CALPAS
Automatic Foreign Particle Scanning Analyzer

For Foreign Color, Foreign Shape….

For Powders, Transparent & Opaque Pellets, Wet Suspension, Film-Tape….

Offline to Online

SCIGENTEC CO., LTD

www.scigentec.com

CALPAS, Intelligent Foreign Particle Analyzer

In recent years, the direction of industrial technology has required not only product performance but also management of the unexpected micro objects that have a big influence on ensuring the product's sustainable performance and clean external appearance. An increase in high-value-added products must be accompanied by a higher level of quality management.

CALPAS (Color [Component] AnaLysis for PArticulate System) is designed to analyze the foreign materials that arise unexpectedly in pellet and powder systems from the petrochemical, plastic, food, and pharmaceutical industries. A quality management system must monitor impurities from production in order to ensure high-quality outcomes.

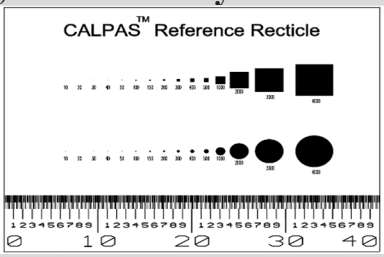
Measurement of foreign objects is an important factor in determining a product's quality standard, and only continuous analysis can immediately determine quality. Passive sample analysis performed by humans requires a lot of manpower, and due to human limitations, such analysis is often difficult to conduct. Maintaining stable and consistent product quality—monitoring and controlling the entire process to determine product grade change for "grade pass"—requires a continuous and consistent grasp of quality to optimize production. In the Fourth Industrial Revolution, the recording and sharing of processes and real-time information through the control process is becoming an essential element in the emerging smart manufacturing industry.

For the purpose of the removal and removal, it is expected not only to automate production but also to save money on further investment. The CALPAS online foreign material automatic measuring device, applied to the production site, can be used in a very simple way to quickly and in real time determine the status or quality of the currently manufactured product—and to transfer, store, and use that result.

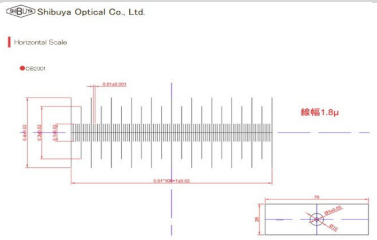
CALPAS,
Standard Offline Version

CALPAS-K,
Online Version

CALPAS, Validation System



Size Standard (50 micron)



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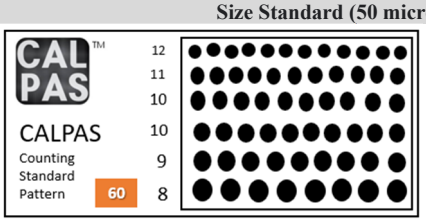
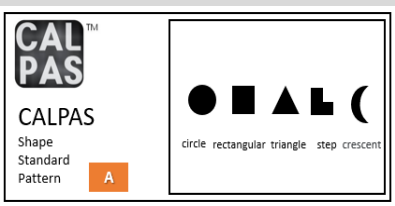


Counting Standard



Shaping Standard

Color Standard (Digital)

CALPAS Sensor

CALPAS consists of a high-precision camera, a long working-distance lens, a multidimensional LED illumination system, and software that enables detection of unusual colored particles of dirt and modified variants, or carbonized material differences. It is available to customize CALPAS via modular hardware combinations to cover a variety of options, depending on the application.

In addition to analyzing material by color and using the same equipment, CALPAS also detects the size and shape of foreign material—characterizing it as long, twin, snakeskin, and other shapes.

CALPAS improves quality management by detecting and diagnosing foreign colored material such as black dots and red, yellow, and other impurities. Unexpected colored particles can greatly impede high-quality appearance and performance.

In addition to general analyses, such as of normal pellets, the device can be configured to analyze transparent pellets—opaque pellets that are very difficult to study without adding AVIDOM, a device specially designed to perform this function. Options can set the minimally detectable amount to 10 μm, at which it is difficult to find foreign bodies in the existing equipment (default specification are 50μm).

Through the system's modularity and flexibility with regard to light source type and sample supply, precise measurement can take place according to different applications such as with high transparent or opaque pellets and powder. The process of analysis consists of: (1) a reliable supply of the sample, (2) five-dimensional LED illumination composed of four channels with dimming options, (3) high-definition, high-speed cameras, and (4) an intelligent image analysis program that applies an automatic analysis algorithm. All this hardware and software are under the real-time control and analysis process, viewable only a mouse click away.

Supply samples derived from manual or automatic control of the feed rate and speed are available in a very short time. CALPAS provides various information about foreign materials including color, size, and shape in real time and in a report format. The equipment is useful for industries that use PVC, PP, PE, PC, and PMMA from petrochemicals, including the pharmaceuticals, foods, and bulk material industries.

Foreign bodies are detected in real time and registered in a special bin. Each foreign body size, shape, color, and other information is also analyzed in real time. The system is designed so that this data is available for reanalysis at any time. The reanalysis function can be adapted to various additional conditions and other different analysis settings.

Image acquisition and analysis algorithms are optimized using dedicated tools to detect and analyze images collected by hardware in real time for faster processing speed. The separate report function to manage the data from the analyzed results relies on a fast reanalysis speed to apply various detection conditions to measured images in the database.

[Features]

- **Detection Limit : 20 μm (10μm as an option)**
- **Particle Size & Shape Range : 3.45~ 60,000 μm**
- **Measurement time (Foreign Color, 50 μm) : Pellet (Opaque) – 2 min. (1 kg),**
  Pellet (Transparent) – 5 min. (1 kg),
  Powder – 15 min. (1 kg)
- **Measurement time (Foreign Shape) : Pellet – 15 min. (1 kg)**
- **Sample Amount : 150ml, 1000ml, 2400ml, 5000ml (Option available)**
- **Material : High precision Aluminum Profile, Stainless Steel**
- **Dimension & Weight : 1130 x 700 x 340 mm, 75kg**
- **I/O : RS232C, Ethernet, RS485**


CALPAS-V


CALPAS-R


CALPAS-F


CALPAS-W


CALPAS-VR


CALPAS-T

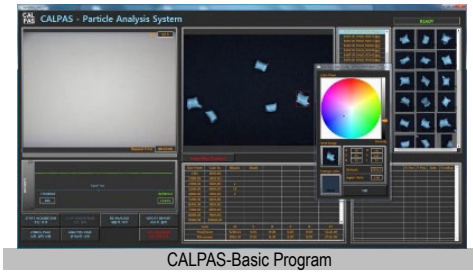

CALPAS-K

CALPAS Program

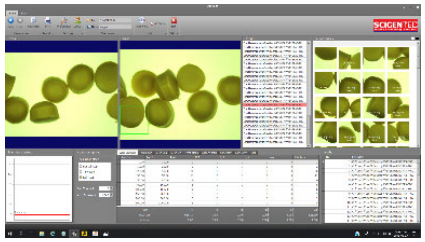
Intelligent CALPAS software enables users to define the values for foreign color and foreign shape according to market and product quality requirements. The detailed setting function is available in the software as a foreign input and can be set from the stored settings, or the user can choose them in advance. This software programming can provide more precise foreign definition management; a user with only one hardware device available can undertake more direct and detailed management of the foreign body and control and manage the foreign body sustainably according to its requirements.

[Features]

- ✧ **Real-Time Analysis**
- ✧ **Auto Start and Stop**
- ✧ **Real-Time Gallery Function**
- ✧ **Real-Time Information on Size and Shape**
- ✧ **Real-Time Statistics**
- ✧ **User-Specific Scaling**
- ✧ **Tracing and Deleting of Doublets**
- ✧ **Coarse Tuning & Fine Tuning**
- ✧ **Size Definition by User or Standard**
- ✧ **Various Size and Shape Evaluation Functions (Feret Max, Feret Min, Feret Mean, EQPC, Aspect Ratio, Sphericity, Convexity, Fiber)**
- ✧ **Foreign Shape Analysis**
- ✧ **Online System Using Sampler and PLC**
- ✧ **Result Data Transfer (PLC)**
- ✧ **Both Side Detection**
- ✧ **Foreign Pellet Sorting**



CALPAS-Basic Program



CALPAS-Pro Program

CALPAS-AI Program

CALPAS AI Software

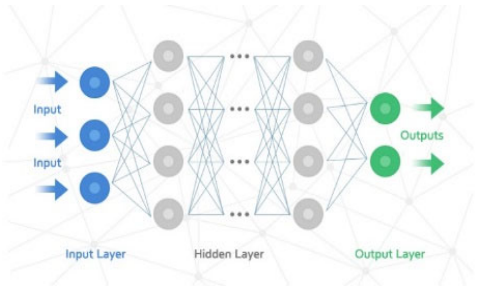
Based on the experience of longtime experts, we have successfully developed CALPAS AI—an artificial intelligence foreign object analysis program—in order to respond to the market demand for differentiated and complicated foreign materials that arise in automotive production. It is possible to eliminate micro-shadows on products with very high levels of foreign object detection, and to identify dust rather than foreign objects in pellets.

The artificial intelligence algorithm applied to CALPAS is a deep-learning method using CNN (Convolutional Neural Networks) that excellently performs image analysis. This technology has improved performance compared to the accuracy and speed of existing methods of analysis. With this feature, the main purpose of CNN is to effectively detect the visual characteristics or features of the image—such as borders, lines, and colors—through various feature maps defined in each layer.

CALPAS has secured algorithms with different dimensions by using our unique image extraction method (CALPAS illumination) and CNN method. In addition, we have introduced an algorithm that satisfies the need for accuracy and speed by setting input and output according to the purpose required by the market and providing an optimized hidden layer design technique accordingly.

The CALPAS AI training algorithm based on the user-provided label image is programmed to automatically adjust the weights of the CNN filters corresponding to the hidden layer, so that no additional manual operation by the user is required. In addition, recognition of the pellet type is possible, and the presence of foreign colors or foreign shapes in one device can prevent an excessive investment in technical cost

CALPAS Deep Learning Function



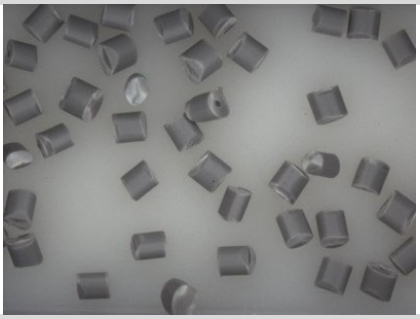
CALPAS Deep Learning Mechnism

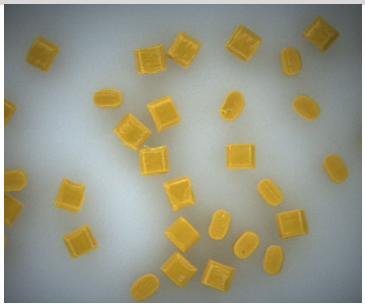
Discrimination Foreign Dot and Dust

CALPAS-V

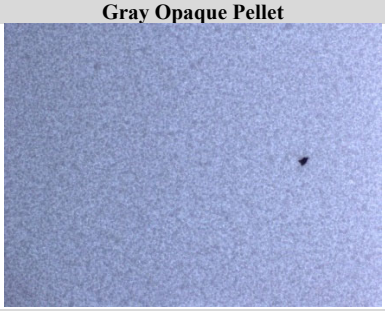
Application for Normal Pellet, Opaque Pellet, Powder (Free-Flowing)

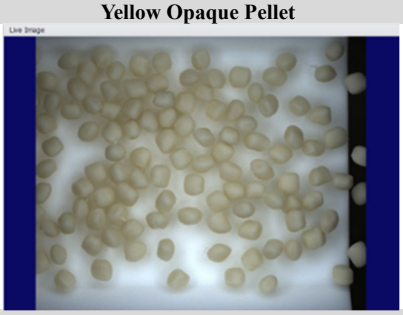
Room Illumination Structure | **Chutes for Pellet/Powder** | **Bottom Illumination Function**





Brown Opaque Pellet | **Gray Opaque Pellet** | **Yellow Opaque Pellet**





SAP granule | **PVC powder** | **Sticky Rubber Pellet**

VIBRATION UNIT			
3-dimensional movement for the constant mass flow with Bottom Illumination Function			
	Movement repeat	:	50 times/second
	The amplitude of vibration	:	100 kinds
	Height control	:	0.5 ~ 15 mm(resolution 0.1 mm)
	Amount of Feed for dry sample	:	mg to 50 ㎏, depends on Hopper capacity
	Material for Shute & Hopper	:	SUS, coated, non-conducting
	Dimension & Weight	:	255 x 158 x 241 mm, 8.5kg

CALPAS-R

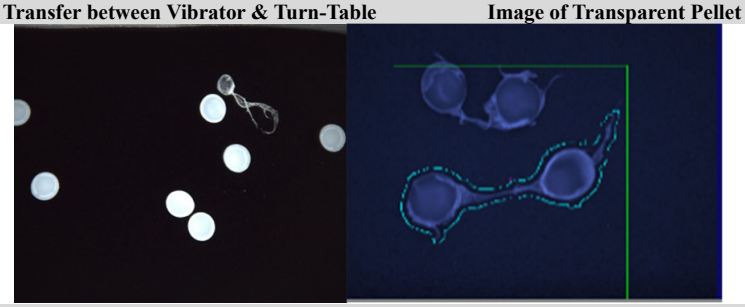
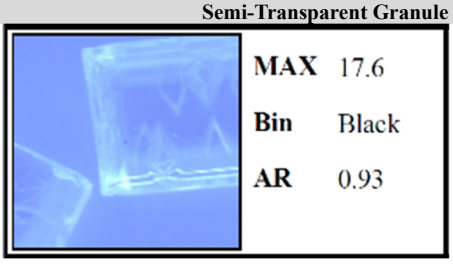
Application for Normal Pellet, Opaque Pellet, Transparent Pellet
Application for Foreign Shape, Particle Size & Shape Analysis







Sample Transfer between Vibrator & Turn-Table | **Image of Transparent Pellet** | **Semi-Transparent Granule**

Foreign Shape Analysis | **10 micron detection (PC)**

TURN-TABLE ROTATION UNIT			
Standard for Transparent pellet with Foreign Shaping Function			
Basic Step Angle (Full/Half)		:	0.072o/0.036o
Max. Torque		:	50kgf.cm
Rotor Inertia Moment		:	280g.cm2
Wound Resistance		:	1.1Ω
Rated Current		:	1.4A/Phase
Reduction Gear Ratio		:	1:10
Protection		:	IP30
Speed Range		:	0~180rpm
Backlash		:	±20'(0.33')
Electro-Magnetic Break	Rated Excitation Voltage / Current	:	24VDC +10% / 0.33
	Rotor Inertia	:	29 x 10-7kgf.cm2
Lost Motion		:	±20'(0.33')
Dimension & Weight		:	420 x 420 x 110 mm, 22kg

CALPAS-VR

Application for Normal Pellet, Opaque Pellet, Rubber Pellet, Powder (Non Free-Flowing)



ROTATIONAL VIBRATION UNIT			
Rotational Hopper for free flowing with Bottom Illumination Function			
	Movement repeat	:	50 times/second
	The amplitude of vibration	:	100 kinds
	Height control	:	0.5 ~ 15 mm(resolution 0.1 mm)
	Amount of Feed for dry sample	:	mg to 50 ㎏, depends on Hopper capacity
	Hopper Rotational Function		1~11rpm (control 0.5rpm)
	Material for Shute & Hopper	:	SUS, coated, non-conducting
	Dimension & Weight	:	255 x 158 x 241 mm, 8.5kg

CALPAS-F

Application for Film, Sheet, Tape, Glass..





FILM INSPECTION UNIT		
Coaxial Illumination with Stage Motor for Black/White Dot, Fish Eye on Film & Sheet		
Step Angle	:	1.8o/Step
Voltage	:	5.25V
Current	:	1.5A/Phase
Resistance	:	3.5+10% ohm/Phase
Inductance	:	2.8+20%(REF) mH/Phase
Holding Torque	:	3800 g.cm
Detent Torque	:	250 g.cm
Insulation Class	:	B
Life	:	6000 H
Dimension & Weight	:	600 x 190 x 190 mm, 25kg

CALPAS-W

Application for Wet Suspension, Slurry….



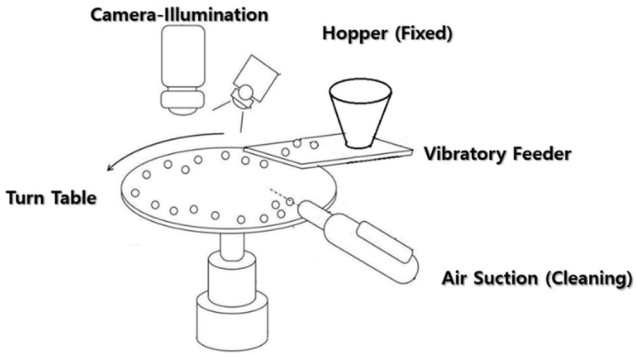

Foreign Detection in Wet Suspension		
Cuvette Material	:	Quartz
Cuvette Width	:	2mm
Pump	:	Peristaltic
Peristaltic Material	:	Marprene, Silicon…
Dimension & Weight	:	240 x 140 x 150 mm, 11.0kg

CALPAS-T

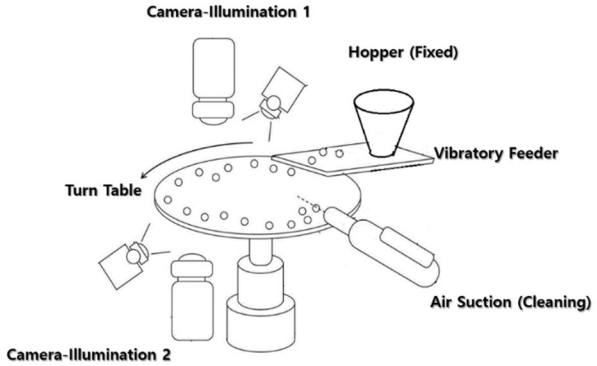
Simultaneous Both-sides Foreign Particle Analyzer

[Options]

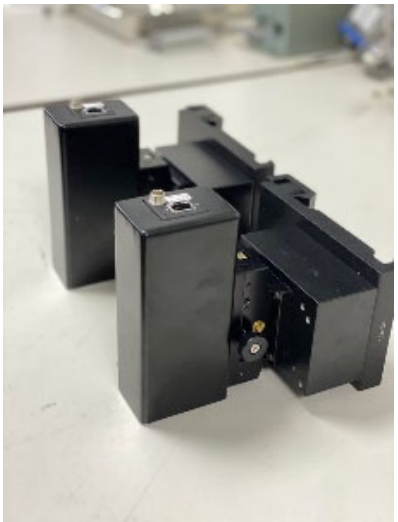
- ✧ 10 micron detection
- ✧ Data Transfer to PLC & Others
- ✧ Sorting by High- Speed Diverter
- ✧ Hopper Size can be upgrade up to 9 Liter (Offline)
- ✧ Real-Time Online Purpose by Connection with Online Isokinetic Sampler
- ✧ Extension to AI (Artificial Intelligence) Functional Software (Deep Learning)



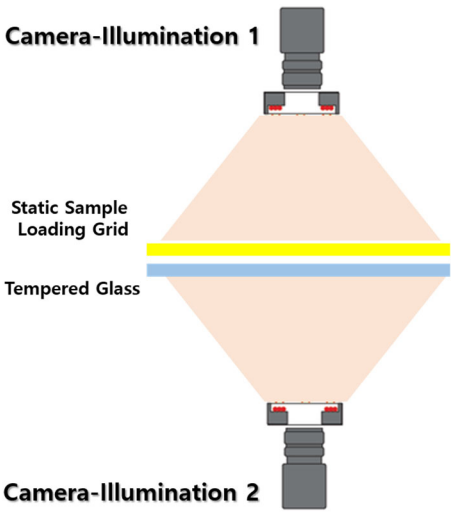
Single Camera Structure



Double Camera Structure



Dual Camera System



Static Dual Camera Structure

CALPAS-K

Online Real-time Foreign Particle Analyzer

CALPAS-K online System

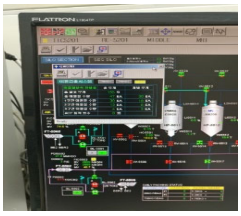
Semi-AutoLine Structure

Offline Use

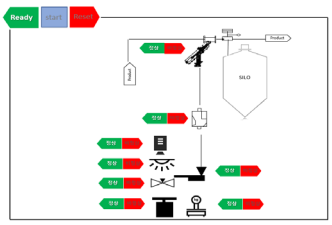
[Features]

- ✧ Robust & Convenient Design
- ✧ Free Movement
- ✧ Automatic Balancing
- ✧ Rigid Industrial PC and control Process Sampler
- ✧ Automatic Ionized Air Control Cleaning System
- ✧ Analysis Speed : 1kg/10min.
- ✧ Hopper Size can be upgrade up to 9 Liter (Offline)
- ✧ Real-Time Online Purpose by Connection with Online Isokinetic Sampler.
- ✧ Various Sample Measuring Stage Selection, Vibrator : Powder & Pellet, Turn Table : All (incl. Transparent) Pellet
- ✧ Various Camera Selection : 5micron, 10 micron, 3CCD….
- ✧ Extension to AI (Artificial Intelligence) Functional Software (Deep Learning)

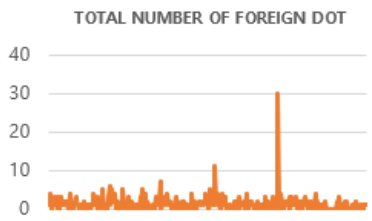
Installation



PLC data transfer



Self diagnostic



Trend Chart

[Options]

Online Sampler

Ultrasonic Flowing Unit

Load Cell

Vacuum Cleaner

CALPAS-TERMINAL

Simultaneous Both-sides Foreign Particle Sorting Machine

The measurement and sorting of foreign substances are important factors in determining the quality of a product and the level of customer trust. Recently these issues have become related not only to appearance but also to safety. However, the ability to suppress the occurrence of the original foreign particles is limited, and the demand for a foreign material measuring eliminator has been continuously increasing.

In the meantime, the method of measuring and sorting foreign matters has been focused on measurement speed, revealing limitations with accurate measurement and problems such as a remarkably low yield in sorting particles with foreign matter. In addition, the lower-limit size of foreign particles has recently been required to be significantly smaller, so the measurement of fine foreign substances must be accurate and processed quickly, and the efficiency of removal must be secured.

To meet this industrial requirement, Scigentec Co., Ltd. has released CALPAS-TERMINAL products. The CALPAS-TERMINAL foreign particle measurement and sorting system basically applies a high-speed rotating turntable to the sample transfer instead of the gravity sedimentation method that can create a mass failure.

The dual-camera illumination system placed on the top and bottom of a special tempered glass turntable can perform the duplicate measurement of foreign matter from both sides at the same time, ensuring accurate and stable measurements up to at least 10 microns.

To significantly reduce optical misjudgments from basic properties of particles (e.g., shadow, perforation, colored reflection), CALPAS works with an artificial intelligence program that accurately judges only foreign matter and is optionally configured to perform very stable and accurate foreign matter measurement and removal simultaneously by real-time merging with foreign matter removal devices such as the high-speed Diverter.

Simultaneous dual-sided measurement from the CALPAS-TERMINAL system has the capacity to analyze up to 200kg per hour on a 50-micron basis. The product can be applied in a very simple way for use in production, quality control, and final product control.

[Features]

- **Dual Detection System**
- **Foreign Color or Foreign Shape Purpose**
- **Various Illumination Control**
- **Robust & Convenient Design**
- **Free Movement**
- **Automatic Balancing**
- **Rigid Industrial PC and control Process Sampler**
- **Automatic Ionized Air Control Cleaning System**
- **Detection Limit : 20 μm**
- **Analysis Speed : 200kg/1hour.**

CALPAS Specification

Power Requirements	AC Input Voltage range (VAC)	:	90 - 264VAC, Class II double insulated
	Input Frequency (Hz)		47 - 63Hz
	Inrush Current (115 / 230VAC)	:	A 15 / 30A 25 / 50A 30 / 60A 30 / 60A
	Power Factor & Flicker	:	EN61000-3-2, EN61000-3-3
	Output Voltage (VDC)	:	24
	Output Maximum Current (A)	:	3.1
	Output Maximum Power (W)	:	74.4
PC requirements	OS	:	Windows 10 IoT Enterprise 2016 LTSB Value
	Processor	:	AMD Ryzen™ embedded V1605B
	Memory	:	DDR4 16GB / 2400MHz So-Dimm
	Storage	:	970 EVO Plus series 250GB NVMe-v7S250BW(OS) + 860 series QVO 1TB MZ-76Q1T0B
	Network	:	LAN 10/100/1000Mbps
Air Requirement (offline)	Pressure	:	2 bar
	Flow Rate	:	10 Liter/Min
	Quality	:	Particle, Oil, Water Free
Air Requirement (online)	Pressure	:	5.5 bar
	Air usage	:	81 in3 (1327 cc) per inch of stroke
	Max. volume per stroke	:	12.5 in3 (205 cc)
	Quality	:	Factory Instrument Air
Operating Environment	Ambient Temp	:	-9 to 50°C (15 to 122°F)
	Operating Humidity	:	- 20 - 95% RH (non condensing)
Illumination	**Light Input**	**:**	**AC100-240, 50/60Hz, 50VA**
	Light Input Current	:	1/0.5A (AC 100/240V)
	Light Output Channel	:	4 Channel
	Light Output	:	24V
	Light Output Current	:	1.0A (Max.)
	Output Control	:	Pulse Width Modulation
	PWM Frequency	:	300kHz
	Brightness Resolution		1024 levels (10 bit)
	Signal Control	:	RS232C
	Capacity	:	120W
Optics	Resolution	:	2464(h) 2056(v), 5.1 Megapixels
	Sensor Size (inch)	:	2/3
	Frame Rate (fps)	:	23.70
	Shutter Speed(μs)	:	52-39,000,000
	Interface	:	GigE
	Voltage(VDC):	:	12
	Pixel Size (μm)	:	3.45(h) 3.45(v)
	Focal Length	:	8mm
	Image Size	:	2/3" (8.8 x 6.6 x 11mm)
	Angle of View	:	56.5 x 43.9 x 67.0 (Hor. x Ver. x Dia.)
	Iris Range (F-Stop)	:	F1.4/F4/F8/F16
	Focusing Range	:	0.1m
	Flange Back	:	17.526mm in air
	Back Focus	:	9.74mm in air
	Filter Thread Size	:	M27x0.5
	Front/Rear Effective Diameter	:	Front Φ17.5mm / Rear Φ15.6mm
	Exit Pupil Location	:	225.6mm
Ionized Cleaning Air	Solenoid Valve Operation	:	Direct lift
	Solenoid Max Static Pressure	:	5 times max psid
	Ionized Air Generating	:	Corona Discharge
	Ionized Air Discharge Voltage	:	4.75kV~5.5kV(4LEVEL)
	Ionized Air Pressure	:	0 ~ 0.5Mpa(Usually under 0.3Mpa
	Ionized Air Flow Rate	:	2.0L/min(±10%) per 1 emitter (under 0.1Mpa)
	Ion Balance	:	Under average ±30V
Validation	Reticle Calibration	:	Edmond Optics, Image Analysis Micrometer
	Scale Divisions	:	0 to 2.5 inches
	Increments	:	0.5 inches
	Dimensions (mm)	:	25.4 x 76.2
	Thickness (mm)	:	1.50 ±0.100
	Dimensional Tolerance (mm)	:	±0.100
	Pattern Tolerance (μm)	:	±2 (±4 for Plate 1 Item #3 and #4)

SCIGETEC
Particlize the Imagination.

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