

# New Scale Robotics



## Introduction to Metrology

with Collaborative Robots  
and Q-Span<sup>®</sup> Workstation Kit

Overview of Course Materials  
for Educational Institutions  
May 7, 2021

# Introduction to Metrology

## Overview of Course Materials



*This course was created to*



Provide training that students can use on the job



Improve students' skill set and job opportunities

*Through this course, students will*



Understand quality control tasks in industry settings

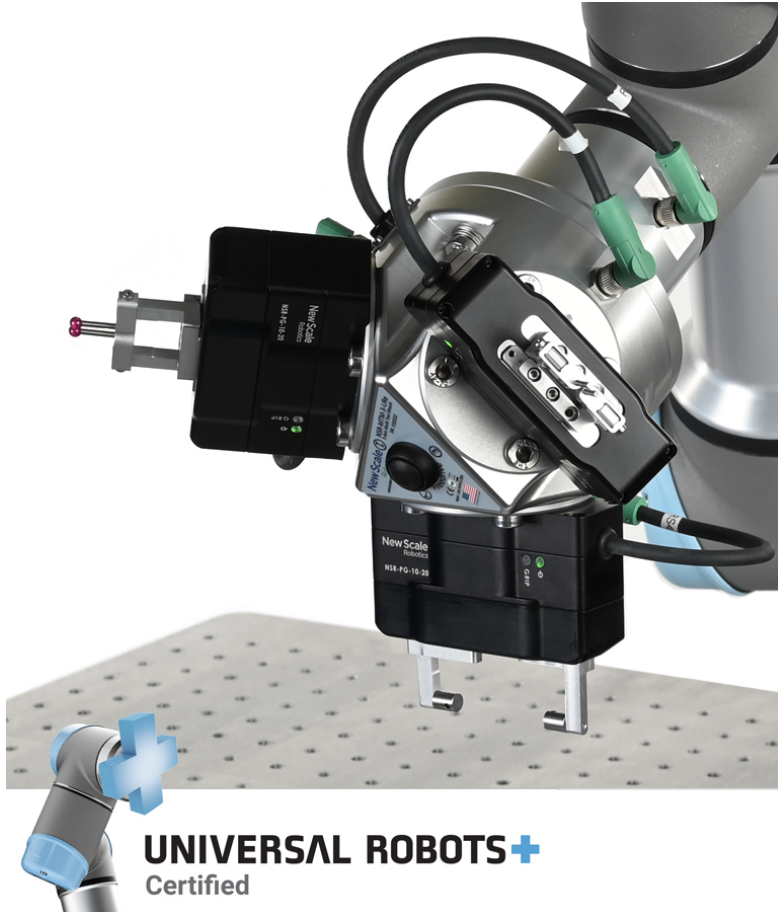


Gain hands-on experience with Universal Robots



Learn how to set up, adjust and use equipment

# What is a Cobot?



- Collaborative robots (cobots)
  - Reduce strain and repetitive stress injuries
  - Are easy to program, quick to deploy
  - Fit in small spaces
  - Are flexible for small-batch manufacturing
- Universal Robots (UR)
  - Leader in cobots
  - Application ecosystem through UR+ Partner Program
  - URCaps and teach pendant: open platform for development
- New Scale Robotics
  - Leader in micromechatronics and automated metrology

Q-Span® Workstation Kit puts it all together for small part handling and inspection

## Course Materials for Robotics and Metrology

### Universal Robot Application Kit

- Training on programming the cobot using URCap
- UR Academy Core

### Metrology and Q-Span Workstation Kit

Metrology is the study of measurement, including:

- Definition of units of measurement
- Validation of measurements
- Traceability to align measurements to standards

Q-Span Workstation Kit provides automated metrology for small parts

# Q-Span Workstation Kit

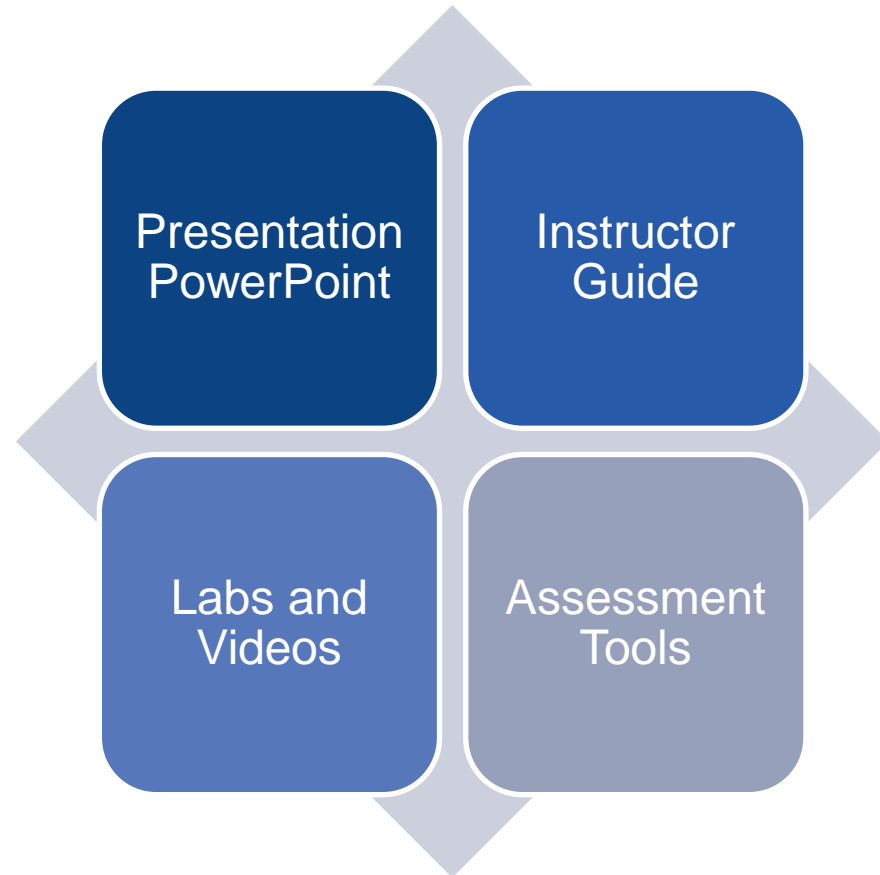
The do-it-yourself (DIY) robotic quality inspection tool



- Combines key functions
  - Automated part handling
  - Robotic caliper measurements
  - Automated data logging
- From “pick and place” to “pick, *measure*, *record* and place”
  - **Pick** small parts
  - **Measure** multiple dimensions on each
  - **Record** data for statistical analysis
  - **Place** and sort parts based on real-time results

# Intro to Metrology Course Material Components

**8-hour training  
course includes**



# For the Instructor

Ready to use  
course materials

PowerPoint deck  
including embedded videos

Instructor's guide

Labs and capstone team project

Quizzes and final exam

# For the Student

Concepts and hands-on experience

Introduction to metrology concepts

Hands-on experience

Start to finish implementation of the Q-Span Workstation Kit



## Introduction to Metrology

### Course Index

1

What is  
Metrology?

2

What is  
Metrology?  
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Measurement

3

Anatomy of  
Q-Span  
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Programming :  
Q-Span  
Workstation Cell  
Setup

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Programming :  
Q-Span  
Workstation  
Basic Functions

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Programming :  
Q-Span  
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Scale &  
Comparative  
Measurements

7

Programming :  
Q-Span  
Batch Testing &  
Data Collection

8

Capstone Team  
Project

9

Final Test /  
Assessment

10

Supplemental



## Module 1: What is Metrology?

- Fundamentals of Metrology
- Video
- The three elements of quality: Quality of Design, Quality of Conformance, and Quality of Reliability
- Quantitative and numerical observations
- Rules for good and bad measurements
- Gauge repeatability & reproducibility



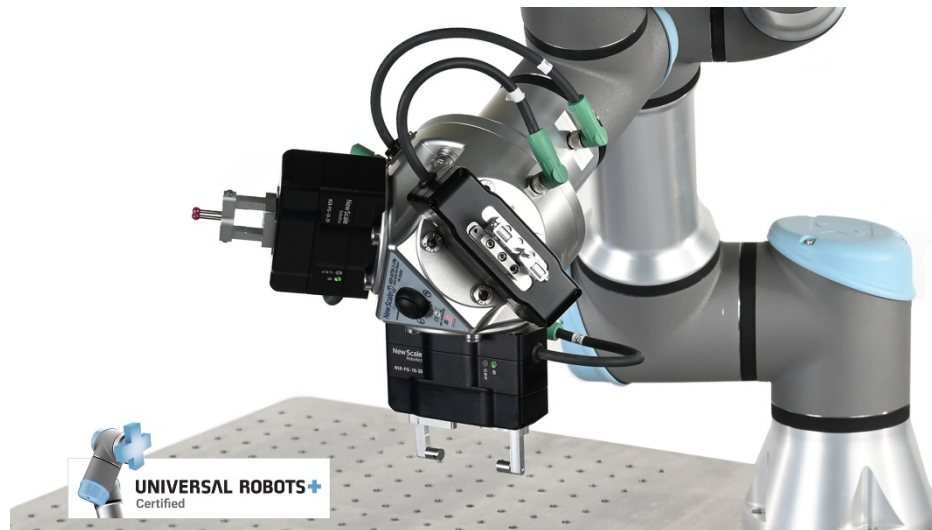
## Module 2: Tools for Measurement

- Types of measurements
- Tools for measuring
- Defining resolution, precision, and accuracy
- Lab: Practice measurements



## Module 3: Anatomy of Q-Span Workstation

- Video
- The basic robotic and measurement tools of a Q-Span Workstation
- Differences between manual measurement and the robotic gripper - caliper
- Initial set-up of Q-Span Workstation



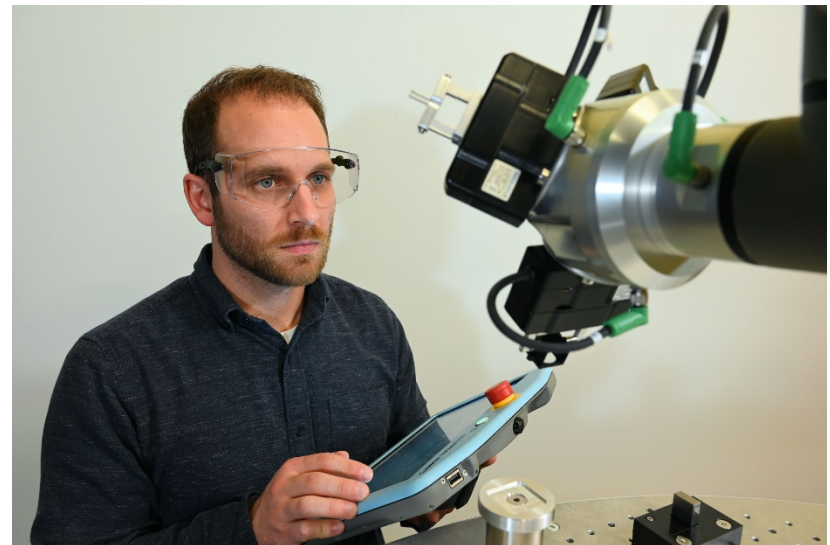
## Module 4: Programming - Q-Span Workstation Kit Setup

- Videos
- Using the robot teach pendant for navigation
- Setting up safety measures
- Review of Q-Span Kit installation program
- Lab



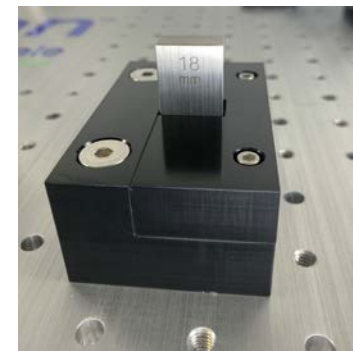
## Module 5: Programming - Basic Functions for Single-Cycle Demo

- Videos
  - Tips and best practices for programming
  - Using the Right-Hand Rule for coordinates
  - Navigating and fixing potential conflicts
  - Running the full Q-Span System demo program
- Lab



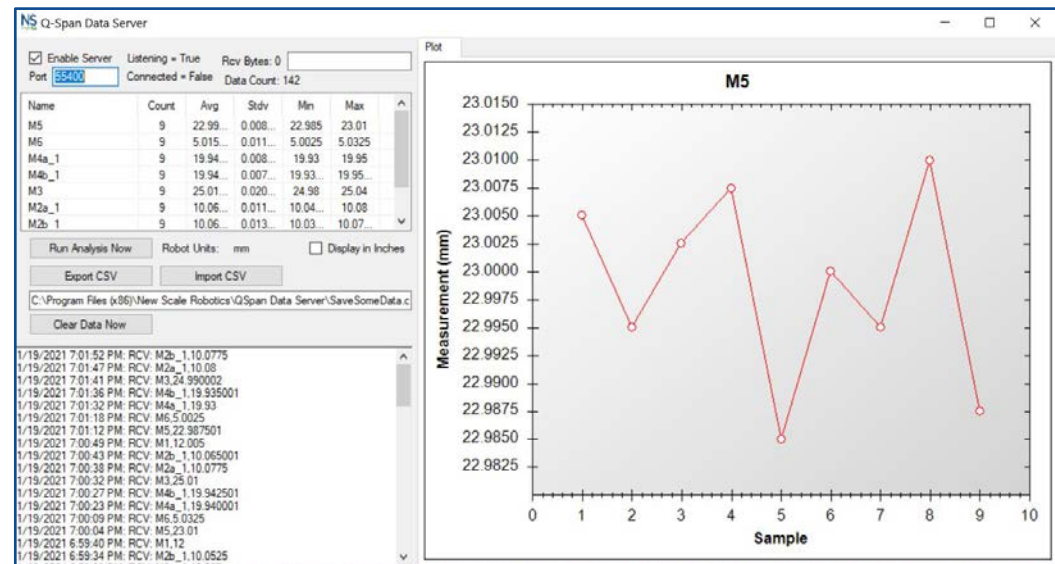
## Module 6: Programming - Full-Scale and Comparative Measurements

- Videos
- Full-scale measurements
- Comparative measurements
- The use of traceability
- Best practices for calibration
- Using gage block and ring gages
- How to use references
- Lab



## Module 7: Programming - Batch Processing and Data Collection

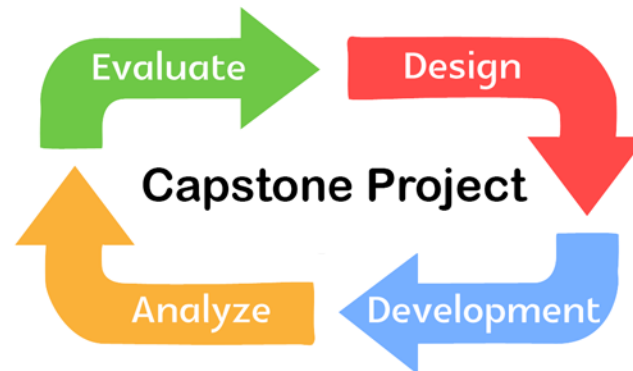
- Videos
- Using Q-Span System to automate the measurement process
- Using Q-Span Data Server PC Application to collect data





## Module 8: Capstone Project

- Use the Q-Span Workstation to implement a real-world metrology process for manufacturing



## Module 9: Final Test

- Comprehensive exam for the course

# Quizzes and Final Exam

- Each module has a quiz
- Final exam assesses overall comprehension of the course

**1**

Chapter One - Answer Key for Quiz and Review; (answers in bold)

1. What is *metrology*? Select all that apply.  
A. The field of weather  
B. The science of measurement  
C. The study of Vernier Calipers  
D. The science of data analysis
2. Select three applications of metrology.  
A. **Validation of Measurement**  
B. **Units of Measure**  
C. Cartesian Geometry  
D. **Traceability**
3. Select three elements of quality.  
A. Quality of Data Analysis  
B. **Quality of Design**  
C. **Quality of Conformance**  
D. **Quality of Reliability**
4. What can be done with measurement data? Select all that apply.  
A. **Monitor Incoming goods**  
B. **Monitor internal processes**  
C. **Monitor final product conformance**  
D. **We make corrections**
5. What is a good measurement? Select all that apply.  
A. **One that can be trusted when making decisions**  
B. One that can be conveniently collected  
C. The design of the product tells us  
D. Procedures and requirements
6. Select the following best practices to avoid a bad measurement. Select all that apply.  
A. Establish reasonable measurement tolerances  
B. **Make sure all measuring tools are properly calibrated**  
C. **Follow procedures & processes to support requirements**  
D. **Track all data collected from measurements**

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Introduction to Metrology 1  
Academic Edition v1 Chapter 1 Answer Key for Quiz and Review

ty. Select all that apply.  
actual number of times, the robots does the same function.  
e data for multiple measuring tests  
**Instrument can produce the same measurement**  
Measurement sequence is always the same process

Select all that apply.  
a collected  
uring devices accuracy  
**Change that can be measured**  
ge of the product

estability and reproducibility? Select all that apply.  
Measurement data is caused by measurement system  
during products at a high rate  
**QR will affect the measurements you record**  
**Measurement system cannot meet the measurement**

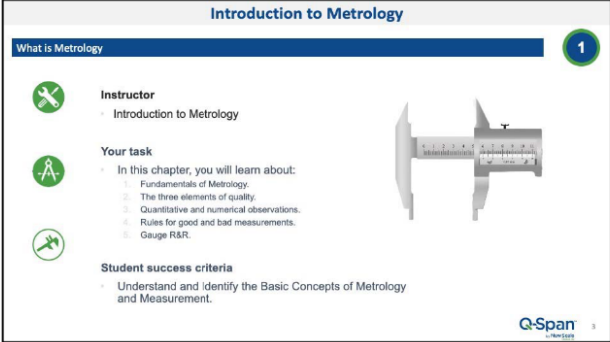
ares that impact how well a measurement is made. Select all that apply.  
machine taking the actual measurement  
measurement taken at the correct location  
Measurement data get recorded properly  
orrect force to make the measurement

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Introduction to Metrology 2  
Academic Edition v1 Chapter 1 Answer Key for Quiz and Review

## Per module

- Slide image
- Notes for the instructor
- Key message
- Tips and FAQ



The slide is titled "Introduction to Metrology" and is labeled as slide 1. It contains the following sections:

- What is Metrology** (with a green '1' in a circle)
- Instructor**
  - Introduction to Metrology
- Your task**
  - In this chapter, you will learn about:
    - Fundamentals of Metrology.
    - The three elements of quality.
    - Quantitative and numerical observations.
    - Rules for good and bad measurements.
    - Gauge R&R.
- Student success criteria**
  - Understand and identify the Basic Concepts of Metrology and Measurement.

An image of a gauge is shown on the right side of the slide. The Q-Span logo is in the bottom right corner.

### Notes for Instructor:

- Use this slide to provide the learners with an overview of chapter 1 and general review of the Universal Robotics Core training.

### > **Remember to say**

- General feedback from students about their experience with UR Academy Core training and about what they learned.
- Explain purpose and course objectives
- Introduce the task and the related success criteria

### > **Key message**

Students will be able to materialize the fundamentals of Metrology and New Scale Robotics Q-Span Metrology solution into a functional application using real robots and equipment

### > **Tips / FAQ**

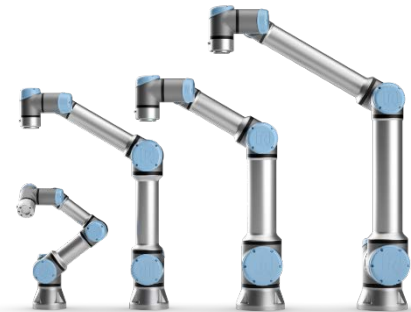
Contact us for a quote

# New Scale Robotics

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