Honeywell

Gamewell FCI FIRE CONTROL INSTRUMENTS

GFP Series

Smoke Control Application

Instruction Manual

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Fire Alarm & Emergency Communication System Limitations

While a life safety system may lower insurance rates, it is not a substitute for life and property insurance!

An automatic fire alarm system—typically made up of smoke detectors, heat detectors, manual pull stations, audible warning devices, and a fire alarm control panel (FACP) with remote notification capability—can provide early warning of a developing fire. Such a system, however, does not assure protection against property damage or loss of life resulting from a fire.

An emergency communication system—typically made up of an automatic fire alarm system (as described above) and a life safety communication system that may include an autonomous control unit (ACU), local operating console (LOC), voice communication, and other various interoperable communication methods—can broadcast a mass notification message. Such a system, however, does not assure protection against property damage or loss of life resulting from a fire or life safety event.

The Manufacturer recommends that smoke and/or heat detectors be located throughout a protected premises following the recommendations of the current edition of the National Fire Protection Association Standard 72 (NFPA 72), manufacturer's recommendations, State and local codes, and the recommendations contained in the Guide for Proper Use of System Smoke Detectors, which is made available at no charge to all installing dealers. This document can be found at http://www.systemsensor.com/appguides/. A study by the Federal Emergency Management Agency (an agency of the United States government) indicated that smoke detectors may not go off in as many as 35% of all fires. While fire alarm systems are designed to provide early warning against fire, they do not guarantee warning or protection against fire. A fire alarm system may not provide timely or adequate warning, or simply may not function, for a variety of reasons:

Smoke detectors may not sense fire where smoke cannot reach the detectors such as in chimneys, in or behind walls, on roofs, or on the other side of closed doors. Smoke detectors also may not sense a fire on another level or floor of a building. A second-floor detector, for example, may not sense a first-floor or basement fire.

Particles of combustion or "smoke" from a developing fire may not reach the sensing chambers of smoke detectors because:

- Barriers such as closed or partially closed doors, walls, chimneys, even wet or humid areas may inhibit particle or smoke flow.
- Smoke particles may become "cold," stratify, and not reach the ceiling or upper walls where detectors are located.
- Smoke particles may be blown away from detectors by air outlets, such as air conditioning vents.
- Smoke particles may be drawn into air returns before reaching the detector.

The amount of "smoke" present may be insufficient to alarm smoke detectors. Smoke detectors are designed to alarm at various levels of smoke density. If such density levels are not created by a developing fire at the location of detectors, the detectors will not go into alarm.

Smoke detectors, even when working properly, have sensing limitations. Detectors that have photoelectronic sensing chambers tend to detect smoldering fires better than flaming fires, which have little visible smoke. Detectors that have ionizing-type sensing chambers tend to detect fast-flaming fires better than smoldering fires. Because fires develop in different ways and are often unpredictable in their growth, neither type of detector is necessarily best and a given type of detector may not provide adequate warning of a fire.

Smoke detectors cannot be expected to provide adequate warning of fires caused by arson, children playing with matches (especially in bedrooms), smoking in bed, and violent explosions (caused by escaping gas, improper storage of flammable materials, etc.).

Heat detectors do not sense particles of combustion and alarm only when heat on their sensors increases at a predetermined rate or reaches a predetermined level. Rate-of-rise heat detectors may be subject to reduced sensitivity over time. For this reason, the rate-of-rise feature of each detector should be tested at least once per year by a qualified fire protection specialist. Heat detectors are designed to protect property, not life.

IMPORTANT! Smoke detectors must be installed in the same room as the control panel and in rooms used by the system for the connection of alarm transmission wiring, communications, signaling, and/or power. If detectors are not so located, a developing fire may damage the alarm system, compromising its ability to report a fire.

Audible warning devices such as bells, horns, strobes, speakers and displays may not alert people if these devices are located on the other side of closed or partly open doors or are located on another floor of a building. Any warning device may fail to alert people with a disability or those who have recently consumed drugs, alcohol, or medication. Please note that:

- An emergency communication system may take priority over a fire alarm system in the event of a life safety emergency.
- Voice messaging systems must be designed to meet intelligibility requirements as defined by NFPA, local codes, and Authorities Having Jurisdiction (AHJ).
- Language and instructional requirements must be clearly disseminated on any local displays.
- Strobes can, under certain circumstances, cause seizures in people with conditions such as epilepsy.
- Studies have shown that certain people, even when they hear a fire alarm signal, do not respond to or comprehend the meaning of the signal. Audible devices, such as horns and bells, can have different tonal patterns and frequencies. It is the property owner's responsibility to conduct fire drills and other training exercises to make people aware of fire alarm signals and instruct them on the proper reaction to alarm signals.
- In rare instances, the sounding of a warning device can cause temporary or permanent hearing loss.

A life safety system will not operate without any electrical power. If AC power fails, the system will operate from standby batteries only for a specified time and only if the batteries have been properly maintained and replaced regularly.

Equipment used in the system may not be technically compatible with the control panel. It is essential to use only equipment listed for service with your control panel.

Alarm Signaling Communications:

- **IP connections** rely on available bandwidth, which could be limited if the network is shared by multiple users or if ISP policies impose restrictions on the amount of data transmitted. Service packages must be carefully chosen to ensure that alarm signals will always have available bandwidth. Outages by the ISP for maintenance and upgrades may also inhibit alarm signals. For added protection, a backup cellular connection is recommended.
- **Cellular connections** rely on a strong signal. Signal strength can be adversely affected by the network coverage of the cellular carrier, objects and structural barriers at the installation location. Utilize a cellular carrier that has reliable network coverage where the alarm system is installed. For added protection, utilize an external antenna to boost the signal.
- **Telephone lines** needed to transmit alarm signals from a premise to a central monitoring station may be out of service or temporarily disabled. For added protection against telephone line failure, backup alarm signaling connections are recommended.

The most common cause of life safety system malfunction is inadequate maintenance. To keep the entire life safety system in excellent working order, ongoing maintenance is required per the manufacturer's recommendations, and UL and NFPA standards. At a minimum, the requirements of NFPA 72 shall be followed. Environments with large amounts of dust, dirt, or high air velocity require more frequent maintenance. A maintenance agreement should be arranged through the local manufacturer's representative. Maintenance should be scheduled as required by National and/or local fire codes and should be performed by authorized professional life safety system installers only. Adequate written records of all inspections should be kept.

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Installation Precautions

Adherence to the following will aid in problem-free installation with long-term reliability:

WARNING - Several different sources of power can be connected to the fire alarm control panel. Disconnect all sources of power before servicing. Control unit and associated equipment may be damaged by removing and/or inserting cards, modules, or interconnecting cables while the unit is energized. Do not attempt to install, service, or operate this unit until manuals are read and understood.

CAUTION - System Re-acceptance Test after Software Changes: To ensure proper system operation, this product must be tested in accordance with NFPA 72 after any programming operation or change in site-specific software. Re-acceptance testing is required after any change, addition or deletion of system components, or after any modification, repair or adjustment to system hardware or wiring. All components, circuits, system operations, or software functions known to be affected by a change must be 100% tested. In addition, to ensure that other operations are not inadvertently affected, at least 10% of initiating devices that are not directly affected by the change, up to a maximum of 50 devices, must also be tested and proper system operation verified.

This system meets NFPA requirements for operation at 0-49º C/32-120º F and at a relative humidity 93% ± 2% RH (non-condensing) at 32°C ± 2°C (90°F ± 3°F). However, the useful life of the system's standby batteries and the electronic components may be adversely affected by extreme temperature ranges and humidity. Therefore, it is recommended that this system and its peripherals be installed in an environment with a normal room temperature of 15-27º C/60-80º F.

Verify that wire sizes are adequate for all initiating and indicating device loops. Most devices cannot tolerate more than a 10% I.R. drop from the specified device voltage.

Like all solid state electronic devices, this system may operate erratically or can be damaged when subjected to lightning induced transients. Although no system is completely immune from lightning transients and interference, proper grounding will reduce susceptibility. Overhead or outside aerial wiring is not recommended, due to an increased susceptibility to nearby lightning strikes. Consult with the Technical Services Department if any problems are anticipated or encountered.

Disconnect AC power and batteries prior to removing or inserting circuit boards. Failure to do so can damage circuits.

Remove all electronic assemblies prior to any drilling, filing, reaming, or punching of the enclosure. When possible, make all cable entries from the sides or rear. Before making modifications, verify that they will not interfere with battery, transformer, or printed circuit board location.

Do not tighten screw terminals more than 9 in-lbs. Over-tightening may damage threads, resulting in reduced terminal contact pressure and difficulty with screw terminal removal.

This system contains static-sensitive components. Always ground yourself with a proper wrist strap before handling any circuits so that static charges are removed from the body. Use static suppressive packaging to protect electronic assemblies removed from the unit.

Units with a touchscreen display should be cleaned with a dry, clean, lint free/microfiber cloth. If additional cleaning is required, apply a small amount of Isopropyl alcohol to the cloth and wipe clean. Do not use detergents, solvents, or water for cleaning. Do not spray liquid directly onto the display.

Follow the instructions in the installation, operating, and programming manuals. These instructions must be followed to avoid damage to the control panel and associated equipment. FACP operation and reliability depend upon proper installation.

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FCC Warning

WARNING: This equipment generates, uses, and can radiate radio frequency energy and if not installed and used in accordance with the instruction manual may cause interference to radio communications. It has been tested and found to comply with the limits for Class A computing devices pursuant to Subpart B of Part 15 of FCC Rules, which is designed to provide reasonable protection against such interference when devices are operated in a commercial environment. Operation of this equipment in a residential area is likely to cause interference, in which case the user will be required to correct the interference at his or her own expense.

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Software Downloads

In order to supply the latest features and functionality in fire alarm and life safety technology to our customers, we make frequent upgrades to the embedded software in our products. To ensure that you are installing and programming the latest features, we strongly recommend that you download the most current version of software for each product prior to commissioning any system. Contact Technical Support with any questions about software and the appropriate version for a specific application.

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This symbol (shown left) on the product(s) and / or accompanying documents means that used electrical and electronic products should not be mixed with general household waste. For proper treatment, recovery and recycling, contact your local authorities or dealer and ask for the correct method of disposal.

Electrical and electronic equipment contains materials, parts and substances, which can be dangerous to the environment and harmful to human health if the waste of electrical and electronic equipment (WEEE) is not disposed of correctly.

Table of Contents

Section 1: About This Manual 9
1.1: Description 9
1.2: Standards and Other Documents 9
1.2.1: Installation Standards 9
1.2.2: Product Standards 9
1.3: UL 864 9th and 10th Edition 10
1.3.1: HVAC Operation and UL/NFPA Standards 10
1.4: Using this Manual 10
1.4.1: Supplemental Documentation 10
1.5: Cautions and Warnings 11
1.6: Hardware Requirements 11
1.7: Software Requirements 11
1.8: Smoke Control Application Requirements 11
1.8.1: Licensing Summary 11
1.9: Smoke Control System Guidelines & Restrictions 12
1.10: Definitions 12
1.11: Principles of Smoke Movement 15
1.12: Principles of Smoke Control 17
1.12.1: Smoke Containment 17
1.13: General System Components 18
1.14: HVAC Equipment 18
1.14.1: HVAC Systems 18
1.14.2: Ductwork 19
1.14.3: Fans 20
1.14.4: Dampers 21
1.15: Control Equipment 22
1.15.1: Fire Alarm Control Panel (FACP) 22
1.15.2: Firefighter's Smoke Control Station (FSCS) 22
1.16: Initiating Devices 22
1.16.1: Smoke Detectors 22
1.16.2: Manual Pull Station 22
1.17: Smoke Control System Types 22
1.17.1: Basic System Descriptions 23
1.17.2: Stairtower Pressurization Systems 24
1.17.3: Elevator Hoistway Systems 25
1.17.4: Zoned Smoke Control Systems 27
1.18: Basic Smoke Control System Operation 30
Section 2: Introduction to the Smoke Control Application 31
2.1: Application Overview 31
2.1.1: Features and Benefits 31
2.2: Smoke Control Overview 31
2.2.1: Control Equipment 31
2.2.2: Initiating Devices 32
2.2.3: Smoke Control Appliances 32
2.3: Smoke Control Zones 33
2.3.1: Smoke Zone/Appliance States 33
2.4: Basic Smoke Control System Layouts 34
2.5: Zoned Smoke Control Scenarios 35
2.5.1: Scenario with Fans and Dampers 35
2.5.2: Scenario with Eight-Story Building 36
Section 3: Smoke Control Configuration 37
3.1: Introduction 37
3.2: Configuring Smoke Control Modules 37
3.2.1: Module Configuration Parameters 37
3.3: Configuring Appliances 39
3.3.1: Appliance Configuration Concepts 39
3.3.2: Appliance Addressing 40
3.3.3: Appliance Subaddressing 40

3.3.4: Appliance Mapping 41
3.4: Appliance Configuration Parameters 41
3.5: Appliance Licensing 43
3.5.1: License Types 43
3.5.2: License Trouble 43
3.6: Smoke Control Zone Overview 44
3.6.1: Zone Mapping 44
3.6.2: Zone Addressing 44
3.6.3: Zone Subaddressing 45
3.7: Smoke Control Zone Licensing 45
3.7.1: License Trouble 45
3.8: Smoke Control Zone Configuration 46
3.9: Zone Mapping 48
3.10: Configuring the Activation Matrix 49
3.11: System Programming Overview 49
3.12: Annunciator Configuration 49
3.12.1: Mapping 49
3.12.2: Annunciator Prioritization 50
3.12.3: Annunciator Enablement and Pairing 50
3.13: Priority-Based Activation 50
3.13.1: Manual Control Priority Rules 50
3.13.2: Priority-Based Activation Scenario 51
3.14: Configuring Virtual Points 52
3.14.1: Overview 52
3.14.2: Virtual Point Trouble 52
3.14.3: Virtual Point Addressing 52
3.14.4: Virtual Point Activation 52
3.14.5: Virtual Point Configuration Parameters 53

Section 4: Monitoring and Operation 55

4.1: Switch Monitoring 55
4.1.1: Overview 55
4.1.2: Expected/Required Indication 55
4.1.3: ACM-30/30W General Zone Configuration 56
4.1.4: LDM2-32/60 Configuration 56
4.1.5: Toggle Implementation 56
4.1.6: Momentary Implementation 57
4.1.7: Lamp Test 58
4.1.8: Switch Monitoring Test 58
4.2: Smoke Control Zone Control 58
4.3: Nested Zone Control 59
4.4: Disable and Bypass 59
4.4.1: Disable State 59
4.4.2: Bypass State 59
4.5: Lockout 60
4.5.1: Automation Control Lockout 60
4.5.2: First Event Lockout 60
4.5.3: Interface Lockout 61
4.6: Reporting 62
4.6.1: Appliance Event Reporting 62
4.6.2: Smoke Control Zone Event Reporting 62
4.7: Periodic Testing 62
4.7.1: Zone and Appliance Testing 62
4.7.2: Testing by Zone 62
4.7.3: Scheduling 63
4.7.4: Test Indications 63

Section 5: Enhancements 65

5.1: Logic Equations 65
5.1.1: Monitoring with Logic Equations 66
5.2: Appliance Enhancements 66
5.2.1: Variable Speed Fan 66

Appendix A: Appliance Subaddressing Use Types 67
A.1: Introduction 67
A.1.1: Using the Subaddressing Tables 67
A.1.2: Table Legend and Notes 67
A.2: Subaddressing Tables 68
Table A.1, “Trouble Use Types” 68
Table A.2, “ON Control Use Types” 69
Table A.3, “ON Monitoring Use Types” 70
Table A.4, “OFF Control Use Types” 71
Table A.5, “OFF Monitoring Use Types” 72
Table A.6, “ON Control, ON Monitoring UseTypes” 72
Table A.7, “OFF Control, OFF Monitoring Use Types” 76
Table A.8, “ON & OFF Control, ON & OFF Monitoring Use Types” 79
Table A.9, “ON & OFF Control Use Types” 89
Table A.10, “ON Control, OFF Monitoring Use Types” 91
Table A.11, “OFF Control, ON Monitoring Use Types” 92
Table A.12, “ON & OFF Monitoring Use Types” 94
Table A.13, “OFF Control, ON & OFF Monitoring Use Types” 96
Table A.14, “ON & OFF Control, OFF Monitoring Use Types” 99
Table A.15, “OFF Control, ON & OFF Monitoring Use Types” 102
Table A.16, “ON & OFF Control, OFF Monitoring Use Types” 110
Appendix B: Appliance Scenarios and Wiring Diagrams 119
B.1: Introduction 119
B.1.1: Using the Appliance Scenarios 119
B.1.2: Module Wiring Diagrams 119
B.1.3: Contacts Format 119
B.1.4: Air Flow Switches 119
B.2: Dedicated Smoke Control Appliances 120
B.2.1: Dedicated Fans 120
B.2.2: Dedicated Motorized Dampers 125
B.2.3: Dedicated EP Dampers 132
B.3: Non-dedicated Smoke Control Appliances 139
B.3.1: Non-dedicated Fans 139
B.3.2: Non-dedicated Motorized Dampers 145
B.3.3: Non-dedicated EP Dampers 154
B.4: HVAC Appliances 163
B.4.1: HVAC Fans 163
B.4.2: HVAC Motorized Dampers 174
B.4.3: HVAC EP Dampers 189

Section 1: About This Manual

1.1 Description

The Gamewell GFP-A/AR Series Smoke Control Application is a firmware-only solution that adds feature-rich smoke control capability to the FACP, while reducing the time and complexity in configuring and programming smoke control devices and zones. The application uses SLC points to connect physical devices to a firmware engine at the FACP. In this way, each device and associated control/monitor module is optimized as a virtual smoke control appliance point (SCA) in the smoke control system. SCA points facilitate the monitoring and verification of the operating state of each appliance, and control the operation states of the appliance.

1.2 Standards and Other Documents

1.2.1 Installation Standards

This product is intended to be installed in accordance with the following standards:

NFPA 12 Standard on Carbon Dioxide Extinguishing Systems
NFPA 12A Standard on Halon 1301 Fire Extinguishing Systems
NFPA 13 Standard for Installation of Sprinkler Systems
NFPA 15 Standard for Water Spray Fixed Systems
NFPA 16 Standard for Deluge-Foam Water Systems
NFPA 17 Standard for Dry Chemical Extinguishing Systems
NFPA 17A Standard for Wet Chemical Extinguishing Systems
NFPA 70 National Electrical Code

- National Electrical Code/Article 300 Wiring Methods,
- National Electrical Code/Article 760 Fire Alarm Systems

NFPA 72 National Fire Alarm and Signaling Code

- Central Station Fire Alarm Systems (Automatic, Manual and Waterflow) Protected Premises Unit
- Local (Automatic, Manual, Waterflow and Sprinkler Supervisory) Fire Alarm Systems.
- Auxiliary (Automatic, Manual and Waterflow) Fire Alarm Systems (requires TM-8).
- Remote Station (Automatic, Manual and Waterflow) Fire Alarm Systems
- Proprietary (Automatic, Manual and Waterflow) Fire Alarm Systems (Protected Premises Unit).
- Initiating Devices for Fire Alarm Systems
- Inspection, Testing and Maintenance for Fire Alarm Systems
- Notification Appliances for Fire Alarm Systems

NFPA 92 Standard for Smoke-Control Systems
NFPA 2001 Clean Agent Fire Extinguishing Systems
NFPA 2010 fixed Aerosol Fire Extinguishing Systems

This product is intended to be installed in occupancies defined by the following codes:
IFC International Fire Code
NFPA 1 Fire Code
NFPA 101 Life Safety Code
NFPA 5000 Building Construction and Safety Code

1.2.2 Product Standards

This product has been designed to comply with standards set forth by the following regulatory agencies:
UL 38 Manually Actuated Signaling Boxes
UL 217 Smoke Detectors, Single and Multiple Station
UL 228 Door Closers - Holders for Fire Protective Signaling Systems
UL 268 Smoke Detectors for Fire Protective Signaling Systems
UL 268A Smoke Detectors for Duct Applications
UL 346 Waterflow Indicators for Fire Protective Signaling Systems
UL 464 Audible Signaling Appliances
UL 521 Heat Detectors for Fire Protective Signaling Systems
UL 864 Standard for Control Units for Fire Protective Signaling Systems
UL 1481 Power Supplies for Fire Protective Signaling Systems
UL 1971 Visual Signaling Appliances

1.3 UL 864 9th and 10th Edition

Per the UL Continuing Certification Program, UL 864 9th edition fire alarm control equipment will retain certification after the rollout of UL 10th edition (12/2/2018).

Installations of UL 864 10th Edition certified equipment are permitted to use UL864 9th Edition certified equipment when approved by the local Authority Having Jurisdiction (AHJ).

For product compliance, refer to the UL listing cards located on the UL online certification directory.
UL Product iQ: https://iq.ulprospector.com/en/

1.3.1 HVAC Operation and UL/NFPA Standards

HVAC operation is not consistent with the UL and NFPA standards for smoke control. HVAC operation should only be used for fan shutdown and building heating, ventilating, and air conditioning purposes.

1.4 Using this Manual

This document describes the concepts, components, and implementation of a smoke control system. The user should be familiar with the following documents, codes, and standards and refer to them for additional information:

- NFPA 92 Smoke Control Systems
- ASHRAE publication entitled Design of Smoke Management Systems
- NFPA 72 National Fire Alarm Code
- NFPA 101 Life Safety Code
- NFPA 90A Installation of Air Conditioning and Ventilation Systems

1.4.1 Supplemental Documentation

Table 1.1 lists documents referenced in this manual and documents for selected compatible devices. The CAMWorks+ Programming Utility is available for download from the manufacturer's website. The document series chart (DCO-GAM) provides current document revision. A copy of this document is included in every shipment.

Table 1.1 Reference Documentation

Document Name	Document Number
GFP-A/AR Listing Manual	LS10239-053GF-E
Lamp Driver Module Instruction Manual	LS10385-000GE-E
ACM-30 Instruction Manual	LS10238-000GE-E
MMI-6SF Manual Installation & Maintenance Instructions	I56-2742-009
MMI-10F Manual Installation & Maintenance Instructions	I56-2743-006
MMO-6RF Manual Installation & Maintenance Instructions	I56-2739-007
MMO-6SF Manual Installation & Maintenance Instructions	I56-2740-010

1.5 Cautions and Warnings

This manual contains cautions and warnings to alert the reader as follows:

CAUTION:

INDICATES INFORMATION ABOUT PROCEDURES THAT COULD CAUSE PROGRAMMING ERRORS, RUNTIME ERRORS, OR EQUIPMENT DAMAGE.

WARNING:

INDICATES INFORMATION ABOUT PROCEDURES THAT COULD CAUSE IRREVERSIBLE DAMAGE TO THE CONTROL PANEL, IRREVERSIBLE LOSS OF PROGRAMMING DATA OR PERSONAL INJURY.

1.6 Hardware Requirements

The required hardware is listed below:

- Panels: GFP-A/AR Series Fire Alarm Control Panel
- Annunciators: ACM-30, ACM-30W, LDM2-32, LDM2-60

1.7 Software Requirements

The minimum computer requirements for this application are as follows:

- CAMWorks+ Version 7.20 or higher

1.8 Smoke Control Application Requirements

A compatible fire panel can be upgraded in the field for smoke control functionality via firmware download from the web-site. Complete the upgrade instructions that accompany the firmware zip file. The Smoke Control Application requires the following components:

- Configured FACP in compliance with the AHJ specified implementation.
- Annunciators: ACM-30, ACM-30W, LDM2-32, LDM2-60
- FSCS: Auser provided floor plan for ACM-30/30W, or custom enclosure for LDM2-32/60
- Control Modules (Refer to Section 2.2.1)
- Monitor Modules (Refer to Section 2.2.1)
- Appropriate number of licenses for appliances, zones, SLC points.

1.8.1 Licensing Summary

Virtual (SLC) Points

Maximum 511 virtual points can be licensed and enabled for each FACP.

- Up to 10 virtual points can be configured without a license.

Smoke Zones Licenses

Maximum 250 zones for each FACP

- SCZ1 adds 1 zone
- SCZ5 adds 5 zones
- SCZ10 adds 10 zones

Appliance Licenses

Maximum 250650 appliances for each FACP

- SCA1 adds 1 Appliance
- SCA10 adds 10 Appliances
- SCA25 adds 25 Appliances
- SCA100 adds 100 Appliances
- SCA230 adds 230 Appliances

NOTE: *No licenses are required for HVAC appliances.*

NOTE: *IMPORTANT! Refer to the GFP-A/AR Listing Document for details on all smoke control licensing options.*

1.9 Smoke Control System Guidelines & Restrictions

- Pressurization is the most desired means of controlling smoke. If at all possible, utilize pressurization over airflow. Airflow is not the most practical method of limiting the movement of smoke because of the large quantities of air required.
- The process of purging is not an acceptable method of smoke control, however, it can be used as a supplement to airflow or pressurization.
- The Firefighters' Smoke Control station (FSCS) must be the top priority control interface and must provide full monitoring and manual override control capability for all smoke control systems and equipment.
- A building diagram that clearly indicates the type and location of all smoke-control equipment (fans, dampers, etc., either individually or by zone), as well as the building areas affected shall either be part of the FSCS or on a separate drawing with instructions to mount adjacent to the FSCS.
- Smoke dampers are classified as 0, I, II, III, or IV based on the amount of leakage they allow. Refer to Table 1.2 for the maximum leakage rates allowed for each classification.
- Duct detectors should not be used for activation of the smoke control systems.
- Manual pull stations should not be used for the activation of zoned smoke control systems, but can be used to activate stairtower pressurization systems.
- For systems implementing elevator smoke control, the open vent at the top of the hoistway should be eliminated.
- Single injection systems should be used in buildings that are eight stories or less. The reason for this is that with single-injection systems, pressurization of the stairtower could fail when a few doors near the supply fan are open. Supply air injected into the stairtower for pressurization purposes could be lost through these openings, thus preventing the pressure differences needed to limit the movement of smoke. Buildings of more than eight stories should utilize a multiple injection system.
- Dedicated smoke control systems require weekly automatic testing.

1.10 Definitions

Specialized terminology used in this manual is defined below.

Automatic Control (AUTO)

A smoke control system operates in automatic control state when initialized automatically by the fire control system's detection of a fire.

Buoyancy

The ability or tendency of smoke to rise in air.

Compensated System

A compensated smoke control system is where the air injected into a stairtower is modulated, or excess pressure is vented depending on the number of doors opened or closed in the stairtower. This keeps the pressure barrier relatively constant.

Dedicated System

A dedicated smoke control system is designed for the sole purpose of controlling smoke within a building, in that smoke control equipment is not linked to the building's HVAC controls. This is accomplished by forming a system of air movement that is separate and distinct from the building's HVAC system and only operates to control smoke.

Expansion

The ability or tendency of smoke to spread out and encompass larger areas.

Firefighter's Smoke Control Station (FSCS)

A Firefighter's smoke control station (FSCS) includes monitoring and overriding capabilities over smoke control systems and equipment provided at designated location(s) within the building for the use of the fire department.

Manual Control

A smoke control system operates in the Manual Control state when controls for the station are changed manually to override automatic control functions.

Multiple Smoke Control Station (MSCS)

Special FSCS application for redundant systems (See Section 3.1.3: Annunciator Configuration).

Noncompensated System

A noncompensated smoke control system is where a single speed fan provides pressurization in a stairtower. Pressure will vary depending on the number of doors opened into the stairtower.

Non-dedicated System

A non-dedicated smoke control system shares components with other air moving equipment. When the smoke control mode is activated, the operating of the building's air moving equipment changes in order to accomplish the objectives of the smoke control design.

OFF/CLOSED Control

The SLC address of the control module used to turn off or close the appliance (optional). Once an SLC point is assigned to a given appliance it cannot be assigned to another appliance.

OFF/CLOSED Monitoring

The SLC address of the monitor module used to verify the off or closed position of the appliance (optional). Once an SLC point is assigned to a given appliance it cannot be assigned to another appliance.

ON/OPEN Control

The SLC address of the control module used to turn on or open the appliance (optional). Once an SLC point is assigned to a given appliance it cannot be assigned to another appliance.

ON/OPEN Monitoring

The SLC address of the monitor module used to verify the on or open position of the appliance optional). Once an SLC point is assigned to a given appliance it cannot be assigned to another appliance.

Pairing

Pairing is a special smoke control function that allows smoke control interfaces to be grouped so that user authentication can be applied to multiple interfaces. The result of pairing is that all paired modules will respond to a manual override when any one of them is so commanded.

Pressurized Stairtowers

Pressurized stairtowers comprise a type of smoke control system in which stair shafts are mechanically pressurized with outdoor air to keep smoke from contaminating them during a fire.

Signaling Line Circuit (SLC) Points

Signaling line circuit points (SLCs) are addressable points that connect physical smoke control devices to control and monitoring equipment and the FACP.

Smoke

The airborne solid particulates and gases that evolve when a material undergoes pyrolysis or combustion, together with the quantity of air that is mixed into the mass.

Smoke Barrier

A vertical or horizontal membrane, such as a wall, floor, or ceiling assembly that is designed and constructed to resist the movement of smoke. A smoke barrier may or may not have a fire resistance rating. Smoke barriers may have openings protected by closing devices or adequate air flows. Smoke barriers define all the boundaries of smoke control zones including walls, floors and ceilings that must be constructed as continuous structures to limit the spread of smoke.

Smoke Control Appliance (SCA)

A pseudo point that represents an air movement device (i.e., fan, damper, door) used in smoke control applications that will typically have two or more associated SLC points for control and/or monitoring.

Smoke Control Application

The Smoke Control Application is a firmware-only solution that adds smoke control capability to the FACP by using virtual addressable points to connect physical devices to specialized engines at the FACP. In this way, each device and associated control/monitor module is optimized as a virtual smoke control appliance point (SCA) in the smoke control system. Smoke control zones (SCZ) allow activation of multiple appliances simultaneously in a specified area.

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 airflows and pressure differences across smoke barriers to limit and direct smoke movement. A smoke control system uses fans to move air and produce pressure variances between smoke barriers which reduce smoke and direct its movement. A smoke control system consists of control equipment, intermediate equipment such as motor controllers and electro-pneumatic valves, and the controlled fans and dampers. Smoke control systems include shaft protection and floor protection systems. Shaft protection includes stairtower pressurization systems and elevator hoistway systems. The individual system or combination of systems utilized depends on local codes and specific building applications.

Smoke Control Zone (SCZ)

A space within a building enclosed by smoke barriers, including the top and bottom, that is part of a zoned smoke control system. Smoke Control Zones are intended to reduce smoke infiltration into non-fire areas. This is accomplished by using partitions, floors and doors to create separate compartments which can be isolated from one another during a fire. The compartments can be entire floors or sections within a floor. Fans are utilized to create pressure differences between smoke control zones, thus limiting the spread of smoke from the original fire area.

Smoke Damper

A device designed to resist the passage of air or smoke that meets the requirements of UL 555S Standard for Smoke Dampers. A combination fire and smoke damper should meet the requirements of UL 555 Standard for Fire Dampers, UL 555C Standard for Ceiling Dampers, and UL 555S Standard for Smoke Dampers. Units for use in Canada should meet the requirements of ULC/ORD-C100-92 Smoke Control System Equipment. Smoke dampers are required in ducts at points where the ducts enter or leave a smoke control zone, unless a duct is part of the smoke control system. Smoke dampers must restrict smoke or air movement out of or into a specific area.

Smoke Exhaust System

A mechanical or gravity system intended to move smoke from the smoke zone to the exterior of the building. It can include smoke removal, purging, and venting systems, as well as the function of exhaust fans utilized to reduce the pressure in a smoke zone. Maintenance of a tenable environment in the smoke zone is not within the capability of these systems. A fire floor exhaust increases the pressure difference across the stairtower doors in addition to reducing the pressure on the fire floor.

Smoke Proof Enclosure

A smoke proof enclosure is a continuous stairway enclosed from top to bottom by a two-hour fire wall and which exits to a public area. Entry into the stairway must be through vestibules or outside balconies on each floor. The design must limit smoke entry and include natural or mechanical ventilation.

Smoke Zone

The smoke control zone in which the fire is located.

Stack Effect

The vertical airflow within a building caused by temperature differences between the interior and exterior of the building.

Stairtower Pressurization Systems

A stairtower pressurization system maintains a smoke-free environment in the stairtower during a fire for the evacuation of building occupants and as a route for firefighters. It should limit smoke infiltration from the fire floor.

Tenable Environment

A tenable environment is one where life can be sustained and the quantity and location of smoke is limited or restricted to allow for evacuation. In a zoned smoke control system, pressure differences are used to maintain a tenable environment in an area intended to protect building personnel during evacuation.

Trouble Delay Timer

A software timer in the smoke control application specifies a time period for equipment to respond to a particular event. If the defined state is not confirmed within this time interval, a trouble condition occurs.

Vestibule

A small entrance hall or room, either to a building or to a room within a building.

Zoned Smoke Control

Zoned smoke control is a system that employs exhaust and pressurization for all contiguous smoke control zones. Remaining smoke control zones in the building may also be pressurized. A zoned smoke control system may be activated by a waterflow switch, heat detector, or automation.

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1.11 Principles of Smoke Movement

This section is a general outline of the concepts, components, and implementation of a smoke control system. During a fire inside of a building, smoke often flows away from the fire to unwanted areas, threatening life and damaging property. Exit passageways, stairwells and elevator shafts often become smoke-filled, inhibiting or preventing safe evacuation.

All fires produce smoke and the movement of smoke will follow the same pattern as the overall air movement within a building. Very simply, a smoke control system must be able to inhibit the flow of smoke within a building. Movement of smoke includes one or more factors listed below and described in the paragraphs that follow:

- stack effect
- buoyancy of the smoke
- expansion
- wind
- elevator effect
- the HVAC system

Stack Effect

Stack effect is defined as the vertical flow of air due to temperature differences between the interior and exterior of a building. Generally, there is an upward movement of air within building shafts (stairwells, elevator hoistways, etc.) when the air outside the building is colder than the air inside. This is referred to as normal stack effect. The air in the building has a tendency to rise because it is warmer and less dense than the outside air. The taller a building is and the greater the temperature differences between the building interior and exterior are, the greater the tendency is for air to rise in the shafts. The opposite is true when the outside temperature is warmer than the temperature inside the building, causing a downward movement of air within building shafts. This is referred to as reverse stack effect. shows the overall airflow tendencies within a building due to normal and reverse stack effect.

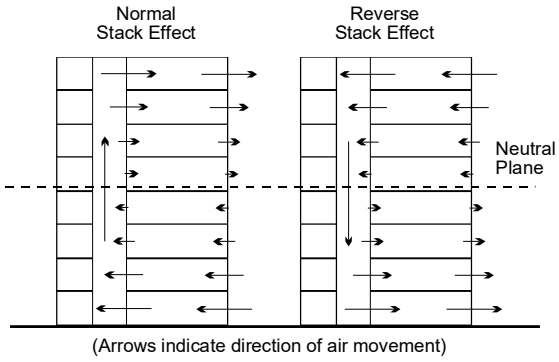


Figure 1.1 Air Flow Due to Stack Effect

The neutral plane of a building is defined as the elevation where the hydrostatic pressure inside the building equals that outside. The neutral plane is normally located at the midpoint of the building, but can occur at any floor and depends on building design. The neutral plane of a building should be determined before design of a smoke control system.

NOTE: *For information on calculating a building's neutral plane, refer to ASHRAE Publication Design of Smoke Management Systems.*

Another factor involved in determining stack effect is the temperature of the smoke. Reverse stack effect, as described below, reacts only with relatively cool smoke caused as a result of smoldering fires. Relatively hot smoke, the result of fast burning fires, will still have a tendency to rise into the shaft against reverse stack effect due to the effects of buoyancy. Normal stack effect reacts with both hot and cool smoke.

In a building with normal stack effect, smoke from a fire will follow the airflow into the shaft. If the source of the fire is below the neutral plane, the smoke will flow up the building shaft until after it crosses the neutral plane. Once the smoke crosses the neutral plane, its tendency will be to flow into the floors above the neutral plane. The effects of buoyancy can also add to the upward movement of smoke due to the temperature of the smoke, as described below.

In a building with reverse stack effect, only relatively cool smoke will follow the downward tendency of air into the shaft. If a smoldering fire occurs on a floor above the neutral plane during reverse stack effect conditions, the smoke will travel into and down the shaft and deposit itself on the floors below the neutral plane. In the case of hot smoke, buoyancy forces can counteract reverse stack effect causing the smoke to move up the shaft.

Buoyancy

High-temperature smoke has a lower density than cool smoke. Because of this reduced density, it has a greater tendency to rise through the air and create a buoyant pressure in the smoke zone. The pressure buildup within a compartment due to buoyancy forces moves smoke to the floor above the fire floor through any leakage paths in the ceiling. The buoyant pressure will also cause smoke movement through any leakage paths in the walls or around doors. As smoke travels away from a fire, its temperature drops due to heat transfer and dilution. Therefore, the effects of buoyancy generally decrease with distance from the fire.

Expansion

In addition to stack effect and buoyancy, the energy released by a fire can cause smoke movement due to expansion. In a fire compartment with only one opening to the building, air will flow into the compartment and hot smoke will flow out. For a fire compartment with open doors and windows, the movement of smoke due to expansion is negligible. However, the effects of expansion should be taken into consideration for tightly sealed compartments where fires can occur. It is possible for the volume of smoke to almost triple in size when temperatures of over 1000°F are reached. For tightly sealed compartments, the buildup of pressure resulting from expansion causes smoke movement through any leakage paths in the walls or around doors.

Wind

Wind can have a dramatic effect on smoke movement. Frequently in fire situations, a window or break is left open in the fire compartment. If the opening is on the windward side of the building, the wind causes a buildup of pressure in the fire compartment and forces smoke throughout the floor and possibly to other floors. Pressures caused by the wind in this condition can be large and easily dominate smoke movement throughout the building. If the opening is on the leeward side of the building, the reverse is true. The negative pressure created by the wind vents the smoke from the fire compartment, greatly reducing the smoke movement through the building (Figure 1.2).

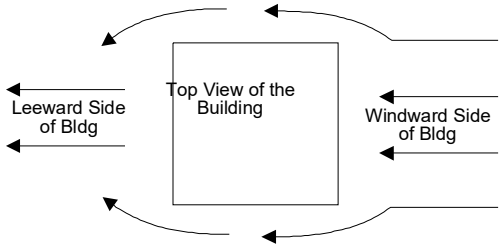
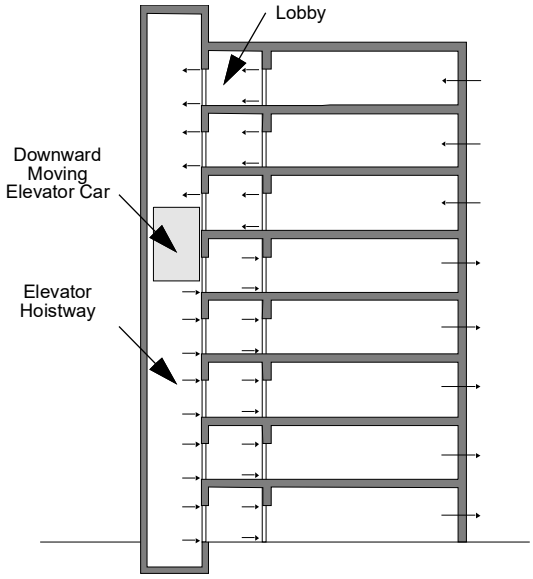


Figure 1.2 Wind Effects on a Building

Elevator Piston Effect

The movement of an elevator car in a shaft produces temporary pressure differences both above and below the moving car.A downward moving elevator car creates a temporary pressure increase in the area below the car and a temporary pressure decrease in the area above the car. The reverse is true for an upward moving elevator car. The temporary pressure increase in the elevator shaft tends to move air into the floors below the car and the temporary pressure decrease tends to move air from the floors above into the elevator shaft (Figure 1.3). Pressure differences due to the piston effect are greater in single car elevator shafts as compared to multiple car shafts because in a multiple car shaft there is usually more room to the left and right of the moving car to allow for pressure relief.



(Arrows indicate direction of air movement)

Figure 1.3 Elevator Piston Effect

HVAC Systems

Before the development of smoke control, HVAC systems were shut down when fires were discovered for two main reasons:

- HVAC system frequently aided the movement of smoke during a fire condition, transporting smoke to every area that it serves.
- HVAC system also supplied air to the fire space, which has a tendency to fuel a fire.

An HVAC system, however, may aid in the detection of a fire in its early stages by transporting smoke from an unoccupied area to a space where building occupants can be alerted to the fire. Once a fire is detected, the HVAC system should be designed to either shut down the fans or provide a special smoke control mode. If neither of these steps is taken, the HVAC system would transport smoke to every area that the system serves, thus endangering life, damaging property, and inhibiting fire fighting.

However, shutting down the fans does not prevent smoke movement through the supply and return air ducts, air shafts, and other building openings due to stack effect, buoyancy, and wind. Installation of smoke dampers for when the system is shut down can help inhibit smoke movement in this case.

NOTE: *Utilizing an HVAC system for smoke control will be discussed in detail in the sections that follow.*

1.12 Principles of Smoke Control

Smoke control employs pressurization to prevent the movement of smoke into stairwells, along with use of the building's ventilation system to vent or exhaust the fire floor and pressurize surrounding floors. Pressurization, produced by mechanical fans, limits smoke movement in fire situations. The three major considerations for smoke control are: smoke containment, purging, and door-opening forces. These principles are described below.

1.12.1 Smoke Containment

The area where the fire is located is considered the smoke zone. Basic principles for containing smoke within that smoke zone are Pressurization (air pressure differences across barriers can act to control smoke movement) and Airflow (ventilation that can control smoke movement if the average air velocity is of sufficient magnitude).

Pressurization

Pressurization results in airflows in the small gaps between smoke control zones preventing smoke movement through these openings. Technically, pressurization uses airflow and thus is a special case of the second principle, but considering the two principles separately is advantageous for smoke control design.

Pressurization is employed by creating pressure differences across partitions that separate the smoke zone from other areas. This can be accomplished by making pressure in the area surrounding the smoke zone higher than pressure in the smoke zone itself (Figure 1.4). Airflow through construction and door cracks prevents the movement of smoke to the high-pressure side. The pressure difference must be sufficient to contain the smoke in the smoke zone and at the same time allow doors leading to exit routes to be opened. *Pressurization is the most desired means of controlling smoke.*

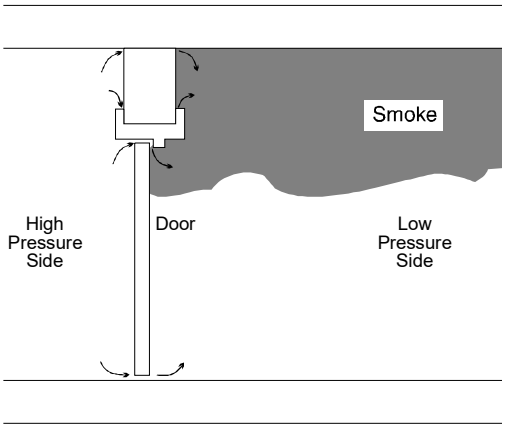


Figure 1.4 Pressurization

Air Flow

When the door in the barrier is open, air flows through the opening. When the air velocity is low, smoke can flow from the smoke zone into unwanted areas. Airflow is employed by controlling the flow of air into a smoke zone and that flow must be sufficient to prevent the migration of smoke from the zone. This process is usually used to prevent the flow of smoke down corridors or through open doorways (Figure 1.5). *Airflow is not the most practical method of limiting the movement of smoke because of the large quantities of air required.*

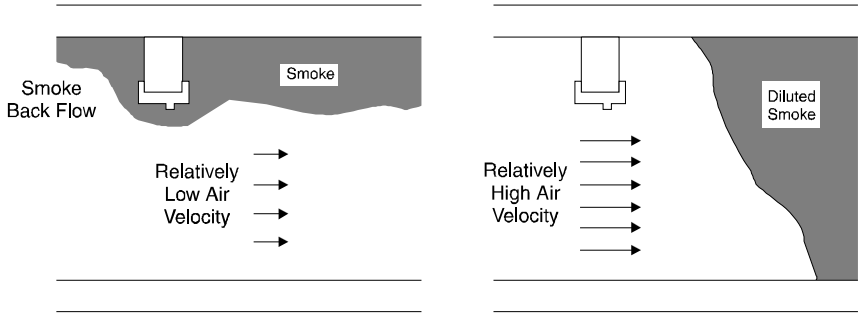


Figure 1.5 Airflow

Purging

Pressurization and Airflow methods for controlling smoke will not always maintain airflows sufficient to prevent smoke from moving through open doors into a protected area. Ideally, doorways will be open for only short periods of time during evacuation. Smoke that has entered a protected space can be purged or diluted by supplying outside air to the space. Purging is employed through the use of an exhaust inlet, usually located near the ceiling, and a supply outlet, usually located near the floor. The supply and exhaust points must be placed far enough apart to prevent the supply air from blowing directly into the exhaust. If the supply and exhaust points are placed too close, the purging operation will not function properly. *While purging is not an acceptable method of smoke control on its own, it can be used as a supplement to airflow or pressurization.*

Door-Opening Forces

A door-opening force is the force required to open a door. During smoke control operation, this force can increase considerably, especially if pressure differences are being used across partitions. The door-opening force during a fire condition can be described as the sum of the forces needed to overcome the pressure difference across the door and to overcome the door closer. *Door-opening forces must be considered for a smoke control system because unreasonably high door-opening forces can hinder or prevent people from reaching their escape routes.*

1.13 General System Components

In general, all smoke control systems have the following basic components (Figure 2.1):

- HVAC equipment (fans, dampers, ductwork, etc.)
- Control Equipment (fire alarm control panel, firefighter's smoke control station, HVAC controls)
- Initiating Devices (smoke detectors, manual pull stations, etc.)

1.14 HVAC Equipment

1.14.1 HVAC Systems

Whether serving the dual purpose of maintaining the environmental conditions in the building and controlling smoke in a fire situation (Non-dedicated System), or the sole purpose of controlling smoke (Dedicated System), HVAC systems can usually be adapted for smoke control, and some HVAC systems can provide the necessary capabilities without modification. When used for smoke control applications, HVAC systems must have the following capabilities:

- supply outside air to a space
- return air from a space
- exhaust air from a space to the outside

An HVAC system can consist of nothing more than a fan in a housing, such as a roof-mounted exhaust fan, or it can be a more complex system with ductwork, supply air outlets, return air inlets, fresh air intakes, humidifiers, filters, heating and cooling coils, preheat coils, and dampers. Examples of commonly used HVAC units and their effects on smoke control are explained below.

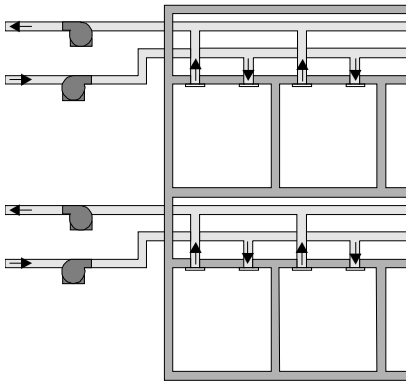


Figure 1.6 Individual Floor Units

Individual Floor Units

Air-handling units of this type usually serve one floor or a portion of a floor. These units may or may not have separate supply and exhaust fans. Individual floor units can be utilized in a smoke control system as long as they are capable of providing sufficient outside air and exhaust capability (Figure 1.6).

Central HVAC System

Centralized equipment is usually employed to provide HVAC functions to multiple floors of a building. These types of systems may require dampers for the supply and exhaust shafts at each floor. Dampers at each floor for the exhaust shaft provide the capability to exhaust smoke from the fire floor while closing the dampers for all other floors. This prevents the unwanted movement of smoke to other floors that the unit serves. Dampers at each floor for the supply shaft provide the capability to pressurize the floors surrounding the fire floor while closing the dampers for all floors where pressurization is not desired (Figure 1.7).

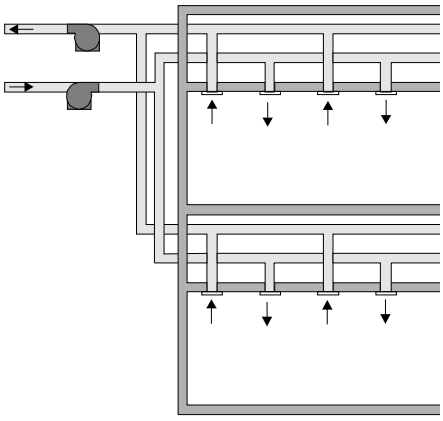


Figure 1.7 Central HVAC System

Induction Units

Induction-type air-handling units are usually used in conjunction with a central HVAC system which supplies high-pressure air to the induction units. Induction units are located around the outside of a building and are used to condition the air for areas around the perimeter of the building. Room air is then drawn into the induction unit and mixed with the primary air from the central system and returned to the room. Induction units serving a fire area should be shut down or the primary air from the central system should be closed off.

Dual Duct Systems

Dual duct systems have separate heating and cooling coils, each located in a separate compartment. These types of systems also have separate ducts to supply hot and cold air from each coil compartment to mixing boxes. The mixing boxes are used to mix the hot and cold air which will be supplied to the area served (Figure 1.8).

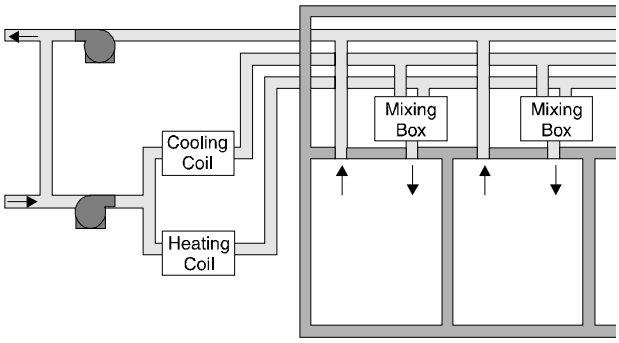


Figure 1.8 Dual Duct System

Multi-zone Systems

Multi-zone systems are similar to dual duct systems since they both have heating and cooling coils located in separate compartments. The difference is that multi-zone systems mix the air at the unit and supply the mixture through low-pressure ducts to each space.

Variable Air Volume (VAV) Systems

Variable Air Volume systems usually supply central cooling only. The individual areas served by these types of systems typically reheat the air near or in the area to be served, or have other sources of heating. Some VAV systems connect a bypass from the intake side of the supply fan to the outlet side of the supply fan (Figure 1.9) to reduce supply air volumes and pressure in the duct work. *Such bypasses must be closed for smoke control applications to ensure sufficient pressurization of protected areas*.

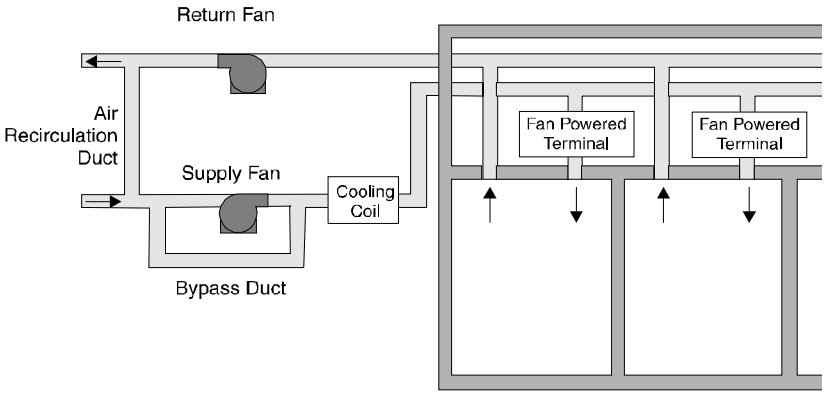


Figure 1.9 VAV System with Fan Powered Terminals

Fan-Powered Terminals

Fan-powered terminals are used in conjunction with VAV systems to provide the reheat capability of cool air being supplied to a particular area and to circulate air within the space. During a fire condition, terminal unit fans serving other areas may continue to operate normally. *Terminal unit fans serving a fire area must be shut off for smoke control applications.*

1.14.2 Ductwork

Ductwork is constructed of various materials including steel, aluminum, concrete, and masonry. Ductwork usually connects fans with the areas to be served. Air travels from supply fan through the supply ducts into the building. Return air is often pulled through the plenum space above the ceiling, as shown in Figure 1.10: View A. Ductwork, however, can be used for the return air as well, as shown in Figure 1.10: View B. When in use, both the supply and return ductwork are typically located in the area above a suspended ceiling.

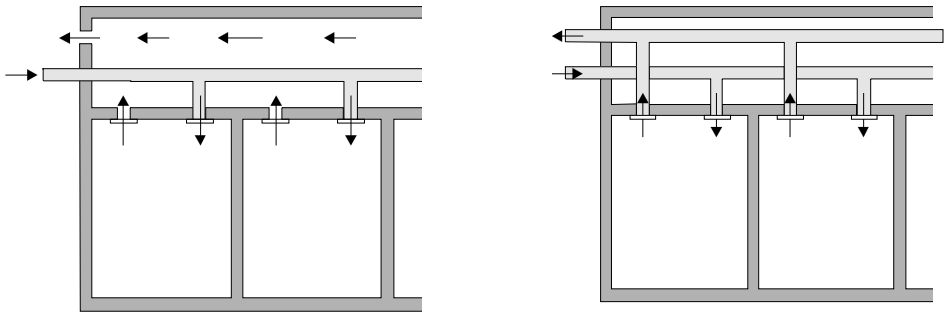
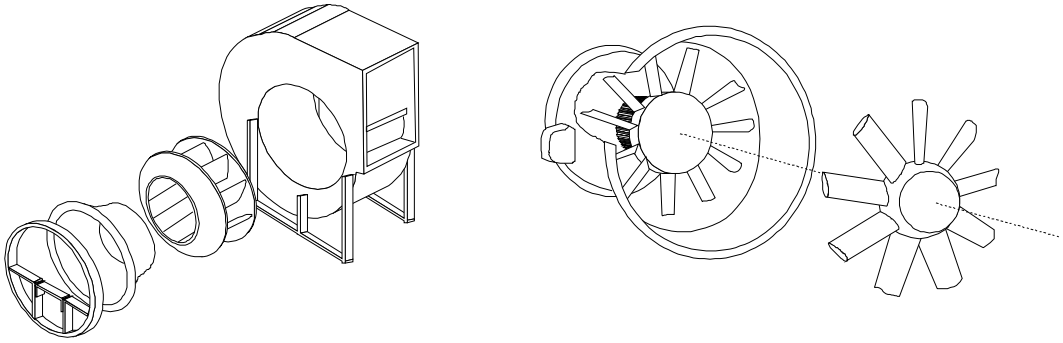


Figure 1.10 Supply and Return Ductwork Examples

1.14.3 Fans

There are two general types of fans: centrifugal and axial. Figure 1.11 shows the basic parts of each fan type. Airflow out of a centrifugal fan is primarily in the direction perpendicular to the airflow in, whereas airflow out of an axial fan is primarily in a direction parallel to the airflow in.



Centrifugal Fan Axial Fan

Figure 1.11 Fan Types

Centrifugal Fans

Centrifugal fan types are usually classified by impeller design: forward-curved, backward-curved, and airfoil.

- Forward-curved centrifugal fans rotate at a relatively low speed and are generally used to produce high flow rates and low static pressures. They are commonly used for low-pressure HVAC applications including residential furnaces and packaged air-conditioning equipment.
- Backward-curved fans rotate at approximately twice the speed of forward-curved fans and are used for general purpose HVAC applications. These type fans are more efficient than forward-curved fans and are commonly more expensive. Both forward- and backward-curved fans have single width blades. Airfoil fans are basically backward-curved fans with blades of varying thicknesses.
- Airfoil blades are designed with the same technology that is used to design airplane wings. Airfoil fans are used for general purpose HVAC, but are reserved for large system applications where high pressures are needed.

NOTE: *Backward rotation of a centrifugal fan results in reduced airflow in the normal direction. It does not result in reverse airflow, which is a common misconception.*

Axial Fans

The most common types of axial fans are propeller fans, tubeaxial fans, and vaneaxial fans.

- Most propeller fans are designed to providing high flow rates and low pressures. Some common applications include kitchen exhaust, rest room exhaust, stairwell pressurization, and space ventilation. *Propeller fans are highly susceptible to adverse pressure conditions such as the effects of wind.*
- Tubeaxial fans are capable of operating at higher pressures than propeller fans. Blades of tubeaxial fans can be of single thickness or airfoil design. Tubeaxial fans are used to provide low- to medium-pressures for HVAC applications.
- Vaneaxial fans are capable of operating at higher pressures than tubeaxial fans. Blades of vaneaxial fans can be of single thickness or airfoil design. Vaneaxial fans are used to provide low- to high-pressures for HVAC applications.

NOTE: *Unlike centrifugal fans, the backward rotation of axial fans normally results in a reverse airflow at a reduced rate.*

1.14.4 Dampers

In HVAC systems, dampers are used to balance airflow, control airflow, relieve excess pressure, resist the passage of fire, or resist the passage of smoke. Dampers used to resist the passage of fire are called fire dampers. Dampers used to control the passage of smoke are called smoke dampers. Fire dampers and smoke dampers can be of multi-blade or curtain construction (Figure 1.12).

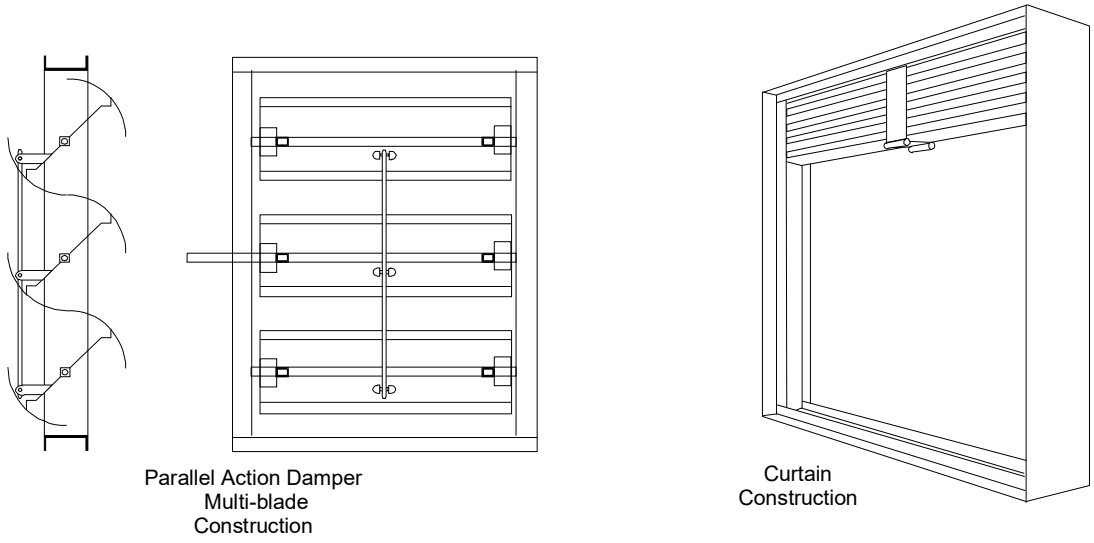


Figure 1.12 Damper Types

Fire Dampers

Fire dampers in the United States are usually constructed and labeled in accordance with standard UL 555 (UL 1990a). Generally, fire dampers, whether multi-blade or curtain type, are held open by a fusible link that comes apart in a fire situation. Multi-blade dampers are usually spring loaded so that when the fusible link is broken, the spring initiates the closing action. Curtain dampers can be closed by spring activation or by gravity once the fusible link is broken.

Smoke Dampers

Smoke dampers in the United States are usually constructed and classified for leakage in accordance with standard UL 555S (UL 1983). UL 555S contains requirements for leakage-rated dampers intended for use in HVAC systems. Smoke dampers are classified as 0, I, II, III, or IV based on the amount of leakage they allow. Table 1.2 lists the maximum leakage rates allowed for each classification. Additionally, each classification is rated for ambient or elevated temperatures of 250°F or higher in increments of 100°F.

Class 0 smoke dampers (zero leakage) are usually used in nuclear power plants or similar situations where absolute containment is required. Classes I, II, III, and IV are usually acceptable for smoke control applications in other types of buildings.

Table 1.2 smoke Damper Classifications

	Leakage (cfm/ft^2)			
Classification	**at 1.0 in. H_2O**	**at 4.0 in. H_2O**	**at 8.0 in. H_2O**	**at 23.0 in. H_2O**
0	0	0	0	0
I	4	8	11	14
II	10	20	28	35
III	40	80	112	140
IV	60	120	168	210

1.15 Control Equipment

1.15.1 Fire Alarm Control Panel (FACP)

The FACP and related equipment should work in cooperation with the smoke control system and not counteract its operation. Normally, detection of a fire by a smoke detector will cause the activation of the smoke control system. Since the detector is usually controlled and monitored by the FACP, some communication between the FACP and the smoke control system may be necessary.

1.15.2 Firefighter's Smoke Control Station (FSCS)

The FSCS usually provides the control and annunciation to a particular smoke control system. Most smoke control systems have an automatic mode that will function upon initial detection of a fire. However, the FSCS must provide full monitoring and manual override control capability for all smoke control systems and equipment. The FSCS should also have the highest priority control over all smoke control systems and equipment. The LDM2-32/60 and ACM-30/30W can be used as an FSCS.

1.16 Initiating Devices

1.16.1 Smoke Detectors

The initiation of a smoke control system is usually caused by the detection of fire conditions from some form of initiating device. These devices can include smoke detectors, heat detectors, and waterflow switches. Smoke detectors, whether photoelectric or ionization type detectors, if properly installed and maintained can provide proper detection of smoke to initiate the activation of the smoke control system. However, activation of one smoke detector may not be sufficient cause to activate the smoke control system. A combination of two detectors (both active) in a particular smoke zone may provide better evidence that the smoke control system should be activated.

Thermal type heat detectors and water flow switches may provide proper detection of a fire, but more often than not, a fire is already in full swing by the time these devices are activated. Although activation of the smoke control system is essential by the time these devices are activated, it would be wise to ensure that the smoke control system is operational before these conditions present themselves.

Duct detectors should not be used for activation of the smoke control system because smoke can migrate away from the fire area into ducts in other areas causing the smoke control system to pressurize and depressurize the wrong areas.

1.16.2 Manual Pull Station

Manual pull stations should not be used for the activation of zoned smoke control systems. A pull station does not give any specific indication of the fire's location. For instance, a person could activate a first floor pull station when evacuating the building because of a fire on the third floor. A zoned smoke control system should not be activated as a result of this pull station because the smoke control system would be pressurizing and depressurizing the wrong areas. However, a stairtower pressurization system or an elevator hoistway system could be activated in order to limit the movement of smoke.

1.17 Smoke Control System Types

A smoke control system must be designed to inhibit the flow of smoke into exit passageways, or other similar areas of the building. Such systems must control the migration of smoke to maintain tenable conditions, but it should not be expected that such areas would be completely free of smoke. Smoke control systems must be engineered with the occupants and building design in mind. Additionally, the smoke control system design should be coordinated with other life safety systems so that they complement each other.

A smoke control system properly installed and programmed in accordance with the documents listed in Section 1.2, “Standards and Other Documents”, should provide the following controls:

- Help maintain a tenable environment in evacuation routes during the time required to evacuate people from the area.
- Help restrict the movement of smoke from the fire area.
- Help provide conditions in non-smoke areas that will enable fire officials to conduct search and rescue operations, and to find and combat the fire.
- Assist in protecting life and property.

Smoke control system types and implementations are depicted in Figure 1.13, showing how a smoke control system can be a dedicated or non-dedicated system. Once that commitment is made, any combination of protection schemes can be implemented. For instance, the user can select a dedicated system which employs both shaft protection and floor protection where a compensated stairtower pressurization system and zoned smoke control are used. Definitions are given below for dedicated and non-dedicated systems, shaft and floor protection, followed by detailed explanations of Stairtower Pressurization, Elevator Hoistway, and Zoned Smoke Control Systems.

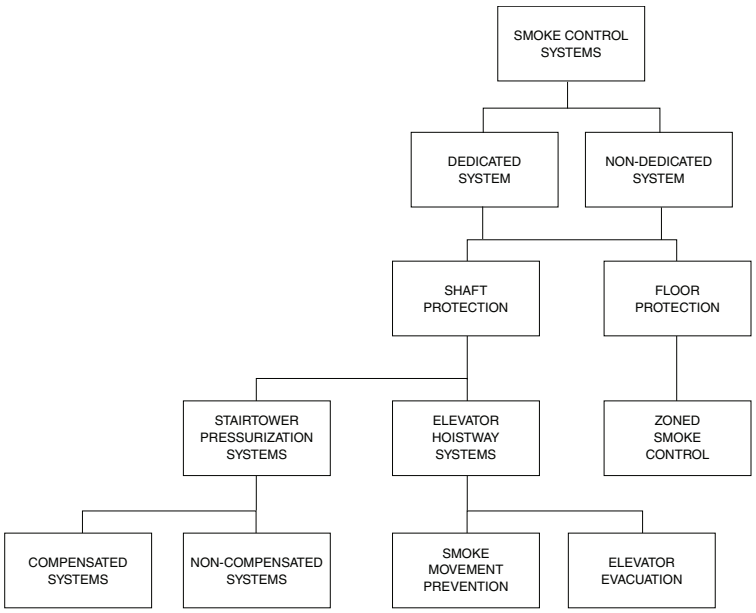


Figure 1.13 Smoke Control System Types and Implementations

1.17.1 Basic System Descriptions

Dedicated Smoke Control Systems

Dedicated smoke control systems are designed for the sole purpose of controlling smoke within a building. The equipment is not linked to building HVAC controls. This is accomplished by forming a system of air movement separate and distinct from the building's HVAC system. Dedicated systems only operate to control the flow of smoke, and may use pressurization or airflow as the control method.

Non-dedicated Smoke Control Systems

Non-dedicated smoke control systems share components with other air moving equipment. When the smoke control mode is activated, operation of the building's air-moving equipment changes in order to accomplish the objectives of the smoke control design. Non-dedicated systems may use pressurization or airflow as the control method.

Shaft Protection

Shaft protection provides for smoke movement in stairtowers and elevator hoistways in either a dedicated or non-dedicated system environment. It is accomplished through stairtower pressurization systems and elevator hoistway systems, described in 2.5.2 and 2.5.3.

Floor Protection

Floor protection systems limit smoke that flows through shafts and cracks in floors or partitions in either a dedicated or non-dedicated system environment. If this smoke is not controlled, its movement between floors can damage property and threaten life in locations remote from the fire. Floor protection is implemented by utilizing variations of zoned smoke control, which is designed to limit this type of smoke movement and described more fully in Section 1.17.4, “Zoned Smoke Control Systems”.

1.17.2 Stairtower Pressurization Systems

Stairtower pressurization systems are used to provide a tenable environment within the stairtower in the event of a building fire. A pressurized stairtower must maintain a pressure difference across a closed stairtower door to limit the migration of smoke. Stairtower pressurization can be accomplished with one of two systems: Noncompensated or Compensated.

- A Noncompensated system injects air from outside the building into the stairtower with a single-speed fan, keeping the pressure in the stairtower constant with all doors closed. If one or more of the doors in the stairtower are opened, the pressure difference will decrease.
- A Compensated system adjusts the pressure in the stairtower based on the combination of doors that are opened and closed, thus maintaining a constant pressure difference throughout the stairtower. This is accomplished by either modulating supply airflows or by relieving excess pressure from the stairtower.

Single Injection

Figure 1.14: View A shows a single-injection system supplies air for pressurization at one location in the stairtower, usually at the top. One of the main concerns with single-injection systems is that the pressurization of the stairtower could fail when a few doors near the supply fan are open. The supply air being injected into the stairtower for the purpose of pressurization could be lost through these openings, thus preventing the pressure differences necessary to limit the movement of smoke. *It is recommended that single injection systems be used in buildings that are eight stories or less.*

Single-injection systems can also have supply air injected from the bottom of the stairtower, but the same failure can occur when the exterior door is opened. The supply air can flow directly out the open doorway preventing pressurization of the stairtower. *It is recommended that supply air inlets be located at least one floor above or one floor below exterior doors.*

Multiple Injection

Figure 1.14: View B shows a multiple-injection systems provide several supply inlets distributed over the height of the stairtower, thereby overcoming the limitations of single-injection systems. Multiple-injection systems can be built with supply air injection points at each floor. Although this would overcome the problem associated with single-injection systems, it may be unnecessary. An acceptable distance for spacing of inlets is three floors. However, spacing of more than three floors can be used as long as the designer determines that the loss of pressurization air through a few open doors does not lead to loss of stairtower pressurization.

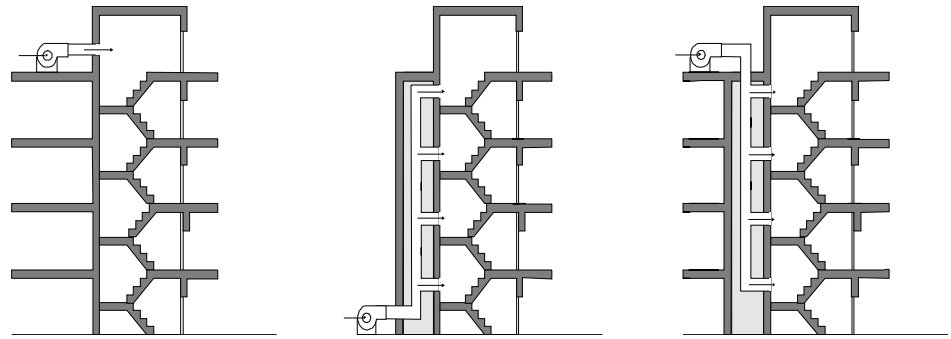


Figure 1.14 Stairtower Pressurization Systems

Compartmentalization

Compartmentalization can be used as an alternative to multiple injection pressurization. It involves dividing the stairtower into a number of sections (Figure 1.15). The stairtower is divided in sections of one to eight floors each, where each compartment is separated from the other by walls and doors that are normally closed. Each compartment would also have at least one supply air injection point. Compartmentalization is used for stairtowers that would normally be too tall for proper pressurization. However, stairtowers which use compartmentalization require a larger floor area to accommodate the walls and doors that separate the compartments. Another drawback for compartmentalization occurs when the doors between the sections are open. This would result in insufficient pressures to limit the movement of smoke. *Compartmentalization is not recommended for densely populated buildings where total evacuation is planned for the stairwell.*

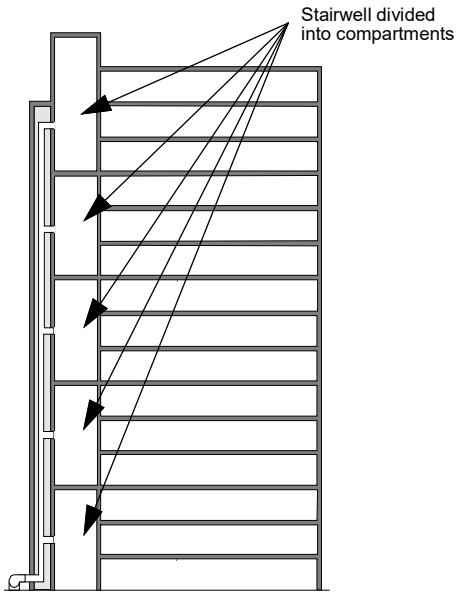


Figure 1.15 Compartmentalization of Pressurized Stairtower

Vestibules

A vestibule is a small room leading into another room, or in this case a stairwell. For the purpose of smoke control, there would be a door leading into the vestibule and a door leading from the vestibule to the stairtower. Since the possibility of both doors being open is smaller than if only one door were present, the possibility of smoke entering the stairtower and the possibility of pressurization air escaping into the building would be reduced. However, an evacuation analysis should be performed to determine the likelihood of both doors being open simultaneously. The vestibule can either be pressurized or not pressurized.

1.17.3 Elevator Hoistway Systems

Elevator hoistways can adversely contribute to smoke movement throughout a building. This is due mainly to elevator doors not being tight fitting, and openings and vents at the top of elevator hoistways. The major contributor to smoke movement in an elevator hoistway is the stack effect of the building. Two categories of elevator smoke control are described in brief below.

- Smoke control for prevention of smoke movement is intended to prevent smoke migration to other floors via the elevator shaft.
- Smoke control for elevator evacuation is intended to provide a safe means of egress in the event of a fire. This would include not only smoke protection, but fire protection and any other features necessary to make the elevator safe for fire evacuation.

There are several ways of accomplishing elevator smoke control:

- Exhausting smoke from the fire floor
- Pressurizing elevator lobbies
- Constructing smoke-tight elevator lobbies
- Pressurizing elevator hoistways

NOTE: *For systems implementing elevator smoke control, the open vent at the top of the hoistway should be eliminated.*

Smoke Movement Prevention Systems

These types of systems are usually designed to supply air to a shaft, producing pressure differences sufficient to prevent the flow of smoke into the elevator hoistway in the event of a fire (Figure 1.16). During a fire condition for this type of system, elevator cars should be taken out of normal service and automatically returned to the ground floor, or an alternate floor if the fire is detected on the ground floor.

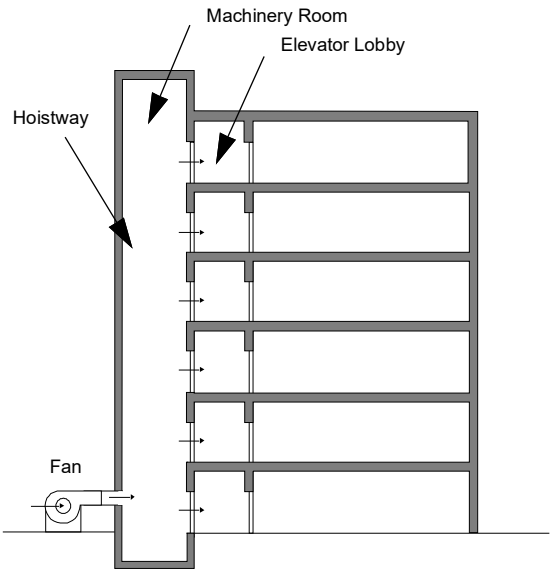


Figure 1.16 Elevator Smoke Control Using Shaft Protection

Elevator Evacuation

Most elevator systems do not provide the proper protection necessary for evacuation in the event of a fire. The question of using elevators for the purpose of fire evacuation has resulted in many concerns, e.g.,

- While waiting for the elevator during a fire condition, occupants may be exposed to fire, smoke, or developing panic.
- Elevators could stop unnecessarily at floors involved in fires, exposing occupants to fire and smoke.
- Elevators cannot start until the doors are closed. In a fire situation, large numbers of people trying to crowd into an elevator might make it impossible to start.
- Power failure due to fire or water damage could render elevators inoperable, possibly trapping occupants between floors.

Therefore, an elevator system used for fire evacuation must meet the following requirements:

- Elevator control must ensure safe efficient evacuation.
- Reliable electrical power must be supplied.
- Elevator controls, control wiring, and electrical power must be protected from fire or water damage.
- Elevator lobbies, hoistways, and machinery rooms must be protected against fire and smoke.

Elevator Pressurization

Smoke control systems for elevator evacuation must provide protection for elevator lobbies, elevator hoistways and elevator machinery rooms. During an evacuation that uses the elevators, building occupants must be protected in the elevator lobby while waiting for the elevator. Another area that needs to be protected is the elevator machinery room to prevent damage to the elevator controls. Figure 1.16 shows an elevator hoistway that is being pressurized. Note that as the elevator hoistway is being pressurized, it is indirectly pressurizing the elevator lobbies and machinery room. Alternate ways to achieve elevator lobby pressurization are:

- Direct pressurization of elevator lobbies (Figure 1.17: View A) can provide better smoke control for lobbies since the higher pressure protects lobbies from small amounts of smoke which may enter the area.
- Exhausting the fire floor (Figure 1.17: View B) utilizes the return air ductwork of the HVAC system. When a fire is detected:

  1. the elevator hoistway is pressurized;
  2. all dampers in the return ductwork for the nonsmoke zones must be closed;
  3. the damper for the smoke zone must be opened;
  4. the exhaust fan must be turned on.

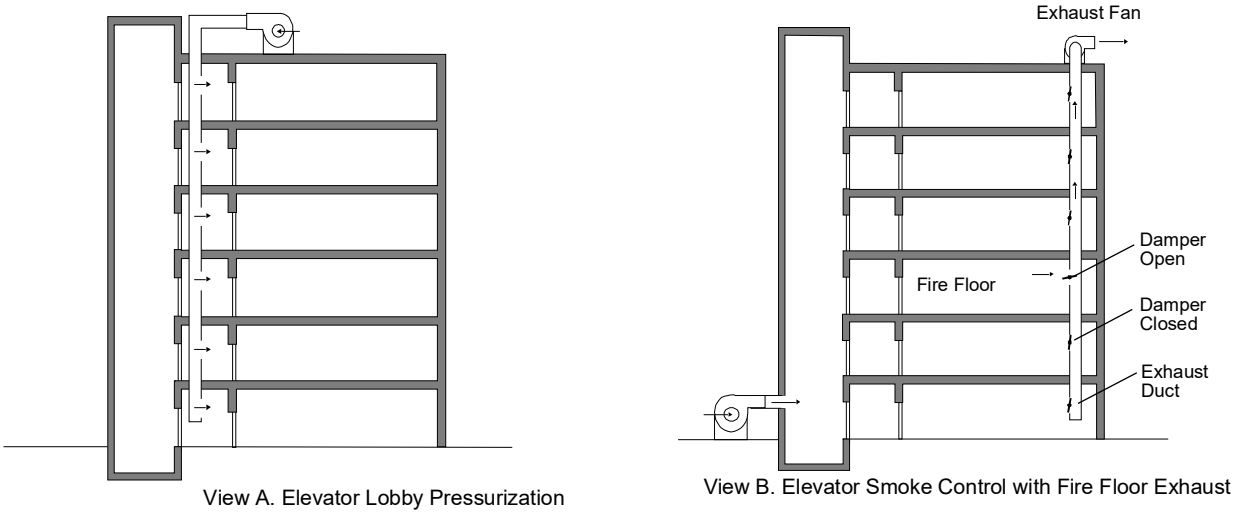


Figure 1.17 Elevator Lobby Smoke Control

1.17.4 Zoned Smoke Control Systems

Buildings can usually be divided into a number of smoke control zones where each zone can be separated from the smoke zone to prevent the movement of smoke. The smoke control zone boundaries are typically partitions, floors, and doors that can be closed. Often each floor of a building is chosen as a smoke control zone boundary. However, a smoke control zone can consist of more than one floor, or a floor can contain more than one zone. All nonsmoke zones can be pressurized, or just those surrounding the smoke zone. Figure 1.18 illustrates examples of smoke control zone configurations.

Zoned smoke control is implemented by venting, or depressurizing, the smoke zone and by either pressurizing all other zones or those zones surrounding the smoke zone. Venting of the smoke zone is important because it prevents significant buildup of pressures as a result of a fire caused by the thermal expansion of gases. Venting can be accomplished through exterior wall vents, smoke shafts, and mechanical exhaust (depressurization).

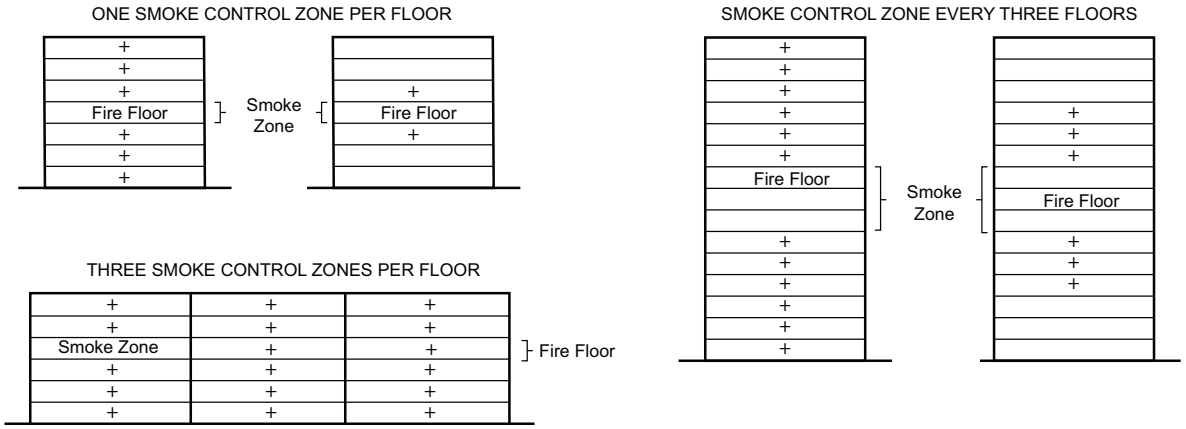


Figure 1.18 Typical Smoke Zone Configurations

Exterior Wall Vents

Zoned smoke control using wall vents consists of a vented smoke zone without any fans to aid the exhaust of smoke and adjacent zones that are pressurized. The wall vents in the smoke zone would automatically open when the smoke control system is activated. This method of smoke control should be used for open area floor plans where each floor of the building is defined as a smoke control zone. The vents should be evenly distributed on the walls to counteract the adverse effects of wind.

NOTE: *This method should not be used when the floor plan involves many partitions or walls.*

Smoke Shafts

Zoned smoke control using smoke shafts consists of one or more vertical shafts and adjacent zones that are pressurized. The vertical shafts are designed to be a path for smoke movement from the smoke zone to the exterior of the building. The shafts can serve one floor, many floors, or one shaft can serve all floors of a building. Each shaft has an opening above the roof level and an opening on each floor that it serves. Each shaft opening is equipped with a normally closed damper that will open in response to a fire on that particular floor. This method of smoke control should be used for open area floor plans where each floor of the building is defined as a smoke control zone. It is recommended that smoke shafts be located as far away from exit passageways as possible to prevent additional problems for evacuation and fire fighting. Smoke shaft inlets should be located in or near the ceiling since hot smoke usually stratifies near the ceiling.

Mechanical Exhaust

Zoned smoke control using mechanical exhaust is very similar to the smoke shaft method and similarly is done in conjunction with pressurization of nonsmoke zones. The driving force of smoke movement for the smoke shaft method is buoyancy. However, when the flow of smoke through the smoke shaft is aided by mechanical fans, the method is known as mechanical exhaust. Mechanical exhaust of the smoke zone can be accomplished through a dedicated exhaust system or by using components of the HVAC system. Exhaust inlets should be located near the ceiling and as far from exit passageways as possible.

HVAC System (for Zoned Smoke Control)

In many instances, the HVAC system can be used to perform zoned smoke control. Figure 1.19: View A illustrates normal HVAC system operation. During a fire condition, the HVAC equipment would be controlled to achieve zoned smoke control objectives, as shown in Figure 1.19: View B.

1. Close damper in the supply duct for the smoke zone.
2. Close dampers in the return duct for all nonsmoke zones.
3. If the system has an air recirculation duct, close the recirculation damper.
4. Turn on supply fan and return fan.

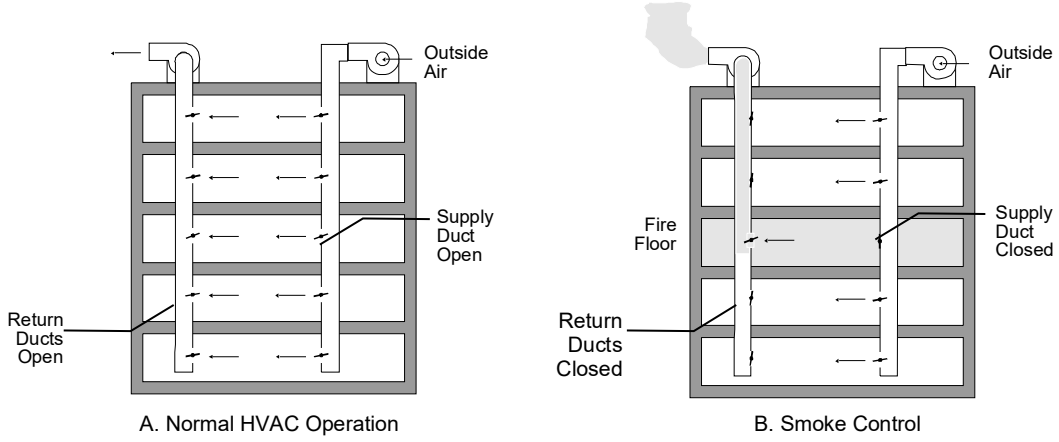


Figure 1.19 Zoned Smoke Control Using HVAC System

Zoned smoke control can also be accomplished in situations where an HVAC system serves only one smoke control zone. An example would be a three floor building where each floor is a separate smoke control zone with a separate HVAC system serving each floor. Zoned smoke control can be achieved by putting the HVAC equipment in the states described below:

In the smoke zone:

1. Turn off supply fan,
2. Close supply damper,
3. Open exhaust damper,
4. Turn on return fan.

In the nonsmoke zone:

1. Turn off return fan,
2. Close return damper,
3. Open supply damper,
4. Turn on supply fan.

Special HVAC System Considerations

When using an HVAC system for smoke control, the location of exhaust outlets and air intakes is critical. To minimize the probability of smoke feedback into the supply intake, the exhaust outlet must be located as far from the supply intake as possible. HVAC building systems can be designed to recirculate air through the use of dampers and by connecting the supply and return ducts.

- Figure 1.20, view A illustrates normal HVAC operation, where the damper in the recirculation duct is partially or completely open to allow air from the building to mix with outside air.
- Figure 1.20, view B illustrates an HVAC system used for smoke control, where the damper in the air recirculation vent must be tightly closed to prevent smoke feedback into the supply air.

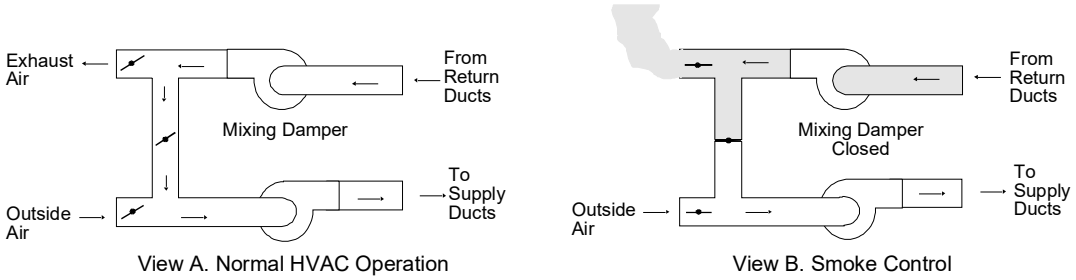


Figure 1.20 HVAC System with Recirculation Capability

1.18 Basic Smoke Control System Operation

All smoke control systems utilize the operation of fans turning on or off and dampers opening or closing in order to control the movement of smoke. For a fan, damper, or other HVAC device to be used for smoke control, the smoke control system must be capable of four basic control and monitoring activations:

- turn a fan ON, regardless of its current state, and verify that it is ON.
- turn a fan OFF, regardless of its current state, and verify that it is OFF.
- OPEN a damper regardless of its state, and verify that it is OPEN.
- CLOSE a damper regardless of its state, and verify that it is CLOSED.
- By combining these basic capabilities, the smoke control system can provide 15 distinct activations for a particular fan or damper, as detailed in Table 1.3

Table 1.3 Smoke Control Operations in Combination

Acronym	Control Capability	Monitoring Capability
1. conOFF/monOFF	Can turn a fan OFF, and...	will verify only when fan is OFF.
	Can CLOSE a damper, and...	will verify only when damper is CLOSED.
2. conOFF/monON	Can turn a fan OFF, and...	will verify only when fan is ON.
	Can CLOSE a damper, and...	will verify only when damper is OPEN.
3. conON/monOFF	Can turn a fan ON, and...	will verify when fan is ON by monitoring for fan to be OFF.
	Can OPEN a damper, and...	will verify when damper is OPEN and when not CLOSED.
4. conON/monON	Can turn a fan ON, and...	will verify only when fan is ON.
	Can OPEN a damper, and...	will verify when damper is OPEN.
5. conON/monON&OFF	Can turn a fan ON, and...	will verify when fan is ON or OFF.
	Can OPEN a damper, and...	will verify when damper is OPEN.
6. conON&OFF/monOFF	Can turn a fan ON or OFF, and...	will verify when fan is OFF.
	Can OPEN or CLOSE a damper, and...	will verify when damper is OPEN and when it is CLOSED.
7. conON&OFF/monON	Can turn a fan ON and OFF, and...	will verify only when fan is ON.
	Can OPEN and CLOSE a damper, and...	will verify when damper is OPEN.
8. conON&OFF/monON&OFF	Can turn a fan ON and OFF, and...	will verify when fan is ON or OFF.
	Can OPEN and CLOSE a damper, and...	will verify when damper is OPEN or CLOSED.
9. conOFF/monON&OFF	Can turn a fan OFF, and...	will verify when fan is ON and when it is OFF.
	Can CLOSE a damper, and...	will verify when damper is OPEN and when it is CLOSED.
10. conON only	Can turn a fan ON, and...	will not verify whether fan is ON.
	Can OPEN a damper, and...	will not verify whether damper is OPEN.
11. conON&OFF	Can turn a fan ON and OFF, and...	will not verify whether fan is ON or OFF.
	Can OPEN and CLOSE a damper, and...	will not verify whether damper is OPEN or CLOSED.
12. monON&OFF	Cannot control a fan, and...	will verify when fan is ON and when it is OFF.
	Cannot control a damper, and...	will verify when damper is OPEN and when it is CLOSED.
13. monON only	Cannot control a fan, and...	will verify when fan is ON.
	Cannot control a damper, and...	will verify when damper is OPEN.
14. monOFF only	Cannot control a fan, and...	will verify when fan is OFF.
	Cannot control a damper, and...	will verify when damper is CLOSED.
15. conOFF only	Can turn a fan OFF, and...	will not verify whether fan is OFF.
	Can CLOSE a damper, and...	will not verify whether damper is CLOSED.

Example: In Table 1.3, Scenario 8 can turn a fan ON and OFF regardless of its state, and will verify when the fan is on. In response to a fire, the fan turns on and the monitoring function will verify that the fan is on, usually by LED illumination.

NOTE: *Refer to Section 2.5, "Zoned Smoke Control Scenarios" for detailed examples.*

Section 2: Introduction to the Smoke Control Application

2.1 Application Overview

The Gamewell-FCI® GFP Series Smoke Control Application is a firmware solution adding feature-rich smoke control capability to the fire alarm control panel (FACP). The application uses signaling line circuit points (SLCs) to connect physical smoke control devices to control equipment and specialized firmware engines. Each device and its associated control/monitor module is thus optimized as a virtual smoke control appliance (SCA point) in the smoke control system. SCA points facilitate the monitoring and verification of the operating state of each appliance, and control each operation state of the appliance as ON/OPEN or OFF/CLOSED. Smoke Control Zones allow activation of multiple appliances in a particular area simultaneously, and the Activation Matrix configures the coordination of appliances in a zone and how they activate.

2.1.1 Features and Benefits

- Minimal logic equations needed, reducing programming time
- Intuitive CAMWorks+ Programming Utility streamlines configuration
- Flexible, scalable deployment with backward compatibility for existing FACPs, control/monitoring units, field wiring.
- Efficient periodic testing via automation or manual control
- Reduced hardware costs

2.2 Smoke Control Overview

During a fire inside of a building, smoke can flow into exit passageways, stairwells and elevator shafts, inhibiting or preventing safe evacuation. Physical smoke control appliances, such as fans, dampers, curtains, or doors, must be recognized, assessed, and then activated as needed to inhibit the flow of smoke within the building. Essentially, the smoke control application comprises the following components:

- Control Equipment (FACP, firefighter's smoke control station, HVAC controls, control interfaces, annunciators, etc.)
- Initiating Devices (smoke detectors, manual pull stations, etc.)
- HVAC equipment (fans, dampers, ductwork, etc.)

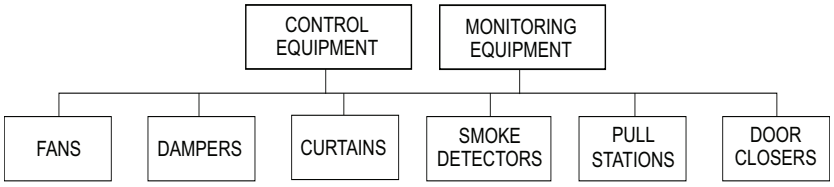


Figure 2.1 Basic Components of a Smoke Control System

2.2.1 Control Equipment

Smoke Control Application

When a fire condition is detected, the smoke control application activates the appropriate automatic control over devices and annunciators. Manual override control and monitoring is available on all smoke control components and equipment.

Fire Alarm Control Panel

The smoke control application and the FACP work together to manage environmental conditions in defined zones of a building. A smoke control zone (SCZ) comprises one or more smoke control appliances that interoperate with the panel. The FACP communicates with the smoke control system by means of SLC points (signaling link circuits). An FACP supports up to 250 smoke control appliances connected via SLC points. These point groups represent virtually the physical appliances to the FACP, thus simplifying control and monitoring of smoke control components.

Modules

Control equipment consists of monitor modules (MMs), control modules (CMs), and relay modules (RMs). They are managed by the appliance and zone software engines at the FACP. Control modules can activate/deactivate a device as ON/OPEN or OFF/CLOSED. Monitor modules serve to verify and report on the current state of a device and any troubles.

- Control Modules (CM): AOM-2SF, MMO-6SF
- Monitor Modules (MM): AMM-4F, AMM-2F, AMM-2IF, MM1-10F, AMM-4SF
- Relay Modules (RM): AOM-2RF, MMO-6RF, AMM-2RIF
  (AMM-2RIF can serve as CM or MM, depending on the application.)
- Dual Relay and Monitor Modules (RM/MM): AMM-2RIF

Firefighter's Smoke Control Station (FSCS)

The FSCS is a customized panel required for each building that allows authorized users to monitor and perform manual overrides in the smoke control system, i.e., open/close dampers, turn off/on fans, etc. (Figure 2.4)

2.2.2 Initiating Devices

Detectors

The detection of fire conditions comes from some form of initiating device, such as smoke detectors, heat detectors, and waterflow switches. Activation of one smoke detector may not be sufficient cause to activate a smoke control system. A combination of two active detectors in a particular smoke zone typically provides better evidence for the smoke control system to be activated.

Manual Pull Stations

A manual pull station can indicate a condition, but does not accurately specify the fire's location. For instance, a person could activate a first floor pull station while evacuating the building because of a fire on the third floor. For this reason, a zoned smoke control system should not be activated as a result of this pull station since the system would be pressurizing and depressurizing the wrong areas.

2.2.3 Smoke Control Appliances

Smoke control appliances can include fans, ductwork, supply air outlets, return air inlets, fresh air intakes, humidifiers, filters, heating and cooling coils, preheat coils, and dampers. A smoke control appliance is assigned to control modules which can activate or deactivate it to match the desired operation state. Smoke control appliances can be activated or deactivated by the following means:

- by manual control of the appliance from a user interface
- by programming for automatic operation of the appliance
- by association with a smoke control zone that is activated manually or by automation

An appliance may controlled into various operational states:

- activating ON/OPEN control will turn on or open the appliance.
- activating OFF/CLOSE control will turn off or close the appliance.
- activating AUTO control will release the device from its current state into its configured default ON/OPEN or OFF/CLOSED smoke control state.

NOTE: *Deactivating ON/OPEN control releases the appliance back to AUTO. The appliance will not necessarily return to an OFF/CLOSED state. The default condition and the dedicated/non-dedicated nature of the appliance will determine the resulting position for an appliance in AUTO. Consult Section 3: and Appendix A for detailed configuration information.*

Dedicated/Non-dedicated Appliances

A dedicated smoke control appliance functions for the sole purpose of controlling smoke and does not function under normal (non-fire) alarm conditions in the building. Dedicated appliances are typically used in areas such as elevator shafts and stair towers that require special smoke control techniques.

Non-dedicated smoke control appliances are not restricted to smoke control; they can participate with the building's HVAC system. In a fire alarm condition, the smoke control system can command a non-dedicated appliance to change its normal mode of operation to achieve the smoke control objectives.

- When configured as a dedicated smoke control appliance, the device will be controlled only by the fire alarm system for smoke control. It will not serve any other function.
- When configured as a non-dedicated smoke control appliance, the device will perform heating, cooling, or ventilation services when no fire alarm condition is in effect. During a fire alarm condition, the smoke control function takes precedence over normal HVAC operation.

HVAC Appliances

Appliances in HVAC systems may be employed as dedicated or non-dedicated smoke control appliances. Both dedicated and non-dedicated HVAC appliances are monitored and controlled by the smoke control system, however non-dedicated HVAC appliances are limited as follows:

- excluded from periodic tests
- excluded from any control-by-event (CBE)
- will not participate in lockout scenarios
- cannot be configured for automated operation

NOTE: *Although a non-dedicated HVAC appliance cannot be configured for automation, it can be commanded to participate when directly activated, or when indirectly activated via zone programming.*

NOTE: *An appliance is recognized by the system for HVAC use when the following conditions are met: 1.) it is configured as non-dedicated, 2.) it is not programmed for automation, and 3.) it is not part of a zone.*

2.3 Smoke Control Zones

Buildings are typically divided into zones that can be separated to prevent the movement of smoke. The smoke control zone boundaries are usually partitions, floors, and doors that can be closed. Often each floor of a building is chosen as a smoke control zone boundary. However, a smoke control zone can consist of more than one floor, or a floor can contain more than one zone. Determining the limits of a smoke zone takes into consideration time of egress, response of smoke detectors, alarms, and the smoke control system. Figure 2.2 shows examples of several typical smoke control zone configurations.

Zoned smoke control is implemented by venting or depressurizing the smoke zone, and by either pressurizing all other zones or those zones surrounding the smoke zone. Venting the smoke zone prevents significant buildup of pressures as a result of a fire caused by the thermal expansion of gases. Venting can be accomplished through exterior wall vents, smoke shafts, and mechanical exhaust (depressurization).

Smoke control zones are not the same as general zones, logic zones, releasing zones, or special function zones. Smoke control zones are associated with a specific node, with each fire panel able to support a maximum of 250 smoke control zones. Smoke control zones are set up using the configuration tool, described in later sections of this manual.

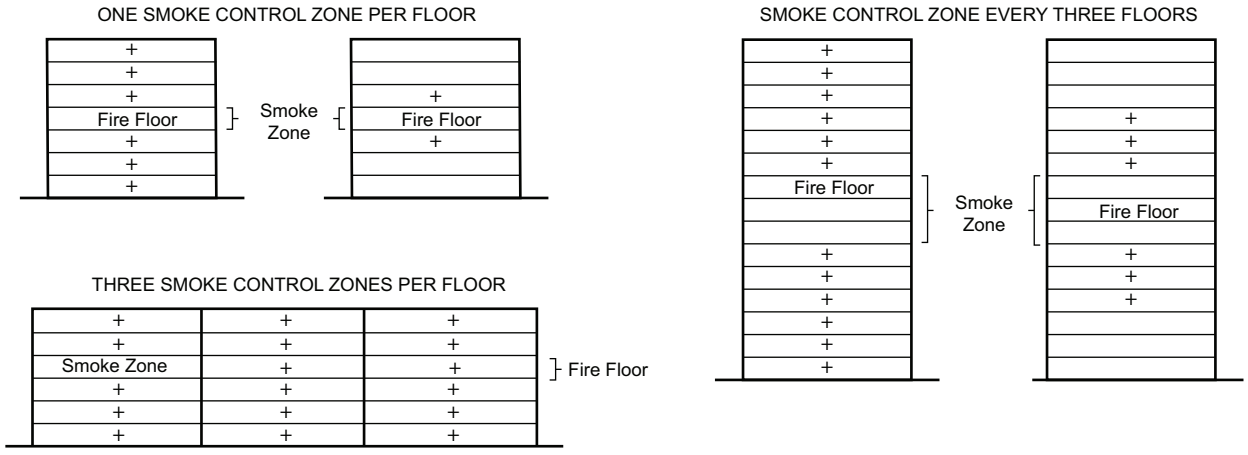


Figure 2.2 Typical Smoke Control Zone Configurations

2.3.1 Smoke Zone/Appliance States

In the smoke control application, the configuration tool is used to assign an appliance to a smoke control zone and define how it will respond to zone conditions. In this way, the appliances assigned to a zone can be activated to match the state of its associated zone. Smoke zone states are characterized as follows:

- ON/Exhaust
- OFF/Isolate
- Pressurize
- Purge
- Test

For each zone state, the smoke control appliances in the zone would have a configured state (ON/OPEN or OFF/CLOSED) that is most suited for the condition in its zone.

For example, if Smoke Zone 1 is in the Pressurize state, then fan SCA1 and damper SCA2 in that zone would be activated to the user-defined state that would pressurize Zone 1. In such a situation, that may mean to turn ON the fan SCA1 and to CLOSE the damper at SCA2.

Similarly, if necessary to purge Smoke Zone 1, then SCA1 and SCA2 would be activated to a state that would purge Smoke Zone 1. In such a situation, that may mean to turn ON the fan SCA1 and to OPEN the damper at SCA2.

NOTE: *When an zone or appliance is manually or automatically activated to change its operation state, the new status is mapped to lamps for displaying and reporting purposes.*

2.4 Basic Smoke Control System Layouts

Structures requiring smoke control can range from a small 4-story multi-family building with a single fire panel to complex high-rises, hospitals, and commercial spaces that require a networked fire system with multiple nodes and enhanced user interfaces. For any deployment, the smoke control application utilizes its appliance and smoke zone engines at a fire panel to handle all control functions and fault reporting. This scalable, distributed solution delivers comprehensive smoke control and monitoring to appliances and zones through:

- coordinated operation of SLC points for a particular smoke control appliance
- intuitive, streamlined programming for smoke control activations and trouble reporting
- tangible events based on combining and timing multiple points
- analytic and diagnostic clarity via displayed active events and saved historical event data

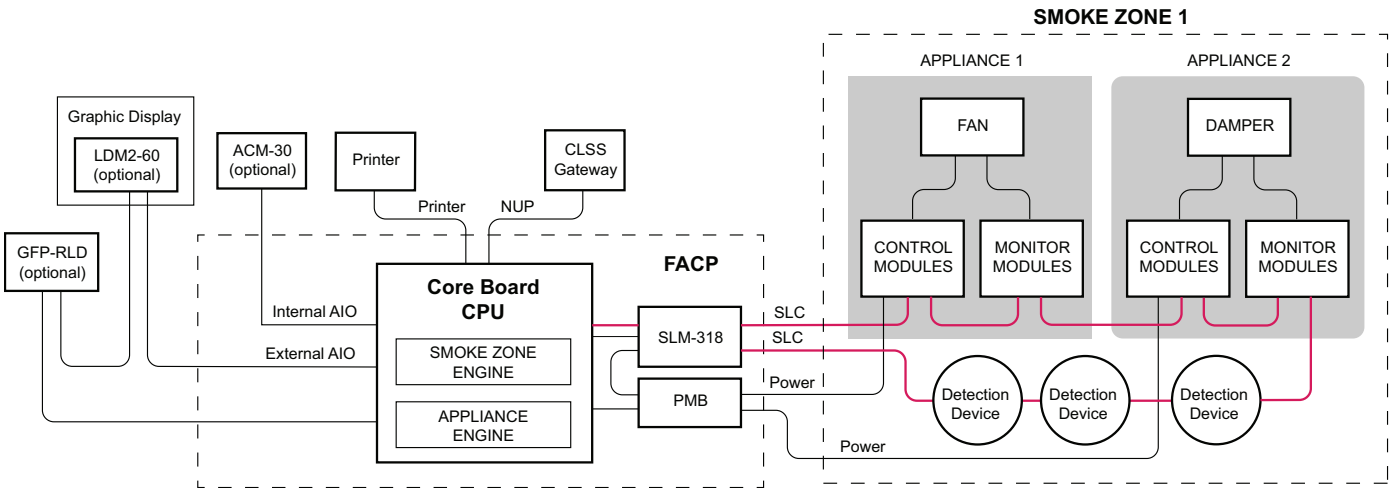


Figure 2.3 Gamewell Smoke Control Application

Figure 2.3 above shows virtual appliances configured in a GFP Series FACP
with SLC points connected to physical appliances in Smoke Zone 1 (one FSCS required).
(one FSCS required)

2.5 Zoned Smoke Control Scenarios

The smoke control situations in this section demonstrates how small and large residential buildings protected by the smoke control application may experience a fire alarm condition. For clarity, these scenarios are simplified with a single fire panel configured for two or more zones with automation control and manual override available at prioritized control interfaces.

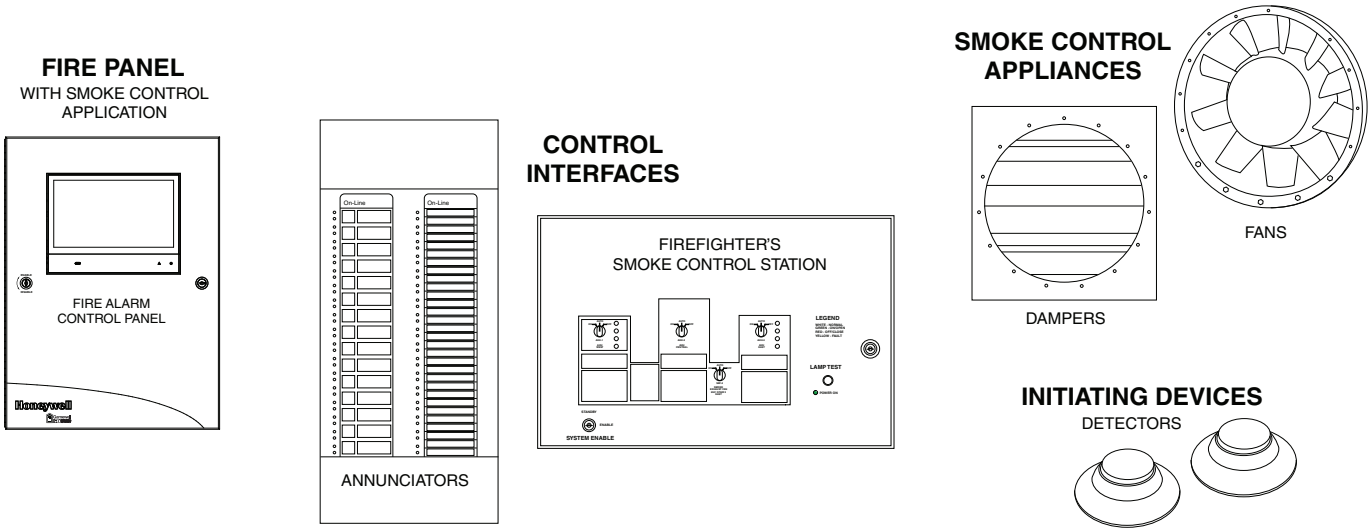


Figure 2.4 Gamewell Smoke Control System Overview

2.5.1 Scenario with Fans and Dampers

Figure 2.5 demonstrates how a system of fans and dampers is used by a multi-zoned smoke control system to appropriately pressurize and exhaust each zone. The smoke control system uses mechanical exhaust with all smoke control zones served by one supply fan and one return fan. There are two vents per zone (one supply, one return) with dampers on each vent.

When a fire is detected, the smoke zone must be depressurized and all other non-smoke zones must be pressurized.

1. Depressurize the smoke zone as follows:
   - CLOSE supply damper (S1).
   - Verify return damper (R1) is OPEN.
   - Turn return fan ON.
2. Pressurize all non-smoke zones as follows:
   - CLOSE return dampers.
   - Verify supply dampers are OPEN.
   - Turn supply fan ON.

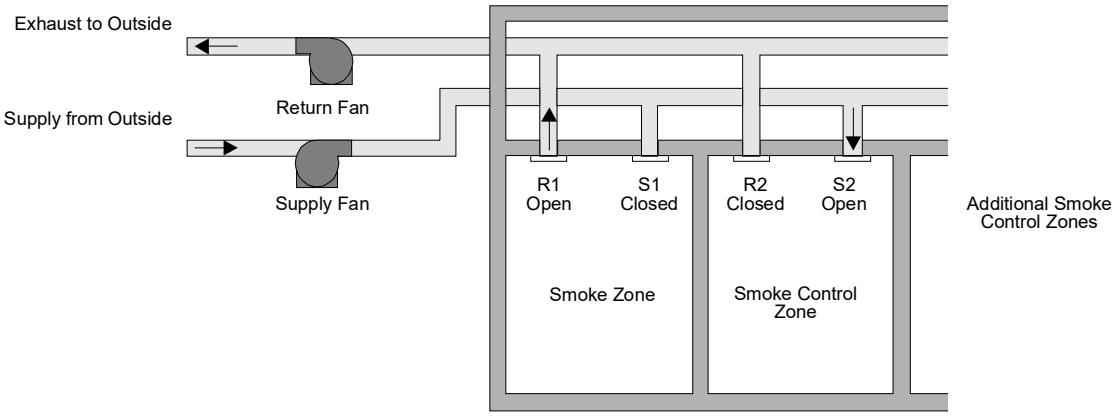


Figure 2.5 Multi-Zone Smoke Control using Fans and Dampers

2.5.2 Scenario with Eight-Story Building

Figure 2.6 shows an eight-story building that utilizes a dedicated smoke control system with each floor designated as a smoke control zone. The structure has a stairtower and an elevator shaft to consider, where the stairtower has a multiple injection system and the elevator hoistway will only be pressurized to prevent the migration of smoke (i.e., it will not be used for evacuation). The smoke control system will utilize pressurization. All dampers are normally open.

In this scenario, a fire is detected on Floor 5. The following operations must occur:

- Pressurize stairwell and elevator shaft
- Pressurize all non-smoke zones
- Evacuate smoke zone

1. Pressurize stairwell and elevator shaft.
   - Turn ON fans for the stairtower and the elevator hoistway.
2. Pressurize all non-smoke zones (Floors 1-4 and Floors 6-8).
   - CLOSE return dampers for all nonsmoke zones, involving 14 dampers.
3. Evacuate smoke zone (Floor 5).
   - CLOSE the two supply dampers for the smoke zone.
   - Turn ON both the supply fan and the return fan.

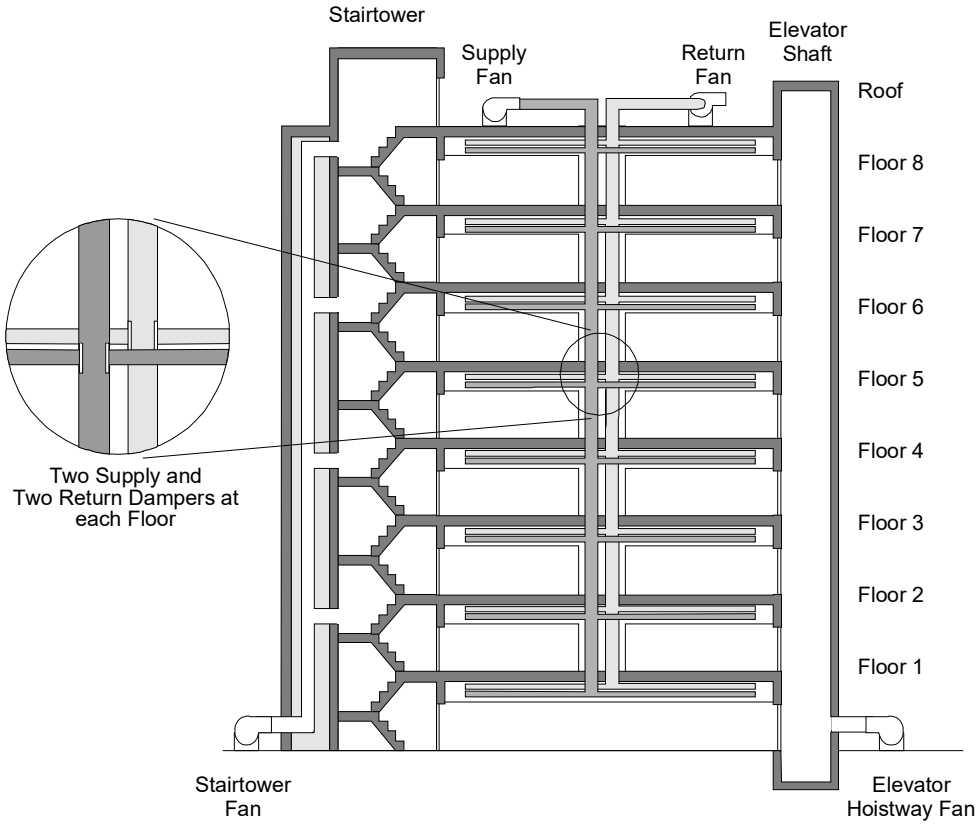


Figure 2.6 Eight-Story Building with Stairtower & Elevator Hoistway

At this point, the smoke control system is fully engaged, and will respond to automatic or manual overrides as needed.

4. After the fire is extinguished, Fire Department personnel at the FSCS can then assert priority by overriding automation in order to manually activate mechanical ventilation of Floor 5. This serves to purge any residual smoke and fumes from Floor 5, replacing them with fresh air.
5. With the post-fire purge completed, an operator at any priority control interface can manually perform a System Reset. This action restores devices and zones to their normal state.

NOTE: *Refer to Section 3, "Smoke Control Configuration" for detailed information on configuring the smoke control application to accommodate your specific building environment.*

Section 3: Smoke Control Configuration

3.1 Introduction

This section details the configuration of a smoke control system using the CAMWorks+ utility for programming, testing, and reporting. All components of the system are set up at this intuitive user interface, reducing programming time. Figure 3.1 illustrates an example Configuration screen. The optimal sequence for configuring a smoke control system is listed below, and described in the paragraphs that follow:

- Modules
- Appliances (SCAs)
- Zones (SCZs)
- Activation Matrix
- System Programming
- Virtual Points

NOTE: *Refer to Appendix B, "Appliance Scenarios & Wiring" for detailed appliance wiring information and example scenarios.*

3.2 Configuring Smoke Control Modules

Monitor modules (MMs), control modules (CMs), and relay modules (RMs) are configured at the Modules Configuration screen. Each configuration parameter is described below.

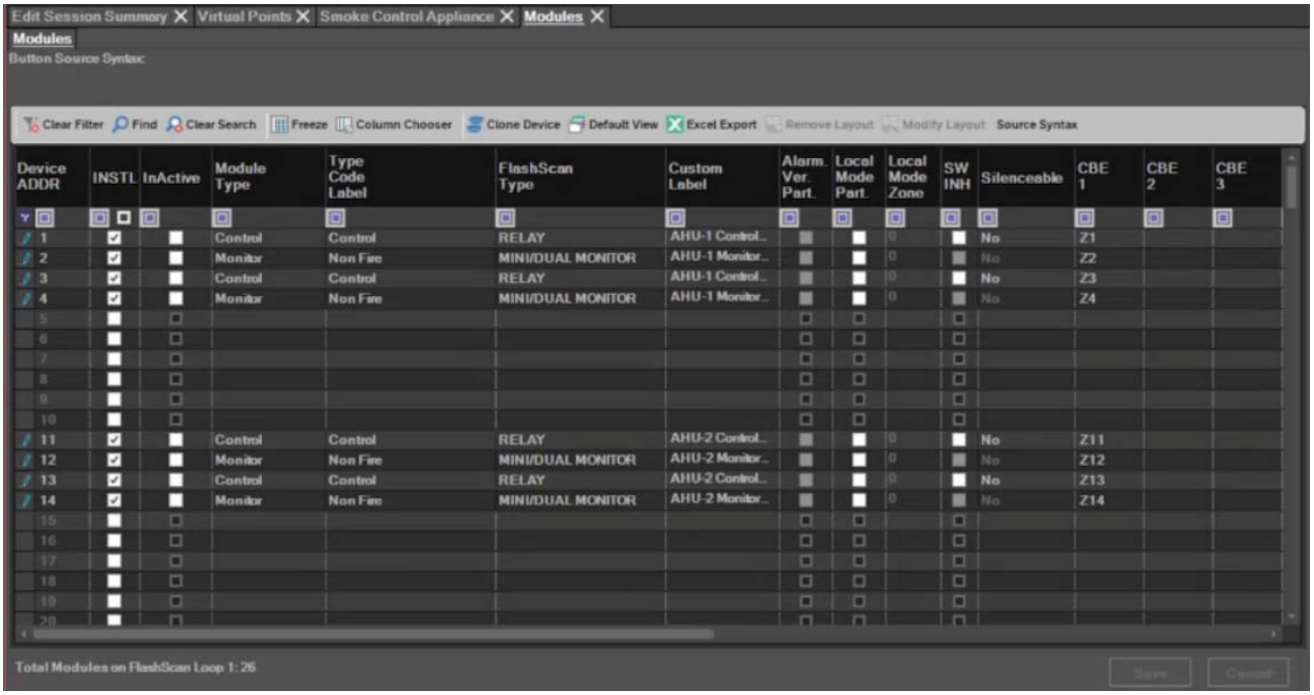


Figure 3.1 Module Configuration Screen

3.2.1 Module Configuration Parameters

Device Address

Module addressing is structured as follows:

NxxxLyyyMzzz or LyyyMzzz

where:

xxx = the node number (from 1 to 240)

yyy = the loop number (from 1 to 10)

zzz = the module number (1 to 159) from the selected loop

INSTL

When checked, the module will be installed as soon as the configuration is downloaded from CAMWorks+ to the system. When not checked, the module will not be installed to the system.

Inactive
Module will be inactive when checked and active when unchecked. Inactive modules will be part of the configuration, but the events (alarms and troubles) will be suppressed until the point goes active, (i.e. no answer troubles). Autoprogram discovery of the point will transition inactive points to active. Re-downloading the configuration with the point Active will transition the point to active.

NOTE: *during the installation process, it is recommended to configure as inactive those points that are not physically wired and connected to the system.*

Module Type
Select module type as Control or Monitor.

Type Code Label
Select the desired type code for the Control or Monitor module.

Flashscan Type Label
Select the Flashscan Type label that provide the most useful description for the control or monitor module.

Custom Label (40 characters)
Text entry field to describe the module.

Alarm Ver. Part. (Alarm Verification Participation)
When enabled (Yes), sets a pattern for an output signal's activation and deactivation. Available for some Monitor type codes. Not applicable in smoke control cases.

Local Mode Participation
When enabled (Yes), fire alarm will activate fire alarm outputs within the same loop if their type ID is the same. Not applicable to the smoke control application.

Degrade Mode Zone
When enabled (Yes), a loop card in communication loss with the panel will refer to the degrade mode assignments for local activations.

SW INH (Switch Inhibit)
When enabled, prohibits manual activation of an NAC or releasing circuit.

Silenceable (Yes or No)
Determines whether an operator will be able to manually silence an activated output and the output’s resound properties.

CBE(1-10)
For up to 10 Control-by-Events, enter the zone address that will activate appliances in that zone based on the configured condition. SLC points used in smoke control appliances do not require CBE programming for smoke control usage. The association of these points to the smoke control appliance is made during the configuration of the appliance. Ancillary functions of the point using CBE programming is permitted. Activation of output modules using CBE will take the lowest priority, below all smoke control appliance assigned behaviors.

Additional configurable parameters:

- Custom Action MSG
- Activation Delay
- LED Enable
- Alarm Delay/PreSignal Participation
- Drill Participation

3.3 Configuring Appliances

An HVAC device used in smoke control applications will typically have two or more configured SLC points associated with its control and status. Control functions can consist of automatic and manual activation of devices, lockout scenarios, bypass scenarios, multiple zone activations, etc. Monitoring functions can report device status, fault conditions, etc.

Appliances are installed and configured in the configuration tool. In the example below, four smoke control appliances are being created and configured. Changes to an appliance are also made at this interface.

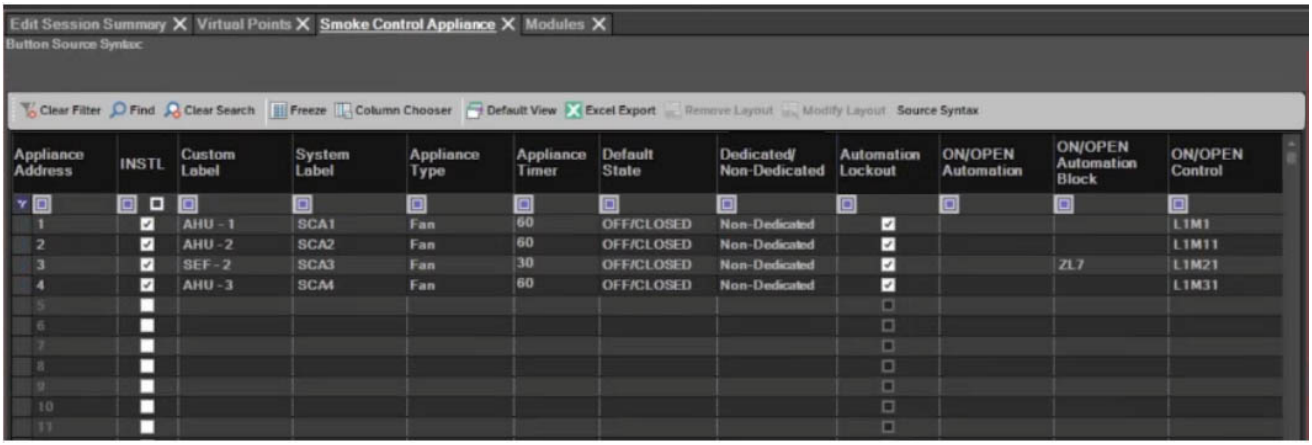


Figure 3.2 Appliance Configuration Screen

3.3.1 Appliance Configuration Concepts

Appliance states can be ON/OPEN, OFF/CLOSED or AUTO. To assist understanding, the ON/OPEN state of an appliance may be considered as the appliance's active state for being ON or OPEN, and the OFF/CLOSED state is also an active state that prohibits an appliance from running or opening. AUTO, RELEASE, and PRIORITY further influence the state and behavior of an appliance. Table 3.3 defines these configuration concepts.

Table 3.1 Basic Concepts

Terminology	Description
AUTO Command	Automation (automatic operation) is a control state that permits the associated SLC points to activate by CBE, or permits the appliance to operate by building controls. The appliance is in neither active state of ON or OFF for smoke control operation.
ON Command	The ON command is a smoke control override that will turn ON or keep the appliance ON or OPEN, regardless of the state of automation or building controls.
OFF Command	The OFF command is a smoke control override that will transition or keep the appliance OFF or CLOSED, regardless of the state of automation or building controls.
RELEASE Command	The RELEASE command allows a user at a control interface with a higher priority to release its manual control of an appliance to the next lower priority control interface, or to the AUTO state. Note: An appliance may not change state when given a Release command.
Normal State	An appliance, such as a fan, is in a Normal state when the default condition of the fan is to be off, and the OFF monitor is active (indicating the fan is off), and the fan is not being forced off (i.e., the control point is inactive). See expanded discussion below.
Interface Priority	Each interface shall be configured for a priority based on their application (FSCS, Mechanical test panel, or other). Higher priority interfaces release to the next lower priority interface according to the following order: 1. FSCS Firefighters' Smoke Control Station 2. Mechanical Test Panel

About OFF, ON and Normal

In the Smoke Control Application, the appliance subaddresses of "Normal", "ON", and "OFF" are mutually exclusive; that is, the appliance cannot be Normal and OFF simultaneously. The appliance subaddress for OFF will be active when the appliance is controlled to be off, whether by automation or manual control. When controlling the fan off, and it is off, then the subaddress for "OFF" should be active, and the subaddress for "Normal" should be inactive; likewise is true for the appliance "ON" subaddress.

NOTE: *To show the current state of the appliance on your display board, map the monitor module point for the OFF monitor directly to the annunciator instead of the appliance subaddress.*

3.3.2 Appliance Addressing

Smoke control appliances are primarily associated with a specific smoke control zone (optional) and a specific node for the purposes of monitoring and control. The SLC points associated with the appliance may also be associated with the same node or a different node on the network. In order to communicate with the FACP, the appliance must be configured with a unique structured address so that the FACP can properly route data. Displayable events, such as fault or disable conditions, will be reported to the network using this address.This unique address is defined for each appliance through the configuration tool, as described in Section 3.4, "Appliance Configuration Parameters".

3.3.3 Appliance Subaddressing

Subaddresses provide for the status reporting of a smoke control appliance. Each appliance supports 12 subaddresses (Table 3.2) that can be configured according to one of 15 scenario types. Generally, subaddress characteristics are:

- Each subaddress will be either ON (active) or OFF (Not Active).
- Multiple subaddresses may be ON simultaneously.
- Appliance subaddresses are mappable to logic equations and annunciator points.
- Appliance subaddress transitions are not displayed events, but are logged in event history.

Table 3.2 Appliance Subaddressing

Name	Syntax	Number	Subaddress Description
ON	.on	1	The ON subaddress is Active when both the ON/OPEN Control and ON/OPEN Monitor modules are active, i.e., the FACP system wants it ON, and it is ON. If no ON monitor has been assigned, this will reflect only the ON control. NOTE: If appliance is active for reasons other than the smoke control system, i.e., a non-dedicated appliance, this point will not activate. For true appliance status, refer directly to the monitor module point.
OFF	.off	2	The OFF subaddress is active when both the OFF/CLOSED control and monitor modules are active, i.e., the FACP system wants it OFF and it is OFF. NOTE: When control point for OFF has been assigned, this subaddress will only be true if that point is active and the feedback points confirm the appliance is OFF.
Transitioning OFF/AUTO to ON	.ton	3	(transitional state) Active when ON timer is running. The ON timer starts when ON Control activates. Timer does not run when ON Control and On Monitor are in the same state.
Transitioning ON/AUTO to OFF	.toff	4	(transitional state) Active when OFF timer is running. The OFF timer starts when OFF Control activates. Timer does not run when OFF Control and OFF Monitor are in the same state.
Trouble	.trb	5	The Trouble subaddress is active when: • monitor is ACTIVE when control is INACTIVE in dedicated mode (outside timer limit). • monitor is INACTIVE when control is ACTIVE in dedicated or non-dedicated mode (outside timer limit). • trouble monitor is active. • AC Fail monitor is active (optionally). • an SLC device is in trouble. • an SLC device is off line. • an SLC device is disabled. • appliance is disabled.
Normal	.norm	6	Active when all other subaddresses are inactive. (See note accompanying Table 3.1, “Basic Concepts”.)
AC Fail	.ac	7	Active when AC Fail monitor is active.
Lockout	.lock	8	Active when appliance is locked out of automation. The point may be ON/OPEN or OFF/CLOSED and still be in LOCKOUT.
Pending ON	.pon	9	• Active when the ON automation/activation condition has been met, but the ON auto-block condition is also met. • Shall only be programmed when an ON control point is assigned. • prevents automatic activations of the appliance; does not prevent manual control.
Pending OFF	.poff	10	• Active when the OFF automation condition has been met, but the OFF auto-block condition is also met. • Used to flash annunciator LEDs. • Shall only be programmed when an OFF control point is assigned. • Prevents automatic activations of the appliance; does not prevent manual control.
Service Disconnect	.sd	11	Active when the Service Disconnect monitor is active.
Transition ON/OFF to AUTO	.tnorm	12	(applicable only to dedicated appliances, since timer does not track non-dedicated appliances) Active when the timer is running when the appliance is returning from ON/OPEN or OFF/CLOSED to AUTO (release). The Normal timer starts when control modules assigned to the appliance deactivate.

NOTE: *Refer to Appendix A, “Subaddressing Use Types” to configure the 12 subaddresses according to 15 scenario type tables.*

3.3.4 Appliance Mapping

An appliance and/or the associated subaddresses can be mapped to local and network endpoints to show the status and control the appliances from various points in the fire alarm system, such as:

- Custom buttons on a Gamewell controller (GFP-A/AR Series)
- Annunciator endpoints on an annunciator (ACM-30, ACM-30W, LDM2-32, LDM2-60)
- Logic equations

3.4 Appliance Configuration Parameters

Each configuration parameter is described in the paragraphs below.

Addressing

The appliance addressing is structured as follows:

NxxxSCAyyyzz or SCAyyyzz

where:

xxx = the node number

yyy = the smoke control appliance number (from 1 to 250)

zz = the subaddress for the appliance (optional)

NOTE: *Appliance subaddressing is a separate addressing scheme used to monitor and report the status of an appliance or zone.*

INSTL (Installed)

When checked, indicates the appliance is installed and subject to control and monitoring. If not checked, the appliance will be ignored by the smoke control system.

Custom Label (40 Characters)

Custom label to describe the appliance.

System Label (40 characters)

Text entry field to assist sorting and filtering in the configuration tool.

Appliance Type

Descriptive text entry field to assist sorting and filtering in the configuration tool. selectable options are: Fan, Damper, Door, Curtain, or (blank entry).

NOTE: *Refer to Section 5.1.1, "Monitoring with Logic Equations" for additional information.*

Appliance Transition Timer

When an appliance is commanded to change states between ON and OFF, this setting determines how much time in seconds will be allowed between activation of the command and verification of the resulting state. A trouble is raised when the configured interval lapses without the appliance correctly changing state.

NOTE: *Appliance Transition Timer occurs during appliance state transitions only. A power loss event is not subject to the transition timer; that is, a trouble would be raised immediately upon power loss detection.*

Default State

For dedicated appliances, this setting configures the default state of the dedicated appliance as ON/OPEN or OFF/CLOSED. This setting causes the appliance to raise a fault when it changes from the default state without control from the fire system.

Dedicated/Non-dedicated

When an appliance is set as dedicated, it will be used only for smoke control and commanded only by the fire alarm system performing smoke control. An appliance set as non-dedicated appliance can also be operated by the fire alarm system performing smoke control, but on an as-needed basis. Otherwise, in nonfire alarm conditions, the non-dedicated appliance can serve a secondary function for the building, such as climate control. Refer to Section 2, "Dedicated/Non-dedicated Appliances" for details.

Automation Lockout (Yes or No)

Select Yes for the appliance to enter the lockout state whenever a zone or appliance on the same node is manually activated. All subsequent automated activation attempts will be blocked.

ON/OPEN Automation (optional)

For an appliance not controlled by a smoke control zone, enter the general zone or logic equation that will directly activate the appliance to the ON/OPEN position. Leave this configuration field blank when the appliance is controlled by a smoke control zone.

ON/OPEN Automation Block (optional)

Enter the general zone or logic equation that will be used to prohibit automatic activation of the appliance's ON/OPEN state. If the appliance is already ON/OPEN by automation, this setting will cause the appliance to be deactivated if the automation block condition is met.

- *Example #1* - A fan has an ON/OPEN Automation Block by a logic equation that monitors the position of one or more dampers. This control ensures the correct number of dampers are open before the fan automatically activates.
- *Example #2* - A duct detector activates a general zone or logic equation mapped to the ON/OPEN Automation Block. An alarm condition of the duct detector shall turn off the supply fan. This control prevents automatic activation and shuts down operation of a supply fan.

NOTE: *An ON/OPEN control point must be specified in order to use On/Open Automation Block.*

NOTE: *Manual control takes priority over the Automation Block. Automation block does not prevent manual control of the appliance or manual control of the smoke control zone that moves the appliance to OFF/CLOSED.*

ON/OPEN Control (optional)

Enter the SLC address of the control module that will activate the ON/OPEN state of the appliance. An SLC point assigned here cannot be assigned to another appliance.

ON/OPEN Monitor: (optional)

Enter the SLC address of the monitor module that will monitor the ON/OPEN state of the appliance. An SLC point assigned here it cannot be assigned to another appliance.

OFF/CLOSED Automation (optional)

Enter the general zone or logic equation that will directly activate the OFF/CLOSED state of an appliance not otherwise assigned to a smoke control zone. Leave this parameter blank when appliance is to be controlled by a smoke control zone.

OFF/CLOSED Automation Block (optional)

Enter the general zone or logic equation that will prevent automatic activation of the OFF/CLOSED state of the appliance. If the appliance is already in the OFF/CLOSED state by automation, the appliance will be deactivated.

NOTE: *An OFF/CLOSED control point must be specified to use OFF/CLOSED Automation Block.*

NOTE: *Automation block does not prevent manual control of the appliance or manual control of the smoke control zone that moves the appliance to OFF/CLOSED.*

OFF/CLOSED Control: (optional)

Enter the SLC address of the control module that will activate the OFF/CLOSED state of the appliance. Once an SLC point is assigned here it cannot be assigned to another appliance.

OFF/CLOSED Monitor: (optional)

Enter the SLC address of the monitor module used to monitor whether the appliance is in an OFF/CLOSED state. Once an SLC point is assigned here it cannot be assigned to another appliance.

NOTE: *A minimum of one control or monitor point is required for each appliance.*

NOTE: *The same SLC point cannot be mapped to multiple appliances.*

Trouble Monitor (optional)

Enter the SLC address of the monitor module used to monitor the appliance for trouble.

- Example: L1M1 is selected to monitor the General Trouble contact closure on a fan controller. Activation of the trouble relay on the fan controller will create a short circuit condition for L1M1. This will be a non-fire activation of L1M1. The appliance will report a General Trouble fault condition and activate the subaddress for a fault.

NOTE: *Additional monitoring points may be used for separately reported fault conditions. Associating such monitoring points with an appliance must be done through logic equations. For example, a dedicated monitor module for a belt brake may need a logic equation beyond a generic trouble.*

AC Fail Monitor (optional)

Enter the SLC address of the monitor module used to monitor the appliance for AC Fail. The connection of the SLC point to the appliance is optional when the trouble event for the appliance is not desired. The type code for the monitor module will dictate events indicated in the system as follows:

- Non-fire type code label for monitor module will create a single trouble AC Fail event for the appliance.
- Trouble monitor type code label for monitor module will create two trouble events: one for the SLC point and one for the appliance.
- Tracking supervisory type code label for monitor module will create two events: one supervisory for the SLC point and one trouble for the appliance.

Service Disconnect (optional)

Enter the SLC address of the monitor module used to monitor the appliance for a non-functional state when the appliance is intentionally taken out of service for maintenance purposes.

NOTE: *Activation of Service Disconnect does not disable or block the appliance from activating when the automation or manual control instructs the appliance to activate.*

Disable Active

NOTE: *This configuration option is planned for a future release.*

Disable Propagation

Sets the desired behavior when the smoke control appliance is disabled.

- Appliance Only - Disables only the appliance and not the associated SLC points.
- All Associated Points - Disables the appliance and all the associated SLC points.

NOTE: *IMPORTANT! This setting will change the number of disable events. Configure this setting at installation, not during runtime.*

Activation Queuing (First In or Last In)

When conflicting operations are received at the same priority, this setting determines whether the first or the last command shall take effect. After the present operation is released, it also determines whether the next state shall reflect the first or the last operation in the queue.

NOTE: *For information on enhanced appliance control, refer to Section 5.1.1.*

3.5 Appliance Licensing

A counting license is required for smoke control appliances. Smoke Control Appliances and Smoke Control Zones are defined and licensed differently. The configuration tool will indicate in the configuration whether the appliance is to be used for HVAC or smoke control. Automation mapping ultimately defines the appliance type:

- When automation is programmed to directly activate an appliance, or when an appliance is activated via the smoke control zone, it is designated as a smoke control appliance.
- If no automation is assigned to activate an appliance as part of appliance programming or zone programming, it is designated as an HVAC appliance. HVAC appliances do not get active feedback, do not participate in lockout, etc.

NOTE: *Determine whether a particular FACP will need an appliance or a zone assigned to that node at the onset of the project when licenses are purchased.*

3.5.1 License Types

- A single license required for each smoke control appliance.
- A single license required for each smoke control zone.
  Assigning an appliance to any smoke control zone in any state will trigger a smoke control zone in use.

NOTE: *No licenses are required for HVAC appliances.*

3.5.2 License Trouble

License trouble will be generated when a license is missing or the number of licenses has been exceeded. License trouble will not compromise the functional performance of the system, i.e., the problem can be resolved at the end of the project.

- SMOKE CONTROL APPLIANCE LICENSE EXCEEDED trouble indicates the number of appliances configured exceeds the number of licenses installed.

NOTE: *IMPORTANT! Refer to the GFP-A/AR Listing Document for detailed information on all smoke control licensing options.*

3.6 Smoke Control Zone Overview

Smoke control zones are not the same as general zones, logic zones, releasing zones, or special function zones, in that they are physical compartments of a protected space, not directly associated with general zones. Although administered by a single control panel, smoke control zones may be distributed throughout a networked system.

Other smoke zone characteristics include:

- a smoke control zone cannot bridge multiple panels
- an appliance can be referenced in multiple smoke control zones

3.6.1 Zone Mapping

Mapping can show the status of zones from various points in the fire alarm system in order to assess and control the smoke control zone as needed. A zone and the associated subaddresses can be mapped to local and network endpoints, such as:

- Annunciator endpoints on a controller (ACM-30/30W, LDM2-32/60)
  - an ACM as a smoke control interface
  - an LDM as a smoke control interface
- Logic equations in a controller

3.6.2 Zone Addressing

For the purposes of monitoring and control, smoke control zones are associated with a specific node. The SLC points associated with the zone may be associated with the same node or a different node on the network. In order to communicate with the FACP, the appliance must be configured with a unique address so that the FACP can properly route data. This unique address is defined for each appliance through the configuration tool, as described in Section 3.3, "Configuring Appliances".

Each subaddress will be either active or inactive. Subaddresses are not mutually exclusive; multiple subaddresses may be active simultaneously. By using this addressing scheme, displayable events, such as fault or disable conditions, will be reported to the network. Table 3.3 lists the smoke control zone subaddresses.

In standalone/local operations, the addressing is structured as follows:

NxxxSCZyyyzz or **SCZyyyzz** where:

xxx = the node number

yyy = the smoke control zone number (from 1 to 250)

zz = smoke control zone subaddress states (optional) listed in Table 3.3 below

3.6.3 Zone Subaddressing

Table 3.3 Smoke Control Zone Subaddressing

Subaddress Name/State	Syntax	Number	Subaddress Description
Exhaust/ON	.ex	1	Turns on based on its automation mapping, or being forced on with feedback of the condition confirmed. See note 1.
Pressurize	.pres	2	Turns on based on its automation mapping or having been forced on and feedback of the condition is confirmed. See note 1.
Isolating/OFF	.iso	3	Turns on based on its automation mapping, or being forced on with feedback of the condition confirmed. See note 1.
Purge	.purg	4	Turns on based on its automation mapping, or being forced on with feedback of the condition confirmed. See note 1.
Test	.test	5	Turns on based on its automation mapping, or being forced on with feedback of the condition confirmed. See note 1.
Exhaust Timer	.extm	6	Turns on for the transition period between being activated and reaching the desired condition. See note 2.
Pressure Timer	.prtm	7	Turns on for the transition period between being activated and reaching the desired condition. See note 2.
Isolating Timer	.istm	8	Turns on for the transition period between being activated and reaching the desired condition. See note 2.
Purge Timer	.putm	9	Turns on for the transition period between being activated and reaching the desired condition. See note 2.
Test Timer	.tstm	10	Turns on for the transition period between being activated and reaching the desired condition. See note 2.
Idle	.idle	11	Turns on for the zone not being called to activate to one of the active positions (Exhaust/ON, Pressurize, Isolate/OFF, Purge, Test). The zone is inactive. See note 3.
Trouble	.tbl	12	Active whenever there is a fault for the zone or an appliance associated with the zone. See note 3. Tracking with fault conditions. (Periodic test fault is a latching fault which will also have this subaddress latch active.)
Normal	.norm	13	Active when all appliances associated with the zone are indicating normal.
AC Fail	.ac	14	Active when any appliance is indicating the AC Fail subaddress as active.
Lockout	.lock	15	Active when the zone is locked out of automation.
Idle Timer	.idtm	16	Turns on for the transition period between being forced off and reaching the desired condition. See note 2.

NOTE: *1. These subaddresses will activate when assigned appliances are in the proper position, irrespective of control commands. If the 90 second timeout is reached, the smoke control zone will generate an "Incomplete Operation" fault.*

NOTE: *2. These subaddresses will activate while assigned appliances are moving to the proper position, to a maximum of 90 seconds.*

NOTE: *3. These subaddresses will also activate when the zone is disabled.*

3.7 Smoke Control Zone Licensing

A counting license will be used for smoke control zones.

- Smoke Control zones are individually licensed.
- If the number of smoke control zones configured exceeds the number of licenses installed, a SMOKE CONTROL ZONE LICENSE EXCEEDED trouble shall be generated.

3.7.1 License Trouble

License trouble will be generated when a license is missing or has been exceeded. License trouble will not compromise the functional performance of the system, so that the problem can be resolved at the end of the project.

- System Trouble ID = SMOKE CONTROL ZONE LICENSE EXCEEDED

NOTE: *Determine whether a particular FACP will need an appliance or a zone assigned to that node at the onset of the project when licenses are purchased. Refer to the GFP-A/AR Listing Document for detailed information on all smoke control licensing options.*

3.8 Smoke Control Zone Configuration

Smoke control zones are set up using the configuration tool, shown in the example below. Each configuration option is described in the paragraphs that follow.

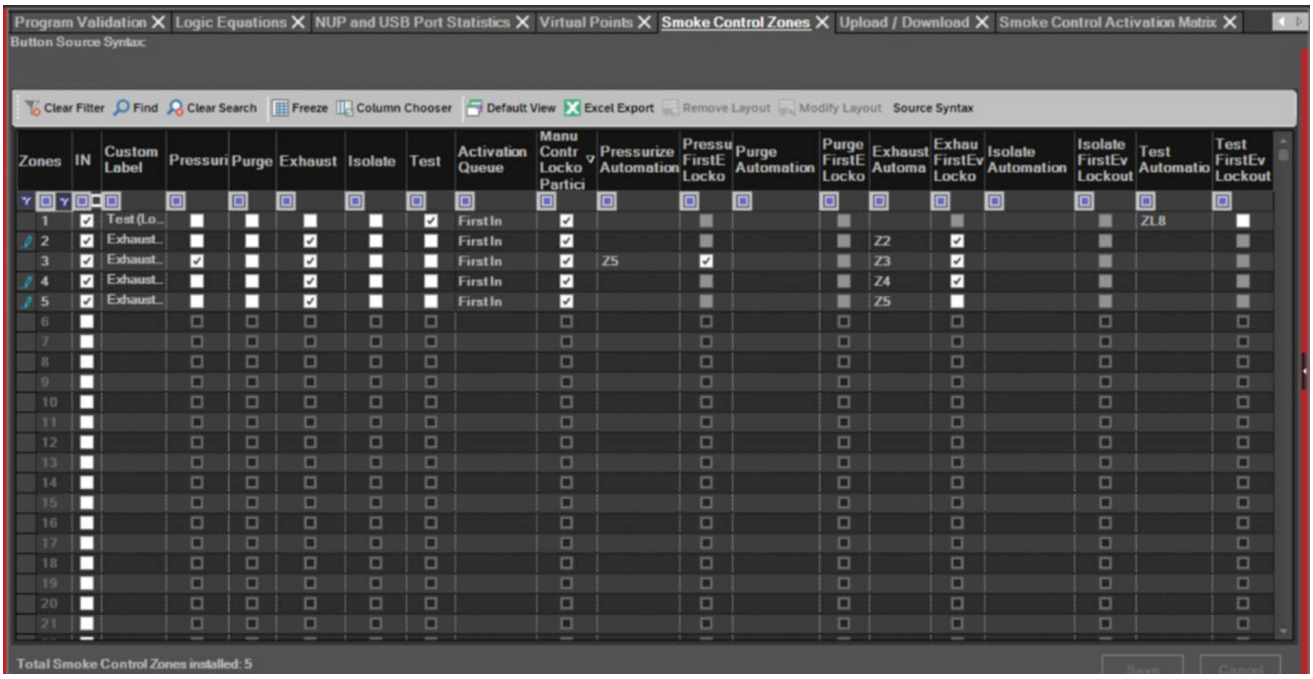


Figure 3.3 Zone Configuration Screen

Custom Label (40 characters)
Custom label to describe the zone.

Pressurize (Yes or No)
Determines whether the smoke control zone will support a PRESSURIZE condition.

Purge (Yes or No)
Determines whether the smoke control zone will support a PURGE condition.

Exhaust (Yes or No)
Determines whether smoke control zone will support an EXHAUST/ON condition.

Isolate: (Yes or No)
Determines whether the smoke control zone will support an ISOLATE/OFF condition.

Test: (Yes or No)
Determines whether the smoke control zone will support TEST mode.

Activation Queuing: FIRST IN or LAST IN.
When conflicting operations are received at the same priority, this setting selects whether the first or last command takes effect. Only after the present operation is released will the next state reflect the first or the last in the queue.

NOTE: *Manual control of smoke control zones from an interface with momentary switches (i.e., ACM-30) must be configured for Last In activation.*

Automation Lockout Participation (Yes or No)
When enabled, the smoke control zone shall enter the lockout state whenever a zone or appliance on the same node is activated by manual control. Automated activations will be blocked.

Pressurize Automation
The general zone or logic zone that will activate the zone to the pressurize condition via automation.

Pressurize First Event Lockout (Yes or No)
Selecting Yes will track the automation logic zone or general zone for Pressurize in this zone and other logic zones or general zones that are participating in First Event Lockout.

- Zone will pressurize if Automation Activation is the first activation processed among the collection of participating logic and general zones.

- Zone will be locked out from an automation activation of pressurization of a different participating logic or general zone activates first.
- Zone will still pressurize if manually controlled to pressurize.

Purge Automation

The general zone or logic zone that will activate the zone to the purge condition via automation.

Purge First Event Lockout (Yes or No)

Selecting Yes will track the automation logic zone or general zone for Purge in this zone and other logic zones or general zones that are participating in First Event Lockout.

- Zone will purge if Automation Activation is the first activation processed among the collection of participating logic and general zones.
- Zone will be locked out from an automation activation of purge if a different participating logic or general zone activates first.
- Zone will still purge if manually controlled to purge.

Exhaust/ON Automation

The general zone or logic zone that will activate the zone to the Exhaust/ON condition via automation.

Exhaust/ON First Event Lockout (Yes or No)

Selecting Yes will track the automation logic zone or general zone for Exhaust/ON in this zone and other logic zones or general zones that are participating in First Event Lockout.

- Zone will Exhaust/ON if the Automation Activation is the first activation processed among the collection of participating logic and general zones.
- Zone will be locked out from an automation activation of Exhaust/ON if a different participating logic or general zone activates first.
- Zone will still Exhaust/ON if manually controlled to Exhaust/ON.

Isolate/OFF Automation

The general zone or logic zone that will activate the zone to the Isolate/OFF condition via automation.

Isolate/OFF First Event Lockout (Yes or No)

Selecting Yes will track the automation logic zone or general zone for Isolate/OFF in this zone and other logic zones or general zones that are participating in First Event Lockout.

- Zone will Isolate/OFF if the Automation Activation is the first activation processed among the collection of participating logic and general zones.
- Zone will be locked out from an automation activation of Isolate/OFF if a different participating logic or general zone activates first.
- Zone will still Isolate/OFF if manually controlled to Isolate/OFF.

Test Automation

The general zone or logic zone that will activate the zone to the test condition via automation. Activation of the test function is only possible via Test Automation. To manually activate the test state of a zone, directly control a general zone that will influence the test automation.

Test First Event Lockout (Yes or No)

Selecting Yes will track the automation logic zone or general zone for Test in this zone and other participating logic zones or general zones that are participating in First Event Lockout.

- This zone will test if the Automation Activation is the first activation processed among the collection of participating logic and general zones.
- This zone will be locked out from an automation activation of test if a different participating logic or general zone activates first.

Additional Information on First Event Lockout

Selecting this condition for the activation state of the zone will ensure that this condition will only activate by automation if it is the first automatic response among the participating zone conditions.

For example, it may be desirable to map multiple zones with an automatic response that triggers an exhaust condition for an alarm within their respective zones. Participation in a First Event Lockout for multiple zones to the Exhaust condition will ensure the automatic response only activates for the zone with the first alarm. Pressurizing adjacent parts of the building to the Exhaust condition may not be participating in first event lockout since they may activate on a variety of scenarios.

3.9 Zone Mapping

Smoke control zones and appliances are mapped using the configuration tool, shown in the example below. Each configuration option is described in the paragraphs that follow.

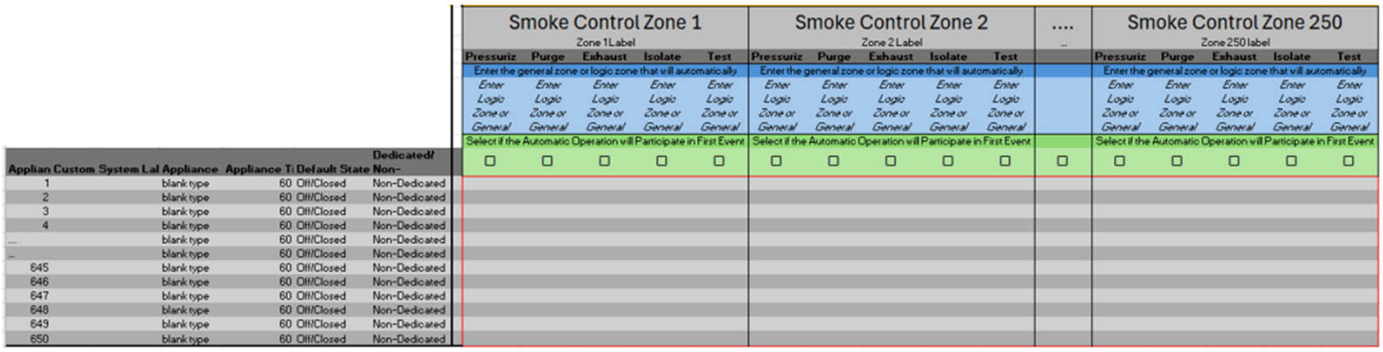


Figure 3.4 Zone Mapping Screen

Custom Label (40 Character)

Duplicates the custom label to describe the appliance.

System Label (40 Character)

Duplicates the Text field from appliance configuration to support sorting and filtering in the configuration tool.

Appliance Type

Duplicates the field from appliance configuration to support sorting and filtering in the configuration tool.

Appliance Timer

Duplicates the field from appliance configuration that shows the timer for transitions of the appliance.

Default State

Duplicates the field from appliance configuration that shows the default configuration of the appliance.

Dedicated/Non-dedicated

Duplicates the field from appliance configuration that describes the behavior of the appliance.

Appliance Mapping

This entry configures the desired behavior of the appliance to match the condition of the smoke control zone.

- Blank (no entry) indicates the appliance is not associated with the zone and will not take direction status changes due to activations or deactivations of this zone.
- ON1 will turn appliance ON/OPEN as soon as the zone subcondition is activated and the ON/OPEN automation block is inactive.
- OFF1 will turn appliance OFF/CLOSED as soon as the zone subcondition is activated and the OFF/CLOSED automation block is inactive.

3.10 Configuring the Activation Matrix

The Activation Matrix screen is used to define the sequence of smoke control operations in one or more zones during an alarm event, test signal, or trouble signal. The matrix identifies appliances in the zone and determines the appropriate way they will operate in the situation, such opening or closing one or more dampers, turning fans on or off, etc.

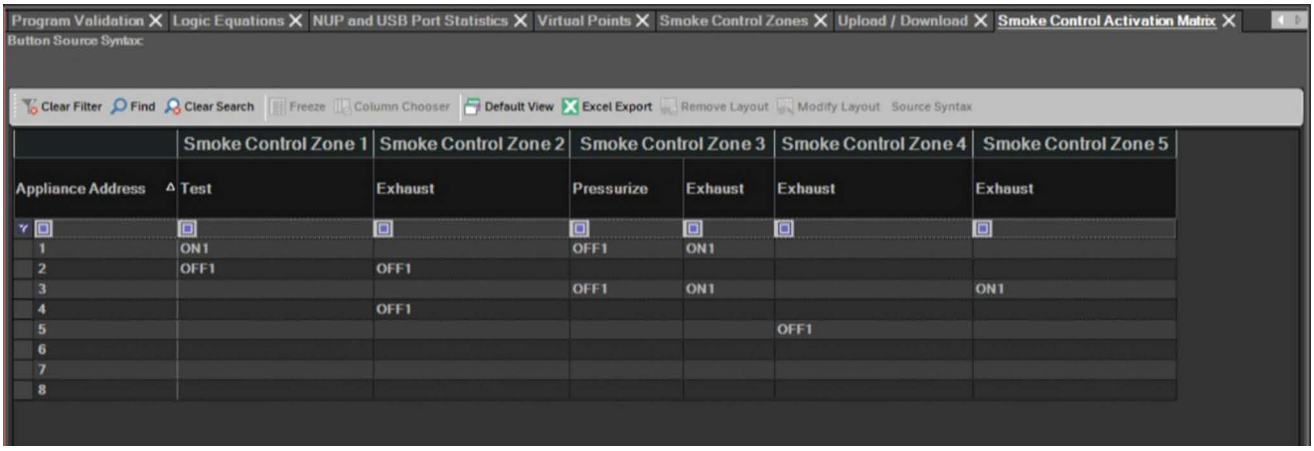


Figure 3.5 Activation Matrix Screen

3.11 System Programming Overview

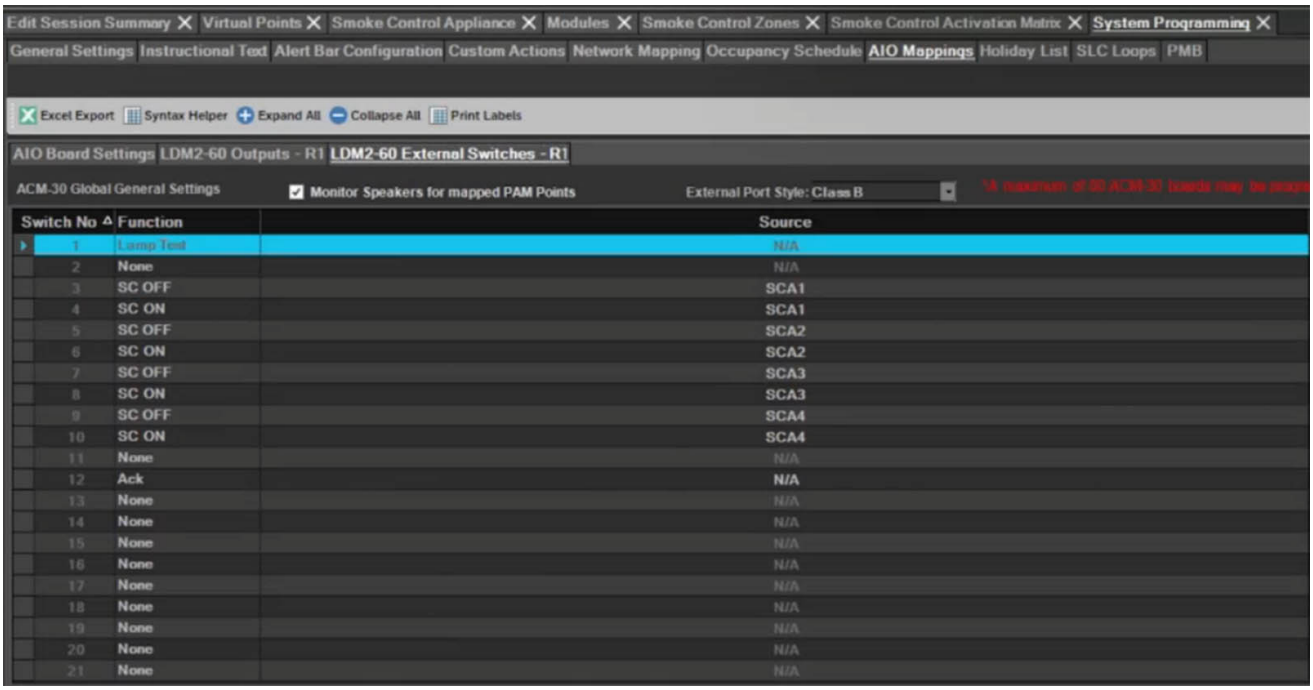


Figure 3.6 Annunciator Configuration Screen (AIO Mapping)

3.12 Annunciator Configuration

In addition to existing mappable targets, annunciators such as the ACM-30/30W and LDM2-32/60 can be used to monitor the conditions of smoke control zones or smoke control annunciators. Control of smoke control zones and appliances may co-exist on the same annunciator as existing control functions with ACM and LDM as control devices. See Section 4.1, “Switch Monitoring” for more information.

3.12.1 Mapping

Smoke control appliances at the subaddress and smoke control zone subaddresses may be monitored by the individual annunciator output points (i.e., ACM-30/30W LEDs or LDM2-32/60 outputs). Through annunciator programming, LED behavior can be assign to blink or steady on indication, allowing the same LED to show the transition subaddress.

For example, the transition ON/OPEN state of a zone or appliance can be shown with a blinking effect, while the non-transition ON/OPEN subaddress is mapped to the steady on indicator.

Smoke control appliances at the base address (not subaddresses) are controllable with the following operations:

- ON/OPEN: Activation will turn ON or OPEN the appliance. Deactivation of ON/OPEN control is a release back to AUTO (not necessarily to the OFF/CLOSED position)
- OFF/CLOSE - Activation will turn OFF or CLOSE the appliance. Deactivation of OFF/CLOSE control is a release back to AUTO (not necessarily to the ON/OPEN position)
- AUTO - Activation will release a smoke control state (ON/OPEN or OFF/CLOSED) and not assert a smoke control activation on the appliance.

Smoke control zones at the base address (not subaddresses) are controllable with the following operations:

- EXHAUST
- PRESSURIZE
- ISOLATE
- PURGE
- AUTO

NOTE: *Activation of Auto will release a smoke control state and not assert a smoke control activation on the smoke control zone.*

3.12.2 Annunciator Prioritization

A prioritization value of 5 (highest), 4, 3, 2, or 1 (lowest) shall be assigned to each annunciator. Shared priorities are permitted. The prioritization applies only to the operations of smoke control zones and smoke control appliances indicated above. Control (ON/OFF) and Disable operations are not prioritized.

3.12.3 Annunciator Enablement and Pairing

The key switch input on the annunciator will provide the enable/disable behavior of the interface. Manual controls will be released (return to AUTO) automatically when an interface is disabled by the key switch input. The key switch address is hard-coded to router on the AIO bus.

NOTE: *When multiple annunciators are used together, only one needs to be wired to the key switch.*

NOTE: *An InterfaceLockout feature allows the FACP to block processing of annunciator inputs. See Section 4.5.3, "Interface Lockout".*

3.13 Priority-Based Activation

In smoke control systems, precedence-based activation refers to a system where the activation of smoke control equipment (fans, dampers) is prioritized based on the availability of multiple control sources. Generally, manual commands from firefighters or fire alarm signals have the highest priority, followed by smoke control automation. This ensures that smoke control measures are activated promptly and reliably during a fire event, overriding other building systems.

Five prioritization levels are provided. To allow for differentiated prioritization of switches on the same graphical display, separate lamp driver modules must be used. For example, operation of the graphical display requires switches associated with smoke control zones to take priority over switches associated with smoke control appliances. Two different Lamp Driver Modules shall be used with different prioritization levels.

- Priority 5
- Priority 4
- Priority 3
- Priority 2
- Priority 1

3.13.1 Manual Control Priority Rules

The highest priority is given to manual overrides from a firefighter's smoke control station (FSCS) or other designated control points. Firefighters can manually override the system to direct fans and dampers for optimal smoke evacuation and containment. The following descending order of precedence shall be followed in processing smoke-control commands:

Highest Priority
The Firefighters' Smoke Control Station (FSCS) shall be configured as Priority 5, the highest available priority.

Next Priorities

Additional control interfaces may also be programmed to smoke control endpoints using one of the available priorities below the FSCS.

Lower Priority

Automated/Automatic responses to the fire condition to manipulate the smoke control endpoints are lower than manual control.

NOTE: *The Interface Lockout allows the FACP to block the processing of annunciator inputs. See Section 4.5.3 for details.*

Lowest Priority

All other automation or manual controls for normal building operations using Control-By-Event or Alter Status of the SLC control points are the lowest priority.The following rules apply:

- SLC control points can only be mapped to ONE appliance.
- Appliances and Zones can only be mapped to each annunciator ONE time; that is, you cannot put two SLC points on the same annunciator for the same appliance or zone.
- Interfaces that are momentary inputs (not toggles) must have the AUTO (i.e., Release) mapped whenever an activation is mapped (i.e., ON/OPEN, OFF/CLOSED, PRESSURIZE, PURGE, EXHAUST/ON, or ISOLATE/OFF).

NOTE: *When a higher priority control source has manually overridden an appliance state, the RELEASE command will release the appliance back to the lower priority control source, or to the AUTO state. Note that an appliance might not change state when given the Release command.*

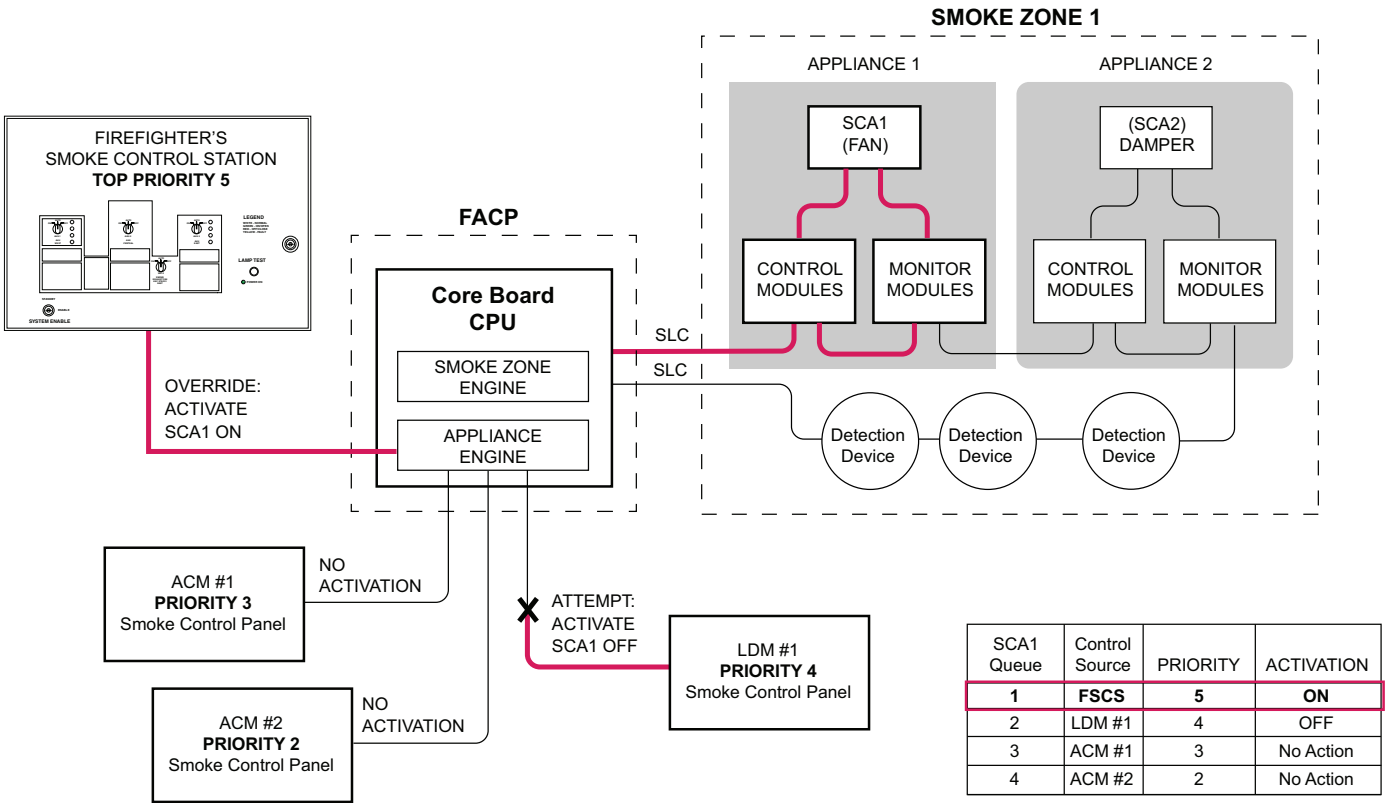
3.13.2 Priority-Based Activation Scenario

In the example below, a priority conflict exists between two control interfaces that want to control SCA1, where an operator at the LDM wants to turn SCA1 (fan) OFF, while a technician at the FSCS wants to turn the same SCA1 fan ON. The interfaces will comply with the activation precedence as configured.

As shown in Figure 3.7, the control interfaces have the following assigned priorities and conditions in effect:

- PRIORITY 5: Firefighters' Smoke Control Station
  Operator at FSCS is attempting to manually activate the fan SCA1 ON.
- PRIORITY 4: LDM #1
  Operator at the LDM is attempting to deactivate the fan SCA1 OFF.
- PRIORITY 3: ACM #1
  No activation/deactivation from this control interface.
- PRIORITY 2: ACM #2
  No activation/deactivation from this control interface.
- PRIORITY 1: Test Panel
  No activation/deactivation from this control interface.

In this scenario, the FSCS has assumed command as the highest priority interface in play and has activated fan SCA1 ON. After the event, the FSCS shall release control to the LDM, which is the next lowest priority control interface.



SCA1 Queue	Control Source	PRIORITY	ACTIVATION
1	**FSCS**	**5**	**ON**
2	LDM #1	4	OFF
3	ACM #1	3	No Action
4	ACM #2	2	No Action

Figure 3.7 Priority-Based Activation Example

3.14 Configuring Virtual Points

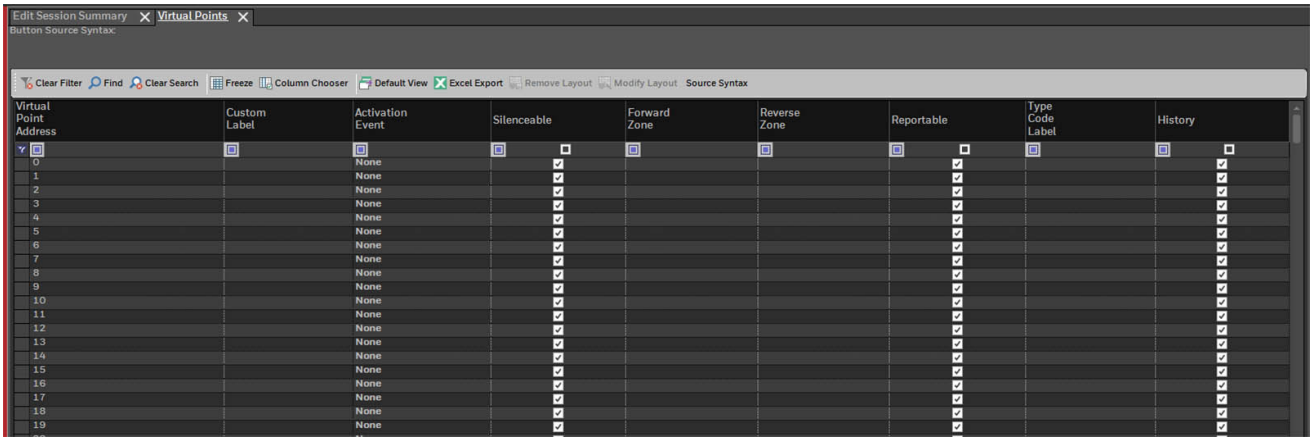


Figure 3.8 Main SLC Configuration Screen

3.14.1 Overview

The smoke control system uses virtual points to create displayable, reportable events without requiring physical hardware. They can be activated manually by a user or by automation through a general zone or logic zone. Each FACP in the system supports their own collection of programmable virtual points for handling different types of operations or conditions.

A maximum limit of 511 virtual points can be licensed and enabled for each panel. Up to 11 virtual points can be configured without a license. Virtual points can serve multiple purposes in the smoke control application, one of which is the coordination of an automated test sequence.

3.14.2 Virtual Point Trouble

When the number of virtual points configured exceeds the base limit plus the licensed quantity, the panel shall indicate a trouble condition by displaying the message, “VIRTUAL POINT LICENSE EXCEEDED”.

NOTE: *The functionality of the virtual points will not be blocked when the trouble is present.*

3.14.3 Virtual Point Addressing

Each virtual point is addressable with its own description or event which allows for events in various points throughout the system. Events on virtual points are displayable on all interfaces, such as GPF-RLD, GFP-A/AR, CLSS, etc.

- The first virtual point (at address zero) is activated from the alert bar of the panel when configured for use as an activation of the Alarm Signal. This is an application unrelated to smoke control.
- Addresses 1-10 are associated from the user interface of the GFP-RLD at the corresponding address when configured as an activation of the Alarm Signal. This is an application unrelated to smoke control.

NOTE: *Virtual points 0-10 may be used for other functions if not being used for Alarm Signal ON (Canadian applications).*

Virtual point addressing is structured as follows:

NxxxVyyy

where: xxx = the node number

yyy = the virtual point number (from 0 to 511)

3.14.4 Virtual Point Activation

Activation and deactivation of virtual points are recorded in history and reflected in CLSS based on the configuration setting. A virtual point can be activated by the following means:

- Manually controlled ON.
- Automated Activation by a Reverse Zone (a logic or general zone). The virtual point goes active if the reverse zone is active.
- Alert Bar mapping (such as Alarm Signal ON)
- Manual control of the general zone assigned in the reverse zone of the virtual point using ACM-30/30W, GFP-A/AR Custom Action Buttons, LDM2-32/60, GFP-RLD Custom Action Buttons, etc.

A point will go inactive in the following conditions:

- Manually controlled OFF
- Signal silence or Reset
- Reverse Zone goes from active to inactive, and the virtual point was active based on reverse zone, not manual control.

NOTE: *A virtual point going active will in turn activate the general zone mapped to the virtual point (forward zone).*

3.14.5 Virtual Point Configuration Parameters

Custom Label

A custom label supporting two languages, 40 characters. For smoke control applications that use virtual points for management of the test, it is suggested to use a custom label that represents the appliances being tested, i.e., “Zone 1 Test” or “Appliance ON test”.

Silenceable

A virtual point configured for silenceable will deactivate (turn OFF) after a signal silence command, even if the reverse zone remains active. The virtual point may re-activate by manual control or a re-activation of the reverse zone (requires the reverse zone to de-activate).

- 0/NO: (Default): Silence has no affect
- 1/YES: Silence clears the event

Forward Zone

Enter the general zone that will be activated when the virtual point is activated. In smoke control cases, enter the general zone that will be used to activate the smoke control zone to test by automation. When configured for silenceable, the forward zone will de-activate in a silenced condition.

Reverse Zone

Enter the general zone or logic zone that will transition from the virtual point to active when the virtual point activates. Virtual points will track the reverse zone, turn OFF in reset, and re-evaluate the reverse zone at the end of the decoupling timer to determine if it should reactivate.

In smoke control cases, create a logic equation that turns on the periodic test at the desired time and duration (e.g., 5 minutes at 2 a.m. on a Sunday morning), or turns on a general zone by manual control to run the test, but not activate when an alarm is in the system. For example:

ZL1 = TIM(SU,02:00:00,02:05:00)

ZL2 = AND(NOT(Z0),OR(Z1000,ZL1))

where: ZL2 is used as the reverse zone.
General Zone 1000 is used to manually activate the test.
General Zone 0 prevents the test from running, or stops the test.

Reportable

Entry (Yes or No) determines whether events at the station point will or will not be reported off-premises. For the smoke control application, the monitoring station typically does not need to know when the test is running. The event will be reported to CLSS regardless of the Reportable setting.

Type Code Label

A 20 character custom type code available in two languages. For the smoke control application, it is recommended to have a general statement related to the usage of this virtual point, such as “Smoke Control Test”.

History

Entry (Yes or No) determines whether state changes at the virtual point will or will not be recorded in history.

Activation Event

The virtual point shall be configured to activate the selected event:

- Fire Alarm
- Security Alarm (Property)
- Critical Process Alarm (Property)
- Supervisory Signal (Equipment)
- Fire Trouble
- Non-Fire Activation
- Non-Fire Activation (no acknowledgment required)

NOTE: *For the smoke control application, it is recommended to create a Non-Fire Activation.*

Section 4: Monitoring and Operation

4.1 Switch Monitoring

4.1.1 Overview

In the smoke control system, the ACM-30/30W and LDM2-32/60 serve as annunciators that provide the FACP or NCD with remote, serially connected arrays of LEDs that indicate the status of addressable points within the system. These devices are also capable of serving as an FSCS or smoke control interface, remotely transmitting commands to the control panel in addition to displaying the status of the system. Common system functions such as signal silence, system reset, and local annunciation controls (local acknowledge and lamp test) are controlled through touchpoints on the annunciator's keypad. Each button on the ACM-30/30W can be programmed to either cooperate with its coordinating LEDs or to operate independently. All buttons and LEDs are customizable.

4.1.2 Expected/Required Indication

An LED indicator on the ACM-30/30W or LDM2-32/60 can be programmed to blink or illuminate steady on in the desired color based on the state of a smoke control appliance. For example, use SCA1.norm to map to the white indicator on an annunciator to be active whenever the smoke control appliance is in the Normal condition.

The typical performance of a smoke control interface is to have all indicators go off when the interface is disabled, and only activate the indicators mapped to trouble for the switches that are still in the OFF-Normal position.

Annunciators are configurable for a blink setting behavior, such as:

- None - does not blink.
- Acknowledge - LED will blink when the target is active but not yet acknowledged.
  LED will go steady when the target is active and the event is acknowledged.
- Alternate - A separate endpoint can be assigned for the steady function versus the blink function. If both conditions are active, the blink function will take priority.

In some regions, the AHJ may specify the method by which LEDs on an annunciator shall light. The smoke control system can configure this function to accommodate the unique AHJ expectations for the system visualization and response. For example, an AHJ may require that the NORMAL light shall extinguish only if an appliance or zone state was activated by manual (switch) control rather than by an automation response. In a given situation, the AHJ may specify that the graphic display shall exhibit a particular behavior, such as:

- never blink
- blink during transition
- support solid states only
- go solid when point is commanded ON
- go solid only when point is confirmed ON
- no feedback displayed until display is enabled
- when display is disabled, illuminate switches in the OFF-Normal position

To achieve AHJ requirements, the smoke control system leverages LED behaviors to follow the state of the appliance or zone it is monitoring regardless of the method by which the appliance or zone was activated (manually or via automation).

4.1.3 ACM-30/30W General Zone Configuration

General zones shall be co-mapped with smoke control points. That is, targets (sources) shall include an optional, single, local, general zone mapped with the smoke control appliance or zone. General settings are defined below and are applicable to the entire annunciator. Required settings:

- The zone shall be Non-Reset Control - that is, it should not turn off with a Reset.
- The zone shall be non-silenceable.
- The precedence participation is unselected (not used for general zones at this time).
- The zone shall not participate in resound by zone.

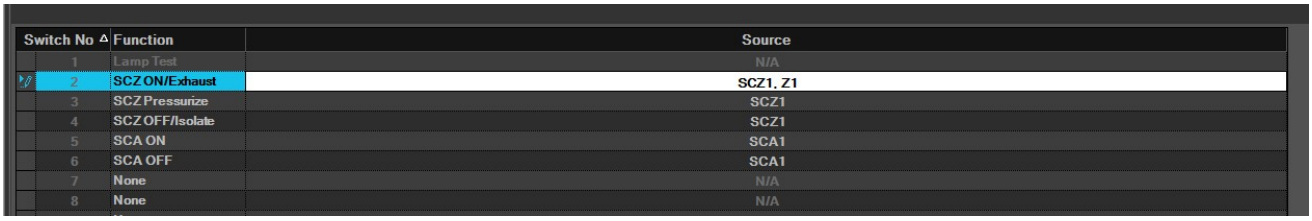


Figure 4.1 ACM-General Settings Screen

Primary Label

A label used for trouble reporting

Lamp Test

Button 32 configured by default for lamp test

ACK Function

Button 31 configured by default option for ACK. (It can be reprogrammed.)

4.1.4 LDM2-32/60 Configuration

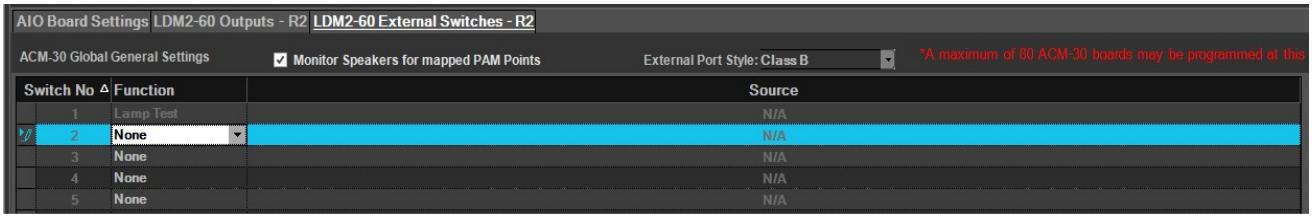


Figure 4.2 Switch Monitoring: LDM External Switches

Switch Type

Toggle or Momentary. This setting determines whether a switch returning to the Normal position is intended to undo the control operation.

- Toggle - like a light switch. A transition from one position to another position will persist. The desired operation will stay in effect for the duration that the switch is in the Off-Normal position. A return to the normal position will undo the operation.
- Momentary - like a push start in a vehicle. A transition from one position to another position will be followed by a transition to the return state. The desired operation will stay in effect after the return, that is, a return to normal is part of the Press and Release.

4.1.5 Toggle Implementation

LDM points set to Toggle detect when a zone or appliance is manually transitioned via a user interface to have a unique status indication for the switch being in the active position

- Off normal position of the switch for SCA ON, SCA OFF, SCZ Purge, SCZ ON/Exhaust, SCZ Pressurize, and SCZ OFF/Isolate shall ACTIVATE the general zone.
- Return to normal position of the switch shall DEACTIVATE the general zone (assuming the zone is not active for another switch).

Note that each switch may have a unique zone assigned, or switches that are common to a single appliance, or a zone may use a common zone, or all switches on the interface may use a common zone. All switches must be in the normal/inactive position for the general zone to go off. The zone should not be activated by any other operation in the system. The zone shall not be reused on multiple interfaces.

NOTE: *SC Auto is not used on a toggle-style interface.*

4.1.6 Momentary Implementation

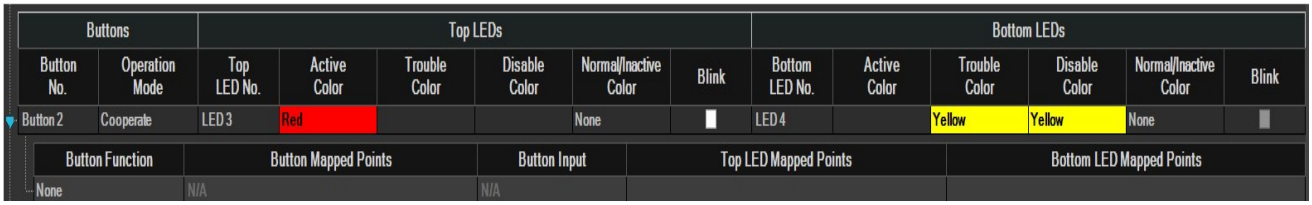


Figure 4.3 Switch Monitoring: ACM Programming

ACM points set to Momentary detect when a zone or appliance is manually transitioned via user interface to have a unique status indication for the switch being in the active position. The same general zone must be mapped to all buttons/switches on that interface with the same target.

SCA ON, SCA OFF, SCZ Purge, SCZ ON/Exhaust, SCZ Pressurize, and SCZ OFF/Isolate shall activate the general zone. SC Auto shall deactivate the general zone.

Example: Where the SCA ON and SCA OFF commands activate Z5; the SC AUTO will deactivate Z5:

- Z5 will be used to indicate that SCA1 is manually activated.
- SCA ON shall be mapped to SCA1,Z5
- SCA OFF shall be mapped to SCA1,Z5
- SC AUTO shall be mapped to SCA1,Z5

NOTE: *IMPORTANT! The SC Auto must be mapped to the annunciator whenever an activation option is mapped to the annunciator.*

Keyswitch (Interface Disable)
Not Used (default), or enter address of annunciator for pairing and enablement requirement.

When an annunciator address is entered, it may be its own address, the address of the router, or another address. The address must be local to this panel.

Smoke Control Priority
Select options 1, 2, or 3 where Smoke Control priority 1 is the highest priority.

Annunciator Programming
These are individual settings for the LDM2-32/60 or ACM-30/30W.

Switch Button
The address of the switch input.

Function
The behavior/operation of the button/switch.

- ON/OPEN, OFF/CLOSED (syntax of Source would be smoke control appliances, or SLC modules)
- AUTO (syntax of Source would be smoke control appliances, SLC modules, or zone). Note that SC Auto is for ACM only, not LDM.
- Exhaust, Pressurize, Purge, Isolate, and Test (syntax of Source would be smoke control zones)
- RESET Smoke Control

Button Mapped Point
The target point to take action on the operation.

Operation Mode

- Select Cooperate (default) to disable and remove programming for top LED mapped point and Bottom LED mapped point.
- Select Independent to enable the independent mapping of points for the LEDs.

LED Number
The index for the LED that is being referenced.

Top LED Blink
Unlocks further programming and operations.

- Off (unchecked selection)
- Select Acknowledge for checked option to blink when the mapped point is in the unacknowledged condition.
- Select Alternate to permit a different point to be assigned. A typical case would be a smoke control zone or appliance that has a different point (subaddress) for the transition state of the device. If both points (the object mapped to steady and the object mapped to blink) are active, steady will take priority.

Mapped Point (Top LED)
The point that the LED will follow.

4.1.7 Lamp Test

In this Lamp test, switch input shall be assumed to be Toggle.

1. PRESS activates the lamp test.
2. RELEASE ends the lamp test.
3. Required test results:
   - Lamp test shall be connected only for the designated master annunciator.
   - Lamp test on the designated master annunciator shall also activate the paired annunciators.
   - Lamp test shall activate all outputs on the annunciator and paired annunciators simultaneously.

4.1.8 Switch Monitoring Test

After programming, fully test the LDM2-32/60 and/or ACM-30/30W.

- Ensure each switch performs its intended function.
- Ensure each LED lights correctly and in the correct color.
- Ensure the annunciator performs the functions outlined in its documentation.

NOTE: *For more information on annunciator operation, consult the ACM-30/30W or LDM2-32/60 documentation.*

4.2 Smoke Control Zone Control

Smoke Control Zones may be activated to a desired state by manual control of the zone from a user interface, or programmed for automatic operation according to the zone condition. Smoke Control Zone states are described below:

- EXHAUST/ON
  Manipulation of smoke control appliances to move contaminated air out of the zone, replaced by make-up air. Can be done by manual operation or automation; can be used to indicate the smoke control zone is ON.
- PURGE
  Manipulation of smoke control appliances to quickly perform air exchange to flush smoke out of a zone after the fire has been extinguished. Typically performed by manual operation only (no automation). At times, a purge operation may be doing Exhaust and Pressurize operations simultaneously. Non-life safety mode.
- PRESSURIZE
  Manipulation of the smoke control appliances to PUSH clean air into the zone/compartment to increase air pressure in reference to the neighboring zones to prevent smoke from entering.
- ISOLATE/OFF
  Relevant in systems utilizing common supply or return ducts, or both. Manipulation of the smoke control appliances so that the common elements are isolated for this zone. Can be used to indicate the smoke control zone is OFF.

NOTE: *Behavior of the zone is dictated by the behavior assigned to the appliances within the zone, not necessarily the name of the condition.*

- TEST
  Functionally exercise the state of each appliance to verify operational conditions.
- RELEASE
  Return from a higher priority control source of a manual control to a lower priority control command, or the Auto state. Note that a zone may not change state when provided a Release command.
- AUTO
  Appliances and control modules assigned to an appliance will be activated or deactivated to match the desired state automatically. CBE programming for the appliance or control module is not required once they are assigned to an zone.
- Direct manipulation of the appliances assigned to a smoke control zone will not activate the zone. For example, when a pressurization fan appliance is assigned the ACTIVE state for pressurization in a smoke control zone, turning the fan ON/OPEN will not turn on the smoke control zone pressurization subaddress. CBE programming for the appliance or control module is not required once they are assigned to an zone.

4.3 Nested Zone Control

Nested zone control is intended for use in complex campuses that require smoke control and have multiple smoke control zones. Zones are grouped consolidated control and status, and can be manipulated via a common switch control. The multiple target zones associated with a single switch input provides a simplified user interface for executing complex activations in segregated zones.

Up to eight smoke control zones, or seven smoke control zones with an optional general zone can be mapped as targets for a single smoke control zone operation, such as SCZ Purge, SCZ ON/Exhaust, SCZ Pressurize, and SCZ OFF/Isolate, SC Auto.

Likewise, multiple zones can be associated with a single status indicator (LDM2-32/60 output or ACM-30/30W LED) to provide a simplified user interface for complex actions in segregated zones. This is done by means of logic equations to AND or OR the status of multiple zones, depending on AHJ expectation.

NOTE: *SC Auto is only allowed on LDM2-32/60 switches set to Momentary, or on ACM-30/30W buttons.*

4.4 Disable and Bypass

The Disable and Bypass modes of operation allow the system to be taken fully or partially off-line in order to perform service and inspection activities without the need for additional hardware. Each condition is described in brief below:

4.4.1 Disable State

Disable is a software state during runtime that prevents activation of a smoke control zone or smoke control appliance by either manual or automatic means. Disabling a zone or appliance will prevent that item from activating under any condition, either by manual control or an automatic/programmed response to an input event. Initiating a Disable condition will generate a Disable event, and disabled points will be grayed out in graphical displays.

The Disable state provides several features and benefits:

- Generates a Disable event for each appliance/device in the zone, or
- Generates a Disable event for the zone only.
- For appliances and zones mapped to an annunciator, a Disable event for the device will indicate a fault condition.

4.4.2 Bypass State

Bypass is a software state during runtime that prevents automated activation of a smoke control zone or smoke control appliance. Initiating a Bypass condition will generate a trouble or supervisory event. Bypassed points are still functional and enabled, but activation control by event (CBE) will be prevented from evaluating true.

NOTE: *Bypassing a zone or appliance is performed with a virtual point that is incorporated into the logic for activation that would prevent the activation logic from evaluating true while the virtual point for bypass is active. When a bypass is activated, the virtual point will create the event in the system. Bypass, in this sense, will not prevent direct manual control of the zone or appliance.*

4.5 Lockout

Lockout will not prevent manual control; manual control will always override the lockout. Lockout will prevent subsequent activations of the appliance or zone by automation/automatic activation.

There are two distinct lockout modes which accommodate specific lockout scenarios. Lockout programming for each mode does not conflict with the other mode. That is, lockout modes can be combined to satisfy innumerable fire protection design expectations. The user may program the system to use only one lockout mode, or two lockout modes simultaneously, etc., or none. Each lockout mode is described below.

4.5.1 Automation Control Lockout

Manual control operation of any smoke control zone or appliance places all participating zones and appliances in a state of lockout to prevent any subsequent automatic operations. In this state, additional manual operations will be permitted and previously triggered automatic operations are not undone.

Basic Functionality

- Each appliance and each zone sub-state has the option to participate in manual control lockout.
- If a manual control decision is made, automatic smoke control operation is blocked so that nothing will activate unexpectedly while the system is in manual control.
- With Lockout enabled for the zone or the appliance, it participates by going into a lockout state whenever there is another zone or appliance on the same node that is manually controlled.

Automation Control Lockout Behavior

Manual control of an appliance on one node has the following effects:

- locks outs other appliances and zones in the same node.
- will not directly lock out appliances on another node.

4.5.2 First Event Lockout

First event lockout is applicable to the actions related to the first event, which could be multiple transitions, such as one zone going to exhaust, adjacent zones going to pressurize. The first automatic operation is executed and unaffected zones and appliances are locked out to prevent further automatic responses to additional fire events. Manual operations are permitted after first event lockout.

Typically, the first response to a fire event happens via automation, and subsequent responses would be implemented only with manual control for optimal, predictable operation. Therefore, first event lockout applies only to automatic activations (automation) and pertains to smoke control zones only. All smoke control zones must be co-located on the same node for participation, and individual appliances assigned to a participating smoke control zone will also participate. CBE equations that activate the smoke control zone sub states will be selected for participation during configuration.

Example: First Event Lockout

1. Z1 performs exhaust on 1st floor and pressurizes 2nd floor.
2. Z2 performs exhaust on 2nd floor and pressurizes 1st and 3rd floor.
3. Z3 performs exhaust on 3rd floor and pressurizes 2nd floor.
4. ZL1 logic equation for pressurizing 2nd floor is OR(Z1,Z3)"

In this example, Z1, Z2, and Z3 are participating. Once the first participation activation occurs, the action assigned to that zone will activate. Automatic activations associated with the other two zones are locked out. ZL1 is not participating; it can still activate even after the lockout occurs.

Each Zone Sub-state automation equation has the option to participate in first event lockout. Once the associated zone sub states activate, the associated zone sub states for the remaining participating equations will go to lockout.

4.5.3 Interface Lockout

The smoke control system can be configured for an Interface Lockout of the annunciator interfaces. Each annunciator interface is provided with a keyswitch. Normally, when switches are thrown at an FSCS, the other lower priority LDM2-32/60 or ACM-30/30W annunciators are only prohibited from changing the same smoke control appliance or zone end-point. With Interface Lockout, the FACP will block the processing of any annunciator inputs.

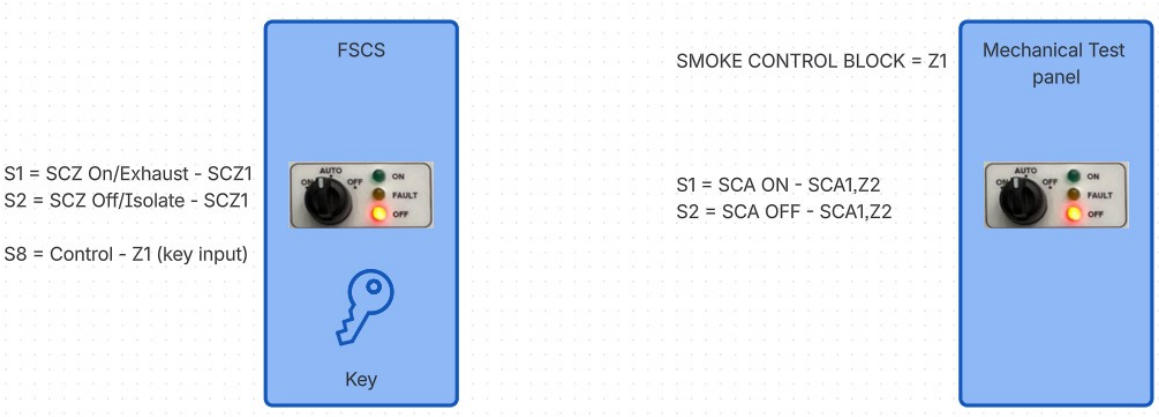


Figure 4.4 Interface Lockout

Keyswitch Locked

When the keyswitch is a locked interface, the fire panel will not process any switch inputs. (Note that Lamp Test is a local operation at the annunciator that does not require panel processing.)

Momentary switch controls sent when the keyswitch is a locked interface will be discarded regardless of the action assigned to the switch; i.e., Acknowledge, Silence, Reset, Control, Disable, SCA ON, SCA OFF, etc.

Toggle switch controls sent will not be processed while the keyswitch is a locked interface.

NOTE: *Restoration to the normal position (undoing a toggle switch) will be ignored when the keyswitch is a locked interface.*

Keyswitch Unlocked

A short circuit across the keyswitch (unlocked interface) will allow the switch inputs for actions. Toggle inputs will be assessed for a change in position from the last known state to detect if the switch was moved prior to the keyswitch.

A switch moved prior to the keyswitch shall be processed once the keyswitch is unlocked.

A switch moved while the keyswitch is unlocked will be processed.

Keyswitch Monitoring

The condition of the keyswitch input is not exposed or available for use in logic equations. A monitor module would be required to monitor the keyswitch to provide a point within the system that can be used in logic equations.

Special Considerations

A keyswitch will provide a lockout method of the interface, but it does not provide the ability to monitor and create events in the system for switches that are in the Off-Normal position when the keyswitch is a locked interface. An event in the system can be created to track the condition of the keyswitch. This functionality requires a monitor module.

4.6 Reporting

4.6.1 Appliance Event Reporting

The smoke control appliance will generate events that can be displayed at the base address for disable or trouble events.

Table 4.1 Appliance Event Reporting

Appliance Trouble	Description	
Smoke Control Appliance License Exceeded	Number of configured appliances exceeds the number of installed licenses.	
General Trouble	Trouble monitor is active.	
AC Fail	AC Fail monitor is active.	
Service Disconnect	The service disconnect monitor is active.	
ON/OPEN Timer Expired	The operation to transition to the ON/OPEN position did not occur in the expected time.	Notes: A monitor is active when the control is inactive in dedicated mode (outside the timer limit). A monitor is inactive when the control is active in dedicated or non-dedicated mode (outside the timer limit).
OFF/CLOSED Timer Expired	The operation to transition to off/closed did not occur in the expected time.	
ON/OPEN Mon Incorrect	The status indicates the appliance is not in the expected condition for ON/OPEN.	
OFF/CLOSED Mon Incorrect	The status indicates the appliances is not in the expected condition for OFF/CLOSED.	
Conflicting Operations	Automation logic evaluates true for both ON and OFF automation actions.	

4.6.2 Smoke Control Zone Event Reporting

The smoke control zone will generate a non-fire displayable event activation for test mode when the test condition is activated. Displayable events will be generated at the base address for disable and trouble events.

Table 4.2 Zone Event Reporting

Appliance Trouble	Description
Smoke Control Zone License Exceeded	Number of configured smoke control zones exceeds the number of installed licenses.
Periodic Test Fault	A fault occurred while the test condition of the zone was active (latching).
Conflicting Operations	Automation turns on two or more zone states.
Incomplete Operation	Not all appliances reached the desired condition

4.7 Periodic Testing

Periodic testing is a code requirement. The smoke control application provides intuitive programmable testing of the smoke control system supported by historical event data. Periodic testing is also an important diagnostic tool. The exact fault may not be present when the service technician arrives to diagnose the problem. Analyzing the historical data generated during periodic testing is an acceptable means of identifying the exact fault condition in effect.

4.7.1 Zone and Appliance Testing

The system is tested by zone where each smoke control zone may be tested concurrently or sequentially. When a zone is activated into test mode, a non-fire activation event will display and be logged in history by the mapping of the activation event to a virtual point. When the test cycle ends, the zone deactivates and the virtual point deactivates.

If a fault condition occurs during activation of test mode, a latched fault will occur at the zone. The nature of the fault condition will be logged in event history.

For smoke control appliances, periodic testing is performed by leveraging a dedicated zone for appliance testing only. All appliances under test would be assigned to that dedicated zone.

4.7.2 Testing by Zone

The fire alarm technician can program the periodic test by zone where each smoke control zone may be tested, concurrently or sequentially. Zone testing does not require any additional zones to be created. Periodic test programming includes:

- Test Scheduling
- Test Activation
- Test Indications and Results

4.7.3 Scheduling

Test activation would be automated at a scheduled time or through manual control so that tests can be reproduced when a service technician arrives to repair a problem. Ideally, test mode can be activated by automation on a desired schedule using a timing logic equation that is active for the duration of a complete test cycle. A timing logic equation (i.e., ZL1 = TIM(MO,01:00:00,01:02:00) schedules the automated activation of the test state of a zone, triggering the periodic test.

NOTE: *Program the logic equation with sufficient duration to complete the activation of all necessary appliances before deactivation.*

NOTE: *It is recommended to incorporate the general alarm condition in the activation logic equation to prevent and stop a periodic test during an alarm condition. If a higher priority event occurs (fire alarm, supervisory, etc.), the programmer must ensure the zone/logic zone that activates an automated test is not executed, and stops activation.*

4.7.4 Test Indications

- Display will show when a test is running in a smoke control zone, and a non-fire event will activate for the virtual point.
- Printer will record the following data:
  - testing cycle start and end with the virtual point for the test execution.
  - whether a testing cycle is aborted when a virtual point is used to combine the alarm condition with the timing equation to identify when the timing equation was stopped or prevented from activating.
  - whether a zone failed a test with the latching periodic test fault.
- Fault conditions occurring during activation of a zone's test mode will cause a latched fault and be logged in history.

Section 5: Enhancements

5.1 Logic Equations

The tables below define the logic equations for SCA (appliance) points and SCZ (zone) points. For smoke control appliances, the equation syntax is:

NyyySCAxxx.abc, where:

yyy = node number of the controller (may be omitted for local operation)

xxx = address of the appliance, from 1 to 250

abc = subaddress syntax of the appliance (see Table 5.1) or zone (see Table 5.2)

Table 5.1 Appliance Subaddresses

Description	Syntax	Subaddress Location
ON	.on	1
OFF	.off	2
Transition OFF/AUTO to ON	.ton	3
Transition ON/AUTO to OFF	.toff	4
Trouble	.trb	5
Normal	.norm	6
AC Fail	.ac	7
Lockout	.lock	8
Pending ON	.pon	9
Pending OFF	.poff	10
Service Disconnect	.sd	11
Transition ON/OFF to AUTO	.tnorm	12

Table 5.2 Zone Subaddresses

Description	Syntax	Subaddress Location
Exhaust	.ex	1
Pressurize	.pres	2
Isolating	.iso	3
Purge	.purg	4
Test	.test	5
Exhaust Timer	.extm	6
Pressure Timer	.prtm	7
Isolation Timer	.istm	8
Purge Timer	.putm	9
Test Timer	.tstm	10
Idle	.idle	11
Trouble	.tbl	12
Normal	.norm	13
AC Fail	.ac	14
Lockout	.lock	15
Idle Timer	.idtm	16

5.1.1 Monitoring with Logic Equations

The subconditions of smoke control appliances and smoke control zones may be used in the evaluation of logic equations. These conditions shall provide the system status that can be used to manipulate the indicators to reflect the requirements of the AHJ, as shown in the examples below.

- ZL1=OR(SCA1.ON, SCA1.TON) will evaluate true whenever an appliance is in the process of turning on or is already on.
- ZL2=OR(SCA1.TON, SCA1.toff, SCA1.tnorm) will evaluate true whenever an appliance is in the process of changing conditions.

5.2 Appliance Enhancements

5.2.1 Variable Speed Fan

Variable speed fans, also known as variable frequency drives (VFDs) allow for adjustments to fan speed based on the severity of the fire or other factors. During a fire, variable speed fans can be used to rapidly extract smoke and heat from the affected area. They can be configured to run at a higher speed during an emergency to maximize smoke extraction. This precise control of airflow and can help to optimize smoke extraction strategies.

SLC addressing is used for the ON Control mapping. If there is a common SLC point used for all speeds then that is the point that shall be programmed. If there is not a common SLC point, then a dummy control point is used to represent when the fan needs to activate. The remaining points shall use logic equations or the zone status to perform a CBE that incorporates the common SLC point activating with additional events dictating the fan speed.

For Example: A variable speed fan supplies air to two zones, each with a damper (SCA2 and SCA3). The expectation is that if only one damper is open, then the fan should run at Speed 1.
If two dampers are open, it should run at Speed 2.

When programming the appliance for the fan, only L1M1 shall be used as the control point. This point will go on whenever the fan needs to activate at either speed.

L1M2 and L1M3 may be used to set the desired speed of the fan. L1M2 and L1M3 will not have direct association with the smoke control appliance.

L1M2 and L1M3 may be activated by traditional CBE and the state of the damper positions to set the speed when L1M1 is active, or SCA1 is active.

Appendix A: Subaddressing Use Types

A.1 Introduction

Appliance subaddresses essentially reveal the state of a smoke control appliance and inform other functions in the smoke control system. Depending on how an appliance is configured and its state at any given time, its subaddresses can drive various outputs, such as LED indicator behavior, participation in logic equations, the activation matrix, etc. The tables in this section illustrate how an appliance's configured options and its 12 subaddresses will result in the expected smoke control behaviors and indications.

A.1.1 Using the Subaddressing Tables

Each subaddressing table in this section defines a category of unique use types and illustrates how to configure the appliance accordingly. The tables also show how and why a particular subaddress would activate or not. For a specific appliance of interest, select the table that matches the capabilities needed by its Control and/or Monitor Module(s); for example, the capabilities of "OFF/CLOSED Control, ON/OPEN and OFF/CLOSED Monitoring" is covered in Table A.15.

Table A.1, "Trouble Use Types"

Table A.2, "ON Control Use Types"

Table A.3, "ON Monitoring Use Types"

Table A.4, "OFF Control Use Types"

Table A.5, "OFF Monitoring Use Types"

Table A.6, "ON Control, ON Monitoring UseTypes"

Table A.7, "OFF Control, OFF Monitoring Use Types"

Table A.8, "ON & OFF Control, ON & OFF Monitoring Use Types"

Table A.9, "ON & OFF Control Use Types"

Table A.10, "ON Control, OFF Monitoring Use Types"

Table A.11, "OFF Control, ON Monitoring Use Types"

Table A.12, "ON & OFF Monitoring Use Types"

Table A.13, "OFF Control, ON & OFF Monitoring Use Types"

Table A.14, "ON & OFF Control, OFF Monitoring Use Types"

Table A.15, "OFF Control, ON & OFF Monitoring Use Types"

Table A.16, "ON & OFF Control, OFF Monitoring Use Types"

A.1.2 Table Legend and Notes

ActQ	Activation Queuing (First-In/Last-In)
1	Point is ON.
0	Point is OFF.
y	Point is installed/configured but it does not matter if it is ON (1) or OFF (0).
x	Point is not installed/configured.
blank	Point could be ON, OFF, AUTO, or uninstalled (not considered for the provided example).
dash (-)	Point can only be unused; i.e., source is not applicable to the combination being called out.
n	Output condition could either be high or low; it is not a factor in the provided example.
Ded or Non	Dedicated or Non-dedicated
Sources	SLC Points, Logic Eq(uations), Conf(iguration Options), Oper(ational States), Act(ivation Queuing)
asterisk (*)	Control point activated first in an Activation Queuing scenario whenever two control points are activated.
Trouble Codes	4EH Service disconnect 5BH Normal timer expired 5CH Incorrect state 12H General trouble 14H AC fail 39H Configuration fault 50H Conflicting operations 56H ON/OPEN timer expired 57H OFF/CLOSED timer expired 58H ON/OPEN mon incorrect 59H OFF/CLOSED mon incorrect

NOTE: *Refer to Appendix B, "Appliance Scenarios & Wiring" for examples and basic wiring diagrams.*

A.2 Subaddressing Tables

Table A.1 Trouble Use Types

	Configured Sources																Subaddress States (Result)													
	SLC Points							Logic Equation				Config		Oper		ActQ	1	2	3	4	5	6	7	8	9	10	11	12		
TYPES	ON Con	ON Mon	OFF Con	OFF Mon	TRBL Mon	AC Fail	Service Disconnect Mon	ON Auto-Block	OFF Auto-Block	ON Auto	OFF Auto	Dedicated/Non-dedicated	Default ON/OFF	Man Cntrl ON/AUTO/OFF	Cmd Zone ON/AUTO/OFF	First-In/Last-In	ON	OFF	Trans ON	Trans OFF	TRBL	Norm	AC Fail	Lockout	Pend ON	Pend OFF	Service Disconnect	Trans Norm	Trouble Code	Notes
1	x	x	x	x													0	0	0	0	1	0	n	0	0	0	n	0		Note 1
2					1												n	n	n	n	1	n	n	n	n	n	n	0	12H	Note 2
3						1											n	n	n	n	1	n	1	n	n	n	n	0	14H	Note 3
4							1										n	n	n	n	1	n	n	n	n	n	1	0	4EH	Note 4

Table A.1 Notes

1. Anytime there are no ON & OFF SLC points installed/configured for an appliance, CAMWorks+ should give a warning or block the download.
2. Anytime the trouble monitor is active, a trouble shall be created.
3. Anytime the AC fail monitor is active, a trouble shall be created.
4. Anytime the service disconnect is active, a trouble shall be created.

Table A.2 ON Control Use Types

	Configured Sources																Subaddress States (Result)													
	SLC Points							Logic Eq				Config		Oper		ActQ	1	2	3	4	5	6	7	8	9	10	11	12		
TYPES	ON Con	ON Mon	OFF Con	OFF Mon	TRBL Mon	AC Fail	Service Disconnect Mon	ON Auto-Block	OFF Auto-Block	ON Auto	OFF Auto	Dedicated/Non-dedicated	Default ON/OFF	Man Cntrl ON/AUTO/OFF	Cmd Zone ON/AUTO/OFF	First-In/Last-In	ON	OFF	Trans ON	Trans OFF	TRBL	Norm	AC Fail	Lockout	Pend ON	Pend OFF	Service Disconnect	Trans Norm	Trouble Code	Notes
	DEFAULT OFF Normal State / AUTO Position																													
1	0	x	x	x				0	-	0	-		OFF	Auto	Auto		0	0	0	0	n	1	n	Note 1	0	0	n	0		Norm/No activ.
2	0	x	x	x				1	-	1	-		OFF	Auto	Auto		0	0	0	0	n	0	n	Note 1	1	0	n	0		Note 2
	ON / OPEN Position																													
3	1	x	x	x				0	-	1	-		OFF	Auto	Auto		1	0	0	0	n	0	n	Note 1	0	0	n	0		Note 3
4	1	x	x	x					-		-		OFF	ON			1	0	0	0	n	0	n	1	0	0	n	0		Note 4
5	1	x	x	x					-		-		OFF		ON		1	0	0	0	n	0	n	1	0	0	n	0		Note 5
	Special Case : OFF / CLOSED Position without OFF / CLOSED Control & Monitor																													
6	0	x	x	x					0		1		OFF	Auto	Auto		0	1	0	0	n	0	n	Note 1	0	0	n	0		Note 6
7	0	x	x	x					-		-		OFF	OFF			0	1	0	0	n	0	n	Note 1	0	0	n	0		Note 7
8	0	x	x	x					-		-		OFF		OFF		0	1	0	0	n	0	n	Note 1	0	0	n	0		Note 8
	DEFAULT ON Non-dedicated only																													
9	y	x	x	x					-		-	Ded	ON				n	0	n	0	1	n	n	n	n	n	n	n		Note 9
10	y	x	x	x					-		-	Non	ON				n	0	n	0	n	n	n	n	n	n	n	n		Note 10
	Normal State / AUTO Position																													
11	0	x	x	x				0	-	0	-	Non	ON	Auto	Auto		0	0	0	0	n	1	n	Note 1	0	0	n	0		Note 11
12	0	x	x	x				1	-	1	-	Non	ON	Auto	Auto		0	0	0	0	n	0	n	Note 1	1	0	n	0		Note 12
	ON / OPEN Position																													
13	1	x	x	x				0	-	1	-	Non	ON	Auto	Auto		1	0	0	0	n	0	n	Note 1	0	0	n	0		Note 13
14	1	x	x	x					-		-	Non	ON	ON			1	0	0	0	n	0	n	1	0	0	n	0		Note 14
15	1	x	x	x					-		-	Non	ON		ON		1	0	0	0	n	0	n	1	0	0	n	0		Note 15
	Special Case: OFF / CLOSED Position without OFF /CLOSED Control & Monitor																													
16	0	x	x	x					0		1	Non	ON	Auto	Auto		0	1	0	0	n	0	n	Note 1	0	0	n	0		Note 16
17	0	x	x	x					-		-	Non	ON	OFF			0	1	0	0	n	0	n	Note 1	0	0	n	0		Note 17
18	0	x	x	x					-		-	Non	ON		OFF		0	1	0	0	n	0	n	Note 1	0	0	n	0		Note 18

Table A.2 Notes

1. Lockout is evaluated by controls not indicated in the table.
2. Automation activation to ON/OPEN has been blocked by a dependency (pending state). No automatic trouble - a virtual point can be used to create a trouble if expected.
3. Possible via automation activation to ON/OPEN with no dependency block.
4. Possible via manual control to ON/OPEN.
5. Possible via commanding zone activation to ON/OPEN.
6. Possible via automation activation to OFF/CLOSED with no dependency block.
7. Possible via manual control to OFF/CLOSED.
8. Possible via commanding zone activation to OFF/CLOSED.
9. For dedicated appliances, setting the appliance that is default ON/OPEN to only be controlled to ON/OPEN is wrong. CAMWorks+ may block the download from happening.
10. For non-dedicated appliances, setting the appliance that is default ON/OPEN to only be controlled to ON/OPEN is fine.
11. Normal/No Activations

12. Automation activation to ON/OPEN has been blocked by a dependency (pending state). No automatic trouble - a virtual point can be used to create a trouble if expected.
13. Possible via automation activation to ON/OPEN with no dependency block.
14. Possible via manual control to ON/OPEN.
15. Possible via commanding zone activation to ON/OPEN.
16. Possible via automation activation to OFF/CLOSED with no dependency block.
17. Possible via manual control to OFF/CLOSED.
18. Possible via commanding zone activation to OFF/CLOSED.

Table A.3 ON Monitoring Use Types

TYPES	Configured Sources															Subaddress States (Result)													
	SLC Points							Logic Eq				Config		Oper		ActQ	1	2	3	4	5	6	7	8	9	10	11	12		
	ON Con	ON Mon	OFF Con	OFF Mon	TRBL Mon	AC Fail	Service Disconnect Mon	ON Auto-Block	OFF Auto-Block	ON Auto	OFF Auto	Dedicated/Non-dedicated	Default ON/OFF	Man Cntrl ON/AUTO/OFF	Cmd Zone ON/AUTO/OFF	First-In/Last-In	ON	OFF	Trans ON	Trans OFF	TRBL	Norm	AC Fail	Lockout	Pend ON	Pend OFF	Service Disconnect	Trans Norm	Trouble Code	Notes
	DEFAULT OFF																													
1	x	0	x	x				-	-	-	-		OFF				0	0	0	0	n	1	n	0	0	0	n	0		Normal
2	x	1	x	x				-	-	-	-		OFF				1	0	0	0	n	0	n	0	0	0	n	0		Active
	DEFAULT ON																													
3	x	0	x	x				-	-	-	-		ON				1	0	0	0	n	0	n	0	0	0	n	0		Active (Inverted)
4	x	1	x	x				-	-	-	-		ON				0	0	0	0	n	1	n	0	0	0	n	0		Normal (Inverted)

Table A.4 OFF Control Use Types

	Configured Sources																Subaddress States (Result)													
	SLC Points							Logic Eq				Config		Oper		ActQ	1	2	3	4	5	6	7	8	9	10	11	12		
TYPES	ON Con	ON Mon	OFF Con	OFF Mon	TRBL Mon	AC Fail	Service Disconnect Mon	ON Auto-Block	OFF Auto-Block	ON Auto	OFF Auto	Dedicated/Non-dedicated	Default ON/OFF	Man Cntrl ON/AUTO/OFF	Cmd Zone ON/AUTO/OFF	First-In/Last-In	ON	OFF	Trans ON	Trans OFF	TRBL	Norm	AC Fail	Lockout	Pend ON	Pend OFF	Service Disconnect	Trans Norm	Trouble Code	Notes
	DEFAULT ON Normal State / AUTO Position																													
1	x	x	0	x				-	0	-	0		ON	Auto	Auto		0	0	0	0	n	1	n	Note 1	0	0	n	0		Norm/No activ.
2	x	x	0	x				-	1	-	1		ON	Auto	Auto		0	0	0	0	n	0	n	Note 1	0	1	n	0		Note 2
	OFF/CLOSED Position																													
3	x	x	1	x				-	0	-	1		ON	Auto	Auto		0	1	0	0	n	0	n	Note 1	0	0	n	0		Note 3
4	x	x	1	x				-		-			ON	OFF			0	1	0	0	n	0	n	1	0	0	n	0		Note 4
5	x	x	1	x				-		-			ON		OFF		0	1	0	0	n	0	n	1	0	0	n	0		Note 5
	Special Case: ON/OPEN Position without ON/OPEN Control & Monitor																													
6	x	x	0	x				0		1			ON	Auto	Auto		1	0	0	0	n	0	n	Note 1	0	0	n	0		Note 6
7	x	x	0	x				-		-			ON	ON			1	0	0	0	n	0	n	Note 1	0	0	n	0		Note 7
8	x	x	1	x				-		-			ON		ON		1	0	0	0	n	0	n	Note 1	0	0	n	0		Note 8
	DEFAULT OFF Non-dedicated only																													
9	x	x	y	x				-		-		Ded	OFF				n	n	n	n	1	n	n	n	n	n	n	n		Note 9
10	x	x	y	x				-		-		Non	OFF				n	n	n	n	n	n	n	n	n	n	n	n		Note 10
	Normal State / AUTO Position																													
11	x	x	0	x				-	0	-	0	Non	OFF	Auto	Auto		0	0	0	0	n	1	n	Note 1	0	0	n	0		Note 11
12	x	x	0	x				-	1	-	1	Non	OFF	Auto	Auto		0	0	0	0	n	0	n	Note 1	0	1	n	0		Note 12
	OFF/CLOSED																													
13	x	x	1	x				-	0	-	1	Non	OFF	Auto	Auto		0	1	0	0	n	0	n	Note 1	0	0	n	0		Note 13
14	x	x	1	x				-		-		Non	OFF	OFF			0	1	0	0	n	0	n	1	0	0	n	0		Note 14
15	x	x	1	x				-		-		Non	OFF		OFF		0	1	0	0	n	0	n	1	0	0	n	0		Note 15
	Special Case: ON/OPEN Position without ON/OPEN Control & Monitor																													
16	x	x	0	x				0		1		Non	OFF	Auto	Auto		1	0	0	0	n	0	n	Note 1	0	0	n	0		Note 16
17	x	x	0	x				-		-		Non	OFF	ON			1	0	0	0	n	0	n	Note 1	0	0	n	0		Note 17
18	x	x	0	x				-		-		Non	OFF		ON		1	0	0	0	n	0	n	Note 1	0	0	n	0		Note 18

Table A.4 Notes

1. Lockout is evaluated by controls not indicated in the table.
2. Automation activation to OFF/CLOSED has been blocked by a dependency (pending state). No automatic trouble - a virtual point can be used to create a trouble if expected.
3. Possible via automation activation to OFF/CLOSED with no dependency block.
4. Possible via manual control to OFF/CLOSED.
5. Possible via commanding zone activation to OFF/CLOSED.
6. Possible via automation activation to ON/OPEN with no dependency block.
7. Possible via manual control to ON/OPEN.
8. Possible via commanding zone activation to ON/OPEN.
9. For dedicated appliances, setting the appliance that is default OFF/CLOSED to only be controlled to OFF/CLOSED is wrong. CAMWorks+ may block the download from happening.
10. For non-dedicated appliances, setting the appliance that is default OFF/CLOSED to only be controlled to OFF/CLOSED is fine.
11. Normal/No Activations
12. Automation activation to OFF/CLOSED has been blocked by a dependency (pending state). No automatic trouble - a virtual point can be used to create a trouble if expected.

13. Possible via automation activation to OFF/CLOSED with no dependency block.
14. Possible via manual control to OFF/CLOSED.
15. Possible via commanding zone activation to OFF/CLOSED.
16. Possible via automation activation to ON/OPEN with no dependency block.
17. Possible via manual control to ON/OPEN.
18. Possible via commanding zone activation to ON/OPEN.

Table A.5 OFF Monitoring Use Types

	Configured Sources															Subaddress States (Result)													
	SLC Points							Logic Eq				Config		Oper		ActQ	1	2	3	4	5	6	7	8	9	10	11	12		
TYPES	ON Con	ON Mon	OFF Con	OFF Mon	TRBL Mon	AC Fail	Service Disconnect Mon	ON Auto-Block	OFF Auto-Block	ON Auto	OFF Auto	Dedicated/Non-dedicated	Default ON/OFF	Man Cntrl ON/AUTO/OFF	Cmd Zone ON/AUTO/OFF	First-In/Last-In	ON	OFF	Trans ON	Trans OFF	TRBL	Norm	AC Fail	Lockout	Pend ON	Pend OFF	Service Disconnect	Trans Norm	Trouble Code	Notes
1	x	x	x	0				-	-	-	-		ON				0	0	0	0	n	1	n	0	0	0	n	0		Normal
2	x	x	x	1				-	-	-	-		ON				0	1	0	0	n	0	n	0	0	0	n	0		Active
3	x	x	x	0				-	-	-	-		OFF				0	1	0	0	n	0	n	0	0	0	n	0		Active (Inverted)
4	x	x	x	1				-	-	-	-		OFF				0	0	0	0	n	1	n	0	0	0	n	0		Normal (Inverted)

Table A.6 ON Control, ON Monitoring UseTypes

	Configured Sources																Subaddress States (Result)													
	SLC Points							Logic Eq				Config		Oper		ActQ	1	2	3	4	5	6	7	8	9	10	11	12		
TYPES	ON Con	ON Mon	OFF Con	OFF Mon	TRBL Mon	AC Fail	Service Disconnect Mon	ON Auto-Block	OFF Auto-Block	ON Auto	OFF Auto	Dedicated/Non-dedicated	Default ON/OFF	Man Cntrl ON/AUTO/OFF	Cmd Zone ON/AUTO/OFF	First-In/Last-In	ON	OFF	Trans ON	Trans OFF	TRBL	Norm	AC Fail	Lockout	Pend ON	Pend OFF	Service Disconnect	Trans Norm	Trouble Code	Notes
	DEFAULT OFF Normal State / AUTO Position																													
1	0	0	x	x				0	-	0	-		OFF	AUTO	AUTO		0	0	0	0	n	1	n	Note 1	0	0	n	0		Norm/No activ.
2	0	1	x	x				0	-	0	-	Ded	OFF	AUTO	AUTO		0	0	0	0	1	0	n	Note 1	0	0	n	0	5CH	Note 2
3	0	1	x	x				0	-	0	-	Non	OFF	AUTO	AUTO		0	0	0	0	n	1	n	Note 1	0	0	n	0		Note 3
4	0	0	x	x				1	-	1	-		OFF	AUTO	AUTO		0	0	0	0	n	1	n	Note 1	1	0	n	0		Note 4
5	0	1	x	x				1	-	1	-	Non	OFF	AUTO	AUTO		0	0	0	0	n	1	n	Note 1	1	0	n	0		Note 5
	Normal / AUTO to ON/OPEN																													
6	1	0	x	x				0	-	1	-		OFF	AUTO	AUTO		0	0	1	0	n	0	n	Note 1	0	0	n	0		Note 6
7	1	0	x	x					-		-		OFF	ON			0	0	1	0	n	0	n	1	0	0	n	0		Note 7
8	1	0	x	x					-		-		OFF		ON		0	0	1	0	n	0	n	1	0	0	n	0		Note 8
9	1	0	x	x				0	-	1	-		OFF	AUTO	AUTO		0	0	1	0	1	0	n	Note 1	0	0	n	0	56H	Note 9
10	1	0	x	x					-		-		OFF	ON			0	0	1	0	1	0	n	1	0	0	n	0	56H	Note 10
11	1	0	x	x					-		-		OFF		ON		0	0	1	0	1	0	n	1	0	0	n	0	56H	Note 11
	ON/OPEN Position																													
12	1	1	x	x				0	-	1	-		OFF	AUTO	AUTO		1	0	0	0	n	0	n	Note 1	0	0	n	0		Note 12
13	1	1	x	x					-		-		OFF	ON			1	0	0	0	n	0	n	1	0	0	n	0		Note 13
14	1	1	x	x					-		-		OFF		ON		1	0	0	0	n	0	n	1	0	0	n	0		Note 14

Table A.6 ON Control, ON Monitoring UseTypes (Continued)

TYPES	Configured Sources																Subaddress States (Result)													
	SLC Points							Logic Eq				Config		Oper		ActQ	1	2	3	4	5	6	7	8	9	10	11	12		
	ON Con	ON Mon	OFF Con	OFF Mon	TRBL Mon	AC Fail	Service Disconnect Mon	ON Auto-Block	OFF Auto-Block	ON Auto	OFF Auto	Dedicated/Non-dedicated	Default ON/OFF	Man Cntrl ON/AUTO/OFF	Cmd Zone ON/AUTO/OFF	First-In/Last-In	ON	OFF	Trans ON	Trans OFF	TRBL	Norm	AC Fail	Lockout	Pend ON	Pend OFF	Service Disconnect	Trans Norm	Trouble Code	Notes
	ON/OPEN to Normal / AUTO																													
15	0	1	x	x					-		-	Ded	OFF	AUTO	AUTO		0	0	0	0	n	0	n	Note 1	0	0	n	1		Note 15
16	0	1	x	x				1	-	1	-	Ded	OFF	AUTO	AUTO		0	0	0	0	n	0	n	Note 1	1	0	n	1		Note 16
17	0	1	x	x					-		-	Ded	OFF	AUTO	AUTO		0	0	0	0	1	0	n	Note 1	0	0	n	1		Note 17
18	0	1	x	x				1	-	1	-	Ded	OFF	AUTO	AUTO		0	0	0	0	1	0	n	Note 1	1	0	n	1		Note 18
	Special Case: ON/OPEN to OFF without OFF/CLOSED Control & Monitor																													
19	0	1	x	x					0		1		OFF	AUTO	AUTO		0	0	0	1	n	0	n	Note 1	0	0	n	0		Note 19
20	0	1	x	x					-		-		OFF	OFF			0	0	0	1	n	0	n	Note 1	0	0	n	0		Note 20
21	0	1	x	x					-		-		OFF		OFF		0	0	0	1	n	0	n	Note 1	0	0	n	0		Note 21
22	0	1	x	x					0		1		OFF	AUTO	AUTO		0	0	0	1	1	0	n	Note 1	0	0	n	1		Note 22
23	0	1	x	x					-		-		OFF	OFF			0	0	0	1	1	0	n	Note 1	0	0	n	1		Note 23
24	0	1	x	x					-		-		OFF		OFF		0	0	0	1	1	0	n	Note 1	0	0	n	1		Note 24
	Special Case: OFF/CLOSED Position without OFF/CLOSED Control & Monitor																													
25	0	0	x	x					0		1		OFF	AUTO	AUTO		0	1	0	0	n	0	n	Note 1	0	0	n	0		Note 25
26	0	0	x	x					-		-		OFF	OFF			0	1	0	0	n	0	n	Note 1	0	0	n	0		Note 26
27	0	0	x	x					-		-		OFF		OFF		0	1	0	0	n	0	n	Note 1	0	0	n	0		Note 27
	DEFAULT ON																													
28	y	y	x	x								Ded	ON				n	n	n	n	1	n	n	n	n	n	n	n		Note 28
29	y	y	x	x								Non	ON				n	n	n	n	n	n	n	n	n	n	n	n		Note 29
	Normal State / AUTO Position																													
30	0	y	x	x				0	-	0	-	Non	ON	AUTO	AUTO		0	0	0	0	n	1	n	Note 1	0	0	n	0		Note 30
31	0	y	x	x				1	-	1	-	Non	ON	AUTO	AUTO		0	0	0	0	n	1	n	Note 1	1	0	n	0		Note 31
	Normal / AUTO to ON/OPEN																													
32	1	0	x	x				0	-	1	-	Non	ON	AUTO	AUTO		0	0	1	0	n	0	n	Note 1	0	0	n	0		Note 32
33	1	0	x	x					-		-	Non	ON	ON			0	0	1	0	n	0	n	1	0	0	n	0		Note 33
34	1	0	x	x					-		-	Non	ON		ON		0	0	1	0	n	0	n	1	0	0	n	0		Note 34
35	1	0	x	x				0	-	1	-	Non	ON	AUTO	AUTO		0	0	1	0	1	0	n	Note 1	0	0	n	0	56H	Note 35
36	1	0	x	x					-		-	Non	ON	ON			0	0	1	0	1	0	n	1	0	0	n	0	56H	Note 36
37	1	0	x	x					-		-	Non	ON		ON		0	0	1	0	1	0	n	1	0	0	n	0	56H	Note 37
	ON/OPEN Position																													
38	1	1	x	x				0	-	1	-	Non	ON	Auto	Auto		1	0	0	0	n	0	n	Note 1	0	0	n	0		Note 38
39	1	1	x	x					-		-	Non	ON	ON			1	0	0	0	n	0	n	1	0	0	n	0		Note 39
40	1	1	x	x					-		-	Non	ON		ON		1	0	0	0	n	0	n	1	0	0	n	0		Note 40
	ON/OPEN to Normal / AUTO (no use types) Note: Transition states to Normal/AUTO do not apply to non-dedicated appliances which go straight to Normal/AUTO upon release of ON/OPEN control.																													
	Special Case: ON/OPEN to OFF/CLOSED without OFF/CLOSED Control & Monitor																													
41	0	1	x	x					0		1	Non	ON	Auto	Auto		0	0	0	1	n	0	n	Note 1	0	0	n	0		Note 41
42	0	1	x	x					-		-	Non	ON	OFF			0	0	0	1	n	0	n	Note 1	0	0	n	0		Note 42
43	0	1	x	x					-		-	Non	ON		OFF		0	0	0	1	n	0	n	Note 1	0	0	n	0		Note 43
44	0	1	x	x					0		1	Non	ON	Auto	Auto		0	0	0	1	1	0	n	Note 1	0	0	n	1	57H	Note 44
45	0	1	x	x					-		-	Non	ON	OFF			0	0	0	1	1	0	n	Note 1	0	0	n	1	57H	Note 45
46	0	1	x	x					-		-	Non	ON		OFF		0	0	0	1	1	0	n	Note 1	0	0	n	1	57H	Note 46

Table A.6 ON Control, ON Monitoring UseTypes (Continued)

	Configured Sources																Subaddress States (Result)													
	SLC Points							Logic Eq				Config		Oper		ActQ	1	2	3	4	5	6	7	8	9	10	11	12		
TYPES	ON Con	ON Mon	OFF Con	OFF Mon	TRBL Mon	AC Fail	Service Disconnect Mon	ON Auto-Block	OFF Auto-Block	ON Auto	OFF Auto	Dedicated/Non-dedicated	Default ON/OFF	Man Cntrl ON/AUTO/OFF	Cmd Zone ON/AUTO/OFF	First-In/Last-In	ON	OFF	Trans ON	Trans OFF	TRBL	Norm	AC Fail	Lockout	Pend ON	Pend OFF	Service Disconnect	Trans Norm	Trouble Code	Notes
	Special Case: OFF/CLOSED without OFF/CLOSED Control & Monitor																													
47	0	0	x	x					0		1	Non	ON	Auto	Auto		0	1	0	0	n	0	n	Note 1	0	0	n	0		Note 47
48	0	0	x	x					-		-	Non	ON	OFF			0	1	0	0	n	0	n	Note 1	0	0	n	0		Note 48
49	0	0	x	x					-		-	Non	ON		OFF		0	1	0	0	n	0	n	Note 1	0	0	n	0		Note 49

Table A.6 Notes

1. Lockout is evaluated by controls not indicated in the table.
2. (Trouble for dedicated appliances in the AUTO position)
   Feedback shows ON/OPEN but ON/OPEN transition timer never started,
   OR No Activations - feedback in the wrong state.
3. (Normal for non-dedicated appliances)
   Feedback shows ON/OPEN but ON/OPEN transition timer never started,
   OR No Activations.
4. Automation activation to ON/OPEN has been blocked by a dependency (pending state).
   No automatic trouble - a virtual point can be used to create a trouble if expected.
5. Automation activation to ON/OPEN has been blocked by a dependency (pending state).
   No automatic trouble - a virtual point can be used to create a trouble if expected.
6. Transition state of Normal/AUTO to ON/OPEN via automation activation.
   Transition ON/OPEN timer running.
7. Transition state of Normal/AUTO to ON/OPEN via manual control.
   Transition ON/OPEN timer running.
8. Transition state of Normal/AUTO to ON/OPEN via commanding zone activation.
   Transition ON/OPEN timer running.
9. ON/OPEN timer expired during the transition state of Normal/AUTO to ON/OPEN via automation activation.
   Transition ON/OPEN sub-address will still be active during trouble.
10. ON/OPEN timer expired during the transition state of Normal/AUTO to ON/OPEN via manual control.
    Transition ON/OPEN sub-address will still be active during trouble.
11. ON/OPEN timer expired during the transition state of Normal/AUTO to ON/OPEN via commanding zone activation.
    Transition ON/OPEN sub-address will still be active during trouble.
12. Possible via automation activation to ON/OPEN with no dependency block.
13. Possible via manual control to ON/OPEN.
14. Possible via commanding zone activation to ON/OPEN.
15. Transition state of ON/OPEN to Normal/AUTO.
    Transition Normal timer running.
16. Automation activation to ON/OPEN has been blocked by a dependency (pending state).
    Transition state of ON/OPEN to Normal/AUTO caused by dependency block.
    Transition Normal timer running.
    No automatic trouble - a virtual point can be used to create a trouble if expected.
17. Normal timer expired during the transition state of ON/OPEN to Normal/AUTO.
    Transition Normal sub-address will still be active during trouble.
18. Automation activation to ON/OPEN has been blocked by a dependency (pending state).
    Normal timer expired during the transition state of ON/OPEN to Normal/AUTO caused by dependency block.
    Transition Normal sub-address will still be active during trouble.

19. Transition state of turning OFF/CLOSED via automation activation.
    Transition OFF/CLOSED timer running.
20. Transition state of turning OFF/CLOSED via manual control.
    Transition OFF/CLOSED timer running.
21. Transition state of turning OFF/CLOSED via commanding zone activation.
    Transition OFF/CLOSED timer running.
22. OFF/CLOSED timer expired during the transition state of turning OFF/CLOSED via automation activation.
    Transition OFF/CLOSED sub-address will still be active during trouble.
23. OFF/CLOSED timer expired during the transition state of turning OFF/CLOSED via manual control.
    Transition OFF/CLOSED sub-address will still be active during trouble.
24. OFF/CLOSED timer expired during the transition state of turning OFF/CLOSED via commanding zone activation.
    Transition OFF/CLOSED sub-address will still be active during trouble.
25. Possible via automation activation to OFF/CLOSED with no dependency block.
26. Possible via manual control to OFF/CLOSED.
27. Possible via commanding zone activation to OFF/CLOSED.
28. For dedicated appliances, setting the appliance that is default ON/OPEN to be controlled to ON/OPEN is wrong.
    CAMWorks+ may block the download from happening.
29. For non-dedicated appliances, setting the appliance that is default ON/OPEN to be controlled to ON/OPEN is fine.
30. Normal/No Activations.
31. Automation activation to ON/OPEN has been blocked by a dependency (pending state).
    No automatic trouble - a virtual point can be used to create a trouble if expected.
32. Transition state of Normal/AUTO to ON/OPEN via automation activation.
    Transition ON/OPEN timer running.
33. Transition state of Normal/AUTO to ON/OPEN via manual control.
    Transition ON/OPEN timer running.
34. Transition state of Normal/AUTO to ON/OPEN via commanding zone activation.
    Transition ON/OPEN timer running.
35. ON/OPEN timer expired during the transition state of Normal/AUTO to ON/OPEN via automation activation.
    Transition ON/OPEN sub-address will still be active during trouble.
36. ON/OPEN timer expired during the transition state of Normal/AUTO to ON/OPEN via manual control.
    Transition ON/OPEN sub-address will still be active during trouble.
37. ON/OPEN timer expired during the transition state of Normal/AUTO to ON/OPEN via commanding zone activation.
    Transition ON/OPEN sub-address will still be active during trouble.
38. Possible via automation activation to ON/OPEN with no dependency block.
39. Possible via manual control to ON/OPEN.
40. Possible via commanding zone activation to ON/OPEN.
41. Transition state of turning OFF/CLOSED via automation activation.
    Transition OFF/CLOSED timer running.
42. Transition state of turning OFF/CLOSED via manual control.
    Transition OFF/CLOSED timer running.
43. Transition state of turning OFF/CLOSED via commanding zone activation.
    Transition OFF/CLOSED timer running.
44. OFF/CLOSED timer expired during the transition state of turning OFF/CLOSED via automation activation.
    Transition OFF/CLOSED sub-address will still be active during trouble.
45. OFF/CLOSED timer expired during the transition state of turning OFF/CLOSED via manual control.
    Transition OFF/CLOSED sub-address will still be active during trouble.
46. OFF/CLOSED timer expired during the transition state of turning OFF/CLOSED via commanding zone activation.
    Transition OFF/CLOSED sub-address will still be active during trouble.
47. Possible via automation activation to OFF/CLOSED with no dependency block.
48. Possible via manual control to OFF/CLOSED.
49. Possible via commanding zone activation to OFF/CLOSED.

Table A.7 OFF Control, OFF Monitoring Use Types

	Configured Sources																Subaddress States (Result)													
	SLC Points							Logic Eq				Config		Oper		ActQ	1	2	3	4	5	6	7	8	9	10	11	12		
TYPES	ON Con	ON Mon	OFF Con	OFF Mon	TRBL Mon	AC Fail	Service Disconnect Mon	ON Auto-Block	OFF Auto-Block	ON Auto	OFF Auto	Dedicated/Non-dedicated	Default ON/OFF	Man Cntrl ON/AUTO/OFF	Cmd Zone ON/AUTO/OFF	First-In/Last-In	ON	OFF	Trans ON	Trans OFF	TRBL	Norm	AC Fail	Lockout Pend ON	Pend OFF	Service Disconnect	Trans Norm	Trouble Code	Notes
	DEFAULT ON Normal State / AUTO Position																													
1	x	x	0	0				-	0	-	0		ON	AUTO	AUTO		0	0	0	0	n	1	n	Note 1	0	0	n	0		Normal/No activ.
2	x	x	0	1				-	0	-	0	Ded	ON	AUTO	AUTO		0	0	0	0	1	0	n	Note 1	0	0	n	0	5CH	Note 2
3	x	x	0	1				-	0	-	0	Non	ON	AUTO	AUTO		0	0	0	0	n	1	n	Note 1	0	0	n	0		Note 3
4	x	x	0	0				-	1	-	1		ON	AUTO	AUTO		0	0	0	0	n	1	n	Note 1	0	1	n	0		Note 4
5	x	x	0	1				-	1	-	1	Non	ON	AUTO	AUTO		0	0	0	0	n	1	n	Note 1	0	1	n	0		Note 5
	Normal / AUTO to OFF/CLOSED																													
6	x	x	1	0				-	0	-	1		ON	AUTO	AUTO		0	0	0	1	n	0	n	Note 1	0	0	n	0		Note 6
7	x	x	1	0				-		-			ON	OFF			0	0	0	1	n	0	n	1	0	0	n	0		Note 7
8	x	x	1	0				-		-			ON		OFF		0	0	0	1	n	0	n	1	0	0	n	0		Note 8
9	x	x	1	0				-	0	-	1		ON	AUTO	AUTO		0	0	0	1	1	0	n	Note 1	0	0	n	0	57H	Note 9
10	x	x	1	0				-		-			ON	OFF			0	0	0	1	1	0	n	1	0	0	n	0	57H	Note 10
11	x	x	1	0				-		-			ON		OFF		0	0	0	1	1	0	n	1	0	0	n	0	57H	Note 11
12	x	x	1	1				-	0	-	1		ON	AUTO	AUTO		0	1	0	0	n	0	n	Note 1	0	0	n	0		Note 12
13	x	x	1	1				-		-			ON	OFF			0	1	0	0	n	0	n	1	0	0	n	0		Note 13
14	x	x	1	1				-		-			ON		OFF		0	1	0	0	n	0	n	1	0	0	n	0		Note 14
	OFF/CLOSED to Normal / AUTO																													
15	x	x	0	1				-		-		Ded	ON	AUTO	AUTO		0	0	0	0	n	0	n	Note 1	0	0	n	1		Note 15
16	x	x	0	1				-	1	-	1	Ded	ON	AUTO	AUTO		0	0	0	0	n	0	n	1	1	1	n	1		Note 16
17	x	x	0	1				-		-		Ded	ON	AUTO	AUTO		0	0	0	0	1	0	n	1	0	0	n	1	58H	Note 17
18	x	x	0	1				-	1	-	1	Ded	ON	AUTO	AUTO		0	0	0	0	1	0	n	n	1	1	n	1	58H	Note 18
	Special Case: OFF/CLOSED to ON/OPEN without OFF/CLOSED Control & Monitor																													
19	x	x	0	1				-		-			ON	AUTO	AUTO		0	0	0	1	n	0	n	Note 1	0	0	n	0		Note 19
20	x	x	0	1				-		-			ON	ON			0	0	0	1	n	0	n	Note 1	0	0	n	0		Note 20
21	x	x	0	1				-		-			ON		ON		0	0	0	1	n	0	n	Note 1	0	0	n	0		Note 21
22	x	x	0	1				-		-			ON	AUTO	AUTO		0	0	0	1	1	0	n	Note 1	0	0	n	0	56H	Note 22
23	x	x	0	1				-		-			ON	ON			0	0	0	1	1	0	n	Note 1	0	0	n	0	56H	Note 23
24	x	x	0	1				-		-			ON		ON		0	0	0	1	1	0	n	Note 1	0	0	n	0	56H	Note 24
	Special Case: ON/OPEN without ON/OPEN Control & Monitor																													
25	x	x	0	0				-		-			ON	ON			1	0	0	0	n	0	n	1	0	0	n	0		Note 25
26	x	x	0	0				-		-			ON		ON		1	0	0	0	n	0	n	1	0	0	n	0		Note 26
	DEFAULT: OFF Non-dedicated only																													
27	x	x	y	y				-		-		Ded	OFF				n	n	n	n	1	n	n	n	n	n	n	n		Note 27
28	x	x	y	y				-		-		Non	OFF				n	n	n	n	n	n	n	n	n	n	n	n		Note 28
	Normal State / AUTO Position																													
29	x	x	0	y				-	0	-	0	Non	OFF	AUTO	AUTO		0	0	0	0	n	1	n	Note 1	0	0	n	n		Note 29
30	x	x	0	y				-	1	-	1	Non	OFF	AUTO	AUTO		0	0	0	0	n	1	n	Note 1	0	1	n	n		Note 30
	Normal / AUTO to OFF/CLOSED																													
31	x	x	1	0				-	0	-	1	Non	OFF	AUTO	AUTO		0	0	0	1	n	0	n	Note 1	0	0	n	0		Note 31
32	x	x	1	0				-		-		Non	OFF	OFF			0	0	0	1	n	0	n	1	0	0	n	0		Note 32
33	x	x	1	0				-		-		Non	OFF		OFF		0	0	0	1	n	0	n	1	0	0	n	0		Note 33
34	x	x	1	0				-	0	-	1	Non	OFF	AUTO	AUTO		0	0	0	1	1	0	n	Note 1	0	0	n	0	57H	Note 34
35	x	x	1	0				-		-		Non	OFF	OFF			0	0	0	1	1	0	n	1	0	0	n	0	57H	Note 35
36	x	x	1	0				-		-		Non	OFF		OFF		0	0	0	1	1	0	n	1	0	0	n	0	57H	Note 36

Table A.7 OFF Control, OFF Monitoring Use Types

	Configured Sources																Subaddress States (Result)													
	SLC Points							Logic Eq				Config		Oper		ActQ	1	2	3	4	5	6	7	8	9	10	11	12		
TYPES	ON Con	ON Mon	OFF Con	OFF Mon	TRBL Mon	AC Fail	Service Disconnect Mon	ON Auto-Block	OFF Auto-Block	ON Auto	OFF Auto	Dedicated/Non-dedicated	Default ON/OFF	Man Cntrl ON/AUTO/OFF	Cmd Zone ON/AUTO/OFF	First-In/Last-In	ON	OFF	Trans ON	Trans OFF	TRBL	Norm	AC Fail	Lockout	Pend ON	Pend OFF	Service Disconnect	Trans Norm	Trouble Code	Notes
	OFF/CLOSED Position																													
37	x	x	1	1				-	0	-	1	Non	OFF	AUTO	AUTO		0	1	0	0	n	0	n	Note 1	0	0	n	0		Note 37
38	x	x	1	1				-		-		Non	OFF	OFF			0	1	0	0	n	0	n	1	0	0	n	0		Note 38
39	x	x	1	1				-		-		Non	OFF		OFF		0	1	0	0	n	0	n	1	0	0	n	0		Note 39
	OFF/CLOSED to Normal / AUTO Transition states to Normal / AUTO do not apply to non-dedicated appliances. These appliances will go straight to Normal / AUTO upon release of OFF/CLOSED control.																													
	Special Case: OFF/CLOSED to ON/OPEN without OFF/CLOSED Control & Monitor																													
40	x	x	0	1				-		-		Non	OFF	ON			0	0	1	0	n	0	n	Note 1	0	0	n	0		Note 40
41	x	x	0	1				-		-		Non	OFF		ON		0	0	1	0	n	0	n	Note 1	0	0	n	0		Note 41
42	x	x	0	1				-		-		Non	OFF	ON			0	0	1	0	1	0	n	Note 1	0	0	n	0	56H	Note 42
43	x	x	0	1				-		-		Non	OFF		ON		0	0	1	0	1	0	n	Note 1	0	0	n	0	56H	Note 43
	Special Case: ON/OPEN without ON/OPEN Control & Monitor																													
44	x	x	0	0				-		-		Non	OFF	ON			1	0	0	0	n	0	n	1	0	0	n	0		Note 44
45	x	x	0	0				-		-		Non	OFF		ON		1	0	0	0	n	0	n	1	0	0	n	0		Note 45

Table A.7 Notes

1. Lockout is evaluated by controls not indicated in the table.
2. (Trouble for dedicated appliances in the AUTO position.)
   Feedback shows OFF/CLOSED but OFF/CLOSED transition timer never started,
   OR No Activations - feedback in the wrong state.
3. (Normal for non-dedicated appliances.)
   Feedback shows OFF/CLOSED but OFF/CLOSED transition timer never started,
   OR No Activations.
4. Automation activation to OFF/CLOSED has been blocked by a dependency (pending state).
   No automatic trouble - a virtual point can be used to create a trouble if expected.
5. Automation activation to OFF/CLOSED has been blocked by a dependency (pending state).
   No automatic trouble - a virtual point can be used to create a trouble if expected.
6. Transition state of Normal/AUTO to OFF/CLOSED via automation activation.
   Transition OFF/CLOSED timer running.
7. Transition state of Normal/AUTO to OFF/CLOSED via manual control.
   Transition OFF/CLOSED timer running.
8. Transition state of Normal/AUTO to OFF/CLOSED via commanding zone activation.
   Transition OFF/CLOSED timer running.
9. OFF/CLOSED timer expired during the transition state of Normal/AUTO to OFF/CLOSED via automation activation.
   Transition OFF/CLOSED sub-address will still be active during trouble.
10. OFF/CLOSED timer expired during the transition state of Normal/AUTO to OFF/CLOSED via manual control.
    Transition OFF/CLOSED sub-address will still be active during trouble.
11. OFF/CLOSED timer expired during the transition state of Normal/AUTO to OFF/CLOSED via commanding zone activation.
    Transition OFF/CLOSED sub-address will still be active during trouble.
12. Possible via automation activation to OFF/CLOSED with no dependency block.
13. Possible via manual control to OFF/CLOSED.
14. Possible via commanding zone activation to OFF/CLOSED.
15. Transition state of OFF/CLOSED to Normal/AUTO.
    Transition Normal timer running.

16. Automation activation to OFF/CLOSED has been blocked by a dependency (pending state).
    Transition state of OFF/CLOSED to Normal/AUTO caused by dependency block.
    Transition Normal timer running.
    No automatic trouble - a virtual point can be used to create a trouble if expected.
17. Normal timer expired during the transition state of OFF/CLOSED to Normal/AUTO.
    Transition Normal sub-address will still be active during trouble.
18. Automation activation to OFF/CLOSED has been blocked by a dependency (pending state).
    Normal timer expired during the transition state of OFF/CLOSED to Normal/AUTO caused by dependency block.
    Transition Normal sub-address will still be active during trouble.
19. Transition state of OFF/CLOSED to ON/OPEN via automation activation.
    Transition ON/OPEN timer running.
20. Transition state of OFF/CLOSED to ON/OPEN via manual control.
    Transition ON/OPEN timer running.
21. Transition state of OFF/CLOSED to ON/OPEN via commanding zone activation.
    Transition ON/OPEN timer running.
22. ON/OPEN timer expired during the transition state of OFF/CLOSED to ON/OPEN via automation activation.
    Transition ON/OPEN sub-address will still be active during trouble.
23. ON/OPEN timer expired during the transition state of OFF/CLOSED to ON/OPEN via manual control.
    Transition ON/OPEN sub-address will still be active during trouble.
24. ON/OPEN timer expired during the transition state of OFF/CLOSED to ON/OPEN via commanding zone activation.
    Transition ON/OPEN sub-address will still be active during trouble.
25. Possible via manual control to ON/OPEN.
26. Possible via commanding zone activation to ON/OPEN.
27. For dedicated appliances, setting the appliance that is default OFF/CLOSED to be controlled to OFF/CLOSED is wrong. CAMWorks+ may block the download from happening.
28. For non-dedicated appliances, setting the appliance that is default OFF/CLOSED to be controlled to OFF/CLOSED is fine.
29. Normal/No Activations
30. Automation activation to OFF/CLOSED has been blocked by a dependency (pending state).
    No automatic trouble - a virtual point can be used to create a trouble if expected.
31. Transition state of Normal/AUTO to OFF/CLOSED via automation activation.
    Transition OFF/CLOSED timer running.
32. Transition state of Normal/AUTO to OFF/CLOSED via manual control.
    Transition OFF/CLOSED timer running.
33. Transition state of Normal/AUTO to OFF/CLOSED via commanding zone activation.
    Transition OFF/CLOSED timer running.
34. OFF/CLOSED timer expired during the transition state of Normal/AUTO to OFF/CLOSED via automation activation.
    Transition OFF/CLOSED sub-address will still be active during trouble.
35. OFF/CLOSED timer expired during the transition state of Normal/AUTO to OFF/CLOSED via manual control.
    Transition OFF/CLOSED sub-address will still be active during trouble.
36. OFF/CLOSED timer expired during the transition state of Normal/AUTO to OFF/CLOSED via commanding zone activation. Transition OFF/CLOSED sub-address will still be active during trouble.
37. Possible via automation activation to OFF/CLOSED with no dependency block.
38. Possible via manual control to OFF/CLOSED.
39. Possible via commanding zone activation to OFF/CLOSED.
40. Transition state of OFF/CLOSED to ON/OPEN via manual control.
    Transition ON/OPEN timer running.
41. Transition state of OFF/CLOSED to ON/OPEN via commanding zone activation.
    Transition ON/OPEN timer running.
42. ON/OPEN timer expired during the transition state of OFF/CLOSED to ON/OPEN via manual control.
    Transition ON/OPEN sub-address will still be active during trouble.
43. ON/OPEN timer expired during the transition state of OFF/CLOSED to ON/OPEN via commanding zone activation.
    Transition ON/OPEN sub-address will still be active during trouble.
44. Possible via manual control to ON/OPEN.
45. Possible via commanding zone activation to ON/OPEN.

Table A.8 ON & OFF Control, ON & OFF Monitoring Use Types

	Configured Sources																	Subaddress States (Result)													
	SLC Points							Logic Eq				Config		Oper		ActQ		1	2	3	4	5	6	7	8	9	10	11	12		
TYPES	ON Con	ON Mon	OFF Con	OFF Mon	TRBL Mon	AC Fail	Service Disconnect Mon	ON Auto-Block	OFF Auto-Block	ON Auto	OFF Auto	Dedicated/Non-dedicated	Default ON/OFF	Man Cntrl ON/AUTO/OFF	Cmd Zone ON/AUTO/OFF	First-In/Last-In		ON	OFF	Trans ON	Trans OFF	TRBL	Norm	AC Fail	Lockout	Pend ON	Pend OFF	Service Disconnect	Trans Norm	Trouble Code	Notes
	DEFAULT OFF Normal State / AUTO Position																														
1	0	0	0	0								Non	OFF	AUTO	AUTO			0	0	0	0	n	1	n	Note 1	0	0	n	0		Norm/No activ.
2	0	0	0	0								Ded	OFF	AUTO	AUTO			0	0	0	0	1	0	n	Note 1	0	0	n	0	5CH	Note 2
3	0	0	0	1									OFF	AUTO	AUTO			0	0	0	0	n	1	n	Note 1	0	0	n	0		Note 3
4	0	1	0	0								Ded	OFF	AUTO	AUTO			0	0	0	0	1	0	n	Note 1	0	0	n	0	5CH	Note 4
5	0	1	0	0								Non	OFF	AUTO	AUTO			0	0	0	0	n	1	n	Note 1	0	0	n	0		Note 5
6	0	0	0	1				1		1			OFF	AUTO	AUTO			0	0	0	0	n	1	n	Note 1	1	0	n	0		Note 6
7	0	0	0	y				1		1		Non	OFF	AUTO	AUTO			0	0	0	0	n	1	n	Note 1	1	0	n	0		Note 7
8	0	0	0	0				1		1		Non	OFF	AUTO	AUTO			0	0	0	0	n	1	n	Note 1	1	0	n	0		Note 8
9	0	0	0	1					1		1		OFF	AUTO	AUTO			0	0	0	0	n	1	n	Note 1	0	1	n	0		Note 9
10	0	0	0	y					1		1	Non	OFF	AUTO	AUTO			0	0	0	0	n	1	n	Note 1	0	1	n	0		Note 10
11	0	y	0	0					1		1	Non	OFF	AUTO	AUTO			0	0	0	0	n	1	n	Note 1	0	1	n	0		Note 11
	Normal/AUTO to ON/OPEN																														
12	1	0	0	1				0		1			OFF	AUTO	AUTO			0	0	1	0	n	0	n	Note 1	0	0	n	0		Note 12
13	1	0	0	1									OFF	ON				0	0	1	0	n	0	n	1	0	0	n	0		Note 13
14	1	0	0	1									OFF		ON			0	0	1	0	n	0	n	1	0	0	n	0		Note 14
15	1	0	0	0				0		1		Non	OFF	AUTO	AUTO			0	0	1	0	n	0	n	Note 1	0	0	n	0		Note 15
16	1	0	0	0								Non	OFF	ON				0	0	1	0	n	0	n	1	0	0	n	0		Note 16
17	1	0	0	0								Non	OFF		ON			0	0	1	0	n	0	n	1	0	0	n	0		Note 17
18	1	0	0	1				0		1			OFF	AUTO	AUTO			0	0	1	0	1	0	n	Note 1	0	0	n	0	56H	Note 18
19	1	0	0	1									OFF	ON				0	0	1	0	1	0	n	1	0	0	n	0	56H	Note 19
20	1	0	0	1									OFF		ON			0	0	1	0	1	0	n	1	0	0	n	0	56H	Note 20
21	1	0	0	0				0		1		Non	OFF	AUTO	AUTO			0	0	1	0	1	0	n	Note 1	0	0	n	0	56H	Note 21
22	1	0	0	0								Non	OFF	ON				0	0	1	0	1	0	n	1	0	0	n	0	56H	Note 22
23	1	0	0	0								Non	OFF		ON			0	0	1	0	1	0	n	1	0	0	n	0	56H	Note 23
	ON/OPEN Position																														
24	1	1	0	0				0		1			OFF	AUTO	AUTO			1	0	0	0	n	0	n	Note 1	0	0	n	0		Note 24
25	1	1	0	0									OFF	ON				1	0	0	0	n	0	n	1	0	0	n	0		Note 25
26	1	1	0	0									OFF		ON			1	0	0	0	n	0	n	1	0	0	n	0		Note 26
	ON/OPEN to Normal/AUTO																														
27	0	1	0	0								Non	OFF	AUTO	AUTO			0	0	0	0	n	0	n	Note 1	0	0	n	1		Note 27
28	0	1	0	0				1		1		Non	OFF	AUTO	AUTO			0	0	0	0	n	0	n	Note 1	1	0	n	1		Note 28
29	0	1	0	0								Non	OFF	AUTO	AUTO			0	0	0	0	n	0	n	Note 1	0	0	n	1	58H	Note 29
30	0	1	0	0				1		1		Non	OFF	AUTO	AUTO			0	0	0	0	n	0	n	Note 1	1	0	n	1	58H	Note 30
	Normal/AUTO to OFF/CLOSED																														
31	0	y	1	0					0		1	Non	OFF	AUTO	AUTO			0	0	0	1	n	0	n	Note 1	0	0	n	0		Note 31
32	0	y	1	0								Non	OFF	OFF				0	0	0	1	n	0	n	1	0	0	n	0		Note 32
33	0	y	1	0								Non	OFF		OFF			0	0	0	1	n	0	n	1	0	0	n	0		Note 33
34	0	y	1	0					0		1	Non	OFF	AUTO	AUTO			0	0	0	1	1	0	n	Note 1	0	0	n	0	57H	Note 34
35	0	y	1	0								Non	OFF	OFF				0	0	0	1	1	0	n	1	0	0	n	0	57H	Note 35
36	0	y	1	0								Non	OFF		OFF			0	0	0	1	1	0	n	1	0	0	n	0	57H	Note 36
	OFF/CLOSED Position																														
37	0	0	1	1				-	0	-	1		OFF	AUTO	AUTO			0	1	0	0	n	0	n	Note 1	0	0	n	0		Note 37
38	0	0	1	1				-		-			OFF	OFF				0	1	0	0	n	0	n	1	0	0	n	0		Note 38
39	0	0	1	1				-		-			OFF		OFF			0	1	0	0	n	0	n	1	0	0	n	0		Note 39

Table A.8 ON & OFF Control, ON & OFF Monitoring Use Types

TYPES	Configured Sources																Subaddress States (Result)													
	SLC Points							Logic Eq				Config		Oper		ActQ	1	2	3	4	5	6	7	8	9	10	11	12		
	ON Con	ON Mon	OFF Con	OFF Mon	TRBL Mon	AC Fail	Service Disconnect Mon	ON Auto-Block	OFF Auto-Block	ON Auto	OFF Auto	Dedicated/Non-dedicated	Default ON/OFF	Man Cntrl ON/AUTO/OFF	Cmd Zone ON/AUTO/OFF	First-In/Last-In	ON	OFF	Trans ON	Trans OFF	TRBL	Norm	AC Fail	Lockout	Pend ON	Pend OFF	Service Disconnect	Trans Norm	Trouble Code	Notes
	OFF/CLOSED to Normal / AUTO For any type of appliances in this scenario, release of the OFF/CLOSED position or a dependency block for OFF/CLOSED automation will cause the appliance to go straight to the Normal/AUTO position (no transition states).																													
	ON/OPEN to OFF/CLOSED																													
40	0	1	1	0				0	0	0	1		OFF	AUTO	AUTO		0	0	0	1	n	0	n	Note 1	0	0	n	0		Note 40
41	0	1	1	0									OFF	OFF			0	0	0	1	n	0	n	1	0	0	n	0		Note 41
42	0	1	1	0									OFF		OFF		0	0	0	1	n	0	n	1	0	0	n	0		Note 42
43	0	1	1	0				0	0	0	1		OFF	AUTO	AUTO		0	0	0	1	1	0	n	Note 1	0	0	n	0	57H	Note 43
44	0	1	1	0									OFF	OFF			0	0	0	1	1	0	n	1	0	0	n	0	57H	Note 44
45	0	1	1	0									OFF		OFF		0	0	0	1	1	0	n	1	0	0	n	0	57H	Note 45
	OFF/CLOSED to ON/OPEN																													
46	1	0	0	1				0	0	1	0		OFF	AUTO	AUTO		0	0	1	0	n	0	n	Note 1	0	0	n	0		Note 46
47	1	0	0	1									OFF	ON			0	0	1	0	n	0	n	1	0	0	n	0		Note 47
48	1	0	0	1									OFF		ON		0	0	1	0	n	0	n	1	0	0	n	0		Note 48
49	1	0	0	1				0	0	1	0		OFF	AUTO	AUTO		0	0	1	0	1	0	n	Note 1	0	0	n	0	56H	Note 49
50	1	0	0	1									OFF	ON			0	0	1	0	1	0	n	1	0	0	n	0	56H	Note 50
51	1	0	0	1									OFF		ON		0	0	1	0	1	0	n	1	0	0	n	0	56H	Note 51
	DEFAULT ON Normal State / AUTO Position																													
52	0	0	0	0								Non	ON	AUTO	AUTO		0	0	0	0	n	1	n	Note 1	0	0	n	0		Note 52
53	0	0	0	0								Ded	ON	AUTO	AUTO		0	0	0	0	1	0	n	Note 1	0	0	n	0	5CH	Note 53
54	0	1	0	0									ON	AUTO	AUTO		0	0	0	0	n	1	n	Note 1	0	0	n	0		Note 54
55	0	0	0	1								Ded	ON	AUTO	AUTO		0	0	0	0	1	0	n	Note 1	0	0	n	0	5CH	Note 55
56	0	0	0	1								Non	ON	AUTO	AUTO		0	0	0	0	n	1	n	Note 1	0	0	n	0		Note 56
57	0	1	0	0				1		1			ON	AUTO	AUTO		0	0	0	0	n	1	n	Note 1	1	0	n	0		Note 57
58	0	y	0	0				1		1		Non	ON	AUTO	AUTO		0	0	0	0	n	1	n	Note 1	1	0	n	0		Note 58
59	0	0	0	y				1		1		Non	ON	AUTO	AUTO		0	0	0	0	n	1	n	Note 1	1	0	n	0		Note 59
60	0	1	0	0					1		1		ON	AUTO	AUTO		0	0	0	0	n	1	n	Note 1	0	1	n	0		Note 50
61	0	y	0	0					1		1	Non	ON	AUTO	AUTO		0	0	0	0	n	1	n	Note 1	0	1	n	0		Note 61
62	0	0	0	y					1		1	Non	ON	AUTO	AUTO		0	0	0	0	n	1	n	Note 1	0	1	n	0		Note 62
	Normal / AUTO to ON/OPEN																													
63	1	0	0	y				0	-	1	-	Non	ON	AUTO	AUTO		0	0	1	0	n	0	n	Note 1	0	0	n	0		Note 63
64	1	0	0	y					-		-	Non	ON	ON			0	0	1	0	n	0	n	1	0	0	n	0		Note 64
65	1	0	0	y					-		-	Non	ON		ON		0	0	1	0	n	0	n	1	0	0	n	0		Note 65
66	1	0	0	y				0	-	1	-	Non	ON	AUTO	AUTO		0	0	1	0	1	0	n	Note 1	0	0	n	0	56H	Note 66
67	1	0	0	y					-		-	Non	ON	ON			0	0	1	0	1	0	n	1	0	0	n	0	56H	Note 67
68	1	0	0	y					-		-	Non	ON		ON		0	0	1	0	1	0	n	1	0	0	n	0	56H	Note 68
	ON/OPEN Position																													
69	1	1	0	0				0	-	1	-		ON	AUTO	AUTO		1	0	0	0	n	0	n	Note 1	0	0	n	0		Note 69
70	1	1	0	0					-		-		ON	ON			1	0	0	0	n	0	n	1	0	0	n	0		Note 70
71	1	1	0	0					-		-		ON		ON		1	0	0	0	n	0	n	1	0	0	n	0		Note 71
	ON/OPEN to Normal / AUTO For any type of appliances in this scenario, release of the ON/OPEN position or a dependency block for ON/OPEN automation will cause the appliance to go straight to the Normal/AUTO position (no transition states).																													

Table A.8 ON & OFF Control, ON & OFF Monitoring Use Types

TYPES	Configured Sources																Subaddress States (Result)													
	SLC Points							Logic Eq				Config		Oper		ActQ	1	2	3	4	5	6	7	8	9	10	11	12		
	ON Con	ON Mon	OFF Con	OFF Mon	TRBL Mon	AC Fail	Service Disconnect Mon	ON Auto-Block	OFF Auto-Block	ON Auto	OFF Auto	Dedicated/Non-dedicated	Default ON/OFF	Man Cntrl ON/AUTO/OFF	Cmd Zone ON/AUTO/OFF	First-In/Last-In	ON	OFF	Trans ON	Trans OFF	TRBL	Norm	AC Fail	Lockout	Pend ON	Pend OFF	Service Disconnect	Trans Norm	Trouble Code	Notes
	Normal/AUTO to OFF/CLOSED																													
72	0	1	1	0					0		1		ON	AUTO	AUTO		0	0	0	1	n	0	n	Note 1	0	0	n	0		Note 72
73	0	1	1	0									ON	OFF			0	0	0	1	n	0	n	1	0	0	n	0		Note 73
74	0	1	1	0									ON		OFF		0	0	0	1	n	0	n	1	0	0	n	0		Note 74
75	0	0	1	0					0		1	Non	ON	AUTO	AUTO		0	0	0	1	n	0	n	Note 1	0	0	n	0		Note 75
76	0	0	1	0								Non	ON	OFF			0	0	0	1	n	0	n	1	0	0	n	0		Note 76
77	0	0	1	0								Non	ON		OFF		0	0	0	1	n	0	n	1	0	0	n	0		Note 77
78	0	1	1	0					0		1		ON	AUTO	AUTO		0	0	0	1	1	0	n	Note 1	0	0	n	0	57H	Note 78
79	0	1	1	0									ON	OFF			0	0	0	1	1	0	n	1	0	0	n	0	57H	Note 79
80	0	1	1	0									ON		OFF		0	0	0	1	1	0	n	1	0	0	n	0	57H	Note 80
81	0	0	1	0					0		1	Non	ON	AUTO	AUTO		0	0	0	1	1	0	n	Note 1	0	0	n	0	57H	Note 81
82	0	0	1	0								Non	ON	OFF			0	0	0	1	1	0	n	1	0	0	n	0	57H	Note 82
83	0	0	1	0								Non	ON		OFF		0	0	0	1	1	0	n	1	0	0	n	0	57H	Note 83
	OFF/CLOSED Position																													
84	0	0	1	1					0		1		ON	AUTO	AUTO		0	1	0	0	n	0	n	Note 1	0	0	n	0		Note 84
85	0	0	1	1									ON	OFF			0	1	0	0	n	0	n	1	0	0	n	0		Note 85
86	0	0	1	1									ON		OFF		0	1	0	0	n	0	n	1	0	0	n	0		Note 86
	OFF/CLOSED to Normal / AUTO																													
87	0	0	0	1								Ded	ON	AUTO	AUTO		0	0	0	0	n	0	n	Note 1	0	0	n	1		Note 87
88	0	0	0	1					1		1	Ded	ON	AUTO	AUTO		0	0	0	0	n	0	n	Note 1	0	1	n	1		Note 88
89	0	0	0	1								Ded	ON	AUTO	AUTO		0	0	0	0	1	0	n	Note 1	0	0	n	1	58H	Note 89
90	0	0	0	1					1		1	Ded	ON	AUTO	AUTO		0	0	0	0	1	0	n	Note 1	0	1	n	1	58H	Note 90
	ON/OPEN to OPEN/CLOSED																													
91	0	1	1	0				0	0	0	1		ON	AUTO	AUTO		0	0	0	1	n	0	n	Note 1	0	0	n	0		Note 91
92	0	1	1	0									ON	OFF			0	0	0	1	n	0	n	1	0	0	n	0		Note 92
93	0	1	1	0									ON		OFF		0	0	0	1	n	0	n	1	0	0	n	0		Note 93
94	0	1	1	0				0	0	0	1		ON	AUTO	AUTO		0	0	0	1	1	0	n	Note 1	0	0	n	0	57H	Note 94
95	0	1	1	0									ON	OFF			0	0	0	1	1	0	n	1	0	0	n	0	57H	Note 95
96	0	1	1	0									ON		OFF		0	0	0	1	1	0	n	1	0	0	n	0	57H	Note 96
	OFF/CLOSED to ON?OPEN																													
97	1	0	0	1				0	0	1	0		ON	AUTO	AUTO		0	0	1	0	n	0	n	Note 1	0	0	n	0		Note 97
98	1	0	0	1									ON	ON			0	0	1	0	n	0	n	1	0	0	n	0		Note 98
99	1	0	0	1									ON		ON		0	0	1	0	n	0	n	1	0	0	n	0		Note 99
100	1	0	0	1				0	0	1	0		ON	AUTO	AUTO		0	0	1	0	1	0	n	Note 1	0	0	n	0	56H	Note 100
101	1	0	0	1									ON	ON			0	0	1	0	1	0	n	1	0	0	n	0	56H	Note 101
102	1	0	0	1									ON		ON		0	0	1	0	1	0	n	1	0	0	n	0	56H	Note 102

Table A.8 ON & OFF Control, ON & OFF Monitoring Use Types

TYPES	Configured Sources																Subaddress States (Result)													
	SLC Points							Logic Eq				Config		Oper		ActQ	1	2	3	4	5	6	7	8	9	10	11	12		
	ON Con	ON Mon	OFF Con	OFF Mon	TRBL Mon	AC Fail	Service Disconnect Mon	ON Auto-Block	OFF Auto-Block	ON Auto	OFF Auto	Dedicated/Non-dedicated	Default ON/OFF	Man Cntrl ON/AUTO/OFF	Cmd Zone ON/AUTO/OFF	First-In/Last-In	ON	OFF	Trans ON	Trans OFF	TRBL	Norm	AC Fail	Lockout	Pend ON	Pend OFF	Service Disconnect	Trans Norm	Trouble Code	Notes
	Activation Queuing (only applies to annunciators with same priority)																													
	First-In																													
103	1*	0	1	0										1on 2off		First-In	0	0	1	0	n	0	n	1	0	0	n	0		Note 103
104	1*	0	1	0											1on 2off	First-In	0	0	1	0	n	0	n	1	0	0	n	0		Note 104
105	1*	0	1	0										1on 2off		First-In	0	0	1	0	1	0	n	1	0	0	n	0	56H	Note 105
106	1*	0	1	0											1on 2off	First-In	0	0	1	0	1	0	n	1	0	0	n	0	56H	Note 106
107	1	0	1*	0										1off 2on		First-In	0	0	0	1	n	0	n	1	0	0	n	0		Note 107
108	1	0	1*	0											1off 2on	First-In	0	0	0	1	n	0	n	1	0	0	n	0		Note 108
109	1	0	1*	0										1off 2on		First-In	0	0	0	1	1	0	n	1	0	0	n	0	57H	Note 109
110	1	0	1*	0											1off 2on	First-In	0	0	0	1	1	0	n	1	0	0	n	0	57H	Note 110
111	1*	1	1	0										1on 2off		First-In	1	0	0	0	n	0	n	1	0	0	n	0		Note 111
112	1*	1	1	0											1on 2off	First-In	1	0	0	0	n	0	n	1	0	0	n	0		Note 112
113	1	0	1*	1										1off 2on		First-In	0	1	0	0	n	0	n	1	0	0	n	0		Note 113
114	1	0	1*	1											1off 2on	First-In	0	1	0	0	n	0	n	1	0	0	n	0		Note 114
	Last-In																													
115	1*	0	1	0										1on 2off		Last-In	0	0	0	1	n	0	n	1	0	0	n	0		Note 115
116	1*	0	1	0											1on 2off	Last-In	0	0	0	1	n	0	n	1	0	0	n	0		Note 116
117	1*	0	1	0										1on 2off		Last-In	0	0	0	1	1	0	n	1	0	0	n	0	57H	Note 117
118	1*	0	1	0											1on 2off	Last-In	0	0	0	1	1	0	n	1	0	0	n	0	57H	Note 118
119	1	0	1*	0										1off 2on		Last-In	0	0	1	0	n	0	n	1	0	0	n	0		Note 119
120	1	0	1*	0											1off 2on	Last-In	0	0	1	0	n	0	n	1	0	0	n	0		Note 120
121	1	0	1*	0										1off 2on		Last-In	0	0	1	0	1	0	n	1	0	0	n	0	56H	Note 121
122	1	0	1*	0											1off 2on	Last-In	0	0	1	0	1	0	n	1	0	0	n	0	56H	Note 122
123	1*	0	1	1										1on 2off		Last-In	0	1	0	0	n	0	n	1	0	0	n	0		Note 123
124	1*	0	1	1											1on 2off	Last-In	0	1	0	0	n	0	n	1	0	0	n	0		Note 124
125	1	1	1*	0										1off 2on		Last-In	1	0	0	0	n	0	n	1	0	0	n	0		Note 125
126	1	1	1*	0											1off 2on	Last-In	1	0	0	0	n	0	n	1	0	0	n	0		Note 126

Table A.8 ON & OFF Control, ON & OFF Monitoring Use Types

TYPES	Configured Sources															Subaddress States (Result)													
	SLC Points							Logic Eq				Config		Oper		ActQ	1	2	3	4	5	6	7	8	9	10	11	12		
	ON Con	ON Mon	OFF Con	OFF Mon	TRBL Mon	AC Fail	Service Disconnect Mon	ON Auto-Block	OFF Auto-Block	ON Auto	OFF Auto	Dedicated/Non-dedicated	Default ON/OFF	Man Cntrl ON/AUTO/OFF	Cmd Zone ON/AUTO/OFF	First-In/Last-In	ON	OFF	Trans ON	Trans OFF	TRBL	Norm	AC Fail	Lockout	Pend ON	Pend OFF	Service Disconnect	Trans Norm	Trouble Code	Notes
	CONFLICTING OPERATIONS																													
127	y	1	y	1													1	1	0	0	1	0	n	0	0	0	n	0	50H	Note 127
128	1	y	1	y						1	1						1	1	0	0	1	0	n	0	0	0	n	0	50H	Note 128

Table A.8 Notes

1on: Command from 1st annunciator: ON
2off: Command from 2nd annunciator: OFF

1off: Command from 1st annunciator: OFF
2on: Command from 2nd annunciator: ON

1. Lockout is evaluated by controls not indicated in the table.
2. For dedicated appliances that are default OFF/CLOSED, Monitor OFF feedback should be active.
3. Normal/No Activation
4. (Trouble for dedicated appliances in the AUTO position)
   Feedback shows ON/OPEN but ON/OPEN transition timer never started,
   OR No Activations - feedback in the wrong state.
5. (Normal for non-dedicated appliances)
   Feedback shows ON/OPEN but ON/OPEN transition timer never started,
   OR No Activations.
6. Automation activation to ON/OPEN has been blocked by a dependency (pending state).
   No automatic trouble - a virtual point can be used to create a trouble if expected.
7. Automation activation to ON/OPEN has been blocked by a dependency (pending state).
   No automatic trouble - a virtual point can be used to create a trouble if expected.
8. Automation activation to ON/OPEN has been blocked by a dependency (pending state).
   No automatic trouble - a virtual point can be used to create a trouble if expected.
9. Automation activation to OFF/CLOSED has been blocked by a dependency (pending state).
   No automatic trouble - a virtual point can be used to create a trouble if expected.
10. Automation activation to OFF/CLOSED has been blocked by a dependency (pending state).
    No automatic trouble - a virtual point can be used to create a trouble if expected.
11. Automation activation to OFF/CLOSED has been blocked by a dependency (pending state).
    No automatic trouble - a virtual point can be used to create a trouble if expected.
12. Transition state of Normal/AUTO to ON/OPEN via automation activation.
    Transition ON/OPEN timer running.
13. Transition state of Normal/AUTO to ON/OPEN via manual control.
    Transition ON/OPEN timer running.
14. Transition state of Normal/AUTO to ON/OPEN via commanding zone activation.
    Transition ON/OPEN timer running.
15. Transition state of Normal/AUTO to ON/OPEN via automation activation.
    Transition ON/OPEN timer running.
16. Transition state of Normal/AUTO to ON/OPEN via manual control.
    Transition ON/OPEN timer running.
17. Transition state of Normal/AUTO to ON/OPEN via commanding zone activation.
    Transition ON/OPEN timer running.
18. ON/OPEN timer expired during the transition state of Normal/AUTO to ON/OPEN via automation activation.
    Transition ON/OPEN sub-address will still be active during trouble.

19. ON/OPEN timer expired during the transition state of Normal/AUTO to ON/OPEN via manual control.
    Transition ON/OPEN sub-address will still be active during trouble.
20. ON/OPEN timer expired during the transition state of Normal/AUTO to ON/OPEN via commanding zone activation.
    Transition ON/OPEN sub-address will still be active during trouble.
21. ON/OPEN timer expired during the transition state of Normal/AUTO to ON/OPEN via automation activation.
    Transition ON/OPEN sub-address will still be active during trouble.
22. ON/OPEN timer expired during the transition state of Normal/AUTO to ON/OPEN via manual control.
    Transition ON/OPEN sub-address will still be active during trouble.
23. ON/OPEN timer expired during the transition state of Normal/AUTO to ON/OPEN via commanding zone activation.
    Transition ON/OPEN sub-address will still be active during trouble.
24. Possible via automation activation to ON/OPEN with no dependency block.
25. Possible via manual control to ON/OPEN.
26. Possible via commanding zone activation to ON/OPEN.
27. Transition state of ON/OPEN to Normal/AUTO.
    Transition Normal timer running.
28. Automation activation to ON/OPEN has been blocked by a dependency (pending state).
    Transition state of ON/OPEN to Normal/AUTO caused by dependency block.
    Transition Normal timer running.
    No automatic trouble - a virtual point can be used to create a trouble if expected.
29. Normal timer expired during the transition state of ON/OPEN to Normal/AUTO.
    Transition Normal sub-address will still be active during trouble.
30. Automation activation to ON/OPEN has been blocked by a dependency (pending state).
    Normal timer expired during the transition state of ON/OPEN to Normal/AUTO caused by dependency block.
    Transition Normal sub-address will still be active during trouble.
31. Transition state of Normal/AUTO to OFF/CLOSED via automation activation.
    Transition OFF/CLOSED timer running.
32. Transition state of Normal/AUTO to OFF/CLOSED via manual control.
    Transition OFF/CLOSED timer running.
33. Transition state of Normal/AUTO to OFF/CLOSED via commanding zone activation.
    Transition OFF/CLOSED timer running.
34. OFF/CLOSED timer expired during the transition state of Normal/AUTO to OFF/CLOSED via automation activation.
    Transition OFF/CLOSED sub-address will still be active during trouble.
35. OFF/CLOSED timer expired during the transition state of Normal/AUTO to OFF/CLOSED via manual control.
    Transition OFF/CLOSED sub-address will still be active during trouble.
36. OFF/CLOSED timer expired during the transition state of Normal/AUTO to OFF/CLOSED via commanding zone activation.
    Transition OFF/CLOSED sub-address will still be active during trouble.
37. Possible via automation activation to OFF/CLOSED with no dependency block.
38. Possible via manual control to OFF/CLOSED.
39. Possible via commanding zone activation to OFF/CLOSED.
40. Transition state of ON/OPEN to OFF/CLOSED via automation activation.
    Transition OFF/CLOSED timer running.
41. Transition state of ON/OPEN to OFF/CLOSED via manual control.
    Transition OFF/CLOSED timer running.
42. Transition state of ON/OPEN to OFF/CLOSED via commanding zone activation.
    Transition OFF/CLOSED timer running.
43. OFF/CLOSED timer expired during the transition state of ON/OPEN to OFF/CLOSED via automation activation.
    Transition OFF/CLOSED sub-address will still be active during trouble.
44. OFF/CLOSED timer expired during the transition state of ON/OPEN to OFF/CLOSED via manual control.
    Transition OFF/CLOSED sub-address will still be active during trouble.
45. OFF/CLOSED timer expired during the transition state of ON/OPEN to OFF/CLOSED via commanding zone activation.
    Transition OFF/CLOSED sub-address will still be active during trouble.
46. Transition state of OFF/CLOSED to ON/OPEN via automation activation.
    Transition ON/OPEN timer running.

47. Transition state of OFF/CLOSED to ON/OPEN via manual control.
    Transition ON/OPEN timer running.
48. Transition state of OFF/CLOSED to ON/OPEN via commanding zone activation.
    Transition ON/OPEN timer running.
49. ON/OPEN timer expired during the transition state of OFF/CLOSED to ON/OPEN via automation activation.
    Transition ON/OPEN sub-address will still be active during trouble.
50. ON/OPEN timer expired during the transition state of OFF/CLOSED to ON/OPEN via manual control.
    Transition ON/OPEN sub-address will still be active during trouble.
51. ON/OPEN timer expired during the transition state of OFF/CLOSED to ON/OPEN via commanding zone activation.
    Transition ON/OPEN sub-address will still be active during trouble.
52. Normal/No Activation.
53. For dedicated appliances that are default ON/OPEN, Monitor ON feedback should be active.
54. Normal/No Activation.
55. (Trouble for dedicated appliances in the AUTO position)
    Feedback shows OFF/CLOSED but OFF/CLOSED transition timer never started,
    OR No Activations - feedback in the wrong state.
56. (Normal for non-dedicated appliances)
    Feedback shows OFF/CLOSED but OFF/CLOSED transition timer never started,
    OR No Activations.
57. Automation activation to ON/OPEN has been blocked by a dependency (pending state).
    No automatic trouble - a virtual point can be used to create a trouble if expected.
58. Automation activation to ON/OPEN has been blocked by a dependency (pending state).
    No automatic trouble - a virtual point can be used to create a trouble if expected.
59. Automation activation to ON/OPEN has been blocked by a dependency (pending state).
    No automatic trouble - a virtual point can be used to create a trouble if expected.
60. Automation activation to OFF/CLOSED has been blocked by a dependency (pending state).
    No automatic trouble - a virtual point can be used to create a trouble if expected.
61. Automation activation to OFF/CLOSED has been blocked by a dependency (pending state).
    No automatic trouble - a virtual point can be used to create a trouble if expected.
62. Automation activation to OFF/CLOSED has been blocked by a dependency (pending state).
    No automatic trouble - a virtual point can be used to create a trouble if expected.
63. Transition state of Normal/AUTO to ON/OPEN via automation activation.
    Transition ON/OPEN timer running.
64. Transition state of Normal/AUTO to ON/OPEN via manual control.
    Transition ON/OPEN timer running.
65. Transition state of Normal/AUTO to ON/OPEN via commanding zone activation.
    Transition ON/OPEN timer running.
66. ON/OPEN timer expired during the transition state of Normal/AUTO to ON/OPEN via automation activation.
    Transition ON/OPEN sub-address will still be active during trouble.
67. ON/OPEN timer expired during the transition state of Normal/AUTO to ON/OPEN via manual control.
    Transition ON/OPEN sub-address will still be active during trouble.
68. ON/OPEN timer expired during the transition state of Normal/AUTO to ON/OPEN via commanding zone activation.
    Transition ON/OPEN sub-address will still be active during trouble.
69. Possible via automation activation to ON/OPEN with no dependency block.
70. Possible via manual control to ON/OPEN.
71. Possible via commanding zone activation to ON/OPEN.
72. Transition state of Normal/AUTO to OFF/CLOSED via automation activation.
    Transition OFF/CLOSED timer running.
73. Transition state of Normal/AUTO to OFF/CLOSED via manual control.
    Transition OFF/CLOSED timer running.
74. Transition state of Normal/AUTO to OFF/CLOSED via commanding zone activation.
    Transition OFF/CLOSED timer running.
75. Transition state of Normal/AUTO to OFF/CLOSED via automation activation.
    Transition OFF/CLOSED timer running.

76. Transition state of Normal/AUTO to OFF/CLOSED via manual control.
    Transition OFF/CLOSED timer running.
77. Transition state of Normal/AUTO to OFF/CLOSED via commanding zone activation.
    Transition OFF/CLOSED timer running.
78. OFF/CLOSED timer expired during the transition state of Normal/AUTO to OFF/CLOSED via automation activation.
    Transition OFF/CLOSED sub-address will still be active during trouble.
79. OFF/CLOSED timer expired during the transition state of Normal/AUTO to OFF/CLOSED via manual control.
    Transition OFF/CLOSED sub-address will still be active during trouble.
80. OFF/CLOSED timer expired during the transition state of Normal/AUTO to OFF/CLOSED via commanding zone activation.
    Transition OFF/CLOSED sub-address will still be active during trouble.
81. OFF/CLOSED timer expired during the transition state of Normal/AUTO to OFF/CLOSED via automation activation.
    Transition OFF/CLOSED sub-address will still be active during trouble.
82. OFF/CLOSED timer expired during the transition state of Normal/AUTO to OFF/CLOSED via manual control.
    Transition OFF/CLOSED sub-address will still be active during trouble.
83. OFF/CLOSED timer expired during the transition state of Normal/AUTO to OFF/CLOSED via commanding zone activation.
    Transition OFF/CLOSED sub-address will still be active during trouble.
84. Possible via automation activation to OFF/CLOSED with no dependency block.
85. Possible via manual control to OFF/CLOSED.
86. Possible via commanding zone activation to OFF/CLOSED.
87. Transition state of OFF/CLOSED to Normal/AUTO.
    Transition Normal timer running.
88. Automation activation to OFF/CLOSED has been blocked by a dependency (pending state).
    Transition state of OFF/CLOSED to Normal/AUTO caused by dependency block.
    Transition Normal timer running.
    No automatic trouble - a virtual point can be used to create a trouble if expected.
89. Normal timer expired during the transition state of OFF/CLOSED to Normal/AUTO.
    Transition Normal sub-address will still be active during trouble.
90. Automation activation to OFF/CLOSED has been blocked by a dependency (pending state).
    Normal timer expired during the transition state of OFF/CLOSED to Normal/AUTO caused by dependency block.
    Transition Normal sub-address will still be active during trouble.
91. Transition state of ON/OPEN to OFF/CLOSED via automation activation.
    Transition OFF/CLOSED timer running.
92. Transition state of ON/OPEN to OFF/CLOSED via manual control.
    Transition OFF/CLOSED timer running.
93. Transition state of ON/OPEN to OFF/CLOSED via commanding zone activation.
    Transition OFF/CLOSED timer running.
94. OFF/CLOSED timer expired during the transition state of ON/OPEN to OFF/CLOSED via automation activation.
    Transition OFF/CLOSED sub-address will still be active during trouble.
95. OFF/CLOSED timer expired during the transition state of ON/OPEN to OFF/CLOSED via manual control.
    Transition OFF/CLOSED sub-address will still be active during trouble.
96. OFF/CLOSED timer expired during the transition state of ON/OPEN to OFF/CLOSED via commanding zone activation.
    Transition OFF/CLOSED sub-address will still be active during trouble.
97. Transition state of OFF/CLOSED to ON/OPEN via automation activation.
    Transition ON/OPEN timer running.
98. Transition state of OFF/CLOSED to ON/OPEN via manual control.
    Transition ON/OPEN timer running.
99. Transition state of OFF/CLOSED to ON/OPEN via commanding zone activation.
    Transition ON/OPEN timer running.
100. ON/OPEN timer expired during the transition state of OFF/CLOSED to ON/OPEN via automation activation.
    Transition ON/OPEN sub-address will still be active during trouble.
101. ON/OPEN timer expired during the transition state of OFF/CLOSED to ON/OPEN via manual control.
    Transition ON/OPEN sub-address will still be active during trouble.

102. ON/OPEN timer expired during the transition state of OFF/CLOSED to ON/OPEN via commanding zone activation.
Transition ON/OPEN sub-address will still be active during trouble.

103. First-In: ON Control
Transition state to ON/OPEN via manual control from 1st annunciator.
Transition state to OFF/CLOSED via manual control from 2nd annunciator in queue.

104. First-In: ON Control
Transition state to ON/OPEN via commanding zone activation from 1st annunciator.
Transition state to OFF/CLOSED via commanding zone activation from 2nd annunciator in queue.

105. First-In: ON Control
ON/OPEN timer expired during the transition state to ON/OPEN via manual control from 1st annunciator.
Transition state to OFF/CLOSED via manual control from 2nd annunciator in queue.

106. First-In: ON Control
ON/OPEN timer expired during the transition state to ON/OPEN via commanding zone activation from 1st annunciator.
Transition state to OFF/CLOSED via commanding zone activation from 2nd annunciator in queue.

107. First-In: OFF Control
Transition state to OFF/CLOSED via manual control from 1st annunciator.
Transition state to ON/OPEN via manual control from 2nd annunciator in queue.

108. First-In: OFF Control
Transition state to OFF/CLOSED via commanding zone activation from 1st annunciator.
Transition state to ON/OPEN via commanding zone activation from 2nd annunciator in queue.

109. First-In: OFF Control
OFF/CLOSED timer expired during the transition state to OFF/CLOSED via commanding zone activation from 1st annunciator.
Transition state to ON/OPEN via commanding zone activation from 2nd annunciator in queue.

110. First-In: OFF Control
OFF/CLOSED timer expired during the transition state to OFF/CLOSED via manual control from 1st annunciator.
Transition state to ON/OPEN via manual control from 2nd annunciator in queue.

111. First-In: ON Control
Possible via manual control from 1st annunciator to ON/OPEN
Transition state to OFF/CLOSED via manual control from 2nd annunciator in queue.

112. First-In: ON Control
Possible via commanding zone activation from 1st annunciator to ON/OPEN.
Transition state to OFF/CLOSED via commanding zone activation from 2nd annunciator in queue.

113. First-In: OFF Control
Possible via manual control from 1st annunciator to OFF/CLOSED.
Transition state to ON/OPEN via manual control from 2nd annunciator in queue.

114. First-In: OFF Control
Possible via commanding zone activation from 1st annunciator to OFF/CLOSED.
Transition state to ON/OPEN via commanding zone activation from 2nd annunciator in queue.

115. Last-In: OFF Control
Transition state to OFF/CLOSED via manual control from the 2nd annunciator when activated after the 1st annunciator's command.
Transition state to ON/OPEN via manual control from the 1st annunciator put into queue if it is still activated.

116. Last-In: OFF Control
Transition state to OFF/CLOSED via commanding zone activation from the 2nd annunciator when activated after the 1st annunciator's command.
Transition state to ON/OPEN via commanding zone activation from the 1st annunciator put into queue if it is still activated.

117. Last-In: OFF Control
OFF/CLOSED timer expired during the transition state to OFF/CLOSED via manual control from the 2nd annunciator when activated after the 1st annunciator's command.
Transition state to ON/OPEN via manual control from the 1st annunciator put into queue if it is still activated.

118. Last-In: OFF Control
OFF/CLOSED timer expired during the transition state to OFF/CLOSED via commanding zone activation from the 2nd annunciator when activated after the 1st annunciator's command.
Transition state to ON/OPEN via commanding zone activation from the 1st annunciator put into queue if it is still activated.

119. Last-In: ON Control
Transition state to ON/OPEN via manual control from the 2nd annunciator when activated after the 1st annunciator's command.
Transition state to OFF/CLOSED via manual control from the 1st annunciator put into queue if it is still activated.

120. Last-In: ON Control
Transition state to ON/OPEN via commanding zone activation from the 2nd annunciator when activated after the 1st annunciator's command.
Transition state to OFF/CLOSED via commanding zone activation from the 1st annunciator put into queue if it is still activated.

121. Last-In: ON Control
ON/OPEN timer expired during the transition state to ON/OPEN via manual control from the 2nd annunciator when activated after the 1st annunciator's command.
Transition state to OFF/CLOSED via manual control from the 1st annunciator put into queue if it is still activated.

122. Last-In: ON Control
ON/OPEN timer expired during the transition state to ON/OPEN via commanding zone activation from the 2nd annunciator when activated after the 1st annunciator's command.
Transition state to OFF/CLOSED via commanding zone activation from the 1st annunciator put into queue if it is still activated.

123. Last-In: OFF Control
Possible via manual control from the 2nd annunciator to OFF/CLOSED when activated after the 1st annunciator's command.
Transition state to ON/OPEN via manual control from the 1st annunciator put into queue if it is still activated.

124. Last-In: OFF Control
Possible via commanding zone activation from the 2nd annunciator to OFF/CLOSED when activated after the 1st annunciator's command.
Transition state to ON/OPEN via commanding zone activation from the 1st annuniciator put into queue if it is still activated.

125. Last-In: ON Control
Possible via manual control from the 2nd annunciator to ON/OPEN when activated after the 1st annunciator's command.
Transition state to OFF/CLOSED via manual control from the 1st annuniciator put into queue if it is still activated.

126. Last-In: ON Control
Possible via commanding zone activation from the 2nd annunciator to ON/OPEN when activated after the 1st annunciator's command.
Transition state to OFF/CLOSED via commanding zone activation from the 1st annuniciator put into queue if it is still activated.

127. ON Monitor and OFF Monitor feedback are both active, resulting in a conflicting operation.

128. Automation logic evaluates true for both ON and OFF automation actions.

Table A.9 ON & OFF Control Use Types

TYPES	Configured Sources: SLC Points: ON Con	ON Mon	OFF Con	OFF Mon	TRBL Mon	AC Fail	Service Disconnect Mon	Logic Eq: ON Auto-Block	OFF Auto-Block	ON Auto	OFF Auto	Config: Dedicated/Non-dedicated	Default ON/OFF	Oper: Man Cntrl ON/AUTO/OFF	Cmd Zone ON/AUTO/OFF	ActQ: First-In/Last-In	Subaddress States (Result): 1 ON	2 OFF	3 Trans ON	4 Trans OFF	5 TRBL	6 Norm	7 AC Fail	8 Lockout	9 Pend ON	10 Pend OFF	11 Service Disconnect	12 Trans Norm	Trouble Code	Notes
	DEFAULT ON & OFF Normal State / AUTO Position																													
1	0	x	0	x										AUTO	AUTO		0	0	0	0	n	1	n	Note 1	0	0	n	0		Norm/No Activ.
2	0	x	0	x				1		1				AUTO	AUTO		0	0	0	0	n	0	n	Note 1	1	0	n	0		Note 2
3	0	x	0	x					1		1			AUTO	AUTO		0	0	0	0	n	0	n	Note 1	0	1	n	0		Note 3
	ON/OPEN Position																													
4	1	x	0	x				0		1				AUTO	AUTO		1	0	0	0	n	0	n	Note 1	0	0	n	0		Note 4
5	1	x	0	x										ON			1	0	0	0	n	0	n	1	0	0	n	0		Note 5
6	1	x	0	x											ON		1	0	0	0	n	0	n	1	0	0	n	0		Note 6
	OFF/CLOSED Position																													
7	0	x	1	x					0		1			AUTO	AUTO		0	1	0	0	n	0	n	Note 1	0	0	n	0		Note 7
8	0	x	1	x										OFF			0	1	0	0	n	0	n	1	0	0	n	0		Note 8
9	0	x	1	x											OFF		0	1	0	0	n	0	n	1	0	0	n	0		Note 9
	Activation Queuing (only applies to annunciators with same priority) First-In																													
10	*1	x	1	x										1on 2off		F-In	1	0	0	0	n	0	n	1	0	0	n	0		Note 10
11	*1	x	1	x											1on 2off	F-In	1	0	0	0	n	0	n	1	0	0	n	0		Note 11
12	1	x	*1	x										1off 2on		F-In	0	1	0	0	n	0	n	1	0	0	n	0		Note 12
13	1	x	*1	x											1off 2on	F-In	0	1	0	0	n	0	n	1	0	0	n	0		Note 13
	Last-In																													
14	*1	x	1	x										1on 2off		L-In	0	1	0	0	n	0	n	1	0	0	n	0		Note 14
15	*1	x	1	x											1on 2off	L-In	0	1	0	0	n	0	n	1	0	0	n	0		Note 15
16	1	x	*1	x										1off 2on		L-In	1	0	0	0	n	0	n	1	0	0	n	0		Note 16
17	1	x	*1	x											1off 2on	L-In	1	0	0	0	n	0	n	1	0	0	n	0		Note 17
	Conflicting Operations																													
18	1	x	1	x						1	1			AUTO	AUTO		1	1	0	0	1	0	n	0	0	0	n	0	50H	Note 18

Table A.9 Notes

1on: Command from 1st annunciator: ON
2off: Command from 2nd annunciator: OFF

1off: Command from 1st annunciator: OFF
2on: Command from 2nd annunciator: ON

1. Lockout is evaluated by controls not indicated in the table.
2. Automation activation to ON/OPEN has been blocked by a dependency (pending state). No automatic trouble - a virtual point can be used to create a trouble if expected.
3. Automation activation to OFF/CLOSED has been blocked by a dependency (pending state). No automatic trouble - a virtual point can be used to create a trouble if expected.
4. Possible via automation activation to ON/OPEN with no dependency block.

5. Possible via manual control to ON/OPEN.
6. Possible via commanding zone activation to ON/OPEN.
7. Possible via automation activation to OFF/CLOSED with no dependency block.
8. Possible via manual control to OFF/CLOSED.
9. Possible via commanding zone activation to OFF/CLOSED.
10. First-In: ON Control
    Possible via manual control from 1st annunciator to ON/OPEN.
    OFF/CLOSED via manual control from 2nd annunciator in queue.
11. First-In: ON Control
    Possible via commanding zone activation from 1st annunciator to ON/OPEN.
    OFF/CLOSED via commanding zone activation from 2nd annunciator in queue.
12. First-In: OFF Control
    Possible via manual control from 1st annunciator to OFF/CLOSED.
    ON/OPEN via manual control from 2nd annunciator in queue.
13. First-In: OFF Control
    Possible via commanding zone activation from 1st annunciator to OFF/CLOSED.
    ON/OPEN via commanding zone activation from 2nd annunciator in queue.
14. Last-In: OFF Control
    Possible via manual control from the 2nd annunciator to OFF/CLOSED when activated after the 1st annunciator's command.
    ON/OPEN via manual control from the 1st annunciator put into queue if it is still activated.
15. Last-In: OFF Control
    Possible via commanding zone activation from the 2nd annunciator to OFF/CLOSED when activated after the 1st annunciator's command.
    ON/OPEN via commanding zone activation from the 1st annunciator put into queue if it is still activated.
16. Last-In: ON Control
    Possible via manual control from the 2nd annunciator to ON/OPEN when activated after the 1st annunciator's command.
    OFF/CLOSED via manual control from the 1st annunciator put into queue if it is still activated.
17. Last-In: ON Control
    Possible via commanding zone activation from the 2nd annunciator to ON/OPEN when activated after the 1st annunciator's command.
    OFF/CLOSED via commanding zone activation from the 1st annunciator put into queue if it is still activated.
18. Automation logic evaluates true for both ON and OFF automation actions.

Table A.10 ON Control, OFF Monitoring Use Types

TYPES	Configured Sources: SLC Points: ON Con	ON Mon	OFF Con	OFF Mon	TRBL Mon	AC Fail	Service Disconnect Mon	Logic Eq: ON Auto-Block	OFF Auto-Block	ON Auto	OFF Auto	Config: Dedicated/Non-dedicated	Default ON/OFF	Oper: Man Cntrl ON/AUTO/OFF	Cmd Zone ON/AUTO/OFF	ActQ: First-In/Last-In	Subaddress States (Result): 1 ON	2 OFF	3 Trans ON	4 Trans OFF	5 TRBL	6 Norm	7 AC Fail	8 Lockout	9 Pend ON	10 Pend OFF	11 Service Disconnect	12 Trans Norm	Trouble Code	Notes
	DEFAUT ON & OFF Normal State / AUTO Position																													
1	x	0	x	0				-	-	-	-	Ded					0	0	0	0	1	0	n	0	0	0	n	0	1DH	Note 1
2	x	0	x	0				-	-	-	-	Non					0	0	0	0	n	1	n	0	0	0	n	0		Note 2
	ON/OPEN Position																													
3	x	1	x	0				-	-	-	-						1	0	0	0	n	0	n	0	0	0	n	0		Note 3
	OFF/CLOSED Position																													
4	x	0	x	1				-	-	-	-						0	1	0	0	n	0	n	0	0	0	n	0		Note 4
	Conflicting Operations																													
5	x	1	x	1				-	-	-	-						1	1	0	0	1	0	n	0	0	0	n	0	50H	Note 5

Table A.10 Notes

1. For dedicated appliances, one of the Monitor points must be active.
2. Normal/No Activations.
   For non-dedicated appliances, it is fine if none of the Monitor points are active.
3. Received feedback of appliance being ON/OPEN.
4. Received feedback of appliance being OFF/CLOSED.
5. ON Monitor and OFF Monitor feedback are both active, resulting in a conflicting operation.

Table A.11 OFF Control, ON Monitoring Use Types

	Configured Sources																Subaddress States (Result)													
	SLC Points							Logic Eq				Config		Oper		ActQ	1	2	3	4	5	6	7	8	9	10	11	12		
TYPES	ON Con	ON Mon	OFF Con	OFF Mon	TRBL Mon	AC Fail	Service Disconnect Mon	ON Auto-Block	OFF Auto-Block	ON Auto	OFF Auto	Dedicated/Non-dedicated	Default ON/OFF	Man Cntrl ON/AUTO/OFF	Cmd Zone ON/AUTO/OFF	First-In/Last-In	ON	OFF	Trans ON	Trans OFF	TRBL	Norm	AC Fail	Lockout	Pend ON	Pend OFF	Service Disconnect	Trans Norm	Trouble Code	Notes
DEFAULT OFF																														
Normal State / AUTO Position																														
1	0	x	x	0					-		-	Ded	OFF	AUTO	AUTO		0	0	0	0	1	1	n	Note 1	0	0	n	0		Note 2
2	0	x	x	0					-		-	Non	OFF	AUTO	AUTO		0	0	0	0	n	1	n	Note 1	0	0	n	0		Note 3
3	0	x	x	1					-		-		OFF	AUTO	AUTO		0	0	0	0	n	n	n	Note 1	0	0	n	0		Norm/No Activ.
4	0	x	x	1				1	-	1	-	Ded	OFF	AUTO	AUTO		0	0	0	0	n	n	n	Note 1	1	0	n	0		Note 4
5	0	x	x	y				1	-	1	-	Non	OFF	AUTO	AUTO		0	0	0	0	n	n	n	Note 1	1	0	n	0		Note 5
Normal State to AUTO Position																														
6	1	x	x	1				0	-	1	-		OFF	AUTO	AUTO		0	0	1	0	n	n	n	Note 1	0	0	n	0		Note 6
7	1	x	x	1					-		-		OFF	ON			0	0	1	0	n	n	n	1	0	0	n	0		Note 7
8	1	x	x	1					-		-		OFF		ON		0	0	1	0	n	n	n	1	0	0	n	0		Note 8
9	1	x	x	1				0	-	1	-		OFF	AUTO	AUTO		0	0	1	0	1	0	n	Note 1	0	0	n	0	56H	Note 9
10	1	x	x	1					-		-		OFF	ON	OFF		0	0	1	0	1	0	n	1	0	0	n	0	56H	Note 10
11	1	x	x	1					-		-		OFF		ON		0	0	1	0	1	0		1	0	0	n	0	56H	Note 11
ON/OPEN Position																														
12	1	x	x	0				0	-	1	-		OFF	AUTO	AUTO		1	0	0	0	n	0	n	Note 1	0	0	n	0		Note 12
13	1	x	x	0					-		-		OFF	ON			1	0	0	0	n	0	n	1	0	0	n	0		Note 13
14	1	x	x	0					-		-		OFF		ON		1	0	0	0	n	0	n	1	0	0	n	0		Note 14
ON/OPEN to Normal / AUTO																														
15	0	x	x	0					-		-	Ded	OFF	AUTO	AUTO		0	0	0	0	n	0	n	Note 1	0	0	n	1		Note 15
16	0	x	x	0				1	-	1	-	Ded	OFF	AUTO	AUTO		0	0	0	0	n	0	n	Note 1	1	0	n	1		Note 16
17	0	x	x	0					-		-	Ded	OFF	AUTO	AUTO		0	0	0	0	1	0	n	Note 1	0	0	n	1	58H	Note 17
18	0	x	x	0				1	-	1	-	Ded	OFF	AUTO	AUTO		0	0	0	0	1	0	n	Note 1	1	0	n	1	58H	Note 18
DEFAULT ON																														
19	y	x	x	y								Ded	ON	AUTO	AUTO		n	n	n	n	1	n	n	n	n	n	n	n		Note 19
20	y	x	x	y								Non	ON	AUTO	AUTO		n	n	n	n	n	n	n	n	n	n	n	n		Note 20
Normal State / AUTO Position																														
21	0	x	x	y					-		-	Non	ON	AUTO	AUTO		0	0	0	0	n	1	n	Note 1	0	0	0	0		Note 21
22	0	x	x	y				1	-	1	-	Non	ON	AUTO	AUTO		0	0	0	0	n	1	n	Note 1	1	0	n	0		Note 22
Normal / AUTO to ON/OPEN																														
23	1	x	x	1				0	-	1	-	Non	ON	AUTO	AUTO		0	0	1	0	n	0	n	Note 1	0	0	n	0		Note 23
24	1	x	x	1					-		-	Non	ON	ON			0	0	1	0	n	0	n	1	0	0	n	0		Note 24
25	1	x	x	1					-		-	Non	ON		ON		0	0	1	0	n	0	n	1	0	0	n	0		Note 25
26	1	x	x	1				0	-	1	-	Non	ON	AUTO	AUTO		0	0	1	0	1	0	n	Note 1	0	0	n	0	56H	Note 26
27	1	x	x	1					-		-	Non	ON	ON			0	0	1	0	1	0	n	1	0	0	n	0	56H	Note 27
28	1	x	x	1					-		-	Non	ON		ON		0	0	1	0	1	0	n	1	0	0	n	0	56H	Note 28
ON/OPEN Position																														
29	1	x	x	0				0	-	1	-	Non	ON	AUTO	AUTO		1	0	0	0	n	0	n	Note 1	0	0	n	0		Note 29
30	1	x	x	0					-		-	Non	ON	ON			1	0	0	0	n	0	n	1	0	0	n	0		Note 30
31	1	x	x	0					-		-	Non	ON		ON		1	0	0	0	n	0	n	1	0	0	n	0		Note 31

Table A.11 Notes

1. Lockout is evaluated by controls not indicated in the table.
2. For dedicated appliances that are default OFF/CLOSED, Monitor OFF feedback should be active in the Normal state.

3. Normal/No Activations.
   For non-dedicated appliances that are default OFF/CLOSED, it is fine if the Monitor module is not active.
4. Automation activation to ON/OPEN has been blocked by a dependency (pending state).
   No automatic trouble - a virtual point can be used to create a trouble if expected.
5. Automation activation to ON/OPEN has been blocked by a dependency (pending state).
   No automatic trouble - a virtual point can be used to create a trouble if expected.
6. Transition state of Normal/AUTO to ON/OPEN via automation activation.
   Transition ON/OPEN timer running.
7. Transition state of Normal/AUTO to ON/OPEN via manual control.
   Transition ON/OPEN timer running.
8. Transition state of Normal/AUTO to ON/OPEN via commanding zone activation.
   Transition ON/OPEN timer running.
9. ON/OPEN timer expired during the transition state of Normal/AUTO to ON/OPEN via automation activation.
   Transition ON/OPEN sub-address will still be active during trouble.
10. ON/OPEN timer expired during the transition state of Normal/AUTO to ON/OPEN via manual control.
    Transition ON/OPEN sub-address will still be active during trouble.
11. ON/OPEN timer expired during the transition state of Normal/AUTO to ON/OPEN via commanding zone activation.
    Transition ON/OPEN sub-address will still be active during trouble.
12. Possible via automation activation to ON/OPEN with no dependency block.
13. Possible via manual control to ON/OPEN.
14. Possible via commanding zone activation to ON/OPEN.
15. Transition state of ON/OPEN to Normal/AUTO.
    Transition Normal timer running.
16. Automation activation to ON/OPEN has been blocked by a dependency (pending state).
    Transition state of ON/OPEN to Normal/AUTO caused by dependency block.
    Transition Normal timer running.
    No automatic trouble - a virtual point can be used to create a trouble if expected.
17. Normal timer expired during the transition state of ON/OPEN to Normal/AUTO.
    Transition Normal sub-address will still be active during trouble.
18. Automation activation to ON/OPEN has been blocked by a dependency (pending state).
    Normal timer expired during the transition state of ON/OPEN to Normal/AUTO caused by dependency block.
    Transition Normal sub-address will still be active during trouble.
19. For dedicated appliances, setting the appliance that is default ON/OPEN to be controlled to ON/OPEN is wrong.
    CAMWorks+ may block the download from happening.
20. For non-dedicated appliances, setting the appliance that is default ON/OPEN to be controlled to ON/OPEN is fine.
21. Normal/No Activations
22. Automation activation with ON dependency blocking (pending state).
    No automatic trouble - customer can use a virtual point to create a trouble if expected.
23. Transition state of Normal/AUTO to ON/OPEN via automation activation.
    Transition ON/OPEN timer running.
24. Transition state of Normal/AUTO to ON/OPEN via manual control.
    Transition ON/OPEN timer running.
25. Transition state of Normal/AUTO to ON/OPEN via commanding zone activation.
    Transition ON/OPEN timer running.
26. ON/OPEN timer expired during the transition state of Normal/AUTO to ON/OPEN via automation activation.
    Transition ON/OPEN sub-address will still be active during trouble.
27. ON/OPEN timer expired during the transition state of Normal/AUTO to ON/OPEN via manual control.
    Transition ON/OPEN sub-address will still be active during trouble.
28. ON/OPEN timer expired during the transition state of Normal/AUTO to ON/OPEN via commanding zone activation
    Transition ON/OPEN sub-address will still be active during trouble.
29. Possible via automation activation to ON/OPEN with no dependency block.
30. Possible via manual control to ON/OPEN.
31. Possible via commanding zone activation to ON/OPEN.

Table A.12 ON & OFF Monitoring Use Types

	Configured Sources																Subaddress States (Result)													
	SLC Points							Logic Eq				Config		Oper		ActQ	1	2	3	4	5	6	7	8	9	10	11	12		
TYPES	ON Con	ON Mon	OFF Con	OFF Mon	TRBL Mon	AC Fail	Service Disconnect Mon	ON Auto-Block	OFF Auto-Block	ON Auto	OFF Auto	Dedicated/Non-dedicated	Default ON/OFF	Man Cntrl ON/AUTO/OFF	Cmd Zone ON/AUTO/OFF	First-In/Last-In	ON	OFF	Trans ON	Trans OFF	TRBL	Norm	AC Fail	Lockout	Pend ON	Pend OFF	Service Disconnect	Trans Norm	Trouble Code	Notes
	DEFAULT ON Normal State / AUTO Position																													
1	x	0	0	x				-		-		Ded	OFF	AUTO	AUTO		0	0	0	0	1	0	n	Note 1	0	0	n	0		Note 2
2	x	0	0	x				-		-		Non	ON	AUTO	AUTO		0	0	0	0	n	1	n	Note 1	0	0	n	0		Note 3
3	x	1	0	x				-		-			ON	AUTO	AUTO		0	0	0	0	n	1	n	Note 1	0	0	n	0		Norm/No Activ.
4	x	1	0	x				-	1	-	1	Ded	ON	AUTO	AUTO		0	0	0	0	n	1	n	Note 1	1	0	n	0		Note 4
5	x	y	0	x				-	1	-	1	Non	ON	AUTO	AUTO		0	0	0	0	n	1	n	Note 1	1	0	n	0		Note 5
	Normal / AUTO to OFF/CLOSED																													
6	x	1	1	x				-	0	-	1		ON	AUTO	AUTO		0	0	0	1	n	0	n	Note 1	0	0	n	0		Note 6
7	x	1	1	x				-		-			ON	OFF			0	0	0	1	n	0	n	1	0	0	n	0		Note 7
8	x	1	1	x				-		-			ON		OFF		0	0	0	1	n	0	n	1	0	0	n	0		Note 8
9	x	1	1	x				-	0	-	1		ON	AUTO	AUTO		0	0	0	1	1	0	n	Note 1	0	0	n	0	57H	Note 9
10	x	1	1	x				-		-			ON	OFF			0	0	0	1	1	0	n	1	0	0	n	0	57H	Note 10
11	x	1	1	x				-		-			ON		OFF		0	0	0	1	1	0	n	1	0	0	n	0	57H	Note 11
	OFF/CLOSED Position																													
12	x	0	1	x				-	0	-	1		ON	AUTO	AUTO		0	1	0	0	0	0	n	Note 1	0	0	n	0		Note 12
13	x	0	1	x				-		-			ON	OFF			0	1	0	0	0	0	n	1	0	0	n	0		Note 13
14	x	0	1	x				-		-			ON		OFF		0	1	0	0	0	0	n	1	0	0	n	0		Note 14
	OFF/CLOSED to Normal / AUTO																													
15	x	0	0	x				-		-		Ded	ON	AUTO	AUTO		0	0	0	0	n	0	n	Note 1	0	0	n	1		Note 15
16	x	0	0	x				-	1	-	1	Ded	ON	AUTO	AUTO		0	0	0	0	n	0	n	Note 1	0	1	n	1		Note 16
17	x	0	0	x				-		-		Ded	ON	AUTO	AUTO		0	0	0	0	1	0	n	Note 1	0	0	n	1	58H	Note 17
18	x	0	0	x				-	1	-	1	Ded	ON	AUTO	AUTO		0	0	0	0	1	0	n	Note 1	0	1	n	1	58H	Note 18
	DEFAULT OFF																													
19	x	y	y	x								Ded	OFF	AUTO	AUTO		n	n	n	n	1	n	n	n	n	n	n	n		Note 19
20	x	y	y	x								Non	OFF	AUTO	AUTO		n	n	n	n	n	n	n	n	n	n	n	n		Note 20
	Normal State / AUTO Position																													
21	x	y	0	x				-		-		Non	OFF	AUTO	AUTO		0	0	0	0	n	1	n	Note 1	0	0	n	0		Note 21
22	x	y	0	x				-	1	-	1	Non	OFF	AUTO	AUTO		0	0	0	0	n	1	n	Note 1	1	0	n	0		Note 22
	Normal / AUTO to OFF/CLOSED																													
23	x	1	1	x				-	0	-	1	Non	OFF	AUTO	AUTO		0	0	0	1	n	0	n	Note 1	0	0	n	0		Note 23
24	x	1	1	x				-		-		Non	OFF	OFF			0	0	0	1	n	0	n	1	0	0	n	0		Note 24
25	x	1	1	x				-		-		Non	OFF		OFF		0	0	0	1	n	0	n	1	0	0	n	0		Note 25
26	x	1	1	x				-	0	-	1	Non	OFF	AUTO	AUTO		0	0	0	1	1	0	n	Note 1	0	0	n	0	57H	Note 26
27	x	1	1	x				-		-		Non	OFF	OFF			0	0	0	1	1	0	n	1	0	0	n	0	57H	Note 27
28	x	1	1	x				-		-		Non	OFF		OFF		0	0	0	1	1	0	n	1	0	0	n	0	57H	Note 28
	OFF/CLOSED Position																													
29	x	0	1	x				-	0	-	1	Non	OFF	AUTO	AUTO		0	1	0	0	n	0		Note 1	0	0	n	0		Note 29
30	x	0	1	x				-		-		Non	OFF	OFF			0	1	0	0	n	0		1	0	0	n	0		Note 30
31	x	0	1	x				-		-		Non	OFF		OFF		0	1	0	0	n	0		1	0	0	n	0		Note 31

Table A.12 Notes

1. Lockout is evaluated by controls not indicated in the table.
2. For dedicated appliances that are default ON/OPEN, Monitor ON feedback should be active.
3. Normal/No Activations
   For non-dedicated appliances that are default ON/OPEN, it is fine if the Monitor module is not active.

4. Automation activation to OFF/CLOSED has been blocked by a dependency (pending state).
   No automatic trouble - a virtual point can be used to create a trouble if expected.
5. Automation activation to OFF/CLOSED has been blocked by a dependency (pending state).
   No automatic trouble - a virtual point can be used to create a trouble if expected.
6. Transition state of Normal/AUTO to OFF/CLOSED via automation activation.
   Transition OFF/CLOSED timer running.
7. Transition state of Normal/AUTO to OFF/CLOSED via manual control.
   Transition OFF/CLOSED timer running.
8. Transition state of Normal/AUTO to OFF/CLOSED via commanding zone activation.
   Transition OFF/CLOSED timer running.
9. OFF/CLOSED timer expired during the transition state of Normal/AUTO to OFF/CLOSED via automation activation.
   Transition OFF/CLOSED sub-address will still be active during trouble.
10. OFF/CLOSED timer expired during the transition state of Normal/AUTO to OFF/CLOSED via manual control.
    Transition OFF/CLOSED sub-address will still be active during trouble.
11. OFF/CLOSED timer expired during the transition state of Normal/AUTO to OFF/CLOSED via commanding zone activation.
    Transition OFF/CLOSED sub-address will still be active during trouble.
12. Possible via automation activation to OFF/CLOSED with no dependency block.
13. Possible via manual control to OFF/CLOSED.
14. Possible via commanding zone activation to OFF/CLOSED.
15. Transition state of OFF/CLOSED to Normal/AUTO.
    Transition Normal timer running.
16. Automation activation to OFF/CLOSED has been blocked by a dependency (pending state).
    Transition state of OFF/CLOSED to Normal/AUTO caused by dependency block.
    Transition Normal timer running.
    No automatic trouble - a virtual point can be used to create a trouble if expected.
17. Normal timer expired during the transition state of OFF/CLOSED to Normal/AUTO.
    Transition Normal sub-address will still be active during trouble.
18. Automation activation to OFF/CLOSED has been blocked by a dependency (pending state).
    Normal timer expired during the transition state of OFF/CLOSED to Normal/AUTO caused by dependency block.
    Transition Normal sub-address will still be active during trouble.
19. For dedicated appliances, setting the appliance that is default OFF/CLOSED to be controlled to OFF/CLOSED is wrong. CAMWorks+ may block the download from happening.
20. For non-dedicated appliances, setting the appliance that is default OFF/CLOSED to be controlled to OFF/CLOSED is fine.
21. Normal/No Activations
22. Automation activation to OFF/CLOSED has been blocked by a dependency (pending state).
    No automatic trouble - a virtual point can be used to create a trouble if expected.
23. Transition state of Normal/AUTO to OFF/CLOSED via automation activation.
    Transition OFF/CLOSED timer running.
24. Transition state of Normal/AUTO to OFF/CLOSED via manual control.
    Transition OFF/CLOSED timer running.
25. Transition state of Normal/AUTO to OFF/CLOSED via commanding zone activation.
    Transition OFF/CLOSED timer running.
26. OFF/CLOSED timer expired during the transition state of Normal/AUTO to OFF/CLOSED via automation activation.
    Transition OFF/CLOSED sub-address will still be active during trouble.
27. OFF/CLOSED timer expired during the transition state of Normal/AUTO to OFF/CLOSED via manual control.
    Transition OFF/CLOSED sub-address will still be active during trouble.
28. OFF/CLOSED timer expired during the transition state of Normal/AUTO to OFF/CLOSED via commanding zone activation.
    Transition OFF/CLOSED sub-address will still be active during trouble.
29. Possible via automation activation to OFF/CLOSED with no dependency block.
30. Possible via manual control to OFF/CLOSED.
31. Possible via commanding zone activation to OFF/CLOSED.

Table A.13 OFF Control, ON & OFF Monitoring Use Types

	Configured Sources																Subaddress States (Result)													
	SLC Points							Logic Eq				Config		Oper		ActQ	1	2	3	4	5	6	7	8	9	10	11	12		
TYPES	ON Con	ON Mon	OFF Con	OFF Mon	TRBL Mon	AC Fail	Service Disconnect Mon	ON Auto-Block	OFF Auto-Block	ON Auto	OFF Auto	Dedicated/Non-dedicated	Default ON/OFF	Man Cntrl ON/AUTO/OFF	Cmd Zone ON/AUTO/OFF	First-In/Last-In	ON	OFF	Trans ON	Trans OFF	TRBL	Norm	AC Fail	Lockout	Pend ON	Pend OFF	Service Disconnect	Trans Norm	Trouble Code	Notes
	DEFAULT OFF																													
	Normal State / AUTO Position																													
1	0	0	x	0					-		-	Ded	OFF	AUTO	AUTO		0	0	0	0	1	0	n	Note 1	0	0	n	0	5CH	Note 2
2	0	0	x	0					-		-	Non	OFF	AUTO	AUTO		0	0	0	0	n	1	n	Note 1	0	0	n	0		Note 3
3	0	0	x	1					-		-		OFF	AUTO	AUTO		0	0	0	0	n	1	n	Note 1	0	0	n	0		Norm/No Activ.
4	0	1	x	0					-		-	Ded	OFF	AUTO	AUTO		0	0	0	0	1	0	n	Note 1	0	0	n	0	5CH	Note 4
5	0	1	x	0					-		-	Non	OFF	AUTO	AUTO		0	0	0	0	n	1	n	Note 1	0	0	n	0		Note 5
6	0	0	x	1				1	-	1	-		OFF	AUTO	AUTO		0	0	0	0	n	1	n	Note 1	1	0	n	0		Note 6
7	0	y	x	0				1	-	1	-	Non	OFF	AUTO	AUTO		0	0	0	0	n	1	n	Note 1	1	0	n	0		Note 7
	Normal / AUTO to ON/OPEN																													
8	1	0	x	1				0	-	1	-		OFF	AUTO	AUTO		0	0	1	0	n	0	n	Note 1	0	0	n	0		Note 8
9	1	0	x	1					-		-		OFF	ON			0	0	1	0	n	0	n	1	0	0	n	0		Note 9
10	1	0	x	1					-		-		OFF		ON		0	0	1	0	n	0	n	1	0	0	n	0		Note 10
11	1	0	x	0				0	-	1	-	Non	OFF	AUTO	AUTO		0	0	1	0	n	0	n	Note 1	0	0	n	0		Note 11
12	1	0	x	0					-		-	Non	OFF	ON			0	0	1	0	n	0	n	1	0	0	n	0		Note 12
13	1	0	x	0					-		-	Non	OFF		ON		0	0	1	0	n	0	n	1	0	0	n	0		Note 13
14	1	0	x	1				0	-	1	-		OFF	AUTO	AUTO		0	0	1	0	1	0	n	Note 1	0	0	n	0	56H	Note 14
15	1	0	x	1					-		-		OFF	ON			0	0	1	0	1	0	n	1	0	0	n	0	56H	Note 15
16	1	0	x	1					-		-		OFF		ON		0	0	1	0	1	0	n	1	0	0	n	0	56H	Note 16
17	1	0	x	0				0	-	1	-	Non	OFF	AUTO	AUTO		0	0	1	0	1	0	n	Note 1	0	0	n	0	56H	Note 17
18	1	0	x	0					-		-	Non	OFF	ON			0	0	1	0	1	0	n	1	0	0	n	0	56H	Note 18
19	1	0	x	0					-		-	Non	OFF		ON		0	0	1	0	1	0	n	1	0	0	n	0	56H	Note 19
	ON/OPEN Position																													
20	1	1	x	0				0	-	1	-		OFF	AUTO	AUTO		1	0	0	0	n	0	n	Note 1	0	0	n	0		Note 20
21	1	1	x	0					-		-		OFF	ON			1	0	0	0	n	0	n	1	0	0	n	0		Note 21
22	1	1	x	0					-		-		OFF		ON		1	0	0	0	n	0	n	1	0	0	n	0		Note 22
	ON/OPEN to Normal / AUTO																													
23	0	1	x	0					-		-	Ded	OFF	AUTO	AUTO		0	0	0	0	n	0	n	Note 1	0	0	n	1		
24	0	1	x	0				1	-	1	-	Ded	OFF	AUTO	AUTO		0	0	0	0	n	0	n	Note 1	1	0	n	1		
25	0	1	x	0					-		-	Ded	OFF	AUTO	AUTO		0	0	0	0	1	0	n	Note 1	0	0	n	1	58H	
26	0	1	x	0				1	-	1	-	Ded	OFF	AUTO	AUTO		0	0	0	0	1	0	n	Note 1	1	0	n	1	58H	
	DEFAULT ON																													
27	y	y	x	y								Ded	ON				n	n	n	n	1	n	n	n	n	n	n	n		
28	y	y	x	y								Non	ON				n	n	n	n	n	n	n	n	n	n	n	n		
	Normal Sate / AUTO Position																													
29	0	0	x	y					-		-	Non	ON	AUTO	AUTO		0	0	0	0	n	1	n	Note 1	0	0	n	0		
30	0	y	x	0					-		-	Non	ON	AUTO	AUTO		0	0	0	0	n	1	n	Note 1	0	0	n	0		
31	0	0	x	y				1	-	1	-	Non	ON	AUTO	AUTO		0	0	0	0	n	1	n	Note 1	1	0	n	0		
32	0	y	x	0				1	-	1	-	Non	ON	AUTO	AUTO		0	0	0	0	n	1	n	Note 1	1	0	n	0		
	Normal / AUTO to ON/OPEN Position																													
33	1	0	x	y				0	-	1	-	Non	ON	AUTO	AUTO		0	0	1	0	n	0	n	Note 1	0	0	n	0		
34	1	0	x	y					-		-	Non	ON	ON			0	0	1	0	n	0	n	1	0	0	n	0		
35	1	0	x	y					-		-	Non	ON		ON		0	0	1	0	n	0	n	1	0	0	n	0		
36	1	0	x	y				0	-	1	-	Non	ON	AUTO	AUTO		0	0	1	0	1	0	n	Note 1	0	0	n	0	56H	

Table A.13 OFF Control, ON & OFF Monitoring Use Types

TYPES	Configured Sources																Subaddress States (Result)													
	SLC Points							Logic Eq				Config		Oper		ActQ	1	2	3	4	5	6	7	8	9	10	11	12		
	ON Con	ON Mon	OFF Con	OFF Mon	TRBL Mon	AC Fail	Service Disconnect Mon	ON Auto-Block	OFF Auto-Block	ON Auto	OFF Auto	Dedicated/Non-dedicated	Default ON/OFF	Man Cntrl ON/AUTO/OFF	Cmd Zone ON/AUTO/OFF	First-In/Last-In	ON	OFF	Trans ON	Trans OFF	TRBL	Norm	AC Fail	Lockout	Pend ON	Pend OFF	Service Disconnect	Trans Norm	Trouble Code	Notes
37	1	0	x	y								Non	ON	ON			0	0	1	0	1	0	n	1	0	0	n	0	56H	
38	1	0	x	y								Non	ON		ON		0	0	1	0	1	0	n	1	0	0	n	0	56H	
	ON/OPEN Position																													
39	1	1	x	0				0		1		Non	ON	AUTO	AUTO		1	0	0	0	n	0	n	Note 1	0	0	n	0		
40	1	1	x	0								Non	ON	ON			1	0	0	0	n	0	n	1	0	0	n	0		
41	1	1	x	0								Non	ON		ON		1	0	0	0	n	0	n	1	0	0	n	0		
	Conflicting Operations																													
42	y	1	x	1									OFF				n	n	n	n	1	0	n	n	n	n	n	n	50H	
43	y	1	x	1								Non	ON				n	n	n	n	1	0	n	n	n	n	n	n	50H	

Table A.13 Notes

1. Lockout is evaluated by controls not indicated in the table.
2. For dedicated appliances that are default OFF/CLOSED, Monitor OFF feedback should be active .
3. Normal/No Activations
   For non-dedicated appliances that are default OFF/CLOSED, it is fine if the Monitor module is not active.
4. (Trouble for dedicated appliances in the AUTO position)
   Feedback shows ON/OPEN but ON/OPEN transition timer never started,
   OR No Activations - feedback in the wrong state.
5. (Normal for non-dedicated appliances)
   Feedback shows ON/OPEN but ON/OPEN transition timer never started,
   OR No Activations.
6. Automation activation to ON/OPEN has been blocked by a dependency (pending state).
   No automatic trouble - a virtual point can be used to create a trouble if expected.
7. Automation activation to ON/OPEN has been blocked by a dependency (pending state).
   No automatic trouble - a virtual point can be used to create a trouble if expected.
8. Transition state of Normal/AUTO to ON/OPEN via automation activation.
   Transition ON/OPEN timer running.
9. Transition state of Normal/AUTO to ON/OPEN via manual control.
   Transition ON/OPEN timer running.
10. Transition state of Normal/AUTO to ON/OPEN via commanding zone activation.
    Transition ON/OPEN timer running.
11. Transition state of Normal/AUTO to ON/OPEN via automation activation.
    Transition ON/OPEN timer running.
12. Transition state of Normal/AUTO to ON/OPEN via manual control.
    Transition ON/OPEN timer running.
13. Transition state of Normal/AUTO to ON/OPEN via commanding zone activation.
    Transition ON/OPEN timer running.
14. ON/OPEN timer expired during the transition state of Normal/AUTO to ON/OPEN via automation activation.
    Transition ON/OPEN sub-address will still be active during trouble.
15. ON/OPEN timer expired during the transition state of Normal/AUTO to ON/OPEN via manual control.
    Transition ON/OPEN sub-address will still be active during trouble.
16. ON/OPEN timer expired during the transition state of Normal/AUTO to ON/OPEN via commanding zone activation.
    Transition ON/OPEN sub-address will still be active during trouble.
17. ON/OPEN timer expired during the transition state of Normal/AUTO to ON/OPEN via automation activation.
    Transition ON/OPEN sub-address will still be active during trouble.

18. ON/OPEN timer expired during the transition state of Normal/AUTO to ON/OPEN via manual control.
    Transition ON/OPEN sub-address will still be active during trouble.
19. ON/OPEN timer expired during the transition state of Normal/AUTO to ON/OPEN via commanding zone activation.
    Transition ON/OPEN sub-address will still be active during trouble.
20. Possible via automation activation to ON/OPEN with no dependency block.
21. Possible via manual control to ON/OPEN.
22. Possible via commanding zone activation to ON/OPEN.
23. Transition state of ON/OPEN to Normal/AUTO.
    Transition Normal timer running.
24. Automation activation to ON/OPEN has been blocked by a dependency (pending state).
    Transition state of ON/OPEN to Normal/AUTO caused by dependency block.
    Transition Normal timer running.
    No automatic trouble - a virtual point can be used to create a trouble if expected.
25. Normal timer expired during the transition state of ON/OPEN to Normal/AUTO.
    Transition Normal sub-address will still be active during trouble.
26. Automation activation to ON/OPEN has been blocked by a dependency (pending state).
    Normal timer expired during the transition state of ON/OPEN to Normal/AUTO caused by dependency block.
    Transition Normal sub-address will still be active during trouble.
27. For dedicated appliances, setting the appliance that is default ON/OPEN to be controlled to ON/OPEN is wrong.
    CAMWorks+ may block the download from happening.
28. For non-dedicated appliances, setting the appliance that is default ON/OPEN to be controlled to ON/OPEN is fine.
29. Normal/No Activations
30. Normal/No Activations
31. Automation activation to ON/OPEN has been blocked by a dependency (pending state).
    No automatic trouble - a virtual point can be used to create a trouble if expected.
32. Automation activation to ON/OPEN has been blocked by a dependency (pending state).
    No automatic trouble - a virtual point can be used to create a trouble if expected.
33. Transition state of Normal/AUTO to ON/OPEN via automation activation.
    Transition ON/OPEN timer running.
34. Transition state of Normal/AUTO to ON/OPEN via manual control.
    Transition ON/OPEN timer running.
35. Transition state of Normal/AUTO to ON/OPEN via commanding zone activation.
    Transition ON/OPEN timer running.
36. ON/OPEN timer expired during the transition state of Normal/AUTO to ON/OPEN via automation activation.
    Transition ON/OPEN sub-address will still be active during trouble.
37. ON/OPEN timer expired during the transition state of Normal/AUTO to ON/OPEN via manual control.
    Transition ON/OPEN sub-address will still be active during trouble.
38. ON/OPEN timer expired during the transition state of Normal/AUTO to ON/OPEN via commanding zone activation.
    Transition ON/OPEN sub-address will still be active during trouble.
39. Possible via automation activation to ON/OPEN with no dependency block.
40. Possible via manual control to ON/OPEN.
41. Possible via commanding zone activation to ON/OPEN.
42. ON Monitor and OFF Monitor feedback are both active, resulting in a conflicting operation.
43. ON Monitor and OFF Monitor feedback are both active, resulting in a conflicting operation.

Table A.14 ON & OFF Control, OFF Monitoring Use Types

	Configured Sources																Subaddress States (Result)													
	SLC Points							Logic Eq				Config		Oper		ActQ	1	2	3	4	5	6	7	8	9	10	11	12		
TYPES	ON Con	ON Mon	OFF Con	OFF Mon	TRBL Mon	AC Fail	Service Disconnect Mon	ON Auto-Block	OFF Auto-Block	ON Auto	OFF Auto	Dedicated/Non-dedicated	Default ON/OFF	Man Cntrl ON/AUTO/OFF	Cmd Zone ON/AUTO/OFF	First-In/Last-In	ON	OFF	Trans ON	Trans OFF	TRBL	Norm	AC Fail	Lockout	Pend ON	Pend OFF	Service Disconnect	Trans Norm	Trouble Code	Notes
	DEFAULT ON Normal State / AUTO Position																													
1	x	0	0	0				-		-		Ded	ON	AUTO	AUTO		0	0	0	0	1	0	n	Note 1	0	0	n	0	1DH	Note 2
2	x	0	0	0				-		-		Non	ON	AUTO	AUTO		0	0	0	0	n	1	n	Note 1	0	0	n	0		Note 3
3	x	1	0	0				-		-			ON	AUTO	AUTO		0	0	0	0	n	1	n	Note 1	0	0	n	0		Norm/No Activ.
4	x	0	0	1				-		-		Ded	ON	AUTO	AUTO		0	0	0	0	1	0	n	Note 1	0	0	n	0	1DH	Note 4
5	x	0	0	1				-		-		Non	ON	AUTO	AUTO		0	0	0	0	n	1	n	Note 1	0	0	n	0		Note 5
6	x	1	0	0				-	1	-	1		ON	AUTO	AUTO		0	0	0	0	n	1	n	Note 1	0	1	n	0		Note 6
7	x	0	0	y				-	1	-	1	Non	ON	AUTO	AUTO		0	0	0	0	n	1	n	Note 1	0	1	n	0		Note 7
8	x	1	1	0				-	0	-	1		ON	AUTO	AUTO		0	0	0	1	n	0	n	Note 1	0	0	n	0		Note 8
9	x	1	1	0				-		-			ON	OFF			0	0	0	1	n	0	n	1	0	0	n	0		Note 9
10	x	1	1	0				-		-			ON		OFF		0	0	0	1	n	0	n	1	0	0	n	0		Note 10
11	x	0	1	0				-	0	-	1	Non	ON	AUTO	AUTO		0	0	0	1	n	0	n	Note 1	0	0	n	0		Note 11
12	x	0	1	0				-		-		Non	ON	OFF			0	0	0	1	n	0	n	1	0	0	n	0		Note 12
13	x	0	1	0				-		-		Non	ON		OFF		0	0	0	1	n	0	n	1	0	0	n	0		Note 13
14	x	1	1	0				-	0	-	1		ON	AUTO	AUTO		0	0	0	1	1	0	n	Note 1	0	0	n	0	57H	Note 14
15	x	1	1	0				-		-			ON	OFF			0	0	0	1	1	0	n	1	0	0	n	0	57H	Note 15
16	x	1	1	0				-		-			ON		OFF		0	0	0	1	1	0	n	1	0	0	n	0	57H	Note 16
17	x	0	1	0				-	0	-	1	Non	ON	AUTO	AUTO		0	0	0	1	1	0	n	Note 1	0	0	n	0	57H	Note 17
18	x	0	1	0				-		-		Non	ON	OFF			0	0	0	1	1	0	n	1	0	0	n	0	57H	Note 18
19	x	0	1	0				-		-		Non	ON		OFF		0	0	0	1	1	0	n	1	0	0	n	0	57H	Note 19
20	x	0	1	1				-	0	-	1		ON	AUTO	AUTO		0	1	0	0	n	0	n	Note 1	0	0	n	0		Note 20
21	x	0	1	1				-		-			ON	OFF			0	1	0	0	n	0	n	1	0	0	n	0		Note 21
22	x	0	1	1				-		-			ON		OFF		0	1	0	0	n	0	n	1	0	0	n	0		Note 22
23	x	0	0	1				-		-		Ded	ON	AUTO	AUTO		0	0	0	0	n	0	n	Note 1	0	0	n	1		Note 23
24	x	0	0	1				-	1	-	1	Ded	ON	AUTO	AUTO		0	0	0	0	n	0	n	Note 1	0	1	n	1		Note 24
25	x	0	0	1				-		-		Ded	ON	AUTO	AUTO		0	0	0	0	1	0	n	Note 1	0	0	n	1	58H	Note 25
26	x	0	0	1				-	1	-	1	Ded	ON	AUTO	AUTO		0	0	0	0	1	0	n	Note 1	0	1	n	1	58H	Note 26
27	x	y	y	y				-		-		Ded	OFF				n	n	n	n	1	n	n	n	n	n	n	n		Note 27
28	x	y	y	y				-		-		Non	OFF				n	n	n	n	n	n	n	n	n	n	n	n		Note 28
29	x	y	0	0				-		-		Non	OFF	AUTO	AUTO		0	0	0	0	n	1	n	Note 1	0	0	n	0		Note 29
30	x	0	0	y				-		-		Non	OFF	AUTO	AUTO		0	0	0	0	n	1	n	Note 1	0	0	n	0		Note 30
31	x	y	0	0				-	1	-	1	Non	OFF	AUTO	AUTO		0	0	0	0	n	1	n	Note 1	0	1	n	0		Note 31
32	x	0	0	y				-	1	-	1	Non	OFF	AUTO	AUTO		0	0	0	0	n	1	n	Note 1	0	1	n	0		Note 32
33	x	y	1	0				-	0	-	1	Non	OFF	AUTO	AUTO		0	0	0	1	n	0	n	Note 1	0	0	n	0		Note 33
34	x	y	1	0				-		-		Non	OFF	OFF			0	0	0	1	n	0	n	1	0	0	n	0		Note 34
35	x	y	1	0				-		-		Non	OFF		OFF		0	0	0	1	n	0	n	1	0	0	n	0		Note 35
36	x	y	1	0				-	0	-	1	Non	OFF	AUTO	AUTO		0	0	0	1	1	0	n	Note 1	0	0	n	0	57H	Note 36
37	x	y	1	0				-		-		Non	OFF	OFF			0	0	0	1	1	0	n	1	0	0	n	0	57H	Note 37
38	x	y	1	0				-		-		Non	OFF		OFF		0	0	0	1	1	0	n	1	0	0	n	0	57H	Note 38
39	x	0	1	1				-	0	-	1	Non	OFF	AUTO	AUTO		0	1	0	0	n	0	n	Note 1	0	0	n	0		Note 39
40	x	0	1	1				-		-		Non	OFF	ON			0	1	0	0	n	0	n	1	0	0	n	0		Note 40
41	x	0	1	1				-		-		Non	OFF		ON		0	1	0	0	n	0	n	1	0	0	n	0		Note 41

Table A.14 ON & OFF Control, OFF Monitoring Use Types

	Configured Sources															Subaddress States (Result)														
	SLC Points							Logic Eq				Config		Oper		ActQ	1	2	3	4	5	6	7	8	9	10	11	12		
TYPES	ON Con	ON Mon	OFF Con	OFF Mon	TRBL Mon	AC Fail	Service Disconnect Mon	ON Auto-Block	OFF Auto-Block	ON Auto	OFF Auto	Dedicated/Non-dedicated	Default ON/OFF	Man Cntrl ON/AUTO/OFF	Cmd Zone ON/AUTO/OFF	First-In/Last-In	ON	OFF	Trans ON	Trans OFF	TRBL	Norm	AC Fail	Lockout	Pend ON	Pend OFF	Service Disconnect	Trans Norm	Trouble Code	Notes
42	x	1	y	1				-		-			ON				n	n	n	n	1	0	n	n	n	n	n	0	50H	Note 42
43	x	1	y	1				-		-		Non	OFF				n	n	n	n	1	0	n	n	n	n	n	0	50H	Note 43

Table A.14 Notes

1. Lockout is evaluated by controls not indicated in the table.
2. For dedicated appliances that are default ON/OPEN, Monitor ON feedback should be active.
3. For non-dedicated appliances that are default ON/OPEN, it is fine if the Monitor module is not active.
4. (Trouble for dedicated appliances in the AUTO position)
   Feedback shows OFF/CLOSED but OFF/CLOSED transition timer never started,
   OR No Activations - feedback in the wrong state.
5. (Normal for non-dedicated appliances)
   Feedback shows OFF/CLOSED but OFF/CLOSED transition timer never started, OR No Activations.
6. Automation activation to OFF/CLOSED has been blocked by a dependency (pending state).
   No automatic trouble - a virtual point can be used to create a trouble if expected.
7. Automation activation to OFF/CLOSED has been blocked by a dependency (pending state).
   No automatic trouble - a virtual point can be used to create a trouble if expected.
8. Transition state of Normal/AUTO to OFF/CLOSED via automation activation.
   Transition OFF/CLOSED timer running
9. Transition state of Normal/AUTO to OFF/CLOSED via manual control
   Transition OFF/CLOSED timer running.
10. Transition state of Normal/AUTO to OFF/CLOSED via commanding zone activation.
    Transition OFF/CLOSED timer running.
11. Transition state of Normal/AUTO to OFF/CLOSED via automation activation.
    Transition OFF/CLOSED timer running.
12. Transition state of Normal/AUTO to OFF/CLOSED via manual control.
    Transition OFF/CLOSED timer running.
13. Transition state of Normal/AUTO to OFF/CLOSED via commanding zone activation.
    Transition OFF/CLOSED timer running.
14. OFF/CLOSED timer expired during the transition state of Normal/AUTO to OFF/CLOSED via automation activation.
    Transition OFF/CLOSED sub-address will still be active during trouble.
15. OFF/CLOSED timer expired during the transition state of Normal/AUTO to OFF/CLOSED via manual control.
    Transition OFF/CLOSED sub-address will still be active during trouble.
16. OFF/CLOSED timer expired during the transition state of Normal/AUTO to OFF/CLOSED via commanding zone activation.
    Transition OFF/CLOSED sub-address will still be active during trouble.
17. OFF/CLOSED timer expired during the transition state of Normal/AUTO to OFF/CLOSED via automation activation.
    Transition OFF/CLOSED sub-address will still be active during trouble.
18. OFF/CLOSED timer expired during the transition state of Normal/AUTO to OFF/CLOSED via manual control.
    Transition OFF/CLOSED sub-address will still be active during trouble.
19. OFF/CLOSED timer expired during the transition state of Normal/AUTO to OFF/CLOSED via commanding zone activation.
    Transition OFF/CLOSED sub-address will still be active during trouble.
20. Possible via automation activation to OFF/CLOSED with no dependency block.

21. Possible via manual control to OFF/CLOSED.
22. Possible via commanding zone activation to OFF/CLOSED.
23. Transition state of OFF/CLOSED to Normal/AUTO.
    Transition Normal timer running.
24. Automation activation to OFF/CLOSED has been blocked by a dependency (pending state).
    Transition state of OFF/CLOSED to Normal/AUTO caused by dependency block.
    Transition Normal timer running.
    No automatic trouble - a virtual point can be used to create a trouble if expected.
25. Normal timer expired during the transition state of OFF/CLOSED to Normal/AUTO.
    Transition Normal sub-address will still be active during trouble.
26. Automation activation to OFF/CLOSED has been blocked by a dependency (pending state).
    Normal timer expired during the transition state of OFF/CLOSED to Normal/AUTO caused by dependency block.
    Transition Normal sub-address will still be active during trouble.
27. For dedicated appliances, setting the appliance that is default ON/OPEN to be controlled to ON/OPEN only is wrong. CAMWorks+ may block the download from happening.
28. For non-dedicated appliances, setting the appliance that is default ON/OPEN to be controlled to ON/OPEN only is fine.
29. Normal/No Activations
30. Normal/No Activations
31. Automation activation to OFF/CLOSED has been blocked by a dependency (pending state).
    No automatic trouble - a virtual point can be used to create a trouble if expected.
32. Automation activation to OFF/CLOSED has been blocked by a dependency (pending state).
    No automatic trouble - a virtual point can be used to create a trouble if expected.
33. Transition state of Normal/AUTO to OFF/CLOSED via automation activation.
    Transition OFF/CLOSED timer running.
34. Transition state of Normal/AUTO to OFF/CLOSED via manual control.
    Transition OFF/CLOSED timer running.
35. Transition state of Normal/AUTO to OFF/CLOSED via commanding zone activation.
    Transition OFF/CLOSED timer running.
36. OFF/CLOSED timer expired during the transition state of Normal/AUTO to OFF/CLOSED via automation activation.
    Transition OFF/CLOSED sub-address will still be active during trouble.
37. OFF/CLOSED timer expired during the transition state of Normal/AUTO to OFF/CLOSED via manual control.
    Transition OFF/CLOSED sub-address will still be active during trouble.
38. OFF/CLOSED timer expired during the transition state of Normal/AUTO to OFF/CLOSED via commanding zone activation.
    Transition OFF/CLOSED sub-address will still be active during trouble.
39. Possible via automation activation to OFF/CLOSED with no dependency block.
40. Possible via manual control to OFF/CLOSED.
41. Possible via commanding zone activation to OFF/CLOSED.
42. ON Monitor and OFF Monitor feedback are both active, resulting in a conflicting operation.
43. ON Monitor and OFF Monitor feedback are both active, resulting in a conflicting operation.

Table A.15 OFF Control, ON & OFF Monitoring Use Types

	Configured Sources																Subaddress States (Result)													
	SLC Points							Logic Eq				Config		Oper		ActQ	1	2	3	4	5	6	7	8	9	10	11	12		
TYPES	ON Con	ON Mon	OFF Con	OFF Mon	TRBL Mon	AC Fail	Service Disconnect Mon	ON Auto-Block	OFF Auto-Block	ON Auto	OFF Auto	Dedicated/Non-dedicated	Default ON/OFF	Man Cntrl ON/AUTO/OFF	Cmd Zone ON/AUTO/OFF	First-In/Last-In	ON	OFF	Trans ON	Trans OFF	TRBL	Norm	AC Fail	Lockout	Pend ON	Pend OFF	Service Disconnect	Trans Norm	Trouble Code	Notes
	DEFAULT OFF Normal State / AUTO Position																													
1	0	0	0	x									ON	AUTO	AUTO		0	0	0	0	n	1	n	Note 1	0	0	n	0		Norm/No Activ.
2	0	1	0	x								Ded	OFF	AUTO	AUTO		0	0	0	0	1	0	n	Note 1	0	0	n	0	5CH	Note 2
3	0	1	0	x								Non	OFF	AUTO	AUTO		0	0	0	0	n	1	n	Note 1	0	0	n	0		Note 3
4	0	0	0	x				1		1			OFF	AUTO	AUTO		0	0	0	0	n	1	n	Note 1	1	0	n	0		Note 4
5	0	1	0	x				1		1		Non	OFF	AUTO	AUTO		0	0	0	0	n	1	n	Note 1	1	0	n	0		Note 5
6	0	0	0	x					1		1		OFF	AUTO	AUTO		0	0	0	0	n	1	n	Note 1	0	1	n	0		Note 6
7	0	1	0	x					1		1	Non	OFF	AUTO	AUTO		0	0	0	0	n	n	n	Note 1	0	1	n	0		Note 7
	Normal /AUTO to ON/OPEN																													
8	1	0	0	x				0		1			OFF	AUTO	AUTO		0	0	1	0	n	0	n	Note 1	0	0	n	0		Note 8
9	1	0	0	x									OFF	ON			0	0	1	0	n	0	n	1	0	0	n	0		Note 9
10	1	0	0	x									OFF		ON		0	0	1	0	n	0	n	1	0	0	n	0		Note 10
11	1	0	0	x				0		1			OFF	AUTO	AUTO		0	0	1	0	1	0	n	Note 1	0	0	n	0	56H	Note 11
12	1	0	0	x									OFF	ON			0	0	1	0	1	0	n	1	0	0	n	0	56H	Note 12
13	1	0	0	x									OFF		ON		0	0	1	0	1	0	n	1	0	0	n	0	56H	Note 13
	ON/OPEN Position																													
14	1	1	0	x				0		1			OFF	AUTO	AUTO		1	0	0	0	n	0	n	Note 1	0	0	n	0		Note 14
15	1	1	0	x									OFF	ON			1	0	0	0	n	0	n	1	0	0	n	0		Note 15
16	1	1	0	x									OFF		ON		1	0	0	0	n	0	n	1	0	0	n	0		Note 16
	ON/OPEN to Normal /AUTO																													
17	0	1	0	x								Ded	OFF	AUTO	AUTO		0	0	0	0	n	0	n	Note 1	0	0	n	1		Note 17
18	0	1	0	x				1		1		Ded	OFF	AUTO	AUTO		0	0	0	0	n	0	n	Note 1	1	0	n	1		Note 18
19	0	1	0	x								Ded	OFF	AUTO	AUTO		0	0	0	0	1	0	n	Note 1	0	0	n	1	58H	Note 19
20	0	1	0	x				1		1		Ded	OFF	AUTO	AUTO		0	0	0	0	1	0	n	Note 1	1	0	n	1	58H	Note 20
	Normal / AUTO to OFF/CLOSED																													
21	0	1	1	x					0		1	Non	OFF	AUTO	AUTO		0	0	0	1	n	0	n	Note 1	0	0	n	0		Note 21
22	0	1	1	x								Non	OFF	OFF			0	0	0	1	n	0	n	1	0	0	n	0		Note 22
23	0	1	1	x								Non	OFF		OFF		0	0	0	1	n	0	n	1	0	0	n	0		Note 23
24	0	1	1	x					0		1	Non	OFF	AUTO	AUTO		0	0	0	1	1	0	n	Note 1	0	0	n	0	57H	Note 24
25	0	1	1	x								Non	OFF	OFF			0	0	0	1	1	0	n	1	0	0	n	0	57H	Note 25
26	0	1	1	x								Non	OFF		OFF		0	0	0	1	1	0	n	1	0	0	n	0	57H	Note 26
	OFF/CLOSED Position																													
27	0	0	1	x					0		1		OFF	AUTO	AUTO		0	1	0	0	n	0	n	Note 1	0	0	n	0		Note 27
28	0	0	1	x									OFF	OFF			0	1	0	0	n	0	n	1	0	0	n	0		Note 28
29	0	0	1	x									OFF		OFF		0	1	0	0	n	0	n	1	0	0	n	0		Note 29
	OFF/CLOSED to Normal / AUTO For any appliance, release of OFF/CLOSED position or dependency block for OFF/CLOSED automation will cause appliance to go straight to the Normal/AUTO position (no transition status).																													
30	0	1	1	x				0	0	0	1		OFF	AUTO	AUTO		0	0	0	1	n	0	n	Note 1	0	0	n	0		Note 30
31	0	1	1	x									OFF	OFF			0	0	0	1	n	0	n	1	0	0	n	0		Note 31
32	0	1	1	x									OFF		OFF		0	0	0	1	n	0	n	1	0	0	n	0		Note 32
33	0	1	1	x				0	0	0	1		OFF	AUTO	AUTO		0	0	0	1	1	0	n	Note 1	0	0	n	0	57H	Note 33
34	0	1	1	x									OFF	OFF			0	0	0	1	1	0	n	1	0	0	n	0	57H	Note 34
35	0	1	1	x									OFF		OFF		0	0	0	1	1	0	n	1	0	0	n	0	57H	Note 35

Table A.15 OFF Control, ON & OFF Monitoring Use Types

TYPES	Configured Sources: SLC Points: ON Con	ON Mon	OFF Con	OFF Mon	TRBL Mon	AC Fail	Service Disconnect Mon	Logic Eq: ON Auto-Block	OFF Auto-Block	ON Auto	OFF Auto	Config: Dedicated/Non-dedicated	Default ON/OFF	Oper: Man Cntrl ON/AUTO/OFF	Cmd Zone ON/AUTO/OFF	ActQ: First-In/Last-In	Subaddress States (Result): 1 ON	2 OFF	3 Trans ON	4 Trans OFF	5 TRBL	6 Norm	7 AC Fail	8 Lockout	9 Pend ON	10 Pend OFF	11 Service Disconnect	12 Trans Norm	Trouble Code	Notes
	OFF/CLOSED to ON/OPEN																													
36	1	0	0	x				0	0	1	0		OFF	AUTO	AUTO		0	0	1	0	n	0	n	Note 1	0	0	n	0		Note 36
37	1	0	0	x									OFF	ON			0	0	1	0	n	0	n	1	0	0	n	0		Note 37
38	1	0	0	x									OFF		ON		0	0	1	0	n	0	n	1	0	0	n	0		Note 38
39	1	0	0	x				0	0	1	0		OFF	AUTO	AUTO		0	0	1	0	1	0	n	Note 1	0	0	n	0	57H	Note 39
40	1	0	0	x									OFF	ON			0	0	1	0	1	0	n	1	0	0	n	0	57H	Note 40
41	1	0	0	x									OFF		ON		0	0	1	0	1	0	n	1	0	0	n	0	57H	Note 41
	DEFAULT ON Normal State / AUTO Position																													
42	0	0	0	x								Ded	ON	AUTO	AUTO		0	0	0	0	1	0	n	Note 1	0	0	n	0	5CH	Note 42
43	0	0	0	x								Non	ON	AUTO	AUTO		0	0	0	0	n	1	n	Note 1	0	0	n	0		Note 43
44	0	1	0	x									ON	AUTO	AUTO		0	0	0	0	n	1	n	Note 1	0	0	n	0		Note 44
45	0	0	0	x				1		1		Non	ON	AUTO	AUTO		0	0	0	0	n	1	n	Note 1	1	0	n	0		Note 45
46	0	1	0	x				1		1			ON	AUTO	AUTO		0	0	0	0	n	1	n	Note 1	1	0	n	0		Note 46
47	0	0	0	x					1		1	Non	ON	AUTO	AUTO		0	0	0	0	n	1	n	Note 1	0	1	n	0		Note 47
48	0	1	0	x					1		1		ON	AUTO	AUTO		0	0	0	0	n	1	n	Note 1	0	1	n	0		Note 48
	Normal / AUTO to ON/OPEN																													
49	1	0	0	x				0		1		Non	ON	AUTO	AUTO		0	0	1	0	n	0	n	Note 1	0	0	n	0		Note 49
50	1	0	0	x								Non	ON	ON			0	0	1	0	n	0	n	1	0	0	n	0		Note 50
51	1	0	0	x								Non	ON		ON		0	0	1	0	n	0	n	1	0	0	n	0		Note 51
52	1	0	0	x				0		1		Non	ON	AUTO	AUTO		0	0	1	0	1	0	n	Note 1	0	0	n	0	56H	Note 52
53	1	0	0	x								Non	ON	ON			0	0	1	0	1	0	n	1	0	0	n	0	56H	Note 53
54	1	0	0	x								Non	ON		ON		0	0	1	0	1	0	n	1	0	0	n	0	56H	Note 54
	ON/OPEN Position																													
55	1	1	0	x				0		1			ON	AUTO	AUTO		1	0	0	0	n	0	n	Note 1	0	0	n	0		Note 55
56	1	1	0	x									ON	ON			1	0	0	0	n	0	n	1	0	0	n	0		Note 56
57	1	1	0	x									ON		ON		1	0	0	0	n	0	n	1	0	0	n	0		Note 57
	ON/OPEN to Normal / AUTO For any appliance, release of ON/OPEN position or dependency block for ON/OPEN automation will cause appliance to go straight to the Normal/AUTO position (no transition status).																													
58	0	1	1	x					0		1		ON	AUTO	AUTO		0	0	0	1	n	0	n	Note 1	0	0	n	0		Note 58
59	0	1	1	X									ON	OFF			0	0	0	1	n	0	n	1	0	0	n	0		Note 59
60	0	1	1	X									ON		OFF		0	0	0	1	n	0	n	1	0	0	n	0		Note 60
61	0	1	1	X					0		1		ON	AUTO	AUTO		0	0	0	1	1	0	n	Note 1	0	0	n	0	57H	Note 61
62	0	1	1	X									ON	OFF			0	0	0	1	1	0	n	1	0	0	n	0	57H	Note 62
63	0	1	1	X									ON		OFF		0	0	0	1	1	0	n	1	0	0	n	0	57H	Note 63
	OFF/CLOSED Position																													
64	0	0	1	X					0		1		ON	AUTO	AUTO		0	1	0	0	n	0	n	Note 1	0	0	n	0		Note 64
65	0	0	1	X									ON	OFF			0	1	0	0	n	0	n	1	0	0	n	0		Note 65
66	0	0	1	X									ON		OFF		0	1	0	0	n	0	n	1	0	0	n	0		Note 66
	OFF/CLOSED to Normal / AUTO																													
67	0	0	0	X								Ded	ON	AUTO	AUTO		0	0	0	0	n	0	n	Note 1	0	0	n	1		Note 67
68	0	0	0	X					1		1	Ded	ON	AUTO	AUTO		0	0	0	0	n	0	n	Note 1	1	0	n	1		Note 68
69	0	0	0	X								Ded	ON	AUTO	AUTO		0	0	0	0	1	0	n	Note 1	0	0	n	1	58H	Note 69
70	0	0	0	X					1		1	Ded	ON	AUTO	AUTO		0	0	0	0	1	0	n	Note 1	1	0	n	1	58H	Note 70

Table A.15 OFF Control, ON & OFF Monitoring Use Types

	Configured Sources																Subaddress States (Result)													
	SLC Points							Logic Eq				Config		Oper		ActQ	1	2	3	4	5	6	7	8	9	10	11	12		
TYPES	ON Con	ON Mon	OFF Con	OFF Mon	TRBL Mon	AC Fail	Service Disconnect Mon	ON Auto-Block	OFF Auto-Block	ON Auto	OFF Auto	Dedicated/Non-dedicated	Default ON/OFF	Man Cntrl ON/AUTO/OFF	Cmd Zone ON/AUTO/OFF	First-In/Last-In	ON	OFF	Trans ON	Trans OFF	TRBL	Norm	AC Fail	Lockout	Pend ON	Pend OFF	Service Disconnect	Trans Norm	Trouble Code	Notes
	ON/OPEN to OFF/CLOSED																													
71	0	1	1	x				0	0	0	1		ON	AUTO	AUTO		0	0	0	1	n	0	n	Note 1	0	0	n	0		Note 71
72	0	1	1	x									ON	OFF			0	0	0	1	n	0	n	1	0	0	n	0		Note 72
73	0	1	1	x									ON		OFF		0	0	0	1	n	0	n	1	0	0	n	0		Note 73
74	0	1	1	x				0	0	0	1		ON	AUTO	AUTO		0	0	0	1	1	0	n	Note 1	0	0	n	0	57H	Note 74
75	0	1	1	x									ON	OFF			0	0	0	1	1	0	n	1	0	0	n	0	57H	Note 75
76	0	1	1	x									ON		OFF		0	0	0	1	1	0	n	1	0	0	n	0	57H	Note 76
	OFF/CLOSED to ON/OPEN																													
77	1	0	0	x				0	0	1	0		ON	AUTO	AUTO		0	0	1	0	n	0	n	Note 1	0	0	n	0		Note 77
78	1	0	0	x									ON	ON			0	0	1	0	n	0	n	1	0	0	n	0		Note 78
79	1	0	0	x									ON		ON		0	0	1	0	n	0	n	1	0	0	n	0		Note 79
80	1	0	0	x				0	0	1	0		ON	AUTO	AUTO		0	0	1	0	1	0	n	Note 1	0	0	n	0	56H	Note 80
81	1	0	0	x									ON	ON			0	0	1	0	1	0	n	1	0	0	n	0	56H	Note 81
82	1	0	0	x									ON		ON		0	0	1	0	1	0	n	1	0	0	n	0	56H	Note 82
	Activation Queuing (only applies to annunciators with same priority																													
	First-In																													
83	1*	0	1	x										1on 2off		First-In	0	0	1	0	n	0	n	1	0	0	n	0		Note 83
84	1*	0	1	x											1on 2off	First-In	0	0	1	0	n	0	n	1	0	0	n	0		Note 84
85	1*	0	1	x										1on 2off		First-In	0	0	1	0	1	0	n	1	0	0	n	0	56H	Note 85
86	1*	0	1	x											1on 2off	First-In	0	0	1	0	1	0	n	1	0	0	n	0	56H	Note 86
87	1	0	1*	x										1off 2on		First-In	0	1	0	0	n	0	n	1	0	0	n	0		Note 87
88	1	0	1*	x											1off 2on	First-In	0	1	0	0	n	0	n	1	0	0	n	0		Note 88
89	1*	1	1	x										1on 2off		First-In	1	0	0	0	n	0	n	1	0	0	n	0		Note 89
90	1*	1	1	x											1on 2off	First-In	1	0	0	0	n	0	n	1	0	0	n	0		Note 90
	Last-In																													
91	1*	0	1	x										1on 2off		Last-In	0	0	0	0	n	0	n	1	0	0	n	0		Note 91
92	1*	0	1	x											1on 2off	Last-In	0	0	0	0	n	0	n	1	0	0	n	0		Note 92
93	1	0	1*	x										1off 2on		Last-In	0	0	1	0	n	0	n	1	0	0	n	0		Note 93
94	1	0	1*	x											1off 2on	Last-In	0	0	1	0	n	0	n	1	0	0	n	0		Note 94
95	1	0	1*	x										1off 2on		Last-In	0	0	1	0	1	0	n	1	0	0	n	0	56H	Note 95
96	1	0	1*	x											1off 2on	Last-In	0	0	1	0	1	0	n	1	0	0	n	0	56H	Note 96
97	1*	1	1	x										1on 2off		Last-In	0	1	0	0	n	0	n	1	0	0	n	0		Note 97
98	1*	1	1	x											1on 2off	Last-In	0	1	0	0	n	0	n	1	0	0	n	0		Note 98
99	1	1	1*	x										1off 2on		Last-In	1	0	0	0	n	0	n	1	0	0	n	0		Note 99

Table A.15 OFF Control, ON & OFF Monitoring Use Types

	Configured Sources																Subaddress States (Result)													
	SLC Points							Logic Eq				Config		Oper		ActQ	1	2	3	4	5	6	7	8	9	10	11	12		
TYPES	ON Con	ON Mon	OFF Con	OFF Mon	TRBL Mon	AC Fail	Service Disconnect Mon	ON Auto-Block	OFF Auto-Block	ON Auto	OFF Auto	Dedicated/Non-dedicated	Default ON/OFF	Man Cntrl ON/AUTO/OFF	Cmd Zone ON/AUTO/OFF	First-In/Last-In	ON	OFF	Trans ON	Trans OFF	TRBL	Norm	AC Fail	Lockout	Pend ON	Pend OFF	Service Disconnect	Trans Norm	Trouble Code	Notes
100	1	1	1*	x											1off 2on	Last-In	1	0	0	0	n	0	n	1	0	0	n	0		Note 100
	CONFLICTING OPERATION																													
101	1	y	1	x						1	1			AUTO	AUTO		1	1	0	0	1	0	n	0	0	0	n	0	50H	Note 101

Table A.15 Notes

1on: Command from 1st annunciator: ON
2off: Command from 2nd annunciator: OFF

1off: Command from 1st annunciator: OFF
2on: Command from 2nd annunciator: ON

1. Lockout is evaluated by controls not indicated in the table.
2. (Trouble for dedicated appliances in the AUTO position)
   Feedback shows ON/OPEN but ON/OPEN transition timer never started,
   OR No Activations - feedback in the wrong state.
3. (Normal for non-dedicated appliances)
   Feedback shows ON/OPEN but ON/OPEN transition timer never started,
   OR No Activations.
4. Automation activation to ON/OPEN has been blocked by a dependency (pending state).
   No automatic trouble - a virtual point can be used to create a trouble if expected.
5. Automation activation to ON/OPEN has been blocked by a dependency (pending state).
   No automatic trouble - a virtual point can be used to create a trouble if expected.
6. Automation activation to OFF/CLOSED has been blocked by a dependency (pending state).
   No automatic trouble - a virtual point can be used to create a trouble if expected.
7. Automation activation to OFF/CLOSED has been blocked by a dependency (pending state).
   No automatic trouble - a virtual point can be used to create a trouble if expected.
8. Transition state of Normal/AUTO to ON/OPEN via automation activation.
   Transition ON/OPEN timer running.
9. Transition state of Normal/AUTO to ON/OPEN via manual control.
   Transition ON/OPEN timer running.
10. Transition state of Normal/AUTO to ON/OPEN via commanding zone activation.
    Transition ON/OPEN timer running.
11. ON/OPEN timer expired during the transition state of Normal/AUTO to ON/OPEN via automation activation.
    Transition ON/OPEN sub-address will still be active during trouble.
12. ON/OPEN timer expired during the transition state of Normal/AUTO to ON/OPEN via manual control.
    Transition ON/OPEN sub-address will still be active during trouble.
13. ON/OPEN timer expired during the transition state of Normal/AUTO to ON/OPEN via commanding zone activation.
    Transition ON/OPEN sub-address will still be active during trouble.
14. Possible via automation activation to ON/OPEN with no dependency block.
15. Possible via manual control to ON/OPEN.
16. Possible via commanding zone activation to ON/OPEN.
17. Transition state of ON/OPEN to Normal/AUTO.
    Transition Normal timer running.

18. Automation activation to ON/OPEN has been blocked by a dependency (pending state).
    Transition state of ON/OPEN to Normal/AUTO caused by dependency block.
    Transition Normal timer running.
    No automatic trouble - a virtual point can be used to create a trouble if expected.
19. Normal timer expired during the transition state of ON/OPEN to Normal/AUTO.
    Transition Normal sub-address will still be active during trouble.
20. Automation activation to ON/OPEN has been blocked by a dependency (pending state).
    Normal timer expired during the transition state of ON/OPEN to Normal/AUTO caused by dependency block.
    Transition Normal sub-address will still be active during trouble.
21. Transition state of Normal/AUTO to OFF/CLOSED via automation activation.
    Transition OFF/CLOSED timer running.
22. Transition state of Normal/AUTO to OFF/CLOSED via manual control.
    Transition OFF/CLOSED timer running.
23. Transition state of Normal/AUTO to OFF/CLOSED via commanding zone activation.
    Transition OFF/CLOSED timer running.
24. OFF/CLOSED timer expired during the transition state of Normal/AUTO to OFF/CLOSED via automation activation.
    Transition OFF/CLOSED sub-address will still be active during trouble
25. OFF/CLOSED timer expired during the transition state of Normal/AUTO to OFF/CLOSED via manual control.
    Transition OFF/CLOSED sub-address will still be active during trouble.
26. OFF/CLOSED timer expired during the transition state of Normal/AUTO to OFF/CLOSED via commanding zone activation.
    Transition OFF/CLOSED sub-address will still be active during trouble.
27. Possible via automation activation to OFF/CLOSED with no dependency block.
28. Possible via manual control to OFF/CLOSED.
29. Possible via commanding zone activation to OFF/CLOSED.
30. Transition state of ON/OPEN to OFF/CLOSED via automation activation.
    Transition OFF/CLOSED timer running.
31. Transition state of ON/OPEN to OFF/CLOSED via manual control.
    Transition OFF/CLOSED timer running.
32. Transition state of ON/OPEN to OFF/CLOSED via commanding zone activation.
    Transition OFF/CLOSED timer running.
33. OFF/CLOSED timer expired during the transition state of ON/OPEN to OFF/CLOSED via automation activation.
    Transition OFF/CLOSED sub-address will still be active during trouble.
34. OFF/CLOSED timer expired during the transition state of ON/OPEN to OFF/CLOSED via manual control.
    Transition OFF/CLOSED sub-address will still be active during trouble.
35. OFF/CLOSED timer expired during the transition state of ON/OPEN to OFF/CLOSED via commanding zone activation.
    Transition OFF/CLOSED sub-address will still be active during trouble.
36. Transition state of OFF/CLOSED to ON/OPEN via automation activation.
    Transition ON/OPEN timer running.
37. Transition state of OFF/CLOSED to ON/OPEN via manual control.
    Transition ON/OPEN timer running.
38. Transition state of OFF/CLOSED to ON/OPEN via commanding zone activation.
    Transition ON/OPEN timer running.
39. ON/OPEN timer expired during the transition state of OFF/CLOSED to ON/OPEN via automation activation.
    Transition ON/OPEN sub-address will still be active during trouble.
40. ON/OPEN timer expired during the transition state of OFF/CLOSED to ON/OPEN via manual control.
    Transition ON/OPEN sub-address will still be active during trouble.
41. ON/OPEN timer expired during the transition state of OFF/CLOSED to ON/OPEN via commanding zone activation.
    Transition ON/OPEN sub-address will still be active during trouble.
42. For dedicated appliances that are default ON/OPEN, Monitor ON feedback should be active.
    Normal/No Activation.
43. For non-dedicated appliances that are default ON/OPEN, it is fine if the Monitor module is not active.
44. Normal/No Activations

45. Automation activation to ON/OPEN has been blocked by a dependency (pending state).
    No automatic trouble - a virtual point can be used to create a trouble if expected.
46. Automation activation to ON/OPEN has been blocked by a dependency (pending state).
    No automatic trouble - a virtual point can be used to create a trouble if expected.
47. Automation activation to OFF/CLOSED has been blocked by a dependency (pending state).
    No automatic trouble - a virtual point can be used to create a trouble if expected
48. Automation activation to OFF/CLOSED has been blocked by a dependency (pending state).
    No automatic trouble - a virtual point can be used to create a trouble if expected.
49. Transition state of Normal/AUTO to ON/OPEN via automation activation.
    Transition ON/OPEN timer running.
50. Transition state of Normal/AUTO to ON/OPEN via manual control.
    Transition ON/OPEN timer running.
51. Transition state of Normal/AUTO to ON/OPEN via commanding zone activation.
    Transition ON/OPEN timer running.
52. ON/OPEN timer expired during the transition state of Normal/AUTO to ON/OPEN via automation activation.
    Transition ON/OPEN sub-address will still be active during trouble.
53. ON/OPEN timer expired during the transition state of Normal/AUTO to ON/OPEN via manual control.
    Transition ON/OPEN sub-address will still be active during trouble.
54. ON/OPEN timer expired during the transition state of Normal/AUTO to ON/OPEN via commanding zone activation.
    Transition ON/OPEN sub-address will still be active during trouble.
55. Possible via automation activation to ON/OPEN with no dependency block.
56. Possible via manual control to ON/OPEN.
57. Possible via commanding zone activation to ON/OPEN.
58. Transition state of Normal/AUTO to OFF/CLOSED via automation activation.
    Transition OFF/CLOSED timer running.
59. Transition state of Normal/AUTO to OFF/CLOSED via manual control.
    Transition OFF/CLOSED timer running.
60. Transition state of Normal/AUTO to OFF/CLOSED via commanding zone activation.
    Transition OFF/CLOSED timer running.
61. OFF/CLOSED timer expired during the transition state of Normal/AUTO to OFF/CLOSED via automation activation.
    Transition OFF/CLOSED sub-address will still be active during trouble.
62. OFF/CLOSED timer expired during the transition state of Normal/AUTO to OFF/CLOSED via manual control.
    Transition OFF/CLOSED sub-address will still be active during trouble.
63. OFF/CLOSED timer expired during the transition state of Normal/AUTO to OFF/CLOSED via commanding zone activation.
    Transition OFF/CLOSED sub-address will still be active during trouble.
64. Possible via automation activation to OFF/CLOSED with no dependency block.
65. Possible via manual control to OFF/CLOSED.
66. Possible via commanding zone activation to OFF/CLOSED.
67. Transition state of OFF/CLOSED to Normal/AUTO.
    Transition Normal timer running.
68. Automation activation to OFF/CLOSED has been blocked by a dependency (pending state).
    Transition state of OFF/CLOSED to Normal/AUTO caused by dependency block.
    Transition Normal timer running.
    No automatic trouble - a virtual point can be used to create a trouble if expected.
69. Normal timer expired during the transition state of OFF/CLOSED to Normal/AUTO.
    Transition Normal sub-address will still be active during trouble.
70. Automation activation to OFF/CLOSED has been blocked by a dependency (pending state).
    Normal timer expired during the transition state of OFF/CLOSED to Normal/AUTO caused by dependency block.
    Transition Normal sub-address will still be active during trouble.
71. Transition state of ON/OPEN to OFF/CLOSED via automation activation.
    Transition OFF/CLOSED timer running.
72. Transition state of ON/OPEN to OFF/CLOSED via manual control.
    Transition OFF/CLOSED timer running.

73. Transition state of ON/OPEN to OFF/CLOSED via commanding zone activation.
    Transition OFF/CLOSED timer running.
74. OFF/CLOSED timer expired during the transition state of ON/OPEN to OFF/CLOSED via automation activation.
    Transition OFF/CLOSED sub-address will still be active during trouble.
75. OFF/CLOSED timer expired during the transition state of ON/OPEN to OFF/CLOSED via manual control.
    Transition OFF/CLOSED sub-address will still be active during trouble.
76. OFF/CLOSED timer expired during the transition state of ON/OPEN to OFF/CLOSED via commanding zone activation.
    Transition OFF/CLOSED sub-address will still be active during trouble.
77. Transition state of OFF/CLOSED to ON/OPEN via automation activation.
    Transition ON/OPEN timer running.
78. Transition state of OFF/CLOSED to ON/OPEN via manual control.
    Transition ON/OPEN timer running.
79. Transition state of OFF/CLOSED to ON/OPEN via commanding zone activation.
    Transition ON/OPEN timer running.
80. ON/OPEN timer expired during the transition state of OFF/CLOSED to ON/OPEN via automation activation.
    Transition ON/OPEN sub-address will still be active during trouble.
81. ON/OPEN timer expired during the transition state of OFF/CLOSED to ON/OPEN via manual control.
    Transition ON/OPEN sub-address will still be active during trouble.
82. ON/OPEN timer expired during the transition state of OFF/CLOSED to ON/OPEN via commanding zone activation.
    Transition ON/OPEN sub-address will still be active during trouble.
83. First-In: ON Control
    Transition state to ON/OPEN via manual control from 1st annunciator.
    OFF/CLOSED via manual control from 2nd annunciator in queue.
84. First-In: ON Control
    Transition state to ON/OPEN via commanding zone activation from 1st annunciator.
    OFF/CLOSED via commanding zone activation from 2nd annunciator in queue.
85. First-In: ON Control
    ON/OPEN timer expired during the transition state to ON/OPEN via manual control from 1st annunciator
    OFF/CLOSED via manual control from 2nd annunciator in queue.
86. First-In: ON Control
    ON/OPEN timer expired during the transition state to ON/OPEN via commanding zone activation from 1st annunciator
    OFF/CLOSED via commanding zone activation from 2nd annunciator in queue.
87. First-In: OFF Control
    Possible via manual control from 1st annunciator to OFF/CLOSED.
    Transition state to ON/OPEN via manual control from 2nd annunciator in queue.
88. First-In: OFF Control
    Possible via commanding zone activation from 1st annunciator to OFF/CLOSED.
    Transition state to ON/OPEN via commanding zone activation from 2nd annunciator in queue.
89. First-In: ON Control
    Possible via manual control from 1st annunciator to ON/OPEN.
    OFF/CLOSED via manual control from 2nd annunciator in queue.
90. First-In: ON Control
    Possible via commanding zone activation from 1st annunciator to ON/OPEN.
    OFF/CLOSED via commanding zone activation from 2nd annunciator in queue.
91. Last-In: OFF Control
    Possible via manual control from the 2nd annunciator to OFF/CLOSED when activated after the 1st annunciator's command.
    Transition state to ON/OPEN via manual control from the 1st annunciator put into queue if it is still activated.
92. Last-In: OFF Control
    Possible via commanding zone activation from the 2nd annunciator to OFF/CLOSED when activated after the 1st annunciator's command.
    Transition state to ON/OPEN via commanding zone activation from the 1st annunciator put into queue if it is still activated.

93. Last-In: ON Control
    Transition state to ON/OPEN via manual control from the 2nd annunciator when activated after the 1st annunciator's command.
    OFF/CLOSED via manual control from the 1st annunciator put into queue if it is still activated.
94. Last-In: ON Control
    Transition state to ON/OPEN via commanding zone activation from the 2nd annunciator when activated after the 1st annunciator's command.
    OFF/CLOSED via commanding zone activation from the 1st annunciator put into queue if it is still activated.
95. Last-In: ON Control
    ON/OPEN timer expired during the transition state to ON/OPEN via manual control from the 2nd annunciator when activated after the 1st annunciator's command.
    OFF/CLOSED via manual control from the 1st annunciator put into queue if it is still activated.
96. Last-In: ON Control
    ON/OPEN timer expired during the transition state to ON/OPEN via commanding zone activation from the 2nd annunciator when activated after the 1st annunciator's command.
    OFF/CLOSED via commanding zone activation from the 1st annunciator put into queue if it is still activated.
97. Last-In: OFF Control
    Possible via manual control from the 2nd annunciator to OFF/CLOSED when activated after the 1st annunciator's command.
    ON/OPEN via manual control from the 1st annunciator put into queue if it is still activated.
98. Last-In: OFF Control
    Possible via commanding zone activation from the 2nd annunciator to OFF/CLOSED when activated after the 1st annunciator's command.
    ON/OPEN via commanding zone activation from the 1st annunciator put into queue if it is still activated.
99. Last-In: ON Control.
    Possible via manual control from the 2nd annunciator to ON/OPEN when activated after the 1st annunciator's command.
    OFF/CLOSED via manual control from the 1st annunciator put into queue if it is still activated.
100. Last-In: ON Control.
    Possible via commanding zone activation from the 2nd annunciator to ON/OPEN when activated after the 1st annunciator's command.
    OFF/CLOSED via commanding zone activation from the 1st annunciator put into queue if it is still activated.
101. Automation logic evaluates true for both ON and OFF automation actions, resulting in a conflicting operation.

Table A.16 ON & OFF Control, OFF Monitoring Use Types

	Configured Sources																Subaddress States (Result)													
	SLC Points							Logic Eq				Config		Oper		ActQ	1	2	3	4	5	6	7	8	9	10	11	12		
TYPES	ON Con	ON Mon	OFF Con	OFF Mon	TRBL Mon	AC Fail	Service Disconnect Mon	ON Auto-Block	OFF Auto-Block	ON Auto	OFF Auto	Dedicated/Non-dedicated	Default ON/OFF	Man Cntrl ON/AUTO/OFF	Cmd Zone ON/AUTO/OFF	First-In/Last-In	ON	OFF	Trans ON	Trans OFF	TRBL	Norm	AC Fail	Lockout	Pend ON	Pend OFF	Service Disconnect	Trans Norm	Trouble Code	Notes
	DEFAULT OFF Normal State / AUTO Position																													
1	0	x	0	0								Ded	OFF	AUTO	AUTO		0	0	0	0	1	0	n	Note 1	0	0	n	0	5CH	Note 2
2	0	x	0	0								Non	OFF	AUTO	AUTO		0	0	0	0	n	1	n	Note 1	0	0	n	0		Note 3
3	0	x	0	1									OFF	AUTO	AUTO		0	0	0	0	n	1	n	Note 1	0	0	n	0		Normal/No Activ.
4	0	x	0	0				1		1		Non	OFF	AUTO	AUTO		0	0	0	0	n	1	n	Note 1	1	0	n	0		Note 4
5	0	x	0	1				1		1			OFF	AUTO	AUTO		0	0	0	0	n	1	n	Note 1	1	0	n	0		Note 5
6	0	x	0	0					1		1	Non	OFF	AUTO	AUTO		0	0	0	0	n	1	n	Note 1	0	1	n	0		Note 6
7	0	x	0	1					1		1		OFF	AUTO	AUTO		0	0	0	0	n	1	n	Note 1	0	1	n	0		Note 7
	Nornal / AUTO to ON/OPEN																													
8	1	x	0	1				0		1			OFF	AUTO	AUTO		0	0	1	0	n	0	n	Note 1	0	0	n	0		Note 8
9	1	x	0	1									OFF	ON			0	0	1	0	n	0	n	1	0	0	n	0		Note 9
10	1	x	0	1									OFF		ON		0	0	1	0	n	0	n	1	0	0	n	0		Note 10
11	1	x	0	1				0		1			OFF	AUTO	AUTO		0	0	1	0	1	0	n	Note 1	0	0	n	0	56H	Note 11
12	1	x	0	1									OFF	ON			0	0	1	0	1	0	n	1	0	0	n	0	56H	Note 12
13	1	x	0	1									OFF		ON		0	0	1	0	1	0	n	1	0	0	n	0	56H	Note 13
	ON/OPEN Position																													
14	1	x	0	0				0		1			OFF	AUTO	AUTO		1	0	0	0	n	0	n	Note 1	0	0	n	0		Note 14
15	1	x	0	0									OFF	ON			1	0	0	0	n	0	n	1	0	0	n	0		Note 15
16	1	x	0	0									OFF		ON		1	0	0	0	n	0	n	1	0	0	n	0		Note 16
	ON/OPEN to Normal / AUTO																													
17	0	x	0	0								Ded	OFF	AUTO	AUTO		0	0	0	0	n	0	n	Note 1	0	0	n	1		Note 17
18	0	x	0	0				1		1		Ded	OFF	AUTO	AUTO		0	0	0	0	n	0	n	Note 1	1	0	n	1		Note 18
19	0	x	0	0								Ded	OFF	AUTO	AUTO		0	0	0	0	1	0	n	Note 1	0	0	n	1	58H	Note 19
20	0	x	0	0				1		1		Ded	OFF	AUTO	AUTO		0	0	0	0	1	0	n	Note 1	1	0	n	1	58H	Note 20
	Normal / AUTO to OFF/CLOSED																													
21	0	x	1	0					0		1	Non	OFF	AUTO	AUTO		0	0	0	1	n	0	n	Note 1	0	0	n	0		Note 21
22	0	x	1	0								Non	OFF	OFF			0	0	0	1	n	0	n	1	0	0	n	0		Note 22
23	0	x	1	0								Non	OFF		OFF		0	0	0	1	n	0	n	1	0	0	n	0		Note 23
24	0	x	1	0					0		1	Non	OFF	AUTO	AUTO		0	0	0	1	1	0	n	Note 1	0	0	n	0	57H	Note 24
25	0	x	1	0								Non	OFF	OFF			0	0	0	1	1	0	n	1	0	0	n	0	57H	Note 25
26	0	x	1	0								Non	OFF		OFF		0	0	0	1	1	0	n	1	0	0	n	0	57H	Note 26
	OFF/CLOSED Position																													
27	0	x	1	1					0		1		OFF	AUTO	AUTO		0	1	0	0	n	0	n	Note 1	0	0	n	0		Note 27
28	0	x	1	1									OFF	OFF			0	1	0	0	n	0	n	1	0	0	n	0		Note 28
29	0	x	1	1									OFF		OFF		0	1	0	0	n	0	n	1	0	0	n	0		Note 29
	OFF/CLOSED to ON/OPEN For any appliance, release of OFF/CLOSED position or a dependency block for OFF/CLOSED automation will cause application to go straight to Normal/AUTO position (no transition states.)																													
	OFF/CLOSED to ON/OPEN																													
30	1	x	0	1				0	0	1	0		OFF	AUTO	AUTO		0	0	1	0	n	0	n	Note 1	0	0	n	0		Note 30
31	1	x	0	1									OFF	ON			0	0	1	0	n	0	n	1	0	0	n	0		Note 31
32	1	x	0	1									OFF		ON		0	0	1	0	n	0	n	1	0	0	n	0		Note 32
33	1	x	0	1				0	0	1	0		OFF	AUTO	AUTO		0	0	1	0	1	0	n	Note 1	0	0	n	0	56H	Note 33
34	1	x	0	1									OFF	ON			0	0	1	0	1	0	n	1	0	0	n	0	56H	Note 34
35	1	x	0	1									OFF		ON		0	0	1	0	1	0	n	1	0	0	n	0	56H	Note 35

Table A.16 ON & OFF Control, OFF Monitoring Use Types

	Configured Sources																Subaddress States (Result)													
	SLC Points							Logic Eq				Config		Oper		ActQ	1	2	3	4	5	6	7	8	9	10	11	12		
TYPES	ON Con	ON Mon	OFF Con	OFF Mon	TRBL Mon	AC Fail	Service Disconnect Mon	ON Auto-Block	OFF Auto-Block	ON Auto	OFF Auto	Dedicated/Non-dedicated	Default ON/OFF	Man Cntrl ON/AUTO/OFF	Cmd Zone ON/AUTO/OFF	First-In/Last-In	ON	OFF	Trans ON	Trans OFF	TRBL	Norm	AC Fail	Lockout	Pend ON	Pend OFF	Service Disconnect	Trans Norm	Trouble Code	Notes
	ON/OPEN to OFF/CLOSED																													
36	0	x	1	0				0	0	0	1		OFF	AUTO	AUTO		0	0	0	1	n	0	n	Note 1	0	0	n	0		Note 36
37	0	x	1	0									OFF	OFF			0	0	0	1	n	0	n	1	0	0	n	0		Note 37
38	0	x	1	0									OFF		OFF		0	0	0	1	1	0	n	1	0	0	n	0		Note 38
39	0	x	1	0				0	0	0	1		OFF	AUTO	AUTO		0	0	0	1	1	0	n	Note 1	0	0	n	0	57H	Note 39
40	0	x	1	0									OFF	OFF			0	0	0	1	1	0	n	1	0	0	n	0	57H	Note 40
41	0	x	1	0									OFF		OFF		0	0	0	1	1	0	n	1	0	0	n	0	57H	Note 41
	DEFAULT ON Normal State / AUTO Position																													
42	0	x	0	0									ON	AUTO	AUTO		0	0	0	0	n	1	n	Note 1	0	0	n	0	5CH	Note 42
43	0	x	0	1								Ded	ON	AUTO	AUTO		0	0	0	0	1	0	n	Note 1	0	0	n	0		Note 43
44	0	x	0	1								Non	ON	AUTO	AUTO		0	0	0	0	n	1	n	Note 1	0	0	n	0		Note 44
45	0	x	0	0				1		1			ON	AUTO	AUTO		0	0	0	0	n	1	n	Note 1	1	0	n	0		Note 45
46	0	x	0	1				1		1		Non	ON	AUTO	AUTO		0	0	0	0	n	1	n	Note 1	1	0	n	0		Note 46
47	0	x	0	0					1		1		ON	AUTO	AUTO		0	0	0	0	n	1	n	Note 1	0	1	n	0		Note 47
48	0	x	0	1					1		1	Non	ON	AUTO	AUTO		0	0	0	0	n	1	n	Note 1	0	1	n	0		Note 48
	Normal / AUTO to ON/OPEN																													
49	1	x	0	1				0		1		Non	ON	AUTO	AUTO		0	0	1	0	n	0	n	Note 1	0	0	n	0		Note 49
50	1	x	0	1								Non	ON	ON			0	0	1	0	n	0	n	1	0	0	n	0		Note 50
51	1	x	0	1								Non	ON		ON		0	0	1	0	n	0	n	1	0	0	n	0		Note 51
52	1	x	0	1				0		1		Non	ON	AUTO	AUTO		0	0	1	0	1	0	n	Note 1	0	0	n	0	56H	Note 52
53	1	x	0	1								Non	ON	ON			0	0	1	0	1	0	n	1	0	0	n	0	56H	Note 53
54	1	x	0	1								Non	ON		ON		0	0	1	0	1	0	n	1	0	0	n	0	56H	Note 54
	ON/OPEN Position																													
55	1	x	0	0				0		1			ON	AUTO	AUTO		1	0	0	0	n	0	n	Note 1	0	0	n	0		Note 55
56	1	x	0	0									ON	ON			1	0	0	0	n	0	n	1	0	0	n	0		Note 56
57	1	x	0	0									ON		ON		1	0	0	0	n	0	n	1	0	0	n	0		Note 57
	ON/OPEN to Normal / AUTO																													
58	0	x	1	0					0		1		ON	AUTO	AUTO		0	0	0	1	n	0	n	Note 1	0	0	n	0		Note 58
59	0	x	1	0									ON	OFF			0	0	0	1	n	0	n	1	0	0	n	0		Note 59
60	0	x	1	0									ON		OFF		0	0	0	1	n	0	n	1	0	0	n	0		Note 60
61	0	x	1	0					0		1		ON	AUTO	AUTO		0	0	0	1	1	0	n	Note 1	0	0	n	0	57H	Note 61
62	0	x	1	0									ON	OFF			0	0	0	1	1	0	n	1	0	0	n	0	57H	Note 62
63	0	x	1	0									ON		OFF		0	0	0	1	1	0	n	1	0	0	n	0	57H	Note 63
	OFF/CLOSED Position																													
64	0	x	1	1					0		1		ON	AUTO	AUTO		0	1	0	0	n	0	n	Note 1	0	0	n	0		Note 64
65	0	x	1	1									ON	OFF			0	1	0	0	n	0	n	1	0	0	n	0		Note 65
66	0	x	1	1									ON		OFF		0	1	0	0	n	0	n	1	0	0	n	0		Note 66
	OFF/CLOSED to Normal / AUTO																													
67	0	x	0	0								Ded	ON	AUTO	AUTO		0	0	0	0	n	0	n	Note 1	0	0	n	1		Note 67
68	0	x	0	0					1		1	Ded	ON	AUTO	AUTO		0	0	0	0	n	0	n	Note 1	1	0	n	1		Note 68
69	0	x	0	0								Ded	ON	AUTO	AUTO		0	0	0	0	1	0	n	Note 1	0	0	n	1	58H	Note 69
70	0	x	0	0					1		1	Ded	ON	AUTO	AUTO		0	0	0	0	1	0	n	Note 1	1	0	n	1	58H	Note 70
	OFF/CLOSED to ON/OPEN																													
71	1	x	0	1				0	0	1	0		ON	AUTO	AUTO		0	0	1	0	n	0	n	Note 1	0	0	n	0		Note 71
72	1	x	0	1									ON	ON			0	0	1	0	n	0	n	1	0	0	n	0		Note 72

Table A.16 ON & OFF Control, OFF Monitoring Use Types

	Configured Sources																Subaddress States (Result)													
	SLC Points							Logic Eq				Config		Oper		ActQ	1	2	3	4	5	6	7	8	9	10	11	12		
TYPES	ON Con	ON Mon	OFF Con	OFF Mon	TRBL Mon	AC Fail	Service Disconnect Mon	ON Auto-Block	OFF Auto-Block	ON Auto	OFF Auto	Dedicated/Non-dedicated	Default ON/OFF	Man Cntrl ON/AUTO/OFF	Cmd Zone ON/AUTO/OFF	First-In/Last-In	ON	OFF	Trans ON	Trans OFF	TRBL	Norm	AC Fail	Lockout	Pend ON	Pend OFF	Service Disconnect	Trans Norm	Trouble Code	Notes
	OFF/CLOSED to ON/OPEN - continued																													
73	1	x	0	1									ON		ON		0	0	1	0	n	0	n	1	0	0	n	0		Note 73
74	1	x	0	1				0	0	1	0		ON	AUTO	AUTO		0	0	1	0	1	0	n	Note 1	0	0	n	0	56H	Note 74
75	1	x	0	1									ON	ON			0	0	1	0	1	0	n	1	0	0	n	0	56H	Note 75
76	1	x	0	1									ON		ON		0	0	1	0	1	0	n	1	0	0	n	0	56H	Note 76
	ON/OPEN to OFF/CLOSED																													
77	0	x	1	0				0	0	0	1		ON	AUTO	AUTO		0	0	0	1	n	0	n	Note 1	0	0	n	0		Note 77
78	0	x	1	0									ON	OFF			0	0	0	1	n	0	n	1	0	0	n	0		Note 78
79	0	x	1	0									ON		OFF		0	0	0	1	n	0	n	1	0	0	n	0		Note 79
80	0	x	1	0				0	0	0	1		ON	AUTO	AUTO		0	0	0	1	1	0	n	Note 1	0	0	n	0	57H	Note 80
81	0	x	1	0									ON	OFF			0	0	0	1	1	0	n	1	0	0	n	0	57H	Note 81
82	0	x	1	0									ON		OFF		0	0	0	1	1	0	n	1	0	0	n	0	57H	Note 82
	Activation Queuing (only to annunciators with same priority) First-In																													
83	1*	x	1	0										1on 2off		First-In	1	0	0	0	n	0	n	1	0	0	n	0		Note 83
84	1*	x	1	0											1on 2off	First-In	1	0	0	0	n	0	n	1	0	0	n	0		Note 84
85	1	x	1*	0										1off 2on		First-In	0	0	0	1	n	0	n	1	0	0	n	0		Note 85
86	1	x	1*	0											1off 2on	First-In	0	0	0	1	n	0	n	1	0	0	n	0		Note 86
87	1	x	1*	0										1off 2on		First-In	0	0	0	1	1	0	n	1	0	0	n	0	57H	Note 87
88	1	x	1*	0											1off 2on	First-In	0	0	0	1	1	0	n	1	0	0	n	0	57H	Note 88
89	1	x	1*	1										1off 2on		First-In	0	1	0	0	n	0	n	1	0	0	n	0		Note 89
90	1	x	1*	1											1off 2on	First-In	0	1	0	0	n	0	n	1	0	0	n	0		Note 90
	Last-In																													
91	1*	x	1	0										1on 2off		Last-In	0	0	0	1	n	0	n	1	0	0	n	0		Note 91
92	1*	x	1	0											1on 2off	Last-In	0	0	0	1	n	0	n	1	0	0	n	0		Note 92
93	1*	x	1	0										1on 2off		Last-In	0	0	0	1	1	0	n	1	0	0	n	0	57H	Note 93
94	1*	x	1	0											1on 2off	Last-In	0	0	0	1	1	0	n	1	0	0	n	0	57H	Note 94
95	1	x	1*	0										1off 2on		Last-In	1	0	0	0	1	0	n	1	0	0	n	0		Note 95
96	1	x	1*	0											1off 2on	Last-In	1	0	0	0	1	0	n	1	0	0	n	0		Note 96
97	1*	x	1	1										1on 2off		Last-In	0	1	0	0	n	0	n	1	0	0	n	0		Note 97
98	1*	x	1	1											1on 2off	Last-In	0	1	0	0	n	0	n	1	0	0	n	0		Note 98
99	1	x	1*	1										1off 2on		Last-In	1	0	0	0	n	0	n	1	0	0	n	0		Note 99
100	1	x	1*	1											1off 2on	Last-In	1	0	0	0	n	0	n	1	0	0	n	0		Note 100

Table A.16 ON & OFF Control, OFF Monitoring Use Types

TYPES	Configured Sources															Subaddress States (Result)													
	SLC Points							Logic Eq				Config		Oper		ActQ	1	2	3	4	5	6	7	8	9	10	11	12		
	ON Con	ON Mon	OFF Con	OFF Mon	TRBL Mon	AC Fail	Service Disconnect Mon	ON Auto-Block	OFF Auto-Block	ON Auto	OFF Auto	Dedicated/Non-dedicated	Default ON/OFF	Man Cntrl ON/AUTO/OFF	Cmd Zone ON/AUTO/OFF	First-In/Last-In	ON	OFF	Trans ON	Trans OFF	TRBL	Norm	AC Fail	Lockout	Pend ON	Pend OFF	Service Disconnect	Trans Norm	Trouble Code	Notes
	Conflicting Operation																													
101	1	x	1	y						1	1			AUTO	AUTO		1	1	0	0	1	0	n	0	0	0	n	0	50H	Note 101

Table A.16 Notes

1on: Command from 1st annunciator: ON
2off: Command from 2nd annunciator: OFF

1off: Command from 1st annunciator: OFF
2on: Command from 2nd annunciator: ON

1. Lockout is evaluated by controls not indicated in the table.
2. For dedicated appliances that are default OFF/CLOSED, Monitor OFF feedback should be active.
3. Normal/No Activations
   For non-dedicated appliances that are default OFF/CLOSED, it is fine if the Monitor module is not active.
4. Automation activation to ON/OPEN has been blocked by a dependency (pending state).
   No automatic trouble - a virtual point can be used to create a trouble if expected.
5. Automation activation to ON/OPEN has been blocked by a dependency (pending state).
   No automatic trouble - a virtual point can be used to create a trouble if expected.
6. Automation activation to OFF/CLOSED has been blocked by a dependency (pending state).
   No automatic trouble - a virtual point can be used to create a trouble if expected.
7. Automation activation to OFF/CLOSED has been blocked by a dependency (pending state).
   No automatic trouble - a virtual point can be used to create a trouble if expected.
8. Transition state of Normal/AUTO to ON/OPEN via automation activation.
   Transition ON/OPEN timer running.
9. Transition state of Normal/AUTO to ON/OPEN via manual control.
   Transition ON/OPEN timer running.
10. Transition state of Normal/AUTO to ON/OPEN via commanding zone activation.
    Transition ON/OPEN timer running.
11. ON/OPEN timer expired during the transition state of Normal/AUTO to ON/OPEN via automation activation.
    Transition ON/OPEN sub-address will still be active during trouble.
12. ON/OPEN timer expired during the transition state of Normal/AUTO to ON/OPEN via manual control.
    Transition ON/OPEN sub-address will still be active during trouble.
13. ON/OPEN timer expired during the transition state of Normal/AUTO to ON/OPEN via commanding zone activation.
    Transition ON/OPEN sub-address will still be active during trouble.
14. Possible via automation activation to ON/OPEN with no dependency block.
15. Possible via manual control to ON/OPEN.
16. Possible via commanding zone activation to ON/OPEN.
17. Transition state of ON/OPEN to Normal/AUTO.
    Transition Normal timer running.
18. Automation activation to ON/OPEN has been blocked by a dependency (pending state).
    Transition state of ON/OPEN to Normal/AUTO caused by dependency block.
    Transition Normal timer running.
    No automatic trouble - a virtual point can be used to create a trouble if expected.
19. Normal timer expired during the transition state of ON/OPEN to Normal/AUTO.
    Transition Normal sub-address will still be active during trouble.

20. Automation activation to ON/OPEN has been blocked by a dependency (pending state).
    Normal timer expired during the transition state of ON/OPEN to Normal/AUTO caused by dependency block.
    Transition Normal sub-address will still be active during trouble.
21. Transition state of Normal/AUTO to OFF/CLOSED via automation activation.
    Transition OFF/CLOSED timer running.
22. Transition state of Normal/AUTO to OFF/CLOSED via manual control.
    Transition OFF/CLOSED timer running.
23. Transition state of Normal/AUTO to OFF/CLOSED via commanding zone activation.
    Transition OFF/CLOSED timer running.
24. OFF/CLOSED timer expired during the transition state of Normal/AUTO to OFF/CLOSED via automation activation.
    Transition OFF/CLOSED sub-address will still be active during trouble.
25. OFF/CLOSED timer expired during the transition state of Normal/AUTO to OFF/CLOSED via manual control.
    Transition OFF/CLOSED sub-address will still be active during trouble.
26. OFF/CLOSED timer expired during the transition state of Normal/AUTO to OFF/CLOSED via commanding zone activation.
    Transition OFF/CLOSED sub-address will still be active during trouble.
27. Possible via automation activation to OFF/CLOSED with no dependency block.
28. Possible via manual control to OFF/CLOSED.
29. Possible via commanding zone activation to OFF/CLOSED.
30. Transition state of OFF/CLOSED to ON/OPEN via automation activation.
    Transition ON/OPEN timer running.
31. Transition state of OFF/CLOSED to ON/OPEN via manual control.
    Transition ON/OPEN timer running.
32. Transition state of OFF/CLOSED to ON/OPEN via commanding zone activation.
    Transition ON/OPEN timer running.
33. ON/OPEN timer expired during the transition state of OFF/CLOSED to ON/OPEN via automation activation.
    Transition ON/OPEN sub-address will still be active during trouble.
34. ON/OPEN timer expired during the transition state of OFF/CLOSED to ON/OPEN via manual control.
    Transition ON/OPEN sub-address will still be active during trouble.
35. ON/OPEN timer expired during the transition state of OFF/CLOSED to ON/OPEN via commanding zone activation.
    Transition ON/OPEN sub-address will still be active during trouble.
36. Transition state of OFF/CLOSED to ON/OPEN via automation activation.
    Transition ON/OPEN timer running.
37. Transition state of OFF/CLOSED to ON/OPEN via manual control.
    Transition ON/OPEN timer running.
38. Transition state of OFF/CLOSED to ON/OPEN via commanding zone activation.
    Transition ON/OPEN timer running.
39. ON/OPEN timer expired during the transition state of OFF/CLOSED to ON/OPEN via automation activation.
    Transition ON/OPEN sub-address will still be active during trouble.
40. ON/OPEN timer expired during the transition state of OFF/CLOSED to ON/OPEN via manual control.
    Transition ON/OPEN sub-address will still be active during trouble.
41. ON/OPEN timer expired during the transition state of OFF/CLOSED to ON/OPEN via commanding zone activation.
    Transition ON/OPEN sub-address will still be active during trouble,
42. Normal/No Activations
43. (Trouble for dedicated appliances in the AUTO position)
    Feedback shows ON/OPEN but ON/OPEN transition timer never started,
    OR No Activations - feedback in the wrong state.
44. (Normal for non-dedicated appliances)
    Feedback shows ON/OPEN but ON/OPEN transition timer never started,
    OR No Activations.
45. Automation activation to ON/OPEN has been blocked by a dependency (pending state).
    No automatic trouble - a virtual point can be used to create a trouble if expected.
46. Automation activation to ON/OPEN has been blocked by a dependency (pending state).
    No automatic trouble - a virtual point can be used to create a trouble if expected.

47. Automation activation to OFF/CLOSED has been blocked by a dependency (pending state).
    No automatic trouble - a virtual point can be used to create a trouble if expected.
48. Automation activation to OFF/CLOSED has been blocked by a dependency (pending state).
    No automatic trouble - a virtual point can be used to create a trouble if expected.
49. Transition state of Normal/AUTO to ON/OPEN via automation activation.
    Transition ON/OPEN timer running.
50. Transition state of Normal/AUTO to ON/OPEN via manual control
    Transition ON/OPEN timer running.
51. Transition state of Normal/AUTO to ON/OPEN via commanding zone activation.
    Transition ON/OPEN timer running.
52. ON/OPEN timer expired during the transition state of Normal/AUTO to ON/OPEN via automation activation.
    Transition ON/OPEN sub-address will still be active during trouble.
53. ON/OPEN timer expired during the transition state of Normal/AUTO to ON/OPEN via manual control.
    Transition ON/OPEN sub-address will still be active during trouble.
54. ON/OPEN timer expired during the transition state of Normal/AUTO to ON/OPEN via commanding zone activation.
    Transition ON/OPEN sub-address will still be active during trouble.
55. Possible via automation activation to ON/OPEN with no dependency block.
56. Possible via manual control to ON/OPEN.
57. Possible via commanding zone activation to ON/OPEN.
58. Transition state of Normal/AUTO to OFF/CLOSED via automation activation.
    Transition OFF/CLOSED timer running.
59. Transition state of Normal/AUTO to OFF/CLOSED via manual control.
    Transition OFF/CLOSED timer running.
60. Transition state of Normal/AUTO to OFF/CLOSED via commanding zone activation.
    Transition OFF/CLOSED timer running.
61. OFF/CLOSED timer expired during the transition state of Normal/AUTO to OFF/CLOSED via automation activation.
    Transition OFF/CLOSED sub-address will still be active during trouble.
62. OFF/CLOSED timer expired during the transition state of Normal/AUTO to OFF/CLOSED via manual control.
    Transition OFF/CLOSED sub-address will still be active during trouble.
63. OFF/CLOSED timer expired during the transition state of Normal/AUTO to OFF/CLOSED via commanding zone activation.
    Transition OFF/CLOSED sub-address will still be active during trouble.
64. Possible via automation activation to OFF/CLOSED with no dependency block.
65. Possible via manual control to OFF/CLOSED.
66. Possible via commanding zone activation to OFF/CLOSED.
67. Transition state of OFF/CLOSED to Normal/AUTO.
    Transition Normal timer running.
68. Automation activation to OFF/CLOSED has been blocked by a dependency (pending state).
    Transition state of OFF/CLOSED to Normal/AUTO caused by dependency block.
    Transition Normal timer running.
    No automatic trouble - a virtual point can be used to create a trouble if expected.
69. Normal timer expired during the transition state of OFF/CLOSED to Normal/AUTO.
    Transition Normal sub-address will still be active during trouble.
70. Automation activation to OFF/CLOSED has been blocked by a dependency (pending state).
    Normal timer expired during the transition state of OFF/CLOSED to Normal/AUTO caused by dependency block.
    Transition Normal sub-address will still be active during trouble.
71. Transition state of OFF/CLOSED to ON/OPEN via automation activation.
    Transition ON/OPEN timer running.
72. Transition state of OFF/CLOSED to ON/OPEN via manual control.
    Transition ON/OPEN timer running.
73. Transition state of OFF/CLOSED to ON/OPEN via commanding zone activation.
    Transition ON/OPEN timer running
74. ON/OPEN timer expired during the transition state of OFF/CLOSED to ON/OPEN via automation activation.
    Transition ON/OPEN sub-address will still be active during trouble.

75. ON/OPEN timer expired during the transition state of OFF/CLOSED to ON/OPEN via manual control.
    Transition ON/OPEN sub-address will still be active during trouble.
76. ON/OPEN timer expired during the transition state of OFF/CLOSED to ON/OPEN via commanding zone activation.
    Transition ON/OPEN sub-address will still be active during trouble.
77. Transition state of OFF/CLOSED to ON/OPEN via automation activation.
    Transition ON/OPEN timer running.
78. Transition state of OFF/CLOSED to ON/OPEN via manual control.
    Transition ON/OPEN timer running.
79. Transition state of OFF/CLOSED to ON/OPEN via commanding zone activation.
    Transition ON/OPEN timer running.
80. ON/OPEN timer expired during the transition state of OFF/CLOSED to ON/OPEN via automation activation.
    Transition ON/OPEN sub-address will still be active during trouble.
81. ON/OPEN timer expired during the transition state of OFF/CLOSED to ON/OPEN via manual control.
    Transition ON/OPEN sub-address will still be active during trouble.
82. ON/OPEN timer expired during the transition state of OFF/CLOSED to ON/OPEN via commanding zone activation.
    Transition ON/OPEN sub-address will still be active during trouble.
83. First-In: ON Control
    Possible via manual control from 1st annunciator to ON/OPEN.
    Transition state to OFF/CLOSED via manual control from 2nd annunciator in queue.
84. First-In: ON Control
    Possible via commanding zone activation from 1st annunciator to ON/OPEN.
    Transition state to OFF/CLOSED via commanding zone activation from 2nd annunciator in queue.
85. First-In: OFF Control
    Transition state to OFF/CLOSED via manual control from 1st annunciator.
    ON/OPEN via manual control from 2nd annunciator in queue.
86. First-In: OFF Control
    Transition state to OFF/CLOSED via commanding zone activation from 1st annunciator.
    ON/OPEN via commanding zone activation from 2nd annunciator in queue"
87. First-In: OFF Control
    OFF/CLOSED timer expired during the transition state to OFF/CLOSED via commanding zone activation from 1st annunciator.
    ON/OPEN via commanding zone activation from 2nd annunciator in queue.
88. First-In: OFF Control
    OFF/CLOSED timer expired during the transition state to OFF/CLOSED via manual control from 1st annunciator.
    ON/OPEN via manual control from 2nd annunciator in queue.
89. First-In: OFF Control
    Possible via manual control from 1st annunciator to OFF/CLOSED.
    ON/OPEN via manual control from 2nd annunciator in queue.
90. First-In: OFF Control
    Possible via commanding zone activation from 1st annunciator to OFF/CLOSED.
    ON/OPEN via commanding zone activation from 2nd annunciator in queue.
91. Last-In: OFF Control
    Transition state to OFF/CLOSED via manual control from the 2nd annunciator when activated after the 1st annunciator's command.
    ON/OPEN via manual control from the 1st annunciator put into queue if it is still activated.
92. Last-In: OFF Control
    Transition state to OFF/CLOSED via commanding zone activation from the 2nd annunciator when activated after the 1st annunciator's command.
    ON/OPEN via commanding zone activation from the 1st annunciator put into queue if it is still activated.
93. Last-In: OFF Control
    OFF/CLOSED timer expired during the transition state to OFF/CLOSED via manual control from the 2nd annunciator when activated after the 1st annunciator's command.
    ON/OPEN via manual control from the 1st annunciator put into queue if it is still activated.
94. Last-In: OFF Control
    OFF/CLOSED timer expired during the transition state to OFF/CLOSED via commanding zone activation from the 2nd annunciator when activated after the 1st annunciator's command.
    ON/OPEN via commanding zone activation from the 1st annunciator put into queue if it is still activated.

95. Last-In: ON Control
    Possible via manual control from the 2nd annunciator to ON/OPEN when activated after the 1st annunciator's command.
    Transition state to OFF/CLOSED via manual control from the 1st annunciator put into queue if it is still activated.
96. Last-In: ON Control
    Possible via commanding zone activation from the 2nd annunciator to ON/OPEN when activated after the 1st annunciator's command.
    Transition state to OFF/CLOSED via commanding zone activation from the 1st annunciator put into queue if it is still activated.
97. Last-In: OFF Control
    Possible via manual control from the 2nd annunciator to OFF/CLOSED when activated after the 1st annunciator's command.
    ON/OPEN via manual control from the 1st annunciator put into queue if it is still activated
98. Last-In: OFF Control
    Possible via commanding zone activation from the 2nd annunciator to OFF/CLOSED when activated after the 1st annunciator's command.
    ON/OPEN via commanding zone activation from the 1st annunciator put into queue if it is still activated.
99. Last-In: ON Control
    Possible via manual control from the 2nd annunciator to ON/OPEN when activated after the 1st annunciator's command.
    OFF/CLOSED via manual control from the 1st annunciator put into queue if it is still activated.
100. Last-In: ON Control
    Possible via commanding zone activation from the 2nd annunciator to ON/OPEN when activated after the 1st annunciator's command.
    OFF/CLOSED via commanding zone activation from the 1st annunciator put into queue if it is still activated.
101. Automation logic evaluates true for both ON and OFF automation actions, resulting in a conflicting operation.

Appendix B: Appliance Scenarios & Wiring

B.1 Introduction

This section illustrates how monitor and control modules can be connected to an appliance as required for any dedicated or non-dedicated scenario. Each scenario type is described in general terms, accompanied by an associated wiring diagram. After identifying the scenario that meets the capability and wiring requirements for a specific appliance, refer to the tables in Appendix A for guidance in configuring the appliance for that use and to recognize the resulting subaddress states.

B.1.1 Using the Appliance Scenarios

- Section B.2.1, “Dedicated Fans”, on page 120
- Section B.2.2, “Dedicated Motorized Dampers”, on page 125
- Section B.2.3, “Dedicated EP Dampers”, on page 132
- Section B.3.1, “Non-dedicated Fans”, on page 139
- Section B.3.2, “Non-dedicated Motorized Dampers”, on page 145
- Section B.3.3, “Non-dedicated EP Dampers”, on page 154
- Section B.4.1, “HVAC Fans”, on page 163
- Section B.4.2, “HVAC Motorized Dampers”, on page 174
- Section B.4.3, “HVAC EP Dampers”, on page 189

B.1.2 Module Wiring Diagrams

Wiring diagrams for each case are provided in this section to assist smoke control system design and installation. Table B.1 lists the modules represented in the diagrams and their supported substitutes.

Table B.1 Monitor and Control Module Substitutions

Component	Supported Devices	End-of-Line Resistor Used
Control Module (CM)	AOM-2SF	47K ohms
	MMO-6SF	47K ohms
Monitor Module (MM)	AMM-4F	47K ohms
	AMM-2F	47K ohms
	AMM-2IF	47K ohms
	MMI-10F	47K ohms
	AMM-4SF	3.9K ohms
Relay Module (RM)	AOM-2RF	[none]
	MMO-6RF	[none]
	AMM-2RIF	47K ohms (for MM inputs)
	Note: AMM-2RIF can serve as CM or MM, depending on the application.	

NOTE: *For more detailed module information, refer to the SLC Manual and the instruction sheets that accompany each module.*

B.1.3 Contacts Format

The listed contacts referenced in this section follow the format shown below:

1a	Form A Contacts (normally open contacts)
1b	Form B Contacts (normally closed contacts)

B.1.4 Air Flow Switches

Any air flow switch used in a smoke control system or an HVAC only system will require UL listing for HVAC applications. Air flow verification may be implemented either with an air flow switch or a pressure differential switch.

B.2 Dedicated Smoke Control Appliances

B.2.1 Dedicated Fans

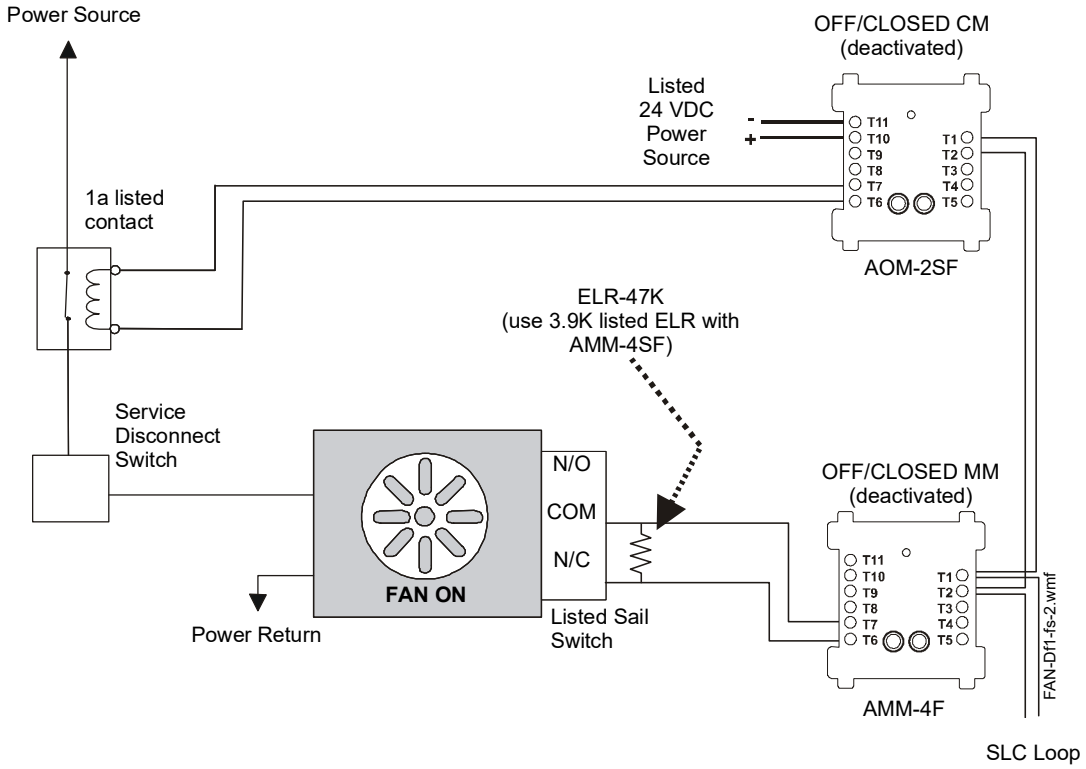


Figure B.1 Dedicated Fan Wiring (Type 1)

Type 1: Fan OFF Control, Fan OFF Monitoring

Figure B.1 shows wiring in a dedicated system that is capable of OFF control of a fan and can monitor the fan's OFF state (Type 1). In this arrangement, the OFF/CLOSED CM is deactivated. The OFF/CLOSED CM controls a normally closed contact which switches power to the fan. (The contact is used when the power being switched is greater than 24 volts.)

When the OFF/CLOSED CM is deactivated, the contact is closed, thus supplying power to the fan. When power is supplied to the fan, the fan is on and the sail switch is open, indicating airflow in the duct.

The OFF/CLOSED MM monitors the closed position of the sail switch, which would indicate when the fan is off. In this case, the OFF/CLOSED MM is deactivated because the fan is on and the sail switch is open.

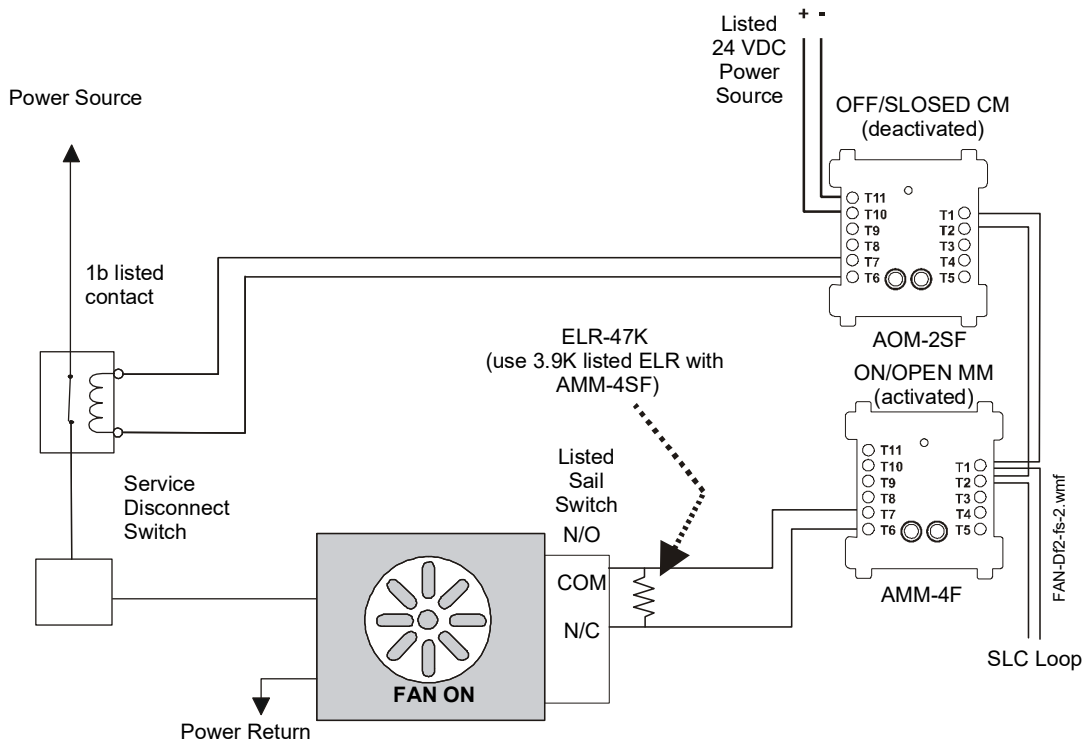


Figure B.2 Dedicated Fan Wiring (Type 2, 3)

Type 2: Fan OFF Control, Fan ON Monitoring

Figure B.2 shows wiring in a dedicated system that is capable of OFF control of a fan and can monitor the fan's ON state (Type 2). In this arrangement, the OFF/CLOSED CM is deactivated. The OFF/CLOSED CM controls a normally closed contact which switches power to the fan. (The contact is used when the power being switched is greater than 24 volts.)

When the OFF/CLOSED CM is deactivated, the contact is closed, thus supplying power to the fan. When power is supplied to the fan, the fan is on and the sail switch is open, indicating airflow in the duct.

The ON/OPEN MM monitors the open position of the sail switch, which would indicate when the fan is on. In this case, the ON/OPEN MM is activated because the fan is on and the sail switch is open.

Type 3: Fan OFF Control, Fan ON and OFF Monitoring

Type 3 represents a fan in a dedicated system that is capable of OFF control of a fan, and can monitor the fan’s ON and OFF states. Since it is possible to determine this information from Type 1 or Type 2, Type 3 would only be necessary for redundancy in verifying the state of the fan. For example, if Type 1 is used instead of Type 3, the OFF state of the fan would be verified when the monitor module is activated, and the ON state of the fan would be verified when the monitor module is deactivated. Types 1 or 2 also saves the use of an additional monitor module. Type 3 would use two monitor modules to provide the same verification as Types 1 or 2.

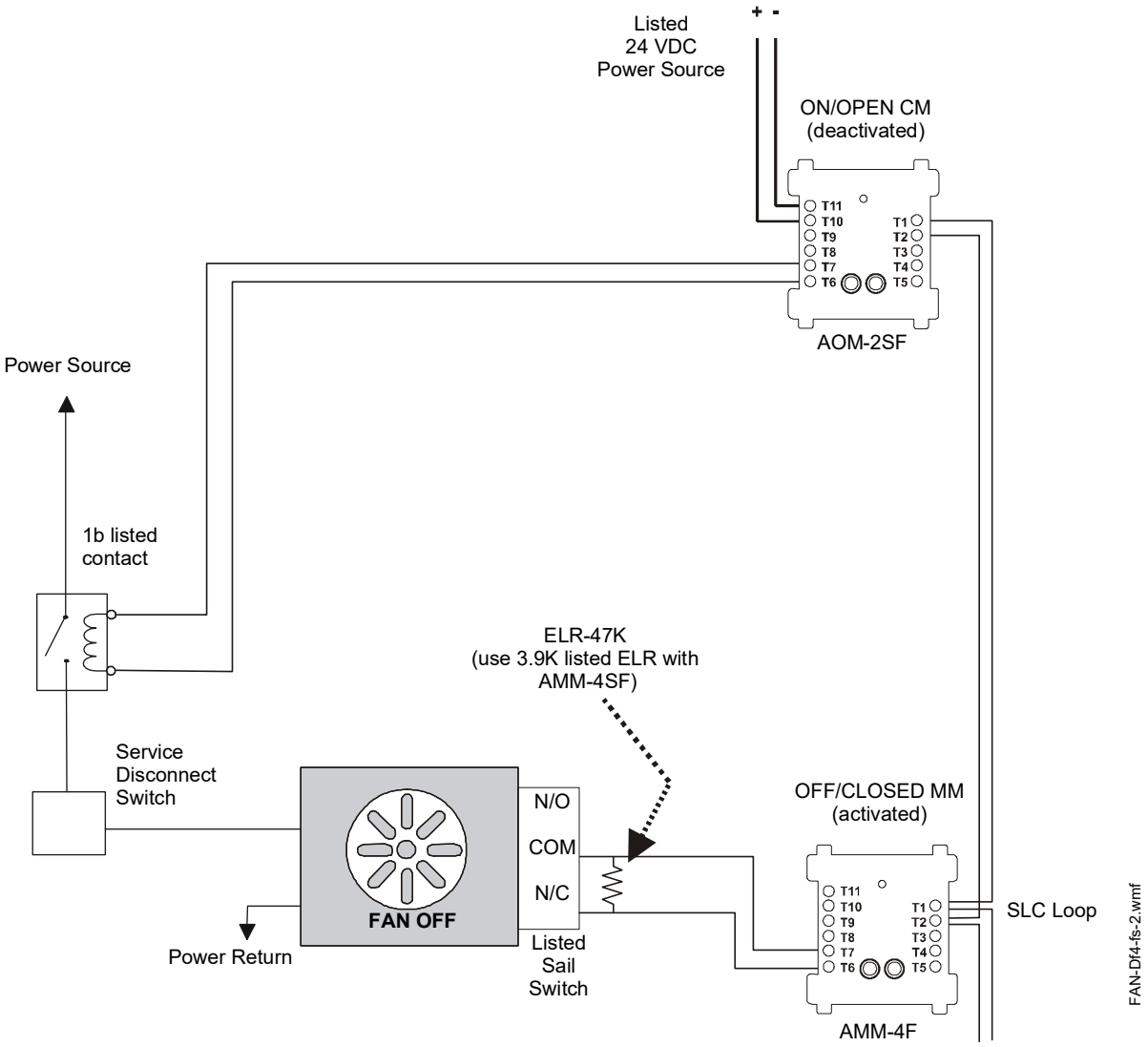


Figure B.3 Dedicated Fan Wiring (Type 4)

Type 4: Fan ON Control, Fan OFF Monitoring

Figure B.3 shows wiring in a dedicated system that is capable of ON control of a fan and can monitor the fan's OFF state (Type 4). In this arrangement, the ON/OPEN CM is deactivated. The ON/OPEN CM controls a normally open contact which switches power to the fan. (The contact is used when the power being switched is greater than 24 volts.)

When the ON/OPEN CM is deactivated, the contact is open, thus cutting power to the fan. When power is cut to the fan, the fan is off and the sail switch is closed, indicating no airflow in the duct.

The OFF/CLOSED MM monitors the closed position of the sail switch, which would indicate when the fan is off. In this case, the OFF/CLOSED MM is activated because the fan is off and the sail switch is closed.

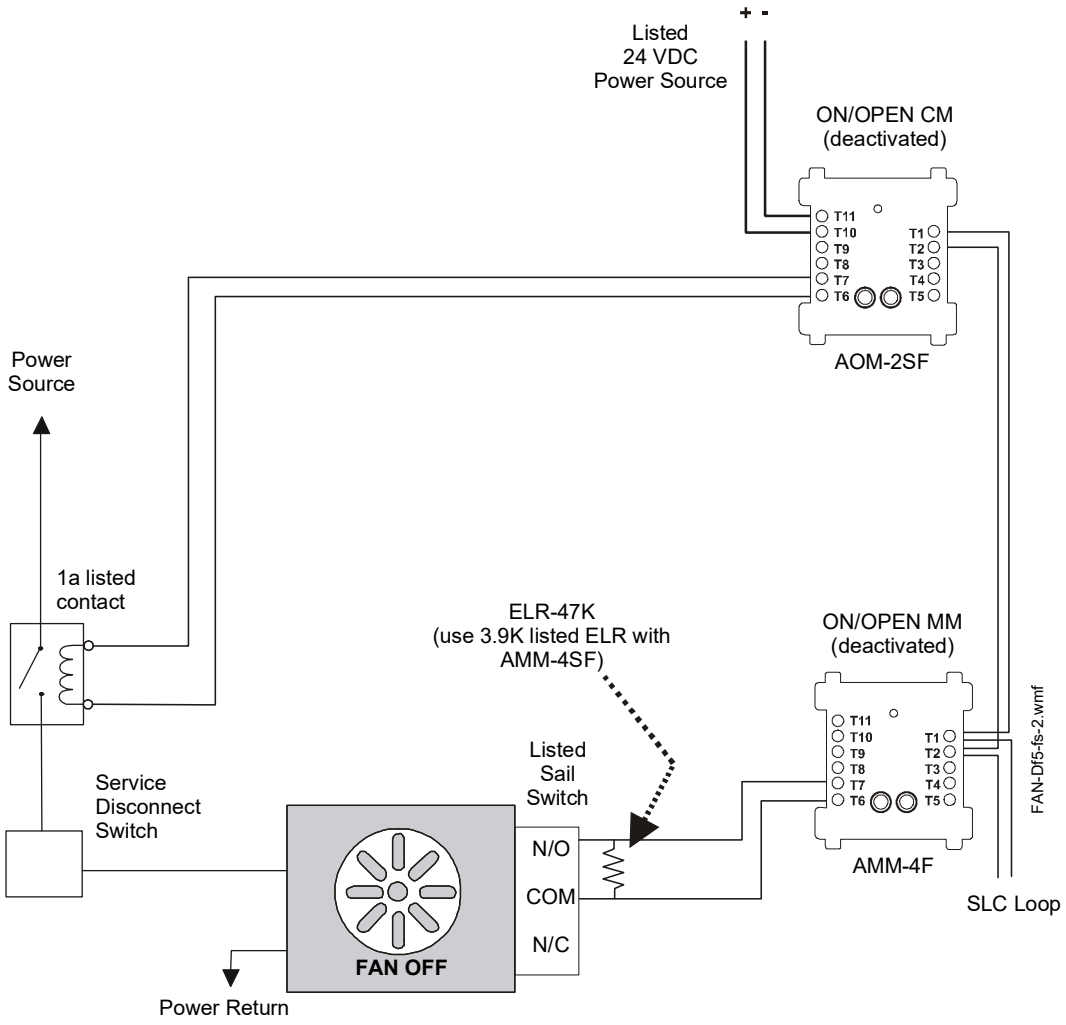


Figure B.4 Dedicated Fan Wiring (Types 5, 6, 7, 8, 9)

Type 5: Fan ON Control, Fan ON Monitoring

Figure B.4 shows wiring in a dedicated system that is capable of ON control of a fan and can monitor the fan's ON state (Type 5). In this arrangement, the ON/OPEN CM is deactivated. The ON/OPEN CM controls a normally open contact which switches power to the fan. (The contact is used when the power being switched is greater than 24 volts.)

When the ON/OPEN CM is deactivated, the contact is open, thus cutting power to the fan. When power is cut to the fan, the fan is off and the sail switch is closed, indicating no airflow in the duct.

The ON/OPEN MM monitors the OPEN position of the sail switch, which would indicate when the fan is on. In this case the ON/OPEN MM is deactivated because the fan is off and the sail switch is closed.

Type 6: Fan ON Control, Fan ON and OFF Monitoring

Type 6 represents a fan in a dedicated system that requires ON control of a fan and can monitor the fan’s ON and OFF states. Since it is possible to determine this information from either Type 4 or Type 5, Type 6 would only be necessary for redundancy in verifying the state of the fan. For example, if Type 4 is used instead of Type 6, the OFF state of the fan would be verified when the monitor module is activated, and the ON state of the fan would be verified when the monitor module is deactivated. Utilizing Types 4 or 5 also saves the use of an additional monitor module. Type 6 would use two monitor modules to provide the same verification as Types 4 or 5.

Type 7: Fan ON and OFF Control, Fan OFF Monitoring

Type 7 represents a fan in a dedicated system that requires ON and OFF control of a fan and can monitor the fan's OFF state. (The use of Type 7 would never be necessary in a dedicated system unless there were a need for redundancy in OFF and ON control.) When the ON/OPEN CM is deactivated, the OFF/CLOSED CM is activated, and vice versa. The ON/OPEN CM controls a normally open contact which switches power to the fan. The OFF/CLOSED CM controls a normally closed contact which switches power to the fan.

When the ON/OPEN CM is deactivated, the contact is open, thus cutting power to the fan. When the ON/OPEN CM is activated, the contact is open, thus cutting power to the fan. Both control modules are not necessary to cut the power to the fan: one is sufficient. When power is cut to the fan, the fan is off and the sail switch is closed, indicating no airflow in the duct.

The ON/OPEN MM monitors the OPEN position of the sail switch, which would indicate when the fan is on. In this case the ON/OPEN MM is deactivated because the fan is off and the sail switch is closed.

Type 8: Fan ON and OFF Control, Fan ON Monitoring

Type 8 represents a fan in a dedicated system that requires ON and OFF control of a fan and can monitor the fan's ON state. (The use of Type 8 would never be necessary in a dedicated system unless there were a need for redundancy in OFF and ON control.) When the ON/OPEN CM is deactivated, the OFF/CLOSED CM is activated, and vice versa. The ON/OPEN CM controls a normally open contact which switches power to the fan. The OFF/CLOSED CM controls a normally closed contact which switches power to the fan.

When the ON/OPEN CM is deactivated, the contact is open, thus cutting power to the fan. When the OFF/CLOSED CM is activated, the contact is open, thus cutting power to the fan. Both control modules are not necessary to cut the power to the fan: one is sufficient. When power is cut to the fan, the fan is off and the sail switch is closed, indicating no airflow in the duct.

The ON/OPEN MM monitors the OPEN position of the sail switch, which would indicate when the fan is on. In this case the ON/OPEN MM is deactivated because the fan is off and the sail switch is closed.

Type 9: Fan ON and OFF Control, Fan ON and OFF Monitoring

Type 9 represents a fan in a dedicated system that requires ON and OFF control of a fan and can monitor the fan's ON and OFF states. (The use of Type 9 would never be necessary in a dedicated system unless there were a need for redundancy in OFF and ON control.) When the ON/OPEN CM is deactivated, the OFF/CLOSED CM is activated, and vice versa. The ON/OPEN CM controls a normally open contact that switches power to the fan. The OFF/CLOSED CM controls a normally closed contact that switches power to the fan.

When the ON/OPEN CM is deactivated, the contact is open, thus cutting power to the fan. When the OFF/CLOSED CM is activated, the contact is open, thus cutting power to the fan. Both control modules are not necessary to cut the power to the fan: one is sufficient. When power is cut to the fan, the fan is off and the sail switch is closed, indicating no airflow in the duct. Since it is possible to determine both ON and OFF verification from Type 7 or Type 8, Type 9 would only be necessary for redundancy in verifying the state of the fan. For example, if Type 7 is used instead of Type 8, the OFF state of the fan would be verified when the monitor module is activated, and the ON state of the fan would be verified when the monitor module is deactivated. Utilizing Types 7 or 8 also saves the use of an additional monitor module. Type 9 would use two monitor modules to provide the same verification as Types 7 or 8.

B.2.2 Dedicated Motorized Dampers

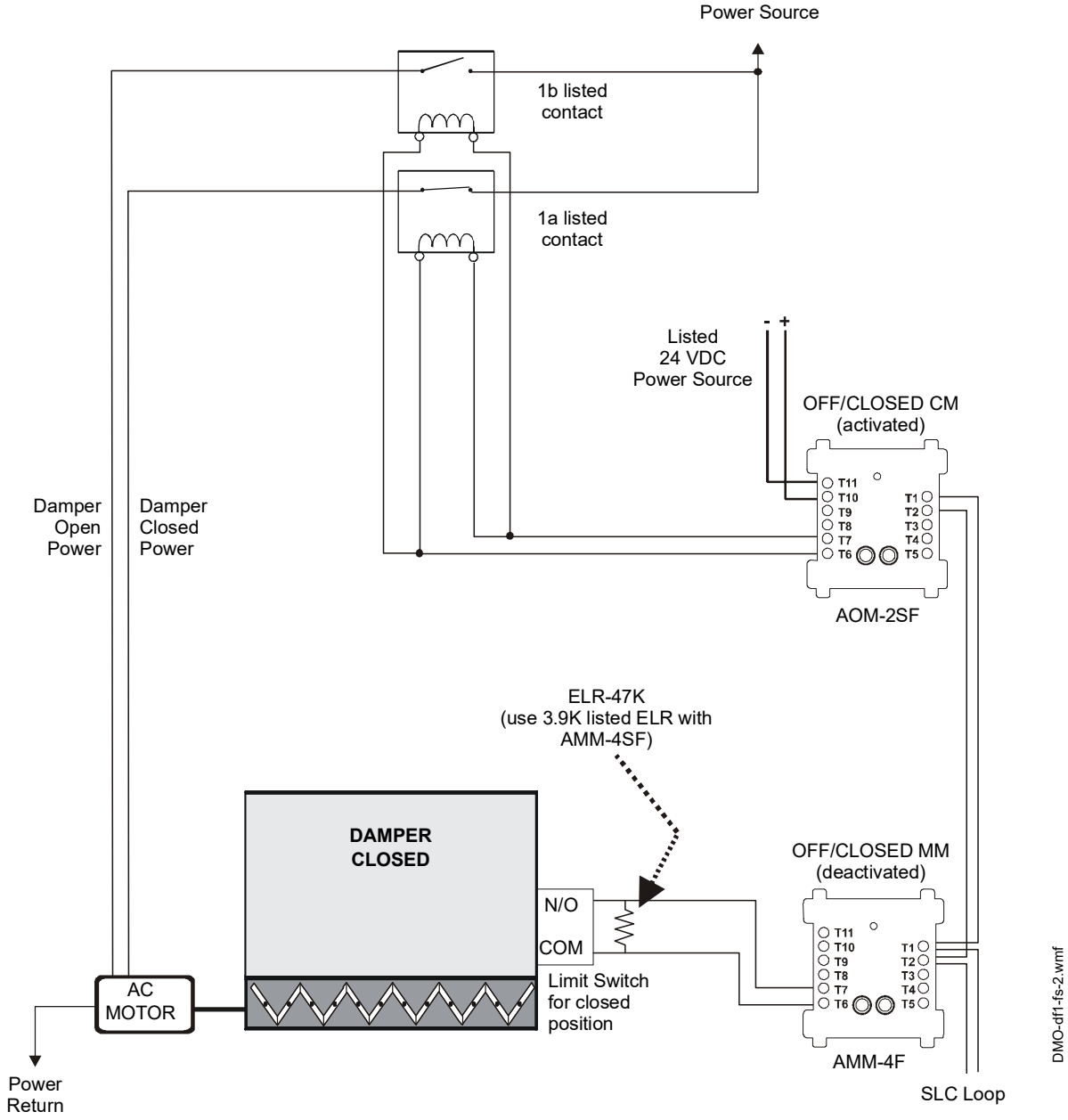


Figure B.5 Dedicated Motorized Damper Wiring (Type 1)

Type 1: Damper CLOSED Control, Damper CLOSED Monitoring

Figure B.5 shows wiring in a dedicated system that is capable of CLOSED control of a motorized damper and can monitor the damper's CLOSED state (Type 1). In this arrangement, the OFF/CLOSED CM is activated. The OFF/CLOSED CM controls a normally closed contact for the damper open power line, and a normally open contact for the damper close power.

When the OFF/CLOSED CM is activated, the normally closed contact is opened and the normally open contact is closed, thus supplying power to close the damper. When the damper completely closes, the damper closed limit switch is closed, indicating that the damper is in the CLOSED position.

The OFF/CLOSED MM monitors the closed position of the damper closed limit switch. With this state, the OFF/CLOSED MM is activated because the damper is closed.

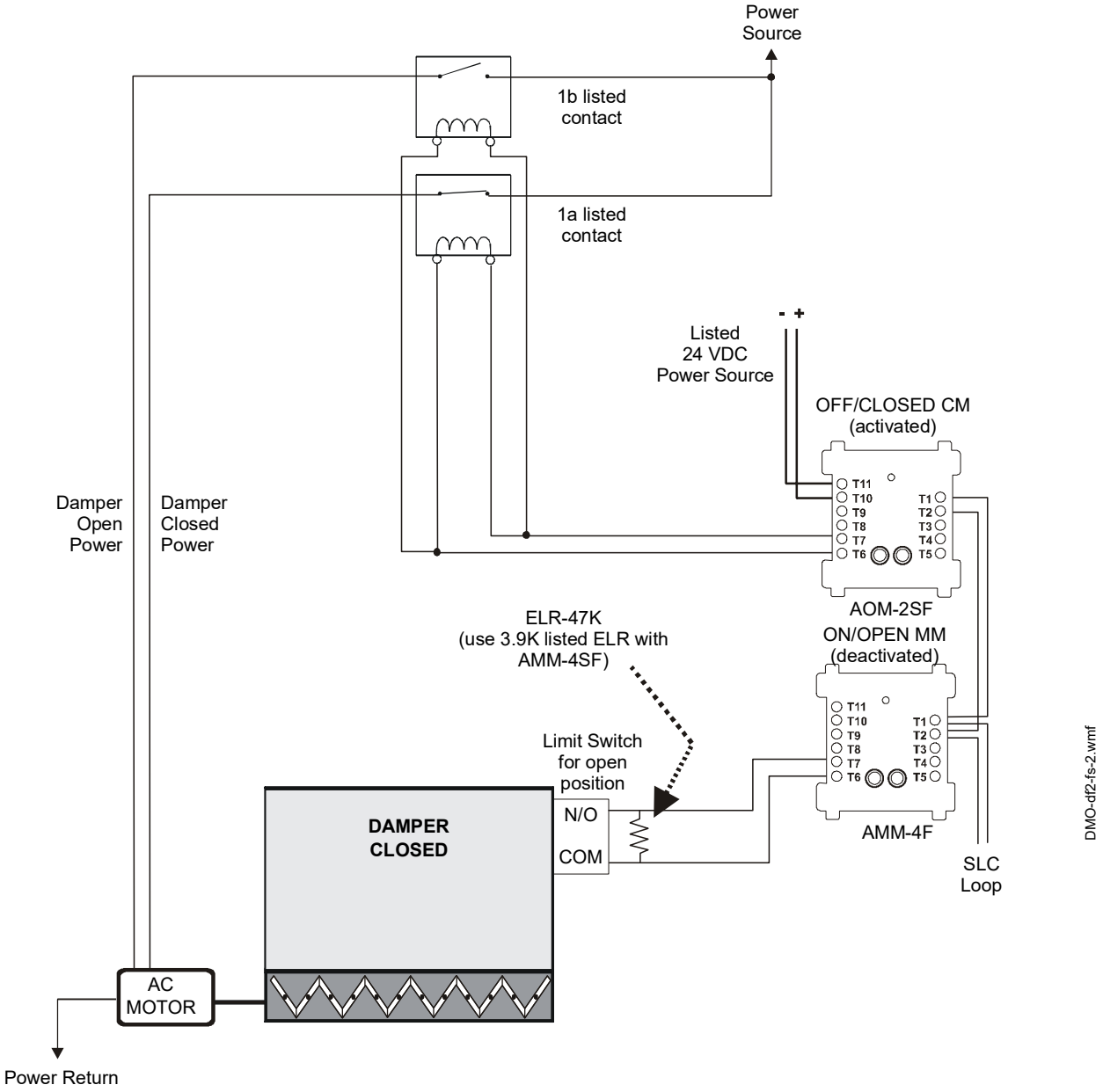


Figure B.6 Dedicated Motorized Damper Wiring (Type 2)

Type 2: Damper CLOSED Control, Damper OPEN Monitoring

Figure B.6 shows wiring in a dedicated system that is capable of CLOSED control of a motorized damper and can monitor the damper's OPEN state (Type 2). In this arrangement, the OFF/CLOSED CM is activated. The OFF/CLOSED CM controls a normally closed contact for the damper open power line, and a normally open contact for the damper close power.

When the OFF/CLOSED CM is activated, the normally closed contact is opened and the normally open contact is closed, thus supplying power to close the damper. When the damper completely closes, the damper closed limit switch is closed, indicating that the damper is in the closed position, and the damper open limit switch is open.

The ON/OPEN MM monitors the closed position of the damper open limit switch. In this case, the ON/OPEN MM is deactivated because the damper is closed.

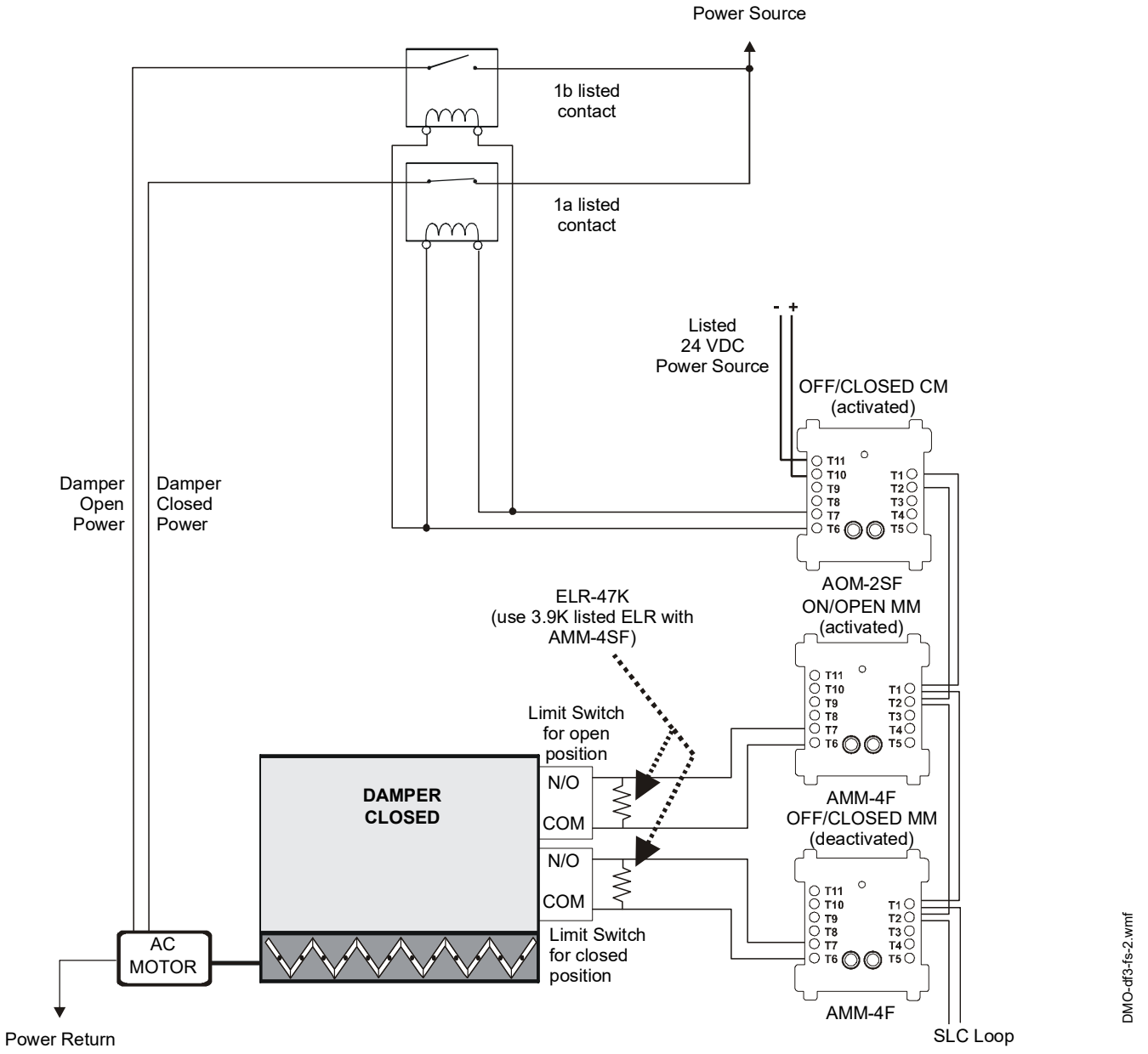


Figure B.7 Dedicated Motorized Damper Wiring (Type 3)

Type 3: Damper CLOSED Control, Damper OPEN and CLOSED Monitoring

Figure B.7 shows wiring in a dedicated system that is capable of CLOSED control of a motorized damper and can monitor the damper's OPEN and CLOSED states (Type 3). In this arrangement, the OFF/CLOSED CM is activated. The OFF/CLOSED CM controls a normally closed contact for the damper open power line, and a normally open contact for the damper close power.

When the OFF/CLOSED CM is activated, the normally closed contact is opened and the normally open contact is closed, thus supplying power to close the damper. When the damper completely closes, the damper closed limit switch is closed, indicating that the damper is in the closed position. (When the damper is in the open position, the damper open limit switch is closed.)

The OFF/CLOSED MM monitors when the damper closed limit switch is closed. In this case, the OFF/CLOSED MM is activated and the ON/OPEN MM is deactivated because the damper is closed.

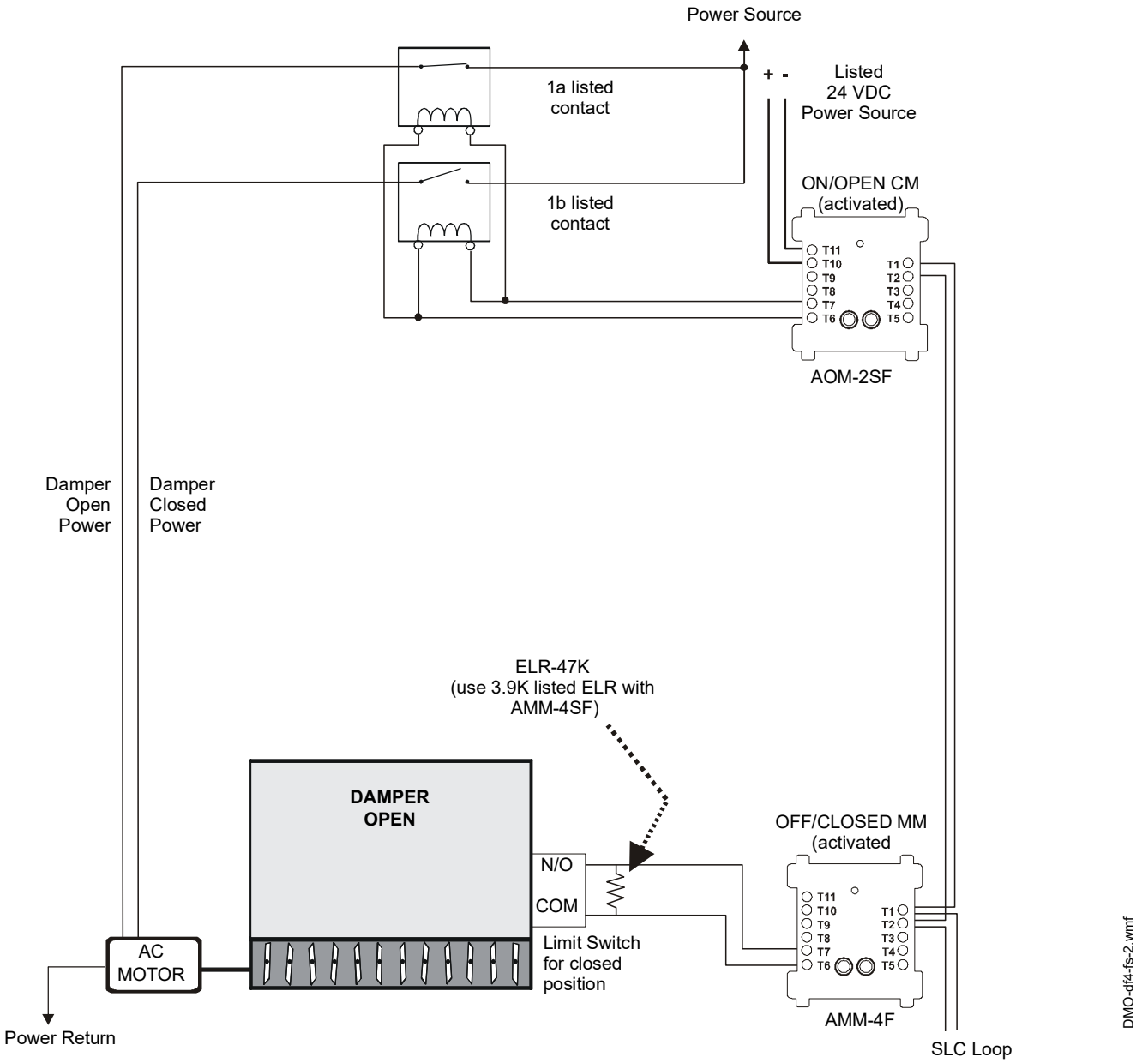


Figure B.8 Dedicated Motorized Damper Wiring (Type 4)

Type 4: Damper OPEN Control, Damper CLOSED Monitoring

Figure B.8 shows wiring in a dedicated system that is capable of OPEN control of a motorized damper and can monitor the damper's CLOSED state (Type 4). In this arrangement, the ON/OPEN CM is activated. The ON/OPEN CM controls a normally open contact for the damper open power line, and a normally closed contact for the damper close power line.

When the ON/OPEN CM is activated, the normally closed contact is opened and the normally open contact is closed, thus supplying power to open the damper. When the damper completely opens, the damper open limit switch is closed, indicating that the damper is in the OPEN position, and the damper closed limit switch is open.

The OFF/CLOSED MM monitors the CLOSED position of the damper closed limit switch. In this case, the OFF/CLOSED MM is deactivated because the damper is closed.

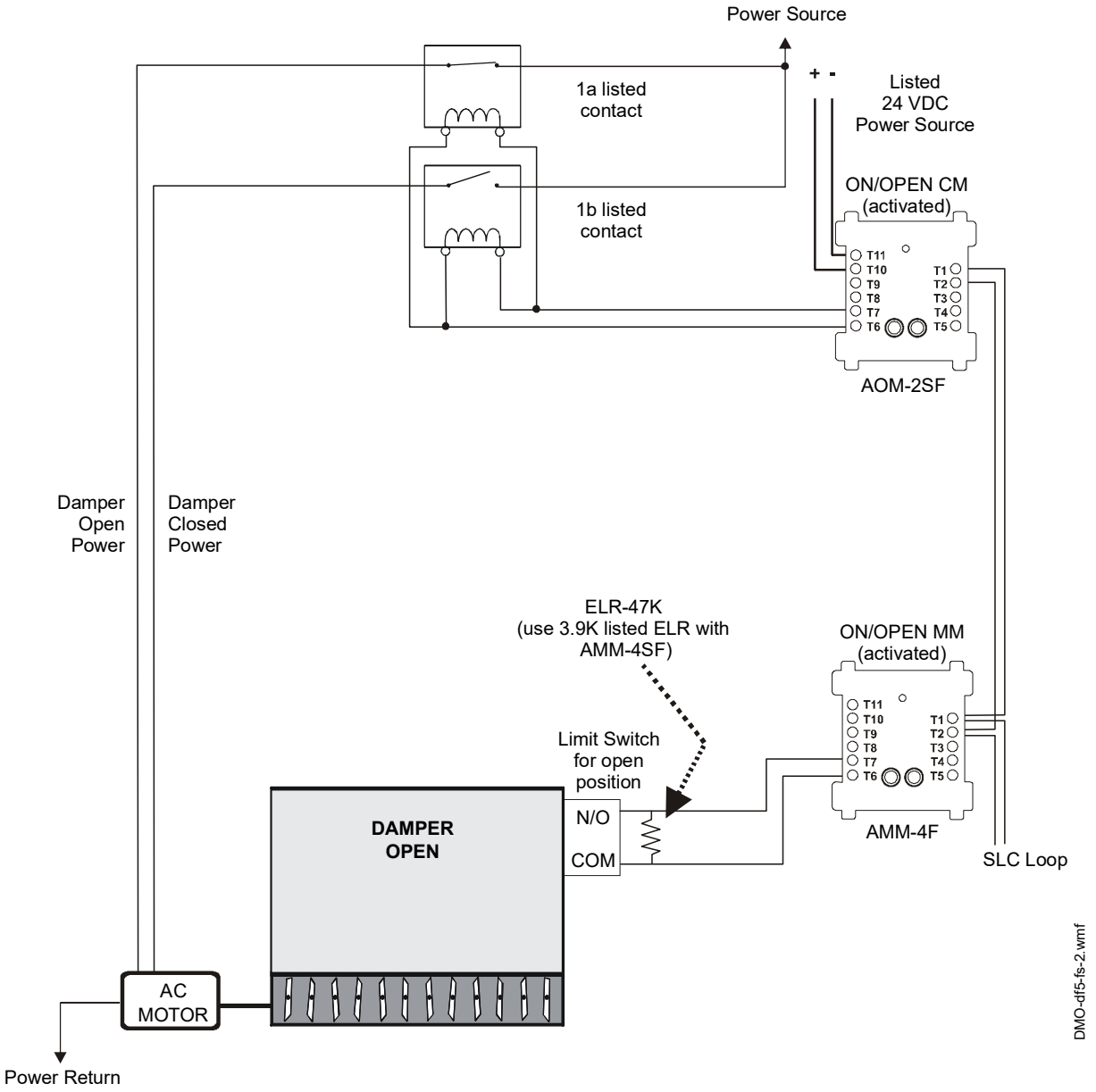


Figure B.9 Dedicated Motorized Damper Wiring (Type 5)

Type 5: Damper OPEN Control, Damper OPEN Monitoring

Figure B.9 shows wiring in a dedicated system that is capable of OPEN control of a motorized damper and can monitor the damper's OPEN state (Type 5). In this arrangement, the ON/OPEN CM is activated. The ON/OPEN CM controls a normally open contact for the damper open power line, and a normally closed contact for the damper close power line.

When the ON/OPEN CM is activated, the normally closed contact is opened and the normally open contact is closed, thus supplying power to open the damper. When the damper completely opens, the damper open limit switch is closed, indicating that the damper is in the open position.

The ON/OPEN MM monitors the CLOSED position of the open position limit switch. In this case, the ON/OPEN MM is activated because the damper is open.

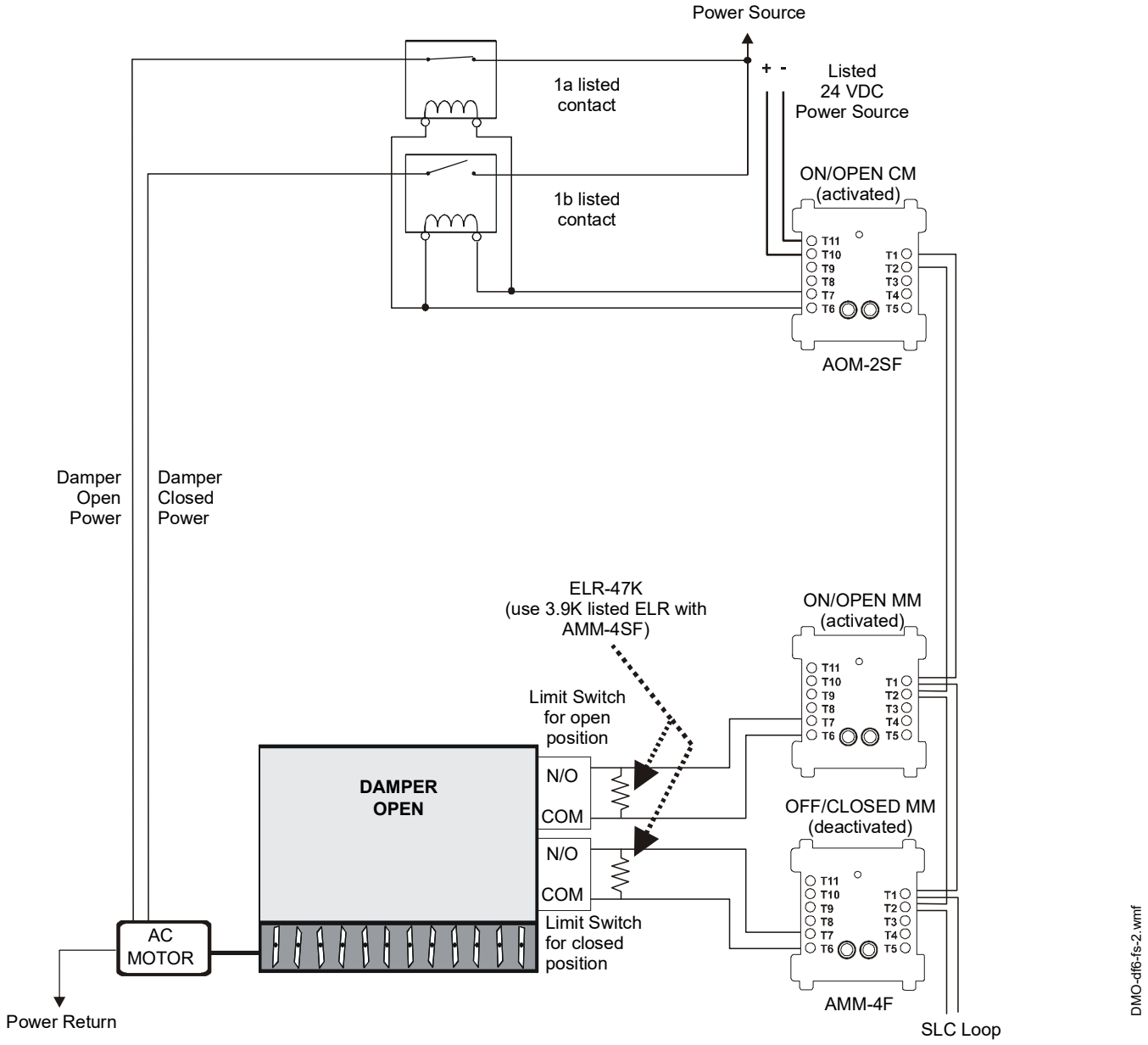


Figure B.10 Dedicated Motorized Damper Wiring (Types 6, 7, 8, 9)

Type 6: Damper OPEN Control, Damper OPEN and CLOSED Monitoring

Figure B.10 shows wiring in a dedicated system that is capable of OPEN control of a motorized damper and can monitor the damper's OPEN and CLOSED states (Type 6). In this arrangement, the ON/OPEN CM is activated. The ON/OPEN CM controls a normally open contact for the damper open power line, and a normally closed contact for the damper close power line.

When the ON/OPEN CM is activated, the normally closed contact is opened and the normally open contact is closed, thus supplying power to open the damper. When the damper completely opens, the open position limit switch is closed, indicating that the damper is in the open position. (When the damper is in the closed position, the closed position limit switch is closed.)

In a dedicated system, a damper would never need both ON and OFF control. A damper for a dedicated system is either normally open and would need to be closed or normally closed and would need to be opened. This is not true for a non-dedicated system.

The ON/OPEN MM monitors when the open position limit switch is closed. In this case the ON/OPEN MM is activated and the OFF/CLOSED MM is deactivated because the damper is open.

Type 7: Damper OPEN and CLOSED Control, Damper CLOSED Monitoring

Type 7 is used for OPEN and CLOSED control of a motorized damper and can monitor the damper's CLOSED state. (Type 7 would never be needed unless redundancy in OFF and ON control were necessary.) When the ON/OPEN CM is deactivated, the OFF/CLOSED CM is activated, and vice versa. The ON/OPEN CM controls a normally open contact which switches the damper open power to the damper. The OFF/CLOSED CM controls a normally open contact which switches damper close power to the damper.

When the ON/OPEN CM is deactivated, the contact is open, thus cutting damper open power to the damper. When the OFF/CLOSED CM is activated, the contact is closed, thus supplying power to the fan. The same capability could be obtained by connecting one normally open contact and one normally closed contact to the output of one control module. For instance, if you are using one ON/OPEN CM, connect the normally open contact to the damper closed power and connect the normally closed contact to the damper open power. Both control modules are not necessary to switch the power to the damper: one is sufficient for a dedicated system as long as two contacts are used.

Type 8: Damper OPEN and CLOSED Control, Damper OPEN Monitoring

Type 8 is used for OPEN and CLOSED control of a motorized fan and can monitor the damper's the OPEN state. (Type 8 would never be needed unless redundancy in OFF and ON control were necessary.) When the ON/OPEN CM is deactivated, the OFF/CLOSED CM is activated, and vice versa. The ON/OPEN CM controls a normally open contact which switches the damper open power to the damper. The OFF/CLOSED CM controls a normally open contact which switches damper close power to the damper.

When the ON/OPEN CM is deactivated, the contact is open, thus cutting damper open power to the damper. When the OFF/CLOSED CM is activated, the contact is closed, thus supplying power to the fan. The same capability could be obtained by connecting one normally open contact and one normally closed contact to the output of one control module. For instance, if you are using one OFF/CLOSED CM, connect the normally open contact to the damper closed power and connect the normally closed contact to the damper open power. Both control modules are not necessary to switch the power to the damper: one is sufficient for a dedicated system as long as two contacts are used.

Type 9: Damper OPEN and CLOSED Control, Damper OPEN and CLOSED Monitoring

Type 9 is used for OPEN and CLOSED control of a motorized damper and can monitor the damper's OPEN and CLOSED states. (Type 9 would never be needed unless redundancy in OFF and ON control were necessary.) When the ON/OPEN CM is deactivated, the OFF/CLOSED CM is activated, and vice versa. The ON/OPEN CM controls a normally open contact which switches the damper open power to the damper. The OFF/CLOSED CM controls a normally open contact which switches damper close power to the damper.

When the ON/OPEN CM is deactivated, the contact is open, thus cutting damper open power to the damper. When the OFF/CLOSED CM is activated, the contact is closed, thus supplying power to the fan. The same capability could be obtained by connecting one normally open contact and one normally closed contact to the output of one control module. For instance, if you are using one OFF/CLOSED CM, connect the normally open contact to the damper closed power and connect the normally closed contact to the damper open power. Both control modules are not necessary to switch the power to the damper: one is sufficient for a dedicated system as long as two contacts are used.as two contacts are used.

B.2.3 Dedicated EP Dampers

Electrical to Pressure (EP) dampers use airflow to operate the opening and closing of the damper. When power is applied to the pressure switch, airflow going to the damper is cut off and the damper closes. When no power is supplied to the pressure switch, airflow is continuous and keeps the damper open.

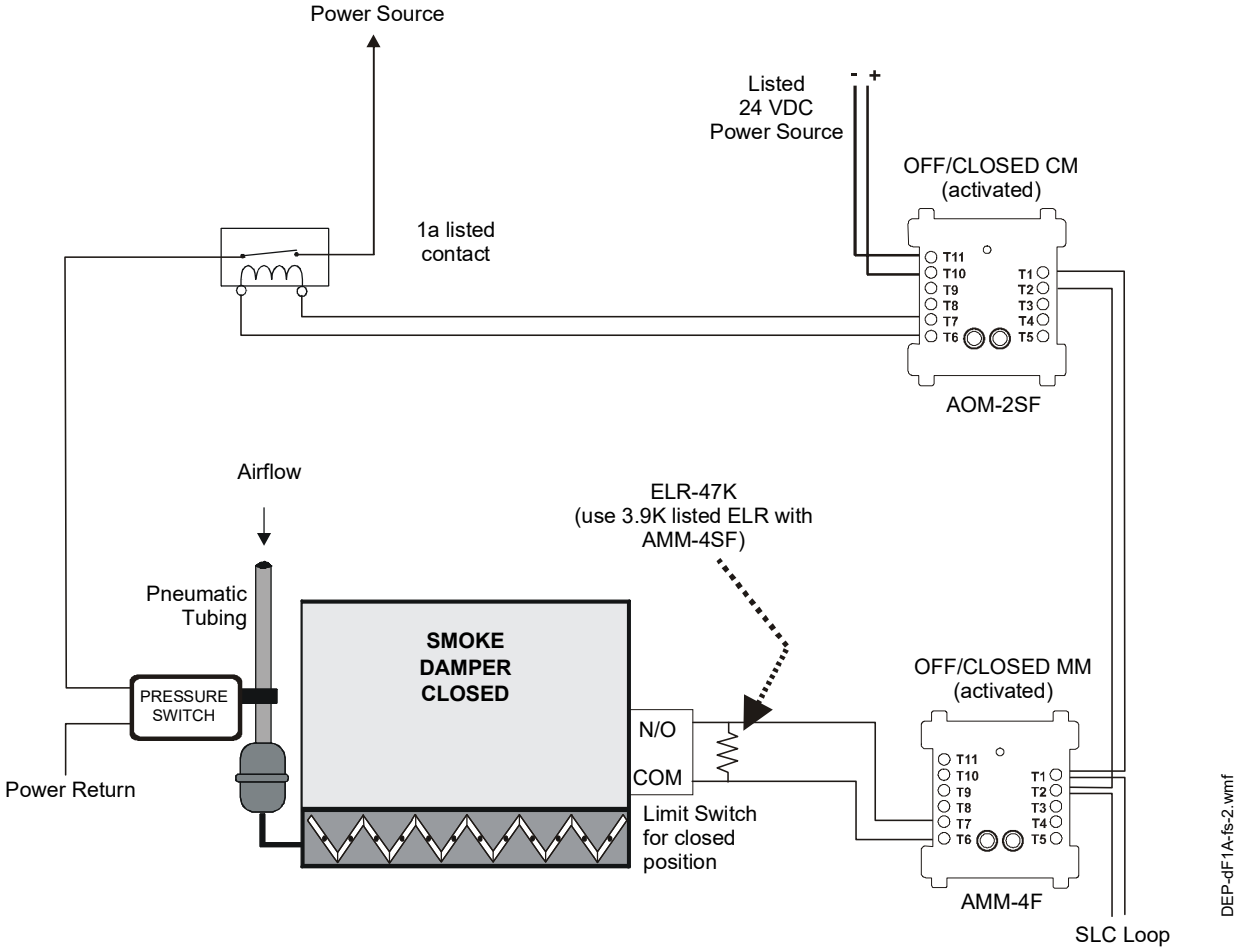


Figure B.11 Dedicated EP Damper Wiring (Type 1)

Type 1: EP Damper CLOSED Control, EP Damper CLOSED Monitoring

Figure B.11 shows wiring in a dedicated system that is capable of CLOSED control of an EP damper and can monitor the damper's CLOSED state (Type 1). In this arrangement, the OFF/CLOSED CM is activated. The OFF/CLOSED CM controls a normally open contact for pressure switch power.

When the OFF/CLOSED CM is activated, the normally open contact is closed, thus supplying power to close the damper. When the damper completely closes, the damper closed limit switch is closed, indicating that the damper is in the closed position.

The OFF/CLOSED MM monitors the closed position of the damper closed limit switch. In this state, the OFF/CLOSED MM is activated because the damper is closed.

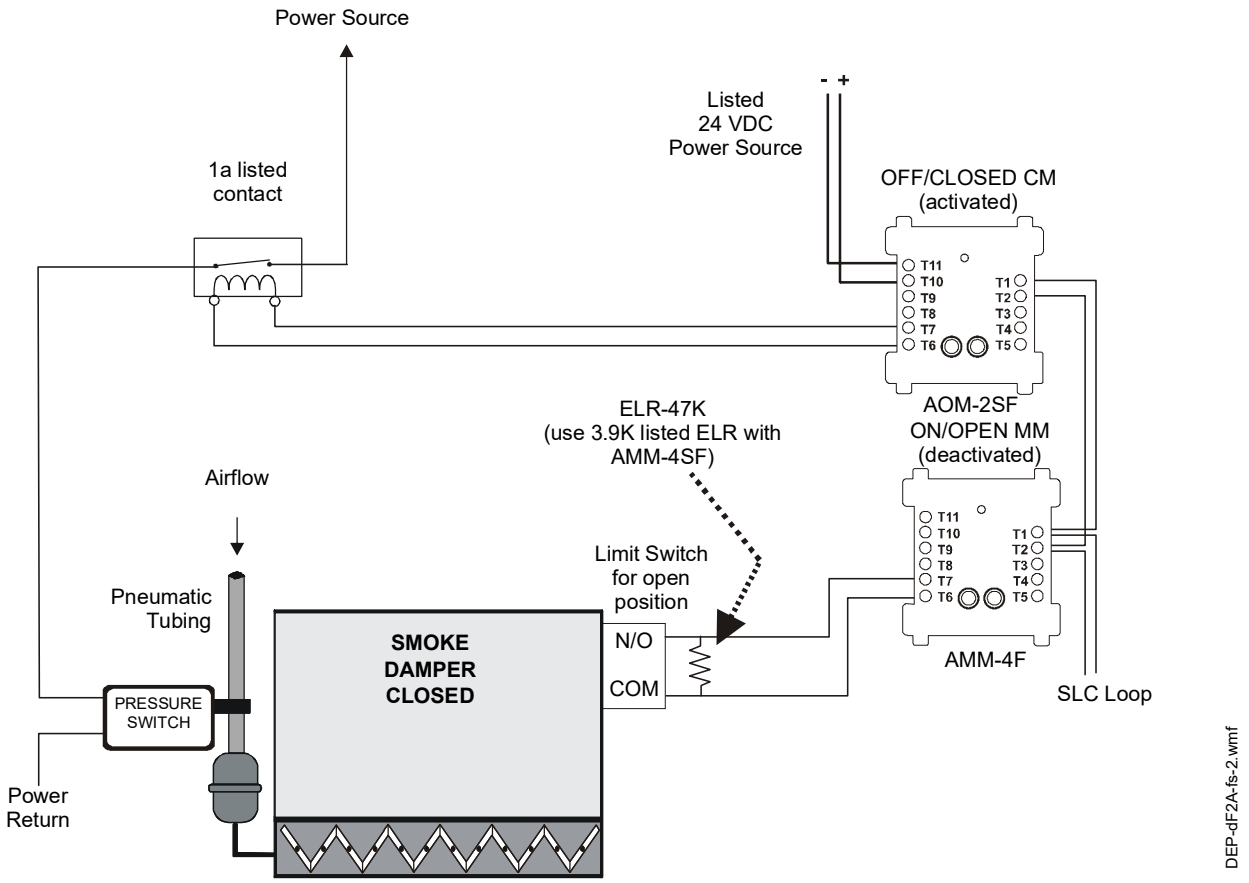


Figure B.12 Dedicated EP Damper Wiring (Type 2)

Type 2: EP Damper CLOSED Control, EP Damper OPEN Monitoring

Figure B.12 shows wiring in a dedicated system that is capable of CLOSED control of an EP damper and can monitor the damper's OPEN state (Type 2). In this arrangement, the OFF/CLOSED CM is activated. The OFF/CLOSED CM controls a normally open contact for pressure switch power.

When the OFF/CLOSED CM is activated, the normally open contact is closed, thus supplying power to close the damper. When the damper completely closes, the damper closed limit switch is closed, indicating that the damper is in the closed position.

The ON/OPEN MM monitors the closed position of the damper open limit switch. In this state, the ON/OPEN MM is deactivated because the damper is closed.

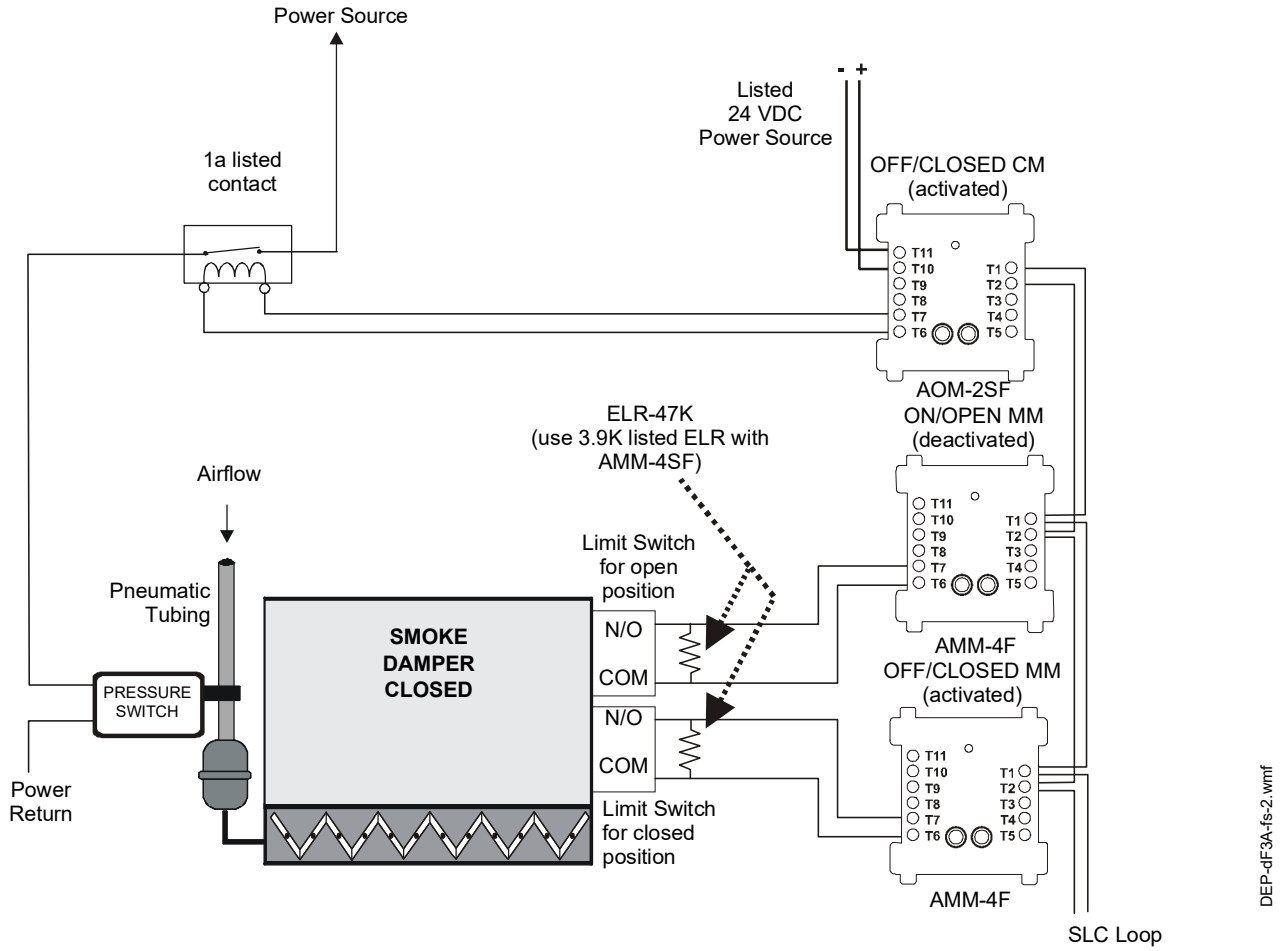


Figure B.13 Dedicated EP Damper Wiring (Type 3)

Type 3: EP Damper CLOSED Control, EP Damper OPEN and CLOSED Monitoring

Figure B.13 shows wiring in a dedicated system that is capable of CLOSED control of an EP damper and can monitor the damper's OPEN and CLOSED states (Type 3). In this arrangement, the OFF/CLOSED CM is activated. The OFF/CLOSED CM controls a normally open contact for pressure switch power.

When the OFF/CLOSED CM is activated, the normally open contact is closed, thus supplying power to close the damper. When the damper completely closes, the damper closed limit switch is closed, indicating that the damper is in the closed position. (When the damper is in the open position, the damper open limit switch is closed.)

The OFF/CLOSED MM monitors when the damper closed limit switch is closed. In this case the OFF/CLOSED MM is activated and the ON/OPEN MM is deactivated because the damper is closed.

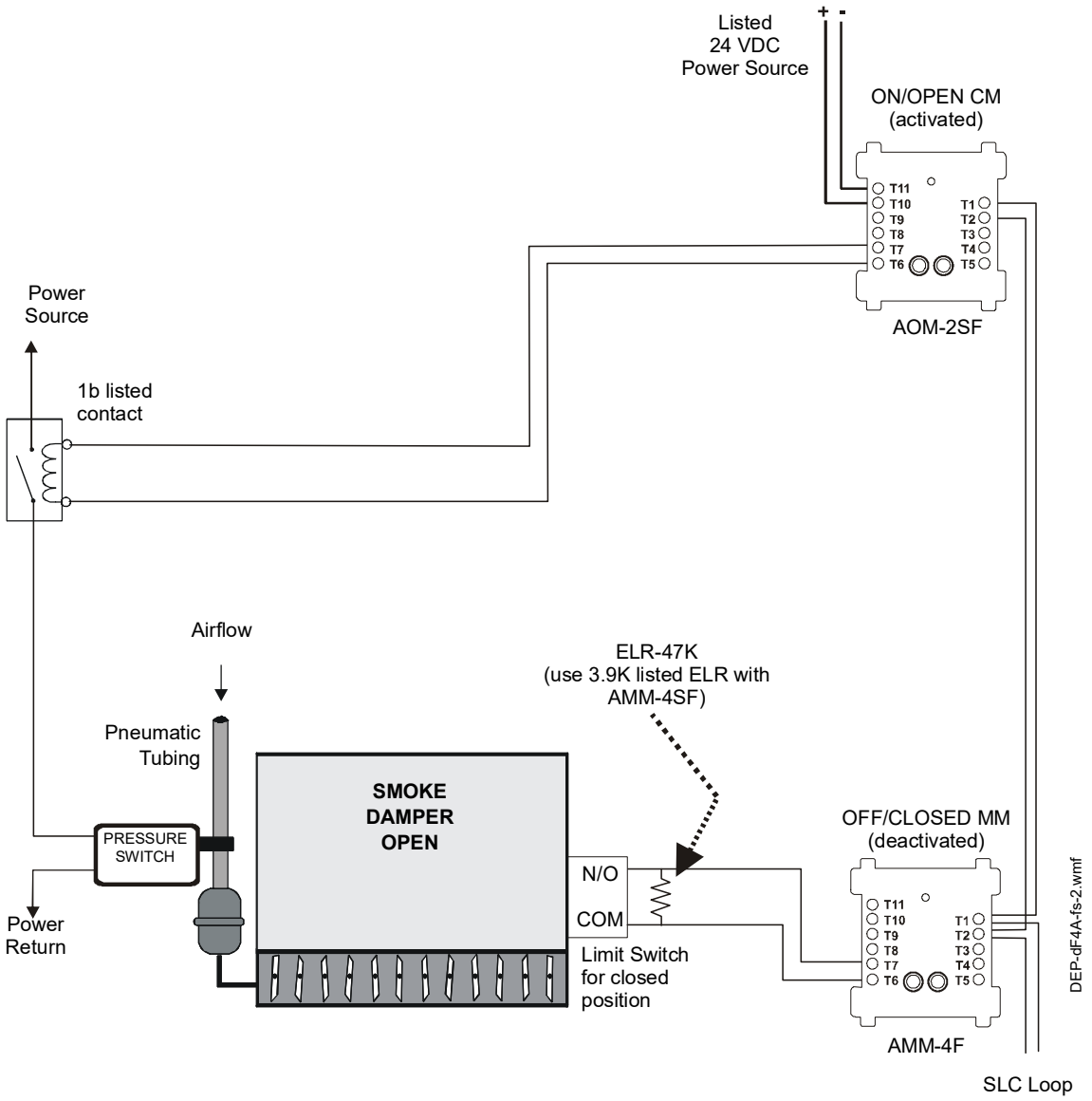


Figure B.14 Dedicated EP Damper Wiring (Type 4)

Type 4: EP Damper OPEN Control, EP Damper CLOSED Monitoring

Figure B.14 shows wiring in a dedicated system that is capable of OPEN control of an EP damper and can monitor the damper's CLOSED state (Type 4). In this arrangement, the ON/OPEN CM is activated. The ON/OPEN CM controls a normally closed contact for pressure switch power.

When the ON/OPEN CM is activated, the normally closed contact is opened, thus cutting power from the pressure switch, causing the damper to open. When the damper completely opens, the damper open limit switch is closed, indicating that the damper is in the open position, and the damper closed limit switch is open.

The OFF/CLOSED MM monitors the closed position of the damper closed limit switch. In this case, the OFF/CLOSED MM is deactivated because the damper is closed.

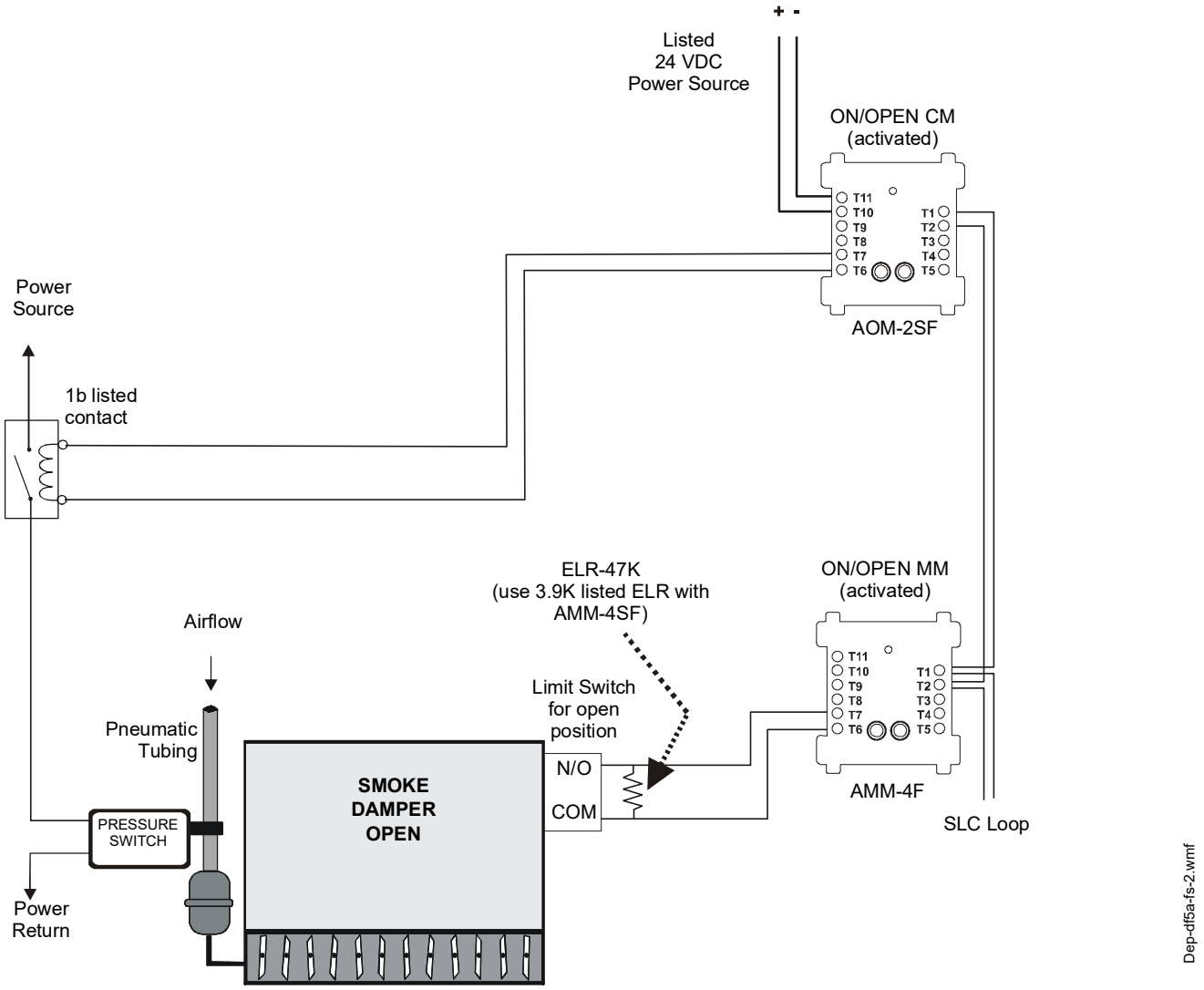


Figure B.15 Dedicated EP Damper Wiring (Type 5)

Type 5: EP Damper OPEN Control, EP Damper OPEN Monitoring

Figure B.15 shows wiring in a dedicated system that is capable of OPEN control of an EP damper and can monitor the damper's OPEN state (Type 5). In this arrangement, the ON/OPEN CM is activated. The ON/OPEN CM controls a normally closed contact for pressure switch power.

When the ON/OPEN CM is activated, the normally closed contact is opened, thus cutting power from the pressure switch, causing the damper to open. When the damper completely opens, the damper open limit switch is closed, indicating that the damper is in the open position.

The ON/OPEN MM monitors the closed position of the damper open limit switch. In this case, the ON/OPEN MM is activated because the damper is open.

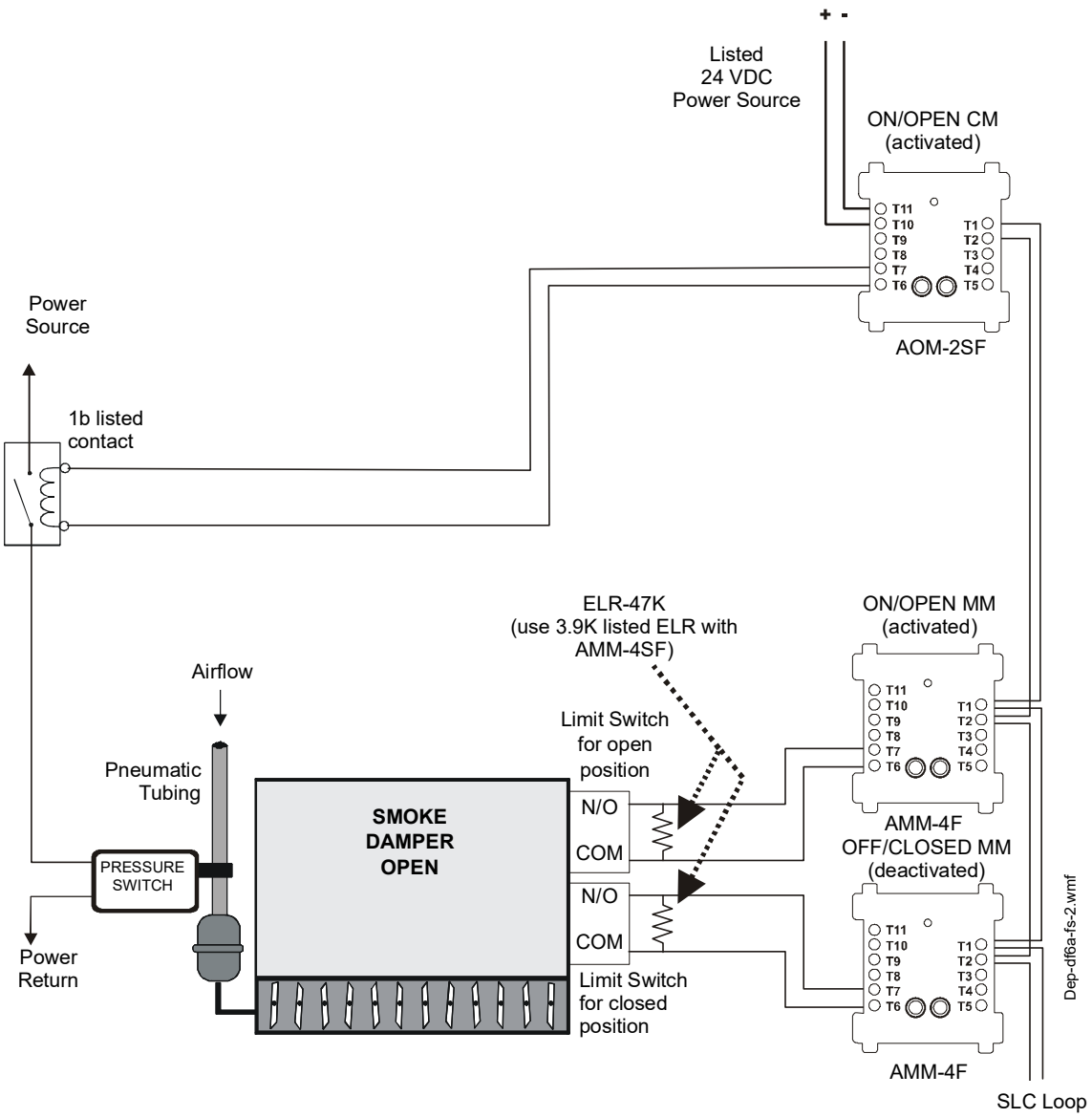


Figure B.16 Dedicated EP Damper Wiring (Types 6, 7, 8, 9)

Type 6: EP Damper OPEN Control, EP Damper Open and CLOSED Monitoring

Figure B.16 shows wiring in a dedicated system that is capable of OPEN control of an EP damper and can monitor the damper's OPEN and CLOSED states (Type 6). In this arrangement, the ON/OPEN CM is activated. The ON/OPEN CM controls a normally closed contact for pressure switch power.

When the ON/OPEN CM is activated, the normally closed contact is opened, thus cutting power from the pressure switch, causing the damper to open. When the damper completely opens, the damper open limit switch is closed, indicating that the damper is in the open position. (When the damper is in the closed position, the closed position limit switch is closed.)

In a dedicated system, a damper would never need both ON and OFF control. A damper for a dedicated system is either normally open and would need to be closed, or normally closed and would need to be opened. This is not true for a non-dedicated system.

The ON/OPEN MM monitors when the open position limit switch is closed. In this case, the ON/OPEN MM is activated and the OFF/CLOSED MM is deactivated because the damper is open.

Type 7: EP Damper OPEN and CLOSED Control, EP Damper CLOSED Monitoring

Type 7 represents wiring in a dedicated system that is capable of OPEN and CLOSED control of an EP damper and can monitor the damper's CLOSED state. When the ON/OPEN CM is deactivated, the OFF/CLOSED CM is activated, and vice versa. Type 7 would never be needed unless redundancy in OFF and ON control were necessary.

The ON/OPEN CM controls a normally closed contact which switches power to the pressure switch. The OFF/CLOSED CM controls a normally open contact which switches power to the pressure switch. Both control modules are not necessary to supply or cut the power to the damper: one is sufficient.

When the ON/OPEN CM is deactivated, the contact is closed, thus supplying power to the pressure switch. When the OFF/CLOSED CM is activated, the contact is closed, thus supplying power to the pressure switch.

Type 8: EP Damper OPEN and CLOSED Control, EP Damper OPEN Monitoring

Type 8 represents wiring in a dedicated system that is capable of OPEN and CLOSED control of an EP damper and can monitor the damper's OPEN state. When the ON/OPEN CM is deactivated, the OFF/CLOSED CM is activated, and vice versa. Type 8 would never be needed unless redundancy in OFF and ON control were necessary.

The ON/OPEN CM controls a normally closed contact which switches power to the pressure switch. The OFF/CLOSED CM controls a normally open contact which switches power to the pressure switch.

When the ON/OPEN CM is deactivated, the contact is closed, thus supplying power to the pressure switch. When the OFF/CLOSED CM is activated, the contact is closed, thus supplying power to the pressure switch. Both control modules are not necessary to supply or cut the power to the damper: one is sufficient.

Type 9: EP Damper OPEN and CLOSED Control, EP Damper OPEN and CLOSED Monitoring

Type 9 represents wiring in a dedicated system that is capable of OPEN and CLOSED control of an EP damper and can monitor the damper's OPEN and CLOSED states. When the ON/OPEN CM is deactivated, the OFF/CLOSED CM is activated, and vice versa. Type 9 would never be needed unless redundancy in OFF and ON control were necessary.

The ON/OPEN CM controls a normally closed contact which switches power to the pressure switch. The OFF/CLOSED CM controls a normally open contact which switches power to the pressure switch.

When the OFF/CLOSED CM is deactivated, the contact is closed, thus supplying power to the pressure switch. When the OFF/CLOSED CM is activated, the contact is closed, thus supplying power to the pressure switch. Both control modules are not necessary to supply or cut the power to the damper: one is sufficient.

B.3 Non-dedicated Smoke Control Appliances

B.3.1 Non-dedicated Fans

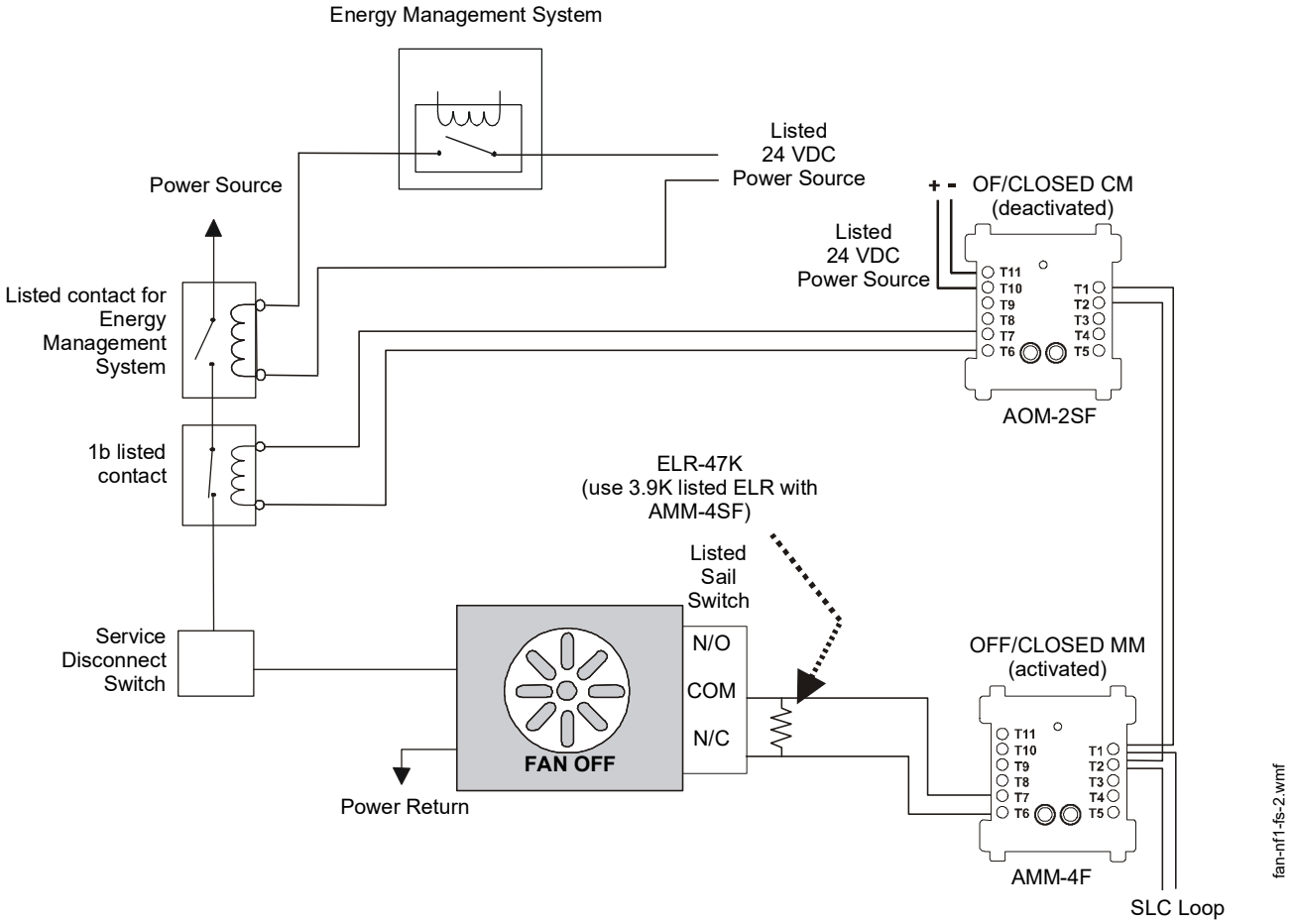


Figure B.17 Non-dedicated Fan Wiring (Type 1)

Type 1: Fan OFF Control, Fan OFF Monitoring

Figure B.17 shows wiring in a non-dedicated system that is capable of OFF control of a fan and can monitor the fan's OFF state (Type 1). In this arrangement, the OFF/CLOSED CM is deactivated. The OFF/CLOSED CM controls a normally closed contact which switches power to the fan. (The contact is used when the power being switched is greater than 24 volts.)

When the OFF/CLOSED CM is deactivated, the contact is closed, thus allowing the EMS to freely control the fan. In this case the EMS is OFF, so no power is being supplied to the fan; the fan is off and the sail switch is closed, indicating no air-flow in the duct.

The OFF/CLOSED MM monitors the closed position of the sail switch, which would indicate when the fan is off. In this case, OFF/CLOSED MM is activated because the fan is off due to the EMS. When the OFF/CLOSED CM is activated, the normally closed contact opens, thus cutting any power to the fan that was being supplied by the EMS.

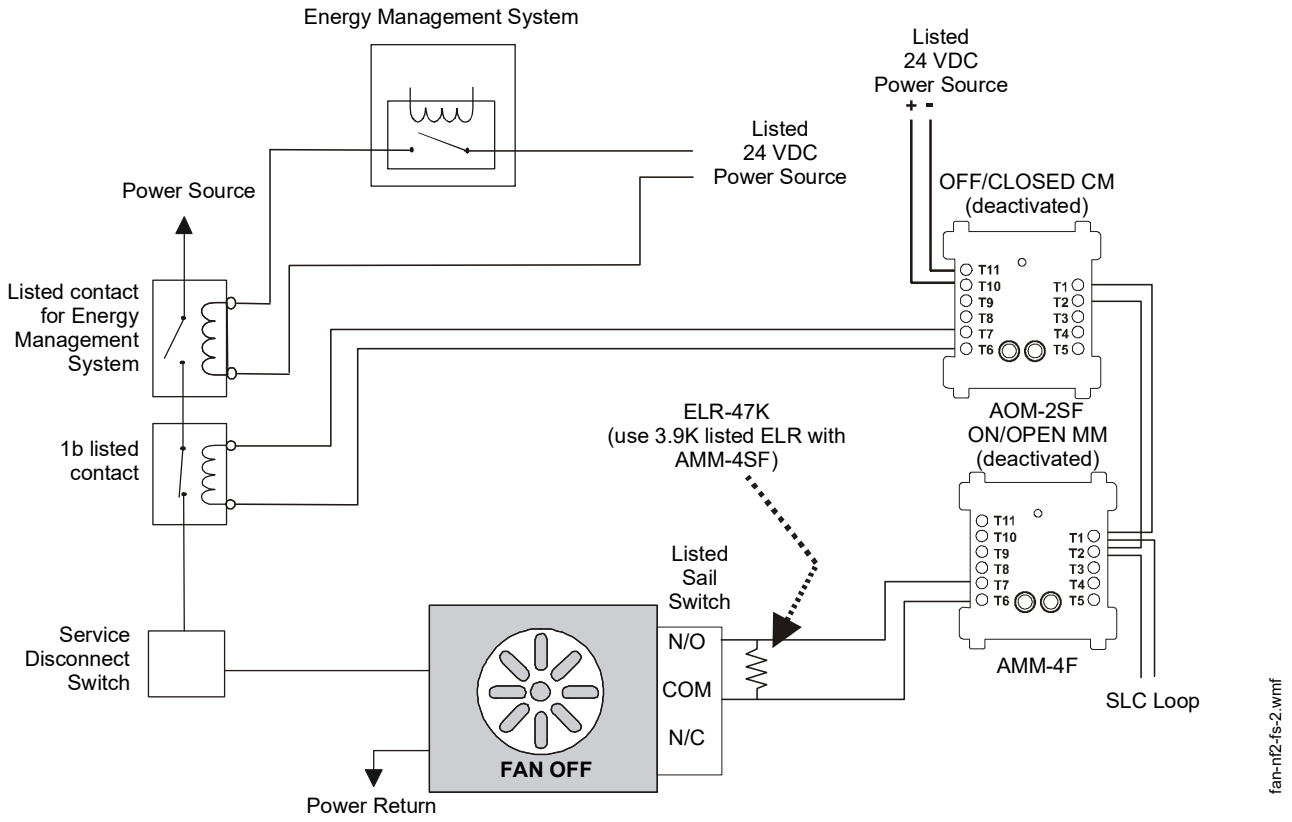


Figure B.18 Non-dedicated Fan Wiring (Types 2, 3)

Type 2: Fan OFF Control, Fan ON Monitoring

Figure B.18 shows wiring in a non-dedicated system that is capable of OFF control of a fan and can monitor the fan's ON state (Type 2). In this arrangement, the OFF/CLOSED CM is deactivated. The OFF/CLOSED CM controls a normally closed contact which switches power to the fan. (The contact is used when the power being switched is greater than 24 volts.)

When the OFF/CLOSED CM is deactivated, the contact is closed, thus allowing the EMS to freely control the fan. In this case the EMS is OFF, so no power is being supplied to the fan; the fan is off and the sail switch is closed, indicating no air-flow in the duct.

The ON/OPEN MM monitors the open position of the sail switch, which would indicate when the fan is on. In this case, the ON/OPEN MM is deactivated because the fan is off due to the EMS. When the OFF/CLOSED CM is activated, the normally closed contact opens, thus cutting any power to the fan that was being supplied by the EMS.

Type 3: Fan OFF Control, Fan ON and OFF Monitoring

Type 3 represents wiring in a non-dedicated system that is capable of OFF control and can monitor the fan’s ON and OFF states. Since it is possible to determine this information from either Type 1 or Type 2, Type 3 would only be necessary for redundancy in verifying the state of the fan.

For example, if Type 1 is used instead of Type 3, the OFF state of the fan would be verified when the monitor module is activated, and the ON state of the fan would be verified when the monitor module is deactivated. Utilizing Types 1 or 2 also saves the use of an additional monitor module. Type 3 would use two monitor modules to provide the same verification as Types 1 or 2.

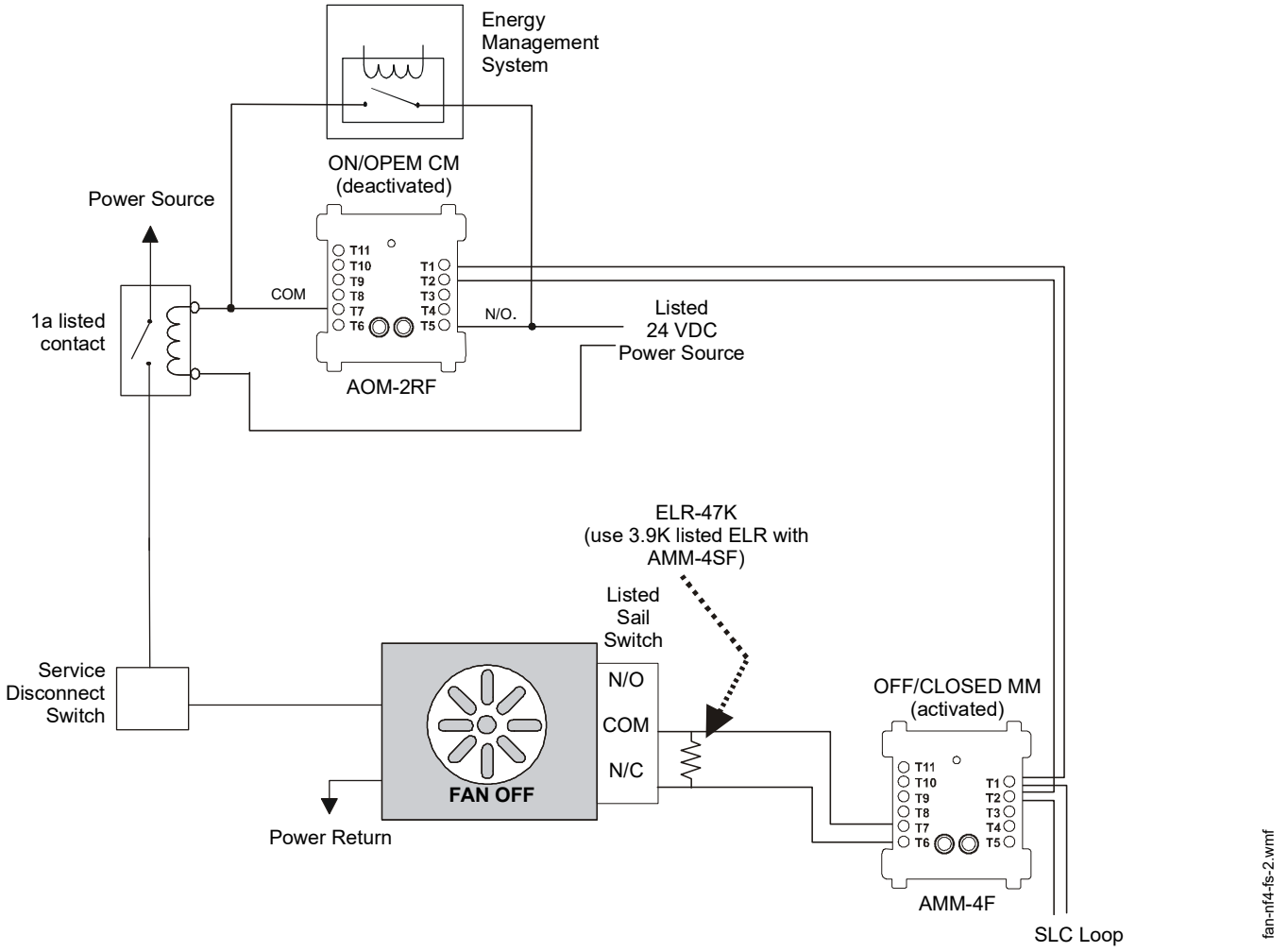


Figure B.19 Non-dedicated Fan Wiring (Type 3)

Type 4: Fan ON Control, Fan OFF Monitoring

Figure B.19 shows wiring in a non-dedicated system that is capable of ON control of a fan and can monitor the fan's OFF state (Type 4). In this arrangement, the ON/OPEN CM is deactivated. The ON/OPEN CM is wired in parallel with the EMS; when wired in parallel with the EMS the CM must be a relay module.

When the ON/OPEN CM is deactivated, the EMS is free to control the fan. In this case the EMS is OFF, so no power is being supplied to the fan; the fan is off and the sail switch is closed, indicating no airflow in the duct.

The OFF/CLOSED MM monitors the closed position of the sail switch, which would indicate when the fan is off. In this case, the OFF/CLOSED MM is activated because the fan is off due to the EMS. When the ON/OPEN CM is activated, the ON/OPEN CM overrides whatever state the EMS is in and closes the normally open contact, thus supplying power to the fan and turning it on.

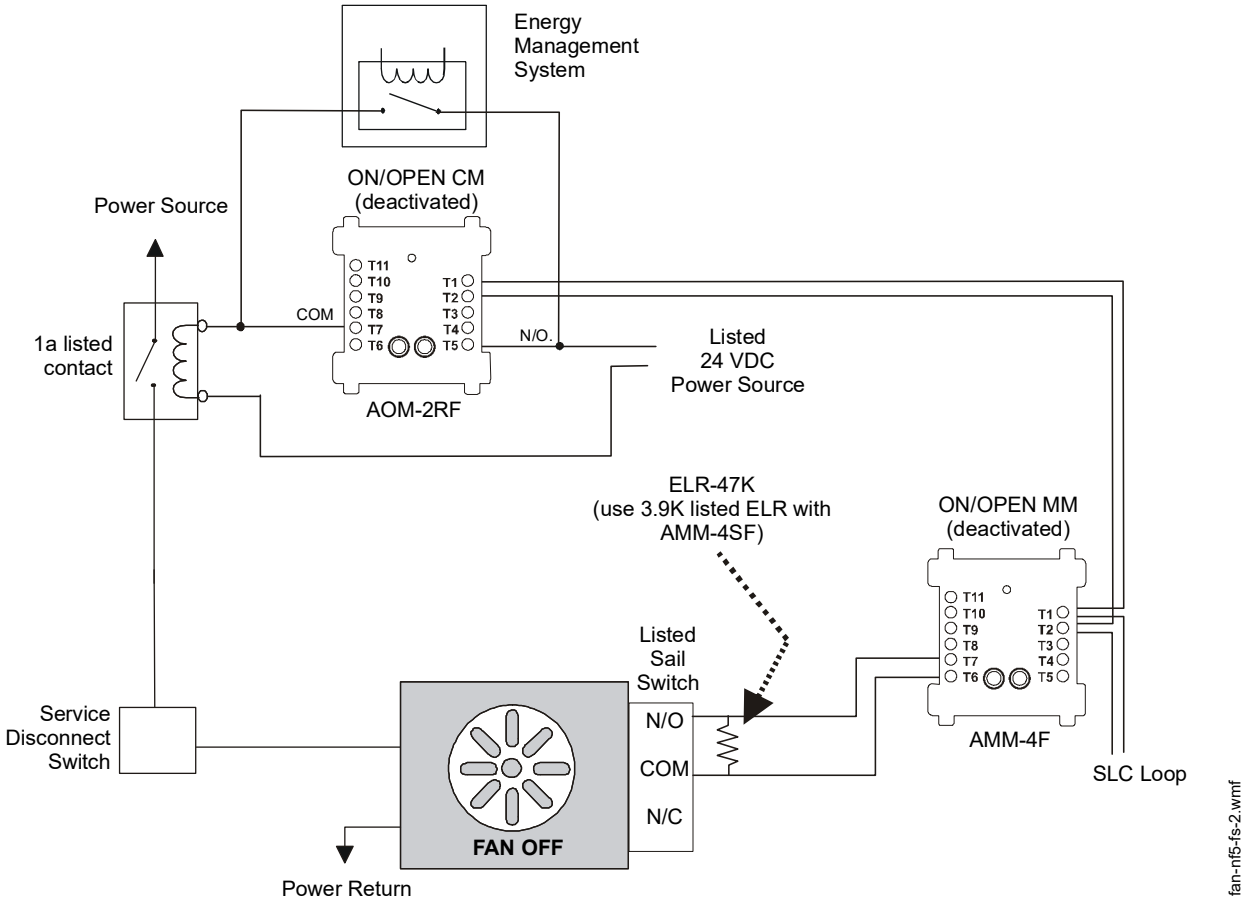


Figure B.20 Non-dedicated Fan Wiring (Types 4, 5)

Type 5: Fan ON Control, Fan ON Monitoring

Figure B.18 shows wiring in a non-dedicated system that is capable of ON control of a fan and can monitor the fan's ON state (Type 5). In this arrangement, the ON/OPEN CM is deactivated. The ON/OPEN CM is wired in parallel with the EMS; when wired in parallel with the EMS the CM must be a relay module.

When the ON/OPEN CM is deactivated, the EMS is free to control the fan. In this case the EMS is OFF, so no power is being supplied to the fan; the fan is off and the sail switch is closed, indicating no airflow in the duct.

The ON/OPEN MM monitors the open position of the sail switch, which would indicate when the fan is on. In this case, the ON/OPEN MM is deactivated because the fan is off due to the EMS. When the ON/OPEN CM is activated, the ON/OPEN CM overrides whatever state the EMS is in and closes the normally open contact, thus supplying power to the fan and turning it on.

Type 6: Fan OFF Control, Fan ON and OFF Monitoring

Type 6 represents wiring in a non-dedicated system that is capable of ON control and can monitor the fan’s ON and OFF states. Since it is possible to determine this information from either Type 4 or Type 5, Type 6 would only be necessary for redundancy in verifying the state of the fan.

For example, if Type 4 is used instead of Type 6, the OFF state of the fan would be verified when the monitor module is activated, and the ON state of the fan would be verified when the monitor module is deactivated. Utilizing Types 1 or 2 also saves the use of an additional monitor module. Utilizing switch group type 4 or 5 also saves the use of an additional monitor module. Type 6 would use two monitor modules to provide the same verification as Types 4 or 5.

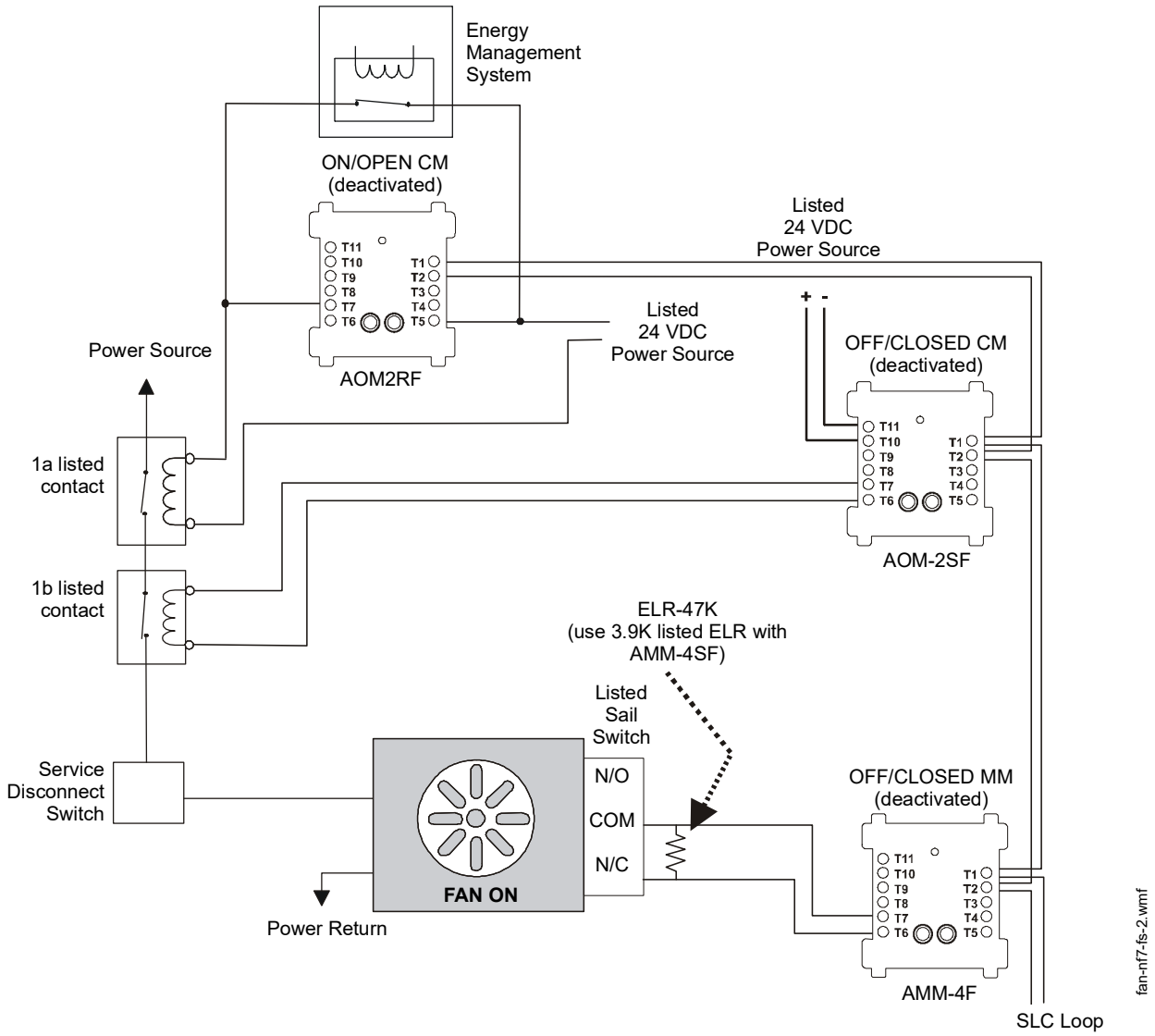


Figure B.21 Non-dedicated Fan Wiring (Type 7)

Type 7: Fan ON and OFF Control, Fan OFF Monitoring

Figure B.21 shows wiring in a non-dedicated system that is capable of ON and OFF control of a fan and can monitor the fan's OFF state (Type 7). In this arrangement, the ON/OPEN CM is deactivated and the OFF/CLOSED CM is deactivated. These two control modules are always in the opposite state when the smoke control system is in operation and are always deactivated during normal operation.

The ON/OPEN CM is wired in parallel with the EMS; when wired in parallel with the EMS the CM must be a relay module. When the ON/OPEN CM and the OFF/CLOSED CM are deactivated, the EMS is free to control the fan. In this case the EMS is, so power is being supplied to the fan. When power is supplied to the fan, the fan is ON and the sail switch is open, indicating airflow in the duct.

The OFF/CLOSED MM monitors the closed position of the sail switch, which indicates when the fan is off. In this case the OFF/CLOSED MM is deactivated because the fan is on due to the EMS. When ON/OPEN CM is activated for smoke control, the ON/OPEN CM overrides whatever state the EMS is in and closes the normally open contact, thus supplying power to the fan and turning it on. When the OFF/CLOSED CM is activated for smoke control, the OFF/CLOSED CM opens the normally closed contact and turns the fan off, overriding whatever state the EMS is in.

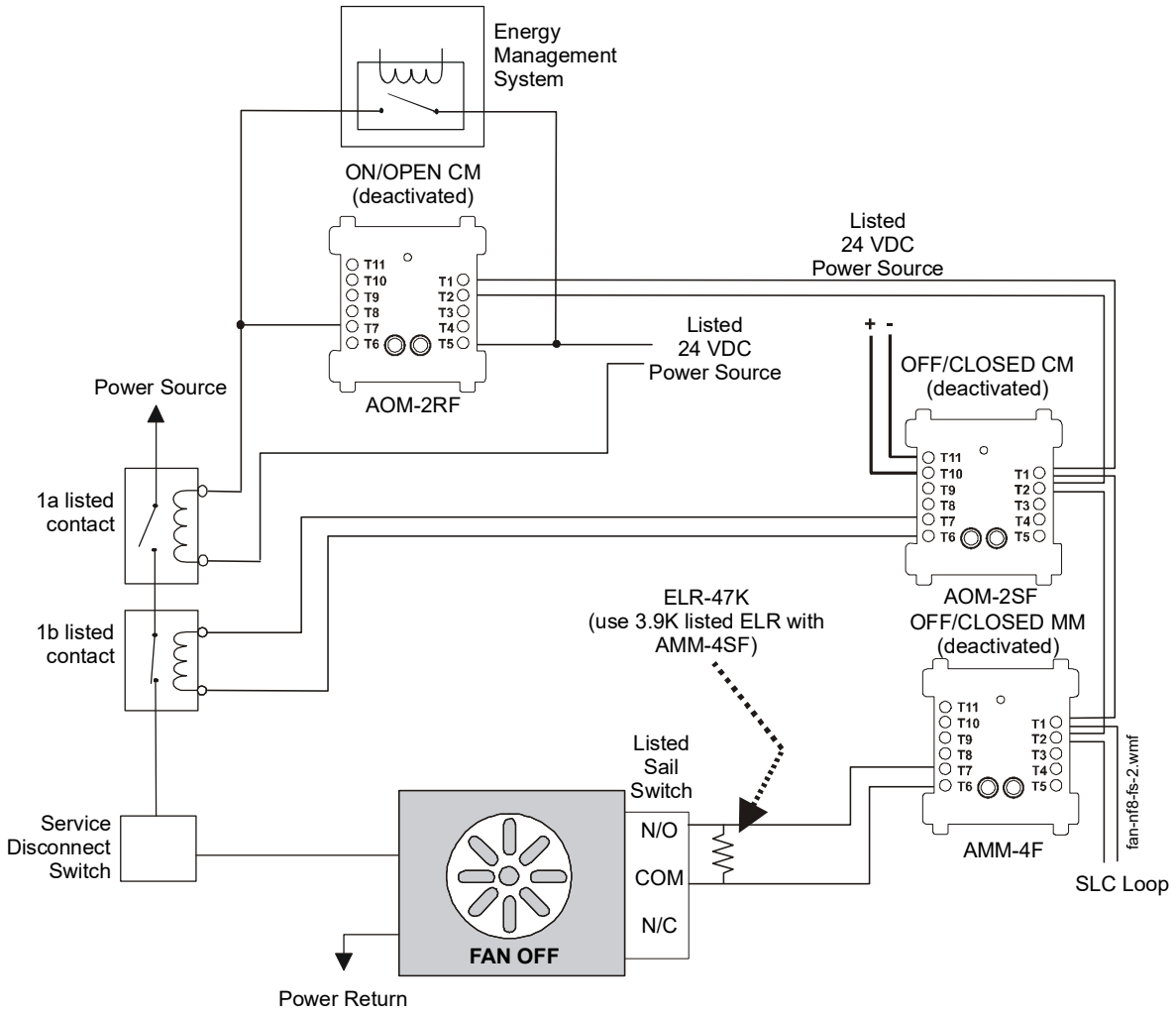


Figure B.22 Non-dedicated Fan Wiring (Types 8, 9)

Type 8: Fan ON and OFF Control, Fan ON Monitoring

Figure B.22 shows wiring in a non-dedicated system that is capable of ON and OFF control of a fan and can monitor the fan's ON state (Type 8). In this arrangement, the ON/OPEN CM is deactivated and the OFF/CLOSED CM is deactivated. These two control modules are always in the opposite state when the smoke control system is in operation and are always deactivated during normal operation. The ON/OPEN CM is wired in parallel with the EMS; when wired in parallel with the EMS the CM must be a relay module.

When the ON/OPEN CM and the OFF/CLOSED CM are deactivated; the EMS is free to control the fan. In this case the EMS is OFF, so no power is being supplied to the fan. When no power is supplied to the fan, the fan is off and the sail switch is closed, indicating no airflow in the duct.

The ON/OPEN MM monitors the open position of the sail switch, which indicates when the fan is on. In this case the ON/OPEN MM is deactivated because the fan is off due to the EMS. When the ON/OPEN CM is activated for smoke control, the ON/OPEN CM overrides whatever state the EMS is in and closes the normally open contact, thus supplying power to the fan and turning it on. When the OFF/CLOSED CM is activated for smoke control, the off/closed CM opens the normally closed contact and turns the fan off, overriding whatever state the EMS is in.

Type 9: Fan ON and OFF Control, Fan ON and OFF Monitoring

Type 9 represents wiring in a non-dedicated system that is capable of ON and OFF control and can monitor the fan's ON and OFF states. Since it is possible to verify both ON and OFF states from Type 7 or Type 8, Type 9 would only be necessary for redundancy in verifying the state of the fan.

For example, if Type 7 is used instead of Type 8, the OFF state of the fan would be verified when the monitor module is activated, and the ON state of the fan would be verified when the monitor module is deactivated. Utilizing switch group types 7 or 8 also saves the use of an additional monitor module. Switch group type 9 would use two monitor modules to provide the same verification as Types 7 or 8.

B.3.2 Non-dedicated Motorized Dampers

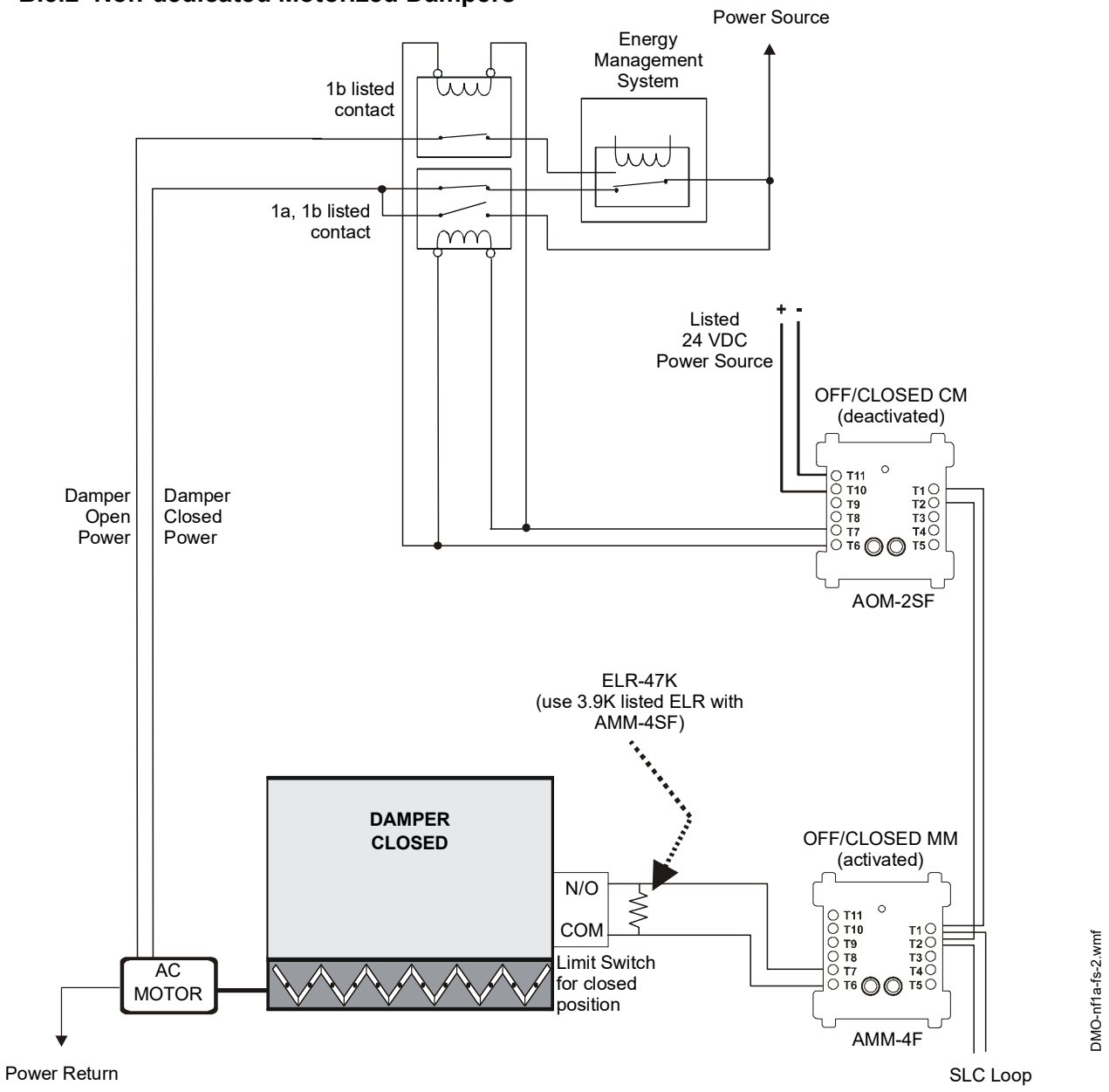


Figure B.23 Non-dedicated Motorized Damper Wiring (Type 1)

Type 1: Damper CLOSED Control, Damper CLOSED Monitoring

Figure B.23 shows wiring in a non-dedicated system that is capable of ON and OFF control of a motorized damper and can monitor the damper's CLOSED state (Type 1). In this arrangement, the OFF/CLOSED CM is deactivated. The OFF/CLOSED CM controls two contacts: a normally closed contact for the damper open power line, and a dual normally open/normally closed contact for the damper close power.

When the OFF/CLOSED CM is activated, the normally closed contact is opened (cutting any power supplied by the EMS to the damper open power line), the normally closed portion of the dual contact is opened (cutting any power supplied by the EMS to the damper closed power line), and the normally open portion of the dual contact is closed, thus supplying power to close the damper.

When the OFF/CLOSED CM is deactivated, the EMS is free to control the damper. The EMS is currently supplying power to the damper closed power line. When power is supplied to the damper closed power line, the damper closes. When the damper completely closes, the damper closed limit switch is closed, indicating that the damper is in the closed position.

The OFF/CLOSED MM monitors the closed position of the damper closed limit switch. In this case the OFF/CLOSED MM is activated because the damper is closed.

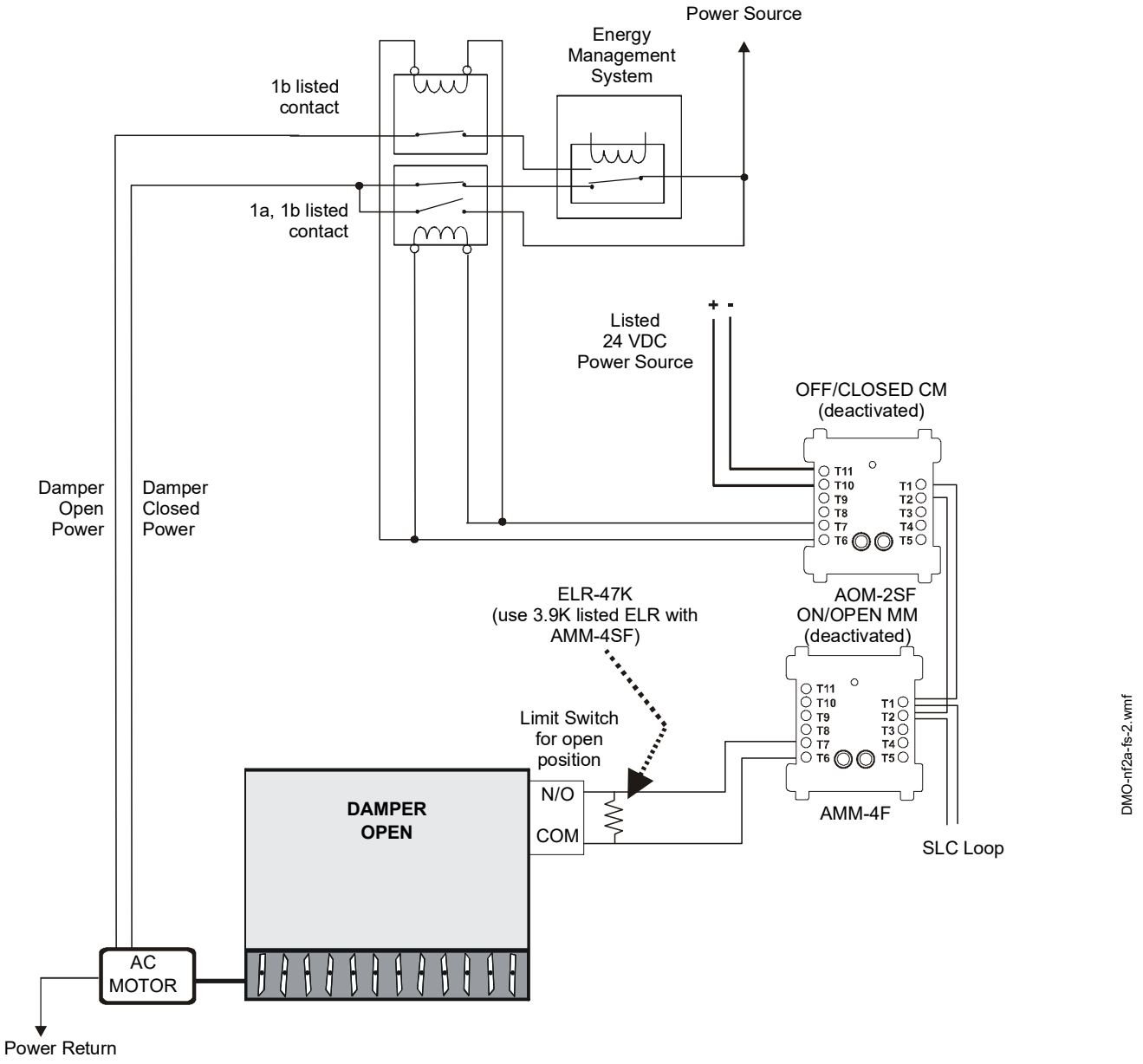


Figure B.24 Non-dedicated Motorized Damper Wiring (Type 2)

Type 2: Damper CLOSED Control, Damper OPEN Monitoring

Figure B.24 shows wiring in a non-dedicated system that is capable of CLOSED control of a motorized damper and can monitor the damper's OPEN state (Type 2). In this arrangement, the OFF/CLOSED CM is deactivated. The OFF/CLOSED CM controls two contacts: a normally closed contact for the damper open power line, and a dual normally open/normally closed contact for the damper close power.

When the OFF/CLOSED CM is activated, the normally closed contact is opened (cutting any power supplied by the EMS to the damper open power line), the normally closed portion of the dual contact is opened (cutting any power supplied by the EMS to the damper closed power line), and the normally open portion of the dual contact is closed, thus supplying power to close the damper.

When the OFF/CLOSED CM is deactivated, the EMS is free to control the damper. The EMS is currently supplying power to the damper closed power line. When power is supplied to the damper closed power line, the damper closes. When the damper completely closes, the damper closed limit switch is closed, indicating that the damper is in the closed position.

The ON/OPEN MM monitors the closed position of the damper open limit switch. In this case the ON/OPEN MM is deactivated because the damper is closed.

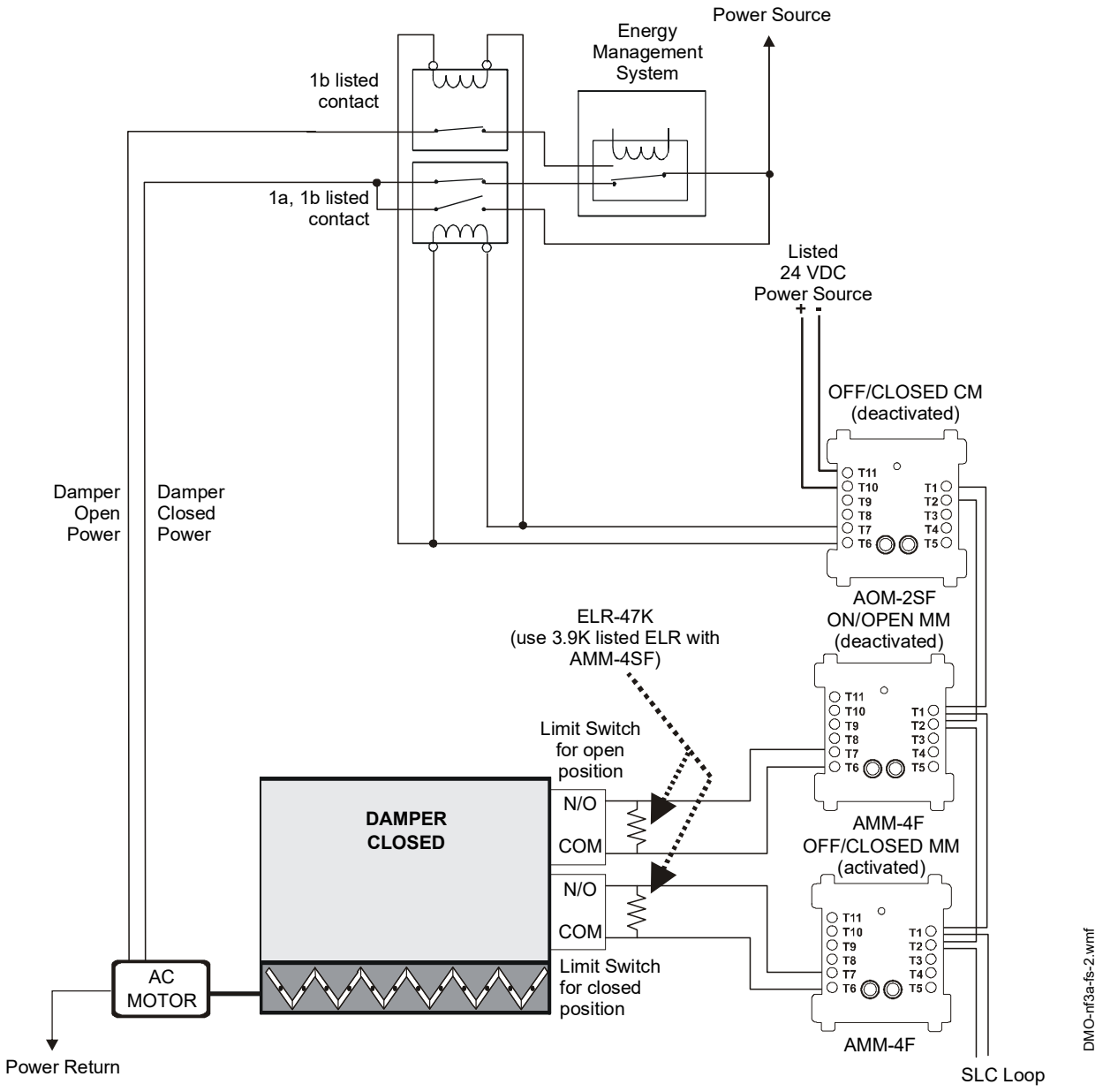


Figure B.25 Non-dedicated Motorized Damper Wiring (Type 3)

Type 3: Damper CLOSED Control, Damper OPEN and CLOSED Monitoring

Figure B.25 shows wiring in a non-dedicated system that is capable of CLOSED control of a motorized damper and can monitor the damper's OPEN and CLOSED states (Type 3). In this arrangement, the OFF/CLOSED CM is deactivated. The OFF/CLOSED CM controls two contacts: a normally closed contact for the damper open power line, and a dual normally open/normally closed contact for the damper close power line.

When the OFF/CLOSED CM is activated, the normally closed contact is opened (cutting any power supplied by the EMS to the damper open power line), the normally closed portion of the dual contact is opened (cutting any power supplied by the EMS to the damper closed power line), and the normally open portion of the dual contact is closed, thus supplying power to close the damper.

When the OFF/CLOSED CM is deactivated, the EMS is free to control the damper. The EMS is currently supplying power to the damper closed power line. When power is supplied to the damper closed power line, the damper closes. When the damper completely closes, the damper closed limit switch is closed, indicating that the damper is in the closed position.

The OFF/CLOSED MM MM monitors the closed position of the damper closed limit switch and the ON/OPEN MM monitors the closed position of the damper open limit switch. In this case the OFF/CLOSED MM is activated and the ON/OPEN MM is deactivated because the damper is closed.

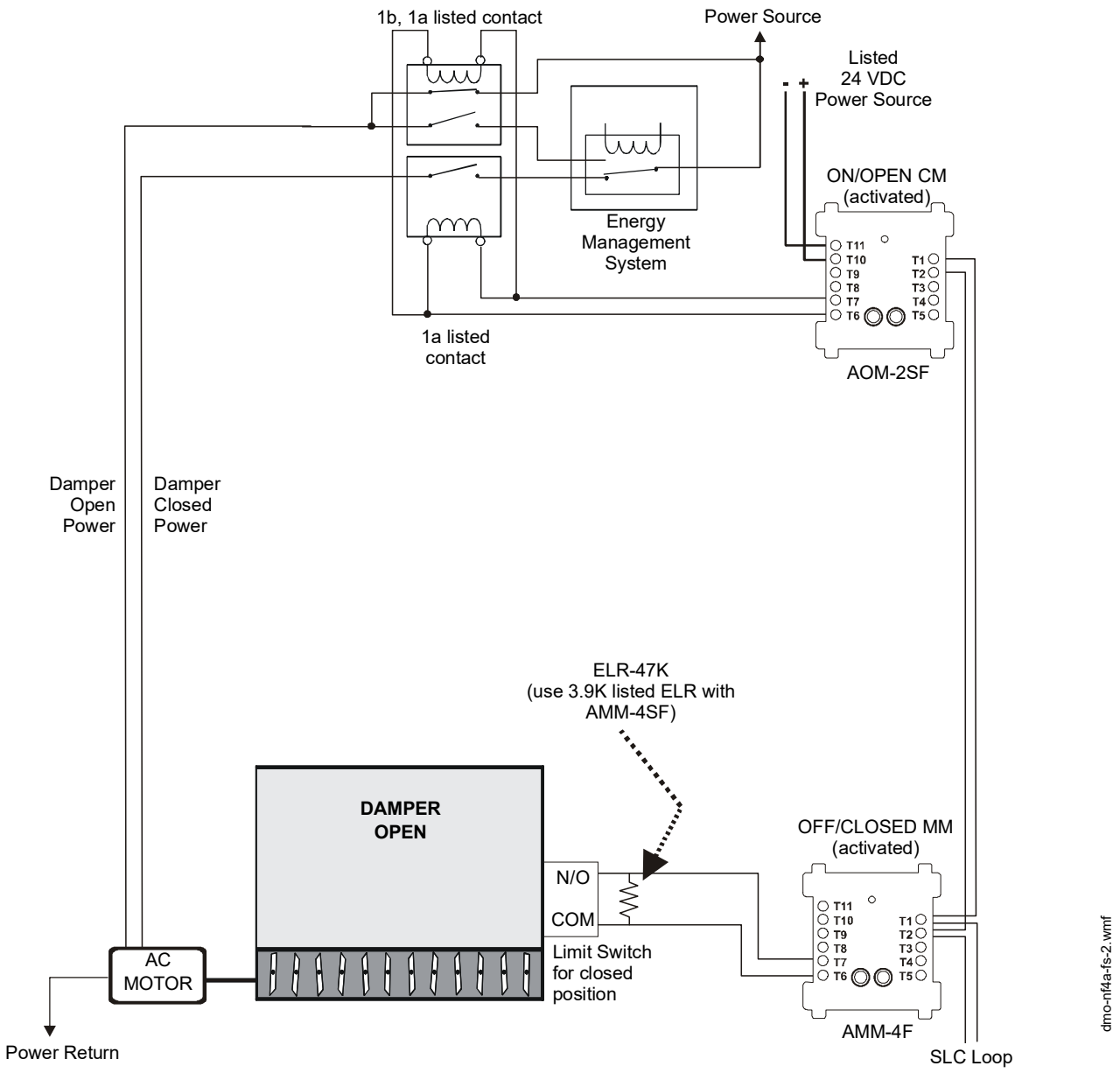


Figure B.26 Non-dedicated Motorized Damper Wiring (Type 4)

Type 4: Damper OPEN Control, Damper CLOSED Monitoring

Figure B.26 shows wiring in a non-dedicated system that is capable of CLOSED control of a motorized damper and can monitor the damper's CLOSED state (Type 4). In this arrangement, the ON/OPEN CM is activated. The ON/OPEN CM controls two contacts: a normally closed contact for the damper closed power line, and a dual normally open/normally closed contact for the damper open power line.

When the ON/OPEN CM is activated, the normally closed contact is opened (cutting any power supplied by the EMS to the damper closed power line), the normally closed portion of the dual contact is opened (cutting any power supplied by the EMS to the damper open power line), and the normally open portion of the dual contact is closed, thus supplying power to close the damper.

When the ON/OPEN CM is deactivated, the EMS is free to control the damper. The EMS is currently being overridden by the ON/OPEN CM.When power is supplied to the damper open power line, the damper opens. When the damper completely opens, the damper open limit switch is CLOSED, indicating that the damper is in the OPEN position.

The OFF/CLOSED MM monitors the closed position of the damper closed limit switch. In this case, the OFF/CLOSED MM is deactivated because the damper is open.

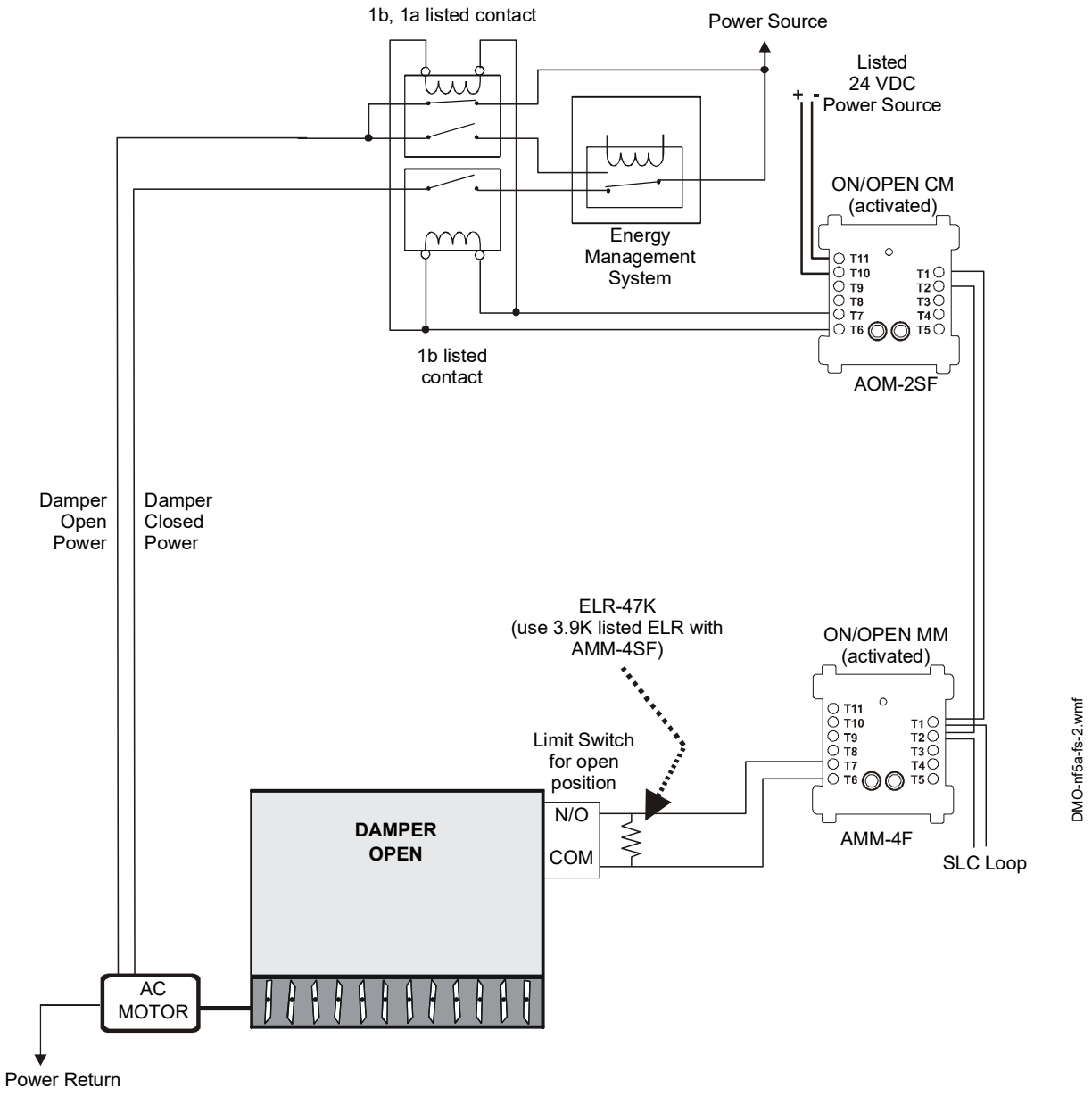


Figure B.27 Non-dedicated Motorized Damper Wiring (Type 5)

Type 5: Damper OPEN Control, Damper OPEN Monitoring

Figure B.27 shows wiring in a non-dedicated system that is capable of OPEN control of a motorized damper and can monitor the damper's OPEN state (Type 5). In this arrangement, the ON/OPEN CM is activated. The ON/OPEN CM controls two contacts: a normally closed contact for the damper closed power line, and a dual normally open/ normally closed contact for the damper open power line.

When the ON/OPEN CM is activated, the normally closed contact is opened (cutting any power supplied by the EMS to the damper closed power line), the normally closed portion of the dual contact is opened (cutting any power supplied by the EMS to the damper open power line), and the normally open portion of the dual contact is closed, thus supplying power to close the damper.

When the ON/OPEN is deactivated, the EMS is free to control the damper. The EMS is currently being overridden by the ON/OPEN CM. When power is supplied to the damper open power line, the damper opens. When the damper completely opens, the damper open limit switch is closed, indicating that the damper is in the open position.

The ON/OPEN MM monitors the closed position of the damper open limit switch. In this case the ON/OPEN MM is activated because the damper is open.

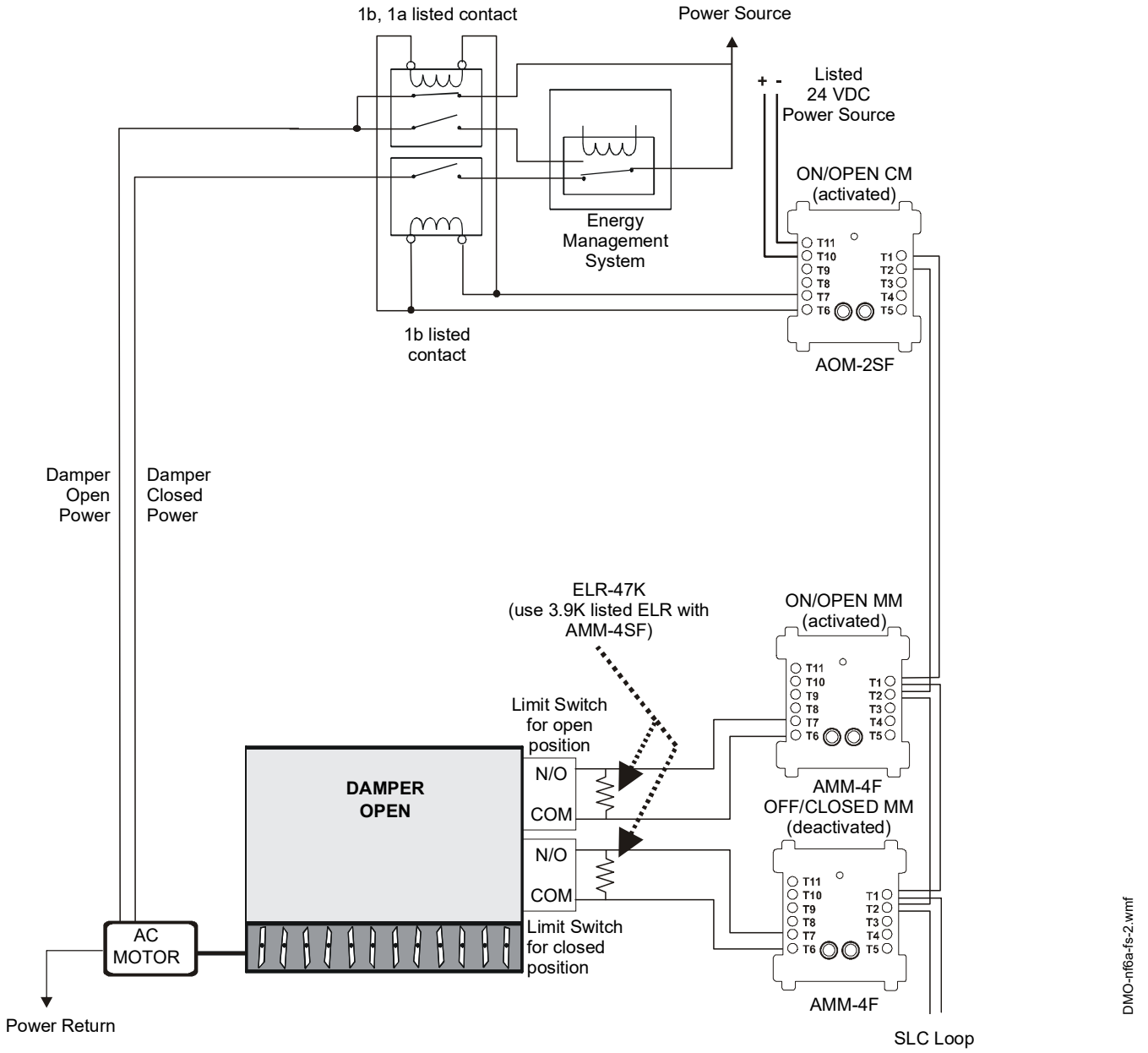


Figure B.28 Non-dedicated Motorized Damper Wiring (Type 6)

Type 6: Damper OPEN Control, Damper OPEN and CLOSED Monitoring

Figure B.28 shows wiring in a non-dedicated system that is capable of OPEN control of a motorized damper and can monitor the damper's OPEN and CLOSED states (Type 6). In this arrangement, the ON/OPEN CM is activated. The ON/OPEN CM controls two contacts: a normally closed contact for the damper closed power line, and a dual normally open/normally closed contact for the damper open power line.

When the ON/OPEN CM is activated, the normally closed contact is opened (cutting any power supplied by the EMS to the damper closed power line), the normally closed portion of the dual contact is opened (cutting any power supplied by the EMS to the damper open power line), and the normally open portion of the dual contact is closed, thus supplying power to close the damper.

When the ON/OPEN CM is deactivated, the EMS is free to control the damper. The EMS is currently being overridden by the ON/OPEN CM. When power is supplied to the damper open power line, the damper opens. When the damper completely opens, the damper open limit switch is closed, indicating that the damper is in the open position.

The OFF/CLOSED MM monitors the closed position of the damper closed limit switch and the ON/OPEN MM monitors the closed position of the damper open limit switch. In this case the OFF/CLOSED MM is deactivated and the ON/OPEN MM is activated because the damper is open.

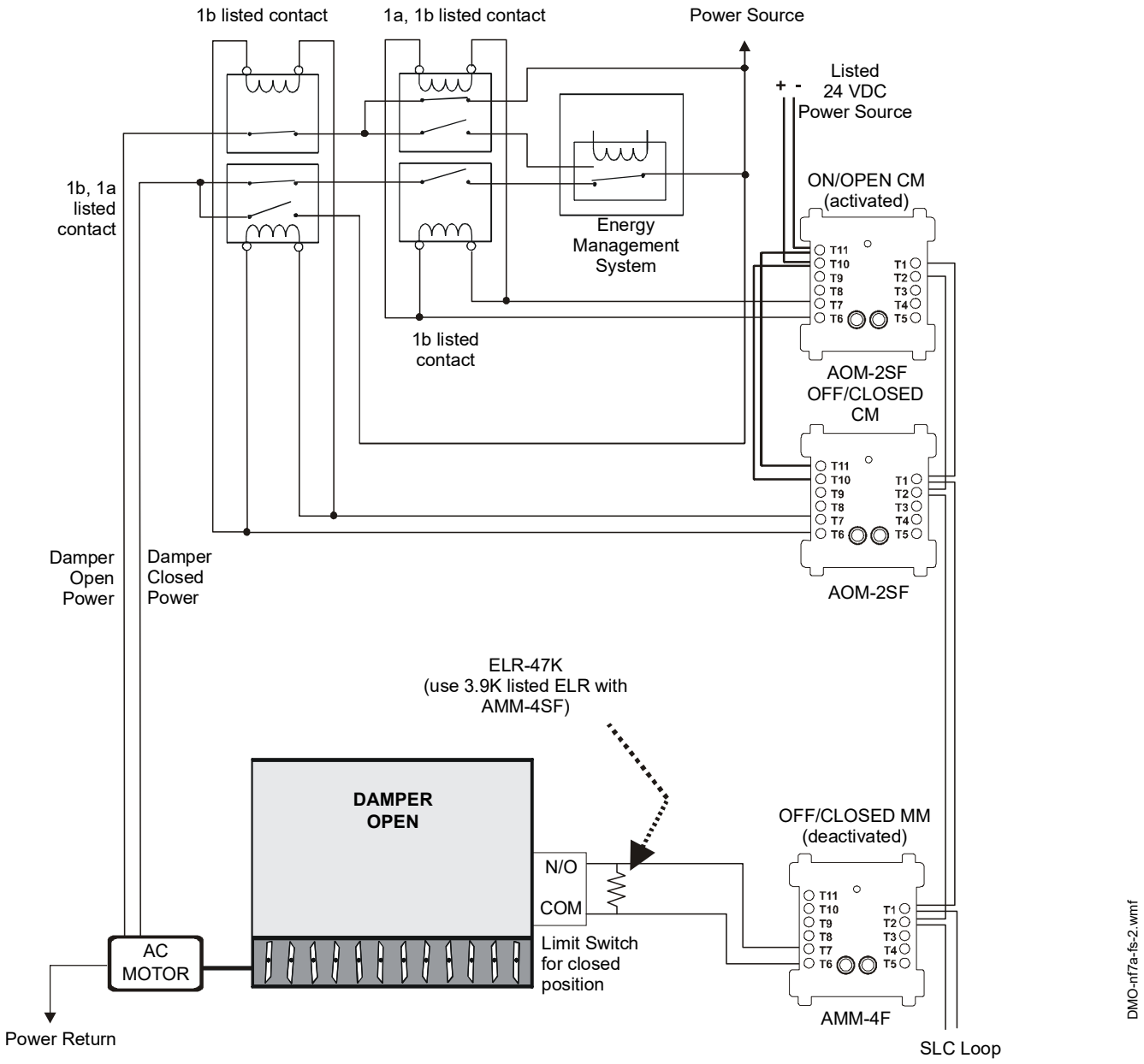


Figure B.29 Non-dedicated Motorized Damper Wiring (Type 7)

Type 7: Damper OPEN and CLOSED Control, Damper CLOSED Monitoring

Figure B.29 shows wiring in a non-dedicated system that is capable of OPEN and CLOSED control of a motorized damper and can monitor the damper's CLOSED state (Type 7). In this arrangement, the ON/OPEN CM is activated and the OFF/CLOSED CM is deactivated. Under normal operation (non-smoke control mode) both control modules would be deactivated, allowing the EMS system to freely control the damper.

The ON/OPEN CM controls two contacts: a normally closed contact for the damper closed power line, and a dual normally open/normally closed contact for the damper open power line. The OFF/CLOSED CM controls two contacts: a normally closed contact for the damper open power line, and a dual normally open/normally closed contact for the damper close power line. When the ON/OPEN CM is activated, the OFF/CLOSED CM is deactivated, and vice versa.

When the ON/OPEN CM is activated, the normally closed contact is opened (cutting any power supplied by the EMS to the damper closed power line), the normally closed portion of the dual contact is opened (cutting any power supplied by the EMS to the damper open power line), and the normally open portion of the dual contact is closed, thus supplying power to open the damper. When power is supplied to the damper open power line, the damper opens. When the damper completely opens, the damper open limit switch is closed, indicating that the damper is in the open position.

The OFF/CLOSED MM monitors the closed position of the damper closed limit switch. In this case the OFF/CLOSED MM is deactivated because the damper is open.

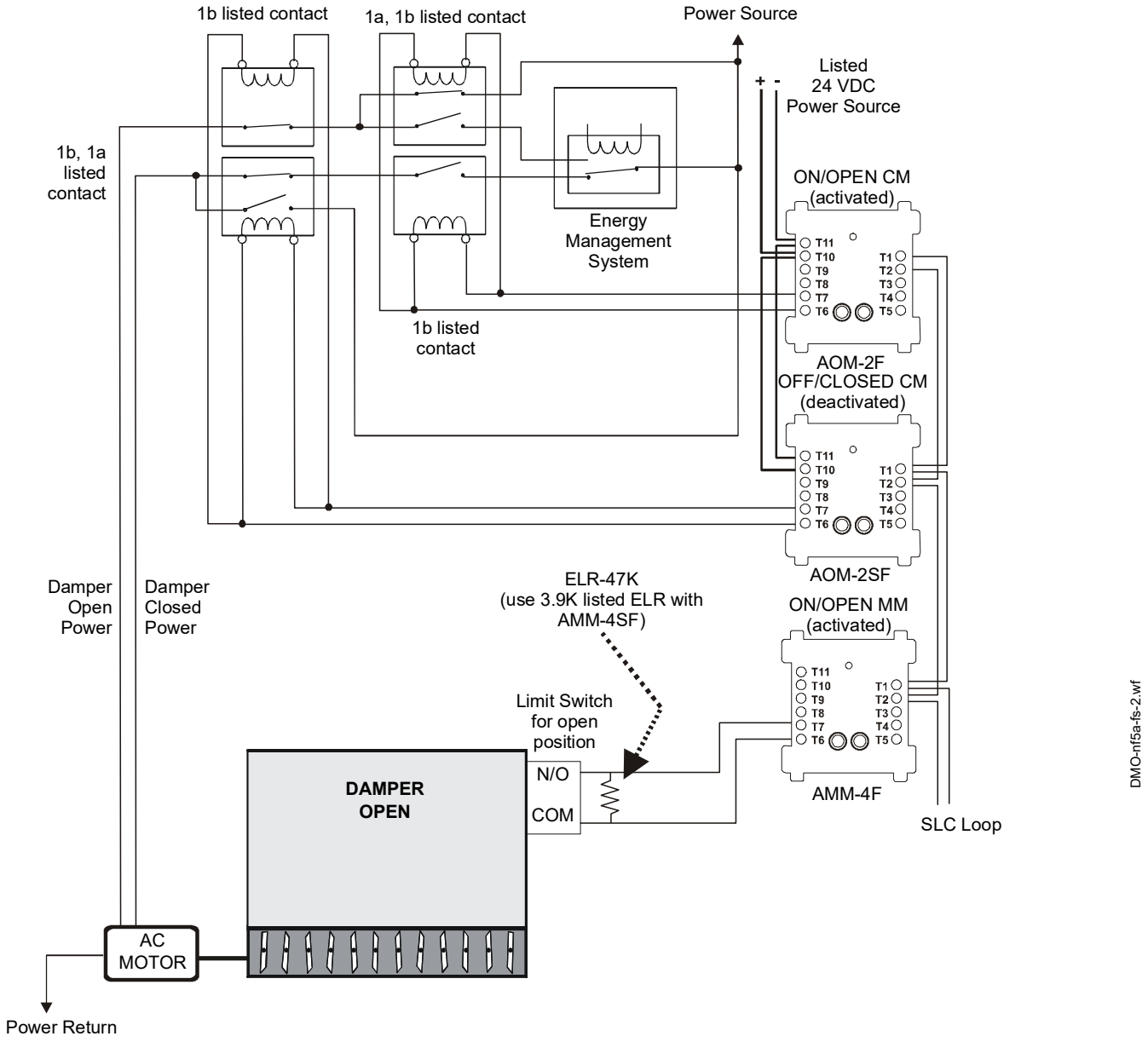


Figure B.30 Non-dedicated Motorized Damper Wiring (Type 8)

Type 8: Damper OPEN and CLOSED Control, Damper OPEN Monitoring

Figure B.30 shows wiring in a non-dedicated system that is capable of OPEN and CLOSED control of a motorized damper and can monitor the damper's OPEN state (Type 8). In this arrangement, the ON/OPEN CM CON is activated and the OFF/CLOSED CM is deactivated. Under normal operation (non smoke control mode) both control modules would be deactivated, allowing the EMS system to freely control the damper.

The ON/OPEN CM controls two contacts: a normally closed contact for the damper closed power line, and a dual normally open/normally closed contact for the damper open power line. The OFF/CLOSED CM controls two contacts: a normally closed contact for the damper open power line, and a dual normally open/normally closed contact for the damper close power line. When the ON/OPEN CM is activated, the OFF/CLOSED CM is deactivated, and vice versa.

When the ON/OPEN CM is activated, the normally closed contact is opened (cutting any power supplied by the EMS to the damper closed power line), the normally closed portion of the dual contact is opened (cutting any power supplied by the EMS to the damper open power line), and the normally open portion of the dual contact is closed, thus supplying power to the damper. When power is supplied to the damper open power line, the damper opens. When the damper completely opens, the damper open limit switch is closed, indicating that the damper is in the open position.

The ON/OPEN MM monitors the closed position of the damper open limit switch. In this case the ON/OPEN MM is activated because the damper is open.

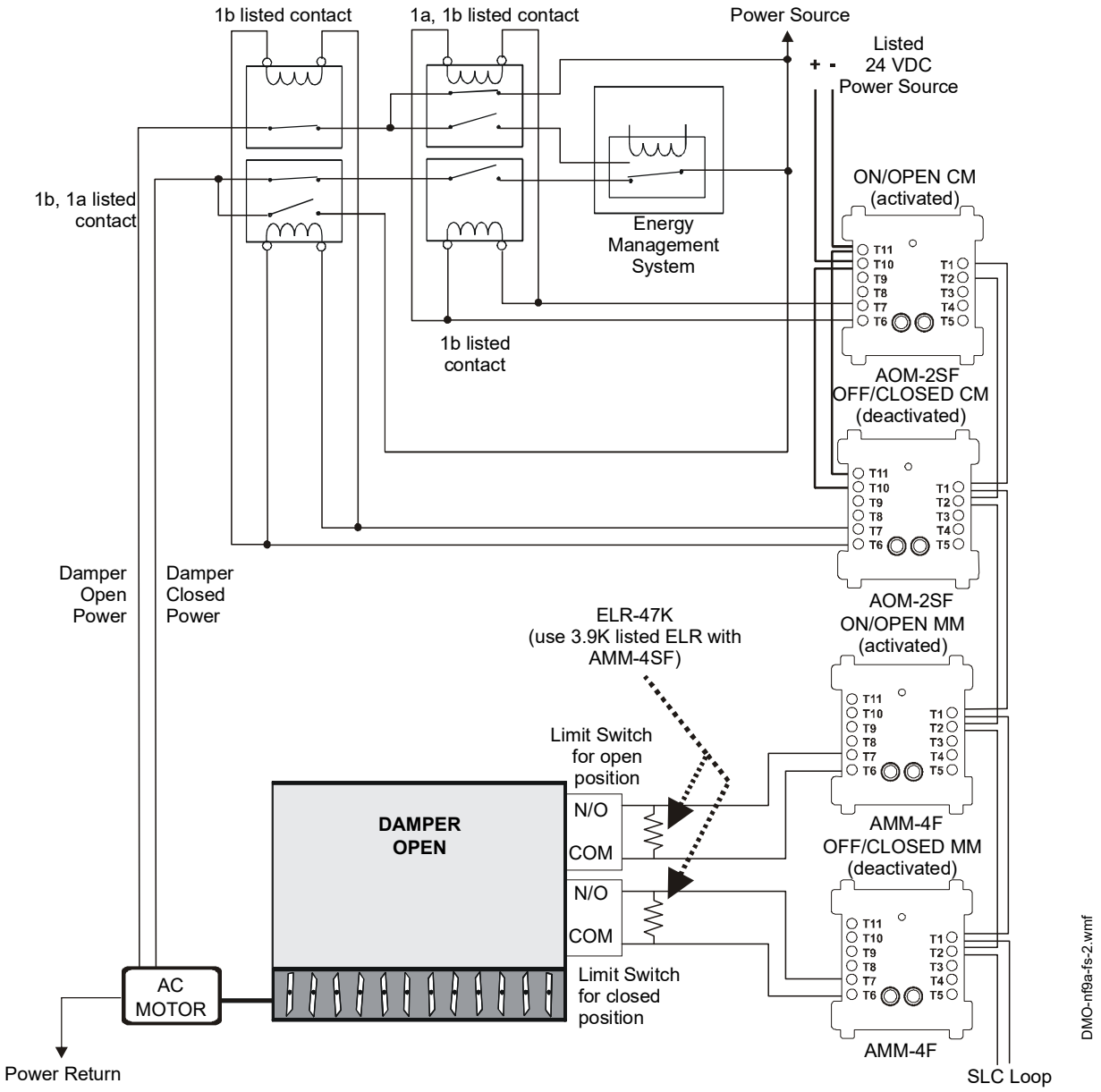


Figure B.31 Non-dedicated Motorized Damper Wiring (Type 9)

Type 9: Damper OPEN and CLOSED Control, Damper OPEN and CLOSED Monitoring

Figure B.31 shows wiring in a non-dedicated system that is capable of OPEN and CLOSED control of a motorized damper and can monitor the damper's OPEN and CLOSED states (Type 9). In this arrangement, the ON/OPEN CM is activated and the OFF/CLOSED CM is deactivated. Under normal operation (non-smoke control mode) both control modules would be deactivated, allowing the EMS system to freely control the damper.

The ON/OPEN CM controls two contacts: a normally closed contact for the damper closed power line, and a dual normally open/normally closed contact for the damper open power line. The OFF/CLOSED CM controls two contacts: a normally closed contact for the damper open power line, and a dual normally open/normally closed contact for the damper close power line. When the ON/OPEN CM is activated, the OFF/CLOSED CM is deactivated, and vice versa.

When the ON/OPEN CM is activated, the normally closed contact is opened (cutting any power supplied by the EMS to the damper closed power line), the normally closed portion of the dual contact is opened (cutting any power supplied by the EMS to the damper open power line), and the normally open portion of the dual contact is closed, thus supplying power to open the damper. When power is supplied to the damper open power line, the damper opens. When the damper completely opens, the damper open limit switch is closed and the damper closed switch opens, indicating that the damper is in the open position.

The ON/OPEN MM monitors the closed position of the damper open limit switch and the OFF/CLOSED MM monitors the closed position of the damper closed limit switch. In this case, the ON/OPEN MM is activated and the OFF/CLOSED MM is deactivated because the damper is open.

B.3.3 Non-dedicated EP Dampers

Electrical to Pressure (EP) dampers use airflow to operate the opening and closing of the damper. When power is applied to the pressure switch, airflow going to the damper is cut off and the damper closes. When no power is supplied to the pressure switch, airflow is continuous and keeps the damper open.

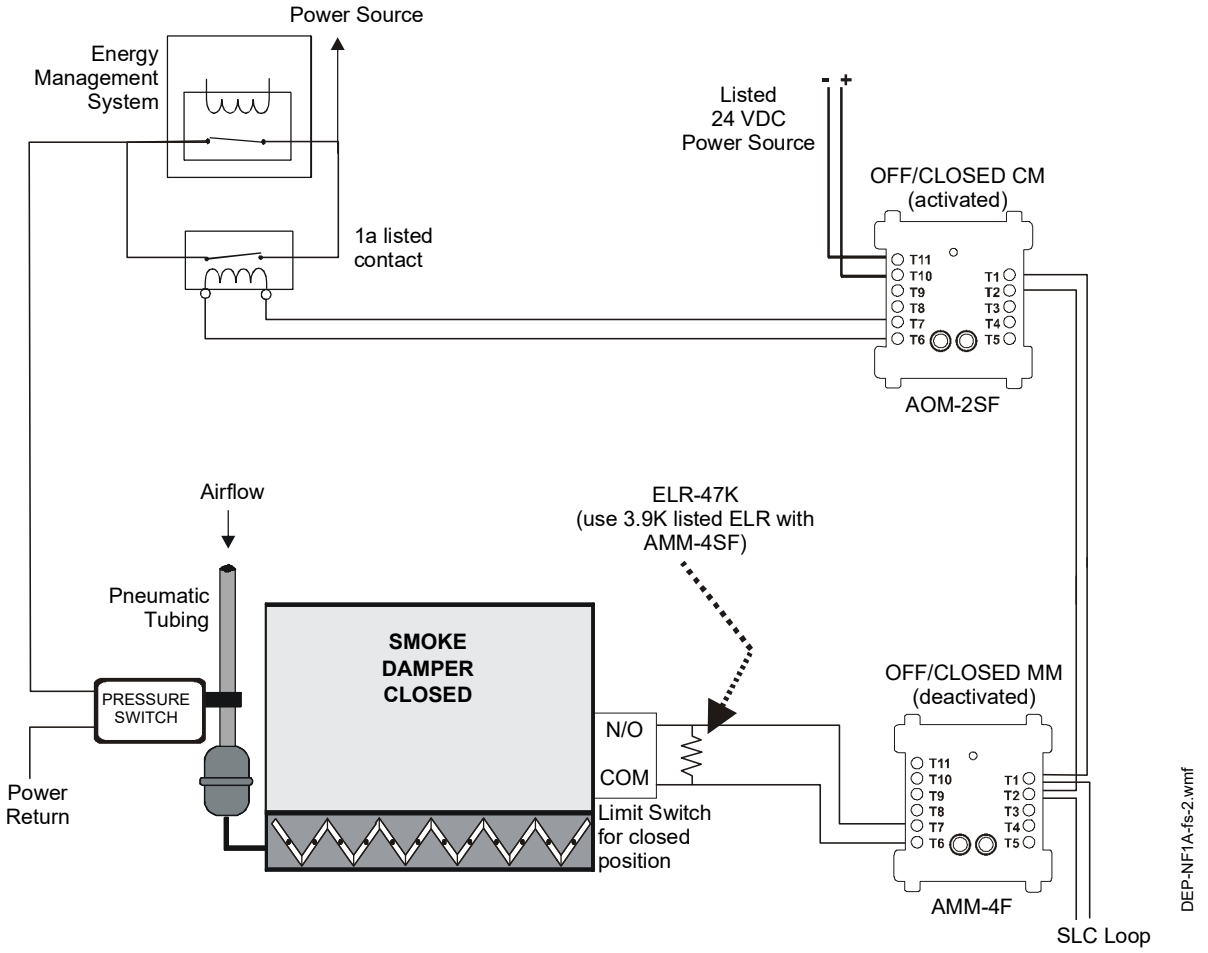


Figure B.32 Non-dedicated EP Damper Wiring (Type 1)

Type 1: EP Damper CLOSED Control, EP Damper CLOSED Monitoring

Figure B.32 shows wiring in a non-dedicated system that is capable of CLOSED control of an EP damper and can monitor the damper's CLOSED states (Type 1). In this arrangement, the OFF/CLOSED CM is activated. The OFF/CLOSED CM controls a normally open contact for the pressure switch power line.

When the OFF/CLOSED CM is activated, the normally open contact is closed. When the contact closes, power is supplied to the pressure switch, which cuts the airflow to the damper and closes it. When the OFF/CLOSED CM is deactivated, the EMS is free to control the damper. The EMS is currently being overridden by the OFF/CLOSED CM. When power is supplied to the pressure switch, the damper closes. When the damper completely closes, the damper closed limit switch is closed, indicating that the damper is in the closed position.

The OFF/CLOSED MM monitors the closed position of the damper closed limit switch. In this case the OFF/CLOSED MM is activated because the damper is closed.

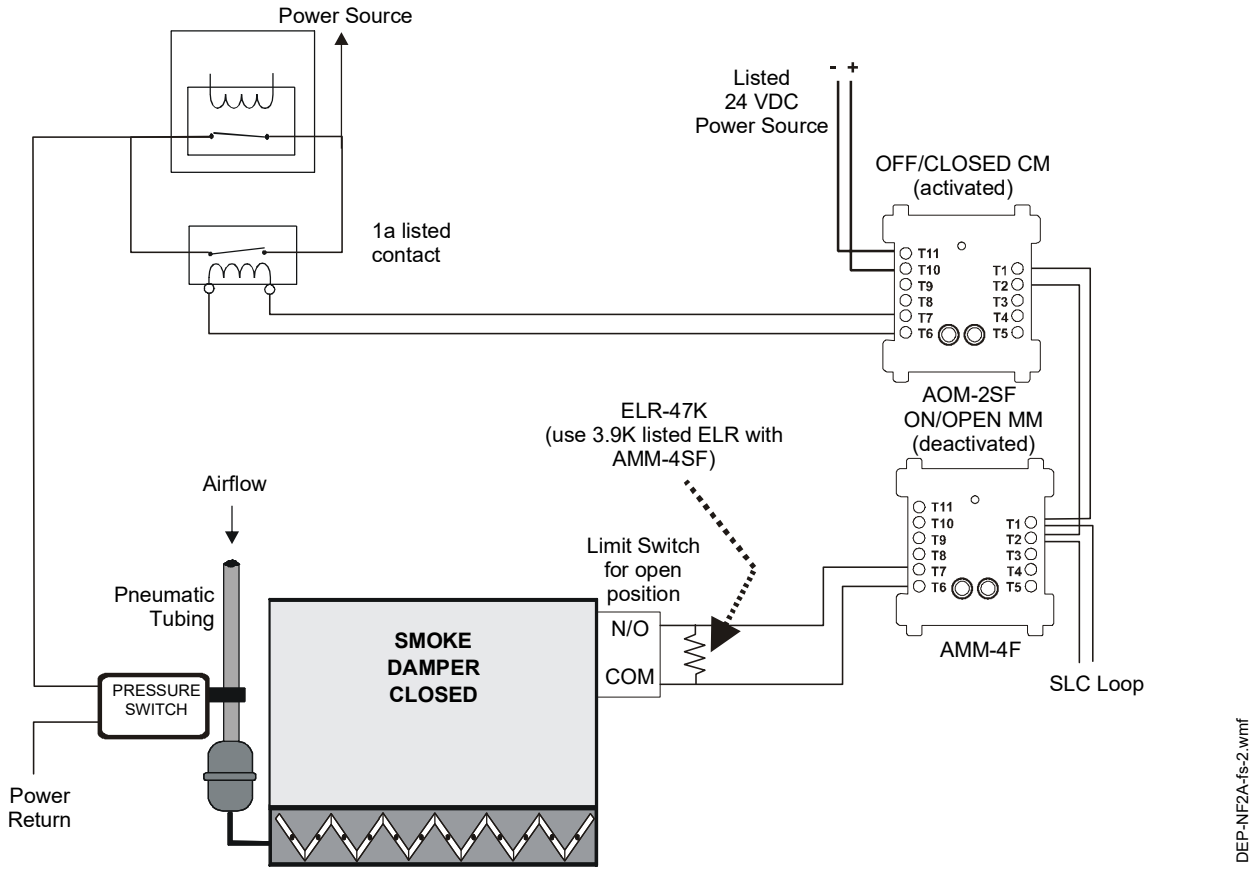


Figure B.33 Non-dedicated EP Damper Wiring (Type 2)

Type 2: EP Damper CLOSED Control, EP Damper OPEN Monitoring

Figure B.33 shows wiring in a non-dedicated system that is capable of CLOSED control of an EP damper and can monitor the damper's OPEN state (Type 2). In this arrangement, the OFF/CLOSED CM is activated. The OFF/CLOSED CM controls a normally open contact for the pressure switch power line.

When the OFF/CLOSED CM is activated, the normally open contact is closed. When the contact closes, power is supplied to the pressure switch, which cuts the airflow to the damper and closes it. When the OFF/CONTROL CM is deactivated, the EMS is free to control the damper. The EMS is currently being overridden by the OFF/CLOSED CM. When power is supplied to the pressure switch, the damper closes. When the damper completely closes, the damper closed limit switch is closed, indicating that the damper is in the closed position.

The ON/OPEN MM monitors the closed position of the damper closed limit switch. In this case the ON/OPEN MM is deactivated because the damper is closed.

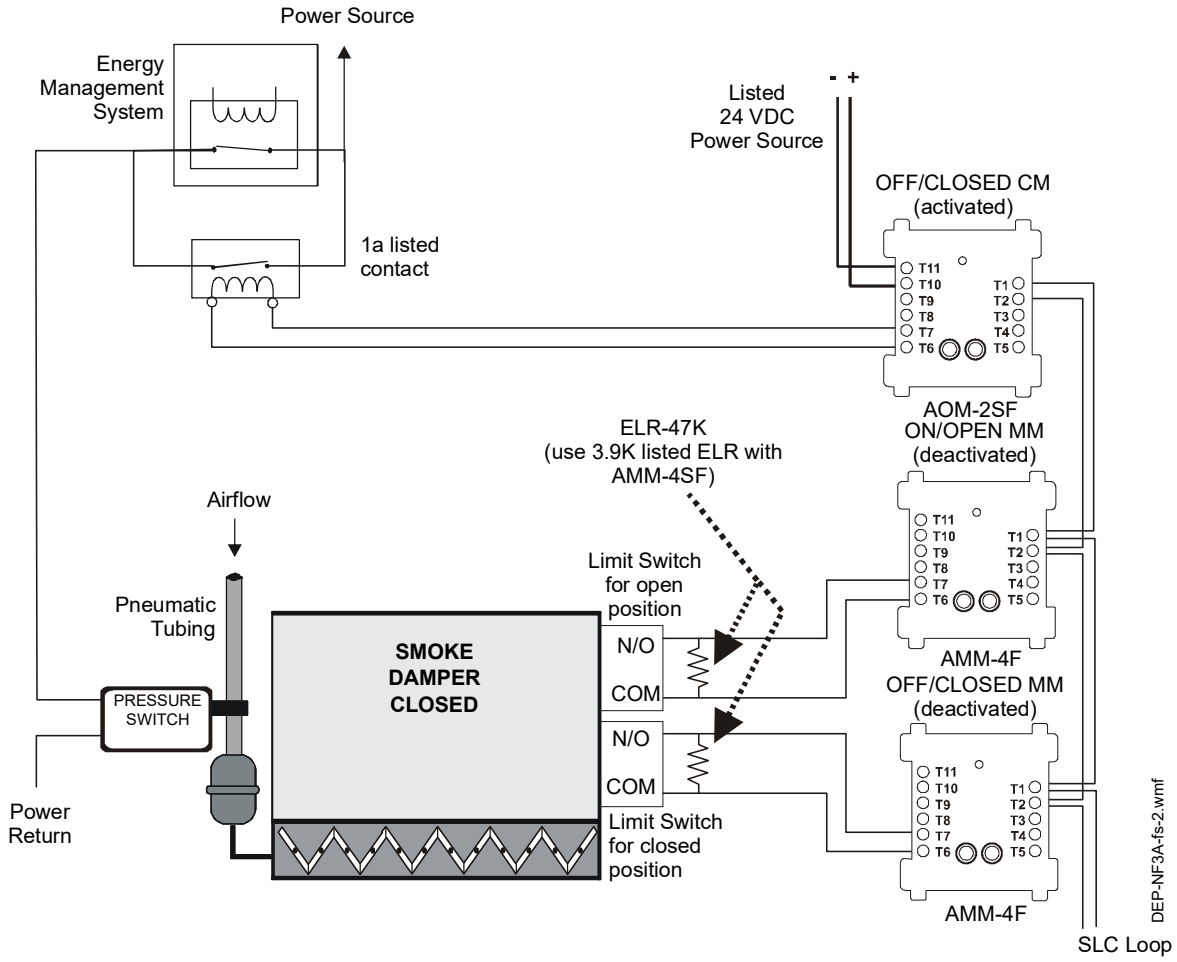


Figure B.34 Non-dedicated EP Damper Wiring (Type 3)

Type 3: EP Damper CLOSED Control, EP Damper OPEN and CLOSED Monitoring

Figure B.34 shows wiring in a non-dedicated system that is capable of CLOSED control of an EP damper and can monitor the damper's OPEN and CLOSED states (Type 3). In this arrangement, the OFF/CLOSED CM is activated. The OFF/CLOSED CM controls a normally open contact for the pressure switch power line.

When the OFF/CLOSED CM is activated, the normally open contact is closed. When the contact closes, power is supplied to the pressure switch, which cuts the airflow to the damper and closes it. When the OFF/CLOSED CM is deactivated, the EMS is free to control the damper. The EMS is currently being overridden by the OFF/CLOSED CM. When power is supplied to the pressure switch, the damper closes. When the damper completely closes, the damper closed limit switch is closed and the damper open limit switch is open, indicating that the damper is in the closed position.

The OFF/CLOSED MM monitors the closed position of the damper closed limit switch and the ON/OPEN MM monitors the closed position of the damper open limit switch. In this case the OFF/CLOSED MM is activated and the ON/OPN MM is deactivated because the damper is closed.

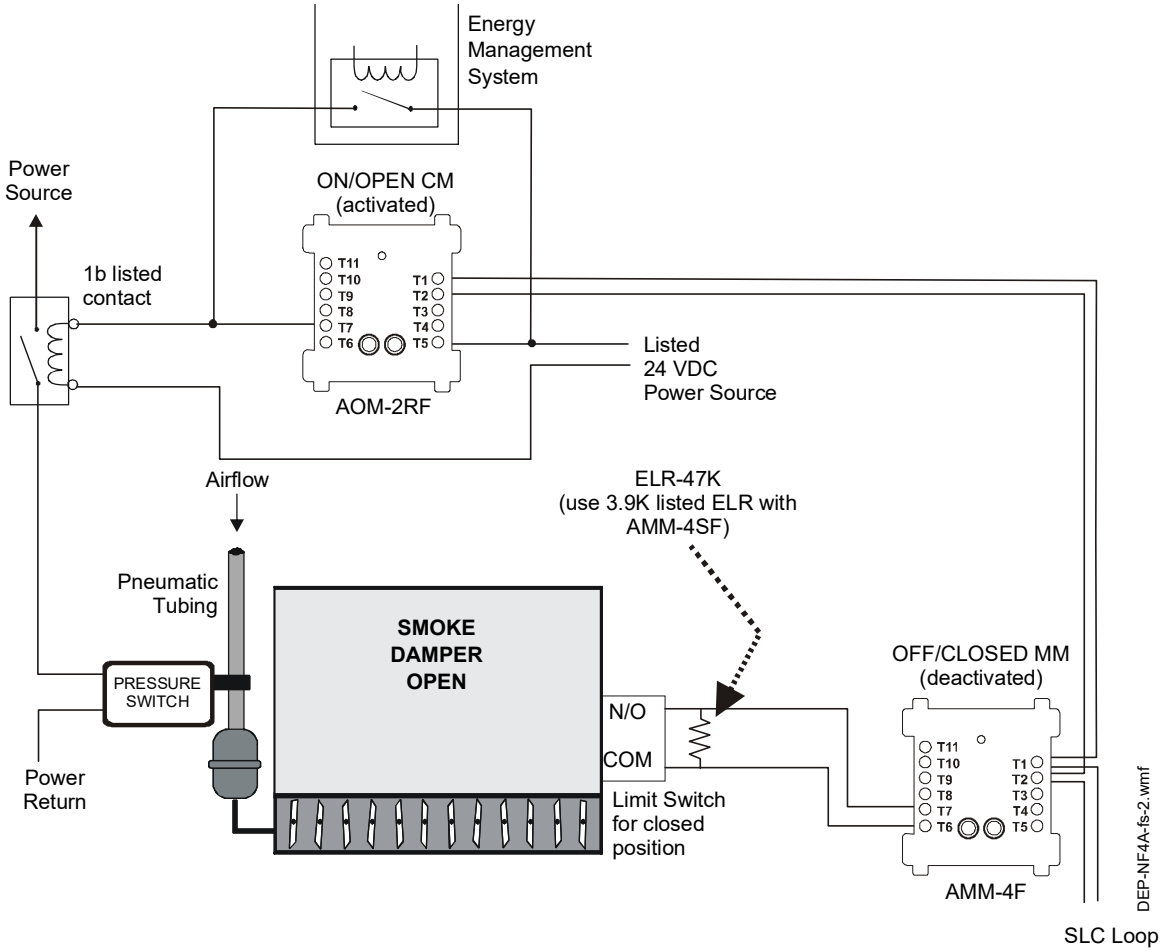


Figure B.35 Non-dedicated EP Damper Wiring (Type 4)

Type 4: EP Damper OPEN Control, EP Damper CLOSED Monitoring

Figure B.35 shows wiring in a non-dedicated system that is capable of OPEN control of an EP damper and can monitor the damper's CLOSED state (Type 4). In this arrangement, the ON/OPEN CM is activated. The ON/OPEN CM controls a normally closed contact for the pressure switch power line.

When ON/OPEN CM is activated, the normally closed contact is opened. When the contact opens, power is cut from the pressure switch, which allows airflow to open the damper. When the ON/OPEN CM is deactivated, the EMS is free to control the damper. The EMS is currently being overridden by the ON/OPEN CM. When power is cut from the pressure switch, the damper opens. When the damper completely opens, the damper open limit switch is CLOSED and the damper closed limit switch is OPEN, indicating that the damper is in the OPEN position.

The OFF/CLOSED MM monitors the closed position of the limit switch. In this case the OFF/CLOSED MM is deactivated because the damper is open.

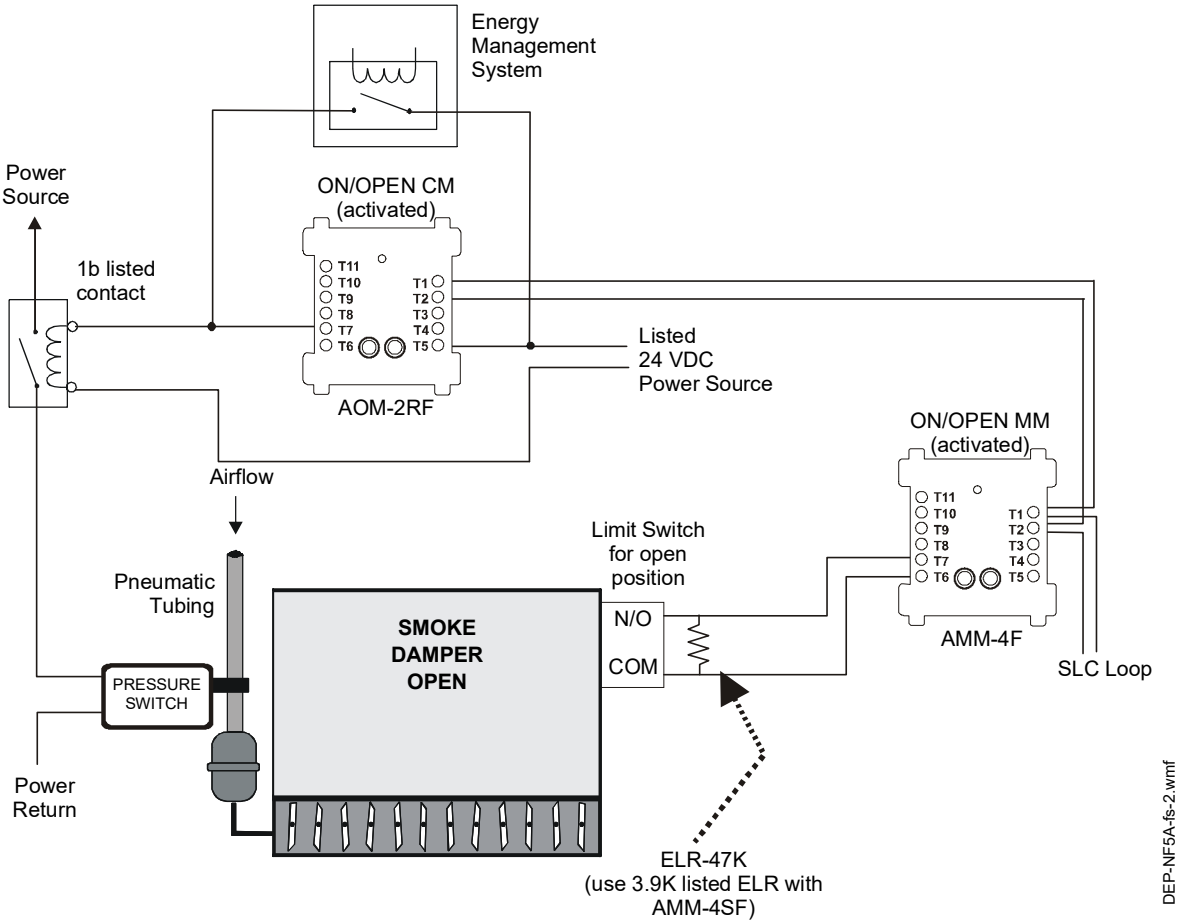


Figure B.36 Non-dedicated EP Damper Wiring (Type 5)

Type 5: EP Damper OPEN Control, EP Damper OPEN Monitoring

Figure B.36 shows wiring in a non-dedicated system that is capable of OPEN control of an EP damper and can monitor the damper's OPEN state (Type 5). In this arrangement, the ON/OPEN CM is activated. The ON/OPEN CM controls a normally closed contact for the pressure switch power line.

When the ON/OPEN CM is activated, the normally closed contact is opened. When the contact opens, power is cut from the pressure switch, which allows airflow to open the damper. When the ON/OPEN CM is deactivated, the EMS is free to control the damper. The EMS is currently being overridden by the ON/OPEN CM. When power is cut from the pressure switch, the damper opens. When the damper completely opens, the damper open limit switch is closed and the damper closed limit switch is open, indicating that the damper is in the open position.

The ON/OPEN MM monitors the closed position of the damper open limit switch. In this case the ON/OPEN MM is activated because the damper is open.

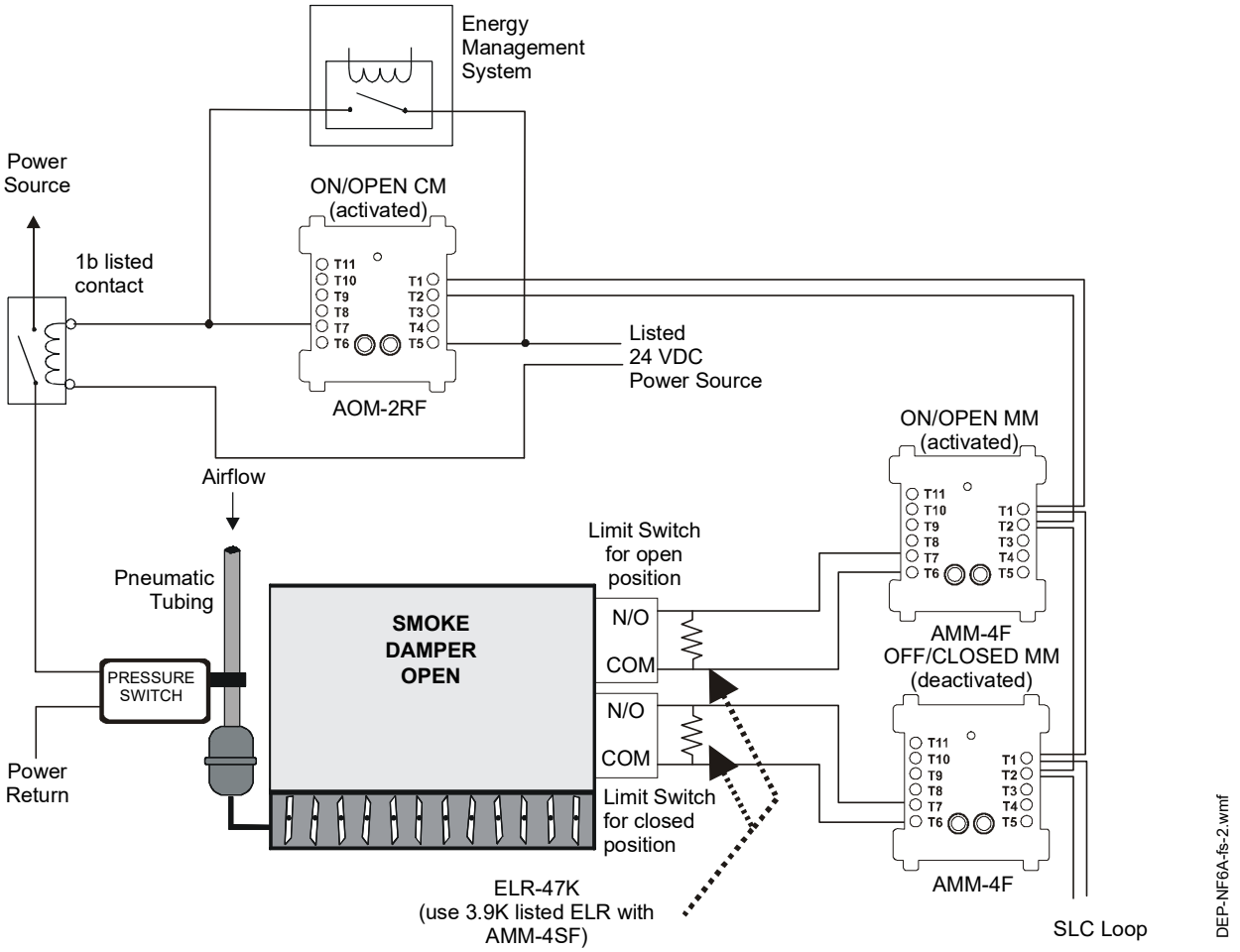


Figure B.37 Non-dedicated EP Damper Wiring (Type 6)

Type 6: EP Damper OPEN Control, EP Damper OPEN and CLOSED Monitoring

Figure B.37 shows wiring in a non-dedicated system that is capable of OPEN control of an EP damper and can monitor the damper's OPEN and CLOSED states (Type 6). In this arrangement, the ON/OPEN CM is activated. The ON/OPEN CM controls a normally closed contact for the pressure switch power line.

When the ON/OPEN CM is activated, the normally closed contact is opened. When the contact opens, power is cut from the pressure switch which allows airflow to open the damper. When the ON/OPEN CM is deactivated, the EMS is free to control the damper. The EMS is currently being overridden by the ON/OPEN CM. When power is cut from the pressure switch, the damper opens. When the damper completely opens, the damper open limit switch is closed and the damper closed limit switch is open, indicating that the damper is in the open position.

The ON/OPEN MM monitors the closed position of the damper open limit switch and the OFF/CLOSED MM monitors the closed position of the damper closed limit switch. In this case the ON/OPEN MM is activated and the OFF/CLOSED MM is deactivated because the damper is open.

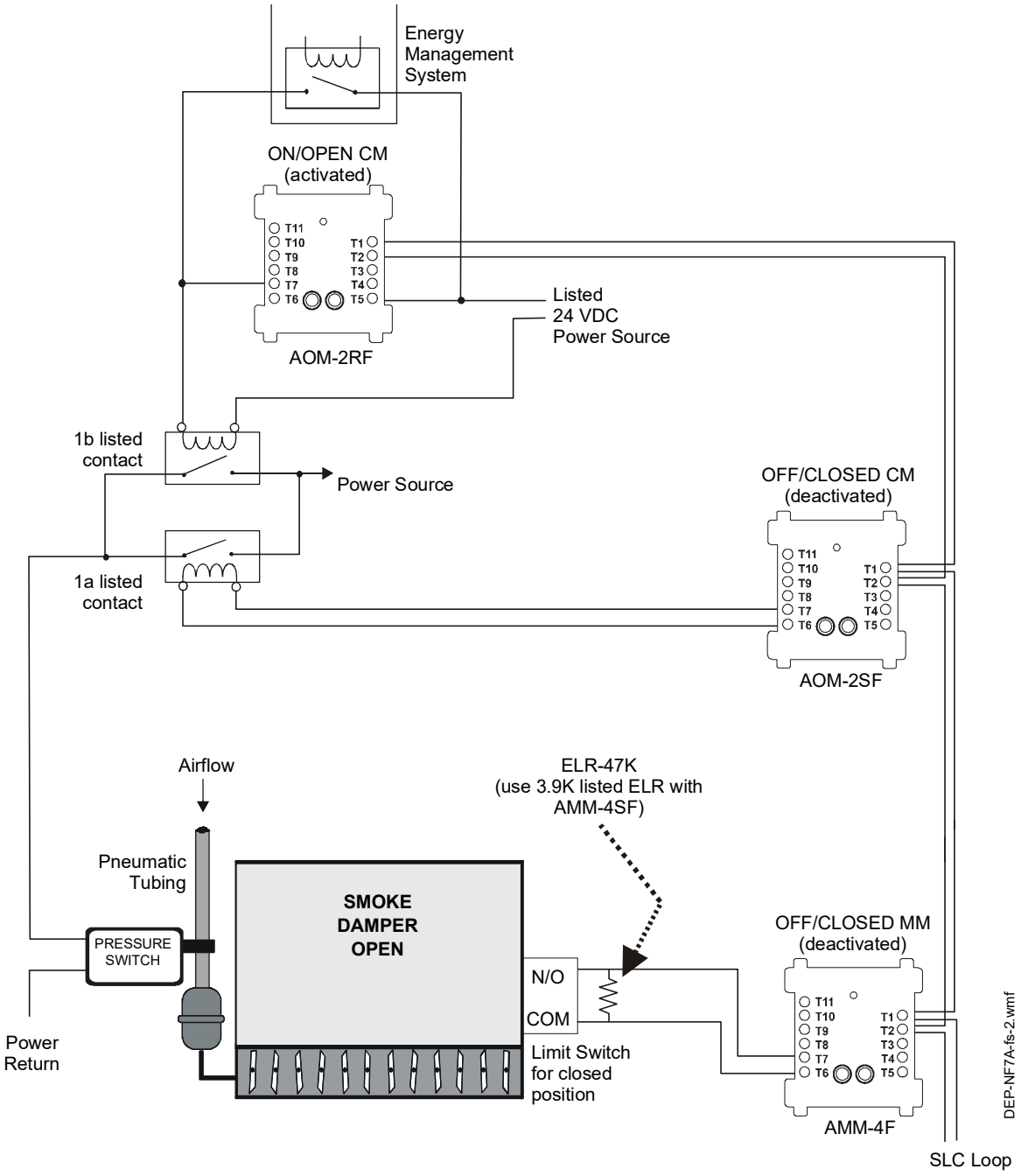


Figure B.38 Non-dedicated EP Damper Wiring (Type 7)

Type 7: EP Damper OPEN and CLOSED Control, EP Damper CLOSED Monitoring

Figure B.38 shows wiring in a non-dedicated system that is capable of OPEN and CLOSED control of an EP damper and can monitor the damper's CLOSED state (Type 7). In this arrangement, the ON/OPEN CM is activated and the OFF/CLOSED CM is deactivated. The ON/OPEN CM controls a normally closed contact for the pressure switch power line.

When the ON/OPEN is activated, the normally closed contact is opened. When the contact opens, power is cut from the pressure switch, which allows airflow to open the damper. When the ON/OPEN CM is deactivated, the EMS is free to control the damper. The EMS is currently being overridden by the ON/OPEN CM. When power is cut from the pressure switch, the damper opens. When the damper completely opens, the damper open limit switch is closed and the damper closed limit switch is open, indicating that the damper is in the open position.

The OFF/CLOSED MM monitors the closed position of the damper closed limit switch. In this case the OFF/CLOSED MM is deactivated because the damper is open.

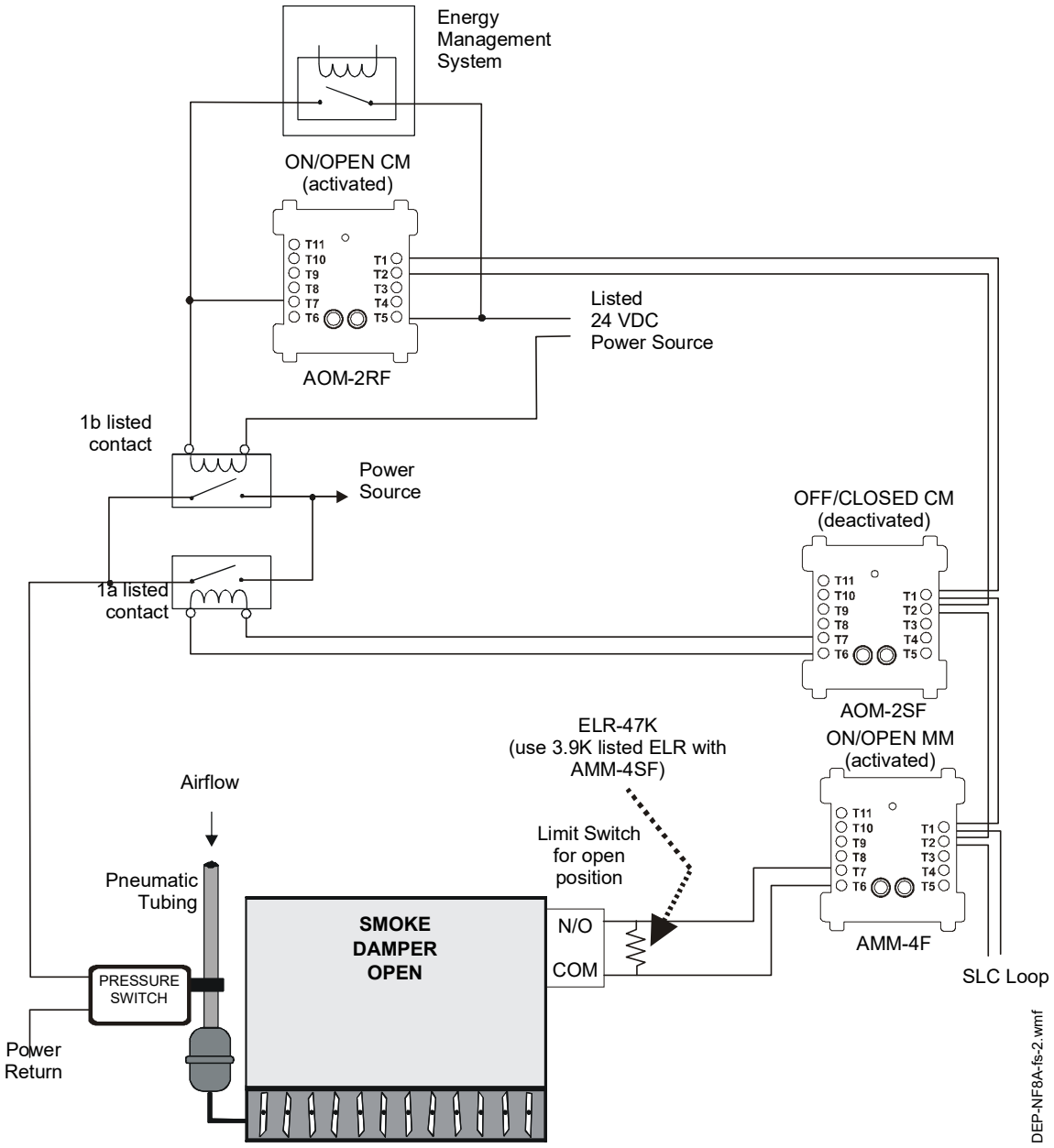


Figure B.39 Non-dedicated EP Damper Wiring (Type 8)

Type 8: EP Damper OPEN and CLOSED Control, EP Damper OPEN Monitoring

Figure B.39 shows wiring in a non-dedicated system that is capable of OPEN and CLOSED control of an EP damper and can monitor the damper's OPEN state (Type 8). In this arrangement, the ON/OPEN CM is activated and the OFF/CLOSED CM is deactivated. The ON/OPEN CM controls a normally closed contact for the pressure switch power line.

When the ON/OPEN CM is activated, the normally closed contact is opened. When the contact opens, power is cut from the pressure switch, which allows airflow to open the damper. When the ON/OPEN CM is deactivated, the EMS is free to control the damper. The EMS is currently being overridden by the ON/OPEN CM. When power is cut from the pressure switch, the damper opens. When the damper completely opens, the damper open limit switch is closed, indicating that the damper is in the open position.

The ON/OPEN MM monitors the closed position of the damper closed limit switch. In this case the ON/OPEN MM is activated because the damper is open.

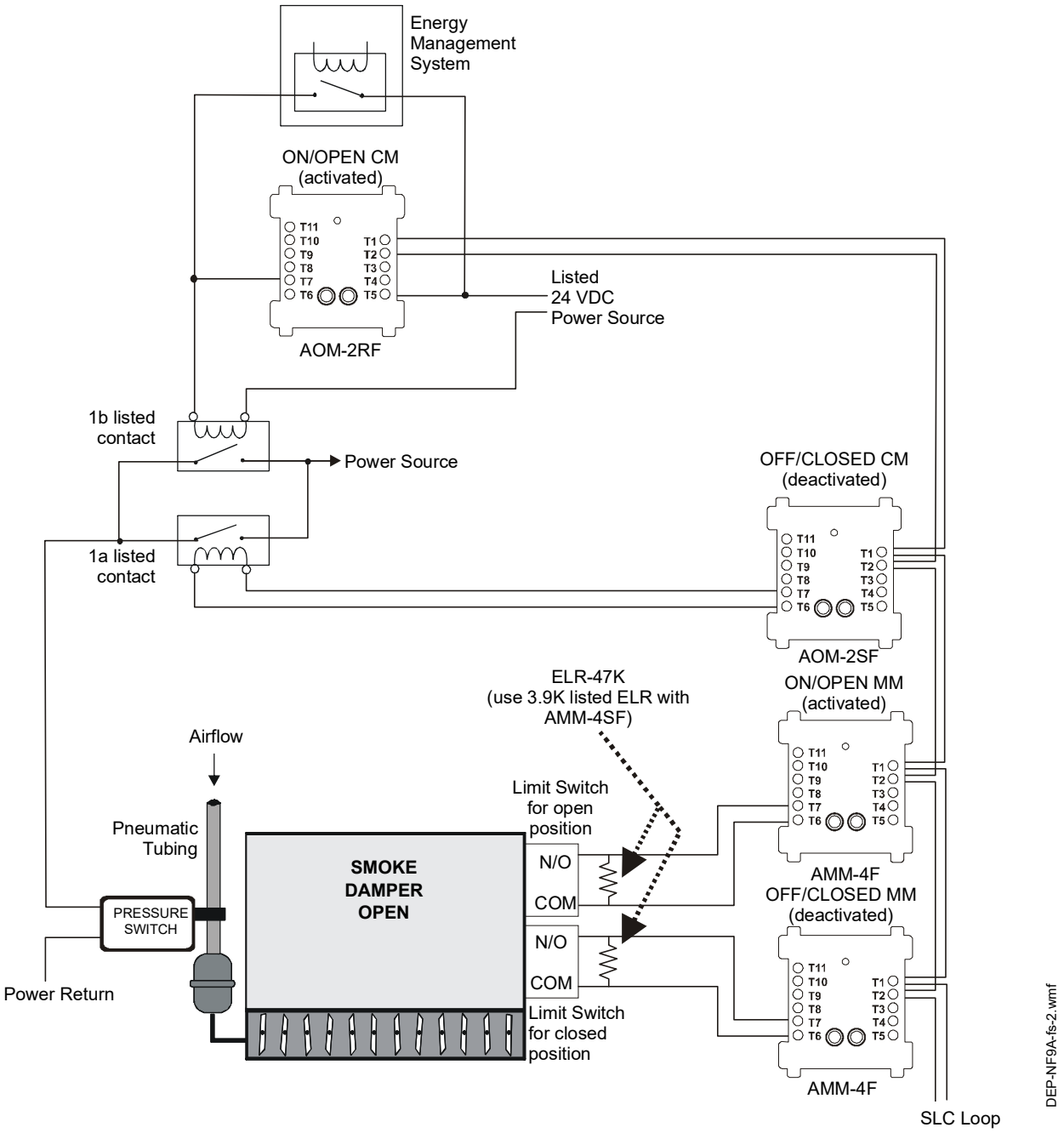


Figure B.40 Non-dedicated EP Damper Wiring (Type 9)

Type 9: EP Damper OPEN and CLOSED Control, EP Damper OPEN and CLOSED Monitoring

Figure B.40 shows wiring in a non-dedicated system that is capable of OPEN and CLOSED control of an EP damper and can monitor the damper's OPEN and CLOSED states (Type 9). In this arrangement, the ON/OPEN CM is activated and the OFF/CLOSED CM is deactivated. The ON/OPEN CM controls a normally closed contact for the pressure switch power line.

When the ON/OPEN CM is activated, the normally closed contact is opened. When the contact opens, power is cut from the pressure switch, which allows airflow to open the damper. When the ON/OPEN CM is deactivated, the EMS is free to control the damper. The EMS is currently being overridden by the ON/OPEN CM. When power is cut from the pressure switch, the damper opens. When the damper completely opens, the damper open limit switch is closed and the damper closed limit switch is open, indicating that the damper is in the open position.

The ON/OPEN MM monitors the closed position of the damper open limit switch and the OFF/CLOSED MM monitors the closed position of the damper closed limit switch. In this case the ON/OPEN MM is activated and the OFF/CLOSED MM is deactivated because the damper is open.

B.4 HVAC Appliances

B.4.1 HVAC Fans

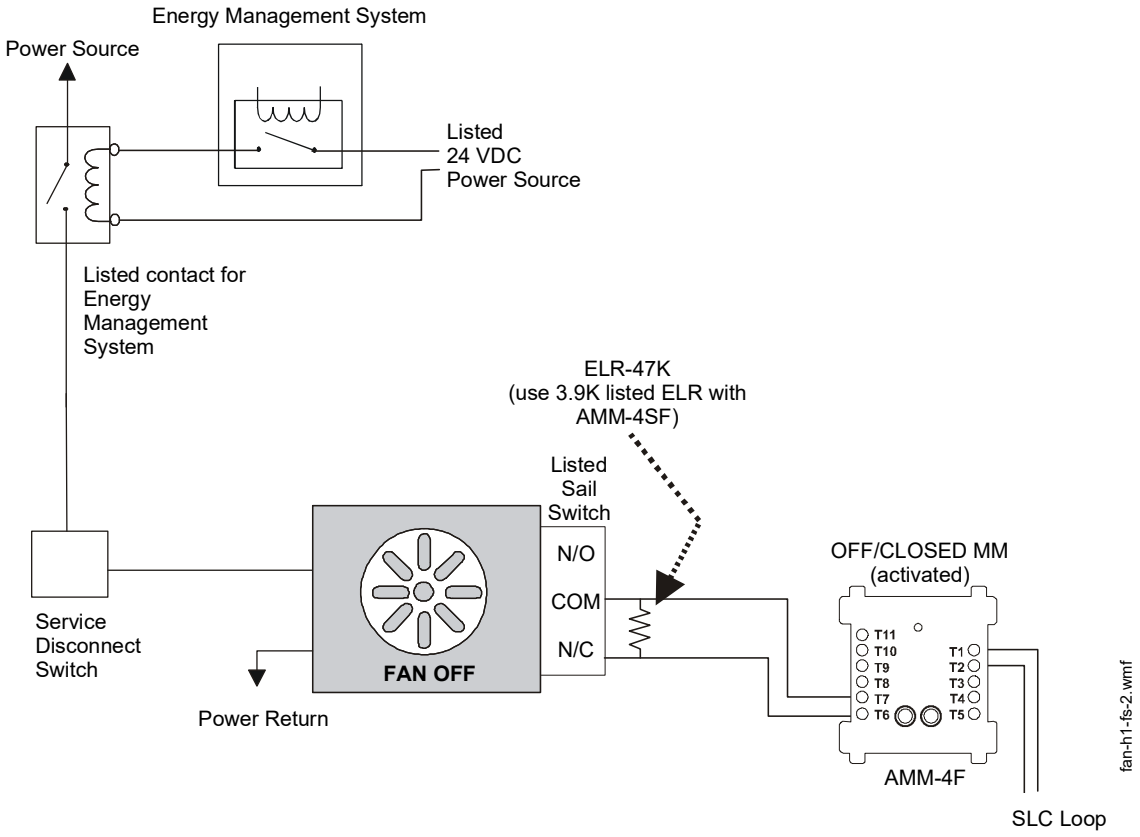


Figure B.41 HVAC Fan Wiring (Type 1)

Type 1: HVAC Fan OFF Monitoring

Figure B.41 shows wiring in an HVAC system that can monitor the fan's OFF state (Type 1). In this arrangement, the EMS is deactivated. The EMS controls a normally closed contact which switches power to the fan. When power is not being supplied to the fan, the fan is off and the sail switch is closed, indicating no airflow in the duct.

The OFF/CLOSED MM monitors the closed position of the sail switch, which would indicate when the fan is off. In this case the OFF/CLOSED MM is activated because the fan is off and the sail switch is closed.

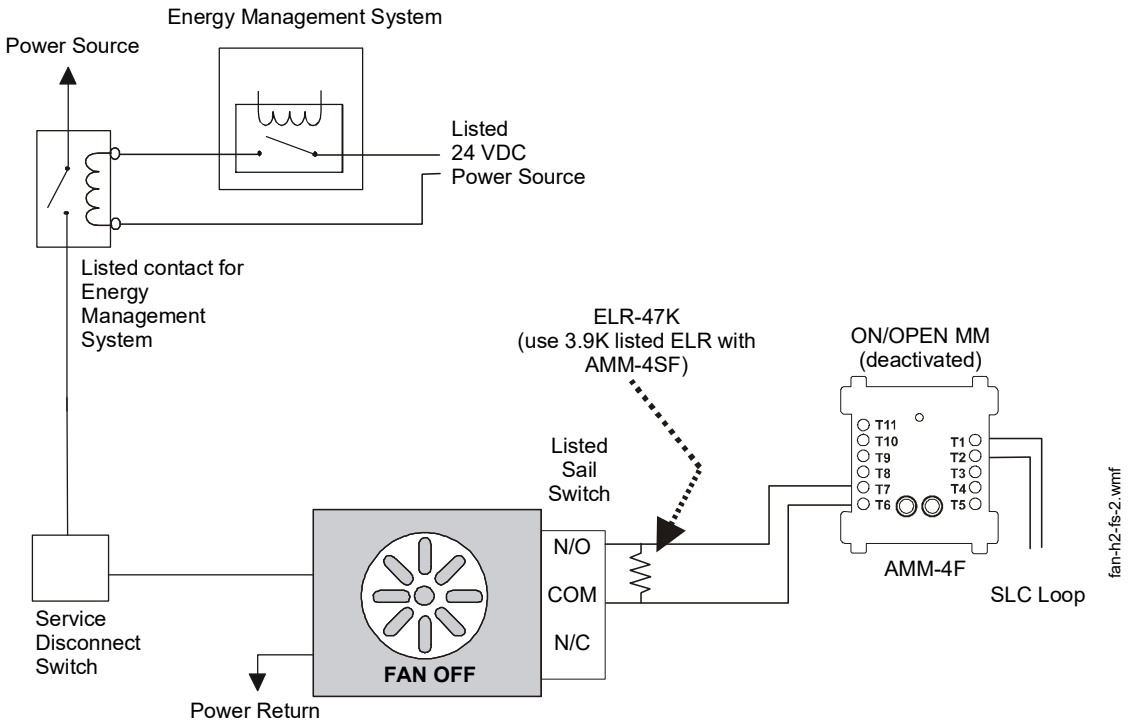


Figure B.42 HVAC Fan Wiring (Types 2, 3)

Type 2: HVAC Fan ON Monitoring

Figure B.42 shows wiring in an HVAC system that can monitor the fan's ON state (Type 2). In this arrangement, the EMS is deactivated. The EMS controls a normally closed contact which switches power to the fan. When power is not being supplied to the fan, the fan is off and the sail switch is closed, indicating no airflow in the duct.

The ON/OPEN MM monitors the open position of the sail switch, which would indicate when the fan is on. In this case the ON/OPEN MM is deactivated because the fan is off and the sail switch is closed.

Type 3: HVAC Fan ON and OFF Monitoring

Type 3 likewise represents wiring in an HVAC system that can monitor the fan's ON and OFF states. Since it is possible to determine this information from Type 1 or Type 2, Type 3 would only be necessary for redundancy in verifying the state of the fan.

For example, if Type 1 is used instead of Type 3, the OFF state of the fan would be verified when the MM is activated, and the ON state of the fan would be verified when the monitor module is deactivated. Utilizing Types 1 or 2 also saves the use of an additional monitor module. Type 3 would use two monitor modules to provide the same verification as Types 1 or 2.

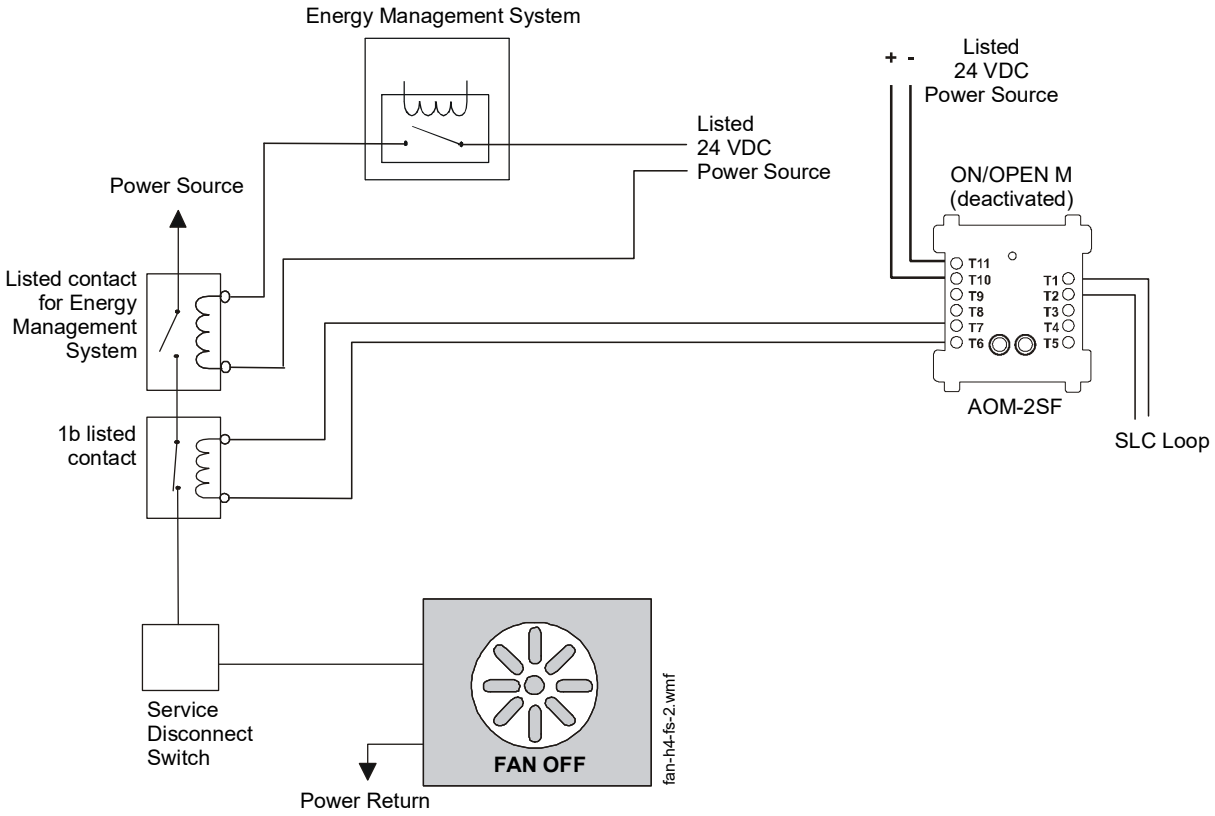


Figure B.43 HVAC Fan Wiring (Type 4)

Type 4: HVAC Fan OFF Control

Figure B.43 shows wiring in an HVAC system that is capable of OFF control of a fan (Type 4). In this arrangement, the OFF/CLOSED CM is deactivated. The OFF/CLOSED CM controls a normally closed contact which switches power to the fan (the contact is used when the power being switched is greater than 24 volts).

When the OFF/CLOSED CM is deactivated, the contact is closed, thus allowing the EMS to freely control the fan. In this case the EMS is off, so no power is being supplied to the fan. When no power is supplied to the fan, the fan is off. When the OFF/CLOSED CM is activated, the normally closed contact opens, thus cutting any power to the fan that was being supplied by the EMS.

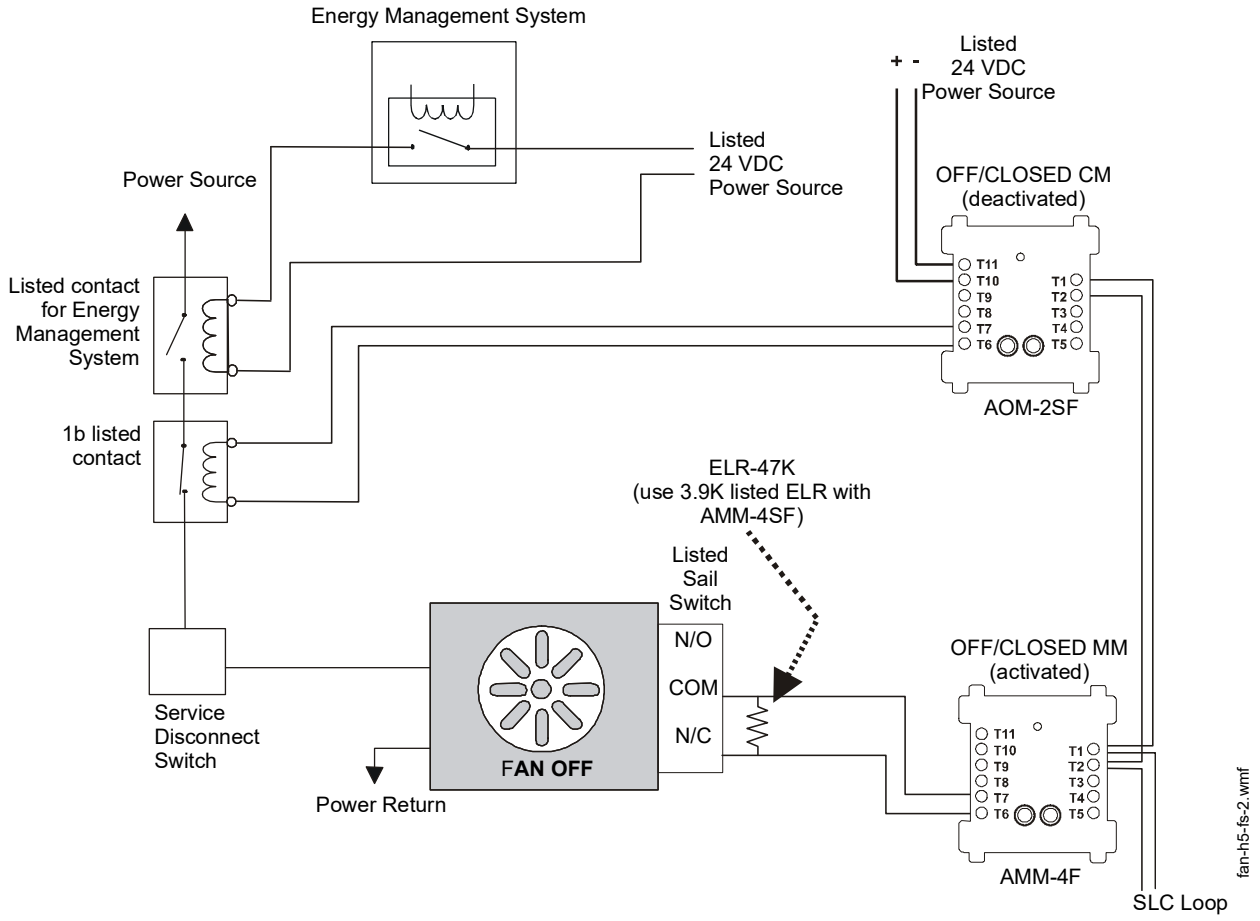


Figure B.44 HVAC Fan Wiring (Type 5)

Type 5: HVAC Fan OFF Control, Fan OFF Monitoring

Figure B.44 shows wiring in an HVAC system that is capable of OFF control of a fan and can monitor the fan's OFF state (Type 5). In this arrangement, the OFF/CLOSED CM is deactivated. The OFF/CLOSED CM controls a normally closed contact that switches power to the fan (the contact is used when the power being switched is greater than 24 volts).

When the OFF/CLOSED CM is deactivated, the contact is closed, thus allowing the EMS to freely control the fan. In this case the EMS is off, so no power is being supplied to the fan. When no power is supplied to the fan, the fan is off and the sail switch is closed, indicating no airflow in the duct.

The OFF/CLOSED MM monitors the closed position of the sail switch, which would indicate when the fan is off. In this case, the OFF/CLOSED MM is activated because the fan is off due to the EMS. When the OFF/CLOSED CM is activated, the normally closed contact opens, thus cutting any power to the fan that was being supplied by the EMS.

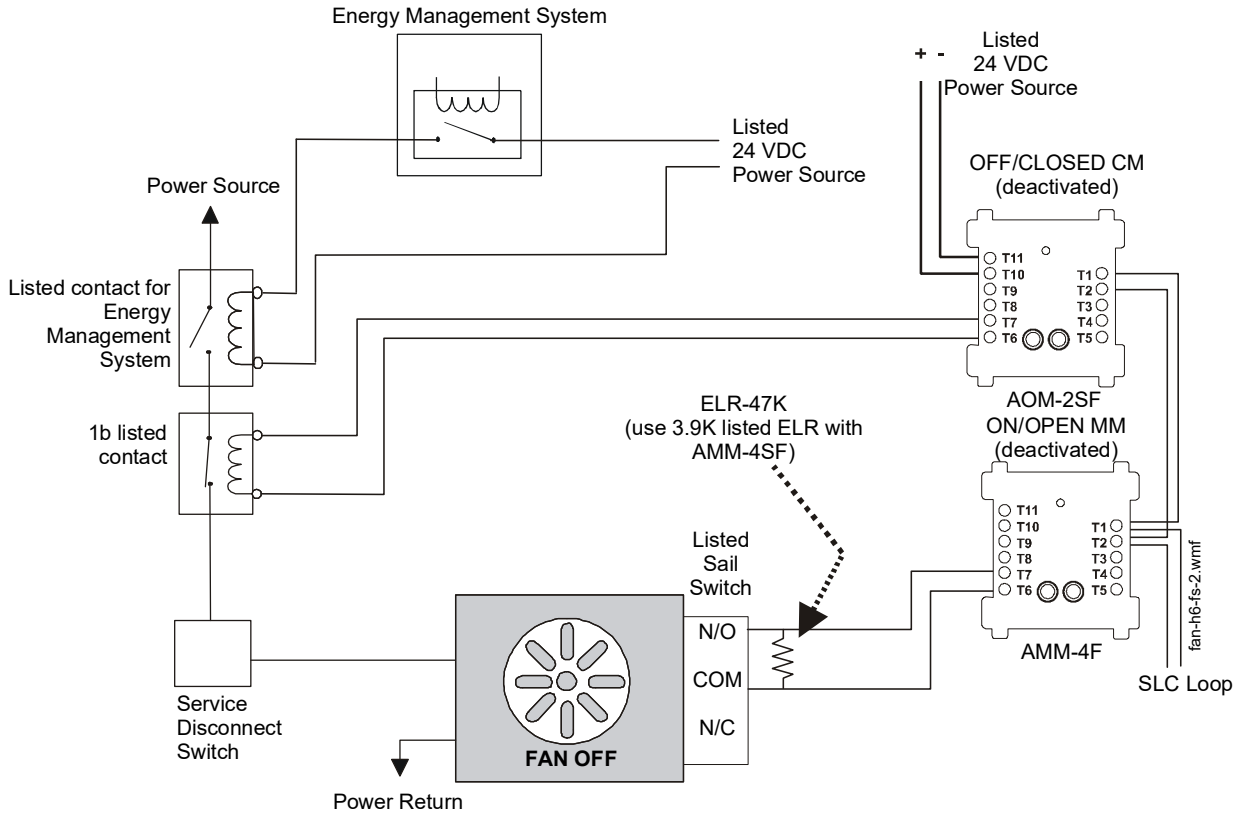


Figure B.45 HVAC Fan Wiring (Types 6, 7)

Type 6: HVAC Fan OFF Control, ON Monitoring

Figure B.45 shows wiring in an HVAC system that is capable of OFF control of a fan and can monitor the fan's ON state (Type 6). In this arrangement, the OFF/CLOSED CM is deactivated. The OFF/CLOSED CM controls a normally closed contact that switches power to the fan (the contact is used when the power being switched is greater than 24 volts).

When the OFF/CLOSED CM is deactivated, the contact is closed, thus allowing the EMS to freely control the fan. In this case the EMS is off, so no power is being supplied to the fan. When no power is supplied to the fan, the fan is off and the sail switch is closed, indicating no airflow in the duct.

The ON/OPEN MM monitors the open position of the sail switch, which would indicate when the fan is on. In this case, the ON/OPEN MM is deactivated because the fan is off due to the EMS. When the OFF/CLOSED CM is activated, the normally closed contact opens, thus cutting any power to the fan that was being supplied by the EMS.

Type 7: HVAC Fan OFF Control, ON and OFF Monitoring

Type 7 is capable of OFF control of a fan and can monitor the fan’s ON and OFF states. Since it is possible to determine this information from Type 5 or Type 6, Type 7 would only be necessary for redundancy in verifying the state of the fan. For example, if Type 5 were used instead of Type 7, the OFF state of the fan would be verified when the monitor module is activated and the ON state of the fan would be verified when the monitor is deactivated.

Utilizing Types 5 or 6 also saves the use of an additional monitor module. Type 7 would use two monitor modules to provide the same verification as Types 5 or 6.

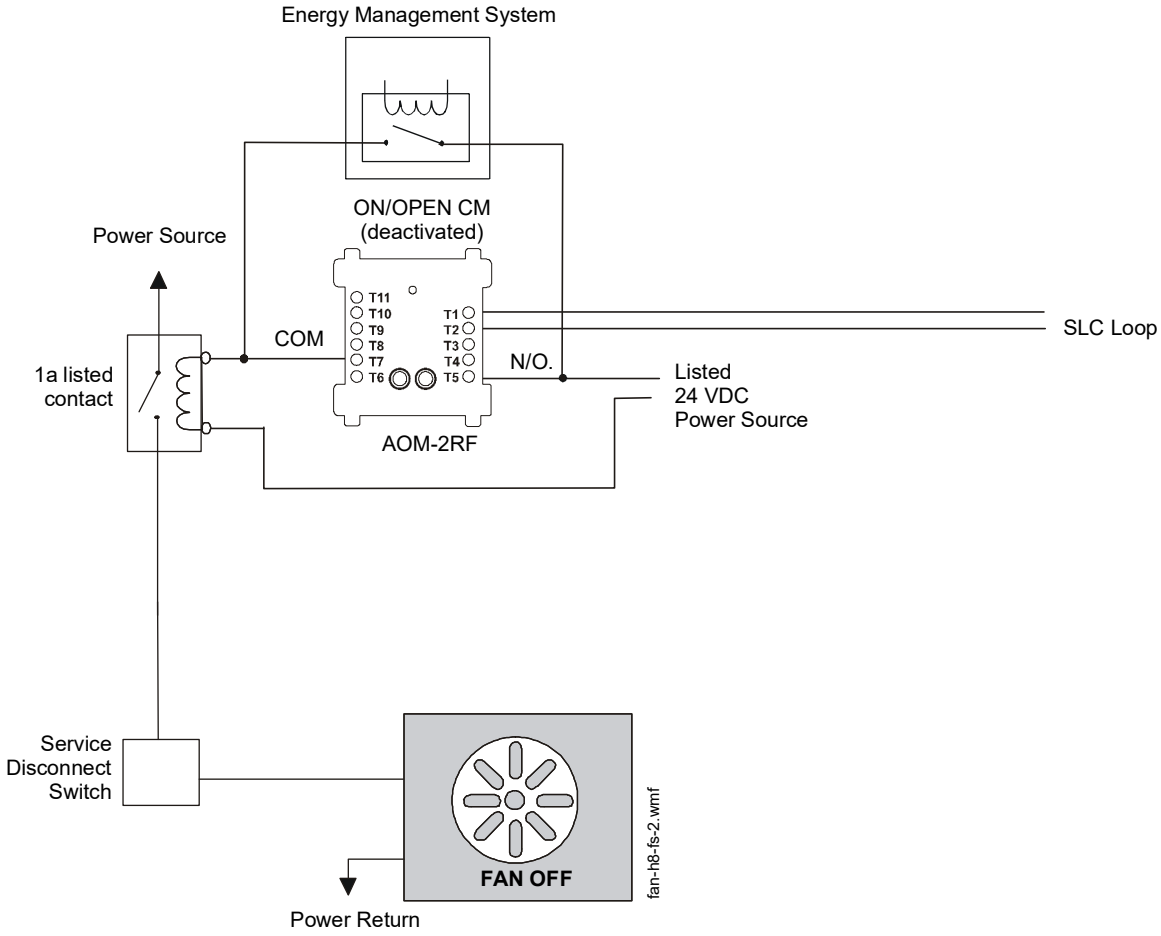


Figure B.46 HVAC Fan Wiring (Type 8)

Type 8: HVAC Fan ON Control

Figure B.46 shows wiring in an HVAC system that is capable of ON control of a fan (Type 8). In this arrangement, the ON/OPEN CM is deactivated. The ON/OPEN CM is wired in parallel with the EMS. (When wired in parallel with the EMS, use a relay module.)

When the ON/OPEN CM is deactivated, the EMS is free to control the fan. In this case the EMS is off, so no power is being supplied to the fan. When no power is supplied to the fan, the fan is off. When the ON/OPEN CM is activated, the ON/OPEN CM overrides whatever state the EMS is in and closes the normally open contact, thus supplying power to the fan and turning it on.

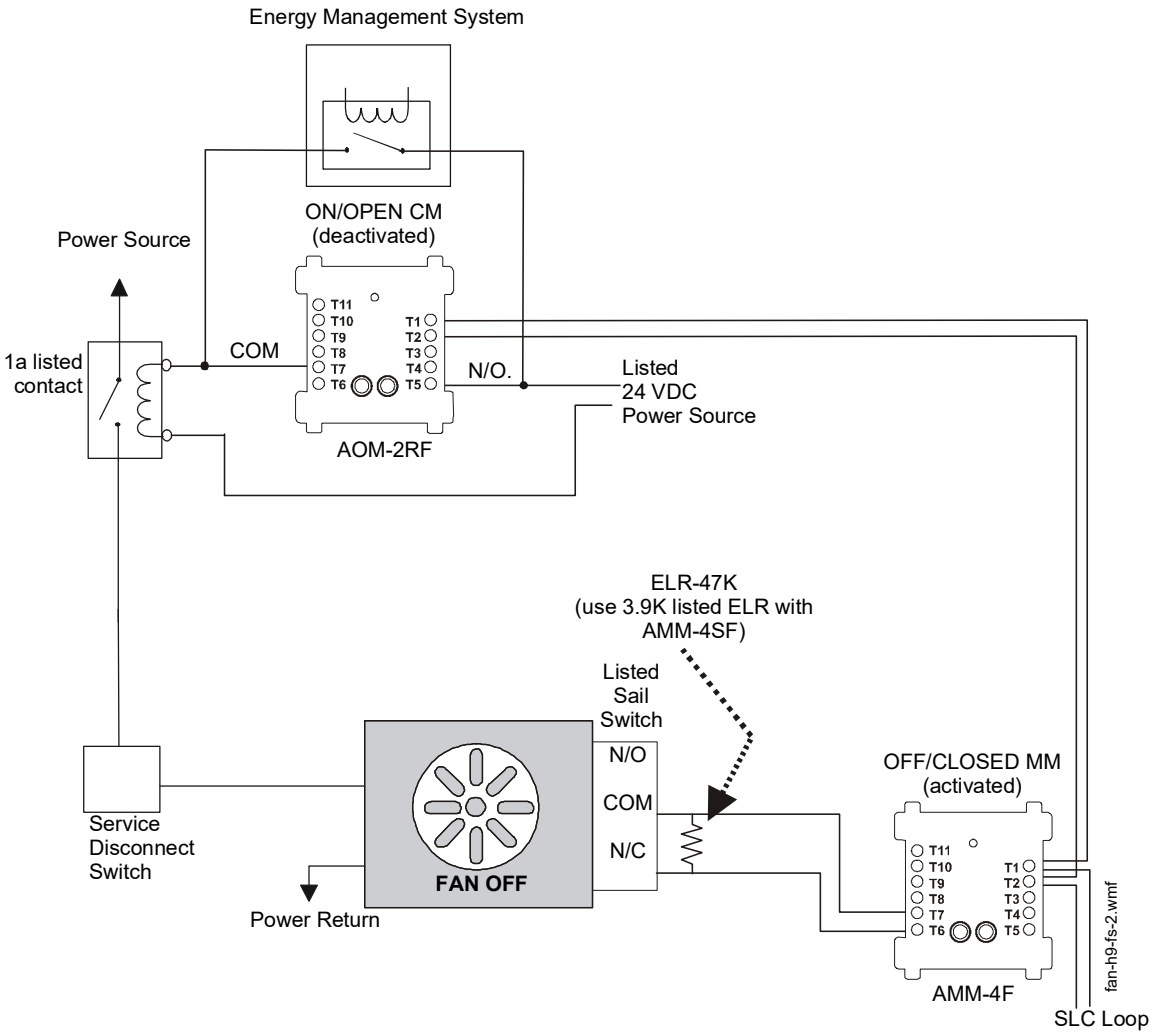


Figure B.47 HVAC Fan Wiring (Type 9)

Type 9: HVAC Fan ON Control, OFF Monitoring

Figure B.47 shows wiring in an HVAC system that is capable of ON control of a fan and can monitor the fan's OFF state (Type 9). In this arrangement, the ON/OPEN CM is deactivated. The ON/OPEN CM is wired in parallel with the EMS. (When wired in parallel with the EMS, the CM must be a relay module.

When the ON/OPEN CM is deactivated, the EMS is free to control the fan. In this case the EMS is off, so no power is being supplied to the fan. When no power is supplied to the fan, the fan is off and the sail switch is closed, indicating no airflow in the duct.

The OFF/CLOSED MM monitors the closed position of the sail switch, which would indicate when the fan is off. In this case the OFF/CLOSED MM is activated because the fan is off due to the EMS.

When the ON/OPEN CM is activated, the ON/OPEN CM overrides whatever state the EMS is in and closes the normally open contact, thus supplying power to the fan and turning it on.

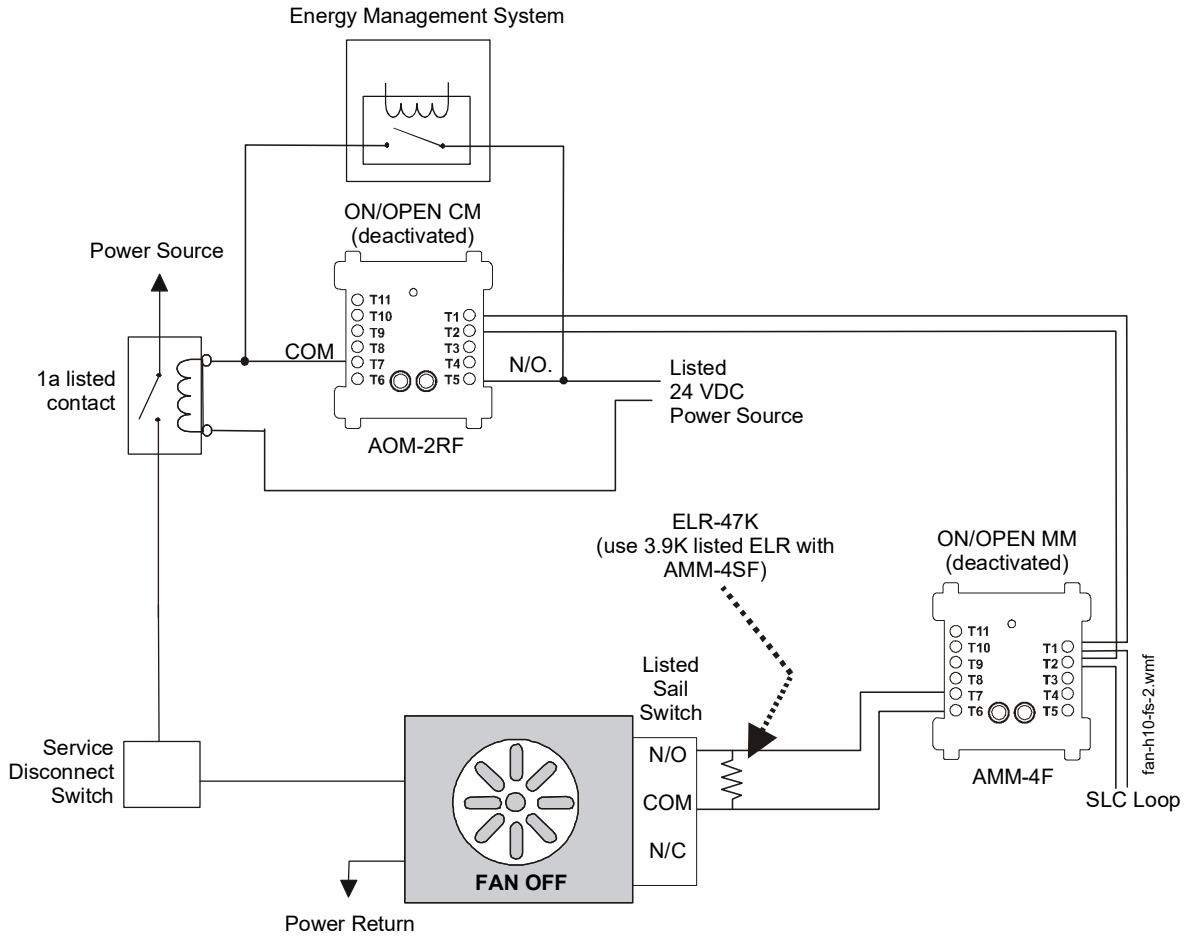


Figure B.48 HVAC Fan Wiring (Type 10)

Type 10: HVAC Fan ON Control, ON Monitoring

Figure B.48 shows wiring in an HVAC system that is capable of ON control of a fan and can monitor the fan's OFF state (Type 10). In this arrangement, the ON/OPEN CM is deactivated. The ON/OPEN CM is wired in parallel with the EMS. (When wired in parallel with the EMS, the CM must be a relay module.)

When the ON/OPEN CM is deactivated, the EMS is free to control the fan. In this case the EMS is off, so no power is being supplied to the fan. When no power is supplied to the fan, the fan is off and the sail switch is closed, indicating no airflow in the duct.

The ON/OPEN MM monitors the open position of the sail switch, which would indicate when the fan is on. In this case the ON/OPEN MM is deactivated because the fan is off due to the EMS.

When the ON/OPEN CM is activated, the ON/OPEN CM overrides whatever state the EMS is in and closes the normally open contact, thus supplying power to the fan and turning it on.

Type 11: HVAC Fan ON Control, ON and OFF Monitoring

Type 11 is capable of ON control of a fan and can monitor the fan's ON and OFF states (Type 11). Since it is possible to determine this information from Type 9 or Type 10, Type 11 would only be necessary for redundancy in verifying the state of the fan. For example, if Type 9 is used instead of Type 11, the OFF state of the fan would be verified when the module is activated and the ON state of the fan would be verified when the monitor module is deactivated.

Utilizing Types 9 or 10 also saves the use of an additional monitor module. Type 11 would use two monitor modules to provide the same verification as Types 9 or 10.

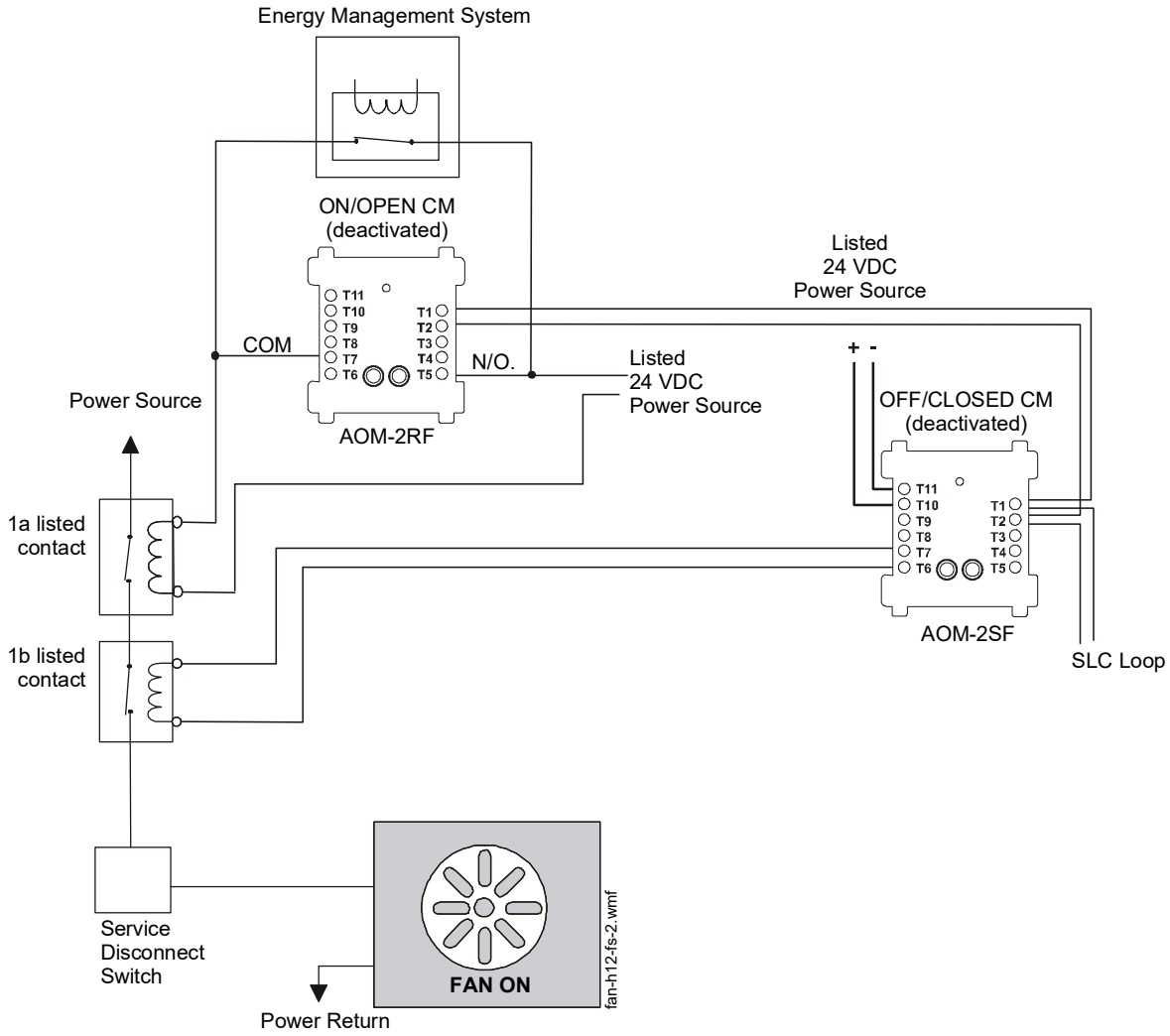


Figure B.49 HVAC Fan Wiring (Type 12)

Type 12: HVAC Fan ON and OFF Control

Figure B.49 shows wiring in an HVAC system that is capable of ON and OFF control of a fan (Type 12). In this arrangement, the ON/OPEN CM is deactivated and the OFF/CLOSED CM is deactivated. These two control modules are always in the opposite state when the smoke control system is in operation and are always deactivated during normal operation. The ON/OPEN CM is wired in parallel with the EMS. When wired in parallel with the EMS the CM must be a relay module.

When the ON/OPEN CM and the OFF/CLOSED CM are deactivated, the EMS is free to control the fan. In this case the EMS is ON, so power is being supplied to the fan. When the ON/OPEN CM is activated for smoke control, the ON/OPEN CM overrides whatever state the EMS is in and closes the normally open contact, thus supplying power to the fan and turning it on. When the OFF/CLOSED CM is activated for smoke control, the OFF/CLOSED CM opens the normally closed contact and turns the fan off, overriding whatever state the EMS is in.

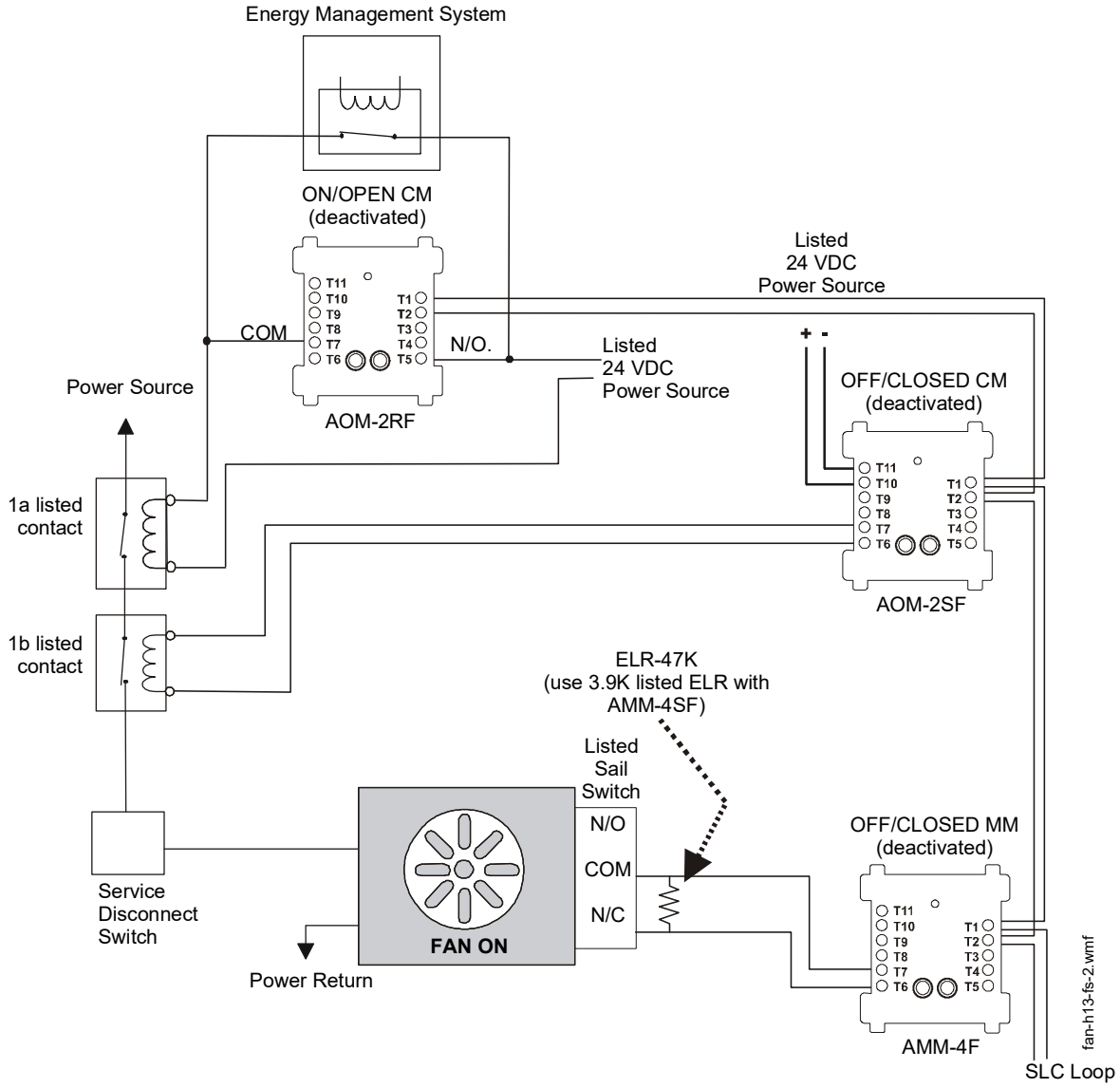


Figure B.50 HVAC Fan Wiring (Type 13)

Type 13: HVAC Fan ON and OFF Control, OFF Monitoring

Figure B.50 shows wiring in an HVAC system that is capable of ON and OFF control of a fan and can monitor the fan's OFF state (Type 13). In this arrangement, the ON/OPEN CM is deactivated and the OFF/CLOSED CM is deactivated. These two control modules are always in the opposite state when the smoke control system is in operation and are always deactivated during normal operation. The ON/OPEN CM is wired in parallel with the EMS. When wired in parallel with the EMS the CM must be a relay module.

When the ON/OPEN CM and the OFF/CLOSED CM are deactivated, the EMS is free to control the fan. In this case the EMS is on, so power is being supplied to the fan. When power is supplied to the fan, the fan is on and the sail switch is open, indicating airflow in the duct.

The OFF/CLOSED MM monitors the closed position of the sail switch, which would indicate when the fan is off. In this case the OFF/CLOSED is deactivated because the fan is on due to the EMS. When the ON/OPEN CM is activated for smoke control, the ON/OPEN CM overrides whatever state the EMS is in and closes the normally open contact, thus supplying power to the fan and turning it on. When the OFF/CLOSED CM is activated for smoke control, the OFF/CLOSED CM opens the normally closed contact and turns the fan off, overriding whatever state the EMS is in.

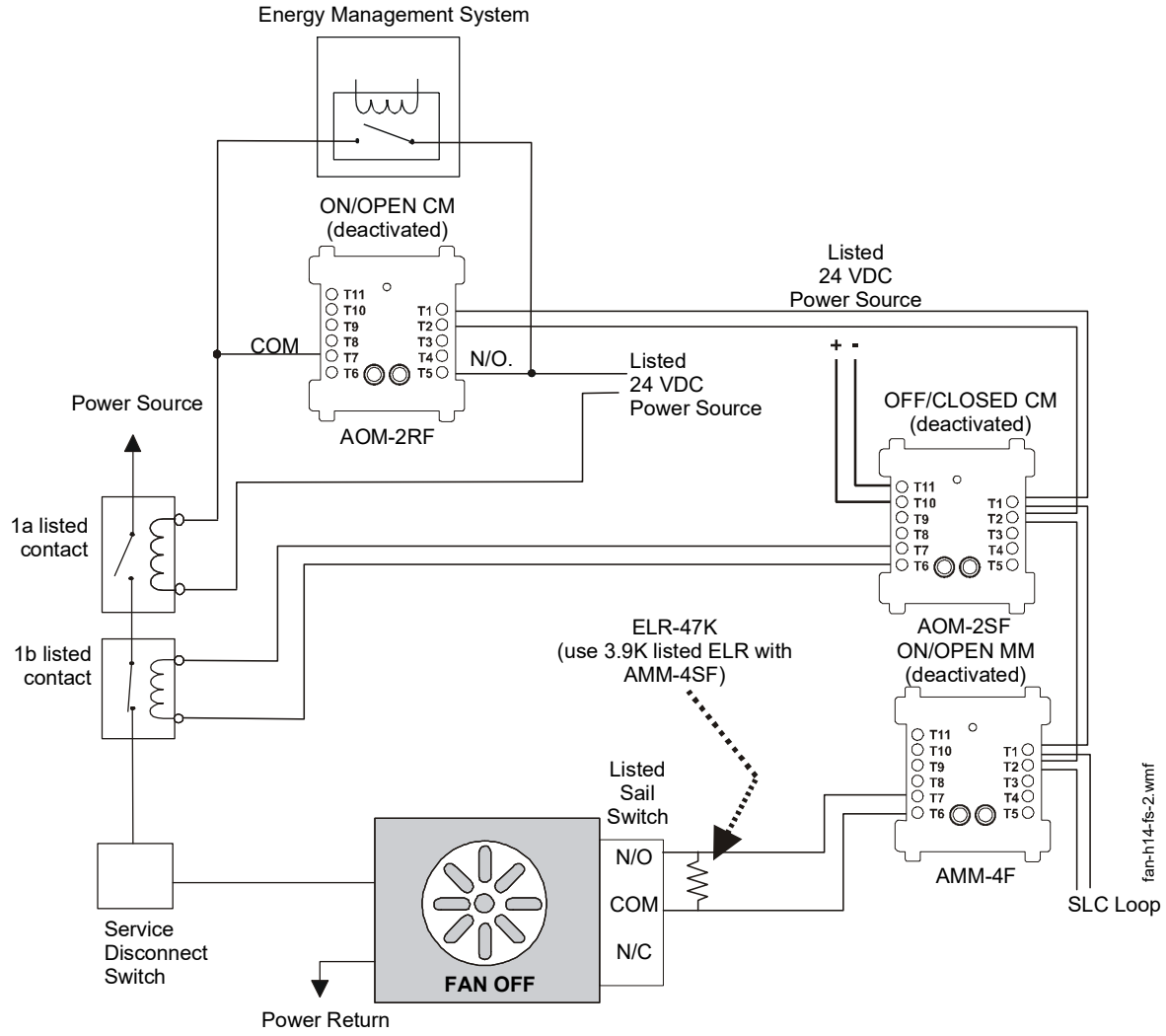


Figure B.51 HVAC Fan Wiring (Types 14, 15)

Type 14: HVAC Fan ON and OFF Control, ON Monitoring

Figure B.51 shows wiring in an HVAC system that is capable of ON and OFF control of a fan and can monitor the fan's ON state (Type 14). In this arrangement, the ON/OPEN CM is deactivated and the OFF/CLOSED CM is deactivated. These two control modules are always in the opposite state when the smoke control system is in operation and are always deactivated during normal operation. The ON/OPEN CM is wired in parallel with the EMS; when wired in parallel with the EMS the CM must be a relay module.

When the ON/OPEN CM and the OFF/CLOSED CM are deactivated, the EMS is free to control the fan. In this case the EMS is off, so no power is being supplied to the fan. When no power is supplied to the fan, the fan is off and the sail switch is closed, indicating no airflow in the duct.

The ON/OPEN MM monitors the open position of the sail switch, which would indicate when the fan is on. In this case the ON/OPEN MM is deactivated because the fan is off due to the EMS. When the ON/OPEN CM is activated for smoke control, the ON/OPEN CM overrides whatever state the EMS is in and closes the normally open contact, thus supplying power to the fan and turning it on.

When the OFF/CLOSED CM is activated for smoke control, the OFF/CLOSED CM opens the normally closed contact and turns the fan off, overriding whatever state the EMS is in.

Type 15: HVAC Fan ON and OFF Control, ON and OFF Monitoring

Type 15 is used for ON and OFF control of the fan and can monitor the fan's ON and OFF states. Since it is possible to determine the ON and OFF states from Type 13 or Type 14, Type 15 would only be necessary for redundancy in verifying the state of the fan. For example, if Type 13 is used instead of Type 14, the OFF state of the fan would be verified when the monitor module is activated and the OFF state of the fan would be verified when the monitor module is deactivated.

Utilizing Types 13 or 14 also saves the use of an additional monitor module. Type 15 would use two monitor modules to provide the same verification as Types 13 or Type 14.

B.4.2 HVAC Motorized Dampers

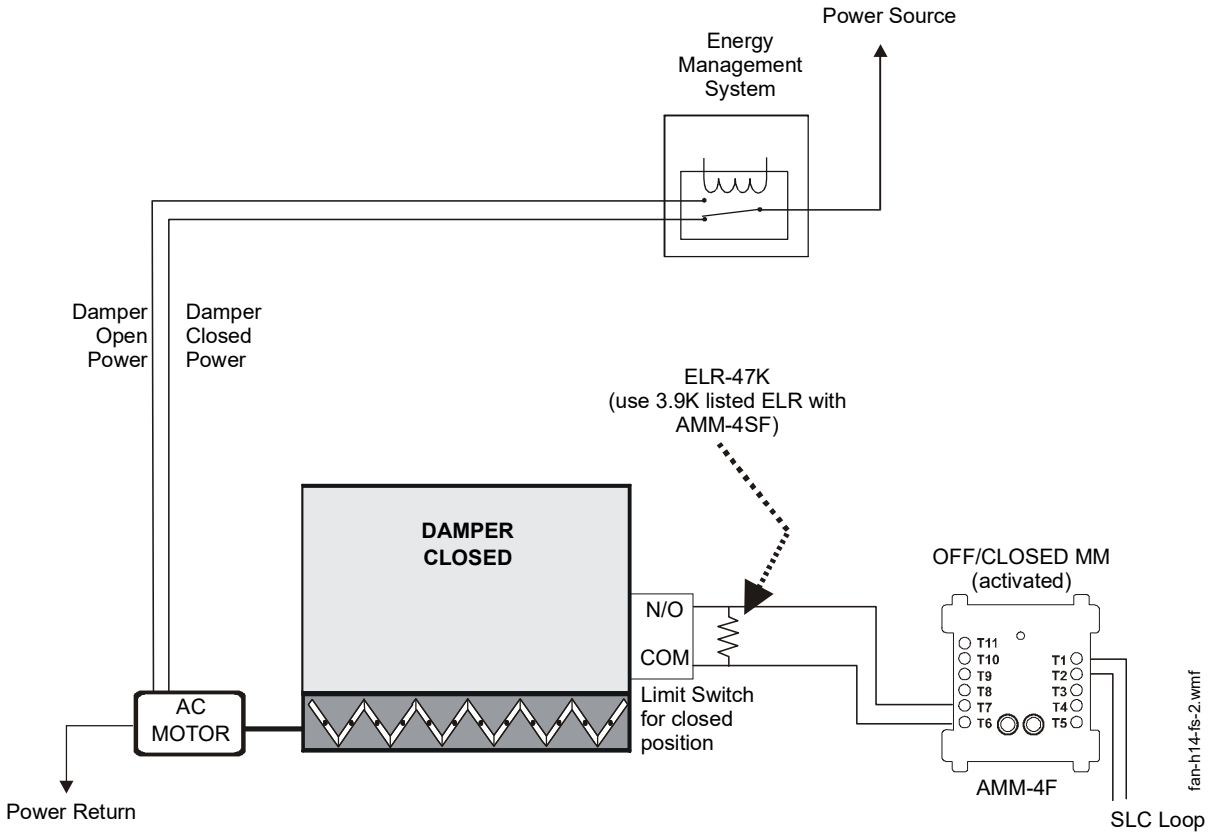


Figure B.52 HVAC Motorized Damper Wiring (Type 1)

Type 1: HVAC Damper CLOSED Monitoring

Figure B.52 shows wiring in an HVAC system that monitors the CLOSED state of a motorized damper (Type 1). In this arrangement, the EMS is supplying power to the damper closed power line. When power is supplied to the damper closed power line, the damper closes. When the damper completely closes, the damper closed limit switch is closed, indicating that the damper is in the closed position.

The OFF/CLOSED MM monitors the closed position of the damper closed limit switch. In this case the OFF/CLOSED MM is activated because the damper is closed.

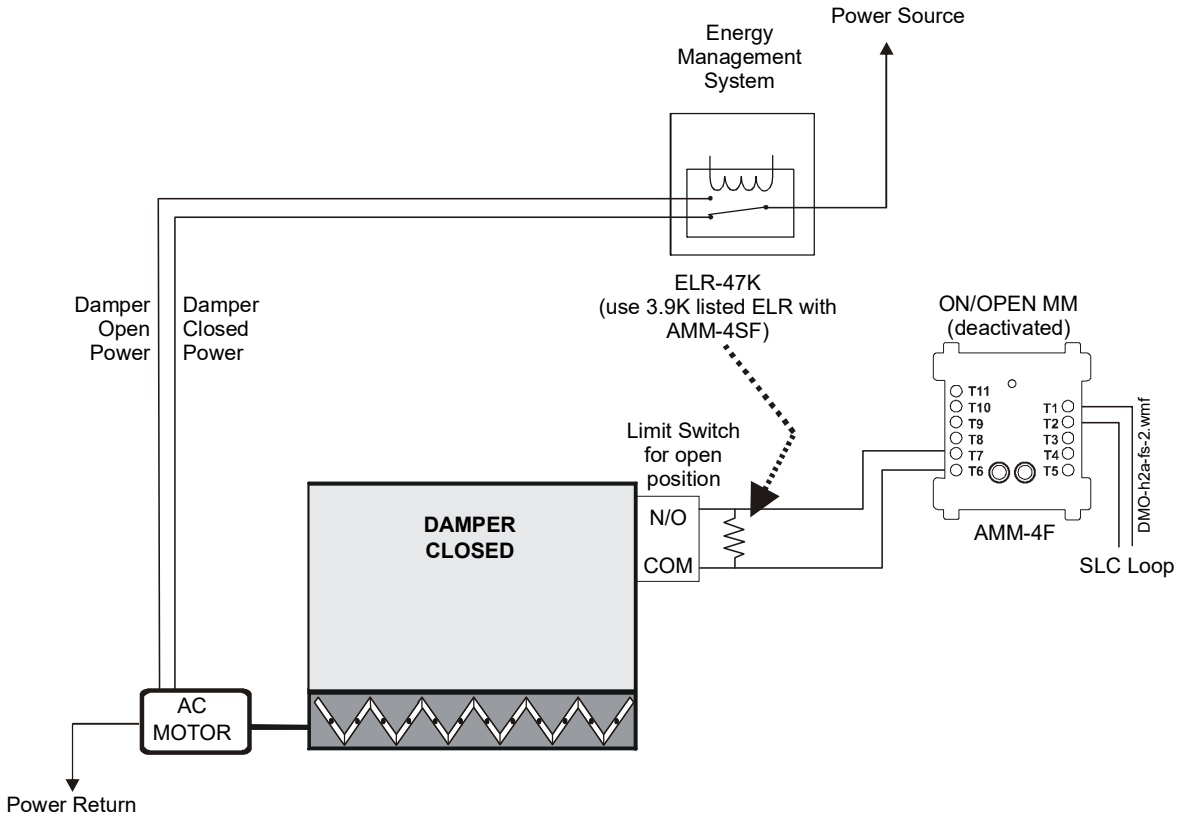


Figure B.53 HVAC Motorized Damper Wiring (Type 2)

Type 2: HVAC Damper OPEN Monitoring

Figure B.53 shows wiring in an HVAC system that can monitor the OPEN state of a motorized damper (Type 2). In this arrangement, the EMS is supplying power to the damper closed power line. When power is supplied to the damper closed power line, the damper closes. When the damper completely closes, the damper closed limit switch is closed, indicating that the damper is in the closed position.

The ON/OPEN MM monitors the closed position of the damper open limit switch. In this case the ON/OPEN MM is deactivated because the damper is closed.

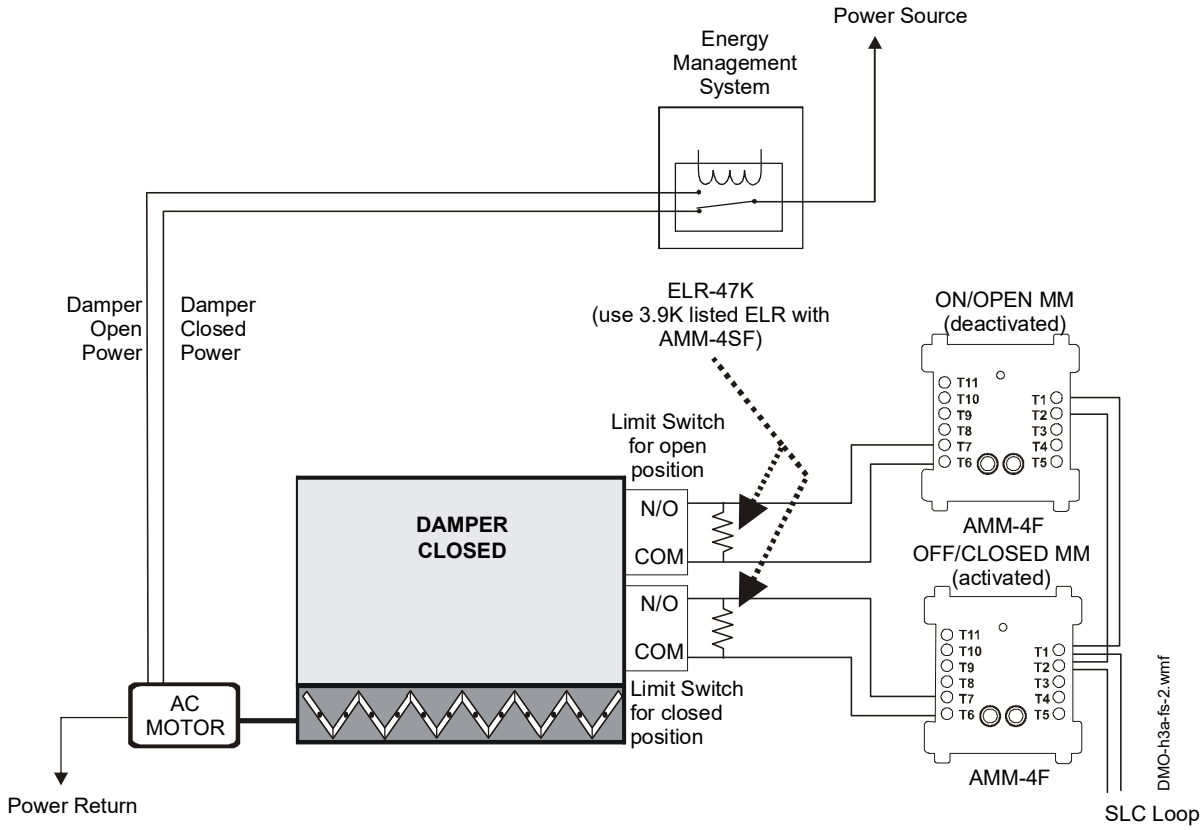


Figure B.54 HVAC Motorized Damper Wiring (Type 3)

Type 3: HVAC Damper OPEN and CLOSED Monitoring

Figure B.54 shows wiring in an HVAC system that can monitor the OPEN and CLOSED states of a motorized damper (Type 3). In this arrangement, the EMS is supplying power to the damper closed power line. When power is supplied to the damper closed power line, the damper closes. When the damper completely closes, the damper closed limit switch is closed, indicating that the damper is in the closed position.

The OFF/CLOSED MM monitors the closed position of the damper closed limit switch and the ON/OPEN MM monitors the closed position of the damper open limit switch. In this case the OFF/CLOSED MM is activated and the ON/OPEN MM is deactivated because the damper is closed.

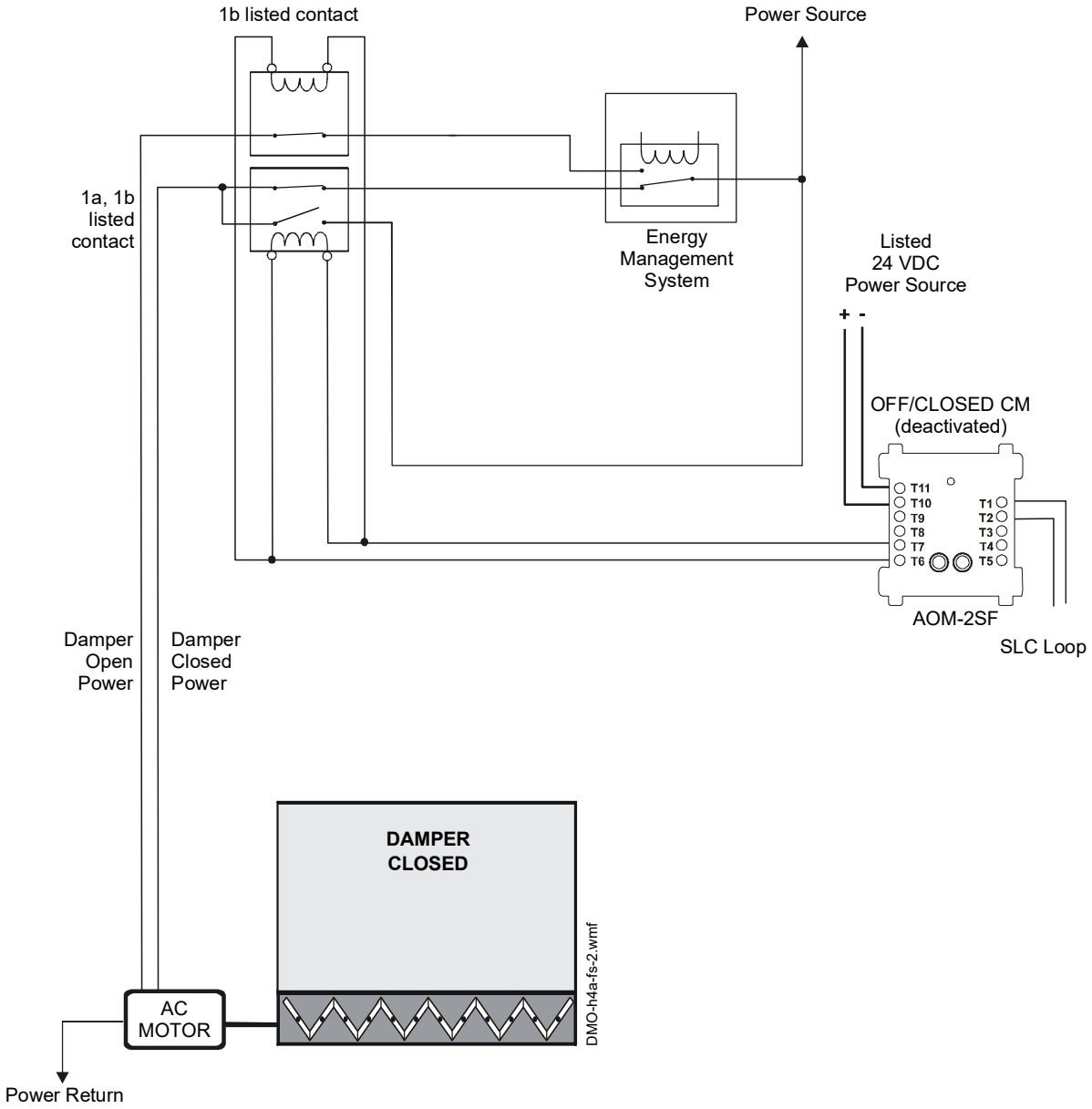


Figure B.55 HVAC Motorized Damper Wiring (Type 4)

Type 4: HVAC Damper CLOSED Monitoring

Figure B.55 shows wiring in an HVAC system that is capable of CLOSED control of a motorized damper (Type 4). In this arrangement, the OFF/CLOSED CM is deactivated. The OFF/CLOSED CM controls two contacts: a normally closed contact for the damper open power line, and a dual normally open/normally closed contact for the damper close power.

When the OFF/CLOSED CM is activated, the normally closed contact is opened (cutting any power supplied by the EMS to the damper open power line), the normally closed portion of the dual contact is opened (cutting any power supplied by the EMS to the damper closed power line), and the normally open portion of the dual contact is closed, thus supplying power to close the damper.

When the OFF/CLOSED CM is deactivated, the EMS is free to control the damper. The EMS is currently supplying power to the damper closed power line. When power is supplied to the damper closed power line, the damper closes.

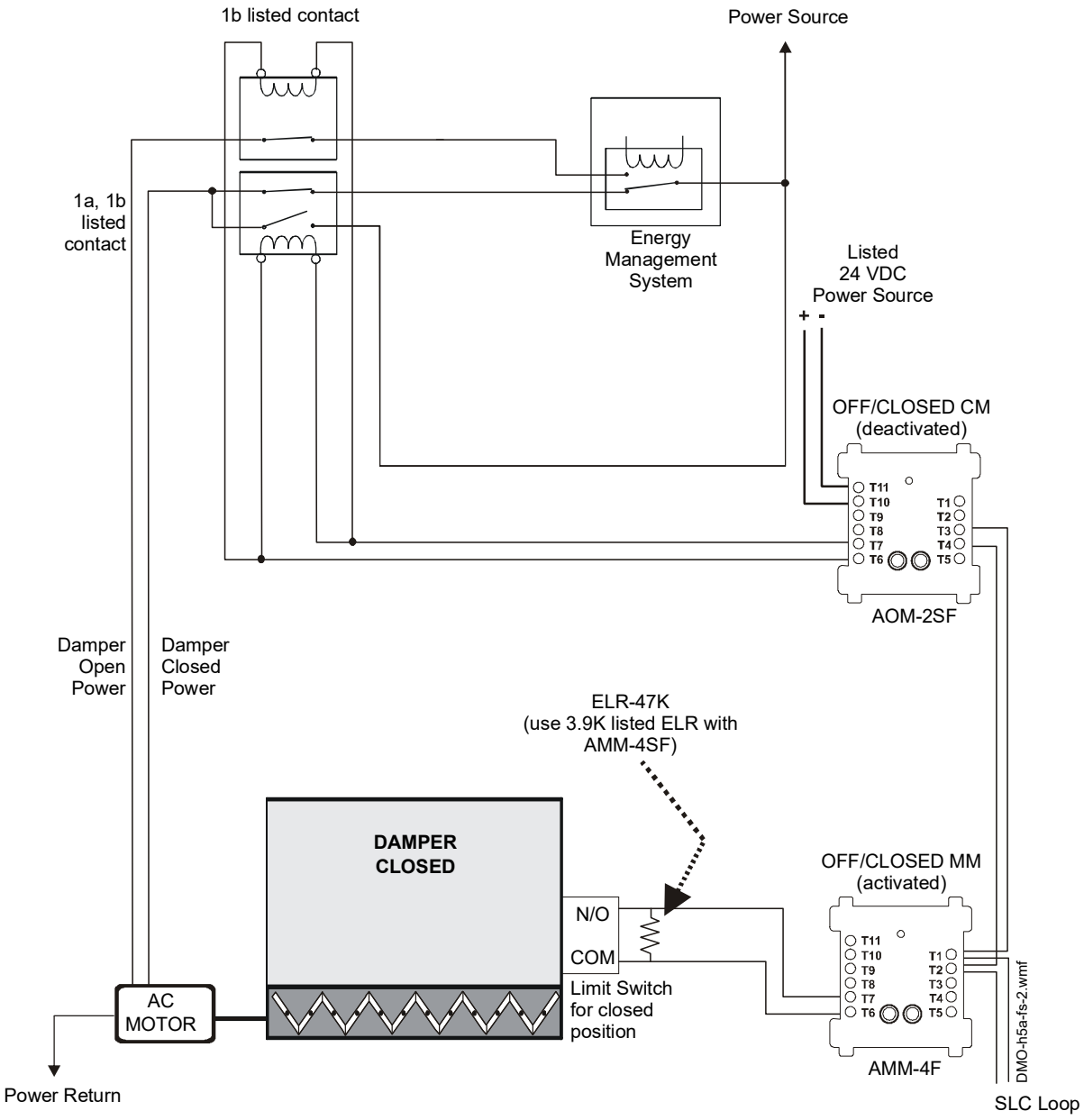


Figure B.56 HVAC Motorized Damper Wiring (Type 5)

Type 5: HVAC Damper CLOSED Control, CLOSED Monitoring

Figure B.56 shows wiring in an HVAC system that is capable of CLOSED control of a motorized damper and can monitor its CLOSED state (Type 5). In this arrangement, the OFF/CLOSED CM is deactivated. The OFF/CLOSED CM controls two contacts: a normally closed contact for the damper open power line, and a dual normally open/normally closed contact for the damper close power. When the OFF/CLOSED CM CM is activated, the normally closed contact is opened (cutting any power supplied by the EMS to the damper open power line), the normally closed portion of the dual contact is opened (cutting any power supplied by the EMS to the damper closed power line), and the normally open portion of the dual contact is closed, thus supplying power to close the damper.

When the OFF/CLOSED CM is deactivated, the EMS is free to control the damper. The EMS is currently supplying power to the damper closed power line. When power is supplied to the damper closed power line, the damper closes. When the damper completely closes, the damper closed limit switch is closed, indicating that the damper is in the closed position.

The OFF/CLOSED MM monitors the closed position of the damper closed limit switch. In this case the OFF/CLOSED MM is activated because the damper is closed.

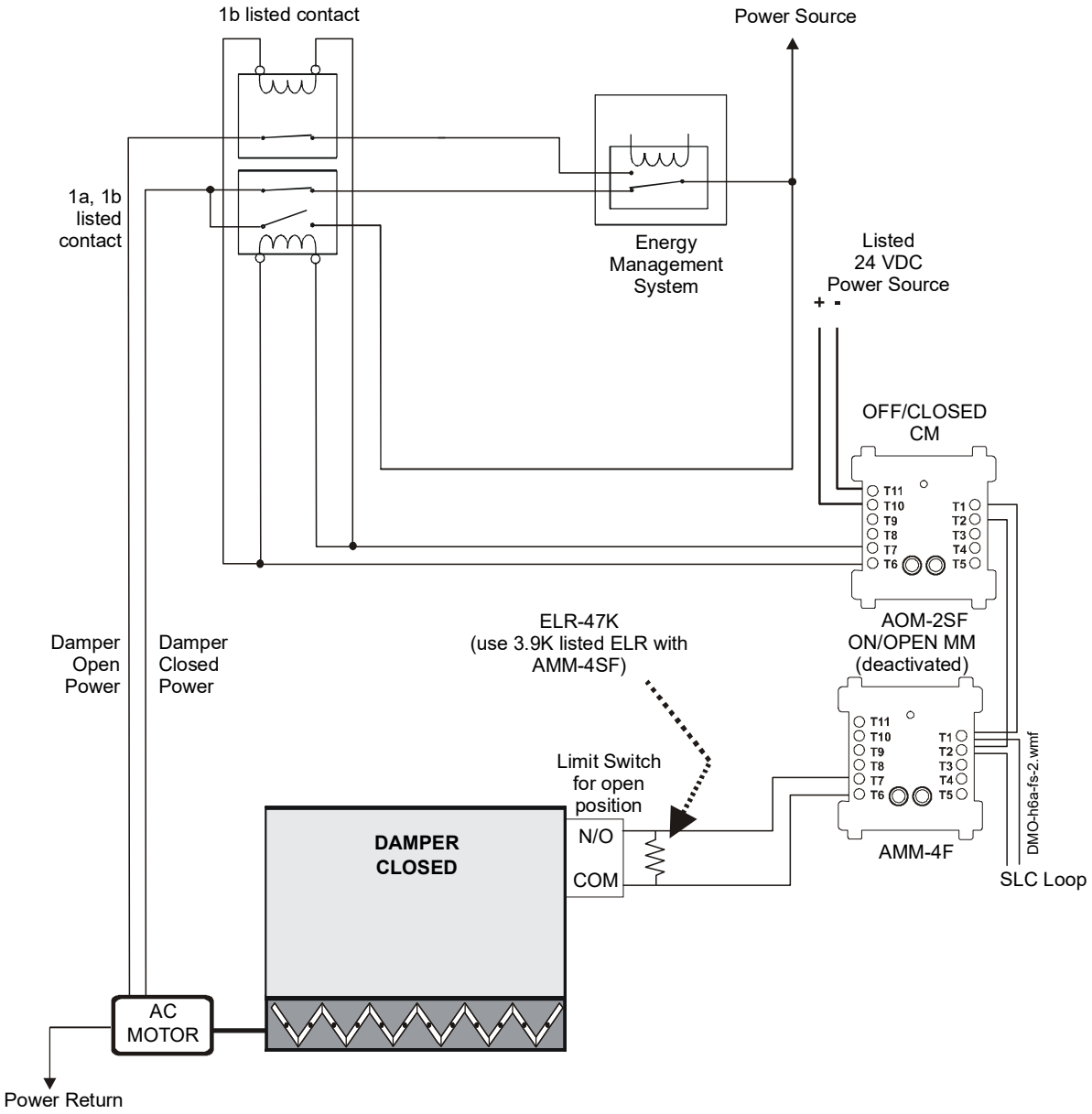


Figure B.57 HVAC Motorized Damper Wiring (Type 6)

Type 6: HVAC Damper CLOSED Control, OPEN Monitoring

Figure B.57 shows wiring in an HVAC system that is capable of CLOSED control of a motorized damper and can monitor its CLOSED state (Type 6). In this arrangement, the OFF/CLOSED CM is deactivated. The OFF/CLOSED CM controls two contacts: a normally closed contact for the damper open power line, and a dual normally open/normally closed contact for the damper close power.

When the OFF/CLOSED CM is activated, the normally closed contact is opened (cutting any power supplied by the EMS to the damper open power line), the normally closed portion of the dual contact is opened (cutting any power supplied by the EMS to the damper closed power line), and the normally open portion of the dual contact is closed, thus supplying power to close the damper.

When the OFF/CLOSED CM is deactivated, the EMS is free to control the damper. The EMS is currently supplying power to the damper closed power line. When power is supplied to the damper closed power line, the damper closes. When the damper completely closes, the damper closed limit switch is closed, indicating that the damper is in the closed position.

The ON/OPEN MM monitors the closed position of the damper open limit switch. In this case the ON/OPEN MM is deactivated because the damper is closed.

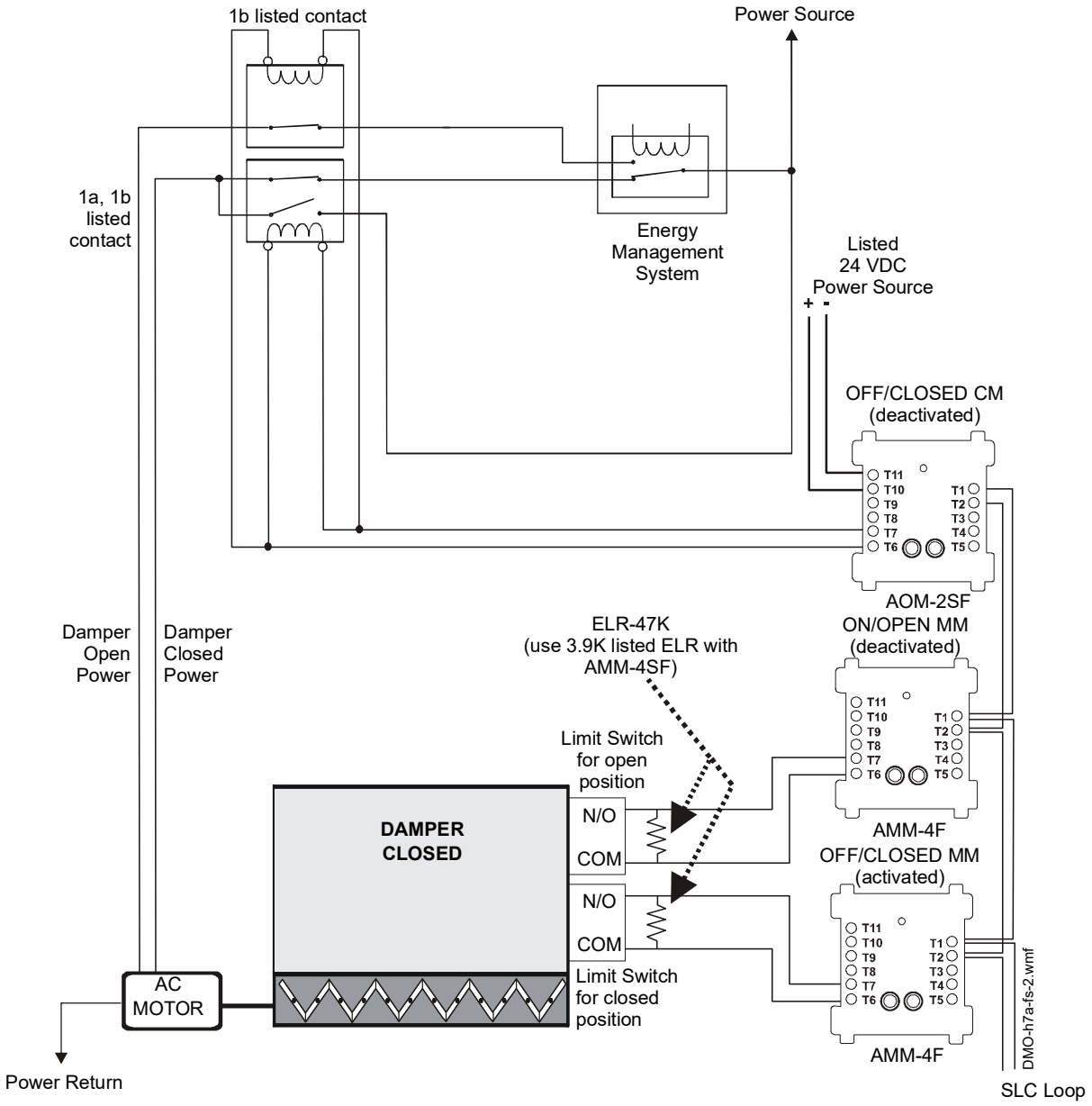


Figure B.58 HVAC Motorized Damper Wiring (Type 7)

Type 7: HVAC Damper CLOSED Control, OPEN and CLOSED Monitoring

Figure B.58 shows wiring in an HVAC system that is capable of CLOSED control of a motorized damper and can monitor its OPEN and CLOSED states (Type 7). In this arrangement, the OFF/CLOSED CM is deactivated. The OFF/CLOSED CM controls two contacts: a normally closed contact for the damper open power line and a dual normally open/normally closed contact for the damper close power line.

When the OFF/CONTROL CM is activated, the normally closed contact is opened (cutting any power supplied by the EMS to the damper open power line), the normally closed portion of the dual contact is opened (cutting any power supplied by the EMS to the damper closed power line), and the normally open portion of the dual contact is closed, thus supplying power to close the damper. When the OFF/CONTROL CM is deactivated, the EMS is free to control the damper.

The EMS is currently supplying power to the damper closed power line. When power is supplied to the damper closed power line, the damper closes. When the damper completely closes, the damper closed limit switch is closed, indicating that the damper is in the closed position.

The OFF/CLOSED MM monitors the closed position of the damper closed limit switch and the ON/OPEN MM monitors the closed position of the damper open limit switch. In this case the OFF/CLOSED MM MON is activated and the ON/OPEN MM is deactivated because the damper is closed.

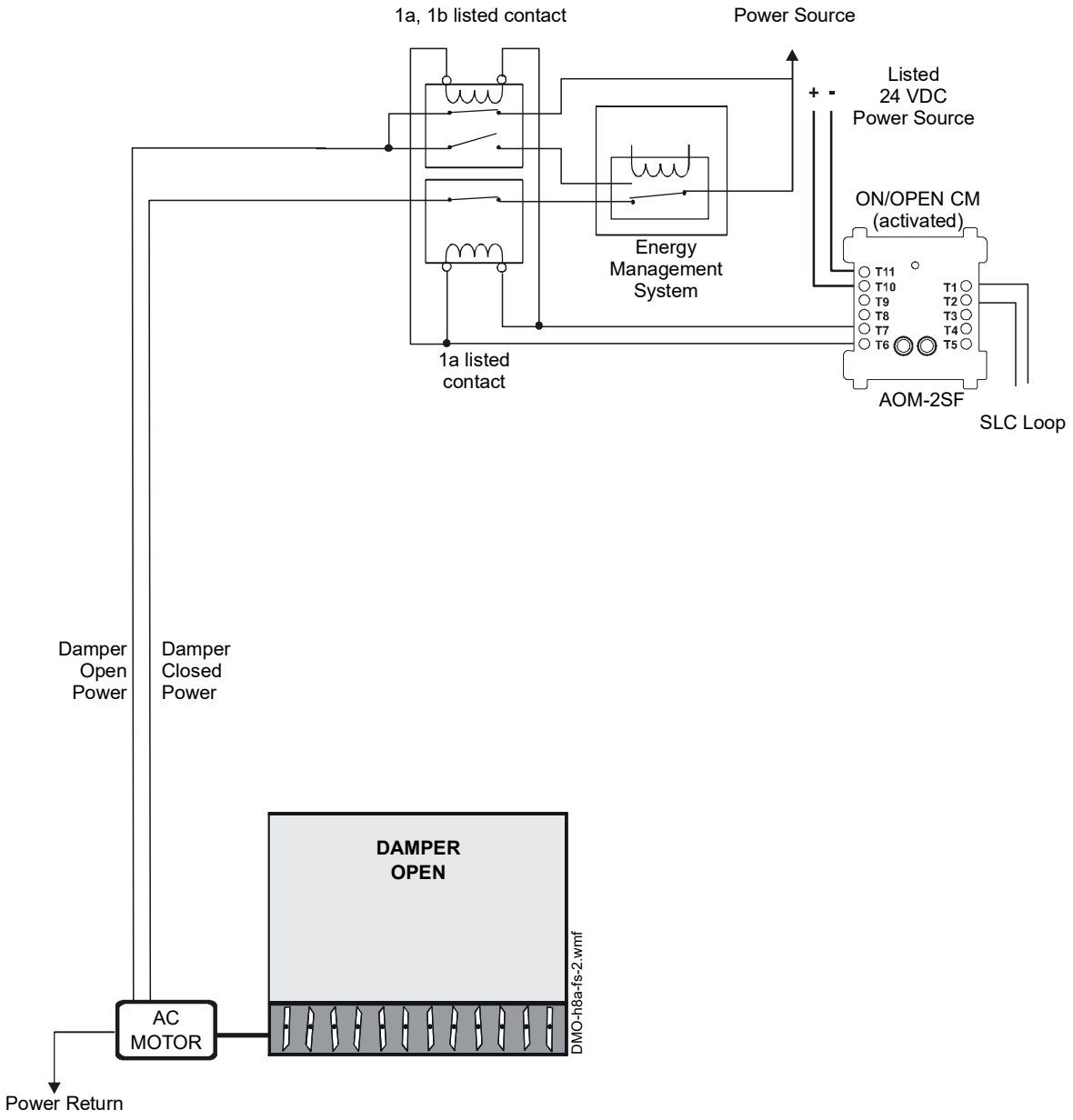


Figure B.59 HVAC Motorized Damper Wiring (Type 8)

Type 8: HVAC Damper OPEN Control

Figure B.59 shows wiring in an HVAC system that is capable of OPEN control of a motorized damper (Type 8). In this arrangement, the ON/OPEN CM is activated. The ON/OPEN CM controls two contacts: a normally closed contact for the damper closed power line, and a dual normally open/normally closed contact for the damper open power line.

When the ON/OPEN CM is activated, the normally closed contact is opened (cutting any power supplied by the EMS to the damper closed power line), the normally closed portion of the dual contact is opened (cutting any power supplied by the EMS to the damper open power line), and the normally open portion of the dual contact is closed, thus supplying power to close the damper.

When the ON/OPEN CM is deactivated, the EMS is free to control the damper. The EMS is currently being overridden by the ON/OPEN CM.

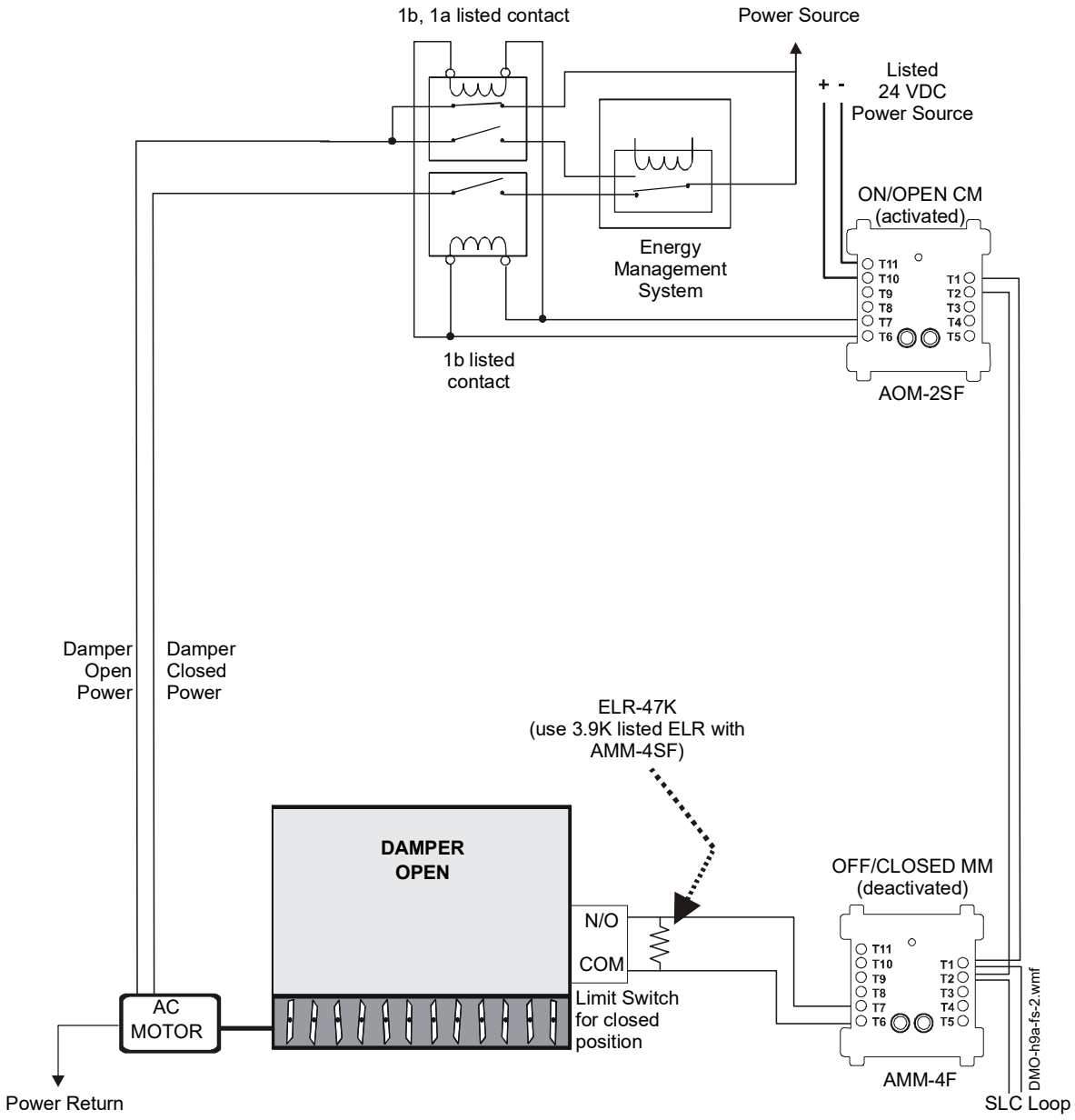


Figure B.60 HVAC Motorized Damper Wiring (Type 9)

Type 9: HVAC Damper OPEN Control, CLOSED Monitoring

Figure B.60 shows wiring in an HVAC system that is capable of OPEN control of a motorized damper and can monitor the CLOSED state (Type 9). In this arrangement, the ON/OPEN CM is activated. The ON/OPEN CM controls two contacts: a normally closed contact for the damper closed power line, and a dual normally open/normally closed contact for the damper open power line.

When the ON/OPEN CM is activated, the normally closed contact is opened (cutting any power supplied by the EMS to the damper closed power line), the normally closed portion of the dual contact is opened (cutting any power supplied by the EMS to the damper open power line), and the normally open portion of the dual contact is closed, thus supplying power to close the damper.

When the ON/OPEN CM is deactivated, the EMS is free to control the damper. The EMS is currently being overridden by the ON/OPEN CM. When power is supplied to the damper open power line, the damper opens. When the damper completely opens, the damper open limit switch is CLOSED, indicating that the damper is in the OPEN position.

The OFF/CLOSED MM monitors the closed position of the damper closed limit switch. In this case the OFF/CLOSED MM is deactivated because the damper is open.

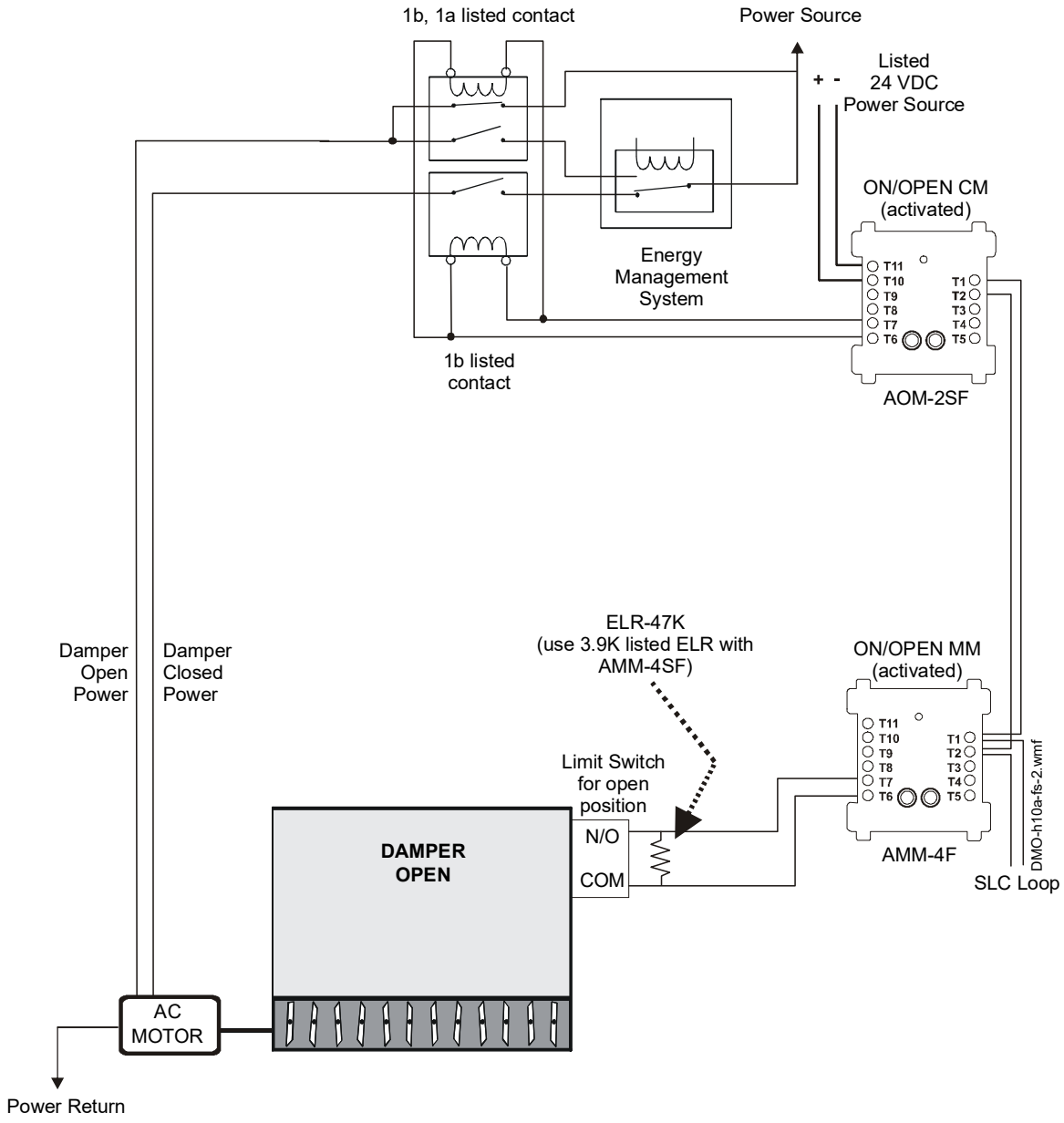


Figure B.61 HVAC Motorized Damper Wiring (Type 10)

Type 10: HVAC Damper OPEN Control, OPEN Monitoring

Figure B.61 shows wiring in an HVAC system that is capable of OPEN control of a motorized damper and can monitor the OPEN state (Type 10). In this arrangement, the ON/OPEN CM is activated. The ON/OPEN CM controls two contacts: a normally closed contact for the damper closed power line, and a dual normally open/normally closed contact for the damper open power line.

When the ON/OPEN CM is activated, the normally closed contact is opened (cutting any power supplied by the EMS to the damper closed power line), the normally closed portion of the dual contact is opened (cutting any power supplied by the EMS to the damper open power line), and the normally open portion of the dual contact is closed, thus supplying power to close the damper.

When the ON/OPEN CM is deactivated, the EMS is free to control the damper. The EMS is currently being overridden by the ON/OPEN CM. When power is supplied to the damper open power line, the damper opens. When the damper completely opens, the damper open limit switch is CLOSED, indicating that the damper is in the OPEN position.

The ON/OPEN MM monitors the closed position of the damper open limit switch. In this case the ON/OPEN MM is activated because the damper is open.

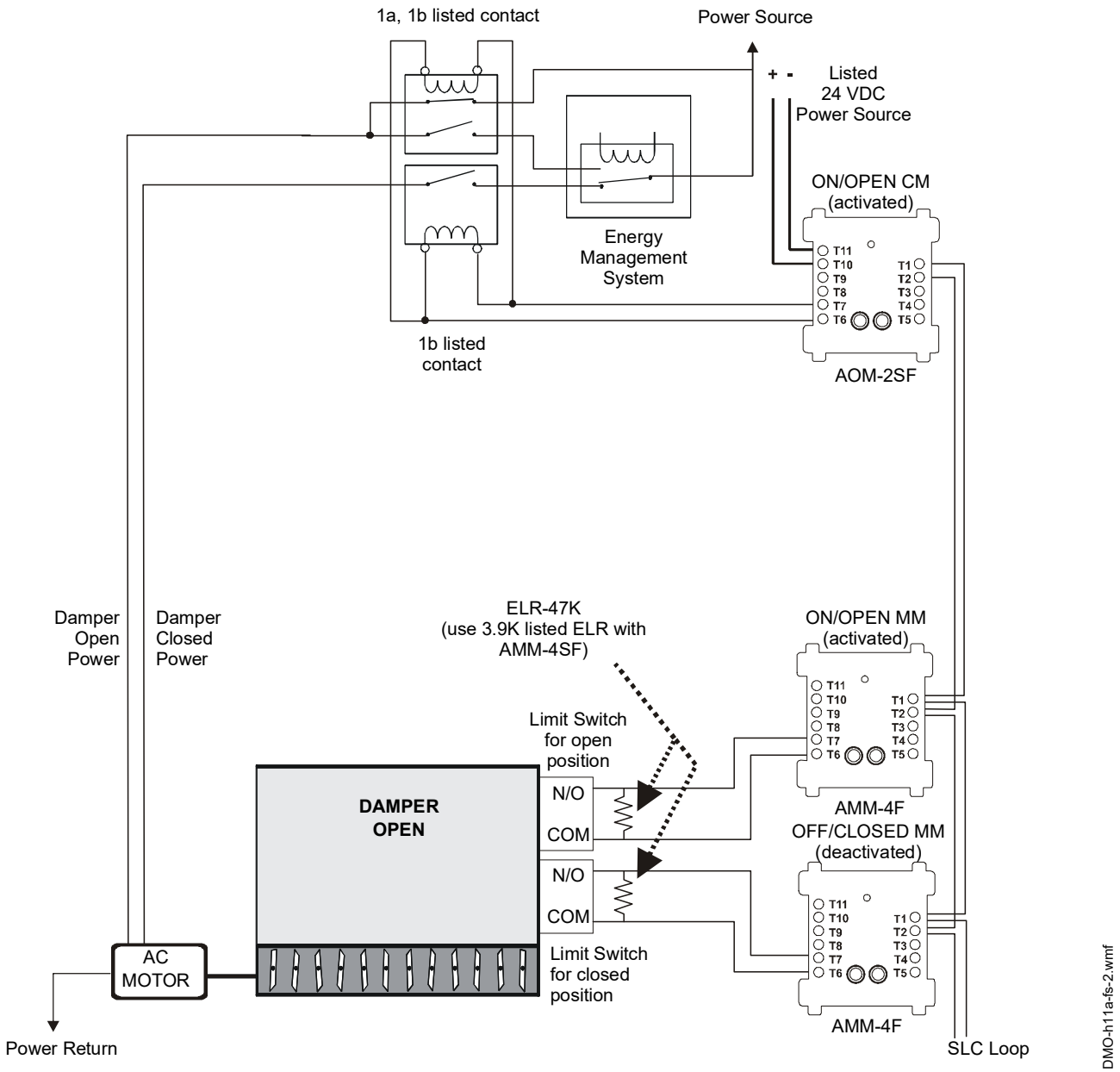


Figure B.62 HVAC Motorized Damper Wiring (Type 11)

Type 11: HVAC Damper OPEN Control, OPEN and CLOSED Monitoring

Figure B.62 shows wiring in an HVAC system that is capable of OPEN control of a motorized damper and can monitor the OPEN and CLOSED states (Type 11). In this arrangement, the ON/OPEN CM is activated. The ON/OPEN CM controls two contacts: a normally closed contact for the damper closed power line, and a dual normally open/normally closed contact for the damper open power line.

When the ON/OPEN CM is activated, the normally closed contact is opened (cutting any power supplied by the EMS to the damper closed power line), the normally closed portion of the dual contact is opened (cutting any power supplied by the EMS to the damper open power line), and the normally open portion of the dual contact is closed, thus supplying power to close the damper.

When the ON/OPEN CM is deactivated, the EMS is free to control the damper. The EMS is currently being overridden by the ON/OPEN CM. When power is supplied to the damper open power line, the damper opens. When the damper completely opens, the damper open limit switch is closed, indicating that the damper is in the open position.

The OFF/CLOSED MM monitors the closed position of the damper closed limit switch and the ON/OPEN MM monitors the closed position of the damper open limit switch. In this case the OFF/CLOSED MM is deactivated and the ON/OPEN MM is activated because the damper is open.

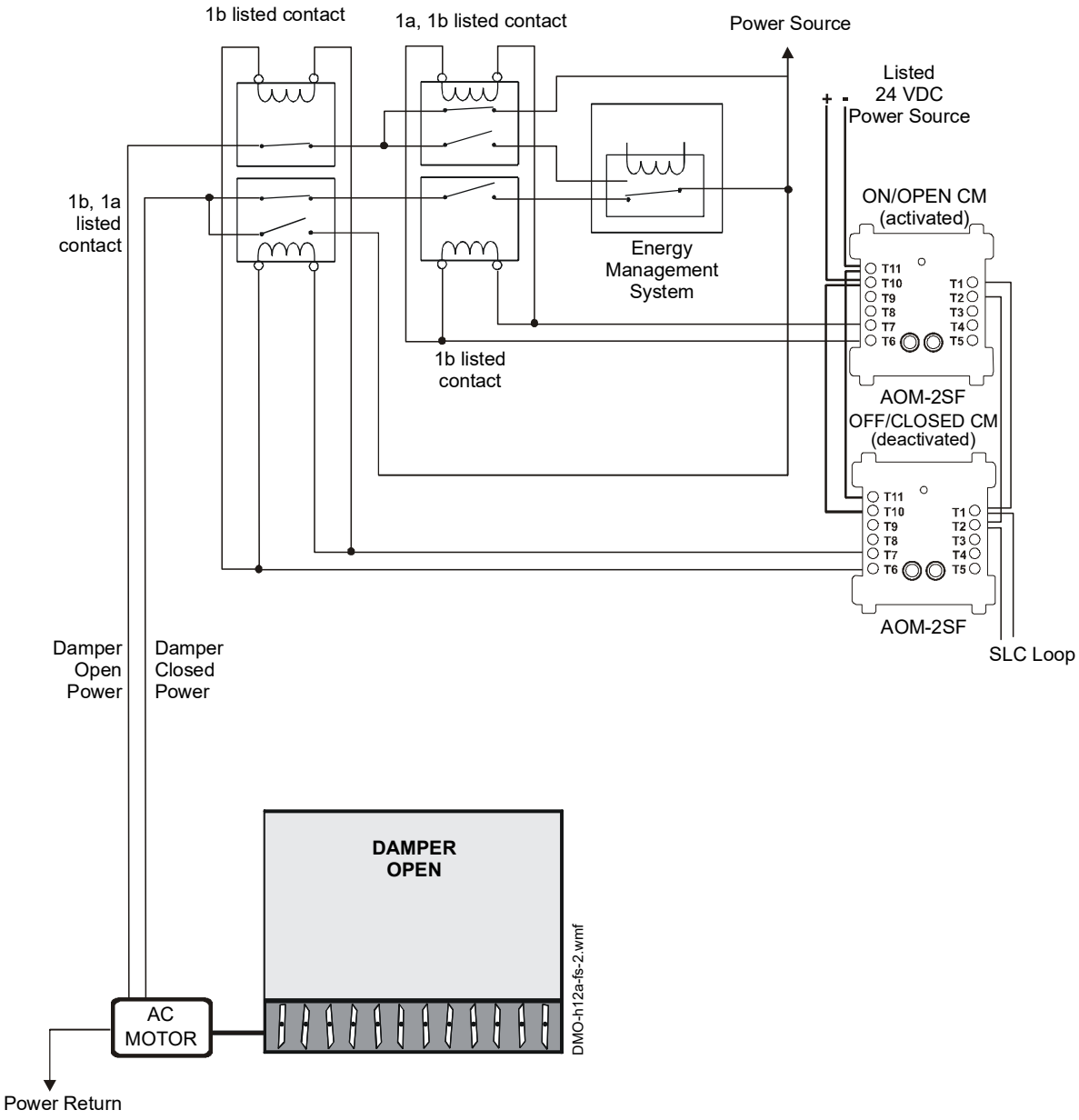


Figure B.63 HVAC Motorized Damper Wiring (Type 12)

Type 12: HVAC Damper OPEN and CLOSED Control

Figure B.63 shows wiring in an HVAC system that is capable of OPEN and CLOSED control of a motorized damper (Type 12). In this arrangement, the ON/OPEN CM is activated and the OFF/CLOSED CM is deactivated. Under normal operation (non-smoke control mode) both control modules would be deactivated, allowing the EMS system to freely control the damper.

The ON/OPEN CM controls two contacts: a normally closed contact for the damper closed power line, and a dual normally open/normally closed contact for the damper open power line. The OFF/CLOSED CM controls two contacts: a normally closed contact for the damper open power line, and a dual normally open/normally closed contact for the damper closed power line. When the ON/OPEN CM is activated, the OFF/CLOSED CM is deactivated, and vice versa.

When the ON/OPEN CM is activated, the normally closed contact is opened (cutting any power supplied by the EMS to the damper closed power line), the normally closed portion of the dual contact is opened (cutting any power supplied by the EMS to the damper open power line), and the normally open portion of the dual contact is closed, thus supplying power to open the damper.

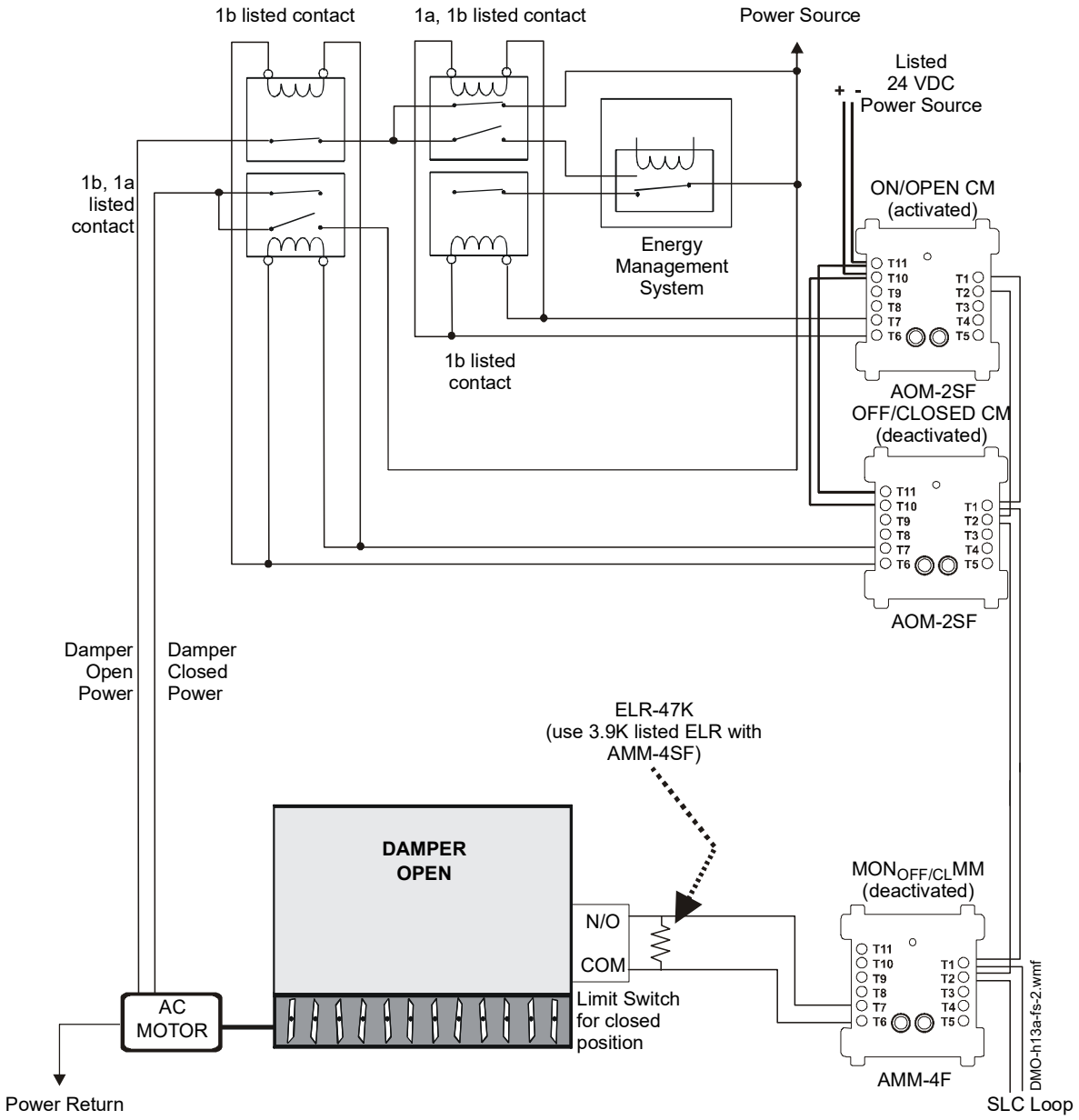


Figure B.64 HVAC Motorized Damper Wiring (Type 13)

Type 13: HVAC Damper OPEN and CLOSED Control, CLOSED Monitoring

Figure B.64 shows wiring in an HVAC system that is capable of OPEN and CLOSED control of a motorized damper and can monitor the CLOSED state (Type 13). In this arrangement, the ON/OPEN CM is activated and the OFF/CLOSED CM is deactivated. Under normal operation (non-smoke control mode) both control modules would be deactivated, allowing the EMS system to freely control the damper.

The ON/OPEN CM controls two contacts: a normally closed contact for the damper closed power line, and a dual normally open/normally closed contact for the damper open power line. The OFF/CLOSED CM controls two contacts: a normally closed contact for the damper open power line and a dual normally open/normally closed contact for the damper close power line. When the ON/OPEN CM is activated, the OFF/CLOSED CM is deactivated and vice versa.

When the ON/CLOSED CM is activated, the normally closed contact is opened (cutting any power supplied by the EMS to the damper closed power line), the normally closed portion of the dual contact is opened (cutting any power supplied by the EMS to the damper open power line), and the normally open portion of the dual contact is closed, thus supplying power to open the damper. When power is supplied to the damper open power line, the damper opens. When the damper completely opens, the damper open limit switch is CLOSED, indicating that the damper is in the OPEN position.

The OFF/CLOSED MM monitors the closed position of the damper closed limit switch. In this case the OFF/CCLOSED MM is deactivated because the damper is open.

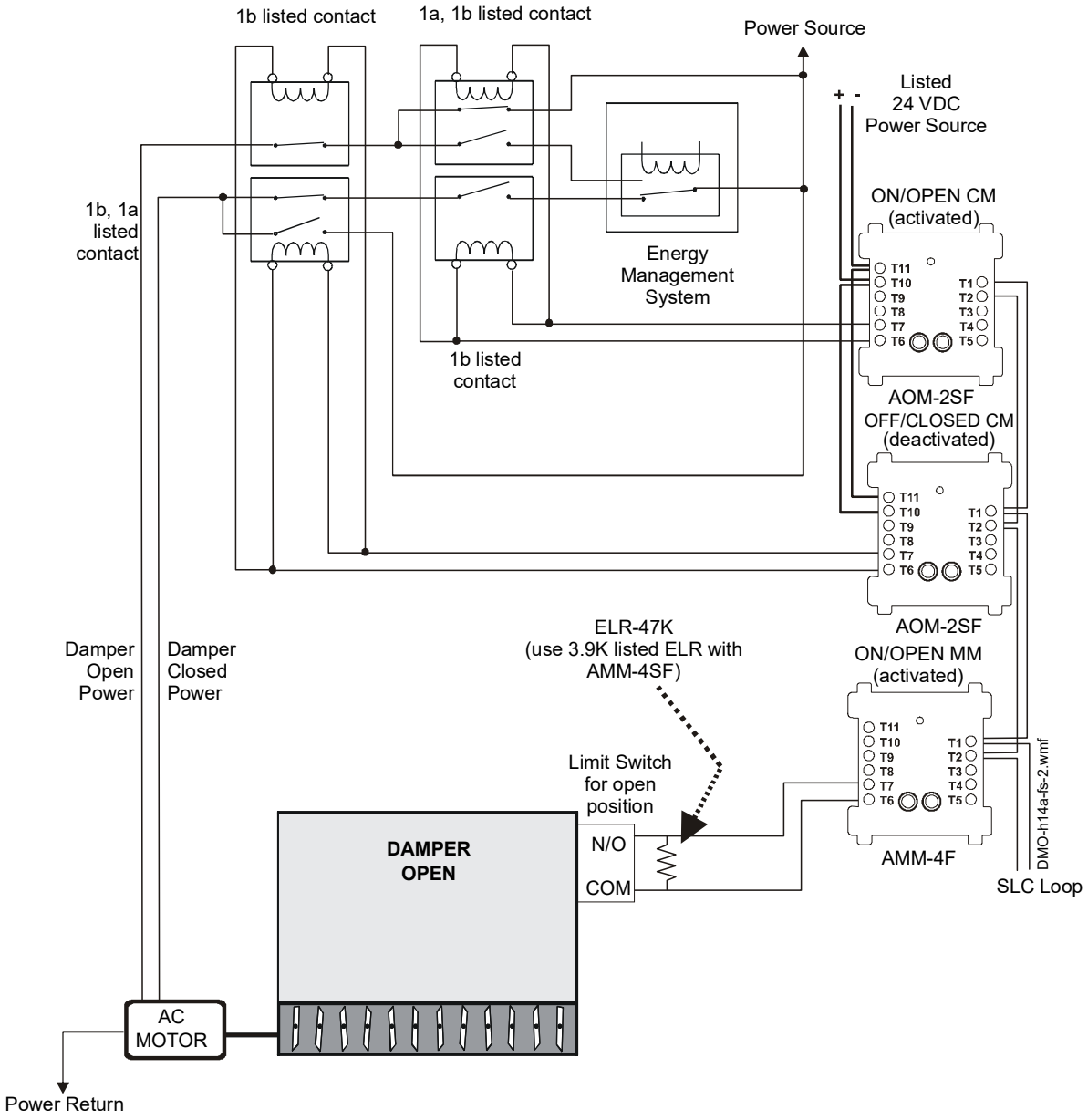


Figure B.65 HVAC Motorized Damper Wiring (Type 14)

Type 14: HVAC Damper OPEN and CLOSED Control, OPEN Monitoring

Figure B.65 shows wiring in an HVAC system that is capable of OPEN and CLOSED control of a motorized damper and can monitor the OPEN state (Type 14). In this arrangement, the ON/OPEN CM is activated and the OFF/CLOSED CM is deactivated. Under normal operation (non-smoke control mode) both control modules would be deactivated, allowing the EMS system to freely control the damper.

The ON/OPEN CM controls two contacts: a normally closed contact for the damper closed power line, and a dual normally open/normally closed contact for the damper open power line. The OFF/CLOSED CM controls two contacts: a normally closed contact for the damper open power line, and a dual normally open/normally closed contact for the damper close power line. When the ON/OPEN CM is activated, the OFF/CLOSED CM is deactivated, and vice versa.

When the ON/OPEN CM is activated, the normally closed contact is opened (cutting any power supplied by the EMS to the damper closed power line), the normally closed portion of the dual contact is opened (cutting any power supplied by the EMS to the damper open power line), and the normally open portion of the dual contact is closed, thus supplying power to open the damper. When power is supplied to the damper open power line, the damper opens. When the damper completely opens, the damper open limit switch is closed, indicating that the damper is in the open position.

The ON/OPEN MM monitors the closed position of the damper open limit switch. In this case the ON/OPEN MM is activated because the damper is open.

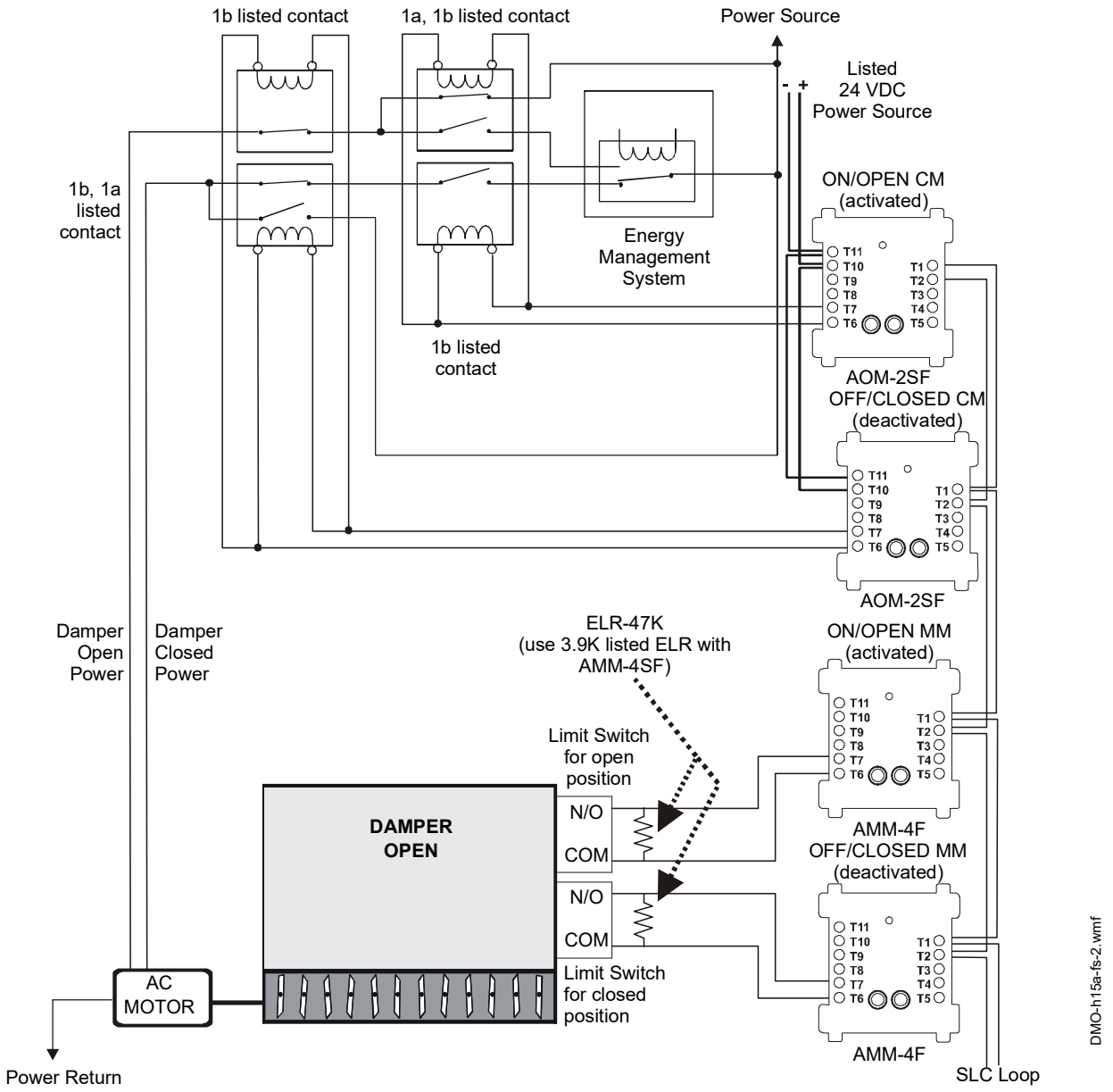


Figure B.66 HVAC Motorized Damper Wiring (Type 15)

Type 15: HVAC Damper OPEN and CLOSED Control, OPEN and CLOSED Monitoring

Figure B.66 shows wiring in an HVAC system that is capable of OPEN and CLOSED control of a motorized damper and can monitor the OPEN and CLOSED state (Type 15). In this arrangement, the ON/OPEN CM is activated and the OFF/CLOSED CM is deactivated. Under normal operation (non-smoke control mode) both control modules would be deactivated, allowing the EMS system to freely control the damper.

The ON/OPEN CM controls two contacts: a normally closed contact for the damper closed power line, and a dual normally open/normally closed contact for the damper open power line. The OFF/CLOSED CM controls two contacts: a normally closed contact for the damper open power line, and a dual normally open/normally closed contact for the damper close power line. When the ON/OPEN CM is activated, the OFF/CLOSED CM is deactivated and vice versa.

When the ON/OPEN CM is activated, the normally closed contact is opened (cutting any power supplied by the EMS to the damper closed power line), the normally closed portion of the dual contact is opened (cutting any power supplied by the EMS to the damper open power line), and the normally open portion of the dual contact is closed, thus supplying power to open the damper. When power is supplied to the damper open power line, the damper opens. When the damper completely opens, the damper open limit switch is closed and the damper closed switch opens, indicating that the damper is in the open position.

The ON/OPEN MM monitors the closed position of the damper open limit switch and the OFF/CLOSED MM monitors the closed position of the damper closed limit switch. In this case the ON/OPEN MM is activated and the OFF/CLOSED MM is deactivated because the damper is open.

B.4.3 HVAC EP Dampers

Electrical to Pressure (EP) dampers use airflow to operate the opening and closing of the damper. When power is applied to the pressure switch, airflow going to the damper is cut off and the damper closes. When no power is supplied to the pressure switch, airflow is continuous and keeps the damper open.

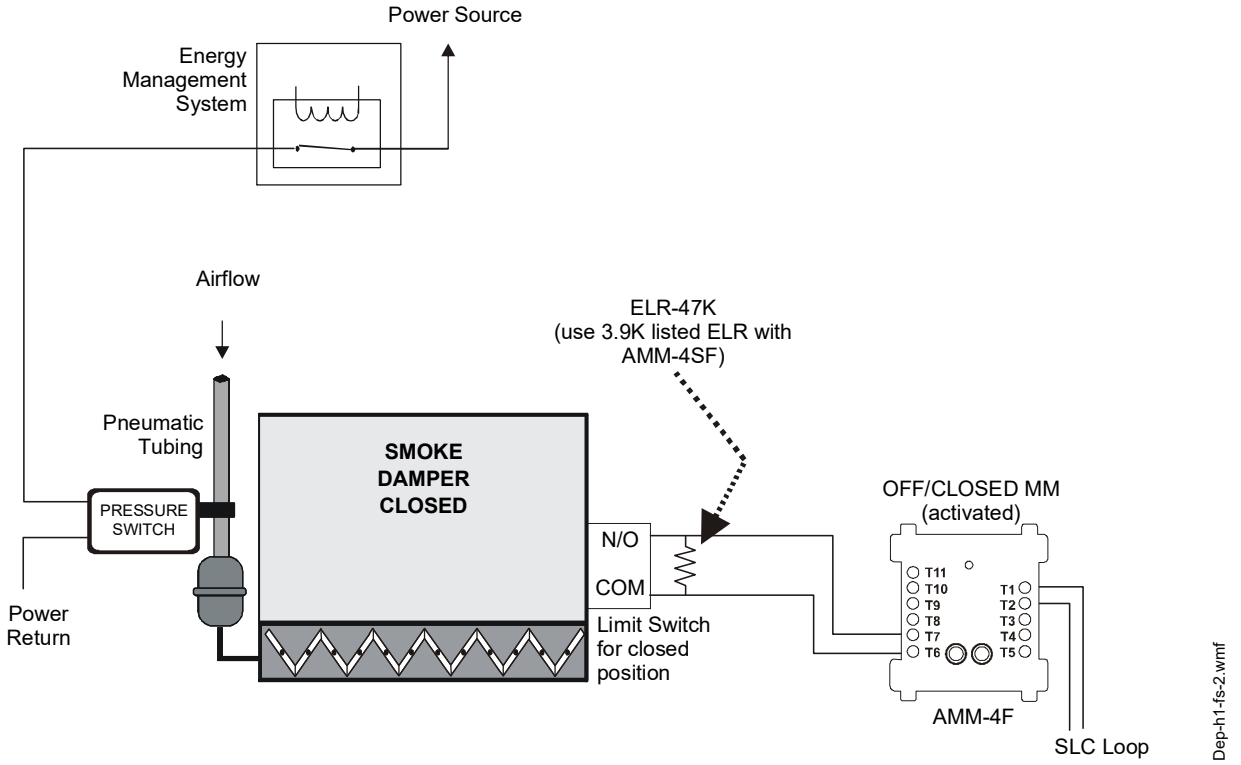


Figure B.67 HVAC EP Damper Wiring (Type 1)

Type 1: HVAC EP Damper CLOSED Monitoring

Figure B.67 shows wiring in an HVAC system that can monitor the CLOSED state of an EP damper (Type 1). In this arrangement, the EMS is supplying power to the pressure switch. When power is supplied, the pressure switch cuts the airflow to the damper, closing the damper. When the damper completely closes, the damper closed limit switch is closed, indicating that the damper is in the closed position.

The OFF/CLOSED MM monitors the closed position of the damper closed limit switch. In this case the OFF/CLOSED MM is activated because the damper is closed.

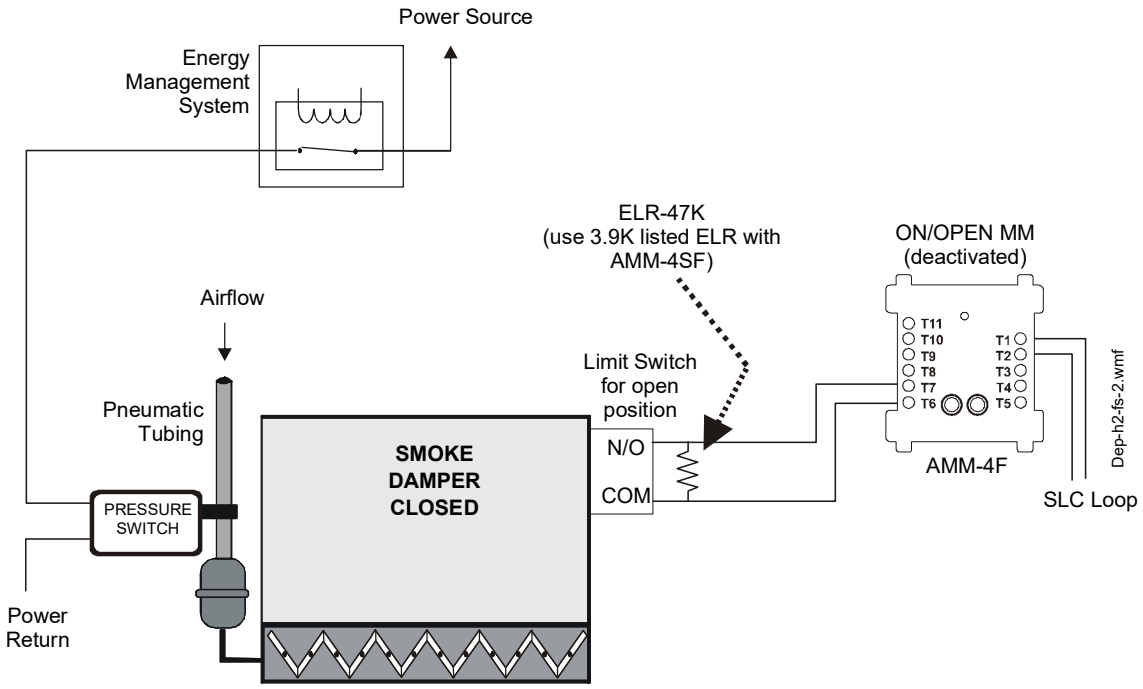


Figure B.68 HVAC EP Damper Wiring (Type 2)

Type 2: HVAC EP Damper OPEN Monitoring

Figure B.68 shows wiring in an HVAC system that can monitor the OPEN state of an EP damper (Type 2). In this arrangement, the EMS is supplying power to the pressure switch. When power is supplied, the pressure switch cuts the airflow to the damper, closing the damper. When the damper completely closes, the damper closed limit switch is closed, indicating that the damper is in the closed position.

The ON/OPEN MM monitors the closed position of the damper open limit switch. In this case the ON/OPEN MM is deactivated because the damper is closed.

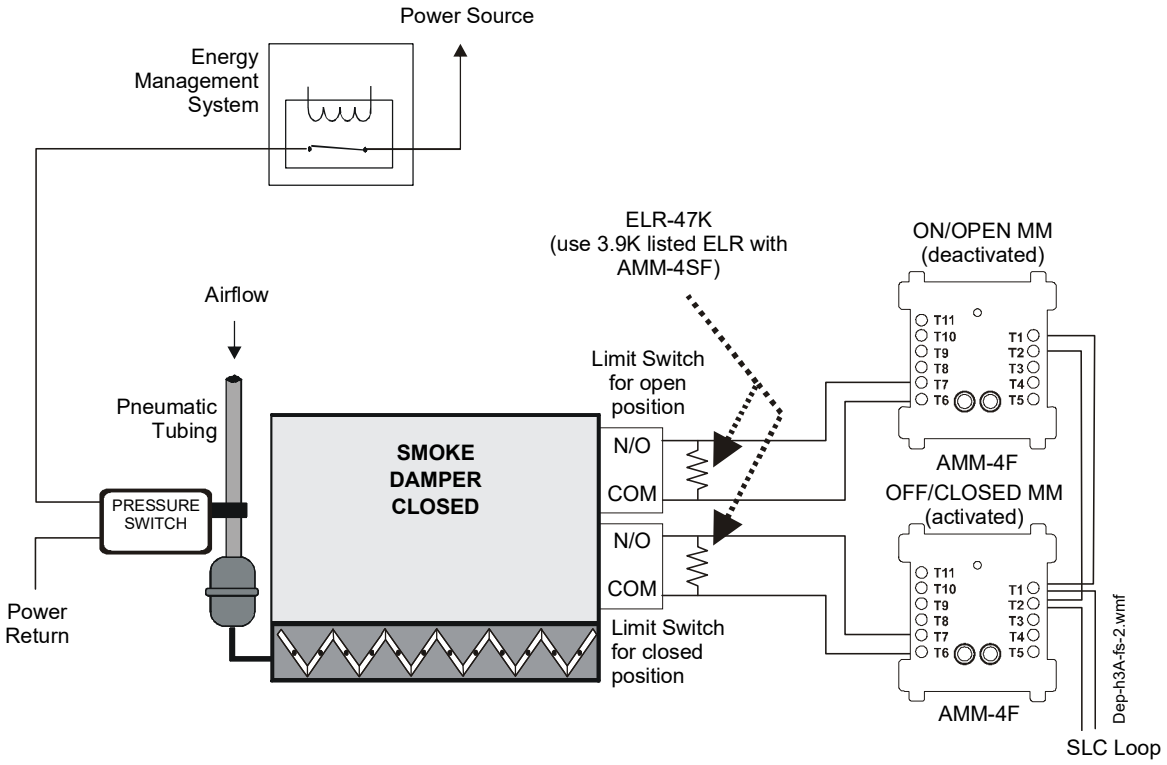


Figure B.69 HVAC EP Damper Wiring (Type 3)

Type 3: HVAC EP Damper OPEN and CLOSED Monitoring

Figure B.69 shows wiring in an HVAC system that can monitor the OPEN and CLOSED states of an EP damper (Type 3). In this arrangement, the EMS is supplying power to the pressure switch. When power is supplied, the pressure switch cuts the airflow to the damper, closing the damper. When the damper completely closes, the damper closed limit switch is closed and the damper open limit switch is open, indicating that the damper is in the closed position.

The OFF/CLOSED MM monitors the closed position of the damper closed limit switch and the ON/OPEN MM monitors the closed position of the damper open limit switch. In this case the OFF/CLOSED MM is activated and the ON/OPEN MM is deactivated because the damper is closed.

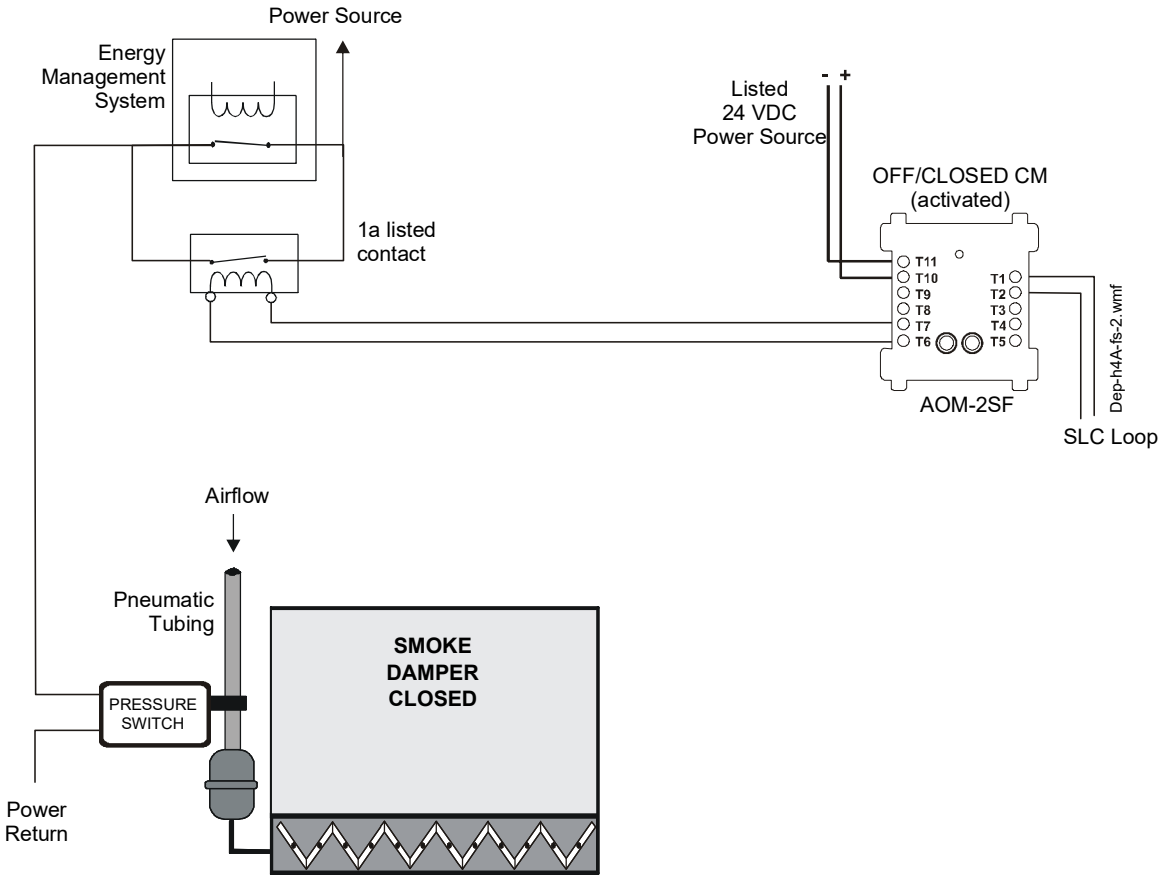


Figure B.70 HVAC EP Damper Wiring (Type 4)

Type 4: HVAC EP Damper CLOSED Control

Figure B.70 shows wiring in an HVAC system that is capable of CLOSED control of an EP damper (Type 4). In this arrangement, the OFF/CLOSED CM is activated. The OFF/CLOSED CM controls a normally open contact for the pressure switch power line.

When the OFF/CLOSED CM is activated, the normally open contact is closed. When the contact closes, power is supplied to the pressure switch which cuts the airflow to the damper, closing the damper. When the OFF/CLOSED CM is deactivated, the EMS is free to control the damper. The EMS is currently being overridden by the OFF/CLOSED CM.

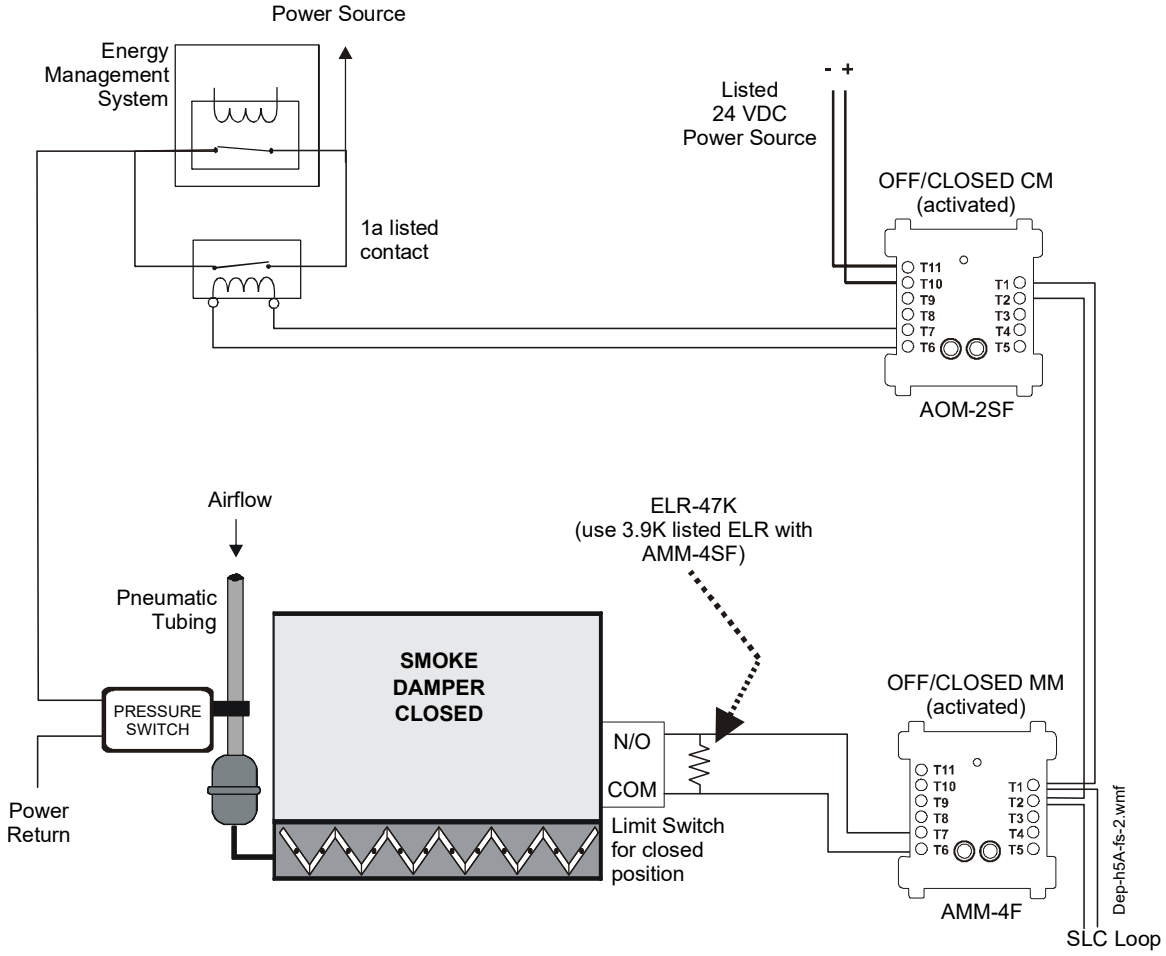


Figure B.71 HVAC EP Damper Wiring (Type 5)

Type 5: HVAC EP Damper CLOSED Control, CLOSED Monitoring

Figure B.71 shows wiring in an HVAC system that is capable of CLOSED control of an EP damper and can monitor the damper's CLOSED state (Type 5). In this arrangement, the OFF/CLOSED CM is activated. The OFF/CLOSED CM controls a normally open contact for the pressure switch power line. When the OFF/CONTROL CM is activated, the normally open contact is closed. When the contact closes, power is supplied to the pressure switch, which cuts the airflow to the damper and closes it.

When the OFF/CONTROL CM is deactivated, the EMS is free to control the damper. The EMS is currently being overridden by the OFF/CLOSED CM. When power is supplied to the pressure switch, the damper closes. When the damper completely closes, the damper closed limit switch is closed, indicating that the damper is in the closed position.

The OFF/CLOSED MM monitors the closed position of the damper closed limit switch. In this case the OFF/CLOSED MM is activated because the damper is closed.

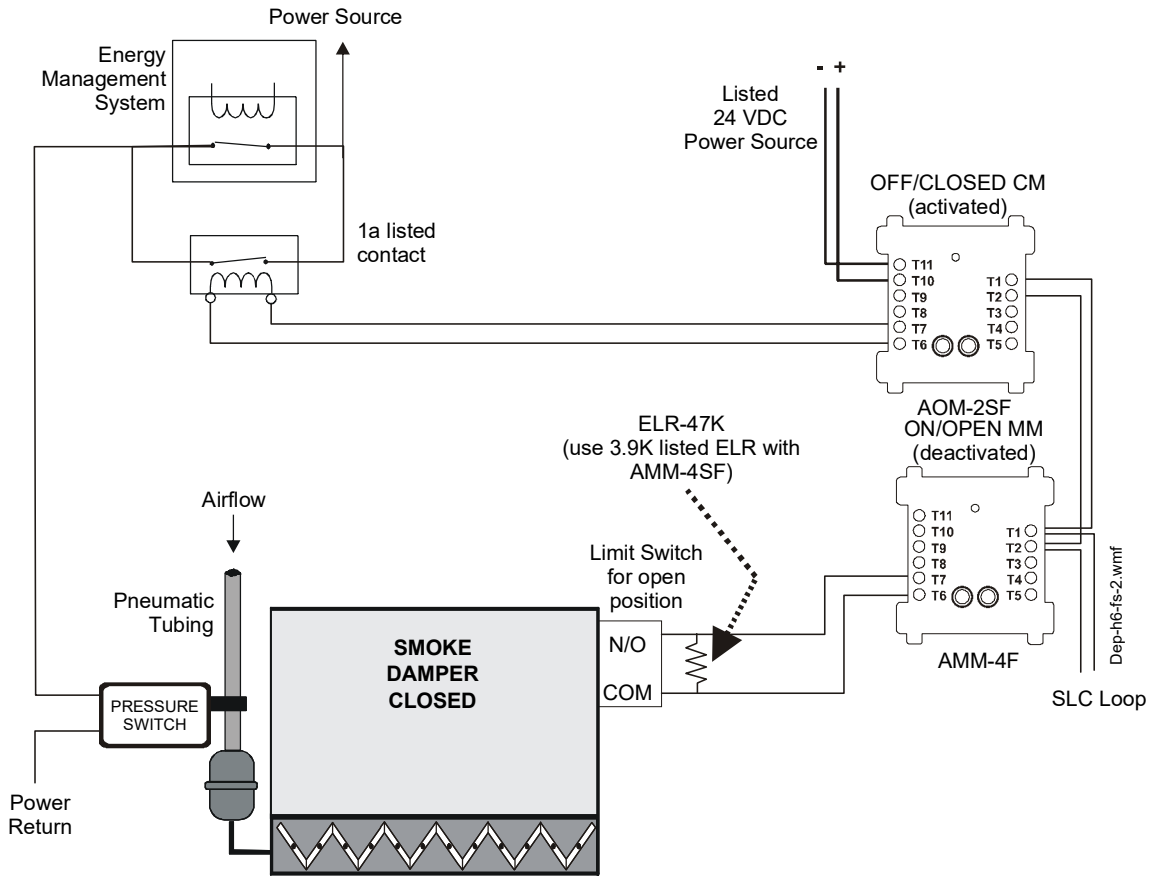


Figure B.72 HVAC EP Damper Wiring (Type 6)

Type 6: HVAC EP Damper CLOSED Control, OPEN Monitoring

Figure B.72 shows wiring in an HVAC system that is capable of CLOSED control of an EP damper and can monitor the damper's OPEN state (Type 6). In this arrangement, the OFF/CLOSED CM is activated. The OFF/CLOSED CM controls a normally open contact for the pressure switch power line.

When the OFF/CONTROL CM is activated, the normally open contact is closed. When the contact closes, power is supplied to the pressure switch, which cuts the airflow to the damper and closes it.

When the OFF/CONTROL CM is deactivated, the EMS is free to control the damper. The EMS is currently being overridden by the OFF/CLOSED CM. When power is supplied to the pressure switch, the damper closes. When the damper completely closes, the damper closed limit switch is closed, indicating that the damper is in the closed position.

The ON/OPEN MM monitors the closed position of the damper open limit switch. In this case the ON/OPEN MM is deactivated because the damper is closed.

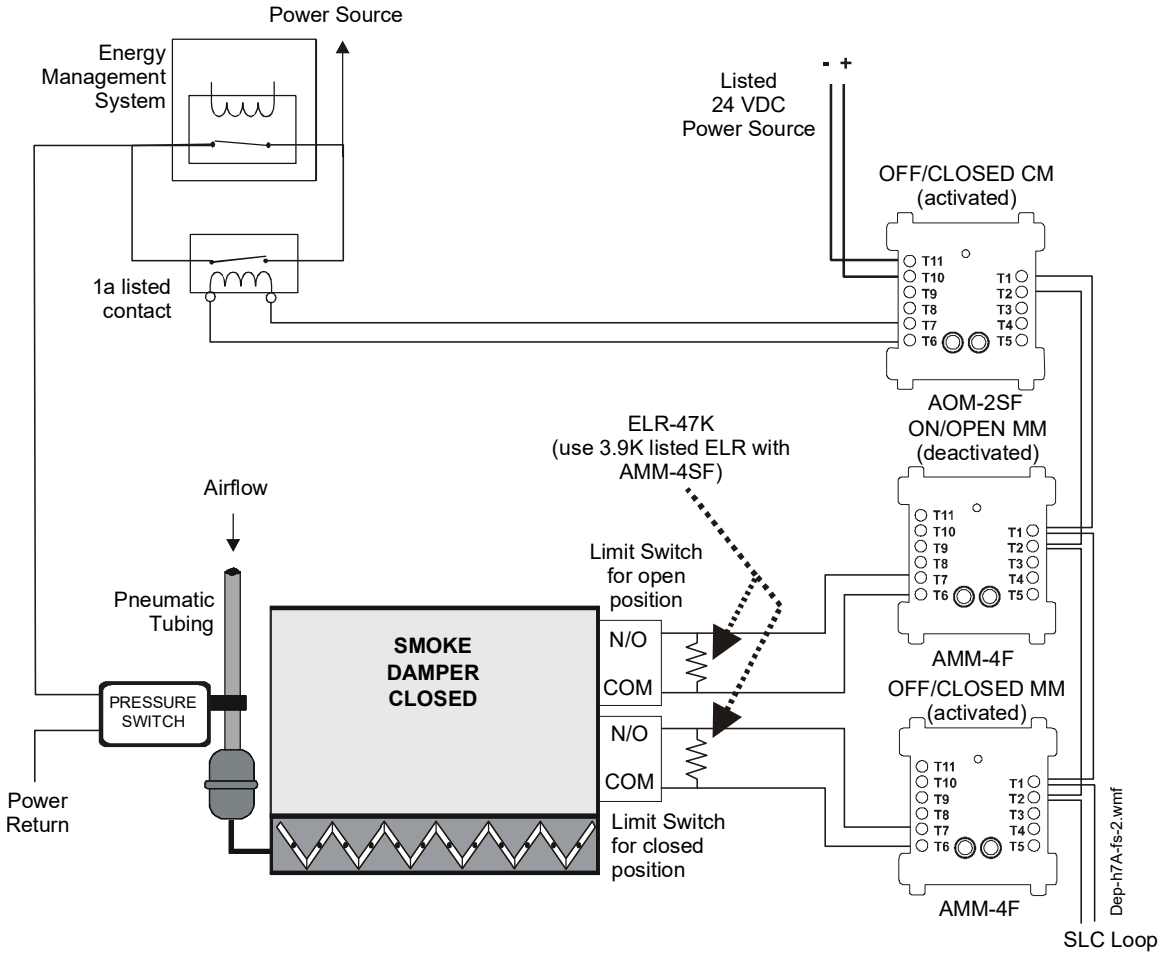


Figure B.73 HVAC EP Damper Wiring (Type 7)

Type 7: HVAC EP Damper CLOSED Control, OPEN and CLOSED Monitoring

Figure B.73 shows wiring in an HVAC system that is capable of CLOSED control of an EP damper and can monitor the damper's OPEN and CLOSED states (Type 7). In this arrangement, the OFF/CLOSED CM is activated. The OFF/CLOSED CM controls a normally open contact for the pressure switch power line.

When the OFF/CLOSED CM is activated, the normally open contact is closed. When the contact closes, power is supplied to the pressure switch, which cuts the airflow to the damper, closing the damper. When the OFF/CLOSED CM is deactivated, the EMS is free to control the damper. The EMS is currently being overridden by the OFF/CLOSED CM. When power is supplied to the pressure switch, the damper closes. When the damper completely closes, the damper closed limit switch is closed and the damper open limit switch is OPEN, indicating that the damper is in the closed position.

The OFF/CLOSED MM monitors the closed position of the damper closed limit switch and the ON/OPEN MM monitors the closed position of the damper open limit switch. In this case the OFF/CLOSED MM is activated and the ON/OPEN MM is deactivated because the damper is closed.

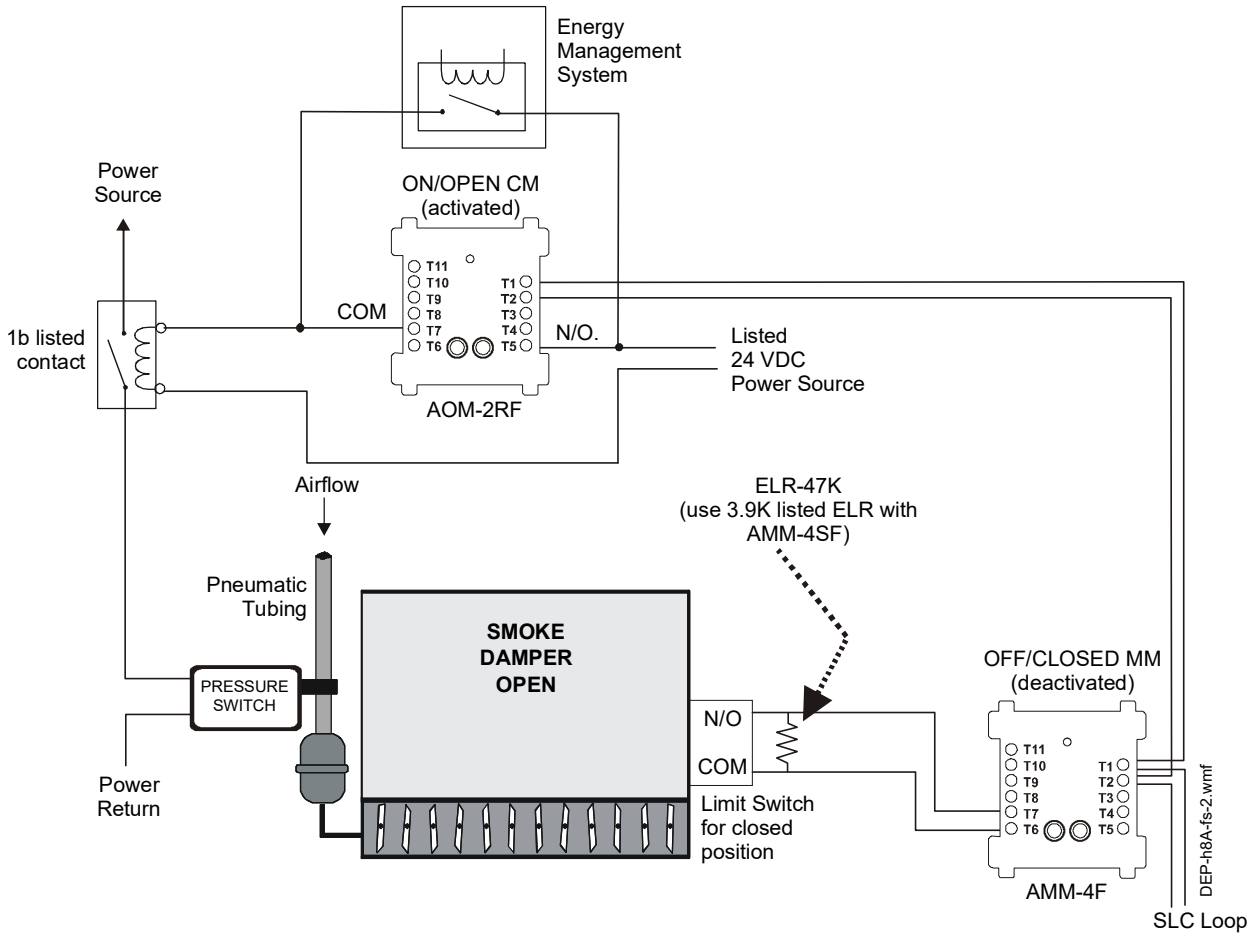


Figure B.74 HVAC EP Damper Wiring (Type 8)

Type 8: HVAC EP Damper OPEN Control

Figure B.74 shows wiring in an HVAC system that is capable of OPEN control of an EP damper (Type 8). In this arrangement, the ON/OPEN CM is activated. The ON/OPEN CM controls a normally closed contact for the pressure switch power line.

When the ON/OPEN CM is activated, the normally closed contact is opened. When the contact opens, power is cut from the pressure switch, which allows airflow to open the damper. When the ON/OPEN CM is deactivated, the EMS is free to control the damper. The EMS is currently being overridden by the ON/OPEN CM.

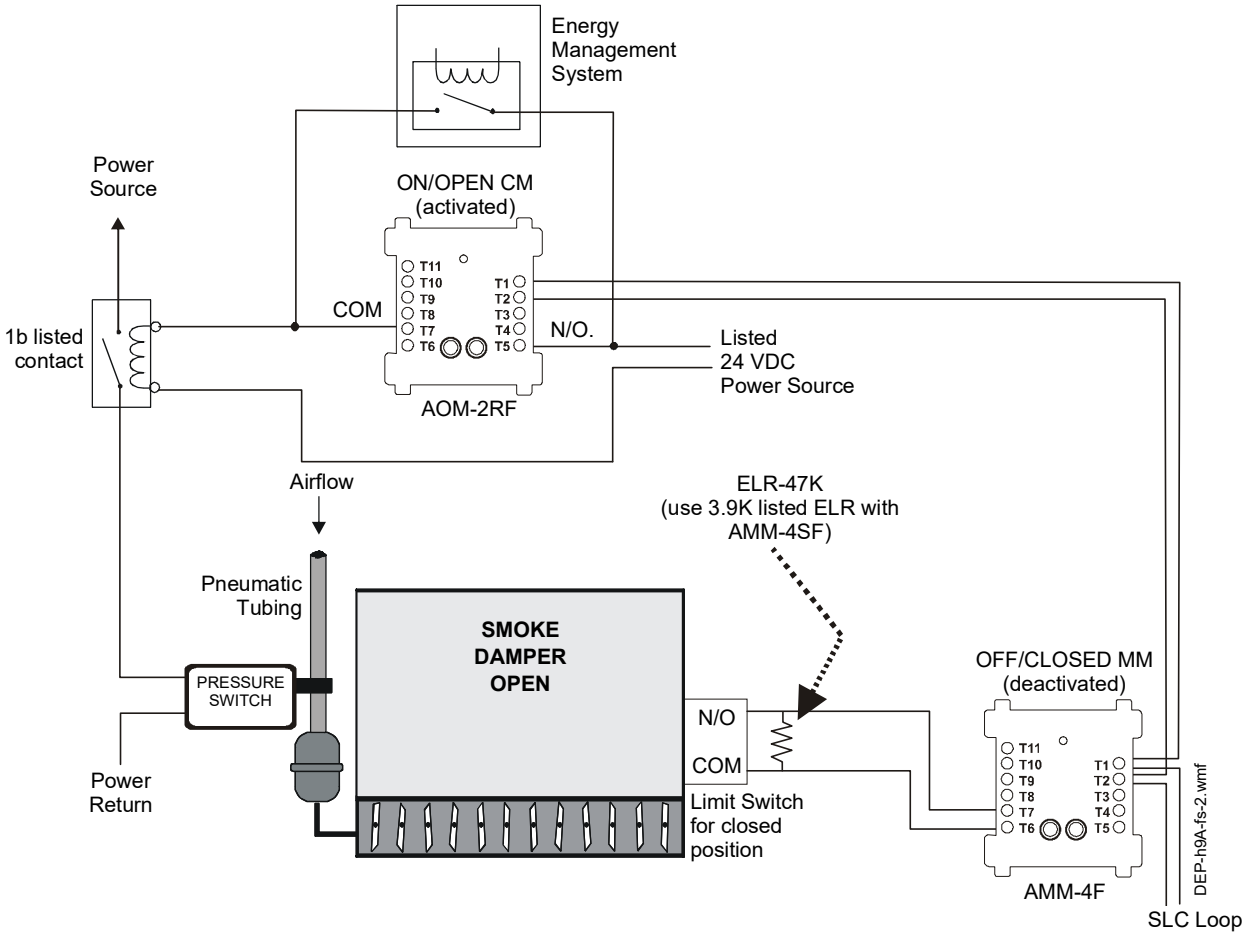


Figure B.75 HVAC EP Damper Wiring (Type 9)

Type 9: HVAC EP Damper OPEN Control, CLOSED Monitoring

Figure B.75 shows wiring in an HVAC system that is capable of OPEN control of an EP damper and can monitor the damper's CLOSED state (Type 9). In this arrangement, the ON/OPEN CM is activated. The ON/OPEN CM controls a normally closed contact for the pressure switch power line.

When the ON/OPEN CM is activated, the normally closed contact is opened. When the contact opens, power is cut from the pressure switch, which allows airflow to open the damper. When the ON/OPEN CM is deactivated, the EMS is free to control the damper. The EMS is currently being overridden by the ON/OPEN CM. When power is cut from the pressure switch, the damper opens. When the damper completely opens, the damper open limit switch is closed and the damper closed limit switch is open, indicating that the damper is in the open position.

The OFF/CLOSED MM monitors the closed position of the damper closed limit switch. In this case the OFF/CLOSED MM is deactivated because the damper is open.

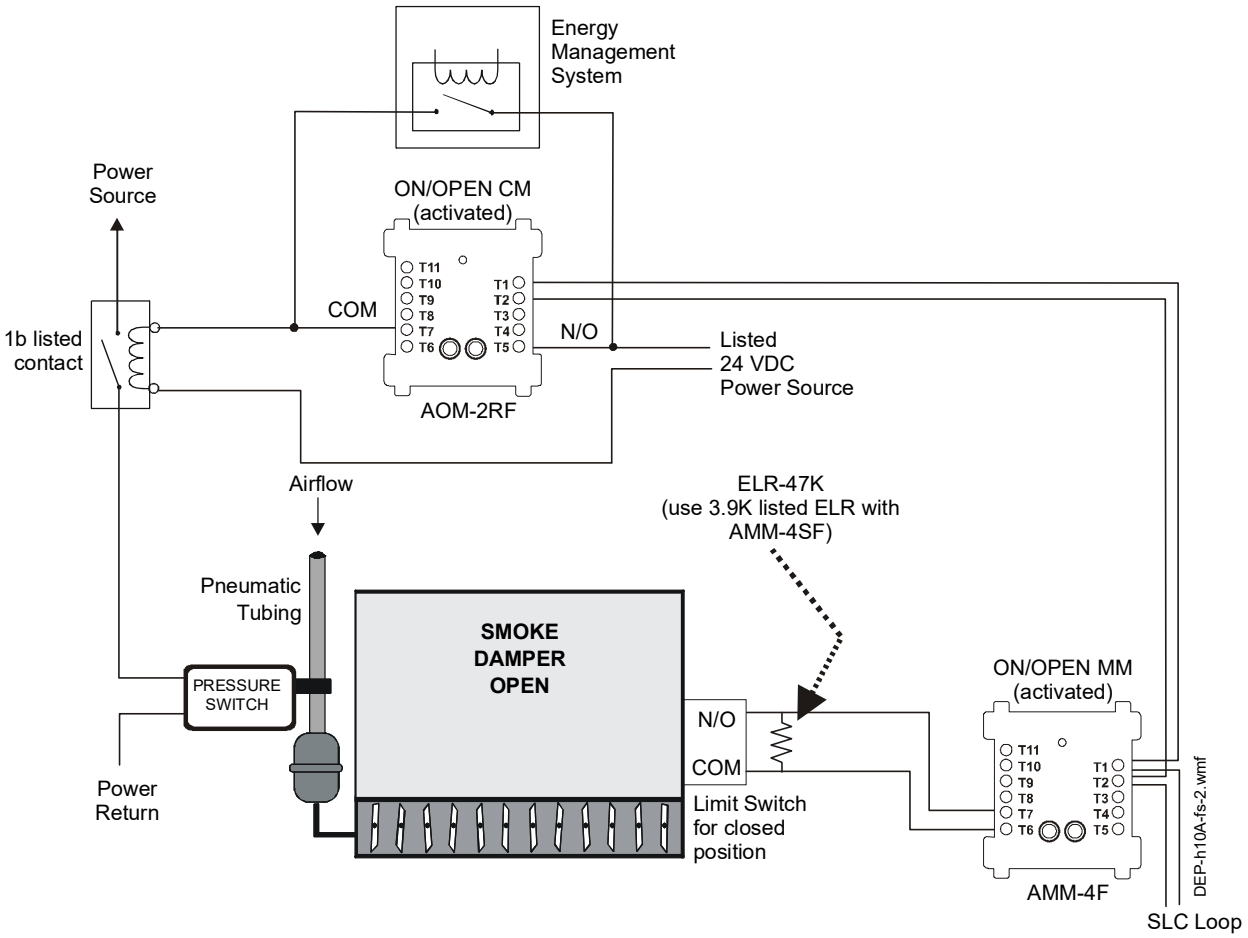


Figure B.76 HVAC EP Damper Wiring (Type 10)

Type 10: HVAC EP Damper OPEN Control, OPEN Monitoring

Figure B.76 shows wiring in an HVAC system that is capable of OPEN control of an EP damper and can monitor the damper's OPEN state (Type 10). In this arrangement, the ON/OPEN CM is activated. The ON/OPEN CM controls a normally closed contact for the pressure switch power line.

When the ON/OPEN CM is activated, the normally closed contact is opened. When the contact opens, power is cut from the pressure switch which allows airflow to open the damper. When the ON/OPEN CM is deactivated, the EMS is free to control the damper. The EMS is currently being overridden by the ON/OPEN CM. When power is cut from the pressure switch, the damper opens. When the damper completely opens, the damper open limit switch is closed and the damper closed limit switch is open, indicating that the damper is in the open position.

The ON/OPEN MM monitors the closed position of the damper open limit switch. In this case the ON/OPEN MM is activated because the damper is open.

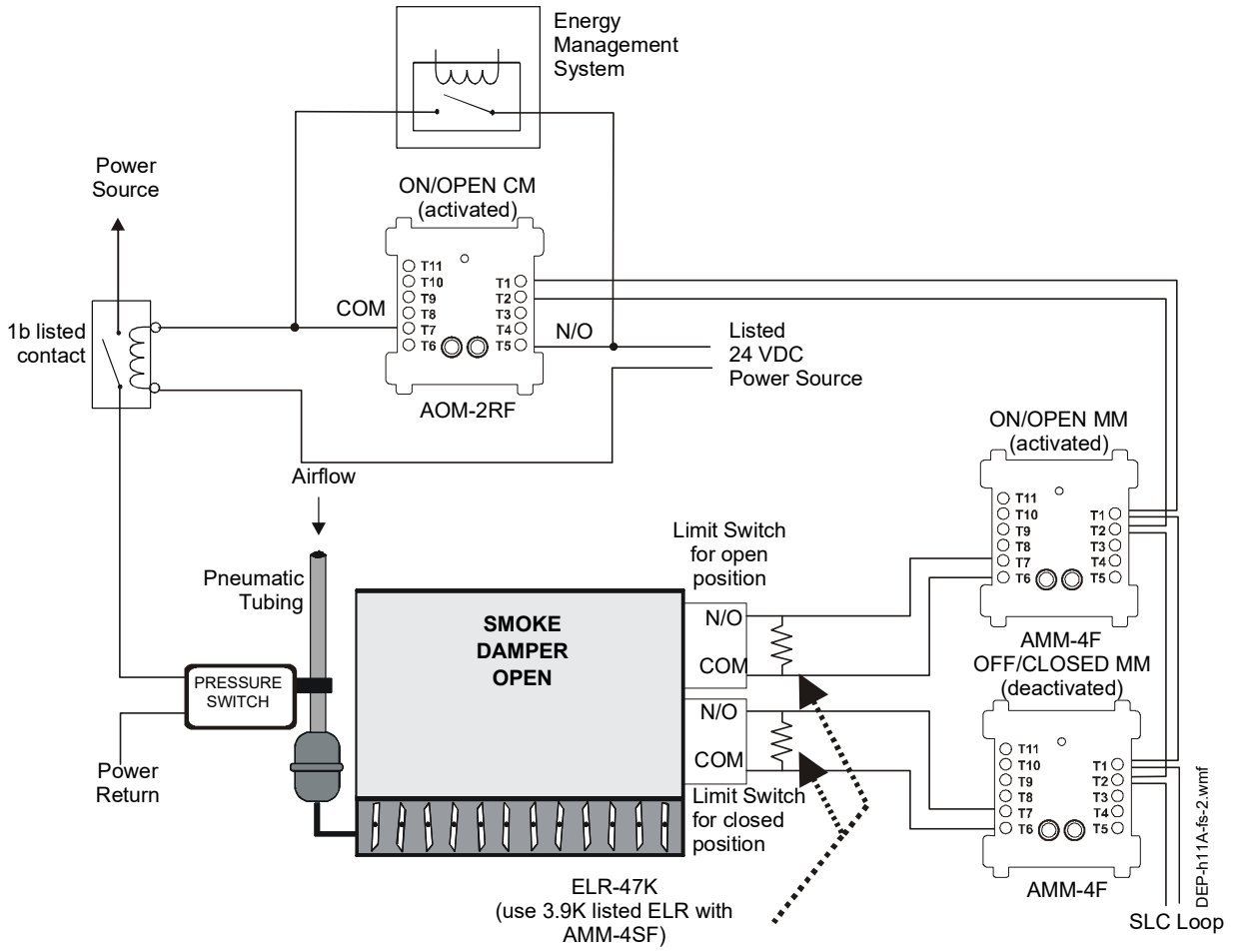


Figure B.77 HVAC EP Damper Wiring (Type 11)

Type 11: HVAC EP Damper OPEN Control, OPEN and CLOSED Monitoring

Figure B.77 shows wiring in an HVAC system that is capable of OPEN control of an EP damper and can monitor the damper's OPEN and CLOSED states (Type 11). In this arrangement, the ON/OPEN CM is activated. The ON/OPEN CM controls a normally closed contact for the pressure switch power line.

When the ON/OPEN CM is activated, the normally closed contact is opened. When the contact opens, power is cut from the pressure switch which allows airflow to open the damper. When the ON/OPEN CM is deactivated, the EMS is free to control the damper. The EMS is currently being overridden by the ON/OPEN CM. When power is cut from the pressure switch, the damper opens. When the damper completely opens, the damper open limit switch is closed and the damper closed limit switch is open, indicating that the damper is in the OPEN position.

The ON/OPEN MM monitors the closed position of the damper open limit switch and the OFF/CLOSED MM monitors the closed position of the damper closed limit switch. In this case the ON/OPEN MM is activated and the OFF/CLOSED MM is deactivated because the damper is open.

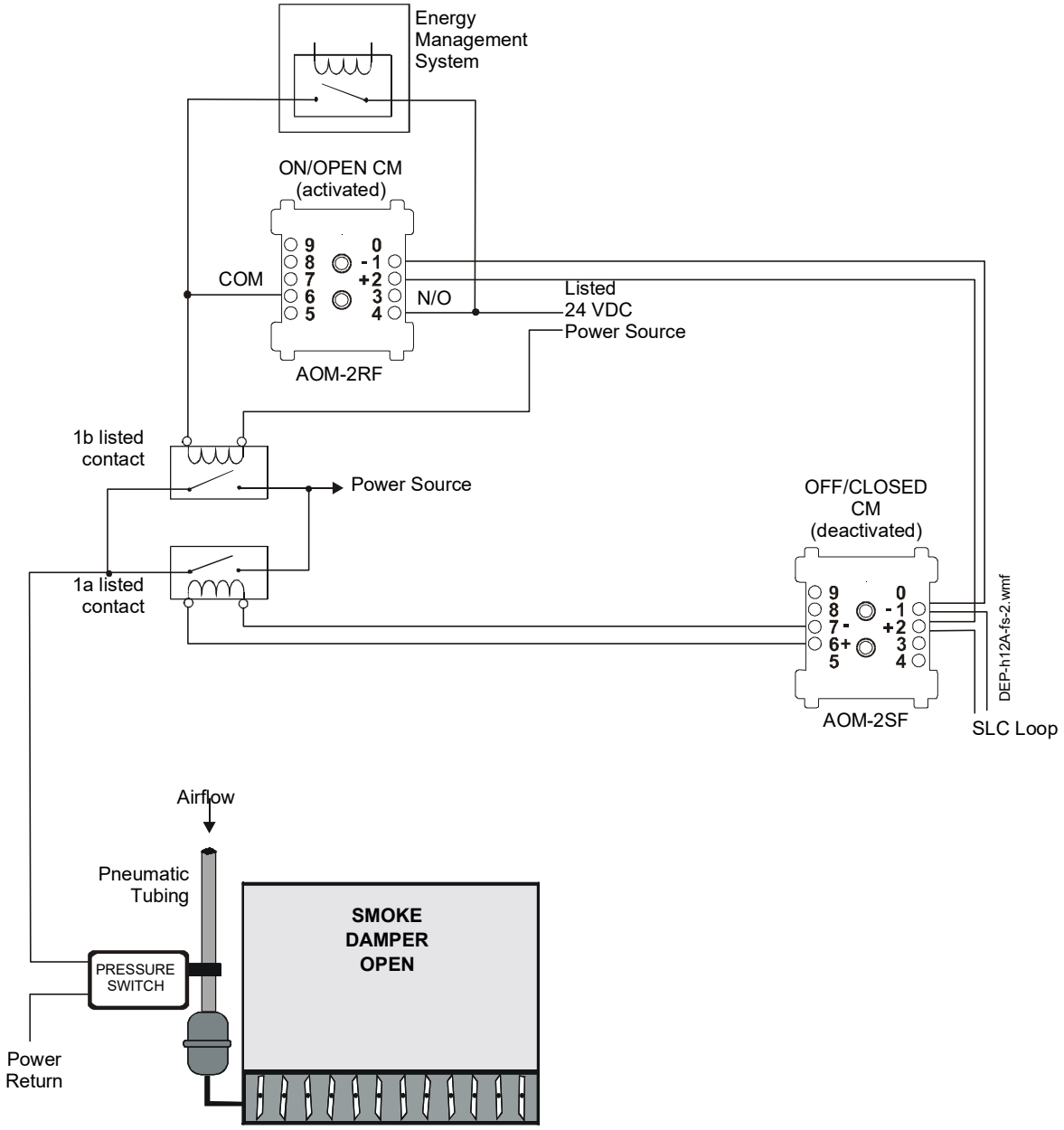


Figure B.78 HVAC EP Damper Wiring (Type 12)

Type 12: HVAC EP Damper OPEN and CLOSED Control

Figure B.78 shows wiring in an HVAC system that is capable of OPEN and CLOSED control of an EP damper (Type 12). In this arrangement, the ON/OPEN CM is activated and the OFF/CLOSED CM is deactivated. The ON/OPEN CM controls normally closed contact for the pressure switch power line.

When the ON/OPEN CM is activated, the normally closed contact is opened. When the contact opens, power is cut from the pressure switch which allows airflow to open the damper. When the ON/OPEN CM is deactivated, the EMS is free to control the damper. The EMS is currently being overridden by the ON/OPEN CM.

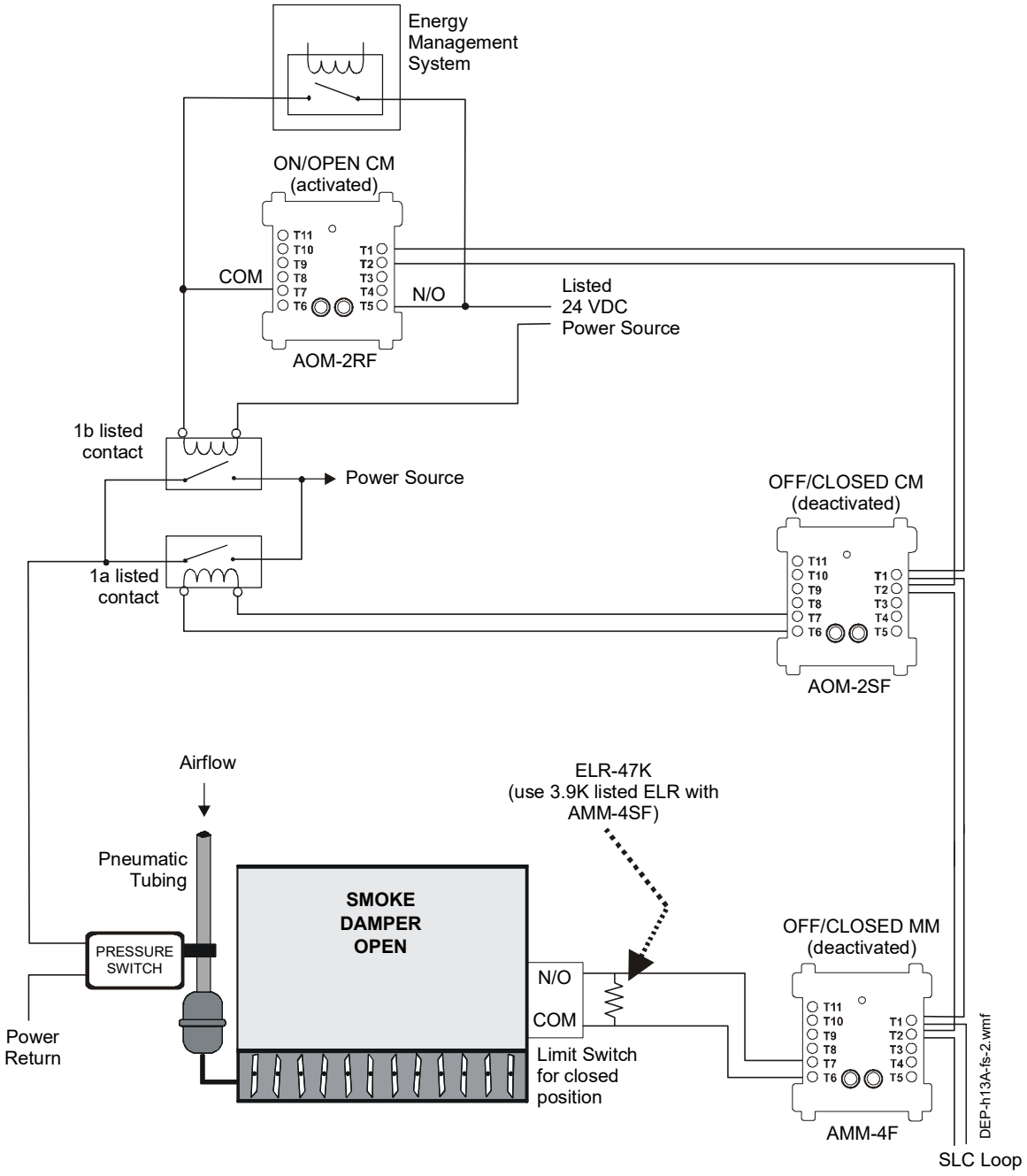


Figure B.79 HVAC EP Damper Wiring (Type 13)

Type 13: HVAC EP Damper OPEN and CLOSED Control, CLOSED Monitoring

Figure B.79 shows wiring in an HVAC system that is capable of OPEN and CLOSED control of an EP damper and can monitor the damper's CLOSED state (Type 13). In this arrangement, the ON/OPEN CM is activated and the OFF/CLOSED CM is deactivated. The ON/OPEN CM controls a normally closed contact for the pressure switch power line.

When the ON/OPEN CM is activated, the normally closed contact is opened. When the contact opens, power is cut from the pressure switch, which allows airflow to open the damper. When the ON/OPEN CM is deactivated, the EMS is free to control the damper. The EMS is currently being overridden by the ON/OPEN CM. When power is cut from the pressure switch, the damper opens. When the damper completely opens, the damper open limit switch is closed and the damper closed limit switch is open, indicating that the damper is in the open position.

The OFF/CLOSED MM monitors the closed position of the damper closed limit switch. In this case the OFF/CLOSED MM is deactivated because the damper is open.

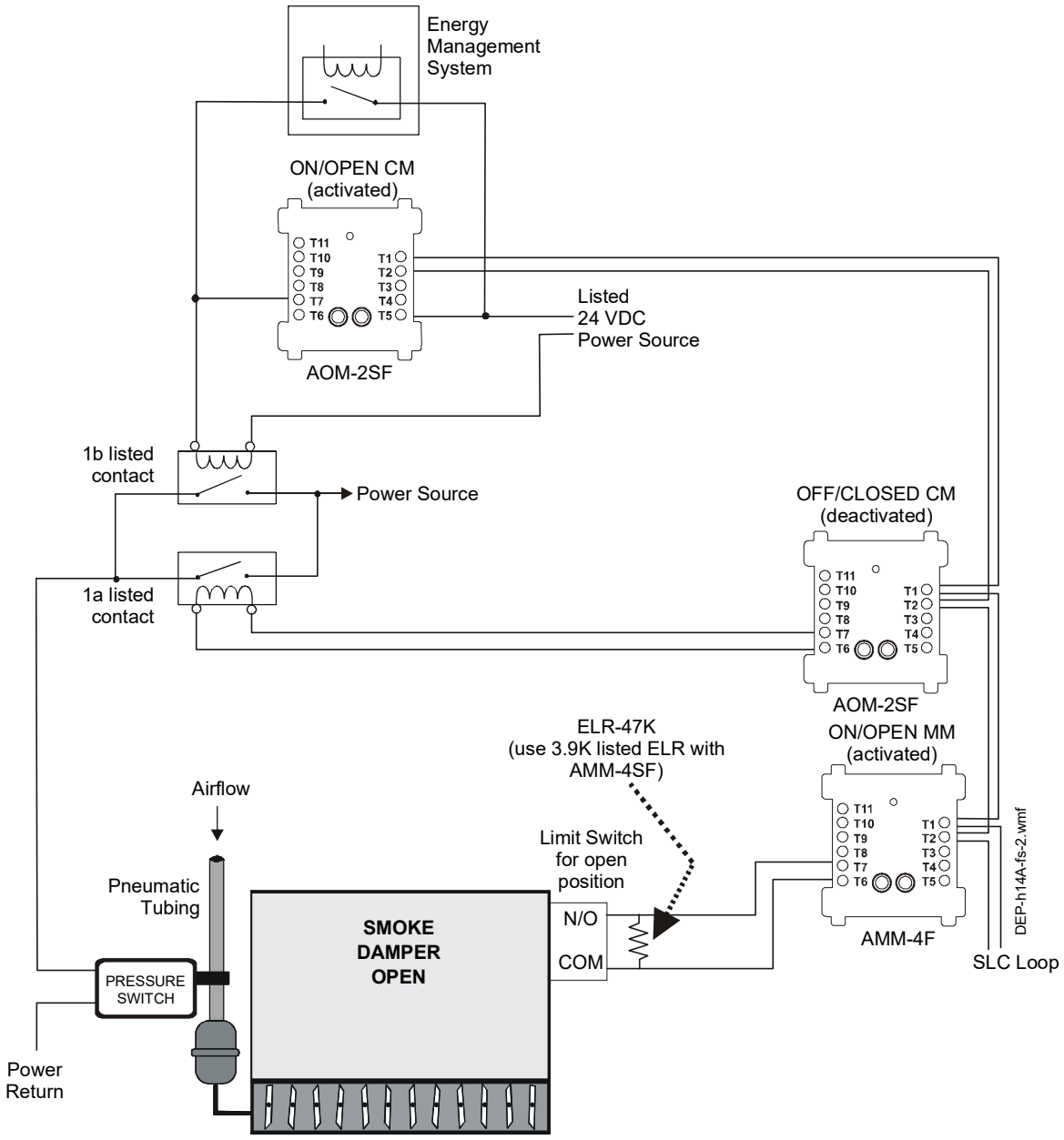


Figure B.80 HVAC EP Damper Wiring (Type 14)

Type 14: HVAC EP Damper OPEN and CLOSED Control, OPEN Monitoring

Figure B.80 shows wiring in an HVAC system that is capable of OPEN and CLOSED control of an EP damper and can monitor the damper's OPEN state (Type 14). In this arrangement, the ON/OPEN CM is activated and the OFF/CLOSED CM is deactivated. The ON/OPEN CM controls a normally closed contact for the pressure switch power line.

When the ON/OPEN CM is activated, the normally closed contact is opened. When the contact opens, power is cut from the pressure switch, which allows airflow to open the damper. When the ON/OPEN CM is deactivated, the EMS is free to control the damper. The EMS is currently being overridden by the ON/OPEN CM. When power is cut from the pressure switch, the damper opens. When the damper completely opens, the damper open limit switch is closed, indicating that the damper is in the open position.

The ON/OPEN MM monitors the closed position of the damper open limit switch In this case the ON/OPEN MM is activated because the damper is open.

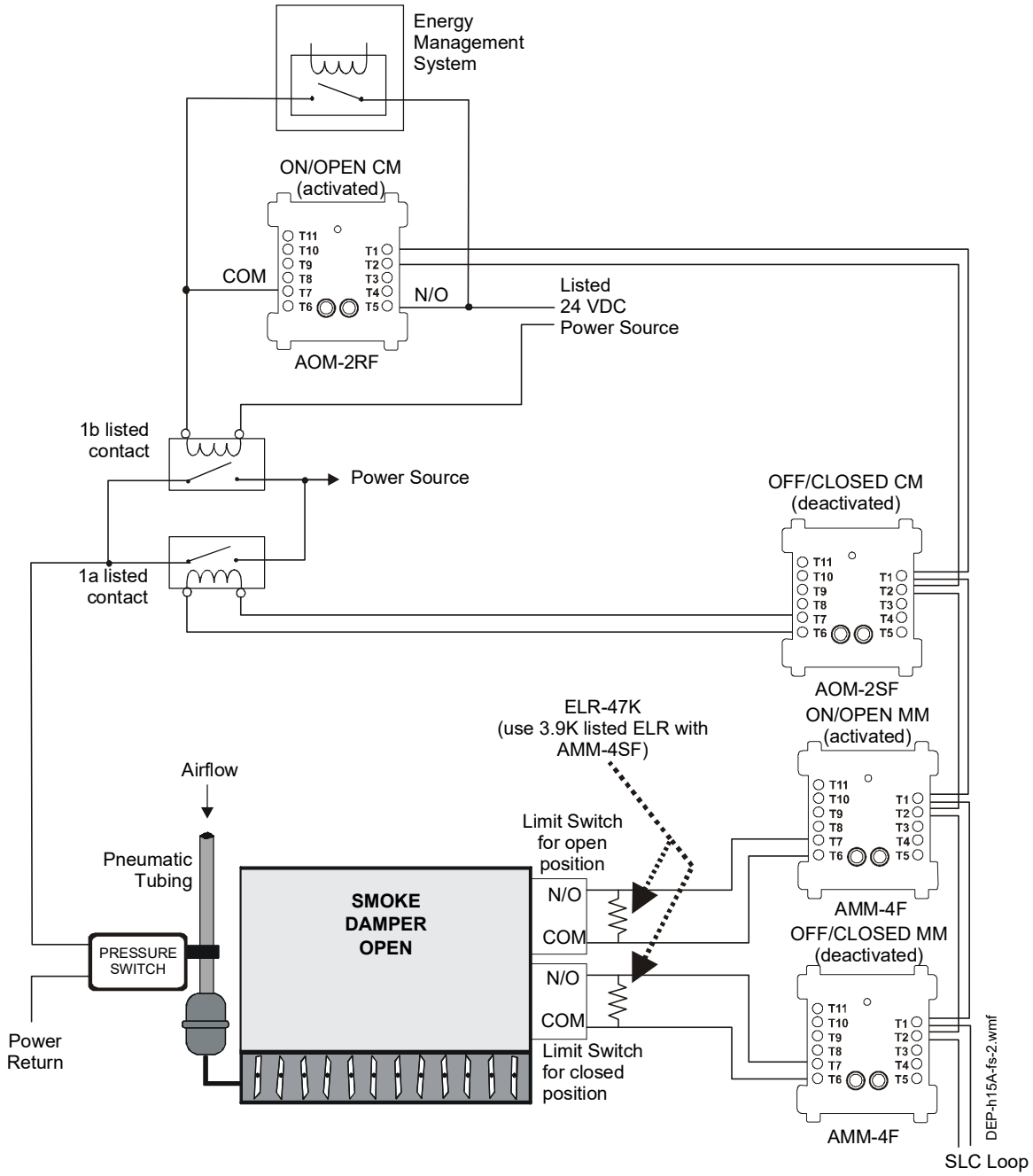


Figure B.81 HVAC EP Damper Wiring (Type 15)

Type 15: HVAC EP Damper OPEN and CLOSED Control, OPEN and CLOSED Monitoring

Figure B.81 shows wiring in an HVAC system that is capable of OPEN and CLOSED control of an EP damper and can monitor the damper's OPEN and CLOSED states (Type 15). In this arrangement, the ON/OPEN CM is activated and the OFF/CLOSED CM is deactivated. The ON/OPEN CM controls a normally closed contact for the pressure switch power line.

When the ON/OPEN CM is activated, the normally closed contact is opened. When the contact opens, power is cut from the pressure switch, which allows airflow to open the damper. When the ON/OPEN CM is deactivated, the EMS is free to control the damper. The EMS is currently being overridden by the ON/OPEN CM. When power is cut from the pressure switch, the damper opens. When the damper completely opens, the damper open limit switch is closed and the damper closed limit switch is open, indicating that the damper is in the open position.

The ON/OPEN MM monitors the closed position of the damper open limit switch and the OFF/CLOSED MM monitors the closed position of the damper closed limit switch. In this case the ON/OPEN MM is activated and the OFF/CLOSED MM is deactivated because the damper is open.

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