

UFM Classic

The UFM Classic units feature
the widest range of forces, strokes
and speeds



For more efficiency.

PROMESS
ASSEMBLY + SENSOR TECHNOLOGY

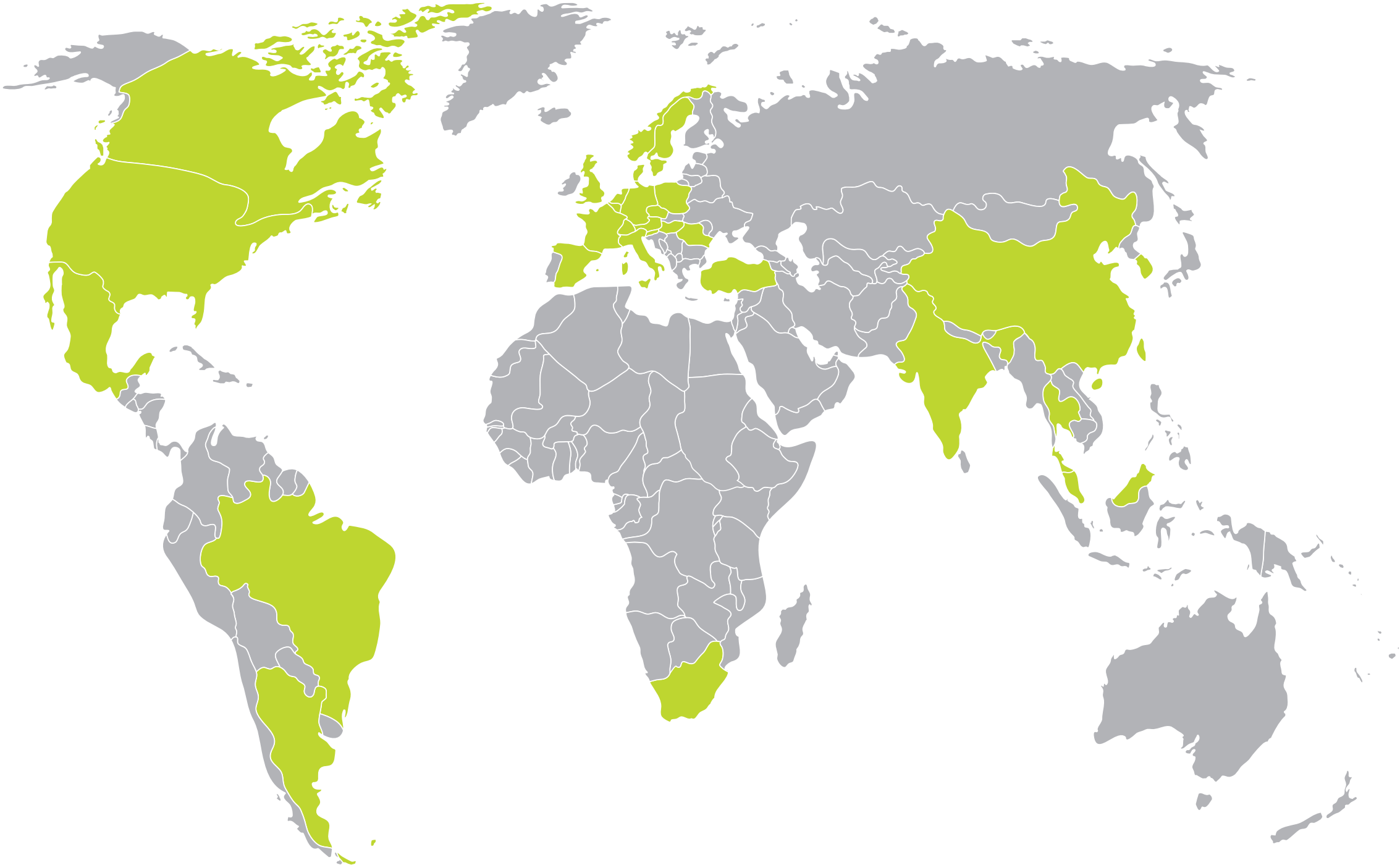
Your partner in the field of assembly and testing technology

Gerhard Lechler founded the company PROMESS in 1977 as an engineering office in the field of technical measurement in Berlin. Initially, the company distributed handmade patented measuring bearings for tool condition monitoring before the electro-mechanical assembly press (UFM) with integrated NC control was born at the end

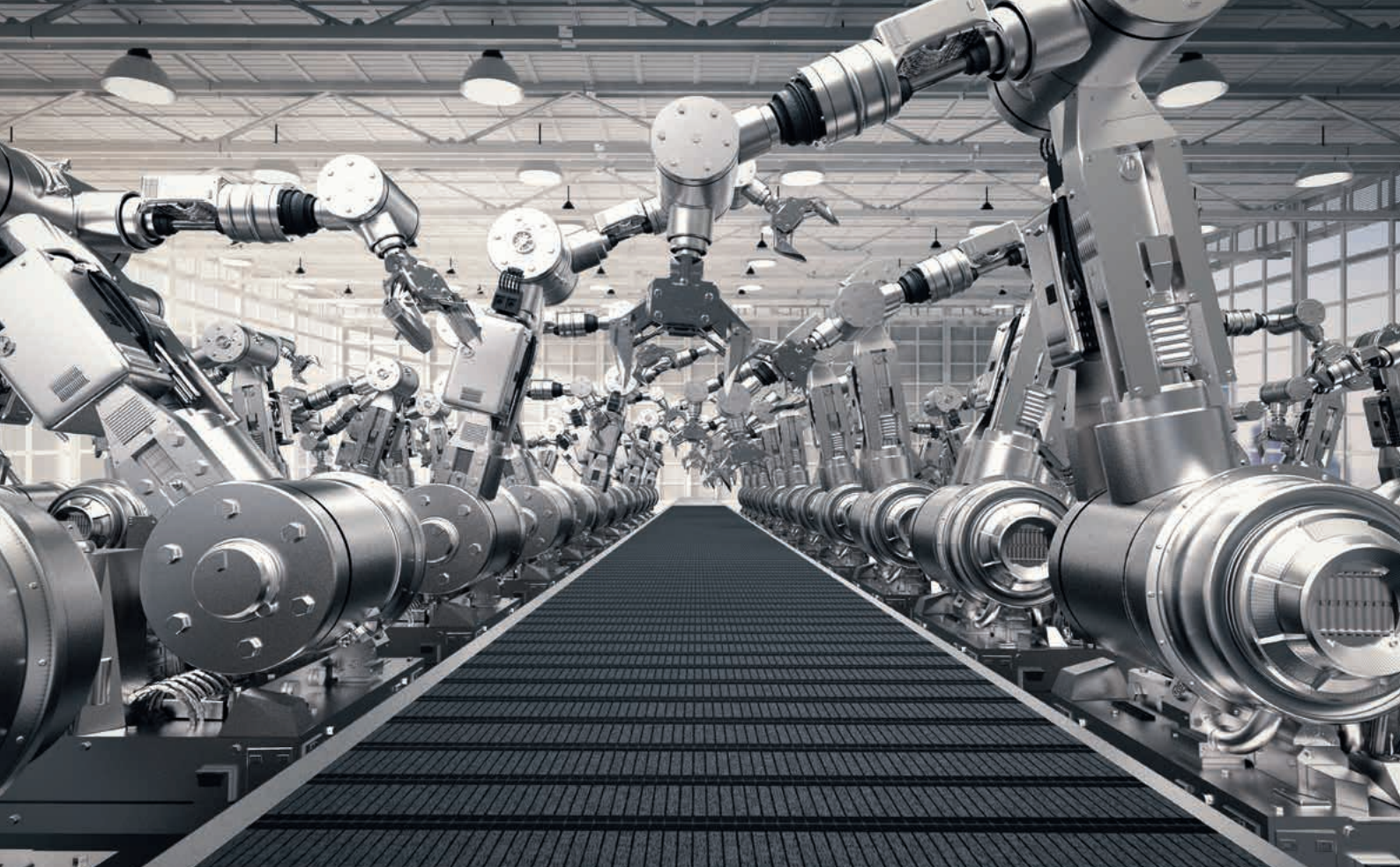
of the 1980s. Right from the beginning it was the strength and the passion of Gerhard Lechler to develop technical solutions for his customers. And this has not changed until today. This passion has continued so that the core competence of PROMESS is still the development of complete technological systems for solving the individual

and complex assembly and testing tasks and requirements of our customers. From process development to preliminary testing, from initial installation to daily production, PROMESS offers holistic expertise from a single source. Our specialist teams have comprehensive knowledge of our products and offer prompt and effective

advice worldwide. Today PROMESS is one of the global leaders in the manufacturing of electro-mechanical assembly presses with the widest range of presses in this field. Currently, more than 15,000 presses are operating in heavy industrial applications. In almost 30 countries all over the world our sales and service partners are looking forward to your enquiries and questions.



Australia	Malaysia
Austria	Mexico
Argentina	Netherlands
Belgium	Norway
Brazil	Poland
Canada	Romania
China	Serbia
Czech Republic	Singapore
Denmark	Slovakia
France	Slovenia
Germany	South Africa
Great Britain	Spain
Hungary	Sweden
India	Switzerland
Italy	Thailand
Korea	Turkey
New Zealand	USA



UFM Classic

The electro-mechanical assembly presses of our series UFM Classic have been conceived for demanding applications in heavy industrial environments. They feature a broad variety of models and thus can be used for divers assembly, joining and testing applications with force-distance monitoring. The user can chose from a wide range of forces, strokes and speeds in order to configure the corresponding servo press for his application. Together with our series UFM Line5, UFM Compact5 and UFM Precision5 we offer suitable solutions for almost every application.

The following specifications are available in the UFM Classic series:

Specifications							
Item no.	Force	Stroke	Speed	Item no.	Force	Stroke	Speed
374003G2	3	100	120	374060G2	60	180	150
374005G2	5	200	240	374065G2	60	330	240
374012G2	12	200	240	374181G2	80	180	150
374014G2	15	200	240	374091G2	80	330	200
374125G2	20	180	150	374103G2	100	330	200
374023G2	20	350	230	374111G2	100	180	110
374131G2	30	180	150	3740151G2	150	400	145
374130G2	30	350	230	374151G2	150	400	145
374040G2	40	180	150	374196G2	300	450	100
374043G2	40	330	240	37510500G2*	500	400	50

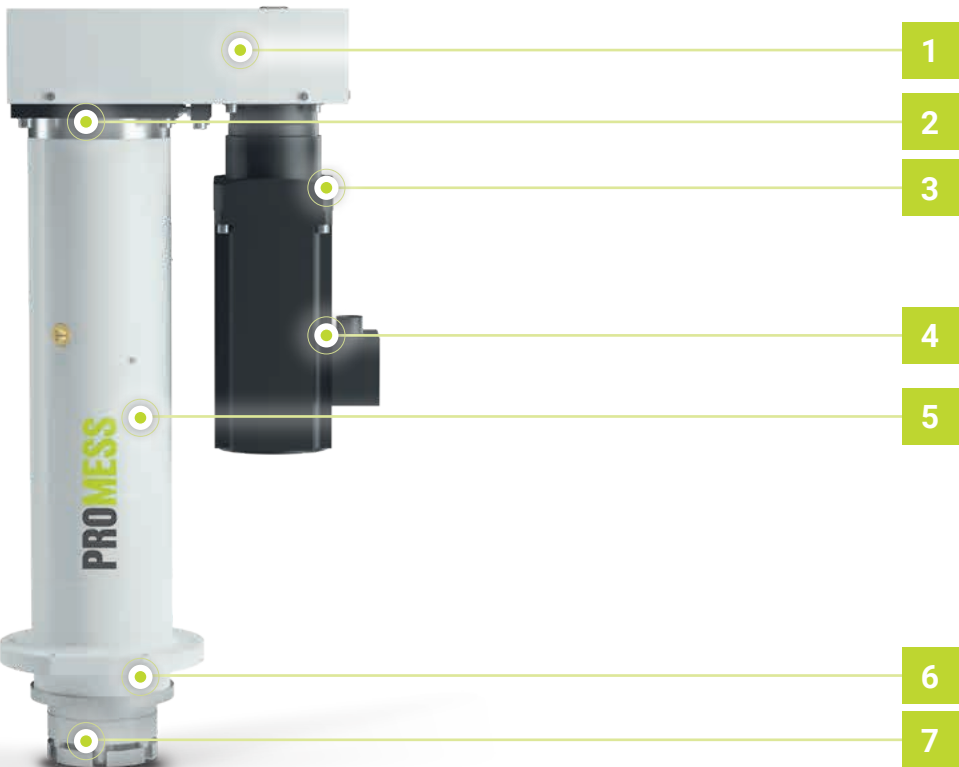
* The 500 kN assembly presses are only available in inline design.

Advantages:

- Movement and monitoring as an integrated solution
- Digital force measuring with 24-bit resolution
- Multi range calibration for force input (optional)
- Optional with absolute transducer
- Only the power amp is required, no need for an additional external monitoring system
- Integrated force-distance monitoring
- Fieldbusses can be optionally expanded using plug-in modules
- PLe for STO by default
- Quick changeover also for small and medium series
- Robust mechanical design for long periods of use
- Clean use

Mechanics

The servo presses UFM Classic feature a **robust mechanics** for the use in heavy industrial environments. The motor is connected to the roller or ball gear drive by a high-performance gear belt. The **precise force measuring** is done by an integrated strain gauge force transducer. PROMESS ensures **high life times** by a large dimensioning of the gear. Due to the parallel design of the presses, low construction heights are realized. The presses feature a repeatability of positioning of <0,01 mm by the robust, **anti-twist ram guidance**. The mounting of the press in a production line is succeeded by the designed flange for it.



Set-up of the mechanics

- 1. Synchronus belt gear
- 2. Integrated strain gauge amplifier
- 3. Gearbox
- 4. AC Servo motor with resolver or absolute encoder with holding brake (optional)
- 5. Steel housing
- 6. Mounting flange
- 7. Anti-twist ram

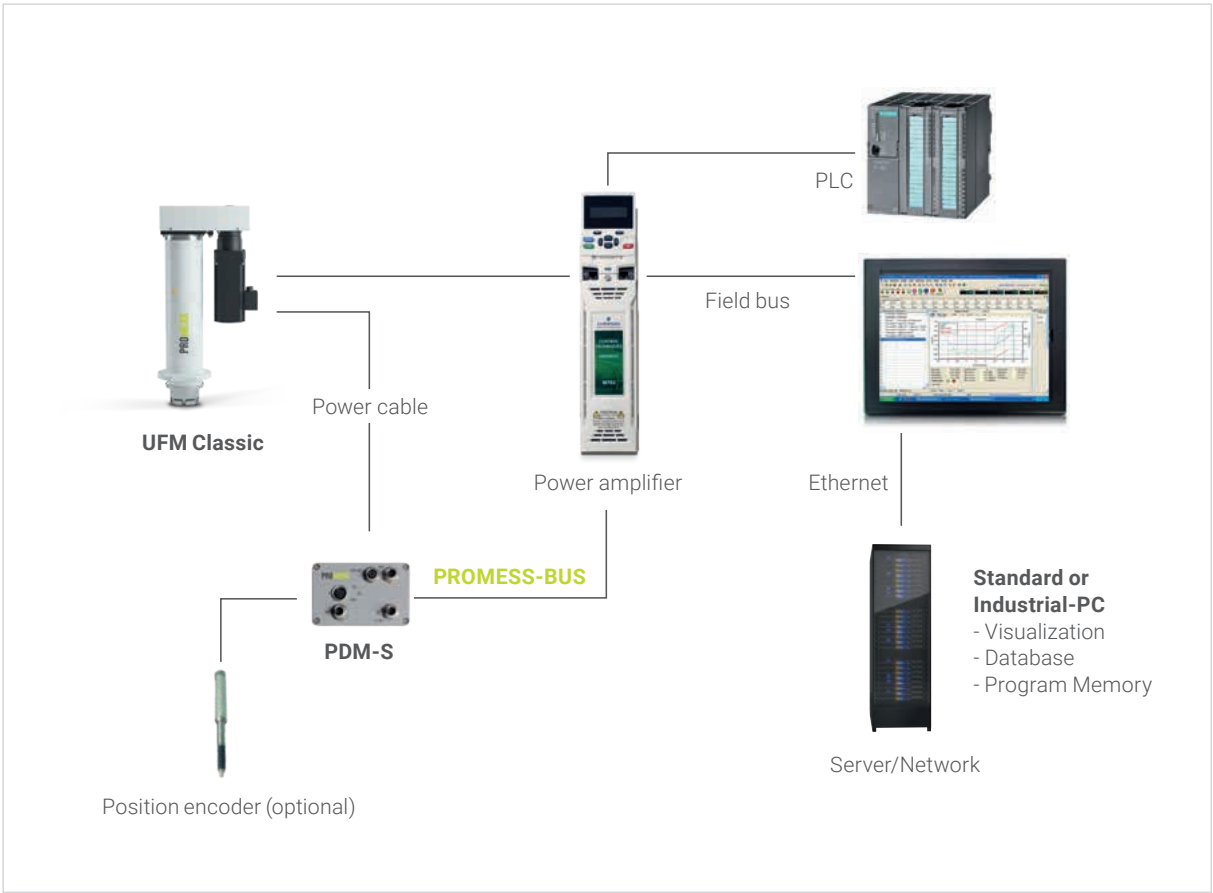
System Design

The mechanical system is controlled by a **servo amplifier** with an integrated NC module. The internal Risc processor coordinates the joining module and can be easily programmed and operated using a **conventional PC**. The control coordinates the mechanical motion of the press as well as monitoring the force and distance. The visualization is realized by a conventional PC. An additional monitoring system is not necessary.

The **digital pre-amplifier PDM-S** is digitally connected to the UFM control via the PROMESS bus. It transfers the force signal of the strain gauge amplifier at a resolution of 16 bit almost trouble-

free. A resolution of 24 bit is possible. With the optional multi range calibration the joining system achieves a system accuracy of 0.3 % from the final value. The characteristic map is created automatically using the UFM Calibrate plugin. The results are stored in a calibration report and can be printed out. Additionally the PDM-S can be used as program memory with the possibility to store 200 programs.

For the connection of the **higher-level PLC** one can chose different fieldbusses like PROFIBUS, PROFINET, EtherNet/IP or EtherCAT.

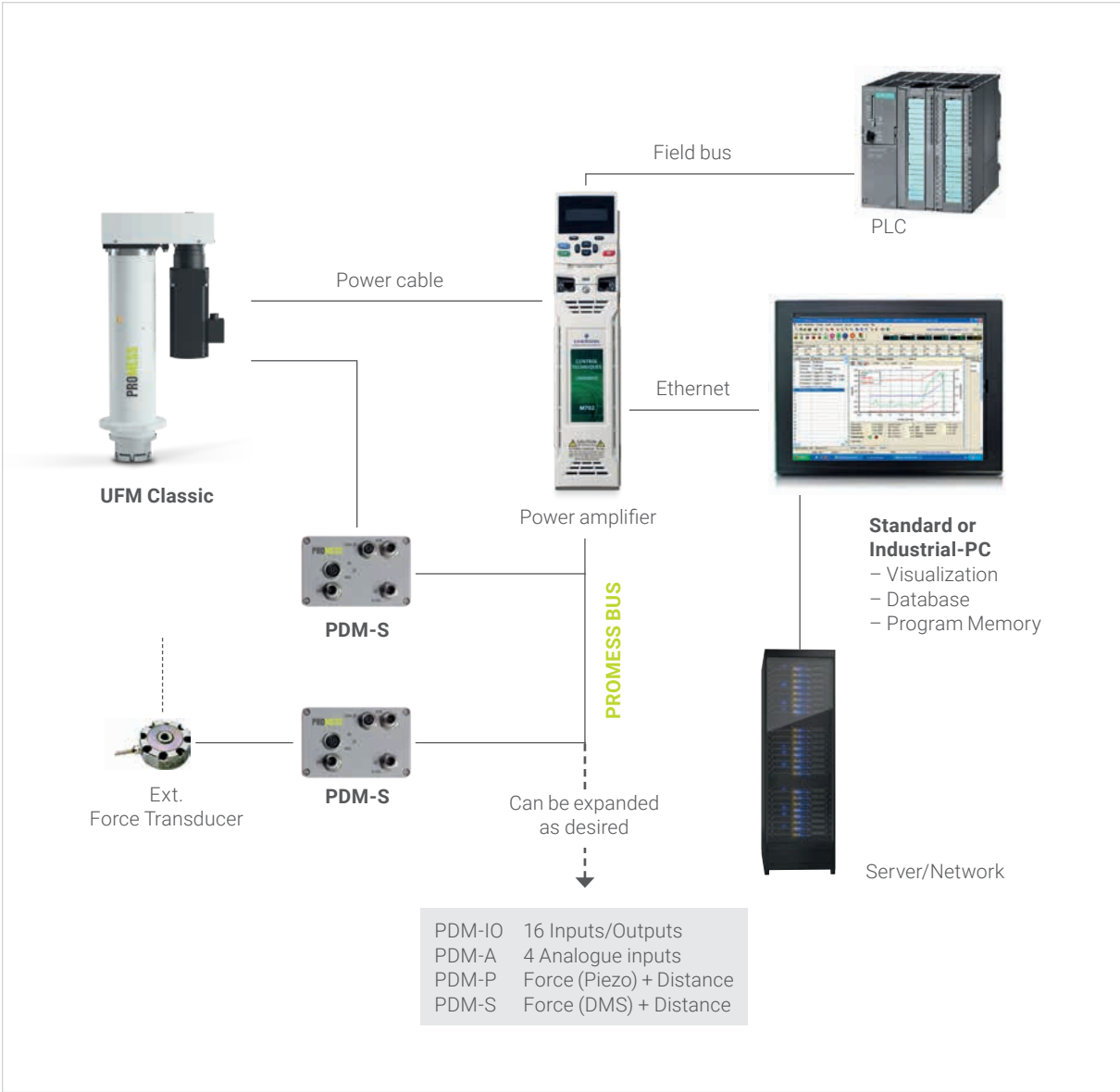


Extension/Line configuration

On a further stage of expansion, additional sensors can be connected and controlled, depending on the requirements of the application.

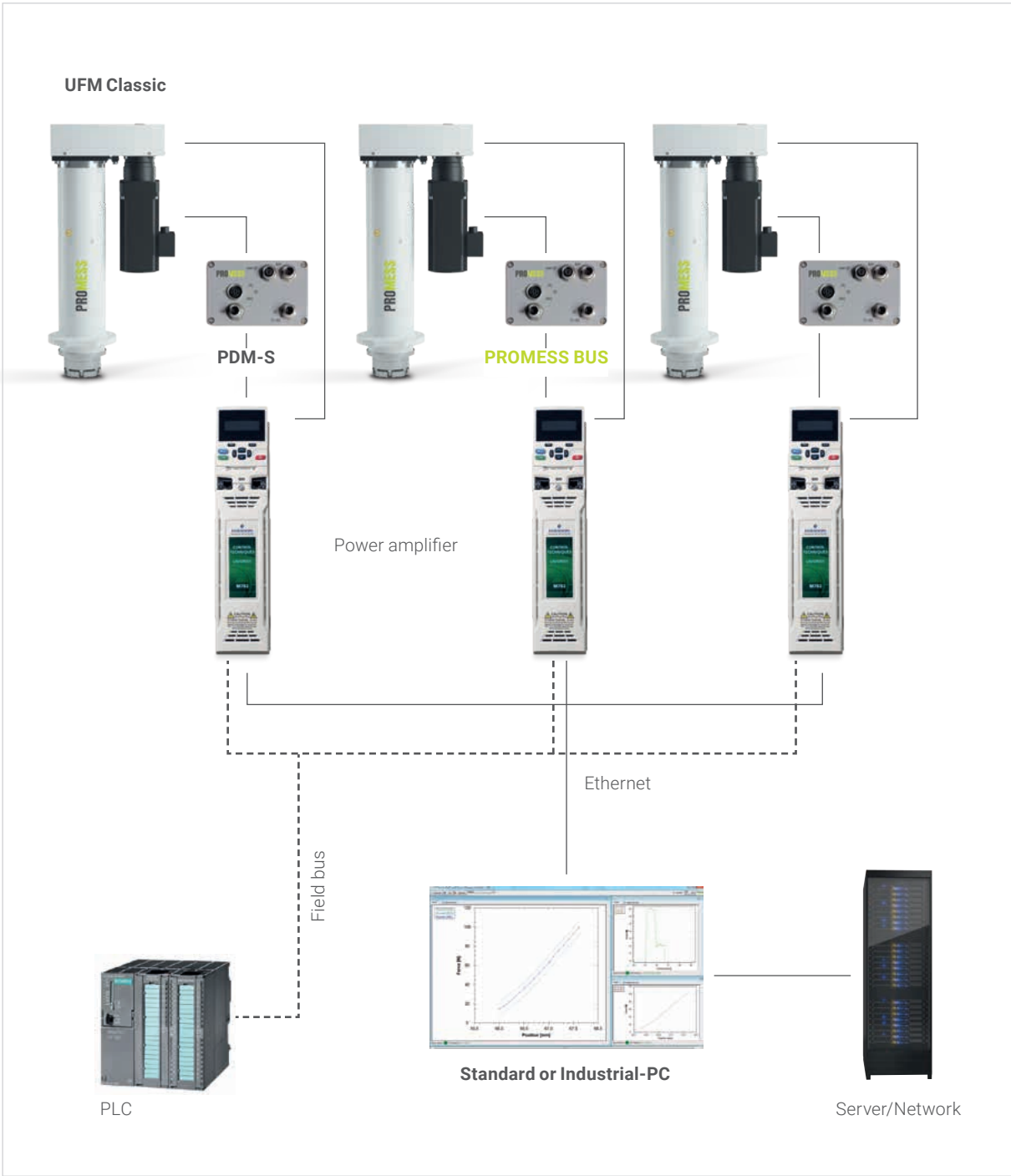
PROMESS offers four different multifunction amplifiers PDM with different functions:

- **PDM-S:** Amplifying of a strain gauge amplifier signal
- **PDM-P:** Amplifying of a piezo amplifier signal
- **PDM-A:** Capture and scaling of up to 4 analogue inputs
- **PDM-IO:** Capture and scaling of up to 16 digital in- and outputs



Stage of expansion

A line configuration with several electro mechanical assembly presses can be realized according to the following functional design.



Line configuration

Software

The servo presses UFM Classic come with our **programming software UFM V5.xx**. It serves for the creation of the press program, for the recording and displaying of the quality data and for the storage of the process data. The software is intuitive to operate and does not require any PLC expertise. It can be used to create simple or advanced joining processes.

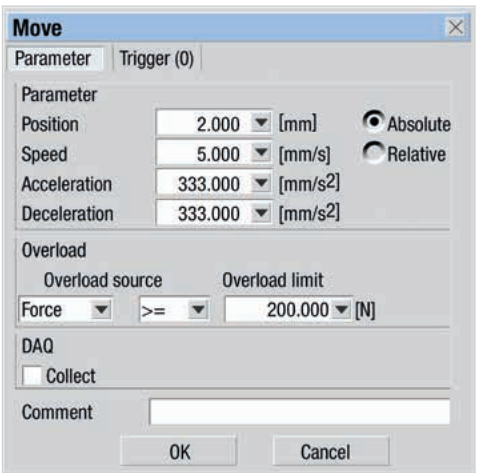
The **transparent and concise program surface** allows users to quickly create programs.

The main window lists all programming steps together with their functions. The **function** screens can be opened successively to enter the process values. Thus the force, displacement, time, speed, acceleration and braking rate can be easily programmed for each step. Once the required input screens have been defined, the joining program is completed and the steps are processed automatically.

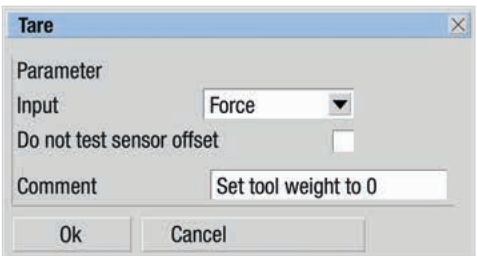
The **monitoring of the joining process** is effected by window and/or envelope technology by force-distance sensors and the analysis and evaluation of the data by our UFM V5.xx software

and the DB Viewer. A force-distance analysis of the joining process enables a 100% control of every part in real time. The data of the analysis is numerically and graphically editable so that the course of the process can be controlled individually. The customer can also pass on the individual programming by using the teach mode functionality. The limit curve will then be learned automatically by a good part. Data for quality control will be stored by the data-base plugin and can be used at every time.

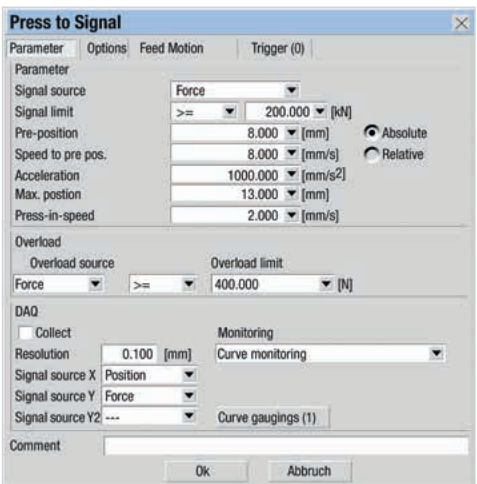
The software features an **integrated User Administration** with different permission levels and logging for process safety. Changes to the program are documented by the log so thus are traceable. Each user profile can be exported and then imported to another station. Thus it is possible to integrate a user administration system and also to connect the system to a higher-level permission system using the .Net interface or fieldbus (e.g. Euchner EKS system).



Entry screen Move



Entry screen Tare



Entry screen Press to Signal

Highlights for demanding applications:

- **Positioning on force slope:**
Joining components until a definite slope (increasing force) or relatively once a knee-point has been detected.
- **Controller module:**
This module allows you to easily solve processes by controlling the process variables and main taining constant signals, e.g., rolling processes with constant force controlling.
- **Measurement data system:**
Measurement data can be captured relative to positions and force, but also relative to freely definable reference points (e.g., relative to achieving a specific threshold).
- **Strain compensation:**
Not only customizable for separate systems, also for specific processes and components.

ONLY WITH US

Triggertechnology by PROMESS

The triggers are „pulse points“ that can be set within the program steps Move, Press to Signal and the controller module. The trigger provokes an action as soon as the defined condition within the program step is fulfilled. The conditions are set by the user. He can set up to seven trigger points in one program step in order to react to processing events during movement. These reactions can include:

- Smooth speeds
- Set the outputs in real time
- Change target parameters during movement
- Correct process tolerances during movement

Modern Database Structure

All process data including the curves are stored in a database. All common database formats such as Oracle, MS SQL and Access are supported. A separate database is created for each station. Programs can be stored and re-used at any time. Thus program changes are traceable and therefore with the entire production. The database can be analyzed using the DB Viewer with its extensive

querying and filtering options. Graphs can be superimposed on each other for comparisons and analyses. Envelopes can be edited and reloaded into the press. The data can also be exported in Excel format at any time. The standard models include the database software package and DB Viewer.

Software Highlights

- Join on position, join on force, join on external signals (e.g., analog or TTL signals)
- Force and speed can be programmed individually during the joining process
- Variables can be used to transmit setpoints, perform calculations using PLC and generate counters
- 100 % quality control using window and/or envelope methods
- 100 % process documentation using modern database structure
- 100 % process analysis using standardized interface to QS-STAT (optional), alternative to process management software IPM (optional) – can be expanded using .net interface
- Trigger function for demanding applications
- High controller accuracy (minimization of overshoot in control processes)
- Display of two graphs in one diagram
- Quick printout of a graph report (screenshot)

Scope of Delivery for Components:

- Universal electro mechanical assembly press Classic
- Absolute transducer (optional)
- Servo amplifier incl. application module, Ethernet module, and UFM V5 Firmware
- Brake resistance
- Digital preamplifier PDM-S
- Cable, fieldbus and more accessories on request



Accessories / Options

The series UFM Classic features various possibilities for customization as well as comprehensive accessories for an optimal use of our servopresses. The accessories complete the mechanics, electric, and software of our products and thus offer complete technologies for solving individual and complex assembly and testing tasks.

Individual electrical cabinet

PROMESS offers customer-specific, modular electric cabinets for the integration of the electromechanical assembly presses into automatic assembly lines. All connections have been wired to terminals. All components are mounted in-house and are tested prior to leaving.

ALL CONNECTIONS IN THE CABINET ARE CONNECTED TO PINS. CUSTOMER-SUPPLIED CONNECTIONS:

- Power connection, 400 V AC
- 2-channel emergency stop circuit, 24 V DC
- PLC interface as digital I/O, 24 V DC
- Fieldbus interface option

THE CABLE SETS CONSISTS OF THE FOLLOWING CABLES:

- Motor power cable
- Resolver cable or encoder cable
- Proximity switch cable
- Connection cable for strain gauge or piezo amplifier
- Ethernet cable to PC



Safety Box PSB

As an option to our assembly presses UFM Precision5 we offer our PROMESS Safety Box PSB as an alternative to the integration in electrical cabinets.

The device features all safety and power components for this purpose. It can easily and quickly be connected by plug & play.

All cables are pluggable. Due to the compact design, the PSB can be mounted next to the assembly press so that cable lengths can be reduced and wiring becomes unnecessary.

By using the PSB your assembly press will be ready for production instantly.

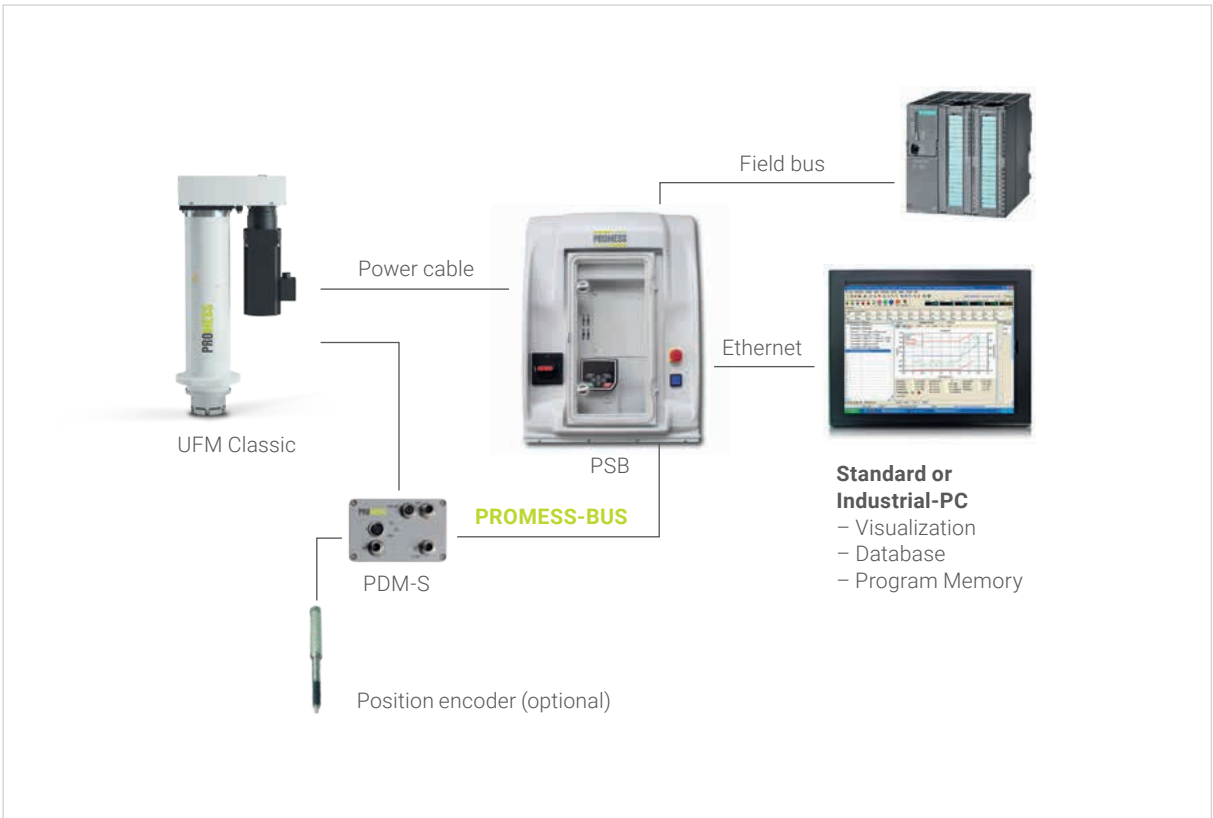


Safety Box PSB

Advantages

- No integration in electrical cabinets
- Reduction of cable lengths
- No wiring work
- No adaption of electrical diagrams
- Short connection time: plug & play
- PLe for STO by default
- Extension on SLS, SS1, possible
- IP Code 54
- Extremely compact design

System Design



System Design

Overview connections



Safety Module PSD

The PSD safety module is delivered tested and ready to install. It contains the power electronics and safety controller for the joining unit. It offers the following safety functionality: STO in PLe in accordance with DIN ISO 13849-1; optional: SSx and SLS in PLd in accordance with

DIN ISO 13849-1 (for UFM Classic with safety brake). The safety module eases and accelerates the installation procedure for the joining unit. The PSD is suitable for our UFM Classic units with and without brakes. As a prerequisite, it must be controlled using fieldbus.

Advantages

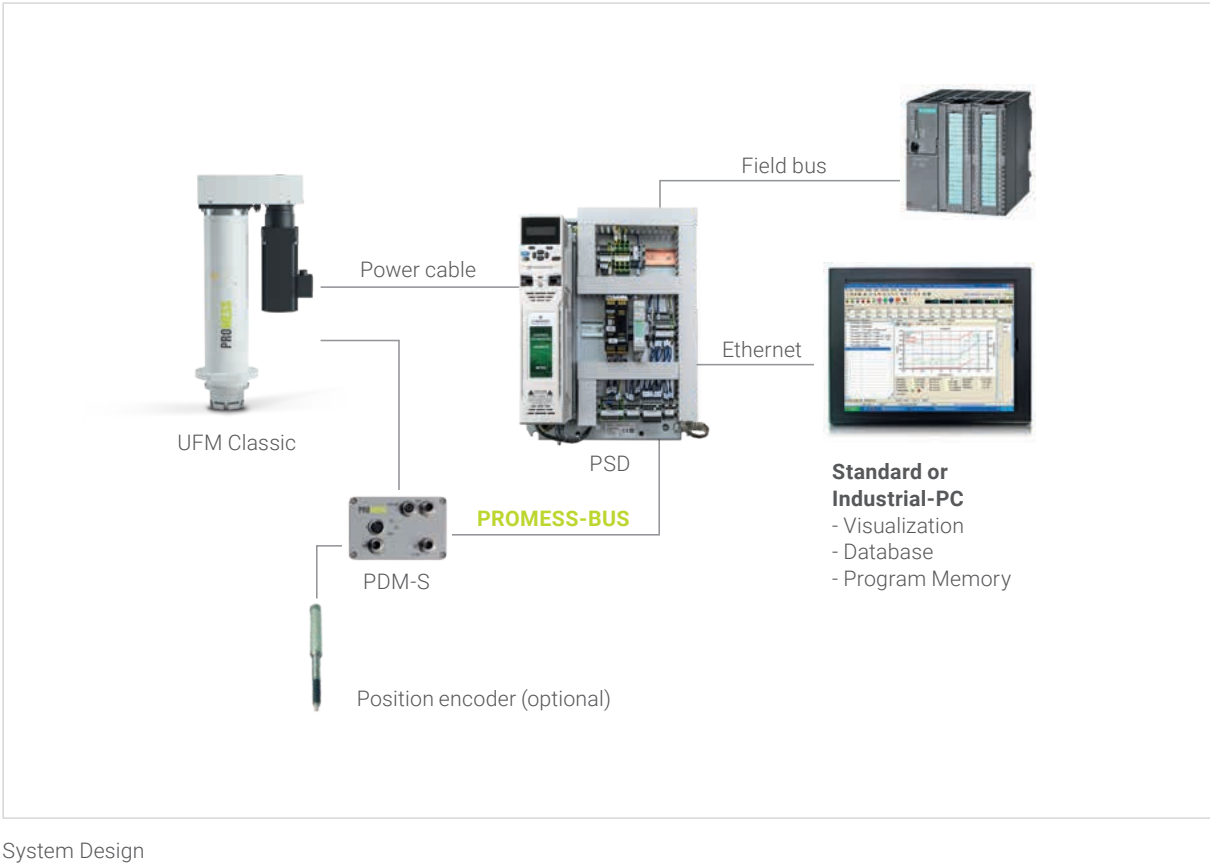
- Short installation times
- Reduced wiring work
- Completely inspected and tested
- EMC tested

PSD 010G1

Connected Components

- AC servo amp with NC module
 - Brake resistance
 - EMC components, main power filter
 - Safety functionality: STO in PLe in accordance with DIN ISO 13849-1; optional: SS1 and SLS in PLd in accordance with DIN ISO 13849-1 (for UFM Classic with safety brake)
- Fieldbus interface (must be ordered separately)
 - Set of cables (must be ordered separately)
 - Connectors (connected to pins): power supply (400 VAC, 24 VDC), 2-channel emergency stop circuit 24 VDC, fieldbus

System Design



PROMESS Digital Modules PDM

PROMESS offers four different multifunction amplifiers PDM. The modules are digitally connected to the UFM control via the PROMESS bus. They feature the following characteristics:



PDM-S
Item no. 14650

Digital preamplifier for strain gauge force transducer, multi range calibration optional

Input Force Transducer	
Accuracy class	0.1%
Sensitivity	0.1 ...5mV/V
Analogue bandwidth	10 kHz typ. (-3dB)
Resolution A/D converter	24 bit
Housing	Aluminium die-cast
Protection class EN 60529	IP 40
Dimensions WxHxD	125x80x57 mm (height without connectors)
Input Encoder	
Tracks	A+, B+, A-, B-
Level	Rectangle TTL 5V
Counter	16 bit



PDM-A
Item no. 14711

Four analogue inputs

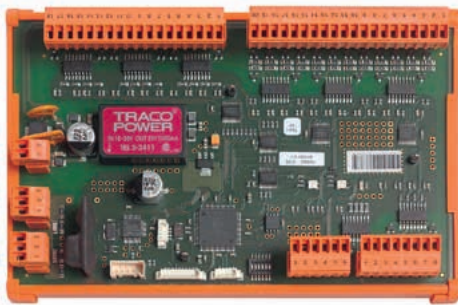
Analogue Inputs	
Precision class	0.25 %
Analogue bandwidth	10 kHz typ. (-3dB)
Resolution A/D converter	24 bit
Housing	Aluminium die-cast
Protection class EN 60529	IP 40
Dimensions WxHxD	125 x 80 x 57 mm (height without connectors)
Supply voltage	24 VDC
Input Encoder	
Tracks	A+, B+, A-, B-
Level	Rectangle TTL 5V
Counter	16 bit



PDM-P
Item no. 14655 / 56

Digital preamplifier for piezo force transducer, multi range calibration optional

Input Force Transducer	
Accuracy class	0.1%
Analogue bandwidth	10 kHz typ. (-3dB)
Resolution A/D converter	24 bit
Housing	Aluminium die-cast
Protection class EN 60529	IP 40
Dimensions WxHxD	125x80x57 mm (height without connectors)
Input Encoder	
Tracks	A+, B+, A-, B-
Level	Rectangle TTL 5V
Counter	16 bit



PDM-IO
Item no. 14700

16 digital in- and outputs

Digital in- and outputs	
Input protection	Electrically isolated
Output protection	Electrically isolated
Eingangsspannung	24 VDC
Ausgangsstrom	24 VDC
Case mounting	Cap rail
Protection class EN 60529	IP 40
Dimensions WxHxD	165x109x55 mm

Frames

C-Frames

The robust C-frames are easily accessible from the front and sides and provide high stiffness and very low bending. They are mainly suitable for use in assembly lines or machines.

By default, the lower plates are equipped with a center hole and 2-T grooves as optimum tool mounts. The upper plates are pre-fabricated to hold a specific joining module.



C-Frames

Four-Column-Frames

Four-column frames are suitable for applications with central axial application of force. They offer low bending that is solely parallel.

By default, the lower plates are equipped with a center hole and 2-T grooves as optimum tool mounts. The upper plates are pre-fabricated to hold a specific joining module.



Four-Column-Frames

External Force Transducer

The servopresses of the series UFM Classic are delivered with integrated strain gauge force transducer. For applications with a need for highest accuracy we offer additional external force transducer which will be mounted at the end of the press ram.

The force transducers of the UFM Classic range are designed to measure tension and compression forces both statically and dynamically. They have been specially designed and dimensioned for the UFM Clasic range of presses. They offer high measurement precision and, when installed, are low in height.



External Force Transducer

Cable Carrier Assembly

PROMESS offers different modules for towing the force transducer cable safely without wear and tear.



Cable Carrier Assembly

Sensors (Position transducers)

The PROMESS NC controller allows you to connect various additional sensors for measuring force, distance, temperature or other variables.

Technical Data				
Item no.	Sensor / Accessory	Cable	Stroke	Resolution
3647	Precision sensor ST 1278	axial	12 mm, neutral position extended	+/- 0,001 m
3640	Precision sensor ST 1278	radial	12 mm, neutral position extended	
4103003080	Precision sensor ST 1277	axial	12 mm, neutral position extended	
4103003078	Precision sensor ST 3078	axial	30 mm, neutral position extended	
11558505	5 m connecting cable for precision sensor ST 127x			

Cable Sets

The standard cable sets are available in lengths of 5, 10, 15, 20 and 25 m. We also offer individual lengths as well as split cable sets with coupling plug.

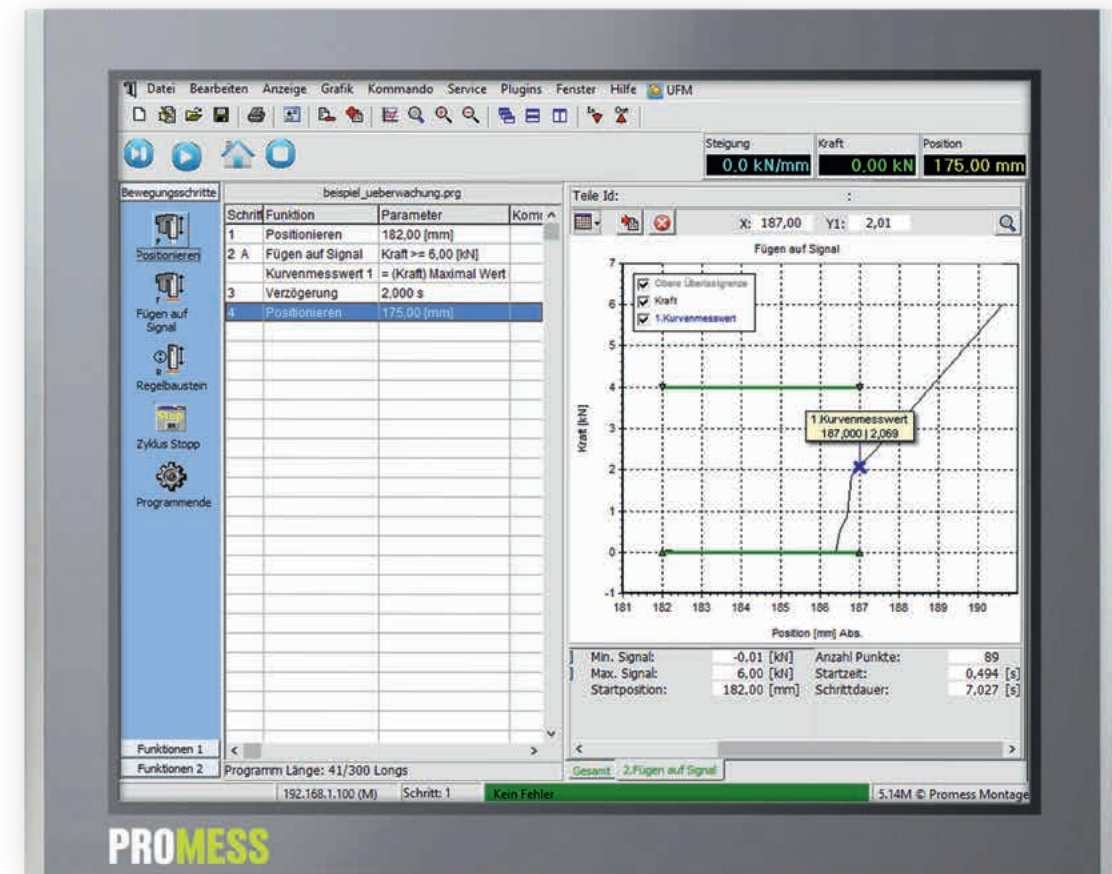
Fieldbusses

PROMESS offers various fieldbusses for communicating between the PLC and NC controller of the servopress. These include: Profibus, Profinet, EtherNet/IP, Modbus TCP/IP. On request, we can also provide additional fieldbusses.



Display and PC

As a programming unit for editing NC programs and for visualizing signals, PROMESS offers industrial PCs and displays on request.



Panel-PC

- Display size 19"
- Resolution 1280 x 1024
- Fanless
- Touchscreen: resistiv

Display

PROMESS offers different displays on request.

Software Plugins

PROMESS offers a range of custom plugins for its powerful UFM V5.xx programming software. These can be connected to the software through the .net interface. This allows the software to be modified on a case-by-case basis and optimized

for specific applications without having to update or change the firmware. The expanded database is also linked to the plugin.

Excerpt from the plugin library:

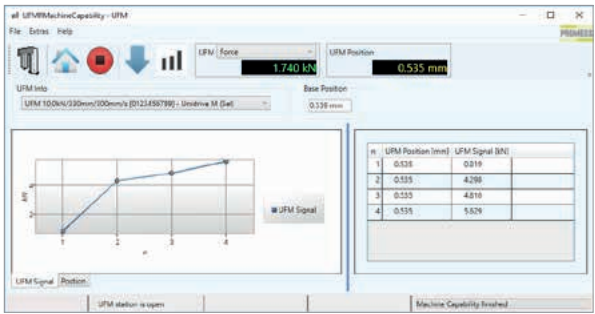
■ UFMR Barcode

The UFMR Barcode plugin can be used to change the program within the UFM software using a barcode scanner. While the program runs, the barcode scanner can be used, for instance, to transfer a Part ID using the UFM dialog function.



■ UFMR MachineCapability

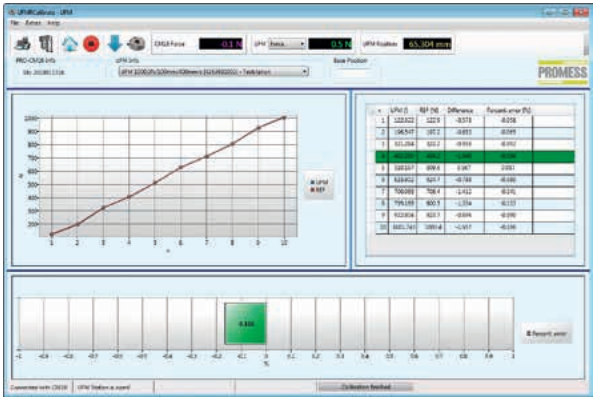
The plugin UFMR MachineCapability is used to determine the machine capability of force measurements in an electromechanical assembly press. The machine capability test is performed by repeatedly running of a UFM program running to a given force value while reading the position and force values of the joining unit as well as optionally the values of a reference transducer.



UFM Machine Capability

■ UFMR Calibrate

The plugin UFM Calibrate was developed for the calibration of the force transducer of our electro-mechanical assembly presses. It supports the 2-point calibration of the analog preamp as well as the characteristic calibration with the integrated range calibration of our digital preamp PDM-S.

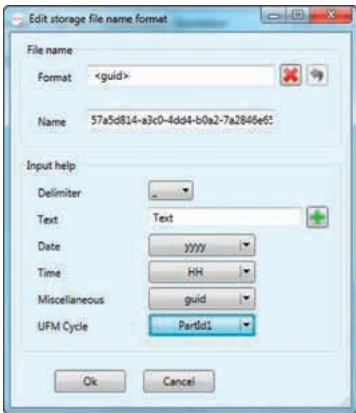


Calibration plugin

It is also possible to perform the calibration using other non-integrated references. In this case, the base point values of the reference transducer are entered manually.

■ URM XML-Writer

The XML Writer plugin is used to export data generated during the joining process, such as gaugings, curve data and variable values, to an XML file. The XML files can be used for any further processing and analysis.



URM XML-Writer

■ UFMR QDE

The UFMR QDE plugin allows you to export quality data into the statistics software Qs-STAT from the Q-DAS company and thus helps you to control and optimize your production process. You can export measurement data as characteristic data, as well as supplementary data and description data for every joining program. Exports are supported for "dfq" as well as "dfd" and „dfx" file formats.



■ UFMR IPM

The plugin UFMR IPM also supports the control and optimization of your assembly process and helps you to detect production failures early. You can export process



Our services for you

From development to after-sales service, we offer the complete package from a single source. On request, we support you from process development through to the use of our assembly presses at your premises. Whether you are using our assembly presses for the first time or are already familiar with them is not important. We offer you the necessary service for a long and sustainable use of our products at every stage.

The service of our products includes the following services:

- Process development
- Preliminary tests
- Rental units
- Start-up operation
- Documentation
- Training courses
- Remote / maintenance
- Calibration service
- Emergency, repair and spare parts service
- Sale of used assembly presses
- Consignment warehouse
- Worldwide sales and service network



For more „green“ efficiency

By choosing a universal joining module from PROMESS, you are choosing a long-lasting, energy-efficient drive system. We design your joining module individually in advance, which avoids overdimensioning and increased energy consumption. This saves you energy costs and conserves resources. Where possible, we take back used assembly presses, rework them and bring them back into the product cycle. The refurbished modules are state-of-the-art and have short delivery times. In addition, you receive a 12-month warranty and contribute to climate protection.



Maintenance

Preventive maintenance is the easiest way to reduce costly downtimes, increase machine service life and boost productivity. A maintenance contract for regular preventive maintenance by our trained personnel ensures maximum use of your products.



Our maintenance contract includes one service assignment per year with the following services:

- Re-grease all lubrication points
- Change of transmission oil as required (if applicable)
- Visual and noise inspection of mechanical and safety-relevant components
- Replacement of worn parts as required and if spare parts are in stock
- Update of the software as required and requested by the customer
- Checking / setting the zero point as required
- Checking the force curve over the nominal stroke
- Preparation of a machine condition report and quotation for the rectification of any defects
- Calibration and adjustment of the force signal, issue of a calibration certificate
- Adjustments (e.g. belt tension) as required
- Travelling expenses included
- Warranty extension by 12 months after maintenance (maximum of 5 years after delivery)
- 10% discount on spare parts
- 10% discount on services and training

Calibration service

Our assembly presses are supplied with a factory calibration. After this, we recommend regular calibration to ensure the reliability of your measuring equipment and to prevent incorrect process parameters from occurring. On request, PROMESS can support you with the calibration and adjustment of your force measuring system with appropriate calibration services. Choose between a factory calibration or a calibration according to an accredited in-house procedure. Both services are carried out by our experienced service technicians on your premises.

Our calibration laboratory is accredited in accordance with DIN EN ISO/IEC 17025:2018 by the German Accreditation Body (DAkkS) and carries out calibrations in the accredited area.

Calibration services	
Factory calibration	Accredited calibration
- Factory calibration of the force measuring system - Factory calibration certificate - Traceable calibration - Conformity assessment	- Calibration of the force measuring system according to accredited in-house procedure - Internationally recognised calibration certificate (with ILAC and DAkkS logo) - Traceable calibration - Conformity assessment (optional) - Fulfilment of the requirements of the DIN EN ISO/IEC 17025 - Recognised measurement uncertainties for each measuring point - Determination of the reversal margin (hysteresis) (optional)
- Adjustment of the force measuring system - Checking the distance measuring system - Function check for noise and wear - Lubrication - Testing the machine capability (optional)	

- ### What are the advantages of calibration according to an accredited procedure compared to factory calibration??

 - Calibration in accordance with the accredited procedure fulfils the requirement 7.1.5.3.2 external laboratories from the IATF 16949 standard.
 - You will receive an internationally recognised calibration certificate that meets the requirements of DIN EN ISO/IEC 17025 and bears the DAkkS logo.
 - Measurement uncertainties are shown and assigned directly to each measuring point.
 - Determination of the reversal span (hysteresis) on request.
 - You have the verification of a traceable calibration.
 - We can carry out a conformity assessment for you on request.

Calibration set

Alternatively, you can calibrate or test the machine capability of your assembly press yourself using our calibration set. The process can be automated using the optionally supplied software. Finally, a log is created that can be exported to Microsoft Excel.

The PROMESS calibration set contains

- Reference transducer
- Evaluation unit for the reference transducer with display and USB interface for connection to a PC
- Calibration certificate of the reference transducers as a factory calibration certificate or as a “DAkkS calibration certificate” possible
- PROMESS UFMR Calibrate software (optional)
- Case

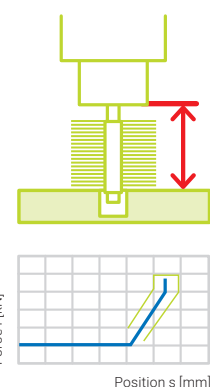


Calibration set	1 kN	5 kN	10 kN	20 kN	50 kN	100 kN	200 kN
Item no.	5106	5107	5104	5101	5103	5105	5108
Force transducer	KAM/1kN/0,2	KAM/5kN/0,2	KAM/10kN/0,2	KAM/20kN/0,2	KAM/50kN/0,2	KAM/100kN/0,2	KAM/200kN/0,2
Base plate	XKM 096			XKM 094		Without	
Diameter/height	Ø40 / 12			Ø90 / 25			
Plug	XKC 041						
Display	KT-V5						
Factory calibration	XKW 221						



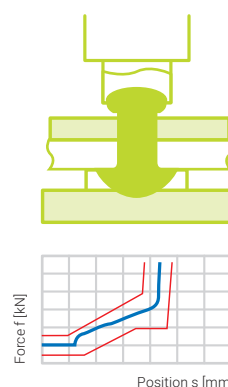
Application Examples

Our electromechanical assembly presses UFM Classic feature various configuration possibilities and thus are successfully used in a multitude of applications. This includes in the automotive industry the assembly and testing of gears, chassis or motor systems. But also in other industries like the electrical or medical industry or the battery production, the servopresses are used for assembly and joining applications with force-distance monitoring.



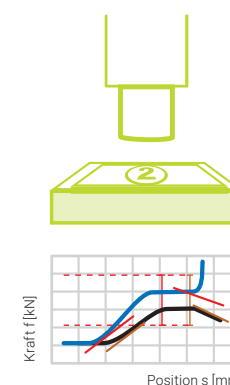
Precision Joining

- Precision joining < 0.002 mm, collision-free due to electronic bending compensation.



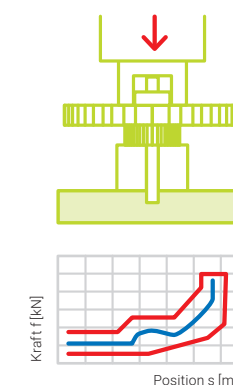
Riveting

- Rivet press with programmable press force and control of power press.



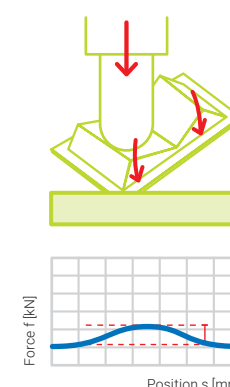
Stamping/Forming

- Stamping and forming with detection of part height and relative forming distance.



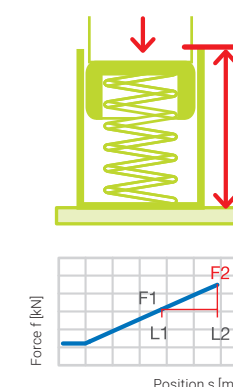
Join on Contact

- Joining on contact with precise shutdown once absolute shoulder position has been reached.



Surface Checks

- Logging of force-distance data for multiple switch points.



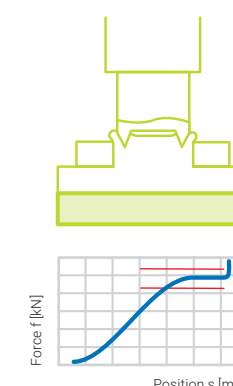
Testing/Measuring

- Logging of force-distance data for multiple positions.



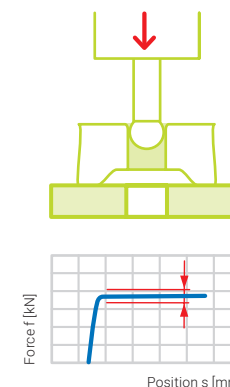
Bending

- Monitored bending of straps, brackets etc. on safety components.



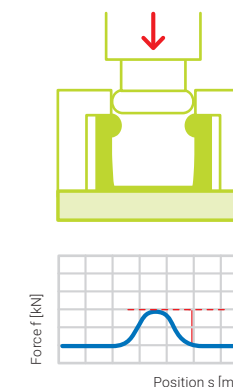
Press-fitting

- Press-fitting with controlled force for relative displacement.



Calibrating

- Calibration with quality assurance through monitored force.



Clipping

- Joining of plastic and medtech parts with monitoring of snapping force.

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