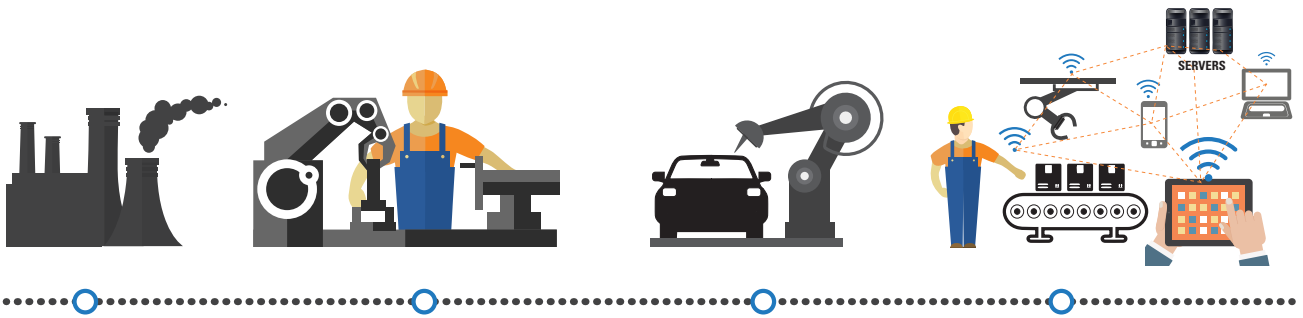




# 'Internet of Things for *Quality*'

is the focussed application of IoT to manufacture of machined parts enabling factories to move to 'Industry 4.0' standards



18th Century

### Industry 1.0

Mechanical production.  
Equipment powered by  
steam and water

19th Century

### Industry 2.0

Mass production assembly  
lines requiring labor and  
electrical energy

20th Century

### Industry 3.0

Automated production  
using electronics and IT

Today

### Industry 4.0

Intelligent production  
incorporated with IoT, cloud  
technology and big data

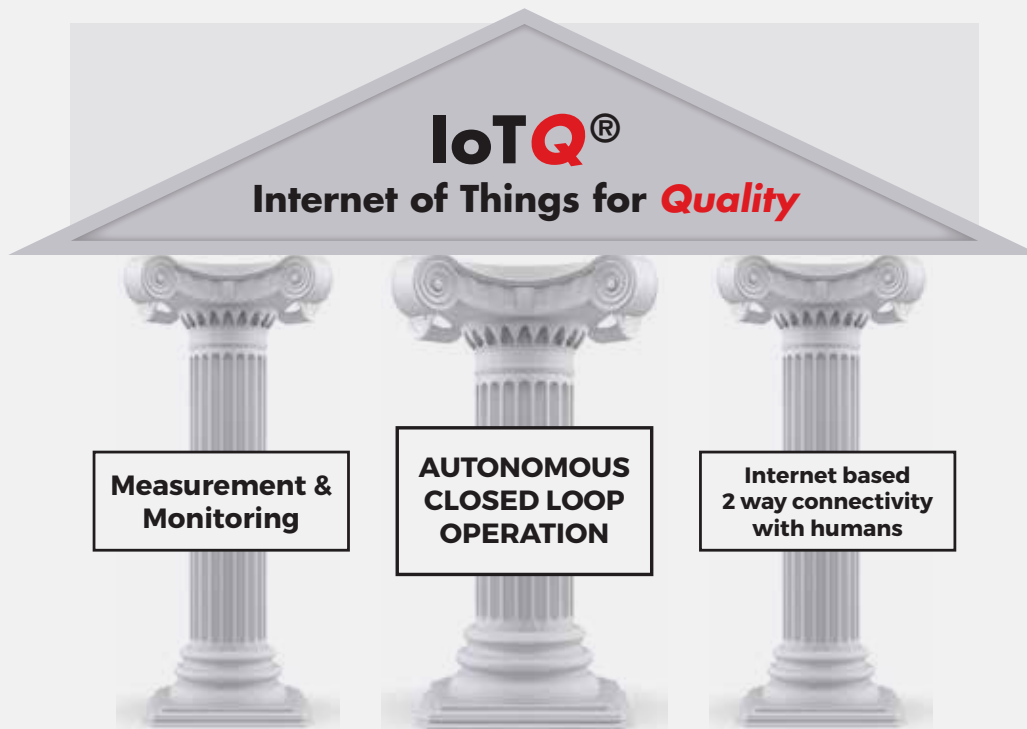
CNC Machining is the most widely used metal cutting technology to make components used in Auto, Aerospace, Defence, Railways & General Engineering industries. **Marshall's IoTQ (Internet of Things for *Quality*)** is the most powerful technology in the world today in the field of CNC Machining which acts like a 'PERFORMANCE MULTIPLIER' for each IoTQ enabled machine. The multiplication is because of quantum jumps in the following areas:

- **Zero defect quality** with **SmartCorrect**<sup>®</sup> (Patent Applied)
- **Tool Insert life optimization** with **SmartInsert**<sup>®</sup> (Patent Applied)
- **Longer machine life & OEE** with machine health monitoring & predictive maintenance with **SmartChek**<sup>®</sup> (Patent Applied)

**TRANSFORMING Manufacturing... *Smartly!***

**At the core of IoTQ** is Marshall's CLOSED LOOP Technology which uses embedded *'Intelligence'* & **Marshall's SmartCorrect®** to take automatic corrective actions after auto-analysis of data (without any human intervention).

## THREE PILLARS OF IoTQ



**1.**

### **Measurement & Monitoring:**

- Dimensional measurement
- Insert wear measurement
- Tool load monitoring
- Machine Health monitoring
- Vibration monitoring
- Coolant pressure & flow monitoring

**2.**

### **Autonomous Closed Loop Operation:**

- Auto-correction of tool offsets
- Tool life management, retirement of worn tools & actuation of sister tools
- Adaptive Control in machining
- Corrective action for Machine health problem

**3.**

### **Internet based 2 way connectivity with humans:**

- Quality information
- Tool Life trends & Consumption information
- Productivity & OEE information
- Machine health & predictive + preventive maintenance information.

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**TRANSFORMING Manufacturing... *Smartly!***

## IoTQ: OPERATING SYSTEM

Marshall's **'SmartCorrect'** Gauging stations are at the heart of the IoTQ operating system.

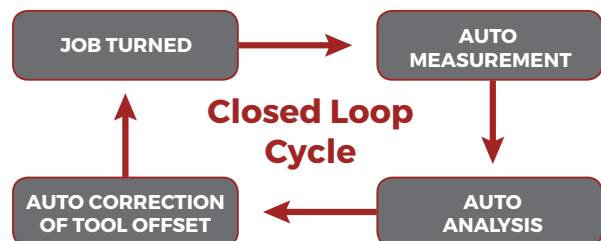
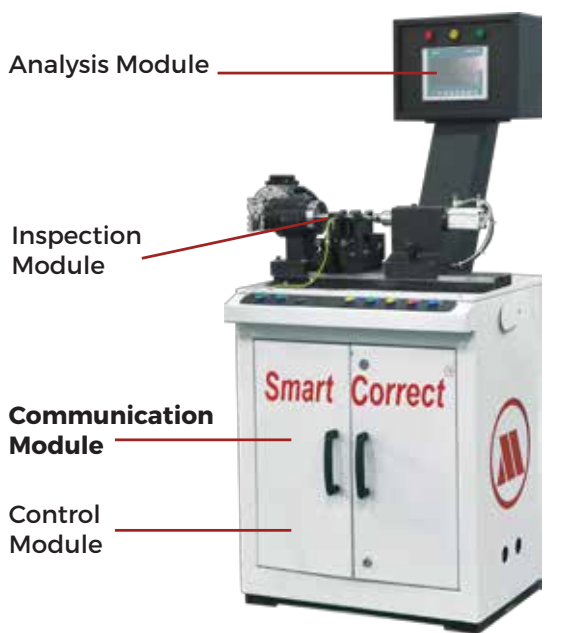
It has 2 way communication with the **'Smart'** CNC Lathe and also with humans through remote server or cloud.



## **SmartCorrect**® The heart of IoTQ®

Facilitates 3 Vital Functions:

**#1 Auto-Correction** of Tool offsets to ensure Zero Defect Production.



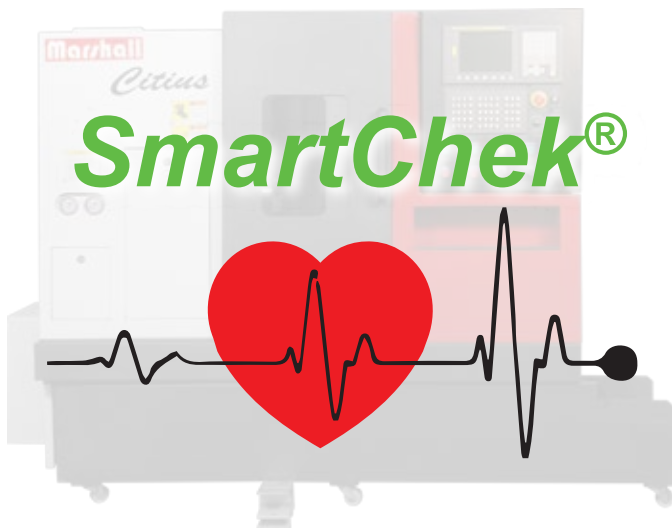
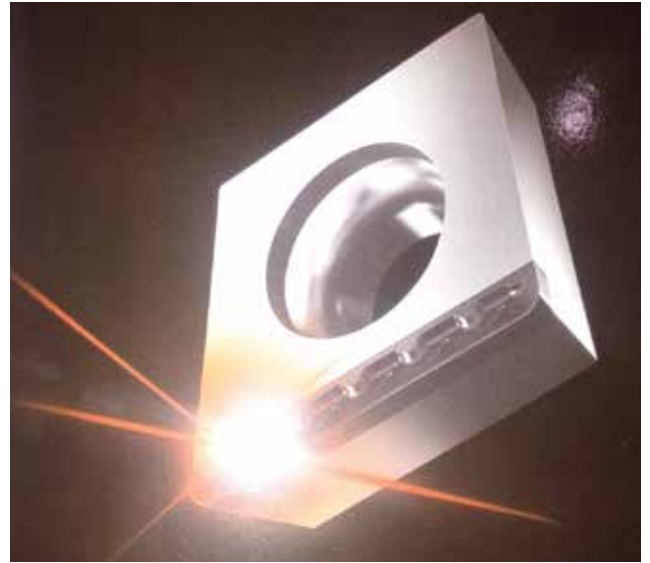
**TRANSFORMING Manufacturing... *Smartly!***

## #2 **SmartInsert**<sup>®</sup>

Patent pending technology for Optimization of tool Insert life.

### **BENEFITS**

- Upto 30% extra Insert life
- Lower tooling cost/component
- Higher machine O.E.E.
- Drastic reduction in accident due to tool insert breakage.



## #3 **SmartChek**<sup>®</sup>

Patent pending technology for Automated 15 second daily health check of machine

### **BENEFITS**

- Predictive Maintenance ensures much longer life.
- Immediate remote detection of Accidents & Corrective action initiation
- Automatic transmission of required information to concerned person.



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