SABRE

Application Guide

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Twinflex and Multipoint Application Guide

Contents

Introduction

Purpose of the Guide

This Application Guide provides an overview of the Rafiki Twinflex System range of fire alarm control panels and associated field devices, and is produced to assist system planners select the appropriate equipment for a particular application.

It is assumed that users of this guide are familiar with the requirements of BS 5839 and other standards and legislation affecting the installation of fire alarm systems. The guide does not provide guidance on, for example, the number of zones required for a particular application, or the number of sounders required to achieve the required sound level. For advice on system design refer to the relevant British Standard, i.e.

- BS 5839-1:1988 Fire detection and alarm systems for buildings. Code of practice for system design, installation and servicing.
- BS 5839-6:1995 Fire detection and alarm systems for buildings. Code of practice for the design and installation of fire detection and alarm systems in dwellings.
- BS EN 54 series.

British Standards may be obtained from:

British Standards Institution
Customer Services
389 Chiswick High Road
London W4 4BR

Tel. 020 8996 9001

Associated Documents

- Twinflex Installation and Operating Instructions
- Twinflex User Guide

Who should use this guide?

This Application Guide is intended primarily for system designers and planners to ensure that the correct equipment is procured prior to installation and that all relevant factors affecting system performance and compliance with standards are taken into consideration.

It will also be of assistance to project engineers in the planning of commissioning and system configuration to meet the design criteria.

Finally, although a rudimentary technical knowledge is assumed, it will assist those unfamiliar with fire alarm systems to select the products most suited to their requirements.

The Twinflex System Range

2-Wire Conventional Fire Detection

Unlike most conventional fire alarm systems which require separate pairs of cables for detector zones and sounder zones, the Twinflex system requires only one pair (two wires) for each zone to accommodate both detection devices and sounders. Furthermore, sounders are incorporated within the detector to reduce system components and simplify installation.

Twinflex Control Panel

The heart of any fire alarm system is the control panel, and the range offered by Rafiki is sufficient to satisfy most applications from small residential and commercial premises up to medium sized industrial sites. Control panel capacity is governed by the number of zones it is equipped with, which will determine to some extent the size of premises that can be protected. The following capacities are available:

- 2 Zone
- 4 Zone
- 8 Zone

Each panel in the range provides similar functions and facilities and all share a common fascia layout featuring clearly marked controls and status indicators.

Twinflex *plus* Control Panel

The Twinflex *plus* range is identical in appearance to the Twinflex range, but with an important additional feature, *Checkpoint Plus*.

Checkpoint Plus provides a special two-stage alarm operation which is designed specifically to cater for the requirements of residential premises, typically hostels, hotels, apartments, and ‘HMOs’ (houses with multiple occupation).

Twinflex Multipoint Detector

The Twinflex Multipoint Detector is a single device providing all the features of normal conventional smoke and heat detectors in a single unit, which can be configured to operate in one of seven modes to suit the environment in which it is located. The device is available with or without an integral sounder, but is otherwise universal in its application. The sounder can be configured for normal volume (90 dB(A) at 1m) or low volume (75 dB(A) at 1m).

Manual Call Point

The Twinflex manual call point is connected to the two-wire zone circuit and provides the means to manually activate the fire alarm system.

Electronic Sounder

For locations where a sounder only is required the ‘Hatari’ electronic sounder can be installed and connected to the two-wire zone cabling.

Any standard 24 vdc electronic sounder or bell can be connected to the conventional sounder output.

Twinflex Output Unit

The Twinflex Output Unit is connected to the two-wire zone cabling and operates whenever a fire condition is active on the system to provide a volt-free contact to interface with building services or ancillary devices, e.g. plant shut down, door release devices, etc.

Twinflex Repeat Panel

The Twinflex Repeat Panel provides remote indication of the control panel status for applications where the main panel may be hidden from general view, or where there is an alternative entrance to the building. The Repeat Panel can incorporate controls to remotely silence, reset and evacuate the system.

Features

The main features provided by the range are:

- All field devices connected to one pair of wires per zone - reducing cable and simplifying installation.
- No special end-of-line device or component required - any field device can be configured as the end of line unit.
- Differentiates between an active manual call point and a detector.
- One single detector meets all applications.

Limitations

- The Twinflex system must utilise Rafiki Multipoint detectors and manual call points - other makes of detector and call point are not compatible with the system.
- Rafiki field devices are not compatible with other manufacturers’ control equipment.

Understanding the Products

General

Each of the products in the range is described in more detail here to assist the designer in selecting the appropriate equipment required for a given application, and to ensure that the final system satisfies all the requirements of the specification and meets the end user's expectations.

Twinflex Control Panel

The Twinflex Control Panel is a conventional fire alarm controller, but the enhanced operation of the Multipoint detector provides many of the features of an analogue detection system. The panel is available in 2, 4 or 8 zones, with each zone able to accommodate the Multipoint detector (with or without sounder), sounder only, manual call point, and output unit. As a guide the following devices can be installed on each zone:

- Sounder only (Twinflex Hatari) 6
- Multipoint detector with sounder (normal volume) 16
- Multipoint detector with sounder (low volume) 32
- Multipoint detector without sounder 32
- Twinflex manual call point 32

Fully Loaded Zone Examples

1 8* Det. Norm & 16* Det. Low
2 10* Det. Norm & 2* Hatari
3 10* Det. Low & 4* Hatari

For combinations of devices the supplier should be consulted if the upper limits are approached.

Operation

The Twinflex Control Panel provides a general alarm operation in response to a fire activation, i.e. the activation of a detector or manual call point will cause all the sounders (including those integral to detectors) on all zones to operate. If any other operation is required, then the Twinflex *plus* should be considered, or the supplier consulted.

Sounder Output

The control panel also offers one conventional sounder/bell output which can be used to drive sounders not exceeding the output capacity of 2/4 zn = 500mA Fuse, 8 zn = 1A Fuse. It should be noted that the use of this circuit only does not comply with British Standards, therefore at least one other sounder (or integral sounder) on a separate zone is necessary.

Remote Fire

A Remote Fire Output is available. This is a 24 vdc output energised when the panel is in alarm condition and may be used to provide a signal to a remote monitoring station. The output can be isolated for system testing and is monitored for open and short circuit fault conditions.

Common Fault

A Common Fault output is provided and consists of normally-open (NO) volt-free contacts which close when the Fault LED is lit, and can be used to signal a fault to a remote location.

Common Fire

A Common Fire output is provided and consists of a volt-free changeover contact which can be used to signal a fire to a remote location or interface with building services.

Class Change

The panel incorporates a 'Class Change' facility which enables the sounders on the system to be activated via a remote input when the panel is in its normal operating condition. As the name suggests, the feature can be used to signal the end of a school period and the start of another by the operation of a remote switch or timer contact. An alternative use for this feature is to interface with another fire alarm system where the Twinflex system may be part of a larger installation and is required to receive an alarm signal when a fire condition is detected elsewhere.

Four separate operating modes are available - refer to the Installation and Operating Instructions for details.

Auxiliary Output

A 24 vdc auxiliary output is provided to power ancillary devices such as door retainers, dampers, etc. The maximum load that can be supported is 250 mA, but it should be noted that the addition of ancillary devices may compromise the standby battery capacity and reduce the standby period to below the required period.

It is recommended that ancillary devices that require a permanent supply are provided with a separate power supply unit (and battery if required).

Repeater Panel

The control panel provides outputs to signal zonal fire and common fault conditions to a repeater panel. When a fire or fault condition exists a switched 0v is applied to the output and can be used in conjunction with the auxiliary output to light a LED in a remote panel.

The control panel also accepts remote inputs to silence, reset and evacuate the panel. Therefore a remote repeater panel can be equipped with control switches to replicate the major user controls on the control panel.

Twinflex *plus* Control Panel

The Twinflex *plus* Control Panel is identical to the Twinflex Control Panel, but with the addition of the *Checkpoint Plus* feature. Therefore, all the features and facilities described above are applicable to this panel.

Checkpoint Plus

The primary benefit of the *Checkpoint Plus* technology is a two-stage alarm operation which has been developed specifically for residential premises required to comply with BS 5839-6. Therefore whenever the application involves premises where people are sleeping the Checkpoint option should be considered.

However, use of the Checkpoint option needs careful consideration at the planning stage to ensure that the required operation is achieved. The most important task is to identify the areas of the protected premises and define the zones accordingly.

At the planning stage, zones are designated as either ‘Dwelling’ or ‘Communal’. Detectors (with sounders) within bedrooms or apartments are connected to zones designated as ‘dwelling’, and devices on zones in circulation areas and escape routes are designated as ‘communal’. A further option enables a dwelling zone to function as a ‘single dwelling’ or ‘multiple dwelling’.

Single Dwelling

The single dwelling configuration applies where there are several rooms within the dwelling, e.g. an apartment or flat, all of which are alerted in the event of a detector in one of the rooms detecting fire.

Multiple Dwelling

With the multiple dwelling configuration, only the active detector sounds its associated alarm. This is the appropriate selection for a single room arrangement such as a bedsit or hotel room. This is achieved by ‘logically linking’ the detectors.

Operation

When a detector connected to a dwelling zone enters the fire state, the integral sounder operates and the Checkpoint feature initiates a checking period during which the panel confirms whether or not the condition is ‘genuine’. If the multiple dwelling option applies, the sounder in the active detector only sounds.

The detector condition is monitored over an adjustable period of up to five minutes. If at the end of the checking period the fire condition no longer exists, the local alarm is silenced and the panel is automatically reset. If the fire condition still exists a general alarm is initiated and all the sounders on the system are activated. In both cases, the activation of a manual call point on a dwelling zone initiates a general alarm. Stand-alone sounders on dwelling zones are not activated until the alarm is confirmed.

When a detector or manual call point connected to a communal zone is activated a general alarm is raised, i.e. all sounders within detectors and stand-alone sounders on the system are energised.

Detector configuration is carried out at the commissioning stage, but communal and dwelling zones must be identified at the design stage and **cabled separately at installation in order to achieve the desired operation.**

Note Repeated zone o/p can be re-configured to indicate ‘Checking Period’. See Installation Guide for details.

Multipoint Detector

Introduction

The Multipoint detector is a single device offering up to seven different modes of operation. At the purchasing stage the planner simply has to determine the number of detectors with integral sounder and the number without. If in doubt the integral sounder option should be selected as the sounder can easily be disabled if not required in a particular location.

Thereafter it is just a matter of selecting the appropriate mode of operation, which is configured at the commissioning stage via a DIL switch in the electronics element of the detector.

The full range of detector types is available in one product. This makes it easier to specify the equipment required before the full properties of the building are known. It also makes it easier to change the detection if required during commissioning, or servicing if the building use changes with time.

Description of Detector

There are two high performance fire sensors incorporated within the Rafiki Multipoint fire detector:

Optical scatter smoke sensor

Based on a high efficiency infra-red LED and receiver pair, the optical chamber includes two lenses and has been designed to be tolerant against the effects of ambient light, dust and insects, whilst giving a high signal/noise ratio for good electronic stability.

Heat sensor

Based on a selected thermistor heat sensor.

Research

Research into fire detection has shown that this is currently the best combination of sensors for giving a good response to a wide range of fires. The heat sensor can be used to boost the response of the optical sensor to free burning fires which produce a lot of heat. This negates the need for ionisation detectors which contain radioactive sources, and have an extremely poor response to smouldering fires. It also means that the specifier does not have to predict in advance the expected type of fire.

The signals from the sensors are processed with a microcomputer. Signals from the sensors are read every 400ms and a fire decision is taken every 5 seconds. This involves analysis using long term averaging as well as faster signals. A set of rules is processed which optimises the detection response depending on the detection mode selected, which gives the fastest response to fires whilst rejecting signals which could cause false alarms.

The background signal from the optical scatter smoke sensor is updated regularly to compensate for the effects of dust build up and long term ageing. Values are stored in non-volatile EEPROM memory, along with calibration data and the device serial number.

Modes of Detection

The detector has the unique ability to select between different modes of smoke and heat detection using DIL switches on the electronics assembly. This means that the detection mode can be optimised for the location where the detectors are installed during commissioning, or as a result of changes in building use without replacing the detectors. **In effect a whole range of detectors is available by switch selection within the one standard product.**

Three smoke and three heat modes are available as follows. A seventh setting allows both Smoke 2 and Heat 2 to be simultaneously active, i.e. combined smoke and heat detector.

Smoke 1
Use where ionisation detectors are normally used, especially when there are high ceilings or a risk of free burning fires.

Smoke 2
Use where optical detectors are normally used when there is a risk of a smouldering fire and for escape routes. Smoke 2 is the default setting.

Smoke 3
Use where optical detectors are normally used in locations exposed to brief concentrations of water vapour or smoke, e.g. from a bathroom, kettle, etc.

Heat 1
Use where a standard rate-of-rise detector would normally be used.

Heat 2
Use where a standard fixed temperature heat detector would normally be used, e.g. commercial kitchens, etc.

Heat 3
Use where a high fixed temperature heat detector would normally be used, e.g. boiler rooms, etc.

Smoke 2/Heat 2
A combination of Smoke 2 and Heat 2 - responds to either smoke or heat, e.g. bedsit, hotel bedroom, etc.

Design Considerations

Introduction

When designing a fire alarm system utilising the Rafiki range of Twinflex equipment there are certain fundamental points that must be understood before finalising the design, i.e.

1. The Twinflex and Twinflex *plus* control panels are separate items of equipment - if the *Checkpoint Plus* facility is required, or is likely to be required in the future, the Twinflex *plus* panel should be selected.

2. The number of zones provided by each panel is fixed. For example, if the current requirement is for four zones, consider an eight zone panel to allow future expansion capability.

3. The two-wire zone configuration must utilise a fire-resistant cable such as MICC, FP200 or other approved shielded cable, in order that the system functions correctly and to comply with British Standards.

4. The Rafiki Twinflex range of field devices is not compatible with other manufacturers' control equipment. Similarly, other manufacturers' field devices, including manual call points, are not compatible with the Twinflex range.

Selecting Equipment

Step 1. Determine the required system operation.

Is a general alarm signal acceptable?	Select from the Twinflex range.
Is a two-stage alarm signal required?	Select from the Twinflex *plus* range.
Are people sleeping on the premises?	Consider the Twinflex *plus* range.

Step 2. Determine the number of zones required.

Based on the recommendations provided in BS 5839, determine the number of zones required to comply with the standard and adequately protect the premises. Generally, at least one zone per floor will be necessary, but other factors such as the floor area and the number of devices that can be connected to a zone should be considered. Select a control panel that provides the number of zones required, bearing in mind possible future expansion. It is better to have too many zones available than too few.

Step 3. Determine the number of detectors required.

Detector density is governed by the system classification and recommendations in BS 5839. Where full protection is required at least one detector should be sited in each room, and evenly spaced within circulation areas and escape routes. Each detector within a room should include an integral sounder. Where there is more than one detector in an area it may not be necessary for all detectors to include a sounder, or the use of stand-alone sounders can be considered.

Step 4. Determine the number of manual call points required.

As a general rule a manual call point should be located adjacent to every exit from the premises, and at the exit from an upper floor to below. In larger premises it may be necessary to locate call points at intermediate positions to minimise the travel distance - refer to BS 5839.

Step 5. Consider alarm audibility.

BS 5839 recommends a general alarm sound level of 65 dB(A) throughout the building, and 75 dB(A) at the bedhead where people are sleeping. The detector integral sounder provides a 'normal' level of 90 dB(A) at one metre which easily satisfies this requirement within individual rooms. In circulation or open areas it may not be necessary to provide a sounder in each detector, or conversely it may be necessary to provide stand-alone sounders where there is little or no detector coverage.

Remember, integral sounders can be simply disabled or set to low volume via the detector DIL switch if the level is too loud, but to increase the sound it is necessary to add stand-alone sounders if there are insufficient integral sounders.

Step 6. Ancillary services.

1 Is it necessary to repeat the fire alarm indications elsewhere in the building, e.g. is there an alternative entrance that may be used by the fire brigade? If so a repeater panel will be required.

2 Is remote silence and reset necessary, e.g. is the control panel inaccessible at certain periods? If so select a repeater panel with remote control facilities.

3 Are auxiliary outputs required to shutdown plant, close doors, etc? If so include an output unit for each signal required. Remember, the output unit requires a separate 24 vdc supply; however, it may not be necessary to provide a separate PSU for each unit - consider the circuit loading and physical location of devices.

Step 7. Battery standby

A standby battery is required to maintain the system in operation in the event of a mains supply failure. The following 'Yuasa' or similar type batteries are recommended:-

- 2/4 Zone Control Panel 2 x 12V 2.1 Ah Battery
- 8 Zone Control Panel 2 x 12V 3.3 Ah Battery

Generally, these battery sizes provide up to 72 hours standby operation followed by 30 minutes alarm operation, but the standby period will be reduced if there are auxiliary standing loads such as may be imposed by devices powered from the auxiliary output. The 8 Zone panel can accept 2 x 12V 7.2 Ah batteries if additional capacity is required. If in doubt refer to the supplier.

Separate power supply units used in conjunction with output units may or may not require standby batteries depending on the application. For example, it may be acceptable for retained fire doors to close in the event of mains failure, in which case a battery is not necessary.

Alternatively, if a ventilation fire damper for instance is being held open via a maintained supply, it may have an undesirable affect on the building operation if it closes under mains fail condition, in which case a battery is required to maintain the supply.

System Installation

General

In order to ensure that the equipment is installed correctly, the installation contractor should be provided with installation instructions and/or a drawing showing the device locations and zone allocations.

Control Panel

The control panel should if possible be located near to the main entrance to the premises so that it is accessible by the fire brigade and authorised personnel. It should not be positioned where it is liable to be damaged by equipment, e.g. trolleys, etc., or is accessible to the general public.

Where a repeater panel is specified the same criteria apply.

The panel should be mounted on a flat wall surface with the indications at approximately eye level. Ensure that the panel door is able to open fully for internal access, and that adjacent equipment cannot damage or interfere with the panel.

Cable entry is via removable ‘knockouts’ in the cabinet. Cable entry holes should not be made elsewhere in the cabinet as damage may be caused to the electronic circuitry, or battery siting may be compromised.

Cabling Requirements

The Twinflex system requires a pair of wires per zone to accommodate the field devices, i.e. detectors, call points, stand-alone sounders, and output units.

Each zone is wired as a radial circuit, i.e. the wires are terminated at the panel at one end and finish at a device in the field - it is not necessary to bring the cable pair back to the panel. Each device on a zone must be connected in parallel with the zone pair, branch circuits and tees are not acceptable.

The cable utilised must be MICC (Mineral Insulated Callender Cable), FP200, or other approved shielded cable. The use of twin and earth or ‘belden’ type cable is not acceptable.

Where a two-stage system (Checkpoint) is being installed, dwelling zones and communal zones must be wired separately, although they may be on the same floor of the building.

Cable type, routing and physical protection should be in accordance with the recommendations in BS 5839.

Mains Supply

The mains supply to the panel should be installed by an electrician in accordance with IEE Wiring Regulations, or local standards. If required an unswitched connection unit can be provided adjacent to the control panel but, ideally, there should be no intermediate isolation points between the main

switchboard and the control panel. The main isolator and any intermediate isolation points must be labelled as recommended in BS 5839.

Manual Call Points

Twinflex manual call points may be flush or surface mounted as required. In either case they are normally mounted at 1.4m above the finished floor level, close to the exit or escape route, and in a prominent position.

Where surface mounting is required it is necessary to specify a surface mounting box when ordering the equipment. For flush mounting a standard 3” x 3” electrical accessory box is adequate.

Multipoint Detector

The position of all detectors should be noted on the system drawings, with due consideration taken of any local conditions which may affect performance, e.g. ventilation outlets, heaters, etc.

The detector (with or without sounder) comprises three parts as follows:

- Base
- Electronics assembly
- Optical chamber

The base fits a standard ‘BESA’ conduit box and is complete with field wiring terminals enabling the zone wiring to be installed, terminated and tested prior to fitting the detector.

The electronics module includes the sounder (when fitted), active LED, and the DIL mode selection switch, and simply plugs into the base at the commissioning stage. A tool is provided with the detector assembly to remove the module if necessary.

The optical chamber is fitted to the base, over the electronics module, and is rotated to lock into position. Asymmetrical locating pins ensure that the chamber can only ft in one position, and a small pane allows the active LED to be visible from below. A special tool is available to remove the chamber for access to the module if necessary.

The detector module is factory preset to the standard sensitivity thermally enhanced smoke detector mode (Smoke 2).

The device LED (and any remote LED) provide the following indications:

1.	Normal operation	LED flashes every 20s
2.	EOL device	LED flashes every 5s
3.	Detector head removed	LED flashes every 1.3s
4.	Alarm condition	LED flashes 350ms on, 350ms off after approx 4 seconds LED stays on continuously until CIE reset.

End-of-Line Device

No special end-of-line device or component is required for the zone circuits; however, the last device on each zone circuit must be configured as an end-of-line unit via the DIL switch. As it may not be possible to identify the last device on the system drawings because of cabling considerations, the commissioning engineer should be instructed to identify the device and configure it accordingly. All devices including stand-alone sounders are acceptable end-of-line devices.

Exceptions to the above are the conventional sounder circuit and the remote fire output, both of which require a resistor to be fitted across the last device, when used.

Detector Application Mode

One of the many benefits of the Rafiki Twinflex system is the unique detector concept whereby a single detector provides up to seven operating modes to suit the application. However, to gain the maximum benefit from this feature, the detector mode must be correctly applied to each specific installation to ensure that the optimum detection is provided.

For many applications the factory preset (Smoke 2) is probably suitable, but where environmental conditions are such that an alternative setting is appropriate, the detector must be configured accordingly.

The selection of mode for each detector may be made by an experienced commissioning engineer, or by the system designer or project engineer. In any case the mode selected for each detector should be recorded within the project documentation and/or on the drawings for future reference. The mode of any detector can subsequently be amended if the environment changes.

For advice on selecting the most appropriate mode for a given application, refer to the chart on page 14.

Multipoint Applications