EXPERT REPORT

a) FORENSIC ANALYSIS OF SINGLE CIRCUIT DATA-BUS CONNECTED HOUSEHOLD BURGLAR AND FIRE ALARM SYSTEM CONTROL UNITS

b) THE DATA-BUS CIRCUIT, DATA-BUS CONNECTED EQUIPMENT, AUXILIARY DC POWER, AND INTERCONNECTED WIRING

c) UL 985, UL 1023, NFPA 72 OF THE NATIONAL FIRE ALARM CODE AND NFPA 72 OF THE NATIONAL FIRE ALARM AND SIGNALING CODE

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INTRODUCTION

Nationally Recognized Manufacturers of Household Burglar and Fire Alarm System Control Units have a duty to comply with their Equipment Manufacturer's Specifications, UL® Standards, NFPA® Standards, Nationally Recognized Industry Standards and Best Practices and The Authority Having Jurisdiction (AHJ).

The standard of care for equipment manufacturers is to have their control panels and other manufactured equipment listed for their intended purpose by a Nationally Recognized Testing Laboratory (NRTL) such as Underwriters Laboratories, Inc. or Intertek in accordance with UL Standards, NFPA-70 of the National Electrical Code, NFPA 72, Statutory Duties, Nationally Recognized Industry Standards and Best Practices and the Authority Having Jurisdiction.

All Household Control Panels[1] shall comply with the equipment manufacturer's specifications, NFPA 72, the National Fire Alarm Code and/or the more current editions of NFPA 72, the National Fire Alarm and Signaling Code which is published by the National Fire Protection Association, Inc. Furthermore, all Household Control Panels are required to be combination listed under UL 1023 and UL 985 respectively. Against the foregoing backdrop, my expert and forensic analysis in this matter has identified that under certain conditions of commonality, Household Burglar and Fire Alarm Control Units both historically and currently being manufactured and sold cannot and do not comply with its represented UL Standards, and NFPA 72 Standards.

BACKGROUND

For more than forty (40) years, I have attained specialized education, skill, knowledge, training, experience, and nationally recognized peer-reviewed credentials in the security survey, needs analysis, system design, application, installation, programming, inspection, testing, maintenance and remote supervising station and/or central station monitoring of more than 5,000 security and/or life safety systems.

Since 1979, I have owned and operated an active alarm contracting practice. Currently, I am actively operating my full-service alarm contracting company in the States of New York and New Jersey.

I am a twenty-three (23) year Designated Expert Instructor for the New York City Police Department (NYPD). The training curriculum which I have created includes, but is not limited to teaching local, state and federal law enforcement agencies on the topics of Alarm Science, the Forensic Study of Alarm Systems, Equipment Manufacturers Specifications, UL Standards. NFPA Standards and Forensic Investigations.

[1] Kindly note that the words "Control Panel" and "Control Units" are being used interchangeably throughout this expert report.

I am the author of the Alarm Science Manual, an internationally recognized and peer-reviewed first-of-its-kind authoritative treatise that is part of the training curriculum for the New York City Police Department (NYPD). This treatise is utilized by the technical community of the alarm, central station, security, and law enforcement sectors.

I have created State Certified Curriculum for over forty (40) Continuing Education Units (CEU)s for certified and licensed alarm contractors covering topics which include, but are not limited to: Alarm Science, Case Studies of Alarm Liability, the Duties of an Alarm Contractor, Alarm System Design, Installation, and Central Station Monitoring, Equipment Manufacturers Specifications, Fire Alarm Science, NFPA 72®, the National Fire Alarm Code and NFPA 72®, the National Fire Alarm and Signaling Code, the Fire Protection Handbook®, Fire Alarm Signaling Systems, UL Standards, and Nationally Recognized Industry Standards and Best Practices.

I have been appointed to serve by the National Fire Protection Association as a Technical Committee Panel Member, in the Special Expert (SE) Category, for NFPA 72® of the National Fire Alarm Code, and for NFPA 72® of the National Fire Alarm and Signaling Code.[2]

Instructor for the National Fire Protection Association (NFPA).

I have been appointed by Underwriters Laboratories, Inc. to serve as a Standard Technical Panel (STP) Member for twenty-three (23) UL Standard Committees.

I am a Certified and Licensed Burglar and Fire Alarm Systems Contractor in five states.

I have been awarded three United States Patents in Electronic Security and Security Systems.

NICET Level IV Certified Senior Engineering Technician (SET) in Fire Protection Engineering Technology/Fire Alarm Systems, by the National Institute For Certification in Engineering Technologies, (NICET). A Division of the National Society of Professional Engineers.

NICET Level II Certified Engineering Technician, (FASI&T) Fire Protection Engineering Technology/Inspection and Testing of Fire Alarm Systems-National Institute For Certification In Engineering Technologies (NICET).

Certified Protection Professional (CPP) Board Certified in Security Management through ASIS International.

Certified Fire Protection Specialist (CFPS) through the National Fire Protection Association.

[2] Technical Committee Member from July of 2002 through November 2009.

Certified Fraud Examiner (CFE) through the Association of Certified Fraud Examiners.

Certified Homeland Protection Associate Level IV (CHPA-IV) through the National Sheriffs Association Institute for Homeland Security-Global Center for Public Safety.

Certified Active Shooter/Hostile Event Response: Plan, Respond, Recover Program Specialist NFPA 3000(PS) through the National Fire Protection Association.

METHODOLOGY

The methodology which I utilized in my forensic analysis of this matter is based on my specialized education, skill, knowledge, training, experience and peer-reviewed credentials as a Nationally Recognized Forensic Expert in the alarm industry for more than forty years. It is also based on my training to and acceptance by the professional communities and sectors of the alarm industry, remote/central station monitoring industry, the security industry and local, state and federal law enforcement agencies.

My expert opinions have been accepted as being reliable by courts and qualified persons in many areas of my expertise, including but not limited to Alarm Science, The Forensic Study of Alarm Systems, UL® Standards, NFPA 72®, the National Fire Alarm Code, NFPA 72®, National Fire Alarm and Signaling Code, Equipment Manufacturers Specifications, and Nationally Recognized Industry Standards and Best Practices.

The expert opinions which I have set forth in this report are generally accepted by other qualified forensic experts in the field of my Subject Matter Expertise (SME).

The information that I relied upon in this report is the type of information that qualified forensic experts in my field reasonably rely upon when expressing opinions about this subject matter.

Similarly, the theories, techniques, tools, and methodologies utilized by me during my forensic analysis of this matter are generally recognized as being valid and reliable by qualified forensic experts in my field.

Notably, I have used these reliable methodologies before in other forensic matters where I have served and testified in both State and Federal Courts; as an expert in Alarm Science, the Forensic Study of Alarm Systems, NFPA Standards, UL Standards, Nationally Recognized Industry Standards and Best Practices and on a multitude of other topics relating to my expertise as a Security System, Fire Alarm, and Security Expert.

I have applied and relied upon my extensive training to and acceptance by the technical communities of the alarm, fire alarm, life safety, remote supervising station, and central station monitoring industries, and as being an instructor to authorities having jurisdictions (AHJ)'s, code officials, and local and national alarm associations across the country, including the Electronic Security Association (ESA) f/k/a the National Burglar and Fire Alarm Association, The Monitoring Association f/k/a the Central Station Alarm Association (CSAA), and a profusion of

other local and nationally recognized alarm companies and UL® Listed Central Station organizations across the country.

I have applied and relied upon industry standards of the Electronic Security Association (ESA) formerly known as the National Burglar and Fire Alarm Association, The Monitoring Association formerly known as the Central Station Alarm Association (CSAA), the Automatic Fire Alarm Association (AFAA), the Security Industry Association (SIA), the National Fire Protection Association (NFPA) and ASIS International.

THE DANGEROUS AND FORESEEABLE VULNERABILITIES OF THE SINGLE DATA-BUS CIRCUIT AND ITS INTERCONNECTING WIRING, DATA-BUS CONNECTED EQUIPMENT, THE AUXILIARY DC POWER OUTPUT CIRCUIT, DC POWERED DEVICES AND ITS INTERCONNECTING WIRING IN THE HOUSEHOLD OCCUPANCY

The dangerous and foreseeable vulnerabilities of the data-bus circuit on a Household Fire Warning System Unit which is listed to UL 985[3] and is combination listed to UL 1023[4] is best illustrated by the fact that the majority if not all equipment manufacturers require that mission-critical devices and/or certain field devices be data-bus connected in parallel to each other. The data-bus circuit and its required parallel connection of interconnected wiring to all data-bus connected devices throughout the protected premises utilizes a four conductor cable. On the other side of the technical spectrum, the auxiliary DC power output circuit terminals from the control panels termination coincides with the corresponding the (+) and (-) terminals of the power side of the data-bus circuit.

Accordingly, once any portion of the data-bus circuit, any or all of its data-bus connected equipment, and/or its wiring is impaired due to a fault or short circuit condition it will instantly shut down the control panels data-bus circuit and all of the interconnected data-bus connected equipment on the system since the majority if not all control panel manufacturers have designed their single data-bus circuit to require connection to all data-bus devices via a parallel connection as explained herein.

The list of equipment which resides on the data-bus circuit, and/or its interconnected circuit wiring in parallel requires a hardwired connection to the control panel and generally includes, but is not limited to all of the remote system keypads, remote system keypads with built-in radio receiving unit(s), external dual diversity wireless radio receiving unit(s), auxiliary DC power connected devices, zone expansion modules, input/output relays, certain power supplies and data-bus connected wireless radio alarm transmitters such as Alarm-Com® and Total-Connect® equipment.

[3] Standard for Household Fire Warning System Units.
[4] Standard for Household Burglar-Alarm System Units.

Similarly, the control units 12 Volt DC auxiliary power output for audio glass break detectors, motion detectors, and other detection devices which require DC power to function and operate are required to be hardwired and parallel connected to the systems data-bus on its positive and negative conductors or on the final wiring terminations where the data-bus circuit starts inside and on the control panel's circuit board.

In sum, the auxiliary DC power output circuit and/or its interconnected wiring and/or its DC powered devices that are installed within the household occupancy using the same (+) and (-) power terminals that the data-bus circuit utilizes significantly expands the control panels danger and vulnerability to catastrophic failure.

Fundamentally, once the data-bus circuit wiring leaves the control panel housing it exposes the entire alarm system to catastrophic and instantaneous failure upon this data-bus circuit wiring becoming faulted, impeded or shorted by fire in any location where the data-bus circuit wiring is installed throughout the home and as it relates to all data-bus connected devices, equipment or wiring which are remote from the control unit and are installed throughout the household occupancy.

By design, UL Listed Household Burglar and Fire Alarm Units which contain a single hardwired data-bus circuit require all of the system keypads, system keypads with built-in wireless radio receiving unit(s), external data-bus connected dual diversity wireless radio alarm receiver(s), data-bus connected zone expansion module(s), data-bus connected input/output modules, auxiliary DC power, a data-bus connected wireless radio alarm transmitter and the like to connect to the control panels data-bus circuit in parallel. Based on the required design characteristics of the equipment, it creates a foreseeably dangerous vulnerability to the overall functionality and reliability of the alarm systems control unit and to all occupants of the home who rely on the system to provide them with intrusion detection and early warning fire and life safety protection.

For the reasons stated in this report, under common conditions, listed UL 1023 and UL 985 control units of this type of design and methodology and other control panel manufacturer's equipment which utilize a similar data-bus circuit design, are being manufactured in deviation to UL 1023, UL 985 and NFPA 72 Standards.

RELIABILITY OF FIRE ALARM SYSTEMS

I. UL 985 Standard for Household Fire Warning System Units, Fifth Edition

39.1 Fire alarm control unit

39.1.1 A household control unit shall be capable of operating reliability and uniformly for all conditions of its intended performance when used in conjunction with initiating devices and indicating devices to form a system combination of the type indicated by the installation wiring diagram and any supplementary information provided.[5]

A Single Data-Bus Circuit which becomes impaired due to a fault or short circuit condition will render a Household Control Unit immediately incapable of operating reliably and uniformly for all conditions of its intended performance.

II. NFPA 72®, National Fire Alarm and Signaling Code, 2019 Edition

14.4.6 Household Fire Alarm Systems. (SIG-HOU)

14.4.6. Household alarm systems shall be inspected, tested, and maintained at least annually according to Table 14.3.1, Table 14.4.3.2, and the manufacturer's published instructions.

14.4.6.2 The responsibility for inspection, testing, and maintenance of smoke alarms and connected appliances shall be in accordance with 14.2.3.

29.6.3* Equipment. The performance of fire-and carbon monoxide (CO)-warning equipment discussed in this chapter shall depend on such equipment being properly selected, installed, operated, tested, and maintained in accordance with the provisions of this Code and with the manufacturer's published instructions provided with this equipment.[6]

[5] See Sections 41.1 and 41.1.1 of the Sixth Edition of UL 985.
[6] See Section 29.4.3 of the 2016 Edition of NFPA 72®, which states, *Equipment. The performance of fire-warning equipment discussed in this chapter shall depend on such equipment being properly selected, installed, operated, tested, and maintained in accordance with the provisions of this Code and with the manufacturer's published instructions provided with this equipment.*

Section A.29.6.3 quantifies the Functional Reliability of Fire Alarm Systems having certain features;

Assumptions-- equipment as follows:

(2) Reliability of fire alarm systems. Fire alarm systems located in dwelling units and having all of the following features are considered to have a functional reliability of 95 percent:

(a) Utilizes a control unit
(b) Has at least two independent sources of operating power
(c) Monitors all initiating and notification circuits for integrity
(d) Transmits alarm signals to a constantly attended, remote monitoring location
(e) Is tested regularly by the homeowner and at least every 3 years by a qualified service technician

(3) Reliability of fire alarm systems without remote monitoring or with wireless transmission. Fire alarm systems for dwelling units with all of the proceeding features except (d) or systems that use low-power wireless transmission from initiating devices within the dwelling units are considered to have a functional reliability of 90 percent. [7]

Technical Analysis and Expert Opinions:

Notwithstanding what NFPA 72 considers as the functional reliability of a Fire Alarm System having certain features is the criticality of the fact that once the single data-bus circuit on a Household UL 985 to UL 1023 Control Unit is impaired as subsumed in this expert report the functional reliability of the fire alarm system in a Household Occupancy of 90% to 95% dramatically cascades down to 0% which equates to a foreseeably dangerous and defective product that increases the propensity of serious personal injury and/or death to occupants within the premises and/or catastrophic destruction of property within the household occupancy.

[7] See Section A.29.4.3 of the 2016 Edition of NFPA 72®.

UL 985-STANDARD FOR HOUSEHOLD FIRE WARNING SYSTEM UNITS [8]

1 Scope

1.1 These requirements cover household fire warning system control units intended to be installed in accordance with the National Fire Alarm Code, ANSI/NFPA 72, and the National Electrical Code, ANSI/NFPA 70.

1.2 A household fire warning system control unit consists of a unit assembly of electrical parts having provision for connection of power supply and initiating device circuits. Provision for connection of a notification appliance circuit is also required unless an alarm sounding device is integral with the control unit. Additional terminals may be provided for the connection of supplementary devices, such as annunciators, remote switches, and the like. A secondary supply, consisting of a rechargeable battery, shall be provided integral with the control unit or provision may be provided for its connection to the control unit.

1.3 Provision for the connection to the control unit of at least one smoke detector is required unless reference is made on the installation diagram for the use of a self-contained smoke detector, such as a single- or multiple-station fire alarm device.

1.4 These requirements also apply to the use of combination systems, such as a combination fire-burglar alarm system control unit, which uses circuit wiring common to both systems. When common wiring is used for combination systems, it shall be connected in such a manner that internal fault conditions (shorts, opens, grounds) in the nonfire alarm (burglary) system circuit wiring, or faults between the fire and nonfire alarm system circuits, will not interfere with the supervision of the fire alarm system or prevent intended alarm signal transmission.[9]

1.5 These requirements do not cover single- or multiple-station fire alarm devices, automatic fire detectors, or alarm notification appliances, such as bells, horns, carbon monoxide alarm devices, emergency initiating devices, non-emergency initiating devices, and the like. They do cover accessories which are external to the control unit and are dependent upon the control unit function, such as end-of-line devices, annunciators, and remote switches.

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[8] The Fifth and Sixth Edition of UL 985 references the same verbiage in sections 1 through 1.6. Section 1.7 appears only in the Sixth Edition.

[9] No equipment manufacturer of Single Data-Bus Connected Household Control Units complies with this part of the Scope of UL 985 under section 1.4. The failure to comply with the Scope of UL 985 at Section 1.4, and as otherwise set forth in this report applies to both manufactured Control Units which are Legacy Based and to Control Units which have been manufactured thereafter, including all UL-985/UL-1023 Control Units which are being produced today. (Emphasis added)

1.6 If a digital alarm communicator transmitter is used to transmit signals to a remote location and it is to be included as a component of the system, it shall comply with the applicable requirements in the Standard for Digital Alarm Communicator System Units, UL 1635. Otherwise the user must be notified that the off-premises transmission method has not been so investigated.

1.7 Where a unit employs security functions, it shall comply with the Standard for Household Burglar-Alarm System Units, UL 1023. Units employing medical alert functions shall comply with the Standard for Home-Health Care Signaling Equipment, UL 1637. A unit utilizing non-fire and/or non-carbon monoxide emergency and/or non-emergency signaling functions shall meet the requirements of the Standard for General-Purpose Signaling Devices and Systems, UL 2017.[10]

UL 1023-STANDARD FOR HOUSEHOLD BURGLAR-ALARM SYSTEM UNITS[11]

1 Scope

1.1 These requirements cover burglar-alarm system units intended for use in residences to protect a complete multiroom residence, one room of a residence, or one opening or area in a residence.

1.2 Household burglar-alarm system units covered by these requirements consist of one or more unit assemblies of electrical components that are designed to detect the presence, movement, sound, or other activity of an intruder. Provisions are made for the connection of a power supply, remote control, and signal circuits by a prescribed method of wiring. These system units usually operate within the limits of Class 2 remote control and signal circuits as defined by Article 725 of the National Electrical Code, NFPA 70.

1.3 These requirements also apply to the use of combination systems, such as a combination fire-burglar-alarm system control unit. A combination system is connected in such a manner that fault conditions (shorts, opens, grounds) in the burglar-alarm system circuit wiring, or interconnections between the fire- and burglar-alarm system circuits, will not interfere with the supervision of the fire alarm system or will not prevent intended alarm signal operation.[12]

1.4 A combination household fire and burglar alarm system shall also comply with the Standard for Household Fire Warning System Units, UL 985.[13],[14]

[10] See the Sixth Edition of UL 985.
[11] See the Sixth and Seventh Edition of UL 1023.
[12] Emphasis added.
[13] Emphasis added.
[14] The Seventh Edition of UL 1023 reference section 1.4, however, the same verbiage appears in Section 1.3.1 of the Sixth Edition of UL 1023.

1.5 These requirements cover accessories that are external to the control unit and that are dependent upon the control unit function, such as end-of-line devices, annunciators, remote switches, and the like.[15]

1.6 Intrusion detection devices, such as motion detectors or sound detectors, are covered by the Standard for Intrusion-Detection Units, UL 639.[16]

1.7 A household burglar alarm system shall provide supervision of the initiating device circuits, so that if there is an open in the circuit or failure of a transmitter device's ability to communicate with its receiver, the open or failure to transmit will be indicated to the alarm system user.[17],[18]

1.8 Only alarm equipment determined acceptable for household burglar alarm service may be installed under the requirements contained in the Standard for Installation and Classification of Residential Burglar Alarm Systems, UL 1641.[19]

NFPA 72®, THE NATIONAL FIRE ALARM CODE AND NFPA 72®, THE NATIONAL FIRE ALARM AND SIGNALING CODE

Alarm contractors have a duty to comply with NFPA 72 Standards in the recommendations, design, installation, programming, inspection, testing, maintenance and remote/central station monitoring of all types of fire alarm and life safety systems for Household Occupancies. NFPA 72 is adopted by most Authorities Having Jurisdiction across the country and is considered both an authoritative treatise and statutory duty in most jurisdictions. Furthermore, alarm equipment manufacturers whose equipment is listed to UL 985 are also required to comply with NFPA 72 Standards.

[15] The Seventh Edition of UL 1023 references section 1.5, however the same verbiage appears in Section 1.4 of the Sixth Edition of UL 1023.
[16] The Seventh Edition of UL 1023 references 1.6, however, the same verbiage appears in Section 1.5 of the Sixth Edition of UL 1023.
[17]Failure of the data-bus circuit due to a fault or short circuit condition will instantly shutdown the systems external wireless radio receiving unit on a Single Data-Bus Connected Control Unit. As a threshold matter and in gross deviation to UL 1023 in section 1.7, if there is an open in the circuit or failure of a transmitter device's ability to communicate with its receiver, the open or failure to transmit will not be indicated to the alarm system user. (Emphasis added)
[18] The Seventh Edition of UL 1023 references 1.7, however, the same verbiage appears in Section 1.6 of the Sixth Edition of UL 1023.
[19] The Seventh Edition of UL 1023 references 1.8, however the same verbiage appears in Section 1.7 of the Sixth Edition of UL 1023.

NFPA 72®, the National Fire Alarm Code covers the application, installation, location, performance, and maintenance of fire alarm systems and their components. NFPA 72®, the National Fire Alarm and Signaling Code provides the latest safety provisions to meet society's changing fire detection, signaling, and emergency communications demands. In addition to the core focus on fire alarm systems, the Code includes requirements for mass notification systems used for weather emergencies, terrorist events, biological, chemical, and nuclear emergencies, and other threats.

UNDER COMMON CONDITIONS UL 985 LISTED HOUSEHOLD FIRE WARNING SYSTEM UNITS DO NOT HISTORICALLY COMPLY WITH THE 2002, 2007, 2010, 2013, 2016 AND 2019 EDITIONS OF NFPA 72®, THE NATIONAL FIRE ALARM CODE AND/OR NFPA 72®, THE NATIONAL FIRE ALARM AND SIGNALING CODE

I. The 2019 Edition Of NFPA 72®, The National Fire Alarm And Signaling Code

29.10.7.5 Faults in other systems[20] or components[21],[22] shall[23] not affect the operation[24] of the fire alarm system.

Technical Analysis and Expert Opinions:

Any faults such as a short-circuit condition from fire or otherwise which impedes the data-bus circuit and/or any of its interconnected data-bus circuit wiring throughout the household occupancy and/or if any of the data-bus connected equipment that is installed in the home is attacked by fire; it will instantly shut down all of the data-bus and parallel connected devices on

[20] A fault and/or short circuit condition on the control panel's auxiliary 12VDC power output circuit will dangerously impact upon the operation of the fire alarm system in that it will catastrophically shut down the entire data-bus circuit and all of the systems external data-bus connected wireless dual diversity radio receiving unit(s) and its wireless radio alarm transmitter.
[21] A fault and/or short circuit condition on any of the data-bus circuit wiring that is installed throughout the home and/or is branched off in parallel within the home to support other data-bus connected devices will dangerously impact upon the operation of the fire alarm system in that it will catastrophically shut down the data-bus circuit of the control unit and the control unit will not be able to function as intended.
[22] A fault and/or short circuit condition on any of the data-bus connected devices will dangerously impact on the operation of the fire alarm system in that it will catastrophically shut down the data-bus circuit.
[23] The word "shall" under NFPA 72 is defined as a mandatory requirement.
[24] Operation of the Fire Alarm System indicates that the control unit will be able to detect a fire alarm and/or trouble condition from any of the systems automatic initiating detection devices which are installed in the protected premises, whether these devices are hardwired, wireless or if the system is based on a hybrid design. The system shall audibly annunciate a fire alarm, life safety and/or trouble condition in the home and the alarm system shall be able to notify the remote/central station of an alarm and/or trouble condition both on-site and remotely.

the system such as the system's mission-critical dual diversity external wireless radio receiving unit and the systems data-bus connected wireless radio alarm transmitter.

If any of the auxiliary DC powered initiating detection devices and/or its interconnecting wiring which connects to the auxiliary 12 Volt power output terminals of the control unit is impeded by fire, it would instantaneously shut down the control unit's data-bus circuit and everything else that is required to be connected to it in parallel.

The control panel terminals for (+) and (-) power on the data-bus circuit are identical to the terminals which the auxiliary DC power output circuit of the control unit is required to connect to in parallel. This configuration is one of the technical dangers and nexus to the data-bus circuitry failure vulnerability.

As subsumed in this report, once the singular data-bus circuit is impaired it has an extremely dangerous and cascading effect on the overall control unit's operation and reliability or in actuality, its instant non-functionality and unreliability as follows;

a) None of the data-bus connected remote system keypads will be able to annunciate alarm and/or trouble conditions within the household occupancy and will instantly become non-functional.

b) Remote system keypads with a built-in wireless radio receiving unit will instantly become non-functional.

c) The systems external data-bus connected dual diversity wireless radio receiving unit will instantly become non-functional.

d) The systems external data-bus connected dual diversity wireless radio alarm transmitter will instantly become non-functional.

e) All of the field installed wireless smoke detectors, wireless rate of rise heat detectors and wireless carbon monoxide detectors plus all of the system's wireless intrusion detection devices will no longer be able to wirelessly communicate to the control unit's external data-bus connected wireless receiving unit and/or any of the keypads which contain a built-in wireless radio receiving unit.

f) Based on the materiality of the fact that the data-bus circuit is impeded and non-functional is the silent danger that all Data-bus connected zone expansion modules are rendered non-functional as well since they are required to be parallel connected to the single data-bus circuit of the control unit.

Thereafter, all of the hardwired burglar and/or fire alarm system zones which are connected to these zone expansion module(s) become non-functional, in that the control unit will not be able to technically detect any alarm and/or trouble signals initiating from them.

Critically, the type of hardwired zones that can be connected to data-bus connected zone expansion module(s) includes both intrusion detection devices and/or fire alarm and life safety devices such as smoke detectors, rate of rise heat detectors, and carbon monoxide detectors.

g) Hardwired zones which are directly connected to the control unit are rendered impaired in that when the data-bus circuit is non-functional none of the remote system keypads in the household can audibly alert subscribers that a trouble and/or an alarm condition exists on their alarm system in that a data-bus failure impedes all of the remote system keypads from functioning. Similarly, with an impaired data-bus no alarm or trouble signals will be wirelessly transmitted to the remote/central station if the sole communications path is a data-bus connected wireless radio alarm transmitter.

h) In certain circumstances, dialer capture wireless radio alarm transmitters will also dangerously fail in that many of the manufacturers of this equipment require it to connect to the control panel's auxiliary DC power output terminals which are parallel connected to the data-bus.

i) No alarm and/or trouble conditions can be annunciated from any of the on-site remote system keypads since their on-board sounders rely on a functional data-bus for power and data to operate. For the same grounds and reasons, the data-bus circuit must be wired in a parallel connection which, in turn, must ultimately terminate in the control unit.

j) Consistent with the dangers associated with a Single Data-Bus Circuit, is that a data-bus circuit failure will not audibly activate the alarm system nor will it indicate a trouble signal within the household occupancy.

k) This dangerous vulnerability is duplicated onto the control panels auxiliary 12 VDC power output since a short circuit on any part of the 12 Volt DC auxiliary power output wiring of the Control Unit after its wiring extends out into the household occupancy will dangerously and instantaneously affect the normal operation and reliability of the fire alarm and the burglar alarm system.

l) The functionality and reliability of the control panel's DC power output circuit requires a dedicated hardwired and parallel connection onto the same power terminals which coincide with the (+) and (-) terminals of the data-bus circuit for all of the other data-bus connected devices that connect to the control unit.

m) On all data-bus connected zone expansion module (s) if a DC-powered smoke detector and/or intrusion detection device(s) or sensor(s) is attacked by fire the data-bus circuit will be rendered non-functional (the power side). Furthermore, the four conductor cable that is used for both the power and circuit connections on normally closed and normally opened zone(s) when connected to a zone expansion module can also become shorted by fire which in turn will render the data-bus non-functional and all associated zones when using a zone expansion module(s).

With no power and data connecting to any of the data-bus connected devices they will suddenly and dangerously fail. Consequently, the control unit's data-bus circuit is rendered non-functional and will remain in that state until the data-bus circuit is restored.

> **29.10.7.6 Where common wiring is employed for a combination system, the equipment for other than the fire and carbon monoxide alarm system shall be connected to the common wiring of the system so that short circuits, open circuits, grounds, or any fault in this equipment or interconnection between this equipment and the fire and carbon monoxide alarm system wiring does not interfere with the supervision of the fire and carbon monoxide alarm system or prevent alarm or trouble signal operation.[25]**

Technical Analysis and Expert Opinions:

The data-bus circuit is designed to be connected to all hardwired data-bus connected remote system keypad stations in the home. Additionally, if a data-bus connected zone expansion module and the like is provided for the installation, it is also required to be connected in parallel onto the data-bus circuit and/or its wiring. By way of further explanation, a zone expansion module is usually connected to up to eight (8) hardwired zones consisting of either burglar, fire alarm and/or both types of detection devices.

It is also important to recognize that it is not uncommon at all for a multitude of zone expansion modules to be installed throughout a single household occupancy in order to support the zones needed on the alarm system. Irrefutably, this underscores the criticality of the unprotected, vulnerable and foreseeably dangerous data-bus circuit.

To the extent the data-bus circuit is impeded by a short circuit condition in any location between the data-bus connected zone expansion module(s)[26] and its separately routed hardwired connection(s) back to the data-bus circuit and/or to any of the wiring which terminates in the listed control unit, it will instantaneously interfere with the supervision of all wireless fire alarm, rate of rise heat detectors and carbon monoxide detectors and it will prevent alarm and trouble signal operation under the fundamental that the system contains at least one external data-bus connected wireless dual diversity radio receiving unit and a data-bus connected wireless radio alarm transmitter.

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[25] The 2019 Edition of NFPA 72®, The National Fire Alarm Code.
[26] And the like.

Fire-and CO-warning systems in dwellings are permitted to be combination systems. Refer to the definition of the term *combination system* in 3.3.111.1. Equipment not required for the operation of the fire alarm system that is modified, removed, or malfunctioning in any way must not impair the operation of the fire alarm system.[27]

3.3.111.1 ***Combination System.*** A fire alarm system in which components are used, in whole or in part, in common with a non-fire signaling system. *(SIG-PRO)*[28]

A.3.3.111.1 ***Combination System.*** Examples of non-fire systems are security, card access control, closed circuit television, sound reinforcement, background music, paging, sound masking, building automation, time, and attendance.

II. Many Inherent Features Which Have Been Incorporated Into The Design Of The Single Data-Bus Circuit On UL 985 And UL 1023 Listed Control Units Are Not Required For The Operation Of The Fire Alarm System And Make This Control Panel Equipment Foreseeably Dangerous, Unreliable And Non-Conforming

a) A data-bus connected zone expansion module is not required for the operation of the fire alarm system.

b) A data-bus connected input/output module is not required for the operation of the fire alarm system.

c) A data-bus connected power supply is not required for the operation of the fire alarm system.

d) 12-Volt Auxiliary DC Power Output and its associated wiring from the control unit which provides auxiliary power to hardwired intrusion detection devices and sensors such as audio glass break detectors and motion detectors that are installed throughout the protected premises are not required for the operation of the fire alarm system. Yet this power output it still resides on the extremely dangerous and unprotected data-bus power terminals which support all of the parallel connected data-bus devices within the household occupancy.

e) More than one (1) data-bus connected remote system keypad station is not required for the operation of the fire alarm system.

f) A data-bus connected remote system keypad station with a built-in wireless radio receiving unit is not required for the operation of the fire alarm system.

[27] Commentary in the National Fire Alarm and Signaling Code® Handbook, Ninth Edition. Emphasis added.
[28] Emphasis added.

THE 2016 EDITION OF NFPA 72® OF THE NATIONAL FIRE ALARM AND SIGNALING CODE

29.7.7.4 Faults in other systems[29] or components[30] shall[31] not[32] affect the operation of the fire alarm system.[33],[34]

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[29] Many devices which are required to be connected onto the data-bus circuit are not required for the operation of the fire alarm system.

[30] By way of example, all hardwired DC powered devices that are part of an alarm system such as motion detectors and audio glass break detectors require the (+) and (-) of same to be powered and directly connected to the auxiliary 12 volt power output terminals of the control panel. Importantly, the (+) and (-) terminals of the auxiliary DC power output circuit of the control unit coincides with the (+) and (-) power wires that support the DC voltage portion of the data-bus circuit of the control panel. This same data-bus circuit of power and data also connects to all of the remote system keypad stations and all data-bus connected devices and equipment. Like other alarm equipment manufacturers, Honeywell®, the world's largest manufacturer of alarm equipment has this design and installation protocol for all of their Vista Line of Control Panels. Moreover, the majority, if not all of the other alarm control panel manufacturers require this same dangerous and vulnerable parallel interconnection to the single data-bus circuit and/or its interconnected wiring. Consequently, any fault and/or short circuit condition that technically obstructs the data-bus circuit wiring from operating as intended, will instantly shut down the data-bus circuit and all of the systems data-bus and parallel connected devices, such as an external wireless data-bus connected dual diversity radio receiving unit(s) and a data-bus connected wireless radio alarm transmitter such as Alarm.com® and Total Connect®. All other data-bus connected modules which are required to have a parallel interconnection to the control unit single data-bus circuit include but are not limited to remotely installed zone expansion modules, certain power supplies and relay modules. Simply put, the data-bus circuit wiring which is installed throughout the home, inside walls and in the attic of the premises creates a foreseeably dangerous vulnerability whereby if a fault and/or short circuit condition impedes the data-bus circuit it will instantly impair the control panels functionality, reliability and its intended and required operation. Therefore, and in this non-functional "state" the alarm system will no longer have the ability to annunciate an alarm or trouble condition within the household occupancy and/or the system will no longer be able to notify the remote/central station during an alarm or trouble signal event for either emergency response by the authorities, subscriber notification or both. As a result the unsuspecting subscribers and/or their family have a heightened risk to serious personal injury and/or death during a fire and/or life safety emergency.

[31] In accordance with NFPA 72 Standards the word "shall" is defined and indicates a mandatory requirement.

[32] Emphasis added.

[33] A fire alarm system consists of a control unit, primary and secondary power, an audible indicating appliance(s) and automatic initiating detection devices such as smoke detectors, rate of rise heat detectors and carbon monoxide detectors.

[34] In the 2019 Edition of NFPA 72, see section 29.10.7.5, in the 2013 Edition of NFPA 72, see 29.7.7.4, in the 2010 Edition of NFPA 72 see section 29.7.6.4, in the 2007 Edition of NFPA 72 see section 11.7.6.4, and in the 2002 Edition of NFPA 72 see section 11.7.6.4.

Historically and currently no UL Listed 1023 and 985 Control Unit can comply with Section 29.7.7.4 of NFPA 72 when it incorporates a single data-bus circuit which requires all of its data-bus connected devices and auxiliary DC output power to be connected to the Control Units Data-Bus in parallel.

> **29.7.7.5 Where common wiring is employed for a combination system,[35] the equipment for other than the fire alarm system shall be connected to the common wiring of the system so that short circuits,[36] open circuits, grounds, or any fault in this equipment or interconnection between this equipment and the fire alarm system wiring does not interfere[37] with the supervision of the fire alarm system or prevent alarm or trouble operation.[38]**

UNDER COMMON CONDITIONS CONTROL PANELS WHICH ARE LISTED TO UL STANDARD 985 DO NOT COMPLY WITH SECTIONS 41.4 AND 41.6 OF THE FIFTH EDITION AND SECTIONS 41.2, 41.2.2, 41.2.3, 41.3, 41.3.1.3, 41.3.1.6, 44.2.3, 44.4, 44.4.1, AND 44.4.2 OF THE SIXTH EDITION OF UL 985 EFFECTIVE MAY 15, 2019

UL Standard 985 for Household Fire Warning System Units requires equipment manufacturers to comply with both UL 1023 and UL 985 Standards. Significantly, on May 15, 2019, the Sixth Edition of UL 985 becomes effective and incorporates critically important changes to the Standard. The Fifth Edition of UL 985 is also addressed in this report.

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[35] The data-bus circuit wiring on a Household Burglar and Fire Alarm System Control Unit and its auxiliary DC power output wiring cannot provide what it is technically required to achieve in order for it to comply with UL 985, UL 1023 and NFPA 72 Standards.

[36] Faults and/or short-circuit conditions on a UL 985 / UL 1023 control panels single data-bus circuit and/or its auxiliary DC power output wiring will instantly render the control panels external data-bus connected wireless dual diversity radio receiving unit non-functional since this receiver is technically required to be connected to the data-bus circuit wiring in parallel as part of its four-conductor wiring cable connection. Similarly, a short circuit condition on the keypads data-bus circuit wiring will instantly render any data-bus connected Alarm.com® or Total Connect® wireless radios non-functional, since they too are required to be connected in parallel to the data bus circuit of the control panel. To the extent the installer connects the power side of the radio to the auxiliary DC output power of the control unit, this configuration is just as vulnerable to a data-bus circuit failure.

[37] Immediately upon the data-bus circuit and/or its wiring becoming impeded it will interfere with the supervision of the fire alarm system and/or it will prevent alarm or trouble signaling operation both on-site and to the remote/central station.

[38] In the 2019 Edition of NFPA 72, see section 29.10.7.6, in the 2013 Edition of NFPA 72 see section 29.7.7.5, in the 2010 Edition of NFPA 72 see section 29.7.6.5, in the 2007 Edition of NFPA 72, see section 11.7.6.5, and in the 2002 Edition of NFPA 72, see section 11.7.6.5. (Emphasis added)

I. Section 41.4 and 41.6 of the Fifth Edition and Section 44.2.3 of the Sixth Edition of UL 985

> 41.4 An open or ground fault in any circuit extending from a household control unit, other than the initiating device circuit, shall not affect the operation of the control unit except for the loss of the function extending from that circuit.[39]
>
> 41.6 A fault condition, open, ground, or short of other than a fire alarm circuit of a combination control unit shall not affect the fire-alarm signaling.

Technical Analysis and Expert Opinions

The data-bus circuit wiring is not an initiating device circuit (IDC) and it is not a fire alarm circuit. If the data-bus circuit wiring is impaired by a ground fault condition on its (+) leg, or otherwise it will dangerously and negatively affect the operation and reliability of the control panel over and above "the loss of the function extending from that circuit."

Given that and under common conditions, a ground fault on the data-bus circuit can materially affect the normal operation of the control unit as elaborated to in this expert report. The same dangerous vulnerability exists when a fault condition, ground or a short circuit occurs on the data-bus circuit wiring and/or onto the devices which are connected to the data-bus circuit such as a short (by fire) attacking one of the system's keypads, a zone expansion module or the DC auxiliary power output wiring that connects in parallel with the (+) and (-) terminals of the data-bus circuit.

A single data-bus circuit design and methodology cannot technically comply with UL 985, UL 1023, and NFPA 72 Standards under common conditions.

II. Sections 41.3 and 41.3.1.3 of the Sixth Edition of UL 985

> 41.3 Combination control unit
>
> 41.3.1.3 Short circuit or open circuit single faults in the non-fire equipment or in the wiring between the non-fire equipment and the fire alarm system shall not impede or impair the monitoring for integrity of the fire alarm system, nor impede or impair any fire alarm signal transmissions or operations. (Emphasis added)

[39] The Fifth Edition of UL 985 references section 41.4. Notably, the same verbiage appears in section 44.2.3 of the Sixth Edition of UL 985.

Technical Analysis and Expert Opinions

Combination Control Units are required to be combination listed under UL 1023 and UL 985 respectively. The data-bus circuit of a control unit which complies with both UL 1023 and UL 985 and its interconnected wiring, and what is required to be connected onto the Single Data-Bus Circuit in parallel is non-fire equipment, yet it can instantly impede or impair the monitoring for integrity of the fire alarm system and it can impede or impair fire alarm signal transmissions to a remote/central station.

III. Section 41.3.1.6 of the Sixth Edition of UL 985

41.3.1.6 The required operation of the fire alarm equipment shall not be impaired by any failure of the non-fire alarm equipment hardware, software or circuits, or by any maintenance procedure, including removal or replacement of defective equipment or powering down of the non-fire equipment.[40]

Technical Analysis and Expert Opinions

A data-bus circuit failure and/or a fault, ground or short circuit on the single data-bus circuit and/or on its interconnected wiring and parallel data-bus connected devices will impair the required operation of the fire alarm system equipment. Similarly, any failure of the non-fire alarm equipment hardware, software or circuits, or by any maintenance procedure, including removal or replacement of defective equipment or powering down of the non-fire equipment as referenced in this expert report will impair the required operation of the fire alarm equipment when connected to a UL 985-UL 1023 Single Data-Bus Connected Control Unit.

IV. Sections 44.4, 44.4.1 and 44.4.2 of the Sixth Edition of UL-985

44.4 Keypads

44.4.1 Keypads and other operator interfaces shall be monitored for integrity so that within 200 seconds a distinctive audible trouble signal will indicate the occurrence of a single break (open) or single ground fault in the interconnections, which would prevent the intended operation of the system for alarms, alarm transmissions to a supervising station, or the signal representative of a failure to complete a signal transmission with a supervising station.[41] The trouble annunciation shall be at an operator interface. Prior to the application of a fault, the control unit shall be energized in the intended standby condition while connected to a rated source of voltage and frequency.

[40] Emphasis added.
[41] Emphasis added.

Exception: Supervision is not required for keypad interconnections to the control unit extending not more than 3 feet (0.91 m) from the control unit."[42]

44.4.2 Annunciation of the audible trouble signal required by 44.4.1 is permitted to be remote from an operator interface when the product's installation instructions alert the user that the product sounding the audible is to be installed in a location where the audible signal can be heard at the operator interface.

Technical Analysis and Expert Opinions

All hardwired system keypad(s) which are installed in a household occupancy have on-board trouble sounders that are integral to each circuit board of the respective keypad(s). As a result, once any of the system keypad(s) and/or its interconnected data-bus circuit wiring and/or its data-bus connected equipment becomes impaired the control panel is not technically able to initiate an audible trouble indication within the household occupancy as is required under the Sixth Edition of UL 985.

Coming full circle, with a singular data-bus circuit a functional hardwired and parallel connection to each of the system keypad(s) which requires both data and power, is a condition precedent before any of the keypad's trouble sounder(s) on the system can technically function and audibly sound. Equally important is that any "operator interfaces" would be required to connect to the same Single Data-Bus Circuit of the Control Unit as well since both historically and currently there is no other technical way in which the Control Unit can provide any function to an operator interface as its relates to trouble and/or alarm conditions. Finally, I am not aware of any

[42] In the alarm industry, it is not typical or industry standard for an alarm contractor to install and locate a hardwired system keypad in a household occupancy that does not extend more than 3 feet from the control unit. This statement excludes self-contained systems which are not part of the analysis. That being said, even if one hardwired system keypad was installed within 3 feet of the control unit any other remote system keypads on the data-bus circuit and/or any other data-bus connected devices and/or any of the interconnecting wiring on the data-bus circuit and/or if the auxiliary DC power output wiring becomes impaired by a fault or short circuit condition during a fire or otherwise, it will render all of the system keypads, including a keypad that is installed within three (3) feet of the control unit non-functional. Equally important, is the 12 volt (+) and (-) auxiliary power output circuit from the Control Unit and its extended wiring within the protected premises. These are required to connect to the same (+) and (-) power terminals that the Control Unit's Single Data-Bus circuit utilizes otherwise creating another serious Control Unit vulnerability. Be that as it may, all equipment manufacturers design their Household Control Units to incorporate one data-bus circuit. This methodology deviates and fails to comply with UL and NFPA Standards in that it causes a serious defects and code violations on the control unit because once this circuit is faulted and/or if a short circuit condition occurs it will impede and shutdown the entire data-bus circuit and all of the systems data-bus and parallel connected keypads and devices, including but not limited to the systems external dual diversity radio receiving unit(s) and the systems wireless radio alarm transmitter.

UL 985-UL 1023 Control Unit which provides any independent connection to an "operator interface."

V. Sections 41.2, 41.2.2, and 41.2.3 of the Sixth Edition of UL-985

41.2 Supervising Stations[43]

41.2.3 Communications path(s) other than those described in 41.2.2 such as internet signaling shall comply with the following:

a) Any failure of the communications path shall be annunciated at the supervising station and at the user interface[44] at the protected premise within 7 days of a fault that affects the communication between the transmitter at the protected premise and the receiver at the supervising station.

b) Failure to complete a signal transmission from the transmitter at the protected premise to the receiver at the supervising station shall result in a trouble annunciation at the user interface at the protected premise.

41.2.2 Digital Alarm Communicator Transmitters (DACTs) serving the protected premises shall comply with the requirements of the Standard for Digital Alarm Communicator System Units, UL 1635, with the following exceptions:

b) Shall only require a call to a single digital alarm communicator receiver (DACR) number;

d) The DACT signal shall be permitted to be transmitted over a dedicated cellular telephone connection.

Technical Analysis and Expert Opinions on

Section 41.2 of UL 985 is entitled Supervising Stations. Section 41.2.2 references Digital Alarm Communicator Transmitters (DACTs) serving the protected premises and their required compliance with the Standard for Digital Alarm Communicator System Units, UL 1635 with four exceptions and Section 41.2.3 references Communication Path(s) other than those described in 41.2, such as internet signaling shall comply with five requirements.

[43] UL 985, Sixth Edition.
[44] The term "User Interface" is recognized by the professional alarm industry and equipment manufacturers of UL 985-UL 1023 Control Units as a Remote System Keypad.

The requirements of letter (a) at Section 41.2.3 of UL 985 cannot be technically accomplished with a Single Data-Bus Connected Control Unit as if there is a fault, ground, or short circuit condition on the data-bus circuit, the Control Unit will not be able to annunciate any failure of the communications path through the user interface at the protected premises since all audible trouble signals in the protected premises initiate from the on-board and integrated sounders that are built into each of the single data-bus connected remote system keypad(s).

The requirements of letter (b) at Section 41.2.3 of UL 985 cannot be technically accomplished with a Single Data-Bus Connected Control Unit as if there is a fault, ground, or short circuit condition on the data-bus circuit, the Control Unit will not be able to detect a failure to complete a signal transmission from the transmitter at the protected premises to the receiver at the supervising station resulting in trouble annunciation at the user interface at the protected premises.

The failure to audibly annunciate a trouble condition within the protected premises upon the system detecting any of the conditions set forth in letters (a) and/or (b) is based upon the fact that all remote system keypad(s) are required to be connected to the Single Data-Bus Circuit of the Control Unit and its hardwired connection(s), and must be in parallel with all of the other data-bus connected devices. Therefore an impaired data-bus circuit as elaborated to throughout this expert report will instantly disable these UL 985 mandates from functioning as is required.

Letter (a) of Section 41.2.2 of UL 985 cannot technically be accomplished with an impaired Single Data-Bus Circuit due to the fact that an impaired data-bus will render an external data-bus connected wireless radio receiving unit non-functional.

Given that, all wireless alarm signals attempting to transmit to the Control Unit during a fire, life safety or intrusion emergency will not be received by an external data-bus connected dual diversity wireless radio receiving unit. With no wireless alarm signals being received the Control Units built in Digital Alarm Communicator Transmitter cannot and will not initiate calling a single digital alarm communicator receiver (DACR) number

With regards to letter (d) of Section 41.2.2 of UL 985, an impaired Single Data-Bus Circuit will suddenly and instantly render a data-bus connected wireless radio alarm transmitter non-functional. Consequently, the wireless radio will not be able to communicate with the remote/central station.

Likewise, a dialer capture wireless radio alarm transmitter will fail with an impaired data-bus circuit to the extent that this type of wireless radio alarm transmitter is powered from the control units auxiliary DC power output, because in most cases the systems auxiliary DC output power is required to be connected in parallel with the Single Data-Bus Circuit.

In accordance with UL Standards, the terminology “user interface” is also known as a remote system keypad.

UNDER COMMON CONDITIONS, CONTROL UNITS WHICH ARE LISTED TO UL STANDARD 1023 DO NOT HISTORICALLY COMPLY WITH THE SIXTH EDITION OF UL 1023 DATED NOVEMBER 25, 1996 AT SECTIONS 27, 27.2 AND 27.3 AND THE SEVENTH EDITION OF UL 1023 DATED SEPTEMBER 1 2017 AT SECTIONS 30, 30.2 AND 30.3

I. Section 27.2 of the Sixth Edition of UL 1023 and the Seventh Edition of UL 1023 at Section 30.2:

Electronic Supervision Test[45]

An open or ground fault in any circuit extending from a household system unit, other than the initiating device circuit, shall not affect the operation of the product except for the loss of function extending from that circuit.[46]

Technical Analysis and Expert Opinions on

If the data-bus circuit wiring is impaired by a ground fault condition on the (+) leg, or otherwise it will dangerously and negatively affect the operation of the control panel over and above the loss of the function extending from that circuit.

All control panels which contain a single data-bus circuit design and methodology cannot technically comply with UL 1023 under these conditions.

Exception: If such a fault will affect the operation of the product, a trouble signal or alarm condition or test feature that will indicate the fault is required

Under the Exception Section to 27.2 of the Sixth Edition of UL 1023 and Section 30.2 of the Seventh Edition of UL 1023, it is an undisputed material fact that the data-bus circuit is not an initiating device circuit.

No UL 1023 and UL 985 Listed household alarm control unit can audibly indicate a trouble signal once the data-bus circuit is faulted and/or once a short circuit condition impairs the data-bus as all of the keypad sounder(s) which are built into each of the parallel and data-bus connected hardwired remote system keypads require a functional data-bus circuit to be in place in order for an audible trouble condition to technically activate within the household occupancy.

Despite the materiality of the fact that an impaired data-bus circuit will dangerously affect the operation and reliability of the product being the control panel; no control panel goes into an alarm condition when there is a fault and/or short circuit condition on the data-bus circuit. Notably,

[45]The Sixth Edition of UL 1023 references Section 27 as Electronic Supervision Test, the same verbiage appears in Section 30 of the Seventh Edition of UL 1023.
[46]Section 27.2 of the Sixth Edition of UL 1023 references the same verbiage as Section 30.2 of the Seventh Edition of UL 1023.

I could not identify, locate, nor am I aware of any control panel which has a 'test feature' that will indicate a fault on any manufactured Control Units data-bus circuit.

In a similar vein, if there is a fault condition on the data-bus circuit of the control panel, it is not technically able to audibly and/or visually annunciate any system failure through any of its remote system keypads until the obstructed data-bus circuit and/or its wiring is restored to a functional state.

II. Section 27.3 of the Sixth Edition of UL 1023 and Section 30.3 of the Seventh Edition of UL 1023:

A fault condition, open ground, or short of other than a burglar-alarm circuit of a combination control unit shall not affect the burglar-alarm signal[47]

Technical Analysis and Expert Opinions

Any fault or short circuit condition which impairs the data-bus circuit will instantly render all control panels that use a singular data-bus non-functional. Notably, this equipment failure will render all external data-bus connected dual diversity radio receiving unit(s) and a data-bus connected wireless radio alarm transmitter non-functional as well.

MISSION CRITICAL: THE UNPROTECTED DATA-BUS CIRCUIT, DATA-BUS CONNECTED EQUIPMENT, AUXILIARY DC OUTPUT POWER, AND ITS INTERCONNECTING WIRING - FORESEEABLE DANGERS ON A SINGLE DATA-BUS CIRCUIT CONTROL UNIT BEING UNRELIABLE AND CATASTROPHICALLY FAILING

I. Remote System Keypads

By way of example, if a fire started inside an attached garage of a residence, it would eventually breach into the living space of the home. Subsequently, the closely situated remote keypad station near the exit/entry garage door of the premises in this scenario and/or its required hardwired four-conductor cable connection to the systems data-bus circuit wiring will likely be attacked by the fire.

Once the fire attacks the keypad and/or the interconnected data-bus circuit wiring, it will instantly create a fault and/or short on the data-bus circuit rendering it non-functional.

[47] Section 27.3 of the Sixth Edition of UL 1023 references the same verbiage as section 30.3 of the Seventh Edition of UL 1023.

Instantaneously, the systems data-bus connected external dual diversity wireless radio receiving unit and its data-bus connected wireless radio alarm transmitter will no longer be able to function or operate.

II. The Data-Bus Circuit Wiring

If a fire started in the attic of a home, in the wall of a home, in a concealed space of the home, in an unprotected area of the home and/or in any other areas of the premises and attacked the data-bus circuit wiring all data-bus and parallel connected modules such as the systems mission-critical external data-bus connected dual diversity wireless radio receiving unit(s) and the systems data-bus connected wireless radio alarm transmitter will instantly become non-functional.

Notwithstanding all of the hardwired data-bus circuit wiring that is installed, exposed, concealed, and vulnerable throughout the premises is the fact that in alignment with this data-bus circuit wiring danger it is seriously duplicated as it relates to all of the other wiring that is provided to remotely installed data-bus connected devices throughout the household occupancy. Routinely, this wiring goes in more than one direction throughout the home. These devices include zone expansion modules, input-output modules and the like.

Following this same methodology, is that all auxiliary DC powered hardwired devices such as audio glass break and motion detectors are also required to connect in parallel to the data-bus circuit and/or its wiring. Therefore, this part of the control units design accurately resembles the serious dangers and vulnerabilities which have been identified on the data-bus circuit throughout this expert report.

III. External Data-Bus Connected Wireless Dual Diversity Radio Receiving Unit

A fault and/or short circuit condition which impairs the data-bus circuit wiring of the alarm system will instantly render the systems external wireless dual diversity radio receiving unit non-functional. Thereafter, the systems external data-bus connected dual diversity wireless radio receiving unit which is specifically designed and intended to receive wireless alarm and trouble signals from all of the field-installed wireless transmitters cannot technically perform any function let alone the function of receiving wireless alarm and/or trouble conditions during alarm emergencies or trouble events.

Remarkably, none of the wireless smoke detectors, carbon monoxide detectors, rate of rise heat detectors, wireless door/window contacts, audio glass break detectors, motion detectors, and panic buttons are able to successfully transmit alarm and/or trouble signals to the control unit so that it can indicate an alarm and/or trouble condition within the household occupancy and at the remote/central station.

IV. Data-Bus Connected Wireless Radio Alarm Transmitter For Remote/Central Station Communications

A fault and/or short circuit condition that impairs the data-bus circuit wiring of the alarm system will instantly render the systems data-bus connected wireless radio alarm transmitter non-functional. Dangerously, no alarm and/or trouble signals can be wirelessly transmitted to the remote/central station so that its central station operators can take appropriate action by immediately dispatching the authorities, notifying the subscriber and/or by performing both of these tasks.

As a brief reflection, all occupants of the home have no way to know that their alarm system is unable to communicate to the Remote/Central Station. To the extent that the subscriber goes to any of their on-site remote system keypads, they will be non-functional. By not knowing any of this critical information, the risk of serious personal injury and/or death to all household occupants is dramatically increased, since they may reasonably believe that the fire department has been dispatched to their home and as a result delay or never call 911 directly.

With regards to the wireless radio alarm transmitters ability to automatically test or not be able to test[48] into the remote/central station, such as what would typically be expected to occur when a one-way wireless radio alarm transmitter is rendered non-functional can only happen on a testing cycle of once a day, once a week or monthly and even then, if a fail-to-test signal is identified at the Remote/Central Station it is only defined as a trouble condition. Clearly, it is highly unlikely that this event would ever occur during an alarm emergency and in any event, a test fail condition from a household occupancy is only considered trouble condition.

V. Data-Bus Connected Auxiliary DC Power Output Wiring And/Or Data-Bus Connected Modules

A fault and/or a short circuit condition that impairs any auxiliary DC power output circuit wiring which is required to connect to the control unit will instantly render the control panel's data-bus circuit non-functional.

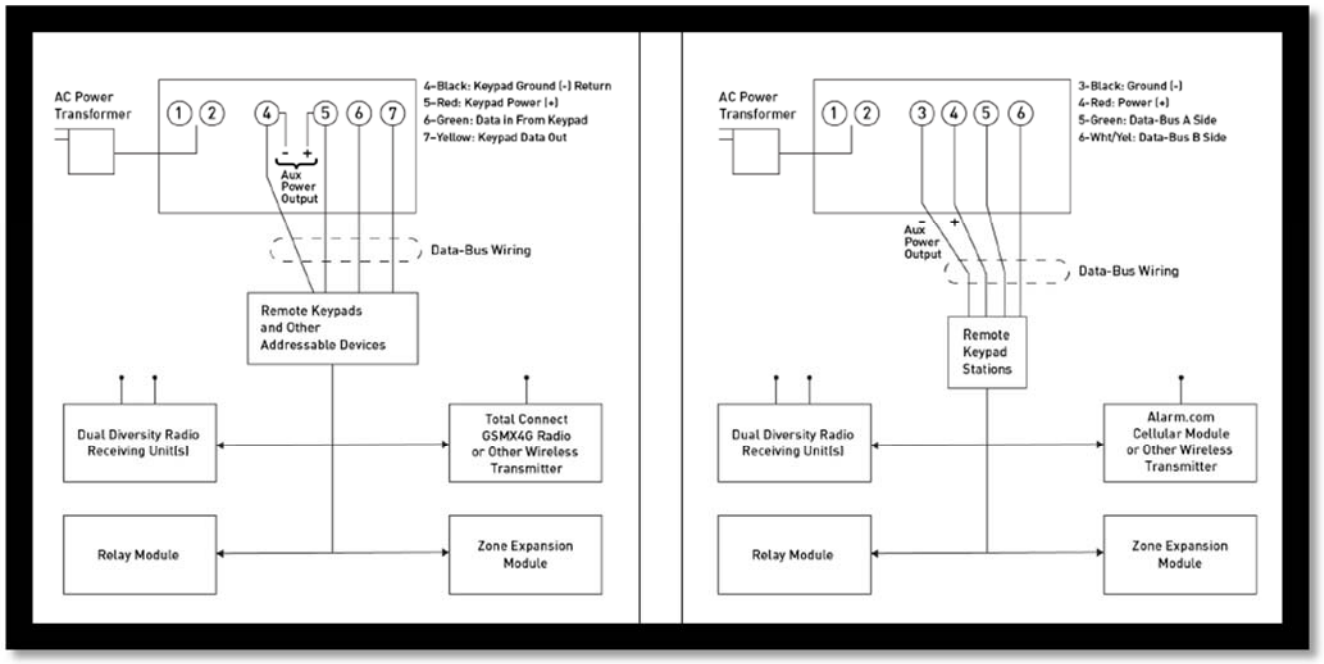
The technical reason why the data-bus circuit becomes non-functional is that all auxiliary powered devices such as hardwired audio glass break detectors, motion detectors and the like are required to be connected in parallel with the (+) and (-) power terminals of the data-bus circuit. Accordingly, a short on any of the auxiliary DC power output wiring of the system will take down the mission-critical data-bus circuit of the control unit and render it non-functional.

[48] Test-fail conditions are generally detected by the Remote/Central Station through their use of UL-1981 Standard for Central-Station Automation Systems software.

Uniformly, all data-bus connected devices such as remote system keypads, zone expansion modules and the like are all connected and wired together in parallel. This control panel requirement needs to be complied with in accordance with the equipment manufacturers specifications of the control unit, or this equipment will not function. Of particular significance is that this latent defect exposes the control unit to a foreseeable catastrophic failure as any field installed modules that become attacked by fire and/or if the connecting wiring between the control panels data-bus and/or its auxiliary DC power output wiring and the field installed data-bus connected devices are attacked by fire this fault and/or short circuit condition will in unison impair/shutdown the data-bus circuit of the control unit and all of the parallel connected devices, modules and equipment within the household occupancy.

EXEMPLAR HONEYWELL VISTA® AND INTERLOGIX, A UTC FIRE & SECURITY COMPANY CONCORD® IV SERIES CONTROL PANEL SCHEMATICS

Honeywell Vista Series Control Panel **UTC Concord IV Control Panel**



CONCLUSIONS

I. Under the identified common conditions, Household Burglar and Fire Alarm System Control Units which utilize a single data-bus circuit and require all data-bus connected devices and auxiliary DC output power to be connected to the data-bus circuit and/or its wiring in parallel do not and cannot comply with the minimum requirements of UL 985, UL 1023 and NFPA 72 Standards respectively evidencing non-conforming equipment.

II. The single data-bus circuit and/or its wiring in parallel on the control unit creates a foreseeably dangerous vulnerability to all occupants of a household occupancy.

III. The data-bus circuit and/or its wiring in parallel adversely affects the reliability of the Control Unit and the alarm system(s).

IV. The data-bus circuit and/or its wiring in parallel increases the propensity of serious personal injury, death and/or loss of property to all occupants who are within the household occupancy when there is a fire, life safety and/or intrusion emergency at the premises.

V. The data-bus circuit and/or its wiring in parallel on the data-bus will fail in the event that there is a fault and/or short circuit condition on the data-bus. Therefore, the system cannot warn household occupants of an alarm condition(s) through any of the on-site data-bus connected remote keypad stations.

VI. All data-bus connected devices which are required to be connected to the data-bus circuit and/or its wiring in parallel on the data-bus will fail in the event that there is a fault and/or short circuit condition on the data-bus. As a result, the system cannot warn household occupants of a trouble condition(s) through any of the on-site data-bus connected remote keypad stations.

VII. All data-bus connected devices which are required to be connected to the data-bus circuit and/or its wiring in parallel on the data-bus will fail in the event that there is a fault and/or short circuit condition on the data-bus. As a result, the system cannot transmit a trouble signal(s) to the remote/central station from a data-bus connected wireless radio alarm transmitter such as Alarm.com or Total-Connect when it is the only communications path for monitoring. Under certain circumstances, a dialer capture wireless radio alarm transmitter will fail as well, if DC power for this radio is connected to the auxiliary power output of the control unit.

VIII. In the event there is a fault and/or short circuit condition on the data-bus circuit of the alarm system it cannot transmit alarm signal(s) to the remote/central station from a data-bus connected wireless radio alarm transmitters such as Alarm.com® or Total-Connect®.

IX. In the event of a sustained short circuit condition on the data-bus circuit of many control panels which have been previously and/or are currently being manufactured today will cause this equipment to become completely non-functional. To restore system functionality on this equipment requires complete control panel replacement.

X. Equipment manufacturers specifications of the identified control units in this forensic analysis and of all other equipment manufacturers who utilize the same or a similar single data-bus circuit methodology, 12 volt auxiliary power output and a parallel connection design requirement, do not warn end user(s) of any of the foreseeable dangers and vulnerabilities associated with a single data-bus circuit control unit.

XI. To the extent that a fire or an impaired data-bus condition occurs it is important to note that the auxiliary DC power output circuit of the control unit and all of its interconnected wiring will fail since it is required to connect to the same terminals as the (+) and (-) terminals of the data-bus circuit. As a result, a fault and/or short circuit condition as noted above and of which impairs the systems auxiliary DC power output, it's interconnected wiring, and/or any of the DC powered devices which connect to this DC circuit will be rendered non-functional.

XII. Investigative interviews of household occupants across the country has revealed that in certain instances person(s) have been seriously injured and/or other persons in the home who were killed during a fire was due to the alarm system failing to provide for early warning detection. Forensic investigation of these alarm systems revealed that a fault and/or short circuit condition impaired the data-bus circuit and/or its wiring. Other hypotheses of the causes of alarm system failure(s) if any, following the scientific method were able to be forensically excluded in these actual losses.

XIII. Forensic investigation of alarm system failures across the country has identified that in certain instances household occupants have been seriously injured and/or killed as a result of the auxiliary DC power output circuit of a control unit and/or its wiring and/or its connected DC powered devices and sensors being attacked or impeded by fire. Thereafter, this failure of the control unit caused the alarm system to fail to function as intended.

Failure of the alarm system was determined to be a significant proximate cause of the damages sustained. Similarly, commonly installed devices such as audio glass break detectors and/or motion detectors which require DC power to operate have been attacked by fire as well. In other words, each of these failure points independently or all together on the alarm system causes the same dangerous and non-functional condition at the control unit. Other hypotheses of the causes of alarm system failure(s) if any, following the scientific method were able to be forensically excluded in these actual losses.

XIV. Investigative interviews of occupants who have survived fires that had the identified type of control units and other control panel manufacturer's equipment installed in their premises have reported that the alarm system did not audibly annunciate trouble and/or alarm conditions from any of the on-site remote system keypad stations. During the forensic investigation physical evidence of damage to the data-bus circuit and/or data-bus connected equipment and/or to the auxiliary DC power output wiring and/or DC powered devices on this circuit was identified. Other hypotheses of the causes of alarm system failure(s) if any, following the scientific method have been forensically excluded in these actual losses.

XV. Investigative interviews of occupants who have survived fires that had the identified type of control units and other control panel manufacturer's equipment installed in their homes have reported that the alarm system sirens/sounders did not audibly activate and no alarm signal(s) were transmitted to the remote/central station. During the forensic investigation physical evidence of damage to the data-bus circuit and/or data-bus connected equipment and/or the auxiliary DC power output wiring and/or to DC powered devices on this circuit was identified. Other hypotheses of the causes of alarm system failure(s) if any, following the scientific method have been forensically excluded in these actual losses.

XVI. Authorities Having Jurisdiction (AHJ) have not been made aware of the fact that Single Data-Bus Connected Control Units cannot and do not comply with UL 985, UL 1023, and NFPA 72 as subsumed throughout this expert report.

XVII. Authorities Having Jurisdiction (AHJ) have not been made aware of the criticality of the foreseeable dangers, risks, and vulnerabilities associated with single data-bus circuit Household Burglar and Fire Alarm Control Units.

XVIII. Authorities Having Jurisdiction (AHJ) have not been made aware of the criticality of the foreseeable dangers, risks, and vulnerabilities associated with an auxiliary DC power output circuit that is required to be connected in parallel onto the single data-bus circuit of Household Burglar and Fire Alarm Control Units.

XIX. It is estimated that *millions and millions* of Alarm Systems associated with these types of Household Burglar and Fire Alarm System Control Units are installed and monitored and/or are currently in the process of being installed and monitored across the country.

XX. Foreseeably all persons who rely on these types of Household Burglar and Fire Alarm System Control Units and both hardwired and wireless[49] intrusion detection and life safety detectors and/or sensors and data-bus connected external wireless dual diversity radio receiving units and a data-bus connected wireless radio alarm transmitter for remote/central station monitoring and/or in certain circumstances dialer capture wireless radio alarm

[49] Under common conditions, these identified dangers can also impact upon both hardwired burglar and fire alarm initiating detection devices.

transmitters, to protect both their family and property, are at an increased risk to catastrophic damages such as serious personal injury, death, and/or loss of property.

The foregoing opinions are held to a reasonable degree of Professional, Technical, Alarm Science, UL Standards, Certified Fire Protection Specialist (CFPS), NFPA 72, and NICET Level IV- Fire Protection Engineering Technology- Fire Alarm Systems certainty. They are also based upon my accumulated and specialized education, skill, knowledge, training, experience and nationally recognized peer-reviewed credentials in the alarm industry for more than forty (40) years.

I specifically reserve the right to amend and/or to supplement this report as my investigation continues and/or to the extent that new information is revealed and/or provided to me as part of my forensic investigation in this matter.

The recipient of this report is hereby prohibited from utilizing it for any purpose other than for which it was originally intended.

Respectfully submitted,

Jeffrey D. Zwirn, CPP[50], CFPS[51], CFE[52], SET[53], FASI&T[54], CHPA-IV[55], NFPA 300 (PS)[56], MBAT[57], President

Level IV

[50] Certified Protection Professional, Board Certified In Security Management, American Society for Industrial Security
[51] Certified Fire Protection Specialist – National Fire Protection Association International (NFPA)
[52] Certified Fraud Examiner National Association of Certified Fraud Examiners
[53] NICET Level IV Certified, Senior Engineering Technician, Fire Protection Engineering Technology/Fire Alarm Systems-National Institute For Certification in Engineering Technologies (NICET)
[54] NICET Level I and II Certified Engineering Technician, Fire Protection Engineering Technology/Inspection and Testing of Fire Alarm Systems-National Institute For Certification In Engineering Technologies (NICET).
[55] Level IV Certified Homeland Protection Associate-National Sheriffs' Association In Partnership With The Global Society of Homeland and National Security Professionals.
[56] NFPA 3000 (PS) Active Shooter/Hostile Event Response; Plan, Respond, Recover Program Specialist Training.
[57] Master Burglar and Fire Alarm Technician.

AUTHORITATIVE TREATISES AND OTHER INFORMATION REVIEWED, RELIED ON AND CONSIDERED

ASTM Designation E 1492 Standard Practice For Receiving, Documenting, Storing, and Retrieving Evidence In A Forensic Science Laboratory;
ASTM Designation E 1188-95 Standard Practice for Collection and Preservation of Information and Physical Items by a Technical Investigator;
ASTM Designation E 1459-92 Standard Guide for Physical Evidence Labeling and Related Documentation;
ASTM Designation E 620-11 Standard Practice for Reporting Opinions of Scientific of Technical Experts;
ASTM Designation E 860-97 Standard Practice for Examining and Preparing Items That are Or May Become Involved in Criminal or Civil Litigation;
Investigative interviews with Equipment Manufacturers, UL, NFPA and Authorities Having Jurisdiction;
UL 268 Standard for Smoke Detectors for Fire Alarm Systems, Underwriters Laboratories, Inc;
UL 639 Standard for Safety Intrusion-Detection Units, Underwriters Laboratories, Inc;
NFPA 730 Guide for Premises Security; National Fire Protection Association;
NFPA 731 Standard for the Installation of Electronic Premises Security Systems; National Fire Protection Association;
UL 985 Standard for Safety Household Fire Warning System Units, Underwriters Laboratories, Inc;
UL 1023 Standard for Safety Household Burglar-Alarm System Units, Underwriters Laboratories, Inc;
UL 1635 Standard for Digital Alarm Communicator System Units, Underwriters Laboratories, Inc;
UL 1641 Standard for Installation and Classification of Residential Burglar Alarm Systems, Underwriters Laboratories, Inc;
UL 1981 Standard for Central-Station Automation Systems, Underwriters Laboratories, Inc.;
NFPA 72 of the National Fire Alarm Code and Handbook, National Fire Protection Association;
NFPA 72 of the National Fire Alarm and Signaling Code and Handbook, National Fire Protection Association;
NFPA 70 the National Electrical Code, National Fire Protection Association;
NFPA 720 the Standard for The Installation of Carbon Monoxide (CO) Detection and Warning Equipment;
The Alarm Connection, A Practical Guide to Burglar and Fire Alarm Systems For Security and Law Enforcement Professionals, Jeffrey Zwirn;
The Alarm Science Manual™ by Jeffrey Zwirn;
Fire Protection Handbook, National Fire Protection Association;
Nationally Recognized Industry Standards and Best Practices;
CPP Curriculum;
NICET Level I-IV Curriculum;
CFPS Curriculum;
Protection of Assets Manuals- ASIS International;

Introduction to Security, Robert J. Fischer, Gion Green;
Handbook of Loss Prevention and Crime Prevention, Lawrence J. Fennelly;
The Complete Book of Electronic Security, Robert Phillips;
NTS, The National Training School, Understanding Alarm Systems, National & Burglar Fire Alarm Association, Inc.;
Fire Alarm Installation Methods, NTS: The National Training School;
Advanced Burglar Alarm Technician, NTS: The National Training School;
Central Station Operator Course, Instructor Guide, Security Industry Association;
Central Station Operator Instructor Course, Student Manual, Security Industry Association;
Basic Central Station Operator Course, Instructor Guide, Security Industry Association;
The National Training School, Central Station Training, National Burglar & Fire Alarm Association, Inc.;
Security Sales Essentials, Electronic Security Association, NTS: The National Training School;
Central Station Training Student Manual, Electronic Security Association;

UL Standards Matrix
UL® 985-Household Fire Warning System Units, 5th Edition

Standard References	5th Edition
These requirements also apply to the use of combination systems, such as a combination fire-burglar alarm system control unit, which uses circuit wiring common to both systems. When common wiring is used for combination systems, it shall be connected in such a manner that internal fault conditions (shorts, opens, grounds) in the nonfire alarm (burglary) system circuit wiring, or faults between the fire and nonfire alarm system circuits, will not interfere with the supervision of the fire alarm system or prevent intended alarm signal transmission.	1.4
Fire alarm control unit	39.1
A household control unit shall be capable of operating reliably and uniformly for all conditions of its intended performance when used in conjunction with initiating devices and indicating devices to form a system combination of the type indicated by the installation wiring diagram and any supplementary information provided.	39.1.1
An open or ground fault in any circuit extending from a household control unit, other than the initiating device circuit, shall not affect the operation of the control unit except for the loss of the function extending from that circuit.	41.4
A fault condition, open, ground, or short of other than a fire alarm circuit of a combination control unit shall not affect the fire-alarm signaling.	41.6

UL Standards Matrix
UL® 985-Household Fire Warning System Units, 6th Edition, Effective May 15th, 2019

Standard References	6th Edition, May 15, 2015
These requirements also apply to the use of combination systems, such as a combination fire-burglar alarm system control unit, which uses circuit wiring common to both systems. When common wiring is used for combination systems, it shall be connected in such a manner that internal fault conditions (shorts, opens, grounds) in the nonfire alarm (burglary) system circuit wiring, or faults between the fire and nonfire alarm system circuits, will not interfere with the supervision of the fire alarm system or prevent intended alarm signal transmission.	1.4
Fire alarm control unit	41.1
A household control unit shall be capable of operating reliably and uniformly for all conditions of its intended performance when used in conjunction with initiating devices and notification appliances and other devices to form a system combination of the type indicated by the installation wiring diagram and any supplementary information provided.	41.1.1
Combination control unit	41.3
Short circuit or open circuit single faults in the non-fire equipment or in the wiring between the non-fire equipment and the fire alarm system shall not impede or impair the monitoring for integrity of the fire alarm system, nor impede or impair any fire alarm signal transmissions or operations.	41.3.1.3
The required operation of the fire alarm equipment shall not be impaired by any failure of the non-fire alarm equipment hardware, software or circuits, or by any maintenance procedure, including removal or replacement of defective equipment or powering down of the non-fire equipment.	41.3.1.6

An open or ground fault in any circuit extending from a household control unit, other than the initiating device circuit, shall not affect the operation of the control unit except for the loss of the function extending from that circuit.	44.2.3
Keypads	44.4
Keypads and other operator interfaces shall be monitored for integrity so that within 200 seconds a distinctive audible trouble signal will indicate the occurrence of a single break (open) or single ground fault in the interconnections, which would prevent the intended operation of the system for alarms, alarm transmissions to a supervising station, or the signal representative of a failure to complete a signal transmission with a supervising station. The trouble annunciation shall be at an operator interface or audible at the operator interface. Prior to the application of a fault the control unit shall be energized in the intended standby condition while connected to a rated source of voltage and frequency. *Exception: Supervision is not required for keypad interconnections to the control unit extending not more than 3 feet (0.91 m) from the control unit.*	44.4.1
Annunciation of the audible trouble signal required by 44.4.1 is permitted to be remote from an operator interface, when the product's installation instructions alert the user that the product sounding the audible is to be installed in a location where the audible signal can be heard at the operator interface.	44.4.2

NFPA 72 Code Matrix
NFPA 72®, The National Fire Alarm Code and NFPA 72®, The National Fire Alarm And Signaling Code

Code Reference	2019 Edition	2016 Edition	2013 Edition	2010 Edition	2007 Edition	2002 Edition
Faults in other systems or components shall not affect the operation of the fire alarm system	29.10.7.5	29.7.7.4	29.7.7.4	29.7.6.4	11.7.6.4	11.7.6.4
Where common wiring is employed for a combination system, the equipment for other than the fire alarm system shall be connected to the common wiring of the system so that short circuits, open circuits, grounds, or any fault in this equipment or interconnection between this equipment and the fire alarm system wiring does not interfere with the supervision of the fire alarm system or prevent alarm or trouble signal operation.	29.10.7.6	29.7.7.5	29.7.7.5	29.7.6.5	11.7.6.5	11.7.6.5
Equipment not required for the operation of the fire alarm system that is modified, removed, or malfunctioning in any way must not impair the opreation of the fire alarm system. Commentary Text from NFPA 72® Handbook	29.10.7.6	29.7.7.5	29.7.7.5	29.7.6.5	11.7.6.5	11.7.6.5

UL Standards Matrix
UL® 1023- Household Burglar-Alarm System Units
Sixth And Seventh Edition

Standard References	6th Edition November 25, 1996	7th Edition September 1, 2017
These requirements also apply to the use of combination systems, such as a combination fire-burglar-alarm system control unit. A combination system is connected in such a manner that fault conditions (shorts, opens, grounds) in the burglar-alarm system circuit wiring, or interconnections between the fire- and burglar-alarm system circuits, will not interfere with the supervision of the fire alarm system or will not prevent intended alarm signal operation.	1.3	1.3
A household burglar alarm system shall provide supervision of the initiating device circuits, so that if there is an open in the circuit or failure of a transmitter device's ability to communicate with its receiver, the open or failure to transmit will be indicated to the alarm system user.	1.6	1.7
Electrical Supervision Test	27	30
An open or ground fault in any circuit extending from a household system unit, other than the initiating device circuit, shall not affect the operation of the product except for the loss of the function extending from that circuit. Exception: If such a fault will affect the operation of the product, a trouble signal or alarm condition or test feature that will indicate the fault is required.	27.2	30.2
A fault condition, open ground, or short of other than a burglar-alarm circuit of a combination control unit, shall not affect the burglar-alarm signal.	27.3	30.3

