Short-Circuit Isolation

In Addressable Fire Detection and Alarm Systems

The requirement for isolation

Analogue addressable fire detection systems are usually designed as loops, with the connecting wires starting and finishing at the fire control panel. Detection devices, manual call points and interfaces are connected at intervals along the cables. Depending on the national or local regulations, audible and visual alarm devices are connected either to the same loop as the detection devices or via dedicated loops. Spurs may be connected at any point of the loop, either directly from the loop wires or from an interface, and are subject to national or local regulation.

Short circuits do not occur very often but, when they do, the consequences can be serious, possibly making the affected loop entirely inoperative. It is for this reason that isolating circuits have been designed and incorporated into various devices that are connected to the loop. The purpose of these isolating circuits is to protect the loop in the event of a short or partial short circuit by disconnecting the part of the loop where the short circuit has occurred. When the short circuit fault has been rectified, the isolating circuitry automatically reconnects the affected section of the loop.

Features of isolating circuits

Isolating circuits are available in different forms:

- As stand-alone isolators
- As printed circuit boards in a version of the detector mounting bases known as 'isolating bases'
- Integrated into other Apollo devices such as manual call points, audible and visual alarm devices, interfaces or detection devices
- Integrated into Soteria® products. All products in the Soteria range are available with a built in isolator

Isolating circuits are intended for use with Apollo XP95®, Discovery® and Soteria products. Isolating circuits are polarity sensitive and normally switch the negative line of the loop.

Apollo isolating circuits allow the connection of between one and twenty detectors (or the equivalent load) between isolators. Devices including or fitted to isolating circuits remain operative when an adjacent loop section is in the isolated state. The isolated state is normally indicated by an illuminated yellow LED on the device.

Operating principles

Under normal operating conditions the isolating circuit provides a low resistance in either direction. If the loop voltage falls to a pre-set level the isolator will switch from the closed state to the open state in order to isolate the loop 'in' and 'out' lines. The isolated section is tested with a test current and is automatically re-connected at a pre-set load resistance value (see Technical data). With reference to Figure 1, the test current is drawn from the loop and it is important for correct operation of the system that the test load be included in the loop calculation made for any system.

Isolator type

There are three types of isolating circuit used in Apollo products:

- The original circuit, known as 20D, has been in use since the introduction of XP95
- The 20I circuit was developed in order to reduce the test current which is applied to isolated sections of the loop. It reduces the test current by two thirds
- The Soteria isolator is incorporated into Soteria products and is not available separately. It performs much like the 20I isolator but with advanced features that will allow additional control of the isolator through Apollo's CoreProtocol®

There are minor differences between each of the isolator types; therefore ratings are given for each type in the technical data.

Fire control panel compatibility

Fire control panels that are certificated by Apollo are also compatible with Apollo isolating circuits but it is essential that compatibility of the fire control panel and isolating device be fully established when designing a fire detection system. Apollo offers a software program with which the viability of a design can be checked. The program, LoopCalc, may be downloaded from Apollo's website: www.apollo-fire.co.uk

If the fire control panel has built-in isolators, it is essential that isolators connected to the loop are switching the same line – positive or negative – as the fire control panel isolators. Although the majority of systems are designed to isolate the negative line, Apollo can supply isolators that switch the positive line, these are distinguished by having a clear LED which emits yellow light in the isolated state. This excludes isolators which are integrated into some devices such as manual call points, interfaces, audible and visual alarm devices and detection devices. These are only available in the negative switching variant.

Note: All detectors and other devices between any two isolators or isolating devices must be in the same fire zone because communications will be lost if a short circuit occurs between isolators. This design consideration may be subject to national or local regulations.

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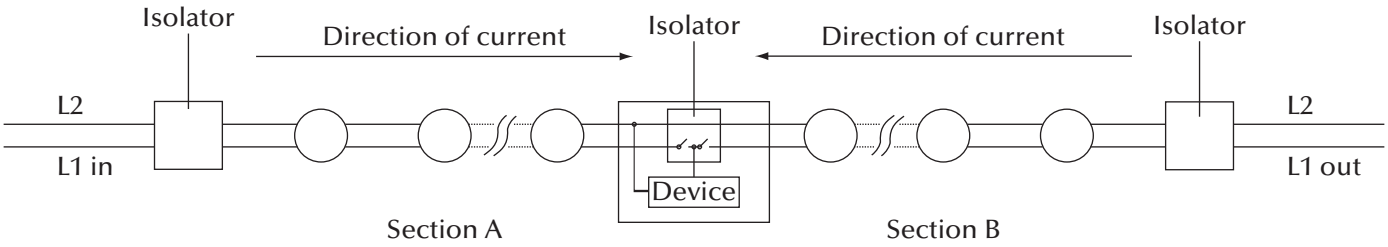
Figure 1 Load calculation diagram



The device surge current must be included in the calculation for both section A and section B, since current might flow from left to right or right to left

Technical data

	EN 54-17 Parameter	*20D*	*20I (from 2009)*	*45681-518*	*55000-812*	*SA7100-100*	*Soteria*
			Electrical				
Supply voltage	Vmin – Vmax	17 – 28V plus 5 – 9V protocol pulses	17 – 28V plus 5 – 9V protocol pulses	17 – 28V plus 5 – 9V protocol pulses	17 – 28V plus 5 – 9V protocol pulses	17 – 35V plus 5 – 13V protocol pulses	17 – 35V plus 5 – 13V protocol pulses
Maximum power-up time		10ms	30ms	30ms	10ms	30ms	30ms
Maximum loop current:							
Continuous	$I_C$max	1A	1A	1A	1A	1A	1A
Short-circuit switching	$I_S$max	3A	3A	3A	3A	3A	3A
Maximum quiescent current:							
at 18V	$I_Q$max	23µA	23µA	23µA	23µA	25µA	25µA
at 24V	$I_Q$max	35µA	35µA	35µA	35µA	38µA	38µA
at 28V	$I_Q$max	45µA	45µA	45µA	45µA	48µA	48µA
at 35V	$I_Q$max	n/a	n/a	n/a	n/a	80µA	80µA
Maximum 'on' resistance	$Z_C$max	200mΩ	200mΩ	200mΩ	200mΩ	80mΩ	80mΩ
Additional features		n/a	n/a	n/a	n/a	n/a	CoreProtocol controllable
			Isolation Specification				
Supply voltage during isolation		18 – 28V	18 – 28V	18 – 28V	18 – 28V	18 – 35V	18 – 35V
Mimimum isolating voltage	V_{SO}min	13.6V	13.6V	13.6V	8V	12.5V	12.5V
Maximum isolating voltage	V_{SO}max	14.8V	14.8V	14.8V	14.8V	15V	15V
Mimimum reconnect voltage	V_{SC}min	12.9V	12.9V	12.9V	8V	12.8V	12.8V
Maximum reconnect voltage	V_{SC}max	18V	18V	18V	18V	19.1V	19.1V
Loop test current in isolated state	$I_L$max	50mA pulsed	28.2mA dc	28.2mA dc	70mA pulsed	33mA pulsed	33mA pulsed
Current in isolated state:							
at 18V		4mA	26.3mA	26.3mA	4mA	0.8mA	0.8mA
at 24V		5.4mA	28.5mA	28.5mA	5.4mA	1.1mA	1.1mA
at 28V		6.4mA	30.0mA	30.0mA	6.4mA	1.3mA	1.3mA
at 35V		n/a	n/a	n/a	n/a	2.2mA	2.2mA
De-isolation test impedance limit:							
Spur connection	Z_{SC}min	300 – 420Ω	520 – 750Ω	670 – 900Ω	140 – 490Ω	515 – 2030Ω	515 – 2030Ω
Loop connection	Z_{SC}max	150 – 210Ω	335 – 450Ω	335 – 450Ω	70 – 245Ω	293 – 434Ω	293 – 434Ω
			Environmental				
Operating temperature		–20°C to 60°C	–20°C to 60°C	–20°C to 60°C	–20°C to 60°C	–10°C to 55°C	See product specification
Storage temperature		–30°C to 80°C	–30°C to 80°C	–30°C to 80°C	–30°C to 80°C	–40°C to 85°C	See product specification
Humidity		0 to 95% RH (no condensation or icing)	0 to 95% RH (no condensation or icing)	0 to 95% RH (no condensation or icing)	0 to 95% RH (no condensation or icing)	0 to 93% RH (no condensation or icing)	See product specification
Design environment		Indoor use only	Indoor use only	Indoor use only	Indoor use only	Indoor use only	See product specification

All data supplied is subject to change without notice.