PERTRONIC

Using Non-Twisted Flat Cable in

ANALOG ADDRESSABLE RETROFITS

Introduction

When upgrading a fire detection system from conventional detection to a Pertronic analog addressable system, it may be desirable to re-use existing cabling. This avoids the expense of purchasing and installing new, twisted-pair cable for AA signaling circuits.

This document discusses the issues that should be considered when deciding whether or not to use existing, non-twisted two-core cable in Pertronic analog addressable ("AA") signaling circuits.

Typical Existing Cabling

A typical conventional detection zone would have non-twisted (flat) two-core cable linking the fire panel to one or more detectors.

Usually each zone is a spur with the panel at one end. Typically the far end is fitted with an end of line termination.

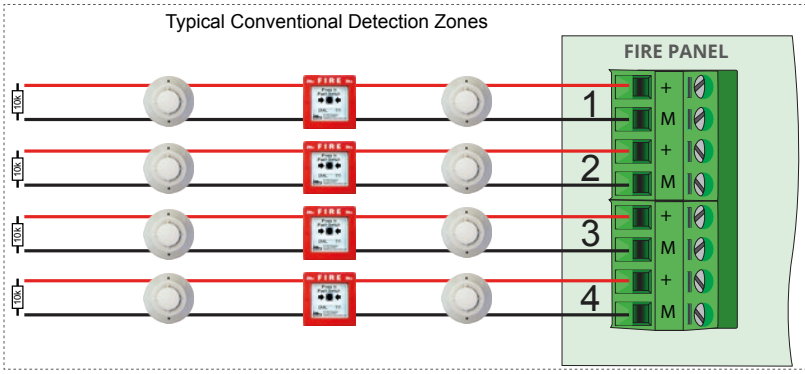

FIGURE 1:
Typical arrangement of conventional detection zones.

Analog Addressable Options

Conventional detection zones can often be upgraded to analog addressable (AA) by replacing the conventional detectors, detector bases, and other devices with AA devices.

Analog addressable fire system devices include smoke detectors, heat detectors, manual call points, monitor modules, loop responders, and loop relays. A mixture of device types may be connected to a single signaling circuit. For more information on the system capabilities, please refer to the datasheets and technical manuals for Pertronic analog addressable panels.

There are two popular configurations:

- Conventional zones may be connected as analog addressable loops, or
- Conventional zones may be converted to analog addressable spurs

A single system may include a mix of loops and spurs.

Fault (defect) supervision with Pertronic analog addressable fire panels works normally on both loop and spur circuits, because the fire panel regularly polls each individual loop device and registers a fault (defect) if any device fails to respond when polled.

NOTE: Remove the end of line resistors. End of line resistors are not required in analog addressable loops or spurs.

Loop Configuration

Existing conventional detection zones may be converted to Pertronic AA loops.

Each loop will consist of a single-pair cable connected from the loop driver “A” terminals, to each analog addressable device in turn, and finally back to the loop driver “B” terminals. The loop is effectively driven from both ends. This means that an open circuit fault (defect) anywhere on the loop will not affect its operation.

In a typical loop conversion, multiple conventional zones are connected in series to create a continuous analog addressable signaling circuit. The two ends of this circuit are connected to the loop driver outputs of Pertronic analog addressable fire panels such as the Pertronic F220 or F100A.

An analog addressable loop isolator module should be installed in series with each link connecting one former conventional zone to another. This ensures that a short-circuit in any zone will not affect normal operation of the other zones on the AA loop.

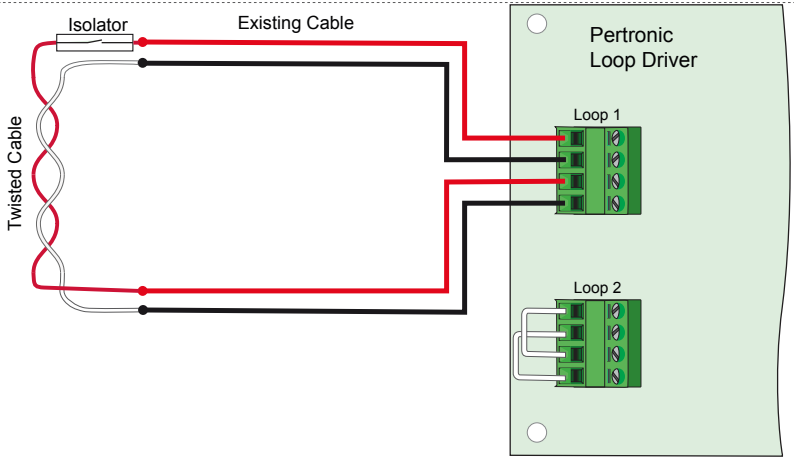

FIGURE 2:
Two conventional detection zones (red & black) connected as an analog addressable loop, using a length of twisted-pair cable (red & white). Note the isolator (see text).

Spur Configuration

A single spur may be connected directly to an AA loop driver output.

No special interface is needed, provided that the AA loop driver output is not connected to any other signaling circuit.

In this case, the A+ and A- terminals (respectively) must be linked to the B+ and B- terminals, otherwise the panel will show a loop fault (defect). (See Figure 3)

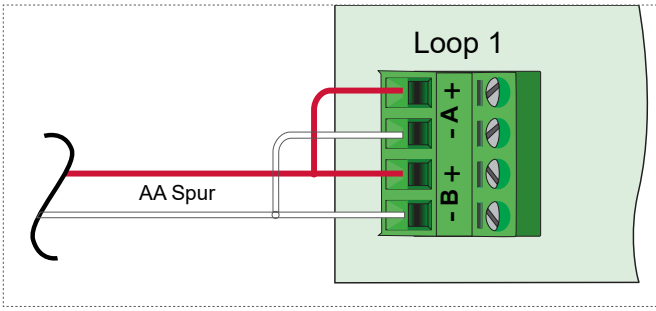

FIGURE 3:
Loop driver output connections for a single-spur Pertronic AA signaling circuit.

When multiple spurs are to be connected to one AA loop driver output, each spur is connected to a spur isolator such as the Pertronic AA Isolator Board – 8-spur (8SAAIB). This module is connected to the panel’s loop driver output as shown in Figure 4. The isolator board ensures that a short-circuit on any individual spur will not affect normal operation of any other spur.

Spur Configuration Cont'd

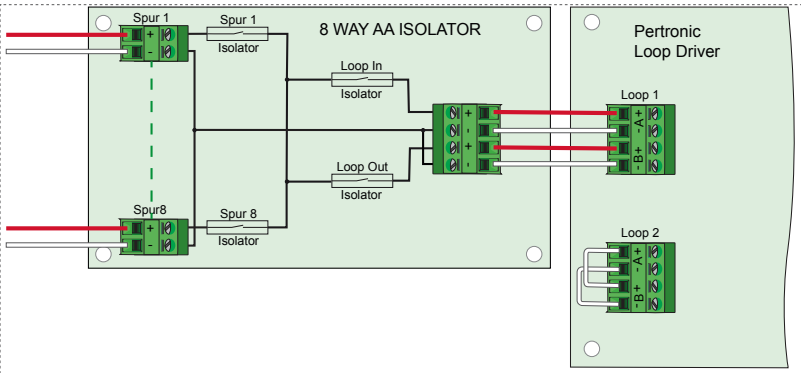

FIGURE 4:
Multi-spur system using the Pertronic 8SAAIB.

A spur may include only one detection zone. This is because an open- or short circuit at any device will isolate all downstream devices from the analog addressable loop.

An analog addressable spur does not need an end-of-line termination.

General Requirements

As with any other fire detection and alarm system, an installation using non-twisted cable must meet all applicable regulatory requirements.

There are specific issues that must be taken into consideration when re-using existing non-twisted cable in AA circuits:

- Circuit length, and
- Interference immunity.

Circuit Length

The end to end length of a Pertronic analog addressable spur or loop circuit may not exceed 2500 metres.

The following issues may reduce the allowable circuit length:

1. The maximum total series resistance must not be more than
   - 50 Ω in an AA loop circuit, or
   - 40 Ω from the fire panel to the end of an AA spur (see note below)
2. Voltage drop in the loop cabling must be limited to an acceptable value
3. Regulatory requirements may affect the design of spurs or loops

Note: If an AA spur branches from a loop which runs outside of the fire panel cabinet, the allowable series resistance of the spur itself is 40 ohms minus one quarter of the loop circuit resistance.

Circuit Resistance

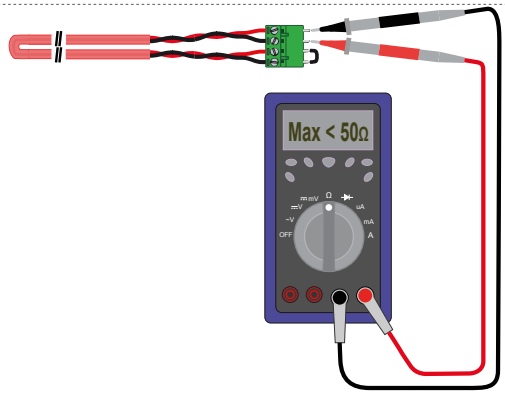

FIGURE 5:
The total series resistance of a two-core AA signaling line cable is the sum of the resistance of both legs. This must not exceed 50 Ω for a loop (shown) or 40 Ω for a spur.

Circuit Length Cont'd

Usually it is not practicable to directly measure the total series resistance by the method shown in Figure 5. For example, if the circuit has isolators, a dc ohm-meter will measure an open circuit on the active leg.

However, the return leg is usually continuous from end to end. Therefore in a loop circuit, the total series resistance can be determined as follows:

1. Measure the resistance of the return leg (Figure 6)
2. Multiply by two

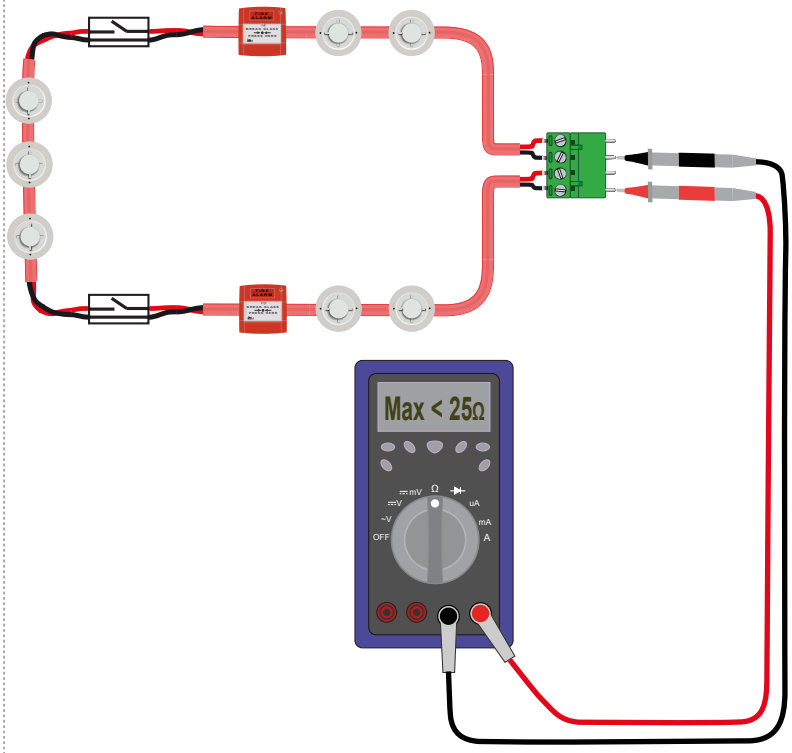

FIGURE 6:
The total series resistance of an AA loop circuit may be determined by measuring the resistance of the return leg (black) and multiplying by two

In the example (Figure 6), the black conductor is the return leg, and the red conductor has two open-circuit isolators.

The resistance of the black (return) leg measures 25 Ω

The total series resistance of both (red and black) legs = (2 x 25) Ω = 50 Ω

The following table shows typical cable length for maximum series resistance with various conductor sizes. Please note that allowable loop or spur length may be further reduced by voltage drop or regulatory considerations.

Conductor Size	Cable Length for Maximum Series Resistance (Rmax)	
	Spur: Rmax = 40 Ω	Loop: Rmax = 50 Ω
1.0 mm²	1000 metres	1200 metres
1.5 mm²	1500 metres	1900 metres
For larger cables, note that the cable shall not be longer than 2500 metres.		

Circuit Length Cont'd

Voltage Drop

To ensure all devices function correctly when one end of the loop is disconnected from the fire panel, the voltage at the far end of the circuit must be greater than the minimum allowable supply voltage for loop-powered devices. In Pertronic systems the minimum acceptable voltage is 15 volts.

Our websites provide calculators for checking the voltage drop for a specified circuit configuration. The calculators provide maximum allowable lengths under two "worst-case" conditions:

- All devices evenly distributed along the circuit; and
- All devices at the far end of the circuit

Please note that although Pertronic analog addressable loops are driven from both ends, they are expected to function normally with one end disconnected. For the purpose of voltage drop calculations, assume the loop is driven from one end only.

Maximum allowable lengths calculated using the loop length calculators apply equally to analog addressable loop and spur circuits.

The loop length calculators are online at:

Australia (AS 1670.1 systems): https://dl.pertronic.net/2ZYmzYS89zuuicpw5MECtM

New Zealand (NZS 4512 systems): https://dl.pertronic.net/5113HmLAkMKguZbhXPg1Jg

Regulatory Requirements

Local fire alarm regulations may impose additional constraints on the length of an analog addressable loop or spur.

Example: In Australia and New Zealand, a spur may not traverse more than one detection zone.

Interference

In most installations, non-twisted cable will provide satisfactory protection against interference.

To prevent interference, the signaling line circuit should be separated from systems that may produce, or be susceptible to, electromagnetic interference. We recommend that non-twisted cable used for AA signaling circuits should be kept at least 25 mm away from other cables. Long parallel runs should be avoided. Non-twisted cable should not be used in analog addressable circuits if the detection cable will run alongside, and close to, other cables that may produce, or be susceptible to, interference.

Earth leakage will increase susceptibility to interference. The resistance between each conductor and the system earth (ground) should be > 50 kΩ.

Conclusion

The re-use of non-twisted cable in Pertronic AA conversions has been well-proven in many projects throughout Australasia.

When used according to the guidelines in this document, non-twisted cable should not lead to problems with electromagnetic interference.

If there is any doubt about the applicability of flat, non-twisted cable in a proposed analog addressable system, please consult Pertronic Industries.