

# BACnet Today & the Smart Grid

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Figure 1: Operator (left) without BACnet and with BACnet (right). (Images courtesy of H. Michael Newman)

## BACnet Operator Workstations

By Steven T. Tom, Ph.D., P.E., Member ASHRAE

In the BBC Radio Series “The Hitchhiker’s Guide to the Galaxy” a civilization created a tremendous supercomputer named “Deep Thought” to answer the ultimate question of life, the universe, and everything. After thinking about the question for several million years, the computer provided the rather unsatisfying answer of “42.” This would not have surprised any specifying engineer. They know that if you ask for the world but issue a vague spec, you’re bound to be disappointed in the results.

The BACnet® committee was faced with a similar situation when it came time to specify what a BACnet Operator Workstation should do. From the earliest

days of BACnet, it was clear that the ultimate goal was to allow an operator to access multiple vendors’ systems through a common operator worksta-

tion. *Figure 1* shows a pair of cartoons that were popularly used in the early days of BACnet to illustrate the need for this common workstation.

The question before the committee was, what should the operator be able to control with this workstation? If the committee tried to satisfy everyone, the answer quickly became “life, the universe, and everything.” The engineer doing detailed setup and commissioning of a BACnet system needed a different set of tools than the technician who was simply trying to answer the question “why is it too hot in room 214?” And neither of those toolsets would satisfy the manu-

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facturer who wanted to provide a simple keypad interface to a single piece of BACnet equipment. The BACnet committee spent more than 10 years in Deep Thought about this question before specifying operator interfaces in 2009. (To be fair, they weren't just pondering this one question during those 10 years. They were also refining and expanding the rest of the BACnet standard, developing specifications for all other BACnet devices, and creating test standards for everything BACnet.)

In the meantime, vendors were providing many interfaces to meet the needs of different operators. The BACnet committee recognized the wisdom of this approach, so rather than combining everyone's requirements into one unwieldy device they created three different kinds of operator interfaces. A BACnet Operator Display (B-OD), a BACnet Operator Workstation (B-OWS), and a BACnet Advanced Workstation (B-AWS).

### BACnet Operator Display (B-OD)

A BACnet Operator Display provides an operator with the ability to view a limited set of BACnet objects and make changes to setpoints and other parameters. These interface requirements are simple enough that they can be met by a keypad display mounted directly on the equipment, or they could be included in a portable device that the operator plugs into a BACnet controller. A B-OD can discover other BACnet devices, so it could "learn" which device it was plugged into, but it's not required to discover all the BACnet objects within a device. Instead, it would probably use preconfigured screens designed to provide access to the most important BACnet objects in the devices, which it expected to discover. (I say "probably" because at the moment there are no BACnet Testing Lab (BTL) listed BACnet Operator Displays.) It's also not required to display graphics and reports, so a text-based display would meet the requirements. *Figure 2* shows a simple text-based equipment mounted display that is similar to a B-OD, although it is not a BTL-listed device.

Of course, a manufacturer could make an Operator Display with a graphic interface if it chose to, but it would still provide an interface that was much more limited than a workstation. Operator Displays have only limited alarming capabilities, and are not required to provide any scheduling or trending capabilities. They also provide only limited network support, with no requirement to broadcast time syncs or provide any backup and restore capabilities.

### BACnet Operator Workstation (B-OWS)

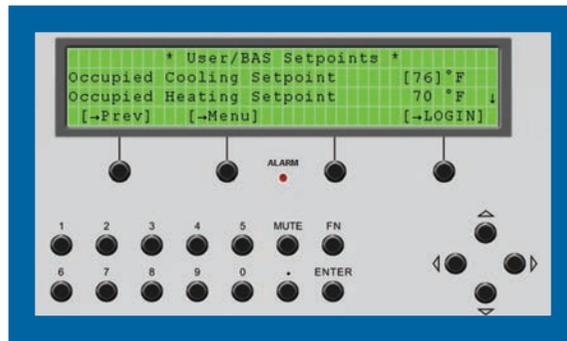
A BACnet Operator Workstation provides a much richer user environment. It's designed to provide an operator with all the information and editing ability he or she needs to manage a

system on a daily basis. In addition to viewing and editing selected BACnet objects, an Operator Workstation can display trends, schedules, and other specialized objects. It can also display reports and graphics. Alarms provide a good example of how a BACnet Operator Workstation provides more features than a BACnet Operator Display. Both interfaces will notify an operator that an alarm has occurred, but an Operator Workstation will also allow the operator to acknowledge the alarm. It will provide a summary of alarms as well, and will allow the operator to adjust the alarm thresholds of analog objects. Examples of BACnet Operator Workstations are shown in *Figures 3* and *4*. Note how the use of graphics enhances the presentation of information. Links on these pages will navigate to other pages, provide more details, display trends, etc.

### BACnet Advanced Workstation (B-AWS)

If a BACnet Operator Workstation is designed to provide an operator with all the information needed to manage the system on a day-to-day basis, what more can an Advanced Workstation do? The answer is, a BACnet Advanced Workstation can be used to configure and commission a BACnet system, and it can also provide advanced network troubleshooting services. This does

not mean that if a vendor does not provide a B-AWS you will have no way to commission the system. No vendor could stay in business if they did not provide the tools needed to configure, commission, and troubleshoot its system. The difference is that a BACnet Advanced Workstation provides *BACnet* tools for completing these tasks. That means you can use it to commission and reconfigure a system with components supplied

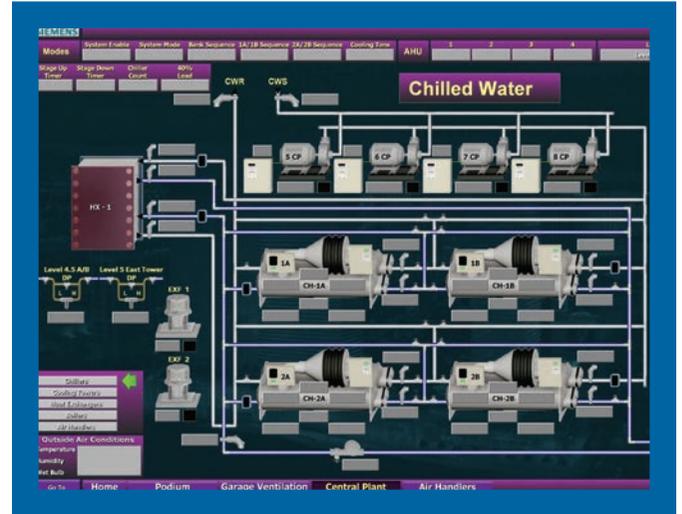
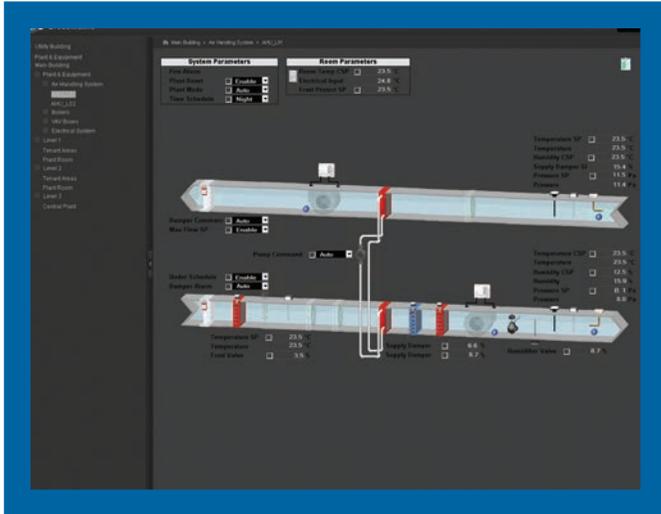


**Figure 2:** A text-based operator display.

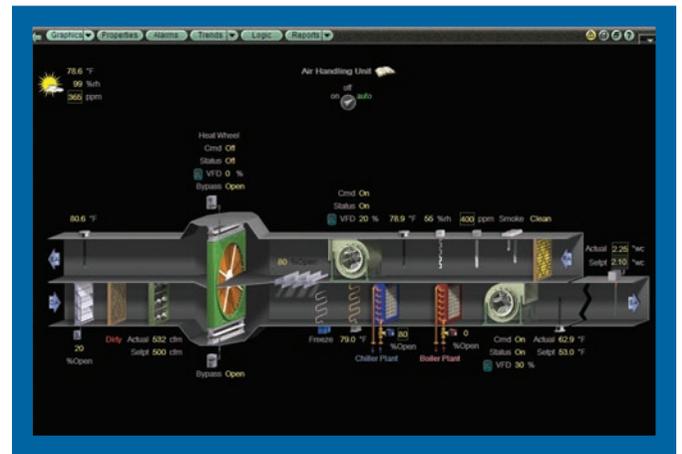
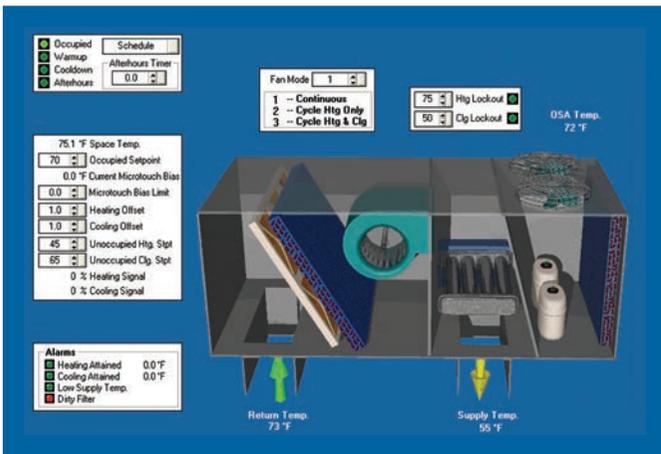
by multiple BACnet vendors, as the happy operator in *Figure 1* illustrated. If your system comes from a single vendor, or if you manage a combined system that's installed and modified by contractors with the appropriate vendor tools, then a BACnet Operator Workstation may be ideally suited to your needs. If, on the other hand, you need to configure controllers made by multiple vendors, then you may need BACnet Advanced Workstation features.

A B-AWS gives the operator the tools needed to manage a system on a daily basis. If that sounds suspiciously like the functionality provided by a B-OWS it's because a B-AWS provides all of the features of a B-OWS, plus the additional features needed to go beyond daily operations. *Figures 5* and *6* show screenshots of BACnet Advanced Workstations.

At an equipment summary level, the screenshots of the Advanced Workstations look very similar to the Standard Workstations. There are obvious style and presentation differences between vendors, but they all show information a user would

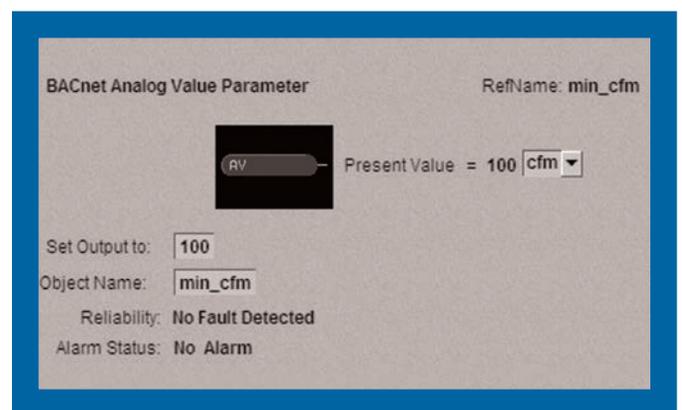


**Figure 3 (left):** BACnet operator workstation (B-OWS). (courtesy of Honeywell International) **Figure 4 (right):** B-OWS (courtesy of Siemens Industry)



**Figure 5 (left):** BACnet advanced workstation (B-AWS). (courtesy of Alerton Controls). **Figure 6 (right):** B-AWS. (courtesy of Automated Logic Corporation)

need for daily operations. The differences between an Advanced and a Standard Workstation would not show up until the user “drilled down” much deeper, to get to configuration settings. As an example, a B-OWS must be able to read, display, and modify the name, present value, units, and status flags of any BACnet analog object. Those are the most commonly used properties of analog objects, but the BACnet standard defines many more properties for these objects. An Analog Input, for example, must have eight required properties and may have up to 19 optional properties. These are properties such as the description, change of value (COV) increment, and the event enable, which are needed to configure the object but which are typically not used during day-to-day operations. The Advanced Workstation must be capable of reading, displaying, and modifying all of these properties. Indeed, it must be capable of reading, displaying, and modifying every standard property of every BACnet object, except for a few specifically excluded life safety and access control objects. To illustrate the differences, *Figure 7* shows the minimum properties of an Analog Value Object that a B-OWS must display while *Figure 8* shows the additional information available in a B-AWS display of the same object. (Note: *Figure 7* is a compos-

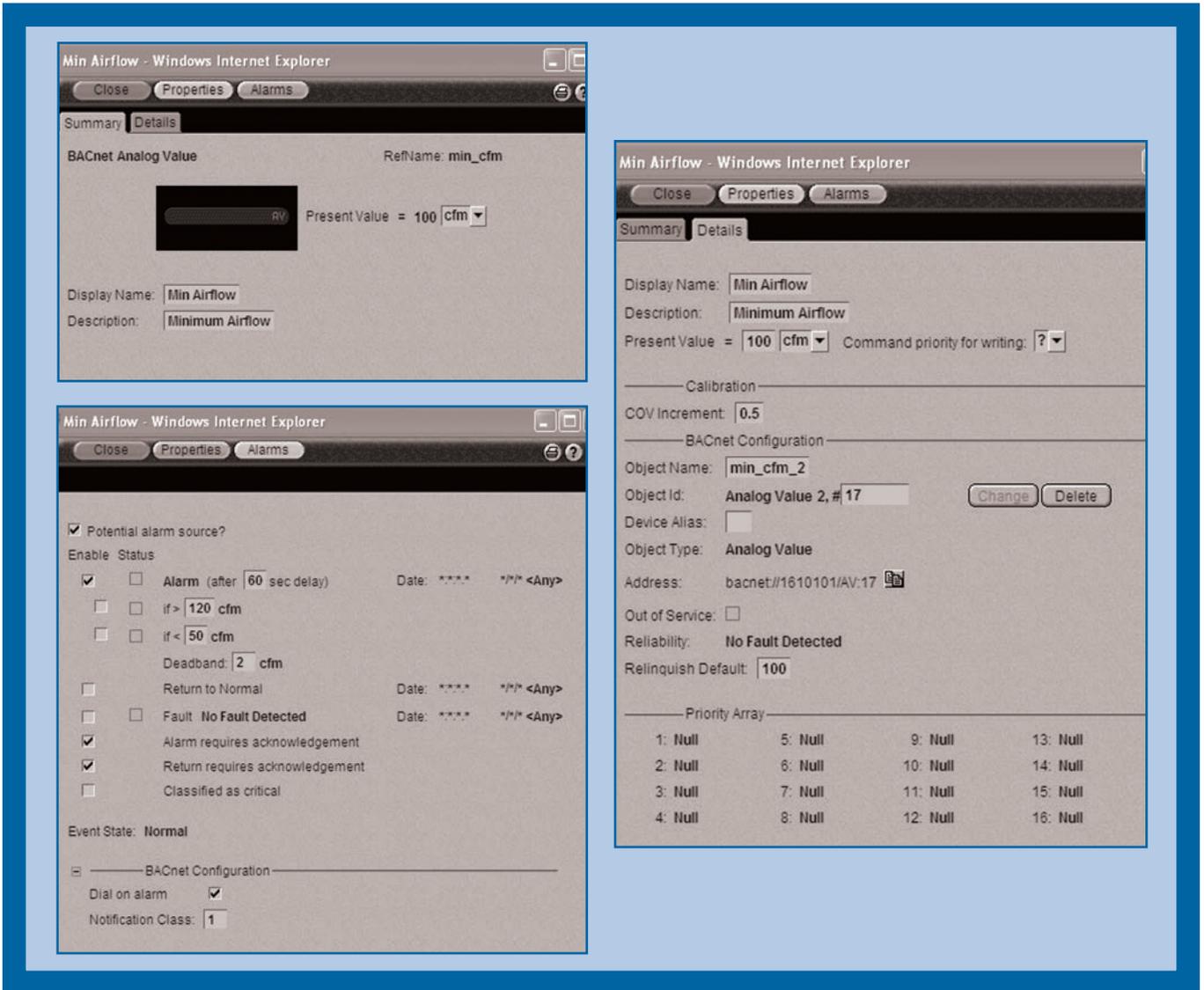


**Figure 7:** Minimum properties displayed by a B-OWS.

ite image edited to show only the minimum values and is not an actual vendor screenshot.)

A similar differentiation exists in the way the workstations handle alarms. All workstations must be able to receive, display, and acknowledge alarms. The Standard Operator Workstation can also modify some of the commonly used alarm

*Advertisement formerly in this space.*



**Figure 8:** BACnet properties displayed by a BACnet advanced workstation.

properties, such as the high limit, low limit, and deadband on an Analog Input object. The Advanced Workstation can do everything the standard workstation can do, plus it can edit properties like `event_enable`, `time_delay`, and `notification_class` that are generally only needed during the start-up and commissioning of a system.

Table 1 shows the specific capabilities each type of operator interface supports in terms of the BACnet Interoperability Building Blocks, or BIBBs. The specific BIBB requirements come directly from the BACnet standard; however, the “Description” column is my attempt to provide a “plain English” explanation of what these BIBBs mean. Diehard BACneteers may quibble with the way I’ve described some of the BIBBs, but then again, diehard BACneteers don’t need to read this article. They already know that “an AE-AVM-A Device is capable of writing any standard form of the `Event_Parameters` property to any Event Enrollment object, excluding `BUFFER_READY`.” After all, it’s in the standard!

### Closing Thoughts

It should be noted that, as with all other aspects of the BACnet standard, the Operator Interface standards are designed to make BACnet products interoperable, not interchangeable. Control system vendors devote a great deal of effort to the “look and feel” of their products, and this is especially true of the user interface. Just because both Vendor A and Vendor B sell workstations that are capable of presenting the schedules contained in Vendor C’s controller does not mean you will be equally happy with either workstation. Vendor A may present the schedule in a manner that’s particularly easy to understand, or Vendor B may provide a simple way to edit multiple schedules at once. The BACnet standard requires both vendors to be able to read Vendor C’s schedule, but it allows them to present the data in any manner they want. It also does not restrict them from offering proprietary features which provide functionality above and beyond the minimum requirements of the BACnet standard.

Category	BIBB	Description	Operator Display (B-OD)	Operator Workstation (B-OWS)	Advanced Workstation (B-AWS)
Data Sharing	DS-RP-A,B	Read One Property	X	X	X
	DS-RPM-A	Read Multiple Properties With One Request		X	X
	DS-WP-A	Write One Property	X	X	X
	DS-WPM-A	Write Multiple Properties With One Request		X	X
	DS-V-A	Read Commonly Used Properties (Values)	X	X	X
	DS-AV-A	Read Any Standard Property of Any Object*			X
	DS-M-A	Modify Commonly Used Properties	X	X	X
	DS-AM-A	Modify any Standard Property of Any Object*			X
Alarm and Event Management	AE-N-A	Receive Notification of Alarms and Events	X	X	X
	AE-ACK-A	Acknowledge Alarms		X	X
	AE-AS-A	Provide a Summary View of Alarms and Events		X	X
	AE-VM-A	View and Modify Some Alarm Configuration Parameters		X	X
	AE-AVM-A	View and Modify All Alarm Configuration Parameters			X
	AE-VN-A	View Some Notification Information	X	X	X
	AE-AVN-A	View all Notification Information			X
	AE-ELVM-A	View and Modify the Event Log			X
Scheduling	SCHED-VM-A	View and Modify Some Schedule Properties		X	X
	SCHED-AVM-A	Create, View, and Modify Schedules and Calendars			X
Trending	T-V-A	Display Trend Values		X	X
	T-AVM-A	Display Trend Values and Modify Trend Configuration			X
Device and Network Management	DM-DDB-A,B	Dynamically Discover and Respond to Another Device	X	X	X
	DM-ANM-A	Discover all BACnet Devices on the Network			X
	DM-ADM-A	Discover and Present a List of All Objects in Any Device			X
	DM-DOB-B	Provide List of Its Own Objects Upon Request	X	X	X
	DM-DCC-A	Exercise Communication Control Over Another Device			X
	DM-MTS-A	Broadcast Time Sync at Operator's Request		X	X
	DM-OCD-A	Create and Delete Objects in Another Device			X
	DM-RD-A	Re-initialize Another Device			X
	DM-BR-A	Backup and Restore Files to Another Device			X

\* Excluding certain life safety and access control objects.

**Table 1:** BACnet operator interface BIBB support.

As an analogy, a Ferrari and a Jeep are both capable of transporting a driver from Point A to Point B, but they provide very different user experiences and value propositions. Car buyers need to decide which one best meets their needs, desires, and budget. Similarly, BACnet defines three different types of user

interfaces, and different vendors offer different implementations of these devices. The BACnet Testing Lab can certify that they all provide the same base level functionality, but it's up to you to decide which workstation best meets your needs, desires, and budget.●