KISTLER

measure. analyze. innovate.

Electro-mechanical NC Joining Systems

Flexible Solutions for Your Application

Electromechanical NC Joining Systems

For joining and press-fit applications, electromechanical NC joining systems are increasingly supplanting the familiar hydraulic, pneumohydraulic or pneumatic joining modules and actuator. In addition to less environmental impact, a more favorable energy balance, compact design, ease of installation and very low-maintenance operation, it is primarily production advantages that make an electromechanical system the obvious choice for the system designer. These include **flexibility, exact postioning,** extremely **high repeatability** and accurately **defined joining forces**.

For continuous monitoring of joining and press-fit processes, the force-displacement monitoring system Type 4740A... is available. It uses a wide variety of tolerance windows to evaluate the force-displacement curves of virtually any application and allows analysis of all four quadrants (forward and backward movement/compression and tension force). In addition to the conventional tolerance windows, dynamic windows for evaluation on the basis of the maximum position achieved, windows for evaluating the gradient, the change in gradient, point-by-point and the mechanical work (integral of the curve), are available. The system already has an Ethernet interface as standard. This allows easy connection to existing process and measurement acquisition systems via I-P.M. or Q-DAS®.
The curve and associated setpoints and actual values can be documented in detail. The NC Compact firmware Type 2159A... loaded into the servo controller is ideal for force-displacement evaluation of standard joining processes with a simple documentation function. For very modest capital and installation costs it facilitates integration into existing user control environments.

NCFT Type 2157B...
NC joining module with integral piezoelectric force sensor with measuring ranges 0,05 ... 1,5 kN.
- Suitable for applications in clean room, e.g. in manufacturing of medicaltechnical consumer products
- Force signal is transmitted wireless for highest measuring precision

NCFH Type 2151B...
NC joining modules with space-saving, gearless, hollow-shaft motor and integral piezoelectric force sensor. The measuring ranges are dependant on size 1 ... 60 kN.
- Short design, 2 sizes
- High speed
- Dynamic processes

NCFS Type 2152B...
NC joining module with internal piezoelectric force sensor and two predefined measuring ranges of 25 and 15 kN.
- Particularly slim design allows closely spaced individual workstations
- More accurate guidance
- Particularly rigid
- Use in automated production facilities

NCFB Type 2160A...
NC joining module with integral piezoelectric force sensor and two predefined measuring ranges of 25 and 50 kN.
- Reasonably priced
- Rugged design
- Ideal for standard joining processes

NCFN Type 2153A...
NC joining modules with integral strain gage force sensor for nominal joining forces of 30, 60, 100, 200 and 300 kN.
- Use in automated production facilities and manually controlled workstations
- Optional safety brake
- Several strokes available

Special design on request.

At a Glance

Electromechanical NC joining systems offer considerable advantages over conventional technologies such as hydraulics or pneumatics.

Process	high increase	low reduce
Flexibility at joining and press-fit processes	↗	
Installation work		↘
Maintenance and cost of ownership		↘
Energy consumption		↘
Environmental benefit	↗	

Services

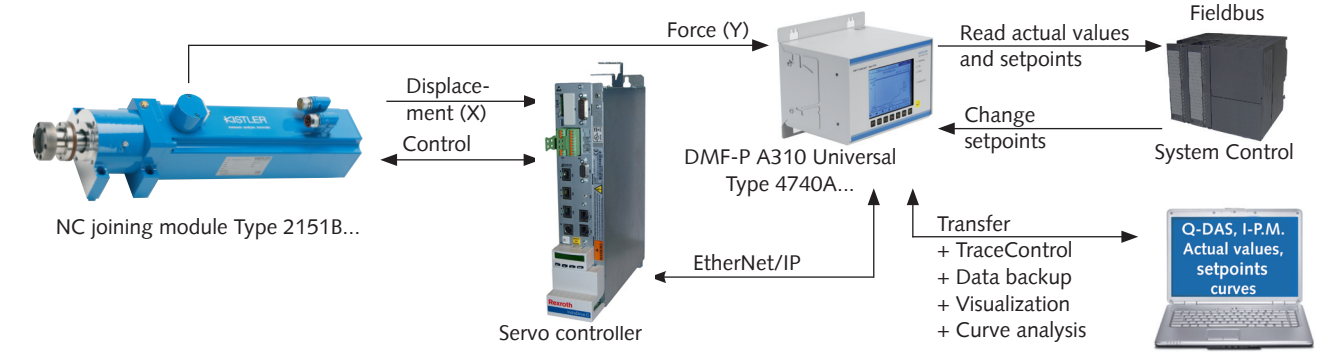
+ Worldwide support with startup
+ Global calibration service
+ Process and cycle time optimization
+ Maintenance contracts
+ Testing of customer samples

The NC Joining Modules NCFT, NCFH, NCFS and NCFB Have an Integral Piezoelectric Force Sensor that Offers:

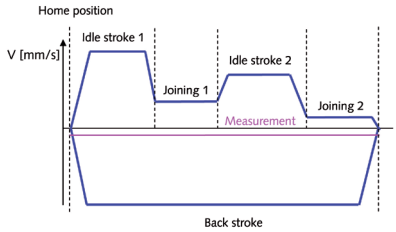
+ Measuring range switching, which is ideal for applications such as mixed production, and avoids having to preset the correct force measuring range
+ Cuts spare parts inventory and design costs
+ Overload protection and more rigid force sensor

Overview with Typical System Configuration and Main Features

System Configuration for Complex Force-Displacement Evaluation and Documentation with DMF-P A310 Universal



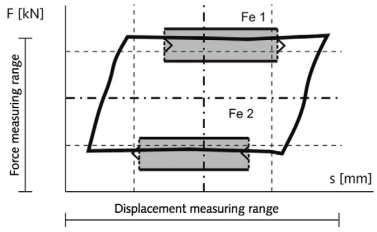
Complex Joining Process



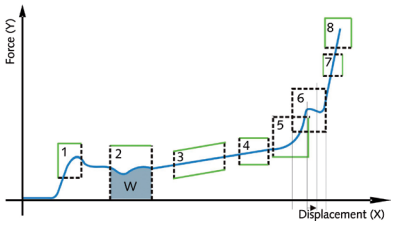
- Up to 16 position sets per program can be freely defined
- Force feedback control
- Force-triggered positioning
- Active deflection compensation system
- Positioning on external displacement sensor
- Fast shutdown
- Mode of operation move, automatic, and service

32 Programs, Each with up to 8 Windows

Type	Name	Type	Name
	1 Start position window		5 Limitation window
	2 Mechanical work		6 Break-point window
	3 Joining window (trapezoidal)		7 Gradient window
	4 Joining window (reference for end point)		8 End window

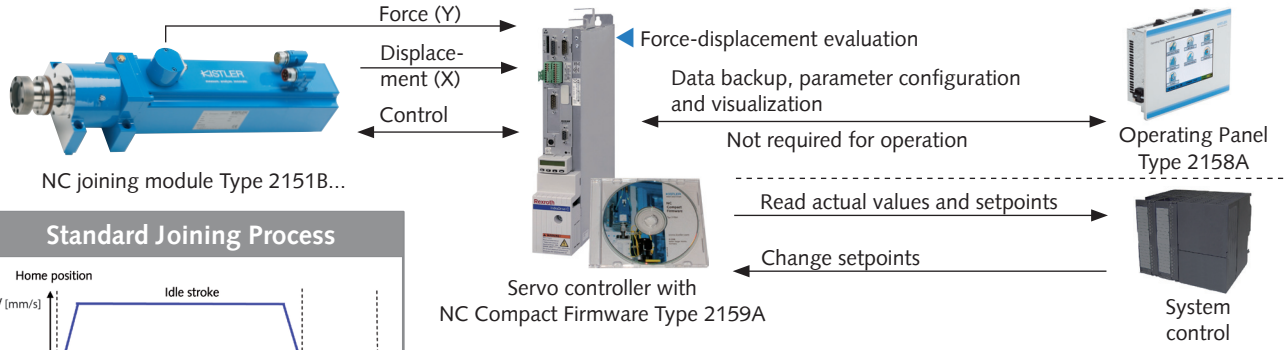


4-Quadrant Measurement

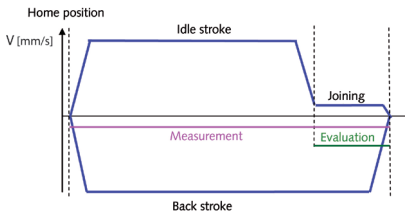


Example of Force-Displacement Diagram

System Configuration Providing Reasonably Priced Entry-level Solution for Force-Displacement Evaluation with NC Compact



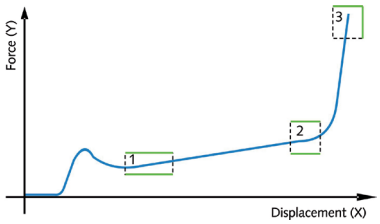
Standard Joining Process



- Up to 4 predefined position sets per program
- Force feedback control
- Force-triggered positioning
- Active deflection compensation system
- Fast shutdown

16 Programs, Each with up to 3 Predefined Windows

Types of Tolerance Window



Example of Force-Displacement Diagram

Overview NC Joining Modules

Measuring Range	0,01 kN	0,1 kN	1 kN	10 kN	100 kN	1 000 kN
Stroke	0 mm	50 mm	100 mm	200 mm	300 mm	400 mm

Max. speed

NCFT
Type 2157B...

- Measuring direction: **tension/compression**
- Piezoelectric force sensor
- With holding brake

NCFH
Type 2151B...
Size 1

- Measuring direction: **tension/compression**
- Piezoelectric force sensor
- With holding brake

NCFH
Type 2151B...
Size 2

NCFS
Type 2152B...

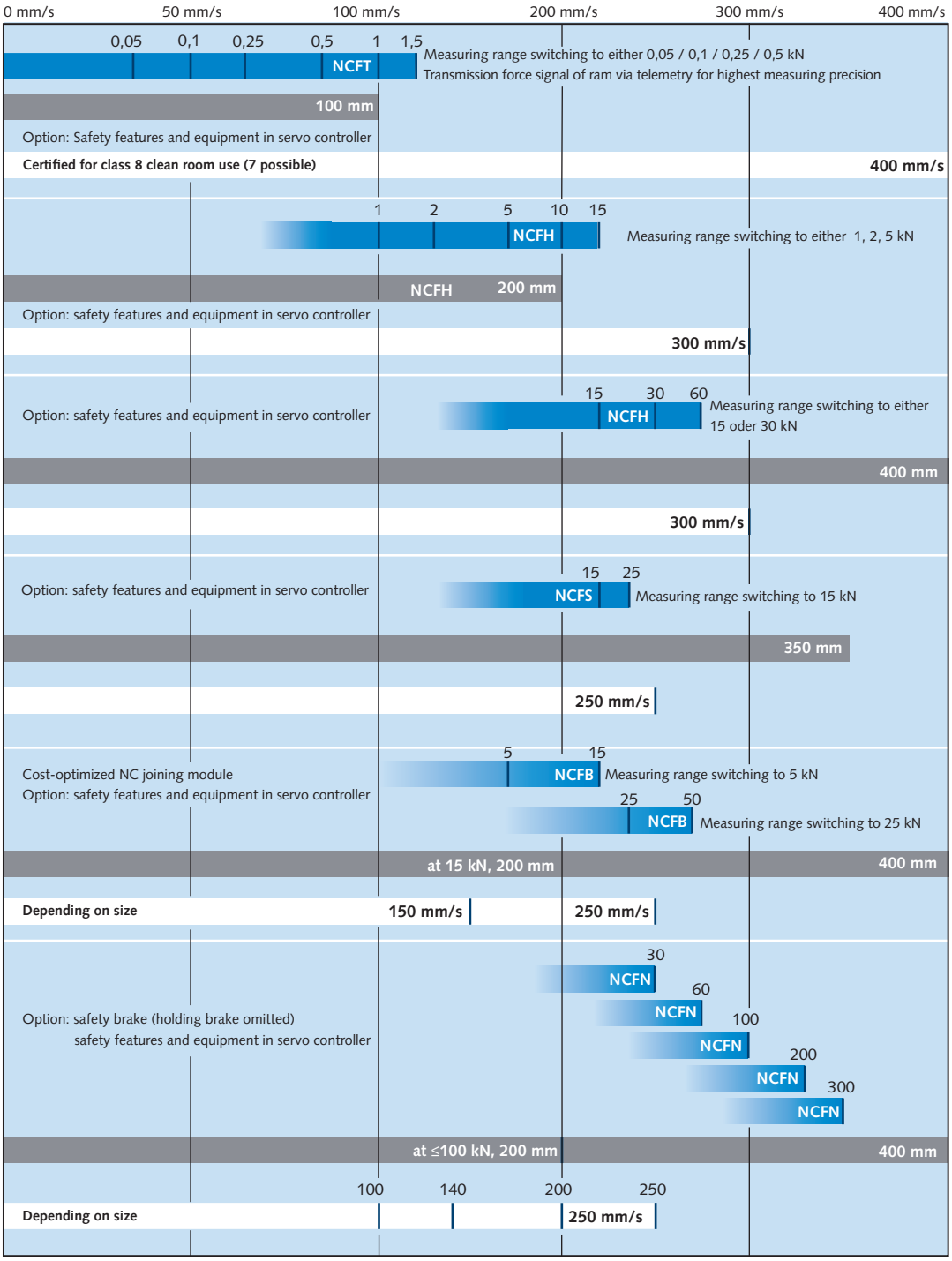
- Measuring direction: **tension/compression**
- Piezoelectric force sensor

NCFB
Type 2160A...

- Measuring direction: **compression**
- Piezoelectric force sensor
- Option holding brake

NCFN
Type 2153A...

- Measuring direction: **tension/compression**
- DMS force sensor
- With holding brake



Electromechanical NC joining systems from Kistler also cover full range of forces up to 300 kN on manual workstations

Note: Each NC joining module has an integral absolute encoder for positioning.
See the relevant data sheet for other technical data.
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Comparison of Force-Displacement Monitoring DMF-P A310 Universal and NC Compact

		High-End-System with DMF-P A310 Universal	NC Compact System	
Monitoring Units				
Type		4740A…	2159A	2158A
Name		DMF-P A310 Universal	NC Compact Firmware	Operating Panel
Main application	Monitoring of joining and press-fit processes. Supplying of result as a good or bad signal to the PLC.	Measurement and monitoring system specifically for electromechanical NC joining modules (e.g. NCFH Type 2151B… etc.).	Force-displacement monitoring system with standard joining processes specifically for electromechanical NC joining modules	Configuration of parameters and visualization of joining process plus data backup
Window	Window evaluation	Absolute and dynamic	Absolute	
		4-quadrant measurement	First quadrant only (pressure/forward direction)	
		Flexible configuration of up to 8 windows per program	Max. of 3 predefined windows per program, evaluation in joining stroke only	
Window types		>30	3	
Evaluation		In DMF-P A310 Universal	In the servo controller	
Number of programs		32	16	
Positions		16 per program	4 per program	
Position sets		Flexible	Fixed	
Measurement switching (piezo)		■	■	
Force control, deflection compensation system, force-triggered positioning, quick cutout		■ (depending on program)	■ (depending on program)	
Interfaces	Profibus	■	■	
	EtherNet/IP, Profinet I/O, DeviceNet, CANopen, DI/DO	optional	on request	
	Ethernet	■	■	
Webbrowser		■	–	
Remote maintenance		■	–	
Display		Button control software s/w	Color touch screen	
Documentation functions	OK/NOK statistics	■	■	
	Curve memory	■	–	
	Q-DAS® transfer format (qs-stat)	■ (certified)	–	
	I-P.M. data format	■	–	
	CSV files with setpoints, actual values and curves	■	■	
Mounting	Panel mounted	■	■	
	Wall mounted or desktop version	■	–	
Installation work		Minor	Minor	
Support for all current NC joining modules from Kistler		■	■	
Accessories for PL e (Type 2154A...)		(optional)	–	

Special features of DMF-P A310 Universal
- Export of measurement curves, setpoints and actual values via Ethernet with spooler functionality
- Parameters can be changed or read via fieldbus
- Documentation of changes to setpoints with user traceability
- Optional connection of external displacement sensors for greater positioning accuracy
- Gradient window, break-point window and point-by-point force-displacement monitoring
- Easy control with integrated sequence control

Special features of NC Compact
- Parameters can be changed or read via fieldbus
- No operating panel required for operation. Panel can run process during start-up even without PLC being operational

Key: ■ = Standard – = not available

General-Purpose Manual Workstations

General-purpose manual workstations from Kistler are standalone units for joining processes with safety gate and integral force monitoring. They are designed for use in development, prototyping and small-scale production.

Their standard equipment also includes the powerful NC control center (NCCC) with Beckhoff PLC and IndraDrive servo controller from Bosch Rexroth.

Electromechanical NC Joining Modules

The manual workstations are based on Kistler's electromechanical NC joining modules. The six standard models with integral force-displacement monitoring cater for a very wide measuring range from 0,25 to 300 kN. This ensures comprehensive coverage of requirements extending from the horological industry to mechanical engineering. Custom variants are also available.

Futureproofed by Flexibility

The manual workstation is readily adaptable to suit a wide variety of joining tasks. Any number of movement and measuring programs can be installed to facilitate changeovers. All in all, the manual workstation from Kistler is always a futureproof investment.

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Application areas for manual workstations in development and small batch production are:

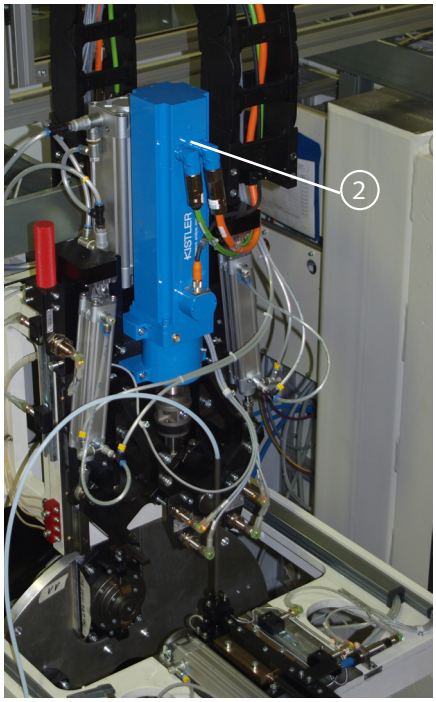
- Braking systems
- Steering component
- Injection systems
- Drive production
- Electronic control
- Chassis components

NC Control Center (NCCC) functionality

- Online teach-in recording
- User management with Administrator, Supervisor and Operator levels
- Several measurement programs in a single position set
- External database connection to Access, SQL, etc.
- Combined window/envelope curve evaluation
- Running highly dynamic joining processes
- Implementation and computation with external variables
- Export in tabular (e.g. Excel®) format
- Export files can be created in TXT or QS-Stat format
- Tension-compression applications
- OK/NOK counter
- Drag and drop creation of position set
- Windows and envelope curves can be entered with mouse or edited in table
- Export of measurement curves as BMP or JPEG file
- Option of collecting several curves and superimposing for comparison purposes

Manual Workstation Type 2171B... with joining force of 10 kN, piezoelectric force monitoring and industrial PC

Application Examples



Assembly line for turbo charger
Turbo charger assembly: in this production line an NCFN Type 2153A..., 30 kN (1) is used for pressing the bearing tube into the housing. The joining depth is referenced onto the workpiece by an external displacement sensor.
Model NCFH Type 2151B...,(2) 15 kN for joining a spring dowel pin and for securing the bearing tube. Overall cycle time is 54 seconds.

Work cycle
- Joining of the bearing tube into the housing
- Joining of the spring dowel pin
- Force - displacement monitoring by DMF-P A300 NCF Type 4734A... .

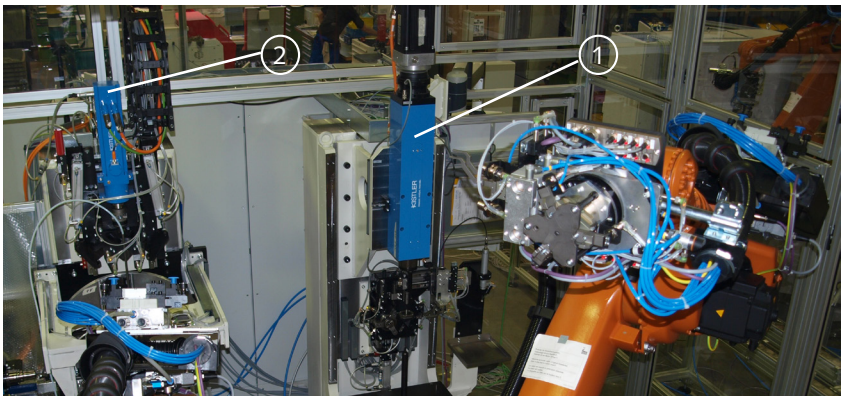
Riveting machine for lightweight brake disk
The model NCFN Type 2153A... is used in this machine to allow riveting of up to 20 different types of lightweight brake disk.
The light aluminum pot allows weight savings of up to 3 kg per vehicle axle depending on size.

Process
- Aluminum pot is heated inductively and joined to the brake disk
- The resultant composite assembly is drilled with 18 holes and then riveted

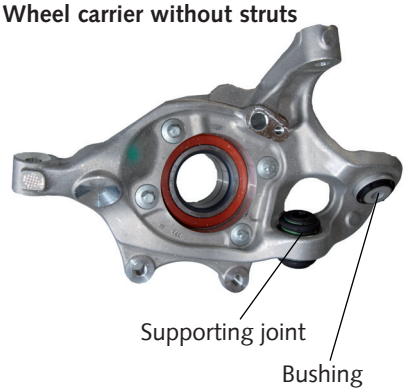
Joining of elastomer supports in tracking stabilisation bars
In this machine the model NCFN Type 2153A..., 60 kN is used with a cycle time of 15 seconds; fully automatic with bearing feeding and part recognition. 20 different variants are covered

Other typical joining and press-fit applications include vehicle wheel carriers

Process
- Screw wheel carrier together
- Press-fit wheel flange
- Press-fit supporting joint and bushing



Wheel carrier without struts



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