Universal Test System for Press-Fit, Joint, Torque and Process Control
DIGIFORCE®

Model 9306

- Controls operations involving press-fit, rotating and panning, such as force and displacement, torque and angle, etc.
- Windows check threading, curve characteristics, hysteresis, gradient, final force and position
- Controls up to 10 work pieces per second
- 32 different models of work pieces in 32 measuring programs, fast change by PLC
- Provides extensive data about process status
- Easy-to-use diagnostic tools for counter-measures
- Built-in statistical functions
- All normal sensor interfaces included as standard
- Profibus DP and DPV1 (option)
- Comfortable data recording with PC software DigiControl

Application
DIGIFORCE® controls processes in which precisely defined functional relationships between two measurement variables must be demonstrated. For example such relationships exist between force and displacement during pressing, and between torque and angle of rotation during bolting. DIGIFORCE® is used widely in the monitoring of fastening, riveting, and caulking operations, as well as in torque control in production of hinges, seat back adjustment mechanisms, rotary switches, etc. DIGIFORCE® is universally applicable. It is used first of all in the design and development phase for determining the set point characteristics of yet undetermined curves. DIGIFORCE® computes and displays these curves graphically. Such a curve can be stored at any time and be re-used as a reference curve.

In a later phase, DIGIFORCE® is integrated in the production environment and fulfills its primary monitoring function in full synchronization with the production system. In addition to being used in fully automated production lines, DIGIFORCE® can also be found assisting many manual tasks such as acceptance sampling in shipping and receiving.

Quick work piece changes are no problem for DIGIFORCE®. Up to 32 work piece-specific parameter sets are available, which can either be controlled by PLC or by menu. The highly comprehensive diagnostics screens provide the user with constant data on the production process. Trend curves allow the user to tell when and how a process is running awry.
Testing procedure
After initiating START on the device, the sensors measure the X-Y coordinates in form of a curve, write them to memory, display them as a graph, and evaluate them by means of a special window technology. If a curve measurement passes through the windows as defined, DIGIFORCE® returns a PASS (OK), otherwise a FAIL (NOK) signal. For universal evaluation of various types of curves, DIGIFORCE® offers 7 different models of windows. A total of 10 different windows of various models can be allocated to each curve measurement. The windows can read and evaluate positive (from left to right) and negative (from right to left) curve directions. In the example below, windows 1 through 4 are positive and 5 and 6 are negative. The windows only evaluate the curve for the direction that has been assigned to them, regardless of whether the curve also runs through the same window in the other direction (as in the case of window 4).

Block Window
The block window monitors the block dimension and the block force of a pressing operation, for example. For this type of window, the curve must enter the pre-determined side of entry and must not exit the window.

Hysteresis Window
This type of window evaluates a progressive or retrograde curve of Y values for a random point on the x-axis. These hystereses are used, for example, as quality characteristics in hinged elements, switches, etc.

Gradient Window
Evaluates the slope of a curve segment between two programmable values of X.

Never Window
If the curve enters this model of window a FAIL (NOK) signal is returned.

Last-point Window
The last value of the curve must be within the window.

Process data
The operator can cycle through the following diagnostics screens while the machine is running.
1. NOK occurrence among all windows in form of a histogram
2. Trend curves of the window entrance and exit values
3. Frequency distribution of the entrance and exit values
4. Graph of last curve measurement
5. Display of Y-Min-Max values of all evaluation windows
6. Y-Min and Y-Max values and also X-Max of the whole measuring curve
7. Textual instruction for the user (can be entered through PC software DigiControl)

Measuring functions
DIGIFORCE® offers 5 measurement functions for different applications:

\[ y = f(x) \]
A variable Y is logged and evaluated as a function of the variable X. A selectable X-interval determines the input of X-Y coordinates. The advantage: Input only occurs when the X variables change.

\[ y = f(x,t) \]
A variable Y is logged and evaluated as a function of the variable X and time. A selectable X-interval determines the input of X-Y coordinates.
\[ y = f(t) \]
A variable at channel Y is logged as a function of time factor t.
Advantage: The X-sensor reading can be disregarded (e.g. the displacement sensor on a press).

\[ x = f(t) \]
A variable at channel X is represented as a function of time.
This allows for example, to monitor displacement or angle characteristics only.

Classifying X or Y
Variables at channel X, such as length, thickness, diameter, or at port Y, such as force, weight, torque, etc., can be divided into 5 classification groups. Each group is allocated to a switching signal. For example this allows a fully automatic sorting of spring characteristics according to an elastic constant.

Limit monitoring in real-time
For channels X and Y, two limits can each be assigned and monitored in real-time. Each limit is assigned to a switching signal. This allows, for example, to change the press setting from “fast” to “slow”.

Reference point for the evaluation window
TRIGGER, BLOCK or ABSOLUTE selectable.

Filtering external tolerances
External tolerances, which can occur in the case of varying positioning heights of work piece fixtures, are suppressed by DIGIFORCE® in a so-called trigger mode. Measurements begin only when assignable trigger threshold values have been reached e.g. if a shaft which should be mounted is touched. At this time the displacement is set to zero.

Measurement programs
For fast work piece changes, DIGIFORCE® can store up to 32 measurement programs, which can be executed either by PLC or by hand.

Adjusting measurement channel settings
Adjustments in the sensor interfaces (model of input, amplification, voltage supply, etc.) are carried out by menu commands. No adjustments in the hardware are necessary. There are no jumpers or adjustment switches!

Calibrating the measurement channels
Three methods:
1. Teach-in calibration
2. According to sensor protocol
3. Shunt calibration

Control via PLC
Two optional logical cards (refer to part number):
p-switched (mainly Europe)
n-switched (mainly USA)
All input and output channels are optodecoupled.

Process Data
On display:
- Entrance/exit values
- Peak values
- Normal distribution of entrance/exit values
- Trend curve of entrance/exit values
- Selectable e.g. y min, y max, x min ...

Through PLC interface:
OK successful pass-through of all windows
NOK at least one window violation
NOKA error during threading, online signal

Real-time signals for system control
S1 ... S4 optionally connectable to channel X or Y.

Serial interfaces
RS232
RS485 (full duplex)
Curve measurements, statistical data, and device settings can all be sent to a master computer or to a printer connected directly to the device.

Protocol
Standard: ANSI 3.28
Option: Profibus DP to 12 MBaud

PC software DigiControl
DIGIFORCE® is a self-contained device and can be operated without any external tools. However, the PC software DigiControl, obtainable as an accessory, offers a number of practical tools:

Changeover via parallel I/O, Profibus, menu or RS232/485

Download measurement curves from 9306
Display single measurement curves individually
Display measurement curve family
Calibrate curves
Print curves
Archive curves
Upload of instrument settings
Edit instrument settings
Download instrument settings
Archive instrument settings
Measurement report for quality assurance and traceability, static data for EXCEL
Sensors for Y-channel

### Strain gauges

- Parameters: ± 0.2 ... 25 mV/V
- Bridge resistance: 120 Ω ... 5 kΩ
- Excitation voltage: 2.5 V or 5 V
- Current: 25 mA
- Kind of excitation: 2 excitation lines, 2 sense lines
- Cut-off frequency in levels: 5 Hz ... 5 kHz selectable
- Total error: < 0.1 %

### Piezoelectric sensors

- Measurement range: ± 1 nC ... ± 500 nC
- Cut-off frequency in levels: 5 Hz ... 5 kHz selectable
- Total error: < 1 %

### Process signals

- Signal range: ± 5 V, ± 10 V
- Cut-off frequency in levels: 5 Hz ... 5 kHz selectable
- Total error: < 0.1 %

### Sensors for X-channel

#### Potentiometers, DC/DC sensors, process signals

- Signal range: ± 5 V, ± 10 V
- Excitation voltage: 5 / 10 V
- Current: approx. 100 mA max.
- Cut-off frequency: approx. 5 kHz (-3 dB)
- Total error: < 0.1 %

#### Incremental sensors

- You can connect sensors with or without reference makers, whose coding consists of pulse strings phase-displaced by 90 degrees.

### Sinusoidal current output

- Signal: 7 ... 16 μA
- Excitation voltage: + 5 V, 300 mA, -5 V, 300 mA
- Cut-off frequency: max. 50 kHz
- Counting range: 16 bit
- Interpolation: four times

### Using a TTL-channel

- Signal: 5 V
- Excitation voltage: + 5 V, 300 mA, -5 V, 300 mA
- Termination resistor: open
- Cut-off frequency: max. 100 kHz
- Counting range: 16 bit
- Interpolation: four times

### LVDT and differential position sensors (option)

- Signal range: ± 25 ... 1000 mV
- Sensor excitation voltage: 1.5 V
- Frequency: 5 kHz
- Current: max. 50 mA
- Resistance: above 50 Ω
- Cut-off frequency: 1 Hz ... 1 kHz selectable
- Upper range drift: 50 ppm/K
- Total error: < 0.1 %

### General Technical Data

- Scanning rate max. at y = f(x): 10 000 values/sec.
- Sample rate at y = f(t), selectable: 500 μs ... 6.5 s
- Digitalization: 12 bits (11 bits + sign bit)
- Memory: 8 000 pairs for measurement curve
- Computing time: 40 - 110 ms
- Range of operating temperature: + 5 ... ± 23 + 50 °C
- Range of storage temperature: 0 ... + 60 °C
- Power excitation: 230 VAC / 25 VA or 115 VAC / 25 VA
- Online switching points delay S1 ... S4: 2 - 10 ms

### Housing

- Desktop/rack housing Protection class: IP40
  - Dimensions: [W x H x D]: 235 x 133 x 255 [mm]
- Wall mounted housing Protection class: IP65
  - Dimensions: [W x H x D]: 265 x 150 x 325 [mm]
- Display
  - Dimensions: 120 x 88 [mm]
  - Pixel: 320 x 240

### Accessories

- Implementation assistance
  - for upload/download of instrument settings
  - for editing of instrument settings

### The CAD drawing (3D/2D) for this device can be imported online directly into your CAD system.

For further information about the burster traceparts cooperation refer to data sheet 80-CAD-EN.

---

**Order Information**

DIGIFORCE® Model 9306 - V  

**Standard**

- 0 0 0 0

- Desktop-rack housing IP40  
- Wall-mounted IP65 (option)  
- Standard interfaces (Strain gauge/Piezoelectric/Incr./±10 V)  0  
- Additional LVDT interface (option)  1

- IO Port, p-switched, power supply 230 VAC  0  
- IO Port, n-switched, power supply 115 VAC (option)  1  
- IO Port, p-switched, power supply 115 VAC (option)  2  
- IO Port, n-switched, power supply 230 VAC (option)  3  

- without Bus, only RS232/485  0  
- Profibus DP, DPV1 (auxiliary RS232)  2

- 2 x DIGIFORCE® 9306 in one common housing 19" housing IP40

---

**Technical changes reserved.**

Latest updates of data sheet always under www.burster.com

For further information about the burster traceparts cooperation refer to data sheet 80-CAD-EN.

**DIGIFORCE® Process Monitoring in Production**

It contains many applications, a detailed product description and an overview table of all fitting sensors.