EPS BEAD SIZING CAMERA

EPS Bead Sizing Camera

Abstract:

The fundamental principle of Dynamic Imaging is relatively straightforward. CANTY's vision-based technique works on the basic principle of capturing high resolution images with a high-speed camera and relaying those images to the CANTY Vector Control Module. The Vector Control Module comes with embedded CANTY Vision Bead Sizing software which analyses the images with the various CANTY algorithms. The binarized image is analyzed under a number of different parameters to provide particle sizing data. The data can then be stored via the excel database or output via 4-20mA/OPC UA/ Modbus / Profibus. The outputs can then be fed into the user's alarm system or DCS.

The Canty camera should be side mounted on the vessel. This is a particle sizing probe that is specifically designed to measure spherical beads of any concentration and overlapping beads (similar to the emulsion software we have). The online real time measurement of the beads allows users to grow the EPS beads to optimum size, then inject pentane and stop the growth of the beads. The batch of beads is screened and dried. The screening eliminates over and undersized beads. The Canty EPS particle imaging camera measures the full distribution, thus providing the optimal yield. Controlling this output can yield 10-15% increases in plant outputs and reduce the waste or secondary product.

Our 1st system was sold to DOW Chemical when they took over the BUNA Rubber plant in Schkopau. Tod Canty visited the site and worked with their pilot plant in the East Germany right after the Berlin wall was demolished. In discussions with their Scientists and working in the lab he determined the optimal lighting and optics to provide the best view and measurement. This online measurement had never been done before and no one else has ever been able to accomplish it to date. The unique combination of fused glass, fiber optic lighting and image analysis provided a system to their pilot plant that was spectacular. The scientist reported the system accomplished every goal and they then wanted it added to their new plant design which was done in the mid 90's. The system has run successfully for over 25 years with minor upgrades (LED lighting and computer) and virtually no spare parts.

The CANTY EPS Camera & light combination is mounted on a single connection, replacing an existing sight glass.

This document will show that the CANTY system not just meets, but exceeds all industry requirements and expectations while keeping installation and maintenance costs as low as possible.

The following key technologies are integrated into the system to provide a reliable and safe measurement:

- CANTY EPS Camera.
- High Intensity LED Lighting
- Fused glass (Glass to metal seal.) See appendix A.
- Jet Spray Ring. See Appendix C.
- Vision Control Module with embedded CANTYVISION™ software. (Rack or DIN mount)

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Benefits of the CANTY System:

There are several benefits to be derived from CANTYVISION™ technology that are unique in the marketplace:

A. Vision into Process

1. View into the process is an enormous help in determining the process state and helpful in determining sources for upset conditions.
2. Brings the image of multiple vessels to a single point for ease of operator monitoring.

B. Process optimization

1. EPS Bead Sizing
2. Determine if the Styrene and water are creating an emulsion in the early stages. If not, a separation occurs and a giant polymer lockup occurs. This event creates a reactor full of polymerized styrene and the plant needs to cut out the material which can cause a loss of weeks of production.
3. Optimization of Process.
4. Control vessel performance to ensure correct Bead Size
5. Repeatability of product quality on each batch
6. The particle distribution mean size provides the measurement needed to increase output by 10-15 % through control of the process.

C. Maintenance

1. Fused Glass-to-Metal design provides a high pressure, rugged viewing port that is highly polished and extremely resistant to vibration and impact.
2. LED light. (Up to 50,000 working hours)

D. Low Cost / Long Life

1. Initial system costs are lowest in the industry.
2. Maintenance costs are very low over the lifetime. System runs unattended.
3. System does not require any physical calibration after installation, but clients may wish to carry out periodic checks based on maintenance/safety schedules.
4. Long Life LED

E. Field Experience

1. Camera systems installed with various customers in the chemical industry

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CANTY camera:

Mechanical Characteristics:

The system is designed for use in the harshest of environments. The camera and light easily replace an existing sight glass for ease of installation. The following materials can be used for the process wetted material: 316/316L/C276/C22.

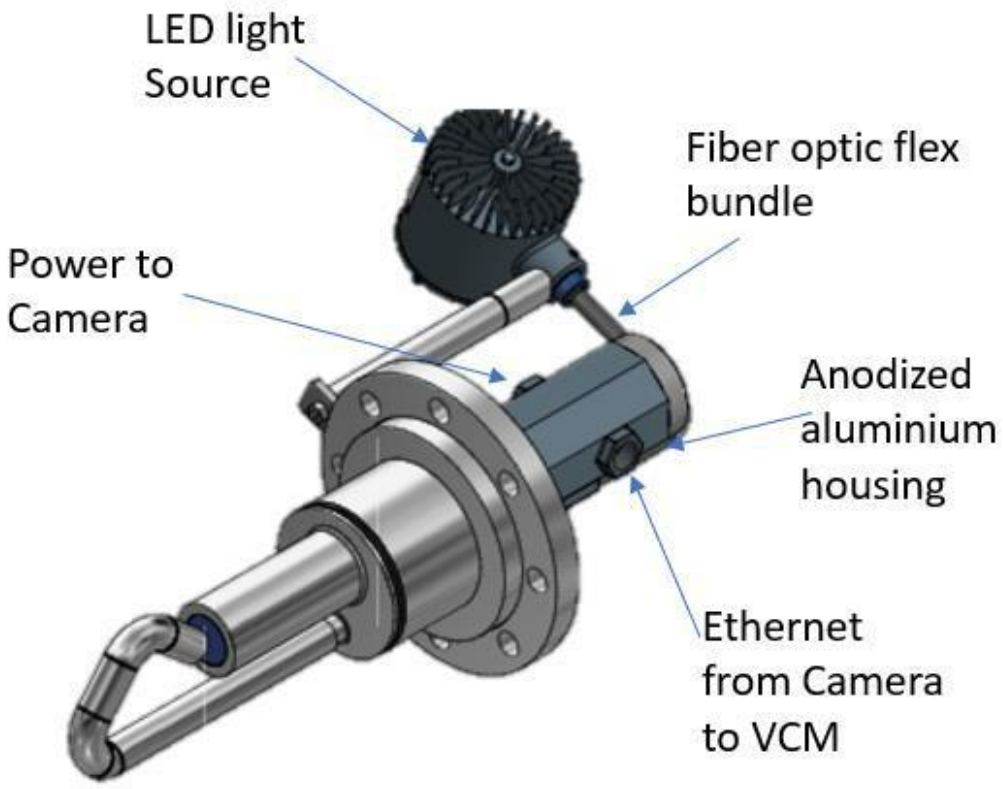

Fig 1.

Mounting is typically done by replacing an existing sight glass.

Typical mounting connections used: Flange mount.

Environmental ratings of the CANTY system: ATEX/IECEX/FM/CSA/IP66/NEMA4X.

For additional environmental requirements please consult your local CANTY office.

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Electrical Characteristics:

The system has been designed to take inputs of Power over Ethernet (PoE up to 100m for the camera only), 24VDC or 120(US)/230(EU/ASIA) VAC @ 60/50Hz depending on region of installation. Power cabling should be 16 AWG (US) / 1.5mm² (EU/Rest of World) as a minimum and data cabling should be CAT 6 up to 328FT / 100M. For distances greater than this, fiber cabling would be required up to a distance of 6.2miles / 10Km.

The Vector Control Module can be mounted in the power supply or remotely in the server room.

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Installation Requirements:

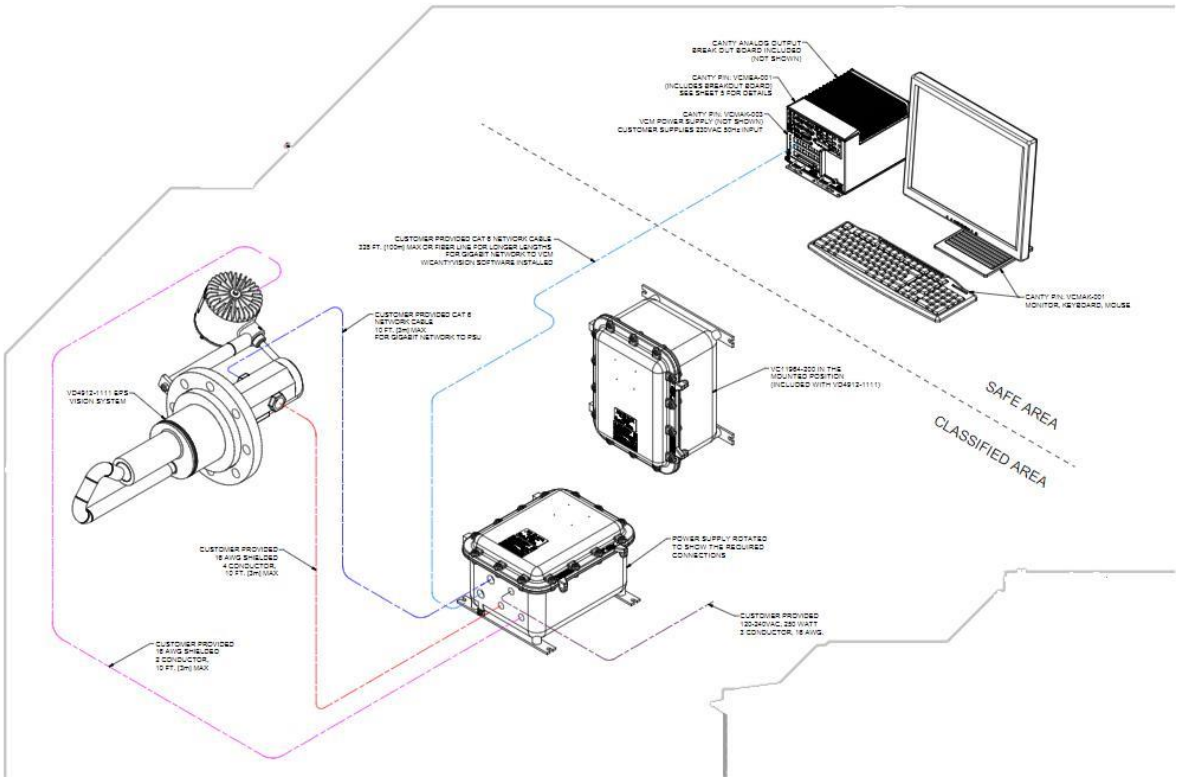


Fig 2.

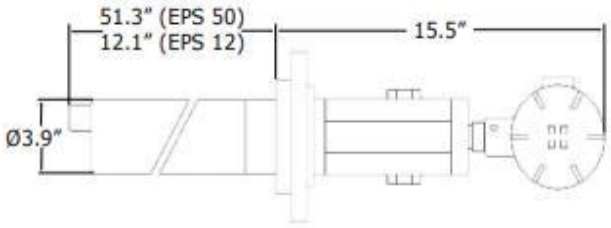
EPS Bead Sizing Camera

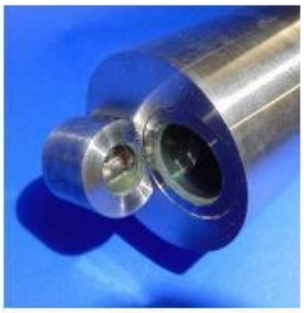
Camera mounting:

EPS 50, EPS 12 SERIES
FLANGE MOUNT WITH 90° ILLUMINATION

Mounting Connections:

- 4" & 6" 150# ANSI flange
- 100 mm & 150 mm DN PN16





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Vector Control Module with Embedded CANTY Vision Bead Sizing Software

Fig 6.

The Vector Control Module (VCM) is a small embedded processor that has CANTYVISION™ software pre-installed. It is designed to keep project costs low and to also eliminate the need for a computer. It is capable of supporting up to 6 camera systems and running analysis on all systems simultaneously.

The system sends out the control signals via OPC or 4-20mA or TCP/IP Modbus to a PLC or DCS for complete control.

The VCM comes with the ability to have full administration-controlled passwords and permissions. This compact design and cost-effective system are easily setup and has a customizable screen. Customers will need to provide a monitor or use an existing one. Wireless options are available and access to technical support can be obtained with an Internet connection.

Using Embedded CANTYVISION™ EPS BEADSIZING software (pre-installed on the Vector Control Module), it is possible to monitor your EPS beads for size and distribution.

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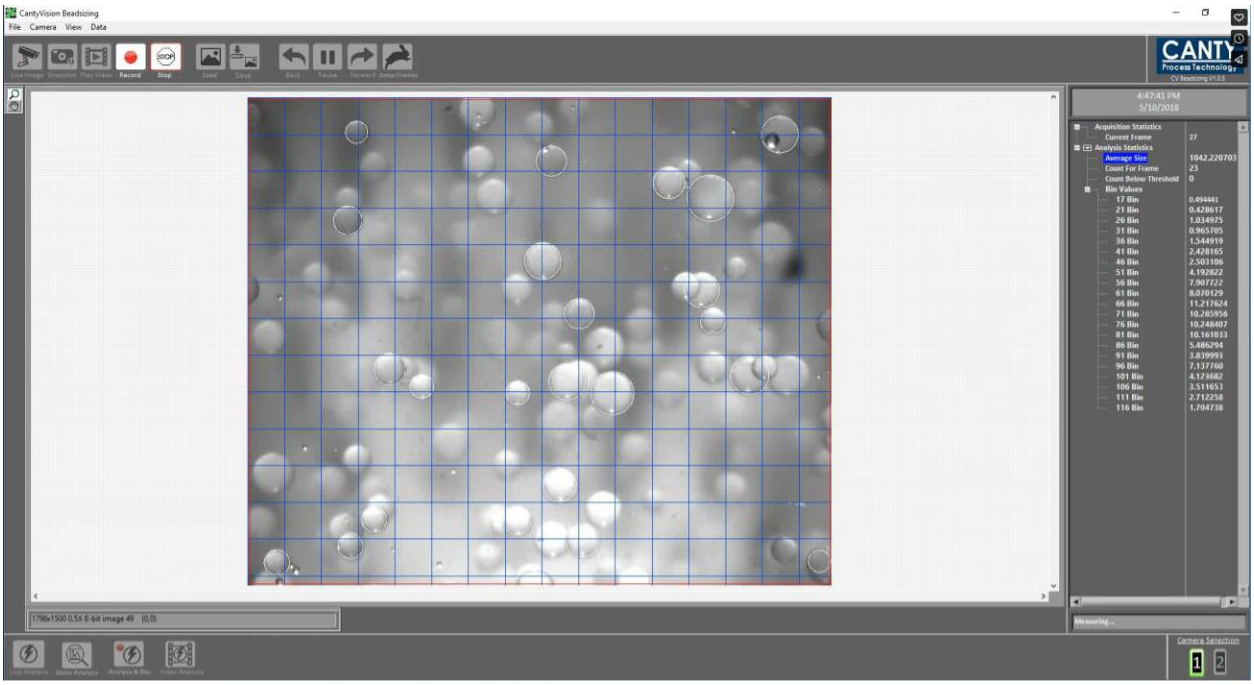
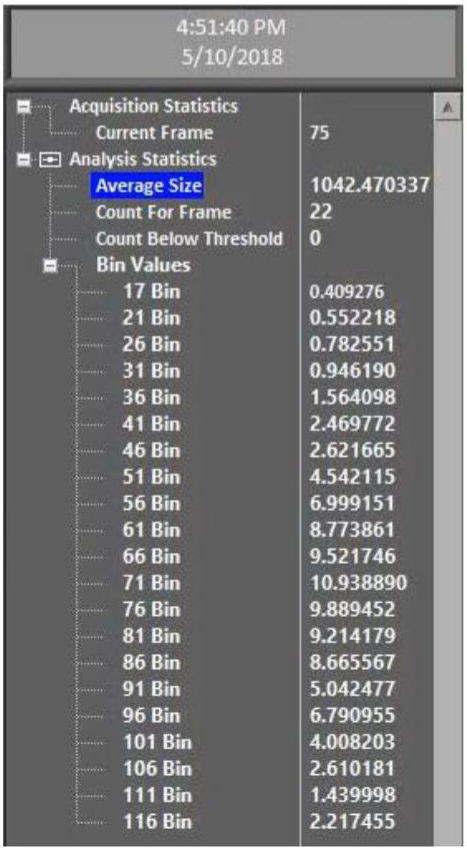
Software Measurements:

Bead Sizing:





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- True particle size requires a shape component.
- Non-imaging instruments provide an indication of particle size.
- Calibration procedures can be involved. Agreement between same type instruments can be difficult to obtain.
- Imaging instruments provide a shape component along with the size measurement (True Particle Size).
- Calibration/verification are guaranteed by physical set up.
- Imaging systems can be correlated to sieve results (ASTM D2776) within 1% accuracy.
- CANTY EPS BEADSIZING software provides real time particle size and distribution measurements

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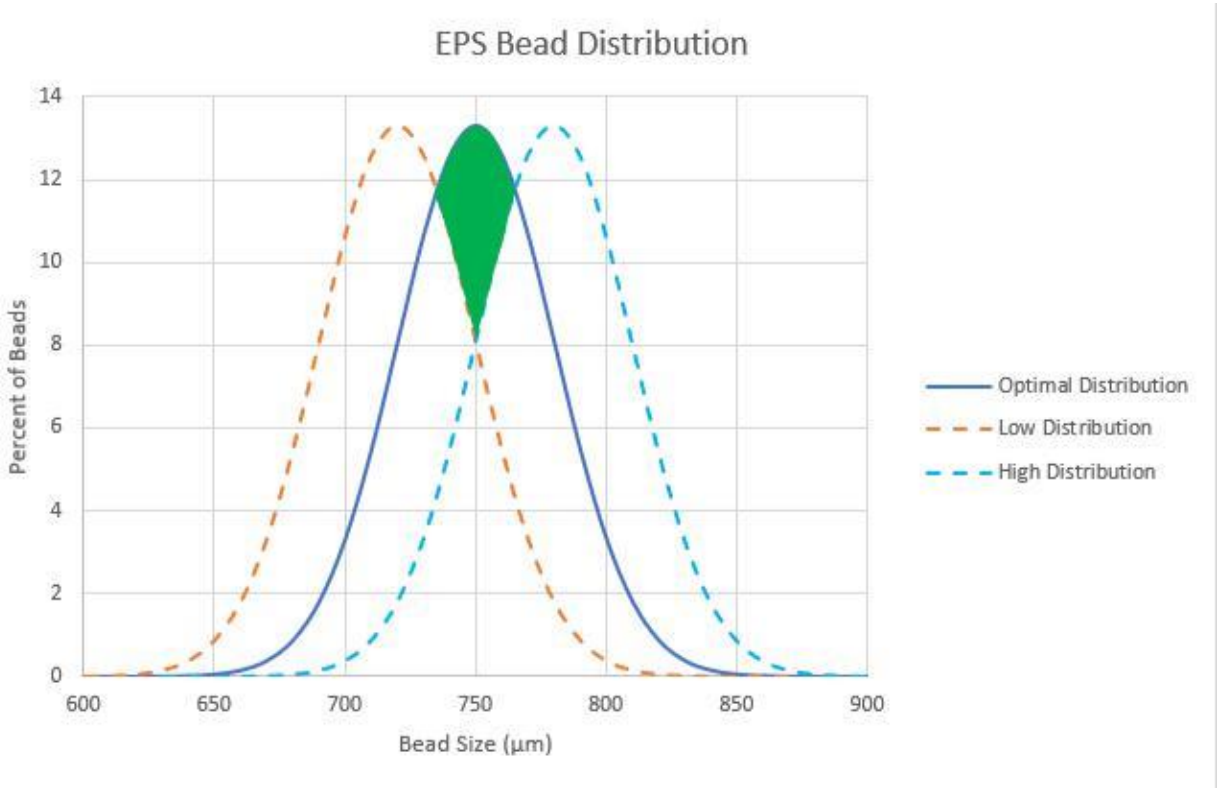
Technology Comparison:



The optimal Bead Sizing measurements is between 700um - 800um which is shown by the blue curve in the above graph.

This is the range that the CANTY EPS Camera performs the measurements. In comparison when the CANTY EPS Camera is not used the customer can only measure the particle size at the edge of this range shown by the orange and green curves.

This gives the customer a much greater range and accuracy for their bead sizing which will allows for greater savings.

EPS Bead Sizing Camera

Conclusion:

Appendix A: Fused Glass

Fusion of glass and metal is a unique process whereby a one-piece construction component is produced. BoroPlus™ glass in its molten form is poured into the center of a metallic ring where it flows to the metal wall. At that point due to the chemical composition of BoroPlus™ glass, the glass fuses to the metal. As the unit is then cooled, the metal, having a higher coefficient of expansion than the glass, contracts onto the solidifying glass putting it under uniform radial compression. The fused glass and metal surface can then be finely polished to produce a smooth even surface with no crevices.

Canty Fuseview Sight Glasses

All Canty Fuseviews feature a unique fusion of glass to metal, which far exceeds all conventional tempered glass windows in safety and performance

The BoroPlus glass and metallic outer ring fuse to become one component

The importance of the fused glass relates to the ability of the unit to stay as clean as possible which is clearly critical for a vision-based system. Due to the fact that there are no crevices or spaces between the fused glass and metal, there is nowhere for product to begin to build up. Non-fused glass and metal systems would not have a smooth transition from glass to metal, and it is in this step area that product (liquid / solids) would inevitably build up. The fused glass also allows higher pressure operation of the systems (up to 600 Bar possible) due to the fact there is no danger of the glass and metal separating into 2 separate components.

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Appendix D: LED Light

The CANTY high intensity LED light has been designed for a working life of 50000 hours of continuous use. The initial concept was developed as part of CANTY's Oil & Gas sub-sea development for their analyzer.

This solid-state lighting development was then incorporated across the product ranges to give a more uniform, dispersed light in order to provide better illumination for the camera systems.

Anodized Aluminum
Explosion Proof/Flame Proof

316L Stainless Steel
IP66 Weatherproof NEMA 4X

EPS Bead Sizing Camera

Appendix E: Ordering

ORDERING INFORMATION

Equipment: The EPS image processing unit comes complete with software and technical start up service so your operators can learn and operate the system effectively.

The system includes a Canty camera/light unit with insertion tip and micro lens for particle viewing. This can be provided in a 50" insertion for retrofit through the reactor top, or an 8" insertion unit that would be mounted through the reactor side wall.

EPS-8S-EXP Process Microscope Camera (see sales sheet TA7739-1)
Stainless steel wetted, 8" insertion camera to view into process fluid. Features include high speed digital camera, fiber-optic lighting, fused glass lens ready to mount to a 4"-150# nozzle.

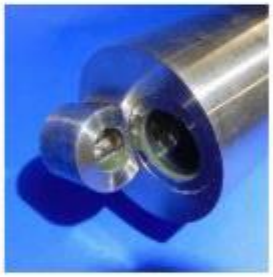
How to order -

EPS - 12S - D - WP

INSERTION LENGTH
8S - 8 inches
12S - 12 inches
50S - 50 inches

FLANGE SIZE
D - 4" 150# ANSI Flange
E - 6" 150# ANSI Flange

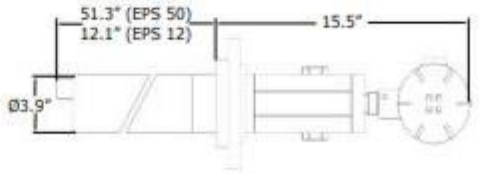
ENVIRONMENTAL RATING
WP - Weatherproof rated
EXP - Explosion proof rated



EPS 50, EPS 12 SERIES
FLANGE MOUNT WITH 90° ILLUMINATION

Mounting Connections:

- 4" & 6" 150# ANSI flange
- 100 mm & 150 mm DN PN16



Please note, this system requires the use of the Canty Vector Control Module.
For additional information please see the VCM datasheet.

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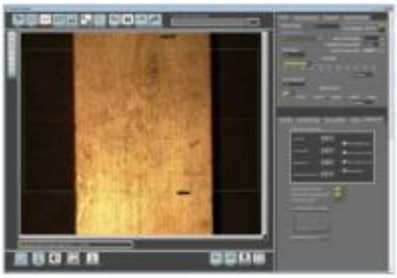
TECHNICAL INFORMATION



Visual Verification On Screen • Easy Command Prompt Module • Graphical & Numerical Analysis Output • Customizable Operator Screen

RACK MOUNT MODELS ◊

PART NUMBER	CAMERAS SUPPORTED †	4-20 Ma OUTPUT, 8 CHANNEL	DIGITAL BREAKOUT BOARD
VCMRA-001	6 POEC or 6 NPOEC	✓	✓
VCMRA-002	3 POEC or 4 NPOEC	✓	✓
VCMRN-004	6 POEC or 6 NPOEC		
VCMRN-005	3 POEC or 4 NPOEC		

All RACK MOUNT VCM's include: 1 LAN Connection.

EXTREME PERFORMANCE

PART NUMBER	CAMERAS SUPPORTED †	4-20 Ma OUTPUT, 8 CHANNEL	DIGITAL BREAKOUT BOARD
VCMEA-001	UP TO 6 WITH POE	✓	✓
VCMEN-004	UP TO 6 WITH POE		

All EXTREME PERFORMANCE VCM's include a total of ten (10) Ethernet Ports (8 POE, 2 NPOE)

VCM LTE - NON-EXPANDABLE

PART NUMBER	CAMERAS SUPPORTED †	4-20 Ma OUTPUT, DIN RAIL MOUNTED MODULE
VCMLA-003	2 POEC or 2 NPOEC	✓ 4 CHANNEL
VCMLA-007	3 POEC or 3 NPOEC	✓ 6 CHANNEL
VCMLN-006	3 POEC or 3 NPOEC	

NOT APPLICABLE FOR PARTICLE SIZING APPLICATIONS.

ADD-ON COMPONENTS

PART NUMBER	FEATURES
VCMAK-001	MONITOR, KEYBOARD & MOUSE KIT
NET1500-10	OPC-UA LICENSE

DISPLAY CONNECTIVITY

MODEL	HDMI	DISPLAY PORT	DVI
EXTREME PERFORMANCE		1	1
RACK MOUNT	1	1	1
VCM LTE		1	

POEC = Power Over Ethernet Camera. NPOEC = Non-power Over Ethernet Camera.
Please note: All cameras must be configured such that there is a direct connection between the camera and the VCM. All cameras cannot be ran through additional hardware such as a switch or hub. VCM's are compatible with Ethernet cables; for longer distances Canty has available for purchase fiber converters that are rated for a variety of environmental classifications. For more information on OPC see document TA10560-1.
Extreme Performance Models: Cellular 4G Internet Option Available. Consult factory for details.
◊ RACK MOUNT models are designed for non-industrial environments with air conditioning and clean, filtered air.
† Number of cameras supported depends on application. Consult factory for more information.
**Assumes cameras are ordered with the VCM. Start up services may be necessary for applications outside of view-only.*
***Depends on model selected. Consult factory for details.*

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Document P/N: TA11500-1034 Rev 15

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Reference Links:

https://www.jmcanty.com/