DISTECH CONTROLS™

Distech Controls UUKL Smoke Control System

Design Guide

UL® 864 UUKL 10th Edition, Smoke Control System

Connecting People with Intelligent Building Solutions

Document Revision History:

1. Version 1.0 – May 2019
2. Version 1.1 – December 2024 – Updated approved firmware and software revisions

Distech Controls UL 864 UUKL, 10th Edition, Smoke Control System

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Chapter 1
INTRODUCTION

This chapter provides general information regarding this design guide and the Distech Controls UUKL Smoke Control System. It also defines various terms and general concepts related to smoke control systems.

In This Chapter

About the Distech Controls UUKL Smoke Control System

The main function of the Distech Controls Smoke Control System is to correctly employ a smoke control strategy. It complies with the Underwriters Laboratories Inc.® (UL) requirements for the UL 864, 10th Edition, UUKL Smoke Control Listing. The Distech Controls UUKL Smoke Control System uses the BACnet® MS/TP LAN communication protocol and is BTL®-Listed as BACnet Advanced Application Controllers (B-AAC) and BACnet Application Specific Controllers (B-ASC).

The Distech Controls' UUKL smoke control system controllers can be interconnected with smoke control listed HVAC equipment to form a complete smoke control system to control the flow of smoke in a fire condition.

The third party fire system is the primary fire annunciation station.

Smoke Control Software and the UUKL Applications Library

EC-Net 4 is the software framework used in all phases of engineering, installation, and commissioning of Smoke Control EC-BOS-8 UUKL and MS/TP bus devices that make up the Distech Controls Smoke Control system.

Smoke control applications are used to issue commands to control devices that pressurize or depressurize an area in a building to minimize the spread of smoke. The smoke control strategy is achieved with the EC-*gfx*Program software, the EC-Net 4 Wire Sheet feature, as well as with the manual override of the smoke control logic provided by the Firefighter's Smoke Control Station (FSCS). The EC-*gfx*Program software and EC-Net 4 are used to create the smoke control sequences for a building.

UUKL Smoke Control Applications

The standard smoke control applications can be installed and executed on any smoke control EC-BOS-8 UUKL. You can use the smoke control applications provided with the Distech Controls UUKL Smoke Control solution as a starting point to create your own application. EC-Net 4 and EC-*gfx*Program must not be accessible to anyone other than designated qualified technicians who are responsible for installing, commissioning, and maintaining the smoke control site configuration. Password restriction in conjunction with EC-Net 4 and EC-*gfx*Program accessibility will prevent unauthorized editing of the smoke control sequences.

You are responsible for ensuring that the smoke control applications comply with state and local regulations, and that it is approved by the Authority Having Jurisdiction (AHJ). You are also responsible for configuring all of the smoke control components, as well as the programming of those components, in order to comply with the UUKL Smoke Control Listing as documented herein.

The Distech Controls UUKL smoke control applications can be downloaded from Distech Controls' Software Center. The Software Center can be downloaded from the Distech Controls website at *www.distech-controls.com*. For more information regarding the smoke control applications, refer to the Distech Controls UUKL Smoke Control System Application Guide (see also *Related Documentation* on page 11).

All ECB UUKL controllers are preloaded with a UUKL specific firmware and the EC-BOS-8 UUKL is preloaded with a UUKL specific software. Only use firmware and software versions pertaining to the Distech Controls UUKL Smoke Control System. If not, this will void the UL 864, UUKL Smoke Control Listing.

System Programming Guidelines for Smoke Control

When programming the system for smoke control applications, the system must conform to the guidelines. Follow these guidelines when defining systems and objects:

- Name all systems used for smoke control in a manner that makes identification obvious. For example, the air handling unit serving the 5th floor might be called AHU_05 and the East stairwell pressurization system might be called EAST_STAIRS.
- Name all objects within a system used for smoke control in a manner that makes identification obvious. For example, the outdoor air damper for AHU1 might be called "AHU1_OAD" and the mixed air damper for AHU1 might be called "AHU1_MAD."
- Use engineering units that are appropriate to easily determine the current status of a device.

About this Guide

This guide specifically addresses the Distech Controls UUKL Smoke Control System. It provides the fundamentals for the controls engineers and technicians to meet properly designed UUKL smoke control specifications.

This guide does not cover all installation and wiring requirements for the Distech Controls' BACnet controllers. It must be used along with other applicable Distech Controls ECB BACnet controller hardware installation guides. Refer to *Related Documentation*.

You can also refer to any other applicable Distech Controls documentation for general information, best practices, basic wiring rules, product specifications, etc. Refer to *Related Documentation*.

Intended Audience

This document is intended for qualified and authorized engineers and technicians who are responsible for designing, engineering and installing a smoke control system that complies with the Underwriters Laboratories, Inc.® (UL) requirements for the UL 864 UUKL 10th Edition Smoke Control Listing.

Symbols Used in this Document

This document uses the following symbols:

Notes

This is an example of Note text. Wherever the note/paper icon appears, it means the associated text provides a time-saving tip or a reference to associated information of interest.

Cautions and Warnings

This is an example of Caution and Warning text. Wherever the exclamation icon appears, it means that there may be an important safety concern or that an action taken may have a drastic effect on the device, equipment, and/or network if it is not done properly.

Related Documentation

To comply with the UUKL Listing, you must follow the requirements and restrictions placed on the smoke control system components as detailed in this and other Distech Controls related documentation pertaining to the UUKL Listing.

It is recommended that you also refer to the Distech Controls UUKL Smoke Control Application Guide:

Refer to	***Document No.***
Distech Controls UUKL Smoke Control Application Guide	UUKL Application Guide_UG_10_EN

For any other documentation related to general system requirements, specifications, basic installation instructions, etc. refer to the following:

Refer to	***For information on***
Network Guide	Best practices, specifications, wiring rules, device termination, and application information to implement reliable communication networks.
Datasheets	Product description and features, specifications, complementary products, etc. The datasheets can also be found on the Distech Controls website.
Product Comparison Charts	Charts comparing the different product models and their features.
Hardware Installation Guides	Installation instructions for various controllers.

References

When designing a smoke control system, the designer should have a good understanding of the following National Fire Protection Association (NFPA) documents, codes, and standards, as well as other applicable documentation:

- NFPA 92 Standard for Smoke Control Systems
- NFPA 70 National Electrical Code®
- NFPA 72 National Fire Alarm and Signaling Code
- NFPA 101 Life Safety Code®
- NFPA 90A Installation of Air-Conditioning and Ventilating Systems
- UL 864 Ninth Edition Standard for Control Units and Accessories for Fire Alarm Systems
- American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE) publication entitled Design of Smoke Control Systems for Buildings

Acronyms and Abbreviations Used in this Document

ADI	**A**utomation **D**isplays, **I**nc.
AHJ	**A**uthority **H**aving **J**urisdiction
AHU	**A**ir **H**andling **U**nit
BACnet	**B**uilding **A**utomation and **C**ontrol **N**etworking **P**rotocol
B-AAC	**B**ACnet **A**dvanced **A**pplication **C**ontrollers
B-ASC	**B**ACnet **A**pplication **S**pecific **C**ontrollers
BAS	**B**uilding **A**utomation **S**ystem
BI	**B**inary **I**nput
BMS	**B**uilding **M**anagement **S**ystem
BO	**B**inary **O**utput
CCW	**C**ounter-**C**lock**w**ise
CW	**C**lock**w**ise
EOL	**E**nd **O**f **L**ine
FSCS	**F**irefighter's **S**moke **C**ontrol **S**tation
HVAC	**H**eating, **V**entilation, and **A**ir **C**onditioning
ID	**ID**entity
I/O	**I**nput**/O**utput
IP	**I**nternet **P**rotocol
LAN	**L**ocal **A**rea **N**etwork
LED	**L**ight **E**mitting **D**iode
MS/TP	**M**aster-**S**lave/**T**oken-**P**assing
MSV	**M**ulti **S**tate **V**alue
NCI	**N**etwork **C**onstant **I**nput
NFPA	**N**ational **F**ire **P**rotection **A**ssociation
PI	**P**roportional **I**ntegral Control
RH	**R**elative **H**umidity
TVS	**T**ransient **V**oltage **S**uppressor
UL	**U**nderwriters **L**aboratories, Inc.
VAV	**V**ariable **A**ir **V**olume

Chapter 2
SMOKE CONTROL PRODUCT LABELING

This section provides information on the Distech Controls UUKL product labeling.

In This Chapter

Smoke Control Equipment Labeling

Sealing Label

The following example shows the UUKL product sealing label.

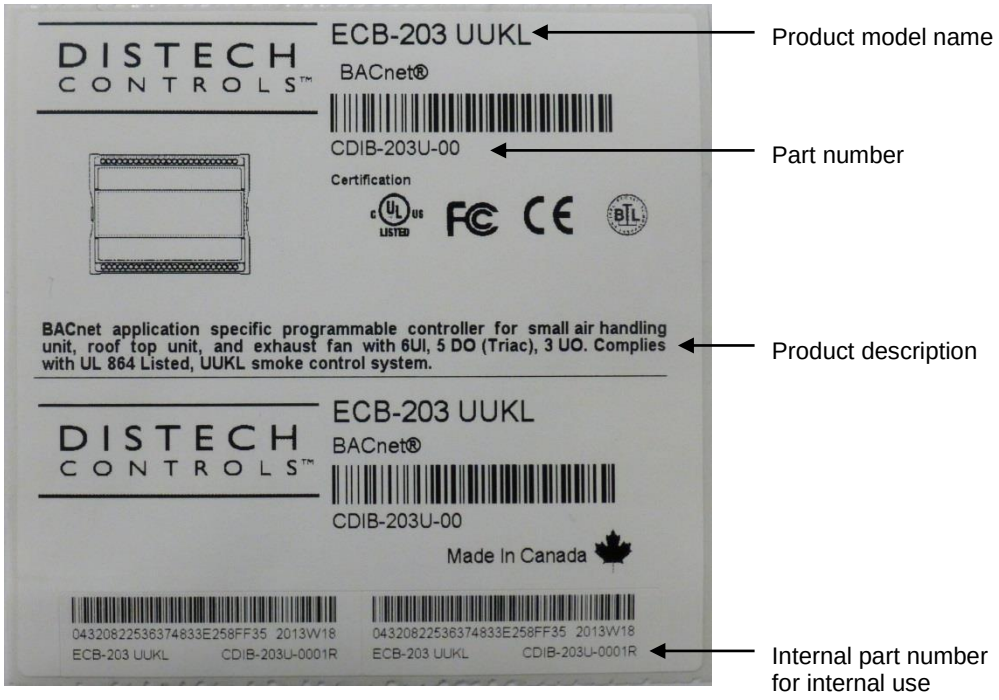


Figure 2-1: Example of a UUKL Product Sealing Label

The sealing label part numbers are described below:

Typical Part Number	***Description***
CDIB-203U-00	C – Controller DI – Distech B – BACnet 203 – Controller model number (e.g. ECB-203) U – UUKL 00 – Revision number
Internal Part Number	***Description***
CDIB-203U-0001R	01R – Internal revision number

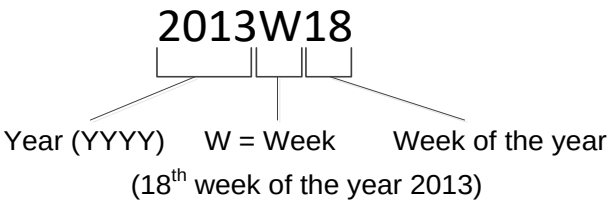
Table 2-1: Sealing Label Description

Side Labels

Here is an example of the side labels on a UUKL listed controller:

Figure 2-2: Example of Equipment Side Labels

Date code description:



Smoke Control Software and Firmware Version Numbering

All ECB UUKL controllers are preloaded with a UUKL specific firmware and the EC-BOS-8 UUKL is preloaded with a UUKL specific software. Only use firmware and software versions pertaining to the Distech Controls UUKL Smoke Control System. If not, this will void the UL 864, UUKL Smoke Control Listing.

All the firmware and software developed at Distech Controls uses the same version numbering system composed of four different components:

<Major>.<Minor>.<Build>.<Revision>

The following table explains the numbering system and the methodology behind creating and updating the version codes.

Fields	*Description*
Major	Represents the major version of the software. This number changes when releasing a new product line, adding an extensive set of new features, or introducing breaking changes in the software.
Minor	Represents the minor version of the software. This number changes for each planned release. A planned release is usually a project that runs for a couple of months where a small set of improvements will be done and/or bugs will be resolved.
Build	The build is an incremental number that changes every day. It is made up of five digits: YYDDD, where YY are the last two digits of the current year and DDD is the day of the year. For example, a build that is produced on January 10th, 2013 will be numbered 13010 whereas a build for December 1st, 2013 will be numbered 13335 (335th day of the year). The build number is helpful in quickly determining when a software or firmware package has been built during the year.
Revision	The revision is an incremental number that starts at one (1) every day, and increases for each build produced during the same day. For example, the build 4.4.13335.3 is the third build on December 1st, 2013.

Table 2-2: Number System and Methodology for Version Numbers

When releasing to the clients, the minor version is always incremented. However, if a critical issue is raised by a client, the modification order process is followed to fix the issue as soon as possible. In that case, a new version will be released with a new build number, but the minor version will stay the same.

Chapter 3
THE FIREFIGHTER'S SMOKE CONTROL STATION (FSCS)

This chapter provides a brief overview of the FSCS guidelines and requirements.

In This Chapter

About the FSCS

The FSCS is a manual control panel for all smoke control equipment in a building. It provides firefighters with information about the state of the smoke control system as well as manual control over all of its components. The panel consists of command switches and LEDs as well as a custom diagram of the building that clearly indicates the type and location of smoke control equipment.

The following image is an example of a firefighter smoke control panel. Since the FSCS is custom made for each application, the layout will vary from panel to panel:

Figure 3-1: Typical Firefighter's Smoke Control Station (Panel)

Physical Arrangement and Location of the Panel

The FSCS should be located in a secure but accessible room or cabinet to prevent unauthorized personnel from tampering with it and it should be clearly marked so that firefighters can quickly locate it.

The front panel of the FSCS contains a diagram of the building that shows the entire smoke control system, along with status lights and override switches for all of the system's components. The diagram of the building should include all smoke control zones, all ducts leading to and from the zones with arrows indicating the direction of air flow in the ducts, and a clear indication of the zones where each piece of equipment is used.

The Ethernet connection between the FSCS and the EC-BOS-8 UUKL must be supervised. Refer to the Distech Controls UUKL Smoke Control Application Guide Page 26 (Communication Failure) for more information.

Connecting to the Gateway

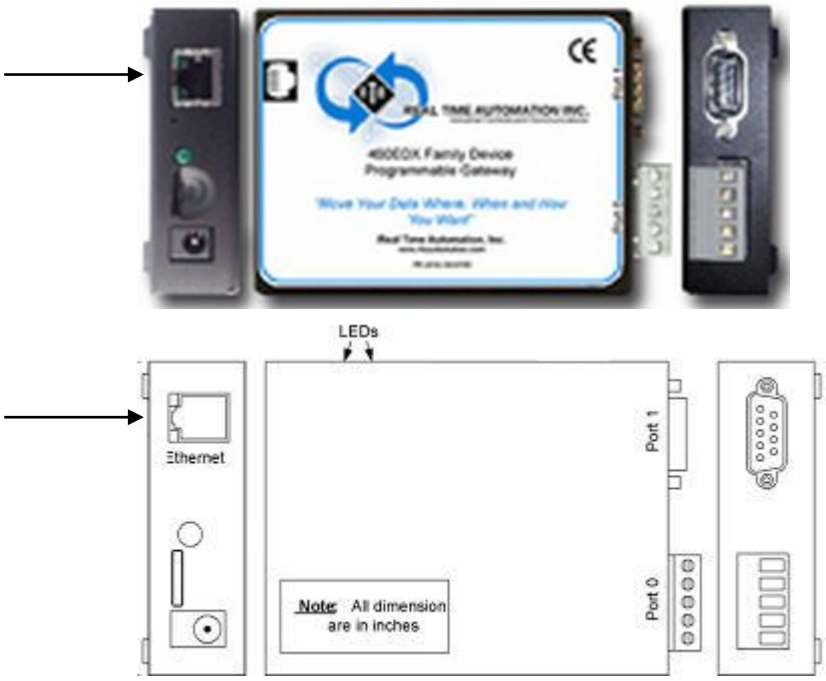


Figure 3-2: BACnet Ethernet Gateway

The BACnet Ethernet connection to the FSCS will be connected to the ports indicated in *Figure 3-2*.

Manual Controls

The panel must have manual controls to activate all fans, dampers, and other equipment related to the smoke control system. These controls must be able to override all automatic control of smoke control equipment. More specifically, the FSCS must be able to override:

- Hand/off/auto switches
- Local start/stop switches on fan motor controllers
- Freeze detection devices
- Duct smoke detectors

However, there are other safety controls that the FSCS must NOT override such as:

- Electrical overload protection
- Maintenance staff's electrical disconnects
- High limit pressure switches

In non-dedicated systems, local motor controller's hand/off/auto switches can remain in-circuit with the FSCS panel. But, they can remain in-circuit only if the switches are in a locked room accessible only to authorized personnel. Also, if such a switch is triggered, a trouble alarm must sound in the building's main control center.

The UUKL Listed FSCS panel operates as part of the Distech Contols' UUKL smoke control system and therefore must be listed by UL as suitable for enabling firefighters to manually control the smoke control system.

FSCS Guidelines

Certain guidelines must be followed when using an FSCS:

- Use a UL 864 UUKL Listed FSCS to provide manual control of smoke control systems. You must use the UL Listed annunciator panel made by Automation Displays, Inc. (ADI). Refer to the *FSCS Requirements* on page 24 for the ADI contact information.
- The FSCS must indicate operation for all smoke control equipment; for example, indicate when the damper reaches its intended position.
- Configure each Binary Output (BO) object used for pressurization and exhaust control outputs with positive feedback. Positive feedback monitors the associated controlled equipment status. Typically, smoke control dampers provide a pair of feedback binary inputs for the two damper end switches, full open and full closed. For smoke control fans, provide positive indication of air flow with either a flow switch or pressure differential sensor to determine the intended operating status of the fan. All inputs must be supervised using the supervised input kits. Refer to *Supervised Input Kits* on page 41.
- Display the status of all smoke control systems on the FSCS.
- Indicate, both visibly and audibly, on the FSCS any trouble conditions, when smoke control equipment does not respond to automatic or manual commands. The FSCS controls the alarm sonalert logic for all smoke control systems, no other application is necessary.
- Prevent the duct smoke detectors from stopping any smoke control fans once the smoke control system has been activated, if the smoke control strategy is such that the return duct exhausts the smoke from the building during the smoke control system operation. Duct smoke detectors are often located in the return duct of a heating, ventilating, and air conditioning (HVAC) fan and connected to stop the fan when smoke is detected, which is in compliance with NFPA 90A.
- Perform tests on all dedicated smoke control systems to verify proper operation of dampers and pressurization fans. This is described in the Weekly Test section in the Distech Controls Smoke Control Application Guide.
- Automatic activation of any smoke control sequence of operation must have priority over any automatic environmental control strategy and over any non-smoke control manual commands. When an automatic smoke control sequence is initiated, the system design must bypass the following overrides:
  - High and low temperature protection devices
  - Return and exhaust air duct smoke detectors
- Indicate a faulty condition from any air duct smoke detector available to the FSCS operators so that they can make informed decisions concerning their override actions if smoke is detected elsewhere, especially in the supply air. This can be in the form of annunciation on the fire alarm system control panel or a remote annunciator controlled by the fire alarm system.
- Highest priority must be given to the FSCS to manually activate or deactivate any predefined smoke control strategy. Give automatic smoke control a higher priority than any manual or automatic HVAC application.
- When a smoke alarm is received and automatically acknowledged by the smoke control system, additional smoke alarms must not cause the smoke control system to take automatic secondary actions. However, the system must execute any manual commands from the FSCS.
- Ensure that the response time for individual smoke control components to reach their intended position from the point of command does not exceed these time periods: 60 seconds for fan operation at the required state plus 10 seconds to annunciate; 75 seconds for completion of damper travel plus 10 seconds to annunciate. If a fan start occurs after damper closes, add these times. If damper must be closed before the fan starts, the total response time could go to 135 seconds for operation, 75 seconds for

damper to close plus 60 seconds for fan to start. Time needed to annunciate is added to this time. (Control system response is the time from automatic detection of a smoke condition to the issuing of the first smoke control command to the equipment.) Refer to *Response Times* on page 35.

- Automatic activation of any smoke control sequence of operation has priority over any non-smoke control manual commands and any automatic environmental control strategy, when an auto smoke control sequence is initiated. High and low temperature protection devices and return and exhaust air-duct smoke detectors are bypassed.

FSCS Requirements

Here is a list of requirements for an FSCS:

- Full monitoring and manual control over all smoke control systems and equipment
- Override (partially or fully) any operation in progress, including programmed actions, non-smoke control manual overrides, and non-smoke control bypasses
- Highest priority over all smoke control systems and equipment
- Building diagram on the front panel that clearly indicates the type and location of all smoke control equipment
- Indication of the actual status (not the command status) of systems and equipment used for smoke control. This includes both the fully open status and fully closed status of each damper, status of each fan used for smoke control, and air flow status of each fan.
- Trigger an audible signal if the operation proof sensor (binary feedback point) fails to provide positive feedback that its command was executed within the allowed response time
- Hardware supervision alarms, such as binary feedback trouble on fans and dampers, as well as the system trouble points, that will turn on the FSCS alarm horn
- Use only one FSCS on a system network used for smoke control applications, unless multiple FSCS panels are approved by the AHJ.

The FSCS must be an approved UL Listed display panel. This panel is available from Automation Displays, Inc. (ADI). Contact ADI to order the FSCS:

Automation Displays, Inc. (ADI)
3533 North White Avenue
Eau Claire, WI 54703
(715) 834-9595
www.adipanel.com

Chapter 4
SMOKE CONTROL SYSTEMS

This chapter provides a general overview and basic operation and functionality of a smoke control system.

In This Chapter

Overview of a Smoke Control System

Smoke is one of the most hazardous problems caused by a fire. While fires are often quite damaging, it is smoke that can cause the most injuries to occupants as well as furnishings and equipment.

Smoke that results from a fire threatens both life and property in the location where the fire takes place but also in other areas of a building that surround the fire. When a building is faced with a fire, the goal of any smoke control system is to control the flow of smoke in other spaces within the building. It keeps smoke from spreading throughout the building, giving the building's occupants a clear evacuation route, as well as reducing the risk of damage to the building's interior.

The main objectives of a smoke control system are to:

- Protect life and minimize property loss
- Maintain a safe, tenable environment in emergency escape routes and areas of refuge while the facility is being evacuated
- Contain the smoke within the fire area, minimize its migration, and minimize damage to other areas of the facility
- Provide settings outside of the fire area where emergency operations can be performed as needed (evacuation, fire control, rescue, etc.)

Smoke Control System Design

A smoke control system is a complete system designed to accommodate a specific installation. Either the smoke control system designer or any other responsible party should provide a specific installation diagram that shows how to connect smoke control equipment to the HVAC and other system equipment. The local authority having jurisdiction (AHJ) is responsible for approving the equipment, installation, or procedure, as well as giving the authorization to occupy a building.

Smoke control systems are complex. They should be designed by trained and qualified engineers.

There are a variety of ways to implement a smoke control system, which present various advantages and disadvantages. System objectives and performance criteria should be determined before beginning any design or construction.

All smoke control systems share the following characteristics:

Tenable environment. A key feature of a smoke control system is to provide a tenable environment outside of the fire area. A tenable environment may not be entirely smoke free, but smoke, heat, and toxic gases are limited or restricted to a level that is not life threatening. This area can be used to protect occupants during evacuation or to provide an area of refuge.

System integrity. Smoke control systems should be designed, installed, and maintained so that the system remains effective during evacuation of the protected areas. Other factors may prompt the system to remain effective for a longer period of time. These factors include reliability of power sources, arrangement of power distribution, equipment and construction, and building occupancy.

Pressure differences. Air pressure differences provide the mechanism that contains smoke within the smoke zone and prevents smoke from moving into other zones. NFPA 92 provides guidelines for recommended pressure differences across smoke barriers and doors.

The pressure differences that smoke control systems produce can fluctuate due to the wind, fan pulsations, doors opening, doors closing, and other factors.

Understanding Smoke Movement

In general, the movement of smoke will follow the same pattern as the overall air movement within a building. The major influences on smoke movement includes stack effect, air/smoke buoyancy, air/smoke expansion, wind, pressure, and the operating HVAC system. In the event of a fire, a combination of these influences usually cause smoke movement.

An accepted way of containing smoke within a compartment or an area is to create pressure differences between smoke control zones. This is accomplished by creating higher pressure in the adjacent space than in the smoke zone. This way, air moves into the smoke zone from the adjacent areas and smoke is prevented from dispersing throughout the building..

In addition, air flow can minimize the movement of smoke through openings such as doors. For example, you can pressurize a stairwell, thereby minimizing the migration of smoke into the stairwell. Should one of the stairwell doors open, the flow of fresh air from the stairwell reduces the movement of smoke into the affected area.

Treat elevator shafts like stairwells and positively pressurize them to prevent vertical migration of smoke through the building. You may close inter-floor and inter-area duct work not being used for active smoke control at the appropriate locations, as detailed.

Types of Smoke Control Systems

Dedicated Smoke Control Systems

A dedicated smoke control system is a fan, damper, or duct system that is designed for the sole purpose of controlling smoke within a building. The dedicated smoke control systems form a system of air movement that is separate and distinct from the building's HVAC system, and they operate only to control the flow of smoke. Dedicated systems are used for special areas, such as elevator shafts and stair towers, that require special smoke control techniques. Because these systems are dedicated to smoke control performance, they are more immune to faults in the building's HVAC system.

To ensure proper functioning, the smoke control equipment must be tested at least once a week. For more information regarding weekly testing schedules, refer to the Distech Controls UUKL Smoke Control Application Guide.

Non-Dedicated Smoke Control Systems

A non-dedicated smoke control system uses parts of the building's HVAC system to control smoke in case of a fire. It shares components with other air moving equipment normally used for building environmental control. When the smoke control mode is activated, the building's HVAC equipment changes in order to accomplish the objectives of the smoke control design. Non-dedicated systems tend to be less costly and occupy less space. However, from an operational standpoint, the control strategy becomes more elaborate. Specific programming strategies must be employed to fulfil the priority of the smoke control system.

A weekly test is not needed in a non-dedicated system as the system is always active and normal operation serves as a valid means of operation.

Smoke Control Methods

Smoke control methods are most commonly applied to building spaces to provide zoned, stairwell, elevator shaft, and atrium smoke control. Smoke control systems are generally designed for one of two uses:

- Shaft protection: Stairwell pressurization systems and elevator hoist way systems.
- Floor protection: Variety of zoned smoke control systems.

Choosing a method or combination of methods depends on the building, fire code requirements, occupancy, and life safety requirements of the specific building or situation.

Stairwell Pressurization

Stairwells or stair towers have a separate ventilation system, isolated from the main building (tenable environment). In the event of a fire, the stairwell will be used by the building occupants as an evacuation route, therefore keeping the stair tower smoke free is crucial. Stairwell pressurization also provides a staging area for firefighters.

On the floor where the fire is located, a pressurized stairwell needs to maintain a pressure difference across a closed stairwell door to minimize smoke infiltration. Either a compensated or non-compensated system can serve this purpose.

Compensated systems adjust to combinations of open and closed doors, while maintaining positive pressure differences across openings. These systems compensate for changing conditions by either adjusting supply air flows or relieving excess pressure from the stairwell.

In a non-compensated system, a single-speed fan directs supply air into the stairwell. This provides one pressure difference with all doors closed, another pressure difference with one door open, and so on.

Other considerations for stairwell pressurization include the location of the supply air source, supply air fans, single and multiple-injection systems, and vestibules.

- To prevent smoke from re-entering the building, the supply air intake should be separate from openings that might expel smoke from the building during a fire. This includes all building exhausts, outlets from smoke shafts, roof smoke vents, heat vents, and open vents from elevator shafts.
- Different types of supply air fans have advantages and limitations, depending on the system design. For example, in a simple single-point injection system, a propeller fan mounted on the roof or an exterior wall can supply air to stairwells. Other single-injection systems and multiple-injection systems may call for a centrifugal or in-line axial fan to overcome the air flow resistance in the supply ductwork to the stairwell.
- A single-injection system supplies pressurization air to the stairwell at one location, usually at the top of the stairwell. When a few doors are open near the air supply injection point, these systems can fail. In a multiple-injection system, air is supplied to the stairwell at several points. For example, pressurization fans can be placed at ground level, roof level, or anywhere in between.
- Stairwell vestibules are either pressurized or non-pressurized. With both doors open in a non-pressurized vestibule, the two doors in series provide increased airflow resistance compared to a single door. A pressurized vestibule with both doors closed can provide a tenable area for refuge. Airflow from the pressurized vestibule indirectly pressurizes the adjacent stairwell.

Elevator Smoke Control

Smoke control in an elevator shaft or hoist way is an important consideration in the overall smoke control plan. Elevator shafts are particularly hazardous because they form perfect chimneys or funnels that draw smoke to the upper levels of a building. Since elevators usually have openings on each floor, and the seals on the elevator doors are often

inadequate and the hoist ways have openings at the top, the elevator shaft can become a mechanism to spread smoke throughout a building. The building stack effect is the main factor that moves smoke in and out of the elevator hoist ways.

Here are some recommendations that can be used to help with the elevator shaft/hoist way problem:

- Exhaust the fire floor
- Pressurize enclosed elevator lobbies
- Build smoke-tight elevator lobbies
- Pressurize the elevator hoist way

The use of one or more of these methods should be carefully evaluated with respect to a particular project. Ideally, elevators should not be used as an escape route during an evacuation.

Zoned Smoke Control

Stairwell pressurization systems are intended to prevent smoke infiltration into the stairwell. However, smoke can flow through floor cracks, partitions, and other shafts, threatening life and damage property. The idea of zoned smoke control is to limit this type of threatening smoke movement.

Buildings may be divided into several smoke control zones. A smoke control zone can consist of one or more floors or a section of one floor. Each zone is separated from other zones by partitions, floors, and doors that can be closed to inhibit smoke movement.

To stop the smoke from spreading throughout the building, the air pressure in the area containing the fire is lowered while the air pressure in the surrounding areas and floors are raised. The pressure differential between the smoke-filled area and the surrounding areas act as a smoke barrier, pushing the smoke back into the smoke-filled zone. The following image shows how this works.

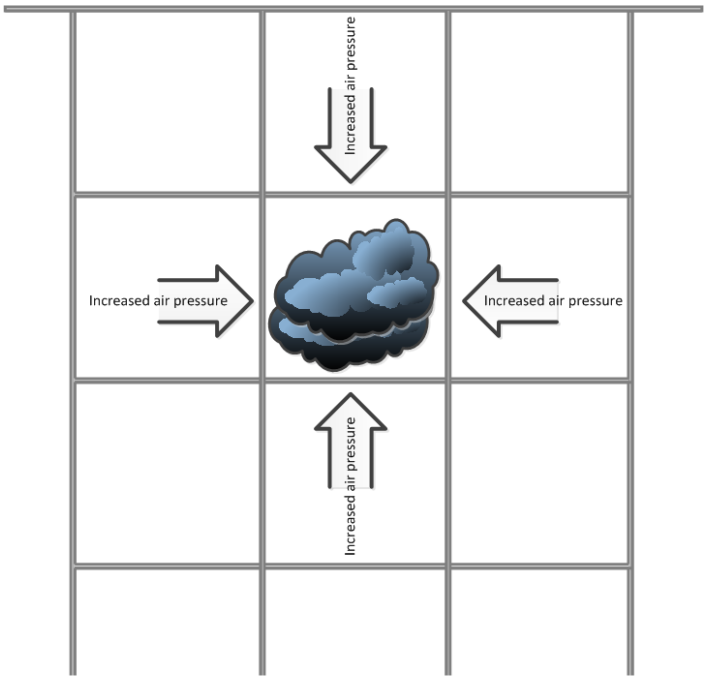


Figure 4-1: Air Pressure Pushing Smoke Back into Smoke-Filled Area in a Building

Smoke zones should be kept as small as possible to facilitate evacuation and to keep the air pressurization to a manageable level. When a fire occurs, most zones may be pressurized, except for the smoke zone.

A zoned smoke control system needs a large amount of outdoor air. For example, in cold climates, letting in large amounts of outdoor air can damage building systems. Emergency preheating systems that warm the incoming air can be used to limit or avoid damage.

Another option is to pressurize only the zones immediately adjacent to the smoke zones. This reduces the quantity of outdoor air needed. However, this method may allow smoke to flow through shafts past the pressurized zone and into unpressurized spaces.

If signals from fire alarm systems are used to activate a zoned smoke control system, the alarm zones must coincide one-to-one with the smoke control zones. This prevents activating the wrong smoke control systems. Even if smoke bypasses the positive pressure zones and causes another smoke alarm, the automatic system should prevent additional automatic sequences from starting.

Smoke Alarm Initiating Devices

The smoke alarm initiation of an automatic smoke detector located in one of the building's smoke zones, generally activates the smoke control system. This activation may initiate the air movement equipment to create higher pressures in the areas surrounding the smoke zone. This may include positively pressurizing areas adjacent to the smoke zone and/or negatively pressurizing the smoke zone and exhausting air from the smoke zone. Subsequent smoke alarm conditions in other zones must be prevented from automatically changing the initial smoke control sequence. Keep in mind the guidelines provided in this section when planning your smoke control strategy.

Do not use duct type smoke detectors exclusively to activate smoke control, for the following reasons:

- The dilution of air in the duct system likely results in a slow response time.
- The supply air duct detector, when exposed to outdoor air in the HVAC supply air duct, may report a false alarm condition.
- The duct system may move smoke from the smoke zone, and this causes the duct detector in the return/exhaust duct of the non-dedicated fan system to register an alarm condition.

The following section describes initiating devices for manual and automatic initiation.

Manual Initiation

Do not use manual pull stations to initiate a smoke control sequence, since there is no certainty that manual devices will be activated in the area of involvement. However, you can use manual pull stations to initiate global operations, such as energizing stairwell and elevator shaft pressurization fans.

Manual implementation of the smoke control strategy takes place at the FSCS. The FSCS must be capable of overriding, either partially or fully, any automatic activation that may be in progress It must also be capable of manually controlling each control point (damper, HVAC fan, and so forth) that is used for smoke control in the facility. Refer to the Distech Controls UUKL Smoke Control Application Guide in *Related Documentation* on page 11 for details on how to integrate an FSCS into an EC-Net 4 system.

Automatic Initiation

For automatic operation of a smoke control sequence you must use a UL 864 Listed fire alarm control unit; (i.e. fire alarm panel) using a set of normally open dry supervised contacts.

End-to-End Verification

To ensure that the smoke control sequence of operation has been applied, an end-to-end verification Class C is required. The verification must be achieved by using damper position indicators and air flow switches or differential pressure sensors. If faults occur because equipment fails to respond or responds incorrectly to commands from the Distech Controls Smoke Control System, an audible and visual trouble signal must be triggered at the FSCS.

For HVAC dampers, used in smoke control sequences, the FSCS must display a positive indication of the damper's fully opened and fully closed positions and must report a faulty condition if the damper position does not agree with the commanded position. To maintain a log of all faulty conditions, including situations where the commanded smoke control sequence does meet the required condition, use the audit trail function to record the last commands and events during a smoke control sequence.

Refer to the Distech Controls Smoke Control Application Guide in *Related Documentation* on page 11 for details on smoke control sequences.

Fan Relay Supervision

Fan relay supervision is required if the project must meet Life Safety Code NFPA 101 requirements (where the fire system uses the HVAC system to sequence control or shutdown an HVAC fan). The auxiliary relay used to control the motor starter on the HVAC system fan must be located within 3 feet of the motor starter. The wiring between the fan shutdown controller and the shutdown relay must be monitored for integrity (supervised). This can be achieved by using electronic supervision or continuously powered shutdown relays that turn the fan off if power is lost to the relay circuit. In addition, proof of fan operation such as an air flow switch is required.

Response Times

The response times for individual components to obtain their intended state after the smoke control system has altered their state should not exceed the following time periods:

- 60 seconds for fan operation at the intended state plus 10 seconds to annunciate
- 75 seconds for completion of damper travel plus 10 seconds to annunciate

Equipment Timing Diagram

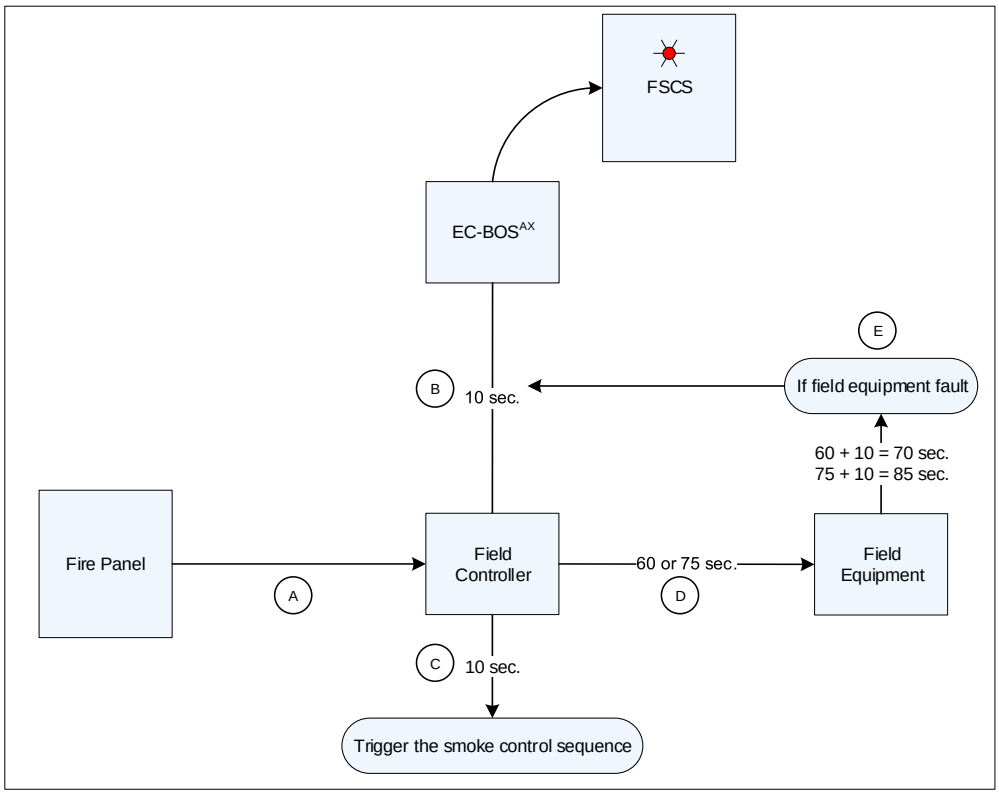


Figure 4-2: Equipment Response Time Diagram

Components	*Description*
A	Alarm received at the fire panel and sent to the field controller.
B	Within 10 seconds, the field controller communicates to the EC-BOS-8 UUKL which then processes the alarm and annunciates the alarm to the FSCS (fire alarm LED).
C	The controller has 10 seconds to trigger the smoke control sequence.
D	The field controller has 60 seconds to start the fan or 75 seconds to position a damper.
E	If the fan does not start the field controller has 70 seconds to annunciate the alarm to the FSCS. If the damper does not reach its position, the field controller has 85 seconds to annunciate the alarm to the FSCS.

Communication Timing Diagram

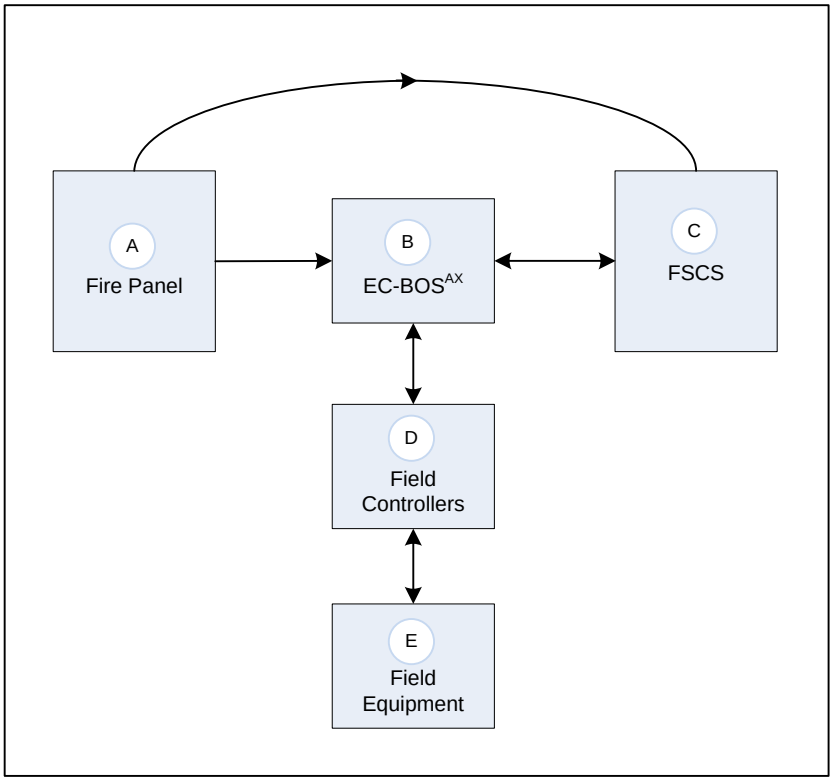


Figure 4-3: Communication Timing Diagram

Components	*Description*
A	When communication with the fire panel is lost, the fault must be annunciated to the FSCS within 200 seconds.
B	When communication with the EC-BOS-8 UUKL fails, the FSCS must detect and annunciate the fault within 200 seconds.
C	When the FSCS fails, the EC-BOS-8 UUKL must detect the fault within 200 seconds.
D	When communication with the field controllers is lost, the fault trouble must be annunciated to the FSCS within 30 seconds.
E	When problems with feedback from the field equipment, the fault must be annunciated to the FSCS within 30 seconds.

Chapter 5
DISTECH CONTROLS' SMOKE CONTROL SYSTEM APPLICATION

This chapter provides application diagrams of the Distech Controls UUKL Smoke Control System that comply with the UL 864 UUKL Listing and describes the surge protection devices and supervised input kits used with the smoke control system.

In This Chapter

Distech Controls Smoke Control System Diagrams

Keep in mind that the illustrations found in this section are only examples; the actual number and placement of components in your system may differ. The smoke control systems must comply with all UUKL devices and communication requirements and restrictions.

Smoke/Non-Smoke Control System Diagram

The following figure depicts a typical smoke/non-smoke control system including how the controllers, FSCS, fire panel, and some protection devices are interconnected.

In a smoke/non-smoke control system, the FSCS can be wired to the BACnet MS/TP Communication network (*Figure 5-1*) or to the BACnet Ethernet cable (*Figure 5-2*). Both examples are shown in the following diagrams.

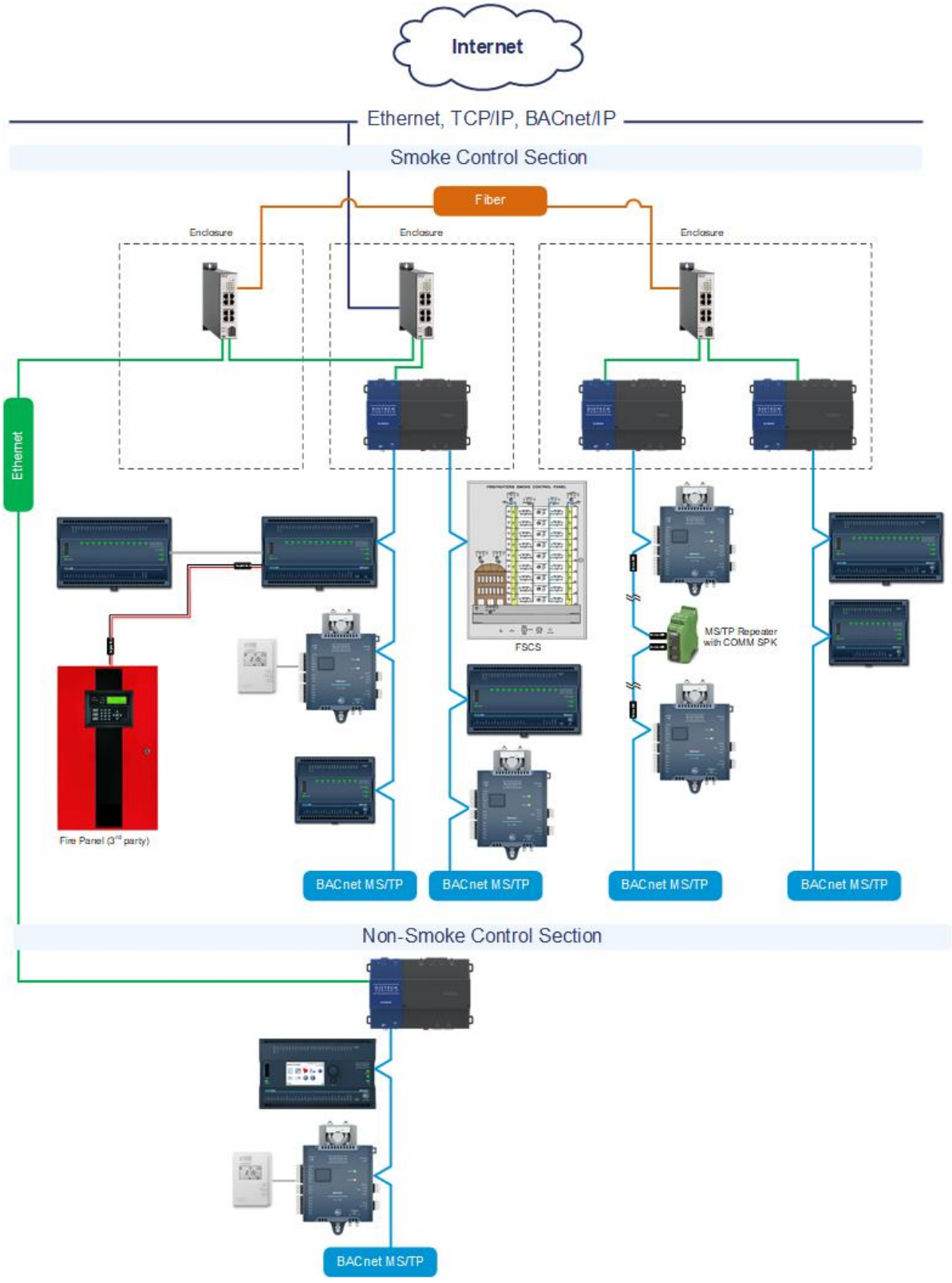


Figure 5-1: Smoke/Non-Smoke Control System Communication Diagram with FSCS on BACnet MS/TP Communication

This next image shows how the FSCS can also be wired to the BACnet Ethernet cable rather than to the BACnet MS/TP as shown in the previous figure:

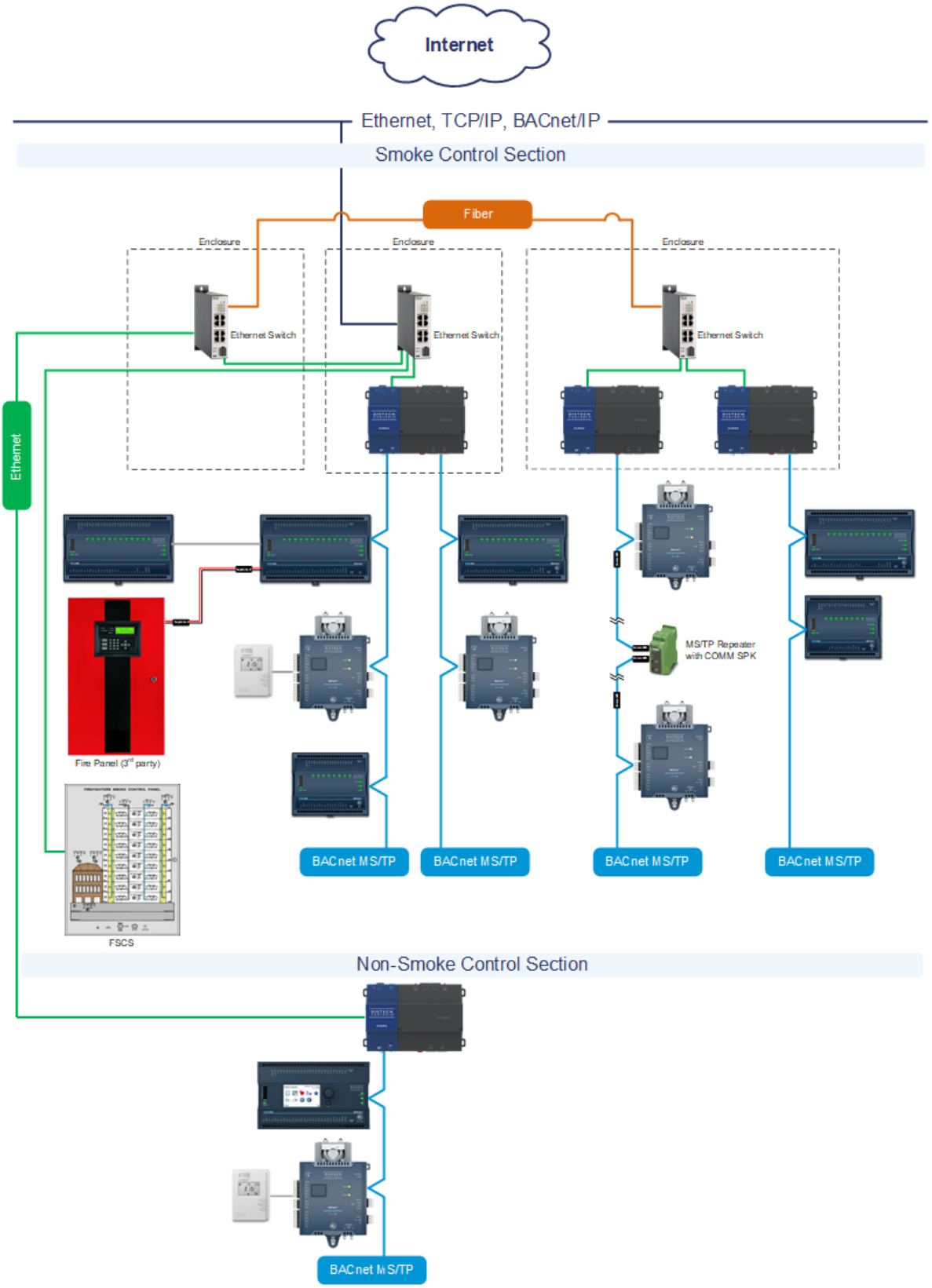


Figure 5-2: Smoke/Non-Smoke Control System Communication Diagram with FSCS on BACnet Ethernet Communication

Keep in mind that a Communication Surge Protection Kit (COMM SPK) is required on repeaters in a smoke control system. This is shown in the above diagrams. For more information regarding when to use the COMM SPK in a multiple room setup, refer to *Communication Surge Protection Kit (COMM SPK)* on page 45.

Supervised Input Kits (SIK)

A supervised input kit must be used with all inputs in the smoke control system. This kit protects the input and detects any trouble with the wiring (ground fault at 0Ω, short wire, etc.).

There are two supervised input kits that need to be wired to the controller and supervised contact; one for the inputs (IN SIK) and another for the dry contact (DC SIK).

Do not use the *IO SPK* with these supervised input kits.

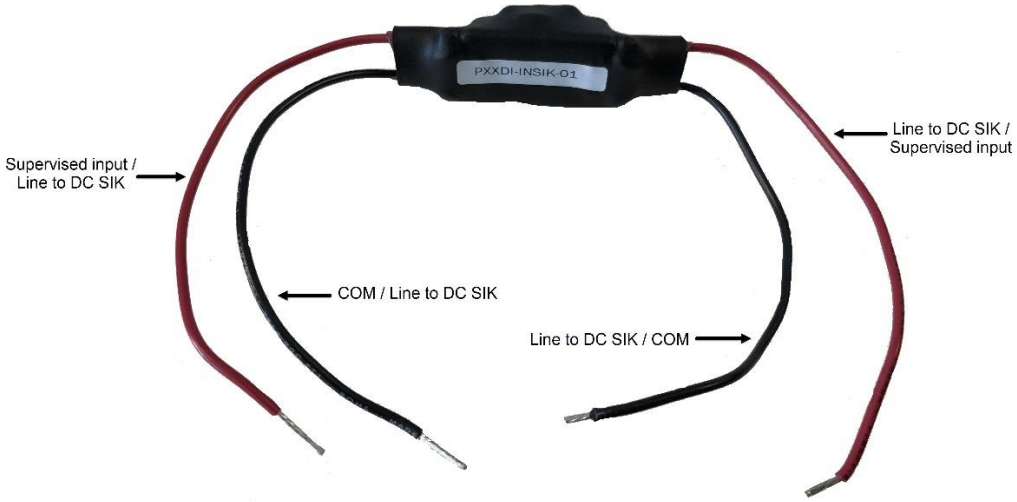


Figure 5-3: Supervised Input Kit – Inputs (IN SIK)

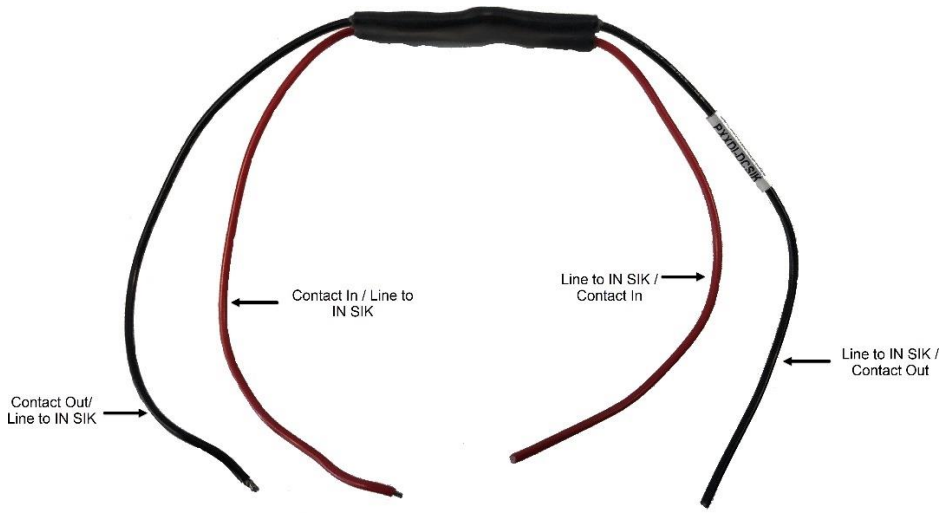


Figure 5-4: Supervised Input Kit – Dry Contact (DC SIK)

The diagram below (*Figure 5-5*), shows how to wire the supervised kits. Each input that is required to be supervised must be connected to a supervised input kit – inputs (IN SIK) before being connected to a wire run. Then the supervised input kit – dry contact (DC SIK) must be wired from the wire run to the entrance of the supervised contact (fire panel, damper end switch, fan relay supervision, etc.). Refer to the following wiring diagram:

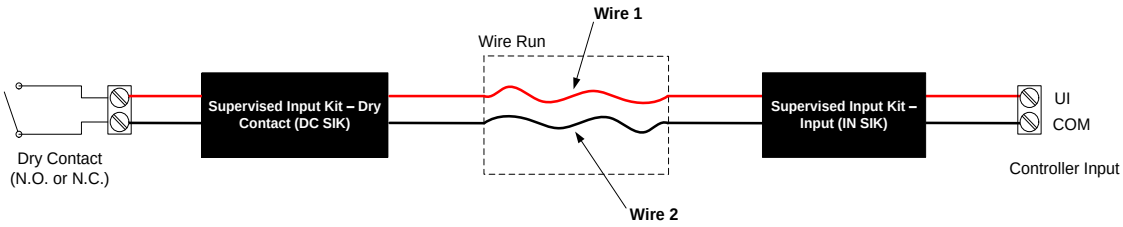


Figure 5-5: Supervised Inputs Kits Wiring Diagram

You can wire either ends of the supervised kits to their supervised input/contact without causing any problems or issues.

In order for the supervised inputs kits to be functional, they must be used in conjunction with the *UUKL_SupervisedInput* custom block in EC-*gfx*Program. Refer to the Distech Controls UUKL Smoke Control Application Guide for more information.

Chapter 6
SURGE PROTECTION DEVICES

This chapter provides an overview of the surge protection device requirements for the Distech Controls UUKL Smoke Control System.

In This Chapter

Power Bar Surge Protection

The Tripp Lite Isobar Ultra 8 and Ultra 12 premium surge and noise suppression devices prevent equipment damage and performance problems resulting from damaging transient surges and line noise.

Tripp Lite 8 Ultra Surge Suppressor

Figure 6-1: Tripp Lite Isobar 8 Ultra Surge Suppressor

Refer to the manufacturer's product documentation for detailed technical specifications.

Tripp Lite ISOBAR 12 Ultra Surge Suppressor

Figure 6-2: Tripp Lite Isobar 12 Ultra Surge Suppressor

Refer to the manufacturer's product documentation for detailed technical specifications.

Surge Protection Kits

Surge protection kits can prevent the spread of overvoltage in electrical installations and protect the equipment connected to it. The following table lists the different types of surge protection kits that must be used with the different connections. These protection kits are UL listed for smoke control applications and therefore should be used with the Distech Controls UUKL Smoke Control System.

Connector Type	*Surge Protection Kit (SPK)*
MS/TP and subnet bus communication	Communication SPK (COMM SPK)
Input/Output not supervised (max. 24Vac by I/O)	Input/Output SPK (IO SPK)
Power 24VAC (Triac)	Power SPK (PWR SPK)
Triac output	TRIAC SPK
Subnetwork RJ-45	Subnet SPK (SN SPK)

A surge protection kit must be used whenever the conduit or cable run between enclosures does not remain in the same room. An example of this is shown in *Figure 6-7*.

To gain maximum protection from the SPK, the connecting conductors should be kept as short as possible.

Communication Surge Protection Kit (COMM SPK)

The Communication SPK is used with the MS/TP bus and 2-Wire Subnetwork bus cables when the conduit or cable run between smoke control equipment enclosures does not remain in the same room.

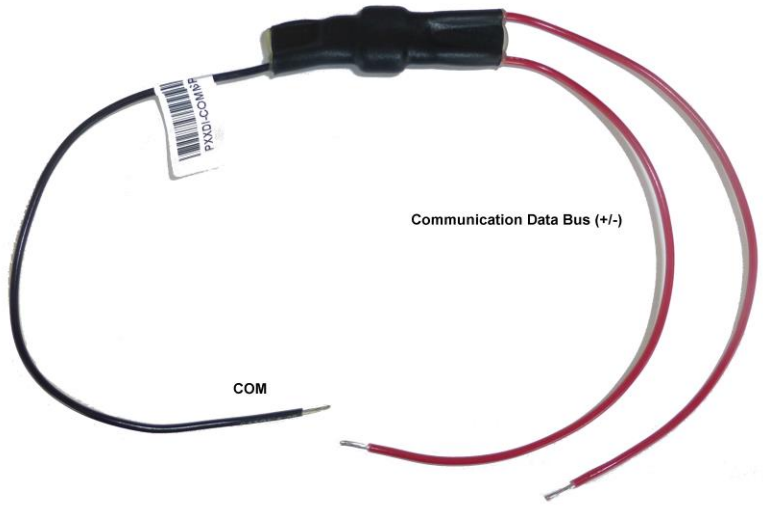


Figure 6-3: Communication Surge Protection Kit (COMM SPK)

The following diagram shows how the COMM SPK is wired to BACnet devices. The ECB-600 in the illustration below does not have a COMM SPK on the NET+ and NET- because the wires remain in the same room. Also take note that the black COM wire is wired to the COM and not to the 24V COM.

Refer to *Figure 6-7* for more details on how the COMM SPK is used within different rooms.

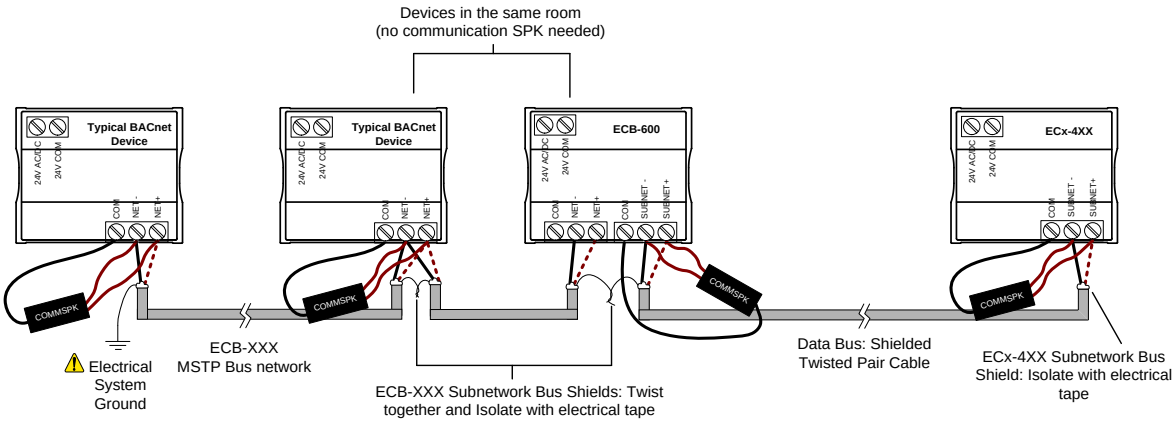


Figure 6-4: Communication SPK Wired to a Device

For further information regarding the MS/TP bus and 2-wire subnetwork bus cables, refer to *Chapter 10 - BACnet MS/TP Network*.

The following diagram shows the wiring run to smoke control equipment enclosures in different rooms and the proper use of the COMM SPK kit to protect the devices from transients. The COMM SPK must be installed when the cable run between enclosures does not remain in the same room. Keep in mind that the COMM SPK is also required on repeaters in a smoke control system.

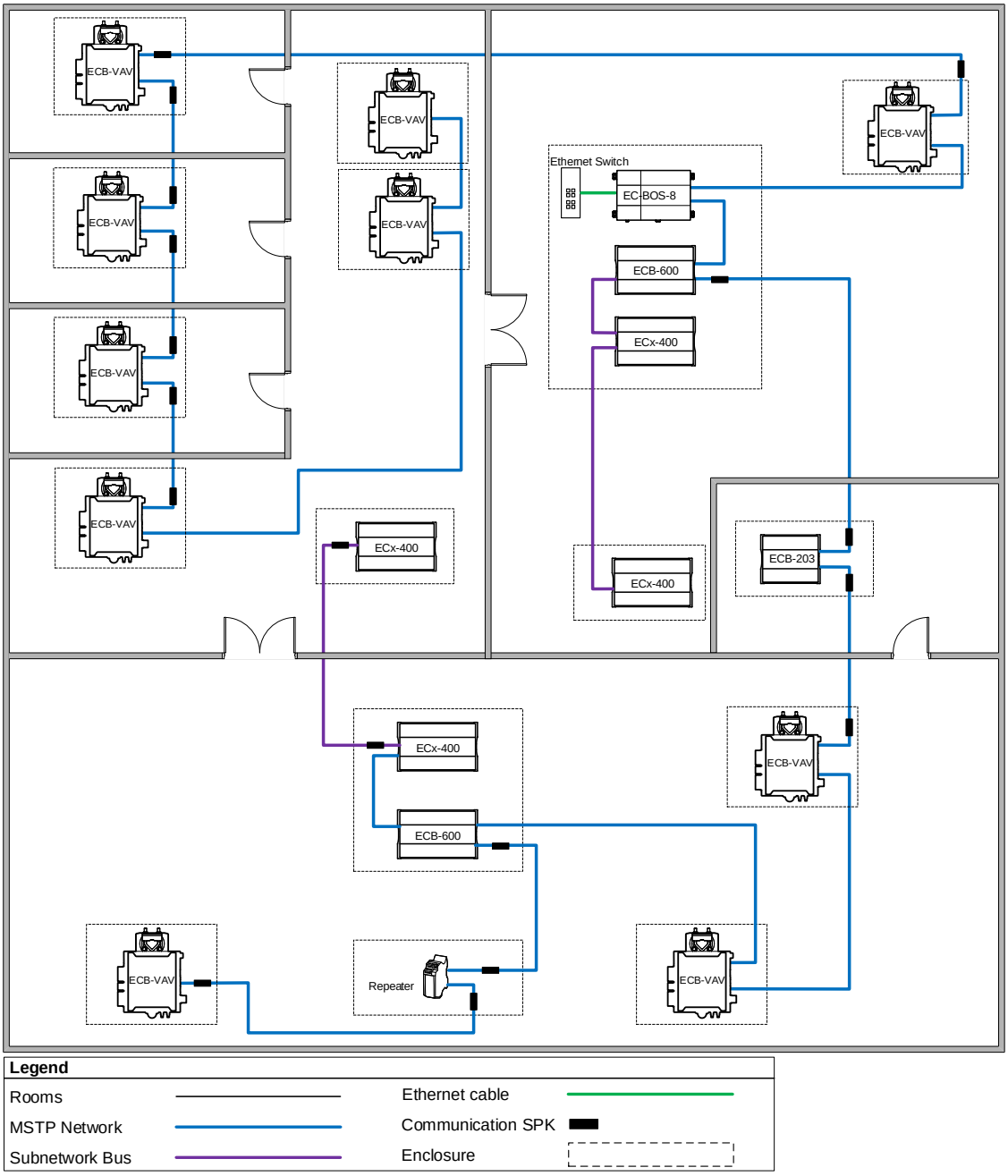


Figure 6-5: COMM SPK Wiring Diagram in a Multiple Room Configuration

Input/Output Surge Protection Kit (IO SPK)

The Input/Output SPK is used with the universal input and output connections when the conduit or cable run does not remain in the same room.

Figure 6-6: Input/Output Surge Protection Kit (IO SPK)

The following figure shows how to wire the IO SPK to a BACnet device. In this example, only a few connections are shown, however you can have as many connections as available on the BACnet device.

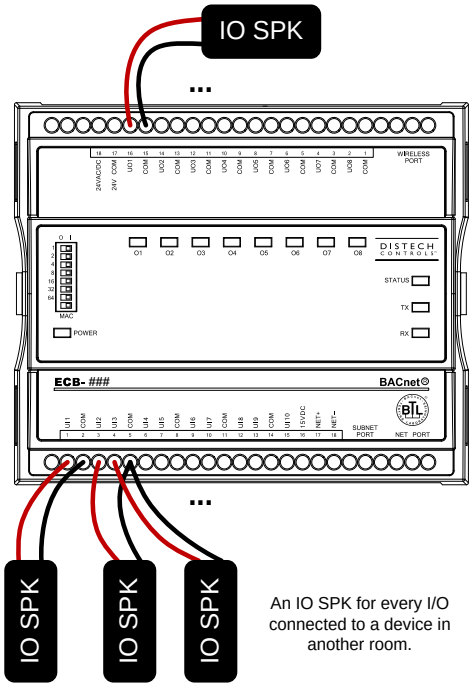


Figure 6-7: Input/Output SPK Wiring Diagram (IO SPK)

Power Surge Protection Kit (PWR SPK)

The Power SPK is used with the 24VAC power terminal when the power supply does not remain in the same room.

Figure 6-8: Power Surge Protection Kit (PWR SPK)

The following figure shows how to wire the Power SPK to a BACnet device.

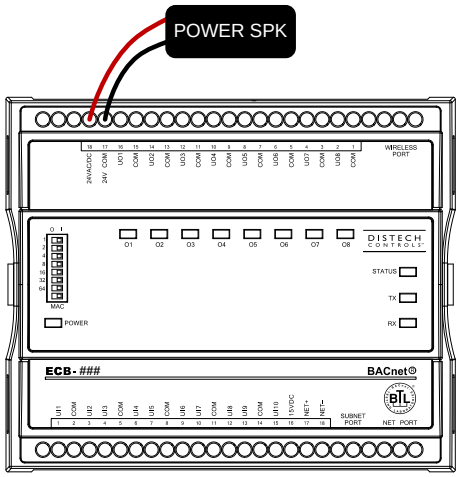


Figure 6-9: Power SPK Wiring Diagram

Triac Surge Protection Kit (TRIAC SPK)

The TRIAC SPK is used with the Triac outputs when the conduit or cable run does not remain in the same room.

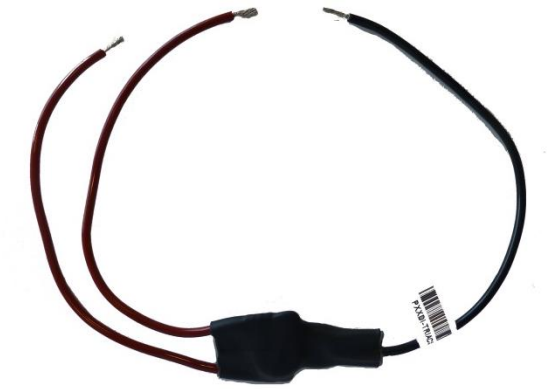


Figure 6-10: TRIAC Surge Protection Kit (TRIAC SPK)

The following figures shows how to wire the TRIAC SPK to an ECB-203 UUKL and ECB-VAV UUKL device.

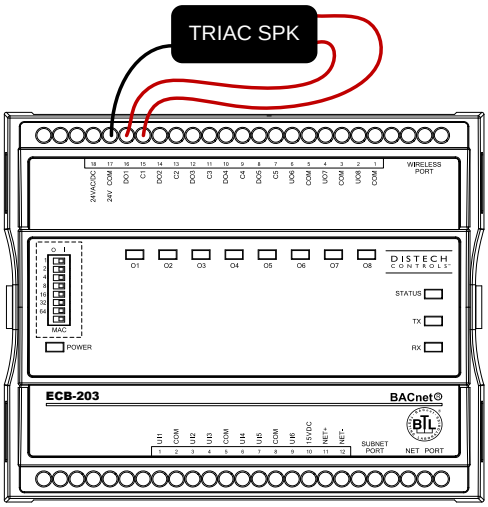


Figure 6-11: TRIAC SPK Wiring Diagram for an ECB-203 UUKL

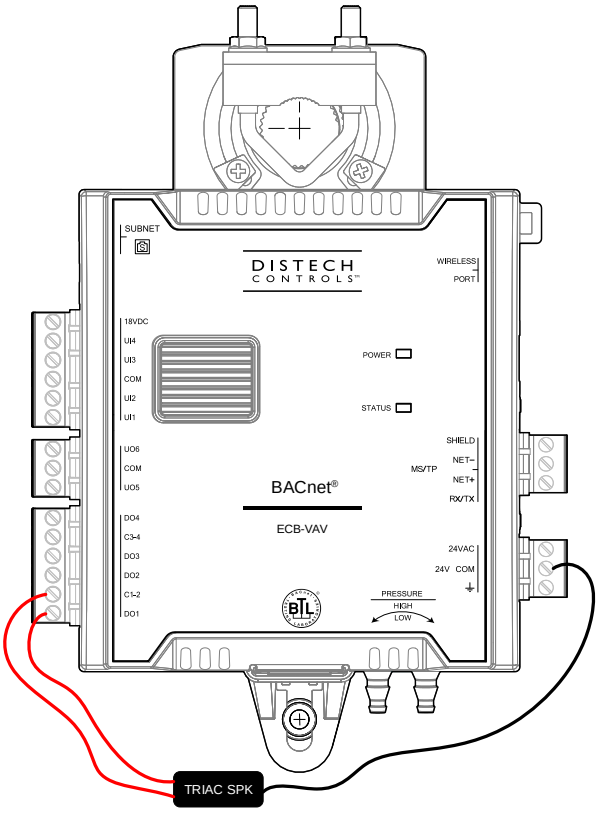


Figure 6-12: TRIAC SPK Wiring Diagram for an ECB-VAV UUKL

Subnetwork Surge Protection Kit (SN SPK)

The Subnet SPK is used to protect the RJ-45 subnetwork port of a UUKL controller against any surge. This SPK must be used when the conduit or cable run does not remain in the same room.

Figure 6-13: Subnet Surge Protection Kit (SN SPK)

The following figure shows how to wire the Subnet SPK to a BACnet device.

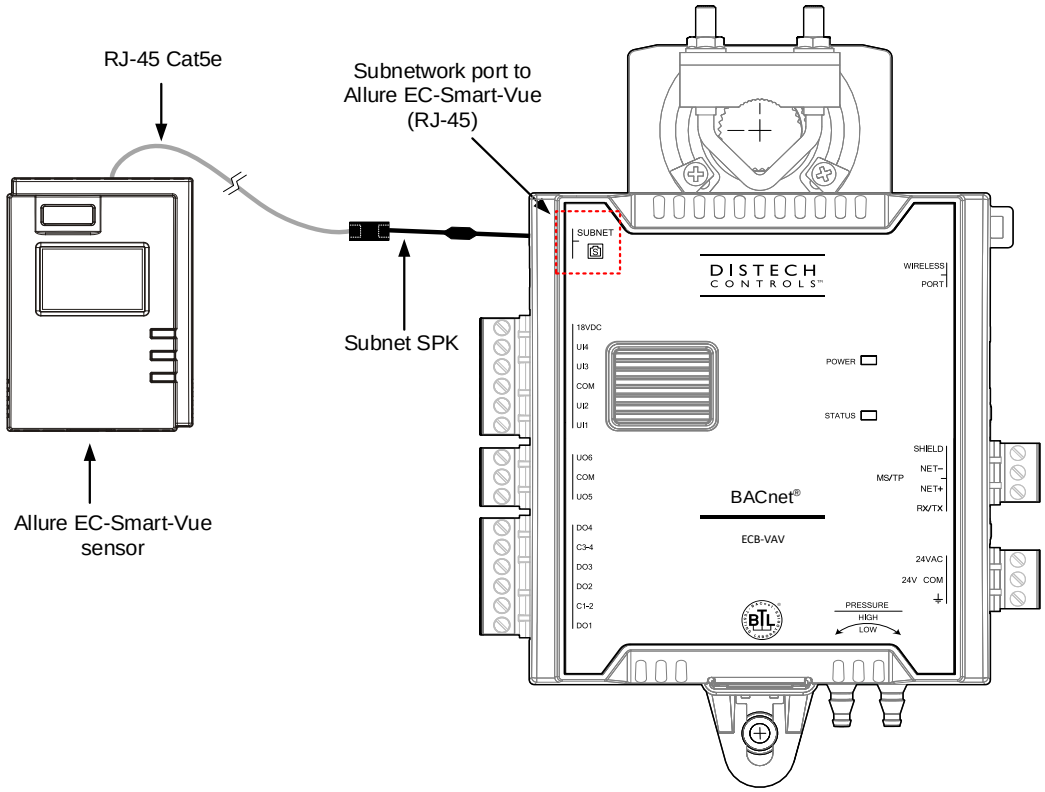


Figure 6-14: Subnet SPK Wiring Diagram

Chapter 7
NETWORK COMMUNICATIONS

This chapter provides an overview of the network communication requirements, devices, and connections for the Distech Controls UUKL Smoke Control System.

In This Chapter

Ethernet Interconnect Switch (EIS) Series

The EIS series by Contemporary Controls provides a solution for applications requiring a larger network diameter and greater throughput.

All models of the EIS series segment the Ethernet network into separate collision domains. The switch functions as a “bridge” between various data links creating a larger network diameter than can be achieved with repeating hubs. Each copper port automatically negotiates with its attached device the data rate (10 or 100 Mbps) and duplex (full- or half-) for that port.

The following models are used with the Distech Controls UUKL Smoke Control System and support both twisted-pair and fiber optics.

- Model EIS8-100T is a copper-only model that offers an eight-port 10BASE-T/100BASE-TX switching hub (for twisted-pair cabling).

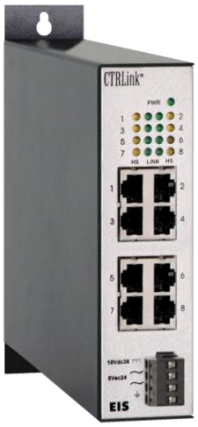


Figure 7-1: EIS8-100T Ethernet Switch, Copper-Only Model

- Model: EIS6-100T-FC is a copper Plus fiber model (multimode fiber) with six ports: Four-port 100BASE-TX/two-port 100BASE-FX (multimode) switching hub with SC connectors.

Figure 7-2: EIS6-100T-FC Ethernet Switch, Copper Plus Fiber Model

- Refer to the manufacturer’s product documentation for detailed technical specifications.
- Refer to *Figure 5-2: Surge Protection Devices and Network Wiring Diagram*, for more wiring information.
- A minimum of one Ethernet switch is required for each smoke control site.

Installation Requirement

One Ethernet switch is required for one or more EC-BOS-8 UUKL controllers within the same room. See following figures:

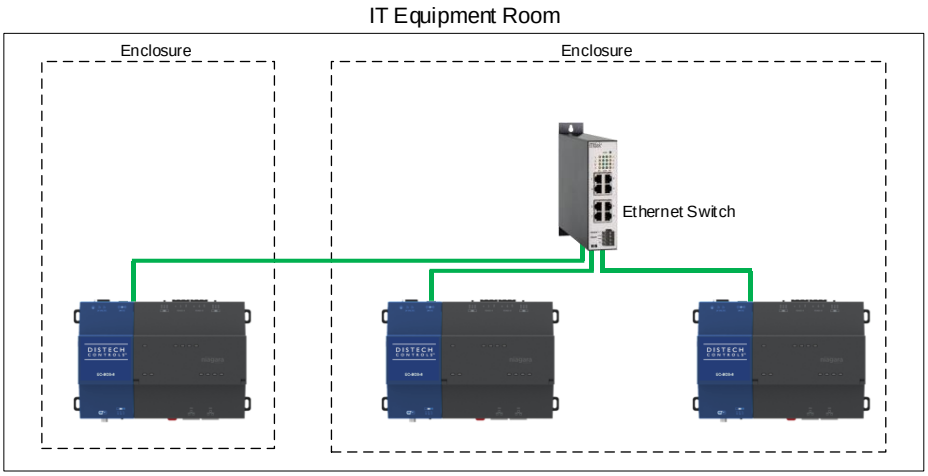


Figure 7-3: Multiple EC-BOS-8 UUKL within the same room

If you have EC-BOS-8 UUKL controllers in separate rooms, one Ethernet switch is required per room:

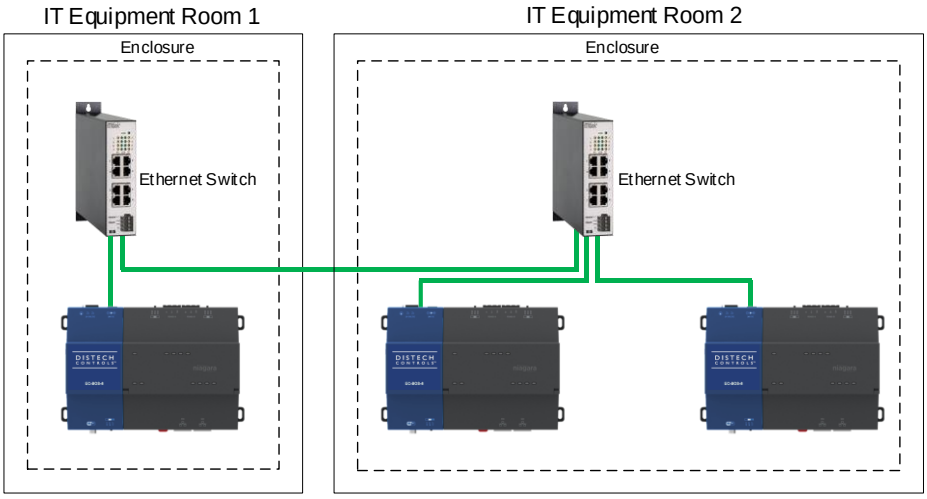


Figure 7-4: EC-BOS-8 UUKL controllers in separate rooms

For further information regarding wiring (Ethernet, copper wires, etc.), refer to *Chapter 10 - BACnet MS/TP Network*.

Fiber-Optic Cable Connections

The following SC-to-SC multimode fiber-optic patch cord by Signamax (model number: FC-4/4-3M) is used with the *Ethernet Interconnect Switch (EIS) Series*, in the Distech Controls UUKL Smoke Control System:

Figure 7-5: SC-to-SC Duplex Multimode Fiber Patch Cord

- 100BASE-FX
- PVC OFNR
- Multimode 62.5 µm
- 6560 feet (2000 meters) maximum length
- ST-style connectors

RS-485 Modular Repeater

The Phoenix Contact Repeater (PSI-REP-RS485W2) is a modular repeater for electrical isolation and range increase in RS-485 2-wire bus systems up to 500 kbps, 4-way isolation, rail-mountable, supply 24V DC.

The repeater must be installed inside a UL Listed enclosure and it serves two purposes:

1. To isolate smoke control equipment from non-smoke control equipment.
2. To extend the physical length of the MS/TP Bus on a single smoke control MS/TP bus.

Figure 7-6: Phoenix Contact Modular Repeater (PSI-REP-RS485W2)

Refer to the manufacturer's product documentation for detailed technical specifications.

Power Supply

The following 24 VDC/0.25 A, 6 W power supply with wall plug is used to power the Phoenix Contact modular repeater as well as the *Ethernet Interconnect Switch*.

Figure 7-7: Power Supply (07PWS-GPSU06U6)

Chapter 8
DISTECH CONTROLS' EC-BOS-8 UUKL SMOKE CONTROL CONTROLLER

This chapter provides a general overview of the Distech Controls' EC-BOS-8 UUKL main smoke control controller and information regarding its associated components.

In This Chapter

EC-BOS-8 UUKL

The EC-BOS-8 UUKL is a compact, embedded controller/server platform that provides complete equipment monitoring and control. It is the main controller in the Distech Controls' Smoke Control System and controls the communication between the other UL listed system components within the smoke control system. The EC-BOS-8 UUKL can be used in a dedicated or non-dedicated smoke control application and must be placed in a locked enclosure.

Figure 8-1: The EC-BOS-8 UUKL Controller

One Ethernet Interconnect Switch (EIS) is required for one or more EC-BOS-8 UUKL controllers within the same room. See figures: *Figure 7-3* and *Figure 7-4*.

The EC-BOS-8 UUKL performs the following functions in a smoke control system:

- Monitors the controllers in the smoke control system and signals the FSCS when there is a communication fault or output override
- Performs weekly self-tests on all the dedicated components in the smoke control system along with the ECB UUKL controllers.
- Displays the alarms on the alarm console
- Manages the user access rights and user categories

Device Layout

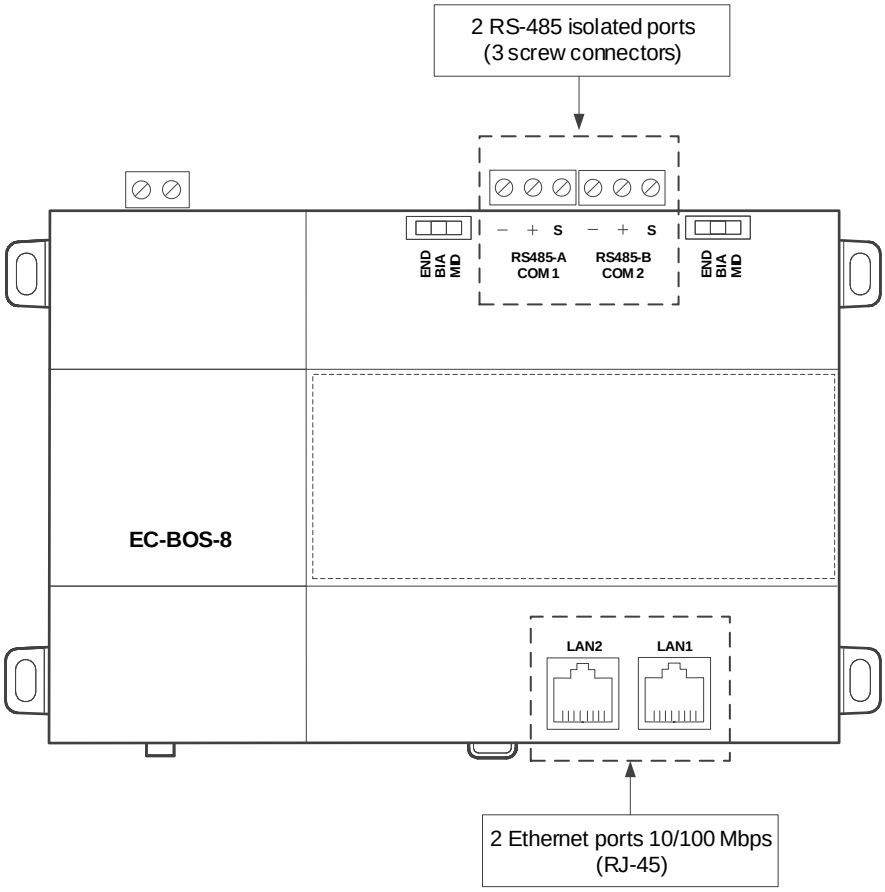


Figure 8-2: The EC-BOS-8 UUKL Device Layout and Wiring Interface

For the MS/TP connections, use the RS-485 Com1 and Com2 connectors.

Required Protection Kit

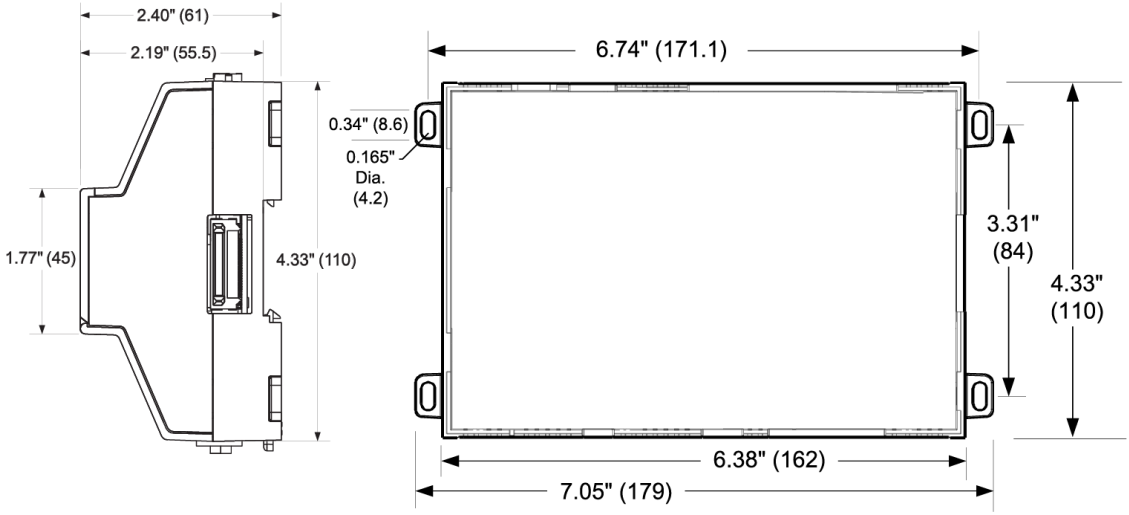
Use the Communication Surge Protection Kit (COMM SPK) for the EC-BOS-8 UUKL. Refer to *Communication Surge Protection Kit (SPK)* on page 45 for wiring details.

Specifications

Platform	
Processor	TI AM3352 1000MHz ARM® Cortex™-A8
Memory	1GB DDR3 SDRAM - Removable micro-SD card with 4GB flash total storage/2GB user storage - Real-time clock - Batteryless - Secure boot
Communications	
Wi-Fi	Client or WAP
Wi-Fi Communication Protocol	IEEE802.11a/b/g/n

	IEEE802.11n HT20 @ 2.4GHz IEEE802.11n HT20/HT40 @ 5GHz
Configurable radio	Off, WAP, or Client
Client Authentication Method	WPAPSK/WPA2PSK supported
USB type A connector	Back-up and restore support
RS-485	2 isolated RS-485 with selectable bias and termination
Ethernet	2 10/100MB Ethernet ports
BACnet Listing	BTL, B-BC listed at Revision 14 with EC-Net 4.10.1.18 or later
Power Supply	
Voltage	24VAC power supply
Consumption	24VA (24VAC)
Operating Systems	
EC-Net 4	4.7 or 4.14
Environmental	
Operating Temperature	32°F to 122°F (0°C to 50°C)
Storage Temperature	-40 to 85ºC (-40 to 185 ºF)
Relative Humidity	5% to 93% - Non condensing
Shipping and Vibration	ASTM D4169, Assurance Level II
MTTF	10 years+
Standards and Regulations	
UL	UL 916 C-UL listed to Canadian Standards Associations (CSA) C22.2 No. 205-M1983 "Signal Equipment"
CE	EN 61326-1
FCC	Part 15 Subpart B, Class B, Part 15 Subpart C
R&TTE Compliance	1999/5/EC R&TTE Directive
Other compliances	CCC, SRRC, RSS, RoHS

Dimensions



UL Label Placement

The UL Listing label is printed on the EC-BOS-8 UUKL controller as shown in *Figure 8-3*.

Figure 8-3: The EC-BOS-8 UUKL Listing Label Placement

RS485 UUKL Option Module

The RS485 is a dual port, electrically isolated adapter, with two 3-position, removable screw-terminal connector plugs. Each port has an RS485 bias switch to set or remove biasing. LEDs verify power and termination from the EC-BOS-8 UUKL and indicate RS485 trunk message traffic.

Figure 8-4: Dual RS485 UUKL Option module

Chapter 9
SMOKE CONTROL ECB BACNET CONTROLLERS

This chapter provides an overview of the UUKL ECB BACnet controllers for the Distech Controls Smoke Control System.

In This Chapter

General Guidelines for the ECB UUKL Controllers

The following general mounting and wiring guidelines apply to all Distech Controls Smoke Control ECB BACnet UUKL controllers. For ECB-VAV UUKL guidelines, refer to the *mounting instructions* in the ECB-VAV UUKL Controller section on page 92.

Mounting Guidelines

The controller can be mounted on a DIN rail to speed up the installation process. The base of the controller can be mounted without the controller cover. If so, make sure that there is sufficient clearance to allow you to install the controller cover later on.

Follow these guidelines when mounting an ECB UUKL controller:

- Ensure that the mounting surface can support the ECB UUKL controller and any user-supplied enclosure.
- Mount the ECB UUKL controller in the proper orientation with the ventilation slots and power supply/output terminal block connectors towards the top to permit proper heat dissipation. When installed in an enclosure, select one that provides sufficient surface area to dissipate the heat generated by the controller and by any other devices installed in the enclosure. Refer to *Figure 9-1*.
- Mount the ECB UUKL controller on an even surface whenever possible.
- Use shims or washers to mount the unit securely on the mounting surface.
- Do not mount the ECB UUKL controller in areas where corroding, deteriorating, or explosive vapors, fumes or gases may be present.
- Do not mount the ECB UUKL controller on surfaces that are prone to vibration, such as duct work, or in areas where electromagnetic emissions from other devices or wiring can interfere with ECB UUKL controller communication.
- Allow sufficient space for cable and wire connections (minimum of 50 mm [2 inches] in each direction).
- Allow for proper clearance around the controller's enclosure and wiring terminals to provide easy access for hardware configuration and maintenance, and to ventilate heat generated by the controller.
- In panel or enclosure mounted applications, apply the following guidelines:
  - Do not install the ECB UUKL controller in an airtight enclosure.
  - Mount the ECB UUKL controller so that the enclosure wall or transformer does not obstruct ventilation of or radiate heat into the ECB UUKL controller housing.

⚠ Any ECB BACnet UUKL controller used for smoke control must be locked in an enclosure to prevent unauthorized access.

Mounting Orientation

The ECB BACnet programmable controllers must be mounted horizontally with the ventilation slots and power supply/output terminal block connectors towards the top to permit proper heat dissipation.

The following illustration shows an example of the proper mounting orientation of the controllers for wall mounting and DIN rail wall mounting:

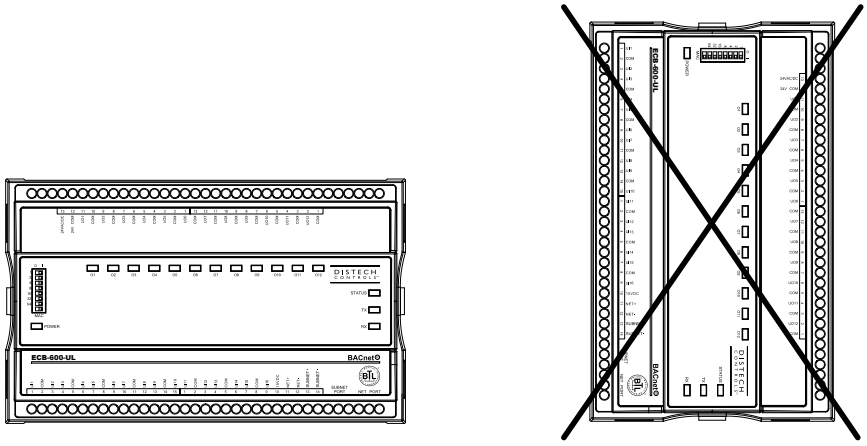


Figure 9-1: Proper Mounting Orientation of the ECB BACnet Programmable Controller for Wall and DIN Rail Mounting

General Wiring Instructions

The following instructions show how to wire an ECB BACnet controller:

1. Wire the MS/TP bus in a daisy chain to other devices on the MS/TP Bus and the EC-BOS-8 UUKL controller and set the proper end-of-line (EOL) terminations. Refer to the section on EOL terminations in *Chapter 10 - BACnet MS/TP Network*, on page 100.
2. Wire the subnetwork bus in a daisy chain manner.

   The ECB-600 controller must be at one end of the subnet port daisy chain if multiple input/output modules are used. Set the End-of-Line (EOL) switch on the last input/output modules.

3. Ensure the device address DIP switches are set to the appropriate address (in the range of 4-127).
4. Add the *Communication Surge Protection Kit (COMM SPK)* to the MS/TP communication terminal block connections and to the subnet bus if an ECx-400 I/O extension module is used. This applies only to connections that run from one room to another. Refer to *Figure 6-4* for a wiring example.
5. Add the *Input/Output Surge Protection Kit (IO SPK)* to the I/O terminal connections that run from one room to another.
6. Add the *Power Surge Protection Kit (PWR SPK)* to the 24VAC terminal connections that run from one room to another.
7. Add the *Subnetwork Surge Protection Kit (SN SPK)* to the RJ-45 subnetwork port connections that run from one room to another.
8. Connect power to the ECB BACnet controller.
9. Download and commission the ECB BACnet controller.

The terminal blocks accept wires ranging from 22 to 14AWG (0.644 to 1.630mm diameter) per pole.

Refer to Chapter 10 - *BACnet MS/TP Network*, on page 100 for more information on how to power a controller that uses a BACnet network for communications.

ECB-600 UUKL Controller

The ECB-600 UUKL controller is designed to control various building automation applications such as air handling units and exhaust fans. This controller has universal inputs and outputs that are ideal for controlling a wide range of HVAC equipment. It uses the BACnet® MS/TP LAN communication protocol and is BTL®-Listed as BACnet Advanced Application Controllers (B-AAC). The ECB-600 UUKL controller supports the ECx-400 UUKL I/O extension module that operates off of a separate sub-bus, giving this controller additional universal inputs and outputs.

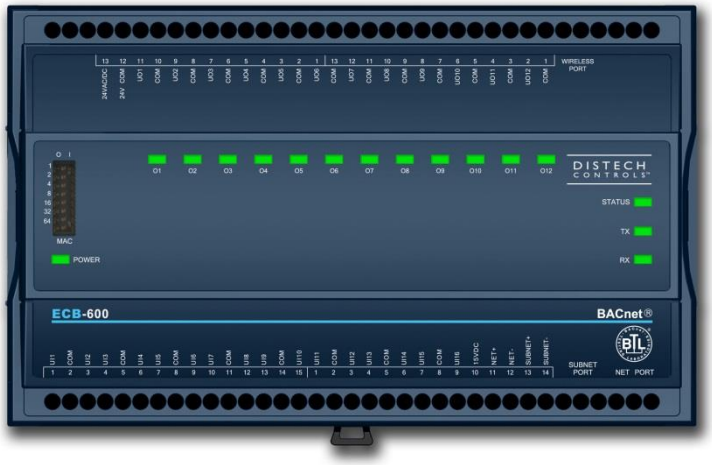


Figure 9-2: The ECB-600 UUKL Programmable Controller

Device Layout

The following illustration shows the device's layout and wiring interface:

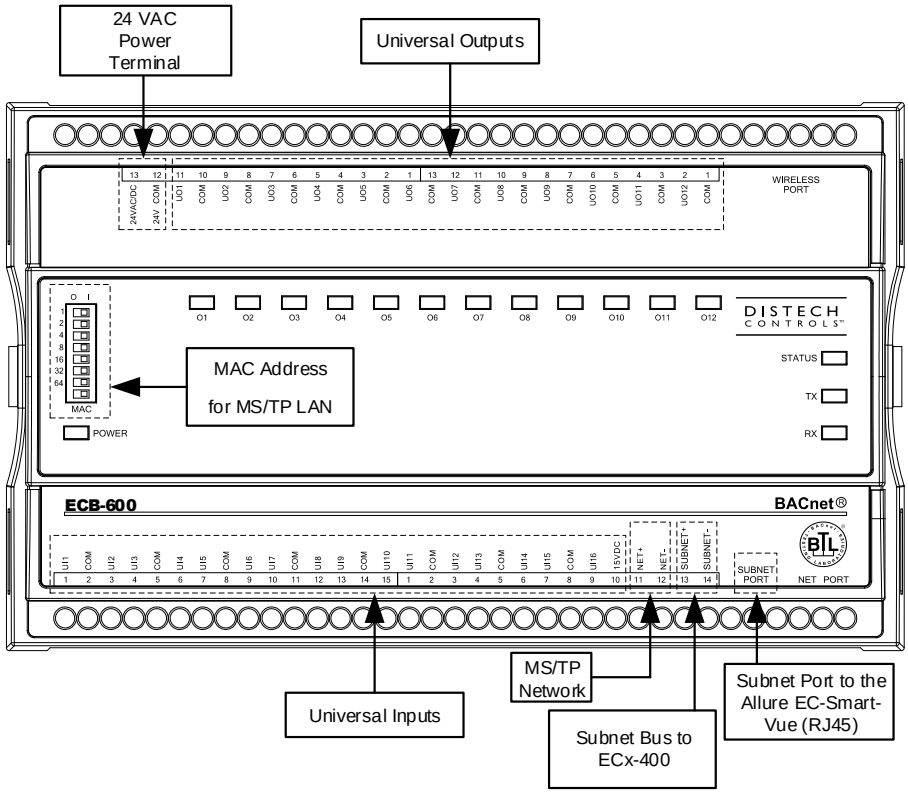


Figure 9-3: ECB-600 UUKL Device Layout and Wiring Interface

Required Protection Kits

Use the following required protection kits for the different types of connectors on this device:

Connector Type	*Surge Protection Kit (SPK)*
MS/TP and subnet bus communication	Communication SPK
Input/Output not supervised (max. 24Vac by I/O)	Input/Output SPK
Power 24VAC	Power SPK
Subnetwork port connection with RJ45 cable	Subnet SPK

For more information regarding the different surge protection kits and wiring details, refer to *Surge Protection Kits* on page 45.

Specifications

Power Supply Input	
Voltage Range	24VAC, Class 2
Frequency Range	60Hz
Overcurrent Protection	Field replaceable fuse
Fuse Type	3.0A
Power Consumption	22 VA typical plus all external loads[1], 65 VA max. **Note**: External loads must include the power consumption of any connected modules such as an Allure Series Communicating Sensor. Refer to the respective module's datasheet for related power consumption information.
Communications	
Communication Bus	BACnet MS/TP
BACnet Profile	B-AAC
EOL Resistor	Built-in, jumper selectable
Baud Rates	9600, 19 200, 38 400, or 76 800 bps
Addressing	Dip switch or with an Allure EC-Smart-Vue Series Communicating Sensor
Subnetwork	
Communication	RS-485
Cable	Cat 5e, 8 conductor twisted pair
Connector	RJ-45
Connection Topology	Daisy-chain
Hardware	
Processor	STM32 (ARM Cortex™ M3) MCU, 32 bit
CPU Speed	72 MHz
Applications Memory	1 MB Non-volatile Flash
Storage Memory	2 MB Non-volatile Flash
RAM Memory	96 kB RAM
Real Time Clock (RTC)	Built-in Real Time Clock with rechargeable battery Network time synchronization is initially required
RTC Battery	20 hours charge time, 20 days recharge time Up to 500 charge/discharge cycles
Green LEDs	Power status & LAN Tx
Orange LEDs	Controller status & LAN Rx
Communication Jack	BACnet 1/8" (3.5mm) stereo audio jack
Mechanical	
Dimensions (H × W × D)	4.7 × 7.7 × 2.03" (119.38 × 195.58 × 51.47 mm)
Shipping Weight	1.17lbs (0.53 kg)
Enclosure Material	FR/ABS
Enclosure Rating	Plastic housing, UL94-5VB flammability rating Plenum rating per UL1995
Environmental	
Operating Temperature	32°F to 122°F (0°C to 49°C)
Storage Temperature	-4°F to 122°F (-20°C to 50°C)
Relative Humidity	0 to 93% Non-condensing
Standards and Regulation	
FCC	Compliance with FCC rules part 15, subpart B, class B
UL Listed (CDN & US)	UL916 Energy management equipment
California State Fire Marshal Listing	CSFM: 7300-2187:0100
CEC Appliance Database	Appliance Efficiency Program

Universal Inputs (UI)

General	
Input Type	Universal; software configurable
Input Resolution	16-Bit analog / digital converter
Power Supply Output	15VDC; maximum 320mA (same room installations)
Contact	
Type	Dry contact
Counter	
UI1 to UI4:	
Type	SO output compatible
Maximum Frequency	50Hz maximum
Minimum Duty Cycle	10milliseconds On / 10milliseconds Off
UI5 to UI10:	
Type	Dry contact
Maximum Frequency	1Hz maximum
Minimum Duty Cycle	500ms On / 500ms Off
0 to 10VDC	
Range	0 to 10VDC (40kΩ input impedance)
0 to 5VDC	
Range	0 to 5VDC (high input impedance)
0 to 20mA	
Range	0 to 20mA, 249Ω jumper configurable internal resistor
Resistance/Thermistor	
Range	0 to 350 KΩ
Supported Thermistor Types	Any that operate in this range
Pre-configured temperature sensor types:	
Thermistor	10KΩ Type 2, 3 (10KΩ @ 77ºF; 25ºC)
Platinum	Pt1000 (1KΩ @ 32ºF; 0ºC)
Nickel	RTD Ni1000 (1KΩ @ 32ºF; 0ºC) RTD Ni1000 (1KΩ @ 69.8ºF; 21ºC)

Universal Outputs (UO)

General	
Output Type	Universal; software configurable
Output Resolution	10-bit digital to analog converter
Output Protection	Built-in snubbing diode to protect against back-EMF, for example when used with a 12VDC relay Output is internally protected against short circuits
Load Resistance	Minimum 200 Ω for 0-10VDC and 0-12VDC outputs Maximum 500 Ω for 0-20mA output
Auto-reset fuse	Provides 24VAC over voltage protection
0 or 12VAC (On/Off)	
Range	0 or 12VDC
Source Current	Maximum 60 mA at 12VDC (minimum load resistance 200Ω)
PWM	
Range	Adjustable period from 2 to 65 seconds
Thermal Actuator Management	Adjustable warm up and cool down time
Floating	
Minimum Pulse On/Off Time	500 milliseconds

Drive Time Period	Adjustable
0 to 10VDC	
Range	0 to 10VDC
Source Current	Maximum 60 mA at 10VDC (minimum load resistance 200Ω)
0 to 20mA	
Range	0 to 20mA
Type	Current source (jumper configurable)
HOA	
Hand-Off-Auto switch	When equipped. Supervision allows control logic to read the current HOA switch and potentiometer settings
Threshold	Configurable
Potentiometer Voltage Range	0 to 12.5VDC

UL Label Placement

The UL Listing label must be placed inside the UUKL controller cover as shown in the following figure:

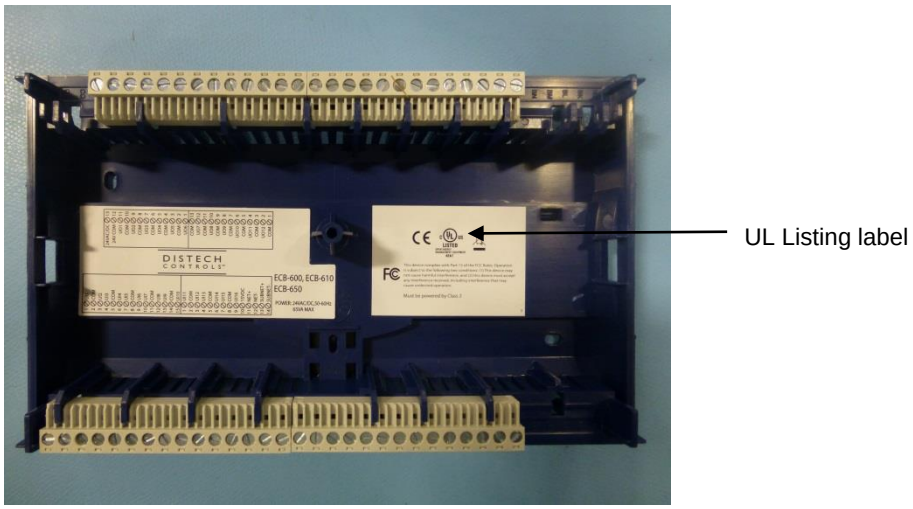


Figure 9-4: ECB-600 UUKL Listing Label Placement

ECx-400 UUKL I/O Extension Module

The ECx-400 UUKL is an I/O extension module that operates off of a separate sub-bus, giving the ECB-600 UUKL controller additional universal inputs and outputs.

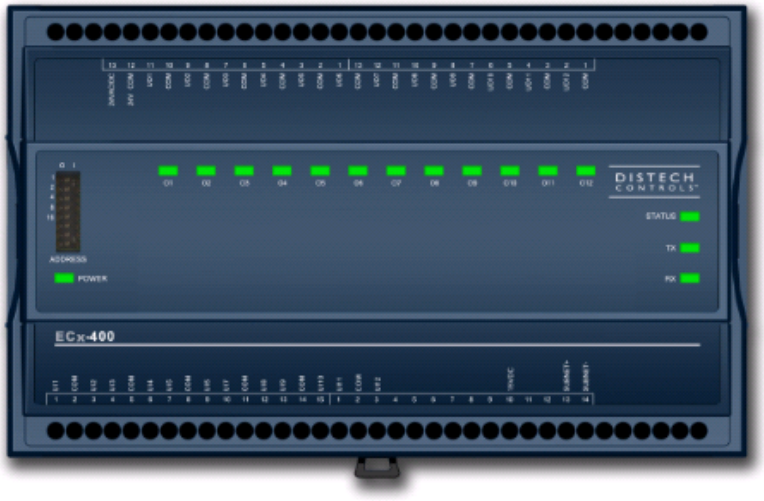


Figure 9-5: ECx-400 UUKL I/O Extension Module

Device Layout

The following illustration shows the device's layout and wiring interface:

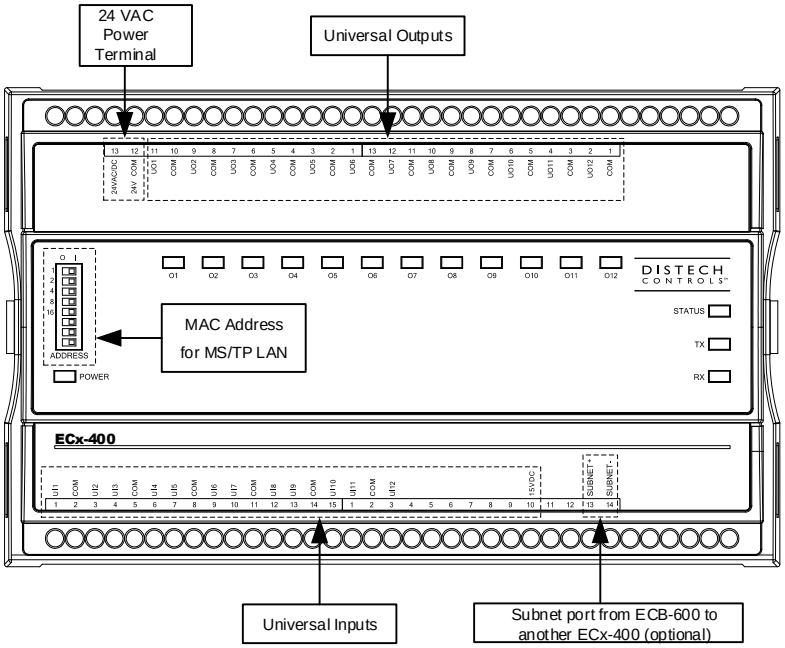


Figure 9-6: ECx-400 UUKL Device Layout and Wiring Interface

Required Protection Kits

Use the following required protection kits for the different types of connectors on this device:

Connector Type	*Surge Protection Kit*
MS/TP and subnet bus communication	Communication SPK
Input/Output not supervised (max. 24Vac by I/O)	Input/Output SPK
Power 24VAC	Power SPK

For more information regarding the different surge protection kits and wiring details, refer to *Surge Protection Kits* on page 45.

Specifications

Power Supply Input	
Voltage Range	24VAC; Class 2
Frequency Range	60Hz
Overcurrent Protection	Field replaceable fuse
Fuse Type	3.0A
Power Consumption	22 VA typical plus all external loads **Note:** External loads must include the power consumption of any connected modules such as an Allure Series Communicating Sensor. Refer to the respective module's datasheet for related power consumption information.
Communications	
Communication Bus	RS-485
Baud Rates	38 400
Addressing	Dip switch
Hardware	
Processor	STM32 (ARM Cortex™ M3) MCU, 32 bit
CPU Speed	64 MHz
Applications and Storage Memory	64 kB Non-volatile Flash
RAM Memory	20 kB RAM
Green LEDs	Power status & LAN Tx
Orange LEDs	Controller status & LAN Rx
Communication Jack	BACnet 1/8" (3.5mm) stereo audio jack
Mechanical	
Dimensions (H × W × D)	4.7 × 7.7 × 2.03" (119.38 × 195.58 × 51.47 mm)
Shipping Weight	1.17lbs (0.53 kg)
Enclosure Material	FR/ABS
Enclosure Rating	Plastic housing, UL94-5VB flammability rating Plenum rating per UL1995
Installation	Direct DIN-rail mounting or wall mounting through mounting holes
Environmental	
Operating Temperature	32°F to 122°F (0°C to 49°C)
Storage Temperature	-4°F to 122°F (-20°C to 50°C)
Relative Humidity	0 to 93% Non-condensing
Standards and Regulation	
CE Emission	EN61000-6-3: 2007; A1:2011
CE Immunity	EN61000-6-1: 2007
FCC	Compliance with FCC rules part 15, subpart B, class B

UL Listed (CDN & US)	UL916 Energy management equipment
California State Fire Marshal Listing	CSFM: 7300-2187:0100
CEC Appliance Database	Appliance Efficiency Program

Universal Inputs (UI)

General	
Input Type	Universal; software configurable
Input Resolution	16-Bit analog / digital converter
Power Supply Output	15VDC; maximum 320mA (same room installations)
Contact	
Type	Dry contact
Counter	
Type	Dry contact
Maximum Frequency	1Hz maximum
Minimum Duty Cycle	500ms On / 500ms Off
0 to 10VDC	
Range	0 to 10VDC (40kΩ input impedance)
0 to 5VDC	
Range	0 to 5VDC (high input impedance)
0 to 20mA	
Range	0 to 20mA, 249Ω jumper configurable internal resistor
Resistance/Thermistor	
Range	0 to 350 KΩ
Supported Thermistor Types	Any that operate in this range
Pre-configured temperature sensor types:	
Thermistor	10KΩ Type 2, 3 (10KΩ @ 77ºF; 25ºC)
Platinum	Pt1000 (1KΩ @ 32ºF; 0ºC)
Nickel	RTD Ni1000 (1KΩ @ 32ºF; 0ºC) RTD Ni1000 (1KΩ @ 69.8ºF; 21ºC)

Universal Outputs (UO)

General	
Output Type	Universal; software configurable
Output Resolution	10-bit digital to analog converter
Output Protection	Built-in snubbing diode to protect against back-EMF, for example when used with a 12VDC relay Output is internally protected against short circuits
Load Resistance	Minimum 200 Ω for 0-10VDC and 0-12VDC outputs Maximum 500 Ω for 0-20mA output
Auto-reset fuse	Provides 24VAC over voltage protection
0 or 12VAC (On/Off)	
Range	0 or 12VDC
Source Current	Maximum 60 mA at 12VDC (minimum load resistance 200Ω)
PWM	
Range	Adjustable period from 2 to 65 seconds
Thermal Actuator Management	Adjustable warm up and cool down time
Floating	
Minimum Pulse On/Off Time	500 milliseconds
Drive Time Period	Adjustable

0 to 10VDC	
Range	0 to 10VDC
Source Current	Maximum 60 mA at 10VDC (minimum load resistance 200Ω)
0 to 20mA	
Range	0 to 20mA
Type	Current source (jumper configurable)
HOA	
Hand-Off-Auto switch	When equipped. Supervision allows control logic to read the current HOA switch and potentiometer settings
Threshold	Configurable
Potentiometer Voltage Range	0 to 12.5VDC

UL Label Placement

The UL Listing label must be placed inside the ECx-400 UUKL I/O Extension Module cover as shown in the following figure:

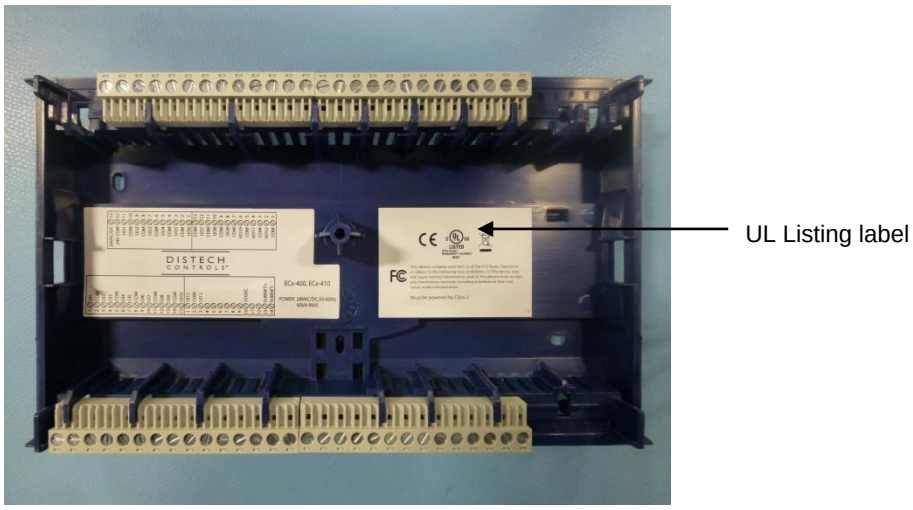


Figure 9-7: ECx-400 UUKL Listing Label Placement

ECB-400 UUKL Controller

The ECB-400 UUKL programmable controller is designed to control various equipment such as air handling units and exhaust fans. This controller has universal inputs and outputs that are ideal for controlling a wide range of HVAC equipment. This controller uses the BACnet® MS/TP LAN communication protocol and is BTL®-Listed as BACnet Advanced Application Controllers (B-AAC).

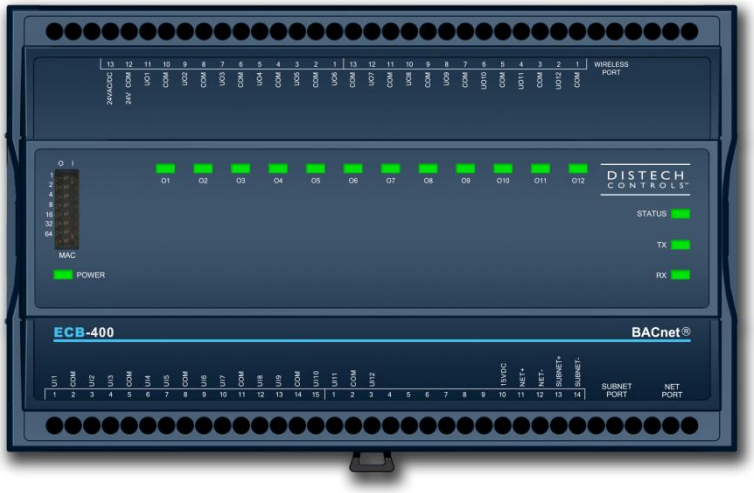


Figure 9-8: ECB-400 UUKL Programmable Controller

Device Layout

The following illustration shows the device's layout and wiring interface:

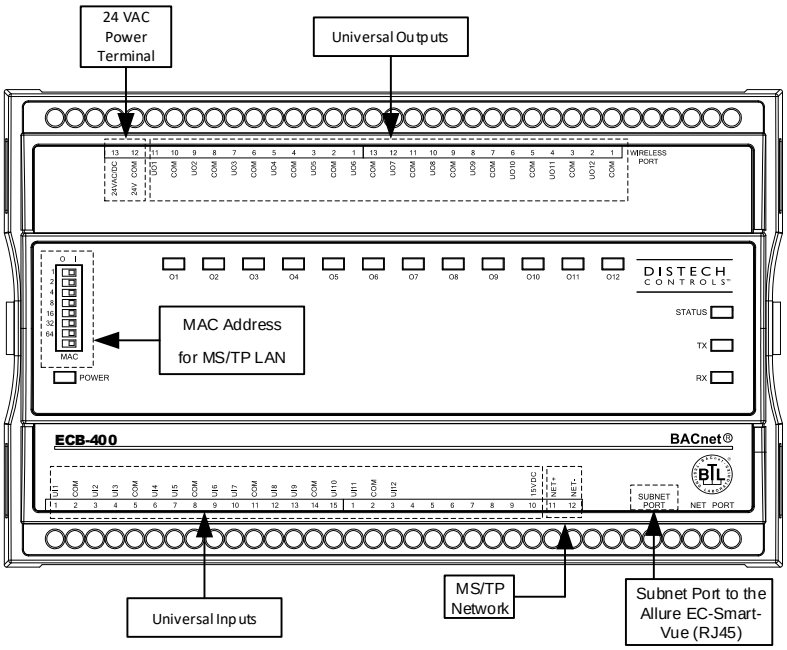


Figure 9-9: ECB-400 UUKL Device Layout and Wiring Interface

Required Protection Kits

Use the following required protection kits for the different types of connectors on this device:

Connector Type	*Surge Protection Kit (SPK)*
MS/TP and subnet bus communication	Communication SPK
Input/Output not supervised (max. 24Vac by I/O)	Input/Output SPK
Power 24VAC	Power SPK
Subnetwork port connection with RJ45 cable	Subnet SPK

For more information regarding the different surge protection kits and wiring details, refer to *Surge Protection Kits* on page 45.

Specifications

Power Supply Input	
Voltage Range	24VAC; Class 2
Frequency Range	60Hz
Overcurrent Protection	Field replaceable fuse
Fuse Type	3.0A
Power Consumption	22 VA typical plus all external loads **Note:** External loads must include the power consumption of any connected modules such as an Allure Series Communicating Sensor. Refer to the respective module's datasheet for related power consumption information.
Communications	
Communication Bus	BACnet MS/TP
BACnet Profile	B-AAC
EOL Resistor	Built-in, jumper selectable
Baud Rates	9600, 19 200, 38 400, or 76 800 bps
Addressing	Dip switch or with an Allure EC-Smart-Vue Series Communicating Sensor
Subnetwork	
Communication	RS-485
Cable	Cat 5e, 8 conductor twisted pair
Connector	RJ-45
Connection Topology	Daisy-chain
Hardware	
Processor	STM32 (ARM Cortex™ M3) MCU, 32 bit
CPU Speed	72 MHz
Applications Memory	1 MB Non-volatile Flash
Storage Memory	2 MB Non-volatile Flash
RAM Memory	96 kB RAM
Real Time Clock (RTC)	Built-in Real Time Clock with rechargeable battery Network time synchronization is initially required
RTC Battery	20 hours charge time, 20 days recharge time Up to 500 charge/discharge cycles
Green LEDs	Power status & LAN Tx
Orange LEDs	Controller status & LAN Rx
Communication Jack	BACnet 1/8" (3.5mm) stereo audio jack
Environmental	
Operating Temperature	32°F to 122°F (0°C to 49°C)

Storage Temperature	-4°F to 122°F (-20°C to 50°C)
Relative Humidity	0 to 93% Non-condensing
Standards and Regulation	
CE Emission	EN61000-6-3: 2007; A1:2011
CE Immunity	EN61000-6-1: 2007
FCC	Compliance with FCC rules part 15, subpart B, class B
UL 864	UL 864, 10th Edition, UUKL Listed Smoke Control Equipment
UL Listed (CDN & US)	UL916 Energy management equipment
California State Fire Marshal Listing	CSFM: 7300-2187:0100
CEC Appliance Database	Appliance Efficiency Program

Universal Inputs (UI)

General	
Input Type	Universal; software configurable
Input Resolution	16-Bit analog / digital converter
Power Supply Output	15VDC; maximum 240mA (same room installations)
Contact	
Type	Dry contact
Counter	
UI1 to UI4:	
Type	SO output compatible
Maximum Frequency	50Hz maximum
Minimum Duty Cycle	10milliseconds On / 10milliseconds Off
UI5 to UI10:	
Type	Dry contact
Maximum Frequency	1Hz maximum
Minimum Duty Cycle	500ms On / 500ms Off
0 to 10VDC	
Range	0 to 10VDC (40kΩ input impedance)
0 to 5VDC	
Range	0 to 5VDC (high input impedance)
0 to 20mA	
Range	0 to 20mA 249Ω jumper configurable internal resistor
Resistance/Thermistor	
Range	0 to 350 KΩ
Supported Thermistor Types	Any that operate in this range
Pre-configured Temperature Sensor Types:	
Thermistor	10KΩ Type 2, 3 (10KΩ @ 77ºF; 25ºC)
Platinum	Pt1000 (1KΩ @ 32ºF; 0ºC)
Nickel	RTD Ni1000 (1KΩ @ 32ºF; 0ºC) RTD Ni1000 (1KΩ @ 69.8ºF; 21ºC)

Universal Outputs (UO)

General	
Output Type	Universal; software configurable
Output Resolution	10-bit digital to analog converter
Output Protection	Built-in snubbing diode to protect against back-EMF, for example when used with a 12VDC relay

	Output is internally protected against short circuits
Load Resistance	Minimum 200 Ω for 0-10VDC and 0-12VDC outputs Maximum 500 Ω for 0-20mA output
Auto-reset fuse	Provides 24VAC over voltage protection
0 or 12VAC (On/Off)	
Range	0 or 12VDC
Source Current	Maximum 60 mA at 12VDC (minimum load resistance 200Ω)
PWM	
Range	Adjustable period from 2 to 65 seconds
Thermal Actuator Management	Adjustable warm up and cool down time
Floating	
Minimum Pulse On/Off Time	500 milliseconds
Drive Time Period	Adjustable
0 to 10VDC	
Range	0 to 10VDC
Source Current	Maximum 60 mA at 10VDC (minimum load resistance 200Ω)
0 to 20mA	
Range	0 to 20mA
Type	Current source (jumper configurable)
HOA	
Hand-Off-Auto switch	When equipped. Supervision allows control logic to read the current HOA switch and potentiometer settings
Threshold	Configurable
Potentiometer Voltage Range	0 to 12.5VDC

Digital Outputs (DO)

General	
Output Type	24VAC Triac; software configurable
Maximum Current per Output	0.5A continuous 1A @ 15% duty cycle for a 10-minute period
Power Source	External
0 or 24VAC (On/Off)	
Range	0 or 24VAC
PWM	
Range	Adjustable period from 2 to 65 seconds
Floating	
Minimum Pulse On/Off Time	500 milliseconds
Drive Time Period	Adjustable
Power Source	External

UL Label Placement

The UL Listing label must be placed inside the UUKL controller cover as shown in the following figure:

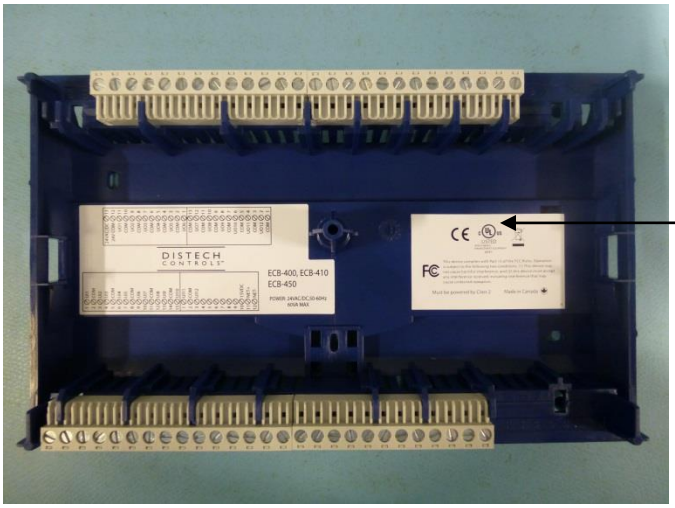


Figure 9-10: ECB-400 UUKL Listing Label Placement

ECB-300 UUKL Controller

The ECB-300 UUKL programmable controller is designed to control various equipment such as air handling units and exhaust fans. This controller has universal inputs and outputs that are ideal for controlling a wide range of HVAC equipment. This controller uses the BACnet® MS/TP LAN communication protocol and is BTL®-Listed as BACnet Advanced Application Controllers (B-AAC).

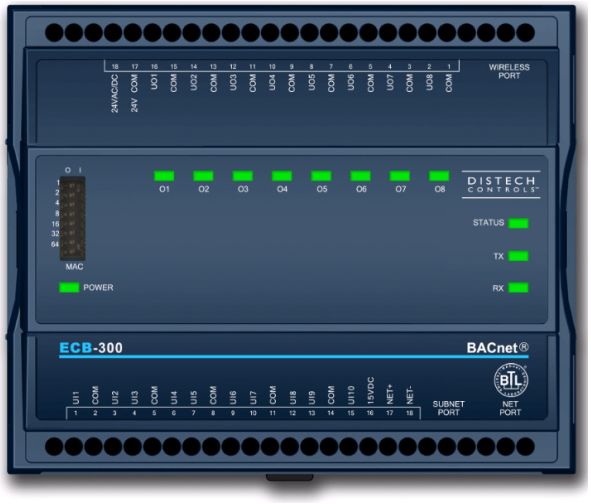


Figure 9-11: ECB-300 UUKL Programmable Controller

Device Layout

The following illustration shows the device's layout and wiring interface:

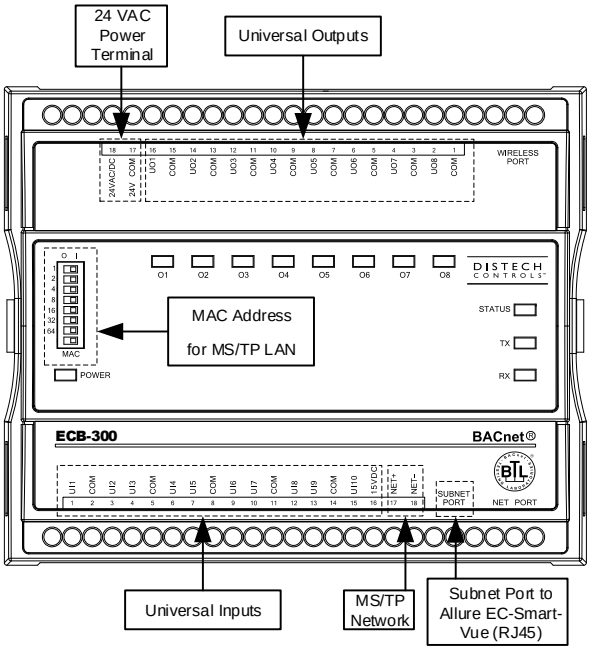


Figure 9-12: ECB-300 UUKL Device Layout and Wiring Interface

Required Protection Kits

Use the following required protection kits for the different types of connectors on this device:

Connector Type	*Surge Protection Kit*
MS/TP and subnet bus communication	Communication SPK
Input/Output not supervised (max. 24Vac by I/O)	Input/Output SPK
Power 24VAC	Power SPK
Subnetwork port connection with RJ45 cable	Subnet SPK

For more information regarding the different surge protection kits and wiring details, refer to *Surge Protection Kits* on page 45.

Specifications

Power	
Voltage Range	24VAC; Class 2
Frequency Range	60Hz
Overcurrent Protection	Field replaceable fuse
Fuse Type	3.0A
Power Consumption	16 VA typical plus all external loads, 38 VA max.
Communications	
Communication Bus	BACnet MS/TP
BACnet Profile	B-AAC
EOL Resistor	Built-in, jumper selectable
Baud Rates	9600, 19 200, 38 400, or 76 800 bps
Addressing	Dip switch or with an Allure EC-Smart-Vue Series Communicating Sensor
Subnetwork	
Communication	RS-485
Cable	Cat 5e, 8 conductor twisted pair
Connector	RJ-45
Connection Topology	Daisy-chain
Hardware	
Processor	STM32 (ARM Cortex™ M3) MCU, 32 bit
CPU Speed	72 MHz
Memory	1 MB Non-volatile Flash (applications); 2 MB Non-volatile Flash (storage) 96 kB RAM
Real Time Clock (RTC)	Built-in Real Time Clock with rechargeable battery Network time synchronization is initially required
RTC Battery	20 hours charge time, 20 days discharge time; Up to 500 charge / discharge cycles
Status Indicator (LEDs)	Green: power status & LAN Tx; Orange: controller status & LAN Rx
Communication Jack	BACnet 1/8” (3.5mm) stereo audio jack
Environmental	
Operating Temperature	32°F to 122°F (0°C to 49°C)
Storage Temperature	-4°F to 122°F (-20°C to 50°C)
Relative Humidity	0 to 93% Non-condensing
Standards and Regulations	
CE Emission	EN61000-6-3: 2007; A1:2011
CE Immunity	EN61000-6-1: 2007
FCC	Compliance with FCC rules part 15, subpart B, class B

UL Listed (CDN & US)	UL916 Energy management equipment
UL 864	UL 864, 10th Edition, UUKL Listed Smoke Control Equipment
California State Fire Marshal Listing	CSFM: 7300-2187:0100
CEC Appliance Database	Appliance Efficiency Program
CE Emission	EN61000-6-3: 2007; A1:2011

Universal Inputs (UI)

General	
Input Type	Universal; software configurable
Input Resolution	16-Bit analog / digital converter
Power Supply Output	15VDC; maximum 240mA (same room installations)
Contact	
Type	Dry contact
Counter	
UI1 to UI4:	
Type	SO output compatible
Maximum Frequency	50Hz maximum
Minimum Duty Cycle	10milliseconds On / 10milliseconds Off
UI5 to UI10:	
Type	Dry contact
Maximum Frequency	1Hz maximum
Minimum Duty Cycle	500ms On / 500ms Off
0 to 10VDC	
Range	0 to 10VDC (40kΩ input impedance)
0 to 5VDC	
Range	0 to 5VDC (high input impedance)
0 to 20mA	
Range	0 to 20mA 249Ω jumper configurable internal resistor
Resistance/Thermistor	
Range	0 to 350 KΩ
Supported Thermistor Types	Any that operate in this range
Pre-configured Temperature Sensor Types:	
Thermistor	10KΩ Type 2, 3 (10KΩ @ 77ºF; 25ºC)
Platinum	Pt1000 (1KΩ @ 32ºF; 0ºC)
Nickel	RTD Ni1000 (1KΩ @ 32ºF; 0ºC) RTD Ni1000 (1KΩ @ 69.8ºF; 21ºC)

Universal Outputs (UO)

General	
Output Type	Universal; software configurable
Output Resolution	10-bit digital to analog converter
Output Protection	Built-in snubbing diode to protect against back-EMF, for example when used with a 12VDC relay Output is internally protected against short circuits
Load Resistance	Minimum 200 Ω for 0-10VDC and 0-12VDC outputs Maximum 500 Ω for 0-20mA output
Auto-reset fuse	Provides 24VAC over voltage protection

0 or 12VAC (On/Off)	
Range	0 or 12VDC
Source Current	Maximum 60 mA at 12VDC (minimum load resistance 200Ω)
PWM	
Range	Adjustable period from 2 to 65 seconds
Thermal Actuator Management	Adjustable warm up and cool down time
Floating	
Minimum Pulse On/Off Time	500 milliseconds
Drive Time Period	Adjustable
0 to 10VDC	
Range	0 to 10VDC
Source Current	Maximum 60 mA at 10VDC (minimum load resistance 200Ω)
0 to 20mA	
Range	0 to 20mA
Type	Current source (jumper configurable)

UL Label Placement

The UL Listing label must be placed inside the UUKL controller cover as shown in the following figure:

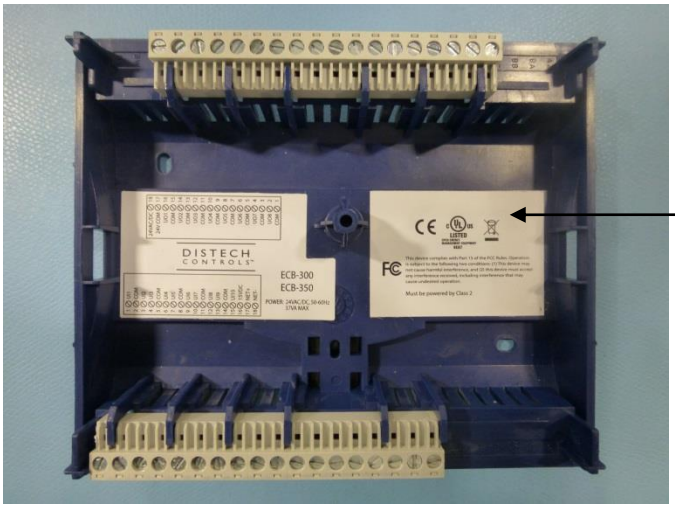


Figure 9-13: ECB-300 UUKL Listing Label Placement

ECB-203 UUKL Controller

The ECB-203 UUKL programmable controller is designed to control terminal units such as rooftop units, small air handling units, and exhaust fans. This controller has various input types including resistance, voltage, and digital-based ones. Moreover, it provides digital, floating, pulse width modulation, and proportional control outputs for valves, heating elements, fans, and lighting applications. This controller uses the BACnet® MS/TP LAN communication protocol and is BTL®-Listed as BACnet Application Specific Controllers (B-ASC).

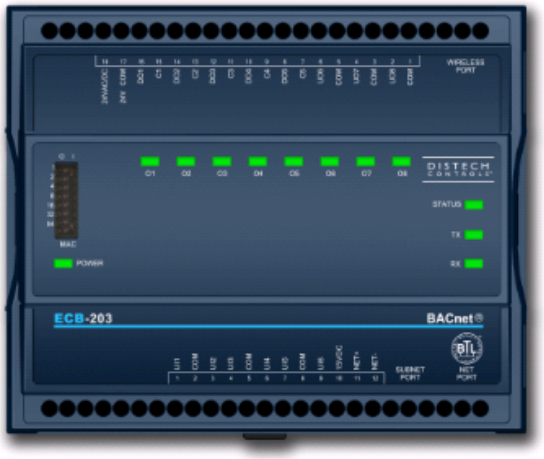


Figure 9-14: ECB-203 UUKL Programmable Controller

Device Layout

The following illustration shows the device's layout and wiring interface:

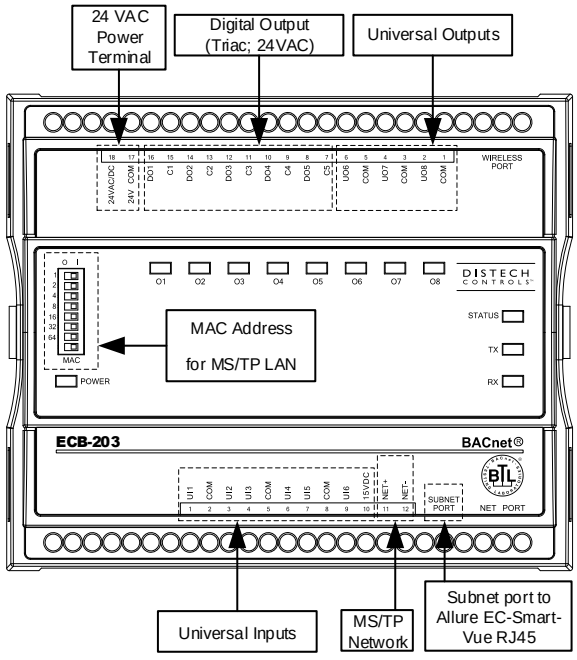


Figure 9-15: ECB-203 UUKL Device Layout and Wiring Interface

Required Protection Kits

Use the following required protection kits for the different types of connectors on this device:

Connector Type	*Surge Protection Kit*
MS/TP and subnet bus communication	Communication SPK
Input/Output not supervised (max. 24Vac by I/O)	Input/Output SPK
Power 24VAC Digital output (Triac; 24VAC)	Power SPK
Triac output	TRIAC SPK
Subnetwork port connection with RJ45 cable	Subnet SPK

For more information regarding the different surge protection kits and wiring details, refer to *Surge Protection Kits* on page 45.

Specifications

Power	
Voltage Range	24VAC; Class 2
Frequency Range	60Hz
Overcurrent Protection	Field replaceable fuse
Fuse Type	2.0A
Power Consumption	14 VA typical plus all external loads, 23 VA max.
Communications	
Communication Bus	BACnet MS/TP
BACnet Profile	B-ASC
EOL Resistor	Built-in, jumper selectable
Baud Rates	9600, 19 200, 38 400, or 76 800 bps
Addressing	Dip switch or with an Allure EC-Smart-Vue Series Communicating Sensor
Subnetwork	
Communication	RS-485
Cable	Cat 5e, 8 conductor twisted pair
Connector	RJ-45
Connection Topology	Daisy-chain
Hardware	
Processor	STM32 (ARM Cortex™ M3) MCU, 32 bit
CPU Speed	68 MHz
Applications Memory	384 kB Non-volatile Flash
Storage Memory	1 MB Non-volatile Flash
Memory (RAM)	64 kB RAM
Real Time Clock (RTC)	Built-in Real Time Clock without battery Network time synchronization is required at each power-up cycle before the RTC become available
Green LEDs	Power status & LAN Tx
Orange LEDs	Controller status & LAN Rx
Communication Jack	BACnet 1/8" (3.5mm) stereo audio jack

Mechanical	
Dimensions (H × W × D)	4.7 × 5.7 × 2.03” (119.38 × 144.78 × 51.47 mm)
Shipping Weight ECB-203	0.97lbs (0.44 kg)
Enclosure Material	FR/ABS
Enclosure Rating	Plastic housing, UL94-5VB flammability rating Plenum rating per UL1995
Installation	Direct DIN-rail mounting or wall mounting through mounting holes (see figure above for hole positions)
Environmental	
Operating Temperature	32°F to 122°F (0°C to 49°C)
Storage Temperature	-4°F to 122°F (-20°C to 50°C)
Relative Humidity	0 to 93% Non-condensing
Standards and Regulations	
CE Emission	EN61000-6-3: 2007; A1:2010
CE Immunity	EN61000-6-1: 2007
FCC	Compliance with FCC rules part 15, subpart B, class B
UL Listed (CDN & US)	UL916 Energy management equipment
UL 864	UL 864, 10th Edition, UUKL Listed Smoke Control Equipment
California State Fire Marshal Listing	CSFM: 7300-2187:0100

Universal Inputs (UI)

General	
Input Type	Universal; software configurable
Input Resolution	16-Bit analog / digital converter
Power Supply Output	15VDC; maximum 240mA (same room installations)
Contact	
Type	Dry contact
Counter	
Type	Dry contact
Maximum Frequency	1Hz maximum
Minimum Duty Cycle	500milliseconds On / 500milliseconds Off
0 to 10VDC	
Range	0 to 10VDC (40kΩ input impedance)
0 to 5VDC	
Range	0 to 5VDC (high input impedance)
0 to 20mA	
Range	0 to 20mA 249Ω jumper configurable internal resistor
Resistance/Thermistor	
Range	0 to 350 KΩ
Supported Thermistor Types	Any that operate in this range
Pre-configured Temperature Sensor Types:	
Thermistor	10KΩ Type 2, 3 (10KΩ @ 77ºF; 25ºC)
Platinum	Pt1000 (1KΩ @ 32ºF; 0ºC)
Nickel	RTD Ni1000 (1KΩ @ 32ºF; 0ºC) RTD Ni1000 (1KΩ @ 69.8ºF; 21ºC)

Universal Outputs (UO)

General	
Output Type	Universal; software configurable
Output Resolution	10-bit digital to analog converter
Output Protection	Built-in snubbing diode to protect against back-EMF, for example when used with a 12VDC relay Output is internally protected against short circuits
Load Resistance	Minimum 200 Ω for 0-10VDC and 0-12VDC outputs Maximum 500 Ω for 0-20mA output
Auto-reset fuse	Provides 24VAC over voltage protection
0 or 12VAC (On/Off)	
Range	0 or 12VDC
Source Current	Maximum 60 mA at 12VDC (minimum load resistance 200Ω)
PWM	
Range	Adjustable period from 2 to 65 seconds
Thermal Actuator Management	Adjustable warm up and cool down time
Floating	
Minimum Pulse On/Off Time	500 milliseconds
Drive Time Period	Adjustable
0 to 10VDC	
Range	0 to 10VDC
Source Current	Maximum 60 mA at 10VDC (minimum load resistance 200Ω)

Digital Outputs (DO)

General	
Output Type	24VAC Triac; software configurable
Maximum Current per Output	0.5A continuous 1A @ 15% duty cycle for a 10-minute period
Power Source	External
0 or 24VAC (On/Off)	
Range	0 or 24VAC
PWM	
Range	Adjustable period from 2 to 65 seconds
Floating	
Minimum Pulse On/Off Time	500 milliseconds
Drive Time Period	Adjustable
Power Source	External

UL Label Placement

The UL Listing label must be placed inside the UUKL controller cover as shown in the following figure:

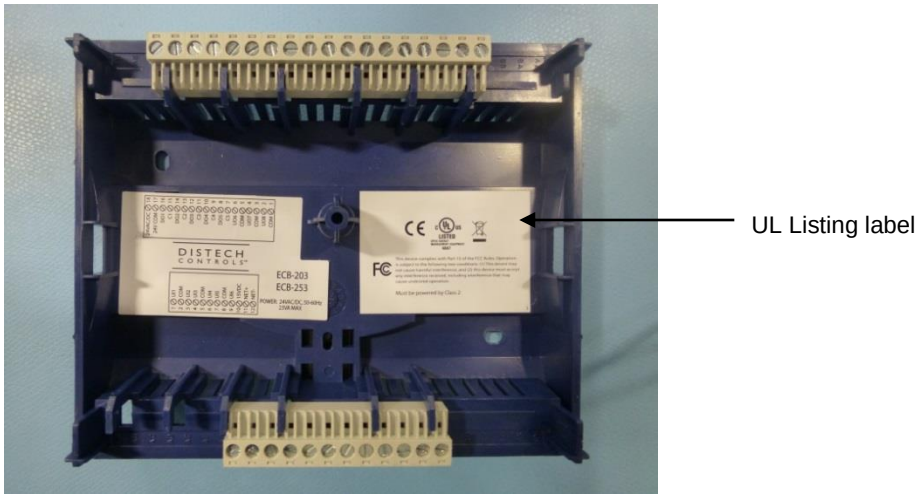


Figure 9-16: ECB-203 UUKL Listing Label Placement

ECB-VAV UUKL Controller

The ECB-VAV UUKL programmable variable air volume (VAV) controller is designed to control any variable air volume box. This controller provides digital, floating, pulse width modulation, and proportional control outputs for valves, heating elements, fans, and lighting applications. The ECB-VAV UUKL uses the BACnet® MS/TP LAN communication protocol and is BTL®-Listed as BACnet Application Specific Controllers (B-ASC).

Figure 9-17: ECB-VAV UUKL Programmable VAV Controller

Device Layout

The following illustration shows the device's layout and wiring interface:

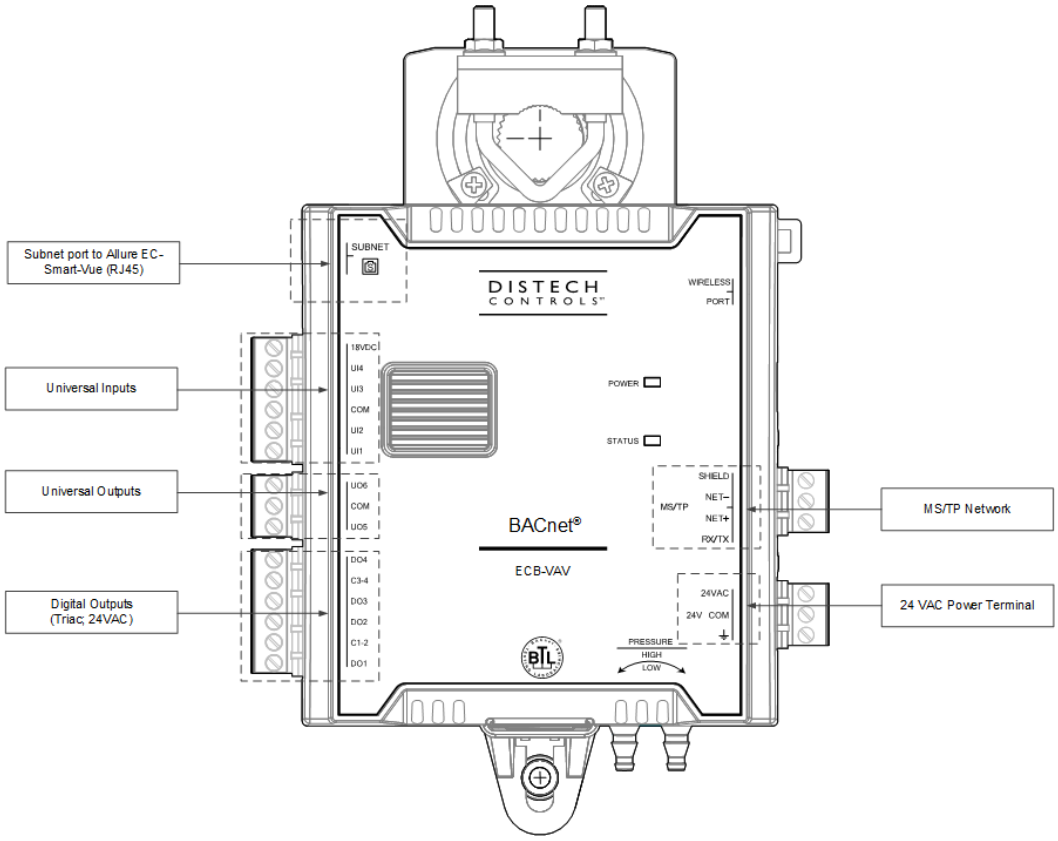


Figure 9-18: ECB-VAV UUKL Device Layout and Wiring Interface

Mounting Instructions

Mounting Position

To prevent condensation on the VAV box's damper shaft from entering the controller's electronics, the controller's mounting orientation should be any position above the damper shaft (between 0 and 180°) so that any condensation from the damper shaft will fall away from the controller's electronics.

Further countermeasures may be required in some installations. This is important in hot, humid climates where the VAV box is located near exterior doors or loading bays that may be blocked open or when the VAV box air supply is below 50°F (10°C). See following figure:

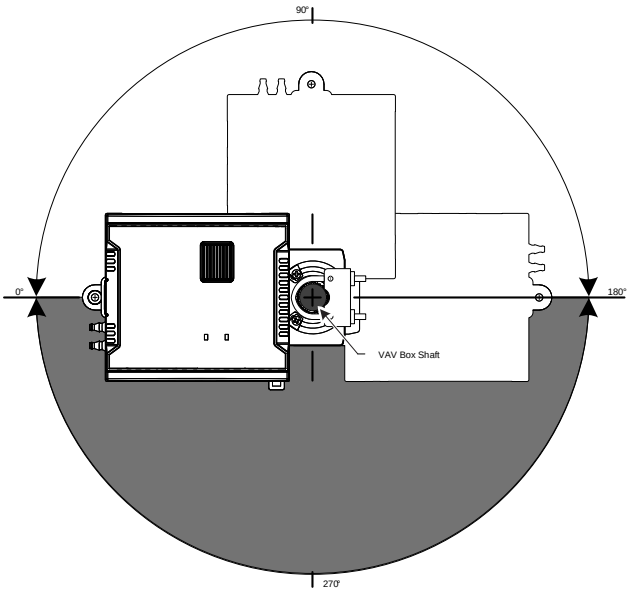


Figure 9-19: ECB-VAV UUKL Device Layout and Wiring Interface

Mounting Procedure

For proper installation and subsequent operation of the controller, follow these mounting instructions.

1. Configure the controller's DIP switches.
2. The VAV controller comes with the sliding grommet pre-installed.
3. Orient the controller into position on to the damper shaft so that wiring connections are easily accessible. The controller must be fitted onto the shaft such that the base of the controller is parallel to the VAV box (perpendicular to the damper shaft). If the damper shaft has an external bushing that prevents the controller from being mounted flush to the side of the VAV box, use a spacer of the same thickness to compensate and to ensure the controller is at a right-angle to the shaft to prevent binding.
4. Screw the controller onto the VAV box through the controller's Sliding Grommet. The sliding grommet allows the controller to move back and forth when the VAV box's damper shaft is off center. Ensure to center the grommet along its travel range and ensure that the screw enters the VAV box at a right angle. Using a power screwdriver with a 6" extension, attach the controller to the VAV box with the 1" [25mm] screw provided with the controller (see *Supplied Mounting Hardware – Drive the screw at a right-angle to the VAV Box* through the controller's sliding grommet (See *Standard Mounting Method: Mounting a controller on a damper shaft*. Otherwise, mark the positions for the screw on the VAV box with a punch and then drill a hole the into the VAV box. Then attach the controller to the VAV box with the 1" [25mm] screw provided with the controller.

Figure 9-20: Screwdriver Shaft Extension

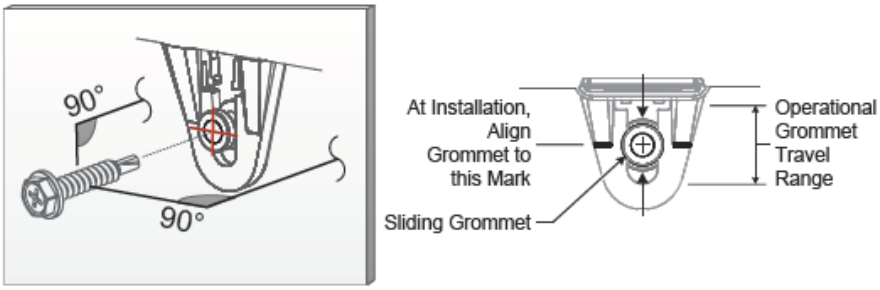


Figure 9-21: Supplied Mounting Hardware – Drive the screw at a right-angle to the VAV Box

Avoid over-tightening the screw so as to not strip the threads. Make sure the screw does not pierce too far into the VAV box and interfere with damper blade movement.

5. Find the damper position by the marking typically found on the end of the damper shaft.

Figure 9-22: Typical Damper Shaft End Marking

6. Determine the direction required to close the damper: Clockwise (CW) or Counterclockwise (CCW). Turn the damper shaft with a pair of pliers to fully close the damper for 90° boxes or fully open the damper for 45° or 60° boxes

7. Press and hold down the *Actuator Clutch for Manual Adjustment* button, and turn the controller's shaft coupler until it touches the mechanical end-stop to either the fully closed position (90° boxes) or the fully open position (45° and 60° boxes).

8. For 90° VAV boxes: If the damper closes CCW, turn the coupler to the CCW mechanical stop limit. If the damper closes CW, turn the coupler to the CW mechanical stop limit. The open mechanical stop is factory preset for 90° boxes.
For 45° and 60° VAV boxes: The mechanical stops must be set for both the fully closed and fully open damper positions. By installing the controller at the fully open position, the controller provides the open mechanical stop for 45° and 60° boxes. The closed damper seal provides the fully closed stop.

9. Tighten the U-Bolt clamp on to the damper shaft using an 8 mm (5/16 in.) wrench or socket. Tighten the bolts between 11 and 15 Nm (100 and 130 lb·in).

10. Test for free damper shaft movement: Press and hold down the *Actuator Clutch For Manual Adjustment* button and manually turn the actuator coupling to be certain that the actuator can rotate from full closed to full open positions without binding.

11. Connect the VAV box's flow sensor tubing to the controller's *Pressure Sensor Inputs*. The connection is polarity free (high-low ports are interchangeable). Create a condensation trap in the pneumatic tubing by forming it into a vertical loop.

12. Finalize the installation by rotating the damper to the full open position.

The terminal blocks accept wires ranging from 22 to 14AWG (0.644 to 1.630mm diameter) per pole.

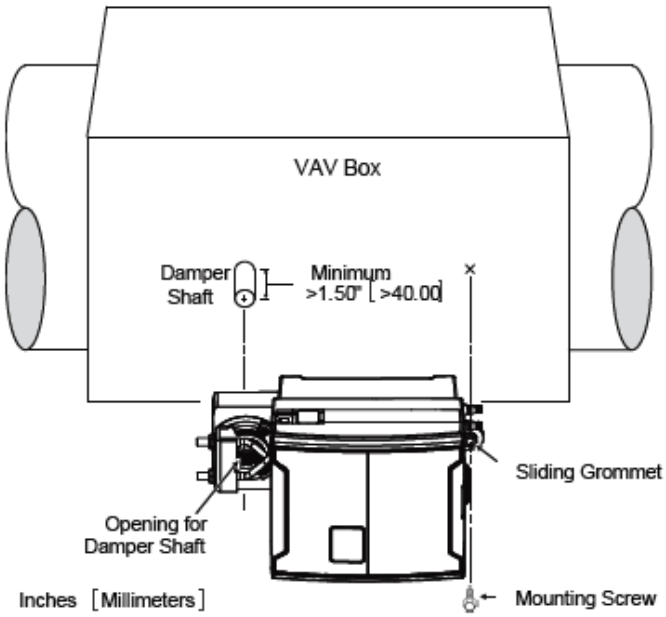


Figure 9-23: Standard Mounting Method: Mounting a controller on a damper shaft

Required Protection Kits

Use the following required protection kits for the different types of connectors on this device:

Connector Type	***Surge Protection Kit***
MS/TP and subnet bus communication	Communication SPK
Input/Output not supervised (max. 24Vac by I/O)	Input/Output SPK
Power 24VAC Digital output (Triac; 24VAC)	Power SPK
Triac output	TRIAC SPK
Subnetwork port connection with RJ45 cable	Subnet SPK

For more information regarding the different surge protection kits and wiring details, refer to *Surge Protection Kits* on page 45.

Specifications

Power	
Voltage Range	24VAC; Class 2
Frequency Range	60Hz
Overcurrent Protection	Field replaceable fuse
Fuse Type	3.0A
Power Consumption	4 VA typical plus all external loads, 75 VA max (including powered triac outputs). **NOTE**: External loads must include the power consumption of any connected modules such as an Allure Series Communicating Sensor. Refer to the respective module's datasheet for related power consumption information.

Communications	
Communication Bus	BACnet MS/TP
BACnet Profile	B-ASC
EOL Resistor	Built-in, selectable
Baud Rates	9600, 19 200, 38 400, or 76 800 bps
Addressing	Dip switch or with an Allure EC-Smart-Vue Series Communicating Sensor
Subnetwork	
Communication	RS-485
Cable	Cat 5e, 8 conductor twisted pair
Connector	RJ-45
Connection Topology	Daisy-chain
Subnetwork	
Processor	STM32 (ARM Cortex™ M3) MCU, 32 bit
CPU Speed	68 MHz
Applications Memory	384 kB Non-volatile Flash
Storage Memory	1 MB Non-volatile Flash
Memory (RAM)	64 kB RAM
Real Time Clock (RTC)	Built-in Real Time Clock without battery Network time synchronization is required at each power-up cycle before the RTC become available
Green LEDs	Power status & LAN Tx
Orange LEDs	Controller status & LAN Rx
Integrated Damper Actuator	
Motor	Belimo brushless DC motor
Torque	45 in-lb, 5 Nm
Degrees of Rotation	95º adjustable
Shaft Diameter	5/16 to 3/4”; 8.5 to 18.2mm
Acoustic Noise Level	< 35 dB (A) @ 95º rotation in 95 seconds
Mechanical	
Dimensions (H × W × D)	7.90 × 5.51 × 3.70" (200.61 × 139.93 × 94.04 mm)
Shipping Weight (Controller)	1.95lbs (0.89 kg)
Enclosure Material	FR/ABS
Enclosure Rating	Plastic housing, UL94-5VB flammability rating Plenum rating per UL1995
Environmental	
Operating Temperature	32°F to 122°F (0°C to 50°C)
Storage Temperature	-4°F to 122°F (-20°C to 50°C)
Relative Humidity	0 to 93% Non-condensing
Nema Rating	1
Standards and Regulations	
CE Emission	EN61000-6-3: 2007; A1:2011
CE Immunity	EN61000-6-1: 2007
CE EMC requirements, conditions and test set-up	EN 50491-5-1: 2010
EMC requirements for HBES/BACS	EN 50491-5-2: 2010
FCC	Compliance with FCC rules part 15, subpart B, class B
UL Listed (CDN & US)	UL916 Energy management equipment
UL 864	UL 864, 10th Edition, UUKL Listed Smoke Control

	Equipment
CEC Appliance Database	Appliance Efficiency Program
On-Board Air-Flow Sensor	
Differential Pressure Range	±2.0 in. W.C. (±500 Pa) Polarity-free high-low sensor connection
Input Resolution	0.00007 in. W.C. (0.0167 Pa)
Air Flow Accuracy	±4.0% @ > 0.05 in. W.C. (12.5 Pa) ±1.5% once calibrated through air flow balancing @ > 0.05 in. W.C. (12.5 Pa)
Pressure Sensor Accuracy	±(0.2 Pa +3% of reading)

Universal Inputs (UI)

General	
Input Type	Universal; software configurable
Input Resolution	16-Bit analog / digital converter
Power Supply Output	18 VDC; maximum 80mA (same room installations)
Contact	
Type	Dry contact
Counter	
Type	Dry contact
Maximum Frequency	1Hz maximum
Minimum Duty Cycle	500ms On / 500ms Off
0 to 10VDC	
Range	0 to 10VDC (40kΩ input impedance)
0 to 5VDC	
Range	0 to 5VDC (high input impedance)
0 to 20mA	
Range	0 to 20mA 249Ω external resistor wired in parallel
Resistance/Thermistor	
Range	0 to 350 KΩ
Supported Thermistor Types	Any that operate in this range
Pre-configured Temperature Sensor Types:	
Thermistor	10KΩ Type 2, 3 (10KΩ @ 77ºF; 25ºC)
Platinum	Pt1000 (1KΩ @ 32ºF; 0ºC)
Nickel	RTD Ni1000 (1KΩ @ 32ºF; 0ºC) RTD Ni1000 (1KΩ @ 69.8ºF; 21ºC)

Universal Outputs (UO)

General	
Output Type	Universal; software configurable
Output Resolution	10-bit digital to analog converter
Output Protection	Built-in snubbing diode to protect against back-EMF, for example when used with a 12VDC relay Output is internally protected against short circuits
Auto-reset fuse	Provides 24VAC over voltage protection
0 or 12VDC (On/Off)	
Range	0 or 12VDC

PWM	
Range	Adjustable period from 2 to 65 seconds
Thermal Actuator Management	Adjustable warm up and cool down time
Floating	
Minimum Pulse On/Off Time	500 milliseconds
Drive Time Period	Adjustable
0 or 10VDC	
Range	0 to 10VDC linear
Source Current	Maximum 20 mA at 10VDC (minimum load resistance 600Ω)
Sink Current	Maximum 2.5mA at 1 VDC (minimum load resistance 4KΩ)

Digital Outputs (DO)

General	
Output Type	24VAC Triac; software configurable
Maximum Current per Output	0.5A continuous 1A @ 15% duty cycle for a 10-minute period
Power Source	External or internal power supply (jumper selectable)
0 or 12VAC (On/Off)	
Range	0 or 24VAC
PWM	
Range	Adjustable period from 2 to 65 seconds
Floating	
Minimum Pulse On/Off Time	500 milliseconds
Drive Time Period	Adjustable
Power Source	Internal power supply

UL Label Placement

The UL Listing label must be placed inside the ECB-VAV UUKL controller cover as shown in the following figure:

Figure 9-24: ECB-VAV UUKL Listing Label Placement

Chapter 10
BACnet MS/TP Network

This chapter provides information regarding the BACnet MS/TP network requirements for the Distech Controls' Smoke Control System. It describes best practices, specifications, wiring rules, device termination, and application information to implement a reliable communication network.

In This Chapter

About the BACnet MS/TP Bus Protocol

The BACnet MS/TP bus protocol is part of the BACnet® ANSI/ASHRAE™ Standard 135-2008 that uses the EIA-485 (RS-485) physical layer standard for data transmission. The BACnet protocol MS/TP Communications Bus is a local network that connects supervisory controllers and field controllers to field point interfaces.

Maximum Number of BACnet MS/TP Devices on a Data Bus Segment and Baud Rate

The following technical parameters limit the number of devices on a BACnet MS/TP Data Bus Segment.

- The BACnet MS/TP Data Bus Segment has a hard limit on the number of devices that can communicate due to the device addressing scheme (the MAC Address Range for BACnet MS/TP Devices).
- Each device presents an electrical load on the BACnet MS/TP Data Bus Segment. This is called *device loading*. The number of devices that can be connected to a BACnet MS/TP Data Bus Segment is limited by the device loading of each device.
- Choosing a low baud rate can cause BACnet MS/TP Data Bus congestion that can limit the amount of data that can be efficiently exchanged between devices connected to the BACnet MS/TP Data Bus. For example, at 9 600 baud, the maximum number of devices is reduced to 25 due to the increased time it takes for token passing between devices. The recommended baud rate is 38 400.
- Distech Controls recommends that you connect no more than 50 of our ⅛ or ½ load devices on a single BACnet MS/TP Data Bus Segment when a baud rate of 19 200 or higher is used (preferably 38 400 baud). This is to ensure that the BACnet MS/TP Data Bus has enough bandwidth to efficiently communicate network variables between controllers.

These parameters are described in greater detail below.

Data Bus Segment MAC Address Range for BACnet MS/TP Devices

The BACnet MS/TP data bus supports up 255 devices:

- Up to 128 devices (with device MAC addresses in the range of 0 to 127) that are BACnet MS/TP Masters (that can initiate communication).
- Up to 128 devices (with device MAC addresses in the range of 128 to 255) that are BACnet MS/TP Slaves (cannot initiate communication).

However, it is recommended that any given data bus segment have no more than 50 devices, when a baud rate of 19 200 or higher is used for the BACnet MS/TP Data Bus. A repeater counts as a device on each data bus segment to which it is connected.

All Distech Controls' devices are categorized as BACnet MS/TP Masters, that is, their device MAC address can be set in the range of 0 to 127 only.

Device Loading

Each device presents an electrical load on the BACnet MS/TP Data Bus Segment. This is called *device loading*. The use of full load devices limits the number of devices connected to a BACnet MS/TP Data Bus Segment to 32 devices. Distech Controls' BACnet MS/TP devices are ⅛ load devices, which allow more devices to be connected to the BACnet MS/TP Data Bus Segment, as compared to full load devices.

However, if a data bus segment with Distech Controls devices are interoperating with one or more devices from another manufacturer that support fewer devices on a data bus segment, then the device that supports the fewest devices on the same data bus is the one that sets the limit for the maximum number of devices for that data bus segment.

Baud Rate

Most devices will have a range of baud rate settings and possibly an AUTO setting that detects the baud rate of other devices transmitting on the data bus and adjusts the baud rate of the device accordingly. Typical baud rates are 9 600, 19 200, 38 400, and 76 800. The baud rate setting determines the rate at which data is sent on the BACnet MS/TP data bus.

At 9 600 baud, the maximum number of devices is reduced to 25 due to the increased time it takes for token passing between devices.

All devices on the data bus must be set to the same baud rate. Therefore, the chosen baud rate must be supported by all devices connected to the data bus.

The recommended baud rate for Distech Controls' devices is 38 400.

Distech Controls' recommends the following:

- Set the baud rate of two controllers on a BACnet MS/TP Data Bus Segment to the same baud rate to provide failover protection.

  For example, set the baud rate of the EC-BOS-8 UUKL (if equipped) and one other controller to 38 400 baud. If the EC-BOS-8 UUKL *becomes* unavailable and there is a power cycle, the controller will set the baud rate for the BACnet MS/TP Data Bus.

- Set all other devices to automatically detect the baud rate.

Data Bus Physical Specifications and Cable Requirements

Cables composed of stranded conductors are preferred over solid conductors as stranded conductor cable better resist breakage during pulling operations. Distech Controls strongly recommends that the following data bus segment cable specifications be respected.

Table 10-1: BACnet MS/TP Data Bus Segment Physical Specifications and Cable Requirements

Parameter	Details
Media	Twisted pair, 24 AWG
Shielding	Foil or braided shield
Shield grounding	The shield on each segment is connected to electrical system ground at one point only; refer to *Data Bus Shield Grounding Requirements*.
Characteristic impedance	100-130 Ohms. The ideal is 100-120 Ohms.
Distributed capacitance between conductors	Less than 100 pF per meter (30 pF per foot). The ideal is less than 60 pF per meter (18pF per foot).
Distributed capacitance between conductors and shield	Less than 200 pF per meter (60 pF per foot).
Maximum length per segment	1220 meters (4000 feet)
Data Rate	9 600, 19 200, 38 400, and 76 800 baud
Polarity	Polarity sensitive
Multi-drop	Daisy-chain (no T-connections)
EOL terminations	120 ohms at each end of each segment
Data bus bias resistors	510 ohms per wire (max. of two sets per segment)

Shielded cable offers better overall electrical noise immunity than non-shielded cable. Unshielded cable or cable of a different gauge may provide acceptable performance for shorter data bus segments in environments with low ambient noise.

Table 10-2: Distech Controls Recommended Cable Types for BACnet MS/TP Data Buses

Bus and Cable Type	Part Number	O.D. (Ø)
300 meters (1000 feet), 24 AWG Stranded, Twisted Pair Shielded Cable – FT6, Rated for Plenum Applications	CB-BACN6BL1000	3.75mm (0.148 in.)

Bus Topology and EOL Terminations

Function of the EOL Terminations

The first and last device on the data bus must have End-of-Line (EOL) termination resistors connected across the two data lines/wires of the twisted pair. These resistors serve the following purposes:

- EOL terminations dampen reflections on the bus that result from fast-switching (high-speed rising and falling data edges) that otherwise would cause multiple data edges to be seen on the bus with the ensuing data corruption that may result. The higher the baud rate a data bus is operating at, the more important that EOL terminations be properly implemented. Electrically, EOL terminations dampen these reflections by matching the impedance to that of a typical twisted pair cable.
- EIA-485 data bus transmitters are tri-state devices. That is they can electrically transmit 1, 0, and an idle state. When the transmitter is in the idle state, it is effectively offline or disconnected from the data bus. EOL terminations serve to bias (pull-down and pull-up) each data line/wire when the lines are not being driven by any device. When an un-driven data bus is properly biased by the EOL terminations to known voltages, this provides increased noise immunity on the data bus by reducing the likelihood that induced electrical noise on the data bus is interpreted as actual data.

When to Use EOL Terminations

EOL terminations should only be enabled/installed on the two devices located at either end of the data bus. All other devices must not have the EOL terminations enabled/installed.

⚠ The type of installation shown in the following figure may require a COMM SPK! For more information, refer to *Communication Surge Protection Kit (COMM SPK)* on page 45.

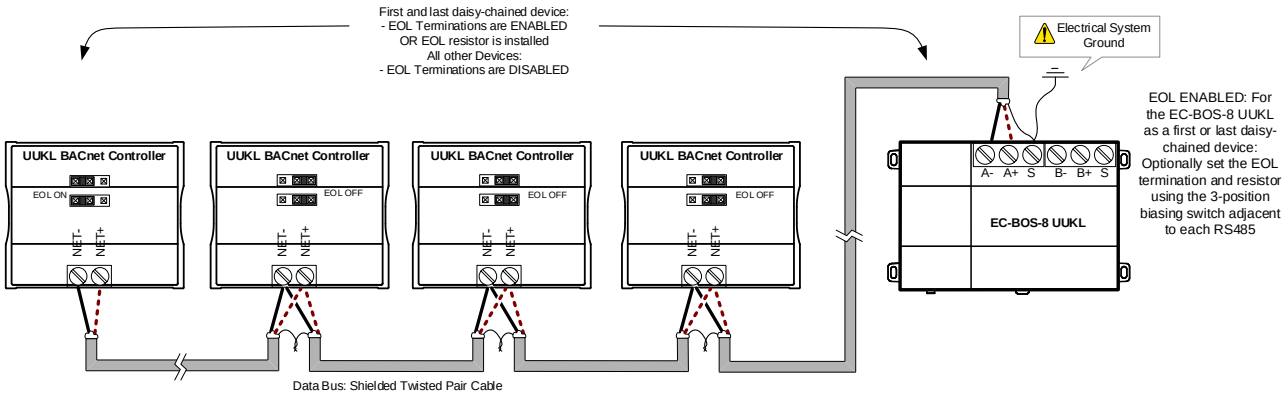


Figure 10-1: EOL Terminations Must be Enabled at Both the First and Last Device on the Data Bus

The type of installation shown in the following figure may require a COMM SPK! For more information refer to *Communication Surge Protection Kit (COMM SPK)* on page 45.

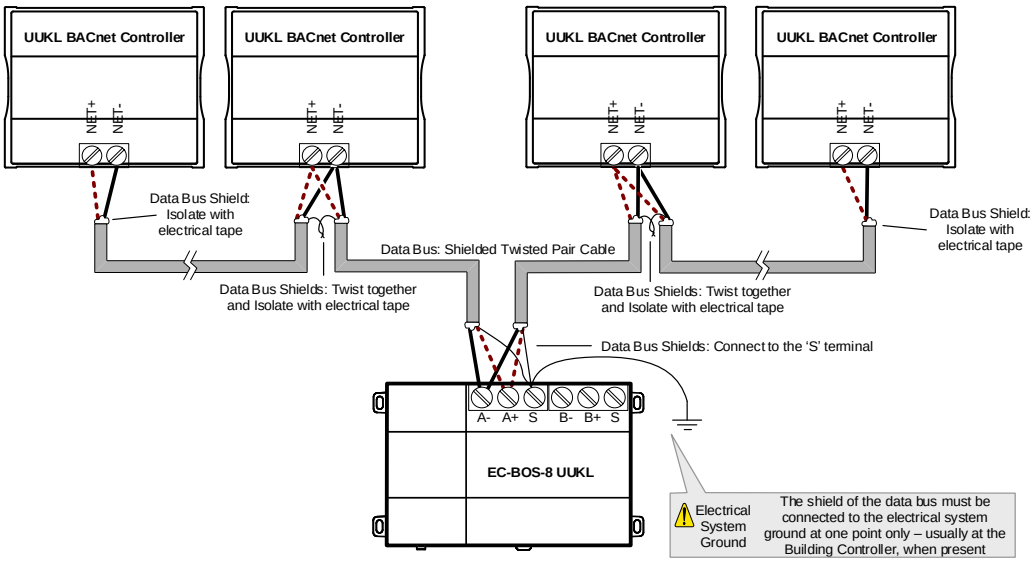


Figure 10-2: Typical Cable-Shield Grounding Requirements for a BACnet MS/TP Data Bus Segment with a Building Controller located in the Middle of the Data Bus

Devices with built-in EOL terminations are factory-set with the EOL termination disabled by default.

The BACnet/IP to MS/TP Adapter does not have EOL Termination (and BACnet MS/TP Data Bus biasing) capabilities to be used at the end of a BACnet MS/TP data bus. Instead, use the BACnet/IP to MS/TP Router for this application.

About Setting Built-in EOL Terminations

The ECB series controllers have built-in EOL terminations. These controllers use jumpers to enable the EOL resistors and biasing circuitry.

Daisy-Chained Data Bus Topology

Use a daisy-chained BACnet MS/TP data bus topology only. No other data bus topology is allowed. The following specifications are required:

- A maximum of 32 nodes and 1200 meters of network cable
- Maximum of 50 nodes when using Distech Controls devices exclusively

- Only linear, daisy-chained devices provide predictable data bus impedances required for reliable data bus operation.
- Only a daisy-chained data bus topology should be specified during the planning stages of a project and implemented in the installation phase of the project.
- A spur is only permitted when it is connected to the bus through a repeater.

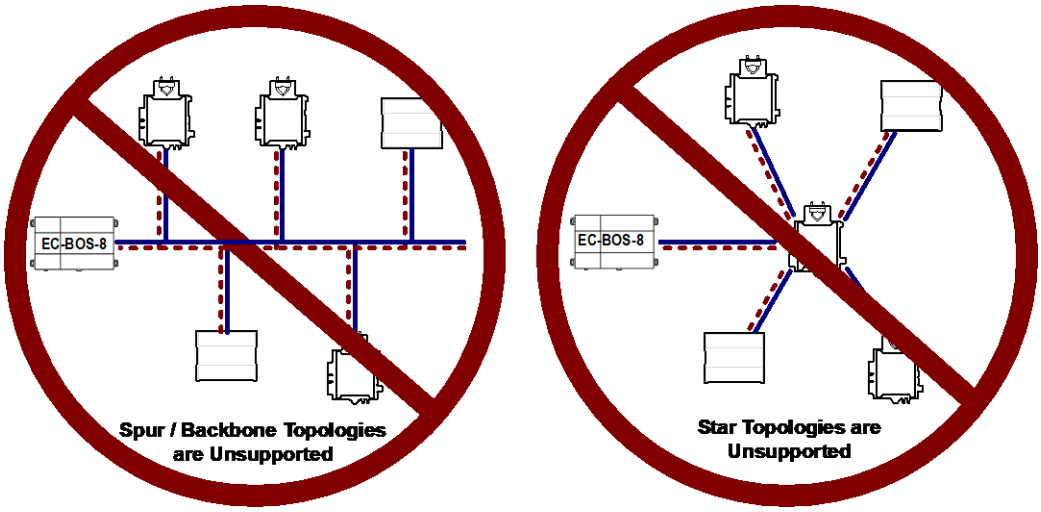


Figure 10-3: Unsupported BACnet MS/TP LAN Topologies

Data Bus Shield Grounding Requirements

The EIA-485 data bus standard requires that the data bus must be shielded against interference. Devices on each data bus segment must be daisy-chained together. A BACnet MS/TP data bus must be properly grounded.

The data bus' cable shield must be twisted together and isolated with electrical tape at each device. Note that the power supply transformer's secondary that is connected to the 24V COM terminal is grounded. This provides the ground reference for the data bus (refer to *BACnet MS/TP is a Three-Wire Bus* on page 109). If the controller is at the end of the BACnet MS/TP data bus, simply isolate the data bus shield with electrical tape.

⚠ Grounding the shield of a data bus segment in more than one place will more than likely reduce shielding effectiveness.

Data Bus Shield Grounding Requirements

The shield on each data bus segment must be connected to electrical system ground at one point only, for example, at the Bus Master (Building Controller) if there is one, as shown below.

⚠ The type of installation shown in the following figure may require a COMM SPK! For more information, refer to *Communication Surge Protection Kit (COMM SPK)* on page 45.

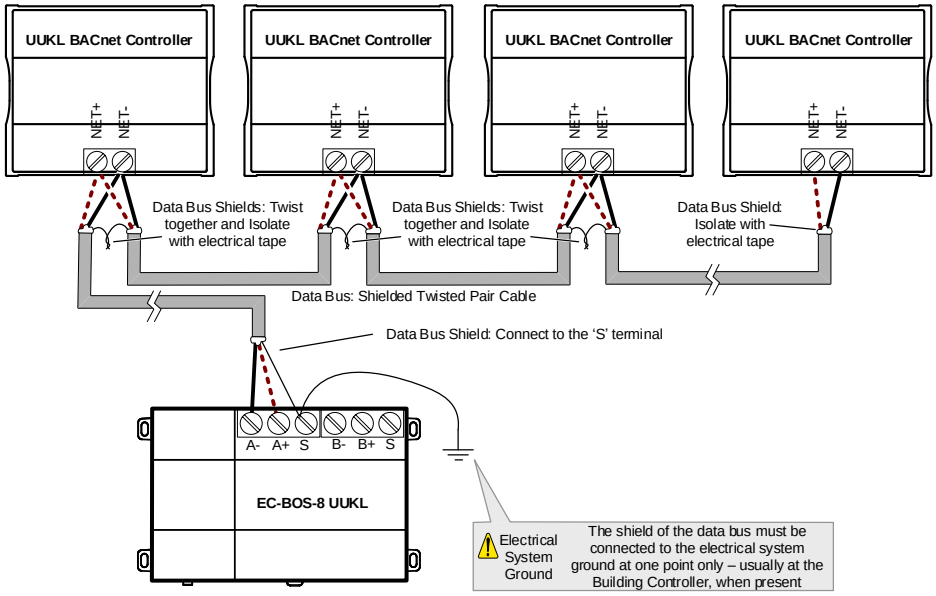


Figure 10-4: Typical Cable-Shield Grounding Requirements for a BACnet MS/TP Data Bus Segment with a Building Controller located at the End of the Data Bus

Power Supply Requirements

BACnet MS/TP is a Three-Wire Bus

Even though data is transmitted over a 2-wire twisted pair, all EIA-485 transceivers interpret the voltage levels of the transmitted differential signals with respect to a third voltage reference common to all devices connected to the data bus (signal reference). In practice, this common signal reference is provided by the building's electrical system grounding wires that are required by electrical safety codes worldwide. Without this signal reference, transceivers may interpret the voltage levels of the differential data signals incorrectly, and this may result in data transmission errors.

Note: ECB/ECL-VAV controllers are insulated devices and therefore may not be grounded. When not grounded, the reference for the BACnet MS/TP data bus is made by connecting the shield of the BACnet MS/TP data bus to the controller's COM terminal to provide a signal reference. This shield is grounded at one point only. See *Figure 10-4*.

Avoid Ground Lift

24VAC Power wiring runs should not be too long, nor have too many devices connected to it. Wiring used to supply power to devices has a resistance that is proportional to the length of the wiring run.

Table 10-3: Resistance of Common Copper Wire Sizes

AWG	Diameter (Ø)		Area		Copper wire resistance	
	(inch)	(mm)	(kcmil)	(mm^2)	(Ω/km)	(Ω/1000 ft)
14	0.0641	1.628	4.11	2.08	8.286	2.525
16	0.0508	1.291	2.58	1.31	13.17	4.016
18	0.0403	1.024	1.62	0.823	20.95	6.385

If the power run from the power supply is relatively long and it supplies power to many devices, a voltage will develop over the length of wire. For example, a 1000 ft of 18 AWG copper wire has a resistance of 6.4 Ohms. If this wire is supplying 1 Ampere of current to connected devices (as shown in *Figure 10-5*), the voltage developed across it will be 6.4 volts. This effect is called ground lift.

The type of installation shown in the following figure may require a PWR SPK! For more information, refer to *Power Surge Protection Kit (PWR SPK)* on page 49.

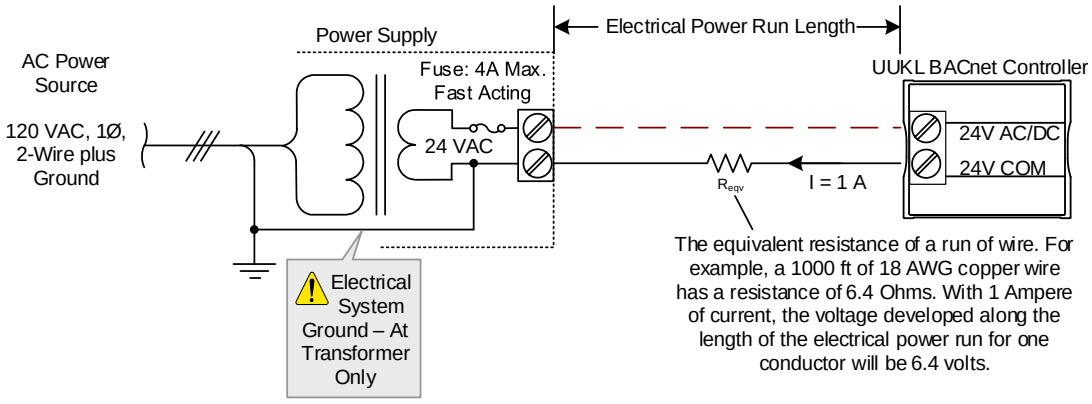


Figure 10-5: Ground Lift from a Long Power Run with a 24VAC Device

If the 24V COM terminal is the signal reference point for the data bus, ground lift offsets the data bus voltage reference that is used to interpret valid data levels sent on the data bus. If the ground lift is more than 7 volts peak, there is a risk of data corruption and offline events due to the device being incapable of correctly reading data signals from the data bus. Thus it is important to keep the power supply (transformer) as close to the controller as possible.

Techniques to Reduce Ground Lift

Reduce the impact of ground lift as follows:

- Use a heavier gauge wire.
- Add more wire runs. Connect these wire runs to the power supply in a star pattern.

About External Loads

When calculating a controller's power consumption to size the 24VAC transformer, you must also add the external loads the controller is going to supply, including the power consumption of any connected subnet module (for example, for Allure EC-Smart-Vue sensors). Refer to the respective module's datasheet for related power consumption information.

Peak Current

Particular attention should be paid to the peak current absorbed by devices that are powered by an AC circuit. All Distech Controls devices use half-wave rectifiers to supply their onboard electronics (this is common with most controls manufacturers). With this configuration, the peak AC current is approximately 2.5 times the average RMS AC current.

Transformer Selection and Determining the Maximum Power Run Length

⚠ Distech Controls' ECB UUKL Controllers are power limited Class 2 Products. To conform to Class 2 installation requirements, only use transformers of 100VA or less to power the device(s).

It is recommended to wire only one controller per 24VAC transformer.

When calculating a controller's power consumption to size the 24VAC transformer, you must also add the external loads the controller is going to supply, including the power consumption of any connected subnet module (for example, Allure™ Series Communicating Sensors).

For VAV devices, if only one 24VAC transformer is available, determine the maximum number of daisy-chained VAVs that can be supplied on a single power cable supplied by a 100 VA transformer, according to the controller's expected power consumption including external loads, the cable's wire gauge, and the total cable length from the following table. Any installation condition that is outside of the parameters of the table below should be avoided.

Daisy-chaining controllers is not permitted when a VAV controller's expected power consumption including external loads is over 15VA. In this case the controller must be connected to the 24VAC transformer in a star topology. The transformer must be installed in close proximity to the controller.

To maximize daisy-chaining performance, the transformer should be installed as close as possible to the first VAV. If this is not possible, then use 14 AWG wire to power the first VAV which can help reduce a voltage drop at the end of the daisy-chain.

⚠ The recommended minimum peak input voltage is $27.2V_p$

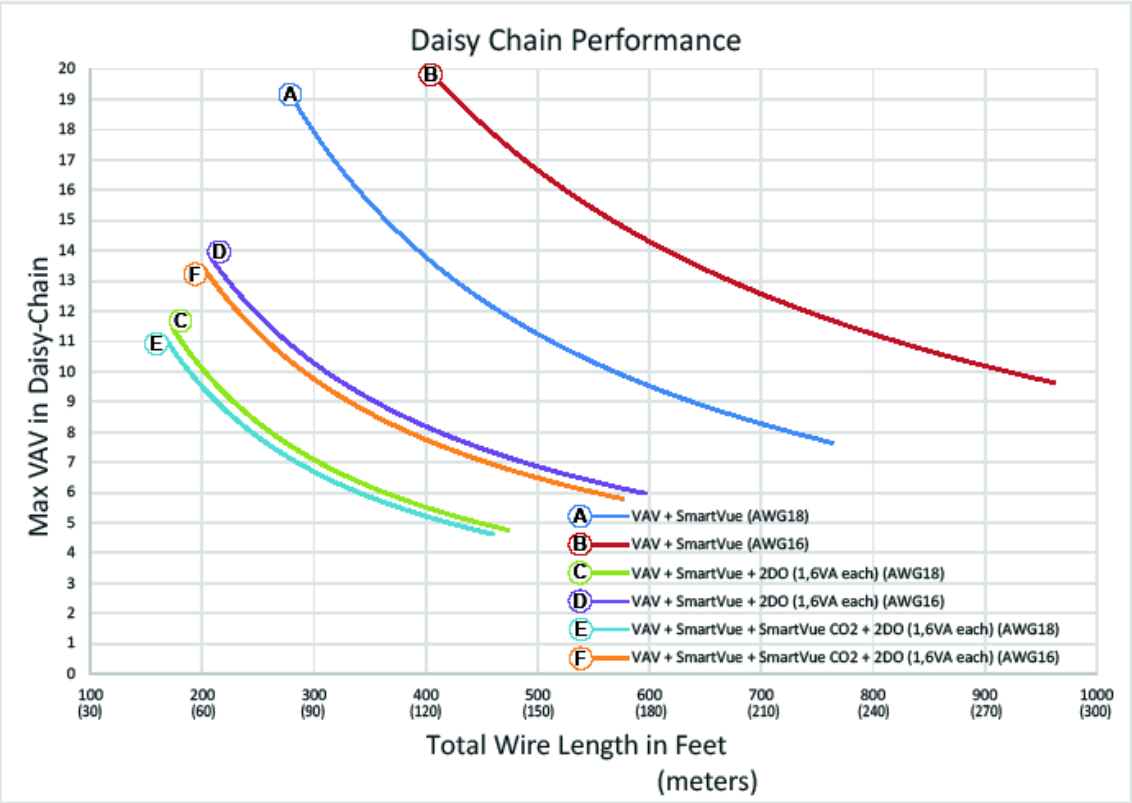


Figure 10-6: Maximum number of VAV Devices on a Daisy-Chain at Evenly Spaced Intervals

⚠ Laboratory testing conditions for the above graph are as follows:

- Distance between each VAV is evenly spaced along the entire wire length
- Transformer specification: 100VA (120/24VAC)
- Tested at room temperature with low voltage line conditions: 108VAC (50Hz)

For non-VAV devices, determine the appropriate size transformer for the job as follows:

1. Add up the power requirements of all devices plus all external loads (refer to *About External Loads* on page 110). Multiply the total power needed by a multiplier of 1.3, as a security margin. For example, to power five devices (15 VA each), the total load is 75 VA multiplied by 1.3 is 98 VA. Choose a size of transformer just over this amount: For example, a 100 VA model.
2. When the total load of a number of devices requires a transformer with a rating greater than 100 VA, use two or more transformers. Ensure that the load to be connected to each transformer follows the guideline of Step 1 above.

Recommended 24V Power Cable

The table below lists Distech Controls' recommended power cable.

Table 10-4: Distech Controls Recommended 24V Power Cable

Cable Type AWG – Number of Conductors	Non-Plenum Applications (FT4)		Plenum Applications (FT6)	
	Part Number	O.D. (Ø)	Part Number	O.D. (Ø)
18-2	CB-W181P-1002	5.0mm / 0.20in.	CB-W181P-2051	5.0mm / 0.20in.
16-2	CB-W161P-1031	4.8mm / 0.19in.	CB-W161P-2062	4.8mm / 0.19in.
14-2	CB-W141P-1081	7.2mm / 0.29in.	CB-W141P-2013	7.2mm / 0.29in.

24VAC Power Supply Connection

Use an external fuse on the 24VAC side (secondary side) of the transformer, as shown in *Figure 10-7*, to protect all controllers against power line spikes.

Maintain consistent polarity when connecting controllers and devices to the transformer. That is, the 24V COM terminal of each controller and each peripheral must be connected to the same terminal on the secondary side of the transformer. This transformer terminal must be connected to the building's ground. This ensures that the 24V COM terminals of all devices connected to any BACnet MS/TP bus in the building are at the same potential.

Most Distech Controls devices use the 24V COM terminal as the signal reference point for the data bus (see Table 10-5: Common Identification Labels for BACnet MS/TP Data Bus Polarity for Distech Controls' Products and Figure 10-2: Typical Cable-Shield Grounding Requirements for a BACnet MS/TP Data Bus Segment with a Building Controller located in the Middle of the Data Bus) for common device terminal labels.

Table 10-5: Common Identification Labels for BACnet MS/TP Data Bus Polarity for Distech Controls' Products

Distech Controls Product	Typical Data Bus Connection Terminals		
	Inverting	Non-inverting	Reference
UUKL ECB Series Controllers	NET –	NET +	24V COM
UUKL ECB-VAV	NET –	NET +	Shield
EC-BOS-8 UUKL	A– B-	A+ B+	S S

As a consequence, you must wire the power supply (for any given number of devices) as shown in *Figure 10-7*, such that the transformer's secondary that is connected to 24V COM /C terminals is connected to the building's ground at the power supply. This ensures that the 24V COM /C terminals of all devices connected to any BACnet MS/TP bus in the building are at the same electrical potential.

- As specified by electrical safety codes worldwide, the building's protective ground network must not be used to conduct electrical current under normal conditions. Such current can lift the reference voltage sensed at a controller's 24V COM terminal, thus resulting in data transmission errors.
- A mechanical ground is unacceptable: Do not use a pipe, conduit, or duct work for a ground. The power supply must have a dedicated ground wire that comes from the main electrical supply panel.

⚠ The type of installation shown in the following figure may require a PWR SPK! For more information refer to *Power Surge Protection Kit (PWR SPK)* on page 49.

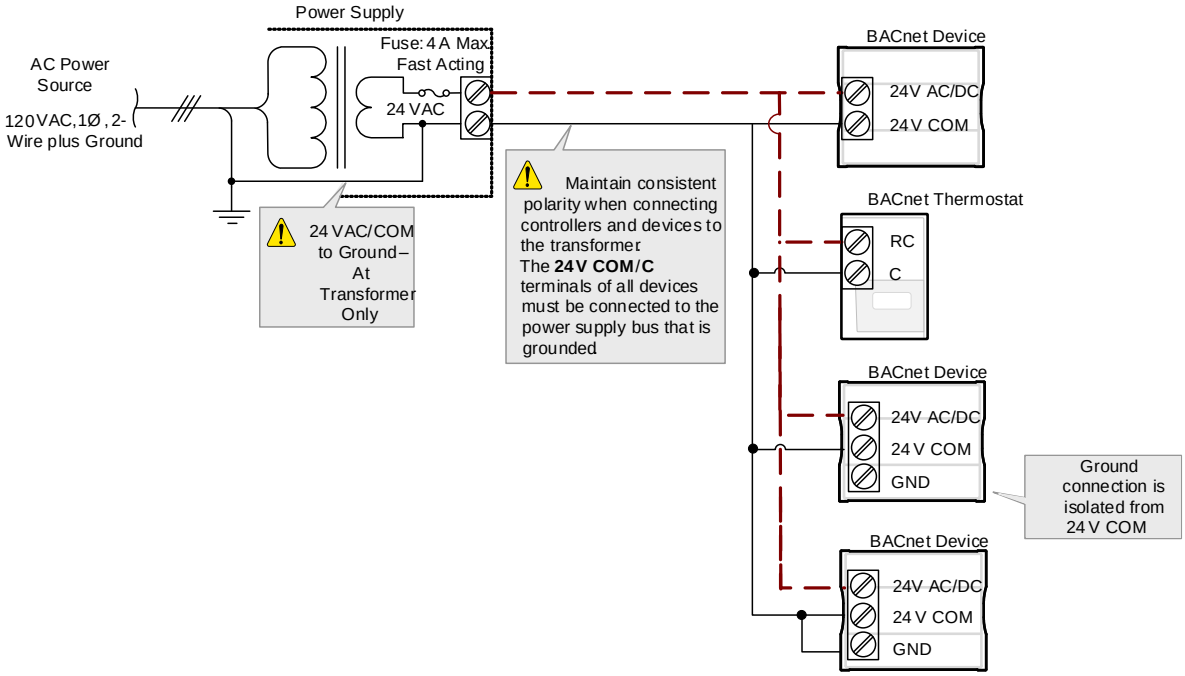


Figure 10-7: Power Wiring Diagram

ECx-400 UUKL I/O Extension Module Power Supply Requirements

When an ECB-600 UUKL is used with one or more ECx-400 UUKL (I/O Extension Module), always use a separate transformer for each ECB-600 UUKL controller and for each of its associated ECx-400 UUKL. Refer to *Transformer Selection and Determining the Maximum Power Run Length* on page 110 for how to choose an appropriate transformer. One terminal on the secondary side of each of these transformers must be connected to the building's ground and to the respective UUKL controller's or ECx-400 UUKL 24V COM terminal. See *Figure 10-8*.

Note that the shield of the 2-Wire Subnetwork Bus Cable must also be grounded, preferably at the ECB-600 UUKL. See also *2-Wire Subnetwork Bus Shield Grounding Requirements* on page 117.

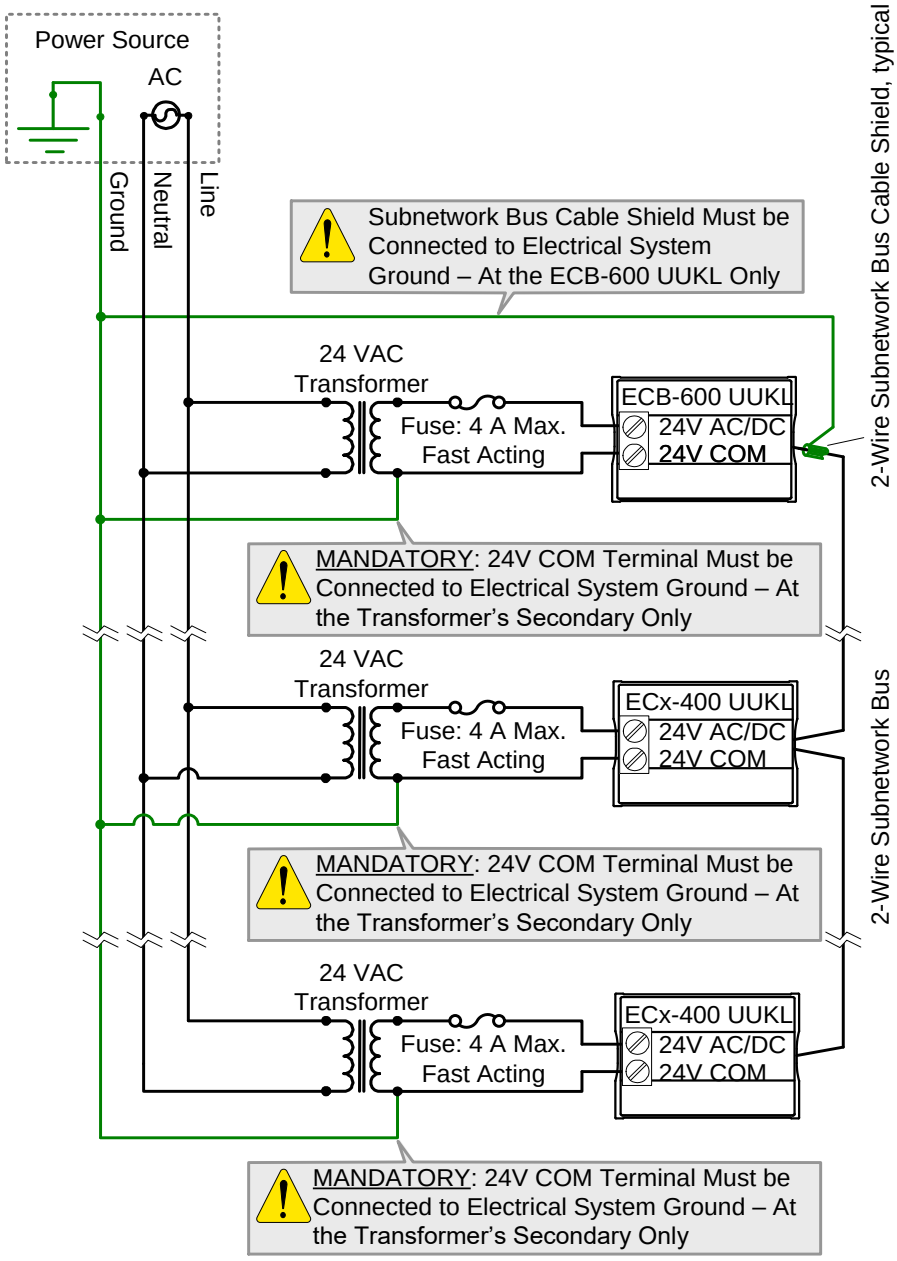


Figure 10-8: Power wiring – AC for ECB-600 UUKL with ECx-400 UUKL extension modules: The 24V COM Terminal of all Devices must be Connected to Ground

⚠ The type of installation shown in the following figure may require a PWR SPK! For more information refer to *Power Surge Protection Kit (PWR SPK)* on page 49.

2-Wire Subnetwork Bus

The 2-Wire subnetwork bus is used to connect ECx-400 UUKL extension module to an ECB-600 UUKL controller.

2-Wire Subnetwork Data Bus is Polarity Sensitive

The polarity of the 2-wire subnetwork bus must be respected as shown in *Figure 10-11*. All terminals identified as **SUBNET+** must be connected to the same conductor. Likewise, all terminals identified as **SUBNET-** must be connected to the same conductor.

2-Wire Subnetwork Data Bus Physical Specifications and Cable Requirements

Cables composed of stranded conductors are preferred over solid conductors as stranded conductor cable better resist breakage during pulling operations. Distech Controls strongly recommends the following 2-wire subnetwork data bus cable specifications be respected.

Table 10-6: Cat 5e Cable Subnetwork Data Bus Physical Specifications and Cable Requirements

Parameter	Details
Maximum number of ECx-400 UUKL I/O Extension Modules	2
Subnet ID Addressing Configuration	DIP switch located on faceplate.
Media	Shielded, twisted pair
Characteristic impedance	100-130 Ohms
Distributed capacitance	Less than 100 pF per meter (30 pF per foot)
Maximum total length of the Cat 5e Cable subnetwork data bus plus the 2-wire subnetwork data bus	300 m (1 000 ft.) Maximum.
Polarity	Polarity sensitive
Multi-drop	Daisy-chain (no T-connections, no routers)
EOL terminations	Built-in. Must be set / enabled on the last ECx-400 UUKL I/O Extension Module only.
Shield grounding	See *2-Wire Subnetwork Bus Shield Grounding Requirements*.

Distech Controls recommends the cable shown below.

Table 10-7: Distech Controls Recommended Cable Types for the 2-Wire Subnetwork Data Bus

Cable Type	Part Number	O.D. (Ø)
300 meters (1000 feet), 24 AWG Stranded, Twisted Pair Shielded Cable - FT6, Rated for Plenum Applications	CB-BACN6BL1000	3.75mm (0.148 in.)

2-Wire Subnetwork Data Bus Topology and End-of-Line (EOL) Terminations

The EOL termination settings for the 2-wire subnetwork data bus will vary depending on whether any Allure Series sensors are connected to the controller's Subnet Port or not. By default, the EOL termination on the ECx-400 UUKL devices and Allure Series sensors are factory-set to OFF.

When ECx-400 UUKL I/O Extension Modules are connected to an ECB-600 UUKL controller's Subnet+ and Subnet- connectors, only the EOL terminations of the ECB-600 UUKL and the last ECx-400 UUKL are set to ON. All other ECx-400 UUKL I/O Extension Modules must have their EOL terminations set to OFF. This is shown below.

For the 2-wire subnetwork data bus, only a daisy-chain topology is acceptable and T-connections and routers are not allowed.

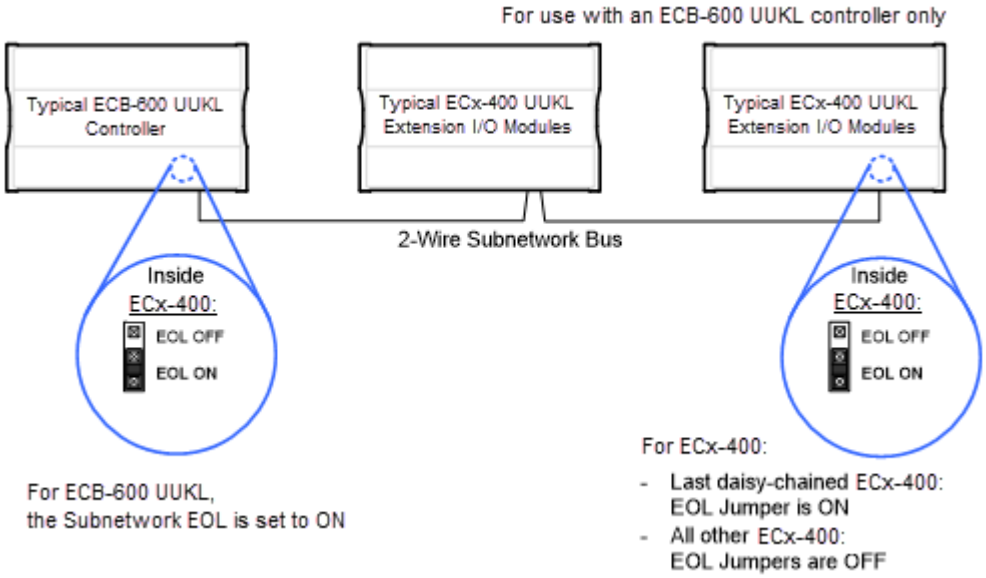


Figure 10-9: Setting the EOL Terminations on the ECx-400 UUKL Subnetwork Data Bus

When ECx-400 UUKL I/O Extension Modules are connected to an ECB-600 UUKL controller's Subnet+ and Subnet- connectors and with one or more Allure Series sensor(s) are connected to the controller's Subnet Port, only the EOL terminations of the last ECx-400 UUKL and the last Allure Series sensor are set to ON. All other ECx-400 UUKL I/O Extension Modules and Allure Series sensors must have their EOL terminations set to OFF. This is shown below.

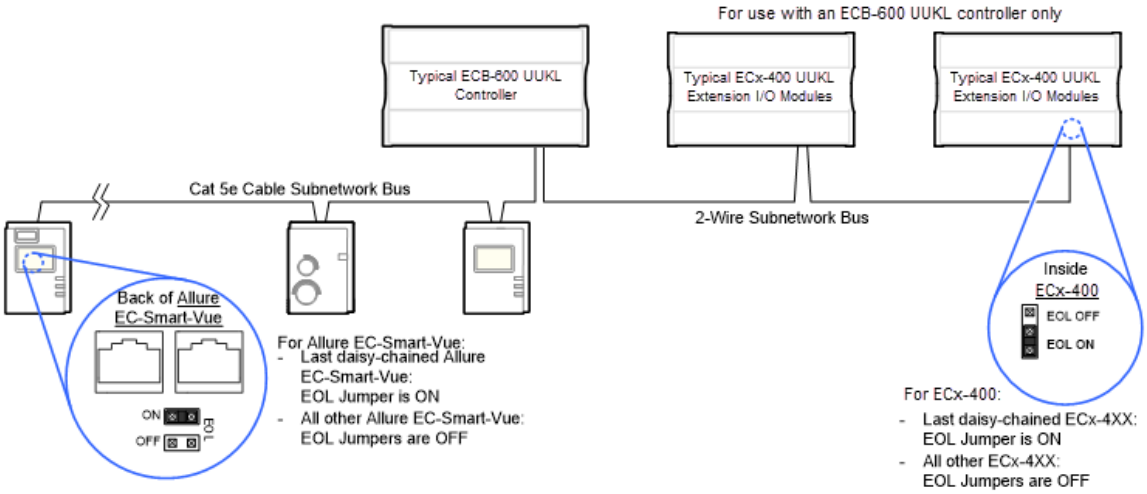


Figure 10-10: Setting the EOL Terminations on the Subnetwork Data Bus when Cat 5e Room Devices are used

2-Wire Subnetwork Bus Shield Grounding Requirements

The 2-Wire subnetwork bus is a three-wire bus that has specific installation requirements. The best protection against interference is to use properly grounded shielded cable for the 2-Wire subnetwork bus. For this, the ECx-400 UUKL extension modules on the 2-Wire subnetwork bus must be daisy-chained together with the cable shield twisted together and isolated with electrical tape at each ECx-400 UUKL extension module.

The shielding of the 2-Wire subnetwork bus cable must be connected to the electrical system ground at one point only, preferably at the ECB-600 UUKL as shown below.

⚠ The type of installation shown in the following figure may require a COMM SPK! For more information, refer to *Communication Surge Protection Kit (COMM SPK)* on page 45.

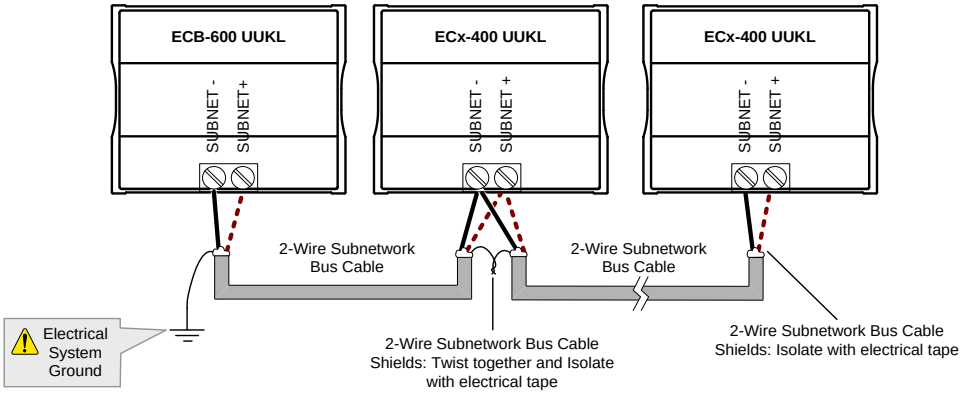


Figure 10-11: ECB-600 UUKL - 2-Wire Subnetwork Bus Shielding

For more information about 2-Wire subnetwork bus grounding, refer to *ECx-400 UUKL I/O Extension Module Power Supply Requirements* on page 113 for ECB-600 UUKL controllers.

ECx-400 UUKL I/O Extension Module Addressing

Each ECx-400 UUKL Extension Module on a 2-Wire subnetwork bus needs to be set to a unique address. The address is set through the DIP switch located on the ECx-400 UUKL Extension Module's faceplate. The range of valid addresses is 1 to 7.

Table 10-8: ECx-400 UUKL Extension Module Address DIP Switch Settings

Switch Position			Value
1	2	4	
OFF	OFF	OFF	Invalid
ON	OFF	OFF	1
OFF	ON	OFF	2
ON	ON	OFF	3
OFF	OFF	ON	4
ON	OFF	ON	5
OFF	ON	ON	6
ON	ON	ON	7

An example of how to set an ECx-400 UUKL Extension Module address DIP switch is shown below.

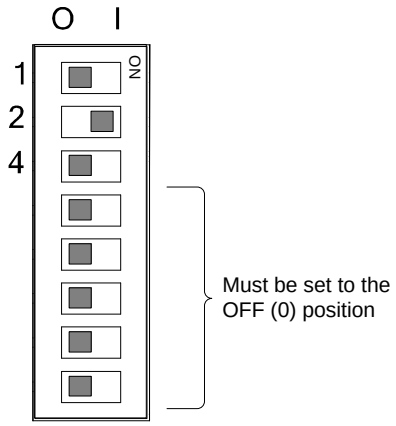


Figure 10-12: Typical ECx-400 UUKL Extension Module Address DIP Switch Set to 2

Power Supply Requirements

The ECB-600 UUKL controller and each associated ECx-400 UUKL Extension Module must have their own dedicated power supply. To size the power supply transformer, refer to *Transformer Selection and Determining the Maximum Power Run Length* on page 110.

Chapter 11
ENCLOSURES AND ACCESSORIES

This chapter provides an overview of the enclosure and accessory requirements for the Distech Controls Smoke Control System.

In This Chapter

Enclosure/Panel Requirements

The enclosures must have the required metal thickness according to its size, mounted and wired in accordance with the UL 864 Control Units and Accessories for Fire Alarm Systems, Tenth Edition specification.

The EC-BOS-8 UUKL, ECB UUKL controllers, Ethernet switches, and all other equipment in a smoke control network must be mounted in a UL Listed enclosure. The enclosures must be locked at all times.

For a list of the different panels and subpanels used in the Distech Controls UUKL smoke control system, refer to *Table 12-9* in the *Component Listing* section.

Figure 11-1: Typical Metal Enclosure

Figure 11-2: Typical Perforated Subpanel, Fits Inside the Metal Enclosure

For detailed panel and subpanel specifications, refer to the manufacturer's website:

http://functionaldevices.com/building-automation/enclosures.php

Power Supply 120VAC/24VAC

The required (primary) power supply is the PSB100AB10-IC Power Supply. It is a UL Listed Open Bracket Single 100VA 120Vac to 24Vac UL Class 2 power limited power supply with 10Amp breaker.

Figure 11-3: PSB100AB10 Power Supply

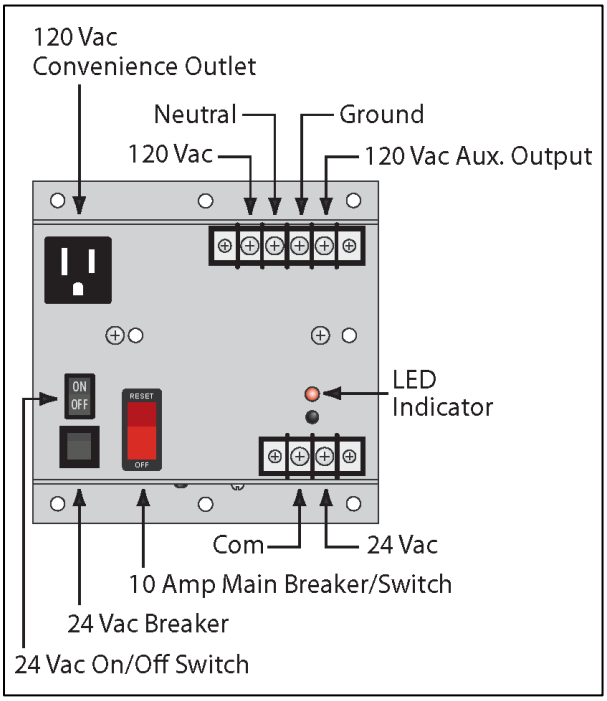


Figure 11-4: PSB100AB10 Power Supply Wiring Diagram

Refer to the manufacturer's product documentation for detailed technical specifications.

Transformer 120/24VAC

The TR100VA002 transformer is a UL® Listed and CSA Certified Class 2, 120 to 24 VAC transformer, with 4Amp circuit breaker, Foot and Dual Threaded Hub Mount. It is used in conjunction with the primary power supply when loads exceed the 100 VA limit. This transformer will add 100VA on the initial 100VA of the primary power supply.

Figure 11-5: TR100VA002 Transformer (100VA)

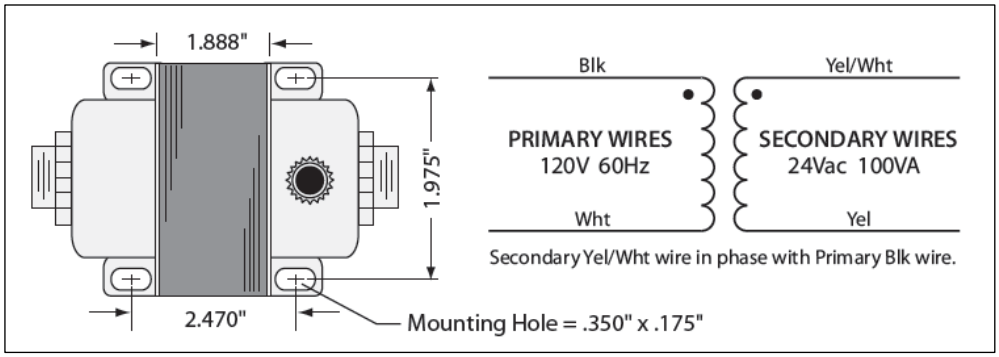


Figure 11-6: TR100VA002 Transformer (100VA) Wiring Diagram

Refer to the manufacturer's product documentation for detailed technical specifications.

Power Panels/Enclosures

Enclosure Wiring Specifications

The BACnet MS/TP communication wire run must be enclosed in its own electrical conduit, whereas all other wires, single or multiple, can be pulled into any other number of conduits as needed except for the 120V wire (non-power limited conductors) which requires another separate conduit. Ensure that a minimum of ¼ inch spacing be maintained between the power limited conductors and non-power limited conductors. Holes must be made into the metal enclosure to install as many conduits as needed.

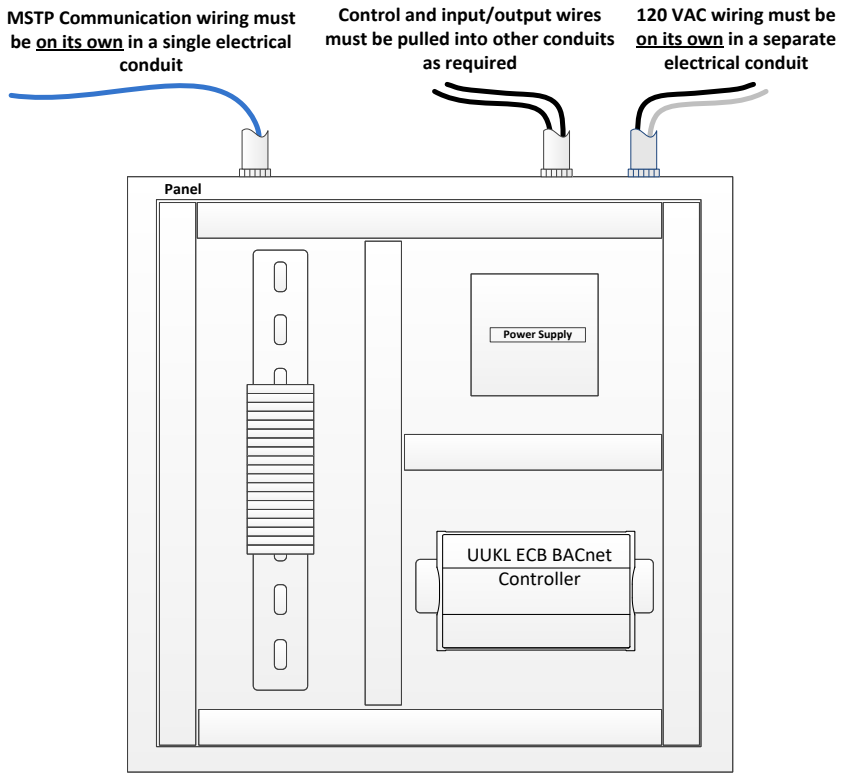


Figure 11-7: Enclosure Wiring for MS/TP Communication

Terminal Blocks

There are two Phoenix Contact Terminal Blocks:

1. Universal terminal block (Part #3044076 UT 2,5)
2. Universal grounding/earth terminal block (Part #3044092 UT 2,5-PE)

Universal Terminal Block

The Phoenix Contact universal terminal block with screw connection:

Figure 11-8: Phoenix Contact Terminal Block Part #3044076

For more detailed information, go to the Phoenix Contact website and refer to the product's technical specifications.

Universal Grounding/Earth Terminal Block

The Phoenix Contact universal grounding/earth terminal block with screw connection:

Figure 11-9: Phoenix Contact Terminal Block Part #3044092

Bridge

The FBS 4-5 Phoenix Contact plug-in bridge (Part #3030187 FBS4-6) is added to the terminal blocks to create a knot.

Figure 11-10: Phoenix Contact Bridge

For more detailed information, go to the Phoenix Contact website and refer to the product's technical specifications.

Partition Plate

The Phoenix Contact partition plate part #3047167ATP-UT:

Figure 11-11: Phoenix Contact Partition Plate

For more detailed information, go to the Phoenix Contact website and refer to the product's technical specifications.

End Clamp

The Phoenix Contact end clamp E/NS 35 N #0800886 offers lagre-surface labeling.

Figure 11-12: Phoenix Contact End Clamp

For more detailed information, go to the Phoenix Contact website and refer to the product's technical specifications.

Circuit Breaker

The Phoenix Contact thermomagnetic device circuit breaker (part # UT 6-TMC M 10A) offers:

- Compact design, large-surface labeling options, and a double plug-in bridge shaft
- Clear assignment of the relevant circuit breaker thanks to the large center labeling area
- High level of system availability because of the reclosure function and clear status display

Figure 11-13: Phoenix Contact Circuit Breaker

For more detailed information, go to the Phoenix Contact website and refer to the product's technical specifications.

Din Rail

The following Phoenix Contact perforated din rail (part #0801733) is used in the power panel and compatible with the products described previously in this section (above).

Figure 11-14: Phoenix Contact Din Rail

For more detailed information, go to the Phoenix Contact website and refer to the product's technical specifications.

Control Accessories in a Smoke Control Panel

The Smoke Control listed accessories such as the *RS-485 Modular Repeater* and *Ethernet Interconnect Switch (EIS) Series* must be mounted in a smoke control enclosure as long as the following guidelines are respected:

1. There must be sufficient space in the enclosure to install all the devices.
2. The total power required by the smoke control devices and the control accessories must not exceed the enclosure's power supply transformer rating. A second transformer may be required to meet the total power requirements.
3. Adding control accessories must not cause the ambient temperature inside the enclosure to exceed 120° F (49° C).

The control accessories that are non-smoke control listed, such as relays, pneumatics, etc., can **NOT** be mounted in a smoke control enclosure. A separate enclosure must be used to install all non-smoke control accessories.

Chapter 12
ORDERING AND REVISION INFORMATION

This chapter provides an overview of the ordering and revision requirements for the Distech Controls Smoke Control System.

In This Chapter

Component Listing

IMPORTANT: Only Distech Controls products listed in the following tables have been tested and listed by UL for use in a Distech Controls UUKL Smoke Control System.

You cannot purchase a similar third-party device and install it in a UL Listed smoke control system. Doing so will void the UL 864, UUKL Smoke Control Listing. Third-party devices must be provided and labeled by the "factory" as described in the UL Smoke Control Listing.

⚠ Installation of a product that is not UL Listed and labeled for this application prevents the entire system from being UL Listed for smoke control!

⚠ All ECB UUKL controllers are preloaded with a UUKL specific firmware and the EC-BOS-8 UUKL is preloaded with a UUKL specific software. Only use firmware and software versions pertaining to the Distech Controls UUKL Smoke Control System. If not, this will void the UL 864, UUKL Smoke Control Listing.

Part Number	***Description***	***Firmware Revision #***
CDIDI-BOS8USWIFIU	EC-BOS-8 UUKL controller	N/A
CDIB-600U-00	ECB-600 UUKL controller	3.15.22056
CDIB-400U-00	ECB-400 UUKL controller	3.15.22056
CDIB-300U-00	ECB-300 UUKL controller	3.15.22056
CDIB-203U-00	ECB-203 UUKL controller	2.20.22056
CDIX-400U-00	ECx-400 UUKL I/O Extension Module	2.5.14093
CDIB-VAXU-IMP-10	ECB-VAV UUKL controller	2.20.22056
PDIDI-NPB82X485U-00	RS485 UUKL Option Module	N/A

Table 12-1: Distech Controls UUKL Controllers and Firmware Revision Number

Description	***Revision #***
Distech Controls EC-*gfx*Program	7.4.xxxxx
Distech Controls EC-NET Support Pack	4.13.24233
Distech Controls UUKL EC-Net	4.14.x.xxx

Table 12-2: Distech Controls UUKL Software Revision Number

Part Number	***Description***
PXXDI-COMMSPK	MS/TP and subnetwork bus (RS-485) communication surge protection kit
PXXDI-IOSPK	Input/Output surge protection kit for universal input and output connections. Not to be used with supervised input kits.
PXXDI-PWRSPK	24VAC power surge protection kit for power terminal connections
PXXDI-TRIACSPK	Triac surge protection kit for the Triac outputs
PXXDI-SNSPK	Subnetwork surge protection kit for the subnet port connection with RJ45 Cat5e cable.

Table 12-3: Distech Controls' UUKL Surge Protection Kits

Part Number	Description
PXXDI-INSIK-01	Supervised Input Kit for inputs.
PXXDI-DCSIK	Supervised Input Kit for dry contacts.

Table 12-4: Distech Controls' UUKL Supervised Input Kits

Part Number	Description
PSI-REP-RS485W2	RS-485 modular repeater by Phoenix Contact

Table 12-5: UUKL RS-485 Modular Repeater

Part Number	Description
EIS8-100T	Ethernet Interconnect switch with eight-port 10BASE-T/100BASE-TX switching hub (for twisted-pair copper cabling)
EIS6-100T/FC	Ethernet Interconnect switch, multimode fiber model with six ports: Four-port 100BASE-TX/two-port 100BASE-FX (multimode) switching hub with SC connectors
FC-4/4-3M	SC-to-SC duplex multimode fiber patch cord by Signamax

Table 12-6: UUKL Network Communication Equipment

Part Number	Description
PDIDI-NPBPWR0XXU	EC-NPB-PWR UUKL power supply module, 24V AC input, 15Vdc output, 30W power supply used with the EC-BOS-8 UUKL
07PWS-GPSU06U6	24 VDC/0.25 A, 6 W power supply with wall plug, used to power the Phoenix Contact modular repeater
PSB100AB10	100 VA 120/24 VAC power supply, 10Amp circuit breaker
TR100VA002	Transformer, 120/24VAC, 100 VA, 4Amp circuit breaker

Table 12-7: UUKL Power Supplies and Transformer

Part Number	Description
ISOBAR8ULTRA	8 Ultra Surge Suppressor by Tripp Lite 8-Outlet Premium Isobar Surge Protector with 12-ft Cord and All-Metal Housing
ISOBAR12ULTRA	ISOBAR 12 Ultra Surge Suppressor by Tripp Lite 12-Outlet Isobar Rackmount Surge Protector with 15-ft Cord and All-Metal Housing

Table 12-8: UUKL Surge Suppressor Bars

Panel Part #	Description
MH4400	Metal housing, NEMA 1, full hinge key latch door 18.00″ H x 18.00″ W x 7.00″ D
MH5500	Metal housing, NEMA 1, full hinge key latch door 25.00″ H x 25.00″ W x 9.50″ D
MH5800	Metal housing, NEMA 1, full hinge key latch door 36.00″ H x 25.00″ W x 9.50″ D
Subpanel Part #	**Description**
SP4404L	Perforated steel subpanel 16.875″ H x 15.750″ W x 0.250″ Thick
SP5504L	Perforated steel subpanel 23.000″ H x 22.500″ W x 0.250″ Thick

Panel Part #	Description
SP5804L	Perforated steel subpanel 34.000″ H x 22.500″ W x 0.250″ Thick

Table 12-9: Distech Controls' UUKL Enclosures/Panels

Part Number	Description
FSCS ADI Panel	ADI FSCS Note: Custom product from Automation Displays, Inc.(ADI®) Contact ADI to order the FSCS: *www.adipanel.com*

Table 12-10: UUKL FSCS Panel

Appendix A
SMOKE CONTROL UL 864, 10TH EDITION, UUKL LISTING COMPLIANCE CHECKLIST

This section summarizes the most common requirements to configure the Distech Controls Smoke Control System to comply with Underwriters Laboratories®, Inc. (UL), UUKL 864 Ninth Edition Smoke Control Listing.

In This Chapter

Introduction

A UL 864, 10th Edition, UUKL Smoke Control Compliance Survey form is followed by tables listing the requirements for UL 864 UUKL Listing compliance. The purpose of this survey is to provide a record of those elements of the NFPA 92 and UUKL that Distech Controls, Inc. does or does not provide. UUKL is an identifier created by UL to identify those products Listed under UL 864 as part of a Smoke Control system. Products covered by this listing are intended to be installed in conjunction with Heating, Ventilating, and Air Conditioning (HVAC) equipment to form a system for controlling the flow of smoke in a building during a fire condition in accordance with NFPA 92 Standard.

It is important that we document the system elements that are being provided. The UL 864, Tenth Edition, UUKL Smoke Control Compliance Survey can be used to provide that documentation.

In the case where a project specification dictates compliance with the UUKL Listing, but contains elements of the system design that conflict with the Listing or are omitted, the completed UL 864 Tenth Edition, UUKL Smoke Control Compliance Survey can be given to the designer and/or the AHJ to obtain recognition and agreement on the extent of Listing compliance. This should occur prior to bid and/or proposal.

Once agreement is reached with the AHJ, designer, and customer, the signed or initialed Smoke Control Compliance Checklist must become a permanent part of the project file.

General UUKL Requirements

The following table lists general requirements for UL 864, UUKL Listing compliance.

Requirement	***Y/N or NA***	***Person Verifying***
The feedback input monitors the associated controlled equipment status (for example, both open and closed, or on and off). For smoke control dampers, there may be a pair of feedback binary inputs for two damper end switches. Any mismatch of a command and status of the binary output occurring longer than the allowed response time must activate a fault light indicator at the FSCS.		
Supervised Input kit must be used.		
A positive feedback indicates status of fans.		
Non UUKL Listed control equipment must be isolated from the UUKL Listed network.		
Weekly Testing is performed on all dedicated smoke control systems.		
Automatic smoke control sequences take precedence over HVAC automatic and manual commands. Manual FSCS takes precedence over everything else.		
Automatic activation of any smoke control sequence of operation has priority over any non-smoke control manual commands and any automatic HVAC control strategy, when an auto smoke control sequence is initiated. High and low temperature protection devices and return and exhaust air-duct smoke detectors are bypassed.		
Response time for individual smoke control fans to reach commanded state is no more than 70 seconds.		
Response time for individual smoke control dampers to reach commanded state is no more than 85 seconds.		
Fire alarm system manual pull stations do not initiate automatic smoke control sequences.		
Smoke detectors are used to initiate a smoke control strategy only as detailed in this document.		
All controllers that monitor or control smoke control equipment are UUKL Listed.		
Electrical disconnects, overloads, duct static pressure limits, and supply air duct smoke detectors are not overridden by manual or automatic smoke control strategies.		

Table A-1: General UUKL Requirements

FSCS UUKL Ninth Edition Requirements

The following table lists general requirements for UL 864, UUKL Listing compliance for FSCSs where required.

Requirement	***Y/N or NA***	***Person Verifying***
The FSCS is UUKL Listed and provides manual control of the smoke control system. A UUKL Listed annunciator panel is used as an FSCS.		
Custom annunciator FSCS is connected to a UUKL Listed Smoke Control EC-BOS-8 UUKL		
The FSCS provides positive indication of operation of all smoke control equipment (for example, both open and closed, on and off).		
The FSCS provides audible and visible fault indication when any smoke control equipment does not respond to automatic or manual commands.		
The FSCS simultaneously displays the status of all smoke control systems, dampers, fans, VAVs, etc.		
The FSCS has manual control over all smoke control systems.		
The FSCS can override (partially or in full) any operation in progress, including programmed actions, non-smoke control manual overrides.		
The FSCS has highest priority over all smoke control systems.		
A building diagram or equivalent on the FSCS clearly indicates the type and location of all smoke control equipment.		
The FSCS indicates the actual status (not the command status) of systems and equipment used for smoke control. This includes the current position of each damper used in an active smoke control sequence and the status of every fan.		
The FSCS activates an audible signal if the fan or damper does not reach its intended position.		
Only one FSCS on the Distech Controls UUKL Smoke Control system is used for smoke control applications unless approved by the AHJ.		
The FSCS manual activation or deactivation of any smoke control device has priority over any automatic smoke control sequence and any other HVAC sequence of operation.		
Any return air duct smoke detector reports an alarm condition to the FSCS and does not stop any equipment.		
All hardware supervision alarms, such as binary feedback alarms on fans and dampers, as well as system alarm points turn on FSCS alarm horn.		

Table A-2: FSCS UUKL Requirements

Smoke Control Wiring UUKL Requirements

The following table lists requirements for UL 864, UUKL Listing compliance for Smoke Control Wiring.

Requirement	***Y/N or NA***	***Person Verifying***
If MS/TP communication circuits leave the room, transient protection is applied as detailed in this document.		
Verify that a Tripp Lite® ISOBAR8ULTRA surge protector or a Tripp Lite ISOBAR12ULTRA surge protector is used as detailed in this document.		
If fiber-optic cable is used, verify that it meets the requirements listed in this document.		
If copper cable is used, verify that it meets the requirements listed in this document.		
Verify that only the EC BOS-8 UUKL model, is used for smoke control in a UL 864, Tenth Edition, UUKL smoke control system.		
If an RS-485-to-RS-485 repeater is used to isolate UUKL from non-UUKL devices on an MS/TP Bus, verify that it is installed in a UL-Listed enclosure.		

Table A-3: Smoke Control Wiring Tenth Edition UUKL Requirements

GLOSSARY

Area of Refuge:

An area of the building separated from other spaces by fire-rated smoke barriers in which a tenable environment is maintained for the period of time that such areas may need to be occupied at time of fire.

Authority Having Jurisdiction:

The organization, office, or individual responsible for approving equipment, materials, an installation, or a procedure.

Building Automation System (BAS):

A network of devices designed to control a variety of functions and systems in a building such as climate control, lighting operations, and alarm management.

Code Space:

The amount of data storage allotted for a compiled control sequence.

Control Sequence:

A series of commands and functions designed to control an output using certain inputs.

Fan In Binding:

The connection of several similar outputs from different sources to one common input.

Firefighter's Smoke Control Station:

A system that provides graphical monitoring and manual overriding capability over smoke control systems and equipment at designated location(s) within the building for the use of the fire department.

Flash Memory:

A type of data storage whereby data can be repeatedly saved and erased and that requires no power to store the information.

Programmable Controller:

A device that can be used to control a system based on a user-developed control sequence.

Internal Point:

A type of input or output within a programmable controller such as a hardware input or network variable output.

Line-by-Line Code:

A code based on textual commands and functions as opposed to graphical code, which is based on block objects.

Network Management Tool:

A program used to supervise a BAS.

Pressurization:

Changes the adjacent areas next to the affected smoke control area or zone from an automatic HVAC controlling sequence to an automatic smoke control sequence. Or changes the manual smoke control sequence from the FSCS panel control to supply a positive pressure in the specific area or zone to help prevent the spread of smoke.

Random Access Memory (RAM):

A type of data storage from which data can be accessed in any order.

Smoke Barrier:

A continuous membrane, either vertical or horizontal, such as a wall, floor, or ceiling assembly, that is designed and constructed to restrict the movement of smoke.

Smoke Control Mode:

A predefined operational configuration of a system or device for the purpose of smoke control.

Smoke Control System:

An engineered system that uses mechanical fans to produce pressure differences across smoke barriers to inhibit smoke movement.

Smoke Control Zone:

A space within a building enclosed by smoke barriers, including the top and bottom, that is part of a zoned smoke control system.

Smoke Zone:

The smoke control zone in which the fire is located.

Stairwell Pressurization System:

A type of smoke control system in which stair shafts are mechanically pressurized, with respect to the fire area, with outdoor air to keep smoke from contaminating them during a fire event.

Tenable Environment:

An environment in which smoke and heat is limited or otherwise restricted to maintain the impact on occupants to a level that is not life threatening.

Zoned Smoke Control System:

A smoke control system that includes smoke exhaust for the smoke zone and pressurization for all contiguous smoke control zones.