

Apollo XF/XLT/Octane

Basic User

Guide



Rev. 1.5
June 24, 2016

The **Apollo XF**, **Apollo XLT** and **Octane** detectors are manufactured by:
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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 TEAM or Genesis 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

1.1 DETECTOR TYPES

The detectors listed in the table below are covered by this basic user guide. Note that a “W” in the detector part number on the label, indicates the detector is a **Window-less** detector.

Name	Description
Octane Pro	10 mm ² SUTW for SEM
Octane Plus	30 mm ² SUTW for SEM
Octane Super	60 mm ² SUTW for SEM
Octane Ultra	100 mm ² SUTW for SEM
Apollo XF	60 mm ² SUTW for SEM
Octane Prime ¹	10 mm ² SUTW for SEM
Apollo XLT	30 mm ² SUTW for TEM
Apollo XLT2	30 mm ² SUTW for TEM
Apollo XLT W	30 mm ² Windowless for TEM
Apollo XLT Light Shield	30 mm ² Windowless w/Light shield for TEM
Apollo XLT2 W	30 mm ² Windowless for TEM
Apollo XLT2 Light Shield	30 mm ² Windowless w/Light shield for TEM
Octane T Ultra W	100 mm ² Windowless for TEM (Racetrack)
Octane T Optima - 30	30 mm ² Windowless for TEM
Octane T Optima - 60	60 mm ² Windowless for TEM
Octane T Plus	30 mm ² SUTW for TEM

Table 1 - Detector models

¹ See Technical specifications for differences from Octane Pro and limitations

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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 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.

2.3 COOLING



The detecting unit is cooled by the detecting unit body's heat sink fins. No fans are used, just ambient cooling via the heat sinks. Be sure these heat sinks are not blocked or covered. Keep away from heat radiators or other heat sources. The detectors may fail if used in an enclosure with inadequate air cooling.

2.4 MOTORIZED SLIDE




Warning! Pinch Hazard!

Fingers may be squeezed when operating the detector optional motorized slide.

- Do not place fingers or hands near the detector when operating the motorized slide.


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

Super Ultra-Thin Windows (SUTW) for EDS detectors were introduced to the EDS market several years ago to improve the transmission of low energy X-rays (e.g. B, C, N, O) through the window. The SUTW is constructed of a 300 nm thick polymer foil with an additional 40 nm of coatings to reduce visible light transmission and permeability. The polymer window is stretched over a silicon grid which provides support over larger areas. The goal of the window is to allow signal X-rays to pass through to the detector component while providing a hermetic seal on the atmosphere surrounding the detection element. While the SUTW serves its intended purpose very well, it can be damaged if care is not taken by users of the EDS system into which the window is installed.

Recall that the overall window thickness is approximately 340 nm, which is 150 times thinner than the average human hair. When the window is damaged, this contaminates the atmosphere surrounding the X-ray detector which in turn can degrade detector performance or cause failure. Damage to the SUTW 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 SUTW

The SUTW 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 SUTW. The collimator provides a physical barrier to protect the SUTW. Do not work with tools near the SUTW.
- 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 SUTW, for example in an attempt to clean the SUTW.
- 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 WHEN NOT IN USE LEAVE THE SEM IN HIGH VACUUM MODE

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.
- The maximum temperature specification on Moxtek AP3 windows is not to exceed 40°C with 1 atm differential or 70°C with zero pressure differential on the window.

2.6.8 DO NOT EXPOSE THE SUTW TO PLASMA

The window manufacturer of the SUTW does not recommend exposing the window to a plasma generated by a plasma cleaner.

2.6.9 WINDOWLESS DETECTORS



Care should be taken to allow the detector to warm before venting the microscope to air. Failure to do so may damage the detector module.

3 INSTALLATION AND ENVIRONMENT REQUIREMENTS

Keywords: Room requirements, power needed, electrical requirements

3.1 POWER REQUIREMENTS

Component	XM2 Configuration
Workstation Power	400 watts (maximum); 100-240 Volts, 50/60 Hz, 3.5 to 7.0 Amps
Monitor	25 watts (typical) ; 100-240 Volts, 50/60 Hz
Detector	75 watts; 100-240 Volts, 47-63 Hz, 0.5 to 1.25 Amps

Table 2 - Power requirements

3.2 SPACE AND WEIGHT SPECIFICATIONS

Workstation dimensions: 17.5 (H) x 7.75 (W) x 19.5 in (44 x 20 x 49.5 cm)
 Workstation weight: 33.0 lb. (14.97 kg)

Detector Body dimensions 4.375 (W) x 4.375 (H) x 6.75 in (L) (110 x 110 x 165 mm)
 Detector Weight 8 lb. (3.63 kg)

3.3 ENVIRONMENT REQUIREMENTS

Parameters	Operating Conditions
Temperature	+5°C to +30°C
Humidity	0% to 85% RH, non-condensing
Barometric Pressure	525 to 800mm of Hg
Air Velocity	0 to 0.5m/sec

Table 3 - 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 a Ethernet connection for the detector, and the Detector, 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:
2. Power on the detector using the switch on the small “brick” style power supply. [Figure 1](#)

Windows Login:

-  User: **Administrator**
-  Password: **apollo**

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 detector when connected to the Network board in the PC. This should be flashing rapidly (i.e. 10 flashes) /sec and continuously.

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

TEAM Login:



-  User: **Administrator**
-  Password: **apollo**



Figure 1 - Detector Power Supply

4.2 DETECTOR COOLING

By default, detector cooling is “Off” until it is started by the user. When the cooling is started, either in Genesis or in TEAM, the detector should cool down in about 2 minutes. See the status lights on Page [14](#) or software indicators on Page [15](#), to see the status of the cooling, and when the detector is ready to use. Spectra can be collected after the detector reaches its operating temperature, but for optimal performance and stable peak positions, it may be best to wait about 60 minutes.

Note that when using the detector, a few microscope conditions may need to be met, and may require the user to manually acknowledging the status is OK. See [Figure 3](#) for Safety Interlocks.

A Windowless detector should only be cooled when the microscope chamber is in high vacuum!

4.2.1 STATUS LEDs

There are two status LEDs located on the back panel of the detector. They function as follows:

Status 1 LED	Indication
RED	Warm
Blinks YELLOW	Cooling
Blinks GREEN	Near Operating Temp
GREEN	At Operating Temp
Blinks RED	Warming

Status 2 LED	Indication
RED	Not ramping
Blinks YELLOW	Cooling
Blinks GREEN	Ramping

Table 4 - Status LEDs definitions

When the detector is first powered ON both Status lights on the detector back panel will light **RED**.

- ⚙ There is a **Yellow** LED that should be lit at the Ethernet connection when powered ON.
- ⚙ There is a **Green** LED that will flash at the Ethernet connection when connected to the Network board in the PC. This should be flashing rapidly (i.e. 10 flashes /sec) and continuously before starting the Genesis or TEAM software.

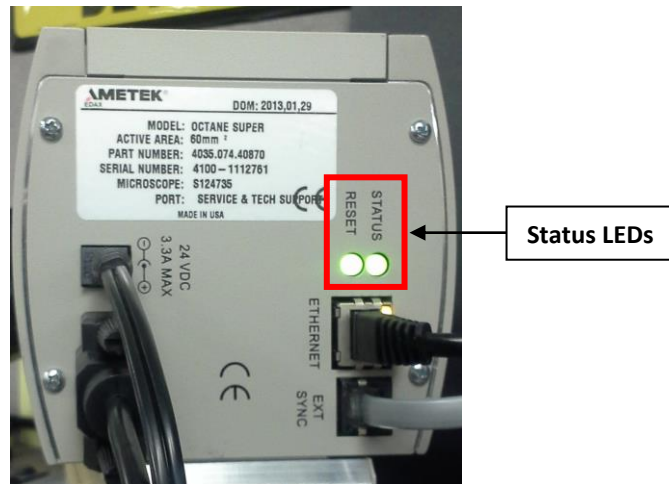


Figure 2 - Detector Status Lights

4.2.2 USING AN OCTANE DETECTOR WITH TEAM SOFTWARE

Check all detector functionality in the TEAM software. See the next section for Genesis software.

Turn the detector cooling on in the **Detector Status** area.

The detectors may be hardware or software interlocked with the microscope. Some or all may simply be software buttons that the user must acknowledge that it is ok to cool the detector. **Toggle each button** so each **Safety Interlock is Green**.

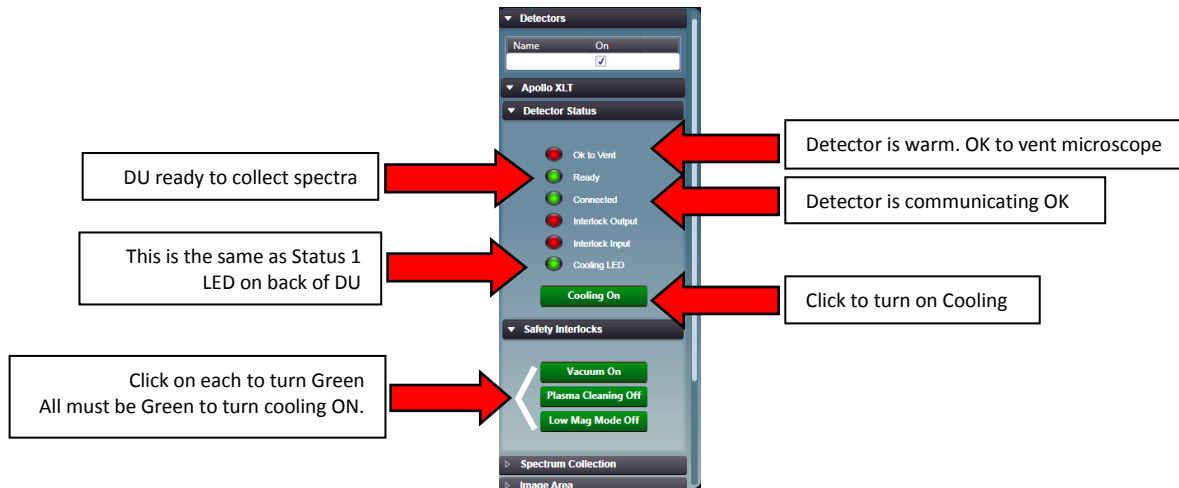



Figure 3 - Detector control and detector status in TEAM

 **Care should be taken to warm a Windowless detector before venting the microscope to air. Failure to do so may damage the detector module!**

Status Indicator	Green	Red
OK to Vent	DU is warm. OK to vent microscope	DU is cold. Not OK to vent microscope for Windowless DU
Ready	DU is cold. OK to collect spectra.	DU is not ready to collect spectra
Connected	Communication with DU is OK	No communication with detector
Cooling LED	DU is cold, at Operating Temp	DU is Warm
Cooling On	Detector cooling is on	Detector cooling is off

4.2.3 USING AN OCTANE DETECTOR WITH GENESIS SOFTWARE

When a detector is used with the Genesis software, a small icon is placed in the Windows Task Tray that provides control for the detector for cooling and driving the optional motorized slide.

The detectors may be hardware or software interlocked with the microscope. Some or all may simply be software buttons that the user must acknowledge that it is ok to cool the detector. Toggle so each Safety Interlock is Green.

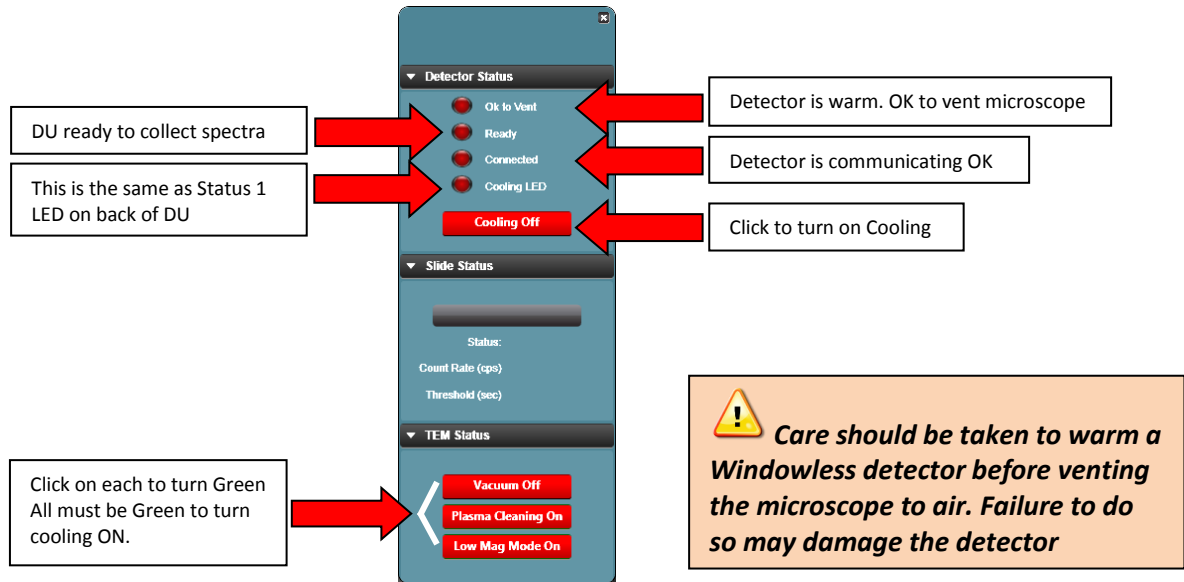


Figure 4 - Detector control and detector status for Genesis

4.3 MOTORIZED DETECTOR

If the detector is configured with a motorized slide, when a user wants to use the detector for analysis, after cooling the detector, there will be a software control to insert the detector into the analyze position. The control is in the TEAM software with the detector cooling controls, or in the Genesis detector controls in the Task Tray.

- ☞ The detector must be moved to the **Analyze** position to collect spectra and maps.
- ☞ The detector should be moved to the **Retract** position when not in use.

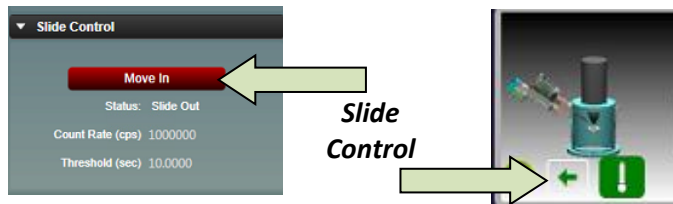


Figure 5 - Motorized Slide Control

There are Slide controls in the **TEAM Environment Panel** as well as in the **Advanced Properties Panel**.

A detector with a motorized slide, will automatically retract from the Analyze position if it detects a high count condition. This high count condition is normally set by the factory or installation service engineer. The purpose is to protect the detector from high energy backscattered electrons in a TEM which can be harmful to the detector. Under those conditions, the detector cooling may also be shut down.

- ☞ Retract the motorized slide detector before shutting down the system

4.4 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.

4.5 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.

4.6 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. Spectra can be collected after the detector reaches its operating temperature, but for optimal performance and stable peak positions, it may be best to wait about 60 minutes. It is okay to leave the detector cold when the microscope chamber is left under vacuum. There is a user preference option in the software 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 $K\alpha$ 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 $\leq 40\%$ as you should use during normal use.

5 BASIC SYSTEM CABLING

5.1 TYPICAL WORKSTATION CONFIGURATION

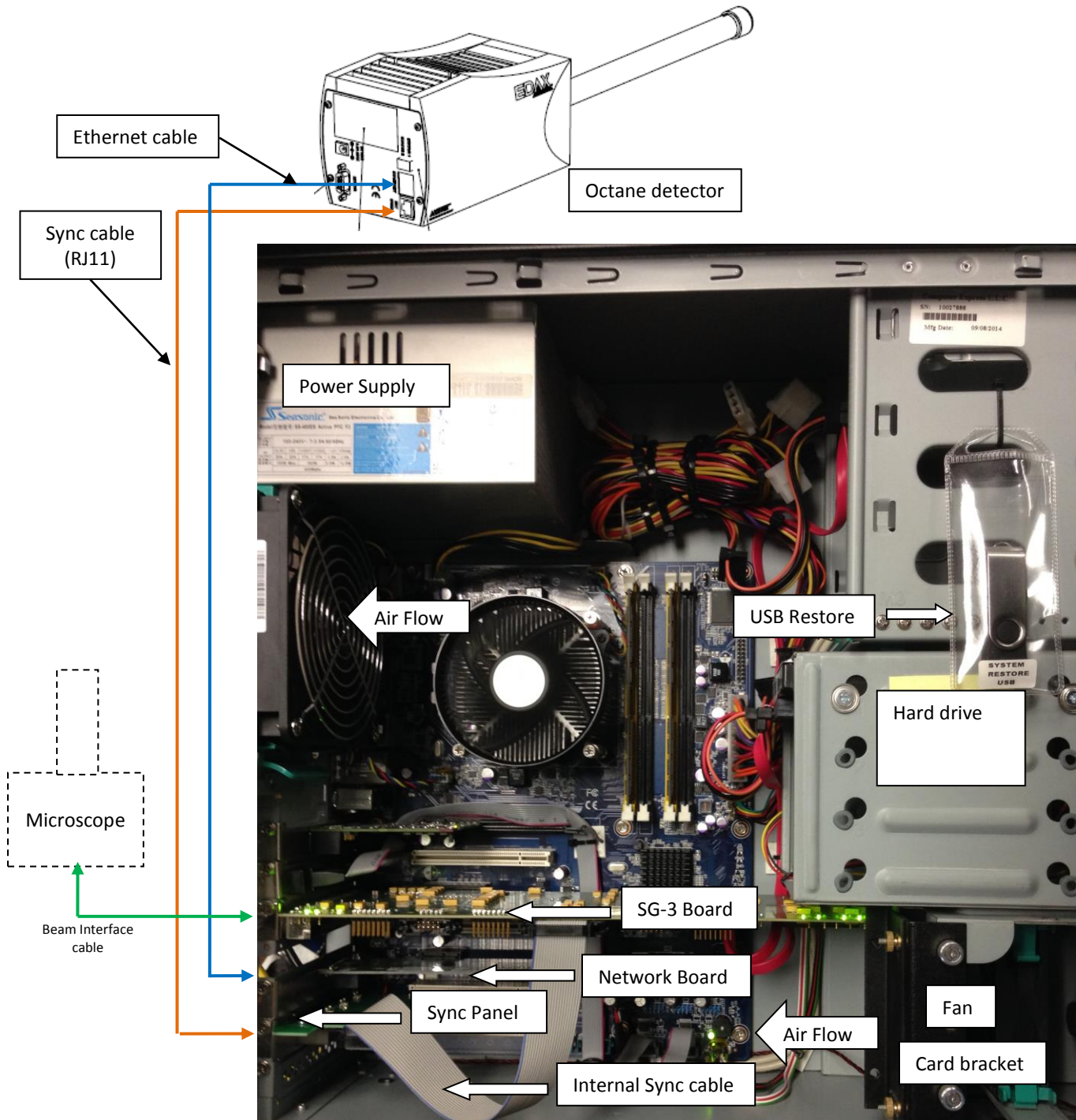


Figure 6 - PC Workstation Connections

5.2 TYPICAL MICROSCOPE SYSTEM CONFIGURATION (SG-2)

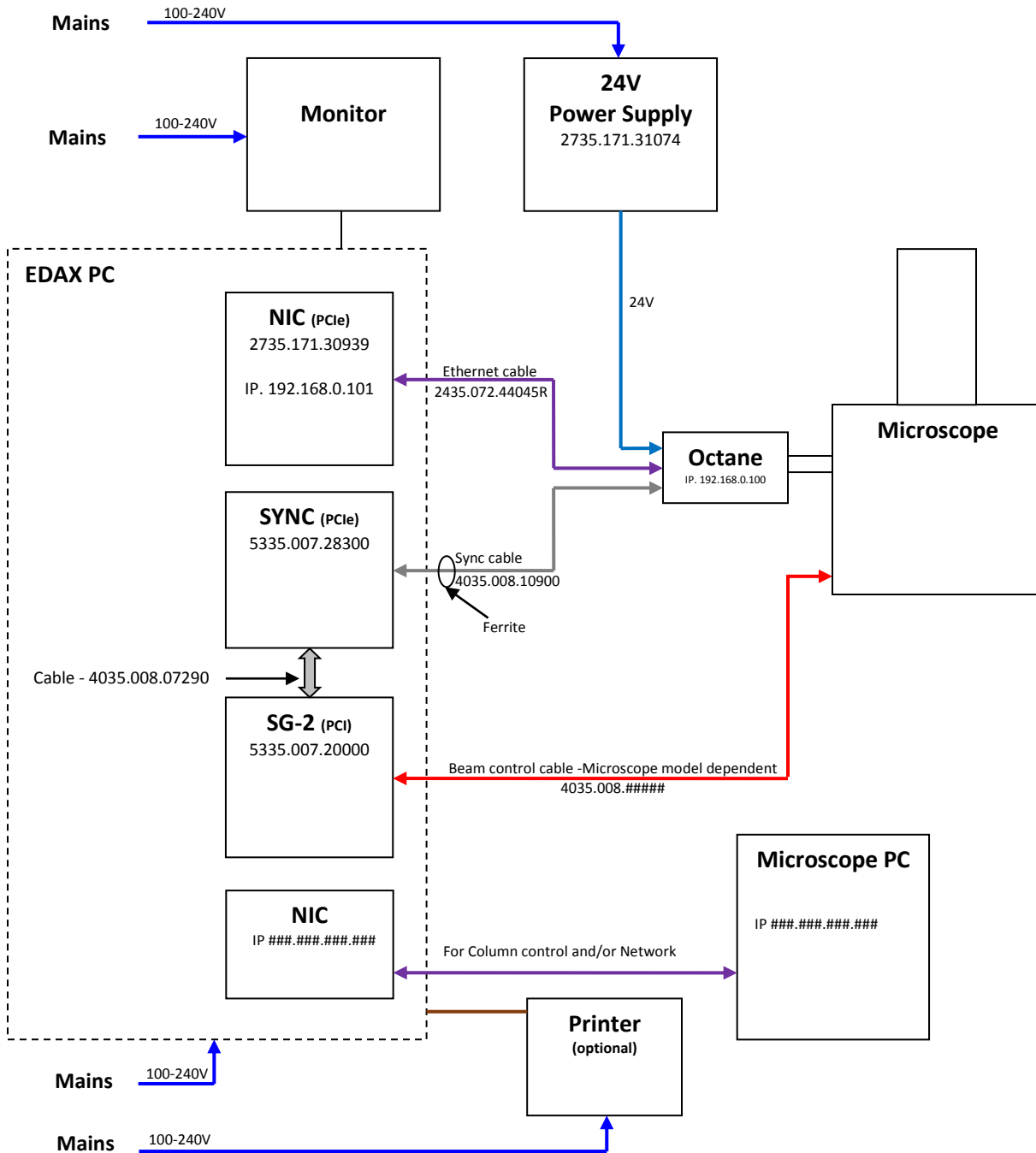


Figure 7 - Typical System Connections (SG-2)

5.3 TYPICAL DUAL DETECTOR MICROSCOPE SYSTEM CONFIGURATION

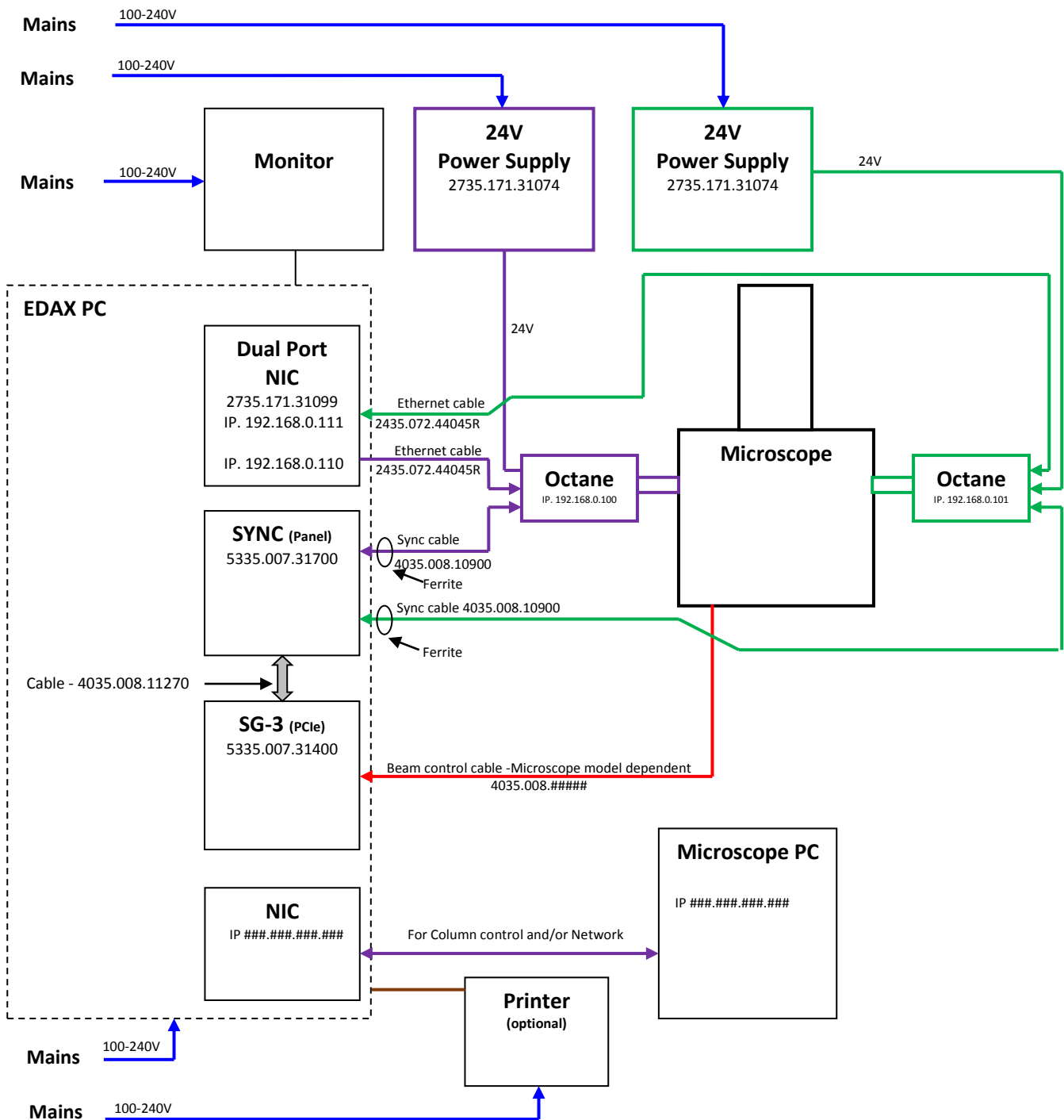


Figure 8 – Typical Dual Detector Microscope system configuration

5.4 TYPICAL MICROSCOPE SYSTEM INTERCONNECT (SG-3)

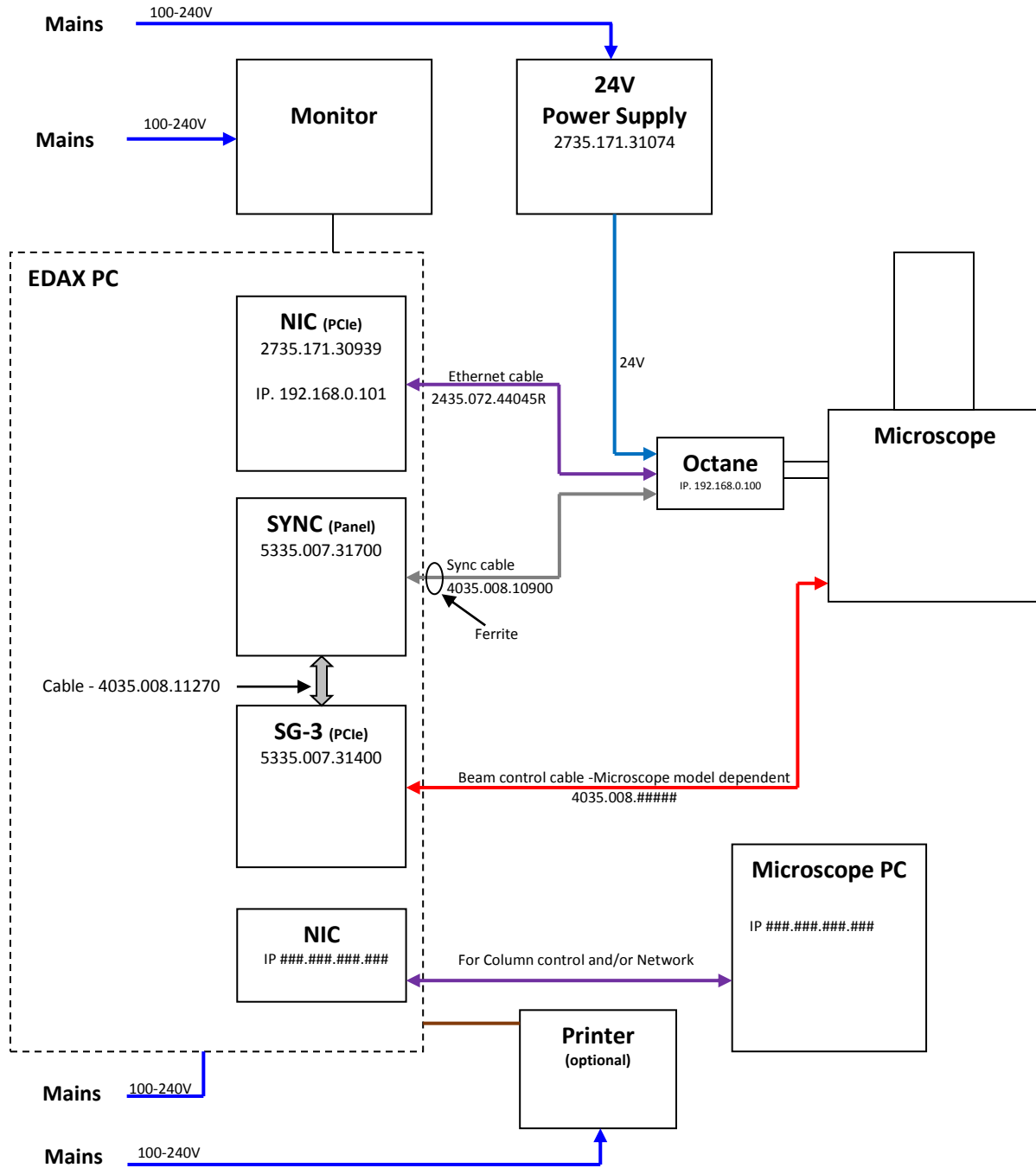


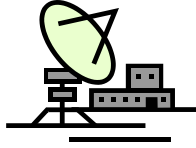
Figure 9 - Typical System Connections (SG-3)

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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 TEAM 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

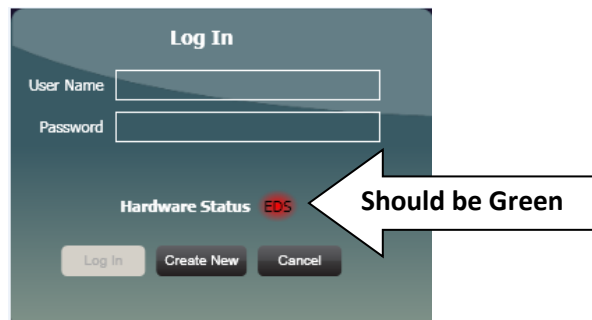


Figure 10 - TEAM Login - RED Hardware Status

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** when Windows has started.

If the detector shown in the **Advanced Properties** is not an Apollo XF, Apollo XLT or Octane detector, it could also be an indication of loss of communication with the detector, as shown in the example below.

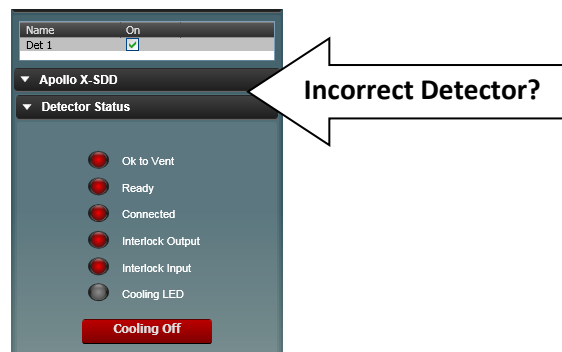


Figure 11 - Wrong detector displayed in TEAM

- ✓ Power off the detector using the switch on the small black power “brick” for the detector.
- ✓ Reboot the PC.
- ✓ At the Windows login screen, turn the detector power back on.
- ✓ Login to Windows.
- ✓ Check the LED status for the Ethernet connection as per page [14](#).
- ✓ Wait 1-2 minutes
- ✓ Launch TEAM or Genesis software