Installation Instructions

For Controllers with
MS/TP Automatic MAC Addressing

Important notices

Disclaimer

KMC Controls

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SECTION 1

Introduction to automatic addressing

MS/TP automatic MAC addressing is a process developed by KMC Controls to automatically assign MAC addresses to MS/TP controllers. This section is an overview of the automatic addressing process.

About automatic addressing

To reduce field labor costs KMC Controls has developed a unique process to automatically assign MAC addresses and device instance numbers to BACnet MS/TP controllers. The automatic MAC addressing process eliminates the need for an installing technician to address individual controllers in the field or for preaddressed controllers to be installed at specific locations.

- ◆ A unique BACnet device instance is automatically assigned at the factory. The device instance is generated from the electronic model number and part of the serial number embedded within the controller. With over four-million allowable device instance numbers, the probability of duplicate numbers on the same job site is very small.
- ◆ When all controllers are connected to an MS/TP network, the MAC addresses are automatically assigned by the automatic MAC addressing process.
- ◆ After automatic addressing is complete, MAC addresses are locked into the controllers.
- ◆ Controllers can then be programmed and configured from a central location using either BACstage or TotalControl.

About automatic addressing controllers

Automatic addressing controllers operate in two modes, anchor or nomad.

anchor controller A BACnet controller from KMC Controls that has been designated to assist in an automatic process to assign MAC addresses to nomad controllers on an MS/TP network.

An anchor controller:

- Has the default MAC address 3. Its MAC address must be 0, 1, 2, or 3.
- Has a unique device instance assigned at the factory. Three device instance labels are affixed to the controller at the factory.
- Was shipped as a nomad and then changed to an anchor with the restart button.
- Locates the nomad controllers on its local MS/TP network and provides a MAC address to them.
- Locks the MAC addresses assigned by the automatic addressing process into the nomad controllers on the local MS/TP network.

nomad controller The nomad state is the default state for automatic addressing controllers. Through an automatic process, a nomad controller acquires a MAC address from an anchor controller on the local MS/TP network.

A nomad controller:

- Does not have a MAC address but does have a unique device instance assigned at the factory. Three device instance labels are affixed to the controller at the factory.
- Acquires a MAC address through the automatic addressing process.
- Can be converted to an anchor with the restart button.
- Runs Control Basic programs at start up.

Overview of installation

On the job site, the pre configured controllers are installed by the electricians or installing technicians and then started by a controls technician.

Installing the controllers

Controllers with automatic addressing are installed following standard wiring and network practices for BACnet MS/TP networks. As each controller is installed, its location is noted. Recording is simplified by removing a device instance label from the controller and placing it on the system plans or worksheet. Once installed, the controller can be then be powered and all built-in programs with local functions will be begin to run.

If the network includes BACnet controllers that require a fixed MAC address, those controllers are installed and addressed following normal procedures.

Router and BACstage set to MAC 0, 1 or 2   Anchor: MAC 3   Nomads: MAC 4-127
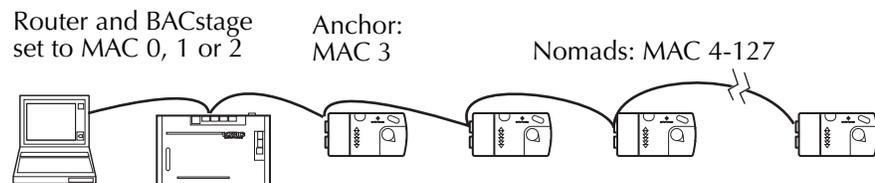
Illustration 1–1 Typical automatic addressing MS/TP network

Setting the MAC addresses

Once all controllers on a network are connected and powered, the controls technician designates one of the controllers with automatic addressing as the anchor controller. The technician uses only the restart button on the controller. The anchor then initiates a process of discovery and MAC assignment.

1. The anchor controller monitors network traffic and gathers all of the MAC addresses in use.
2. Once the anchor determines the addresses in use, it looks for nomad controllers on the network that require a MAC address. A nomad controller is a controller with automatic addressing that has not been designated as an anchor.
3. Nomad controllers then acquire a MAC addresses from a pool of available addresses provided by the anchor.

Although service tools, computers or special software are not required for controllers with automatic addressing, the technician may choose to monitor the process with BACstage or TotalControl.

Locking the addresses

Once the process of discovery and assignment is complete, the technician locks the MAC addresses into the controllers using only the restart button on the anchor controller.

If additional controllers are added to the MS/TP network, a technician repeats the discovery and assignment process.

Applicable models

Automatic MAC addressing is available in controllers with firmware version 2.0.0.0 and later. This includes the following models:

BAC-5801	BAC-7003	BAC-7301C	BAC-7303C
BAC-5802	BAC-7051	BAC-7302	BAC-7401
BAC-5831	BAC-7053	BAC-7302C	BAC-7401C
BAC-7001	BAC-7301	BAC-7303	

SECTION 2

Installing controllers with automatic addressing

The following procedures cover installing BACnet automatic addressing controllers on MS/TP networks.

The automatic MS/TP addressing process from KMC Controls is a unique process of discovering and assigning MAC addresses. It is designed to save time and money by eliminating the need to assign individual MAC addresses and device instance numbers to controllers before they are installed on a network.

Before you install automatic addressing controllers

You will need the following items to install and configure a network with automatic addressing controllers.

◆ Have available and be familiar with the TotalControl or BACstage programs.
◆ A digital voltmeter.
◆ Application Note *AN0404A, Planning BACnet Networks.*
◆ Installation and operation guides for each model of controller on the network.
◆ A set of system plans with controller locations.
◆ Be familiar with the automatic addressing process as described in the section *Introduction to automatic addressing on page 5*.

Setting up a new network with automatic addressing controllers

Use this procedure to configure a single MS/TP network with all new BACnet controllers from KMC controls. The steps in this procedure are repeated for each MS/TP network on the BACnet system.

◆ The controllers are installed on a standard MS/TP network following guidelines in Application Note *AN0404A, Planning BACnet networks* and the installation instructions supplied with the controllers.

◆ MAC addresses 0, 1 and 2 are reserved for the BAC-5050 router, the BAC-1616 building controller and software and service tools such as BACstage.

◆ The anchor controller is MAC address 3.

◆ The nomad controllers will acquire MAC addresses from 4 to 127 from the anchor controller.

Install the controllers on the network

1. Install and wire the controllers following standard practices for BACnet MS/TP networks.

2. As each controller is installed, the installing technician must copy the device instance number from the controller and record it with the location of each unit.
   - Use one of the instance labels affixed to the controller for this record keeping.
   - The second label remains on the controller to identify the device instance assigned to the controller.

3. As the installation for a controller is complete, turn on the controller power.

4. When all of the controllers are installed, verify the following:
   - All controllers are powered.
   - The network has the MS/TP end-of-line switches set properly.

5. Measure the bias voltage on each segment of the network. Measure voltages at each end-of-line controller and before and after each repeater. Use a digital voltmeter to measure from controller ground to each communication terminal.
   - The nominal voltage between terminal +B and ground is between 1.4 and 2.6 volts DC.
   - The nominal voltage between terminal -A and ground is between 1.2 and 2.3 volts DC.
   - There should always be 0.2 to 0.4 volts DC between -A and +B.
   - The -A terminal should always be the lower of the two voltages. If the voltage measured does not conform to these guidelines, perform network troubleshooting before continuing.

Initiate the addressing sequence

Once controllers are installed on the network and the network is verified, begin the automatic addressing sequence.

1. Choose one controller as the anchor. The anchor controller assigns addresses to the rest of the nomad controllers on the MS/TP network.
   - The controller you choose can be anywhere in the network, but make it accessible.
   - Mark the controller as the network anchor.
   - If there is BACnet traffic on the network from other devices—such as from a router or BACnet building controller—the Com LED will flash once every six seconds.
   - The Ready LED flashes one second On, one second Off. See *Illustration 5-1 on page 33*.

2. Change the controller to an anchor controller by doing the following:
   a. Set the network switch to Off (disconnected).
   b. Press and hold the restart button for 10 seconds. The Ready LED will start flashing rapidly. The Com LED will remain dark.
   c. Release the restart button.
   d. Turn off controller power.
   e. Set the anchor network switch to On (connected).
   f. Turn on controller power. The Ready LED will blink slowly and the Com LED will flash rapidly. This controller is now an anchor with a MAC address of 3.

3. The anchor will begin assigning addresses to the other controllers. For small systems address assignment may take only a few minutes; for larger systems the process may take 30 minutes or more.

4. Monitor the progress of automatic addressing with BACstage or TotalControl. After a few minutes controllers that have been assigned addresses and that have joined the network will appear in the BACstage device list or the TotalControl Network Manager list. See *Using BACstage and TotalControl with automatic addressing on page 27*.

Lock the network

After all nomad controllers have acquired a MAC address from the anchor, lock the network with the restart button. The network may also be locked with BACstage. To lock the network with BACstage see *Using the automatic Addressing commands in BACstage on page 30*.

! Caution

Automatic addressing does not include an unlock command. Once the network is locked controllers can no longer participate in automatic addressing. To change the MAC address of a locked controller, you can only change it manually with either BACstage or TotalControl.

Lock the network by doing the following:

1. On the anchor controller, press and hold the restart button for 10 seconds.
2. When the Ready LED changes to the lock pattern—two short flashes and then a long pause—release the button.

3. Use BACstage or TotalControl to find the controller with the highest MAC address. Set Max Master in that controller to the same value as the MAC address.

Once the anchor can find no more controllers to address, it will stop running the addressing routine. If you do not see all the controllers that should be in your network, additional troubleshooting will be required. Some possible issues that will prevent controllers from appearing in the device list are:

◆ Loose wiring
◆ The network switch is Off (disconnected)
◆ Missing or damaged network isolation lamps
◆ Improper controller grounding
◆ The controller is not powered.

Once problems are corrected, follow the procedure for adding a controller to the automatic addressing network.

Adding new automatic addressing controllers to an existing automatic addressing network

Use the following procedures to add a new automatic addressing controller to an existing automatic addressing network.

Note

For a small number of controllers it may be faster to change each controller to an anchor and then change the MAC address with BACstage or TotalControl before adding it to a network. See *Replacing a single controller* on page 17.

Install the controller and initiate the auto addressing sequence

1. Connect the controller to the network and then turn on the controller power.
2. Use BACstage to restart the anchor controller. The Com LED on the new controller will flash once every 6 to 10 seconds indicating it is properly receiving information over the network.
3. Use BACstage or TotalControl to change Max Master in the existing controller with the highest MAC address to a value high enough to accommodate the addition of new controllers.
4. As you continue to observe the Com LED you will see a new pattern of a single long pulse followed immediately by three fast flashes. This indicates the controller has received a temporary MAC address and is waiting to be assigned. The assignment process may take several minutes. You will continue to see the one-and-three LED pattern.
5. Once assigned a MAC address, the controller will join the network, begin communicating and the Com LED will flash faster.
6. Use BACstage or TotalControl to find new devices on the network and verify that the controller has acquired a MAC address. See *Using BACstage and TotalControl with automatic addressing* on page 27.

Lock the network

After the new controller has acquired a MAC address from the anchor, lock the network with the restart button. The network may also be locked with BACstage. To lock the network with BACstage see *Using the automatic Addressing commands in BACstage* on page 30.

! **Caution**

Automatic addressing does not include an unlock command. Once the network is locked controllers can no longer participate in automatic addressing. To change the MAC address of a locked controller, you can only change it manually with either BACstage or TotalControl.

Lock the network by doing the following:

1. On the anchor controller, press and hold the restart button for 10 seconds.
2. When the Ready LED changes to the lock pattern—two short flashes and then a long pause—release the button.
3. Use BACstage or TotalControl to find the controller with the highest MAC address. Set Max Master in that controller to the same value as the MAC address.

Once the anchor can find no more controllers to address, it will stop running it's addressing routine. If you do not see all the controllers that should be in your network, additional troubleshooting will be required. Some possible issues that will prevent controllers from appearing in the device list are:

◆ Loose wiring
◆ The network switch is Off (disconnected)
◆ Missing or damaged network isolation lamps
◆ Improper controller grounding
◆ The controller is not powered.

Once problems are corrected, follow the procedure for adding a controller to the automatic addressing network.

Adding automatic addressing controllers to a network of older KMC BACnet controllers

Use this procedure to add automatic addressing controllers to a network of KMC BACnet controllers that do not have automatic addressing firmware. This procedure is similar to the procedure *Setting up a new network with automatic addressing controllers* on page 10.

✎ **Note**

For a small number of controllers it may be faster to change each controller to an anchor and then change the MAC address with BACstage or TotalControl before adding it to a network. See *Replacing a single controller* on page 17

1. Install the new controllers. As each controller is installed, the installer must copy the device instance number from the controller and record it with the location of each unit.
   - Use one of the instance labels affixed to the controller for this record keeping.
   - The second label remains on the controller identify the device instance assigned to the controller.
2. As each controller is installed, turn on the power at the controller.
3. Verify that the network has the end-of-line switches set properly.
4. Measure the bias voltage on each segment of the network. Measure voltages at each end-of-line controller and before and after each repeater. Use a digital voltmeter to measure from controller ground to each communication terminal.
   - The nominal voltage between terminal +B and ground is between 1.4 and 2.6 volts DC.
   - The nominal voltage between terminal -A and ground is between 1.2 and 2.3 volts DC.
   - There should always be 0.2 to 0.4 volts DC between -A and +B.
   - The -A terminal should always be the lower of the two voltages. If the voltage measured does not conform to these guidelines, perform network troubleshooting before continuing.
5. Use BACstage or TotalControl to do the following:
   - Change Max Master in the existing controller with the highest MAC address to a value high enough to accommodate the addition of new controllers.
   - Verify that all existing network controllers are still on the network.
6. Once you verify network integrity, proceed to designating an automatic addressing controller as the anchor.

Install an anchor controller

You may use either an existing controller with upgraded firmware or a new, automatic addressing controller as an anchor.

Use an existing controller as an anchor You may use an existing controller with the MAC address of 0, 1, 2, or 3 as an anchor if it is upgraded to firmware version R2.0.0.0 or later. See *Upgrading older controllers to automatic addressing firmware on page 26*. Once the firmware is upgraded, return the controller to the network and proceed to *Initiate automatic addressing on page 15*.

Use a new automatic addressing controller as an anchor   To use one of the new controllers as the anchor may require changing the MAC address of an existing controller to make available a MAC address of 0, 1, 2, or 3. A new controller is then installed as an anchor with the original MAC address of the old controller.

1. Choose an existing controller with a MAC address of 0, 1, 2, or 3. The preferable choice is the controller with MAC address 3. Use BACstage or TotalControl to change the MAC address to the next available MAC address on the network.
2. Designate one of the automatic addressing controllers to use as an anchor.
3. Change the controller to an anchor by doing the following:
   a. Set the network switch to Off (disconnected).
   b. Press and hold the restart button for 10 seconds. The Ready LED will start flashing rapidly. The Com LED will remain dark.
   c. Release the restart button.
   d. Turn off controller power.
   e. Set the anchor network switch to On (connected).
   f. Turn on controller power. The Ready LED will blink slowly and the Com LED will flash rapidly. This controller is now an anchor with a MAC address of 3.
4. If the anchor replaced a controller with MAC address of 0, 1, or 2, use BACstage or TotalControl to change the MAC address to match the controller it replaces.

Initiate automatic addressing

1. Turn on power the anchor controller power or cycle the power on the anchor controller.
2. The anchor will begin assigning addresses to the other controllers. For small systems address assignment may take only a few minutes; for larger systems the process may take 30 minutes or more.
3. Monitor the progress of automatic addressing with BACstage or TotalControl. After a few minutes controllers that have been assigned addresses and that have joined the network will appear in the BACstage device list or the TotalControl Network Manager list.

Lock the network

After all the new nomad controllers have acquired an address from the anchor controller, lock the addresses with the restart button. The network may also be locked with BACstage. To lock the network with BACstage see *Using the automatic Addressing commands in BACstage* on page 30.

! **Caution**

Automatic addressing does not include an unlock command. Once the network is locked controllers can no longer participate in automatic addressing. To change the MAC address of a locked controller, you can only change it manually with either BACstage or TotalControl.

Lock the network by doing the following:

1. On the anchor controller, press and hold the restart button for 10 seconds.
2. When the Ready LED changes to the lock pattern—two short flashes and then a long pause—release the button.
3. Use BACstage or TotalControl to find the controller with the highest MAC address. Set Max Master in that controller to the same value as the MAC address.

Once the anchor can find no more controllers to address, it will stop running the addressing routine. If you do not see all the controllers that should be in your network, additional troubleshooting will be required. Some possible issues that will prevent controllers from appearing in the device list are:

- ◆ Loose wiring
- ◆ The network switch is off (disconnected)
- ◆ Missing or damaged network isolation lamps
- ◆ Improper controller grounding.
- ◆ The controller is not powered
- ◆ MAX Master is set too low in one or more controllers.

Once problems are corrected, follow the procedure for adding a controller to the automatic addressing network.

Adding controllers to a third-party network

Adding controllers a network of third-party controllers is similar to adding them to a network of controllers with older KMC BACnet controllers.

- ◆ For a few controllers follow the directs in the topic *Replacing a single controller* on page 17.
- ◆ For a large number of controllers follow the procedure *Adding automatic addressing controllers to a network of older KMC BACnet controllers* on page 14.

Replacing a single controller

To replace an existing controller with a new, automatic addressing controller, change the new controller to an anchor and then set the MAC address with BACstage before adding it to the network.

On a controller with factory default settings which is not on a network, the Com LED will remain off. If the Com LED is flashing, then it may already be an anchor. In that case, go to step 2. Otherwise, create an anchor by using the following method:

1. Set the network switch to Off (disconnected).
2. With the controller power already turned on, hold the red restart button until the Ready LED flashes rapidly This usually takes about 10 seconds.
3. Turn the power off and then back on. The controller will start up as MAC address 3. After 15 to 20 seconds the Com LED will begin to flash rapidly. The default baud rate is 38.4 kilobaud. For other baud rates see *Alternate baud rate* on page 25.
4. Connect to the controller with BACstage. The unit will be MAC address 3 in the device list. Click the device name.
5. Open the Device Object dialog.
6. Change the MAC address, Max Master, and device instance to those of the controller being replaced.
7. Cold start the controller.
8. Send the backup file to the controller.
9. Set the network switch to On (connected) before installing the controller.

Combining locked networks with assigned networks that are not locked

A network should not be locked until all controllers are confirmed to be online. This procedure covers installations in which a network segment was automatically addressed separately from the main network—using a separate anchor controller—and then mistakenly locked.

Temporary Segment A

Temporary Segment B (locked)

| A |
| B |

BAC-5800 or
BAC-7000 series
controller

24-volts AC

~
-

Anchor MAC 2
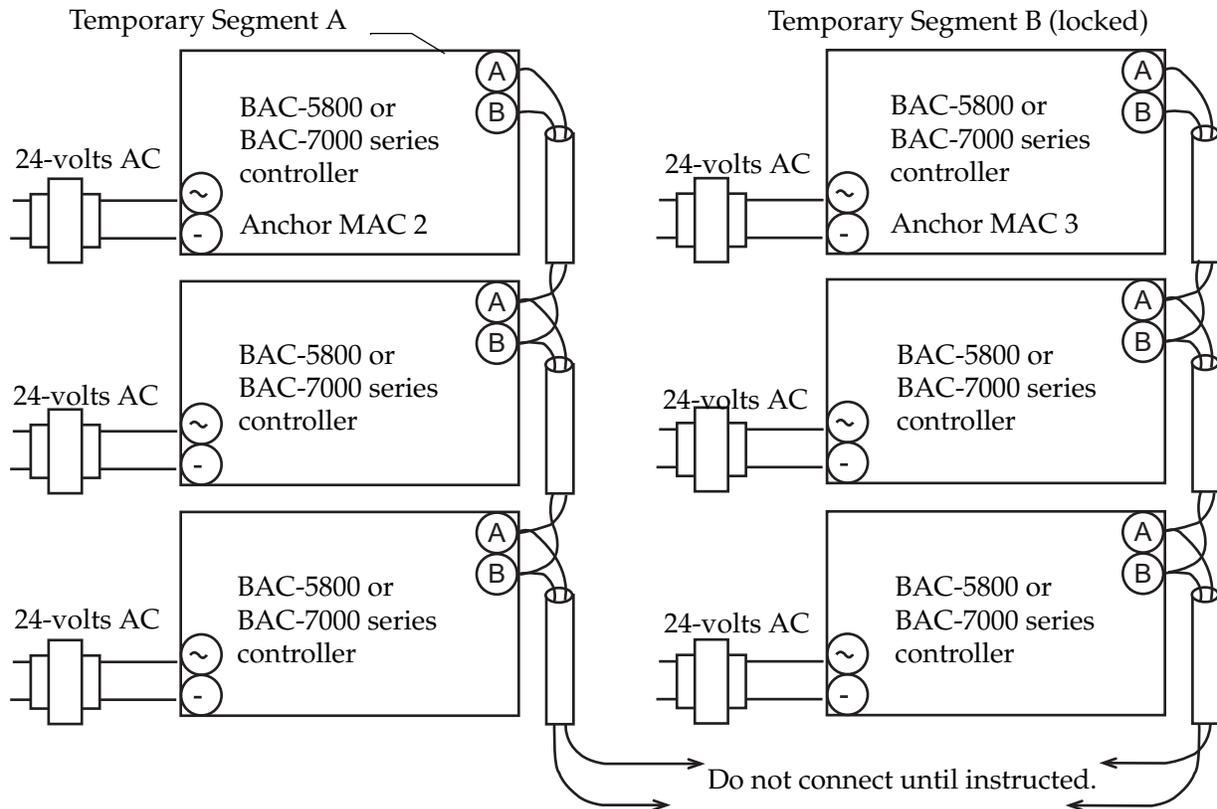
Illustration 2-1 Figure 2: Combining locked and assigned network segments

If temporary Segment B has been locked, and Segment A has been assigned but not locked, do the following:

1. In Segment A, set the network switch on the anchor controller to Off (disconnected). This prevents the controller from addressing until we are ready.
2. Change the MAC address of the anchor controller in Segment A to one less than the anchor on Segment B. That will give anchor A the higher priority. For this example the anchor on Segment A will have a MAC address of 2 while the anchor on Segment B has a MAC address of 3.
3. Use BACstage or TotalControl to cold start each of the controllers on Segment A. This will force each nomad to lose their network assignments and go silent. They will continue to run their application programming to control equipment but cannot retrieve network data.

4. On Segment B, set the network switch on the anchor controller to Off (disconnected). This is to prevent it from addressing any of the controllers that were just cold-started.

5. Connect the two segments together as shown in Illustration 2-1.

6. Verify the end-of-line switches are now set correctly for the completed network.

7. Verify that the locked controllers on Segment B are still communicating by rediscovering the network with either BACstage or TotalControl. None of the Segment A controllers will appear in the list. If any communication problems arose from combining networks, perform network troubleshooting before continuing.

8. Set the network switch of the anchor on Segment A to On (connected).

9. Use BACstage or TotalControl to restart the anchor on Segment A.

10. In BACstage monitor the progress by viewing the device list. Wait a few minutes and then click **Find New Devices**. Controllers that have been assigned addresses and have joined the network will now appear in the list.

11. Lock the addressees in Segment A. This is described in the section *Lock the network* on page 11.

12. Set the network switch of the anchor controller on Segment B to On (connected).

13. All controllers should be visible on the network.

14. Use BACstage or TotalControl to find the controller with the highest MAC address. Set Max Master in that controller to the same value as the MAC address in the controller.

Combining locked networks

A network should never be locked until you have confirmed that all controllers are online.

◆ Locked networks can only be combined if there are no duplicate MAC addresses and no duplicate device instance numbers assigned to the controllers.

◆ Locked controllers can not participate in the automatic addressing process.

To combine locked networks do the following:

1. Connect to one of the networks with BACstage—usually the smaller of the two—and change the MAC address of each controller to a MAC address that is not in use on the larger network.

2. Once MAC addresses are unique you can combine the locked networks by completing the network connection between them.

Power failure before locking the network

If power is lost on a segment of the MS/TP network before the network is locked, the nomad controllers will not show up on the network when power is restored. Once power is restored to the entire network, cycle the power on the anchor controller to restart the automatic addressing sequence. The automatic anchoring sequence may also be restarted with BACstage. See *Using the automatic Addressing commands in BACstage* on page 30.

SECTION 3

Additional procedures for automatic addressing controllers

This section covers topics that may be useful during an installation of automatic addressing controllers.

Verifying the mode of the controller

Verifying that a controller is either an anchor or nomad requires BACstage, changing the network switch and observing the Com and Ready LEDs at the controller.

The following test will confirm if a controller is an anchor, nomad or a controller with a locked MAC address.

1. Set the network switch to Off (disconnected).
2. Cycle the controller's power.
   - If the Com LED remains dark, then the controller is a lost nomad.
   - If the COM LED flashes it is either an anchor or controller with a locked MAC address. Go to the next step.
3. Set the network switch to On (connected).
4. Connect to the controller with BACstage and open the device object.
   - If the MAC address is 0, 1, 2, or 3 it is an anchor controller.
   - If the MAC address is in the range of 4–127 it is a controller with a locked MAC address.

Changing the mode of the controller

To change the mode of the controller—anchor-to-nomad or nomad-to-anchor—requires access to the controller's power and restart button. It may require also require using BACstage or TotalControl.

To change an anchor controller into a nomad

To change an anchor to a nomad requires restoring the controller to the factory settings. This changes the controller as follows:

- ◆ Removes all programming.
- ◆ Removes all configuration settings.
- ◆ Restores the controller to factory default settings.
- ◆ Changes the controller to an automatic addressing nomad controller.

! Caution

Resetting the controller erases all configuration and programming. After resetting to factory settings, you must configure and program the controller to establish normal communications and operation.

To change an anchor into a nomad controller do the following:
1. If required, use BACstage or TotalControl Design Studio to backup the programming in the controller.
2. Remove the power jumper.
3. Press and hold the red restart button.
4. Replace the power jumper while continuing to hold the restart button.
5. Release the restart button.
6. Use BACstage to restore the programming and configuration of the controller. This is described in the section .

To change a nomad controller into an anchor

Changing a nomad into an anchor changes the controller as follows:

- ◆ The MAC address is 3
- ◆ The default baud rate is 38.4 kilobaud. For other baud rates see .

To change the controller to an anchor, do the following:

1. On the controller, set the network switch to Off (disconnected).
2. Apply power to the controller.
3. Press and hold the restart button until the Ready LED flashes rapidly. This will take about 10 seconds.
4. Release the button.
5. Cycle the power. The controller now has MAC address 3 assigned to it. After 15 to 20 seconds the Com LED will begin to flash once per second.

Returning a controller to factory settings

Restoring a controller to factory settings changes the controller as follows:

◆ Changes the controller to an automatic addressing nomad. The nomad controller will communicate only with an anchor controller.
◆ Removes the MAC address.
◆ The device instance number changes to a preset instance based on the serial number and model of the controller.
◆ Removes all programming.
◆ Removes all configuration settings.
◆ Restores the controller to factory default settings.

! Caution

Restoring the controller erases all configuration and programming. After restoring to factory settings, you must configure and program the controller to establish normal communications and operation.

To restore the controller to factory settings.

1. If possible, use BACstage or TotalControl Design Studio to backup the controller.
2. Remove the power jumper.
3. Press and hold the red restart button.
4. Replace the power jumper while continuing to hold the restart button.

Once a controller is restored to factory settings, do one of the following to configure it:

◆ Connect it to an automatic addressing network as described in the section *Adding new automatic addressing controllers to an existing automatic addressing network* on page 12. Once it is connected and its MAC address is assigned, it can be programmed from BACstage or TotalControl.
◆ Program it on a bench as described in the topic *Programming nomad controllers* on page 24. When it is programmed connect it to an automatic addressing network as described in the section *Adding new automatic addressing controllers to an existing automatic addressing network* on page 12.
◆ Changed it to an anchor controller so it can be configured with BACstage. This is described in *Changing the mode of the controller* on page 22.

Programming nomad controllers

Use the following procedure to program automatic addressing nomad controllers before sending them to a jobsite. This procedure will require the following:

◆ A 24-volt transformer such as an XEE–6111–40 available from KMC Controls.
◆ An automatic addressing controller to use as an anchor controller.
◆ A computer with BACstage 2.1 or later installed.

Anchor setup procedure

1. Connect an automatic addressing controller as the anchor controller shown in Illustration 3-1.
2. Set the anchor controller to anchor mode as described in the topic *Changing the mode of the controller* on page 22.
3. Connect to the anchor controller with BACstage. The controller will be listed in the device list as MAC address 3.
4. Using BACstage, open the device object in the anchor controller.
5. Change the Max Master property to a value no higher than 10 and then save the changes.
6. Use the BACstage to reinitialize the controller with a cold start.
7. Set the network switch on the anchor to On (connected).
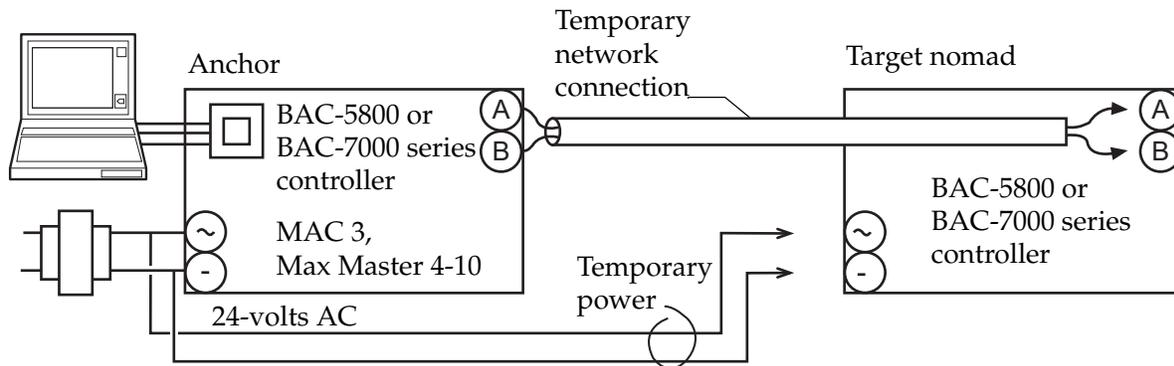
Illustration 3-1 Bench setup for programming nomad controllers

Programming target nomad controllers

Use the following procedure with the bench setup shown in Illustration 3-1 to program nomad controllers before sending them to a job site.

✎ **Note**

The target nomad controller must remain powered during this process. If power is lost the controller will return to factory settings and the process will have to be repeated from the beginning.

1. Complete the network connection between the anchor and the target nomad controller as shown in Illustration 3-1.

2. Connect and apply power to a new target nomad controller. The Com LED will be off. After a few seconds, the Com LED will begin a repeating pattern of flashing on for one second and then off for six seconds.
3. Connect to the anchor controller with BACstage.
4. From the BACstage **Device Menu** choose **Auto Addressing** and then **Restart Anchor**. After a few seconds the nomad controller Com LED will display one long flash followed by three short flashes.
5. When the Com LED on the target nomad changes to three short flashes followed by a long flash you can see the nomad in the device list. This signals that the nomad has acquired a temporary MAC address. The Com LED flashing pattern may also appear to be continuous rapid flashing.
6. Select the target nomad from the BACstage device list and then make programming changes in the controller.
7. When programming is complete, use the BACstage to reinitialize the controller with a cold start.
8. Turn off power to the target nomad controller.
9. Repeat for additional nomad controllers.

Cold starting controllers

Performing a cold start changes the controller as follows:

◆ Restarts the controller programs.
◆ Returns all object states to their initial factory settings or to their relinquished defaults until the controller programs update them.
◆ Leaves configuration and programming intact.

❗ Caution

Returning object values to their relinquished defaults during a cold start may abruptly turn connected equipment on or off. To prevent equipment damage, turn connected equipment off or temporarily remove the output terminal blocks from the controller before performing a warm start.

To perform a cold start:

1. While the controller is powered, press and hold the restart button.
2. Remove the power jumper.
3. Release the restart button *before* replacing the power jumper.

Alternate baud rate

Controllers will detect the active baud rate of the network when they are powered up or cold started. If no network activity is detected, the controller will use 38.4 kilobaud. When other baud rates are used, set the network switch to On when the controller is first powered up on the network to assure the controller finds the correct baud.

To disable auto baud, connect to the controller with BACstage and clear the **Auto** check box in the Device Object dialog.

Upgrading older controllers to automatic addressing firmware

Upgrading an older controller with automatic addressing firmware you will need a KMD-5698 Universal Flash Kit and the latest automatic addressing firmware. Firmware is available for download from the KMC Controls web site.

1. Back-up the controller data using BACstage or TotalControl.
2. Use the Flash Wizard to update the firmware.
3. When controller power is turned on the controller is locked and has the same MAC address, baud, and device instance as before.
   - If the controller has a MAC address of 0, 1, 2, or 3 then it is an anchor and it will perform all anchor functions.
   - If its MAC address is 4 or higher it is a locked nomad and cannot participate in auto addressing. To use auto addressing, turn the controller into an anchor by changing its MAC address or turn the controller into a nomad, which will require a factory reset as described in *Returning a controller to factory settings* on page 23.
4. Once the controller has been factory restored, has received its MAC address from an anchor, and is on the network, then restore the original configuration.

SECTION 4

Using BACstage and TotalControl with automatic addressing

This section describes how to use BACstage or TotalControl with the BACnet automatic addressing process.

The MS/TP automatic MAC addressing process can be implemented without using special software. However, using either BACstage or TotalControl may assist with installation.

With BACstage you may:

- ◆ Lock the MAC addresses into nomad controllers
- ◆ Restart the automatic addressing process
- ◆ Reinitialize controllers
- ◆ Monitor the progress of the automatic addressing process
- ◆ Reinitialize controllers
- ◆ Change Max Master and MAC addresses.

Use TotalControl to:

- ◆ Monitor the progress of the automatic addressing process
- ◆ Reinitialize controllers
- ◆ Change Max Master and MAC addresses.

Using BACstage for monitoring and configuration

BACstage may be used for sending commands to an automatic addressing network, monitor the automatic addressing process, reinitialize controllers or changing MAC addresses. For any of these functions, the computer on which BACstage is running may be connected with either of two methods.

◆ Connect to the MS/TP network through the computers LAN connection and a router.

◆ Directly connected to the MS/TP network with a KMD-5576 USB Communicator.

BACstage connected through a router.

BACstage connected directly to the MS/TP network.
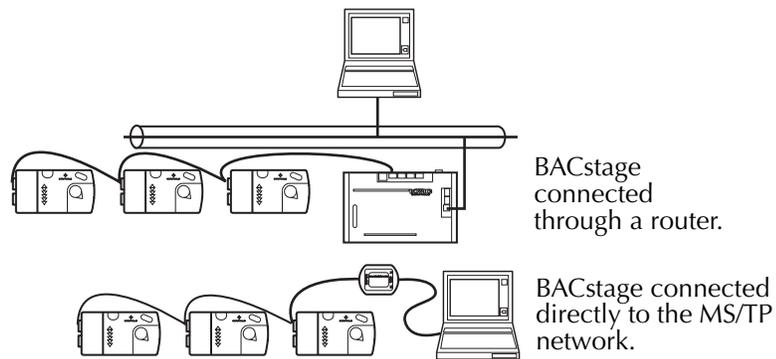
Illustration 4-1 BACstage connections to an MS/TP network

Monitoring with BACstage

To monitor automatic addressing with BACstage do the following:

1. Start BACstage.
2. From the **Access menu** choose or create the system name.
3. Enter the user name and password.
4. When the **Choose Device** dialog opens, do one of the following:
   - If this is a new system and there are no devices in the list, click **Rediscover System**.
   - If there are devices in the list, click **Find New Devices**.

To monitor the process of controllers acquiring a MAC address during the automatic addressing process, periodically click **Find New Devices**.

Illustration 4-2 Devices listed in the Choose Device dialog

✎ **Note**

If connected through a router, other controllers on the BACnet internetwork may also be listed in the Choose Device dialog.

Using the automatic Addressing commands in BACstage

BACstage version 2.1 has several automatic addressing commands with which you can do the following:

◆ Lock MAC addresses into the nomad controllers.
◆ Restart the automatic addressing process.
◆ View the progress of the automatic addressing process.

To use the automatic addressing commands in BACstage do the following:

1. Choose a controller in the **Choose Device** dialog.
2. From the **Device menu**, choose **Auto Addressing** and then one of the following commands.

Request Status Displays the status of automatic addressing in the controller.

Lock Addresses (Anchor controller only) Locks the temporary MAC addresses in nomad controllers and makes the MAC addresses permanent.

Restart Anchor (Anchor controller only) Restarts the automatic addressing process without sending a warm start or cold start command to the anchor controller.
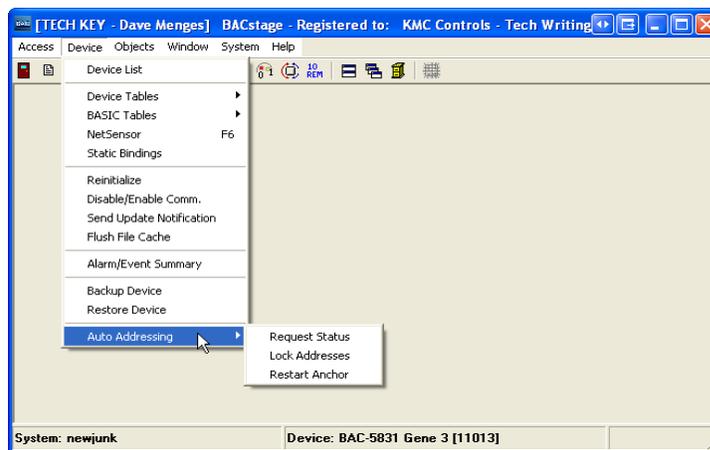

Illustration 4-3 BACstage automatic addressing commands

Using TotalControl with automatic addressing

Use TotalControl for monitoring the automatic addressing process, reinitializing controllers or changing MAC addresses. The TotalControl site connects to the MS/TP network through a router.
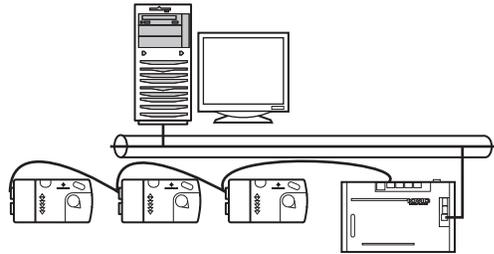
TotalControl connects to an MS/TP network through a router.

Illustration 4-4 Simplified TotalControl internetwork

Monitoring with TotalControl

To use TotalControl to monitor automatic addressing do the following:

1. Start Design Studio and sign on to the site.
2. In the Network Manager list right-click the network icon 🔶.
3. Choose **Find Devices** from the shortcut menu.
4. Select **Specified Network** and **Find Devices** in the **Network Find Devices** dialog.
5. Click **Find**.
6. Repeat steps Section 4 andSection 5 to monitor the progress of the automatic addressing process.
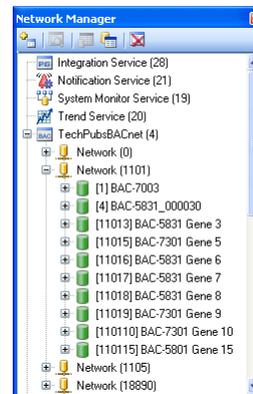
Illustration 4-5 Network Manager list

✎ **Note**

Networks other than the MS/TP network will also be listed in the Network Manager list.

SECTION 5

Diagnostic LED patterns

This section is a set of LED patterns produced by the Ready and Com LEDs on automatic addressing controllers.

Ready LED–Normal operation

During normal operation, the Ready LED pattern is a repeating pattern of On for one second and then Off for one second. The Ready LED will also display other patterns when the restart button is pushed; those patterns are described in previous sections of this manual.


500 ms
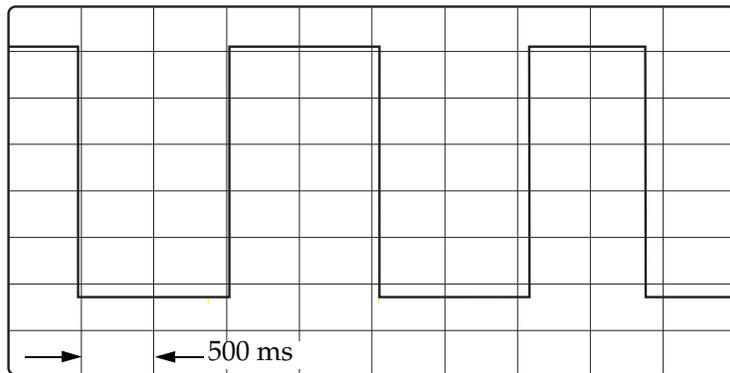
Illustration 5-1 Normal Ready LED

Com LED–Normal token passing

After automatic addressing is complete and the controller is responding to normal network traffic, the Com LED will flash briefly once each time the controller passes the token. The frequency of the flashes will depend upon the size of the network.
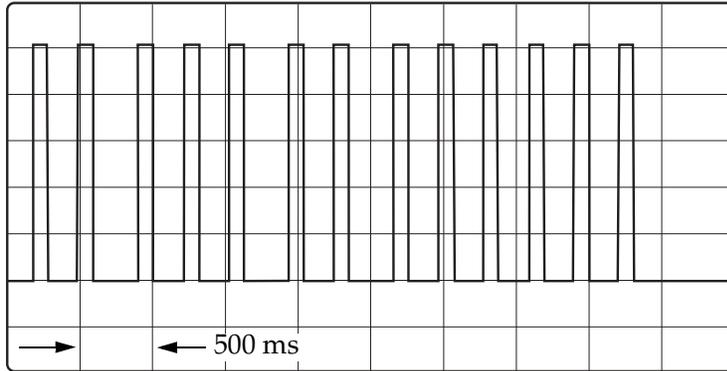

Illustration 5-2 Normal token passing

Com LED–Lost nomad

A lost nomad pattern is displayed when a nomad is first powered or an anchor controller is not connected to the network. The pattern is a single flash followed by a long pause that repeats every seven seconds.
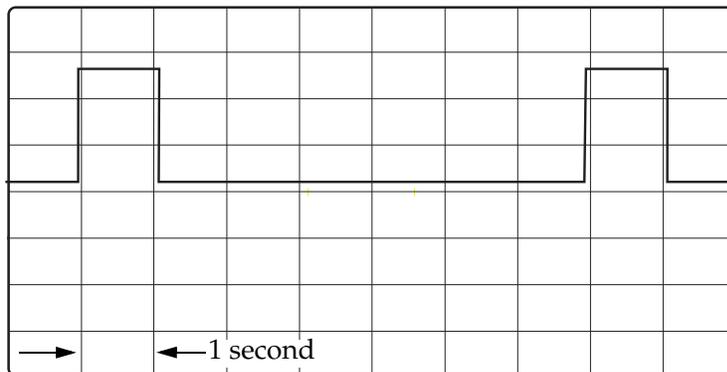

Illustration 5-3 Lost nomad

Com LED-Wandering nomad

The Com LED will display the wandering nomad pattern after a nomad has seen an anchor on the network but has not yet acquired a temporary MAC address. The pattern is single long flash, three short flashes and then a pause. The pattern then repeats.
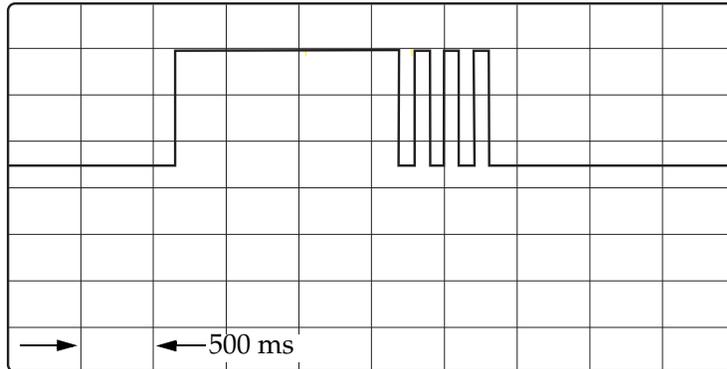

Illustration 5-4 Nomad wandering

Com LED–Assigned nomad

Once the nomad acquires a temporary MAC address, the Com LED flashes the assigned nomad pattern of three short flashes and then a long flash. If the network is very small this pattern may repeat too quickly to observe the long flash and the Com LED may appear to continuously flash with only short flashes.
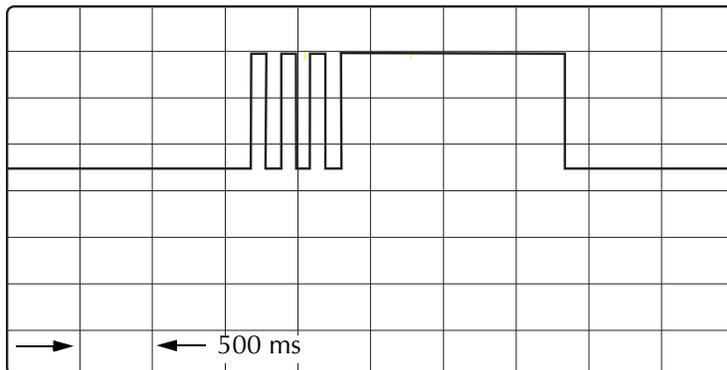

Illustration 5-5 Assigned nomad