MX4428
MXP ENGINEERING / TECHNICAL MANUAL

MX4428 PRODUCT MANUAL
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- APPROVALS -
AUSTRALIAN STANDARD AS4428.1 **- SSL Listing Number .... afp1446** **NEW ZEALAND STANDARD NZS4512-1997 (INCL AMDT 1 & 2)** **- FPA (NZ) Listing number .... VF/117** **AS/NZS 3548 1995 CLASS A**

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The MX4428 Fire Indicator Panel provides a configuration programming facility, which may be accessed via a programming terminal using a password. Because this programming facility allows the user to define in detail the operation of the MX4428 System being customised, changes may be made by the user that prevent this installation from meeting statutory requirements.

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AMENDMENT LOG

21 March 01	Issue 1.0	Original
24 April 03	Issue 1.1	Updated DIM800 Compatibility, added VLC800, LPS800, Alarm Tests
11 March 04	Issue 1.2	DIM800 with s/c fault option. Added "specs", noted source of MXPPROG, updated MXP software version history.
28 January 05	Issue 1.3	Added requirements for AS1670.1. Noted DIM800 supply supervision threshold is not adjustable. Added MIM800 max cable length on inputs to its specs. Updated Table 3-2. Added 5B, replaced 814IB with 5BI. Noted MkII Sounder Base has AS2220 and ISO tones. Added note re acceptable type mismatches. Added reference to software version 1.12.
28 October 05	Issue 1.4	Added 614CH, 614I, 614P, System Sensor 885WP-B detectors to Table 3-4.
24 March 06	Issue 1.5	Added 614T Section 3.20.3. Added 814P Section 3.9, etc. Added Loop Filter Board, Chapter 10.

TRADEMARKS

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CHAPTER 1
INTRODUCTION

1.1 ABOUT THIS MANUAL

This manual (MX4428 Product Manual Volume 11) is intended to provide all information and procedures required to incorporate one or more MXPs within an MX4428 system. It predominantly covers the function and engineering associated with the MXP itself, its impact on the MX4428 Responder Loop and the analogue loop/line(s) to which the compatible devices are connected. It does not duplicate basic MX4428 system engineering information, except at the point of interface (i.e. at the MX4428 Responder Loop), or for clarification as required. It is therefore a supplement to the F4000 Engineering Manual (F4000 Product Manual, Vol 3), to which the reader is referred for further information.

1.2 ASSOCIATED DOCUMENTATION

1.2.1 PRODUCT RELATED

The following MX4428/F4000 product manuals are available:

Volume 1, F4000 Operator's Manual, provides a complete guide to the operation and maintenance of the F4000 FIP and RDU panels, with Version 1.X software, according to Australian Standards AS1603 Part 4. This manual is provided as standard with non-LCD F4000 FIP panels (LT0057). See Volume 10 for AS4428.1 compliant systems.

Volume 2, F4000 Technical Manual, provides complete technical details on the F4000 system and Hardware/Software components, according to Australian Standards AS1603 Part 4, for servicing purposes (LT0069).

Volume 3, F4000 Engineering Manual, provides complete design details for correctly engineering the F4000/MX4428 system to meet customer and standard specifications (LT0071).

Volume 4, F4000 Installation Manual, provides complete details for correctly installing and placing into operation the F4000/MX4428 system (LT0070).

Volume 5, F4000 Programming Manual, provides details for correctly programming the F4000/MX4428 system to meet the system engineering specifications (LT0072).

Volume 6, F4000 AAR Technical & Engineering Manuals, Volume 6-1 provides Technical details on the AAR and Addressable Devices, and Volume 6-2 provides Engineering Design information for correctly engineering the AAR loop (LT0095/LT0096).

Volume 7, F4000 LCD Operator's Manual, provides a complete guide to the operation and maintenance of F4000 LCD FIP panels with Version 2.X software, according to Australian Standards AS1603 Part 4, AS4050(INT), and New Zealand Standard NZS4512. From Issue 2.35A onwards LT0117 includes networked operation, previously covered in a separate manual LT0150 (LT0117/LT0118). See Volume 10 for AS4428.1 compliant systems.

Volume 8, F4000 NZ Fire Indicator Panel Technical Manual, provides additional installation and technical information regarding the application of F4000/MX4428 Analogue Addressable Fire Alarm Systems in New Zealand (LT0126).

Volume 9, F4000 MPR Technical & Engineering Manuals, Volume 9-1 provides technical details on the MPR and Addressable devices, and Volume 9-2 provides Engineering Design information for correctly engineering the MPR loop (LT0139/LT0140).

Volume 10, MX4428 AS4428.1 LCD Operator's Manual, provides a guide to the operation and maintenance of MX4428 AS4428.1 LCD FIP panels with Version 3.10 software, according to Australian Standard AS4428.1, and New Zealand Standard NZS4512. This manual (LT0249) is provided as standard with MX4428 panels.

Volume 11, MX4428 MXP Technical / Engineering Manual, (LT0273) provides technical details on the MXP and its addressable devices, and provides engineering design information for correctly engineering the MXP loop.

F4000 Point Text Installation & Operation Manual (LT0228) provides details of the Point Text expansion option.

SmartConfig User Manual (LT0332) provides details on programming an MX4428 database using the SmartConfig program.

1.2.2 STANDARD RELATED

This manual makes reference to the following Australian Standards –

AS1603.4	Automatic Fire Detection and Alarm Systems Part 4 - Control and Indicating Equipment
AS1670.1	Automatic Fire Detection and Alarm Systems- System Design, Installation, and Commissioning.
AS1851.8	Maintenance of Fire Protection Equipment Part 8 - Automatic Fire Detection and Alarm Systems.
AS4428.1	Automatic Fire Detection and Alarm Systems. Control and Indication Equipment.

This manual makes reference to the following New Zealand Standard –

NZS4512	Automatic Fire Alarm Systems in Buildings.

1.3 SPECIFICATIONS

Inputs / Outputs	1. Standard F4000 / MX4428 Responder Loop. 2. Analogue Loop for up to 200 MX devices, with a maximum output current = 400mA. 3. RS232 Diagnostics Port.
Card Size	194mm * 140mm * 35mm.
Supply Voltage	17.0VDC to 30.0VDC.
Current Consumption	50mA to 1.3A depending on the number and type of devices connected. Refer to section 5.1.
Operating Temperature Range	-5°C to +50°C, 10% to 93% RH non condensing.

1.4 TERMINOLOGY

AAR	Analogue Addressable Responder.
AC	Alternating Current.
ACZ	Ancillary Control Zone.
ADR	Advanced Detector Responder.
Analogue Loop	The wiring that allows an MXP to communicate with and supply power to the addressable devices it is to monitor.
ARR	Advanced Relay (and Detector) Responder, which is an ADR fitted with an RRM.
AVF	Alarm Verification Facility, or alarm check.
AZF	Alarm Zone Facility, previously referred to as "GROUP".
CO	Carbon Monoxide
CV	Current Value (Filtered reading from detector)
DC	Direct Current.
Detector	Addressable device used to detect fires that interfaces to the MXP via the Analogue Loop. It contains one or more sensors.
EOL	End of Line device.
Evacuation Device	Sounder for warning of evacuation.
FIP	Fire Indicator Panel, as defined by standards.
GLOBAL	A function that may affect more than one zone.
HH	History High - the highest value a variable has reached
HL	History Low - the lowest value a variable has reached.
LCD	Liquid Crystal Display (usually alphanumeric)
LED	Light Emitting Diode (Visual Indicator).
MAF	FIP Master Alarm Facility.
MIC X	Measure of smoke density used with ionisation smoke detectors.
MPR	Multi Protocol Responder.
MXP	MX Protocol Responder
MCP	Manual Call Point (break glass switch).
Module	Addressable I/O device that interfaces to the MXP via the Analogue Loop.
NA	Not Applicable.
NC	Normally Closed.
NLR	Number of logical responders.
NO	Normally Open.
PCB	Printed Circuit Board.
Point	Any addressable device (detector or module) with a unique address that is connected to the analogue addressable loop.
PSU	Power Supply Unit.
Responder	A general term for all responder types, e.g. ADR, ARR, MPR, MXP, AAR and IOR that may be connected to the MX4428 Loop.
Responder Loop	A 4 core cable for communication and power to all responders connected to an MX4428 FIP.
ROR	Rate of Rise.
RF	Radio Frequency.
RRM	Responder Relay Module.
RZDU	Remote Zone Display Unit.
Sensor	Part of a detector which senses the environment - smoke or temperature or CO.
SLV	Step limited (or slope limited) value.
Zone	Fire searchable area of Building.

CHAPTER 2
RESPONDER LOOP DESIGN CONSIDERATIONS

2.1 MXP APPLICATION CONSIDERATIONS

The inclusion of one or more MXPs in an MX4428 system requires consideration of .....

(i) The definition of zones throughout the area to be protected.

(ii) Assessment of the detectors and other addressable device types and positions required to monitor each zone and interface to external equipment. This will indicate if and where the MXP's addressable devices are most appropriate, for purely functional reasons or for reducing system cost through reduced wiring.

The Design Engineer should be fully familiar with the concept of logical responders, as described in Section 2.2, before allocating an MXP to monitor multiple alarm zones.

This process should result in an initial system design defining .....

- Number and location of all Responders including MXPs.
- Number and location of all addressable devices.
- Planned cable route for MX4428 Responder Loop.
- Planned cable route(s) for MXP Analogue Loop(s).

(iii) Using the design rules given in this manual, analyse each MXP Analogue Loop/Line to confirm .....

- the MXP's current capability is adequate for the proposed devices (see Section 3.2).

- the proposed cable has the correct AC characteristics (see Section 4.4).

- the proposed cable has the correct DC characteristics (see Section 4.5).

(iv) Using Section 5 of this manual, in conjunction with the MX4428 Engineering Manual (LT0071), analyse the MX4428 responder Loop. This should result in.....

- the type and size of cable to be used for the power and signal portions of the MX4428 Responder Loop.

- the number and position of Loop Boosters required (if necessary).

(v) The results of (iii) and (iv) indicate whether or not the proposed system design is practical and/or cost-effective. If not, analyse what factors have contributed to the design being impractical, re-design these areas or consider the use of loop boosters and return to step (i).

(vi) Assess and document the programming of the MX4428 Master to support the system design. Programming of the MX4428 is covered in the MX4428 Programming Manual LT0072, with additional details of using SmartConfig in the SmartConfig user manual LT0332. The following data must be entered to support MXPs.

- information which, when downloaded to the MXP, defines how the MXP is to process the data received from addressable devices on the Analogue Loop/Line(s),
- information retained at the Master which defines how it is to process data received from configured MXPs on the MX4428 Loop.

2.2 "LOGICAL" RESPONDERS

2.2.1 THEORY

The MX4428 Master Panel can transfer data to and from up to 127 uniquely addressed Responders distributed around the MX4428 Responder Loop. Its database is structured to support the 4 circuit inputs and 4 relay outputs associated with the most common responder type, the ADR. Incorporating an MXP, which supports up to 200 input, output, or input / output points, represents a departure from the original ADR / AAR structure, but it is similar to that used for the MPR multiprotocol responder.

To incorporate the MXP, while still preserving the original 1 x MX4428 LOOP ADDRESS SUPPORTS 4 INPUTS (“CIRCUITS”) AND 4 OUTPUTS (“RELAYS”) database assumption, the concept of "logical responders" is used. A logical responder refers to a single responder loop number, supporting 4 inputs and 4 outputs. An ADR/ARR therefore represents a single logical responder. A responder that supports more than 4 inputs and outputs, such as the MXP, must therefore occupy multiple responder loop numbers. That is, it is a "multiple logical responder" unit. One MXP may in fact be configured at the MX4428 FIP to be between 1 and 50 logical responders.

Since an MXP can support up to 200 points irrespective of how many logical responders it has been configured to represent, it may be necessary to allocate multiple points to each logical responder circuit input or relay output. This has certain implications described below, the most significant being that it is a logical responder “circuit” which is mapped to a zone, not a point, and it is a logical responder “relay” which is mapped to an ACZ, not a single output point. Thus if multiple devices are allocated to a circuit, they must all be in the same zone, and if multiple outputs are allocated to a relay, they will generally be controlled as one.

2.2.2 LOGICAL RESPONDERS

Points map to logical responder circuits and relays as shown in Table 2-1 for different numbers of logical responders.

Basically the 200 points are evenly distributed across the number of logical responder circuits/relays (= number of logical responders * 4), with the remainder allocated to the last circuit.

Input devices are map to the circuit. Output devices usually map to the relay, but may map to the circuit by programming.

The 50 logical responder option is the only one that allows unique monitoring and full front panel indication of all 200 individual points without using the MX4428 Point Text expansion option. The 50 logical responder option however, uses 50 of the 127 available MX4428 responder loop addresses and therefore limits the remainder of the MX4428 system.

Figure 2.1 shows an example 3 logical responder MXP, which has a capability of 3 X 4 = 12 circuits (C1/1-1/4, C2/1-2/4, C3/1-3/4) and 12 relays (R1/1-1/4 ..... R3/4).

Splitting up the possible 200 addressable devices equally among the 12 circuits results in each circuit being able to service 200/12 = 16 devices, with 8 left over. Thus devices 1-16 are associated with circuit C1/1, devices 17-32 are associated with C1/2, etc, up to C3/4, which not only handles its own 16 points but also the extra 8 device addresses (193-200) otherwise not catered for. Input devices are mapped to circuits, and output devices are usually mapped to relays but may alternatively be mapped to the circuit.

Number of Logical Responders (NLR)	Number of Circuits (Relays) available (NC = 4 * NLR)	Number of Points per circuit (relay) PC = 200/NC	Total Quantity of Points in Last Circuit
1	4	50	50
2	8	25	25
3	12	16	24
4	16	12	20
5	20	10	10
6	24	8	16
7	28	7	11
8	32	6	14
9	36	5	25
10	40	5	5
11	44	4	28
12	48	4	12
13	52	3	47
14	56	3	35
15	60	3	23
16	64	3	11
17	68	2	66
18	72	2	58
19	76	2	50
20	80	2	42
21	84	2	34
22	88	2	26
23	92	2	18
24	96	2	10
25	100	2	2
26	104	1	97
27	108	1	93
28	112	1	89
29	116	1	85
30	120	1	81
31	124	1	77
32	128	1	73
33	132	1	69
34	136	1	65
35	140	1	61
36	144	1	57
37	148	1	53
38	152	1	49
39	156	1	45
40	160	1	41
41	164	1	37
42	168	1	33
43	172	1	29
44	176	1	25
45	180	1	21
46	184	1	17
47	188	1	13
48	192	1	9
49	196	1	5
50	200	1	1

Table 2-1 Point Allocation For Various Numbers of Logical Responders

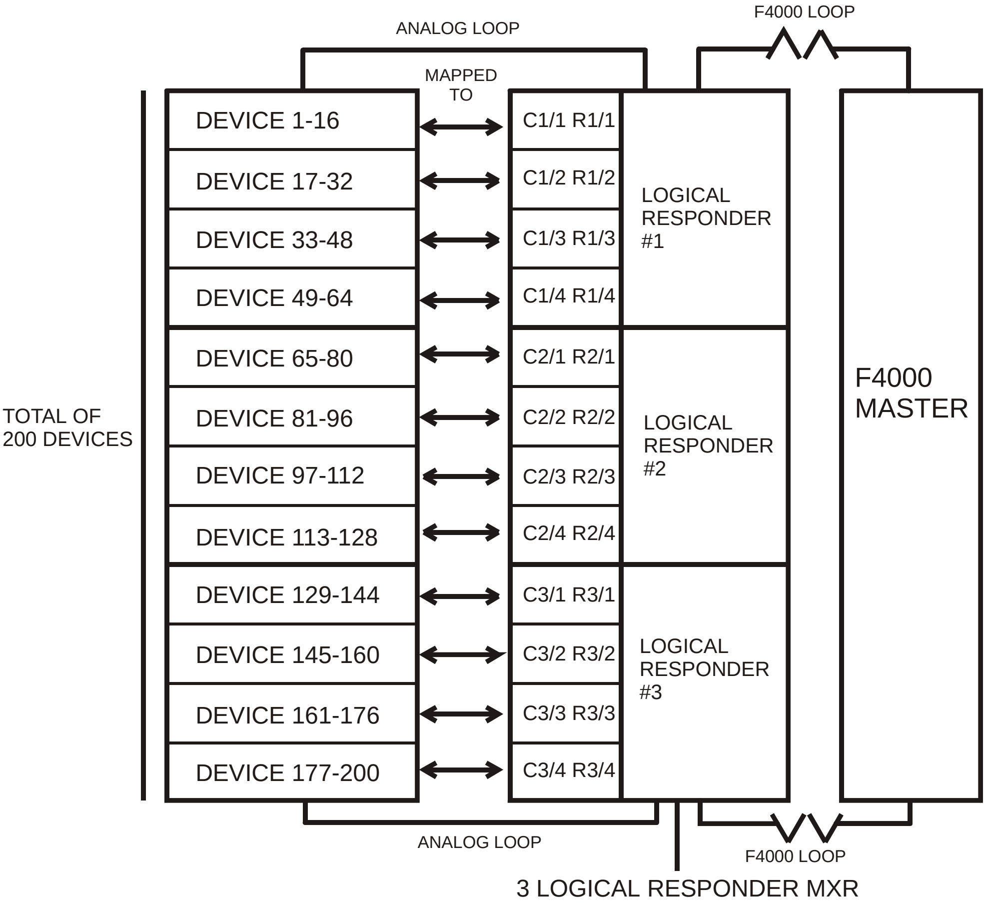


Figure 2.1 Device To Circuit Mapping For 3 Logical Responder MXP

2.2.3 POINT TO CIRCUIT TO ZONE MAPPING

Taking the 3 logical responder example in the previous sections, assume that of the 16 possible device addresses that belong to C1/1, only 10 of these are in fact used, and that 7 are input devices, and the remaining 3 are output devices. Further, assume that the MX4428 FIP is configured to map C1/1 to ZONE 1.

In this case, an alarm sensed by any of the 7 input devices would put C1/1 into alarm, which in turn would put ZONE 1 into alarm, a condition indicated on the MX4428 Master front panel. However, the MXP also generates what is referred to as an **extended event**, indicating precisely which of the 7 input devices caused the alarm. This is transmitted to the MX4428 Master where it is presented on the front panel LCD, entered in the history log and printed on the logging printer (if programmed).

If, for instance, in this example it was input device 6 that caused the ALARM then the extended event would take the form .....

"P1/6 ALARM" where .....

..... P = POINT

1 = BASE ADDRESS OF RESPONDER
6 = DEVICE NUMBER

If the Point Text expansion option is fitted at the MX4428 Master, the event will be associated with a text description of the point.

So far only input devices have been considered. To continue our example for output devices, if the MX4428 Master generated an output command, via output logic, to turn on R1/1, then the MXP would activate all output devices associated with that relay, that is, in this case, all 3.

2.3 IMPLICATIONS TO SYSTEM DESIGN

The System Designer should be aware of the following MX4428 characteristics before proceeding with the design .....

(i) While the MX4428 with MXP capability can support up to 16 x 200 (3,200) points (i.e. addressable devices), the Master unit has a maximum of 528 zones with which to indicate the status of the system.

The 528 zones may be used to display the status of either an "alarm zone", representing the status of a particular sub-section of the area to be monitored, or an "ancillary control zone" (ACZ), representing the status of an output controlled by the MX4428 system.

The Point Text expansion option can be used to extend this capability. Refer to the F4000 Point Text Installation and Operation Manual (LT0228) for further information.

(ii) FIP zone indicators are controlled according to the zone's status, which is generated from the mapped circuit status. That is, the 4 circuits monitored by each of the 127 logical responders can control a maximum of 4 x 127 = 508 unique zones.

The point handling capability of an MX4428 system requiring individual LED indicators per monitored point is therefore reduced to 508.

Therefore, the more individual LED indications that the FIP must show for each MXP the more logical responders that MXP must represent.

Every additional 4 zones that must be indicated for the addressable devices on an MXP incurs a cost of 1 additional logical responder (i.e. MX4428 responder loop address).

(iii) For the same reasons as given in (ii) above, the more individually controllable output devices the MXP must drive and control from logic, the more logical responders the MXP must represent.

CHAPTER 3
DEVICE INFORMATION AND PROGRAMMING

3.1 DEVICE TYPES

The MXP can communicate with a mix of up to 200 addressable devices, within limits defined by loop size.

3.1.1 MX DEVICES

MX devices fall into three basic types:

(a) Sensors - Detectors (814PH, 814CH, 814I, 814H, VLC800)

(b) Ancillaries - Input (Monitor) (MIM800, MIM801, CIM800, DIM800)
- MCP (CP820, FP0838, FP0839)
- Output (Control) (RIM800, SNM800, LPS800)

(c) Bases - Standard Base (MUB, 5B)
- Short Circuit Isolator (5BI)
- Relay Base (814RB)
- Sounder Base (814SB, MkII Sounder Base)

In addition non-addressable smoke, thermal or flame detectors may be connected to the MXP loop by means of the DIM800 Detector Input Module.

Code	Description	Input / Output	Remote LED
814PH	Photoelectric Smoke + Heat Detector	I/O	Y
814CH	Carbon Monoxide + Heat Detector	I/O	Y
814I	Ionisation Smoke Detector	I/O	Y
814H	Heat Detector	I/O	Y
VLC800	Vesda Aspirating smoke detector	I/O	Y
MIM800	Mini Input Module	Input	
MIM801	Mini Input Module normally closed interrupt (FP0837)	Input	
CP820	Manual Call Point	Input	
FP0838 FP0839	NZ Manual Call Point	Input	
CIM800	Contact Input Module	Input	
DIM800	Detector Input Module	Input	
RIM800	Relay Interface Module (unsupervised load wiring)	Output	
SNM800	Sounder Notification Module (relay output with supervised load wiring)	Output	
LPS800	Loop Powered Sounder	Output	

The devices above are addressed by the

801AP	Service Tool

or by command from the diagnostics terminal of an MXP.

The standard base for use with the 814 detectors is:

MUB	Minerva Universal Base (4”)
5B	Minerva Universal Base (5”)

The following special purpose bases may also be used.

5BI	Isolator Base
814RB	Relay Base
814SB	Sounder Base
MkII Sounder Base (802SB, 812SB, 901SB, and 912SB)	Sounder Base

The 814RB and 814SB may be plugged into an MUB, 5B or a 5BI, or mounted directly on a wall / ceiling.

Note that none of the bases are addressable devices. The functional bases (814RB, 814SB, and MkII Sounder Base) are controlled by the MXP via the detector which is plugged into them.

The devices above marked as “Input/Output” are always inputs, but may also be used as outputs via the Remote Indicator output and the signal to the 814RB, 814SB, and MkII Sounder Base functional bases. The output functionality is programmable and not necessarily related to the input status.

The devices which have a remote LED output may drive a Tyco E500Mk2 remote LED. The functionality of this LED is programmable and it does not necessarily follow the local LED.

A brief description of the capabilities of each device follows:

a) 814I Analogue Ionisation Smoke Detector

This unit uses an ionisation chamber (with a small radioactive source) to detect airborne particles of combustion products.

b) 814H Analogue Heat Detector

This detector incorporates a temperature sensor. The temperature sensor processing may be programmed as Type A (rate of rise plus fixed temperature = 63°C), Type B (fixed temperature only = 63°C), Type C (rate of rise plus fixed temperature = 93°C), or Type D (fixed temperature only = 93°C). Type A, B, C or D operation is programmable at the MX4428 panel.

c) 814PH Analogue Photoelectric Smoke Detector + Heat Detector

This unit uses light scattering to detect airborne particles of combustion products, and in addition incorporates a temperature sensor. The heat function may be programmed in the same way as for the 814H detector.

d) 814P Analogue Photoelectric Smoke Detector

This unit uses light scattering to detect airborne particles of combustion products.

e) 814CH Analogue CO (Carbon monoxide) Detector + Heat Detector

This unit uses a special sensor to detect carbon monoxide, and in addition incorporates a temperature sensor. The heat function may be programmed in the same way as for the 814H detector.

f) Mini Input Module MIM800

This unit has a single input for monitoring clean contacts (e.g. MCPs, flow switches conventional detectors with hard contact outputs, relay contacts, switches). As well as monitoring the state of the contacts the MIM800 can supervise the wiring for open circuit fault and (optionally) short circuit fault.

g) Mini Input Module MIM801

This unit has a single input for monitoring clean contacts (e.g. MCPs, flow switches, conventional detectors with hard contact outputs, relay contacts, switches). As well as monitoring the state of the contacts the MIM801 can supervise the wiring for short circuit fault and (optionally) open circuit fault. The MIM801 is very similar to the MIM800, however it is optimised for normally closed applications and can generate an interrupt on an open circuit. (Interrupt is only used when a fast response is required.) (The MIM800 and CIM800 can also generate interrupts, but only in response to closing contacts.)

h) Contact Input Module CIM800

This unit has two separate inputs for monitoring switch or relay contacts (e.g. MCPs, flow switches, conventional detectors with hard contact outputs, relay contacts, switches). As well as monitoring the state of the contacts the CIM800 can supervise the wiring for open circuit fault and (optionally) short circuit fault. Although there are two separate inputs, both belong to the same point. Either input in alarm will put the point into alarm, and either input in fault will put the point into fault. Unused inputs must be terminated with a 200Ω resistor.

i) Detector Input Module DIM800

This unit has two separate inputs for monitoring conventional detectors. As well as monitoring the state of the detectors they can supervise the wiring for open circuit faults. Although there are two separate inputs, both belong to the same point. Either input in alarm will put the point into alarm, and either input in fault will put the point into fault. An external power supply is required. The voltage requirements for some conventional detector types are very specific. (Refer to section 3.20).

j) Australian Call Point Module CP820

This unit consists of a MIM800 complete with a call point switch and break-glass housing.

k) New Zealand Call Point Module FP0838, FP0839

This unit consists of a MIM801 complete with a call point switch and break-glass housing. FP0838 is flush mounting while FP0839 is surface mounting.

l) Relay Interface Module RIM800

This unit has voltage free changeover relay contacts rated at 2A 30Vdc for external loads. No supervision of load wiring is provided. However the relay position is supervised and a “relay checkback fail” fault will be generated if it does not operate.

m) Sounder Notification Module SNM800

This unit has a relay rated at 2A 30Vdc for switching external loads. Supervision of load wiring and the load supply is provided. The relay position is supervised and a “relay checkback” fault will be generated if it does not operate.

n) Short Circuit Isolator 5BI

This detector base is designed for isolating short circuited sections of the analog loop. For instance it can be used where the loop wiring crosses zone boundaries and it will prevent a short circuit from affecting more than one zone. As well as housing a detector it can be used with no detector inserted.

o) Sounder Base 814SB and MkII Sounder Base

These detector bases are designed as low cost warning devices. The MkII Sounder Base is a newer version of the 814SB. Some variants are loop powered while others are powered by an external supply. The sounder is controlled by the detector which is plugged into the base, but the operation of the sounder can be quite separate from the operation of the detector.

The 814SB can be setup to generate a number of tones (none of which are AS2220 or ISO8201 compliant), and three sound levels are selectable.

The MkII Sounder Base models can be setup to generate a number of tones including AS2220 and ISO8201 compliant evacuation tones, and on some models the sound level is continuously adjustable. Currently none of the MkII Sounder Base models are SSL listed.

Note that the current taken by a loop powered sounder base is very much higher than any of the other loop devices (except the LPS800), and the number of sounder bases on a loop is limited by the available current.

p) Relay Base 814RB

This detector base is designed for a low cost output device. It is controlled by the detector which is plugged into it, but the operation of the relay can be quite separate from the operation of the detector. A voltage two pole changeover relay is provided, rated at 1A 30V dc.

q) Loop Powered Sounder LPS800

This device is similar to the SNM800, in that it drives one or more external sounders, however the sounder power comes from the loop rather than an external power supply. The available output current is much lower than that of a SNM800, and as all this current comes from the loop, the number of LPS800s and their load is limited by the available loop current.

r) Vesda VLC800

The Vision Systems VLC800-MX VESDA Laser COMPACT is an aspirating smoke detector. It samples the smoke from air which is extracted via piping from a large area of a building. The sensitivity is adjustable over a wide range at the VLC800 by PC software programme. The VLC800 requires a 24V power supply.

A summary of the electrical specifications of the various devices is shown in Table 3-1.

All loop devices are rated at a loop voltage of 20Vdc - 40Vdc and a signalling voltage of 2V p-p – 6V p-p. Alarm Currents specified do not include remote indicators. Add 7mA for each remote indicator.

<table>
<tr><th colspan="2">DEVICE</th><th>FUNCTION</th><th>Comments</th></tr>
<tr><td colspan="2">814I</td><td>Ionisation Smoke Detector</td><td>Requires base</td></tr>
<tr><td colspan="2">814H</td><td>Heat Detector</td><td>Requires base</td></tr>
<tr><td colspan="2">814PH</td><td>Photo Smoke + Heat Detector</td><td>Requires base</td></tr>
<tr><td colspan="2">814P</td><td>Photo Smoke Detector</td><td>Requires base</td></tr>
<tr><td colspan="2">814CH</td><td>CO + Heat Detector</td><td>Requires base</td></tr>
<tr><td colspan="2">MIM800</td><td>Mini Input Module</td><td>EOL 200Ω
Alarm R (if used) 100Ω
Max Wiring R 10Ω</td></tr>
<tr><td colspan="2">MIM801</td><td>Mini Input Module (normally closed interrupt)</td><td>N/O mode - as MIM800
N/C -
EOL 200Ω
Max wiring R 50Ω</td></tr>
<tr><td colspan="2">CIM800</td><td>Contact Input Module</td><td>EOL 200Ω
Alarm R (if used) 100Ω
Max Wiring R 10Ω</td></tr>
<tr><td colspan="2">DIM800</td><td>(Conventional) Detector Interface Monitor</td><td>EOL 4k7
Requires separate supply.</td></tr>
<tr><td colspan="2">CP820</td><td>Call Point</td><td></td></tr>
<tr><td colspan="2">FP0838, FP0839</td><td>NZ Call Point</td><td></td></tr>
<tr><td colspan="2">RIM800</td><td>Relay Interface Module</td><td>2A 30Vdc</td></tr>
<tr><td colspan="2">SNM800</td><td>Sounder Notification Module (Supervised relay output)</td><td>2A 30Vdc.
Requires external supply.</td></tr>
<tr><td colspan="2">LPS800</td><td>Loop Powered Sounder Module</td><td>Provides 24V at up to 75mA</td></tr>
<tr><td colspan="2">MUB</td><td>Standard Base</td><td></td></tr>
<tr><td colspan="2">5BI</td><td>Isolator Base</td><td></td></tr>
<tr><td colspan="2">814SB</td><td>Loop Powered Sounder Base</td><td>Selectable tone (not AS2220 or ISO8201)
Adjustable sound level</td></tr>
<tr><td rowspan="4">MkII Sounder Bases</td><td>802SB</td><td>Loop Powered Sounder Base</td><td>Selectable tone (Including AS2220 and ISO 8201 Evacuation tone)
Adjustable sound level</td></tr>
<tr><td>812SB</td><td>Loop Powered Sounder Base</td><td>Selectable tone (Including AS2220 and ISO 8201 Evacuation tone)</td></tr>
<tr><td>901SB</td><td>Externally Powered Sounder Base</td><td>Selectable tone (Including AS2220 and ISO 8201 Evacuation tone)
Adjustable Sound Level.
Requires external 24V</td></tr>
<tr><td>912SB</td><td>Externally Powered Sounder Base</td><td>Selectable tone (Including AS2220 and ISO 8201 Evacuation tone)
Requires external 24V</td></tr>
<tr><td colspan="2">814RB</td><td>Relay Base</td><td>1A 30Vdc
2 pole changeover</td></tr>
<tr><td colspan="2">VLC800</td><td>Vesda aspirating smoke detector</td><td>Requires external supply. Requires PC to set up.</td></tr>
</table>

Table 3-1 Compatible Device Summary

The MXP will allow some alternative devices to be used without generating a fault, where the inserted device can provide all the features of the configured device. This includes an 814PH or 814CH used where an 814H was programmed, a CIM800 used where a MIM800 was programmed, and an 814PH used where an 814P was programmed.

3.2 DEVICE HANDLING CAPABILITY

3.2.1 OVERVIEW

The parameters which determine the maximum number of each device type that can be put on a loop are as follows. The column "MAX NO. DEVICES" assumes that all devices are of the same type. If this is not the case, it is necessary to perform the calculations described below.

DEVICE	MAX NO. DEVICES	Quiescent Current	Alarm Current	AC Units (max 250 total)	IB Units (max 100 IB units between Isolator Bases)
814I	200	330uA	3.0mA	1	1.4
814H	200	250uA	3.0mA	1	1
814PH	200	275uA	3.0mA	1	1.2
814P	200	275uA	3.0mA	1	1.2
814CH	200	275uA	3.0mA	1	1
MIM800	200	275uA	2.8mA (with LED) 275uA (no LED)	1	1.5
MIM801	200	275uA	2.8mA (with LED) 275uA (no LED)	1	1.5
CIM800	200	275uA	2.8mA	1	1
DIM800	200	100uA (Loop)	100uA (Loop)	1	1
CP820	200	275uA	2.8mA	1	1.5
RIM800	200	285uA	2.8mA (with LED) 285uA (no LED)	1	5
SNM800	200	450uA	3.0mA (with LED) 450uA (no LED)	1	5
LPS800	33 or less, depends on load	450uA	Load current + 4mA, with minimum of 12mA	1.5	1
5BI	N/A	80uA		0.2	N/A
814SB	40(Quiet) 30(Medium) 24(Loud)	400uA	9mA(Quiet) 12mA(Medium) 15mA(Loud)	2.4	2.5
802SB*	200(Quiet) 50 (Loud)	200uA	1.2mA (Quiet) 6.8mA (Loud)	0.5	2.5
812SB*	18	200uA	21mA	0.5	2.5
901SB*	200	200uA	200uA (Loop)	0.5	2.5
912SB*	200	200uA	200uA(Loop)	0.5	2.5
814RB	200	50uA	100uA	0.3	1.6
VLC800	125	300uA	300uA (no LED) 2.8mA (with LED)	2	1

*Models of MkII Sounder Base

Table 3-2 Device Quantities and Loading

The particular combination of device types, external loads, cable length and type may limit the total number of devices. This is calculated in the following sections.

There are two types of load which must be considered - DC and AC. Also if isolator bases are used, the loading between each isolator base must be considered.

It is recommended that the PC program F4000CAL is used for conducting the loop loading calculations. However note that it does not include the isolator base loading, this must be done manually.

3.2.2 DC LOAD

The total current available from the MX Loop terminals on the MXP is 400mA DC.
This must supply operating current to all addressable devices an the loop. This not only includes the quiescent current required to power the device electronics, but also the additional current drawn by devices in the ALARM state or by associated ALARM LEDs and other loop powered outputs.

The sum of currents for all devices connected to the loop is calculated using the “alarm current” values shown in Table 3-2. Note –

1) The MXP limits the number of Alarm LEDs turned on at any one time to 5 (programmable at MX4428).
2) Remote LEDs must be allowed for at 7mA each. Remote LEDs programmed to follow the detector LED will be limited by the number of alarm LEDs. However remote LEDs programmed to operate on “Circuit Alarm” or “Relay” will not be limited in any way.
3) LEDs on relay output devices (SNM800, RIM800, LPS800) will operate when the relay is activated, if the MXP is configured at the MX4428 to flash the LED on Poll “Global Blink Mode”.
4) The 814RB, RIM800 and SNM800 relay load current must not be supplied from the analogue loop.

The sum of all currents must not exceed 400mA.

Furthermore, the voltage drop in the cable must not exceed 16.0V, regardless of which end of the loop the cable is driven from. This is in order to ensure that with the minimum 36V voltage available from the MX Loop terminals on the MXP, the minimum voltage at any device will be at least 20V.

If you have any LPS800 devices on the loop, you may need to design for a higher minimum loop voltage and a lower voltage drop. Refer to section 3.23.2.

3.2.3 AC LOADING

Calculate the total of the “AC Units” shown in Table 3-2. The total must not exceed 250.

Also ensure that the cable length does not exceed the values in Table 3-3.

Cable type	Cable length
MICC 2L1.5, 2L2.5, 1H1.5, 2H2.5	1.8 km*
Steel Wire Armour (SWA)	1.8 km*
Fire resistant ‘foil and drain wire’, e.g. Radox FR3013, FP200, Lifeline, Firetuff	2 km
BS6883 marine cable	2 km

Table 3-3 Maximum Cable Lengths

* Up to 2km of these cable types may be used on condition that the maximum AC loading is restricted to less than 220 AC units per loop.

3.2.4 ISOLATOR BASE LOADING

If isolator bases are being used, calculate the sum of the "IB Units" from Table 3-2 for each section of cable between isolator bases (or between the last isolator base and the end of a cable spur). Include only **one** of the detectors at the ends of the section. The sum for any section must not exceed 100.

See also section 4.1.3 for details of AS1670 requirements and section 4.1.4 for details of NZS4512 requirements.

3.2.5 EXAMPLE

Consider an MXP monitoring 200 * 814PH detectors with 10 814SB Sounder Bases set to High, on a 1300 metre long loop, using 1.5mm^2 wire. The cable is divided (with 9 Isolator Bases) into 10 segments with 1 Sounder Base and 20 detectors on each segment.

(i) Calculate DC Load

IA = 195 x 275uA (No. of detectors in NORMAL)
+ 5 x 3.0mA (No. of detectors with Alarm LEDs turned on, assume limited to 5 max by MXP)
+ 10 x 15mA (Number of 814SB Sounder Bases)
+ 9 x 80uA (Number of Isolator Bases)
(Ref Table 3-2. Note 1mA = 1000uA)
= 220mA which is well under 400mA

For the voltage drop calculation, assume the worst case in the first instance, i.e. that all devices are at the far end of 1300 metres. The loop resistance of 1.5mm^2 wire is 25Ω per 1000m and the isolator base resistance is 0.25Ω.
Total R = 25Ω x 1.3 + 9 x 0.25Ω
= 34.75Ω.
Voltage drop = 34.75 x 0.220 = 7.7V, which is well under the maximum allowable of 16V.

(ii) Calculate AC Load

AC Units = 200 x 1 (detectors)
+ 10 x 2.4 (Sounder Bases)
+ 10 x 0.1 (Isolator Bases)
= 225 which is less than the maximum allowable of 250.

Cable length is well under the limits specified in Table 3-3.

(iii) Calculate IB Load

IB Units for each section = 20 * 1.2 (814PH) + 1 * 2.5 (814SB)
= 26.5 which is less than 100.

As all parameters are within the specified limits, the design is satisfactory.

3.3 OUTPUT CONTROL

The following “outputs” are available on the Analogue loop –

- Output modules – RIM800, SNM800, and LPS800
- Functional Base outputs of detectors (controlling 814SB, MkII Sounder Base or 814RB)
- Remote LED output of detectors.

Each of these is programmable at the MX4428 for which of 3 sources controls the output.

In all cases the outputs are turned off if the point is isolated.

The 3 selectable sources are as follows –

1. Relay output
The output is controlled by the state of the corresponding relay output as sent to the responder. The relay output state can be controlled directly with a logic equation, be controlled by the state of the ACZ that the relay is mapped to (this also allows supervision fault states on the SNM800 and LPS800 output to be indicated), or be controlled by the test state of the flow switch zone it is mapped to.

The functional bases and remote LED outputs for detectors mapped to circuit X of logical responder R will be controlled by the state of relay X of logical responder R, i.e. the relay with the same number as the detector circuit.

2. Circuit alarm
The output will turn on when the corresponding circuit goes into alarm. If the circuit maps to a latching zone then the output will turn off when the zone alarm is reset. If the circuit does not map to a latching zone the output will turn off when the circuit goes out of alarm. The circuit alarm state is determined by the MXP and so can’t include other responder circuits, nor the state of the zone(s) the circuit maps to. (Use “relay output” if these are needed.)

The functional bases and remote LED outputs for detectors will be controlled by the circuit the detector is mapped to. Output modules mapped to relay X of logical responder R will be controlled by circuit X of logical responder R, i.e. the circuit with the same number as the relay.

WARNING - the output will not be disabled by zone isolate.

3. Point alarm
The output will turn on when that point goes into alarm. If the point maps to a latching zone then the output will stay on until the zone alarm is reset. If the point does not map to a latching zone the output will turn off when the point goes out of alarm.

This option is not available on output modules (RIM800, SNM800, and LPS800).

WARNING - the output will not be disabled by zone isolate.

3.3.1 PROGRAMMING

The programming of the output functions is done by setting the "mode" value for the RIM800, SNM800, and 814I, and by one of the 7 device parameters for the 814H, 814PH, and 814CH. The LPS800 is programmed as an SNM800.

For example the following are the settings for the 814I.

Mode	Functional Base Control	Remote LED Control
0	Circuit Alarm	Circuit Alarm
1	Circuit Alarm	Relay
2	Circuit Alarm	Point Alarm
4	Relay	Circuit Alarm
5	Relay	Relay
6	Relay	Point Alarm
8	Point Alarm	Circuit Alarm
9	Point Alarm	Relay
10	Point Alarm	Point Alarm

The value must be chosen from the above table to give the desired settings for controlling the functional base and the remote LED.

For the 814PH and 814CH, programming of the "enhancement multiplier" is included in the same parameter. The desired enhancement multiplier must be multiplied by 16 and the result added to the above numbers. The tables in the sections for these detectors (3.9.3 and 3.10.3) include the result when the default enhancement multiplier is used.

For the 814H detector and for an 814PH or 814CH with enhancement disabled, the "enhancement multiplier" is irrelevant and therefore the above numbers may be entered directly if desired. The global defaults for parameter 6 for all these detector types should always include the desired enhancement multiplier * 16.

For the SNM800, other options are also included in the mode. Refer to section 3.22.4 for details.

3.3.2 OUTPUT STATE UNDER EXCEPTIONAL CIRCUMSTANCES

All outputs retain their state if the MX4428 stops polling the responder (e.g. processing is stopped), or if the MXP stops polling the devices (e.g. due to a new configuration download from the MX4428). If a detector is removed from a relay or sounder base, the relay or sounder output turns off.

If power to the MXP is lost, loop powered sounder bases turn off. RIM800 and SNM800 outputs, relay bases and possibly externally powered sounder bases usually retain their state until MXP power is restored, then turn off when polling resumes (which may take some minutes if the MXP has been off for some hours and lost its configuration), then revert to ON after a few seconds if this is the correct state.

3.4 DETECTOR PARAMETER SETTINGS SUMMARY

The following table gives a summary of the MX4428 default and alternate settings, and approved range, for each detector type.

Detector	Default	Alternate	Range	Comments
814PH Smoke	12% (80 det units)	8% (37 det units)	8% - 12%	Enhancement is optional, default off.
814PH Smoke FastLogic	Medium	N/A	Low, Medium, High (all approved with nominal sensitivity = 8%)	Enhancement is optional, default off.
814PH Heat component	63	N/A	60 - 65	Type B default. Type A is option Off is option.
814CH CO	38ppm (0.3 MIC X) (93 det units)	66ppm[1] (0.6 MIC X) (160 det units)	23 - 66ppm[1]	Enhancement is optional, default off. (23ppm = 0.15 MIC X = 60 det units)
814CH Heat component	63	N/A	60 - 65	Type A default. Type B is option Off is option.
814I	0.39 MIC X (66 det units)	0.22 MIC X (23 det units)	0.2 - 0.4 (Aus) 0.2 - 0.6 (NZ)	0.59 MIC X =130 det units
814H	63	N/A	60 - 93 (Aus) 50 - 80 (NZ)	Type A default. Type B option. Types C/D by changing temperature to 93.
VLC800	Fixed at 100		0.005% / m to 20% / m	Note that actual sensitivity is adjusted by PC connected to the VLC800.

[1] 66ppm is outside the approved range of the 814CH as an ionisation detector. However it is an accepted value as a CO detector.

Prealarm

The Prealarm default and alternate sensitivities will generally be about 70% - 80% of the corresponding alarm level. Note that Prealarm will also be more sensitive to rapidly changing conditions as it does not go through the step limiting filter.

Conversion

Det Units = Detector Units.

Temperatures are already converted by the MXP to degrees C and do not require conversion.

Conversion from detector units to displayed values is by imagining a graph with a series of joined straight lines from (0,0) and passing through each of the above defined points (e.g. 814PH 37 det units = 8%) and extrapolated in a continuing straight line past the highest point if necessary.

For the 814PH detector the displayed values bear little resemblance to the static sensitivity of the detector. They are valid only for the tests done in the SSL smoke room.

3.5 DEVICE INSTALLATION

3.5.1 PRECAUTIONS

Observe ESD precautions when installing an MXP responder, or connecting any devices to it. Refer to Product Bulletin PBG0025.

3.5.2 MOUNTING

Detector Bases
Detectors attach to a circular, plastic base which has holes for screw mounting to a flat surface, and screw terminals for connecting the loop wiring. There are various different bases available. Most of the bases may only be mounted as just described, but the 814SB sounder base and the 814RB relay base may be mounted as just described, or may themselves be plugged into one of the other bases, to interpose between it and the detector.

Modules
The Modules are normally mounted within the enclosure of the equipment to which they connect, or in a cabinet, junction box or switch box. They may be mounted on plastic standoffs (4 x HW0130 required) on a gearplate or cabinet, or to a face plate that mounts on a double flush or surface box. A hole may be required for the on-board LED. A standard plate with a hole for the LED and three holes for the Service Tool is available (Ancillary Cover M520). This fits a plastic surface box K2142.

The MIM800/801 is smaller than the other modules, and is supplied in a plastic housing which has a lug for screw mounting.

3.5.3 ADDRESS & LED BLINK PROGRAMMING

Addresses for MX detectors and modules, and options such as LED blink on poll, are most easily set using the MX Service Tool. These are set by placing the detector onto the Service Tool, or connecting the module to the Service Tool with the supplied interface lead, and programming as per the MX Service Tool Instructions. (Be careful not to leave the pins in the module when removing the lead).

For all input devices, including detectors, the LED turns on steady when in alarm. For output devices (RIM800, etc) the LED turns on when the device is activated (if Global Blink Mode is enabled for the MXP). To enable a device's LED to blink on poll, the MXP must have Global Blink Mode enabled at the MX4428 panel, and the device must have LED Blink enabled.

For a mixed system, i.e. some devices are to blink on poll and some are not, then turn off blink on those devices that are not to blink using the Service Tool, and enable Global Blink Mode at the MX4428 panel for the MXP.

3.6 MX4428 PROGRAMMING

In the following sections information is given about the programming of each device in the MX4428. An explanation of the mode and the various parameters is given for each device type, along with the global parameters that affect that device type. It is critical that only the listed mode values are used for each device type, as in many cases the mode value is used to define the actual device type. An incorrect mode value may cause a POINT TYPE MISMATCH to be generated, or it may just render a device not able to work.

In some of the following sections descriptions are given about changing the sensitivity for a detector by altering the specific parameter for that detector. This is correct (it sets the value for just that individual detector), but in many cases it may be better to adjust the global sensitivity for that device type so that all detectors of that type take on the new value. For example, in NZ mode it is recommended that the global heat alarm temperature be set to 57°C for both 814PH and 814CH, rather than setting each specific detector to this value.

Details for NZ mode settings are contained in the F4000 NZ Technical Manual (LT0126).

These details are most relevant when programming the MX4428 from a (dumb) programming terminal. Alternatively you can program with "SmartConfig", which displays and edits functional parameters and takes care of mapping the functional parameters into the appropriate mode and parameter bytes for each device type.

3.7 814H HEAT DETECTOR

3.7.1 GENERAL

The 814H is an analogue thermal detector. The detector senses the air temperature and sends this value to the MXP. The MXP makes any decisions as to whether this is an alarm, fault, normal or whatever. The MXP can be programmed (at the MX4428 panel) to interpret the values to implement a Type A, Type B, Type C, or Type D Heat Detector. The integral LED is turned on by the MXP when an alarm is detected.

The 814H has a temperature sensing range of -25°C to 95°C. The approved operating temperature range is -10°C to +70°C. The accuracy of the 814H (as interpreted by the MXP), within the range 0°C to 70°C, is typically + / - 2°C.

The remote LED and functional base outputs are programmable for their functionality (refer to section 3.3).

3.7.2 814H SPECIFICATIONS

Line Connections	L(–), L1(+)
Supply Voltage:	20Vdc - 40Vdc
Supply Current:	250uA (typical quiescent)
Alarm Current:	3.0mA (typical)
Remote LED Current:	7mA (Tyco E500Mk2)
Dimensions:	110mm (diameter) x 55mm (including MUB base)
Weight	79g
Base	MUB, 5B, 5BI, 814RB, 814SB, or MkII Sounder Base

3.7.3 MX4428 PROGRAMMING OPTIONS - 814H

The programming values for the 814H are described in the following tables.

“Mode” enables or disables rate of rise processing. Mode = 4 selects type A/C (heat rate of rise enabled), and mode = 5 selects type B/D (heat rate of rise disabled). Only select one of these two values. (Note that when rate of rise is disabled, the parameters relating to rate of rise are ignored - there is no need to adjust them.)

For type C and D operation set the heat fixed temperature alarm threshold **(Parameter 1)** to 93 (°C).

Parameter 0 may be adjusted to select a different Pre-Alarm temperature.

For special purposes, the fixed temperature alarm threshold may be set to any value between 60 and 93 for Australia, and between 50 and 80 for New Zealand. In New Zealand also set the global parameter **“8XX HEAT SL1”** to (the highest alarm temperature - 20) / 10 (rounded up if the result is fractional).

For functional base and remote LED programming set **Parameter 6** as per the table. Refer to section 3.3 for further details.

The remaining parameters should not need changing.

Parameter	Description				Default
Mode	Value	Heat Type			4
	4	A/C – rate of rise enabled.			
	5	B/D – rate of rise disabled			
P0	Heat fixed temperature pre-alarm threshold °C				56 (°C)
P1	Heat fixed temperature alarm threshold °C				63 (°C)
	57	New Zealand			
	63	Australian Types A / B			
	93	Australian Types C / D			
P4	b3:b0	ROR Pre alarm Threshold	Number + 5 gives the Threshold in °C/min		7 (12°C/min)
	b7:b4	ROR Alarm Threshold			9 (14°C/min)
P5					
P6	Enhancement multiplier (default 12) * 16 plus code below				192
	Code	Functional Base Control	Remote LED Control	Final value with default enh multiplier	
	0	Circuit Alarm	Circuit Alarm	192	
	1	Circuit Alarm	Relay	193	
	2	Circuit Alarm	Point Alarm	194	
	4	Relay	Circuit Alarm	196	
	5	Relay	Relay	197	
	6	Relay	Point Alarm	198	
	8	Point Alarm	Circuit Alarm	200	
	9	Point Alarm	Relay	201	
	10	Point Alarm	Point Alarm	202	
Note – enhancement multiplier is unused for individual 814H detector settings, but must be retained in MX4428 default settings, as the same defaults are used for the 814H and 814PH.					

The following global parameters, which may be set at the MX4428, affect all applicable points on all MXPs.

MX4428 Reference	Description	Default
8XX HEAT FD1	Heat FD1 (CV Filter)	4
8XX HEAT FD2	Heat FD2 (ROR determination)	7
8XX HEAT SL1	Heat SL1 (Fixed temp step limit, °C/5sec)	2
8XX HEAT SL2	Heat SL2 (ROR step limit, °C/min/5sec)	3

3.8 814I IONISATION SMOKE DETECTOR

3.8.1 GENERAL

The 814I is an ionisation smoke detector. The detector senses the amount of smoke present and sends this value to the MXP. The MXP makes any decisions as to whether this is an alarm, fault, normal or whatever. The integral LED is turned on by the MXP when an alarm is detected.

The remote LED and functional base outputs are programmable for their functionality (refer to section 3.3).

3.8.2 814I SPECIFICATIONS

Line Connections	L(–), L1(+)
Supply Voltage	20Vdc - 40Vdc
Supply Current	330uA (typical quiescent)
Alarm Current	3.0mA (typical)
Remote LED Current	7mA (Tyco E500Mk2)
Dimensions	110mm (diameter) x 55mm (including MUB base)
Weight	81g
Base	MUB, 5B, 5BI, 814RB, 814SB, or MkII Sounder Base

3.8.3 MX4428 PROGRAMMING OPTIONS - 814I

The programmable values for the 814I are explained in the following table.

Normally only the **mode** needs to be programmed, and then only if a functional base or remote LED is required and its operation is different from the default. Refer to section 3.3.

In some cases the alarm sensitivity **(Parameter 1)** may need to be changed from the default. The approved range for Australia is 0.22 MIC X (23) to 0.39 MIC X (66). The available range is 0.22 MIC X (23) to 0.59 MIC X (130). If the alarm sensitivity is changed, the pre-alarm sensitivity **(Parameter 0)** should normally be changed to about 75% of the alarm sensitivity.

The remaining parameters should not need changing.

Parameter	Description			Default
Mode	Value	Functional Base Control	Remote LED Control	0
	0	Circuit Alarm	Circuit Alarm	
	1	Circuit Alarm	Relay	
	2	Circuit Alarm	Point Alarm	
	4	Relay	Circuit Alarm	
	5	Relay	Relay	
	6	Relay	Point Alarm	
	8	Point Alarm	Circuit Alarm	
	9	Point Alarm	Relay	
	10	Point Alarm	Point Alarm	
P0	Pre Alarm Threshold			50
P1	Alarm Threshold			66
	Value	Threshold		
	23	0.22 MICX (Alternate)		
	66	0.39 MICX **(Default)**		
	130	0.59 MICX		
P2	Fault Limit (i.e. values below this are assumed to indicate a detector fault)			10
P3	Dirty Alert Limit (i.e. a “dirty alert” will be raised if the tracked “clean air” value reaches this limit)			120
P4	b3:b0	Filter Divisor		3
	b7:b4	Step Limit		5
P5	Tracking Interval i.e. the interval at which the tracked “clean air” value is adjusted.			30 (minutes)
P6	Tracking adjustment - fixed at 1 in MXP			1

The following global parameters which may be set at the MX4428 affect all applicable points on all MXPs.

MX4428 Reference	Description	Default
8XXI UPPER TRACKING LIMIT	Ionisation Upper Tracking Limit (i.e. the maximum assumed value for clean air)	120 (MXP Default)

3.9 814PH PHOTOELECTRIC SMOKE & HEAT DETECTOR & 814P PHOTOELECTRIC SMOKE ONLY DETECTOR

3.9.1 GENERAL

The 814PH is a photoelectric smoke detector which also includes a temperature sensor. The detector senses the amount of smoke present and the temperature and sends these values to the MXP. The MXP makes any decisions as to whether this is an alarm, fault, normal or whatever, based on the smoke level, temperature, or rate of rise of temperature, and/or a combination of these. The integral LED is turned on by the MXP when an alarm is detected.

Refer to the specifications of the 814H for more details on the heat sensing element of the 814PH.

The 814P is the same as the 814PH, except that it has no temperature sensor.

The remote LED and functional base outputs are programmable for their functionality (refer to section 3.3).

3.9.2 814PH & 814P SPECIFICATIONS

Line Connections	L(–), L1(+)
Supply Voltage	20Vdc - 40Vdc
Supply Current	275uA (typical quiescent)
Alarm Current	3.0mA (typical)
Remote LED Current	7mA (Tyco E500Mk2)
Dimensions	110mm (diameter) x 55mm (including MUB base)
Weight	76g
Base	MUB, 5B, 5BI, 814RB, 814SB, or MkII Sounder Base

3.9.3 MX4428 PROGRAMMING OPTIONS - 814PH/814P

In the MX4428 programming there are two different device types that use the 814PH/814P detector. Type 16 814PH is used when the 814PH is used with the SmartSense algorithm and type 27 814PHFL is used when the FastLogic algorithm is required. These different device types allow the MX4428 to have separate sensitivity settings for the algorithms and for the sensitivities to be displayed correctly.

However, the mode value actually defines to the MXP which algorithm is to be used.

Mode values 0 – 7 must only be used with a device type of 814PH, and mode values 8 – 15 must only be used with a device type of 814PHFL. Do not use an incorrect mode, as the values displayed at the MX4428 will not match those being used or generated at the MXP.

The 814P must be programmed as an 814PH, with no heat. I.e. only modes 7 and 13 are allowed. The MX4428 will display the point type as 814PH.

The programmable values for the 814PH and 814P are described in the following tables.

The **mode** selects the detection mode for the detector - smoke only, enhanced smoke, heat enabled or disabled, heat rate of rise enabled or disabled, smoke detection algorithm is SmartSense or FastLogic, etc. Note that when a particular function is disabled by the setting of the mode, the parameters relating to that function are not used and should therefore be left with their default settings.

Parameter 1 selects the smoke alarm threshold.

With the SmartSense algorithm, the actual alarm threshold is selected as per the table. The approved range is 8%/m (Parameter 1 = 37) to 12%/m (Parameter 1 = 80).

With the FastLogic algorithm Parameter 1 values of 0, 1, or 2 will select Low, Medium, or High sensitivity respectively. Any other value will select the sensitivity defined in the global parameter 8XXPH FUZZY ALGORITHM. Parameter 1 can usually be left at its default setting for all detectors and those detectors with their mode set to FastLogic will then use the setting in the global parameter 8XXPH FUZZY ALGORITHM. All three FastLogic sensitivities are SSL approved and all have a nominal sensitivity of 8% / m.

Parameter 3 may be adjusted to vary the fixed temperature alarm threshold. It may be set to any value between 60 and 65 in Australia, and between 50 and 65 in New Zealand.

Parameter 2 may be adjusted to select a different Pre-Alarm temperature.

Parameter 6 selects the functional base and remote LED output operation (refer to section 3.3) and the “enhancement multiplier” which should normally be left at the default value (12).

The remaining parameters should not need changing.

Parameter	Description				Default
Mode	Value	Smoke Algorithm	Enhance smoke sensitivity with heat Rate of Rise.	Heat Type A – rate of rise enabled B – rate of rise disabled	3
	0	SmartSense	Yes	A	
	1	SmartSense	Yes	B	
	2	SmartSense	No	A	
	3	SmartSense	No	B	
	4	None		A	
	5	None		B	
	6	SmartSense	Yes	No heat alarm	
	7	SmartSense	No	No heat alarm *	
	8	FastLogic	Yes	A	
	9	FastLogic	Yes	B	
	10	FastLogic	No	A	
	11	FastLogic	No	B	
	12	FastLogic	Yes	No heat alarm	
	13	FastLogic	No	No heat alarm *	
P0	SmartSense smoke Pre Alarm Threshold				68
P1	SmartSense smoke Alarm Threshold				80
	Value	Threshold			
	37	8% / m (alternate)			
	80	12% / m **(default)**			
	FastLogic Sensitivity				
	Value	Sensitivity			
	0	Low			
	1	Medium			
	2	High			
	Any other	Global Parameter "8XXPH Fuzzy Algorithm"			
P2	Heat fixed temperature pre-alarm threshold °C				56 (°C)
P3	Heat fixed temperature alarm threshold °C				63 (°C)
	Value	Usage			
	57	New Zealand			
	63	Australian Types A / B			
P4	b3:b0	ROR Pre alarm Threshold	Number + 5 gives the Threshold in °C/min		7 (12°C/min)
	b7:b4	ROR Alarm Threshold			9 (14°C/min)
P5	b3:b0	Smoke Filter Divisor			3
	b7:b4	Smoke Step Limit			4
P6	Enhancement multiplier (default 12) * 16 plus value below				192
	Value	Functional Base Control	Remote LED Control	Result with default enh multiplier	
	0	Circuit Alarm	Circuit Alarm	192	
	1	Circuit Alarm	Relay	193	
	2	Circuit Alarm	Point Alarm	194	
	4	Relay	Circuit Alarm	196	
	5	Relay	Relay	197	
	6	Relay	Point Alarm	198	
	8	Point Alarm	Circuit Alarm	200	
	9	Point Alarm	Relay	201	
	10	Point Alarm	Point Alarm	202	

* These are the only modes allowed with the 814P detector.

The following global parameters which may be set at the MX4428 affect all applicable points on all MXPs.

MX4428 Reference	Description	Default
8XXPH UPPER TRACKING LIMIT	Photo Upper Tracking Limit (i.e. the maximum assumed value for clean air)	56 (MXP Default)
8XXPH DIRTY ALERT LIMIT	Photo Dirty Alert Limit (i.e. a “dirty alert” will be raised if the tracked “clean air” value reaches this limit)	56
8XXPH TRACK INTERVAL	Photo Tracking Interval i.e. the interval at which the tracked “clean air” value is adjusted.	30 (minutes)
8XXPH FUZZY ALGORITHM	Fuzzy Sensitivity if Device Parameter 1 is not 0, 1, or 2 0 = low 1 = medium 2 = high	1 (medium) (MXP also chooses Medium if this parameter is not 0, 1, or 2)

3.10 814CH CARBON MONOXIDE + HEAT DETECTOR

3.10.1 GENERAL

The 814CH is a carbon monoxide (CO) detector which also includes a temperature sensor. The detector senses the amount of CO present and the temperature and sends these values to the MXP. The MXP makes any decisions as to whether this is an alarm, fault, normal or whatever, based on the CO level, temperature, or rate of rise of temperature, and/or a combination of these. The integral LED is turned on by the MXP when an alarm is detected.

Refer to the specifications of the 814H for more details on the heat sensing element of the 814CH.

The remote LED and functional base outputs are programmable for their functionality (refer to section 3.3).

3.10.2 814CH SPECIFICATIONS

Line Connections	L(–), L1(+)
Supply Voltage	20Vdc - 40Vdc
Supply Current	275uA (typical quiescent)
Alarm Current	3.0mA (typical)
Remote LED Current	7mA (typical Tyco E500Mk2)
Dimensions	110mm (diameter) x 55mm (including MUB base)
Weight	88g
Base	MUB, 5B, 5BI, 814RB, 814SB, or MkII Sounder Base

3.10.3 MX4428 PROGRAMMING OPTIONS - 814CH

The programmable values for the 814CH are described in the following tables.

The **mode** selects the detection mode for the detector - CO only, enhanced CO, heat enabled or disabled, heat rate of rise enabled or disabled, etc. Note that when a particular function is disabled by the setting of the mode, the parameters relating to that function are not used and should therefore be left with their default settings.

Parameter 1 selects the CO alarm threshold. Some possible settings are shown in the table. Note the alternate setting of 66ppm is not an SSL listed setting for an ionisation detector (the 814CH was SSL tested using the tests for an ionisation detector under AS1603.2, as at the time there was no approved standard for CO detector). Although this setting is acceptable for a CO detector it should only be used for special applications where installation conditions exclude other smoke detectors and yet the background CO level may be higher than normal. At this sensitivity the background CO level should not exceed 30ppm.

Parameter 3 may be adjusted to vary the fixed temperature alarm threshold. It may be set to any value between 60 and 65 in Australia.

Parameter 2 may be adjusted to select a different Pre-Alarm temperature.

Parameter 6 selects the functional base and remote LED output operation (refer to section 3.3) and the “enhancement multiplier” which should normally be left at the default value (12).

The remaining parameters should not need changing.

Parameter	Description				Default
Mode	Value	Enhance CO sensitivity with heat Rate of Rise	Heat Type A – rate of rise enabled B – rate of rise disabled		2
	0	Yes	A		
	1	Yes	B		
	2	No	A		
	3	No	B		
	6	Yes	No heat alarm		
	7	No	No heat alarm		
P0	CO Pre Alarm Threshold				80
P1	CO Alarm Threshold				93
	Value	Threshold			
	60	23ppm			
	93	38ppm **(default)**			
	160	66ppm (alternate)			
P2	Heat fixed temperature pre-alarm threshold °C				56 (°C)
P3	Heat fixed temperature alarm threshold °C				63 (°C)
	Value	Usage			
	57	New Zealand			
	63	Australian Types A / B			
P4	b3:b0	ROR Pre alarm Threshold	Number + 5 gives the Threshold in °C/min		7 (12°C/min)
	b7:b4	ROR Alarm Threshold			9 (14°C/min)
P5	b3:b0	CO Filter Divisor			3
	b7:b4	CO Step Limit			3
P6	Enhancement multiplier (default 12) * 16 plus value below				192
	Value	Functional Base Control	Remote LED Control	Result with default enh multiplier	
	0	Circuit Alarm	Circuit Alarm	192	
	1	Circuit Alarm	Relay	193	
	2	Circuit Alarm	Point Alarm	194	
	4	Relay	Circuit Alarm	196	
	5	Relay	Relay	197	
	6	Relay	Point Alarm	198	
	8	Point Alarm	Circuit Alarm	200	
	9	Point Alarm	Relay	201	
	10	Point Alarm	Point Alarm	202	

3.11 MUB UNIVERSAL BASE

3.11.1 GENERAL

The MUB accommodates any of the MX 814 series detectors, and may also have an 814RB, 814SB, or MkII Sounder Base plugged into it.

3.11.2 MUB AND 5B WIRING

Figure 3.1 shows the wiring for a MUB and 5B, including optional wiring of a remote indicator.

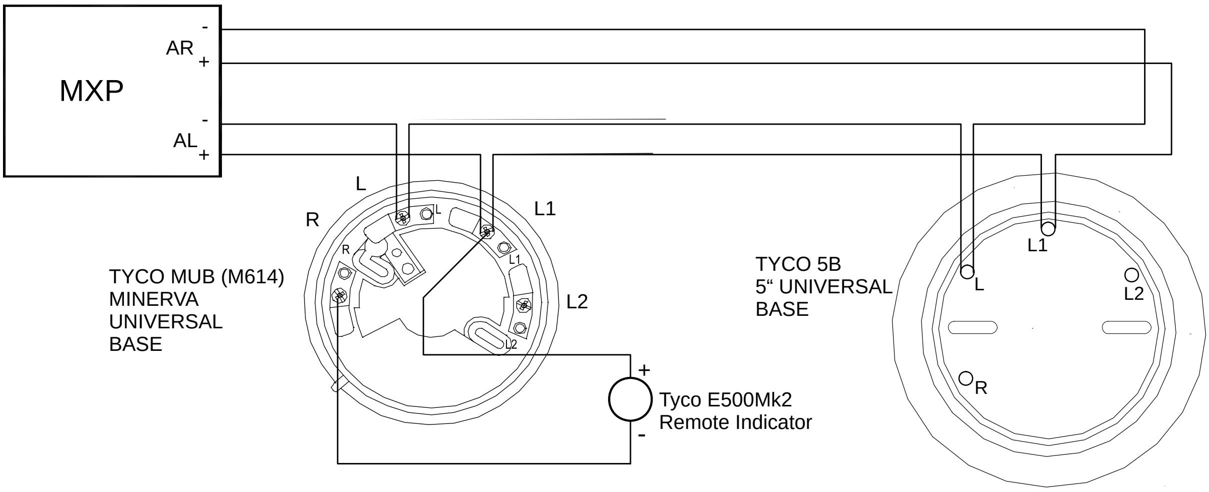


Figure 3.1 MUB and 5B Wiring

3.11.3 REMOTE INDICATOR WIRING

A remote indicator may be wired to an MUB, Relay Base, or Sounder Base as shown for example in Figure 3.1.

A single Remote Indicator may be wired up to a number of detector bases, so that it turns on if any one of the detectors turns it on. The R terminals of the detectors involved should be looped together.

This common group must not include an isolator base or extend across an isolator base.

The brightness may increase slightly if more than one detector turns on the remote indicator.

3.12 5BI ISOLATOR BASE

3.12.1 GENERAL

The 5BI base is designed for isolating short circuited sections of the analog loop. For instance it can be used where the loop wiring crosses zone boundaries to prevent a short circuit from affecting more than one zone. When isolator bases are used, it is strongly recommended that two additional isolator bases (possibly with no detectors inserted) be installed at the start and end of the loop, close to the MXP.

Isolator bases may also be used to join multiple lines together in a single star arrangement, for example when a number of conventionally wired zones are being converted to MX and a loop cannot be wired.

Refer to section 4.1 for more details on the analog loop configuration.

There is a limit to the number of other devices which may be connected on the section of cable between isolator bases. Calculate the sum of the "IB Units" from Table 3-2 for each section of cable. The sum for each section must not exceed 100.

A section of cable is the portion between isolator bases or between an isolator base and the MXP, or if a star configuration or tee is being used, between an isolator base and the end of the cable.

3.12.2 SPECIFICATIONS

Line Connections IN	M(–), L1(+)
Line Connections OUT	L2(–), L1(+)
Remote LED Connection	R(–), L1(+)
Supply Voltage	20Vdc - 40Vdc
Supply Current	80uA (typical quiescent)
Dimensions	110mm (diameter) x 22mm (excluding detector)
Weight	80g

3.12.3 WIRING

Figure 3.2 shows wiring for an 5BI, including connection of an external remote indicator.

Note that a common remote indicator may not be wired to a set of bases which are on different sides of an isolator base.

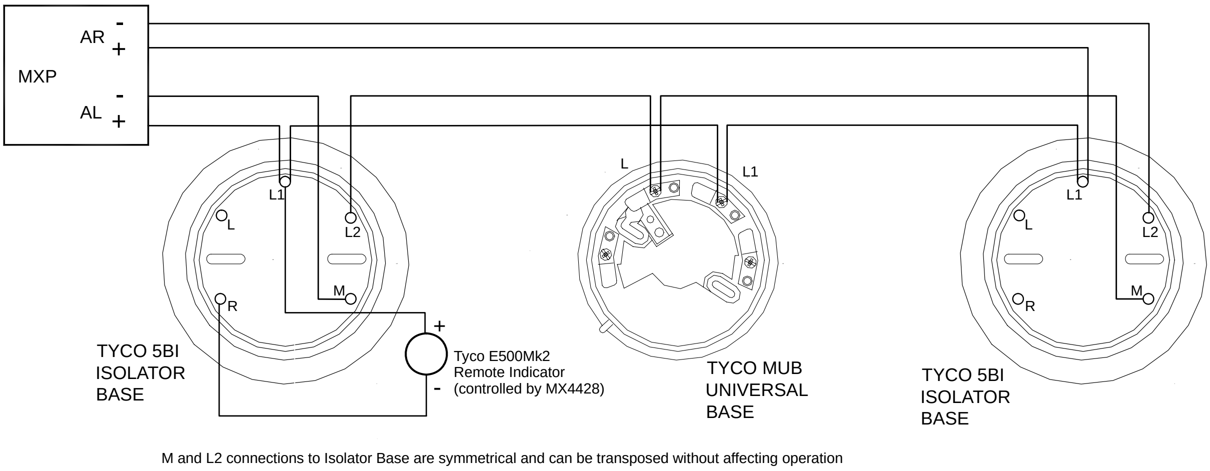


Figure 3.2 5BI Wiring

3.13 814RB RELAY BASE

3.13.1 GENERAL

The 814RB detector base is designed as a low cost output device. The relay is controlled by the detector which is plugged into the base, but the operation of the relay can be quite separate from the operation of the detector. (Refer to section 3.3.)

The 814RB Relay Base provides two sets of volt-free, change-over contacts capable of switching ancillary equipment rated at up to 1A resistive @ 30Vdc. One set is labelled NO, C, NC (for normally open, common, and normally closed.) The other set is labelled 1 for NC, 2 for C, and 3 for NO. The terminals accept a single cable of up to 2.5 sqmm. Relay operation is controlled by the MX4428 via an output from the detector. Hence, a detector **must** be fitted to the base in order for the relay to operate as the relay base does not have its own address.

The 814RB may be plugged into a MUB standard base, 5B standard base, or 5BI isolator base, or mounted directly on the ceiling or wall.

3.13.2 SPECIFICATIONS

Line Connections	L(–), L1(+)
Remote LED Connection	R(–), L1(+)
Supply Voltage	20Vdc - 40Vdc
Supply Current	50uA (typical quiescent) 100uA (output active)
Relays	Two changeover volt-free contacts Switching current: 1A @ 30V dc Resistance: On: 50mΩ Off: > 1 x 10^9Ω . Switching time: <10ms Life expectancy: 100,000 operations
Dimensions	110mm (diameter) x 37mm (excluding detector)
Weight	153g

3.13.3 WIRING

Refer to Figure 3.3 for details of the relay terminals. Loop wiring and remote LED wiring is the same as the MUB, refer to Figure 3.1. Contact wiring connects to the following terminals

First Pole	NC	Normally Closed
	C	Common
	NO	Normally Open
Second Pole	1	Normally Closed
	2	Common
	3	Normally Open

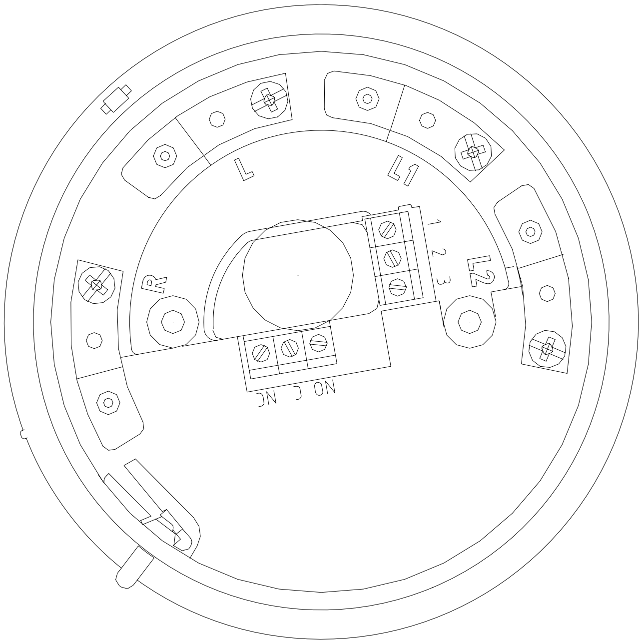


Figure 3.3 Relay Base

3.14 814SB SOUNDER BASE

3.14.1 GENERAL

The 814SB detector base is designed as a low cost warning device. One of three different tones may be selected (none of which are AS2220 compliant), and three sound levels are selectable. Note that the current taken by a sounder base is very much higher than most other loop devices, and the number of sounder bases on a loop is limited by the available current.

The sounder is controlled by the detector which is plugged into the base, but the operation of the sounder can be quite separate from the operation of the detector. (Refer to section 3.3.)

The tone switch allows selection of one of three different tones –
1 - continuous tone (825Hz)
2 - fast sweep (saw tooth envelope at 15Hz)
3 - slow sweep (saw tooth envelope at 5Hz) (Factory Setting)

The volume switch provides three different levels of loudness:
1 - 70dB(A) (quiet)
2 - 80 dB(A) (medium)
3 - 90 dB(A) (loud) (Factory Setting)

The 814SB may be plugged into a MUB standard base, 5B standard base, or 5BI isolator base, or mounted directly on the ceiling or wall.

3.14.2 SPECIFICATIONS

Line Connections	L(–), L1(+)
Remote LED Connection	R(–), L1(+)
Supply Voltage	20Vdc - 40Vdc
Supply Current	400uA (typical quiescent) 9mA (active in QUIET setting) 12mA (active in MEDIUM setting) 15mA (active in LOUD setting)
Dimensions	110mm (diameter) x 37mm (excluding detector)
Weight	163g

3.14.3 WIRING

Wiring is the same as the MUB, refer to Figure 3.1.

3.15 MKII SOUNDER BASE

3.15.1 GENERAL

The MkII Sounder Base is a range of detector bases which are designed as low cost warning devices, some of which are loop powered and others are externally powered. The sounder is controlled by the detector which is plugged into the base, but the operation of the sounder can be quite separate from the operation of the detector. (Refer to section 3.3.)

The MkII Sounder Bases cannot be plugged into other bases. They must be mounted directly on the ceiling or wall.

At the time of writing, the MkII Sounder Bases are not SSL approved to AS4428. However they may be used for supplementary local sounders.

3.15.2 SPECIFICATIONS

Line Connections	L(–), L1(+)
Remote LED Connection	R(–), L1(+)
Supply Voltage	20Vdc - 40Vdc
Quiescent Supply Current	200uA (ex MX loop)
Dimensions	110mm (diameter) x 37mm (excluding detector)
Weight	186g

	802SB	901SB	812SB	912SB
Power Source	Loop	24VDC	Loop	24VDC
Adjustable volume	Yes		No	
Volume	68-90dBA		100dBA	
Minimum Volume Current Consumption	1.2mA (loop)	1.2mA (ext supply)	N/A	
Maximum Volume Current Consumption	6.8mA (loop)	6.8mA (ext supply)	21mA (loop)	21mA (ext Supply)
Tone 1	Dutch Slow Sweep **(AS2220 Evacuate)**			
Tone 2	Temporal 4			
Tone 3	Slow Sweep			
Tone 4	March Time Beep			
Tone 5	Fast Sweep			
Tone 6	Temporal 3 **(ISO8201 Evacuate)**			
Tone 7	Alternating			
Tone 8	Continuous			

3.15.3 WIRING

Wiring for the 802SB and 812SB is the same as the MUB, refer to Figure 3.1. The 901SB and 912SB wiring is similar, but they also require a 24V connection. Refer to the installation sheet supplied with these bases.

For the 901SB and 912SB, it is recommended that the external supply covers only one zone, or the power wiring be arranged so that an open circuit in the power feed cannot affect more than one zone. A loop arrangement with supervision and a reverse-feed relay can be used to achieve this - refer to Product Bulletin PBF0200.

3.16 MIM800 AND MIM801 MINI INPUT MODULES

3.16.1 GENERAL

The MIM800 and MIM801 Mini Input Modules are suitable for interfacing voltage free contacts such as switches, relay contacts, flow switches, or non-indicating detectors.

Dedicated Manual Call Point products are available that have the MIM800 or MIM801 mounted on the back of an MCP. Refer to sections 3.18 and 3.19.

Both the MIM800 and MIM801 may be used in normally open or normally closed configurations, and the normally open configuration may or may not include short circuit fault monitoring. Refer to Figure 3.4 for wiring topology.

The normal response time to an input change of state is 0 – 5 seconds, as each device is polled at 5 second intervals by the MXP. If faster operation is required, **interrupt** operation can be enabled. Interrupt operation allows a change to be signalled by the device so that the MXP detects the change immediately, rather than waiting for the next poll of the device.

To interrupt on closing contacts, the MIM800 is required. To interrupt on opening contacts, the MIM801 is required. An interrupt can be generated on only the transition from normal to alarm, transitions from alarm to normal will always require up to 5 seconds to be recognised.

Fault supervision is provided by a 200Ω EOL resistor - open circuit fault in a normally open configuration and short circuit fault in a normally closed configuration. In addition the normally open configuration can be programmed to also generate fault on short circuit. In this case only one alarm contact is allowed, a 100Ω resistor must be wired in series with the alarm contacts, and the fault threshold must be specially programmed. (Set Parameter 2 to 176 for a MIM800 and parameter 5 to 40 for a MIM801).

The input wiring should be limited to less than 10m in length and located well away from all electrical noise sources.

Recognition of a fault condition takes about 30 seconds.

The MIM800 and MIM801 have screw terminals for an Alarm Indicator LED. No series resistor is required. A current of about 2.5mA will be supplied when the LED is on.

WARNING
DO NOT JOIN INPUT WIRING BETWEEN MODULES OR CONNECT TO ANYTHING OTHER THAN VOLTAGE FREE CONTACTS

3.16.2 MIM800 / MIM801 SPECIFICATIONS

Dimensions	Height: 13mm Width: 48mm Depth: 57mm	
Weight	22g	
Line Connections	L-, L+	
Supply Voltage	20V – 40V	
Supply Current	Standby Current : 275uA (typical) LED on : 2.8mA (typical)	
Contact Inputs	Monitoring Voltage	5V
	Line Resistance (MIM800 and all N/O)	10Ω max
	Line Resistance (MIM801 N/C)	50Ω max

Maximum input cable length	10m
EOL	200Ω + / - 5%.
Alarm Resistance	100Ω + / - 5%. (if used)

3.16.3 FIELD WIRING

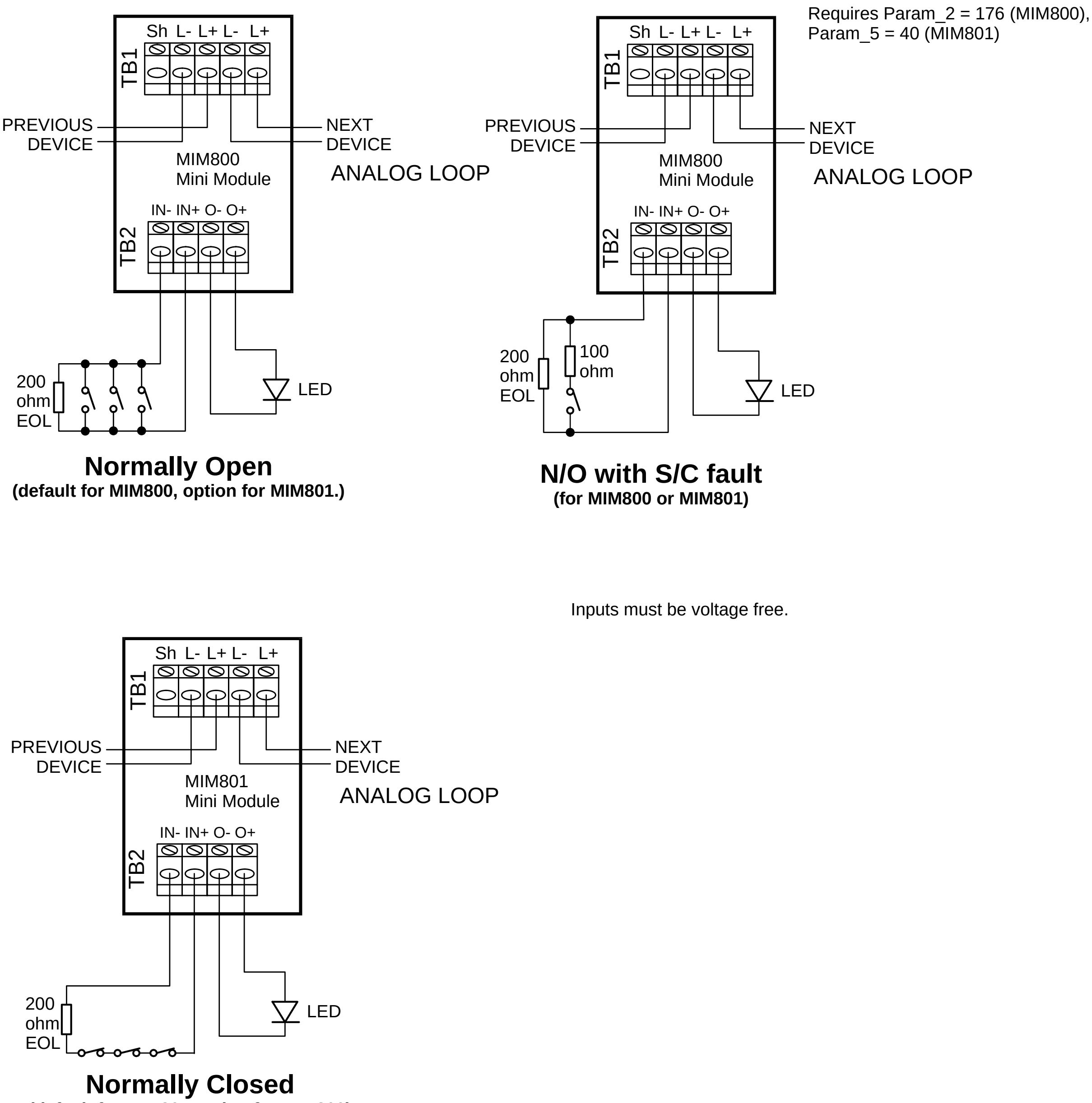


Figure 3.4 CLEAN CONTACT DEVICE CONNECTION TO MIM800 / MIM801

3.16.4 MX4428 PROGRAMMING OPTIONS - MIM800 / MIM801

The **mode** sets the operating configuration.

For the MIM800 the default value of 4 selects normally open operation with no interrupt. A mode of 6 selects normally open with interrupt on alarm. Changing **parameter 2** to 176 enables short circuit fault detection. Setting the mode to 5 enables normally closed operation.

For the MIM801 the default value of 15 selects normally closed operation with interrupt on alarm (e.g. for New Zealand callpoints). Setting the mode to 13 disables interrupt on alarm (e.g. for heat circuits or other non-immediate alarm conditions). Setting the mode to 12 enables normally open operation and then changing **parameter 5** to 40 enables short circuit fault detection.

Normally Open

Parameter	Description		Default
Mode	4	No interrupt	4
	6	Interrupt	
P0	Normal to alarm threshold		122
P1	Normal to o/c threshold		50
P2	Alarm to s/c threshold		0
	0	No alarm resistor	
	176	100 ohm alarm resistor	
P3			
P4			
P5			
P6			

Normally Closed

Parameter	Description	Default
Mode	Change to 5 to select normally closed operation	4
P0	Normal to s/c threshold	122
P1	Normal to alarm threshold	50
P2		
P3		
P4		
P5		
P6		

3.16.5 MX4428 PROGRAMMING OPTIONS - MIM801

Normally Open

Parameter	Description		Default
Mode	Change to 12 to select normally open operation		15
P0			
P1			
P2			
P3	Normal to alarm threshold		110
P4	Normal to o/c threshold		170
P5	Alarm to s/c threshold		0
	0	No alarm resistor	
	40	100 ohm alarm resistor	
P5			
P6			

Normally Closed

Parameter	Description		Default
Mode	Value	Description	15
	13	No interrupt	
	15	Interrupt, does not use AVF even if enabled	
P0			
P1			
P2			
P3	Normal to s/c threshold		110
P4	Normal to alarm threshold		170
P5			
P6			

3.17 CIM800 CONTACT INPUT MODULE

3.17.1 GENERAL

The CIM800 Contact Input Module is suitable for interfacing voltage free contacts, e.g. switches, relay contacts, flow switches, or non-indicating detectors. It has two inputs, the state of which are ORed together to generate the point status. Therefore unused inputs must be terminated with the EOL resistor.

The CIM800 may be used in normally open or normally closed configurations, and the normally open configuration may or may not include short circuit fault monitoring. Refer to Figure 3.5 for wiring topology.

The normal response time to an input change of state is 0 – 5 seconds, as each device is polled at 5 second intervals by the MXP. If faster operation is required, **interrupt** operation can be enabled. Interrupt operation allows a change to be signalled by the device so that the MXP detects the change immediately, rather than waiting for the next poll of the device.

The CIM800 can only interrupt on “closing” contacts, and interrupt operation is only applicable for normally open contacts. Transitions from closed to open will always require up to 5 seconds to be recognised. Therefore it cannot be used for callpoints on NZ systems.

Fault supervision is provided by default with a 200Ω EOL resistor - open circuit fault in a normally open configuration and short circuit fault in a normally closed configuration. In addition the normally open configuration can be programmed to also generate fault on short circuit. In this case only one alarm contact is allowed, a 100Ω resistor must be wired in series with the alarm contacts, and the fault threshold must be specially programmed - set Parameter 2 to 176.

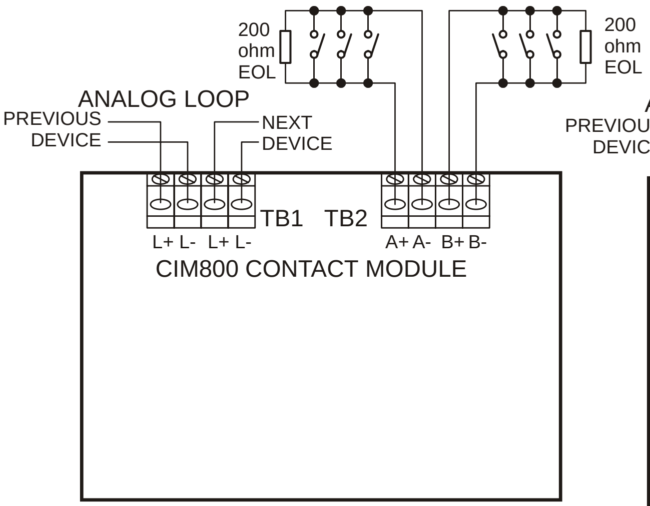
Recognition of a fault condition takes about 30 seconds.

WARNING DO NOT JOIN INPUT WIRING BETWEEN INPUTS OR MODULES OR TO ANYTHING OTHER THAN VOLTAGE FREE CONTACTS

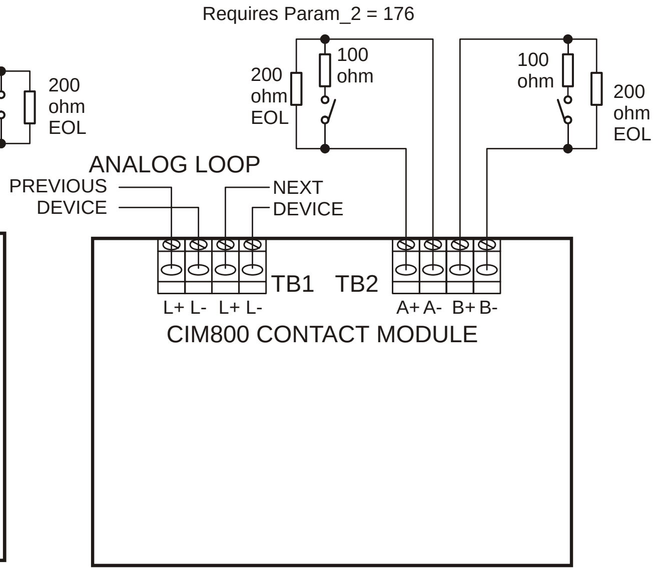
3.17.2 CIM800 SPECIFICATIONS

Dimensions	Height: 61mm Width: 84mm Depth: 25mm	
Weight	100g	
Line Connections	L-, L+	
Supply Voltage	20V – 40V	
Supply Current	Standby Current : 275uA (typical) LED on : 2.8mA (typical)	
Contact Inputs	Monitoring Voltage	5V
	Line Resistance	10Ω max
	EOL	200Ω + / - 5%.
	Alarm Resistance	100Ω + / - 5% (if used).

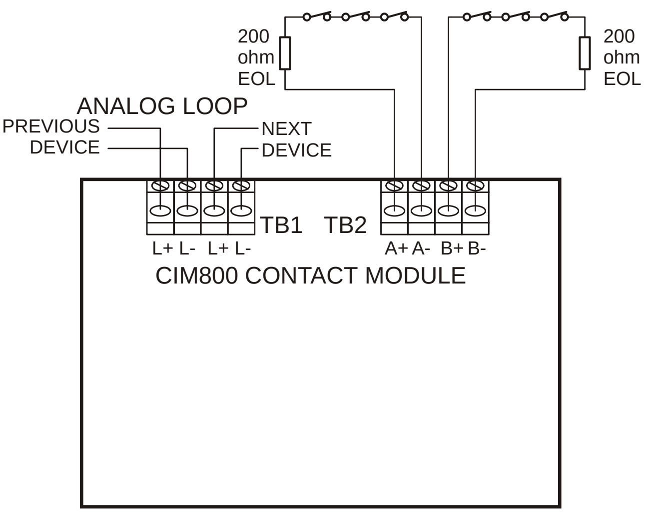
3.17.3 FIELD WIRING



Normally Open



Normally Open, S/C = Fault



Unused inputs (A or B) must be terminated with a 200 ohm EOL resistor.

A and B inputs must be voltage free.

Normally Closed

Figure 3.5 CLEAN CONTACT DEVICE CONNECTION TO CIM800

3.17.4 MX4428 PROGRAMMING OPTIONS - CIM800

The **mode** sets the operating configuration. The default value of 8 selects normally open with no interrupts, whereas a value of 10 enables interrupt on alarms.

A mode of 9 selects normally closed operation. Interrupt is not available.

Normally Open

Parameter	Description		Default
Mode	8	No interrupt	8
	10	Interrupt	
P0	Normal to alarm threshold		122
P1	Normal to o/c threshold		50
P2	Alarm to s/c threshold		0
	0	No alarm resistor	
	176	100 ohm alarm resistor	
P3			
P4			
P5			
P6			

Normally Closed

Parameter	Description	Default
Mode	Change to 9 to select normally closed operation	8
P0	Normal to s/c threshold	122
P1	Normal to alarm threshold	50
P2		
P3		
P4		
P5		
P6		

3.18 CP820 MANUAL CALL POINT

3.18.1 GENERAL

The CP820 Manual Call Point consists of a MIM800 mounted on a Break Glass Switch assembly. The MIM800 is factory programmed with a different type-id to allow the CP820 to be distinguished from a generic MIM800.

The normal response time to an input change of state is 0 – 5 seconds, as each device is polled at 5 second intervals by the MXP. If faster operation is required, **interrupt** operation can be enabled. Interrupt operation allows a change to be signalled by the device so that the MXP detects the change immediately, rather than waiting for the next poll of the device.

The CP820 is made without an EOL resistor and no wiring fault monitoring is provided as all the wiring is internal.

The CP820 device processing will not use AVF, even if it is enabled for the circuit the CP820 is allocated to.

3.18.2 MX4428 PROGRAMMING OPTIONS - CP820

The **mode** determines whether interrupt operation is enabled or not. A value of 0 (default) means interrupt is disabled, while a value of 2 enables interrupt operation.

Parameter	**Description**		**Default**
Mode	0	No interrupt	0
	2	Interrupt	
P0	Normal to alarm threshold		122
P1			
P2			
P3			
P4			
P5			
P6			

3.19 FP0838 / FP0839 MANUAL CALL POINTS

3.19.1 GENERAL

The FP0838 and FP0839 Manual Call Points consist of a MIM801 mounted on an 1841 Break Glass Switch assembly. They are designed for normally closed contacts as is required in New Zealand.

The normal response time to an input change of state is 0 – 5 seconds, as each device is polled at 5 second intervals by the MXP. As faster operation is required in New Zealand, **interrupt** operation should be enabled for the MIM801. Interrupt operation allows a change to be signalled by the device so that the MXP detects the change immediately, rather than waiting for the next poll of the device. Default programming of the MIM801 selects open circuit alarm and interrupt operation.

The FP0838 and FP0839 Call Points include a LED visible from the front. This lights on alarm and can be programmed to blink when the MIM801 is polled. Operation is otherwise as for the MIM801.

3.19.2 MX4428 PROGRAMMING OPTIONS - FP0838 / FP0839

These Call Points are programmed as MIM801s. Refer to section 3.16.5.

3.20 DIM800 DETECTOR INPUT MONITOR

3.20.1 GENERAL

The DIM800 Detector Input Module is suitable for interfacing conventional non-addressable detectors e.g. heat detectors, smoke detectors, beam detectors, etc, onto the MXP loop.

Alarm and o/c fault conditions are determined by the MXP. An alarm can be recognised within 5 seconds if AVF is not enabled for the circuit, or 15-20 seconds if AVF is enabled. Recognition of a fault condition takes about 30 seconds.

The DIM800 has two inputs, the state of which are ORed to generate the point status. Therefore unused inputs must be terminated with the correct EOL.

The DIM800 provides electrical isolation of the detector circuit(s) from the MXP loop.

The DIM800 requires an external supply to power the detector circuit and the module itself. If external power is not provided the DIM800 will not respond to polls and a NODE FAIL fault will be indicated. The voltage of the external supply at the DIM800 is critical to ensure compatibility with particular detectors. Refer to Table 3-4.

The external supply cannot be derived from the MXP loop or the MX4428 responder loop, and in some cases cannot be taken from the MX4428 main power supply. Where the voltage range is critical, it is recommended that a dedicated power supply and battery be used. The voltage drop in the wiring from the power supply to the DIM800 must be calculated to ensure the supply voltage at the DIM800 is within specification. If multiple DIM800s are on the same cable, then the maximum current drawn by each DIM800 (e.g. input short circuit) must be used.

The external supply must comply with AS4428.1 and AS4428.5 and should be set to 27.3V by default. The wiring from a common PSU to multiple DIM800 modules must be arranged so that a single open circuit does not prevent alarms from being generated in more than one zone. A loop arrangement with supervision and a reverse-feed relay can be used to achieve this - refer to Product Bulletin PBF0200.

If the detector itself requires a 24V power supply that needs to be switched off to reset the detector, e.g. some beam detectors, refer to Product Bulletin PBF0213 for a suitable arrangement. Do not use the SW+ and SW- terminals available on early DIM800 models.

Field wiring of the DIM800 is shown in Figure 3.6. The wiring instructions for the particular detector/base must be referred to as some detectors break the negative line, and others the positive line, when the detector is removed.

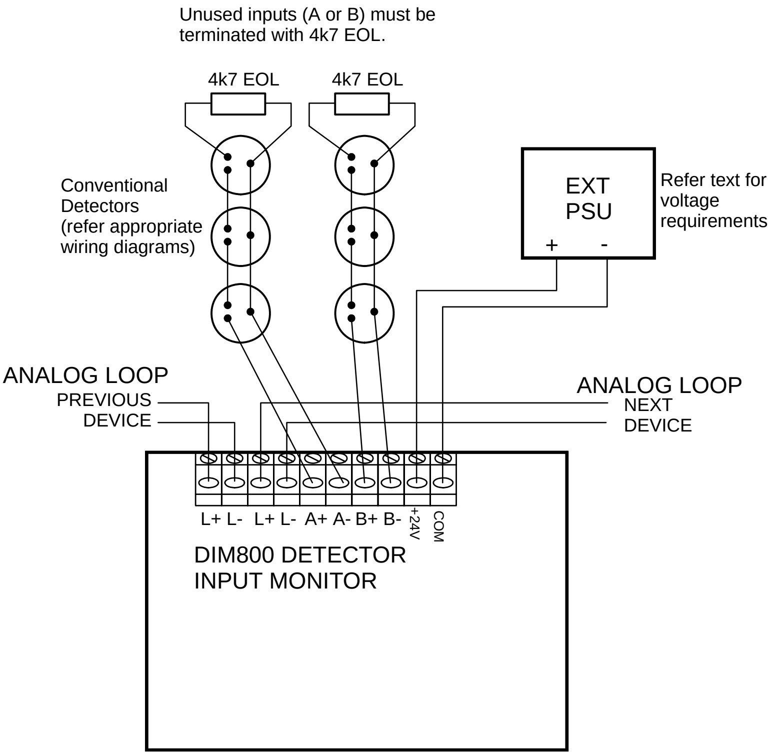


Figure 3.6 DIM800 Field Wiring

3.20.2 DIM800 SPECIFICATIONS

Dimensions	Height: 61mm Width: 84mm Depth: 25mm
Weight	100g
Line Connections	L-, L+
Loop Supply Voltage	20V – 40V
Loop Supply Current	Standby/Alarm Loop Current : 100uA (typical)
EOL	4k7 + / - 1%.
Detector Load	3.0mA max per circuit
External Current (normal)	7.5mA (excluding detectors)
External Current (shorted)	30 - 50mA (depends on supply voltage)
External Supply Voltage	Refer to Table 3-4 for each detector.
Maximum Line Resistance	50Ω (with detectors) 1750Ω (with hard contacts only)
Short Circuit Fault Option	Maximum line resistance 34Ω Minimum Detector Alarm Voltage 5.0V

3.20.3 DIM800 DETECTOR COMPATIBILITY

Series	Model	Max Qty	External Supply Voltage at DIM
Minerva	614P Photo Detector	25	20.0V – 28.7V
	614I Ionisation Detector	38	20.0V – 28.7V
	614CH Carbon Monoxide + Heat Detector	32	20.0V – 28.7V
	614T Heat Type A, B, C, D	23	20.7 – 28.7V
	MD614 Heat Detector	40	20.7V - 28.7V
	MR614 Photo Detector	22	20.7V - 28.7V
	MR614T HPO Detector	21	20.7V - 28.7V
	MU614 CO Detector	40	20.7V - 28.7V
	MF614 Ionisation Detector	30	20.7V - 28.7V
	T614 Heat Type A, B, C, D	23	20.7V - 28.7V
Simplex	4098 – 9603EA Ionisation Detector	24	20.0V - 28.7V
	4098 – 9601EA Photo Detector	24	20.0V - 28.7V
	4098 – 9618EA,-9619EA,-9621EA Heat Detectors	24	20.0V - 28.7V
Olsen	P24B Photoelectric Detector	24	20.7V - 24.7V
	P29B Photoelectric Detector	20	20.7V - 26.7V
	C24B Ionisation Detector	40	20.7V - 26.7V
	C29B (Ex) Ionisation Detector	40	20.7V - 26.7V
	R23B Flame Detector*	20	20.7V - 24.7V
	R24B Flame Detector	3	22.7V - 28.7V
	DO1101 Photo Detector*	16	21.7V - 27.7V
	DLO1191 Beam Detector*	1	22.7V - 28.7V
	P136 Duct Sampling Unit	5	20.0V - 28.7V
	T56B Heat Detector	40	20.0V - 28.7V
	All above Olsen Detectors with Z52B, Z54B, Z54B Mk2, Z56, Z500 base as appropriate		
	T56B Heat Detector with Z52B, Z55B, Z56N, Z500N Base	40	20.0V - 28.7V
System Sensor	885WP-B Weatherproof Heat Detector Type B *@	40	20.0V – 28.7V
-	Hard Contact Devices (T54B, B111, etc)	40	20.0V - 28.7V
Hard contact devices must be rated for at least 30V and currents up to 50mA. * Not an SSL Listed combination @ Remote indicator output cannot be used in common with Tyco 614 series or the Minerva M614 series (and most other Tyco/Olsen) detectors.			

Table 3-4 Conventional Detector Compatibility

3.20.4 MX4428 PROGRAMMING OPTIONS - DIM800

Parameter	Description		Default
Mode	Value	Description	0
	0	Short = Alarm	
	1	Short = Fault	
P1	Normal to Alarm Threshold		51
P2	Normal to Fault Threshold		22
P3	Supply Fault Threshold		60 (this is MXP default used if MX4428 value = 0). On the latest revision of DIM800, the threshold cannot be usefully varied by changing this parameter.
P4	Alarm to Short Threshold		225 (this is MXP default used if MX4428 value = 0)

3.21 RIM800 RELAY INTERFACE MODULE

3.21.1 GENERAL

The RIM800 Relay Interface Module is suitable for relay outputs which require clean voltage free contacts and no supervision. For example it can be used to signal states to other systems (e.g. BMS or security systems), or to energise loads that do not need to be supervised, e.g. Door Holders.

3.21.2 RIM800 SPECIFICATIONS

Dimensions:	Height: 61mm Width: 84mm Depth: 25mm
Weight	100g
Line Connections	L-, L+
Supply Voltage	20V – 40V
Supply Current	Standby Current : 285uA (typical)
	LED on : 2.8mA (typical)
Contact Rating	2A 30Vdc 0.6A 120Vac (not permitted by AS / NZS standards) 0.3A 240Vac (not permitted by AS / NZS standards)

3.21.3 RIM800 FIELD WIRING

The field wiring is shown in Figure 3.7.

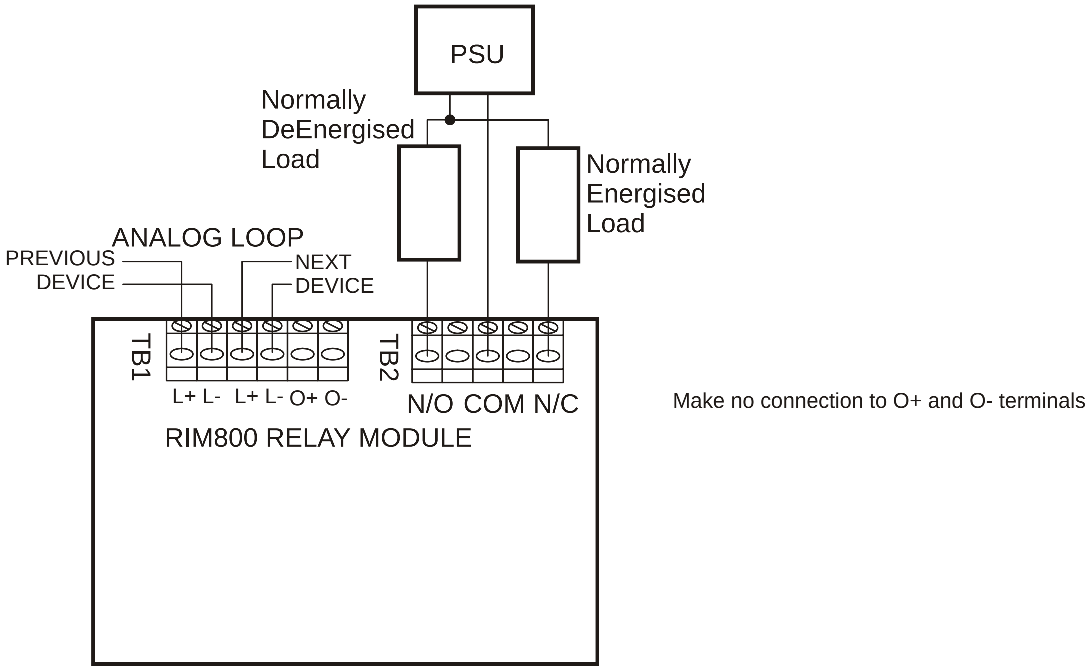


Figure 3.7 RIM800 Field Wiring

3.21.4 MX4428 PROGRAMMING OPTIONS - RIM800

The **mode** selects the control source for the RIM800 output. By default (mode = 4) the output follows the logical relay. However if the mode is 0 then the output is controlled by the corresponding circuit alarm state.

Parameter	**Description**		**Default**
Mode	Value	Description	4
	0	Controlled by Circuit Alarm	
	4	Controlled by Relay	
P0			
P1			
P2			
P3			
P4			
P5			
P6			

3.22 SNM800 SOUNDER NOTIFICATION MODULE

3.22.1 GENERAL

The SNM800 Sounder Notification Module is suitable for relay outputs which require supervision of the load wiring and optional supervision of the DC power supply (if any).

When inactive, a reverse polarity supervision voltage is applied to the load wiring. The load devices must therefore have internal or external reverse blocking diodes.

The load supervision can detect short and open circuit states on the load wiring only when the relay is inactive.

The 24V DC supply may be supervised.

The load must be isolated from ground and all voltage sources. All inductive loads (e.g. bells or relays) must have back-emf diodes or other noise clamping devices fitted.

Recognition of a fault condition takes about 30 seconds.

3.22.2 SNM800 SPECIFICATIONS

Dimensions	Height: 61mm Width: 84mm Depth: 25mm
Weight	100g
Line Connections	L-, L+
Supply Voltage	20V – 40V
Supply Current	Standby Current : 450uA (typical) LED On : 3.0mA (typical)
Output Circuit EOL	27k ohms, 0.5 watt
Contact Rating	2A 30Vdc

Load must be isolated from ground and all supplies.

3.22.3 SNM800 FIELD WIRING

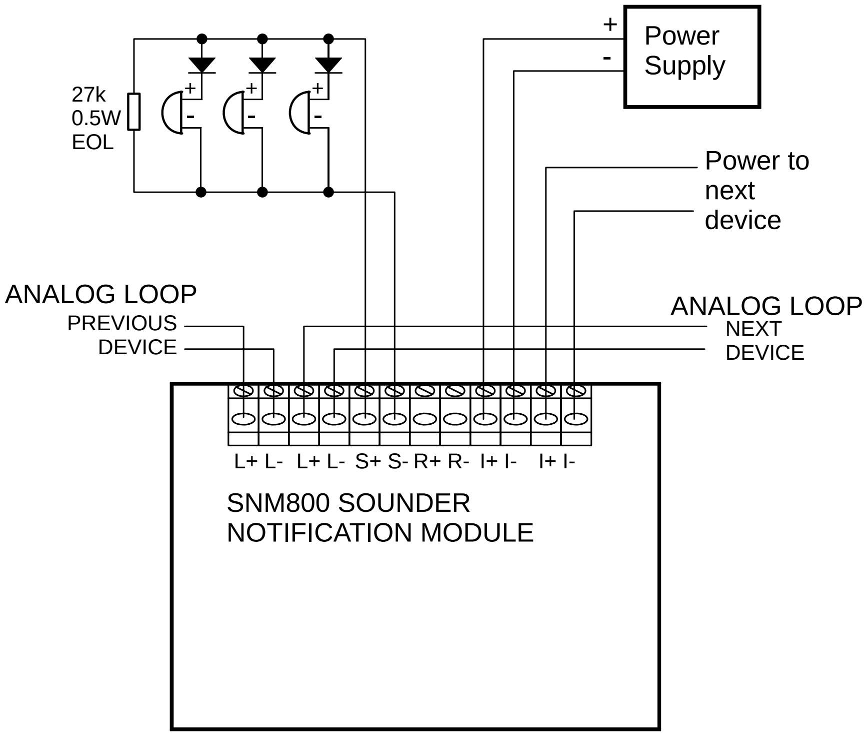


Figure 3.8 SNM800 Field Wiring

It is recommended that the external supply covers only one zone, or the power wiring be arranged so that an open circuit in the power feed cannot affect more than one zone. A loop arrangement with supervision and a reverse-feed relay can be used to achieve this - refer to Product Bulletin PBF0200.

3.22.4 MX4428 PROGRAMMING OPTIONS - SNM800

The **mode** selects the control source for the SNM800 output, load supervision, and EOL supervision. By default (mode = 15) the output follows the logical relay, the external supply is supervised, and the EOL is supervised.

Parameter	Description				Default
Mode	Mode	Output Control	Monitor Supply ?	Monitor EOL ?	15
	8	Cct Alarm	No	No	
	9	Cct Alarm	No	Yes	
	10	Cct Alarm	Yes	No	
	11	Cct Alarm	Yes	Yes	
	12	Relay	No	No	
	13	Relay	No	Yes	
	14	Relay	Yes	No	
	15	Relay	Yes	Yes	
P0					
P1	Normal to o/c fault threshold				221
P2	Normal to s/c fault threshold				20
P3	Supply fault threshold				200
P4					
P5					
P6					

3.23 LPS800 LOOP POWERED SOUNDER MODULE

3.23.1 GENERAL

The LPS800 Loop Powered Sounder Module is suitable for 24V DC outputs powered by the MX Loop. It can supply up to 75mA at 24VDC.

When inactive, a reverse polarity supervision is applied to the load wiring. The load devices must therefore have reverse blocking diodes.

The load supervision can detect short and open circuit states on the load wiring only when the output is inactive.

The load must be isolated from ground and all voltage sources. All inductive loads (e.g. bells or relays) must have back-emf diodes or other noise clamping devices fitted.

Recognition of a fault condition takes about 30 seconds.

3.23.2 LPS800 SPECIFICATIONS

Dimensions	Height: 87mm Width: 148mm Depth: 14mm
Weight	100g
Line Connections	L-, L+
Supply Voltage	20V – 40V
Supply Current	Standby Current : 450uA (typical) Operated with load up to 8mA : 12mA. Operated with load over 8mA : Load current + 4mA
Output Circuit ELD	22k ohms, 0.5 watt
Output Current Rating	75mA@24V nominal.
Voltage Drop	2V max

Note that the LPS800 has a minimum voltage drop of 2V between the line voltage and the output terminals. When the loop voltage is less than 26V, the output voltage may be less than 24V. At the minimum loop voltage of 20V, only 18V will be available for the sounder devices. From this you must subtract the voltage drop in the wiring to the sounder devices to obtain the voltage at the sounder device terminals. You must ensure the sounder devices operate correctly at this voltage.

Alternatively you must design the loop so that the minimum voltage is higher than 20V and sufficient to give the required voltage at the sounder terminals. Refer to section 3.2.2 for loop voltage drop calculations.

The load must be isolated from ground and all supplies.

3.23.3 MX4428 PROGRAMMING OPTIONS - LPS800

The LPS800 is programmed as an SNM800. Refer to section 3.22.4.

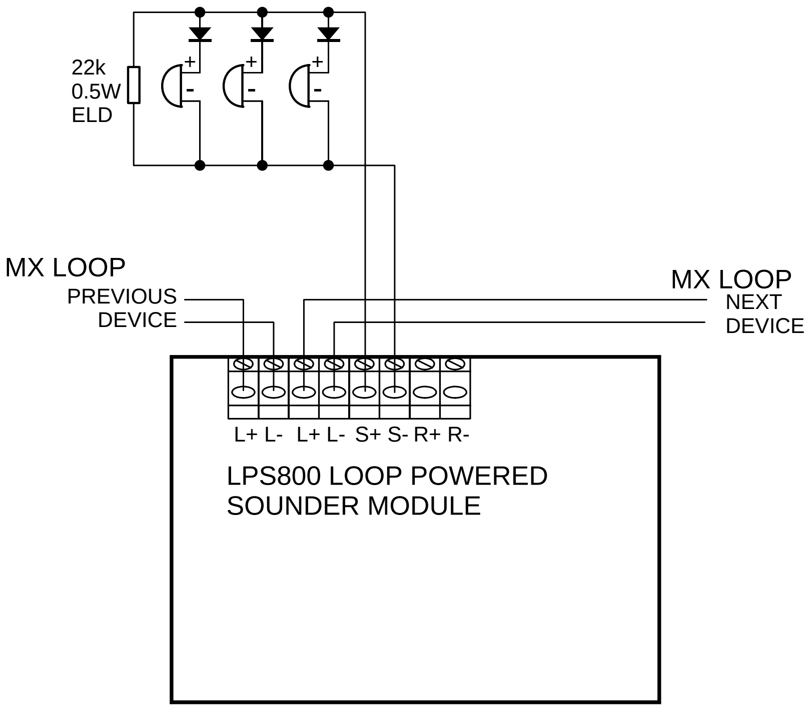


Figure 3.9 LPS800 Field Wiring

3.24 VLC-800MX VESDA LASERCOMPACT

3.24.1 GENERAL

The VLC800 is a derivative of the standard VESDA LaserCOMPACT product family, with the primary difference that it communicates directly on the MX loop.

VESDA LaserCOMPACT detectors provide very early warning of potential fire conditions by drawing air samples through 25mm pipe up to 80m long. Smoke is sampled through holes in the pipe and transported to the detector by an integrated aspirator or fan. Holes are positioned according to the application and often follow the spacing of standard conventional point detectors. Where necessary, sampling points can be constructed using capillary extensions.

The VLC800 alarm sensitivity can be set to between 0.005% obscuration / m and 20% obscuration / m. A PC plugged into the VLC800 is required to set the sensitivity, to normalise the airflow, and perform other setup functions. The sensitivity is NOT controlled at the MX4428.

Refer to Tyco Safety Products UK publication 17A-03-VLC for further details on installing, commissioning and servicing the VLC-800.

3.24.2 VLC800 SPECIFICATIONS

Environment:		Indoor Application only
IP Rating:		IP30
Operating Temperature:		
	Detector Ambient:	-10°C to +39°C
	Sampled Air:	-20°C to +60°C
Relative Humidity:		10-95% non-condensing
Dimensions:		
	Height:	225mm
	Width:	225mm
	Depth:	85mm
Weight:		1.9kg
Sampling Network:		
	Maximum Area Coverage:	800m^2
	Maximum Pipe length:	80m with up to 15* holes, or 2 x 50m with up to 9* holes per pipe
	Pipe Size:	ID15 - 21mm OD 25mm

‘*’ more holes may be used on networks designed using the VESDA Aspire pipe modelling software.

External 24V dc:		
	Supply Voltage:	18 to 30V dc
	Current Consumption:	Standby: 225mA Alarm: 245mA
MX Loop:		
	Normal:	300uA
	Non operational (VLC off):	300uA
	Alarm:	300uA
	Alarm with external relay:	dependant on the relay
	Alarm with external LED:	3.3mA

Onboard relay: rated 2A @ 30V dc

3.24.3 MX4428 PROGRAMMING OPTIONS - VLC800

The only programmable items for the VLC800 are

1. The pre alarm threshold.
2. The source of the remote LED output.
3. The source of the onboard relay output and external relay output (they operate together).

The VLC800 shares default values with the 814H, 814PH, and 814PHFL. However the alarm threshold is fixed at 100 regardless of any default setting. The default pre alarm setting of 68 translates to 68% of the alarm value which although a suitable value, can be changed if required.

Parameter	**Description**				**Default**
P0	Pre Alarm Threshold				68
P6	192 plus value below				192
	Value	Relay Control	Remote LED Control	Resulting parameter	
	0	Circuit Alarm	Circuit Alarm	192	
	1	Circuit Alarm	Relay Logic	193	
	2	Circuit Alarm	Point Alarm	194	
	4	Relay Logic	Circuit Alarm	196	
	5	Relay Logic	Relay Logic	197	
	6	Relay Logic	Point Alarm	198	
	8	Point Alarm	Circuit Alarm	200	
	9	Point Alarm	Relay Logic	201	
	10	Point Alarm	Point Alarm	202	

AVF may be applied to the circuit the VLC800 point maps to.

3.25 AVF / RAD / SAD / FLOWSWITCH DELAYS

AVF/RAD or SAD or FLOWSWITCH or AVF/SAD may be configured for a "circuit" and will apply to all input devices on the circuit except CP820 devices, and MIM801 devices with "interrupt" enabled.

3.25.1 AVF/RAD

Note that AVF is usually unnecessary on the addressable detectors as the built in filtering already provides significant protection against false alarms. AVF provides an additional time delay to verify that the alarm is still present at the end of the AVF delay. It operates as follows –

Time	Action
0	Alarm detected at detector or module - not sent to MX4428.
5 seconds	Reset detectors (remove power) on DIM module. Do nothing on other modules.
10 seconds	Remove reset to detectors on DIM module (re-apply power), and set alarm count to 0 for DIM module (requiring count up to 6 for alarm recognition).
15 seconds	Resample detector or module, if still in alarm condition then alarm is transmitted to MX4428 immediately.
15 – 135 seconds	Immediate recognition of alarm condition and transmission to MX4428.
135 seconds	If no alarm start again.

3.25.2 SAD

All devices on circuits set up as "SAD" at the MX4428 have the "return to normal" signalled to the MX4428 delayed by 60 seconds. If the state goes back into alarm during this time, the timer will be reset.

3.25.3 AVF/SAD

All devices on circuits set up as "AVF/SAD" at the MX4428 delay into alarm as per AVF/RAD and delay out of alarm as per SAD.

3.25.4 FLOWSWITCH

All devices on circuits set up as "Flowswitch" at the MX4428 have the alarm signalled to the MX4428 delayed by 15, 30, or 60 seconds (depending on the MX4428 programming). If the state goes out of alarm during the delay time, the timer will be reset.

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CHAPTER 4
ANALOGUE LOOP DESIGN CONSIDERATIONS

4.1 ANALOGUE LOOP CONFIGURATION SELECTION

4.1.1 LINES & LOOPS

The interface between the MXP and its addressable devices requires two wires.

The MXP has two lines (“left” and “right”) which are designed to be connected in a loop.

The LOOP configuration is generally preferred and indeed will often be mandatory for compliance with standards as discussed below.

However the MXP can be used to connect to multiple lines in a star configuration. Dual line mode is not supported.

4.1.2 LOOP FAULT TOLERANCE

Standards require that a line/loop fault condition cause minimal disruption to the system's ability to detect and transmit alarms to the Fire Panel. The MXP achieves this in the following way .....

The MXP has access to each device from both ends of the loop. The loop is normally sourced from “left” and monitored at the “right” terminals. Disappearance of 40V power at the “right” end, due to an open circuit FAULT on either the + or – wires, can be detected (causing a FAULT event to be sent to the MX4428 Master) and corrected by switching the Line driver onto the “right” terminals. The LOOP mode is therefore inherently fault tolerant to any one open circuit on any one of the 2 wires.

However, a short circuit on the loop will, in general, cause the MXP to loose communication with all devices. Thus it is recommended that isolator bases be used to minimise the loss due to a short.

When designing fire alarm systems, the designer should be aware of any local statutory requirements, as well as those of AS1670.1 and NZS4512.

4.1.3 AS1670.1 DESIGN REQUIREMENTS

Australian Standard AS1670.1 sections 3.1 and 3.2 require the analogue loop to comply with the following:

- The maximum number of actuating devices (i.e. detectors and input modules) in an alarm zone shall not exceed 40.
- A single short circuit shall not disable more than 40 devices connected to the MXP loop/line. This means than if more than 40 devices are to be connected to an MXP, short circuit isolators must be used. The count of 40 includes conventional detectors connected to a DIM800 or other ancillary input device

4.1.4 NZS4512 DESIGN REQUIREMENTS

- Isolator Bases must be fitted between zones (or on the first device either side of a zone boundary) so that a single short circuit or break will affect no more than one zone.
- In many cases the tones produced by the 814SB sounder base are not acceptable. Refer to NZS4512 for detailed requirements.

4.2 ANALOGUE LOOP/LINE LAYOUTS

4.2.1 LINE MODE

The MXP is designed to run in LOOP mode only. The dual line mode of the MPR is not supported. However a star configuration can be used, refer to section 4.2.3.

4.2.2 LOOP DESIGN WITH SHORT CIRCUIT ISOLATORS

There are two main reasons for using isolator bases on the analogue loop.

(i) When the MXP powers up a line/loop, it will only have to power up one section of the line/loop at a time, reducing the power required by the MXP from the MX4428 supply loop during startup.

(ii) If the loop is shorted then the MXP will loose communication with only those devices on the shorted section between 2 isolators. If every detector was mounted on an isolator base, then all detectors would remain functional in the event of a single short circuit.

Refer to Figure 4.1 for an example of loop wiring with Isolator Bases.

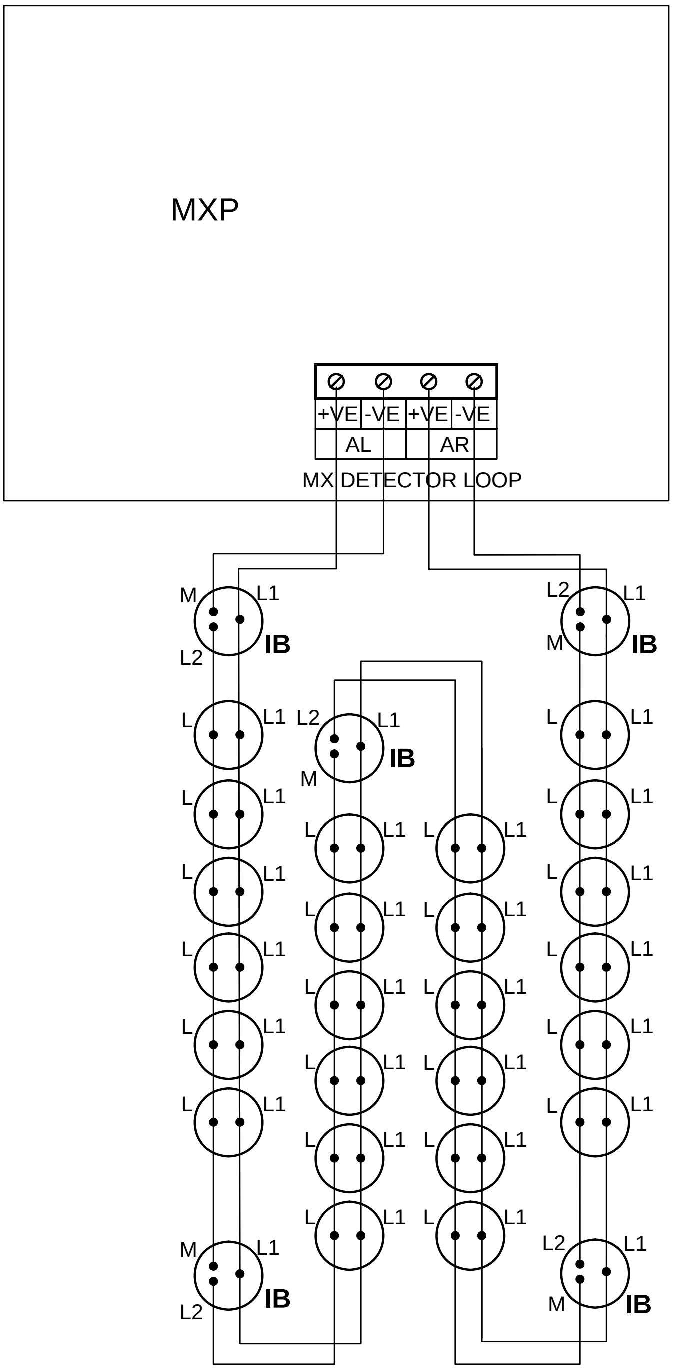


Figure 4.1 Loop with Isolator Bases

Note 1: Although it is not essential to have Isolator Bases between the MXP and the first / last device on the loop, greater protection is provided by doing so. It is recommended that the cable between the MXP line terminals and the adjacent Isolator Bases should be kept as short as possible, and have no devices attached to it. These Isolator Bases could be located at the MXP without detectors plugged into them.

Note 2: The maximum number of devices between Isolator Bases is 100 or less depending on the devices. Refer to section 3.2.4.

Note 3: The M and L2 connections are interchangeable.

4.2.3 STAR CONNECTION OF ANALOGUE LINES

It is not always necessary to connect addressable systems as loops, especially if an existing conventional detector system is being converted to addressable detectors. As the existing detector zone cables probably already terminate at the main panel, it is possible to connect these in a star connection to the MXP as shown in Figure 4.2.

The two line terminals should be joined together as shown in Figure 4.2. The total length of cable connected to the MXP should not exceed 2000m.

Because shorting the cable in one line will short out all the other lines connected to the same MXP, it is recommended that 5BI Isolator Bases be fitted at the start of each line and then placed every 20 - 40 devices along each line. (Refer to section 3.2.4 for the calculations to determine where the isolator bases must be positioned.) The cabling from the MXP to the initial Isolator Bases should be as short as possible. In fact 5BI Isolator bases without detectors can be used at the star junction point.

Note: The Star Connection is not recommended for new installations. A loop configuration should be used as it offers open circuit fault protection and with Isolator Bases, short circuit protection.

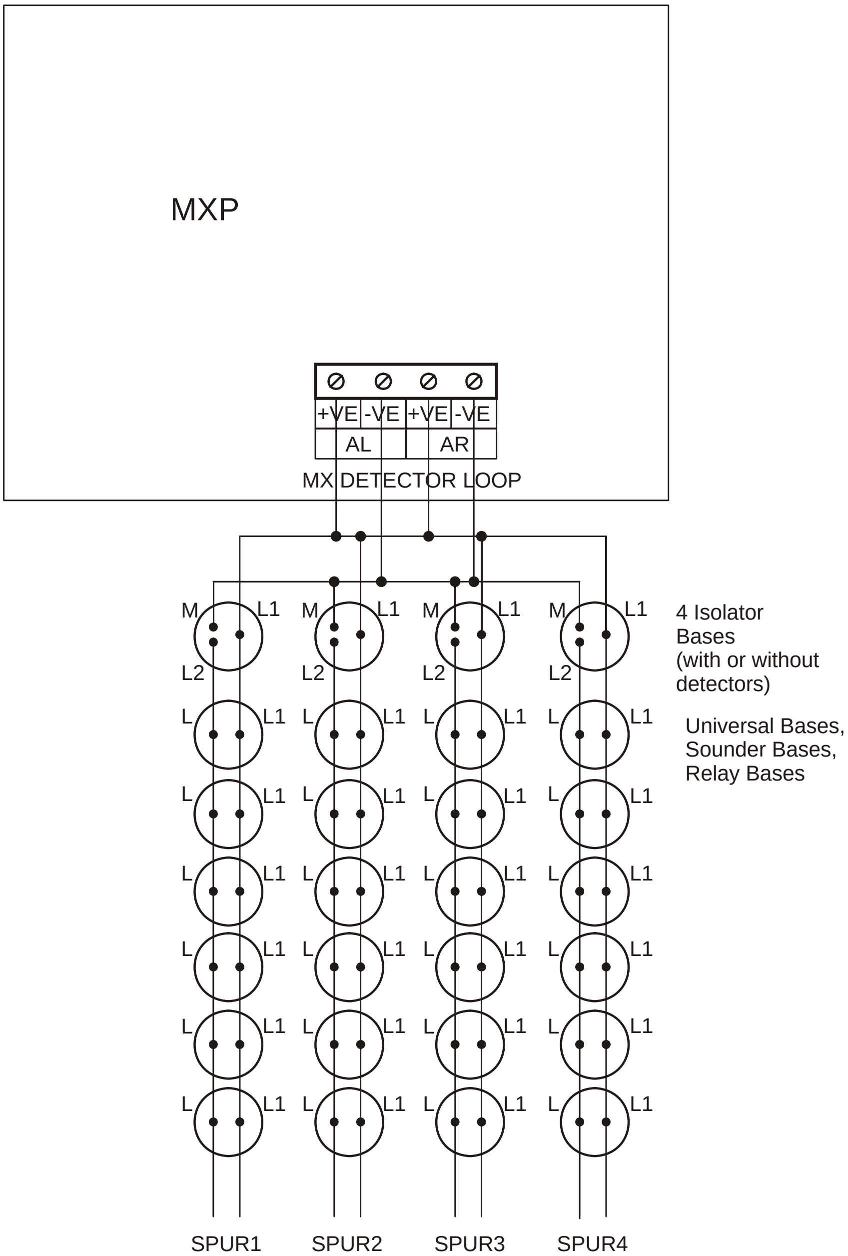
4.2.4 SPURS

Both the loop topography described in section 4.2.2 and the star topography described in section 4.2.3 can have "spurs" attached. (Spurs on a spur for the star topography.)

Any such spur should be connected to the loop or its parent spur with an isolator base.

However spurs are not recommended for new installations as an open circuit will disconnect all detectors further away from the MXP than the open circuit, and a short circuit on a spur will disconnect the whole spur.

In any case, to comply with standards, all the detectors on a spur should be in the same zone.



NOTE : Total cable length < 2000m

Figure 4.2 STAR CONNECTION ON MXP

4.3 CABLE SELECTION CONSIDERATIONS

Selection of cable to implement the Analogue Loop requires specification of .....

(i) CABLE TYPE
(i.e. construction and choice of materials)

This is determined from consideration of .....

MECHANICAL - REQUIREMENTS	For instance, does the application specification, or prevailing standards, call for fire rated, armoured, etc.

ELECTRICAL - REQUIREMENTS	Different construction/materials give different AC characteristics, noise immunity, etc.

(ii) CABLE WEIGHT
(i.e. gauge of wire used)

MECHANICAL- REQUIREMENTS	Does the application specification, or prevailing standards, call for a minimum gauge (AS1670.1 specifies a minimum of .75mm² standard, for instance).
ELECTRICAL - REQUIREMENTS	What is the minimum gauge wire that can be used without exceeding the maximum voltage drop for the number of devices over the required loop length.

The four areas to be considered therefore are
- AC requirements
- DC requirements
- Mechanical requirements
- Noise immunity

4.4 AC REQUIREMENTS

4.4.1 GENERAL

All common types of wiring with a total length of up to 2000m may be used. Refer to section 3.2.3.

4.5 DC CONSIDERATIONS

4.5.1 GENERAL

A maximum voltage drop of 17V is allowed on the cable from the MXP to the most distant device. This applies both where
- the cable is driven from the “left” end only.
- the cable is driver from the “right” end only.

Refer to the calculations in section 3.2.2.

4.6 MECHANICAL CONSIDERATIONS

Electrical considerations aside, the system design should take into account mechanical aspects such as .....
- Need for fire rated cable.
- Need for mechanical protection.

4.7 NOISE CONSIDERATIONS

Although the MXP loop has been designed for minimum electrical interference, it is still capable of both picking up and generating electrical interference. The longer the loop the greater the potential problems. Each analogue loop must be considered on its own merits, taking into account possible noise sources along the loop's proposed routing. Normal engineering practice applies, such as keeping the loop wiring separate from other wiring, especially power cables, speaker cables, leaky coaxial cable and noise sensitive cables for audio systems.

In extreme cases it may be necessary to implement the analogue loop as a screened pair, with the screen connected to the metal case at the MXP only.

CHAPTER 5
MXP CURRENT CONSUMPTION

5.1 THEORY

The MXP current consumption is considerably higher than that of the other responders (even higher than the MPR, in fact it can be considerably higher than the MPR depending on the sounder load). It must be carefully considered when engineering the MX4428 responder loop.

Use of the F4000CAL PC program is strongly recommended as it performs the following calculations automatically.

A formula for predicting the MXP current is.....

I(mA) = (ITOT(mA) * (40V / VIN) * (1 / PCE)) + (IQ(mA) * (24V / VIN))

Where .....

PCE	=	Power converter efficiency = 0.80
IQ	=	MXP quiescent current at 24V = 50mA.
ITOT	=	Total current sourced into the AL and AR terminals, which can be calculated as shown in Section 3.2.2
VIN	=	MX4428 Responder Loop voltage

5.1.1 ALARM CURRENT

The alarm current calculated for all responders can be calculated and used to ensure that
1) The total current to be sourced from the MX4428 does not exceed 2.0A
2) No responder will see a supply voltage of less than 17V, allowing for the minimum battery voltage at the MX4428 and voltage drops in the responder loop wiring.

Once MXP currents are calculated, the voltage drops around the responder loop can be calculated. This will give a more accurate figure for the operating voltage of each MXP which will result in a slightly different current consumption. The full calculation is an iterative process when performed manually, and it is recommended that the PC program F4000CAL is used.

Taking the example from section 3.2.5, where the alarm current was calculated at 221mA, the MXP supply current at (22V) will be

I(mA) = (ITOT(mA) * (40V / VIN) * (1 / PCE)) + (IQ(mA) * (24V / VIN))
= (221 * (40 / 22) * (1 / 0.8)) + (50 * (24 / 22))
= 502mA + 55mA
= 557mA.

This current, together with the load of other responders on the MX4428 responder loop, can be used to calculate the voltage drops on the responder loop power wiring, and possibly refine the value used for the MXP supply voltage (22V above). The calculations can be performed iteratively until little change is evident.

It is of interest to recalculate the current consumption assuming for example the supply voltage is only 17.0V (the minimum operating voltage of the MXP). In this case the consumption is increased to 721mA. It can be seen that if the responder loop power wiring has too much resistance, the voltage to the responders is reduced by their current consumption, which results in them requiring even more current and compounding the problem.

5.1.2 QUIESCENT CURRENT

The quiescent current of all responders can be calculated and used to ensure there is enough battery capacity and supply current at the MX4428.

The quiescent current for the MX loop is calculated as in section 3.2.2, but using the quiescent current instead of the alarm current. Then the MXP supply current can be calculated as described in section 5.1. Once again iterative calculations may be required to adjust for the responder loop voltage drop.

5.1.3 HEAT LOSS

The heat loss from the MXP PCB can be calculated as follows –

W = ITOT(mA) * 40V * (1 - PCE) / PCE + IQ(mA) * 24V

Where .....

W	=	Heat loss in milliwatts
PCE	=	Power converter efficiency = 0.80
IQ	=	MXP quiescent current = 50mA at 24V.
ITOT	=	Total current sourced into the AL and AR terminals, which can be calculated as shown in Section 3.2.2

Using the above figures, the equation simplifies to

W(mW) = ITOT(mA) * 10V + 1200mW

This can be calculated separately for quiescent and alarm conditions, depending on whether quiescent or alarm figures are used to calculate IQ.

The maximum possible heat loss is 5.2 watts.

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CHAPTER 6
EVENT LOG AND STATUS AT MX4428

6.1 RETURNED ANALOG VALUES

The MXP returns up to 4 different analog values per device - CV, TV, HH, and HL. The following table details what each value means for each device type.

Type	CV	TV	HH	HL
814H	Temperature Current Value	ROR	History High of Temperature SLV	History High of ROR SLV
814PH	Smoke CV	Smoke TV	HH percent* (max% of Temp SLV, Temp ROR SLV, Smoke SLV)	Temp CV
814CH	CO CV	CO TV	HH percent* (max% of Temp SLV, Temp ROR SLV, CO SLV)	Temp CV
814I	Current Value	Tracked Value	History High of SLV	History Low of SLV
MIM800	analog i/p	–	History High	History Low
MIM801	analog i/p	–	History High	History Low
CP820	analog i/p	–	History High	History Low
CIM800	analog i/p 1	analog i/p 2	Hist High (both)	Hist Low (both)
DIM800	analog i/p 1	analog i/p 2	Hist High (both)	Hist Low (both)
SNM800	EOL Supervision	Supply Supervision	History High EOL Supervision	History Low EOL Supervision
LPS800	Analog i/p 0 (while not operated)	Analog i/p 1 (while not operated)	History High of analog i/p 0 (while not operated)	History Low of analog i/p 0 (while not operated)
RIM800	–	–	–	–
VLC800	Current Value	Fixed at 12	History High %*	0

*HH percent will indicate whichever of Temperature, Rate of Rise, or Smoke/CO has been highest, in terms of the percentage of its alarm threshold. It will be rounded to the nearest 5%, and the last digit will indicate which type it represents. A last digit of 0 or 5 indicates smoke or CO. A last digit of 1 or 6 indicates temperature, and a last digit of 2 or 7 indicates temperature rate of rise.

For example, 51 will indicate that temperature has been highest at 48-52% of the alarm threshold. 65 will indicate smoke/CO has been highest, at 63-67% of the alarm threshold.

For temperature 20°C will be 0% and the alarm limit 100%.

All History High and History Low values (where used as maximum and minimum) will be based on Step Limited values i.e. the same values as are used for alarm comparison. However note that PreAlarm comparisons are performed using “CV”, i.e. values without Step Limited filtering. Therefore a PreAlarm may occur even though the “History High” value is less than the PreAlarm Threshold.

6.2 FAULT AND ALARM EVENT LOG

The table below lists examples of event log items which are produced at the MX4428 panel. Circuit / point event logging must be enabled to see the events listed below. Zone events are not shown.

Event on MXP	Event Logged	Event Logged on return to normal
Database tx from F4000 to MXP	RSP 1 DATABASE TX START	RSP 1 DATABASE TX COMPLETE
Point Alarm	CCT 1/1 ALARM PNT 1/30 ALARM	CCT 1/1 ALARM CLR PNT 1/30 ALARM CLR
Point Fault	CCT 1/1 FAULT PNT 1/20 FAULT	PNT 1/20 FAULT CLR CCT 1/1 NORMAL
Point Pre-Alarm	PNT 1/3 PRE-ALARM	PNT 1/3 ALARM CLR
SNM800 wiring o/c or s/c	RLY 1/1 FAULT PNT 1/26 SUPERVISION FAULT	PNT 1/26 NORMAL OFF RLY 1/1 NORMAL
SNM800 Supply Fail	RLY 1/1 FAULT PNT 1/26 LOAD SUPPLY FAIL	PNT 1/26 NORMAL OFF RLY 1/1 NORMAL
SNM800 / RIM800 checkback fail	RLY 1/1 FAULT PNT 1/24 CONTROL CB FAIL	PNT 1/24 CONTROL CB NML (RIM800) PNT 1/26 NORMAL ON (or OFF) (SNM800) RLY 1/1 NORMAL
DIM800 Supply Low	CCT 1/1 FAULT PNT 1/25 FAULT PNT 1/25 LOAD SUPPLY FAIL	PNT 1/25 FAULT CLR CCT 1/1 NORMAL
Point scan fail	PNT 1/22 NODE FAIL CCT 1/1 FAULT	PNT 1/22 NODE FAIL CLR CCT 1/1 NORMAL
Detector calibration fault	CCT 1/1 FAULT PNT 1/2 FAULT PNT 1/2 PARAMETER ERROR	CCT 1/1 NORMAL PNT 1/2 FAULT
Loop o/c	RSP 1 LOOP OPEN CIRCUIT	RSP 1 LOOP OPEN CIRCUIT CLEARED
Loop line A or B short or overload	RSP 1 LOOP SHORT CIRCUIT	RSP 1 LOOP SHORT CIRCUIT CLEARED
Type Mismatch	PNT 1/1 POINT TYPE MISMATCH	PNT 1/1 POINT TYPE OK
Foreign Device	PNT 1/3 FOREIGN DEVICE (note- re-logged after DP command)	
System Test or autotest - device not normal at start	PNT 1/2 TEST START NOT NML CCT 1/1 FAIL SELF TEST 3 1	
System Test or autotest - device alarm test fail	PNT 1/1 ALARM TEST FAIL CCT 1/1 FAIL SELF TEST 3 1	
Zone alarm test device fail	PNT 1/1 ALARM TEST FAIL	

Diagnostic Pollscan result -Correct point found	P1/22 LINE 1 OK LINE 2 OK LED OFF TYPE OK
Diagnostics Pollscan result - point not found	P1/100 LINE 1 FAULT LINE 2 FAULT LED OFF TYPE OK
Diagnostic Pollscan result -Type mismatch	P1/20 LINE 1 OK LINE 2 OK LED OFF TYPE BAD

Note "Type Mismatch" means a different device type was found at an address, from the type programmed in the panel configuration for that address. An example of this would be a MIM800 found at an address that is configured to have an 814PH. Refer to section 3.1.1 for details of some device substitutions that are accepted without generating a fault.

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CHAPTER 7
MXP TECHNICAL DESCRIPTION

7.1 GENERAL

The MXP has two major functions:

(i) To provide an interface to an MX4428 responder (communications/power) loop, via which data gathered by the MXP may be transferred to the MX4428 Master for display, annunciation, and processing as appropriate.

(ii) To provide an interface to the Analogue Loop. Data retrieved from the devices connected to the Analogue Loop is processed to determine the ALARM/NORMAL/ FAULT status of each device, and this data is passed on to the MX4428 Master via the MX4428 Loop Interface. The Analogue Loop interface also allows outputs to be sent to those devices that support them, to initiate device tests, activate relays, etc.

The MXP is implemented as one printed circuit board (1901-213).

7.2 CIRCUIT DESCRIPTION

7.2.1 BLOCK DIAGRAM

A block diagram of the MXP is given in Figure 7.1.

The MXP can be divided into 4 sections:

(i) The microprocessor and memory. This is the "heart" of the MXP.

(ii) The power supply. The power supply produces the 40V isolated supply for the Analogue Loop and also the 5V isolated supply for the microprocessor.

(iii) The MX4428 Loop Interface. The Loop Interface contains the connect, disconnect circuitry for the MX4428 Loop Power Supply and also the serial data driver circuits.

(iv) The Analogue Loop Interface. This section contains the Loop Driver/ Receiver circuit and the Loop Isolator circuits.

7.2.2 MICROPROCESSOR & LOGIC CIRCUITRY

The MXP is controlled by the 68302 Microprocessor CPU (U1). Connected to the CPU bus is the FLASH (U2) which contains the MXP software, and the RAM (U3 and U4) which is used for storing parameters and data associated with devices on the Analogue Loop.

The 68302 includes a communications processor with 3 serial ports. These are used for the 2 responder loop ports and a diagnostic port.

To reduce the number of components on the PCB, a PAL (Programmable Array Logic) (U5) is used to generate bus signals such as RD-, L WR-, and U WR-. It also drives the status LED and is used to read some of the DIP switches.

Both the FLASH (U2) and PAL (U5) are factory programmed for use in the MXP. However the FLASH (U2) can easily be reprogrammed in the field.

7.2.2.1 Power On Reset & Watchdog Circuits

The power on reset consists of the DS1232 (U6), which drives the RST signal to the CPU low when the 5V supply is below 4.6 Volts. This ensures that the CPU does not corrupt the RAM when the 5V supply collapses, and the CPU starts up reliably when the 5V supply turns on. The DS1232 also includes a Watchdog circuit inside, to produce a RESET if the CPU stops running properly.

7.2.2.2 Memory

Memory addresses are decoded by the MC68302. When first powered up the FLASH occupies the bottom 8k bytes. However the software relocates the FLASH so that the memory addressing is as follows -

```
000000 - 03ffff RAM
400000 - 47ffff FLASH
800000 - 80000f LED and SWITCHES via PAL
f00000 - f00fff INTERNAL RAM AND PERIPHERALS
```

The RAM memory and PAL chip are powered by the +5VB supply, which has a supercap (C68) to supply power when the MXP is powered down. This allows the MXP to retain its RAM memory contents for typically 10 hours on MXP power down.

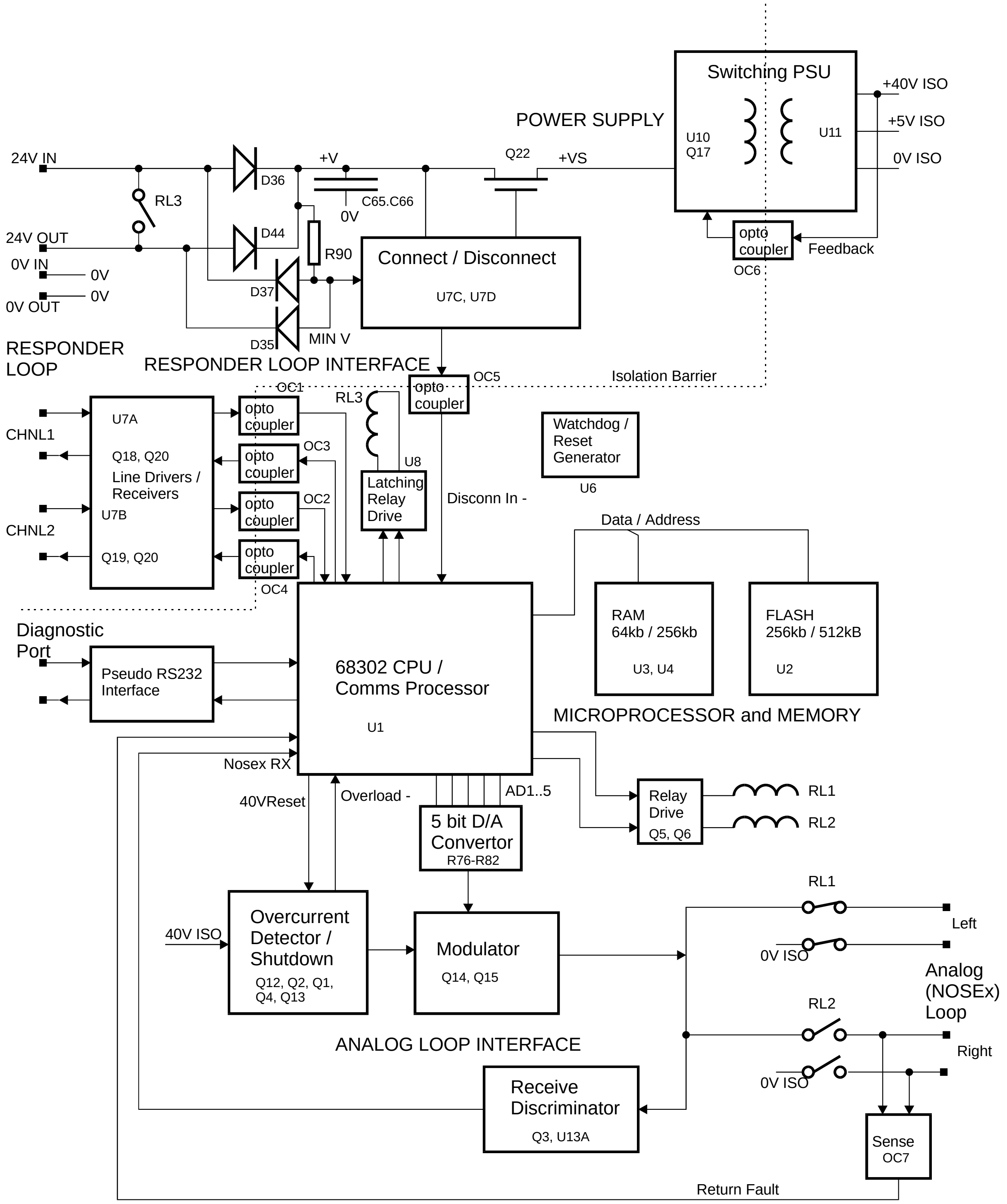

Figure 7.1 MXP Block Diagram

7.2.3 MXP POWER SUPPLY

The raw power to the board is supplied from the 24VIN terminal (via D36) or the 24VOUT terminal (via D34), or both, depending on the Loop conditions.

This voltage "+V" is smoothed and maintained by reservoir capacitors C65, C66, and C71, which store sufficient charge to maintain the circuitry under transient loop fault conditions.

From "+V" the following supplies are derived:

(i)	+VS	This is a switched version of "+V", which is switched OFF when the loop supply falls below the voltage required for correct operation of the MXP.
(ii)	40V ISO	A regulated, isolated 40V supply used to drive the Analogue Loop circuitry and addressable devices.
(iii)	24V ISO	Derived from 40V ISO to power 24V relays.
(iv)	5V	Used to power the CPU and logic circuitry.
(v)	5VB	Used to power the RAM and PAL. Backed up by supercap (C68).

Descriptions of the circuitry required to generate these power supplies follow.

7.2.3.1 +VS Circuitry

The MXP is specified to operate over an MX4428 loop supply range of 17.0V to 30.0V. The MX4428 loop fault clearing technique relies on the fact that responders that are not powered up "look like" a high impedance (see Section 7.2.4 for details). The circuitry is therefore divided up into two sections, a (relatively) high current portion which becomes active only when adequate voltage is available, and a low current portion that is continuously powered up and whose sole purpose is to sense the loop voltage and control the enabling/disabling of the high current circuitry. Loop voltage sensing is performed by comparator U7:C and associated components which, in turn, operate power switch Q22 to feed +VS. Since the voltage regulator draws peak currents up to around 5A, a FET is used for Q22, which gives a low voltage drop for minimal control (gate) current.

D39, R12, R35, R113 ensure that +VS becomes active if the loop supply exceeds 17.0V, with R28, R110, D38 providing about 4V of hysteresis (i.e. once switched on +VS will stay switched on until the supply voltage drops below 13V).

7.2.3.2 40V ISO

The 40V ISO and 5V ISO supplies are produced using the switch mode power supply controller IC U10, FET Q17, and associated components. The circuit configuration is such that the circuit operates in flyback mode, energy being stored in L1 primary during Q17's ON period and transferred to the two secondary windings during the OFF period.

The current into the diode of optocoupler OC6 increases rapidly as the 40V ISO voltage passes through 40V (adjustable by means of VR1). The optocoupler OC6 controls the feedback to U10 pin 2 which adjusts the duty cycle of the current pulses into L1's primary and maintains regulation of 40V ISO.

R6 and C63 provide stability, essentially coupling the sawtooth from the internal oscillator to the comparator – input, thereby making the + input a much lower gain pulse width control than it would otherwise be. R107, R65, C38 provide over-current protection, while C34 defines the frequency of oscillation (approximately 80KHz). D41 and C77 provide a “soft start” circuit to reduce the current taken during the startup time.

7.2.3.3 24V ISO

The 40V ISO voltage is regulated by a linear regulator consisting of Q23, D40 and associated components. This supply is only required to supply a low current (about 30mA max) to drive relays. The reference diode (D40) used for the 24V supply is also used as the reference for the 40V supply.

7.2.3.4 +5V ISO & +5V Batt

A second L1 secondary winding is used to produce an 8V supply, This 8V supply is poorly regulated and may vary from 7.5V to 10V depending on the 40V ISO load. The 8V supply is regulated by U11 to 5.2V.

This supply is then passed through D32 to produce the 5V supply for the CPU and logic circuitry. The 5.2V supply also passes through D31, to produce +5V Batt, and this supply contains a supercap (C68) which is used to keep this supply up after the power supply has shutdown. R66 is used to limit the charge current to the supercap. This supply is used to power the RAM on the MXP, and retain its contents during short (up to a few hours) power downs.

7.2.4 MX4428 LOOP INTERFACE

7.2.4.1 Loop Disconnect Circuitry

The MXP, like all MX4428 compatible Responders, includes a DISCONNECT relay (RL3) which is used to isolate shorts on the power supply loop.

Normally 24V power passes from one Responder to the next via the 24VIN terminal / DISCONNECT relay / 24 VOUT terminal path, supplying power to the Responder on the way through. D35, D37, R90 form a diode gate such that a loop short on either 24VIN or 24VOUT applies a low voltage to comparator U7:D. This generates a DISCON IN- signal to the microprocessor which then opens the DISCONNECT relay to isolate the fault. Depending on the time taken for the shorted section to be isolated, the power output of the MX4428 panel may collapse completely, removing power from all responders. Therefore it is necessary for them to respond rapidly to the DISCON IN signal and open the DISCONNECT relay in their last dying gasps before their power supplies collapse to zero.

Generally, all Responders on the loop respond in like fashion and break the loop supply. (Depending on the position of the short, and loop resistances, some may not open their DISCONNECT relays.) Starting from the Responder nearest the MX4428 Master, each Responder then makes a decision, based on the value of “MIN V” (refer to Figure 7.1) whether to re-connect the relay or not. If MIN V is less than +V/2, the loop fault is on one of its 24V terminals, so it will not re-close its DISCONNECT relay. If, however, MIN V is greater than +V/2 the fault lies beyond the next Responder and it can therefore apply power to that Responder.

The newly powered up Responder then makes a similar decision, followed by each successive Responder up to the Responder with the loop fault on its far side which will not close its DISCONNECT relay.

Similarly Responders on the other end of the Responder loop will close their DISCONNECT relays, up to the Responder connecting to the section of the loop with the short circuit.

With a single short circuit, all responders will eventually be powered up (receiving power from one end of the loop or the other), however the two responders on either side of the short will have their DISCONNECT relays open.

7.2.4.2 Disconnect Relay Driver

U8A and U8B with Q10 and Q11 form a bridge circuit to drive DISCONNECT relay RL3. This is a magnetically latched relay to save power consumption. Its position can be switched by providing a short pulse of voltage, with the polarity of the voltage controlling the position.

In response to DISCON IN– going low, the microprocessor outputs a 10 msec pulse to DISCON OUT+, which applies “0V” to RL3 pin 16 through D5 and U8 pin 2, and “+24V” through Q11 to RL3 pin 1, thereby setting the relay contacts to their open state. When DISCON IN+ goes low the microprocessor outputs a 10 msec pulse to CONOUT, which applies “0V” to RL3 pin 1 through D6 and U8 pin 1, and “+24V” through Q10 to RL3 pin 16, thereby re-setting the relay contacts to the closed state.

The DISCON IN– signal is configured as an interrupt signal to the CPU. This allows a very fast response to it going low and ensures the relay is opened immediately. This is necessary as a short anywhere on the responder loop will often result in the responder power collapsing completely and the relay must be opened while sufficient charge remains in capacitors C64, C65, C66, and C59-C62.

When neither DISCON OUT+ nor CONOUT is high, no power is applied to the coil of RL3.

7.2.4.3 MX4428 Communications Circuitry

The duplicated MX4428 communications channels are implemented using serial ports 1 and 2 of the 68302 CPU. The two transmit lines are isolated with optocouplers and buffered with Darlington drivers. The receive circuits are protected with series resistors and shunt diodes/capacitors, digitised with comparators, and isolated with optocouplers.

Passing messages around the loop is done entirely with software. For details of the MX4428 responder protocol and loop operation, refer to “F4000 Technical Manual - Appendix C, Responder Communication Protocol”.

7.2.5 ANALOGUE LOOP INTERFACE

The Analog Loop (also known as MXP loop or NOSEx loop) is a two-wire circuit with the MXP being the master and up to 200 addressable devices which are slaves.

The MXP supplies the loop power (36 - 39V dc) which powers the addressable devices and sounder outputs. The loop + voltage is modulated with a 4V p-p dual frequency sinewave in order to transmit data using the power wire.

Both the MXP and the addressable devices transmit and receive in the same way. The addressable devices normally only transmit immediately after they have been polled by the MXP, however in special circumstances they can transmit **interrupt** messages when they have something urgent to send.

An example of a message on the loop is shown in Figure 7.2.

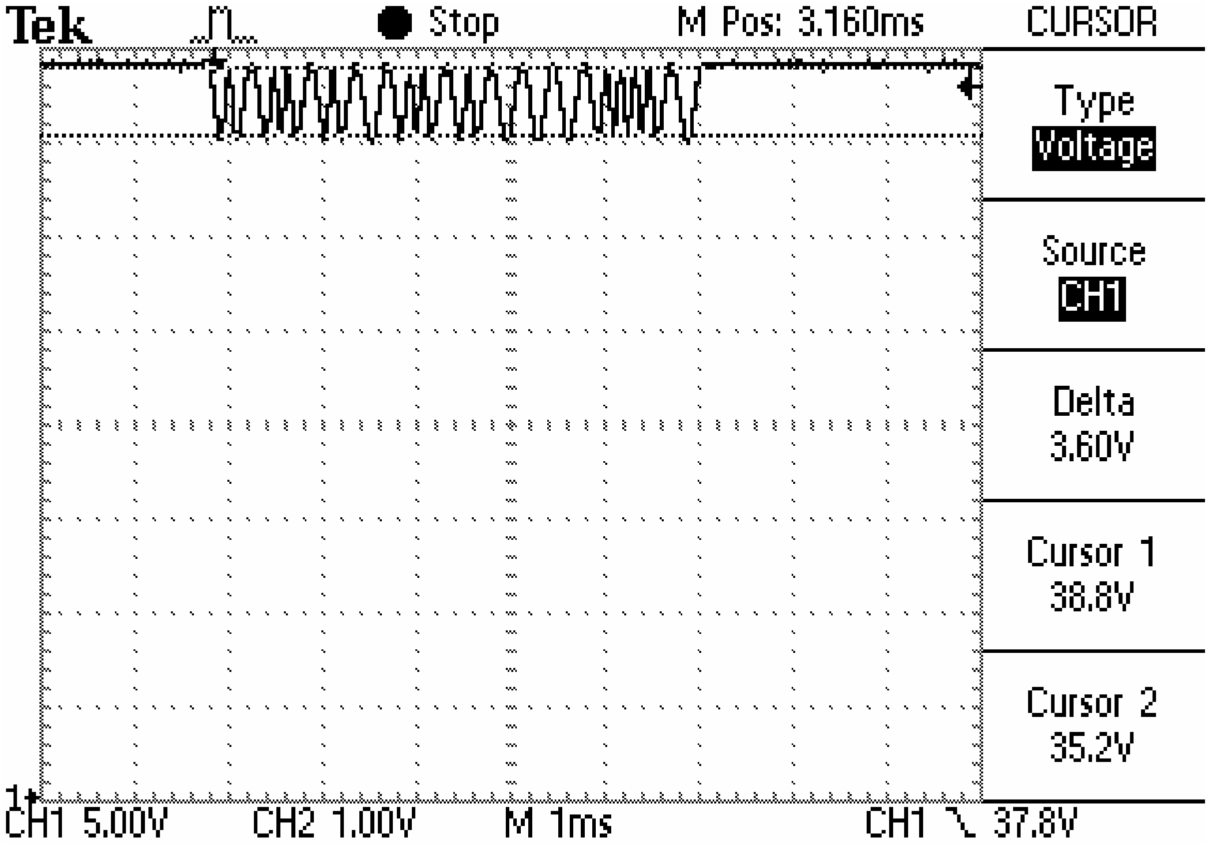

Figure 7.2 Analog Loop Typical DC Level and Data Waveform

7.2.5.1 Over-Current Protection

The current drawn by the analog loop passes through current sense resistors R22 - R26. When the voltage across these resistors exceeds approximately 0.65 volts (corresponding to a current of just over 400mA), the collector of Q2 begins to conduct. Thermistor RV3 and resistor R119 compensate for the fact that the VBE threshold voltage of Q2 varies with temperature. Q2 conducting pulls the gate of Q12 to +40V and switches off Q12. The drain of Q12 then drops to around 5V or less depending on the load on the analog loop. Q13 is then turned on by the current through R5. Q13 then holds Q12 off even though the overload is now gone and Q2 is no longer conducting.

This “latched” over-current situation can only be reset by the CPU. The CPU senses the absence of 40V through the sense resistors R68 and R67 and the signal OVERLOAD– going to a logic low. The CPU (periodically) tries to reset the over-current latch by applying a short (approx 5 ms) pulse to “40V RESET”. This pulse turns on Q4 and Q1, which turns off Q13. Q12 will then turn back on and stay hard on as long as there is no over-current.

For the duration of this 5 ms pulse, the latching action of the circuit is disabled, and Q12 will act as a linear current limiter. During this time the dissipation in Q12 can be up to 40V * 400mA i.e. 16 watts. This will be an excessive dissipation for Q12 if it continues indefinitely, which is why the reset pulse is limited to 5 ms, and indeed why the latching action is required in the first place.

7.2.5.2 Data Transmission

Each bit transmitted consists of single cycle of a sinewave of one frequency for a ‘0’ and another frequency for a ‘1’. Each cycle is made up from a number of discreet samples, with a 5uS spacing between samples. For each sample the digitised value is output on the 68302 CPU onto signals AD1, AD2, AD3, AD4, and AD5. These signals are converted to an analog voltage “TXDATA” by resistors R72, R73, R74, R75, R76, R77, R82, R81, R80, and R79, which form a conventional R/2R ladder. Resistor R78 adds a DC offset of about 1.5V to the TXDATA voltage.

Transistor Q14 is a current sink with the current controlled by the TXDATA voltage. The varying current develops an AC voltage of 4V p-p across R85. This AC voltage is coupled onto the gate of Q15 through C53. Q15 provides the DC power for the loop (R85 is too high a resistance for this purpose). Q15 is a source follower, and its source follows the voltage on its gate. The circuit of R85, Q15 and associated components can be viewed as a circuit with about 2 - 4 volts DC drop (at 0 - 400mA load), but which has a high AC impedance determined by R85. (Somewhat like an inductor in that it has a low DC resistance but high AC impedance.) This supplies power to the loop but at the same time allows the MXP transmitter (Q14) and the transmitters in the addressable devices to modulate the voltage for data transmission.

7.2.5.3 Data Reception

The data on the analog loop is filtered by L9, L10, C30, R32, R33 and C39. C37 provides DC blocking. D2 and D3 with C40 clamp the incoming voltage to 1.2V p-p. The filtered, clamped voltage is amplified by Q3 and then sliced by U13A to form a 0 - 5V square wave from the incoming sinewave. The received data is decoded into 0s and 1s by timing and software within the CPU. Note that the slice level is about 0.6V from the peaks of the AC voltage on the loop and not at the mid point of the AC component.

7.2.5.4 Open Circuit Fault Handling

The loop is normally driven from the AL terminals, and not driven by the AR terminals. Optocoupler OC7 checks that power is reaching the far end of the loop i.e. the AR terminals. If this is not the case, the CPU will close relay RL2 so that the loop is driven (power and data) from both ends. Thus a single open circuit will result in all addressable devices still receiving power and still being able to communicate with the MXP. Two open circuits may result in loss of power and communications with some devices.

Periodically (every 30 seconds) when the loop is driven from both ends, the CPU will open the right end relay to check whether the open circuit fault has gone away.

7.2.5.5 Short Circuit Fault Handling

If the CPU finds that the over-current detector described in section 7.2.5.1 is unable to be reset or is operating repeatedly in a short time, it will try to drive the loop from one end at a time in case the short is present only when driving from one end of the loop. In this case it will drive the loop from the other end only. However it will try the faulty end very briefly once every 30 seconds to see if the fault has gone away.

Note that if there are no isolator bases in the loop, the short will appear from both ends and all devices will be effectively disconnected.

If there are isolator bases, then after an initial overload which will be reset, the isolators will isolate the section of the loop with the short. The loop will then appear to have an **open circuit** and will be driven by both ends simultaneously as described in section 7.2.5.4. Only those devices connected to the shorted section will be disconnected.

In the event that there are isolator bases installed, but there is a short on the section of loop between the MXP and the first (or last) isolator, the MXP will detect the short and drive the loop only from the opposite end. Every 30 seconds it will very briefly try reconnecting the faulty end to see if the fault has gone away. This reconnection must be very brief (if the short is still present), as it will cause the loop voltage to collapse, and the voltage must be restored quickly enough so that the addressable devices retain enough charge in their power supply filter capacitors and do not reset.

7.3 MXP ADJUSTMENTS

None of these adjustments should require changing in the field, unless PCB components have been changed.

7.3.1 40V ISO SUPPLY VOLTAGE ADJUSTMENT

Disconnect all circuits from the analog loop terminals. Connect 24V to the responder loop power terminals. Adjust VR1 so that the voltage measured between TP16 “40V ISO” and TP15 “0V ISO” is 40.0V + / – 0.5V.

7.3.2 TX DATA VOLTAGE ADJUSTMENT

Disconnect all circuits from the analog loop terminals. Adjust VR2 so that the AC signal voltage measured with an oscilloscope between TP3 “LINE” and TP15 “0V ISO” is 4.0V - 4.8V p-p.

Refer to Figure 7.2 for an example waveform. Note that that waveform was captured with an analog loop and some addressable devices connected and so the measured voltage is slightly less than that specified.

Note that the MXP will need to be connected to an MX4428 FIP, or **standalone** mode activated, for any data to be transmitted.

7.3.3 40V ISO SUPPLY CURRENT LIMIT ADJUSTMENT

Disconnect all circuits from the analog loop terminals. Connect 24V to the responder loop power terminals. Apply a slowly increasing load current to the loop terminals and check at what current the overload circuit operates (i.e. current and voltage drop to zero before being restored by the software - this may happen repeatedly). The overload should occur at a current of 415mA to 430mA. If it is over this range snip out one of the resistors R22 - R25. If it is under this range, re-insert one of these resistors (R22 and R23 are 22Ω and R24 and R25 are 47Ω). Repeat the procedure as required.

7.4 MXP LED INDICATIONS

The status LED (LD1) on the MXP board indicates the following conditions –

Indication	**Condition**
2 quick flashes every 2 seconds	The MXP is normal and polled by the MX4428 panel.
1 quick flash every 2 seconds	The MXP is normal apart from NOT being polled by the MX4428 panel.
7 flashes then a pause, repeating. Each of the 7 flashes indicates a particular fault is present when the flash is **long**, or not present when the flash is **short.**	1st flash : Device polling is stopped due to a configuration download from the MX4428 panel. 2nd flash : One or more configured devices is not responding. 3rd flash : The MXP is not being polled by the MX4428 panel. 4th flash : The responder loop power relay has been opened due to a short on one side of the MXP. 5th flash : The detector loop is open circuit. 6th flash : The detector loop is shorted on "left" terminals. 7th flash : The detector loop is shorted on "right" terminals.
Continuous very rapid flashes	The MXP has just powered up. This phase should only last a couple of seconds.

7.5 PARTS LIST

PART NUMBER.	DESCRIPTION	QTY/ASSY	REF DESIG
PA0893	PCB ASSY,1901-213,F4000 MXP RESPONDER		
CA0001	CAP,CERAMIC,10P,50V	1.0000	C45
CA0002	CAP,CERAMIC,15P,50V	2.0000	C1 C2
CA0004	CAP,CERAMIC,68P,50V	1.0000	C63
CA0005	CAP,CERAMIC,100P,50V	1.0000	C39
CA0009	CAP,CERAMIC,2N2,50V	1.0000	C37
CA0010	CAP,CERAMIC,4N7,50V	2.0000	C69 C70
CA0013	CAP,CERAMIC,22N,40V	2.0000	C41 C42
CA0016	CAP,CERAMIC,47P,50V	1.0000	C43
CA0021	CAP,CERAMIC,1N,100V,P2.54MM	6.0000	C30 C31 C32 C35 C36 C38
CA0022	CAP,CERAMIC,10N,63V,P2.54MM	2.0000	C47 C48
CA0023	CAP,CERAMIC,MONOLITHIC,100N,50V,P2.54MM	23.0000	C3 C5 C6 C7 C8 C9 C10 C11 C12 C13 C14 C15 C16 C17 C18 C19 C20 C21 C22 C23 C24 C25 C26
CA0201	CAP,ELECTRO,RADIAL,1U,50V,D5mm,H12mm,P2mm	1.0000	C40
CA0202	CAP,ELECTRO,RADIAL,2U2,50VMIN,DXL 6.5 X12MM MAX	1.0000	C53
CA0206	CAP,ELECTRO,RADIAL,10U,63V MIN,6.5 x 12 MAX	5.0000	C49 C50 C51 C52 C77
CA0211	CAP,ELECTRO,RADIAL,100U,16V	1.0000	C67
CA0218	CAP,ELECTRO,RADIAL,220U,63V,D10.5MM,H22M,P5MM	4.0000	C59 C60 C61 C62
CA0235	CAP,ELECTRO,RADIAL,470U,35V,D10.5mm,H20mm,P5mm	3.0000	C64 C65 C66
CA0327	CAP,POLYESTER,10%,P5mm,L7.5xT2.5xH6.5mm,10N,100V	3.0000	C44 C54 C57
CA0328	CAP,POLYESTER,10%,P5mm,L7.5xT2.5xH6.5mm,100N,63V	3.0000	C27 C28 C29
CA0330	CAP,POLYESTER,10%,P5mm,L7.5xT2.5xH6.5mm,47N,63V	1.0000	C46
CA0331	CAP,POLYESTER,10%,P5mm,L7.5xT2.5xH6.5mm,1N,100V	1.0000	C34
CA0630	CAP,SUPER CAP,0.22F,5.5V	1.0000	C68
CA0634	CAP,POLYESTER,10%,P5mm,L7.5xT3.5xH8.0mm,10N,400V	1.0000	C72
CA0635	CAP,ELECT,330U,35V,LOW ESR,D10mm,P5mm,H16mm	1.0000	C76
CL0453	COIL,L453,F4000 MXP,ISOLATED PSU,RM8 CORE	1.0000	L1
CN0063	CONNECTOR,IC SOCKET,20 PIN	1.0000	U5
CN0151	CONNECTOR,MOLEX,41761-4,MALE	1.0000	J5
CN0360	CONNECTOR,TERMI-BLOCK,VERT,4.0sqmm,5mm,4 WAY	3.0000	J1 J2 J3
CN0475	CONNECTOR,HEADER,0.1",SIL,6mm PIN,2 WAY	1.0000	LK1
CN0476	CONNECTOR,HEADER,0.1",SIL,6mm PIN,3 WAY	1.0000	LK3
CN0543	CONNECTOR,MINI JUMP WITH TAG,3 AMP	2.0000	LK1 LK3
CR0019	CRYSTAL,16.000MHz,30pF,HC49/4H	1.0000	XT1
DD0003	DIODE,1N4004	5.0000	D7 D8 D9 D35 D37
DD0004	DIODE,1N5404	2.0000	D34 D36
DD0005	DIODE,1N4148	8.0000	D2 D3 D4 D5 D6 D38 D41 D43
DD0027	DIODE,ZENER,0W5,D2.5mm,P10mm,5%,8V2	1.0000	D15
DD0030	DIODE,ZENER,0W5,D2.5mm,P10mm,5%,12V	1.0000	D42
DD0042	DIODE,ZENER,1W0,D3.0mm,P10mm,5%,6V2	1.0000	D33
DD0059	DIODE,SCHOTTKY,BYV10-40,1A,40V	2.0000	D31 D32
DD0060	DIODE,BAT85,SCHOTTKY,200MA,30V	4.0000	D27 D28 D29 D30
DD0061	DIODE,ZENER,HIGH SURGE,3W2,D3.8mm,P10mm,5%,33V	4.0000	D20 D21 D22 D23
DD0062	DIODE,ZENER,1W0,D3mm,P10mm,5%,24V	1.0000	D40
DD0065	DIODE,ZENER,HIGH SURGE,3W2,D3.8mm,P10mm,5%,36V	1.0000	D50
DD0073	DIODE,ZENER,HIGH SURGE,3W2,D3.8mm,P10mm,5%,7V5	1.0000	D19
DD0080	DIODE,BIDIRECTIONAL SUPPRESSOR,BZW04-28B (OR -31B)	3.0000	D16 D17 D18
DD0087	DIODE,MUR115	2.0000	D24 D25
DD0100	DIODE,ZENER,HIGH SURGE,3W2,D3.8mm,P10mm,5%,47V	6.0000	D10 D11 D12 D13 D14 D26
HW0237	HARDWARE,TRACK PIN,T1565-01	17.0000	TP1 TP2 TP3 TP4 TP5 TP6 TP7 TP8 TP9 TP10 TP11 TP12 TP13 TP14 TP15 TP16 TP17
IC0135	IC,7805CT,VOLTAGE REGULATOR,5V 4%,1.5A,TO220	1.0000	U11
IC0258	IC,LM393,OP AMP,DUAL,PRECIS VOLTAGE COMPAR,LOW PWR	1.0000	U13
IC0305	IC,LM385BZ 2.5,MICROPOWER VOLT REF DIODE,2.5V,TO92	1.0000	D39
IC0319	IC,LP339,QUAD COMPARATOR,ULTRA LOW POWER,DIL	2.0000	U7 U8
IC0413	IC,DS1232LP,LOW POWER MICROMONITOR	1.0000	U6
IC0447	IC,LM3578AN,750mA SWITCHING REGULATOR,DIL	1.0000	U10
IC0500	IC,OPTOCOUPLER,SFH608-4,CTR 160% @ 1mA,DIL	7.0000	OC1 OC2 OC3 OC4 OC5 OC6 OC7
LD0021	LED,3MM,RED,HIGH BRIGHT	1.0000	LD1
NT0007	NUT,HEX,M3,ZP	1.0000	Q17
PA0899	PCB ASSY,1901-213,F4000 MXP RESPONDER SMD CMP ONLY	1.0000	
PT0020	POT,CERMET,100E,TOP ADJ,1 TURN,SPECTROL,63P	1.0000	VR2
PT0045	POT,CERMET,20K,TOP ADJ,1 TURN,SPECTROL,63P	1.0000	VR1
RL0051	RELAY,OMRON G6BU-1114C,12VDC,LATCHING	1.0000	RL3

RL0052	RELAY,OMRON G6A-274P-24VDC	2.0000	RL1 RL2
RR0001	RESISTOR,0.6W,1%,50PPM,D2.5mm,P10mm,1E00	1.0000	R84
RR0013	RESISTOR,0.6W,1%,50PPM,D2.5mm,P10mm,22E0	2.0000	R22 R23
RR0016	RESISTOR,0.6W,1%,50PPM,D2.5mm,P10mm,39E0	1.0000	R92
RR0017	RESISTOR,0.6W,1%,50PPM,D2.5mm,P10mm,47E0	2.0000	R24 R25
RR0022	RESISTOR,0.6W,1%,50PPM,D2.5mm,P10mm,120E	2.0000	R66 R85
RR0023	RESISTOR,0.6W,1%,50PPM,D2.5mm,P10mm,150E	1.0000	R93
RR0027	RESISTOR,0.6W,1%,50PPM,D2.5mm,P10mm,330E	2.0000	R32 R33
RR0029	RESISTOR,0.6W,1%,50PPM,D2.5mm,P10mm,470E	1.0000	R64
RR0032	RESISTOR,0.6W,1%,50PPM,D2.5mm,P10mm,820E	1.0000	R119
RR0033	RESISTOR,0.6W,1%,50PPM,D2.5mm,P10mm,1K00	4.0000	R16 R47 R63 R65
RR0034	RESISTOR,0.6W,1%,50PPM,D2.5mm,P10mm,1K20	3.0000	R100 R102 R120
RR0037	RESISTOR,0.6W,1%,50PPM,D2.5mm,P10mm,2K20	3.0000	R88 R89 R90
RR0038	RESISTOR,0.6W,1%,50PPM,D2.5mm,P10mm,2K70	2.0000	R8 R10
RR0041	RESISTOR,0.6W,1%,50PPM,D2.5mm,P10mm,4K70	1.0000	R91
RR0043	RESISTOR,0.6W,1%,50PPM,D2.5mm,P10mm,6K8	2.0000	R99 R101
RR0044	RESISTOR,0.6W,1%,50PPM,D2.5mm,P10mm,8K20	3.0000	R7 R9 R98
RR0045	RESISTOR,0.6W,1%,50PPM,D2.5mm,P10mm,10K0	23.0000	R48 R49 R50 R51 R52 R53 R56 R57 R58 R59 R60 R61 R62 R70 R71 R79 R80 R81 R82 R87 R115 R116 R117
RR0047	RESISTOR,0.6W,1%,50PPM,D2.5mm,P10mm,15K0	1.0000	R43
RR0048	RESISTOR,0.6W,1%,50PPM,D2.5mm,P10mm,18K0	3.0000	R67 R78 R94
RR0049	RESISTOR,0.6W,1%,50PPM,D2.5mm,P10mm,22K0	2.0000	R95 R104
RR0051	RESISTOR,0.6W,1%,50PPM,D2.5mm,P10mm,33K0	5.0000	R17 R18 R19 R20 R118
RR0053	RESISTOR,0.6W,1%,50PPM,D2.5mm,P10mm,47K0	1.0000	R54
RR0054	RESISTOR,0.6W,1%,50PPM,D2.5mm,P10mm,56K0	2.0000	R31 R86
RR0056	RESISTOR,0.6W,1%,50PPM,D2.5mm,P10mm,82K0	1.0000	R103
RR0057	RESISTOR,0.6W,1%,50PPM,D2.5mm,P10mm,100K	10.0000	R3 R4 R5 R6 R12 R14 R15 R21 R34 R69
RR0058	RESISTOR,0.6W,1%,50PPM,D2.5mm,P10mm,120K	3.0000	R112 R121 R122
RR0059	RESISTOR,0.6W,1%,50PPM,D2.5mm,P10mm,150K	5.0000	R27 R28 R29 R30 R36
RR0060	RESISTOR,0.6W,1%,50PPM,D2.5mm,P10mm,180K	2.0000	R68 R83
RR0061	RESISTOR,0.6W,1%,50PPM,D2.5mm,P10mm,220K	3.0000	R11 R123 R124
RR0062	RESISTOR,0.6W,1%,50PPM,D2.5mm,P10mm,270K	1.0000	R111
RR0065	RESISTOR,0.6W,1%,50PPM,D2.5mm,P10mm,470K	3.0000	R40 R41 R42
RR0069	RESISTOR,0.6W,1%,50PPM,D2.5mm,P10mm,1M00	4.0000	R45 R46 R125 R127
RR0071	RESISTOR,0.6W,1%,50PPM,D2.5mm,P10mm,1M50	1.0000	R126
RR0072	RESISTOR,0.6W,1%,50PPM,D2.5mm,P10mm,1M80	2.0000	R37 R38
RR0077	RESISTOR,0.6W,1%,50PPM,D2.5mm,P10mm,10M0	1.0000	R1
RR0085	RESISTOR,0.6W,1%,50PPM,D2.5mm,P10mm,1E80	1.0000	R26
RR0740	RESISTOR,0.25W,1%,100PPM,D2.5mm,P10mm,20K	6.0000	R72 R73 R74 R75 R76 R77
RR0767	RESISTOR,0.25W,1%,100PPM,D2.5mm,P10mm,62K0	1.0000	R113
RR0775	RESISTOR,0.25W,1%,330K ***** USE RR0063 *****	2.0000	R35 R110
RR0802	RESISTOR,NETWORK,0.125W,5%,0.1" SIP,9 PIN,8+C,10K	1.0000	RN1
RR0803	RESISTOR,NETWORK,0.125W,5%,0.1" SIP,9 PIN,8+C,100K	1.0000	RN2
RR0810	RESISTOR,2W,5%,D4mm,P15mm,PR02,330E	2.0000	R108 R109
RR0862	RESISTOR,0.6W,1%,50PPM,D2.5mm,P10mm,1M21	1.0000	R39
RR0865	RESISTOR,0.25W,1%,2M20 ***** USE RR0073 *****	1.0000	R44
RR0887	RESISTOR,THERMISTOR,NTC,0.5W,4K7,-4.9%/K,10%	1.0000	RV3
RR0918	RESISTOR,VARISTOR,130VAC,0.25W	1.0000	RV2
RR0926	RESISTOR,2.5W,10%,200ppm,D6.0mm,P22.5mm,0E03	1.0000	R107
SC0041	SCREW,MACHINE,PH POZI,M3 X 6MM,ZP	1.0000	Q17
SF0243	SOFTWARE, F4000 MXP RESPONDER, V1.00 PAL	1.0000	U5
SU0198	SUNDRY,CHOKE,RF,10%,D4.0mm,P15mm,2U2H,1A	2.0000	L9 L10
SU0204	SUNDRY,CHOKE,RF,10%,D4.0mm,P15mm,4U7H,820mA	7.0000	L2 L3 L4 L5 L6 L7 L8
SW0005	SWITCH,DIL,8P1T	1.0000	SW1
SW0155	SWITCH,PUSHBUTTON,PCB MOUNT,NO,6mm x 6mm,L=5mm	1.0000	SW2
TR0029	TRANSISTOR,BC550	8.0000	Q3 Q4 Q5 Q6 Q7 Q9 Q10 Q11
TR0031	TRANSISTOR,BC557B,PNP,50V,100mA,TO92	5.0000	Q1 Q2 Q8 Q13 Q16
TR0049	TRANSISTOR,MPSA13/14,NPN DARL,30V,0.5A,0.5W,TO92	2.0000	Q18 Q19
TR0074	TRANSISTOR,MPSA63	2.0000	Q20 Q21
TR0075	TRANSISTOR,MTP2955E,MOSFET,P CH,60V,8A,40W,TO220	2.0000	Q12 Q22
TR0083	TRANSISTOR,BST72A,MOSFET,N CH,80V,300MA,.83W,TO92	1.0000	Q24
TR0084	TRANSISTOR,TIP110,NPN DARL,60V,2A,TO220	2.0000	Q14 Q23
TR0085	TRANSISTOR,HEATSINK,TO220,VERTICAL,17degC/W	1.0000	Q17
TR0094	TRANSISTOR,MTP12N10,MOSFET,N CH,100V,12A,79W,TO220	1.0000	Q17
TR0095	TRANSISTOR,RFP15N05L,MOSFET,N CH,15A,50V,60W,TO220	1.0000	Q15
WA0026	WASHER,CRINKLE,STAINLESS STEEL,M3	1.0000	Q17
IC0392	IC,MC68302FC16,uP,132 P PQFP,16MHz,68000+SERIAL PR	1.0000	U1
IC0429	IC,62256,32K X 8 SRAM,70ns,SMT 28PIN SOP,LOW POWER	2.0000	U3 U4
PB0893	PCB BARE,1901-213,F4000 MXP RESPONDER	1.0000	
SF0242	SOFTWARE, F4000 MXP RESPONDER, V1.00 FLASH BOOT	1.0000	U2

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CHAPTER 8
MXP DIAGNOSTIC TERMINAL

8.1 MXP DIAGNOSTIC TERMINAL OPERATION

8.1.1 INTRODUCTION

The MXP provides diagnostic functions via its serial port (J5) with a terminal or PC connected. Commands may be entered which :

- Display the analogue values (Raw values, Filtered values, etc) of selected devices.
- Select devices for such display.
- Display and reset error counters.
- Determine all the devices and their types, as seen from each end of the loop.
- Change an addressable device's address.
- Perform advanced diagnostics.

The MXP diagnostic serial port operates at 19200 baud, 8 data bits, no parity, 1 stop bit. A 3-wire cable is needed and it is wired the same as the MX4428 FIP programming terminal cable. This needs either a DB9 or DB25 connector and can be ordered as fully assembled cables using part numbers LM0042 (DB25) and LM0041 (DB9).

To utilise the colour logging facility an ANSI terminal emulator mode is required. Hyperterm and Accuterm are suitable for Windows and Procomm is suitable for DOS. For simple applications where logging to disk and scroll-back are not required mxpprog32 can be used with Windows and mxpprog can be used with DOS – these are included in SF0250.

8.1.2 MENU OF COMMANDS

To see the menu of commands available, type H <Enter> HE <Enter>or HELP <Enter>. Currently, this will produce the following-

```
***   MXP monitor version 1.02 (c)2000   ***

H       : this help
AH      : advanced help
-------- Point Logging Commands -------------
CO      : Colour toggle (requires ANSI terminal emulation)
SP n m  : select points n to m, n&m optional
SP      : show selected points
SPA     : select all points
CP n m  : clear points n to m, n&m optional
CPA     : clear all points
P       : alternate for SP
-------- General Diagnostic Commands --------
ST      : Display General Status
STANDALONE n : standalone operation, heat threshold=n
-------- NOSEx loop diagnostics -------------
TC      : NOSEx comms error count display
EC n m  : NOSEx comms detailed error count display
RS      : NOSEx comms error count reset
DP      : Do diagnostics poll
CA x y  : Change address of device old address x to new address y
```

8.1.3 SELECTING POINTS FOR MONITORING

Before the MXP can display analog values received from points, the user must select the points to be monitored (i.e. include in the monitoring list). This is done using the following commands –

SPA	Adds all points to the list of points to be monitored.
SP nnn	Adds point nnn to list.
P nnn	Adds point nnn to list
SP nnn mmm	Adds points nnn to mmm.
P nnn mmm	Adds points nnn to mmm.
CPA	Clears all points from monitoring list.
CP nnn	Clears point nnn from list.
CP nnn mmm	Clears points nnn to mmm from list.
SP	Displays all points selected to be monitored (i.e. in monitoring list)

The values nnn and mmm must be in the range of 1-200.

Note that if more than about 50 points are monitored at once, the serial output may not be fast enough and some data may be discarded.

If it is not required to monitor any points be sure to deselect all points (CPA). Monitoring a large number of points may have a detrimental effect on processing time. Therefore enter the CPA command before disconnecting the laptop after monitoring points.

8.1.4 DISPLAYING DEVICE ANALOGUE VALUES - CV, TV, ETC

Once points have been selected for display, the MXP will display at least one line for each selected point, each time the point replies to a poll (or sends an interrupt message).

For those devices with two sensors (814PH, 814CH) with both sensors configured, two lines will be displayed – one line for temperature and another line for smoke or CO.

Colour logging may be selected with the "CO" command to make the displayed log clearer. Green is used for heat sensors, yellow for photo sensors, magenta for CO sensors, cyan for ionisation sensors, and white for ancillaries. A brown/yellow background is used for values in fault, green background for values in pre-alarm, red background for values in alarm.

An example line of the displayed values is
`T=165; P=  2; HEAT= 20; Fl= 20; SL= 20; RoR= 0; SLRoR= 0`
T=xxxx refers to the time in seconds. It recycles back to 0 after 4290 seconds.
P=xxx refers to the point number (1 .. 200).

The format is designed to be both human readable and suitable for capturing and importing into a spreadsheet. In the latter case, it is suggested that "delimited" text import is used, with "=" and ";" being used as delimiters.

The following paragraphs describe the parts of the log specific to each device type.

8.1.4.1 Heat Sensor of 814H, 814PH, and 814CH

```
T=165; P=  2; HEAT= 20; Fl= 20; SL= 20; RoR= 0; SLRoR= 0
```

HEAT=xxx gives the raw value received from the detector converted to °C.
Fl=xxx gives the filtered temperature (CV) in °C. This is the value which is compared with the threshold to decide if a pre-alarm exists.
SL=xxx gives the filtered and slope limited temperature (SLV) in °C. This is the value which is compared with the threshold to decide if an alarm exists. This item will not be displayed if there is no fixed temperature alarm configured, e.g. if the heat sensor is used only to enhance the smoke or CO.

RoR=xx gives the rate of rise in °C/minute. This is the value which is compared with the threshold to decide if a rate of rise pre-alarm exists, and the value which is used to “enhance” smoke or CO processing. This item will not be displayed if there is no rate of rise alarm configured and there is no enhancement of smoke or CO.
SLRoR=xx gives the slope limited rate of rise in °C/minute. This is the value which is compared with the threshold to decide if a rate of rise alarm exists. This item will not be displayed if there is no rate of rise alarm configured.

8.1.4.2 Photo Sensor of 814PH

```
T=165; P=  1;  OPT= 26; Cal= 32; TV= 23; CV-TV=  3; SL-TV=  3
```

OPT=xxx gives the raw value received from the detector (0 .. 255).
Cal=xxx gives the “calibrated” value (i.e. the raw value adjusted to compensate for the varying outputs of different detectors with the same smoke level).
TV=xxx gives the tracked value (or long term average pedestal), i.e. the value which is assumed to be the output of the detector in clean air.
CV-TV=xxx gives the filtered calibrated value less the clean air value (TV). CV-TV is the value which is compared with the threshold to decide if a pre-alarm exists.
SL-TV=xxx gives the filtered and slope limited value less the clean air value (TV). SL-TV is the value which is compared with the threshold to decide if an alarm exists.

8.1.4.3 Carbon Monoxide Sensor of 814CH

```
T=165; P=  2;   CO= 25; Cal= 25; TV= 30; CV-TV= -4; SL-TV= -4
```

CO=xxx gives the raw value received from the detector (0 .. 255).
Cal=xxx gives the “calibrated” value (i.e. the raw value adjusted to compensate for the varying outputs of different detectors with the same CO level).
TV=xxx gives the tracked value (or long term average pedestal), i.e. the value which is assumed to be the output of the detector with no CO present. (Note that as this value is measured in the factory and stored in the detector then not subsequently adjusted, it is a constant for each detector.)
CV-TV=xxx gives the filtered calibrated value less the zero CO value(TV). CV-TV is the value which is compared with the threshold to decide if a pre-alarm exists.
SL-TV=xxx gives the filtered and slope limited value less the zero CO value (TV). SL-TV is the value which is compared with the threshold to decide if an alarm exists.

8.1.4.4 814I Ionisation Detector

```
T=165; P= 20;  ION= 74; TV= 74; CV-TV=  0; SL-TV=  0
```

ION=xxx gives the average of the two raw values received from the detector (0 .. 255).
TV=xxx gives the tracked value (or long term average pedestal), i.e. the value which is assumed to be the average of the two detector sensors in clean air.
CV-TV=xxx gives the filtered calibrated value less the clean air value(TV). CV-TV is the value which is compared with the threshold to decide if a pre-alarm exists.
SL-TV=xxx gives the filtered and slope limited value less the clean air value (TV). SL-TV is the value which is compared with the threshold to decide if an alarm exists.

8.1.4.5 MIM800 Mini Input Module

```
T=165; P= 21;  MIM=100
```

MIM=xxx gives the raw value received from the module.

8.1.4.6 MIM801 Mini Input Module

```
T=165; P= 30;  MIM801=131
```

MIM801=xxx gives the raw value received from the module.

8.1.4.7 CP820 Manual Callpoint

`T=165; P= 22;   CP=0`
CP=xxx gives the raw value received from the callpoint.

8.1.4.8 CIM800 Contact Input Module

`T=165; P= 23;  CIM A= 90, B= 91`
CIM A=xxx; B=yyy. xxx gives the raw value relating to the module input A and yyy gives the raw value relating to the module input B.

8.1.4.9 DIM800 Detector Input Module

`T=1334; P= 25;  DIM A= 26;B= 26; Supply=198`
DIM A=xxx;B=yyy; Supply=zzz. xxx gives the raw value relating to the module input A, yyy gives the raw value relating to the module input B, and zzz gives that raw value from supply monitoring.

8.1.4.10 RIM800 Relay Interface Module

`T=1334; P= 24;  RIM=224`
RIM=xxx gives the digital inputs to the module ASIC, converted to a integer. The only bit of use is the least significant bit - the number should be odd if the relay is activated, even otherwise.

8.1.4.11 SNM800 Sounder Notification Module

`T=1334; P= 26;  SNM=255,  3`
SNM=xxx, yyy. xxx gives the raw value relating to the EOL monitoring (when the relay is de-activated), and yyy gives the raw value relating to the power supply monitoring.

8.1.4.12 LPS800 Sounder Notification Module

`T=1334; P= 27;  LPS=151, 78`
LPS=xxx, yyy. xxx relates to the voltage at the + terminal. yyy relates to the voltage at the – terminal.

8.1.4.13 VLC800 Vesda Laser Compact

`T=1334; P= 28; VLC= 17; DI=0xe0; Cal= 17;  TV= 12; CV-TV= 5; SL-TV=5`
VLC=xx gives the analog value received from the VLC800. DI=0xaa : aa gives the digital inputs coded in hexadecimal, where bit 0 = "urgent fault", bit 1 = "any fault", bit 2 = "all faults serviceable", bit 3 = "filter fault", bit 4 = "walk test". Bits 6 and 7 appear to be always 1s.

8.1.5 ST (STATUS COMMAND)

The ST command gives a self explanatory synopsis of the status of the MXP, including the version number and details of the software programmed into the Flash IC.

```
>>ST
MXP Version 1.02, compiled 15:31:03 May 07 2001

Polling Running
All NOSEx devices responding
Being polled by F4000
Responder Loop Disconnect Relay : Connected (Normal)
NOSEx loop OK
1309 polling cycles since power-up / database load
0 detector/ device leds on
```

8.1.6 ANALOG LOOP DIAGNOSTICS

8.1.6.1 TC Command (Total Counts)

This command gives totals of node failures and powerups on the analog loop. See the EC command to get values broken down to individual devices.

```
>>tc
Transmit echo reception fail count 5
Total reply fail count 191
Total device powerups 0
```

“Transmit echo reception fail count” indicates the number of times the MXP has been unable to receive its own transmission on the analog loop. This should normally increment only when the loop is subjected to abnormal events, e.g. shorts. This value is not cleared when the MXP powers up, it is only cleared by the RS command.

“Total reply fail count” increments when a device does not reply to a poll, but has not already been deemed to have failed. When a device is removed this value will increment by 12. This value is not cleared when the MXP powers up, it is only cleared by the RS command.

“Total device powerups” increments when a device powers up. This should normally increment by one for each device when the loop first powers up, and by one each time a detector is plugged into a base with the loop powered up. If it increments at other times it is indicative of a problem which requires investigation. This value is set to zero when the MXP powers up.

8.1.6.2 EC Command (Error Counts)

This command gives total error counts as per the TC command, and then also gives the reply fail counts for individual devices, and an indication of whether each device is deemed to be in “scan fail”. These individual counts are not cleared when the MXP powers up, but are reset by the RS command.

This command is also useful to determine which points are configured and what their type is.

```
>>ec
Transmit echo reception fail count 5
Total reply fail count 191
Total device powerups 0
Individual reply fail counts...
Point   1   Photo/Heat,    17 Scan Fail
Point   2      CO/Heat,     0
Point   3    Heat Only,     0
Point  20   Ionisation,     0
Point  21          MIM,     0
Point  22           CP,     0
Point  23          CIM,    54
Point  24          RIM,    54
Point  25          DIM,    24
Point  26          SNM,    54
```

8.1.6.3 RS Command (Reset)

This command resets (sets to zero) all the counters displayed by the TC and EC commands.

8.1.6.4 DP Command (Diagnostic Poll)

This command lists all the devices found (irrespective of the MX4428 programming) by issuing a command to each side of the loop (left and right) which requests all devices to identify themselves. Thus it can be used to find what devices are present on the loop and which devices are found from each end, if the loop is broken or isolator bases have opened. This can help identify which section of the loop cable is broken or shorted.

It will list devices found with any address including addresses above 200. If two or more devices are present with the same address they will usually be detected, however their replies may collide resulting in neither being detected. Therefore a second attempt is made on each line in order to maximise the chance of locating multiple devices with the same address. On the second attempt, only devices not found on the first attempt are displayed.

This command is a local version of the MX4428 DP command.

```
>>dp
>>Diagnostic Pollscan line 1
Scan attempt 1
Adr 2 : CO/Heat
Adr 3 : Heat Only
Adr 20 : Ionisation Foreign (not programmed)
Adr 21 : MIM
Adr 22 : CP
Adr 23 : CIM
Adr 24 : RIM
Adr 25 : DIM
Adr 26 : SNM
Scan attempt 2
Diagnostic Pollscan line 2
Scan attempt 1
Adr 2 : CO/Heat
Adr 3 : Heat Only
Adr 20 : Ionisation
Adr 21 : MIM
Adr 22 : CP
Adr 23 : CIM
Adr 24 : RIM
Adr 25 : DIM
Adr 26 : SNM
Scan attempt 2
Diagnostic pollscan complete
```

The DP command will note as “foreign” any devices which are found but not currently programmed. However it will not display devices which are programmed but not found. Other messages may be given, e.g. “Duplicate Device”, “Unknown Type”, “Used as Heat only”, “Used as MIM”, “Type Mismatch”.

8.1.6.5 CA Command (Change address)

The change address command may be used to change the address of a single device (the first number) on the analog loop to a new address (the second number). If devices are added one at a time, this command may be used to assign their addresses instead of using the programming tool. New devices from the factory normally have an address of 255.

Both new and old addresses may be any number greater than 0 and up to 255. Addresses between 201 and 255 will be inaccessible to the MX4428.

```
>>ca 20 100
Re-address device 20 to 100 ?y
Verify OK
```

The MX4428 configuration is not altered by this command.

If there is no device with the old address, or if there is already a device with the new address, an error message will be displayed and the change will not be made.

Normal polling resumes when the command is completed.

8.1.7 ADVANCED COMMANDS

The following commands are available for specialised purposes. Use these commands only as instructed by Tyco Safety Products Christchurch.

```
>>ah
Advanced diagnostic commands.
Use these commands only as instructed by Tyco Safety Products
Chrsitchurch

------- General -----------------------------------
RD      : relay diagnostics toggle
MEM     : memory diagnostics menu
TASK    : display task times
STACK   : display stack free space
STANDALONE a b : standalone operation, heat threshold=a, step limit=b
------- Point Record diagnostics ------------------
PR n    : show point n record
NR      : show next record
LR      : show last record
AR      : show next assigned record
SR      : show selected point records
DD      : point record description
-------- NOSEx loop/device diagnostics -------------
NC      : NOSEx comms log toggle
DR d e  : Read eeprom address e from device address d
DW d e x: Write x to eeprom address e of device address d
        : d is in decimal, e and x in hexadecimal
FP a b x y: force points a to b analog values x,y
```

8.1.8 MX4428 DIAGNOSTICS

Several commands are available on the MX4428 “Analog Diagnostics” (DG then DA) menu which affect the MXP.

These commands are as follows

FP r p Set the LED of point **p** on responder **r** to flash when polled.
LN r p Turn on steady the LED of point **p** of responder **r**.
L1 r Poll all points of responder **r** using line 1 (“left”) only. Any failures to respond will be treated as usual i.e. will generate “node fail” events.
L2 r Poll all points of responder **r** using line 2 (“right”) only. Any failures to respond will be treated as usual i.e. will generate “node fail” events.
P1 r p Poll point **p** only of responder **r** using line 1 (“left”) only.
P2 r p Poll point **p** only of responder **r** using line 2 (“right”) only.
FO, LO, or PO Any of these commands cancels all the above special functions.

DP r	Perform a “diagnostic poll” on responder **r.** This command initiates a diagnostic poll, similar to that described in section 8.1.6.4. The results are displayed automatically on the MXP but not the MX4428. To see the results on the MX4428 use the **DR** command.
DR r	Display the results from the last **DP** command on responder **r**. (Use this command at least 30 seconds after a **DP** command.)
GH r	Reset history of all points on responder **r**.
GT r	Reset tracked values (clean air values) of all points on responder **r**.
RH r p	Reset history of point p on responder **r**.
RT r p	Reset tracked value (clean air value) of point **p** on responder **r**.

The above commands are described in more detail in the F4000 Programming manual.

The remaining commands on the DA menu may display returned values from the MXP, but have no direct affect on the MXP.

8.1.9 MXP EVENT LOG

Some events at the MXP are logged to the diagnostic terminal regardless of whether any points are selected for display or commands entered at the MXP. These events are generally self explanatory, and include –

- MXP Powering up (logs message and displays diagnostic help menu.)
- MXP Major state change including Initial Powerup state, Sending Learn Information, Acquiring Database, Normal Running.
- System test and Autotest initiated from MX4428, and result thereof.
- Diagnostic Pollscan initiated from MX4428.
- Pollscan to “Learn” system configuration initiated from MX4428.

8.2 FLASH PROGRAMMING

On occasion, Tyco Safety Products Christchurch may provide a new version of the MXP software. This software is stored in the Flash IC, U2. It can be updated in the field as described below.

8.2.1 FILES REQUIRED

The following files will be supplied for a Flash software version update –

MXP.MXP	Flash contents in special format
FLASHPGM.S19	Flash programming program to run in MXP
MXPPROG.EXE	Flash programming program to run in PC (for DOS)
MXPPROG32.EXE	Flash programming program to run in PC (for WIN32)

All of these files should be in the same drive / directory, on a floppy disk or the hard disk.

8.2.2 PROCEDURE

1. The MXP must be powered up either from the responder loop or an external 24V power supply.
2. Make a note of the current DIP switch settings on the MXP, then set all DIP switches OFF.
3. Connect the PC to the MXP programming port with an F4000 programming lead.
4. If the PC is running DOS or Windows 3.x run the program MXPPROG from a DOS prompt in the directory with the files. If you are using a COM port other than COM1 include the name of the port on the command line e.g. “MXPPROG COM2”.
5. If the PC is running any 32 bit Windows variant (95, 98, NT, ME, 2000, XP etc) run the program MXPPROG32. (You can do this by typing MXPPROG32 from a command prompt in the directory with the files, or by double clicking MXPPROG32.EXE in Windows Explorer or My Computer. If you are using a COM port other than COM1 you will need to include the port name on the command line, the easiest way to do this is from a command prompt.)
6. Insert the WRITE ENABLE link (LK1) on the MXP.
7. Press the RESET button on the MXP.
8. The programming procedure is now automatic. A typical screen log of this automatic procedure is shown below –

```
MXP Terminal / Flash Programmer. Type ESC at any time to exit

To program flash with new version ...
Switch all MXP DIP switches OFF, insert FLASH WRITE ENABLE LINK and press reset
Don't type keys while program is running (except ESC to exit if needed)

To use as a terminal ...
Just type your commands, HE<Enter> for help

=====================================================
MXR Boot ROM V1.01. Address = 127, Switch 8 = 0
Valid application program in flash

BOOT : Waiting for load
********************************************************************************
********************************************************************************
********************************************************************************
***************************************************************
Loaded OK
Running from Start address (8000)

=====================================================
MXR Flash Programmer V1.11.

1 : Erase Entire Flash (all unprotected blocks)
3 : Load MXR Binary File and Program into Flash
```

```
4 : Flash Information
1
Erasing, wait
Erase OK

1 : Erase Entire Flash (all unprotected blocks)
3 : Load MXR Binary File and Program into Flash
4 : Flash Information
3

FlashPgm : Waiting for load
0134d0 bytes
000000
001000
002000
003000
004000
005000
006000
007000
008000
009000
00a000
00b000
00c000
00d000
00e000
00f000
010000
011000
012000
013000

Loaded
Checksum is correct
Done, Switch MXP DIP switches normal,
remove FLASH WRITE ENABLE LINK and press reset

MXR Flash Programmer V1.11.

1 : Erase Entire Flash (all unprotected blocks)
3 : Load MXR Binary File and Program into Flash
4 : Flash Information
```

9. If the above does not happen, check that all the required files are present, check the DIP switch settings and WRITE ENABLE link and try starting again from the beginning - exit from the program MXPPROG.EXE or MXPPROG32.exe by typing <ESC> and restart it, the press the MXP RESET button again. If there is still a problem obtain a fresh copy of the files and try again. If the problem persists, note carefully exactly what is displayed on the screen and contact Tyco Safety Products Christchurch.
10. Remove the WRITE ENABLE link, or insert it onto one pin only.
11. Reset the DIP switches to the original settings noted in step 2.
12. Press the reset button.

13. Check the display on the terminal emulator to ensure the program runs and the new version is installed. An example of the output on power up is shown below. Note that some of this may scroll off the screen, however the "MXP Monitor version x.xx ..." line should be visible and will enable you to verify the new version. If necessary type ST <Enter> to see the version.

```
=====================================================
MXR Boot ROM V1.01. Address = 99, Switch 8 = 1
Valid application program in flash
Jumping to application program


**************************************************************
MXP Version 1.02 Powered Up
Address 99
Initial Power Up State


***   MXP monitor version 1.02 (c)2000   ***
```

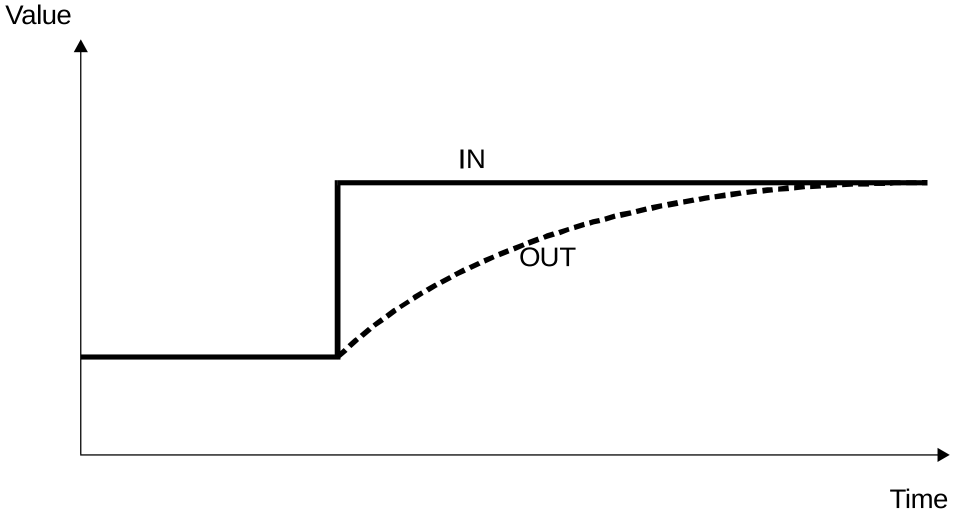
(menu follows)

14. Write the new software version (1.02 in this example) on the label of the Flash IC, U2.

CHAPTER 9
DEVICE PROCESSING

9.1 EXPONENTIAL FILTER

An “exponential filter” is used to smooth values received from all detector types and remove “noise”.



This is a kind of moving average of recent samples, with the most recent samples given the most weighting. The output of the filter will exponentially approach the input (like an electronic RC filter).

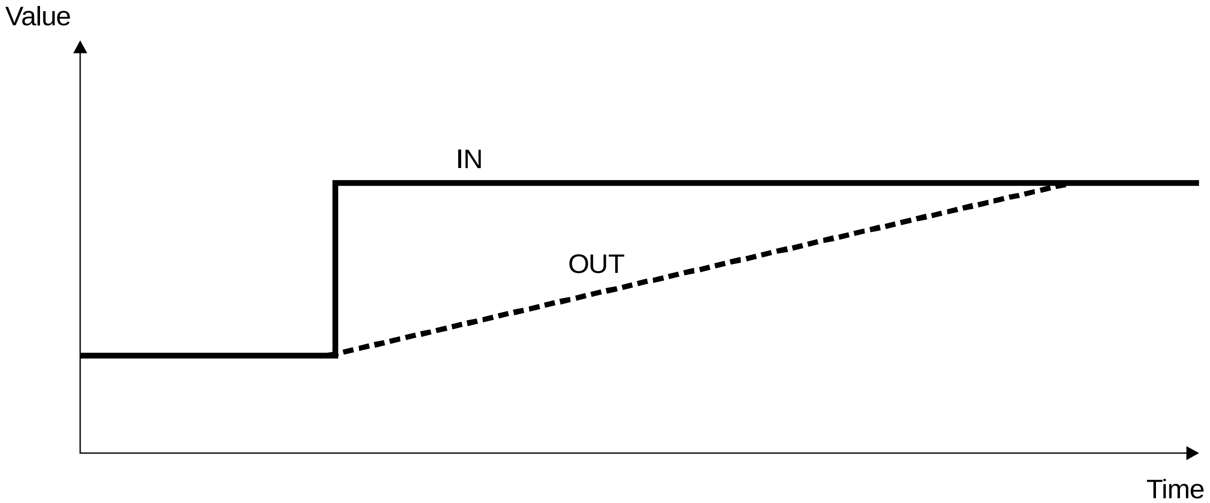
$OUT_n = OUT_{n-1} + (IN - OUT_{n-1}) / FD$.

FD is the filter divisor. The bigger FD, the slower the filter.

This filter usually requires calculation using units much smaller than the units being filtered. For instance it could use floating point arithmetic or integer arithmetic using units of 1/256 of the “detector units”. Conversion from the calculation units back to detector units should use rounding rather than truncation.

9.2 STEP LIMITING FILTER

“Step Limiting” is used after the exponential filter on all detector types, to reduce sensitivity to large short term changes in input values which may represent false alarms.



The output of the filter approaches the input with a maximum slope, or maximum step on each sample.

$ADJ = IN - OUT_{n-1}$
IF ADJ > SL THEN ADJ = SL
IF ADJ < -SL THEN ADJ = -SL
$OUT_n = OUT_{n-1} + ADJ$

SL is the step limit for each sample period. The smaller SL the slower the filter.

9.3 HEAT PROCESSING

9.3.1 CONVERSION OF DETECTOR READING TO °C

The temperature readings from the detector (814H or the temperature element of an 814PH or 814CH) are returned from input AI1 of the MX ASIC. These are converted to °C according to the following table. This gives the closest temperature for each reading.

Rdg	°C	Rdg	°C	Rdg	°C	Rdg	°C	Rdg	°C	Rdg	°C	Rdg	°C
0	Fault	40	7	80	26	120	42	160	59	200	80	240	120
1	Fault	41	7	81	27	121	42	161	59	201	81	241	120
2	Fault	42	8	82	27	122	43	162	60	202	82	242	120
3	Fault	43	8	83	28	123	43	163	60	203	83	243	120
4	Fault	44	9	84	28	124	44	164	60	204	84	244	120
5	0	45	9	85	28	125	44	165	61	205	85	245	120
6	0	46	10	86	29	126	44	166	61	206	85	246	120
7	0	47	10	87	29	127	45	167	62	207	86	247	120
8	0	48	11	88	30	128	45	168	62	208	87	248	120
9	0	49	12	89	30	129	45	169	63	209	88	249	120
10	0	50	12	90	30	130	46	170	63	210	89	250	120
11	0	51	13	91	31	131	46	171	64	211	90	251	Fault
12	0	52	13	92	31	132	47	172	64	212	90	252	Fault
13	0	53	14	93	32	133	47	173	65	213	91	253	Fault
14	0	54	14	94	32	134	48	174	65	214	92	254	Fault
15	0	55	15	95	32	135	48	175	66	215	93	255	Fault
16	0	56	15	96	33	136	48	176	67	216	94		
17	0	57	16	97	33	137	49	177	67	217	95		
18	0	58	16	98	34	138	49	178	68	218	95		
19	0	59	17	99	34	139	50	179	68	219	97		
20	0	60	17	100	34	140	50	180	69	220	98		
21	0	61	18	101	35	141	50	181	69	221	99		
22	0	62	18	102	35	142	51	182	70	222	100		
23	0	63	19	103	35	143	51	183	70	223	102		
24	0	64	19	104	36	144	52	184	71	224	103		
25	0	65	20	105	36	145	52	185	72	225	104		
26	0	66	20	106	37	146	53	186	72	226	105		
27	0	67	20	107	37	147	53	187	73	227	107		
28	0	68	21	108	37	148	53	188	73	228	108		
29	0	69	21	109	38	149	54	189	74	229	109		
30	0	70	22	110	38	150	54	190	74	230	110		
31	0	71	22	111	39	151	55	191	75	231	112		
32	1	72	23	112	39	152	55	192	75	232	114		
33	2	73	23	113	39	153	55	193	76	233	115		
34	3	74	24	114	40	154	56	194	77	234	117		
35	3	75	24	115	40	155	56	195	77	235	119		
36	4	76	25	116	40	156	57	196	78	236	120		
37	5	77	25	117	41	157	57	197	79	237	120		
38	5	78	25	118	41	158	58	198	79	238	120		
39	6	79	26	119	42	159	58	199	80	239	120		

The temperature is then processed according to Figure 9.1 to generate the various alarm and pre-alarm conditions. The RORCV value is also used for enhancement of the smoke or CO values when this is enabled.

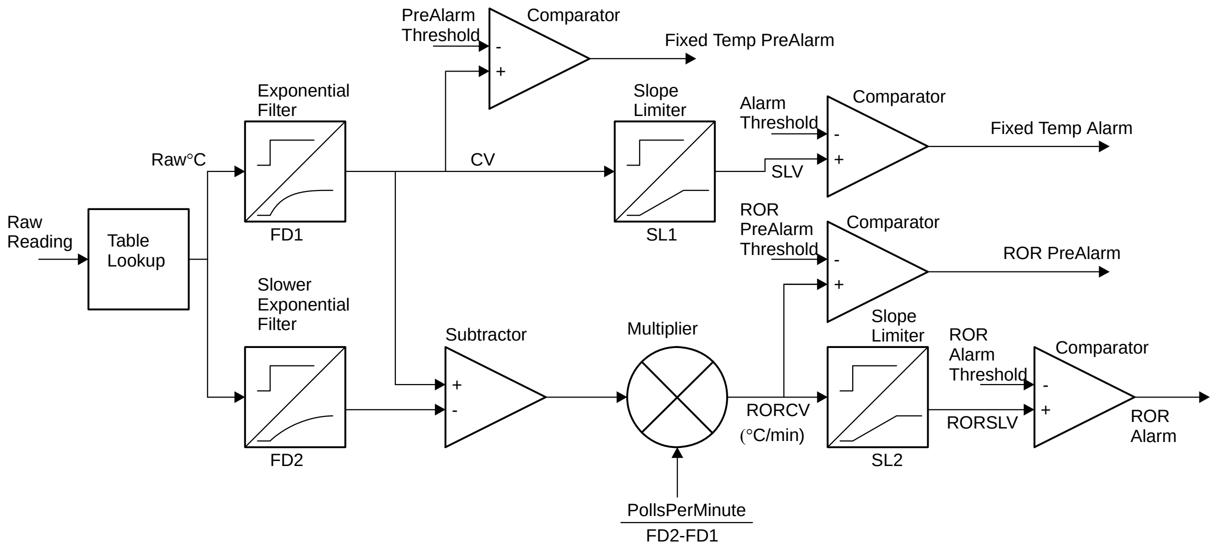


Figure 9.1 Heat Processing Diagram

9.4 PHOTO PROCESSING

9.4.1 SMARTSENSE PROCESSING

The smoke reading of the detector is returned as input AI0 from the device ASIC. Figure 9.2 shows a general view of the processing of the values received from the photoelectric sensor. It is of interest that the value is multiplied by a factor (between 1 and 4) depending on the factory calibration of the sensor, and again multiplied by a factor depending on the temperature rate of rise (when “enhanced” operation is selected). In both cases the “tracked value” is subtracted, the multiplication applied, and the “tracked value” added back in. This is so that all scaling occurs relative to the clean air value.

When the MXP or detector powers up the clean air value or “tracked value” is initially set to the average of the reading from the detector after about 30 seconds and the value stored in the detector EEPROM, and then may continue to track up or down by 1 each poll for the next 3 minutes.

When the “tracked value” is reset manually by command from the MX4428, it is set to a value which will make CV equal to TV. Unless the calibration factor is exactly 1.0, the new TV is not simply the same as the previous CV.

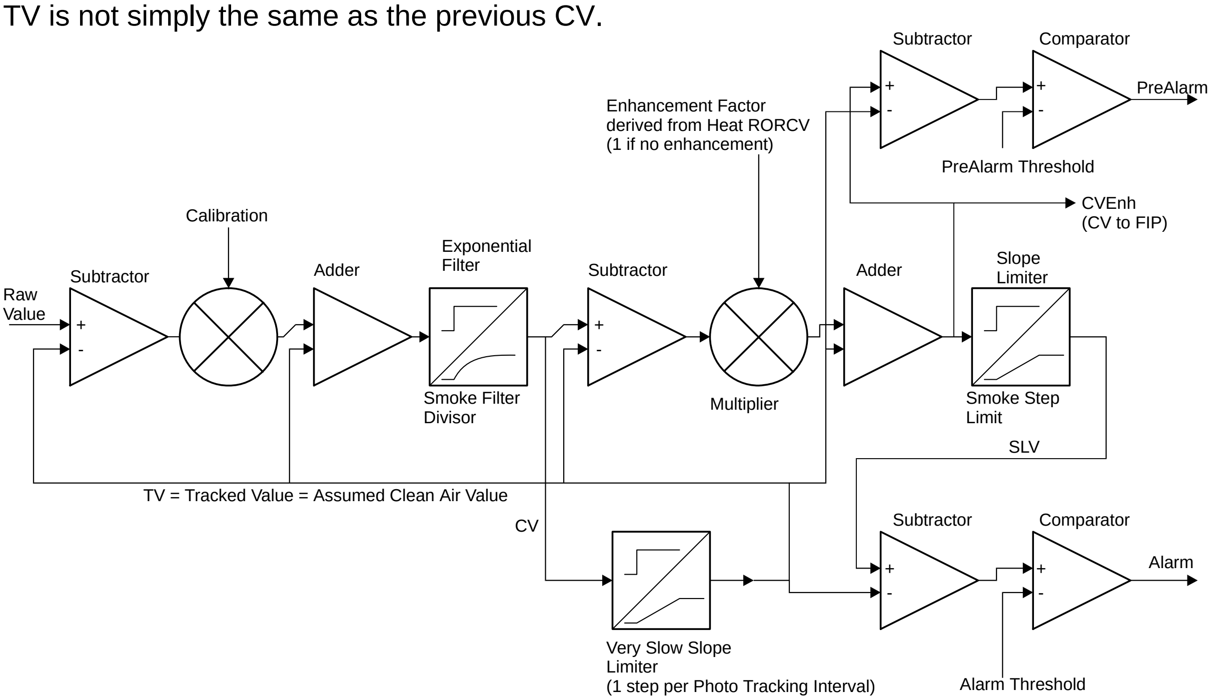


Figure 9.2 Photo Processing Diagram - SmartSense

9.4.2 SMARTSENSE ENHANCEMENT

Figure 9.3 shows the amount by which smoke readings are increased depending on the temperature rate of rise.

The default enhancement multiplier parameter is 12. The graph (Figure 9.3) shows the effect of this factor and also the effect of an alternative parameter of 6.

If enhancement is disabled, (or less efficiently if the enhancement multiplier parameter is set to 0) the multiplier is exactly 1.

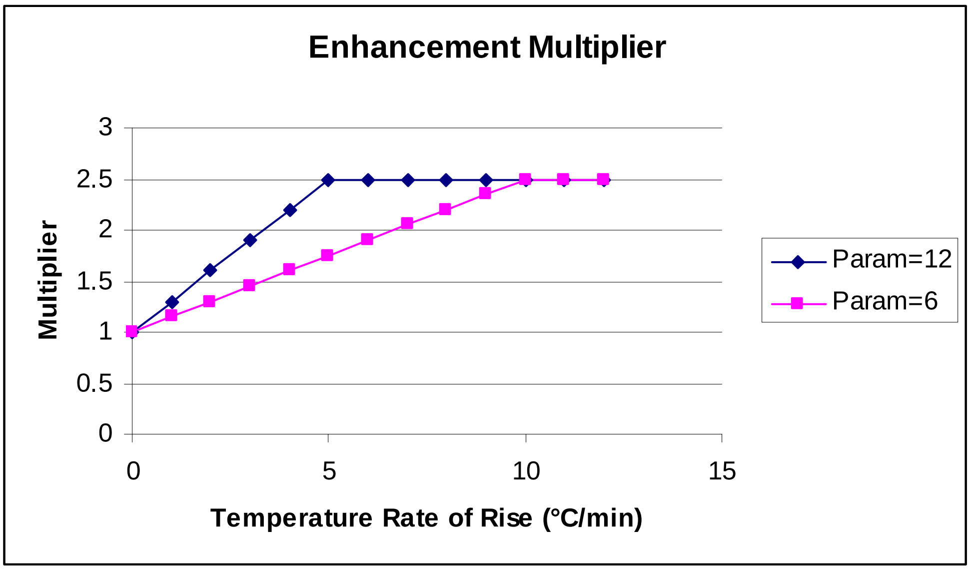


Figure 9.3 Enhancement of smoke reading for temperature rate of rise

9.4.3 FASTLOGIC PROCESSING

When "FastLogic" is selected, most processing is done within the proprietary "FastLogic" module. The internals of that module are beyond the scope of this manual.

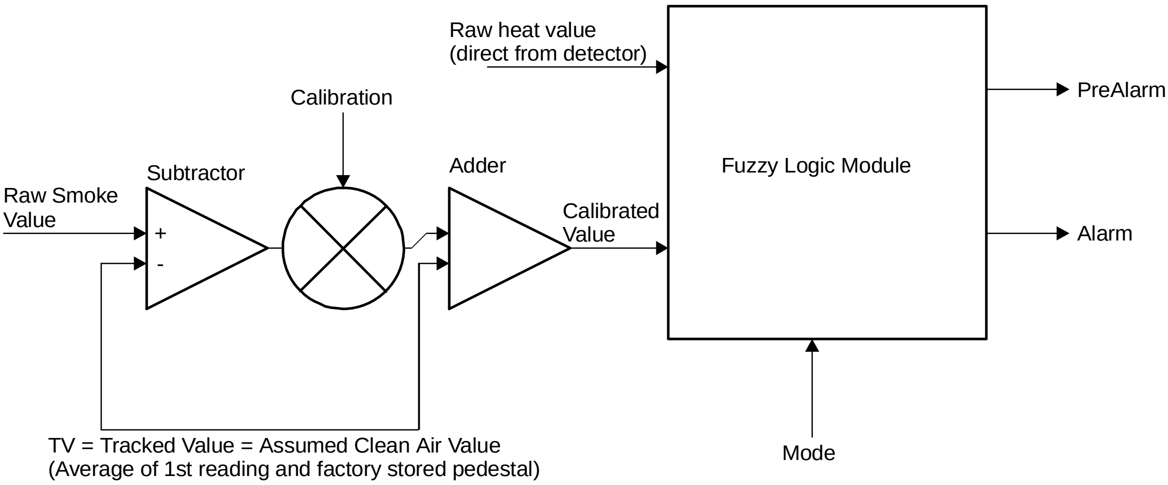


Figure 9.4 Photo Processing Diagram - FastLogic

9.5 CO PROCESSING

9.5.1 CALIBRATION AND TEMPERATURE COMPENSATION

The CO reading of the detector is returned as input AI0 of the device ASIC. The CO readings are adjusted depending on a calibration factor set at the factory and stored in EEPROM.

9.5.2 "ENHANCEMENT"

Figure 9.3 shows the amount by which CO readings are increased depending on the temperature rate of rise. (This is the same for the CO detector as the Photo detector.)

The default enhancement multiplier parameter is 12. The graph (Figure 9.3) shows the effect of this factor and also the effect of an alternative parameter of 6.

If enhancement is disabled, (or less efficiently if the enhancement multiplier parameter is set to 0) the multiplier is exactly 1.

9.5.3 CO PROCESSING

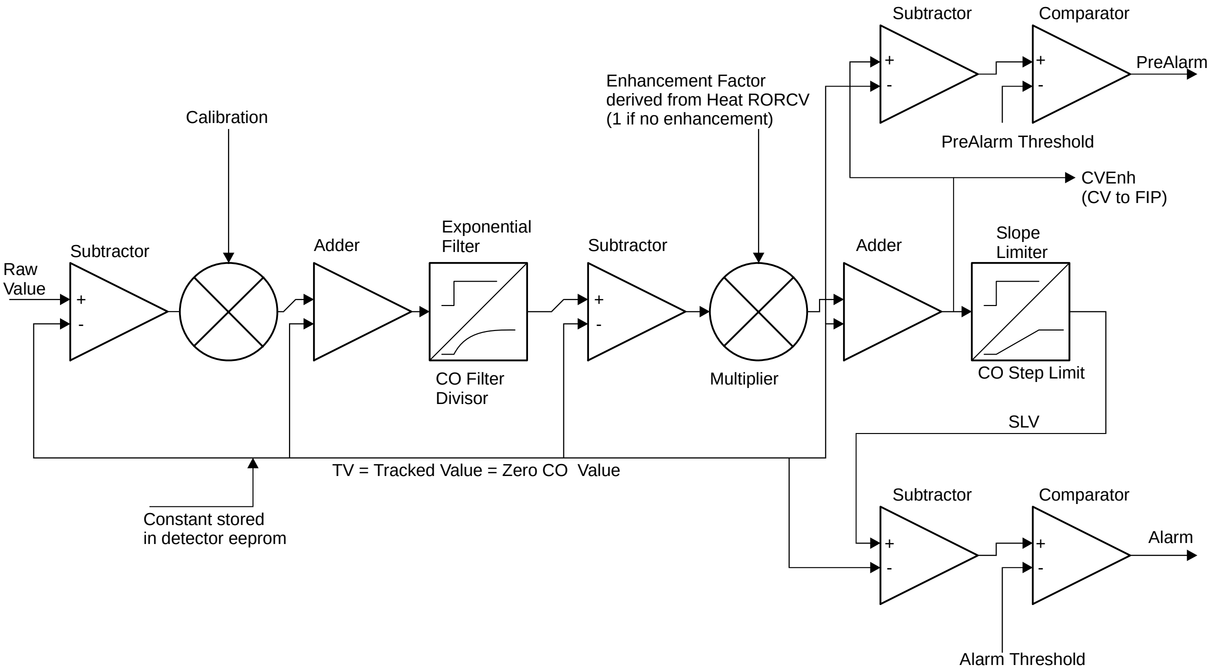


Figure 9.5 CO Processing Diagram

9.6 IONISATION PROCESSING

The smoke reading of the detector is returned in two parts as inputs AI0 and AI1 of the device ASIC. In the MXP the **average** value of AI0 and AI1 is used for all calculations, so that all returned values to the MX4428 lie within the range of 0 – 255. (Note that TEPG literature refers to the **sum** of the two inputs.)

The processing is shown in Figure 9.6. The tracked value is initialised by setting it to a high value (100) when the MXP or detector powers up, and allowing the tracked value to increment / decrement by 1 for each of the first 4 minutes.

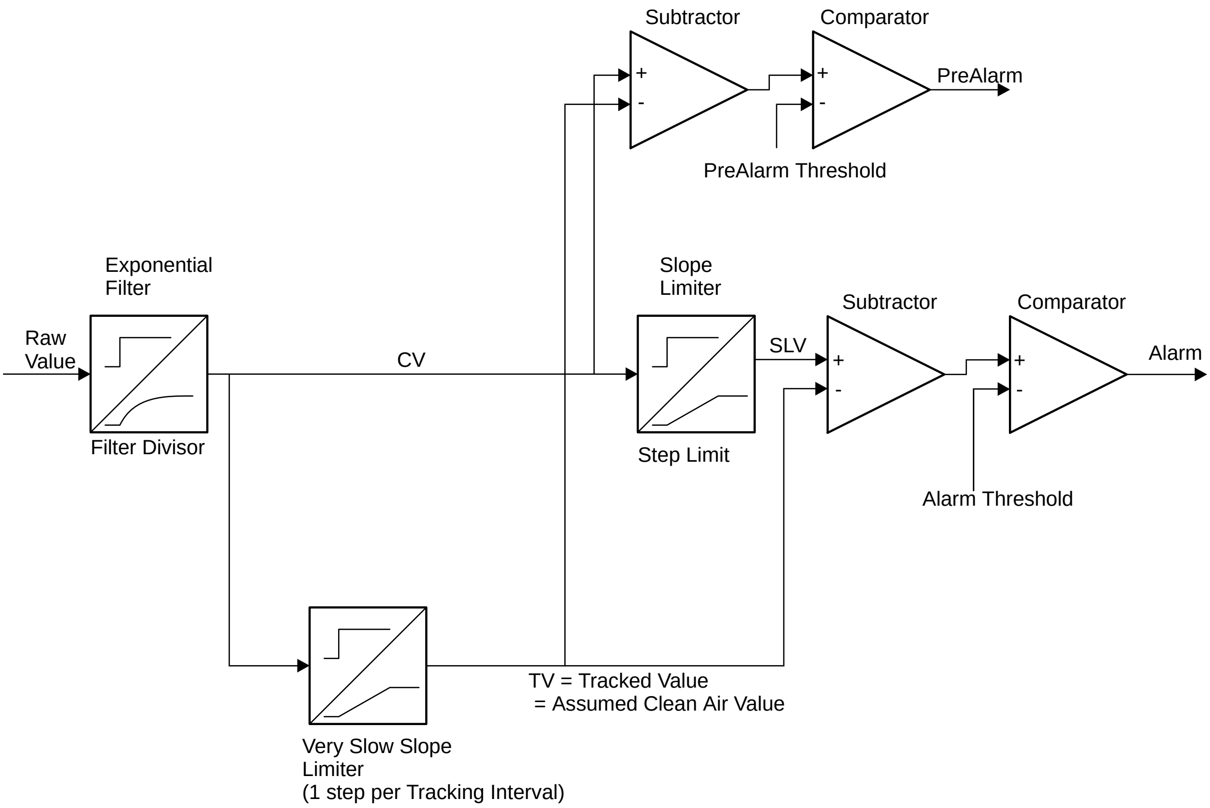


Figure 9.6 Ionisation Detector Processing

9.7 MIM800 / CIM800 / MIM801 PROCESSING

The MIM800 and CIM800 return a value which depends on the external resistance across the contact terminals and which can be modelled by the equation –

VALUE = 226 * (150 + 3) / (150 + Rext + 3)

The MIM801 returns a value which depends on the external resistance across the contact terminals and which can be modelled by the equation –

VALUE = 226 * (Rext + 3) / (150 + Rext + 3)
(unless Rext is open circuit, then value = 255)

(Note 150 represents an internal 150Ω resistor, 3 represents a 3Ω FET on resistance, and 226 represents (3.3V - DIODEV) / 3.3V * 255

Graphs of these values are show in Figure 9.7. Also shown are the default thresholds, and the interpretations of the input ranges between the thresholds.

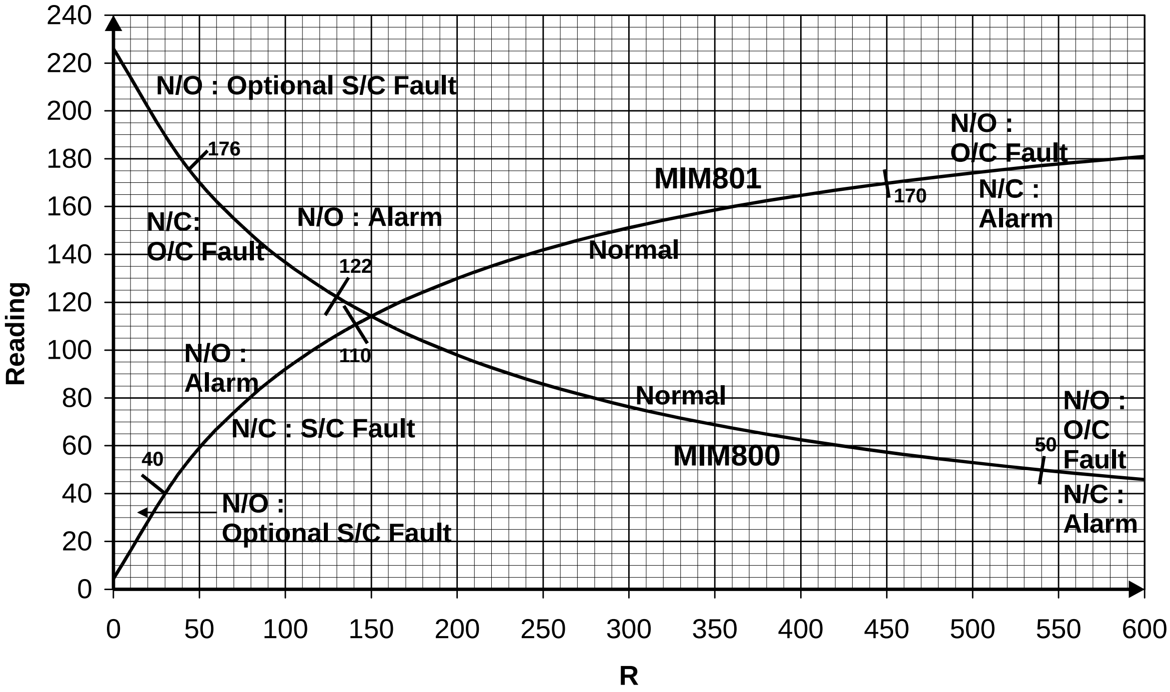


Figure 9.7 MIM800 / MIM801 Reading versus resistance

The usual parameters are as follows –

	MIM800 / CIM800			MIM801		
	P0	P1	P2	P3	P4	P5
No alarm resistor (Default)	122	50	0	110	170	0
With alarm resistor			176			40

These are designed for the following configurations–

Device	Mode	Contact R	EOL R	Max Wiring R
MIM800 CIM800	N/O	Not used	200Ω	50Ω
	N/O	100Ω	200Ω	10Ω
	N/C		200Ω	50Ω
MIM801	N/O	Not used	200Ω	50Ω
	N/O	100Ω	200Ω	10Ω
	N/C		200Ω	50Ω

Parameters for alternative contact and EOL resistors could be derived from the graphs in Figure 9.7.

9.7.1 ALGORITHM - MIM800, CIM800

The unverified input condition is evaluated according to the following table, depending on the mode (N/O or N/C) and the values of parameters P0, P1, and P2.

P2=0	**P2 not = 0**	**N/O**	**N/C**
	P2<=reading<=255	Short circuit fault	Short
P0<=reading<=255	P0<=reading<P2	Alarm	
P1<=reading<P0	P1<=reading<P0	Normal	Normal
0<=Reading < P1	0<=Reading < P1	Open circuit fault	Alarm

Changes in these states are verified as described in section 9.22.

For the CIM800, if either input is in fault, the point will be in fault. If either input is in alarm, the point will be in alarm. It may therefore be in fault and alarm at the same time.

9.7.2 ALGORITHM - MIM801

The unverified input condition is evaluated according to the following table, depending on the mode (N/O or N/C) and the values of parameters P0, P1, and P2

P5=0	**P5 not = 0**	**N/O**	**N/C**
P4<=reading<=255	P4<=reading<=255	Open circuit fault	Alarm
P3<=reading<P4	P3<=reading<P4	Normal	Normal
0<=Reading < P3	P5<=Reading < P3	Alarm	Short circuit fault
	0<=Reading < P5	Short circuit fault	

Changes in these states are verified as described in section 9.22.

9.8 DIM PROCESSING

9.8.1 LOAD GRAPH

Figure 9.8 shows the V / I characteristics for the DIM detector terminals, together with the fault and alarm thresholds when using the default parameters. The shaded areas show the region of uncertainty.

Three lines are shown for three supply voltages.

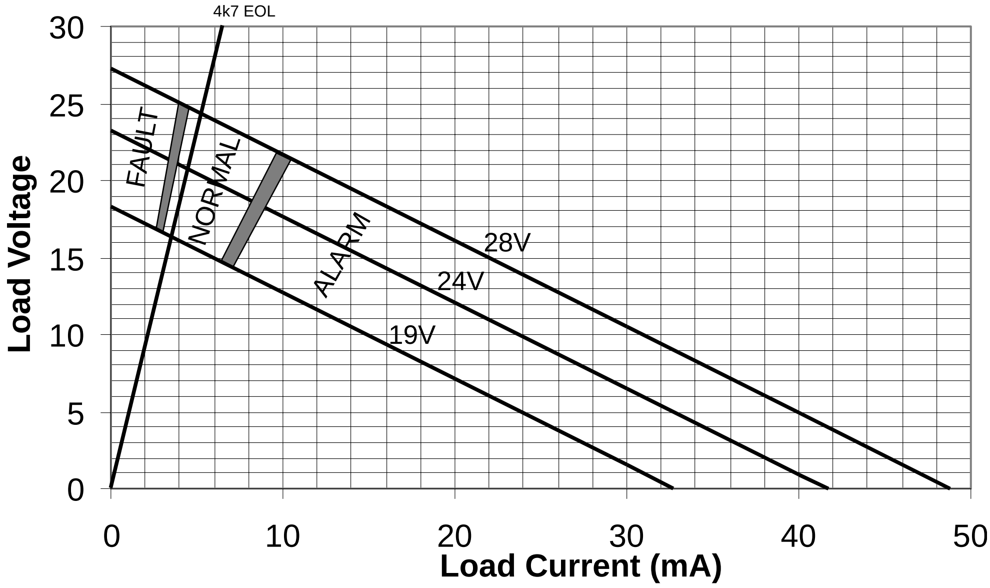


Figure 9.8 DIM LoadLine Characteristics

9.8.2 DIM MODEL

The reading from the DIM module can be modelled using the following method.
Calculate “R” from a point on the load line = Load Voltage / Load Current.
Reading = 137000 / (560 + R)

For example take the point where the 4k7 EOL resistor crosses the 24V line.
R = 20.8 / .0044
= 4700
Reading = 137000 / (560 + 4700)
= 26

Note that for a given “R”, the reading is independent of the supply voltage.

9.8.3 ALGORITHM - DIM800

The unverified input condition is evaluated according to the following table, depending on the values of parameters P1, P2, and P4. (if P4 is 0, assume it is 225).

Input	Condition (Mode 0)	Condition (Mode 1)
P4 <= reading <= 255	Alarm	Short
P1 <= reading < P4	Alarm	Alarm
P2 <= reading < P1	Normal	Normal
0 <= reading < P2	Open circuit fault	Open circuit fault

Changes in these states are verified as described in section 9.22.

9.8.4 SUPPLY MONITORING - DIM800

The DIM800 supply is monitored with input AI3 of the device ASIC. If the supply voltage is less than 18V, a SUPPLY FAIL fault is generated. (The threshold can be changed with parameter 3 if needed.) If the supply fails completely, a DIM800 with revision less than 10 will stop responding to polls and a NODE FAIL fault is generated.

9.9 RIM PROCESSING

9.9.1 POSITION MONITORING

Correct Relay state	DI0	Condition
Not activated	0	OK
	1	Relay Stuck
Activated	0	Relay Stuck
	1	OK

Changes in these states are verified as described in section 9.22. Verified faults representing a “relay stuck” condition are logged as CONTROL CB FAIL at the MX4428, with the return to normal event logged as CONTROL CB NML.

9.10 SNM PROCESSING

9.10.1 PROGRAMMING

Supply Monitoring Required	DO6
No	1
Yes	0

9.10.2 SUPPLY FAULT DETERMINATION

Input AI1	Condition
AI1 > P3	Supply Fault
AI1 <= P3	Supply OK

Note that Parameter 3 cannot reliably be adjusted to monitor supplies of different voltages.

9.10.3 EOL AND POSITION MONITORING

Correct Relay Position	AI0	Condition
Not activated	P1 < AI0 <= 255	Open circuit fault
	P2 <= AI0 <= P1	Normal
	0 <= AI0 < P2	Short circuit fault
	Any	No Position Fault
Activated	Any	No Open Circuit Fault No Short Circuit Fault
	P1 <= AI0 < 255	No Relay Stuck Fault
	0 <= AI0 < P1	Relay Stuck Fault

Changes in these states are verified as described in section 9.22.

Both short circuit faults and open circuit faults will be logged as SUPERVISION FAULT, and relay stuck faults will be logged as CONTROL CB FAIL. Only the first fault will be logged. When all relay faults go away, the event logged at the MX4428 will be NORMAL OFF or NORMAL ON as the case may be, regardless of the original fault logged.

9.11 LPS PROCESSING

9.11.1 ELD AND POSITION MONITORING

Correct Relay Position	AI0, AI1	Condition
Not activated	AI0 > 200 AND AI1 < 50	Open circuit fault
	50 < AI0 <= 110	Short circuit
	0 <= AI0 <=50	Relay fault
	Otherwise	Normal
Activated	AI0 > 50	Relay Fault
	AI0 <= 50 AND AI1 <= 50	Short circuit
	AI0 <= 50 AND 50 < AI1 <= 200	Relay Fault
	Otherwise	Normal

Changes in these states are verified as described in section 9.22.

Both short circuit faults and open circuit faults will be logged as SUPERVISION FAULT, and relay stuck faults will be logged as CONTROL CB FAIL. Only the first fault will be logged. When all relay faults go away, the event logged at the MX4428 will be NORMAL OFF or NORMAL ON as the case may be, regardless of the original fault logged.

9.12 VLC800 PROCESSING

9.12.1 GENERAL

The VLC800 is processed like an 814PH, with the following parameters.
Tracked Value is fixed at 12.
Alarm Threshold is fixed at 100. (Corresponding to a raw value of 112).
Filter Divisor is fixed at 3.
Step Limit is 255 (so essentially there is no step limit).
PreAlarm is adjustable at the MX4428.

So the only filtering is the exponential filter with a filter divisor of 3. This gives some filtering, but with a minimal delay.

As the alarm threshold is always 100, the current level (CV-TV) is an indication of the smoke level in terms of % of the alarm threshold programmed into the VLC800 itself.

9.13 FILTER STEP LIMITS

Note that Step Limits are always expressed as “Units per 5 seconds”. This differs from MPR where heat units are “units per 10 seconds”, but smoke limits are “time to alarm” (the inverse). The MXP change results in

- Heat and smoke being consistent with each other.
- Using a constant slope, rather than a constant time to alarm, as the threshold is varied, means that increasing the alarm threshold also means that the minimum time to alarm will be increased which is generally what would be expected. This gave better results with the various sensitivities of the photo detector in the SSL test room, i.e. a constant Step Limit could be used for all sensitivities.

9.14 ZONE ALARM TEST

A zone alarm test performs a test in the detector for all detectors in a zone which are capable of supporting it viz 814PH, 814CH, and 814I. The Detector LEDs do not operate. No filtering is applied during remote tests and the fuzzy logic is replaced by a simple comparison test. Any devices already in alarm, prealarm or fault, or isolated, do not partake in the test.

Failure of a capable detector to produce the expected output generates an immediate fault.

The actual alarm returned to the MX4428 goes through AVF if programmed.

The MXP does not return “Test Pass” until all alarm-capable devices in the circuit go into alarm.

9.15 ZONE FAULT TEST

No MX detectors are capable of a remote fault test. Therefore with all detectors and devices a fault is simulated in polling software.

“Test Pass” requires all devices in the circuit to pass.

9.16 AUTOTEST AND SYSTEM TEST

The Flash Checksum is checked. (Note also, a checksum fail on power up will result in the MXP application software not even starting, but the MXP will await a program load via its diagnostic port.)

Specific checking of the configuration RAM is not required as it is being continually checked (with anomalies resulting in a download request from the MX4428).

For an autotest where remote device testing is enabled in the MX4428, and for all system tests, all detectors which are capable of a remote alarm test are tested. The LEDs do not operate and no alarms caused only by the remote test are returned to the MX4428. A device with an external wiring fault or which is isolated, or in alarm or pre-alarm, is not subject the test and is not reported. A device with a fault, other than external wiring, or which is in scan fail scan fail, or relay checkback fail, or type mismatch, results in failure of the test (abnormal at start). No filtering is applied during remote tests.

9.17 NON LATCHING TEST MODE

In this mode no alarms are latched, and all filtering is bypassed, however detector and device LEDs follow the alarm status. About 10 seconds after a device goes into alarm it is automatically “held in reset” for about 10 seconds, and then sampling starts again from the beginning.

9.18 COMMISSION MODE

Filtering is speeded up or bypassed. AVF is bypassed.

9.19 FAST POINT TEST

A point which supports remote test is put into alarm by its remote test facility. A point which does not support remote test is put into alarm by simulating a high reading. Filtering is speeded up or bypassed. AVF is bypassed.

9.20 SLOW POINT TEST

A point which supports remote test is put into alarm by its remote test facility. A point which does not support remote test is put into alarm by simulating a high reading. Filtering and AVF operate normally.

9.21 SUMMARY OF ALL TEST MODES

Table 9-1 shows the features of the various alarm tests which may be applied to detectors and input ancillary devices.

Note that there is no remote test facility on a 8xxH heat detector or on the heat component of a 8xxPH or 8xxCH detector. On MX4428 there is no way to specify an alarm test on the heat component of an 8xxPH or 8xxCH detector.

	AutoReset	Commission Mode	Zone Alarm Test	System test. Auto test with test fire	Fast Point Test	Slow Point Test	Normal
Detector test applied	No		Yes on smoke / CO (Alarm result simulated on 8xxH ie Heat only detector and on ancillary input modules)			Yes on smoke / CO. Simulated 100°C on 8xxH. Simulated alarm on ancillaries.	No
FastLogic	Switches to SmartSense					As cfgd	As cfgd
Filter Divisor	2 on Smoke / CO As cfgd on heat		1 (bypassed)			As cfgd	As cfgd
Enhancement	None		None			None	As cfgd
Step Limit	Bypassed		Bypassed			As cfgd	As cfgd
AVF	Bypassed		As cfgd on DIM. Bypassed on analog detectors	N/A	Bypassed	As cfgd	As cfgd
Detector / Anc LED operates	Yes		No	No	Yes	Yes	Yes
Circuit / zone goes into alarm	Yes - but zone isolated at FIP	Yes	When ALL points in alarm	No	Yes	Yes	When alarm condition reached
Point alarm generates event	Yes	Yes	No	No	Yes	Yes	Yes
History high, low updated	No	Yes	No	No	No	No	Yes
Tracking updated	No	Yes	No	No	No	No	Yes
FIP CV Updated	Yes	Yes	No	No	No	Yes	Yes
Reset terminates test	No effect at MXP				Yes	Yes	N/A

Table 9-1 Test Modes Summary

9.22 ANCILLARY FILTERING

If a poll returns the alarm state, then up to 5 immediate re-polls are made. If all these are still in the alarm state then an alarm is generated. If one of the succeeding polls is not in the alarm state, then immediate re-polling stops, but an up-down counter will be retained for the next poll. This counter counts up when an alarm condition is measured, and down when a non-alarm condition is measured. So if there are 5 polls in the alarm state then 1 non alarm the counter will be left at 4. On the next scheduled poll the counter starts from the value it had previously, so only 2 successive polls returning the alarm condition will be required to reach the alarm condition.

The up-down counter always counts up and down (between 0 and 6) depending on whether an alarm condition or not is read from the detector. When the counter reaches 6 a filtered alarm state is generated. When the counter reaches 0 a filtered non-alarm condition is determined. An immediate re-poll is done if the last poll is in the opposite state to the filtered state.

Ancillary faults are filtered in the same way, except that only 4 polls are needed rather than 6, and there is no immediate re-polling, 4 polls 5 seconds apart are required.

9.23 RESET

9.23.1 RESET OF ADDRESSABLE DETECTOR

For about 20 seconds after reset is applied to an addressable detector, the exponential filter and slope limiting filter are disabled if their input values are less than their output values. In other words their outputs will follow their inputs downwards with no filtering. However increases in input values will be filtered as usual.

If the LED is latched on due to a previous alarm it will be turned off.

The state of any AVF applied to the detector is reset to the “no-alarm” quiescent state.

RESET has no effect on 814PH detectors operating in “FastLogic” mode.

9.23.2 RESET OF DIM MODULE

Power is removed from the attached conventional detectors for about 5 seconds. Then power is re-applied, and sampling resumes 5 seconds later.

If the DIM module LED is latched on due to a previous alarm it will be turned off.

The state of any AVF applied to the detector is reset to the “no-alarm” quiescent state.

9.23.3 RESET OF ANCILLARY INPUT DEVICE

If the LED is latched on due to a previous alarm it will be turned off.

The state of any AVF applied to the detector is reset to the “no-alarm” quiescent state.

9.23.4 RESET OF ANCILLARY OUTPUT DEVICE

No action.

9.24 DEVICE INITIALISATION AND POLLING

The following actions are taken for each device when it powers up or when the MXP powers up. One action is performed on (or instead of) each 5 second poll.

- If fault bit was received, use HEALTH command to verify that fault was caused by powerup.
- Use READEE command to check type.
- Send SETALL command to select which values are returned, to set the interrupt thresholds (if any), set the Digital Outputs required for correct operation and set the status register for LED blink if required.
- Use READEE command to get factory calibration value for Photo and CO devices.
- Use READEE command to get factory "clean air" value for Photo and CO devices.
- Use READEE command to get the stored LED blink bit. This may require the SETALL command to be sent again.

Once this is complete FASTAV commands will be used to read the analog inputs (FASTDI command for RIM) on each poll, except for the occasional use of the SETOUT command to Reset / unreset the DIM detectors and as a background refresh of digital outputs.

SETOUT commands to set **changed** digital outputs will be interspersed between polls, with no request to return data.

GLOBADR commands are used to find all devices during a "Learn" initiated by the MX4428 and "Diagnostic Pollscan" initiated by the MX4428 or MXP diagnostic terminal.

(Refer to the "NOSEx SPECIFICATION" document for more details of the above commands.)

9.25 SOFTWARE VERSIONS

The following software versions have been released for general use.

Version	Features
1.03	First full release
1.04 (Limited Release)	Fixed failure of photo self test when using fuzzy logic with some detectors. Fixed standalone mode did not work if no valid database.
1.05 (Limited Release)	Added "typewrite" command to easily reprogram CO self test pulse length. Fixed failure of CO self test with new detectors, and subsequent other faults due to the detector powering down.
1.06	Fixed failure of photo self test when using fuzzy logic with some detectors. Fixed standalone mode did not work if no valid database. Added "typewrite" command to easily reprogram CO self test pulse length. Fixed failure of CO self test with new detectors, and subsequent other faults due to the detector powering down. Added automatic detection of CO detectors with insufficient self test pulse length (as stored in detector eeprom), and correction thereof. Fixed threshold used for remote test of photo detector using fuzzy logic with individual sensitivity. Fixed reporting of scan-fail (problem introduced in 1.05). Changed version returned to MX4428 from c0 to c6.
1.07	Implemented fast and slow point test, commission mode. Fixed no scan fail fault on CH detector (introduced in V1.06) Added support for LPS800. (Programmed as SNM800) Changed version returned to MX4428 to c7.
1.09	Added support for Vesda VLC800. Amended 814I remote test decision to prevent some detectors from incorrectly failing a remote test. Changed version returned to MX4428 to c9.
1.10	Fixed CO detector processing. Versions 1.07 to 1.09 inclusive did not apply the "calibration factor" stored in the detector eeprom, meaning that most detectors were less sensitive than they should have been (possibly outside the SSL limits of +/- 50%). VLC800 self test - moved decision point to the third poll after the "stimulus". (The data at the previous decision point was not necessarily valid.) Reprogrammed the eeprom containing the pulse length to the length required for the self test MX4428 Analog diagnostics AO command did not always cancel AS and AQ commands. (PR was workaround.) AO now fixed. Changed version returned to MX4428 to $ca.
1.11	DIM800 now has an option for short circuit fault Fixed the problem that where there was only one DIM800 on the loop, and it was the only device on the loop, it did not get processed. Fixed the 814PHFL Fastlogic modes, in particular smoke only actually selected heat only. Changed version returned to MX4428 to $cb.
1.12	Fixed continual transmission of global maintenance alert on then off when a “dirty” point was isolated. Changed version returned to MX4428 to $cc.

CHAPTER 10
MXP LOOP FILTER BOARD

10.1 USE OF MXP LOOP FILTER BOARD

Some field problems have occurred with the MXP detector loop picking up interference from adjacent or nearby wiring, resulting in faults and possibly prealarms. The “MXP Loop Filter board” (part number PA1038) is now available and it can easily be fitted to an MXP in order to remove the interference and restore normal operation.

One or more of the following symptoms may be evident –

1. Intermittent “scan fail” faults.
2. Intermittent unexpected Prealarms.
3. The MXP diagnostic port “Total reply fail count” is much higher than expected (normally you should get less than 1 per hour).
4. The above problems occur in time with some external event e.g. lift motors running, radio transmitters operating etc.

Note that symptoms 1 – 3 above can also be caused by other factors e.g. the loop has too many devices connected or is too long. The MXP Loop Filter board will not help if this is the case.

10.2 FITTING

Remove the loop wiring from the MXP. Fit the filter board in the loop wiring terminals of the MXP. Then fit the loop wiring to the filter board. Refer to Figure 10.1.

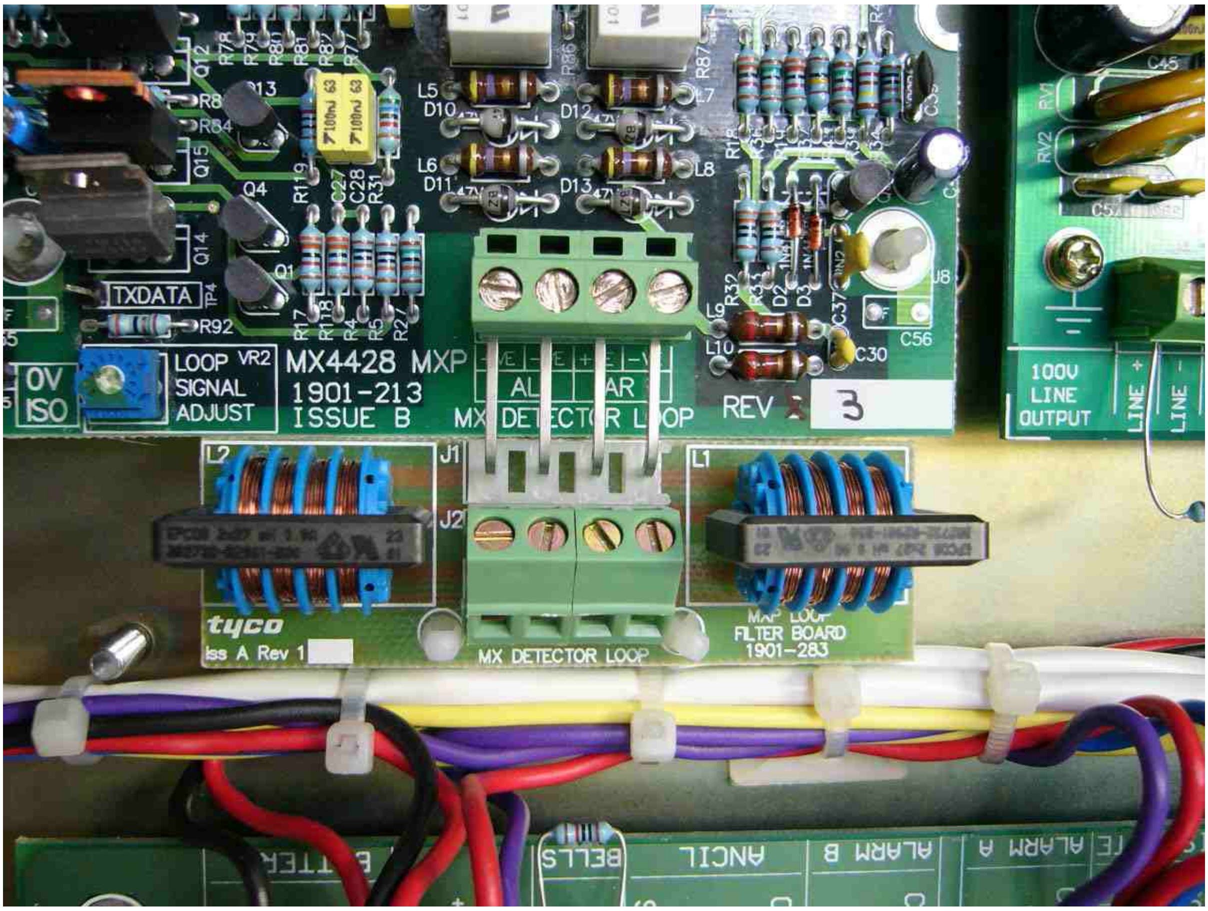


Figure 10.1 MXP Loop Filter Board Fitted to an MXP

Note – if you are fitting the board to an MXP in a responder box, you may need to tip the underside of the plastic standoffs inwards to get the board to fit into the MXP board connector easily – it will help if you rotate each standoff so that its plastic latch is pointing away from the edge of the board. Once the board is inserted you can straighten the standoffs before tightening the screws on the MXP loop wiring terminals.

Be sure to check that the system is operating normally, and that the problem you started with is solved.

10.3 DIAGNOSTICS

Connect a terminal or laptop running a terminal emulator program to the MXP diagnostics port using LM0041. Select baud 19200, no parity, 8 databits, 1 stop bit.

Enter the command RS. This will reset the error counters. Wait a few minutes. Enter TC. The "Total reply fail count" count should be zero. Keep checking it periodically. It should not increase by more than about 1 per hour. If there is a problem the count may increase every few seconds. To try to correlate the errors/retries with other events you can keep typing TC (or Control-R to repeat the last command) and see when the errors are occurring.

Alternatively to try to correlate the errors/retries with other external events you can enter the command NC (Nosex comms log toggle) so that the Nosex comms log is enabled. Then you will see activity on the screen in real time every time a device does not reply. (Note - one device that should not be present is polled every 5 seconds, it should not reply and this lack of reply is displayed on the screen). Be sure to type NC again so that the Nosex Comms log is disabled before disconnecting the terminal.

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