

ABB Robotics

# Integrated Force Control

Robotic real-time tactile feedback

Fully integrated force control technology

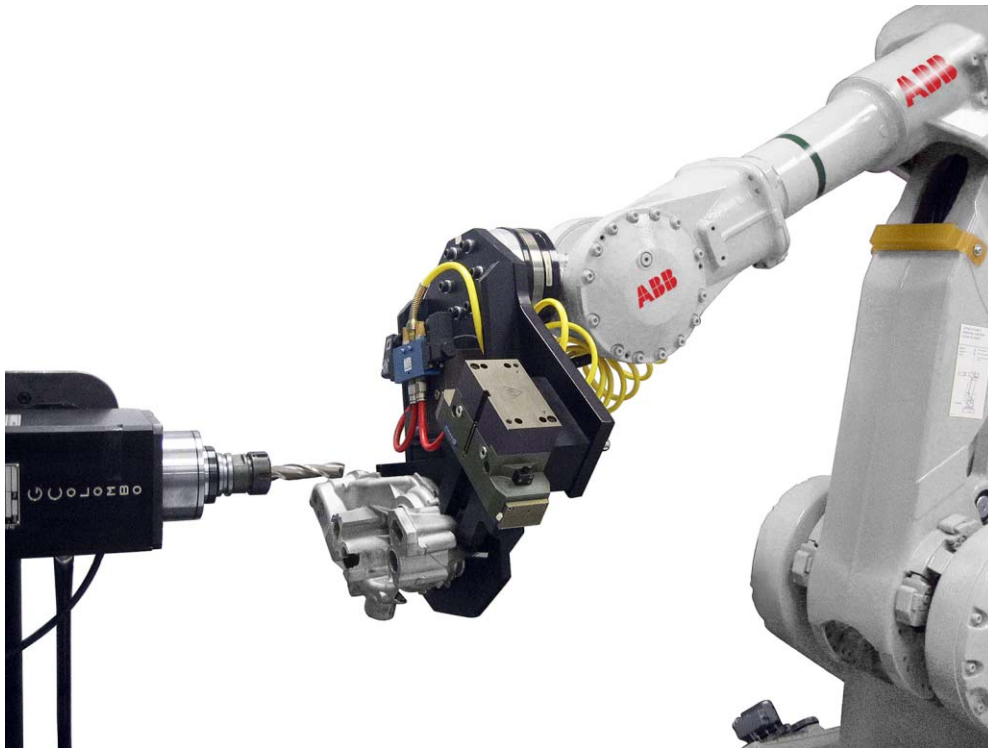
# Integrated Force Control

## Robotic tactile feedback



- Force controlled robots
- Creates precision without the expense of being precise
- Manage geometrical differences
- Improved process quality
- Reduces cycle time
- Saves programming time
- Increases life of process tools
- ABB Integrated Force Control
- Fully integrated hardware and software reduces complexity and cost
- One stop shop for advanced force control functionality

# Integrated Force Control Application usage



## **Machining applications**

- Grinding / Polishing
- Deburring / Deflashing

## **Automotive assembly**

- Assembly of torque converter, clutch, pistons, etc

Other assembly tasks

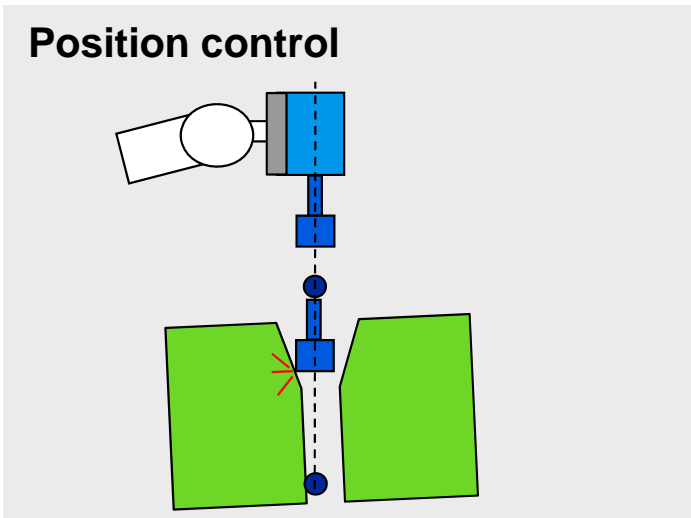
Product testing

Automated fastening

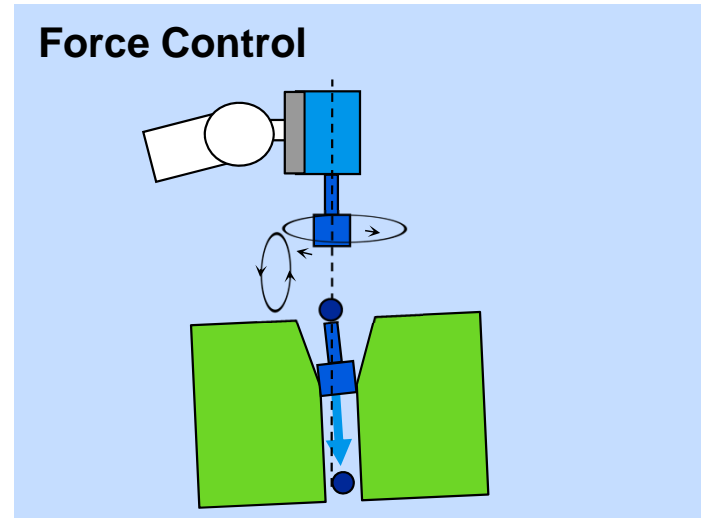
Force control technology opens up  
new robot applications

# ABB Force Control Technology

## Assembly applications



- Fixed path
- Fixed speed
- Uncontrolled contact force
- Potential part damage
- Potential tool damage
- Potential assembly failure



- + Adaptive path
- + Adaptive speed
- + Controlled contact force
- + Eliminate part damage
- + Increase tool life
- + Reduce assembly failure

# ABB Force Control Technology

## Application case: Automotive mechanical assembly



### **Torque converter assembly**

- Cylinder fit in a hole
- Four steps of searching
- Double gearbox alignment

### **Clutch assembly**

- Toothed hub must be inserted through five identical toothed rings
- Rings can move in horizontal plane and rotate about vertical axis

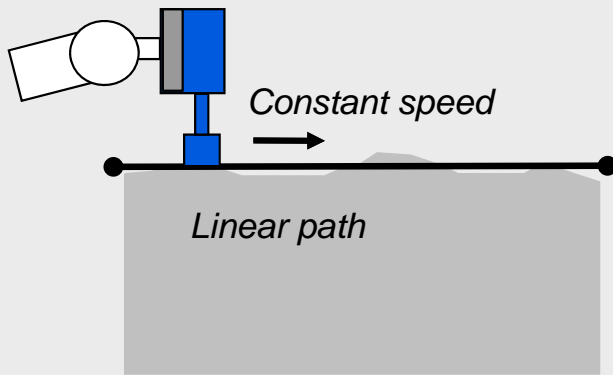
### **Benefits**

- Cycle time typically reduced by 50% versus manual assembly

# ABB Force Control Technology

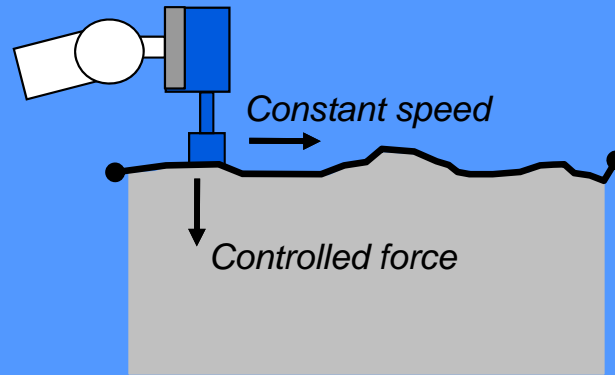
## Machining applications

### Position control



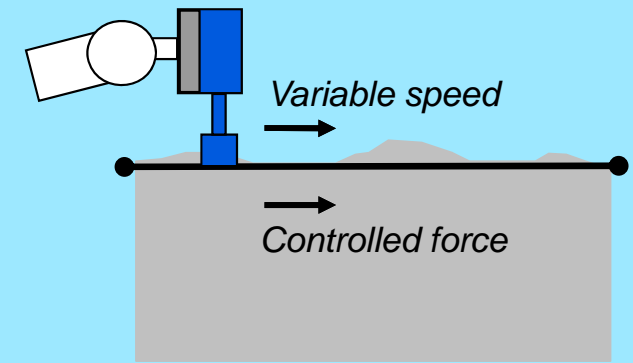
- Fixed path
- Fixed speed
- Uncontrolled contact force
- Potential part damage
- Potential tool damage
- Potential bad quality

### Force Control "Pressure"



- + Adaptive path
- + Constant speed
- + Controlled contact force
- + Eliminate part damage
- + Increase tool life
- + In-built process quality

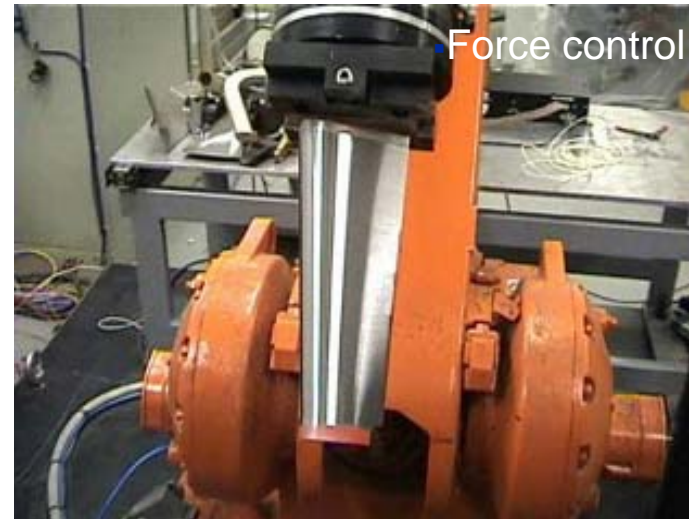
### Force Control "SpeedChange"



- + Fixed path
- + Variable speed
- + Controlled contact force
- + Eliminate part damage
- + Increase tool life
- + In-built process quality

# ABB Force Control Technology

## Application case: Polishing of turbine blades



### Target:

- Achieve a consistent grinding result.
- Make the system easy to program
  
- Force control is used to maintain a constant force on the part during the process.
- Benefits: the part surface is grinded equally on the whole surface. Increased quality versus manual operation.

# Integrated Force Control

## Fully integrated hardware and software



Contains all required components to use ABB's proven force control technology

### **ABB Force sensor**

- Measures all six components of force and torque
- Robot mounted or room fixed
- Adapter plate
- Shielded high-flex cables
- Voltage measurement board
  - Measurement interface to IRC5 controller
- Force control software



# ABB Force Sensor

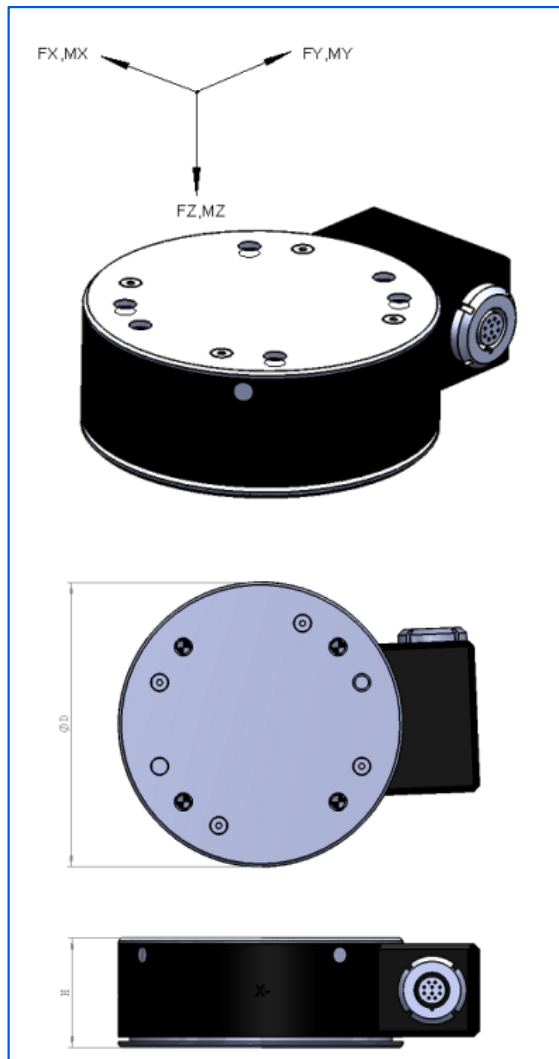
## Fully integrated for high precision robotic applications



- Fully integrated into ABB's hardware and software reduces complexity and cost
- One stop shop for advanced force control functionality
- Robust
  - High overload protection – 10 times nominal load
  - EMC tested
  - IP65 rating
- Compact and lightweight
- High precision for robotic applications
  - Assembly
  - Grinding & Polishing
  - Testing & Weighting
- Flexibility – can be used both mounted on robot or stationary

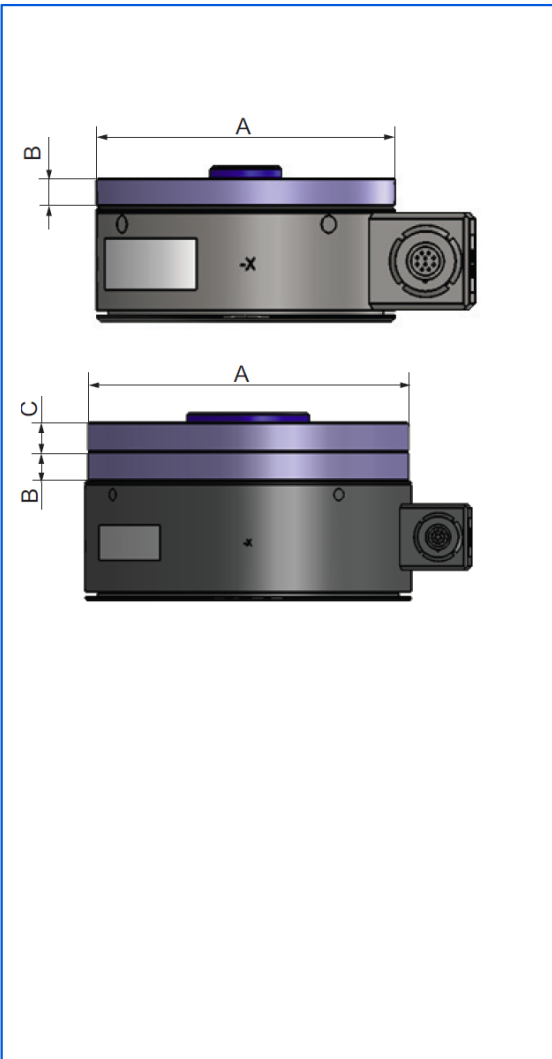
# ABB Force sensor

## Sensor specification



Specification	Sensor 165	Sensor 660	Sensor 2500
<b>Capacity</b>			
Fx, Fy	165 N	660 N	2500 N
Fz	495 N	1980 N	6250 N
Mx, My, Mz	15 Nm	60 Nm	400 Nm
<b>Overload capacity</b>			
Fx, Fy	1650 N	6600 N	25000 N
Fz	4950 N	19800 N	62500 N
Mx, My, Mz	150 Nm	600 Nm	400 Nm
Operating temperature	-40 to +100°C	-40 to +100°C	-40 to +100°C
IP rating	IP65	IP65	IP65
<b>Dimensions</b>			
Height	40 mm	40 mm	62 mm
Diameter	Ø 104 mm	Ø 104 mm	Ø 168 mm
Weight	1.25 kg	1.25 kg	5.00 kg
<b>Suitable robots</b>	IRB 140 IRB 1600 IRB 2400 IRB 2600	IRB 2400 IRB 2600 IRB 4400 IRB 4600	IRB 4400 IRB 4600 IRB 6620 IRB 6640 IRB 6650S IRB 6700

# ABB Force sensor Adapter specification



Specification	Sensor 165	Sensor 660	Sensor 2500	
<b>Number of adapters</b>	Single	Single	Double	Double
<b>Adapter dimensions</b>				
Height (mm)	10 mm	10 mm	25 mm	30 mm 35 mm
Diameter (mm)	104 mm	104 mm	140 mm	165 mm 210 mm
Weight (kg)	0.6 kg	0.6 kg	2.8 kg	4.8 kg 9.1 kg
<b>Suitable robots</b>	IRB 140	IRB 2400	IRB 4400	IRB 4400 IRB 6620
	IRB 1600	IRB 2600	IRB 4600	IRB 4600 IRB 6640
	IRB 2400			IRB 6650S
	IRB 2600			IRB 6700

# ATI Force Sensor

## Alternative force sensor



- ABB force control technology can be used with other force sensors from other suppliers
- ABB also uses ATI Force/Torque sensors
- Models Delta, Theta and Omega
- IP60 or IP65 protection
- Delivered with
  - Adapter plate
  - Cabling
  - Calibration information for IRC5 integration

# Force control software

## The brain of robotic tactile sense



- Advanced software for the force control technology
- Fully integrated and pre-configured for ABB force sensor
- High performance real-time path correction based on sensor feedback
  - Very fast response time
- Specific set of RAPID instructions for force control applications
- Process feedback from force sensor
- Functions for
  - Sensor calibration, load identification, gravity compensation
  - Conditions and reference values
  - Recovery and supervision

# Integrated Force Control Summary



## Force controlled robots

- Creates precision without the expense of being precise
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## ABB Integrated Force Control

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**Power and productivity  
for a better world™**

**ABB**