fieldbus system been through?

There are a number of different tests that the Honeywell Experion FIM and connected Fieldbus devices go through:

- As part of the system design, the FIM is rigorously tested in various small and large size test beds. A range of devices is used, and, in the case of system stress testing, FIMs and Links are fully loaded to product specification limits.
- In parallel with this activity, Honeywell has the Foundation test the FIM stack for "conformance" to FF specifications.
- Each major release warrants that the Experion Fieldbus system go through the Foundation's Host Interoperability Support Test (HIST). The HIST procedure (FF-569) defines possible Fieldbus features that may be implemented within the host and tested. Not all features are supported by each host. Tests are run only against features that are supported, and the Foundation registers the host, listing those features it has passed.
- Honeywell maintains a world-class Fieldbus Interoperability Test Laboratory for testing Fieldbus devices with the FIM. We test devices from Honeywell and other

Fieldbus Test System in Ft. Washington, PA, lab

manufacturers to ensure devices work well in the Experion™ PKS system. A public web site is maintained on http://hpsweb.honeywell.com/ to inform customers which devices have been tested. In addition, a means is provided to contact Honeywell to arrange for free testing of any device.

- The Interoperability Test lab also conducts rigorous regression tests on devices as new releases of Experion are developed and deployed.

Do I have to test a Fieldbus device before I can use it with the Honeywell Experion Fieldbus Interface Module?

No. You only need Device Descriptor (DD) files and the device, and you can be up and running in minutes. However, experience has shown that interoperability testing is important, and so we highly recommend that you check first to see that we have tested the device.

What do I have to do add a new device to a control scheme?

In Experion, adding Fieldbus devices and control is easy! Here are the steps:
- Read the Device Descriptor files in seconds to add the device definition to Experion.
- Connect up the device and let the FIM self-recognize it.
- Modify the tag and address of the device if needed.
- Commission the device by loading it in the Control Builder tool. This performs a number of important tasks like clearing the device schedule and making it visible to the HMI.
- At this point, you can configure any changes you would like to make to the device.
- Next, add the device's function blocks to control modules (CMs), load and go.
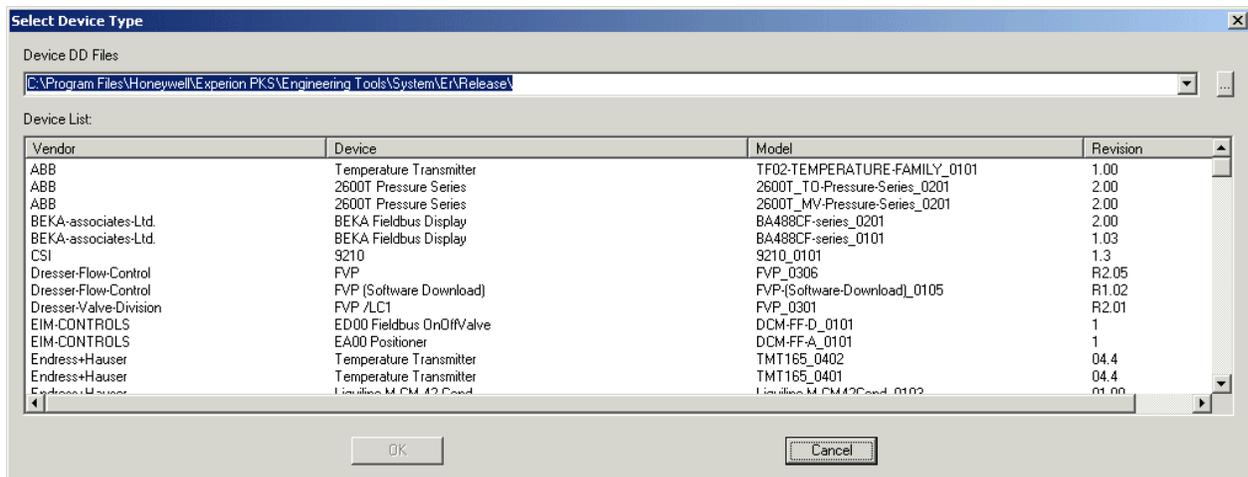
Reading Device Descriptor files is easy in Experion!

What testing does Honeywell do of third party Fieldbus devices? Why is this so important?

The Honeywell Fieldbus Interoperability Test Lab tests a fieldbus device starting with DD file importing all the way through complete function block testing. Some of the key elements the tests look for include:

- device recognition
- commissioning
- network behavior
- behaviors of all parameters
- connection and loading of function blocks

- control behavior with the host and on the wire
- function block behavior as expected.

Other aspects tested include parameter read/write behavior, use of methods, block instantiation, device power cycle behavior, device calibration (where applicable), alarming, and event reporting. While the Foundation and device vendors both perform extensive testing of devices, their perspectives are different and neither perspective can be expected to cover the full range of possible applications. One area of particular interest is function block behavior, critical to any distributed control system. Device vendors often perform limited testing with systems, leaving it up to the systems vendors to insure that devices behave as expected in the control environment. This is where Honeywell comes in to perform as much testing as possible to ensure the device will perform as expected in a given situation.

Does Experion PKS support manufacturer-specific extensions of parameters and connections?

Unlike some other control systems, Honeywell Experion PKS provides full access to manufacturer-specific extensions (think of these as added "customized" parameters) to FF device blocks. It not only supports Honeywell's own and Honeywell partner's field device extensions, but Experion fully supports all manufacturer-specific extensions to all vendors' blocks. The user can view and access not only specialized parameters, but can even make function block connections to manufacturer-specific input and output parameters of all devices.

Do I have to pay to have a Fieldbus device tested?

There is no charge for testing any registered device with Honeywell Experion PKS. We only ask that arrangements be made to provide a device and the appropriate DD files. In most cases, the device is obtained directly from the vendor.

What is the capacity of a Honeywell Fieldbus control system? How many devices can you handle?

Capacity limits are published in our product specifications. Honeywell has tested both the existing 2-Link FIM and the new C-Series 4-Link FIM to 16 devices per link. Based on experience, this generally accepted as a good, practical limit. For the C-Series FIM, we allow up to 15 redundant or non-redundant FIMs (60 links) per C300 controller, and up to 125 redundant or non-redundant FIMs per Server. The maximum number of devices supported per Server is 8000. Servers can be linked together using DSA (Distributed Server Architecture), providing operator access to tens of thousands of Fieldbus devices.

How does redundancy of the Fieldbus Interface Module work in Experion? If my primary Fieldbus Interface Module fails, will there be a bump in control?

FIM redundancy is implemented as a primary/backup pair scheme. The primary FIM is the Link Master device (at Fieldbus address 16) and manages the link schedule, performing network maintenance activities, publishing/subscribing to control data, listening to alerts, and so on. The backup FIM (at Fieldbus address 17) is a completely passive listener, maintaining a continuously updated copy of the primary FIM database and link schedule. It remains in a constant state of readiness until called upon. In the event of a switchover, failure or disconnect of the primary FIM, the backup instantly become the primary FIM (at address 16). This switchover is so fast that the link never perceives a bump. Control schemes for redundant and non-redundant FIMs are configured exactly alike. Of course, once the problem that caused the first FIM to drop the link is repaired, it can be commanded to again become the primary FIM.

Does Honeywell support and recommend using Fieldbus "control on the wire"? What exactly is "control on the wire?"

"Control on the wire" really means using the control function blocks (such as PID) available in Fieldbus devices. It refers to the scenario where an entire control loop from input to output is run without using the host's (Experion) control functions. There are some significant advantages to using "control on the wire." Control latency is always better and more predictable on the bus. When combined with presence of the Backup Link Active Scheduler, control can continue in the event connection to the host is lost. Honeywell both recommends and supports control in the Fieldbus devices. Honeywell also provides faceplates in support of FF control algorithms.

Can I upgrade my devices using the Honeywell Experion system? Do I need to remove them from service?

Honeywell developed and patented Fieldbus Code Download, a technology whereby firmware of a device can be upgraded (or downgraded) directly on the bus without removing it from service. This patent has been made available to the Foundation and, with some modifications, has become a Fieldbus standard. Experion supports both the original Honeywell Code Download protocol and the revised Fieldbus version. This means a user does not have to remove a device from the field (or alternately, carry a bulky laptop to the field to connect to a device) to perform device upgrades.

Do I have to have a separate maintenance package to see Fieldbus maintenance and diagnostics information?

The Experion system makes all device blocks, including Resource and Transducer, as well as all contained parameters available to the Control Builder tool. There is no need for a separate maintenance package to see Fieldbus maintenance and calibration parameters as well as diagnostics information. The engineer and operator have full access to all of these parameters from Control Builder and from Station, the Experion HMI. In Control Builder, users can also customize the parameter views inside a Control Module to their specific needs. This is a very powerful tool in troubleshooting, device analysis, and configuration. In addition, any alarms generated by devices and their function blocks are captured, made available to the operator, logged, and managed by the system.

What is the PKS Advantage program?

The PKS Advantage Program provides an environment for collaboration with other automation solutions suppliers. The program allows for exploration and implementation of FF-based features, such as additional device or system diagnostics, and functionality to provide added value to customers. The program encourages participants to also seek out ways to augment or validate process or equipment data which can then support decision making around plant operations. The PKS Advantage Program is recognized as our industry's most open and non-exclusive approach to bringing about such results.

What is the Link Active Schedule? Why is a Backup Link Active Schedule (BLAS) important?

Fieldbus works by scheduling the execution times of function blocks and publications between those blocks in a deterministic and efficient way. The Link Active Scheduler (LAS) runs in the host (the FIM) and performs this function. Some devices (Link Master class devices) have the capability to receive a copy of the LAS and be available to take over control of the link schedule in

the event connection of the FIM is lost or broken. This copy is called the Backup Link Active Schedule (BLAS), and a BLAS-capable device will only take control when it sees the host is gone. When the FIM returns to service, the device will relinquish the LAS duties to it. The Experion FIM not only supports the BLAS but permits multiple BLAS-capable devices on a link. Some vendors do not support this. The BLAS is extremely important, because it provides for control to continue even if the system connection to the host is lost, thus providing additional robustness.

Are Fieldbus devices from different manufacturers interchangeable?

Conventional 4-20 mA devices transmit a single signal on one pair of wires. If two transmitters from different manufacturers perform the same function (e.g., pressure measurement) and have the same calibrated range, then the two instruments are completely interchangeable and will appear identical to the host system. Interchangeability is not hard to accomplish when only one piece of information (4-20 mA) is being sent to a host. Fieldbus devices are capable of generating multiple measurements on the bus. For the most part, function blocks conform to standards and are basically the same from device to device. However, a device from one manufacturer may have some parameter not seen in another manufacturer's device.

How can I tell where a Fieldbus device block is being used in a control scheme?

In Experion, all Fieldbus blocks used in Control Modules are identified by an FF logo in the control drawings. This is very useful, since we allow FF and non-FF blocks to be mixed in control schemes. Each FF block contains the tag name of the device it comes from so that its source can be readily identified.

Can I use both Fieldbus and non-Fieldbus functions in my control scheme?

Yes, Experion is equally at home with both Fieldbus and non-Fieldbus function blocks as well as both kinds of I/O. Fieldbus and non-Fieldbus functions can be mixed and matched in Control Modules. In fact, we even allow non-published parameters from Fieldbus function blocks to be exposed and read into controller function blocks in Experion.

How can the operator see what a loop with control on the wire is doing?

In Experion, the operator normally views and operates control schemes through a combination of custom graphics populated with live control information and standard group and point displays. Simply double-clicking any control point parameter in a display brings up the detail display for that loop. This detail display consists of a number of pages of important information. In addition, a "live chart" display showing the control scheme as built by the engineer is shown. Honeywell is the only system to feature this live chart display. This works the same for Fieldbus control on the wire as it does for Experion C200 and C300 control points.

How can I use one of the new segment diagnostic modules to assess the operation of the segment?

Fieldbus segment diagnostic modules are extremely powerful tools which provide real-time information about the Fieldbus link. A number of products have been under development and are presently emerging. Some of the mechanisms for integrating with the control system include Ethernet, OPC and FF. In the particular case of the Fieldbus mechanism, the diagnostic module just becomes another device and gets loaded, with all diagnostic information completely integrated into Experion. OPC data likewise can be integrated via the Experion OPC Client

capability. In some cases, the vendor has chosen to use a separate server and application, in which case this screen can be viewed separately or on the same display as our HMI.

Does Experion PKS support Fieldbus Methods?

The Experion PKS Method Manager fully supports methods made available in the DD files supplied by the device vendor. The methods results summary is documented in a transportable ASCII format and self documented to a log file system. Methods are initiated from Control Builder Methods Manager or the operator detail display. Users must have the appropriate logon security privileges, so only authorized personnel can run Methods.
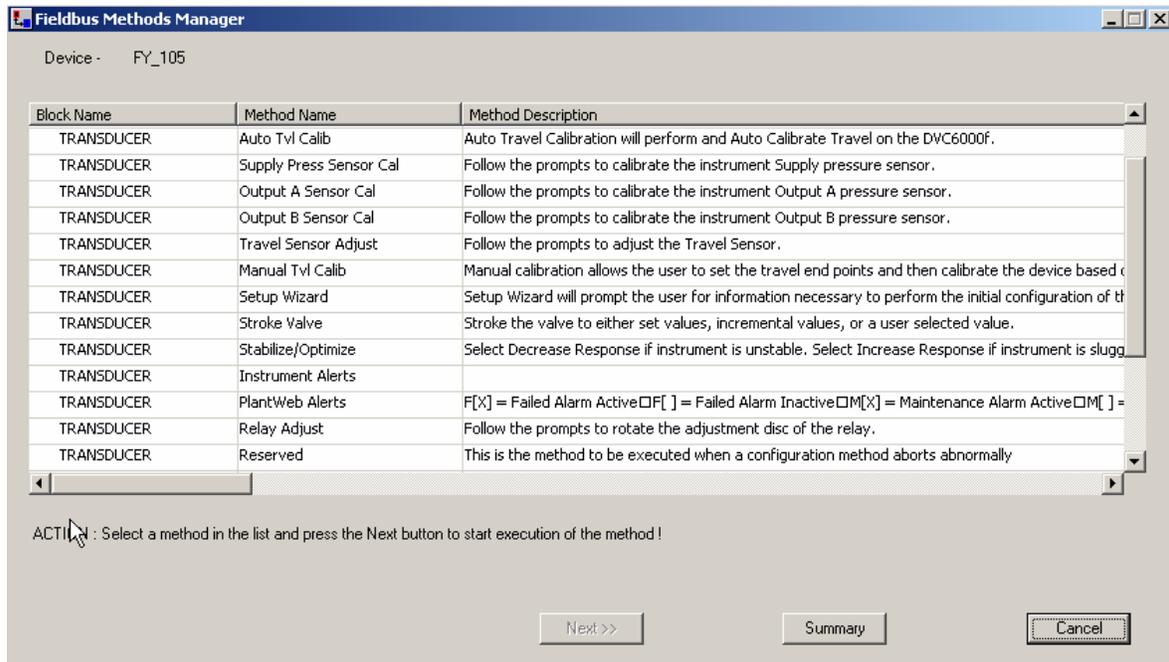
Method Management Available List (as per vendor DD file)

What is Block Instantiation? Does Experion PKS support Block Instantiation?

In addition to permanent or fixed function blocks, manufacturers may allow optional instantiable function blocks for their devices. This gives the user additional flexibility to instantiate (create) additional function blocks they need and not instantiate blocks they do not need in a given fieldbus device. The Fieldbus Foundation refers to this capability as Block Instantiation. It avoids the issue of stocking different catalogued devices to gain all the combinations of function blocks needed in a plant. You simply instantiate the blocks you need for each application loop. Experion PKS fully supports Block Instantiation, allowing the user to add or delete blocks as needed. You can tell a device supports Block Instantiation because the instantiable blocks will appear in the Library with an "I_" prefix for its tag.

I changed a parameter in a Fieldbus device connected to Experion by using an external tool, but the parameter did not update in an Experion display. What might be wrong?

The Fieldbus specification calls for the block parameter ST_REV (which stands for static revision) to be incremented when a static parameter is changed in a device that is in service. Static parameters are those normally changed very infrequently, like units, ranges, tuning constants, etc. To conserve bandwidth, static parameters are read once by the FIM and cached. They are

only re-read if the ST_REV count changes. Some devices have been seen which do not properly update ST_REV when static parameters are changed externally or via the device front panels.

Why does it take a long time to commission (load) a device? Why do some devices take longer than others?

When a device is first commissioned, Experion needs to put it into a known initial state and clear any remnants of the prior configuration. This includes:

- Clearing all VCRs (Virtual Communication Relationships). VCRs are communication connections that are established for a given link. Some devices allow all VCRs to be cleared with a single write. Other devices do not permit this. Therefore, Experion clears all VCRs one by one to ensure proper clearing of VCRs regardless of the device manufacturer's clearing scheme.
- Clearing all block execution schedule (FB_START) entries.
- Clearing the Link Active Schedule (LAS) if the device is link master capable.
- Clearing all Link Objects (connecting function block parameters among each other or to the outside world).
- Writing configured values to all configuration parameters unless partial load is selected.

This process can take from about 30 seconds to as long as almost 5 minutes, depending on the device. Differences in load times between devices are primarily explained by two factors:

- Device speed – some devices are slow when static or non-volatile parameters are written, which includes VCRs, FB schedules, LAS etc.
- Number of VCRs, FB_START entries and Link Objects – some devices have a very high number of them. A single channel pressure transmitter with 64 VCRs as a prime example of that (where a much smaller number is required).

Why don't I see all of the available function blocks in the Monitor view after I commission a device?

This is how Experion Fieldbus works! There are two primary reasons. The first is that all block execution schedule information is cleared when Experion commissions a device. The only useful blocks at that point are the Transducer and Resource blocks. So, they are the only blocks exposed. The second (and more important reason) is that a function block must be contained in a loaded Control Module to be used. Unused blocks are not of interest in the Monitor view since they have not been loaded or configured (they would take up unneeded space and resources). All blocks, on the other hand, even the unused ones, are visible in the Project view, which is used for configuration.

How are fieldbus addresses allocated? What should I do if I connect a device and it cannot be seen?

To join a network as a permanent member, a Fieldbus device must be assigned a name and data link address. Device names are called physical device tags (PD_TAG). Devices without tags are designated as temporary and connected to the bus at one of four default temporary node addresses. The following figure shows the general allocation of addresses to field devices.
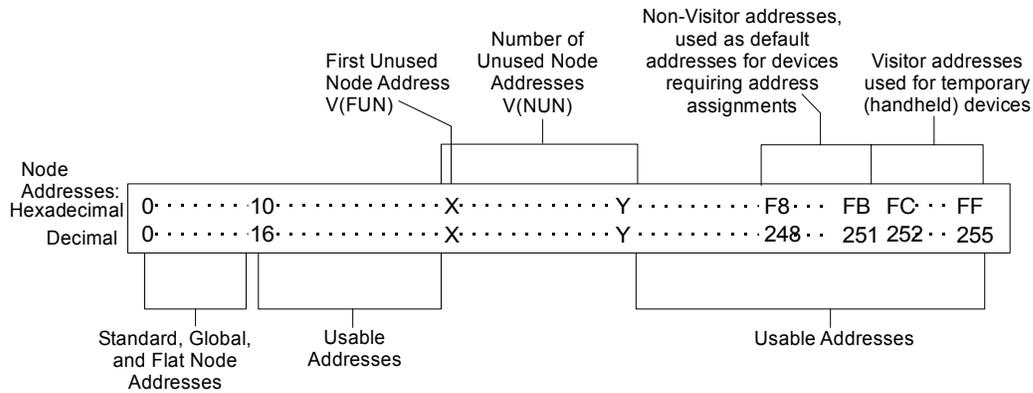
The FIM is always assigned address 16 [decimal], and the redundant (backup) FIM is assigned address 17. The preferred address range for Fieldbus devices is 20 to 40 decimal [14 to 28 hexadecimal]. To get the best possible link performance, all control systems limit the number of addresses polled. The FIM defaults the first unused node address (FUN) to 41 decimal [29 hexadecimal]. The number of unused addresses (NUN) is defaulted to 206. Thus, by default, addresses 41 through 247 are not polled.

If a device with an address in the unused range is connected, it will not be seen. If NUN is temporarily changed to zero, all addresses will be polled, and the device can be found. Its address can now be changed to one in the preferred address range, and NUN can be returned to its default. If NUN is not returned to its default, network performance and recovery of devices on the network may requires unacceptably long periods of time as the token rotation times will be considerably longer.