PERTRONIC
F220

(F220-2S and F220-2L)

AUTOMATIC FIRE ALARM TECHNICAL MANUAL

UNITED STATES

ISSUE 1.04

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Pertronic Industries Inc

0063 F220 Tech Manual USA v9.04.02 20240530

Abbreviations and Definitions:

ACK	Acknowledge	Panel keyswitch used to acknowledge an off-normal situation such as an alarm, pre-alarm, trouble, supervisory or active event. 'Acknowledge' keypresses are recorded in the Main Log.
Activated	Not in its normal state	
AHJ	Authority Having Jurisdiction	The organization, office, or individual responsible for enforcing the requirements of the code or standard, or for approving equipment, materials, an installation, or a procedure. NFPA 72-2019 3.2.2
AVF	Alarm Verification Feature	A feature designed to minimize 'false alarms' by ensuring multiple operation of devices (smoke detectors) before the alarm is raised. DDA, AVF and PAS are mutually exclusive.
DDA	Dual Detector Alarm	Available to detectors only. If set, when a detector is activated, the panel will go into a prealarm state. If a second DDA detector is activated, the panel will go into alarm. The default flag setting is 'Not Set'. DDA, AVF and PAS are mutually exclusive.
EOL	End of Line	End of Line termination, nominally 10kΩ Resistor, used to monitor the presence and integrity of the detector circuit.
FACP	Fire Alarm Control Panel	The main fire alarm system component, provided with primary and secondary power sources that monitors equipment and circuits, receives input signals from initiating devices, activates notification appliances and transmits signals off-site. Also referred to as a FACU Fire Alarm Control Unit.
F220		Generic Pertronic fire panel identifier. Specific panel/model numbers are located in Table 23-1: Pertronic Panels
Group		A software defined collection of SLC devices, zones, and system events
HPHO	High Sensitivity Photoelectric/ Optical Detector	
IA	Intelligent Addressable	Previously called analog addressable
Latched	A state that is maintained once invoked	Removal of the cause and a reset is required to remove a latched state
LCD	Liquid Crystal Display	
LED	Light Emitting Diode	
LED addressing	LED addressing	Historically in Pertronic systems, a Boolean addressing scheme has been used to control the state (ON/OFF) of indicator LEDs in LED Annunciators. This scheme has been extended to include "virtual" LEDs as an output option for SLC devices, Zones, Groups, Timers, System Events, Logic Blocks, etc. which can be configured or mapped to activate shared functions and events within a F220 panel and trigger reactive behavior across a F220 network.
MPS	Manual Pull Station	
NAC	Notification Appliance Circuit	A circuit in which the FACP can communicate to notification appliances such as strobes, bells, horns, and loudspeakers

NC	Normally closed	Relay or switch contacts
NO	Normally Open	Relay or switch contacts
OC	Open Circuit	
PAS	Positive Alarm Sequence	A fire panel option that delays the notification of a fire (fire department, alarm notification devices etc.) so that suitably trained personnel have time to investigate the cause of the alarm. The alarm must be acknowledged within 15 seconds and, once acknowledged, up to 180 seconds to investigate the alarm. PAS, AVF and DDA are mutually exclusive.
PCB	Printed Circuit Board	
Photo	Photoelectric optical detector	
PTIR	Photo Thermal Infrared Detector	
SC	Short Circuit	
SLC	Signaling Line Circuit	A circuit in which a FACP can communicate to addressable input and output devices, modules, annunciators, interfaces, control units and transmitters.
SLC Zone		A circuit, typically, in a designated area of a protected building, that when an alarm or trouble occurs will trigger a programmed response in the FACP. Detectors and modules can be assigned to one zone only.

IMPORTANT NOTE:

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

Warning: Any changes or modifications not expressively approved by the grantee could void the user's authority to operate this equipment.

As a F220 system can be provided with optional accessories, the system that was tested and approved was the largest system possible.

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1. INTRODUCTION

1.1 Functional Description

The Pertronic F220 is a modular, expandable, intelligent addressable automatic fire alarm system designed for medium to large building applications.

Figure 1-1: Pertronic F220 Analog Addressable Fire Alarm Control Unit

- It is expandable from 2 to 8 addressable SLCs giving a maximum of up to 1272 addressable smoke or heat detectors plus up to 792 manual pull stations, modules, or addressable relays for the system.

- The panel uses a 7 inch (180 mm) 800 x 480-pixel color display to unmistakably identify the panel status. The alarm mode is clearly identified using red status bars, and by using large easy to read text descriptors. Trouble information, disabled device information, pre-alarm conditions, walk test, supervisory and system information all have their own unique colored display screens to provide comprehensive easy-to-use information for all users including fire department personnel, building managers, and service technicians.

- The F220 has 9 separate event logs to provide all users with powerful diagnostic information. These logs and other reports can be accessed through Pertronics FireUtils PC based application software.

- All the F220 functions, which incorporate the configuration data specific to the site, is controlled by software that is stored in non-volatile flash memory on the Mainboard. The configuration data, generated by FireUtils can be installed:
  - Using a USB flash memory stick, or
  - Via an Ethernet port on the Mainboard, or
  - If installed, an Ethernet port on the Net2Card board.

  The configuration data can only be modified by service personnel with Level 4 Access.

- Remote access. LCD Annunciators are available to provide remote access to one F220 panel on the external RS-485 bus – the F220-Full Function Annunciator (F220-FFANN-UL), or multiple F220 panels on the NET2 network (NET2-FFANN-UL)

- The F220 fire alarm system is available in one of 2 cabinets. A lockable front door provides access to the Keyboard-Display.

- The F220 conforms to UL864 and FM Global Requirements

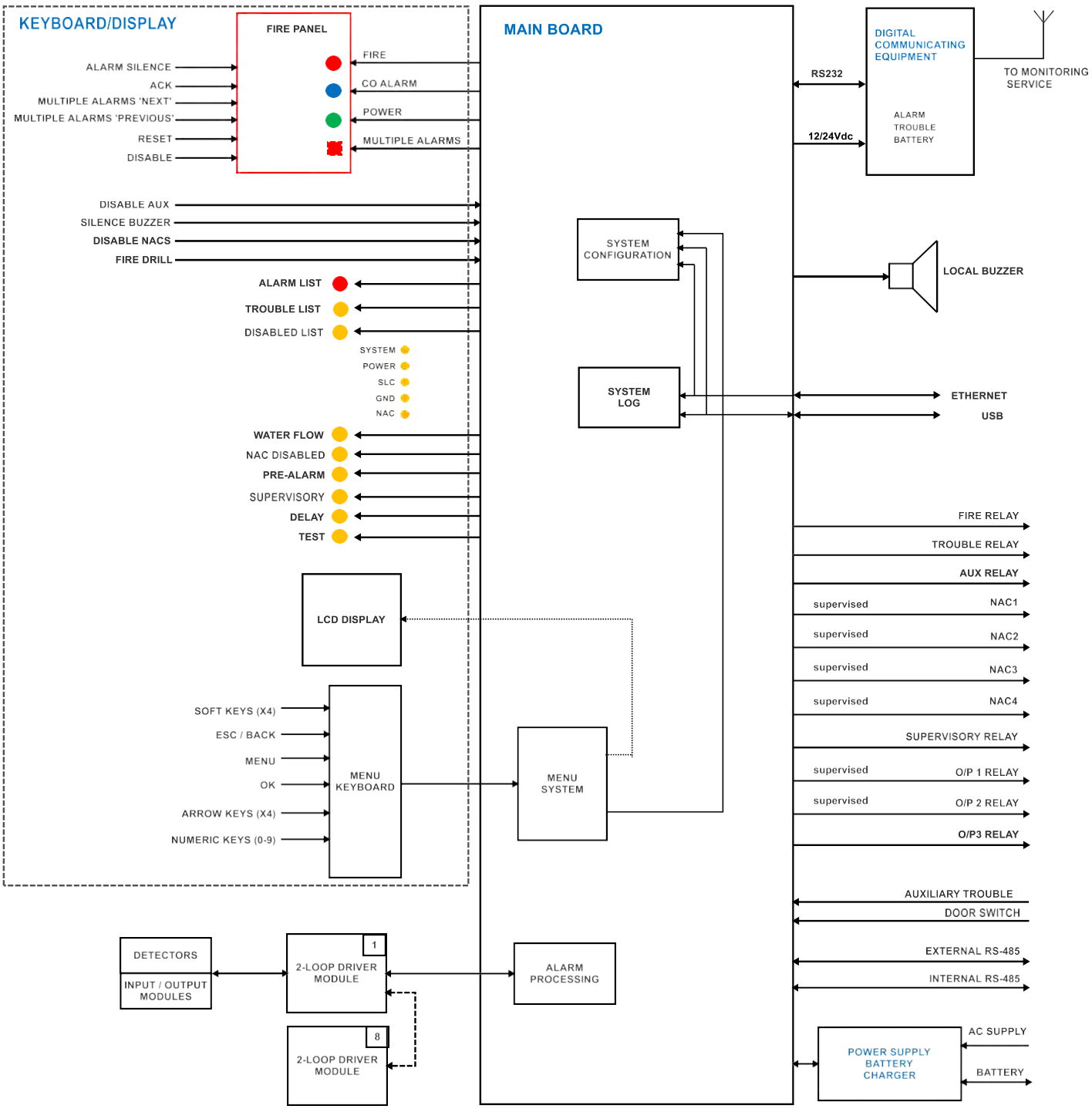


Figure 1-2: F220 Block Diagram

1.2 Overview of Features

1.2.1 General Features

- Large 7-inch (180 mm) 800 x 480-pixel active matrix TFT color LCD display
- Comprehensive front panel controls, including:

  Emergency Response panel

  Alarm List display key

  Trouble List display key

  Disabled List display key

  Disable Aux control key

  Silence Buzzer control key

  Disable NACs control key

  Evacuation test control (Fire Drill)
- F220 configuration data generated by the Pertronic FireUtils, a PC based software application, can be uploaded in a few seconds using the Ethernet port or a USB flash drive containing the configuration file.
- The F220 has a minimum of two independent intelligent addressable SLCs, a maximum of 8. (Refer to Table 23-1 for specific Product Codes and Descriptions)

  The Signaling Line Circuits (SLCs) can accept addressable input devices and addressable relays.

  The SLCs are short circuit and over-voltage protected.
- Input devices include Detectors, Manual Pull Stations, and Modules.

  Each input device can be configured for full Fire system operation or indicator only operation.

  Each input device can be configured to disable any NAC circuit.

  Each input device can be configured to activate the on-board relays: O/P3, Supervisory, Auxiliary, Fire and Trouble, and Outputs O/P1 and O/P2.

  Each input device can be configured to activate multiple SLC relays.

  Each input device can be mapped to any zone.

  Each zone can be configured to activate multiple SLC relays.

  The sensitivity of each detector can be independently selected.
- Addressable SLC Relays can be configured as relays, buzzers or NAC relays, or as Door Holder relays. (**NOTE**: SLC Relays configured as Door Holders can be disabled using the front panel Disable button)
- On-board relays for external signaling – Fire Alarm relay, Trouble relay, Supervisory relay, an Auxiliary relay, and three Output relays, two of which are supervised.
- Carbon monoxide and waterflow monitoring
- Disabling zones or individual SLC input devices (detectors and modules) is possible.
- Comprehensive system test functions include testing all detectors and a battery load test conducted at a programmable time and repeated from once up to seven times a week. A simple menu selection enables the display of individual detector analog values on the LCD display.

- A 10,000-event history log, with each entry time stamped. The log may be downloaded, for viewing or storing, to a USB flash drive, or to a laptop, or PC through the Ethernet connection.
- Additional logs for Alarms (2000), Pre-alarms (500), Troubles (500), Supervisory (500), Disablements (500), Disablement Activity (500), Active Events (500), and System Events (500).
- Control inputs include an Auxiliary Trouble input.
- A door interlock provides warning of door closure when panel control functions are in the off-normal state.
- Night mode, when enabled, provides all detectors with a second sensitivity level. Night mode can be controlled by an internal 24-hour timer or an external input. (Refer to Sections 4.3 and 8.2.1 for more details)
- **Positive Alarm Sequence (PAS)** provides a timed delay of a general alarm to give trained responders, after acknowledging the initial alarm within a 15 second period, time to investigate the cause of the alarm signal before the Fire Department is called. PAS, AVF and DDA are mutually exclusive.
- **Alarm Verification Feature (AVF)** provides a delay from activated smoke detectors (not heat detectors or input modules such as an MPS or 3-way switch) to minimize the number of false alarms. After the device has been activated the F220 will wait a maximum of 30 seconds (i.e., the AVF Active period) to see if the device is still activated. If it is, the Fire Department is called immediately. If not, the F220 will wait an additional confirmation period (i.e., AVF Delay period) of 60 seconds. If the device is activated again during the 'AVF Delay' period, the Fire Department is called, otherwise at the end of the delay period the F220 reverts to 'Normal'. AVF, PAS, and DDA are mutually exclusive.
- **Double Detector Alarm (DDA).** This detector option sets/resets the 'Dual Detector Alarm' flag. The panel requires two or more DDA enabled detectors to be in a prealarm state for panel to go into alarm. If its DDA flag is set, when a detector reaches its alarm threshold the panel will go into a prealarm state. If a second DDA enabled detector reaches its alarm threshold, the panel will go into alarm. The default flag setting is 'Not Set'. DDA, AVF, and PAS are mutually exclusive.

  NOTE: Systems employing multiple detector operation such as AVF and DDA in a protected area must reduce the installation spacing of the detectors to 0.7 times the linear spacing in accordance with NFPA 72.
- **Logic Blocks** provide a means of conditioning output control using Boolean logic. An individual block's logic examines inputs to decide whether the block is active, and if so, enables the output. Conditional operators such as AND, OR and ANY2 can be applied. In addition, each input can also be logically inverted. Each of the 999 logic blocks can be configured to operate relays, call the fire department, and turn on NAC and evacuation amplifiers.
- **Timers** allow configurable delays to outputs to be applied. Programmed outputs such as relays can be delayed based on inputs such as date, time of day, or detector state (alarm, trouble etc.). The F220 has 200 general purpose timers.
- Automatic Daylight-Saving adjustment (based on time zone selection at system setup).

1.2.2 Serial Communication Facilities

- External High-Speed RS-485 Bus: For remote F220 Annunciator displays.

- Internal High-Speed RS-485 Bus: For communication between the Mainboard, Keyboard-Display, Charger Controller and Net2Card.
- Extension Bus: High-Speed RS485 bus for communication between the Mainboard and the SLC Loop Driver boards.
- RS-232 Port: Connects the Fire Alarm Control Unit to the Digital Communicator to wirelessly transmit events such as Fire, Alert and Trouble events to a Central Station or Fire Department.
- USB Port: For uploading of configuration data and downloading of configuration, logs, etc. to a USB flash drive.
- Ethernet Port: For uploading and downloading of configuration data, logs etc. to a laptop or PC.

1.2.3 Access restrictions:

- Access Level 1: Access for persons who might be expected to investigate and initially respond to a fire or trouble signal.

  The outer door is closed and locked. Visual and audible indications can be seen and heard through the transparent outer and dead-front doors.
- Access Level 2: Access for persons who are trained to operate the control unit.

  The panel's outer door has been unlocked and opened. The authorized person can operate all controls on the Keyboard-Display.
- Access Level 3: Access for persons who are trained and authorized to do the following:

  (a) Reconfigure the site-specific data held within the control unit or controlled by it.
  (b) Maintain the control unit in accordance with the manufacturer's published instructions and data.

  Access to Level 3 requires access to Level 2 first, and the inner door needs to be opened with a screwdriver to gain access to the USB and Ethernet ports.

  A password is required to enter FireUtils, the PC based application program to configure the site data via the panel's Ethernet port or Net2Card. A keycode is required to download a configuration file from a USB stick directly to the Mainboard.
- Access Level 4: Access by persons who are trained and authorized either to repair the control unit or to alter its site-specific data or operating system program.

  Access to Level 4 requires access to Level 3 first, then hardware tools to access or remove the coin cell battery. A keycode is required to enter the section of the menu to download the site configuration data and new firmware via the USB port.

1.3 Specifications

Cabinet:		
Dimensions	US Small Cabinet:	w:13.78 x h:23.62 x d:5.63 in (w:350 x h:600 x d:143 mm)
	US Large Cabinet:	w:15.35 x h:25.98 x d:8.39 in (w:390 x h:600 x d:213 mm)

	Specified depth is measured to the front face, excluding the index. Some fittings protrude forward of the front face.	
Material	19 gauge (0.04375 in/1.1 mm) mild steel, powder-coated	
Color	Gloss Black Ripple 953 57249 (Dulux Paint Code)	
Power Supply, Primary:		
5 Amp PSU	**Input**	100-132V AC 60Hz, 176 VA
	Output	27.5V, 135 W. For details refer to Table 19-7
	Quiescent Current	31 mA
	Maximum Load	4.5 A @ 28 Vdc (Charge current <225 mA) 2.7 A @ 28 Vdc (Charge current 2.1 A)
	Battery Charging Output	27.4 V @ 68°F (20°C), temperature compensated for sealed lead-acid batteries 2.1 A maximum current, Reverse polarity protected
7 Amp PSU	**Input**	100-132V AC 60Hz, 230 VA
	Output	27.5V, 180W. For details refer to Table 19-7
	Quiescent Current	31 mA
	Maximum Load	6.7 A @ 28 Vdc (Charge current <225 mA) 4.7 A @ 28 Vdc (Charge current 2.1 A)
	Battery Charging Output	27.4 V @ 68°F (20°C), temperature compensated for lead-acid batteries 2.1 A maximum current Reverse polarity protected
Power Supply, Secondary:		
Battery	**Nominal Voltage**	24 Vdc
	Type	Valve Regulated Lead Acid (VRLA) in AGM or Gel types only
	Capacity	7 Ah to 55 Ah
	F220-2S Cabinet	Battery cavity: 13.5w x 4.3h x 4.1d in (345 x 110 x 105mm)
	F220-2L Cabinet	Battery cavity: 13.9w x 135h x 175d in (355 x 135 x 175mm)
	NOTE: 1. The choice of power supply and battery capacity depends on the system load. This depends on the number and type of optional extras, together with the number and type of external devices powered by the F220 fire alarm panel power supplies. 2. If larger capacity batteries are required and they are unable to fit in the F220 cabinet, those external batteries must be “close-nippled” to the F220 cabinet.	

Panel:		
Quiescent Current	148 mA 45 mA 3.5 mA 124 mA 250 mA (max.)	F220 panel only, normal state. for each SLC Driver board. for each group of 10 detectors, Manual Pull Stations or modules. Panel in 'Trouble' (backlight on). Panel in 'Fire' (relays and backlight on).
Zone Allocation	Up to 999 physical zones. Where network sites require unique zone numbers for each panel an offset feature (Zone Offset) allows zone numbers in the range 0001 to 64999 to be used for the network. See Section 8.3.1.	
Intelligent Addressable SLCs	The basic F220 FACP has one SLC board, expandable to 4. Each SLC board has 2 SLC loop drivers (i.e., max of SLC 8 loop drivers). Each SLC loop can operate as one Class A or Class X (4 terminals, continuous 2 wire circuit, returning to panel), or two Class B (2 terminals each).	
Detectors, Manual Pull Stations, and Modules	Each SLC can have up to 159 detectors plus up to 99 Manual Pull Stations or modules. (**NOTE**: HPHO Smoke Detector 7351 can support only 99 SLC addresses) A four-SLC F220 will accept a maximum of 636 detectors and 396 Manual Pull Stations or Modules. An eight-SLC F220 will accept a maximum of 1272 Detectors and 792 Modules. Each SLC device (e.g., pull station, CO device, flow switch) can be mapped to a zone, any of the 4 NACs, and to multiple addressable relays. Each SLC device can be configured to independently activate any of the Auxiliary, Supervised Outputs 1 and 2, and Output 3 relays. Each SLC device can be configured to individually or collectively activate an 'Alarm', and/or 'Fire Relay', or operate as a Supervisory, monitoring signals from other systems. The detectors can be tested when required via the panel menu. Zones and individual detectors and Manual Pull Stations may be disabled.	
SLC Characteristics	Maximum SLC Length: Maximum SLC Current: Maximum SLC Resistance: Conductor Size: Cable Type:	Up to 8,000ft (2500m) end to end (14 AWG (2.5mm^2) cable), with appropriate configuration. 600 mA/loop Classes A and X: 50 Ω (combined resistance for both conductors) Class B: 40 Ω (combined resistance for both conductors) 12 to 22 AWG (4.0 mm^2 to 0.5 mm^2) Twisted pair cable recommended.
SLC Isolators	SLC Isolators are used to separate the zones within SLCs.	
Detector Sensitivity	Detector sensitivities are individually adjustable.	

	Refer to the individual detectors for information on the levels that are available and their default values.
Device Disablement	Detectors and monitor inputs (e.g., MPS, PSW, FSW, VMD, etc.) can be individually disabled. Zones may also be disabled.
Addressable Relays:	There are seven addressable relays on the Mainboard– Fire, Trouble, Aux, Supervisory, O/P1, O/P2 and O/P3. Both O/P 1 and 2 are supervised. See Section 19.1.2 Mainboard PCB Field Wiring. Each SLC can include up to 99 addressable relays. The address space is shared with the Manual Pull Station and Module addresses. This means the sum of Manual Pull Stations plus modules plus addressable relays cannot exceed 99. No two addresses can be the same.
Notification Appliance Circuits (NACs)	There are four supervised NACs circuits. Each NAC can be configured as either Class A or Class B; one Class A or one Class B circuit per NAC. Max. number of System Sensor devices per circuit is 25 and a total of 50 per Panel. Max. number of Wheelock or Gentex devices per circuit is 50 and a total of 100 per panel. Power is limited to 3.0 Amps max. per circuit. Total load on the NACs should not exceed the capacity of the power supply (5A or 7A) Each NAC can be individually configured to be permanently ON. Class B only. Maximum power in this mode is limited to 300mA per NAC. For max cable length of Class A and Class B circuits refer to Section 19.1.9
Fire Relay	Single form C contact, 2.0 A @ 30 Vdc resistive load, normally de-energized. Not supervised.
Trouble Relay	Single form C contact, 2.0 A @ 30 Vdc resistive load, normally energized. Not supervised.
Aux Relay	Single contact, normally open, rated 2.0 A @ 30 Vdc resistive load. Not supervised.
Supervisory Relay	Single form C contact, 2.0 A @ 30 Vdc resistive load. Not supervised.
O/P1	Supervised by a 10 kΩ End of Line resistor (configurable) Rated 28 Vdc, 1.0A. Protected by a PTC resettable fuse.
O/P2	Supervised by a 10 kΩ End of Line resistor (configurable). Rated 28 Vdc, 1.0A. Protected by a PTC resettable fuse.
O/P 3 Relay	Single form C contact rated 5 A @ 30 Vdc resistive load. Not supervised.
Auxiliary Outputs	8 mappable auxiliary outputs accessible via 1 connector; FET current sink drivers; for internal panel use only, 100 mA per output. Not supervised.
Isolated RS-232 Port	Link to Digital Alarm Communications Transmitter. 115.2 kb/s, 8 bits, no parity, 1 stop bit.
USB Port	USB 2.0 compatible, for USB flash downloads and uploads
Ethernet Port	RJ45 10/100 Mb/s

External High-Speed RS-485 Bus	Baud rate: 115.2 kb/s. Class B 3.0 A maximum load, EFuse
Internal High-Speed RS-485 Bus	Baud rate: 115.2 kb/s 500mA maximum load
Extension Bus	Baud rate: 115.2 kb/s. 500mA maximum load
Ground Monitoring:	A 'Ground Trouble' indicator is provided on the front panel to indicate a ground fault trouble. A 'Ground Trouble' occurs when any internal panel circuitry and/or external circuits such as SLCs, NACs, RS485 busses etc. connected to the panel have a low resistance (i.e., short circuited, or '0 ohms') path to AC power ground.
Environmental:	Temperature: 32°F to 120°F (0°C to 49°C) Humidity: 104°F (40°C) or below, ≤ 95 % relative humidity 105°F to 122°F (41°C to 50 °C), ≤ 75 % relative humidity
Cabling:	All cabling for the Pertronic F220 Fire Alarm System shall comply with NFPA 70 and NFPA 72, together with relevant project requirements and local codes or regulations.

Table 1-1: F220 Specifications

1.4 Capacity

Intelligent Addressable SLCs	Up to 8 SLCs (max). The basic F220 panel is supplied with 1 SLC Driver board. There are 2 SLCs per board.	
Intelligent Sensors	1,272 (max)	
Intelligent Modules, MPSs & Addressable Alarm Devices	792 (max)	
Zones	Up to 999 consecutively numbered zones per F200 panel, within the range of 1 to 64999.	
Logic Blocks	999 (max)	
General Purpose Timers	200 (max)	
Groups	999 (max)	
Individually Addressable LEDs	2048 (max)	
Network Inputs	999 (max). Inputs 1 to 640 directly configurable. Inputs 641 to 999 accessible via Logic Block facility.	
History Logs	Main Event Log (All)	10,000 events (max)
	Alarm Log	2,000 events (max)

	Pre-Alarm Log	500 events (max)
	Supervisory Log	500 events (max)
	Trouble Log	500 events (max)
	Disablement Log	500 events (max)
	Disabled Activity Log	500 events (max)
	Active Event Log	500 events (max)
	System Event Log	500 events (max)
	PSU Log	5,000 events

Table 1-2: F220 Maximum Capabilities

2. F220 FRONT PANEL CONTROLS AND DISPLAY

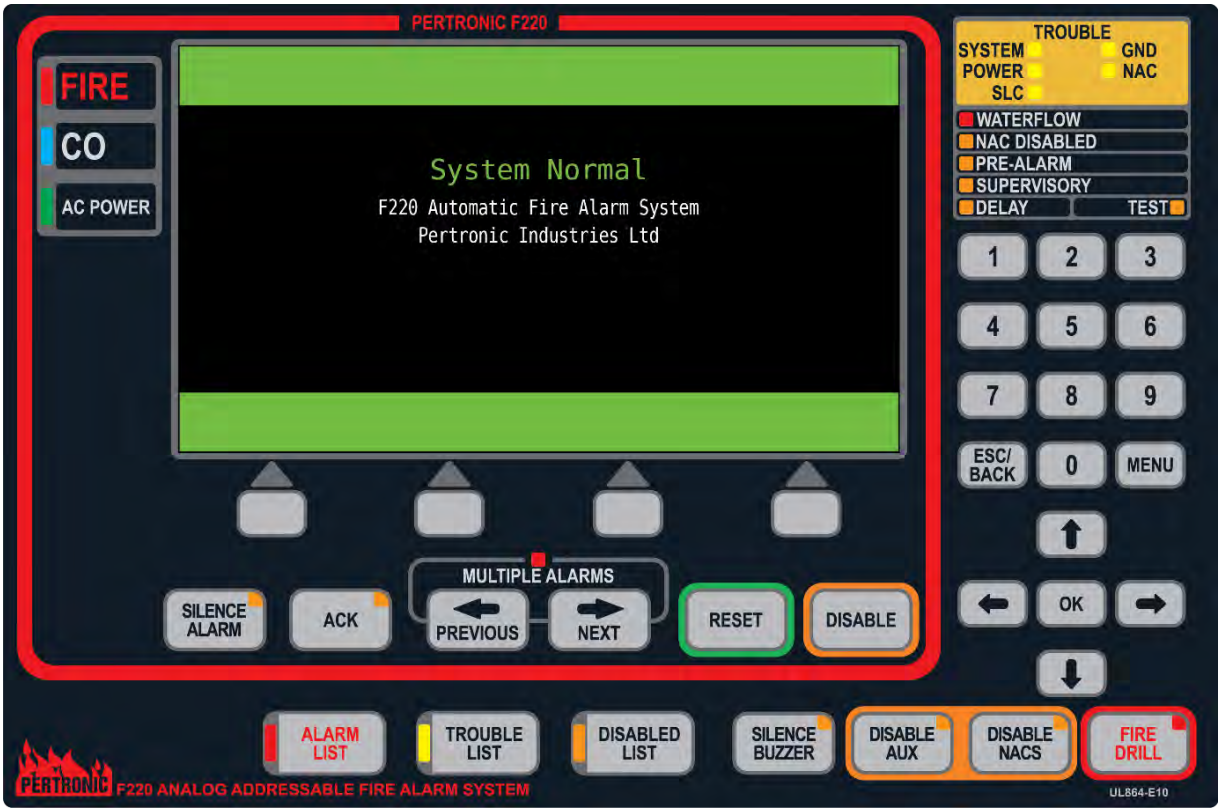


Figure 2-1: F220 Front Panel

2.1 Fire Alarm Panel

The Fire Alarm Panel (Figure 2-1) comprises the emergency response panel or window within the red border. Outside the red border there are other engineering controls and indicators for the use of the building owner or service and maintenance personnel.

2.2 Alphanumeric LCD Display and Menu Functions

The color LCD display is an integral part of the Fire Alarm Panel and provides information and menu structures for use by:

- Fire Department
- System users
- Technicians
- Engineers

2.2.1 Event Display and Event Queues

Whenever an event occurs on the F220 system it is placed into one of the queues in the table below. The queues are color coded on the display.

Queue		Contains / example	Priority
Alarm	Alarm	Device(s) in Alarm	Highest
Pre-Alarm	Pre-Alarm	Detectors that are very near the alarm threshold	
Supervisory	Supervisory	Outputs of systems monitoring, suppression systems, air handling systems or other life (e.g., CO events), safety or property protection systems.	
Trouble	Trouble	Contains all panel troubles such as 'duplicate address', missing devices, power supply, system, SLC, ground, and NAC troubles	
Walk Test	Walk Test	Zones that have "Walk Test" alarms	
Disablement	Disablement	All devices and zones that have been disabled	
System Events	System Events	See Table 8-4: System Event Types	
Active Events	Active Events	Typically inputs from monitoring devices that are "off normal".	Lowest
System Normal	System Normal	Normal View (no events in any queue).	

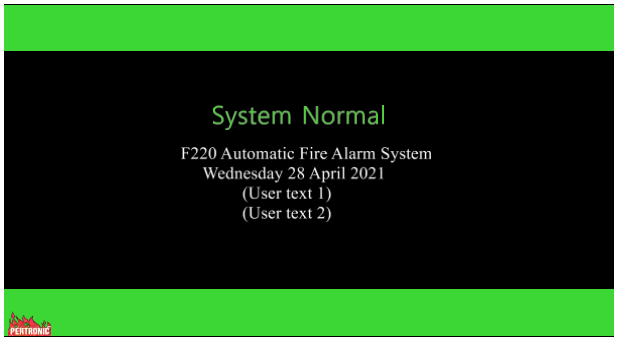
An event queue that contains current information is deemed to be active, and the event queue with the highest priority will be displayed. Other active queues, with lower priority events, will be indicated by the appropriate LED indicator. The user may switch between the events in the displayed active queue by pressing the OK key**.**

The alarm queue contains active alarms. When all alarms have been either reset or disabled the Alarm Queue becomes inactive.

2.2.2 Normal / Date-Time Display

When the F220 is 'Normal' the following screen is displayed showing date/time and two lines of user text. A variant of the Normal screen is also shown when the system is performing background testing.

These displays may also appear after 5 to 10 minutes of no keypad activity.



2.2.3 System Off-Normal Display

An 'Off Normal' display will occur when an activity is present such as a Trouble or Supervisory. This results in the display changing color from green to one of the colors listed above (e.g., yellow for Trouble, violet for Supervisory); with the color of the event with the highest priority being displayed.

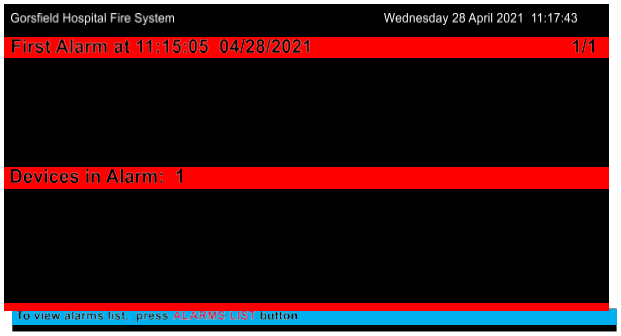
In this example the color of the bands of this 'Off Normal' summary display are orange indicating Pre-Alarm conditions.

2.2.4 Fire Alarm Display

The first fire alarm present on the Fire Panel is always presented at the top of the 'Primary Alarm' screen (diagram below left) and will remain there until the system has been reset.

The next alarm that occurs will be displayed below the first (diagram below right). Subsequent alarms can be viewed on the 'Primary Alarm' screen by using the 'Previous' and 'Next' keys of the 'Several Alarms' function to scroll through them. Note that the sequence number of the alarm

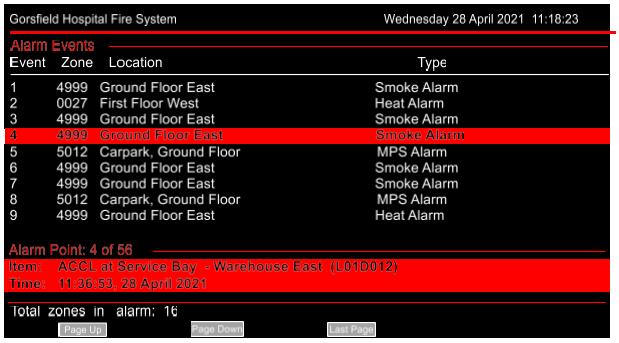
and the time that it occurred is also displayed. When in the ‘Primary Alarm’ screen, the Reset button resets all alarm events.



‘Primary Alarm’ screen

‘Primary Alarm’ screen

Whenever alarms are present the ‘Alarm List’ LED will be ON indicating that users can press the associated key to view details of all points that currently are in alarm (“points” include: devices, logic blocks, timers etc.).



‘Alarm List’ screen

In the example shown there are a total of 56 points in alarm (“points” includes: devices, logic blocks, timers etc.) and these can be viewed by using Page Up or Page Down soft keys. Select a particular event using the keyboard ↑ or ↓ keys.

In the Alarm List screen, each event can be disabled individually using the ‘Disable’ key switch. If the ‘Disable’ button is used, the ‘Disabled List’ LED will be ON. Pressing this button will display a list of those detectors that have been disabled.

NOTE:

1. In the ‘Primary Alarm’ view, one press of the ‘Reset’ button resets all latched fire events.
2. In the ‘Primary Alarm’ view, one press of the ‘Disable’ button opens the ‘Alarm List’ screen.
3. In the ‘Alarm List’ view each latched fire event can be individually disabled.

2.2.5 Pre-Alarm List Display

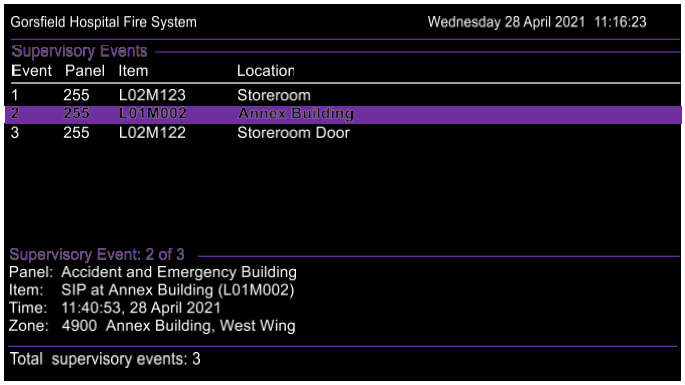
The Pre-Alarm list will be displayed if it is the highest priority active queue. If alarms are present as well, alarms will have priority, and the presence of Pre-Alarms will be indicated by the Pre-Alarm LED turning ON. Press the 'OK' key to view the Pre-Alarm list.

Pre-Alarm events can be selected using the keyboard ↑ or ↓ keys and once selected can be Reset or Disabled

Use Page Up or Page Down soft keys to view information not currently on-screen.

2.2.6 Supervisory Display List

Supervisory events are usually generated by equipment that is monitoring other life safety or property protection systems and indicate an abnormal status other than a trouble. For example, fire suppression systems where valve position, water temperature, water pressure and pump conditions are monitored.



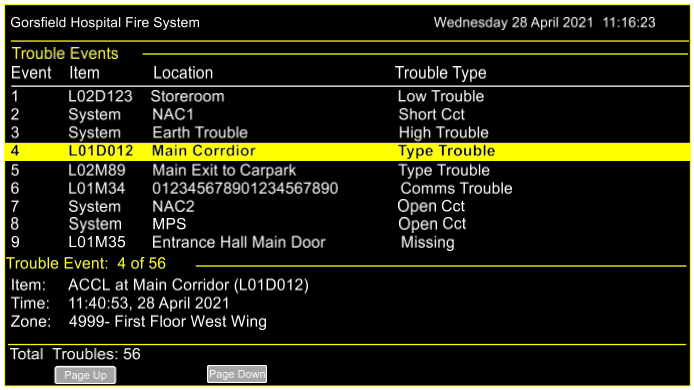
2.2.7 Trouble Display

Troubles will be displayed on the screen as they occur as a Trouble Event. Trouble messages are automatically canceled when the Trouble is removed.

2.2.7.1 Trouble Events

Troubles, not associated with a zone, with be displayed on the 'Trouble Events' screen, the 'Trouble List' LED on the front panel will be ON, along with one or more Trouble category indicators (System, Power, SLC, Ground, NAC). If the display is not currently showing on the

screen, it can be viewed by pressing the ‘Trouble List’ key, or repeatedly pressing ‘OK’ until it appears.

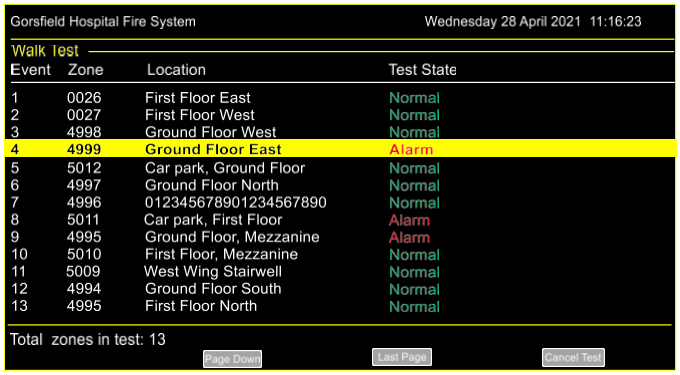


Trouble events can be selected using the keyboard ↑ or ↓ keys and once selected can be Reset or Disabled.

Use Page Up or Page Down soft keys to view information not currently on-screen.

2.2.8 Walk Test Zone Alarm Display

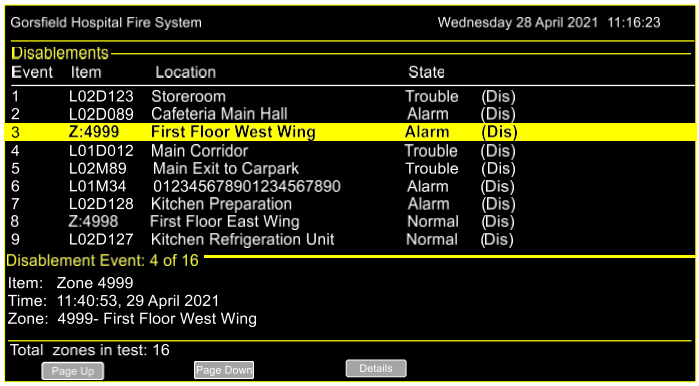
When ‘Walk Test’ is activated for a zone a screen showing the zones currently in walk test and their state will be displayed.



The user is also able to cancel ‘Walk Test’ on a per zone basis by moving the yellow highlight to the desired zone and selecting the ‘Cancel Test’ soft key.

2.2.9 Disablement Display

The ‘Disablement LED’ will be ON whenever devices have been disabled. If the Disablement display is not currently showing on the screen, it can be viewed by pressing the Disablement key or repeatedly pressing OK until it appears.

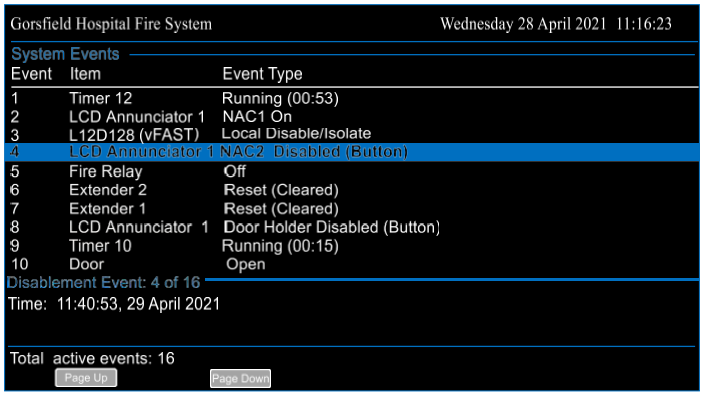


Disablement events can be selected using the keyboard ↑ or ↓ keys and once selected can be Reset or Disabled.

Use Page Up or Page Down soft keys to view information not currently on-screen.

2.2.10 System Events

If a System Event is present, but not the highest priority, the 'System Events' screen will not be displayed. It can be viewed by repeatedly pressing 'OK' until it becomes visible.



Time and date information for the currently selected event can be viewed at the bottom of the screen. The blue selection bar can be moved by using the keyboard ↑ or ↓ keys.

Use Page Up or Page Down soft keys to view information not currently on-screen.

2.2.11 Active Events

If an Active Event is present but not the highest priority, the 'Active Events' screen will not be displayed. It can be viewed by repeatedly pressing OK until it becomes visible.

Further information for the currently selected event can be viewed at the bottom of the screen. The blue selection bar can be moved by using the keyboard ↑ or ↓ keys.

Use Page Up or Page Down soft keys to view information not currently on-screen.

2.2.12 User Menu Operations

The ‘User Menu’ is used for accessing functions such as Disablement functions, History Logs, System Summary, Device Status Information and Service Menu.

The first, or top, level of the ‘User Menu’ is reached by pressing the ‘Menu’ key followed by the numeric key corresponding to the sub-menu option required.

For further information on the User Menu and its functions, refer to section 10.

2.2.13 Emergency Response Indicators

The six indicators on the fire alarm panel are as follows:

Indicator	Function	Color	Description
	FIRE	Red	General Fire Alarm Indicator.
	CO	Blue	Indicator ON when a Carbon Monoxide detector is activated. By default, a CO event is not latched.
	AC Power	Green	ON when AC power is available.
	Silence Alarm	Yellow	ON when all notification appliances have been silenced/deactivated after the ‘Silence Alarm’ button has been pressed Blinking ON and OFF if the panel or one or more panels on the network have silenced alarms and one or more panels still have active alarms. New alarms, received after the Silence Alarm button has been pushed, will cause the alarms to sound and the Silence Alarm LED to turn OFF.
	Ack	Yellow	Flashing ON and OFF when an off-normal situation, such as an alarm, pre-alarm, trouble, supervisory, or active event has occurred. ON when all off-normal situations have been acknowledged. OFF when all off-normal situations have been resolved and the system reset.

	Multiple Alarms	Red	Indicator for several alarms. Flashing ON and OFF if three or more devices are in alarm.

2.2.14 Emergency Response Controls

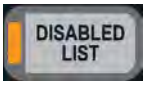
Switch	Control	Function
	Silence Alarm	Press to temporarily silence all audible notification appliances (but not the panel buzzer) and turn off the visual notification appliances on the four NACs, and SLC circuits except those NACs configured as AUX Power. The 'Silence' function is cancelled if: • the 'Silence Alarm' button is pressed again (toggle action) • any new 'Alarm' event or any action of 'Disable NACs' function. Input(s) activating the 'Silence' output must return to Normal before 'silence' can re-activate. The 'Silence Alarm' event is recorded in the Main Log. Selectively silencing individual NACs is not available.
	Ack	Press to 'Acknowledge' all unacknowledged off-normal events (Alarm, Pre-Alarm, Trouble, Supervisory). Adds 'Acked' to the text of the event time in the off-normal event display and the keypress is recorded in the Main Log. Will mute the Buzzer but not the annunciators on the four NACs.
	Previous, Next (Multiple Alarms)	Scroll keys used to view devices in alarm. The scroll keys will only have effect if three or more devices are in alarm.
	Reset	Press to 'Reset' the FACP to its 'Normal' condition. Any off-normal events remaining after the FACP has reset will be re-established within 20 seconds.
	Disable	In the 'Primary Alarm View', pressing 'Disable' navigates to the 'Alarm List' view. In the 'Alarm List' view each latched fire event can be individually selected and then disabled by pressing the 'Disable' button.

2.3 Engineering Indicators and Controls

The indicators and controls outside the Fire Alarm Panel are for the use of the building owner or service and maintenance personnel. These are shown in Figure 2-1: F220 Front Panel.

2.3.1 Engineering Indicators

Indicator	Function	Color	Description
	Alarm List	Red	Indicates that devices are in alarm and can be viewed by pressing the associated switch.
	Trouble List	Yellow	Common Trouble indicator. ON whenever any Trouble is present on the system. In addition, one or more Trouble category indicators will also be ON (see below).

Indicator	Function	Color	Description
			Troubles can be viewed on the display by pressing the associated 'TROUBLE LIST' switch
	Disabled List	Yellow	Indicates that devices are disabled. Disablements can be viewed on the display pressing the associated 'DISABLED LIST' key.
	Silence Buzzer	Yellow	ON if the Buzzer has been silenced. Refer to Section 2.2.14
	Disable AUX	Yellow	ON if the AUX relay has been disabled. Refer to Section 2.2.14
	Disable NACs	Yellow	ON if all four NACs have been disabled except those NACs configured as AUX Power. Refer to Sections 2.2.14, and Section 2.3.2
	Fire Drill	Red	ON when the Fire Drill switch has been pressed to initiate a Fire Drill (manual evacuation). Pressing the Fire Drill switch again will turn the indicator OFF and deactivate the fire drill evacuation
	System	Yellow	ON if a System Trouble is present - Program monitoring, Configuration memory
	GND	Yellow	ON when an 'GND' is detected by the FACP. A 'Ground Trouble' occurs when any internal panel circuitry and/or external circuits such as SLCs, NACs, RS485 busses etc. connected to the panel have a low resistance (i.e., short circuited, or '0 ohms') path to AC power ground.
	Power	Yellow	ON when there is a Power Trouble with the FACP or devices connected to the SLC e.g., AC power missing, battery test failure.
	NAC	Yellow	ON when a Notification Appliance Circuit (NAC) wiring trouble is detected, such as a short or open circuit. Devices are connected to the NAC in either a Class A or Class B configuration.
	SLC	Yellow	ON when a Signaling Line Circuit (SLC) trouble is present e.g., wiring open or short
	Waterflow	Red	ON if there is waterflow in a sprinkler system.
	NAC Disabled	Yellow	ON if any NAC circuits have been disabled.
	Pre-Alarm	Yellow	ON when detectors have gone off-normal and potentially could soon go into an Alarm state
	Supervisory	Yellow	ON when a supervisory input is in the active state.
	Delay	Yellow	Must be mapped to an Output Type from devices, modules, system events, timers, logic blocks etc. to be activated. For example, ON when one or more output circuits are in a delayed operating mode.

Indicator	Function	Color	Description
	Test	Yellow	ON when one or more zones are in 'Walk Test' mode, or an 'Output Test' is running

2.3.2 Engineering Controls

Switch	Control	Function
	Alarm List	The 'Alarm List' button has a toggle function. Alternate presses will cause the LCD display to switch between the 'Primary Alarm View' and the 'Alarm List' screens.
	Trouble List	Press to view a list of all current trouble events
	Disabled List	Press to view a list of all devices currently disabled
	Silence Buzzer	Press to silence the F220 Buzzer. When silenced, the F220 buzzer is muted, and 'Silence Buzzer' indicator is ON. If another buzzer event occurs (alarm, trouble etc.), the buzzer will reactivate. If the Buzzer is still silenced 4 hours after an Alarm or 24 hours after a Trouble, it will automatically resound.
	Disable Aux	Press to toggle the disable/enable state of the Aux Relay. When disabled, the Auxiliary relay is prevented from activating, the Disabled List and Disable Aux indicators are on, and the Main and Disablement logs are updated. If the Aux Relay is already active, the 'Disable Aux' key is disabled. Pressing the 'Disable Aux' key again, enables the activation of the Aux Relay, and turns off the 'Disable Aux' and 'Disabled List' indicators
	Disable NACs	Press to toggle the disable/enable state of the four NAC circuits. When disabled, all NAC circuits, except those configured as AUX Power, are prevented from activating any attached devices, the 'NAC Disabled', 'Disable NACs', 'Trouble List', and 'Disabled List' indicators are ON, the 'ACK' LED will flash, and the Main, Disablement and Trouble Logs are updated. Pressing 'Disable NACs' again will enable the four NAC circuits and turn the 'NAC Disabled', 'Disable NACs', 'Trouble List' and 'Disable List' indicators OFF.
	Fire Drill	Press to turn ON or OFF the building Fire Drill. The Fire Drill switch is disabled if 'Disable NACS' has been enabled. Use the 'OK' key to step through any active events (e.g., Trouble, System, Disablements, etc.)
	Function Keys	These four keys select the soft-key functions displayed at the bottom of the display
	OK key	Used to accept 'edit', 'configuration' and other information for data entry functions. Can also be used to select a highlighted menu item.
	Menu key	1. Used to select User and Engineering Menus.

Switch	Control	Function
		2. Used to return to top level menu system while in 'Engineering Display'
	Esc/Back key	1. Used to return to the next higher (parent) level in the menu (except in 'Engineering Display') 3. In 'Engineering Display', Used to enter or exit the various Classic LCD User menu options.
	Navigation Keys	Used to move between 'fields' while viewing lists or 'editing' functions. Can also be used to move a highlight in menus.
	Numeric Keys	Can be used in some menus when a numeric value is required. For example, entering a zone number

3. SYSTEM STARTUP AND SYSTEM SELF-TESTS

3.1 System Initialization

When the F220 system is first powered up or Reset, the following processes will occur before the system is able to process “device activations”:

- The boot-loader program loads a copy of the operating system from non-volatile memory to RAM.
- The operating system is initialized and runs.
- The F220 fire panel application starts running, and,
- Independently, the Keyboard-Display unit starts up and establishes communications with the Mainboard.

3.2 Normal Operation System Tests

When the F220 is operating, various tests are continually performed. These tests fall into two categories:

a) General system tests carried out by the F220 Mainboard; and

b) SLC tests carried out by the SLC Driver Boards.

3.2.1 System Self-Checks

Frequency	Check
500 ms	NACs 1-4, Output 1, Output 2, AUX Trouble I/P, Door Open, Ground Leakage, CRC Check.
One second	Average charge current (100mS sample), AC Present (100mS sample), SLCs
Thirty seconds	Digital Communicator
Sixty Seconds	Average output current (1 sec sample), battery voltage, battery present. A log of significant voltages, current draw and temperature can be retrieved from the panel (the PSU Log) via USB and/or FireUtils.
Hourly	Average battery temperature (10minute sample)
Daily	F220 Fire Alarm System runs from the secondary rechargeable supply for a period of 40 minutes.
Each time the panel door is closed	F220 FACP checks for additional Remote Annunciators which may have been added.

3.2.2 Watchdog

If the processor does not pass regularly through predefined firmware locations, the watchdog resets the processor, and a trouble is signaled on the automatic restart.

4. INTELLIGENT ADDRESSABLE INITIATING SLCS

Detection circuits in the Pertronic F220 fire alarm system use an intelligent addressable loop architecture. A panel may have up to 8 intelligent addressable Signaling Line Circuits (SLC). Each SLC consists of a single-pair cable connected as either:

1. Class A: A supervised loop running from the SLC driver (A terminals) to each intelligent addressable device in turn, and back to the SLC driver (B terminals). The SLC is effectively driven from both ends (Figure 4-2).This means that a single open circuit, anywhere on the SLC, will not affect its operation and will generate a trouble.

2. Class X: A Class X supervised loop is identical to a Class A loop, except that isolators are included in the circuit to allow communication to continue to devices past a single short-circuit (Figure 4-2). Isolators can be installed to electrically isolate a zone or individual detectors and modules (Section 4.5).

3. Class B: A supervised 2 wire circuit, two circuits per SLC (Figure 4-3). A single open or ground fault will generate a Trouble.

Intelligent addressable fire system devices include smoke detectors, heat detectors, manual pull stations, monitor modules, and SLC relay units. A mixture of device types may be used. Section 14: Detectors and Modules lists the addressable devices that may be connected to the F220.

Each SLC provides detector addresses 1 to 159 for smoke and heat detectors, and module addresses 1 to 99 for manual pull stations, SLC relays, etc.

A maximum of 258 devices may be installed on each SLC (159 detectors plus 99 MPSs and modules). Each detector or module must have a unique address. No two detectors can have the same address and similarly no two modules can have the same address.

The zones within a SLC are typically assigned logical areas in the premise's layout and/or by local code requirements. Each zone is allocated a zone number and can be allocated a 31-character zone descriptor.

The F220 detects SLC troubles by performing a continuity test before each poll sequence. SLC isolators are used between zones to prevent more than one zone being lost in the event of an SLC short-circuit.

Figure 4-2 and Figure 4-3 illustrate systems with two intelligent addressable SLCs, showing detectors (D), modules (M), and isolators (ISO), and a typical device numbering scheme.

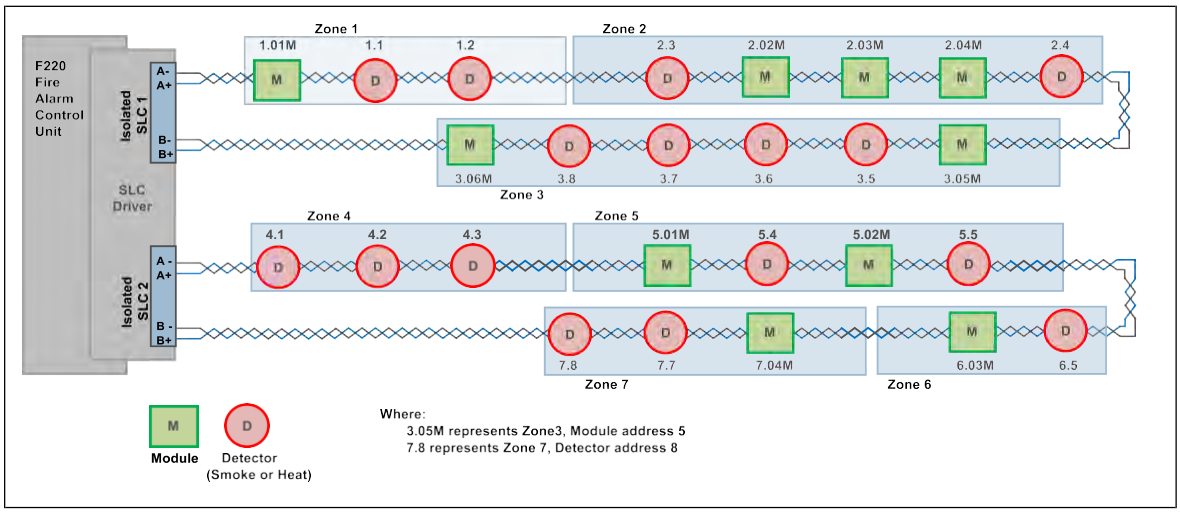


Figure 4-1: Class A SLC, with device labelling

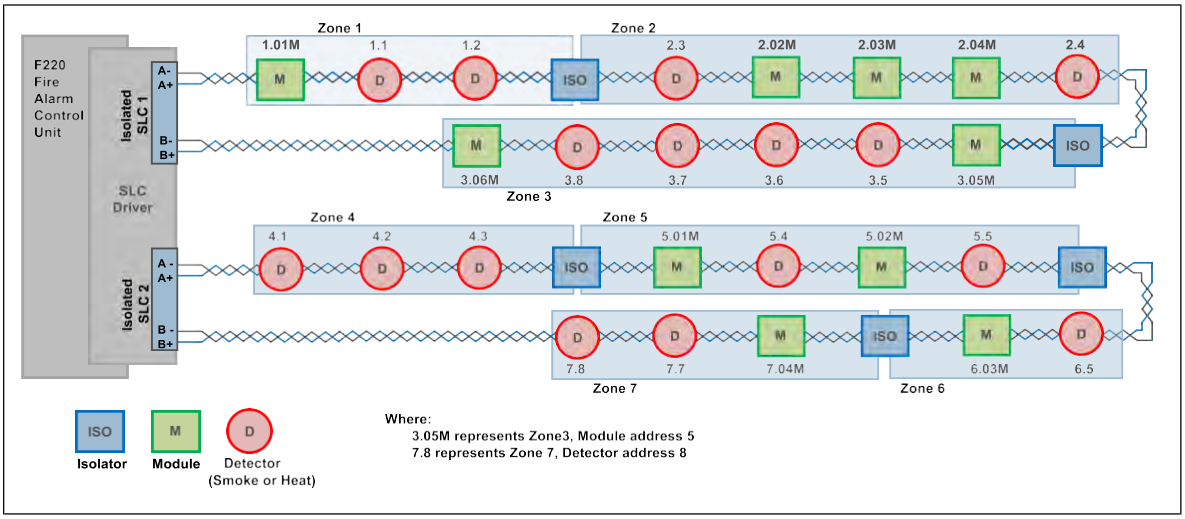


Figure 4-2: Class X SLC with isolators isolating each zone

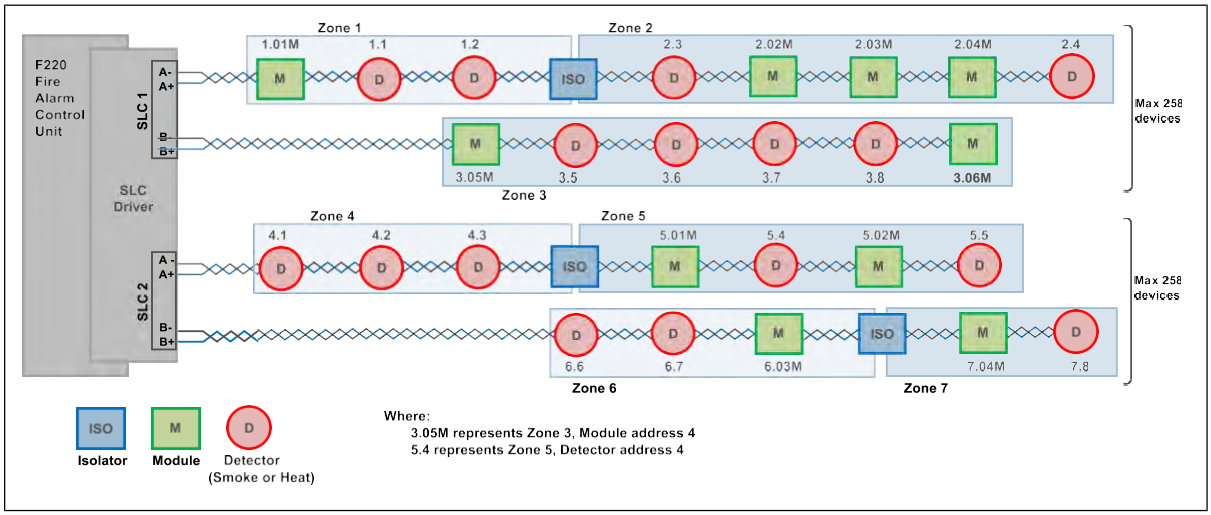


Figure 4-3: Class B SLC, with device labelling

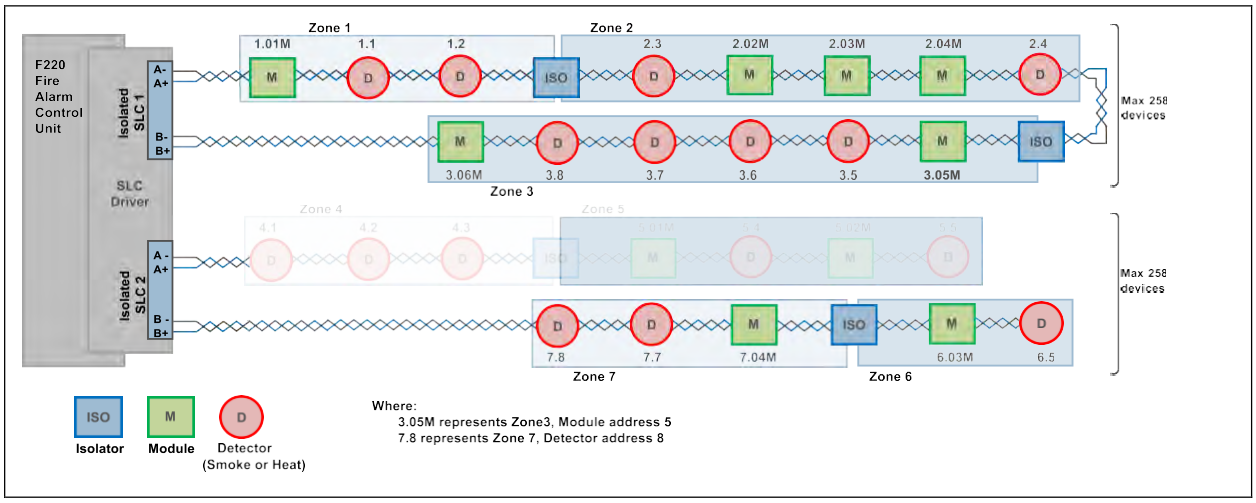


Figure 4-4: A mixed configuration comprising one Class X and two Class B SLCs

NOTE:

The number of detectors in each zone, and the number of zones covered by a single intelligent addressable SLC, may be limited by regulatory or project requirements. Consult all applicable regulations and specifications to ensure that any proposed SLC configuration complies with all mandatory requirements

4.1 SLC Driver

Intelligent addressable SLCs are controlled by one or more F220 SLC Driver units.

Each F220 SLC Driver is responsible for two intelligent addressable SLCs and executes commands for devices relating to operation and disablement. It sends the current alarm and trouble status to the F220 Mainboard for each connected device and reports its own current status.

The SLC Driver performs the following functions:

- Polls SLC devices for current status.
- Compares device readings with alarm thresholds.
- Updates detector clean air values once per hour.
- Communicates with the F220 Mainboard.

4.2 SLC Design

The intelligent addressable SLC must satisfy applicable regulatory requirements (see section 16, as well as the F220 system specifications).

The maximum end-to-end SLC length depends on the cable characteristics, as well as the number, type, and distribution of connected devices, including detectors and modules.

To develop a practical layout for an intelligent addressable SLC, it is necessary to consider the effect of two factors: Series cable resistance (Section 4.2.1), and the positions and current consumption of SLC devices (Section 4.2.2).

Twisted pair cable is recommended as it offers better crosstalk and interference performance over untwisted cable when placed near other cables. SLC cable runs alongside and close to other cables that may produce, or be susceptible to, interference should be avoided.

4.2.1 Series Cable Resistance

For Class A, the maximum end to end SLC cable resistance must not exceed 50 ohms. This is the combined resistance for both conductors; that is, each leg of the circuit shall not exceed 25 ohms (2 x 25= 50).

For Class B, the maximum SLC cable resistance must not exceed 40 ohms (combined resistance of both conductors)

This leads to the following upper limits on the end-to-end SLC length:

Conductor Size	Upper Limit on SLC Length	
	Class A	Class B
12 gauge (4.0 mm²)	8,000 feet (~2500 meters)	8,000 feet (~2500 meters)
16 gauge (1.5 mm²)	6,000 feet (~1800 meters)	4800 feet (~1450 meters)
18 gauge (1.0 mm²)	3,600 feet (~1100 meters)	3,100 feet (~945 meters)

Table 4-1: Upper Limits on the SLC Length

In practice it is not feasible to directly measure the SLC cable resistance after SLC devices have been installed. This is because each isolating device is an open circuit unless the SLC is powered up. Powering up the SLC makes it impracticable to directly measure the cable resistance with a standard multimeter. The following is one method for determining cable resistance.

Inferred measurement using a multimeter-

Unplug the SLC from the SLC driver, and as shown below, measure the resistance between SLC In negative and SLC Out negative. This value should not exceed 25 ohms. Assume the positive leg has the same or similar resistance value.

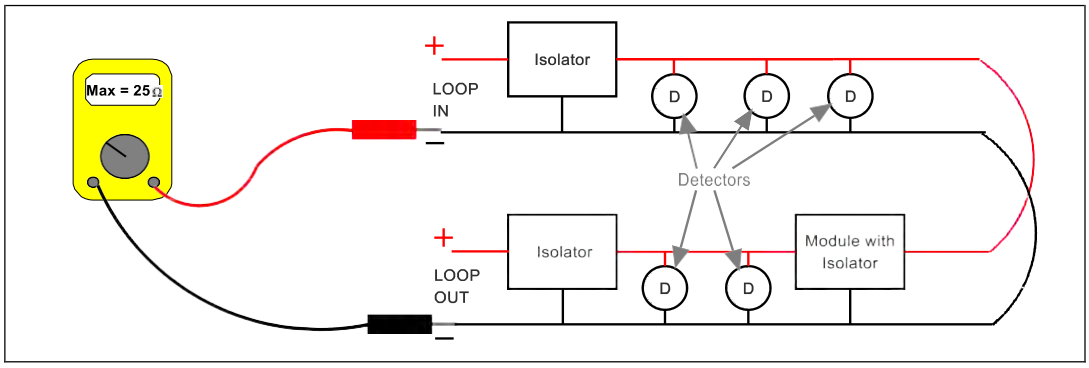


Figure 4-5: Measuring Cable Resistance

4.2.2 Effect of SLC Configuration on Maximum SLC Length

The SLC lengths shown in Table 4-1 are suitable for a lightly loaded SLCs with devices evenly distributed along its length. If the SLC is heavily loaded, or if the devices are bunched close together, then it may be necessary to reduce the SLC length.

NOTE:

The total current consumption of all devices on one SLC loop must not exceed: 500 mA

4.3 Detectors

The intelligent addressable detectors used by the F220, and their corresponding Type designators are:

Detector	Type Designator
System Sensor 2351B Photoelectric smoke detector	PHO
System Sensor 2351TB Photoelectric and thermal detector	PHO
System Sensor 2351BR Photoelectric smoke detector, remote test	PHO
System Sensor 5351B Fixed temperature thermal detector	HEAT
System Sensor 5351RB Rate of Rise thermal detector	HEAT
System Sensor 5351H High temperature thermal detector	HEAT
System Sensor 2351TIR Photo thermal infra-red detector	PTIR
System Sensor 7351 High sensitivity photo-electric detector	HPHO

Table 4-2: Detector Type Designators

Two levels of detection are implemented for analog detectors, Pre-Alarm and Alarm. When the Pre-Alarm level is reached, the Pre-Alarm list will be displayed on the Panel and a Trouble generated, if set in FireUtils. When the Alarm level is reached, an Alarm is generated.

Each detector can be configured for a range of sensitivities (Refer to Table 14-1: Detector Sensitivity Table).

Each of the parameters shown in Table 4-3 may be set for each detector in FireUtils' SLC Editor

Parameter	Value	Description
Sensitivity	-5 to +3	The number of levels available depends on the device type. The default sensitivity value is 0. More sensitive levels are positive, less sensitive are negative (Refer to Table 14-1). Different detector sensitivities can be set for day and night (Refer to Section 11.15).

Parameter	Value	Description
Configuration Flags	NAC 1 to 4	Individually setting these flags causes the corresponding NAC circuit to activate when the detector is in the alarm condition. The default Flag setting is Set.
	Fire Relay	When Fire Relay is set, the Fire Relay activates in the alarm state. The default setting is Set.
	Aux	Selecting Aux causes the 'Aux' relay to activate when the detector is in the alarm state. If Disable Aux is active, the detector will have no effect on the auxiliary relays. The default flag setting in Set.
	Alarm	When set, the local buzzer is sounded when an alarm condition occurs. Press 'Ack' or 'Silence Buzzer' key to silence. The local buzzer will automatically reactivate if it has been silenced for 4 hours following an Alarm, 24 hours following a Trouble, or if the trouble signal conditions are restored to normal. If the alarm is reset and subsequently a new alarm occurs, the buzzer sounds again. The default flag setting is Set.
	Latching	If a detector is set as 'latched', the alarm condition is latched by the F220, otherwise the output follows the state of the detector. The default flag setting is Set
	AVF	OFF or ON. This option sets the 'Alarm Verification Feature' for smoke detectors, not heat detectors nor input modules such as MPSs, and 3-Way switches. If AVF is set and the device goes into an 'alarm' state within the delay (or verification) period following the first activation, the F220 will signal the appropriate 'Alarm' condition for that device. The default flag setting is 'Not Set'. PAS, DDA and AVF flags are mutually exclusive.
	PAS	OFF or ON. This option sets the 'Positive Alarm Sequence' for detectors. Not available for modules. If PAS is set for a detector when it goes into a 'alarm', a delay is implemented before the NAC circuits are activated and the supervising or central station are notified. For details, refer to Section 8.8. The default flag setting is 'Not Set'. PAS, DDA and AVF flags are mutually exclusive.
	DDA	ON or OFF. This option sets the 'Dual Detector Alarm' flag. Available to detectors only. If set, when a detector is activated, the panel will go into a prealarm state. If a second (or more) DDA enabled detector is activated, the panel will go into alarm. The default flag setting is 'Not Set'. DDA, AVF and PAS are mutually exclusive.
	Super	Setting the supervisory flag allows the F220 to monitor the condition of other systems, processes or equipment. For example, duct detectors, Ss, sprinkler valves. The default flag setting is 'Not Set'.

Table 4-3: Device Parameters

Detectors may also be assigned the following parameters:

Parameter	Description
Zone Number	A number 1 to 64999 (or zero (0) for no assignment) which corresponds to a physical zone area in the building.
	NOTE: 1. The Network Zone Offset parameter has an effect here (see Section 8.3.1). The Zone Offset is required where a large number of panels on a network are required to use unique zone numbers for display. The offset simply increases all apparent zone numbers by the offset value. The range of zone numbers remains at 999, and zone 0 is still valid in those cases where a zone number is not required. The maximum value of the Zone Offset is 64000, resulting in a displayed zone range of 64000 to 64999 inclusive. 2. The Network Zone Offset parameter for each panel on the network is set in FireUtils 'Panel Editor'.
Descriptor	A 31-character descriptor can be assigned to each detector. This descriptor is used when displaying an event associated with the detector on the LCD display. Both the detector and zone descriptors are normally used on the display. If the detector has no descriptor assigned, the zone descriptor only is used, otherwise the "Loc:" field is left blank. A descriptor can be assigned to a detector using the SLC Editor in FireUtils.

Table 4-4: Detector parameters

4.4 Virtual Detectors

A Pertronic virtual detector is one where the analog output of one detector (the "parent") is used to generate different states which are used typically to warn, or give a "heads-up", of a more serious condition that is about to occur.

An F220 may have "virtual" detectors programmed. Each virtual "child" detector has a copy of the current status of the "parent" detector but is processed as an independent detector with separate alarm level, output mapping, and descriptor. This allows for up to four (4) different levels of panel response based on detector sensitivity (See Table 14-1: Detector Sensitivity Table, Section 11.15 Day/Night Mode).

The F220 uses a lower-case 'v' to designate virtual detector types. Hence a parent "PHO" detector can have child "vPHO" detectors and a parent "PTIR" can have child "vPTIR" detectors, etc. Parent detectors are programmed as usual, but any virtual devices must be programmed at the address immediately following the parent's address.

An example of virtual detector use might be to use the System Sensor® Pinnacle™ High Sensitivity Photoelectric Smoke Detector to provide escalating response to different levels of smoke, as illustrated below:

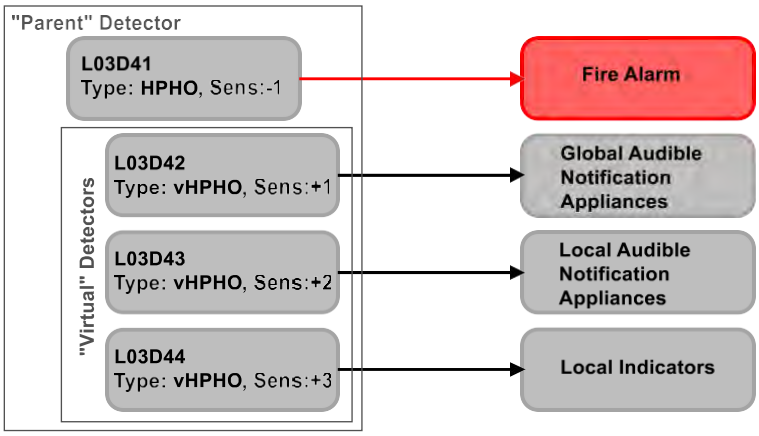


Figure 4-6: Example of Virtual Detector Use

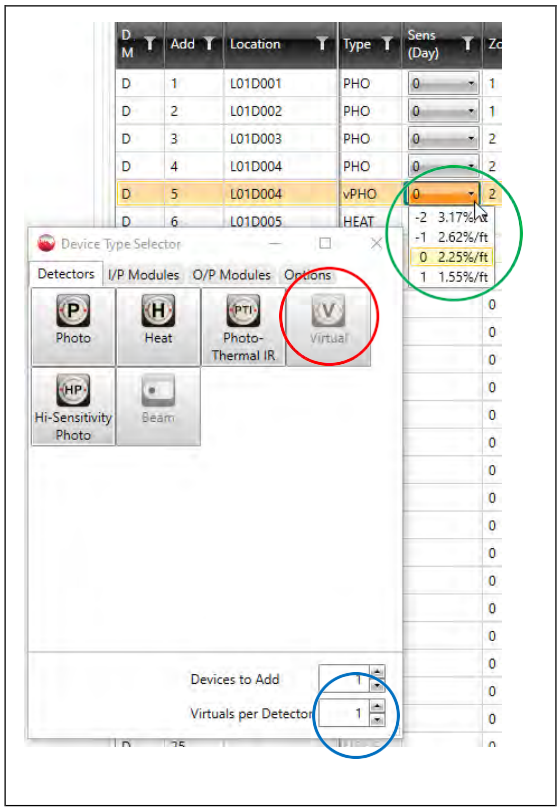
NOTE: The 'parent' (or base) detector should always be the least sensitive (i.e. -1 in Figure 4-6) and the following 'virtual' detectors should have increasing sensitivity (i.e.. +1, +2 and +3 in Figure 4-6)

4.4.1 Limitations

- Virtual detectors cannot be configured to turn ON the Fire Relay. It is expected that all virtual devices will be progressively more sensitive than their parent detector.
- There are no Pre-Alarm events generated for virtual detectors.
- There can be at most 3 virtual devices attached to a real detector.
- A Trouble event can be generated by a virtual detector. This will occur if the parent is missing, the virtual detector type is a different from that of the parent, another detector is at the same address, or if there are more than 3 virtual detectors configured.

4.4.2 Creating a Virtual Detector using FireUtils

- Select the SLC in FireUtils' Component Tree to display the SLC Editor.
- To add a virtual detector, first select the 'parent' detector, then select Virtual device button from the Device Type Selector (red circle).
- In the drop-down box (green circle), select the appropriate Pre-Alarm sensitivity level.
- Higher/positive numbers are more sensitive; lower/negative numbers are less sensitive.
- To quickly add the desired number of virtuals to each detector, use the "Virtuals per Detector" quantity box (blue circle)
- The virtual device button will be greyed out if the 'parent' device type cannot support a virtual detector or if an appropriate address is not selected



4.5 Trouble Isolation between Zones

A SLC isolator is used to electrically isolate adjacent sections of the intelligent addressable SLC (See Class X, Section 4.0). An isolator must be installed at each zone boundary, if the applicable regulations or system requirements demand that a trouble in one zone shall not prevent normal SLC operation in any other zone. The isolator monitors adjacent SLC connections for short and open circuits. If a short or open circuit is detected, the isolator disconnects the SLC connection in that zone.

Provided that both ends of the SLC are terminated at the F220, and there is an isolator at the beginning and end of each zone, a short or open circuit on any zone will not affect the operation of the rest of the SLC.

A suitable isolator module is the System Sensor M500X Isolator. Isolators are not required adjacent to the F220 as isolation is provided by the F220 SLC Driver board.

The following diagram illustrates a typical SLC configuration with isolators at appropriate locations:

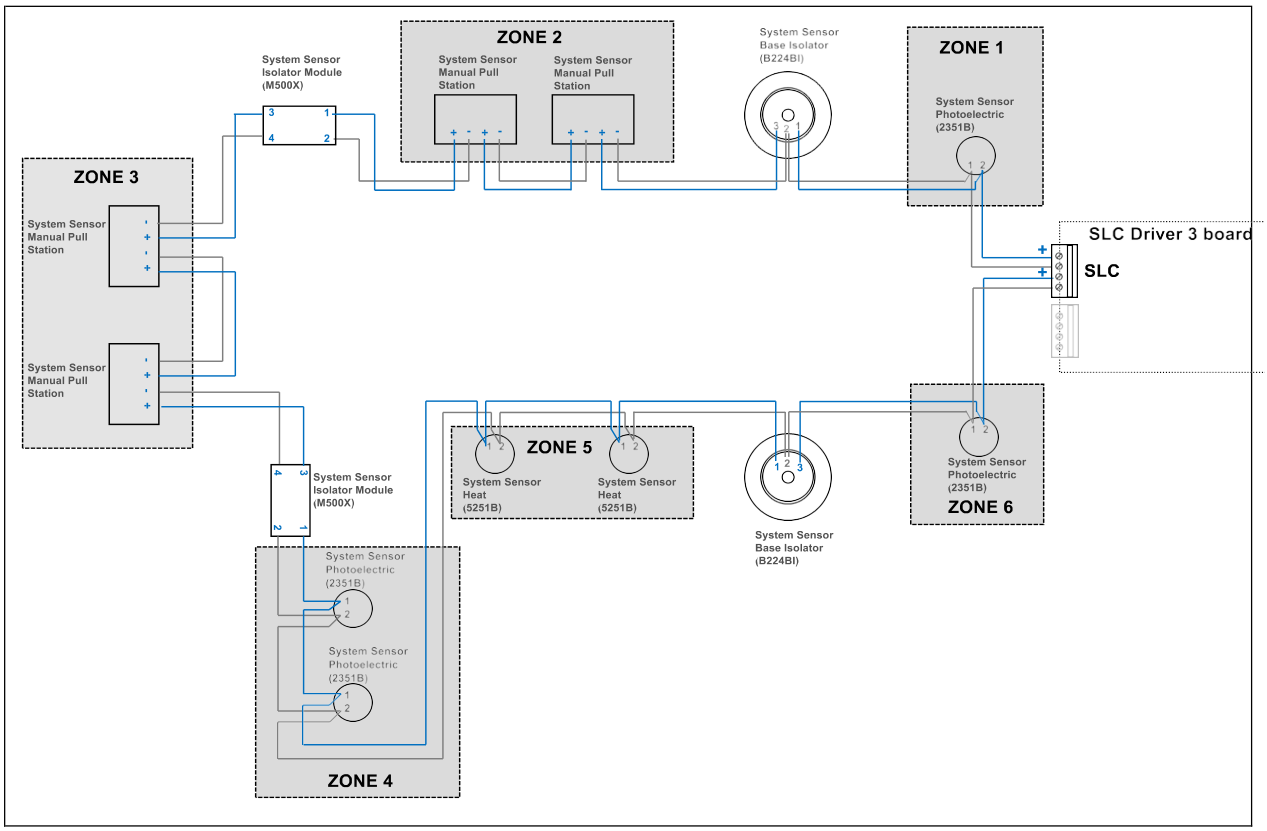


Figure 4-7: Isolation between Zones in a Class X SLC loop

4.6 Manual Pull Stations

The F220 uses the Pertronic Addressable Pull Station, product code MPS-PI.

If a Manual Pull Station is activated, it is immediately polled again to re-confirm the ‘Alarm’ state.

Manual Pull Stations give ‘Normal’, ‘Trouble’, and ‘Alarm’ states to the F220.

Each pull station can have parameters programmed in FireUtils’ SLC Editor. The parameters are the same as for the detectors, except for ‘Sensitivity’, ‘PAS’, ‘AVF, DDA, and ‘Supervisory’ which are not applicable to Manual Pull Stations.

Manual Pull Stations may also be individually assigned a zone number and descriptor, as for detectors (described in Table 8-3).

The selected address (1 to 99) is part of the Module address allocation.

4.7 Monitor Modules

The F220 uses the following modules for additional inputs to the system:

- System Sensor M500MAP Single Input Monitor Module
- System Sensor M500X Short Circuit Isolator
- System Sensor M501MAP Monitor Module (Miniature)
- System Sensor M502MAP Zone Monitor Module

- System Sensor M500DMAP Dual Input Monitor Module
- System Sensor M500DMRAP Dual Relay Monitor Module
- System Sensor M500RAP Relay Module
- System Sensor M500SAP Single DPDT Output Control Module
- System Sensor CR-6 Six Relay Control Module
- System Sensor IM-10 Ten Input Monitor Module
- System Sensor SC-6 Six Supervised Control Module

A variety of Type designators, with corresponding functions, are allowable for input modules. These are programmed and controlled in a manner similar to Manual Pull Stations and are assigned parameters and descriptors in the same way. Monitor modules may be programmed for unlatched operation.

The Input Device Type designators and a description of their function are listed in Table 4-5.

Type Designator	Function and Operation	
MPS	Manual Pull Station	Alarm always enabled.
WFL	Waterflow Input	As for MPS operation, except that Alarm can be disabled. Latching, Fire Call Latch, Alarm, Aux and Super settings can be enabled and disabled. Default: Fire Relay, Aux, Alarm and Latching enabled Fire Call Latch, Super disabled.
FSW	Flow Switch	
PSW	Pressure Switch	
VMD	Valve Monitor Device	
SIP	Sub-Indicator Panel	
ISO	Switch Input (Disable)	When active, the zone assigned to the input is disabled, along with all other devices within that zone. When the input is returned to Normal, the zone is no longer disabled, and all other devices within the zone are returned to the Normal state.
ZMU	Zone Monitor Unit	Used only by M502MAP modules. A zone of conventional devices may be connected to the M502MAP module. The F220 Aux power output or an external PSU can be used. To reset latching devices, the PSU supply to the M502MAP must be broken with a relay (e.g., M500RAP). This relay may be triggered from the “Device Reset” system event output.
SW	Switch input	As for MPS operation, except that Latching, Fire Call Latch, Alarm, and Super settings can be enabled and disabled.
PLNT	Switch input - PLNT	
MON	Switch input - MON	
VES	` input	
SW_H	Hidden Switch input	The SW_H device type is for controls that do not require display or event logging. Latching, and Fire Call Latch are not allowed.
AUX		D500DMRAP modules: 2 inputs, 1 relay output and 2 input, 2 relay output.

Table 4-5: Input Module Parameters, Designators and Description

Some modules provide a two- or four-wire monitored input circuit. A 47 kΩ EOL (end of line) resistor is required for the two-wire configuration. (Refer to the Installation and Maintenance Instructions for the M500 series modules). If a separate external power supply is used to power a module, that supply must match the class of the SLC (i.e., Class A, B or X).

The selected address (1 to 99) is part of the Module address allocation.

4.8 SLC Input Device Parameter Default Settings

The default settings for the SLC Input devices are:

Parameter	Default State	Notes
Sensitivity	zero (0)	Applies to detectors only, except Beam
NAC 1 to 4	Set	All SLC input devices, except 3-way, disable and hidden switches, and M500DMRAP
Fire Relay	Set	All SLC input devices except virtual detectors, 3-way, disable and hidden switches and M500DMRAP
AUX Relay	Set	All SLC input devices, except 3-way, disable and hidden switches, and M500DMRAP
Alarm	Set	All SLC input devices, except 3-way, disable and hidden switches, and M500DMRAP
Latching	Set	All SLC input devices, except 3-way, disable and hidden switches, and M500DMRAP
Fire Call Latch	Not Set	All SLC input devices
AVF	Not Set	Applies to smoke detectors, not heat detectors or input modules such as MPSs, and 3-Way switches.
PAS	Not Set	All SLC detectors
DDA	Not Set	All SLC detectors
Super	Not Set	Applies to all input devices except MPS, Heat detectors and 3-way switches

Table 4-6: Default Device Settings

The default settings of all detectors, virtual detectors, input and output modules can be modified in FireUtils. In the SLC Editor, select the 'Options' tab in the 'Device Type Selector' and click on the 'View/Edit Defaults' button to display the 'SLC Device Defaults' window.

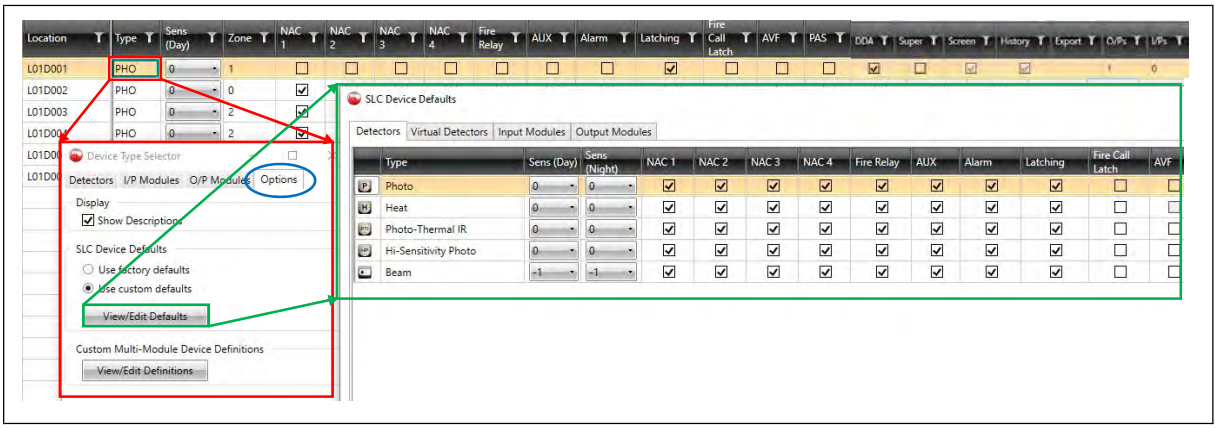


Figure 4-8: Changing the default settings of SLC devices in FireUtils

4.9 SLC Relays

The F220 uses System Sensor M500SAP Supervised Control Module, and System Sensor M500RAP Relay Control Module for relay operation. Both are SLC intelligent addressable output modules. The selected address (1 to 99) is part of the Module address allocation.

The M500SAP control module relay output has a supervised set of relay contacts that uses a 47kΩ EOL (end of line) resistor for monitoring purposes. (Refer to the Installation and Maintenance Instructions for further information).

All relays can be allocated a zone number (1 to 64999), which corresponds to the physical zoning of the SLC devices. The zone number is used by the F220 when reporting a Trouble state from a relay control module, and to disable the module when the zone is disabled.

SLC Relays can be configured through the SLC Editor in FireUtils to be one of four types (Refer to Table 4-7).

For further information on mapping of Groups and LED number mapping to relays, refer to Section 8: Configuring the F220.

Type	Description	Operated by	Disabled by
AUX AUXS	AUX Relay type supervised and non-supervised	Output mapping	Disabling the zone in which the relay is assigned, or by disabling the device address. Operating the panel DISABLE AUX push button
NAC NACS	Notification Appliance Relay type supervised and non-supervised	Output mapping The panel 'FIRE DRILL' push-button or from a Full Function LCD Annunciator connected to the External High-Speed RS-485 Bus	Isolating the zone in which the relay is assigned, or by disabling the device address or operating the panel disablement menu. Operating the panel `Disable NACs` push button.
DHR DHRS	Door Holder type supervised and non-supervised	Output mapping	Disabling the zone in which the relay is assigned, by disabling the device address, or accessing Disable Door Holder Activation in the panel's disablement menu.
RLY RLYS	Relay Output type supervised and non-supervised	Output mapping	Disabling the zone in which the relay is assigned, or by disabling the device address.

Table 4-7: Output Device Types

4.9.1 Additional SLC Relay Settings

Parameter	Value	Description
Flags	Screen	Forces events to be displayed on the F220 Keyboard-Display (defaults to Active Events queue) and forces History and Export to be set.
	History	Any change of state of the relay will be entered in the History Log.
	Export	Any change of state of a SLC output device (e.g., relay) is made visible on the network. Force History to be set.

Table 4-8: Additional Flags for SLC Relays

4.9.2 Configuring SLC Relays in FireUtils

- In the SLC Editor, select a cell in a row, right click and select 'Device Type Selector'.
- Select the 'O/P Modules' tab.
- Select the appropriate module, supervised or unsupervised.

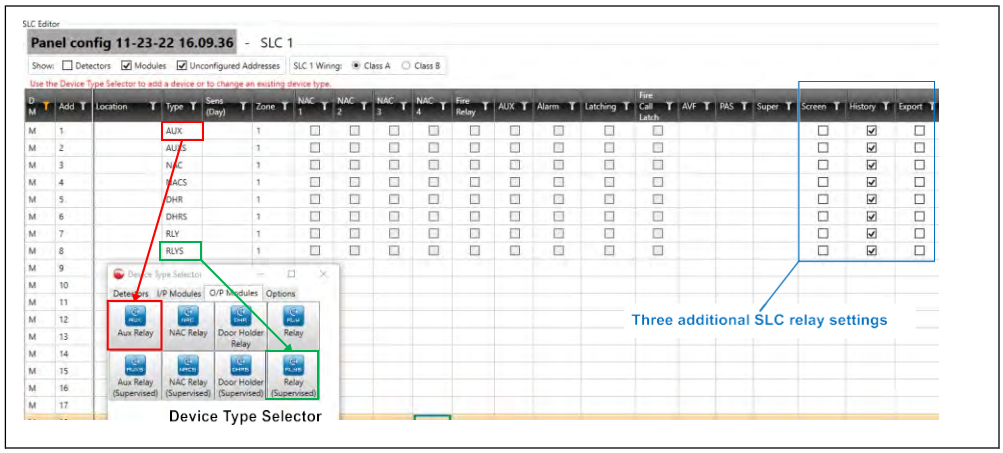


Figure 4-9: Creating and configuring SLC Relays in FireUtils

4.10 Intelligent Addressable Communications Protocol

The F220 Intelligent Addressable SLC and connected input and output devices communicate using the System Sensor CLIP protocol.

5. SERIAL COMMUNICATION: RS-485

The F220 has two independent RS-485 buses:

- External High-Speed RS-485 Bus
- Internal High-Speed RS-485 Bus
- Extension High-Speed RS-485 Bus

These buses facilitate communication between the F220 Mainboard and other Pertronic fire alarm system components, including the Keyboard-Display, Charger Controller, Annunciator displays, SLC (Loop) Drivers and Ancillary Peripherals.

All buses use multi-drop, half-duplex communication where the F220 Mainboard is the controller, and all connected devices are polled. A 9-bit protocol is used to communicate with the polled devices. The first data byte contains the address of the polled device.

When polled, a connected device reports its current status.

5.1 External High-Speed RS-485 Bus

The F220 External High-Speed RS-485 Bus runs at 115.2 kb/s. It is used to connect the F220 Remote Annunciators such as the LCD Full Function Annunciator (F220-FFANN-UL) and future peripheral units.

The maximum number of Remote Annunciators that can be attached to the External High-Speed RS-485 bus is 32. The bus must be terminated with a 120Ω End-of-Line resistor. For connection diagrams refer to Figure 20-3 and Figure 20-28. Power for the Remote Annunciators attached to the bus is limited to 3.0 A (Table 19-1).

Device	Mainboard Connector	Mainboard Label
Remote Annunciators	K24 K6	EXTERNAL RS485 External RS485 (Not intended for field wiring)

Table 5-1: External High-Speed RS-485 Bus Connectors

5.2 Internal High-Speed RS-485 Bus

This bus carries communication between the Mainboard, Keyboard-Display, Net2Card and Charger Controller. Bus speed 115.2 kb/s.

Device	Mainboard Connector	Mainboard Label
Charger Controller	K39	CHARGER CONTROLLER
Unassigned	K12, K41, K43, K44, K45	HIGH SPD RS485
Keyboard-Display	K42	F220 KEYBOARD
NET2CARD	K12, K41, K43, K44, or K45	HIGH SPD RS485

Table 5-2: Internal High-Speed RS-485 Devices and Connections

5.3 Extension Bus

The Extension Bus runs at 115.2kb/s and carries communication between the Mainboard and the SLC (Loop) Driver boards.

Device	Mainboard Connector	Mainboard Label
SLC Loop Driver	K36	EXTENSION BUS

Table 5-3: Extension High-Speed RS485 Devices and Connections

6. OTHER SERIAL COMMUNICATION PORTS

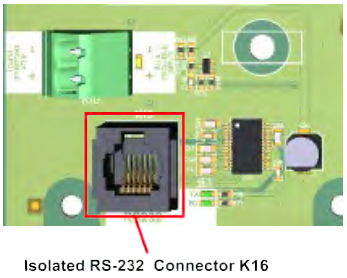
In addition to the RS-485 buses, the F220 has the following serial communication ports:

- RS-232 Serial port
- USB port
- Ethernet port

Details of these ports and their use are covered in the sections that follow.

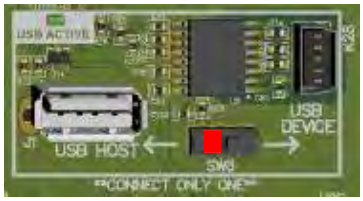
6.1 RS-232 Port

An isolated RS-232 port is provided for connection to the Fire Panel's Digital Communicator. The port operates at a default speed of 9.6 kb/s (1 start bit, 8 data bits, 1 stop bit).



6.2 USB Port

The USB can operate in two modes that are switch selectable.



6.2.1 Host Mode

This mode is used to Read and Write to USB memory devices that have been connected to the USB HOST connector.

These files have the following functions:

File Type	Function	Read / Write
Configuration	Save current configuration or Load a new configuration	Read / Write
History Log	Save current history log	Write
Status	Save current device status	Write
Mainboard Firmware	Load a firmware update for the Mainboard	Uses inbuilt system bootloader

6.2.2 Device Mode

No functionality is available for any current user applications.

6.3 Ethernet Port

An Ethernet port is provided on the F220 Mainboard for a direct connection to a user computer that is running FireUtils ®.

In FireUtils ®, for a direct connection (See Section 18.3 for details)

- In the ‘Panel’ tab, click the ‘Connection Type’ button labelled ‘TCP/IP’.
- In the ‘TCP/IP’ section, click on ‘Panel Ethernet’, and ‘Discover’.
- The Name and IP Address for the connection will appear in the selector box.
- Click on the selector box to the left of the desired connection.
- Enter the Engineer’s password (see Section 18.3) and click the ‘Connect’ button.
- If successful, the connection status will be displayed in the ‘Panel Response’ window.
- If unsuccessful, an error message will be displayed.
- Once connected, the ‘Connect’ toolbar button will change to ‘Disconnect’.

Refer to Section 18.4 Sending a Configuration File to a F220 Panel for more details.

7. FIRMWARE UPLOADS

7.1 F220 Mainboard (Main PCB Assembly)

F220 firmware can be loaded into an F220 using a USB memory stick. The firmware update process effectively isolates the F220 from whatever network it may be connected to while the update is in progress.

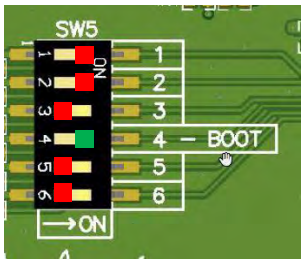
The firmware update process does not check the firmware version, the uploaded file will always replace the currently loaded firmware.

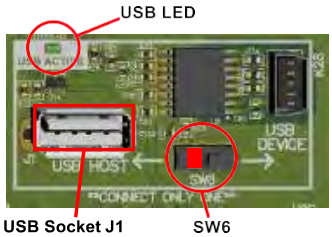
USB memory stick setup:

- The USB memory stick must be FAT32 formatted, See 7.4 USB Flash Memory File System Format.
- Open the zip file containing the firmware to be installed. The zip file name will be in the format eNet_package_USA_vx.x.x.zip where x is the version numbering.
- Copy the entire directory named ‘F220_Installer’ in the zip file to the root directory of the USB memory stick.

F220 main board setup:

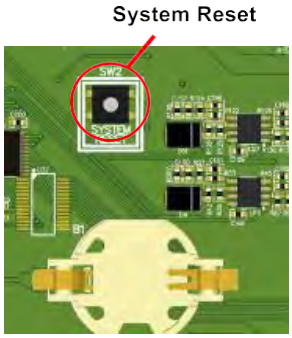
- Set SW5_4 to ‘ON’ (Green square)
- Set SW6 to ‘Host’, if required.





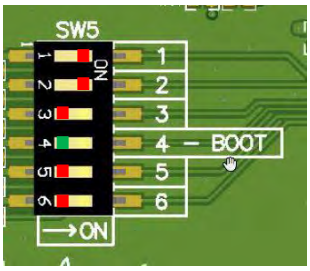
- Press the System Reset button SW2.
- Wait for the USB LED to start a slow blink (~2 per second) to indicate the F220 main board is ready for a firmware upload.

  See Figure 7-1: USB LED Activity for F220 Mainboard Firmware Upload



Loading F220 main board firmware:

- Insert USB memory stick into USB socket J1.
- The USB active LED will be fast blinking while the firmware is being loaded (there may be a 10 to 20 second initial delay). The firmware will take up to a couple of minutes to load.
- The USB active LED will stay on continuously after successfully loading the firmware from the USB memory stick. A slow blink at this stage indicates a failure.
- Remove the USB memory stick.
- Set SW5_4 to 'OFF'.
- Press the System Reset button SW2.



The F220 main board will start using the new firmware.

USB LED Activity	Notes
Slow blink, 0.5s on /0.5s off	F220 Mainboard is ready for a firmware upload and waiting for a USB memory stick to be inserted.
Constant fast blink	F220 Mainboard is uploading firmware from a USB memory stick
Steady on	Successful firmware upload.
Slow blink, 0.5s on /0.5s off	Firmware upload failure if the USB memory stick is still inserted.

Figure 7-1: USB LED Activity for F220 Mainboard Firmware Upload

NOTE:

The current configuration of the F220 panel can be downloaded from the Mainboard to a USB stick. The process is as follows.

1. Insert a FAT32 formatted USB stick into the USB socket J1.
2. Use the Save Configuration in User Menu > Service Menu > USB Menu > Save Configuration. Further details are given in section 10.5.3

7.2 F220 Keyboard/Display

The F220 keyboard/display firmware can be loaded into an F220 keyboard/display using a USB memory stick.

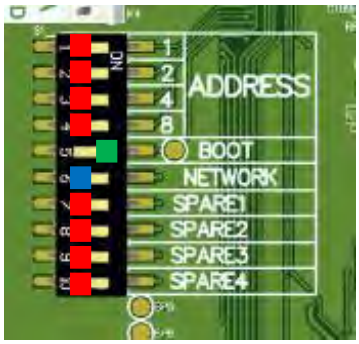
The firmware update process does not check the installed firmware version, the uploaded file will always replace the currently loaded firmware.

USB memory stick setup:

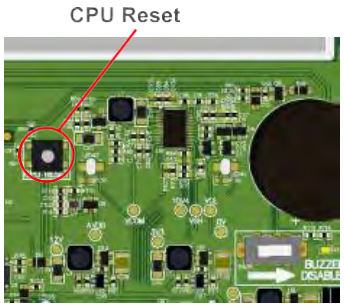
- The USB memory stick must be FAT32 formatted, See 7.4 USB Flash Memory File System Format.
- Open the zip file containing the firmware to be installed. The zip file name will be in the format eNet_package_USA_vx.x.x.zip where x is the version numbering.
- Copy the entire folder named “F220Display_Installer into the root directory of the USB stick.

F220 keyboard/display setup:

- Set DIP switch S1 switch 5 to ON (Green square). This switch is labelled “BOOT”. This switch is only read at startup.
- Set DIP switch S1 switch 6 to OFF (Blue square), if required. This switch is labelled “NETWORK”. This switch is only read at firmware upload time. It is recommended that this switch be left in this position to indicate that the board is intended to be an F220 keyboard/display. If this switch is set to ON, the NET2-FFANN-UL firmware will be uploaded.



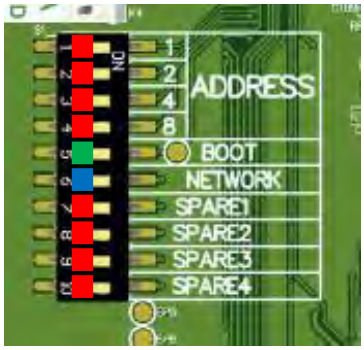
- Press the reset button SW17, “CPU Reset”.
- Wait for the USB LED to start a slow blink to indicate the F220 keyboard/display is ready for a firmware upload. See Figure 7-2: USB LED Activity for F220 keyboard/display Firmware Upload



Loading F220 keyboard/display firmware:

- Insert USB memory stick into socket J2.
- The USB active LED will be fast blinking while the firmware is being loaded. The firmware may take up to a couple of minutes to load and there may be brief periods of LED on time as loading progresses.
- The USB active LED will stay on continuously for at least five seconds after successfully loading the firmware from the USB memory stick. A slow blink at this stage indicates a failure.

- Remove the USB memory stick.
- Set DIP switch S1 switch 5 to OFF.
- Press the reset button SW17, “CPU Reset”.



The F220 keyboard/display will start using the new firmware.

At start up the display will show the firmware version.

Checking the firmware version also indicates if conversion from F220 to Remote Annunciator firmware (or vice versa) was successful.

A log file will be created (if it does not exist already) on the USB memory stick and it will have brief details of the result of the last firmware upload timestamped and appended to the file.

LED25 (USB Active)	Notes
Slow blink, 0.5s on /0.5s off	F220 keyboard/display is ready for a firmware upload and waiting for a USB memory stick to be inserted.
Constant fast blink	F220 keyboard/display is uploading firmware from a USB memory stick. Brief interruptions to the blinking are normal.
Steady on	Successful firmware upload.
Slow blink, 0.5s on /0.5s off	Firmware upload failure if the USB memory stick is still inserted.

Figure 7-2: USB LED Activity for F220 keyboard/display Firmware Upload

7.3 Net2Card and SLC (Loop) Driver Firmware

For uploading firmware to:

- Net2Card, refer to Section 20.6.4 .
- SLC (Loop) Driver, refer to Section 19.3.3.

7.4 USB Flash Memory File System Format

The USB flash memory stick must have a FAT32 file system format for correct operation of the configuration process. The easiest way to check the format of USB memory is to plug the memory into a PC and when it is mounted:

- Open a file explorer window.
- Right click the drive letter representing the USB memory.

- Select “Properties” from the menu.

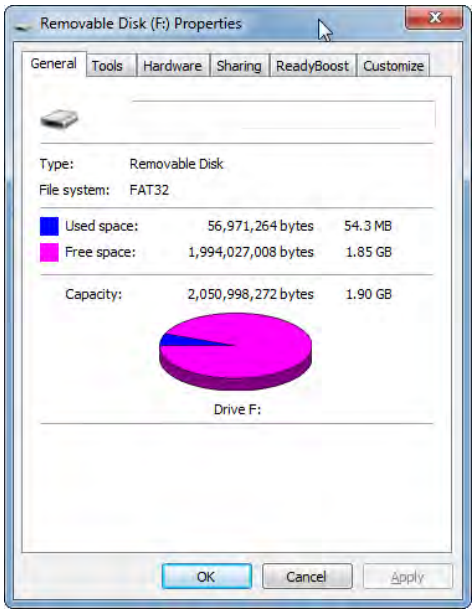


Figure 7-3: USB Memory Stick Properties

The file system should be FAT32.

If the file system is NTFS or some other format, it can be formatted to FAT32. There are several ways of formatting to FAT32, all involve total loss of any existing files. Any reformatting is best done on a smaller size (less than 32GB) USB memory stick. An internet search on “FAT32 USB format” should provide some good advice on reformatting using ordinary PC operating system utilities.

The configuration/firmware files must be loaded onto a USB flash memory stick for loading into the F220. The configuration files must have the correct names and be in the correct directory, the directory must also be in the correct location in the USB memory.

8. CONFIGURING THE F220

This section details how the F220 panel is configured to meet the requirements specific to the site. The configuration of the F220 panel is undertaken using Pertronic's FireUtils software. FireUtils is a computer application that allows users to configure and analyze Pertronic Fire Panels and Networks. It displays configuration data in a series of panes and tables for inserting and editing SLC devices, zones, timers, groups, logic blocks, PAS/AVF/DDA processes, auxiliary and supervisory outputs.

An overview of FireUtils is given in Section 18. For a detailed description refer to the FireUtils User Manual

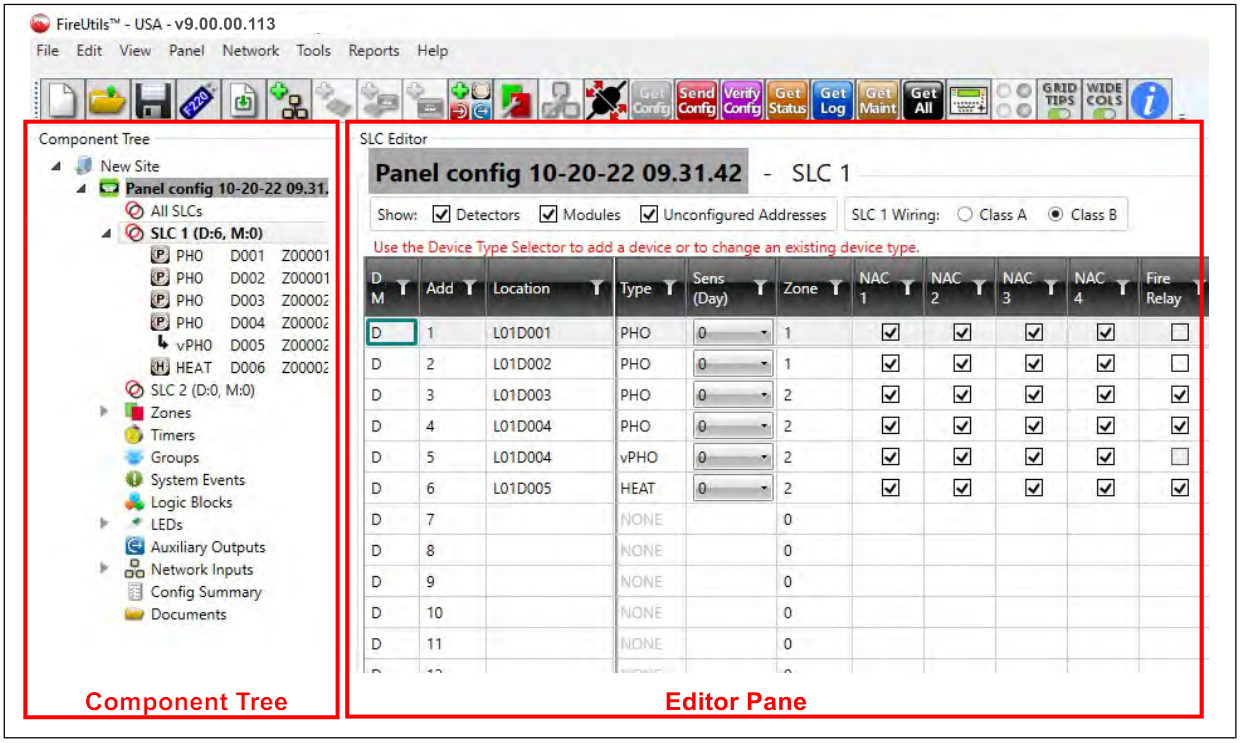


Figure 8-1: FireUtils' Main Application Window.

There are 14 different Editor panes: from the Site Editor through to the Network Inputs and Nodal Mapping Objects Editors.

8.1 Configuration options (UL Notice to Users)

NOTICE TO USERS, INSTALLERS, AUTHORITIES HAVING JURISDICTION AND OTHER INVOLVED PARTIES				
This product incorporates field programmable software. For the product to comply with the requirements in the Standard for Control Units and Accessories for Fire Alarm Systems, UL864, certain programming features, or options, must be limited to specific states or not used at all as indicated below.				
Program feature or option	**Permitted in UL864? (Y/N)**	**Possible Settings**	**Settings permitted in UL864**	**Comments**

Detector Alarm parameter	N	Detectors can be programmed to not generate an alarm and not report to the central station when activated. Refer to Table 4-3 Device Parameters • Set/enabled (default) • Not Set/disabled	Detector Alarm flag • Set/enabled	
Mains Fail	Y	Refer to Main Fail in Table 8-4 • Range: 0 to 4 hours • 2 hours (default)	1 to 3 hours	
Timers	N	Timers used to delay the reporting of a Trouble, Supervisory, or Alarm signal	None	Any timer used to delay reporting of events or affect any feature/function that could cause the system to operate outside of the required NFPA 72 timelines and beyond the maximum required times that this system has been tested to UL 864 is not permitted.
Buzzer on Trouble	Y	Refer to 'Buzzer on Trouble' in Section 2.2.7 • Set/enabled (default) Not Set/disabled	Buzzer in Trouble Set/enabled	
Buzzer on Pre-Alarm	Y	Refer to 'Buzzer on Trouble' in section 2.2.7 • Set/enabled (default) • Not Set/disabled	Buzzer on Pre-Alarm • Set/enabled	
CO Supervisory parameter	Y	Refer to section 11.9 • Set/enabled (default) • Not Set/disabled	CO supervisory flag • Set/enabled	
Detectors Latching parameter	Y	Refer to Table 4-4 • Set/enabled (default). • Not Set/disabled.	If detector's alarm flag is set/ enabled, latching flag is • Set/enabled	Both Alarm and Latching flags are set/enabled by default
Modules Latching parameter	Y	Refer to Table 4-6. • Set/enabled (default) • Not Set/disabled	If module's function is to produce a fire event, Latch flag is • Set/enabled	Both Alarm and Latching flags are set/enabled by default.
Non synchronization of NACs	N	Refer to Section 11.4 NACs • Synchronized NAC (default) • Non-synchronized. Aux Power	• Synchronized NAC (default) • Aux Power	
Automatic Battery Test	N	• Each day of the week can be checked to perform a battery test on that day.	All Days of the Weeks flags are Not Set/disabled (default).	Days of the week flags are 'Not Set' by default. If enabled and the primary power failed immediately

				after an automatic battery test, the batteries would not be at full capacity.
NAC 1 to 4 Supervised (panel editor)	Y	• Checked (Supervised) Unchecked (not supervised)	• Checked (Supervised) •	
Buzzer On Trouble (panel editor)	Y	• Checked (use buzzer) • Unchecked (buzzer not used)	Checked (use buzzer)	
Buzzer On Pre-Alarm (panel editor)	Y	• Checked (use buzzer) • Unchecked (buzzer not used)	• Checked (use buzzer)	

Table 8-1: UL864 Compliant Configuration Options

8.2 SLC Device Configuration

The F220 supports a flexible configuration system. Using the SLC Editor in FireUtils, SLC detectors and modules can be configured to activate NACs, relays, SLC Outputs (see Section 8.2.1), and selected System Events (see Section 8.5). It can also be used, among other tasks, to assign a device to a zone and/or group, set detector sensitivities, monitor and record events, and latch a device's alarm condition, if required.

In FireUtils, select and click on 'SLC' in the Component Tree to display the SLC Editor. (**NOTE:** In Figure 8-1 above, 'SLC 1 D5:M:3' has 5 detectors and 3 modules).

For convenience, Figure 8-2 and Figure 8-3 shows the SLC Editor in two parts, with a brief description of the function of each column. Both parts incorporate configuration data for 8 SLC devices. A more detailed description of device parameters are given in Table 4-3 through to Table 4-8.

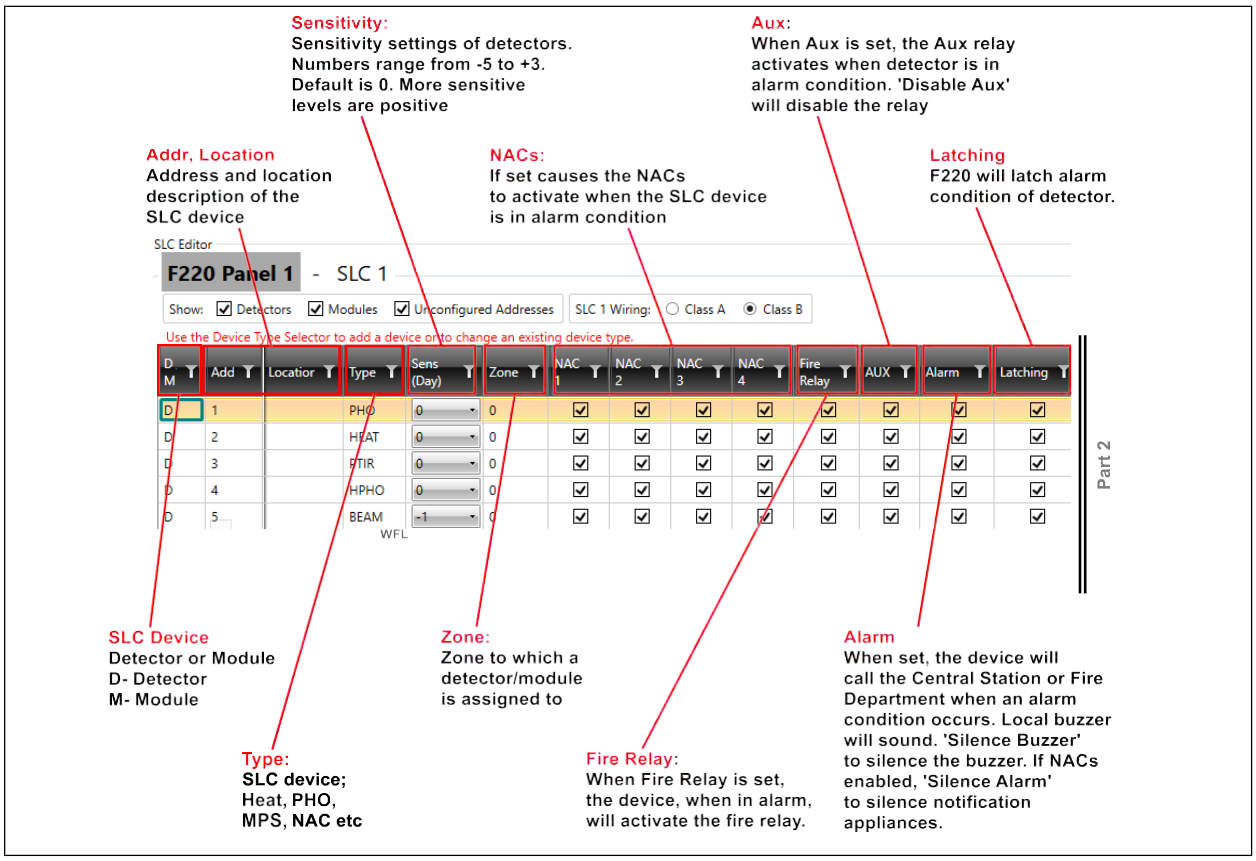


Figure 8-2: Part 1 of FireUtils' SLC Editor

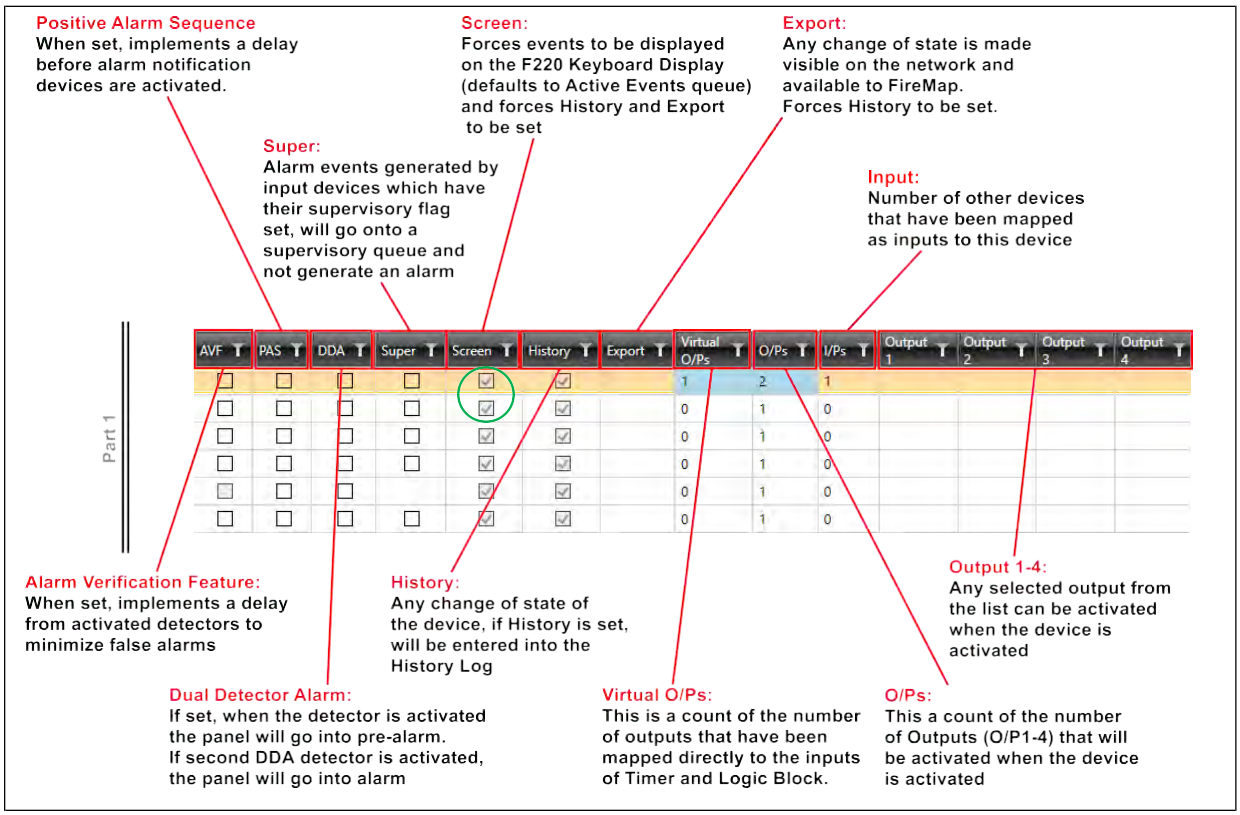


Figure 8-3: Part 2 of FireUtils' SLC Editor

8.2.1 SLC Output Registers

The four Output Registers of each SLC device can be configured to trigger numerous actions (Output Types) ranging from activating a relay or SLC based NAC, to disabling a detector, zone, module or NACs.

However when the SLC device is activated, its output must pass an extra qualification or requirement (see Figure 8-4 below), such as being in 'Alarm' or 'Trouble', before it is passed on to the SLC output register to which it has been mapped. The activation qualification is dependent (see Section 8.2.2) on the type of SLC device – detector, input or output module.

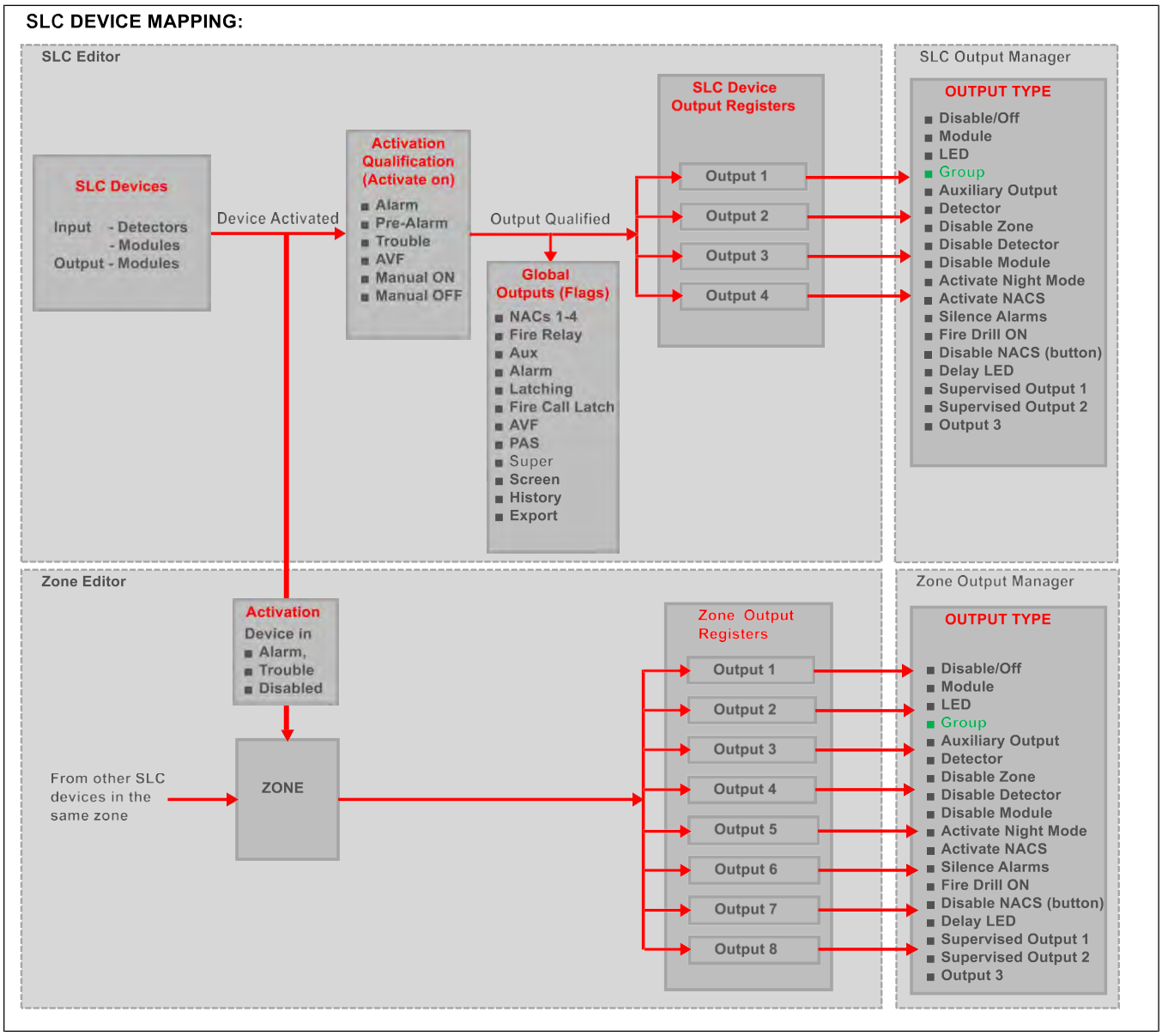


Figure 8-4: Configuring an SLC device and Zone Output registers

Each SLC Output Registers may be configured to have one of the following Output Types

Output Type	Description
Disable/Off	The output register for the SLC device is disabled.
Module	Drives a SLC module; for example, a SLC relay. When a SLC Device is selected, the input device, zone or group can be mapped to a SLC relay or detector (**NOTE**: in the case of a detector, just the detectors' LED will illuminate). The device is selected in the standard LxxMyyy or LxxDyyy format, where xx represents the device`s loop number (L1 to L20) and yy its address (D1 to D159 or M1 to M99).

Output Type	Description
LED	When an LED is selected, the zone, SLC device, group etc. can be configured, for example, to an LED Annunciator or be used to virtually activate or trigger other panel and network functions and events.
Group	A Group simply extends the output function to a further 15 outputs. This may be desirable either to extend the number of outputs available to an SLC device or zone, or to collect similar panel functions into different groups. Groups can map to another group but the group it is mapped must have a higher number than the first. When a Group is selected, the SLC device maps to one of 999 groups.
Auxiliary Output	When Aux is selected, the zone, SLC device or group maps to one of 8 auxiliary, open collector, outputs. The Aux Outputs are located on the F220 Mainboard (K35). Range 1 to 8. **NOTE:** 1. Aux Outputs are available for internal panel use only 2. This output does not activate the AUX Relay
Detector	Simply turns on the detector LED for sounder base type applications. When a SLC Device is selected, the input device, zone or group can be mapped to a SLC relay or detector (in the case of a detector, just the detectors' LED will illuminate). The device is selected in the standard LxxMyyy or LxxDyyy format, where xx represents the device`s loop number (L1 to L20) and yy its address (D1 to D159 or M1 to M99).
Disable Zone	Disables the selected zone. Range 1 to 999.
Disable Detector	A single selected SLC detector may be disabled. Range 1 to 159.
Disable Module	A single selected SLC module may be disabled. Range 1 to 99.
Activate Night Mode	Places the panel into Night mode. Refer to Section 11.15 Day/Night Mode
Activate NACs	Activates all annunciators attached to the four NACs.
Silence Alarms	Pressing the 'Silence Alarm' will temporarily silence all audible notification appliances and turn off the visual notification devices on the four NACs, except those NACs configured as AUX Power. Any notification appliance on a SLC circuit will be silenced/deactivated when the 'Silence Alarm' button is pressed. The 'Silence' function is cancelled by any new 'Alarm' event or any action of 'Disable NACs' function. Input(s) activating the 'Silence' output must return to Normal before 'silence' can re-activate.
Fire Drill ON	Replicates the action of the `Fire Drill` button on the front panel, activating notification appliances on the four NACs and SLCs, and generating a standard 'Evacuate' sequence. The Fire Relay is not activated, and an alarm is not sent to the central station.

Output Type	Description
Disable NACs (Button)	Disables NAC devices in the same manner as using the 'Disable NACs' button on the Keyboard-Display except those NACs configured as AUX Power. This output over-rides the NACs ON command, as does the local 'Disable NACs' button. Local buttons override the mapped function. If local control is taken, the input(s) driving the 'Disable NACs' (Button) output must be returned to normal before it will take effect again.
Delay LED	Turns on the Delay LED on the Keyboard-Display indicating that a 'Delay to Output' is operating.
Supervised Output O/P1	Alternative supervised output that can be configured for independent use.
Supervised Output O/P2	Alternative supervised output that can be configured for independent use.
Output 3	When Output 3 is selected, the output maps to the Unsupervised Output 3 Relay on the F220 Mainboard.

Table 8-2: Output Types

8.2.2 SLC Device Output Qualification

SLC devices have an extra qualification applied to their outputs, whereby the device must be in the selected state for the output to activate. The options available are:

Qualification	Description
None/Alarm	The default: activate on alarm events. This is independent of whether the device is configured to generate an alarm queue priority event or not.
Trouble	Activate when the device is in a Trouble state.
PreAlarm	Detectors: Active if the detector is currently in PreAlarm state. ISO modules: Activate when there are any active devices within the configured zone. Switch Input (Hidden) Modules (In FireUtils: SW_H): Activate if the device has been activated by another output.
AVF	Activated if AVF is enabled
ManualON	A Switch Input (3 way) module (FireUtils SW3) device is in the ON state.
ManualOFF	A Switch Input (3 way) module (FireUtils SW3) device is in the OFF state.

Table 8-3: SLC Output Qualification

8.2.3 Implementation in FireUtils

In FireUtils, to configure a device's Output Registers, select and click on the appropriate SLC in the Component Tree to open the SLC Editor. Double click using the mouse's left button on the Output Register cell to open the Output Manager (See Figure 8-5)

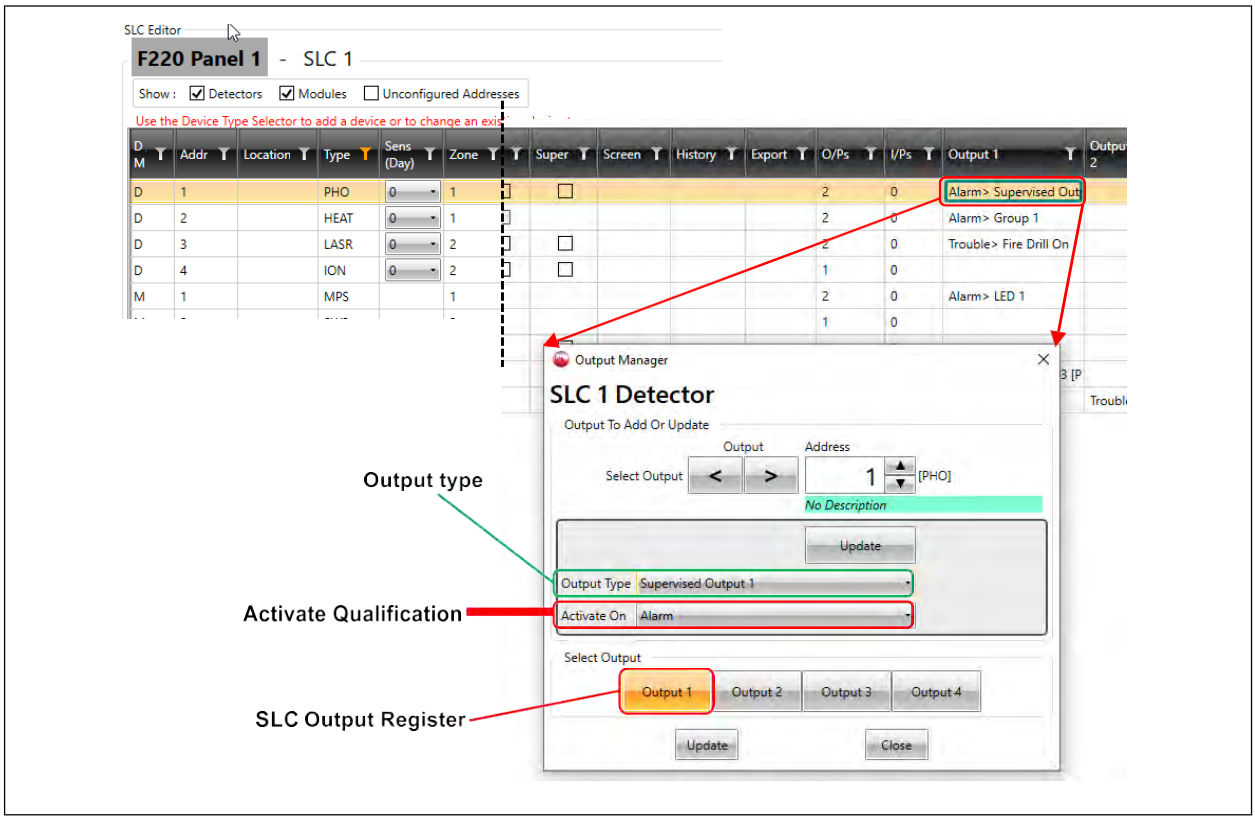


Figure 8-5: FireUtils' SLC Editor and Output Manager

Example

Take the example of a heat detector wired into zone 1 of SLC1, with its activation qualification set to Alarm (See Figure 8-5 above). If the heat detector output state changes from Normal to Pre-Alarm, its output will be blocked and not passed onto the SLC Output Register to which it is mapped. If the detector's state later turns to Alarm, the SLC output register will be enabled, and one (or more) of the preselected (configured) 19 Output types, listed in Table 8-2, will become active.

8.3 SLCs Configured to Zones

The SLC device may also be configured to a zone (Refer to Figure 8-4), the zone configured to one of 8 Zone Output Registers, and each Zone Output Register configured to one of the 18 Output Types listed in Table 8-2. When any of the devices in the zone becomes active (that is, in an Alarm, Trouble or Disabled state), the Zone Output to which the zone is configured, will be enabled, activating the preselected output type.

In the example (Figure 8-6) below, when any of the four detectors in Zone 1 becomes active, Zone Output 1 is enabled, activating L01M04, an Output Module at address 4 on SLC1. This module is a ‘Supervised Relay for NAC Control’.

The zone is not recorded in the history log as being active, but the detector is. Resetting the detector will reset the panel.

8.3.1 Implementation in FireUtils

In the Component Tree of FireUtils, select Zones to access the Zone Editor

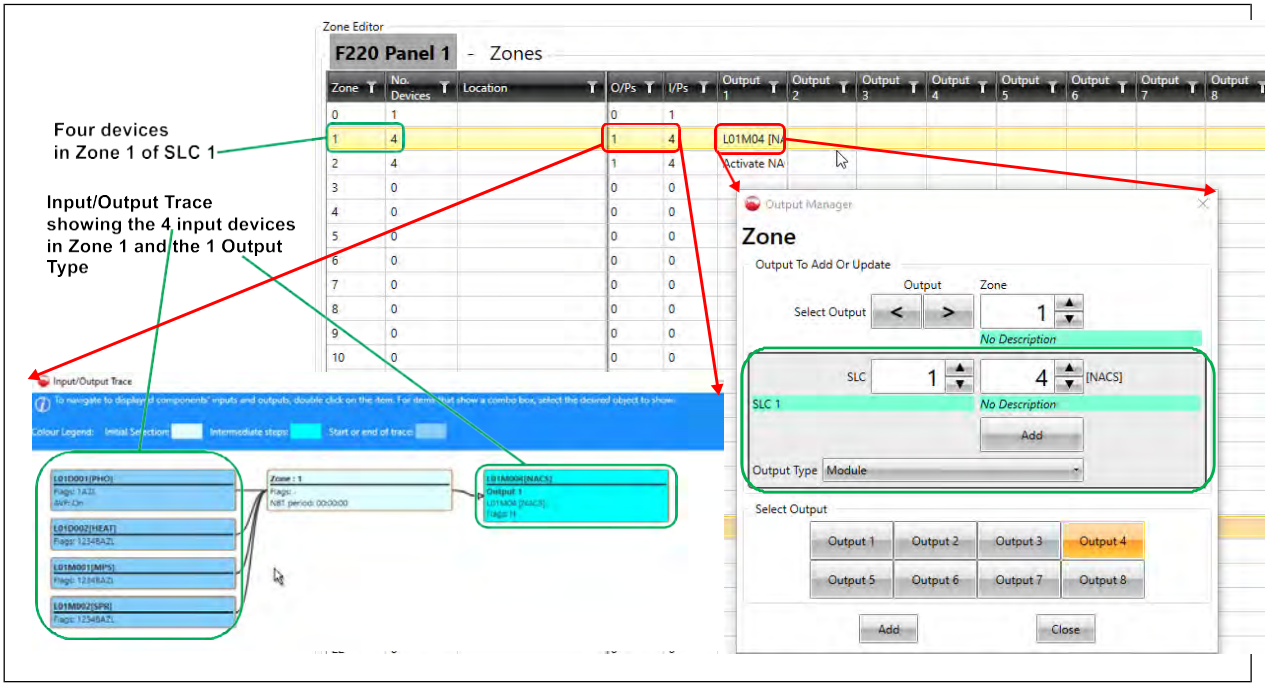


Figure 8-6: FireUtils’ Zone Editor, Output Manager, and I-O Trace

The Output Manager is accessed by double clicking the left mouse button on the desired Output Register grid cell (e.g., Output 1). Select the Zone (e.g., Zone 1), the Output Type (e.g., Module), and the other parameters associated with that particular Output Type inside the green highlighted box, if there are any. Click on both ‘Add’ or ‘Update’ buttons, and ‘Close’.

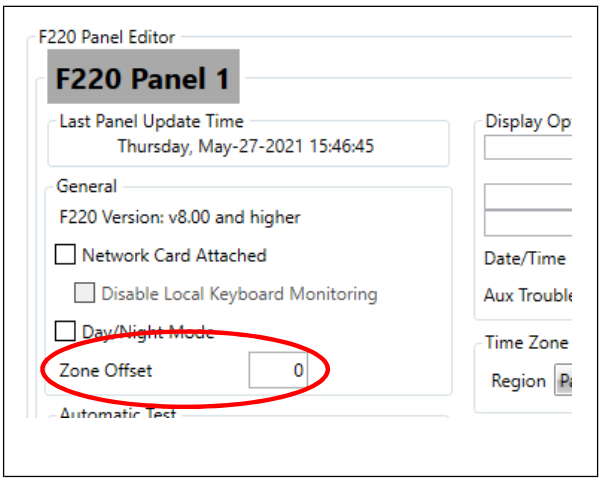
The Input/Output Trace is a diagram that shows which SLC input devices and Output Types are mapped to the zone. It is accessed by double clicking the right mouse button on either the I/P or O/P cell (See Figure 8-6).

NOTE:

Where network sites require unique zone numbers for each F220 Panel, an offset feature allows zone numbers in the range 0001 to 64999 to be used for the network.

As there can be up to 999 physical zones per panel, the zone offset can have a maximum value of 64000.

The Zone Offset is located on FireUtils Panel Editor.



8.4 Group Configurations

Outputs from SLC devices, Zones and System Events may be combined and configured into a Group, and the Group, in turn, using the Group Editor configured to one of 15 Group Output Registers. In the Group Output Manager, each Output Register can be configured to one of the 18 Output Types listed in Table 8-2.

When any of the devices in the Group is active, the configured Group Output will be enabled, activating the preselected Output Type.

A Group can be configured to another Group, however, the configuration will fail to operate unless the Group to which it is configured (or mapped) has a higher group number than the first group.

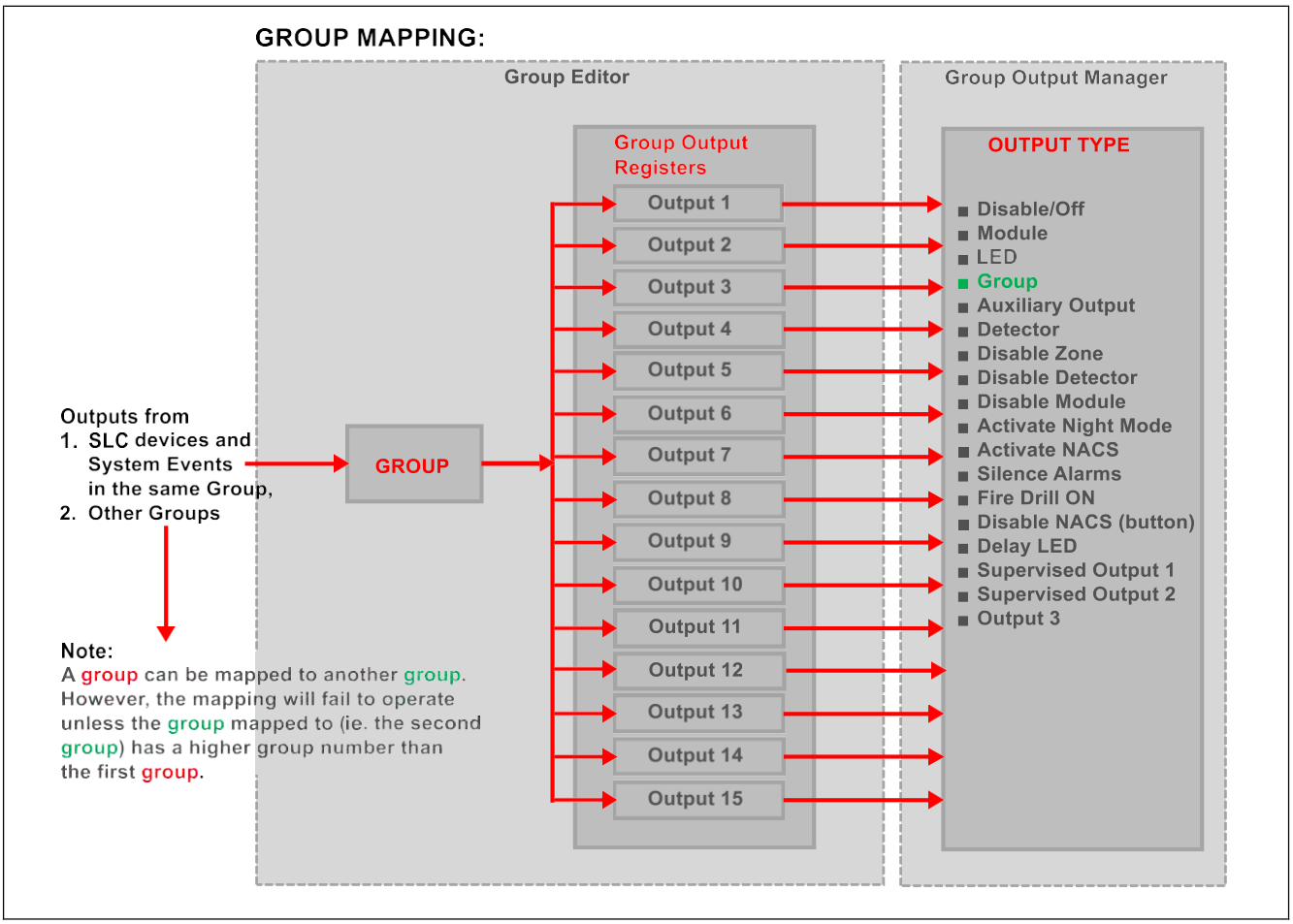


Figure 8-7: Configuring a Group

8.4.1 Example: Configuring a Group in FireUtils

In this example, the requirement is for the outputs of 3 SLC1 smoke detectors and 4 SLC2 smoke detectors to be configured to a Group. When any of those detectors, and only those detectors, go into alarm, Output 1 Relay, which is connected to a door holder, will be activated.

Process

1. In FireUtils SLC Editor, double click on Output 1 of detector 1 to display the Output Manager as shown in Figure 8-8.
2. In the Output Managers drop down menus, select the Group option in ‘Output Type’, 2 in ‘Group’, and Alarm in ‘Activate On’.
3. Outputs from Zones, System Events, Logic Blocks and other Groups could be mapped to this group, if required. In this example, however, only the outputs from 6 other detectors will be mapped to Group 2.
4. Repeat for other detectors.

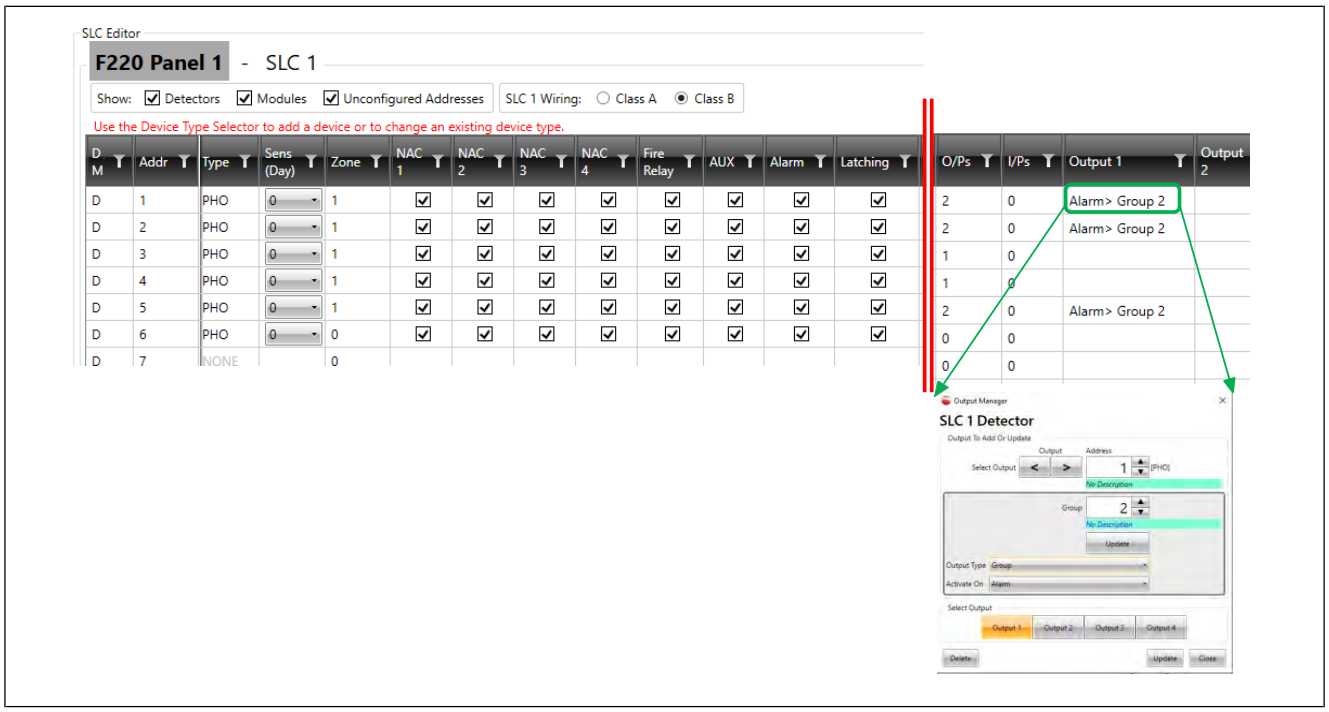


Figure 8-8: FireUtils SLC Editor: Configuring detector outputs into a group

5. Select Groups in FireUtils Component Tree to access the Group Editor.
6. Double click on Output 1 of Group 2 to display the Output Manager (Figure 8-9) and select Supervised Output 1 in the 'Output Type' drop down menu.

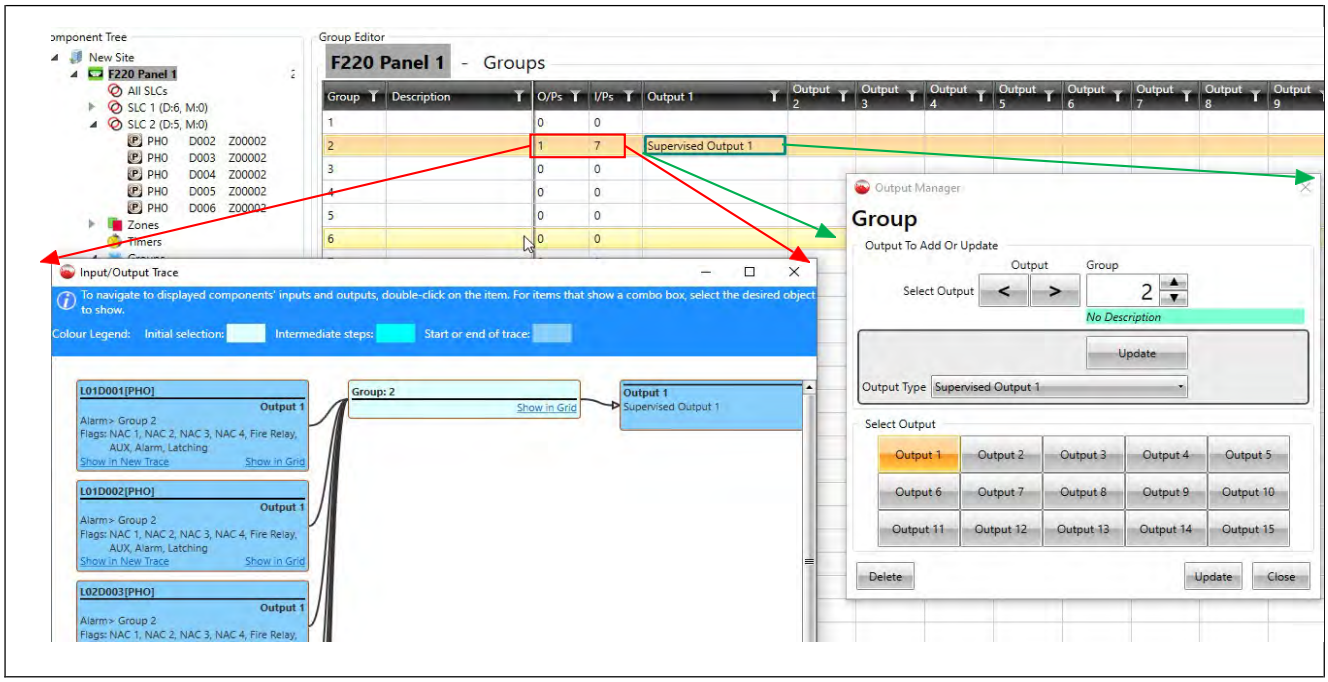


Figure 8-9: FireUtils' Group Editor, Output Manager and I-O Trace

7. To display Group 2's input and output configurations, double click on Group 2's O/Ps or I/Ps cells (Figure 8-9).

8.5 System Events Configuration

System Events are an easy way to modify Panel behavior based on common Panel states and/or events such as Alarm, Trouble, and Disable.

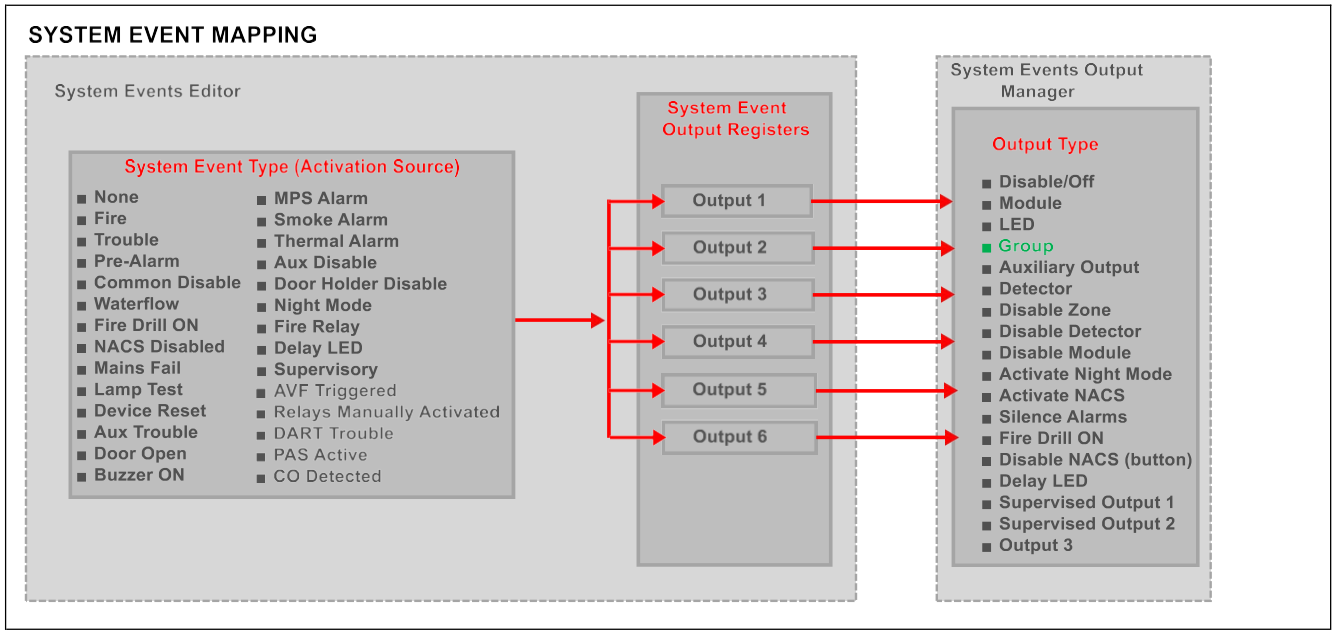


Figure 8-10: Configuring System Events

The System Event Type (activation source) block consists of 28 event types, ranging from 'Fire' and 'Trouble' through to 'Relays Manually Activated' and 'Communicator Trouble', that can be programmed as the source of an event. Each Event can be programed to activate six System Events Output Registers. If more than six outputs are required for a particular event, then depending on requirements, further slots may be used as an alternative to using Groups.

The 28 event types that can activate the Output Register are:

Type	Description
Fire	Global Fire condition set.
Trouble	Global Trouble condition set.
Pre-Alarm	At least one detector is in pre-alarm state.
Common Disable	At least one device or zone is disabled.
Waterflow	Waterflow is active.
Fire Drill On	Fire Drill is active.
NACs Disabled	Activated when the NACs are disabled.
Mains Fail	AC power supply absent. Although a mains failure on a panel, or on the network, is indicated locally immediately, the event can be delayed being sent to the digital communicator and on to the remote processing center for up to 4 hours. This option is configured in FireUtils. Range: 0 to 4 hours in one-hour steps. Default: 2 hours.

Lamp Test	Activated when the F220 is in Global Lamp Test mode. Local lamp test will not trigger this event. Provided for lamp test of external equipment. **NOTE**: No configured LED outputs will be activated by a Lamp Test.
Device Reset	Active for 40 seconds after system reboot or power-up, or 5 seconds after a Reset. Intended for use with devices which require a power-down to unlatch an 'Alarm' condition.
Aux Trouble	Active when the AUX TROUBLE input on the mainboard is in an open circuit state.
Door Open	Active when any Annunciator or the main panel door is open.
Buzzer On	Active when the F220 buzzer is activated.
MPS Alarm	Active when any MPS device is in 'Alarm'.
Smoke Alarm	Active when any smoke detector is in 'Alarm'.
Thermal Alarm	Active when any heat detector is in 'Alarm'.
Aux Disable	AUX Disable control is active
DHR Disable	DOOR HOLDER DISABLE control is active.
Night Mode	Active when panel is in Night mode. **NOTE**: Enabling Day/Night mode in FireUtils' Panel Editor make 2 sensitivity levels available for each detector. Night Mode can be activated manually (e.g., via an input module) or automatically (e.g., via a Logic Block using a combination of date and time inputs)
Fire Relay	FIRE Relay control is active
Delay LED	Turns on the Delay LED on the Keyboard-Display indicating that a 'Delay to Output' is operating
Supervisory	Active when a supervisory signal is active.
AVF Triggered	Active when AVF is triggered
Relays Manually Activated	One or more relay outputs have been manually activated via the front panel's User Menu. Applies to SLC output modules only (Aux, NAC, Door Holder, Relay)
Communicator Trouble	Active when RS232 communications with the communicator fails, or if the communicator reports a loss in the link to the Central Station
PAS Active	A PAS timer is active
CO	The CO device is active.

Table 8-4: System Event Types or Activation Sources

The 18 Output Types in the drop-down menu are the same as listed in both 'SLC Device' and 'Group Configuration' (Refer to Table 8-2: Output Types)

8.5.1 Implementation in FireUtils

To access the System Events Editor in FireUtils, select System Events in the Component Tree.

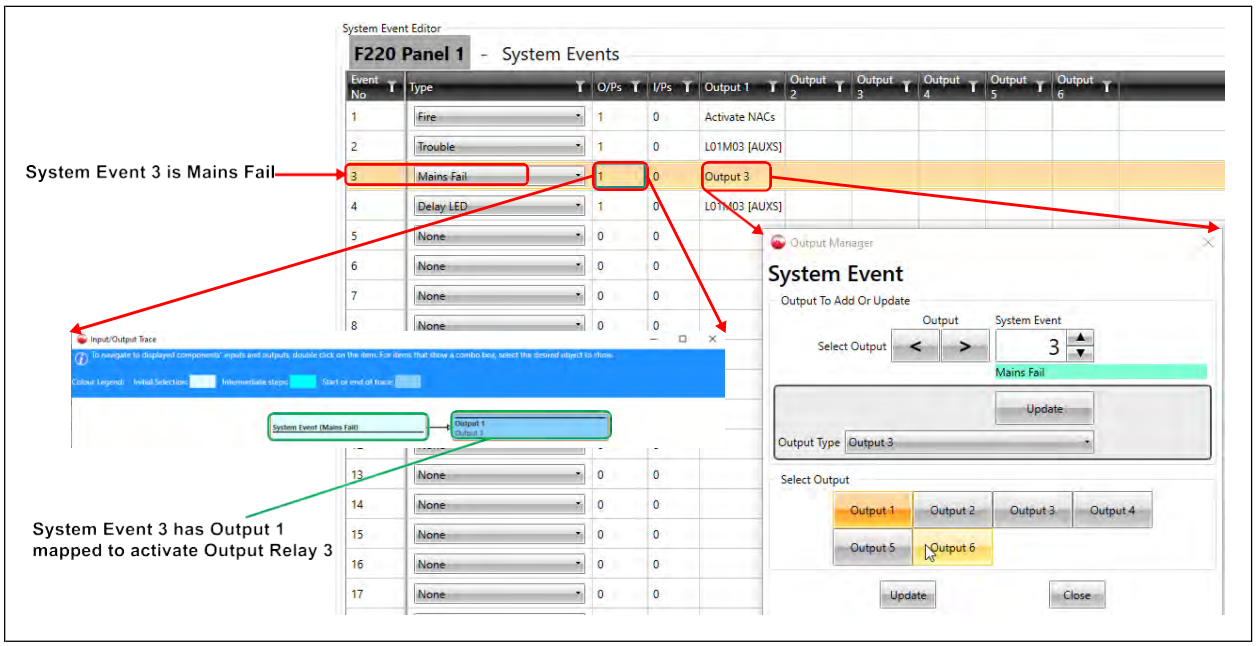


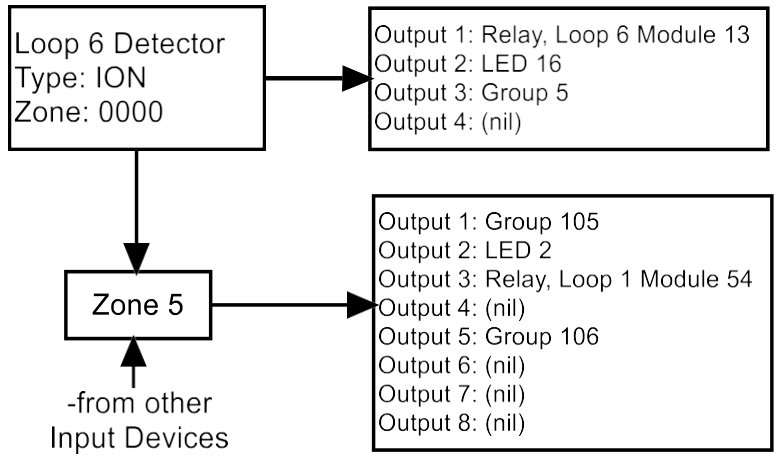
Figure 8-11: FireUtils' System Editor, Output Manager, and I-O Trace

IMPORTANT NOTE:

Outputs are activated when the specified event is active or, for SLC devices only, the device is in a selected state (see Section 8.2.2). The ultimate state of an output depends on the collective state of all the activating inputs. That is, the inputs are logically OR'ed together.

As a result, any active input, zone or group which is paired to a particular output will ensure the output remains active. Conversely, all inputs that directly or indirectly map to a given output must be inactive (Normal) for the output to be switched OFF. The exception to this occurs when a relay output is disabled (depending on the type) using one of the isolating functions at the panel (e.g., Disable AUX or Disable NACs).

SLC Device Configuring:



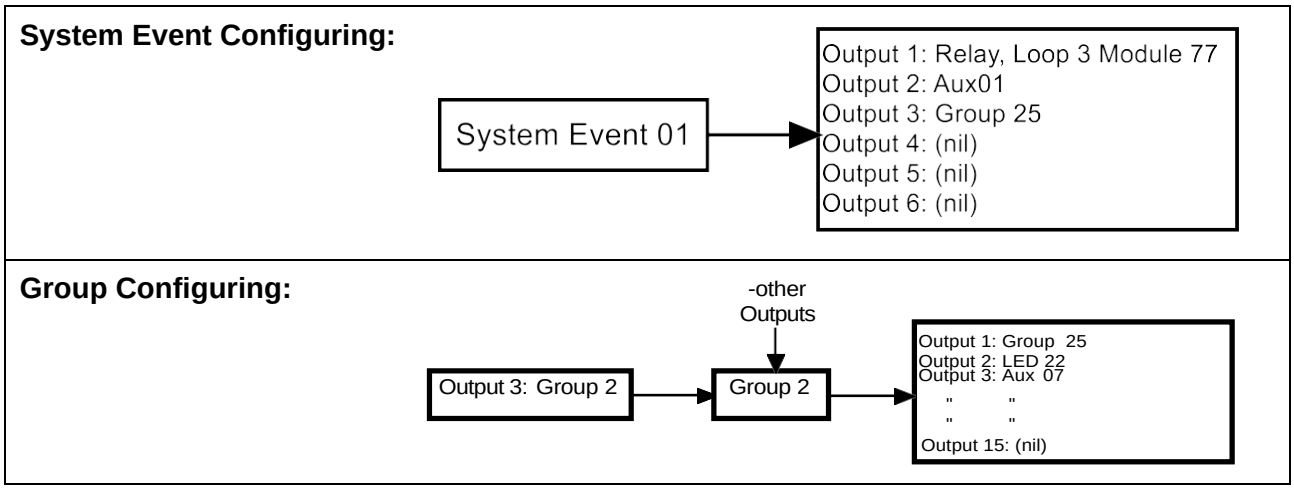


Figure 8-12: Configuration Structure Examples

8.6 Configuring Boolean Logic Blocks

Logic blocks are used to create more complex cause-and-effect programming via AND, OR, and ANY2 logic conditions. They allow many more control options to be handled by the panel software rather than external hardware. The F220 supports logical operations in up to 999 Logic Blocks.

A Logic Block can be considered to be a 'black box' with 8 logical inputs and 4 outputs (plus the 10 global system outputs – NACs 1 to 4, Fire Relay, Aux Relay, Alarm, Latching, Screen and History) as shown in Figure 8-13 below.

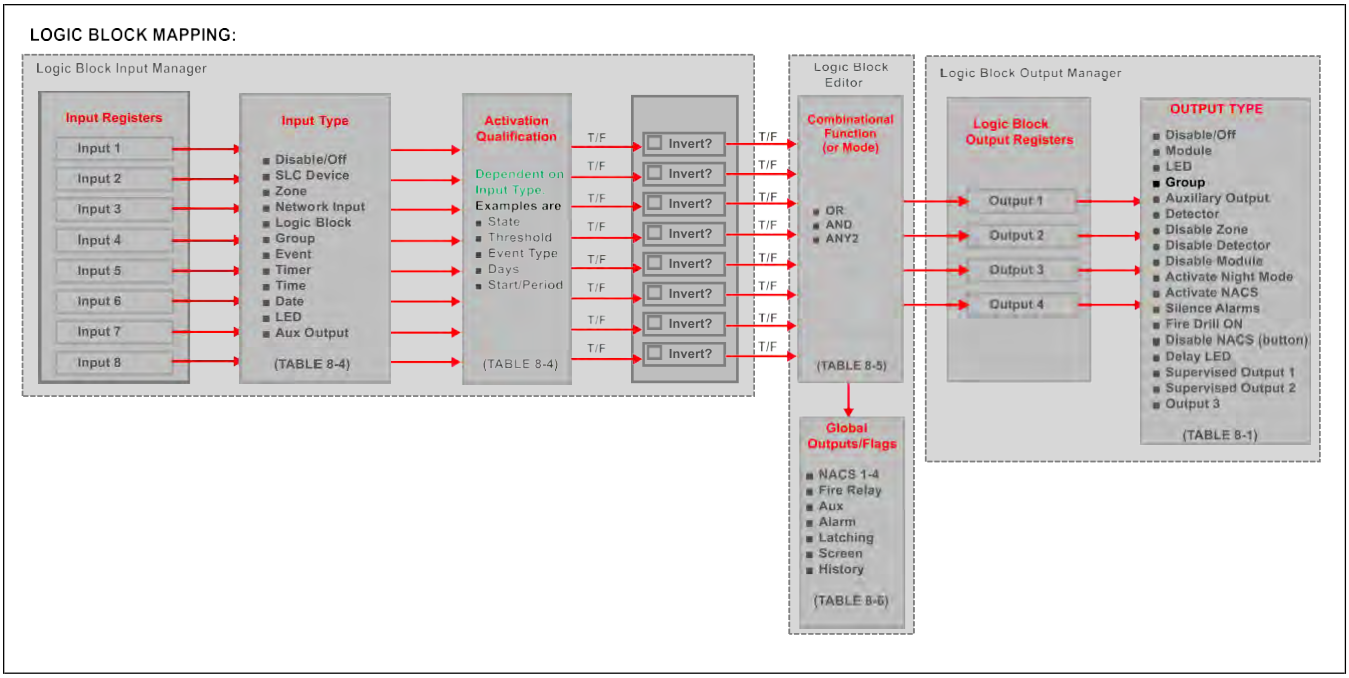


Figure 8-13: Configuring Logic Blocks

The block's logic examines the inputs to which it has been configured to decide whether the block is in a designated state ('Activation Qualification', Figure 8-13) and if so, enables the Output Register to which the input is configured. The Output Registers are in turn mapped to one of 18 different Output Type listed in Table 8-2.

8.6.1 Logic Block Input Types and Activation Qualifications

The Inputs used by the Logic Blocks (as well as Timers, refer to Section 8.7) provide a logical True or False value to act upon. The various types of input, associated parameters and state description are listed in Table 8-5 below.

Input Type	Parameters	Activation Qualification Description
Device	FromSLC, FromAddress, ToAddress, State, Threshold	Looks at the state of one or more devices on the same SLC; these can be Detectors or Modules. The State can be any of: • Input Active: specified input device has activated • Output Active: specified output device has activated • Pull station, Smoke, Heat: Pull Stations/Smoke/Heat Only in 'Alarm' • Pre-Alarm: detectors in 'Pre-Alarm' state • Disable: disabled devices • Trouble: device currently in 'Trouble' • Missing: device not responding • Dirty: detector reached Maintenance Alarm threshold • Test: device is being tested via the Test menu (not from 24Hr Test) • ManOFF: a SW3 device is in the OFF position • ManON: a SW3 device is in the ON position • AVF. AVF set to On • AVF Active. A detector has become active and the delay/verification timer is running. Threshold determines the number of devices that must be active for the input to be considered True. Threshold can be set from 1 ('ANY' in FireUtils, that is the OR function) or all devices ('ALL' in FireUtils, the AND function).
Zone	ZoneNumber, State	True if the specified zone activity matches input's state (i.e., Active, Trouble or Disable).
Network Input	Network Input	True if the selected Network Input has been activated.
Logic Block	FromLogicBlock, Span, ToLogicBlock, Threshold	True if the specified logic block is true. Span determines the range of block numbers to examine, so that the range is ToLogicBlockNumber.(FromLogicBlockNumber+Span). Threshold determines the number of blocks that must be active for the input to be considered True. Threshold can be set from 1 ('ANY' in FireUtils, OR function) up to 5. A value of zero is treated as all blocks within the range ('ALL' in FireUtils, AND function).

Input Type	Parameters	Activation Qualification Description
Group	GroupNumber	True if the specified group has been activated
Event	Event Type	True if the specified system event type is active. A system event can be None, Fire, Trouble, Pre-Alarm, Common Disable, Waterflow, Fire Drill On, NAC Disabled, Mains Fail, Lamp Test, Device Reset, Aux Trouble, Door Open, Buzzer On, MPS Alarm, Smoke Alarm, Thermal Alarm, Aux Disable, Door Holder Disable, Night Mode, Fire Relay, Delay LED, Supervisory, AVF Triggered, Relays Manually Activated, Communicator Trouble, PAS Active, and CO supervisory.
Timer	TimerNumber, State	True if the selected timer TimerNumber is in the selected state. The State values can be one of OFF, Running, Complete or Disabled.
Time	Start, Period, Weekday	True if the weekday is in Weekday (MTWTFSS) and if the current time falls in the range of Start to (Start+Period). Duration can be up to 12 hours (12:00:00) and Start can be up to 23:59:59. Times wrap to the next day if the sum exceeds 24 hours, so a Start of 21:00:00 & Period of 10:00:00 is valid from 9pm to 7am.
Date	From, To, Weekday	True if the current date falls within the range 'From' date to 'To' date and the weekday is in Weekday mask. 'From' date can be higher than 'To' date if the input should be true over the 31-Dec to 01-Jan period.
LED	From LED, Span, To LED, Threshold	True if the specified LED has been activated. Span determines the range of LED numbers to examine, so that the range is 'From LED' to 'To LED number (ToLED = FromLED+Span). Threshold determines the number of LEDs that must be active for the input to be considered True. Threshold can be set from 1 ('ANY' in FireUtils, OR function) up to 5. A value of zero is treated as all LEDs within the range ('ALL' in FireUtils, AND function).
Auxiliary Output	Aux OutputNumber	True if the specified user auxiliary output has been activated (Max Aux Output is 8).

Table 8-5: Input Type and Activation Qualification Descriptions

8.6.2 Logic Block Inputs

Each Logic Block can have up to 8 different inputs, with each input being any one of the different Input Types. Each input can also be logically inverted. For example, the block may test for a group NOT being active.

8.6.3 Logic Block Input Mode

When a Logic Block has more than one input, the overall logic function associated with the Logic Block can be as shown in Table 8-6 below. The Mode is set in FireUtils' Logic Block Editor

Function	Description
OR	Any active input causes the block to become active.
AND	All defined inputs must be active to cause the block to become active.
ANY2	Any 2 or more active inputs cause the block to become active.

Table 8-6: Block Input Mode

8.6.4 Logic Block Input Configuration using FireUtils

In Figure 8-14, Logic Block 1 has 2 inputs. Input 1 is from a SLC Photoelectric Detector (PHO) at address 1 (L01D001). Input 2 is a System Event, active when there is a Fire. These inputs are configured in the Logic Block Input Manager (Inputs 1 and 2 respectively). For each input, the Input Type, Address, Activation Qualification (State, Threshold, …), Invert and so on are configured as per the parameters listed in Table 8-5.

However, as shown in the Input/Output Trace, both the Detector and the Fire Event have to be active (i.e., Input Mode is set to AND) for the Logic Block to activate an Output Register.

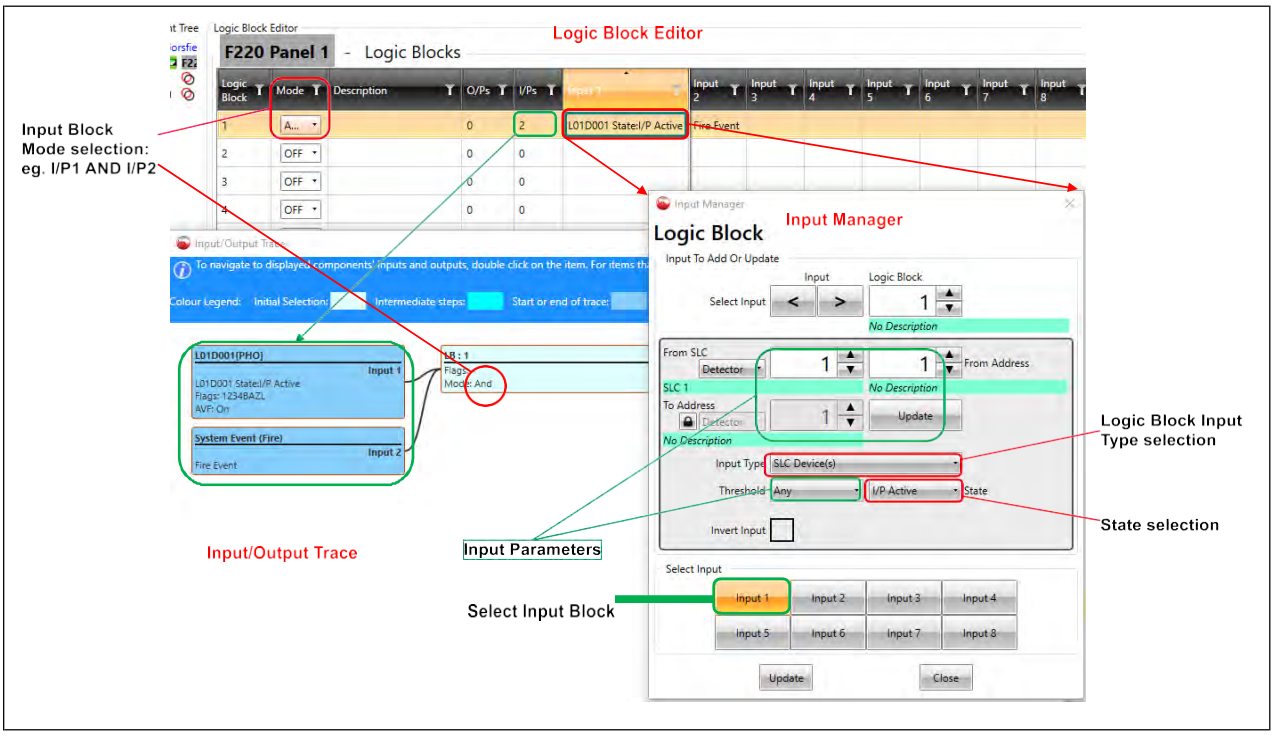


Figure 8-14: FireUtils' Logic Block Input Manager

8.6.5 Logic Block Descriptions

The block has a descriptor field for assigning meaningful text to a logical operation. The block descriptor is shown with on-screen of logged events.

8.6.6 Logic Block Output Registers

Each Logic Block can be configured in the Logic Block Editor to 4 Output Registers, which, in turn, can be configured to activate one of the 19 Output Types from a drop-down list. These Output Types are listed in Table 8-2 and are identical to those used in SLC, Zone, Group and System Events mapping functions.

8.6.7 Logic Block Global Outputs/Flags

In addition to the 4 Output Registers, the logic blocks can be configured to activate the 10 global system outputs: the 4 NACs, the Fire and Auxiliary Relays, the Alarm, and the Latching, Screen and History flags.

The full list is:

Flag	Symbol	Description
NACs	1, 2, 3, 4	Activates selected NAC on the mainboard
Fire Relay	B	Activates the Fire Relay on the mainboard
Auxiliary Relay	A	Activates the Aux relay on the mainboard
Alarm	Z	Activates warning buzzer. Forces OnScreen set and event into 'Alarm' queue.
Latching	L	Latches logic event until manual reset. Forces OnScreen to be set.
OnScreen	S	Forces event to be displayed on LCD (defaults to System Events queue) and forces History to be set.
History	H	Log event in historical event buffer.

Table 8-7: Logic Block Flags

8.6.8 Logic Block Output Configuration using FireUtils

Figure 8-15 below demonstrates how the Logic Block Output Manager in FireUtils can be used to configure Output Registers 1 and 2 to activate the Supervisory and Output 3 relays on the mainboard. This can only happen when both photoelectric detector PHO L01D001 (logical) AND system event Fire, configured using the Input Manager, are both active.

The detector is also configured (highlighted in green), in the Logic Block Editor, to activate all the Global System outputs; NACs 1 to 4, the Fire and Auxiliary relays, the Alarm, and the Screen and History flags.

All the flags' settings are highlighted in the LB1 block of the Input/Output Trace.

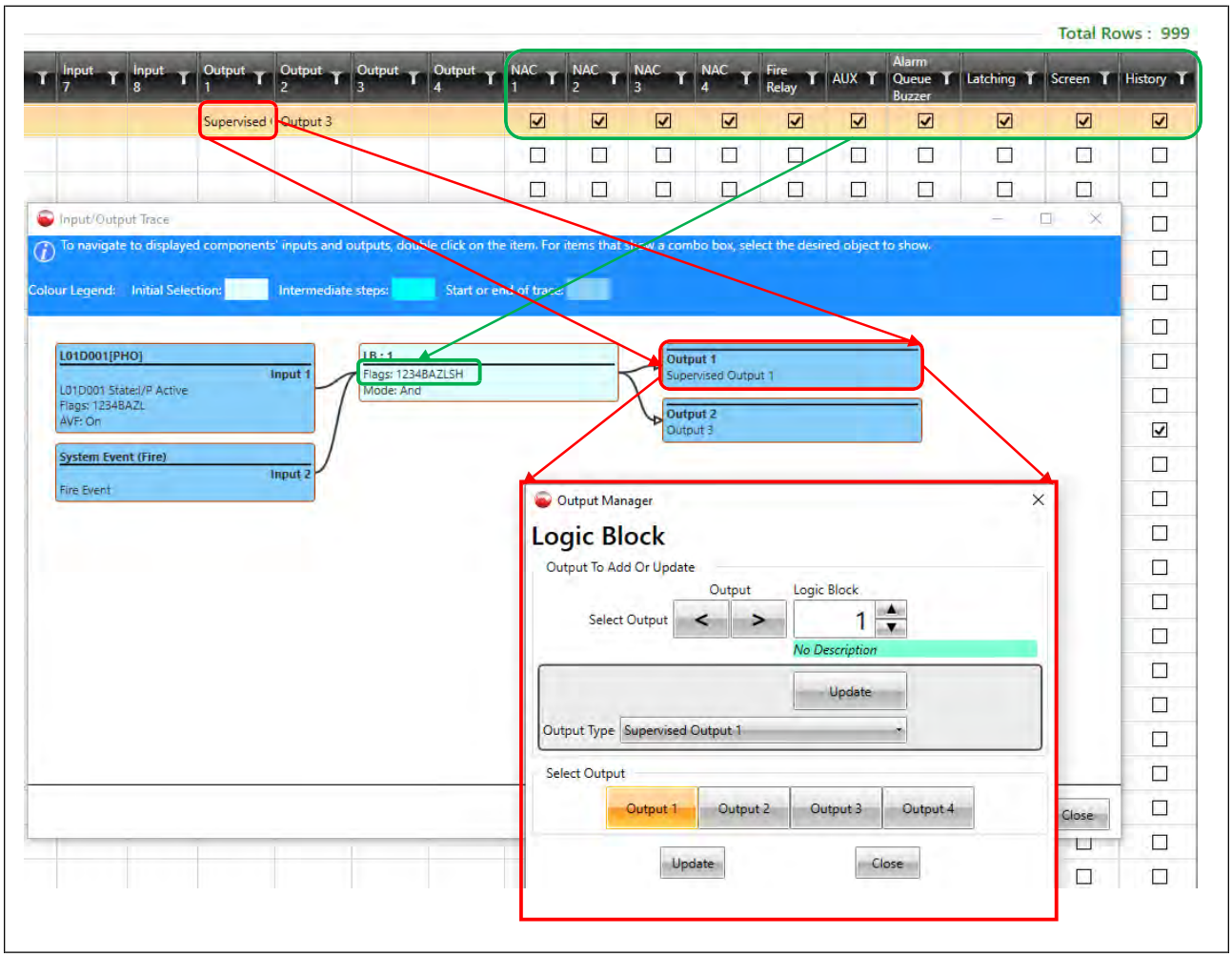


Figure 8-15: Logic Block's Output Manager, Logic Block Editor, and I-O Trace

8.7 Timers

Timers are programming elements which allows time control options to be handled by the panel software instead of external timer hardware. Timers are used to impose delays on output activations, delay Alarm conditions, and trigger outputs at set times during the day or week. They are configured using FireUtils.

The F220 Timers consist of two preload registers (T1 and T2), four input controls (Start, Reset, Disable, Override), four outputs (both T1 and T2 have 2 outputs), and 12 global system flags for configuration. A number of different behaviors can be selected using the options provided.

The F220 supports up to 200 Timers.

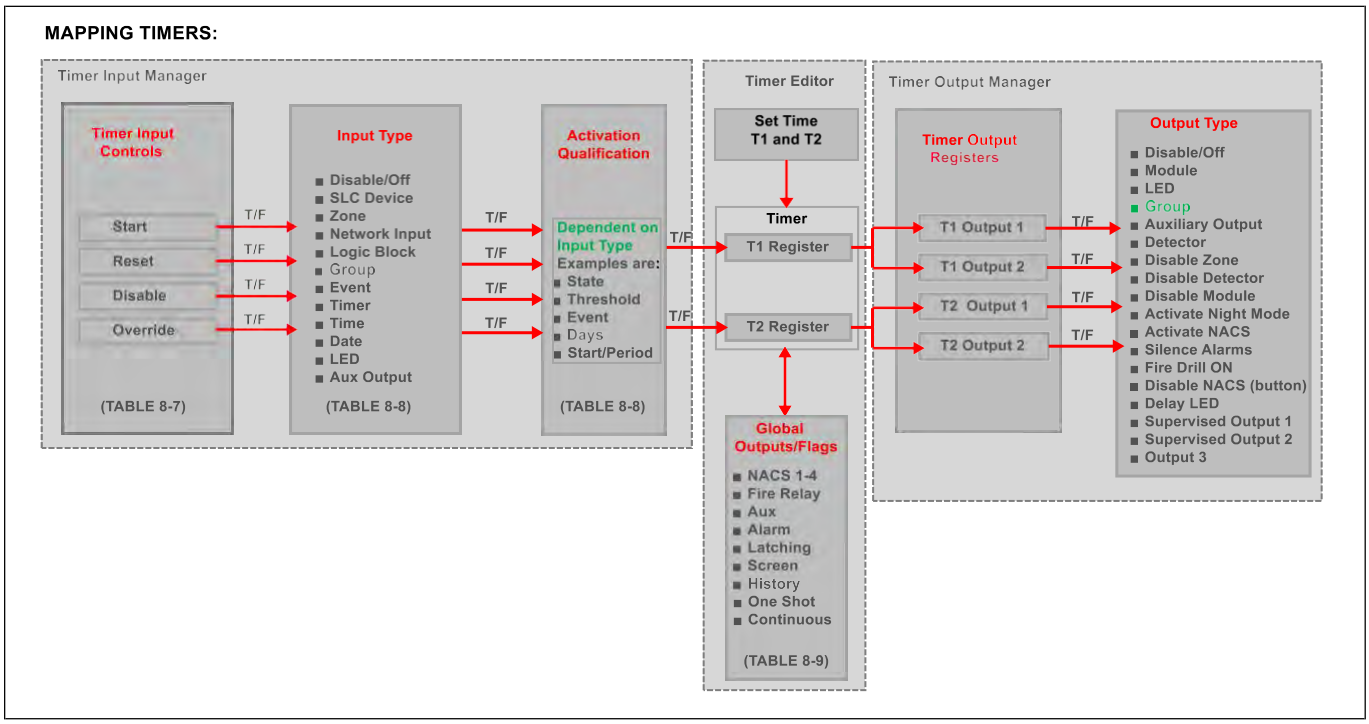


Figure 8-16: Configuring a Timer

8.7.1 Timer Registers

The Timer preload registers provide the values for the main timing of the Timer.

- T1 register loads the initial Timer Delay (up to 12 hours), which begins when the Timer is started.
- T2 register sets the second period of the Timer (also up to 12 hours), which begins when the T1 period is complete.
- T1 must be set to a non-zero value for the Timer to operate.

8.7.2 Timer Input Controls

The Timer has 4 input controls - Start, Reset, Disable and Override. Each control input is triggered when the selected logical Input Type (which is identical to those for the F220 Logic Blocks, Table 8-5) is active.

Input Name	Description
Start	Starts the Timer. The Timer can operate in either 'Normal', 'One-Shot' or 'Continuous mode. In 'Normal' mode, the Timer will return to Normal (i.e., reset) when the Start condition is removed. In 'One-Shot' mode, once the Timer is activated it will continue to the expiration time regardless of the state of the Start condition. In 'Continuous' mode, the Timer will continue to run through its T1 and T2 periods until the Start condition is removed.

Input Name	Description
Reset	If the Timer is running and the Start input is still active, the Timer resets to the start of the T1 period, as though it has just been started. If the Start input is inactive, the Timer resets to Normal. **NOTE:** Timers can always be manually reset (if configured to be on-screen) using the front-panel RESET key, as for SLC devices.
Disable	Disables the Timer. This overrides all other inputs and forces the Timer OFF.
Override	Forces the Timer to time out immediately.

Table 8-8: Timer Control Inputs

8.7.3 Timer Input Types and Activation Qualifications

The Inputs used by the Timers provide a logical True or False value to act upon. The various types of input, associated parameters and state description are listed in Table 8-9 below.

Input Type	Parameters	Activation Qualification Description
Device	FromSLC, FromAddress, ToAddress, State, Threshold	Looks at the state of one or more devices on the same SLC; these can be Detectors or Modules. The State can be any of: • Input Active: specified input device has activated • Output Active: specified output device has activated • Pull station, Smoke, Heat: Pull Stations/Smoke/Heat Only in 'Alarm' • Pre-Alarm: detectors in 'Pre-Alarm' state • Disable: disabled devices • Trouble: device currently in 'Trouble' • Missing: device not responding • Dirty: detector reached Maintenance Alarm threshold • Test: device is being tested via the Test menu (not from 24Hr Test) • ManOFF: a SW3 device is in the OFF position • ManON: a SW3 device is in the ON position • AVF. AVF set to On • AVF Active. A detector has become active and the delay/verification timer is running. Threshold determines the number of devices that must be active for the input to be considered True. Threshold can be set from 1 ('ANY' in FireUtils, that is the OR function) or all devices ('ALL' in FireUtils, the AND function).
Zone	ZoneNumber, State	True if the specified zone activity matches input's state (i.e., Active, Trouble or Disable).
Network Input	Network Input	True if the selected Network Input has been activated.

Input Type	Parameters	Activation Qualification Description
Logic Block	FromLogicBlock, Span, ToLogicBlock, Threshold	True if the specified logic block is true. Span determines the range of block numbers to examine, so that the range is ToLogicBlockNumber.(FromLogicBlockNumber+Span). Threshold determines the number of blocks that must be active for the input to be considered True. Threshold can be set from 1 ('ANY' in FireUtils, OR function) up to 5. A value of zero is treated as all blocks within the range ('ALL' in FireUtils, AND function).
Group	GroupNumber	True if the specified group has been activated
Event	Event Type	True if the specified system event type is active. A system event can be None, Fire, Trouble, Pre-Alarm, Common Disable, Waterflow, Fire Drill On, NAC Disabled, Mains Fail, Lamp Test, Device Reset, Aux Trouble, Door Open, Buzzer On, MPS Alarm, Smoke Alarm, Thermal Alarm, Aux Disable, Door Holder Disable, Night Mode, Fire Relay, Delay LED, Supervisory, AVF Triggered, Relays Manually Activated, Communicator Trouble, PAS Active, and CO Device.
Timer	TimerNumber, State	True if the selected timer TimerNumber is in the selected state. The State values can be one of OFF, Running, Complete or Disabled.
Time	Start, Period, Weekday	True if the weekday is in Weekday (MTWTFSS) and if the current time falls in the range of Start to (Start+Period). Duration can be up to 12 hours (12:00:00) and Start can be up to 23:59:59. Times wrap to the next day if the sum exceeds 24 hours, so a Start of 21:00:00 & Period of 10:00:00 is valid from 9pm to 7am.
Date	From, To, Weekday	True if the current date falls within the range 'From' date to 'To' date and the weekday is in Weekday mask. 'From' date can be higher than 'To' date if the input should be true over the 31-Dec to 01-Jan period.
LED	From LED, Span, To LED, Threshold	True if the specified LED has been activated. Span determines the range of LED numbers to examine, so that the range is 'From LED' to 'To LED number (ToLED =FromLED+Span). Threshold determines the number of LEDs that must be active for the input to be considered True. Threshold can be set from 1 ('ANY' in FireUtils, OR function) up to 5. A value of zero is treated as all LEDs within the range ('ALL' in FireUtils, AND function).
Auxiliary Output	Aux OutputNumber	True if the specified user auxiliary output has been activated (Max Aux Output is 8).

Table 8-9: Input Type and Activation Qualification Descriptions

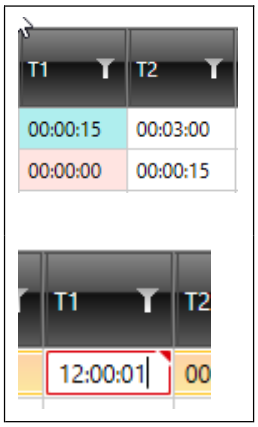
8.7.4 Timer Input Configuration using FireUtils

Figure 8-17 shows how FireUtils' Timer's Editor and Input Manager are used to configure Timer 1's T1 and T2 registers, as well as configuring the photoelectric smoke detector L01D001 to start T1 when it becomes active. Using the Timer Editor, T1 has been set to run for 15 seconds and T2 for 3 minutes.

At the completion of the 15 seconds, T2 will be run for 3 minutes.

NOTE:

1. If T1 and T2 have been set correctly, within the allowable minimum and maximum time periods, the background color of T1 will change to blue.
2. If T2 has been set but not T1, the background color of T1 will change to red.
3. If times greater than 12 hours are entered into either T1 or T2, the cell outline will become red



The Input Manager is accessed by double clicking the Timer 1 'Start' cell.

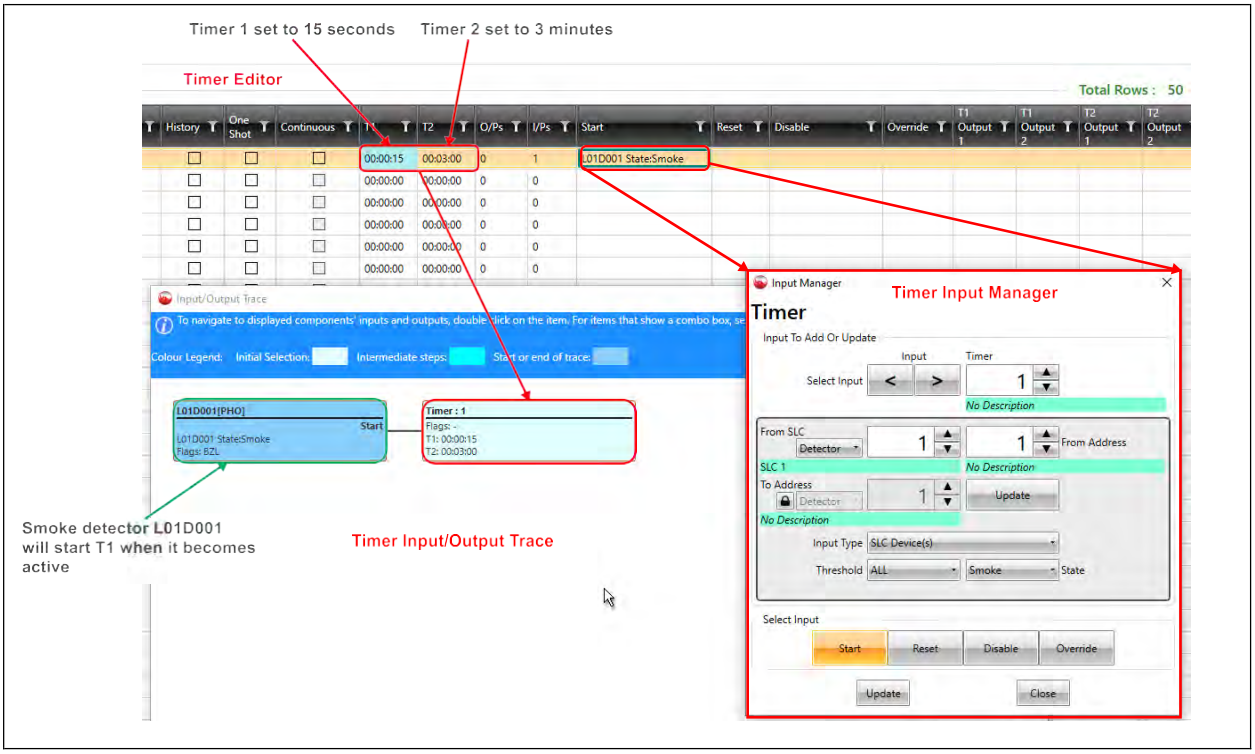


Figure 8-17: Setting up Timer 1 using FireUtils' Timer Editor

8.7.5 Timer Outputs

There are four Outputs Registers associated with each Timer:

- Two T1 outputs, which are activated while the T1 period is active.
- Two T2 outputs which are active during the T2 period or when the Timer completes, depending on the options.

Each Output Register can be configured to activate one of the 18 Output Types from a drop-down list. These Output Types are listed in Table 8-2 and are identical to those used in SLC, Zone, Group, System Events and Logic Block mapping functions.

In addition to the 4 Output Registers, the timers can be configured, or mapped, to activate the 12 global system outputs/flags: the 4 NACs, the Fire and Auxiliary Relays, the Alarm, and the Latching, Screen, History, One Shot and Continuous flags. Refer to Section 8.7.7 for more details on these configuration flags.

8.7.6 Timer Output Configuration using FireUtils

In FireUtils, to configure a timer, access the Timer Output registers by double-clicking on the T1 and/or T2 Output cell. Now select one of the 18 Output Types to activate when the smoke detector becomes active. In the example below (Figure 8-18), both T1 and T2 outputs have been assigned to turn the Delay LED on.

Note that a 'Disable' input has also been added. If the detector is disabled in any way, Timer 1 will turn off.

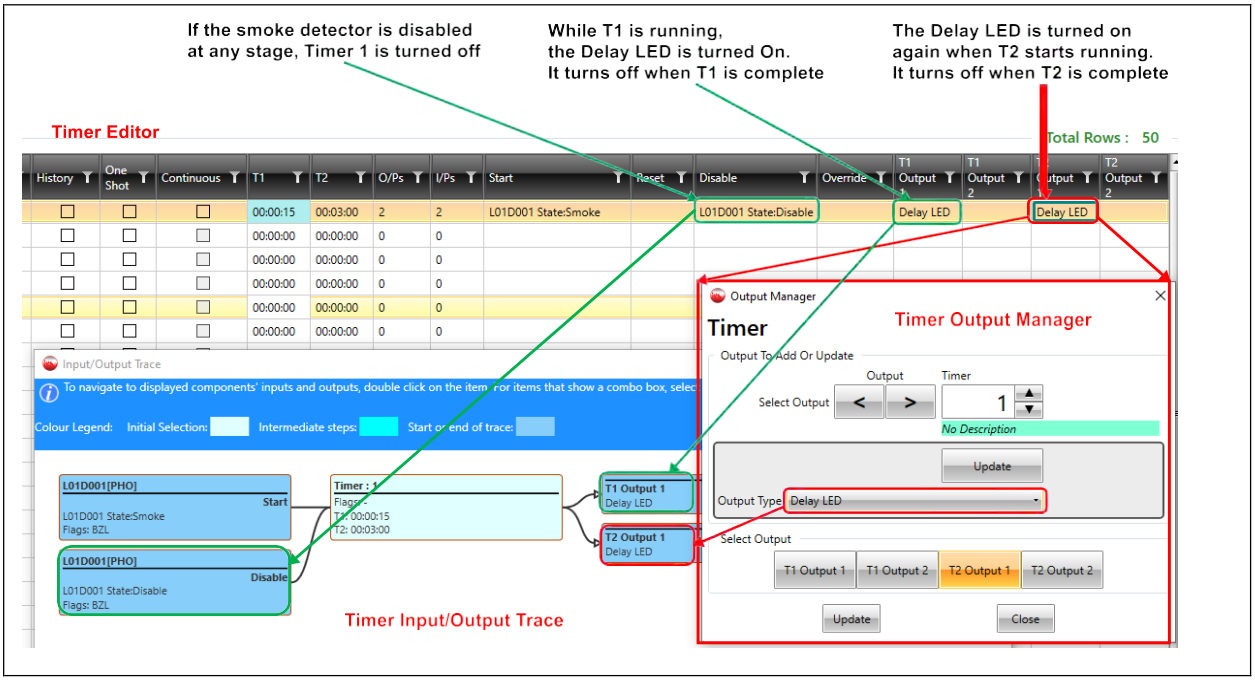


Figure 8-18: Setting Timer 1's Output Registers T1 and T2

8.7.7 Timer Configuration Flags

The Timer has a set of flags that it can activate, for example one or more NACs, the Fire and Auxiliary Relays and so on. The full list is shown in Table 8-10.

Flag	Symbol	Description
NAC1 to 4	1, 2, 3, 4	Activates the NAC
Fire Relay	B	Activates the Fire Relay on the mainboard. Also activates the History flag, forcing an event in the 'Alarm' queue
Auxiliary Relay	A	Activates Auxiliary Relay on the mainboard
Alarm	Z	Activates warning buzzer. Forces OnScreen set and event into 'Alarm' queue
Latching	L	Latches Timer complete at the end of T1 (T2 becomes redundant and is reset to zero if its value is non-zero) until manually reset. Forces OnScreen and History to be set.
Screen	S	Forces events to be queued to display (defaults to Information queue) and forces History to be set.
History	H	Log events in historical event buffer.
OneShot	O	The Start input behaves like a momentary contact input – the Timer runs to completion even if the Start input is deactivated. Similarly, the Start input must be returned to normal before the Timer can be restarted.
Continuous	C	The Timer runs continuously (T1 to T2 to T1, …) until reset. This flag can only be set if bit Latching is not set and T2 is non-zero.

Table 8-10: Timer Configuration Flags

8.7.8 Timer Descriptor

The Timer has a descriptor for assigning meaningful text to a Timer function. This descriptor is shown with all displayed or logged events.

8.7.9 Timer Events

The OnScreen (S) and History (H) flags described above control the handling of the main Timer events, but there are other events, which behave differently. The full list of available Timer Events is shown in Table 8-11.

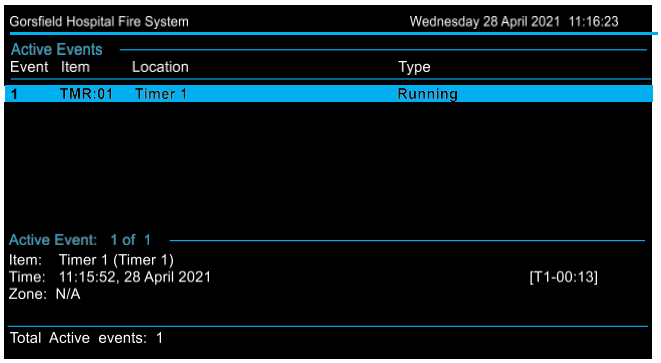
Event	Description
Normal	Timer is normal or has normalized.
Started	Timer has started. Logged in the historical event buffer if S bit is not set.
Complete	Timer has timed out, or Override input was activated.
Disable	Timer disabled. This event is always displayed regardless of S and H bits.
Reset	Timer was reset. This event is always logged to the event buffer only.
Over-ridden	Timer over-ride input was activated. Always logged to event buffer.
Stopped	Timer was stopped, either by deactivating Start or at the end of T2. Always logged.

Running	Same as Started event but used if S bit is set.
Alarm	Same as Complete but logged as an Alarm event (bit Z set).

Table 8-11: Timer Events

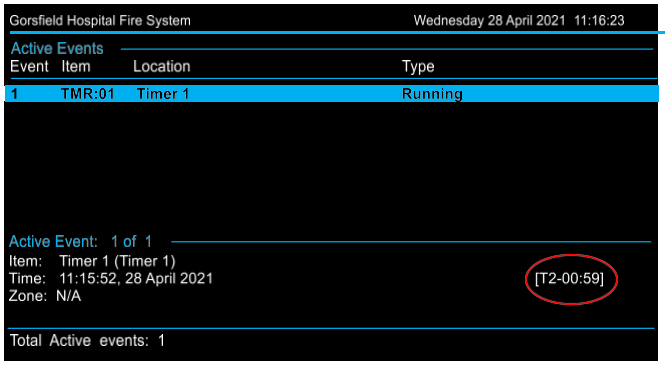
8.7.10 Timer Event Display

Once started, and if the OnScreen (S) flag is set, pressing the 'OK' button will display the Timer on the LCD screen.



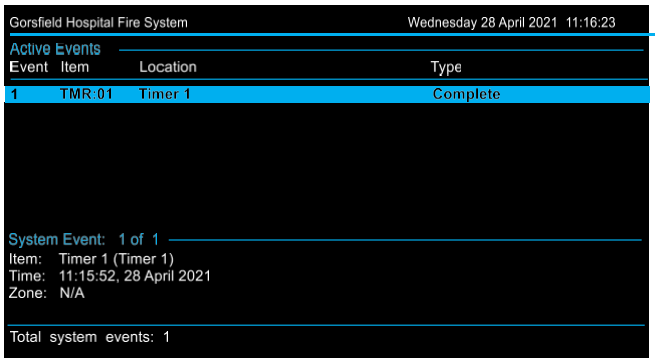
This shows that Timer 1 was started at 11:15:52, is in its T1 period, with 13 seconds to run.

The timer description is 'Timer 1'.

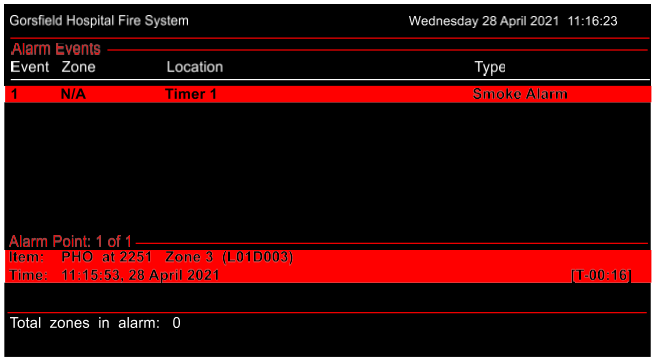


If the timer has a T2 period defined, T2 will be displayed once T1 is complete.

NOTE: In FireUtils, for any timer having the Latching (L) flag enabled inhibits setting a time in T2.



If Latching (L) is set, at the end of the T1 period, the display will show 'Complete' as shown (diagram left)



Or, in the case where Timer 1 had its Alarm Queue (Z) flag set, an alarm event would be generated.

8.8 Positive Alarm Sequence (PAS)

The Positive Alarm Sequence (PAS) is a function which implements a delay from a general alarm signal in a building or structure before alarm notification devices (e.g., strobe) are activated and the Supervising Station or Fire Department notified.

When the first PAS enabled detector is activated, the signal must be acknowledged within 15 seconds using the `ACK` button on the Fire Panel`s display. If acknowledged, the trained response personnel have a further 180 seconds to investigate the alarm source and reset the FACP. If the signal is not acknowledged within the 15 seconds acknowledge period, or an alarm from a different initiating device is received, the alarm notification process will begin.

Similarly, in the 180 second Investigation period, if another device goes into alarm, or the FACP is not reset, the alarm notification process will begin.

A flow diagram of the process is shown in Figure 8-19.

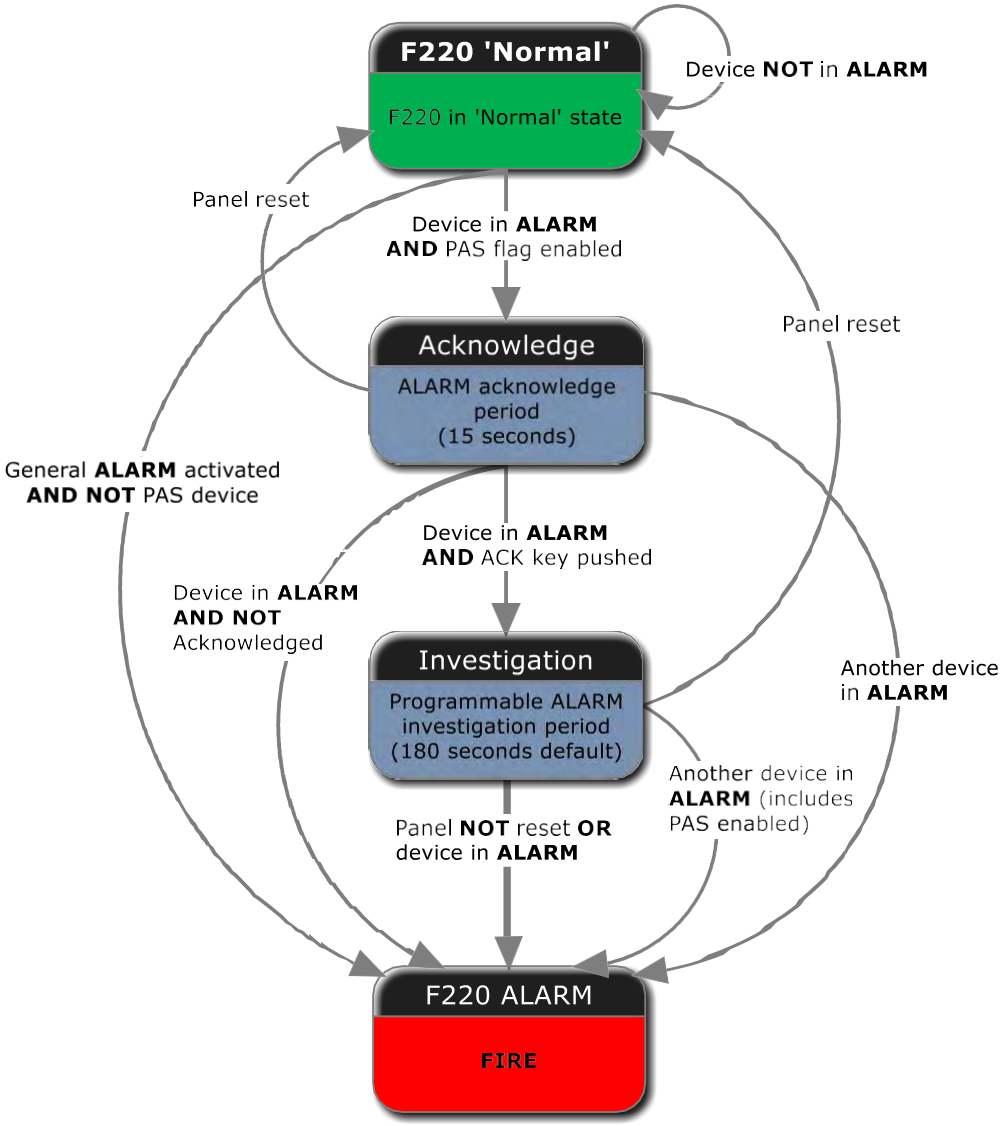


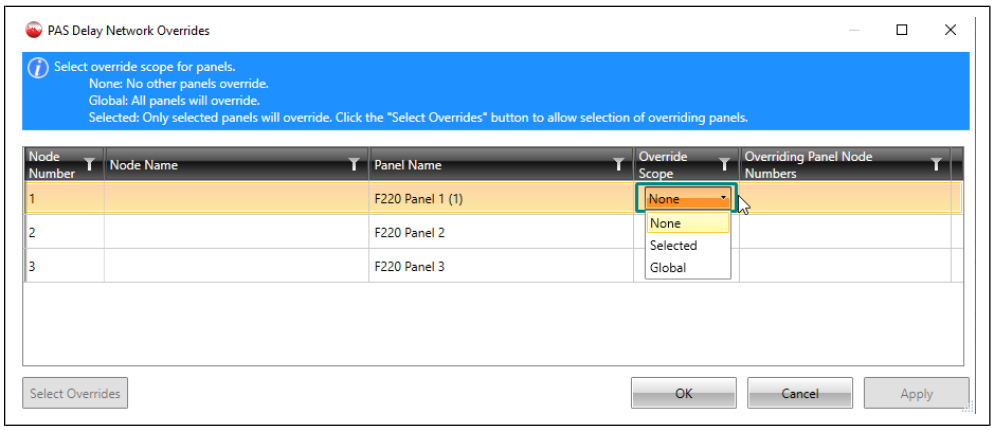
Figure 8-19: Positive Alarm Sequence Process

NOTE:

PAS can be configured to work between panels across a network.

In the Investigation Period, if any device connected to other panel or panels, goes into alarm, the PAS enabled device will also go into alarm.

- Right click on Network in the Component Tree and select ‘PAS Delay Network Overrides’.
- In the Override Scope drop down window, select ‘Global’ to capture all panels in the network or ‘Selected’ to allow individual panels to be selected.



The use of PAS is typically limited to specific types of occupancies or building uses such as in large product or assembly lines, occupied stadiums and arenas, medical operating rooms, theatres and so on.

NOTE:

1. A positive alarm sequence should only be installed in accordance with NFPA 72 *National Fire Alarm and Signaling Code*.
2. Building or occupancy codes need to be consulted to determine if a PAS enabled system is permitted, and specific permission must be obtained from the Authority Having Jurisdiction (AHJ) before it can be used.

8.8.1 Acknowledge and Investigation Periods

Each PAS device has two associated period parameters. The Acknowledge period defines the time period the trained personnel have to Acknowledge the presence of the alarm. Once acknowledged, the PAS initiates the Investigation period, which extends the time available to deal with the alarm. The Investigation period can be truncated in two ways.

1. If the fire alarm is false, the FACP can be reset by pressing the Reset button on the front panel.
2. If a fire exists, a Manual Call Station should be activated to immediately actuate an alarm.

NOTE:

1. The Acknowledge operation, by pressing the ACK button located on the front panel of the FACP, can be performed only *once***,** and only during the Acknowledge period (not during the Investigation period).
2. The default values for the Acknowledge and Investigation periods are 15 seconds and 180 seconds, respectively.

IMPORTANT NOTE: PAS Bypass

NFPA 72 requires the “system provide means of bypassing the positive alarm sequence” (23.8.1.2.1.2).

A PAS system bypass provides a method for trained personnel to activate the alarm, if required, without waiting for the delay periods to expire. The bypass, typically a Manual Pull Station, must be located where the trained personnel are stationed and close to either the FACP or a Net2/F220 Full Function Annunciator.

8.8.2 Event Generation

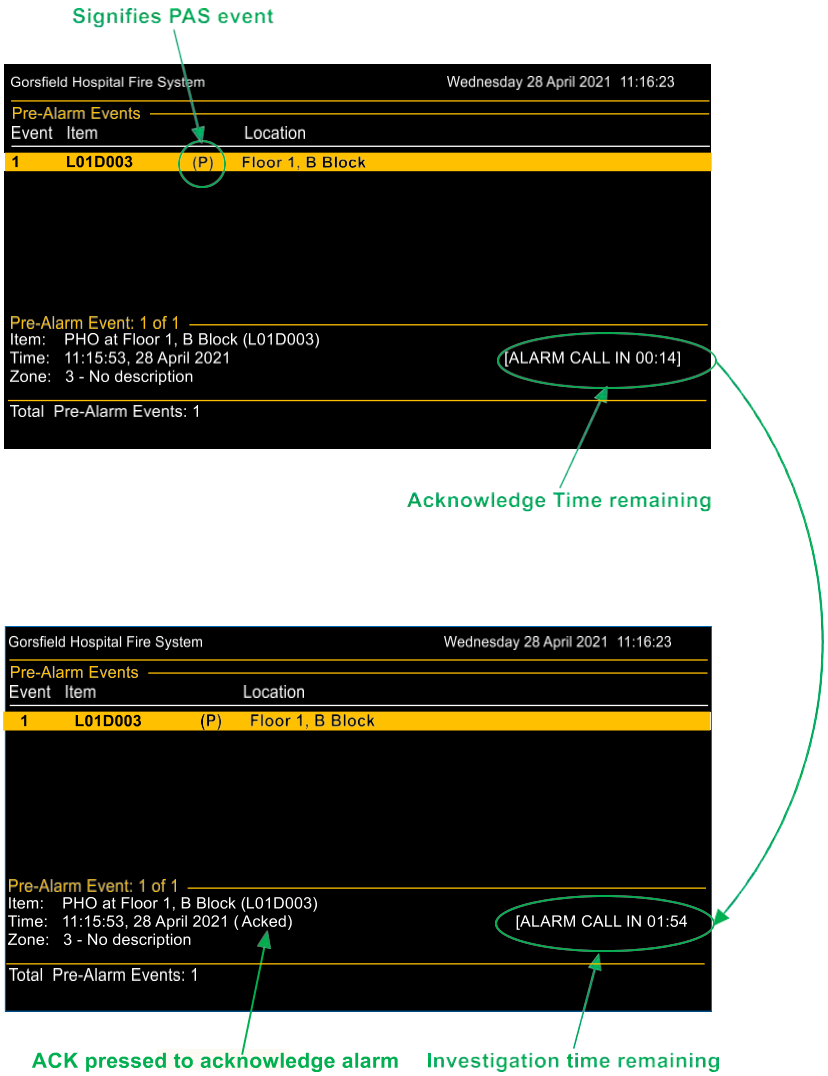
The PAS generates various events during operation that can be viewed in the History Logs (Menu > History Logs> Main Log, Historic Alarm Events and Historic Active Events). The sequence of events for an alarm that eventually results in an ‘Alarm’ are shown below in Table 8-12.

Event	Message	Message Location	Description
PAS Alarm	PAS Pre -Alarm at LnnDnn	Alarm Log, Pre-Alarm Log	A detector within the PAS has activated
PAS Running	PAS running at LnnDnn	Main Log, Active Log	PAS has started and the acknowledge timer is running.
PAS Running	PAS Acknowledged at LnnDnn	Main Log	PAS has been acknowledged
PAS Running	PAS Running-inv at LnnDnn	Active Log	PAS has been acknowledged and the investigation timer is running
PAS Normal	Normal at LnnDnn	Main Log	The PAS timer has been reset
ALARM	Alarm at---------	Alarm Log	The detector that initiated the “Alarm” condition has been latched in Alarm and the Fire Relay activated.

Table 8-12: Event Messages

8.8.3 PAS Displays

The PAS condition will be presented on the LCD as a ‘Pre-Alarm Event’ and not in the usual Fire Alarm view. The time remaining to acknowledge the alarm is shown at the bottom right of the display and once the ACK button has been pressed the display will show the investigation time remaining. See sample displays below:



PAS enabled, Pre-Alarm activated due to 1st Alarm

- Pre-Alarm Events screen displayed.
- Timer starts counting down from 15 seconds.
- PRE-ALARM LED ON.
- ACK LED flashing.
- Buzzer ON.

After 15 seconds, if Pre-Alarm not acknowledged

- Pre-Alarm is escalated to Alarm condition.
- Alarm screen displayed.
- ACK LED flashing.
- NACs activated, if enabled.
- Fire Department/Supervising Station notified, if enabled.

After 15 seconds, if Pre-Alarm is acknowledged

- ACK LED ON.
- PRE-ALARM LED ON.
- Timer starts counting down from 3:00 minutes.
- SILENCE BUZZER LED ON.
- User must reset panel within 3:00 minutes.

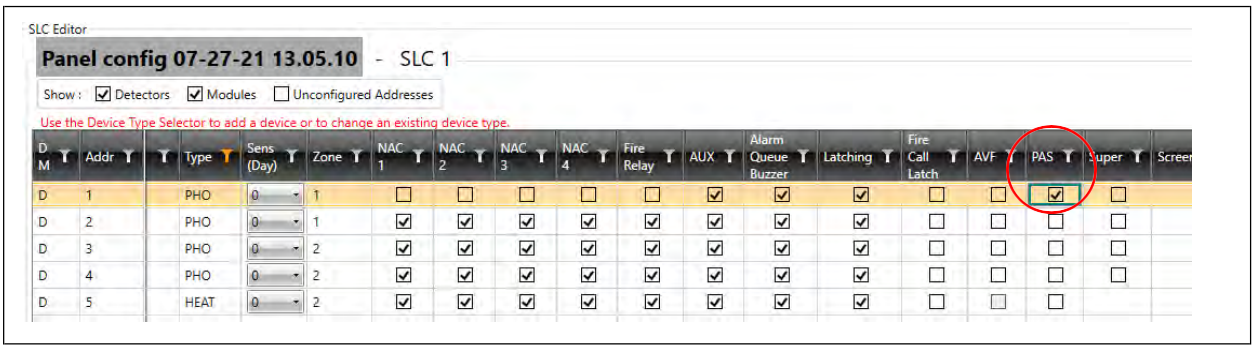
Investigation period complete, panel not Reset

- Pre-Alarm is escalated to Alarm condition.
- Alarm screen displayed.
- ACK LED flashing.
- PRE-ALARM LED OFF, ALARM LED ON.
- NACs activated, if enabled.
- Fire Department/Supervising Station notified, if enabled.

Figure 8-20: PAS Alarm Events display with Acknowledge and Investigation time remaining

8.8.4 PAS Setup in FireUtils

In FireUtils, PAS is enabled for a detector by setting its PAS flag in SLC Editor



D M	Addr		Type	Sens (Day)	Zone	NAC 1	NAC 2	NAC 3	NAC 4	Fire Relay	AUX	Alarm Queue Buzzer	Latching	Fire Call Latch	AVF	PAS	Super	Screen
D	1		PHO	0	1	☐	☐	☐	☐	☐	☑	☑	☑	☐	☐	☑	☐	
D	2		PHO	0	1	☑	☑	☑	☑	☑	☑	☑	☑	☐	☐	☐	☐	
D	3		PHO	0	2	☑	☑	☑	☑	☑	☑	☑	☑	☐	☐	☐	☐	
D	4		PHO	0	2	☑	☑	☑	☑	☑	☑	☑	☑	☐	☐	☐	☐	
D	5		HEAT	0	2	☑	☑	☑	☑	☑	☑	☑	☑	☐	☐	☐		

Figure 8-21: Enabling PAS in FireUtils

IMPORTANT NOTE:

Under NFPA 72, multiple or compounded delays that could further delay occupant notification and fire department response must not be programmed into the system. For example, combining PAS with AVF or "cross zoning" (the operation of multiple automatic detectors to initiate the alarm response) delays. In FireUtils, AVF and PAS are mutually exclusive; that is, only one can be enabled at a time.

NOTE:

1. A virtual detector is one where the analog output of a detector (the `parent`) is used to generate different (or virtual) states (see Section 4.4 for more details).
2. Although PAS can be applied to both the parent and the virtual detector, only a single assignment should be used as multiple assignments will advance the PAS directly to the Alarm state, with no acknowledge or investigation periods, when the device is activated.
3. PAS, AVF and DDA flags are mutually exclusive both on a detector and on its 'attached' virtual detector. That is, it is not possible for PAS to be enabled on one, and DDA or AVF on the other.
4. Careful consideration needs to be taken when applying PAS to detectors that also have virtual detectors.

8.9 Alarm Verification Feature (AVF)

The Alarm Verification Feature is designed to minimize false alarms by monitoring smoke detectors for a period of time before an alarm is raised. It is a feature that is applied to smoke detectors only (Photo, PTIR, HPHO and Beam); not heat detectors, MPSs, 3-Way switches or other SLC input devices.

AVF is enabled 'per device' in FireUtils' SLC Editor (Section 8.9.2). When an AVF-enabled smoke detector goes into alarm (i.e., activated), there is a 30 second time window where additional

activations of that device are ignored. This period is referred to as ‘AVF Active’ in this document and as the ‘Retard-reset-restart’ period in NFPA documentation.

NOTE:

1. AVF can be configured to work between panels across a network. Refer to the ‘AVF Delay Network Overrides’ in the FireUtils manual.

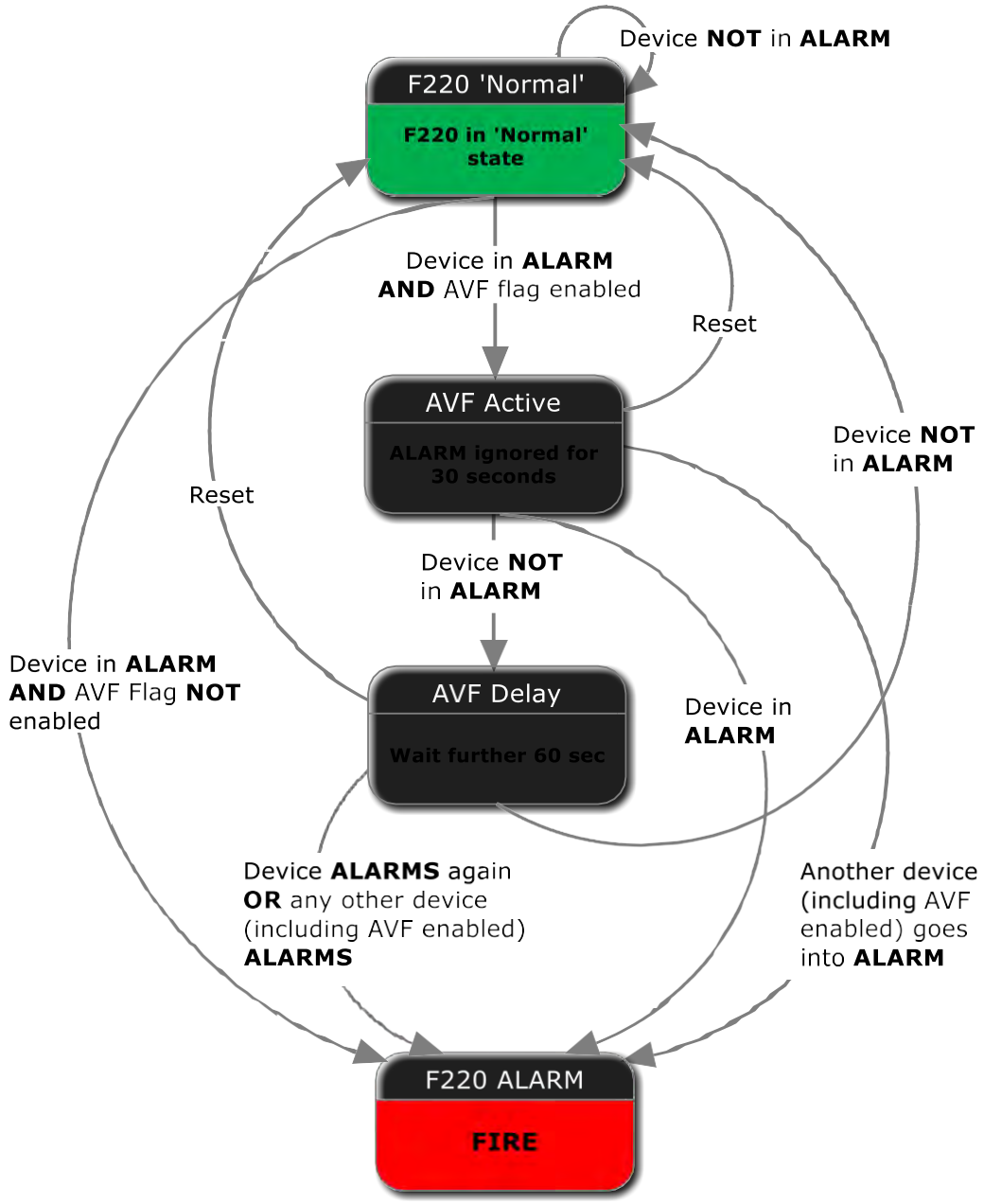
   If any AVF enabled device connected to other panel goes into alarm, the PAS enabled device will also go into alarm.

   - Right-click on Network in the Component Tree and select ‘AVF Delay Network Overrides’.
   - In the Override Scope drop down window, select ‘Global’ to select all panels in the network or ‘Selected’ to allow individual panels to be selected.
2. Systems employing multiple detector operation such DDA in a protected area must reduce the installation spacing of the detectors to 0.7 times the linear spacing in accordance with NFPA 72.

8.9.1 AVF Active

When an AVF-enabled smoke detector goes into alarm, the panel indicates ‘Active: 1’ on the ‘System’ screen. At the completion of the 30 second ‘AVF Active’ window, if the device is still in alarm the panel will immediately enter an alarm condition (refer to Figure 8-22). If the device is not in alarm, an additional 60 second ‘AVF Delay’ (NPFA’s ‘Confirmation’) period starts.

During the ‘AVF Active’ period if another device, AVF enabled or not, goes into alarm, the panel will go into alarm immediately.



Note:
1. AVF Active = Retard-Reset-Restart period
2. AVF Delay = Confirmation period

Figure 8-22: AVF Event Sequence

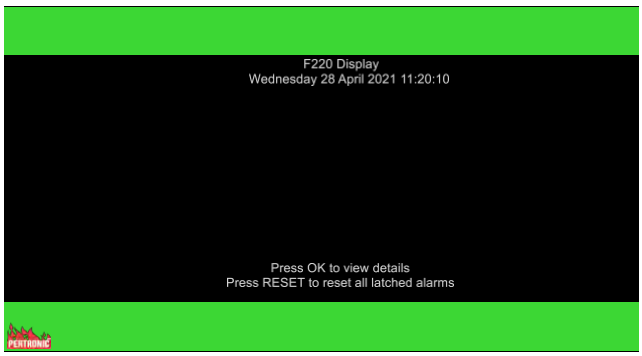
During the 'AVF Delay' period, if the device goes into alarm again or another, non-AVF enabled device goes into alarm, the panel will immediately go into alarm.

If that device is not in alarm at the end of the ‘AVF Delay’ period, the panel ceases to indicate ‘Active’ and returns to the ‘System Normal’ screen.

The maximum time from an AVF-enabled detector becoming activated to reporting an Alarm is 90 seconds.

NOTE:

The default values for the Active and Delay periods are 30 seconds and 60 seconds, respectively. These periods cannot be altered in FireUtils nor on the SLC (Loop) Driver board.



If an AVF-enabled smoke detector becomes active, the ‘System Normal’ screen will display the number of AVF detectors that are active.

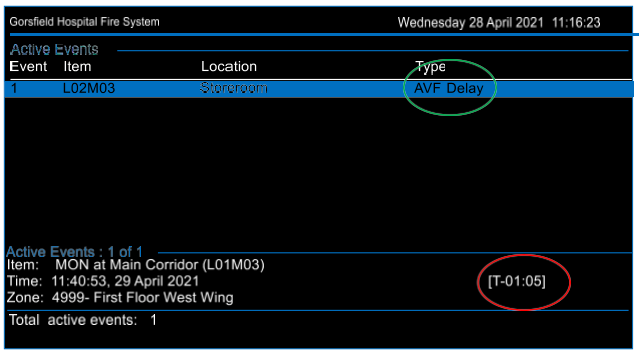
Pressing ‘OK’ will display the ‘Active Events’ screen

The ‘Active Events’ screen identifies the smoke detector that is active, and the time remaining (highlighted; red oval) of the ‘AVF Active’ period (highlighted: green oval) as the timer counts down from 30 to zero.

If the smoke detector is either:

- Still in alarm at the end of the delay period,
- Reactivates during the confirmation period, or
- Another detector activates in the same zone,

the panel will go into ‘Alarm’ immediately.



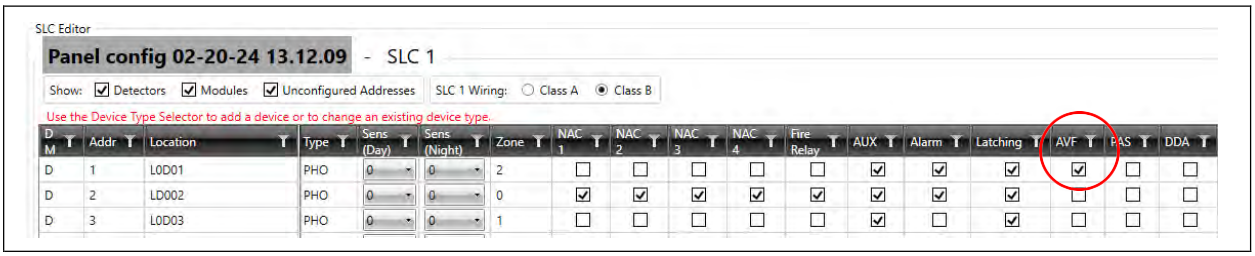
If the smoke detector returns to its normal state during the 'AVF Active' period, the Active Events screen will switch to the 'AVF Delay' (highlighted: green oval) period and the timer will add 60 seconds to whatever remains of the original 30 second 'AVF Active' time. In this example 60 seconds has been added to the remaining 5 seconds of the AVF Active period.

NOTE:

1. Careful consideration needs to be taken when applying AVF to detectors that also have virtual detectors. A virtual detector is one where the analog output of a detector (the `parent`) is used to generate different (or virtual) states (see Section 4.4 for more details). AVF can be applied to either to the `parent`, the virtual, or to both which causes the following Panel responses:
   - If the AVF flag is enabled on both the parent and virtual detectors, both will go AVF active, and ultimately into alarm after the Delay and Confirmation Periods. This will occur at the end of either period only if the parent and the virtual detector are still activated, have been reactivated, or another detector is activated.
   - If AVF is enabled on the detector only, only the detector`s AVF will be activated, the virtual detector will go into alarm immediately.
   - If AVF is enabled on the virtual detector only, both the detector will go immediately into alarm.
2. AVF, PAS and DDA flags are mutually exclusive both on the detector and on its 'attached' virtual. That is, it is not possible for AVF to be enabled on one, and PAS or DDA on the other.

8.9.2 Enabling AVF in FireUtils

In FireUtils, AVF is enabled for a detector by setting its AVF flag in SLC Editor



IMPORTANT NOTE:

Under NFPA 72, multiple or compounded delays must not be programmed into the system that could further delay occupant notification and fire department response. For example, combining PAS with AVF or “cross zoning” (the operation of multiple automatic detectors to initiate the alarm response) delays. In FireUtils, AVF, DDA and PAS are mutually exclusive; that is, only one can be enabled at a time.

8.10 Dual Detector Alarm (DDA)

With the Dual Detector Alarm (DDA) feature, the panel requires two or more activated DDA enabled detectors for it to go into alarm. If its DDA flag is set, when a detector reaches its alarm threshold the panel will go into a prealarm state. If a second DDA enabled detector reaches its alarm threshold, the panel will go into alarm. The default flag setting is ‘Not Set’. DDA, AVF, and PAS are mutually exclusive.

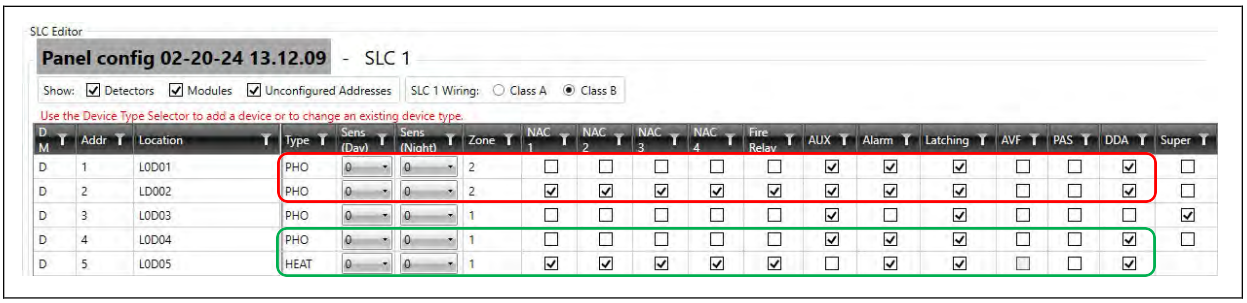
The Dual Detector Alarm feature is designed to allow flexibility in fire detection. If the two (or more) DDA enabled detectors have the same criteria (for example, both photoelectric), DDA can minimize false alarms. If the two detectors have different criteria, for example one photoelectric and the other thermal, DDA can improve the response in the detection of both smoldering (photoelectric) and fast flaming (heat) fires.

IMPORTANT NOTE:

In accordance with NFPA 72**,** systems employing multiple detector operation such as AVF and DDA in a protected area must reduce the installation spacing of the detectors to 0.7 times the linear spacing.

8.10.1 Enabling DDA in FireUtils

DDA is enabled ‘per device’ in FireUtils’ SLC Editor as shown below.



D M	Addr	Location	Type	Sens (Day)	Sens (Night)	Zone	NAC 1	NAC 2	NAC 3	NAC 4	Fire Relay	AUX	Alarm	Latching	AVF	PAS	DDA	Super
D	1	L0D01	PHO	0	0	2	☐	☐	☐	☐	☐	☑	☑	☑	☐	☐	☑	☐
D	2	LD002	PHO	0	0	2	☑	☑	☑	☑	☑	☑	☑	☑	☐	☐	☑	☐
D	3	L0D03	PHO	0	0	1	☐	☐	☐	☐	☐	☑	☐	☑	☐	☐	☐	☑
D	4	L0D04	PHO	0	0	1	☐	☐	☐	☐	☐	☑	☑	☑	☐	☐	☑	☐
D	5	L0D05	HEAT	0	0	1	☑	☑	☑	☑	☑	☐	☑	☑	☐	☐	☑	