Volumetric laser scanner for stockpile inventory management
Level Products

Automated stockpile management
The 3D volumetric scanner system measures the volume of material stockpiles stored out in the open or in large structures like warehouses, silos, bunkers, domes and sheds. By integrating accurate laser technology into a network of scanning instruments, complex surfaces can be mapped accurately. The system makes use of remote monitoring and data processing services to guarantee data integrity to the level needed for confident stock management and precise auditing.

System attributes
- Maintenance free, non-contact laser scanner
- No calibration required
- Regular scheduled surface mapping for granular solid material stockpiles
- Auto-ranging to measure points from 0.5 m to 93 m (1.64 ft to 305 ft)
- Scanning motion covers a complete hemisphere
- Heated optics prevent condensation issues
- Rugged and robust powder coated aluminum enclosure of the scanner can be used in any environment

High performance
- Performs a complete scan in under an hour
- Less than 0.3° beam divergence for precision targeting
- Collects thousands of points per scan
- Artifact removal provides dependable inventory information
- Can penetrate moderate dust

Many different materials
- Measures all clearly visible surfaces irrespective of texture, granularity, slope and / or color
- Accurately measures to the surface of mineral ores, grains, and synthetic materials
- Examples include: gold and metal ores, sugar, fertilizers, coal, corn, rice, coffee and plastic pellets

Many different structures
- Works in all types of storage buildings including warehouses, silos, tanks, bunkers, sheds and domes
- Can provide volume estimation for open air stockpiles
- Provides volume estimates with less than 2 % error for volumes greater than 100 m$^3$ (3531 ft$^3$)

A convenient solution
- No calibration or maintenance required (permanently sealed and lubricated bearings)
- CSA, ATEX and IECEx potentially explosive atmosphere ratings
- Easy to install and configure without filling or emptying the vessel
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1.0 About This Manual

1.1 Purpose of Document
This document is intended for personnel installing, maintaining and using the VM3D Volumetric scanning system. It contains instructions for installation, operation and troubleshooting.

Please read this manual carefully before attempting to install or operate this product. To ensure personal safety and optimal performance, make sure you thoroughly understand the contents of this manual before installing, using or performing maintenance on any part of the VM3D system.

All servicing of the equipment is to be performed by Qualified Service Personnel only. There are field serviceable parts in the VM3D control box but not in the VM3D scanner. Any maintenance or repair work on the VM3D scanner must be carried out at the factory.

No user/operator adjustments inside the VM3D Volumetric Laser Scanner System are necessary or recommended by the manufacturer.

Service of control box can be done in the field.

1.2 Definition of Symbols
This publication includes Warning, Caution, and Information symbols where appropriate to point out safety-related as well as other important information. It also includes the Tip symbol to point out useful hints to the reader. The corresponding symbols should be interpreted as follows:

The laser warning symbol indicates the presence of a potential hazard related to the presence of a laser.

The electrical warning symbol indicates the presence of a potential hazard which could result in electrical shock.

The ISO General Warning symbol indicates safety information that must be followed by the user. The information concerns the presence of a potential hazard which could or may result in personal injury or even death.

The information symbol alerts the reader to pertinent facts and conditions in the use of the equipment.

The tip symbol indicates advice on, for example, how to use a certain function.

1.3 System and Component Names
This publication describes different components of the VM3D Volumetric Laser Scanner System, i.e.:
VM3D Scanner
VM3D Control Box
VM3D Data Center Service

The ESD symbol indicates the presence of equipment sensitive to electrostatic discharge.

The Ground symbols is used to identify protective earth conductor terminals.
2.0 Introduction

The VM3D Volumetric Laser Scanner is a laser scanner for measuring the volume of material in a warehouse or on a stock pile. The scanning capability produces accurate measurements of rough surfaces with a complex profile and the output gives a true representation of the volume of material.

The VM3D Scanners are unlike single point level transmitters; they take into account the shape of the surface, accurately calculating the effects of "cone-up", "cone-down" or irregularities on the material volume. Whilst a single point measurement can produce errors in excess of 30% on the true volume, the VM3D Scanner uses thousands of data points to improve the volumetric accuracy to better than two percent in most applications. The VM3D Volumetric Laser Scanner System is a complete process and stock control tool in a single system.

• Measures the volume of material in warehouses and on stock piles
• Rugged and robust housing
• Built-in dust protection
• Built-in fog protection

The VM3D System is composed of a VM3D control box and the VM3D scanner(s). One VM3D control box can supply up to 4 VM3D scanners and transmits the raw data from the VM3D Scanner(s) to the ABB data center over the 3G cellular service.

The VM3D scanner makes use of non-contact laser technology to map the surface profile of a stockpile thus allowing the volume of material to be determined. The dimensions of warehouses, bunkers and walled vessels are stored at the data center. The difference between the measured volume and the empty volume gives the material volume in cubic meters. The VM3D Scanner is mounted above the material to be measured. It is aimed vertically downwards and must be mounted high enough so that the entire surface can be scanned otherwise more than one VM3D Scanner is required.
3.0 Site Preparation

3.1 Site Considerations
The installation has to be planned ahead and safety protocols and working instructions of the plant need to be considered.

Safety protocols
Each plant has regulations and procedures that need to be identified and adhered to especially with regards to documentation, welding guidelines, special regulations concerning small spaces, working at heights and what equipment is allowed to be brought in the plant. The inductions of all personnel involved with the installation have to be prepared.

Cable routes
Power and Ethernet cables need to be installed for the VM3D Scanner to operate. The VM3D control box should be installed in a convenient location for servicing taking into account the star topology of the system and the 100 m (328 ft) limit on the length of the cables going to the VM3D scanners. The VM3D control box requires a dedicated electrical circuit coming from the plant's electrical distribution panel. In general the simpler the cable installation-routing is, the better but the cable routing depends on many factors. Those factors are, but are not limited to, local routing standards, site configuration, risk due to vehicle traffic, obstructions to be avoided and the 100 m (328 ft) limit on cable lengths. It is important to keep the cables out of possible harm's way.

VM3D Control Box mounting
The maximum cable distance between VM3D Control Box and VM3D scanners is 100 m. The VM3D Control Box must be powered by a dedicated circuit from the plant's distribution panel, able to supply up to 500 VA. ABB suggests AWG 14 electrical wires between the distribution panel and the VM3D Control Box. The circuit must be protected by a suitable primary branch circuit breaker and comply with the local Electrical code.

Data Handling
The raw data measured by the VM3D scanners is encrypted and sent over the 3G cellular network to the ABB data center for compilation and analysis. This requires appropriate 3G or GPRS (2G) cellular coverage. In many cases this can be achieved by mounting the antenna and cable supplied by ABB on the VM3D control box. Low signal strength at the position of the control box will require the antenna to be installed at an alternate location that is as high as possible, away from heavy metal structures and possibly outdoors. In some cases it may also require the use of a special antenna; for example a directional antenna pointing to the closest cell phone tower. If 3G coverage is not available the data can also be sent using a customer supplied internet connection. Please contact ABB to discuss special antenna installations or customer supplied internet connections, refer to back cover for contact information.

Mounting
The ABB VM3D Control Box is delivered with brackets for wall mounting. The VM3D scanner is designed to be mounted vertically on a flange above the stock pile of material to be measured. Prior to installation it is necessary to determine where the mounting brackets for the flanges will be mounted and how they will be attached to the existing structure. The design of the VM3D scanner mounting flanges should be based on the diagram shown on page 14.

VM3D Scanner positions
The VM3D scanners should be mounted for optimal viewing; e.g. the smallest number of scanners to get complete coverage are installed bearing in mind that the furthest distance that can be measured from the VM3D scanner head is 93 m (305 ft). The VM3D scans a pattern of concentric circles over a hemisphere. The VM3D scanner must be installed high enough to get a good angle of scan with respect to the material stockpile. It must be able to move freely over 360° and should not be installed below material feeders or anyplace where there is a likelihood of the scanner being struck by or buried in material. In some cases beam placement inside structures can be a problem. When multiple VM3D scanners are to be installed for a single stockpile they must be positioned for maximum coverage while ensuring that there is still some overlap. The environment should be evaluated in terms of dust and fog thickness and variations. Thick dust and or fog will limit the distance that the scanner can measure and reduce the accuracy of the overall volume determination. There are often times when dust is at a minimum, typically between loading cycles. These times need to be determined and used to decide on the best times to perform stockpile scans.
4.0 Safety

4.1 Warnings, Cautions and Notices
User must comply with all warnings, cautions and notices indicated in this manual. Failure to comply with any of the warnings, cautions or notices can result in personal injuries and/or equipment damages. If you do not fully understand the information contained in this manual, please contact ABB. Refer to the back cover of this manual.

4.2 Certification
ABB instruments receive the following safety certifications:

Electromagnetic compatibility directive 2004/108/EC
Low voltage directive 2006/95/EC
CE marking directive 93/68/EEC
ATEX directive 94/9/EC (Europe)
Refer to SM/LM80-EN Safety Report for ATEX.

Hazardous Locations Safety; Canadian Standards Association (for Canada and the US)

Potential explosive atmospheres (global access)

TUV, Electrical Safety

Electrical safety
CAN/CSA C22.2 No. 61010-1:2004
UL 61010-1:2004
EN 61010-1:2004
C1: This product has been tested to the requirements of CAN/CSA-C22.2 No. 61010-1, second edition, including Amendment 1, or a later version of the same standard incorporating the same level of testing requirements.

4.3 Handling
The VM3D Control Box and the VM3D scanner weigh 12 kg each. ABB recommends the use of a lift or the help of another person to lift the VM3D Control Box and the VM3D Scanners. Make sure to use proper body mechanics (bend your knees) when lifting the VM3D Control Box or the VM3D scanners to avoid personal injuries.

4.4 Power Connections
In accordance with international safety standards, the VM3D control box uses a three wire power cord connected directly to the plant electrical panel that provides grounding for the chassis of the control box and up to four VM3D scanners.

4.5 General Warnings
Failing to comply with any of the instructions, precautions or warnings contained in this manual is in direct violation of the standards of design, manufacture, and intended use of the equipment.
ABB assumes no liability for the user’s failure to comply with any of these safety requirements.

Do not, under any circumstances, remove the warning and caution labels. Information must be available at all times for the security of the user.

Do not operate the equipment in an area if there is a risk of flammable gases.

Read this manual thoroughly before using this equipment.

Do not use the equipment if you do not understand the content of this manual or if the equipment shows any sign of damage. Please contact ABB customer service. Refer to the back cover of this manual for contact information.

If the equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.

Equipment intended for field installation by qualified service personnel according to manufacturer’s installation instructions and local/national wiring requirements.

4.6 ESD Warning
Electrostatic Sensitive Components
Any maintenance procedures inside the VM3D scanner terminal block or inside the VM3D control box should be performed using appropriate ESD precautions. If you are not familiar with ESD protection, contact ABB customer support. Refer to the back cover of this manual for contact information.

4.7 Electrical Warnings
High Voltage
Disconnect power at circuit breaker of the plant’s distribution panel before opening VM3D Control Box.

Ensure that the equipment and any devices or power cords connected to the VM3D Volumetric Laser Scanner System are properly grounded.

Protective earthing connection (grounding) must be active at all times.

The absence of grounding can lead to a potential shock hazard that could result in serious personnel injury. If an interruption of the protective earthing is suspected cut the power to the VM3D system at the plant’s distribution panel and have the electrical circuit tested.
4.8 Environmental Information

The VM3D Volumetric Laser Scanner System has required the extraction and use of natural resources for its production. Therefore, the VM3D Volumetric Laser Scanner System may contain hazardous substances that could impact health and environment. In order to avoid dissemination of these hazardous products into the environment and also to reduce the extraction and protect our natural resources, ABB Inc. strongly recommends to use appropriate recycling systems in order to make sure materials used to produce your equipment are reused or recycled in a sound way. At the end of life of the system, contact your distributor before disposing of your equipment.

The VM3D Volumetric Laser Scanner System is not subject to the European WEEE directive based on the exemption for fixed industrial installations. However, most of its components are easily recyclable. The VM3D system falls into this category by virtue of the fact that it is meant to be permanently installed by a qualified installer in industrial warehouses in locations like petrochemical complexes, ore processing sites and food processing sites in order to measure the volume of stockpiles kept inside the warehouses. The VM3D system is not meant to be moved from site to site and serves no useful stand-alone purpose.

4.9 Laser Safety

The VM3D scanner uses a near infrared laser for distance measurements. The VM3D scanner is classified as a class 1M laser device according to IEC60825-1, Ed 1.2, 2001-08. Class 1M devices are considered eye safe and cannot lead to eye injury unless an optical instrument that focuses down the energy is used.

- Wavelength 905 nm
- Peak power 24 W
- Average Power 12 mW
- Pulse Duration 20 ns
- Pulse rep frequency 25 khz
- Pulse energy 50 nJ
- Beam diameter 20 mm
- Divergence \( \Delta < 0.3^\circ \)

Class 1M laser product according to IEC60825-1, Ed 1.2, 2001-08 during all procedures of operation:
Laser radiation, do not view directly with optical instruments (binoculars, telescopes, magnifying lenses)
4.10 Labels and Label Placement

Figure 4-1 VM3D Scanner Name Plate, located on top part of scanner (Certifications Pending)

Figure 4-2 VM3D Scanner Laser warning, located on bottom part of scanner near aperture (Certifications Pending)

Figure 4-3 Company Logo

Figure 4-4 Location of VM3D Scanner Labels
Figure 4-5 VM3D Control Box-General Purpose Name Plate, located on the front cover of the control box, refer to Figure 5-5

Figure 4-6 VM3D Control Box-EX Name Plate, located on the front cover of the control box, refer to Figure 5-5
5.0 Installation

Installation of the VM3D system consist of

- installing the control box typically on a wall
- wiring inside the control box
- connecting power to the control box
- installing the VM3D scanners at their predetermined locations
- connecting cables (power and Ethernet) between the VM3D scanners and control box
- connecting the antenna

These steps are described in detail in following sections. Prior to installation, the locations of the control box and the scanners need to be determined taking into consideration the 100 m (328 ft) cable limit.
5.1 General information
The VM3D Volumetric Laser Scanner System is an optical, line of sight device that is used for non-contact volume measurement. The scanner should be placed to minimize obstacles between it and the stockpile being monitored.

5.2 Unpacking
The VM3D Volumetric Laser Scanner System, composed of the VM3D control box and one or more VM3D scanner(s), is supplied in cardboard containers with internal shock absorbing packaging. Always transport the VM3D system in the packaging supplied to reduce the chance of damage.

5.3 Handling
The product is designed to withstand many industrial environmental conditions. However, a few handling precautions will ensure reliable operation of the unit for many years to come:
- DO NOT DROP THE VM3D SCANNER or VM3D Control Box.
- Do not open when an explosive dust atmosphere is present.
- Remove dirt or dust from glass lenses of the VM3D scanner with a clean, damp cloth. Avoid oily rags.
- Always turn off power at the electrical panel before doing any installation or maintenance.
- Use a 12 x 12 x 300 mild steel bar to open and close the VM3D scanner’s wiring compartment.
- Care must be taken to keep the seal of the VM3D scanner clean and lightly lubricated with Vaseline®.
- Do not expose the inside of the VM3D control box or of the VM3D scanner to any liquids or dirt.
- Ensure that the cable glands are tight after connecting the external cables.
- Ensure that the lid of the terminal compartment is tight after connections have been made.
- Do not point the VM3D scanner at the sun.
- Store in a cool dry place.
- Do not apply force to moving parts.
- Do not look directly at the VM3D scanner with optical instruments such as binoculars or a telescope.
- The use of an anti-static wrist strap is recommended when VM3D Control Box cover or VM3D Scanner compartment are open.

5.4 Environmental Conditions
The VM3D Laser Scanner System should be installed in an area that complies with the specified specifications, refer to 7.0 Technical Specifications. Direct exposure to the sun may require a sun shield for the VM3D scanner as well as for the VM3D control box to prevent overheating. When installed, the VM3D scanner should be accessible for commissioning, programming and troubleshooting if necessary.

5.5 Alignment
The VM3D scanner is simple to install and align. The VM3D scanner requires a clear line of sight to the stock pile to be measured and should be mounted vertically.

5.6 ESD (Electro Static Discharge) and Lightning Strike / Event
The VM3D laser scanner system uses electronic components that can be damaged by lightning strikes or static electricity present in most work environments. In order to protect the VM3D system components from such hazards, make sure it is connected to a good ground earth, that all electrical connections are tight, that appropriate surge protection circuits are installed and that lightning rods are used if the equipment is to be mounted at high exterior locations.

5.7 Earthing
The ground conductor from the distribution panel to the VM3D control box is used as the main ground of the VM3D system. The external side-screw is for local grounding, to be wired to a grounded structure.
5.8 Cables and connections
Use only braided shielded cables (AWG16 or 1.5 mm² multi-core cables recommended) that are rated for exposure to direct sunlight and chemicals potentially present in the stockpile area for power distribution and Ethernet. The use of cable conduits is recommended to reduce risks of mechanical or chemical damage to cables. Care should be taken when laying out cables to respect the maximum bending radius and avoid high voltage electrical circuits.

5.9 Special Conditions of Safe Use
- Do not open the terminal compartment when an explosive dust atmosphere is present.
- Appropriate insulated lugs or ferrules shall be used for connections to the terminal blocks and screws.
- Use only the cable glands supplied with the system.

5.10 VM3D Scanner Dimensions

Figure 5-1 VM3D Scanner Dimensions
5.11 VM3D Scanner Installation

The VM3D Scanner should be installed above a stock pile, the laser head pointing downwards towards the surface of the material to be measured. If the VM3D Scanner is installed outside, a sun screen should be in place to protect it from direct sunlight which can cause it to overheat.

The VM3D Scanner must be mounted at a location with minimal wind or vibrations and high enough so that a clear and constant view of the surface is obtainable. This is particularly important when the warehouse or silo is full otherwise “shadows” can occur during the scanning process which will lead to an overestimation of the material volume.

It is recommended that the VM3D Scanner be installed with a metallic mounting flange, based on the diagram on page 13. This flange should be relatively flat. The system’s accuracy is impacted by the anchor stiffness. No visible jitter due to anchor weakness should be perceptible in normal operation. The mounting surface should be relatively flat (surface flatness better than 0.25 mm (0.01 in) recommended) and free from debris prior to installation. Four (4) M12 x 1.75mm pitch fasteners grade 8.8 or SAE fasteners 1/2-13 grade 5 or higher are to be used with either a threaded flange or nylon locking nuts.

In order to avoid galvanic corrosion issues and preserve assembly integrity, galvanized fasteners, nuts and washers are preferred to stainless steel hardware.

If the mounting flange includes threads, the threads shall be dimensioned according to the fastener grade to preserve assembly integrity at installation and over time. Always use washers under fasteners heads and nuts. Use zinc plated DIN 125 or SAE standard washers.

The length of the fasteners shall be determined based on the thickness of the mounting interface in order to have at least two full threads protruding over the nylon locking element of the nuts. Assembly torque for typical M12 x 1.75mm pitch grade 8.8 fasteners is 85 N·m. Use the same value for SAE 1/2-13 grade 5 fasteners.

Local regulations shall be followed with regards to environmental loads such as seismic loads, ice, wind, etc. Proof testing the mounting bracket considering maximum recommended environmental loads is imperative to guarantee safe installation.

5.12 Electrical Connections of the VM3D Scanner

Use only the circled connections

![Figure 5-2 Electrical and wiring connections](image)
5.13 Mounting plate

ABB does not supply standard mounting hardware for the VM3D as each installation is different. However, mounting brackets should be based on the following suggested mounting plate design. The VM3D control box comes with hardware for standard wall mounting.

Use at least 6.35 mm (0.25 in) thick steel plate
5.14 VM3D Control Box Installation

The VM3D box is available in three versions; i.e. one standard version for use in a safe environment and two versions for use in a hazardous area. Of the latter, one model is painted steel and one model is stainless steel for corrosive environments. The VM3D control box is delivered fully assembled. Open the cardboard box and take out the VM3D control box. The procedure with detailed instructions on how to install the VM3D control box on the wall are inside the control box. Refer to picture 5-4 and 5-5 for dimensions. Use a sun shield to avoid exposing the control box to direct sunlight if it is mounted outside.

5.14.1 VM3D Control Box - Steel for general purpose

The VM3D Control Box weighs 12 kg. ABB recommends the use of a lift or the help of another person to lift the VM3D Control Box. Make sure to use proper body mechanics (bend your knees) when lifting the VM3D Control Box to avoid personal injuries.

The VM3D control box must be connected to a circuit breaker on a dedicated circuit in the plant's electrical distribution panel. The circuit breaker must be within easy reach of the operator and clearly marked as the power disconnecting device for the VM3D system.

Figure 5-3 Dimensions of VM3D Control Box - Steel General purpose

Figure 5-4 VM3D Control Box Dimensions for installation
The VM3D Control Box version for hazardous areas (either painted steel or stainless steel) has to be properly grounded. To assure the proper grounding, one nylon washer was removed from its fastener of each gland plate at factory. Refer to below picture for details. Refer to above drawing for torque details.
Once the VM3D control box is installed on the wall, the antenna and wiring have to be connected, i.e. Ethernet and power cables from the VM3D scanners to the VM3D control box and mains power to the control box. One VM3D control box can control up to 4 scanners. The VM3D Control box has been designed to be powered as soon as power is turned on at the plant’s circuit breaker.

Prior to opening the door of the VM3D control box or performing any maintenance on the VM3D system, power must be disconnected at the circuit breaker in the plant’s electrical distribution panel. Access to the breaker located in the plant’s distribution panel must not be hindered in any way; do not obstruct the door opening, do not position equipment that obstructs access to the circuit breaker, leave 350 mm (14 in) clearance above the panel.

Figure 5-9 VM3D Control Box Connectors
ABB recommends the following cables and connectors:

<table>
<thead>
<tr>
<th>Item</th>
<th>Specifications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ethernet cable</td>
<td>Belden 7939A 7939A -40°C with shield, stranded, bonded, OD 0.315in</td>
</tr>
<tr>
<td>Ethernet connectors</td>
<td>RJ45 shielded connector for AWG 24-26 Stranded wires</td>
</tr>
<tr>
<td>Power cable (from control box to scanners)</td>
<td>16 AWG, 105°C or +, 3 conductors shielded</td>
</tr>
<tr>
<td>Antenna cable</td>
<td>LMR-400 low-loss coaxial cable</td>
</tr>
</tbody>
</table>

5.15 Wiring inside the VM3D Control Box

Once the VM3D control box is installed and the power and Ethernet cables are laid out in the plant, the cables need to be passed through the cable glands, the Ethernet connectors need to be crimped on and the electrical connections inside the control box need to be completed. Refer to the wiring diagram for details (Figure 5-10).

Prior to completing the electrical connections inside the VM3D control box, make sure that the power is interrupted at the circuit breaker in the plant’s electrical distribution panel. Wiring inside the VM3D control box needs to be done by qualified personnel only. The length of power input AC wires inside the VM3D Control Box enclosure shall be at least 150 mm (6 inches) long. Some strain relief needs to be applied on all wires during installation. Wire identification shall meet the requirements of the local/national electrical code. The layout inside the VM3D control box must not be altered. The input ground conductor must be connected to the plate at the designated areas as identified in the wiring diagram.

The VM3D Control box uses CE and ATEX certified cable glands. The VM3D control box itself is delivered with cable glands for power and Ethernet. Each VM3D scanner is delivered with 4 1/2" NPT cable glands. Two cable glands are used to connect power and Ethernet to the VM3D scanner and two for connection to the control box. At delivery all cable gland entries are protected. When installing them, make sure to fold the cable shield over the O-ring which presses the braiding against the inside wall of the body, this ensures good electrical contact.

ABB will not assume any responsibility for any cable glands other than the ones supplied with the VM3D system. Cables glands not designed for braided shielded cables or cables glands lacking ATEX and CE certifications should never be used.

ABB recommends the use of metal cable conduits for wiring particularly if some parts of the installation are outside. If metal conduits are not used, ABB recommends the use of surge/lightning protectors. Ignoring these recommendations could result in permanent damage to the VM3D system and may void the warranty. Contact ABB for more information on surge and lightning protection, refer to the back cover of this manual for contact information.

The VM3D control box comes with two surge/lightning protectors for the 3G cellular antenna cable. One of the surge protectors is permanently mounted to the control box, and the other one is meant to be installed at the point where the antenna cable enters the building if the antenna is mounted outside. Properly grounded lightning protection is typically required for any cables entering a building from outside. Refer to the antenna installation section for more details.
Figure 5-10 Wiring diagram
5.16 Fuses
The AC input power is protected by means of a circuit breaker and the output power for the VM3D scanners is protected with fuses, refer to the wiring diagram. Spare fuses are supplied with the VM3D control box; they are located inside the control box in a spare fuse box. Make sure only the correct fuses are used; 2A/250V fast (5x20 mm).

5.17 Antenna Installation
Proper installation of the antenna is an important aspect to the correct function of the VM3D system. Below are instructions on how to safely install the antenna. In addition to the general safety instructions in this manual you must observe all local plant safety procedures and safety laws applicable to your country.

The easiest way to install the antenna is on top of or nearby the VM3D Control Box. Make sure to properly ground the antenna through the VM3D Control Box frame ground.

If the VM3D system does not function with the antenna in this configuration, for example if the building blocks radio transmissions, the antenna will have to be installed at a high point outside the building. The location of the antenna installation should be selected for maximum signal strength.

Most countries require properly grounded surge/lightning protector to be installed when a cable enters a building. Make sure to comply with the national building codes and electrical standards. Note that the cable supplied with the antenna is not weatherproof. For outdoor installation use an appropriate cable, refer to Section 5-14 for cable recommendations.

If the antenna has to be installed on a structure like a mast or a tower, make sure to build the structure according to the safety standards in your country and to have the antenna installed by qualified personnel.

The antenna supplied by ABB with the VM3D system offers a 360-degree radiation pattern that will function in most medium to high population density areas. If the installation site is very remote and the 3G signal is weak you may require a directional antenna. Contact ABB more information on alternate antennas, see back cover for contact information.
### Antenna Details

<table>
<thead>
<tr>
<th><strong>Antenna</strong></th>
<th><strong>Details</strong></th>
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<tbody>
<tr>
<td>Manufacturer</td>
<td>Terra Wave</td>
</tr>
<tr>
<td>Manufacturer Part Number</td>
<td>M4030030O10006T</td>
</tr>
<tr>
<td>Antenna type</td>
<td>Omnidirectional</td>
</tr>
<tr>
<td>Operating frequency range</td>
<td>824 – 2500 Mhz</td>
</tr>
<tr>
<td>Nominal input impedance</td>
<td>50 ohms</td>
</tr>
<tr>
<td>Gain</td>
<td>3 dBi</td>
</tr>
<tr>
<td>Maximum Power input</td>
<td>100 W</td>
</tr>
<tr>
<td>Vertical Beamwidth</td>
<td>50°</td>
</tr>
<tr>
<td>Horizontal Beamwidth</td>
<td>360°</td>
</tr>
<tr>
<td>Polarization</td>
<td>Vertical</td>
</tr>
<tr>
<td>VSWR @ 50 ohms</td>
<td>&lt;= 1.5</td>
</tr>
<tr>
<td>Size</td>
<td>4” x 5” [10.16 cm x 12.7 cm]</td>
</tr>
<tr>
<td>Weight</td>
<td>817g</td>
</tr>
<tr>
<td>Connector</td>
<td>N Jack (female)</td>
</tr>
<tr>
<td>Connector placement</td>
<td>Bottom</td>
</tr>
<tr>
<td>Mount Hardware Inclusive</td>
<td>Yes</td>
</tr>
<tr>
<td>Mount Hardware that fits</td>
<td>1.25” – 2” [3.175 cm - 5.08 cm] Mast</td>
</tr>
<tr>
<td>Wind</td>
<td>193 km/h</td>
</tr>
</tbody>
</table>

General recommendations for antenna installation:
1. Observe all relevant local and national safety procedures, regulation and laws applicable to the installation site.
2. Antenna installation should be done by qualified personnel only.
3. Consider safety and performance when selecting the installation site (away from metals structures like heating and cable ducts...).
4. Plan ahead for the installation; have the necessary machinery to raise the mast or tower on hand, have clear work assignments for all the installation team members, have a supervisor on hand to oversee the installation.
5. The installation should not take place if there is any risk of lightning or strong winds.
6. All the installation team must have appropriate safety gear including but not limited to insulated safety shoes, rubber gloves, high visibility safety vest, safety harness ...
7. During installation do not use a metal ladder. Use a wood or fiberglass ladder instead.
8. If any part of the antenna assembly comes into contact with a power line, make sure all members of the installation team stand back and call the local power utility.
9. Never touch nor let any part of your body touch the antenna when the power is switched on at the VM3D control box circuit breaker in the plant’s distribution panel.

ABB recommends that the antenna be grounded, country regulations regarding antenna grounding must always be observed.

The cable should be kept as short as possible because cable length also determines the amount of signal loss (the longer the run, the greater the loss). ABB recommends using a LMR-400 low-loss coaxial cable between the VM3D Control Box and the 3G antenna.

The surge/lightning protector supplied with the VM3D control box must always be used when the antenna is mounted outside. It is designed to protect radio equipment from static electricity and surges of up to 5kA. This will not provide protection against a direct lightning strike, a lightning rod should be installed to avoid this.

The gas discharge tube inside the surge/lightning protector changes from an open circuit to a short circuit almost instantaneously in the presence of voltage and energy surges, providing a path to ground for the energy surge. Even if the gas discharge tube has a multi-strike capability, the gas discharge tube should be replaced after an event. ABB supplies one spare gas discharge tube located in the VM3D Control Box with the fuses.

Two lightning protectors are supplied with the VM3D Control Box. One is permanently connected to the enclosure, the other is supplied as a front-end discharge unit, intended to be installed just before entering the building. The supplied lightning protector specifications are given in the table below.

The antenna supplied with the VM3D system comes with a mounting bracket and mounting hardware. The antenna should always be mounted vertically with the cable pointing downward. Weatherproofing must be applied at the connection point from the antenna to the antenna cable.
<table>
<thead>
<tr>
<th>Specification</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Manufacturer</td>
<td>L-com</td>
</tr>
<tr>
<td>Manufacturer part number for Lightning arrester</td>
<td>AL-NMNFB-9</td>
</tr>
<tr>
<td>Manufacturer part number for Replaceable 90V gas discharge tube</td>
<td>LPX090</td>
</tr>
<tr>
<td>Frequency Range</td>
<td>0 - 3 GHz</td>
</tr>
<tr>
<td>Connectors Types</td>
<td>N-Male to N-Female Bulkhead</td>
</tr>
<tr>
<td>Protector Complies With</td>
<td>IEC / IEEE Standard</td>
</tr>
<tr>
<td>VSWR</td>
<td>1:1.3 Max</td>
</tr>
<tr>
<td>Insertion Loss</td>
<td>0.4 dB Max (0 - 3GHz)</td>
</tr>
<tr>
<td>Impedance</td>
<td>50 ohms</td>
</tr>
<tr>
<td>Standard Gas Tube Element:</td>
<td>90 V 20%</td>
</tr>
<tr>
<td>DC Breakdown Voltage Indicated</td>
<td></td>
</tr>
<tr>
<td>Gas Tube Impulse Breakdown Voltage</td>
<td>1000 V 20%</td>
</tr>
<tr>
<td>Gas Tube Insulation Resistance</td>
<td>10,000 Mohms</td>
</tr>
<tr>
<td>Maximum Withstand Current</td>
<td>5 KA</td>
</tr>
<tr>
<td>Power Envelope power</td>
<td>20W</td>
</tr>
<tr>
<td>Continuous wave power</td>
<td>10W</td>
</tr>
</tbody>
</table>

### 6.0 Operation

The VM3D system (VM3D scanner(s) and VM3D control box) is set to operate automatically. Once the system is installed and configured, it does not require user intervention for regular operation. The end-user retrieves the computed volume and data from the ABB website, refer to section 9.0 Volume estimation using ABB data center.
### 7.0 Technical Specifications

The electrical specifications are given in the following tables. All values are nominal.

#### Measurement

<table>
<thead>
<tr>
<th>Measurement</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single point range</td>
<td>0.5 m to 93 m (1.5 ft to 305 ft)</td>
</tr>
<tr>
<td>Single point resolution</td>
<td>±10 mm (0.4 in)</td>
</tr>
<tr>
<td>Single point accuracy</td>
<td>±30 mm (1.2 in)</td>
</tr>
<tr>
<td>Coverage</td>
<td>Complete hemisphere scan</td>
</tr>
<tr>
<td></td>
<td>Nominal surface coverage 65m (213 ft) radius circle (90° cone, scanner 65 m (213 ft) above stockpile)</td>
</tr>
<tr>
<td>Accuracy</td>
<td>Less than 2% error on volumes greater than 100 m³ (328 ft³)</td>
</tr>
<tr>
<td>Update rate</td>
<td>Complete scan in under 1 hour</td>
</tr>
</tbody>
</table>

#### VM3D Scanner per control box

| Maximum per control box | 4                                      |

#### Electrical Specifications of VM3D Control Box

<table>
<thead>
<tr>
<th>Specification</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rated input voltage</td>
<td>115/230 VAC</td>
</tr>
<tr>
<td>Line voltage fluctuation</td>
<td>Not to exceed 10% of the nominal line voltage</td>
</tr>
<tr>
<td>Rated frequency</td>
<td>47-63 Hz</td>
</tr>
<tr>
<td>Rated power consumption</td>
<td>500 VA</td>
</tr>
<tr>
<td>Fuse type (output)</td>
<td>2A/250V fast (5 x 20 mm; 0.2 x 0.79 in)</td>
</tr>
<tr>
<td>Output rating</td>
<td>24V, 1A (4x)</td>
</tr>
</tbody>
</table>

#### Mechanical Specifications of VM3D Control Box

<table>
<thead>
<tr>
<th>Specification</th>
<th>General Purpose</th>
<th>Hazardous area (dust ignition protection)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Width</td>
<td>304 mm (12 in)</td>
<td>388 mm (15.28 in)</td>
</tr>
<tr>
<td>Height</td>
<td>508 mm (20 in)</td>
<td>500 mm (19.69 in)</td>
</tr>
<tr>
<td>Depth</td>
<td>224 mm (8.8 in)</td>
<td>205 mm (8.07 in)</td>
</tr>
<tr>
<td>Weight (approx.)</td>
<td>16 kg (35 lb)</td>
<td>17.2 kg (38 lb)</td>
</tr>
<tr>
<td>Enclosure</td>
<td>Mild steel, left hinged door</td>
<td>Painted steel, left hinged door</td>
</tr>
<tr>
<td>Mounting</td>
<td>Wall mount</td>
<td>Wall mount</td>
</tr>
</tbody>
</table>

#### Electrical Specifications of VM3D Scanner

<table>
<thead>
<tr>
<th>Specification</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rated input voltage</td>
<td>18-32V DC (24V typical)</td>
</tr>
<tr>
<td>Current</td>
<td>1.5A peak, 0.65A continuous, 4.5A in-rush at start-up (&lt;100ms)</td>
</tr>
</tbody>
</table>

#### Mechanical Specifications of VM3D Scanner

<table>
<thead>
<tr>
<th>Specification</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overall dimensions (W x H)</td>
<td>190 x 884 mm (7.48 x 34.8 in)</td>
</tr>
<tr>
<td>Weight</td>
<td>12 kg (± 0.5) (26.4 lb)</td>
</tr>
</tbody>
</table>

#### Environmental Specifications

<table>
<thead>
<tr>
<th>Specification</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating temperature range</td>
<td>-20 °C to 50 °C (-4 °F to 122 °F)</td>
</tr>
<tr>
<td>Storage temperature range</td>
<td>-20 °C to 70 °C (-4 °F to 158 °F)</td>
</tr>
<tr>
<td>Pressure</td>
<td>Atmospheric</td>
</tr>
<tr>
<td>Relative humidity</td>
<td>0% to 95%</td>
</tr>
<tr>
<td>Pollution degree</td>
<td>3 Pollution Degree 3: Conductive pollution or dry nonconductive pollution that becomes conductive due to condensation occurs. To be found in industrial environment or construction sites (harsh environments).</td>
</tr>
<tr>
<td>Altitude</td>
<td>Up to 2000 meters (6562 ft)</td>
</tr>
<tr>
<td>IP Rating</td>
<td>IP66 (Dust proof, can be washed down with high pressure hose)</td>
</tr>
<tr>
<td>Over voltage category</td>
<td>II The IEC defined the term Installation Category Overvoltage Category to address transient voltages. Category II = Energy-consuming equipment to be supplied from the fixed installation.</td>
</tr>
</tbody>
</table>
8.0 Maintenance, Service & Repair

There are no field serviceable parts in the VM3D scanner, all scanner service and repair must be carried out at the factory.
All service and repair on the VM3D control box must be carried out by authorized factory trained personnel.

The VM3D system does not require any scheduled maintenance to maintain specifications. The only maintenance consists in cleaning the lenses if dust or dirt accumulates on them and changing fuses and/or gas discharge tubes on occasion.

High Voltage
Disconnect power at the VM3D system dedicated circuit breaker in the plant’s electrical distribution panel before opening the VM3D control box.

8.1 Fuse replacement
Fuses are to be replaced as soon as they are blown. Spare fuses are available in a duly identified box inside the VM3D Control Box. Use only fuses as specified 2A/250V fast (5x20 mm). Make sure to restock with spare fuses after each use.

8.2 Cleaning
To ensure long-term reliability and performance of the VM3D scanners, the external moving parts of the body and laser head should be cleaned regularly. In particular the spaces between the moving head and the scanner arms can get clogged with dirt and should be regularly cleaned with a paintbrush.
Use a soft, lint free cloth to wipe off any buildup of dust and dirt on the VM3D scanner lenses. Periodic inspection of the lenses is recommended. The higher the dust level or environmental exposure the more frequent these inspections should be.
Ensure that the O-ring seal on the enclosure lid is kept clean and free from dust particles. Vaseline® should be used as a lubricant for the O-ring.

The VM3D Volumetric Laser Scanner System does not contain user serviceable parts and there is no service allowed by the customer. Service is only to be handled by authorized FACTORY TRAINED PERSONNEL. Please contact ABB, refer to back cover for contact details.

Before Contacting ABB
If you are unable to solve a problem contact ABB. Before contacting ABB, please check the following:
- All cables are properly installed.
- The operation indicator on the electronic module is ON.
- Check for proper voltage AC input and DC output power supply.

Before returning a VM3D scanner or control box to ABB for service, you must first:
- Obtain a Contamination Data Sheet from ABB’s after sales service.
- Fill out and sign the Contamination Data Sheet. Do not forget to check the checkboxes of the Non-contaminated Material Declaration section. Then return the fully completed Declaration to ABB.
- Obtain the authorization from ABB personnel. You must receive a Return Merchandise Authorization (RMA) prior to sending the analyzer back to ABB, otherwise reception of equipment will be refused.

8.3 Repacking
To prepare the VM3D scanner or control box for shipment, perform reverse procedure of Unpacking on page 10. Make sure to pack the VM3D Volumetric Scanner system in its transportation box with the internal shock absorbing packaging.
9.0 Volume estimation using ABB data center

The VM3D system transmits the raw point cloud over the 3G cell phone network to the ABB data center where the point cloud is intelligently analyzed to produce a picture of the stockpile and an estimate of the volume and mass it contains. The analysis makes use of the building blueprints to determine the depth of the stockpile and avoid having to empty the building to obtain a baseline. This analysis also eliminates artifacts like machinery and visible building structures from the volume estimate even if they move from scan to scan.

The complete data transmission chain uses highly secure encrypted data communications, and ABB will enter into a legally binding agreement with the end user not to reveal any of their confidential inventory information.

To access saved data, go to: www.vm3dabb.com and enter your login details as provided by ABB. Upon successful login, the ‘Site Management’ page is displayed where site information can be accessed/managed as well as Individual stockpile information.

A customer can have multiple sites, each site can have multiple warehouses and each warehouse can have multiple stockpiles that need monitoring. These sites can be separate into physical plants or into ‘areas’ of the same plant. New sites and/or new vessels can be created but must be managed by the Data Centre.

A site/vessel in green indicates that it is selected (i.e. if a site is selected, the vessels displayed will be for that site only). Double-click on a particular site and the relevant information about the site will be displayed, like the geographical location, name, material housed, etc. Double-clicking on a particular vessel displays the relevant information about the vessel, like the name, material housed, specific gravity, vessel dimensions, etc.

Clicking on the vessel name gives further access to the vessel, material, physical dimensions, etc. Also displayed is a list of scanner or scanners and its/their serial numbers that are associated with that vessel. See below screenshots.
All this is populated by the Data Centre but can be edited by the customer. For ease of access, the ‘Latest Scans’ area contains the 5 most recently uploaded scans and the scans can be downloaded directly from here. The Metadata is populated for convenient viewing of data.

3D :: Bunker - Vessel management

Scanned image listing

<table>
<thead>
<tr>
<th>Scan date &amp; time</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>2010/09/10 05:00:00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2010/09/10 05:00:00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2009/08/09 05:00:00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2009/08/08 05:00:00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2009/06/08 05:00:00</td>
<td></td>
<td></td>
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<td>2009/06/07 05:00:00</td>
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<td></td>
</tr>
<tr>
<td>2009/05/24 05:00:00</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Appendix A: Certifications

CE DECLARATION OF CONFORMITY

Manufacturer: ABB Inc.
Address: 585 Charest Boulevard East, Suite 300
         Québec (Québec), G1K 9H4, CANADA

Herewith declares that:

Product: VM3D
         3D Volumetric Laser Scanner System

Model: VM3D Control Box
       VM3D Control Box-EX
       VM3D Scanner

- in accordance with the requirements of the following documents:

- are in conformity with the provisions of the following directives:
  - Low Voltage Directive 2006/95/EC
  - CE Marking Directive 93/68/EEC
  - ATEX Directive 94/9/EC*

- and furthermore declares that the following (parts /clauses of) harmonized standards have been applied:
  - EN 61010-1: 2001 – Safety requirements for electrical equipment for measurement, control and laboratory use. General requirements.
  - EN 61326-1: 2006 – Electrical equipment for measurement, control and laboratory use - EMC requirements.
  - EN 301 489-24 V1.4.1: 2007-09 – Electromagnetic compatibility and Radio spectrum Matters (ERM);
    Electromagnetic Compatibility (EMC) standard for radio equipment and services; Part 24: Specific conditions for IMT-2000
    CDMA: Direct Spread (UTRA) for Mobile and portable (UE) radio and ancillary equipment.
  - EN 301 489-1 V1.9.2: 2011-09 – Electromagnetic compatibility and Radio spectrum Matters (ERM);
    Electromagnetic Compatibility (EMC) standard for radio equipment and services; Part1: Common technical Requirements.

The equipment identified above complies with all the essential requirements of the directives when installed and maintained in accordance to ABB Inc. VM3D Operating instruction OI/VM3D and VM3D Safety Specifications SM/VM3D.

* For the control box only: ATEX certificate valid only with the ATEX certified VM3D Control Box-EX.

Place: Québec (Québec), CANADA

Josée Labrecque
Product Line Manager

Andreas Strauch
ATEX responsible

Marc Corriiveau
General Manager

Date: 03/01/2014

ABB Inc.
### CB TEST CERTIFICATE

**CERTIFICAT D'ESSAI OC**

**Product**  
Power supply equipment  
Control Box

**Name and address of the applicant**  
Name et adresse du demandeur

ABB Inc.  
585 Charest Boulevard East, Suite 300  
Quebec QC G1K 9H4, CANADA

**Name and address of the manufacturer**  
Nom et adresse du fabricant

ABB Inc., 585 Charest Boulevard East, Suite 300, Quebec QC G1K 9H4, CANADA

**Name and address of the factory**  
Nom et adresse de l’usine

ABB Inc., 585 Charest Boulevard East, Suite 300, Quebec QC G1K 9H4, CANADA

**Ratings and principal characteristics**  
 Valeurs nominales et caractéristiques principales

- Rated Input Voltage: 115/230 Vac  
- Rated Frequency: 47.5~63 Hz  
- Rated Input Power: 500 VA  
- Protection Class: I

**Trade mark (if any)**  
Marque de fabrique (s'il en existe)

ABB

**Additional information (if necessary)**  
Information complémentaire (s'il en existe)

ACTL - No CB report provided for the power supply. The acceptance of this CB report is to be determined by the receiving NCB based on the power supply national approvals.

**Modeltype Ref.**  
Ref. de type

VM3D Control Box

**IEC 01610-1:2001**

**Date**  
2013-03-18

**Signature**  
William Stinson  
TÜV SÜD Product Service GmbH - Certification Body - Ridlerstrasse 65 - D-80333 München

This CB Test Certificate is issued by the National Certification Body  
Ce Certificat d'essai OC est établi par l'Organisme National de Certification

Page 1 of 2
Attachment to Certificate CB 13 02 64584 010

ABB Inc.
585 Charest Boulevard East, Suite 300,
Quebec, QC, G1K 9H4, Canada

License Conditions:

1. The equipment has been investigated for IP66, Type 4 enclosure for indoor & outdoor environments, continuous operation in a manufacturer specified maximum operating ambient temperature of 50°C.

2. EMC/EMI not investigated in this report.

3. All warnings and safety-related documentation shall be in a language acceptable to the authority having jurisdiction where the equipment is to be installed.

4. Equipment not evaluated for use in hazardous (classified) environments.

5. Equipment not evaluated for use with flammable liquids or materials.

6. Evaluated for use on branch circuits protected at 20 A, if used on circuits with protection at higher levels, additional evaluation may be required.

7. Equipment intended for field installation by qualified service personnel according to manufacturer's installation instructions and local/national wiring requirements. Strain relief and conduit entry not evaluated. Wiring shall be suitable for strain relief provided. Conduit installation shall be evaluated to clauses 6.10.3ADV.5-6 for Canada, and 6.10.3A.5-6 for the US.

8. Equipment intended to be permanently connected and protected with an appropriate mains disconnect device as part of the building installation.

9. The free length of a lead inside the enclosure shall be at least 5 inches (150mm) as per national differences for Canada (clause 6.10.3ADV.3) and US (clause 6.10.3A.3). Lead identification shall meet the requirements as per national differences for Canada (clause 6.10.3ADV.4) and US (clause 6.10.3A.4). This is to be evaluated in the end system.

10. No CB certificate or report provided for the power supply. The acceptance of this CB report for the end product is to be determined by the receiving NCB based on the power supply national approvals.
CERTIFICATE
No. U8 13 03 64584 013

Holder of Certificate: ABB Inc.
585 Charest Boulevard East, Suite 300
Quebec QC G1K 9H4
CANADA

Production Facility(ies): 64584

Certification Mark:

Product: Power supply equipment
Control Box

Model(s): VM3D Control Box

Parameters:
- Rated Input Voltage: 115/230 Vac
- Rated Frequency: 47-63 Hz
- Rated Input Power: 500 VA
- Protection Class: I

Tested according to:
- CAN/CSA C22.2 No. 61010-1:2004
- UL 61010-1:2004
- EN 61010-1:2001

The product was voluntarily tested according to the relevant safety requirements noted above. It can be marked with the certification mark above. The mark must not be altered in any way. This product certification system operated by TÜV SÜD America Inc. most closely resembles system 3 as defined in ISO/IEC Guide 67. Certification is based on the TÜV SÜD "Testing and Certification Regulations". TÜV SÜD America Inc. is an OSHA recognized NRTL and a Standards Council of Canada accredited certification body.

Test report no.: 240-1209560-000

Date: 2013-03-13
Page 1 of 2
Attachment for Certificate no. U8 13 03 64584 013
Dated 2013-03-13

License Conditions:

1. The equipment has been investigated for IP66 Type 4 enclosure for indoor &
outdoor environments, continuous operation in a manufacturer specified maximum
operating ambient temperature of 50°C.

2. EMC/EMI not investigated in this report.

3. All warnings and safety-related documentation shall be in a language acceptable to
the authority having jurisdiction where the equipment is to be installed.

4. Equipment not evaluated for use in hazardous (classified) environments.

5. Equipment not evaluated for use with flammable liquids or materials.

6. Evaluated for use on branch circuits protected at 20 A, if used on circuits with
protection at higher levels, additional evaluation may be required.

7. Equipment intended for field installation by qualified service personnel according to
manufacturer's installation instructions and local/national wiring requirements. Strain
relief and conduit entry not evaluated. Wiring shall be suitable for strain relief
provided. Conduit installation shall be evaluated to clauses 6.10.3ADV.5-8 for
Canada, and 6.10.3A.5-6 for the US.

8. Equipment intended to be permanently connected and protected with an appropriate
mains disconnect device as part of the building installation.

9. The free length of a lead inside the enclosure shall be at least 6 inches (150mm) as
per national differences for Canada (clause 6.10.3ADV.3) and US (clause
6.10.3A.3). Lead identification shall meet the requirements as per national
differences for Canada (clause 6.10.3ADV.4) and US (clause 6.10.3A.4). This is to
be evaluated in the end system.

Test Report No: 240-1209560-000
Page 2 of 2

TÜV SÜD AMERICA INC • 10 Centennial Drive • Peabody, MA 01960 USA • www.TUVamerica.com
Certificate of Compliance

Certificate: 70001535
Project: 70001535
Issued to: ABB Inc.
585 Charest BLVD East
Quebec
PROVINCE QUEBEC
Attention: Mr. Jean Yves Neron

The products listed below are eligible to bear the CSA Mark shown with adjacent indicators 'C' and 'US' for Canada and US or with adjacent indicator 'US' for US only or without either indicator for Canada only

CSA
C
US

Issued by: E. Giusti
E.GIUSTI

PRODUCTS
CLASS 2258 02 - PROCESS CONTROL EQUIPMENT - For Hazardous Locations
CLASS 2258 82 - PROCESS CONTROL EQUIPMENT - For Hazardous Locations - Certified to US Standards

Class II, Division 1 Groups E, F and G; Class III;
Ex tb IIIC T85°C;
Zone 21, AEx tb IIIC T85°C ;

Volumetric Laser Scanner System model VM3D. The system consists of one (1) VM3D Control Box-EX and up to four (4) VM3D Scanners.
Input rated 115 – 230VAC, 47 – 63Hz, 500VA and output rated 24VDC, 1.5A peak, 1.0A continuous for each scanner (up to 4).

Ethernet communication circuit (one per scanner) is available as well.

Ambient temperature range: -40°C ... +60°C
APPLICABLE REQUIREMENTS

CAN/CSA C22.2 No. 0-M1991 - General Requirements - Canadian Electrical Code, Part II
CAN/CSA 61010-1 Ed.2 - Safety Requirements for Electrical Equipment for Measurement, Control, and Laboratory Use - Part 1 General Requirements
CAN/CSA 60079-0:11 - Electrical apparatus for explosive gas atmospheres – Part 0: General requirements
CAN/CSA-60079-31:12 - Explosive atmospheres — Part 31: Equipment dust ignition protection by enclosure “t”
CAN/CSA 60529:2005 - Degrees of Protection Provided by Enclosures (IP Code) (identical national adoption)
ANSI/ISA-61010-1 (82.02.01): 2004 - Safety Requirements for Electrical Equipment for Measurement, Control, and Laboratory Use - Part 1 General Requirements
ANSILSA 60079-0 (12.00.01): 2009 (IEC ed.4 2009 mod.) - Electrical Apparatus for Use in Class I, Zone 0, 1 & 2 Hazardous (Classified) Locations: General requirements
ANSILSA-60079-31 (12.10.03)-2009 - Explosive atmospheres — Part 31: Equipment dust ignition protection by enclosure “t”
ANSILIEC 60529:2004 - Degrees of Protection Provided by Enclosures (IP Code) (identical national adoption)

MARKINGS

The following markings appear in a permanent and visible manner on each product, on CSA Accepted label(s):
(1) Submitter’s name
(2) Model number
(3) Serial number or date code
(4) Electrical rating
(5) Hazardous location designation
(6) CSA monogram
(7) Temperature code rating
(8) Ambient temperature range

Warning labels: The following markings and cautions appear in a permanent manner.

CAUTION: DO NOT OPEN WHEN EXPLOSIVE ATMOSPHERE IS PRESENT OR WHEN ENERGIZED

WARNING: SUBSTITUTION OF COMPONENTS MAY IMPAIR SAFETY

Note: (Bilingual Markings)
Jurisdictions in Canada may require these markings to be also in French. It is the responsibility of the customer to provide bilingual marking, where applicable, in accordance with the requirements of the Provincial Regulatory Authorities. It is the responsibility of the customer to determine this requirement and have bilingual wording added to the "Markings".
Supplement to Certificate of Compliance

Certificate: 70001535  Master Contract: 155295

The products listed, including the latest revision described below, are eligible to be marked in accordance with the referenced Certificate.

<table>
<thead>
<tr>
<th>Project</th>
<th>Date</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>70001535</td>
<td>December 20, 2013</td>
<td>Original Certification.</td>
</tr>
</tbody>
</table>
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