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# APPROVAL REPORT

**AlarmLine LINEAR TEMPERATURE DETECTION SYSTEM  
INCLUDING SERIES 4 LINEAR HEAT DETECTOR  
INTERFACE MODULE AND P/N K82017, K82021 AND K82078  
SENSOR CABLE  
(Product Modifications)**

**Prepared for:**

**KIDDE FIRE PROTECTION LTD.  
BELVUE ROAD  
NORTHOLT, MIDDLESEX  
ENGLAND UB5 5QW**

**0B9A2.AY**

**(3220)**

**August 14, 1997**

FACTORY MUTUAL



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**AlarmLine LINEAR TEMPERATURE DETECTION SYSTEM  
INCLUDING SERIES 4 LINEAR HEAT DETECTOR INTERFACE MODULE  
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from

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**I INTRODUCTION**

1.1 Kidde Fire Protection requested an Approval examination of modifications to their AlarmLine linear heat detector.

1.1.1 The first modification is the change in the negative coefficient material used in the manufacture of the AlarmLine cable from "O.B.C." to "Trimellitate".

1.1.2 The second modification is the partial redesign of the series 4 linear heat detector (LHD) interface module to accommodate a new sensitivity selector and changes required to meet European EMI resistance.

1.1.3 The newer material heat sensing cable, designated as Type "T", and the older material heat sensing cable, designated as Type "C", are intended to be interchangeable with both newer and older version controls. The two cables require different alarm settings in the controllers which are obtained from separate nomograms in the installation instructions.

1.1.4 Mixing Type "T" heat sensing cable with any other type heat sensing cable is not permitted.

1.2 It was also requested that the two-wire AlarmLine module which was previously

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Approved for use with the Kidde-Fenwal model 3210 fire alarm control panel also be Approved for use with the previously Approved Kidde-Fenwal models 2320, Scorpio (Reference FMRC Report 0Y5A0.AY) and Gemini (Reference FMRC Report 0P2A6.AY) fire alarm control panels.

1.3 The AlarmLine cables and controllers were previously Approved for FMRC Reports 0R5A4.AY (2-wire AlarmLine version with Kidde-Fenwal 3210 fire alarm control panel) and 0M3A0.AY (4-wire AlarmLine version). This report supplements those reports.

1.4 The AlarmLine linear heat detection is private labeled by Kidde-Fenwal, Inc. Kidde-Fenwal uses the same name for the equipment but assigns different part numbers and installation instructions.

1.5 The AlarmLine cable with control equipment previously underwent a spacing test for open area protection. The recommended maximum spacing between parallel cables, located on a flat ceiling, was found to be 30 feet (9.1 m).

1.6 The AlarmLine control equipment was evaluated for indoor application only. The IP55 enclosure rating for the series 4 LHD interface module was not tested and is not covered by this Approval.

1.6.1 The use of AlarmLine cable and control equipment for hazardous area applications as described Chapter 1 of the attached Kidde Fire Protection manual and in section 9 of the attached Kidde-Fenwal installation manual was not evaluated and is not covered by this Approval.

1.6.2 The AlarmLine applications shown in Chapter 7 of the attached Kidde Fire Protection manual and sections 8.2 through 8.11 of the attached Kidde-Fenwal installation manual were not evaluated and are not covered by this Approval.

1.6.3 Except as listed elsewhere in this report, components mentioned in the attached Kidde Fire Protection and Kidde-Fenwal literature were not evaluated as part of this project and are not covered by this Approval.

1.7 Applicable portions of the following standards were used for the examination and evaluation of the equipment included in this report:

National Fire Protection Association; *National Fire Alarm Code*, ANSI/NFPA 72, 1996.

Factory Mutual Research Corporation, Approval Standard; *Thermostats for Automatic Fire Detection*, Class Number 3210 (July 1978)

1.8 The series 4 LHD two-wire interface modules are Approved for use only with

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initiating device circuits (IDC) from the Approved Kidde-Fenwal models 3210, 2320, SCORPIO and GEMINI (common control board IDCs) fire alarm control panel.

1.8.1 Connection of multiple series 4 LHD two-wire interface modules, which prevent alarm transmission from some operational modules if one or more modules on the same initiating device circuit are in trouble condition (as shown in Chapter 5.2 of the Kidde Fire Protection manual), do not comply with NFPA 72-1996, Section 3-8.2.2, and are not covered by this Approval.

1.9 Due to the lack of duplicate terminals for power and signal connections as required by NFPA 72-1996, Section 5-1.3.4, and lack of supervision of power to the module, Approval of the four wire version of the series 4 LHD interface module is limited to installations where the module(s) are mounted within a Kidde-Fenwal fire alarm control panel or within enclosures located not greater than 20 feet from the control equipment where the conductors are installed in conduit or equivalently protected against mechanical injury. (See Section V REMARKS)

1.10 The equipment examined for this report will be listed in the Factory Mutual Research Approval Guide (See Appendix I).

## II DESCRIPTION (See Attached)

2.1 The following paragraphs, and the attached Kidde Fire Protection and Kidde-Fenwal literature, describe the equipment covered by this Approval. The manufacturer has made available all necessary component information and specifications which have been examined and are on file at FMRC.

2.2 The following table lists the current AlarmLine part numbers for modules, housings, and cables:

DESCRIPTION	Kidde Fire Protection Part Number	Kidde-Fenwal Part Number
Standard PVC sensor cable 656 ft. (200 m) coil	K82017	73-117068-013
Nylon coated sensor cable 656 ft. (200 m) coil	K82021	73-117068-016
Bronze braided sensor cable 656 ft. (200 m) coil	K82078	73-117068-019

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2-wire interface module with mounting plate for the 3210 panel	N/A	73-117068-001
4-wire interface module with relay output and surface mount enclosure	K82194	73-117068-046
2-wire interface module circuit board only	EK82013	73-117068-042
Surface mount enclosure only, for interface module circuit board	217029000	73-117068-044

2.3 There is no change to the mounting options for the interface modules, cable splicing or termination procedures over the previously Approved versions.

2.4 The maximum AlarmLine heat sensing cable time and temperature duration has been reduced to 257°F (125°C) for 24 hours.

2.5 A second nomogram has been added to the installation instructions for use with the Type "T" cable to determine proper alarm point setting based on cable length and desired alarm temperature.

2.5 A maximum of three 2-wire interface modules will be permitted on a single initiating device circuit (IDC) for the Kidde-Fenwal models 2320 and SCORPIO and GEMINI (common control board IDCs) fire alarm control panels. The maximum of two 2-wire interface modules per IDC for the Kidde-Fenwal model 3210 fire alarm control panel remains unchanged.

### III MARKING

3.1 Each interface module is marked with the name of the manufacturer, model designation, Alarmline Series 4 LHD, serial number, terminal designations, and the Factory Mutual Research Approval mark.

3.2 The Alarmline cable is marked at one meter intervals with the year of manufacture, batch number, wire color code, "Alarmline Fire Detection Systems", the cable type and the designation "FM APPROVED".

3.3 Each roll of the Type "T" AlarmLine cable is marked with an adhesive warning label cautioning the user not to mix Type "T" AlarmLine sensor cable with Type "C" or Type "B" sensor cable on the same interface module.

### IV EXAMINATION AND TEST

4.1 Tests were conducted at Factory Mutual Research Corporation (FMRC) in Norwood,

MA and at Kidde-Fenwal, Inc. in Ashland, MA on representative samples of the equipment covered by this report. All samples were compared with appropriate drawings and component information supplied by the manufacturer and found to meet FMRC requirements.

**4.2 Operational Testing** - Representative samples of the AlarmLine cable and interface modules were tested to verify the manufacturer's performance claims.

**4.2.1 Actuation Set Point Temperature** - Samples of the cable were subjected to an ambient temperature increase of less than 2°F/minute (1.1°C/minute). The nomograms were verified at settings representing the low, mid and high ends of the sensitivity range.

**4.2.2** It was verified that the Type "C" cable could be operated properly by the modified version interface module and that the Type "T" cable could be properly operated by the original version and modified version interface modules.

**4.2.3 High Ambient Stability Test** - A sample of the Type "T" cable connected to a modified version interface module was subjected to a temperature of 153°F (67.2°C) which was the maximum ambient temperature given by the nomogram for the set point and cable length. There was no false alarm or fault signal during the 24 hour test period. This corresponds to approximately 10% below the set point temperature.

### **4.3 Environmental Tests**

**4.3.1 Low/High Temperature Tests (Module)** - A sample of the modified interface module was subjected to -13°F (-25°C) and +125°F (52°C) for 24 hours each. After the tests the module, with cable connected, responded within 3% (in °F) of the set point temperature.

**4.3.2 Low/High Temperature Tests (Cable)** - A sample of the Type "T" cable was subjected to -40°F (-40°C) and +350°F (175°C) for 24 hours. After the tests the cable, with module connected, responded within 3% (in °F) of the set point temperature.

**4.3.3 High Humidity Test** - Samples of the modified interface module and Type "T" cable were conditioned for 24 hours at 100°F (38°C) with 90% relative humidity. After the test the module, with cable connected, responded within 3% (in °F) of the set point temperature and showed no adverse effect due to moisture.

**4.4 Voltage Variation** - A sample of the modified interface module was tested with the power supply voltage varied over the manufacturer's rated voltage range for the detector (17 - 30 VDC). These extremes exceed the normal voltage variation test range of 85-110% of a nominal voltage of 24 VDC and were therefore an acceptable alternative. No change in response was observed.

**4.5 Dielectric Strength (Module)** - A dielectric breakdown test was conducted on a representative sample of the modified interface module. A potential of 500 VAC was applied between the points listed below. No arcing, insulation breakdown or leakage indication on the test instrument was observed during the one minute tests.

- a. Relay, AlarmLine cable and power terminals (connected together) and the outer surface of the module housing wrapped in foil.
- b. Relay, AlarmLine cable and power terminals (connected together) and the module metal faceplate with LEDs and test switch.
- c. Relay terminals (connected together) and AlarmLine cable and power terminals (connected together).

**4.6 Dielectric Strength (Cable)** - A dielectric breakdown test was conducted on a representative six foot (1.8 m) sample of the Type "T" cable with bronze braid outer covering. A potential of 5000 VAC was applied individually between each internal conductor and the bronze braid. No arcing, insulation breakdown or leakage indication on the test instrument was observed during the one minute tests.

**4.7 Vibration Test** - A sample of the modified interface module was subjected to vertical vibration for four hours with a total displacement of 0.02 inch (0.5 mm) and a frequency sweep of 10 - 30 - 10 Hz at two cycles per minute. In both cases the detectors continued to operate properly during and after the test with no loose hardware or mechanical damage.

**4.8 Radio Frequency Interference** - Although not required for Approval, the following tests were made. A sample of the modified interface module connected to a sample of Type "T" cable was subjected to frequencies of 155 MHz and 450 MHz with radiation power levels of 5.0 Watts at a distance of 24 inches (0.61 m) from the equipment. The equipment did not false alarm or give any indication of instability as a result of these exposures.

**4.9 Line Surge/Transient Tests** - Although not required for Approval, protection against line transients was considered. For these tests each input/output circuit of the series 4 LHD interface module was subjected to five transient waveforms having peak levels of 100, 500, 1000, 1500 and 2400 VDC, as delivered into a 200 ohm load. The module failed in the alarm condition during the 500 VDC test. No other failures resulted from the other circuits tested.

**4.10 Compatibility** - Three 2-wire AlarmLine modules were connected as shown in the installation instructions to a single IDC in representative samples of Kidde-Fenwal SCORPIO and GEMINI fire alarm control panels. In the GEMINI panel the IDC was located on the common control board. (See Section V REMARKS)

4.10.1 It was verified that the modules operated correctly with the primary power to

the panels varied from 110% of rated to the point of transfer to secondary power (both 120 and 240 VAC versions), and with the secondary power varied from 85% of rated to the maximum battery float voltage. Maximum permitted auxiliary panel load was applied during low primary and low secondary tests.

4.10.2 It was verified that the supervision requirements of NFPA 72-1996 including the performance requirements for Class B (Style B) of Table 3-5 were met.

4.10.3 Due to the similarity between the SCORPIO and the 2320 panels the tests were not repeated with the 2320 panel.

## **V REMARKS**

5.1 The 4-wire version of the interface module provides both alarm and fault (trouble) relay contacts but does not supervise the 24 VDC input power to the module.

5.2 At the time of the testing Kidde-Fenwal installation instructions showed three modules connected on a single IDC. The final revision has limited the number to two modules per IDC.

## **VI FACILITIES AND PROCEDURES AUDIT**

The Kidde Fire Protection Ltd. manufacturing facilities in Northolt, Middlesex, UK and in Cramlington, Northumberland, UK along with the Thermocable (flexible elements) Ltd. manufacturing facilities in Bradford, West Yorkshire, UK are currently included in FMRC's Facilities and Procedures Audit program. The manufacture of the equipment included in this report represented no change to manufacturing or quality control procedures already in place. Kidde Fire Protection and Thermocable (flexible elements) Ltd. facilities and quality control procedures will continue to be inspected for as long as this Approval remains in effect.

## **VI MANUFACTURER'S RESPONSIBILITIES**

6.1 The manufacturer shall provide instructions for installation, operation and maintenance with each unit.

6.2 The manufacturer shall advise Factory Mutual Research Corporation of all proposed changes to the material shown in the Documentation List of this report via the Approved Product Revision Report (Form 797).

## Appendix I

FMRC Approval Guide listings:

**Fire Detection, Heat Actuated****Kidde Fire Protection Ltd Belvue Rd Northolt Middlesex UB5 5QW England**

Alarmline Heat Detection System. Consists of line type sensing cable and series 4 LHD interface module P/N K82194. Cables consist of four 26 AWG solid copper conductors covered with a negative temperature coefficient material, insulated by a sheath of high temperature PVC ("Standard Sensor Cable" P/N K82017) or PVC with nylon jacket ("Nylon Coated Sensor" P/N K82021). A version with a protective outer weave of phosphor bronze braid is available for applications requiring abrasion protection ("Bronze Braided Sensor" P/N K82078). Cable consists of four copper conductors. Pairs of conductors are joined at one end of the cable; the other end connects to the interface module. Each cable is self-restoring, up to 257°F (125°C), depending on time of exposure to high temperature. The alarm temperature is set by a 12-position alarm trip switch on the interface module. Nylon sheathed cable is recommended for low temperature installations (less than 0°F [-17°C]); however, installation and repair of the cable must be done at temperatures of 32°F (0°C) and higher. Each K82194 interface module is suitable for indoor use and for a temperature range of -13° to 122°F (-25° to 50°C), requires 24 V dc power, provides LEDs and a test switch for alarm and fault, and is equipped with alarm and trouble relay contacts for connection to the initiating device circuit of the Approved fire alarm control panel. Maximum spacing for AlarmLine cable for open area protection is 30 ft (9 m).

**Kidde-Fenwal Inc 400 Main St Ashland MA 01721**

AlarmLine Linear Heat Detector. Consists of line type sensing cable and interface module. Cables consist of four 26 AWG solid copper conductors insulated with a negative temperature coefficient material and covered with an outer jacket of PVC ("Standard Sensor Cable" P/N 73-117068-013) or PVC with nylon jacket ("Nylon Coated Sensor" P/N 73-117068-016). A version with a protective outer weave of phosphor bronze braid is available for applications requiring abrasion protection ("Bronze Braided Sensor" P/N 73-117068-019). Cable is self restoring up to 257°F (125°C) depending upon time of exposure to high temperature. The alarm temperature is set by a 12 position selector on the interface module. Two versions of interface module are available. 2-wire interface module compatible with initiating device circuit in Kidde-Fenwal 3210, 2320, SCPRPIO and GEMINI (common control board) fire alarm control panels for power and signal (P/N 73-117068-04 without 3210 panel mounting plate or P/N 73-117068-001 with 3210 panel mounting plate). Surface mount enclosure (P/N 73-117068-044) available for mounting module external to the fire alarm control panel. 4-wire interface module with surface mount enclosure (P/N 73-117068-046) requires supervised 17 to 30 VDC power and provides a single set of alarm and trouble relay contacts for connection to initiating device circuit of an Approved fire alarm control panel. Interface modules are suitable for indoor use at -

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13°F (-25°C) to 125°F (52°C) and provide LEDs and a test switch for alarm and fault. Maximum spacing for AlarmLine cable for open area protection is 30 ft (9 m). "Nylon Coated Sensor" is recommended for low temperature applications (less than 0°F (-17°C)); however, installation and repair of the cable must be done at temperatures of 32°F (0°C) and higher.

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Appendix II

DOCUMENTATION LIST

The documentation listed below is applicable to this Approval and is on file at Factory Mutual Research Corporation. No changes of any nature to the equipment shall be made unless notice of the proposed change has been given and prior written authorization by Factory Mutual Research Corporation has been received. The Approved Product Revision Report, FMRC form 797, shall be forwarded to Factory Mutual Research Corporation as notice of any proposed changes.

DESCRIPTION	DRAWING NO.	REV
LINEAR HEAT DETECTION (Kidde Fire Protection)	Manual No. 59812-211	2
AlarmLine Linear Heat Detector Installation Manual and Applications Guide	P/N MC-428	07/97
CONTROL P.C.B. ASSY. FOR ALARMLINE SERIES 4 LHD	43452-256	2
SERIES 4 LHD C.D.	43452-256-CD	2
RELAY BUFFER PCB ASSEMBLY	K82193	4
CIRCUIT DIAGRAM FOR RELAY BUFFER BOARD	K82192	2
KIT - TERMINATION SENSOR	73-117068-030	AC
SPLICE - WIRE	73-117068-028	CC
DETECTOR - LINEAR HEAT SERIES 4	73-117068-042	BA
CABLE - SENSOR (HIGH RESISTANCE)	73-117068-013, 73-117068-016, 73-117068-019	BA

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**VII CONCLUSION**

The AlarmLine linear heat detection system components described in this report meet Factory Mutual Research Corporation requirements. Approval will be in effect when the appropriate agreement is signed and a copy is received by Factory Mutual Research Corporation.

**ATTACHMENTS:**

*LINEAR HEAT DETECTION*

(Kidde Fire Protection Manual No. 59812-211, Revision 2)

*AlarmLine Linear Heat Detector Installation Manual and Applications Guide*

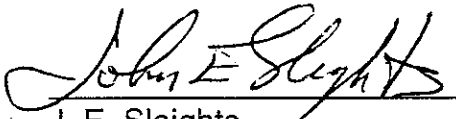
(Kidde-Fenwal, Inc. P/N MC-428 Effective July, 1997)

Appendix I: FMRC Approval Guide Listing

Appendix II: Documentation List

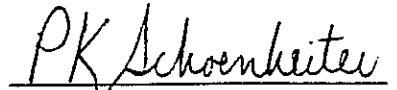
PROJECT DATA RECORD: 0B9A2.AY

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