




OPIS 35™ Configuration for ATEX Zone 0

The OPIS 35™ laser accessory is a companion to the HyperFlux™ PRO Plus (HFPP) Raman Spectrometer. The combination of both devices allows Raman analysis to be performed safely in an explosive atmosphere. The OPIS 35™ was designed pursuant to the set of IEC 60079 standards specifying the requirements for construction, testing and marking of equipment capable of putting optical radiation and electricity into a regulated explosive atmosphere. The OPIS 35™ is certified by two regulatory bodies, ATEX and IECEx, which issue the following "marks" for this device:

ATEX  II (1) G [Ex ia op is IIC T4 Ga]
IECEx [Ex ia op is IIC T4 Ga]

The ATEX mark certifies that the OPIS 35™ conforms to Directive 2014/34/EU of the European Parliament and Council of the European Union. Understanding IECEx and ATEX certification can be complicated. Proper application of the OPIS 35™ is better understood by breaking down the certification marks. The internationally recognized IECEx mark is embedded in square brackets. The brackets indicate the OPIS 35™ is designated as "Associated Apparatus." An Associated Apparatus cannot be placed in a regulated environment containing an explosive atmosphere; rather, it must reside in a safe environment. However, the overall mark does mean the device's optical radiation and electrical current outputs can be sent into the regulated atmosphere.

Table 1 below summarizes the key terminology outlined in the IEC 60079-0, 60079-11 and 60079-28 standards. Before using the OPIS 35™, the user should review these standards or consult with a safety expert to ensure the equipment designation satisfies the requirements for the regulated ATEX zone.

Definitions of IECEx and ATEX terminology

Ex	Refers to a potentially explosive atmosphere.
ia	Indicates that the electrical apparatus is "intrinsically safe" and if used correctly cannot be a source of ignition.
op is	Indicates that the optical radiation (laser light) emitted from the device is "inherently safe" in that the device is designated unable to cause an ignition given the temperature and EPL groups as defined as follows:
IIC	Defines an area with an explosive gas atmosphere other than mines susceptible to firedamp.
T4	Is the temperature group of the set of potential flammable gases for which the instrument is not capable of igniting. Gases designated in the T4 group have ignition temperatures of 135°C or higher.
Ga	Refers to Equipment Protective Level (EPL). The OPIS 35 carries a "very high" level of protection, which has sufficient security that it is unlikely to cause ignition in normal operation or during expected malfunctions in the time span between there being an outbreak of gas and the equipment being de-energized. Ga is the most stringent EPL.

TABLE 1: IECEx and ATEX definitions

The ATEX mark recognizes the IECEx certification by simply embedding the IECEx mark. The ATEX mark goes further by restating the type of atmosphere for which the equipment is certified for use. The parentheses in the ATEX mark conveys the same information as the brackets in the IECEx mark.

- II - Equipment group II device suitable for installation on the earth's surface and not susceptible to firedamp
- 1 - The inherently safe optical radiation and intrinsically safe electric circuit located in the non-hazardous area can be connected to Category 1 equipment (ATEX Zone 0 as classified in the European Directive 1999/92/EC) located in the hazardous area
- G - Equipment suitable for gas atmosphere

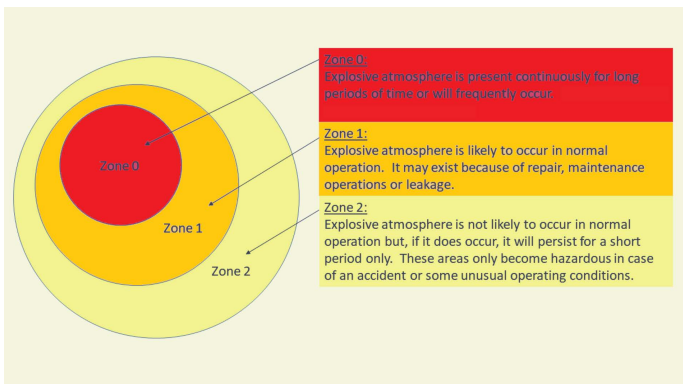


FIGURE 1: The OPIS 35™ is certified for gas group IIC, which corresponds to Zone 0, the most stringent requirement.

With an understanding of the ATEX Zone and the certification mark, Figure 2 illustrates a compliant Raman system configuration. The OPIS 35™ and HFPP must be placed in a safe zone. The Raman probe and sample would be inside the regulated zone, as shown in the diagram below.

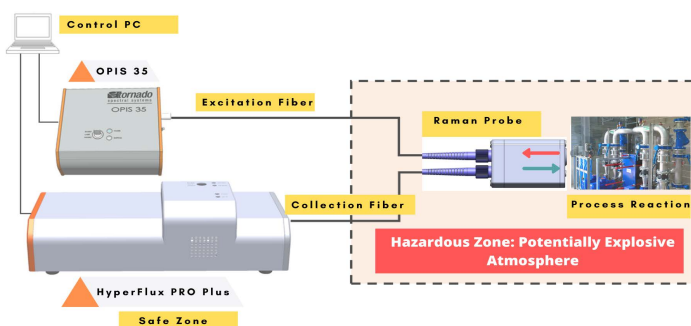


FIGURE 2: Raman probe and sample inside regulated zone

The OPIS 35™ produces and transmits an intrinsically safe level of laser light (optical radiation), so by design, any item connected to the OPIS 35™ maintains compliance with ATEX Zone 0 optical safety without modification. Furthermore, the integrated hardware interlock will trigger the laser shutdown from an event originating in the hazardous zone. In addition, since the OPIS 35™ is ATEX certified for highest risk Zone 0, by extension Zone 1 and Zone 2 are also covered.

All that remains for a fully ATEX-compliant system is to ensure that the Raman probe, optical fibers, and remote stop switch and/or laser emission indicator have documents providing evidence of conformity to the ATEX Zone in which these components are being located. The installation would ensure that the optical fibers and electrical wiring from the safe zone to the ATEX zone are fed via a rated cable gland. The OPIS 35™ installation is made possible by the fact that the laser produces an intrinsically safe level of laser light – if the explosive atmosphere is accidentally exposed to the OPIS radiation, it is incapable of creating an ignition. Since the probe simply transmits the intrinsically safe light from the OPIS 35™, it does not need additional safety controls or complicated sensors to maintain compliance with Zone 0 safety standards. The key point on the probe is that with the <35mW radiation, there is no need to deploy an expensive hermetically sealed, or purged version.

Operating the OPIS 35™ is simple. With proper hardware connections established between the OPIS 35™ and the HFPP main unit, the SpectralSoft™ control software will detect the OPIS 35™ and disable the main unit's internal laser. The user need not worry about radiation emanating from two different sources. For additional laser safety, the OPIS 35™ will not emit radiation unless it is properly connected to the HFPP. The user may also disconnect the OPIS 35™ to regain access to the main unit's internal laser for non-ATEX applications in a laboratory environment or other safe zone.

Finally, the OPIS 35™ is a perfect companion for Tornado's spectrometer. Given the spectrometer's 10x-20x advantage in light collection power, running an OPIS 35™ Raman measurement at <35mW can deliver the same quantitative performance expected from a traditional Raman spectrometer with its laser operating at full power. The synergy of OPIS and HFPP makes possible a cost-effective means to deliver a high-precision Raman on-line process monitor in an ATEX regulated location, delivering **Measurements-You-Can-Trust.**