PROPOSAL FOR
Moraine Park
Technical College

4.5.4 SF

10-25-2015

HEXAGON
METROLOGY
10-25-2015

Tom Roehl  
Moraine Park Technical College  
235 North National Ave.  
Fond Du Lac, WI 54936-1940

PROPOSAL NO: Moraine Park Technical College 454 SF FDL Rev2

Dear Tom:

Thank you for the opportunity to propose the 454 SF to you. We are confident it will meet your application requirements and provide years of reliable service.

Our commitment to producing accurate and reliable CMMs is recognized around the world. Our installed base encompasses millions of tools and machines, and tens of thousands of seats of software. Hexagon Metrology offers products and services for metrology applications in over 200 industry segments. We support our customers with actionable measurement information throughout the complete life cycle of their products – from development and design to production, assembly and final inspection. We empower our customers with control of their manufacturing processes, enhance the quality of their products and increase efficiencies in their manufacturing plants anywhere in the world.

We hope the following proposal will prove favorable to you. It will remain valid for 60 days. Hexagon Metrology, Inc. standard terms and conditions will apply.

We offer comprehensive support to our customers. Please visit the following sites for more information:

Online Support  
HexagonMetrologyU  
Online Store

For any additional question you might have, please do not hesitate to contact me or our office anytime. We look forward to being your partner in all your measurement needs.

Sincerely,

Rick Schaffer  
District Sales Manager  
262-392-3500
I. SYSTEM SUMMARY

MACHINE
The 4.5.4 SF CMM offers a robust dimensional inspection capability in a fully automated and economical CMM designed and built to excel in harsh manufacturing environments, shoulder-to-shoulder with machine tools. Linear bearings and heavy-duty components provide you with a highly reliable, low maintenance measurement solution.

- 4.5.4 SF Metrology Frame
- UMP-360 Controller
- Next Jog Box
- HH-MI Probe Head
- Accessory Kit 3 - M3
- Fixture Starter Kit including 32 Elements and Baseplate
- LED Workspace Illumination
- Z-212 Granite Surface Plate Cleaner (ground shipment only)
- Probe Qualification Sphere
- Demonstration Block

COMPUTER & SOFTWARE SYSTEM
The computer and software offering have been optimized for walk up and measure operations. Computer and software upgrades are available for part programming environments.

- Dell T3610 or current model
- 24” LCD Touch Screen
- PC-DMIS Cad

SERVICE & SUPPORT

- Installation¹
- Onsite Performance Verification²
- Online Help Files, PC-DMIS
- System User’s Manual on CD
- PC-DMIS Cad Training (one student for five days at Hexagon Metrology)³
- One Year System Warranty with Telephone Applications Support⁴

¹ Customer should uncrate and move the CMM to the intended installation location at least 24 hours prior to arrival of the Hexagon Metrology service technician in order for the machine to reach ambient temperature. If the customer requires, Hexagon Metrology can provide this service for an additional fee (see quotation for details).

² Upon completion of the measuring system installation, a technician will verify performance to either ISO or ASME B89 standards.

³ Software training credits are valid for one year from the date of shipment and do not include travel and living expenses of attendees.

⁴ Successful completion of the basic PC-DMIS software training is prerequisite for telephone applications support.
II. TERMS OF QUOTATION

BASIC SYSTEM PRICE $49,734.00
Educational Pricing $44,760.00

NOTE: Hexagon offers an educational Incentive with the purchase of the CMM up to 20 seats of off-line software at No-Charge.

Purchase Orders made to: Hexagon Metrology, Inc.
250 Circuit Drive
North Kingstown, RI 02852

Terms & Conditions: Hexagon Metrology, Inc. Standard Terms & Conditions Apply; any sale is expressly conditioned on acceptance of such terms. The Standard Terms & Conditions and Third Party Software Terms & Conditions, are viewable at: www.hexagonmetrology.us/terms

CAGE CODE: 1WUK4

DUNS #: 02 6146535
Submit PO To: Hexagon Metrology, Inc.
Email: cos.hmi.us@HexagonMetrology.com
FAX: (401) 886-2768

Tax Exemption: If applicable, a Tax Exemption Certificate must be submitted to Hexagon Metrology, Inc. with the Purchase Order

Delivery: 4 to 6 weeks for standard configurations, plus time for shipping, A.R.O., to be confirmed at the time of order placement

Shipping Terms: Prices quoted are F.C.A. (“free carrier at”) North Kingstown, RI in accordance with the International Chamber of Commerce INCO Terms 2010.

Title Transfer: Title transfers to Buyer upon shipment from factory of origin including all risks and rewards of ownership

Quotation Validity: 60 Days
Remit Payment Only To: Hexagon Metrology, Inc.
Lockbox No. 771742
1742 Solutions Center
Chicago, IL 60677-1007
III. CUSTOMER QUOTATION DETAILS

INCLUDED IN PACKAGE

4.5.4 SF
The 4.5.4 SF is like a machine tool for quality control—no other CMM performs like it in tough shop-floor conditions. The SF series draws its design inspiration from over fifteen years of shop floor machine production experience and thousands of units in the field worldwide. It is designed from the ground up to surpass the demanding requirements of shop floor users. This rugged CMM excels in the harsh environment of machine shops and manufacturing cells with advanced thermal compensation, covered ways, built-in vibration resistance and shop-hardened design. It's flexible — using standard 110/220 volt outlets with no need for shop air. The compact footprint and roll-around stand, specifically designed to fit through a standard door, lets users easily move the SF series anywhere in the shop where precise dimensional inspection is required. It's economical to own and operate, with low up-front cost and simple maintenance. Gaining immediate insight into quality control helps you react quickly to process variations, reducing scrap and increasing productivity.

UMP-360 Control System
Controller electronics supports touch-trigger capability and temperature compensation models on Global Classic systems. The UMP-360 is also compatible with the jog box which comes standard with all Global CMMs. The UMP-360 comes in a compact IP-32 rated electrical cabinet that is mounted to the back of the machine.

Next Jog Box (NJB)
Our new jog box with ergonomic design and improved durability. NJB system comes packaged with a cradle and cradle holder to allow for a safe placement when not in use.

Replace the HH-T with the HH-MI
The HH-MI is a manual indexable probe head with an integrated probe. HH-MI features repeatable indexing coupled with a high precision integrated touch trigger probe. The indexing capability in 15° increments in both axes allows the stylus to swivel through 168 positions without the need for recalibration. Indexing between positions is an easy, one-handed operation; tactile and visual feedback lets you know when the probe is ready to measure.

Accessory Kit 3 - M3
M3 threaded stylus kit includes:
(Qty. 1) Mounted probe Ø 6.35 mm
(Qty. 1) Ball stylus Ø 2 mm x L 21 mm, Steel
(Qty. 1) Ball stylus Ø 3 mm x L 21 mm, Steel
(Qty. 1) Ball stylus Ø 4 mm x L 21 mm, Steel
(Qty. 1) Extension L 10 mm, Steel
(Qty. 1) Extension L 20 mm, Steel
(Qty. 1) 5-way stylus center, Steel
INCLUDED IN PACKAGE

PC-DMIS CAD and Autopath
PC-DMIS CAD lets customers create inspection programs and evaluate measurement results taking full advantage of their CAD models. The software provides the tools needed to work with CAD files ranging from simple 2D drawings through complex 3D solid models. Includes the PC-DMIS Autopath module – exciting new measurement software technology that automatically optimizes feature measurement and probe path creation. Includes PC-DMIS CAD training which is a five day class for one operator at a Hexagon Metrology Training Facility (travel expenses excluded). Requires computer upgrade to Dell Precision T3610.

Measurement Volume Lighting - LED Lighting
Sometimes measuring tasks require a brightly illuminated work area. Rather than improvise fixed or handheld solutions, this feature provides an engineered solution to illuminate the 4.5.4 SF measuring volume with bright LED lights that turn on automatically when the CMM is powered on.

Standard Steel Qualification Sphere

Fixture Starter Kit including 32 Elements
A simple to use fixturing system, that is made up of a base plate with threaded inserts and a number of components with various tip options that allow quick and easy assembly. One of the nice features of this system is it is expandable by using extra base plates that are especially designed to easily connect.

This is a great productivity tool that allows customers to build fixtures in minutes, that are reproducible and repeatable. Enabling programs to be executed without the need for any manual intervention.

Includes:
- (Qty. 2) Tension Clamp Medium
- (Qty. 2) Tension Clamp Posts
- (Qty. 1) Slider Block
- (Qty. 3) Stand Off Flat Magnet
- (Qty. 4) Cones Nylon
- (Qty. 1) Starter Case
- (Qty. 1) User Guide
- (Qty. 1) Thumbscrew M8
- (Qty. 2) Ø16 x 20 Stand Off
- (Qty. 2) Ø16 x 30 Stand Off
- (Qty. 2) Ø16 x 50 Stand Off
- (Qty. 2) Ø20 x 20 Stand Off
- (Qty. 2) Ø20 x 30 Stand Off
- (Qty. 2) Ø20 x 50 Stand Off
- (Qty. 2) Stand Off Pin
- (Qty. 2) Baseplate Retainers
- (Qty. 1) Baseplate 300 mm x 400 mm x 12 mm thick with Alphanumeric legend identification and holding plates

Z-212 Granite Surface Plate Cleaner
Hexagon’s recommended product for keeping your CMM granite surface plate clean and protected (ground shipment only; this item cannot be shipped by airplane or boat).

Included: One eight ounce can*

*NOTE: See ‘Machine Options’ for additional order information
INCLUDED IN PACKAGE

Dell Precision T3610 or current model

PROCESSOR: Quad Core XEON E5-1607, 3.0GHz, 10MB
RAM: GB DDR3, 1600MHz, NECC, 4x2GB
HD: 600GB, SAS, 2.5", 10,000rpm
DVD: 16X DVD+/-RW
GRAPHICS: 2GB nVIDIA Quadro K2000, 2DP and 1DVI
MOUSE: Dell MS111 USB Optical Mouse
OS: Windows 7 Professional, 64-bit
LAN: 2 Gigabit Ethernet Ports
PORTS: 1 Serial Port

24” Flat Panel LCD Monitor
- Dell UltraSharp U2412M LCD Monitor, 0.27 mm pixel pitch
- 1920 x 1200 resolution at 60 Hz
- Only available when monitor / keyboard arm is purchased
## MACHINE OPTIONS

<table>
<thead>
<tr>
<th>Option</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Hard Copy Manuals</strong></td>
<td>$210 per manual</td>
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<tr>
<td>All manuals are provided on CD-ROM with every system. Hard copy manuals are also available as an option for this nominal charge.</td>
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<tr>
<td><strong>Site Vibration Survey</strong></td>
<td>$4,120</td>
</tr>
<tr>
<td>A vibration site survey must be conducted prior to purchasing an isolation system. The price includes the physical survey within the United States and analysis of the test data.</td>
<td></td>
</tr>
<tr>
<td><strong>Pre-Installation Support</strong></td>
<td>$1,680</td>
</tr>
<tr>
<td>The 4.5.4 SF CMM should be uncrated and moved by the customer to the installation location at least 24 hours prior to arrival of the Hexagon Metrology service technician in order for the machine to reach ambient temperature, required for performance verification. If the customer requires, Hexagon Metrology can provide this service for an additional fee (see above). This service does not include rigging support, which the customer must provide.</td>
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<tr>
<td><strong>Active Vibration Isolation System</strong></td>
<td>On Request</td>
</tr>
<tr>
<td>A site vibration survey is recommended to determine if the proposed installation site meets the vibration requirements detailed in the “4.5.4 SF Site Preparation Manual”. If the vibration site survey uncovers a vibration problem at the proposed installation site, we may be able to offer a solution in the form of an active vibration dampening system. Vibration isolation systems may only be quoted once a vibration site survey has been performed and the results sent to Hexagon Metrology, Inc. for review. The use of a vibration isolation changes the working and overall heights of the CMM.</td>
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<tr>
<td><strong>Additional Z-212 Granite Surface Plate Cleaner</strong></td>
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</tr>
<tr>
<td>Hexagon’s recommended product for keeping your CMM granite surface plate clean and protected (ground shipment only; this item cannot be shipped by airplane or boat). If you wish to purchase additional Granite Cleaner, please visit our web store at <a href="https://store.hexagonmetrology.us/">https://store.hexagonmetrology.us/</a></td>
<td></td>
</tr>
<tr>
<td><strong>Message Lighting</strong></td>
<td>$1,500</td>
</tr>
<tr>
<td>This option provides the user with a unique user interface to the current status of the CMM. With bright colored LED lights mounted in the Z cover, the user is provided with a glance-able, at a distance view of the status of the CMM. The LED status lights switch between colors to present the status.</td>
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<tr>
<td><strong>Monitor / Keyboard Arm</strong></td>
<td>$2,499</td>
</tr>
<tr>
<td>This option moves the monitor mount from the end of the left Y axis beam to an arm that accommodates either a touch screen or LCD monitor and a wireless mouse and keyboard. Ideal for programming or program modifications at the machine. 21.5” LCD monitor included. Monitor upgrades appear in computer upgrade section.</td>
<td></td>
</tr>
</tbody>
</table>
SOFTWARE UPGRADES AND OPTIONS

Additional Software Training
Additional classroom training for operators and programmers is available at the many Hexagon Metrology Training Facilities around the nation. Price is per student per class and excludes students travel expenses. Classes can be scheduled Training/Course Catalogue:

PC-DMIS PRO DCC Software Training (101 and 102 - 4 Days) $1,440
PC-DMIS CAD Level 1 DCC Software Training (101, 102 and 103 - 5 Days) $1,800
PC-DMIS CAD++ Level 2 DCC Software Training including Training for touch-trigger probes (201 and 202 - 4 Days)* $1,440

*Note: It is recommended that a customer completes PC-DMIS CAD training prior to attending a PC-DMIS CAD++ Class.

SOFTWARE UPGRADES AND OPTIONS

PC-DMIS Offline Software License - Single
Use an offline software license to create part programs while the CMM is being used to measure parts. This special price is valid with the sale of a new CMM and includes the Autopath Bundle.

CAD Offline $7,900
CAD++ Offline $12,900
HEXAGON METROLOGY ONLINE COURSES

Hexagon Metrology is the largest source of PC-DMIS training anywhere, and the only official factory training source for PC-DMIS in the USA. Our full time staff of instructors is uniquely qualified to teach practical dimensional metrology skills such as PC-DMIS programming, CMM operation, CMM maintenance and metrology integration.

Our eLearning courses concentrate on supplemental metrology skills development, and are intended as a complement to classroom training.

Learn more by clicking on this link here: Video and Introduction: HexagonMetrologyU

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**Special offer:**

We are offering one of any of the following on-line Hexagon Metrology University classes at no additional charge with the purchase of a new CMM. These on-line classes are a great way for customers to get additional training without having to travel and also provide a nice introduction of what HMU has to offer.

**Please choose one of the following online courses for free (additional courses are listed with an introductory price).**

**Course recommended as preparation before participating in our classroom training:**

**Math for Metrology 101**  
$49  
This eLearning course introduces the student to the math concepts needed to succeed. The course teaches concepts such as integers, using parentheses, rounding, units of length, coordinate systems, and much more.

**Math for PC-DMIS 201**  
$49  
This eLearning course covers Basic Math in PC-DMIS, Basic Trigonometry, Coordinate Systems and Vectors. PC-DMIS Assignment commands, variables and Generic Features are taught. One lesson teaches basic triangles and the Pythagorean Theorem. Cartesian, Polar and Cylindrical coordinate systems are also explained with examples of conversions. Vector theory is explained more simply by discussing an axis change over a unit distance.

**Blueprint Interpretation 101**  
$69  
This eLearning course prepares the student to be able to use blueprints for dimensional inspection. It describes all areas of the title block, 1st and 3rd angle projections, and outlines lines and views. The learner is also taught dimensioning and tolerancing symbols.
Course recommended for further training and improvement of skills after participating in our classroom training:

**PC-DMIS Constructions 101**  
$49  
This eLearning course explains the use of PC-DMIS Constructed Features. The lessons not only include examples for each feature type, but actual applications are given for many construction types such as: intersection points, pierce points, constructed lines, midplanes and many more. Feature calculation types are also covered including least squares and maximum inscribed. Constructed tangent lines, circles, projections, and PC-DMIS's new Width feature are also included.

**PC-DMIS Alignments 101**  
$49  
This eLearning course provides a functional description of multiple types of alignments including a comparison to mechanical fixtures. It includes in depth descriptions of three more types of alignments and relates them to mechanical situations. Feature constraints, degrees of freedom, and 2D/3D feature type constraints are also covered.

**PC-DMIS for CMM 104 - Offline Supplement**  
$69  
This is an eLearning supplemental course to PC-DMIS for CMM 101, with a focus on offline programming. Helpful offline programming tools are explained to simplify and expedite the programming process. Topics covered include: Transformations, Quick Fixture tools, Clearance Cube, Probe Path Animation, and collision detection.

**PC-DMIS for CMM 111**  
$99  
This eLearning course is an extension of the PC-DMIS for CMM 101 course. Numerous lessons build upon the classroom PC-DMIS for CMM 101 course including helpful customization options and more complex measurements and dimensioning. Additional auto features are reviewed as well as custom toolbars, and using video and pictures in your programs.

**Visual Basic for PC-DMIS 101**  
$59  
This eLearning course teaches Visual Basic 6 and PC-DMIS scripting (with examples). Topics covered include: creation of a graphical user interface (GUI), PC-DMIS Custom Forms, and use of Visual Basic Controls. The material not only covers basic VB6 topics, but shows the learner how to use VB6 to control PC-DMIS.
IV. SPECIFICATIONS

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<tr>
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</thead>
<tbody>
<tr>
<td></td>
<td>X</td>
<td>Y</td>
<td>Z</td>
<td>X</td>
</tr>
<tr>
<td>Without touchscreen</td>
<td>833 (32.8)</td>
<td>1375 (52.2)</td>
<td>2020 (79.5)</td>
<td>365 (14)</td>
</tr>
<tr>
<td>With touchscreen</td>
<td>1105 (43.5)</td>
<td>1556 (61.2)</td>
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</tbody>
</table>

Note: ISO 10360-2 test with maximum part weight performed as an option upon request only.

According to ISO 10360-2:2009:

- \( E_{RMSE} \): \( 3.1 + 0.05 \times \Delta T + (3.0 + 0.2 \times \Delta T) \times L / 1000 \)
- \( E_{RMSPE} \): \( 3.1 + 0.05 \times \Delta T + (3.0 + 0.2 \times \Delta T) \times L / 1000 \)
- \( R_{MAX} \): 3.1

According to ASME B89.4.1b-2001:

- \( R_{MAX} \) is repeatability in \( \mu \)m;
- \( A_0[L] \) is volumetric accuracy in \( \mu \)m, where \( L \) is ball bar length in mm.

Accuracy performance specifications valid under the following thermal conditions:

- Ambient Temperature: 15-60°C;
- Maximum temporal variation: 20°F/h and 10°F/d;
- Maximum spatial variation: 1°C/m horizontal and vertical.

Probing configurations used for performance tests:

- HP-T, HH-M1: 3mm tip, 30 mm stylus length;
- HP-TM, TP20: standard force module, 3mm tip diameter, 10mm stylus length.

Installation site vibration must be less than 2\( \mu \)m maximum horizontal and vertical amplitude over 5-50Hz to ensure stated performance levels.

<table>
<thead>
<tr>
<th>Max. 3D Speed (mm/s)</th>
<th>Max. 3D Accel. (mm/s²)</th>
</tr>
</thead>
<tbody>
<tr>
<td>4,5,4 SF</td>
<td>433</td>
</tr>
</tbody>
</table>
V. INSTALLATION RESPONSIBILITIES

Unless explicitly stated otherwise, this summary identifies the key milestones in the 4.5.4 SF installation process and identifies the appropriate responsible party. It is provided here in order to explain in more detail the scope of this proposal in order to avoid any possible misunderstandings and to facilitate a smooth and timely installation process.

<table>
<thead>
<tr>
<th>DESCRIPTION</th>
<th>RESPONSIBILITY</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transportation</td>
<td>Customer</td>
</tr>
<tr>
<td>From Hexagon Metrology factory to</td>
<td></td>
</tr>
<tr>
<td>the customer facility</td>
<td></td>
</tr>
<tr>
<td>Handling at Destination</td>
<td>Customer</td>
</tr>
<tr>
<td>Rigging, forklift/crane and labor</td>
<td></td>
</tr>
<tr>
<td>Place machine in permanent location</td>
<td>Customer</td>
</tr>
<tr>
<td>Uncrate machine, prepare components</td>
<td></td>
</tr>
<tr>
<td>for installation</td>
<td>Customer</td>
</tr>
<tr>
<td>Utilities/Environmental/Site</td>
<td>Customer</td>
</tr>
<tr>
<td>Requirements</td>
<td></td>
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<tr>
<td>Conformance to environmental</td>
<td></td>
</tr>
<tr>
<td>specifications</td>
<td></td>
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<tr>
<td>Compressed air supply per machine</td>
<td>Customer</td>
</tr>
<tr>
<td>requirements</td>
<td></td>
</tr>
<tr>
<td>Electrical provision per machine</td>
<td>Customer</td>
</tr>
<tr>
<td>requirements</td>
<td></td>
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<tr>
<td>Vibration evaluation of installation site</td>
<td>Customer</td>
</tr>
<tr>
<td>Completion and return of Site</td>
<td>Customer</td>
</tr>
<tr>
<td>Preparation Checklist</td>
<td></td>
</tr>
<tr>
<td>Installation</td>
<td>Customer</td>
</tr>
<tr>
<td>Rigging, forklift/crane and labor</td>
<td></td>
</tr>
<tr>
<td>Machine installation and startup</td>
<td>Hexagon Metrology</td>
</tr>
<tr>
<td>Calibration and verification</td>
<td>Hexagon Metrology</td>
</tr>
</tbody>
</table>

5 Customer should uncrate and move the CMM to the intended installation location at least 24 hours prior to arrival of the Hexagon Metrology service technician in order for the machine to reach ambient temperature. If the customer requires, Hexagon Metrology can provide this service for an additional fee (see quotation for details).

6 By completing the Site Preparation Checklist the customer is verifying that the site has been prepared per the Site Preparation Manual and ready for installation of the CMM. I understand that I will be billed for wait time associated with an unprepared site once the Technician has arrived.

7 A Hexagon Metrology service person will perform a certification either to ISO10360-2:2001 or ANSI B89.4.1 whichever is specified by the customer. If not specified, then ANSI B89 will be performed. If B89.4.1 certification is required, then the following procedure will be performed at the customer’s site.

- Perform a repeatability test in accordance to ANSI B89.4.1 1997 paragraph 5.3.
- Perform a volumetric test using a Ball bar in accordance to ANSI B89. 1997 paragraph 5.5.2

Linear Displacement verification can be purchased as an option.

If ISO 10360-2:2001 certification is required, then the following procedure will be performed at the customer’s site.

- Perform MPE Volumetric uncertainty according to ISO-10360-2:2001 section 5.
- Perform MPEp Probing uncertainty according to ISO-10360-2:2001 section 5.