FIRE DETECTION UNIT (FDU)

FOR THREE PHASE LOCOMOTIVES
(WAG9, WAG9H / WAP7 / WAP5)

USER MANUAL

RELEASE 1.0

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Submitted By

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1. Introduction

The Fire Detection Unit, hereinafter referred as FDU, is used in the 3-phase locomotives of classes WAP5, WAP7 & WAG9 (and variants) operated in Indian Railways. The FDU works by sensing the presence of smoke particles in a sample of the machine room air. In case of presence of smoke (or fire) it generates an alarm by activating a relay, which is used in the locomotive control circuit to annunciate to the driver and also to cut off the locomotive power. Two levels of alarms are generated.

2. Functional Details

2.1 System Architecture
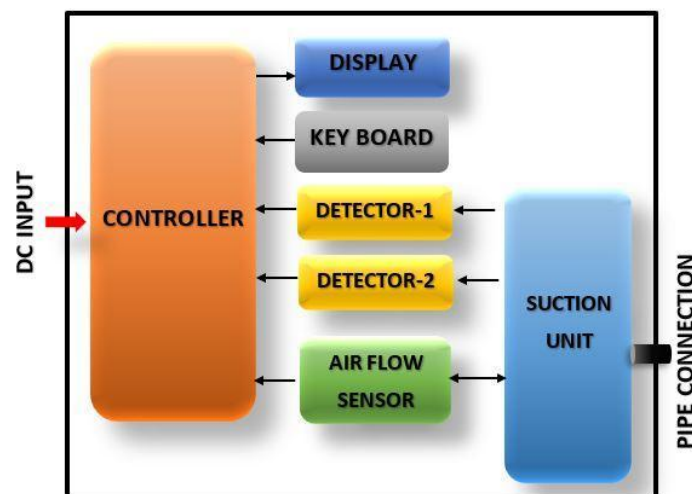
The working principle of the FDU is explained in the block diagram. A non-metallic pipe is laid along the machine room wall, which contains small holes at predefined intervals and pre-defined size. One end of the pipe is connected to the FDU through a PG29 coupler joint. The Fig-1 given below illustrates this arrangement.

Due to the suction fan in the FDU, machine room air will be sucked into the pipe through the small holes distributed along the length of the pipe. Due to the small diameter holes, only a representative sample of the machine room air will enter the FDU. The air sample collected inside the FDU chamber comes in contact with the smoke sensor. There are two smoke sensors. The smoke sensor works

according to the principle of scattered light by smoke particles, as defined in the specification. If the air contains smoke particles beyond the pre-defined threshold, the sensor activates. The smoke sensor outputs are connected to a microcontroller (ARM microcontroller) for activating the alarms, displays and output relays.

FDU with suction fan

Fig-1

Air sampling tube with holes
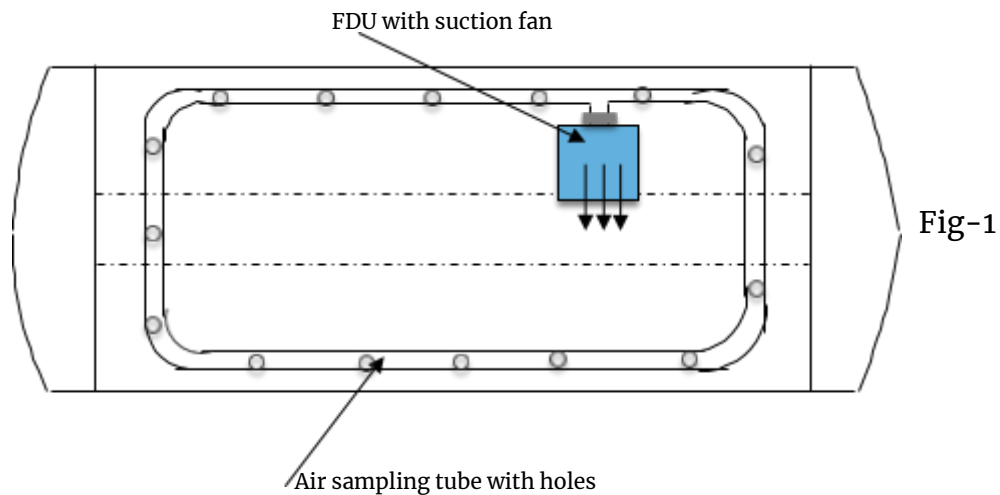
The condition of the sampled air is continuously monitored using an air monitoring system. A sample of the air is passed through an air filter and the flow is monitored. In case the air contains dust particles beyond the acceptable levels, it could affect the performance of the FDU and also may lead to false alarm. If the dust content is more than acceptable, the air flow measuring system will generate alarm to enable cleaning of the FDU.

The front panel is provided with a cluster of LEDs as defined in the specification. The LEDs are intended to give status of equipment in operation (Green), Fault/malfunction (Yellow) and Smoke Alarm 1 & Smoke Alarm 2 (Red). Also in our design we have eliminated Potentiometer and banana sockets which is used to set calibration voltage for Air flow sensor and to measure voltage in the multimeter respectively, in our design we have provided Membrane Up and down keys to set calibration voltage and graphical display to display the calibration voltage instead of using multimeters. The panel has also a reset button.

2.2 Connection diagram

The alarm status of the FDU is made available through potential free relay contacts (5 relays) wired as given in Fig-2. These relay contacts are wired to the loco electronics (VCU) for providing visual indication to the driver as well as for fault log and activation of traction circuit.

Fig-2

Contact "Fault"
Normal State :
10-11 : open
10:23 : close
Fault State:
10-11 : close
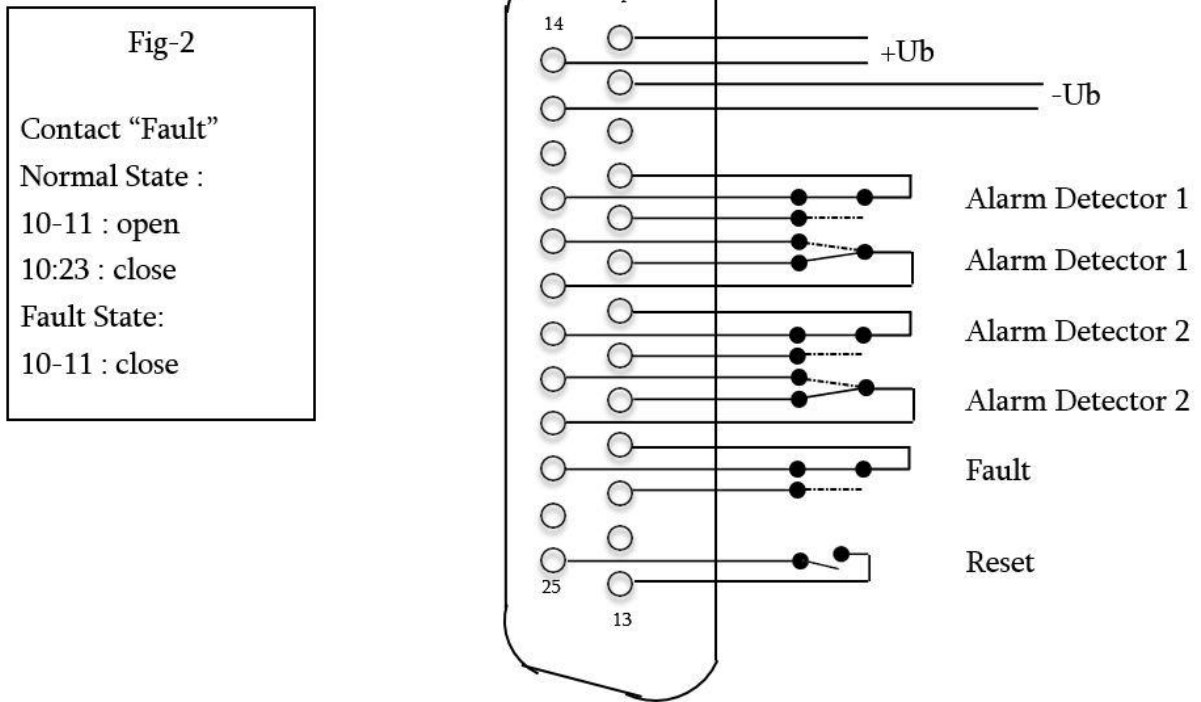
2.3 Initial Power ON setup

After power ON the start-up screen
appears. The display shows airflow voltage
and the Operation LED (Green) will glow.
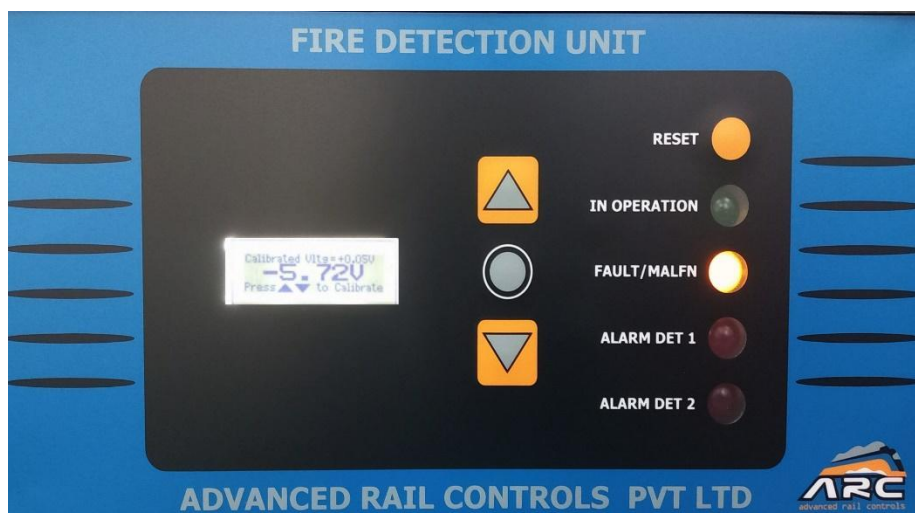Initially the FDU has to be calibrated.
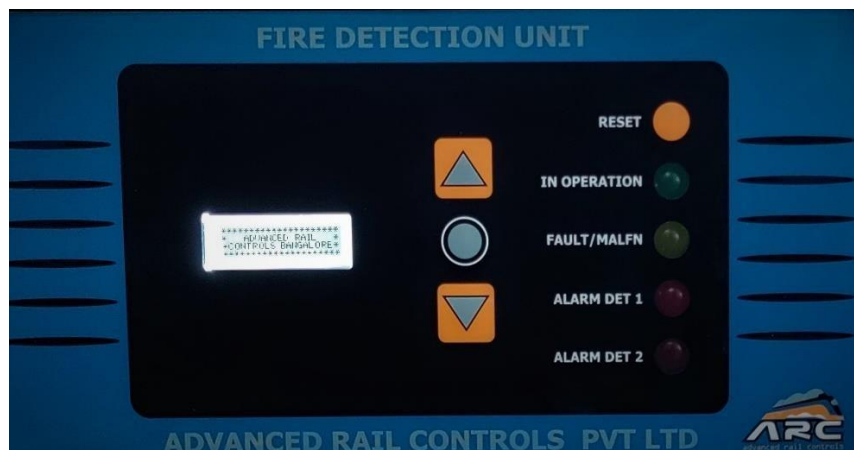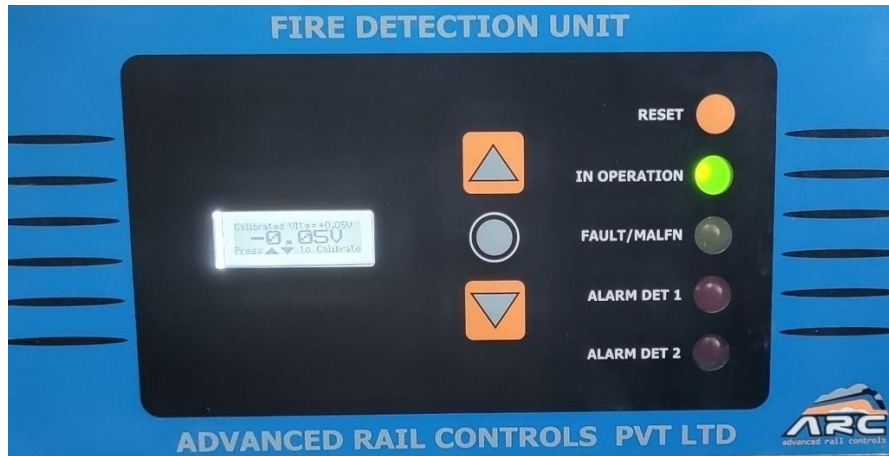
To calibrate press either **Up/Down** button now another screen appears **"To calibrate press (◎)** **button"**. Then it shows **"Calibrating……"**. When calibration is completed, final screen appears "Calibrated voltage = **+/-0.05V".**
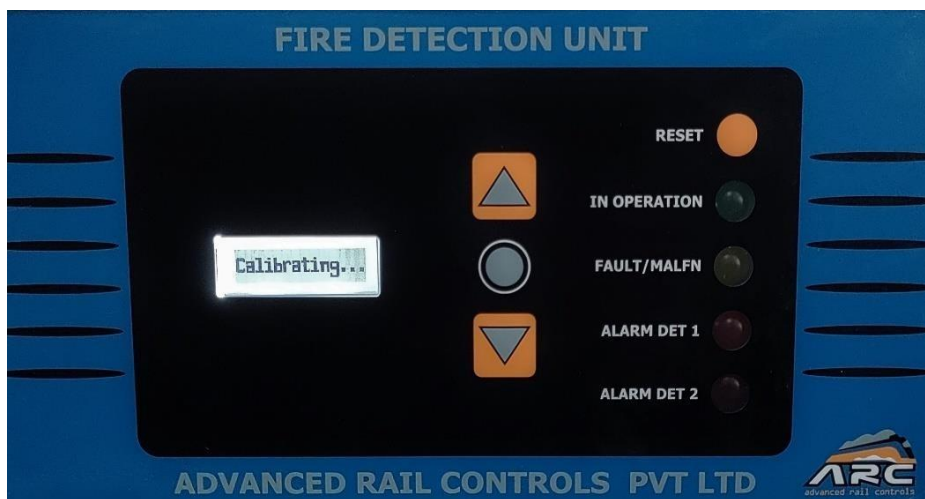
Connect the suction pipe to the FDU. When all the holes of the pipe are closed Fault/Malfunction LED (Yellow) will glow.

If any smoke is detected at any suction point of the pipe either Alarm smoke detector 1 or Alarm smoke detector 2 (Red) will glow.

If the FDU detects any fault/malfunction or any smoke is detected then it has to be calibrated once again.

3.0   CONTACT DETAILS

For any warranty/service-related queries, please contact

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