ForceMaster

Low-Cost Monitoring for Manual Presses

Model 9110

Code:	9110 EN
Delivery:	ex stock
Warranty:	24 months

NEW
Single-channel force monitoring

- **Excellent value "Plug & Work" complete system**
- **Easy auto-configuration with automatic setting of the evaluation tools**
- **Smart Card system for manipulation free configuration and storage of settings**
- **Acoustic and optic error indication**
- **Data logging on USB stick (optional)**
- **PLC sequence control function (optional)**
- **Analysis and configuration software included**
- **Automatic sensor identification**
- **Hub and other component counters**

Applications

Pressure on price and quality continue to rise. The need to monitor even the simplest manufacturing and assembly process is increasingly common. With 100% monitoring of force/time curves or force displacement/time curves, the ForceMaster satisfies all requirements for ensuring the reliability of even simple press-fit processes. Thanks to its ultra-simple, single-button operation and intelligent auto-configuration, even semi-skilled staff can set up the equipment safely and quickly. "Card & Go" is the smart system that uses master, tool and PLC smart cards to make equipment settings, inhibit unauthorized changes and to trigger actions in sequence with the production process.

The ForceMaster 9110 has been developed specifically for monitoring manual lever presses. Simple manual workstations can be monitored extremely efficiently using the ForceMaster. Easy control functions that used to require an additional PLC can now be performed reliably with the ForceMaster. Tools can be changed quickly and easily using tool cards.

The ForceMaster is used for example for

- ► Pressing ball bearings
- ► Compressing powders
- ► Press-fitting pinion gears

Description

The ForceMaster has a multi-voltage power supply. Excitation of the load cell and displacement sensor is provided by internal voltage-conditioning circuits. Sensor identification is built into the sensor plug, allowing sensors to be connected easily with no further configuration needed.

The integral auto-configuration tool uses a GOOD component to train the ForceMaster with the measurement curve and automatically set the evaluation elements. The user can make any further fine-tuning and adjustments to these settings manually if required.
Visual indicators such as a red and green indicator lamp signal "Good" or "Bad" parts. An audible sound is also output for "Bad" parts.
The built-in PLC function allows sequence control of up to 60 steps. This can be used, for instance, to control pneumatic cylinders, compressors for blowing out workpieces, and reject gates for OK/NOK parts.

The PC software, which is included free of charge can be used for measurement-curve analysis and fine-tuning the evaluation elements. It also lets the user view and archive the measurement curves recorded on the USB stick.

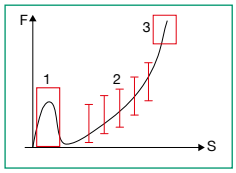
9110 EN

Automatic sensor identification

The connected sensors are automatically detected by a special plug, so there is no need to configure each of the measurement channels. Faulty sensors or different measurement ranges can be changed in an instant, with no risk of mixing up sensors!

Auto-configuration

The auto-configuration function is an outstanding feature of the ForceMaster 9110.
This tool automatically predefines the start condition and position of the evaluation elements.
The basis for these settings is a GOOD production process in auto-configuration mode. The first stage in this process is to tare the force channel. This is necessary because the ForceMaster 9110 can only measure unipolar forces. Taring corrects any offset voltages and drift in the load cells. Then the ForceMaster 9110 waits for an upward movement of the press. Once the force exceeds a configurable force threshold, measurement recording begins.
If nothing else changes, the ForceMaster waits for a downward movement of the press. The teach-in training process is stopped once measurements pass below the start point. Then the measurements are analyzed and the configuration settings are made. Afterwards, in a second step, the user can choose whether to use force displacement limits (horizontal limits) or 2 gates (vertical limits) for the evaluation. There is also the option to monitor the 1 feed-in area for a maximum force. Another option is to enable monitoring of the 3 block force. As part of the block-force monitoring function, the user can also enable monitoring of the end deformation.
In addition, changes can be made to the internally calculated values and limits manually.



Main evaluation types

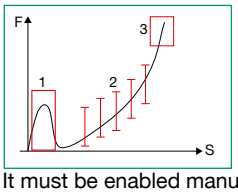
- ► Force displacement limits
- ► Gates (vertical force displacement)

The user can also enable:

- ► Feed-in force monitoring
- ► Block-force monitoring
- ► End-deformation monitoring
- ► Force alarm 1
- ► Force alarm 2

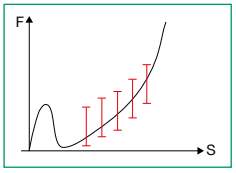
Description of evaluation types

Feed-in area 1



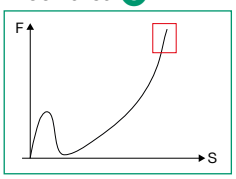
Within this area, the measurement process can be monitored for exceeding a maximum force (upper feed-in limit). Good parts are not allowed to exceed this limit.
The feed-in area is always disabled after the teach-in measurement process.
It must be enabled manually.

Gates (vertical limits) 2



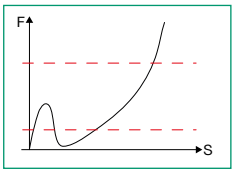
With force-displacement limits, the force in this area must always exceed a minimum force (lower force limit). The force must then not drop below this limit again over the entire area. For good parts, the force must also not exceed a second force limit, the "upper force limit".
In the measuring range, the horizontal force-displacement limits are replaced by vertical force-displacement limits. 5 gates are active. Each are defined by a displacement position and an upper and lower force. The measurement curve must pass through the gate between these two forces. The gates do not have to be placed in a specific order. Evaluation is not performed until the last gate has been passed in the displacement direction.

Block area 3



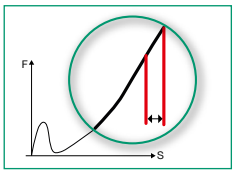
This area is usually where the end of the measurement lies, which a good part must always reach. The force limits "lower block limit" (which must be exceeded) and "upper block limit" (which the force must not drop below) are used to monitor the block force.
The measurement curve must end in this area. The curve must not go beyond the displacement point defining the block end (NOK). The measurement curve is allowed to have already exceeded the "lower block limit" when it enters this area. It is not allowed, however, to drop below the "lower block limit" again in this area.
The block area is always disabled after the teach-in measurement process. It must be enabled manually.

Force alarms



In addition to the evaluation areas 1 - 3 force alarms 1 and 2 are always available.
Force alarm 1 is used to monitor the load cell outside a started measurement. Since this is monitored over the displacement, this force monitoring is not enabled for the Y=f(t) function (no displacement measurement).
Force alarm 2 is used for continuous monitoring of the load cell - both outside and during a measurement.
CAUTION: The force alarms do not generate an NOK evaluation. They are simply used to set the "Alarm occurred" PLC output for information purposes. But only if sequence control is not enabled!

End deformation



This option is used for monitoring deformation of the workpiece around the maximum force. This is done by measuring the displacement when the force exceeds the "lower block limit".
The end deformation is obtained from the difference between the maximum displacement during the measurement process and the deformation value saved when the force exceeded the "lower block limit". The calculation starts once the force has dropped below the "lower block limit" again during the return stroke.
End-deformation monitoring is always disabled after the teach-in measurement process. It must be enabled manually.

Components

Following counter options are accessible via the menu

- ► Parts OK
- ► Parts NOK
- ► Total parts
- ► Down-counter
- ► D-set (set value for down-counter)
- ► T.stroke (total-stroke counter)

PLC sequence control function (optional)

Control is based on the principle of a sequencer. A built-in electronic cam switch is provided for this purpose. The combination of these two forms of control provides a very powerful range of functions.
In principle, one can visualize a cam as a displacement range, which is also linked to the direction of movement. This makes it possible to program certain actions that are active for as long as the press stays in this range.
A sequence is composed of a series of commands that are processed step by step. Each step contains a condition and an action. The controller waits at each step until the condition is met and then carries out the action. Only then it does move on to the next step.
There are 8 inputs and 8 outputs available. Depending on the safety requirements and risk levels of the application, additional measures must be taken to achieve the necessary "safety level".

Data logging on the USB stick

Curve data can be saved on an USB stick for subsequent analysis and assessment. This is possible for a press-insertion operation that has a cycle time of ≥ 1 second.

Display options

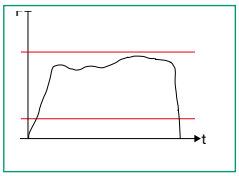
The display can show the following options: live sensor values, actual value for force/displacement or time, live evaluation, parts counter or maximum sensor values.

2417-009110EN-5672-081524

Special option force monitoring

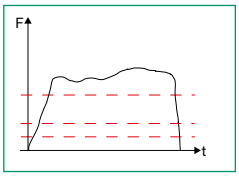
The force-time option is designed for straightforward force measurements requiring evaluation. For this application, just one load cell is connected to the ForceMaster 9110.

Force thresholds



Force thresholds can be used to monitor whether the force lies in a defined range. A green light indicates that the force lies in the specified range. A force that exceeds the upper force threshold triggers a visual and acoustic alarm. Evaluation takes place online during measurement.

Limits



In addition, 3 limits are available for defining various switching results. With hysteresis settings, a limit buffer and customizable switching behaviour, these switching results can be tailored to customers' requirements. There is also a facility to delete the limit via a digital input.

Smart cards

Master card

Only the master card allows access to the configuration menu. Without this card, the user is only permitted to view the general equipment data. It is also possible to specify in the configuration settings that faulty parts can only be confirmed with a master card.

Tool card

The tool card can be used to save and then reload a parts-specific program configuration (ForceMaster 9110 settings for measuring and evaluating a particular device under test).

This is useful, because different parts (depending on calibration quality) can then be measured on the same equipment or in future also on different ForceMaster 9110 units, without needing to perform an auto-configuration.

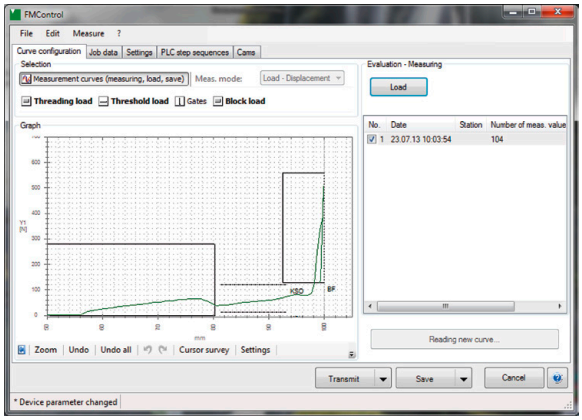
PLC card

A sequence-control program and the associated cam configuration can be stored on the PLC card and reloaded later.

PC software

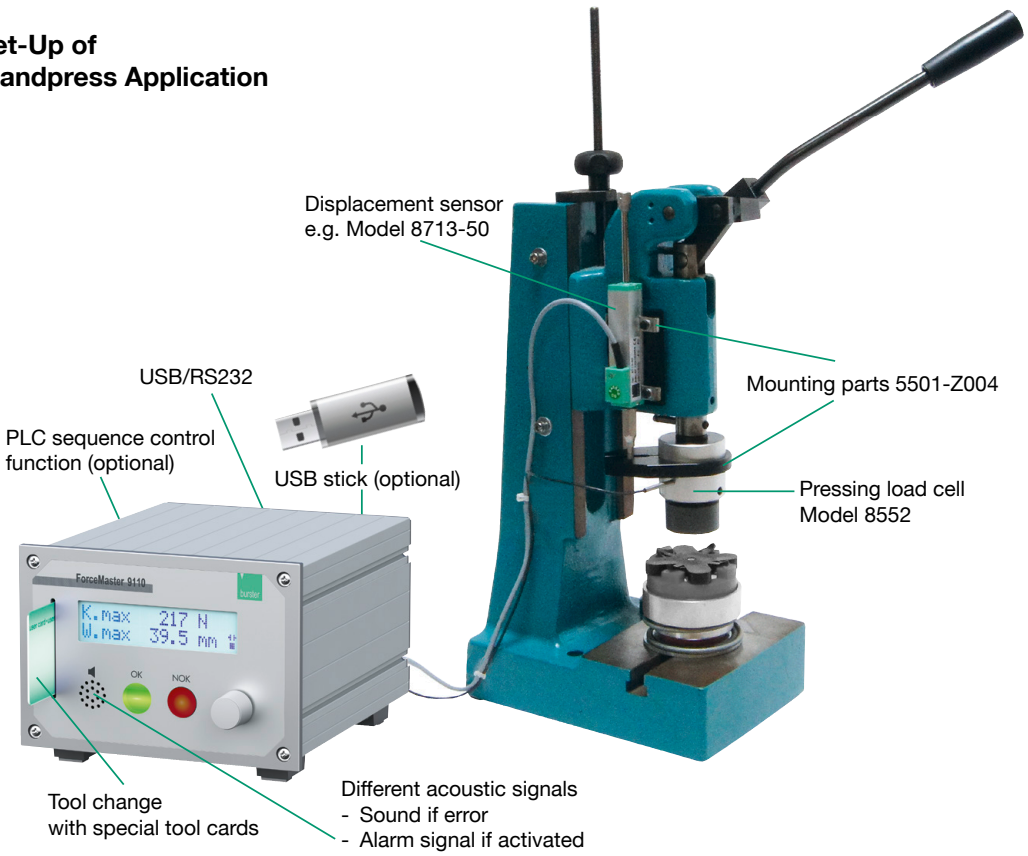
The free of charge configuration and analysis software FMControl offers following possibilities:

- ► Device parametrization
- ► Backup function
- ► Setting of evaluation elements according to auto configuration
- ► Programming the sequence
- ► Analysis of measurement curve
- ► Data storage and archiving
- ► Management and creation of tool smart cards



Application

Typical Set-Up of Manual Handpress Application



9110 EN

Load cell model 8552

The force is measured by a load cell, which is fitted on the press ram between sensor and tool. The load cell is equipped with mechanical overload protection.

Technical Data

Accuracy:	< ± 2 % F.S.
Measuring ranges:	from 0 ... 100 N to 0 ... 20 kN (50 kN ... 100 kN with model 8451)
Maximum force during use:	approx. 120% of rated force
Degree of protection:	IP54 to EN 60529
Diameter:	50 mm
Height without peg:	50 mm
Peg diameter:	10 mm
Sensor hole diameter x depth: (other pegs/holes optionally available)	standard 10^{H7} x 25 mm

When the sensor is used in the press, it is important to ensure that it is operated without transverse forces during the working stroke. Therefore the tool must be guided with the minimum possible play and the workpiece must be positioned securely.

Detailed technical data on the load cell is given in the 8552 data sheet.

Displacement sensor Model 8713 (optional)

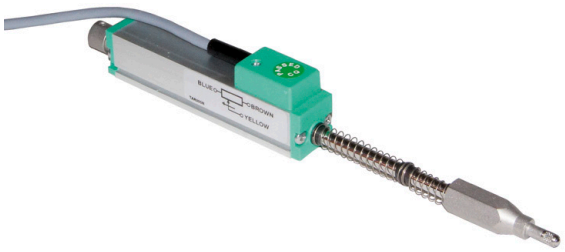
The full working stroke of the press ram can be monitored by a model 8713 displacement sensor firmly mounted on the press head.

Technical Data

Linearity deviation:	< 0.1 % full scale
Resolution:	0.01 mm
Degree of protection:	IP40 to EN 60529

When the displacement sensor is retrofitted to an existing press, a sketch is available which identifies the positions of the mounting holes that need to be made on the press head. We recommend using our 5501-Z004 mounting kit for this purpose.

Detailed technical data on the displacement sensor is given in the 8712/8713 data sheet.



Technical Data

Sensors for the force channel

Bridge resistor:	350 Ω ... 5 kΩ
Connection type:	4-wire
Sensor excitation:	5 V
Excitation current:	20 mA
Power consumption:	approx. 0.3 VA
Input voltage:	1 mV ... 10 mV
Total error:	< 1 % F.S.

Sensors for the displacement channel

Sensor type:	potentiometric displacement sensor
Track resistance:	1 kΩ ... 5 kΩ
Total error:	< 1 % F.S.

General equipment data

Display:	2 line illuminated LCD display
Warning and confirmation sounds:	configurable signal type
Alarm signal volume:	up to 75 dB
Measurement channels:	force/displacement or force/time
Communication interfaces:	USB - Slaveport type B, on the back RS232 - D-SUB 9, 19.2 kbaud data rate
Mains power supply:	90 ... 240 V AC / 50 ... 60 Hz
Cut-off frequency:	1 kHz
Operating temperature range:	5°C ... 40°C
Storage:	- 10°C ... 60°C
Air humidity:	10 ... 80 %, non-condensing
Enclosure type:	aluminum section
Degree of protection:	IP20
Connections:	coded special plugs
Sampling interval:	10 kHz
Protection class:	1
Number of I/O:	8 inputs / 8 outputs
Response time relay:	1 ms
Total current of all outputs:	0.3 A internal excitation 1.5 A external excitation
Dimensions (W x H x D):	174 x 119 x 213 [mm]
Weight:	approx. 3 kg

Order Code

ForceMaster Standard	**9110 - V**	☐	☐	☐	☐	
		0	**0**	**0**	**0**	
Options	PLC sequence control function		1			
	USB stick data logging				1	
Single-channel force only		1				

Order Information

ForceMaster with PLC function and USB data logging
Analysis and configuration software **Model 9110-V0101**

Accessories

In order to fit the displacement sensor securely and firmly on the press head or on the load cell itself while still allowing fine adjustment, assembly kits are available that include all necessary parts such as carriers, plates, screws and mounting diagram for correct positioning

for 8451 load cell, measurement range up to 0 ... 20 kN **5501-Z002**
for 8451 load cell, measurement range starting from 0 ... 50 kN **5501-Z003**
for 8552 load cell **5501-Z004**

For further information see accessories' data sheet.

Cables

Connecting cable for potentiometric displacement sensors including plug (e.g. 8712) **Model 99221-591A-0090030**
RS232 cable to PC **Model 9900-K333**
USB cable to PC **Model 9900-K349**

Smart carts

Master card for full configuration access **Model 9110-Z001**
PLC card for storing PLC sequences on the card **Model 9110-Z002**
Tool card for saving tool data and measurement programs **Model 9110-Z003**

Connectors

Connector plug for load cells, containing stored sensor calibration data **Model 9900-V245**
Connector plug for potentiometric displacement sensors, containing stored sensor calibration data **Model 9900-V221**
Connector assembly **Model 99005**

2417-009110EN-5672-081524