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MicroTech® BACdrop™

Sales and Application Guide

What is BACdrop?

The MicroTech® BACdrop™ panel is a gateway that allows any BACnet™-based building automation system (BAS) to communicate with most MicroTech unit or supervisory controllers (see list below). The BACdrop panel translates between the standard BACnet protocol (ANSI/ASHRAE 135-1995) and the proprietary MicroTech protocol. No modification to standard MicroTech hardware or current software is necessary to enable the BACdrop gateway to work.

The easiest way to think of the BACdrop panel is in terms of Open Protocol™. Like an Open Protocol Master panel (OPM), it provides a single-point connection from a BAS network to a MicroTech sub-network, providing read and write access to up to 63 MicroTech controllers. One big difference between the BACdrop and OPM panels is that BACnet is a standard, public protocol, and thus *no Open Protocol license agreement is required*. Another difference is that the BACdrop panel is much smarter than an OPM panel and contains more processing power. This processing power is used to translate the data that is going across the interface. (In the OPM panel, no data translation is necessary; it simply passes the MicroTech data through.)

Because the BACdrop panel performs data translation, a BACdrop panel is required for *all* BACnet-to-MicroTech applications—even those with only one MicroTech controller or those that will have a MicroTech supervisory controller (CSC, RMS, RMC). This is another important difference between the BACdrop and OPM panels that should be kept in mind.

The BACdrop gateway is a router¹ that creates a BACnet image of its associated MicroTech controllers. From the BACnet side of the gateway, the MicroTech controllers *appear* to be BACnet nodes with normal BACnet objects and services. Thus, the MicroTech controllers become *virtual* BACnet controllers, and the BACdrop gateway itself becomes essentially transparent. The data transmission rates to a BACnet monitoring PC (provided by others) are as good as or better than those in a complete MicroTech system with Monitor™ software (see below).

PLEASE NOTE:

The BACdrop gateway translates MicroTech protocol into BACnet protocol and functions similar to a router in that the BACdrop panel passes messages upon request at the same speed as the MicroTech unit controller, 9600 bps. The BACdrop panel does not buffer (store) this data. Since the data is not being stored, the BACdrop panel may only pass data as quickly as it is receiving data. Though the BACdrop panel may be passing the MicroTech data to a high-speed Ethernet LAN (10 Mbps), the data coming into and out of the BACdrop panel is at 9600 bps. If the building automation system, (BAS), is not buffering data and instead is pulling data real-time, it may take several seconds or even several minutes to provide data coming from the MicroTech controller(s) through the BACdrop gateway to a graphic, trend log or other BAS application. If a buffering function is required, the

¹ The BACdrop gateway is a router, but it cannot be classified as a “BACnet Router” since, by definition, a BACnet router connects two real BACnet subnetworks.

systems integrator must provide it. See the sections in this document regarding Data Transmission Performance to help the systems integrator estimate the appropriate requirements for each project. As shipped from the factory, the BACdrop panel supports only the *latest revisions* of *standard* MicroTech controller applications. This is true because the application-specific memory locations within all supported MicroTech controllers are mapped and stored within the BACdrop panel's memory. If necessary, custom MicroTech control applications can be supported by the BACdrop panel. Contact the McQuay Controls group for a quote. For retrofit jobs, new MicroTech software can be loaded into older MicroTech controllers to make them BACdrop compatible. Contact the appropriate product group for more information.

The BACdrop panel is Year 2000 compliant in accordance with McQuay International's definition. For more information, see ED Y2000-MTE, which is available on McQuay OnLine or the McQuay Web site.

BACdrop Capabilities

The BACnet standard was developed with flexibility in mind. It recognizes that a typical BAS includes many types of devices (e.g., smart sensors, smart actuators, controllers, PC interfaces) with a variety of functions and capabilities. Not every BACnet device needs to implement the same set of BACnet elements. To facilitate the discussion and specification of BACnet devices, the BACnet standard requires each BACnet device to have a *protocol implementation conformance statement* (PICS). The PICS is a concise summary of all the BACnet features that have been implemented in that device. McQuay International has released two PICS: one for the BACdrop panel and one for the MicroTech controller applications (virtual BACnet devices). A common PICS is used for the MicroTech controllers because at the nuts-and-bolts level of the PICS, all MicroTech applications are supported identically. As you will see, to read and understand a PICS requires some level of BACnet knowledge.

The PICS is intended to streamline the specification and submittal process. However, it still allows room for error in under- or over-specification. Good BACnet specifications will clearly describe the required BAS capabilities in addition to including the PICS attributes desired. In some cases, the written description and the PICS description may not line up. For example, even though the MicroTech virtual BACnet controllers do not support the BACnet GetAlarmSummary service—which may be required by a specification and listed in its PICS requirement—they do allow alarms to be read and reported just like any other data. In this case, BACdrop would meet the intent but not the letter of such a specification. A BACnet-wise sales representative will understand this and point it out to the specifier.

In general, the BACdrop gateway provides the BACnet BAS and its supported MicroTech controllers with about the same capabilities that they would have in an Open Protocol application. That is, the BAS may read from or write to the MicroTech controllers, but the MicroTech controllers may not request any data from any device on the BACnet side of the gateway. The MicroTech network is *passive*—just like in an Open Protocol application.

Supported MicroTech Applications

The BACdrop panel contains a program and point mapping information that allow it to create virtual BACnet controllers for almost all standard MicroTech applications. The point mapping information is contained in a point mapping file (PMF) that is loaded into the BACdrop panel at the factory. If necessary, new revisions of the PMF file can be easily downloaded in the field.

The following standard MicroTech applications are supported in the current version of the PMF file:

- Unit ventilator
- Applied rooftop systems
- Self-contained air conditioning systems
- Series-100 centrifugal chiller (old-style MicroTech controls) and LLLB controller
- Series-200 centrifugal chiller
- Reciprocating chiller (only U.S. manufactured at present)

- Air-cooled screw chiller (type ALS)
- Water cooled screw chiller (types WHS, PFS-B, PFS-C)
- Large-tonnage water cooled screw chiller with J&E Hall compressor (type PES)
- Air cooled scroll chiller (type AGZ)
- MicroTech Chiller System Controller (CSC)
- MicroTech Remote Monitoring and Control Panel (RMC)
- MicroTech Remote Monitoring and Sequencing Panel (RMS)

The contents of the standard PMF file have been documented in a series of BACnet Data Information Packets (BDIP). One BDIP has been created for each supported MicroTech application. The BDIPs are intended for use by a BAS systems integrator. As with Open Protocol, the MicroTech points listed in the BDIPs are simply made *available* to the systems integrator. It is up to the specifying engineer and the systems integrator to determine which of these points to actually implement in the BAS. In almost every case, the same points that are made available via Open Protocol are made available via BACdrop. If a specification calls for points that the BDIP does not list, please contact the McQuay Controls group—there is a good chance that they can be added to the standard PMF file at no charge.

Custom Software

The BACdrop gateway is preprogrammed with a PMF file that supports most current, standard MicroTech controller applications. While we encourage the use of standard MicroTech software whenever possible, we recognize that at times this is impractical. If necessary, the McQuay Controls group can create a custom PMF file that will support a custom MicroTech software application. In some situations, custom MicroTech controller software may be compatible with the standard PMF file, but this must be confirmed by the McQuay Controls group. Contact the McQuay Controls group for more information and/or a quote on a custom PMF file.

If a custom PMF file is necessary, it can be downloaded to the BACdrop gateway in the field during the commissioning process.

LAN Options

The BACnet protocol currently offers four LAN options for connecting BACnet nodes: ISO 8802-3 (Ethernet®), ARCNET®, MS/TP (EIA-485), and LonTalk®. *It is important to understand that the BACdrop panel is compatible with only the Ethernet LAN in its 10BaseT medium.* We chose 10BaseT Ethernet because it is the most common type of LAN medium. If necessary, routers can be obtained that will convert one LAN type to another, but they can be expensive to purchase, install, and commission. Typically, the provider of the BAS will also provide any systems integration products and services, which would normally include LAN media conversion routers. *To help avoid a customer claim regarding this issue, you must assure that this is made explicit in any sales contract.* Please keep this point in mind when bidding a BACdrop project.

Careful consideration must be given before selecting the LonTalk LAN option. In this LAN option, high-level BACnet application layer messages are transmitted over the low-level data link and physical layers of the LonTalk protocol. Note that normal LonWorks® or LonMark® controllers are not able to understand these BACnet messages (and vice-versa) without a smart gateway to perform translation. Since a translation gateway is required, the typical and logical place to locate it would be between the *physical* BACnet and LonTalk networks. As a result, it is unlikely that LonTalk will be used regularly as a BACnet LAN option.

Data Transmission Performance

In the BACdrop panel—and its MicroTech virtual BACnet controllers—normal data transmission is carried out by four workhorse BACnet services:

- ReadProperty
- ReadPropertyMultiple
- WriteProperty
- WritePropertyMultiple

For each of these, the BACdrop gateway is able to execute requests that it receives from the BAS. The BACdrop is not able to initiate requests, and it has no need to, since its MicroTech controllers are at the field-bus level. These characteristics are the essence of the BACnet “conformance class 3” specification of the MicroTech virtual BACnet controllers. The main point to keep in mind is that the BAS must always initiate any sort of communication to the MicroTech controllers. The BACdrop gateway, on behalf of its MicroTech controllers, can only gather the requested information and respond.

In a typical BAS, the responsiveness of a PC-based operator interface is usually the most important criterion of data transmission performance. This responsiveness depends on the BAS system as well as the BACdrop gateway and the MicroTech network. In a typical BAS, communication requests are limited to (1) reads and occasionally writes for the points that are on the current screen and (2) reads and writes for a few other points in the background, such as alarm data or scheduled start/stop commands. However, not all BAS systems are the same, and some may initiate more requests than others, which can affect performance. Some BAS systems may also make their requests at slower rates than others, which of course is beyond the control of the BACdrop gateway.

That being said, here are a few benchmark statistics that should give you some idea of the BACdrop’s responsiveness:

Performance measure	Level-1 BACdrop	Level-2 BACdrop
BACdrop packet turnaround, ReadProperty, 1 Present_Value request	118 ms	121 ms
BACdrop packet turnaround, ReadPropertyMultiple, 20 Present_Value requests (see note below)	1780 ms	1801 ms
BACdrop packet turnaround, WriteProperty, 1 Present_Value request	132 ms	136 ms
BAS screen turnaround, ReadProperty, 1 Present_Value request, heavy traffic	1.9 s	2.0 s
BAS screen turnaround, ReadProperty, 20 Present_Value requests, heavy traffic	6.9 s	8.4 s
BAS screen turnaround, ReadPropertyMultiple, 20 Present_Value requests, heavy traffic (see note below)	6.3 s	8.0 s
BAS screen turnaround, WriteProperty, 1 Present_Value request, heavy traffic	3.3 s	3.7 s

There are two types of parameters listed in the table above: “BACdrop packet turnaround” and “BAS screen turnaround.” These are explained below.

The performance data for 20 present values is intended to show the total time required to service a typical screen’s worth of controller data. The 20 values were read in two ways: individually with the ReadProperty service and en masse with the ReadPropertyMultiple service (see note below).

The level-2 BACdrop test data shows the performance of a system in which a MicroTech supervisory controller (i.e., CSC, RMS, or RMC) is present. In this type of application, the supervisory controller must be level 1, which forces the BACdrop to level 2. The BACdrop’s responsiveness is affected slightly because it must be polled by the level-1 supervisory controller. See “MicroTech Supervisory Controllers and the Level-2 BACdrop” below for more on level-2 BACdrop applications.

Note: The BACnet ReadPropertyMultiple service can cause excessive delays when a controller is offline. This is because the BACnet rules require that an attempt be made to read each property declared in the ReadPropertyMultiple service request, even after the first two or three read attempts time out and fail. If it is known that certain controllers will routinely be offline (e.g., power turned off), it may be advantageous to perform reads using only the ReadProperty service. As the above data show, the speed advantage offered by the ReadPropertyMultiple service over the ReadProperty service is minimal.

BACdrop Packet Turnaround

The “BACdrop packet turnaround” times listed above are for complete turnaround within the BACdrop/MicroTech network; i.e., the period between the points at which the BACdrop receives a data request packet at its Ethernet port and posts a response packet at its Ethernet port. During this period, the BACdrop translates the BACnet message to MicroTech, sends out the request on the MicroTech network, and then receives the response and translates it back to BACnet for use by the BAS.

The BACdrop packet turnaround times were gathered using VTS (Visual Test Shell) software, which was created by NIST (National Institute of Standards and Technology). They show that the BACdrop/MicroTech system is extremely quick. Note that this test does not include elements that are outside of the BACdrop/MicroTech network (i.e., BAS software, Ethernet network traffic), and which would be required in a usable BAS.

BAS Screen Turnaround

The “BAS screen turnaround” times listed are for complete turnaround on a BAS request; i.e., the period between the points at which the BAS issues the request and the PC updates the screen (for a read) or the MicroTech controller receives the update (for a write). We used a typical third-party BACnet BAS that is available on the market today. The values in the above table will vary significantly, depending on the BACnet BAS being used and the amount of traffic on the Ethernet network. In our tests, the Ethernet network was extremely busy (we used the McQuay International internal LAN system). These numbers are intended to provide a rough feel for performance that might be experienced by a user in a *worst-case* environment. Note that this test includes elements that are outside of the BACdrop/MicroTech network (e.g., BAS software, network traffic) and over which we have no control.

Example of BAS System Turnaround Time

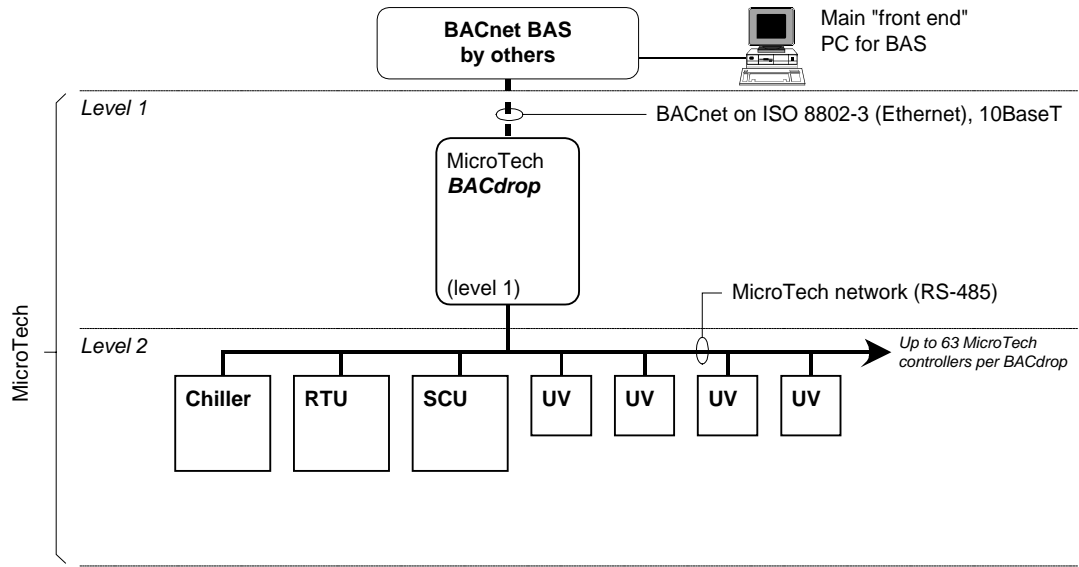
A simulation was set up to demonstrate typical end-to-end turnaround times through a BAS. The simulated system consisted of four MicroTech vertical self-contained unit (SCU) controllers, a BACdrop panel, and a BAS work station. A screen was created for the BAS that represented 16 points for each of the four SCU controllers. This particular BAS issues a Who-Is device discovery sequence whenever a screen is to be displayed. The average time required to display all 64 points during this discovery process was measured at 15.5 seconds. Once the BAS completed the device discovery it would perform Read Property Multiple requests periodically to refresh the data on the screen. These screen updates required approximately 4.3 seconds to update the 64 points. This particular BACnet building automation system was connected to the BACdrop panel over an Ethernet, 10 Mbps cable.

MicroTech Supervisory Controllers and the Level-2 BACdrop

When a MicroTech supervisory control panel is used (CSC, RMS, RMC, or LLLB), data transmission speed will be affected. The reason for this is related to the nature of the MicroTech master-slave network topology.

See figures below. When a MicroTech supervisory controller is not used, the BACdrop is in the level-1 master position in the MicroTech network. This allows it to obtain data from its level-2 slave controllers in the most efficient way possible. When a MicroTech supervisory controller is used, it must occupy the level-1 master position, forcing the BACdrop panel to a level-2 slave position. This means that the level-1 controller (e.g., CSC) must poll the BACdrop for all requests it has of other controllers (e.g., chiller temperatures) on the network. Because the level-2 BACdrop must wait to be polled, a delay is introduced that will ultimately affect the responsiveness at the BAS PC. As the above data show, this delay is minimal.

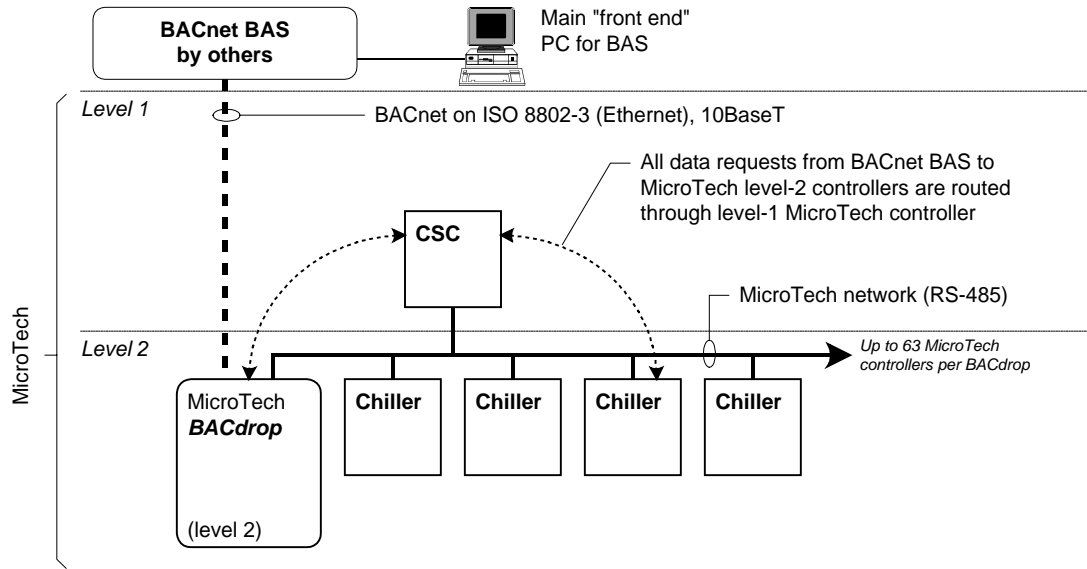
Typical BACdrop Application (Level-1 BACdrop)



Monitor Software and BACdrop

In general, Monitor software should *not* be used in a BACdrop network—except perhaps for temporary troubleshooting purposes. In this instance, a PC containing Monitor software could be directly connected to Port A (TTY) of any MicroTech controller for access to that controller only. (The BACdrop commissioning software is also capable of this.) In a BACnet BAS with a BACdrop-MicroTech subnetwork, the user interface software for the main “front end” PC should be provided by the systems integration company.

BACdrop Application with a MicroTech Supervisory Controller (Level-2 BACdrop)



When the BACdrop is level 1 (see figure above), communications between the PC containing Monitor software and other MicroTech controllers on the network is physically impossible. Only the MicroTech controller that the PC is directly connected to can be communicated with. This excludes the BACdrop panel itself—Monitor software cannot be used to communicate with the BACdrop panel by any means. (The BACdrop commissioning software allows this.)

When the BACdrop is level 2 (see figure above), communications between the PC containing Monitor software and other MicroTech controllers on the network is possible, but it will severely affect the data transmission rates through the BACdrop gateway. *We do not recommend such an application.*

Commissioning a BACdrop Job (Supervision)

From the perspective of the person doing the commissioning (the “Comissioner”), the goal when commissioning a BACdrop job is the same as when commissioning an Open Protocol job—to establish good communications throughout the MicroTech network so that the third-party BAS can connect to a single port and communicate to all MicroTech controllers. It is the responsibility of the Comissioner to provide this service, which we call “supervision.” The Comissioner’s supervision responsibility typically ends where the system integrator’s Ethernet cable enters the BACdrop panel. (Again, this must be agreed to in the sales contract.)

Before supervision can begin, all electrical and mechanical subcontractor work must be completed, MicroTech supervisory controllers (if any) must be installed, and all mechanical equipment must be fully operational.

Supervision on each job is available in one of two ways:

a. Sales representative service agency

Personnel from the sales representative office commission the network. Estimates and work are 100% the responsibility of the sales representative. Before supervision is made available in this way, or support for this supervision alternative is provided by the McQuay Controls group, the service agency technician *must* participate in a MicroTech network commissioning class.

b. Local McQuay Factory Authorized Service office (MicroTech trained)

MicroTech-trained personnel from a local McQuay Factory Authorized Service office commission the network. Project documentation is required by the McQuay Factory Authorized Service two weeks before commissioning. For firm quotes, contact the MicroTech-trained McQuay Factory Authorized Service office nearest you.

To enable a technician to check the MicroTech network, a PC is required—as it is in an Open Protocol application. However, for the BACdrop situation, a special commissioning program will be used instead of Monitor software. This new commissioning software is Windows based and is easy to use. In fact, no special BACdrop training is required. *Anyone who has previously successfully completed the MicroTech network systems training course should be able to commission a BACdrop job.* The BACdrop IM manual provides comprehensive and detailed information and procedures that will fill in the gaps. Note that the BACdrop commissioning software is a 32-bit program that must be run on Windows 95/98.

In addition to a PC, the following equipment may be needed to commission and troubleshoot a BACdrop-MicroTech network:

- Standard serial cable, DB9 (required)

This cable connects between the serial ports on the commissioning PC and the BACdrop gateway. The connection allows a technician to configure the BACdrop for the specific job requirements. If necessary, it also allows a technician to download a revised BACdrop program or PMF file.

If there are no problems on a project (e.g., network wiring, addressing), this is the only connection the technician will need to make.

A serial cable is a standard product that is available through all PC retail stores.

- MicroTech PC Communications Cable Kit (optional)

All experienced MicroTech technicians should already have this cable kit. It allows a PC to be directly connected to a MicroTech controller. If communications problems exist with a particular controller, the PC running the BACdrop commissioning software can be used to do some direct-connect troubleshooting on that controller. (If available, Monitor software could also be used to do the same thing.) For example, checksums and addresses can be verified and port configurations and network levels can be changed.

The cable kit is available only from McQuay International. The part number is 057186802.

- Ethernet card for the PC and Ethernet hub or crossover cable (optional)

This equipment allows the commissioning PC to be connected to the BACdrop's Ethernet port. The commissioning software can then be used to verify communications to each MicroTech controller through the BACdrop gateway. This is analogous to commissioning an Open Protocol project; i.e., the McQuay representative connects to and verifies communications through the same port that the BAS company will eventually use. If there are communications problems, this technique can be used to prove that they are on the BAS side of the gateway.

Ethernet cards, hubs, and crossover cables are standard products that are available through most PC retail stores. For a PCMCIA Ethernet card, we recommend Linksys or 3Com.

- RS-232 to RS-485 converter (optional)

This converter allows the commissioning PC to be connected directly to the MicroTech network (RS-485) through its serial port (RS-232). The PC emulates a level-1 controller. The commissioning software can then be used to verify communications to each MicroTech controller. This method might also be useful in isolating a communications problem to the BACdrop panel.

An RS-232 to RS-485 converter can be obtained through most electronics supply houses such as B&B Electronics or Black Box. We recommend B&B model 485PTBR. B&B can be reached at 815-433-5100.

Pricing

For BACdrop pricing, refer to Price List 1400. For additional pricing information, contact the McQuay Controls group of McQuay International in Minneapolis.

Literature

The following documentation regarding BACdrop is available on McQuay OnLine. The “r” character in the document number and file name indicates the revision number.

Document	Number	File name
BACdrop IM manual	IM 689- <i>r</i>	IM689- <i>r</i> .DOC
BACdrop certified drawing	CD 585562	CD585562.DOC
BACdrop submittal sheet	ED 15049	ED15049.DOC
BACdrop PICS (protocol implementation conformance statement)	N/a	PICS-BAC.DOC
MicroTech virtual BACnet controller PICS	N/a	PICS-MT.DOC
BDIP (BACnet data information packet) for MicroTech air-cooled screw chiller applications (type ALS)	BD 01- <i>r</i>	BD01- <i>r</i> .DOC
BDIP for MicroTech water cooled screw chiller applications (types WHS, PFS-B, PFS-C)	BD 02- <i>r</i>	BD02- <i>r</i> .DOC
BDIP for MicroTech scroll chiller applications (type AGZ)	BD 03- <i>r</i>	BD03- <i>r</i> .DOC
BDIP for MicroTech large-tonnage water cooled screw chiller applications (type PES with J&E Hall compressor)	BD 04- <i>r</i>	BD04- <i>r</i> .DOC
BDIP for MicroTech series-100 centrifugal chiller applications; includes MicroTech Lead-Lag/Load Balance (LLLb) controller	BD 05- <i>r</i>	BD05- <i>r</i> .DOC
BDIP for MicroTech series-200 centrifugal chiller applications	BD 06- <i>r</i>	BD06- <i>r</i> .DOC
BDIP for MicroTech reciprocating chiller applications (U.S. models only)	BD 07- <i>r</i>	BD07- <i>r</i> .DOC
BDIP for MicroTech self-contained air conditioning applications	BD 08- <i>r</i>	BD08- <i>r</i> .DOC
BDIP for MicroTech applied rooftop system applications	BD 09- <i>r</i>	BD09- <i>r</i> .DOC
BDIP for MicroTech unit ventilator applications	BD 10- <i>r</i>	BD10- <i>r</i> .DOC
BDIP for MicroTech Remote Monitoring and Sequencing Panel (RMS)	BD 11- <i>r</i>	BD11- <i>r</i> .DOC
BDIP for MicroTech Remote Monitoring and Control Panel (RMC)	BD 12- <i>r</i>	BD12- <i>r</i> .DOC
BDIP for MicroTech Chiller System Controller Panel (CSC)	BD 13- <i>r</i>	BD13- <i>r</i> .DOC

Additional Information

For more information regarding BACdrop, contact the McQuay Controls group of McQuay International in Minneapolis.

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