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SMARTER. RÖHM.

iJaw

Clamping force measurement during machining.

RÖHM


SOME CALL IT
A VISION.
WE CALL IT
A SOLUTION.

7 BILLION PEOPLE. AND EVERYONE IS DIFFERENT.

In 1910 we applied for a patent on a significantly improved drill chuck. With this chuck, we made a major contribution to industrial manufacturing. In the advancing age of industrialization, products that had previously been produced by hand could be manufactured quickly and cost-effectively in large quantities.

More than a hundred years later, our society is changing again. Increasing individualization calls for more and more customized products. The idea of industrialization - achieving good prices through high volume - no longer works. “Smart” manufacturing technologies are needed, which enable very small volumes – perhaps just one unit of a product – to be produced efficiently.

For us as a specialist in clamping and gripping technology, “smart” manufacturing technologies means future products offering smart clamping and gripping.

WE TAKE NATURE AS OUR MODEL. CLAMPING AND GRIPPING WITH PRECISELY THE REQUIRED FORCE.

With this in mind, we have developed clamping and gripping technology with integrated sensor technology.

A range of clamping inserts are available to adapt the iJaw to different clamping tasks.

On the outside, it's very hard to tell the iJaw apart from a standard clamping jaw. It can be easily used on all standard lathe chucks.
The electronics and power supply are hidden inside the iJaw. They can be used to measure:

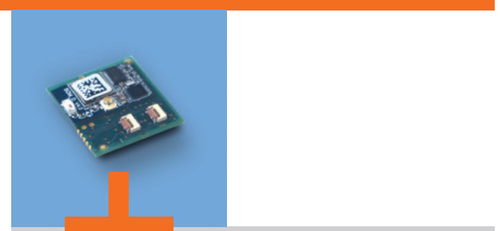
- Clamping force
- Acceleration
- Temperature

The iJaw clamping jaws fit on lathe chucks with standard jaw interfaces, e.g. the Röhm DURO-A RC chuck.

FOR RÖHM, INDUSTRY 4.0 GOES DEEPER THAN MEASURING CLAMPING AND GRIPPING PERFORMANCE BETWEEN JOBS.THAT IS WHY WE HAVE DEVELOPED A WIRELESS SYSTEM FOR REAL-TIME MONITORING AND DATA TRANSMISSION WHILE YOU ARE MACHINING.

Some people may still think that Industry 4.0 simply means engineering with cables. Of course, the data has to be transmitted from the sensor somehow. But is a cable really needed? We believe that Smarter Clamping works much better without cables. Therefore, our sensors have an integrated power supply based on standard, rechargeable lithium ion batteries, and send their data wirelessly (without cables). We use IO Wireless technology to achieve this.

RÖHM HAS AN EXCLUSIVE PARTNERSHIP TO MANUFACTURE WIRELESS IO-LINK SOLUTIONS FOR CLAMPING TECHNOLOGY.



What is IO Wireless?

IO-Link is a short distance, bi-directional, digital, point-to-point, wired (or wireless), industrial communications networking standard (IEC 61131-9) used for connecting digital sensors and actuators to either a type of industrial fieldbus or a type of industrial Ethernet.

IO-Link Wireless is an extension of IO-Link on the physical level.
An IO-Link Wireless Master („W-Master“) behaves like a Master to the superordinate system. There are only virtual ports „down“ to the IO-Link Wireless Devices („W-Devices“).

(Source: Wikipedia, downloaded on 8/01/2022, https://en.wikipedia.org/wiki/IO-Link

THE iJaw SYSTEM ARCHITECTURE

These components enable clamping force measurement in real time.

1. iJaw

The heart of the technology are clamping devices with integrated sensors for measuring the clamping force and other physical variables.

2. Gateway

The universal gateway receives the data and forwards it. Thereby means universal, really universal - further sensors can be integrated into the gateway. The interface for this is open. This can be sensors that are already installed in the machine or additional sensors from third-party applications.

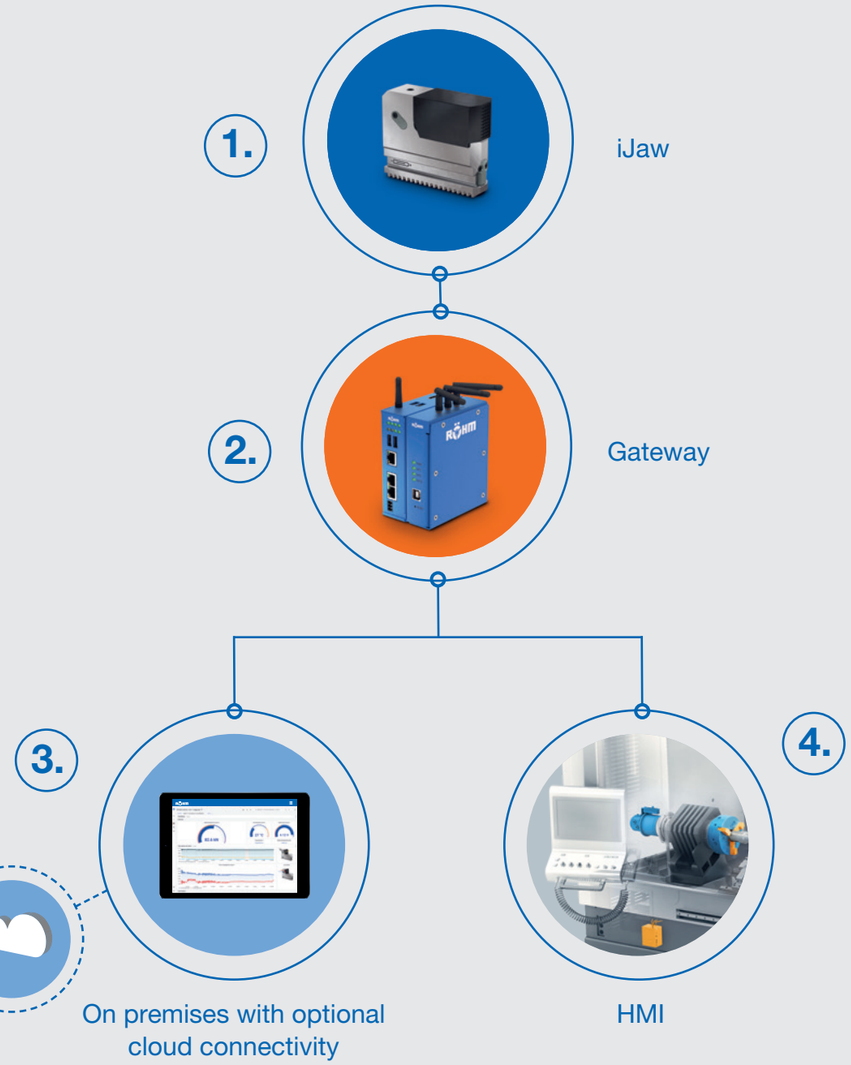
3. On Premises

The gateway forwards the data to a PC. There, clamping forces are processed and visualized in real time. Optionally the machining data can be saved in the cloud for documentation or analysis purposes.

4. HMI

The gateway can be alternatively connected directly to the machine via Profinet. This enables measured data to be displayed directly on the machine HMI.

Imagine the gateway as a new, integral component of your machine tool. A wide range of sensors can be integrated. This turns your machine into an open system and you save on the need for the proprietary components that currently perform a similar task.



THAT‘S WHAT THE iJaw STANDS FOR: MORE PRODUCTIVITY, LOWER COSTS, HIGHER SAFETY.

- Faster setup
- Demand-oriented, plannable maintenance
- Productivity increase
- Process optimization
- Automation

Enhanced machine availability

Reduced manufacturing costs

- Fewer errors during setup
- Shorter processing times
- Detection of production errors
- Higher part quality

Increased safety while machining

- Setting up with optimum clamping force
- Quick detection of loss of clamping force
- Alarm in case of undercutting
- Timely intervention possible
- Prevent loss of workpiece
- Machine shutdown possible

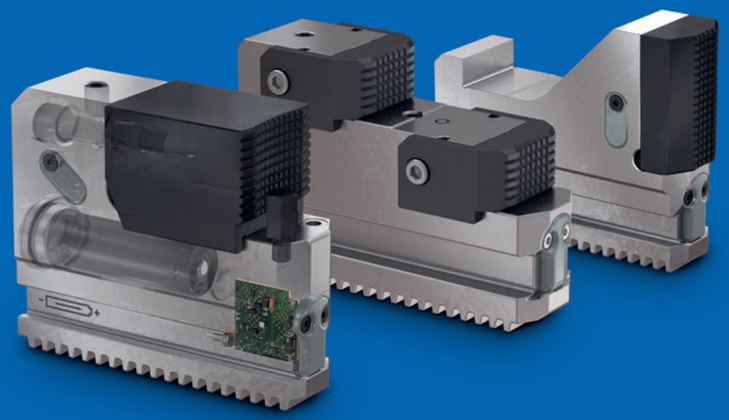
Documentation of machining data

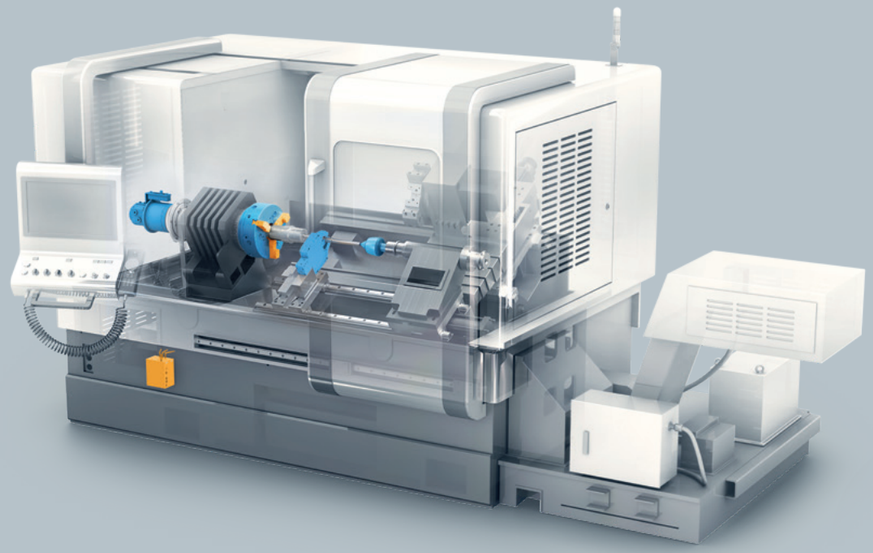
- Fulfillment of the obligation to provide evidence
- Performance of analyses

THE TECHNOLOGY

COMPONENT:

CLAMPING DEVICE WITH INTEGRATED SENSORS *iJaw*





HMI-CONNECTION

COMPONENT:

UNIVERSAL GATEWAY

ON PREMISES

COMPONENT:

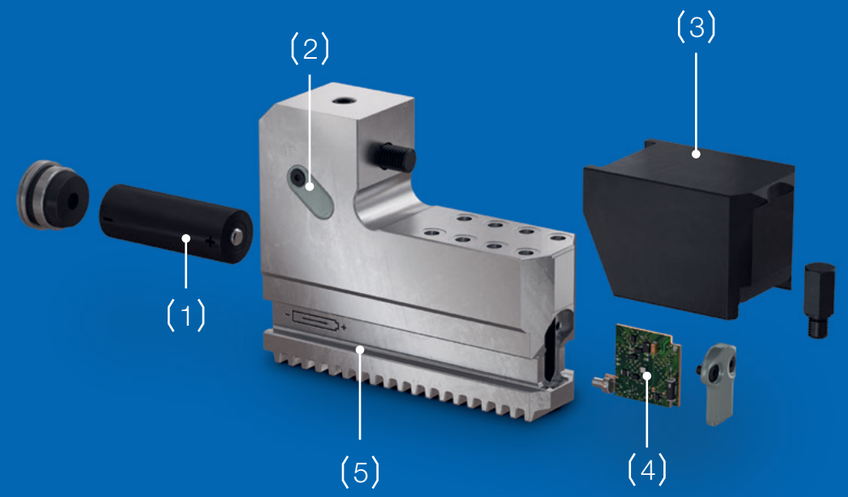
CLAMPING DEVICE WITH INTEGRATED SENSORS *iJaw*

A set of clamping jaws consists of three iJaws. One jaw with sensors is normally sufficient for measurement and wireless data transmission. The other jaws have no sensors. They have an identical mechanical design and have corresponding counterbalance weights to ensure perfect concentricity even at high speeds.

For more complex clamping tasks – such as detection of incorrect feed in automation – it may make sense to use multiple jaws with sensors.

All jaws have one or more brackets that can be individually fitted with interchangeable clamping sets and thus adapted to the specific clamping task.

The iJaw components are protected to IP68 standard and are dust and waterproof. To protect against hot and abrasive chips, the transmission unit is sealed with a special polymer.



(1) IP68 dust and waterproof battery compartment cover housing the lithium ion battery

(2) Sensor

(3) Clamping insert

(4) IO-Link Wireless interface with antenna

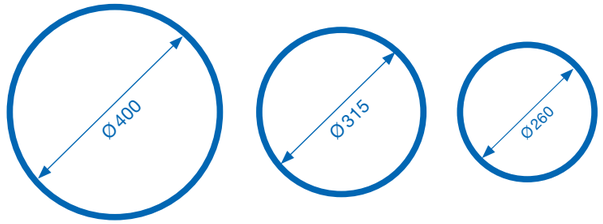
(5) Monoblock jaw

iJaw – TECHNICAL DATA

Size	260			315			400		
Jaw geometry									
	single-step	two-step	through-hole	single-step	two-step	through-hole	single-step	two-step	through-hole
Clamping height per clamping step [mm]	35	17	50	35*	20	50*	35*	22	50*
Max. speed external clamping [U/min²]	4.700			4.000			3.500		
Clamping force, up to [kN]	135			180			240		
Max. distance iJaw-antenna [m]	15								
Battery runtime 2.300 mAh	up to 504 h | 21 days (depending on transfer rate)								
Wireless frequency [GHz]	2,4 – 2,48								
Transfer rate [Hz]	100								

Subject to change
**coming soon*

SHAPES, SIZES AND VERSIONS



SIZES

The iJaw is available in three sizes 260, 315 and 400. Other sizes are available on request.

JAW INTERFACE AND COMPATIBLE CHUCKS

90-degree serration interface

The iJaw clamping jaws are compatible with Röhm chucks with 90-degree serration interface power cucks with quick-change jaw system DURO-A RC [left] and DURO-NCSE [right]). Can also be used on other manufacturers‘ 90-degree serration chucks (e.g. SMW Autoblok, Schunk, Kitagawa, etc.)

60-degree serration interface

The iJaw clamping jaws are available for Röhm chucks with 60-degree serrations lathe chucks with quick-change jaw system and individual unlocking, DURO-NC [left], manually clamping lathe chucks with quick-change jaw system, DURO-T [right])

GEOMETRIES

The iJaw is available as:

Single-step jaw (with hard and soft clamping inserts)

Two-step jaw (with hard and soft clamping inserts)

Through-hole jaw

Available soon: jaw for independent chucks

Clamping inserts for single-step jaws

Claw type jaw inserts, short

Claw type jaw inserts, long

Clamping insert hard, short

Clamping insert hard, long

Clamping insert soft

Clamping insert hard, through-hole

Face contact bolt

Clamping inserts for two-step jaws

Clamping insert hard

Clamping insert soft

Clamping insert, through-hole, hard

Clamping step cover

Clamping inserts for through-hole jaws

Clamping insert hard

Clamping insert soft

COMPONENT:

UNIVERSAL GATEWAY

The gateway is made up of an industrial PC based on Raspberry Pi 3 technology for data processing and interfaces, along with the IO-Link Wireless master.

With the universal Gateway the data is transferred

The gateway communicates with the iJaw using the IO-Link Wireless technology. The integrated LAN interface transmits the data to a computer via Ethernet, where it can then be processed.

The sensor-integrated jaws and your machine communicate with the universal gateway

Of course, the data can also be processed directly on the machine. To do this, the gateway is connected to your machine using the integrated Profinet interface. Your machine control system can then process your data in real time and display it on the HMI panel.

The universal gateway gives you a universal interface inside your machine – for additional sensors and third-party products

Our universal gateway uses exclusively standard protocols and interfaces. Its specification is freely accessible. Additional sensors – your own or from third-party suppliers – can be incorporated without additional hardware using the universal gateway. This enables you to build a bit of future-proofing and interoperability into your machine.

iJaw WITH NO GATEWAY?

Already have an IO-Link Wireless gateway in your machine? Then you can use this existing gateway to communicate with the iJaw. Contact us for more details.

Profinet connection: Hilscher Netpi+
Dimensions [mm]105x70x140

* *Subject to changes*

INDUSTRIAL PC

Power supply:
18 VDC-30 VDC, 4,2 W-9 W

IO-LINK WIRELESS MASTER

Power supply:
5 VDC, 550 mA

COMPONENT

iJaw ON-PREMISES

Machine tools can be very easily retrofitted with the iJaw. For this you need only the sensorized clamping jaws, the gateway, an industrial PC and a medium for the visualization of the measured data. This can be a local PC or a mobile tablet.

The system is controlled by the web App iJaw Mobile. With this application you establish the connection between the iJaw and the gateway in order to be able to retrieve the data.

You can create orders, manage your jaws and receive warnings, e.g. if the minimum clamping force is undershot.

Optionally, you can connect your system to the cloud. It enables additional functions such as process or productivity analyses and the documentation of large quantities of measurement data. With the iJaw Mobile app, you can access your data from anywhere and evaluate processing data or have warning messages displayed.

THE RETROFIT SOLUTION ENABLES THE FOLLOWING FUNCTIONS:

iJAW ON-PREMISES

- Measurement of the clamping forces of internal and external clamping at standstill and under rotation
- Display of minimum and maximum clamping force
- Alarm in case of undercutting or exceeding of the clamping force
- Display of the clamping force curve
- Temperature of the iJaw
- Charge status of the battery

ADD-ON OPTION CLOUD

- Productivity analysis from stored clamping force data
- Process analysis from stored clamping force data
- Documentation with extended memory
- Dashboard of all jobs produced
- Dashboard of all iJaws used

COMING SOON

COMPONENT:

HMI CONNECTION

By HMI connection we mean the integration of the iJaw functions into the control of the machine tool by the manufacturer. Via the universal gateway, the data from the iJaw can be transferred to the machine. The machine control then has read access to the data in real time. The data can be used for control, regulation and visualization purposes.

THE OEM-SOLUTION ENABLES THE FOLLOWING FUNCTIONS

BASIC FUNCTIONS

- Measurement of the clamping forces of internal and external clamping at standstill and under rotation
- Display of minimum and maximum clamping force
- Alarm in case of undercutting or exceeding of the clamping force
- Display of the clamping force curve
- Temperature of the iJaw
- Charge status of the battery
- Chuck efficiency and monitoring of the chuck condition when data from the pressure indicator is available.

POSSIBLE FUNCTION EXTENSIONS (EXAMPLES):

- Limitation of the maximum speed to avoid of undercutting of the clamping force
- Active control of the clamping pressure at standstill
- Trend analysis for chuck condition
- Calculation tool for minimum clamping force
- Calculation tool for thin-walled components
- Triggering of a machine stop when falling below the the minimum clamping force and much more

(1) Real time display of clamping force
(2) Calculation of minimum clamping force
(3) Battery charge status
(4) Clamping force calculation for different applications
(5) iJaw temperature display
(6) Chuck efficiency and condition
(7) Numeric clamping force display

SCOPE OF DELIVERY

COMPONENT	QUANTITY	DESCRIPTION
iJaw, bracket jaw	**1**	Clamping jaw includes: o Metal battery compartment cover o Plastic antenna cover o Force measurement sensor o Electronics board o Antenna o Initial calibration o Precision balanced
iJaw, bracket jaw	**2**	Clamping jaw without sensors, precision balanced
Clamping insert, hard	**3**	short
Face contact bolt	**3**	5 mm
Optional: different clamping inserts		soft, hard/long, claw type long, claw type short, through-hole
Optional: Face contact bolts		5 mm - 30 mm length

COMPONENT	QUANTITY	DESCRIPTION
2 rechargeable batteries (of which 1x replacement battery)	**1**	LiPo standard round cell 16,340 650 mAh
Gateway	**1**	iIntegrated iJaw master board and NetPi
Battery charger	**1**	
Documentation	**1**	Printed operating manual and integration guide.
Access data for live dashboard	**1**	
Optional: Case	**1**	Blue hard plastic, including milled hard foam inlays
Software	**1**	You can find the latest iJaw software at www.roehm.biz/iJaw Driver for NetPi (GSDML file), integration guide

CASE STUDIES

The iJaw delivers the technology for the next generation of clamping devices. This also means the next generation of machine tools.

On the following pages, we would like to highlight various benefits of the iJaw. Whether you are focused on efficiency, precision, quality, or safety, we are certain that we will show you possibilities that will inspire you. One thing is clear: as with every new technology you will find applications that we don’t (yet) know about and probably haven’t even thought of.

We look forward to hearing about them.
Just talk to us!

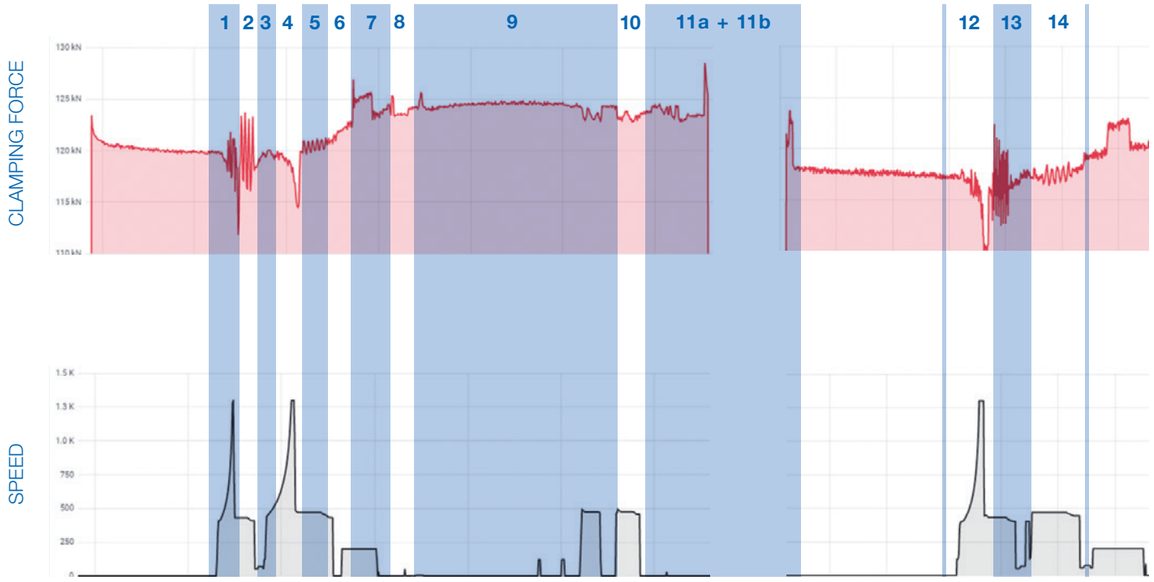
YOUR WORKPIECE TALKS AND YOUR iJaw LISTENS AND REPORTS IN REAL TIME.

With the iJaw you can measure clamping forces in real time. They are transmitted wirelessly to the gateway via IO-Link Wireless and from there – via Profinet – to the machine and/or – via LAN – to the cloud.

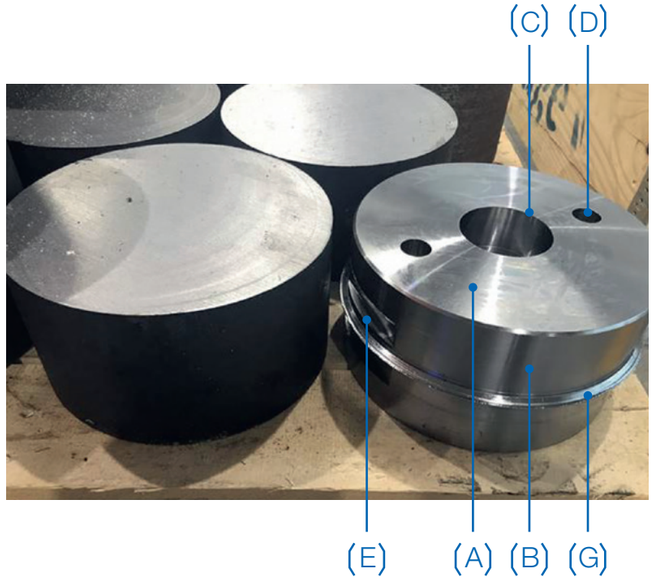
The following example shows production of a turned part in series production on a multi-spindle lathe. A DURO-A RC 315 type automatic power chuck with jaw quick change system and a set of iJaw clamping jaws are used on each of the two spindles.

MACHINING ON THE MAIN SPINDLE

SUBSEQUENT MACHINING ON THE COUNTER SPINDLE



MACHINING STEPS



Turning, milling and drilling lathe stock (left) on a multi-spindle machine. Right: Fully machined workpiece.

1	Facing (roughing) of surface **A**. Speeding up the spindle causes a reduction in the clamping force due to the centrifugal forces)
2	Facing (roughing) of surface **B**
3	Tool change
4	Facing (finishing) of surface **A**. Further fall in clamping force due to centrifugal forces increasing with speed.
5	Facing (finishing) of surface **B**
6	Drilling of hole **C**
7	Drilling of hole **D**
8	Rotary milling **E**
9	Turning of clamping seat **G**
10	Surface milling
11a + 11b	Transfer from main spindle to counter spindle, increase in clamping force due to axial offset of the two spindles
12	Facing
13	Turning (roughing)
14	Turning (finishing)

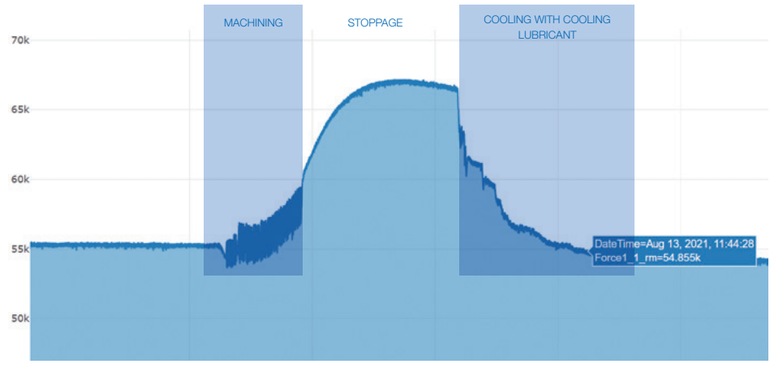
CASE STUDY: MACHINING THE TACTILE CLAMPING SYSTEM

If you would like to know how your machine tool and your workpiece work together

The iJaw measures the clamping force between the clamping jaw and the workpiece – continuously, up to 24/7. So you know what the clamping force is before, during and after machining in real time. Excessive clamping forces can be just as problematic for your machining as insufficient forces.

Maybe you are machining thin-walled components – then you are familiar with the problem of deformation due to excessive clamping force. The iJaw helps you to prevent an excessive clamping force being set and thus pinching of the parts.

The problem of insufficient clamping forces is obvious: Components are not adequately held in place by the clamping device. The workpiece may even fall out or be thrown out of the clamping device – in the worse case during machining and at high speed. Every machining professional knows that (with external clamping) speed is the natural enemy of machining: the centrifugal forces counteract the clamping forces, which means that the clamping force declines as the speed incr eases.



Time/clamping force graph: Change in clamping force during and after machining due to centrifugal force influences and thermal expansion.

Let's stay with the change in clamping forces. What about machining that extends over a longer period – perhaps even several days? Can you be sure that the clamping force will not decline over time? Mainly due to micro-leaks in the hydraulic system? Or because of a change in volume of the hydraulic oil due to thermal effects? With the iJaw, you can detect these changes and respond to them.

Talking of changes in volume caused by thermal effects. Did you know that the clamping force increases by more than 10%, solely due to the change in volume of the workpiece caused by the machining? And this is even the case after machining? The data from the iJaw shows the effect: when the coolant supply is shut off after machining, heat is no longer dissipated through the coolant but through the component itself. The heat spreads over the entire workpiece, starting from the machining surface.

SUMMARY:

With the iJaw, clamping forces can be measured during machining in real time. Different physical influences on the applied clamping force are fully recorded. Evaluation of the data, either by the machine operator or an automatic evaluation, means that machining processes can be set more precisely, reliably and efficiently.

YOU CAN TALK TO US ABOUT:

- Thin-wall components
- Heavy components
- Long clamping and machining times
- Thermal influences
- Pressure-sensitive surfaces and materials

CONSIDER THIS:

On power operated machine tools, the clamping force is adjusted using the hydraulic or pneumatic pressure of the clamping cylinder. Isn't that enough? Within the cylinder – clamping device – jaw combination, there are a series of mechanical components that apply and transmit the force. Every engineer knows that mechanical components are essentially subject to losses – even with the very best lubrication and maximum precision the efficiency is never 100%. This means that only part of the clamping force generated by the clamping cylinder is actually applied to the workpiece. In addition, this clamping force is dynamically influenced (e.g. centrifugal force, thermal influences etc.). Only the iJaw measures the actual clamping force applied to the workpiece and it is precisely this clamping force that is crucial for the performance of the overall "machining" system.

CASE STUDY: SERVICE
THE PREDICTIVE CLAMPING SYSTEM (1)

If you would like to know when your clamping device needs lubrication, maintenance or repair

The iJaw measures the clamping force between the clamping jaw and the workpiece. At the same time, your machine tool measures the hydraulic pressure on the cylinder, i.e. the pressure required to achieve the desired clamping force.

The ratio of the applied clamping force to the hydraulic pressure corresponds to the efficiency of the clamping system. Evaluation of this data is the basis for predictive maintenance (condition based service): As the efficiency gradually falls with each machining cycle, the data is analyzed to predict the ideal time for maintenance, such as a lubrication cycle, to ensure optimum performance and efficiency.

If the data shows sudden changes, a fault in the clamping system may have occurred. Analysis and appropriate action can be taken.

SUMMARY:

The iJaw enables clamping forces to be measured continuously. Evaluation of the applied forces over time and their comparison with current forces helps predict upcoming maintenance and or repairs.

YOU CAN TALK TO US ABOUT:

- Predictive maintenance
- Maintenance of clamping force
- Condition based service

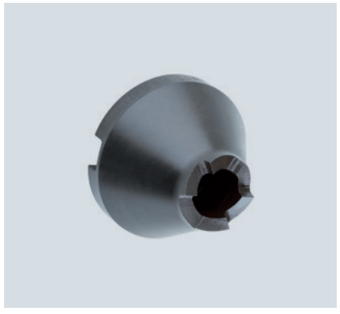
CASE STUDY: INLINE QUALITY TESTING THE INSPIRING CLAMPING SYSTEM

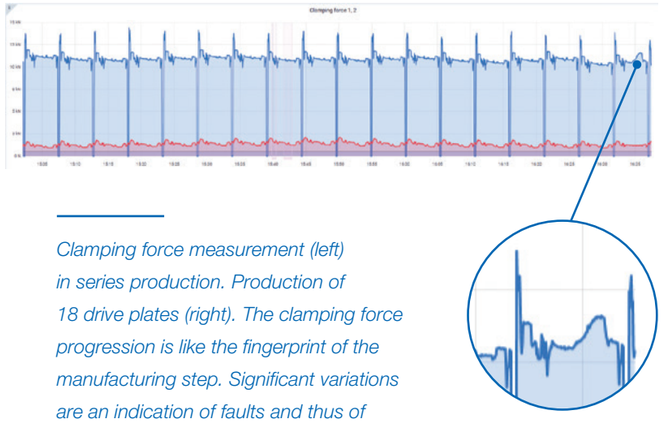
If you would like to know whether you are producing quality

The iJaw measures the clamping force between the clamping jaw and the workpiece in real time. The clamping force changes during machining, not only due to dynamic influencing factors such as centrifugal force, but primarily because of the cutting forces when machining. Regardless of the absolute coordinates set when positioning your machining tool, the clamping force – changed due to the cutting force occurring – tells you whether the machining process is effective or not.

Evaluation of this clamping force data during machining – independently of the machine tool control system – enables information about the quality produced to be obtained.

The iJaw therefore provides quality assurance feedback and can lead to reductions in post-process costs.





Clamping force measurement (left) in series production. Production of 18 drive plates (right). The clamping force progression is like the fingerprint of the manufacturing step. Significant variations are an indication of faults and thus of incorrect production and a faulty product.

SUMMARY:

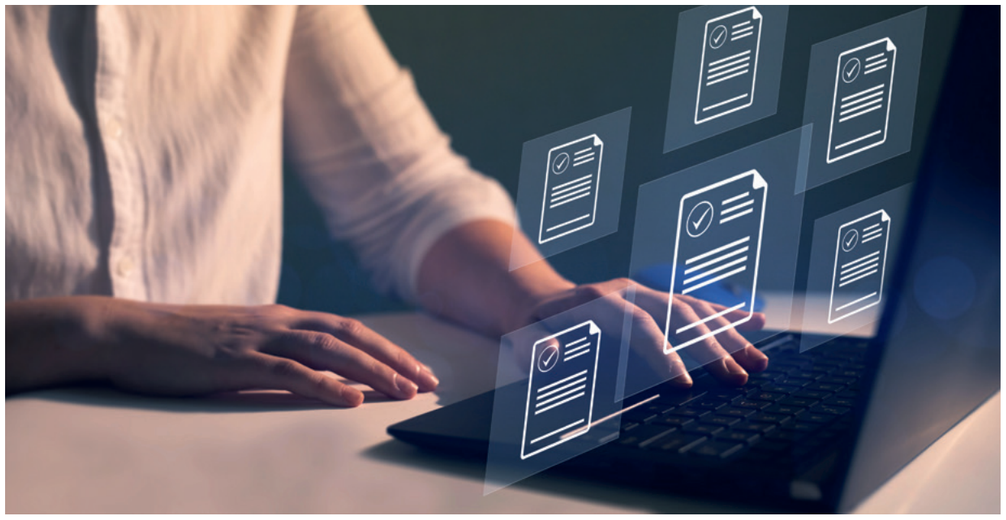
With the iJaw, clamping forces can now be measured during machining in real time. Influences during machining are also recorded and allow conclusions to be drawn about the overall quality of the machining.

YOU CAN TALK TO US ABOUT:

- Variations in blank geometry
- Variations in tool geometry
- Variations in finished part geometry

CASE STUDY: DOCUMENTATION THE CLAMPING SYSTEM WITH A MEMORY

If you would like to document manufacturing processes



The iJaw measures the clamping force between the clamping jaw and the workpiece before, during, and after machining, with a large number of individual measurements (100 Hz). The measured data thus provides detailed documentation of the machining process.

The data is archived for future reference and accountability. Manufacture of critical components can therefore be analyzed retrospectively, for example, for damage analysis, or to investigate weaknesses in complex and lengthy manufacturing processes.

DATA IN THE CLOUD – THE iJaw DOMAIN FOR DOCUMENTATION

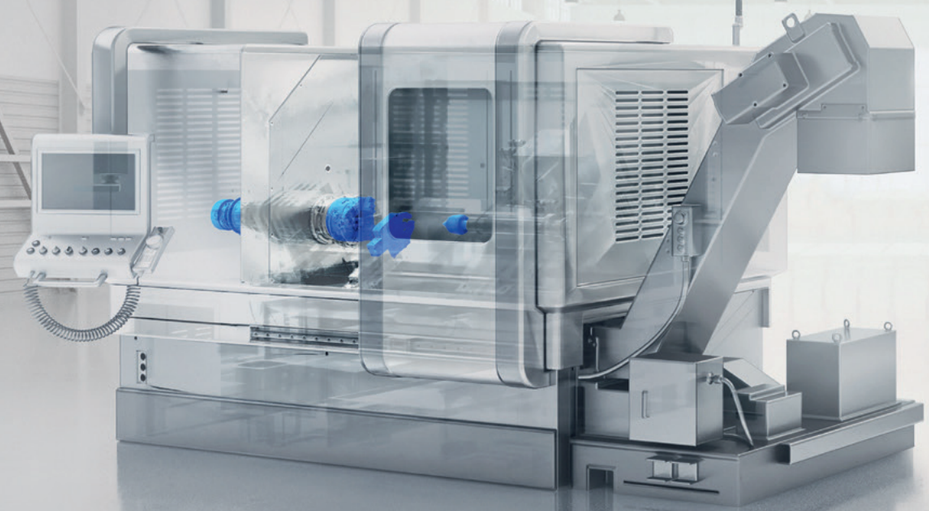
With the iJaw, the measured data (clamping force, speed, temperature, time) can be transmitted to the cloud. The cloud-based iJaw dashboard allows the measured data to be visualized and evaluated at any time, without any connection to the machine. Historic data can also beaccessed and evaluated at a later time.

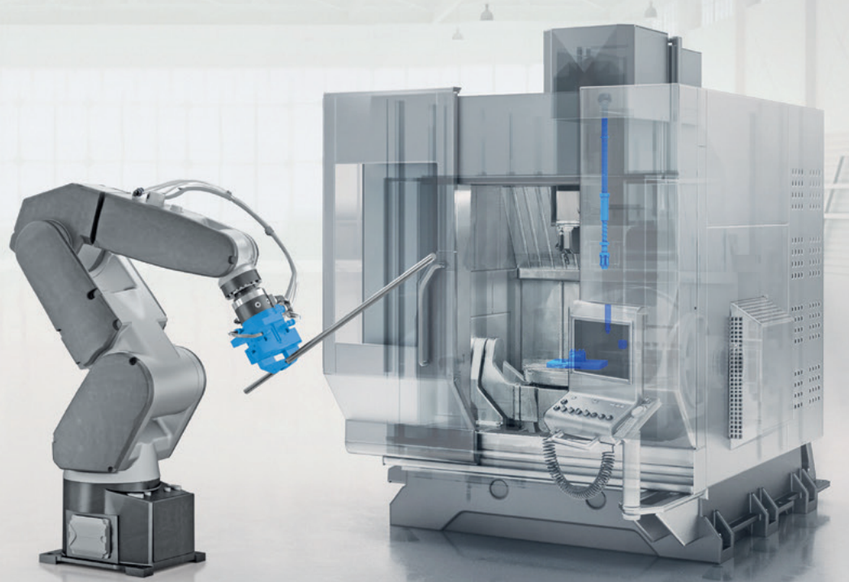
SUMMARY:

With the iJaw, clamping forces can be measured, documented and archived for all stages in the manufacturing process.

YOU CAN TALK TO US ABOUT:

- Components subject to documentation
- Analysis and optimization of manufacturing processes
- Safety-critical components





Our iJaw is much more than a clamping jaw that can measure and much more than a measuring instrument that can clamp.

The iJaw is the first family member from our sensor integrated clamping device platform.

We will gradually expand this platform with further clamping devices that are not just “smart”, they are “smarter”.

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Subject to changes.
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