Element
Basic User Guide

EDAX
Smart Insight
AMETEK
MATERIALS ANALYSIS DIVISION

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The **Element** detectors are manufactured by:
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Table of Contents

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1 INTRODUCTION

Removing any of the instrument covers, may pose a safety hazard as high voltages may be exposed.

The detector is a sophisticated precision instrument. Removal of any system's covers must be done by qualified EDAX Factory trained engineers or representatives.

All User / Operator adjustments and calibrations are done within the Element software environment. Users of the system should not attempt removing any covers or making any service adjustments.

Proceed with caution where the following label is found.

Do not attempt to use until fully understanding its proper connections and functions. Users should have a basic understanding of the operation of the system before operating.

Please send feedback regarding this manual to:
edax.support@ametek.com

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2 SAFETY PRECAUTIONS

Use the following safety guidelines to help ensure personal safety and to help protect the detector system from potential damage.

2.1 HIGH VOLTAGES

Exercise extreme caution where this label is found. High Voltage is present and can cause burn, shock and/or cause serious injury.

There is circuitry in the detecting unit that generates high voltage (200 VDC) required to bias the detector. Terminals carrying these voltages may be exposed when covers or panels are removed.

2.2 ELECTRO STATIC DEVICE (ESD) WARNING

- ☐ Use ESD handling precautions when handling the electronics. Static voltages as low as 60 volts can destroy the state-of-the-art integrated circuits used in the system.
- ☐ Always ground yourself to the equipment chassis before removing or replacing a printed circuit board (PCB).
- ☐ PCB repairs should always be performed on a conductive surface, with the technician grounded (via a conductive wrist strap with a built in current limiting resistor) to this surface.
- ☐ Use an antistatic bag when carrying PC boards.

2.3 NOT HOT SWAPPABLE

The electronics are NOT hot swappable unless otherwise specified. The power to the system must be turned off before inserting or removing any of the modules, boards or any of the interconnecting cables. If this precaution is not taken, component will be damaged nearest to the connecting pins.

2.4 COOLING

Detector cooling

The detecting unit is cooled by the detecting unit body's heat sink fins. No fans are used, just ambient cooling. Be sure the detector body is not blocked or covered. Keep away from heat radiators or other heat sources.

Analyzer cooling

The analyzer is cooled by multiple fans inside the analyzer. Be sure the fan speeds are properly set in the bios, and that the fans are all operational. The components inside the analyzer may fail if used with inadequate air cooling. See Figure 7.

DPP Box cooling

The DPP Box has components which can get very hot. The box should be kept away from any heat sources for adequate operation.

2.5 RADIATION SAFETY

The electron microscope generates ionizing radiation when the electron beam is energized. The detector is designed to have radiation leakage far less than the allowable level when properly mounted with all covers and shielding in place.

EDAX warrants that its detectors and microscope interfaces when assembled and installed per EDAX Engineers or Representatives, will provide Radiation Safety performance levels that will be in compliance with the original Microscope design specifications.

Removal of any of the system's covers must be done by qualified EDAX Factory trained service engineers or representatives. Opening covers or bypassing interlocks may expose users to radiation.

If the EDAX detector is removed from the microscope, it should be replaced by the original blanking port cover provided by the microscope vendor.

Modification of covers or shielding or use of any other material than provided by EDAX or the microscope vendor must be reviewed by a certified radiation expert and EDAX Inc. before use.

Caution: The radiation levels should be checked around the instrument after any service in which covers or any radiation containment parts were removed.

2.6 EXTENDING DETECTOR WINDOW LIFE

Introduction

The detector is sealed with a very thin window to permit light element x-rays to easily pass through it. When the window is damaged, this contaminates the atmosphere surrounding the X-ray detector which in turn can degrade detector performance or cause detector failure. Damage to the window can be caused by physical contact, excess vibration, exceeding pressure or temperature specifications, vapor condensation, electrical discharge to the detector or other factors.

2.6.1 DO NOT ALLOW THE DETECTOR TO COME INTO CLOSE PROXIMITY OR CONTACT WITH HIGH VOLTAGE COMPONENTS

Do not allow the detector to come into close proximity or contact with high voltage components inside the electron microscope, e.g. the extraction grid of a video detector. This can lead to an unsafe electrical discharge to the detector which may damage the window.

2.6.2 PREVENT PARTICLE CONTAMINATION INSIDE THE SAMPLE CHAMBER

Particulates inside the sample chamber have a tendency to become entrained in the gas flow while venting the sample chamber. The gas flow during a chamber vent or increase in chamber pressure is generally turbulent meaning that entrained particles can fly in all directions, including toward the detector window. Particulates which impact the window can cause micro cracks compromising the vacuum seal of the window. In more extreme situations, particles can fully penetrate the window causing what is known as a "bullet hole", which causes a larger leak in the detector. It is also possible to dislodge particles from the sample via the electron beam. If these particles are charged, they may be accelerated toward the detector, which is at ground potential.

Recommendations:

- ☐ Always use particle free gloves when loading samples or working in the sample chamber.
- ☐ Be certain that there are no loose particles on the sample before placing the sample in the chamber. Sample surfaces, fractures and powdered samples stuck to an adhesive should be cleaned with compressed air to ensure the surfaces are clean and free of loose particles.
- ☐ Avoid venting the sample chamber too quickly. Specifically, do not exceed **10 cm/s gas velocity** into the chamber, as this can increase the risk of particle-induced detector window damage. This may require a small aperture in the vent port or decrease in supply pressure if N2 purge is used to reduce the gas velocity.
- ☐ If there is a high risk of particulates becoming dislodged during some operation in the microscope, fully retract the detector to minimize the risk of damaging the detector window.

2.6.3 PROPER CARE WHEN USING A COMPRESSED GAS TO VENT THE SAMPLE CHAMBER

Ensure that the gas pressure does not exceed 2 atm.

Recommendations:

- ☐ Release any latching mechanism that is designed to keep the chamber door closed.
- ☐ Make certain that the chamber door will open normally when the chamber reaches atmospheric pressure.
- ☐ Avoid venting the chamber too quickly as this can cause unsafe pressure-induced vibrations on the window. See recommendations in section **2.6.2** above.

2.6.4 AVOID HITTING THE DETECTOR OR INDUCING MECHANICAL VIBRATIONS IN THE DETECTOR OR WINDOW

The detector window can be ruptured by excessive physical vibration or shock.

Recommendations:

- ☐ Be careful not to run samples into the EDS detector.
- ☐ Close the sample chamber door gently.
- ☐ Do not pull the sample chamber door open while venting the sample chamber. This may lead to unsafe pressure fluctuations inside the sample chamber which could damage the detector window.

2.6.5 AVOID TOUCHING THE WINDOW

Recommendations:

- ☐ Exercise extreme caution when working near the detector window. The collimator provides a physical barrier to protect the window. Do not work with tools near the window.
- ☐ If it is necessary to remove the collimator, the collimator should be removed and installed by a trained technician so as not to touch the window or stress the end cap tip.
- ☐ Do not direct pressurized gas or liquid streams at the detector window, for example in an attempt to clean the window.
- ☐ If necessary to clean the microscope chamber, retract or remove the detector using extreme caution not to bump the detector tip or collimator.

2.6.6 LEAVE THE SEM IN HIGH VACUUM MODE

When not in use, If possible, leave the SEM in High Vacuum mode instead of in low vacuum or wet mode.

2.6.7 DO NOT EXPOSE THE DETECTOR TO EXTREME TEMPERATURES

Be mindful of conditions which may cause vapor condensation on the window or may cause the temperature at the window to exceed manufacturer's specifications. This may occur during a microscope chamber bake or operation of a heat stage.

Recommendations:

- ☐ If there is a possibility that the sample may emit vapors while in the sample chamber, especially vapors acidic or alkaline in nature, fully retract the EDS detector to minimize the risk of condensation on the detector window.
- ☐ Take care when using a heating stage to follow manufacturer's guidelines. Prior to using the heat stage, confirm the EDS detector window type and temperature specifications as well as the heat load on the EDS window during operation of the heating stage.

2.6.8 DO NOT EXPOSE THE DETECTOR WINDOW TO PLASMA

We recommend you do not expose the detector window to a plasma generated by a plasma cleaner.

3 INSTALLATION AND ENVIRONMENT REQUIREMENTS

3.1 POWER REQUIREMENTS

Component	Rating
Workstation Power	550 watts (maximum); 100-240 Volts
Monitor	55 watts (typical) ; 100-240 Volts
Detector	20 watts (max) (< 10 w typ.) ; 100-240 Volts

Table 1 - Power requirements

3.2 SPACE AND WEIGHT SPECIFICATIONS

Workstation dimensions:	17.7 x 6.7 x 18.0 in (44.9 x 17.0 x 45.7 cm)
Workstation weight:	33.0 lb. (14.97 kg)
Detector Body dimensions	1.75 (W) x 4.0 (H) x 3.25 in (L) (45 x 105 x 82 mm)
Detector Weight	5 lb. (2.2 kg)

3.3 ENVIRONMENT REQUIREMENTS

Parameters	Operating Conditions
Temperature	0°C to 35°C
Humidity	0% to 85% RH, non-condensing
Barometric Pressure	525 to 800 mm of Hg
Air Velocity	0 to 0.5 m/sec

Table 2 - Environment requirements / Operating conditions

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4 BASIC DETECTOR OPERATION

4.1 STARTUP

A minimum EDS configuration consists of a PC Workstation with an Ethernet and USB connection for the detector and DPP Box, with its external power supply.

Start up the system as follows:

1. Power on the PC Workstation. The default Windows Login from the EDAX Factory is:**Administrator**, password: **apollo**.
2. Power on the detector using the switch on the small DPP Box.

Windows Login:
📖 User: **Administrator**
📖 Password: **apollo**

Then launch the Element software. By default, there is an Administrator login set up for Element software.

Element Login:
📖 User: **Administrator**
📖 Password: **apollo**

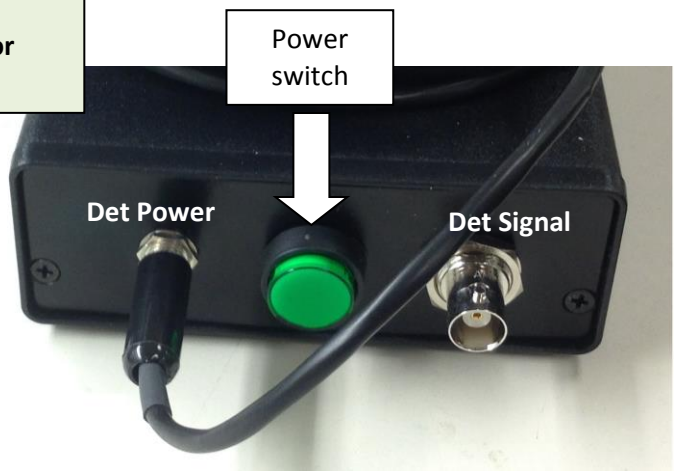


Figure 1 – DPP Box

4.1.1 DPP BOX STARTUP

Check that the light on the pushbutton lights up when powered on. If the light does not come on, check that the power supply is plugged into an AC outlet. There is a Green LED that will flash at the Ethernet connection on the DPP box when it is connected to the Network board in the PC after the PC has started

The detector communication is normally established within a couple of minutes after the PC has started. There is a **Green** LED that will flash at the Ethernet connection on the DPP Box when connected to the Network board in the PC. This should be flashing rapidly (i.e. 10 flashes) /sec and continuously.

The Element software needs the **TeamKey.edx** license key file in the root of the C:\ drive in order to run.

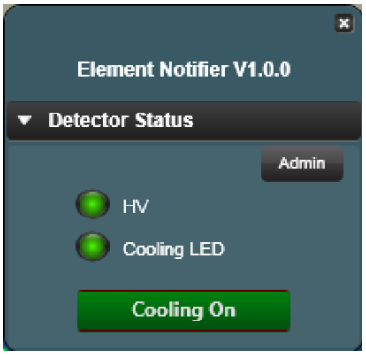
4.2 DETECTOR COOLING

By default, detector cooling is "**Off**" until it is started by the user. When the cooling is started, in the Element software, the detector should cool down in about 2 minutes.

4.2.1 ELEMENT NOTIFIER DETECTOR STATUS.

When TEAM Element starts, it will automatically start the **Element Notifier cooling utility in the system tray** as seen below. Left click on the Red dot/Green dot to control the detector cooling. The dot changes color when cold vs warm. Click on the **Cooling On** button to start cooling.

☐ The following window will be displayed:



There are 3 cooling states for the detector. Cooling LED:
Red – Warm, no cooling applied.
Yellow – Cooling is in progress, the detector should reach the proper operating temperature in a minute or two.
Green – Cooling has reached the recommended value, the detector is ready to collect spectral data.

Figure 2 - Element Notifier in the System Tray to turn Detector Cooling On

Cooling Button	Status	Action
Cooling On [Green]	**Detector is cold**	Clicking on this **Cooling On** button will turn off the cooling and the button changes to **Cooling Off**.
Cooling Off [Red]	**Detector is warm**	Clicking on this **Cooling Off** Red button will stay Red until both the HV and Cooling LED become steady Green. Then the button will change to **Cooling On** and turn Green.

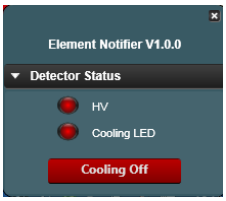


Figure 3 - Element Notifier showing cooling off

4.2.2 TURN DETECTOR COOLING ON

Click on the **Cooling On** button in the Element Notifier to start or to stop detector cooling. The button will change states when it is clicked on. (Cooling control is done through the USB connection.)

4.3 ADDING TO COMPANY NETWORK

⚠ Care must be taken if the EDAX computer is added to a company network, the detector and its Network Interface Card (NIC) IP information are NOT CHANGED. Changing any of the detector networking configuration may cause the system to stop functioning.

EDAX service engineers will require Administrator login privileges to service the system.

4.4 LIGHT ELEMENT OPERATION

1. Check that the geometry is correct when collecting spectra. For example, an incorrect tilt used, giving an incorrect Take Off Angle, will affect the Quant results. You can also correct this after the data has been collected by editing the spectra file parameters.
2. Check that you are using a well-defined peak when quantifying. Avoid using peaks that are "buried" in the background.
3. Use one of the longer amp times when specifically looking for light energy elements. They typically provide better light element performance.
4. Use low accelerating voltage when specifically looking for light energy elements.
3. Make sure the samples are flat and homogeneous when possible.
4. Collect for sufficient time to improve the statics when the peaks are very small, for example when looking at Boron.

4.5 FREQUENTLY ASKED QUESTIONS (FAQ)

Q1. Should I leave the detector powered on all of the time?

A1. In most laboratory conditions (stable power, temperature controlled), leaving the detector powered on all of the time is fine.

Q2. Should I leave the detector cold all of the time?

A2. The detector will reach operating temperature in about two minutes, so it does not need to be left cooled when not in use. It is okay to leave the detector cold when the microscope chamber is left under vacuum. There is a user preference option to automatically turn the cooling off after inactivity, in case the user prefers to turn the cooling off automatically.

Q3. The software displays a message that the detector temperature is not changing, or a communication problem with the detector. What should I do?

A3. In this case, **power off the detector** using the switch on the small black power "brick" for the detector **then reboot the PC.** Then **power the detector back on** after Windows has started.

Q4. How often should I calibrate?

A4. Many labs only calibrate their systems during a regularly scheduled service preventative maintenance visit. The detector will need to be calibrated in some cases when then spectrum peaks do not match the blue line modeled peaks. For this case, a calibration will bring the peaks into alignment with the modeled line. In other cases, labs may want to set a regular calibration schedule any time from weekly to monthly.

Q5. What count rate should I use to calibrate?

A5. We recommend using a copper and aluminum sample with a primary beam at ≥ 20 kV. Adjust the sample position so both Copper and Aluminum can be seen on the same screen. Set the position so the Copper and Aluminum Kα peaks are similar in height, but with the Al peak larger than the CuK peak by 20 to 50%. Set the beam conditions so the Dead Time is ≤ 40% as you should use during normal use.

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5 BASIC SYSTEM CABLING

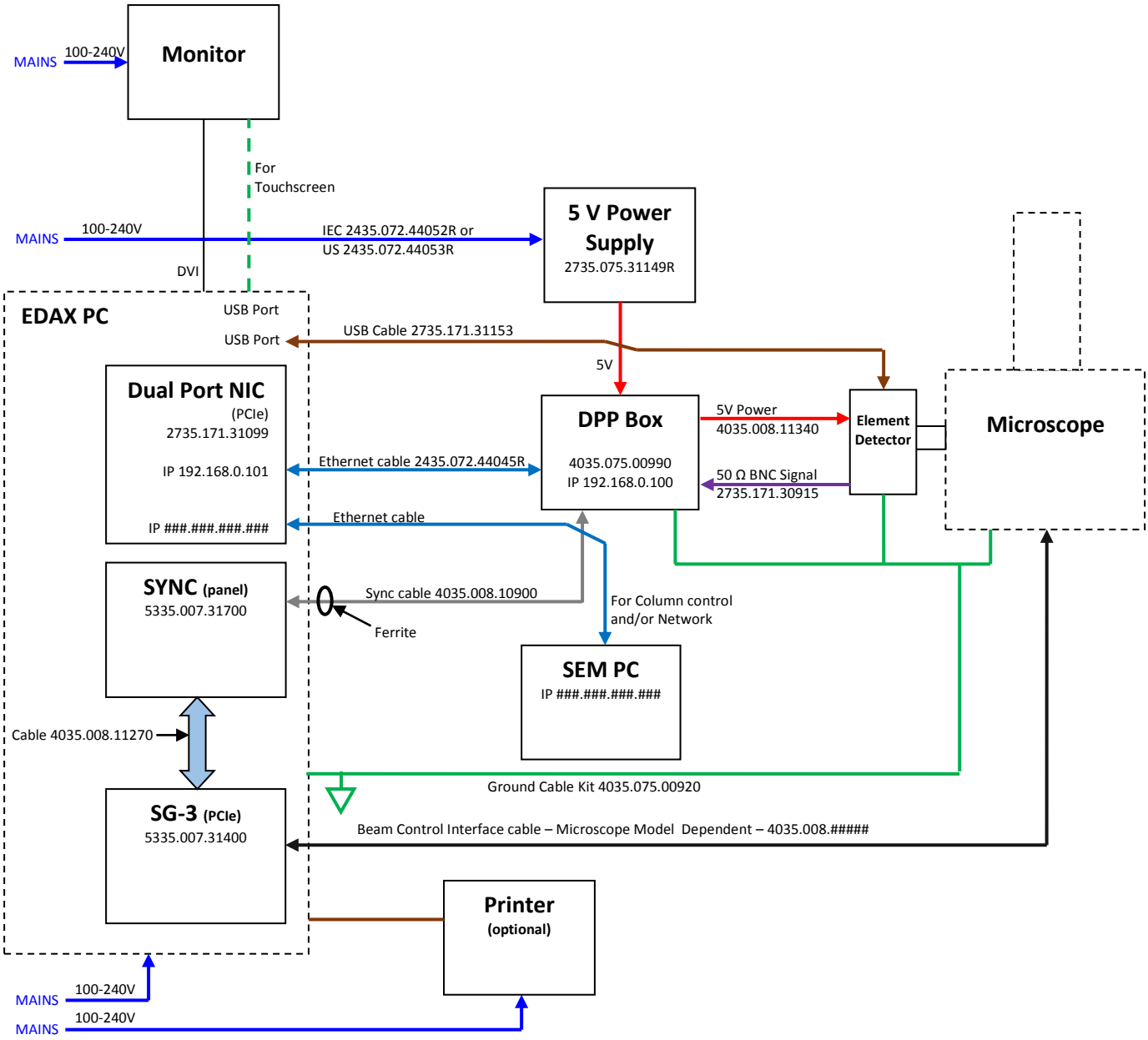

Figure 4 - Typical System Connections

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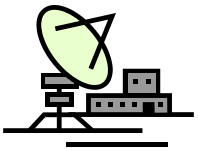
6 TROUBLESHOOTING

6.1 REMOTE DIAGNOSTICS



When possible, it may be useful to use a remote access program such as Teamviewer to diagnose the system before an on-site visit. Remote access will allow an EDAX engineer to examine log files, diagnose system operation and allow service-level updates and adjustments to the detector. Using clues from remote diagnostics will allow parts to be ordered in advance for an on-site visit if an on-site visit is required.

6.2 DETECTOR PROBLEMS

The detector is connected, and communicates with the software with a network connection. It is possible a spontaneous computer glitch can cause a loss of communication with the detector. A typical Element software login may show a **RED** indicator for the EDS hardware, as shown below, or display a message about DPP service failing to start:

Common fix
Power PC Off
Power Detector OFF
Check cable connections
Power PC Back ON
Power the Detector ON

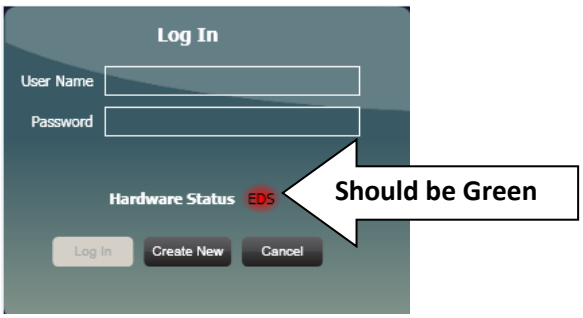


Figure 5 – TEAM Element Login - RED Hardware Status

In this case, **power off the detector** using the switch on the sDPP Box (see page 13) **then reboot the PC.** Then **power the detector back on** when Windows has started.

If the detector shown in the **Advanced Properties** is not an Element detector, it could also be an indication of loss of communication with the detector.

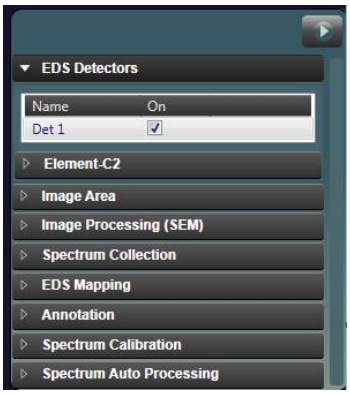


Figure 6 – Element Detector in Softwre

- ✓ Power off the detector using the switch on the DPP Box for the detector.
- ✓ Reboot the PC.
- ✓ Then turn the DPP Box power back on.

6.3 BOARDS INSIDE THE PC

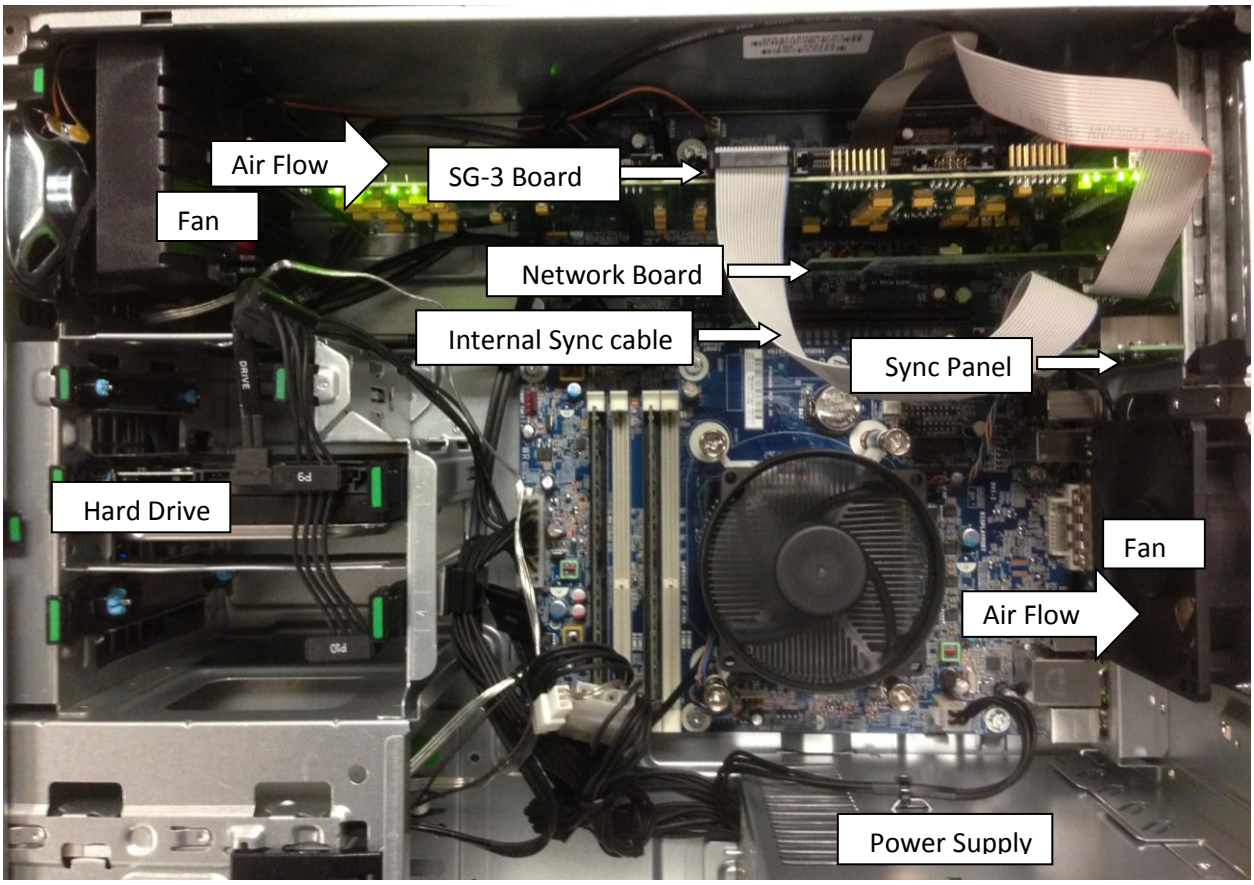


Figure 7 - Boards inside the analyzer (HP Z230)