Short-circuit isolation in XP95 ® and Discovery® fire detection systems

THE REQUIREMENT FOR ISOLATION

Analogue addressable fire detection systems are usually designed as loops, with the connecting wires starting and finishing at the control panel. Detectors and interfaces are connected at intervals along the cables. Depending on the local regulations, manual call points and sounders are connected either to the same loop or to other, dedicated loops. Spurs may be connected at any point of the loop, either directly from the loop wires or from an interface such as a Zone Monitor.

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 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 reconnects the affected section of the loop.

FEATURES OF ISOLATING CIRCUITS

Isolating circuits are delivered as stand-alone isolators with their own mounting bases or as printed circuit boards in a version of the detector mounting bases known as ‘isolating bases’. Isolating circuits are also fitted to interfaces such as Input/Output Units or Sounder Control Units.

Isolating circuits are intended for use with XP95 and Discovery detectors and interfaces. 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.

Detectors fitted to isolating bases and interfaces with built-in 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 isolating unit.

OPERATING PRINCIPLES

Under normal operating conditions the isolating circuit provides a low resistance of 0.2Ω 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 every four seconds with a current pulse and is automatically re-connected at a pre-set load resistance value (see 'Technical Data).

The current pulses are drawn from the loop and it is important for correct operation of the system that the pulse load be included in the loop calculation made for any system.

ISOLATOR TYPE

Two types of isolating circuit are used in Apollo products: one is the original circuit known as 20D which has been in use since the introduction of XP95. The other isolating circuit was developed in order to reduce the test current which is applied to isolated sections of the loop. It is known as the '20I' isolator and has the advantages of reducing the test current by two-thirds. In other respects the capabilities of the isolating circuits are very similar although some of the higher current devices are not so easily powered up. Ratings are therefore given for both isolating circuits.

The table gives the loadings possible with both 20D and 20i isolating circuits. Information is also included on the circuit incorporated into interface 55000-812 which is not used elsewhere.

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PANEL COMPATIBILITY

Control panels that are registered Apollo compatible are also compatible with Apollo isolating circuits but it is essential that compatibility of 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 panel has built-in isolators, it is essential that isolators connected to the loop switch the same line–positive or negative–as the 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.)

Note: all detectors and other devices between any two isolators or isolating devices should be in the same fire zone, because communications with them will be lost if a short-circuit occurs between isolators.

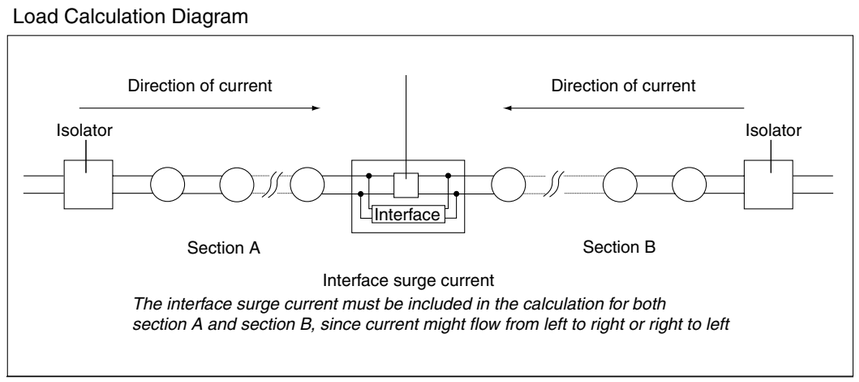

Fig 1 *Diagram to show loading of an isolated loop*

Technical Data

	20I (from 2009)	**20D**	**55000-812**	**EN54–17 parameter**
Electrical				
XP95/Discovery loop voltage	17V–28V plus 5–9V protocol pulses			V_{min-} V_{max}
Maximum power-up time	30ms	10ms		
Maximum loop current continuous short-circuit switching	 1.0A 3.0A			 I_{Cmax} I_{Smax}
Quiescent current at 18V at 24V at 28V	 23µA 35µA 45µA			 $I_{\mathbf{q}max}$
Maximum 'on' resistance	0.2Ω			Z_{Cmax}
Isolation specification				
Supply voltage during isolation	18–28V			
Isolating voltage	13.6–14.8V		8–14.8V	V_{SOmin}—V_{SOmax}
Re-connect voltage	12.9–18V		8–18V	V_{SCmin}— V_{SCmax}
Loop test current in isolated state	28.2mA	50mA	70mA	I_{lmax}
Current in isolated state at 18V at 24V at 28V	 26.3mA 28.5mA 30.0mA	 4.0mA 5.4mA 6.4mA		
De-isolation test impedance limit spur connection loop connection	 670-900Ω 335-450Ω	 300–420Ω 150–210Ω	 140–490Ω 70–245Ω	 Z_{SCmin}—Z_{SCmax}
Environmental				
Operating temperature	–20° C to +60°C			
Storage temperature	–30° C to +80°C			
Operating humidity	0%–95%RH (no condensation or icing)			
Design environment	Indoor use only			

Table 2 *Techinical data*