VMS Volume Measurement System
3D Laser Scanner System for Volume and Surface Measurement

Rough and resistant 3D system for harsh environmental conditions

Triple-IN GmbH
Experts in Laser Distance Measurements
Applications

Measuring and Monitoring

Advanced automation technology is a huge step forward for the improvement of business in outdoor industrial fields, being the key of success to achieve high-quality and efficiency. Triple-IN Volume Measurement System, called VMS, is the best tool for solutions designed focusing on optimization of stockyards operations, surface and volume measurements, open pit mine management and landfills monitoring. A 3D laser scanner system is the best answer to all of these requirements and the VMS can provide different scanning information: data for volume calculation of a stockpile, point cloud of a selected or wide area, profiles for anti-collision systems and others. Open-air working areas all around the world are typically facing the same daily operational challenges that affect the overall profitability. Some of them are often related to harsh environmental conditions like bad weather and dust. Triple-IN answers with its own technology providing multi-echo evaluation and multi-layer scanning, which allow measures of surfaces and volumes with extreme accuracy. The VMS works without causing any interference with operating machines and workers.

Typical Applications

The VMS is the suitable solution for surfaces and volumes measurements, so it is mainly useful in coal and all kind of ore stockyards, landfills, garbage dumps and in all outdoor areas where a fast and precise measurement is required. This leads to monitoring and planning applications of also rockfaces and open pit mines. Even indoor, VMS works for applications of volume measurement in bunkers and incinerators.
VMS for Vale

A complete solution resulting from the integration of VMS with GPS RTK device and a stockyard management software is realized thanks to the collaboration between TSA for Vale, a brazilian mining company, and Triple-IN.

It is a tailor-made solution for stackers and reclaimers in stockyards, with high potentials in mining and every kind of volume measurement applications for productivity maximization.

The VMS is mounted at the top of the machines, delivering a constant flow of 4 profiles in 4 scan layers, two at the left and two at the right of the boom, which are directly used for the calculation of collision warning: this system detects obstacles and produces warning signals depending on the movement speed of the machine.

The collision avoidance calculation in the stacker or reclaimer system and the volume calculation in the stockyard system are continuous and in parallel, without any operational stop.

When required, the central control room operator can make a total scan of the stockyard with only a simple command, to have a clear view of the area, with particular care of each machine: this can eliminate a lot of unproductive operations, such as air-reclaiming and ground-digging.

Benefits of VMS

VMS has a wide range of benefits, leading to a significant reduction of operating costs:

- equipment utilization has a tangible improvement of efficiency
- working area utilization is optimized with a wide view on all the operations in the field
- machine safety can be ensured by the anti-collision system with a reduction in maintenance costs
Multi-layer Technology for Functions Combination

VMS is a very flexible system, available in different versions to meet customers needs as best as possible. In some applications the Pulse Array Camera sensor (PAC), with its multi-layer technology, is the right solution to get different functions in only one system. Multi-layer technology is an extraordinary way of scan, which allows laser scanners to become essential for new solutions: multiple scan lines provide data in a wide area without any sensor rotation need. Triple-IN has designed this technology in the way of being suitable for different applications and has also thought of different sensor configurations to achieve different goals. Therefore, multi-layer technology results to be a customized system depending on the application of the customer. For example, in a stockyard where there is the need of management and monitoring, a VMS with PAC tilted of 45° is the best solution (see picture below). The system is mounted at the top of the machines and the sensor can continuously scan the single machine working area, without any interference of the machine boom (for anti-collision and stockpiles volume measurement). When required, making the sensor rotate on the rotary table, a complete scan of the area can be provided for stockyard management.

Benefits of Multi-layer Technology

There are different benefits coming from multi-layer technology, which change depending on the application it is used for. The most common advantages are:

• Wide area of continue data collection, without any sensor rotation
• Customized configuration depending on the target application
Triple-IN designed its multi-echo evaluation technology to make laser measurements more independent from weather conditions and to bring data reliability to the highest level.

The picture below shows a profile taken by the VMS in a typical scenario of a rainy day. The sensor reliably detects all the targets with the multi-echo technology, collecting data about buildings, fences and all real targets available in the site of interest without the interference of the raindrops. Only where there is free sky, the sensor returns the echoes of the raindrops.

The multi-echo evaluation is the perfect technology for applications involving measurements in bad weather conditions, such as rain and snow, as well as low visibility environments.

The most important benefits that anyone can take from the multi-echo evaluation are:
- Improvement of data collection in even bad weather conditions
- Improvement of low-visibility environments working operations
- Maximum detection reliability
Technical Data

Rough and resistant for environmental protection

Technical data of the VMS depends on the composition of the system, suited for the applications required. Mainly it is composed by:
- the sensor, which takes care of the measures and data collection
- the rotary table, responsible of the rotation of the sensor
- rough housing, protecting measuring components from harsh environments
- optional internal blower, available for very dusty environmental conditions

Sensor Technical Data

2D Laser Scanner mountable on the VMS can be PSxxx-90 sensors or PACxxx-90-y-zz sensors. For detailed sensor technical data, please refer to the technical datasheet of the desired device.

Rotary Table Technical Data

<table>
<thead>
<tr>
<th>Specification</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Horizontal Rotation Range</td>
<td>-170° to + 170°</td>
</tr>
<tr>
<td>Horizontal Resolution</td>
<td>0,011° (0,2 mrad)</td>
</tr>
<tr>
<td>Rotation Scan Speed</td>
<td></td>
</tr>
<tr>
<td>Power Supply</td>
<td>24 V DC - 1.75 A</td>
</tr>
<tr>
<td>Network Interface</td>
<td>100 MBit/s Ethernet</td>
</tr>
<tr>
<td>Communication Interface</td>
<td>Binary and ASCII Command Interfaces</td>
</tr>
<tr>
<td>Rotary Table Housing</td>
<td>Aluminum Die Cast - Seawater resistant</td>
</tr>
<tr>
<td>Operating Temperature Range</td>
<td>-10°C to +50°C</td>
</tr>
<tr>
<td>Storage Temperature Range</td>
<td>-30°C to +80°C</td>
</tr>
<tr>
<td>Weight with PAC sensor and enclosure</td>
<td>&gt; 10 kg</td>
</tr>
</tbody>
</table>

VMS Volume Measurement System
Dimensional Drawings

Housing with Inclinometer

- 90°
- 450.00
- 162.00
- 50.00
- 90.00

Outline Dimensions (all in mm)

Housing without Inclinometer

- 90°
- 277.00
- 162.00
- 18.00

Outline Dimensions (all in mm)

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About Triple-IN

Company Vision

Triple-IN’s main efforts are focused on the development and commercialization of powerful 1D, 2D and 3D laser distance sensors and systems based on its KEM technology. The KEM method is the pillar of the idea to transfer the performances of complex and expensive measurement systems in low-cost sensors for indoor and outdoor automation applications. The strong willingness for innovation constantly pushes Triple-IN to find new solutions in optics, array and scanning technologies, also joining forces with leading universities, research facilities or high technology partners, working closely sharing experience and knowledge.

Products

Continuous developments and innovations have led Triple-IN to the realization of a number of outstanding products currently operating in the most various environments. From the harshest open pit mine to the biggest airport, the KEM technology is supporting partners to run their applications and offer customized and affordable solutions to their clients. The Pulse Sensors (PS), the Pulse Array Camera sensors (PAC) and the Volume Measurement System (VMS) are only some of the successful Triple-IN products, always at the top of the list of reliability, precision and convenience.

Application Center

At Triple-IN, people with a lot of experience in laser distance measurement and outdoor applications constantly work to help partners and customers to give solutions to the automation challenges they face. To better meet partners needs, Triple-IN has built up the Triple-IN Application Center (TAC), a team dedicated to listen to and support those challenges in the most efficient way. Sensors integration in desired applications is carefully followed up, focusing on the full satisfaction of customers’ expectations. TAC service is always at partners disposal, available contacting tac@triple-in.de

Triple-IN GmbH
Experts in Laser Distance Measurements

Poppenbütteler Bogen 64
D-22399 Hamburg
Germany
Voice: 0049 (0) 40 500 91998
Fax: 0049 (0) 40 527 34933

www.triple-in.de

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