

FireDrench

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AE-FD-CTU-3

FIRE SPRINKLER PUMP CONTROLLER

INSTALLATION, OPERATION &
MAINTENANCE MANUAL

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APPLICATIONS
ENGINEERING LTD

CONTENTS

1. Safety Information	
2. Product Overview	
3. Theory of Operation	
4. Front Panel Overview	
5. Inputs & Outputs	
6. Engineer Mode & Programming System Settings	
7. Wiring & Installation	
8. Faults & Alarms	
9. Commissioning	
10. Maintenance	
11. USB Functions	
12. Technical Specification	
13. Compliance	
14. Spare Parts	
15. Disposal & Environment	
16. Warranty	
17. Revision History	

1. SAFETY INFORMATION

This controller is designed for use in automatic fire sprinkler systems and must be installed, commissioned and maintained by competent persons in accordance with BS 9251:2021 and all applicable local regulations.

DANGER - HAZARDOUS VOLTAGE

The pump output switches live mains voltage up to 3 kW. Isolate all power before removing covers or working on the unit. Failure to comply may result in serious injury or death.

WARNING

Installation must be carried out by a competent person. Do not bypass or disable any safety or monitoring functions. Ensure the enclosure is securely mounted and all cables are correctly glanded and supported.

CAUTION

Verify all wiring before applying power. Ensure correct configuration before commissioning.

- Read this manual carefully before installation and keep for future reference.
- Installation and service by authorised and competent personnel only.
- Dispose of this product in accordance with local regulations.

2. PRODUCT OVERVIEW

2.1 System Overview

The FireDrench AE-FD-CTU-3 is an automatic fire sprinkler pump controller designed for residential and domestic sprinkler systems. It monitors system conditions and controls the fire pump, test valve and associated alarms in accordance with BS 9251:2021.

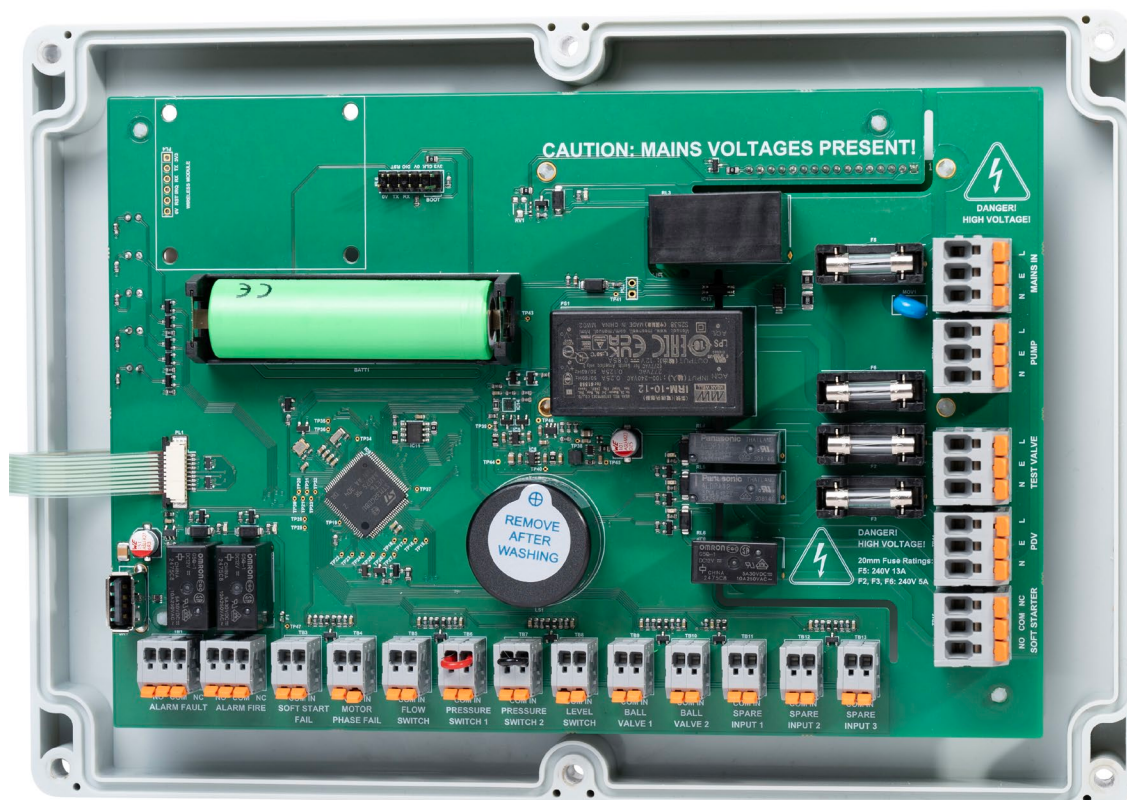
The controller supports Automatic Test, Fire Mode, Assumed Fire Mode, Cooling Mode and Jockey Mode with comprehensive fault detection and event logging.

2.2 Key Features

- Designed in accordance with BS 9251:2021
- Automatic scheduled test function
- Optional Monitored inputs with EOL and series resistors
- Soft starter interface
- Event log capacity up to 5000 events
- Configurable input supervision
- Supports Category 1, 2, 3 and 4 systems
- Fire, Assumed Fire, Cooling and Jockey modes
- Six relay/output functions plus PDV and test control
- 72-hour battery backed clock and fault memory
- USB for configuration, logs and firmware
- Provision for future communications module

2.3 System Architecture

The controller integrates monitoring inputs, control outputs and a front panel user interface into a compact wall-mounted control unit.



3. THEORY OF OPERATION

3.1 Operating Modes Overview

The controller automatically selects operating mode based on the state of the flow switch, pressure switches and other monitored inputs.

3.2 Standby Mode

In Standby Mode the controller waits for a change of input state and follows the programmed logic path accordingly.

3.3 Fire Mode

Fire Mode is triggered by an activated flow switch. The pump output changes state, the Fire LED illuminates and the buzzer pulses, PDV opens if enabled.

3.4 Assumed Fire Mode

Assumed Fire Mode is triggered by one or both pressure switches activating, without the flow switch. The pump runs and Cooling Mode will be enabled to prevent pump overheating; fire LED also illuminates.

3.5 Jockey Mode

Jockey Mode is triggered by pressure loss and attempts to re-pressurise the system before determining whether a fire condition exists. The pump operates for a configurable duration allowing the controller to determine whether:

- Pressure loss is minor, or
- A genuine fire condition exists.

3.6 Automatic Test Mode

Automatic Test Mode operates at a configured day and time unless the controller is already in Fire Mode or Assumed Fire Mode.

The controller automatically:

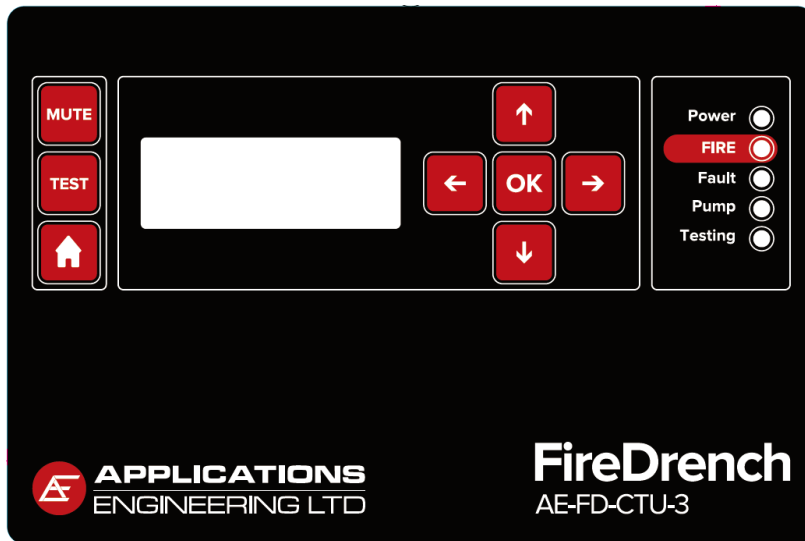
- Operates the test valve
- Verifies pressure switch operation
- Verifies flow switch operation (can be skipped in test mode)
- Records test results
- Logs faults

3.7 Cooling Mode

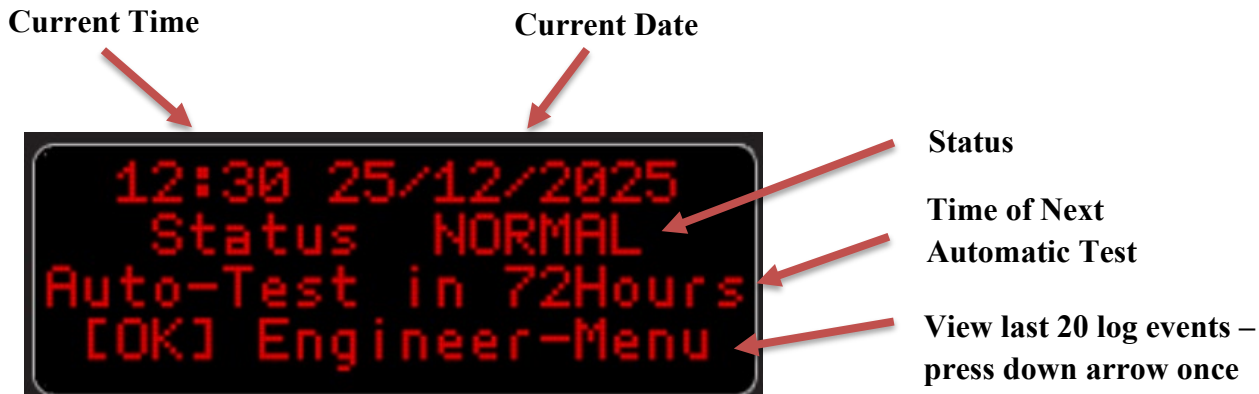
Cooling mode periodically operates the test valve to prevent pump overheating in assumed fire mode. Cooling cycles and duration are fully configurable.

4. FRONT PANEL OVERVIEW

4.1 Keypad Layout



4.2 Home Screen



4.3 Indicators (LEDs)

LED	ON condition	OFF condition
Power	AC power OK	AC power lost
Fire	Water flowing or fire condition active	No water flowing
Fault	Any fault present	No fault
Pump	Pump running	Pump stopped
Testing	Test in progress	No test active

4.4 Button Functions

Button	Symbol	Function	Notes
Arrow Keys		Move cursor / select options	Single press
OK		Confirm selection	Single press
TEST		Start Manual Test	Single press in Engineer Mode (Engineering mode is entered after passcode screen)
TEST		Run Pump 10s (No Test Valve operation)	Hold TEST button for >5s in Engineer Mode (Engineering mode is entered after passcode screen)
TEST		Force Fire Mode	Hold TEST button for >15s in Engineer Mode (Engineering mode is entered after passcode screen)
TEST		Lamp Test (Energises all LEDs for 5 Seconds)	Hold TEST button for >5s ON HOME SCREEN
MUTE		Mute buzzer 24h	Single press
MUTE		Manual Pump Stop	Hold MUTE button >10s in any mode
MUTE		Clear Faults (also see 9.4)	Hold MUTE button >20s in any mode
HOME		Return to home screen	Single press

4.5 Audible Alarm (Buzzer)

Status	Audible pattern
Fire / Assumed Fire	Pulsed continuously at 0.5Hz
Fault	Pulsed slow warning
Pump Running	Pulsed running indication
Power Fail	Continuous

5. INPUTS & OUTPUTS

5.1 Inputs

All inputs are two-way terminals, they can take either NO or NC inputs, this is configured within the device settings menu.

Input	Description	Input
Flow Switch	Sprinkler flow input	NO, NC or Fault monitored
Pressure Switch 1	Pressure monitoring	N/C only (to be BS 9251:2021 compliant)
Pressure Switch 2	Pressure monitoring	N/C only (to be BS 9251:2021 compliant)
Level Switch	Tank water level	NO, NC or Fault monitored
Ball Valve Switch 1	Valve position monitoring	NO, NC or Fault monitored
Ball Valve Switch 2	Valve position monitoring	NO, NC or Fault monitored
Spare Inputs 1-3	Configurable inputs	NO, NC or Fault monitored
Motor Phase Fail	Pump phase status	NO or NC
Soft Starter Fail	Soft starter status	NO or NC

All inputs except the Pressure Switches 1 & 2, Motor Phase Fail, and the Soft Starter Fail can be fault monitored so that a short or open circuit, in the wiring between controller and the corresponding switch, can be detected and an appropriate fault raised.

The fault detection circuit will be designed to work with switches incorporating a 47K Ω parallel (EOL) and a 4.7K Ω series resistors (FIRE, ALARM)

5.2 Outputs

Output	Description	Rating / Type
Fire Alarm	Fire output to external alarm or sounder	Volt-free relay (rated at 24VDC 2A maximum)
Fault Alarm	Fault output to external alarm or sounder, will give fault signal in the event of a loss of power	Volt-free relay (rated at 24VDC 2A maximum)
Pump Motor Output	Single-phase pump control	230VAC up to 3kW
Test Valve Output	Automatic test valve	230VAC
PDV Output	Priority demand valve	230VAC
Soft Starter Output	Soft starter interface	Volt-free relay (Used with our 3-Phase Pump sets)

6. ENGINEER MODE & PROGRAMMING SETTINGS

Engineer Mode provides access to system settings, input configuration, logs, USB functions and manual tests. Access is passcode protected, and the controller automatically exits after inactivity.

Enter Engineer Mode:

OK → Engineer Mode → Enter Passcode → OK

Default passcode: 111983

Menu	Function
System Log	View, download or clear event log (5000-event capacity)
System Settings	Configure jockey mode, delays, auto-test and cooling
Device Settings	Configure date/time, inputs and firmware updates
PDV	Enable/Disable Priority Demand Valve
Service Settings	Configure service reminder, interval, installer name & number
Settings to & from USB	Upload/Download system and device settings to USB

6.1 System Settings

Delays are the length of time after a switch activates before a signal is registered to prevent false activations

System Setting	Setting	Function
Jockey Mode	Excessive Operation Limit	Set 4-20 starts per week (12 Default)
Jockey Mode	Jockey Pump Duration	Set 5-120 seconds (20 Default)
Trigger Settings	Flow Switch Delay	Set 5-25 seconds (5 Default)
Trigger Settings	Flow Switch Trigger	Set 5-25 seconds (25 Default)
Trigger Settings	Pressure Switch Reset Delay (Length of time after a jockey run the pump overruns and pressure switch condition is disregarded, allowing the system pressure to settle without activating again)	Set 0-10 seconds (5 Default)
Trigger Settings	Low Water Delay	Set 0-60 seconds (10 Default) *10 seconds after low level fault, the PDV will close
Auto-Test	Auto-Test Day	Mon, Tue, Wed, Thu, Fri, Sat, Sun (Tuesday Default)
Auto-Test	Auto-Test Time (of day)	24-hour clock (09:00 Default)
Auto-Test	Auto-Test Duration (max duration before fault)	60-600 seconds (60 Default)
Cooling Settings	Cooling Duration (time test valve open for)	0-60 seconds (3 Default)
Cooling Settings	Cooling Cycles	1-60 times an hour (30 default)

System and Device Settings can also be set by our online configuration web page. Use the below configurator, save the settings, and upload via USB (any USB with FAT/FAT32 format).

To upload settings from USB:

OK → Engineer Mode → Enter Passcode → Settings from USB → OK

<https://www.appeng.co.uk/sprinkler-configurator-form/>

To download settings from controller to USB:

OK → Engineer Mode → Enter Passcode → Settings to USB → OK

The downloaded settings can then be uploaded to the online configurator for review and modification.

6.2 Device Settings

Settings	Function
Date/Time	Configure current date & time
Firmware Update	View or perform a firmware update via a file upload from a USB

6.2.2 Input Settings (Within Device Settings)

Input Select	Setting	Function
Flow Switch	Flow Switch Mode	Set flow switch to NO, NC or disabled
Flow Switch	Flow Switch Supervised	Enable supervised circuits using resistors
Flow Switch	Flow Switch Test	Test switch operation (activate device without setting off alarm)
Pressure Switch	Pressure Switch Mode	Set switch to NO, NC or disabled
Pressure Switch	Pressure Switch Test	Test switch operation (activate device without setting off alarm)
Level Switch	Level Switch Mode	Set switch to NO, NC or disabled
Level Switch	Level Switch Supervised	Enable supervised circuits using resistors
Level Switch	Level Switch Test	Test switch operation (activate device without setting off alarm)
Ball Valve	Ball Valve Mode	Set switch to NO, NC or disabled
Ball Valve	Ball Valve Supervised	Enable supervised circuits using resistors
Ball Valve	Ball Valve Test	Test switch operation (activate device without setting off alarm)
Spare Inputs	Spare Inputs Mode	Set switch to NO, NC or disabled
Spare Inputs	Spare Inputs Supervised	Enable supervised circuits using resistors
Spare Inputs	Spare Inputs Type	Set spare input device to Ball Valve, Flow, Pressure, Level switch or Other
Spare Inputs	Spare Inputs Test	Test switch operation (activate device without setting off alarm)
Soft Starter	Soft Starter Input	Set to NO, NC or disabled
Motor Phase	Motor Phase Input	Set to NO, NC or disabled

System and Device Settings can also be set by our online configuration web page. See above 6.1

6.3 Manual Testing

A manual test may be initiated within Engineer Mode. A single press of the TEST button in Engineer Mode (Engineering mode is entered after passcode screen)

OK → Engineer Mode → Enter Passcode → OK → TEST → OK

The controller automatically:

1. Opens test valve
2. Checks both pressure switches activate
3. Operates pump
4. Checks flow switch activates (if no flow switch activation after 10 seconds, an entry is made into log 'TEST: FLOW SW SKIPPED' and test is allowed to complete. No fault is raised.
5. Closes Test Valve
6. Checks both pressure switches reset

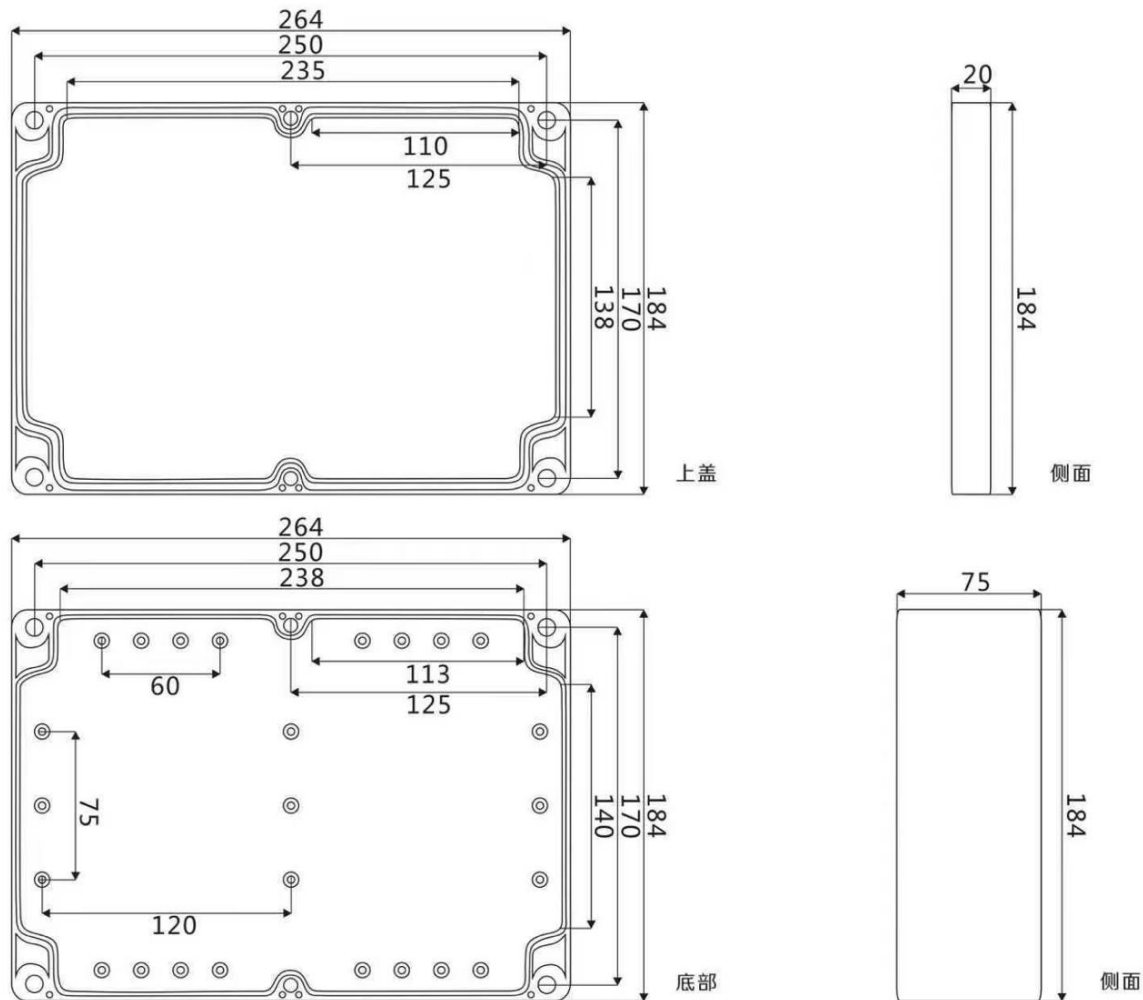
7. Check flow switch resets
8. Stops pump
9. Logs results
10. Restores normal operation

7. INSTALLATION

7.1 General

- Mount vertically on a secure surface.
- Allow sufficient access for service and maintenance.
- Do not mount in locations exposed to direct water ingress.
- Use suitable glands and maintain enclosure rating.

7.2 Mounting & Dimensions



7.3 Wiring Overview

- Wiring Diagram on next page.
- Separate mains and low voltage wiring. Verify all cable terminations before applying power.
- Fit the supplied rechargeable battery after all wiring has been completed.



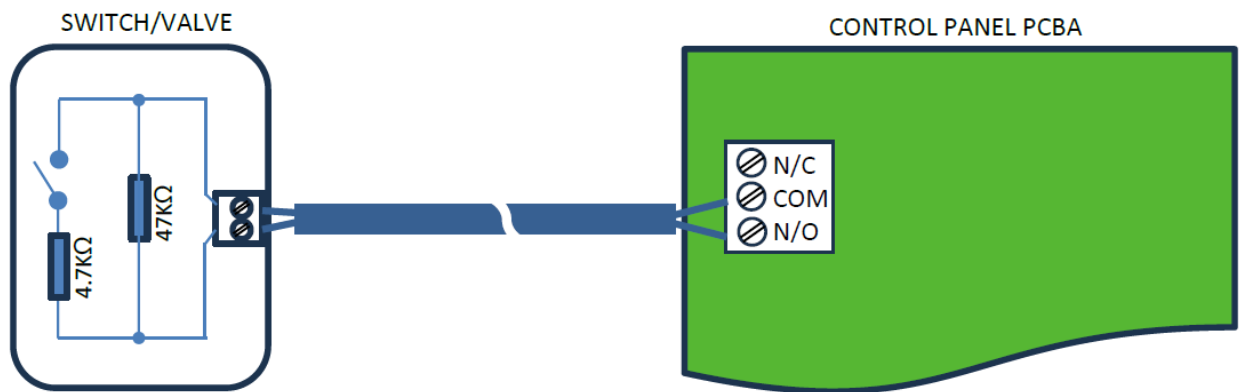
7.4 Wiring - Fault Monitoring

All inputs except the Pressure Switch 1, Pressure Switch 2, Motor Phase Fail Switch and the Soft Starter Fail Switch can be fault monitored so that, a short or open circuit in the wiring between controller and the switch can be detected and an appropriate fault raised. The installer can choose between fault monitored and non-fault monitored contacts for all inputs except those listed above.

The fault detection circuit will be designed to work with switches incorporating a $47\text{K}\Omega$ parallel resistor (EOL) and a $4.7\text{K}\Omega$ series resistor (FIRE, ALARM).

For all fault monitored inputs except the flow switch, a $47\text{K}\Omega$ parallel (EOL) can be placed in the device terminals.

For the Flow switch, a $4.7\text{K}\Omega$ fire resistor needs to be placed in series in the switch, in addition to the $47\text{K}\Omega$ parallel (EOL) as per below diagram, this will give a fire signal on activation.



8. FAULTS & ALARMS

8.1 Fault Philosophy

Faults are displayed on the LCD, logged in the system event log, activate the fault alarm output and operate the internal buzzer. Fire Mode and Assumed Fire Mode override fault conditions.

8.2 Fault List

Fault	Reset Type
Flow Switch Fail	Latching (require manual reset)
Pressure Switch Fail	Latching (require manual reset)
Automatic Test Failure	Latching (require manual reset)
Level Switch Fail	Auto reset
Ball Valve Switch Fail	Auto reset
Motor Phase Fail	Auto reset
Soft Starter Fail	Auto reset
Pump Fail	Auto reset
Mains Fail	Auto reset
Test Valve Fail	Auto reset

Faults are categorised into two types:

- Auto reset – Will automatically reset when fault resolved
- Latching faults - Require manual reset by running a test

8.3 Fault Indications

Faults are displayed on the LCD, logged in the system event log, activate the fault alarm output and operate the internal buzzer. Fire Mode and Assumed Fire Mode override fault conditions

- Display on LCD
- Activate fault relay
- Sound buzzer
- Log event history

8.4 Clearing Faults

Faults are cleared by holding MUTE button down for >20 seconds (see 4.4).

The controller will run an auto-test after the user has Cleared Faults. The auto-test starts 10 seconds after the faults are reset, if any faults are still present, fault mode will be engaged again.

8.5 Clearing Fire Signal

Fire signal is cleared by holding MUTE button down for >10 seconds (see 4.4), to stop the pump, then by holding MUTE button down for >20 seconds, to run an automatic test and return the controller to normal.

The controller will run an auto-test after the user has Cleared Faults. The auto-test starts 10 seconds after the faults are reset, if any faults are still present, fault mode will be engaged again.

The pump can also be stopped and Fire mode reset by turning the mains power off.

In either condition, if the system hasn't returned to normal, the pressure switches will stay activated and the Fire state will return.

9. COMMISSIONING

9.1 Pre-Commissioning Checks

Check	Result
Incoming supply verified	PASS / FAIL
Earth continuity checked	PASS / FAIL
Pump rotation verified	PASS / FAIL
Pressure switches set	PASS / FAIL
Flow switch tested	PASS / FAIL
Alarm outputs tested	PASS / FAIL
Test valve tested	PASS / FAIL
PDV tested	PASS / FAIL

9.2 Functional Test Checklist

Test	Expected Result	Result
Power up	Power LED ON and LCD active	PASS / FAIL
Manual test	Test sequence starts	PASS / FAIL
Auto-test	Auto Test Scheduled	PASS / FAIL
Fire mode	Pump starts and fire indication active	PASS / FAIL
Fault reset	Fault clears following reset procedure	PASS / FAIL

10. MAINTENANCE

Routine maintenance should be carried out every 6 months

- Inspect enclosure and cable glands.
- Verify LED operation and buzzer function.
- Check event log for recurring faults.
- Perform manual test.
- Check battery as part of service schedule, should be replaced every 5 years.
- Verify all field devices operate correctly.

11. USB FUNCTIONS

The controller supports FAT/FAT32 USB memory devices for firmware updates, settings import/export and event log download. The USB port is intended for competent service engineers only.

12. TECHNICAL SPECIFICATION

Parameter	Specification
Model	AE-FD-CTU-3
Supply voltage	230VAC 50Hz
Pump output	Single phase pump up to 3kW
Display	4 x 20 character LCD
Inputs	11
Outputs	6
Event log	5000 events
Real Time Clock (RTC) accuracy	+/- 1 minute/month
USB	Settings, logs and firmware

Dimensions	Size
Height	266mm
Width	184mm
Depth	95mm

13. COMPLIANCE

The FireDrench AE-FD-CTU-3 has been designed for use in systems requiring BS 9251:2021 functionality and is intended for UKCA & CE compliance as part of the complete product technical file.

Test	Standard
Conducted Emissions	BS EN IEC 61000-6-3:2021
Radiated Emissions	BS EN IEC 61000-6-3:2021
Fast Transient and Burst Immunity	BS EN 61000-4-4:2012
Voltage Dips and Interruptions	BS EN IEC 61000-4-11:2020
Electrostatic Discharge	BS EN 61000-4-2:2009
Surge Immunity	BS EN 61000-4-5:2014+A1:2017

14. SPARE PARTS

Test	Standard
AE-FD-CTU-3-ENCLOSURE	Plastic Enclosure
AE-FD-CTU-3-KEYPAD	Front keypad
AE-FD-CTU-3-PCB	Main controller PCB
AE-FD-CTU3-BAT	Rechargeable battery

15. DISPOSAL & ENVIRONMENT

Dispose of electrical equipment and batteries in accordance with local regulations. Do not dispose of electrical equipment with general waste.

16. WARRANTY

Applications Engineering Ltd warrants this product against manufacturing defects subject to standard terms and conditions.

17. REVISION HISTORY

Issue	Date	Description
01	Jan 2026	Initial release
02	Mar 2026	Updated controller firmware
03	July 2026	Updated images