

White Paper: Hazardous area classification and overview of Arista Industrial computers



Abstract

This technical white paper addresses primary specifications and classification of hazardous area classifications/hazardous locations safety issues, industry regulations and security standards across the globe. This white paper will also give insight on class 1 division 2 and zone system for protection. Particularly for chemical, petrochemical and other similar industries where an explosion protected equipment is a necessity.

With a focus on maintaining a completely safe industrial environment this paper will give provide information on Arista specialized range of non-incendive, corrosion resistant and HMI embedded system with thin clients industrial panel PCs, touch panel PCs, UL class 1 division 2 certified specialized for work in food processing, cold storage, pharmaceuticals and other harsh industrial environment.



Hazardous area classification in a nutshell and overview of Arista Industrial computers

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Introduction

The complexity of today's industrial automation needs, demands a safe and secure working environment. Manufactures and end users require more extensive effort to invest and comply with security regulations to avoid any unexpected fire or explosion hazard. Specifically when it comes to hazardous area classified locations. Electrical equipments in the industrial area are prone to cause explosions under certain atmospheric conditions.

Understanding the tough industrial needs Arista talented team of engineers focuses on the safety essentials and comply with electrical equipment regulations according to hazardous classified locations and different country's standard. Arista works hard over every certifications and testing centre for the design and manufacturing of equipment

What is an explosion?

An Explosion is a sudden expansion involving physical or chemical decay with a rapid increase in pressure, resulting in a heavy blast and shock. In a chemical explosion molecule decomposes into combustible gases produced at a very high temperature. For an explosion to take place three factors which are flammable materials, air (oxygen) and ignition sources has to be present in sufficient quantities in the atmosphere.

There are several ways of protecting electrical equipment hazard, to avoid explosion when used in flammable materials, combustible and fibers.

Refer to figure1 below:

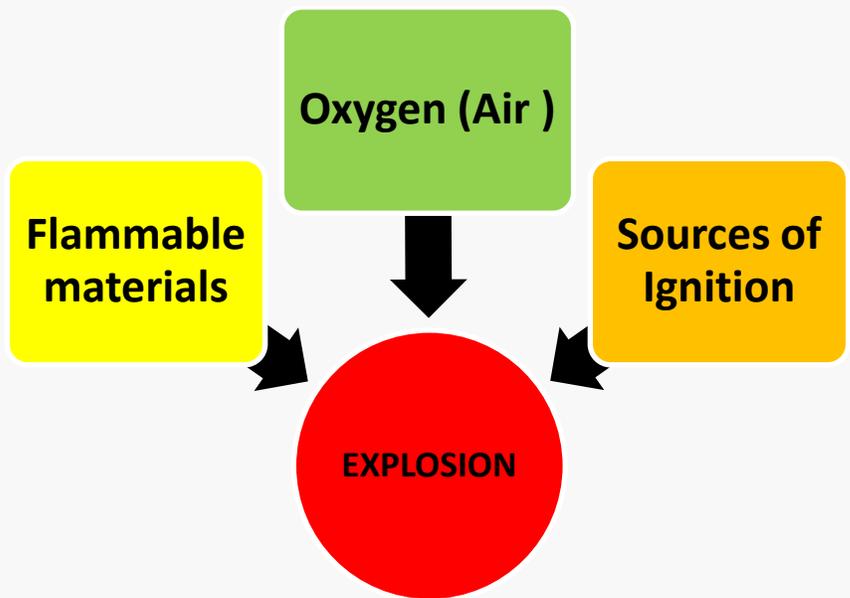


Figure 1

An explosion does not occur only in the presence of flammable materials, there should be sufficient quantity of such materials present for any hazard to occur. However, there are plenty of classifications and requirements that fall under hazardous zone and their level of severity. Country Specific regulating bodies set up standards for safety, explosion protection and level of severity.

Find detailed information below:

Country/Region	Standard & Marking	Description
North America		For North America hazardous locations, equipment certification are performed by nationally recognized laboratories UL, MET, FM and CSA. In addition, the American National Standard Institute coordinates US standard to be used internationally and allow equipment to be used globally.
Europe		This standard is in accordance with EU directives; EN 60079 and 61241 specifically cover explosion protection. The CE along with Ex mark follows indications of the group and category. Also, if Group II equipment relates to the gases (G) or dust (D)
International		This standard addresses “Hazardous Locations”, “Hazardous Area”, and “Explosive Atmosphere”. Places where flammable liquids, vapors, gases or combustible dusts along with sufficient quantities to cause fire or explosion.

Design Regulations for anti-explosion electrical industrial automation equipments.

Regulations are specifically meant for equipment to be used in hazardous locations defined by law. However, these might vary according to the location, country laws and other factors. Equipment not pertaining to regulations can counter delay in their shipping and face legal and liability issues.

Regulations for Class/Division system are formulated by NEC, CEC, OSHA and NFPA (National Fire Protection Association).It is mandatory for every manufacturer to adhere by compliance, these are monitored by UL and other testing groups as mentioned above. After equipment pass test they are provided with a certificate stating; “explosion protection safety conditions are met and they are secured to be used for production”.



**North America Hazardous
classified location, Zone
Classification**

Class I

*Location consisting of flammable
gases or vapors in an amount to
create a hazard.*

Division 2

*Locations with fewer chances of
hazard but can exist with due to
unwanted interference.*



Non-Incendive standard defined for Electrical equipment

International Society of Automation (ISA) and the American National Standard Institute (ANSI) have defined the non-incendive standard for electrical equipments to be used in hazardous locations. These standards provide design, construction and electrical marking requirements to be used in Class I and Class II, and Class III, Division 1 and 2 hazardous locations.

Hazardous zone and their classification

In simple terms, hazardous classified location is any area, building, commercial or industrial premises which are likely to be exposed to fire or explosion due to the presence of flammable gases, vapors, flammable liquids, combustible dusts and other similar things in the very high amount. Hazardous locations can be classified into various categories according to the nature of flammable vapors or liquids. These categories can be defined by classes and classified by NFPA Publication 70, NEC and CEC. Below are the classification of locations and division, which define the type of explosive or ignitable substance present in the atmosphere.

Class Definition: North America Classification System

In the United States and North America, manufacturer's in general follow standards set up by National Electric Code (NEC). Other popular classifications are NFPA publication and CEC. These benchmarks along with NEC specify type of hazardous materials based on class, division and groups.

Class/Division standards are the primary methods catering the design and manufacturing of industrial equipments across North America. The in-depth classification is widespread but it addresses all aspects of explosion protection and safety measures best practices. All these classes are categorized as per different explosives or ignitable substances that are found in the Atmosphere. The intent of this paper is to focus primarily on Class I division 2 locations and its further classification.

Refer to the brief explanation and description below for the North America Classification system.

<i>Class</i>	<i>Area</i>	<i>Division</i>	<i>Group</i>	<i>Temperature Class</i>
<p>Hazardous materials categories are classified by NFPA Publication 70, NEC and CEC. The three classes define the type of explosive or ignitable material present in the atmosphere.</p> <p>Class I: Locations where flammable gases or vapors are found.</p> <p>Class II: Locations where combustible dust, which can be involved in an event of ignition.</p> <p>Class III: Locations with presence of frequent ignitable fibers or flyers.</p>	<p>It defines the possibility of hazardous materials to be present and use of appropriate equipment with safe installation practices.</p>	<p>The classes mentioned are further classified into Division I and Division II.</p> <ul style="list-style-type: none"> • Division 1 Ignitable concentrations of flammable gases or vapors, they might exist because of frequent repair, maintenance, operations or any sort of leakage. Also breakdown and equipment with fault or failure are in this division. • Division 2 Volatile flammable liquids or gases stored in containers or closed system, but are exposed in any sort of accident, breakdown or abnormal operation of equipment. 	<p>Division I and II are further classified into groups of hazardous material with varying gases, vapors or dusts in the air. The groups are defined of flammable materials rating with respect to other materials.</p>	<p>It is the maximum temperature meant for equipment operating on the surface of equipment and should not go beyond the ignition temperature of the nearby atmosphere.</p>

Zone System Classification

As discussed above Class/Division system are specifically used in North America for the purpose of regulating and defining hazardous locations for equipment safe handling and installation. However, outside of North America, the zone system is being used as a primary source equipment in manufacturing and installation. Zone system is quite similar to class/division system; it defines and categorizes hazardous area and potential risk sources.

Refer figure 2 for a detailed classification.

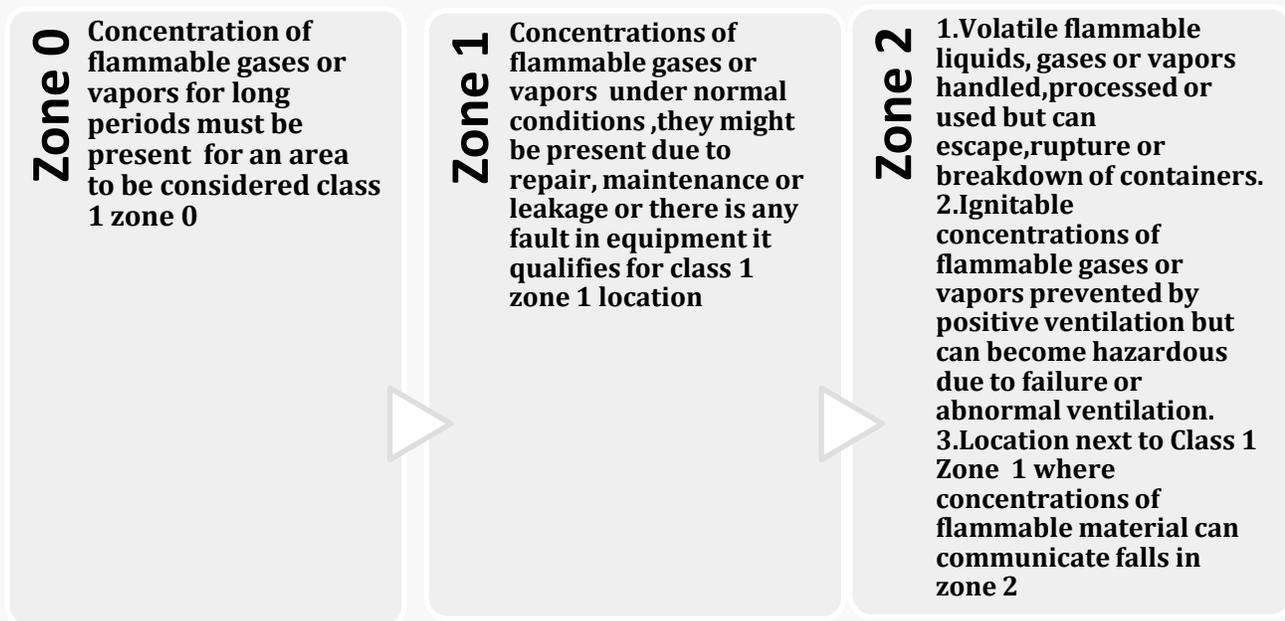


Figure 2

Likewise, there are other zones that cover potential flammable dust hazard, refer to the table below:

Zone 20	Zone 21	Zone 22
Frequent or large presence of flammable dust	Occasional or less presence of flammable dust	Very less chances for presence of flammable dust.

To get a clearer picture, frequency of occurrence of an event determines the hazard level of that location. Hence, the more flammable materials are present in atmosphere the more are chances for an explosion to occur.

Refer to the table below:

Frequency	Zone
Constant, rare or occasionally	Zone 0 and 1
Irregular condition	Zone 2

In addition, it is important to understand how the flammable substances/materials are categorized and how to get a better understanding of each of them.

Refer to figure 3 below:

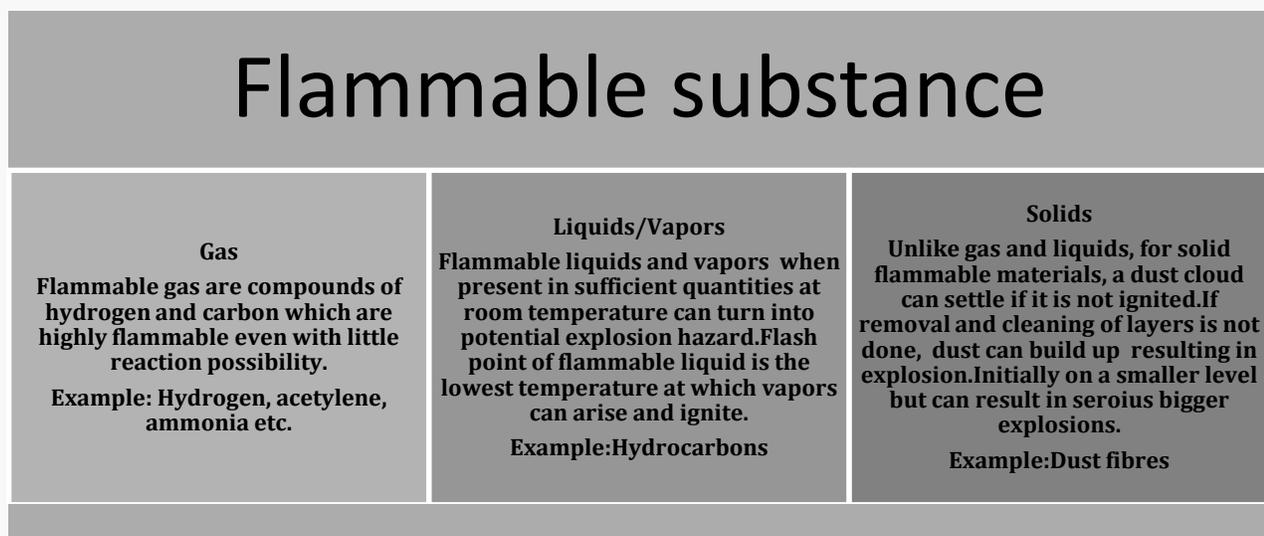


Figure 3

Note: Ignition or explosion can only occur when flammable gas, liquid or solid material have their lower and upper flammability limits. Hence, not necessarily the presence of flammable material will result in a fire hazard.

Temperature Class definition and explanation:

Equipment used in hazardous area is assigned to a temperature class which defines maximum surface temperature the device can go. This temperature should not exceed the ignition temperature of the atmosphere. With minimum presence of ignition temperature, during the normal atmospheric pressure without spark or flame is able to set fire or a combustion or independent heating of the element. The dedicated rating for a temperature class also helps in preventing combustion that is dependent on the combustion point of the material present in that area.

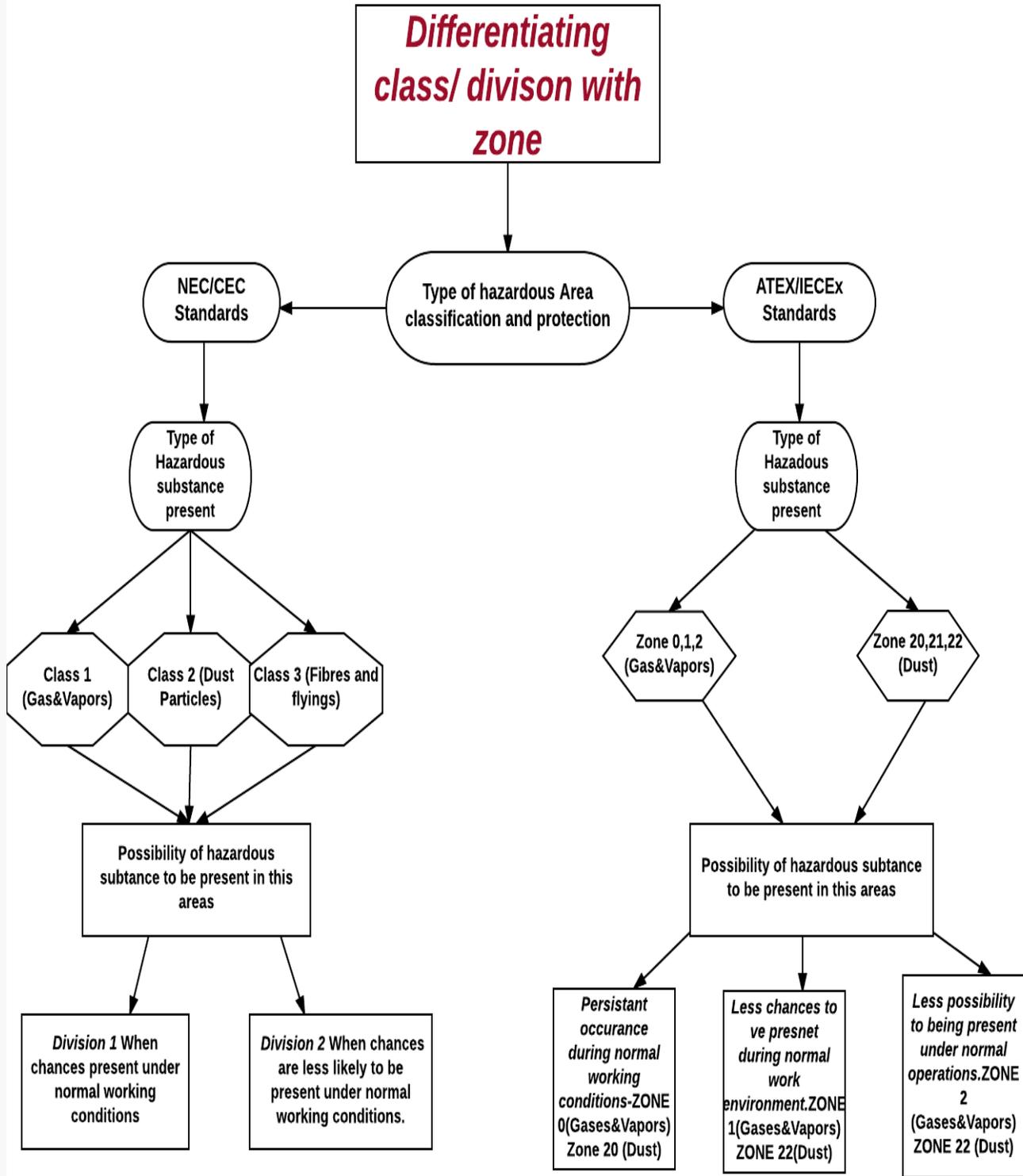
Temperature classification are given to hazardous areas and temperature class ratings are applied to instruments. Values for the *temperature classification* ranges from T1 to T6, where T1 implies a minimum ignition temperature (>450° C [842° F]) and T6 has a minimum ignition temperature >85° C [185° F].

Temperature class rating, this relates to the maximum temperature instrument is supposed to produce typically at a 40°C environmental temperature. However, this might vary in reference to other ratings. T1 thru T6 are used in temperature class ratings, where T1 is maximum temperature generated by instrument at 40° C is 450° C and T6 is the maximum generated by the instrument is 85° C.

Refer to table below for a detailed view:

Temperature classification/Rating	Min Ignition Temperature/Area	Max instrument temperature/Equipment
T1	>450 °C, 842 °F	450 °C, 842 °F
T2	>300 °C, 572 °F	300 °C, 572 °F
T3	>200°C, 392 °F	200°C, 392 °F
T4	>135 °C, 275 °F	135 °C, 275 °F
T5	>100 °C, 212 °F	100 °C, 212 °F
T6	>85 °C, 185 °F	85 °C, 185 °F

Differentiating Class/Division system with their Zone system



Sources of Ignition

It is also important to know what sources can initiate a hazard, below is the list. Table A provide a general source of ignition while table B shows ignition sources from industrial electrical equipments.

Table A

Sources	Example
Open flame Electric powered devices	Match, lighter, cigarette or similar products. Heater, electric blanket or any other similar equipment.
Fuel-gas equipments	Gas fire, heating device etc
Hot objects	Spark, hot pipes etc
Chemical Reaction	Very rare
Exposure to heat from external source like a fire nearby.	
Unknown or spontaneous heating	Usually happens due to leakage, oil soaked rugs etc.
Radio Frequency (range 1&2)	
Ultrasonic	
Lightening	

Table B

Sources	Example
Electrical Spark	Takes place when circuits are broken,or there is often breakage in the circuits.
Hot surface	Hot surface ignition takes place due to the heat provided by coils,lamps,resistors or hot bearings.Hence,resulting is sudden fire.
Friction	Usually happens due to a strike between case or enclosure.

Installing and operating equipments in hazardous locations

The mission of every manufacturer,industry owner, and installer is to adhere to the regulations and standards for maximum security in their facility. Specifically for hazardous locations following safety guidelines is a must, it helps in avoiding any kind of danger and potential hazard instances.

Refer to the figure 4 below:



Figure 4

Protection techniques:Hazardous Area

Hazardous area can be defined as any industrial space with presence of three fundamental components: flammable substance, oxidizer and source of flame/ignition. Hence such areas

require specialized equipment to prevent and avoid explosion. This might sound as a straightforward process but it isn't, these are guided by regulations, guidelines and laws which are already discussed above in this paper.

The National Electrical Code (NEC), National Fire Protection Association, OSHA has set up benchmarks for hazardous area explosion protection. North America region Factory Manual (FM) and Underwriters Laboratories (UL); and Canadian Standard Association (CSA) for Canada are the certifying agencies, recently the two of them are working together on implementing programs to be made valid in both countries.

Electrical equipment to be used in hazardous area should be installed with one or more protection techniques for proper and secure operations.

As mentioned earlier, there are several methods by which equipment can be made flame and explosion proof, limiting energy and other sources.

Refer to the figure below for a detailed explanation.

Protection Method	Explanation
Explosion proof equipment	To meet the criteria for explosion proof rating, the enclosure should be able to prevent explosion, extinguish flames internally so that external ignition are prevented.
Dust-ignition proof equipment	It will exclude dust; prevent sparks and ignition in exterior dust on the enclosure.
Hermetically sealed Equipment	Equipment is sealed against the external atmosphere to prevent entry of hazardous gases or vapors.
Intrinsic safety or non-incendive	Equipment electric circuits are designed in a way not to release sufficient energy for an ignition to occur. Non incendive circuits and components prevent any kind of arc or thermal effect.
Purged and pressurized system	Equipment with internal circuits under pressure and ejects any sort of combustible gas and dust.

Overview of Arista Class 1 Division 2 Hazardous Zone Industrial computers

Arista offers a wide range of Non-Incendive fully sealed packed application for hazardous zone. The range is Class 1 Division 2 certified and is completely safe to be used in an environment with the presence of flammable gases, vapors or combustible dust. Arista is proud to deliver best HMI

embedded systems with strong monitors and integrated display. Also the range includes industrial panel PCs, industrial thin clients and multi touch projected capacitive touch.

The HMI enabled systems, monitors and displays for hazardous area are constructed with completely sealed, stainless steel enclosure, NEMA 4/4X enclosure with environmental rating UL 50 on the entire monitor and fully sealed I/O parts. The Hazardous area monitor supports temperatures from -20 to 50C, industrial grade with high quality display and resolution. In addition LCD display computers are completely sealed, water-resistant and rugged; performs completely well in the presence of dust, water, wash downs or disinfectants. The range is ideal for food processing, cold storage, pharmaceutical and any other harsh industrial environment.



Arista ARP-2200AP range

Features of ARP-2200AP:

- UL Listed safety standards, non incandive industrial panel PC for use in Class 1 Division 2 Groups A, B, C, D Hazardous classified locations.
- Sealed with stainless steel enclosure(4/4x ip 65/66 and NEMA 4/4x)
- Industrial-grade, high bright LCD flat touch screens panels.
- The HMI application meets Class I Division 2 hazardous locations (North America Classification).

About Us:

Arista is a pioneer in the industry of product development, engineering, manufacturing and customer support. Originally formed in 1994, Arista has offices in China, India and Taiwan. With years of experience and expertise in Industrial Panel PCs, Industrial Monitors, Box PCs and Fanless Embedded computers, Rack Mount Computers, ACP ThinManager Ready Thin Clients, embedded CPU Boards and video Extender/Switches. Arista has served customers with reliability, Integrity and Trust. Find out more [here](#).



Disclaimer

This paper provides only an overview of hazardous area and zone classification for equipment safety. It should not be considered as a substitute for safety guidelines and regulations. It is also recommended to consult an official legal advisory or other concerned authority in your organization for latest and updated safety regulations.